a VIDA GROUP company

Datapaq11
User Manual

for use with Tracker version 4.0

Issue 1

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

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Software and user manuals are available in other languages. Please contact Datapaq for details.

Contents

EUROPEAN COMMUNITY ELECTROMAGNETIC COMPATIBILITY DIRECTIVE (89/336/EEC)

The following product type manufactured by

Datapaq Ltd
160 Cowley Road, Cambridge CB4 0GU, United Kingdom

complies with the requirements of the European Community Electromagnetic Compatibility Directive (89/336/EEC).

Product

Datapaq11B Thermocouple Data Logger

Standard Applied

Class B and Industrial Location Immunity	**EN61326-1: 1997**

The Datapaq11 Logger

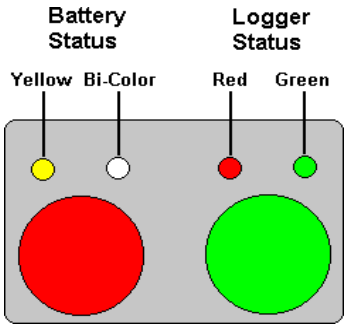
The Datapaq11 data logger combines the latest in logging technology with the typically rugged characteristics of a Datapaq logger to provide a powerful yet highly accurate analysis tool. With 110,000 data point storage over ten selectable channels, and a fast 0.1-s sampling rate (with a maximum nine channels selected), the Datapaq11 makes in-depth process analysis a reality.

Features such as ‘falling temperature trigger’ and ‘button start’ allow you to commence data collection at the important stages of your process, and capture fast moving events, such as fast cooling cycles.

The Datapaq11 can be fitted with a choice of different battery types to suit various applications, ranging from general-purpose heat treatment to long-duration kiln monitoring

1 Datapaq11 Status Lights

The Datapaq11 is equipped with two sets of LEDs, a set of two showing the status of the battery, and another set of two showing the status of the data logger and its memory.



Datapaq11 Logger Status LEDs

LED Indication	Meaning
Yellow LED on.	Logger battery on charge.
Yellow LED flashes every 5 sec.	Logger battery is low.
Yellow LED flashes every 1 sec.	Battery depassifying (occurs only when first fitting high-temperature lithium battery BP1030).
Red and Green LEDs flash alternately 5 times.	Logger has been successfully reset.
Red and Green LEDs flash alternately at sample interval.	Logger is awaiting trigger: Time trigger/Rising temperature trigger or Start button.
Red and Green LEDs flashing together.	Falling temperature trigger selected. Changes to alternate Red and Green flashing on temperature rise. Green only flashing once triggered.
Red and Green LEDs flash together once every sample interval.	Channel 1 is above the trigger temperature for rising temperature trigger, **or** channel 1 is below trigger temperature for falling temperature trigger, hence the logger cannot trigger.
Green LED flashes once every sample interval (max 5-sec interval).	Logger is recording data from the probes.
Green LED flashes rapidly, 5 times.	Logger has successfully downloaded data to the computer.
Red LED flashes every 5 sec.	Logger internal memory contains data.
Red LED flashing rapidly.	Logger is waiting for the communications cable to be removed when in a diagnostic or telemetry test mode.
Red and Green LEDs alternately flashing rapidly.	Logger is running a diagnostic test for the telemetry.
Red LED flashes continuously, once per sec.	Internal error; contact Datapaq.
Red, Green and Yellow LEDs flash simultaneously	Logger has reset on 'Power on'. The logger will start recording with predefined parameters.
Yellow and Bicolor Red LEDs on steady.	Logger fast charging.
Yellow and Bicolor Green LEDs on steady.	Logger slow charging.

2 Datapaq11 Push Button Actions

Action	Result	Notes
Press Green button and hold for 1 second.	Starts logging	In telemetry mode also starts sending data.
Press Red button and hold for 1 second.	Stops logging.	Data retained in memory. Logger cannot be re-started until data downloaded. 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 also.
Press Green and Red buttons together and hold for 3 seconds.	Turns logger off.	Data retained in memory.
Press Green button for 1 second after downloading data.	Starts logging.	Last re-set conditions (sampling interval, probe selection, labels, etc.) used as default.

3 Datapaq11 Logger Specifications

	Datapaq11	Datapaq11 - TX
Model Number	DP1106	TX1260 (Europe) TX1250 (USA) (Receiver kit RX1202/ RX1200 also required)
Channels	10	10
Range	0 to 1,370°C/32 to 2,498°F	0 to 1,370°C/32 to 2,498°F
Max. ambient operating temp.	110°C/230°F (70°C/158°F when using NiMH rechargeable batteries)	110°C/230°F (70°C/158°F when using NiMH rechargeable batteries)
Sampling interval	0.1 s to 60 mins (see Note 1)	3 s to 60 mins (see Note 2)
Accuracy	±1°C/±2°F	±1°C/±2°F
Resolution	0.5°C/1.0°F	0.5°C/1.0°F
Logging Start by	Manual (button) Temperature (rising or falling) Time	Manual (button) Temperature (rising or falling) Time
Pre-trigger data	Stored: 60 readings	Stored: 60 readings
Total Memory	110,000 data points over 10 channels	110,000 data points over 10 channels
Battery	See 'Batteries' (below)	See 'Batteries' (below)
Battery life	See 'Batteries' (below)	See 'Batteries' (below)
Back-up battery	High-temperature lithium	High-temperature lithium
Back-up battery life	Change annually	Change annually
Number of LEDs	4 status indicators	4 status indicators
Dimensions (mm)	200 (L) x 98 (W) x 20 (H)	200 (L) x 98 (W) x 20 (H)
Telemetry Option	Hard wired	Radio

Note 1: *The 0.1 s sampling interval is available when up to 9 channels are selected. Sampling interval 0.2 s when all 10 channels in use.*

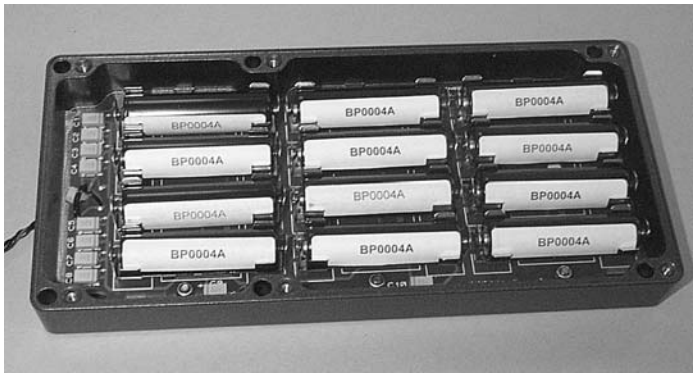
Note 2: *When using telemetry the minimum sampling interval is increased from 0.1 s to a minimum 3 s as the information is sent in a number of 'packets' which requires a longer time to complete.*

4 Batteries

Three different types of battery are available, depending on the application.

Part #	Description	Battery life	Operating temperature	Typical applications
BP1029A	NiMH rechargeable. Charging time c. 2–3 hrs.	Up to 110 hrs with or without RF telemetry	70°C/158°F	All furnace applications where conventional thermal barriers (with heat sink) are used.
BP1030	High-temperature lithium replaceable. Obtainable only through Datapaq.	Up to 425 hrs without telemetry, up to 300 hrs with telemetry	110°C/230°F	All furnace applications where water-jacket barriers are used. Kiln applications include sanitaryware, tableware, bricks. Suitable for all Kiln Tracker thermal barriers
BP0010	Expansion Paq. Bolts directly to base of Datapaq11. Takes 12 x BP0004 lithium batteries. Dimensions as Datapaq11.	Up to 1,000 hrs with or without RF telemetry	105°C/221°F	Long-duration kiln applications including bricks, refractory. Suitable only for Kiln Tracker thermal barriers TB6100 and TB6200.
BP0004	High-temperature lithium replaceable batteries (as for BP0010 Expansion Paq, above).			

NiMH rechargeable battery BP1029A (left) and high-temperature lithium battery BP1030 (right).



Expansion Paq BP0010 with lithium batteries BP0004 in place.

Note 1: *All the above batteries are interchangeable by the user*

Note 2: *As the Expansion Paq fixes directly to the base of the Datapaq11, the height of the logger is effectively doubled. Only thermal barriers TB6100 and TB6200 will accept this logger size, and are then limited to 10 thermocouple channels.*

Note 3: *As the Expansion Paq fixes directly to the base of the Datapaq11, it must be removed if the transmitting frequency of the logger needs to be changed.*

4.1 Factors Affecting Battery Life

An indication of typical battery life is given in the table above, but this is affected by certain operating conditions:

- **Operating Temperature.** Essentially, the higher the ambient temperature the battery operates in, the lower will be the life. Batteries that operate for a large part of the process cycle at 20–30°C (68–86°F) will have a longer life than those that operate for the majority of the process cycle at the maximum operating temperature limits.
- **Sampling Interval.** The shorter the sampling interval, the shorter will be the battery life. This is because power is being consumed each time the logger takes a reading. A short sampling interval will achieve the maximum amount of information, but this must be balanced against the greater battery charge required. This is less critical for NiMH rechargeable batteries than for replaceable batteries.
- **Operating with RF Telemetry.** Sending data to a receiver outside the furnace or kiln requires almost double the power needed to simply read and store the data.
- **Programming and Downloading the Data.** When these operations are carried out it is necessary to connect to the computer via a communications cable, and power is consumed as soon as the cable is plugged into the logger. The software warns the user to disconnect from the PC, but if the logger is left connected this will affect battery life. This is only the case with lithium batteries however, as the rechargeable NiMH batteries will be able to charge via the communications cable.

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.

4.2 Life of Lithium Batteries BP1030

Because of the great potential variability in operating conditions, values given here are no more than an indication of the battery life that can be expected. The best predictions can be obtained only by experience of the batteries' use under the actual working conditions.

No Telemetry Used

Battery life is independent of temperature if no telemetry is used.

Sample Interval	Battery Life (hrs)
0.1 s	40
0.5 s	80
1 s	160
10 s	320
5 min	400 (max.)

Telemetry Used

When telemetry is used, battery life is reduced if the logger temperature is higher.

Sample Interval	Logger Peak Temperature (°C)	Battery Life (hrs)
3 s	105 <80	30 100
10 s	105 <80	80 160
1 min	105 <80	200 300
5 min	105 <80	300 400

4.3 Depassifying Lithium Batteries BP1030

When the batteries are first made, the two major chemical components form a high-resistance layer, called the passivation layer. This has two main effects.

- Prevents self-discharge, giving a long shelf life (greater than 10 years).
- Prevents large currents being drawn from the battery on initial usage.

The passivation layer must be removed before the battery will work. This process – called depassivation – occurs only on initial fitting of a new battery, or on the refitting of an old battery whose passivation layer has reformed. For this reason it is not advised to remove the battery pack between uses, as the current saved would normally be much less than that taken by the next depassivation (unless the logger was used no more often than about every six months).

The battery pack used in the Datapaq11 passes a depassivation current of 60–80 mA for a period of 16 minutes. After a rest period of 4 minutes following this, the logger is ready for use. During this time the yellow LED flashes once a second and the logger is non-operative; it will not respond to any switches or to the communications lead.

Thus, depassivation proceeds as follows:

1. Fit new battery.
2. Yellow LED flashes dimly every second.
3. After 20 minutes, yellow LED stops flashing.
4. Logger is ready for use.

4.4 Points About Non-rechargeable Battery Packs

- The charger is non-operational. Plugging the charger into the logger will not do anything, and *all* power will still be supplied by the battery pack. Thus, if the logger holds data and the old battery has failed, the logger will need a new battery before the data can be downloaded; it is no use plugging in the charger.
- There is no way to determine life left in the battery, as its voltage stays constant until the battery is completely exhausted. Thus there is no warning of battery failure (unlike the rechargeable battery packs which have low-battery indication), and the logger simply stops working – though a warning message during download will show that this has happened. *Thus it is necessary to note the time for which the logger has been used in order to determine when the battery is likely to fail.* A rough indication of the likely battery life of lithium batteries BP1030 is given above.
- The lithium high-temperature batteries BP0004 used in the Expansion Paq BP0010 will not require depassivation, and should start up immediately. Note, however, that all battery types go through a depassivation requirement test when first fitted: the battery has 80 mA drawn from it, and if, after 3 seconds, the terminal voltage does not fall below 5.1 V (nominal), the depassivation cycle is aborted; during this period the yellow LED flashes three times. The logger is then ready for use.

4.5 Fitting Batteries

Battery Packs BP1029A and BP1030

1. Unscrew the four screws from the lid of the battery compartment, on the underside of the Datapaq11, and remove the lid.
2. Disconnect the old battery at the cable connector and remove it.
3. Connect the new battery and replace the lid.

Datapaq11 with NiMH rechargeable battery BP1029A in place.

Expansion Paq BP0010

1. Unscrew the four screws from the lid of the Datapaq11's battery compartment, remove the lid, and put it aside.
2. Remove the two red 'runner' strips on the base of the logger to expose the four screws beneath.
3. Remove the two screws nearest to the thermocouple sockets.
4. Disconnect the logger's old battery (if fitted) and remove.
5. Connect the cable in the Expansion Paq to the cable in the logger's battery compartment.
6. Place the Expansion Paq onto the base of the Datapaq11 and secure it with the six screws provided.

Expansion Paq (above) being fitted to Datapaq11, showing battery cables connected.

7. Fit the 12 BP0004 high-temperature lithium batteries into the Expansion Paq, ensuring correct orientation.
8. Re-fit the Expansion Paq lid, and secure with its six screws.

4.6 Battery Disposal

For both NiMH and lithium batteries, please consult local regulations for safe battery disposal in your area.

5 Datapaq11 RF Telemetry Specifications

5.1 Transmitter

The transmitter module is pending approval to national specifications as follows:

EU	I-ETS-300-220
US	FCC part 90, 1996, clause 90.217

Specifications

Frequency	EU: 433.075 to 433.450 MHz US: 464.100 to 464.475 MHz
Effective radiated power	10 mW
Range	200 metres open space, typically 30 metres when in oven.
Temperature range	0 to 105°C/32 to 221°F
Humidity	85% RH non-condensing

5.2 Receiver

The receiver passes the digital data directly to the PC via the Comms cable (supplied). It must be tuned via the dip switches to the same frequency as the transmitter in the data logger. It has a signal strength meter and no external controls.

5.3 Selecting a Frequency

Frequency allocations are defined by national and international regulations. The default frequency may be appropriate, but if this frequency is already in use an alternative can be selected from the following tables.

Note 1: *Both transmitter and receiver must be tuned to the same frequency.*

Note 2: *The DIP switches in the transmitter and the receiver will require* ***different*** *settings to obtain the same frequency. The tables below give the correct settings for transmitter and receiver.*

5.4 Frequency Allocations – Europe

***Note**: Switches 7 and 8 in the receiver are are set as follows: switch 7 = OFF, switch 8 = ON. These are factory settings. Do not change these positions.*

Receiver – Europe

Channel Center Frequency (MHz)	Switch Settings					
	S1/1	S1/2	S1/3	S1/4	S1/5	S1/6
433.075	ON	ON	ON	ON	ON	ON
433.100	ON	ON	ON	ON	ON	OFF
433.125	ON	ON	ON	ON	OFF	ON
433.150	ON	ON	ON	ON	OFF	OFF
433.175	ON	ON	ON	OFF	ON	ON
433.200	ON	ON	ON	OFF	ON	OFF
433.225	ON	ON	ON	OFF	OFF	ON
433.250	ON	ON	ON	OFF	OFF	OFF
433.275	ON	ON	OFF	ON	ON	ON
433.300	ON	ON	OFF	ON	ON	OFF
433.325	ON	ON	OFF	ON	OFF	ON
433.350	ON	ON	OFF	ON	OFF	OFF
433.375	ON	ON	OFF	OFF	ON	ON
433.400	ON	ON	OFF	OFF	ON	OFF
433.425	ON	ON	OFF	OFF	OFF	ON
433.450	ON	ON	OFF	OFF	OFF	OFF

Transmitter (Data Logger) – Europe

Channel Center Frequency (MHz)	Switch Settings					
	S1/1	S1/2	S1/3	S1/4	S1/5	S1/6
433.075	OFF	ON	ON	ON	ON	ON
433.100	OFF	ON	OFF	ON	ON	ON
433.125	OFF	ON	ON	OFF	ON	ON
433.150	OFF	ON	OFF	OFF	ON	ON
433.175	OFF	ON	ON	ON	OFF	ON
433.200	OFF	ON	OFF	ON	OFF	ON
433.225	OFF	ON	ON	OFF	OFF	ON
433.250	OFF	ON	OFF	OFF	OFF	ON
433.275	OFF	ON	ON	ON	ON	OFF
433.300	OFF	ON	OFF	ON	ON	OFF
433.325	OFF	ON	ON	OFF	ON	OFF
433.350	OFF	ON	OFF	OFF	ON	OFF
433.375	OFF	ON	ON	ON	OFF	OFF
433.400	OFF	ON	OFF	ON	OFF	OFF
433.425	OFF	ON	ON	OFF	OFF	OFF
433.450	OFF	ON	OFF	OFF	OFF	OFF

5.5 Frequency Allocations – USA

***Note**: Switches 7 and 8 in the receiver are are set as follows: switch 7 = OFF, switch 8 = ON. These are factory settings. Do not change these positions.*

Receiver – USA

Channel Center Frequency (MHz)	Switch Settings					
	S1/1	S1/2	S1/3	S1/4	S1/5	S1/6
464.100	ON	ON	ON	ON	ON	OFF
464.125	ON	ON	ON	ON	OFF	ON
464.150	ON	ON	ON	ON	OFF	OFF
464.175	ON	ON	ON	OFF	ON	ON
464.200	ON	ON	ON	OFF	ON	OFF
464.225	ON	ON	ON	OFF	OFF	ON
464.250	ON	ON	ON	OFF	OFF	OFF
464.275	ON	ON	OFF	ON	ON	ON
464.300	ON	ON	OFF	ON	ON	OFF
464.325	ON	ON	OFF	ON	OFF	ON
464.350	ON	ON	OFF	ON	OFF	OFF
464.375	ON	ON	OFF	OFF	ON	ON
464.400	ON	ON	OFF	OFF	ON	OFF
464.425	ON	ON	OFF	OFF	OFF	ON
464.450	ON	ON	OFF	OFF	OFF	OFF
464.475	ON	OFF	ON	ON	ON	ON

Transmitter (Data Logger) – USA

Channel Center Frequency (MHz)	Switch Settings					
	S1/1	S1/2	S1/3	S1/4	S1/5	S1/6
464.100	ON	ON	ON	ON	ON	ON
464.125	ON	ON	OFF	ON	ON	ON
464.150	ON	ON	ON	OFF	ON	ON
464.175	ON	ON	OFF	OFF	ON	ON
464.200	ON	ON	ON	ON	OFF	ON
464.225	ON	ON	OFF	ON	OFF	ON
464.250	ON	ON	ON	OFF	OFF	ON
464.275	ON	ON	OFF	OFF	OFF	ON
464.300	ON	ON	ON	ON	ON	OFF
464.325	ON	ON	OFF	ON	ON	OFF
464.350	ON	ON	ON	OFF	ON	OFF
464.375	ON	ON	OFF	OFF	ON	OFF
464.400	ON	ON	ON	ON	OFF	OFF
464.425	ON	ON	OFF	ON	OFF	OFF
464.450	ON	ON	ON	OFF	OFF	OFF
464.475	ON	ON	OFF	OFF	OFF	OFF

5.6 Changing the Frequency

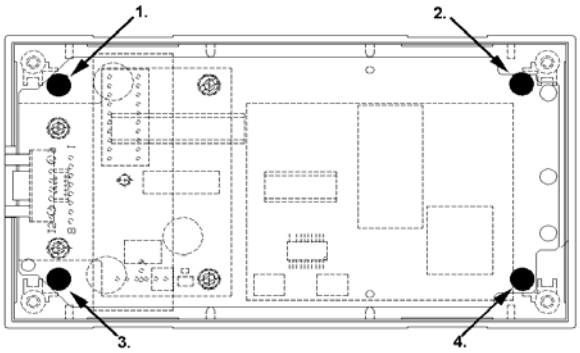
If the level of interference found during testing is unacceptable it may be necessary to select an alternative frequency.

Note 1: *Both transmitter and receiver must be tuned to the same frequency.*

Note 2: *The DIP switches in the transmitter and the receiver will require* ***different*** *settings to obtain the same frequency. See tables above.*

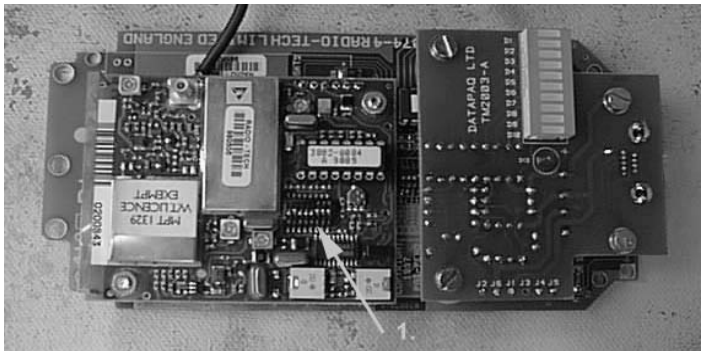
Receiver

1. Unscrew four screws from the base of the receiver and remove its cover.
2. Remove the four PCB retaining screws and carefully rotate the PCB.



Receiver with cover removed showing the four PCB retaining screws.

3. Set the first six DIP switches in accord with the new frequency.
   Switch 7 = OFF, switch 8 = ON; do not change these factory settings.



The receiver's PCB showing DIP switch.

4. Re-assemble the receiver.

Transmitter

Access to the transmitter's DIP switch is via the 'Remove To Set Freq' label on the underside of the Datapaq11.

1. Carefully remove the 'Remove To Set Freq' label.
2. Set the first six DIP switches to the settings applicable to the new frequency. *Switches 7 and 8 are are set as follows: switch 7 = OFF, switch 8 = ON. These are factory settings. Do not change these positions.*
3. Attach a new 'Remove To Set Freq' label.

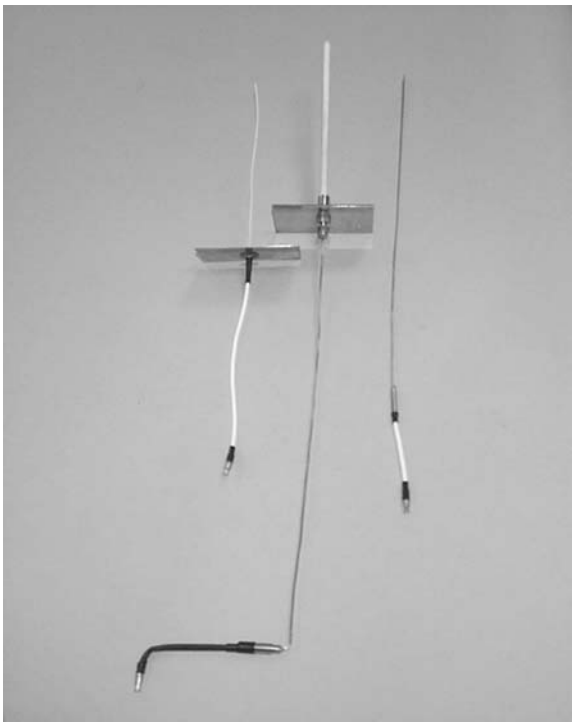
6 Transmitting Antennas

In the original version of the Datapaq11 the antenna was based on a thermocouple and was connected to the logger via thermocouple channel 10; the antenna read the ambient temperature as well as transmitting the telemetry signal. The new Datapaq11 uses a different type of antenna, and the connection to the logger is no longer made through a thermocouple channel but via a round MCX socket next to the channel 10 socket.

As shown below, there are several types of transmitting antenna that can be used with the Datapaq11, each optimized for a specific type of application. The antenna must be treated with great care, as it is vital to the correct functioning of the system. Any damage to the antenna could render the system inoperable.

Part #	Description	Operating Temperature	Typical Applications
TX2020	Kiln Tracker LT antenna. MCX connector for fitting into logger.	Up to 265°C/ 510°F.	Tunnel kiln, under car.
TX2021	Kiln Tracker LT antenna. Lemo connector for fitting into thermal barrier.	Up to 265°C/ 510°F.	Tunnel kiln, under car.
TX2030	Furnace Tracker VHT antenna.	Up to 1,000°C/ 1,830°F.	Furnace. Cannot be used for water quench or slab/billet applications. Can also be used for kiln applications where temperature under car exceeds 250°C/480°F.

Part #	Description	Operating Temperature	Typical Applications
TX2051	Furnace Tracker VHT/Q antenna. 410 mm long.	Up to 1,200°C/ 2,190°F.	Low-height quench thermal barriers.
TX2052	Furnace Tracker VHT/Q antenna. 820 mm long.	Up to 1,200°C/ 2,190°F.	Low-height quench thermal barriers.



Transmitter antennas (left to right) TX2020, TX2030, TX2051.

6.1 Fitting Transmitting Antennas

Extreme care should be taken when handling, fitting, or positioning an antenna as the performance of the whole system will deteriorate if it is fitted incorrectly.

TX2020 and TX2021 Antennas (Kiln Tracker only)

Two antennas are supplied with the Kiln Tracker system. They differ only in having a different fitting.

Fitting. The TX2020 antenna fits directly into the logger and is used when the front of the thermal barrier faces the operator. After fitting all the thermocouples into the barrier and inserting the data logger, the antenna is plugged into the logger and is taken out through the barrier lid.

The TX2021 antenna fits directly into the rear of the barrier and is used when the rear of the thermal barrier faces the operator. After inserting the data logger and securing the lid, the barrier is fitted beneath the kiln car. After all the thermocouples have been plugged into the barrier, the antenna is plugged into the Lemo socket in the rear of the thermal barrier.

Note: *These antennas should not be used when temperatures beneath the kiln car are expected to exceed 250°C/480°F. If this is the case, contact Datapaq for advice.*

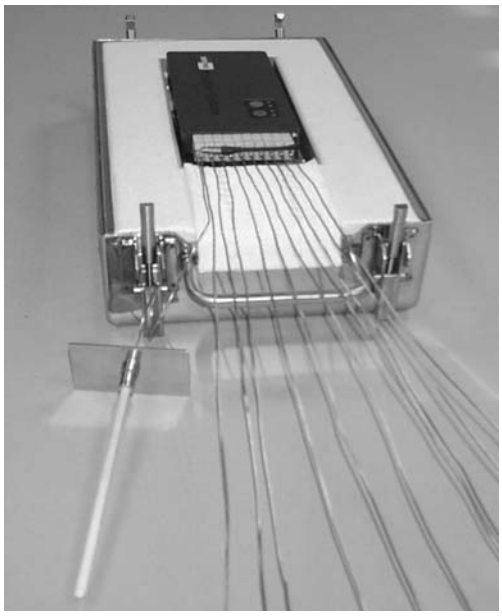
Note: *To prevent damage to the antenna, always fit the antenna last, after the barrier, thermocouples and logger have been fitted.*

Positioning. Kiln antennas should hang down beneath the kiln car, with the center coax vertical. They should be positioned where they are not likely to be disturbed, e.g. clamp the ground plane to a joist near the thermal barrier.

TX2030 Antenna (Furnace Tracker only)

Fitting. It is imperative that the entire length of the coaxial cable, and the junction between it and the antenna wire, lie within the barrier and its seal. A stiffening wire beneath the shrink-wrap coating ensures that the co-ax turns through 90° as soon as it exits the Lemo connector. The low-temperature side of the antenna will thus not be subjected to the fierce heat of the furnace.

Positioning. The antenna should exit the thermal barrier to the side of thermocouple #1. The wire behind the ground plane is flexible, and the antenna can be shaped so that the ground plane can be attached to the thermal barrier with wire. As conditions inside furnaces vary greatly it may be necessary to carry out a few runs to find the optimum position. Try positioning the ceramic tube vertically, then horizontally, until the strongest signal is found.



TX2030 antenna and logger installed in thermal barrier. Note coaxial section of antenna lying across the thermocouple connectors.

TX2051 Antenna (Furnace Tracker only)

Fitting. This type of antenna is used in conjunction with the TB5810 thermal barrier, when it is positioned inside the low-height quench system. As the front plate of this thermal barrier has a limited amount of thermocouple outlets, it is necessary to remove thermocouple #10 before the antenna can be fitted. This antenna comes fitted with a silicone-rubber plug. Use a small amount of silicone grease or other lubricant to help ease the plug through the faceplate.

After programming the data logger, plug in thermocouples 1–9 as normal. String the flexible low-temperature wire carefully below the thermocouples, then around thermocouple #1 and over the top of the thermocouples to plug the MCX connector in alongside thermocouple #10.

Slide the logger inside the TB5810 case making sure that the antenna wire is not caught between the faceplate and the body of the barrier.

Note: *Do not tamper with the antenna. The fiber braid Nextel™ insulation must remain covering its whole length. The antenna length is crucial to telemetry performance. If the Nextel insulation wears through, it must be*

replaced. If the bare antenna wire touches the product basket, the performance of the antenna will degrade.

Note: *In applications where a longer antenna is required due to the size of the thermal barrier, the longer antenna must be supplied by Datapaq.*

Positioning. The antenna should exit the thermal barrier in place of thermocouple #10. As conditions inside furnaces vary greatly, it may be necessary to carry out a few runs to find the optimum position. Try positioning the antenna wire vertically, then horizontally, until the strongest signal is found. Ensure the Nextel insulation is in good condition before running (see note above); this insulation prevents the bare antenna wire grounding on the products, which would diminish the signal strength.

7 Receiving Antennas

Three types of receiving antenna can be used:

Part #	Description	Typical Applications
RX1010A, RX1011A	¼-wave 'whip' antenna.	Mainly for furnace applications where reception is good and a higher-specification antenna is not required, e.g. mesh-belt furnaces.
RX1012A, RX1013A	Unity gain end feed antenna.	Furnace or kiln applications where portability is required and a higher-specification antenna is needed, e.g. continuous-coil annealing furnaces, sanitaryware firing.
RX0020A to RX0130A, RX2020A to RX2130A	Low-loss modular array.	Mainly for permanent or semi-permanent installation next to a long tunnel kiln, e.g. brick, roof tile. Length of kiln must be specified prior to supply.

7.1 Fitting Receiving Antennas

RX1010A and RX1011A Antennas (Furnace Tracker only)

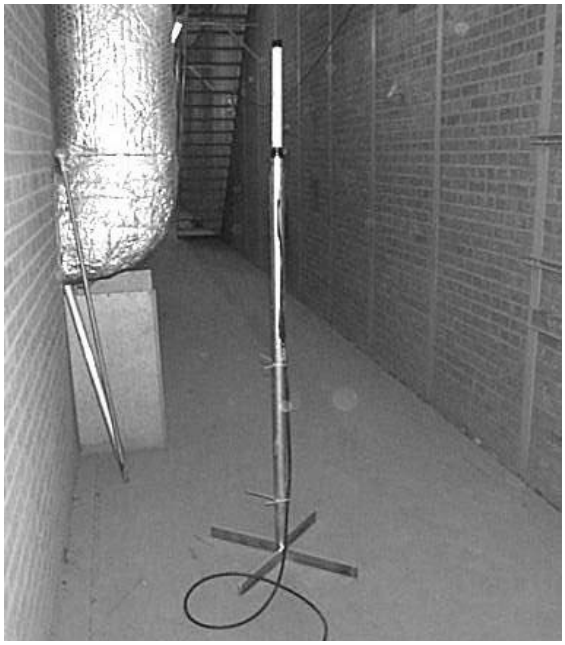
Fitting. Fits directly onto the side of the receiver and is used in applications where the receiver can be positioned near the furnace and reception is good throughout the process.

Positioning. Position antenna vertically and keep the receiver as far from the computer as possible. Move the receiver along the furnace until the best signal strength is received.

RX1012A and RX1013A End Feed Receiver Antennas (Furnace and Kiln Tracker)

Fitting. This antenna may be supplied with a low-loss coaxial extension cable RX1210A or RX1240A, a female-to-female BNC connector RX1054A, and a stand to hold the antenna RX1020A. If so, extend the stand, open out the feet, and position the antenna in the holder, use the BNC connector to connect the cable to the connector on the tail of the antenna, and plug the other end of the cable into the receiver.

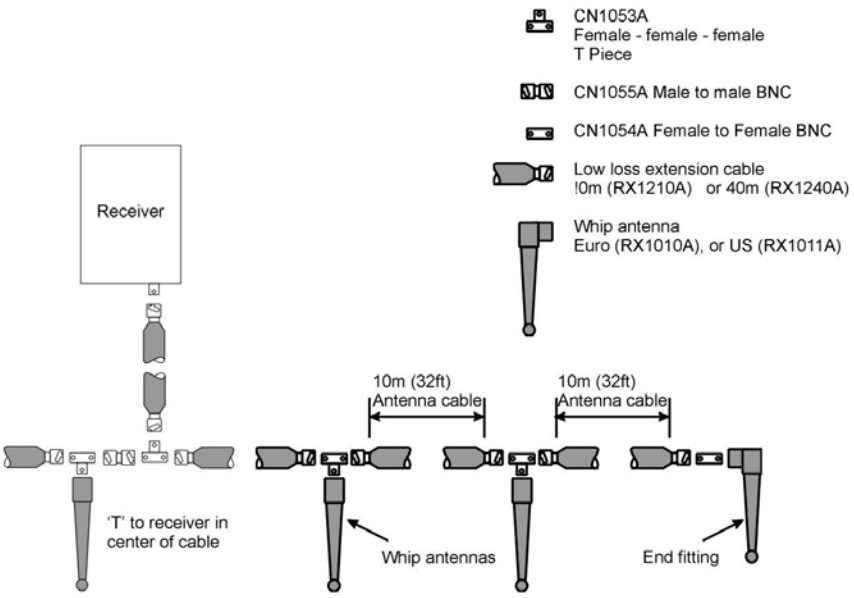
Positioning. Position this antenna vertically in its stand, and move the stand and antenna along the furnace or kiln until the best signal strength is received.



End feed antenna installed next to a kiln.

RX0020A/RX0130A and RX2020A/RX2130A Low-loss Modular-array Receiver Antennas (Kiln Tracker only)

Fitting. This antenna is generally supplied in 10-metre-length kit form. Ideally, total length of the antenna should be just short of the kiln length (e.g. kiln length 103 m, length of antenna array 100 m. Start at one end of the kiln and fit the parts together as shown in the diagram below. As you work along the kiln, hang the antenna as described in the following paragraph.



Positioning. This antenna should hang in catenary fashion along the kiln, suspended by cable ties every 3 m maximum. Distance above the floor, and away from the kiln, may vary from kiln to kiln, but the best starting position is for the antenna to hang about 2.5 m (8 feet) above the ground and about 1 m (3 feet) from the side of the kiln. Brackets may need to be constructed to hang the antenna from the guard rails along the top of the kiln, or if there is an electrical ducting running along the kiln in a convenient position then consider using that if it will safely hold the weight of the cable. Position the ¼-wave 'whip' antennas (at the end of each 10-m section) vertically towards the floor.

Low-loss modular-array antenna installed along a kiln.

8 Collecting Data in Real Time

Real Time data collection operates in a very similar way to normal operation of the software, though there are some additional features and restrictions in the way the software operates.

All Modes	Zoom available, but only via the Graph menu Zoom dialog box or holding down the right mouse button to reveal the analysis options. All data, including any acquired before Oven Start, is included in the analysis calculation, therefore calculate by zone cannot be implemented. Options selected via the Analysis Options dialog box cannot be changed during data acquisition.
Calculate Peak Differences	Not available when align probes is selected. See Defining Product and Oven Section of the Software Manual.

9 Conducting an RF Telemetry Real Time Run

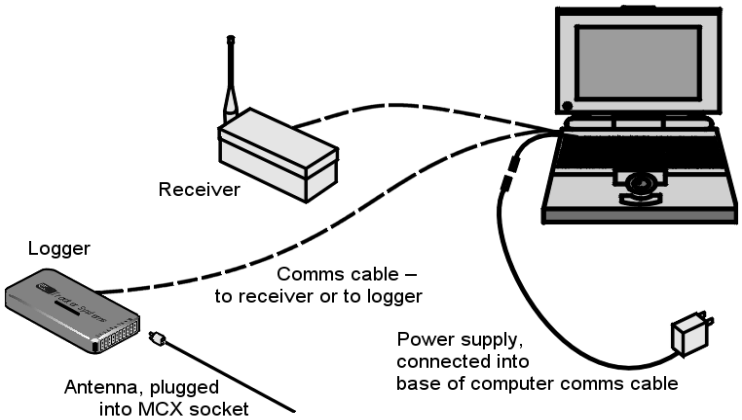
Radio telemetry provides the means of observing the temperatures your product experiences as it passes through the oven, in *real time*, as it happens; with no physical connection between data logger and analysis software. To use radio telemetry, you must plug the supplied antenna into the Datapaq11 logger.

For setting the telemetry system up initially it is suggested to follow the instructions in section 9.1 Testing Radio Communication and Signal Strength. To optimize transmission and reception, refer to section 9.2 Optimizing Signal Strength.

Following the satisfactory reception of signal, use the procedure in section 9.3 Performing a Real Time Run, for performing real-time runs using telemetry.

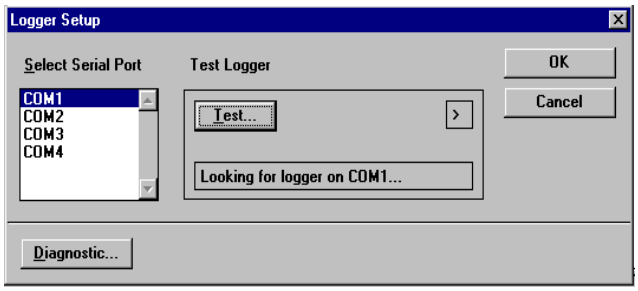
Note: *Radio telemetry cannot be used with the following thermal barriers: TB2005, TB4021 or any thermal barrier designed exclusively for the Datapaq 9000 data logger.*

9.1 Testing Radio Communication and Signal Strength

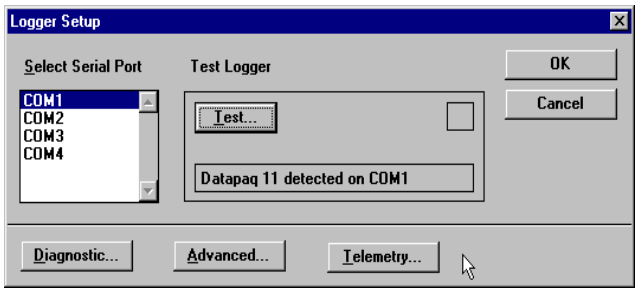


The first time the telemetry system is used it is recommended to follow this extended procedure to confirm satisfactory transmission and reception of data. Once this procedure has been satisfactorily performed, refer to section 9.3 Performing a Real Time Run.

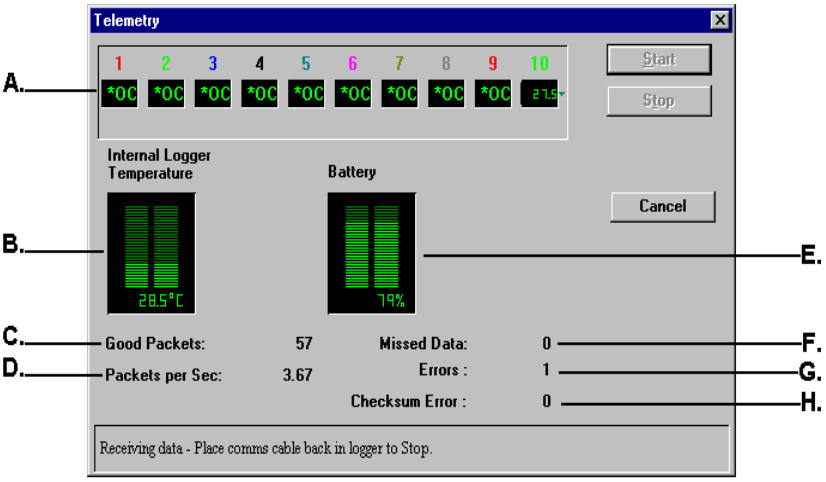
1. Ensure the transmitting antenna is plugged into the data logger.
2. Using the computer communications cable supplied, connect the data logger to the appropriate COM port on your computer.
3. Connect the power supply to the communications cable, using the connection near the COM port of the computer, and plug the power supply into a mains socket.
4. Connect the thermocouple probes to the data logger.
5. If not already running, launch the Datapaq Tracker software.
6. From the menu, select **Logger\Setup...**
7. In the Select Serial Port list box, select the number of the port to which the logger is connected.



8. Click on the **Test...** button. If the data logger is detected, its type and the COM port to which it is connected are displayed. Additional buttons **Advanced...** and **Telemetry...** appear in this dialog.



9. Click on the **Telemetry...** button.



*The **Telemetry** dialog box appears.*

A. **Real-time digital displays**.

B. **Internal Logger Temperature**. A color bar graph showing the temperature inside the data logger. Colors are; blue below 25 °C, green from 25 to 60 °C, red above 60 °C. Note, the maximum permissible temperature is 70 °C, above which the logger turns off.

C. **Good Packets**. Counts the valid data received and processed by the software.

D. **Packets per Second**. The rate of data received.

E. **Battery**. A color bar graph indicating the charge status of the logger's battery. Colors are red below 25 °C, otherwise green.(*NB High-temperature lithium batteries do not work with the battery indicator*)

F. **Missed Data**. The number of packets transmitted, but not received.

G. **Errors**. The number of incomplete or invalid packets.

H. **Checksum Error**. The number of valid packets received containing invalid data.

10. Click on the **Start** button. The logger's red status LED flashes continuously and the message 'Remove comms cable and insert it in the receiver' appears at the bottom of the **Telemetry** dialog box.
11. Disconnect the comms cable from the logger. The logger's green status LED flashes.
12. Connect the cable to the receiver. The receiver's signal strength meter indicates data are being received, and live data appear in the **Telemetry** dialog box. Continue monitoring to ensure data transmission is reliable.

Using the Telemetry dialog box and the signal-strength meter, refer to section 9.2 Optimizing Signal Strength to obtain the best receiver position and setup. When finished, remove the comms cable from the receiver and plug back into the logger to stop data transmission.

9.2 Optimizing Signal Strength

The furnace environment can be an extremely harsh one in relation to the transmission and reception of radio telemetry. Shielding by large structures, heat and electrical noise from the furnace installations can all cause problems.

Note: *For antenna type TX2051 do not tamper with the aerial. The Nextel™ insulation must remain covering its whole length. The antenna length is crucial to telemetry performance. In applications where a longer antenna is required due to barrier size, the antenna must be supplied by Datapaq.*

When setting up the system take the following into account:

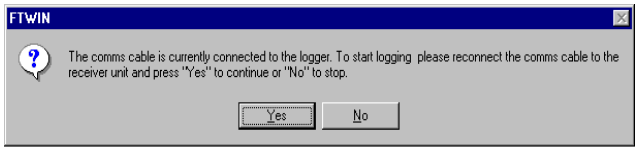
- Wherever possible, make sure the transmitting antenna is positioned vertically. If, because of height restrictions in the furnace, this is not possible, position it as near-vertical as you can.
- Computers generate considerable interference, so keep the receiver module as far away from your computer as possible.
- Keep the receiver away from any source of electrical power, e.g. power supplies driving the furnace.

Careful positioning of the receiver and receiving antenna, taking the above into account, will provide satisfactory results in most installations.

9.3 Performing a Real Time Run

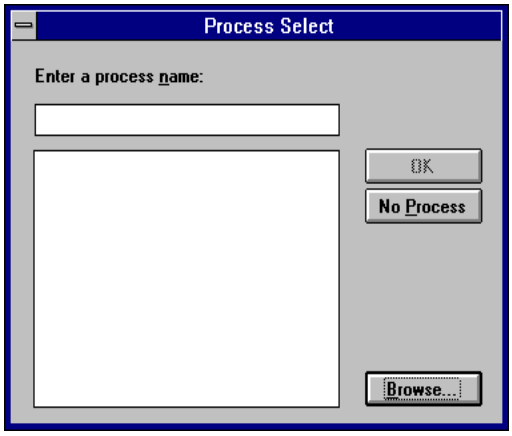
1. Connect the logger to the PC, as previously, and click the Logger Reset button.

2. The **Reading Data from Logger** dialog box appears, followed by the **Logger Reset** dialog box. Select probes, sampling interval etc as instructed in your software manual. Ensure that the **Radio Telemetry** option is selected from the **Telemetry** options. Click OK. The **Logger Resetting** dialog appears, followed by ...



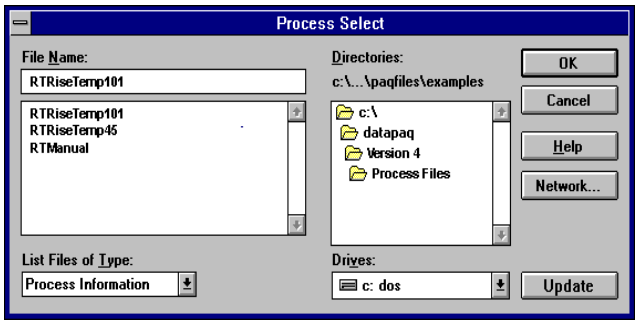
3. Unplug the comms cable from the logger and connect it to the receiver. Click **Yes** to proceed.

4. The logger's red and green status LEDs flash alternately and the **Process Select** dialog box appears.



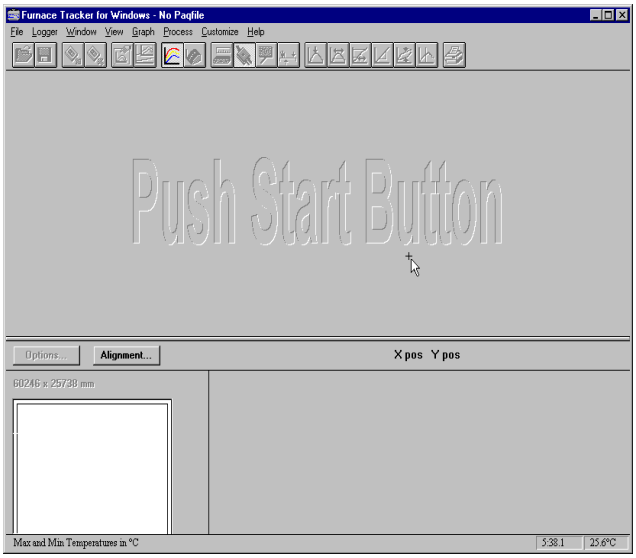
*The **Process Select** dialog box.*

5. Select a Process or choose No Process. If the appropriate Process is not shown click on Browse..



*The **Process Select** dialog box appears.*

6. In the **Drives** list box, click on the drive, in the **Directories** list box, click on the directory, then sub-directory, in the **File Name** list box, click on the Process. Click **OK**.
7. Click **OK** again. The analysis screen appears showing the trigger status message which will be either **Awaiting Trigger**, *or*, **Push Start Button**.



The analysis screen, trigger status is Push Start Button .

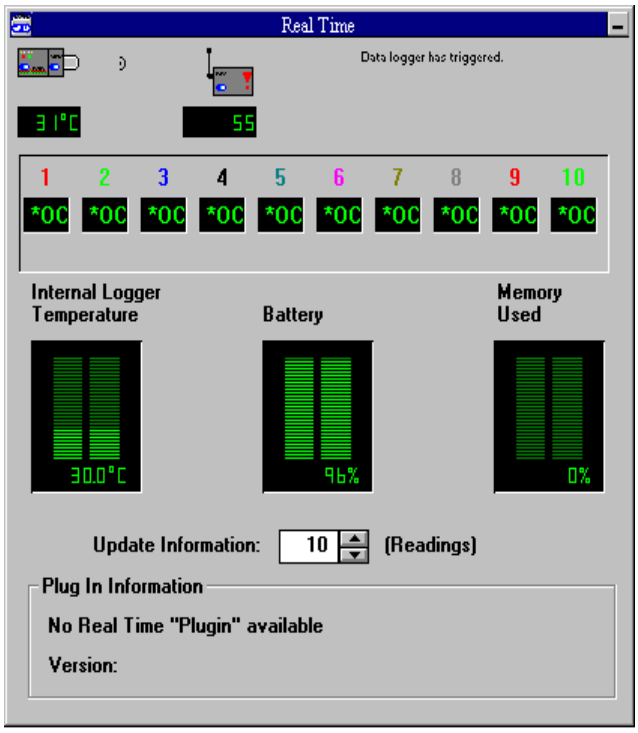
8. If the trigger status message is Push Start Button, push and hold the logger's Start button until the logger's green status LED flashes.

***Note:** To work efficiently, the transmitter antenna must be fitted; this will often have to be done after the logger is installed in the thermal barrier.*

9.4 Real Time Tool

During a real time run, information on the status of the data logger is available on the Real Time Tool. This shows the logger's battery status, internal temperature and memory status. It also shows the number of data packets received.

On the **Standard Toolbar**, click on the **Real Time Tool** button, or from the menu select **Window… Real Time Tool**. These options are only available during real time data collection.



*The **Real Time** dialog box appears.*

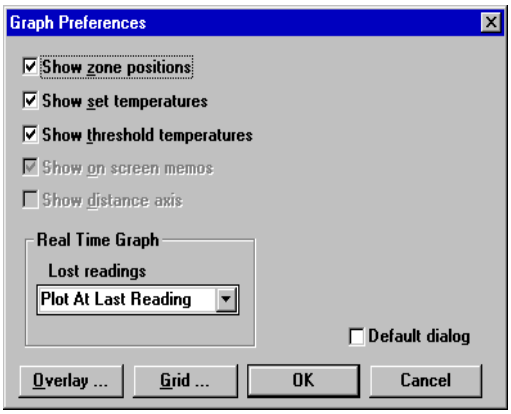
***Note 1:** For the telemetry system to relay accurate data, the logger's internal temperature must not exceed 105°C/230°F.*

***Note 2:** Battery status will not be shown accurately if using high-temperature lithium batteries BP1030 or BP 0004.*

9.5 Graph Options – Lost or Missed Data

In the event that some data are lost during data transmission the Graph can be configured to display the data in the color of choice or simply left blank.

From the menu select **Graph**.. **Options**.. **Preferences**.



In the Real Time Graph Lost Readings list box select the option of your choice.

Plot At Last Reading will fill the gap where data has been missed with the last good reading received. To set the color of the trace for missed readings from the Menu select **Customize .. Colors**, highlight **Lost Readings** and select the color of choice.

Leave Blank will simply leave a gap in the graph for the missed data.

It is recommended that the **Leave Blank** option is selected. Downloading data from the logger after the run will provide an accurate record regarding the lost readings.

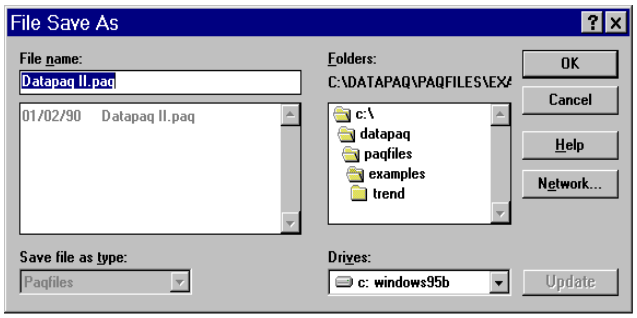
The total number of missed readings for a run is shown on the Standard Report.

9.6 Stopping and Saving the Real Time Run

Once the run is complete real time data collection can be stopped in one of three ways;

1. By pressing the Stop button on the logger.
2. By plugging in the comms cable into the logger.
3. By selecting **Logger.. Stop Real Time** from the Menu.

Whatever method used the software will display the **File Save As** dialog box.



Save the file in the usual way.

10 Conducting a Hardwired Real Time Run

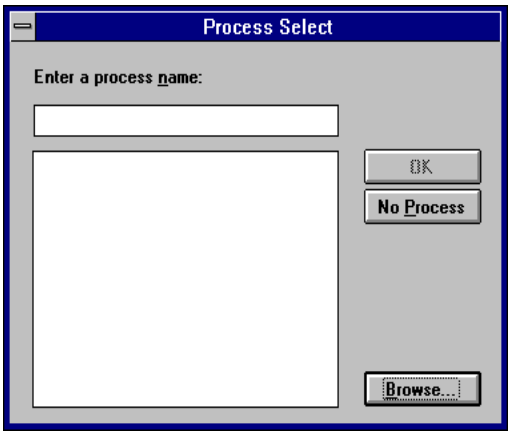
When the transmitter is not fitted, the Datapaq11 logger with Version 4 Datapaq Tracker software is capable of performing real time runs by transmitting readings to the PC, as they are recorded, via the computer interface cable. This allows the system to gather real time information from the process.

10.1 Resetting the Data Logger for a Real Time Run

1. Click the Logger Reset button.

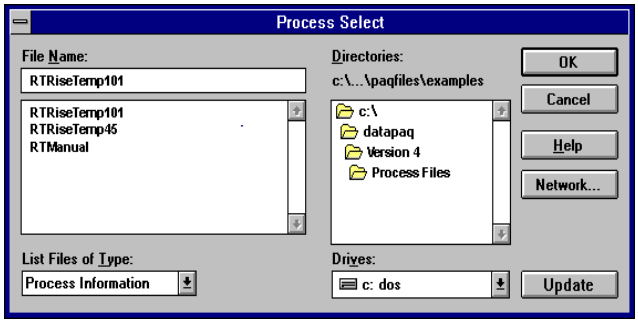
The **Reading Data from Logger** dialog box appears, followed by the **Logger Reset** dialog box. Ensure that the **Hardwired Real Time** option is selected from the **Telemetry** options. Once the reset is complete the software will go into real time mode; proceed as follows.

2. In the **Logger Reset** dialog box, click **OK**. The logger's red and green status LEDs flash alternately and the **Process Select** dialog box appears.



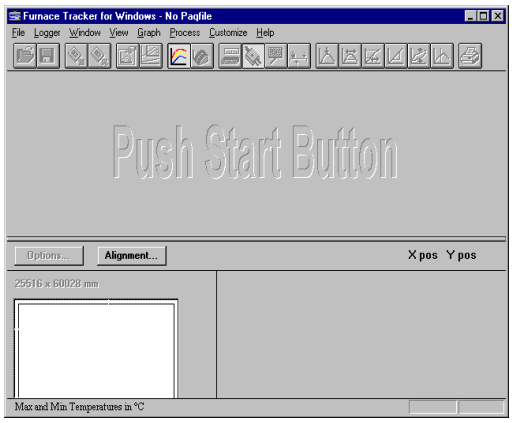
*The **Process Select** dialog box.*

3. Select a Process or choose No Process. If the appropriate Process is not shown click on Browse..



*The **Process Select** dialog box appears.*

4. In the **Drives** list box, click on the drive, in the **Directories** list box, click on the directory, then sub-directory, in the **File Name** list box, click on the Process.
   Click **OK**.
5. Click **OK** again. The analysis screen appears showing the trigger status message which will be either **Awaiting Trigger**, *or*, **Push Start Button.**



The analysis screen, trigger status is Push Start Button.

6. If the trigger status message is Push Start Button, push and hold the logger's Start button until the logger's green status LED flashes.

10.2 Real Time Tool

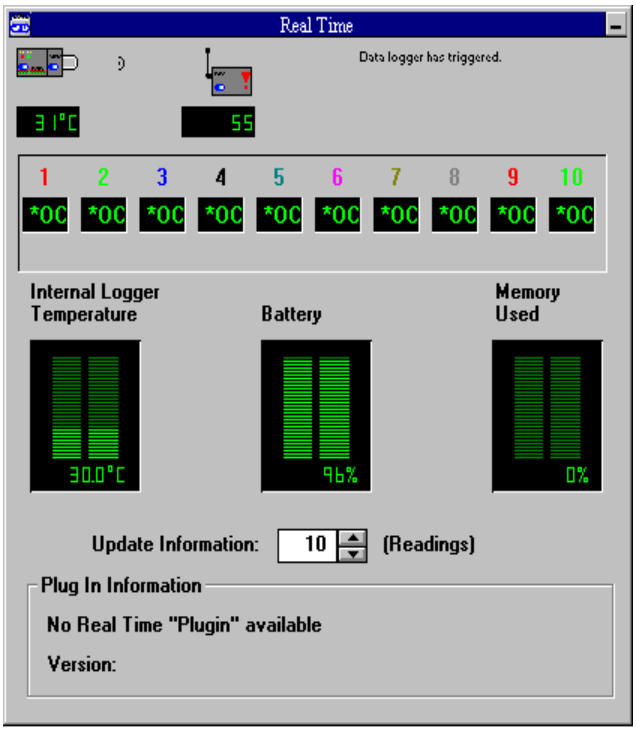
During a real time run information on the status of the data logger is available on the Real Time Tool. This shows the loggers battery status, internal temperature and memory status. It also shows the number of data packets received.

On the **Standard Toolbar**, click on the **Real Time Tool** button, or from the menu select **Window… Real Time Tool**. These options are only available during real time data collection.

10.3 Stopping and Saving the Real Time Run

Once the run is complete real time data collection can be stopped in one of two ways;

1. By pressing the Stop button on the logger.
2. By selecting **Logger.. Stop Real Time** from the Menu.



*The **Real Time** dialog box.*

Whatever method used data collection will stop and the File Save As window appears. Save the file in the usual way.

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