



Dewe-101

Technical reference manual



Thank you!

Thank you very much for your investment in our unique data acquisition systems.

These are top-quality instruments which are designed to provide you years of reliable service. This guide has been prepared to help you get the most from your investment, starting from the day you take it out of the box, and extending for years into the future.

1 Table of contents

1	Table of contents.....	2
2	Safety Instructions.....	3
	Restriction of Hazardous Substances	6
3	Main system	9
3.1	Front side connectors	9
3.2	Back side connectors.....	10
3.3	Connector description	11
3.3.1	Power supply input	11
3.3.2	GPS display connector	12
3.3.3	EPAD connector	12
3.3.4	SYNC connector	13
3.3.5	USB interface connectors (Universal serial bus).....	13
3.3.6	Ethernet LAN connector	13
3.3.7	Power supply for accessories.....	14
3.3.8	VGA connector	14
3.3.9	Analog input connector	15
3.3.10	CAN1 / CAN2 input connector	15
3.3.11	Counter / Digital input	16
3.3.12	Ground connector	16
3.3.13	DEWE 101 power status LED	16
3.4	Typical sensor connection	17
3.5	Bridge sensor connection	19
4	Specifications	21
5	Using DEWE 101 in Dewesoft	31
5.1	Hardware setup.....	31
5.2	Using analog/counter/digital/CAN inputs	34
6	Firmware upgrade	36

2 Safety Instructions

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Warranty Information:

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

Support

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Safety symbols in the manual:

WARNING Calls attention to a procedure, practice, or condition that could cause body 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. DEWESOFT d.o.o. 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.

Environmental Considerations

Information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling a DEWESOFT system:

System and Components Recycling

Production of these 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 its 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 information about recycling on the DEWESOFT web site www.dewesoft.org

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. However we take care about our environment and the product is lead free.

Safety instructions for all DEWESOFT systems

- The DEWESOFT 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 DEWESOFT 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 DEWESOFT 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.
- You may not connect higher voltages than rated to any connectors.
- 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.

3 Main system

3.1 Front side connectors

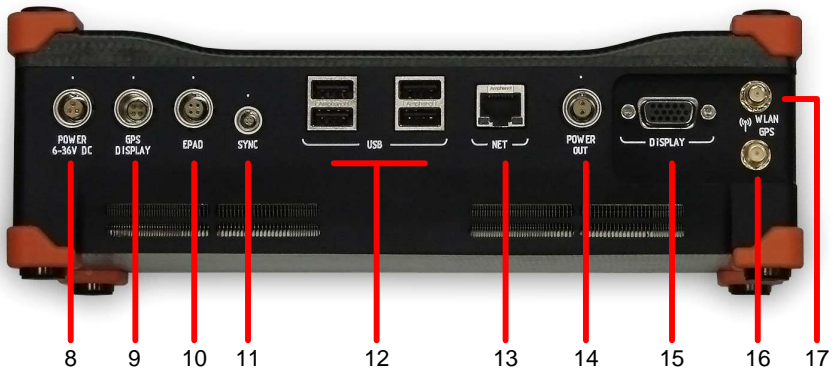


Connector overview:

- 1 Analog input
- 2 Counter / Digital input
- 3 Can1 / Can2 input
- 4 AD Card status LED
- 5 Ground connector
- 6 DEWE 101 power status LED
- 7 Power-on button

DEWE-101

3.2 Back side connectors



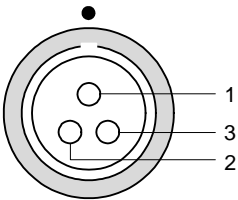
Connector overview:

- 8 Power supply input
- 9 GPS display connector
- 10 EPAD connector
- 11 SYNC connector
- 12 USB interface connectors
- 13 Ethernet LAN connector
- 14 Power supply for accessories
- 15 VGA connector
- 16 GPS antenna connector
- 17 WLAN antenna connector

3.3 Connector description

3.3.1 Power supply input

Power supply input	
Input:	
Input range:	6 - 36Vdc
Input frequency:	DC
Max.input current:	10A



Pin Assignment

- 1: V+
- 2: GND
- 3: Remote on

System will power on when you press Power on button **OR** apply V+ voltage to Remote on pin. To power off system, press Power on button.

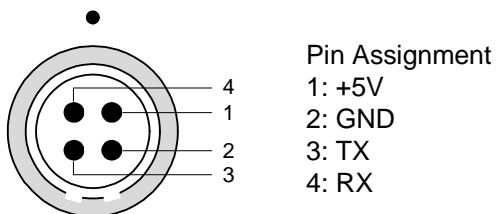
Mating connector: LEMO FGG.1B.303.CLAD52

DEWE-101

3.3.2 GPS display connector

The GPS display connector offers the possibility to connect VGPS display to DEWE-101.

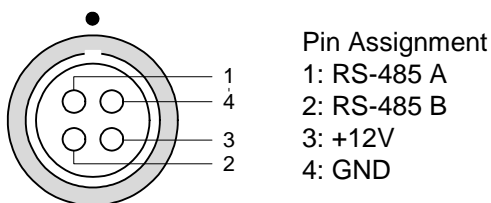
Mating connector: LEMO FGJ.1B.304.CLLD52



3.3.3 EPAD connector

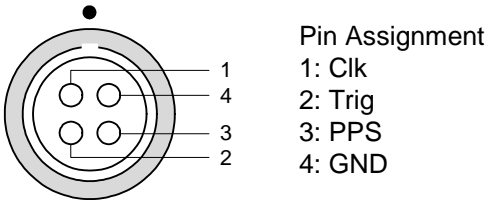
To connect DEWETRON EPAD modules to the system. EPAD connector is internally connected to COM2 port.

Mating connector: LEMO FGG.1B.304.CLAD52



3.3.4 SYNC connector

Mating cable connector: LEMO FGG.00.304.CLAD27Z



3.3.5 USB interface connectors (Universal serial bus)

The USB interface connector meets standard USB pin assignment

3.3.6 Ethernet LAN connector

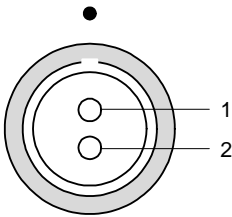
The DEWE-101 system supports 10/100 BaseT Ethernet with standard RJ45 connector.

DEWE-101

3.3.7 Power supply for accessories

To supply your accessories with power supply input voltage. Voltage is available when DEWE-101 is running.

Mating cable connector: LEMO FGG.1B.302.CLAD52

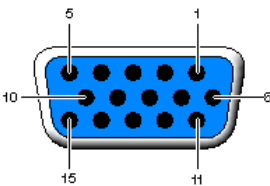


Pin Assignment

- 1: V+
- 2: GND

3.3.8 VGA connector

The VGA connector offers the possibility to connect a CRT or other standard VGA displays to the system.

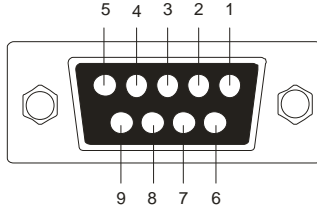


Pin Assignment

- 1: Red video
- 2: Green video
- 3: Blue video
- 4: -
- 5: Ground
- 6: Red video ground
- 7: Green video ground
- 8: Blue video ground
- 9: +5V
- 10: Ground
- 11: -
- 12: Data line
- 13: H-Sync
- 14: V-Sync
- 15: Clock

3.3.9 Analog input connector

9-pin D-SUB female connector for analog input:

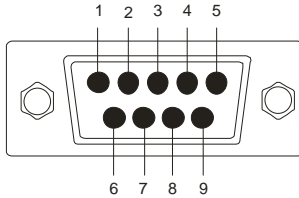


Pin Assignment

- 1: EXC+
- 2: IN+
- 3: Sense-
- 4: AGND
- 5: +12V
- 6: Sense+
- 7: IN-
- 8: EXC-
- 9: TEDS

3.3.10 CAN1 / CAN2 input connector

9-pin D-SUB male connector for CAN bus:



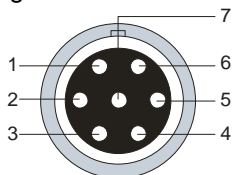
Pin Assignment

- 1: +5V
- 2: CAN_LOW
- 3: DGND
- 4: RES
- 5: RES
- 6: DGND
- 7: CAN_HIGH
- 8: RES
- 9: +12V

DEWE-101

3.3.11 Counter / Digital input

Counter input (mating cable connector: LEMO FGG.1B.307.CLAD52)



Pin Assignment

- 1: IN0/A
- 2: IN1/B
- 3: IN2/Z
- 4: RES
- 5: +5V
- 6: +12V
- 7: DGND

3.3.12 Ground connector

For some kind of measurements, it's necessary to give the system an additional ground connection

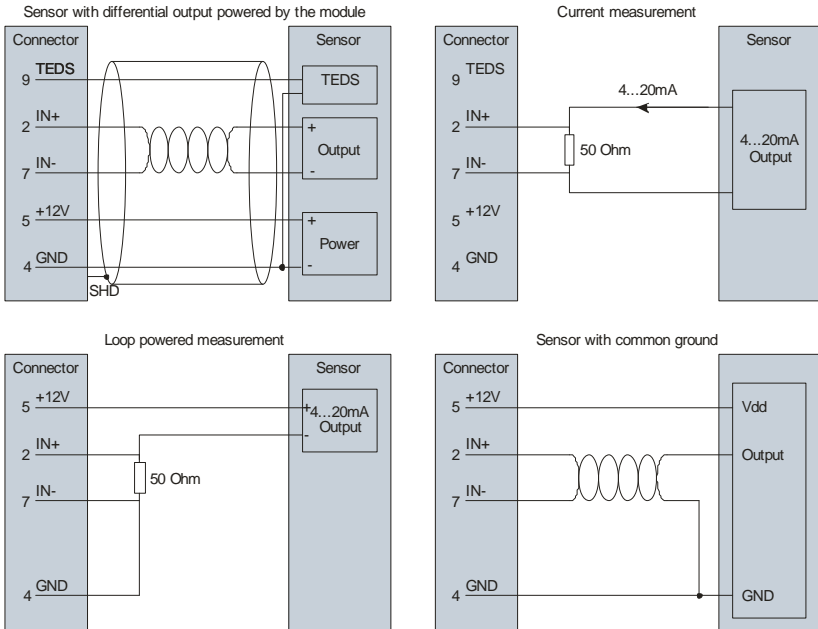
3.3.13 DEWE 101 power status LED

Status LED indicates current system state (look at table below):

LED indicator	Description
OFF	System powered down
Green blinking at startup	System starting
Green	Normal operation
Red blinking at startup	System preheating at cold enviroment (< 0°C)
Red	Heating / Cooling (Depends on enviromental temperature)

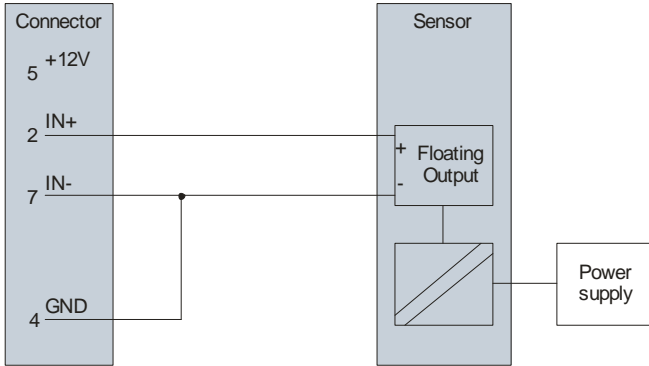
3.4 Typical sensor connection

For correct measurements, it is highly recommended to ground the DEWE-101 with GND banana plug on the side.

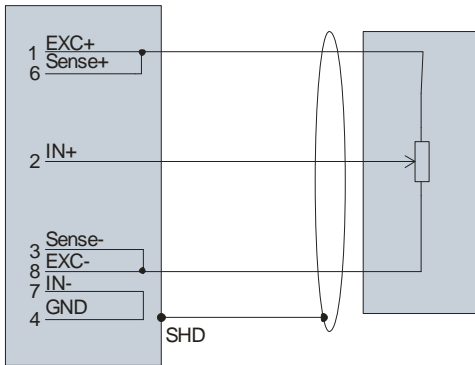


DEWE-101

Single ended connection



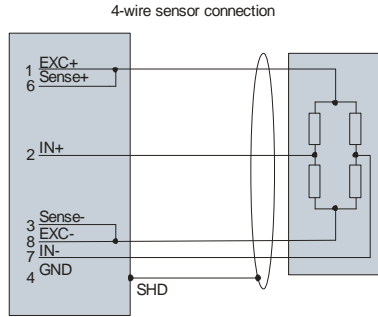
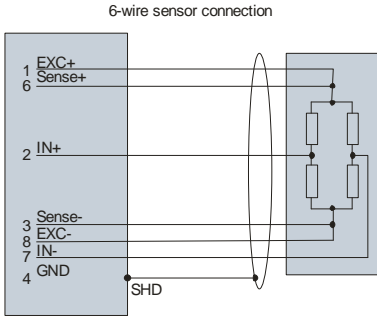
Potentiometer sensor connection



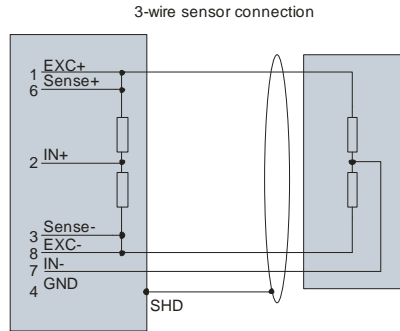
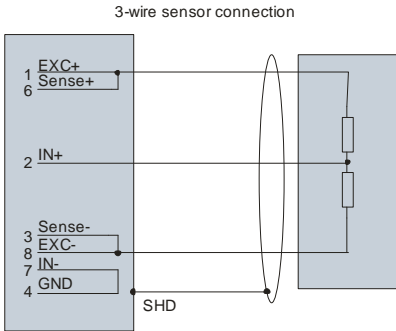
Important: If sensors or other signal sources with isolated external power supply are used, ground signals of DEWE-101 and external power supply should be connected over connector GND wire or over “common GND” input on housing to prevent common-mode voltage problems.

3.5 Bridge sensor connection

Full bridge:



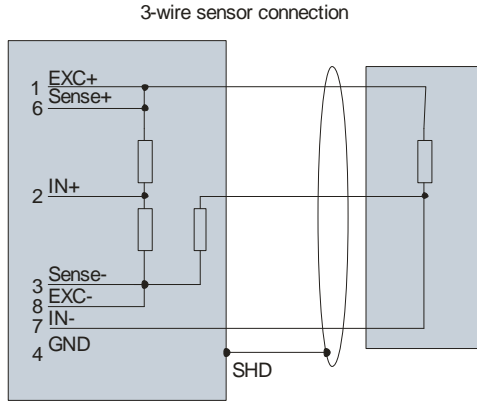
Half bridge:



Note: Bridge completion needs to be done in the connector.

DEWE-101

Quarter bridge:



Note: Bridge completion needs to be done in the connector.

4 Specifications

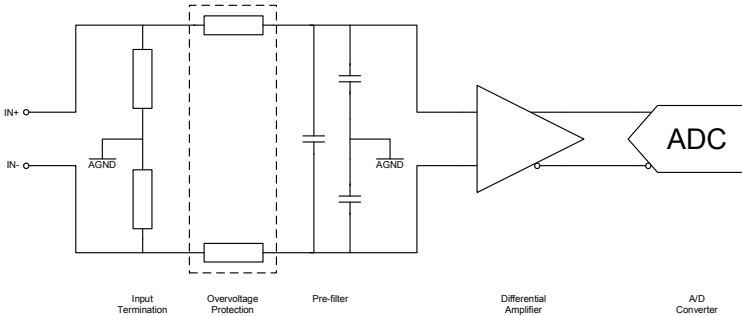
Analog inputs									
Number of channels	8								
Inputs	Voltage, bridge (IEPE, temperature with adapters)								
ADC type	24 bit sigma delta with anti-aliasing filter (see section ADC)								
Sampling rate	simultaneous 200kS/sec sampling rate								
Input type	Differential								
Input ranges	$\pm 10V$, $\pm 1V$, $\pm 100mV$, $\pm 10mV$								
Sensor supply	12V, 400mA sensor supply $\pm 5V \pm 0.1\%$ bridge sensor supply								
Overvoltage protection	$\pm 70V$ input protection								
Dynamic range	107dB@ $\pm 10V$ range								
DC accuracy	<table border="0"> <tr> <td>10 V range</td> <td>0,1% of value +1 mV</td> </tr> <tr> <td>1 V range</td> <td>0,1% of value +0.5 mV</td> </tr> <tr> <td>100 mV range</td> <td>0,1% of value +0.1 mV</td> </tr> <tr> <td>10 mV range</td> <td>0,1% of value +0.1 mV</td> </tr> </table>	10 V range	0,1% of value +1 mV	1 V range	0,1% of value +0.5 mV	100 mV range	0,1% of value +0.1 mV	10 mV range	0,1% of value +0.1 mV
10 V range	0,1% of value +1 mV								
1 V range	0,1% of value +0.5 mV								
100 mV range	0,1% of value +0.1 mV								
10 mV range	0,1% of value +0.1 mV								
Input impedance	20M Ω 47pF(differential) 10M Ω 33pF(common mode)								
CMRR	>80dB (see section CMRR)								
Maximum common mode voltage	$\pm 13V$								
Signal to noise	<table border="0"> <tr> <td>0.1kS/s to 51.2kS/s</td> <td>105dB</td> </tr> <tr> <td>51.2ks/s to 102.4kS/s</td> <td>100dB</td> </tr> <tr> <td>102.4kS/s to 200kS/s</td> <td>75dB</td> </tr> </table>	0.1kS/s to 51.2kS/s	105dB	51.2ks/s to 102.4kS/s	100dB	102.4kS/s to 200kS/s	75dB		
0.1kS/s to 51.2kS/s	105dB								
51.2ks/s to 102.4kS/s	100dB								
102.4kS/s to 200kS/s	75dB								

DEWE-101

Counter/Digital inputs	
Number of channels	8 counters/24 digital input, fully synchronized with analog
Modes	counting, waveform timing, encoder, tacho, geartooth sensor
Counter timebase	50MHz
Counter resolution	32-bit
Compatibility	TTL/CMOS
Configuration	Pull-up with 100k Ω
Input low level	-0,7V to 0.7V
Input high level	2V to 5V
Overvoltage protection	\pm 30V input protection
CAN bus	
Number of ports	2
Interface type	CAN 2.0B, up to 1 MBit/sec
Special applications	OBDII, J1939, CAN output
Galvanic isolation	Not isolated
Bus pin fault protection	\pm 36V
ESD protection	8kV
General specifications	
Power supply	6-36 V DC
Maximum sensor power consumption	6 W
Maximum power consumption	50W
Physical dimensions	24.5 x 14.5 x 7 cm
Weight	2 kg
Operating temperature	-20 to 60 deg. C
Storage temperature	-40 to 85 deg. C
Humidity	95% RH non condensing @ 60 $^{\circ}$ C

Analog input configuration:

Block diagram of analog input (all analog inputs are identical):



The high input impedance (10M Ω ground referenced) has no distortion influence on the measured signal.

ADC:

The DEWE-101 uses 8 delta-sigma A/D converters. If you sample with a data rate of 102.4 kS/s, the ADC actually samples the input signal with 13.1072 MS/s (multiply the data rate with 128) and produces 1-bit samples which are applied to the digital filter. The filter expands the data to 24-bits and rejects signal parts greater than 51.2 kHz (Nyquist frequency). It also re-samples the data to the more conventional rate of 102.4 kS/s.

A 1-bit quantizer introduces many quantization errors to the signal. The 1-bit, 13.1072 MS/s from the ADC carry all information to produce 24-bit samples at 102.4 kS/s. The delta-sigma ADC converts from high speed to high resolution by adding much random noise to the signal. In this way the resulting quantization noise is restricted to frequencies above 100 kHz. This noise is not correlated with the useful signal and is rejected by the digital filter.

ADCs can only represent signals of a limited bandwidth. The maximum frequency you can represent is the half of the sampling rate. This maximum frequency is also called Nyquist frequency. The bandwidth between 0 Hz and the Nyquist frequency is called Nyquist bandwidth. Signals exceeding this frequency range can not be converted correctly by the sampler.

DEWE-101

For example, the sample rate is 1000 S/s, the Nyquist frequency is 500 Hz. If the input signal is a 375 Hz sine wave, the resulting samples represent a 375 Hz sine wave. If a 625 Hz sine wave is sampled, the resulting samples represent a 375 Hz sine wave too. This happens because signals exceeds the Nyquist frequency (500 Hz). The represented frequency of the sine wave is the absolute value of the difference between the input frequency and the closest integer multiple of the sampling rate (in this case 1000 Hz).

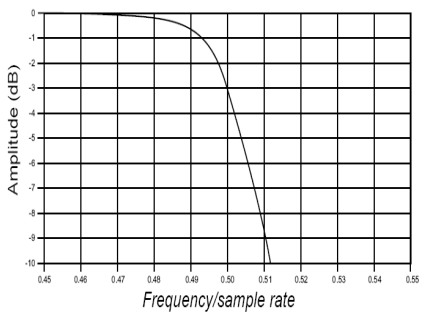
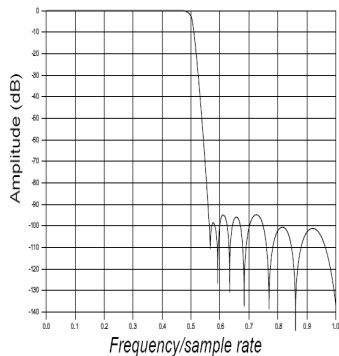
When the sampler modulates frequencies out of the Nyquist bandwidth back to the 0 to 500 Hz baseband it is called aliasing. Signals which are not pure sine wave can have many components (harmonics) above the Nyquist frequency. These harmonics are erroneously aliased back to the baseband, added to parts of the accurately sampled signal and produces a distorted data set. To block frequencies out of the Nyquist bandwidth, a lowpass filter is applied to the signal before it reaches the sampler.

Each input channel has its two pole anti-alias lowpass filter with a cutoff frequency of about 250 kHz. The very high cutoff frequency allows an extremely flat frequency response in the bandwidth of interest and a small phase error. The analog filter precedes the analog sampler. The analog sampler operates at 256 times the selected sample rate for rates below 51.2 kS/s, 128 times for rates between 51.2 kS/s and 102.4 kS/s. For rates over 102.4 kS/s the oversampling is 64 times. That means, the ADC operates at 13.1072 MS/s if you select a sample rate of 102.4 kS/s ($128 * 102.4 \text{ kS/s}$).

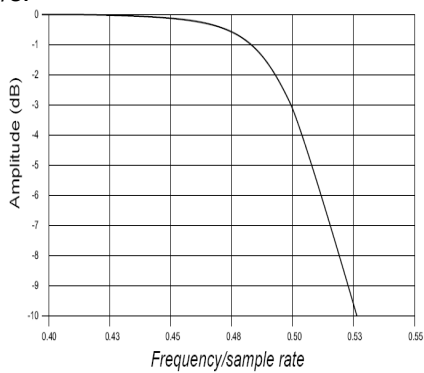
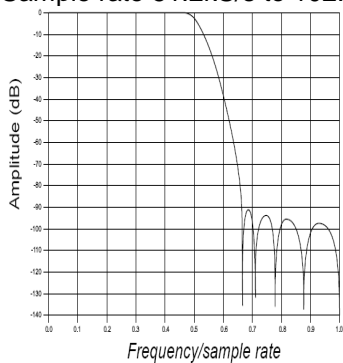
The 1-bit oversampled data is passed to a digital anti-aliasing filter. This filter has no phase error and an extremely flat frequency response. It also has an extremely sharp roll-off near the cutoff frequency (0.38 to 0.494 times the sample rate) and the rejection above 0.5465 times the sample rate is greater than 92 dB. The output stage of the digital filter resamples higher frequencies to 24-bit samples.

The digital filter passes only signal components within the Nyquist bandwidth or within multiples of the Nyquist bandwidth of 64, 128 or 256 times (depending on sampling rate). The analog filter rejects most noise near these multiples. The following diagrams show the frequency response of the input circuitry.

Sample rate 0.1kS/s to 51.2kS/s:

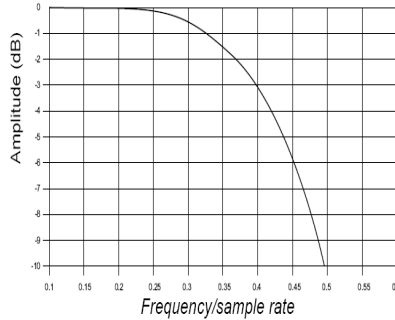
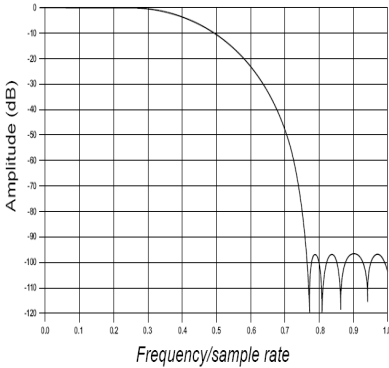


Sample rate 51.2kS/s to 102.4kS/s:



DEWE-101

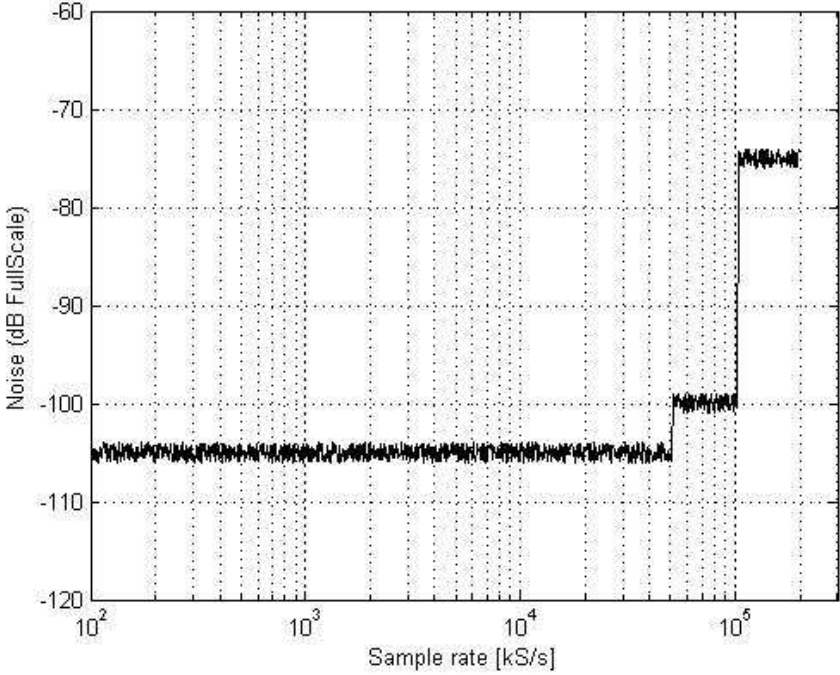
Sample rate 102.4kS/s to 200kS/s:



The ADC samples at 64, 128 or 256 times the data rate (depending on the adjusted sample rate). Frequency components above one half of the oversampling rate ($> 32, 64$ or 128) can alias. Most of this frequency range is rejected by the digital filter. The filter can not reject components that lie close to integer multiples of the oversampling rate because it can not differentiate these components from components between 0 Hz and the Nyquist frequency. That means, if the sample rate is 100 kS/s and a signal component is between 50 kHz and 12.8 MHz (128×100 kHz), this signal will be aliased into the passband region of the digital filter and is not rejected. The analog filter removes these components before they get to the digital filter and the sampler.

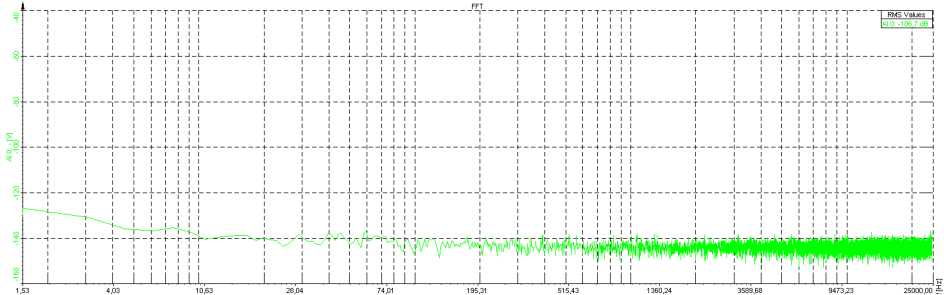
If aliasing is caused by a clipped or overranged waveform, (exceeding the voltage range of the ADC) it can't be rejected with any filter. The ADC assumes the closest value to the actual value of the signal in its digital range when the signal is clipping. The result of clipping is also a sudden change in the signal slope and results in corrupt digital data with high-frequency energy. This energy is spread over the complete frequency spectrum and is aliased back into the baseband. Do not allow the signal to exceed the input range to avoid this.

Idle channel noise (input terminated with 50Ω):

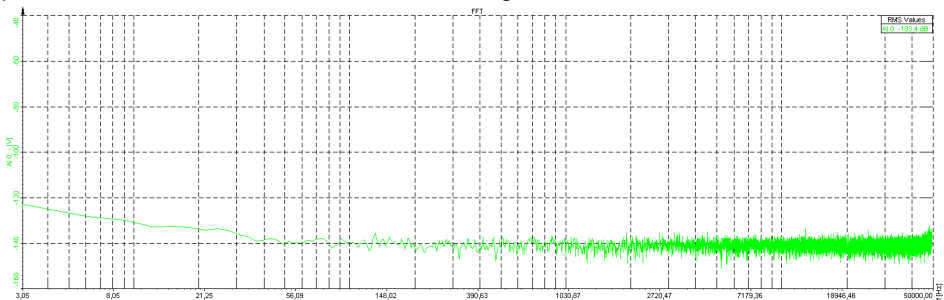


DEWE-101

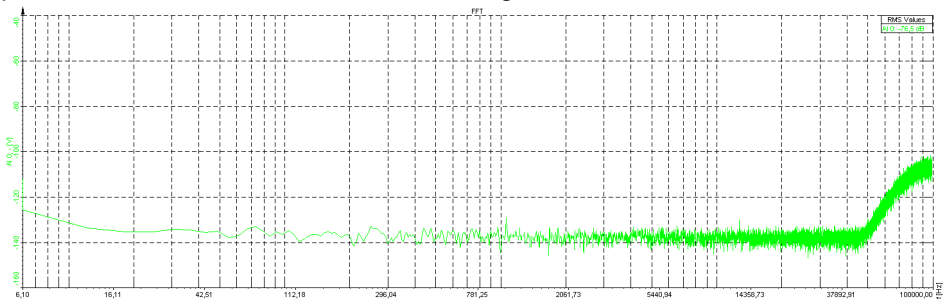
Spectral noise - 50Ω termination – 8 averages – 16k lines@50kS/s:



Spectral noise - 50Ω termination – 10 averages – 16k lines@100kS/s:

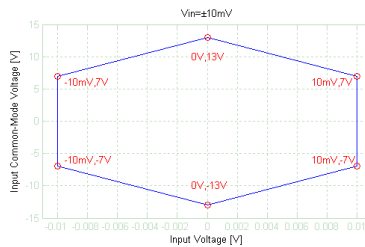
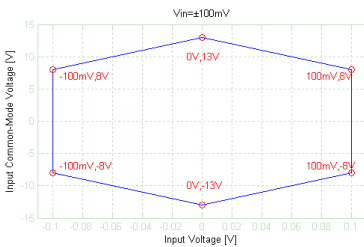
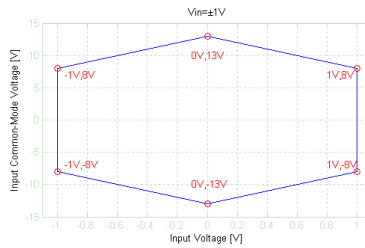
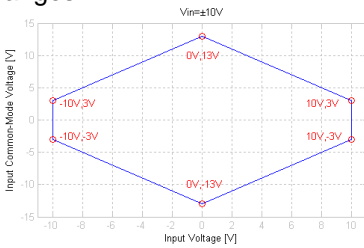


Spectral noise - 50Ω termination – 10 averages – 16k lines@200kS/s:



CMRR:

All 8 analog channels of the DEWE-101 are fully differential inputs with resistance of $10M\Omega||10pF$. The input voltage range is $\pm 10V$, $\pm 1V$, $\pm 100mV$ and $\pm 10mV$. Because of the differential input structure, the difference of the input (Ch x(+) – Ch x(-)) will be shown as the result of the measurement. Although the input is protected for input voltages to $\pm 70V$, the common voltage range of each input is limited to about $\pm 13V$. If the input voltage exceeds this range, the result is not valid even when the difference input voltage is lower than current input range. These voltage ranges will be clipped and introduced as large errors that can be easily identified in frequency spectrum. The figure below show the allowable common-mode input voltages for various input voltages and measurement ranges.



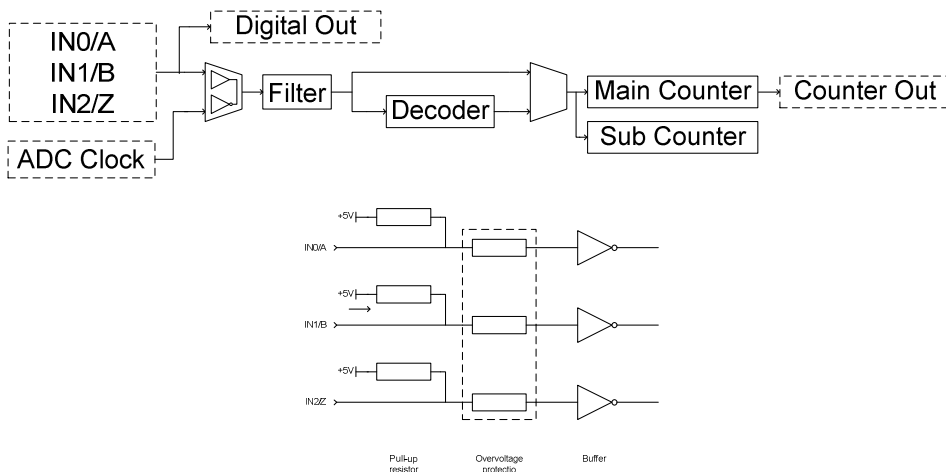
Example:

Many signal sources (function generators) and power supplies are floating sources. That means that they are isolated from each other and from AC power line. If we connect a sensor with differential output and floating power supply to measurement device, then GND of sensor and measurement device can have different voltage potential. This is what the measurement device see as common-mode voltage. This common-mode voltage can range from few volts to few hundred volts, but in almost all cases this renders the measurement. To prevent this effect, GND signals of the sensor and measurement device need to be directly connected. That way we eliminate common-mode voltage. On DEWE-101 this connection is possible over connector GND wire or over "Common GND" receptacle on the housing.

DEWE-101

Counter and digital inputs:

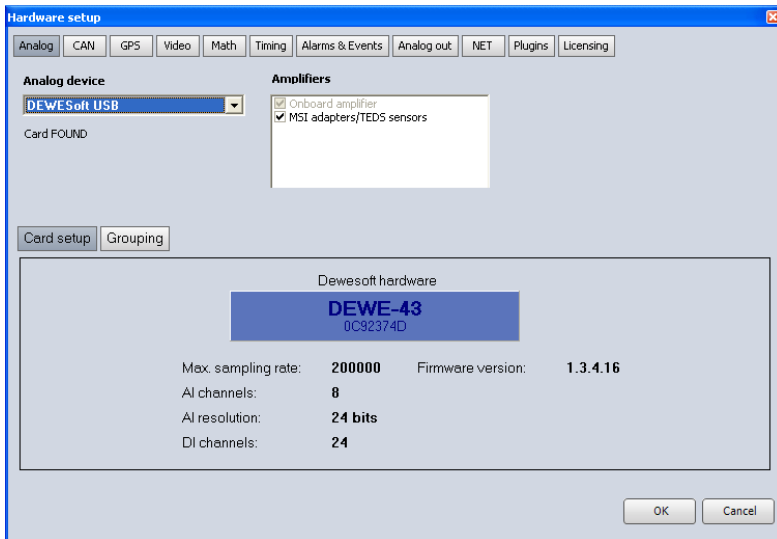
The DEWE-101 is suited with synchronous 32-bit advanced counter and digital inputs. In addition to the basic counter function like simple event counting, up/down counting and gated event counting also period time, pulse width, two-edge separation, frequency and all encoder measurements are supported. All counter inputs can also be used as digital inputs. In addition to the basic counter input selections, ADC Clock can also be used as counter source. The figure bellow shows the block diagram of the counter and input overvoltage protection.



5 Using DEWE 101 in Dewesoft

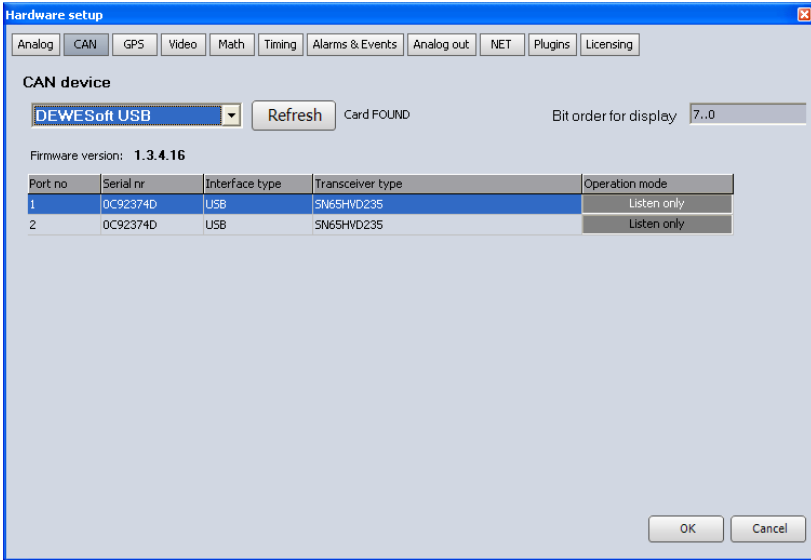
5.1 Hardware setup

To enable analog input and counter in Dewesoft, go to System – Hardware setup and choose Dewesoft USB device.

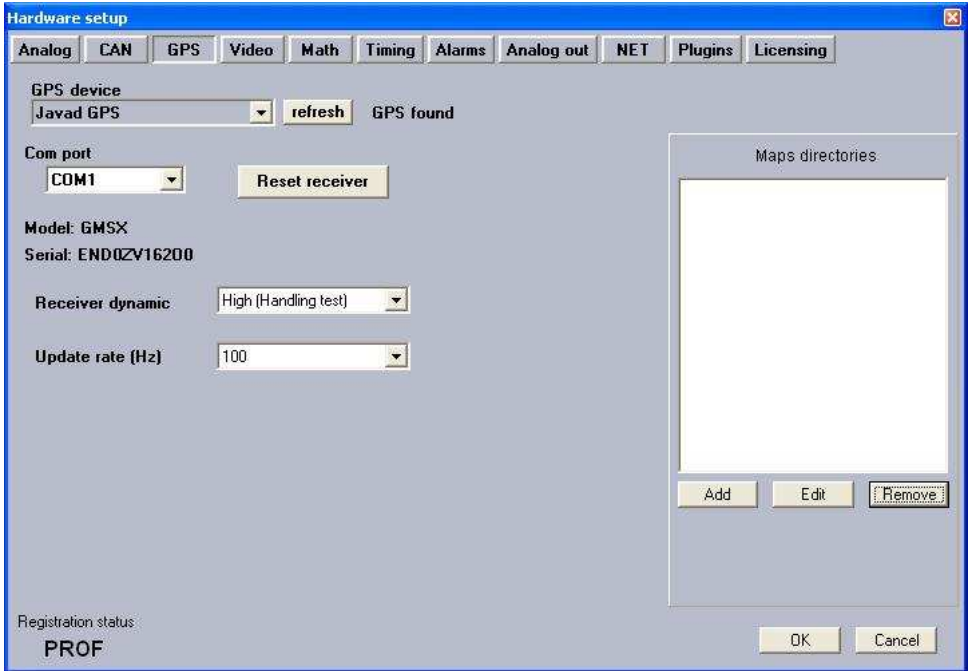


DEWE-101

To enable CAN bus, please go to Can section and select Dewesoft USB device in CAN section. Make sure that the Hardware clock check box is enabled.



To enable GPS, please go to GPS section.



In systems with 100Hz GPS, select “Javad GPS” in GPS device section and COM1 in Com port section.

In systems with 1Hz GPS, select “NMEA compatible GPS” in GPS device section, COM1 in Com port section, and select 38400 in Baud rate section.

Other cards are valid, but this registration comes with each system.

DEWE-101

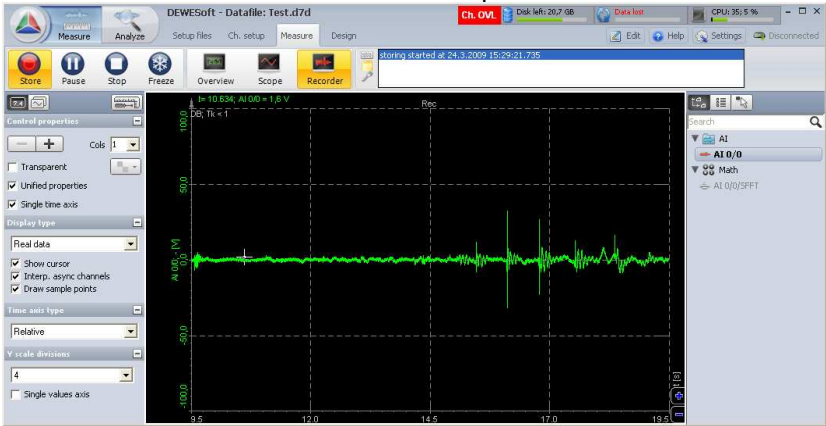
5.2 Using analog/counter/digital/CAN inputs

The use of analog inputs, CAN inputs and digital interface is the same as with all other DAQ devices, which are supported in Dewesoft. Please consult Dewesoft user's manual for more information.

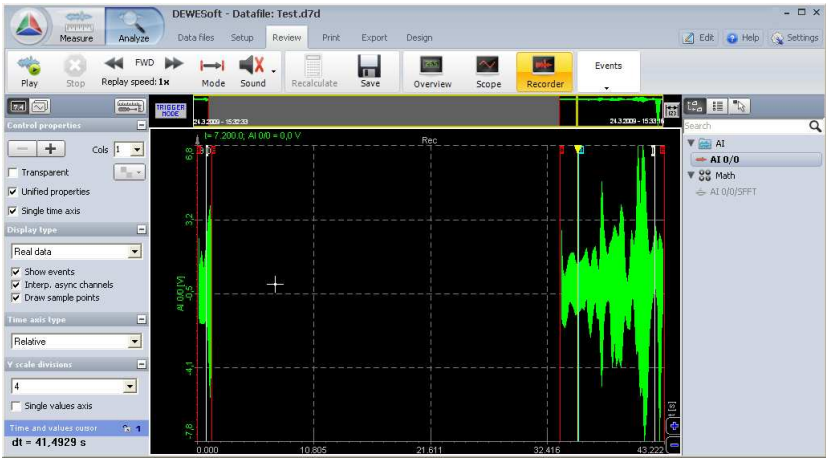
If MSI adapters are used, they will be automatically recognized in the amplifier interface.



When acquiring data and the USB connection is lost, the acquisition will stop. In this case reconnect the unit and restart the acquisition with reconnect button.



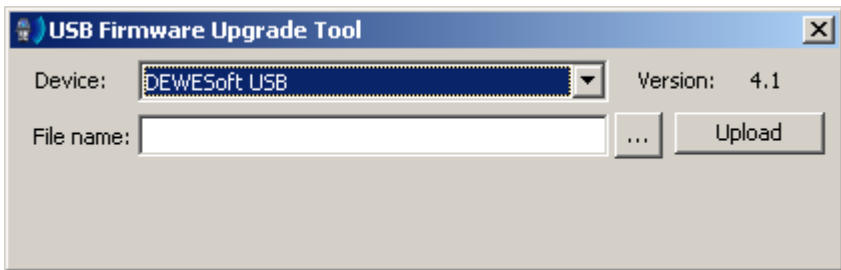
In this case (if the data was being stored, the gap will be filled in with missing data).



6 Firmware upgrade

Please download the latest firmware from Dewesoft web site. Then run “USB Firmware Upgrade Tool” program.

Part 1: Select DEWESoft USB in the “Device” combo box.



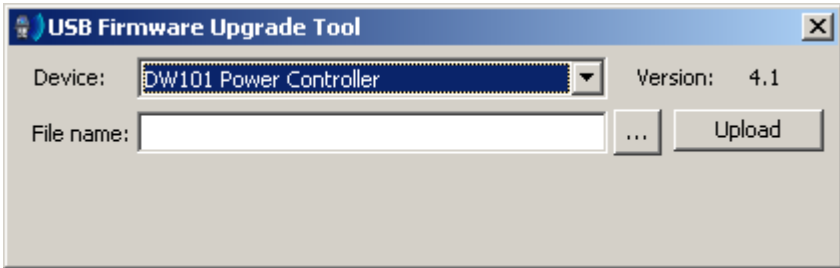
Press “...” button, select BT_xxx_DW101.fwu file and click Open.

Press Upload button and wait until progress bar reaches 100%. Please don't interrupt this operation. Upload takes several minutes.

When upload is finished, press OK and new firmware is uploaded on the device. If this fails for any reason, repeat Part 1 again.

Now go to Part2...

Part2: Select DW101 Power Controller in the “Device” combo box.



Press “...” button, select DW101_xxx.fwu file and click Open.

Press Upload button and wait until progress bar reaches 100%. Please don't interrupt this operation. Upload takes less than a minute.

When upload is finished, press OK and new firmware is uploaded on the device. If this fails for any reason, repeat Part 2 again until OK.

Warning: The system may become unusable if upgrade process is interrupted.

When the process is finished, close upgrade tool, shut down DW101, **disconnect power for 10s**, reconnect power and power up system.