Thermal Uniformity Survey

Auto Report Generating Software

User Guide

invensys®
EUROTHERM®

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THERMAL UNIFORMITY SURVEY (TUS)

USER GUIDE

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TUS AUTO REPORT GENERATOR

1 INTRODUCTION

This product combines an application specific configuration of Eurotherm Report with UHH files produced in Eurotherm Field Test Instrumentation to produce a Temperature Uniformity Survey report which can be used for the purpose of Nadcap compliant Thermal Surveys and other heat treatment related applications.

The report is suitable for use with up to 48 Survey Sensors and up to 7 survey setpoints – across a single zone of operation. Appending the report with additional detail for separate zone instrumentation and controller performance can generate multi zone furnace reports.

The software is required by heat treatment providers in the Aerospace Industry to automate the production of Temperature Uniformity Survey reports and provides an efficient way to produce reports of a standard compliant format with equipment specific data.

1.1 REQUIREMENTS FOR TUS AUTO REPORT GENERATOR

The TUS is a Microsoft Excel workbook with a VBA code implemented to generate the printed report. It has been developed using Microsoft Windows XP Professional using Excel 2003. The thermal data is taken from the Eurotherm Review database using the Eurotherm Report package to interface between the Review database and the TUS application workbook. To run the report Report and TUS must be loaded onto the reporting pc and access to the necessary review database is required either locally or via a remote connection.

1.2 ORDER CODE

The order code is 6000PLUS/TUS.

This order code delivers two CDs as part of the Eurotherm 6000 family of software products
CD 1 Eurotherm Report
CD 2 Temperature Uniformity Survey Auto Report Generator template.

6000PLUS/TUS is sold as a single site user licence where the TUS Excel template on CD 2 can be transferred to other machines on the same site.

All machines running the Excel Template must have a single user licence of Eurotherm Report.

For additional site machines Eurotherm Report can be purchased separately, under order code 6000PLUS/REPORT.

1.3 APPLICATION SOFTWARE

The application software is designed to function using the following:-

1.3.1 Operating Systems

Microsoft Windows XP Professional SP2 (preferred)

1.3.2 Minimum hardware requirements

Pentium 3 800MHz,
256MByte RAM
2GByte free space on hard drive

1.3.3 Microsoft Excel

Excel 2003

1.3.4 Eurotherm Software

Review (Full or 'Lite'): V3.7.4 or above.
Report Issue 6 or above.

2 SET-UP INSTRUCTIONS

The TUS Auto Report Generator is set up in two phases, firstly report setup, then report generation.

In report setup the users is prompted to fill in a number of survey specific pages which relate to the thermal processing equipment under test.

A description of the information required in the test setup pages follows.

Unless defined as optional, information must be entered in to all fields to meet the requirements of the report as defined in AMS2750D, Section 3.5.21.1.

2.1 THERMAL SURVEY REPORT DATA ENTRY PAGE

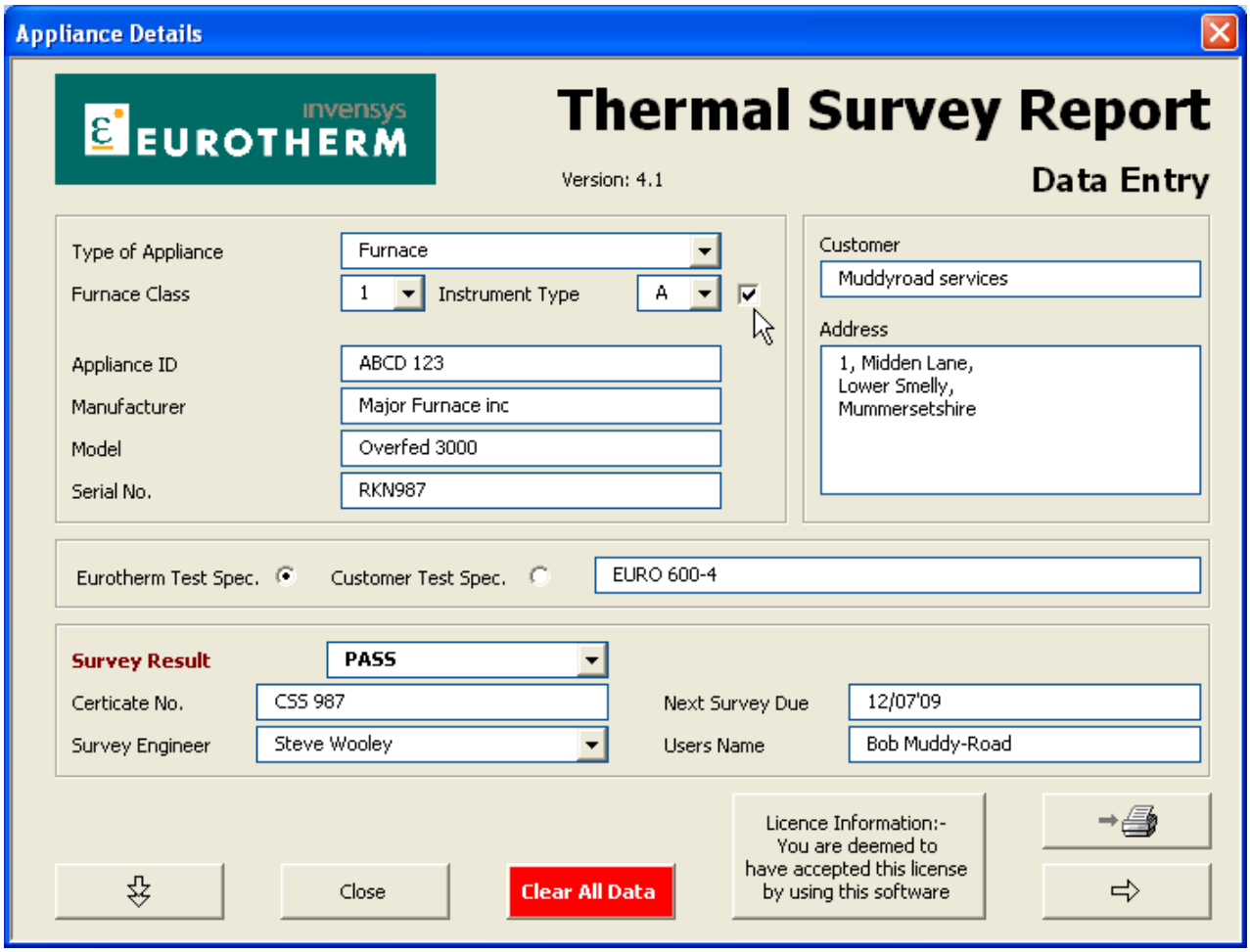


Figure 2.1 Report data entry page

2.1.1 Data Entry Page Fields

Type of Appliance	Details for the appliance types can be entered from a drop down list, The list may be edited in the Thermal Survey Report initial setup page “Appliance Types” Tab.
Furnace class	This field is enable by clicking in the associated tick box (figure 2.1), and allows the user to select a Furnace class to be selected from a drop-down list. Used for AMS2750D surveys.
Instrument type	Similar to ‘Furnace Class’ above, but for instrument type,
Appliance ID	Allows the user to enter a reference string to identify the plant property number.
Manufacturer	Optional entry of the name of the thermal processing equipment manufacturer.
Model	Optional entry of the thermal processing equipment model number.
Serial No	Optional entry of the thermal processing equipment serial number.
Customer	Allows entry of the name of the customer for whom the report is being provided.
Address	Entry of the address of the customer for whom the report is being provided.
Test specification	Tick the radio button associated with the authorising testing specification. The choices are either the service providers own quality standards procedure or those of the customer. A space is available for the entry of the relevant specification reference.
Survey Results	This is not an automatic pass/fail identification but is entered by the authorising agent of the TUS Automatic Report Generator service provider. The Pass/Fail status of the report is selected from a drop-down list.
Certificate Number	Enter a unique certificate number for the report to be generated.
Survey Engineer	Select the name of the Survey Engineer who conducted the test from a drop down list. The list may be edited in the Thermal Survey Report initial setup page Survey Engineers Tab (section 2.2.5).
Next Survey due	Enter the date for the next scheduled survey.
Users Name	Enter the name of the person responsible for the day-to-day use of the equipment.

2.1.2 Licence agreement

TUS Automatic Report Generator is a single site licence and the Excel Template may be transferred across machines on individual customer sites.
The application requires Eurotherm Report to be resident on the machine and access to the Review database, which can either be local to the report machine or available over the network.
Eurotherm Report software is a single user licence and a separate copy must be obtained for each machine which is required to run the TUS software.

2.1.3 Navigation

The double down arrow navigates to the initial setup pages (section .2.2).
The Close button closes the report setup form.
The “Clear All Data” button clears all data from the printed report.
The Single right arrow button navigates to the data source page (section 2.3)
The Print button navigates to the print option page (section 2.6).

2.2 INITIAL SETUP

By pressing the double down arrow on the initial data entry screen (figure 2.1, above) the 'Initial Setup' screen is displayed. This allows initial settings to be entered by the service providing company. Once this has been saved the screen will not be required again, except for any future modifications.

2.2.1 Company Details Tab

The Company Details Tab allows the Company details to be entered to give corporate identity to the report document once printed.

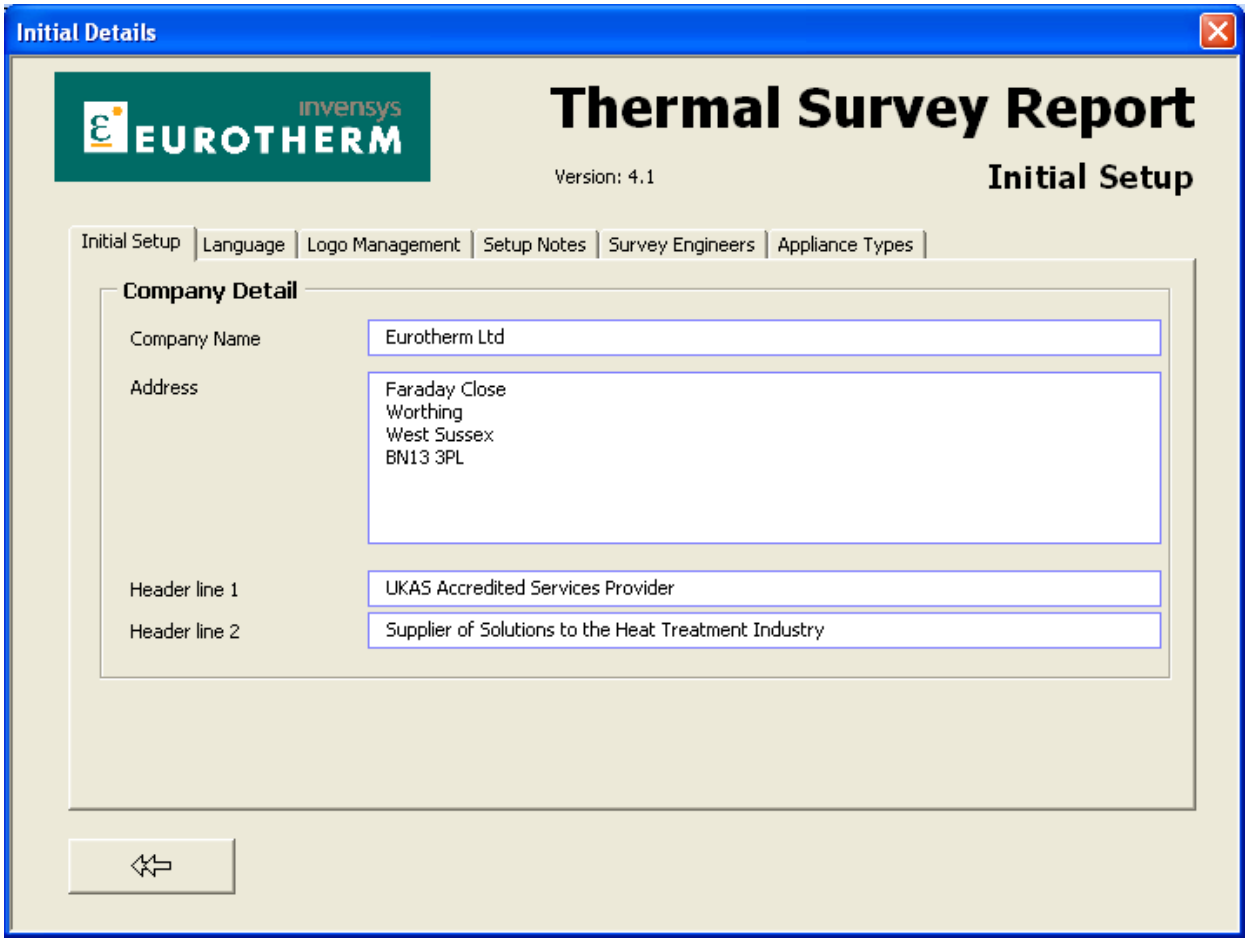


Figure 2.2.1 Initial setup tab

ENTRY FIELDS

Company Name	This is placed, with the company address details, at the bottom of the first page of the report.
Details	This is the entry of up to 5 lines of address information at the bottom of the first page of the report.
Header line 1	This allows the entry of text (typically company name) that is seen in bold at the top of the first page of the report.
Header line 2	This allows the entry of text (typically a company statement) that is seen in bold at the top of the first page of the report.

The Double arrow key is used to return to the Data Entry page described in section 2.1.

2.2.2 Language tab

Allows the user to select the language for the report software and also the temperature units and time format to be used. All selections are made using drop-down list selection.

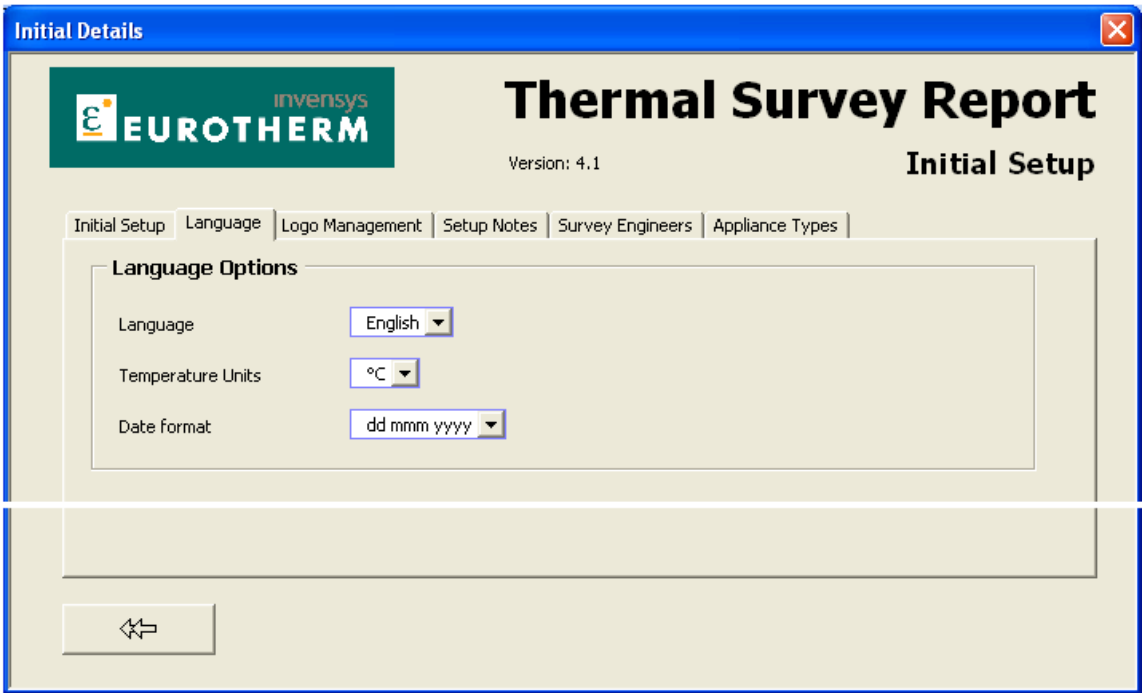


Figure 2.2.2 Language tab

2.2.3 Logo Management tab

The Logo Management tab allows the insertion of image files into the printed report. These are imported and stored within the program and are not required to be available at run time. All/any of these fields can be left blank if wished

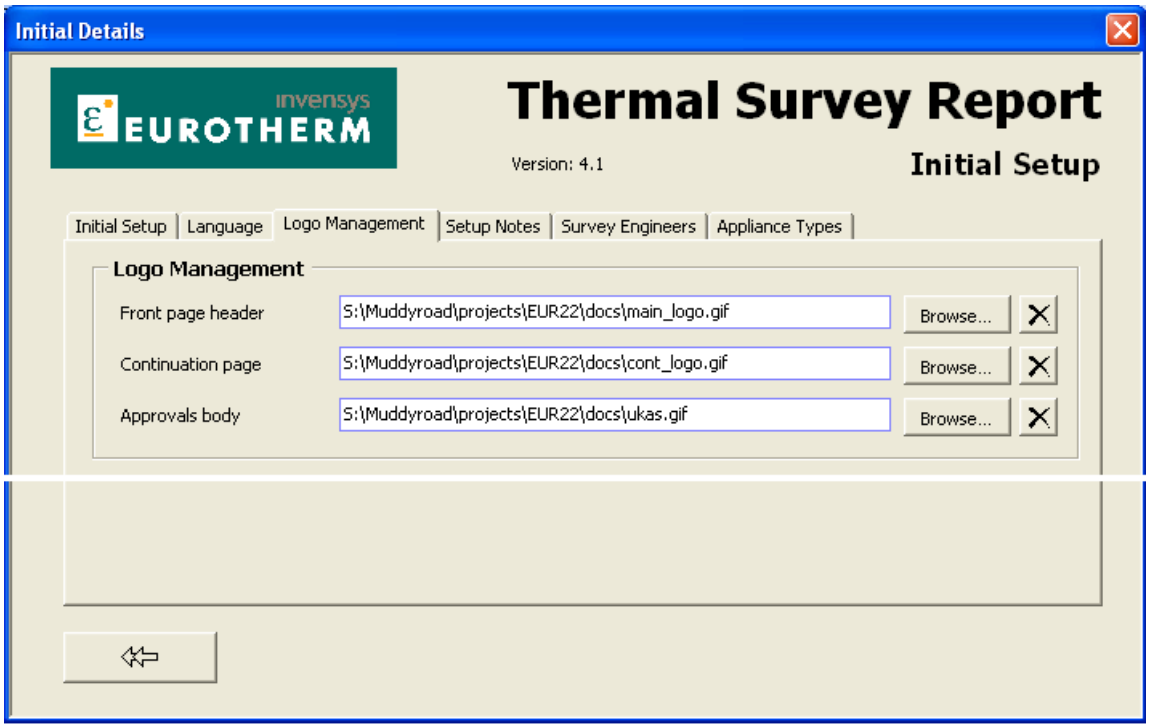


Figure 2.2.3 Logo Management tab

2.2.3 LOGO MANAGEMENT TAB (Cont.)

Front page header — This is the image seen at the top of the first page of the report. This is typically the full company logo.

Continuation page — This is the image seen at the top of all remaining pages of the report. This is typically a smaller company logo.

Approvals body — This is the image seen at the bottom of all pages of the report. This is typically the quality system logo.

2.2.4 Setup Notes tab

The Setup Notes tab allows the insertion of specific fixed notes that the survey engineer is able to select as required using drop down lists. Five of these notes can be configured All/any of these fields can be left blank if wished.

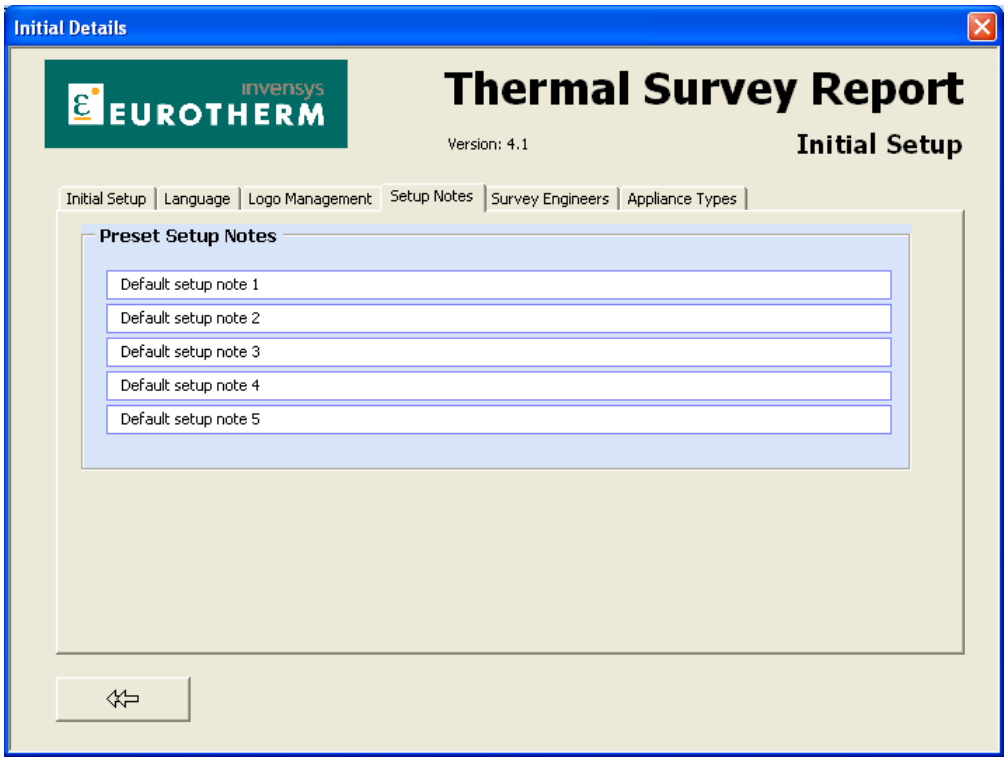


Figure 2.2.4 Setup notes tab screen

2.2.5 Survey Engineers tab

This allows the user to type in up to ten names to appear in the drop-down list in the Survey Result area of the Data entry page described in section 2.1 All/any of these fields can be left blank if wished.

Note for AMS2750D the name of the survey engineer must be shown on the report.

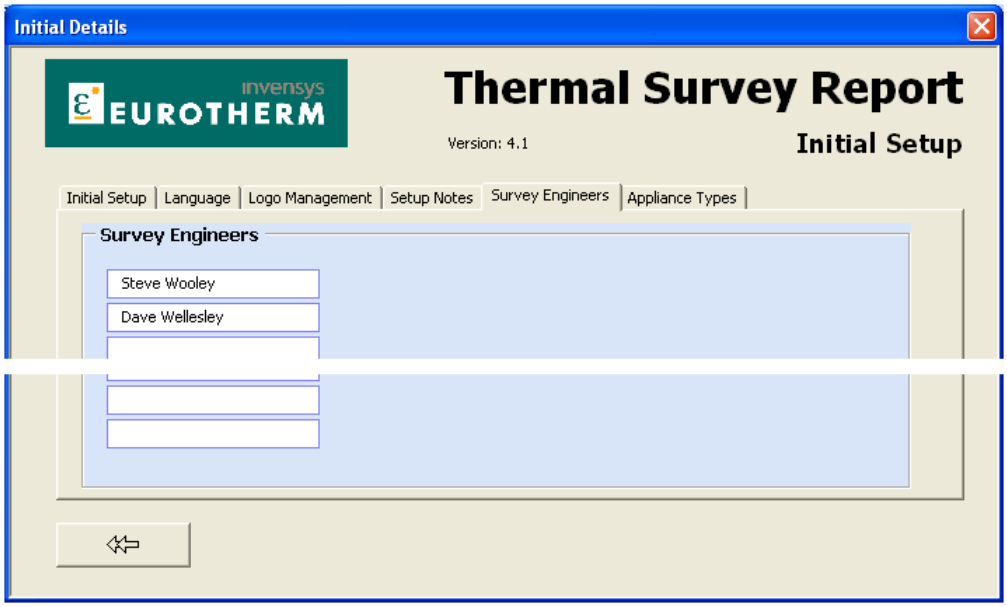


Figure 2.2.5 Survey Engineers tab

2.2.6 Appliance Types tab

The Appliance Types screen allows the insertion the type of equipment that is being surveyed names and allows the user to select as required using drop down lists. All/any of these fields can be left blank as required.

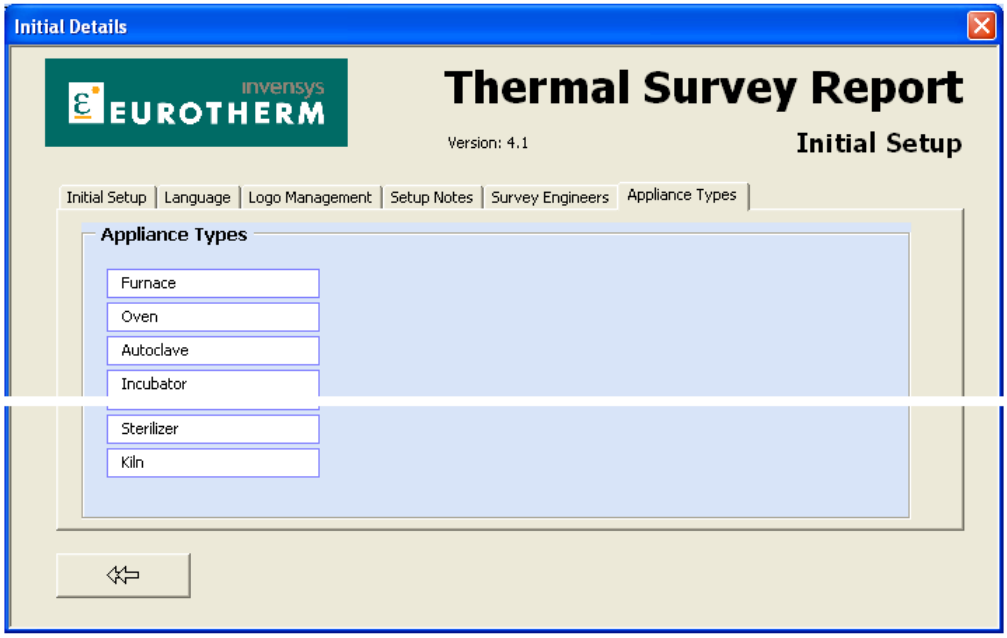


Figure 2.2.6 Appliance Types tab screen

2.2.7 Navigation

Using the double left arrow key returns the user to the Thermal Survey Report 'Data Entry' page as described in section 2.1.

2.3 DATA SOURCE

The data source page is entered by using the right-arrow key in the Data Entry page (section 2.2)

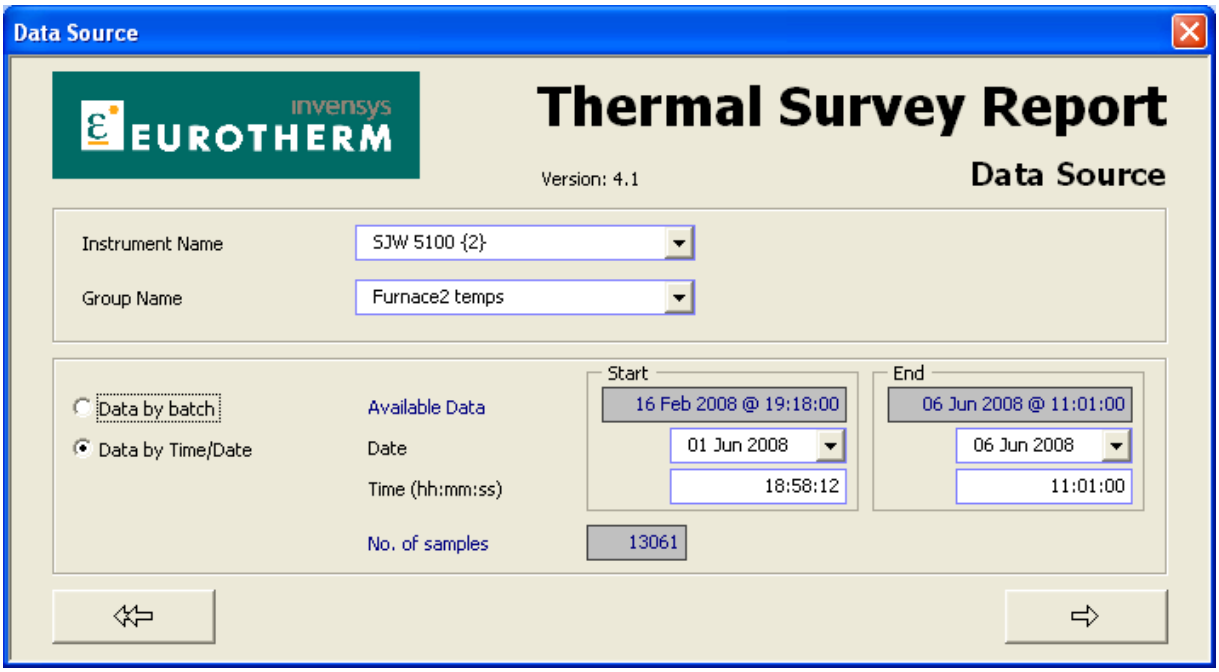


Figure 2.3 Data source page

2.3.1 Data Source Page entries

Instrument Name	Select, from a drop down list, the relevant 6000 series Field Test Instrument defined Instrument name. The drop down list is generated from instruments in the Review database.
Group Name	Select, from a drop down list, the relevant 6000 series Field Test Instrument defined Group name. The drop down list is generated from Groups in the Review database.
Data by Batch	(Figure 2.3.1, below) The required 6000 series Field Test Instrument defined batch name is selected from a drop-down list, generated from Groups in the Review database. The number of samples in the selected batch is displayed as a Read-only number. A warning is given if there are too many samples.
Data by Time/Date	(Figure 2.3 above) For reports generated by Time/Date, enter the time and date values into start and end time fields for the required report period. Read-only displays show the start and end time of the available data, and the total number of samples in the selected portion of this range of data. A warning is given if there are too many samples.

Note the Time and Date fields must accurately reflect the overall time period for measurements associated with the required test duration.

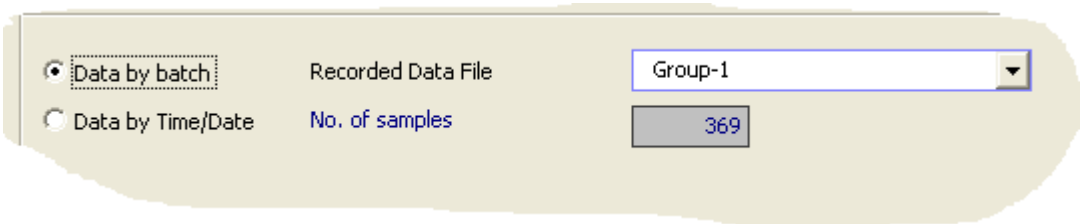


Figure 2.3.1 Data by batch

2.3.2 Channel Setup

Operation of the single right arrow button from the Thermal Survey Report 'Data Entry' page (figure 2.1, above) navigates to the Channel Setup Page. This page allows assignment of the survey sensors to thermocouple channels within the Field Test Instrument.

SURVEY CHANNELS TAB

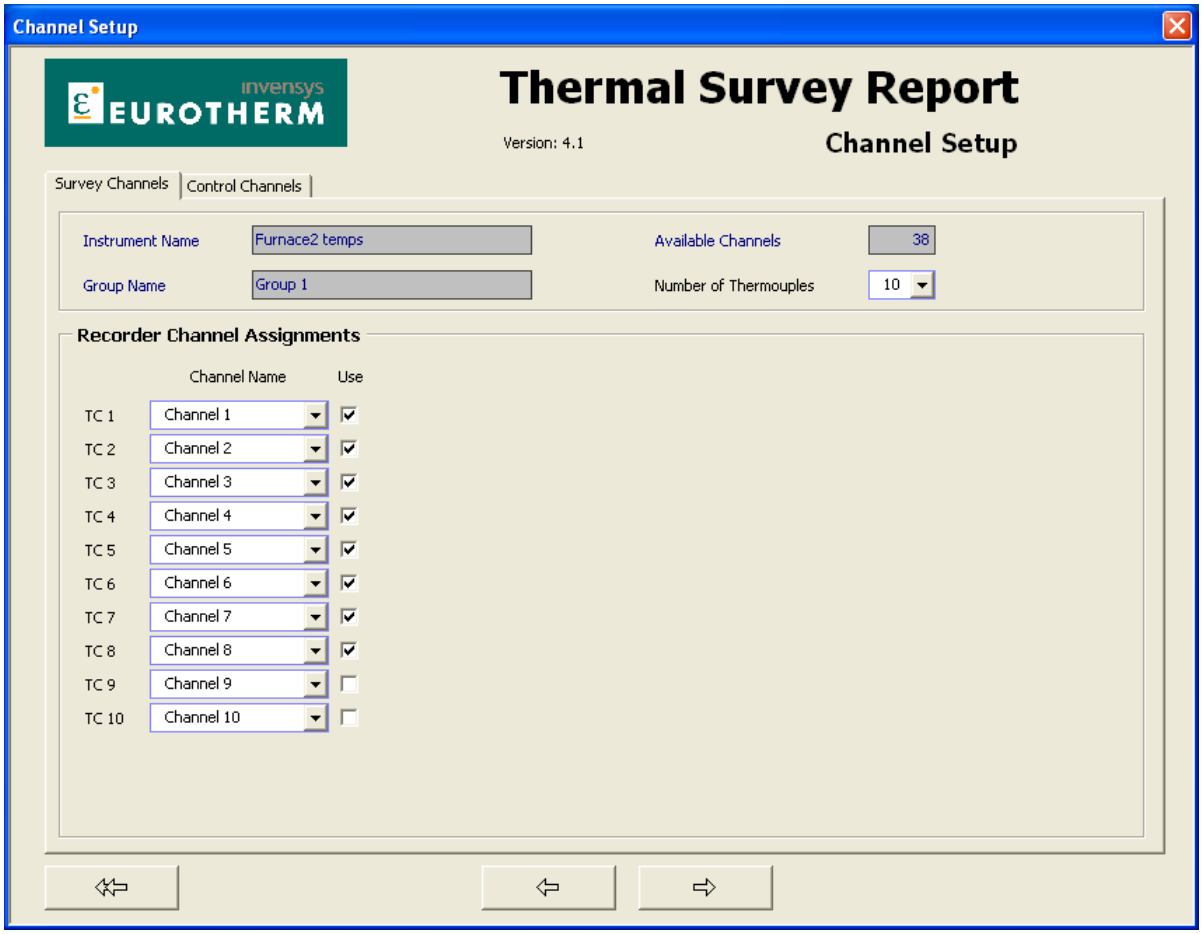


Figure 2.3.2a Survey Channel tab

Instrument Name — Taken from the Data Source page entries (section 2.3.1)

Group Name — Taken from the Data Source page entries (section 2.3.1)

Available channels — show the number of channels available within the database associated with the specified instrument / group.

Number of thermocouples
Select the number of thermocouples to be included in the report. may or may not match the number of thermocouple in the database.

Recorder channel assignments
Allows the user to define which channel each thermocouple is connected to. A maximum of 48 channels may be included in the report.

Use — Allows the user to remove individual thermocouples/channels from the report.

Right arrow — Goes to Setpoint setup page (Section 2.4)

Left arrow — Returns to data source page (section 2.3.1)

Double left arrow — Returns to data setup page (section 2.1)

2.3.2 CHANNEL SETUP (Cont.)

CONTROL CHANNELS TAB

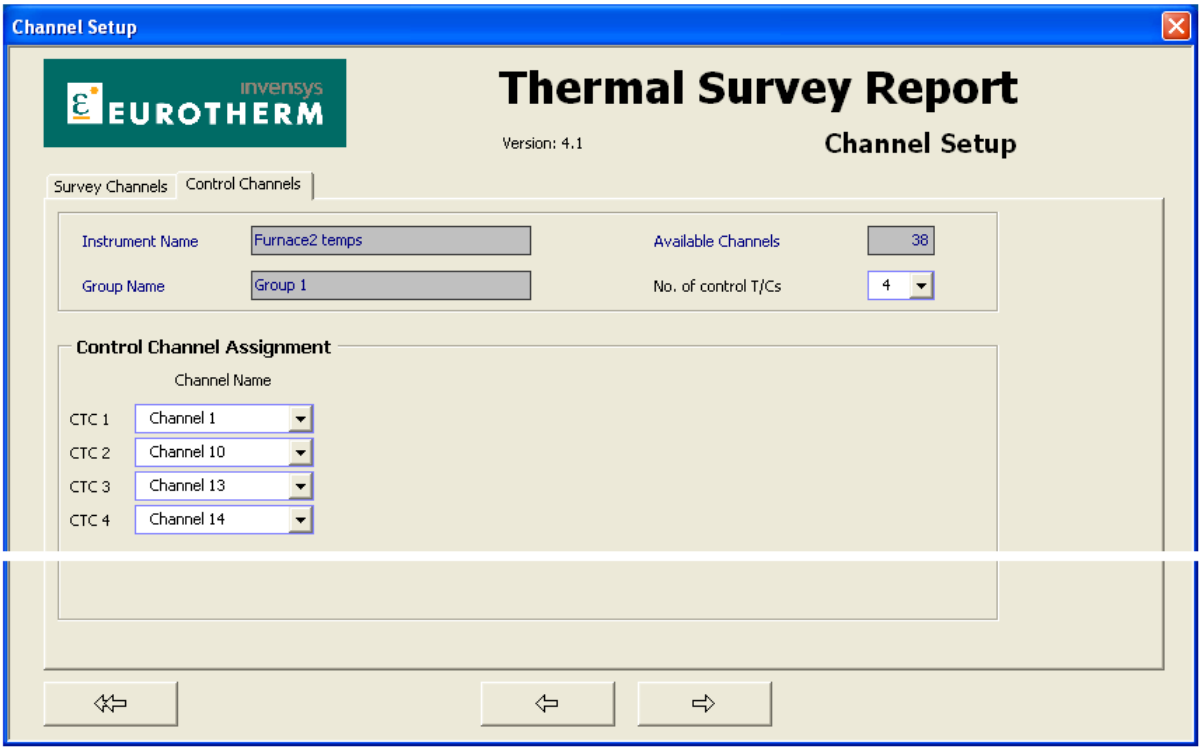


Figure 2.3.2b Control channel tab

CONTROL CHANNEL ASSIGNMENT

It is possible to incorporate the zone temperature controller readings in the report.

This option is available where the controller can be automatically linked to the Field Test Instrument using master communications or a parallel Thermocouple connection. Protocols available for master communications between the 6000 series Field Test Instrument and independent control equipment are MODBUS RTU and MODBUS TCP.

Instrument Name — Taken from the Data Source page entries (section 2.3.1)

Group Name — Taken from the Data Source page entries (section 2.3.1)

Available channels — show the number of channels available within the database associated with the specified instrument / group.

Number of control T/Cs
Select the number of control thermocouples to be included in the report. This number may or may not match the number of thermocouples in the database.

Control channel assignment
Allows the user to define which channel each thermocouple is connected to. A maximum of 6 control channels may be included in the report.

Use — Allows the user to remove individual thermocouples/channels from the report.

Right arrow — Goes to Setpoint setup page (Section 2.4)

Left arrow — Returns to data source page (section 2.3.1)

Double left arrow — Returns to data setup page (section 2.1)

2.4 SETPOINT SETUP

This screen, entered by operating the right arrow on the Channel Setup page (section 2.3) allows the user to enter the number and value of setpoints being surveyed.

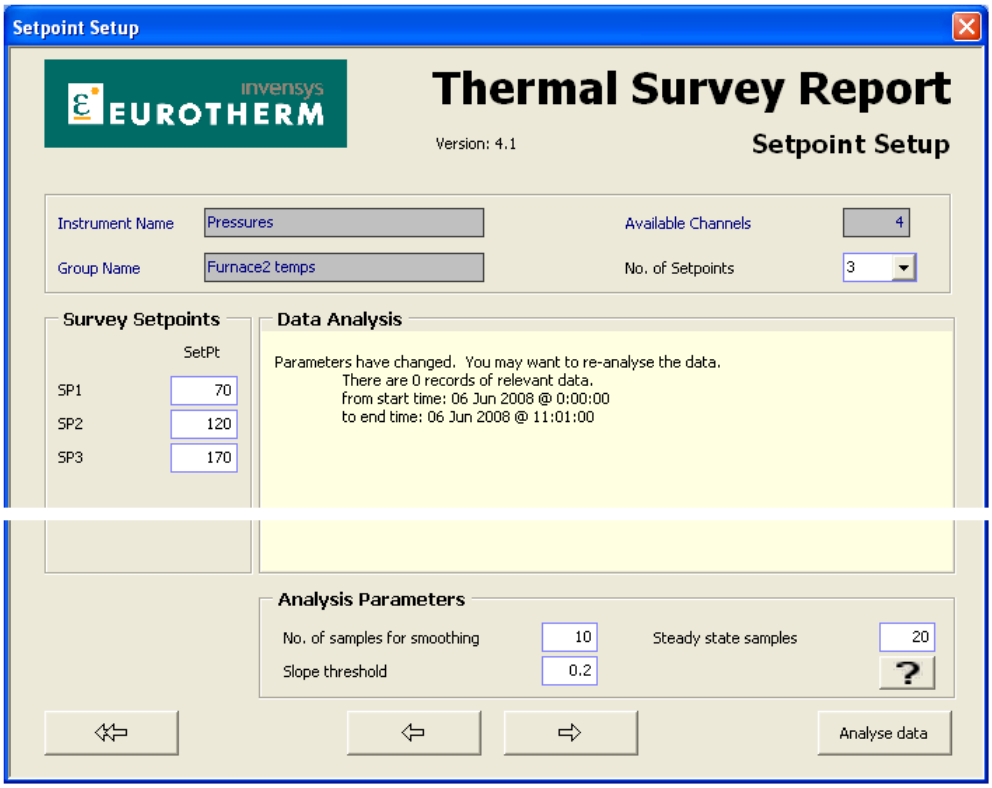


Figure 2.4 Setpoint setup screen

2.4.1 Displayed fields

Instrument Name	A read only field showing the name of the instrument from which the data has come.
Group Name	A read only field indicating the name of the group in the instrument from which the data has come.
Available channels	This is a read only field indicating number of channels that have been recorded in the Review database.
Number of Setpoints	The number of setpoints used when the survey data was collected. This is user selectable between one and seven from a drop-down menu.
Survey setpoints	The setpoint temperature values are entered here.
Data Analysis	This area indicates, searches and validates the data for validity and likely setpoint values if the user does not know the setpoint value(s) used for the survey. The 'Analyse Data' button is used to trigger operation of this function.
Analysis parameters	No. of samples for smoothing = R Steady state samples = S Slope threshold = ΔT (°C/sample interval) Depending on the response of the equipment under test and the sampling interval of the data, these values may need to be changed for optimum results.
Analyse Data	This triggers the data analysis function described above.

2.4.2 The analysis process

The following actions all take place on the raw data (that is, before any corrections are applied). The raw data is not modified in any way.

1 The specified thermocouples are progressively averaged over xR samples to produce a single smoothed data set.
For example, for R = 10, the first smoothed data point will be the average across all thermocouples for samples 1 to 10. The 2nd smoothed data point will be the average across all thermocouples for samples 2 to 11, and so on.

2 The difference between each of these values is calculated to give a set of gradients.

3 Once the measurement period has commenced the gradients are continuously scanned to find, at least, S successive values that are less than ΔT. If it finds such a set, it reports this as a steady state, together with the start time. When a gradient that exceeds ΔT is found, it reports that as the end time. This continues until the end of the smoothed data.

4 If all data at a particular sample is non-numeric (e.g. No data or Under Range etc.) an error is generated and reported. Data analysis stops at that point.

5 Provided at least one thermocouple produces numeric values at every sample, the above analysis will complete.

6 Each thermocouple is now scanned for non-numeric data and any such data is reported. If steady state conditions are found, they are likely to be close to the intended setpoints during the survey, provided the data channels have been correctly configured. The number of setpoints and their values may need to be edited.

NAVIGATION

The double left arrow returns to the Data Entry screen (Section 2.1).

The single left arrow returns to Channel Setup (Section 2.3).

The single right arrow button takes the user to the Detail Data Entry set of screens (Section 2.5).

2.5 DETAIL DATA ENTRY

2.5.1 Instrumentation tab

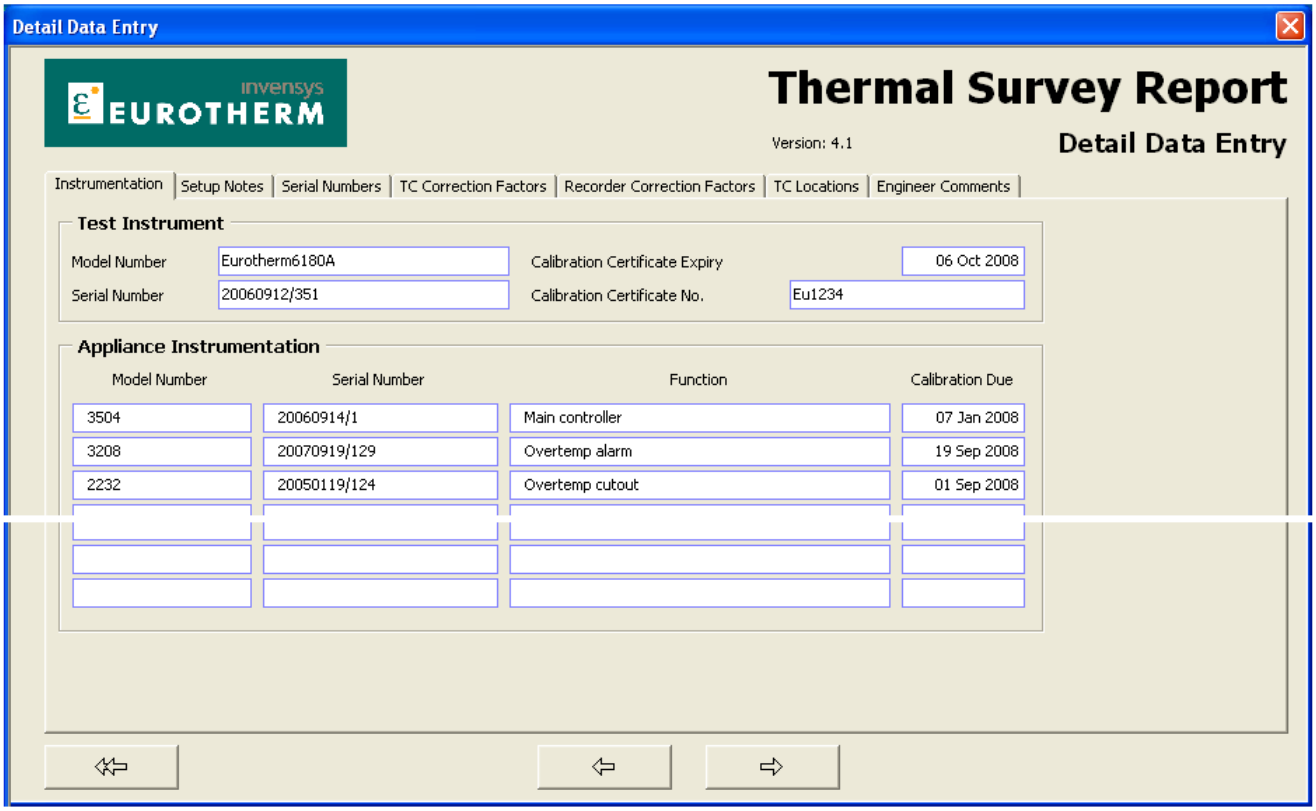


Figure 2.5.1 Detail data entry Instrumentation Tab

Test Instrument — Enter the Model Number, Serial Number, Calibration Certificate number and Certificate Expiry date for the Test Instrument used to collect the data for this report.

Appliance Instrumentation
Enter the Model Number, Serial Number, Function and Calibration Due date for the Control Monitoring and Recording instruments.

2.5.2 Setup Notes Tab

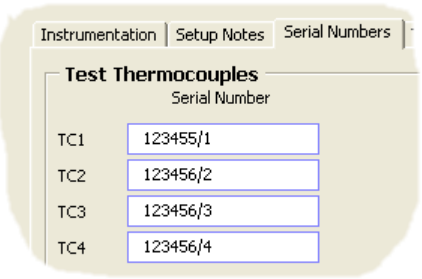
Preset Set-up Notes — Five fixed-format data entry fields are available for setup notes, which can be called from a drop down box. The fixed format notes are assigned and edited in the initial setup page, “Setup Notes” Tab (section 2.2.4).

Free format Set-up Notes
Five further free-format data entry fields are available for additional report Set-up notes.

2.5.3 Serial Numbers Tab

TEST THERMOCOUPLES

Enter the serial numbers of the Thermal Survey Thermocouples in the data entry fields provided. The number of data entry fields matches the number of thermocouples selected for the report.



2.5.4 TC Correction tab

This allows correction factors to be entered for each of the thermal survey sensors at each of the defined setpoints. The defined setpoints default to those assigned in the Setpoint Setup page (section 2.4). Once the values have been entered for Thermocouple 1, the values can be copied to all the other thermocouples on the page by using the 'COPY TC1 TO ALL' button.

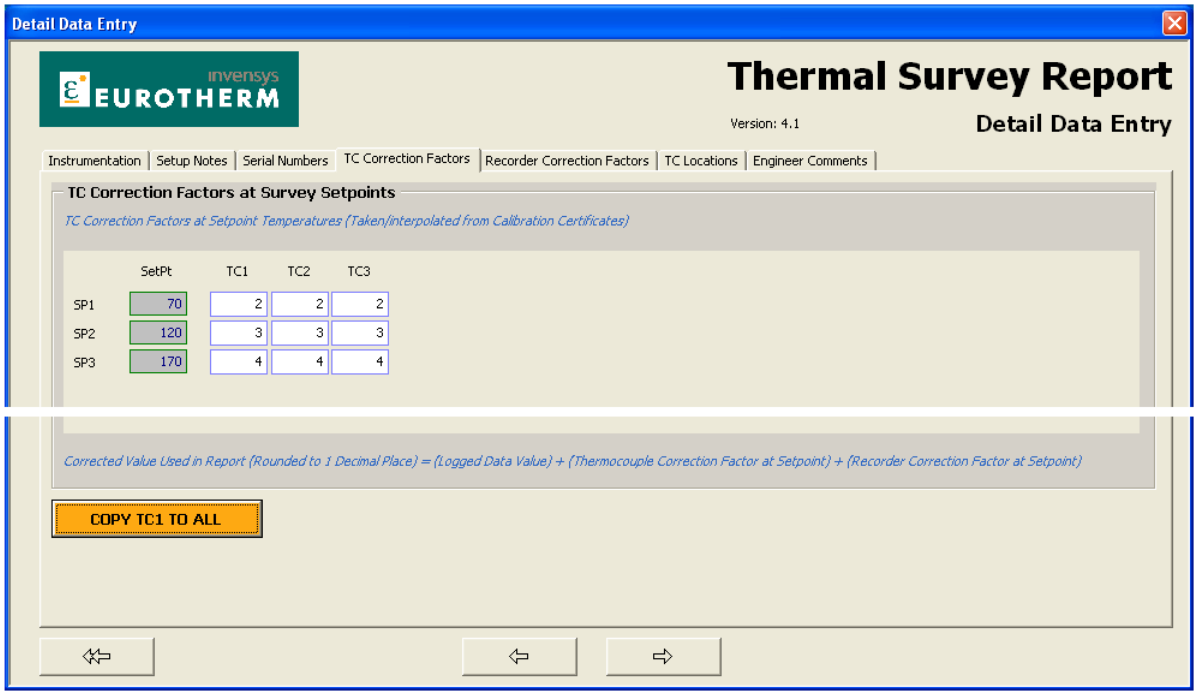


Figure 2.5.4 TC Correction tab screen

2.5.5 Recorder Correction tab

Enter the correction factors for each of the thermocouple channels at each of the defined setpoints. The defined setpoints will default to those assigned in the Setpoint Setup menu page (section 2.4).

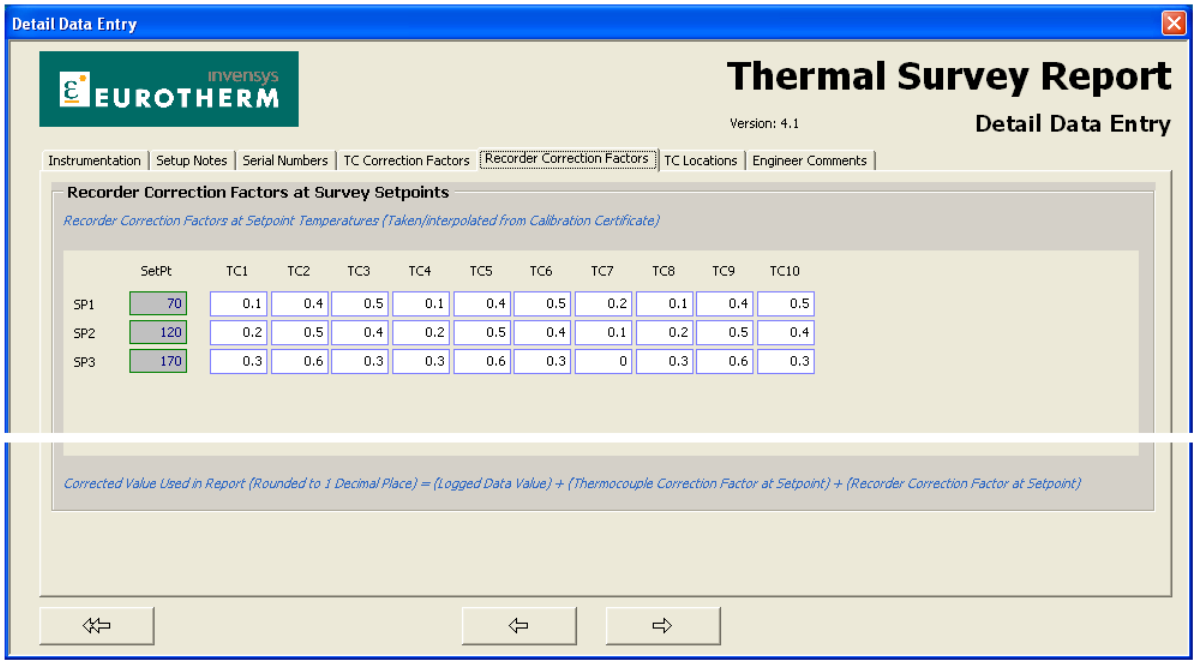


Figure 2.5.5 Recorder correction tab screen

2.5.6 TC Locations tab

This page allows the generation or import of three-dimensional diagrams to identify thermal survey sensor locations against defined survey test frames or representative loads. In addition an optional descriptor can be assigned for the location of the thermal survey sensors.

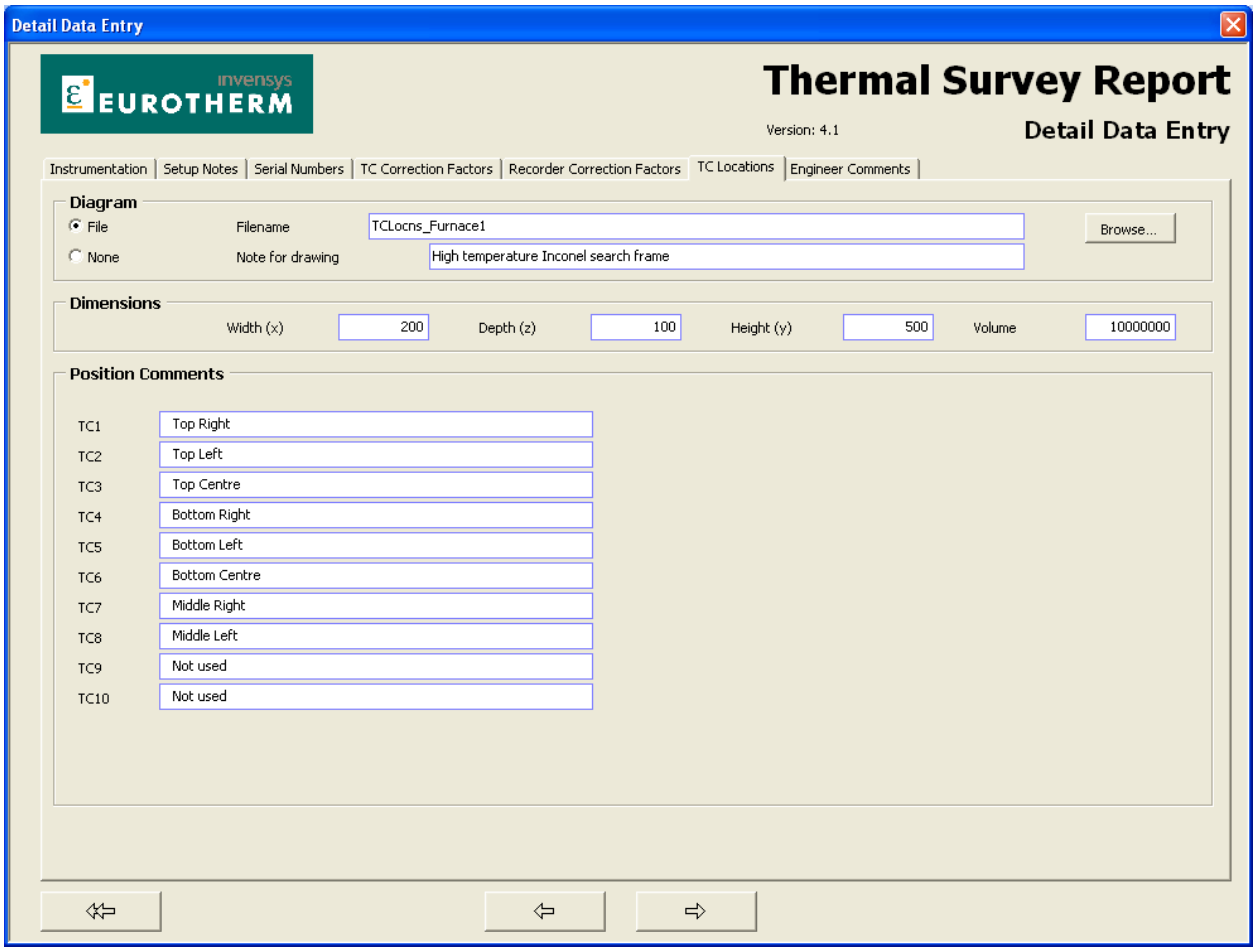


Figure 2.5.6 Thermocouple locations tab screen

DIAGRAM

From File	Enter a filename, or use the 'Browse...' facility to locate a pictorial file to be associated with the report.
None	None allows an option not to include a three-dimensional diagram within the report. If this option is chosen free format fields are available to describe the thermal survey thermocouple locations.
Note for Drawing	Free format fields are available to associate a note and dimensions about the survey frame or representative load.

Notes

1. If a diagram is not included in the report for AMS2750D a three-dimensional space diagram of the thermal survey sensor locations and associated test frame or representative load must be available on site.
2. For AMS2750D It is also a condition of the report that three-dimensional diagrams must be available on site for control, recording and load sensors.
3. Also calibration reports for the control monitoring and recording instrumentation, the Field Test Instrumentation and Thermal Survey Sensors must be available on site

2.5.6 TC LOCATIONS TAB (Cont.)

Position Comments — Allows the user to enter a description of the thermal survey sensor locations and for AMS2750D must be used where there is no three-dimensional diagram is associated with the report.

2.5.7 Engineer Comments tab

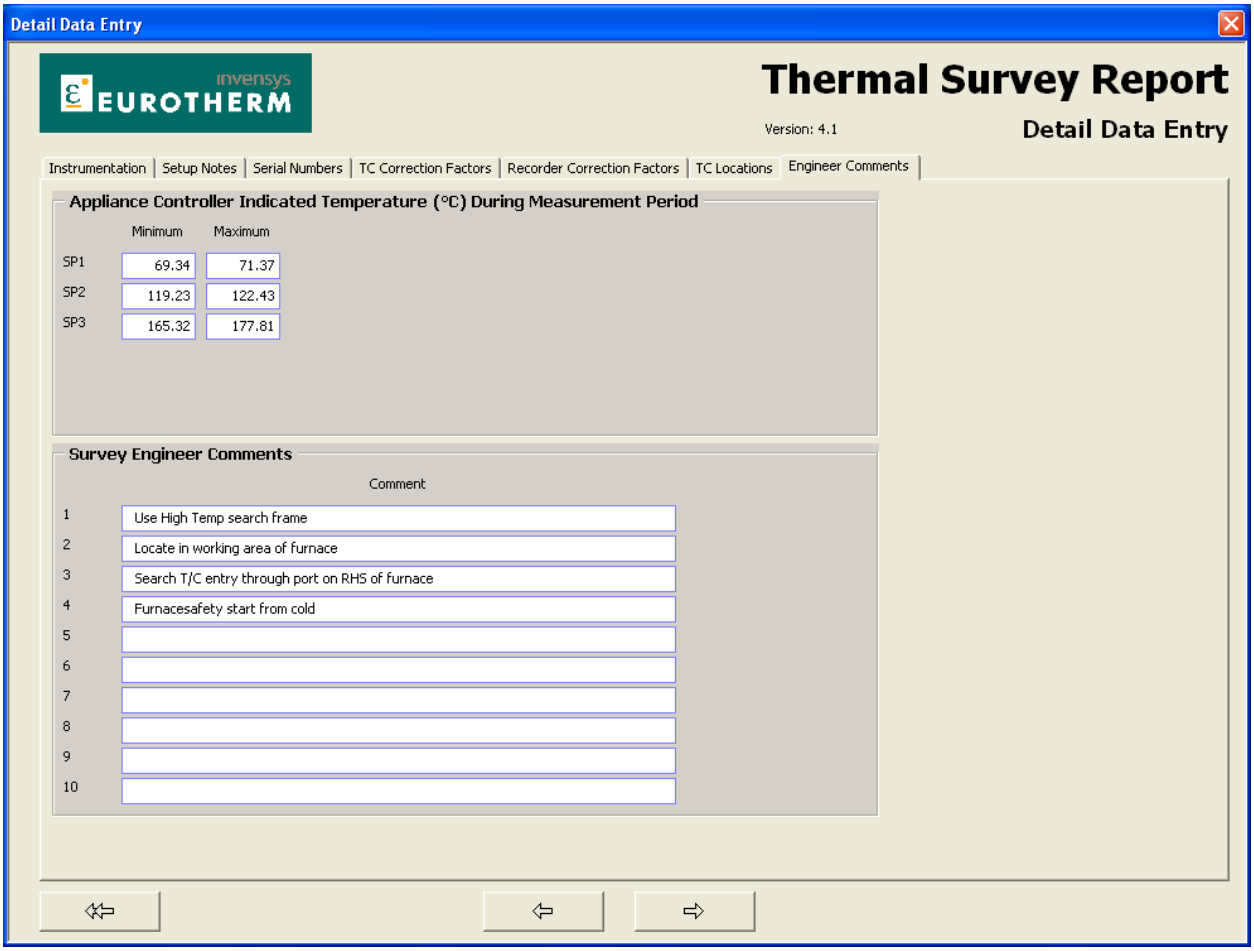


Figure 2.5.7 Engineer comments tab

APPLIANCE CONTROLLER INDICATED TEMPERATURES DURING MEASUREMENT PERIOD

Enter details for the observed highest and lowest indicated control temperatures, which occurred during the period of stability for each of the defined setpoints

> Note For multi zone furnace applications, detail about additional zones instrumentation including serial numbers, model numbers and performance should be appended to this automatically generated report.

SURVEY ENGINEERS COMMENTS

10 Free format fields are available for the entry of engineers' notes. These can include items which may not formally required as part of the report but must be available on site e.g.:
Control Instrument tuning parameters
TUS Sensor failure comments
Events or actions effected by the test engineer during the thermal survey
Other engineers' findings about the survey results

2.5.7 ENGINEERS COMMENTS TAB (Cont.)

NAVIGATION

Use the right arrow key to navigate to the 'Printing' setup page (section 2.6) or the left arrow key to return to the Setpoint Setup page (section 2.4). The double left arrow key can be used to return to the Data Entry page (Section 2.1).

Note For AMS2750d this automatically generated report should be appended with trend information from the control monitoring and recording instruments.

2.5.8 Stability Criteria tab

Three options (selectable via radio buttons) are available to determine stability criteria for the Thermal Survey measurement period at each of the defined setpoints. These options are: Real time, Elapsed time and Stable temps.

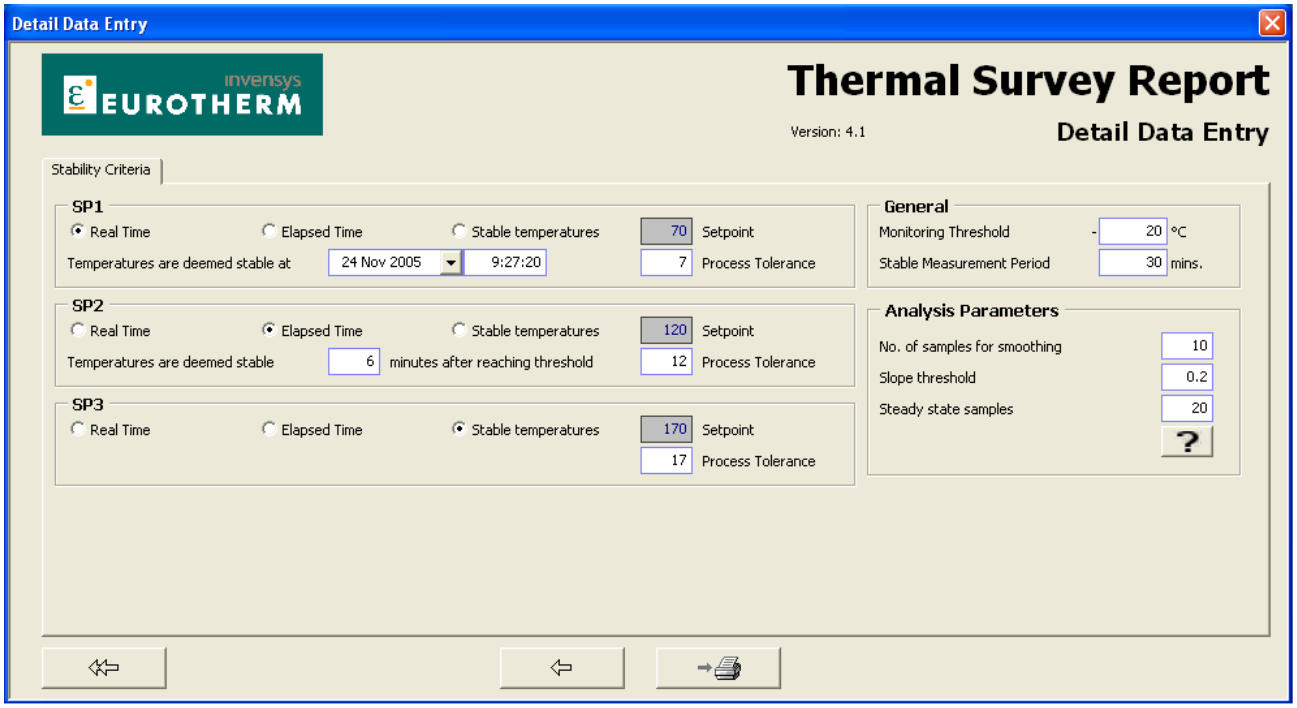


Figure 2.5.8 Stability criteria tab

ENTRY FIELDS

Real Time — Enter the real time at which the thermal survey sensors were deemed to be stable.

The time can be evaluated from the following:
Observations made by the survey engineer during the test.
Indications observed by evaluation of data in Eurotherm Review.
Indication defined in the "Analyse Data" area of the Setpoint Setup page (section 2.4).

Real time values can be independently edited for each Setpoint to make allowance for any variability in performance of the thermal processing equipment at different temperatures.

Elapsed Time — Enter the time in minutes after all thermocouples achieved the monitoring threshold at which the survey sensors were deemed to be stable.

Stable Temps — In this mode the software determines the point at which the test achieved stability based on the information provided in the Setpoint Setup page "Analysis Parameters" (section 2.4).

2.6 PRINTING

This screen controls report generation and printing.

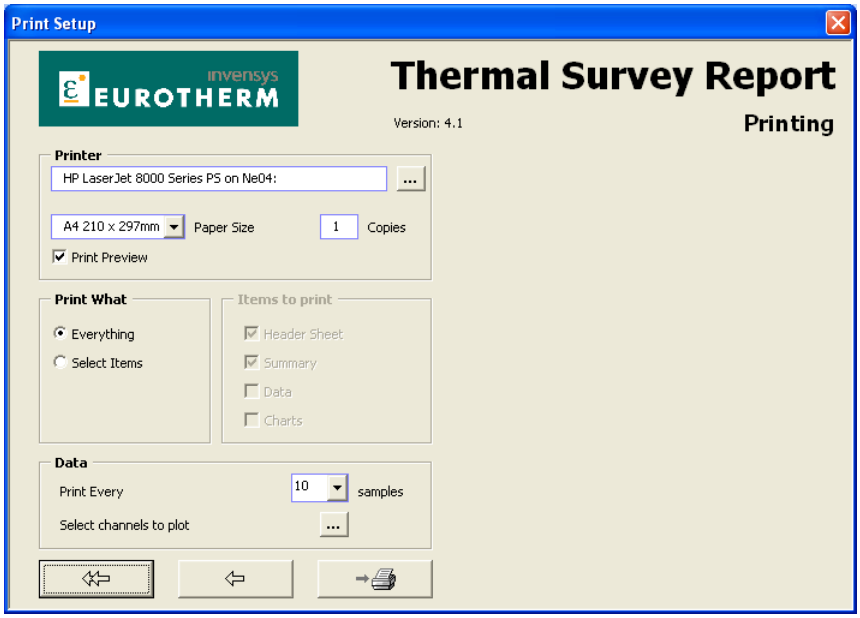


Figure 2.6 Printing screen

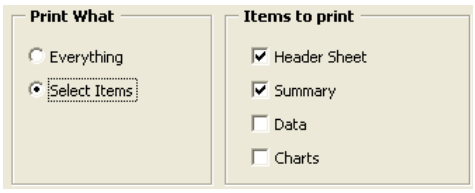
2.6.1 Page items

PRINTER

Printer	Select from the printers that have been installed on the PC. This can include PDF printers to generate a PDF file.
Paper Size	Selects between A4 and US Letter (American Quarto or AQ).
Print Preview	Rather than printing the document directly to a printer it appears as a print preview on the screen.
Copies	Allows the number of copies of the report to be printed to be selected printer.

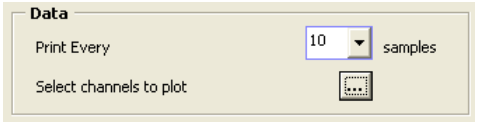
PRINT WHAT

Everything	Prints all sections of the report.
Select items	Choose to generate and print a subset of the available sections within the report. For AMS2750D all sections are required.



2.6.1 PAGE ITEMS (Cont.)

DATA



Print Every
This allows the user to select an appropriate set of data values to be printed as text The samples printed are actual logged data values, not interpolated values.

It is a condition of AMS2750D that a tabular record of results is produced at a maximum interval of every two minutes. Therefore if the time shown in the time period shown in “data originally sampled every” window shows 30 seconds the print every window should be set to 4 samples (4 * 30 seconds = 2 minutes).

Select channels to print

Clicking on this button causes the ‘Trends Setup page’ to be displayed. This allows the user to deselect trends which are not required in the final report. Once the selection has been made for SP1, the ‘COPY SP1 TO ALL’ button may be used to copy the trend selection to other setpoints, which can then be further edited if required.

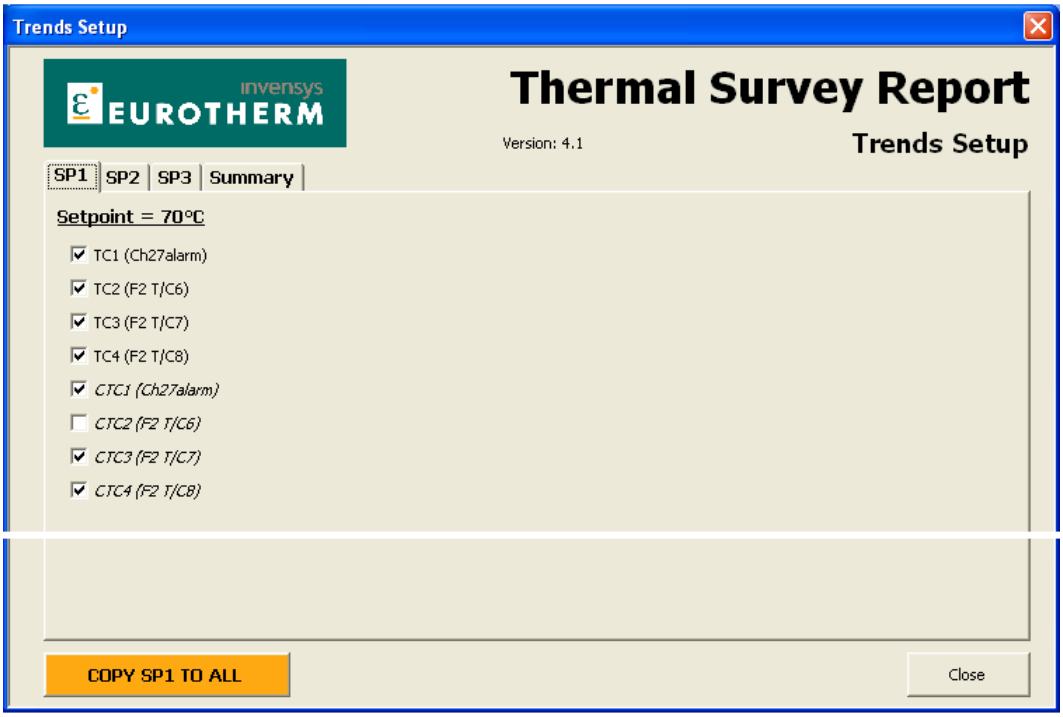


Figure 2.6.1 Select channels to be printed

NAVIGATION

The Double left arrow key takes the user back to the initial Data Entry page (section 2.1).
The Single left arrow key takes the user back one screen to the Detail Data Entry page (section 2.5).
Arrow Right To Printer key generates and prints the report (section 3).

2.7 HELP

Pressing the '?' button on any screen on which it appears calls a context sensitive help page, such as that shown below for the Stability Analysis page.

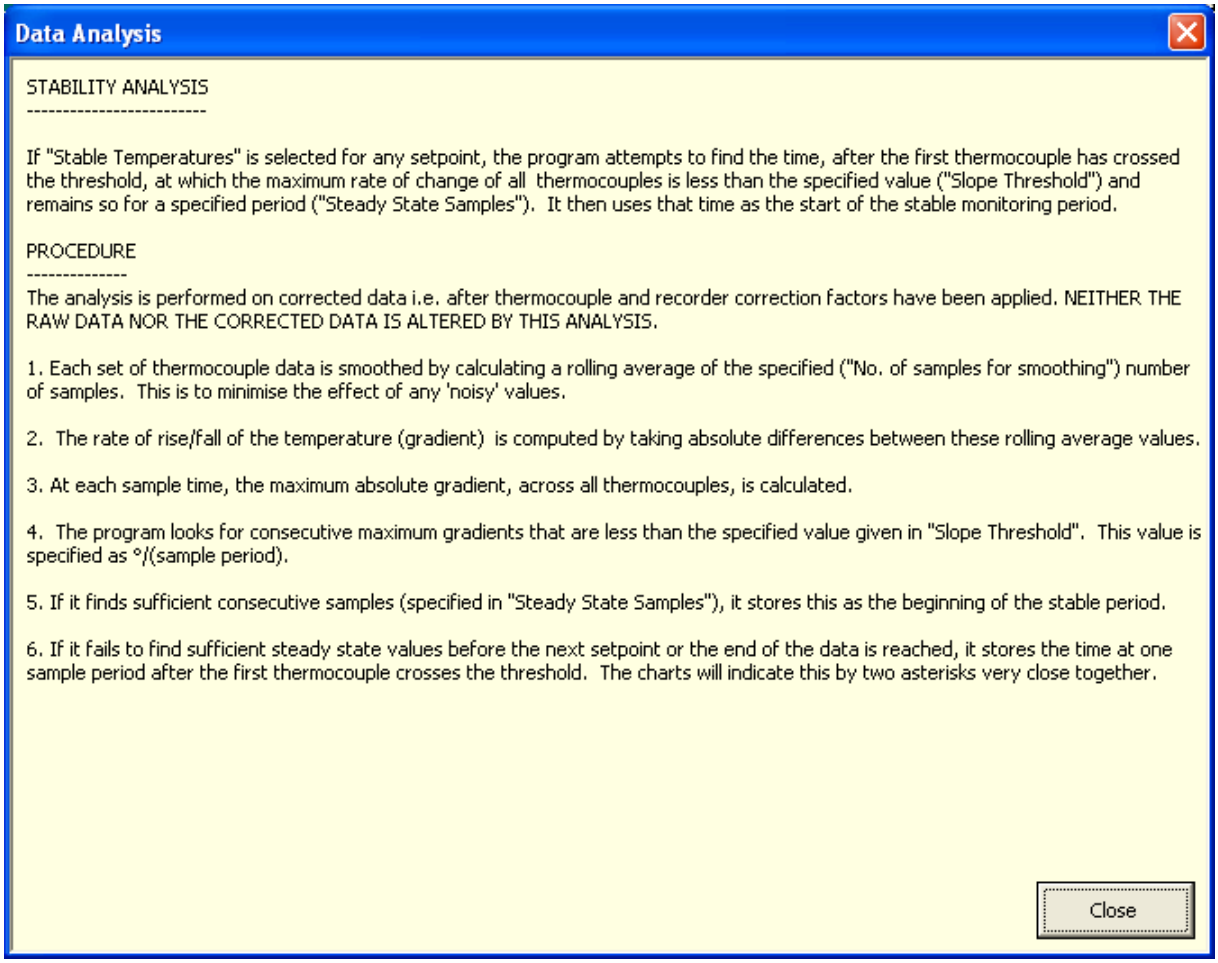


Figure 2.7 Typical Help page

3 REPORT GENERATION

When Print report is selected from the 'Printing' page (section 2.6), the user is asked to delete copies of previously compiled charts.

The report takes a few minutes to process and produces a finished document using information supplied in the setup pages and data from the defined Instrument and Group database.

Tabs are available in the compiled spreadsheet for the completed report and charts associated with overall TUS performance as well as furnace performance at each of the defined setpoint.

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