Tpaq6 Data Logger

USER MANUAL

for Kiln Tracker®

for use with

insight software

Issue 1

MA5590A

DATAPAQ®

A Fluke Company

Tpaq6 Data Logger

User Manual

for Kiln Tracker®

for use with

insight software

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Datapaq™ is the world's leading manufacturer of process temperature-monitoring instrumentation. The company maintains this leadership by continual development of its advanced, easy-to-use Tracker systems.

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DATAPAQ PART NO. MA5590A

European Union Directives

The following product types

TPaq6 Thermocouple Data Logger

manufactured by Datapaq Ltd.
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comply with the requirements of European Union directives as follows.

Directive 2004/108/EC Electromagnetic Compatibility (EMC)
Standards Applied

EN61326-1: 2006 – Group 1, Class B equipment (emissions section only), and Industrial Location Immunity (immunity section only).
CFR47: 2007 Class A – Code of Federal Regulations: Part 15 Subpart B, Radio Frequency Devices, Unintentional Radiators.

RoHS Compliance Datapaq temperature monitoring equipment is exempt from EU Directive 2002/95/EC (restriction of the use of certain hazardous substances in electrical and electronic equipment) under category 9 Monitoring and Control Instruments. This Datapaq product nevertheless uses RoHS-compliant components and manufacturing processes.

Manual set in 10 pt Gill Sans.

User manuals are available in other languages; contact Datapaq for details.

SAFETY WARNINGS

For safe use of Datapaq equipment, always:

- Take care to follow its supplied instructions.
- Observe any warning signs shown on the equipment itself.

Indicates **potential hazard**.

On Datapaq equipment this normally warns of high temperature, but where you see the symbol you should consult the manual for further explanation.

Warns of **high temperatures**.

Where this symbol appears on Datapaq equipment, the surface of the equipment may be excessively hot (or excessively cold) and may thus cause skin burns.

CONTENTS

Introduction

Datapaq® Kiln Tracker®, incorporating Insight™ software, is a complete system for monitoring the temperature profiles of products within your kiln; accurate data acquisition and powerful analysis techniques are combined with flexibility and ease of use. The Tracker system's power and flexibility make it a perfect tool for process-temperature monitoring, from commissioning and troubleshooting to process optimization, ensuring consistent quality of product and maximum efficiency.

Current temperature characteristics can quickly be compared with previously stored reference curves to detect operating abnormalities – and innovative analysis techniques help in identifying problems, fine-tuning the process and reducing running costs.

A printing option allows the user to generate reports, including the analysis results.

The basic Tracker system hardware comprises:

- Data logger (including communications lead and charger) (p. 11).
- Thermal barrier and thermocouple probes (not covered here; see the relevant manual supplied with your system).

This manual is for Kiln Tracker systems supplied with a **Tpaq6 data logger**, and focuses on all aspects of using the logger, including its operation with hardwired telemetry. There is also guidance on setting up the Insight software; complete information on using the software is contained in the online Help system available when it is installed. For information on choosing and using the logger's thermal protection and thermocouple probes, as well as step-by-step instruction on how to collect temperature-profile data on a product as it runs through your kiln, see the dedicated system manual supplied.

Tpaq6 Data Logger

The Tpaq6 is for clay-block and sanitary-ware kiln applications where long-duration runs at high ambient temperatures call for large memory capacity and rugged electronics. Its capacity for 10,000 data readings on each of 6 selectable channels, together with variable sampling intervals, makes it a supremely powerful, accurate and in-depth analysis tool.

The logger's key features are:

- Six thermocouple channels for maximum data collection on each run.
- Huge memory capacity: 60,000 data points (10,000 per channel) for detailed process analysis.
- Short sampling intervals to collect maximum data in minimum time.
- High accuracy: to ±0.3°C/0.5°F for compliance to tight specifications.
- Hot data protected by non-volatile memory or software warning if reset is attempted before download.
- USB and serial RS232 communication capability.
- Hardwired telemetry for real-time monitoring in batch kilns – with full analysis functions and alarms to alert if the process is out of specification (with Insight Kiln Tracker software only; see p. 29).

Tpaq6 logger, showing LEDs and stop/start buttons (upper surface), communications port (front edge) and thermocouple sockets (right).

- Four status LEDs to show the exact logger activity after disconnection from the computer.
- Start and stop buttons for easy user control.
- Rugged industrial case and electronics allow operation in harsh kiln environments.
- Reset by start button after download for speed and simplicity.

Versions are available for use with type K, R or S thermocouples (see specifications, below).

Tpaq6 Logger Specifications

General Specifications

Length	200 mm/7.87 inches
Width	98 mm/3.86 inches
Height	20 mm/0.79 inches
Channels	6
Storage	10,000 data-points per channel
Max. operating temp.	110°C/230°F
Data-collection start	Start/stop button, temperature rise/fall, time
Hot-data protection	By non-volatile memory, and software warning if reset attempted before download
Communications	USB or serial RS232
Logger reset	Possible after download by start button (using previous run parameters)
Battery type	VHT Lithium
Max. battery life [1]	340 hours
Sample interval [2]	
No telemetry	0.1 s to 50 min
Hardwired telemetry	1 s to 50 min

[1] With 1-minute sample interval, at 100°C. Maximum battery life depends on sample interval and operating temperature (see p. 14).

[2] Minimum interval with 6 thermocouples in use, 0.3 s; 0.1-s interval requires maximum 3 thermocouples used; 0.2-s interval requires maximum 6 thermocouples.

Specifications for Specific Thermocouple Types

	Type K	Type R	Type S
Connector color	Green	Orange	Orange
Measurement range[1]	−100°C to 1,370°C −148°F to 2,498°F	0°C to 1,760°C 32°F to 3,200°F	0°C to 1,650°C 32°F to 3,002°F
Accuracy[2]	±0.3°C/0.5°F	±1.0°C at 200°C ±0.7°C at 1,000°C ±1.8°F at 392°F ±1.3°F at 1,832°F	±1.0°C at 200°C ±0.8°C at 1,000°C ±1.8°F at 392°F ±1.4°F at 1,832°F
Resolution	0.1°C/0.2°F	0.1°C/0.2°F	0.1°C/0.2°F

[1] For accuracy data between -190°C/-310°F and -100°C/-148°F, contact Datapaq.

[2] Using sample interval > 0.8 s. For accuracy data using other sample intervals, and at temperatures other than those shown, contact Datapaq.

Due to continuing product development, specifications are subject to change without notice.

Stop/Start Button Actions

Action	Results	Notes
Press GREEN button.	Starts logging.	In telemetry mode also starts sending data.
Press RED button.	Stops logging.	Data retained in memory. Logger cannot be restarted until data downloaded. Red LED flashes every 5 s to warn of data in memory. If in telemetry mode will also send 'end of run' signal to end real-time run.
Press GREEN and RED buttons together and hold for 3 s.	Turns logger off.	Data retained in memory.
Press GREEN button after downloading data.	Starts logging.	Last re-set conditions (sample interval, probe selection, etc.) used as default.

Logger LEDs

The logger is equipped with two sets of LEDs: two LEDs show the status of the battery, and two show the status of the logger and its memory.

Battery Status LEDs

Yellow	Red	Meaning
Flashing once per second	Off	Battery is at 20% or less of maximum charge.

Logger Status LEDs

Red	Green	Meaning
5 flashes, *alternating* with green LED	5 flashes, *alternating* with red LED	Logger successfully reset.
Flashing, *alternating* with green LED, at sample interval	Flashing, *alternating* with red LED, at sample interval	Logger awaiting trigger.
On	Flashing at sample interval	Logger awaiting trigger but one or more thermocouples is open circuit.
Flashing *together* with green LED	Flashing *together* with red LED	All probes are above trigger temperature, and thus data-recording cannot be triggered by rising temperature (or, if falling trigger is set, all probes are below trigger point).
Off	Flashing at sample interval	Logger acquiring data.
Flashes 5 times (once per second)	Off	Connection between communications lead and logger has been made.
Flashing every second	Off	Internal error.
Flashing every 5 seconds	Off	Logger has data in memory which has not been downloaded.

Batteries

The Tpaq6 logger is powered by four non-rechargeable lithium batteries, Datapaq part no. BP0004.

Battery Life

For a given battery type, battery life is affected by the following factors.

- **Operating Temperature** – Essentially, the higher the ambient temperature the battery operates in, the lower will be the life. Batteries that operate for a large part of the process cycle at relatively low temperatures will have a longer life than those that operate for the majority of the process cycle at the maximum operating temperature.
- **Sample Interval** – The shorter the sample interval, the shorter will be the battery life. This is because power is being consumed each time the logger takes a reading. A short sample interval will achieve the maximum amount of information, but this must be balanced against the greater battery charge required.
- **Programming and Downloading the Data** – When these operations are carried out it is necessary to connect to the computer via a communications cable, and power is consumed as soon as the cable is

plugged into the logger. The software warns the user to disconnect from the PC, but if the logger is left connected this will affect battery life.

Given the factors that can affect the life of a battery it is obviously difficult to predict accurately. The LEDs on the logger will give the best indication of when the battery is low. In the user's own conditions, experience will quickly indicate typical battery life, and a log should be kept for the first few runs, noting sample interval. As an indication, the maximum battery life that can be expected in the Tpaq6 logger under the most favorable conditions is 350 hours.

Sample Interval	Logger Peak Temp.	No. of Channels	Battery Life (hrs)
< 1 s	100°C/212°F	6	160
3 s	100°C/212°F	6	300
1 min	100°C/212°F	6	330

Removing/Replacing Lithium Batteries BP0004

When the logger ceases to operate due to exhausted batteries, they should be immediately removed and disposed of.

WARNING

Lithium batteries – Fire, explosion and severe burn hazard

Lithium batteries are potentially dangerous and require great care in handling and storage. You must read the section 'Handling Lithium Batteries' (below) and the Safety Data Sheet supplied with the batteries.

Remove and replace the batteries as follows.

1. Select a clean, dry, non-conductive work surface; do not use a metallic surface or anti-static matting. Take off any conductive jewellery and put it out of the way. Wear eye protection.
2. Remove the four screws retaining the battery cover.
3. Carefully remove each of the old batteries, one at a time, from the battery compartment.

   Ensure that the battery terminals cannot be short-circuited in any way – to each other, to the logger or to any tools. There is risk of explosion.

4. Place each battery separately on the work surface, maintaining good separation between them. Mark the work surface area into which they are placed, in order to identify them as the old batteries.
5. Ensure the battery compartment is clean and dry, and carefully wipe the battery contacts with a dry lint-free cloth or tissue with attention to the contact area. Do not bend or distort the contacts.

6. Remove the new batteries from their protective UN-compliant packaging, and retain this for later use.
7. Carefully install each new battery one at a time into the battery compartment.

Observe the polarity of the batteries and of the contacts within the battery compartment.
Ensure that the battery terminals cannot be short-circuited in any way – to each other, to the logger or to any tools. There is risk of explosion.
Always replace all of the batteries at the same time.
Never use batteries other than BP0004 supplied by Datapaq.

8. Re-check that batteries are installed with correct polarity, then refit the battery cover and retaining screws.
9. Carefully place the old batteries one at a time into the empty packaging. Do not allow them to be short-circuited.

See below for disposal of lithium batteries.

Handling Lithium Batteries

WARNING
Lithium batteries – Fire, explosion and severe burn hazard
Lithium batteries are potentially dangerous and require great care in handling and storage.
• Do not short-circuit • Do not attempt to recharge •
• Do not reverse-connect • Do not open batteries •
• Do not expose battery contents to water •
• Do not solder anything to the battery • Do not incinerate •
• Do not mix cells • Do not leave discharged cells in the logger •
These instructions must be carefully read in full, and understood, by any person likely to handle, replace or dispose of lithium thionyl chloride batteries.

Do not open, crush or deform the battery cells. If the lithium metal within the cell is exposed to the air and moisture, an explosion or fire may result. The contents are flammable, corrosive and extremely irritating to the lungs and respiratory system. Lithium metal and thionyl chloride cause chemical burns on contact with skin.

The inorganic lithium thionyl chloride batteries BP0004 supplied by Datapaq will, when used correctly, provide a safe and dependable source of power. They represent the only current battery technology that can meet the demands of high-temperature operation. Unlike more conventional batteries, lithium cells contain flammable materials, and consequently safety precautions must be taken

during transport, storage, handling and disposal. If lithium batteries are mistreated there is a risk of leakage of the flammable contents or an explosion resulting in a fire.

Each battery is marked as follows:

> **Warning: Fire, explosion, and severe burn hazard.**
> **Do not recharge, disassemble, heat above 110°C, incinerate or expose contents to water.**

To meet the requirements of the Control of Substances Hazardous to Health Regulations 2002 (COSHH), each battery consignment includes a Safety Data Sheet. Any person likely to handle, replace or dispose of lithium thionyl chloride batteries must be made aware of this data sheet. The sheet should be passed to your Health and Safety officer for future reference; extra copies are available from Datapaq. The sheet contains details of **first-aid and firefighting procedures**.

Transport, and Storage Before Use

Due to the flammable content, lithium thionyl chloride batteries are classified as Dangerous Goods under UN transport regulations. The packaging used to supply the cells is UN-compliant and is labeled accordingly. The batteries must be transported only within this packaging.

Packages containing lithium batteries should be handled with care. Rough handling may result in batteries becoming damaged which may cause leakage, explosion or fire.

On receipt **do not remove** the lithium batteries from their UN-compliant packaging. Store the batteries within their original packaging until required.

The lithium batteries should be stored apart from all other flammable materials.

The storage area should be cool, dry, ventilated and weatherproof. Temperatures generally should be below 35°C/95°F. Do not store next to radiators or boilers or in direct sunlight. Avoid storage temperatures above 75°C/167°F.

Disposal of Used Lithium Batteries

The used batteries should be disposed of as soon as possible. Even though no longer capable of powering the logger, the batteries remain flammable and have sufficient energy to cause a fire or to explode if short-circuited. The UN-compliant packaging should thus be used to store the used batteries after removal from the logger and at disposal. The used batteries may be disposed of in normal communal refuse unless local regulations disallow this.

Disposal of the batteries at permitted waste-treatment and disposal sites may be by burial or incineration - but otherwise **do not dispose of in fire and do**

not incinerate. The BP0004 lithium batteries do not contain mercury, cadmium or any other heavy metal or other hazardous material according to EC Directives 91/157/EEC and 93/86/EEC.

Disposal of Logger and Batteries

Under the EU WEEE directive, users should return **loggers** and **NiMH rechargeable batteries** to Datapaq for disposal at the end of their useful life. Lithium batteries can be disposed of by the user; see above.

Care and Maintenance of the Logger

Store in a dust-free environment.

It is recommended that Datapaq loggers are calibrated at least once a year. The Datapaq calibration procedure comprises:

- Inspection of the logger, externally and internally.
- Heat-cycle test of up to 14 hrs in Datapaq's own ovens, up to 60°C/140°F without a thermal barrier.
- Stability testing, using a stable temperature source and varying ambient temperatures.
- Calibration and updating of the logger's firmware.
- Issue of a number of different types of calibration certificate – including those that meet ISO17025 and AMS2750 requirements – from our UKAS (United Kingdom Accreditation Service)-accredited laboratory.

No other company can offer this degree of in-depth testing as well as a full calibration service. To calibrate your logger, please return it to the Service Department at Datapaq (see title page for contact details).

Using the Logger with Insight Software

See your dedicated system manual for full details on:

- Choosing appropriate thermal barriers and thermocouple probes.
- Installing the logger into the barrier.
- Conducting a temperature-profile run of your process.

Before the logger is used for the first time, you must:

1. **Install** Insight software.
2. Establish **communication** between the logger and the computer/software.

Before each profile run, you will:

3. **Reset** the logger to prepare it to receive fresh data.

After the logger/barrier assembly is recovered from the kiln, you will then:

4. **Download** the data from the logger.

These stages are described below.

Installing/Removing Insight

The recommended minimum computer specification for Datapaq Insight is as follows.

- 1 GHz processor.
- 2 Gb RAM.
- Monitor resolution 1024 × 768, 256 colors.
- 100 Mb free hard disk space.
- DVD drive.
- 1 free COM (serial) port or USB port.
- Microsoft Windows™ XP, Vista, 7, 8 or above.
- Microsoft Internet Explorer 4 or above.

Installation

Ensure you are logged into Windows in Administrator mode.

For most systems, installation will start automatically on placing the Insight DVD in the drive. (If installation does not start, click the Windows Start button and select Run; browse to your DVD drive, and run Setup.exe.)

Follow the on-screen instructions. You will need your license number to hand, which is to be found on:

- Your license agreement.
- The outside of the DVD case.
- The outside of the system packaging.

Insight's link with the logger must also be made while Windows is in Administrator mode, and it is thus best to do this now, as part of the Insight installation: connect the logger to the PC and follow the procedure under 'Communications Setup' (below). Once this has been done, an operator will be able to use Insight with the logger connected to the PC without being in Administrator mode.

Upgrading

It is not necessary to remove an existing version of the software before installing a new one. Settings and data files used with the current installation will be maintained.

Removal

From the Windows Start button menu, select Settings and then Control Panel. Double-click Add/Remove Programs, select Datapaq Insight and click Add/Remove.

Using the Software

Full details on using the Insight software are contained entirely within its online Help system: access this by clicking Help, and then Contents, on Insight's main menu. Then, within Help, click on Contents headings and topics to expand and read them.

You may also click the Help button in any dialog – or press the F1 key – to bring up help information relevant to the task being performed.

Communications Setup

After Insight has been installed, it is necessary to establish communication between the data logger and the PC, as follows.

The logger can be connected to the PC by either a COM (serial) port or a USB port. Only one logger at a time can be connected to the PC's USB ports: it is not possible to connect simultaneously more than one logger to the PC using USB ports and then to choose which one to use.

1. Using the communications lead supplied, connect the logger to a free COM (serial) port or to a USB port on the PC (to minimize communications problems, connect the lead first to the PC and then to the logger). The red LED on the logger should flash five times to confirm that the connection between the communications lead and the logger has been made.

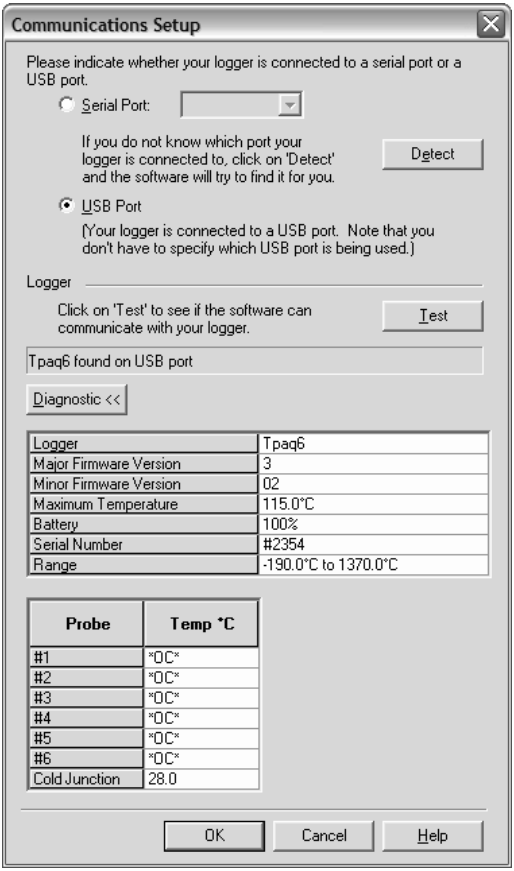
   If using USB, and if the PC is having a Datapaq logger connected for the first time, Windows will display a 'Found New Hardware' message. After a few seconds, Windows will display 'Datapaq Paq21 Logger', and, after a further few seconds, 'Your hardware is installed and ready to use'. If any warnings are displayed about driver-signing, confirm them (Datapaq drivers have been tested, and were installed when Insight was installed).

   Typical sources of problems with establishing communication

   - **Damaged communications lead or connectors** – Check for breaks and other damage. Replace the lead.
   - **Communications lead not fully inserted** – Check correct sockets are being used.
   - **Wrong COM port selected** – Follow the procedure below to select the correct port.

2. On the Insight software's menu bar, select Logger > Setup to open the Communications Setup dialog.
3. Select the type of port to which the logger is connected: USB port or COM (serial or RS232) port. For a COM port, select the port number, or click Detect to auto-detect the port in use.
4. Click Test.

If the logger is detected, its type and the port to which it is connected are displayed.



The Communications Setup dialog for the Tpaq6 logger, with Diagnostic section expanded.

SHORTCUT

Pressing F4 on the keyboard opens the Communications Setup dialog, looks for the port currently in use, and displays the port and logger type (equivalent to clicking Detect in the dialog).

For more information on the logger in use, click the Diagnostic button which now appears. Additional data shown covers firmware version, maximum permitted internal logger temperature, battery charge status, serial number and temperature recording range. Current temperature of the probes (updated once a second) is also shown – or open circuit (*OC*) if no probe is attached; the temperature of the thermocouple cold junction is effectively the current internal temperature of the logger.

Setting Frequency of Electricity Supply

To increase the efficiency of the logger's noise rejection, and thereby provide more stable measurements, select the frequency of the local electricity supply as follows.

1. In the Insight software, select Tools > Options and click on the Logger tab and then on the Advanced button.
2. Select 50 or 60 Hz frequency. 50 Hz is most widely used, but 60 Hz is used in North America, several countries in South America, and in Japan and Korea.

Resetting the Data Logger

The data logger needs to be reset, as follows, before it can receive fresh data. (To reset the logger for a run using telemetry, see p. 30.)

The procedure described here uses the Insight software's Logger Reset dialog.

If you are less sure of the process, you can instead use the Logger Reset Wizard to guide you, step-by-step, through this stage of running a profile: click  *on the Insight toolbar, or select Tools > Wizards from the menu. (NB Not available with Insight Lite software.)*

Any data stored in the logger but not yet analyzed must be downloaded before proceeding, as resetting the logger will permanently erase all data stored in it.

1. Use the communications lead supplied to connect the logger to a free COM (serial) port or USB port on the PC; align the red dot on the logger socket with the red dot on the lead's plug.

   To minimize communications problems: a) connect the lead first to the PC and then to the logger; b) if using USB, always use the same USB port – the one which was first used to set up communications (p. 21).

   The red LED on the logger should flash five times to confirm that the connection between the communications lead and the logger has been made (if it does not, see 'Communications Setup', p. 21). If the logger is not already charged, connect the battery charger lead to the charger connector on the communications lead.

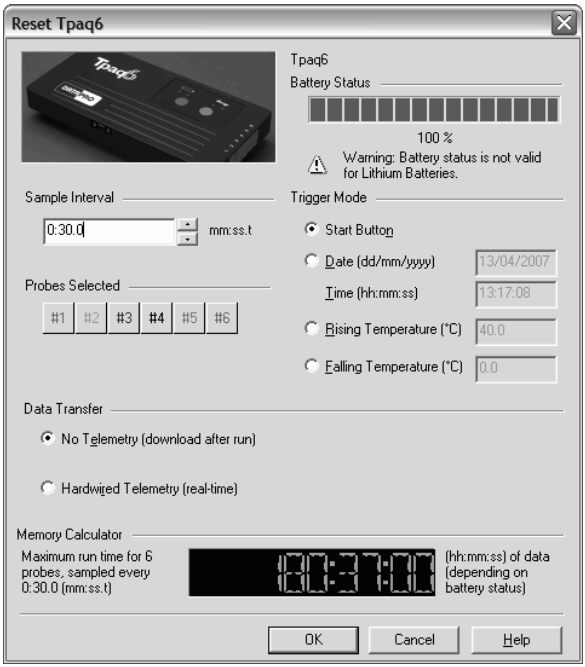
2. Open the Logger Reset dialog (click  on the Insight toolbar, or press function key F2, or select Logger > Reset from the menu bar) and specify your reset options.

   Sample Interval Set the time which is to elapse between each set (sample) of data points (one data point for each probe) that the logger will collect. The shorter the sample interval the better you will be able to record

short-term variations in your temperature regime – but the total recording time available to you will be reduced, and battery life could be shortened so much that it will not be enough for a long kiln process. A rule of thumb is to set sample interval at 1 minute per day of operation, e.g. use 3-minute interval for a 3-day process, 15-s interval for a 6-hour process. For limitations on number of probes allowed when using short sample interval, see p. 12.

Probes Selected To conserve memory in the logger, click on the relevant buttons to deselect those probes which will not be used. The number of probes available and the logger memory size are dependent on the model of logger used. *Probe 1 must always be one of those selected.* For limitations on number of probes allowed when using short sample intervals, see p. 12.

Telemetry Select 'No Telemetry'. (To reset the logger for use with hardwired telemetry, see p. 30.)



The Reset dialog for the Tpaq6 logger.

Memory Calculator Calculates the maximum time for which the logger can collect data, given the sample interval, the number of probes and the logger's memory size. The time available may be further limited by the level of battery charge.

Battery Status No battery status display is available for loggers powered by lithium batteries. If in any doubt about the ability of the batteries to perform a profile run (see 'Battery Life', p. 14), abort the reset procedure by clicking 'Cancel' and replace the batteries.

Trigger Mode Select here a means to start the logger recording data.

Start Button After reset, data-recording starts when the logger's green start button is pressed and held for 1 second.

Date and Time Data recording starts at a specified date and time. The current date appears by default. This trigger mode is not available if the number of runs is set to more than one (see below).

Rising Temperature Data-recording starts when the temperature of any probe rises to the specified value.

Falling Temperature Data-recording starts when the temperature of probe no. 1 reaches the specified value as it is falling.

3. After clicking OK, the logger is reset and a message box confirms the sample interval and trigger mode you have set.
4. Disconnect the communications lead from the logger; the logger's status LEDs briefly flash red and green alternately to confirm logger reset.

Downloading Data

If data acquisition has to be stopped manually, press and hold the logger's red stop button until the red and green logger-status LEDs are on simultaneously. A red logger-status LED flashing every 5 seconds indicates data stored in the logger but not yet downloaded to the PC.

The procedure described here uses the Insight software's Logger Download dialog.

If you are less sure of the process, you can instead use the Logger Download Wizard to guide you, step-by-step, through this stage of running a profile: click on the Insight toolbar, or select Tools > Wizards from the menu. (NB Not available with Insight Lite software.)

1. Connect the logger to the PC with the communications lead. The red LED on the logger should flash five times to confirm that the connection between the communications lead and the logger has been made.
2. Open the Logger Download dialog (click on the toolbar, or press function key F3, or select Logger > Download from the menu bar) and wait while the data is downloaded to the PC. For an explanation of any error messages generated during this process, see p. 33.

If you see the message
Logger stopped due to going over temperature
the data logger's maximum-permitted internal temperature has been exceeded, and it may have suffered damage. Contact Datapaq for advice. The reason for the excessive temperature, which may be the result of process operational problems or the use of an inappropriate thermal barrier, must be resolved before further profile runs take place.

3. The Select Process dialog then appears in order that you may choose a process file to apply to the results. If the process file and its components have been given names, these are shown when the process file is selected. Click 'No Process' if you do not want to apply a process file. (NB Not available with Insight Lite software.)

If you will normally not wish to apply a process file to the results, you can opt not to have the Select Process dialog displayed immediately after a download (from the menu bar, select Tools > Options > Process File); a process file may still be applied subsequently.

4. The newly downloaded data then appears on screen and can be displayed (numerically and graphically), analyzed and printed as you wish; see Insight's online Help system. Save the data as a 'paqfile' (select File > Save or Save As).

You can set alarms to be triggered during a logger download, to warn you of incomplete data recorded during the profile run (from the menu bar, select Tools > Options > Run Alarms).

Specifying Furnace/Kiln Start

If you have not applied a process file, or if the process file you applied did not specify that the **furnace/kiln start position** be adjusted, you may want to adjust the furnace/kiln start position now: from the menu bar, select Process > Adjust Furnace/Kiln Start, or use the right-click menu.

This can be valuable as it permits different paqfiles, i.e. data from different temperature profile runs, to be compared with each other. If you do not wish to adjust the furnace/kiln start at this point, you may still do so at any time subsequently.

For an explanation of furnace/kiln start, and how to adjust it, click Help in the Adjust Furnace/Kiln Start dialog.

If using Insight for Kiln Tracker, and if no kiln zones are set up, you may select Process > Adjust Kiln Start (or use the right-click menu) to enter a duration for the process; this will add a marker on the graph to show the **kiln end**. To remove the marker, set the duration to zero. (NB Not available with Insight Lite software.)

Completing the Documentation

On the menu bar, select Edit > Notes to enter the operator's name and any **additional information** you may wish to record about the profile run. This will be saved with the paqfile and will also appear in your **printed report** (select File > Print Options).

Information about the logger and the data-collection process for the paqfile (including time/date, trigger mode and maximum internal logger temperature) can be seen in the Paqfile Properties dialog (select File > Properties, or right-click on the graph and select from the pop-up menu). (NB Not available with Insight Lite software.)

For further features of the Insight software – particularly data analysis and the use of process files – see the online Help system (on Insight's menu bar, select Help > Contents).

Using Hardwired Telemetry

In addition to the standard off-line analysis, real-time analysis by **hardwired (serial) telemetry** is possible with Insight software when used with an intermittent or periodic kiln (a batch process).

Thus, with thermocouples trailing from the kiln and attached to the logger outside the kiln, data being gathered by the logger is transmitted via the communications lead directly to the PC, and the temperature profile can be watched developing as data is received, i.e. in real time.

Telemetry is not available with Insight Lite software.

Some kiln processes can have long durations. In these instances telemetry can allow you to identify possible problems during the process, and make adjustments. You can then use a second system to confirm that the remedial action has been satisfactory.

By following the procedure in this chapter, you will use the Logger Reset and Logger Download dialogs to run a temperature profile using hardwired telemetry.

Running a profile in real time is performed in essentially the same way as a normal (non-telemetry) run (see p. 23, and your dedicated system manual), but, in addition:

- The **communications lead** is left attached to the logger.
- A **process file** can be applied before the run starts in order that the data can be understood more readily as it appears on screen.
- While the run is in progress, the **real-time display** of incoming data can be customized as preferred, and the logger's status can be checked.

Resetting the Logger for a Run Using Telemetry

The data logger needs to be reset, as follows, before it can receive fresh data.

The procedure described here uses the Insight software's Logger Reset dialog.

If you are less sure of the process, you can instead use the Logger Reset Wizard to guide you, step-by-step, through this stage of running a profile: click  *on the Insight toolbar, or select Tools > Wizards from the menu.*

Any data stored in the logger but not yet analyzed must be downloaded before proceeding, as resetting the logger will permanently erase all data stored in it.

1. Use the appropriate supplied communications lead to connect the logger to a free COM (serial) port or USB port on the PC.

   To minimize communications problems: a) connect the lead first to the PC and then to the logger; b) if using USB, always use the same USB port – the one which was first used to set up communications (*p. 21*).

   The red LED on the logger should flash five times to confirm that the connection between the communications lead and the logger has been made (if it does not, see 'Communications Setup', p. 21).
2. Open the Logger Reset dialog (click  on the Insight toolbar, or press function key F2, or select Logger > Reset from the menu bar), select hardwired telemetry, and specify your other reset options (see p. 23).
3. After clicking OK, the logger is reset and a message box confirms the sample interval and trigger mode you have set.
4. Leave the communications lead connected to the logger, and click OK.
5. The logger's red and green status LEDs then briefly flash alternately to confirm logger reset; click OK.
6. The Select Process dialog then appears in order that you may choose a process file to apply to the results. If the process file and its components have been given names, these are shown when the process file is selected in the list. Click 'No Process' if you do not want to apply a process file.
   (A process file allows you to see the temperature profile in relation to the oven zones as the profile appears on screen during the run. See the Insight software for an introduction to process files: press function key F1, or select Help > Contents from the menu bar, and click the section 'Process Files: Oven, Recipe, Product'.)

You may specify that a **password** is required when an attempt is made to close Insight while a real-time telemetry run is in progress: select Tools > Options > General from the menu bar.

Install the logger in the thermal barrier and **place the system in the kiln** as described in your dedicated system manual.

Real-time Display During the Run

After the first few data packets have been received, the data starts to be displayed in the Graph and Analysis Windows, scrolling in real time as new data is received. You may change the way the data is displayed with the Axes tab of the Graph Options dialog (from the right-click menu, or from the main menu select View > Graph Options): under Telemetry, specify how much of the recently received data is displayed, and whether you wish to see only a certain temperature (y-axis) range, centered on a the latest data.

You may **zoom** the display as when viewing a paqfile (see the online Help system), except that:

- Double-clicking on the graph (or selecting Real Time Zoom from the View menu or right-click menu) shows only the most recently received portion of the data on the scrolling graph (see above).
- Saved zoom modes are not available.

If the **y-axis** is not set to be centered (see above), the default y-axis zoom changes as more data is received, in order to accommodate all received data.

To **move the graph** across the viewing area, hold Shift and drag the mouse pointer.

You may overlay one or more **tolerance/ideal curves** on the graph to compare with the data as it is being received (select View > Overlay). Other paqfiles cannot be overlaid.

You may adjust the **kiln start** position while a real-time run is in progress (select Process > Adjust Oven Start, or use the right-click menu).

Calculations shown in the **Analysis Window** for the chosen data analysis mode update continuously as new data is received. As for non-real-time runs, calculations are performed only on the currently zoomed area shown on the graph. However, if the graph is scrolling and showing just the most recently received portion of the results, the analysis calculations will be performed as if on the full zoom view.

If you wish to **view another paqfile** while the logger is in listen mode, i.e. while data is being received and viewed in real time, you must first stop real time mode (see 'Ending the Run', below).

Ending the Run

To **end or pause data-collection** while a telemetry run is still in progress, select Logger > Stop Real Time Mode. Data then continues to be collected by the logger, but it is no longer received in real time by Insight (download from the logger after the run is finished to retrieve the full data). The graphical and numerical data received up to that point remain on screen, available for viewing and analysis, and can be saved as a paqfile.

While the logger is still operating, you may **resume the collection of data** by Insight: select Logger > Logger Listen Mode. This second bout (and any subsequent bouts) of data-collection can also be ended and saved as a separate paqfile, as above.

If **Autosave** is enabled (select Tools > Options > General), the data being gathered is automatically saved periodically during a telemetry run. If the system fails during the run, the last-autosaved version of the data is displayed automatically when Insight is next run, and you may then choose to save it as a paqfile.

When the run is complete, ensure that data received by Insight has been **saved as a paqfile**. If you wish, you may download the data held in the logger (p. 25), though it should normally be adequate simply to save, as a new paqfile, the data already received.

Troubleshooting

Logger Communications Problems

- **Communications lead not fully inserted** – Check correct sockets are being used.
- **Damaged communications lead or connectors** – Check for breaks and other damage; replace the lead.
- **Wrong COM port selected** – See 'Communications Setup' (p. 21) to select the correct port.

To minimize communications problems:

- **Connect the lead first to the PC** and then to the logger.
- If using USB, **always use the same USB port** – the one which was first used to set up communications (p. 21).

Logger Download Error Messages

Error Message	Action
There are insufficient readings in the logger	Check trigger set point (time or temperature). Check logger's battery for charge. Check date/time settings on computer. Check probes and their connections. Reset logger and test probes (see 'Logger Diagnostics', below).
Logger stopped due to going over temperature	The logger's maximum-permitted internal temperature has been exceeded and it may have suffered serious damage: contact Datapaq for advice.
Logger stopped due to low battery	Replace the batteries, then repeat the profile run.
Logger memory full	Data collection may have stopped before the run was completed: check the data collection period and sample interval before resetting the logger for another run (see 'Resetting the Data Logger', p. <?>).

Checking the Data

Thermocouple probes are generally reliable, but damage resulting from inappropriate use or handling can produce erroneous readings. If you suspect that invalid data may have been introduced into your temperature profile (paqfile), select the View Data tab in the Insight software's Analysis Window to view the raw data as downloaded from the logger. The various types of invalid

data which may be contained in a paqfile are shown in the analysis grid as follows.

OC	Open circuit.
LO	Temperature measured was below the range of the logger.
HI	Temperature measured was above the range of the logger.
***	Calculation cannot be performed (not necessarily because the data are invalid). Does not appear in View Data analysis mode.

Probes with an intermittent open circuit may produce spiky, erratic profiles. Note that spikes are inevitable when probes are disconnected from a running data logger. Typical causes of invalid or interrupted data are:

- Thermocouple becoming detached from the logger.
- Faulty connection.

Readings which are inconsistent with those of other probes may be caused by a short circuit (see 'Logger Diagnostics', below). The probe concerned must be replaced.

Logger Diagnostics

Running the data logger diagnostics provides information on the status of the logger and the means to test the thermocouple probes. Short circuits and open circuits may be revealed: these are sometimes intermittent, and can be a function of temperature and/or rate of change of temperature, or caused by bending the probe cable.

1. Connect the logger to the PC (to minimize communications problems, connect the lead first to the PC and then to the logger). The red LED on the logger should flash five times to confirm that the connection between the communications lead and the logger has been made.
2. Connect a full set of thermocouple probes to the logger, leaving them at ambient temperature.
3. On the Insight software's menu bar, select Logger > Comms Setup to open the Communications Setup dialog.
4. Select the type of port to which the logger is connected: USB port or COM (serial or RS232) port. For a COM port, select the port number, or click Detect to auto-detect the port in use.
5. Click Test.
6. If the logger is detected, the Diagnostic section of the dialog appears (see p. 22). The Temperature list box identifies all available probe channels, the indicated temperature or status, and the temperature of the internal cold junction.
7. Check that all probes are indicating the same temperature. Replace any

showing *OC* (open circuit), or having inconsistent readings indicating an intermittent short circuit.

8. Place the probes into a bowl of hot water and check that all probes show a similar increase in temperature. Replace any showing ambient temperature as this indicates a short circuit. If any probe shows a temperature significantly less than ambient its plug may be incorrectly oriented in the logger socket or wired incorrectly.
9. Click OK to close the dialog.

Testing Thermocouple Probes

Although thermocouples are generally robust, they can be damaged during handling. Use the following procedure to confirm their operation after installation. Note that this test is not an alternative to calibration but will highlight faulty probes, and thus avoid a wasted profile run.

1. Connect the data logger to the PC via the communications lead.
2. Connect the thermocouples to be tested.
3. In the Insight software, select Logger > Reset and set as follows:
   – Sample Interval: 0.5 s.
   – Probes Selected: de-select any not in use.
   – Telemetry: hardwired telemetry.
   – Trigger Mode: start button.

   Click OK.
4. Follow instructions from Insight.
5. When data recording is being shown live on screen, select the View Data analysis tab and subject thermocouples to a known temperature (e.g. freshly boiled water). Faulty probes will give values significantly different from those expected and should be replaced.

Printing Problems

- Check correct printer selected: on menu bar, select File > Print Setup.
- Check printer cable connections.

Datapaq Service Department

If you cannot resolve your problem, please contact the Service Department at Datapaq (see title page for contact details).

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