GP2 Data Logger Controller

Research-grade logger controller - capable of complex calculated measurements and advanced feed-back control

User Manual

version 2.0

Delta-T Devices Ltd

Contents

Unpacking

The GP2 package contains:

- GP2 Logger (with 6AA batteries to be fitted by the user)
- **GP2-USB** USB cable for GP2
- DVD with DeltaLINK 3 software, video tutorials and documentation
- This GP2 User Manual
- Screwdriver and cable gland spanner

Accessory Options

GP2-RLY Relay Expansion Module - 4 extra relays and power terminals		Page 12
WS-CAN an open Protective Canopy with U-bolts and logger mounting kit for GP2 or DL2e loggers		Page 20
M-ENCL lockable enclosure		Page 23
DL-MKT Universal Mounting Kit – a flat plate with U-bolts, nuts and bolts for GP2, GP1 and DL6 loggers		Page 23
GP2-G5-LID Expansion Lid with 5 cable glands for 3 to 10 mm dia. cables		Page 20
GP2-P2-LID Expansion Lid with 2 soil moisture Profile Probe connectors		Page 21
8-way M12 analogue signal extension cables (**EXT/8W-xx** where xx = 5,10 or 25m)		Page 16
5-way M12 serial communication + power extension cables (**EXT/5W-xx** where xx = 1, 5,10 or 25m)		Page 16
GP2-NTP 3-way network T- Piece for connection to EXT/5W-xx cables		Page 16
GP2-NPC Network Power Cable – to supply power via a GP2-NTP and/or EXT/5W-xx cable		Page 16
GP2-USB USB cable, 1.5m		Page 16
GP2-RS232 RS232 cable, 1.5m		Page 16
GP2/GP1-M8 network adapter cable, 1m		Page 16
GP2-PSU Mains Power Supply[1] with mains cable **PC-XX** where XX = UK, EU, US, IN or CN		Page 16
GP2-SER Service Pack:– battery holder, desiccant, cable gland bungs & seals, lid screws, wire links, screwdriver and dust cap on lanyard		

[1] Not weatherproof, for indoor use only

Overview

- The GP2 has 12 differential analogue input channels[2], four event/digital counter channels, and a serial input channel up to 62 SDI-12 sensors[3] or a single WET sensor.
- Two output relays can be extended to 6 using a relay expansion module.
- Two banks of terminals provide a 3V precision reference, or unregulated power for sensors. There is also one 5V and one 12 V power terminal.
- Each sensor can be read at a different rate, from 1 second to >1000 days.
- Multiple recording rates are possible for any combination of measurements.
- Multiple recording types are provided:- average, minimum, maximum, total, integral, wind-rose, conditional.
- The logger can hold about 2.5 million readings.
- Each relay can control a separate experiment, zone or test protocol, each based on different threshold settings or conditional logic.
- Simple programs are quickly created on your PC, assisted by the sensor library and a helpful user interface, and then sent to the logger.
- Sophisticated program scripts can be created without having to learn a programming language or typing out any commands.
- New measurements can be created mathematically along with complex control algorithms, using algebraic and trigonometric functions and conditional logic, with easily created sequences of instructions.
- You can create and manipulate your own “variables” for e.g. disease risk factor, integral error, days since soil moisture below a threshold, etc.
- Thresholds can be changed while logging, by using program settings.
- A simulator assists the checking and understanding of the behaviour of logging and control programs. A weather pattern can be repeated, or new one randomly created. It is particularly useful for irrigation.
- Video tutorials, online help, a sensor library and friendly user interface are provided for the DeltaLINK 3 software.

Sensors Supported

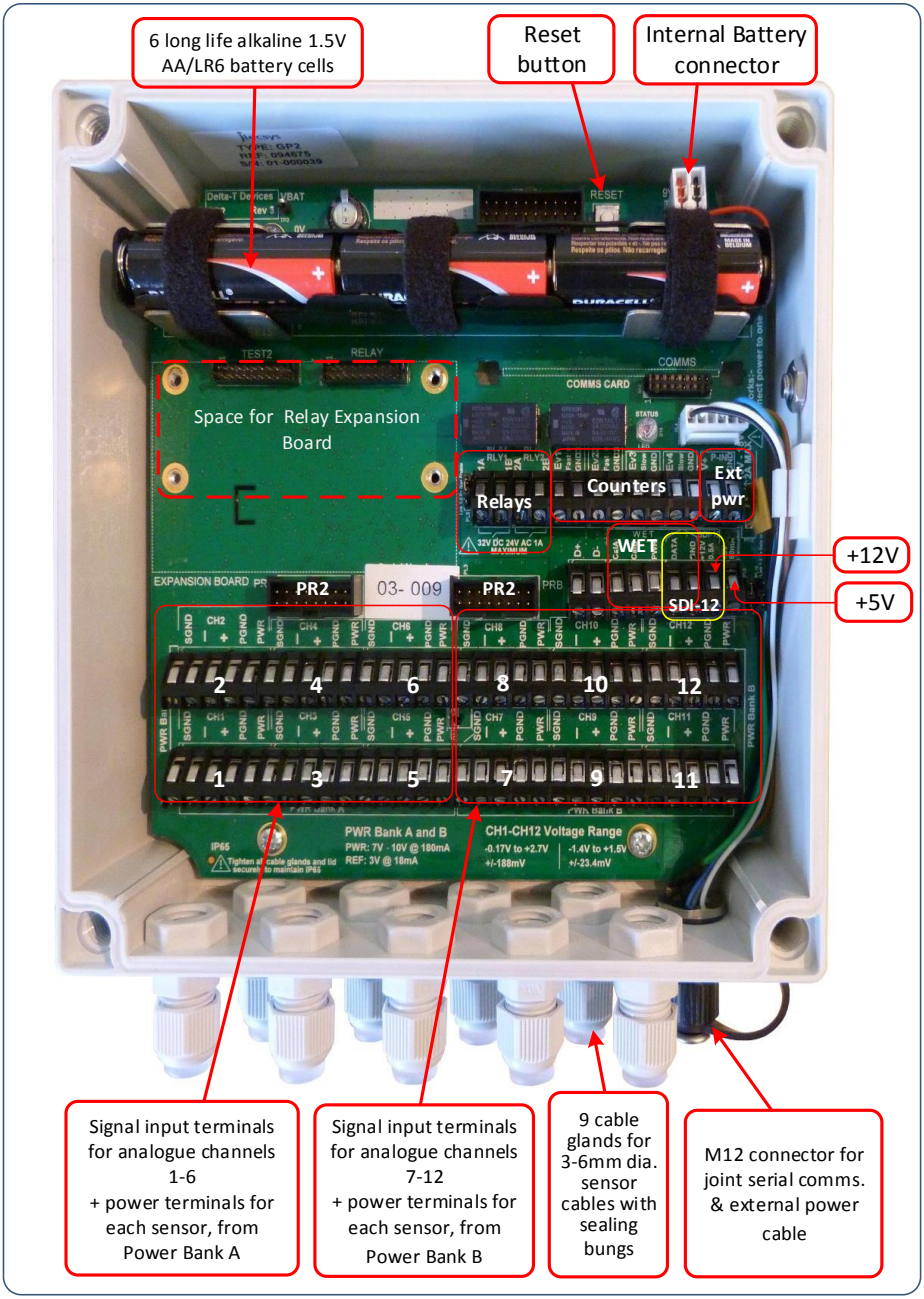
- All Delta-T sensors. Many third party SDI-12 sensors.
- User defined sensors based on voltage, current, resistance, bridge, potentiometer, counter, frequency and digital state sensors.
- Any number of calculated measurements.

Tutorials

See **GP2 Intro Series Tutorials** at
http://www.youtube.com/user/DeltaTDevices/videos
…or on the Delta-T Software and Manual DVD

[2] or 24 single-ended analogue channels – but note the limitation on the number of cable glands.
[3] See also the SDI-12 for GP2 User Manual

Layout


6 long life alkaline 1.5V AA/LR6 battery cells
Reset button
Internal Battery connector
Space for Relay Expansion Board
Relays
Counters
Ext pwr
WET
SDI-12
+12V
+5V
PR2
03- 009
PR2
2
4
6
8
10
12
1
3
5
7
9
11
PWR Bank A and B
CH1-CH12 Voltage Range
Signal input terminals for analogue channels 1-6 + power terminals for each sensor, from Power Bank A
Signal input terminals for analogue channels 7-12 + power terminals for each sensor, from Power Bank B
9 cable glands for 3-6mm dia. sensor cables with sealing bungs
M12 connector for joint serial comms. & external power cable

Event Channels

Use **Event 1** or **2** to monitor fast switch closures or pulses up to 30 kHz, such as a flow meter.
Use **Event 3** or **4** to monitor slower switch closure or pulses <100Hz, such as a rain gauge. A 5ms de-bounce feature reduces the risk of double counting.

Relay Channels

The **Relay** channels have an open or closed latching switch, protected with a resetting thermal-fuse. They can be used in a variety of ways, e.g. to control several different experiments or irrigation zones, or alarms, or to switch power to sensors.
Each relay can switch up to 1A at 24VAC or 32V DC.
See also the Relay Expansion Module on page 12.

Status LED

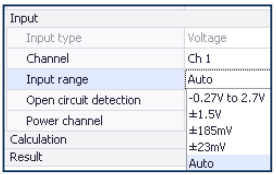
Two flashes per ten seconds means the GP2 is **logging**.
Four flashes in a group indicate an **error.**
No flash means **not logging** or **no battery** power.

If the logger locks up, briefly press the **Reset** button.

After pressing **Reset,** 4 LED flashes indicate that the GP2 is doing a **warm reset**. Your program and data are preserved and logging will resume.

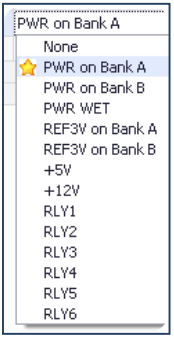
Hold **Reset** for more than 5 seconds until a second set of four LED flashes occur to initiate a **cold reset**. This restores the factory-set default program and deletes all data including any program which you may have added.

Analogue Channel Considerations



The differential analogue channels accept signals nominally 0 to 2.5V, with a full signal range of -1.4 to +2.7V.
The input range of custom sensor types can be set to auto-range or to fixed ranges.

Ensure each voltage input on the (+) or (-) terminals is kept within the permitted common mode range of -2.5V to +3V relative to logger GND. Ensure these limits are not exceeded, particularly if powered sensors are not powered by the GP2. The input signal may need to be connected to the logger ground. If the signal is floating then place a 10kohm resistor between (-) and (SGND).



Sensor Power

Analogue channels have (PWR) terminals to allow power to be switched to sensors. Sensors can be powered with an adjustable warm-up time prior to taking a reading. The duration of the warm-up period can be increased in multiples of one second.
The PWR power terminals associated with channels 1 to 12 can supply a regulated or unregulated voltage.
On Bank A and B the GP2 can provide either 3V (±0.2mV) or 5 to 10.5V (unregulated). In addition 5V (±2%) and 12V (±0.4V) DC are available on

separate screw terminals. External power can also be switched to sensors via up the two internal relays and four extra relays of the Relay Expansion Module.
For SDI-12 sensors refer to the **SDI-12 for GP2 User Manual.**
The WET sensor PWR terminal also supplies 5.0 to 10.5 VDC unregulated and can be used by another sensor if no WET sensor is connected.

Install DeltaLINK

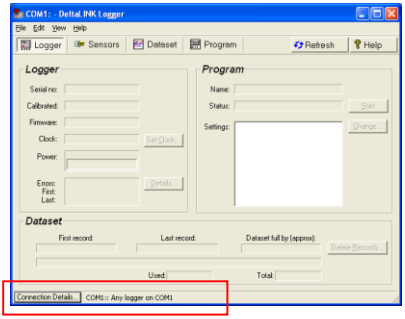
To operate the DeltaLINK 3 software for the GP2 logger you need:

- A PC running Windows Vista, XP, 7, 8 or later
- One free USB or RS232 port
- DVD drive or internet connection for software install
- GP2 to PC USB cable (supplied with GP2) or GP2 RS232 cable
- Delta-T Software and Manuals DVD (supplied with GP2) or internet connection

The following are also useful

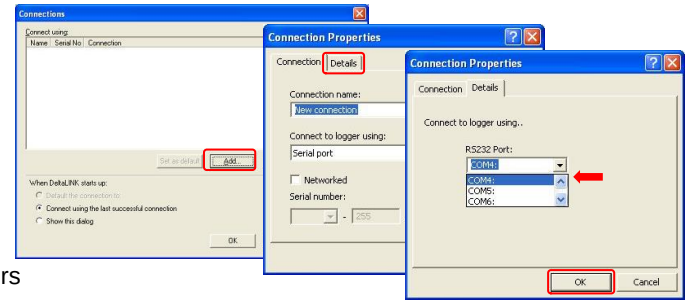
- Acrobat Reader for .pdf documents (free from www.adobe.com)
- Microsoft Excel 97 or later for the Excel Dataset Import Wizard

1. Insert the Software and Manuals disk into your DVD drive, or obtain DeltaLINK 3 from http://www.delta-t.co.uk.
2. Select **Install DeltaLINK** and follow the on-screen instructions.
3. Setup creates a desktop shortcut to **DeltaLINK**, and puts a **Firmware Upgrade** program, a **GP2 Calibration Certificate Generation** program, a **GSM Config Utility** and a **Document Library** folder in the DeltaLINK 3 program group.
4. An install program is also provided, if needed, for the GP2 to PC USB cable.
5. See the **Release Notes** in the **Document Library** or at http://www.delta-t.co.uk.



Connect to GP2

1. Connect GP2 to the PC using the serial cable provided.
2. Run DeltaLINK.
3. If DeltaLINK discovers your logger it displays this in the status bar – see at right.
   If the GP2 is not found select **Connection Details, Add, Details, Detect USB Port** or select the correct COM port from the drop down list.



See ***How to find your USB COM port*** on page 19.

If using networked loggers see page 18.

Sources of Help

Online Help

Click **Help** from any DeltaLINK window (or press F1) in selected areas for context sensitive information about DeltaLINK operation and functionality.
Select **Start**, **All Programs**, **Delta-T Devices**, **DeltaLINK**, **Document Library**.

Video Tutorials

Before attempting to program the GP2 watch the video tutorials –
at http://www.youtube.com/user/DeltaTDevices/videos

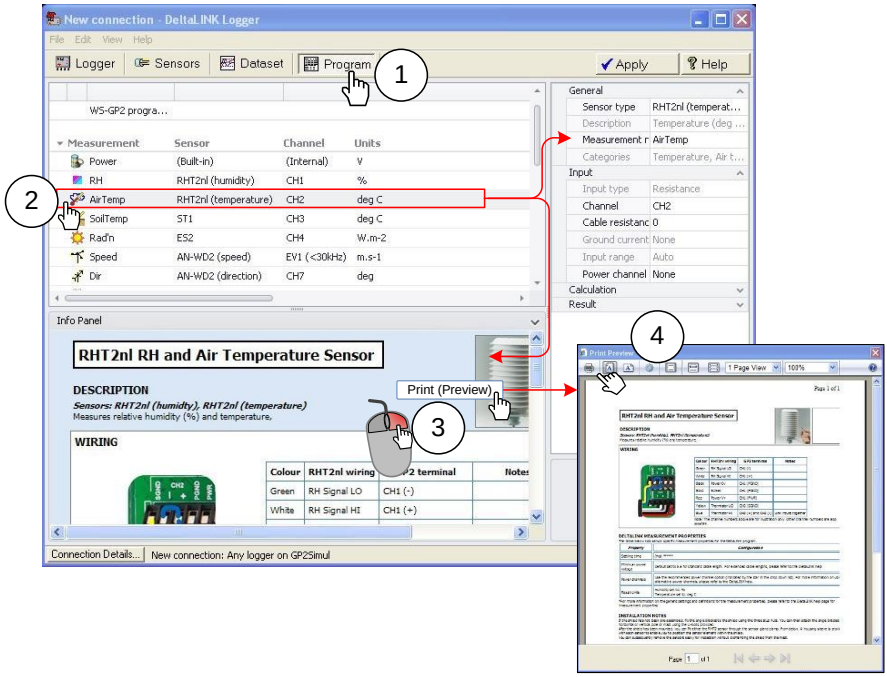
or on the Delta-T Software and Manual DVD.

These tutorials show the progressive development of a soil moisture sensor program, followed by its use to control soil moisture using an irrigation control relay.

Run DeltaLINK at the same time and see if you can reproduce the instructions along with the instructor.

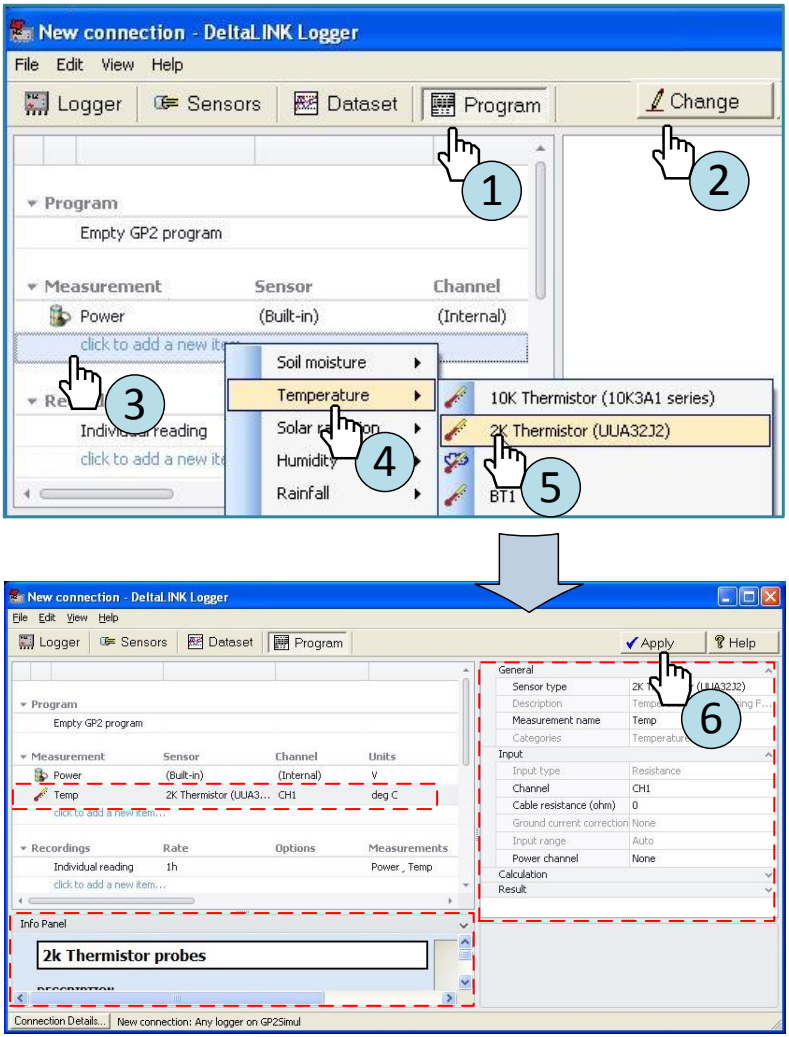
Sensor Wiring Instructions

Wiring, installation and programming notes are provided for all sensors in the GP2 sensor library. This information appears in the Info Panel when a sensor is selected in the **Measurement** section as shown in Step 2 below,
Left click on the wiring diagram to enlarge it.
If wiring up in the field it may help to have these printed - see steps 3 & 4.



Create a Simple Program in 6 Easy Steps

Before you start you need to have DeltaLINK connected to your GP2 (see above), or to the GP2 Simulator (see below).



1. Select **Program**
2. Select **Change**
3. Click on **"Click to add new item,** under **Measurement**
4. Select **Temperature** (or any other option from the list)
5. Select **2K Thermistor** (or any other option)
6. Select **Apply** to send the program to your GP2 or the simulator

You can now, if you wish, click on the **Sensors** tab and **Read Now** to watch real-time readings, or cut to the chase, select the **Logger** tab and **Start Logging**.

Note after step 5 above, that the the icon and label for the sensor appear in the **Measurement** list in the left hand window. Also, detailed properties for the chosen sensor appear in the right hand window, including the channel number, and, as we saw earlier, the sensor connection instructions appear in the lower left **Info Panel**.

Under **Recording** the row labelled **Individual reading** indicates a rate of once per hour. To change this, select the row – which will open the recording options on the right hand panel, and choose your own Recording rate.

Note: Before you can change a program, stop logging and delete the logged data (select **Logger, Stop** then **Delete Records).**

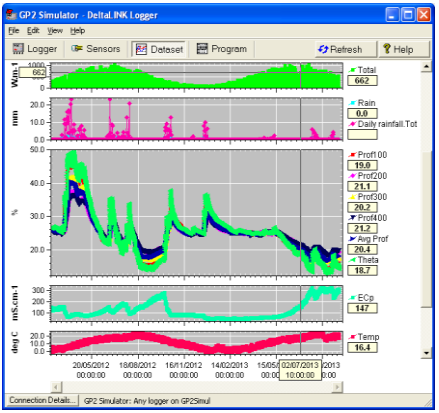
The GP2 Simulator

This simulates the weather and its effect on a variety of sensors. Before sending a program to your logger, try it out on the Simulator.

You can speed up time in the simulator to check the behaviour of your program.

Restart the simulator and it will recreate the same weather as before, from the same date. This lets you see the effect of changes to a program.

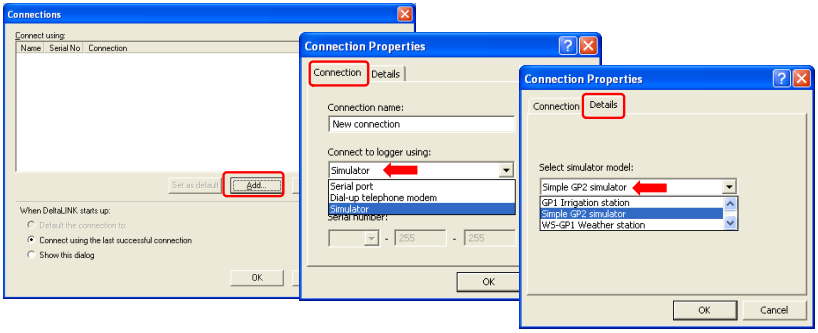
(Note the simulated weather uses an artificial pattern and pseudo-random numbers, so don't rely on it for anything important.)



Graphs of solar radiation, rain, soil moisture, salinity and temperature generated by the DeltaLINK Simulator

Connect to GP2 Simulator

1) Ensure DeltaLINK is connected to the GP2 Simulator as follows:-
   a) Select **Program, Connection Details, Add** and on the **Connection Properties, Connection** tab set **Connect to logger using** to **Simulator**
   b) On the **Details** tab set **Select simulator model** to **GP2 simulator.**
2) Click on **OK**, then **OK** again to connect



Sample Programs

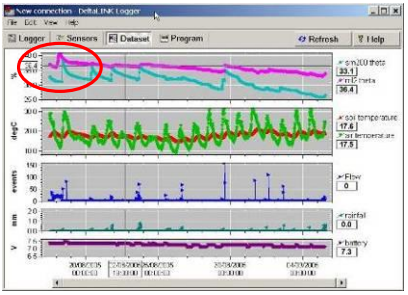
Several sample programs are provided. To use these select **Edit, Import Program**, and select one from the **Open** dialog.

Check Sensor Operation and Start Logging

1. Select the **Sensors** window and click the **Read now** button. The sensor readings will continually refresh on a scrolling time graph.
2. Observe the sensor reading display in the scrolling charts and value panels while adjusting sensor wiring and/or installation conditions.
3. Click the **Cancel** button when finished.
4. Once sensors are setup select the **Logger** tab and click **Start** to commence logging.

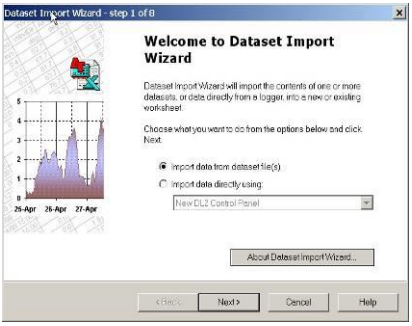
Retrieve, View and Save Logged Data

1. Select the **Dataset** window. All stored data in the logger will be retrieved and displayed on the screen.
   Click **Refresh** if required.
2. Select **File, Save** to save the data to a dataset file on your PC.
3. Select **File, Open** to open and view a previously saved dataset file.



Dataset Import Wizard

This helps import logged data files into MS Excel spreadsheets.
Get it from http://www.delta-t.co.uk or from the Delta-T Software and Manuals DVD.



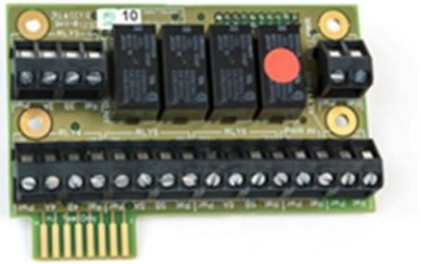
To Install Dataset Import Wizard:

1. From the Delta-T Software and Manuals DVD select **Dataset Import Wizard Excel add-in**.
2. If prompted by Excel, select **Enable Macros**. Note: Excel's security settings must allow macros to run: refer to Excel Help.
3. Dataset Import Wizard will report that it has installed successfully, and will add the **Import Dataset(s)** to the **File** menu (or to the **Add-Ins** ribbon in Excel 2010).
4. To Start Dataset Import Wizard: Start Excel, select **Import Dataset(s)** and follow the on-screen instructions.

Note: The GP2 memory can exceed the 65,000 row limit of Excel prior to Excel 2007. If so, either update Excel, or import the data into multiple worksheets.

Appendix 1: GP2 Relay Expansion Module

Contents



This contains:

4 x mounting screws

4 x stand-off pillars

5 x link wire

1 x GP2 relay expansion PCB

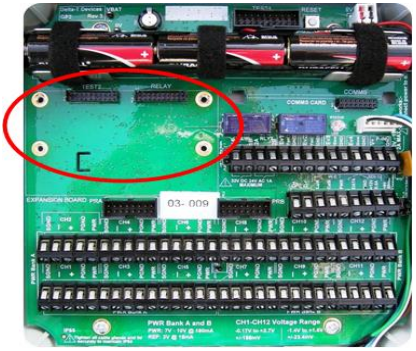
Overview

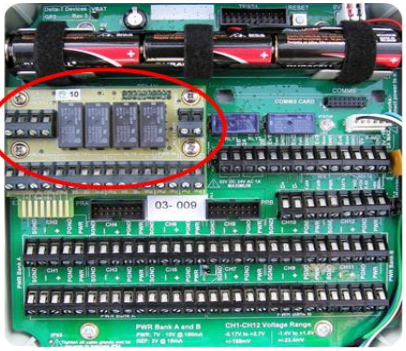
The GP2 contains 2 relays, used as switches. This expansion module provides 4 more, bringing the total to 6.

These can only be used with low voltage applications, not mains power.
DO NOT CONNECT 110V or 240V MAINS POWER TO THE RELAY

Each relay is protected from overvoltage and overcurrent using a resettable fuse that will activate at 1A. The relays can handle up to 24V AC or 32V DC .

The relay expansion module fits onto the ‘EXPANSION BOARD’ position on the GP2 PCB (as shown below).



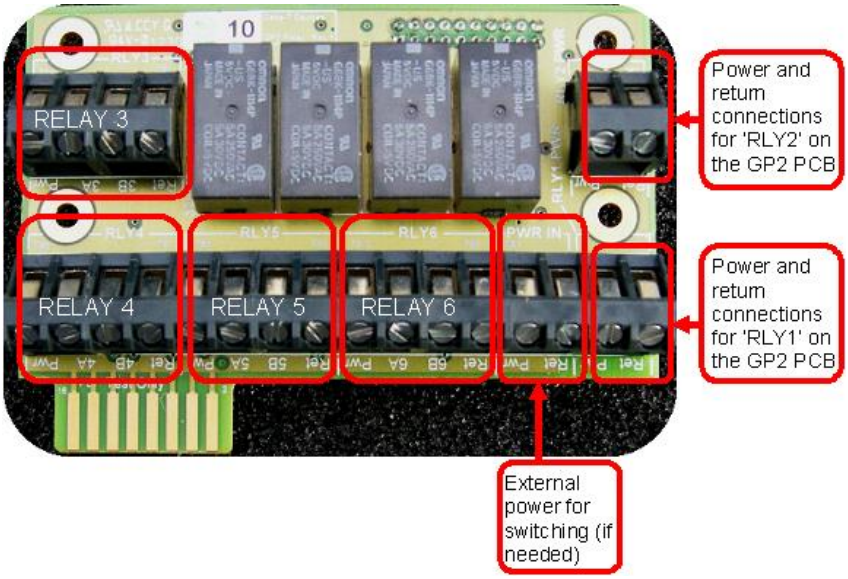


Fitting Instructions

Warning: use anti-static procedures when handling the relay expansion module

1. Screw in the 4 hex stand-off pillars (provided) into the 4 positions on the GP2 PCB
2. Push the relay expansion module onto the GP2 PCB as shown above. The header on the bottom of the module should fit into the ‘RELAY’ connector on the GP2 PCB and the 4 screw holes should line up with the hex stand-off pillars underneath.
3. Use the 4 screws (provided) to secure the PCB down on to the GP2.

Relay Layout



Note: All ‘Pwr’ and ‘Ret’ terminals are joined together on the circuit board
Power should not exceed 1A at 32V DC or 26V AC

DO NOT CONNECT 110V or 240V MAINS POWER TO THE RELAY

How to Control the Relays

To instruct the relays to switch on or off you need to set up suitable ‘control’ conditions which meet your requirements. This is done using the DeltaLINK program.
For more information on how to do this, please refer to the DeltaLINK online help. You may also find the video tutorials helpful.

Relay Wiring - Option 1:
Power supply NOT shared by all the relays

Using more than one power supply: To use the relays to switch in various devices where each uses a separate, different power supply then connect the positive wire directly from the selected power supply into the relay of choice. Do not use the 'Pwr' and 'Ret' routing options on the board:

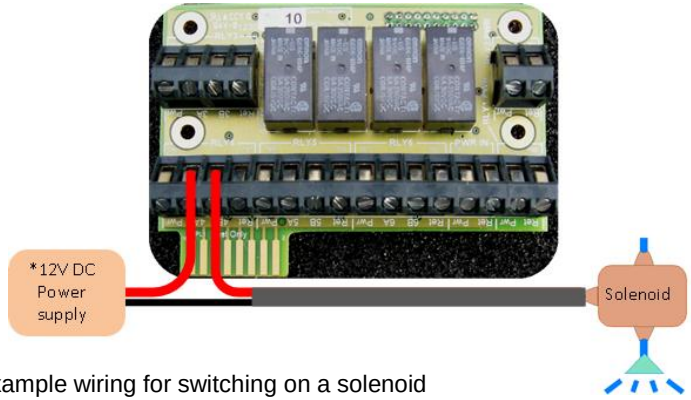


Figure A1: Example wiring for switching on a solenoid valve using the A and B terminals of relay number 4

Relay terminals, applicable to relays 1 - 6

Pwr: Not used

A: Connect to power supply positive (+) output

B: Connect to pump positive (+) wire

Ret: Not used

Connect the pump negative (-) wire directly to the power supply negative (–) terminal.

**** DO NOT CONNECT 110V or 240V MAINS POWER TO THE RELAY ****

Relay Wiring – Option 2:
Power supply shared by all the relays:

If you want to switch in several devices that all share the same power supply, such as pumps or solenoids, you can use the external power option and route the power through to each relay via the 'Pwr' and 'Ret' terminals:

- **External power in ('PWR IN'):**

Pwr: Connect to the +ive terminal on the power supply
Ret: Connect to the –ive terminal on the power supply

- **Relay terminals, applicable to relays 1 - 6**

Pwr: Link to the 'A' terminal next to it, e.g. '4A'
A: As above, linked to 'Pwr'
B: Connect to pump +ive wire
Ret: Connect to pump –ive wire

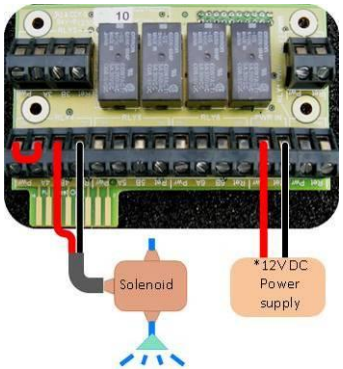


Figure A2: Switching in a solenoid valve using a common power supply through relay number 4

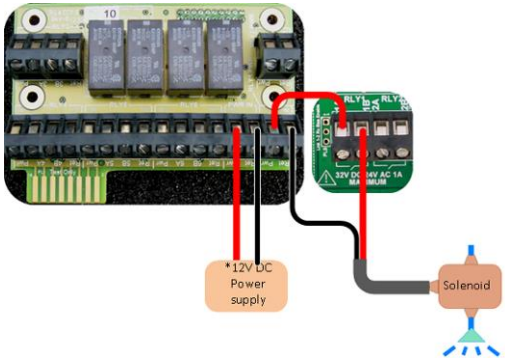


Figure A3: Switching in a solenoid valve using a common power supply through relay number 1 on the main PCB.

*Warning: The relay only can take up to 1A at 24V AC or 32V DC.

**** DO NOT CONNECT 110V or 240V MAINS POWER TO THE RELAY ****

Appendix 2: GP2 Network Cabling

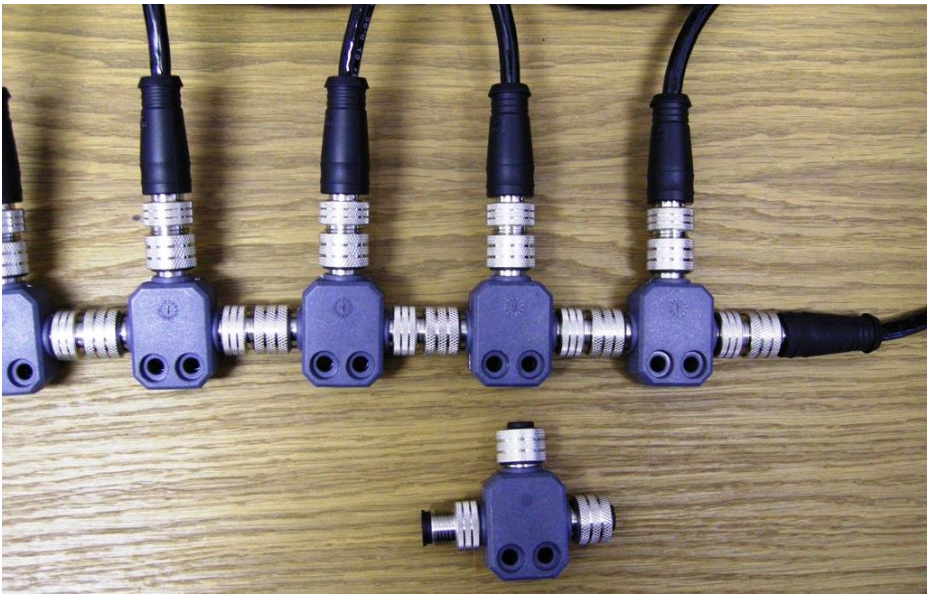


Figure A4 A network of 7 GP2 loggers connected to a PC via a total 100m of EXT/5w-xx extension cables and seven M12 5-way T-Piece connectors. This is the maximum number of loggers and maximum cable length supported.

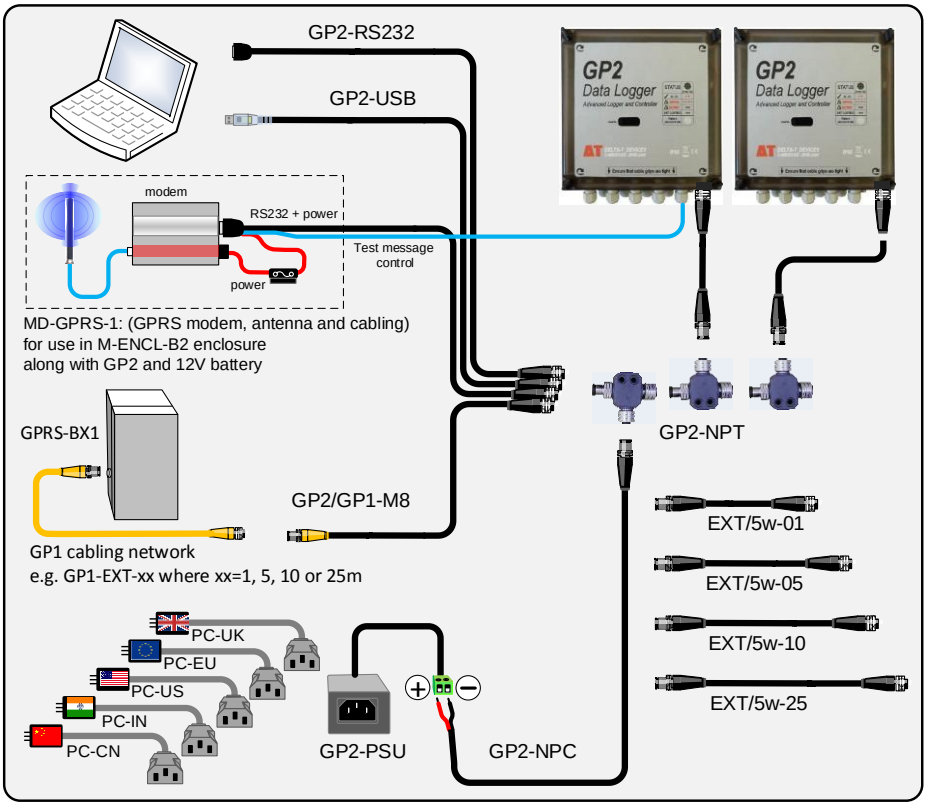


Figure A5 GP2 Network Cabling options

Notes

- A mini USB cable (not shown in Fig A5) - is required in order to configure the modem at the logger end. This is supplied as standard with the Delta-T GPRS modem solutions i.e. GPRS-BX1 and MD-GPRS-1.
- Seven is the maximum number of loggers which can be supported on a combined network of GP1 (and/or DL6) and GP2 loggers.

WARNINGS

- Only one external power supply should ever be connected to the network. Never connect more than one external battery.
- The GP2 network serial communication and power cable should not exceed 3A or 15V DC.
- Lead acid batteries must have a 2.5A in-line fuse in series with the +'ve wire to protect the network cabling.
- Do not charge any external battery (including one in the GSM modem box) via any extension cables.
- Do not power the GPRS modem via any extension cables.
- These warnings apply to all GP2 and GP1 network cabling systems.

DeltaLINK System Requirements

You need DeltaLINK version 3.2 or later.

Go to http://www.delta-t.co.uk for the current version of DeltaLINK or install it form the **Delta-T Software and Manuals DVD**.

Creating a Network Connection

1. Connect your PC to the GP2 network, via the GP2 USB cable or GP2-RS232 cable, or, if using a modem, via the cabling indicated in Figure A5..
2. Start **DeltaLINK**. Select **Connection Details** to display a window listing all (known) logger connections. The first time you do this the list may be empty.
3. In the **Connections** dialog, click **Add**… to pop up the **Connection Properties** dialog. See Figure A6.

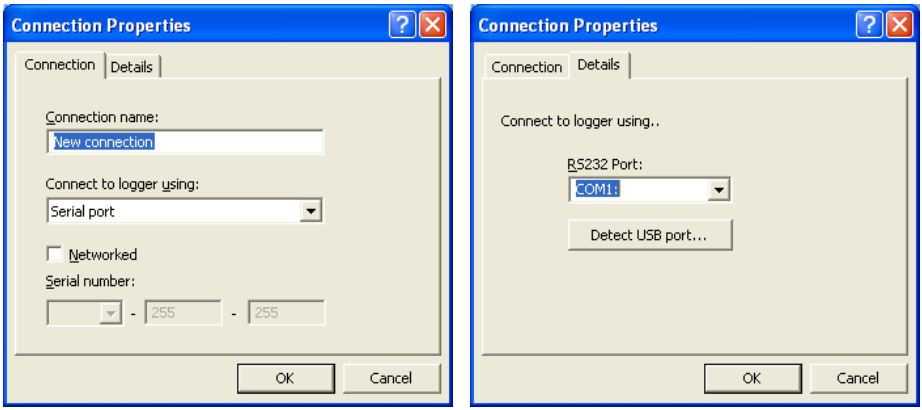


Figure A6 Connections Properties

4. In **Connect to logger using**: select the communication method, e.g. Serial.
5. Select the Details tab and enter connection details e.g. COM3.
   See also: ***How to Find your COM*** Port on page 19.
6. Select the **Connection** tab, tick the **Networked** check box, and enter the serial number of the GP2 that you want to address.
7. Enter a descriptive Connection name, e.g. or “GP2 3-24 on COM3 (USB).
8. Click OK, and in the Connections dialog select the new connection and click OK.
9. DeltaLINK will then open the connection in a new window.
10. Repeat the procedure for each logger on the network, with a unique connection name for each.

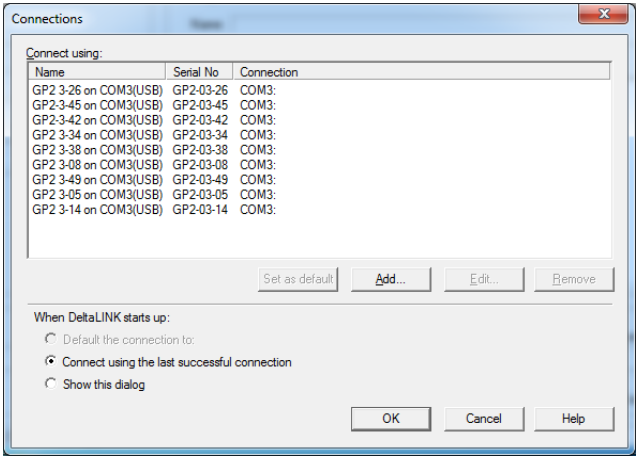
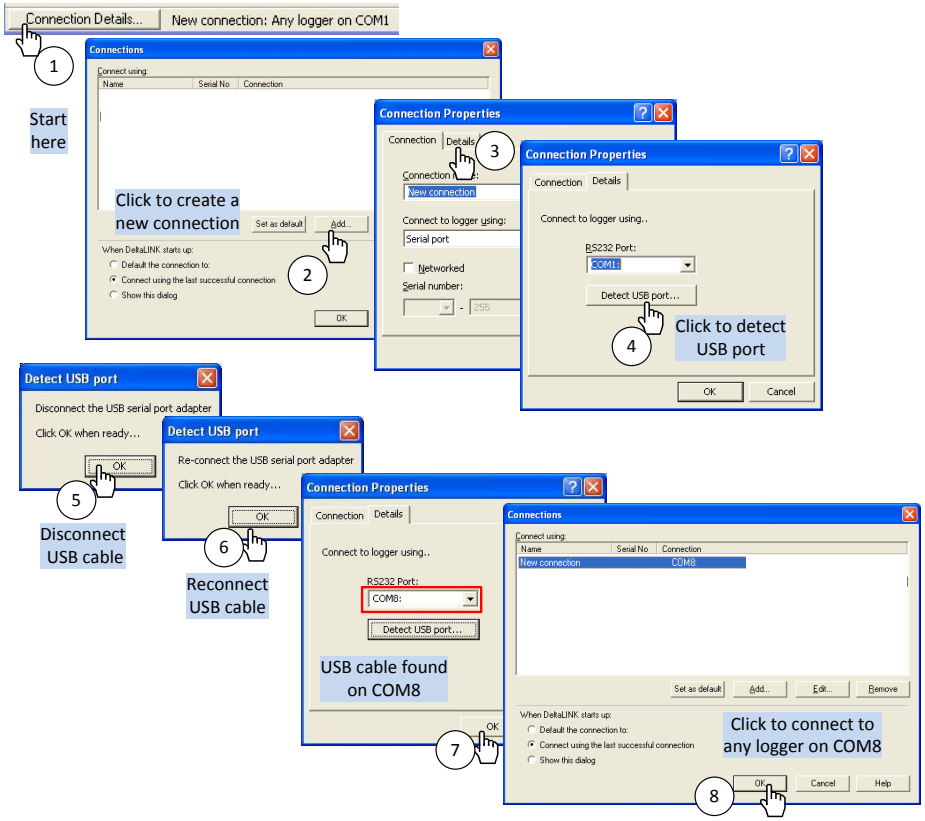


Figure A7 Example showing how DeltaLINK displays connections to GP2 loggers on the network connected to a PC on COM Port 3

How to find your USB COM port



Appendix 3: Cable Expansion Lids

Note: The GP2 case has 9 cable glands for 3-6 mm diameter cables. Additional and/or larger cables can be fitted using this expansion lid.

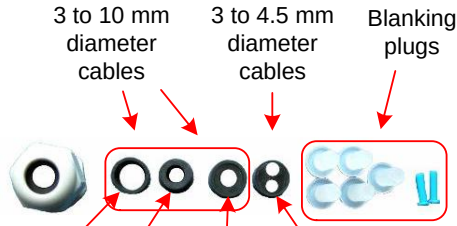
GP2-G5-LID

This GP2 lid has 5 general purpose cable glands.

Each gland can accept either a cable with an outer diameter of 3 to10mm diameter, or it can take 2 cables of diameter 3 to 4.5mm - using a gland insert with two holes.

Fit the lid in place using a cross-head cross-head screwdriver (not supplied).

GP2



For larger cables separate the inner and outer sleeves and use only the outer sleeve

When using the twin hole insert, ensure both holes are used – if using only one cable, then a blanking plug (or similar) must be put into the other hole. Failure to do this will mean the enclosure is not sealed, and may damage the insert.

See also: ***Appendix 7: Make sure the GP2 is properly sealed*** on page 25.

GP2-P2-LID

This expansion lid has 2 connectors for PR2 soil moisture profile probes, which are each connected via type EXT/8w-xx extension cables.

Inside the lid are two short internal cables with plugs which fit onto the PR2 sockets on the main PCB, as shown on page 5.

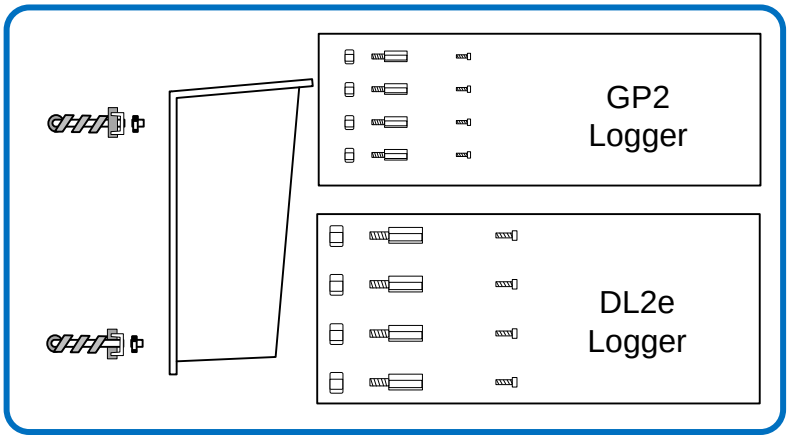
PR2/6 probes connect to channels 1-6 and 7-12 in the GP2 logger.

Pr2/4 probes connect to channels 1-4 and 7-10, leaving four of the 12 logger differential analogue channels free (along with all the relay and counter channels).

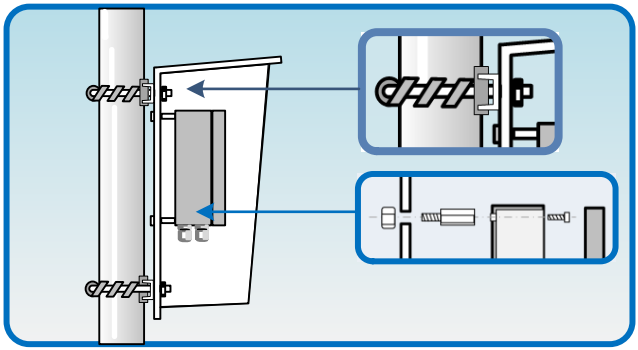
Note: to connect 3 PR2/4 probes you need to use a GP2-G5-LID and 3 PRC/w-05 PR2 to bare wire cables, (the cable glands in the main GP2 case do not take the larger PR2 cables.

Appendix 4: WS-CAN Canopy

Parts



Assembly



Appendix 5: DL-MKT Universal Data Logger Mounting Kit

The Universal Mounting Kit is a 2mm thick flat stainless steel plate with U-bolts suitable for attaching to a 42 mm (1⅝ inch) diameter vertical pipe or post and with nuts and bolts for GP2, GP1 and DL6 loggers.

Appendix 6: M-ENCL-B2 Enclosure with GPRS Modem Gateway to DeltaLINK Cloud

The enclosure is designed for use with the standard Delta-T M2 2m mast. It is an alternative to the weather station canopy and provides greater weather protection, electrical shielding, and security for GP2 logger and its related accessories.

- Weatherproof to IP54 standard
- Side opening door with twin locks
- Gland plate with 12 cable glands
- Two inch dia pole mounting brackets (2 off)
- Trunking for tidy cable routing
- Earthed back plate and strap

Detail showing an **M-ENCL–B2** Enclosure with additional options installed:- top left GPRS Modem Gateway type **MD-GPRS-DLC**, bottom left - a solar charger regulator (which along with a 30W solar panel and cabling forms a **SOL4-KIT2,** and bottom right a 12V, 10 Ah battery type **LBAT4**

For further information see:

- M2 Enclosure User Manual
- GPRS Modem Gateway User Manual

at http://www.delta-t.co.uk.

or on the Delta-T Software and Manuals DVD.

See also:

- http://www.delta-t.co.uk/DeltaLINK-Cloud.asp
- www.deltalink-cloud.com

Appendix 7: Make sure the GP2 is properly sealed

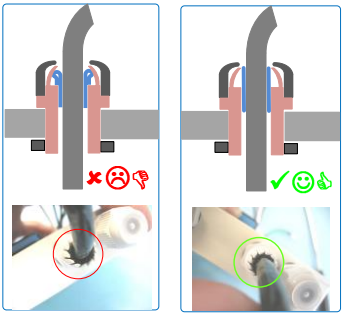
Make sure the case is not cracked nor damaged in any way

Check there is no dirt, foreign objects or damage to the rubber lid seal – this could compromise the integrity.

Firmly tighten all 4 lid screws

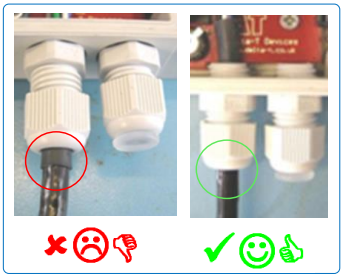
Make sure the rubber seal in the cable gland looks intact and clean.

Make sure the rubber seal hasn't pealed back on itself when a cable was inserted.

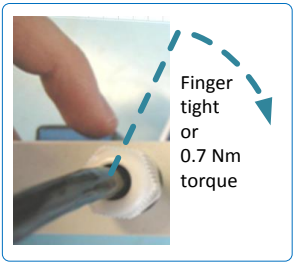


Ensure unused cable glands have a blanking plug fitted.

Tighten cable glands onto the cable, not onto heat shrink.

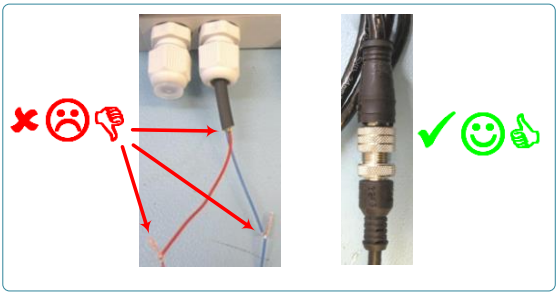


Tightened the cable glands as hard as you can by hand or use a torque wrench set to 0.7 nm.



A cable coming out of a GP2 with bare wires exposed, or a break in the insulation, can allow water to enter, so ensure the whole cable is properly sealed.

If possible use sealed connectors and mount the logger vertically with the cable glands facing down.



GP2 Specifications

General Specifications

Program repeat rate	Multiples of 1s
Real time clock	± 1 minutes per month typical, ±5 minute`s per month worst case. (-20 to +60 °C)
Communications	RS232 115.2kBaud, USB-RS232 adapter cable supplied
Networking	Up to 7 GP2s on 100 m of network cabling, with optional power distribution over network cabling
Input protection	All terminals protected to ±15VDC, 24VAC, including battery reverse polarity
Regulatory compliance	Surge tested IEC61000-4-5 PASS A ESD tested IEC61000-4-2 PASS A EMC tested IEC61000-4-3 PASS A CE Compliant FCC Compliant
Environmental	Operating: -20 to +60 °C
Enclosure	Fitted with cable glands, IP65
Data storage	4 MBytes FLASH memory. Storage capacity (compressed): 2.5 million values (typical). Autowrap option (i.e. overwrite earliest data when memory full) and/or manual deletion of data without interrupting logging.
Activity indicator	Every 10s, LED signals logging and error status

Analogue Input Specifications

Analogue input channels	12 differential. Each provided with signal (+), (-) and 0V (SGND), and power (PWR) and power return (PGND) terminals, and individually configurable for differential voltage, 3-wire resistance, bridge, potentiometer, or for a pair of single-ended voltage or 2-wire resistance measurements (up to 24 in total).
Input ranges	4 ranges, -1.4V to 2.7V maximum
Auto-ranging	Optional, adaptive
Sensor source impedance	<11K source resistance <20nF source capacitance
Sensor excitation	20uA current source for resistance and precision 3V for bridge and potentiometric measurements provided at each terminal cluster.
Open circuit detection	Optional, (+) and (-) terminals biased to -5V and +5V respectively for 2 ms via 50KΩ prior to the measurement
Settling time	Optional, 1 to 200 ms for high value resistance measurements
Reading duration	Per analogue measurement: 6ms built-in settling time + 2ms if open circuit detection enabled + optional settling time + 20ms or 16.67ms depending on mains filter frequency + additional 20 or 16.67ms if 2nd auto-range cycle required Plus, per program execution cycle: 20 ms startup + 2 to 8 self-calibration cycles of 11ms (dependent on mix of required measurements) + 26ms resistance self-calibration if required
Noise rejection	Common mode rejection ratio: >70 dB Common mode range: +3V to -2.5V For Bridge measurements, common mode nulled at +1.5V. Normal mode mains rejection (50/60Hz): 100 - 60dB (0 to 0.1% mains frequency error)
Input leakage	<2nA typical (-20 to +60°C: <12nA)
Input resistance	0.8 to 3.8 GΩ
Stability	0.02% worst case over 1 year Recalibration recommended every year
Cold junction thermistor	Built-in, 0.1°C precision 10K Thermistor + logger contribution as below. Isothermality <0.1°C per 1°C per hour temperature change

Analogue Accuracy

	Input range	GP2 at 25 ° C	-20 to +60 °C	Noise*
Voltage differential	-0.17V to 2.7V	0.004% + 87µV	0.036% + 148µV	33 µV
	-1.4V to 1.5V	0.004% + 87µV	0.036% + 148µV	33 µV
	±185mV	0.008% + 17µV	0.067% + 38µV	5.9µV
	±23mV	0.024% + 13µV	0.09% + 31µV	4.3µV
Voltage ** single-ended	-1.7V to 2.7V	0.007% + 86µV	0.043% + 119µV	33 µV
	-1.4V to 1.5V	0.007% + 86µV	0.043% + 119µV	33 µV
	±185mV	0.013% + 11µV	0.076% + 25µV	5.9µV
	±23mV	0.017% + 9 µV	0.084% + 22 µV	4.3µV
Resistance 3-wire	135KΩ	0.045% + 4.15Ω	0.138% + 6.46Ω	1.6 Ω
	9KΩ	0.059% + 0.63Ω	0.184% + 0.93Ω	0.3 Ω
	1KΩ	0.091% + 0.42Ω	0.229% + 0.28Ω	0.2 Ω
Resistance 2-wire	135KΩ	0.045% + 15.4Ω	0.109% +22.9Ω	1.6 Ω
	9KΩ	0.052% + 11.8Ω	0.155% + 17.4Ω	0.3 Ω
Bridge	±62mV/V***	0.037% + 20µV/V	0.077% + 48µV/V	2 µV/V
	±7.5mV/V	0.053% + 15µV/V	0.100% + 41µV/V	1.5 µV/V
Potentiometer	0 to 1	0.036% + 0.00015	0.057% + 0.00017	36 µV or 0.00002%
Thermistor (3-wire)	10K, -20 to +60°C	0.04°C	0.08°C	<0.01°C
	2K, -20 to +60°C	0.05°C	0.09°C	<0.01°C
Thermocouple**** K type (differential)	±23mV	0.47°C	1°C	<0.3°C

* RMS noise, included in offset figure

** Single-ended voltage measurements are subject to further offset errors due to current flowing in signal ground.

*** mV per 1V excitation

**** GP2 contribution to measurement error only, sensor error is additional

Digital Input Specifications

Counter/frequency/digital state channels	2 x fast, 30 kHz, 30 us debounce 2 x slow, 100 Hz, 5 ms debounce Accepts logic level (low <0.8V, high >2.4V) or open collector or voltage-free switch closure inputs.
SDI-12 sensors	Up to 62 SDI-12 sensors[4]. See also **SDI-12 for GP2 User Manual**.
WET sensor	1 x WET sensor channel (see footnote 4). Water content, bulk/pore conductivity and temperature.

Relay Outputs

Relay channels	2 plus 4 with optional relay expansion card
Type	Latching, single pole single throw
Rating	24VAC, 32VDC, 1A thermal fuse overload protection
Functions	Alarm, control, scripts, or switching power to sensors

Other

Dimensions	225 x 185 x 75 mm (Standard lid, no cables)
Weight	1 kg (Standard lid, No packaging, No relay PCB)
Package contents	GP2 logger with lid Dessicant and dessicant storage bag Toolkit- spanner and screwdriver Software and Manuals DVD GP2 User Manual
Warranty	1 year

[4] The serial input channel can be connected to either one WET sensor or to an SDI-12 sensor network, but not both at the same time.

Power Supply Specifications

Internal battery	6 x AA alkaline cells
External power	IN: 10 to 15VDC, 2A via screw terminals or network cabling OUT: 2.5A via network cabling
Mains adapter	Accessory, provides 12VDC regulated, 2.5A
Sleep current	< 60uA typical (-20 to +60 °C: 120uA) Plus 30uA for each digital input held low. <1mA (input regulator current) when running from external power supply unit
Wake current	<10 mA, plus any current supplied to sensors
Backup	GP2 draws current from internal battery or external supply, whichever provides the higher voltage, so internal battery serves as backup supply if external power fails. Internal backup capacitor retains program state and maintains the clock for >1 hour for battery change or if both supplies fail.
Low power detection	3.09V to 3.42V shutdown to self-preservation mode 4.1 V analogue readings fail User defined minimum power for analogue measurements powered via PWR Bank A or B (below). Measurements invalidated if requirement not met.

Sensor Power and Warm-up Specifications

Any of the sources below can be selected for powering sensors. Power is switched when required, either immediately before a measurement or with 1s to 60s warm-up duration in advance.

PWR Bank A	5 to 10.5 V unregulated, 180 mA. Routed to PWR terminals of analogue input channels CH1 to CH6.
PWR Bank B	As PWR Bank A, routed to CH7 to CH12
REF 3V Banks A, B	Calibrated 3V reference for bridge and potentiometer excitation, ±0.2 mV (-20 to +60: ± 0.9mV) 18mA. Routed to Bank A and B terminals, so excludes use of PWR on the selected Bank.
WET PWR	5 to 10.5V, 50 mA min, 150mA max unregulated
+5V	5.0VDC ±2% (-20 to +60: ±3%), 50mA, shared with internal functions
+12V	12 ± 0.4VDC (-20 to +60: ±0.6VDC), 0.5A
Relays RLY 1 to 6	Relay can be configured switch power to sensors from an independent external supply.

DeltaLINK 3 Software Specifications

DeltaLINK 3 is Windows software for configuring, managing and downloading data from the GP2 data logger

System requirements

Screen	1024 x 600 or more
Operating system	MS Windows XP SP3 or later
DVD drive	To install from DVD or download from http://www.delta-t.co.uk.

Features

Compatibility	GP2 (GP1, DL6 data loggers – see footnote[5])
Logger status	Logger, program, memory and battery status, and error log.
Program settings	Modify selected aspects of program behaviour without interrupting program execution.
On demand measurements	Measurement values charted on demand at any time, for setting up and checking that 'all is well'
Data download	Chart and table views of downloaded data, export as text file. Caching to optimize download times of large datasets
Program editor	Multifunction GP2 program editor displays the logging program, with point and click programming interface (GP2 loggers only).
Online help	Detailed context-sensitive Help and reference.
GP2 simulator	This can simulate a GP2 which is logging Delta-T sensors and operating irrigation valves in a mid-latitude maritime climate. For experimenting with program outcomes.[6]
Command line tool	Downloads and manages logged data and error log. Can run in a Windows scheduled task to automate data download.
Document library	Folder containing rich product documentation and application note resources
Firmware update	Update to most recent firmware version

[5] Software support for DL6 and GP1 loggers uses earlier version of DeltaLINK

[6] The Simulator does not support SDI-12 sensors at the moment (i.e. June 2016)

Multifunction GP2 Program Specifications

Measurements	Analogue, digital and calculated measurements. Unlimited number (subject to channel availability and program size). Individually configured for input type, calculation method and result limits, or by selection of a sensor type from a sensor library picking list.
Input types	Voltage, resistance, current, bridge, potentiometer, counter, frequency, digital state, WET.
Calculation methods	No calculation, average, min., max., mean, sum, linear scaling, slope and intercept, linearization table, comparator, thermocouple, soil moisture, pore conductivity and custom formulae.
Delta-T sensor library	Delta-T sensor library provides sensor types for all GP2-compatible Delta-T line item sensors, including detailed HTML Sensor configuration notes.
Custom sensor library	User-defined custom sensor library, including configuration notes created with built-in HTML editor.
Recordings	Individual readings, statistics, total, integral, wind (including direction and vector average, gust, wind roses), conditional
Controls	Relay switching controlled by independent Activate and Rest conditions, safety conditions (limit duration of Active and Rest periods), with optional additional recording while Active, and optional pulsing. Conditions expressed as custom formulae and evaluated at defined repeat rates or on a digital event or on a DeltaLINK button click.
Alarms	Relay switching triggered by evaluation of a measurement and comparison against a numeric threshold value(s) or a custom formula. Optional pulsing.
Scripts	Custom scripts, executed at a defined repeat rate, including conditional branches (IF… ELSEIF…ELSE…ENDIF), recording, switching relays and use of variables.
Variables	For use in custom formulae and scripts
Program settings	Variables and critical control parameters optionally configured to be adjusted while the program runs.
Video tutorial	Instructions for building up a sophisticated program in easy stages.

Script Editor Specifications

Point and click user interface for constructing custom formulae and scripts incorporating the following programming elements:

Statements *	IF… ELSEIF…ELSE…ENDIF, RECORD, ASSIGN
Values	Constants (number, integer, time, duration), variables, measurements, outputs
Operators	Arithmetic: +, –, *, /, % Logical: ==, <>, >=, <, <=, AND, OR
Numeric status	IsNumber, IsNan, IsOverflow, IsUnderflow
Mathematical functions	Minimum, Maximum, Average, Sum, Sin, Cos, Tan, ASin, ACos, Atan, SinH, CosH, Ln, Log10, Exp, Pow, Abs, Atan2
Time and date	NOW, Time, Day of month, Month, Day of Week, Day of Year, Week of Year, Week of Month, Year

* Statements are applicable only in scripts. Other elements may not be applicable, depending on the context.

Simulator Specifications

The simulator assists the development of logging and control programs, simulating a temperate maritime climate at a latitude of 51 degrees North, such as that in the UK.

Soil water, nutrient and heat fluxes are simulated.

Soil moisture is lost by drainage and by surface evaporation and evapotranspiration - from a spring-sown crop harvested in the autumn.

Water uptake peaks in high summer, nutrient uptake peaking earlier.

Soil water is replenished by rainfall, and by irrigation which is modelled by switching the GP2's relays.

Irrigation can be with fresh water or saline/nutrient solution – these differ in their effect on soil salinity – and can be measured by a simulated flow meter.

The simulator can be speeded up and the same weather pattern can be repeated.

SDI-12 sensors are not currently supported in the simulator.

For full details please see ***DeltaLINK 3 Help.***

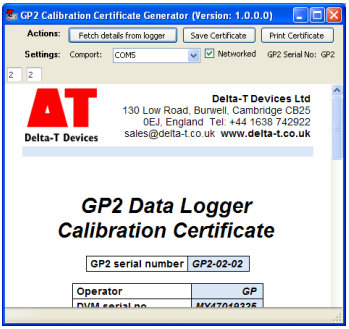
Product Care and Maintenance

The battery can be changed quickly without losing program settings or data, but no additional data will be logged while the battery is removed. Change the battery if the voltage indicated on the **Logger** window of **DeltaLINK** is under 5.5V or below the supply voltage needed for sensors.

One 25g bag of **desiccant** protects the logger from condensation. Replace with fresh desiccant annually to ensure continued logger accuracy and reliability. Keep the cover on and cable glands sealed except when connecting sensors or changing the battery.
Logger sealing: See ***Appendix 7: Make sure the GP2 is properly sealed*** on page 25.

The Service Kit (**GP2-SER**) contains desiccant, a replacement battery holder, spare M8 connector cover cap & lanyard, and spare sealing bungs.

GP2 Calibration Certificate



To see your current calibration certificate:-

- Connect your PC to your GP2
- Run **GP2 Calibration Certificate Generator** from the **Start, All Programs, Delta-T Devices, DeltaLINK 3** menu
- Enter the number of your GP2 COM port connection and, if networked, the GP2 serial number
- Select **Fetch Details from logger**
- Select **Save** or **Print Certificate** as required.

Legal and Regulatory Advice

Please read **GP2 Product Usage.pdf** in the **DeltaLINK 3\Document Library** folder.
The GP2 is CE compliant, conforming to the essential requirements of EMC directive 2004/108/EC.
For US markets the GP2 is Part 15 FCC compliant.

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