Geosignal ™

Datalogger XV 100 USB

Version 1.0.4

User Manual

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Introduction

Thank you for purchasing a data logger XV 100 USB (thumb drive standard alone DC voltage data logger).

XV 100 is a single channel stand alone voltage data logger storing up to 37435 measures on its internal memory, it is implemented as generic USB disks and is designed to operate under any computer operating system capable of reading standard USB flash drives (pen drives).

Some of the features XV 100 are:
- One analog channel with 10 bit resolution.
- Seven programmable voltage ranges form 0-1V to 0-100V
- Double calibration for maximum precision.
- Multiple starts with separate timestamps for each sampling section.
- Text file output compatible with common software like Open Office and Excel.
- Memory erasing protected by password.
- Programmable sampling interval from one second to one week.
- 3V CR2032 lithium battery (not included),

XV 100 does not need any specific software for data downloading and programming, as programming is done by editing a text file "CONTROL.TXT" which is found on the disk itself.

Data is saved on a read only file named "DATALOGS.CSV"

The data logger will start to scan at the given time with the given scan rate after being detached from the USB socket.


Safety Precautions

Although this voltage data logger can measure DC voltages up to 100V it must not be used with any voltage greater than 48V as it not insulated and contact with such voltages may cause electric shock and death.

The case of this logger is connected to the 3V battery negative which is electrically separated from the negative black lead. If the case of the logger comes in contact with any part of the measuring circuit, an incorrect measurement may result and the battery may be discharged faster than usual.

Getting Started

Initialising

- Make sure a battery has been inserted in the rear slot of the data logger (battery must be purchased separately as it is not included with the data logger).
- The data logger is password protected and needs to be initialised before use, each data logger has a different password (code) which is required for erasing and initialising.
- Please keep the code in a safe place as it is always required for erasing the memory.
- Connect the data logger to a USB socket of a USB host enabled device (PC, tablet, etc).
- The data logger will appear like a USB disk storing two files: CONTROL.TXT and DATALOGS.CSV. Open the file CONTROL.TXT with a simple text editor. If your system does not have a native text editor please install one before using the data logger. We have tested Notepad on Windows, Gedit on Ubuntu, and Ted on Android 4.0; Users of Intel based Macs should install a "Virtual Machine" running Windows or Ubuntu images to use the data logger.
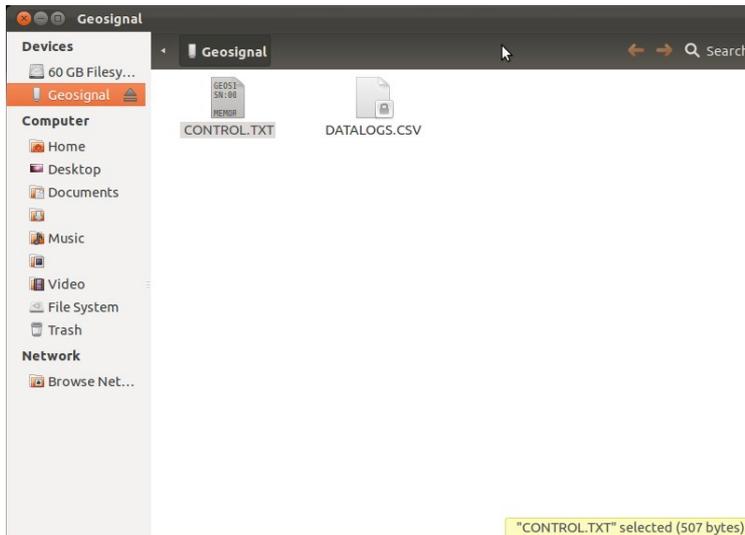
- The file CONTROL.TXT on a new XV 100 will appear as below:

```
GEOSIGNAL USB DATA LOGGER
SN:00000001

MEMORY: code?
DATE: 13Y/05M/22D Tu
TIME: 12H:00M:06S
SCAN RATE: 00s
START TIME: 05M/22D 12H:00M:30S Tu
CLOCK: +000
VINPUT: 00.090V+010Vr


Edit values and save file to program them.
Do not change position and length of fields.
Detach and plug device to show actual programmed values.
Log starts at Start Time after device is detached from USB.
Scans: 00s 01s 10s 01m 10m 01h 01d 01w
Clock +-sec per week
Vrange 1,2,5,10,20,50,100
Input code to unlock device.
```

- *(Note: Above colours are not shown on the file; they are only for clarity)*
- Replace the line "MEMORY: code?" with "MEMORY: xxxxx" where xxxxx is the 5 digit code specific to your data logger. For example if your code is 01234, type:
- "MEMORY: 01234"

- Save the file to activate the code: the red LED of the data logger will quickly flash for a few seconds and the data logger will restart. (<u>The LED is located on the right side near the USB plug</u>).
- Close and reopen the file CONTROL.TXT. Now, if the code was correct, it will read: "Memory: 00000" indicating that the memory is blank and the device ready.

Programming
- Each time the data logger is plugged into a USB socket and CONTROL.TXT is read by the computer operating system: the data logger reads its memory, registers and input and changes the information contained in CONTROL.TXT. Please NOTE: we have found that after the data logger has been inserted into a USB socket, all the different operating systems (we have tested) read the file just ONCE.
- Please note that the logger is not USB powered, so battery is intensively used during USB connection. Do not forget to remove the logger from USB after programming.
- Open CONTROL.TXT and edit the scan rate, current time, and starting time; do not change position and length of the fields; for example: "DATE: 13Y/01M/01D Tu" must not be changed in "DATE: 13Y/1M/1D Tu"
- Possible scan rates are: 01s 10s, 01m, 10m, 01h, 01d, 01w (00s means stop)
- Save the file, the data logger LED will blink.
- If the data logger LED did not blink the file was not really saved but it is just temporarily stored in the computer cache. This behaviour depends on the operating system. Windows and Ubuntu immediately save the file but some other OS or older versions may require you to unmount the device or go through the process of "Safely remove the device".
- Please also note that the data logger internal time is programmed into the data logger in the precise moment the red LED blinks.
- Detach the data logger to start the acquisition.
- If the starting time is past or inconsistent the data logger will correct the starting time automatically.
- If you instead only wanted to stop the data logger then you should have programmed the scan rate as: "SCAN RATE: 00s"
- At scan time the red led will blink for an instant.

Downloading Data
- Plug the data logger into any USB socket of a computer.
- Scanning will stop and will be resumed once the data logger is detached.
- Copy the file DATALOGS.CSV from the disk drive to your computer and open it with a text editor, or Open Office, or Excel.
- Make sure the data has been actually copied on your computer hard disk before erasing the data logger memory.

Erasing memory
- Plug the data logger into any USB socket of a computer.
- Do not try to erase the file DATALOGS.CSV as it will only be removed from the computer cache, not from the memory of the data logger.
- Open the file CONTROL.TXT with a text editor,
- Replace the line "MEMORY: 37435" with "Memory: ERASExxxxx" where xxxxx is the 5 digit code specific to your data logger. For example if your code is 01234, type: "Memory: ERASE01234"
- Please note: The command is case sensitive "ERASE" must be in capital letters.
- Save the file to activate the code: the red LED of the data logger will quickly flash for a few seconds and the data logger will restart.
- <u>CLOSE</u> and reopen the file CONTROL.TXT: Now, if the code was correct, it will read: "Memory: 00000" indicating that the memory is blank and the device ready.

Replacing battery
- Please note that the logger is not USB powered, so battery is intensively used during USB connection. Please keep USB connection time to a minimum to extend battery life.
- Battery Life Expectancy: a new CR 3032 battery should allow the logger to record the full memory four times including short USB connections for programming and download.
- Battery voltage is checked automatically by the data logger when it is inserted into the USB socket. If the battery is found to be below 2.8V the message "LOW BATTERY!!" is displayed in the file CONTROL.TXT.
- Detach the data logger from the USB socket.
- Make sure the data logger is stopped and it is not sampling in the next minutes.
- Remove the old battery by inserting a metal pin into the small hole located on the left hand side of the logger, or pull the battery out by using a pair of thin tweezers.
- Wait one minute for the data logger to reset and then insert a new battery into the data logger.
- Connect the data logger to a computer and reprogram the date and time.

Reset
- To properly reset the data logger: Remove the battery and wait for at least 60 seconds before reinserting the battery again: please wait longer if the data logger has just been detached from the USB socket.
- After that the file CONTROL.TXT of the data logger will show that the current time has been reset and needs to be reprogrammed. If not then redo the procedure and wait longer.

Read inputs in real time
- The data logger reads its input when it is plugged into the USB socket. The current value is shown in CONTROL.TXT

Voltage Range and Quick Calibration
- The voltage range of the instrument can be changed by editing the line : "`VINPUT: 00.000V+010Vr`" of CONTROL.TXT, change the range and save the file.
  For example: "`VINPUT: 00.000V+020Vr`" will change the range to 0-20V.
- Ranges available are 0-1V, 0-2V, 0-5V, 0-10V, 0-20V, 0-50V, 0-100V
- Use the smallest range possible for the voltage being monitored In order to achieve the best accuracy.
- Please note that the 0-1V range and the one second scan rate cannot be selected together.
- Calibration and measurement units can be changed by editing CONTROL.TXT.
  For example on XV 100 it is possible to adjust the gain of the data logger.
- If the logger is out of calibration (In this example the data logger is indicating +4.950V at the reference voltage of 5.0V) this 1% error can be adjusted by editing and saving the line "`VINPUT: 00.000S+010Vr`". Change V with S (Scale) where "`+010`" means: "adjust the input of roughly about 1.0% in positive". The six characters preceding S (`00.000S`) are required but can be any values for the purpose of calibrating the instrument.
- The adjustment can be up to +10% (+128S) or down to -10% (-127S).
- Please refer to the next chapter 'Calibration' for further details.

Memory Structure

The memory of the data logger is flash memory and structured in the clusters and sectors of a generic detachable USB drive.
The maximum number of datapoints is 37435. Each start (when the data logger is plugged into USB and restarted, but the memory is not erased) will reduce the memory capacity of about 75 datapoints as timestamps and calibration parameters takes some room as they need to be saved on the data logger internal flash memory.

The data logger will appear as a disk storing two files: CONTROL.TXT and DATALOGS.CSV.
CONTROL.TXT is meant to control the data logger and to show its current state, memory and time.
DATALOGS.CSV contains the data. If it is empty its length is zero.

CONTROL.TXT once opened with a text editor like notepad will appear as follow:

```
GEOSIGNAL USB DATA LOGGER
SN:00000001

MEMORY: 00136
DATE: 13Y/01M/22D Tu
TIME: 12H:40M:48S
SCAN RATE: 10s
START TIME: 01M/22D 12H:00M:30S Tu
CLOCK: +000
VINPUT: 00.080V+010Vr


Edit values and save file to program them.
Do not change position and length of fields.
Detach and plug device to show actual programmed values.
Log starts at Start Time after device is detached from USB.
Scans: 00s 01s 10s 01m 10m 01h 01d 01w
Clock +-sec per week
Vrange 1,2,5,10,20,50,100
To erase: MEMORY: ERASE+code
```
(Note: Above colours are not shown on the file; they are only for clarification)

This file is created when the data logger is plugged into the USB socket and the operating system of the computer or tablet or host device reads the contents of the file.
It important to understand that the file is not necessarily created when the file is opened by you.

When editing this file it is extremely important not to change the position and length of the fields as the data logger will refuse to program itself if data is found in the wrong position.
Also take in account that the parameters typed into the file that you are editing with the computer are transferred to the data logger only when the computer decides to. Normally this happens when you 'Save' with the text editor, but some operating systems require you to unmount the data logger (UNIX command) or to go through the process of 'Safely remove the drive' before the data is actually programmed into the data logger.
The data logger features a red LED to inform you that data has been actually stored on its memory by the Computer operating system.
The data logger will also restart when an important data change like erasing or calibration has been performed, these changes have priority over date, time, starting time and scan rate which are not programmed when a restart is processed.

When a restart occours the data logger detaches and reattaches itself to the USB. the device will update its local instance of the file CONTROL.TXT and you need to close and reopen the file to see the changes and to edit the file again.

CONTROL.TXT shows:

`SN:00000001`   (Serial number which is unique for each data logger)

`MEMORY: 00136` (Memory used: stored datapoints) it can also be used to erase the memory.

`DATE: 13Y/01M/22D Tu` (Current Date in reverse order Year/Month/Day)

`TIME: 12H:40M:48S` (Current Time actually when the data logger was inserted into USB)

`SCAN RATE: 10s` (Current Scan rate which can be: `00s`, stopped; `01s`, one second; `10s`, ten seconds; `01m`, one minute; `10m`, ten minutes; `01h`, one hour; `01d`, one day; `01w`, one week).

`START TIME: 01M/22D 12H:00M:30S Tu`

in decreasing importance order: Month/Day Hour:Minute:Second Weekday.

The weekday is necessary only when using a weekly scan rate.

`CLOCK: +000` indicate the clock calibration in + or – seconds per week and can be changed to adjust the internal clock if it is running fast or slow.

`VINPUT: 00.496V+010Vr` indicates the current reading and range (0-10V)

The possible options are:

`VINPUT: 00.000V+001Vr` set Range (with 7 ranges available) `001`–>0-1V

`VINPUT: 00.000V+002Vr` set Range 0-2V

`VINPUT: 00.000V+005Vr` set Range 0-5V

`VINPUT: 00.000V+010Vr` set Range 0-10V

`VINPUT: 00.000V+020Vr` set Range 0-20V

`VINPUT: 00.000V+050Vr` set Range 0-50V (max voltage 48VDC)

`VINPUT: 000.00V+100Vr` set Range 0-100V (max voltage 48VDC)

The default range for a new data logger is (`010`) 0+10V

WARNING: do no connect the logger to voltages greater than 48V as it is not insulated and that may electrocute you

`00.000O+010Vr` (**O** for offset) compensates "zero calibration" by adding 10 millivolt x range to measures; for example: if the range is 10V this will add 10mV x 10 = 100mV.

`VINPUT: 000.00S+001Vr` sets the "scale calibration": add input x "scale calibration" x 0.00085 (basically this allows you to increase of decrease the gain on the input up to +10% (`00.000S+127Vr`) or down to -10% (`00.000S-128Vr`) in order to compensate for any gain errors. Please see the chapter Calibration for further details.

Data File Structure

The stored data is accessible by opening a text file in csv format (comma separated values). Formerly: comma separated vector.

The format of the file can be as following:

```
2013/05/06,16:02:50,03.000,V
2013/05/06,16:02:51,03.000,V
----------------------------------------
----------------------------------------
2013/05/06,16:05:00,03.000,V
2013/05/06,16:05:01,03.001,V
----------------------------------------
```

The date is in reverse order: year/month/day.

Time is in 24h format (0-23).

The voltage datum takes a 6 character field.

The last field marks the measurement units, V (Volt) in this case.

All fields are separated by a comma and the period marks the decimal point.

If the logger is used in a country where comma is used for the decimal point please adjust the file import options of the software you are using.

The format of date and time can be changed after importing.

The dashed lines indicates that the logger was stopped and later restarted.

When a restart occurs some sectors of the disk are used to store the restart information and dashes are printed in the data file to show that.

Calibration

The data logger allows calibration for the voltage input and a 'seconds per week' calibration of the internal quartz clock.

Calibration is done by editing and saving the parameters VINPUT or CLOCK of the file CONTROL.TXT

`CLOCK: +012`   for example will add approx 12 seconds per week on a slow clock, it is possible to add up to 127 seconds or to detract -128.

XV 100 will show and can be programmed with the following:
`VINPUT: 00.000O+010Vr` compensate zero by adding 10 millivolt x range to measures.
`VINPUT: 00.000V+001Vr` set Range (7 ranges available) `001->0-1V`
`VINPUT: 00.000V+002Vr` set Range 0-2V
`VINPUT: 00.000V+005Vr` set Range 0-5V
`VINPUT: 00.000V+010Vr` set Range 0-10V
`VINPUT: 00.000V+020Vr` set Range 0-20V
`VINPUT: 00.000V+050Vr` set Range 0-50V
`VINPUT: 000.00V+100Vr` set Range 0-100V
`VINPUT: 00.000S+001Vr` set the scale calibration: add (voltage input) x scale (`001`) x 0.0085 (basically this allows you to increase of decrease the gain on the sensor up to +10% (`000.00S+127`) or down to -10% (`000.00S-128`) in order to compensate for any gain errors.

The "zero offset calibration" can be used in particular situations like compensating for a sensor not outputting zero volt at rest.
If the value recorded by the data logger differs by some millivolt from the expected value then correct this value by updating the `VINPUT: 00.000O+000Vr` line accordingly.
For example if the range is 0-1V: `VINPUT: 00.000O+008Vr` will add 0.008V to any measurements. If instead the range is 0-10V that will add 0.080V.

The "scale calibration" constant can be modified as described below.
The difference between the readings can be compensated by increasing or decreasing the gain of 0.00085 multiplied by the scale calibration value.
The value of 0.00085 has been chosen to allow an adjustment of +-10% within the range of ± 127 scale-calibration units.

The instrument holds two separate scale calibration constants: low voltage, high voltage.
Calibrate the instrument twice: first with a range of 0-5V then change range to 0-50V and repeat the operation.

Example:
A 0-10V 10 bar pressure sensor is connected to the data logger:
the data logger shows 00.050V at zero bar
set `VINPUT: 00.000O-050` and save the file.
After that the data logger shows 09.900V at 10Bar pressure.
`1-(9.9/10) = 0.01`
`0.01/0.00085 = 11.76 → approx 12 scale calibration units`
set `VINPUT: 00.000S+012` and save the file.
At this point the zero calibration may have changed and the new value needs to be recalculated:
`0.030V` times `0.00085` times `12 = 0.000306V`
the value is below the sensitivity of the instrument and can be ignored.

Troubleshooting

Datalogger does not connect to PC

- Battery flat: Replace battery
- Perform a reset: please try a few times.

Inconsistent date and time

- Reprogram date and time unplug and re-plug the data logger.
- Perform a reset: please try a few times.

Datalogger does not program scan rate or date and time:

- After saving CONTROL.TXT make sure device is unmounted or "Safely removed"

Datalogger is connected but an error is produced when downloading data file:
- Erase memory

Measures downloaded are inconsistent:

- Change the operating range to one more appropriate.

Datalogger does not store data:
- Scan rate was not programmed or mistake in setting the starting date and time. Always check twice for the correct start time before saving CONTROL.TXT.
- Out of Memory: Erase memory

Technical specifications

Please note that specifications may change without notice.

Voltage Data Logger

Model	XV 100 USB	
Analog channels	1	1023 subdivisions of FS
Ranges	V	0-1V, 0-2V, 0-5V, 0-10V, 0-20V, 0-50V 0-100V
AD Converter	1	10 bit
Input Impedance	OHM	375 KOHM
Un-calibrated Accuracy	V	0.02V (0-5V range)
Power supply	1	3V CR2032 Lithium Battery
On time of 3V output at sampling	Sec	Approx 0.7 sec (2V range) Approx 1.2sec (1V range)
Current absorption	µA	30 on standby mode 8mA while connected to USB
Communications	1	USB
Internal Timer	Yes	100 year calendar with leap year
Sampling interval		1 sec, 10 sec, 1 min, 10 min, 1 hour, 1 day, 1 week 1 sec rate is not available when 0-1V range is selected
Software	No	Not required
Operating Temp.	°C	-40 + 85 °C
Dimensions (maximum)	mm	72 x 33 x 7 mm
Protection Grade		IP40

Appendix

Schematic View of 3 pin connector of XV100
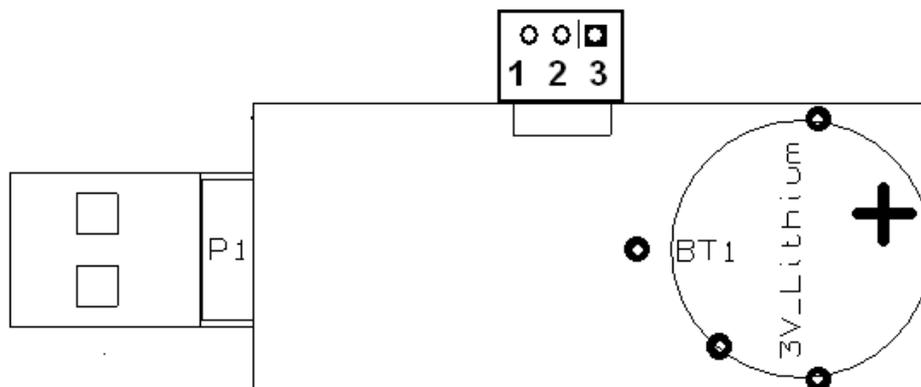
1. AGND V– Input (3 V- out)
2. V+ Input
3. 3 V+ out

Notes:
- Pin 3 is energised with +3V at sampling time and can be used to switch on sensors or other devices.
- Please take the maximum care in connecting pin 3 as this input is not protected from over voltages and a mistaken connection may damage the data logger.
- Case is connected to battery negative (GND) and it is disconnected from AGND between scans. GND can be used as return of power for external sensors but any connections between AGND and GND will drain battery power when the data logger is supposed to be at rest (between scans).

Order Code

Order codes
XV100:   4101

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