Delta-T Devices

GP2 Data Logger and Controller

The GP2 is a powerful, weatherproof, research grade data logger with unique features for recording and controlling field experiments

- 12 differential channels
- High performance microvolt sensitivity
- Easy set up
- Flexible configuration
- Versatile communication options

DeltaLINK-Cloud
www.deltalink-cloud.com

New online data viewing and sharing service

see page 6

Now SDI-12 Enabled

see pages 4 and 5

WS-GP2 Weather Station Data Sheet available at www.delta-t.co.uk

Advanced capabilities

- Flexible control outputs
- Excellent analog accuracy
- Powerful Script Editor
- Virtual channels
- Unique program Simulator
- Data visualisation

Delta-T Devices

The GP2 Data Logger

The GP2 provides a versatile solution for both simple and complex recording and control applications. For many applications the GP2 is quicker and simpler to set up and install than competitive systems, while still providing full access to a rich set of advanced features.

The relay outputs can control experiments and applications with exceptional sophistication using the Script Editor. The GP2 has unique reliability - built on Delta-T's 25 years' experience in designing and manufacturing data loggers.

Ease of use

Simple point and click software makes it easy to configure channel set-up and recording intervals. The menus that support the advanced customisation options can be displayed or hidden as required.

Sensor connections are laid out logically with clear, easy-to-follow diagrams and notes.

The GP2's weatherproof case, battery power and convenient accessories make it very easy to install in the field – often without the need for a secondary enclosure.

Sensors

- **12 differential (or 24 single-ended) analog inputs configurable as:**
  - Voltage
  - Resistance (2-wire or 3-wire)
  - Bridge
  - Potentiometer
  - Thermistor (3-wire)
- **4 digital inputs as:**
  - Counters, 2 fast + 2 slow
  - Frequency
  - Digital state
- **1 Delta-T WET sensor channel**
- **Unlimited virtual channels**

GP2 with PR2 Sensors

GP2 with ML3 ThetaProbe

GP2 with Expansion Lid type GP2-G5-LID fitted

Flexibility and customisation

The GP2's analog inputs can be fully customised. Each channel can have its own input type and recording parameters. DeltaLINK software gives the user control over reading frequency, thresholds and units, and provides recording options for average, min and max, plus specialised wind options - including wind rose, gusts and wind averaging

Users can add their own custom sensor types to the sensor library, exploiting the GP2's detailed configuration options. The GP2 provides 4 input ranges down to microvolt resolution with adaptive auto-ranging, excellent analog accuracy, and configurable sensor excitation - enabling it to support nearly all analog sensors.

Calculations based on the measurements from several input channels can be recorded and displayed as additional virtual channels (calculated measurements).

Control

Control conditions for experiments and applications can range from simple thresholding to sophisticated calculations using the Script Editor (e.g. irrigation control, PID control, seasonality etc.). Control parameters (e.g. target soil moisture level) can be adjusted throughout an experiment without interrupting data logging. See "Advanced features" on page opposite for further details.

Dependable quality

The GP2 is a research grade data logger, designed and manufactured to be rugged, sealed and completely dependable. Its program editor has built-in error checking, and enables the full logger configuration (including advanced features) to be road-tested before activation. Sensor integrity, set-up and connections can also be checked before or during logging by viewing real-time measurements. Fault tolerance is provided by intelligent statistics (rejecting erroneous sensor measurements), and safety conditions (upper and lower limits on active and rest periods). The relay outputs can be configured as intelligent alarm outputs, and LEDs on the front panel provide a quick visual reassurance that logging is proceeding ok.

GP2 Data Logger

Expansion

A range of expansion lids is available with additional cable entry points and configurations, including dedicated Profile Probe connectors or wider diameter cable entry glands.

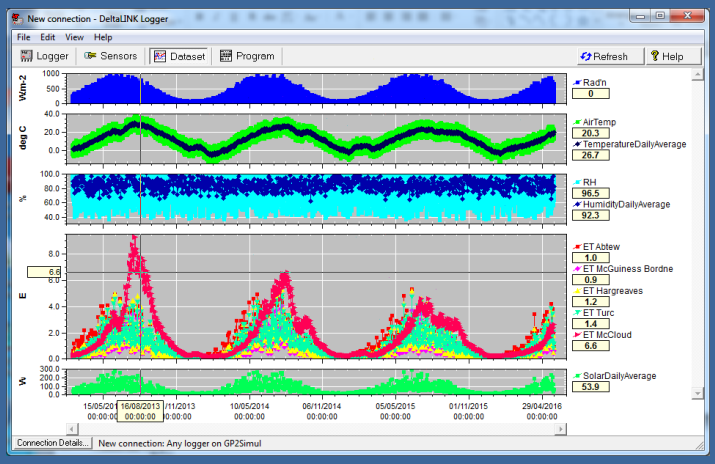
The number of programmable control relay outputs can be increased from 2 to 6 using the optional Relay Expansion Module. Up to 7 GP2 Data Loggers can be networked to create complex monitoring and control systems.

Storage, communication & power

4 Mbytes of FLASH memory enable storage of 2.5 million readings (typical). Data can be collected by laptop locally via USB/RS232 or remotely using the GPRS modem options.

The GP2 has 6 alkaline AA internal batteries as standard. An optional mains power adapter is available (type GP2-PSU). Up to 7 GP2s can share power and communications using an M12 cabling network (see Ordering Information below),

For external battery power options please enquire at sales@delta-t.co.uk



Running the GP2 Simulator gives years of data displayed almost instantly

Advanced features

The GP2 is a flexible and powerful research and control tool - enabling model implementation, simulation and evaluation. The new Script Editor is easy to use, yet allows the creation of complex functions such as disease prediction, degree days, dew point, wind chill factor, PID control, and evapotranspiration calculation and analysis.

Script Editor

This powerful software feature creates step by step operations to control simple or complex processes or recording requirements. The degree of sophistication it offers means the potential applications are numerous and varied. The editor interface is easy to use – no programming language is involved.

- Creates sequences of operations to implement models
- Advanced control and recording capabilities
- Easy user interface: no typing out of commands; no programming language
- Implement simple or complex conditions, algebraic expressions and record result values

Virtual Channels

Data can be processed to obtain max, min, sum etc. and the results logged to a virtual channel. Calculations can be made using any channel combination. Calculated measurements also allow implementation of custom formula - including trig function, normal math function and more.

Simulator

This unique software feature allows logging programs to be tested before real-world activation. For applications involving weather data, irrigation or soil moisture recording, the environmental variables can be changed to test how the program responds. Years of logging time can be simulated in just a few minutes.

- Implement simple or complex conditions, algebraic expressions and record result values
- Create and manipulate variables e.g. for disease risk factor

Ordering Information

GP2 Data Logger
Advanced data logger and controller with 12 analog, 4 event, and 2 relay channels, plus 1 WET Sensor channel. Includes DeltaLINK PC Software, USB cable, Quick Start Guide and Software and Manuals Disk.

Expansion Lid with 5 cable glands type GP2-G5-LID
GP2 lid with 5 general purpose cable glands. Each gland accepts either a single cable of 3mm to 10mm diam, or 2 cables of 4.5mm to 3mm diam (using gland insert).

Expansion Lid with 2 Profile Probe connectors type GP2-P2-LID
GP2 lid with 2 sockets for connection to Profile Probe cables (PRC/M12-05).

Relay Expansion Module type GP2-RLY
Provides 4 extra relay outputs. Increases number of relay channels from 2 to 6.

GP2 Network Power Cable type GP2-NPC
For use with GP2-NTP Network T-Piece. Connects to EXT/5W-xx cables to provide power and communications to one or more GP2 Loggers.

Network T-Piece type GP2-NTP
Enables GP2 Data Logger to use M12 network cabling. Connects to EXT/5W-xx M12 cables and to GP2-USB cable.

Mains Power Supply type GP2-PSU
For GP2 Data Logger. Input: 100 - 240V AC, 50 - 60Hz. Output: 2.5A, 12V via screw terminals (requires minimum 2A, 2-core wire). Must be protected from weather. Suitable for powering GP2 directly, or via GP2-NPC Network Power Cable. Requires correct IEC mains lead, type PC-UK, PC-EU, PC-US, PC-IN or PC-CN.

Mains lead, national plug to IEC connector types PC-UK, PC-EU, PC-US, PC-IN, PC-CN
Connects to GP2-PSU and LBC4.

Service Pack type GP2-SER
Contains battery holder, cable gland bungs and a selection of other spares.

Universal Mounting Kit type DL-MKT
Suitable for GP1, GP2 and DL6.

GPRS modems in weatherproof enclosures are available.

Delta-T offers a range of weather stations, including systems based on the GP2 Data Logger. Please visit www.delta-t.co.uk for details.

Delta-T Devices

PRODUCT UPDATE

The GP2 Data Logger now SDI-12 enabled

New Feature

The GP2 Data Logger has been upgraded to support SDI-12 sensors. From March 2016 all new GP2s come with SDI-12 as standard and earlier GP2s can be easily updated via a software download at www.delta-t.co.uk

- **Huge additional input capacity for SDI-12 sensors**
- **Existing analog and digital channels fully available**
- **Highly flexible logger + sensor networks**
- **Free of charge upgrade – comes as standard with new GP2s**

Ease of Use

- **Seamless integration into GP2 Program Editor, facilitating construction of sophisticated calculations and other operations from SDI-12 measurements**
- **Unusually easy point and click configuration; firmware handles scheduling and issuing commands**
- **Real time, on-demand readings for diagnostics and reassurance**

Program Editor

DeltaLINK 3.2 seamlessly integrates SDI-12 functionality into the GP2 Program Editor.

After entering the SDI-12 address and other SDI-12 measurement details, each measurement can feature in Recordings, Custom Formulas, Conditions and Scripts – in exactly the same manner as conventional analog and digital measurements, and without further reference to SDI-12 commands or measurement timings.

Free Upgrade – Further Information

GP2 SDI-12 is a DeltaLINK and firmware upgrade for the GP2 which equips the GP2 with SDI-12 functionality. As of March 2016 DeltaLINK 3.2 and GP2 firmware 2.10 will be supplied as standard with all new loggers.

The GP2 logger is already fitted with SDI-12 capable hardware, so the firmware 2.10 upgrade can be retrospectively applied to all existing GP2 loggers without hardware modification.

The upgrade will be available to download free of charge from the Delta-T website – www.delta-t.co.uk.

Scheduling

The GP2 firmware takes care of scheduling (including power switching) and issuing the necessary commands to ensure that results are available for the program to process when required. DeltaLINK's 'Read Now' feature provides additional on-demand readings, in real time, for commissioning and diagnostic use - and for reassurance that an installation is functioning as intended.

Sensor Library

An SDI-12 sensor library containing pre-configured SDI-12 sensor configurations and installation notes for widely used SDI-12 sensors is available for download from www.delta-t.co.uk. When imported into DeltaLINK, ready-configured SDI-12 measurements can be easily added to a program with a single point and click menu selection. The SDI-12 library will be continuously updated - please enquire or submit a request if a sensor of interest is not listed. Users who wish to utilise the full flexibility of SDI-12 devices can generically configure each SDI-12 measurement parameter. An SDI-12 Transparent Mode terminal is provided for directly issuing SDI-12 commands - as required for setting the SDI-12 address, and also for advanced configuration operations such as using SDI-12 extended commands.

Cables and Connectors

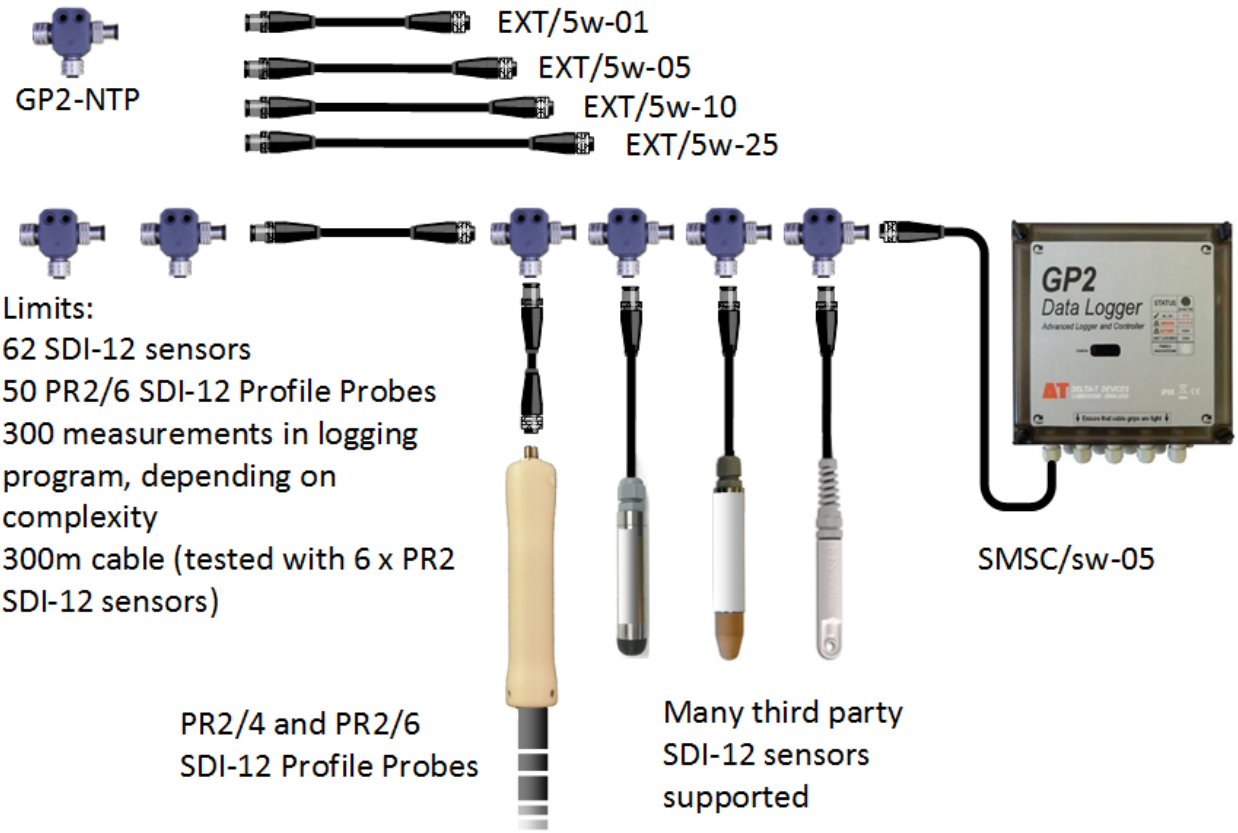
A field-attachable connector for SDI-12 interconnects with the rugged Delta-T M12 5-way sensor/RS232 cabling system. The interchangeable extension cables and T-connectors allow an SDI-12 bus to be easily assembled - and also disassembled when diagnosing the cause of SDI-12 bus operation faults. GP2 SDI-12 is compliant with SDI-12 Specification Version 1.3.

The GP2 provides a regulated +12 V, 0.5 A supply, which is switched to optimise power consumption.

SDI-12 Profile Probes

When the SDI-12 version of the PR2 Profile Probe is launched, the SDI-12 GP2 will be a natural choice of data logger. Up to 50 SDI-12 Profile Probes can be connected to a single GP2 SDI-12 Data Logger (subject to power requirements).

Use of SDI-12 sensors with a GP2 Logger and Controller



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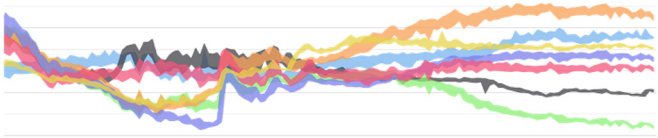
www.deltalink-cloud.com



Sharing Sensor Data

DeltaLINK-Cloud is a **free** online data viewing and sharing service for Delta-T data loggers. Collect, view and share your sensor data with ease. Anywhere. Anytime.

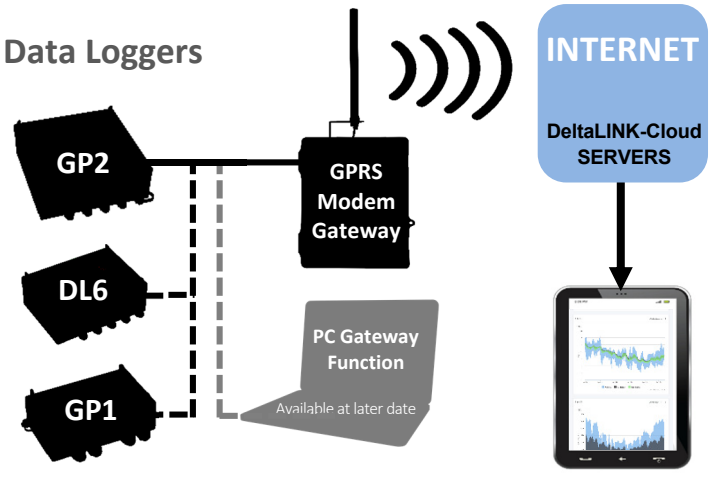
- **FREE Service**
- **Remote data monitoring**
- **Share data and collaborate**
- **Automatic upload**
- **Mobile, tablet and PC compatible**
- **Flexible charting and reporting**
- **Smart SIM card provided**
- **Secure and encrypted**
- **Multi-language (Fr, De, Es, 中文)**

Try it right now!

Visit **www.deltalink-cloud.com** now, register easily - and you can be experiencing the power of this free cloud based platform within minutes.

The site contains sample data for you to experiment with – illustrating the many features and benefits of using this secure, state-of-the art data service.

DeltaLINK-Cloud is a secure cloud based connectivity, data management and automatic data retrieval solution. The website allows a user to monitor the status of their devices, graph and export the uploaded data and share access to data with project collaborators/ stakeholders. All website functionality comes for free and is accessible from most modern internet capable devices (phones, tablets and computers).



Visit the DeltaLINK-Cloud Information page at:

www.delta-t.co.uk/deltalink-cloud.asp

GP2 Data Logger

East Malling Research

Precision Irrigation experiments and commercial crop trials

In early 2012 world-renowned horticultural research institute **East Malling Research (EMR)** identified a requirement for a sophisticated and reliable Data Logger and Controller - for application in a number of challenging long-term research and commercial trial projects.

These projects are on-going and focus on the cultivation of substrate-grown soft fruit crops, and the effects that precision automated irrigation treatments have on marketable yields and quality of fresh produce.

EMR selected the GP2 Data Logger and Controller (in combination with volumetric water content sensors) as an ideal technical solution to support the research.

Mike Davies, a Principal Scientific Assistant at EMR, explains a key benefit of the GP2 which was central to their decision to use the logger:

"A major advantage of the GP2 Data Logger is that up to 12 moisture sensors can be monitored concurrently. This enables us to easily position multiple sensors in strategic locations across the cropping area - to help account for the inherent variability in soft growing systems."

Another advantage of the GP2 is that it provides an easily accessible way for users to create scripts for implementing models and systems. This enables the East Malling team to quickly create custom rules to control each experiment, and they are able to define their own algorithms and formulas without the need for specialist programming skills.
In addition, the team are able to utilise a unique feature of the GP2 Data Logger – real time adjustment of threshold values, *whilst* the logging/control program is running.

Mike Davies explains further:

"Throughout the experiments, individual values from the sensors are averaged using the GP2 script function, so that irrigation events are triggered once a user defined threshold is reached.

We create the upper and lower thresholds for irrigation events as a script in the GP2 logger - and these can then be easily changed, without stopping the program. This means that we can adjust the frequency and duration of irrigation events (on-the-fly) to account for changes in environmental conditions or different crop developmental stages – an invaluable feature."

Another key aspect of the GP2 Data Logger which is central to the research experiments and field trials relates to its advanced communications capability.

Mike Davies, Science Project Leader at East Malling Research, accessing project data from a GP2 Logger.

"A great advantage of the GP2 is that the logger can be accessed remotely, via the Delta-T GPRS system." says Mike,

"This allows us to view both real time sensor readings and the stored data set. It's a very useful feature that allows us to monitor substrate volumetric moisture contents, to check that irrigation events have been applied and to identify any issues with readings from individual sensors.

The GPRS system also allows us to make changes to the loggers remotely, such as changing the threshold values that trigger irrigation, or changing the programme within the logger."

It's clear that the important on-going experiments and trials at EMR and associated farms have been well served by the GP2 Data Logger and controller. Mike Davies concludes that:

"In collaboration with Delta-T and other industry partners, we are continuing to develop the GP2-based precision control of irrigation and fertigation of substrate-grown soft fruit crops, and other potted protected edible crops. The aim of this research is to improve resource use efficiency, marketable yields, shelf life, and consistency of quality of fresh produce."

GP2 Data Logger

Specifications

Analog Channels

12 differential inputs, configurable as a combination of:

- Differential voltage channels (12 max)
- Single-ended voltages (common ground, 24 max)
- 2-wire resistances (24 max)
- 3 wire resistances (12 max)
- Bridge & potentiometric sensors (12 max)
- Temperature sensors (12 max, 2-wire thermistors 24 max)

Temperature sensors

- Thermistors (types 2k and 10k)
- Thermocouples (types J, K and T)

Digital Channels

4 digital inputs configurable as a combination of:

- Fast counters or frequency (30 kHz, 2 max)
- Slow counters or frequency (100Hz, 2 max)
- Digital state (logic level / open collector / switch closure, 4 max)

WET Sensor

1 serial input providing:

- Water content, bulk/pore conductivity and temperature

Input protection

All input terminals protected to ± 15V DC or 24V AC continuous, including battery reverse polarity.

Sensor excitation

Calibrated 3V reference, +5V and +12V stabilised or 5 to 10.5V (battery or external power), user selectable.

Recording options

Individual readings, statistics, total, integral, wind direction, vector average, gust, wind roses, conditional recording.
Readings converted into engineering units using look-up tables, polynomial or linear conversion.

Recording rate

1 second to > 24hrs, independently programmable for each channel.
Sampling rate typically > 16 channels per second.

Calculated measurements

Unlimited user-configured virtual channels calculated from measurements using algebraic and trigonometric functions.

Reading storage

4 Mbytes of FLASH memory storing 2.5 million readings (typical), exported as text file with caching for large datasets.

Analog Channels	Input Ranges	Accuracy		Noise	Notes
		GP2 at 25°C	-20 to +60°C		
Voltage					
Differential or Single-ended*	± 23mV **	0.022% + 12µV	0.08% + 27µV	2.0µV	* Single-ended voltage measurements are susceptible to additional offset errors due to current flowing in the signal ground. ** Selectable adaptive auto-ranging / fixed range.
	± 185mV	0.009% + 22µV	0.07% + 38µV	2.5µV	
	-1.4 to +1.5V	0.005% + 115µV	0.04% + 150µV	25µV	
	-0.17 to +2.7V				
Thermocouple	0 to 70°C	0.39°C	0.79°C	0.05°C	Cold junction temperature is measured at isothermal terminals, response < 0.1°C / °C/hour
Bridge sensors	± 7.5mV/V***	0.05% + 15µV/V	0.09% + 37µV/V	1.5µV/V	*** mV per 1V excitation
	± 62mV/V	0.04% + 24µV/V	0.08% + 48µV/V	2µV/V	
Potentiometer	0 to 1	0.036% + 0.00015	0.057% + 0.00017	0.00002	Ratiometric
Resistance					
3-wire	1kΩ	0.1% + 0.4Ω	0.21% + 0.4Ω	0.15Ω	
	9kΩ	0.07% + 0.9Ω	0.19% + 1Ω	0.2Ω	
	135kΩ	0.05% + 6Ω	0.14% + 7Ω	1.0Ω	
2-wire	9kΩ	0.06% + 12Ω	0.16% + 18Ω	0.2Ω	
	135kΩ	0.05% + 17Ω	0.11% + 23Ω	1.0Ω	
Thermistor	2k, -20 to +60°C	0.05°C	0.08°C	< 0.01°C	3-wire resistance measurements
	10k, -20 to +60°C	0.04°C	0.09°C	< 0.01°C	

Long term stability ±0.02% worst case over 1 year.
Noise figures quoted are rms values.
Input impedance 0.8 to 3.8GΩ.

Common mode range +3V to -2.5V.
Common mode rejection ratio > 70dB.
For more detailed accuracy specifications, see the User Manual

Control

2 Relay outputs expandable to 6 with Relay Expansion Module

- Latching SPST relays rated 1A, 24V AC 32V DC for powering sensors, controlling external equipment or providing alarms.

Software

DeltaLINK 3.0 provides full GP2 status display, program editor with detailed context-sensitive help, data download and chart/table display, real-time sensor readings, integrated Script Editor and program simulator, video tutorials - supplied free and available for download - try it now at www.delta-t.co.uk

Sensor library standard library includes all supplied sensors, extensible to custom types with built-in editor.

Relay control relay switching controlled by simple thresholds, complex condition expressions or fully customisable scripts evaluated at defined repeat rates, or at digital events or manually. Control parameters and targets can be optionally configured as program settings and adjusted without interrupting logging.

Simulator check complex programs, control scripts and recording formats before logging deployment using realistic measurement simulations, available for all standard sensor library types.

Hardware and System

Internal power 6x AA alkaline cells, typically sufficient for 300k readings.

External power 10 to 15V DC, 2A via screw terminals or network cabling.

Sleep current < 60µA typical + 30µA for each digital input held low.

Wake current < 10mA + any current supplied to sensors.

Communications SDI-12, RS-232 serial, 115.2kBaud. USB adaptor cable included.

Networking Up to 7 GP2s on 100m of network cabling.

Environmental Operating temperature -20 to +60°C, weatherproof case. (IP65) with desiccant and humidity indicator.

EMC conformity Tested to comply with EN 50081-1 and EN-50082-1 (1992) harmonised emissions and immunity standards.

Size/Weight 225 x 185 x 75mm / 1.0kg (base configuration).

For further technical specifications, see the User Manual at www.delta-t.co.uk

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