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1. Introduction

These instructions are for all 1000 Series Squirrel dataloggers and for the SQ400 and SQ800 dataloggers. For 1000 Series loggers with firmware version up to and including 3.1, the readings are displayed and recorded with a resolution of 10 bits binary which is equivalent to 1 part in 1000. From version 3.2 onward and for the SQ400 and SQ800, the resolution has been improved to 12 bits on most ranges equivalent to 1 part in 4000, full details are given in the Technical Data section (to check the firmware version of your datalogger use the STAT function). The illustrations in this handbook are for 12 bit models. No details are given of data transfer, analysis or remote operation for which separate instructions are provided with each computer program.

Section 2 provides an overview of the operating buttons and describes their functionality.

Section 3 gives an introduction to the main functions of the datalogger.

Section 4 offers a quick start guide to set up the datalogger from the default settings.

Section 5 provides a comprehensive description of all the datalogger functions.

Section 6 shows you how to wire up sensors to the appropriate channels and to make connections with event channels and external trigger options to start and stop logging.

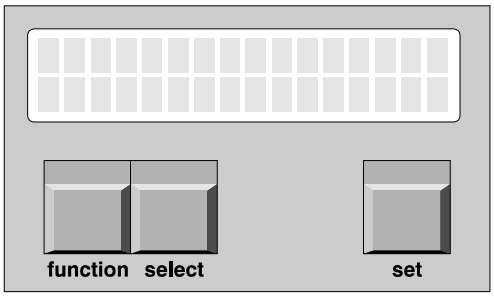
Section 7 is a concise troubleshooting guide.

Section 8 details the safety and operating conditions.

Section 9 contains technical information relating to all models.

2. Overview of the operating buttons

The operating buttons allow the setup of all of the major functions of the logger.



function selects the function.

select selects the channel or sub function.

set is used to change any of the settings.

To switch the datalogger on**,** press and hold *function*. To switch it off, leave in LOG or OUTPUT function for a few seconds. If the datalogger is left on in any other function it will automatically switch off after 4 minutes.

3. The functions of the datalogger

3.1 LOG

Used to start and stop logging. In addition this function displays the number of readings already stored in the memory (used), and the number of readings which may be stored in the remaining memory (free). All the readings stored in memory may be erased in this function. In addition, this function will allow you to display how many separate runs have been recorded.

3.2 METER

Displays the value of the channels which have been selected, in the appropriate units. The readings are updated every second.

3.3 REVIEW

Displays the recorded values of the selected channels, starting with the first reading in the last run (if the logger is not currently logging). If the logger is currently logging, then the first reading in the current run is displayed.

3.4 TIME / date

Displays the real time and date on two lines. The 24 hour clock may be displayed in the appropriate country format (see 3.11g); the time increments every second. Only the last two figures of the year are used and this is taken to increase from the oldest possible past date setting of (19)94 to the furthest possible future date setting of (20)63, also the year (20)00 is taken to be a leap year. This makes these loggers Year 2000 Compliant.

3.5 START time / date

This option allows you to set a future time and date at which logging will start.

3.6 INT log / sample (logging / sampling interval)

The interval function is used to set the time intervals at which readings are taken and stored in memory. The logging interval can be set between 1 second and 12 hours in 1 second increments. The second line is used to set the time intervals (less than or equal to the logging interval) at which inputs are sampled for averaging or for alarm detection. Averages are calculated and then stored in memory at the logging interval.

3.7 OUTPUT

Used for output of recorded data to a computer. During downloading of data, the LCD displays the number of blocks to be downloaded and this is decremented after each successful transmission of a block. No baud rate setting is required as it is automatically selected.

3.8 MODE

Used to select the type of logging required, namely Interval, Average, Event, Event+Interval, Event+Average. This function also allows you to select how logging may be started and stopped via an external trigger or by alarm detection, if required. In addition, you can select whether you wish logging to stop when the memory is full or whether logging continues and old data is overwritten.

3.9 CHANNEL SETUP

Used to select the channels from which you require data to be recorded. The range for each channel is also selected, which could include engineering units if these have been set up. This function also displays how many channels have been selected to record

3.10 ALARM SETUP

For models with an alarm function, this is used to set high and low alarm thresholds for the analogue and pulse channels. Alarm thresholds are only tested during logging and then if the alarm status of any channel changes, an additional alarm recording is made. This means that to record alarms it is only necessary to set the thresholds for the channels to be monitored and to check that the sampling interval is appropriate.

3.11 STAT (status)

This function displays the following status information concerning the datalogger:-

a) internal battery voltage
b) number of days remaining of viable battery life when logging
c) external supply voltage
d) memory size (with the ability to change memory size in 1K increments)
e) sensor power-on time (adjustable up to 60 seconds before the reading is taken)
f) alarm relay configuration (can be set to not used, unlatched or latched)
g) date format (adjustable)
h) language format (adjustable)
i) mains frequency filter (adjustable)
j) model number and current version of firmware

4. How to start logging from the default settings

4.1 Set time/date

The real time and date are displayed on two lines. The time is set in the format HH:MM:SS. and the date default format is DD/MM/YY. Press *function* until the display shows:-

TIME	10:42:59
date	25/12/97

Press *set* and the following prompt appears:-

TIME	10:43:11
HOLD TO CHANGE	

Hold *set* button and cursor will appear:- (the clock will stop)

TIME	10:43:17
date	25/12/97

Press *select* to move cursor:-

TIME	10:43:17
date	25/12/97

Press *set* to change value:-

TIME	10:46:17
date	25/12/97

Press *function* when settings are correct:- (cursor will disappear and clock will restart with new settings).

TIME	10:46:19
date	25/12/97

If invalid data is entered, the display changes the settings to the nearest valid time/date.

4.2 Select logging interval

The logging interval can be set between 1 second and 12 hours in 1 second increments. This is the interval at which recordings are stored. Press *function* until display shows:-

INT log 00:00:30

```
sample    00:00:00
```

Press *set* to display:-

```
INT log   00:00:30
HOLD TO CHANGE
```

Hold *set* button and cursor will appear:-

```
INT log   00:00:30
sample    00:00:00
```

Press *select* to move cursor:-

```
INT log   00:00:30
sample    00:00:00
```

Press *set* to change value:-

```
INT log   00:00:35
sample    00:00:00
```

This example changes the logging interval from 30 to 35 seconds. Press *function* to clear the cursor and to continue with setup.

4.3 Set the type of logging required

The possible types of logging are detailed in section 5.8.1. However, the default setting is for recording data at fixed intervals only. Press *function* until mode is displayed:-

```
MODE log
interval
```

You need do nothing else except set which channels to log if you simply need to record data at the logging intervals set in section 4.2

4.4 Set the number and types of channels

Each model has a specified combination of channels; please consult the data sheet in Section 9 for details of your particular model. This section will guide you to set up a temperature and voltage/current channel. Press *function* until the following is displayed:-

```
CHANNEL SETUP
  1 used
```

The default setting will always be the first range of the first channel. If you deselect all channels, then you will not be able to progress until you have configured at least one channel. In this case, pressing the function key will only display the following

message:-

```
CHANNEL SETUP
NONE SELECTED
```

Please proceed to the following sections for instructions on how to set up specific channels.

4.4.1 Temperature channel setup

Thermistors, thermocouples and platinum resistance sensors are capable of accurately measuring temperatures within different ranges. Grant Squirrel dataloggers offer the appropriate ranges for each type of sensor. This example is for a datalogger with thermistor type inputs. Press *select* once and the following message will be displayed: - (Pressing select several times will allow you to scroll through the channels)

```
CH 1    S °C
 -50.00 / 150.00
```

Press *set* and hold for 3 seconds:-

```
CH 1    S °C
HOLD TO CHANGE
```

```
CH 1    Y °C
 -50.00 / 150.00
```

The temperature range then increments to the next available range with every press of the *set* button:-

```
CH 1    U °F
 -58.00 / 302.00
```

Leave the display showing your chosen range and press *select* to set up another channel.

4.4.2 Voltage/current channel setup

These channels may be configured for voltage or current. There are 18 voltage ranges and 2 current ranges. Voltage/current channels have an additional range called the EU (Engineering Units) range where the user can select specific engineering units (e.g. m/s) and a max/min scale (e.g. 0/50 m/s). The appropriate voltage/current range is then selected from the existing hardware ranges (e.g. 0/1 V). In the above example, 0/50 m/s = 0/1V and the display in METER mode will show readings in m/s. Also, all data in this channel will be stored and downloaded using m/s as the unit. In the above example, the CHANNEL SETUP function will alternate between the following displays:-

```
CH 6   EU m/s
     0.0 /    50.0
```

```
CH 6   EU V
```

```
 0.0000 / 1.0000
```

The EU range may only be changed by using a PC based Data Transfer and Setup program such as SquirrelView (please see price list or contact your distributor for details). Whenever a voltage/current channel has not been set up, the initial range is always the default EU range and is displayed as follows:-

```
CH 6   EU %
   0.00 / 100.00
```

```
CH 6   EU V
 0.0000 / 1.0000
```

Press *select* to change channel. For example, select channel 5:-

```
CH 5
     not used
```

Press *set* and hold for 3 seconds:-

```
CH 5
HOLD TO CHANGE
```

Now press *set* to scroll through the voltage/current ranges. Leave the display showing your chosen range and press *select* to set up another channel or press *function* to continue with logger setup.

4.4.3 Humidity channel setup

The default EU (Engineering Unit) range for all voltage/current inputs (as described in 4.4.2), is 0/1V = 0/100% and is suitable for Grant humidity probes. These probes plug into any voltage/current input selected using the CHANNEL SETUP function. Press and hold *set* for 3 seconds to change an unused voltage/current channel to the default EU range. **N.B. It is essential that the 'sensor on' time is set to 1 second. Please see 5.11.4 for further details.**

4.5 Start logging

Press *function* until the following is displayed:-

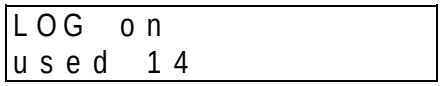
```
LOG off
used 0
```

Now press and hold *set* to start logging:-

```
LOG off
HOLD TO START
```

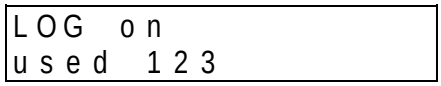
When the display changes to show that logging is waiting to start or has started, the button may be released. The display will then turn off within 10 seconds to conserve

power. (Some memory slots will be used up immediately in order to store the header data describing the setup for this run which is needed for output to computer.)

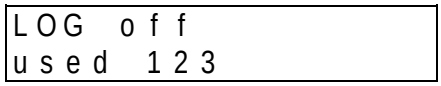


4.6 Stop logging

Press *function* to wake up the logger:-



Hold *set* to stop logging:-



5. More about the functions of the datalogger

5.1 The LOG function

5.1.1 Logging status displays

Whenever *function* is pressed while the logger display is blank, the display will indicate the logging state. This indicates that logging is in progress and that 123 memory slots have been used so far:-

```
LOG  on
used  123
```

Alternatively, the display below indicates that logging has stopped and that 124 memory slots have been used:-

```
LOG  off
used  124
```

If the START function has been used (see 5.5), the logger waits for a specific time and date to start logging, and the following is displayed:-

```
LOG  waiting
used  0
```

This display is also shown during the initial sensor on time if this is non-zero.
Alternatively, it may indicate that triggered recording has been selected (see 5.8.7) and logging is paused awaiting the trigger (e.g. a signal from the external trigger input).

5.1.2 Used / free memory / number of runs recorded

Whenever a function is entered, press *select* to scroll through the available sub-functions. Here the first screen displays the number of memory slots already used for storage of data and header blocks:

```
LOG  off
used  100
```

The next screen displays the number of memory slots available for further logging:

```
LOG  off
free  64900
```

The number of separate runs already recorded (out of a maximum of 99) is displayed in the last screen. If the logger is logging, then the current run number is displayed:

```
LOG  off
```

```
run  3
```

5.1.3 Start/stop logging

If you have just unpacked your datalogger and have not previously used this model then please go to section 4. Whenever you first enter the LOG function you can press and hold *set* to start and stop logging:-

```
LOG  off
used  12345
```

```
LOG  on
used  12345
```

N.B. you can only start and stop logging when the display shows either of these screens. There are conditions when logging cannot be started and these are indicated by the following error messages:

NO MORE RUNS	The maximum number of runs for the current memory mode has been exceeded
MEMORY FULL	There is insufficient space in memory for another run
LOW SUPPLY	The battery must replaced or an external supply connected

5.1.4 How to clear the memory

The procedure for clearing the memory has been designed to reduce the risk of the user accidentally clearing the memory. It is not possible to clear the memory either while logging or waiting to log. It is only possible to clear the memory using the following sequence:

Press *function* to wake up the datalogger and press *select* within 10 seconds to obtain either of the following displays:-

```
LOG  off
free  12345
```

```
LOG  off
run  3
```

Now you can clear the memory by pressing and holding *set* for 2 seconds:-

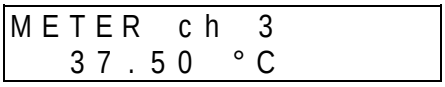
```
LOG  off
HOLD  TO  CLEAR
```

5.2 The METER function

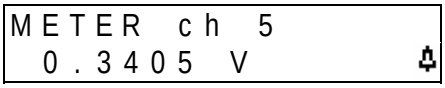
This displays the value of the selected channel using the currently selected range for that channel. Except as described below, on entering the METER function the display will show the value of the first channel selected and this value will be updated every second. This example assumes you have selected the following channels:-

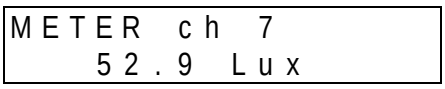
Channel 3	-50.0/150.0 °C
Channel 5	0.000/1.000 V
Channel 7	0.0/5.0V=0/500 Lux

As soon as you enter the METER function, the display will show:-

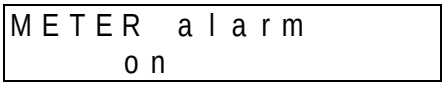


There are three possible fault conditions: an input exceeding the range maximum will be shown as ‘high’ and an input below the range minimum will be shown as ‘low’. For thermocouples and platinum resistance channels only, a break in one of the input connections will be shown as ‘open’
You may view the other channels by pressing *select* to scroll through those which have been selected:





If logging is in progress and the selected channel has a value outside the alarm thresholds set for that channel then a bell symbol appears at the bottom right.
If alarm thresholds have been set and if the alarm relay output has been enabled, then an additional screen is displayed before the channel value screens:-



This shows the status of the alarm relay output and allows this output to be turned off by pressing and holding the *set* button. There are three possible states indicated as follows:

- on — The relay contact is closed due to the alarm condition selected in the Alarm Setup and Status - Alarm Relay functions
- reset — The user has pressed the *set* button to clear the alarm and the relay output is open, but the condition which produced the alarm is still present. This state changes to ‘off’ if the alarm condition is removed.
- off — The relay contact is open and there is no alarm condition

After the user has reset the alarm it can only turn on again after the condition causing the original alarm has been removed i.e. the state must go from ‘reset’ to ‘off’ before the ‘on’ state becomes possible.

5.2.1 Pulse count channels

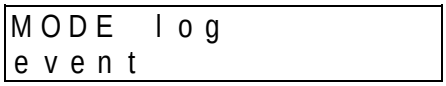
When viewing a pulse count channel in METER mode, the display will show an accumulating total of pulse counts. This total may be reset to zero by pressing *set*. Please note that zero reset will not be available when logging is in progress; in this case, the accumulating total will be automatically set to zero at the beginning of each logging interval. See section 5.9.3 for further details.

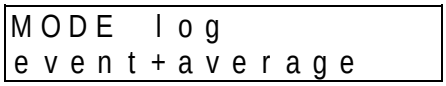
5.2.2 Event/digital channels

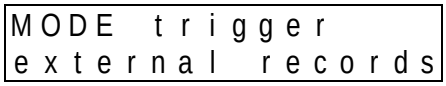
The display will either show binary or decimal format, depending on which has been selected in CHANNEL SETUP. See section 5.9.4 for further details.

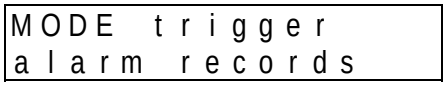
5.2.3 Elapsed time between events

An additional channel is automatically selected when you have selected the following logging modes: - (See section 5.8 for further details)

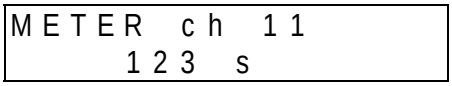






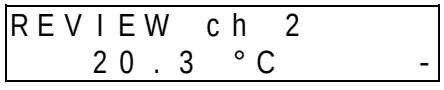


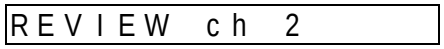
This channel (which numerically follows the event channel) measures the elapsed time in seconds between events or triggers and may be viewed in METER mode:-

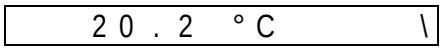


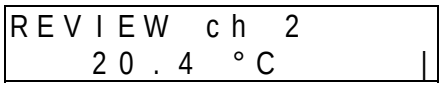
5.3 The REVIEW function

The display shows the recorded values of the selected channel in the most recent run or in the current run if logging is in progress. Press *select* to choose which channel you wish to review. Then each press of *set* will update the readings from first to last in that run. A rotating bar indicates that the next reading has been selected:-

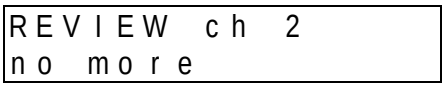








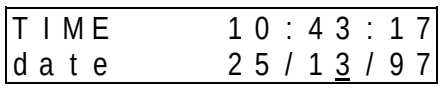
Holding down *set* will display the readings rapidly until the following is displayed:-

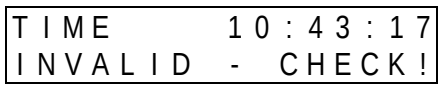


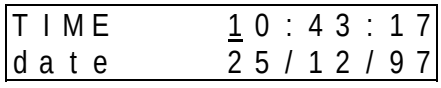
At any time you may skip to another channel and restart the review by pressing *select*.

5.4 The TIME and date function

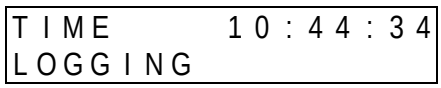
This displays the real time and date on two lines. The time clock is in a 24 hour format (HH:MM:SS). The format of the date may be changed using the STAT function. Please see section 4.1 for details of how to set the time and date. Although invalid times and dates are allowed to be set, when *function* is pressed, the entries are validated. The logger modifies the entries to the nearest valid setting and displays a warning that the initial entries were invalid. For example, the following would occur in UK date format i.e. DD/MM/YY:-





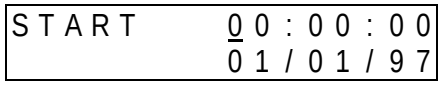


The time and date cannot be altered if logging is in progress. Pressing *set* will indicate this to the user:

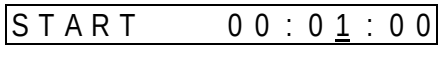


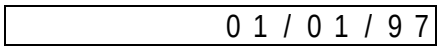
5.5 The delayed START function

This function is used if you wish to set a future time and date at which logging will start. Once you are in this function, press and hold *set* until you obtain a cursor:-

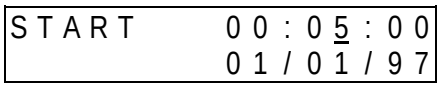


Now press *select* to place the cursor under the entries that you need to change:-

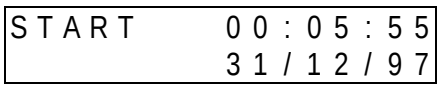




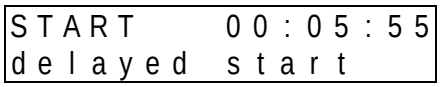
This entry may now be changed by pressing *set* until the desired value is achieved:-



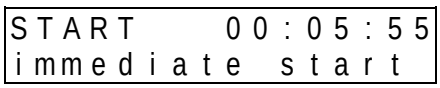
Other entries may be changed in a similar way, using *select* and *set*. When the desired delayed start time and date has been set, you can press *function* to store these parameters:-



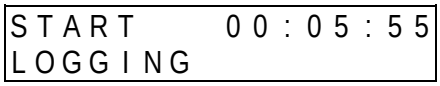
It will usually be the case that the start time will be later than the current real time and the logger will wait until the start time before commencing logging. In this case the following message will be displayed:-



N.B. Please remember that you must also set the logger to start logging in the LOG function (see 5.1.3). If you have set the start time and date to earlier than the current real time then the following message is displayed:-



Logging will then commence as soon as you set the logger to start logging. At this time, the start time will automatically be adjusted to the current real time. The start time and date cannot be altered if logging is in progress or if the logger is waiting to start logging; this will be indicated by the following message when *set* is pressed:-



Please note that invalid settings are treated as for time and date

5.6 The INT function (logging/sampling interval)

Depending upon the logging mode selected (see 5.8), readings may be stored in memory at fixed intervals or when certain events occur or a combination of both of these. In the INT function this logging interval is shown on the top line and can be set between 1 second and 12 hours as described in section 4.2. In logging modes which include averaging, the inputs are measured at a shorter interval (called the sample interval) and the average of these measurements is recorded at the logging interval. The sample interval is also the time at which alarm thresholds are tested when these have been set in the ALARM SETUP function. It is shown on the bottom line and can be set between 1 second and 12 hours provided that a logging mode including averaging is selected or alarms are in use:-

```
MODE log
average
```

```
MODE log
event+average
```

There is a minimum possible value for the intervals dependant on the number of analogue channels selected to log and their type of up to 3 seconds e.g. greater than ten analogue channels always requires at least 2 second intervals. It is best to choose a sample interval which divides exactly into the logging interval, but if not then any remainder must satisfy the minimum interval criterion. If any of these conditions are not met then an error message is displayed and the nearest suitable values substituted:-

```
INT log 00:00:30
INVALID - CHECK!
```

It is not necessary to change the sampling interval if recordings are made in non-average modes and without alarms. The sampling interval will be automatically set to zero:-

```
INT log 00:00:30
 sample 00:00:00
```

Please note that the logging/sampling interval cannot be changed while logging is in progress or while logging is waiting to commence:-

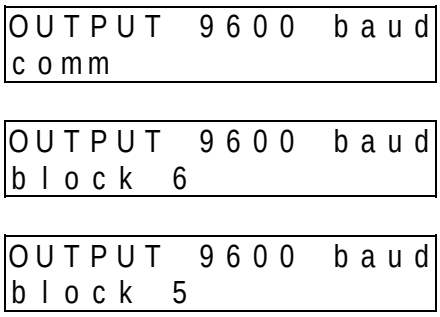
```
INT log 12:00:00
LOGGING
```

5.7 The OUTPUT function

This function is used to output data to a computer using the following programs:-

Data transfer only	FileWise for Windows
Data transfer and direct/remote setup	DARCA
Data transfer and analysis	SquirrelWise for Windows

A short time after entering OUTPUT the display will clear and the logger will enter sleep mode which is required prior to active communication. The baud rate is automatically selected to match the received signal. During downloading, the number of blocks to be downloaded is displayed and this number changes after each successful transmission of a block. While not actively communicating, "idle" is displayed. An example of some of the displays which may be seen during the downloading process are shown below:



The number of blocks transmitted will decrement until the display clears to indicate that all the data has been transferred. Please note that downloading of data can be achieved while logging is in progress and that the following minimum logging intervals are permissible, corresponding to the appropriate baud rates:-

Baud rate	Minimum logging interval
300	10 seconds
1200	3 seconds
2400	2 seconds
4800 or greater	1 second

5.8 The MODE function

Once you have entered this function using the *function* button, press *select* to select from the following sub-functions (Please note that you cannot change any entries in the MODE function while logging is in progress or while readings are still stored in the memory).

5.8.1 Mode log

Press *set* to change the type of logging required from the following options.

5.8.2 Interval logging

```
MODE log
interval
```

The inputs from each channel selected are measured at each logging interval and stored in memory. Pulse inputs record the total number of pulses received during this interval. The logger records the first readings after the sensor on time if any, although pulse inputs record a dummy value at this point. Please see section 4.2 for instructions on how to change logging intervals.

5.8.3 Logging averages

```
MODE log
average
```

In this option, the inputs from each channel selected are measured at each sample interval, which is set at a shorter interval than the logging interval. All the sample interval readings taken within the logging interval period are averaged. This average is then recorded at each logging interval. Readings from pulse count channels and event/digital channels cannot be averaged and the actual values at the end of the logging interval are stored. Please see section 5.6 for instructions on how to change sample intervals.

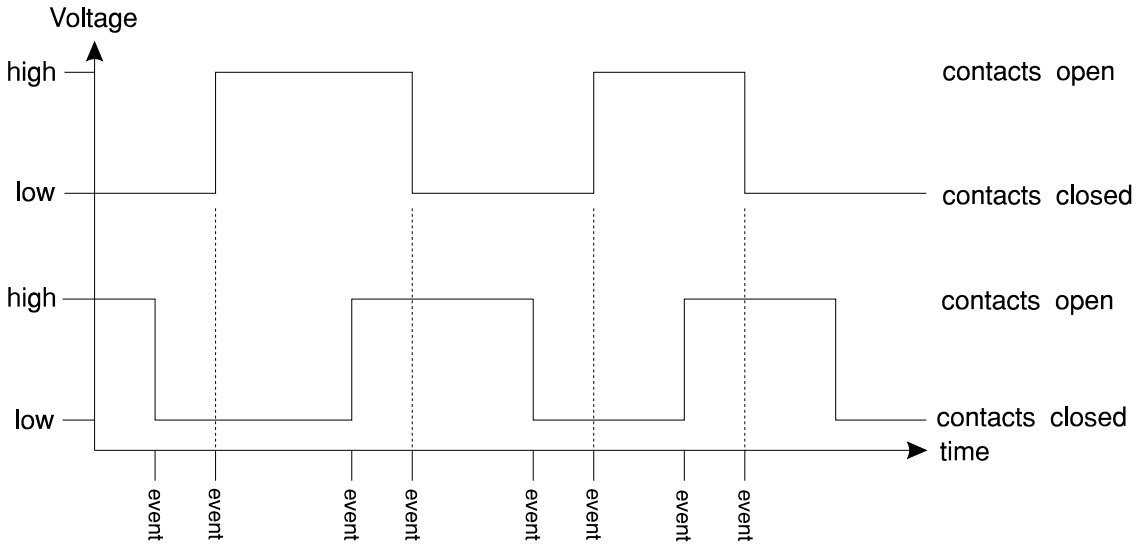
5.8.4 Logging events only

```
MODE log
event
```

The event inputs are monitored every second irrespective of logging and sample intervals selected. Whenever any of the eight inputs of the event/digital channel change between LOW (less than 0.5V DC) and HIGH (between 4V and 5V DC) voltage levels or between contact and no contact in either direction, the following occurs:-

a) The states of the eight inputs are recorded together with the time since the last event.
b) Readings are also taken and stored from all other channels which have been set to log.
c) If the pulse channel has been selected then the number of pulses accumulated since

the last event will also be recorded.
If no event occurs during any 18 hour period then a ‘dummy’ or ‘confidence’ recording is made. See section 5.9.4 for further details about event channels. Please note that logging must be started in the usual way by pressing *set* in the LOG function (see section 4.5).



In this example only two event lines are being used. A recording is made whenever an event occurs, which is whenever either event line changes level:-

5.8.5 Interval logging with events

MODE log
event+interval

This is a combination of event and interval recordings and therefore readings are taken at the end of each recording interval and each time any event input changes state. If events coincide with the logging interval then two sets of recordings are made. Pulse inputs record a ‘dummy’ value when events occur and true accumulated values are only recorded after each recording interval.

5.8.6 Logging averages with events

MODE log
event+average

This is a combination of event and average recordings. Averaging occurs exactly as in section 5.8.3 and event recordings allow non-averaged values of the selected channels to be recorded whenever an event occurs (see 5.8.4). Pulse inputs record a ‘dummy’ value when events occur and true accumulated values are only recorded after each recording interval.

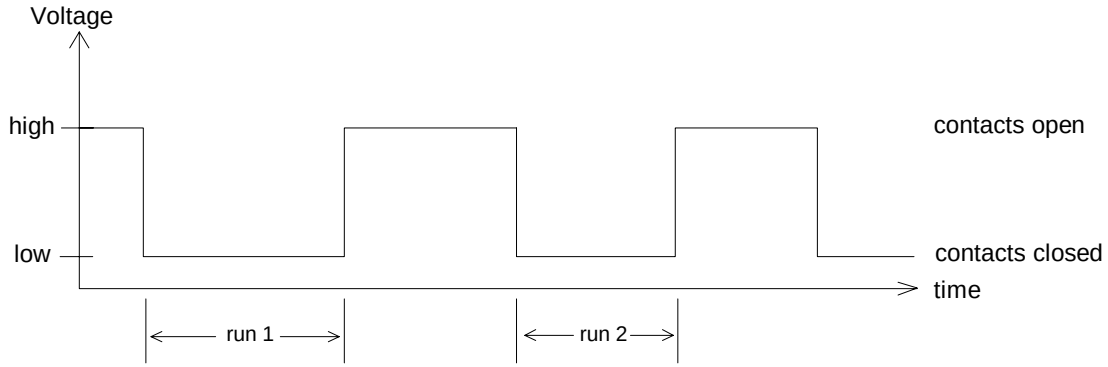
5.8.7 Trigger MODE

In this mode, logging can be started and stopped by external signals or by the presence or absence of an alarm condition. Press *set* to change to the following available options:-

5.8.8 Externally triggered multiple runs

MODE trigger
external runs

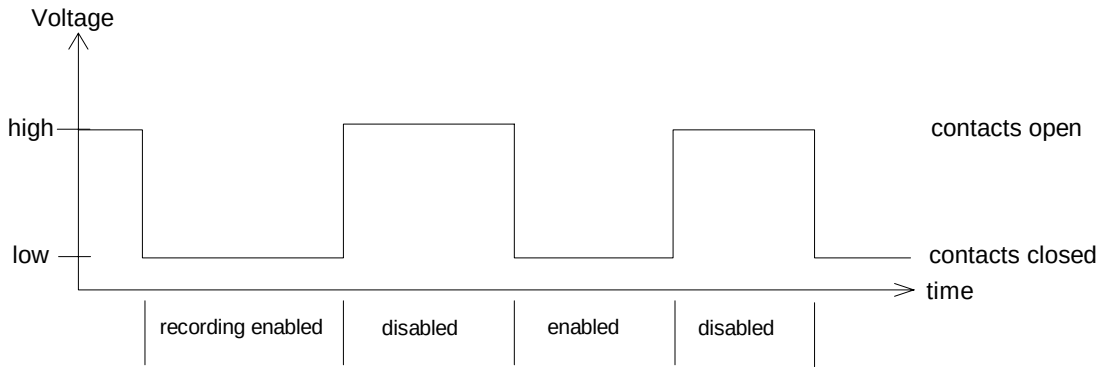
Logging is started in the usual way by pressing *set* in the LOG function (see 4.5). The logger only records when the external trigger is present. Readings will be taken from each of the channels selected (in whichever logging mode has been selected - see 5.8.1). A new run is started whenever the external trigger is re-applied and recording will stop after the 99th run or when the memory is full.



5.8.9 External triggering in a single run

MODE external
trigger records

Logging is started in the usual way by pressing *set* in the LOG function (see 4.5.). The logger only records when the external trigger is present. Readings will be taken from each of the channels selected (in whichever logging mode has been selected - see 5.8.1). However, all recordings are contained in a single run which pauses when the external trigger is absent. Whenever the trigger is removed this is marked by a dummy recording. This will be of value if you need to analyse these triggered events on one time axis. The time channel is selected automatically to log the time between recordings. If no trigger is applied during any 18 hour period, a ‘dummy’ or ‘confidence’ recording is made.



5.8.10 Wiring up for external triggering

All connections are made to the 'signal' connector (15-way male D). Connect external trigger signal High to pin 14 (external trigger input) and external trigger signal Low to pin 9 (common - Squirrel ground).

5.8.11 Types of signals which will trigger the logger

If external contacts are used, logging will start when they close (connecting pin 9 to pin 14), and stop when they open. Alternatively, voltage levels can be used instead of contacts. In this case, a low level of less than 0.5V DC will start logging and a high level of between 4V and 6V DC will stop logging.

5.8.12 Alarm triggered multiple runs

MODE trigger
alarm runs

This operates in the same way as external triggering except that the trigger is taken to be true when any channel with alarm thresholds set is in an alarm condition.

5.8.13 Alarm triggering in a single run

MODE trigger
alarm records

This operates in the same way as external triggering except that the trigger is taken to be true when any channel with alarm thresholds set is in an alarm condition.

5.8.14 Memory mode

You can choose how the memory is used to store the readings.

5.8.15 Hold memory

MODE memory
stop when full

The logger will stop when all available memory has been used. Please note that you may view how much free memory is available at any time by entering the LOG function and pressing *select* (see section 5.1.2). Also, the memory size may be restricted down to a minimum of 1K in the STAT function (see section 5.11.3).

5.8.16 Continuous memory

```
MODE memory
continuous
```

The logger overwrites the oldest recordings once the memory is full. This ensures that you always have the most recent data stored in the logger irrespective of how long the logger has been logging. However, only one run is allowed and if the logger is stopped and a restart is attempted the following message will be displayed:-

```
LOG off
NO MORE RUNS
```

5.9 The CHANNEL SETUP function

This is used to select the channels and set the range for each channel. Each model has a specified combination of channels; please consult the data sheet in Section 9 for details of your particular model. Once you enter this function, you will be informed of the number of channels which have currently been selected:-

```
CHANNEL SETUP
  9 used
```

Pressing *select* will enable you to scroll through all of the channels. Some of the channels may not be currently selected, and these will be indicated as follows:-

```
CH 5
    not used
```

Holding down the *set* button will allow you to set up the channel:-

```
CH 5
HOLD TO CHANGE
```

And each time *set* is pressed, the display will reveal the available measuring ranges for that channel. Once you have set the appropriate range for a particular channel, you can at any time press *select* to view another channel's setup status. However, if logging is in progress then it will not be possible to change the channel setup and the following will be displayed:-

```
CH 3        °C
LOGGING
```

If logging has stopped, but there are readings stored in memory, it is still not possible to change channel setup and the following is displayed:-

```
CH 6   EU m/s
CANNOT CHANGE
```

In the instance that all channels have been de-selected, the logger will challenge any attempt to leave the function until at least one channel has been selected: -

```
CHANNEL SETUP
NONE SELECTED
```

5.9.1 Temperature channels

Please consult the data sheet in Section 9 to confirm which temperature sensors are compatible with your model of datalogger. Most temperature sensors provide an output which is non-linear across its operating temperature range and each model has a built-in, sensor specific linearization protocol. Most offer a selection of temperature ranges relating to the operating range of the specific sensor and may also have separate ranges for variants such as types K and T thermocouples or 3 and 4 wire platinum resistance sensors. For example the following are some of the ranges offered for thermocouple channels:-

```
CH 1    K °C
 -200.0 /  200.0
```

Where the resolution will be 0.1°C, and:-

```
CH 1    K °C
 -200.0 /  450.0
```

Where the resolution will be 0.2°C.

5.9.2 Voltage / current channels

Normally, these channels may be configured for voltage or current. There are 18 voltage ranges and 2 current ranges, details of which may be found in the data sheet in Section 9. These channels have an additional range called the EU (Engineering Units) range where you can select specific engineering units (e.g. Lux) and a max/min scale (e.g. 0/500 Lux); the appropriate voltage/current range is then selected from the existing hardware ranges (e.g. 0/5V). In this example, when the appropriate channel is selected, the following will be displayed:-

```
CH 7   EU Lux
     0.0 /  500.0
```

```
CH 7   EU V
   0.000 /  5.000
```

The EU range may only be set up using the program, contact your distributor for details. Whenever a voltage/current channel has not been set up, the initial range is always the default EU range this range is suitable for use with humidity probes as supplied by Grant Instruments and is displayed as follows:-

```
CH 6   EU %
    0.00 / 100.00
```

```
CH 6   EU V
 0.0000 / 1.0000
```

5.9.3 Pulse count channel

The last but one input on each model is a pulse count channel. Typical applications are outputs from tipping bucket rain gauges, optical meter readers, etc. Any sensor offering the following outputs can be monitored:-

a) Voltage of between 4 and 6V at a pulse width of 1 microsecond and a frequency of less than 2 kHz.
b) Voltage-free contact with a minimum contact time of 5 milliseconds at a maximum frequency of 100 Hz.

Pulses are counted throughout the logging interval and the accumulated total is stored at the end of this period. The count is set to zero for the beginning of the next logging interval. The following ranges are available for pulse count channels:-

```
CH 9          pulse
        0 / 65000
```

```
CH 9          kpulse
    0.00 / 650.00
```

An additional range, called the EU (Engineering Unit) range, may be set up using the Grant program. This allows the user to specify engineering units and a max/min scale corresponding to either of the pulse ranges. From firmware issue 4.0 onwards, a default EU range is provided suitable for use with tipping bucket rain gauges as supplied by Grant Instruments (0.2mm rain per pulse).

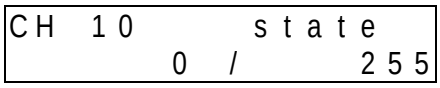
5.9.4 Event/digital channel

Following the pulse channel is the event/digital channel. This channel has eight separate digital inputs which can be displayed for metering and review either as eight binary bits or as a decimal number. The *set* button is used to select this option:-

```
CH 10        state
     11111111
```

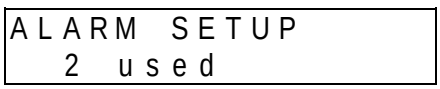
This shows the status of all eight digital inputs. Each input is shown either as ‘0’ (contacts closed/voltage low) or as ‘1’ (contacts open/voltage high). The term ‘event’ is

applied to these inputs as they can be used to trigger recording on any change. If you have selected to log in any of the event modes (see section 5.8) then this channel will be automatically selected. A typical application is the monitoring of the opening and closing of doors.
Another option for this channel is that the eight event inputs are displayed as a decimal number, and this is selected by pressing *set* again (This option only changes the way in which the channel is displayed it does not affect the operation of event logging modes).



5.10 The ALARM SETUP function

This is used to set high and low alarm thresholds for the analogue and pulse channels. The high alarm turns on when a channel is greater than or equal to the value set for the 'high start' threshold and turns off when it is less than or equal to the value set for the 'high stop' threshold. This provides hysteresis to prevent natural fluctuations in the channel value from causing frequent changes in alarm condition. Similarly the low alarm turns on when a channel is less than or equal to the value set for the 'low start' threshold and turns off when it is greater than or equal to the value set for the 'low stop' threshold. You may set only the high or low thresholds or both for any channel.
The terms latched and unlatched are used below to describe alarms. A latched alarm is present from the first occurrence of an alarm condition until cleared by clearing the memory, starting a new logging run or using the *set* button as described in section 5.2. An unlatched alarm is present only while the alarm condition persists.
When any alarm settings are present, the sampling interval is automatically enabled and is used to test the analogue channels for alarm conditions. The pulse channel, however, only reaches its correct value at the logging interval and hence is checked for alarms at this interval. See the INT function for details of how to set the sampling interval. If there is no special reason for a shorter sampling interval, then it is recommended that the sampling interval be set equal to the logging interval. Also, the time channel is automatically selected to provide the elapsed time between alarm readings. Alarm thresholds are only tested during logging and then if the alarm status of any channel changes, an additional alarm recording is made. This means that to record alarms it is only necessary to set the thresholds for the channels to be monitored and to check that the sampling interval is appropriate.
If a channel is set to an EU range, then its alarm thresholds are displayed and set using the corresponding hardware range.
When you enter the alarm function, the display shows the number of channels for which alarm thresholds have been set:-



Pressing the *select* button will enable you to scroll through the channels selected for logging and will display the high and low alarm thresholds for each. If a threshold has not been set then dashes are shown. For the high alarm threshold, the alarm turns on when the channel measurement equals or exceeds the figure on the top line (high start)

and turns off when it equals or is less than the figure on the bottom line (high stop). For the low alarm threshold, the alarm turns on when the channel measurement is less than or equals the figure on the bottom line (low start) and turns off when it equals or exceeds the figure on the top line (low stop). Readings resulting from fault conditions are interpreted as follows: a 'high' reading is treated as greater than the highest possible normal reading: 'low' is treated as less than the lowest normal reading: 'open' is ignored:-

```
CH 3          70.00
   high       69.50
```

```
CH 3           ----
    low        ----
```

Holding down the *set* button will allow changes to be made:-

```
CH 3          70.00
HOLD TO CHANGE
```

The cursor will appear and signs and leading zeros will be displayed to mark the digits available to be changed. The first cursor position is on the threshold which turns the alarm on i.e. the top line for the high alarm but the bottom line for the low alarm. The other setting provides hysteresis and is automatically set to 10 bits from the 'on' threshold unless changed by the user:-

```
CH 3         ±070.00
   high      +069.50
```

Press *select* to move cursor:-

```
CH 3         +070.00
   high      +069.50
```

Press *set* to change value:-

```
CH 3         +080.00
   high      +069.50
```

The displayed threshold may also be cleared by pressing and holding the set button until the display shows dashes in place of figures:-

```
CH 3         +070.00
HOLD TO CLEAR
```

If all alarm settings are cleared while in an alarm triggered mode then that mode setting is automatically cancelled and the message 'CHECK SETTINGS' is displayed. This message is used to alert the user whenever changes made in the current function produce an enforced change in some other setting.

When you have finished editing press the *function* button which will redisplay the settings without the cursor or leading zeros. If the setting made was impossible, then the previous values will be restored and the error message 'INVALID - CHECK' displayed. The following are the checks which must be satisfied: high start > high stop: high start > low stop: low stop > low start: high stop > low start.
To continue and set another threshold, press *select* until it is displayed and then repeat the above steps.
To leave the alarm setup function, press *function* again.

5.10.1 Alarm Output

The signal connector has a voltage free relay contact output (see section 9.4.1) which may be selected to close for either the latched or the unlatched alarm status of all channels combined as selected in the STAT function (see section 5.11.5).

5.10.2 Alarm Triggering

As previously stated, setting a valid alarm threshold automatically causes alarms to be recorded as part of any run but it is also possible to use alarms as a means of triggering runs i.e. a run can be started only when there is an alarm condition. For details see sections 5.8.12 and 5.8.13

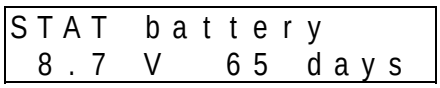
5.10.3 Alarm Status

The unlatched alarm status of each individual channel is displayed in the METER function during logging, for details see section 5.2.

5.11 The STAT function

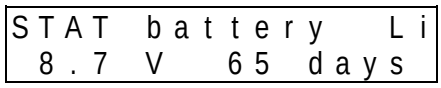
This function describes the following status information of the logger and is accessed by pressing *select*.

5.11.1 Battery life indication

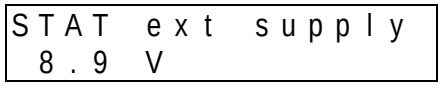


This displays the approximate remaining life of the internal batteries in days, and the current voltage level of the batteries. The estimated battery life takes into account the number of channels selected and the log/sample intervals. The battery life figure will usually decrease if the number of channels set to log is increased and the logging interval is decreased. Averaging functions in particular will increase battery consumption considerably. Temperature fluctuations affect battery voltage and hence the remaining battery life. The battery life estimate assumes that the working temperature will be between -20°C and +65°C. At -30°C, the battery life can be decreased to 10% of normal. The battery life estimate also takes into account the sensor switch on time, and assumes that the sensor draws 10 mA.
The memory which stores the data and logger settings is protected by a Lithium coin cell (see 8.5). If "Li" is displayed in the top right hand corner of the display, then the

Lithium coin cell must be replaced.

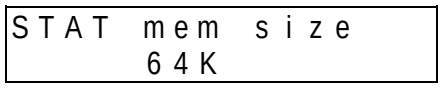


5.11.2 External power supply



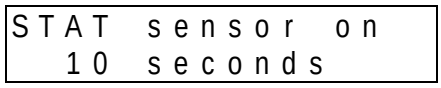
The logger can also be used with an additional regulated external DC power supply. This is recommended particularly for longer term deployment, averaging, high current demand sensors and when using the logger in METER mode for prolonged periods. If the external supply is disconnected, the internal batteries provide back-up to keep the memory secure or to continue logging.

5.11.3 Memory size selection



Memory size may be changed within this function. This is particularly useful if you know how much information you need over a particular time period and wish to avoid excessive data retrieval and downloading. If you wish to change the memory size press and hold *set*. Subsequently pressing *set* will scroll through the available memory sizes from 1K to 64K in 1K increments. Holding down *set* will allow you to scroll through the memory sizes faster. Larger memory size options are available and for these the size setting increments in 10K steps for settings of greater than 30K.

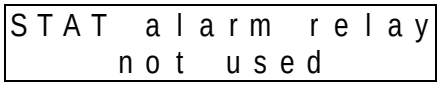
5.11.4 Sensor power on facility



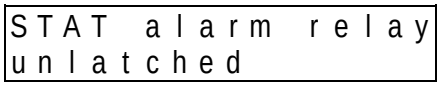
Some voltage/current channels have additional connections to allow sensors to be supplied with power from logger. Some models allow this power to be set at either 9V DC or 5V DC. This setting can be changed only by dismantling the logger and moving the jumpers for each output as required. See section 8.9 for more information on moving the jumpers. The 9V setting is only approximate. The voltage is that of the internal batteries (or external power supply, if present). The 5V DC is accurate to ±0.1%. Some sensors need to be switched on prior to measurement for a minimum length of time to allow the output to stabilise.
This facility allows you to switch the sensor on between 1 second and 60 seconds (in 1 second increments) prior to measurement; all sensor power outputs will turn on together. The maximum total current available is 50 mA. If you have more than 1 sensor connected which needs this facility then you must choose the longest sensor switch on time required. The sensor switch on time may be changed by pressing and holding set;

subsequent presses will allow you to scroll through the values. Holding down set will allow you to scroll through the values faster. A value of 0 seconds switches the sensor power on 10 milliseconds before the first channel is read.
Please note that in logging modes which combine event with interval or average logging, the 'sensor on' time is measured with respect to the fixed interval or sample time respectively. Therefore, no particular 'sensor on' time can be guaranteed for the event recordings. However, in 'event only' logging, any non-zero 'sensor-on' time setting causes the sensor power output to be on continuously.
N.B. The 'sensor on' time should be set to zero when not required as otherwise battery life will be wasted.

5.11.5 Alarm Relay



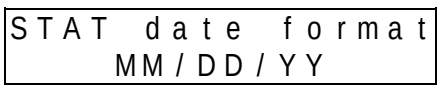
An isolated single pole normally open relay contact is available at the signal connector which can be configured to close when there is either an unlatched or latched alarm condition (see section 5.10 for details). The contact will switch a maximum of 0.5A and 50V; the user is advised to provide appropriate suppression when inductive or capacitive loads are to be switched. The configuration is changed by pressing and holding *set*:-



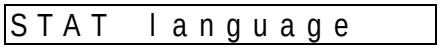
N.B. If this output is not required then it should be set to 'not used' as this avoids wasting battery power in the relay.

5.11.6 Date format selection

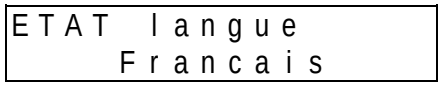
The date format is shown in the UK default format; the following formats are also available and may be changed by pressing and holding *set*:



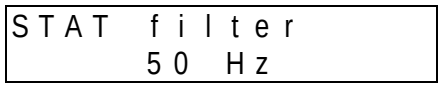
5.11.7 Language format selection



This displays the language format which is changed by pressing and holding *set*. The following are examples of the above display in the relevant language:-



5.11.8 Mains filter frequency



The mains filter frequency is displayed. This must be set to the local mains electricity supply frequency to produce the most accurate readings. The frequency is changed using the *set* button; press and hold to change the filter frequency to 60 Hz.

5.11.9 Logger firmware version and model type

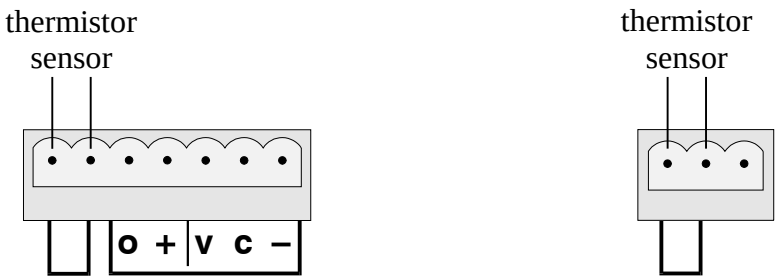
This displays the model number and version of firmware followed by the serial number of the Squirrel datalogger.

6. Making connections to the datalogger

1000 Series dataloggers have a fixed channel configuration; please refer to the datasheet in Section 9 to find which of the following are relevant. The 800 datalogger has universal analogue channel inputs which are described in section 6.6

6.1 Wiring up thermistor sensors

Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. Thermistors are always connected to adjacent pins and have no designating letters, as they have no polarity.



Note: in both cases the left hand connection is ground and should be connected to the cable screen, if any.

6.2 Wiring up platinum resistance sensors

Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. 1000 Series loggers support both 3 and 4 wire Pt100 sensors as shown below.

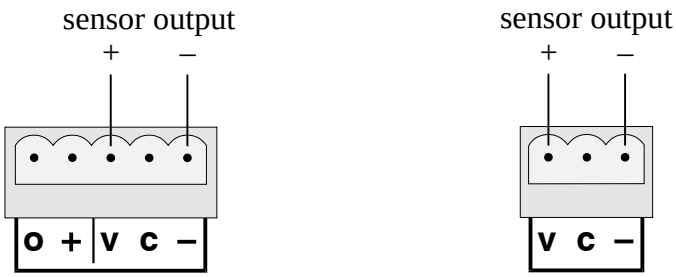
3 wire connection

4 wire connection

N.B. It is essential for 3 wire sensors that the resistances of all the connections are equal, i.e. the wires used for these connections should be of the same material, gauge and length. This allows the circuit to cancel the effects of lead resistance on the sensor measurement. The right hand connection marked - c is ground and may be used to connect to a separate cable screen if any.

6.3 Wiring up sensors to voltage channels

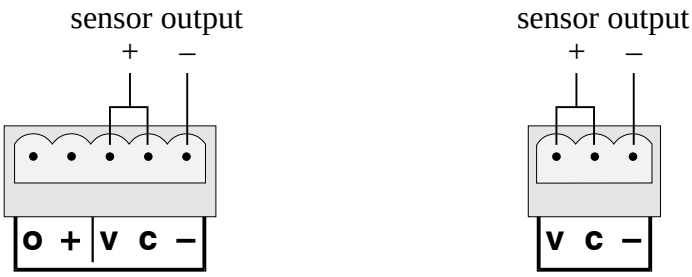
Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. The positive output from the sensor should be connected to the ‘v’ input, and the negative to the ‘-’ input:-



Note: if the cable used has an independent screen, then this may be connected to the ground terminal which is marked ‘o’.

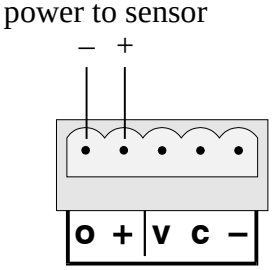
6.4 Wiring up sensors to current channels

Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. The connections are the same as for voltage with the addition of a link between the ‘c’ and ‘v’ inputs:-



6.5 How to provide a power supply to the sensors

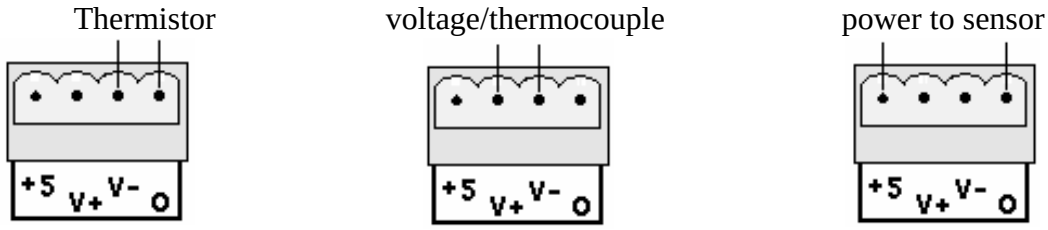
Each voltage/current channel has its own connections to allow sensors to be supplied with power at 5V DC or 9V DC. By default, the voltage will be at approximately 9V DC. The exact voltage will depend on the state of the internal batteries or the voltage of the external power supply, if present.



Some models have the option to change the sensor power to 5V DC (±0.1%). This is dealt with in section 5.11.4. The maximum total current available is 50 mA. Section 5.11.4 describes the logger setup procedure to switch power to the sensors prior to measurement. The diagram shows how to connect the sensor to the switched sensor power supply.

6.6 Wiring up universal analogue channels

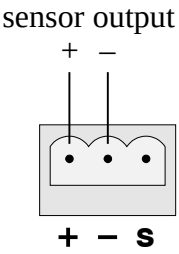
Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger



Thermistors have no polarity but if the cable is screened then the screen should be connected to the ground terminal marked '0'. Voltage and thermocouple inputs should be connected as shown above observing the marked polarity; the '0' terminal may be used to connect an independent cable screen if any. Current measurement requires the use of an adaptor Grant part no SQ08A700 which attaches to the input connector converting the voltage terminals to a current input. Channels 1 to 4 (SQ800) or 1 and 2 (SQ400) provide 5V regulated sensor power at the terminals marked '+5' and '0', and channels 5 to 8 (SQ800) or 3 and 4 (SQ400) provide sensor power from the 9V internal battery or from the external power supply (if this exceeds the internal battery voltage) at the terminals marked '+' and '0'.

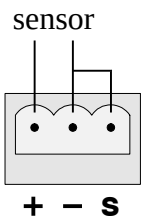
6.7 Wiring up a pulse count channel

The pulse count channel may be wired for a voltage input or a voltage-free contact (see section 5.9.3 for details of voltages and mechanical contact conditions). The positive connection should be made to the ‘+’ input and the negative to the ‘-’ input:-



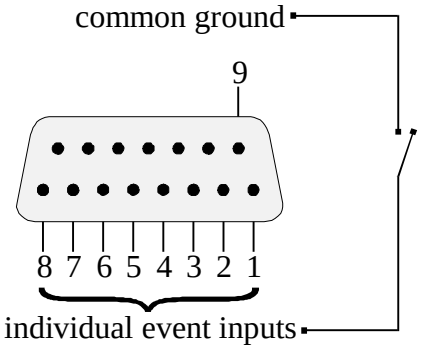
Note: the ‘-’ connection is ground and should be connected to the cable screen, if any.

For a voltage-free contact input, the contact ‘debounce’ circuit must be connected. This involves linking the ‘-’ pin to the ‘s’ pin:-



6.8 Wiring up event channels

Any or all of the eight event inputs on the ‘signal’ connector (15-way male D) may be connected (via a contact or signal source) to the common ground pin, as indicated in the following diagram:-



The above diagram shows all events being monitored using contact closures, but events may also be monitored using changes in voltage levels (see 5.8.4). If the maximum voltage could exceed 5V, then the addition of a 1K resistor in series with the input will allow voltages up to 6V to be used. If the cable used has a screen, this should be connected to the common ground pin 9.

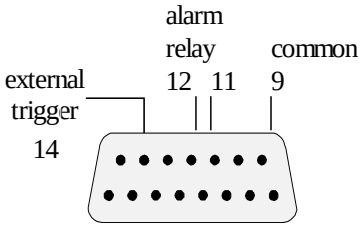
If any of the connected event channels change state, then this will constitute an event.

6.9 Wiring up for external triggers

Logging can be started or stopped by an external signal. This external signal can be in the form of a voltage or a contact and should be connected between pin 14 and common ground of the signal connector as shown below. See 5.8.11 for further information.

6.10 Wiring up for alarm relay output

When the alarm relay output is selected as described in section 5.11.5, the connections are available at pins 11 and 12 of the signal connector as shown below. The relay contact is isolated from all other logger connections and will switch a maximum resistive load of 0.5A and 50V. The user must provide appropriate suppression when inductive or capacitive loads are to be switched and the peak current must not exceed



0.5A.

7. Troubleshooting guide

7.1 "Why won't it do that?"

Having described the many things you can do with a Squirrel datalogger, here are just a few operations that are not possible:-

- clear the memory while logging is in progress
- start logging when the memory is full
- start logging if no channels have been selected
- perform multiple runs if memory is in continuous mode
- reset pulse count while logging is in progress
- change date and time while logging
- change start date and time while logging
- change log and sample intervals while logging

It is not possible to change the following either when there are readings stored in memory or when logging is in progress:

- Log mode
- External trigger mode
- Memory mode
- Channel set up and ranges
- Engineering unit ranges
- Memory size
- Language type
- Sensor switch on time
- Date format
- Filter frequency

7.2 Use with modems

The following general advice is given to assist in setting up a modem for connection to the logger in a remote control application and should be read in conjunction with the instruction manual of the modem concerned. It is assumed that the modem understands the AT command language i.e. it is Hayes compatible. There are differences between the facilities and hence the command sets of various modems and the following suggested commands may not all be available and some may be different. To set up the modem, it must be connected to a computer or other device capable of sending data at the baud rate (or speed) to be used for the modem link. Note that some modems set their speed at that of the last AT command received. The main considerations are that the logger cannot send AT commands or provide any control; in particular it cannot provide flow control or control of any interface signals such as DTR (data terminal ready). The modem must be set to auto answer. Error correction or data compression should not be used. The baud rate should be fixed. The setup should be saved in non-volatile memory such that correct operation will automatically resume after a power failure.

Note: Please refer to SquirrelView Help for further details on your logger and how to use it with SquirrelView.

8. Safety and operating conditions

8.1 Operator safety

TO PROTECT AGAINST SHOCK HAZARDS TO OPERATORS, datalogger inputs and outputs should not be connected to voltages of more than 25V DC or RMS AC with respect to earth (ground) unless the datalogger is inside a protected enclosure.

8.2 Squirrel safety

The following inputs are protected up to specific voltages:

INPUT TYPE	MAXIMUM VOLTAGE
Analogue	25
External trigger	6
Pulse	6
Event	5 (can be increased to 6V, see 6.8)
External Power Supply	14

DO NOT APPLY LARGER VOLTAGES OR THE SQUIRREL COULD BE DAMAGED.

8.3 Errors caused by ground connections

For voltage and current inputs only. While a reading is being taken, these have both input terminals connected through a 1MΩ resistor network to the datalogger ground. At all other times, both terminals are floating. Datalogger ground may become connected to mains earth (ground), for example through a mains operated computer or an earthed mains power pack. If this happens, measuring errors will be caused if either input terminal is at a voltage of more than ± 15V with respect to datalogger ground. All other inputs and outputs have one terminal permanently connected to the datalogger ground.

8.4 Operating conditions

The datalogger can be used at temperatures between -30 and +65°C and with relative humidity up to 95% (non-condensing).
At ambient temperatures below -5°C the display becomes progressively slower to change, and may fade at temperatures below -30°C. However, this will not affect any other functions of the datalogger; readings will be retained in the memory and logging will continue.
If a datalogger is used in a low ambient temperature, internal condensation can occur if it is brought into a warmer environment. The datalogger should be placed in a sealed container (a plastic bag provides a cost effective solution). The container should not be unsealed until the datalogger has warmed up to room temperature.

8.5 Protection against memory loss

The memory which stores the data and datalogger settings is protected by a Lithium coin cell (3V Panasonic BR2032). This battery is only used if the voltage of the main batteries is below the operating threshold. If there are no main batteries connected, the Lithium coin cell will protect the stored data for approximately 2 years.
The condition of the Lithium coin cell may be checked in the STAT battery function (see 5.11.1). If 'Li' is displayed in the top right hand corner of the display, then the Lithium coin cell must be replaced.

8.6 Changing batteries

It is important that one of the following procedures is used to change the batteries, otherwise memory and logger settings may be lost:-
Stop logging, remove the batteries and wait at least 2 minutes before fitting new batteries as a complete new set of the same type. Alternatively, connect an external power supply for uninterrupted logging, and then change the batteries.
The condition of the Lithium cell is only tested when power is first applied after a period without either battery or external supply. Thus the first method described above should be used where possible. Also the main batteries should be removed and replaced when changing the Lithium cell.
It is good practice to ensure that the logger is not left for long periods without the main batteries as this will drain the Lithium coin cell, which will need to be replaced.

8.7 Resetting the datalogger

The Squirrel datalogger has a 'watchdog' facility which automatically resets it in the unlikely event of a system failure. If failure occurs, the watchdog will reset the datalogger and stop logging (if logging is in progress). Stored data can then be downloaded.
Should the datalogger ever hang up completely, it must be reset manually by pressing the reset button. This reset button is located to the left of and below the opened battery compartment and is accessible through the aperture where the catch of the battery lid engages; it should be depressed using a blunt insulated probe. If this fails, remove all power to the datalogger and leave it for 10 minutes before reconnecting, and then press the reset button.

8.8 Changing fuses

There are three places where fuses are used to protect the circuits of the datalogger. These are the external power supply input, the sensor supply outputs and each current channel input. If an external supply is connected and cannot be measured as described in section 5.11.2 then the logger power supply fuse may be faulty. If none of the sensor supply outputs are working then the sensor supply output fuse may be faulty. If a current channel does not measure correctly, then its fuse may be checked by measuring the resistance between the c and - terminals of the input, this should be 10 ohms.
Fuses should only be replaced by a competent person. Any damage caused to the

instrument while attempting to replace a fuse yourself cannot be covered by the guarantee. You should return the Squirrel to your supplier who will be able to replace it for you. If you are comfortable with this, and feel you are competent enough, proceed as follows:

The four case screws must be removed (one is hidden under a battery contact in the battery box). The top of the case can then be lifted off. The 500mA fuse on the board with the external power connector is for the external power input. The channel input fuses (250mA) are by the connector for each current input. The sensor supply fuse (250mA) is on the far right of one of the input boards.

8.9 Sensor supply voltage

A Squirrel which has adjustable sensor supply voltage is shipped with the voltage selector jumpers all set to 9V. If 5V ±0.1% is required to power a sensor, then an internal jumper needs to be moved. For more information on the sensor supply, see section 5.11.4.

The method for removing the top of the case is detailed above, in section 8.8, and the same cautions apply. All boards down to the one which needs the adjustment will need to be removed. The sensor power jumpers should always cover two of the three pins, and are usually situated close to the input connectors. The appropriate jumper needs to be moved to connect the middle pin to the other edge pin. The boards must then be reassembled in the correct order, taking great care to align all of the pins on the internal connectors.

9. Technical data

9.1 Inputs, ranges and resolutions

Note that not all ranges are available on all models. Please consult a brochure for details.

Input type	Available ranges		Resolution
Thermistor temperature U,Y,S	-50 to 150°C	-58 to 302°F	0.05°C
Thermocouple temperature K	-200 to 200°C	-328 to 392°F	0.1°C
Impedance: 100kΩ	-200 to 450°C	-328 to 842°F	0.2°C
	-200 to 1200°C	-328 to 2192°F	0.5°C
	0 to 950°C	32 to 1742°F	0.25°C
Thermocouple temperature T	-200 to 200°C	-328 to 392°F	0.1°C
Impedance: 100kΩ	-200 to 350°C	-328 to 662°F	0.2°C
PT100 temperature (P3/P4)	-200 to 100°C	-328 to 212°F	0.1°C
Max line resistance 100Ω	-200 to 400°C	-328 to 752°F	0.2°C
	-200 to 600°C	-328 to 1112°F	0.3°C
DC voltage	0 to 50mV	-25 to 25mV	50µV
Impedance: 1MΩ	0 to 100mV	-50 to 50mV	50µV
	0 to 200mV	-100 to 100mV	50µV
	0 to 500mV	-250 to 250mV	0.5mV
	0 to 1V	-500 to 500mV	0.5mV
	0 to 2V	-1 to 1V	0.5mV
	0 to 5V	-2.5 to 2.5V	5mV
	0 to 10V	-5 to 5V	5mV
	0 to 20V	-10 to 10V	5mV
DC current	4 to 20mA (as 0 to 100%)		0.05%
Impedance: 10Ω	0 to 20mA		10µA
Pulse count	0 to 65,000		1
Impedance: 1MΩ	0 to 650,000		10
State or	00000000 to	11111111	1
Digital	0 to 255		1

Accuracy Voltage: ±0.1% of reading ±0.1% of range
Temperature/current: ±0.2% of reading ±0.1% of range

Analogue/Digital Converter The SQ400/800 and 1000 Series dataloggers have a 12 bit A/D converter; most ranges therefore offer a 12 bit resolution. Some short ranges or those with nonlinear responses offer only a 10 or 11 bit resolution.

9.2 Ranges and Models

The various models of the 1000 Series have 8 or 16 analogue channels as listed in this table together with the SQ400 which has 4 and the SQ800 which has 8.

Model SQ	Thermistor	PT100	Thermo couple K/T	Voltage Current	Sensor supply	Digital Inputs
1001	**4**			**4**	**4**	**1 + 8**
1002	**8**					**1 + 8**
1003			**4**	**4**	**4**	**1 + 8**
1004		**8**				**1 + 8**
1005			**8**			**1 + 8**
1007				**8**	**4**	**1 + 8**
1021	**8**			**8**	**8**	**1 + 8**
1022	**16**					**1 + 8**
1023			**8**	**8**	**4**	**1 + 8**
1025			**16**			**1 + 8**
1026		**8**		**8**	**4**	**1 + 8**
1027				**16**	**8**	**1 + 8**
400	**up to 4***		**up to 4***	**up to 4***	**2(5V)+2(9V)**	**1 + 8**
800	**up to 8***		**up to 8***	**up to 8***	**4(5V)+4(9V)**	**1 + 8**

* The total number of analogue channels must be less than 4 (SQ400) or 8 (SQ800)

9.3 CE Mark

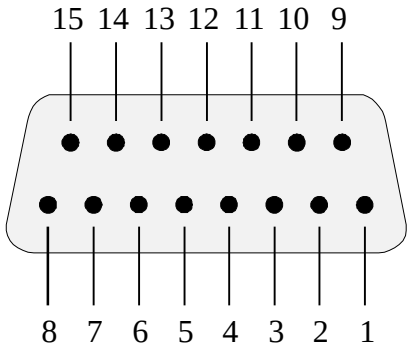
In order to improve the resistance of the instrument to electrostatic discharge, the signal connector is supplied fitted with a protective cover. This cover should be retained and used whenever no connection to the signal connector is required

9.4 Connections

9.4.1 Signal Connector

The connector marked ‘signal’ is a 15 way male D connector. It is both a digital/event input, and the external trigger input. The connections are as follows:

15 way male D connector	Description
1	Event bit 1 (MSB)
2	Event bit 2
3	Event bit 3
4	Event bit 4
5	Event bit 5
6	Event bit 6
7	Event bit 7
8	Event bit 8 (LSB)
9	Digital ground
10	Do not connect
11	Relay output
12	Relay output
13	Do not connect
14	External trigger input
15	Do not connect

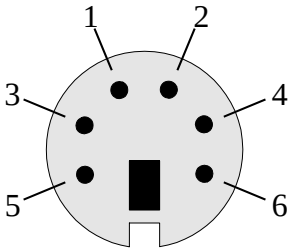


Solder view of female
15 way D connector

9.4.2 Output connector

The connector marked ‘output’ is for communications between the Squirrel and a computer or modem for remote control and for data transfer. The connections are as follows:

6 way male mini DIN connector	Description
1	Reserved
2	Serial output
3	Digital ground
4	+9V output
5	Reserved
6	Serial input



Solder view of male 6 pin
mini DIN connector

9.4.3 LC68 connection details

For direct connection of a logger to a computer, the LC68 cable is used.
The connections are as follows:

9 way female D connector	Description	6 way male mini DIN connector
5	Ground	3
3	Data from computer to Squirrel	6
2	Data from Squirrel to computer	2
link 4 to 6		
link 7 to 8		

9.4.4 LC69 connection details:

To connect a logger to a modem, the LC69 cable is required.
The connections are as follows:

25 way male D connector	Description	6 way male mini DIN connector
7	Ground	3
2	Data from Squirrel to modem	2
3	Data from modem to Squirrel	6
15	+9V from Squirrel	4
link 4 to 5 to 20		

9.5 Specification

Accuracy	Voltage	±0.1% of reading ±0.1% of range
(at 20°C)	Temperature/Current	±0.2% of reading ±0.1% of range
Environment	Ambient temperature -30 to 65°C. Humidity up to 95% (non-condensing).	
Power supplies	Internal: six size AA manganese-alkaline batteries (such as Duracell MN1500). External: 9-14V DC at 100mA.	
A/D converter	12 bit	
Battery life	At least 6 months with all channels recording every 5 minutes.	
Clock accuracy	1 second/day at 20°C.	
Physical details	Dimensions: *(l)* 180 mm x *(h)* 120 mm x *(s)* 60 mm or *(d)* 85 mm. Weight (including batteries): 1 kg. Material: ABS - blue suede finish.	
Interface	RS232C at these baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200	
RS232 Output	6 pin female mini-DIN socket.	
Sensor power	0-60 seconds, 50mA maximum total load.	
Relay Output	0.5A, 50V maximum for resistive loads add suppression if load is inductive or capacitive	
Digital inputs	Pulse count, event, external trigger. Impedance: 1MΩ	
	Start/low	0 to 0.5V DC or contacts closed.
	Stop/high	4 to 6V DC or contacts open.