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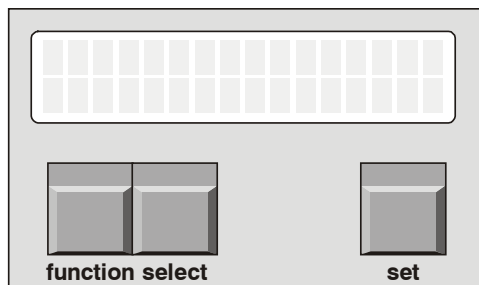
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## 1. Overview of the operating buttons

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.

## **2. The functions of the datalogger**

### **2.1 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 that 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.

### **2.2 METER**

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

### **2.3 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.

### **2.4 TIME / date**

Displays the real time and date on two lines. The 24 hour clock may be displayed in the appropriate country format (see 2.10f); the time increments every second.

### **2.5 START time / date**

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

### **2.6 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 24 hours in 1-second increments. The second line is used to set the time intervals at which inputs are sampled; these readings are averaged and then stored in memory at the logging interval.

## **2.7 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.

## **2.8 MODE**

Used to select the type of logging required, namely Interval, Average, Event, Event+Interval, Event+Average. This function allows you to select how logging may be started and stopped via an external trigger, 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.

## **2.9 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 by Darca. This function also displays how many channels have been selected to record.

## **2.10 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 (up to 60 seconds before the reading is taken)
- f) date format configuration (adjustable)
- g) language format (adjustable)
- h) mains frequency filter (adjustable)
- i) model number and current version of firmware
- j) temperature units
- k) network option

### 3. How to start logging from the default settings

#### 3.1 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: -

T I M E	1 0 : 4 2 : 5 9
d a t e	2 5 / 1 2 / 9 4

Press *set* and the following prompt appears: -

T I M E	1 0 : 4 3 : 1 1
H O L D	T O C H A N G E

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

T I M E	<u>1</u> 0 : 4 3 : 1 7
d a t e	2 5 / 1 2 / 9 4

Press *select* to move cursor: -

T I M E	1 0 : 4 <u>3</u> : 1 7
d a t e	2 5 / 1 3 / 9 4

Press *set* to change value: -

T I M E	1 0 : 4 <u>6</u> : 1 7
d a t e	2 5 / 1 2 / 9 4

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

T I M E	1 0 : 4 6 : 1 9
d a t e	2 5 / 1 2 / 9 4

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

### 3.2 Select logging interval

The logging interval can be set between 1 second and 24 hours in 1-second increments. Recordings are stored at this interval. Press *function* until display shows: -

```
I N T   l o g   0 0 : 0 0 : 3 0
s a m p l e   0 0 : 0 0 : 0 0
```

Press *set* to display: -

```
I N T   l o g   0 0 : 0 0 : 3 0
H O L D   T O   C H A N G E
```

Hold *set* button and cursor will appear: -

```
I N T   l o g   0 0 : 0 0 : 3 0
s a m p l e   0 0 : 0 0 : 0 0
```

Press *select* to move cursor: -

```
I N T   l o g   0 0 : 0 0 : 3 0
s a m p l e   0 0 : 0 0 : 0 0
```

Press *set* to change value: -

```
I N T   l o g   0 0 : 0 0 : 3 5
s a m p l e   0 0 : 0 0 : 0 0
```

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

### 3.3 Set the type of logging required

The possible types of logging are detailed in section 4.8.1. However, the default setting is for recording data at fixed intervals only. Press *function* until mode is displayed: -

```
M O D E   l o g
i n t e r v a l
```

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 3.2.

### 3.4 Set the number and types of channels

Each model has a specified combination of channels, please consult the data sheet in Section 17 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.

#### 3.4.1 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 °C
- 30 . 0 / 70 . 0
```

Press *set* and hold for 3 seconds: -

CH 1	°C
HOLD TO CHANGE	

CH 1	°C
- 50 . 0	/ 150 . 0

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

CH 1	°F
- 22 . 0	/ 158 . 0

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

### 3.4.2 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. 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 . 000	/ 1 . 000

The EU range may only be set up using Darca (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: -

```
C H 6   E U  %  
    0 . 0 / 1 0 0 . 0
```

```
C H 6   E U  V  
    0 . 0 0 0 / 1 . 0 0 0
```

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

```
C H 5  
    n o t   u s e d
```

Press *set* and hold for 3 seconds: -

```
C H 5  
H O L D   T O   C H A N G E
```

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.

### 3.4.3 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 4.10.4 for further details.**

## 3.5 Start logging

Press *function* until the following is displayed: -

```
L O G   o f f  
u s e d   0
```

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

```
LOG   o f f
HOLD  T O  S T A R T
```

The display shows that logging has started and will turn off within 10 seconds to conserve power. (Some memory slots will be used up immediately in order to store the header file.)

```
LOG   o n
u s e d  1 4
```

### 3.6 Stop logging

Press *function* to wake up the logger: -

```
LOG   o n
u s e d  1 2 3
```

Hold set to stop logging: -

```
LOG   o n
HOLD  T O  S T O P
```

```
LOG   o f f
u s e d  1 2 3
```

## 4. More about the functions of the datalogger

### 4.1 The LOG function

#### 4.1.1 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: -

L O G	o n
u s e d	1 2 3

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

L O G	o f f
u s e d	1 2 4

If the START function has been used (see 4.5), the logger waits for a specific time and date to start logging, and the following is displayed: -

L O G	w a i t i n g
u s e d	0

Alternatively, this may indicate that externally triggered recording has been selected (see 4.8.7), in which case logging may be started by an external trigger (e.g. a machine switching on).

#### 4.1.2 Used / free memory / number of runs recorded

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

L O G	o f f
u s e d	1 0 0

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

```
L O G    o f f
f r e e  6 4 9 0 0
```

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:

```
L O G    o f f
r u n    3
```

#### 4.1.3 Start/stop logging

If you have just unpacked your datalogger and have not previously used this model then please go to section 3. Whenever you first enter the LOG function you can press and hold *set* to start and stop logging: -

```
L O G    o f f
u s e d  1 2 3 4 5
```

```
L O G    o n
u s e d  1 2 3 4 5
```

N.B. you can only start and stop logging when the display shows either of these screens.

#### 4.1.4 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 while either 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: -

```
L O G    o f f
f r e e  1 2 3 4 5
```

```
L O G    o f f
r u n    3
```

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

```
LOG   o f f
HOLD  T O C L E A R
```

## 4.2 The METER function

This displays the value of the selected channel using the currently selected range for that channel. As soon as you enter the METER function, the display will show the value of the first channel selected and these values will be updated every second. This example assumes you have selected the following channels: -

Channel 3	-30.0/70.0 °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: -

```
M E T E R   c h   3
          3 7 . 5   ° C
```

You may view the other channels by pressing *select* to scroll through those that have been selected:

```
M E T E R   c h   5
          0 . 3 4 0   V
```

```
M E T E R   c h   7
          5 2 . 9   L u x
```

### 4.2.1 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 4.9.3 for further details.

#### 4.2.2 Event/digital channels

The display will either show binary or decimal format, depending on which has been selected in CHANNEL SETUP. See section 4.9.4 for further details.

#### 4.2.3 Elapsed time between events

An additional channel is automatically selected when you have selected the following logging modes: - (See section 4.8 for further details)

```
M O D E   l o g
e v e n t
```

```
M O D E   l o g
e v e n t + i n t e r v a l
```

```
M O D E   l o g
e v e n t + a v e r a g e
```

```
M O D E   e x t e r n a l
t r i g g e r   r e c o r d s
```

This additional channel (which numerically follows the last physical channel) is for measuring time between recordings. The number of seconds that have elapsed between events or external triggers will be displayed in this channel and may be viewed in METER mode: -

```
M E T E R   c h   1 1
           1 2 3   s
```

#### 4.3 The REVIEW function

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

```
R E V I E W   c h   2
```

```
2 0 . 3 ° C -
```

```
R E V I E W   c h   2  
2 0 . 2 ° C \
```

```
R E V I E W   c h   2  
2 0 . 4 ° C |
```

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

```
R E V I E W   c h   2  
N o   m o r e
```

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

#### 4.4 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 for using the STAT function. Please see section 3.1 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: -

```
T I M E       1 0 : 4 3 : 1 7  
d a t e       2 5 / 1 3 / 9 4
```

```
T I M E       1 0 : 4 3 : 1 7  
I N V A L I D - C H E C K !
```

```
T I M E       1 0 : 4 3 : 1 7  
d a t e       2 5 / 1 2 / 9 4
```

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

```
T I M E      1 0 : 4 4 : 3 4
L O G G I N G
```

#### 4.5 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: -

```
S T A R T    0 0 : 0 0 : 0 0
              0 1 / 0 1 / 9 4
```

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

```
S T A R T    0 0 : 0 1 : 0 0
              0 1 / 0 1 / 9 4
```

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

```
S T A R T    0 0 : 0 5 : 0 0
              0 1 / 0 1 / 9 4
```

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: -

```
S T A R T    0 0 : 0 5 : 5 5
              3 1 / 1 2 / 9 4
```

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: -

```
S T A R T    0 0 : 0 5 : 5 5
d e l a y e d   s t a r t
```

**N.B. Remember that you must also set the logger to start logging in the LOG function** (see 4.1.3). If you have set the start time and date to earlier than the current real time then the following message is displayed: -

```
S T A R T      0 0 : 0 5 : 5 5
i m m e d i a t e   s t a r t
```

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: -

```
S T A R T      0 0 : 0 5 : 5 5
L O G G I N G
```

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

#### 4.6 The INT function (logging/sampling interval)

Depending upon the logging mode selected (see 4.8), 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 the logging interval is shown on the top line and can be set between 1 second and 24 hours (unless 'fast logging mode' is used – see section 13). In logging modes that 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 shown on the bottom line and can be set between 1 second and 12 hours provided that a logging mode including averaging is selected: -

```
M O D E      l o g
a v e r a g e
```

```
M O D E      l o g
e v e n t + a v e r a g e
```

If you have already selected either of the above modes but have not

selected a sampling interval, the following will be displayed: -

```
I N T   l o g   1 2 : 0 0 : 0 0
C H E C K   I N T E R V A L S
```

The logger will then automatically select a sampling interval of 1 second for logging intervals up to and including 12 hours: -

```
I N T   l o g   1 2 : 0 0 : 0 0
s a m p l e   0 0 : 0 0 : 0 1
```

A sampling interval of 2 seconds is the minimum for logging intervals over 12 hours. It is not necessary to change the sampling interval if recordings are made in non-average logging modes. The sampling interval will be automatically set to zero: -

```
I N T   l o g   1 2 : 0 0 : 0 0
s a m p l e   0 0 : 0 0 : 0 0
```

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

```
I N T   l o g   1 2 : 0 0 : 0 0
L O G G I N G
```

#### 4.7 The OUTPUT function

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

Data transfer and setup	Darca Lite
Data transfer and analysis	Darca Plus / Squirrelwise
Data transfer, direct/remote setup and analysis	Darca Plus

Once you enter OUTPUT the display will clear and the datalogger will quickly enter sleep mode, which is required prior to active communication. The baud rate is automatically selected by the program that is used. Eltek Squirrels with serial numbers 6000 and above will work at up to 38400 baud, where as Grant Squirrels will work at up to

19200 baud. 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:

```

O U T P U T   9 6 0 0   b a u d
c o m m s   b l o c k   6
  
```

```

O U T P U T   9 6 0 0   b a u d
i d l e
  
```

```

O U T P U T   9 6 0 0   b a u d
c o m m s   b l o c k   5
  
```

The number of blocks transmitted will decrement until the display clears to indicate that all the data have 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 - 38400	1 second

## 4.8 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).

### 4.8.1 Mode log

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

### 4.8.2 Interval logging

```
M O D E   l o g
i n t e r v a l
```

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 as soon as logging is started, although pulse inputs record a dummy value at this point. Please see section 3.2 for instructions on how to change logging intervals.

#### 4.8.3 Logging averages

```
M O D E   l o g
a v e r a g e
```

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 3.2 for instructions on how to change sample intervals. After any change between interval and average modes, the following will be displayed as a reminder: -

```
M O D E   l o g
C H E C K   I N T E R V A L S
```

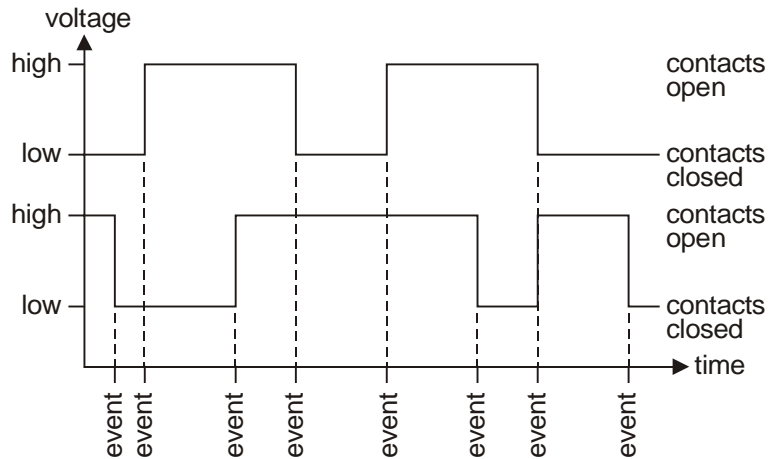
#### 4.8.4 Logging events only

```
M O D E   l o g
e v e n t
```

The event inputs are monitored every second irrespective of log and sample intervals selected. Whenever any of the eight inputs of an 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, the following occurs: -

- a) the state of each of the eight event lines is recorded together with the time and date of the event.
- b) readings are also taken and stored from all other channels which have been set to log.
- c) if a 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 4.9.4 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 3.5). 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: -



#### 4.8.5 Interval logging with events

```

MODE    l o g
e v e n t + i n t e r v a l

```

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.

#### 4.8.6 Logging averages with events

```
MODE  log
event+average
```

This is a combination of event and average recordings. Averaging occurs exactly as in section 4.8.3 and event recordings allow non-averaged values of the selected channels to be recorded whenever an event occurs (see 4.8.4). Pulse inputs record a 'dummy' value when events occur and true accumulated values are only recorded after each recording interval.

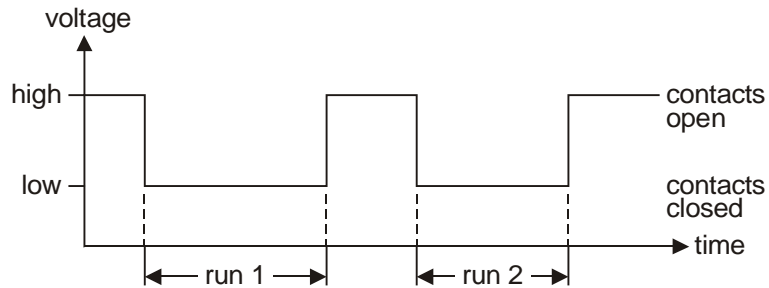
#### 4.8.7 External trigger MODE

In this mode, logging can be started and stopped by external signals. Press *set* to change to the following available options: -

#### 4.8.8 Externally triggered multiple runs

```
MODE  external
trigger runs
```

Logging is started in the usual way by pressing *set* in the LOG function (see 3.5). 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 4.8.1). 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.



#### 4.8.9 External triggering in a single run

```

MODE  external
trigger records

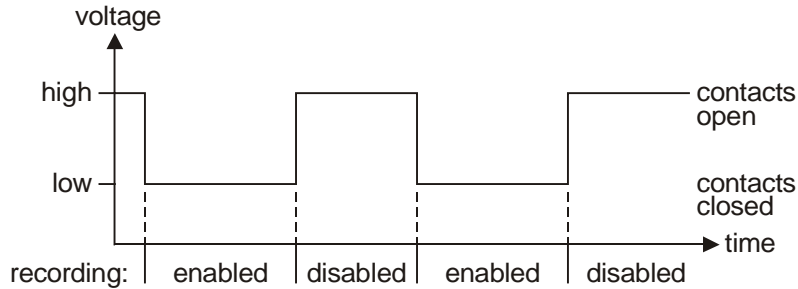
```

Logging is started in the usual way by pressing *set* in the LOG function (see 3.5.). 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 4.8.1). However, a new run is not started when the external trigger is re-applied and therefore a complete record of all externally triggered readings will be recorded in only one run. 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.

Whenever the trigger is removed, a final dummy recording is made and then recording stops. If no trigger is applied during any 18-hour period, a 'dummy' or 'confidence' recording is made.

#### 4.8.10 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 13 (common - Squirrel ground).



#### 4.8.11 Types of signals which will trigger the logger

If external contacts are used, logging will start when they close (connecting pin 13 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.

#### 4.8.12 Memory mode

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

#### 4.8.13 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 4.1.2), and the memory size may be restricted down to a minimum of 1K in the STAT function (see section 4.10.3).

#### 4.8.14 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 be displayed: -

```
LOG   o f f  
NO   M O R E   R U N S
```

Data can be downloaded at any time (even during logging) without loss of recordings.

#### 4.9 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 17 for details of your particular model. Once you enter this function, you will be informed of the number of channels that have currently been selected: -

```
C H A N N E L   S E T U P  
9   u s e d
```

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: -

```
C H   5  
      n o t   u s e d
```

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

```
C H   5  
H O L D   T O   C H A N G E
```

Then, 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
```

#### 4.9.1 Temperature channels

Please consult the data sheet in Section 17 to confirm which temperature sensors are compatible with your model of datalogger. Most temperature sensors provide an output that is non-linear across its operating temperature range and each model has a built-in, sensor specific linearisation protocol. Most offer a selection of temperature ranges relating to the operating range of the specific sensor and may have separate ranges for variants such as types K and T thermocouples or 3 and 4 wire platinum resistance sensors. For example, a logger with thermistor inputs will offer the following ranges: -

```
CH 1 ° C
- 3 0 . 0 / 7 0 . 0
```

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

```
CH 1 ° C
- 5 0 . 0 / 1 5 0 . 0
```

where the resolution will be 0.2°C. See section 1 for details of how to connect thermistor sensors.

#### 4.9.2 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 17. 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: -

C H	7	E U	L u x
	0 . 0	/	5 0 0 . 0

C H	7	E U	V
	0 . 0 0 0	/	5 . 0 0 0

The EU range may only be set up using Darca (refer to the 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: -

C H	6	E U	%
	0 . 0	/	1 0 0 . 0

C H	6	E U	V
	0 . 0 0 0	/	1 . 0 0 0

Some loggers are fitted with current-only or voltage-only inputs. In these cases, only the appropriate ranges are available in the CHANNEL SETUP function.

#### 4.9.3 Pulse count channel

All models have at least one 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 one microsecond and a frequency of less than 2 kHz.
- b) Voltage-free contact with a minimum contact time of five 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: -

C H	9		p u l s e
		0 /	6 5 0 0 0

C H	9		k p u l s e
		0 . 0 0 /	6 5 0 . 0 0

An additional range, called the EU (Engineering Unit) range, may be set up using Darca. This allows the user to specify engineering units and a max/min scale (e.g. 0/1300 mm rain) corresponding to either of the pulse ranges. All data in this channel will, in this example, be stored and downloaded using mm rain as the unit; mm rain will also be displayed in METER mode.

#### 4.9.4 Event/digital channel

Each model has at least one event/digital channel. This type of channel is used to log events or eight bit numbers. There are eight event inputs available and *set* is used to select this option: -

C H	1 0		s t a t e
		1 1 1 1 1 1 1 1	

This shows the status of all the digital inputs. Each of the eight event lines is stored either as '0' (contacts closed/voltage low) or as '1' (contacts open/voltage high). The number 0 or 1 is called the state. If you have selected to log in any of the event modes (see section 4.8.6) then the last event channel will be automatically selected. A typical application is the monitoring of the opening and closing of doors. Another option for event channels is that the eight event inputs are displayed as a decimal number, and this is selected by pressing *set*.

C H	1 0		s t a t e
		0 /	2 5 5

## 4.10 The STAT function

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

### 4.10.1 Battery life indication

S T A T	b a t t e r y
8 . 7 V	6 5 d a y s

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 that stores the data and datalogger settings is protected by a Lithium coin cell (see 16.5). If “Li” is displayed in the top right hand corner of the display, then the Lithium coin cell must be replaced.

S T A T	b a t t e r y	L i
8 . 7 V	6 5 d a y s	

### 4.10.2 External power supply

S T A T	e x t	s u p p l y
8 . 9 V		

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 backup to keep the

memory secure or to continue logging.

#### 4.10.3 Memory size selection

S T A T	m e m	s i z e
6 5	K	

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 65K (and even greater if a larger memory is fitted) in 1K increments. Holding down *set* will allow you to scroll through the memory sizes faster.

#### 4.10.4 Sensor power on facility

S T A T	s e n s o r	o n
1 0	s e c o n d s	

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 16.9 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  $\pm 0.1\%$ . 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.

#### 4.10.5 Date format selection

```
S T A T   d a t e   f o r m a t  
D D / M M / Y Y
```

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*:

```
S T A T   d a t e   f o r m a t  
Y Y / M M / D D
```

```
S T A T   d a t e   f o r m a t  
M M / D D / Y Y
```

#### 4.10.6 Language format selection

```
S T A T   l a n g u a g e  
E n g l i s h
```

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: -

```
S T A T U S   S p r a c h e  
D e u t s c h
```

```
E T A T   l a n g u e  
F r a n c a i s
```

#### 4.10.7 Mains filter frequency

S T A T	f i l t e r
	5 0 H z

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.

#### 4.10.8 Logger firmware version and model type

This displays the model number and version of firmware followed by the serial number of the 1000 series Squirrel datalogger.

#### 4.10.9 Temperature Units

This function enables you to change the temperature units in the Squirrel between degrees Fahrenheit and Celsius.

#### 4.10.10 Network Option

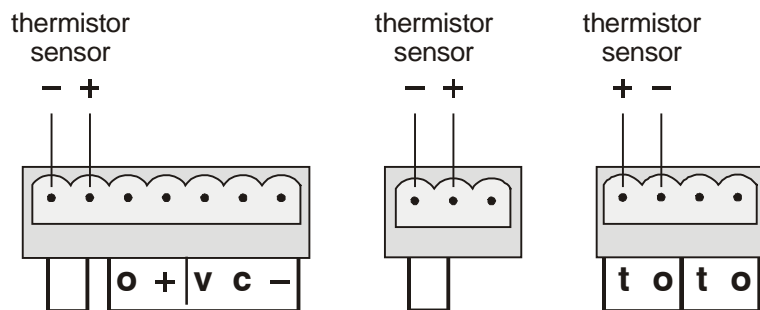
In Squirrels with Network capability this enables you to switch network functionality on and off. The Network setting in Darca must be configured to correspond with this setting in order to communicate with the Squirrel.

## 5. Making connections to the datalogger

Your 1000 Series Squirrel datalogger has a fixed channel configuration. Please refer to the datasheet in Section 17 to determine which of the following are relevant.

### 5.1 Wiring up thermistor sensors

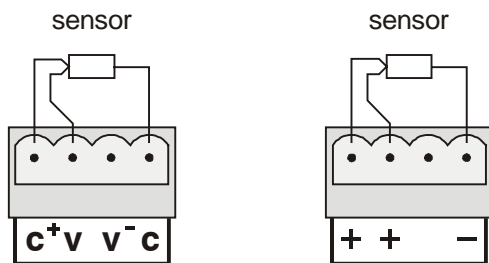
Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. Thermistors are always connected to adjacent pins and often have no designating letters, since they have no polarity.



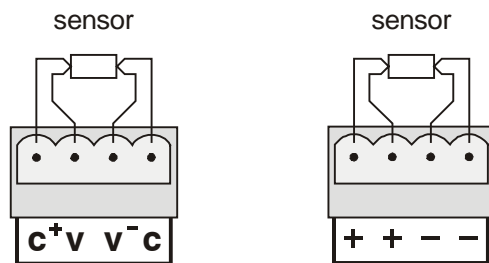
Note: The '-' denotes the ground connection. This should be connected to the cable screen, if any.

### 5.2 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, and may be marked in either of the two ways shown below.



3 wire connection

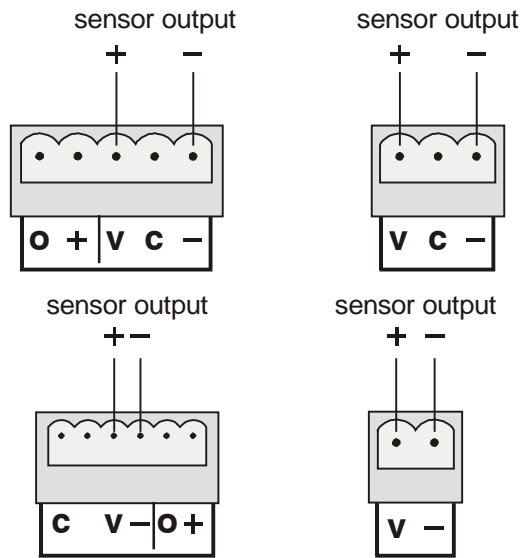


4 wire connection

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.

### 5.3 Wiring up sensors to voltage channels

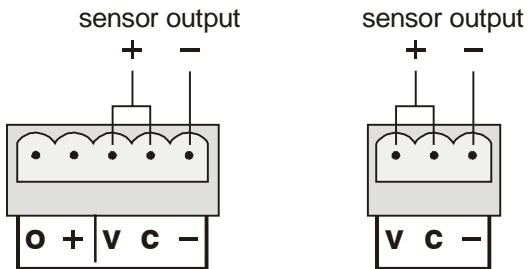
Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. The positive output from the sensor should be connected to the 'v' input and the negative to the '-' input: -

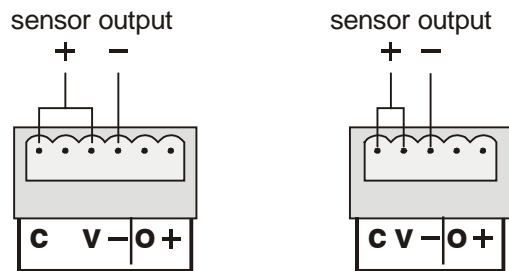


Note: if the cable used has an independent screen, this may be connected to the ground terminal, which is marked 'o'.

#### 5.4 Wiring up sensors to current channels

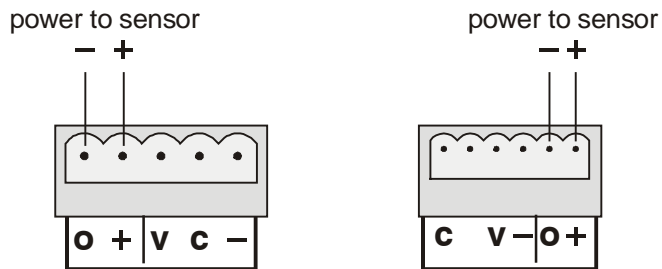
Individual plug-in terminal blocks with cable restraints are provided to make the connections to the inputs on the datalogger. The connections are the same as for voltage with the addition of a link between the 'c' and 'v' inputs: -



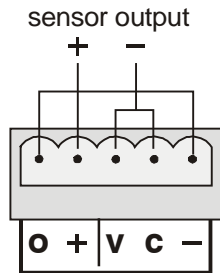


### 5.5 How to provide a power supply to the sensors

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 ( $\pm 0.1\%$ ). This is dealt with in section 4.10.4. The maximum total current available is 50 mA. Section 4.10.4 describes the logger setup procedure to switch power to the sensors prior to measurement. The following diagram shows how to connect the sensor to the switched sensor power supply: -

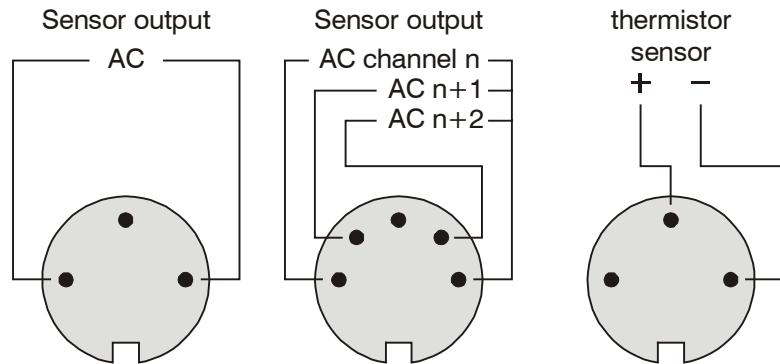


## 5.6 Wiring Up Current Loop Sensors driven by the Squirrel



## 5.7 Wiring up an AC voltage input

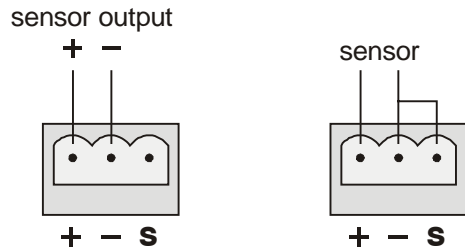
AC inputs have either 3 or 5 pin DIN sockets for connecting a range of different sensors. Rogowski coils, Voltage Transducers and Current Transducers can be connected to any of the AC voltage inputs. Some inputs also allow thermistors to be connected.



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

## 5.8 Wiring up a pulse count channel

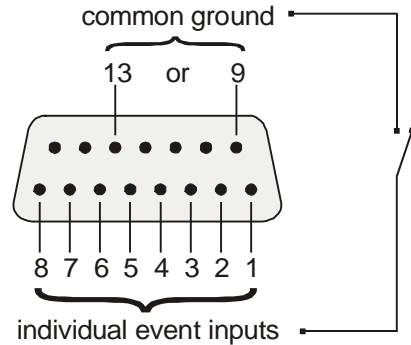
Pulse count channels may be wired for a voltage input or a voltage-free contact (see section 4.9.3 for details of voltages and mechanical contact conditions). The positive connection should be made to the '+' input and the negative to the '-' input. For a voltage-free contact input, the contact 'debounce' circuit must be connected. This involves linking the '-' pin to the 's' pin: -



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

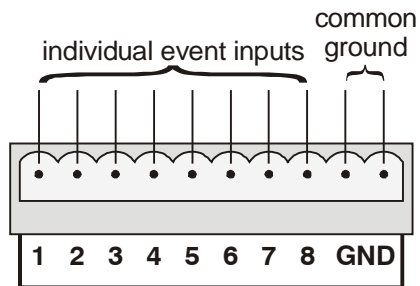
## 5.9 Wiring up event channels

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 one of the common ground pins, as indicated in the following diagram: -



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

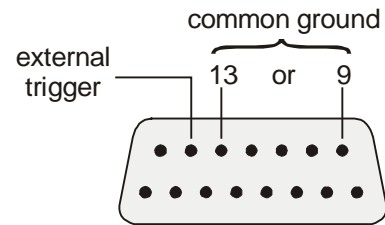
The above diagram shows all events being monitored using contact closures, but events may also be monitored using changes in voltage levels (see 4.8.4). 1000 Series loggers with additional event channels will have a 10 way terminal block. Inputs may be connected via a contact to one of the common ground pins, as indicated in the following diagram: -



In both cases, 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.

## 5.10 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. See 4.8.11 for further information.



## 6. Troubleshooting guide

### 6.1 “Why won’t it do that?”

Having described the many things you can do with a 1000 Series Squirrel, 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. Memory Card Squirrels

Memory Card Squirrels have a slot in the front for a low power PCMCIA SRAM card of between 128Kb and 4Mb in size. The Squirrel can log directly onto the card, or copy runs onto it from its internal memory. A Windows file system allows direct access to Squirrel data from a PC.

### 7.1 Types Of Card

Not all types of SRAM card are compatible with the Squirrel. The following manufactures of card have been tested and are recommended:

- Panasonic
- Mitsubishi
- King Max
- Pretec

Other cards may be compatible but could result in excessive current consumption.

### 7.2 Preparing the Card

Before the Squirrel can use the card, it must be formatted and then prepared with Darca's 'Memory Card Utils' feature.

Note: If your SRAM card does not appear as a Removable Drive in Windows Explorer, you must configure Windows to read SRAM cards with your card holder. Search for 'SRAM' in Windows Help for information on how to do this.

#### 7.2.1 Formatting the card

Open Darca's 'Memory Card Utils' feature (it is accessed from the File menu). Your SRAM card will appear under the list of 'Removable Drives', with corresponding status information in the three boxes to the right. Click the 'Format Drive' button to open Windows' Format utility. Use the 'Start' button to format the card as you would a floppy disk (do not worry that the type of format is set to 'Quick').

#### 7.2.2 Preparing the card

Before the Squirrel can store data on the Memory Card, the card must be 'prepared' by creating a file on it to hold the data. Use the 'Prepare' button to create this file (it will be named 'Squirrel.tad'). Check that the size of this file corresponds to the size of the Memory Card.

## 7.3 Squirrel Settings

An additional function has been added to the Squirrel. This controls the use of the memory card, and is the only place where a card should be inserted or removed. The function consists of three sub-pages.

### 7.3.1 Card size

Before inserting a memory card, the display will show the following:

```
C A R D   a b s e n t  
i n s e r t   c a r d   h e r e
```

This tells you that this is the point where a card may be inserted. Until this is done, pressing the *select* button will not display the next page of the function. Once a card is inserted, its size is calculated and displayed:

```
C A R D   p r e s e n t  
s i z e   1 0 4 0 K
```

The card size displayed is a calculation of how many thousand readings can be stored on it. Note that this is approximately half the number of kilobytes on the card. This is also the point where a used card may be removed.

Cards may also be erased in this function. If you have inserted a card that contains Squirrel data, but you wish to clear it in order to record a new run onto it, press and hold the *set* button. The display will show the following:

```
C A R D   p r e s e n t  
H O L D   T O   C L E A R
```

If the size of the card is not displayed, it is due to one or more problems. The nature of the problem is clearly stated on the display:

```
C A R D   p r e s e n t  
F I L E   N O T   F O U N D !
```

In this example, the Squirrel has found that the card has not been properly prepared with the SQPrep utility. Until this is done successfully, the logger cannot use the card. If the display shows 'REPLACE BATTERY!' then the battery is starting to fail and should be replaced as soon as possible. If the display shows 'BATTERY DEAD!' and there is important data in the card, then you should replace the battery **before** removing the card from the logger. 'WRITE PROTECTED!' is displayed if the Write Protect switch on the card is on. The logger cannot write to the card while it is write protected, so this should be switched off. Once the Squirrel is configured to use the card rather than the memory, the following will be displayed:

```
C A R D   i n   u s e
s i z e   1 0 4 0 K
```

This tells you of the status of the card, and reminds you not to remove the card.

### 7.3.2 Choose memory

Pressing the *select* button again will display the memory selection page. This is where you can choose whether the internal memory or the memory card should be used when logging. This screen also displays information about any data stored on the card. In this example, the card has no Squirrel data in it.

```
C A R D   e m p t y
u s i n g   m e m o r y
```

If there is any Squirrel data present in the card, then the display will show the following:

```
C A R D   h o l d s   d a t a
u s i n g   m e m o r y
```

By default, the internal memory is used. If you have inserted a blank formatted card onto which you would like to log, then this is probably the only setting that needs changing. Press and hold the set button to switch between the internal memory and the memory card.

```
C A R D   e m p t y  
H O L D   T O   C H A N G E
```

The display will then show the following:

```
C A R D   e m p t y  
u s i n g   c a r d
```

If there is already Squirrel data in the card, then the display will show the following warning instead of the usual 'HOLD TO CHANGE' message:

```
C A R D   c h o o s e   m e m  
O V E R W R I T E   C A R D ?
```

N.B. Neither this function nor the next can be accessed while the Squirrel is logging to the card.

### 7.3.3 Copy readings

It is sometimes more convenient to copy a set of readings to the card rather than to actually log to the card. The final CARD function facilitates this. Press and hold the set button to copy all the readings to the memory card.

```
C A R D   c o p y   d a t a  
b a c k u p   t o   c a r d ?
```

While copying, the display shows a message to that effect. Copying data can take as long as 4 minutes for a 2Mb card, or just 15 seconds for a 128Kb card.

```
C A R D   c o p y   d a t a  
c o p y i n g   d a t a
```

If the card already contains data, the same 'OVERWRITE CARD?' message will appear. It is possible to copy to the card while the Squirrel is logging to its internal memory, though this may take longer. Note that this function cannot be accessed while the Squirrel has been set up to use the memory card instead of its internal memory.

## **7.4 Extracting the data**

### **7.4.1 Introduction**

The data in the SRAM card can be extracted in two ways. It can be downloaded in the normal way, or the memory card can be removed and inserted into a computer where the data can be copied directly onto the hard disk. The second method is performed using the 'File Conversion' tab in Darca's Memory Card Utils.

### **7.4.2 File Conversion**

Once the card is in the PC, the data can be copied and processed by the File Conversion utility.

- Select the 'Squirrel.tad' file from your SRAM card with the first 'Browse' button. The filename will appear in the 'Selected TAD File' box.
- Choose the name and location of the DAT file that you want the data to be stored in with the second 'Browse' button.
- Click the 'Convert' button to copy the data from the SRAM card and store it on your PC as the chosen DAT file.

## 8. Electricity Squirrels (1010, 1020)

Electricity Squirrels have inputs for AC transducers, like Rogowski coils, current and voltage transducers. An extra function in the Squirrel allows easy reviewing of the maximum logged values stored on each channel. Additionally, the last two channels out of every eight can be used for temperature probes.

### 8.1 Logger functions

#### 8.1.1 Intervals

Due to the long settling times when measuring AC, the Squirrel's minimum log or scan interval is increased to 5 seconds when more than one analogue channel is selected. Selecting digital channels does not affect this minimum interval.

#### 8.1.2 Maximum

While logging, the Squirrel monitors each selected channel for peak values. This function allows the user to review the maximum logged value on each channel.

```
M A X I M U M   c h   1
  2 4 8 . 8   V
```

Along with the maximum value of the channel, the time at which it occurred is also stored. If the same peak value occurs more than once, then the time stored is that of the most recent peak. To view the time at which the maximum occurred, press the *set* button:

```
M A X I M U M   c h   1
  2 5 / 0 3 / 9 6   1 1 : 5 4
```

The maximum on the next channel can be viewed by pressing the *select* button.

### 8.2 Selecting ranges

Ensure that the range selected is correct for the type of transducer connected to the input - i.e. the 0 to 1000A CT range must not be used for a Rogowski coil and vice-versa. Note that AC ranges that start at 0 only achieve 0.1% accuracy at above 1.2% of scale.

### 8.2.1 Ranges

A completely new set of analogue ranges is implemented on the 1010: -

1010	1020	Input type	Available ranges	Resolution
1-8	1-16	AC Transducer	0 to 200A coil 0 to 500A coil 0 to 1000A coil 0 to 2000A coil 0 to 1000A CT 0 to 300V 170 to 270V	0.2A 0.5A 1A 2A 1A 0.3V 0.1V
7 & 8	7 & 8, 15 & 16	Thermistor	-25.0 to 125.0°C	0.1°C
9	17	Pulse count	0 to 65,000 0 to 650,000	1 10
10	18	Digital State	0 to 255 00000000 to 11111111	

### 8.3 Making connections to the datalogger

It is possible to connect many different types of sensors to the 1010 Squirrel Datalogger. These include Rogowski coils, miniature CT's (1A, 5A, 7.5A), VTS and VTP voltage transducers and air & surface temperature sensors. This is our standard range, though other transducers may be available to order.

## 9. Squirrels with pH channels

Some Squirrels have pH inputs. Such inputs require individual two-point calibration, and temperature compensation. The Squirrel supports two types of temperature compensation - measured and pre-set.

### 9.1 Channel Selection

The pH channels have two ranges available. These are actually both the same range; the difference is where the temperature compensation comes from. Choose from the pre-set temperature (which can be altered in the STAT function), or from the associated temperature channel (as illustrated below). If the latter is chosen, one of the -50°C to +150°C ranges of the temperature channel must also be selected otherwise the logger will perceive this as an error and switch the range to use the pre-set compensation. In this situation, the display will show 'INVALID – CHECK!' to alert the user that this has happened.

C H	9	p H	( c h 1 )
	0 . 0	/	1 4 . 0

It is worth noting that if the temperature channel is selected but no probe is plugged in, then compensation will again be taken from the pre-set value. In this case, the pH 'range' is unchanged; the temperature input would still be used if it were connected.

### 9.2 Pre-setting the Temperature

If the temperature of all the pH probes is known to be constant (or if high accuracy is not required) then it is not necessary to use a temperature probe for compensating the pH probe. The temperature of the pH probe can be set in the STAT function.

S T A T	p H	t e m p
	2 0 . 0	° C

Press and hold *set* to change the value. The longer *set* is pressed the faster the value changes.

### 9.3 Choosing the Calibration Point

Calibration of the pH probes requires two buffer solutions. One must be pH 7.0; the other may be pH 4.0, 9.0 or 10.0. The other extra STAT function is for setting the pH of this second buffer solution.

S T A T	p H	s l o p e
4 . 0 0		

Press and hold *set* to change the value.

### 9.4 Calibrating the Midpoint (pH7.0)

Before any sensor can be used with the Squirrel, it must be calibrated using two buffer solutions. An additional CALIBRATION function allows the setting of both pH 7.0 and pre-selected calibration point (or 'slope' - see above). Select the CALIBRATION function. After a couple of seconds, the display will change to show the calibration settings (see below).

Place each probe individually in a pH7 buffer solution and allow it time to settle (the time this takes will depend on the probe, and how it has been stored or used. See 'Care and Use of pH Probes', below). If the temperature compensation is being measured, then the relevant temperature probe must be put in the same solution.

B U F F E R 7	c h	9
6 . 6 4	p H	2 0 . 0 C

Once the value has settled, the display should show 'BUFFER7' in the top left-hand corner. If it reads 'O/RANGE', then the pH input is too far out of range to be set as the midpoint. This is typically caused by a pH probe that has expired. Once the probe has settled, press and hold the *set* button. 'HOLD TO CHANGE' will appear on the display and then the logger will recalibrate itself on the current channel to read 7.00 pH: -

B U F F E R 7	c h	9
7 . 0 0	p H	2 0 . 0 C

If the display is showing 'O/RANGE' when the *set* button is pressed, the display will show 'CANNOT SET' to indicate that the probe cannot be calibrated. The Squirrel retains its previous calibration setting. Select the next pH channel with the select button, and calibrate it in the same way. This must be done for all the channels that are required.

## 9.5 Calibrating the Slope

The second calibration point is the slope. The pH of the buffer solution used in this function should be set in the STAT function, as described above. Once that is set as desired, calibration of the slope can be performed in this function. The probes must be rinsed, placed in the specified buffer solution, and allowed time to settle. If the temperature compensation is being measured, then the temperature probes must be put in the same solution.

S L O P E 9	c h 9
9 . 3 1	p H

Once the probes have settled, the display should show 'SLOPE n' (where 'n' is 4, 9 or 10). If this does not match the solution that is being used, then the slope value in the STAT function must be changed appropriately (see above). If it reads 'O/RANGE', then the pH input is too far out of range of the preset value for the Squirrel to be calibrated to it. Again, this is typically caused by a pH probe that has expired. Once the value has settled, press and hold the *set* button. 'HOLD TO CHANGE' will appear on the display and then the logger will recalibrate itself on the current channel to read the correct value (in this example, 9.00 pH): -

S L O P E 9	c h 9
9 . 0 0	p H

If the display is showing 'O/RANGE' when the *set* button is pressed, the display will show 'CANNOT SET' to indicate that the probe cannot be calibrated. The Squirrel retains its previous calibration setting. Select the next pH channel with the select button, and calibrate it in the same way. This must be done for all the channels that are required.

## **9.6 Current Consumption and Battery Life**

Due to the sensitive nature of pH probes, the Squirrel has to provide a constant power supply to the pH input circuitry when pH inputs are in use. This power supply is switched on when one or more of the pH channels are selected for metering or recording. If the logger is not recording or waiting for a delayed start, the power supply is switched off at midnight.

This power supply is the reason for the decreased battery life. This is reflected in the displayed battery life in the STAT function.

## **9.7 Care and Use of pH Probes**

pH probes are very sensitive. Depending on their age and history, they can take a while before settling on a value. During probe calibration, each pH probe should be allowed enough time to settle. Always wait until the reading to stays constant for ten seconds. This is usually fairly quick, but old probes, probes that have been allowed to dry out, and probes that have been in either a very high or very low pH may take a while to settle. Occasionally, the output of a probe may continue to wander, never really settling on a value. This is an indication that the probe has expired and should be replaced.

As explained in the above section, the logger will power down its pH input circuitry under certain conditions. When this happens, any pH probes that may be connected will deteriorate more quickly than normal, so it is strongly recommended that any pH probes be disconnected and stored properly when not in use.

The tip of a pH probe should always be kept wet, so there are some important points to remember when storing one. After use, the tip of the sensor should be rinsed in pH 7.0 buffer solution. The end cap should then be sealed on while the tip is still wet.

These actions should help to preserve the life of the probe, and make for speedier calibration when it is next used.

## 10. Special Instructions

This section contains instructions for special 1000 Series Loggers, so do not necessarily apply to your Squirrel(s).

### 10.1 Alarms

- High and low alarms individually configurable on each channel.
- The alarm output is asserted, and the relay contact is closed, whenever any channel is in an alarm state while logging.

#### 10.1.1 Squirrel settings

##### *Low Alarm*

For each selected channel, a lower alarm threshold can be set or unset. By default, no value is set.

```
L O W   A L A R M   c h   1
- - - - ° C
```

To select the channel, on which you require an alarm condition, press *select* until the required channel is displayed. Then press and hold *set* to enter the edit mode.

```
L O W   A L A R M   c h   1
H O L D   T O   C H A N G E
```

A lower alarm threshold will appear for editing. The value used will be the value that was last used by this channel before it was unset. If there has never been an alarm set on this channel or if the previous value is not valid for the current range, then the bottom of the current range will be substituted. Use the *select* button to move the cursor, and the *set* button to change the value.

```
L O W   A L A R M   c h   1
- 3 0 . 0 ° C
```

To remove the alarm setting, enter an illegal value. Any setting that the Squirrel can make no sense of will cause the lower alarm threshold to become inactive, e.g., two minuses: -

L O W	A L A R M	c h	1
-	-	0 . 0	° C

When editing is complete, press the *function* button to leave the edit mode. The setting will be validated and redisplayed. To re-edit, press and hold the *set* button again. To move onto the next channel, press *select*. The alarm appears on pin 10 of the 'signal' connector.

#### *High Alarm*

Operation of this function is identical to the Low Alarm function described above.

#### *Meter*

When metering, the display will show two asterisks when you are viewing a channel that is currently in an alarm condition:

M E T E R	c h	3	* *
3 7 . 5	° C		

This is helpful in finding the channel that is causing the alarm.

## **10.2 Wind Speed & Direction**

Special circular averaging on EU range for wind direction.

### **10.2.1 Wind Direction**

Squirrels with Wind Direction inputs have a specially configured EU range on the last voltage channel. This is set to a hardware range of 0-5V dc and will read 0° to 360° for this input. The direction is also displayed as N, WSW, etc.

### **10.2.2 Averaging**

A special averaging mode is implemented on channel 8. When wind direction is being measured and the Log Mode is set to Average then the logger will sample as normal at the scanning interval. Each reading that is calculated from these samples is a true circular average - it is not averaged as 0-5V dc as this would cause an erroneous readings under

certain conditions (e.g. When the direction varied around North - say 375° to 5° - the mathematical average would be 180° which is South!).

### **10.2.3 Wind Speed**

Sometimes, another specially configured EU range can be found on the last but one voltage channel. This is set to a hardware range of 0-5V dc and will read 0 to 154.3ms<sup>-1</sup> for this input.

## 11. Modems

It is very important to correctly configure the modem that is going to be connected to the Squirrel. Most problems involving Darca and modems can usually be traced to the Squirrel's modem not being set up.

Connect the modem directly to the computer using the RS 232 port, which is usually at the back of your computer and labelled Comm 1 or Comm 2. To configure this modem you will need to use a simple terminal emulation program such as Windows Terminal. You can then send 'AT commands' to the modem in order to configure it in the way you require. When using such a program, be sure to set it to the correct Comm port, and to **the baud rate which you will be using once the modem is connected to the Squirrel.**

Unfortunately, as each manufacturer has their own version of the AT command set, this help file cannot list the necessary commands for your particular modem. However, most modern modems have sensible defaults and clear instruction manuals.

**IMPORTANT:** These guidelines assume that all the modem's settings are the 'factory defaults'. If this modem is brand new, then this is probably so. If not, look up how to restore the defaults in the modem's handbook. On some modems, some of the settings described below may require a tiny DIP-switch to be set, rather than an AT command to be sent. Occasionally, a manufacturer will put more than one 'factory default' profile in the modem. In this case, make sure that the profile has auto-baud rate negotiation and hardware (not software) flow control. N.B. references to RTS/CTS mean hardware flow control, which is appropriate. References to XON/XOFF mean software flow control, which would be unsuitable.

### 11.1.1 Common AT Commands

These instructions assume you have a new, high-speed modem with a data input buffer of at least 1k. Most modern modems conform to this requirement.

1. Ensure that the baud rate in the terminal emulator you are using is set to a baud rate that is compatible with the Squirrel. This is typically between 1200 baud and 9600 baud (the faster the better).
2. Leave the modem's hardware flow control enabled. The Squirrel cannot use flow control, but the data packets that it sends are so small they will fit into the modem's input buffer without over-filling it and causing the transmission of flow control signals. The error correction and data compression can also be left enabled.
3. Since Darca will ultimately be dialling this modem up, it needs to be told to automatically answer any calls. Thankfully, this is always done with a particular S-register (S0). So, to set the modem to answer after 2 rings, the following should be sent:

**ATS0=2[Enter].**

Should you require the modem to answer after 4 rings, substitute the 2 for a 4. Some modems require a DIP-switch to be set to enable auto answering.

4. This new configuration must be saved in the modem so that whenever the power to the modem is turned on this new profile will be used. It is important to make sure that the baud rate at which you send the following command is compatible with your Squirrel (i.e. 9600 baud or slower for 1000 Series Squirrels), as you are also storing this baud rate along with the settings that have changed in points 2 & 3. The exact AT command will depend on your modem, but is typically:

**AT&W[Enter].**  
or **AT&W1[Enter].**

## 12. Model 401/451 and derivatives

The 400 Series Squirrels are simpler 4 channel dataloggers based on the 1000 Series and retain many of the features of the 1000 Series. The differences between the 400 and 1000 series are as follows:

### Model 451

- The external triggering function has no effect, as there is no input for an external trigger.
- There is no pulse or event input.

### Model 401

- These Squirrels do not have either a display or buttons. Control and configuration of the Squirrel must be performed with a remote control program such as Darca.
- The LED flashes periodically (whether or not the Squirrel is logging).

## 13. Fast Logging

### 13.1 Logging Interval

In order for the Squirrel to operate in fast logging mode, only analogue channels must be selected. No digital channels may be selected. The logging mode must be set to **Interval**, the external trigger mode can be **unused** or set to **external trigger runs**, and the memory mode must be **stop when full**. If these conditions are met the Logging Interval function will look something like this:

I N T	l o g
0 0	: 0 0 : 0 0 . 1

The interval can be altered in the normal way. If 'fast logging mode' is not required, then the tenths of a second should be set to zero. Interval values up to 9.9 seconds can be set in fast logging mode. It is not possible to set values greater than this if the tenths are not set to zero.

When logging in fast logging mode, no function other than 'LOG' can be selected. This is true even if the interval is, for example, 8.4 seconds. (If the interval were 8 seconds or 9 seconds, this restriction would not apply, as the logger would behave as normal). When in fast logging mode, the Squirrel can still be stopped and started in the normal way.

- When using an external trigger to start fast recordings, the logger must either be in the Log function or the display must be off.
- When attempting to start fast logging using the delayed start option, the logger must be left with the display off.
- The minimum logging interval allowed depends on the number of selected channels. Allow 0.1 second for every 8 channels.
- Logging intervals of 2, 3, 4, 5, 6, 7, 8, 9 seconds operate as normal logging.
- Important: Unused channels must be de-selected when logging in the fast mode. If left selected, the readings on the selected channels may be slightly inaccurate.

### 13.2 Translation with Darca

The tenths of a seconds will not be included in the standard time column as this is not compatible with most spreadsheets. When translating files

that have been recorded in fast mode, it is necessary to include the elapsed time column. To switch it on, select *Preferences* then *Export* and choose *Generate Elapsed Time Column*.

### **13.3 Darca Contact**

It is not possible to contact the Squirrel (for either controlling or downloading) while it is logging in 'fast logging mode'. Logging must first be stopped using the button on the front of the Squirrel.

## **14. GenII Radio Data Logging System**

### **14.1 Introduction**

*This GenII information is for systems where programming transmitters is from the RX250 Receiver Logger.*

The GenII radio data logging system records data from sensors located at some distance from the Receiver Logger (type RX250 or RX250-AL) where cables would be impractical and expensive. The radio range of the system can be as much as 2 or 3 km over open ground (using the standard compact helical antennas). Range can be increased using the RP250GL repeater.

The GC, GS or GL series of compact transmitters can be supplied with a variety of different sensors. These can be either integral or plugged in, and are transmitted with a resolution of up to 0.025% of the input range. Each transmitter can have up to 15 channels, which can be spread over more than one type of input. Up to 250 transmitted channels spread across a maximum of 125 transmitters can be recorded by one Receiver Logger. Additionally, more than one system can run side by side on the same radio frequency.

The RX250 or RX250-AL is used to program each of the transmitters with the channel set-up, humidity calibration information, and the transmission interval. All of these settings are stored in the transmitter in non-volatile memory, so there is no need to re-configure them when the batteries are changed. The alkaline battery pack in the transmitter is designed for 5 years operation with a transmission interval of 10 minutes.

### **14.2 Initial Setup**

#### **14.2.1 Connections**

The MP12/U power supply should be plugged into a mains outlet, and the other end connected to the socket in the RX250 labelled '12V DC Regulated'. The aerial should be attached SMA antenna socket.

### 14.2.2 Enabling RX250 or RX250AL Setup

The RX250 **STAT** function contains extra pages for configuring the Squirrel with the transmitter system.

One of these pages prevents the current settings being tampered with by controlling whether changes may be made to the RX250 and transmitter configuration. It is found after the 'mem-size' page, and looks like this:

```
S T A T   s e t u p
D I S A B L E D
```

Pressing and holding *set* changes this to 'ENABLED'. This must be enabled to carry out any changes to the RX250 and transmitters' configuration.

### 14.2.3 Limiting the Number of Channels

Unlike most Squirrels, the RX250 does not have a pre-set number of channels. This is because the system is very open-ended and allows the user to connect any number of transmitters to the RX250. The maximum number of channels is 250. However, a maximum value of the number of channels to be used must be entered into the RX250. This is so that the Channel Setup function knows when to wrap around from the last channel to the first one. This is located in an additional page in the STAT function:

```
S T A T   m a x - c h a n s
2 0   c h a n n e l s
```

Press and hold *set* to change the value to anywhere between 4 and 250 channels.

### 14.2.4 Transmitter ID

Each transmitter has a unique serial number (found on the label on the base of the transmitter) which is used as an identifying code by the RX250. It is shown on the RX250 display during transmitter related functions, such as Channel Setup. Every transmitted value is

accompanied by this number so that when the RX250 receives it, it knows which transmitter has sent it and can work out which channel the data belongs in.

## **14.3 System Configuration**

### **14.3.1 Transmitter Set-up**

An LC-TX, Programming Lead is supplied to connect each transmitter to the RX250 'output' connector. The LC-TX has a male 6-pin mini-DIN at one end, and a 3.5mm stereo jack plug on the other. This is to connect the RX250 to each transmitter when setting them up.

Each transmitter must be connected in turn to the RX250 in order to configure the channels and set the transmission interval. This process simultaneously configures both the RX250 and the transmitter, and depends on them being connected to each other.

There are three aspects to the set-up:

1. The transmission interval.
2. Selection of the channels to be transmitted.
3. The calibration of the sensors.

These settings can only be changed if the RX250 is not logging and has had its memory cleared.

Before attempting to set a transmitter up, install 4 x AA batteries. Now check that the red LED on the top panel flashes as the power is applied. After connecting the battery, the transmitter will be in one of two states. Either the LED will flash briefly every 8 seconds, or it will flash for slightly longer at the present transmit interval, as it flashes every time it transmits. From the factory, the transmitters should be flashing every 8 seconds. This is an indication that the transmitter is not configured, and serves as a warning that it will not be transmitting any data.

Now connect the LC-TX. Plug the 6-pin mini-DIN in to the RX250 socket labelled "output" and the 3.5mm jack into the socket located on the PCB within the transmitter, this is only accessible if the bottom cover is removed (held in place by two Pozzi head self-threading screws). The battery pack can now be carefully withdrawn, but left connected.

### 14.3.2 Transmission Interval

Setting the interval function, described in Section 4.6, is used on the RX250 to set the logging interval. Another page in the “INT mode” has been added to enable the transmission intervals in the transmitters to be changed. After connecting a transmitter, pressing the *select* button enters this sub-functions of “INT mode”, “INT TX” will display the interval that is currently set in the transmitter that is connected to the RX250

```
I N T   T X - 1 2 3 4
t x - i n t       0 : 0 5 : 0 0
```

If the RX250 fails to find a transmitter connected to the Squirrel, the display will show the following:

```
I N T
c o n n e c t   T X
```

If this is displayed even with a transmitter connected, then the connections should be checked, as should the state of the battery in the transmitter.

The default value of the transmission interval is 5 minutes, which is the recommended value for an half hour or hourly-logging interval. The transmission interval can be changed in exactly the same way as the log or scan interval is changed in the Squirrel. Once the required value is shown on the display, the *function* button must be pressed to transfer the new setting into the transmitter. The display is then updated to reflect the new value in the transmitter.

Pressing the *function* button again will move the RX250 into the next function, as usual. Alternatively, if there are a number of transmitters to configure, another may be connected at this point. The display is automatically updated to show the new transmitter’s serial number and transmit interval.

It is worth mentioning that the transmission interval is in fact an ‘average’ transmission interval. The transmission will occur at a random point during each transmit interval. This minimises the chances of transmissions from two or more transmitters systematically crashing into each other. It also means that it can appear to an observer that the gap between two transmissions can be almost as much as twice the transmit interval. In this case, a transmitter would be transmitting at the very

beginning of one interval and at the very end of the next.

### 14.3.3 Channel Set-up

As with the standard Squirrel, this function is used to configure the channels on the system. The difference with the RX250 is that the ranges available on any channel will entirely depend on the transmitter that is connected. Consequently, the RX250 must be connected to a transmitter with the programming lead when setting up channels.

Entering Channel Set-up for the first time will show this on the display:

```
C H A N N E L   S E T U P
0   u   s   e   d
```

The RX250 channel is selected in the normal way using the *select* button:

```
C H   1
n o t   c o n f i g u r e d
```

Pressing the *set* button steps through the available channels of the transmitter:

```
C H   1       T X - 1 2 3 4   A
- 5 0   / 1 5 0   ° C
```

Here, the RX250 is showing the current channel configuration for channel 1. In the middle of the top line of the display, the transmitter number is displayed.

The 'A' on the right hand side of the display shows the selected channel within the transmitter. Note that the channels of the transmitters are assigned letters to prevent them being confused with the numbers of the RX250 channels.

Pressing the *set* button again will move the display onto the next available channel within the transmitter. After several presses, the display will show 'not configured' again. This means that the channel is switched off, and will not be transmitted or logged.

There are several circumstances where the above display is not shown. This could happen if, for example, the transmitter is either not

functioning, or if it has not been connected to the RX250. It is also possible that the transmitter is already configured, and all its channels are allocated. In this last situation, the RX250 will display this:

```
CH 1
NO SPARE CHANS
```

As transmitter channels are assigned to RX250 channels, the number of available channels within any particular transmitter will drop. This is because the system prevents the user mistakenly assigning a single transmitted channel to more than one RX250 channel.

Using this system, there could be circumstances that may leave the transmitter thinking it is assigned to channels in a RX250, and the RX250 not having those channels assigned within it. A special function is available in the Squirrel to break this deadlock by deleting such erroneous assignments - see the section below on "TX Battery and Reliability".

Once the Squirrel channels have been assigned to transmitter channels as required, the Channel Setup function can still be used to browse the channel setup, even with no transmitter connected. Additionally, the channels can be switched on and off. Pressing the *set* button on a previously setup channel with no transmitter attached will cause the display to show the following:

```
CH 1
not logged
```

Obviously, the transmitter that was previously set-up to log on this channel will still be transmitting the data, but changing this setting has instructed the RX250 to ignore it. The previous setting has not been lost, and the logging of this channel's data can be restored by pressing the *set* button again with the transmitter not connected. It is always preferable to deselect the channel **with** the transmitter connected, but this method is convenient where it is impractical to retrieve the transmitter. It is also useful for logging different subsets of the installed transmitters.

#### 14.3.4 Metering

The RX250 Squirrel has two methods of displaying values in the Meter function:

1. If the transmitter is connected directly to the RX250, the current value for each channel will be displayed.
2. If the transmitter is not connected, then the display will show the last received value for that channel. It is possible that in this situation there may not have been any received values from the transmitter. The RX250 would then display the following:

```
M E T E R   c h   1
- - - -   ° C
```

This simply indicates that there have not yet been any readings from that channel received by the RX250. This will be replaced with a value as soon as the RX250 receives one.

If a transmitter is plugged in that hasn't (yet) been set up in the Channel Set-up function of the RX250, the display will show the following:

```
M E T E R
u n k n o w n   T X
```

In order to meter this transmitter, it would be necessary to assign it to a channel in the Channel Set-up function.

#### 14.3.5 TX Battery and Reliability

The TX battery and Reliability function can be found after the Channel Setup function. As with some of the other functions, its behaviour depends on whether a transmitter is connected to the RX250 with the programming lead.

If no transmitter is connected, the RX250 will display a summary of each transmitter when the *select* button is pressed:

```
T X - 1 2 3 4
5 7 %           9 3 % r e l
```

Pressing the *select* button again will show a different transmitter (assuming more than one has been set-up for the RX250). The order in which the transmitters are shown in this function reflects the sequence in which they were configured on the RX250.

If the RX250 has not yet received a battery reading from any particular transmitter, then the display will show a series of dashes instead of the battery voltage:

T X - 1 2 3 4
- - - - 9 3 % r e l

As soon as the RX250 receives information on the level of the battery, it will be displayed here.

The reliability figure on the right-hand side of the display is there to give an idea of how well the transmitted data packets are being received by the RX250. Note that before logging starts the reliability value is unavailable, so it is replaced with a series of dashes:

T X - 1 2 3 4
5 7 % - - - % r e l

The reliability value is expressed as a percentage of how many transmissions were successful. It is calculated by comparing the number of packets successfully received by the RX250 during the last logging interval with the number of packets expected, based on the transmission interval of the transmitter. This figure is then subject to a rolling average, so it is only after a few record intervals that the figure is representative of the reception reliability of the transmitter. A typical system, where the transmitters are well within the operating range, and where there aren't a large number of transmitters on short intervals, should show reliability figures in the high nineties.

Should the RX250 report a lower value for any transmitter, then this is an indication that the transmitter should be moved to a different location to improve reception at the RX250. Sometimes a small move will improve the reception greatly.

If the reliability figures are all above 95% and if there are no dropouts in the data, then the transmission interval could be increased to extend the battery life. Bear in mind that this would reduce the number of

transmissions in each record interval, and so increase the chances of a dropout in the data.

#### 14.3.6 Deleting Transmitters

The Channel Setup function is designed to allow the selection and deselection of transmitter channels. Wherever possible, all channel configuration should be done in Channel Setup. However, there are situations where a transmitter needs to be removed from the RX250 channel configuration without the transmitter being available to properly deselect it using the Channel Setup function. This can be achieved by selecting the transmitter in the TX Battery and Reliability function, and then pressing the *set* button. The display briefly shows the following:

```
T X - 1 2 3 4
H O L D   T O   D E L E T E
```

If the *set* button is held down the RX250 briefly displays the following, and deletes all record of it from its configuration:

```
T X - 1 2 3 4
D E L E T I N G   S Q
```

Finally, the display ends up with 'DELETED' on the bottom line. Accessing the Channel Setup function will confirm that all channels that were using this transmitter are now 'not configured'. Note that the transmitter is not aware of this, and will still be transmitting. This not only wastes battery power in the transmitter, but also leaves its broadcasts still occasionally colliding with those from other transmitters. It is for this reason that channel deselection is best done using the Channel Setup function.

In the above screen shot, the display shows 'DELETING SQ'. This indicates that the RX250 is only deleting the settings in the RX250 for this transmitter. This behaviour is different when a transmitter is plugged into the RX250 with the programming lead. In this instance, the TX Battery and Reliability function will only show information about the connected transmitter, and the information it shows is a little different:

```
T X - 1 2 3 4
5 7 %      2 C H
```

Whether or not the connected transmitter is configured for use with the RX250, it will show the above details. The battery capacity is shown as before, but here it is taken straight from the transmitter. On the other side of the display, (where the reliability was previously displayed) is shown the number of channels the transmitter is configured to transmit. These may or may not have been set up on this RX250. The *select* button does nothing in this situation, as the RX250 will only report on the connected transmitter. The *set* button still does the same job, but with a slightly different angle. If the transmitter has come from another system (i.e. has not been set up on **this** RX250), pressing and holding the *set* button will delete all the channel assignments within the transmitter:

```
T X - 1 2 3 4
D E L E T I N G   T X
```

Note that the display shows that the RX250 is deleting the configuration of the transmitter this time. If the connected transmitter **is** configured to work with the RX250, the display will show the following:

```
T X - 1 2 3 4
D E L E T I N G   S Q + T X
```

This indicates that the transmitter's configuration is being deleted **and** the associated channel assignments in the RX250 are being deleted. In either situation, the state of the transmitter is confirmed afterwards:

```
T X - 1 2 3 4
8 . 3   V      0 C H
```

The number of channels used in the transmitter is now reported to be zero.

### 14.3.7 Calibration

Humidity sensors only can be calibrated in software by connecting the transmitter to the RX250 with the LC-TX programming lead. The wired connection is required for two reasons. Firstly, the value from the sensor is sent to the RX250 immediately, so it can be clearly seen when a sensor value has settled. Secondly, the calibration is stored in the transmitter, rather than in the RX250, so the calibration of the sensor can be done away from the system, if required.

The Calibration function can perform either a one or two point calibration. The value of both points can be changed to match the calibrator.

In order to enter the Calibration function, a transmitter must be connected, and the *select* button pressed:

```
C A L I B R A T I O N
```

If *select* is pressed without a transmitter connected, the RX250 will display a message to instruct the user to do so:

```
C A L I B R A T I O N  
c o n n e c t   T X
```

Once a transmitter is attached to the RX250 with the programming lead, pressing the *select* button puts the RX250 into the calibration mode.

```
C A L I B R A T E   1 3 . 0 %  
S E N S O R   2 1 . 6 %
```

Before performing the calibration though, it is necessary to set the calibration points. Pressing the *select* button twice more allows you to set the lower calibration point:

```
C A L   P O I N T   1  
1 3 . 0 %
```

Pressing and holding the *set* button allows subsequent presses to increment the value in 0.5% increments up to 60.0%. This value should

be set to match the calibrator that will be used. A single point calibration will **only** use Cal Point 1, which is the zero point. Pressing the *select* button moves the display onto Cal Point 2, which is the span, and is only used for two-point calibrations. This is adjusted in same way as the first, but the range available is 50.0% to 100.0%. Cal Point 1 should always be lower than Cal Point 2 for two-point calibrations.

#### 14.3.8 Calibrating the Sensors

Pressing the *select* button from the Cal Point 2 setup puts the RX250 back to the first calibration page. This calibrates the lower selected point on the sensor. The display shows Cal Point 1 and the current value from the sensor:

CALIBRATE	22.0%
SENSOR	21.6%

The sensor should be placed in the calibration device. Once the reading has stabilised, the *set* button should be pressed and held to set the sensor to read the value of Cal Point 1 for the present input. If the calibration is too far out, the RX250 displays 'CAN'T SET'. This may be caused by setting the wrong value for the Cal Point, by putting the sensor in the wrong solution, or it could mean that the sensor element needs replacing. This can be done by the user, after which the calibration must be performed again. A two-point calibration can be performed by repeating the above procedure for Cal Point 2. Pressing *select* moves the RX250 on to the second calibration point.

#### 14.3.9 RX250 LED Indicators

There are two LED indicators on the rear of the RX250. The green LED is marked 'run/rx' and shows the reception status. While the logger is in a state to receive data from the transmitters, the green LED will flash about once a second. Occasionally, it will stay on for about a second. This indicates a new data packet has just been received. If the LED is constantly off, the RX250 has switched off the receiver. This typically indicates that the RX250 has lost external power and its batteries are nearly flat (see section below on the RX250 power supply).

The red LED is marked 'check system'. It indicates a system problem and can be ON due to a number of conditions. The user should

investigate. These conditions are:

1. One (or more) of the transmitter's batteries has dropped below 10%
2. The RX250 has not received a data packet from one (or more) of the transmitters during the last record interval.

The source of both of these problems can be determined with the TX Battery and Reliability function. As soon as all the problems have been alleviated, the LED will switch off again.

The second problem could be due to a transmitter being moved or damaged, or by a transmitter being out of range.

If the battery voltage in a transmitter is low, the battery will need to be replaced. However, preventative action can still be taken before the data being logged will start being affected. Once the battery voltage falls to 0% the transmission will stop to prevent the RX250 storing inaccurate readings. The battery can be replaced without any need to reconfigure the transmitter, as the settings are stored in its non-volatile memory. The red LED will be switched off once the RX250 receives a data packet containing a valid battery reading.

If both red and green LED flash simultaneously this indicates that the logger is operating in an invalid mode. Both LEDs will revert to normal operation once logging recommences. The RX250 will normally self-recover. Both LEDs flashing simultaneously can indicate a radio fault, in which case Eltek should be contacted.

#### **14.3.10 Transmitter LED Indicator (top panel)**

A red LED on the transmitter flashes for the following reasons.

**A brief blink every 8 seconds** indicates that it is operating normally, but is not configured to transmit anything. It is put into this state from a 'cold start' (i.e. from the factory). It will stay in this mode until it is set up with the RX250.

**A longer blink on each transmission.** Once configured indicates normal operation.

**A brief blink every second** indicates a successful connection has been made to the PC and Darca Plus. The LED will revert to the configured status after 3 seconds when the communications is disconnected.

**A double blink every 8 seconds** indicates a fault. The transmitter will need attention.

A concealed test switch, accessed using e.g. a paper clip, is located behind a small hole in the transmitter rear panel. This is a very useful feature when setting up the system and when conducting a radio survey.

- Holding the switch down will cause the transmitter to transmit approximately every second until released.
- A brief press will cause a transmission every 5 seconds (albeit at a random point in time in the 5 second slot) for about 20 transmissions. It will revert to normal operation after.

#### **14.3.11 RX250 Power Supply**

The RX250 is supplied with six Ni Mh rechargeable batteries installed in the battery compartment. These are charged from the 12V DC input jack. The batteries can keep the RX250 powered for up to 24 hours (if fully charged) in the event of a power failure.

The RX250 will inhibit the receiver prior to total battery exhaustion, in this event, the RX250 continues logging at the specified interval, but stores dummy values. While powered down, the 'run/rx' LED will stop flashing.

When AC power returns the logger automatically enables the receiver and starts to recharge the battery and can take up to 3 days to fully recharge. The battery page of the STAT function indicates the number of hours the receiver will keep running in the event of AC supply failure. If discharged it may take more than 1 day of recharging before the hours displayed in this function rises above 0. If the RX250 is not logging, the receiver circuitry will turn off within ten minutes after the external power is removed.

**WARNING: UNDER NO CIRCUMSTANCES SHOULD NON RECHARGEABLE BATTERIES BE INSTALLED IN THE RX250. DOING SO MAY CAUSE THEM TO LEAK OR EXPLODE. FAILURE TO OBSERVE THIS WARNING WILL INVALIDATE THE WARRANTY.**

The battery should last for many years. However annual testing is recommended, once the system is more than 3 years old, by unplugging the mains adapter while the RX250 is logging and letting the unit run for

a few hours. If the receiver switches off sooner than indicated by the STAT function, then replacement rechargeable batteries should be obtained from Eltek Ltd.

#### **14.3.12 Transmitter Battery Pack**

When changing the transmitter battery always replace with a set of 4 new AA alkaline batteries. The transmitter LED will flash when it restarts correctly. If this does not happen remove the battery, wait 10 seconds and reconnect it.

#### **14.3.13 Improving Reception**

Radio waves travel best in open unobstructed spaces. Aerials work best high up in open spaces. Unfortunately, it is rarely possible to have both of these criteria met! but these two statements should be kept in mind when installing the radio system. This will lead to the best performance of the system that can be obtained in a given situation. Note that metal objects and thick walls significantly attenuate radio signals. Reinforced concrete is a real signal killer as it can act like a metal screen.

If a nearby source of interference contains frequency components in the band of the system, then the receiver will obviously be desensitised. This is especially true if the interference is stronger than the signal from a distant transmitter. Typical sources of interference are mobile phones, walkie-talkie type radios, computer equipment (especially older equipment) and anything with a radio transmitter in it, e.g. the components of a wireless security system.

#### **14.3.14 Locating the Transmitters**

For best range place the transmitter as high up as possible. Keep away from damp or metal clad walls, metal objects, cabling, pipes, etc. Also bear in mind that the fewer obstacles in the path to the receiver will give the greater range and reliability of the system.

#### **14.3.15 Locating the RX250**

The RX250 is a single unit that combines both receiver and data logger. Locate the RX250 central to the transmitters and clear of sources of radio interference. See 14.3.3 Improving reception above.

Where range is not a problem the built in antenna supplied should be

used and provides a very compact installation. Range can be very significantly improved using the optional dipole antenna. This should be mounted as high as possible and away from sources of interference.

## 15. Darca

### 15.1 Introduction

Darca is a 32-bit Windows program for setting up, downloading, and translating data from 1000 Series and other compatible Squirrels. It has many features designed to speed up and assist in all aspects of Squirrel management:

- Modern interface makes the advanced features of the Squirrel easily accessible and configurable.
- Multithreaded communications routine improves responsiveness.
- Multiple channels can be edited simultaneously.
- Downloading times have been substantially reduced on all new Squirrels.
- Squirrels can be contacted directly or via modem.
- Phone list makes accessing a number of Squirrels straightforward.
- Setups can be saved to disk and uploaded to Squirrels.
- Squirrel settings can be quickly changed off-line, and then uploaded efficiently at a later date.
- Automated contacts can set up and download Squirrels on demand or from separate 'Shed' scheduling utility (included).
- Channels can be renamed for easier identification when metering.
- Alarms can be set up and metered - even on Squirrels without alarms.
- Data can be graphed using powerful graphing tools.
- 

#### 15.1.1 Online Help

The majority of the documentation for Darca is kept online in the Help system. For more information on any item within the program, click Help, or press the F1 key. The Help file also contains a detailed tutorial.

#### 15.1.2 System Requirements

System requirements are:

- PC running Windows 98,SE,ME,XP,2000 and NT4.
- CD-Rom disk drive (for installation).

- 8Mb RAM.
- 4Mb free hard disk space for program.
- VGA (or better) display.
- One unused serial port.
- Additional hard disk space for data.
- Compatible modem, (for dialling up remote RX250, if required)
- LC68 cable (RX250 to PC serial cable)

### 15.1.3 Installation

1. Insert CD in CDROM drive.
2. From the **Start Menu**, choose **R**un...
3. Type **x:\setup** (where x is CDROM drive) and press return.
4. Follow the on-screen instructions. Note: The installation program will create a folder called 'Darca' within the folder you specify.
5. To run Darca, select the Darca icon from the **Programs Menu**.
6. To launch Shed automatically every time Windows is started, create a shortcut to Shed in the **StartUp** group.

Darca creates two sub-folders within its main program folder:

- 'Setup' – which is used for storing Squirrel setup files.
- 'Squirrels' – which keeps a database of information about every Squirrel contacted in order to speed up contact time.

These sub-folders are for the storage of Squirrel settings and data, and may be moved to a different location - provided that the relevant details are updated in the Folders tab of the Settings|Preferences dialog box.

## 15.2 Overview

Darca stands for Downloading and Remote Control Application. It is designed to communicate with Eltek, the main functions are;-

1. Downloading data
2. Exporting data into a spreadsheet or Graphing data
3. Remote configuration of settings and channel set-up.

This may be achieved either through a direct RS232 cable, or via modems connected to the public telephone system (or a private exchange).

### 15.2.1 Darca Plus and Darca Lite

Darca is available in two versions: Darca Plus and Darca Lite. These two versions are exactly the same except that Darca Plus contains graphing tools and modem contact. An upgrade ('Darca Up') is available to upgrade from Darca Lite to Darca Plus.

*Note: GenII Radio Data Logging System is designed for use with Darca Plus only.*


The documentation that comes with Darca, such as the online help, will refer to the features available in Darca Plus as well as the standard features common to both versions. These extra features should be ignored by users of Darca Lite.

## 15.3 The Main Window

The Main Window is the first window that appears when Darca is launched. The top of the Main Window carries a menu bar through which all of the program's functions can be accessed. The Status Bar at the bottom displays information about the status of communication between Darca and the Squirrel. Between the Menu Bar and the Status Bar is the Control Panel. The buttons that appear on here depend upon the current connection status. When Darca is first started, the Control



Panel shows the buttons listed below:

 Export Data - Converts a Squirrel Data file (.DAT) into a text file suitable for importing into spreadsheet programs.




 View Graph – Displays a graph of a DAT file. (Darca Plus)



 View Export – Displays exported data in a table. (Darca Lite)



 Preferences - Makes changes to the way Darca operates.

 Contact Wizard - Goes through two steps of establishing contact with the Squirrel, allowing configuration of the way the Squirrel will be contacted.

## 15.4 The Contact Wizard

The Contact Wizard provides an easy way to select the method that Darca will use to contact the Squirrel. In the first stage of the Wizard, the type of connection must be chosen from Manual, Automated or Offline. Choosing 'Offline' in step 1 of the Contact Wizard will ask for a Squirrel name and then start a new Offline Setup based on this Squirrel.

If the choice made is either Manual or Automated, the Contact Wizard moves to step 2, where either a Direct or a Modem connection can be selected. A Direct connection will simply contact the Squirrel via the LC68 cable, whereas a Modem connection requires a phone number with which to dial the modem. Step 2 of the Contact Wizard also asks whether the Squirrel is Networked, and allows configuration of the Communications settings through the 'Configure Communications' button.

An Automated contact is an advanced method for automating the process of contacting one or more Squirrels on regular basis. A contact started in this way cannot be interacted with.

## 15.5 The Contact Window

The Contact Window appears once a Squirrel has been contacted. From here the settings in the Squirrel can be changed online, logging can be started and stopped, runs can be download from the Squirrel and the

Squirrel's memory can be cleared. The Meter Channels window can also be opened.



The following buttons appear on the Contact Window:



Download Runs – Displays the Download dialog box.



Meter Channels - Displays the current input of all the selected channels in diagrammatic or graph form (Darca Plus only).

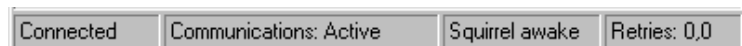


Squirrel Settings - Configures various aspects of the Squirrel using Darca.

Channel Setup – Configures the channels on the Squirrel.

## 15.6 The Status Bar

The Status Bar at the bottom of the window contains four areas that indicate the status of the connection between the Squirrel and Darca:



- The left-hand box simply shows whether or not a connection has been established.
- The next box shows the current state of the communications through the selected serial port.
- The third box is the state of the Squirrel. This can either be asleep or awake. Darca must wake the Squirrel before communications can start.
- The right hand box shows 'Retries' followed by two numbers. The first number is the number of times Darca has failed to wake up the Squirrel. The second number is the number of times Darca has not had a response from a transmitted command.
- 

## 15.7 Menus

The menus provide access to all of the functions and options of Darca. Some of the menu items are just alternative ways of getting to the same functions that the buttons provide.

### 15.7.1 File Menu

The File Menu contains the options for all the file-based operations in Darca. It also contains the option to quit the program.

#### *Open Setup*

Allows Darca Squirrel Setup files (\*.dss) to be loaded from disk. If this option is selected when Darca is in contact with a Squirrel, then the selected Squirrel setup is sent to the Squirrel. Note that the setup file can only be sent to the same model of Squirrel for which it was created. This option is also available when Darca is not connected to a Squirrel. In this context, Darca will open the file in offline mode. This allows the settings within the file to be changed without the need to connect a Squirrel. See 'offline contact' in the online help for more information.

#### *Close Setup*

Closes an open Squirrel Setup File. If the file has not been saved, a

prompt appears to confirm the action.

#### *View Export*

Enables the viewing of exported Squirrel data in text or tabular form.

#### *View Graph*

Displays a graph of a Squirrel data file together with summary information.

#### *Save Setup*

Stores the current Squirrel setup to disk. If the current setup has not yet been named, the Save Setup As dialog appears.

#### *Save Setup As*

Stores the current Squirrel setup to disk after prompting for a filename.

#### *Download*

Only available during contact with a Squirrel, this option initiates the transfer of recorded data from the Squirrel to the computer.

#### *Export*

Once data has been downloaded from the Squirrel, it may need to be processed into a form that can be read by a spreadsheet application. Choosing this option brings up a dialog from which the data file can be selected. Darca then processes the data in accordance with the current Export Settings and writes it into a new file. Note that Darca can be configured to automatically export the data immediately after a download.

#### *Memory Card Utils*

Some special Squirrels use PC Memory (SRAM) Cards to store data. These utilities enable preparation and management of the card and its data.

#### *Exit*

Quits the program.

### **15.7.2 Contact Menu**

The Contact Menu contains the available options for contacting Squirrels in Darca. It also contains the option to subsequently disconnect from the Squirrel.

#### *Direct*

Initiates contact with a Squirrel connected to the computer's serial port.

The correct serial port must be selected and a compatible baud rate must first be chosen from the Communications option in the Settings menu.

#### *Modem*

Jumps to the 2<sup>nd</sup> page of the Contact Wizard, and selects the Modem option. This page of the wizard allows a phone number to be entered. Once this is done, the Next>> button starts the modem dialling, and initiates the contact. It is important to configure the Squirrel modem correctly; for more information on how to do this, refer to Darca's online help.

#### *Automated*

To minimise connection time, and to allow execution of a predetermined set of actions on a Squirrel, Darca can be configured to carry out contacts automatically. The required tasks can be specified in the Preferences option on the Settings menu.

#### *Contact Wizard*

See The Main Window for more information.

#### *Disconnect*

Stops all communication between Darca and the Squirrel, and returns Darca to the Contact Window. In offline contact this option closes the current Squirrel Setup File and returns Darca to the Main Window.

### **15.7.3 Settings Menu**

The Settings Menu contains options that configure Darca. Options for changing the Squirrel's settings are found in the Squirrel Menu.

#### *Preferences*

Displays a multi-tabbed dialog box from which most of Darca's settings can be changed. Nearly all of these settings are stored when Darca is exited.

#### *Communication*

All of the communication settings for Darca are displayed in the communications dialog box. These settings are stored when Darca is exited. Settings for the modem can also be changed from here, though any changes in these will not be retained when the program is exited.

#### *Phone List*

A list of descriptions, phone numbers and Squirrel serial numbers can

be stored in the phone list. The Tool Bar at the top of the phone list window has buttons to enable entries to be added, edited and removed. Clicking on one of the headings will sort the entries by the selected column.

#### **15.7.4 Squirrel Menu**

The Squirrel Menu only appears when Darca is in contact with a Squirrel. It contains the all the options for changing the settings of the Squirrel.

##### *Refresh Status*

Periodically, the Squirrel Status window is updated with the current status of the Squirrel. This option forces Darca to update this window immediately and re-open it if it has been closed.

##### *Log*

The Squirrel's current logging state is shown by this menu item. A check mark next to this option indicates that the Squirrel is currently logging. Selecting this option will change the logging state by either starting or stopping the Squirrel logging (depending on the current state). The logging state of the Squirrel can also be changed by the central control of the Contact Window.

##### *Clear Memory*

This option is not available when the Squirrel is logging. When it is, this option will clear all the readings from the Squirrel's memory. The memory can also be cleared using the central control of the Contact Window.

##### *Settings*

All of the Squirrel's settings (with the exception of the channel setup) are controlled from a single tabbed dialog box, which can be accessed by selecting this option. If the Squirrel is not reset, there will be some settings that cannot be changed.

#### **15.7.5 View Menu**

The items in the View Menu are all for showing non-dialog windows for either displaying Squirrel information or changing channel settings. Any or all of the windows opened from the View Menu may be open simultaneously. Reselecting an already open window will bring that window to the front.

### *Squirrel Status*

This window is automatically shown when contact is established. It is recommended that this window is left open permanently, and moved to a convenient location on the screen. It can then be quickly referred to at any time for the current status of the Squirrel. This window will be automatically opened to confirm significant changes to the Squirrel settings (e.g. whenever the Squirrel is set to start logging).

### *Meter*

The Meter Window shows all the current input states of all the currently enabled channels. The interval at which it is updated can be changed in the Settings|Preferences dialog box. The appearance of the meters can be controlled from the context menu, which is brought up by right clicking anywhere on the Meter Window.

### *Channel Setup*

A spreadsheet-style grid clearly shows each channel and its corresponding settings. Ranges, EU Settings, and Alarms can be reconfigured for individual or multiple channels from the Channel Setup Window. A context menu (which can be brought up by right clicking on the Channel Setup Window) shows the available options for the currently selected channel(s). Selecting Edit Channel brings up a tabbed dialog box from which all of the changes are made.

### *Transmitter Status*

This feature is for use with Eltek Telemetry Squirrels only. It displays information about the transmitters connected to the Squirrel.

### **15.7.6 Help Menu**

The Help Menu contains all of the normal help menu items for the program. A comprehensive on-line help system (including a tutorial section) gives all the information needed to get the most out of Darca.

## **15.8 The Graph Window**

The Graph Window may appear in two forms – the Offline Graph Window or the Online Graph Window. As well as displaying the graph and legend, both windows contain a toolbar that provides features to manipulate the graph:

### **15.8.1 The Offline Graph Toolbar**

#### *Graph Appearance*

This window allows general graph settings such as colour, gridlines, 3D graphing options and plot type to be configured. These settings are stored and are used whenever a new graph is opened.

#### *Chans / Axes*

This window provides control over the ranges of the graph axes and the selection of which channels are to be plotted on the graph and their assigned colour and axis.

#### *Cursor*

The graph cursor displays the exact data values at a point on the graph when it is clicked on.

#### *Thresholds*

Graph thresholds allow the plotting of threshold limits alongside the channels' data on the graph.

#### *Summary*

The summary window shows information about the Squirrel used to create the data, the data itself, and statistics calculated from the data.

#### *Note*

In order to identify meaningful points on the graph, notes may be drawn onto the graph which consist of a line at the relevant point together with a text label.

### **15.8.2 The Online Graph Toolbar**

The online graph toolbar contains many of the same tools as the offline graph toolbar. However, there are two additional ones:

#### *Save*

This saves all the data plotted on the online graph into a Squirrel DAT file which may be viewed later once contact is finished.

#### *Pause*

This pauses the flow of data onto the graph and stops it scrolling until pausing is finished, whereupon data received during the paused period will be plotted onto the graph.

## **15.9 Automated Contact with a Squirrel**

Darca's Automated Contact feature allows you to specify a number of tasks which you wish to be performed during a contact with a Squirrel. This is particularly useful if you have a number of Squirrels which all require a set series of operations to be performed during contact, or if you are using a modem to connect to your Squirrel and wish to minimise the length of the phone call. There are four tasks which may be performed on a Squirrel during automated contact: Download All Runs (the most recent run is always downloaded), Clear And Restart, Send Setup File and Update Time And Date. The Send Setup File option allows you to configure the Squirrel exactly as you require using a previously saved setup.

### **15.9.1 Scheduling Automated Contacts using Shed**

Shed allows you to perform scheduled automated contacts by launching Darca at a specified time. It is possible to specify the exact type of automated contact using command-line parameters, more details of which can be found in Darca's online help. You may schedule repeated automated contacts with a Squirrel by using the 'frequency' setting in Shed.

## 16. Safety and operating conditions

### 16.1 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.

### 16.2 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 5.9)
External Power Supply	14

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

### 16.3 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 1M $\Omega$  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  $\pm 15V$  with respect to datalogger ground. All other inputs and outputs have one terminal permanently connected to the datalogger ground.

### 16.4 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 remain sealed until the datalogger has warmed up to room temperature.

### **16.5 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 4.10.1). If 'Li' is displayed in the top right hand corner of the display, then the Lithium coin cell must be replaced.

### **16.6 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.

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.

### **16.7 Resetting the datalogger**

The 1000 Series Squirrel datalogger has a 'watchdog' facility that automatically resets the datalogger 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 black 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 it and leave it for 10 minutes before

reconnecting, and then press the reset button.

## 16.8 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 4.10.2 then the logger power supply fuse may be faulty. If none of the sensor supply outputs is working then the sensor supply output fuse may be faulty. If a current channel does not measure correctly then its fuse should 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. All fuses are the round plug-in types.

## 16.9 Sensor supply voltage

The Squirrel is shipped with the sensor supply voltage selector jumpers all set to 9V. If  $5V \pm 0.1\%$  is required to power a sensor, then an internal jumper needs to be moved. For more information on the sensor supply, see section 4.10.4.

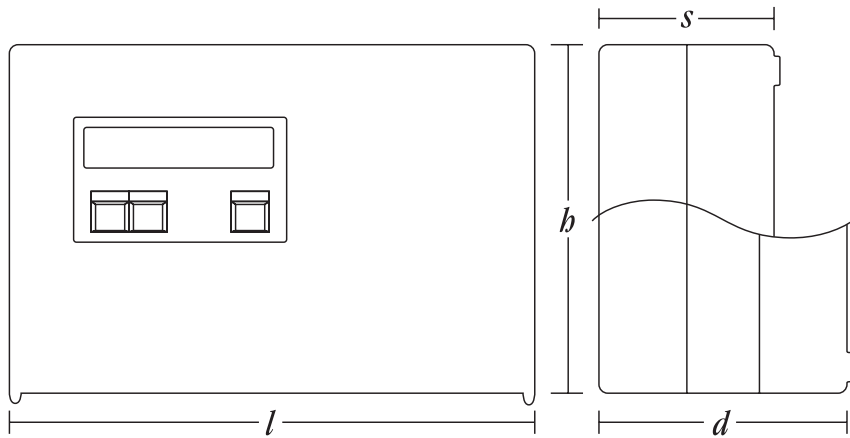
The method for removing the top of the case is detailed above, in section 16.8, **and the same cautions apply**. All boards down to the one that needs the adjustment will need to be removed. The sensor power jumpers should always cover two of the three pins, and are usually situated close the input connectors. 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.

## 17. Technical data

### 17.1 Inputs, ranges and resolutions

Input type	Available ranges		Resolution
Thermistor temperature (U) <i>Best resolution</i>	-50 to 150°C	-58 to 302°F	See below
		-5 to 75°C	0.05°C
		-25 to 5°C & 75 to 100°C	0.1°C
		-40 to -25°C & 100 to 125°C	0.2°C
		-50 to -40°C & 125 to 150°C	0.4°C
Thermocouple temperature (T) <i>Impedance: 100kΩ</i>	-200 to 200°C	-328 to 392°F	0.1°C
	-200 to 350°C	-148 to 662°F	0.2°C
Thermocouple temperature (K) <i>Impedance: 100kΩ</i>	-200 to 200°C	-328 to 392°F	0.1°C
	-200 to 450°C	-328 to 842°F	0.2°C
	-200 to 1200°C	-328 to 2192°F	0.5°C
PT100 temperature (P3/P4)	-200 to 100°C	-328 to 212°F	0.1°C
	-200 to 400°C	-328 to 752°F	0.2°C
	-200 to 600°C	-328 to 1112°F	0.25°C
DC voltage <i>Impedance: 1MΩ</i>	0 to 50mV	-25 to 25mV	50μV
	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 <i>Impedance: 10Ω</i>	4 to 20mA (as 0 to 100%)	
0 to 20mA		10μA	
Pulse count <i>Impedance: 1MΩ</i>	0 to 65,000		1
	0 to 650,000		10
Digital State <i>Impedance: 1MΩ</i>	0 to 255 00000000 to 11111111		

## 17.2 Specification



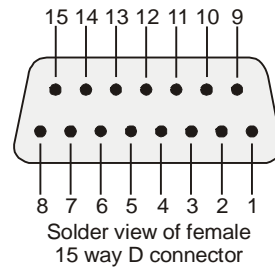
<b>Accuracy (at 20°C)</b>	Voltage $\pm 0.1\%$ of reading $\pm 0.1\%$ of span Temperature $\pm 0.2\%$ of reading $\pm 0.1\%$ of span
<b>Environment</b>	Ambient temperature -30 to 65°C. Humidity up to 95% (non-condensing).
<b>Power supplies</b>	Internal: six size AA manganese-alkaline batteries (such as Duracell MN1500). External: 9-14V DC at 100mA.
<b>Battery life</b>	At least 6 months with 8 channels recording every 5 minutes.
<b>Clock accuracy</b>	1 second/day at 20°C.
<b>Physical details</b>	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.
<b>Interface</b>	RS232C at these baud rates: 300, 600, 1200, 2400, 4800, 9600.
<b>RS232 Output</b>	6 pin female mini-DIN socket.
<b>Sensor power</b>	0-60 seconds, 50mA maximum total load.
<b>Digital inputs</b>	Pulse count, event, external trigger. Impedance: $1M\Omega$ Start/low 0 to 0.5V DC or contacts closed. Stop/high 4 to 6V DC or contacts open.

## 18. Connections

### 18.1 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:

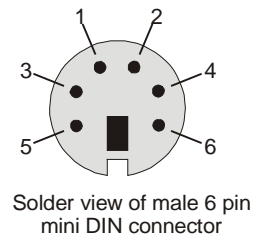
15 way male D	Description
1	Event bit 8 (MSB)
2	Event bit 7
3	Event bit 6
4	Event bit 5
5	Event bit 4
6	Event bit 3
7	Event bit 2
8	Event bit 1 (LSB)
9	Digital ground
10	Alarm output
11	Relay contact 1
12	Relay contact 2
13	Digital ground
14	External trigger input
15	Spare input



### 18.2 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 (S2 out)
2	Serial output
3	Digital ground
4	+9V output
5	Reserved (S2 in)
6	Serial input



### 18.2.1 LC69 connection details

For connecting a 1000 Series Squirrel to a modem, the cable LC69 is required:

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
4, 5 & 20	Link A	

### 18.2.2 LC68 connection details

For direct connection to a 1000 Series Squirrel, the cable LC68 is used:

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
4 & 6	Link A	
7 & 8	Link B	

### 18.2.3 Network cable connection details

As for LC68, but all the 1000 series Squirrels are connected in parallel:

PC 9 way female D connector	Squirrel 1 6 way male mini DIN connector	Squirrel 2 6 way male mini DIN connector		Last Squirrel 6 way male mini DIN connector
5	3	3	Repeat	3
3	6	6	For all	6
2	2	2	Loggers	2
4 & 6				
7 & 8				