F200

Precision Thermometer

AΣΛ

AUTOMATIC SYSTEMS LABORATORIES

Operator's Handbook

Quick Start Guide

Issue 3

Smart Probe Conversion Kit

Smart Probe Editor Software

Smart Probe Editor Handbook

Firmware Download

Visit the ASL web site

F200
Precision Thermometer

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<u>Downloading the latest F200 instrument firmware</u>

This utility will allow you to access the latest firmware for the F200.

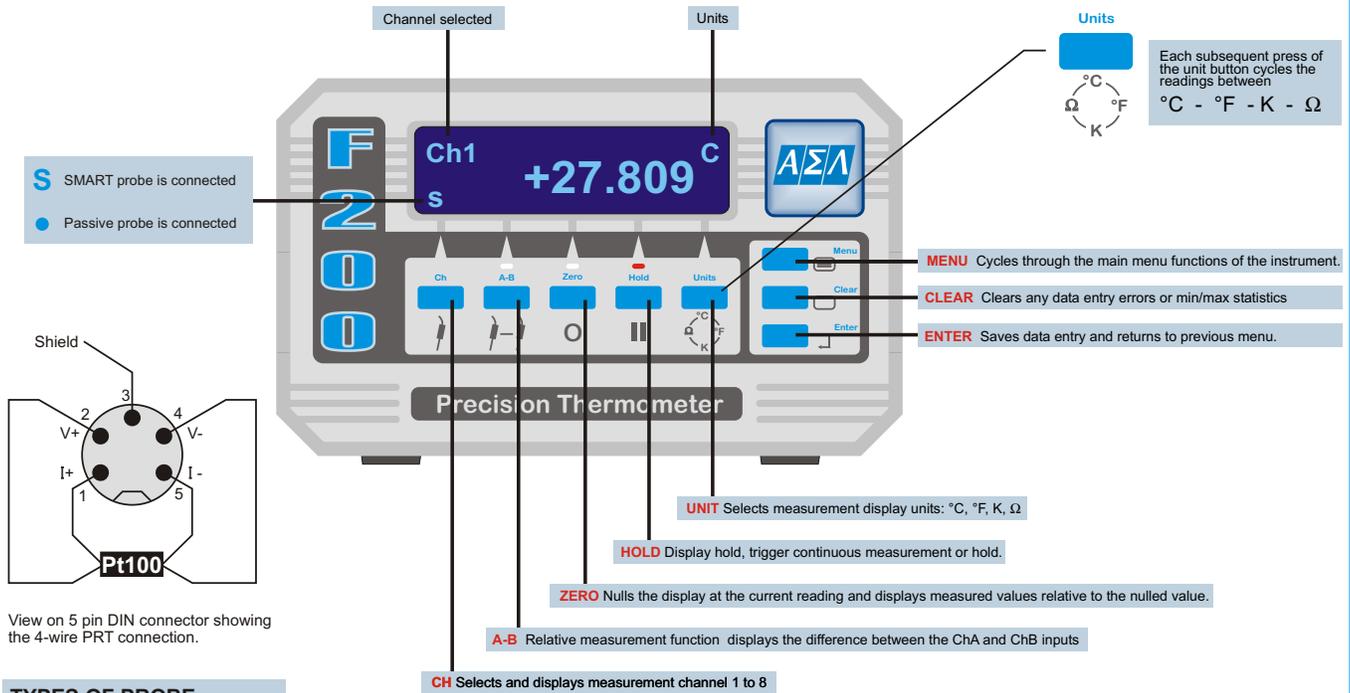You will require a user name and password. Contact the <u>ASL</u> sales office for more information.

Ensure that your computer is connected to the Internet.

Press the button below and follow the instructions on screen.

After you have successfully downloaded the self extracting files to your computer, you must ensure that your F200 is connected to a computer using the correct RS232 cable which must be a 9-way female to 9-way female null modem type.

Visit the downloader

F200 has been designed for ease of use and this quick start should help you to know your instrument. A more comprehensive guide is available in the Operator's Handbook on CD Rom.

Channel selected   Units

S SMART probe is connected

● Passive probe is connected

Ch1 **+27.809** C
s

Units

Each subsequent press of the unit button cycles the readings between
°C - °F - K - Ω

Shield

Pt100

View on 5 pin DIN connector showing the 4-wire PRT connection.

MENU Cycles through the main menu functions of the instrument.

CLEAR Clears any data entry errors or min/max statistics

ENTER Saves data entry and returns to previous menu.

UNIT Selects measurement display units: °C, °F, K, Ω

HOLD Display hold, trigger continuous measurement or hold.

ZERO Nulls the display at the current reading and displays measured values relative to the nulled value.

A-B Relative measurement function displays the difference between the ChA and ChB inputs

CH Selects and displays measurement channel 1 to 8

TYPES OF PROBE

F200 can accept up to eight thermometer input channels. The 4-wire SMART probes or passive PRTs are connected via the 5-pin DIN sockets located on the instruments top panel for ease of use. SMART probes are automatically detected before each measurement process and are indicated by **S** on the bottom left hand corner of the display. Passive probes are indicated by a dot.

SMART probes store their calibration data and other useful data in an EEPROM in the probe's plug which can be plugged into any channel. Passive probes have their calibration data stored in the F200 and can only be used in the channel where you have selected to enter this data.

PASSWORD PROTECTION

User entry to editing the probe calibration (Menu 1) and instrument calibration (Menu 3) are password protected. The user default is **9900**, but this can be changed to your own password using any terminal program via the RS232 interface.

THE MENU

Subsequent pressing of the MENU button will cycle the main menu through the top level menu enabling you to configure your F200.

Menu 1- Review/Edit Probe Calibration allows you to review probe calibration and edit probe coefficients. F200 provides 3 standard algorithms for converting resistance to temperature. The choice will depend on the type of PRT and its calibration.

● Din (1992):- used for un-calibrated industrial probes with 0.00385 "alpha" value, to provide a conversion of resistance to temperature in accordance with BS EN60751 (ITS90) standard.

● CvD coefficients:- Callendar Van Dusen used for calibrated industrial or low "alpha" PRTs of 0.00385.

● ITS90 coefficients:- used for calibrated high "alpha" PRTs of nominally 0.003926.

Menu 2 - Statistics is a basic statistical utility which allows you to capture maximum and minimum readings. Can be reset to zero.

Menu 3 - Options allows you to calibrate the F200 against a fixed value resistor, turn the RS232 communication ON and OFF and to display the version of firmware in your instrument.

Menu 4 - Review SMART probe data is only accessible if a SMART probe is connected and allows you to:
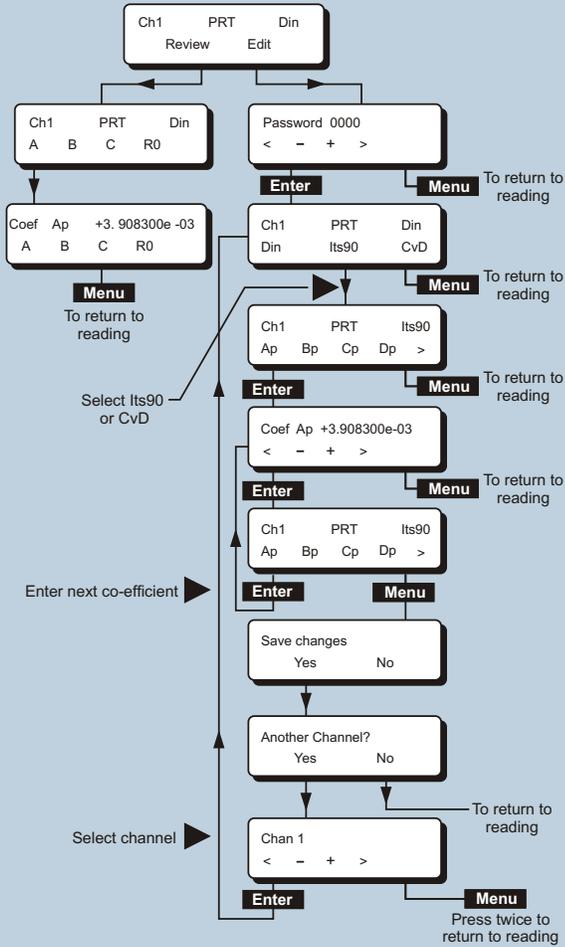
● View calibration date and calibration due date.   ● View source (calibration house).   ● View probe serial number.

● View maximum and minimum temperatures since last calibration.   ● View maximum and minimum temperatures ever.

Menu 5 - Set Date/Time allows the real time clock to be set.

Menu 6 - Brightness allows the display brightness to be set for different ambient light conditions to suit the user.
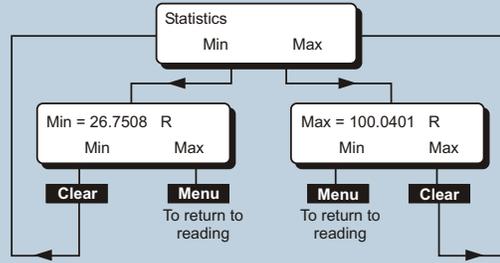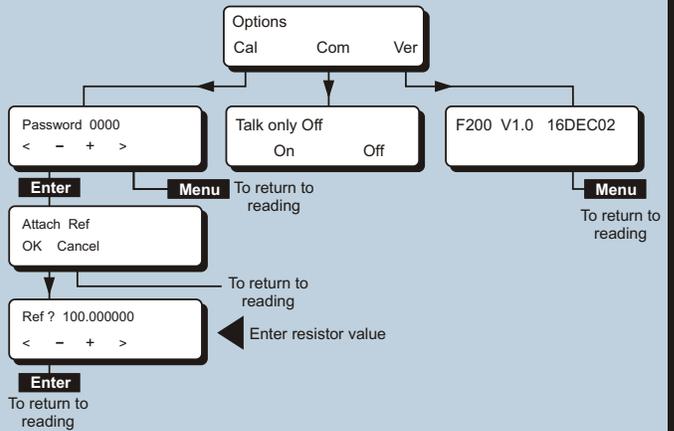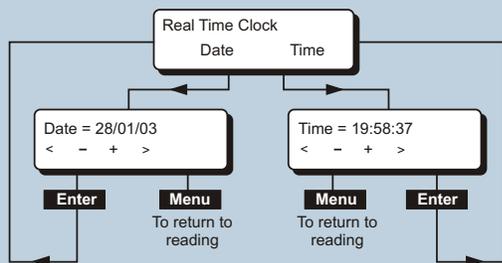
Menu 1
REVIEW / EDIT
- Probe Calibration

Ch1   PRT   Din
Review   Edit

Ch1   PRT   Din
A   B   C   R0

Password 0000
<   −   +   >

Enter   **Menu**
To return to reading

Coef Ap   +3. 908300e -03
A   B   C   R0

Menu
To return to reading

Ch1   PRT   Din
Din   Its90   CvD

Menu
To return to reading

Select Its90 or CvD

Ch1   PRT   Its90
Ap   Bp   Cp   Dp   >

Enter   **Menu**
To return to reading

Coef Ap +3.908300e-03
<   −   +   >

Enter   **Menu**
To return to reading

Ch1   PRT   Its90
Ap   Bp   Cp   Dp   >

Enter next co-efficient ►

Enter   **Menu**

Save changes
Yes   No

Another Channel?
Yes   No

Select channel ►

Chan 1
<   −   +   >

Enter   **Menu**

To return to reading

Press twice to return to reading

Menu 2
STATISTICS
- Max/Min

Statistics
Min   Max

Min = 26.7508 R
Min   Max

Clear   **Menu**
To return to reading

Max = 100.0401 R
Min   Max

Menu   **Clear**
To return to reading

Menu 3
OPTIONS
- Calibration / Communicate / Firmware version

Options
Cal   Com   Ver

Password 0000
<   −   +   >

Enter   **Menu**

Talk only Off
On   Off

To return to reading

F200 V1.0   16DEC02

Menu
To return to reading

Attach Ref
OK   Cancel

To return to reading

Ref ? 100.000000
<   −   +   >

◄ Enter resistor value

Enter
To return to reading

Menu 5
SET
- Date / Time

Real Time Clock
Date   Time

Date = 28/01/03
<   −   +   >

Enter   **Menu**
To return to reading

Time = 19:58:37
<   −   +   >

Menu   **Enter**
To return to reading

Menu 6
BRIGHTNESS
- Display

Brightness
−   +

Menu
To return to reading

Menu 4
REVIEW
- SMART probe data

Only accessible if SMART probe is attached

SmartProbe
Review

Version: 1 lock : 0
Cal Type: Din

Enter   **Menu**
To return to reading

Cal date: 07-01-2003
Due date: 07-01-2004

Enter   **Menu**
To return to reading

Calibration House ►

Source:
ASL

Enter   **Menu**
To return to reading

Probe Serial No ►

Serial Number:
ASL0001

Enter   **Menu**
To return to reading

Max since cal: 32
Min since cal: 0

Enter   **Menu**
To return to reading

Remains when probe is re-calibrated. ►

Max ever: 32
Min ever: 0

Enter   **Menu**
To return to reading

F200 Menu Structure

Smart Probe Conversion Kit

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Contents

  1 x 5 Pin Smart connector DIN plug
  1 x 'S' Smart Probe cable identification sleeve

About Smart Probes

Smart Probes are like passive probes except for one key advantage, all the probe details, calibration data and probe history are stored within the probe's plug and not within the measurement instrument. Smart Probes can freely be moved from channel to channel or instrument to instrument without the need to manually enter any data into the measurement instrument.

How Smart Probes Work

The connector on a Smart Probes is fitted with a SMART memory device; this device is transparent during temperature measurements. Before each measurement cycle the probe is interrogated, if a Smart Probe is detected an 's' is displayed in the bottom left hand corner of the display. The probe data is read into the measurement instrument for use in the measurement process.

Smart Probe Data Security

To maintain a high level of data security the Smart Probe has a built in data lock. If the data lock is set, the Smart Probe data cannot be modified. The state of the data lock can be changed from a PC via the F200 serial communication port using the ASL Smart Probe Editor software.

Lock = 0   Probe unlocked data can be modified.
Lock = 1   Probe locked data cannot be modified.

Smart Probe Calibration Supervisor

To assist in maintaining a valid calibration the instrument checks the Smart Probes next calibration date and compares it with the instruments current date. If the smart probe date is found to have expired the instrument will warn the operator *'Probe is out of calibration'*.

Smart Probe Working Range Monitor

The Smart Probe working range monitor is used to monitor if a smart probe is used outside its specified working range.
On completion of each measurement, the new reading is compared with the probe working range. If the new reading is found to be outside the probe working range, the appropriate data fields are updated.

Smart Probe Assembly Procedure

To make a Smart Probe you simply have to fit a Smart Connector to your probe assembly. Your Smart connector already has a configured memory device fitted inside. You will need to un-screw the assembly and remove the cable clamp so that you own probe's cable can be connected to the appropriate pins as shown in the diagram below. Ensure that the "S" Smart Probe identification sleeve is fitted to the cable.

Smart Probe Conversion Kit

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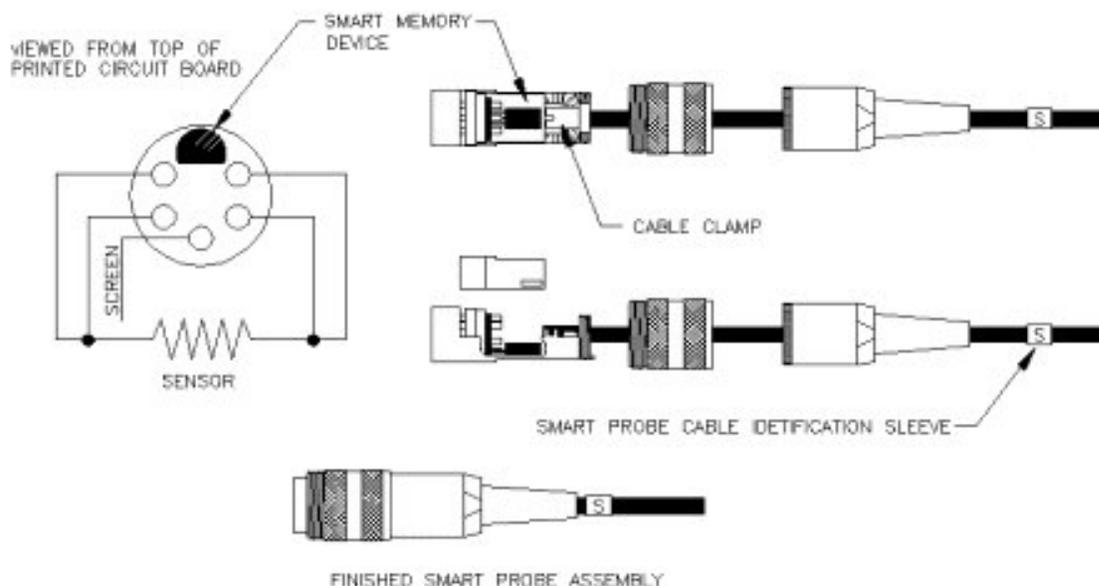
Review Edit Smart Probe Data

The Smart Probe data can be reviewed or edited in a number of ways.

o   Review the data from the F200 Smart Probe menu (refer to section 4.1.6. of F200 handbook).
o   Review or edit the temperature conversion method and coefficients from the F200 channel set up menu (refer to section 4.1.3. of F200 handbook).
o   Review or edit the data from a PC via the F200 serial communication port using the ASL Smart Probe Editor software.
o   Review or edit the data from a PC via the F200 serial communication port using a standard PC serial communication terminal program (refer to section 7 of F200 handbook).

Smart Probe Data

Lock
Store the Smart Probe data lock state, maintain a high level of data security.
Format
SENSe:FRTD:FORmat   Store the Smart Probe data format, for use in maintaining future compatibility.
Probe ID
SENSe:FRTD:IDENtification   Store the Smart Probe identification number, 20 characters maximum.
Conversion Standard
SENSe:FRTD:STANdard   Store the required resistance to temperature conversion method, Din, CvD or ITS90.
Coefficient Ap, Bp, Cp, Dp, R0.01, Wt, An, Bn
SENSe:FRTD:COEFficient   Store the required coefficient for use in resistance to temperature conversion.

Conversion	Temperature Range	Required Coefficients
Din	-200#C to 850#C	R0, A, B, C.
CvD	-200#C to 850#C	R0, A, B, C.
ITS90	83.8058K to 273.16K	R0.01, An, Bn.
ITS90	273.15K to 961.78#C	R0.01, Ap, Bp, Cp, Dp, Wt.
ITS90	273.15K to 660.323#C	R0.01, Ap, Bp, Cp.
ITS90	273.15K to 419.527#C	R0.01, Ap, Bp.
ITS90	273.15K to 231.928#C	R0.01, Ap, Bp.
ITS90	273.15K to 156.59865#C	R0.01, Ap.
ITS90	273.15K to 29.7646#C	R0.01, Ap.
ITS90	234.3156K to 29.7646#C	R0.01, Ap, Bp.

Min working range
SENSe:FRTD:RANGe   Store the Smart Probe working range minimum value, range 0 to 400 ohms.
Max working range
SENSe:FRTD:RANGe   Store the Smart Probe working range maximum value, range 0 to 400 ohms.
Min since last cal
Record the minimum value the smart probe exceeded outside its working range since it was last calibrated, automatically reset when the Smart Probe is wiped.
Max since last cal
Record the maximum value the Smart Probe exceeded outside its working range since it was last calibrated, automatically reset when the Smart Probe is wiped.
Min ever
Record the minimum value the Smart Probe exceeded outside its working range during its working life, automatically reset when the Smart Probe is wiped.
Max ever
Record the maximum value the Smart Probe exceeded outside its working range during its working life, automatically reset when the Smart Probe is wiped.
Date
SENSe:FRTD:CAL:DATE   Store the date the Smart Probe was calibrated DD/MM/YYYY.
Next Date
SENSe:FRTD:CAL:NEXT   Store the date the Smart Probe next calibration is due DD/MM/YYYY.
Source
SENSe:FRTD:CAL:SOURce   Store name of the company responsible for the Smart Probe calibration 20 characters maximum.
Calibration History
SENSe:FRTD:CAL:HISTory?   Maintain the calibration history of the Smart Probe. The calibration history is automatically updated when the next calibration date is updated. The calibration history is cleared when the probe is wiped.

Your new Smart Probe has been configure with the following data prior to shipment:

Probe ID:	Set to Blank			Conversion Type	Din
			Ap		3.908300e-03
Format:	1	Bp			-5.775000e-07
			Cp		-4.183000e-12
Lock:	No	R0			100.000000 ohms

Working Range: Minimum   20 ohms   Calibration Date: Set to date the Smart Probe was configured.
                Maximum   390 ohms   Next Date: Set to 1 year from the configured date
                                             Source: Set to Un-Calibrated

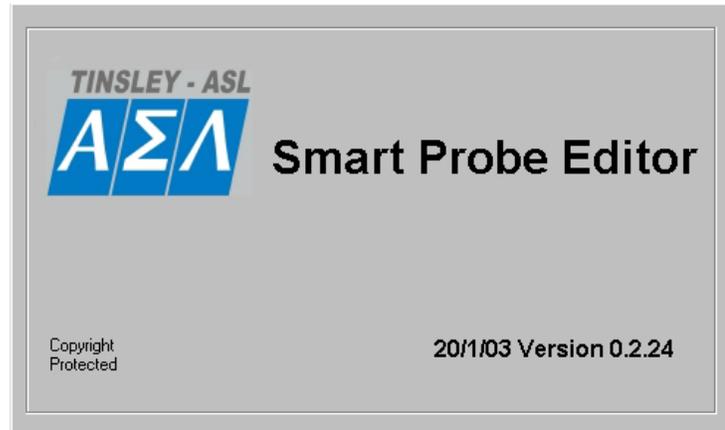**Table of Contents**

1   Running the Smart Probe Editor

Select Programs from the system Start menu.

Select Smart_Probe_Editor from the list of applications shown.

Click on Smart_Probe_Editor to run the utility.

The welcome screen will appear briefly followed by the control panel.

2 Function keys

2.1 Wipe Probe
Sets the selected smart probe to default settings and clears the calibration history. The user is prompted "Are you sure you want to wipe the probe?"

2.2 Read Probe:
Reads the selected probe and updates the smart probe edit fields.

2.3 Write to Probe
Updates the selected smart probe with the data from the smart probe editor fields.

2.4 Save to File
Saves the smart probe editor settings to a specified file.

2.5 Read File
Loads the smart probe editor with the settings from a selected file.

2.6 Print Report
Prints the smart probe editor settings to a printer.

2.7 Help
How to use the smart probe editor.

2.8 About
Smart probe editor manufacture and software version.

2.9 Close
Close the application.

3 System

Comm Port: Select the serial communication port the instrument is connected to.

System ID: On the first communication the field displays the instrument identification string in the form

<manufacture>,<model no>,<serial no>,<firmware version>.

Password: Enter the instrument current password to allow the modification of the smart probe data 4 digit number default password 9900.

Channel: Select the instrument input channel the smart probe you wish to configure is connected to.
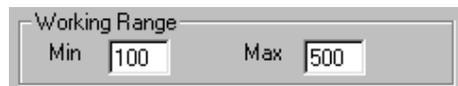
4   Probe Control
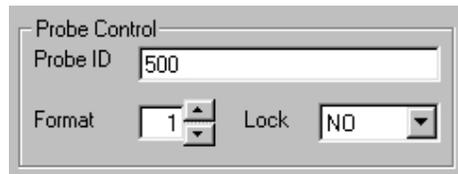
Probe ID: Enter the serial number of the smart probe 20 characters maximum.

Format: Displays the smart probe data format. Always set to 1.

Lock: Each smart probe has a lock facility, if a smart probe Lock is set to 'Yes' the data in the smart probe can not be modified from the instrument.
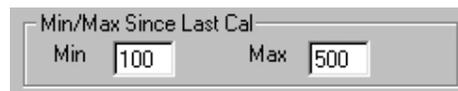
5   Working Range

Min: Enter the minimum working range for the smart probe 0 to 400 ohms.

**Max**: Enter the maximum working range for the smart probe 0 to 400 ohms.

Min since last cal: Displays the minimum value the smart probe exceeded outside its working range since its last calibration, automatically reset each time the smart probe is written to.

Max since last cal: Displays the maximum value the smart probe exceeded outside its working range since its last calibration, automatically reset each time the smart probe is written to.
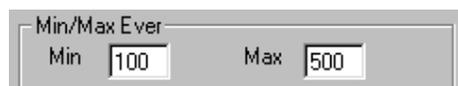
Min ever: Displays the minimum value the smart probe exceeded outside its working range during its working life, automatically reset each time the smart probe is wiped.

Max ever: Displays the maximum value the smart probe exceeded outside its working range during its working life, automatically reset each time the smart probe is wiped.

6 Coefficients

Conversion type: Select the required resistance to temperature conversion method Din, CvD or ITS90.

Ap, Bp, Cp, Dp, R0.01, Wt, An, Bn

Conversion	**Temperature Range**	Required Coefficients
Din	-200°C to 850°C	R0, A, B, C.
CvD	-200°C to 850°C	R0, A, B, C.
ITS90	83.8058K to 273.16K	R0.01, An, Bn.
ITS90	273.15K to 961.78°C	R0.01, Ap, Bp, Cp, Dp, Wt.
ITS90	273.15K to 660.323°C	R0.01, Ap, Bp, Cp.
ITS90	273.15K to 419.527°C	R0.01, Ap, Bp.
ITS90	273.15K to 231.928°C	R0.01, Ap, Bp.
ITS90	273.15K to 156.59865°C	R0.01, Ap.
ITS90	273.15K to 29.7646°C	R0.01, Ap.
ITS90	234.3156K to 29.7646°C	R0.01, Ap, Bp.

7　Calibration

Date: Enter the date the smart probe was calibrated DD/MM/YYYY.

The date is automatically set to the current PC date when the program is launched.

Next Date: Enter the date the smart probe next calibration date is due DD/MM/YYYY.

Source: Enter name of the company responsible for the smart probe calibration 20 characters maximum.

Calibration History: Displays the calibration history after reading the selected smart probe. Calibration history can only be cleared by the Wipe Probe function.

8   Please Enter (Calibration certificate)
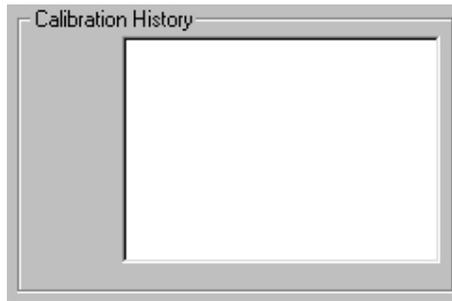
The following data is not stored in the smart probe but is included for reference in the printed report.

Probe Type: **Enter the smart probe type eg T100-450.**

Certificate Number: Enter the smart probe calibration certificate reference number.

Table of Contents

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1. Introduction

1.1 Overview

The F200 Precision Thermometer is a high accuracy instrument designed for laboratory and industrial temperature measurement and calibration applications.

Features include:

- The number of input channel can be expanded from two to eight channels;
- A large graphic VFD display for excellent viewing of temperature measurement values and configuration settings;
- Galvanically isolated RS232C communication interface (4KV isolation) as standard for automated monitoring and calibration applications;
- Self calibration against a traceable external standard;

The F200 will operate with all 4-wire Pt100 (100 Ohm) platinum resistance thermometers.

Temperature measurement units are selectable by single front panel key operation;

$\circ$C, $\circ$F, K & Ω.

Resistance accuracy is better than $\pm$4mΩ, (over full range at +20°C ±2°C) equivalent to temperature measurement precision of $\pm$10mK for Pt100 thermometers. Total system measurement uncertainties as low as $\pm$15mK are possible when the F200 is used with a calibrated reference thermometer. Overall system accuracy depends on the PRT quality and calibration.

1.2 Definitions and Terminology

i.   0°C = 273.15 K

ii.   1 mK (milli-Kelvin) = 0.001°C (one milli-degree Celsius)

iii.   1 milli-degree C = 0.001°C = 1m°C = 1mK = 1.8m°F

iv.   1 milli-degree F = 0.001°F = 1m°F = 0.56mK = 0.56m°C

v.   Alpha, or α, is the temperature coefficient, or temperature sensitivity, of the platinum wire used in PRTs. In general, the greater the alpha value, the better the PRT thermometer measurement reproducibility, stability and performance.

vi.   Abbreviations for platinum resistance thermometers include:

        PRT   (Platinum Resistance Thermometer)

        Pt100   (PRT with nominally 100Ω resistance at 0°C)

        RTD   (Resistance Temperature Device)

vii.   System accuracy refers to the overall, combined accuracy of the F200 and thermometer.

General warning symbol. This indicates that a hazardous condition or general danger may exist. **You must read the relevant sections in the Operator's Handbook before operating the instrument.**

1.3 Principles of measurement

1.3.1 PRT measurement

The F200 measures the voltage (V_t) developed across the unknown sensor resistance (R_t) and the voltage (V_s) across a stable internal reference resistance (R_s). The voltages are in proportion to the resistances so the thermometer resistance is derived from:

$R_t = R_s \times V_t / V_s$

This technique achieves immunity from slow moving time and temperature drift in the electronics, as it is not affected by voltage measurement gain variations or current source fluctuations.

In the same way that AC resistance measurement eliminates thermal EMFs, switched DC achieves a similar advantage. Switched DC works by reversing the current flow on alternate measurement cycles and taking the average value, thereby cancelling any thermal EMF offsets from the measurement.

For PRTs, the relationship between resistance and temperature varies slightly from one PRT to another. Therefore, no matter how accurately the F200 measures the PRT resistance, if the relationship between resistance and temperature for a particular PRT is not known, accurate temperature measurement is not possible.

The F200 uses PRT calibration data to overcome this problem and calculates temperature from temperature conversion functions stored in either the PRT's 'SMART' connector or the instruments internal memory. This method enables the F200 accurately to convert resistance to temperature, uniquely for each PRT used. It is very important therefore that a PRT without 'SMART' connector is used on the correct and properly configured input channel.

The system accuracy is a combination of the F200 accuracy in measuring PRT resistance and the calibration uncertainty placed on the PRTs by the calibrating laboratory. Using the F200 with PRT type T100-250-1, this is $\pm0.025°C$ for temperatures from -50°C to +250°C.

2. Setting up the F200

2.1 Safety information

- Please read the safety information sheet before operating the F200.

2.2 Unpacking the instrument

When you unpack the F200 thermometer, check that the following items are present before starting to use the unit:

- 1x   F200 precision thermometer
- 1x   AC power cord
- 1x   Quick-start guide
- 1x   Operator's handbook on CD
- 1x   Calibration certificate

Please contact the ASL Technical Services Group immediately if any of these items are missing or damaged.

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3. About the F200

This section introduces you to the features and functions of the F200 Precision Thermometer.

3.1 The Front Panel

VFD Display

Front panel buttons
Function keys
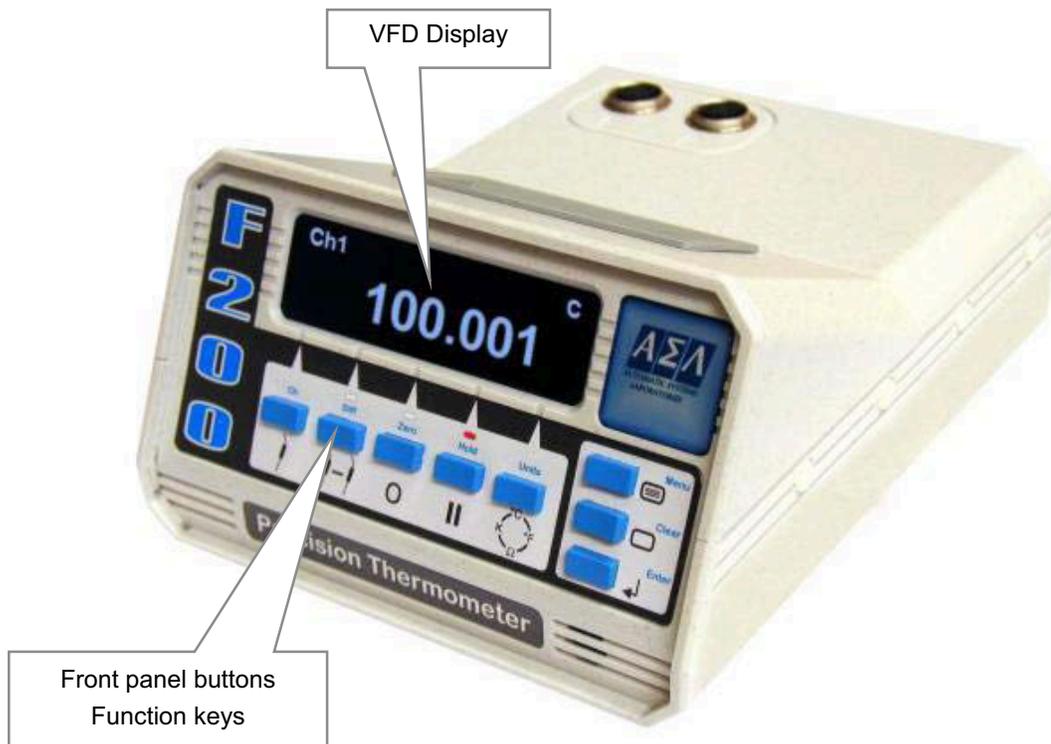
Figure 3.1- Front Panel

3.2 About the display screen

The large graphic VFD display screen is your direct link to the instrument, presenting you with information or menus that prompt you on what to do next.

3.3 The Front Panel keypad

The instrument keypad consists of five **Function** keys and three **Menu** keys.

In **Temperature Measurement Mode** the function keys are use to directly control the measurement operation of the instrument.

In **Instrument Configuration Mode** the function keys operate as soft keys along with the menu keys to enable the operator to configure the instrument

For a detailed description of how to use the keys to configure and operate the instrument, refer to Section 5.

Table 3.1   Summary of front panel key functions

Key symbol	Description	Function
Selecting Input Channels		
Ch	Select input channel 1 to 8	Selects and displays measurement channel 1 to 8
A-B	Select differential measurement ChA − ChB	Relative measurement function displays the difference between selected ChA and ChB inputs
Setting up Measurement Options		
ZERO	Measurement display zero function	Nulls the display at the current reading and displays measured values relative to the nulled value.
HOLD	Measurement run/ hold	Display hold, trigger continuous measurement or hold.
UNIT	Measurement units	Selects measurement display units: ˚C, ˚F, K, Ω
Menu Functions		
MENU	Select Menu options	Cycles through the main menu functions of the instrument.
CLEAR	Clear data entry	Clears any data entry errors or min/max statistics
ENTER	Save entry	Saves data entry and returns to previous menu.

3.4 Thermometer inputs

The thermometer-input 5 pin DIN sockets are located on the top panel for ease of use. The number of input channels can easily be expanded from two to eight channels. When the instrument is turned on, it automatically detects the number of input channels.

Each input channel can accept either a Smart probe or a Passive probe; any combination of probes can be use together.

The selected input channel is interrogated before each measurement cycle, smart probes are identified by '**s**' on the bottom left hand corner of the display, passive probes are identified by a dot '**.**'. Open circuit thermometer input channels will be reported as '**No Probe**'.
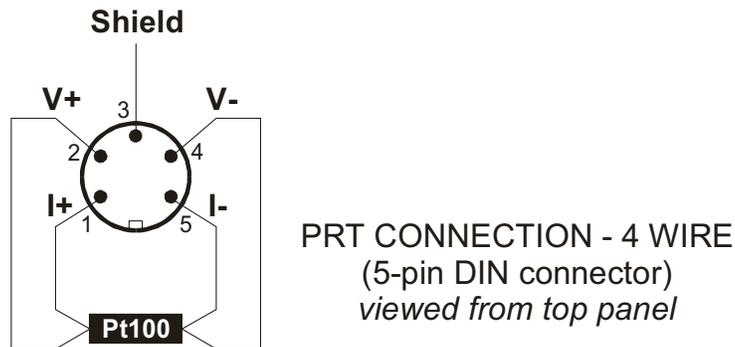
Figure 3.4.1   4-Wire Passive PRT input connection configuration
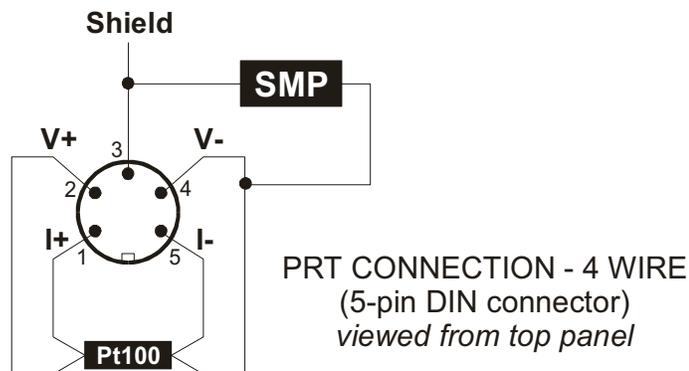
Figure 3.4.2   4-Wire SMART Probe PRT input connection configuration

3.5 Rear panel

Figure 3.5 - Rear Panel layout, showing all options

3.5.1 AC Power Input Socket

The instrument is fitted with a universal input power supply unit; the AC power input socket accepts 3-pin IEC320 AC type power connector.

The instrument is protected by an internal T1 amp Anti surge surface mount fuse (case size 1206) located in a fuse carrier on the front right of the main PCB.

The power lead supplied with the instrument contains a separate ground lead, this ground lead provides the instrument safety ground, to maintain this safety the instrument must be grounded.

3.5.2 Rating plate

Instrument rating plate, contains the AC voltage range, operating supply frequency range, the instrument maximum power consumption and instrument serial number.

3.5.3 Supply On/Off Switch

The supply switch is used to switch the instrument On or Off.

Switching the supply Off does not is isolate the instrument, to isolate the instrument make sure the instrument is disconnected from the AC line and any other equipment.

3.5.4 RS232 Communication interface connector

RS232 communication via a 9 way D type plug is fitted as standard.

3.5.5 Name plate

Instrument nameplate, contains the manufacture name and address details.

4. Operating the F200

4.1 Instrument operating mode

The instrument has two operating modes:

- the **Temperature Measurement Mode** which displays channel status information and a sequence of measurement readings;
- the **Configuration Mode** which lets you set up and configure the instrument.

4.1.1 Temperature Measurement Mode

In temperature measurement mode the instrument function is controlled directly from the five function keys.

4.1.1.1 Selecting thermometer input channel

Press the '**Ch**' channel key to select the required input channel, the current selected channel number is displayed on the main display.

4.1.1.2 Selecting differential input measurement

Press the '**A–B**' key to select differential measurement.

Instruments with only two input channels available will automatically configure for Ch1 – Ch2 measurement.

Instruments with more then two input channels will display the differential channel selection menu. Select the required ChA and ChB input channels using the appropriate soft key, '+' increment channel number, '–' decrement channel number.

```
┌─────────────────────────────────────┐
│  ChA: x              ChB: y          │
│   –      +            –      +        │
└─────────────────────────────────────┘
```

On completion of selecting the required channel numbers press '**Enter**'.

The selected channel numbers are displayed on the main display.

To cancel differential measurement press the '**A-B**' key, a front panel LED indicates the current state.

4.1.1.3 Selecting relative temperature measurement

In Zero mode, the instrument displays subsequent readings relative to a fixed offset. Press the '**Zero**' key the instrument stores the last reading as the fixed offset; this will be subtracted from all subsequent readings. To cancel Zero mode press the '**Zero**' key again, a front panel LED indicates the current state.

Changing the display Units will automatically cancel Zero mode.

4.1.1.4 Selecting run/hold mode

In Hold mode the instrument measurement cycle is stopped.

Press the '**Hold**' key to alternate between Run and Hold mode; a front panel LED indicates the current state.

4.1.1.5 Selecting Units

Press the '**Unit**' key to select the required measurement units, Resistance (Ω), Celsius (°C), Fahrenheit (°F) or Kelvin (K), the current selected units are displayed on the main display.

Changing the Units will automatically clear the maximum and minimum recorded values in statistics.

4.1.2 Configuration Mode

In configuration mode the instrument function is controlled from the three menu keys and the five function keys now operating as soft keys. The function of a soft key is indicated on the VFD display directly above the key.

To enter the instrument configuration mode press the '**Menu**' key.

The instrument menu structure for ease of use is arranged as a series of top-level menu's leading to a series of sub menu's. To cycle through the top level menus repeatedly press the '**Menu**' key. To select the required sub menu, press the appropriate soft key. To exit a sub menu and return to temperature measurement mode press the '**Menu**' key.

4.1.2.1 Top level menu

Channel configuration menu, review or edit the channel temperature conversion algorithm and coefficients.

```
Chx            PRT             Din
      Review         Edit
```
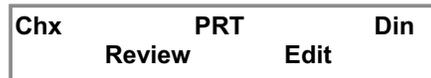
Statistics menu, review or clear maximum and minimum recorded values.

```
Statistics
      Min            Max
```

Options menu, calibrate the instrument, set talk only mode or review the instrument firmware issue.

```
Options
Cal            Com             Ver
```

Smart Probe review menu (menu only available if smart probe detected).

```
Smart Probe
      Review
```

Real Time Clock menu set the real time clock date and time.

```
Real Time Clock
      Date           Time
```
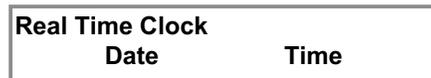
Brightness menu set the display brightness.

```
Brightness
      -              +
```

4.1.3 Setting up Temperature measurement

To enable accurate resistance to temperature conversion to be carried out by the instrument the PRT characterisation data is required

o   temperature conversion algorithm

o   temperature conversion algorithm coefficients

The data can be stored in either a smart probe or the instrument internal none-volatile memory, each thermometer input channel store one set of PRT characterisation data.

4.1.3.1 Temperature measurement with smart probe (s)

If a smart probe is detected on a selected input channel the PRT data is loaded direct from the smart probe. Smart probe data always takes preference over the instrument channel data but does not over write the instrument channel data, no other set up is required.

4.1.3.2 Temperature measurement with passive probes (.)

The instrument can store one set of PRT characterisation data for each thermometer input channel.

4.1.3.3 Temperature conversion algorithm

The instrument provides three standard algorithms for converting resistance to temperature. The choice will depend on the type of PRT and its calibration.

- Din (1992):- used for un-calibrated industrial PRTs with 0.00385 'alpha' value, to provide a conversion of resistance to temperature in accordance with BS EN60751 (ITS 90) standard.
- CvD coefficients:- Callendar Van Dusen used for calibrated industrial or low alpha PRT's of 0.00385.
- ITS90 coefficients:- used for calibrated high alpha PRT's of values 0.003926 to 0.003928.

4.1.3.4 Review Temperature conversion algorithm

Select the required input channel using the '**Ch**' key.
Select the channel set up menu using the '**Menu**' key.

```
Chx          PRT          Din
      Review        Edit
```

The channel number and temperature conversion method are displayed on the first line of the menu.

4.1.3.5 Review Temperature conversion algorithm coefficients

Press the '**Review**' soft key the coefficient selection menu will be displayed.

```
Chx          PRT          Din
A      B      C      R0
```

Select the coefficient to review using the appropriate soft key.

```
Coef A = +3.908300e-03
A      B      C      R0
```

To review the next coefficient press the appropriate soft key.

Select '**<**' or '**>**' soft key to scroll between pages (Its90 coefficients only).

Press '**Menu**' key to exit configuration mode and return to measurement mode.

4.1.3.6 Edit temperature conversion algorithm and coefficients

Select '**Edit**' from the channel set up using the appropriate soft key.

The password enter menu will be displayed.

Password 0000			
<	-	+	>

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to enter the password (Default password 9900).

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

On exit from the coefficient edit menu the password protection is reset.

On entering the correct password the resistance to temperature option menu will be displayed.

Chx	PRT	Din
Din	ITS90	CvD

Select the temperature conversion method using the appropriate soft key, the coefficient selection edit menu will be displayed.

Chx		PRT	Din
A	B	C	R0

Select the required coefficient to edit using the appropriate soft key; the coefficient edit menu will be displayed.

Coef A = +3.908300e-03			
<	-	+	>

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to select the next coefficient to edit.

Press the '**Menu**' key, the save changes option menu will be displayed.

Save changes	
Yes	No

Press the '**Yes**' soft key to save changes to memory.

Press the '**No**' soft key to discard the changes.

If a smart probe is detected the changes will be saved in the smart probe, if a passive probe is detected the changes will be saved into the instrument channel configuration.

The select another channel options menu will be displayed.

Another Channel?	
Yes	No

Press the '**Yes**' soft key the channel selection menu will be displayed.

Press the '**No**' soft key to exit configuration mode and return to measurement mode.

```
Chan 1
<        -        +        >
```

Press the ' **−** ' or '**+**' soft key to decrement or increment the channel number.
Press the '**Enter**' key to select the input channel and return to the channel set up menu.

4.1.4 Statistics

The instrument automatically records maximum and minimum readings during its operating period.

Select the Statistics menu using the '**Menu**' key.

```
Statistics
        Min            Max
```

Press the '**Min**' soft key to display the current minimum value.
Press the '**Max**' soft key to display the current maximum value.
Press the '**Clear**' key to clear the current statistical values.
Press the '**Menu**' key to exit configuration mode and return to measurement mode.
The statistical values are also cleared when the units are changed and at power on.

4.1.5 Options

From the Options menu you can select to calibrate the instrument, set the RS232 communication talk only mode or review the model number, firmware version and instrument serial number.

Select the Options menu using the '**Menu**' key.

```
Options
Cal            Com            Ver
```

4.1.5.1 Calibrate the instrument

Refer to Section 6 to calibrate the instrument.

4.1.5.2 Talk only mode

In Talk only mode the instrument ignores all received serial communication commands, on completion of each measurement cycle the channel number, measurement value and units are automatically output over the RS232 serial communication port.

Select the '**Com**' soft key; the Talk only selection menu is displayed.

```
Talk only Off
        On            Off
```

Press the '**On**' soft key to set RS232 serial communication Talk only mode on.
Press the '**Off**' soft key to set RS232 serial communication Talk only mode off.
Press the '**Menu**' key to exit configuration mode and return to measurement mode.

4.1.5.3 Firmware Version

Select the 'Ver' soft key, the instrument firmware version,

```
V1.1C    6August03
Serial No 1005
```

firmware date and instrument serial number are displayed.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

Smart Probe review menu option is not available in A-B measurement mode.

4.1.6 Smart Probe review

The smart probe review menu allows the user to quickly

```
Smart Probe
        Review
```

view the smart probe data.

Select the smart probe review menu using the '**Menu**' key.

Press the '**Review**' soft key to enter the smart probe

review menu.

```
Version = 1      lock = 0
Cal type :       Din
```

Press the '**Enter**' key repeatedly to step through the

data review pages.

Version   Smart probe data format.

Lock   Password protection state.

0 = smart probe data locked can not be changed from the instrument.

1 = smart probe data unlocked can be changed from the instrument.

Cal type   Selected method of resistance to temperature conversion algorithm to use, Din,

ITS90 or CvD.

The temperature conversion coefficients can be

```
Cal date:         dd-mm-yyyy
Due date:         dd-mm-yyyy
```

reviewed from the channel set up menu.

Cal date   Date of the smart probe calibration.

Due date   Date the smart probe calibration is

```
Source:
ASL
```

next due.

Source   Company whom carried out the smart

```
Serial Number:
ASL123456
```

probe calibration.

```
Max since cal:
Min since cal:
```

Serial Number Serial number of the smart probe.

Max since cal Maximum recorded temperature the smart probe has been exposed to since it was

last calibrated (units are in resistance).

Min since cal Minimum recorded temperature the smart probe has been exposed to since it was

last calibrated (units are in resistance).

Max ever   Maximum recorded temperature the smart

probe has been exposed to during its

working life (units are in resistance).

```
Max ever:
Min ever:
```

Min ever   Minimum recorded temperature the smart probe has been exposed to during its

working life (units are in resistance).

Press the '**Menu**' key at any point to exit configuration mode and return to measurement mode.

4.1.7 Real Time Clock

The instrument maintains the date and time from its internal real time clock.

Select the Real Time Clock menu using the '**Menu**' key.

```
Real Time Clock
          Date            Time
```

4.1.7.1 Date Setting

Select the '**Date**' soft key, the date edit menu showing the current date will be displayed.

```
Date = dd/mm/yy
<        -        +        >
```

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to save the new date and return to the real time clock menu.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

4.1.7.2 Time Setting

Select the '**Time**' soft key, the time edit menu showing the current time will be displayed.

```
Time = hh/mm/ss
<        -        +        >
```

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to save the new time and return to the real time clock menu.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

4.1.8 Display Brightness

The intensity of the vacuum fluorescent display can be adjusted to suit the working environment. The pre-set level is stored in non-volatile memory and recalled at power on.

Select the Brightness menu using the '**Menu**' key.

```
Brightness
          -                    +
```

Press the ' **-** ' soft key to decrease the display brightness.

Press the '**+**' soft key to increase the display brightness.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

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5. Instrument Measurement Range

5.1 Instrument measurement working range

The instrument measurement circuit can detect the following conditions Open Circuit Probe, Over Range measurement and Under Range measurement.

5.2 Open Circuit Probes

Open circuit input channels and open circuit probes are reported as No Probe on the display and over the communication interface.

Over Range measurements are reported as O_Range on the display and over the communication interface.

Under Range measurements are reported as U_Range on the display and over the communication interface.

5.3 Measurement Range

Measurement Units	Conversion	Under Range	Over Range	Units
Resistance	None	0	410	ohms
Temperature	Din90	-201	+851	C
	CvD	-201	+850	C
	ITS90	-201	+963	C

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6. Smart Probes

6.1 About Smart Probes

Smart probes are like passive probes except for one key advantage, all the probe details, calibration data and probe history are stored within the probe and not within the measurement instrument. Smart probes can freely be moved from channel to channel or instrument to instrument without the need to manually enter any data into the measurement instrument.

6.2 How Smart Probes Work

Each smart probe if fitted with a small none volatile memory device, this device is transparent during temperature measurements.

Before each measurement cycle the probe is interrogated, if a smart probe is detected an '**s**' is displayed in the bottom left hand corner of the display. The probe data is read into the measurement instrument for use in the measurement process.

6.3 Smart Probe Data Security

To maintain a high level of data security the smart probe has a built in data Lock. If the data lock is set, the smart probe data cannot be modified.

The state of the data Lock can only be changed from a PC via the F200 serial communication port using ASL Smart Probe Edit software or a standard PC serial communication terminal program.

Lock = 0   Probe unlocked data can be modified.

Lock = 1   Probe locked data cannot be modified.

6.4 Smart Probe Calibration Supervisor

To assist in maintain a valid calibration the instrument checks the smart probe next calibration date and compares it with the instruments current date. If the smart probe date is found to have expired the instrument will warn the operator 'Probe is out of calibration'.

6.5 Smart Probe Working Range Monitor

The smart probe working range monitor is used to monitor if a smart probe is used outside its specified working range.

On completion of each measurement, the new reading is compared with the probe working range. If the new reading is found to be outside the probe working range, the appropriate data fields are updated.

6.6 Review Edit Data

The smart probe data can be reviewed or edited in a number of ways

- o Review the data from the F200 Smart Probe menu refer to section 4.1.6.
- o Review or edit the temperature conversion method and coefficients from the F200 channel set up menu, refer to section 4.1.3.
- o Review or edit the data from a PC via the F200 serial communication port using the ASL Smart Probe Edit software.
- o Review or edit the data from a PC via the F200 serial communication port using a standard PC serial communication terminal program refer to section 8.

6.7 Smart Probe Data

Lock

Store the smart probe data Lock State, maintain a high level of data security.

Format

SENSe:FRTD:FORmat

Store the smart probe data format, for use in maintaining future compatibility.

Probe ID

SENSe:FRTD:IDENtification

Store the smart probe identification number, 20 characters maximum.

Conversion Standard

SENSe:FRTD:STANdard

Store the required resistance to temperature conversion method, Din, CvD or ITS90.

Coefficient Ap, Bp, Cp, Dp, R0.01, Wt, An, Bn

SENSe:FRTD:COEFficient

Store the required coefficient for use in resistance to temperature conversion.

Conversion	**Temperature Range**	Required Coefficients
Din	-200°C to 850°C	R0, A, B, C.
CvD	-200°C to 850°C	R0, A, B, C.
ITS90	83.8058K to 273.16K	R0.01, An, Bn.
ITS90	273.15K to 961.78°C	R0.01, Ap, Bp, Cp, Dp, Wt.
ITS90	273.15K to 660.323°C	R0.01, Ap, Bp, Cp.
ITS90	273.15K to 419.527°C	R0.01, Ap, Bp.
ITS90	273.15K to 231.928°C	R0.01, Ap, Bp.
ITS90	273.15K to 156.59865°C	R0.01, Ap.
ITS90	273.15K to 29.7646°C	R0.01, Ap.
ITS90	234.3156K to 29.7646°C	R0.01, Ap, Bp.

Min working range

SENSe:FRTD:RANGe

Store the smart probe working range minimum value, range 0 to 400 ohms.

Max working range

SENSe:FRTD:RANGe

Store the smart probe working range maximum value, range 0 to 400 ohms.

Min since last cal

Record the minimum value the smart probe exceeded outside its working range since it was last calibrated, automatically reset when the smart probe is wiped.

Max since last cal

Record the maximum value the smart probe exceeded outside its working range since it was last calibrated, automatically reset when the smart probe is wiped.

Min ever

Record the minimum value the smart probe exceeded outside its working range during its working life, automatically reset when the smart probe is wiped.

Max ever

Record the maximum value the smart probe exceeded outside its working range during its working life, automatically reset when the smart probe is wiped.

Date

SENSe:FRTD:CAL:DATE

Store the date the smart probe was calibrated DD/MM/YYYY.

Next Date

SENSe:FRTD:CAL:NEXT

Store the date the smart probe next calibration is due DD/MM/YYYY.

Source

SENSe:FRTD:CAL:SOURce

Store name of the company responsible for the smart probe calibration 20 characters maximum.

Calibration History

SENSe:FRTD:CAL:HISTory?

Maintain the calibration history of the smart probe. The calibration history is automatically updated when the next calibration date is updated. The calibration history is cleared when the probe is wiped.

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7. Calibrating the F200

7.1 F200 Instrument calibration

The dc bridge measurement technique used in the F200 is inherently very stable and linear, better than $\pm$ 4 mΩ over the full range at +20°C ±2°C (equivalent to $\pm$ 10 mK with a Pt100 PRT). However drift of the internal reference resistor will occur with time making periodic re-calibration necessary.

7.1.1 Instrument Calibration Supervisor

To assist in maintain a valid calibration, at power on the instrument next calibration date is compared with the instrument current date. If the next calibration date is found to have expired the instrument will warn the operator.

```
Instrument out
Of Calibration
```

Press the '**No**' soft key to continue if you do not wish to calibrate the instrument.
Press the '**Yes**' soft key to enter the instrument calibration menu, the password enter menu will be displayed.

```
Calibration Now?
      Yes           No
```

7.2 Equipment

Temperature controlled environment at +20°C ±2°C
Calibrated 400 ohm +/- 10 ohm reference resistor at +/- 1 ppm accuracy.

7.3 Calibration procedure

Place the instrument to be calibrated in a +20°C ±2°C temperature controlled environment for at least 60 minutes.

Select thermometer input channel 1 using the '**Ch**' key.
Set the measurement units to resistance using the '**Units**' key.
Select the Options menu using the '**Menu**' key.

```
Options
Cal           Com           Ver
```

Press the '**Cal**' soft key; the Calibration menu will be displayed.

```
Calibration
      Cal           Date
```

Instrument Calibration Date Review

Press the '**Date**' soft key, the instrument Calibration
and Calibration Due date will be displayed.

Cal Date	27-06-2003
Due Date	27-06-2004

Press the '**Enter**' key to return to the calibration menu.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

Press the '**Cal**' soft key, the password enter menu
will be displayed.

Password 0000			
<	-	+	>

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to enter the password (Default password 9900).

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

On exit from the instrument calibration menu the password protection is reset.

On entering the correct password the instrument will
prompt you to attach the reference resistor to input
channel 1.

Attach Ref	
OK	Cancel

Press the '**OK**' soft key when the precision reference resistor is connected to channel 1.

The instrument will now measure the reference resistor and display its value to the nearest 100 ohm's
on the edit menu, from the edit menu enter the actual reference resistor value.

Press the '**<**' or '**>**' soft key to move the flashing cursor
to the required digit.

Ref res 400.0000			
<	-	+	>

Press the ' **−** ' or '**+**' soft key to decrement or increment
the flashing digit.

Press the '**Enter**' key when the actual reference resistor value is correct.

The instrument will calculate the difference between the actual and measured reference resistor
values and apply the correction.

Instrument Calibration Date Setting

(New text and menus add to the end of section 6.3 Calibration procedure)

The instrument will display the Calibration date edit
menu with the instrument current date, to edit the date

Cal Date	dd/mm/yy		
<	-	+	>

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to save the new date and display the Next Calibration menu.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

The instrument will display the Next Calibration date edit menu with the instrument current date incremented by one year, to edit the date.

Next Date	dd/mm/yy	
< -	+	>

Press the '**<**' or '**>**' soft key to move the flashing cursor to the required digit.

Press the ' **−** ' or '**+**' soft key to decrement or increment the flashing digit.

Press the '**Enter**' key to save the new date and return to measurement mode.

Press the '**Menu**' key to exit configuration mode and return to measurement mode.

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8. Communications Interface

8.1 Introduction

The F200 is fitted with an RS-232 serial communication interface as standard.

8.2 Overview of the RS-232 Serial Interface

This conforms to specification ANSI/EIA/TIA-232-E-1991 Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) employing serial binary data interchange.

Signal levels; MARK (logical '1'); -3V to -15V

SPACE (logical '0'); +3V to +15V

Data is transferred using the TXD (transmit data) and RXD (receive data) lines.

Data flow control is by the RTS (request to send) and CTS (clear to send) lines to prevent data loss due to an instrument receiver buffer overflow. RTS is an output from the instrument that indicates its receiver status. When asserted (low), it indicates that it is ready to receive another character. When negated (high), the instrument receiver buffer is full and cannot receive another character until the buffer is processed (if the PC sends one, it may be lost). As soon as space becomes available in the receiver buffer, RTS is re-asserted to allow the PC to send the next character.

When the instrument detects receipt of a command terminator character, RTS is negated whilst the command line buffer is read and validated. This is to prevent the PC sending further characters whilst a command is being validated. Following validation, RTS is re-asserted to permit the next command to be transmitted by the PC.

CTS is an input to the instrument and controls the transmission of characters. If the PC asserts CTS (low), then the instrument will transmit the next character from the output buffer (if one is waiting). If the PC negates CTS (high), then the instrument will not transmit the character, but will wait until CTS is re-asserted. TXD will remain in the mark (low) condition whilst CTS is negated. Note that changing CTS during transmission of a character will not disrupt the transmission of that character.

8.2.1 The RS-232 Connector

RS-232 connection is via a 9-way (plug) D-type connector on the back panel as shown in Figure 8.2.
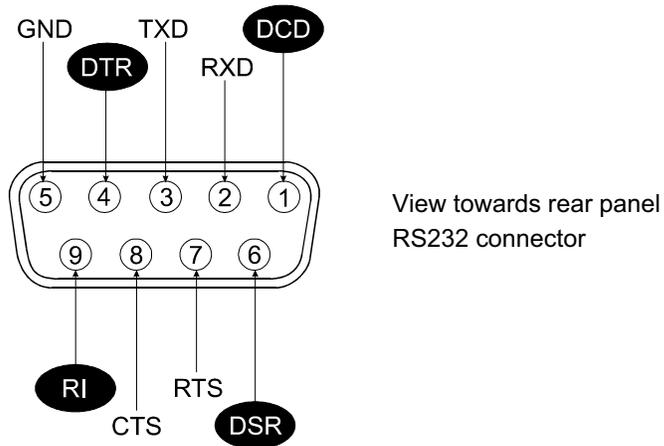
Figure 8.2 - RS-232 Connector

8.2.2 Pin Connections

Computer			Instrument	
25-Pin Connector	9-Pin Connector	Function	9-Pin Connector	Function
3	2	Rx	3	Tx
2	3	Tx	2	Rx
7	5	GND	5	GND
6	6	DSR		
4	7	RTS	8	CTS
5	8	CTS	7	RTS

To make an RS232 connection, use fully screened cable assemblies to maintain EMC integrity. A 5-wire (TXD, RXD, GND, RTS, CTS) cross over cable is recommended.

A 3 wire connection (TXD, RXD, GND) is not recommended, but may be implemented by connecting RTS and CTS together at the instrument end. In this case, the DTE must not send characters too quickly as this will cause the instrument receive buffer to overflow, leading to lost data.

8.3 RS-232 Settings

The RS232 serial interface command set follows the SCPI format.

Input data flow will be controlled via RTS, CTS lines to prevent input buffer overflow occurring.

The instrument can be set to function in one of two serial communication modes, Talk only mode or Remote mode.

8.3.1 Talk only mode (Auto output)

Talk only mode can be set On or Off from the instrument Options menu, its selected state is saved in the instrument internal none-volatile memory and retrieved at power up.

In talk only mode the instrument ignores all incoming commands and remains under local control.

On completion of each measurement the instrument will automatically output the channel number, measurement value and units over the RS232 serial interface port.

Talk only mode is useful for outputting data directly to a serial printer without the need for a PC.

8.3.2 Remote mode (Local lockout)

In Remote mode the instrument can only be controlled over the RS232 serial interface port, the instrument front panel keys are locked out.

To enable Remote mode the instrument must first be set for Remote mode operation.

8.3.3 Power up state

Talk only mode: State recalled from instrument none-volatile memory.

Remote mode: Off.

8.3.4 Communication protocol

Baud rate fixed at 9600

Data bits 8

Stop bit 1

Start bit 1

Parity none

8.3.5 Programming command syntax

The programming command language is based on the SCPI command format. Commands consist of one or more command words with each command word separated by a colon (:), a question mark (?) for a command requiring a response, a white space character used to separate the first parameter from the command words, a list of parameters (<parameter>) with each parameter separated by a comma (,), followed by a command terminator carriage return (CR) or carriage return line feed (CR)(LF).

Colon (:)   Separates command words.

Question mark (?)   Command requires a response.

Comma (,)   Separates parameters list.

8.3.6 Long form short form commands

Command words have a long form and short form version, the short form version is indicated by upper case characters.

Example:

SYSTem:REMote   long form

SYST:REM   short form

8.3.7 Case sensitivity

Command words are not case sensitive, you can use upper or lower case characters or any combination. Example:

SYSTEM:REMOTE = system:remote

8.3.8 Command Terminators (CR) or (CR)(LF)

All commands sent to the instrument must be terminated with a carriage return (CR) character. It is permitted to send (CR)(LF) to terminate a message; the (LF) is ignored.

8.3.9 Input Buffer

The instrument receives messages into an input buffer and only starts executing commands after receipt of a command terminator.

8.3.10 Output Data Format

Non-reading queries	<80 ASCII character string
Reading Temperature	SDDDD.DDD (CR) (LF)
Resistance	SDDD.DDDD (CR) (LF)
Talk Only format	Chx, SDDDD.DDD, "Units" (CR) (LF)
where	Chx = channel number
	S = sign (− negative, blank positive)
	D = decimal Digit (0-9)
	"Units" = selected measurement units C, F, K or R
	(CR) = carriage return character
	(LF) = linefeed character

8.4 RS-232 Interface Commands

8.4.1 SYSTem:REMote

Command	SYST:REM
	SYSTEM:REMOTE
Return	None
Function	Place the instrument in remote mode for RS232 interface control.
	Display rem on the instrument display.
	Abort the current measurement cycle.
	Clear the last reading from the display.
	Clear the output buffer.
	Lock out the instrument front panel keys.
	Set the trigger mode to Single shot.
	Place the instrument in Hold mode.

8.4.2 SYSTem:LOCal

Command	SYST:LOC
	SYSTEM:LOCAL
Return	None
Function	Return the instrument to local mode.
	Remove rem from the instrument display.
	Enable the instrument front panel keys.
	Set the instrument in Hold mode.

8.4.3 *IDN?

Command	*IDN?	
Return	<manufacturer>,<model no>,<serial no>,<firmware version>	
Parameters	<manufacture> ASL	
	<model no>	F200
	<serial no>	Serial number of the instrument.
	<firmware version>	Current firmware version and date.
Function	Read the instrument's identification code consisting of the manufacturer name, instrument model number, instrument serial number, firmware version and date.	

8.4.4 CAL:DATE <year>,<month>,<day>

Command	CAL:DATE <year>,<month>,<day>	
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Return	-203	Password protected
Protection	Password protected command.	
Function	Enter the instrument calibration date.	

8.4.5 CAL:DATE?

Command	CAL:DATE?	
Return	<year>,<month>,<day>	
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Function	Query the instrument calibration date.	

8.4.6 CAL:NEXTDATE <year>,<month>,<day>

Command	CAL:NEXTDATE <year>,<month>,<day>	
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Return	-203	Password protected
Protection	Password protected command.	
Function	Enter the instrument next calibration date. At power up this date is compared with the instrument current date to determine if the instrument calibration date has expired.	

8.4.7 CAL:NEXTDATE?

Command	CAL:NEXTDATE?	
Return	<year>,<month>,<day>	
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Function	Query the instrument next calibration date.	

8.4.8 System Command Summary

Command	Description
SYSTem:PASSword:DEFAult	Sets password to the default value.
SYSTem:PASSword:CENable	Enable protected commands.
SYSTem:PASSword:CENable:STATe?	Queries the password cenable state.
SYSTem:PASSword:CDISable	Disable protected commands.
SYSTem:PASSword:NEW	Change the system password.
SYSTem:BEEPer:IMMediate	Sounds a single beep immediately.
SYSTem:TIME	Sets the internal clock time.
SYSTem:TIME?	Queries the internal clock time.
SYSTem:DATE	Sets the internal clock date.
SYSTem:DATE?	Queries the internal clock date.
CAL:DATE	Sets the instrument calibration date.
CAL:DATE?	Queries the instrument calibration date.
CAL:NEXTDATE	Sets the instrument next calibration date.
CAL:NEXTDATE?	Queries the instrument next calibration date.

8.5 Measurement Command Group

The measurement command group is used to select channels, configure channel parameters and acquire readings.

8.5.1 CONFigure:CHANnel <channel>

Command	CONF:CHAN <channel> CONFIGURE:CHANNEL <channel>
Return	None
Parameters	<channel> 1 to 8 single channel measurement Chx-Chy differential measurement mode.
Function	Select the specified channel to be measured without initiating a measurement, only channels that are available can be selected. Abort the current measurement cycle. Clear the last measurement from the display. Clear the output buffer. Set the instrument to Hold.

8.5.2 CONFigure?

Command	CONF? CONFIGURE?
Return	<channel>,<standard>

Parameters	<channel> 1 to 8 single channel measurement.
	                Chx-Chy differential measurement mode.
	<standard> 1 Din90 (EN60751)
	                2 CvD
	                3 ITS90

Function	Query the current selected channel and its configuration.

8.5.3 FETch?

Command	FET? FETCH?
Return	<channel>,<measurement>,<units>
Parameters	<channel> 1 to 8 single channel measurement X-Y differential measurement mode. <measurement> last measurement value. <units> currently selected units.
Function	Transfer the last reading stored in the instrument's internal memory by the INITiate command to the instrument's output buffer. After reading the memory is cleared and further FETCh? commands do not return anything until a fresh INITiate command is sent.

8.5.4 READ?

Command	READ?
Return	<channel>,<measurement>,<units>

Parameters	<channel>	1 to 8	single channel measurement
		X-Y	differential measurement mode.
	<measurement>		last measurement value.
	<units>		currently selected units.

Function	Initiate a measurement of the current selected input channel, the reading is sent directly to the instrument's output buffer.
	If TRIGger mode is set to SINGle shot, only one reading is taken and the instrument returns to Hold mode.
	If TRIGger mode set to INFinite, continuous readings are taken with all readings sent to the output buffer.

8.5.5 MEASure Command

The MEASure commands work similar to the CONFigure commands, except that an immediate measurement is performed with the result being sent to the output buffer.

8.5.6 MEASure:CHANnel? <channel>

Command	MEAS:CHAN? <channel>
	MEASURE:CHANNEL? <channel>

Parameters	<channel>	1 to 8	single channel measurement
		Chx-Chy	differential measurement mode.

Return	<channel>,<measurement>,<units>

Parameters	<channel>	1 to 8	single channel measurement
		X-Y	differential measurement mode.
	<measurement>		last measurement value.
	<units>		currently selected units.

Function	Abort the current measurement cycle.
	Clear the last measurement from the display.
	Clear the output buffer.
	Select the channel as specified initiate a measurement, the reading is sent directly to the instrument's output buffer.
	If TRIGger mode is set to SINGle shot, only one reading is taken and the instrument returns to Hold mode.
	If TRIGger mode set to INFinite, continuous readings are taken with all readings sent to the output buffer.

8.6 UNIT Command Group

The UNIT command group is used to control the instrument global parameters.

8.6.1 UNIT:TEMPerature \<units\>

Command	UNIT:TEMP \<units\>		
	UNIT:TEMPERATURE \<units\>		
Parameters	\<units\>	C or CEL	Degrees Celcius
		F or FAR	Degrees Fahrenheit
		K	Degrees Kelvin
		R	Resistance
Return	None		
Function	Set the global temperature units.		
	Clear the last measurement from the display.		

8.6.2 UNIT:TEMPerature?

Command	UNIT:TEMP?		
	UNIT:TEMPERATURE?		
Return	\<units\>		
Parameters	\<units\>	C or CEL	Degrees Celcius
		F or FAR	Degrees Fahrenheit
		K	Degrees Kelvin
		R	Resistance
Function	Query the global temperature units.		

8.7 Trigger Command Group

The TRIGger commands are used to control the instruments operation.

8.7.1 INITiate

Command	INIT
	INITIATE
Return	None
Function	Abort the current measurement cycle.

Clear the last measurement from the display.
Clear the output buffer.
Set the trigger mode to Single shot.
Initiate a single measurement of the current selected input channel without returning a reading, up date the instrument display with the new reading.
Return the instrument to Hold.

Use the FETCh? command to transfer the reading to the output buffer.

8.7.2 ABORt

Command	ABOR
	ABORT
Return	None
Function	Abort the current measurement cycle.

Clear the last measurement from the display.
Clear the input and output buffers.
Set the trigger mode to single shot.
Set the instrument to Hold.

8.7.3 TRIGger:MODE <mode>

Command	TRIG:MODE <mode>		
	TRIGGER:MODE <mode>		
Parameters	<mode>	SINGle	Single shot trigger mode
		INFinite	Infinite trigger mode (Run/Hold)
Return	None		
Function	Set the trigger mode to single shot measurement or infinite measurement.		

Setting trigger mode to single shot results in a single measurement when initiated.
In infinite mode continuous measurement are taken when the Measure? or Read? commands are sent.
Abort the current measurement cycle.
Clear the last measurement from the display and output buffer.
Set the trigger mode to the state as defined by the command
Set the instrument to Hold.

8.8 System Related Commands

The SYSTem commands are used to control the instrument none-measurement global parameters.

Protected data   Calibration data, smart probe data.

The instrument will return the error code -203 if a password protected command is received that is currently disabled.

8.8.1 SYSTem:PASSword:DEFAult

Command	SYST:PASS:DEFA
	SYSTEM:PASSWORD:DEFAULT
Return	None
Function	Set the instrument password to the default password.
	Default password = **9900**

8.8.2 SYSTem:PASSword:CENable <password>

Command	SYST:PASS:CEN <password>	
	SYSTEM:PASSWORD:CENABLE <password>	
Parameters	<password>	4 digit numerical string
Return	-221	incorrect password sent
Function	Allow the password protected data to be modified.	

8.8.3 SYSTem:PASSword:CDISable <password>

Command	SYST:PASS:CDIS <password>	
	SYSTEM:PASSWORD:CDISABLE <password>	
Parameters	<password>	4 digit numerical string
Return	-221	incorrect password sent
Function	Prevent the password protected data from being modified.	

8.8.4 SYSTem:PASSword:CENable:STATe?

Command	SYST:PASS:CEN:STAT?	
	SYSTEM:PASSWORD:CENABLE:STATE	
Return	<state>	
Parameters	<state> 0	Password protected commands disabled (default at power up).
	1	Password protected commands enabled.
Function	Query the system command enable state.	

8.8.5 SYSTem:PASSword:NEW <current password>,<new password>

Command	SYST:PASS:NEW <current password>,<new password>
	SYSTEM:PASSWORD:NEW <current password>,<new password>

Parameters	<current password>	4 digit numerical string
	<new password>	4 digit numerical string

Return	-221

Function	Change the system password.

8.8.6 SYSTem:BEEPer:IMMediate

Command	SYST:BEEP:IMM
	SYSTEM:BEEPER:IMMEDIATE

Return	None

Function	Sound a single beep immediately.

8.8.7 SYSTem:TIME <hour>,<minute>,<second>

Command	SYST:TIME <hour>,<minute>,<second>
	SYSTEM:TIME <hour>,<minute>,<second>

Parameters	<hour>	0 to 23 set hours
	<minute>	0 to 59 set minutes
	<second>	0 to 59 set seconds

Return	None

Function	Set the system calendar/clock time value.
	The instrument uses the 24-hour clock format.

8.8.8 SYSTem:TIME?

Command	SYST:TIME?
	SYSTEM:TIME?

Return	<hour>:<minute>:<second>

Parameters	<hour>	0 to 23 set hours
	<minute>	0 to 59 set minutes
	<second>	0 to 59 set seconds

Function	Query the system calendar/clock time value.
	The instrument uses the 24-hour clock format.

8.8.9 SYSTem:DATE <year>, <month>, <day>

Command	SYST:DATE <year>,<month>,<day>
	SYSTEM:DATE <year>,<month>,<day>
Parameters	<year> 4 digit numerical string
	<month> 1 to 12 set minutes
	<day> 1 to 7 set seconds
Return	None
Function	Set the system calendar/clock date value.

8.8.10 SYSTem:DATE?

Command	SYST:DATE?
	SYSTEM:DATE?
Return	<year>,<month>,<day>
Parameters	<year> 4 digit numerical string for year
	<month> 1 to 12 for month
	<day> 1 to 7 for day
Function	Query the system calendar/clock date value.

8.9 SENSe Command Group

The SENSe command group is used to control the instrument measurement parameters.

8.9.1 SENSe:ZERO:AUTO <mode>

Command	SENS:ZERO:AUTO <mode>
	SENSE:ZERO:AUTO <mode>

Parameters	<mode>	1 or ON	Auto-zero mode on
		0 or OFF	Auto-zero mode off

Return None

Function Set the auto-zero mode on or off for relative measurements to a fixed offset. The Zero mode LED on the instrument front panel indicates the current selected mode.

8.9.2 SENSe:ZERO:AUTO?

Command	SENS:ZERO:AUTO?
	SENSE:ZERO:AUTO?

Return <mode>

Parameters	<mode>	1	Auto-zero mode ON
		0	Auto-zero mode OFF

Function Query the auto-zero mode.

8.9.3 SENSe:FRTD:CAL:DATE <year>,<month>,<day>

Command	SENS:FRTD:CAL:DATE <year>,<month>,<day>
	SENSE:FRTD:CALIBRATION:DATE <year>,<month>,<day>

Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day

Return	-203	Password protected
	-222	No smart probe detected

Protection Password protected command.

Function Enter the calibration date to the selected smart probe, save the old calibration date in history. Clear the max and min recorded values outside working range since last cal.

8.9.4 SENSe:FRTD:CAL:DATE?

Command	SENS:FRTD:CAL:DATE?	
	SENSE:FRTD:CALIBRATION:DATE?	
Return	<year>,<month>,<day>	
	-222	No smart probe detected
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Function	Query the calibration date for the selected smart probe.	

8.9.5 SENSe:FRTD:CAL:NEXT <year>,<month>,<day>

Command	SENS:FRTD:CAL:NEXT <year>,<month>,<day>	
	SENSE:FRTD:CALIBRATION:NEXT <year>,<month>,<day>	
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Return	-203	Password protected
	-222	No smart probe detected
Protection	Password protected command.	
Function	Enter the next calibration date to the selected smart probe.	

8.9.6 SENSe:FRTD:CAL:NEXT?

Command	SENS:FRTD:CAL:NEXT?	
	SENSE:FRTD:CALIBRATION:NEXT?	
Return	<year>,<month>,<day>	
	-222	No smart probe detected
Parameters	<year>	4 digit numerical string
	<month>	1 to 12 for month
	<day>	1 to 7 for day
Function	Query the next calibration date for the selected smart probe.	

8.9.7 SENSe:FRTD:CAL:HISTory?

Command	SENS:FRTD:CAL:HIST?	
	SENSE:FRTD:CALIBRATION:HISTORY?	
Return	\<year\>,\<month\>,\<day\> Provided in a list format x dates long.	
	-222	No smart probe detected
Parameters	\<year\>	4 digit numerical string
	\<month\>	1 to 12 for month
	\<day\>	1 to 7 for day
Function	Query the calibration date history for the selected smart probe.	

8.9.8 SENSe:FRTD:CAL:SOURce \<source\>

Command	SENS:FRTD:CAL:SOUR \<source\>	
	SENSE:FRTD:CALIBRATION:SOURCE \<source\>	
Parameters	\<source\>	20 byte maximum ASCII string.
Return	-203	Password protected
	-222	No smart probe detected
Protection	Password protected command.	
Function	Save the calibration source reference code to the selected smart probe.	

8.9.9 SENSe:FRTD:CAL:SOURce?

Command	SENS:FRTD:CAL:SOUR?	
	SENSE:FRTD:CALIBRATION:SOURCE?	
Return	\<source\>	
	-203	Password protected
	-222	No smart probe detected
Parameters	\<source\>	20 byte maximum ASCII string.
Protection	Password protected command.	
Function	Query the calibration source reference code for the selected smart probe.	

8.9.10 SENSe:FRTD:FORMat \<format\>

Command	SENS:FRTD:FORM \<format\>	
	SENSE:FRTD:FORMAT \<format\>	
Parameters	\<format\> 1	Smart probe data format 1.
Return	-203	Password protected
	-222	No smart probe detected
Protection	Password protected command.	
Function	Enter the data code format used for the selected smart probe.	

8.9.11 SENSe:FRTD:FORMat?

Command	SENS:FRTD:FORM?
	SENSE:FRTD:FORMAT?

Return	<format>	
	-222	No smart probe detected

Parameters	<format>	1	Smart probe data format 1.

Function   Query the data code format used for the selected smart probe.

8.9.12 SENSe:FRTD:STANdard <standard>

Command	SENS:FRTD:STAN <standard>
	SENSE:FRTD:STANDARD <standard>

Parameters	<standard>	1	Din90 (EN60751)
		2	CvD
		3	ITS90

Return   None

Protection   Password protected command.

Function   Set the selected channel temperature conversion method.
Smart probe input save to smart probe.
None smart probe input save to instrument internal channel configuration.

8.9.13 SENSe:FRTD:STANdard?

Command	SENS:FRTD:STAN?
	SENSE:FRTD:STANDARD?

Return   <standard>

Parameters	<standard>	1	Din90 (EN60751)
		2	CvD
		3	ITS90

Function   Query the selected channel temperature conversion method.
Smart probe input query the smart probe.
None smart probe input query the instrument internal channel configuration.

8.9.14 SENSe:FRTD:COEFficient <coefficient>,<value>

Command	SENS:FRTD:COEF <coefficient>,<value>	
	SENSE:FRTD:COEFFICIENT <coefficient>,<value>	
Parameters	<coefficient>	Ap, Bp, Cp, Dp, R0, Wt, An or Bn
	<value>	Scientific notation to six decimal places eg 3.908300e-03
		R0 as a decimal to six decimal places eg 100.123456
Return	None	
Protection	Password protected command.	
Function	Set the selected input channel specified coefficient value.	
	Smart probe input save to smart probe.	
	None smart probe input save to instrument internal channel configuration.	

8.9.15 SENSe:FRTD:COEFficient? <coefficient>

Command	SENS:FRTD:COEF? <coefficient>	
	SENSE:FRTD:COEFFICIENT? <coefficient>	
Parameters	<coefficient>	Ap, Bp, Cp, Dp, R0, Wt, An, Bn or all
Return	<value>	Scientific notation to six decimal places eg 3.908300e-03
		R0 as a decimal to six decimal places eg 100.123456
Function	Query the selected input channel specified coefficient value.	
	Smart probe input query the smart probe.	
	None smart probe input query the instrument internal channel configuration.	

8.9.16 SENSe:FRTD:IDENtification <identification>

Command	SENS:FRTD:IDEN <identification>	
	SENSE:FRTD:IDENTIFICATION <identification>	
Parameters	<identification> 20 byte maximum ASCII string	
Return	-203	Password protected
	-222	No smart probe detected
Protection	Password protected command.	
Function	Enter the identification number to the selected smart probe.	

8.9.17 SENSe:FRTD:IDENtification?

Command	SENS:FRTD:IDEN?	
	SENSE:FRTD:IDENTIFICATION?	
Return	<identification>	
	-222	No smart probe detected
Parameters	<identification>	20 byte maximum ASCII string
Function	Query the identification number for the selected smart probe.	

8.9.18 SENSe:FRTD:RANGe <rmax>,<rmin>

Command	SENS:FRTD:RANG <rmax>,<rmin>	
	SENSE:FRTD:RANGE <rmax>,<rmin>	
Parameters	<rmax>	0 to 400 ohm's
	<rmin>	0 to 400 ohm's
Return	-203	Password protected
	-222	No smart probe detected
Protection	Password protected command.	
Function	Enter the working range of the selected smart probe.	

8.9.19 SENSe:FRTD:RANGe?

Command	SENS:FRTD:RANG?	
	SENSE:FRTD:RANGE?	
Return	<rmax>,<rmin>	smart probe working range
	<rmax>,<rmin>	recorded value outside working range since last cal
	<rmax>,<rmin>	recorded value outside working range ever
	-222	No smart probe detected
Parameters	<rmax>	0 to 400 ohm's
	<rmin>	0 to 400 ohm's
Protection	Password protected command.	
Function	Query the working range and working history of the smart probe.	

8.9.20 SENSe:FRTD:LOCK

Command	SENS:FRTD:LOCK <state>		
	SENSE:FRTD:LOCK <state>		
Parameters	<state>	0	Smart probe data unlocked
		1	Smart probe data locked
Return	-203		Password protected
	-222		No smart probe detected
Protection	Password protected command.		
Function	Set the smart probe data protection state, before any smart probe data can be changed it must first be unlocked.		

8.9.21 SENSe:FRTD:LOCK?

Command	SENS:FRTD:LOCK?		
	SENSE:FRTD:LOCK?		
Return	<state>		
Parameters	<state>	0	Smart probe data unlocked
		1	Smart probe data locked
		-222	No smart probe detected
Function	Query the smart probe data protection lock state.		

8.9.22 Command summary

Measurement command summary

Command	Description
CONFigure:CHANnel	Select the specified channel.
CONFigure?	Query the channel configuration.
FETCh?	Fetch a single reading.
READ?	Initiate a measurement and fetch a reading.
MEASure:CHANnel?	Select the specified channel. Initiate a measurement and fetch a reading.

Unit command summary

Command	Description
UNIT:TEMPerature	Sets the temperature units to be used.
UNIT:TEMPerature?	Queries the temperature units.

Trigger command summary

Command	Description
INITiate	Initiate a single measurement.
ABORt	Abort the current measurement.
TRIGger:MODE	Sets the trigger mode.
TRIGger:MODE?	Queries the trigger mode.

System Command Summary

Command	Description
SYSTem:PASSword:DEFAult	Sets password to the default value.
SYSTem:PASSword:CENable	Enable protected commands.
SYSTem:PASSword:CENable:STATe?	Queries the password cenable state.
SYSTem:PASSword:CDISable	Disable protected commands.
SYSTem:PASSword:NEW	Change the system password.
SYSTem:BEEPer:IMMediate	Sounds a single beep immediately.
SYSTem:TIME	Sets the internal clock time.
SYSTem:TIME?	Queries the internal clock time.
SYSTem:DATE	Sets the internal clock date.
SYSTem:DATE?	Queries the internal clock date.

Sense Command Summary

Command	Description
SENSe:ZERO:AUTO	Sets the auto-zero measurement mode.
SENSe:ZERO:AUTO?	Queries the auto-zero measurement mode.
SENSe:FRTD:LOCK	Set the smart probe data lock state.
SENSe:FRTD;LOCK?	Query the smart probe data lock state.
SENSe:FRTD:CAL:DATE	Sets the smart probe calibration date.
SENSe:FRTD:CAL:DATE?	Queries the smart probe calibration date.
SENSe:FRTD:CAL:NEXT	Sets the smart probe next calibration date.
SENSe:FRTD:CAL:NEXT?	Queries the smart probe next calibration date.
SENSe:FRTD:CAL:HISTory?	Queries the smart probe calibration date history.
SENSe:FRTD:CAL:SOURce	Sets the calibration company reference code.
SENSe:FRTD:CAL:SOURce?	Queries the calibration company reference code.
SENSe:FRTD:FORMat	Sets the data format code in the smart probe.
SENSe:FRTD:FORMat?	Queries the data format code in the smart probe.
SENSe:FRTD:STANdard	Sets the temperature conversion type.
SENSe:FRTD:STANdard?	Queries the temperature conversion type.
SENSe:FRTD:COEFficient	Sets the temperature conversion coefficients.
SENSe:FRTD:COEFficient?	Queries the temperature conversion coefficients.
SENSe:FRTD:IDENtification	Sets the smart probe identification number.
SENSe:FRTD:IDENtification?	Queries the smart probe identification number.
SENSe:FRTD:RANGe	Sets the smart probe working range.
SENSe:FRTD:RANGe?	Queries the smart probe working history.

9. Options and Accessories

9.1 Accessories

The following expansion may be retrofitted to the F200:

Order Suffix	Description
F200-2/8	Expansion from 2 to 8 channels

Other options available for the F200 include:

Part Number	Description
FA-SMART	Smart connector
FA-DIN5	5-pin DIN plug
FA-ADAP-250	Adaptor box to allow connection to spade terminal or free wire terminated PRTs
F200-CAL-A	UKAS system calibration at -50, 0, +100 & +250°C
F200-CAL-B	UKAS system calibration at -70, 0, +100 & +450°C
FA-SC200	Soft carry case
EXT-C	Probe extension cable (DIN/DIN)

A range of standard probes are available:

Order Suffix	Description
T100-200-1S	100Ω un-calibrated PRT range –50 to +200°C Smart connector
T100-200-1S-NAM	100Ω PRT UKAS calibration at –50 to +200°C Smart connector
T100-250-1S	100Ω un-calibrated PRT range –50 to +250°C Smart connector
T100-250-1S-NAM	100Ω PRT UKAS calibration at –50 to +250°C Smart connector
T100-450-1S	100Ω un-calibrated PRT range –70 to +450°C Smart connector
T100-450-1S-NAM	100Ω PRT UKAS calibration at –70 to +450°C Smart connector

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10. Specification

10.1 Resistance thermometer measurement

PRT Characterisation	ITS90
	Din90 BS EN60751:1996, IEC60751:1983
	CvD BSEN1904:1984, IEC751:1983
Resistance measurement range	1 to 400 ohm
Temperature measurement range	ITS90 -200 to +962ºC
	Din90 -200 to +850ºC
	CvD -150 to +850ºC
Display resolution	0.001ºC
Resistance measurement uncertainty	± 4mΩ (@ +20˚C ±5˚C)
Temperature coefficient (resistance measurement)	0.2ppm/°C (0.05mK/°C)
Long term stability (resistance measurement)	± 25ppm (±2.5mΩ) / year
Temperature measurement uncertainty Pt100	Over -200 to +800ºC ± 0.01ºC
Pt100 sense current	1mA (DC) polarity switchable
User selectable measurement display units	R/ºC/ ºF/ K
Input channels	2, 4 or 8 expandable
Input connection	5 pin DIN
Measurement configuration	4 wire
Input impedance	>10M Ω
Max common and differential mode input voltage	±40VDC, 28Vrms

10.2 Display

User interface, display	128 x 18 High brightness dot graphic VFD display

10.3 Supply

Mains supply voltage range	90 – 264Vac
Power consumption:	30VA max
Supply frequency range	47 - 63Hz

10.4 Environmental

Storage temperature range	-20ºC to +50ºC
Service temperature range	0ºC to +40ºC
Specified operating temperature range	+15ºC to +25ºC
Operating relative humidity conditions	<80% RH, non-condensing

10.5 Dimensions

All dimensions in millimetres.

Weight:	1kg (2.2lbs)
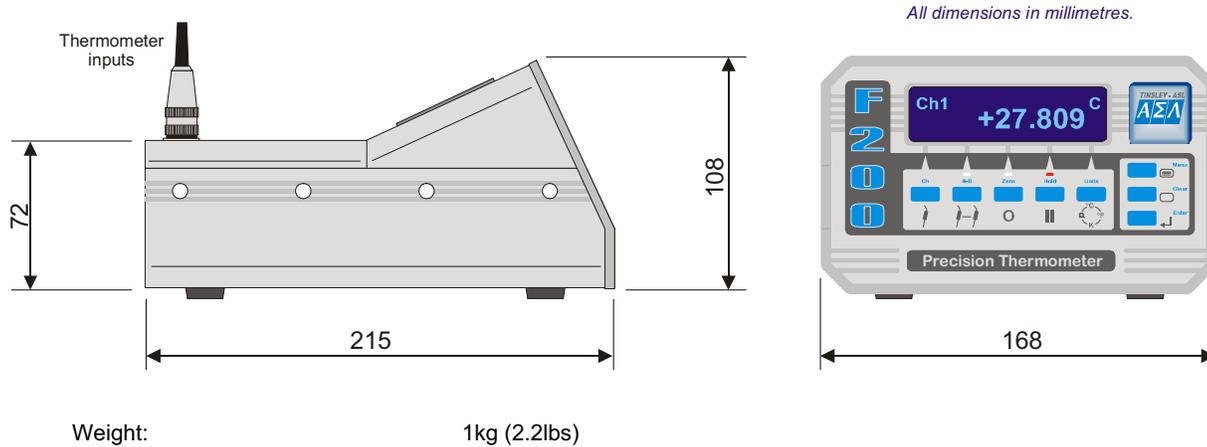
10.6 Pt 100 System Accuracy

System accuracy is the combined accuracy of the F200 plus the calibration uncertainty of the PRT. Accurate figures for the instrument and system with the range of calibrated PRTs available for the F200 are shown below. These figures are based on a 1 year measurement uncertainty for the F200 of ±4 mΩ which is equivalent to ±10mK with PT100 PRT

F200 + T100-250-1 PRT (-50°C to +250°C)

-50°C	0°C	+100°C	+250°C
±20mK	±20mK	±20mK	±20mK

F200 + T100-450 1 PRT (-70°C to +450°C)

-70°C	-40°C	0°C	+100°C	+250°C	+450°C
±40mK	±20mK	±20mK	±20mK	±20mK	±100mK

11. Cleaning and Maintenance

11.1 Cleaning

Make sure the F200 is disconnected from the mains supply before cleaning.

Clean the outside of the instrument with a soft, clean cloth dampened with mild detergent. Do not allow water to enter the instrument.

WARNING: Never use alcohol or thinners as these will damage the instrument.

Never use a hard or abrasive brush.

11.2 Preventive Maintenance

WARNING: Inspect the mains supply cable regularly to ensure that insulation is not damaged.

11.3 General Safety Warning

WARNING: If the F200 is used in a manner not specified by ASL, then the protection provided by the instrument may be impaired.

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12. Service and Warranty

F200 equipment and accessories, (unless stated otherwise), are covered by a 12 month warranty for parts and labour from the date of dispatch from ASL. This warranty does not include costs incurred in returning the equipment to the factory for repair.

12.1 Technical Support

For all technical support, repair, warranty and service inquiries please contact:

Customer Support Group
ASL.
275 King Henry's Drive
New Addington
Croydon
Surrey
CR0 0AE
UNITED KINGDOM

Telephone: +44 (0)1689 800799
Fax: +44 (0)1689 800405

E-Mail: service@aslltd.co.uk

Web Page: www.aslltd.co.uk

12.2 Returned Instruments

All returned goods should be sent carriage paid, insured and packed well, to the above address.

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