Seametrics

GDL 4-20 mA Datalogger

Instructions

What is a GDL?

Seametrics GDL is a datalogger to which analog sensors can be attached and then read from Seametrics Aqua4Plus control software. It takes the analog signals and converts them into digital signals. The GDL board can read the sensors in real time or record sessions of data for later upload. This industry standard digital RS485 interface device records thousands of records, operates on low power, and features easy-to-use software with powerful features.

This particular unit is a GDL with two 4-20 mA channels. Output can be displayed in mA, microAmps, or user-defined units.

The GDL is powered with eight AA batteries The unit is programmed using a laptop or desktop Windows® based computer via its RS485/RS232 connector and easy to use Aqua4Plus software. Once programmed the unit will measure and collect data on a variety of time intervals.

Initial Inspection and Handling

Upon receipt of your datalogger, inspect the shipping package for damage. If any damage is apparent, note the signs of damage on the appropriate shipping form. After opening the carton, look for concealed damage. If concealed damage is found, immediately file a claim with the carrier.

Do's and Don'ts

- *Do* handle the device with care.
- *Don't* install the device such that the box or any of its connectors are submerged.
- *Don't* support the device with the connector or with the connectors of an attached cable.
- *Don't* bang or drop the device on hard objects.

GDL Connectors

This GDL comes with three connectors - two for connecting 4-20 mA devices and one communication connector for connecting to the computer.
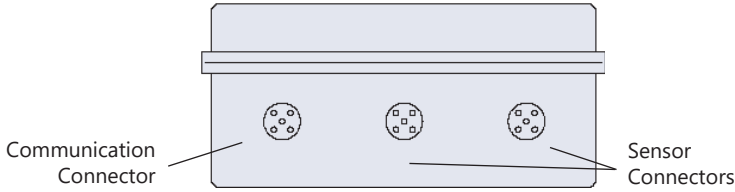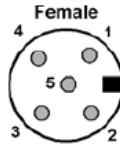

The GLD has one communication connector and a variable number of sensor connectors, depending on your configuration.

Connecting Your 4-20 mA Devices to the GDL

Connect your 4-20 mA devices to the sensor connectors.

Pin 1   12 Volts

Pin 3   Signal return

Pin 5   GND

Connecting GDL to Computer

Connect the GDL to your computer's USB port, as shown below. Drivers and instructions come with the adapter. (For alternate connection options, see Appendix C.)
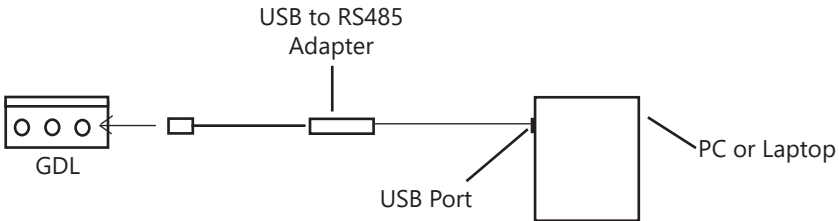
Connect the sensor to your PC using Seametrics' USB to RS485 adapter. (See Appendix C for alternate connections.)

Aqua4Plus Software

The GDL comes with the Aqua4Plus host software that is installed on your PC or laptop. This software is used to program the datalogger, to retrieve data from the logger, to view collected data, and to export data to external files for use with spreadsheets or databases. Refer to the Aqua4Plus software manual for details on installing and using Aqua4Plus.

Warm Up Time

Many analog sensors require a warm-up time before readings are stable. The GDL board has a programmable field for warm-up time. (Note: the GDL reads all channels each time it takes a reading. Therefore, this warm-up time should be set to the longest warm-up time needed by the particular sensors you have connected, even though some may require a much shorter warm up time.)

Set this warm up time by clicking on Warm Up Time... on the Configure menu.

User Defined Units

In addition to normal unit selections, the 4-20 mA channels have a User Defined option. For instance, normally a 4-20 mA channel would have mA and microAmps as units options. If the user has a pressure sensor connected to a 4-20 mA channel, output may be desired in psi. For that there is a User Defined Units option.

Configure User Defined Units as follows:

1. Connect your GDL box to the computer and start Aqua4Plus.

2. Scan for sensors and select the GDL. (Refer to the Aqua4Plus software manual for details on using Aqua4Plus.)

3. In the Display Units box (under the Options menu), there are three entries for 4-20 mA channels – mA, uA, and User Defined. Select User Defined.
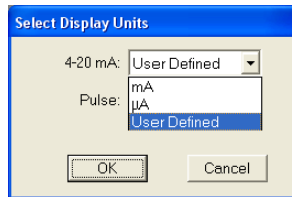
Select User Defined Units

4. You can only set field calibration when there are no sessions on the GDL. Be sure to upload any data on the sensor and erase all sessions, before continuing.

5. From the Configure window, select Field Calibration. (Refer to figure on next page for an illustration of Field Calibration window.)

6. In the left panel, highlight the channel you want to configure. Each channel can have its own user defined units. For example, if you have the first channel connected to a pressure sensor, you might want those units to be psi. If you have the second channel connected to a temperature sensor, you might want those units in degrees Celcius.

7. Define your own user units in the Field Calibration window as follows.

    •   <u>User Units</u>: Enter a name for your units in the User Units box. For example, you might enter *psi*.

    •   <u>Scale</u>: Compute the scale value as follows:
        (*Total range of measurement in your units*) / 16 / 1000
        For example: if you want to measure 0 – 15 psi:
        15 / 16 / 1000 = .0009375
        Enter this value in the box labeled Scale.

    •   <u>Offset</u>: Compute the offset value as follows:
        minimum user units - (scale * 4000)
        Using our 0 – 5 psi example above, this would be
        0 - (.0009375 * 4000) = -3.75
        Enter this value in the Offset box.

    •   <u>Dec Places</u>: Enter the number of decimal places you want displayed during readings.

    •   <u>Min</u> and <u>Max</u>: Enter the minimum and maximum values for your new units. (These values will define the limits on data graph.)

    •   <u>Comment</u>: If desired, enter a comment in this box.

8. Click OK to save to the sensor.

Configure User Defined Units on the Field Calibration Window

Changing Batteries

Because changing the batteries involves opening the weather-tight seal, **this <u>must</u> be done in a clean, dry environment to avoid contamination or moisture damage to the circuitry.**

The GDL runs on eight AA alkaline batteries.

To replace the batteries, remove the four corner screws and lift off the lid. Gently lift out the battery pack. Replace the batteries, and then place the lid on the box, tightening the screws securely. **NOTE: The box is directionally keyed. Failure to replace the lid correctly will prevent a tight seal and will result in water leakage.**

No slot   Slot

Note: keyed slot in box before replacing lid.

While the GDL comes with the easy to use Aqua4Plus software, you can also use standard Modbus® RTU or SDI-12 equipment to easily take readings, so as to tie into your existing equipment or networks.

You may need to use Aqua4Plus to make a few settings, prior to directly reading the GDL with your equipment. These settings may include units for returned values, baud rate, and SDI-12 command structure. These are described in the following sections.

Setting Units for Direct Read

By default, the 4-20mA channels return readings in mA.

However, you can select from a variety of units for direct read measurements. If you want to change to different units. Set these units using Aqua4Plus.

1. Click on the Configure menu, and then select Advanced.

2. From the flyout menu, select Direct Read Units.

3. On the popup box, click the down-arrows next to 4-20mA, and then select the units you want.

4. Click OK
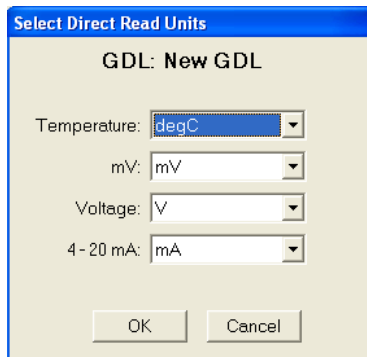
Use Aqua4Plus to select the units for your direct
read measurements, whether Modbus or SDI-12.

Once set, these units are saved on the sensor and direct readings, either via Modbus or via SDI-12, will return values using these units. (Note: These settings do not affect the units used on the Aqua4Plus display. Refer to the Aqua4Plus software manual for details on using Aqua4Plus.)

Reading Via Modbus® RTU

Baud Rate

Your GDL comes configured to communicate at 38,400 baud, with 8 data bits, one stop bit, and no parity. The logger can also be set to 19,200 or 9600 baud, if needed for your application. If needed, set your GDL to the desired baud rate using Aqua4Plus, per instructions earlier in this manual.

Taking Measurements

Read measurements using Modbus function 03 – Read Holding Registers.

Readings are located in two registers each. (GDL register address is zero based, i.e., starts at zero. If your equipment uses one based addressing, you will need to add one to the register addresses.)

Table 1: Register addresses for GDL Data Logger		
Addresses for standard channels		
	Zero Based	One Based
4-20 mA 1	62602	62603
4-20 mA 2	62604	62605

For further addressing information and detailed examples, please go to our website: seametrics.com

The data is returned as 32-bit IEEE floating-point values, high word first, also referred to as big-endian or float inverse.

GDL's Power On Function

Some devices require a warm-up or stabilization time after application of power before accurate readings can be taken. The GDL provides a means to explicitly turn power on or off to the analog circuit and any devices attached to the switched power output prior to requesting a reading. This same function allows you to specify how long the circuit remains on after a reading has been taken.

There is a "power on" register on the GDL (register 62720 or 0xF500). When a positive value "n" is written to this register, the power is turned on to the sensing probe and remains on for n/4 seconds. When a reading is requested, the timer is reset and the sensing element remains on for another n/4 seconds. To force the power off immediately after a reading, for power savings, write a zero to the register. If the power to the entire GDL sensor is turned off, this value defaults to 30 (or 7.5 seconds).

The recommended procedure to ensure proper warm-up/stabilization and to conserve power is:

1. Write Power On value of 30 (30/4 = 7.5 seconds) *

    • Power turns on

    • Starts sampling about two times per second

2. Wait 7 seconds then request a reading *

    • Returns most recent sample

    • Resets Power On value to 30 (30/4 = 7.5 seconds) *

3. Write Power On value of 0 (zero)

    • Turns power off

    • Retains last reading

If your attached sensors have a longer warm-up/stabilization time, increase these values.

If you Cannot Write to the Power On Register

If you are reading your device using a meter or other device that cannot write the Power On but simply takes readings on a specified schedule, be sure to set the polling interval to less than 7.5 seconds. This will ensure that the GDL is always providing power to the connected sensors and readings should be fresh and stable. Note that the first reading when you turn on the sensor and meter will be old but will refresh within a second or two.

Reading Via SDI-12

Addressing

Default SDI-12 Address: 0

Channel Setup Using Aqua4Plus

Standard SDI-12 commands are limited to returning a maximum of nine values. The GDL, depending on how it is configured, may have as many as 15 channels. For this reason, Aqua4Plus contains an SDI-12 setup utility to allow you to define which channels are returned for the M or C, M1 or C1, M2 or C2, and M3 or C3 commands.

Open the SDI-12 setup utility from Aqua4Plus by clicking on the Configure Menu and then selecting Advanced. From the flyout menu, select SDI-12 Setup.
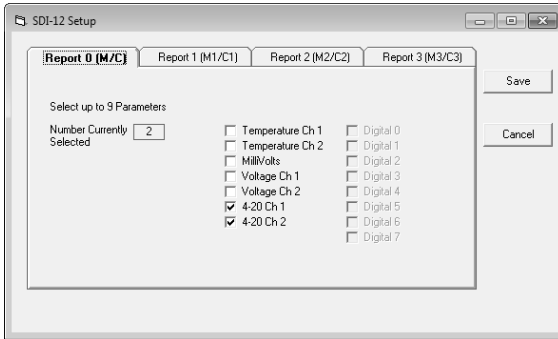
*Use the SDI-12 Setup window to define what
values are returned for specific SDI-12 commands.*

This window consists of four tabs, one for the M and C commands, one for the M1 and C1 commands, one for the M2 and C2 commands, and one for the M3 and C3 commands.

On the tab for the command you want to define, checkmark the channels to be returned using this command, either or both of the 4-20 channels.

Once you have selected the channels for each command you want to use, click on OK to save the information to the logger.

SDI-12 Command Nomenclature

\<a\> = Sensor address

{crc} = SDI-12 compatible 3-character CRC

\<cr\> = ASCII carriage return character

\<lf\> = ASCII line feed character

highlighted values indicate variable data

SDI-12 Commands

//*** Sensor Identification

\<a\>I! \<a\>13 INWUSA GDL**2.9sssssssss**\<cr\>\<lf\>

       // note: 2.9 will change to reflect current firmware revision

       // sssssssss = device serial #

//*** Acknowledge Active, Address Query

\<a\>! \<a\>\<cr\>\<lf\>

?! \<a\>\<cr\>\<lf\>

//*** Change Address

\<a\>A\<b\>! \<b\>\<cr\>\<lf\> // change address to \<b\>

//*** Request measurement

M!, M1!, M2!, or M3!

Example:

\<a\>M! \<a\>0024\<cr\>\<lf\> // request measurements as set up for M!

\<a\>D0! \<a\>**+22.0512+12.0512**\<cr\>\<lf\>

//*** Request measurement with CRC

MC!, MC1!, MC2!, or MC3!

Example:

\<a\>MC! \<a\>0024\<cr\>\<lf\> // request measurements as set up for M!

\<a\>D0! \<a\>**+22.0512+12.0512**{crc}\<cr\>\<lf\>

//*** Concurrent measurement

C!, C1!, C2!, or C3!

Example:

\<a\>C! \<a\>00204\<cr\>\<lf\> // request measurements as set up for C!

\<a\>D0! \<a\>**+22.0512+12.0512**\<cr\>\<lf\>

//*** Concurrent measurement with CRC

C!, C1!, C2!, or C3!

Example:

\<a\>CC! \<a\>00204\<cr\>\<lf\> // request measurements as set up for C!

\<a\>D0! \<a\>**+22.0512+12.0512**\<cr\>\<lf\>

Channel Specifications

Range	0 to 24 mA
Resolution	730 nA
Common mode voltage range	0V .. 5.25V

Power Supply

Internal *(AA alkaline cells)*	12 VDC or 3 VDC
Auxiliary	6.0V - 24.0V *(not to exceed 24.0V)*
Switched voltage output	Standard: 12V *(current limited to 65mA)*
	Optional: up to 48V at 50 mA

Power consumption*

Sleep mode w/ 3 volts	200 uW
Active mode w/ 3 volts	10.5 mW
Sleep mode w/ 12 volts	625 uW
Active mode w/ 12 volts	11 mW

**Exclusive of digital expansion board and any attached devices*

Enclosure

Material	Polycarbonate (IP67)
Dimensions	5.5" x 3.1" x 2.6" (14 x 7.9 x 6.6 cm) — excluding connectors
Connections	1 communication port
	2 sensor ports

Communication Connector

The GDL comes with one five-pin communication connector. Use this for communicating with your computer.

Pin	Description	Internal wiring color
1	12 Vdc + *	Brown
2	Modbus D –	White
3	Modbus D +	Blue
4	S D I - 1 2 Signal	Black
5	Ground	Gray

Male
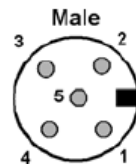
* May or may not be connected, depending on application

Connecting via RS232 Serial Port

In its cabled configuration, the sensor cable is terminated with a weather-resistant connector. In its cableless configuration, the sensor is terminated with a weather-resistant connecter inside a screw-cap. Connect the weather-resistant connector to your computer's serial port as shown below.

*Connect the sensor to your computer using an RS485/RS232 adapter and an interface cable.*
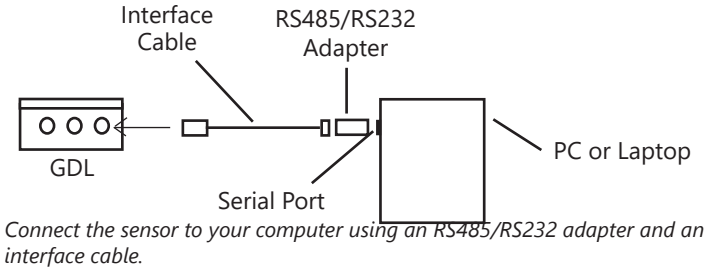
Connecting with a USB/Serial Adapter

USB-to-Serial cables are readily available from many electronics and computer stores, as well as numerous sites on the Internet. Seametrics has tested and recommends the Keyspan USA-19HS. It is available from Seametrics as well as from many sites on the Internet. Install as follows:

1. Plug into USB port.

2. Install the drivers provided with the particular unit.

3. Determine the port number to which the adapter is assigned.

    - Right-click on My Computer.

    - From the popup menu, select Manage to open the Computer Management window.

    - On left panel, click on Device Manager.

    - On right panel, double-click on Ports.

    - A list of active COM ports will be displayed. Note the COM number assigned to the adapter you just installed.
      For example: Keyspan USB Serial Port (COM4)

    - Close Manager.

4. Connect to the sensor.

5. On the Aqua4Plus software, select the COM port noted above. (If you do not see your new COM port in the dropdown box, open the Communications dialog box from the Options menu. Increase the Highest COM port number, up to a maximum of 15.)
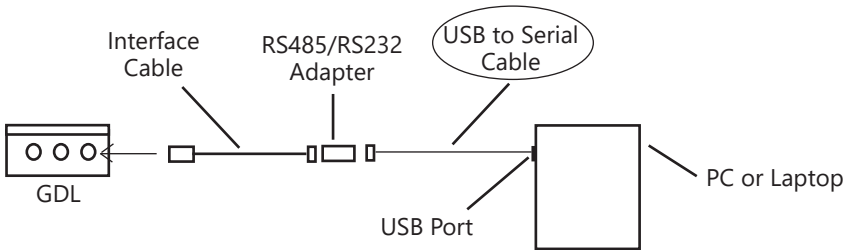
Connection using a USB to Serial Adapter

LIMITED WARRANTY/DISCLAIMER - GDL DATALOGGER

A. Seller warrants that products manufactured by Seller when properly installed, used, and maintained, shall be free from defects in material and workmanship. Seller's obligation under this warranty shall be limited to replacing or repairing the part or parts or, at Seller's option, the products which prove defective in material or workmanship within TWO (2) years from the date of delivery, provided that Buyer gives Seller prompt notice of any defect or failure and satisfactory proof thereof. Any defective part or parts must be returned to Seller's factory or to an authorized service center for inspection. Buyer will prepay all freight charges to return any products to Seller's factory, or any other repair facility designated by Seller. Seller will deliver replacements for defective products to Buyer (ground freight prepaid) to the destination provided in the original order. Products returned to Seller for which Seller provides replacement under this warranty shall become the property of Seller.

This limited warranty does not apply to lack of performance caused by abrasive materials, corrosion due to aggressive fluids, mishandling or misapplication. Seller's obligations under this warranty shall not apply to any product which (a) is normally consumed in operation, or (b) has a normal life inherently shorter than the warranty period stated herein.

In the event that equipment is altered or repaired by the Buyer without prior written approval by the Seller, all warranties are void. Equipment and accessories not manufactured by the Seller are warranted only to the extent of and by the original manufacturer's warranty.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. SELLER'S WARRANTY OBLIGATIONS AND BUYER'S REMEDIES THEREUNDER (EXCEPT AS TO TITLE) ARE SOLELY AND EXCLUSIVELY AS STATED HEREIN. IN NO CASE WILL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES, LABOR PERFORMED IN CONNECTION WITH REMOVAL AND REPLACEMENT OF THE SENSOR SYSTEM, LOSS OF PRODUCTION OR ANY OTHER LOSS INCURRED BECAUSE OF INTERRUPTION OF SERVICE. A NEW WARRANTY PERIOD SHALL NOT BE ESTABLISHED FOR REPAIRED OR REPLACED MATERIAL, PRODUCTS OR SUPPLIES. SUCH ITEMS SHALL REMAIN UNDER WARRANTY ONLY FOR THE REMAINDER OF THE WARRANTY PERIOD ON THE ORIGINAL MATERIALS, PRODUCTS OR SUPPLIES.

B. With respect to products purchased by consumers in the United States for personal use, the implied warranties including but not limited to the warranties of merchantability and fitness for a particular purpose, are limited to twenty four (24) months from the date of delivery.

Some states do not allow limitations on the duration of an implied warranty, so the above limitation may not apply to you. Similarly, some states do not allow the exclusion or limitation of consequential damages, so the above limitation or exclusion may not apply to you. This limited warranty gives you specific legal rights; however, you may also have other rights which may vary from state to state.