DL4 4-CHANNEL DIGITAL LOGGER

INSTALLATION & OPERATION INSTRUCTIONS

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TABLE OF CONTENTS

1. INTRODUCTION

This document describes the installation, commissioning, operation and maintenance of the DL4 4-channel logger. All hardware aspects are covered in detail but the software aspects of commissioning and operation are only covered as an overview.

1.1 Overview

The DL4 logger provides secure reliable logging of digital inputs. The normal use of the logger is to count pulses generated by volt-free contact closures and store the number of pulses recorded over a configurable time interval (typically every 30 minutes). Alternatively the logger can monitor the state of an input and store the time and date of any changes of state (on-to-off or off-to-on).

The logger is mains powered but the logged data is kept in non-volatile (battery supported) storage so that logged readings are maintained while the mains power is off. The logger can be supplied with a UPS (Un-interruptible Power Supply) that allows data to be logged for several days without mains power.

The logger can provide security of data with 4 levels of passwords, but for applications that do not require this, the logger can be programmed to operate without passwords.

The logger is fully configurable in terms of channel type, logging interval, channel size and security, and can also be configured to generate channel alarms.

The logger has a number of communications options, including an integral telephone modem and an RS485 network. The RS485 network allows a number of inter-linked loggers to be interrogated from a central point or via a single modem connection. The DL4 logger is fully compatible with other SHM loggers (eg. the UL8 Universal 8-channel logger) and these loggers can be networked in any combination.

All SHM loggers communicate using the same efficient reliable real-time protocol.

There are a number of software applications that can communicate with SHM loggers :-

- Stark RT (Windows). This is a full-function real time energy monitoring and reporting suite that will collect data automatically from SHM loggers and provide comprehensive analysis of the data.

- UREAD (DOS). This is a utility that can collect data locally from an SHM logger and store the data in a file for subsequent import into Stark RT. It is designed for use if the communications link to a logger is temporarily unavailable.

- UCSV (DOS). This utility collects data from an SHM logger and stores it as a Comma-Separated-Value (CSV) file that can be imported into database and spreadsheet programs (eg. Microsoft Excel).

- UCOMM (DOS). This utility is required to commission and configure an SHM logger. If SHM carry out the commissioning of the logger on site, the user may not need this utility, unless there is a requirement to alter the configuration subsequently.

1.2 Safety Warning

The installation of the Logger requires connection to hazardous voltages, and should only be undertaken by suitably qualified personnel. The main circuit board has exposed voltages at mains live potential.

The equipment should be connected to the supply earth at terminal E of terminal block TB1.

Always ensure that the equipment is installed with the above earthing arrangements in place.

1.3 Electromagnetic Compatibility (EMC)

To comply with EMC regulations, the DL4 should be installed with regard to minimizing interference to any sensitive equipment nearby.

The use of screened cables ensures minimal RF interference and also reduces the susceptibility of the system to external interference.

When using screened cable, the screen should be earthed at the logger end on the spade connector provided (PL7), and with as short a tail as possible. The length of the un-screened conductors as they emerge from the screen to the terminal block should also be kept as short as possible.

In certain circumstances, un-screened cables (eg. multi-pair 'telephone' type cable) may work satisfactorily. In these cases the cable runs should be short, and should not run alongside high-current power supply cabling. However, if in doubt, screened cabling should be used.

1.4 Disposal (WEEE)

In the European Union, this symbol indicates that this product is not to be disposed of with household waste, according to the WEEE Directive (2002/96/EC). This product should be deposited at an appropriate facility to enable recovery and recycling. For more information about disposal of waste electronic equipment, contact your local waste authority, approved WEEE scheme or household waste disposal service.

1.4.1 Battery Disposal

Caution. Do not dispose of the batteries in a fire or with household waste. Contact your local waste disposal agency for the address of the nearest battery disposal site.

2. INSTALLATION

2.1 Siting

The logger should be sited with regard to the length of cabling required, the proximity to a telephone socket (if required) and the availability of a mains supply.

The logger will typically be interfaced to the pulse outputs of up to 4 meters, but quite long cable runs from logger to meter are permissible. Hence proximity to the meters need not be an issue, particularly if a site is already wired with a multi-pair cable network.

The optional integral modem is supplied with a 3 metre cable. If possible the logger should be sited within 2m of a BT telephone socket.

If the logger is to communicate directly with a PC (rather than via a modem) then the logger should ideally be sited less than 15m from the PC. In situations where this is not possible, an RS485 link (this is an option that must be ordered) can be used, allowing PC to logger distances of up to 1500m.

The logger should also be reasonably close to a mains supply, either a switched fused spur (preferable) or a 13A socket.

In addition, the minimum clearances specified in Figure [1] should be observed, otherwise access to the cable-entry glands and local interrogation socket will be difficult.

2.2 Fixing

Release the 4 screws at the corners of the polycarbonate lid of the DL4 and remove the lid.

The logger base plate is fixed to the wall by four screws, one at each corner.

The fixing holes can either be pre-drilled using the dimensions given in Figure [1], or the base plate can be used as a template.

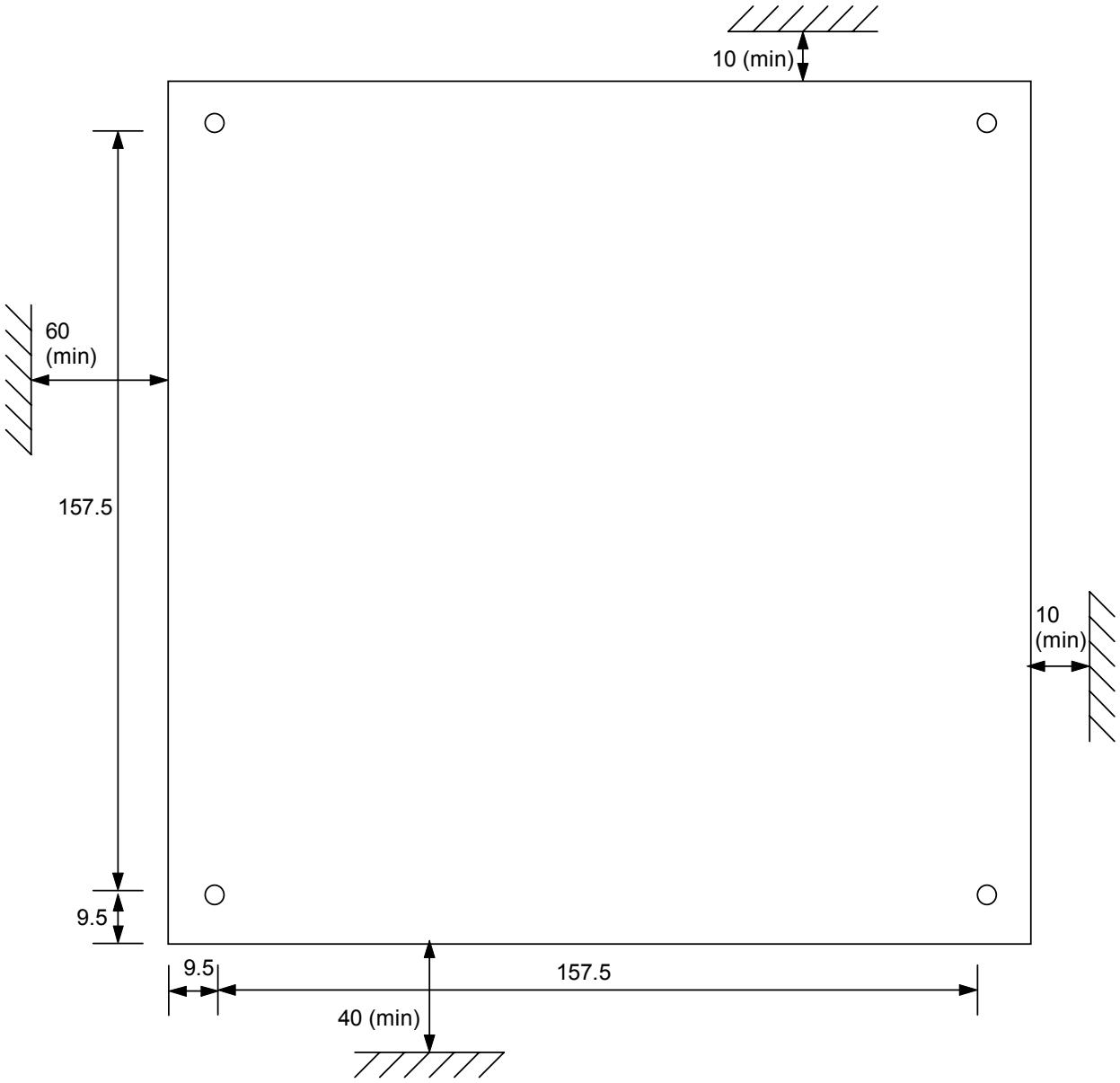
Fixing screws may be up to 3.5 mm diameter (No. 8) and must be pan-head. Note the effective “thickness” of the logger is 10mm.

NB. Ensure sufficient clearance below the logger for cable entry via the conduit connectors, and to the left for the RS232 connection.

Figure 1 - Fixing Hole Dimensions

All dimensions in millimetres.

Ensure minimum clearances around enclosure are observed.



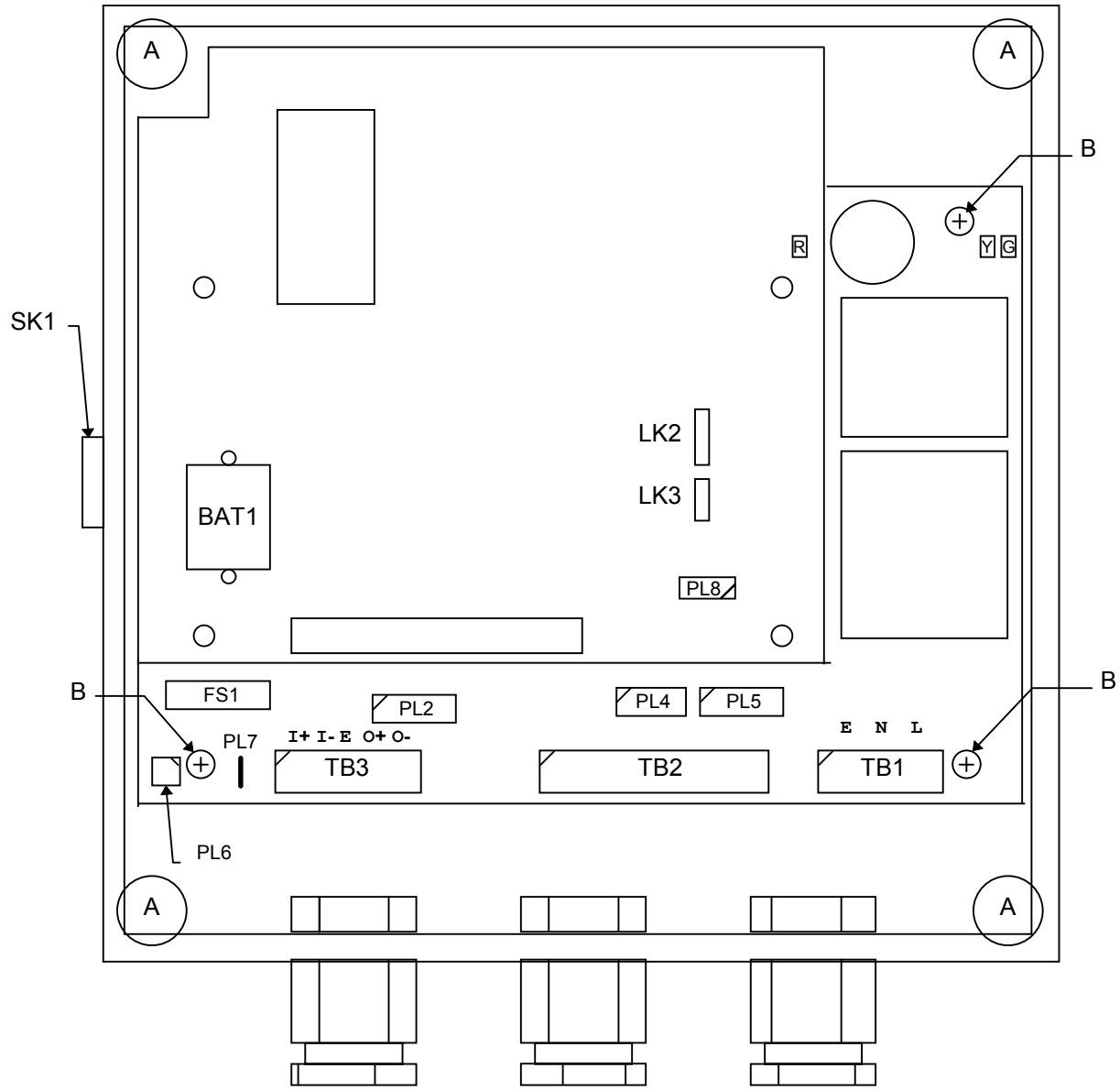
2.3 Wiring

All cabling must enter the logger through the enclosure base via the bottom face. Three 20 mm diameter knock-outs are provided. These are easily removed by using a screwdriver to lever them out. These holes are designed to take conduit fittings if required.

All connections to the logger circuitry are plug-in. The mains power and input connections use plug-in screw terminal blocks. If the logger is to be commissioned at a later date, the mains and input connections can be left unplugged if desired.

NB. Refer to the safety warning in section 1.2. It is important that the 'E' terminal of TB1 is earthed.

Figure 2 - PCB and Connector Layout



NB. In the above figure, holes marked 'A' are for the screws that fix the logger to the wall. Holes marked 'B' are for the screws that fix the logger PCB sub-assembly to the enclosure.

NB. Not all connectors shown will be fitted to the logger PCB. The actual connectors fitted will depend on which options have been ordered.

2.3.1 Mains

This connects via the 3-way terminal block TB1. The mains Live, Neutral and Earth connections are labelled **L**, **N** and **E** respectively. TB1 is a 2-part plug-in screw terminal block.

Typical power taken will not exceed 3 Watts and a supply spur fused at 3A is recommended.

Note that the DL4 is designed for operation on a fixed voltage, normally 230 volts AC (nominal).

2.3.2 Inputs

These connect via the 8-way terminal block TB2. The inputs are marked **1** to **4**, and the common earth terminals are marked '**-**'. TB2 is a 2-part plug-in screw terminal block.

Screened "Twisted Pair" cables are preferred for wiring up the inputs. A screened multi-core cable is a suitable alternative. Unscreened cable may be suitable for some installations.

The screen or screens of the input cables should be wired to the earth spade connector (PL7) next to TB3. The length of the tail from the screen to the earth tag should be kept as short as possible (less than 2 cm).

Cable runs of up to 1000m should be possible. With long runs, thicker cable may be needed to minimize the cable resistance.

The following diagram shows how to connect volt-free contact pulse outputs and transistor switch outputs. Note that for transistor outputs, the correct polarity must be observed. For volt-free relay contacts, the polarity does not matter.

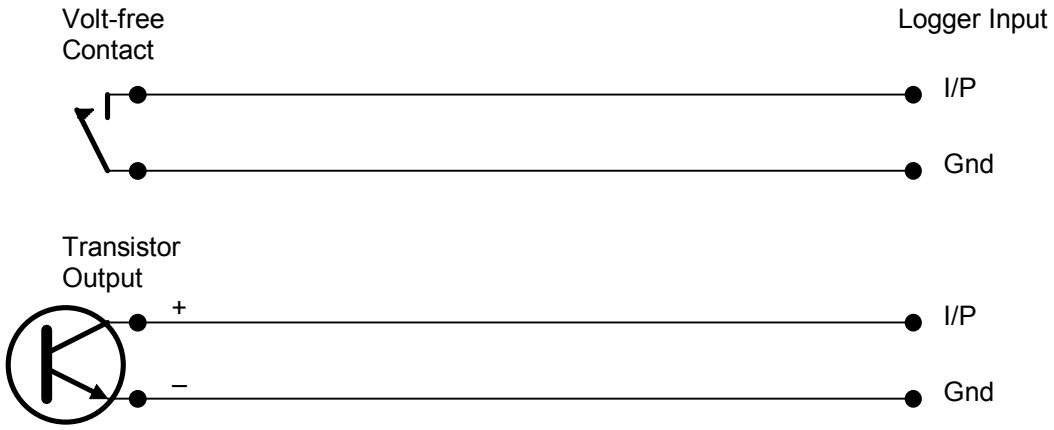


Figure 3 - Input Connection Circuit

2.3.3 Telephone

If the optional integral modem is fitted, it will be located on the underside of the main PCB underneath TB2 (this is not illustrated in Figure [2]). The modem has an RJ12 socket on the front for connection to the telephone line. A 3m lead with an RJ12 plug on one end and a standard BT 431A plug on the other is provided with the modem. If a longer lead is required, the one provided can be extended with a normal telephone extension lead.

2.3.4 Network

This connects via the 5-way terminal block TB2. The inputs are marked **I** + and **-**, the outputs are marked **O +** and **-** and the common earth terminal is marked **E**. TB3 is a 2-part plug-in screw terminal block.

The network uses RS485 signalling, which is a physical link standard for communicating serial data over long distances ('long range RS232').

Screened "Twisted Pair" cables are strongly recommended for wiring up the RS485 network. The RS485 network is actually a chain, with the **O+** and **O-** of one logger connected to the **I+** and **I-** inputs respectively of the next logger in the chain.

The screen of the network cables should be wired to the common earth terminal on TB3. The length of the tail from the screen should be kept as short as possible (less than 2 cm). Cable runs of up to 1500m should be possible.

The following diagrams show the different ways of connecting up loggers using the RS485 interface. Note that in all cases, the correct polarity of the Receive and Transmit signals **must** be observed.

NB If connecting to the logger network at RS232 levels (eg. PC or external modem), then connection should be via the Remote Communications Port (PL2). The set-up is then similar to Figure [4].

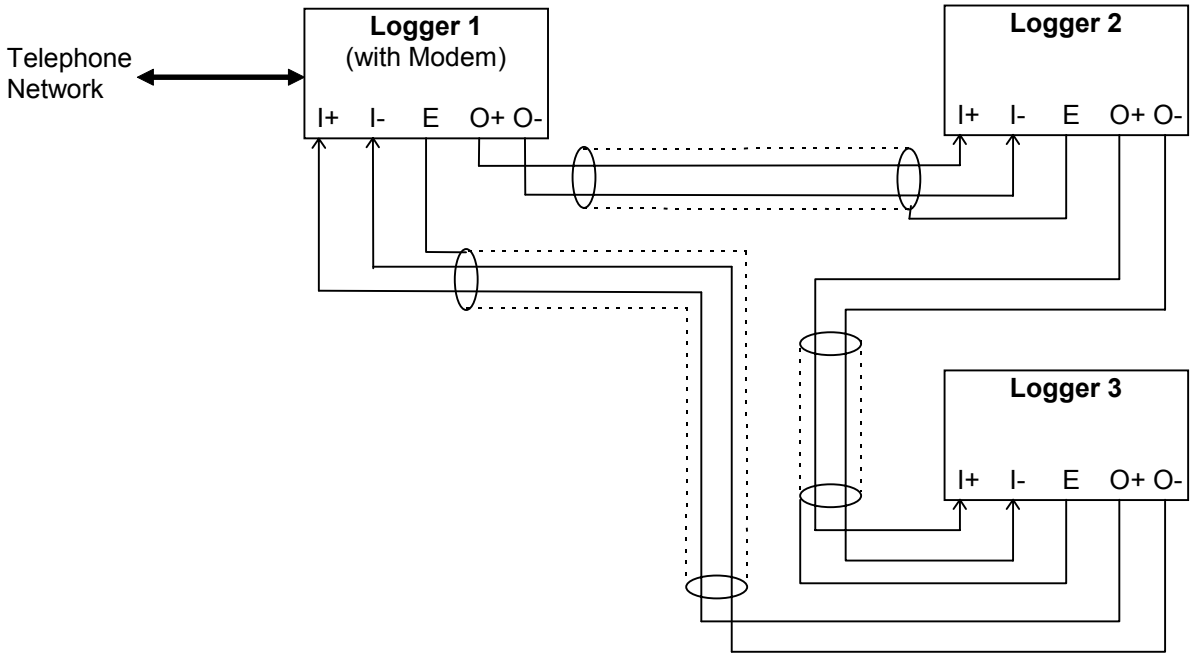


Figure 4 - RS485 Network interrogated via a modem

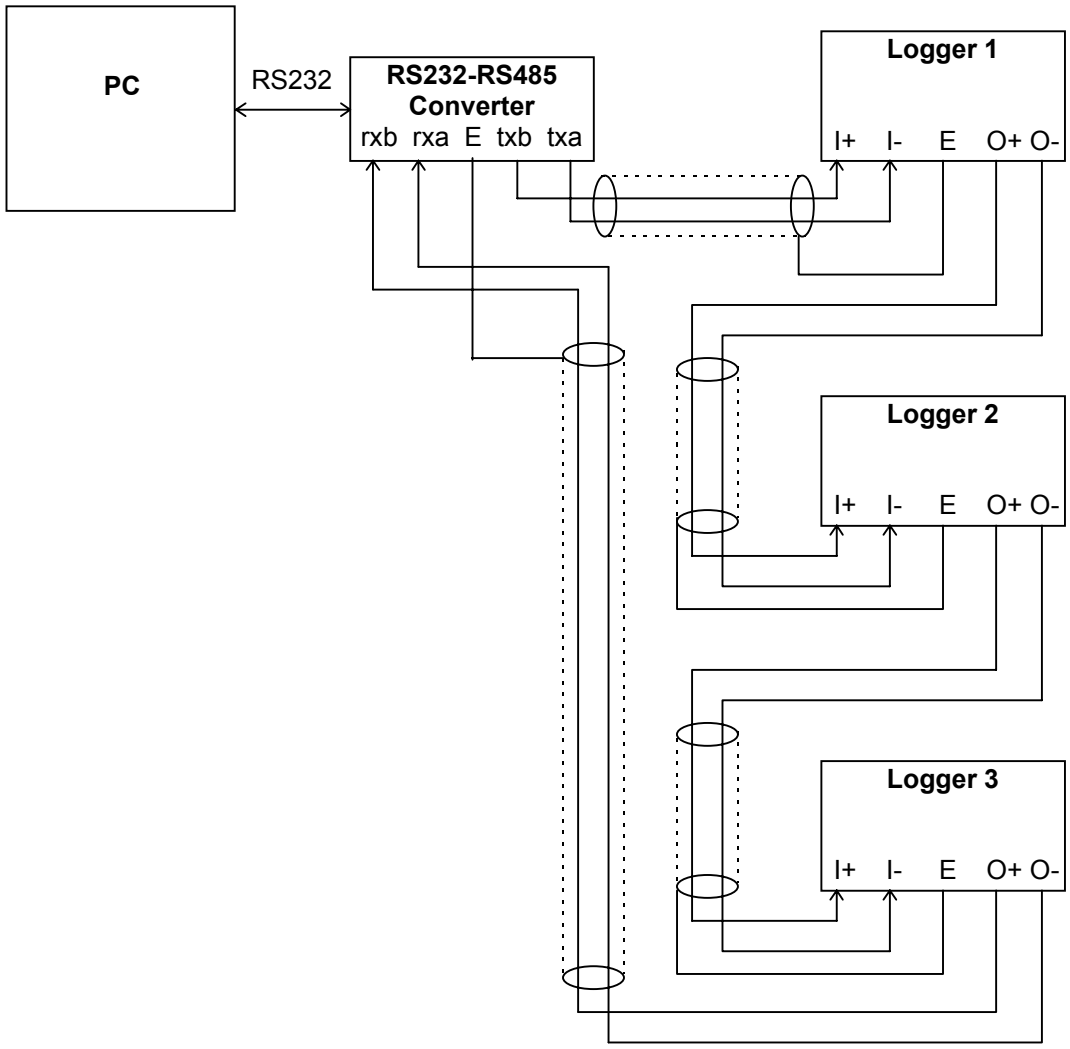


Figure 5 - RS485 Network directly connected to PC

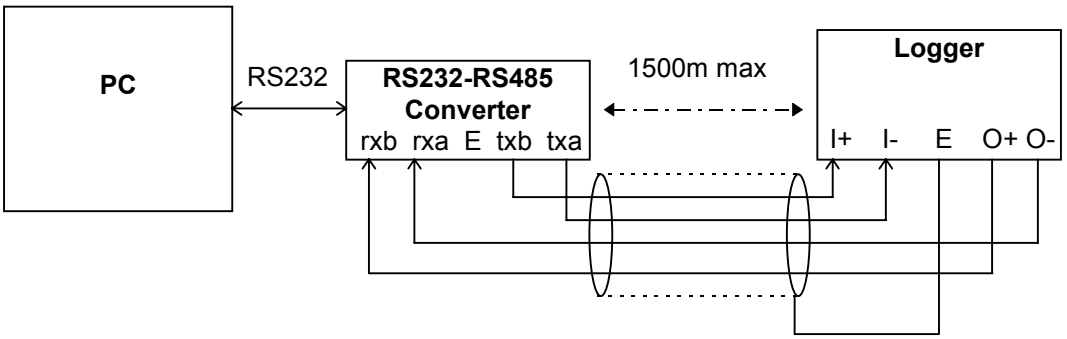


Figure 6 - Single Logger - Direct (long distance) connection to PC

2.3.5 Cable Types

Screened cables are recommended for all external connections for the logger. Apart from that, the type of cable used is not critical, and the terminal blocks will accept a wide range of types and sizes. However, for users requiring examples of suitable cables, the following table gives details of some specific types.

Mains Cables	Conduit cables	24/0.2 (0.75 mm^2) Tri-Rated (BS6231, CSA TEW, UL 1015) (Eg. RS 364-354)
	3-core cable	24/0.2 (0.75 mm^2) (BS6500) (Eg. RS 378-094)
Pulse / Status Inputs	Conduit cables	16/0.2 (0.5 mm^2) Tri-Rated (BS6231, CSA TEW, UL 1015) (Eg. RS 364-281)
	Twisted-Pair (Screened)	7/0.254 (22 AWG) (Eg. RS 360-649)
	Multi-Core Screened	7/0.2 (0.2 mm^2) (Eg. RS 367-454)
RS485 LAN Cables	Twisted-Pair (Screened)	7/0.254 (22 AWG) (Eg. RS 360-649)

3. COMMISSIONING

The commissioning process consists of :-

- Inspecting the installation
- Powering up the logger and checking basic functionality
- Programming the logger configuration using UCOMM
- Verifying that all sensors / transducers are working, connected and being recorded
- Generating an electronic configuration certificate
- Completing a Logger Commissioning Record

Use of the UCOMM commissioning utility requires specialist knowledge of the logger and its operation.

3.1 Initial Checks

Check that the links on the upper PCB are correctly installed for options supplied. Refer to section 4.5 for details.

Ensure all connectors are properly plugged in.

If the logger is supplied with a UPS, plug in the main battery (connector PL5 - if it is not already connected). Switch on the mains supply and check that the green and yellow indicators (Mains & Charge) are lit and that the red Heartbeat indicator is flashing. If the UPS option has not been ordered, there will be no main battery and the yellow indicator should be off.

3.2 Configuring using UCOMM

UCOMM is a special configuration software utility available separately from SHM. The logger can be pre-configured prior to installation, or it can be configured after installation.

The use of UCOMM is covered in a separate manual.

The logger has a software-programmable configuration that is stored in non-volatile EEPROM memory. This means that it is retained even when all mains and battery power is disconnected. UCOMM is used to read, display, edit and store this configuration information.

The following parameters should be set or checked using UCOMM :-

1. The Logical Logger Number. For a single-logger installation, the default of 1 can be used. However for an RS485 network of loggers, each must have a unique Logical Logger Number. It is most convenient to program this to 11, 12, 13 etc. in order round the network.

2. The option codes "Option A" and "Option B". These ensure that the logger firmware recognises the options fitted. Refer to the UCOMM manual.

3. If any special firmware features, such as "Dial In", "Modem Answer Window" or "Alarms" are required, these must be suitably configured.

4. Channel configuration for each channel. For Digital (Pulse) channels, this comprises :-
   Logging Interval
   Physical Input number
   Channel Size (memory allocation)
   Pulse pre-scaler value
   Initial count

5. If alarms are required, they should be enabled for the alarm channels and the high and low thresholds set.

6. The logger time. NB. It is normal for the logger to use the same time reference all year (eg. Greenwich Mean Time) rather than re-program it for daylight saving times.

It is advisable to check the configuration data after installation, even if the logger has been pre-configured. In particular, if the Memory battery has been disconnected at any time or become discharged, then the logger's clock / calendar will not have a valid time, and the correct time will need to be commissioned before the logger begins logging.

3.3 Verification

Connect a portable PC to the 9-way D connector (SK1) and run the configuration utility UCOMM on the PC.

Check that the configuration can be read and is correct.

Check that the logger's time and date are correct.

Use the 'Read Channels' function to display all the channel inputs. Where possible, check that each input is operating correctly as follows :-

- For Pulse inputs, the advance in the count can be compared to the advance on the meter registers, or pulses can be artificially induced by shorting the cable at the far end.

- Status inputs can be tested by changing the state of the device being monitored.

If the logger is fitted with a modem, check by dialling from another location that the logger answers the line and that data can be read.

In normal every day use, the logger will be interrogated by a specialist software application, such as Stark RT Energy Monitoring Software. The final step is to configure the application with details of the logger, and check that it will interrogate the logger correctly, via modem, LAN or whatever communications medium is being used.

4. DESCRIPTION

4.1 Indicators

The DL4 Logger has three indicator LEDs. The LED functions are as follows :-

- **AC Mains** - Green (Lower PCB). Indicates presence of the mains supply when lit.
- **Battery Charge** - Yellow (Lower PCB). Indicates that the main battery is connected and is being charged when lit.
- **Heartbeat** - Red (Upper PCB). Flashes briefly once per second showing that the main processor is properly functioning.

  If the flashes are so brief as to be barely visible it may indicate that the clock / calendar does not have a valid time and date. The logger will not log anything in this state, but all that is required to restore normal operation is to set the logger to the correct time.

4.2 Connectors

Refer to Figure [2] which shows the position of the connectors on the DL4 main PCB. Some connectors are only fitted if the logger has been ordered with a specific option. Pin 1 on each connector is indicated on the figure by a diagonal line.

TB1 - Mains Supply This 3-way terminal block provides the mains Live, Neutral and Earth connections (labelled **L**, **N** and **E** respectively).

1	Earth
2	Neutral
3	Live

TB2 - Channel Inputs

This 8-way terminal block connector provides connections for the 4 logger inputs.

Each logger input consists of two terminals, the Input itself and the Common (ground). The numbered terminals refer to the Input Number. Terminals marked with a dash are commoned together to the ground of the logger circuitry.

1	Input 1
2	Ground
3	Input 2
4	Ground
5	Input 3
6	Ground
7	Input 4
8	Ground

TB3 - RS485 Network

This is a 5-way terminal block (only fitted if the RS485 network option has been ordered). There are 2 terminals for the receiver input, 2 terminals for the transmitter output and a common earth terminal. Note that the transmitter and receiver connections are polarity-sensitive.

1	Receive Data +
2	Receive Data -
3	Earth
4	Transmit Data +
5	Transmit Data -

SK1 - Local Communications Port

This is a 9-way D-type socket. This connector can be used as a V24/V28 (RS232-C) connection to an adjacent PC using a straight-through lead.

The signals supported are RXD and TXD. The connector is wired as a DCE, so it can be connected directly to a PC serial port (which is wired as a DTE).

2	RXD (output)
3	TXD (input)
5	Ground
6	DSR (+5v output)

PL2 - Remote Communications Port This is a polarized 6-way plug. It is intended for connection to a BT modem or radio modem where remote interrogation of the logger is required.

It is also used for accessing an RS485 network of loggers at RS232 levels.

The signals supported are RXD, TXD and DTR, and the connections below are labelled as a DTE. Connection to modems requires a special cable which should be ordered separately.

1	No connection
2	TXD (output)
3	RXD (input)
4	Ground
5	No connection
6	DTR (output)

PL4 - Modem Serial Switch This is a 5-way polarized plug (only fitted if the Modem Serial Switch option has been ordered).

Connection to the Modem Serial Switch requires a special cable which is supplied when this option is ordered.

1	RXD from modem
2	Switched RXD
3	TXD to modem
4	Switched TXD
5	Ground

PL5 - Pulse Output This is a 6-way polarized plug (only fitted if the Relay option has been ordered). It has two sets of change-over contacts. A mating socket with flying leads is supplied when this option is ordered.

1	Normally Closed 1
2	Common 1
3	Normally Open 1
4	Normally Closed 2
5	Common 2
6	Normally Open 2

PL6 - Main Battery This is a polarized 2-way plug. It connects to the 7.2V main battery pack which is secured under the sub-chassis.

1	Battery +
2	Battery -

PL7 - Earth This is an earthed single-pole blade connector.

PL8 -Diagnostic This is a polarized 4-way plug. It allows a diagnostic connection to the transmit and receive data on the communication port.

1	Earth
2	TXD
3	RXD
4	+5 volts

4.3 Fuse

The supply from the battery is fitted with a 20mm 500mA quick-blow fuse **FS1**.

4.4 Batteries

Two batteries are normally provided in the standard unit.

4.4.1 Main Battery

The operating main battery is a 7.2V Nickel-Cadmium 6-cell battery pack and forms part of the logger UPS. This is maintained on constant trickle charge and provides approximately 5 days of continuous logging after the mains supply fails. Full recharge takes approximately 24 hours, though the logger will function normally as soon as mains is re-applied. The main battery pack lead is normally NOT plugged in to the logger as shipped.

4.4.2 Memory Battery

The memory battery is a 3.6V Nickel-Cadmium battery which is also maintained on trickle charge. This provides memory retention of the logged data for 1 month in battery-supported RAM (random access memory). The memory battery also powers the crystal controlled clock calendar circuit. The memory battery is plugged into the upper circuit board and retained by a cable clip.

4.5 Configuration Links

The logger PCBs have jumper links which are used to further configure the operation of the unit. These links are 0.1" pitch shorting jumpers which plug into arrays of 0.1" spaced pins.

The table below shows the links required for various combinations of options. Any option combinations not shown are not permitted.

Integral Modem	Extern. Modem	RS485 Network	RS485 Direct Conn.	Modem Serial Switch	LK 2	LK 3
					NORMAL	NORMAL
●					NORMAL	NORMAL
	●				NORMAL	NORMAL
		●			NET & /MOD	NORMAL
●		●			NET & MOD	NORMAL
	●	●			(omit)	NETACC
			●		NET & /MOD	NORMAL
				●	NORMAL	NORMAL
		●		●	(omit)	NETACC

NB. For the combination RS485 and External modem, the RS232 connection to the modem MUST be made via the Remote Communications Port PL2.

5. OPTIONS

5.1 Hardware Options

The functionality of the basic logger can be extended by fitting various options. These must be factory fitted. Loggers cannot be upgraded in the field.

5.1.1 Modems

5.1.1.1 Integral BT Modem

A special BT modem can be fitted on the underside of the lower PCB. It has a socket on the front for the line connection and is supplied with a cable that plugs into a standard BT line socket.

The modem is supplied programmed with a profile to suit the operation of the logger. It usually factory-programmed using the following AT commands :-

1	AT&F0E0	Set factory profile zero WITHOUT echo
2	AT&K4	Software flow control
3	ATS0=1	Auto-answer after 1 ring
4	AT&Z0=01962...	If dial-in required, telephone number that logger is to dial.
5	AT&W0	Store as power-up profile

5.1.1.2 External Modems

External modems are connected via a special cable (which must be ordered separately) connected to PL2.

To operate correctly (particularly with the Modem Answer Window and Dial-In software options, the modem profile must be set for the following :-

1. **NO** local echo
2. XON/XOFF flow control
3. Answer after 1 ring
4. Disable answer if DTR off
5. If dial-in required, the number to dial

For a US Robotics 14400 modem, these settings correspond to the following AT commands :-

1	AT&F2E0	Set software flow-control factory profile WITHOUT echo (also sets DTR mode)
2	ATS0=1	Auto-answer after 1 ring
3	AT&Z0=01962...	If dial-in required, telephone number that logger is to dial.
4	AT&W0	Store as power-up profile

5.1.2 RS485

This option allows a number of loggers to be connected up in a chain network, using a 2-wire plus earth cable between each logger. The maximum distance between each link in the chain is 1500m.

The two ends of the chain are connected to the PC that is to interrogate all the loggers. This PC requires an RS232 to RS485 adapter to be fitted. Alternatively, one of the loggers can be fitted with an integral or external modem, to act as the common access point. Access from PC to any of the loggers is then via dial-up modem.

This option can also be used for direct connection to a PC where the distance involved means that RS232 would not work. The PC requires an RS232 to RS485 adapter to be fitted.

5.1.3 Modem Serial Switch

This option allows the logger to share an external modem with another device.

A special ‘T’ cable is supplied with this option that is interposed between the modem and the other device and also connects to the logger. Serial communications are normally directed to the other device, but when a special command is received, serial communications are switched over to the logger.

This option can also be used with a network of loggers connected via RS485.

NB. This option cannot be fitted in conjunction with the Relay Output option.

5.1.4 Output Relay

This option provides a pair of volt-free changeover relay contacts. These contacts can be programmed to provide a 30-minute synchronization pulse, or to provide an alarm notification.

A cable that plugs into the relay connector is provided with this option.

NB. This option cannot be fitted in conjunction with the Modem Serial Switch option.

5.2 Software Options

The following software options are available on all loggers and can be enabled as part of the configuration process.

5.2.1 Modem Answer Window

The Modem Answer Window option is allows a logger to share a telephone line with another device. If enabled, the logger only answers calls during a pre-programmed time window. The logger's modem is programmed to answer after only one ring. If the line is shared with a FAX or other modem or answering machine, this must be programmed to answer after more than one ring to prevent conflict.

The window start and end time are programmed into the logger as times of day (hh:mm). The window is at the same time every day. If the start and end times are programmed with identical times, the logger will answer call at any time of day. If the start and end times are programmed with the special dummy times 24:00 and 24:01, the logger will never answer calls.

Note that for testing purposes it possible to get the logger to answer the calls outside the normal window if a special ring sequence is used.

5.2.2 Dial In

This is another function that allows a logger to share a telephone line with another device. With Dial-In, the logger (or network of loggers connected via RS485 links) is programmed to dial the number of the controlling PC at a specific time every day. The actual time of first dial-in is randomized with a delay of up to 10 minutes, and the logger will keep trying for up to one hour if it cannot get through. A Dial-In logger can share the line with any device without restriction.

The dial-in start time is programmed into the logger as a time of day (hh:mm). If this the dial-in time is programmed with the special dummy time 24:00, then dial-in will be disabled. The telephone number dialled is stored in the modem profile rather than the logger.

Where an RS485 network is used, the dial-in start time is programmed into the logger that is connected to the modem.

5.2.3 Alarms

A logger can be programmed to check its inputs for alarm conditions and notify the user if any parameter goes out of limits.

Each channel in the logger can be programmed with two alarm thresholds (High and Low). The channel can be programmed to generate an alarm if its reading is between the two threshold values or outside the two values. Each channel alarm can also be individually enabled or disabled.

When an alarm condition is detected, an Alarm Flag is logged alongside the historical data.

The logger can be programmed to use latching or non-latching alarms.

Non-latching alarms are simplest - when the channel reading changes to a non-alarm value, the channel alarm ceases.

Latched alarms are used if the alarm state is to persist until acknowledged by the user, even if the original alarm condition ceases. The alarm is acknowledged by sending a special message to the logger. Acknowledging the alarm will clear the alarm state even if the channel reading is still at an alarm value. The channel alarm will only be re-activated if the reading subsequently changes from a non-alarm value to an alarm value.

The way an alarm is detected depends on the type of channel as follows :-

- Digital channels are checked once per minute (at 00 seconds) using the increase in count since the start of the whole logging period. Note that if the alarm becomes active during one logging period, it will stay on at least until the end of the next logging period (as it is only at this time that it is clear that the channel is not going to generate an alarm again).

- Status channels are checked once per second.

When alarms occur, the logger can be programmed to notify the user using the optional relay and/or by dialling in to a PC. The telephone number dialled is stored in the modem profile rather than the logger.

The relay is provided with contacts that are closed for the non-alarm condition and open for the alarm condition. This means that if the logger power fails or if the cable is cut, an alarm will be raised.

If notification is via the on-board relay, it is possible to program one of the logger inputs to be used for a reset button or remote contact that will cancel the relay alarm. Once the alarm relay has been reset, it will only be re-activated if a new channel alarm occurs.

For each channel, the alarm type can be configured to :-

- Disabled Channel does not generate alarms

- Inside Window Alarm if channel reading >= Low and <= High

- Outside Window Alarm if channel reading < Low or > High

The High and Low thresholds can be programmed, but the Low threshold cannot be greater than the High threshold (although they can be the same).

Alarm notification is a separate process that can depend on the alarm state of one or more channels. The following parameters configure the notification process :-

- Latched Mode Enables / Disables latched alarms for all channels

- Alarm Mask Determines which channel(s) generate alarm notifications

- Relay Notif. Enables / Disables notification via optional relay

- Dial-in Notif. Enables / Disables notification via dial-in. If enabled, the logger should either be fitted with a modem or be on an RS485 network accessed via a modem.

- Reset Input Determines which logger input (if any) is used to cancel notification via the relay

Operation of alarm notification is explained below.

5.2.3.1 Non-Latched Alarms

In this mode, the alarm notification (relay and / or dial-in) can be cancelled (if required), but the occurrence of a new alarm will re-trigger notification. If alarm notification is not cancelled, the notification simply follows the alarm condition. The alarm relay will be activated :-

1. When any un-masked channel alarm changes from off to on

The alarm relay will be de-activated :-

1. When all un-masked channels alarms are off

2. When the alarm reset input (if configured) is shorted to ground

The logger will begin dialling in :-

1. When any un-masked channel alarm changes from off to on. If the logger and its modem control access to an RS485 network, this applies to any un-masked channel in any logger on the network

The logger will stop dialling in :-

1. When all un-masked channels' alarms are off. If the logger and its modem control access to an RS485 network, this means all un-masked channels in every logger on the network

2. When the logger receives a "Stop Dialling In" message

5.2.3.2 Latched Alarms

In this mode, the alarm notification (relay and / or dial-in) can be cancelled (if required), but the occurrence of a new latched alarm will re-trigger notification. If alarm notification is not cancelled, the notification can only be de-activated by sending messages to acknowledge all channels generating alarms. The alarm relay will be activated :-

1. When any un-masked channel latched alarm changes from off to on. If the logger and its modem control access to an RS485 network, this applies to any un-masked channel in any logger on the network

The alarm relay will be de-activated :-

1. When all un-masked channels' latched alarms are off. This can only happen if all active alarms are acknowledged by messages from the PC. If the logger and its modem control access to an RS485 network, this means all un-masked channels in every logger on the network.

2. When the alarm reset input (if configured) is shorted to ground

The logger will begin dialling in :-

1. When any un-masked channel latched alarm changes from off to on

The logger will stop dialling in :-

1. When all un-masked channels' latched alarms are off. This can only happen if all active alarms are acknowledged by messages from the PC.

2. When the logger receives a "Stop Dialling In" message

6. MAINTENANCE

In the unlikely event of failure, the entire electronics sub-assembly can be unplugged and removed very easily to be returned to SHM for repair or exchange.

6.1 Removing the Sub-Chassis

If you need to remove the sub-chassis, first unplug any connectors that are wired up.

The sub-chassis is secured to the base of the enclosure by three 38 mm long self-tapping screws (marked 'B' on Figure [2]). Once these screws are removed, the entire sub-chassis can be removed. The sub-chassis must be manoeuvred so that the 9-way D-type connector on the left hand side clears the cut-out in the base of the enclosure.

Replacement is the reverse of the removal procedure. When manoeuvring into position, ensure that the 9-way D-type connector on the left hand side engages in its cut-out.

6.2 Battery Life

The batteries are maintained on low trickle charge with complete discharge occurring only rarely when there are extended power cuts. Under these conditions the batteries can be expected to last for a period in excess of 5 years.

6.3 Battery Replacement

When the main battery requires changing the sub-chassis must be removed from the main enclosure to release the battery. Removal of mains supply and main battery will cause the logger to stop logging. When the main battery is replaced the logger should not lose data or time since these are maintained by the memory battery.

The main battery will support time and data retention while the memory battery is changed.

If both the main battery and the memory battery are disconnected in the absence of mains power, then the logger will lose memory of its logged data and the clock will stop. However, it will not lose its personality profile which is maintained permanently in EEPROM memory.

NB. If the clock stops because of removal of the battery, then the logger will need to have the time and date re-commissioned before it will start logging again.

When changing one or both batteries the personality profile should be checked with a local portable PC first, and confirmed to be the same after the installation is complete. The calendar clock setting should also be checked and reset if necessary.

7. TECHNICAL SPECIFICATION

Digital Inputs	Quantity		4 digital inputs
	Pulse Counting Inputs		Volt-free contact closure input, 10k pull-up to +5V.
		Minimum pulse width	20ms
		Maximum pulse rate	20Hz
	Status Inputs		Binary status input, 10k pull-up to +5V.
		Glitches recorded	20ms (minimum)
	Protection	Series protection	100 mA PTC thermistor (80 - 100 ohms).
		Shunt protection	12 volt TranZorb^{TM} type transient suppressor.
	Isolation		Sensor input common is grounded.
Channels	Quantity		4 data logging channels
	Input		Each channel can be configured to monitor any of the 4 physical inputs.
	Configuration		Each channel can be independently configured for channel capacity and logging interval.
	Data integrity		Logging interval can be dynamically changed without losing historic data.
	Immediate values		All channel inputs can be read as immediate values.
	Types		Each channel can be configured to log data as pulse totalization or status change.
	Pulse Counting Channels	Configurable pre-scaler	1 to 255
		32-bit pulse count register	Pre-setable 9-digit start value.
	Status Channels	Event logging	Time and date of every change of state logged.
		Resolution	1 second

	Logging capacity		128 Kbytes of RAM memory provides storage for up to 24,000 readings. See table below.
Communications	Format	Character Set	7-bit printable ASCII characters and carriage-return.
		Data Format	Asynchronous 7 data bits, 1 stop bit.
		Parity	Even, Odd, Mark (1) or Space (0).
		Baud Rate	1200, 2400, 4800 or 9600
	Flow control		XON / XOFF in both directions.
	Local access		RS232 port (9-way D-type).
	Remote access		Separate RS232 port for connection of external BT modem or PAKNET radio modem.
	Modems		Integral BT modem option available.
Time/Date			Quartz calendar clock oscillator synchronized by host when reading.
	Accuracy		Accuracy +/- 1 second per day
	External Synch.		Volt-free relay contact option provides 1-sec time synchronization pulse every 1/2 hour.
Security	Passwords		4-level security system with 32-bit numeric passwords.
		Disabling	Programming null (zero) as the password disables it.
		Level 1	Read data - each channel has its own unique password.
		Level 2	Configure channel - each channel has its own unique password.
		Level 3	Time Control - a single password controls access to regulate the time.
		Level 4	Logger Commissioning - a single password controls access for overall commissioning at installation.
	Authentication		Logger readings are protected by an authentication algorithm (based on a 32-bit key) which appends a 16-bit validator to each block of readings. Each channel has its own unique validation key.

	Comms.		Data transmission is verified by a longitudinal parity check code on each packet (maximum 250 characters).
Electrical	External supply		240V AC +/- 15%
		Power consumption	3VA (maximum)
	Main Battery		7.2V NiCad (if UPS option fitted).
		Endurance	120 hours sustained logging operation in the absence of external power.
	Memory Battery		3.6V NiCad
		Endurance	35 days of retention for logged data and calendar clock.
Wiring	Connectors	Terminal Blocks	Two-part terminal blocks allow pre-wiring of enclosure prior to fitting of electronic sub-chassis, and easy maintenance.
Enclosure	Construction		Two parts. Base and cover.
		Material	Polycarbonate.
		Fastening	4 cover screws. Can be drilled to fit a seal.
		Mounting	4-hole wall mounting.
	Cable entry		Three 20mm conduit knock-outs for bottom entry of cables.
	Dimensions	Width	175 mm
		Height	175 mm
		Depth	100 mm
	Weight		1 kg.
	Environmental		IP 51

Logging memory is allocated on a per-channel basis in blocks of 3000 readings. This allows four 6000-reading channels or one 24,000 reading channel or any other combination.

Data logging times for standard 128k logger configured as four equal-memory channels:-

Logging Interval (mins)	1	2	5	10	15	20	30	60
Duration (days)	4	8	20	41	62	83	125	250