Datapaq TP6 Data Logger

USER MANUAL

for **Datapaq®**
Tracker Systems

with
Insight™ *software*

Issue 1b
MA0240A

FLUKE.

Process Instruments

Datapaq TP6 Data Logger
User Manual

for
Datapaq® Tracker Systems *with* Insight™ *software*

Issue 1b

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

SAFETY WARNINGS

For safe use of Datapaq equipment, always:
- Take care to follow its supplied instructions.
- Observe any warning signs shown on the equipment.

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

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

The following product type

Datapaq TP6 Thermocouple Data Logger manufactured by Fluke Process Instruments, Lothbury House, Cambridge CB5 8PB, UK complies with the requirements of regional directives as follows.

International Electrotechnical Commission

IEC 61010-1:2010 (3rd edition) – Safety requirements for electrical equipment for measurement, control, and laboratory use.

European Union

Directive 2014/30/EU – Electromagnetic Compatibility (EMC) $C\epsilon$

EN 61326-1:2013 – Group 1, Class B equipment (emissions section only), and Industrial Location Immunity (immunity section only*)*

EN61000-3-2:2014 – Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current <= 16A per phase)

EN61000-3-3:2013 – Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16A per phase and not subject to conditional connection

Directive 2014/53/EU – Radio Equipment Directive (RED)

EN 55011:2009 (+A1) – Industrial, scientific and medical (ISM) radio-frequency equipment – Radio disturbance characteristics – Limits and methods of measurement. Group 1, Class B equipment

EN 300 220-2 V2.4.1 – Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 2: Harmonized EN covering essential requirements under article 3.2 of Directive 2014/53/EU

EN 300 328 V2.1.1 other than F.H.S.S – Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

EN 301 489-1 V2.2.0 draft Class B Emissions – Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

EN 301 489-1 V2.2.0 draft – called from Pt 17 Immunity – Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

EN 301 489-3 V1.4.1 – Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz

EN 301 489-17 V3.2.0 draft – Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

Directive 2014/35/EU – Low Voltage Directive

Directive 2006/66/EC – Battery Directive as amended by 2013/56/EU

Directive 2011/65/EU (amended by (EU) 2015/863) – Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS III).

Federal Communications Commission, USA

Electromagnetic Compatibility Directive for digital devices.

CFR47 Class A – Code of Federal Regulations: Part 15 Subpart B, Radio Frequency Devices, Unintentional radiators.

CFR47 – Code of Federal Regulations: Part 15 Subpart C - Radio Frequency Devices - Intentional Radiators

CONTENTS

Introduction

Datapaq® Tracker systems, incorporating Insight™ software, are complete systems for monitoring and analyzing the temperature profiles of products within your heat-treatment process; 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 powerful and flexible printing option allows the user to generate and customize reports, including any or all of the analysis results or raw temperature data.

The basic Tracker system hardware comprises:

- Data logger (including communications lead and charger) (p. 13).
- Thermal barrier and thermocouple probes (not covered here; see the relevant manual supplied with your system).
- Hardwired telemetry (p. 63) as standard, and an optional TM21 radio-telemetry system (described in its own *User Manual*).

This manual is for Tracker systems supplied with a **Datapaq TP6 data logger**, and focuses on all aspects of using that logger. There is also guidance on setting up the Insight software; complete information on using the software is contained in the online Help system available after it is installed. For information on choosing and using the logger's thermal protection (barriers and heatsinks) 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 process, see the relevant manual supplied with your system.

> *This manual, and other Datapaq user documentation, in **various languages**, is available on the Insight installation USB key.*

Logger Specifications and Operation

The TP6 data logger is at home in a wide range of heat-treatment applications. Its capacity for recording over 4.3 million data-points makes it a supremely powerful, accurate and in-depth data-collection tool; combined with a built-in transmitter to see temperature profiles developing in real time, this is an ideal data logger for all applications.

The logger's key features are:

- Two **model sizes** to suit different applications.
- Huge **memory capacity** for detailed process analysis: a total of over 4.3 million data-points (p. 15).
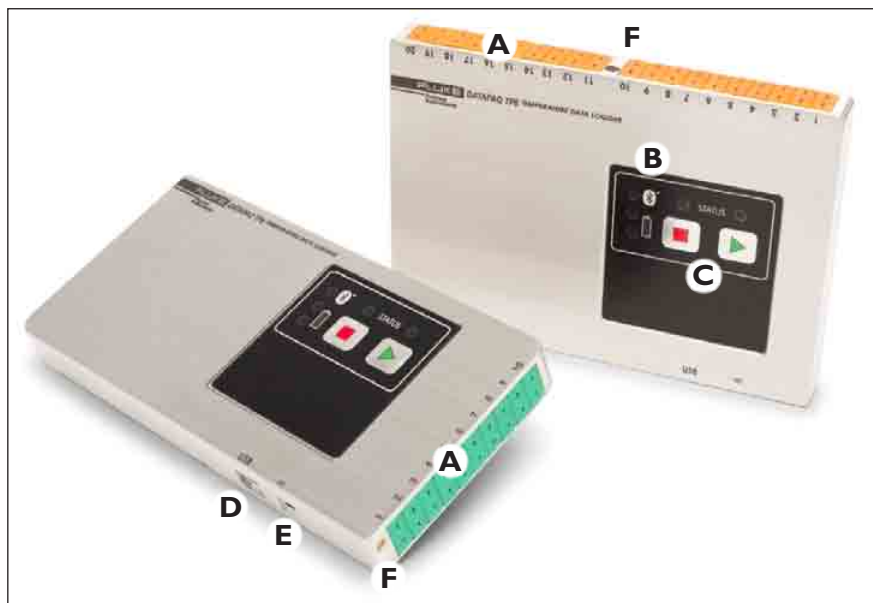
TP6 loggers: 10-channel narrow and 20-channel wide

A *Thermocouple sockets.*
B *Battery and logger status LEDs (p. 17).*
C *Stop/start buttons (p. 19).*
D *USB communications socket (p. 45).*
E *Charging socket (p. 24).*
F *Transmitter-aerial socket (for use with TM21 telemetry system).*

- Ten or 20 **thermocouple channels** (depending on model size; see below) for maximum data collection on each run.
- Can be specified for use with various **thermocouple types** (B, J, K, N, R, S, T; see p. 16) and with **analog inputs** (current and/or voltage; see p. 34) – or with a **mixture** of thermocouple types and/or analog inputs.
- Powered by standard **alkaline AA batteries** or by user-replaceable **rechargeable NiMH batteries (BP6010)**; for **high-temperature** applications involving logger operating temperatures (i.e. inside the thermal barrier) of up to 110°C/230°F, can also be powered by non-rechargeable **lithium batteries (BP0021)**. Any logger can use any battery-type interchangeably if appropriate battery housings are used (available separately). See p. 20.
- Short **sample intervals**, to collect maximum data in minimum time (p. 15).
- High **accuracy** for compliance to tight specifications (see p. 16): for type K thermocouples, ±0.3°C/0.5°F (above −100°C/−148°F); for type N thermocouples, ±0.4°C/0.7°F (above 0°C/32°F).
- Data gathered by the logger but not yet downloaded ('**hot data**') is protected by non-volatile memory or by software warning if reset is attempted before download.
- **USB** and **Bluetooth®** communication (p. 34).
- **Hardwired telemetry** (p. 63) or (if specified for use with optional TM21 system) **radio telemetry** for monitoring in real time – both with full analysis functions and alarms to warn the user if the process is out of specification.
- Five **LEDs** to show the exact status of the logger's activity and its batteries (p. 17).
- **Start and stop buttons** for easy user control (p. 19, p. 61).
- Rugged case and electronics allow operation in **harsh environments** of dust, pressure and vacuum.
- **IP67 water-resistance** rating to guarantee reliability/data integrity.
- **Reset** possible by start button alone, for speed and simplicity (p. 54).

The TP6 logger achieves **ingress protection standard IP67**, which specifies that, when immersed in water to a depth of 1 m for 30 minutes, water must not enter in any harmful quantity.

Specifications

	Narrow – 10-channel TP6100A	Narrow – 20-channel TP6200A	Wide – 20-channel TP6300A
Height Width Length	20 mm/0.8 in. 97 mm/3.8 in. 198 mm/7.8 in.	20 mm/0.8 in. 97 mm/3.8 in. 198 mm/7.8 in.	20 mm/0.8 in. 124 mm/4.9 in. 177 mm/7.0 in.

Thermocouples	Available for a single thermocouple type, or for combinations of up to three types: B, J, K, N, R, S, T (see specifications for each, below).
Analog inputs:	See p. 34.
Current	Measurement range 4–20 mA. Accuracy ±0.1% at 24°C/75°F.
Voltage	Measurement range 0–10 V. Accuracy ±0.1% at 24°C/75°F.
Operating temperature (of the logger itself)	Dependent on battery type: Rechargeable −40°C to 70°C/−40°F to 158°F. Alkaline −40°C to 55°C/−40°F to 131°F. Lithium −40°C to 110°C/−40°F to 230°F.
Humidity range	0–100% non-condensing.
Operating pressure (excluding limitations on battery)	10^{-7} bar at 20°C to 20 bar at 110°C 1.5×10^{-6} psi at 68°F to 290 psi at 230°F
Ingress protection (without thermal barrier)	IP67 (submersion to 1 m in water for 30 min) with thermocouples fitted.
Real-time monitoring	Hardwired (serial) telemetry via communications lead (p. 63), or via Bluetooth (p. 37), as standard. Radio (RF) telemetry via optional built-in transmitter.
Data capacity	Over 4.3 million data-points in total, plus associated pre-trigger data (see p. 61) and calibration data. This is sufficient for, e.g., 10 runs of 10 hrs with 10 probes and sample interval 5 sec. Using fewer probes (see p. 50) increases the possible run-time.
Hot-data protection	By non-volatile memory, and software warning if reset attempted before download.
Logger reset	By Insight (p. 48) or by start button (using previous reset options) (p. 54).
Sample interval:[1]	
No telemetry	1–3 channels 0.1 s to 50 min. 4–9 channels 0.2 s to 50 min. 10 channels 0.3 s to 50 min. 11–20 channels 1 s to 50 min.
Hardwired telemetry	1–10 channels 1 s to 50 min. 11–20 channels 2 s to 50 min.
Radio telemetry[2]	1–20 channels 2 s to 50 min. *In Japan*, 4 s to 50 min.
Data-collection start	No trigger, Start button, Date and time, Rising temperature, Falling temperature.

Pre-trigger data stored	Yes (configurable; see p. 60).	
Multiple runs	Collect data from up to 10 runs before downloading (see p. 52).	
Multiple events	Up to 10 events (different probe selections, sample intervals and trigger modes for different stages of a profile run; see p. 52).	
Communications	USB 2.0, Mini-B socket. Bluetooth (p. 34) (*not available in all countries*).	
PC/software compatibility	See p. 43.	
Battery	Interchangeable types, each in different battery housing (see p. 20):	

- NiMH rechargeable, 4 × 1.2 V (*BP6010 – only Datapaq battery-packs are suitable*). For battery life, see p. 23.
- Alkaline, 4 × AA 1.5 V (Duracell or other quality batteries recommended). For battery life, see p. 27.
- Lithium thionyl chloride non-rechargeable, 4 × AA 3.6 V, for high-temperature use (*BP0021 – only Datapaq supplied batteries are suitable*). For battery life, see p. 29.

Battery charger	CH0070 power-supply unit: input 90–264 V AC, 50–60 Hz, 400 mA. Must not be used if the ambient temperature is below 10°C/50°F or over 40°C/104°F.
USB power	Logger is powered by USB when connected; no batteries are then required (except when being reset for a non-telemetry run; see p. 48).

[1] Intervals of 1 s and above can be set only in whole seconds.

[2] Data applies to radio telemetry using a single transmission, i.e. no interleaving (see *TM21 Radio-telemetry System User Manual*; or, in Insight's Help system, select Menu Functions > Logger > Reset).

Specifications for Specific Thermocouple Types

	Type B	Type J	Type K
Measurement range	55°C to 1,815°C 131°F to 3,299°F	0°C to 800°C 32°F to 1,472°F	−190°C to 1,370°C −310°F to 2,498°F
Accuracy* (using sample interval > 0.8 s)	±3.0°C at 400°C ±1.0°C at 1,500°C ±5.4°F at 752°F ±1.8°F at 2,732°F	±0.3°C ±0.5°F	±0.5°C below −100°C ±0.3°C above −100°C ±0.9°F below −148°F ±0.5°F above −148°F
Resolution	0.1°C/0.2°F	0.1°C/0.2°F	0.1°C/0.2°F
Socket color (IEC 60584-3)	Gray	Black	Green

	Type N	Type R	Type S
Measurement range	−190°C to 1,300°C −310°F to 2,372°F	0°C to 1,760°C 32°F to 3,200°F	0°C to 1,760°C 32°F to 3,200°F
Accuracy* (using sample interval > 0.8 s)	±0.5°C below 0°C ±0.4°C above 0°C ±0.9°F below 32°F ±0.7°F above 32°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	±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
Socket color (IEC 60584-3)	Pink	Orange	Orange

	Type T
Measurement range	−196°C to 400°C −321°F to 752°F
Accuracy* (using sample interval > 0.8 s)	±0.5°C below −100°C ±0.3°C above −100°C ±0.9°F below −148°F ±0.5°F above −148°F
Resolution	0.1°C/0.2°F
Socket color (IEC 60584-3)	Brown

* There will be an additional error of 0.01°C for every 1°C difference between the temperature at which the logger is operated (i.e. the logger's internal temperature) and the temperature at which it was calibrated. For more-detailed accuracy data, contact Fluke Process Instruments.

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

Logger LEDs

The logger is equipped with two sets of two LEDs:

- **Yellow** and **green/red** show the status of the **battery**.
- **Red** and **green** show the status of the **logger and its memory**.

Also a single **blue** LED to show Bluetooth status.

*To see an **animated demonstration** of all the LED sequences: in Insight, select Help > LED Sequences; or, in Insight's Help system, select Introduction > Logger LEDs.*

Battery Status LEDs

Yellow	Green/Red	Meaning
Off	Off	Battery has at least 20% of full charge (charger not connected), *or...* Charger is connected but logger is acquiring data (in which case logger-status green LED will be flashing), *or...* Fault with battery or logger.
Flashing every second	Off	Battery has 20% or less of full charge (charger not connected).
Off	RED	Battery charging.
Off	GREEN	Charging complete (charger connected).
Off	Flashing RED once per second	Battery being preconditioned due to being too hot, too cold or too deeply discharged (see p. 25).
Double-flash every second	Off	Lithium batteries are being depassivated (see p. 32).

Logger Status LEDs

Red	Green	Meaning
Red and green LEDs each give 5 flashes, *alternating* with each other		Logger successfully reset.
Red and green LEDs flash continuously, *alternating* with each other, at sample interval *		Logger awaiting trigger (see p. 50) (in most situations, except as below).
Red and green LEDs continuously give double-flash *together*, every 5 seconds		Logger awaiting start-button trigger for 2nd or subsequent runs in multiple-run mode (see p. 52).
On	Flashing at sample interval *	Logger awaiting trigger, but one or more of the enabled input channels is open circuit.
Red and green LEDs flash *together*, at sample interval *		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). Reset temperature trigger (see p. 50).
Off	Flashing at sample interval *	Logger acquiring data.
Flashes 5 times	Off	Connection between communications lead and logger has been made.
Flashing every 5 seconds	Off	Logger has data in memory which has not been downloaded. (Logger will power-off after 5 mins – or after 30 mins if Bluetooth is on.)
2 quick flashes every second	Off	Logger too hot to start logging (after pressing start button).
Flashing every second	Off	Internal error. (Logger will power-off after 5 mins – or after 30 mins if Bluetooth is on.)

Red	Green	Meaning
One flash	Off	Start button pressed during a profile run to mark an event (see p. 61).

* Flashing interval will actually fall in range 0.5–5 s.

Other Sequences

When the logger is powered on, the yellow battery and green logger status LEDs flash together once.

If the logger has Bluetooth communication enabled, the **blue LED** will flash every 5 seconds while **Bluetooth is active**.

When red and green buttons are pressed, together, to **turn off logger** (see below), all five LEDs flash together, once.

Start/Stop Button Actions

Action	Results	Notes
Press GREEN button *after data from previous run has been* **downloaded** *and/or logger has been* **reset**.	Starts logging.	If logger was not reset after previous run, the last reset options (sample interval, probe selection, etc.) are used as default. In telemetry mode, logger also starts sending data.
Press GREEN button *when* **logger contains 'hot data'**, *i.e. data which has not been downloaded.*	If in *single-run mode* or if in *multiple-run mode and 10 runs have been performed* (p. 52), logger powers up (but will not start a new run or delete data). If in *multiple-run mode and fewer than 10 runs have been performed*, logger starts logging.	Each run of a multiple run will be performed using the same data-collection options, until the logger is reset.
Press RED button	Stops logging. As confirmation, red and green logger-status LEDs both flash once. *NB Does not work if operation of the stop button has been disabled (see p. 61).*	Data is retained in memory. Logger cannot be restarted until data is downloaded (unless in multiple-run mode, p. 52). Red LED flashes every 5 seconds to warn of data in memory. If in telemetry mode, will also send 'end of run' signal to end real-time run.

Action	Results	Notes
Press RED and GREEN buttons together *and hold for **1 second.***	Turns logger off. All five LEDs flash together, once. *If logger was not previously responding to buttons, LEDs will NOT flash.*	*Communications lead must not be connected. If the Stop button is disabled (see p. 61), and sometimes otherwise, it may be necessary to turn off the logger by removing and replacing the batteries.* Data is retained in memory. The previous reset options are retained as current default (p. 54).

*It is possible to set the logger up so that use of the stop button is **disabled** during a profile run. See p. 61.*

Battery

Every TP6 logger can use three battery types interchangeably.

- NiMH rechargeable (see p. 23).
- Alkaline AA (see p. 26).
- Lithium non-rechargeable for high-temperature use (see p. 29).

Each type uses a different battery housing, identified by a different-colored label (see below) which also shows the logger's permitted operational temperature. All types can be replaced by the user.

The **key differences between the three battery types**, in use, are as follows.

	NiMH	Alkaline	Lithium
Part Number	BP6010	BP0011 or equivalent	BP0021
Label on battery housing	White	Blue	Red
Logger's operating temperature (internal)	−40°C to 70°C −40°F to 158°F	−40°C to 55°C −40°F to 131°F	−40°C to 110°C −40°F to 230°F
Rechargeable	Yes	No	No
Battery life (10 channels, sample interval 1 min., logger temperature 70–100°C/158–212°F, no telemetry)	200 hrs (between charges) (see p. 23)	450 hrs (see p. 27)	500 hrs (see p. 29)
Charge level shown by Insight (p. 22)	Yes	Yes	No
Special safety measures	No	No	Yes (see p. 32)
Disposal (p. 39)	Return to Fluke Process Instruments	Recycling center	Recycling center (see also p. 33)

Interchangeable battery-packs and housings:
NiMH rechargeable (top, p. 23), lithium (center, p. 26) and alkaline (right, p. 29).

The logger automatically detects the type of battery in use, which prevents damage to non-rechargeable batteries if the charger is connected by mistake.

To **remove the battery housing** from the logger (in order to replace with a new one or to change the battery type in use), see p. 26.

For disposal of batteries, see p. 39.

*When the communications lead is attached, the logger is **powered via USB**. Batteries can be left in the logger, but they are not then required (except when the logger is being reset for a non-telemetry run; see p. 48).*

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 shorter 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.

- **Bluetooth** – Bluetooth communication causes extra battery drain (around 20%), and should be turned off (see p. 36) if not used.
- **Operating with Radio Telemetry** – Sending data to a receiver outside the oven, furnace or kiln requires more power than that needed simply to read and store the data.

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 and whether radio telemetry was used.

See the sections below on specific battery types for **guideline battery-life data**.

The Logger Reset dialog (p. 49) shows actual battery use: the **time since the battery was last charged or last changed**.

Charge Level of Batteries

When the battery's charge drops to 20% of the full level, this will be shown by the **logger LEDs** (p. 17).

For **NiMH and alkaline batteries** only... When connected to the PC, the **Insight software** shows the logger's battery-charge level as a percentage of full charge, as follows:

- In the main Logger Reset dialog (p. 48).
- When using wizards which reset the logger.
- During communications setup (p. 47).
- When using the Real Time Tool dialog during Bluetooth telemetry (p. 37) or during use of the optional TM21 radio-telemetry system.

*For **alkaline batteries**, the battery-charge level displayed by Insight will be valid only if Duracell or other quality batteries are fitted. Using inferior batteries may cause misleading percentages to be shown.*

Battery Voltage

The logger records the battery voltage during a profile run. This is then downloaded to be stored in the paqfile and can be displayed on screen alongside the temperature profile. See p. 60.

Auto Power-off

To save battery life, the logger will **power-off automatically** in the following situations.

- The communications lead is unplugged when the logger does not contain data which has not been downloaded (e.g. after a data-download) and the logger has not been reset.
- The PC is powered down while the logger is connected to it.
- The logger contains data from a previous run which has not been downloaded (the logger-status red LED will be flashing every 5 seconds), and has been in this state for 5 minutes (or for 30 mins if Bluetooth is turned on; see p. 34). Note that:
  - The power-off will not cause this data to be lost.
  - The data will continue to be marked as 'not yet downloaded', reducing the chance of it being accidentally deleted later.
- The logger-status LEDs have been indicating an error (red LED will be flashing every second) for 5 minutes.
- The logger has Bluetooth turned on but there has been no Bluetooth communication for 30 minutes.

> *When the communications lead is attached, the logger is **powered via USB** (see p. 21) and will not automatically power-off.*

The logger will **automatically power-up** in the following situations.

- The communications lead (connected to a powered PC) is plugged in. The logger is then ready to communicate with the PC.
- The start button is pressed. The logger will then resume the mode that it was in when it powered-off, e.g. not-yet-downloaded data will continue to be protected from accidental deletion.

NiMH Rechargeable Batteries

The logger can use a pack of four rechargeable 1.2 V nickel-metal-hydride (NiMH) cells (BP6010). These are suitable for applications where the logger's operating temperature (i.e. the temperature of the logger itself) does not exceed 70°C/158°F. *Only Datapaq battery-packs are suitable.*

For the service life and replacement of the battery, see p. 25.

Life of NiMH Batteries

The data below can serve as a guide – though the values given are no more than an indication of the battery life that can be expected. See p. 21 for general considerations that affect actual battery life.

No. of Channels	Sample Interval (sec.)	Logger Temperature	Battery Life (hrs)	
			No Radio Telemetry	Radio Telemetry Used
10	3	25°C/77°F	–	155
10	3	70°C/158°F	–	135
10	60	25°C/77°F	340	255
10	60	70°C/158°F	240	–
10	180	25°C/77°F	–	–
10	180	70°C/158°F	–	245
20	3	25°C/77°F	–	–
20	3	70°C/158°F	–	120
20	60	25°C/77°F	–	–
20	60	70°C/158°F	240	–
20	180	25°C/77°F	–	–
20	180	70°C/158°F	–	160

Charging NiMH Batteries

Recharge the battery as follows.

1. Plug the charger into the electricity supply.
2. Plug the charger lead into the charging socket on the logger.

A full charge is typically delivered in less than 2 hours, maximum about 3 hours. Indication of battery/charging status is provided by colored LEDs on the logger (see p. 17).

*The charger must not be used if the **ambient temperature** is below 10°C/50°F or over 40°C/104°F.*

The logger intelligently monitors the battery, ensuring it is never overcharged. Thus, by leaving the charger connected to the logger, the logger will always be on charge and ready for use. This will not damage the battery or reduce its service life.

Note that the logger will not charge while collecting data. The charger can be connected to the logger while logging, but charging will stop as soon as data-collection starts.

New batteries – or ones which have been unused for several months – should be charged for 24 hours before use.

NiMH batteries discharge slowly even when not in use and will need charging if left for more than three weeks.

Where batteries are too cold (below 0°C/32°F), too hot (over 45°C/113°F) or too deeply discharged, they must be **preconditioned** before fast charging can begin. Pre-conditioning (slow charging) occurs automatically if it is required, and is shown by the battery status LEDs (flashing red). If the battery is still being pre-conditioned after 5 hours, there may be a fault; contact Fluke Process Instruments.

Replacing NiMH Batteries

The logger employs non-volatile memory, so – even when the battery is removed and replaced – stored data will not be lost.

Service life of the rechargeable NiMH battery is up to about 500 charge/discharge cycles.

The **battery-pack is easily replaced** by the user, as follows.

1. Ensure the logger is **powered off**: press green and red buttons together, and hold for 1 second (see also p. 20).

2. Undo the four screws retaining the battery cover until the cover can be removed

3. Gently pull the battery housing downwards to disconnect it from the logger.
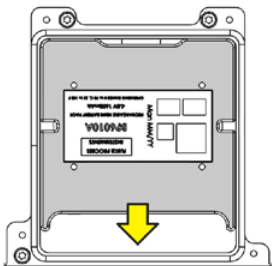
4. Remove the battery pack and dispose of it appropriately (see p. 39).

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5. Insert the new battery pack, with the label side visible when fitted into the logger, and push it upwards to engage with the connector in the logger.
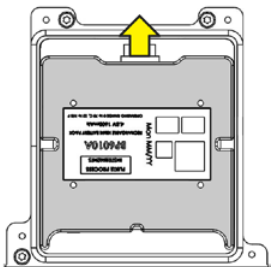
6. Check that the o-ring seal is still properly located in the groove in the case around the battery-compartment.
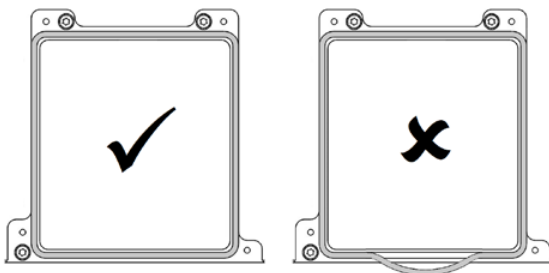
7. Secure the battery-compartment cover with its four screws.
8. After fitting the screws, ensure that the battery-compartment cover is flush with the logger case.
9. **Charge for 24 hours** before first use (see p. 24).

To **remove the battery housing** (in order to replace with a new one or to change the battery type in use), proceed as follows.

1. Open the battery-compartment door and remove the battery-pack, as above.
2. Pull out the battery housing.
3. Insert the new battery housing, ensuring the internal connector has engaged.
4. Secure the battery-compartment door as described above.

Alkaline Batteries

If the correct battery housing is fitted (see p. 20), the logger can use four alkaline AA 1.5 V. cells. Fluke Process Instruments recommends the use of Duracell or other quality batteries. These are suitable for applications where the logger's operating temperature (i.e. the temperature of the logger itself) does not exceed 55°C/131°F.

*For **alkaline batteries**, the battery-charge level displayed by Insight (p. 22) will be valid only if Duracell or other quality batteries are fitted. Using inferior batteries may cause misleading percentages to be shown.*

Life of Alkaline Batteries

The data below can serve as a guide – though the values given are no more than an indication of the battery life that can be expected. See p. 21 for general considerations that affect actual battery life.

No. of Channels	Sample Interval (sec.)	Logger Temperature	Battery Life (hrs)	
			No Radio Telemetry	Radio Telemetry Used
10	3	25°C/77°F	–	–
10	3	70°C/158°F	–	245
10	60	25°C/77°F	–	–
10	60	70°C/158°F	700	–
10	180	25°C/77°F	–	–
10	180	70°C/158°F	–	530
20	3	25°C/77°F	–	–
20	3	70°C/158°F	–	175
20	60	25°C/77°F	–	–
20	60	70°C/158°F	575	–
20	180	25°C/77°F	–	–
20	180	70°C/158°F	–	440

Replacing Alkaline Batteries

Carry out as follows.

1. Ensure the logger is **powered off**: press green and red buttons together, and hold for 1 second (see also p. 20).
2. Undo the four screws retaining the battery cover until the cover can be removed.

3. Gently pull the battery housing downwards to disconnect it from the logger.
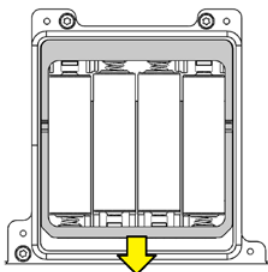
4. Remove the batteries from the housing, one at a time and dispose of them appropriately (see p. 39).

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. Carefully install each new battery, one at a time, into the battery housing. Check that the battery polarity is correct; the correct orientation is marked on the bottom of the housing.

> *Check that you are using the **correct battery type** for the battery housing fitted. If in doubt, remove the housing (see p. 26) and check the label on it.*

7. Push the battery housing upwards so that it engages with the connector on the logger.
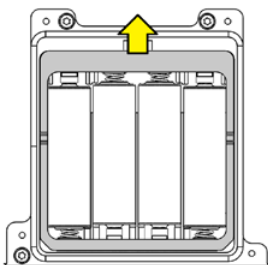
8. Check that the o-ring seal is still properly located in the groove in the case around the battery-compartment.
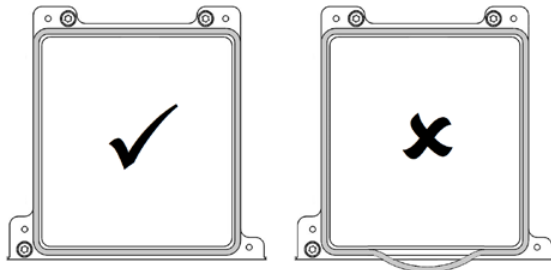
9. Secure the battery-compartment cover with its four screws.

10. After fitting the screws, ensure that the battery-compartment cover is flush with the logger case.

To **remove the battery housing** from the logger (in order to replace with a new one or to change the battery type in use), see p. 26.

Lithium Batteries

For high-temperature applications, if the correct battery housing is fitted (see p. 20), the logger can use four lithium thionyl chloride non-rechargeable AA 3.6 V cells. These are suitable for applications where the logger's operating temperature (i.e. the temperature of the logger itself) does not exceed 110°C/230°F.

> **WARNING**
> *Only lithium batteries supplied by Datapaq, BP0021, are suitable for use with the TP6 logger.*

Life of Lithium Batteries

The data below can serve as a guide – though the values given are no more than an indication of the battery life that can be expected. See p. 21 for general considerations that affect actual battery life.

No. of Channels	Sample Interval (sec.)	Logger Temperature	Battery Life (hrs)	
			No Radio Telemetry	Radio Telemetry Used
10	3	25°C/77°F	–	–
10	3	100°C/212°F	–	445
10	60	25°C/77°F	–	–
10	60	100°C/212°F	700	–
10	180	25°C/77°F	–	–
10	180	100°C/212°F	–	600
20	60	25°C/77°F	–	–
20	60	100°C/212°F	–	325
20	180	25°C/77°F	–	–
20	180	100°C/212°F	–	575

Replacing Lithium Batteries

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

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. Ensure the logger is **powered off**: press green and red buttons together, and hold for 1 second (see also p. 20).

3. Undo the four screws retaining the battery cover until the cover can be removed.

4. Gently pull the battery housing downwards to disconnect it from the logger.
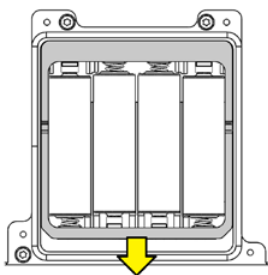
DO NOT replace the Lithium batteries with the battery housing still fitted in the logger. The Lithium batteries are configured as two stacks of 2 cells in parallel, the logger will start to de-passivate the Lithium batteries as soon as the first pair are fitted, this may result in the second pair not being de-passivated enough or even at all if the battery housing is fitted to the logger whilst the batteries are being replaced. Alkaline batteries may be replaced in-situ since they form a single battery stack of 4 cells in series and do not require de-passivation before use.

5. Remove the batteries from the housing, one at a time.

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.

6. 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.

7. 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.

8. Remove the **new batteries** from their protective UN-compliant packaging, and retain this for later use.

9. Carefully install each new battery, one at a time, into the battery housing. Check that the battery polarity is correct; the correct orientation is marked on the bottom of the housing.

> *Check that you are using the **correct battery type** for the battery housing fitted. If in doubt, remove the housing (see p. 26) and check the label on it.*
>
> *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 those supplied by Datapaq.***
>
> *Do not mix different types of Datapaq battery, nor batteries of any other type; this could lead to an explosion.*

10. 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.

11. Push the battery housing upwards so that it engages with the connector on the logger.

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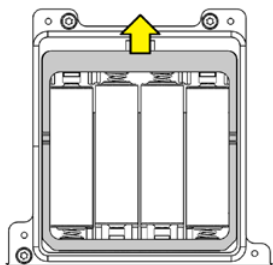
12. Check that the o-ring seal is still properly located in the groove in the case around the battery-compartment.
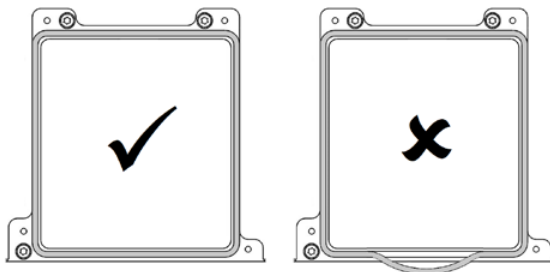
13. Secure the battery-compartment cover with its four screws.

14. After fitting the screws, ensure that the battery-compartment cover is flush with the logger case.

15. Datapaq batteries must be **depassivated** before they are used for the first time. This takes place automatically after placing them in the logger, as follows.
    a. Yellow LED produces two rapid flashes every second.
    b. After 20 minutes, yellow LED stops flashing.
    c. Logger is ready for use.

To **remove the battery housing** from the logger (in order to replace with a new one or to change the battery type in use),

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 Datapaq inorganic lithium thionyl chloride batteries 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 150°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 Fluke Process Instruments. 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. Under the European Union Batteries and Accumulators Directive, the used batteries which are removed from the

logger by the user should be disposed of at an appropriate recycling center. **Do not dispose of in fire and do not incinerate.** Datapaq BP0021 lithium batteries do not contain mercury, cadmium or any other heavy metal or other hazardous material according to EU Directives 91/157/EEC and 93/86/EEC.

Analog Inputs

In addition to storing data from thermocouple input, the TP6 can be specified to support the recording of current and/or voltage data to allow other types of sensor to be used. For measurement ranges and accuracy, see p. 15.

Such analog input is made via one or more of the logger's numbered sockets (when fitted, colored white), relevant channel numbers being shown on a label on the rear of the logger. For each analog input on the logger, a white plug is provided for connection to the chosen sensor device.

> **WARNING**
> *Incorrect connection to the current and/or voltage sockets may cause serious damage to the logger. Always check the label carefully to ensure that input cables are connected to the correct channels.*

Data from the analog-input channels is displayed by Insight as a custom unit on the right-hand axis of the graph window. To set up custom units in Insight, select Tools > Options > Units, and click Help for a full explanation.

Analogue inputs support the same sample intervals as thermocouples (see p. 15).

> *Analog inputs can be calibrated by Fluke Process Instruments, and this generates a separate calibration certificate from that produced by calibrating thermocouple inputs (see p. 38). Unlike thermocouple inputs, however, the logger does not store the results of analog-input calibration, and thus: a calibration certificate cannot be printed by the user; a logger correction factor file for analog inputs cannot be produced.*

Bluetooth Communications

> *Bluetooth communication is not available in all countries. Where unavailable, Bluetooth options in Insight will be greyed out.*

As an alternative to using its communications lead, the logger can use Bluetooth to communicate with the PC. This can be used for:

- Resetting the logger (p. 48).
- Downloading data from the logger to the PC (p. 56).

- Short-range wireless telemetry (see below).
- Downloading diagnostic information for troubleshooting (see p. 72).

> *The reliable transmission range will vary but will typically not exceed 5 m, and reception may not be possible from a logger inside a thermal barrier.*
>
> *Bluetooth communication will not operate if the logger's temperature is above 85°C/185°F.*
>
> *The logger will power-off automatically if Bluetooth is turned on (see below) but there has been no Bluetooth communication for 30 minutes.*
>
> *Bluetooth communication causes extra battery drain, and should be turned off (see p. 36) if not used.*

The TP6 logger is configured by default to be ready to use Bluetooth communication. All that is necessary (as with any Bluetooth device) is to pair it with the PC with which it will communicate. Thereafter, the operations listed above can be performed without connecting the communications lead between logger and PC. If Bluetooth is turned on but the communications lead is connected, the lead (not Bluetooth) will be used preferentially.

Pairing

The logger and PC must be paired as two Bluetooth devices before communication can take place between them. For PCs without built-in Bluetooth support, it will be necessary to fit a Bluetooth adapter (dongle) to a spare USB port; if using the adapter for the first time, follow its driver-installation procedure.

> *Most available Bluetooth adapters are suitable – but NB that the adapter must support Bluetooth low energy (BLE', 'LE').*

Ensure that the logger is not connected to the PC with the communications lead, then proceed as follows (details may vary, depending on the Windows version in use).

1. Ensure that Bluetooth is enabled on your PC by checking for the icon 🅱 in your Windows system tray (notification area), usually at the bottom right of your Windows desktop: right-click it, and select 'Open Settings' to open the Bluetooth Settings dialog. Ensure the following settings:
   - *Uncheck* 'Allow Bluetooth devices to find this computer' (if you wish to prevent unauthorized connection to your PC).
   - *Check* 'Allow Bluetooth devices to connect to this computer'.
   Click 'OK' to close the dialog.
2. In Insight, select Logger > Setup to display the Communications Setup dialog (see p. 47). Click 'Detect', and wait until Insight recognizes and lists suitable nearby loggers. (Loggers shown in red are those previously used

and/or too far away. To remove such a logger from the list, right-click on its name and click Remove on the popup.)

3. Select the name of the logger in the 'Bluetooth' section of the dialog, click the 'Test' button in the 'Logger' section, and the logger name will be displayed there to confirm that communication is possible with that logger. Clicking the 'Diagnostic' button should expand the dialog to show current probe information and other data (p. 47).

4. Click 'OK' to close the dialog.

The logger and PC are now paired and ready to communicate.

Troubleshooting

In case of problems with establishing Bluetooth communication, try the following.

- Move the logger closer to, or further away from, the PC. If the logger's name is shown in **red** in the Communications Setup dialog, the logger is too far away.

- If using a Bluetooth adapter, unplug and re-insert it.

- Unplug any devices attached to USB 3 ports (active USB 3 ports can interfere with Bluetooth).

- Restart the logger (see p. 69).

More Than One Logger

When Bluetooth communication is initiated (e.g. by starting a logger reset), and more than one Datapaq Bluetooth logger is present, Insight will display the **Select Logger** dialog with a list of available loggers and their serial numbers. Select the chosen logger and then click 'OK'; clicking 'Cancel' will cancel communication.

Turning Bluetooth On and Off

By default, as soon as pairing has been achieved (see above), Bluetooth is turned on in the logger, but, under the following conditions, it will automatically be turned off:

- When the logger and PC are connected by communications lead. Thus will be turned off when hardwired telemetry (p. 63) is in use.

- When the logger is collecting data and storing it in memory.

- When radio-telemetry is in use.

When the logger is able to receive Bluetooth communication, the blue LED will flash every 5 seconds.

Bluetooth communication causes extra battery drain, and should be turned off, as follows, if not used.

1. Ensure the logger is connected to the PC using the communications lead.

> *Logger and PC **must be connected by the communications lead** in order to turn Bluetooth either on or off.*

2. In Insight, select Logger > Setup to display the Communications Setup dialog.

3. Click 'Test', The logger name will be displayed and the 'Bluetooth' button will be enabled.

4. Click 'Bluetooth' to display the **Bluetooth Setup** dialog.

5. A message below the 'Check Status' button will show whether Bluetooth is currently enabled or disabled (turned on or off) – or whether the logger and PC are not connected by cable. Click the button if necessary.

6. Click 'Enable Bluetooth' (to turn on) or 'Disable Bluetooth' (to turn off) as required, and a message will confirm the change.

Bluetooth Telemetry

Temperature-profile data gathered by the logger can be passed directly to the PC, in real time, by using Bluetooth communications. Because good Bluetooth reception cannot usually be achieved with a logger inside a thermal barrier (see p. 35), the logger will normally be outside the thermal process, with thermocouples trailing from the oven/furnace/kiln to the logger. The process of running a profile is thus as for hardwired telemetry (p. 63) – and the major benefit of Bluetooth telemetry is to isolate the logger from the PC and thereby avoid earth-loop problems.

The procedure follows that used for hardwired telemetry (see p. 63) except that:

- Logger reset (p. 48) must be carried out using Bluetooth (i.e. do not connect the logger to the PC using the communications lead). The 'Bluetooth Telemetry' option is then available to be selected in the **Logger Reset dialog**.

- While a run is in progress, you may use the **Real Time Tool dialog** to check the integrity of data-packets as they are received, as well as the status of the logger (click ⊞ on the toolbar, or select View > Real Time Tool).

Data can be collected from only one logger at a time. If more than one logger is present and gathering data, choose which logger's data to gather and display in real time by selecting Logger > Logger Listen Mode; this displays the **Select Logger** dialog (see p. 36).

Wireless telemetry over greater ranges, and/or involving use of a thermal barrier, will require the TM21 radio-telemetry system (available separately).

Over-temperature Protection

The logger and the Insight software work together to reduce the likelihood of damage occurring due to the logger's internal temperature being too high. (For the logger's operating-temperature range, see p. 15.)

- Insight can be instructed to **show a warning message if a reset is attempted** (p. 48), or to **prevent a reset**, while the logger is above a specified temperature (default 45°C/113°F); see p. 60.

- If logging is started without resetting the logger using Insight (i.e. by simply pressing the start button and thus using the previous reset options; see p. 54), the logger **will not start logging** if its internal temperature is above 45°C/113°F. The logger-status red LED will show 2 quick flashes every second.

- If the logger's internal temperature exceeds 75°C/167°F (when fitted with NiMH or alkaline battery) or 115°C/239°F (when fitted with lithium battery), it shuts down, preserving data already collected. When the data is downloaded, Insight will give a warning that this has happened.

> *The logger records its internal temperature during a profile run. For access to this data, see p. 60.*
>
> *To check the logger's current internal temperature when connected to a PC running Insight, select Logger > Setup and click 'Diagnostic' (p. 45). The temperature is also displayed in the Reset dialog (p. 48).*

Testing and Calibration

It is recommended that the logger is tested and calibrated by Fluke Process Instruments at least once a year. The calibration procedure comprises:

- Inspection of the logger, externally and internally.
- Battery- and charge-testing.
- Heat-cycle test of up to 14 hours in the ovens of Fluke Process Instruments.
- Stability testing, using a stable temperature source and varying ambient temperatures.
- Calibration and updating of the logger's firmware.
- Issue of certificate, which can be traced back to UKAS or NIST calibration standards.

To calibrate your logger, please return it to the Service Department at Fluke Process Instruments (see p. 72).

For full certification and traceability, calibration data is stored in each logger for instant access by Fluke Process Instruments engineers. To **print a calibration certificate** for a logger, in Insight select File > Print Calibration Certificate (*NB not available with all Insight products*), and then choose whether to print a certificate for:

- The logger which was used to create the currently displayed paqfile (temperature profile). or
- The logger (if any) which is currently connected to the PC.

For maximum accuracy, Insight can use the logger's calibration data to create a **logger correction factor file** which can be applied to downloaded temperature-profile data (*NB not available with all Insight products*). The file may be created from calibration data which is:

- Entered manually, or
- Contained in the logger, or
- Contained in a paqfile.

To **create** a logger correction factor file, run the Logger Correction Factor Wizard (select File > New > Logger Correction Factors). To be **prompted to apply** a correction factor file whenever data is downloaded, select Tools > Options > Logger, and check 'Prompt for correction factors when downloading'.

Even without creating a logger correction factor file, the logger can be set to apply logger correction to collected data **automatically** every time data is downloaded. Connect the logger to the PC, and in Insight select Tools > Options > Logger, and check 'Automatically apply logger correction when downloading'. (*NB not available with all Insight products.*)

For a full description of logger correction factors, see 'Correction Factors' in Insight's ***Help system***.

*To carry out your own basic testing of the operation of the **logger and its thermocouples**, see p. 71.*

Disposal of Batteries and Loggers

Always adhere to the applicable statutory regulations for recycling and waste disposal. For details of recycling Fluke Process Instruments products within the European Union, see www.fluke.com.

Under the European Union Batteries and Accumulators Directive, used **alkaline and lithium batteries** which are removed from the logger by the user should be disposed of at an appropriate recycling center. For additional information on handling and disposing of lithium batteries, see p. 32.

Under the European Union WEEE Directive, users should return **all NiMH batteries and all loggers** (whether or not containing batteries) to Fluke Process Instruments for disposal at the end of their useful life.

Restrictions on Use

The following general considerations apply to use of the logger and its associated equipment. For reasons of health and safety, and to avoid harm or damage to the logger, to other equipment and to the environment, *always observe the following restrictions and cautions*.

For the logger's specifications, see p. 13.

- It is essential to use the logger with the **correct Datapaq thermal barrier** for your individual process, as supplied and approved by Fluke Process Instruments. Failure to use the appropriate approved barrier, or use in an unapproved manner (e.g. using above the specified temperature, or for longer than the specified time, or with insufficient opportunity for adequate cooling between profile runs), can cause catastrophic damage to the data logger or to other equipment, and can endanger health, or may lead to *major injury or death*. In particular, exceeding the logger's specified temperature range for any length of time may cause **battery-leakage** producing toxic fumes and leading to respiratory irritation and chemical skin burns. For the same reasons, never use a damaged thermal barrier.

- Ensure that all dimensions of your logger/barrier/accessory assembly are such that it will **fit comfortably within the oven/furnace/kiln** through all stages of the process. Pay particular attention to handles, catches, etc., and to trailing thermocouples. Failure to do this can cause the assembly to jam in the oven with consequent overheating and potentially-severe damage to the equipment. Resultant battery-leakage, and the process of recovering the equipment, may cause skin burns and respiratory irritation.

- **Batteries**:
  - If using rechargeable batteries (see p. 20), use only the Datapaq mains battery charger supplied with your logger. Using a **charger which is not approved** by Fluke Process Instruments for use with your logger could cause *major injury or death*.
  - Do not charge the battery in a **wet environment**, e.g. outside. This could cause *major injury or death*.
  - Always use the correct Datapaq batteries (see p. 20). Using with unapproved batteries may cause **battery-leakage** producing toxic fumes and leading to respiratory irritation and chemical skin burns. Never use a damaged battery-pack.
  - **First plug the battery charger into the mains**, i.e. before connecting the logger.
  - Charge batteries only within **temperature range** 5–45°C/41–113°F (mains charger).

- ○ Keep battery-packs **clean and dry**. Clean dirty connectors with a dry, clean cloth.
  - ○ Do not **disassemble or crush** battery-packs.
  - ○ Do not put battery-packs near **heat or fire**, nor in **sunlight**.
  - ○ If not used for an **extended period**, remove battery-pack from logger to prevent battery-leakage and resultant damage.
- Do not use the logger, or other Datapaq equipment, in **humid/wet process environments or corrosive atmospheres** unless specifically approved for such use by Fluke Process Instruments. Damage to the equipment may result.
- Never connect thermocouples to **mains electricity**, nor allow thermocouples to touch an **oven's heating elements**. This could cause *major injury or death*.
- Take care when handling thermocouple cables to avoid accidental damage to the eyes by **sharp thermocouple-tips**.
- Use **PTFE thermocouples** only within their approved temperature range. Use at higher temperatures produces irritant toxic fumes. See the dedicated *User Manual* for your Datapaq Tracker system.
- Never carry the logger by **holding the attached communications lead or thermocouples**. This can lead to injury by dropping the logger onto your body, and may damage the lead, thermocouples or sockets.
- On removal from the oven, the **thermal barrier and logger will be hot enough to burn skin** – even though their temperature will not be apparent. Use protective gloves.
- Do not remove the logger from the thermal barrier by **tipping it out of the barrier**. This can lead to injury by dropping the logger onto your body, and may damage the logger.
- The user must **on no account attempt any disassembly or repair** of the logger (other than to replace batteries, p. 20). Any such attempt risks battery-leakage and may cause skin burns and respiratory irritation, and will invalidate any existing warranty or service agreement with Fluke Process Instruments. For information on the Datapaq Service Department, see p. 72.

Using the Logger with Insight Software

See your dedicated Datapaq Tracker 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 (see below).
2. Establish **communication** between the logger and the computer/software (p. 45).

Before each profile run, you will:

3. **Reset** the logger to prepare it to receive fresh data (p. 48).

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

4. **Download** the data from the logger (p. 56).

These stages are described below.

Installing/Removing Insight

Datapaq Insight used with the TP6 logger requires the following minimum **computer specification**.

- 1 GHz processor.
- 2 Gb RAM.
- Monitor resolution 1024×768, 256 colors.
- 100 Mb free hard disk space.
- 1 free USB port.
- Microsoft Windows™ 7 (SP1), 8, 10 or above.
- Microsoft Internet Explorer 4 or above.

The TP6 logger operates only with Datapaq Insight v.9.5 and above.

Software Distribution

Your software will be provided on a combined USB key/software license card. If you wish to install the software directly from the USB key follow the instructions in the next section. If you do not wish to install the software from the USB key, you can download it from the Fluke Process Instruments website. Go to www.flukeprocessinstruments.com/insight.

Installation

> *Ensure you are logged into Windows in Administrator mode.*

If you are using the Insight USB key to install the software, insert it into a spare USB port on your PC, use Windows Explorer to browse to the USB key and run Setup.exe.

If you downloaded the software, use Windows Explorer to browse to the folder where you downloaded into and run it.

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

- Your license agreement.
- Your combined USB key/license card
- 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

Use the standard procedure for your Windows version, e.g.

- *In Windows 7* – Start button > Control Panel > Programs and Features, and double-click Datapaq Insight.
- *In Windows 10* – Start button > Settings > System > Apps & features, and click Datapaq Insight.

Help System

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.

> By default, **only one logger at a time** can be connected to the PC and it is not possible to connect simultaneously more than one logger to different USB ports on the PC and then to choose which logger to use (but see p. 67 for use of multiple loggers). (Bluetooth communication does permit switching between multiple loggers; see p. 36.)

1. Using the communications lead supplied, connect the logger to a free 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 the PC is having a Datapaq logger connected for the first time, Windows will display a 'Found New Hardware' message and the PC is then ready to work with the logger. If any warnings are displayed about driver-signing, confirm them (Datapaq drivers have been tested, and were installed when Insight was installed).

   > In case of problems in establishing communication, see p. 69.

2. On the Insight software's menu bar, select Logger > Setup to open the Communications Setup dialog.

3. Click Test.

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

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 every 5 seconds) 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.

Communications Setup   ✕

Please indicate how to communicate with your logger:

◉ USB Port
(Your logger is connected to a USB port. Note that you don't have to specify which USB port is being used.)

○ Bluetooth: 🅱

The following Bluetooth enabled devices were detected. Click on Detect to search for Datapaq loggers.

Logger	Serial Number	Detect
▶ Datapaq TP6	493401	

○ Serial Port: [▾]

If you do not know which port your logger is connected to, click on 'Detect' and the software will try to find it for you.   **Detect**

Logger

Click on 'Test' to see if the software can communicate with your logger.   **Test**

Datapaq TP6 (#493401) found on USB port

[Diagnostic <<] 🅱 [Bluetooth...]   [Advanced]

Logger	Datapaq TP6
Major Firmware Version	1
Minor Firmware Version	20
Maximum Temperature	70.0°C
Battery	70% (NiMH)
Serial Number	#493401
Range	-190.0°C to 1370.0°C

Probe	Readings	Probe	Readings
#1 (°C) K	24.9	#11 (°C) K	24.8
#2 (°C) K	24.9	#12 (°C) K	24.9
#3 (°C) K	24.8	#13 (°C) K	24.9
#4 (°C) K	24.8	#14 (°C) K	24.8
#5 (°C) K	24.9	#15 (°C) K	24.8
#6 (°C) K	24.8	#16 (°C) K	24.8
#7 (°C) K	24.8	#17 (°C) K	24.8
#8 (°C) K	24.8	#18 (°C) K	24.8
#9 (°C) K	24.9	#19 (°C) K	24.9
#10 (°C) K	24.9	#20 (°C) K	24.9
Internal (°C)	24.9		

[OK]   [Cancel]   [Help]

The Communications Setup dialog for the TP6 logger, with Diagnostic section expanded.

*It is advisable at this stage to set the **frequency of the local electricity supply** within Insight.*

Running a Temperature Profile

By following this procedure you will use the Logger Reset and Logger Download dialogs to run a temperature profile **without telemetry**, i.e. data is collected by the logger and stored internally – until it is downloaded to the PC after the run is completed and then saved as a new 'paqfile' (p. 56). (To run a profile using hardwired telemetry, see p. 63.)

> *When the logger is plugged into the PC – whether or not Insight is running – the logger is automatically detected: you will by default be presented with a **popup option to reset the logger or to download data** from it. If you accept one of these options, the operation will start (Insight will first open if necessary). If you disable the popup feature and wish later to re-enable it, right-click the TP6 icon in the Windows system tray (notification area).*

Resetting the Data Logger

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

> *It is not necessary to go through the reset procedure if using single-run mode (p. 52) and if the previous reset options are to be re-used: see p. 54.*
>
> *If the logger is **too hot** from the previous run, Insight will (by default) display a warning message – showing the logger's current internal temperature – until it cools; Insight can also be set to prevent reset in these circumstances (this feature is configurable; see p. 60).*
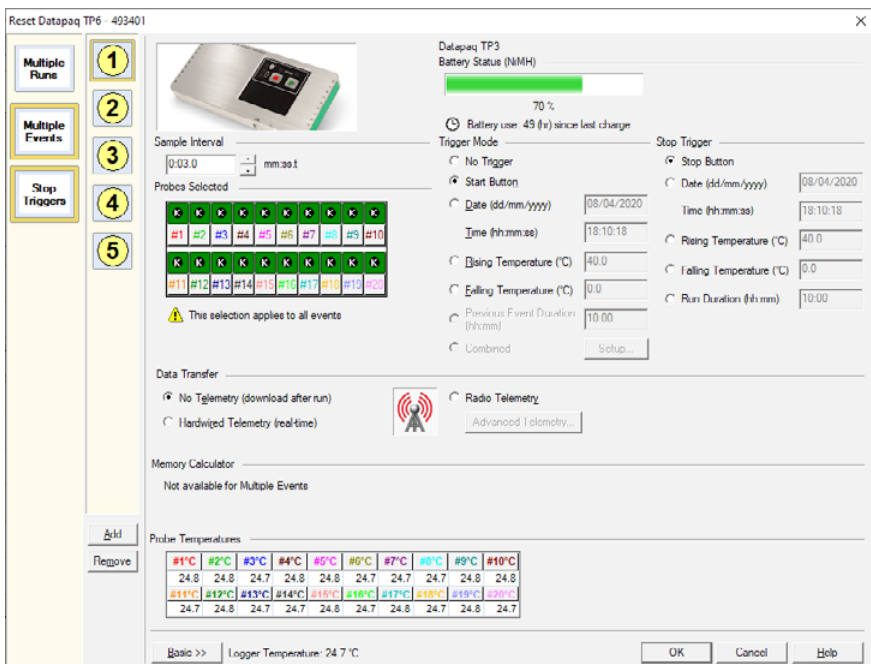>
> *The procedure described here uses the Insight software's Reset dialog. If you are less sure of the process, you can instead use the Logger Reset Wizard to guide you, step-by-step, through this stage of running a profile: click ⚡ on the Insight toolbar, or select Tools > Wizards from the menu.*
>
> *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**. If the reset process is started on a logger which contains data from a previous run which has not been downloaded, a warning message will show this (and the logger-status red LED will be flashing every 5 seconds).*
>
> *When the communications lead is attached, the logger is **powered via USB**, but – for a normal (non-telemetry) profile run – batteries must be in place in the logger during reset to ensure a power supply when the communications lead is later removed (batteries are not required if resetting for hardwired telemetry; see p. 63). If using rechargeable batteries, the battery charger may be connected to the logger but this is not necessary.*

1. Use the communications lead supplied to connect the logger to a free 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 it does not, see 'Communications Setup', p. 45).

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

The advanced form of the Reset dialog for the 20-channel TP6 logger. Multiple events (p. 52) and stop triggers (p. 51) have been selected.

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 the temperature regime – but the total recording

time available will be reduced, data will take longer to download to the PC after a run, and battery life could be shortened so much that it will not be enough for a particularly long process. For longer processes, 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 intervals, see p. 15. A default (fixed) sample interval can be set which cannot be edited in the Reset dialog (see p. 60).

Probes Selected   If some probes will not be used during the profile run, it is usually helpful to exclude them from the temperature profile: click on the relevant buttons to deselect those probes. The number of probes available is dependent on the model of logger used. *Probe 1 must always be one of those selected.*

Battery Status   The charge indicator gives both the current percentage of full charge held by the logger battery (see p. 22), and a color-coded report:

GREEN   Sufficient charge to perform a run.
YELLOW   May be enough charge for a run, but battery getting low.
RED   Insufficient battery charge: recharge or change the batteries.

The battery charge level will not be displayed if the logger is on charge: disconnect the charger to verify battery status.

The display is invalid for lithium batteries.

NiMH batteries discharge slowly even when not in use and will need charging if left for more than three weeks. For battery life and charging, see p. 21.

Battery use is shown: the time (in hours:minutes:seconds) since the battery was last charged or last changed.

If in any doubt that battery charge is sufficient for the next run, abort the procedure by clicking 'Cancel', and recharge the logger or fit new batteries.

Trigger Mode   Select here a means to start the logger recording data (not all modes are available if using multiple-run mode; see above).

No Trigger   Data-recording starts immediately the reset is complete (if resetting via Bluetooth, p. 34) or when the communications lead is disconnected after reset. If possible, connect the thermocouples to the logger before disconnecting the logger from the PC; this avoids the logger recording invalid data (open-circuit errors; see p. 70) until the thermocouples are connected.

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.

Rising Temperature   Data-recording starts when the temperature of *any probe* reaches the specified value as it is rising.

Falling Temperature   Data-recording starts when the temperature of *any probe* reaches the specified value as it is falling.

> *If a temperature trigger mode is set, the logger also records pre-trigger data; see p. 61.*

Stop Trigger   If required, you may select a means to stop the logger recording data. To enable selection of a stop trigger, first click **Advanced** in the Reset dialog, then click 'Stop Triggers' to display the options. A stop trigger can be set in both single-run and multiple-run modes (see p. 52): in multiple-run mode, a stop trigger can be used to stop logging of one run in readiness to start the next.

Stop Button   Data-recording stops when the logger's red stop button is pressed and held for 1 second (ensure that use of the stop button is not disabled; see p. 61.)

Date and Time   Data recording stops at a specified date and time. (Not available if using multiple-run mode.)

Rising Temperature   Data-recording stops when the temperature of *all probes* has reached the specified value as it is rising.

Falling Temperature   Data-recording stops when the temperature of *all probes* has reached the specified value as it is falling.

Run Duration   Data-recording stops when a specified time (starting from the start of logging) has elapsed. Note that no warning will be displayed if you specify a time which exceeds the expected battery life.

To **disable** the operation of stop triggers, click 'Stop Triggers' again. Alternatively, click 'Basic' (which will also return you to the standard Reset dialog); selections made to setup stop triggers (and multiple events) are then lost.

Data Transfer   Select 'No Telemetry'. (For use of hardwired telemetry, see p. 63; for Bluetooth telemetry, see p. 37.)

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

If multiple-run mode (p. 52) is selected, note that the time shown is the total available for all runs until the logger is reset. The memory calculator does not operate if multiple events (p. 52) are set.

Probe Temperatures   The current temperature measured on each of the logger's channels is shown, updated every 5 seconds. This serves as a useful check that thermocouples are working properly.

Logger Temperature   The current internal temperature of the logger is shown. (To display the internal temperature during the profile run, as part of the paqfile, see p. 60.)

Multiple Runs   Rather than having to download data at the end of every profile run (the default behavior), the logger can collect data for up to 10 runs before downloading (see also p. 57, p. 59). To enable this multiple-run mode, first click **Advanced** in the Reset dialog, then click the 'Multiple Runs' button which appears.

In single-run mode (*the default, if 'Multiple Runs' is not selected*)*:*
  - ○ Data must be downloaded after every run.
  - ○ When starting the next profile run, the data held in the logger will be deleted automatically (this is prevented if the data has not yet been downloaded), so there is no need to reset the logger unless you wish to change the data-collection options. (See p. 54 for starting a new run using previous reset options.)
  - ○ Any trigger mode (see p. 50) can be selected.
  - ○ Hardwired, Bluetooth and radio telemetry can all be used.

In multiple-run mode:
  - ○ The logger can collect data from up to 10 profile runs before it needs to be downloaded (p. 56).
  - ○ After 10 profile runs have been performed, the logger must be reset using Insight in order to delete data from the logger and empty it for further runs.
  - ○ The memory calculator shows the total time available for all runs until the logger is reset.
  - ○ Individual profile runs can be downloaded from the logger at any time, but this does not free up any space in the logger's memory until the whole memory is emptied by performing a reset using Insight.
  - ○ Each multiple run will be performed using the same data-collection options, until the logger is reset.
  - ○ To *start data-collection* for each run, only the start button and temperature *trigger modes* can be selected (see p. 50).
  - ○ *Stop data-collection* at the end of each run by using the stop button. If the stop button has been disabled (see p. 61), instead set a *stop trigger* to stop collection according to rising/falling temperature or specified duration (see p. 51). Pressing the stop button when paused between runs will always terminate multiple-run mode.
  - ○ Hardwired and Bluetooth telemetry cannot be used (but radio telemetry can be used).

Multiple Events   By default, the same probe selections, sample interval and telemetry options are used for the whole of a profile run – but multiple-event mode allows you to specify different settings within different stages of the run, each new stage being triggered by a specified combination of time and/or

---

temperature. To enable this multiple-event mode, first click **Advanced** in the Reset dialog, then click the 'Multiple Events' button which appears; this further expands the dialog and activates a default minimum of two events. Select the event-number you wish to modify, and make selections.

Sample Interval – Enter the interval you wish to use for the currently-selected event.

Probes Selected – Select the probes which you wish to collect data during the currently-selected event (see p. 50).

Trigger Mode – For event 1, any trigger mode (see p. 50) can be selected. Subsequent events can be triggered by:
- ○ Date and time.
- ○ Rising or falling temperature.
- ○ Specified duration of previous event being reached.
- ○ Combination of date/time and temperature – whichever occurs first (not available if multiple-run mode, p. 52, is also set).
- ○ Combination of duration and temperature – whichever occurs first.

Stop Trigger – Set any stop trigger (or no stop trigger) as described on p. 51. Click 'Stop Triggers' to enable/disable. NB A stop trigger will stop the entire run, not an individual event; each event (except the final one) will normally be stopped by the next event starting.

Data Transfer – Multiple events can operate while telemetry is used, but only one type of telemetry (hardwired or Bluetooth or radio) can be used during a single profile run.
- ○ If radio telemetry is selected, it can be enabled or disabled for specific events: click the appropriate event number, and then 'Radio Telemetry' or 'No telemetry'.
- ○ If hardwired or Bluetooth telemetry is selected, it will operate for all events in the profile run.
- ○ If the sample interval set for a given event is too short for radio telemetry (see p. 15), telemetry will stop during that event. If a subsequent event's sample interval is long enough, telemetry will resume.
- ○ For Bluetooth telemetry, if the value of a sample interval entered in the dialog is too short for reliable transmission, the value will be modified as necessary.

Click 'Add' to define additional events (maximum 10). To remove an event, select the event-number and click 'Remove'; subsequent events are then renumbered. To **disable** the operation of multiple events, click 'Multiple Events' again, or click 'Basic' (which will also return you to the standard Reset dialog). Selections made to setup multiple events (and stop triggers) are then lost.

The dialog's memory calculator (p. 51) does not operate if multiple events are set.

Multiple runs, multiple events and stop triggers can all be set in combination.

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 – then continue flashing alternately, at the chosen sample interval (maximum 5 seconds between flashes), to show that the logger is waiting to be triggered. If the trigger mode (p. 50) has been set to no trigger, data-recording starts immediately, and green LED flashes at sample interval (p. 18).

Using Previous Reset Options

From run to run, the logger retains the last-programmed set of reset options – even if the battery has been removed in the meantime. Thus it is not necessary to go through the reset procedure if the same reset options are to be re-used. Instead, simply **press the start button** (and hold until LEDs flash) to start data-collection with the same reset options as before (if trigger mode was set to date and time, logging will nevertheless start immediately). Temperature data which is still held in the logger and which has been downloaded will then be overwritten.

The logger will not start logging if:

- The logger contains data which has not been downloaded (thus, either download the data, p. 56, or reset the logger with Insight and thereby delete the data, p. 48).

or

- The logger's internal temperature is above 45°C/113°F (see p. 38).

*If using **multiple-run mode** (p. 52), you must reset the logger using Insight before starting a new series of runs.*

Starting the Run

See the dedicated *User Manual* for your Datapaq Tracker system, and/or consult Fluke Process Instruments, for details of:

- Choosing and installing **appropriate thermocouple probes** on your product.

- Selecting an appropriate **thermal barrier** for the logger.

> *Ensure the **thermal barrier has cooled** sufficiently since its last use.*
>
> *Before using a new barrier for the first time, or if you suspect a barrier has absorbed **moisture**, you should run it once through your process without the logger to remove the moisture.*

Then, when the logger has been reset as above, proceed as follows.

1. Plug the **thermocouples** into the logger's numbered sockets. If you are using a process file (p. 58), ensure that the probe/socket numbers on the logger correspond to those used to define probe numbers and locations in that file.

   > *Do not lift the logger by the thermocouple cables. This will damage the cables and connectors.*

2. The indication from the logger's **red and green LEDs** (p. 18) depends on its current status:
   - *Logging has already started* (*no trigger was set; p. 50*) – Green LED flashing at sample interval).
   - *Logger waiting for start of data-collection to be triggered* – In most situations (except as below), red and green LEDs flash alternately, at the sample interval.
   - *Logger in multiple-run mode and waiting to start 2nd or subsequent runs of a series, with start button as trigger* – Continual double-flashes, both LEDs together.

   If there is any other LED indication, logging may be unable to start; see p. 18.

3. If the trigger mode is start button, press and hold the logger's **start button** for about 1 second until the green LED starts to flash at the sample interval.

   > *Data-recording cannot start until the **logger has cooled** sufficiently from the previous run. If it is still too hot, pressing the start button will cause the logger-status red LED to give two quick flashes every second.*

4. Ensure the **barrier's sealing surfaces are clean and undamaged**. A good seal between barrier and thermocouple cables is essential if the logger is to be protected. Put the **logger in place in the barrier** (within the heatsink if used), laying the thermocouple cables across the sealing material to exit the barrier at the cutout, ensuring they are side by side and not crossing each other.

5. **Fit the lid**, ensuring a good seal around the thermocouple cables. Secure the lid's catches with the locking pins, if fitted.

Downloading Data

Recover the system from the oven/furnace/kiln as soon as it is safe to do so.

> **WARNING**
>
> The thermal barrier **and logger** will be **hot enough to burn skin** – even though their temperature will not be apparent. Use protective gloves.
>
> **Failure to remove the logger quickly from the hot thermal barrier could damage the logger.**
>
> Do not remove the logger by tipping it out of the barrier. This can lead to injury by dropping the logger onto your body, and may damage the logger.
>
> See the dedicated User Manual for your Datapaq Tracker system.

1. Open the thermal barrier. Placing it on a cold surface will increase its rate of cooling. (An additional thermal barrier should be purchased if insufficient time is available to allow it to cool between test runs.)

2. 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 (if use of the stop button is disabled – see p. 61 – connecting the communications lead when the logger is removed from the barrier will stop the logger collecting data). 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.

3. Remove the logger from its thermal barrier.

4. Use the communications lead supplied to connect the logger to a free USB port on the PC.

   > If data-collection has not already stopped (see above), connecting the communications lead will stop the logger collecting data.
   >
   > To minimize communications problems: a) connect the lead first to the PC and then to the logger; b) always use the same USB port – the one which was first used to set up communications (p. 45).
   >
   > If **Bluetooth communications** are enabled (p. 34), the whole download process can be performed as described below, but without the communications lead connected.

   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.

---

5. Open the Logger Download dialog (respond to the popup on connecting the logger, or click ⬇ on the toolbar, or press function key F3, or select Logger > Download from the menu bar).

6. If the logger holds data from **multiple runs** (p. 52), Insight displays a numbered thumbnail of each profile, with data-collection time shown (*except in some Insight products; see below*). Any profiles whose data has already been downloaded are marked in the display. By default, all profiles will be selected for download, unless they contain fewer than 10 data-points. Click on thumbnails to deselect any you wish not to download. You may select to **Merge all selected runs into a single paqfile**: this will combine the data in a single paqfile (for an explanation of merging, see Menu Functions > File > Utilities in the online Help system). Click 'OK' to start downloading the selected profile data; click 'Cancel' to abort the downloads.

> *Downloading individual runs from the logger does **not** delete those runs from memory or clear space for further runs to be added. The only way to delete data from the logger's memory is to perform a reset using Insight (p. 48), and this deletes all the profile-run data stored in the logger.*
>
> *In some Insight products, individual runs cannot be selected for download: instead, all profiles in memory are downloaded.*
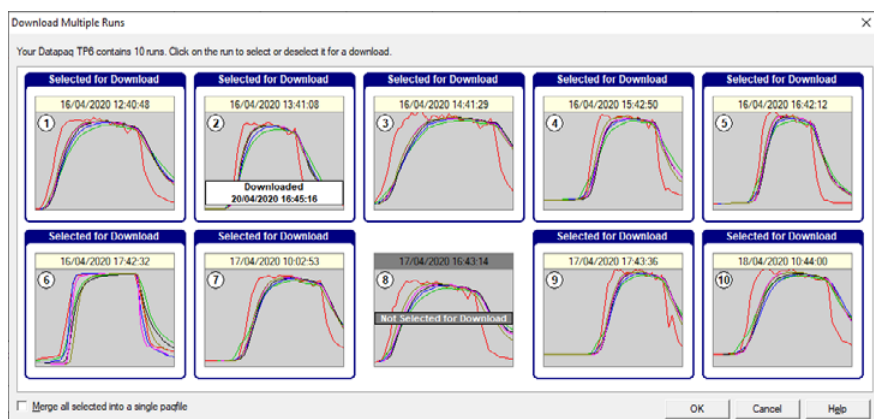
Downloading data from multiple profile runs stored in the logger (not in some Insight products; see text). In this example, all profiles except no. 8 are selected for download; profile no. 2 has already been downloaded, but will now be downloaded again; the profiles will not be merged.

7. Wait while the data is downloaded to the PC.

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. 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; contact Fluke Process Instruments for advice.

*A warning message will also be shown if the logger has stopped recording data due to a **low battery**.*

In all cases, data recorded up to the point of error will have been preserved.

*For **recommended actions** to take in response to error messages, see p. 69.*

8. If enabled, the **Select Process** dialog or the **Select Oven/Furnace/Kiln, Recipe and Product** dialog then appears in order that you may choose a process, oven/furnace/kiln, recipe or product file which will be applied to the results. Click 'No Process' or 'Cancel' if you do not want to apply one.

*A **process file** allows you to see the temperature profile in relation to the oven/furnace/kiln 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'.*
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.

9. The newly downloaded data then appears on screen numerically and graphically. Save the data as a 'paqfile' (select File > Save or Save As).

The data from your profile run can now be displayed, printed and analyzed as you wish; see Insight's online Help system for full details.

The means of proceeding to the **next profile run** after a logger download depends on the contents of the logger memory, on whether the logger is in multiple- or single-run mode (p. 52), and on whether you wish to change the data-collection options.

- Logger in **multiple-run mode**:
  - If the logger memory contains **nine or fewer profile runs** (whether or not they have been downloaded), **data-recording for the next run can be started by using the trigger selected in the previous reset** (e.g. start button or rising temperature; see p. 50); the other previous data-collection options will then also be used.
  - If the logger memory contains **10 profile runs** (whether or not they have been downloaded), **a new run cannot be started until the logger memory has been emptied by resetting using Insight** (p. 48).
- Logger in **single-run mode**:
  - When starting the next profile run, the data held in the logger will be deleted automatically (this is prevented if the data has not yet been downloaded), so there is no need to reset the logger unless you wish to change the data-collection parameters (see p. 54).
- For both **multiple- and single-run modes**:
  - To start a new run with **different data-collection options**, reset the logger using Insight (p. 48).

Preparing the Data for Analysis

For full details of Insight's powerful analysis capabilities, see the online Help system: on Insight's menu bar, select Help > Contents > Data Analysis. Before starting full analysis of the downloaded data, it may be advisable to:

- Apply a process file, if not already done (see p. 58).
- Specify the oven/furnace/kiln start position in the data (see below).
- Record any notes specific to the profile run (see below).

Specifying Oven/Furnace/Kiln Start

If you have not applied a process file, or if the process file you applied did not specify that the **oven/furnace/kiln start position** be adjusted, you may want to adjust the oven/furnace/kiln start position now: from the menu bar, select Process > Adjust Oven/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 oven/furnace/kiln start at this point, you may still do so at any time subsequently.

If using Insight 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.

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).

Storing Notes and Printing a Report

To use Insight to store any **notes or photos** which you may wish to associate with the profile-run data, select Edit > Notes.

To select options for **printing a customized report** of the profile-run data and its analysis results, select File > Print Options.

Logger Defaults and Details

Defaults for several of the logger's variables can be set using Insight. Select Tools > Options > Logger (and click 'Advanced' for most features):

- Default number of **probes**.
- **Model** and **identification number** (serial number) of the logger (read from last logger used).
- **Calibration** information, including enabling a warning for re-calibration and setting options for applying logger correction. For details, see p. 38.
- Use of warning message and/or disabling of reset if the **logger is hotter than a specified temperature** (default 45°C/113°F).
- Ability to display profiles of the logger's **internal temperature** and/or **battery voltage** for the run: these appear in the Graph and Analysis Windows as if they are data from additional probes; battery voltage is shown on the graph's right-hand y-axis. Display of both is disabled by default: to enable, in Insight select File > Properties > Advanced. Also, download of internal-temperature data from the logger to the paqfile is disabled by default: if you wish to view this data, download must be enabled in the Logger tab of the Global Options dialog *before running the profile*.
- Ability to download and display **pre-trigger data** (see below).

- Default (fixed) **sample interval** which cannot be edited in the Reset dialog (p. 49). The value entered is subject to the maximum and minimum permitted intervals (see p. 15).

- **Frequency of the local electricity supply**. Setting this correctly increases the efficiency of the logger's noise rejection, and thereby provides more stable measurements: 50 Hz is most widely used, but 60 Hz is used in North America, several countries in South America, and in Japan and Korea.

- Ability to include a **marker** within the data being gathered by pressing the logger's start button (see below).

- **Disable stop button** during a profile run. Thus, after logging is started, it can then be stopped only by connecting the communications lead (if necessary, disconnect then re-connect the lead) or by setting a stop trigger (p. 51). Note that:
  - Setting this option does not prevent use of the stop button during hardwired telemetry.
  - Setting this option prevents use of the stop button when the logger is in multiple-run mode (p. 52) and is gathering data, but, when in multiple-run mode but paused between runs, the stop button can always be used to terminate multiple-run mode.

- The logger's **internal data-sampling rate** can be reduced to a slower rate in order to increase the amount of data which is averaged in creating a single data-point. This option is disabled by default, but can be useful to reduce issues with noise in the data.

For full details of using the dialog, see Insight's online Help.

Pre-trigger Data

If a temperature trigger (see p. 50) is used to start data-logging, the logger also records data before this point is reached. The most-recent c. 60 of these data-points are retained by the logger. You can download this pre-trigger data by setting a default (see above), and it will then form part of the temperature profile, falling before the zero time point.

If the logger does not reach the temperature required to start data-logging, Insight will always download the pre-trigger data, in order to aid the user in determining why triggering did not occur.

Marking Events in Real Time

If the logger is accessible during a profile run (i.e. if using telemetry), it is possible to include a marker at any point within the data, while it is being gathered, by **pressing the logger's start button** (the logger-status red LED will flash once). When the data is displayed by Insight, it will show a **vertical-line memo** at that point in the data, and the memo's text and format can

subsequently be edited. Such markers can also be added in real time by using Insight. For details, see Insight's Help system: Introduction > Using Memos.

This feature is disabled by default. To enable, in Insight select Tools > Options > Logger > Advanced.

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 telemetry** (serial telemetry) is possible with Insight software when used with an intermittent or periodic oven/furnace/kiln (a batch process).

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

Some 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.

> *You may alternatively run a real-time profile, with the logger outside the heat-process, by using **Bluetooth telemetry**, which avoids any potential earth-loop problems. The performance of the Bluetooth, from within the oven/furnace/kiln should be evaluated before using as standard. See p. 37.*
>
> *Use of the optional **TM21 radio-telemetry system** is described in its own User Manual.*

Running a Temperature Profile Using Hardwired Telemetry

By following the procedure in this chapter, you will use the Logger Reset dialog 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. 48, and the dedicated *User Manual* for your Datapaq Tracker system), but, in addition:

- The **communications lead** is left in place, connecting the PC 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 (not available with Insight Furnace Surveying software).
- The logger will not normally enter the oven/furnace/kiln, so there is no need to use a **thermal barrier** to protect it.

- 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 and Starting the Logger When Using Hardwired Telemetry

The logger is reset and started exactly as for a normal (non-telemetry) profile run (see p. 48), except that:

- In the Reset dialog, select **Hardwired Telemetry**. (This option is not available if Bluetooth communication is being used for the reset – thus, ensure that logger and PC are connected by the communications lead.)
- **Multiple-run** mode (p. 52) is not available with hardwired telemetry or with Bluetooth telemetry (but is available with the TM21 radio-telemetry system).
- For use of **multiple events** with telemetry (different sample intervals and trigger modes for different stages of the profile run), see p. 52.
- After clicking OK in the Reset dialog:
  - If enabled, the **Select Process** dialog or the **Select Oven, Recipe and Product** dialog then appears in order that you may choose a process, oven, recipe or product file which will be applied to the results as the profile appears on screen during the run. Click 'No Process' or 'Cancel' if you do not want to apply one. (A process file allows you to see the temperature profile in relation to the oven/furnace/kiln zones as the profile appears on screen during the run. See p. 58.)
  - If enabled, the **Apply Correction Factors** dialog then appears in order that you may choose a logger and/or thermocouple correction factor file (see Insight's Help system) to apply to the results. Click **No Factor** if you do not want to apply a correction factor file.
- **Leave the communications lead attached** to the logger and PC.

*With the communications lead attached, the logger is **powered via USB**. Batteries can be left in the logger, but they do not need to be fitted during hardwired telemetry.*

*If using rechargeable NiMH batteries, it is possible to have the **charger connected** during hardwired telemetry, but note that charging will stop as soon as data-collection starts (see p. 24).*

*In some circumstances, data collected may be subject to errors from earth-loop interference. If this is suspected, a suitable **isolator** should be fitted to the USB connection; contact Fluke Process Instruments for advice (see p. 72). Or use Bluetooth telemetry (see p. 37).*

*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.*

*If the **logger's memory becomes full** during hard-wired data-collection, the logger will continue gathering data, but excess data will be passed to the PC and not stored by the logger. When the profile run is complete, the full data can then be saved as a paqfile within Insight (see p. 56).*

If the stop button has been set to be disabled (p. 61), this will not apply during hardwired telemetry, i.e. the stop button will always operate.

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** or other paqfiles on the graph to compare with the data as it is being received (select View > Overlay) (not available with Insight Furnace Surveying software).

You may open one or more existing paqfiles in **separate tabs** and switch between them and the real-time data.

You may adjust the **oven/furnace/kiln start** position while a real-time run is in progress (select Process > Adjust Oven/Furnace/Kiln 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.

While a real-time run is in progress, you may apply a **process file** (p. 58) to the incoming data (or change the one currently being used): select Process > Apply New Process.

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 during a telemetry run. If the PC system fails during the run, the autosaved version of the data is displayed automatically when Insight is next run, and you may then choose to save it as a paqfile. If the run is still in progress, re-starting logger listen mode will resume data-collection in the same paqfile, appending new data at the correct time in the file. If correction factors (see Insight's Help system) were applied to the original data, you will be prompted to apply them also to the new data.*

When the run is complete, **stop the logger** by pressing the stop button. 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. 56), though it should normally be adequate simply to save, as a new paqfile, the data already received.

Multiple Loggers

Using multiple loggers permits data to be gathered from a greater number of thermocouple channels than can be achieved with a single logger.

*When using the **Furnace Surveying** module of Insight, the use of multiple loggers is handled entirely by the Temperature Uniformity Survey Wizard which is available within that module.*

*In **Bluetooth telemetry**, data can be gathered from multiple loggers but not simultaneously; see p. 37.*

Use the **Logger Reset Wizard** to guide you step-by-step through the whole process of resetting multiple loggers: click on the Insight toolbar, or select Tools > Wizards (with hardwired telemetry, multiple loggers cannot be reset using the Reset dialog). You must first enable the use of multiple loggers in the Global Options dialog: select Tools > Options > General.

Incoming telemetry data from multiple loggers can be displayed either on a **single graph** and stored in a single paqfile (and the whole of the data is analyzed just as for a single-logger paqfile), or data from each logger can be shown on a **separate tab** so that you may switch easily between each developing profile and save (and analyze) them separately. To choose between these options, select Tools > Options > General, and check/uncheck 'Combine Multiple Loggers into a Single File'.

If using a single graph, Insight's floating **logger toolbar** controls the display of data from each logger, and allows data from any one logger to be saved as a separate paqfile. The logger number – shown in the logger toolbar – allows duplicate probe numbers from the multiple loggers to be separately identified in the Analysis Window and probe toolbar, and in the probe key to the right of the graph.

The **sort order** of the duplicate probe numbers in the Analysis Window is changed by the and buttons.

Troubleshooting

Logger Download Error Messages

Error Message	Action
There are insufficient readings in the logger	Check trigger set point (if trigger is time or temperature; p. 50). Check user has pressed start button (if trigger is start button). Check sample interval is not too long (p. 49). Check logger's battery for charge (p. 22). Check date/time settings on computer. Check thermocouples and their connections (see 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 Fluke Process Instruments for advice.
Logger stopped due to low battery	Recharge the battery, 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 (p. 48).

Logger Communications Problems

For Bluetooth communications, see p. 34.

For the process of setting up communications between logger and PC, see p. 45.

Typical sources of problems with establishing communication:

- **Communications lead not fully inserted.**
- **Damaged communications lead or connectors** – Check for breaks and other damage. Replace the lead and/or use Bluetooth communication (p. 34).

In addition:

- **Check the logger and battery status from the LEDs** – See p. 17. If necessary, recharge the battery, ensuring the charging LEDs are illuminated correctly.
- **Try restarting the logger** (any data present in the logger's memory is retained):
  1. Disconnect communications lead from logger.
  2. Turn logger off (press red and green buttons together, and hold for 1 second); all five LEDs flash together, once (see also p. 20).
  3. Reconnect communications lead to logger.

4. Red logger-status LED will flash five times to confirm connection.

- Confirm that:
  - You are using a version of Insight compatible with your logger. The TP6 operates only with Insight v.9.5 and above (see "The TP6 logger operates only with Datapaq Insight v.9.5 and above." on page 43).
  - You are not using a demo version of Insight (in Insight, select Help > About).

To minimize communications problems:

- **Connect the lead first to the PC** and then to the logger.
- **Always use the same USB port** – the one which was first used to set up communications (p. 45).

Checking the Data

If you suspect that **invalid data** may have been introduced into your temperature profile (paqfile), perhaps by damaged thermocouples (see below), select the View Data tab in Insight'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. Will occur if recording starts before thermocouples are plugged in.

NA   Telemetry data not received. Check antenna connectors.

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 of invalid data. Does not appear in View Data analysis mode.

Typical causes of invalid or interrupted data are:

- Damaged thermocouple cable.
- Thermocouple becoming detached from plug/logger.
- Faulty connection at thermocouple's hot junction.

Readings which are inconsistent with those of other thermocouples may be caused by a **short circuit** (see below). The thermocouple concerned must be replaced.

Open circuit readings can occur during a profile run if a thermocouple becomes damaged. The logger will then continue sampling on that channel, but, by default, an alarm will be registered. For further details of such alarms, or to disable the alarm, select Tools > Options > Run Alarms.

Thermocouples with an intermittent open circuit may produce spiky, erratic profiles. Note that spikes are inevitable when thermocouples are disconnected from a running data logger.

Testing the Logger and Thermocouples

Although thermocouples are generally robust, they can be damaged during handling. Use the following procedure to confirm the operation of logger and thermocouples after installation. Note that this test is not an alternative to calibration (p. 38), but will highlight a malfunctioning logger or faulty probes and thus avoid a wasted profile run.

Do one of the following:

- With a full set of thermocouples attached to the logger, and the logger connected to a PC running Insight, open the Logger Reset dialog (p. 48) or the Diagnostic section of the Communications Setup dialog (p. 47); this shows current probe temperatures – *or...*
- Set up the system as if to monitor a profile run using hardwired telemetry (see p. 63 for details), and note the temperatures registered by the thermocouples as they are displayed in Insight – *or...*
- To test the thermocouples alone, use a digital thermometer (of a type to match the thermocouple type) and attach it to each thermocouple in turn.

Proceed as follows.

1. Note readings first at ambient temperature: thermocouples registering no data in Insight, or an open circuit with a digital thermometer (*OC* in the Communications Setup dialog), may be broken. Inconsistent readings may indicate an intermittent short circuit.

2. If a satisfactory ambient reading is recorded, apply heat to the thermocouple-tip via fingers or other heat source. An increased temperature should register.
   - If the reading does not change, the thermocouple is short circuit or has other damage and must be replaced.
   - If the temperature shows a decrease, the thermocouple connections are reversed.

3. Confirm correct operation at 100°C/212°F by placing the thermocouple-tip in freshly-boiled water.

4. Replace any damaged thermocouples and test again.

Printing Problems

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

Datapaq Service Department

If you cannot resolve your problem, please contact your nearest Datapaq Service Department at Fluke Process Instruments. For contact details, see www.flukeprocessinstruments.com – or email as follows:

Europe, Asia (except China), Africa, Australasia – datapaqservice@ flukeprocessinstruments.co.uk

China – service@flukeprocessinstruments.com.cn

Americas – auto-rma-us@fluke.com

The user may easily download and **email key diagnostic information** to Fluke Process Instruments:

1. Connect the logger to the PC with Insight running.
2. Select Logger > Setup > Advanced, or Help > Service.
3. Select a name and location for the downloaded file, and a destination for the email.

The file created is accessible to Fluke Process Instruments but is not designed to be opened by the user.

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*Major entries are shown **in bold**.*

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