GroPoint G

Growing innovation.

Bluetooth SDI-12 Datalogger
OPERATION MANUAL

Table of Contents

Summary

The GroPoint Bluetooth SDI-12 Data Logger is an SDI-12 data logger and a wireless access point to retrieve data through a smartphone. The data logger is battery operated and can be left in the field (in situ) connected to SDI-12 sensors, collecting measurements, and allowing access to the data for download when convenient.

The GP Reader app (free, available for Android devices only) is used to check current conditions, configure the logger sensor measurement list, and sample interval, and to download logged data. With the app open on your smartphone, simply push the button on the Bluetooth Data Logger to wake it up and automatically establish a wireless connection. Tap the Download button in the app to download all logged data.

Data is stored in non-volatile memory and is retained even if the battery fails. The 4 Mbyte memory can hold up to up to 12 months of measurements depending on measurement interval and sensor measurements selected.

The Bluetooth SDI-12 Datalogger can connect multiple SDI-12 sensors (with additional 4-Port SDI-12 Expansion Bars). The number of sensors is limited by the SDI-12

protocol definition and network configuration.   We recommend limiting the number of sensors to 10.

The SDI-12 protocol allows for up to 62 sensors; however, the limitation on total cable length of all sensors is 2000ft. A cable bus can have 10 sensors connected to it, each with 200 feet of cable (total of 2000ft of cable). With fewer than 10 sensors, longer cable lengths are possible. With more sensors, short cable lengths must be used, e.g. 20 sensors each with 100ft of cable. The total aggregate cable length of all sensors must not exceed 2000ft. Although the SDI-12 specification allows for the maximum of 2000ft of aggregate cable on the SDI-12 network; factors such as temperature and moisture can increase signal attenuation and data disruption on the long cables. Our recommendation is to allow a minimum of 20% margin for error.

Batteries

Batteries are supplied but NOT connected/installed. Logger must be opened and batteries connected prior to operation of the logger.

Battery Set-Up

1. Unscrew the four Phillips head screws on the lid and carefully separate the enclosure, exposing the batteries.
2. For C cell, connect the battery holder plug. For AA batteries, install batteries in the holders. Note the battery polarity diagrams in the holders.
3. Replace the lid, ensuring the rubber gasket is properly aligned on all edges.
4. Retighten the four lid screws, being careful not to overtighten and to tighten evenly at all four corners.
5. Depending on the logging interval, power consumption of the sensors, and operating temperatures; batteries may last several years or several months. Replace batteries when the GP Reader app shows the battery level of less than 30%. For AA batteries use lithium or industrial grade alkaline batteries for best results. Carbon zinc batteries are not recommended. We have found the Energizer Ultimate Lithium battery to perform consistently well in colder temperatures. For C cell, replace with equivalent Li-SOCl-2 type Lithium non-rechargeable battery, e.g. SAFT LSH14.

High power consumption sensors, rapid measurement interval as well as operating temperature will influence battery longevity and performance. We have selected high

performance batteries with proven, consistent performance across a wide operating temperature.

Enclosure Mounting

The Datalogger enclosure is rated IP67 (weatherproof, protected against the ingress of water and dust). For best results, please follow these mounting recommendations:
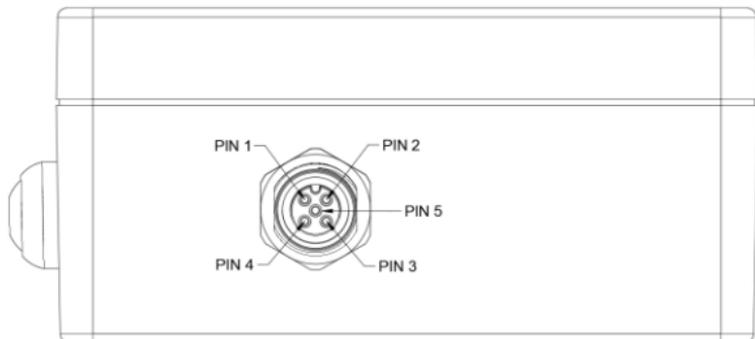
1. Mount the data logger with the connector hanging down.
2. Do not mount the data logger in a location where it will receive directed sprays of water on it, e.g. from a sprinkler.

External Connections

M12-5 Female Pin Functions

M12-5 Connector Pinout	Function
1	Sensor Power
2	External Logger Power
3	N / A
4	SDI-12 I/O
5	Ground

M12-5 Female Connector Pinout

Connecting a Sensor

Align and insert the M12 plug into the panel mount socket on the data logger, far enough such that the screw ring threads will engage with the socket. Once fully inserted, turn the screw ring clockwise until snug.

M12 connector:

M12 Connector

Connecting External Logger Power

The logger can be operated from an external power supply instead of internal batteries. If both are used, the external supply provides main power and the batteries provided backup power. Use a 2-port or more M12-5 expansion bar to allow for the connection of an external power supply to power the logger. Positive power on pin 2, ground on pin 5.

Power Supply Requirements	
Voltage Range	+4.5VDC to +5.5VDC
Current Rating	1.0A minimum

Warning: Exceeding +6.0VDC may permanently damage the Bluetooth Logger.

Connecting External Sensor Power

To conserve battery life the BTDL Logger supplies sensor power only during measurements. If you have a sensor that requires continuous power, then an external sensor power supply is required. You may safely connect this power supply to the sensor power line on pin 1 of the M12 connector; ground should be connected to pin 5. Use a 2-port or more M12-5 expansion bar.

GP Reader App

Android Device

1. Search for "gp reader" in the Google Play Store.
2. Select the GP Reader app by RIOT Technology Corp.
3. Click on the INSTALL button.

IOS Device

Coming Soon!

Getting Started with the App

1. Make sure your device has its Bluetooth wireless hardware turned on.
2. Start the GP Reader app.
3. You grant the app Location permission (to use Bluetooth connectivity) and file access (to save downloaded data). Follow the prompts.
4. Follow the prompts and select the file location to create the GPReader folder. It is important to remember the location of the GPReader folder, we suggest using the Documents folder for ease of finding later.
5. Click the "**Connect"** button. The app begins to scan for a GroPoint Bluetooth data logger. To minimize power

consumption, if no connection is made, the scanning will automatically halt after 30 seconds if no data logger is discovered.

6. Press the button on the GroPoint Bluetooth to activate it. Once a data logger is detected, the app will display it in the list of available data loggers. Select it from the list.

7. Once connected to your sensors, you can take instantaneous measurements, configure measurement interval, add & delete sensors, set measurement types, delete all logged data, start and stop logger and download data.
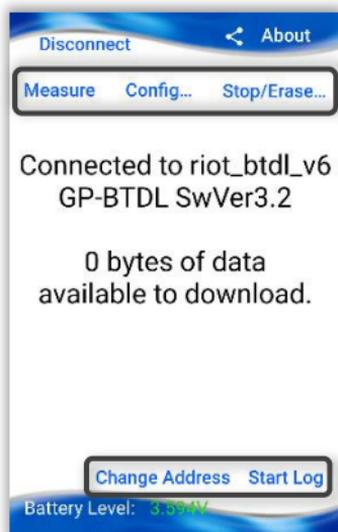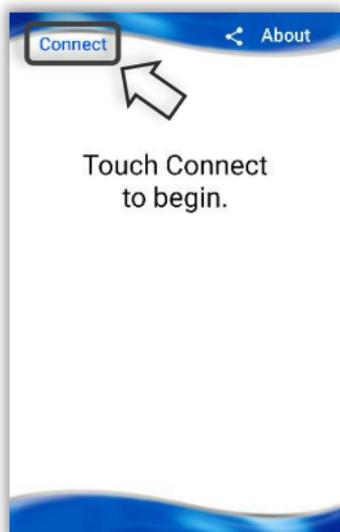
8. For a real-time measurement of soil conditions, press the **"Measure"** button. You will see an output of your current sensor measurements that are configured in the Configuration menu. If an error occurs, open the 'config' menu and check that the measurement(s) selected are supported for your type of sensor, and that the correct sensor address is set.
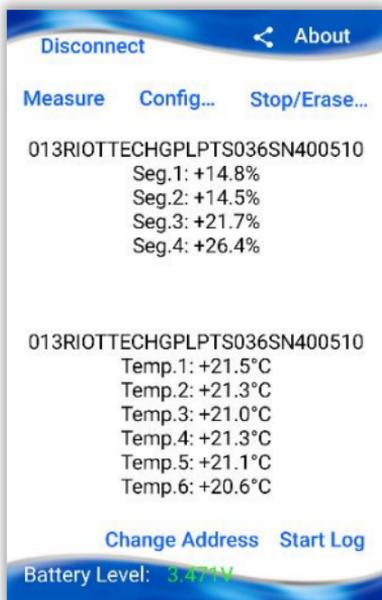
Customizing BTDL Settings
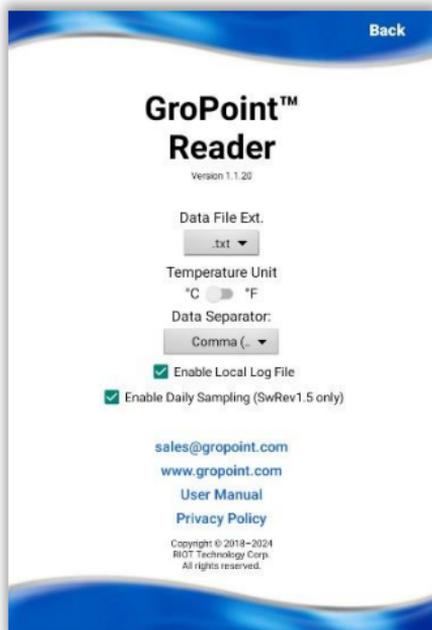
1. Click the "**About**" button to display the About screen. Here you can customize your data format, units, enable daily sampling and log file.
2. Click the drop-down menu under 'Data File Ext.' to select the desired data file extension; .txt, .csv, or .dat.
3. To change the temperature units, click the toggle to change between °C or °F. The default temperature unit is °C.

4. To change the data separator, click the drop-down menu and select the desired data separator; comma (,), semicolon (;), or tab (\t). The decimal point character will follow regional settings of the device.
5. You can also enable a log of all SDI-12 transactions with the data logger by clicking 'Enable Local Log File'. The log file is stored in your predetermined file location for the GP Reader folder with the name GPReaderLog.txt. We recommend turning on this feature for diagnostics only. Turning this on will slow down data download rates by about 15%.
6. You can enable daily sampling by clicking 'Enable Daily Sampling'. **Note** that this feature is only supported by BTDL SwRev 1.5 and higher. Go to the Daily Sampling section of this manual to learn more about this feature before enabling it.
7. There are also links GroPoint email and website, as well as links to the BTDL user manual (this document) and to the app privacy policy.

Touch the "**Back**" button to return to the main view screen.

About Sensor Addresses

New SDI-12 sensors have a factory default address of "0". If you are attaching multiple sensors to a logger then all sensors must be assigned unique addresses. **Only one sensor may be attached to the logger at a time when changing its address.**
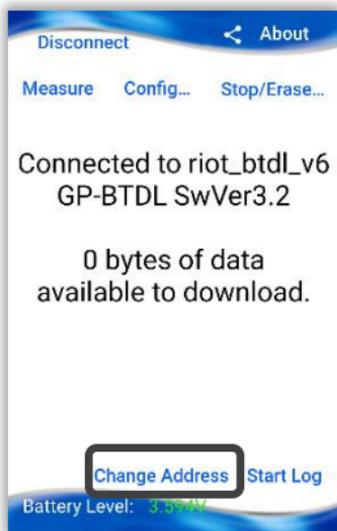
Address Set-Up

1. Attach a single sensor to the logger.
2. Click "**Change Address**".
   Note: You can only change the sensor address when a single sensor in connected to the data logger.

3. Current address is shown by the grey dot. Touch and drag the blue dot to select the new address.
   a. Note that each sensor address on a logger must be unique.
   b. Network Configuration Tip:
      i. Label sensors and keep a list of addresses with friendly names and the location of deployment.
4. Click "**Set Address**" to update the sensor's address.
5. Disconnect the sensor from the data logger.
6. Repeat the above steps for each sensor within the sensor network.
7. Once all sensors are assigned unique addresses, they may all be attached to the data logger.

Logger Configuration

The logger must be configured to select the desired sensor measurements, what name to save the data under, and the measurement interval. Default configuration is 0M! measurement only. Click on the **Config...** button to show the configuration page:

1. Enter the logger's "Friendly Name". This name will be used for saved data files. Because the {friendly name} is a component of the saved data filenames, if you have multiple loggers, you must ensure that they all have unique friendly names to ensure data is not over written and for ease of identifying each data logger. The limit for the friendly name is 32 characters. **DO NOT**

use an of these illegal characters in the friendly name: ? * \ / " ' :

2. Select the measurement interval, for example, every 1 hour. This is the measurement interval for all sensor measurements.

3. Click the Add button to add a sensor measurement. Click the Delete button to remove a selected measurement.

4. For each sensor measurement you must specify the sensor address and the measurement you want to make. Refer to the sensor's data sheet for supported measurements. For example, 3-segment GroPoint Profile sensors support two measurements: aM! for moisture measurements and aM1! for temperature measurements. If you want both measurements to be logged, then both measurements must be added.

5. To check the current logger configuration, make sure that all desired sensors are connected and click "**Test**..." Each measurement will be checked, and real time measurement data will be shown.

   - A warning message saying "No response" may occur for a selected measurement. If this occurs, check the sensor connections and/or sensor address assignments.

- A warning message saying "Not supported" will appear if a measurement configuration is selected that is not supported by that sensor.
6. Click "Update" to write the logging configuration to the data logger. You must click "Update" to send the new configuration from the app to the logger.
7. Click "Start Log" to launch the logger.

In the launch process the logger will clear its data storage memory, and then check for the sensor ID for each selected sensor address. If all sensors are found during the ID scan, then the app will launch the logger into low power logging mode and disconnect from the app.

> **Note:** If you wish to change logger configuration while already logging, make sure you download the data after making changes to ensure the new configuration is updated properly.

How to Download Data

1. Reconnect Bluetooth Data Logger to Android device
2. If there is no data yet to download, click on the "Start Log" button to start logging. NOTE: make sure desired logger configuration is correct first.

3. To download data, click the "Download" button to retrieve the data. Once the data is downloaded, the recently downloaded data is displayed. Each line is the record for a sensor at a particular time and date. You may use pinch gestures to resize the text, and drag gestures to scroll through the displayed data.
   If the download file was large then only a subset of the most recent data is displayed (last 200 records or so). All the data downloaded will be available in each sensor's download file in the GPReader folder.

4. New data downloaded is appended into the existing sensor files provided that the friendly name is not changed. If you change the logger's friendly name, the next time data is downloaded new data files will be created using the new friendly name. The old files will remain in the GP Reader folder.

5. Use your device's File Manager app to navigate to the GPReader folder for a list of all sensor data files. Files use the "Friendly Name" as the base filename plus the sensor's serial number (or sensor address if no serial number is recognized in the ID string) along with the .txt file extension (or .csv or .dat depending on the file extension setting in the About page). A separate data file will be created for each sensor.

NOTE:

    a. It is important to remember where you chose to store your data files when you first downloaded and installed the app.

    b. The app never deletes files to ensure that no data is ever lost. To manage personal device storage; periodically delete old raw data files once you are satisfied that they have been properly downloaded and parsed.

6. The raw download data files are retained from each new download even if there are no issues with the data parsing. Files are named {friendly name}.nnn where nnn starts at ".001" and nnn is a numerically increasing extension, e.g. .001, .002, 003 etc. etc. These files should be manually deleted periodically to free up device storage.

7. Raw data files may be viewed as a text file but will not make sense until it is parsed by the app (after the logger is relaunched). You should never need to view the raw data files unless there is failure during the parsing stage. In this case the raw data files can be provided to RioT for assistance in data recovery.

8. Data files can easily be shared by email or Google drive by pressing the share icon in the app.

How to Format Data

1. When raw data is parsed it creates a separate data file for <u>each</u> sensor. File name is {friendly name} (sensor's serial number).txt (or .csv or .dat depending on extension setting)
2. You can set your file format (including delimiter) in the About Menu in the App.
3. The parsed data files are formatted date/time, sensor address, measurement values.
4. Note that multiple measurement values from GroPoint sensors are aggregated into a single line. For example, with a 3-Segment moisture probe with temperature measurements, the data downloaded in .txt format will be presented as follows:

```
Date, Sensor Address, Segment 1 Moisture,
Segment 2 Moisture, Segment 3 Moisture, Temp
1, Temp 2.
```
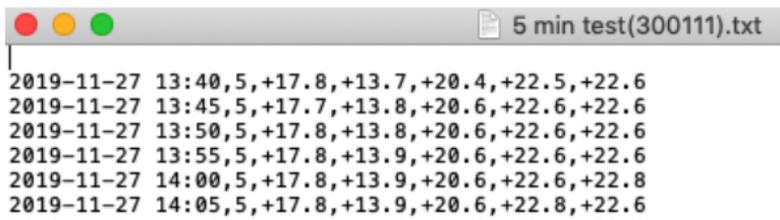
```
● ● ●                              5 min test(300111).txt

2019-11-27 13:40,5,+17.8,+13.7,+20.4,+22.5,+22.6
2019-11-27 13:45,5,+17.7,+13.8,+20.6,+22.6,+22.6
2019-11-27 13:50,5,+17.8,+13.8,+20.6,+22.6,+22.6
2019-11-27 13:55,5,+17.8,+13.9,+20.6,+22.6,+22.6
2019-11-27 14:00,5,+17.8,+13.9,+20.6,+22.6,+22.8
2019-11-27 14:05,5,+17.8,+13.9,+20.6,+22.8,+22.6
```

How to Erase Data / Stop Log

To stop the logger and put it into a low power state click the **Stop/Erase...** button.

Erase Log Without Downloading

To stop, or erase data logger without downloading, click "Stop/Erase". Stopping the logger will allow you to pause the data logging process and put it into a low power state.

Erasing the log will delete your stored data and stop the data logging process.

ERASING THE LOG IS IRREVERSIBLE

Daily Sampling Interval – Based on Temp.

This feature is designed to extend battery life in cold operational environments or in environments where measurements are not useful above or below certain temperatures. Measurement interval can be configured to change based on exceeding specified temperature thresholds. For example, change from hourly measurement interval to daily measurement interval when the temperature is below 0 °C.

This feature only works with the GroPoint GPLP Profile sensors and with datalogger firmware SwRev 1.5 and higher. Daily Sampling is only compatible with GPLP sensors that have M1 or M2 temperature measurement commands configured.

Once below certain temperatures, soil moisture data may be unnecessary, however since the datalogger is deployed in a remote environment, the user cannot travel to site to change the interval. Examples include agricultural applications where the soil moisture data is relevant to a growing season, warmup, or cool down shoulder seasons. In some cases, for hydrology and scientific deployments where soil moisture sensors are deployed in remote

locations and the relevant measurements are related to soil temperatures above a specific level.

When enabled, the data logger will check the temperature. If it is below the set threshold temperature, measurements will be skipped for a designated period (typically 24 hours). When the temperature is above the threshold temperature, regular logging at the measure interval will resume.

Example:

Temperature (degrees C)	Measure Interval (hours)
20	4
15	4
10	4
5	4
0[1]	24
-5	24
0	24
5[2]	4
10	4

[1]Switched to daily sample interval when below threshold.

[2]Switched back to normal interval when above threshold

Configuring Daily Sampling Feature

Click the "About" button and enable daily sampling; return to the home screen by clicking the "Back" button.

1. Click the "Config" button and enable daily sampling
2. Here you will see 'Test Temp at:' then a dropdown
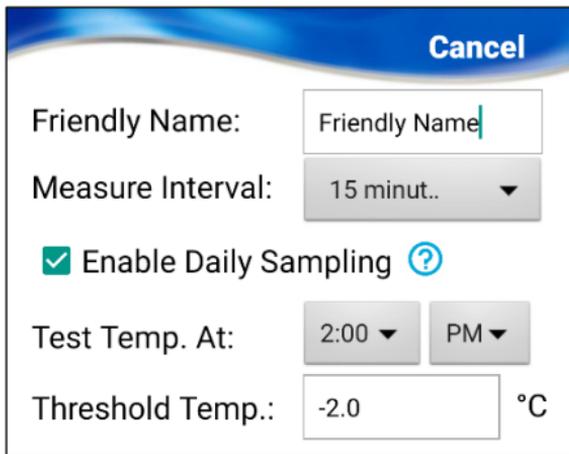
Cancel		
Friendly Name:	Friendly Name	
Measure Interval:	15 minut.. ▼	
☑ Enable Daily Sampling ⑦		
Test Temp. At:	2:00 ▼	PM ▼
Threshold Temp.:	-2.0	°C

menu to pick a time. This sets the time the data logger will test the temperatures to see if they are above or below the threshold temperature.

3. 'Threshold Temp:' sets the minimum temperature at which the data logger will record data at the measure interval. Below the threshold temperature the data logging switches to daily sampling mode at the specified Test Temp at time. Temperature must be specified in °C.
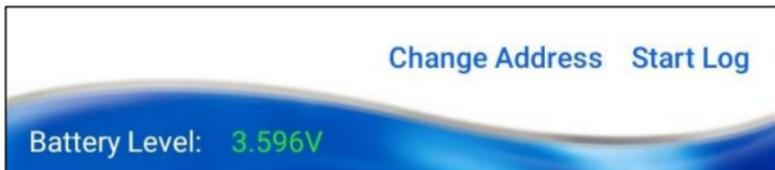
Battery Level Indicator

The battery level indicator displays what voltage the BTDL batteries are at. The voltage is displayed in the following color scheme to signify the battery health:

Green: Battery voltage is good.

Yellow: Battery voltage is okay but consider changing batteries soon.

Red: Battery voltage is critically low. Change batteries before logging.

The battery type is pre-configured at the factory except for logger firmware 1.7 or lower. For these loggers, when first connecting to the logger a prompt will be displayed (see next page) asking what type of batteries are installed, AA Lithium, C-Cell Lithium, or external power. Please choose the correct battery type as this controls the battery level warnings.

Connected to

Battery Type on Device:

AA

C Cell

External Power Supply
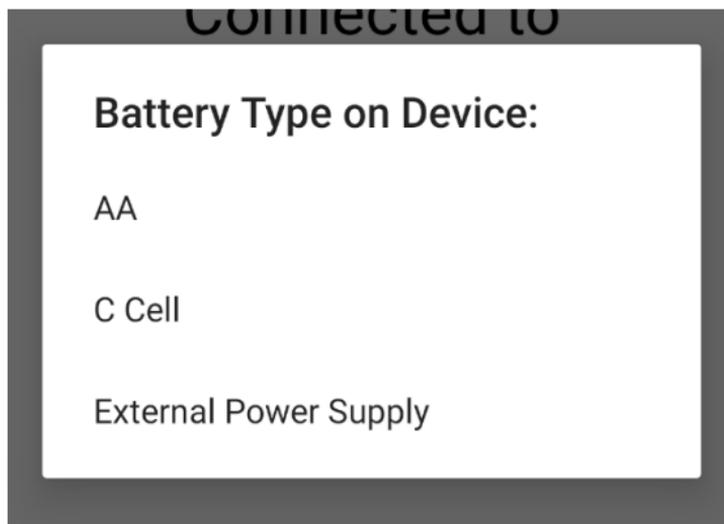
If the battery type needs to be changed after initial connection, press **and** hold the "Battery Level" label to display the battery type prompt again.

If the batteries used are not one of the available options, you may choose to disable the battery warnings from the About page. Note that in this case no battery level warnings will be displayed, and the user is responsible for monitoring the battery level and changing batteries as necessary.

Advanced App Functions:

Add Comment to Log File
(invoke with a long press on
Disconnect/Connect)
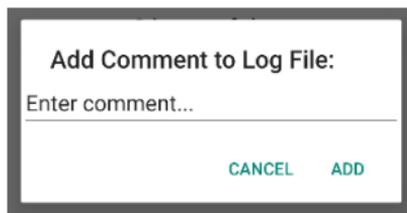
> Add Comment to Log File:
> Enter comment...
>
> CANCEL   ADD

A long press on the Connect/Disconnect button will display an "Add Comment to Log File" dialog. Here the user may enter a comment to include in the GP Reader Log file. This can be useful in diagnostic situations to document actions that were performed while a log is being collected.

Transparent Command Mode
(invoke with a long press on
Measure)
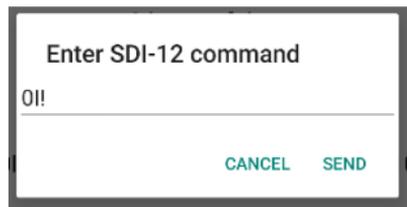
> Enter SDI-12 command
> 0I!
>
> CANCEL   SEND

A long press on the Measure button will display an "Enter SDI-12 Command" dialog. This allows the user to send any command directly to the sensor. This can be useful to manually scan addresses, request sensor ID, or send sensor specific extended SDI-12 commands.