FLUKE®

Process Instruments

# Datapaq DP5 Data Logger

USER MANUAL

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

Issue 1
MA5740A

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# User Manual

*for*

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

Issue 1

*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.*


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DATAPAQ PART NO. MA5740A

# 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 DP5 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**

CE

*Directive 2014/30/EU* – ElectroMagnetic Compatibility (EMC).

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

*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 V3.1.1 – Short Range Devices (SRD) operating in the frequency range 25 MHz to 1000 MHz; Part 2: Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for non specific radio equipment.

EN 301 489-1 V2.2.0, Class B Emissions, Immunity – ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised 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.

*Directive 2011/65/EU* – Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

**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.

nqa. ISO 9001 Registered



Manual set in 10 pt Gill Sans.

User manuals are available in other languages; contact Fluke Process Instruments for details.

## OPEN-SOURCE FIRMWARE AND SOFTWARE ACKNOWLEDGEMENTS

**Apache**

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**USB drivers – libusbK version 3.0.7.0**



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NOTE: Portions of dpscat use source code from libwdi which is licensed for LGPL use only. (See dpscat.c)

NOTE: libusbK-inf-wizard.exe is linked to libwdi which is licensed for LGPL use only.

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# 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:

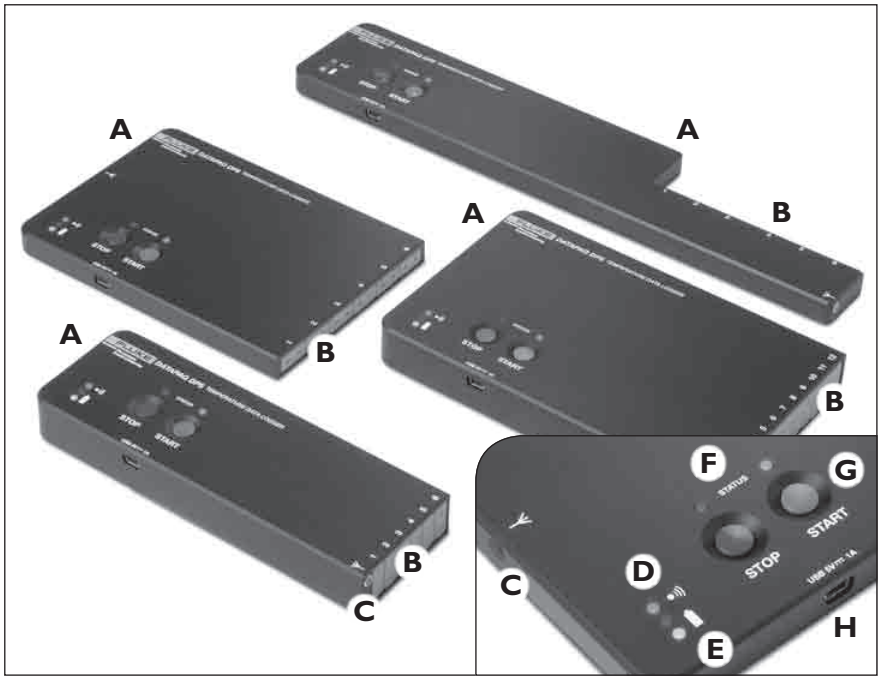
- Data logger (including communications lead and charger) (p. 11).
- Thermal barrier and thermocouple probes (not covered here; see the relevant manual supplied with your system).
- Hardwired telemetry (p. 45) as standard, and an optional TM21 radio-telemetry system (described in its own *User Manual*).

This manual is for Tracker systems supplied with a **Datapaq DP5 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 DVD included with Datapaq systems. During the software installation (p. 28), you may select documents to be copied to your PC for rapid on-demand viewing through Insight.*

# Logger Specifications and Operation

The DP5 data logger is designed for use in a wide range of heat-treatment applications. Its capacity for recording 50,000 data-points over each data-channel makes it a powerful, accurate and in-depth data-collection tool. When combined with the option of a built-in transmitter allowing temperature profiles to be seen developing in real time, this is an ideal data logger for all applications.




*DP5 loggers: 6-channel super-slim (top), 6-channel standard (left), 12-channel (right), 6-channel narrow (bottom).*

- **A** *Battery-compartment door (on rear, see p. 20).*
- **B** *Thermocouple sockets.*
- **C** *Transmitter-aerial socket (for use with TM21 telemetry system).*
- **D** *Bluetooth LED* •)) *(p. 15).*
- **E** *Battery LEDs* ▮ *(p. 14).*
- **F** *Logger-status LEDs (p. 15).*
- **G** *Stop/start buttons (p. 16).*
- **H** *USB communications/charging socket (p. 29, p. 19).*

The logger's key features are:

- A range of **model sizes**, including narrow and low-height versions, to suit different ovens and applications.
- Six or 12 **thermocouple channels** (depending on model) for maximum data collection on each run.
- Huge **memory capacity** for detailed process analysis: a total of 50,000 data-points over each data-channel (p. 13).
- Can be specified for use with **thermocouple types** K, N or T (p. 14).
- Powered by user-replaceable **rechargeable NiMH batteries**. See p. 16.
- **Rapid sampling**, to capture data in fast-moving processes (p. 13).
- High **accuracy** for compliance to tight specifications: ±0.5°C (±0.9°F) for most purposes (see p. 14).
- Data gathered by the logger but not yet downloaded ('**hot data**') is protected by non-volatile memory and by software warning if reset is attempted before download.
- **USB** communication and charging.
- **Hardwired telemetry** (p. 45) and (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.
- **LEDs** to show the exact status of the logger's activity and its batteries (p. 14).
- **Start and stop buttons** for easy user control (p. 16, p. 42).
- Aluminum case and rugged electronics allow operation in **harsh environments** of dust, pressure and vacuum.
- **Reset** can be done by start button alone, for speed and simplicity (p. 35).
- **Multiple-run** capability (p. 34).

The DP5 is available in several variants:

- Standard case format – low-height; six channels.
- Narrow format – primarily for use in reflow ovens with narrow conveyors or where space is otherwise restricted; six channels.
- Super-slim – narrow and low-height; six channels.
- Wide – 12-channel.

# Specifications

| | DP5 Standard 6-channel DP5x60[1] | | DP5 Narrow 6-channel DP5x62 | | DP5 Super-slim 6-channel DP5x61 | | DP5 12-channel DP5x12 | |
|---|---|---|---|---|---|---|---|---|
| **Height** | 11.7 mm | 0.46 in. | 20 mm | 0.8 in. | 11.7 mm | 0.46 in | 20 mm | 0.8 in. |
| **Width** | 106 mm | 4.2 in. | 57 mm | 2.2 in. | 60 mm | 2.4 in. | 106 mm | 4.2 in. |
| **Length** | 150 mm | 5.9 in. | 165 mm | 6.5 in. | 301 mm | 11.9 in. | 165 mm | 6.5 in. |

[1] Second numeral in part number (x) represents thermocouple type: 2 = type T, 6 = type K, 9 = type N.

| | |
|---|---|
| **Thermocouples** | Type K, N or T (see specifications for each, below). |
| **Operating temperature** (of the logger itself) | −20°C to 85°C/−4°F to 185°F. |
| **Humidity range** | 0–100% non-condensing. |
| **Operating pressure** | Up to 15 bar/216 psi for 30 mins. |
| **Real-time monitoring** | Hardwired (serial) telemetry via communications lead (p. 45). Radio (RF) telemetry via optional built-in transmitter. |
| **Data capacity** | 50,000 data-points per channel: sufficient for, e.g., 10 runs of 8 minutes with 12 probes and sample interval 0.05 sec. |
| **Hot-data protection** | By non-volatile memory, and software warning if reset attempted before download. |
| **Logger reset** | By Insight (p. 31) or by start button (using previous reset options) (p. 35). |
| **Sample interval:**[1] | |
| **No telemetry** | 1–12 channels 0.05 s to 10 min. |
| **Hardwired telemetry** | 1–12 channels 0.2 s to 10 min. |
| **Radio telemetry**[2] | 1–12 channels 1 s to 10 min. |
| **Data-collection start** | Auto start (no trigger), Start button, Date and time, Rising temperature, Falling temperature. |
| **Pre-trigger data stored** | Yes (configurable; see p. 41). |
| **Multiple runs** | Collect data from up to 10 runs before downloading (see p. 34). |
| **Onboard features** | Storage of calibration data (see p. 22). |
| **Communications** | USB 2.0, Mini-B socket. |
| **PC/software compatibility** | See p. 27. |
| **Battery** | Datapaq NiMH rechargeable battery-pack BP1080, 2.4 V, 500 mAh (only Datapaq battery-packs are suitable). Can be replaced by user; see p. 16. For battery life, see p. 16. |
| **Battery charging** | Datapaq USB charger CH0080 (fast charge: temperature range 5–45°C/41–113°F) or from PC's USB port (slow charge: temperature range 0–85°C/32–185°F. See p. 19. |
| **USB power** | Logger is powered by USB when connected to PC. |

[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 K | Type N | Type T |
|---|---|---|---|
| **Measurement range** | −100°C to 1,370°C<br>−148°F to 2,498°F | −100°C to 1,300°C<br>−148°F to 2,372°F | −150°C to 400°C<br>−238°F to 752°F |
| **Accuracy*** with sample interval **0.5 s or higher** | ±0.5°C<br>±0.9°F | ±0.5°C<br>±0.9°F | ±0.5°C<br>±0.9°F |
| **Accuracy*** with sample interval **below 0.5 s** | ±1.0°C<br>±1.8°F | ±1.0°C<br>±1.8°F | ±1.0°C<br>±1.8°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) | Green | Pink | 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.*

# 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 LEDs*

| Green/Red | Yellow | Meaning |
|---|---|---|
| Off | Off | Battery has at least 20% of full charge (charger not connected), or...<br>Charger is connected but logger is acquiring data (in which case logger-status green LED will be flashing), or...<br>Fault with battery or logger. |
| Off | Flashing every 5 seconds | Battery has 20% or less of full charge (charger not connected). |

| Green/Red | Yellow | Meaning |
|---|---|---|
| RED | Off | Battery fast-charging (connected to charger). |
| RED, blinking off briefly every 5 seconds | Off | Battery slow-charging (connected to PC). |
| GREEN | Off | Charging complete (charger or PC connected). |
| RED double-flash every second | Off | Battery failed preconditioning and is probably damaged. |

## *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. 33) (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. 34). |
| 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. 33). |
| 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.) |
| 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) |

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

## *Other Sequences*

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 (quick press). | Turns logger on. | |
| Press GREEN button (0.5-second press) 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. 34), 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 (0.5-second press). | 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. 42). | Data retained in memory. Logger cannot be restarted until data is downloaded (unless in multiple-run mode, p. 34). 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. |
| Press RED and GREEN buttons together and hold for 5 seconds. | Turns logger off. All four LEDs flash together, once. *NB If communications lead is connected, logger remains powered and cannot be turned off by this means; disconnect lead and try again* (see also p. 42 *for disabling of stop button*). | Data retained in memory. The previous reset options are retained as current default. |

# Battery

The logger uses a pack of rechargeable nickel-metal-hydride (NiMH) cells: 2.4 V, 500 mAh. When past its service life, the battery-pack can be replaced by the user; see p. 20. Only Datapaq battery-packs are suitable.

## *Battery Life*

Battery life (discharge time) of NiMH rechargeable batteries is affected by the following factors.

- **Operating Temperature** – 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.
- **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 telemetry was used.

The following data, for a 12-channel logger, can serve as a guide – though values given here are no more than an indication of the battery life that can be expected.

| No. of Channels | Sample Interval (sec.) | Logger Temperature | Battery Life (hrs) | |
|---|---|---|---|---|
| | | | No Radio Telemetry | Radio Telemetry Used |
| 6 | 0.05 | 25°C/77°F | 14 | – |
| 6 | 0.05 | 75°C/167°F | 14 | – |
| 6 | 0.5 | 25°C/77°F | 20 | – |
| 6 | 0.5 | 75°C/167°F | 16 | – |
| 6 | 1 | 25°C/77°F | 38 | 10 |
| 6 | 1 | 75°C/167°F | 29 | 10 |
| 6 | 5 | 25°C/77°F | 110 | 22 |
| 6 | 5 | 75°C/167°F | 90 | 20 |
| 6 | 20 | 25°C/77°F | 175 | 55 |
| 6 | 20 | 75°C/167°F | 155 | 48 |

| No. of Channels | Sample Interval (sec.) | Logger Temperature | Battery Life (hrs) | |
|---|---|---|---|---|
| | | | No Radio Telemetry | Radio Telemetry Used |
| 12 | 0.05 | 25°C/77°F | 14 | – |
| 12 | 0.05 | 75°C/167°F | 13 | – |
| 12 | 0.5 | 25°C/77°F | 12 | – |
| 12 | 0.5 | 75°C/167°F | 10 | – |
| 12 | 1 | 25°C/77°F | 24 | 9 |
| 12 | 1 | 75°C/167°F | 19 | 8 |
| 12 | 5 | 25°C/77°F | 85 | 20 |
| 12 | 5 | 75°C/167°F | 70 | 18 |
| 12 | 20 | 25°C/77°F | 150 | 50 |
| 12 | 20 | 75°C/167°F | 135 | 47 |

### 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. 14).

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. 31).
- When using wizards which reset the logger.
- During communications setup (p. 30).
- When using the Real Time Tool dialog as part of the optional TM21 radio-telemetry system.

### 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. 42.

### 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. 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.

*When the logger is attached to a powered-on PC by the communications lead, the logger is **powered via USB** 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.

## *Charging*

Recharge the battery as follows.

1. Plug the communications lead into the logger.
2. If charging from **mains power** (fast charge):
   - Plug the battery charger into the mains, then
   - Connect the lead to the charger.

   Alternatively (slow charge), connect the lead to the **USB port** of a PC which is already powered on.

**WARNING**

*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 use the charger supplied with the DP5 to attempt charging of the Datapaq Q18 logger (that logger will not be charged).*

*Do not charge the battery in a **wet environment**, e.g. outside. This could cause major injury or death.*

*Charge batteries only within **temperature range** 5–45°C/41–113°F (mains charger) or 0–85°C/32–185°F (PC's USB port).*

A full charge is delivered in about 1.5 hours by charging from the mains supply, or in about 14 hours by charging from a PC. Indication of battery/charging status is provided by colored LEDs on the logger (see p. 14).

After charging from the mains supply for 10 minutes, battery charge will be sufficient for a typical reflow profile run of 12 minutes when using 12 channels and a 0.2-s sample interval (without telemetry).

*The logger intelligently monitors the battery, ensuring it is never overcharged. Thus, by leaving the mains charger or PC 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.*

*When connected to the PC during reset (p. 31) and download (p. 37), the logger will be charging.*

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

A **new battery-pack** – or one which has 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.

**WARNING**

*If the logger is not in regular use, **the battery should be charged at least every 3 months**. If this is not done, the battery may drain to a level where it cannot successfully be recharged.*

*If not used for an **extended period**, remove battery-pack from logger to prevent battery-leakage and resultant damage.*

## *Replacing Batteries*

**WARNING**

*Use only the correct Datapaq battery-pack, BP1080. Using unapproved batteries can lead to **battery-leakage** producing toxic fumes and causing respiratory irritation and chemical skin burns. Never use a damaged battery-pack (e.g. with split in heatshrink covering, wires detached, etc.).*

*Keep battery-packs **clean and dry**. Clean dirty connectors with a dry, clean cloth.*

*Do not **disassemble or crush** battery-packs.*

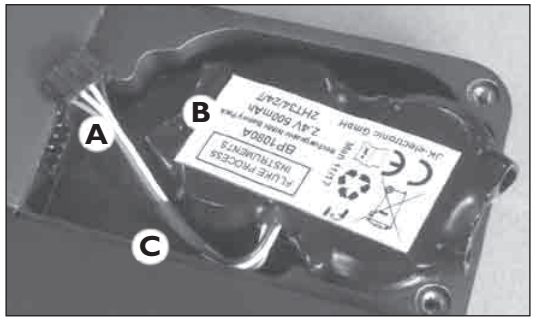
*Do not put battery-packs near **heat or fire**, nor in **sunlight**.*

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 about three years or 1,000 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 5 seconds.
2. On the rear of the logger, undo the two screws (marked by arrows) which secure the **battery cover**.
3. Lift the battery-pack out of position, and carefully pull the **battery-pack connector** out of its socket (**A**, shown separated).




**WARNING**

*Do not pull or hold battery-packs (whether old or new) by their connector wires.*

4. Remove the **old battery-pack** (**B**) and dispose of it appropriately (see p. 23).
5. Connect the **new battery-pack** and then place it inside the battery compartment with its connector wires lying alongside it (**C**). Take care not to leave any debris in the battery compartment as this could cause malfunction.
6. Close the **cover of the battery compartment**, ensuring that the connector wires are not trapped by the cover. Secure the cover with the two screws.
7. **Charge fully** before first use (see p. 19).

# 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. 13.)

- Insight can be instructed to **show a warning message if a reset is attempted** (p. 31), or to **prevent a reset**, while the logger is above a specified temperature (default 45°C/113°F); see p. 41.
- 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. 35), the logger **will not start logging** if its internal temperature is above 45°C/113°F. The logger-status red LED will show two quick flashes every second.

- If the logger's internal temperature exceeds 85°C/185°F, 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. 42.*

*To check the logger's current internal temperature when connected to a PC running Insight, select Logger > Setup and click 'Diagnostic' (p. 29). The temperature is also displayed in the Reset dialog (p. 34).*

# 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. 53).

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. 52.*

# 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.co.uk.

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. 11.

- The logger is **not approved for use in potentially-explosive atmospheres** as defined by the EU ATEX directives. ***Do not use the logger in such atmospheres: there is risk of major injury or death***.

*cont.* >>

- 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. 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** 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**:
  - 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 (e.g. with split in heatshrink covering, wires detached, etc.).
  - If charging from mains power, **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) or 0–85°C/32–185°F (PC's USB port).
  - 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.

*cont.* >>

- 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. 53.

# Using the Logger with Insight Software

See your dedicated Datapaq Tracker system *User 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. 29).

Before each profile run, you will:

3. **Reset** the logger to prepare it to receive fresh data (p. 31).

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

4. **Download** the data from the logger (p. 37).

These stages are described below.

## Installing/Removing Insight

Datapaq Insight used with the DP5 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.
- DVD drive.
- 1 free USB port.
- Microsoft Windows™ Vista (32-bit only), 7, 8, 10 or above.
- Microsoft Internet Explorer 4 or above.

*The DP5 logger operates only with Datapaq Insight v.9.0 and above.*

## *Installation*

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

For most systems, installation will start automatically on placing the Insight DVD in the drive. (If installation does not start, click the Windows Start button and select Run; browse to your DVD drive, and run Setup.exe.) As part of the installation, you can choose PDFs of Datapaq user documentation to be copied to your PC for rapid on-demand viewing through Insight.

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

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

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

## *Upgrading*

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

## *Removal*

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. 48 for use of multiple loggers).*

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. 51.*

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

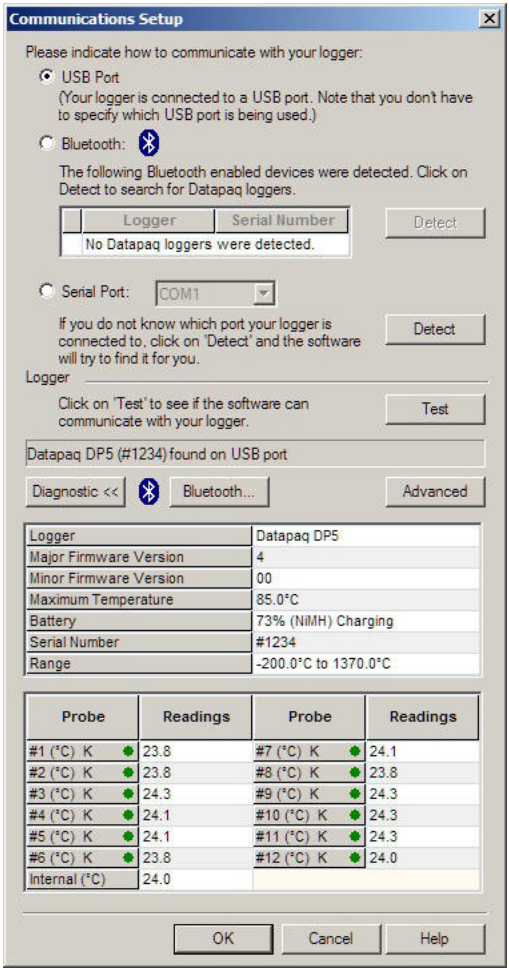
If the logger is detected, its type and the port to which it is connected are displayed.

**SHORTCUT**

*Pressing F4 on the keyboard opens the Communications Setup dialog, tests for communication with a logger, and displays the logger type and other data (equivalent to clicking Test in the dialog).*

For more information on the logger in use, click the Diagnostic button which now appears. Additional data shown covers firmware version, maximum permitted internal logger temperature, battery charge status, serial number and temperature recording range. Current temperature of the probes (updated 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.




*The Communications Setup dialog for the DP5 logger, with Diagnostic section expanded.*

*It is advisable at this stage to set the **frequency of the local electricity supply** within Insight.* *See p. 42.*

# 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. 37). (To run a profile using hardwired telemetry, see p. 45.)

*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 logger 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. 34) and if the previous reset options are to be re-used: see p. 35.*

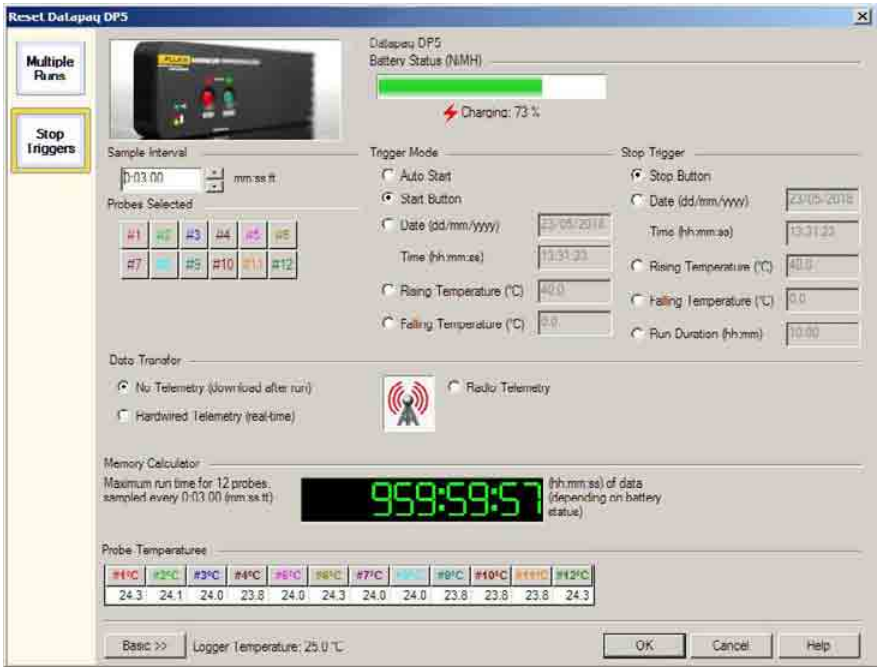
*If the logger is* ***too hot*** *from the previous run, Insight will (by default) display a warning message – showing the logger's current internal temperature – until it cools; Insight can also be set to prevent reset in these circumstances (this feature is configurable; see p. 41).*

*The procedure described here uses the Insight software's Reset dialog. If you are less sure of the process, you can instead use the* ***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).*

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. 29).
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 12-channel DP5 logger. Stop triggers (p. 33) 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. In processes of 2–10 mins such as reflow and vapor-phase soldering, 0.5 second is recommended. For limitations on sample intervals, see p. 13. A default (fixed) sample interval can be set which cannot be edited in the Reset dialog (see p. 41).

**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. 18), 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 immediately.

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. 16.

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

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

*Auto Start* (*no trigger*) Data-recording starts immediately 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. 52) until the thermocouples are connected.

*Start Button* After reset, data-recording starts when the logger's green start button is pressed and held for 0.5 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. 42.*

**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. 34): 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 0.5 second (ensure that use of the stop button is not disabled; see p. 42.)

*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 are then lost.

**Data Transfer** Select 'No Telemetry'. (For use of hardwired telemetry, see p. 45.)

**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. 34) is selected, note that the time shown is the total available for all runs until the logger is reset.

**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. 42.)

**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. 38, p. 40). 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. 35 for starting a new run using previous reset options.)
- Any trigger mode (see p. 33) can be selected.
- Hardwired and radio telemetry can be used.

*In multiple-run mode:*

- The logger can collect data from up to 10 profile runs before it needs to be downloaded (p. 37).

- 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 mode*s can be selected (see p. 33).
- *Stop data-collection* at the end of each run by using the stop button. If the stop button has been disabled (see p. 42), instead set a *stop trigger* to stop collection according to rising/falling temperature or specified duration (see p. 33). Pressing the stop button when paused between runs will always terminate multiple-run mode.
- Hardwired telemetry cannot be used (but radio telemetry can be).

*Multiple runs and stop triggers can 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 trigger mode (p. 33) has been set to auto start, data-recording starts immediately, and green LED flashes at sample interval (p. 15).

### 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. 37, or reset the logger using Insight and thereby delete the data, p. 31).

or

- The logger's internal temperature is above 45°C/113°F (see p. 21).

*If using **multiple-run mode** (p. 34), 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. 39), 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. 15) depends on its current status:
   - *Logging has already started* (*no trigger was set; p. 33*) – 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. 15.

3. If the trigger mode is start button, press and hold the logger's **start button** for about 0.5 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 both flash once (if use of the stop button is disabled – see p. 42 – 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.*

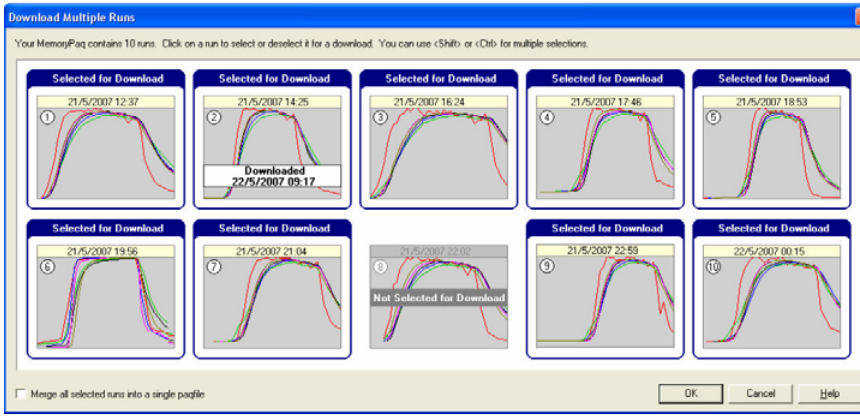
*To minimize communications problems: a) connect the lead first to the PC and then to the logger; b) always use the same USB port – the one which was first used to set up communications (p. 29).*

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. 34), 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. 31), 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. 51.*

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'.*

*cont. >>*

*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. 34), 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. 33); 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 memory has been emptied by resetting the logger using Insight** (p. 31).
- 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. 35).
- For both **multiple- and single-run modes**:
  - To start a new run with **different data-collection options**, reset the logger using Insight (p. 31).

# 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. 39).

- 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.

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

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.
- **Calibration** information, including enabling a warning for re-calibration and setting options for applying logger correction. For details, see p. 22.

- 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. 32). The value entered is subject to the maximum and minimum permitted intervals (see p. 13).
- **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. 33). 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. 34) 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.

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

## *Pre-trigger Data*

If a temperature trigger (see p. 33) 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.

*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.

*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 and Logger Download dialogs to run a temperature profile using hardwired telemetry.

Running a profile in real time is performed in essentially the same way as a normal (non-telemetry) run (see p. 31, 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. 31), except that:

- In the Reset dialog, select **Hardwired Telemetry**.
- **Multiple-run** mode (p. 34) is not available with hardwired telemetry (but is available with the TM21 radio-telemetry system).
- 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. 39.)
  - 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**.*

*Note that the logger **will not charge while collecting data**. The logger will be charging while connected to the PC during reset, but charging will stop as soon as data-collection starts (see also p. 19).*

*In some circumstances, data collected maybe 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. 53).*

*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. 37).*

*If the stop button has been set to be disabled (p. 42), this will not apply during hardwired telemetry, i.e. the stop button can always be used to stop a hardwired-telemetry run.*

### *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. 39) 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. 37), 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.

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. 33).<br>Check user has pressed start button (if trigger is start button).<br>Check sample interval is not too long (p. 32).<br>Check logger's battery for charge (p. 18).<br>Check date/time settings on computer.<br>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. 31). |

## Logger Communications Problems

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.

In addition:

- **Check the logger and battery status from the LEDs** – See p. 14. 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 5 seconds); all four LEDs flash together, once.
  3. Reconnect communications lead to logger.
  4. Red logger-status LED will flash five times to confirm connection.

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. 29).

# 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. 22), 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. 31) or the Diagnostic section of the Communications Setup dialog (p. 30); this shows current probe temperatures – *or*...

- Set up the system as if to monitor a profile run using hardwired telemetry (see p. 45 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.

# INDEX

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

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