Automotive
Energy & Power Analysis
Field Service
Environmental
Research & Development

DEWE-VGPS-200C

Technical reference manual

ISO9001

... the precision signal conditioning company

worldwide
DEWETRON
www.dewetron.com

Content

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Warranty Information

A copy of the specific warranty terms applicable to your DEWETRON product and replacement parts can be obtained from your local sales and service office.

Support

For any support please contact your local distributor first or DEWETRON directly.

For Asia and Europe, please contact:

DEWETRON Ges.m.b.H.
Parkring 4
A-8074 Graz-Grambach
AUSTRIA
Tel.: +43 316 3070
Fax: +43 316 307090
Email: support@dewetron.com
Web: http://www.dewetron.com

The telephone hotline is available
Monday to Friday between
08:00 and 17:00 CET (GMT +1:00)

For the Americas, please contact:

DEWETRON, Inc.
10 High Street, Suite K
Wakefield, RI 02879
U.S.A.
Tel.: +1 401 284 3750
Toll-free: +1 877 431 5166
Fax: +1 401 284 3755
Email: support@dewamerica.com
Web: http://www.dewamerica.com

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Parkring 4
A-8074 Graz-Grambach / Austria

Printing History

Please refer to the page bottom for printing version.

Safety instructions

Safety symbols in the manual

	*Indicates hazardous voltages.*

WARNING	*Calls attention to a procedure, practice, or condition that could cause bodily injury or death.*

CAUTION	*Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.*

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. DEWETRON Elektronische Messgeraete Ges.m.b.H. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as option and will not be shipped as standard parts.

Safety instructions for all DEWETRON systems

- The DEWETRON data acquisition systems may only be installed by experts.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal),a non interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.
- DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a DEWETRON sales and service office for service and repair to ensure that safety features are maintained.
- Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.
- No modifications are allowed at the instrument. The fuse in the power module has to be replaced by the same type. For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holder labels and print on the power module may not be removed.
- DO NOT service or adjust alone. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a DEWETRON sales and service office for service and repair to ensure that safety features are maintained.
- Before opening the instrument (experts only) or exchanging the fuse in the power module disconnect power!
- Don’t touch internal wiring!
- Don’t use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- Install filler-panels in unused slots.
- The power-cable and -connector serve as Power-Breaker. The cable must not exceed 10 feet, disconnect function must be possible without tools.
- Safety of the operator and the unit depend on following these rules.

General System Information

Environmental Considerations

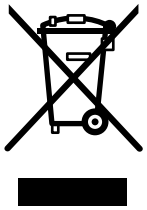
Information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling a DEWETRON system:

System and Components Recycling

Production of this components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at it's end of life! Please recycle this product in an appropriate way to avoid an unnecessary pollution of the environment and to keep natural resources.



This symbol indicates that this system complies with the European Union’s requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further informations about recycling on the DEWETRON web site www.dewetron.com

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead.

GPS based system for speed and displacement measurement

Features:

- Synchronized data acquisition combined with real time speed measurement
- **Speed sensor:**
- 200 Hz update rate for speed and distance output
- Supports RS-232, USB and CAN interface
- Supports differential GPS (SBAS) as a standard
- Online signal quality monitoring for standalone applications
- Lowest latency time at speed and distance output
- No calibration required
- **Clock output:**
- Output clock rate of up to 10 MHz
- Two independent output frequencies
- Synchronization of DEWE-ORION-1624 systems
- PPS accuracy of 100 ns
- Continuous synchronization to absolute GPS time
- Absolute long time stable

Specifications

DEWE-VGPS-200C	GPS based system for speed and displacement measurement		
Measurement specifications			
Speed		Absolute position	valid for RS-232, USB, CAN
Accuracy	0.1 km/h ±0.05 % of range [1]	Accuracy	< 40 cm CEP [4]
Min to Max	0.1 km/h to 500 km/h	Refresh rate	20 Hz
Resolution	0.01 km/h	Resolution	< 10 cm
Analog output	25 mV/km/h [2] (0 to 5 V)	Latency time	< 2 ms using DEWESoft
Displacement		Timing	
Accuracy	< 20 cm/km [3]	Trigger accuracy	100 ns
Digital output	500 pls/m [2] (TTL level)	Clock acc. GPS locked	without drift
Refresh rate	200 Hz	Clock acc. GPS unlocked	< 1 ppm
Latency time	12 ms	Clock/Trigger signal level	TTL (LVDS for ORION-1624)
System specifications			
Input	TNC connector for GPS antenna, event mark input		
Output	Speed, displacement, RS-232, USB, CAN, VGPS display, Timebase generator		
Power Supply	9 to 36 V_{DC}, 3 W		
Dimensions	165 x 115 x 50 mm (6.5 x 4.5 x 2 in.)	Display: 131 x 64 x 27 mm (5.2 x 2.5 x 1.1 in.)	
Weight	740 g (1.63 lbs)	Display: 265 g (0.58 lbs)	
Operating temperature	0 °C to 60 °C (standard)		
Storage temperature	-20 °C to +70 °C		
Humidity (operating)	10 % to 80 %, non condensing 5 % to 95 %, rel. humidity		
Vibration	MIL-STD 810F 514.5 procedure I operating test procedure frequency range: 5 to 200 to 5 Hz; 5 x 12 min each direction displacement amplitude ±3.5 mm (5 to 8.45 Hz) acceleration amplitude 1 g (8.45 to 92 Hz) displacement amplitude 92 to 113 Hz: ±0.029 mm acceleration amplitude 1.5 g (113 to 200 Hz)		
Shock	MIL-STD 810F 516.5 procedure I non operating test procedure ½ sinus 11 ms 10 g, 3 shocks positive, 3 shocks negative		

(1) Acquiring more than 6 satellites, averaged over 3 values
(2) Free programmable
(3) Acquiring more than 6 satellites, driving at constant speed
(4) Circular Error Probable
- *40 cm differential operation using local base station*
- *90 cm differential operation using BEACON*
- *1.8 m differential operation using SBAS*
- *3 m autonomous operation*

DEWE-VGPS-200C

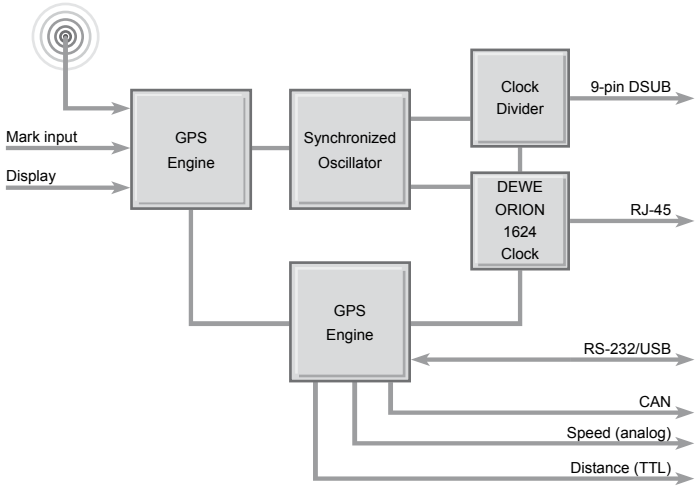
Device overview

With the DEWE-VGPS-200C DEWETRON offers a unique combination of a high dynamic GPS based speed sensor and a GPS synchronized time base generator. This combination allows completely synchronized data acquisition of multiple systems located inside and outside of moving vehicles.

The sensitivity of the analog speed and displacement output is free programmable. Due to the 200 Hz update rate the latency time is as low as 12 ms. Using the unique PPS sync technology of DEWESoft the latency time of the digital interfaces (RS-232, USB or CAN) are corrected online.

The time synchronization is supported for the whole DEWE-ORION series and also for many 3rd party A/D-boards.

The diagram below gives a basic idea about the DEWE-VGPS-200C functionality.



The base of any GPS receiver is precise time measurement. In addition to the position information a precise PPS (pulse per second) is generated by the GPS engine. This pulse is used to synchronize a 40 MHz oscillator with software PLL (phase locked loop). The result is an ultra stable 40 MHz clock source which is completely free of drift over time.

Out of this 40 MHz base clock, the programmable clock divider generates the clock frequency for the data acquisition system. Due to the over-clocking of delta sigma converters, a special output clock is required for synchronized sampling. This is available on a RJ45 connector for clocking the DEWE-ORION-1624.

The communication to the host is provided over CAN, USB or standard RS-232 interface.

Functionality of the LEDs

Power

Indicates the power and hardware status. At power-on this LED flashes for approx. 7 seconds until the receiver is recognized which is indicated by a solid LED. If it blinks three times in a row, there is a hardware failure (e.g. no receiver found, …).

Sat.

Flashes according to the number of used satellites. A short flash means that it has locked onto a satellite but that satellite is not yet being used for the calculation of the position. A long flash means that the satellite is fully locked and used for the calculations.

Status

When the Status LED flashes alone (no flashing Satellite LED), the GPS is not locked to a satellite.

Mounting the aerial

The aerial supplied with the VGPS is designed to be mounted magnetically on top of the vehicle in a horizontal plane. If the surface is not metallic, the aerial may be fixed by placing a piece of strong tape over the top of the aerial. The positioning of the aerial is critical to the correct operation of the VGPS.

Note: For correct working, the aerial requires a metallic subsurface with a minimal diameter of 15 cm. This surface doesn't has to be ferromagnetical.

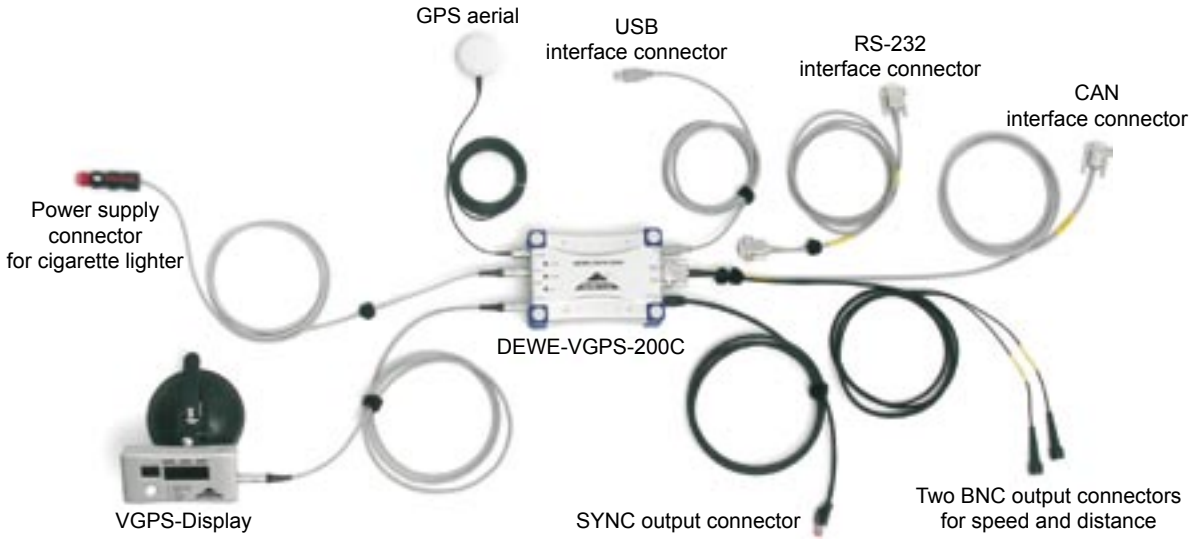
The aerial picks up the signals from up to 12 satellites which are all in different places in the sky. These satellites are not necessarily directly overhead, and can often be close to the horizon. Therefore it is best to mount the aerial in a way, that the least amount of metal obscures the view of the sky. On a domed roof, place the aerial on the top of the dome. On an open car with a roll-over bar, place the aerial horizontally on the highest point of the roll-over hoop and tape the wire securely to the frame. Although the VGPS can work with at least three satellites, it's precision increases the more satellites it finds. If one satellite disappears over the horizon, or behind an object, there are other satellites still in view.

Warm-Up time

When the VGPS is used for the first time, has been moved more than 200 km or not used for 10 hours (since last usage), it is recommended to perform a 'cold start'. To get the best performance from your VGPS in the future, perform this cold start in an open place with a good all round view to the sky. Allow the VGPS to map the satellites for at least 20 to 30 minutes. The VGPS builds up the 'Ephemeris' data on each satellite which is stored in a non-volatile memory, and means future satellite tracking is swift and stable. Once the VGPS has carried out a successful cold start, future satellite lock from power up will take between 15 seconds and 1 minute. Before going to test in a shady environment with tall objects or near to trees, allow the VGPS to settle in an open space for 5 to 10 minutes.

DEWE-VGPS-200C

Scope of supply

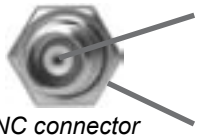


Connection

Connector overview:

Aerial connector

Connect the GPS aerial to the TNC connector.

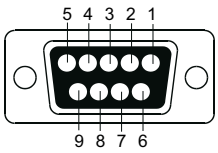


TNC connector

RS-232 interface / CAN connector

The RS-232 interface connector (female) is configured as standard RS-232 interface. Standard 9-pin RS-232 cable is allowed to connect, if CAN is not used.

9-pin SUB-D connector (female)



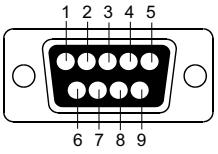
Schematic

Pin assignment
1: Free run operation
2: TXD (Transmitted Data)
3: RXD (Received Data)
4: Not connected
5: GND (Ground)
6: PPS (pulse per second)
7: Not connected
8: CAN H
9: CAN L

Signal out connector

The 9-pin DSUB 9 (male) connector is configured as output connector for following signals:

9-pin SUB-D connector (male)



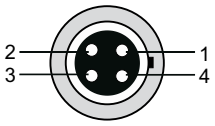
Schematic

Pin assignment
1: PPS (pulse per second)
2: Scan clock output
3: Second clock output
4: Distance output
5: Analog speed output
6: GND (Ground)
7: GND (Ground)
8: GND (Ground)
9: AGND (Analog speed ground)

VGPS-Display connector

To connect the external display to the DEWE-VGPS-200C system.

4-pin Lemo connector (female) EGG.1B.304.CLL



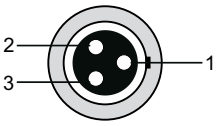
Schematic

Pin assignment
1: +5 V_{DC}
2: GND
3: TXD
4: RXD

Mark input connector

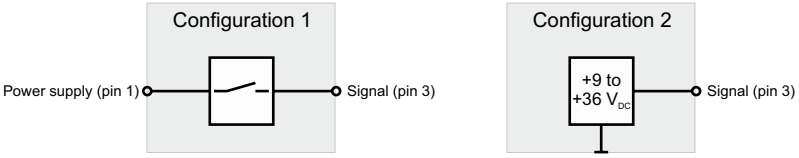
Connects an external trigger source to the DEWE-VGPS-200C system.

3-pin Lemo connector (female) EGG.1B.303.CLL



Schematic

Pin assignment
1: +9 to +36 V_{DC} power supply
2: GND power supply
3: Signal



USB connector

The USB interface connectors meets standard USB pin assignment.

4-pin USB connector

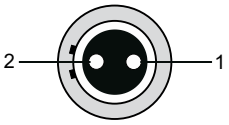
Schematic

Pin assignment
1: +5 V
2: D-
3: D+
4: GND

Power supply connector

Connects the DEWE-VGPS-200C system to an external DC power supply.

2-pin Lemo connector (male) EGJ.1B.302.CLA



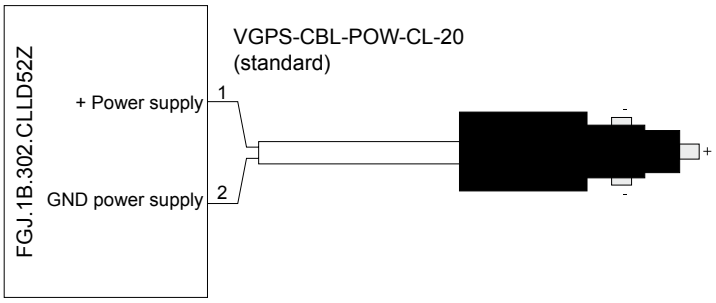
Schematic

Pin assignment
1: +9 to 36 V_{DC} power supply
2: GND power supply

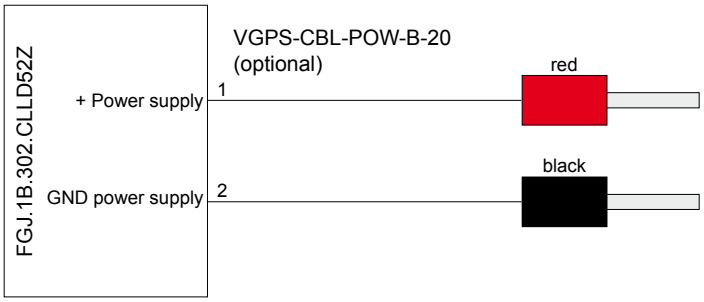
Cable for external power supply

Type of cable: LIYY 2x0.75, length: 2 m

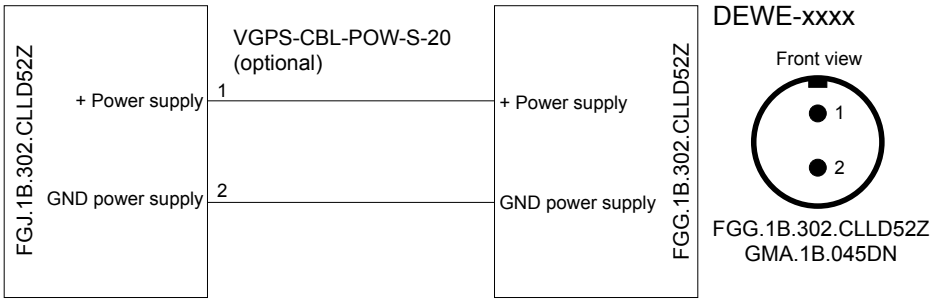
VGPS



VGPS

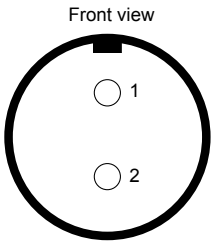


VGPS



DEWE-xxxx

FGG.1B.302.CLLD52Z
GMA.1B.045DN

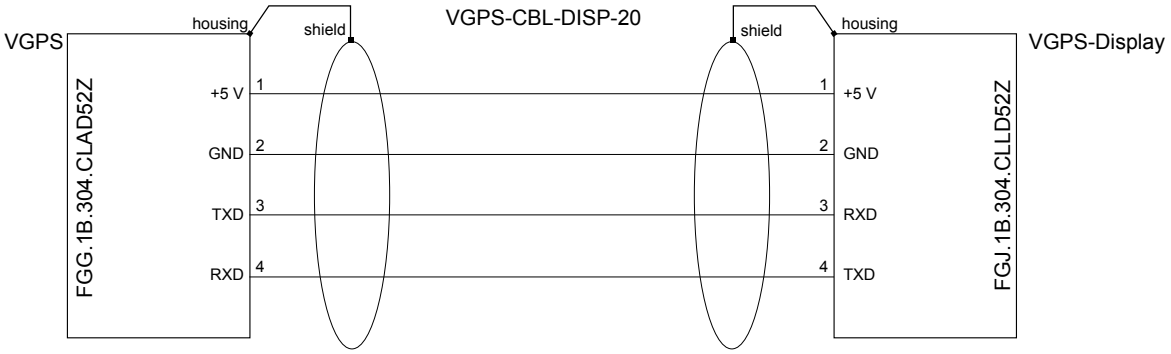


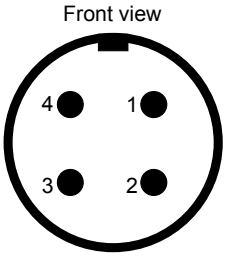
FGJ.1B.302.CLLD52Z
GMA.1B.045DN

Power supply unit
(optional)

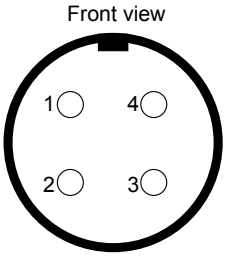
Cable for connecting VGPS to VGPS-Display

Type of cable: LIYCY 4x0.25 shielded, length: 2 m





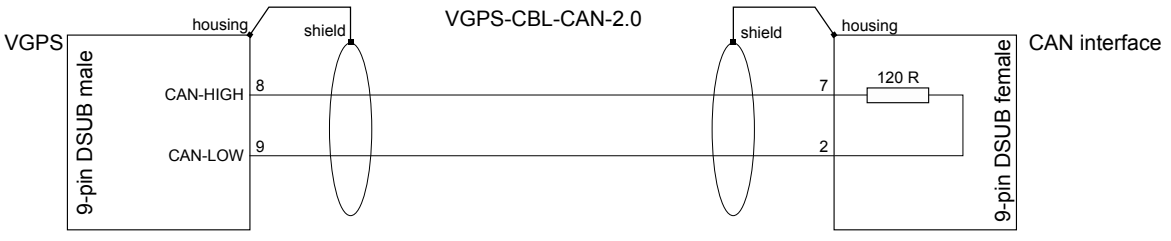
FGG.1B.304.CLAD52Z
GMA.1B.045DN

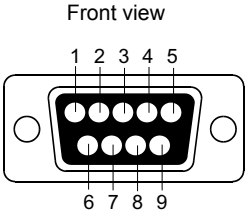


FGJ.1B.304.CLLD52Z
GMA.1B.045DN

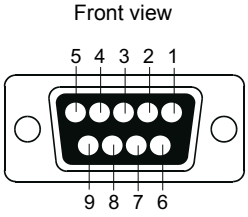
Cable for connecting VGPS to CAN

Type of cable: LIYCY 2x0.25 shielded, length: 2 m





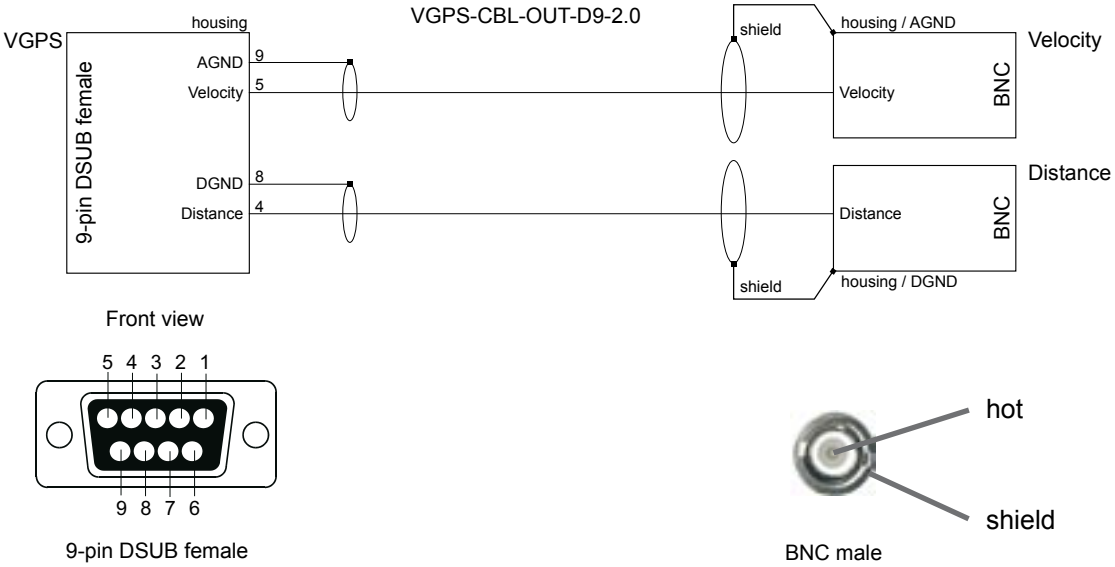
9-pin DSUB male



9-pin DSUB female

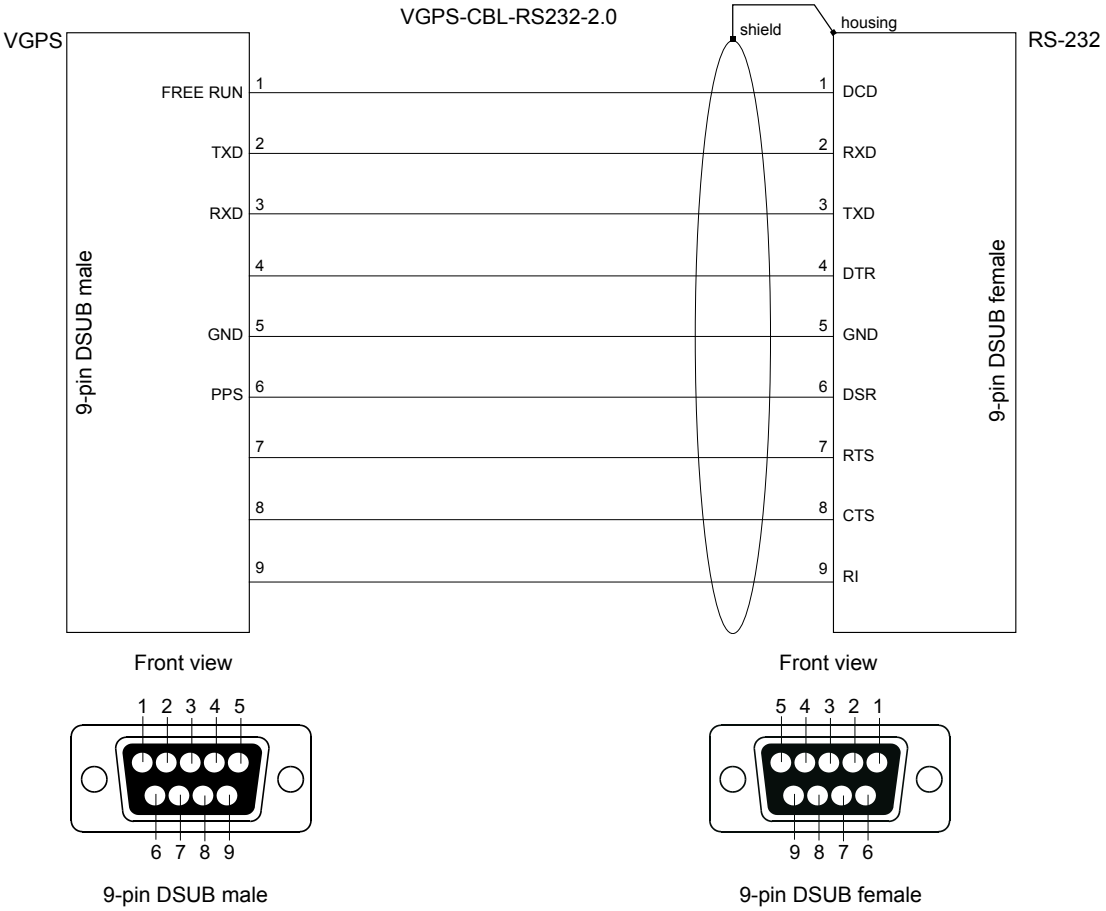
Output cable velocity and distance

Type of cable: RG-174, length: 2 m



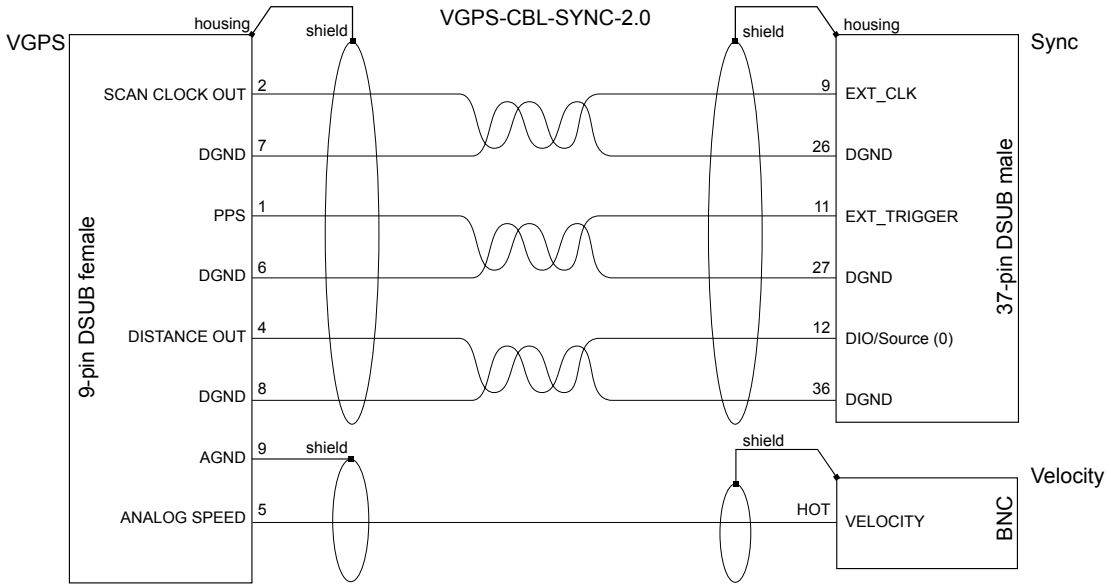
RS-232 interface cable

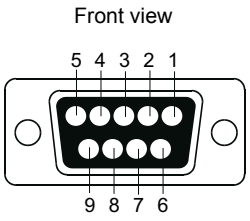
Type of cable: 10x0.14 shielded, length: 2 m



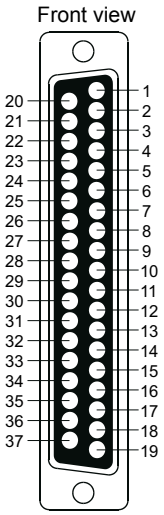
Sync and velocity output (optional cable)

Type of cable: 3x2x0.25 shielded and RG-174, length: 2 m

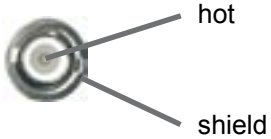




9-pin DSUB female



37-pin DSUB male



BNC male

Digital display operation

The LED display is used to monitor various GPS parameters.

Display description:

Blinking middle dashes on all digits - the display is unable to communicate with the VGPS. Pressing and releasing the push-button on the front of the VGPS-Display switches the display to different mode. After pressing the push-button, the LED beside mode changed to appropriate display mode.

Mode 01:

Number of satellites and velocity in mph.

Mode 02:

Number of satellites and velocity in kilometers per hour

Mode 03:

GPS UTC time reported by the satellites goes up in increments of 0.05 seconds. The format is: hh.mm.ss. The base for the time is Universal Time co-ordinated, derived from the atomic clocks on board the satellite and hence is extremely accurate.

Mode 04:

Heading in degrees
Number of satellites and heading of the vehicle relative to true North.
Resolution: 0.1 degree

Mode 05:

Number of satellites and height of the vehicle relative to the Datum WGS84 (approx. 50 meters below UK sea level)
Resolution: 0.1 meters

Options

Brake trigger operation

(Available to purchase as an option)

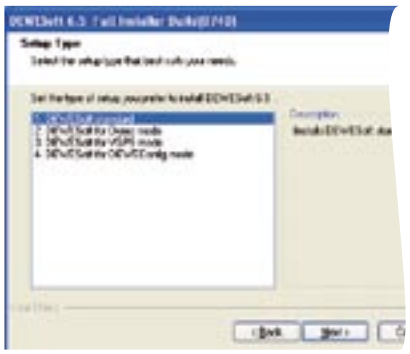
The brake trigger is designed to be mounted on the brake pedal or the accelerator pedal, and gives an indication when the pedal is pressed. The normal method of fixing is via rubber bands. The brake trigger can be used during a brake stop to determine the speed at which the brake pedal was pressed, and the braking distance from this point can be viewed. This switch can be connected directly to an input of the data acquisition system or to the DEWE-VGPS-200C. The DEWE-VGPS-200C will recognize the exact time of the switching point. A serial command with this time information will be transmitted to the data acquisition unit. DEWESoft displays this event as a separate channel. This channel can be used during post processing to calculate the brake distance.

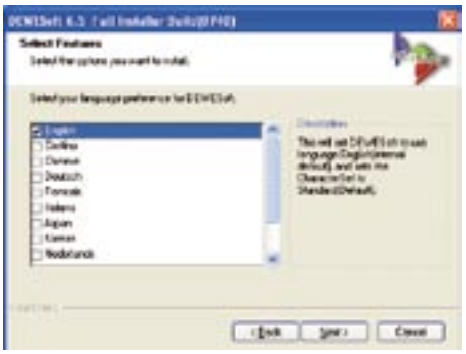
Brake trigger switch

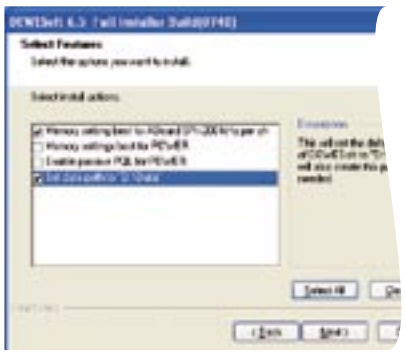
Installation of the DEWESoft measurement software

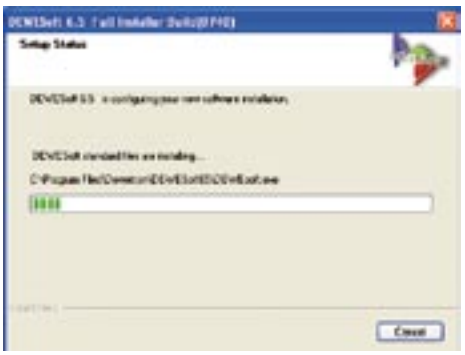
Start the installation software on the System-DVD, shipped with the system.

Follow the instructions of the install program according to your license.

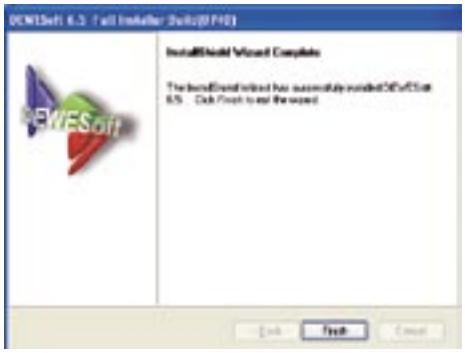


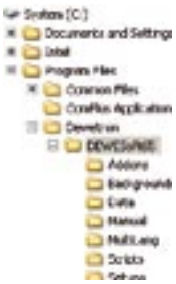






Now DEWESoft is installed on your computer. The software creates some directories on your harddisk.

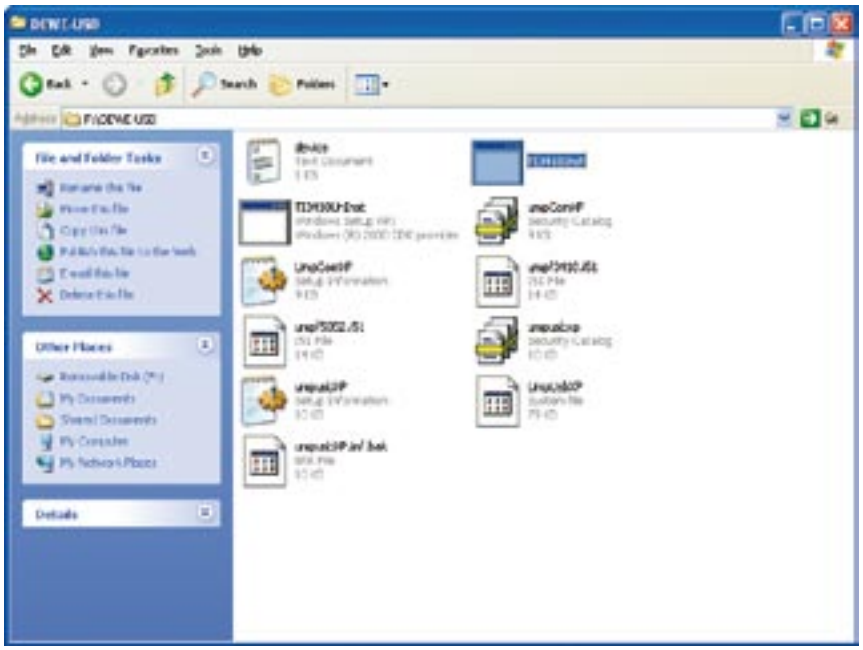




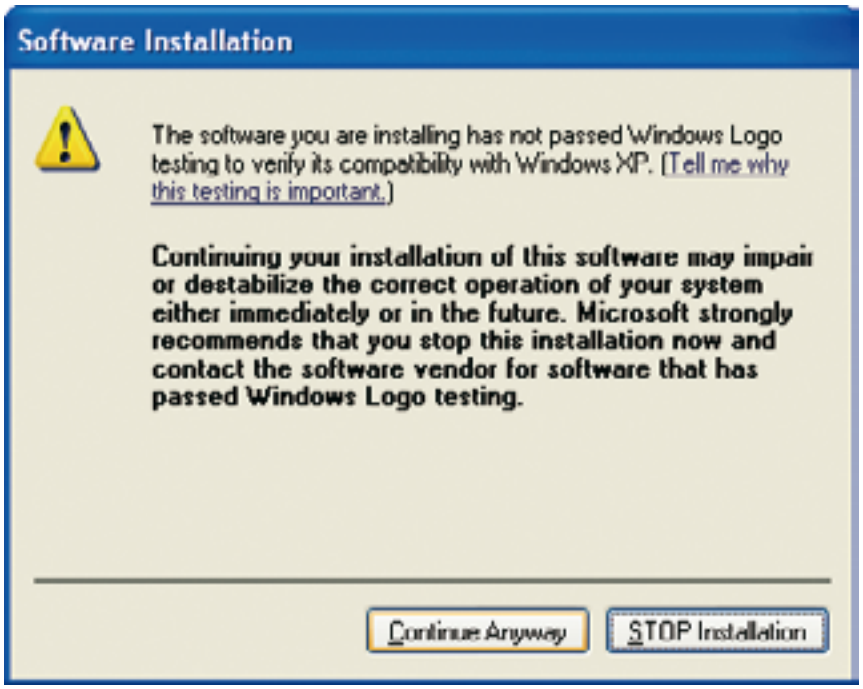
You can start the software in the Windows start menu or use the icon created on your desktop. For more information about the DEWESoft installation please refer to the *DEWESoft Software Users Manual*.

Installation of the DEWE-VGPS-200C drivers

Execute the file „TI3410Inst.exe“ from the System-DVD
(usually D:\Install\Drivers\7_Communication\DEWE-USB where D is the units DVD-Drive letter).

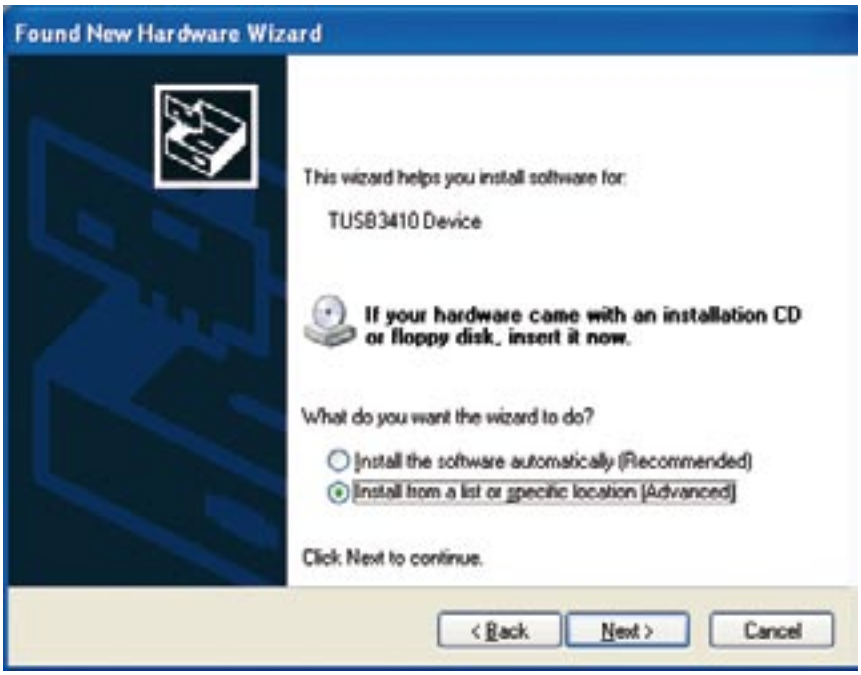


Click on “Continue Anyway” to accept the software installation.

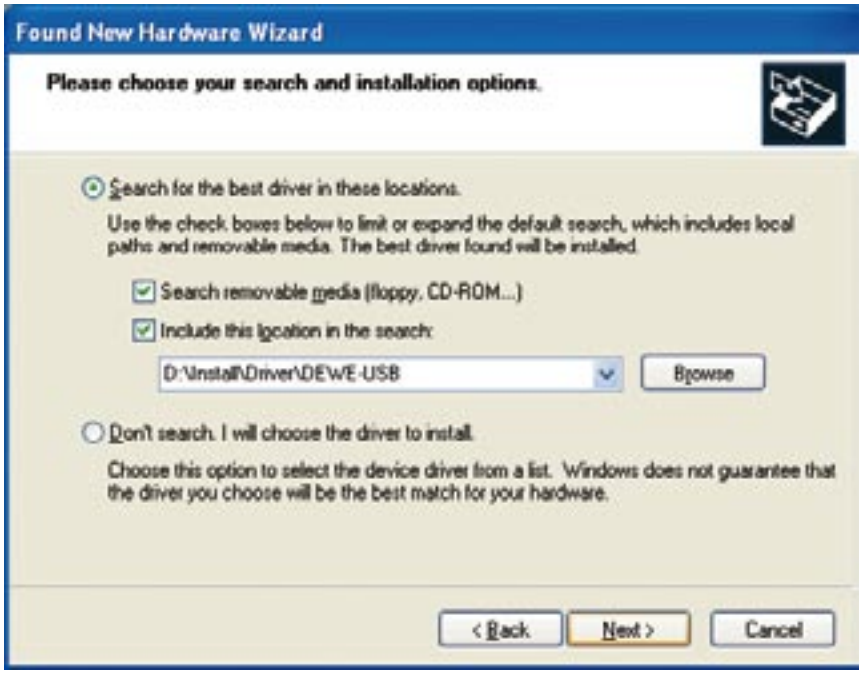


Power the DEWE-VGPS-200C and connect it to the DAQ-System via USB.
When the hardware screen appears, select “No, not this time”

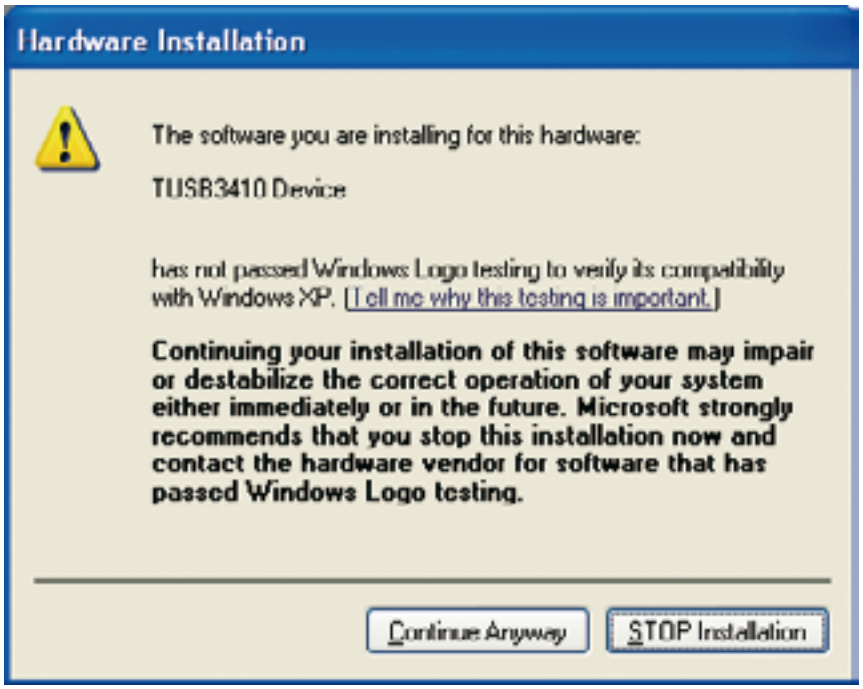
Select “Install from a list or a specific location”



Choose the DEWE-USB folder from the DEWE-System DVD
(D:\Install\Drivers\7_Communication\DEWE-USB)

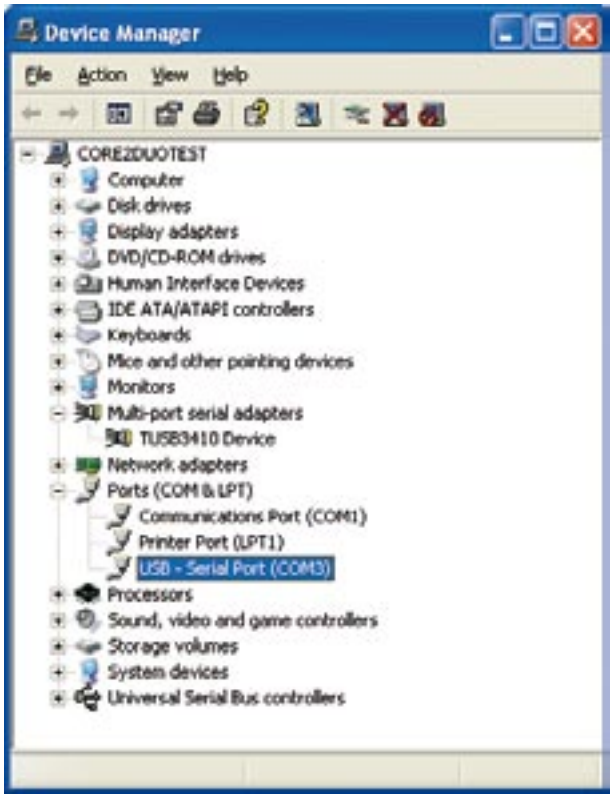


When prompted for the driver installation, select “Continue Anyway”



To complete the driver installation click “Finish”

The Windows-Device-Manager should now show 2 new entries: (TUSB3410 Device and USB-Serial Port). Please note the COM port listed next to the “USB-Serial port” entry. This COM port is used for communicating with the DEWE-VGPS-200C when connected via USB.

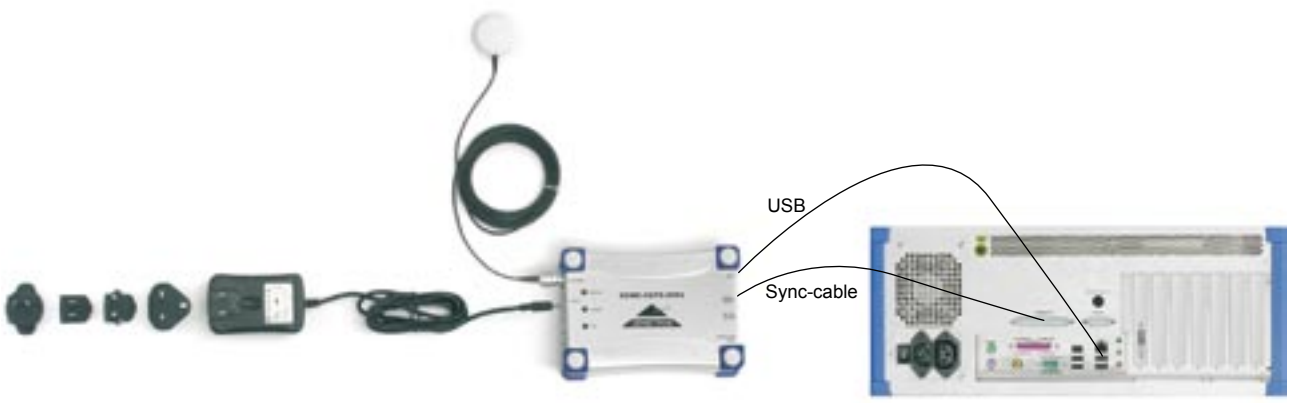


The driver has been successfully installed.

Connecting the DEWE-VGPS-200C hardware to the DAQ-System

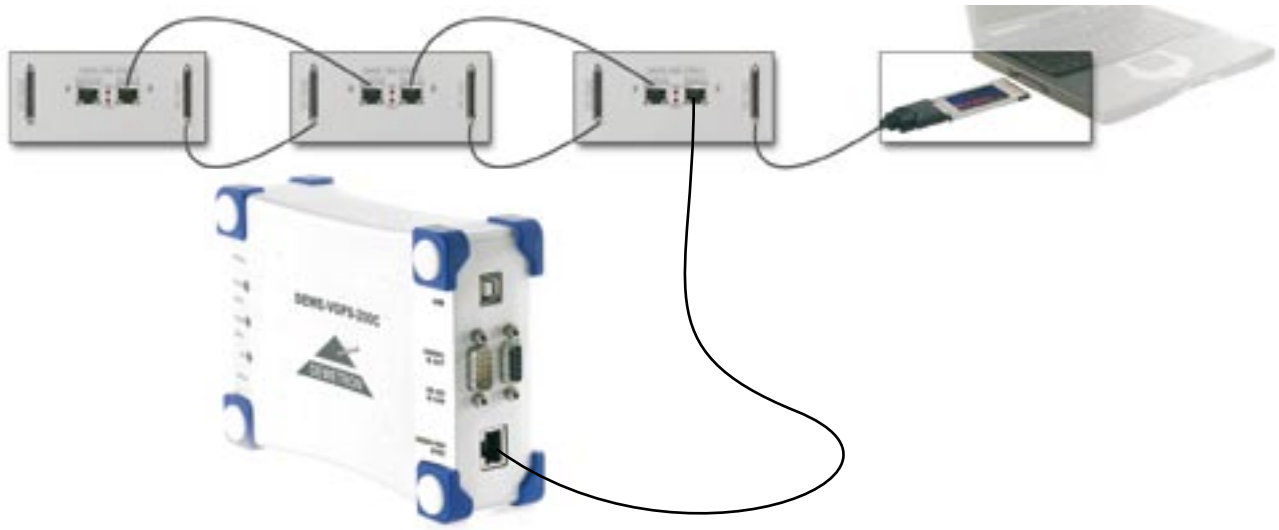
Synchronization to standard A/D-boards

To synchronize standard data acquisition systems a start trigger and the possibility of external clocking is required. Usually DEWETRON data acquisition systems are equipped with a 37-pin DSUB connector. This digital multi function connector contains the required clock and trigger input for easy connection to the clocking unit.



Synchronization to DEWE-ORION-1624

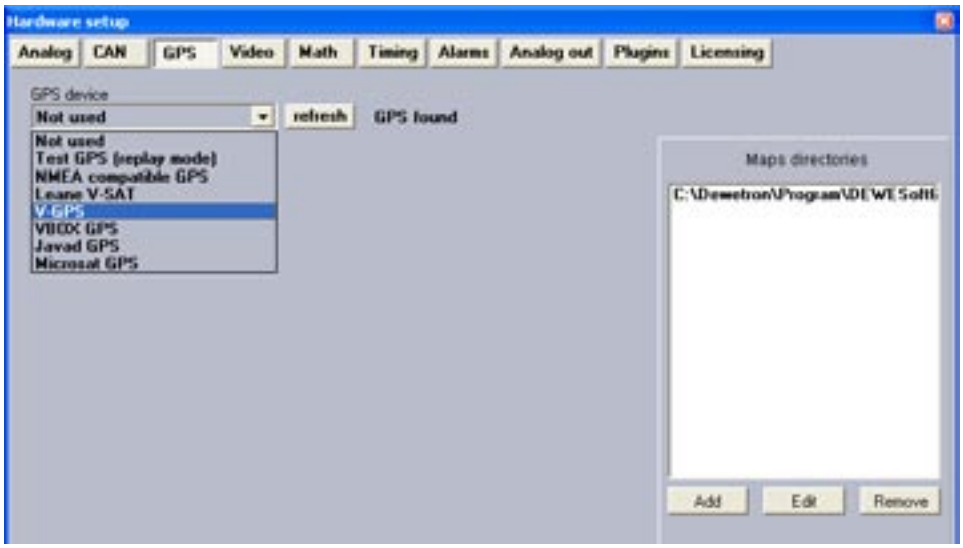
One of the unique features of the DEWE-VGPS-200C is the possibility to synchronize also data acquisition systems using delta sigma ADC technology like DEWE-ORION-1624. The main challenge is to produce the up to 256 times over sample clock used for these types of analog to digital converters. For this purpose the DEWE-VGPS-200C is equipped with a RJ45 connector for connection to the DEWETRON data acquisition system. A standard CAT5e or CAT6 Ethernet cable with up to 30 m can be used for connection.



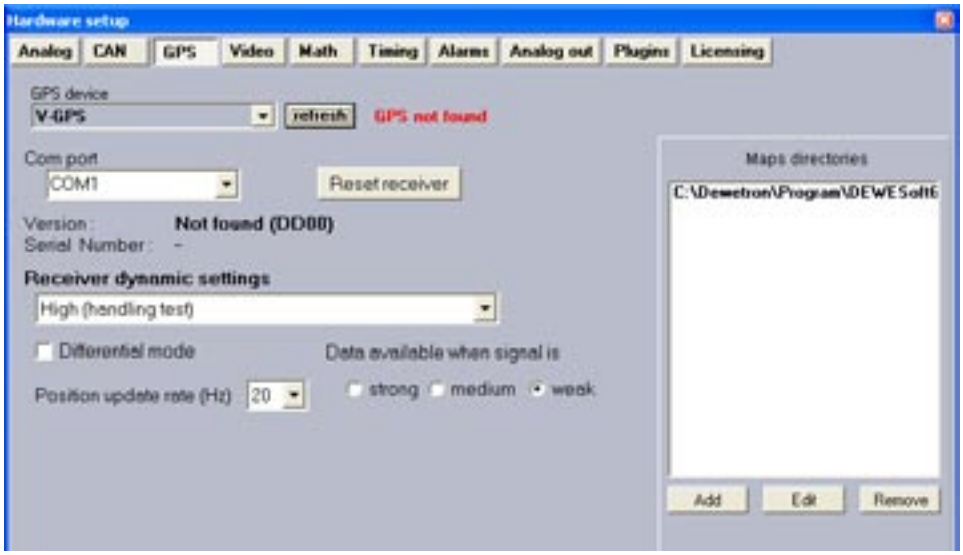
Please note: also the data acquisition has to be provided ORION-1624-SYNC option for having access to the synch bus of the board.

Configuration of DEWESoft for the DEWE-VGPS-200C

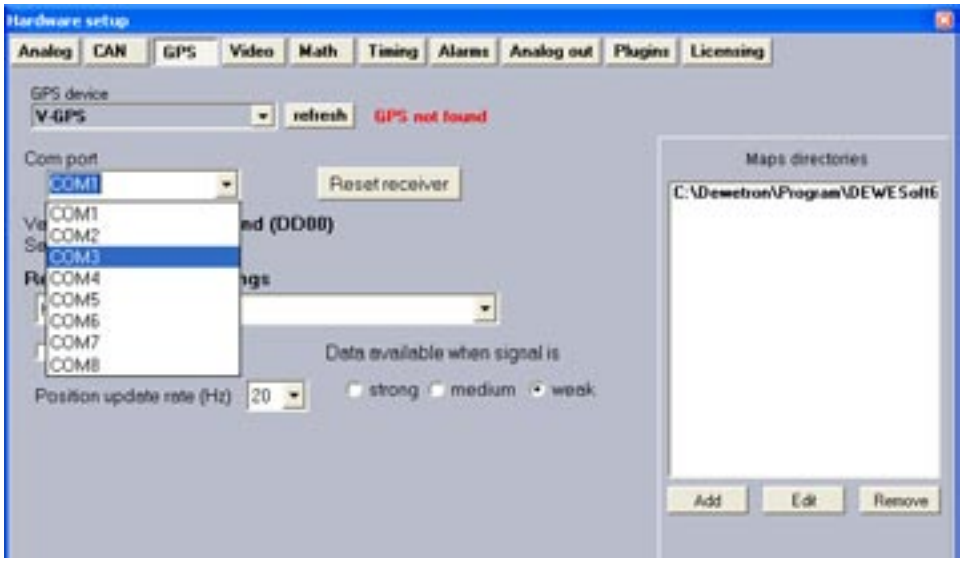
To unlock the GPS functionality in DEWESoft the GPS has to be configured in the Hardware Setup screen (System → Hardware Setup → GPS):

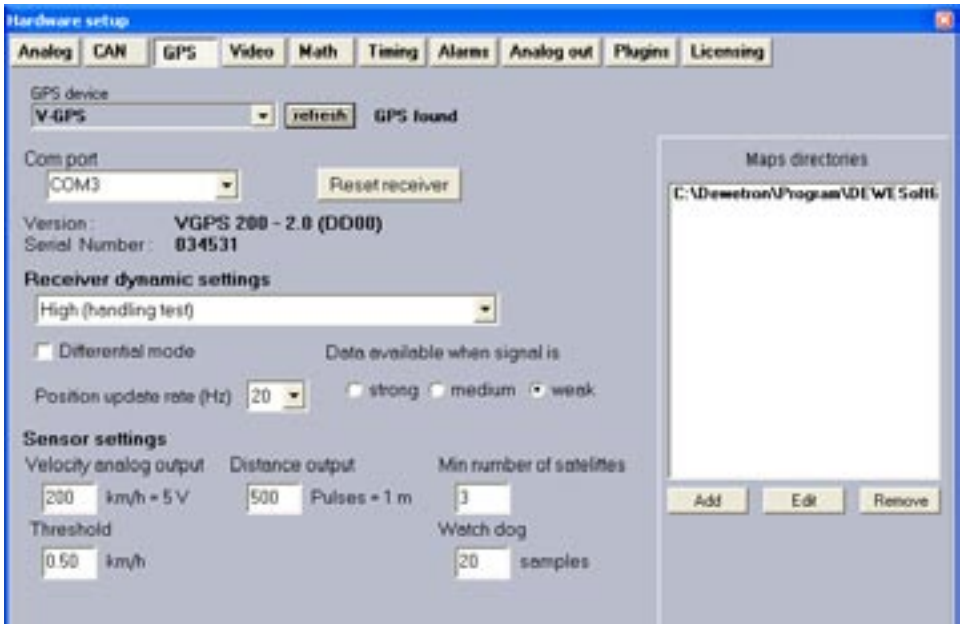


Select V-GPS from the GPS device dropdown menu. DEWESoft will automatically try to find a GPS on the standard COM port.



If the GPS can not be found select the port where the GPS is connected from the COM port dropdown menu and hit the Refresh button.If the DEWE-VGPS-200C is connected to the DAQ-System via RS232 interface, select the onboard COM port (usually COM1 or COM2). If it is not connected via USB interface, select the COM port which is listed next to the entry "USB Serial port" in the Windows device manager (for further information please refer to the section: "Installation of the DEWE-VGPS-200C drivers").





GPS device

A list of the supported GPS systems. Select the VGPS device.

Com port

Communication port selection COM1 (standard setting) to COM8.

Version

Hardware version of the VGPS system.

Serial number

Serial number of the connected GPS sensor. Serial number is recorded to reconstruct the measurement conditions.

Receiver dynamic settings

Depending on the application, the DEWE-VGPS-200C offers the possibility to set it into three different settings. These can be done in the pull down menu Receiver dynamic settings.

Highest (car performance for analog out): This setting should be used if the low latency time of 12 ms at the analog and speed output is needed.

High (car performance): Because of the PPS-Sync facility of the DEWE-VGPS-200C, this setting will not increase the latency time and the dynamic behavior using the serial interface for data acquisition. The delay time at the analog and displacement output may be up to 22 ms.

Normal (data logging): Select this mode for highest accuracy and lowest noise of the position and velocity signal.

Receiver setup

The “Reset receiver” button will reset the internally used receiver. This function has no influence on all settings below.

Update rate (Hz)

This setting will define the sample rate of the serial data storage. This command will not influence the update rate of the analog and digital output.

Differential mode

The VGPS allows differential operation also in the standard configuration. In principle there are three varying types of differential mode supported:

- SBAS
- Beacon
- Local Base Station

The SBAS differential mode is supported within the standard shipment. By simple enabling the differential mode the SBAS is selected. The SBAS is based on additional satellites which send correction values for getting higher accuracy of the absolute position. Depending on the location the SBAS mode is automatically selected: WAAS in Northern America, EGNOS in Europe and MSAS in Japan. For the Beacon differential operation a different aerial is required. The Beacon is based on additional signal sent in the middle wave frequency. For information about the availability of Beacon signals please refer to:

http://www.iala-aism.org/web/pages/publications/cadrepubli.html

The most accurate operation is the differential mode using a additional Local Base Station. For that operation two VGPS systems are required: One VGPS system is fixed mounted (at a Local Base Station) the second is for mobile operation. The fixed VGPS sends the correction data (for example via GSM-modem) to the mobile VGPS.

Since the analog speed and the digital distance output is not based on the absolute position, the accuracy of them will not increase significantly when using the differential mode.

Data available

Not only the satellite count is a criterion for the quality of the received signal. Also the arrangement of the satellites is important to get high reliable GPS data. The VGPS -200C can automatically calculate the reliability of the received GPS signals. Based on that calculation, the VGPS automatically disables the data transfer. This is especially useful when the VGPS is used as a stand alone speed sensor where only the analog speed and the digital distance output is used. Please refer also to the **Watch dog** description.

Velocity analog output

The maximum value of the analog output can be set with that input field. The valid range is between 50 and 500 km/h.

Distance output

Here you can define the number of pulses per meter of the digital distance output. Measuring the frequency of this output gives also a high accuracy speed output. For example if this output is set to 500 pulses per meter a frequency of 1 kHz equals 2 meters per second (or 7.2 km/h). Selectable ranges from 10 to 1000 pulses per meter.

Threshold

Defines the minimum speed for the output. All values below the specified values are automatically set to 0 km/h. This will eliminate the output noise at fixed position of the sensor. The input range can be set between 0.00 and 10.00 km/h. This setting has also influence to the CAN output. Please refer to chapter CAN BUS.

Min. number of satellites

When the number of satellites is less than specified input, the analog output will be set to the maximum output. The digital output is set to the same corresponding frequency. For example if the analog output is set to 200 km/h and the digital output is set to 500 pulses per meter the output frequency can be calculated as follows:

$$f_{out}[kHz] = \frac{\text{analog outputrange} * \text{pulses per meter}}{3600} = \frac{200 * 500}{3600} = 27.777\ kHz$$

This setting is very important if the sensor is only used for speed measurement without serial data connection to guarantee the quality of the analog and digital output. Please note that the VGPS will not work properly when just receiving 3 satellites, therefore the setting makes only sense at receiving 4 satellites or more. The maximum satellites which can be received are 12. This function can be disabled by setting 0. This setting has also influence to the CAN output. Please refer to chapter CAN BUS.

Watch dog

If the sensor lost the satellites, the VGPS stops automatically sending data. In this case also the digital and analog output will not be updated. Only the last valid value is shown at these outputs. To prevent this condition or to be sure that the analog and digital output are always correct you have to activate the watch dog function of the sensor. For example if you set the watch to 1, the analog and digital output goes immediately to there limits (please refer to min. number of satellites) after one missing update from the receiver. This function can also be combined with the data available setting. As soon as the received signal is not within the specified reliability, the VGPS will stop sending the measured data. If the watch dog is enabled, the analog and the digital output were set to their limits.

Maps directories

Select the directories, where you stored your maps. The standard setting is C:\Dewetron\Program\DEWESoft6\Maps. You can copy your maps into this directory, add individual directories or remove unused directories from the box. Convert the maps to .jpg or .bmp format before selecting them.

Timing settings

Hardware setup

In addition to a high precision speed sensor the DEWE-VGPS-200C is also a high precision timing source for synchronized data acquisition. In this operation mode the DEWE-VGPS-200C generates the clock for the data acquisition system. Beside of generating a clock from of up to 10 MHz for data acquisition systems a clock engine for synchronized acquisition using DEWE-ORION-1624 is included also.

This operation mode needs to be enabled in the Hardware setup of DEWESoft: (System → Hardware Setup → Timing):

- Select DEWE-VGPS-200C from the Timing device dropdown menu.

Max. frequency

The maximum output frequency of the DEWE-VGPS-200C is 10 MHz for standard clock output and 200 kHz for DEWE-ORION-1624 operation.

Number of clocks

If a DEWE-ORION-1624 is installed one synchronized clock source is available for clocking the A/D board. In the standard operation mode a second clock source is available (reserved for future use).

Correction limit

For synchronizing the internal oscillator with the PPS signal at least 4 satellites are required. If the GPS signal is lost during acquisition the DEWE-VGPS-200C continues sourcing the data acquisition system with a precision clock source. Without synchronising to the GPS signal, the oscillator may drift. Therefore the absolute time synchronisation can not be guaranteed anymore. However, as soon the GPS signal is available again, the GPS-200C recognizes a possible drift and tries to correct this inaccuracy. If the drift during the free-run time is higher than the defined “Correction limit”, a new data file is automatically generated with exact time stamping.

The maximum allowed correction limit is 500 ms.

The graph below gives an idea how the DEWE-VGPS-200C behaves when the GPS signal is lost during data acquisition. In this example the drift of the oscillator is smaller than the allowed correction limit.

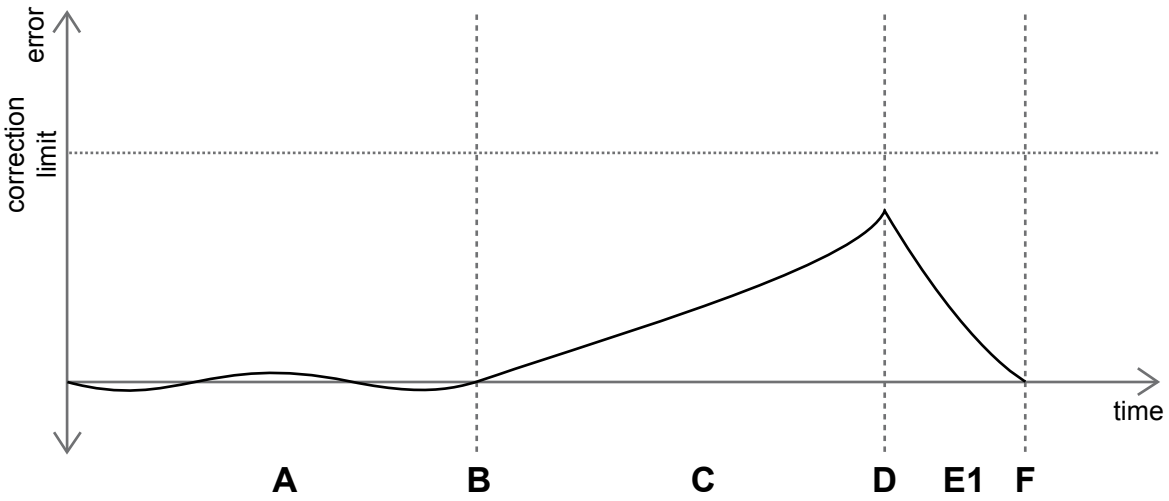
A) This state shows the normal operation. The internal clock is synchronized to the GPS once per second.

B) At this point the number of acquired satellites is lower than 4. The unit stops automatically locking for the GPS time.

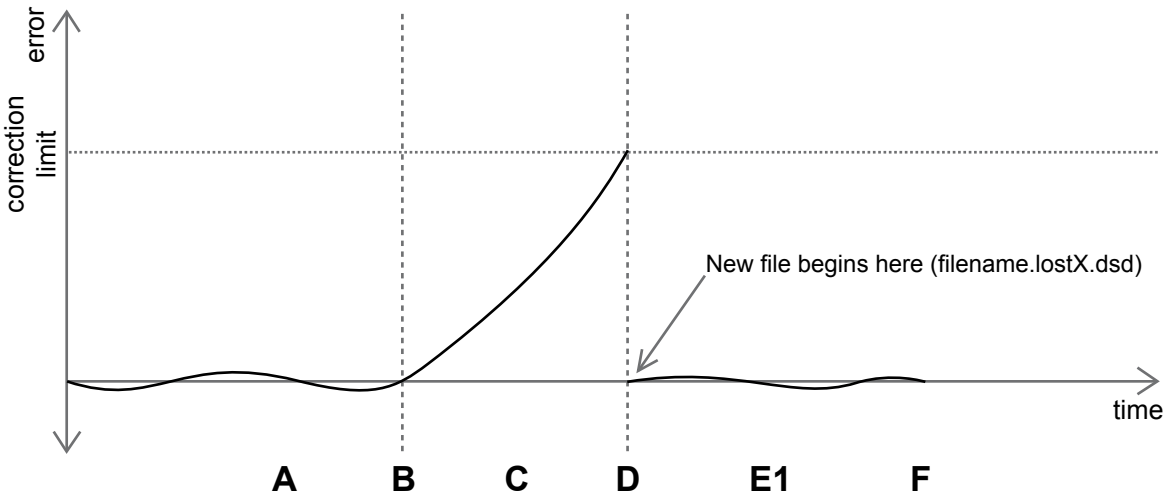
C) In the free-run operation the oscillator drift is obvious.

D) After receiving again the GPS signal the error during the free run cycle is calculated.

E1) Because the oscillator drift is smaller than the defined correction limit the DEWE-VGPS-200C automatically corrects the drift for getting again time synchronized data. So the data acquisition is not interrupted although the GPS signal was lost. The correction is done with the maximum rate of 5 µs/sec.

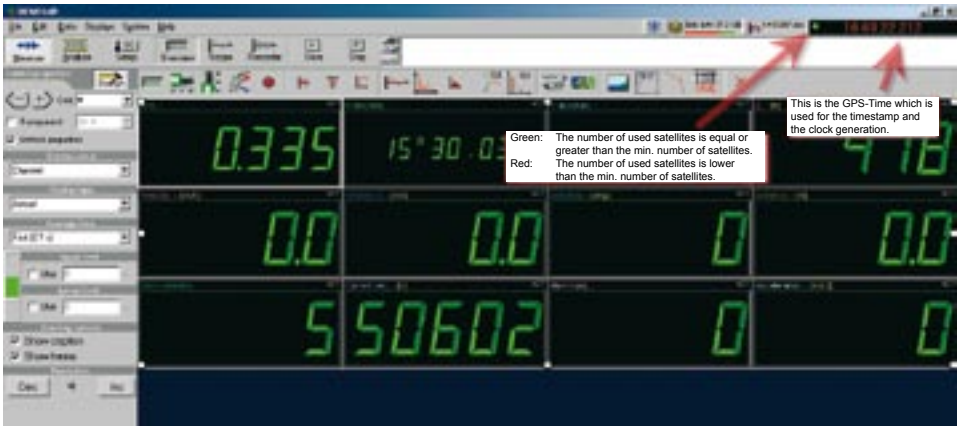


But if the interrupt is too long the oscillator drift may be higher than the defined correction limit. In this case automatically the existing data file is closed and a new file is generated with adding “Lost” of the current filename: “DataFilennameLostX” where X is a running number for each GPS signal lost.

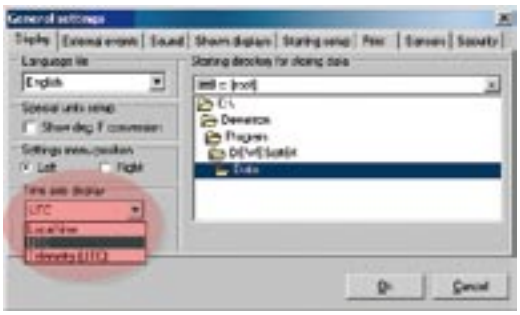


As soon the timing device is selected DEWESoft automatically sets the data acquisition hardware to external clocking for receiving the sample frequency out of the DEWE-VGPS-200C. In addition to this each measurement starts synchronized with the PPS signal. The time information of the data file is taken out of the GPS-time and not anymore from the local PC time.

The actual time form the DEWE-VGPS-200C is shown at the right top corner. In addition to this an indicator gives you the information if the clock generator is locked to the GPS data (green dot) or if it is operating in FREE-RUN mode (red dot).



As default the local time is stored inside the data file. But if the measurement results from multiple systems located in different time zones should be analyzed it is recommended to set to UTC or GPS time. Doing so, the data from all data acquisition systems are containing the same absolute time stamp.



Measurement setup

When you finished the hardware settings, click on the “Setup” button.

Channel Setup

The screenshot below shows the channel setup screen of the DEWE-VGPS-200C. In the column *ON/OFF* you can select the channels for storing during the measurement. The default channel names are displayed in the column *NAME*. You can change them with a double click on it. Beside the channel names the actual value is displayed.

- X absolute: Longitude component of position in degrees, minutes and fraction of minutes
- Y absolute: Latitude component of position in degrees, minutes and fraction of minutes
- Z: Altitude in meters above sea level
- Velocity: Speed over ground (vector of all 3 dimensions)
- Velocity Z: Vertical component of the speed vector
- Direction: True track over ground
- Distance: Integration of speed for getting the displacement. Only speed levels above 0.5 km/h are used to calculate the distance
- Used sat.: Numbers of satellites used for calculation of position and speed
- Mark input: Indicates an event at the mark input by changing the level from 0 to 1

The circle at the left bottom corner gives an overview of the satellites in view of the GPS receiver and which of them are used from the receiver. The color of the shown satellites indicates the signal strength of them. From grey to dark green which is the strongest density. Satellites shown in the centre of the circle are directly above the GPS-aerial. Satellites shown at the border of the circle are near the horizon.

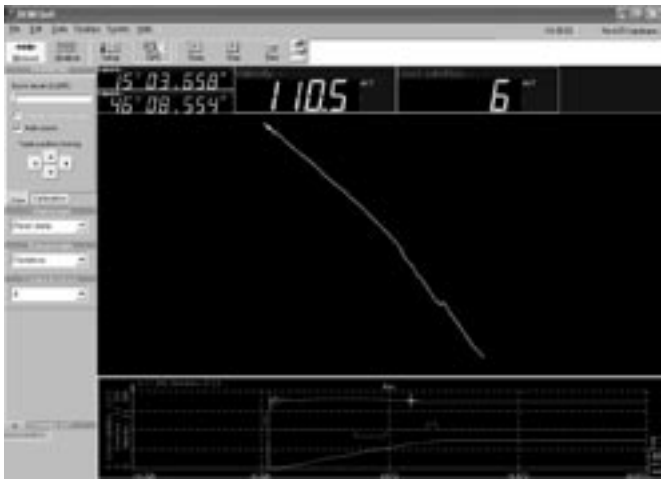
The field <PPS sync> and <Differential mode> change there color from grey to green depending if the appropriate feature is available at the moment (green means available).

The PPS synch is used for hardware synchronisation to analog channels. This will eliminate the time shift caused due the calculation time of the GPS receiver and of the data transfer time of the RS-232 port.

Measurement

Now you are ready for measurement. Clicking the “GPS“ button opens the measurement screen.

With the “Store“ and “Stop“ button you can control the measurement manually.



Analyze

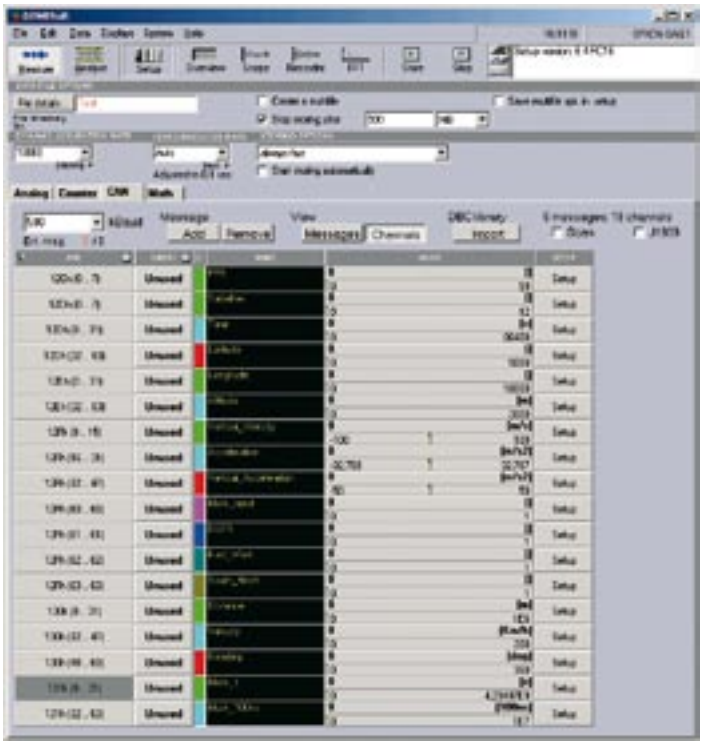
After measurement you can analyze and protocol the stored data. One click on the “Analyze“ button gives you the possibility to choose a recorded data file and analyze it.

Use the cursor functions to zoom in, cut out, measure, and print out. With the “Export“ function you can export data to other applications, like Excel, Word etc.

Find details about DEWESoft in the *DEWESoft Software Users Manual*.

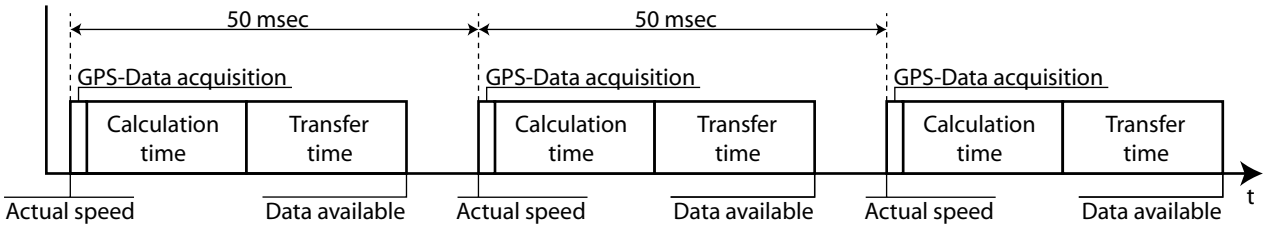
CAN BUS

Beside the RS-232 and USB interface the DEWE-VGPS-200C can be also operated with a CAN high speed interface with 500 kBaud. A required DBC-file is available for automatic settings of the data acquisition system.



The update rate of the GPS signals is 20 times per second on the CAN bus. In addition to the standard GPS channels the PPS channel is available also. This message is generated once per second, almost latency free and can be used for defining the latency time on the CAN bus for all other GPS channels.

The latency time on the CAN channels is related to the basic structure to any GPS-based sensors. After acquiring the GPS raw data the time consuming calculation to get finally the position and speed and the data transfer time will delay the data from the DEWE-VGPS-200C.



By comparing the CAN channel “one_pps” to all other GPS-channels on the CAN bus the latency mainly caused by calculation and data transfer time can be completely eliminated. In opposite to the general opinion the update rate does not cause the main error at the speed sensors – the main error is caused by the latency time. Therefore it is important to take care about the latency time.

The picture below shows you how to eliminate the latency time already during the data acquisition. Inside the CAN at each CAN identifier the latency can be defined for automatic correction. The typical delay on the CAN interface is around 18 ms.

Please note this delay time is not defined in the CAN-DBC file. Defining a latency time on CAN channels is a special feature of DEWESoft and not supported at the standard DBC interface!

The following list gives an idea about the available CAN channels. The standard base identifier is 0x12C (= 300 decimal).

Identifier name *PPS* (base +0: 0x12C):

1) Channel name *PPS*:
   PPS and current second. This message is sent right after PPS pulse without significant delay from GPS and it can be used for software synchronization.

Identifier name *Sats_Time_Latit* (base +1: 0x12D):

This message is sent after decoding data from GPS engine – independent of the used number of satellites.

2) Channel name *Satellites*:
   The number of satellites currently used for acquisition.
3) Channel name *Time*:
   This is a count of 10 ms intervals since midnight UTC with a resolution of 10 ms.
   (5383690 = 53836.90 seconds since midnight or 14 hours, 57 minutes and 16.90 seconds)
4) Channel name *Latitude*:
   Position in degrees and minutes (DDMM.MMMMM) with a resolution of 10 micro minutes. 515924579 = 51 Degrees, 59.24579 Minutes

   Bit 7 in the channel status of identifier VertVel_Accel_VertAccel_Status indicates northern or southern hemisphere.

Identifier name *Sats_Time_Latit* (base +2: 0x12E):

This message is sent after decoding data from GPS engine – independent of the used number of satellites.

5) Channel name *Longitude*:
   Position in degrees and minutes (DDMM.MMMMM) with a resolution of 10 micro minutes.
   5882246 = 0 Degrees, 58.82246 Minutes

   Bit 6 in the channel status of identifier VertVel_Accel_VertAccel_Status indicates eastern or western

hemisphere.

6) Channel name *Altitude*:
   Indicates the height in meters relative to WGS 84 with a resolution of 10 cm

Identifier name *VertVel_Accel_VertAccel_Status* (base +3: 0x12F):

This message is only sent if the number of used satellites is equal or higher than the minimum number of satellites set in the hardware setup of DEWESoft.

7) Channel name *Vertical_Velocity*:
   The vertical velocity is given in m/s with a resolution of 2 decimal points.
8) Channel name *Acceleration*:
   This channel is calculated with differentiating the Velocity channel and is scaled in m/s².
9) Channel name *Vertical_Acceleration*:
   This channel is calculated with differentiating the Vertical_Velocity channel and is scaled in m/s².
10) Channel name *Mark_Input*:
    Indicates the state of the mark input connector. It is set to “1” if this input is active.
11) Channel name *DGPS*:
    Is set to “1” if the GPS receiver is in differential mode. Indicates the state of the mark input connector. It is set to “1” if this input is active.
12) Channel name *East_West*:
    Is set to “1” if located in the east hemisphere of globe.
13) Channel name *South_North*:
    Is set to “1” if located in the south hemisphere of globe.

Identifier name *Dist_Vel_Heading* (base +4: 0x130):

14) Channel name *Distance*:
    This channel indicates the distance in meters with a resolution of 0.25 mm since unit is powered on. The distance is not updated if the velocitiy is below the threshold level. If the number of received satellites is lower than the limit the distance increase rapidly like with a speed of 500 km/h. Please refer also to the hardware setup.
15) Channel name *Velocity*:
    This channel shows the speed over ground scaled in km/h. The velocity is set to zero below the threshold level. If the number of received satellites is lower than the limit the velocity is set to 500 km/h. Please refer also to the Hardware setup
16) Channel name *Heading*:
    The direction (true track over ground) is measured with a resolution of 0.01°.

Identifier name *Mark* (base +5: 0x131):

The exact time of the mark input is measured with an accuracy of better than 1 µs. The exact time of this event is transferred.

17) Channel name *Mark_s*:
    These are the seconds since midnight UTC when the event occurs.

18) Channel name *Mark_100ns*:
    The fraction of seconds with a resolution of 100 ns.

EC-Certificate of conformity

Manufacturer: **DEWETRON Elektronische Messgeraete Ges.m.b.H.**

Address: **Parkring 4**
A-8074 Graz-Grambach Austria

Tel.: +43 316 3070 0
Fax: +43 316 3070 90
e-mail: sales@dewetron.com
http://www.dewetron.com

Name of product: **DEWE-VGPS-200C**

Kind of product: *GPS based system*

The product meets the regulations of the following EC-directives:

73/23/EEC
"Directive on the approximation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits amended by the directive 93/68/EEC"

89/336/EEC
"Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility amended by the directives 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC

The accordance is proved by the observance of the following standards:

LV	**Safety**	IEC/EN 61010-1:1992/93 IEC/EN 61010-2-031	IEC 61010-1:1992/300 V CATIII Pol. D. 2 IEC 1010-2-031
EMC	**Emissions**	EN 61000-6-4	EN 55011 Class B
	Immunity	EN 61000-6-2	Group standard

Graz, October 14, 2008
Place / Date of the CE-marking

Dipl.-Ing. Roland Jeutter / Managing director

Notes