

AT

DELTA-T DEVICES

The DL2e is a versatile, programmable field data logger, well suited to remote site, industrial and laboratory applications. Easy to operate, the DL2e system offers a wide choice of sensors, logging intervals, data collection and analysis facilities.

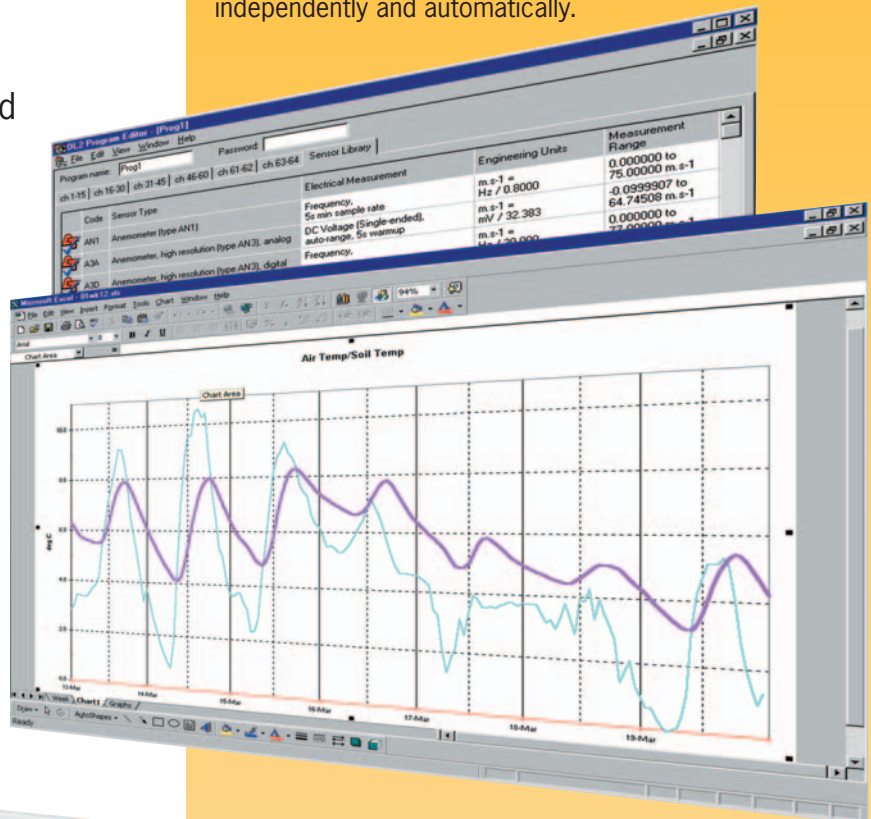
- Battery powered, weatherproof, rugged and portable
- Logs DC, AC, Resistance, Counter, Frequency and Status channels
- Simple GSM Modem connections and automatic data collection from remote sites
- Memory for up to 128k readings
- Easy programming with new Ls2Win 32-bit Software

DL2e DATA LOGGER PRODUCT INFORMATION

Proven versatility Chosen by thousands of customers worldwide across science and industry, the DL2e is a highly versatile, rugged and portable data logging system that offers impressive performance and ease of use at low cost.

The DL2e is supplied with the Ls2Win software package. This sets up logging sessions, sensor libraries and conversions from raw readings to physical units, and controls the collection of stored data via the DL2e's RS-232 serial interface.

Once set up, the DL2e acquires data independently and automatically.



Expandable As standard, the DL2e includes a 15/30 channel DC analogue input card, 4 resident channels (2 digital inputs and 2 relay outputs), and memory for over 64,000 (64k) timed readings. An extra RAM chip extends this to 128k readings. Input cards and extra RAM are easily fitted by the user.

Suitable for most sensors The DL2e measures DC and AC voltage, current, resistance, logic state, pulse train and contact closure inputs, in almost any configuration (see panel on page 2). During programming, each channel can be set up with an individual sensor type and range, a data conversion characteristic, reading frequency from 1 second to 24 hours, and limits above or below which a flag is set or an output relay switched.

Logging sequences may be started at a preset time and date, or by an external event, and can be repeated as many times as desired. The DL2e also provides for sensor excitation and warm-up, control outputs, and malfunction warnings.

DL2e Data Logger - reliable, flexible data l

Data handling

Engineering units Where base measurements of voltage, resistance, current and count must be converted to physical units, the DL2e includes a library of conversions into appropriate units for many popular sensor types. Using the Ls2Win software, users may also program the DL2e with their own non-linear conversions in the form of look-up tables, and specify linear readings conversions in the form $y = mx + c$.

Compression saves memory space by recording only the average, maximum or minimum reading for that channel in a

Measurement configurations

Single-ended voltage up to $\pm 2V$ DC For general purpose voltage measurement where a common earth is acceptable, use the LAC1 in 30 channel mode.

Differential voltage up to $\pm 2V$ DC Advised for low level signals, such as thermocouples, or where signals are susceptible to electrical noise. Use LAC1 in 15 channel mode, or alternatively LFW1. Can also be used in a fully floating configuration where there is an existing connection to the DL2e earth.

Voltage up to $\pm 50V$ DC Fit LPR1 or LPR1V cards with precision divider resistors in series with LAC1 cards.

AC voltage up to 2V rms True rms AC voltage measurement is provided by the ACD1 card, which accepts 15 input channels.

Current Fit precision shunt resistors across Logger terminals, or to LPR1 or LPR1V card(s) in series with LAC1 card(s).

Resistance 10k Ω to 1M Ω An LAC1 in 15 or 30 channel, 2 wire resistance mode is suitable.

Resistance 100 Ω to 10k Ω At lower resistance values, it is better to use an LAC1 in 15 channel mode with 3 wire resistance connection, or an LFW1.

Resistance <500 Ω For small resistance values, for best precision, or where cable resistance is significant compared to the measured value, use 4 wire measurement with the LFW1 card. This is also recommended when measuring small changes from a precise base value, e.g. with Pt100 sensors.

AC resistance Sensors such as gypsum blocks and granular matrix soil moisture sensors require AC excitation to prevent polarisation. Use an ACD1 card with ACS1 excitation source.

Bridge measurement For small resistance changes with no well defined base value, e.g. strain gauges, use LFW1 in full, half or 3 wire bridge mode.

Potentiometers For sensors such as displacement transducers, the LFW1 provides excitation for potentiometric measurement.

Time Period, Frequency, Event Count Sensors producing a logic level pulse or contact closure output can be connected to a resident digital input, or to a DLC1 card.

selected period from 5 seconds to 24 hours, instead of every reading.

Flags can be used to show a faulty, noisy or out-of-range reading, or can show a reading above or below preset limits for that sensor

Logger configuration

The DL2e system offers AC, DC, 4-wire and digital input cards, and cards for input attenuation and protection. The standard logger case can accept four cards of mixed type. For configurations of five or six cards, a case height extension LMCK1 is available. All options maintain IP65 sealing. Logger task set up, data handling, and stored data collection are all carried out via a PC using the Ls2Win software supplied.

Analogue measurement

For all voltage, resistance and current measurements, the DL2e automatically selects from four ranges with a resolution of 12 bits plus polarity sign. The DL2e accommodates up to 60 analogue channels, logged at a maximum 10 channels/second.

All analogue input cards offer a basic maximum input range of $\pm 2V$ (2V rms for ACD1), which may be extended by using attenuator or input protection cards.

Standard Analogue Card, type LAC1

Provides measurement of 30 channels of single-ended voltage, or 2-wire resistance, or 15 channels of differential voltage, or 3-wire resistance.

4-Wire Card, type LFW1

Provides 12 channels of 4-wire measurement, virtually eliminating errors due to cable resistance when measuring low value resistances such as Pt100 sensors. 2 LFW1 cards may be installed in the DL2e, giving a maximum of 24 4-wire channels. The LFW1 also provides 1-4V excitation for bridge-connected sensors such as strain gauges and load cells, and for potentiometric sensors such as some wind vanes and displacement transducers.

An Input Protection Card can be used with the LFW1 for input protection, but not for signal conditioning.

AC/DC Analogue Card, type ACD1

Provides 15 measurement channels which may be individually configured for AC voltage (true rms), DC voltage (differential), 2- or 3-wire resistance, or thermocouples.



DL2e loggers are ideal for meteorological applications. Delta-T can supply complete weather stations including masts.

Built for all environments

Weatherproof, rugged and portable

The DL2e is a true stand-alone unit, operating without inconvenient external power supplies, memory modules and connector housings. The main case is protected to IP65 rating, which states that "water hosed against the enclosure shall have no harmful effect". Sensor connections are housed in a weatherproof compartment on the side of the case.

Power supply options: 6 AA alkaline cells power the DL2e for up to 1 year, or until 500k readings have been taken. If required, an external 7-15V DC power supply can be connected via a weatherproof socket. Solar power options are available.

Easy sensor connection: A screwdriver is the only tool needed for connecting sensors to the numbered screw terminal connector blocks. As these plug into the logger's terminal panel, it is easy to detach the DL2e from its sensors. For thermistors or other resistance sensors, the DL2e supplies its own current excitation.

Data security: Every aspect of the DL2e design gives priority to data security. Readings are stored in highly reliable double battery-backed RAM. A password facility can prevent unauthorised interruption of logging and erasure of data.

Input protection: All DL2e input channels are protected against brief high voltage pulses. In extreme conditions, analogue input protection can be improved with the optional Input Protection Card type LPR1V, fitted with transient absorbing varistors.

On-site checking: The Logger's LCD can show instantaneous output from any sensor in engineering units. It can also show battery and memory status, and report on any sensor malfunctions which may have occurred during logging.

AC Excitation Source type ACS1

Applies excitation and signal conditioning to sensors such as gypsum blocks and granular matrix soil moisture sensors.

Attenuator Card, type LPR1

Enables mounting of precision resistors for use as voltage dividers or current shunts. Maximum 30 channel capacity. The **Input Protection Card, type LPR1V**, is the same with the addition of transient absorbing varistors across each channel.

Digital Signals

Counter Card, type DLC1

Provides 15 pulse or event counting channels, with 16-bit capacity (total counts 65472). Maximum 62 counter channels, including the 2 resident digital inputs.

Frequency measurements

The DL2e can interpret data from counter channels as a frequency or rate, by averaging the logged count over the recording interval.

Resident channels

Two digital inputs and two relay outputs are built into the DL2e. The inputs may be used for logging digital logic level or switch contact status, for pulse count and frequency measurement, or for recording the occurrence of events and for triggering logging sequences. The outputs provide volt-free changeover contacts for alarms, sensor power and warm-up, or control.

Ordering information

The DL2e system has numerous options, accessories and spares, all of which are detailed in the current price list.

A DL2e minimum system package is available which includes the DL2e logger fitted with LAC1 input card and 64k readings memory, logger/PC configuration software type Ls2Win, an RS-232 serial cable and comprehensive user manual. All DL2e accessories are fully compatible with the earlier DL2 logger system.



Using the DL2e with a hand-held terminal

In addition to the new Ls2Win Software, optional Attach software allows a Psion Workabout (hand-held terminal) to collect data and load configurations into the DL2e. Attach can be downloaded from our website free of charge.

Ls2Win - Software Tools for the DL2e Data Logger

- automatically poll data from multiple sites
- program, interrogate and control the logger
- retrieve and display recorded data
- import data into Microsoft Excel or Access

Logging tasks are set up using a PC and the Ls2Win software, via the logger's RS-232 serial port. Data collection can be handled without disturbing logging

Ls2Win contains four integrated software modules:

Program and Sensor Library Editors

The standard sensor library contains entries for most standard sensors and Delta-T sensor types; these include application hints and wiring details. Entries for new sensor types can be quickly added. The Program Editor lists all available channels and makes it easy to pick a sensor type, logging interval and other options.

Dataset Import Wizard

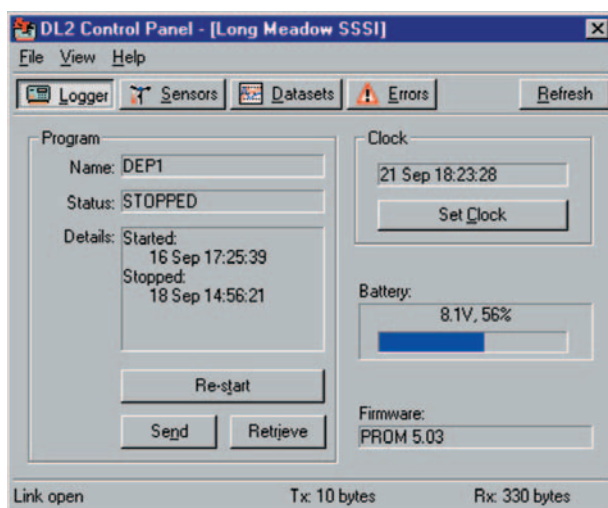
uses the power of Excel to directly import, display and graph datasets. The Wizard guides the user through importing datasets into a Worksheet. User-configured Excel templates can be used to create daily, weekly or monthly graphs. Ls2Win can also be used to generate Excel graphs automatically.

Dataset Viewer

Alternatively, with the Dataset Viewer, it is possible to avoid using Excel. The logger datasets are converted into comma separated ASCII .dat files, for importing into most data analysis applications.

DL2 Control Panel provides communication facilities for the DL2e. It can monitor logger status, dataset status and display realtime readings for any sensor.

Modems DL2 Control Panel also manages modem communications, and provides easy pre-configured desk-top connections using any installed modem. GSM modems enable cable-free, worldwide communication with DL2e Data Loggers. Data can be collected on demand or alternatively: **using Windows Scheduler and a GSM phone or land line connection, you can automatically collect data from one or more loggers at regular intervals. This is also also known as "polling".**



A self-running demo of Ls2Win can be downloaded from www.delta-t.co.uk

Upgrading your existing DL2e Logger

Ls2Win is included free of charge with all new DL2e purchases, it is also available as a software upgrade for existing DL2 and DL2e loggers. In most cases, even loggers over 10 years old can be upgraded (if the installed PROM is earlier than version 3.0, a new PROM will also be required). Ls2Win will be compatible with all existing datasets, sensor libraries and logger configurations.

If you decide to upgrade, it makes sense to also consider a factory recalibration of your logger, which should ideally be carried out every one or two years.

Logger upgrades, PROMs and recalibrations are all reasonably priced - please enquire for further details.

DL2e Specifications

Logging

LOGGING INTERVAL AND SPEED INPUT CHANNELS

1, 5, 10, 30 seconds, 1, 5, 10, 30 minutes, or 1, 2, 4, 12 or 24 hours, programmable for each channel. Readings can also be reduced to averages, maxima or minima at these intervals. Typically 10 channels per second in total.
60 channels maximum, depending on input cards installed, plus 2 resident digital inputs and 2 relay outputs.

Analogue Inputs

STANDARD ANALOGUE CARD, LAC1

Each LAC1 multiplexer card can select analogue inputs from:

Either: 15 channels of differential voltages and/or 3-wire resistances
Or: 30 channels of single-ended (common ground) voltages and/or 2-wire resistances

Directly measures voltages up to $\pm 2V$ or resistances $< 1M\Omega$. Voltages up to $\pm 50V$ and currents can be measured using precision divider or shunt resistors mounted directly on the input screw terminals, or on an LPR1 or LPR1V card.

4-WIRE CARD, LFW1

Each LFW1 card can handle up to 12 bridge, potentiometric, differential voltage or 2- or 4-wire resistance sensors. 4-wire resistance measurements virtually eliminate cable resistance errors. 4-wire Pt100 platinum resistance thermometers, (e.g. DIN 43760/BS1904 types) are measured over -200 to $+850^{\circ}C$. In the -17 to $+57^{\circ}C$ range of Logger and Pt100 temperature, resolution of $0.01^{\circ}C$ and accuracy of $\pm 0.2^{\circ}C$ are obtained.

AC/DC INPUT CARD, ACD1 VOLTAGE READINGS

Each ACD1 card provides 15 measurement channels which may be individually configured for AC voltage (true rms), DC voltage (differential), 2- or 3-wire resistance. DC and resistance specifications are the same as for LAC1.

		Full Scale	Resolution (12 bits + sign)
	4 ranges, user-selected or autoranged:	Range 1: $\pm 4mV$ Range 2: $\pm 32mV$ Range 3: $\pm 262mV$ Range 4: $\pm 2.097V$	$1\mu V$ $8\mu V$ $64\mu V$ $0.5mV$
DC Accuracy (typical figures in brackets)	Logger temperature Full scale error Long term stability Differential offset Noise Input impedance Common Mode Range Common Mode Rejection Ratio	15 to 25°C $\pm 0.07\%$ (0.04%) $\pm 0.25\%$ (0.02%) over 1 year $\pm 10\mu V$ ($3\mu V$) $\pm 0.02\%$ ($0.2\mu V$ rms) 100M Ω approx. $\pm 2V$ or $\pm 1.05V$ if "+" input is closer to logger 0V than "-" input (140dB), on voltage range 1	-20 to +60°C $\pm 0.2\%$ (0.1%) $\pm 12\mu V \pm 0.02\%$
AC Accuracy	Input level (mV ac rms) 0 to 10 10 to 50 50 to 100 100 to 2000	Sinusoidal signals 45-60 Hz, -20 to $+60^{\circ}C$ Reads zero in this range $\pm 3mV$ $\pm 0.6\%$ reading $\pm 0.25mV$ $\pm 0.6\%$ reading	Sinusoidal signals 65-1000 Hz Reads zero in this range $\pm 0.6\%$ reading Non-sinusoidal signals Crest factor 1.0 to 1.7 Reads zero in this range maximum additional error $\pm 1.0\%$ reading

RESISTANCE READINGS

Autoranging 12-bit voltage readings with programmable 2, 20, 200 or 2000 μA excitation, giving 1M Ω full scale, or better than 0.01 Ω resolution on lowest range

Accuracy

As voltage readings, with additional errors:

	15 to 25°C	-20 to +60°C
Logger temperature 2 μA excitation other excitation currents	$\pm 0.3\%$ reading $\pm 0.05\%$ reading	$\pm 0.6\%$ reading (to $+50^{\circ}C$) $\pm 0.1\%$ reading
2-wire LAC1, ACD1	$\pm 5\Omega$ typical	$\pm 5\Omega$ typical

INPUT PROTECTION

Analogue inputs withstand $\pm 15V$ continuously, and much higher voltages in brief pulses (500V 1.2/50 μs). For additional protection, see LPR1V below

ATTENUATOR CARD, LPR1

For use with Standard Analogue Card LAC1 only. Provides socketed positions for mounting signal conditioning resistors to 30 channels. Resistor positions may be left vacant or resistors fitted in shunt or divider configuration, for measuring currents up to 0.1A or voltages up to $\pm 50V$ respectively

INPUT PROTECTION CARD, LPR1V

Connects transient-absorbing varistors to 30 Standard Analogue Card inputs, or 12 4-wire card inputs, for input protection to 2kV 1.2/50 μs . Also provides socketed resistor positions for signal conditioning, but only when used with LAC1 (as LPR1 above). Can cause significant inaccuracies when measuring resistances $> 100k\Omega$

Digital Inputs and Outputs

DIGITAL INPUTS

All loggers have 2 resident 16-bit counter channels that continuously monitor logic levels or switch closures, logging digital status, counts or frequency (up to 100Hz), or for triggering special logging sequences

COUNTER CARD, DLC1

Each DLC1 card provides up to 15 extra 16-bit counter or frequency channels. Maximum frequency: 500Hz for switch closures, 500kHz for 5V logic level signals. Every channel can record up to 65472 counts over the logging interval.

RELAY OUTPUTS

2 SPDT relays for powering up sensors, or for providing alarms or malfunction warnings. 1A, 24V rating.

Other Specifications

PROCESSING OF RAW READINGS

The DL2e converts readings into engineering units using look-up tables or a linear conversion $y = mx + c$. User expandable sensor library includes Delta-T sensors (pages 15-18), Platinum Resistance Thermometers, Thermistors (Fenwal 2K, 2K252, 10K and 100K types), and Thermocouples (types J, K and T). Cold junction temperature is measured at isothermal terminals.

DISPLAY

A 2-line LCD shows instantaneous output from any sensor (in engineering units if appropriate), time, battery and memory condition, and status messages, without disturbing logging.

MEMORY DATA FORMAT

Highly reliable CMOS RAM, double battery-backed. Expandable from 64k readings (standard) to 128k. Automatic RAM check. ASCII, easily loaded into many spreadsheets and other packages, e.g. Excel, Lotus 1-2-3. Transmitted readings are date/time stamped, and labelled in engineering units with errors flagged. Data files created by the LS2e software are comma separated. RS-232 serial, up to 9600 baud. Up to 10000 readings transferred per minute without disturbing logging.

INTERFACE POWER

6 internal AA alkaline cells typically provide power for 500k readings, or 24 hours' operation using the keypad/LCD or RS-232 interface, or 12 months' quiescent operation. An external 7-15V DC supply can be used, with the alkaline batteries providing a back-up. The internal lithium cell will retain data for 2 months in the event of a power supply failure.

ENVIRONMENTAL EMC CONFORMITY SIZE/WEIGHT

Operating temperature: -20 to $+60^{\circ}C$. IP65 weatherproof main case with desiccant and humidity indicator. Tested to comply with EN 50081-1 and EN-50082-1 (1992) harmonised emissions and immunity standards
280 x 220 x 140mm / 2.7kg.



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