# DS-NET
# Technical Reference Manual
# Version: 3.3.6


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KINGSCI INSTRUMENTS
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地址：北京市海淀区小营西路27号金领时代大厦12层
电话：136 1171 664；010-5361 2036
传真：010-5635 3026
网站：www.chinaksi.com
电邮：ksi@chinaksi.com

*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.

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# Table Of Contents

# 1 Notice

The information contained in this document is subject to change without notice.

| | |
|---|---|
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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.

## Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

## Restricted Rights Legend:

Use Austrian law for duplication or disclosure.

Dewesoft GmbH
Grazerstrasse 7
A-8062 Kumberg
Austria / Europe

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## Copyright



# 1.1 Safety instructions

### Your safety is our primary concern! Please be safe!

## 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. |

## General Safety Instructions

| | |
|---|---|
| **WARNING**  | 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 GmbH 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

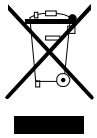
Information about the environmental impact of the product.

## 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 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).

## 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.

## General safety and hazard warnings for all Dewesoft systems

- Safety of the operator and the unit depend on following these rules
- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT 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 3 meters, disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advices for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- 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.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.

- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorised personnel only.
- Adverse environmental conditions are:
  - Moisture or high humidity
  - Dust, flammable gases, fumes or dissolver
  - Thunderstorm or thunderstorm conditions (except assembly PNA)
  - Electrostatic fields, et cetera.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuit, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened
- 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.
- 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.
- If you assume a more risk less use is not provided any more, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more risk less operation is not possible any more, if
  - the system is damaged obviously or causes strange noises.
  - the system does not work any more.
  - the system has been exposed to long storage in adverse environmental.
  - the system has been exposed to heavy shipment strain.
- DO NOT touch any exposed connectors or components if they are live wired. The use of metal bare wires is not allowed. There is a risk of short cut and fire hazard!
- Warranty void if damages caused by disregarding this manual. For consequential damages NO liability will be assumed!
- Warranty void if damages to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of:
  - high magnetic or electromagnetic fields
  - transmitting antennas or high-frequency generators

- for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned to the specification of the system only. Fire hazard in case of overload!
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipments in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use at humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advices of the connected systems.

This product has left the factory in safety-related flawless and in proper condition.
In order to maintain this condition and guarantee safety use, the user has to consider the security advices and warnings in this manual.

## EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.
Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for protection of buildings, are excluded from the scope of IEC 61326-3-1.

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传真：010-5635 3026
网站：www.chinaksi.com
电邮：ksi@chinaksi.com

# 2 About this document

This is the Technical Reference Manual for DS-NET Version 3.3.6.

The manual is divided into several chapters. You will find:

- A description of the system and the main combination and expansion options
- The description of the connection variants and the pin assignments on the inputs and outputs
- A comprehensive introduction to the configuration of the modules using the program `test.commander` and DEWESoft™
- Comprehensive explanation of the module measurement technology and background information about working procedure
- Technical data

The software that has been used must be:

- DEWESoft™ Version 7.0.4 or higher
- DEWESoft™ DS NET Plugin Version 4.3 or higher
- DEWESoft™ DS NET Import Version 2.2 or higher
- Firmware of the DS GATE module must be: Version V0.58 or higher

You will not find a description of the DS NET CPU and DS NET CAN modules. Those are described in the *DS-NET-CPU - Technical Reference Manual* (see 2.2.2 DS-NET-CPU users manual).

## 2.1 Legend

The following symbols and formats will be used throughout the document.

| | |
|---|---|
| **IMPORTANT**  | Gives you an important information about a subject.<br>Please read carefully! |

| | |
|---|---|
| **HINT**  | Gives you a hint or provides additional information about a subject. |

| | |
|---|---|
| **EXAMPLE**  | Gives you an example to a specific subject. |

| Example | Meaning | Description |
|---|---|---|
| **Cancel** | Button | a button that you can click |
| *File* | Menu Item | a menu item, will open a sub menu or a dialog |
| `Times New Roman` | List Item | an item in a list (or tree) that you can select |
| Events | Tab Sheet | a tab sheet that you can select |
| `C:\Program Files\OpenOffice.org 3\readme.txt` | File Path and Name | a file name or path |
| *Windows Key* | a term | any kind of term (maybe also compound) |

*Table 1: Layout formats used in the documentation*

# 2.2 Online versions

## 2.2.1 DS-NET users manual

The most recent version of this manual can be downloaded from your homepage:

http://www.dewesoft.com/support

On the left side of this page select *User manuals* and then click the download link for the *DS NET users manual*.

## 2.2.2 DS-NET-CPU users manual

The *DS-NET-CPU - Technical Reference Manual* describes in detail the DS-NET-CPU module and also other special modules that can be used in combination with the DS-NET-CPU module (e.g. DS-NET-CAN module).

You can find the latest version of the *DS-NET-CPU - Technical Reference Manual* here:
http://www.dewesoft.com/support

On the left side of this page select *User manuals* and then click the download link for *DS NET CPU users manual*.

## 2.2.3 DEWESoft™ tutorials

*The DEWESoft™ tutorials* document, provides basics and additional information and examples for working with DEWESoft™ and certain parts of the program.

The latest version of the DEWESoft™ tutorials can be found here:
http://www.dewesoft.com/dewesoft7/download

On the left side of the page, select *Manuals and tutorials* and then click the download link of the *DEWESoft 7 tutorials* entry.

# 2.3 Glossary and abbreviations

This glossary includes explanations of some of the most important terms and abbreviations that are used in documentation.

### Backplane

The part of the housing that serves as the back side for the modules and contains the socket (green PCB)

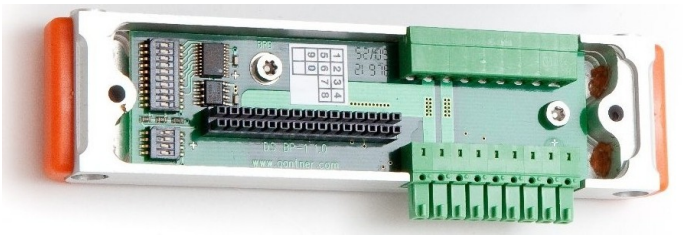


*Illustration 1: Backplane with Socket*

### Bit

Bit, the basic unit of information storage, a single binary digit that is either *0* or *1*.

see also Baud (Bd)

## Baud (Bd)

is synonymous to symbols per second per second. It is the unit of symbol rate, also known as baud rate or modulation rate; the number of distinct symbol changes.

A baud rate, by definition, means the number of times a signal in a communications channel changes state or varies.

| **EXAMPLE 1** | |
|---|---|
|  | A 2400 baud rate means that the channel can change states up to 2400 times per second. |

This is often confused with the bit rate (expressed in bit/s), which is related, but may be different.
The number of bit per baud is determined by the modulation technique.

| **EXAMPLE 2** | |
|---|---|
|  | If we use a baud rate of 2400,and a phase modulation (which can transmit four bits per baud), this means that we can transfer 9600 bit/s.<br>2400 baud x 4 bits per baud = 9600 bps |

The baud rate (communication speed) between the DS GATE and the measurement modules can be configured via software.

## CJC

Cold junction compensation.

Thermocouples measure the temperature difference between two points, not absolute temperature. To measure a single temperature one of the junctions - normally the cold junction - is maintained at a known reference temperature, and the other junction is at the temperature to be sensed.

Having a junction of known temperature, while useful for laboratory calibration, is not convenient for most measurement and control applications. Instead, they incorporate an artificial cold junction using a thermally sensitive device such as a thermistor or diode to measure the temperature of the input connections at the instrument, with special care being taken to minimize any temperature gradient between terminals. Hence, the voltage from a known cold junction can be simulated, and the appropriate correction applied. This is known as cold junction compensation.

For DS NET TH8 screw connector modules (5.12 DS NET TH8) you need a special connector TH8-CJC that has the CJC included.

The DS NET TH8-C modules have an integrated CJC.

For DS NET BR4 screw connector modules (see 5.7 DS NET BR4)you need a special connector BR4-CJC that has the CJC included.

## DCF 77

DCF77 is a longwave time signal and standard-frequency radio station. Its primary and backup transmitter are located in Mainflingen, about 25 km south-east of Frankfurt am Main, Germany. The signal can be received can be received in large parts of Europe, as far as 2000 km from Frankfurt.

## DIP Switch

A DIP switch is a set of manual electric switches that are packaged in a group in a standard dual in-line package (DIP)

see 6.2 DIP Switches on page 156 for details

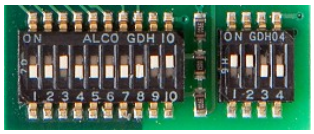



*Illustration 2: DIP switches*

## Dewesoft

Dewesoft refers to the company.

DEWESoft™ refers to the software suite for data acquisition, data processing, data analysis and much more.

## DEWE-43

Dewesoft's hand-held USB measurement instrument (perfect for use with a laptop) can measure with sample rates up to 200kS/s per channel. It has 8 analogue inputs, 8 counter inputs, 24 digital inputs and 2 CAN ports. This hand-held instrument is most flexible to acquire signals like voltage, current, temperature, strain, vibration, pressure and more. Perfect to do recording, signal analysis, machine analysis, FFT and reporting.

The DEWE-43 can be hardware synchronised with DS-NET systems and is thus the perfect add-on if you have fast (up to 200kHz) and slow (up to 10kHz) signals.

*Illustration 3: DEWE-43*

## DHCP

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. Computers that are connected to IP networks must be configured before they can communicate with other computers on the network. DHCP allows a computer to be configured automatically, eliminating the need for intervention by a network administrator.

In the absence of DHCP, hosts may be manually configured with an IP address.

DS NET systems are configured to use DHCP per default (see 3.3.3 Connection using DHCP for details).

## DS GATE

The Dewesoft gateway module is the most important part of a DS NET system, because it is responsible for all the communication between the DS NET modules and the host system. It can also be used to configure the modules.

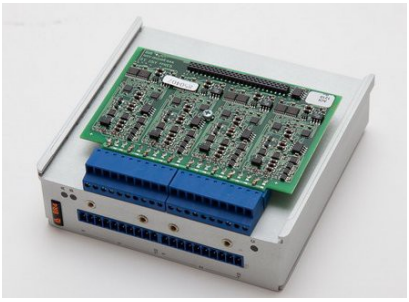
see 5.3 DS GATE for details


## DS NET

The Dewesoft Networking measurement system (hardware) is a modular, highly flexible and industrial data acquisition system.

It consists of a DS GATE communication module and up to 16 DS NET modules (see 5 DS NET Modules for details).

## DS NET Module



The term module refers to the combination of the module housing (metal part) and the module PCB.

A wide range of available modules allows optimized solutions for single task applications, such as dynamic signal acquisition up to 10 kS/s, inputs/outputs for all types of signals, galvanic isolation of the inputs and outputs, and high channel count per system.

for details see: 5 DS NET Modules

## DSP

A digital signal processor (DSP) is a specialized microprocessor with an optimized architecture for the fast operational needs of digital signal processing.

The measurement modules use DSPs to process the the measured data.

## Ethernet

Ethernet is a family of frame-based computer networking technologies for local area networks (LANs).

The DS GATE module can be connected via Ethernet to a host system (typically a PC which runs DEWESoft™)

## FFT

Fast Fourier transformation (FFT) can be used to show the frequency components of the acquired signals in amplitude and frequency. DEWESoft™ has a built-in visual control that makes FFT easy to use.

## FPGA

A field-programmable gate array (FPGA) is an integrated circuit designed to be configured by the customer or designer after manufacturing: hence *field-programmable*.

## Garmin®

Garmin® International Inc. produces GPS receivers for satellite based positioning and navigation.
Garmin® is a registered trademark.

http://www.garmin.com

## GND

the electrical ground (aka. earth)

## GPS

The Global Positioning System (GPS) is a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites.

## Hex Key

aka. Allen key, Unbrako key, and Inbus key

A hex key is a tool of hexagonal cross-section used to drive bolts and screws that have a hexagonal socket in the head (internal-wrenching hexagon drive).

## Host System

The DS NET system is usually connected to a host system that will regularly fetch the measurement data.

A typical host system is a Windows-PC that runs DEWESoft™, but I may as well be a Modbus client.

Moreover the DS NET system may be used standalone (without any host system) as a data logger.

## Hz

The hertz (symbol: Hz) is the SI unit of frequency defined as the number of cycles per second of a periodic signal.

## IP Address

Devices that are participating in the Ethernet must have a unique logical addresses: the IP (Internet Protocol) address.

see 3.3.1 Ethernet explained for details

## IRIG-B

The Inter Range Instrumentation Group (IRIG) is the standards body of the Range Commanders Council (RCC). They publish a number of standards: e.g. IRIG timecodes The different timecodes defined in the Standard have alphabetic designations. A, B, D, E, G, and H.
IRIG-B has a Bit rate of 100 Hz.

## LAN

A local area network (LAN) is a computer network covering a small physical area.

A LAN may use different communication technologies: e.g. Ethernet or wireless communication

## LED

A light-emitting diode is a semiconductor light source.

It is used in all modules of the DS NET system to indicate the status of the modules.

## LEMO

LEMO is the name of the high quality push-pull connectors that are used for the power-supply cable and the sync cables of the DS NET system.
The company that produces these connectors is also called LEMO (www.lemo.com)


## LSB

The Least Significant Bit is the bit position in a binary integer giving the units value, that is, determining whether the number is even or odd. The LSB is sometimes referred to as the right-most bit, due to the convention in positional notation of writing less significant digits further to the right.

## Microsoft®

Microsoft® Corporation is a public multinational corporation head-quartered in Redmond, Washington, USA that develops, manufactures, licenses, and supports a wide range of products and services predominantly related to computing through its various product divisions.

DEWESoft™ is a Windows®-based application and thus a Windows® operating system must be installed on the measurement PC where DEWESoft™ is installed.

see www.microsoft.com

## NET Option

aka. DEWESoft NET, Dewe NET

With DeweNET your measurement system can be controlled remotely with ease of use you couldn't imagine before. DeweNET also serves as the centre of Distributed Data Acquisition systems where you have multiple systems located either together or scattered across an entire continent. IRIG and GPS time will take care that data will stay synchronized, no matter how long the acquisition runs.

## NMEA 0183

NMEA 0183 (or NMEA for short) is a combined electrical and data specification for communication between marine electronic devices such as echo sounder, sonars, anemometer (wind speed and direction), gyrocompass, autopilot, GPS receivers and many other types of instruments. It has been defined by, and is controlled by, the U.S.-based National Marine Electronics Association.
DS NET can use NMEA 0183 information from a GPS device, that you can connect to the RS232 interface of the DS GATE.

## OS

An operating system (OS) is a set of system software running on a device that manages the system hardware.

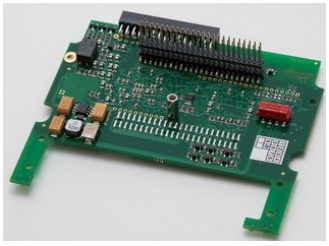
This may refer to the operating system of a PC (Windows is required for DEWESoft™) or to the operating system of the DS GATE module.

## PC

DS NET systems are typically connected to a Personal Computer which runs DEWESoft™ to fetch the measurement data.

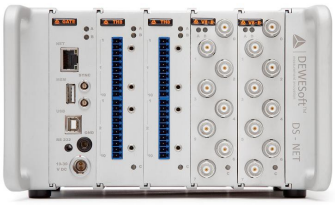
See also: Host System

## PCB



A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate.

## Portable Line



The portable line of the DS NET system has a robust housing that can accommodate up to 16 modules.

See also: Rack Line

## Rack Line

The rack line of the DS NET system allows up to 12 DS NET modules to be used in a standard 19-inch rack

See also: Portable Line

## RTD

Resistance thermometers, also called resistance temperature detectors or resistive thermal devices (RTDs), are temperature sensors that exploit the predictable change in electrical resistance of some materials with changing temperature; e.g. Pt100 and Pt1000

## RS-232

*Recommended Standard 232*: is a standard for serial communication. It is commonly used in computer serial ports.

DS GATE provides a RS-232 connector.

## RS-485

RS-485 is a synonym for EIA-485 which is a standard defining the electrical characteristics of drivers and receivers. Digital communications networks implementing the EIA-485 standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi-drop configuration. These characteristics make such networks useful in industrial environments and similar applications.

DS NET uses RS-485 for the internal communication between the DS GATE and the DS NET modules.

## SNTP

Simple Network Time Protocol (SNTP) is a protocol for synchronizing the clocks of computer systems over packet-switched, variable-latency data networks. It is a simpler and less accurate version of the Network Time Protocol (NTP).

## Socket

The socket is the PCB that fits into the backplane.

## Synchronisation cable

These synchronisation cables can be used to synchronise several DS NET systems with each other: see 4.1 Synchronisation for details.

## Torx

Torx , developed by Camcar Textron, is the trademark for a type of screw head characterized by a 6-point star-shaped pattern. People unfamiliar with the trademark generally use the term star, as in star screwdriver or star bits.

## USB

Universal Serial Bus is a specification to establish communication between devices and a host controller (usually PCs).

DS GATE provides 2 USB ports, one of which can be used for the data logger functionality.

## UART

A universal asynchronous receiver/transmitter is a special type of *asynchronous receiver/transmitter*, a piece of hardware that translates data between parallel and serial forms.

The DS NET system has 2 internal communications lines. The 2 corresponding UARTs can be configured in `test.commander`.

Each of the DS NET modules must be assigned to exactly one of these UARTs and each UART can communicate with a maximum of 8 modules.

## Windows®

A PC operating system by Microsoft®. DEWESoft™ will work on Windows® XP, Windows® Vista and Windows® 7. Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

# 3 Getting started

This chapter will help you to install the software, connect your DS NET system to the PC via Ethernet and will show you how to do your first measurement.

To follow these steps, you need the following items:

- your brand new DS NET system (included in the shipment)
- your DS NET USB stick (included in the shipment)
- your PC with Windows-XP or Windows 7 installed (Windows-Vista is not recommended, but may work)

## 3.1 Software installation

This chapter will explain how to correctly install all the required software for your DS NET system on your measurement PC.

The software installation procedures and screen-shots in chapter 3.1 Software installation refer to Windows® XP, except for chapter 3.1.1 Windows® 7 which is especially dedicated to Windows® 7.

### 3.1.1 Windows® 7

This chapter describes special things to take care of when using Windows® 7 (the rest of chapter 3.1 Software installation refers to Windows® XP).

#### 3.1.1.1 Windows® 7: DEWESoft™ installation

During the installation process on a Windows® 7 operating system, you may see following security warnings and messages.

When you see the *Windows Security Warning* in Illustration 4 during the installation of DEWESoft™, click *Install this driver software anyway.*

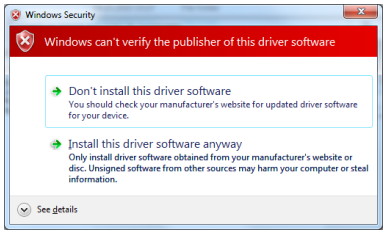



*Illustration 4: Windows 7: Driver Installation - Security Warning*

When you see the *Windows Security Alert* in Illustration 5 during the installation of DEWESoft™, click *Allow access*.

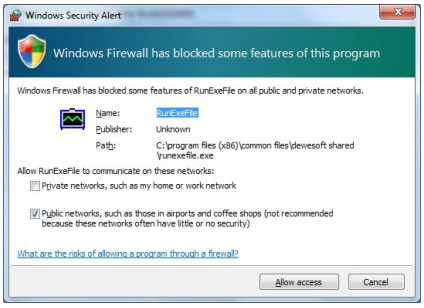



*Illustration 5: Windows 7: Firewall Dialog*

When you see the *Windows Security Dialog* in Illustration 6 during the installation of DEWESoft™, check the *Always trust software from "Dewesoft"* check-box..


*Illustration 6: Windows 7: Device Software - Security*

...and then click **Install**.

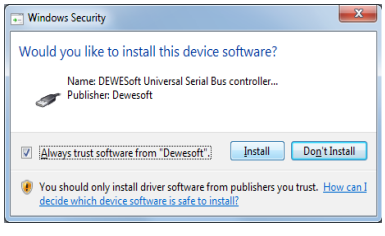



*Illustration 7: Windows 7: Device Software - Trust*

### 3.1.1.2 Windows® 7: DEWESoft™ plugin registration

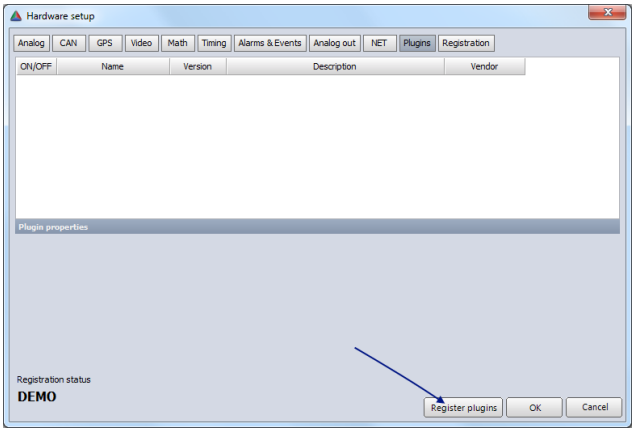



*Illustration 8: Windows 7: Plugin Registration*

Due to the User Access Control mechanism in Windows® 7 (and also Windows® Vista), DEWESoft™ cannot register the plugins automatically.
Thus you must click the **Register plugins** button (see blue arrow in Illustration 8) once, whenever you add any plugins.

### 3.1.1.3 Windows® 7: Ethernet communication

When you make a direct connection from your DS-NET system to your PC, Windows® 7 may block the connection because it classifies the LAN connection as *Unidentified network*.

In this case, you must reconfigure windows to trust the connection. Detailed information about how to to this can be found here: http://goo.gl/7MR6J[1]

The fastest way is to download the file `Set_Unidentified_Networks_Private.reg` (from the internet page mentioned above and to execute it). You will need Administrator rights to do this.

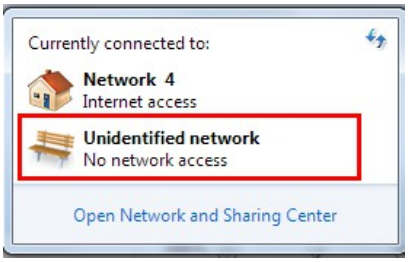



*Illustration 9: Unidentified network*

### 3.1.1.4 Windows® 7: test.commander

The program `test.commander` always needs to be executed with an user that has administrator rights on Windows® 7 – otherwise it will abort with an error message when you try to read the configuration of a connected DS NET system.

1 this is a shortened URL, so that you need not type too much – the full version for this URL is: http://www.sevenforums.com/tutorials/71408-unidentified-networks-set-private-public.html

To set this up, right click on the `test.commander` link in the Windows® 7 start-menu. In the pop-up menu, click on *Properties*:

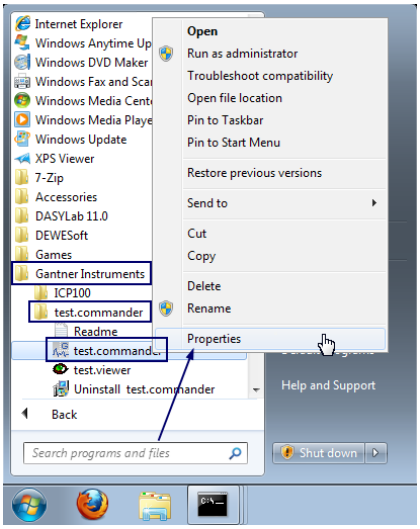



*Illustration 10: Windows 7: test.commander Properties*

On the Shortcut tab-sheet, click on **Advanced...**:

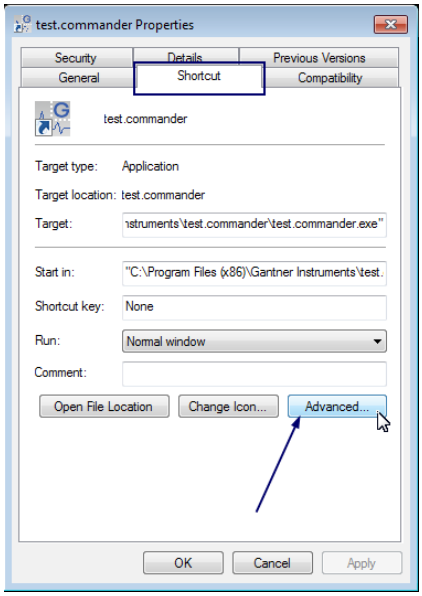



*Illustration 11: Windows 7: test.commander Shortcut Properties*

Now check the *Run as administrator* check-box and click **OK** to close the dialogues (you may need to provide an Administrator password to do this):

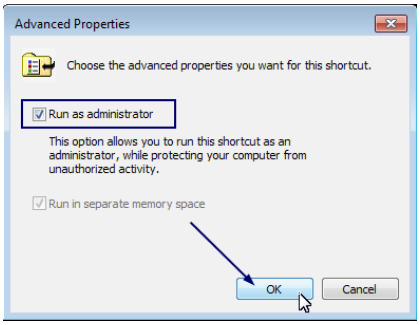



*Illustration 12: Windows 7: test.commander Advanced Shortcut Properties*

## 3.1.2 Windows basics

The next chapters will cover some Windows basics that you will need in the following chapters.

### 3.1.2.1 Opening windows control panel

Click the Windows **start** button and then click **Control Panel**:


*Illustration 13: Open Control Panel*

If you are in *Category View*:

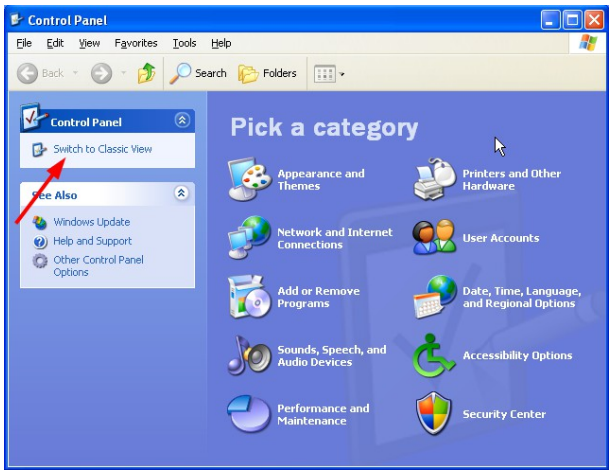



*Illustration 14: Control Panel: Category View*

click *Switch to Classic View* on the left side. Now you should see the *Control Panel* in *Classic View*:

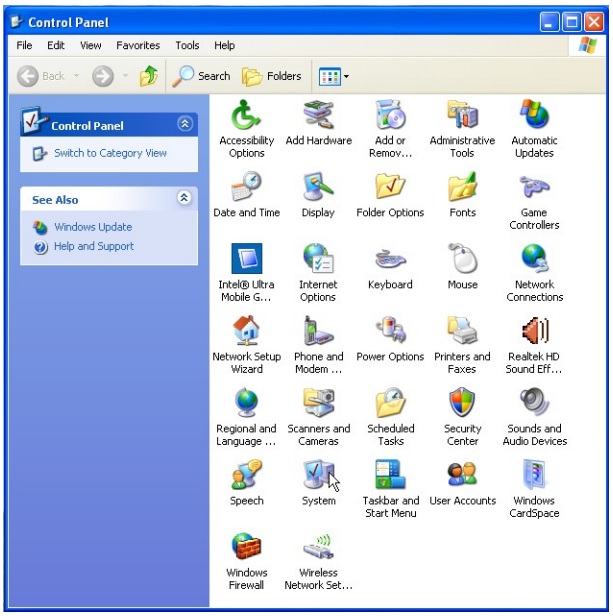



*Illustration 15: Control Panel: Classic View*

## 3.1.3 DEWESoft™ installation

This chapter includes information about installing DEWESoft™ for your DS NET system.

A general guideline of how to install DEWESoft™ can be found here:
http://www.dewesoft.com/download?file=Dewesoft7_QuickStart.doc

Attach the USB stick to your computer and start the DEWESoft™ installer by double clicking on `DEWESoft_FULL_7_0_3.exe` (see Illustration 16).

**HINT**

For newer versions the file name vary:
e.g. `DEWESoft_FULL_7_0_4.exe`, `DEWESoft_FULL_7_1.exe`, etc.

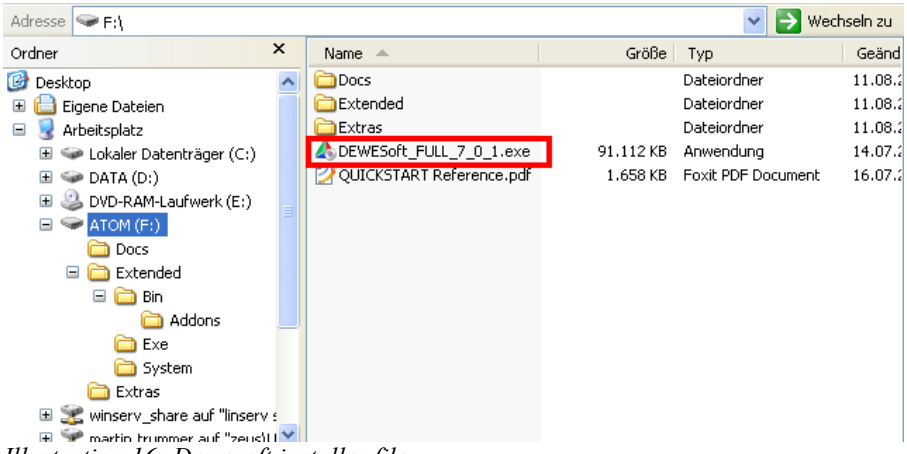



*Illustration 16: Dewesoft installer file*

### 3.1.3.1 Uninstall previous version

If you already have an older incompatible version of DEWESoft™ installed, the installer may show you this error dialog:

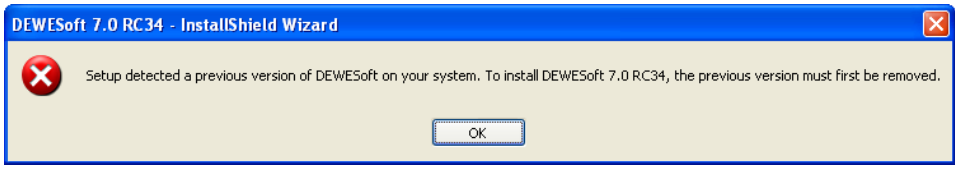



*Illustration 17: Uninstall previous version message*

DEWESoft™ can be uninstalled like any other windows program:
Go to *Start* – *Control Panel* - `Software`:

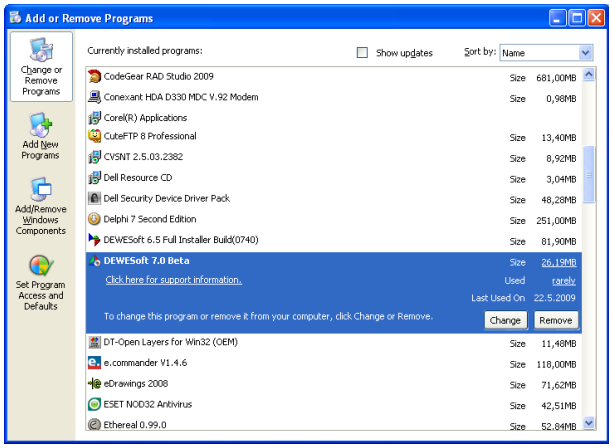



*Illustration 18: Uninstall previous Dewesoft version*

Click **Remove** and follow the instructions.

### 3.1.3.2 Installing new DEWESoft™ version

The first screen you see is the Welcome Screen:

click **Next >** to continue.

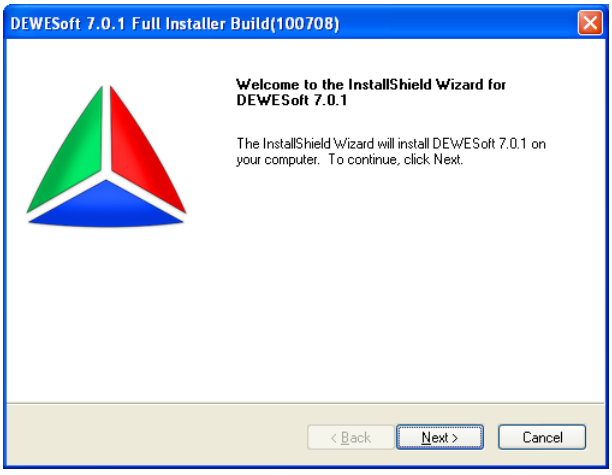



*Illustration 19: Dewesoft Installer: Welcome Screen*

In the *License Agreement* screen, read the license conditions carefully.

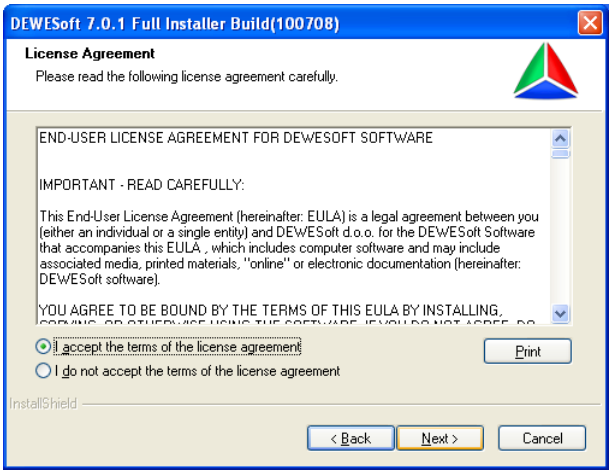



*Illustration 20: Dewesoft Installer: License Agreement*

If you agree, select the *I accept the terms of the license agreement* radio box and click **Next >** to continue.

In the *Setup Type* page, you must select the type of installation.

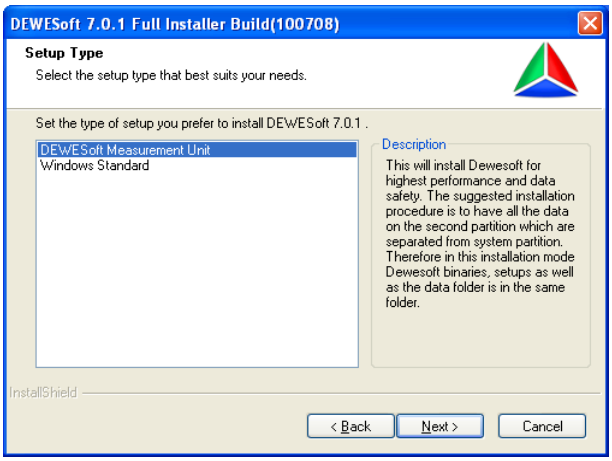



*Illustration 21: Dewesoft Installer: Setup Type*

The default and recommended setup type is *DEWESoft Measurement Unit*.

Note, that the path of the DEWESoft™ installation may vary depending on the setup type that you chose and on the number of hard-disk-partitions that are available on your system:

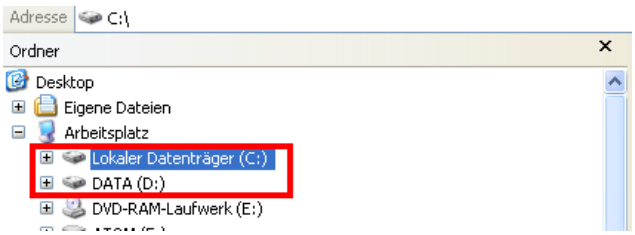
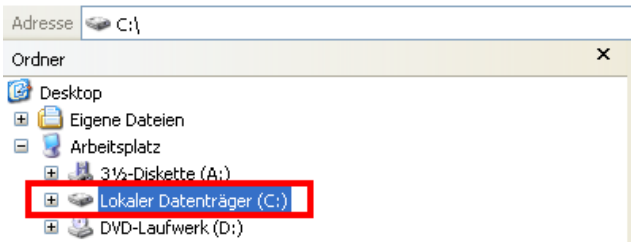
| In Illustration 22, you can see that two hard-disk-partitions `C:` and `D:` exist (`E:` is a DVD drive) | In Illustration 23, you can see that only one hard-disk-partition `C:` exist (`D:` is a DVD drive) |
|---|---|
|  |  |
| *Illustration 22: Two partitions* | *Illustration 23: One partition* |

*Table 2: Hard-disk-partitions*

## DEWESoft measurement unit

The setup type *DEWESoft Measurement Unit* will install DEWESoft™ for highest performance and data safety.

If you have 2 or more hard-disk-partitions, then we recommend to to have all the data on the second partition (or even second hard disk or array of disks) which are separated from the system partition. The System partition gets fragmented over time and then the writing performance dramatically drops
Therefore in this installation mode DEWESoft™ binaries, setups as well as the data folder will be installed in the same folder e.g. `D:/Dewesoft7`) on the second hard-drive-partition.
If you ever need to install a new operating system or need to reformat the system hard-drive-partition, the DEWESoft™ installation can remain: just the device drivers need to be reinstalled.

| Directory name | Explanation | Default path |
|---|---|---|
| Bin | contains DEWSoft.exe | D:\DEWESoft7\Bin\V7_0 |
| Addons | .dll files for plugins must be copied into this directory | D:\DEWESoft7\Bin\V7_0\Addons |
| Data | this is where DEWESoft™ will store your measurement data | D:\DEWESoft7\Data |
| Setups | this is where your DEWESoft™ setup files will be stored | D:\DEWESoft7\Setups |
| System | this is where DEWESoft™ project files are stored | D:\DEWESoft7\System\V7_0 |
| Log | this is where DEWESoft™ will store log files | D:\DEWESoft7\System\V7_0\Logs |

*Table 3: DEWESoft™ directories (Measurement Unit Installation)*

## Windows standard

The setup type *Windows Standard* will install DEWESoft™ binaries in the Windows *program files* folder and setups and data files in the *My documents* folder.

This installation fully complies with Windows installation policies and is recommended for installing DEWESoft™ for viewing the data on corporate computers with strict IT policies.

| Directory name | Default path |
|---|---|
| Bin | C:\Programme\DEWESoft7\Bin\V7_0 |
| Addons | C:\Programme\DEWESoft7\Bin\V7_0\Addons |
| Data | user dependant directory:<br>C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\Data |
| Setups | user dependant directory:<br>C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\Setups |
| System | user dependant directory:<br>C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\System\V7_0 |
| Log | user dependant directory:<br>C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\System\V7_0\Logs |

*Table 4: DEWESoft™ directories (Windows Standard Installation)*

click **Next >** to continue.

The installer now let's you choose the *Destination Location* for the installation:

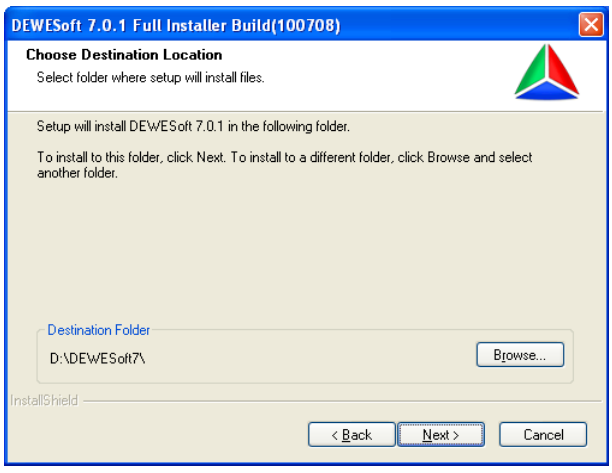



*Illustration 24: Dewesoft Installer: Destination Location*

Note that the path shown in the screen shot above is dependant on what setup type you have chosen.

**IMPORTANT**

Do not change the installation location!
This might cause problems with some plugins and features of DEWESoft™.

click **Next >** to continue.

Enter your customer information:

click **Next >** to continue.

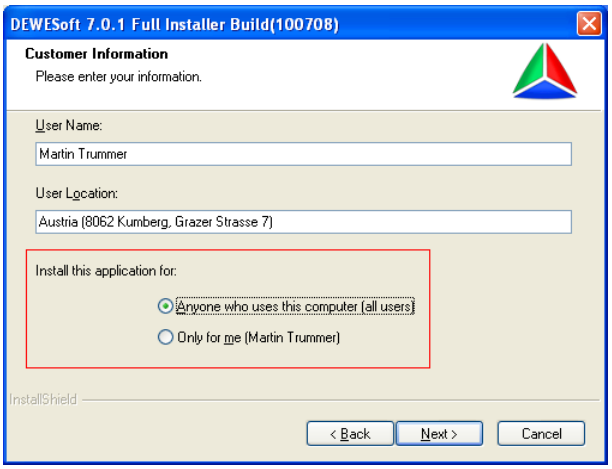



*Illustration 25: Dewesoft Installer: Customer Info*

Select the optional features that you want to install from the list – it makes only sense when you have purchased a valid license for the option.

click **Next >** to continue.

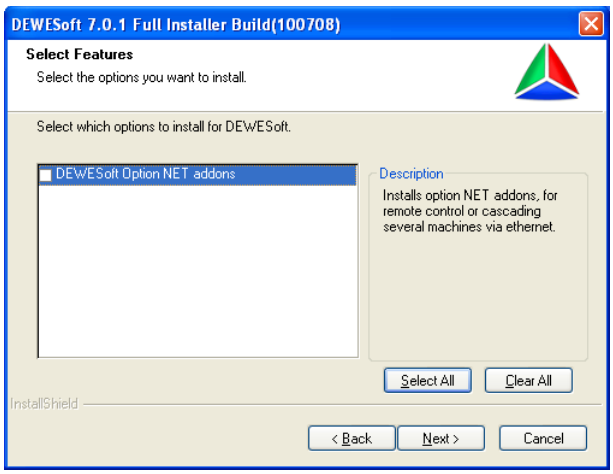



*Illustration 26: Dewesoft Installer: Select Features*

**HINT**

The information in the red rectangle of Illustration 25 is only available for setup type *Windows Standard*.

Select the language that you want to use in DEWESoft™:

Click **Next >** to continue.

Note: The language can be changed later in DEWESoft™ at any time.

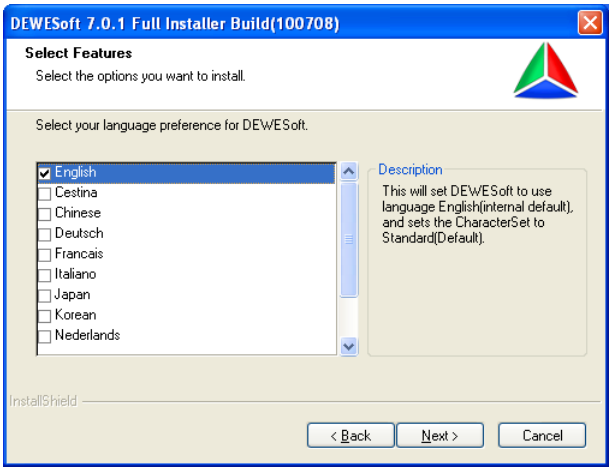



*Illustration 27: Dewesoft Installer: Select Language*

Now the installer has all the information that is required to start the installation:

Press **Install** to start the installation.

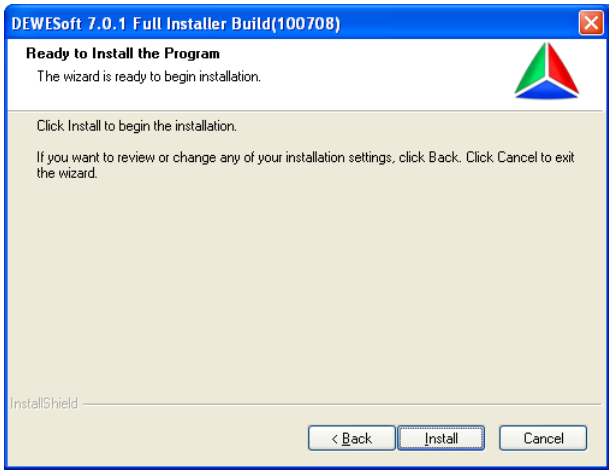



*Illustration 28: Dewesoft Installer: Ready To Install*

You may get a warning concerning the Windows-Logo-Test (see Illustration 29). You can safely ignore this and continue the installation.

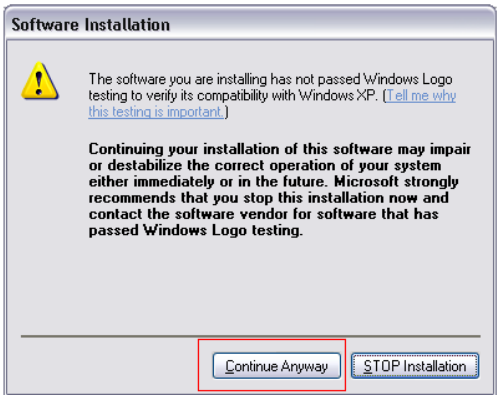



*Illustration 29: Dewesoft Installer: Windows-Logo-Test warning*

When the DEWESoft™ installation has completed successfully, you will see the final screen:

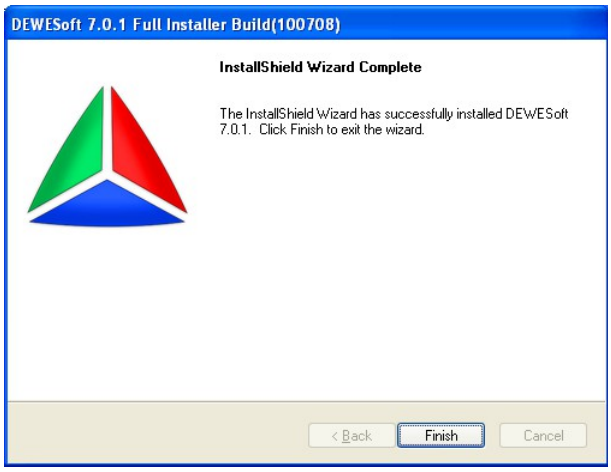



*Illustration 30: Dewesoft Installer: Installation Complete*

When you press **Finish** to complete the DEWESoft™ installation, you will see the following message:

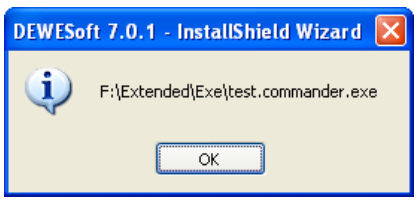



*Illustration 31: Dewesoft Installer: test.commander message*

Press **OK** to start the `test.commander` installation (see 3.1.4 test.commander installation).

## 3.1.4 test.commander installation

When the DEWESoft™ installation has finished the `test.commander` installation will start automatically.

**HINT**

If the installation of `test.commander` did not start automatically, or if you have aborted the `test.commander` installation you can always start it again by executing the `test.commander.exe` program in the folder `Extended\Exe\` on your USB stick.

When the installation starts, you should see the *Welcome Screen*.
Press **Next >** to continue.

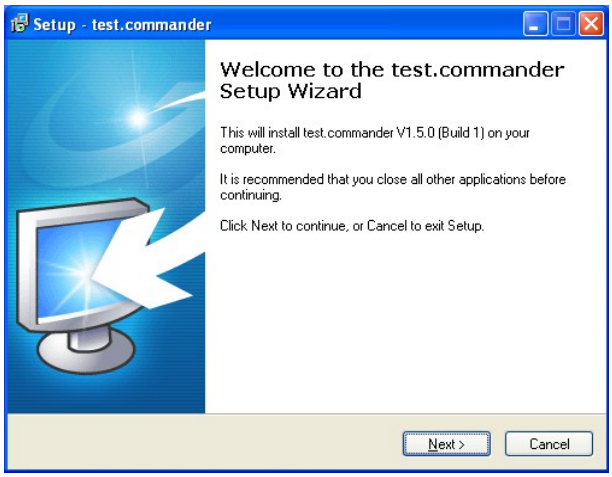



*Illustration 32: test.commander Installation: Welcome screen*

Select the destination location where `test.commander` will be installed.
It is recommended not to change the default location.
Press **Next >** to continue.

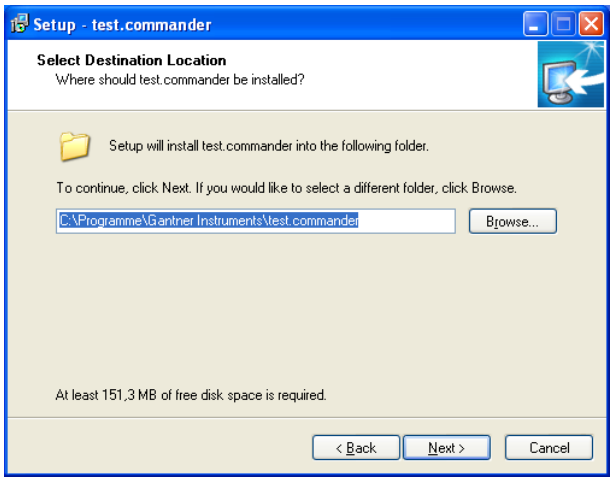



*Illustration 33: test.commander Installation: Destination Location*

Select the *Start Menu Folder*:
Press **Next >** to continue

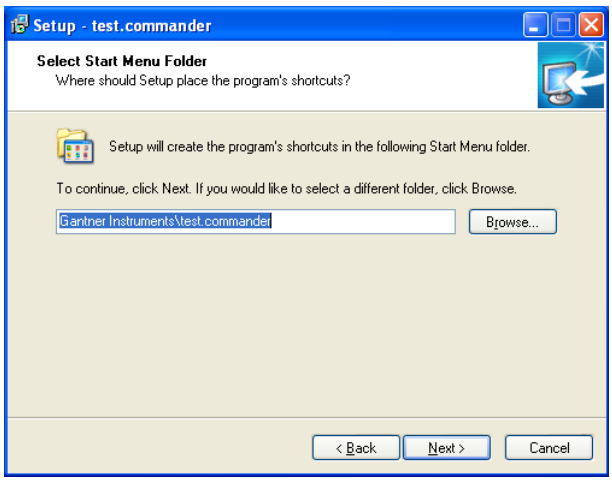



*Illustration 34: test.commander Installation: Select Start Menu Folder*

The last screen will show you a summary of the installation information:
Press **Install** to start the installation procedure.

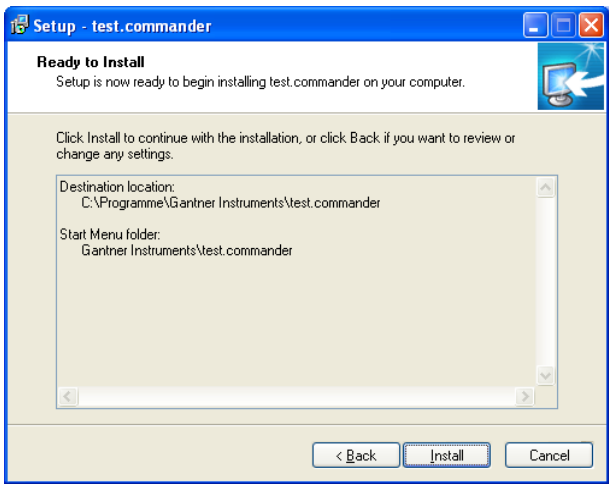



*Illustration 35: test.commander Installation: Ready To Install*

During the installation procedure you will notice that also the `ICP100` program is installed:

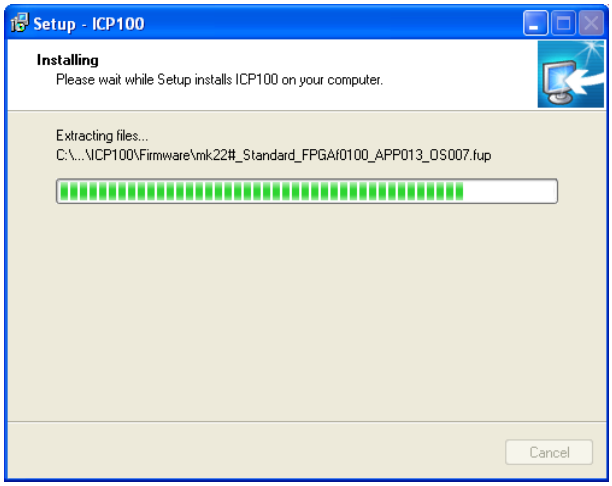



*Illustration 36: test.commander Installation: ICP100 setup*

When the `test.commander` installation procedure has finished, you can close the setup program by clicking **Finish**.

Now the new installed programs should show up in your windows start menu:


*Illustration 37: Windows Start Menu: Dewesoft*

`test.commander` will be in the *Gantner Instruments* group along with `ICP100`.

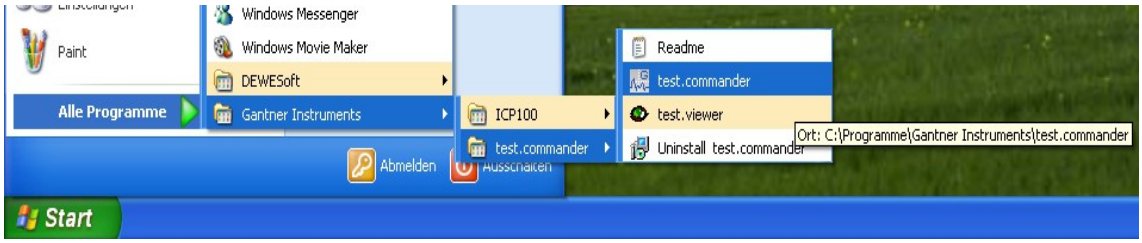



*Illustration 38: Windows Start Menu: test.commander*

# 3.2 Licensing

This chapter describes what software licenses are needed to get started with your DS NET system.

## 3.2.1 DS NET licensing

Note, that all licenses regarding DS NET will only work when the DS NET device is connected to your PC and the device has been activated in the hardware setup of the DS NET plugin (see Illustration 67 on page 41).

If you have used the DEWESoft™ installer from your DS NET USB-stick, you can skip this chapter – licensing will work out of the box.

### 3.2.1.1 Standard edition license

When the DS NET system is shipped to you, it will contain a *Standard Edition* license and you only have to connect the DS NET via Ethernet to your PC. There's no need to copy any `.lic` files if you only want to use the *Standard Edition* license.

For more details on how to activate the *Standard Edition* license, see 3.4 DEWESoft™ configuration on page 39.

| **HINT** | This will only work if you have the DS NET plugin Version 3.3.0 or higher installed on your system.<br>The correct versions of DEWESoft™ and the DS NET plugin are of course available on the USB stick that was included in your shipment. |
|---|---|

### 3.2.1.2 Other editions and options

In order to use other DEWESoft™ editions than SE (e.g. Professional, Enterprise, ..) or additional DEWESoft™ options (e.g. Power, NET, ..) the correct license file, must exist in the `System` directory of your DEWESoft™ installation.
The default location of the `System` directory is: `D:\DEWESoft7\System\V7_0\` (see 3.1.3.2 Installing new DEWESoft™ version on page 21 for details about the directory structure).

When you installed DEWESoft™ via the installer from the USB stick that was included in your shipment, there's nothing else to do – the installer has already copied the license file to the correct location.

In all other circumstances, (e.g. you don't want to use the installer, because you have an existing DEWESoft™ 7 installation that is newer than the one on the USB-stick), you have to copy the files manually.

The license file is located in this directory on your USB-stick: `\Extended\System\`
e.g. `\Extended\System\DW7_L1L1_L1L1_L1L1.lic`

Copy it to the `System` directory of your DEWESoft™ installation: the default location of this directory is: `D:\DEWESoft7\System\V7_0\` (see 3.1.3.2 Installing new DEWESoft™ version on page 21 for details about the directory structure):

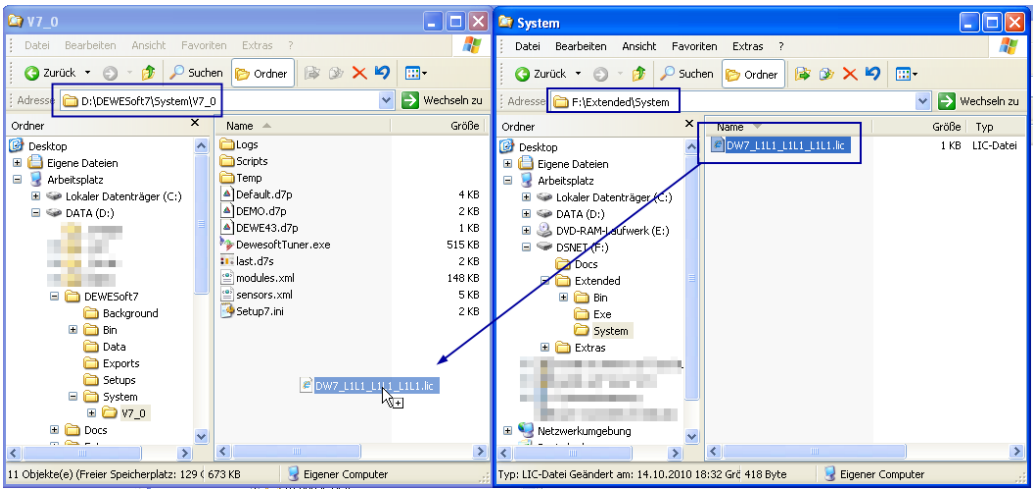



*Illustration 39: Copy license file*

## 3.2.2 test.commander

After installation, **test.commander** will work in the non-licensed DEMO mode. In this mode, the `test.commander` will also work, but some functions may not be available. Thus it is recommended that you enter the license for your installation.

When the program `test.commander` is started for the first time, you must select the language for the program user interface (see Illustration 40):

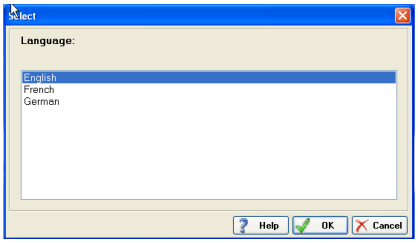



*Illustration 40: test.commander: Select Language*

When you click **OK** you will see the *About* dialog:

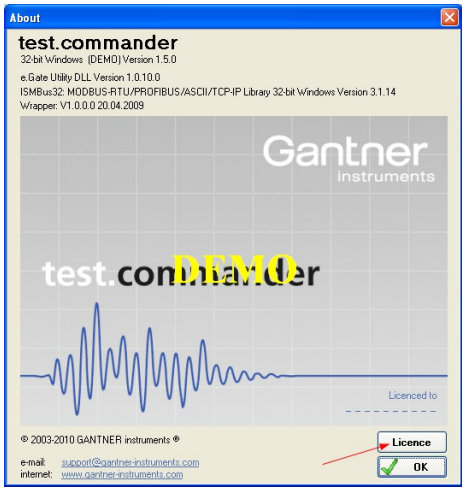



*Illustration 41: test.commander: About dialog*

In the *About* dialog, press **Licence** to open the *Licencing* dialog:

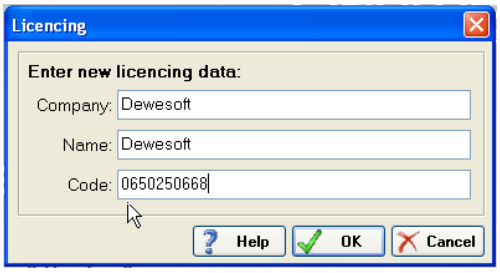



*Illustration 42: test.commander: Licencing dialog*

**IMPORTANT**

Note that the leading zero that you must enter in the *Licencing* dialog (Illustration 42) is part of the code. If you omit it, the code will not work.

When you press **OK**, the license will be stored.

Note, that the program `ICP 100` is now also licensed – it uses the same license as `test.commander`.

A printed, version of your license certificate for `test.commander` is included with your shipment. You will also find the license as `pdf`-file on the USB stick: the file is called `License Certificate for Gantner.pdf` and is stored in the `Docs` directory.

**HINT**

You can always enter/change the license later. Just select *Help* > *About...* in `test.commander` to open the *About* dialog and then follow the steps described above.

## 3.3 Ethernet connection

This chapter explains how to connect your DS NET system via Ethernet to your PC.

Chapter 3.3.1 Ethernet explained provides an explanation of how Ethernet works. If you are already familiar with Ethernet, you can skip this chapter.

| HINT | It is recommended to always have the DS NET system in the same subnet as your PC.<br>If they are in different subnets some functions may not work<br>e.g. the device cannot be found by `test.commander`'s scan function (note: it will still work, if you enter the IP address manually) |
|---|---|

| HINT | We recommend the use of industrial Ethernet switches. DS GATE uses auto negotiation and operate, if available, with 100 MBit/s and full duplex for the transmission |
|---|---|

## 3.3.1 Ethernet explained

When devices are connected via Ethernet, every device must have valid TCP/IP settings.

Devices that are participating in the Ethernet must have a logical addresses: the IP address (e.g. *192.168.1.28*)

The IP address fulfills the functions of identifying the device and locating it on the network. It allows a device to communicate with other devices.
The IP address of each device must be unique and can be configured in one of the following 2 ways:

- automatically: in this case a DHCP-server is running in the network and the devices will ask the DHCP-server for the TCP/IP settings (IP Address, subnet mask, gateway, …) when they start up. The DHCP server will make sure that each device receives valid TCP/IP settings and a unique IP address.
  e.g. this is used in company LANs
- manually: in the absence of a DHCP server, the TCP/IP settings must be configured manually for each device.
  e.g. this is used when you want to make a direct connection between 2 devices.

### 3.3.1.1 Subnets

A subnet-work (aka. subnet), is a logically visible, distinctly addressed part of a single Internet Protocol network. Subnetting breaks a network into smaller realms that may use existing address space more efficiently, and, when physically separated, may prevent excessive rates of Ethernet packet collision in a larger network

### 3.3.1.2 Anatomy of an IP address

In order to be able to send data across multiple networks, the address is divided into two parts:

- *Network prefix*: A contiguous group of high-order bits that are common among all hosts within a network.
- *Host identifier*: The remaining low-order bits of the address that are not designated in the subnet mask. This part specifies a particular device in the local network.

In TCP/IP notation you specify the IP address of the device and the subnet mask.
From these settings the Network prefix and the Host identifier can be calculated:

**EXAMPLE 3**

Subnet mask: `255.255.255.0`
IP address: **`192.168.1.`**`28`
Note, that the digits in bold of the IP address above identify the *Network prefix* (`192.168.1`) and the remaining digits remain for the *Host identifier* (`28`) relative to this network.
Examples of IP addresses within the same subnet:
**192.168.1**.1, **192.168.1**.2, …up to **192.168.1**.255
Examples of IP addresses that are not in the same subnet:
10.10.0.28, 192.168.2.28, 74.125.77.104, ..

**EXAMPLE 4**

Subnet mask: `255.255.`**`0.`**`0` (now the 3rd number is 0 instead of 255)
IP address: **`192.168.`**`213.28`
Note, that the digits in bold of the IP address above identify the *Network prefix* (`192.168`) and the remaining digits remain for the *Host identifier* (`213.28`) relative to this network.
Examples of IP addresses within the same subnet:
**192.168**.1.1, **192.168**.1.2, …up to **192.168**.1.255
**192.168**.2.1, **192.168**.2.2, …up to **192.168**.2.255
**192.168**.255.1, **192.168**.255.2, …up to **192.168**.255.255
Examples of IP addresses that are not in the same subnet:
10.10.0.28, 192.160.2.28, 74.125.77.104, ..

### 3.3.1.3 Port numbers

In order for the Ethernet communication to work, the following ports must be open for communication:

| Protocol | Port number | Description |
|---|---|---|
| TCP | `21` | FTP communication (for reading and changing the DS-NET configuration) |
| TCP | `8001` | High speed port for measurement data transfer (see also 5.3.3.1 Block transfer on page 97 ) |
| TCP | `8010` | Transparent port UART0 (for slave configuration of modules in `test.commander`) |
| TCP | `8011` | Transparent port UART1 (for slave configuration of modules in `test.commander`) |
| UDP | `8000` | High speed port: UDP alternative to TCP port `8001` |
| TCP | `10000`[2] | Data port (ASCII, Modbus): see also 5.3.3.2 Online values on page 97 |
| UDP | `1234` | for optional usage of the program *e.con* (not used with DEWESoft™) |
| UDP | `5565` | Broadcast port/ASCII: used to find DS-NET devices in the network (see 4.2.6 Scanning for devices on page 62) |

*Table 5: DS-NET port numbers*

## 3.3.2 DS NET factory settings

When DS GATE is delivered to you, DHCP is active and the static IP address is set to `192.168.1.28`.

When you power up your DS NET system, it will try to get valid TCP/IP settings from a DHCP server in the network. If the DS GATE does not receive TCP/IP settings via DHCP after a few seconds, it will fall back to its static IP address (the default setting of the static IP address of the DS GATE is `192.168.1.28`).

## 3.3.3 Connection using DHCP

When DS GATE is delivered to you, DHCP is active. To establish a connection:

- make sure, that your DS NET device is powered off
- connect your DS NET system with a standard Ethernet cable to the LAN that your PC, and the DHCP server, are also connected to
- now power up the DS NET system. It will contact the DHCP server to obtain an IP address and will then be available under this IP address in your LAN

2 This communication port can be changed e.g. you could use the default Modbus port 502

There's nothing more to configure in this case.

| HINT | |
|---|---|
|  | If the DS GATE does not receive TCP/IP settings via DHCP after a few seconds, it will fall back to its static IP address (the default setting of the static IP address of the DS GATE is 192.168.1.28). |

## 3.3.4 Direct Connection (no DHCP)

If there is no DHCP server available, you must manually configure all the relevant settings.

In this chapter we will explain how to change the configuration of your PC so that you can establish a direct connection to the DS NET device.

### 3.3.4.1 Open the LAN connection status dialog

In Windows open *Start* - *Control Panel*:

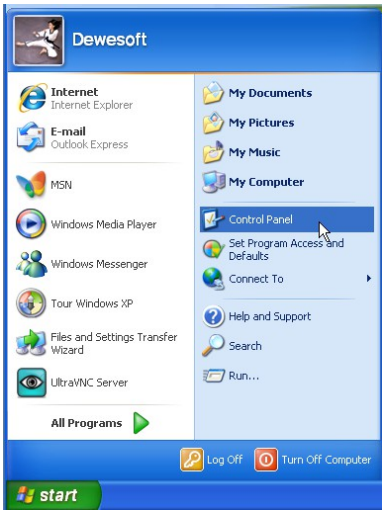



*Illustration 43: Open Control Panel*

and select *Network Connections*:

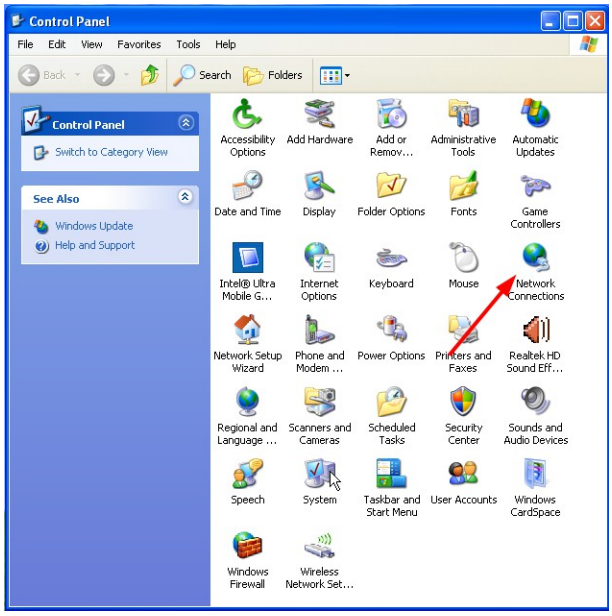



*Illustration 44: Open Network Connections*

Open the connection that your DS NET system is connected to:

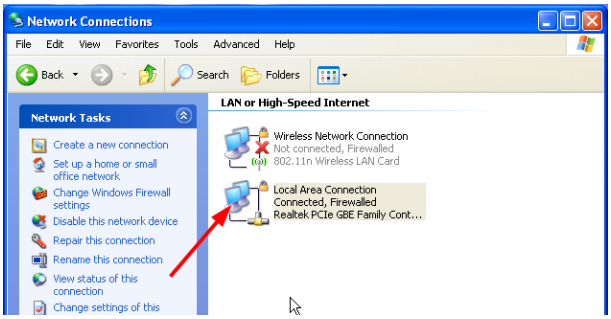



*Illustration 45: Open Local Area Connection*

Select *Properties* in the context menu of the connection:

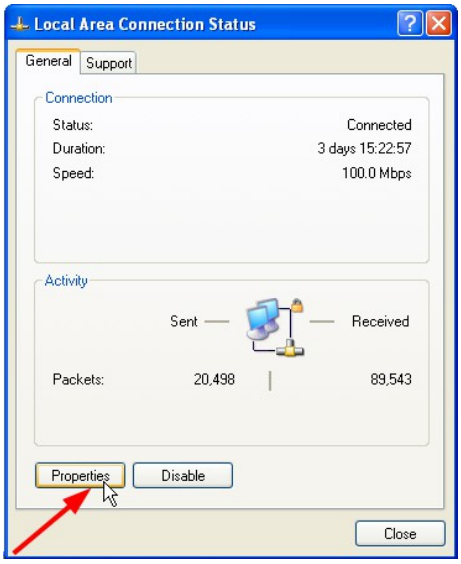



*Illustration 46: Open Local Area Connection Properties*

## 3.3.4.2 Setting the IP address on the PC

Since the static IP address of the DS GATE is set to `192.168.1.28` we will change the configuration of the PC so that the PC will have an IP address that is in the same subnet. First open the LAN connection status dialog: see Open the LAN connection status dialog on page 32) and click **Properties**.

In the list box *This connection uses the following items* scroll down to the `Internet Protocol (TCP/IP)` entry and click **Properties**:

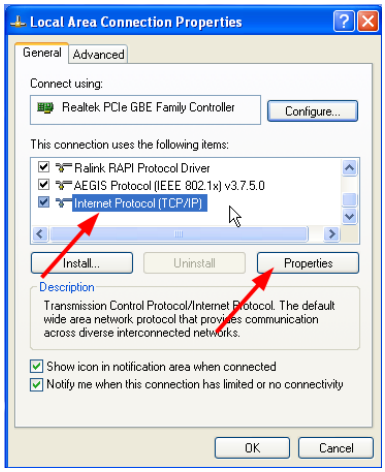



*Illustration 47: Open TCP/IP Properties*

## 3.3.4.3 Setting an alternate IP

NOTE: in some cases this may be required, but we recommend to set a fixed IP address instead: see 3.3.4.4 Setting a fixed IP

If your computer is currently configured to *Obtain an IP address automatically*:

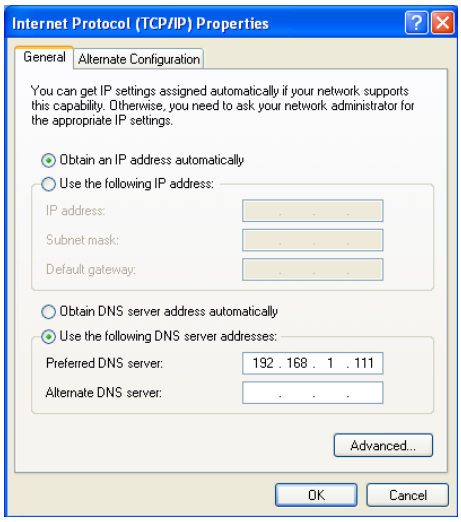



*Illustration 48: Obtain an IP address automatically*

then you can change to the Alternate Configuration tab, where you should select *User configured* and enter an *IP address* and *Subnet mask* that match the configuration of your DS NET system (for details see 3.3.1 Ethernet explained).

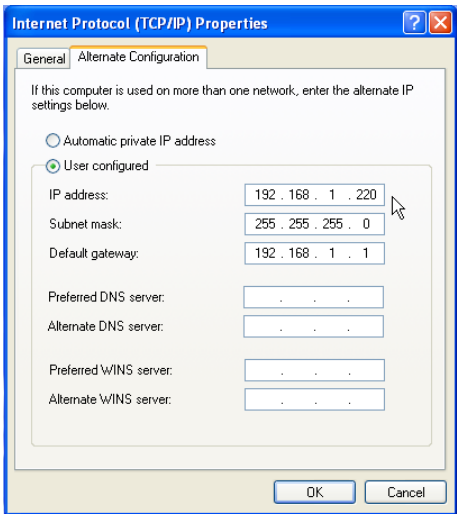



*Illustration 49: Alternate Configuration*

### 3.3.4.4 Setting a fixed IP

If a fixed IP is set for your PC, as you can see in Illustration 50, then you should first make a note of the current settings note the current settings (just in case that you want to restore them later) and then enter an *IP address* and *Subnet mask* that match the configuration of your DS NET system (for details see 3.3.1 Ethernet explained).

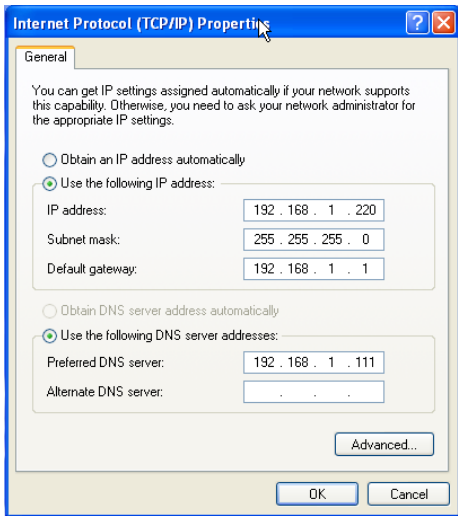



*Illustration 50: TCP/IP Connection: fixed IP*

After you have confirmed your changes, the IP address of the TCP/IP connection will be changed.

### 3.3.4.5 Discovering the IP address and subnet mask of your PC

First open the LAN connection status dialog: see Open the LAN connection status dialog on page 32).

Then switch to the Support tab:
and click **Details...**.

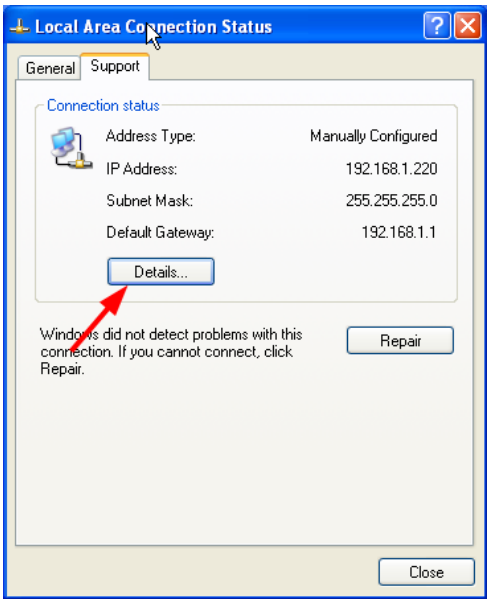



*Illustration 51: Support tab-sheet*

You can see the current *IP address* and *Subnet Mask* in the list of *Network Connection Details*:

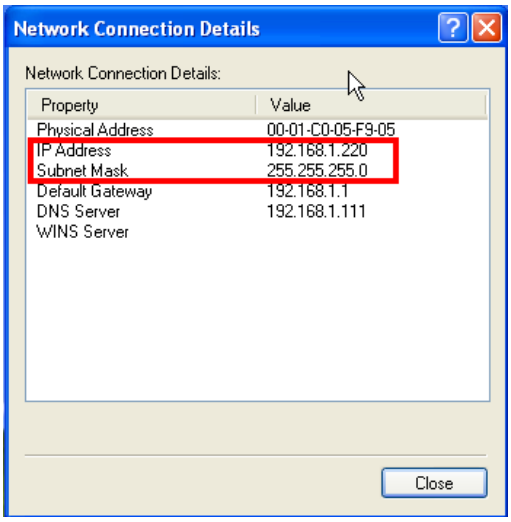



*Illustration 52: Network Connection Details*

**HINT**

If the connection already supports IP version 6, the list entries may be called *IPv4 IP Address* and *IPv4 Subnet Mask* respectively.

## 3.3.5 Allowing access to network devices (firewall)

Each PC should be protected by a firewall. A firewall will monitor the incoming and outgoing network connections of your PC.

Some firewalls may block the communication to the DS NET system. Thus, you have to explicitly allow this communication or disable the firewall.

This section will show you how to handle the default Windows firewall.
If you have any other firewall or security software installed on your PC, please make sure to also configure it correctly or deactivate it temporarily when required.

**CAUTION**

You should only disable the firewall if you are not connected to the Internet: e.g. when you have directly connected your DS NET system to your PC or if your company LAN is protected by another firewall.

### 3.3.5.1 Unblocking connections

When any program on your PC is trying to communicate with the DS NET system, the firewall may show you a warning like this:


*Illustration 53: Windows-Firewall: Security Alert*

This will typically happen when you activate the DS NET plugin in the *Hardware setup* of DEWESoft™ for the first time.

If the name of the program is DEWESoft™ (or `test.commander`, or `ICP100`), you can safely select unblock to allow the communication.

| IMPORTANT | |
|---|---|
|  | You must have administrator rights on the PC to be able to unblock the connection. If this is not the case, ask your administrator to do this for you.<br>You must enable communication for all programs which use an Ethernet connection to communicate with the DS GATE or DS NET modules. |

### 3.3.5.2 Restrict connections

If required, you can restrict the connection, for example to your own network.

Open the Windows Control Panel (see 3.1.2.1 Opening windows control panel).

Now click on *Windows Firewall*:

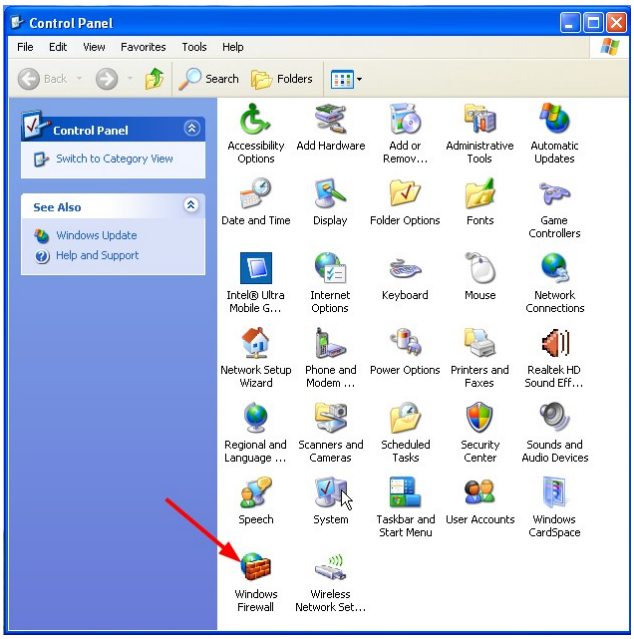



*Illustration 54: Open Windows Firewall*

Switch to the Exceptions tab:

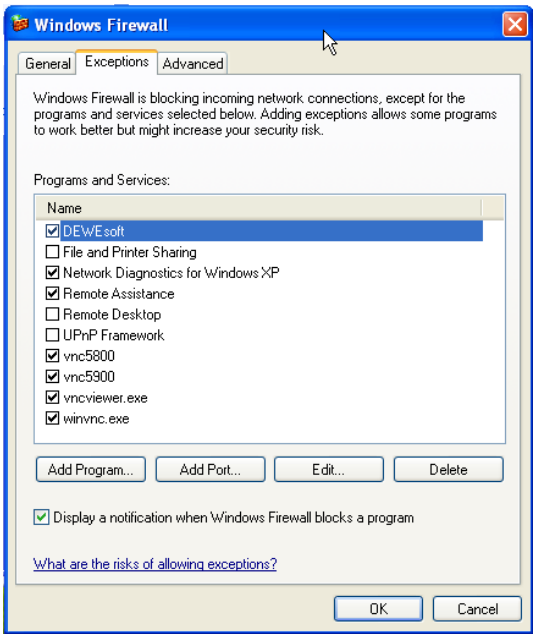



*Illustration 55: Windows Firewall: Exceptions*

**HINT**

The entry for `DEWESoft` in the *Programs and Services* list will only exist, if you have already unblocked the program (see Unblocking connections on page 36).

Click **Edit...**:
Note that the Path may vary depending on the setup type that you have chosen during the installation (see 3.1.3.2 Installing new DEWESoft™ version for details).


*Illustration 56: Windows Firewall: Edit a Program*

Click **Change scope...**:
And specify whether permission is to be given only for your own subnet or even only for certain addresses.

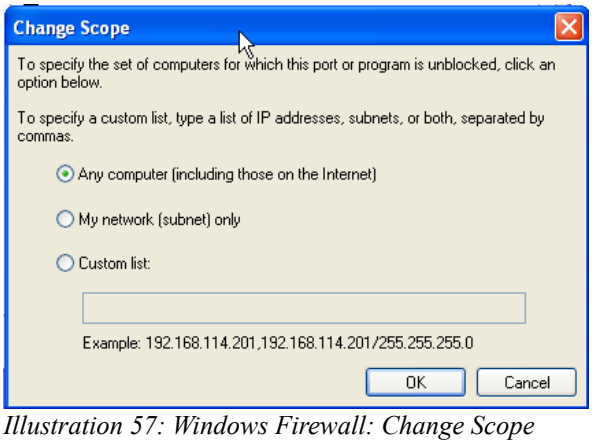



*Illustration 57: Windows Firewall: Change Scope*

## 3.3.5.3 Deactivating the firewall

This chapter will show you how to disable the Windows Firewall.

**CAUTION**

You should only disable the firewall if you are not connected to the Internet: e.g. when you have directly connected your DS NET system to your PC or if your company LAN is protected by another firewall.

First open the Windows Control Panel (see 3.1.2.1 Opening windows control panel).

Click *Administrative Tools*:

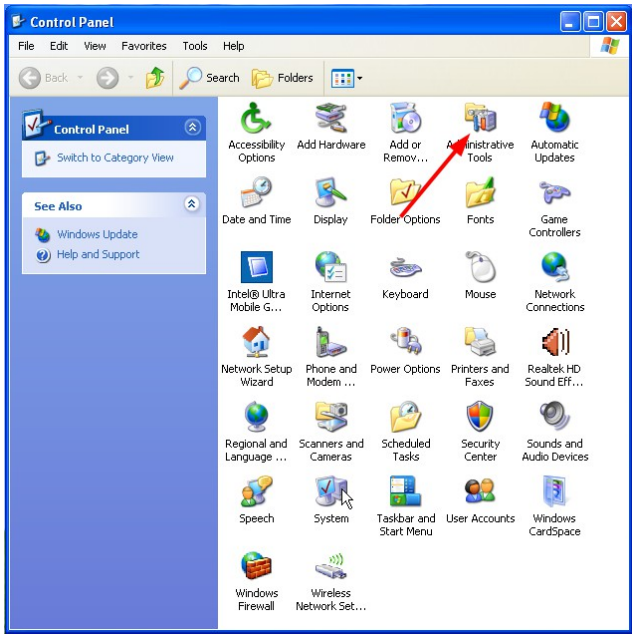



*Illustration 58: Control Panel: Administrative Tools*

Open *Services*:

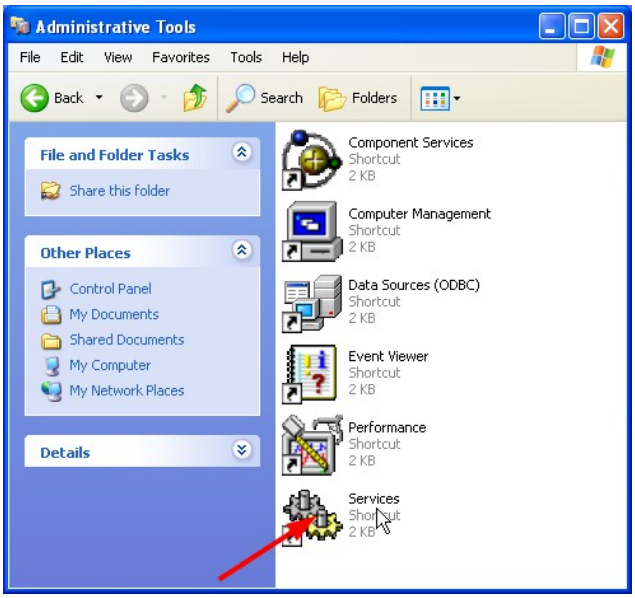



*Illustration 59: Administrative Tools: Services*

Now scroll down to the `Windows Firewall/Internet Connection Sharing (ICS)` entry:

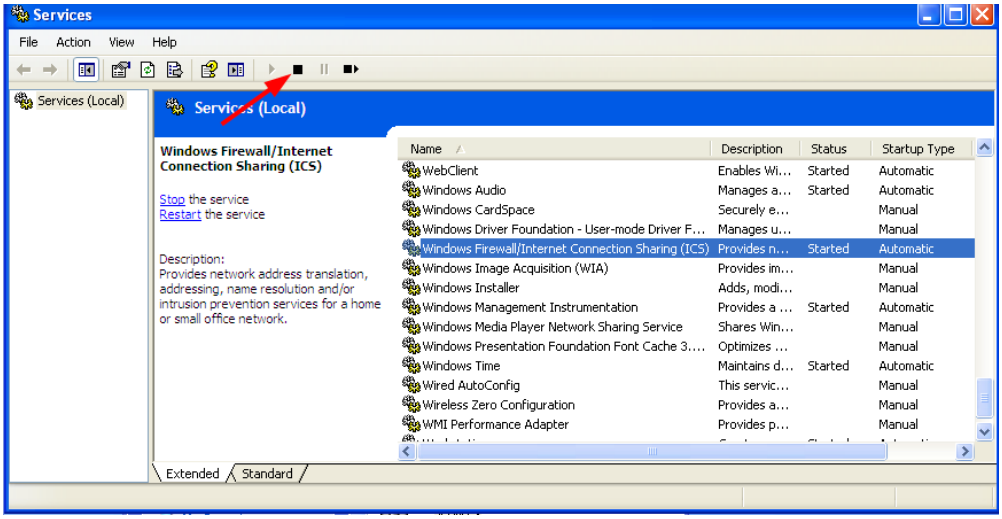



*Illustration 60: Stop Windows Firewall Service*

And press the **stop** button (red arrow in Illustration 60).

**CAUTION**

Do not forget to enable the firewall again, before you connect to the Internet.

## 3.4 DEWESoft™ configuration

This chapter describes the basic steps to establish a connection between your DS NET system and DEWESoft™. For more details see 4 DS NET plugin.

Before you can use DS NET in DEWESoft™, you have to correctly set it up in *Hardware setup.* Open *Settings* – *Hardware setup...*:

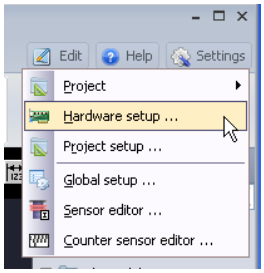



*Illustration 61: DEWESoft™: Open Hardware setup*

**HINT**

If *Hardware setup ...* is disabled, then click **Acquisition** and then **Ch. setup** (see Illustration 62):


*Illustration 62: Channel Setup Mode*

Now that you are in channel setup mode, the *Hardware setup ...* option will be enabled.

In the Registration tab sheet, you will see that DEWESoft™ is in *Demo mode* and that a *Trial license* has been created:

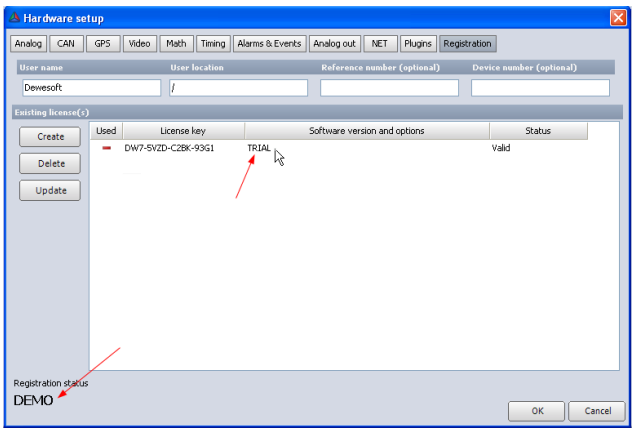



*Illustration 63: DEWESoft™: Demo mode*

Now switch to the Plugins tab-sheet, scroll down to the *DS NET* plugin and click on the **Unused** button (the button label will now change to **Used**: meaning that the plugin is activated now).

If the list of plugins is empty, see 3.1.1.2 Installing new DEWESoft™ version on page 18.

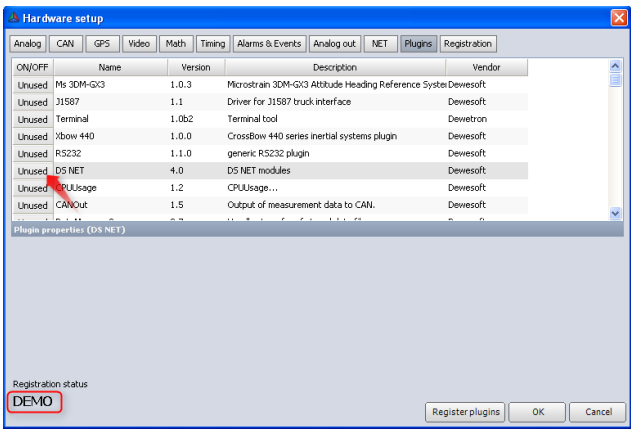



*Illustration 64: Activate DS NET plugin*

When you do this, the DS NET plugin will be activated and it will immediately start to scan your network to find DS NET devices:

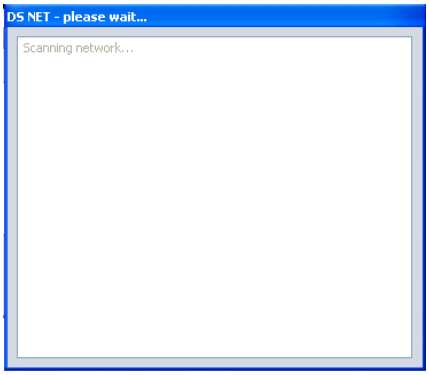



*Illustration 65: DS NET plugin: Scanning network*

When it is done, you should see your DS NET device in the list of *Unassigned online masters*:
If you do not see your device in the lists, see 4.2 Hardware setup which will explain the hardware setup dialogue in much more detail.

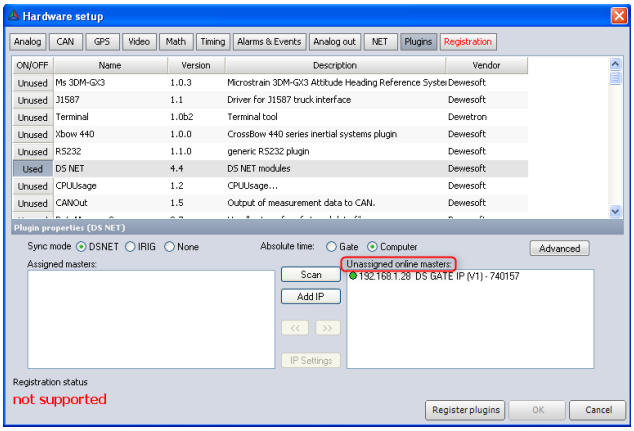



*Illustration 66: DS NET plugin: unassigned gate*

Now select your device and then click the << button to move it to the list of *Assigned masters*:
Please note, that the *Registration status* (at the left bottom of the screen) has changed from *not supported* to a valid status (in this case to SE, but this could be different depending on the DEWESoft™ edition that you have ordered).

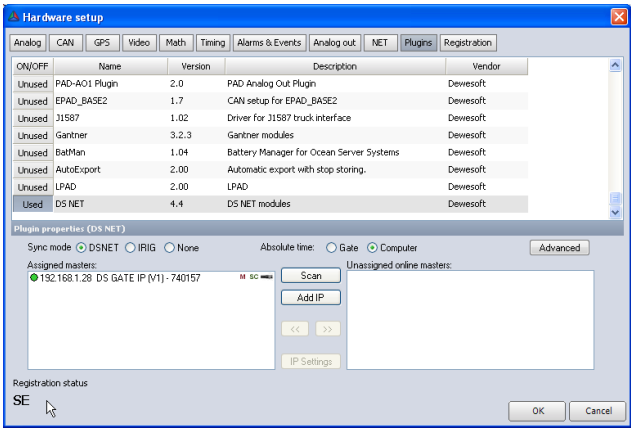



*Illustration 67: DS NET plugin: Assigned device*

When you now switch back to the Registration tab-sheet, you will see that the DS NET plugin has created a new *License key* called *DSNET* automatically (Note, that this is not a `.lic` file).

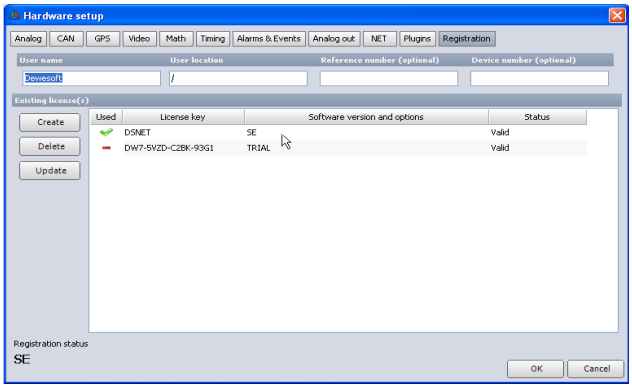



*Illustration 68: DS NET plugin: automatic license*

When you press **OK** to close the hardware setup and save your changes, the DS NET plugin will initialize the DS NET system that we have just activated. It will read the DS NET system- and module configuration and prepare the channel-setup:

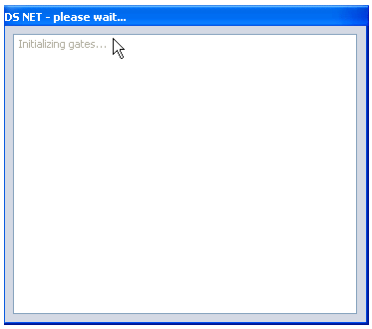



*Illustration 69: DS NET plugin: Initializing gates...*

When you now go back to *Channel setup* and click the DS NET symbol, you will see that the DS NET system and all it's channels will show up.

That's it. Now you can use all the channels and DEWESoft™ features, that you already know from any other devices.

# 4 DS NET plugin

This chapter describes the DS NET plugin in detail. For the basic steps to get started with the plugin, see 3.4 DEWESoft™ configuration.

## 4.1 Synchronisation

When acquiring data from multiple measurement channels, the degree to which the data of the different channels can be correlated to each other in time can be very important. If the data of the different channels is not synchronised, your analysis may be inaccurate or even completely wrong. The faster you acquire the data, the more important synchronisation becomes (e.g. when you only acquire one data point for a temperature measurement per minute for a relatively short measurement period, synchronisation to other measurement channels may be irrelevant).

Since this is such an important point, DEWESoft™ offers you a wide range of possible ways to synchronise you data. To understand all the DEWESoft™ features and settings, it is important to know the basics and the definition of the terms that are used in this discussion: so the following glossary should give us a sold foundation for the advanced topics that will follow.

When we talk about synchronisation in this chapter, we always mean inter-device-synchronisation between different measurement devices: e.g. between 2 DS-NET systems or between a DEWE-43 and a DS-NET system, etc.
Also the data from different channels and modules inside one measurement system are subject to synchronisation. This intra-device-synchronisation is usually very accurate and thus negligible.

### 4.1.1 Synchronisation Glossary

#### 4.1.1.1 Sampling

The analogue signals that we want to measure are continuous time signals. Since all computer based systems are digital, we need to convert those continuous time signals to discrete time signals: this process is called sampling.
A sample refers to a value at a point in time.

The Illustration 70 shows the continuous analogue signal.

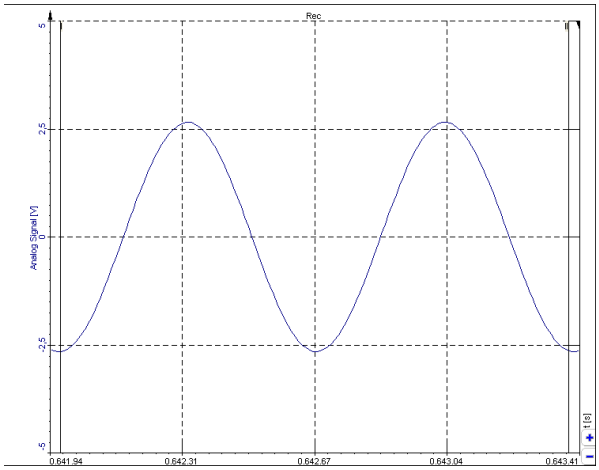



*Illustration 70: Continuous signal*

Illustration 71 below shows the sampled version of the signal in Illustration 70. The actual data consists only of the sampled points that you see. The lines in between the points are just interpolated.

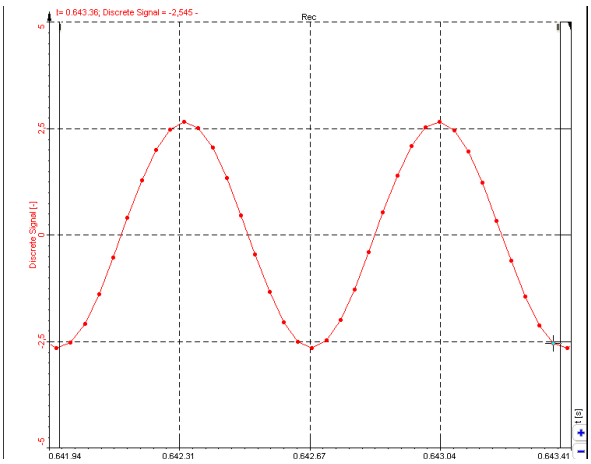



*Illustration 71: Sampled (discrete) signal*

Illustration 72 below shows another sampled version of the signal in Illustration 70. But in comparison to Illustration 71 we used a lower sample rate in this case. Because of the lower sample rate, we have fewer data points acquired and thus the interpolated signal does not resemble the original signal as good as Illustration 71 does.

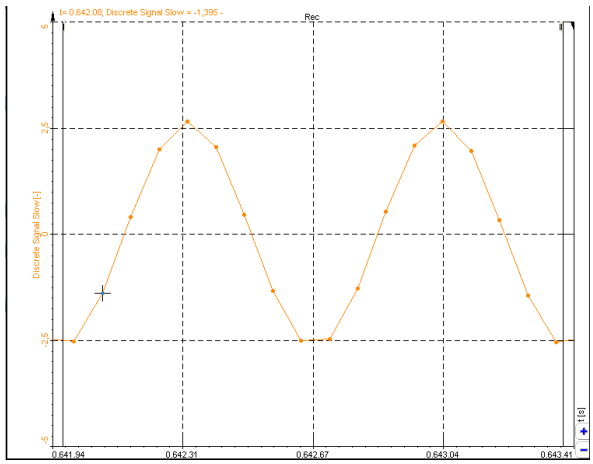



*Illustration 72: Slower sampled (discrete) signal*

The sampling rate (aka. sample rate, sampling frequency) defines the number of samples per second taken from the continuous signal to create the discrete signal. The unit for the sampling rate is hertz (Hz) .
The inverse of the sampling frequency is the sampling period or sampling interval, which is the time between samples.

### 4.1.1.2 Clock

A clock signal is a particular type of signal that oscillates between a high and a low state and is utilized like a metronome to coordinate actions.

E.g. each DS-GATE has an internal clock. The sampling of the data-points is always correlated to this clock – so that the data-points of all channels (on all modules) refer to the same point in time[3].

### 4.1.1.3 Masterclock

Masterclock is a DEWESoft™ term that refers to the main clock that is used to synchronize data and actions inside the DEWESoft™ software.

Clockmaster is another DEWESoft™ term that refers to the hardware device that provides the masterclock to DEWESoft™.

There are several possible source for the masterclock:

- whenever you have activated an analogue device in DEWESoft™ it will be used as clockmaster
- when you have no hardware devices activated at all, then the computer's clock will be used
- when you have only DS-NET systems (no analogue devices) activated in hardware setup, then you can choose if any of the DS-NET systems is the clockmaster, or if the computer will be the clockmaster

3 Like all real-world devices also the clock generator of the DS-GATE is not ideal. It may have a jitter of about 21ns. But this is negligible related to the (much slower) sample rates.

In the example of Illustration 73 we have used one channel called *DEWE-43_Voltage* (from a DEWE-43 of course), one mathematical channel called *Math DEWE43-half* (which just divides the value of the *DEWE-43_Voltage* channel by 2) and one channel of a DS-NET called *V1*.

Since DEWE-43 is an analogue device, it will be the clockmaster. The mathematical channel will be synchronized with the masterclock: thus the points ❶ and ❷ are perfectly aligned.

The channels of the DS-NET system are of course asynchronous in this case, thus the data point ❸ is not aligned to the synchronous channels.

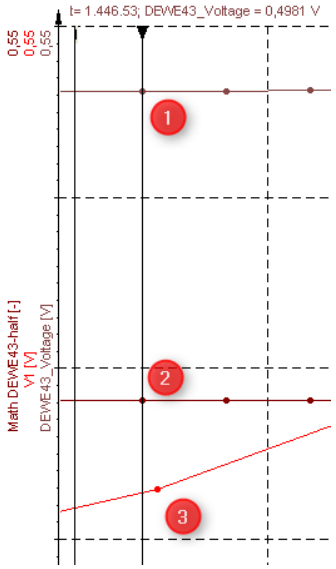



*Illustration 73: Masterclock*

## 4.1.1.4 Sampling jitter

The sampling frequency is normally assumed to be constant. Samples should be converted at regular intervals.

In real-world application this can not be achieved. The error introduced is called sampling jitter, which describes the time variation of the real clock in relation to the ideal clock.

## 4.1.1.5 Sync / Async channels

In DEWESoft™ there are 2 fundamentally different types of channels: synchronous and asynchronous channels.

Synchronous channels always have exactly one data point related to the masterclock and the time between 2 adjacent data points is always constant.

In the example below you can see 3 synchronous channels and that the data points of all the channels are perfectly aligned to each other.

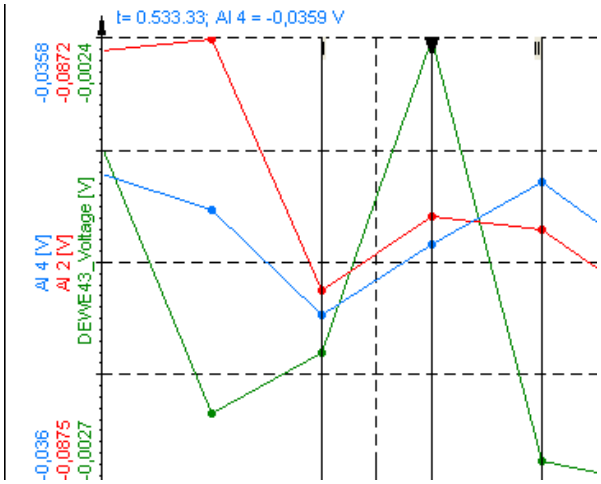



*Illustration 74: Synchronous channels*

Asynchronous channels may have data points at any instant of time and the time between 2 adjacent data points may vary.

In the example below you see the green signal which is a synchronous channels of a DEWE-43 (which is clock master) and 3 channels from 3 different DS-NET systems which are of course asynchronous. When you take a look at he black line denoted with ❶ in Illustration 75 you can see that the asynchronous data points are not aligned to the green synchronous data points and also not aligned to each other.

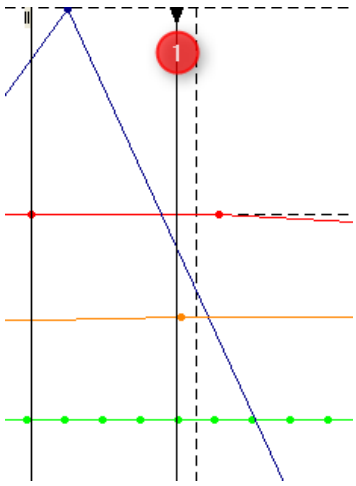



*Illustration 75: Asynchronous channels*

Sync channels are much easier to handle because of the fact that the time between all their data points is equal. This also makes some computations much easier (which means, that CPU power is much lower).
E.g. displaying sync channels in a recorder is easy, but displaying asynchronous channels in a recorder requires many more calculations and thus much more CPU power (because we need to calculate the right horizontal position for each data point).

Some functions in DEWESoft™ only work with synchronous channels: e.g. in the channel list of the FFT or scope screen only sync channels will show up – async channels cannot be used.

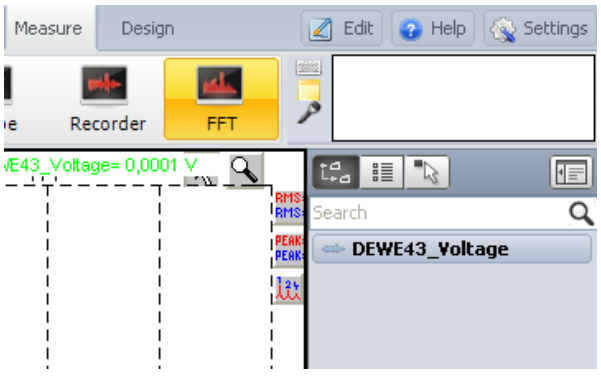



*Illustration 76: FFT screen: only sync channels*

In the recorder screen you can also use async channels. The Illustration 77 shows the Recorder screen with the same channel setup as Illustration 76.

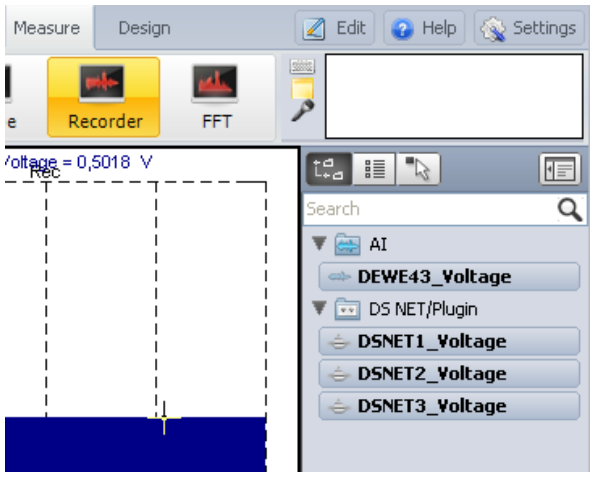



*Illustration 77: Recorder screen: also async channels*

### 4.1.1.6 Absolute time

The DS GATE does not have a battery powered real time clock (RTC), i.e. when you power off the DS NET and on again, the time-information in the DS GATE will always start with 1st, Jan, 2005 00:00:00.

However this is not a problem in most cases and there are other ways to get the time-information.

Absolute time in DEWESoft™:

- DS-NET running as asynchronous device: in this case the time will be taken from the clock master anyway
- DS-NET running as clock master: in this case you can choose if you want to use the time-information from the computer or from the DS-GATE (see chapter 4.2.1 Sync mode on page 56).

When you need the absolute time directly from DS-NET (without DEWESoft™); e.g. logging to USB stick (see 7 Data Logger on page 163), reading data via ASCII, Modbus, etc.), you can:

- use SNTP: see 4.1.4.2 SNTP on page 50
- use NMEA 0183 (GPS, DCF 77): see 4.1.4.3 NMEA-0183 on page 51
- contact Dewesoft to get a quote about a special hardware version with internal RTC
- set the time of the DS-GATE manually in DEWESoft™: see 4.3.3.1 DS GATE pop-up menu on page 66

## 4.1.2 Sync options

When you have several measurement systems each of those systems has it's own internal clock (e.g. 2 DS-NET systems). Since no real-world hardware is perfect the 2 clocks will run at slightly different speeds and thus will drift more and more apart from each other.

### 4.1.2.1 No synchronisation

If you use no synchronisation at all the time shift between the signals of the 2 devices will become bigger and bigger the longer the measurement takes.

At the beginning of the measurement the 2 signals will be very good aligned. In Illustration 78 you can only see one of the signals, because the second one is exactly the same and thus hidden behind the red one.

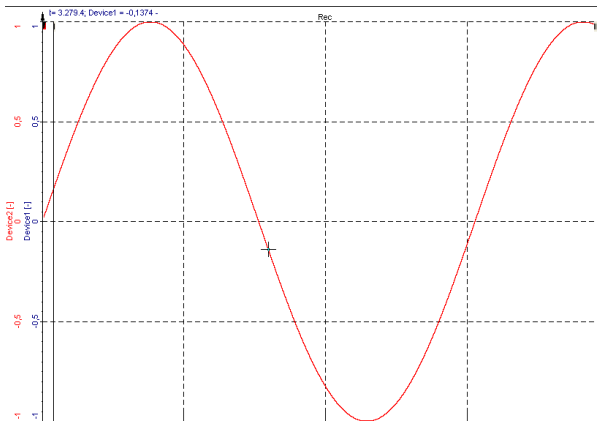
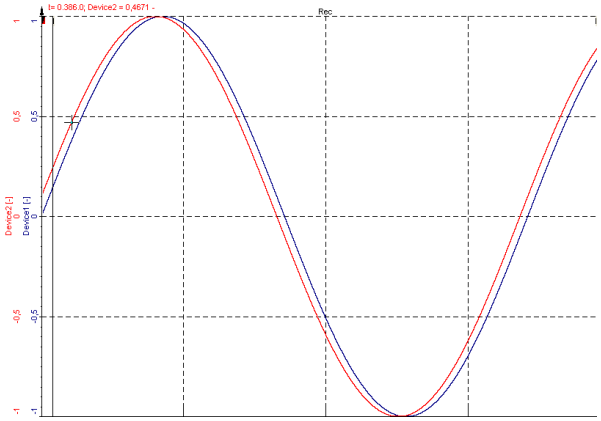
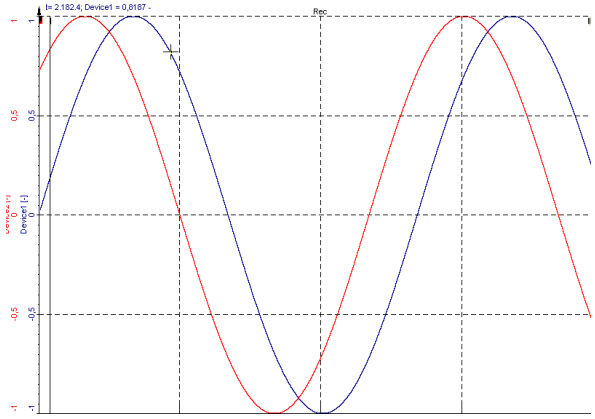



*Illustration 78: No sync: start of measurement*

| | |
|---|---|
| After some time (depending on the relative clock drift of the 2 devices), you will see that the signals are not perfectly aligned any more... | ...and the longer the measurement takes, the worse the offset will become. |
|  |  |
| *Illustration 79: No sync: small offset* | *Illustration 80: No sync: big offset* |

Note: DS-NET channels will always be at least soft-synced (see 4.1.2.3 Software synchronisation).

## 4.1.2.2 Hardware synchronisation

The best way to synchronise the clocks of several DS-NET devices is to use some sort of hardware synchronisation (e.g. a synchronisation cable) that transmits a signal that can be used by the devices to synchronise their clocks to each other.

When using DS-NET systems with hardware sync cables the maximum jitter between channels of the synchronised measurement systems will be ±2µs.

Note that the hardware synchronisation function is not related in any way to the setting of the clockmaster.

### 4.1.2.3 Software synchronisation

When the data that we get from asynchronous devices includes also a time-stamp, DEWESoft™ can do a so called *software synchronisation*. In this case, the channels will still be asynchronous and will have a time delay relative to other synchronous channels, but at least the time-drift will stay almost constant.

The DS-NET plug-in will always use soft sync for asynchronous channels.

Illustration 81 shows 3 channels of 3 different DS-NET systems. DSNET1 and DSNET2 are connected via hardware sync cables (DSNET3 is not).
We do not use any analogue device.

You can see that the channels of the synchronised systems DSNET1_Voltage, DSNET2_Voltage are perfectly aligned to each other and the the asynchronous channel DSNET3_Voltage of the 3rd (not hardware-synchronised) system is delayed by some milliseconds (which is often acceptable when you are measuring slow signals).

Even if you leave that measurement running for days and weeks, the time drift will stay almost constant.

The typical time delay between the signal of a DEWE-43 and a software synced channels of a DS-NET @1kHz is about 1ms.

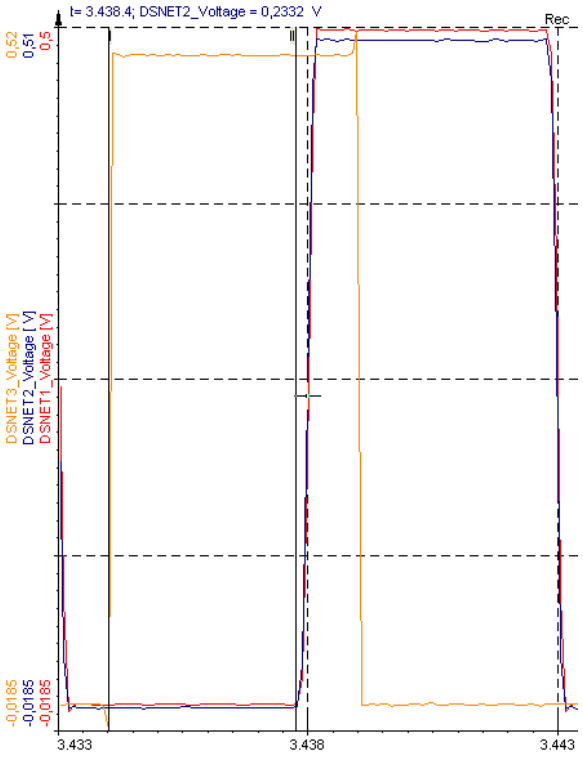



*Illustration 81: Soft sync*

## 4.1.3 Overview

If you want to use several DS NET systems together, there are several ways how to synchronise them.

| | typical synchronisation jitter | absolute time | Description |
|---|---|---|---|
| **Ethernet only (Soft sync)** | n.A. | n.A. | only Ethernet cable is connected – no other options in this case Software sync is used<br>see 4.1.2.3 Software synchronisation on page 49 |
| **SNTP** | <=500ms | <=500ms | depends on the SNTP source and network traffic<br>see 4.1.4.2 SNTP on page 50 |
| **NMEA-0183 (RS232)** | <=500ms | <=500ms | depends on the used device (e.g. DCF 77, 1Hz, 5Hz Garmin® GPS)<br>see 4.1.4.3 NMEA-0183 on page 51 |
| **HW-sync** | ±2µs | only in combination with other methods | the DS NET systems are connected via synchronisation cables<br>see 4.1.4.4 Hardware synchronisation on page 51 |

*Table 6: Synchronization overview*

## 4.1.4 One PC and several DS NET systems

**IMPORTANT**

The information in this section applies only then when you use one PC running DEWESoft™ with no other *Analog devices* enabled (see 4.2.1 Sync mode).

### 4.1.4.1 Ethernet only

In this constellation the DS-NET devices and the measurement PC are connected to the Ethernet. No other cables or other options are used. The DS-NET plug-in will software synchronise the channels of the 2 systems (see 4.1.2.3 Software synchronisation on page 49):

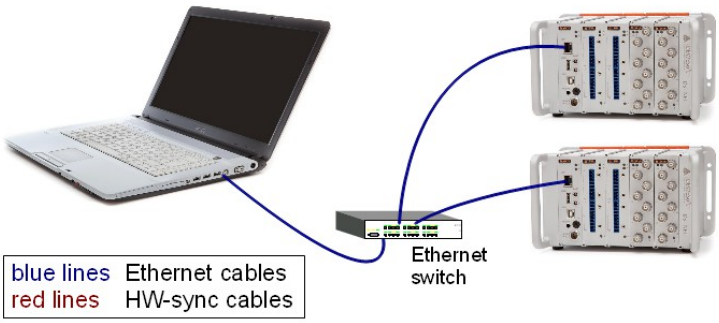



*Illustration 82: Synchronisation: Ethernet only*

### 4.1.4.2 SNTP

In this case you can configure each DS NET system to get the time information from an SNTP server via Ethernet:

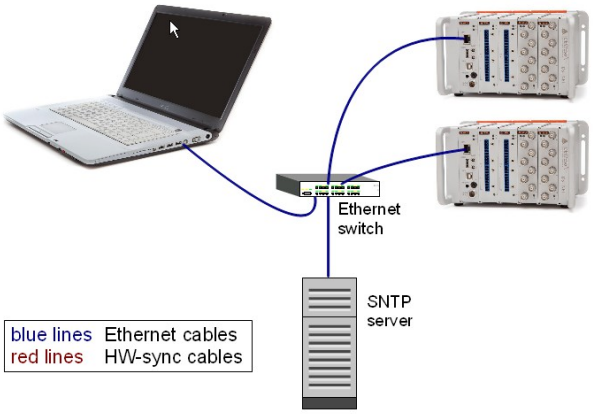



*Illustration 83: Synchronisation: SNTP*

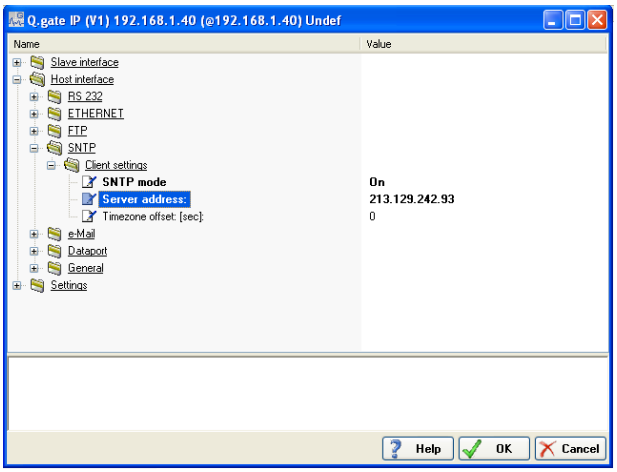



Illustration 84: test.commander: SNTP configuration

Also note, that you must have setup your *ETHERNET* settings right, so that DS NET can reach the destination SNTP server. Check if the value for your *Default Gateway Address* (see blue rectangle in Illustration 85) is okay.

If you specify a host name instead of the IP address for your SNTP server, then you also need to set a correct value for your DNS server (see red rectangle in Illustration 85).

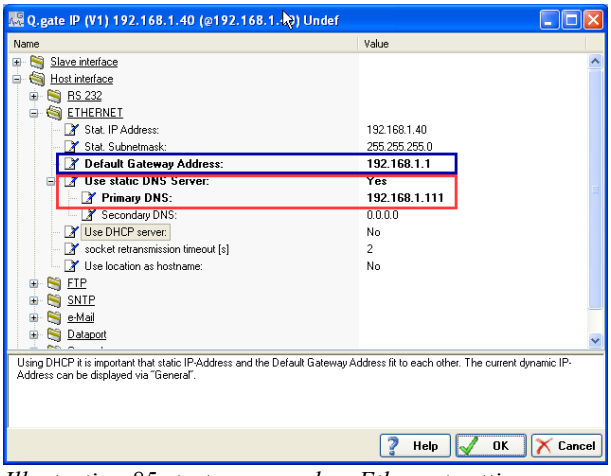



*Illustration 85: test.commander: Ethernet settings*

### 4.1.4.3 NMEA-0183

In this case you must connect your NMEA-0183 compatible device to the RS232 connector of the DS NET and configure the correct parameters (*Baudrate*, *Char Format*) for the serial communication. Please consult the manual of your NMEA-0183 device to get these parameters. You can activate this function in *Config mode*: see : GPS on page 75

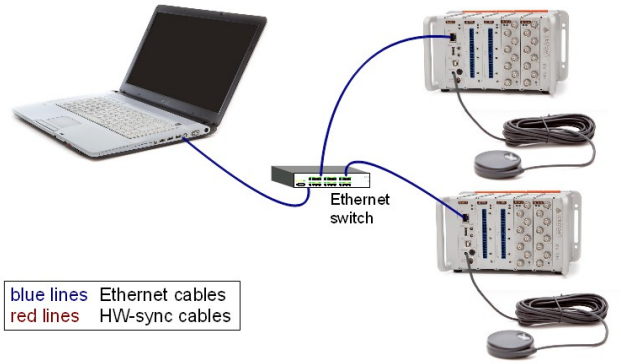



*Illustration 86: Synchronisation: NMEA-0183 via GPS*

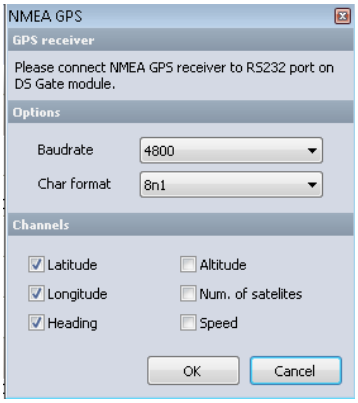



*Illustration 87: NMEA-0183 configuration*

NMEA-0183 devices:

- GPS
  In order to use GPS signals, you must have unobstructed line of sight to four or more GPS satellites – so this will not work inside of buildings.
  Moreover, please note, that the GPS device might need about one minute until it has a valid time information that it can send.
- DCF 77
  The DCF 77 radio signal can also be received inside of buildings in large parts of Europe, as far as 2000 km from Frankfurt (Germany).

With a setup like that shown in Illustration 86 you will get the NMEA jitter accuracy of <=500ms between the systems. This can be very useful, when the DS NET devices are far away from each other and thus using hardware synchronisation cables is not possible.

If the systems are close to each other you can also combine this option with hardware synchronisation (see 4.1.4.4 Hardware synchronisation and 4.1.4.5 Synchronisation combinations).

### 4.1.4.4 Hardware synchronisation

In this case you must daisy chain your DS NET systems with special synchronisation cables (see Illustration 89). The cables have *Lemo 00B* connectors which fit into the *SYNC* connectors of the DS GATE (see Illustration 88).

These cables can be ordered as options to your DS NET systems:
DS-NET-SYNC-CBL-05 (length 0.5m), DS-NET-SYNC-CBL-3 (length 3m).

The synchronisation signal between the DS-NET systems uses an RS-485 interface with a frequency of about 500 kHz and the maximum possible length of the cable is about 400 meters.

*Illustration 88: HW-sync cable*

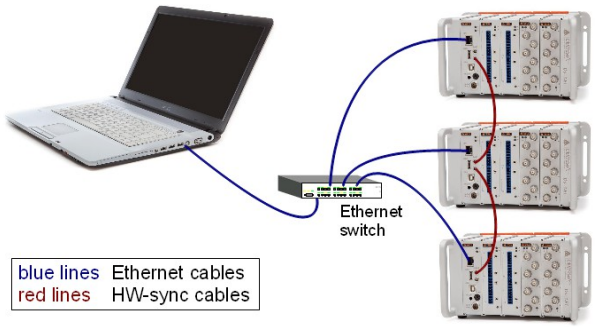



*Illustration 89: Synchronisation: HW-sync*

All slaves must be connected to the master with the synchronisation cables but the order is not important. If you take a look at Illustration 89: it does not matter which one of the systems is the master – you just have to make sure, that all units are connected.

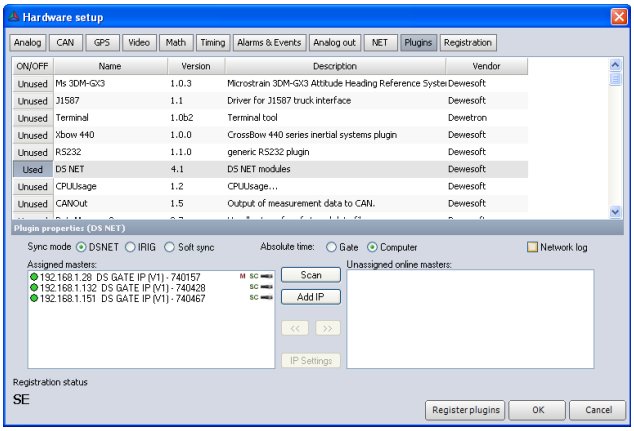



*Illustration 90: DS NET plug-in: HW-synchronisation*

In the example above we use 3 DS-NET systems that are connected via Sync-cable.
Note, that the system (IP `192.168.1.28`) marked with the red M (at the right side) in the in the list *Assigned masters* of the DS NET plugin (see 3 in Illustration 90) will be the master and all other systems will be slaves.
see also 4.2.1 Sync mode on page 56

If we now take a look at the configuration of the 2 DS NET systems in `test.commander`, we can see that:

The master DS NET system has no *Input synchronisation protocol* set…

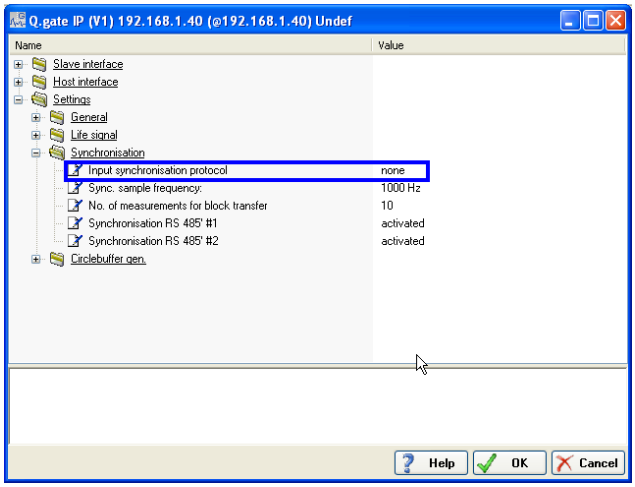



*Illustration 91: test.commander: Synchronization settings of the master*

…and the slaves have the *Input synchronisation protocol Q.sync over RS485* set

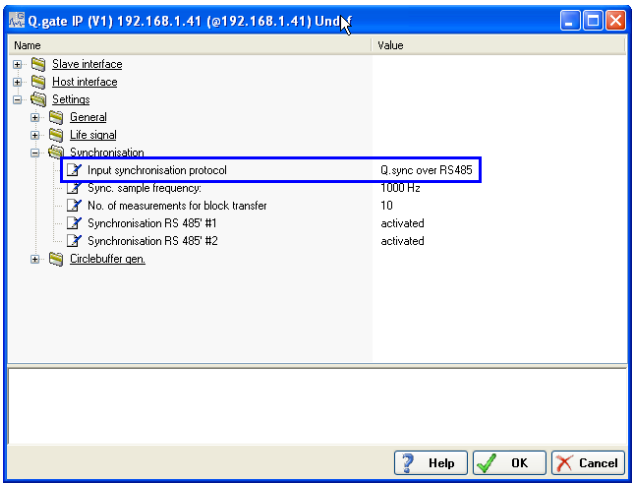



*Illustration 92: test.commander: Synchronization settings of the slave(s)*

### external IRIG

You can also use an external IRIG clock for synchronisation with external devices.

In *Hardware setup* you need to select *Sync mode* `IRIG` (see also 4.2.1.2 Sync mode: IRIG 58).

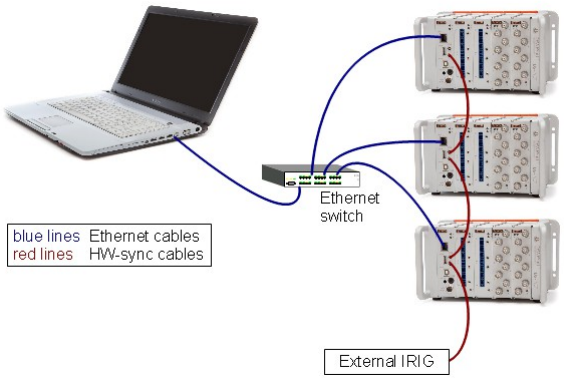



*Illustration 93: External IRIG synchronisation*

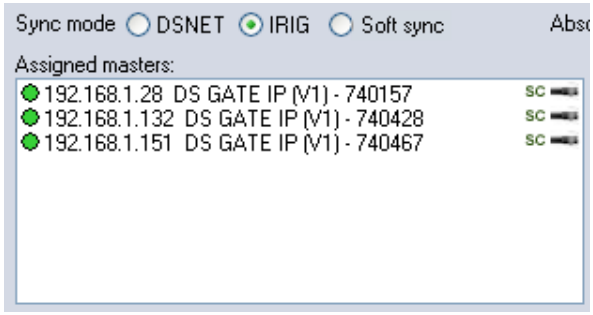



*Illustration 94: External IRIG sync: HW Setup*

## 4.1.4.5 Synchronisation combinations

You can setup any combinations of synchronisation methods, you like. DS NET will always choose the most accurate one, in this order:

- HW-sync
- GPS IRIG-B (no hardware available yet)
- GPS NMEA
- SNTP
- Internal clock

**EXAMPLE 5**

Consider 2 DS NET systems A and B: for each of them we use GPS NMEA timing (via RS232), SNTP (via Ethernet) and synchronisation cables (via hardware cables).

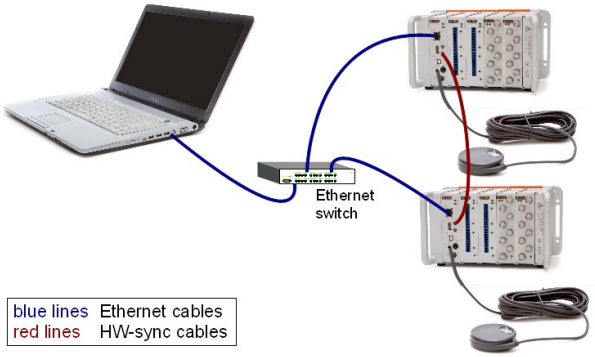



*Illustration 95: Synchronisation: 2 GPS and HW-sync*

Then we check the *HW-sync* (see 4.2.1 Sync mode) check-box of the DS-NET plug-in, so that system A will be the clock-master and system B will be the slave unit.

Since we use hardware synchronisation the relative jitter between the 2 DS NET systems will always be ±2µs.

Unit B will always receive the time-info via the synchronisation cables from unit A.

Unit A will use GPS to get the absolute time, if it is available. If GPS is not available yet (e.g. when you start your GPS up, it may take about a minute to find the satellites), but the SNTP server can be reached, SNTP will be used to get the absolute time. Later, when GPS also sends time-information, the GPS time will be used, because it is more accurate than SNTP.

If the hardware synchronisation cable between the 2 devices is manually destroyed during the measurement, both devices will fall back to GPS NMEA timing and you would still have at least the GPS NMEA accuracy.
But since this case is very unlikely, you would usually buy one GPS device and connect it to the master DS NET device.

**EXAMPLE 6**

In contrast to Example 5, we only have one GPS receiver in this case. The DS NET systems are synchronized via hardware synchronisation cables.

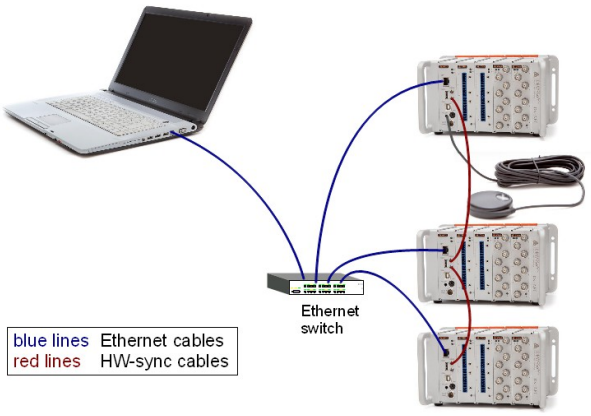



*Illustration 96: Synchronisation: GPS and HW-sync*

In this case we also have absolute time from the GPS receiver and the minimal jitter because we use hardware synchronisation. The only drawback compared with the setup in Example 5 is, that we loose the synchronisation, if one of the hardware synchronisation cables is destroyed.
In this configuration you have to make sure that the GPS receiver is connected to the master unit (see Illustration 90).

## 4.1.5 Several PCs and DS NET systems

When you want to use several PCs you need to activate the DEWESoft™ NET option in *slave mode* on each measurement PC (In Illustration 97 below every DS-NET system has a DS NET CPU module running Windows and DEWESoft™: see 2.2.2 DS-NET-CPU users manual). With one more client PC running DEWESoft™ with the NET option configuration as master measurement unit, you can connect to any of the measurement PCs, take a look at the data and even reconfigure the DEWESoft™ settings of the measurement PC.

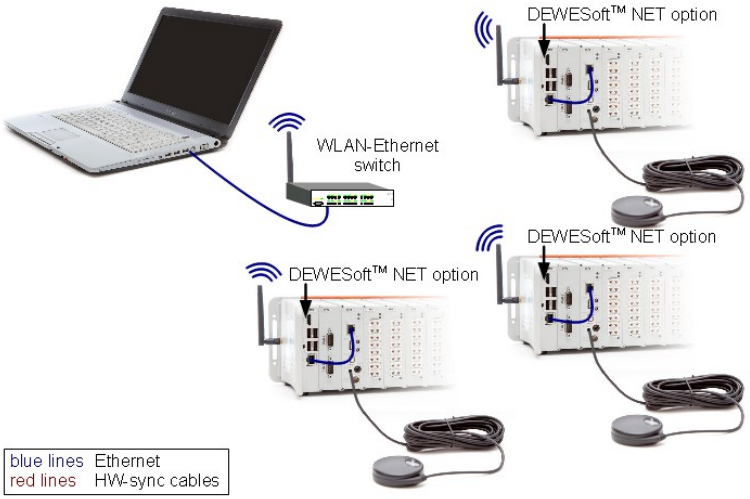



*Illustration 97: DEWESoft™ NET Option*

When you want to connect to several measurement PCs at the same time (e.g. to store the data in one file), then you need some sort of very exact synchronisation between the measurement PCs. This is very important, because since no clock is perfect the clocks of the measurement PCs would diverge over time and the data that you collect over the NET option would not be synchronous!

Please consult the DEWESoft™ online help for all *Timing* options.

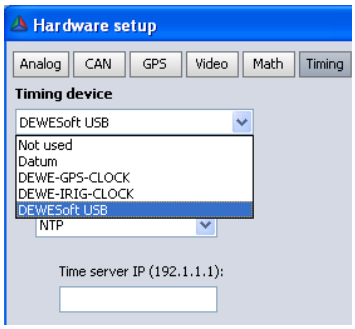



*Illustration 98: Hardware setup: Timing*

# 4.2 Hardware setup

The basic hardware setup is described in 3.4 DEWESoft™ configuration. This chapter will cover the odds and ends.

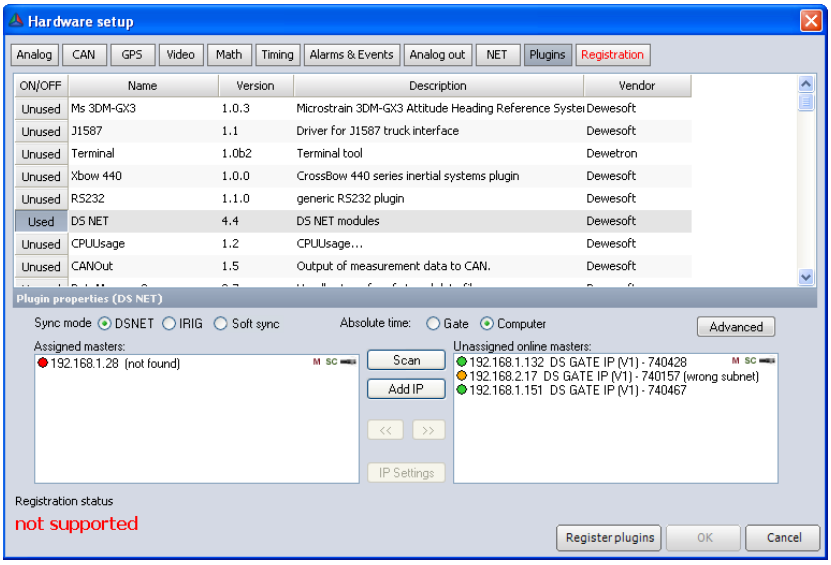



*Illustration 99: DS NET plugin: Hardware setup*

## 4.2.1 Sync mode

When it comes to synchronisation (see also 4.1 Synchronisation on page 43)there are several possible cases to consider:

When you are using an *Analog device* (in *Settings* – *Hardware Setup...* - Analog – *Analog device*), the clock of the analogue device will always be used as the master clock: no matter what you setup for the DS-NET systems.
Note: In *Ch. setup* you can see an information label that will tell you if the DS-NET is currently running as clockmaster or asynchronous device (see ❶ Illustration 123 on page 65):

The image below shows a DS-NET which is currently running as clockmaster.


*Illustration 100: DS-NET as Clockmaster*

The image below shows a DS-NET which is currently running as asynchronous device.

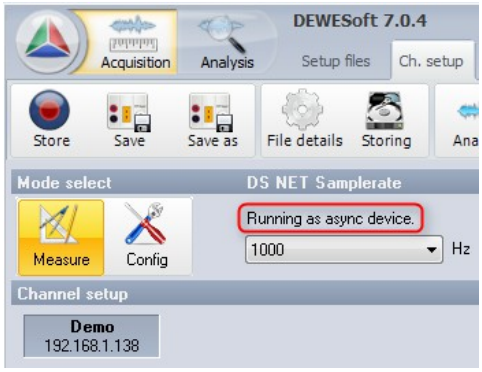



*Illustration 101: DS-NET as async device*

If no analogue device is used, then you have the *Sync mode* options *DSNET*, *IRIG* and *None* which will be explained in more detail in the following chapters.

When you right click an entry in the *Assigned masters* list, you see a pop-up menu with some more options regarding the synchronisation (depending on the *Sync mode* not all options may be enabled).

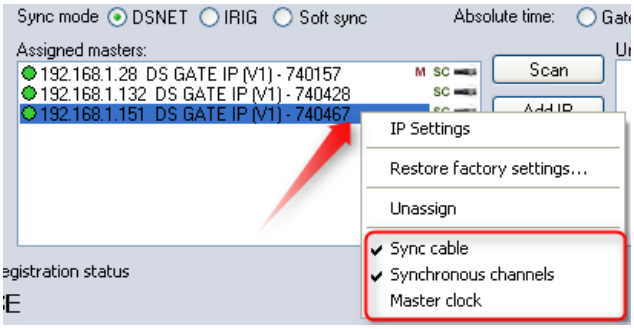



*Illustration 102: Sync mode: pop-up*

## 4.2.1.1 Sync mode: Soft sync

When you select sync mode *Soft sync*, then none of your DS-NET systems will be the clock master (see 4.1.1.3 Masterclock on page 44) and all channels will be asynchronous (see 4.1.1.5 Sync / Async channels on page 45). The DS-NET plugin will do the software synchronisation (see 4.1.2.3 Software synchronisation on page 49).

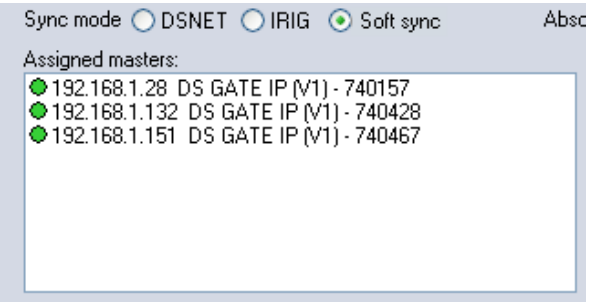



*Illustration 103: Sync mode: Soft sync*

### 4.2.1.2 Sync mode: IRIG

When you select sync mode *IRIG*, then you must connect an external IRIG source to one of your DS-NET systems and interconnect the DS-NET systems via HW-sync cables to each other. The external IRIG clock source will be the clockmaster (see 4.1.1.3 Masterclock on page 44) and the other systems are hardware synced to each other (see 4.1.2.2 Hardware synchronisationon page 48).

In this scenario you can only have one sample rate for all DS-NET systems.

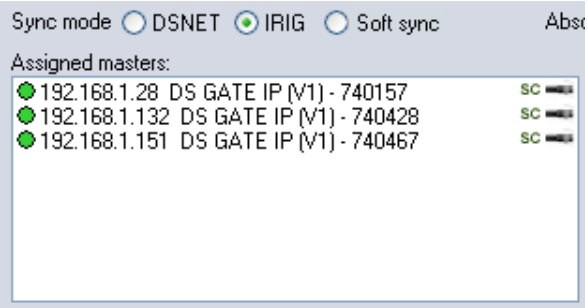



*Illustration 104: Sync mode: IRIG*

You can also deactivate the *Synchronous channels* check box (see Illustration 103) for some of the systems.

In the example below, the 3rd system is connected via hardware cable, but it uses asynchronous channels.

So you can have a sample rate different to the other 2 DS-NET systems, but since the sync cable is connected, the data will still be aligned to those of the synchronous systems.

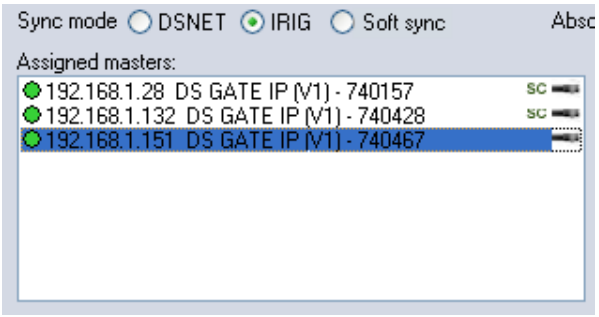



*Illustration 105: IRIG: one asynchronous DS-NET*

Yet another option would be to deactivate the *Sync cable* check box (see Illustration 103) for some of the systems.

In the example below, the 3rd system is not connected via hardware cable and thus it's channels are of course asynchronous and the DS-NET plugin will do the software synchronisation (see 4.1.2.3 Software synchronisation on page 49).

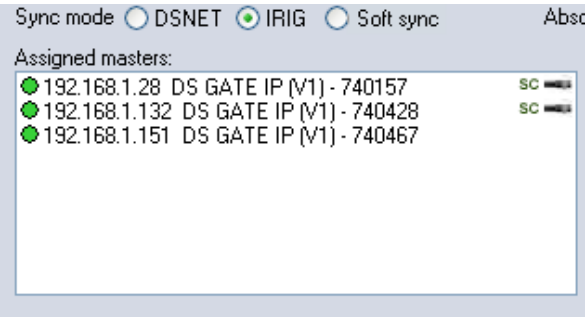



*Illustration 106: IRIG: one system without HW-sync cable*

### 4.2.1.3 Sync mode: DSNET

The sync mode DSNET is much like the sync mode IRIG with the difference that one of the DS-NET systems is the clockmaster (see 4.1.1.3 Masterclock on page 44).

You can select *Master clock* (see Illustration 103) for one of the DS-NET systems.

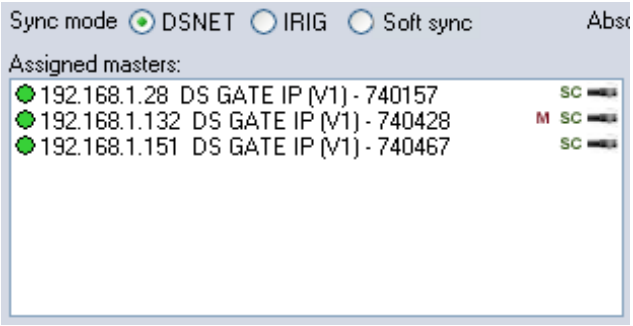



*Illustration 107: Sync mode: DSNET*

You can also deactivate the *Synchronous channels* check box (see Illustration 103) for some of the systems.

In the example below, the 3rd system is connected via hardware cable, but it uses asynchronous channels.

So you can have a sample rate different to the other 2 DS-NET systems, but since the sync cable is connected, the data will still be aligned to those of the synchronous systems.

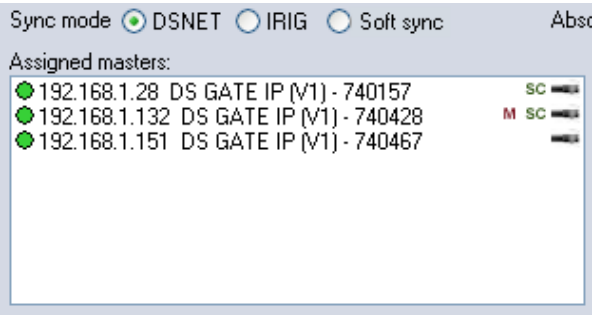



*Illustration 108: DSNET: one asynchronous DS-NET*

Yet another option would be to deactivate the *Sync cable* check box (see Illustration 103) for some of the systems.

In the example below, the 3rd system is not connected via hardware cable and thus it's channels are of course asynchronous and the DS-NET plugin will do the software synchronisation (see 4.1.2.3 Software synchronisation on page 49).

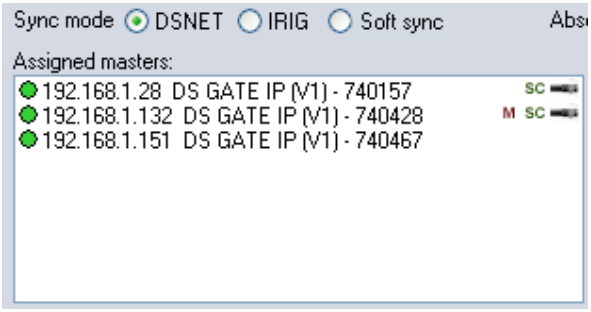



*Illustration 109: DSNET: one system without HW-sync cable*

## 4.2.2 Advanced

When you press the **Advanced** button in the hardware setup, the *Advanced Settings* dialogue (see Illustration 110) will show up.

(1) *Wait for gates at load setup for N seconds*: see 4.2.2.1 Startup wait time
(2) *Network Log*: see 4.2.2.2 Network Log
(3) *Log level*: see 4.2.2.2 Network Log

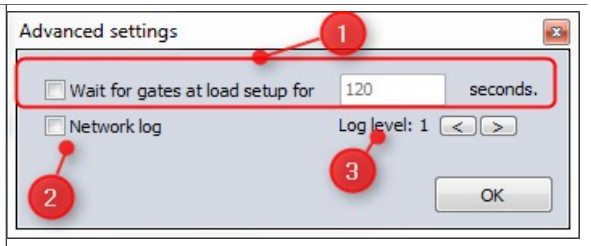



*Illustration 110: Advanced Settings*

### 4.2.2.1 Startup wait time

Usually when you load a setup, then the DS-NET plugin will try to find the DS-NET systems that are specified in hardware-setup. If the devices are not found for any reason, then the setup will be loaded anyway and the devices that have not been found will be marked erroneous.

When you activate the *Wait for gates at load setup for N seconds* check-box, then the DS-NET plugin will repeatedly try to find all DS-NET systems that are specified in hardware-setup: until either all systems are found or the specified number of seconds has expired.

| **EXAMPLE 7** | Let's assume we have a PC that starts up very fast. DEWESoft™ is configured to start up automatically when Windows is started (i.e. it is in the *Autostart* folder) and start storing right away.<br>If the DS-NET system is still booting while DEWESoft™ is already being started then the DS-NET plugin cannot find the DS-NET (because it is still booting) and the automatic storing will not work.<br>In this case you can activate the *Wait for gates at load setup for N seconds* check-box, and specify a wait time, so that the DS-NET plugin will try longer to find the DS-NET system. |
|---|---|

### 4.2.2.2 Network Log

If you activate the *Network Log* check-box, the DS-NET plugin will write log message about the network communication. The *Log level* will define how many details will be written to the log files.

#### Log level

Specifies how much data the DS-NET plugin will write to it's log files.

1. *Error Log*: **recommended default** - writes only minimal log messages (i.e. when an error occurs)
2. *Event Log*: writes more log messages than *1. Error Log*.
3. *Network Log*: writes very detailed information about the network communication
   You should only activate this temporarily when you are explicitly told to do so by our support team, because it will write excessive log-files. This may be the helpful to analyse problems with your Ethernet connection.

## 4.2.3 Device lists

As you can see in Illustration 99 the hardware setup of the DS NET plugin uses two lists to manage DS NET devices:

- *Assigned masters*: Only devices in this list will be used by DEWESoft™
- *Unassigned online masters*: devices in this list will not show up in channel setup and cannot be used for measurement

To move a device from one list to the other, use the << and >> buttons or drag and drop the list entry.

The order of the assigned DS NET devices is important, since this order will also be used in the channel setup.

| Each entry in the list consists of following parts: | 192.168.1.33 \| [Front Engine] \| DS GATE IP (V1) \| 740157 |
|---|---|
| a coloured circle, indicating the Ethernet status of the DS NET | ● see table below for explanation |
| the IP address of the DS GATE module | *192.168.133* |
| the name of the DS-GATE (if it has been set)<br>see also Renaming a DS-GATE page 66 | *Front Engine* |
| designation of the model (device type) | *DS GATE IP (V1)* |
| the serial number of the DS GATE module | *740157* |

Colour codes of the circles in the lists:

| Circle colour | Example device | Description |
|---|---|---|
| ● | 192.168.1.132 | This device is okay |
| ● | 192.168.2.17 | This device is not in the same Ethernet subnet, as the computer (the computer is set to IP address 192.168.1.220 and subnet mask 255.255.255.0 in this case) see 3.3 Ethernet connection for more details |
| ● | 192.168.1.28 | This device has been used before but is currently not online (e.g. powered off, Ethernet cable disconnected, ..) or it's IP address has been changed. Select this entry and press the >> button to remove the device. |

*Table 7: DS NET plugin: Hardware setup - Colour codes*

## 4.2.4 Identifying a device

When you double click a device in any of the lists, the LEDs of the DS GATE will start to flash very fast for a short period of time. This is very useful if you have several DS NET devices connected to your LAN.

## 4.2.5 IP settings

When you select a DS GATE in the hardware setup and press the **IP Settings** button, you will see the *IP Settings* dialogue:

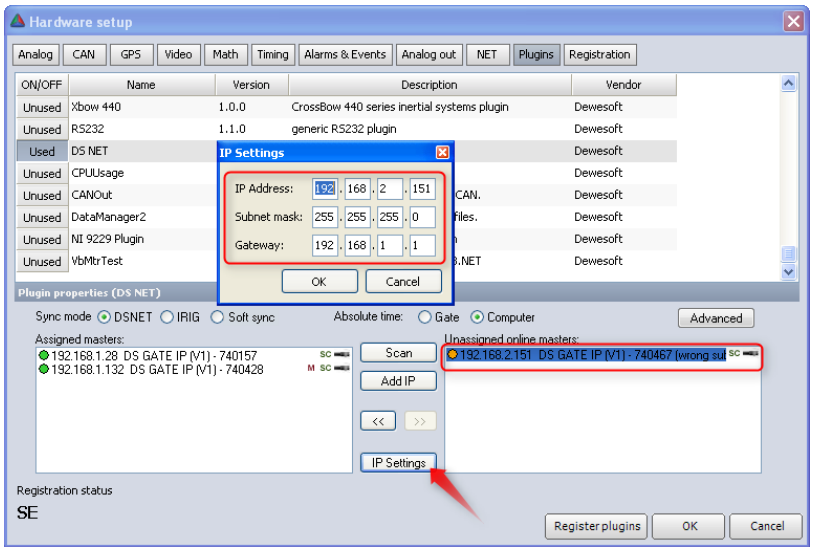



*Illustration 111: DS NET plugin: Hardware setup - IP Settings dialogue*

Now you can change the IP address to another address that belongs to the same subnet that the Ethernet connection of your PC is using:

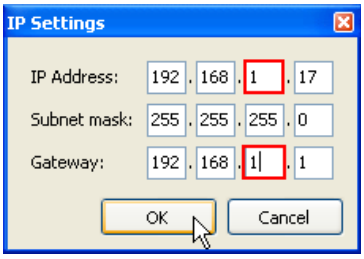



*Illustration 112: DS NET plugin: Hardware setup - Change IP settings*

When you click **OK** the new settings will be written to the DS GATE and the DS NET plugin will start a new scan for DS NET devices in the network:

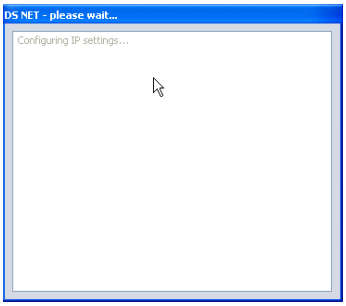



*Illustration 113: DS NET plugin: Hardware setup - Configuring IP settings...*

Now that we have changed the IP address, you will see that the colour of the circle has changed to green:

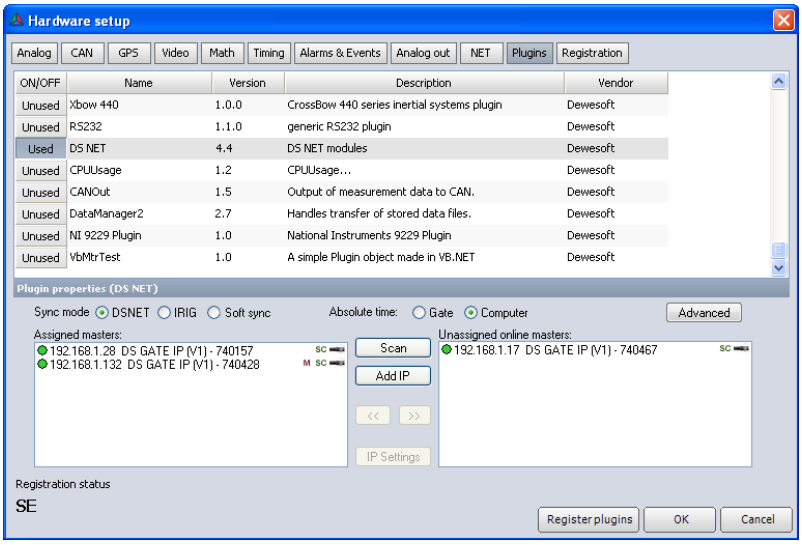



*Illustration 114: DS NET plugin: Hardware setup - corrected IP address*

## 4.2.6 Scanning for devices

When you open the hardware setup of the DS NET plugin, it will automatically scan your Ethernet for available DS NET devices.

However, if you add another device after you have opened hardware setup, you must press **Scan**, to update the list of devices.

## 4.2.7 Closing Hardware setup

When you are satisfied with your setup, press **OK**. The DS NET plugin will now read the configuration of the assigned DS NET devices. This process may take up to several minutes, dependant on the number of modules of the DS NET system.

The configuration of the assigned devices will also be read every time you start DEWESoft™.

# 4.3 Channel setup

The channel setup of the DS NET plugin has 2 modes: *measure mode* and *configuration mode*.

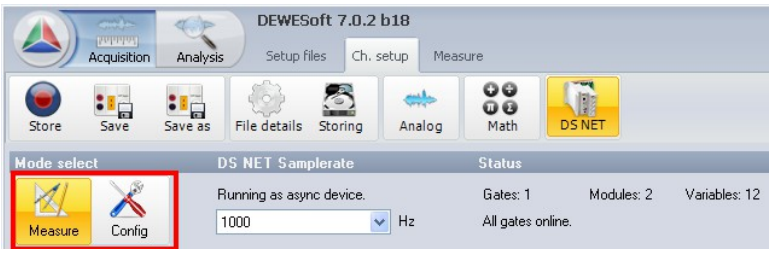



*Illustration 115: DS NET plugin: Channel setup - Mode select*

In *measure mode*, you can already see live measurement values, select channels, change some properties of the channels (name, colour) and set the scaling of channels. Most of these settings will be stored in the DEWESoft™ xml-setup file and will not be transferred to the DS NET system (so these changes are active almost instantaneously).

In *config mode*, you can change the measurement type, assign modules that are connected to the DS GATE, and set basic channel parameters. When you leave the *config mode* and switch back to *measure mode*, the changes will be transferred to the DS NET. This process may take up to several minutes, dependant on the number of modules of the DS.

## 4.3.1 Status

The *Status* message should always be *'All gates online'* (see Illustration 115 above).

All other messages mean some kind of warning.

The following warning occurs if you have enabled USB logging (see 7 Data Logger on page 163) and you have selected a sample rate that is too high for USB logging.


*Illustration 116: Warning: Fillrate too high*

The warning below may occur when you have assigned DS-GATEs in Hardware setup but these systems cannot be reached. Some possible reasons:

- the systems may not be powered on
- there could be some problem with the Ethernet connection (cables, switches, etc.)
- maybe the IP addresses of these DS-GATEs have been changed outside of this DEWESoft™ instance.

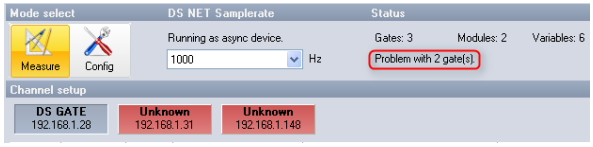



*Illustration 117: Warning: Problem with gate(s)*

The warning below may occur when you have changed the *Sync Mode* in hardware setup (see 4.2.1 Sync mode on page 56).
Just do what the warning message tells you. Click the **Config** button to enter *Config mode* and then click **Measure** to leave *Config mode*. The plugin will then set the correct clock settings on your DS-NET system/s and then the DS-NET configuration will match your changes in hardware setup.

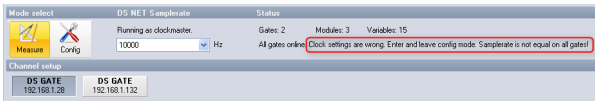



*Illustration 118: Warning: Clock settings are wrong*

The warning below may occur when there are some communication problems inside of the DS-NET system. The cause for this can be some misconfiguration, e.g.

- wrong setting for Baud rate of the internal UARTs(should be set to 12MBaud)
- wrong setting of the DIP switches for the termination resistances (see 6.2 DIP Switches on page 156)

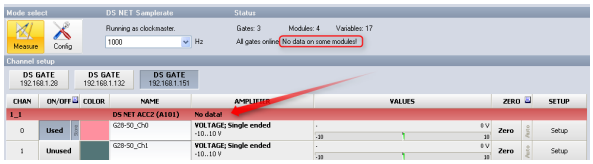



*Illustration 119: Warning: No Data*

## 4.3.2 Sample rate

One of the most important settings is the sample rate. The sample rate defines how many data points, the DS NET will transfer to DEWESoft™. So a higher sample rate also means that more data needs to be transferred via Ethernet to DEWESoft™.

Note, that the sample rate can be changed in *measure mode* and in *config mode*.

The maximum possible sample rate shown in the drop-down is dependant on the number of enabled channels: see Example 8 below.

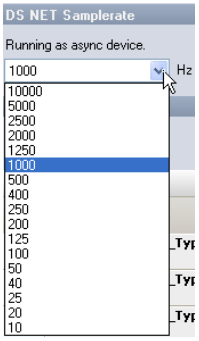



*Illustration 120: DS NET plugin: Sample Rate*

**EXAMPLE 8**

When you have a DS-NET system with 128 channels, the maximum sample rate will be 1kHz (see also Example 10 on page 98).
If you only need 16 of those channels for a measurement, you can disable all other channels in *Config Mode* (see Enabling/Disabling channels on page 71). When you then go back to measure mode, you will only see the 16 enabled channels in the setup grid and you will be able to select a higher sample rate (10kHz in this case).

If some of the measurement modules exceed their maximum sample rate, they will output the same data until the next internal sampling point. To clarify this, let's take a look at the following example:

We have a DS NET system with 2 channels:

- *Temp*: a thermocouple sensor connected to a TH8 module with enabled 50Hz filter
- *Poti*: a potentiometer connected to an ACC2 module

The sample rate that we have set is *1kHz*. When we take a look at the measurement data of both channels:

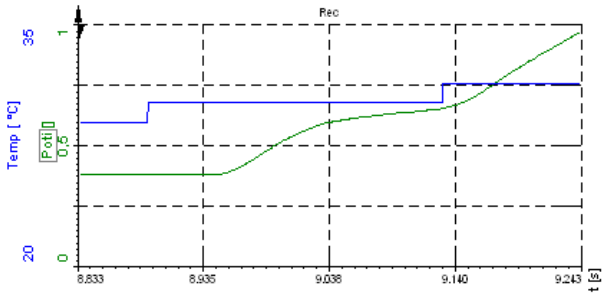



*Illustration 121: Sample Rate Example: Measured Data*

we can see that the rate, at which the *Temp* changes is very slow (about *4Hz*) and the rate of the *Poti* is very fast (the full sample rate of *1kHz*).

When we use a very high zoom level, so that we can see individual data points, we can see the same number of data points for both channels and that the slow *Temp* channel uses the same value until the next change:

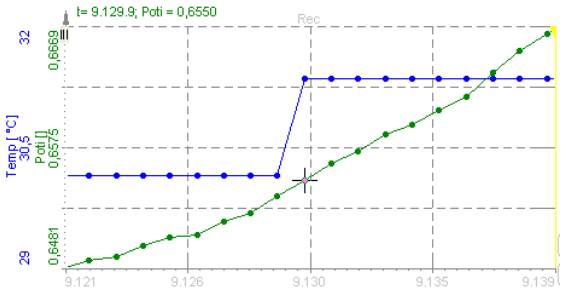



*Illustration 122: Sample Rate Example: Measured Data Points*

## 4.3.3 Measure mode

In *measurement mode* you can alter all the parameters which don't influence the real time behaviour, such as channel naming, zeroing, scaling by software and so on. Each channel can be configured by pressing the **Setup** button on the right hand side of the table.

Note, that all these settings are stored in your DEWESoft™ xml-setup file – they are not stored in the DS NET device.

| **HINT** | The only exception is the sample rate (see 4.3.2 Sample rate), which will also be written to the DS NET system immediately when you change it.<br>Actually the sample rate would belong to the configuration mode. But in order to be consistent with other DEWESoft™ setup screens and since this is one of the most important settings, it is also available in *measure mode*. |
|---|---|

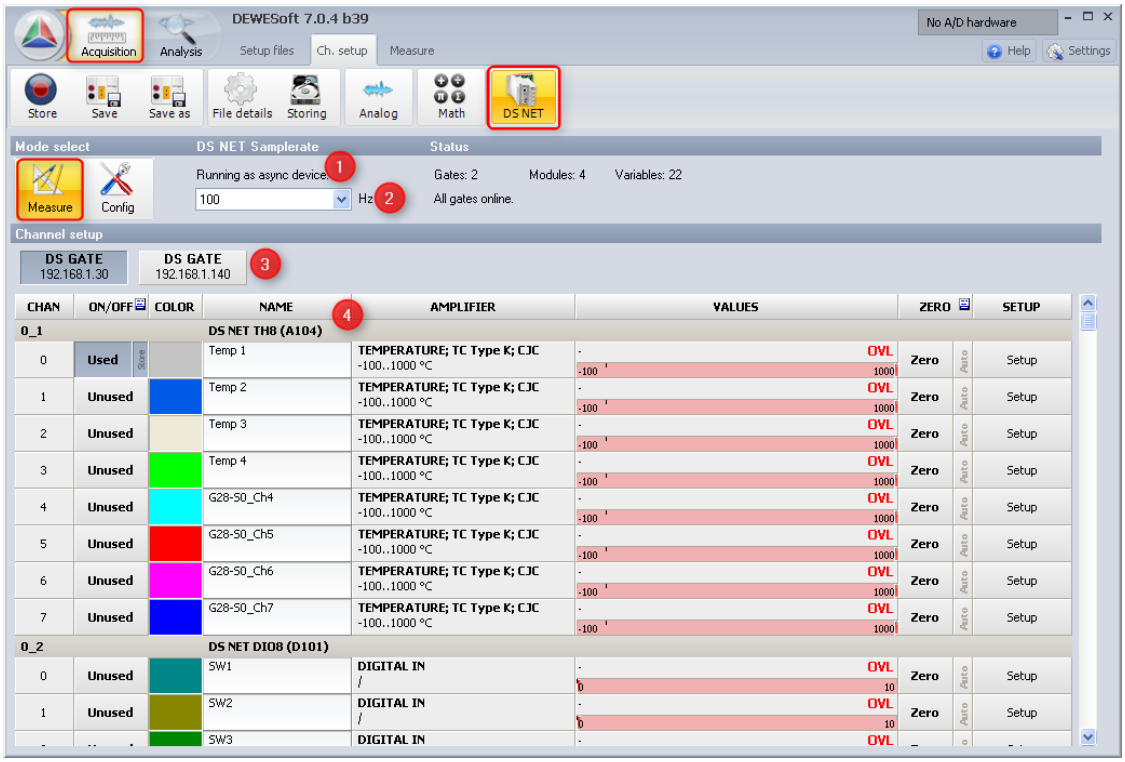



*Illustration 123: Measure mode screen*

❶ This information label will inform you if the device is running in async mode or in synch mode: see 4.2.1 Sync mode on page 56

❷ You can change the sample rate of the current device with this drop down box: see 4.3.2 Sample rate on page 64

❸ For DS-NET that you have activated in the *Hardware setup* (see 4.2 Hardware setup on page 56) a button will show up here. When you right-click the button you can access the DS GATE pop-up menu (see 4.3.3.1 DS GATE pop-up menu below)

❹ The setup channel grid will show all enabled channels (see Enabling/Disabling channels on page 71) of the currently selected DS-NET.

### 4.3.3.1 DS GATE pop-up menu

When you right click a **DS GATE** button (see ❸ in Illustration 123) in *measure mode* , you can select following items from the DS GATE pop-up menu:

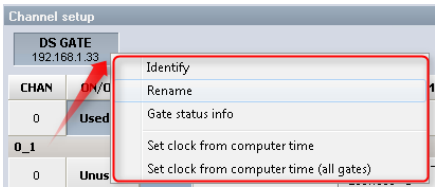
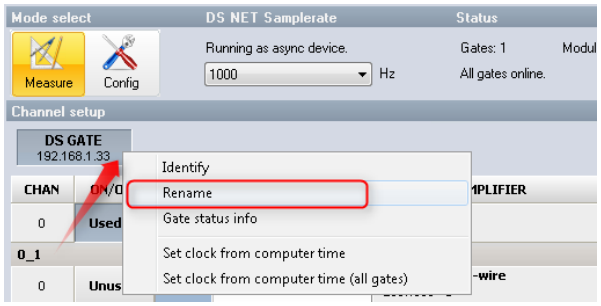
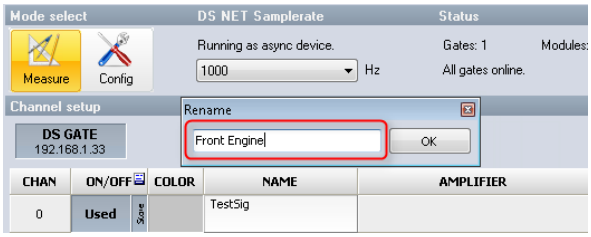


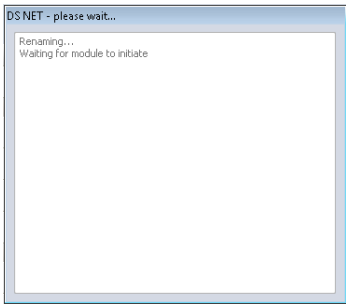
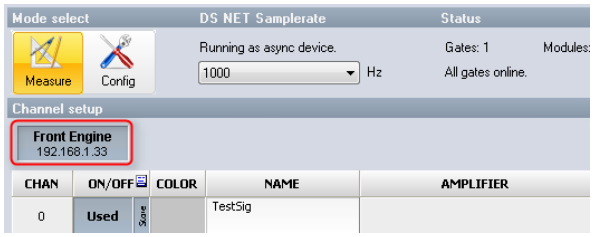

*Illustration 124: DS GATE pop-up menu*

- *Identify*: when selected, the LEDs of the DS-GATE module will blink for a short period of time. This can be very useful when you are working with several DS-NET systems.
- *Rename*: allows you to assign an arbitrary meaningful name to the DS-GATE: see Renaming a DS-GATE below
- *Gate status info*: shows you some status/error information of the DS-NET system. This can give you very useful information if the error LED of the DS-GATE is active.
- *Set clock from computer time*: when selected, the time of the currently selected DS-GATE will be set to the computer time: see 4.1.1.6 Absolute time on page 47
- *Set clock from computer time (all gates)*: same as above, but for all active DS-GATEs

#### Renaming a DS-GATE

Renaming DS-GATEs is a really nice feature, when you have several DS-GATEs. It makes it much easier to identify the device as only by the IP address.

| Right-click on any of your DS-NET devices in channel setup and select *Rename* from the pop-up menu: | In the *Rename* dialogue enter a meaningful name for the DS-GATE: |
|---|---|
|  |  |
| *Illustration 125: Pop-up menu: Rename* | *Illustration 126: Rename dialogue* |

| | |
|---|---|
| Wait until the new name is written to the DS-GATE... | and finally you can see that the DS-GATE is now identified by the new name. |
|  *Illustration 127: Rename: Wait dialogue* |  *Illustration 128: Renamed DS-GATE* |

The name will also show up in the device lists of the hardware setup: see 4.2.3 Device lists on page 60.

## 4.3.3.2 Channel names

When you change a channel name in measure mode, the name will only be used only by DEWESoft™: i.e. the name will not be changed in the DS NET system automatically. But when you switch to the *config mode* after changing channel names, in the measure mode, the names will also be shown in *config mode*, and when you leave the *config mode*, all the configuration settings (including the new channel names) will be transferred to the DS NET system.

### Automatic renaming

This is a special feature regarding channel names.

When the channel names in the DS NET system are called *Variable 1*, *Variable 2*, etc. and you connect this DS NET system to DEWESoft™ for the first time, the channels will be renamed automatically.

For example take a look at Illustration 129: on the left side, you see the channel names that have been setup in test.commander: *Variable 1*, *Variable 2*, etc.

When you connect this device to DEWESoft™ for the first time, you can see that the channels have been renamed. e.g. the very first channel is now called: *G154-S0_Ch0*.

*154* is the last part of the DS NET IP, *S0* refers to the modules address (as defined by the DIP switches: see 6.2.1 Setting the address) and *Ch0* refers to the channel number inside of the module.

With this naming convention all channels now have unique names.

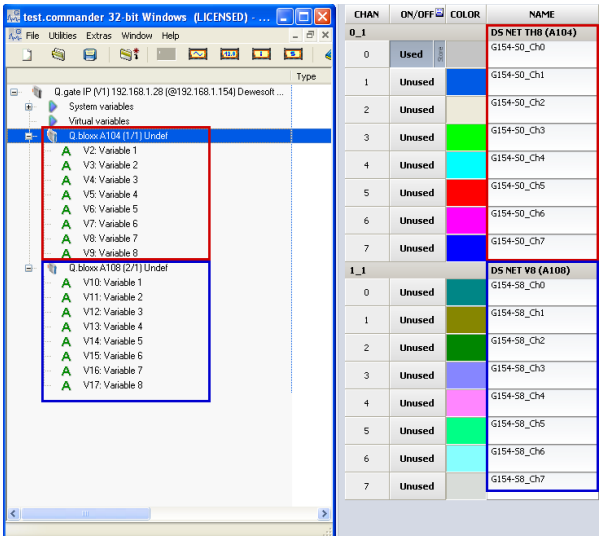


*Illustration 129: Automatic channel renaming*

## 4.3.3.3 Channel setup

In the channel setup you can setup the *Channel name*, *Units* of measurement, *Color*, *min value*, *max value*, …

The min/max value can be taken either from the measurement range of the module (*Auto*) or can be set manually. If we reduce the range manually, this will not strip the measured values, but simply define the default limits for visualization, the data will still be measured also beyond those ranges.
Note: when you now go to the measurement screen and assign this channel to a display component, it will automatically use these min/max values.

There are several ways to perform the scaling. The first option is *Scaling by function*, where we can enter the *Scale* factor or *Sensitivity*, which is usually defined for sensors. The different sections in the *Dewesoft 7 tutorials* (see 2.2.3 DEWESoft™ tutorials on page 8) provide an insight view how to set the scaling (e.g. read section *2.5 Strain measurement*).

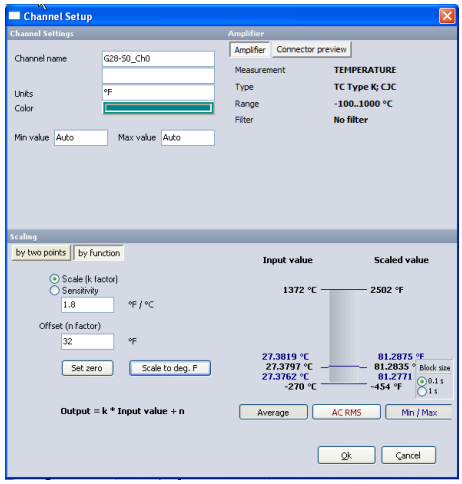



*Illustration 130: DS NET plugin: Measure Mode - Channel Setup*

The second option is to calibrate the measurement using real time values.
Let's say, you want to measure the force: enter *N* in the Units section, press **by two points** in the *Scaling* section, remove all the loads that might be attached to your sensor, press *Calibrate* **from average** for the first point. This will remove the offset. Next we can apply a known load of e.g. 50 N, enter the 50 N as the second point reference and press *Calibrate* **from average** for the second point. This will measure the value of the applied load and calculate the appropriate scaling factor.

The **Connector preview** button, has the same features as in the *Config mode* (see Channel configuration setup on page 72), except that the selected connector is not stored when you change it (in *Config mode* it will be stored); i.e. when you close the dialogue and open it again, your change will be lost.

When you have finished configuring the channel, you can leave the setup dialog by pressing the **Ok** button.

## 4.3.3.4 Zeroing

If a measurement is performed which requires zeroing (typically strain measurements), we can do that for each channel separately. Simply press the **Zero** button for the channel (to undo the zeroing press the button again with the right mouse button):

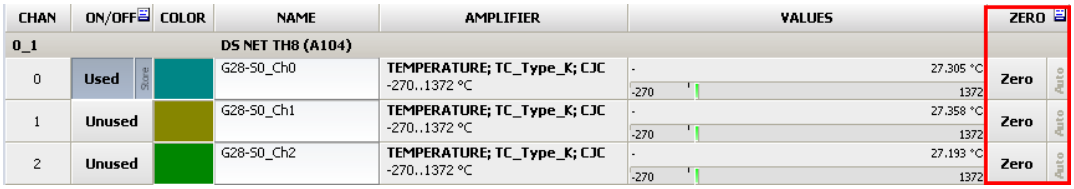



*Illustration 131: DS NET plugin: Measure Mode - Zeroing*

Additionally you can zero groups of channels by pressing the small vertical **Auto** button (at the right side of the the **Zero** button) and then select *Zero all Auto channels* from the drop-down of the *ZERO* column header:

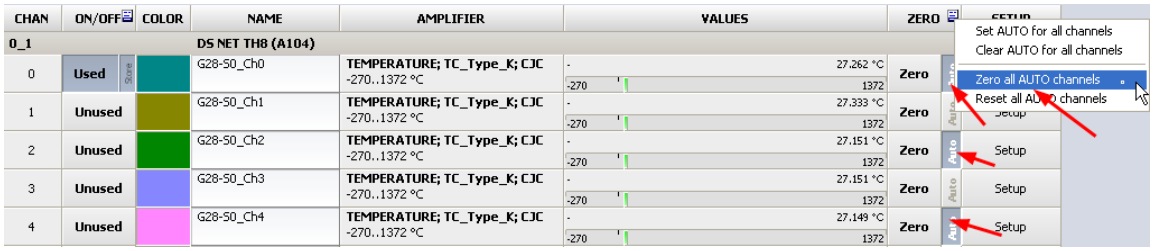



*Illustration 132: DS NET plugin: Measure Mode - Auto Zeroing*

or you can press the **Zero** button in *Measure mode*.


*Illustration 133: Measure mode: Auto zero*

## 4.3.4 Config mode

The configuration mode is used to reprogram the number of channels, setup of the channel itself, in short, all the properties which influence the modules and the way how they acquire the data.

All these settings will be stored in the DS GATE module and in the measurement modules respectively.

When you switch from *Measure mode* to *Config mode*, the modules will be put into a special configuration state. This process may take up to several minutes, dependant on the number of modules of the DS NET system. During this time, you will see a pop up dialog:

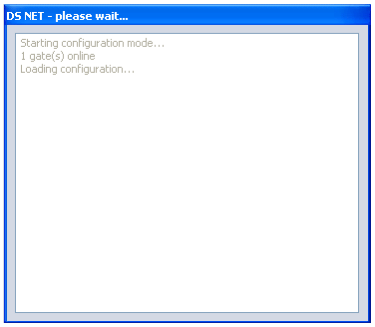



*Illustration 134: DS NET plugin: Switching to Config mode*

## 4.3.4.1 Module configuration screen

When the configuration has been read, you will see the module configuration screen:

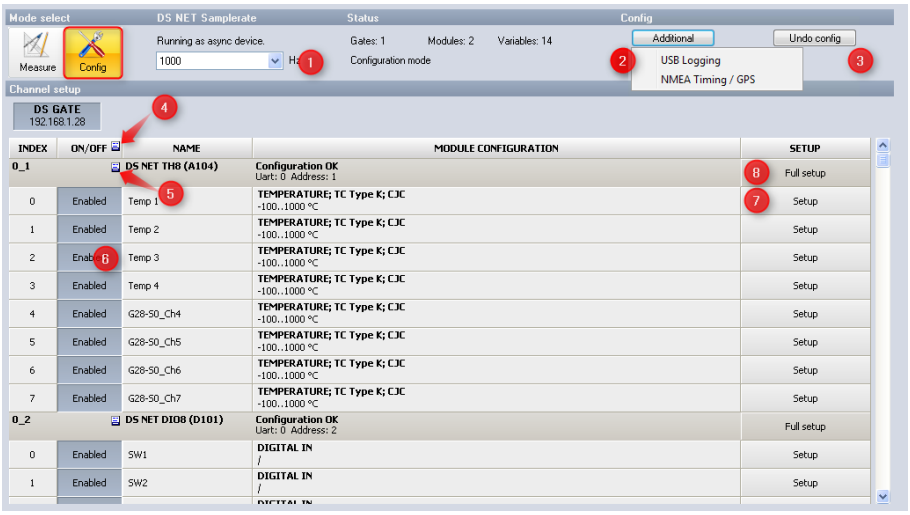



*Illustration 135: DS NET plugin: Config Mode*

❶ This drop-down allows you to change the sample rate: see 4.3.2 Sample rate on page 64

❷ When you press the **Additional** button, you see 2 more options:
*USB logging*: Click this item to enable/disable USB logging (for all connected DS-NET systems): see also 7 Data Logger on page 163
*GPS*: click this item to enable/disable NMEA timing (see 4.1.4.3 NMEA-0183 on page 51) and GPS (see GPS on page 75)

❸ When you press the **Undo config** button, all your configuration changes (that you have made since you have entered the *Config mode*) will be lost and the plugin will switch back to *Measure mode*.
Note: Resolved configuration issues (see 4.3.4.2 Resolving configuration issues on page 76) , cannot be undone.

❹ When you click on the header cell of the *ON/OFF* column, you can enable/disable all channels of the DS-NET system at once.
The number of enabled channels will also affect the maximum possible sample rate: see 4.3.2 Sample rate on page 64

❺ When you click on the module-header cell of the *ON/OFF* column, you can enable/disable all channels of the module at once.
see also Enabling/Disabling channels below

❻ When you click on the **Enabled/Disabled** button in the *ON/OFF* column of a channel, you can enable/disable this single channel.
The number of enabled channels will also affect the maximum possible sample rate: see 4.3.2 Sample rate on page 64

❼ When you click the **Setup** button of a single channel, a setup dialog for the channel will be opened. The dialog is different for each kind of measurement module: see Channel configuration setup below.

❽ When you press the **Full setup** button in the module-header of the *SETUP* column, the program *ICP100* will be opened, where you can do all required settings for the module. For the vast majority of measurement and configuration settings, this is not necessary – use the DEWESoft™ internal setup (see ❼ above).
However, if you have special requirements (e.g. calculations in the DS-NET module), then *ICP100* will give you access to all available options.

**HINT**

If your DS NET system has several similar modules (e.g. 4 TH8 modules), you can set up the first one and then copy and paste the settings to the other modules:

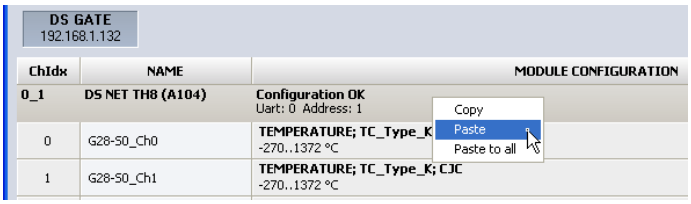



*Illustration 136: Copy & paste module settings*

Right click on the first module that you have already set up correctly and then select `Copy`.
Now right click on a module that should receive these settings and select *Paste* from the pop up menu. This will copy all the module hardware properties and settings.
If you want to copy the settings to all other modules of the same type, select *Paste to all*.

When you have setup all your channels and you switch back from *Config mode* to *Measure mode*, all the settings will be written to the DS NET system. This process may take up to several minutes, dependant on the number of modules of the DS NET system.

## Enabling/Disabling channels

You can enable/disable channels in the *ON/OFF* column of the configuration mode (see Module configuration screen above). This will have following consequences:

- disabled channels will not show up in Measure mode (see 4.3.3 Measure mode on page 65)
- the number of enabled channels will affect the max. possible sample rate: see 4.3.2 Sample rate on page 64
- all enabled channels will be stored in the USB datafiles (see 7 Data Logger on page 163)

## Channel configuration setup

The dialogue is different for each kind of measurement module. But the basic function and controls are the same for different modules.

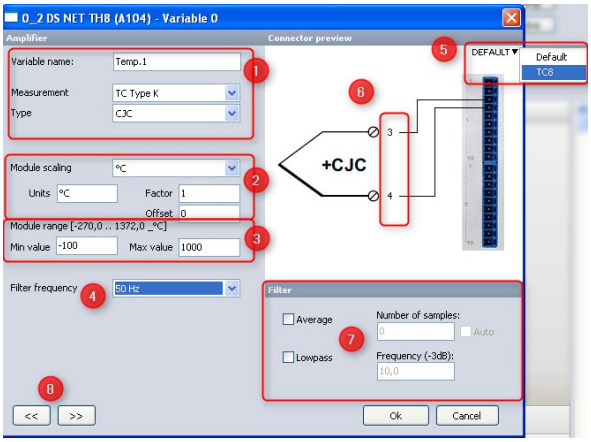



*Illustration 137: Channel configuration setup*

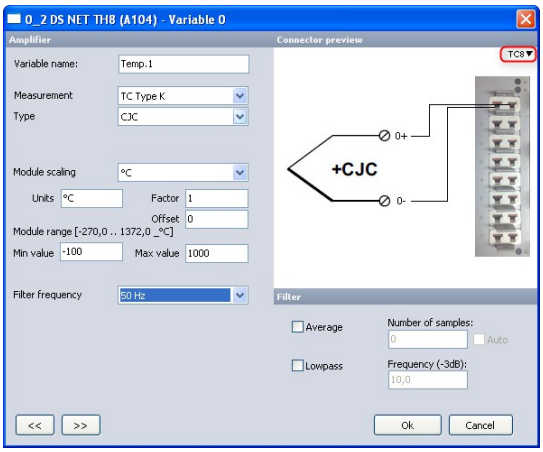



*Illustration 138: Alternative connector example (TH8 thermocouple)*

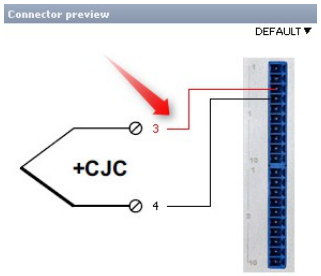



*Illustration 139: Highlight connection*

❶ Basic settings for each module-
The *Variable name* (aka. *Channel name*) is an arbitrary name to identify the channel. see also 4.3.3.2 Channel names on page 67.
The *Measurement* and *Type* drop-downs are related to each other and are different depending on the measurement module type (see also 5.2.2 Measurement Modules on page 89)
e.g. a DS NET V8 module can only measure voltages(and current via shunt, a DS NET TH8 module can measure temperature and has *Types CJC* and *Diff. TC* (see 5.12.3 TH8: Thermocouple on page 129).

❷ *Module scaling*: you can either choose a predefined scaling from the *Module scaling* drop-down box (different values, depending on the module type), or enter the *Unit*, *Factor* and *Offset* manually.

❸ The module range fields let you enter the module minimum and maximum range. see Module Range/Range Error below

❹ Optional settings dependant on the modules: e.g. the *Filter frequency* for a DS NET TH8 module will affect all channels of the module.

❺ Some modules have different connectors: e.g. the TH8 module comes with 2 different connectors: the default 10-pin screw connectors (DS NET TH8) and the optional thermocouple connectors (DS NET TH8-C): see Illustration 138 above
Note: when you select a different connector type in *Config mode*, it will be saved in the DS-GATE

❻ When you move the mouse cursor over a pin, the current wire will change it's colour to red, to make it easier to identify the driver: see Illustration 139 above

❼ Allows you to activate filters for the channel

❽ Use these buttons to go to the previous (<<) or next channel (>>) in the channel list

## Module Range/Range Error

The module range m*in value* and m*ax value* settings of a channel configuration is very important and should be considered carefully.

**HINT**

Do not confuse the *module range* min/max value with the DEWESoft™ min/max value of the channel!
Compare Illustration 141 and Illustration 140 below. The following examples will explain the difference in more detail.

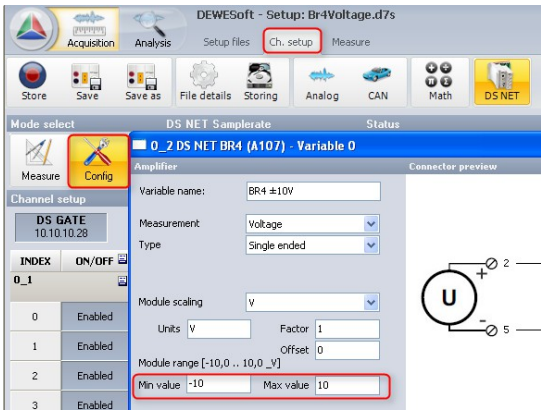



*Illustration 140: Module range min/max values*

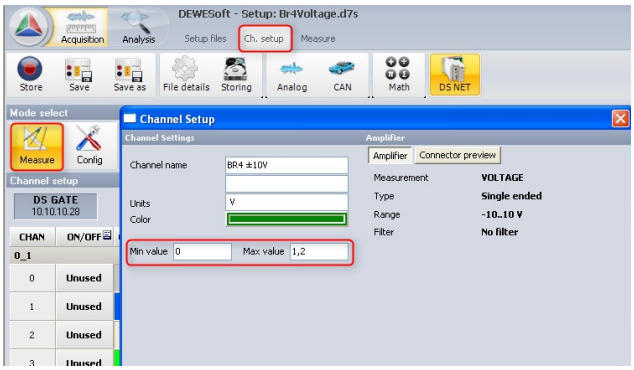



*Illustration 141: DEWESoft™ min/max values*

The most important function of these values is to set the measurement range of the channel. For example, the DS NET BR4 module has 3 different ranges for voltage measurement: `±10 V`, `±1 V` and `±100 mV`.

When you want to measure very low voltage signals, you should set the lowest module range: in this case *min value* `-100mV` *max value* `+100mV`. This will give you the most accurate results when measuring these low voltages.

In Illustration 142 you can see the same signal of about `55mV` on 2 channels of the same BR4 module.
The red channel named *BR4 ±100mV* has been setup with the module range `-100mV` to `+100mV` and gives very precise values.
The green channel named *BR4 ±10V* has been setup with the module range `-10V` to `+10V` and gives less accurate values for such a low voltage signal.

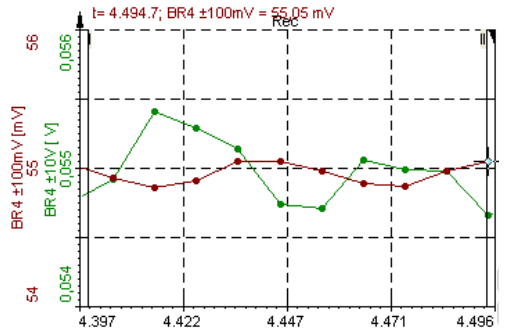



*Illustration 142: BR4: 55mV signal*

Beware, that you will lose the signal information, if your signal goes out of the module range that you have specified, during measurement – the channel cannot measure signals that are out of the specified range and will thus send the module range's *max value* to DEWESoft™ (`+100mV` in this case).

Illustration 143 shows what happens in our example when we apply a voltage of about `1.5V` to the module:
The green channel named *BR4 ±10V* which has been setup with the module range `-10V` to `+10V` still gives us the correct value.
But the red channel named *BR4 ±100mV* (which has been setup with the module range `-100mV` to `+100mV`) cannot handle this high signal, because it is out of it's measurement range, so it can only display the highest possible value (`+100mV` in this example) and since the signal is out of range, an error LED of the module will be switched ON (see explanation below).

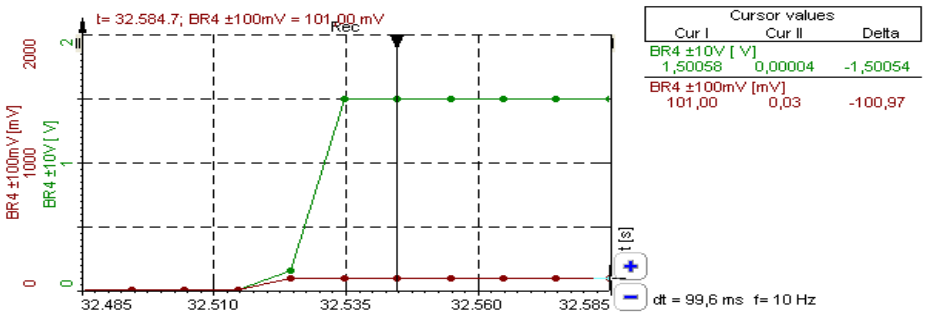



*Illustration 143: BR4: 1.5V signal*

Another important function that is related to these module range min/max values is the *Range Error* check function which is *ON* per default for all channels. This function is very useful to detect a broken sensor connection or an out-of-range condition.

Note: Even when you deactivate a channel (in *Config Mode*), the range error LED function for the channel is still enabled – this is because you could still use a deactivated channel inside the module for calculations. If you really want to disable this function, you can do so in `ICP 100` when you click on the *Range/Error* column of the channel.

Typically each measurement module has 1 error LED per connector: e.g. the DS NET TH8 module has 2 (blue) 10-pin connectors and 2 (red) error LEDs: B, C (compare to Illustration 169: Module LEDs on page 92). If **any** of the channels of a connector has a range error, the corresponding (red) error LED will be switched ON.

For the BR4 example above (see Illustration 143), this means, that (if the 2 channels *BR4 ±100mV* and *BR4 ±10V* are connected to the first connector of the BR4 module), the error LED B (see Illustration 169: Module LEDs on page 92) will be ON, because the channel *BR4 ±100mV* is out of range.

Now let's elaborate on this example to see how the module range min/max values relate tot he DEWESoft™ min/max values:.

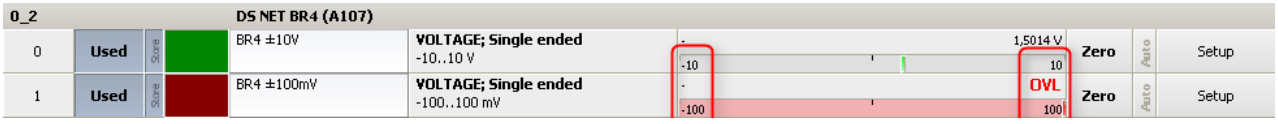



*Illustration 144: BR4 1.5V measure mode*

When we do not change any settings, we can see that the DEWESoft™ min/max values (see 4.3.3.3 Channel setup no page 68) are the same as the module range min value/max value of the channel (see ❸ in Channel configuration setup above).

The green channel *BR4 ±10V* has a DEWESoft™ min value of `-10V` and a DEWESoft™ max value of `10V` and shows the correct voltage.
The red channel *BR4 ±100mV* has a DEWESoft™ min value of `-100mV` and a DEWESoft™ max value of `+100mV` and the signal is out of it's DEWESoft™ measurement range. You can see this immediately in the setup screen, because the value-bar of this channel is red and instead of the signal value, you can see the red term *OVL* (for overflow).

Now, let's change the DEWESoft™ min/max values of the channels (click the **Setup** button in measure mode).
For the green channel *BR4 ±10V* we set DEWESoft™ min to `0V` and max to `1.2V`.
For the red channel *BR4 ±100mV* we set DEWESoft™ min to `-200mV` and max to `200mV`.

In *Ch. Setup* (see Illustration 145) we can now see that the green channel *BR4 ±10V* shows an overflow. And the the red channel *BR4 ±100mV* doesn't.

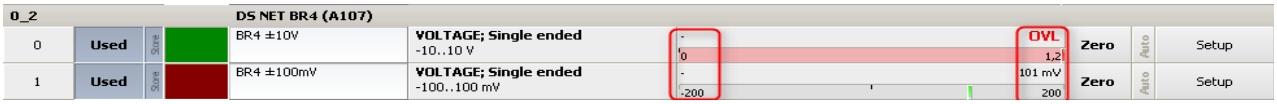



*Illustration 145: BR4 1.5V signal: measure mode range*

When we switch to the DEWESoft™ Measurement screen (Illustration 146), we can see that the green channel *BR4 ±10V* still shows the correct value (although it shows OVL in *Ch. Setup*) and the red channel *BR4 ±100mV* still shows the max. range value of *+100mV*.(although we have set a DEWESoft™ range of *±200mV*).

This clearly shows that the DEWESoft™ min/max value settings can neither increase nor decrease the maximum module range that we have setup in Config mode. It is just a convenience setting for a quick overflow check in the channel setup grid and nowhere else (also not in the measure screens: see Illustration 146).

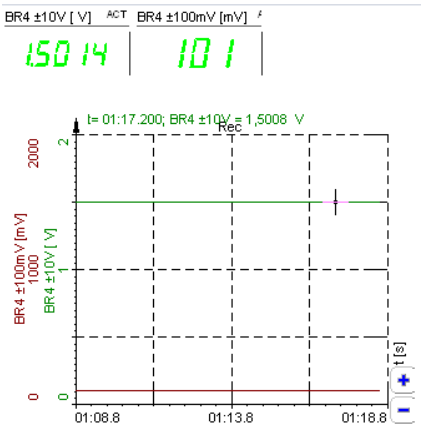



*Illustration 146: BR4 1.5V signal: Measure screen*

## GPS

When you click on the **Additional** button (in config mode of the channel setup), you can enable/disable NMEA timing (see 4.1.4.3 NMEA-0183 on page 51) and GPS information:

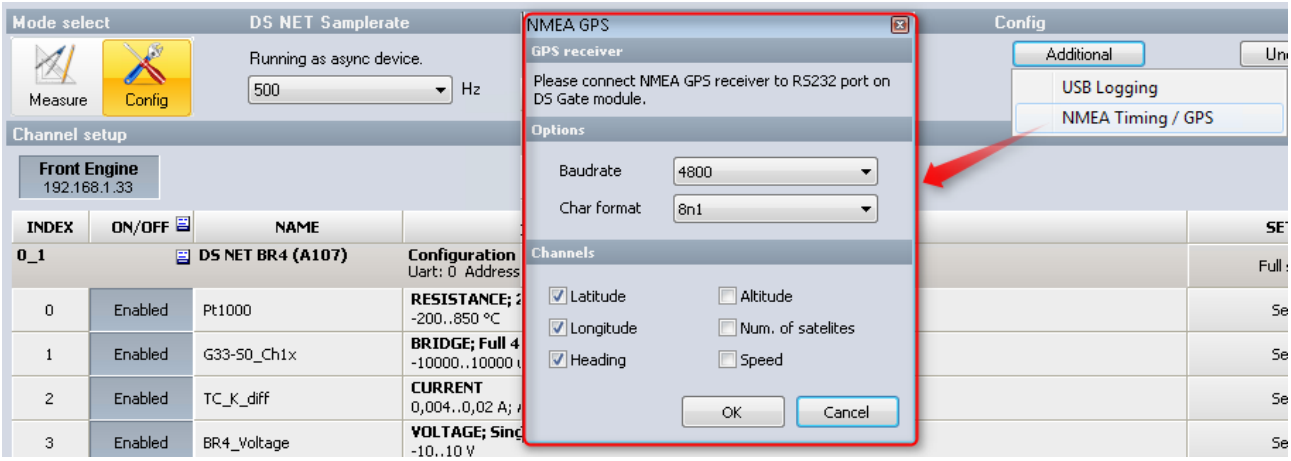



*Illustration 147: GPS activation*

To use this function you must connect your NMEA-0183 compatible device to the RS232 connector of the DS NET and configure the correct parameters (*Baudrate*, *Char Format*) for the serial communication.
Please consult the manual of your NMEA-0183 device to get these parameters.

When GPS information is not available (e.g. you have a DCF77 receiver connected) or you only need NMEA timing, then you can deselect the check-boxes of all channels. Otherwise choose the GPS channels that you want to use.

When you switch back to *Measure mode*, you can see all selected channels in the channel list:

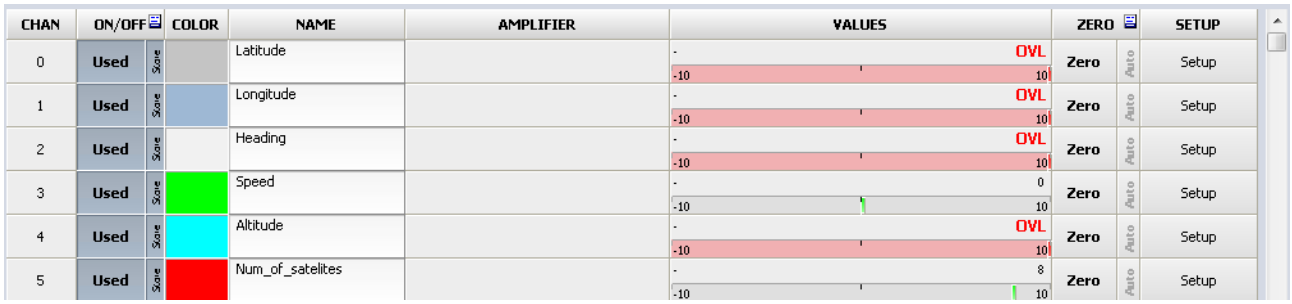



*Illustration 148: GPS channels*

## 4.3.4.2 Resolving configuration issues

There are cases where the modules have configuration issues, which will be described in this section.

If there are any configuration issues, you will see an **Auto resolve** button in the *Configuration Mode* of the DS NET plugin (Illustration 149). The quick way to fix all the issues is to simply click this button and let the plugin do all the work automatically: see the following paragraph Auto resolve, which will also cover the alternative way to resolve the issues step by step.

### Auto resolve

If there are any configuration issues, you will see an **Auto resolve** button in the *Configuration Mode* of the DS NET plugin:

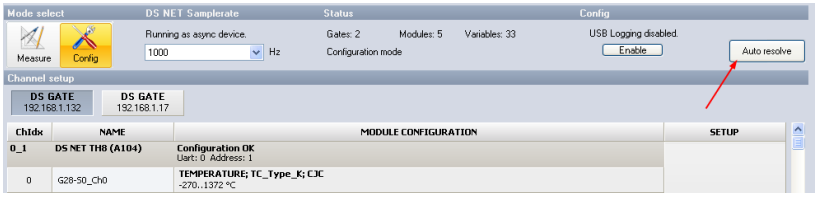



*Illustration 149: DS NET plugin: Auto resolve*

When you press **Auto resolve**, the DS NET plugin tries to resolve configuration issues automatically. A pop up dialog will be displayed until it has finished:

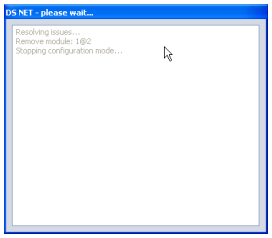



*Illustration 150: DS NET plugin: Auto resolve in progress*

## Adding a new module

After you have extended your existing DS NET system (see 6.8 Adding a new module), you need to go to *Configuration Mode*:

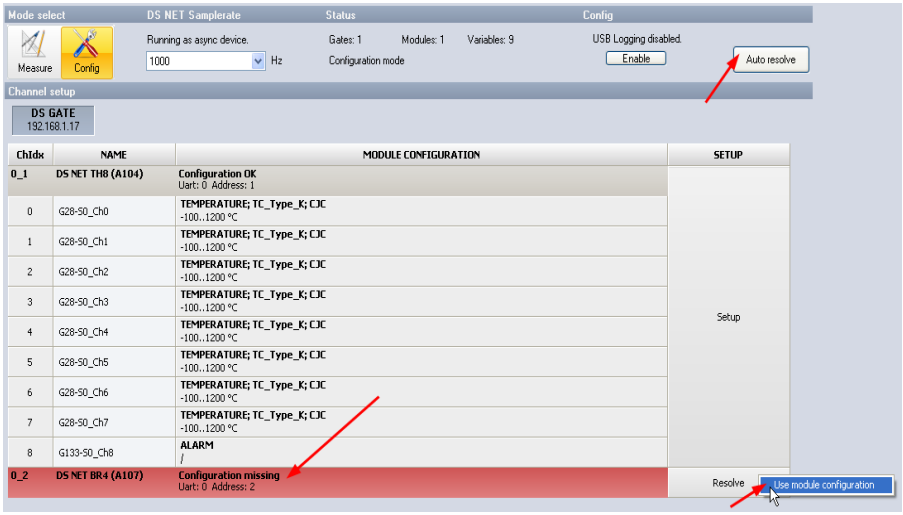



*Illustration 151: DS NET plugin: Config Mode after adding a new module*

You can see that:

- the **Auto resolve** button (see paragraph Auto resolve above) is visible in this case
- the new module (DS NET BR4) has been found, but that it does not have any configuration yet
- the new module does not have a **Setup** button, but a **Resolve** button instead

When you click the **Resolve** button, a pop-up menu will appear and you can click **Use module configuration** to start resolving the configuration issue. When this step has succeeded, we need to restart the module:

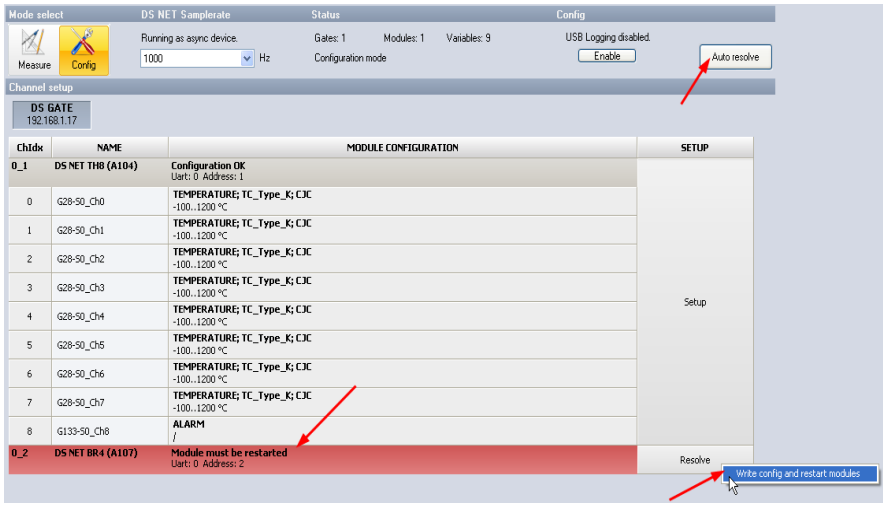



*Illustration 152: DS NET plugin: Config Mode: restart new module*

Click the **Resolve** button again and in the pop-up menu click **Write config and restart modules**.

Now the module is configured correctly, the resolve-buttons are gone and can be used for measurement.

## Replacing a module

After you have physically replaced a module (see 6.10 Replacing a module), you will see that the configuration of the new module is now incompatible with the existing configuration:

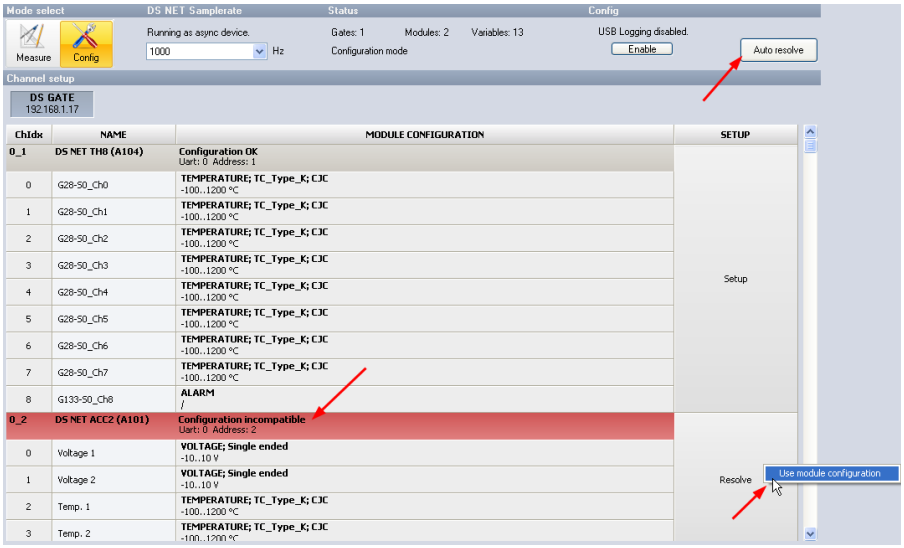



*Illustration 153: DS NET plugin: Config Mode after replacing a module*

In this example we have exchanged a DS NET TH8 with a DS NET ACC2 module.

You can see that:

- the **Auto resolve** button (see paragraph Auto resolve above) is visible in this case
- the new module (DS NET ACC2) has been found, but that its configuration is incompatible to the existing one
- the new module does not have a **Setup** button, but a **Resolve** button instead

When you click the **Resolve** button, a pop-up menu will appear and you can click **Use module configuration** to start resolving the configuration issue. When this step has succeeded, we need to restart the module:

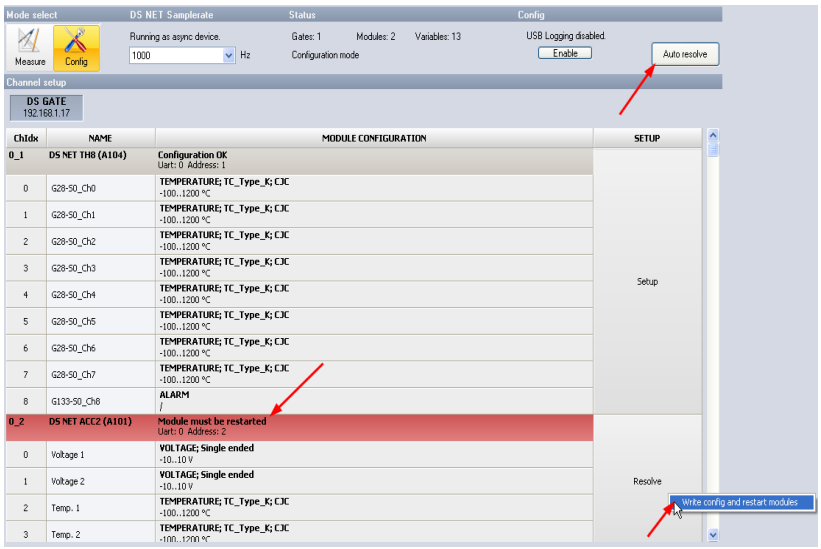



*Illustration 154: DS NET plugin: restart module after replacing a module*

Now the module is configured correctly, the resolve-buttons are gone and the new module can be used for measurement.

## Removing a module

After you have physically removed a module (6.7 Insert/remove a module), you will see that the configuration of the module is still there, but of course the module cannot be found:

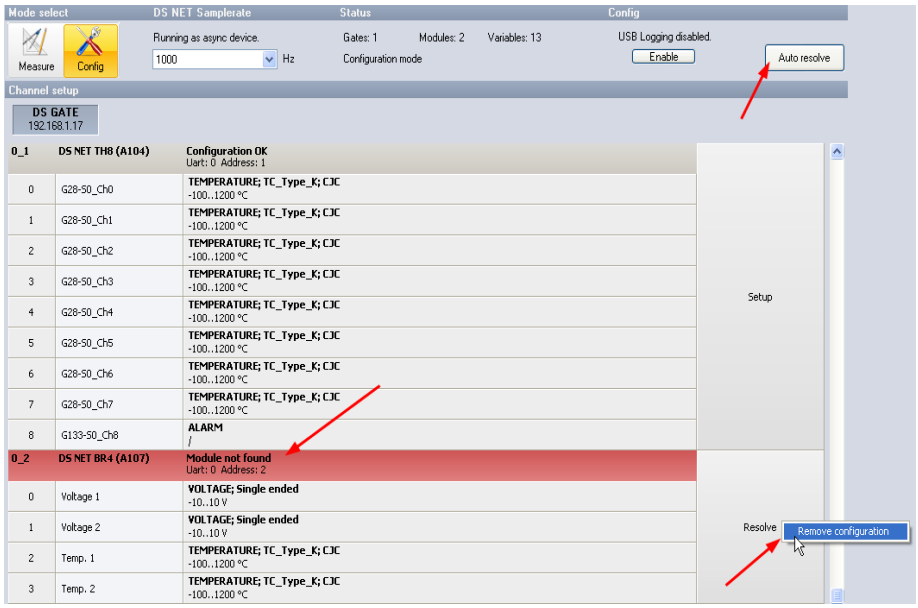



*Illustration 155: DS NET plugin: Config Mode after removing a module*

In this example we a DS NET BR4 module has been removed.

You can see that:

- the **Auto resolve** button (see paragraph Auto resolve above) is visible in this case
- the configuration of the module (DS NET BR4) still exists, but that the module cannot be found
- the new module does not have a **Setup** button, but a **Resolve** button instead

When you click the **Resolve** button, a pop-up menu will appear and you can click **Remove configuration** to permanently delete the old configuration. When this step has succeeded, the configuration will be gone:

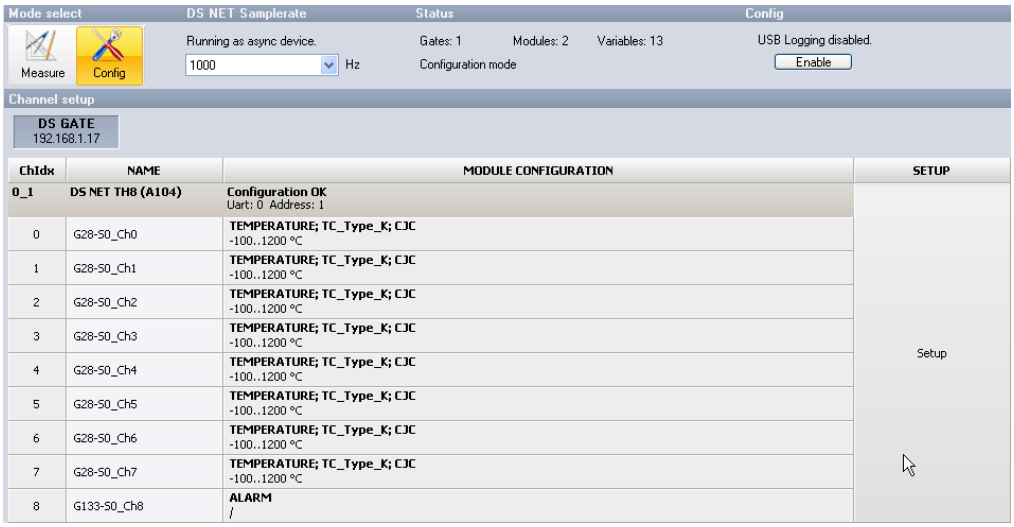



*Illustration 156: DS NET plugin: Config Mode after removing a modules configuration*

Now the old configuration has been removed, the resolve-buttons are gone and and the configuration is correct.

## 4.3.4.3 Analogue inputs

All module signals are defined as variables. Therefore, for the entry activate the tab Variable Settings in the configuration window.

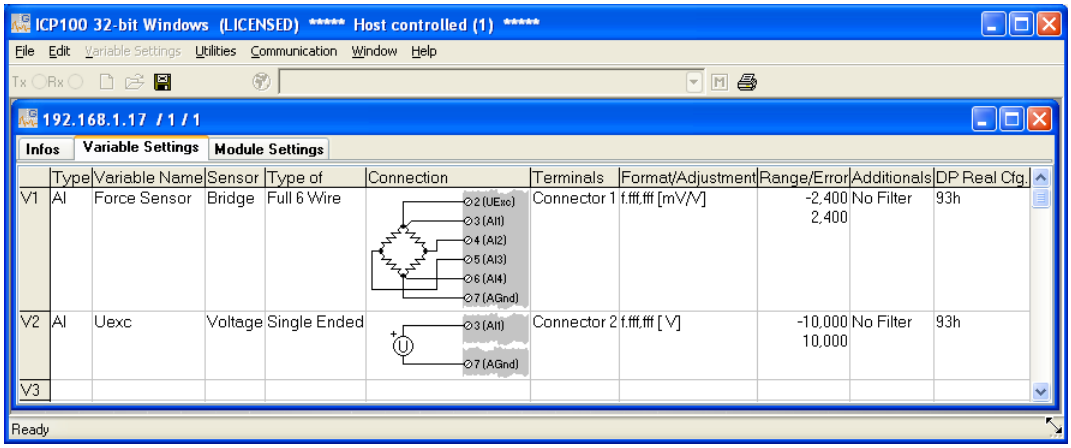



*Illustration 157: DS NET plugin: analog inputs*

4. Click in the *Type* column of the first row (V1 = Variable 1) or select the row (click on V1) and use *Variable Settings* – *Type*.

5. Select `Analog Input` and click on **OK**.

6. Click in the column *Variable Name* and enter a meaningful name for the connected sensor.

7. Click in the *Sensor* column and specify the type of sensor. Depending on the type of module you have various options available, e.g. *Bridge* for strain-gauge full and half-bridges, *Pt100*, *Resistance* for resistors or *Voltage* for voltage measurements and *IEPE* sensors.

8. Click in the *Type* column and specify the type of circuit or further information about the sensor type.
   Depending on the selected sensor type, you have various options available, e.g. *2-Wire* or *4-Wire* (circuit) for resistive transducers or *Full 4-Wire* or *Full 6-Wire* (circuit) for strain-gauge full bridges.
   The *Connection* column shows you the pin assignment to be used. Check that your sensor is connected correctly.
   When you create several channels, the physical outputs of the module will always be occupied from top to bottom automatically.

9. Click in the *Format/Adjustment* column to enter the scaling for the sensor. This is additional scaling performed on the module.
   Usually you can do the scaling in DEWESoft™ (see 4.3.3.3 Channel setup), but sometimes it may be useful to do the scaling at this level: e.g. for scaling an alarm output.
   Here you can also enter how many post decimal places (*Precision*) and how many places in total are to be output (*Field Length*). The field length is calculated including the decimal point, but without any commas displayed for the thousands.
   After you closed the dialog the number of transferred places and the unit are displayed in the *Format/Adjustment* column, e.g. `ff,fff.f [kN]` for an output in the unit *kN* with a total of seven characters including the decimal point and one post decimal place. If negative numbers occur, the display in this example is limited to -9,999.9 (seven characters without the comma).

10. Click in the *Range/Error* column to limit the permissible value range (this may also change the measurement range: e.g. for voltage measurement of the ACC2 module: see 5.4.1 ACC2: Voltage on page 99) and to define the reaction in the case of an error (optional).

11. Optionally, you can specify filtering of the sensor signal in the *Additionals* column.

12. When you are done, select *File* - *Save to file*.

## 4.3.4.4 Digital inputs/outputs

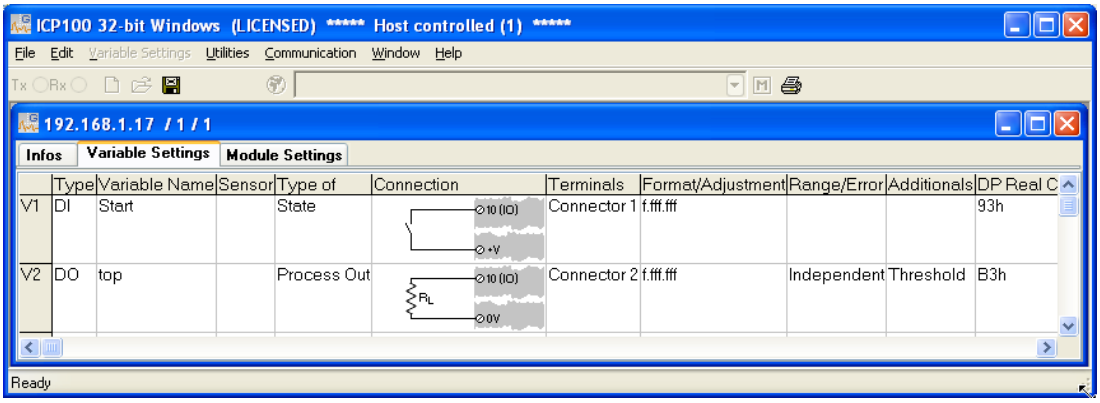



*Illustration 158: DS NET plugin: Digital inputs/outputs*

1. Click in the *Type* column of the first row (V1 = Variable 1) or select the row (click on *V1*) and use *Variable Settings* – *Type*.

2. Select `Digital Input` or `Digital Output` and click on **OK**.
   The *Connection* column shows you the pin assignment to be used. Check that your sensor is connected correctly.
   When you create several channels, the physical outputs of the module will always be occupied from top to bottom automatically.

3. Click in the column *Variable Name* and enter a meaningful name for the connected sensor.

4. For a digital output click in the *Type* column and specify whether you want to use the output as *Status indicator (State)* or *Process Out*.

5. *Process output*: The output monitors a module signal and changes the output level under certain conditions. Click in the *Additionals* column and specify the type of alarm monitoring.
   You can specify up to four alarm conditions. When one of the conditions is satisfied, the alarm signal is triggered. At the right top of the graphical displays, select the thresholds for the alarm condition. Enter the values for the switching thresholds in the (scaled) unit of the selected signal. Use either fixed values (constants) or select other variables.

6. *Status indicator (State)*: The output can be set via a command from the DS GATE or from a Host application: e.g. in DEWESoft™ these channels can be used as *control channels*.
   Note: make sure, that the *Data Direction* of the channel is set to *Input/Output* (click on the *Format/Adjustment* column and then on the button **Data Direction**).

7. Click in the *Format/Adjustment* column to specify the transfer format.
   Since digital signals do not require any post decimal places, you can enter `0` for *Precision*. `1` is sufficient for the *Field Length*. With a digital input you can also specify a unit (optional).
   For several inputs/outputs there is also the type *Set8* with which 8 inputs or outputs are transferred as a number (4-byte float format, single precision format).
   When the dialog is closed, the number of transferred places and the unit in the *Format/Adjustment* column, e.g. `f`, are displayed.

8. Click in the *Range/Error* column to define the reaction in the case of an error for the digital outputs (optional).

9. When you are done, select *File* - *Save to file*.

## 4.3.4.5 Analogue outputs

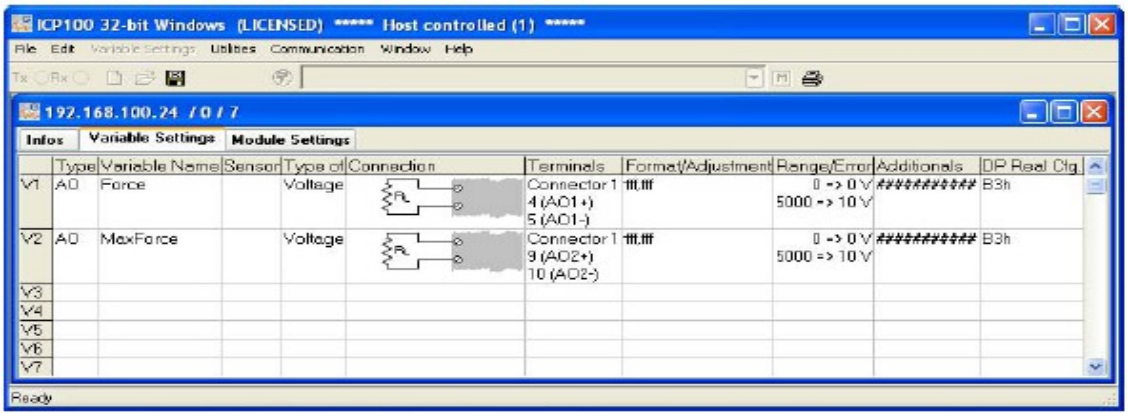



*Illustration 159: DS NET plugin: Analog outputs*

1. Click in the *Type* column of the first row (V1 = Variable 1) or select the row (click on V1) and use *Variable Settings* – *Type*.

2. Select `Analog Output` and click on **OK**.
   The *Connection* column shows you the pin assignment to be used. Check that your sensor is connected correctly. When you create several channels, the physical outputs of the module will always be occupied from top to bottom automatically.

3. Click in the column *Variable Name* and enter a meaningful name for the connected sensor.

4. Click in the *Type* column and specify whether you want to use the output as a *Voltage* or a *Current* output.

5. Click in the *Format/Adjustment* column to specify the transfer format.
   Here you can enter how many post decimal places (*Precision*) and how many places in total are to be output (*Field Length*). The field length is calculated including the decimal point, but without any commas displayed for the thousands.
   After you closed the dialog the number of transferred places and the unit are displayed in the *Format/Adjustment* column, e.g. `ff,fff.f [kN]` for an output in the unit *kN* with a total of seven characters including the decimal point and one post decimal place. If a negative numbers occur, the display in this example is limited to -9,999.9 (seven characters without the comma).

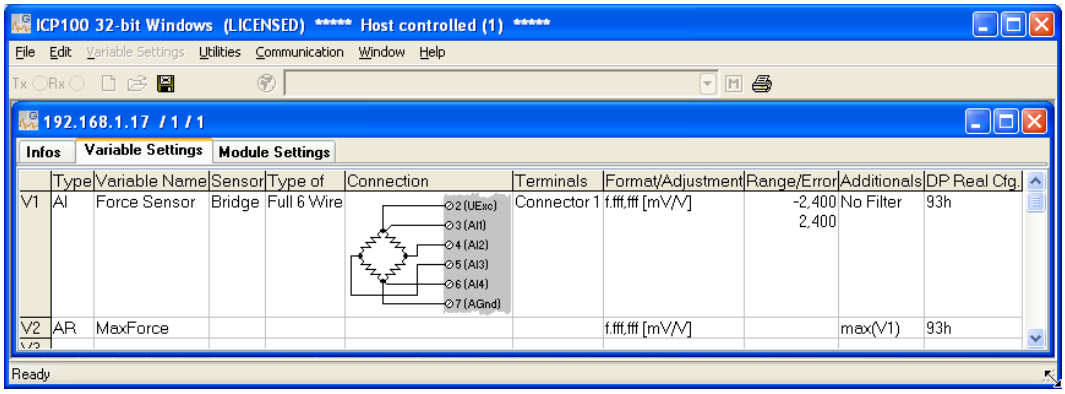
6. Click in the *Range/Error* column to limit the permissible value range and to define the reaction in the case of an error (optional).

7. Click in the *Additionals* column to specify the signal source (variable) used for the output.

8. When you are done, select *File* - *Save to file*.

## 4.3.4.6 Defining computations

You can also do simple computations directly in the module.




1. Click in the *Type* column of the row (V2 = Variable 2) or select the row (click on V2) and use *Variable Settings* – *Type*.
2. Select `Arithmetic` and click on **OK**.
3. Click in the column *Variable Name* and enter a meaningful name for the arithmetic formula.
4. Click in the *Additionals* column and specify the required computation.
   In the upper dialog field you can enter a formula which uses the existing module variables (this is similar to what you would do on a traditional pocket calculator).
   The bottom section contains buttons, that will insert the respective formula into the input field at the top, when clicked.
   When you are done, click **OK**.
5. Click in the *Format/Adjustment* column to specify the transfer format.
   Here you can enter how many post decimal places (*Precision*) and how many places in total are to be output (*Field Length*). The field length is calculated including the decimal point, but without any commas displayed for the thousands.
   After you closed the dialog the number of transferred places and the unit are displayed in the *Format/Adjustment* column, e.g. `ff,fff.f [kN]` for an output in the unit *kN* with a total of seven characters including the decimal point and one post decimal place. If a negative numbers occur, the display in this example is limited to -9,999.9 (seven characters without the comma).
6. When you are done, select *File* - *Save to file*.

## 4.3.4.7 Specifying alarm monitoring

In order to monitor a limit and to output a level on a digital output when an alarm occurs, you can directly use the function of the digital output. You do not need to set up any alarm monitoring. The alarm monitoring is used to monitor signals in the module and to make the result available to the PC as a preconditioned signal. Checking the original signal in the PC or PLC can therefore be omitted.

1. Click in the *Type* column of the next free row (V2 = Variable 2) or select the row (click on V2) and use *Variable Settings* – *Type*.
2. Select `Alarm` and click on **OK**.
3. Click in the column *Variable Name* and enter a meaningful name for the alarm signal.
4. Click in the *Additionals* column and specify the type of alarm monitoring.
   You can specify up to four alarm conditions. When one of the conditions is satisfied, the alarm signal is triggered.
   At the right top of the graphical displays, select the thresholds for the alarm condition. Enter the values for the switching thresholds in the (scaled) unit of the selected signal. Use either fixed values (constants) or select other variables.

5. Click in the *Format/Adjustment* column to specify the transfer format.
   Here you can enter how many post decimal places (*Precision*) and how many places in total are to be output (*Field Length*). The field length is calculated including the decimal point, but without any commas displayed for the thousands.
   After you closed the dialog the number of transferred places and the unit are displayed in the *Format/Adjustment* column, e.g. `ff,fff.f [kN]` for an output in the unit *kN* with a total of seven characters including the decimal point and one post decimal place. If a negative numbers occur, the display in this example is limited to -9,999.9 (seven characters without the comma).
   Since the alarm signal, like digital signals, does not require any post decimal places, you can enter `0` for *Precision*. `1` is sufficient for the *Field Length*.
   When the dialog is closed, the number of transferred places and the unit in the *Format/Adjustment* column, e.g. `f`, are displayed.

6. When you are done, select *File* - *Save to file*.

## 4.3.5 Setup explained

The most important thing to understand when working with DEWESoft™ and DS NET setup data, is that there are 2 locations where the setup data is stored:

- DS NET stores it's setup data in the DS GATE module
  This makes it possible to use the DS NET system standalone (e.g. as a data logger, see 7 Data Logger on page 163)
  this data consists of everything that you can setup in *config mode* (see on page 69)
  all these settings (and even more) can also be done in `test.commander`)
- DEWESoft™ stores it's setup data in an xml-file
  (e.g. `default.d7s`) located in the DEWESoft™ `Setup` directory (see 3.1.3.2 Installing new DEWESoft™ versionon page 21)
  this setup includes all the settings of the *config mode* plus all the settings of the *measure mode* (see 4.3.3 Measure mode on page 65)

The best way to explain the subtleties of the interaction between these setups is to show some examples.

### 4.3.5.1 First use in DEWESoft™

When you use the DS NET system for the first time on a new DEWESoft™ installation, you have to activate the DS NET system in hardware setup (see 4.2 Hardware setup on page 56). When you then close the hardware setup, the DS NET plugin will read all available information of the DS NET system: e.g. the number of modules, the module types, the current sample rate, the channels for each module, and so on. That means, that all information that is shown and can be changed in the *config mode* (see on page 69) of the plugin is already available.

On the other hand, we don't have any information about the DEWESoft™ settings for this device, that means, that all the values shown in the *measure mode* (see 4.3.3 Measure mode on page 65) are still the default values: e.g. no *min/max* values, or *scaling* have been set (see 4.3.3.3 Channel setup on page 68).

### 4.3.5.2 Changing measure mode settings

When you now change any settings in the *measure mode* they will only affect DEWESoft™ (except for the sample rate).

| **EXAMPLE 9**  | When you enter a scaling factor (see 4.3.3.3 Channel setup on page 68) for the channel, the factor will be used immediately to scale the values that we get from the DS NET system, but the DS NET system has not been changed in any way – it still sends the same values as before, but DEWESoft™ is calculating and displaying the scaled value. |
|---|---|

If you would now exit DEWESoft™ and restart it again, your scaling factor settings would be lost, so you should better save these settings:

### 4.3.5.3 Saving DEWESoft™ setup data

If you want to preserve your current settings in *measure mode*, you need to save your DEWESoft™ setup:

After you have saved your setup (and also after you load a setup), the DEWESoft™ window title, will show the name of the current setup (see red rectangle in Illustration 161)

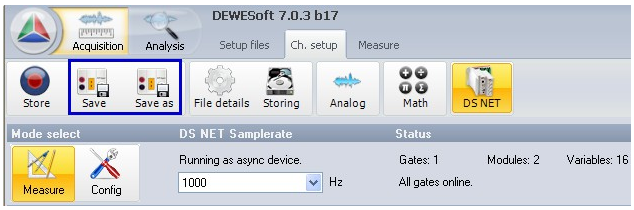



*Illustration 160: Save channel setup*

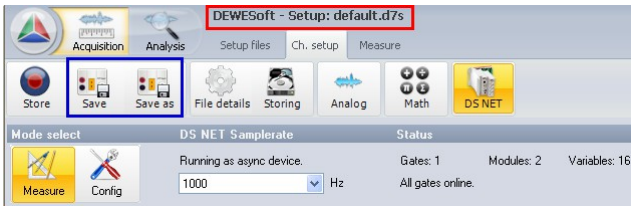



*Illustration 161: Current channel setup*

After you have saved your the DEWESoft™ setup, you can close DEWESoft™, restart it, load the setup again and your settings will be restored.

### 4.3.5.4 Differing configurations

When you load a DEWESoft™ setup that also includes a DS NET configuration, the DS NET plugin will read the DS NET configuration from the DS NET and compare it with the settings, that are stored in the DEWESoft™.

If the 2 configurations do not match, you will be asked which of the setups you want to use:

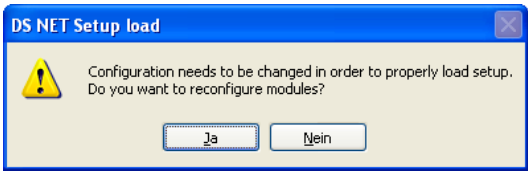



*Illustration 162: Differing Configurations*

If you press:

- *Yes*: the current DEWESoft™ configuration which is stored on your PC will be written to the DS NET systems and the modules: This process may take up to several minutes, dependant on the number of modules of the DS NET system.
- *No*: the configuration of the DS NET system will be used for the current DEWESoft™ setup.
  You may want to save the DEWESoft™ setup (see 4.3.5.3 Saving DEWESoft™ setup data) which now includes the matching setup from the DS NET system: Otherwise you will be asked the same question again next time you load this setup.

Either way, the 2 configurations will match afterwards.

### 4.3.5.5 Setup/System mismatch

When you try to load a setup for a different system than the one that is currently connected, you will see a warning message similar to this one:

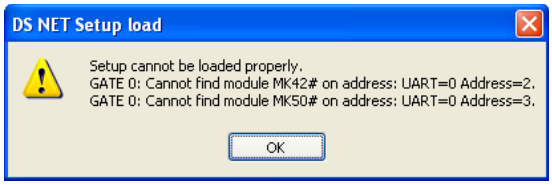



*Illustration 163: Setup/System mismatch*

For example, when you have a DS NET system that consists of 3 measurement modules and try to load a DEWESoft™ setup that has been created with a DS NET system that had 5 modules.

In this case you may experience unexpected results, so you should check all the channels and settings thoroughly.

### 4.3.5.6 Similar Systems

One special case is when you have 2 DS-NET systems with the same modules: e.g. we have

- DS-NET A with only one BR-4 module – all channels configured for bridge measurement
- DS-NET B has also one BR-4 module – all channels configured for resistance measurement

Now start DEWESoft™, activate DS-NET A in hardware setup (only DS-NET A, let's say DS-NET B is not even powered on) and save a channel setup.

Then we go to hardware setup and remove DS-NET A (maybe even power it off) and activate DS-NET B instead. When we now leave hardware setup DEWESoft™ detects that the serial number of the connected DS NET has changed and will show you this dialogue:

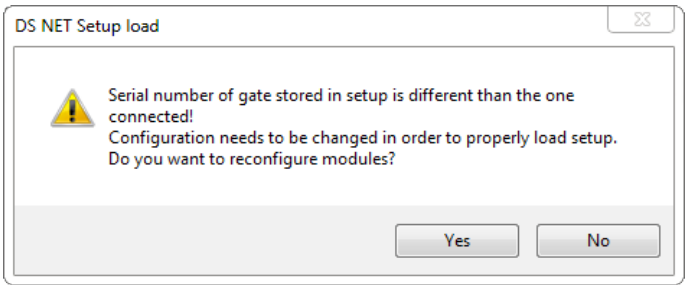



*Illustration 164: Serial number changed dialogue*

When you click **Yes**, the currently connected DS-NET B will be reconfigured according to the current channel setup: this means after this process both DS-NET systems will have the same configuration; i.e. both are setup for bridge measurement.

When you click **NO**, the currently connected DS-NET (system B) will not be reconfigured and the current channels setup is ignored. The configuration will be read from DS-NET B and you will still have the original configuration (DS-NET A is for bridge measurement, DS-NET B is for resistance measurement).

# 5 DS NET Modules

## 5.1 DS NET system: general description

The DS NET system offers the highest flexibility for inputs like voltage, current, temperature, strain, vibration, pressure and more. Each DS NET system can use up to 16 modules, and is connected via Ethernet TCP/IP to the host computer.

The modules in the DS NET series have been developed for industrial measurement and testing technology, in particular for multi-channel measurements of electrical, mechanical and thermal signals on engine and component test-rigs as well as for monitoring processes and long-term supervision.

The individual modules can be combined to form one system that exactly fits your needs.
Every DS NET device needs exactly one DS GATE which is the heart of the system..

On all modules the power supply, the bus interface and the inputs and outputs are electrically isolated from one another.

The DS NET system hardware comes in two different lines: the portable line and the rack line

### 5.1.1 DS NET portable line

The portable line of the DS NET system has a robust housing that can accommodate one DS GATE and up to 16 measurement modules.

*Illustration 165: DS NET Portable Line 13 modules*

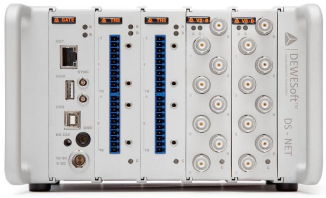


*Illustration 166: DS NET Portable Line 4 modules*

### 5.1.2 DS NET rack Line

The rack line of the DS NET system allows one DS GATE and up to 12 DS NET modules to be used in a standard 19-inch rack.

*Illustration 167: DS NET Rack Line*

## 5.2 DS NET Modules: general information

A typical DS NET system consists of exactly one DS GATE module and up to 16 measurement modules (see 5.2.2 Measurement Modules on page 89).

There are also some special modules that can be used to expand the system.

## 5.2.1 Special modules

These modules are not controlled by the DS GATE (in contrast to the measurement modules.

| Name | Short description | Detailed information / page |
|---|---|---|
| **DS GATE** | controller unit of all measurement modules (power supply, communication, …) | 5.3 DS GATE / 95 |
| **DS SUPPLY** | provides galvanically isolated DC sensor supply voltages | 5.16 DS NET SUPPLY / 140 |
| **DS NET WLAN** | provides WLAN access to the DS GATE | 5.17 DS NET WiFi / 141 |
| **DS NET CPU** | a full-featured, fanless mini PC (including SSD harddrive, LAN, WLAN, …), that can run DEWESoft™ | 2.2.2 DS-NET-CPU users manual / 8 |
| **DS-NET-CAN2** | provides 2 isolated CAN channels (for DS-NET CPU) | 2.2.2 DS-NET-CPU users manual / 8 |

*Table 8: DS NET: special modules*

## 5.2.2 Measurement Modules

The following table shows an overview of all available measurement modules for the DS-NET system.

| Module type | ACC2 | CFB2 | BR8 | BR4 | BR4-D | V8 | V8-B | V8-200 | V4 | V4-B | V4-HV | TH4 | TH8 | TH8-C | DIO8 | AO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCB type** | A101 | A106 | A116 | A107 | | A108 | | A108-200 | A123 | | A128 | A124 | A104 | | D101 | A109 |
| **Max. Samplerate[Hz]** | 10k[4] | 10k | 10k | 10k[4] | | 10k | | 10k | 10k | | 10k | 10k | 100[5] | | 10k | 10k |
| **Isolation [V][6]** | 500[7] | 500[7] | 500[7] | 500[7] | | 500[7] | | 500[7] | **1.2k**[8] | | **1.2k**[8] | **1.2k**[8] | 500[7] | | 500[9] | 500[7] |
| **Page** | 99 | 104 | 109 | 112 | | 120 | | 123 | 125 | | 127 | 131 | 128 | | 133 | 136 |
| **Analogue Input Types** | | | | | | | | | | | | | | | | |
| **Voltage max. Range** | 2 ±60V | | | 4 ±10V | 4 ±10V | 8 ±10V | 8 ±10V | 8 ±200V | 4 ±10V | 4 ±10V | 4 ±1kV | 4 ±80mV | 8 ±80mV | 8 ±80mV | | |
| **Current Range (0..25mA)** | 2 | | | 4 | 4 | 8[10] | 8[11] | | 4[11] | 4[11] | | | | | | |
| **Resistance** | 2 | | | 4 | 4 | | | | | | | | | | | |
| **Potentiometer** | 2 | | | 4 | 4 | | | | | | | | | | | |
| **Pt100, Pt1000** | 2 | | | 4 | 4 | | | | | | | | | | | |
| **Thermocouple** | 2[12] | | | 4[12] | 4[13] | | | | | | | 4 | 8[12] | 8 | | |
| **Full, ½, ¼ bridges** | 2[14] | 2[15] | 8 | 4[16] | 4[17] | | | | | | | | | | | |
| **Inductive full, ½ bridges** | | 2 | | | | | | | | | | | | | | |
| **LVDT** | | 2 | | | | | | | | | | | | | | |
| **IEPE/ICP** | 2 | | | | | | | | | | | | | | | |
| **Digital Input Types** | | | | | | | | | | | | | | | | |
| **Frequency** | | | | | | | | | | | | | | | 4 | 2 |
| **Pulse Width** | | | | | | | | | | | | | | | 4 | 2 |
| **Counter** | | | | | | | | | | | | | | | ■[18] | ■[19] |
| **Time** | | | | | | | | | | | | | | | 4 | 2 |
| **Status** | 2 | 4 | | | | 2 | | | | | | | | | 8 | 4 |

4 only 8Hz for thermocouples
5 only 8Hz with active mains rejection
6 isolation voltage: channel/channel, to power supply and to interface (unless otherwise noted on the module specifications)
7 1kVDC peaks, 500VDC for some minutes, 250VDC permanent
8 1.2kVDC permanent
9 isolation voltage between group/group (connector/connector): 1kVDC peaks, 500VDC for some minutes, 250VDC permanent
10 V8-SHUNT adapters are available as option
11 with external shunt (no adapter available)
12 external CJC adapters are available as option (see TH8-CJC, BR4-CJC, ACC2-CJC)
13 differential temperature measurement only (no CJC adapter available)
14 ¼ bridge completion adapters ACC2-120/ACC2-350 are available as option
15 ¼ bridge completion adapters CFB2-120/CFB2-350 are available as option
16 ¼ and ½: bridge completion adapters BR4-120/BR4-350 are available as option
17 ¼ and ½: bridge completion adapters BR4-D-120/BR4-D-350 are available as option
18 only 2 quadrature four-wire counters can be used, or 4 standard, up/down or quadrature two-wire counters
19 only 1 quadrature four-wire counter can be used, or 2 standard, up/down or quadrature two-wire counters

| Module type | ACC2 | CFB2 | BR8 | BR4 | BR4-D | V8 | V8-B | V8-200 | V4 | V4-B | V4-HV | TH4 | TH8 | TH8-C | DIO8 | AO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analogue Output Signal** | | | | | | | | | | | | | | | | |
| **Voltage (±10V)** | | 2 | | | | | | | | | | | | | | 4 |
| **Current (4…20mA)** | | | | | | | | | | | | | | | | 4 |
| **Digital Output Signal** | | | | | | | | | | | | | | | | |
| **Frequency** | | | | | | | | | | | | | | | 8 | 4 |
| **Pulse Width** | | | | | | | | | | | | | | | 8 | 4 |
| **Status** | 2 | 4 | | | | 2 | | | | | | | | | 8 | 4 |
| **Connectors** | | | | | | | | | | | | | | | | |
| ■..standard connectors, □ optional connectors | | | | | | | | | | | | | | | | |
| **Screw** | ■ | ■ | | ■ | | ■ | | ■ | ■ | | | | ■ | | ■ | ■ |
| **BNC** | □[20] | | | | □[21] | | ■ | | | ■ | ■ | | | | | |
| **DSUB 9** | | | ■ | | ■ | | | | | | | | | | | |
| **Thermocouple** | | | | | | | | | | | | | | ■ | | |
| **Spring Terminal** | | | | | | | | | | | | ■ | | | | |
| **Miscellaneous** | | | | | | | | | | | | | | | | |
| **Sensor supply [V]** | | | | | <=12 | | | | | | | | | | | |
| **Approx. Weight [g][22]** | 400 | 400 | 800 | 400 | 450 | 400 | 500 | 400 | 400 | 500 | 600 | 400 | 400 | 500 | 400 | 400 |
| **Approx. Power Consumption [W]** | 2 | 2.5 | 2.5 | 2.5 | 2.5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

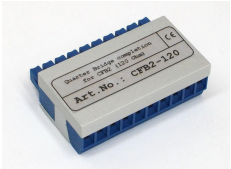
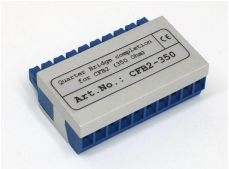
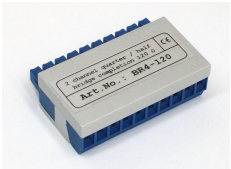
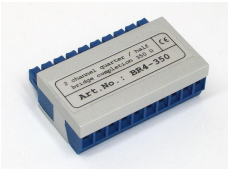
*Table 9: DS NET Modules*

**HINT**

You numbers in the signal groups of Table 9 above is the maximum number of channels that you can use for the signal type corresponding to this row (and to this module = column of the table).
You can use all the channels of the different signal groups (analogue/digital input/output) at the same time.
For example, the DS-AO4 module could have 4 digital input channels (e.g. all of type *Status*), 4 output channels (e.g. 2 *Voltage*, 2 *Current*), and 4 digital output channels (e.g. 4 *Status*) at the same time – this means DEWESoft™ would show 12 channels for the module.
Inside of each signal group you can of course only use the number of channels specified for each input type: e.g. for a DS-AO4 you cannot use 2 *Pulse Width* and 2 *Time* signals at the same time.
But you can mix signals (to some extend – please refer to the module's chapter for details): e.g. for DS-AO4 you can have 1 *Pulse-Width* and 1 *Time* signal at the same time.

20 possible with optional adapter: ACC2-BNC (only for IEPE measurement)
21 possible for BR4-D module with optional DSUB-BNC adapter (only for voltage measurement)
22 PCB, module housing, backplane (incl. socket): see also: 6.1.2 Weight & Power Consumption on page 155

## 5.2.3 Optional connector adapters

| | | | |
|---|---|---|---|
| **TH8-CJC**<br>4 channel thermocouple adapter with integrated CJC for DS NET TH8 (see page 128). |  | **BR4-CJC**<br>2 channel thermocouple adapter with integrated CJC for DS NET BR4 (see page 112). |  |
| **ACC2-CJC**<br>1 channel thermocouple adapter with integrated CJC for DS NET ACC2 (see page 98) |  | **ACC2-BNC**<br>1 channel screw connector to BNC adapter<br>see ACC2: IEPE sensor on page 102 |  |
| **ACC2-120**<br>1 channel ¼ bridge completion adapter 120Ω for DS NET ACC2 (see page 98) |  | **ACC2-350**<br>1 channel ¼ bridge completion adapter 350Ω for DS NET ACC2 (see page 98) |  |
| **CFB2-120**<br>1 channel ¼ bridge completion adapter 120Ω for DS NET CFB2 (see page 104) |  | **CFB2-350**<br>1 channel ¼ bridge completion adapter 350Ω for DS NET CFB2 (see page 104) |  |
| **BR4-120**<br>2 channel ¼ and ½ bridge completion adapter 120Ω for DS NET BR4 (see page 112) |  | **BR4-350**<br>2 channel ¼ and ½ bridge completion adapter 350Ω for DS NET BR4 (see page 112) |  |
| **BR4-D-120**<br>1 channel ¼ and ½ bridge completion adapter 120Ω for DS NET BR4-D (see page 113) |  | **BR4-D-350**<br>1 channel ¼ and ½ bridge completion adapter 350Ω for DS NET BR4-D (see page 113) |  |
| **DSUB-BNC**<br>1 channel DSUB9 to BNC adapter (voltage input) for DS NET BR4-D (see page 113) |  | **V8-SHUNT**<br>4 channel shunt adapter for current measurement: 25mA (100Ω) for DS NET V8 (see page 120) |  |

## 5.2.4 Terminal connections

The minimum and maximum cable sizes that can be connected to the standard screw connectors are:

| cable | minimum | maximum |
|---|---|---|
| plain cable | 0.14 $mm^2$ | 1.5 $mm^2$ |
| cable with wire-end sleeves without plastic sleeves | 0.25 $mm^2$ | 1.5 $mm^2$ |
| cable with wire-end sleeves with plastic sleeves | 0.25 $mm^2$ | 0.5 $mm^2$ |

*Table 10: Cable sizes for terminal connection*

### 5.2.4.1 Back side connector

The inter-socket connector (the green 9 pole Phoenix connector in Illustration 168) has the following pin assignments:

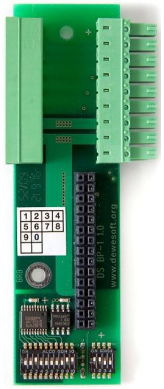


*Illustration 168: Socket PCB*

| Pin No. | Name | Notes |
|---|---|---|
| 1 | Sync 1 | only used for CFB-2 |
| 2 | Sync 2 | only used for CFB-2 |
| 3 | RS-485 B2 | B-line of UART 2 |
| 4 | RS-485 A2 | A-line of UART 2 |
| 5 | RS-485 B1 | B-line of UART 1 |
| 6 | RS-485 A1 | A-line of UART 1 |
| 7 | Supply 0V | |
| 8 | Supply +V | |
| 9 | Ground | internally connected to Supply 0V |

## 5.2.5 LED flash codes (for measurement modules)

Each measurement module has 3 LEDs (A, B, C). LED A is blue, LEDs B and C are red (see Illustration 169). Note, that the DS GATE module does not have LED C.

See also: 5.3.2 LED flash codes (DS-GATE) on page 96.

When the system has started up and everything is okay the blue LEDs (A) of the DS GATE and all modules should be on (and not flashing). Any other status indicates some kind of warning or error.

If any red LED (B or C) of analogue modules are on, this means that the module has detected a range error (see Module Range/Range Error on page 73). This function may be used to detect a broken sensor connection of thermocouple modules.

In the following paragraphs we will use these symbols to indicate the status of a LED:

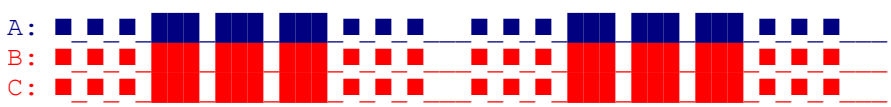
| Symbol | Description |
|---|---|
| ■■■ | LED is ON for a long period of time |
| ■ | LED is ON for a short period of time |
| _ | LED is OFF for a short period of time |
| ____ | LED is OFF for a long period of time |

*Table 11: LED flash codes legend*

*Illustration 169: Module LEDs*

### 5.2.5.1 SOS

SOS flashing sequence:




This means that the socket- and module configuration do not match.

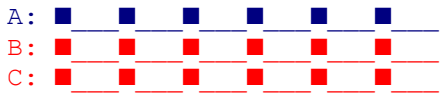
This could be solved by:

- enter the configuration mode of the DS NET plugin and check if there are configuration issues (see Auto resolve on page 76)
  then leave the configuration mode (go back to measure mode) so that the new configuration is written to the module
- downloading the new configuration via `test.commander`
- correct the settings for hot-swapping: see also 6.2.2.2 Troubleshooting

#### 5.2.5.2 Application download mode

This indicates that the module is running the operating system software.

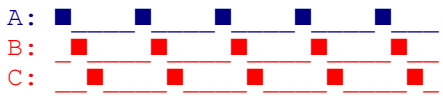
This is usually only an intermediate state while downloading a new application. After the download has finished, the application will be started.




*Application download mode flashing sequence*

#### 5.2.5.3 OS download mode

When an OS (or *FPGA*) download is in progress the module changes into this configuration mode. After the download succeeded a restart is required to get into the measurement mode again.




*Operating system download sequence*

#### 5.2.5.4 DSP communication lost

When the communication to the *DSP* has been lost.


*DSP communication lost*

#### 5.2.5.5 FPGA communication lost

When the communication to the *FPGA* has been lost.

One possible cause is that the *Baud* rates of the DS-GATE and the module do not match.


*FPGA communication lost*

## 5.2.6 Sensor information

### 5.2.6.1 Connecting sensors with sensing leads

Resistive sensors require an excitation voltage to be able to provide their output signal. For sensor excitation a current is passed through the connecting lead, which however causes a loss of voltage due to the resistance of the connecting lead. Consequently, the sensor is then not supplied with the voltage set on the amplifier module, but rather with a slightly lower voltage. This leads in turn to a lower output signal and, depending on the cable resistance, losses in the single-figure percentage range can occur even with just a few meters.

Therefore, high quality amplifier modules for the excitation of resistive sensors use so-called sensing leads which can measure the loss of voltage, since only a very small current flows in them. This is because the inputs for the sensing leads have very high input resistances, i.e. usually over 10 MΩ compared to a sensor resistance of a few 100 Ω.

The amplifier module can therefore acquire the voltage arriving at the sensor error-free and increase its excitation voltage to compensate for the losses in the connecting cable. This is particularly the case when the temperature of the connecting cable changes. In this case the cable resistance changes and the sensor output signal would therefore also change if no sensing leads were used.

We therefore recommend the use of sensing leads. This is mainly necessary when several meters of cable are used, low measurement deviations are to be obtained or when the temperature of the cable may vary.

### 5.2.6.2 Current measurement with an external shunt

Current measurements are carried out by measuring the voltage drop across a resistance of known size (shunt resistance). In some modules this is a resistor of 50 Ω, with which you can measure currents up to 25 mA (the maximum shunt power dissipation is limited to 0.25 W). Other modules may require an external shunt connector (e.g. V8).

For higher currents an external shunt is always required which is looped into the line to be measured. The permissible power dissipation of the external shunt has to be suitable for the current to be measured and the voltages dropped across the resistor must not exceed the permissible input voltage on the analogue input. In this case configure the analogue input as a voltage input and setup the scaling, so that you divide the measured voltage by $R_{ext}$.

| IMPORTANT | |
|---|---|
|  | The error in the current measurement using an external shunt depends on the accuracy of the resistor used. |

### 5.2.6.3 Measuring with thermocouples

Thermocouples consist of two *thermoelectric wires* which are formed from different materials, e.g. platinum and platinum/rhodium, and are joined together at one end, usually by welding. If this contact point and the other ends of the thermoelectric cables have different temperatures, a *thermoelectric voltage* is produced at the contact point. This voltage is essentially proportional to the temperature difference between the contact point and the ends of the cables.

Since thermocouples only measure a temperature difference (difference between the temperature at the contact point and the measured temperature at the terminal strip on the module), the terminal temperature must be known or the *transition* from the thermocouple cable or compensating cable to the copper cable must occur at a known temperature level. The first case is known as internal cold junction compensation ($TC_{int}$) and the second case as external cold junction compensation, $TC_{ext}$.

Some measurement modules have an integrated CJC (e.g. TH8-C, TH4), and for others you need an external connector adapter which has an integrated CJC: e.g. BR4-CJC (see page **91)** is required for the BR4 module.

To acquire the temperature with internal cold junction compensation an additional temperature probe is used which measures the reference temperature. In this way, the temperature at the *transition point* is determined and the voltage produced by the thermocouple is corrected depending on the type of thermocouple.

To measure the temperature using external cold point compensation, a second thermocouple of the same type is needed which is connected in series with the first one. The polarity is chosen such that the thermoelectric voltages subtract (see Illustration 245: TH8 differential thermocouple measurement on page 130). The second thermocouple is located at a fixed reference temperature (usually 0 °C). Then, the module calculates the temperature at the measuring point based on the linearisation curve. However, the module requires the information of which reference temperature (cold junction temperature) is being used.

### 5.2.7 Power supply requirements

For the power supply an unregulated DC voltage between 10 and 30 Volts is required, which is connected to LEMO B1 connector on the DS GATE. Each module requires a power of approx. 2 W (for details see 6.1.2 Weight & Power Consumption on page 155) in addition to the power supplied for the connected transducers. The power required is almost constant over the complete voltage range.

| IMPORTANT | When the modules are switched on, there is an increased current demand until the modules are operating in a stable manner: In the start-up phase up to 700 mA (10 ms) per module is needed depending on the supply voltage. After that, you should expect approx. 500 mA per module with a 10 V supply voltage (approx. 170 mA with a 30 V supply voltage).<br>You should therefore use power supplies which can deliver the required peak power when the voltage is switched on.<br>The modules have an internal self-healing (reversible) fuse for protection against over-voltages, over-currents and incorrect polarity. |
|---|---|

## 5.3 DS GATE

The leftmost module (relative to the measurement modules) in a DS NET device is always a DS GATE module. It is also the most important, because it is responsible for the power supply, data handling, configuration and communication.

During measurement it will collect all the data from the other connected modules and host systems (e.g. DEWESoft™) can easily acquire the measurement data. The host system can be connected via Ethernet to the DS GATE module (note that there are also other interfaces available.

Depending on the operating mode of the modules, transmission rates of 1 kHz with up to 128 variables (transferred values with four-byte resolution, real variables) are possible over Ethernet.

DS GATE external connections:

- *NET*: to connect the DS GATE via Ethernet to your LAN or directly to your PC
- *SYNC*: see 4.2.1 Sync mode on page 56
- *MEM*: this connector can be used for slow data logging on a USB stick (see 7 Data Logger on page 163)
- *USB*: the USB connector is not supported at the moment
- *GND*: connection for a ground cable (banana plug)
- *RS 232*: for RS232 communication: see 5.3.1.2 RS232 connector below
- *10-30 V DC*: to connect the power supply: see 5.3.1.1 Power connector below


*Illustration 170: DS-GATE*

| WARNING | It is mandatory to connect a ground cable to the *GND* connector of the DS GATE when you are working with high voltages: e.g. when you are working with the V8-200 module (see 5.9 DS NET V8-200 on page 123) . |
|---|---|

# 5.3.1 DS-GATE connectors

## 5.3.1.1 Power connector

Via the *Lemo 1* connector you can use a supply voltage of 10-30 $V_{DC}$

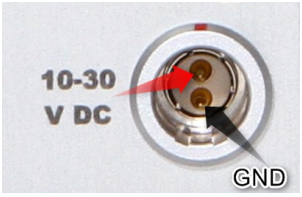



*Illustration 171: Power plug*

## 5.3.1.2 RS232 connector

You can use a 3.5mm stereo jack plug to connect the DS-GATE via RS232 to a PC; e.g. for Modbus/ASCII communication, for time synchronisation (4.1.4.3 NMEA-0183 on page 51), for GPS position data (see GPS on page 75) or to reset the IP address.

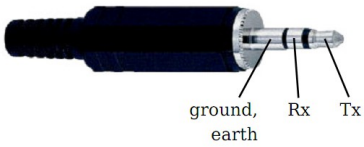



*Illustration 172: RS232 plug*

# 5.3.2 LED flash codes (DS-GATE)

The DS-GATE module has 2 LEDs (A, B). LED A is blue, LEDs B is red (see Illustration 170 above).

See also: 5.2.5 LED flash codes (for measurement modules) on page 92

During start-up the LEDs A and B will be flashing. After some seconds, when the start-up phase has finished, only the blue LED A should be lit. Any other status may indicate some additional information, warning or error.

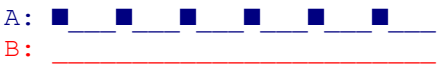
In the following paragraphs we will use these symbols to indicate the status of a LED:

| Symbol | Description |
|---|---|
| ■■■ | LED is ON for a long period of time |
| ■ | LED is ON for a short period of time |
| _ | LED is OFF for a short period of time |
| ___ | LED is OFF for a long period of time |

*Table 12: LED flash codes legend*

## 5.3.2.1 Data connection active

When the blue LED A is blinking slowly, it means that a host-application is accessing the data. E.g. when DEWESoft™ is in *Measure mode*.




*Data connection active*

## 5.3.2.2 USB access

When the blue LED A is blinking fast, it means that the DS-GATE is reading from/writing to a connected USB device (see also 7 Data Logger on page 163).


*USB active*

## 5.3.2.3 Warning/Error indication

When the red LED B is flashing, a warning/error condition has occurred. Use the *Gate status info* feature (see 4.3.3.1 DS GATE pop-up menu on page 66) to get detailed information.


*Warning/Error indication*

#### 5.3.2.4 Fatal Error

When LED B is constantly on, the DS-GATE has a fatal error. Try to restart the DS-NET system (power off, wait for 10seconds and power on again). If the problem persists, you must ship the DS-GATE to Dewesoft for repair.


*Fatal error indication*

### 5.3.3 Reading data

For host applications there are 2 different ways how to read data from the DS-GATE module:

- block transfer (high speed data): only one host application (e.g. to the DEWESoft™ DS-NET-plugin, to the Gantner LabVIEW™ driver, etc.) can read the high speed data at the same time
- online values (request/response): up to 10 host applications (e.g. DEWESoft™ Modbus plugin) can read the online values at the same time

For example, you could have one instance of DEWESoft™ running (the plugin uses the high speed block transfer) and at the same time access the online values from 3 different Modbus host applications (via TCP/IP).

#### 5.3.3.1 Block transfer

In this case, blocks of data will be read from the DS-GATE and transferred to the host application. Since a complete block of data is read, the data transfer is quite fast: up to about 160 kS/s are possible.

Following facts apply:

- only one host application can read the high speed data at the same time
- access is only possible via TCP/IP (not RS232)
- the DS-NET plugin only uses block transfer

#### 5.3.3.2 Online values

In this case, the host application (e.g. a Modbus client) requests the current online values and the DS-GATE will return the current values.

Following facts apply:

- the online values can be read at the same time by several host applications
- access via ASCII protocol or Modbus is possible (either via Ethernet or via the RS232 connector of the DS-GATE)

Note: the Modbus (and ASCII) protocols are request based. that means, the host application must poll for the data and will then get back the current data (an inherently asynchronous process). This process is of course much slower than the high-speed block transfer:
(e.g. 100Hz is already a relatively high sample rate for reading online values on a decent laptop with a low-channel-count DS-NET system).

### 5.3.4 DS GATE: Specifications

All declarations are valid after a warm up time of 45 minutes.

| **HOST INTERFACE ETHERNET** | |
|---|---|
| Protocols | TCP/IP, UDP, PING, ASCII, Modbus TCP/IP |
| Services | DHCP, FTP-Server, FTP-Client, e-Mail-Send-Client (SMTP) |
| Baud rate | 10/100Mbps |
| Data rate | max. 800 kByte/s |
| Number of simultaneous clients | 10 |
| **HOST INTERFACE USB** | |
| Version | USB 2.0 |
| Data rate | typical 100 kByte/s |

| | |
|---|---|
| Devices | Data storage, formatted with FAT or FAT32 (recommended) |
| **INTERNAL SLAVE INTERFACES RS485 (UARTS)** | |
| Number of interfaces | 2 |
| Standard | RS485 |
| Data format | 8E1 |
| Protocol | Local Bus |
| Baud rate | configurable up to 24Mbps |
| Connectable devices | max. 16 modules |
| Isolation voltage | 500 $V_{DC}$[23]<br>isolation voltage: to power supply and to interface |
| **OPERATING SYSTEM INDEPENDENT** | |
| Standardised interface | Ethernet (FTP/Berkeley-Socket) |
| **SYNCHRONISATION OF A MULTI TEST CONTROLLER SYSTEM** | |
| Interface | RS485 standard |
| Mode | Master Slave principle, IRIG standard<br>DCF77, AFNOR, etc.<br>GPS NMEA over RS232<br>SNTP over Ethernet |
| **POWER SUPPLY** | |
| Power supply voltage | 10 up to 30 $V_{DC}$, over voltage and overload protection |
| Power consumption | approximately 3W |
| **ENVIRONMENTAL** | |
| Operating temperature | -20°C up to +60°C |
| Storage temperature | -40°C up to +85°C |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing |
| Vibration | MIL-STD 810F 514.5, procedure I |
| Shock | MIL-STD 810F 516.5, procedure I |
| **MECHANICAL** | |
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm (for details see: 6.1.1 Physical Dimensions on page 154) |
| Weight | approx. 400g (for details see: 6.1.1 Physical Dimensions on page 154) |

**EXAMPLE 10**

External communication
When the DS GATE module transfers data via Ethernet to the host system (e.g. a PC running DEWESoft™), the following number of variables can be transferred at the given sample rate:
128 variables @ 1 kHz (block transfer – see 5.3.3.1 Block transfer on page 97)
16 variables @ 10 kHz (block transfer – see 5.3.3.1 Block transfer on page 97)
64 variables @ 300 Hz (online 5.3.3.2 Online values on page 97)

**EXAMPLE 11**

Internal Communication
When the DS GATE module communicates to its connected DS NET modules, the following number of variables can be transferred (when the UART's data rate is 24MBaud):
200 variables @ 1kHz
20 variables @ 10kHz
2 variables @ 100kHz

# 5.4 DS NET ACC2

The DS NET ACC2 module has two electrically isolated analogue inputs and two digital inputs or outputs.

23 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections.


*Illustration 173: ACC2*

## 5.4.1 ACC2: Voltage

You can measure voltages of up 60 V.

**IMPORTANT**

Voltages which exceed the permissible limits produce incorrect measurement data, because the inputs are protected against over voltages and limit the input voltage.

Note, that the pinning is dependant on the voltage range that you define for the channel. To change the voltage range, go to the channel configuration setup of the module (see Channel configuration setup on page 72).

When you enter a voltage range between *-10* to *+10V* (see ❶ in Illustration 174 below) you must use pins *3* (see ❷ in Illustration 174 below) and *7* (*GND*).

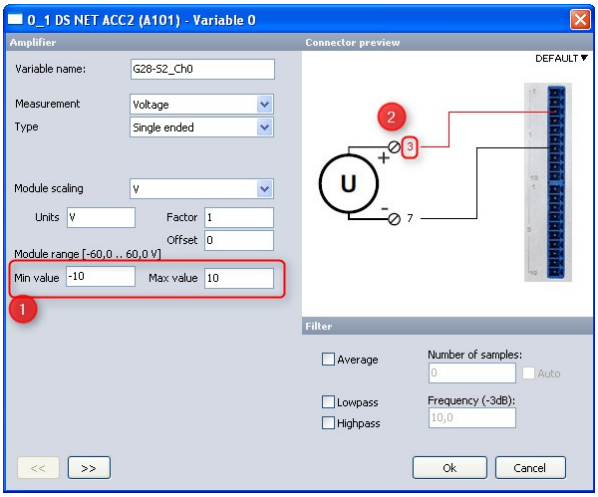



*Illustration 174: ACC2: voltages up to 10 V*

When you enter a voltage range between *-60* to *+60V* (see ❶ in Illustration 175 below) you must use pins *1* (see ❷ in Illustration 175 below) and *7* (*GND*).

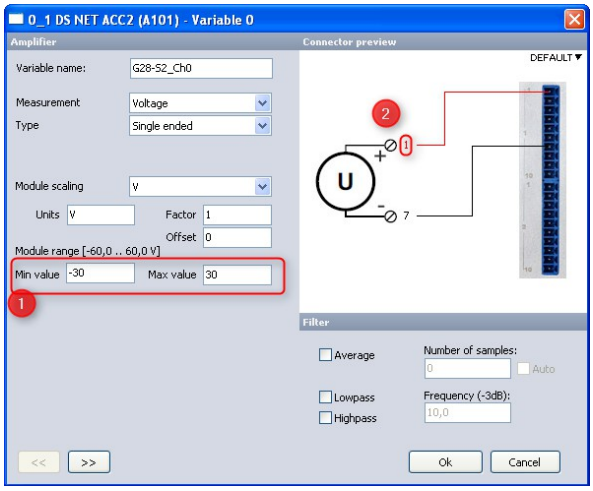



*Illustration 175: ACC2: voltages up to 60 V*

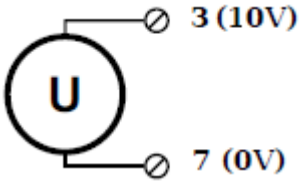



*Illustration 176: ACC2 pinning voltages up to 10V*

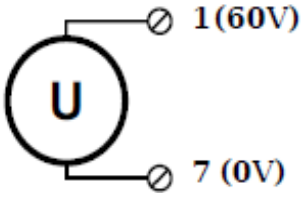



*Illustration 177: ACC2pinning voltages up to 60V*

## 5.4.2 ACC2: Current

A shunt resistance of 50 Ω is integrated for current measurement. This facilitates the measurement of currents up to 25 mA. For higher currents use a voltage measurement with an external shunt (see 5.2.6.2 Current measurement with an external shunton page 94).

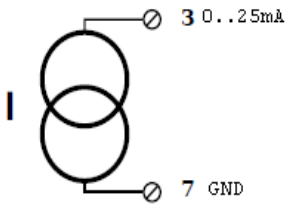



*Illustration 178: ACC2 Current*

**IMPORTANT**

The internal shunt will only be active when the DS-NET system is powered up and initialized. When the system is powered off (and during start-up, reboot, etc.) the internal shunt will not be connected and thus the circuit will not be closed.

## 5.4.3 ACC2: Potentiometer

Potentiometers with resistances between 1 kΩ and 10 kΩ are connected in a three-wire configuration.

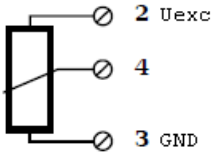



*Illustration 179: ACC2 Potentiometer*

## 5.4.4 ACC2: Resistance, Pt100, Pt1000

You can connect resistances and Pt100/1000 probes in two-wire or four-wire circuits. You specify the selected type of circuit during the module configuration.

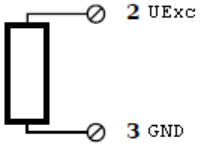



*Illustration 180: ACC2 res. 2 wire*

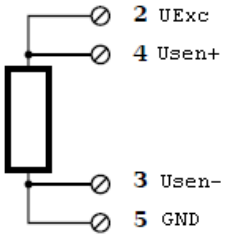



*Illustration 181: ACC2 res. 4 wire*

## 5.4.5 ACC2: Thermocouple

You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U.

See also 5.2.6.3 Measuring with thermocouples on page 94.

For connecting thermocouples you need a special connecting plug which contains the comparative measuring point (cold junction compensation) required for thermocouples.

The adapter can be obtained under the designation ACC2-CJC (see page 91).

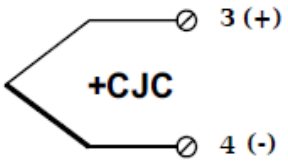



*Illustration 182: ACC2 Thermocouple*

The pin-numbers in the illustration refer to the pins of the CJC adapter (see ACC2-CJC on page 91) that the sensor is connected to (not the pins of the DS-NET module).

Alternatively, you can also use two thermocouples or a reference temperature source.

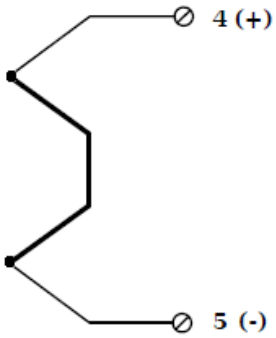



*Illustration 183: ACC2 differential thermocouple measurement*

## 5.4.6 ACC2: Full and half-bridge transducers

With (resistive) full bridges (strain-gauge full bridges) all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration; With half bridges the side drawn in dashes and connection 5 ares omitted.
see also 5.2.6.1 Connecting sensors with sensing leads on page 93
The bridge excitation voltage is between 2.5 and 3 V (the actual value is not important since the module will measure the excitation voltage and correct the measured values).

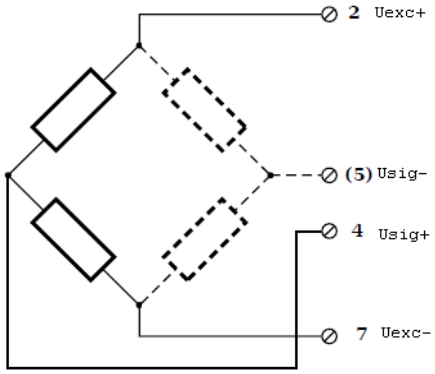



*Illustration 184: ACC2: Full- and Halfbridge 4 wire*

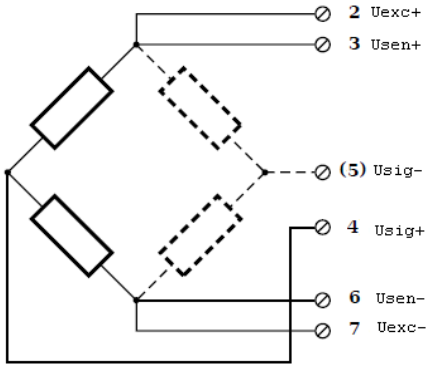



*Illustration 185: ACC2: Full- and Halfbridge 6 wire*

## 5.4.7 ACC2: Strain gauge quarter bridge

For the connection of strain gauge quarter bridges you need the same setup as for the *Full 4 Wire* bridge plus a special connection plug which contains the completion resistances. The plug can be obtained under the designation ACC2-120 with 120 Ω (see page 91) and ACC2-350 with 350 Ω (see page 91).

see also 5.2.6.1 Connecting sensors with sensing leads on page 93

The bridge excitation voltage is between 2.5 and 3 V (the actual value is not important since the module will measure the excitation voltage and correct the measured values).

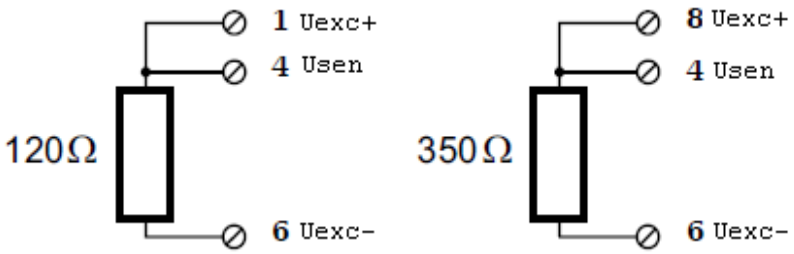



*Illustration 186: ACC2 strain gauge quarter bridge*

The pin-numbers in the illustration refer to the pins of the bridge completion connector (see ACC2-120 on page 91/ACC2-350 on page 91) that the sensor is connected to (not the pins of the DS-NET module).

## 5.4.8 ACC2: IEPE sensor

The sensor is supplied with 4 mA of current from the module (current supply).

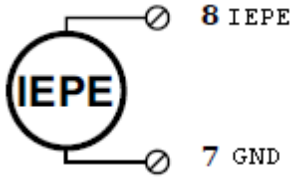



*Illustration 187: ACC2 IEPE sensor*

An optional screw-to-BNC adapter is available under the designation ACC2-BNC (see page 91).

## 5.4.9 ACC2: Digital input and output

On each connecting plug two contacts are available in each case for an input and an output.


*Illustration 188: ACC2 digital input and output*

Note: For the input you can connect the ground of your voltage to the GND connector of the DS-GATE module (see 5.3 DS GATE on page 95).

## 5.4.10 ACC2: Specifications

All declarations are valid after a warm up time of 45 minutes.

| ANALOG INPUTS | |
|---|---|
| Number of channels | 2 |

| | | | |
|---|---|---|---|
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[24]<br>0.05 % in industrial area[25] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 500 $V_{DC}$[26] channel to channel to power supply to interface | | |
| Sensor identification | TEDS class 1 and class 2 according to IEEE 1541.4 | | |
| **VOLTAGE MEASUREMENT** | | | |
| | **Range** | **max. Deviation** | **Resolution** |
| | ±60 V | ±12 mV | 7.2 µV |
| | ±10 V | ±2 mV | 1.2 µV |
| | ±1 V | ±0.2 mV | 120 nV |
| | ±100 mV | ±20 µV | 12 nV |
| Input resistance | >10 MΩ (@ range ±10 V = 1 MΩ; ±60 V = 3 MΩ) | | |
| Noise voltage | 50 $\mu V_{pp}$ | | range ±10 V |
| Long term drift | <1 µV/24 h | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| Max. over-voltage | 30 $V_{DC}$ permanent | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <1 µV/10 K | <0.05 %/10 K | |
| Signal-noise-ratio | > 90 dB @ 1 kHz | > 120 dB @ 1 Hz | |
| **CURRENT MEASUREMENT** | | | |
| (internal shunt 50 Ω) | **Range** | **max. Deviation** | **Resolution** |
| | 0…25 mA | ±5 µA | 3.0 nA |
| Long term drift | <0.1 µA/24 h | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| Temperature influence | **On zero** | **On sensitivity** | |
| | <0.1 µA / 10 K | <0.03 % / 10 K | |
| **RESISTANCE / RTD MEASUREMENT** | | | |
| | **Range** | **max. Deviation** | **Resolution** |
| Resistance, 2-wire | 100 kΩ | ±100 Ω | 12 mΩ |
| Resistance, 2- and 4-wire | 4 kΩ | ±1 Ω | 0.5 mΩ |
| Resistance, 2- and 4-wire | 400 Ω | ±0.1 Ω | 48 µΩ |
| Pt100, 2- and 4-wire | -200 up to +850°C | ±0.25°C | 0.2 m°C |
| Pt1000, 2- and 4-wire | -200 up to +850°C | ±1°C | 0.2 m°C |
| Linearity error | <0.05% of final value at range 100 kΩ | | |
| **BRIDGE MEASUREMENT** | | | |
| Accuracy class | 0.05 | | |
| Bridge Type | full bridge, half bridge, 5-/6-wire connection, quarter bridge with completion terminal | | |
| Sensor resistance | >100 Ω | | |
| Supply | 2.5 V – 3 V | | |
| Measurement range | ±2.5 mV/V | ±50 mV/V | ±500 mV/V |
| Temperature influence | **On zero** | **On sensitivity** | |
| | <10 µV/V/10 K | <0.05 %/10 K | |
| **THERMOCOUPLE MEASUREMENT** | | | |
| | **Whole range** | **-100°C...upper limit** | |
| Type B | better than ±5°C | better than ±2.5°C | |
| Type E, J, K, L, T, U | better than ±1°C | better than ±0.5°C | |
| Type N | better than ±2°C | better than ±1°C | |
| Type R, S | better than ±3°C | better than ±1.5°C | |
| Input resistance | > 10 MΩ | | |
| Common mode voltage | 100 $V_{DC}$ permanent input isolation | | |
| Temperature influence | **On zero** | **On sensitivity** | |
| | <1 µV/10 K | <0.02%/10 K | |
| **IEPE SENSOR MEASUREMENT** | | | |
| | **Range** | **max. Deviation** | **Resolution** |

24 according EN 61326: 1997, appendix B
25 according EN 61326: 1997, appendix A
26 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | | | |
|---|---|---|---|
| | ±10 V | ±10 mV | 1.2 µV |
| Supply | Constant current 4 mA | | |
| Minimum input frequency | 2 Hz | | |
| Limit frequency | 10 kHz | | |
| Temperature influence | **On zero** | **On sensitivity** | |
| | <10 µV/10 K | <0.05%/10 K | |
| **ANALOG/DIGITAL CONVERSION** | | | |
| Resolution | 24 bit | | |
| Sample rate | 10 kHz<br>thermocouple measurement 8Hz | | |
| Conversion method | Sigma-Delta (group delay time 380 µs) | | |
| Antialiasing filter | 20kHz, 5th order | | |
| Digital filter | IIR, low pass, high pass, 4th order<br>1 Hz up to 10kHz in steps, 1, 2, 5, automated sample reduction for lower frequencies | | |
| **DIGITAL IN/OUTPUTS** | | | |
| Number | 2 (1 digital I/O per channel) | | |
| Response time | 0.2 ms | | |
| Input | state, tare, reset | | |
| Input voltage | max. 30 $V_{DC}$ | | |
| Input current | max. 0.5 mA | | |
| Upper threshold | >10 V (high) | | |
| Lower threshold | <2.0 V (low) | | |
| Output | state, alarm | | |
| Contact | open drain p-channel MOSFET | | |
| Load | 30 $V_{DC}$ / 100 mA (ohmic load) | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |
| Storage temperature | -40°C up to +85°C | | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | | |
| Vibration | MIL-STD 810F 514.5, procedure I | | |
| Shock | MIL-STD 810F 516.5, procedure I | | |
| **MECHANICAL** | | | |
| Case | Aluminium | | |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| Weight | approx. 400g for standard measurement modules<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| **CONNECTION** | | | |
| Standard | 2x10 pin screw terminal | | |
| Option | BNC is possible with optional adapter: ACC2-BNC (only for IEPE measurement) | | |

*Table 13: ACC2 Specifications*

## 5.5 DS NET CFB2

The DS NET CFB2 module has 2 electrically isolated analogue input channels, 2 analogue output channels and 4 digital inputs or outputs.

The pin assignment of the two blue 10-pin connectors is identical. On the left of these blue 10-pin connectors, you can see numbers identifying the connector (1/2) and the pin-numbers (1-10). If several connections are possible (e.g. to measure 2 voltage channels on one of the blue 10-pin connectors), you will find the associated pin-numbers comma-separated in the circuit diagram.

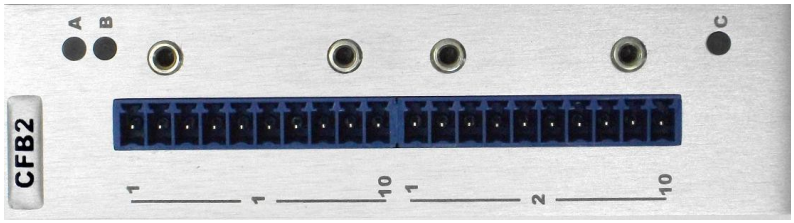



*Illustration 189: CFB2*

| IMPORTANT | When you use the carrier frequency principle, you should activate the synchronisation to avoid crosstalk between the channels.<br>For the master channel you must choose *Sync. Internal* and for all other channels *Sync. External*.<br>Also make sure, that you have selected the same frequency for all channels (e.g. 600Hz, 4800Hz).<br>Note, that the synchronisation feature is only implemented for modules with a serial number higher than 920100. |
|---|---|

## 5.5.1 CFB2: LVDT full bridge

With (inductive) full bridges all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration.
see also 5.2.6.1 Connecting sensors with sensing leads on page 93

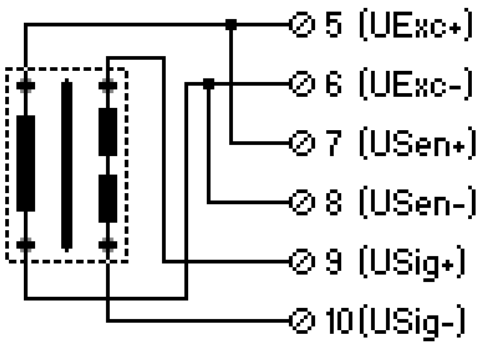



*Illustration 190: CFB2: LVDT full-bridge (4-wire)*

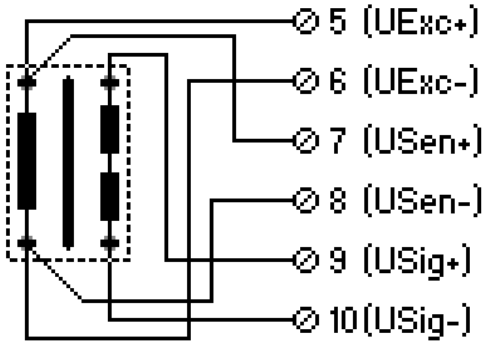



*Illustration 191: CFB2: LVDT full-bridge (6-wire)*

## 5.5.2 CFB2: Full and half bridge transducer

With (resistive) full bridges (strain-gauge full bridges) all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration; With half bridges the side drawn in dashes and connection 10 are omitted.
see also 5.2.6.1 Connecting sensors with sensing leads on page 93

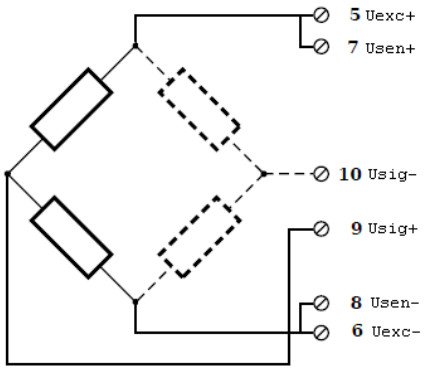



*Illustration 192: CFB2: Fullbridge (4-wire) and Halfbridge (3-wire)*

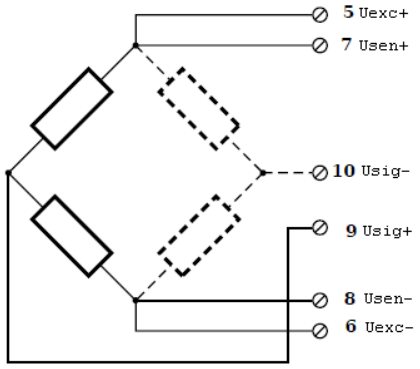



*Illustration 193: CFB2: Fullbridge (6-wire) and Halfbridge (5-wire)*

## 5.5.3 CFB2: Strain gauge quarter bridge

For the connection of strain gauge quarter bridges you need the same setup as for the *Half 3 Wire* bridge plus a special connection plug (adapter) which contains the completion resistances. The adapter can be obtained under the designation CFB2-120 with 120 Ω (see page 91) and CFB2-350 with 350 Ω (see page 91).
see also 5.2.6.1 Connecting sensors with sensing leads on page 93

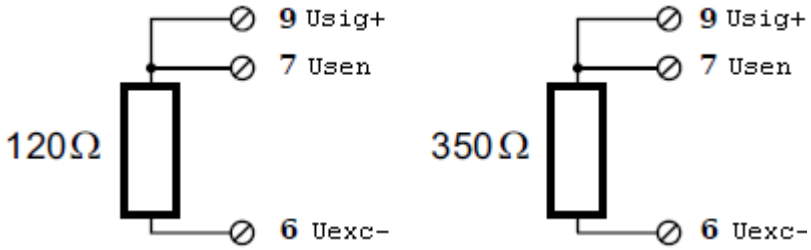



*Illustration 194: CFB2 strain gauge quarter bridge*

The pin-numbers in the illustration refer to the pins of the bridge completion connector (CFB2-120/CFB2-350) that the sensor is connected to (not the pins of the DS-NET module).

## 5.5.4 CFB2: Analogue output

Two analogue outputs are available to supply a voltage.

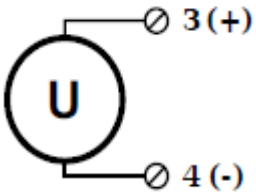



*Illustration 195: CFB2 Analogue output*

## 5.5.5 CFB2: Digital input and output

On each connecting plug two contacts are available for input and output.


*Illustration 196: CFB2 digital input and output*

## 5.5.6 CFB2: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | | | |
|---|---|---|---|---|
| **ANALOG INPUTS** | | | | |
| Number of channels | 2 | | | |
| Accuracy | 0.05 % typical<br>0.1 % in controlled environment[27]<br>0.5 % in industrial area[28] | | | |
| Repeatability | 0.003 % typical (within 24 h) | | | |
| Input resistance | >10MΩ | | | |
| Isolation voltage | 500 $V_{DC}$[29] channel to channel to power supply to interface | | | |
| **SENSOR INFORMATION** | | | | |
| | DC Mode | 600 Hz Carrier Mode (AC) | 4.8 kHz Carrier Mode (AC) | |
| Sensor type | resistive full and half bridge (5/6 wire),<br>quarter bridge with completion terminal (3 wire) | resistive full and half bridge (5/6 wire),<br>quarter bridge with completion terminal (3 wire) | resistive full and half bridge (5/6 wire),<br>quarter bridge with completion terminal (3 wire)<br>inductive full and half bridges,<br>LVDT and RVDT sensors | |
| Permitted sensor cable length | <300 m | <300 m | <100 m | |
| Sensor connection | with or without sense leads for compensation of cable influences<br>full bridge 4 or 6 wire<br>half bridge 3 or 5 wire<br>quarter bridge 3 wire in combination with completion terminal 120 Ω or 350 Ω | | | |
| Sensor excitation (selectable) | DC: 5 VDC | CF: 5 Veff | DC: 2.5 VDC | CF: 2.5 Veff |
| Permitted sensor resistance | >300 Ω | >300 Ω | >100 Ω | >100 Ω |
| Measuring range | ±1.25 mV/V | ±1.25 mV/V | ±2.5 mV/V | ±2.5 mV/V |
| | ±2.5 mV/V | ±2.5 mV/V | ±5 mV/V | ±5 mV/V |
| | ±25 mV/V | ±25 mV/V | ±50 mV/V | ±50 mV/V |
| | ±50 mV/V | ±50 mV/V | ±100 mV/V | ±100 mV/V |
| | ±100 mV/V | ±100 mV/V | ±200 mV/V | ±200 mV/V |
| | ±250 mV/V | ±250 mV/V | ±500 mV/V | ±500 mV/V |
| | ±500 mV/V | ±500 mV/V | ±1000 mV/V | ±1000 mV/V |
| Temperature influence on zero (range 2.5 mV/V) | <1 µV / 10 K | <1 µV / 10 K | <1 µV / 10 K | <1 µV / 10 K |
| Temperature influence on sensitivity (measuring value) | 0.05 % / 10 K | 0.05 % / 10 K | 0.05 % / 10 K | 0.05 % / 10 K |
| Long term drift | <1 µV/V / 48 h<br><2.5 µV / V/8000h | <0.5 µV/V / 48 h<br><1.25 µV / V/8000h | <1 µV/V / 48 h<br><2.5 µV / V/8000h | <0.5 µV/V / 48 h<br><1.25 µV / V/8000h |
| Linearity Error | 0.02 % f.s. | | | |
| Noise voltage at 10 Hz | < 0.3 µV/V | | | |
| Noise voltage at 100 Hz | < 1 µV/V | | | |
| **ANALOG/DIGITAL CONVERSION** | | | | |
| Resolution | 24 bit | | | |
| Sample rate | 10 kHz | | | |
| Conversion method | Sigma-Delta (group delay time 3.8 ms) | | | |

27 according EN 61326: 1997, appendix B
28 according EN 61326: 1997, appendix A
29 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | | | |
|---|---|---|---|
| Antialiasing filter | DC: 1 kHz 5th order | 4.8 kHz CF: 1 kHz 5th order | 600 Hz CF: 100 Hz, 5th order |
| Digital filter | IIR, low pass, high pass, band pass, 4th order, 1Hz up to 1kHz in steps 1, 2, 5 | | |
| Averaging | configurable or automated according the selected data rate | | |
| **ANALOGUE OUTPUTS** | | | |
| Number | 2 voltage outputs | | |
| Accuracy | 0.02 % | | |
| DAC resolution | 16 bit | | |
| Sample rate | 10 kHz | | |
| Output voltage | ±10 VDC | | |
| Perm. load resistance | >2kΩ | | |
| | **on zero** | **on sensitivity** | |
| Temperature influence | <1 mV/10 K | <0.05 %/10 K | |
| Noise voltage in the range of | <10 mV at 1 kHz | <2 mV at 10 Hz | |
| Long term drift | <1 mV/48h | | |
| **DIGITAL IN/OUTPUTS** | | | |
| Number | 4 configurable I/Os | | |
| Input | state, tare, reset | | |
| Input voltage | max. 30 $V_{DC}$ | | |
| Input current | max. 0.5 mA | | |
| Upper threshold | >10 V (high) | | |
| Lower threshold | <2.0 V (low) | | |
| Output | state, alarm, limit switch | | |
| Contact | open drain p-channel MOSFET | | |
| Load | 30 $V_{DC}$ / 100 mA (ohmic load) | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2.5 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |
| Storage temperature | -40°C up to +85°C | | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | | |
| Vibration | MIL-STD 810F 514.5, procedure I | | |
| Shock | MIL-STD 810F 516.5, procedure I | | |
| **MECHANICAL** | | | |
| Case | Aluminium | | |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| Weight | approx. 400g for standard measurement modules<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| **CONNECTION** | | | |
| Standard | 2x10 pin screw terminal | | |

*Table 14: CFB2 Specifications*

## 5.6 DS NET BR8

The DS NET BR8 module has 8 electrically isolated analogue inputs for bridge measurement. It has 8 DSUB9 connectors and has double the width of the other measurement modules.

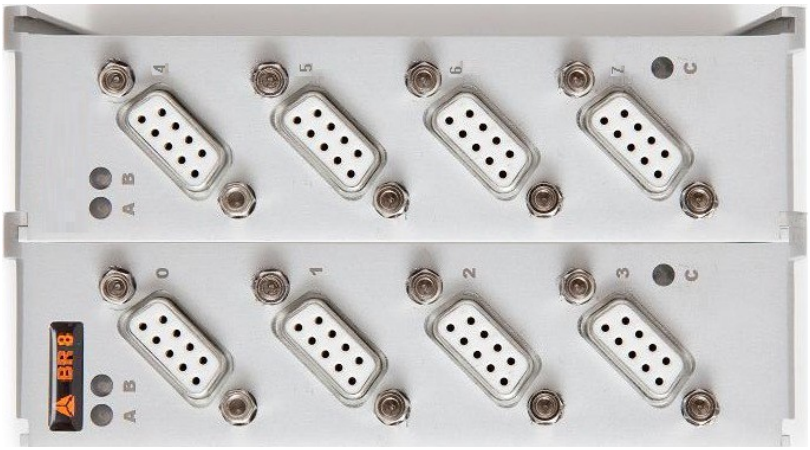



*Illustration 197: BR8*

Illustration 198 shows the pin connection of the D-SUB connectors:

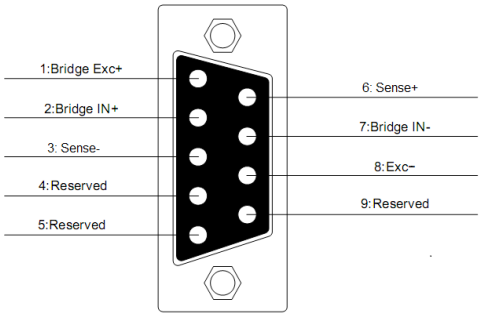



*Illustration 198: BR8: pinout*

### 5.6.1 Full-bridge 6 wire

I

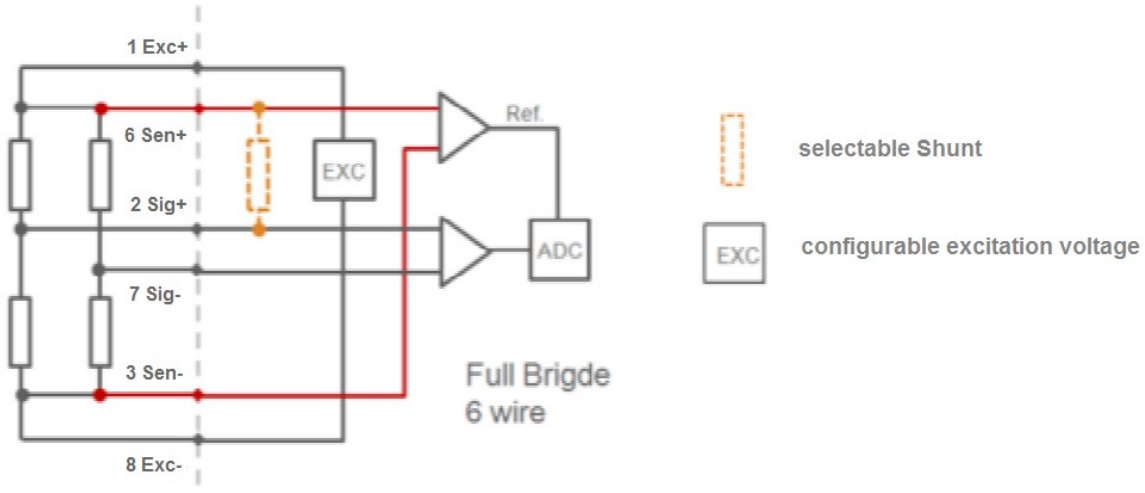



*Illustration 199: BR8 Full-bridge 6 wire*

## 5.6.2 Full-bridge 4 wire

I

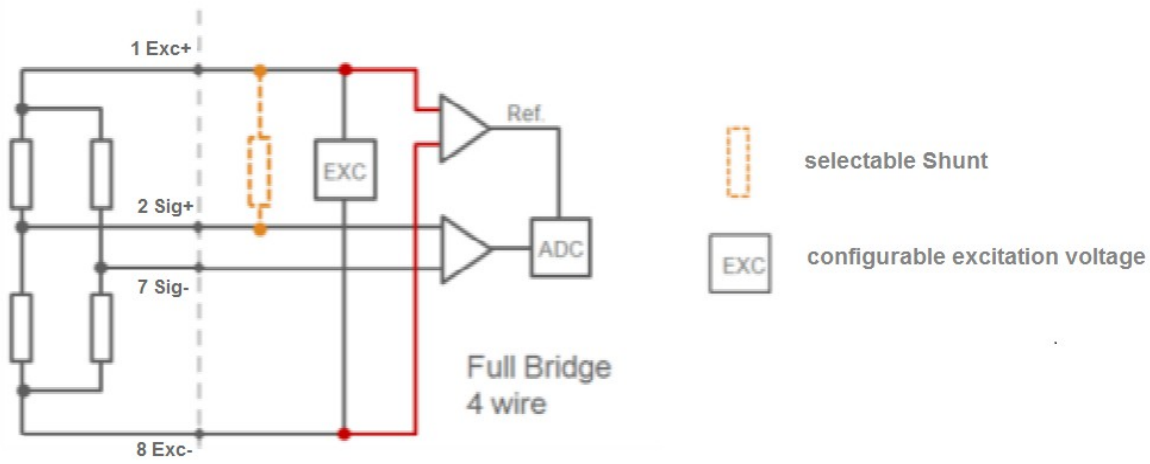



*Illustration 200: BR8 Full-bridge 4 wire*

## 5.6.3 Half-bridge 5 wire

I

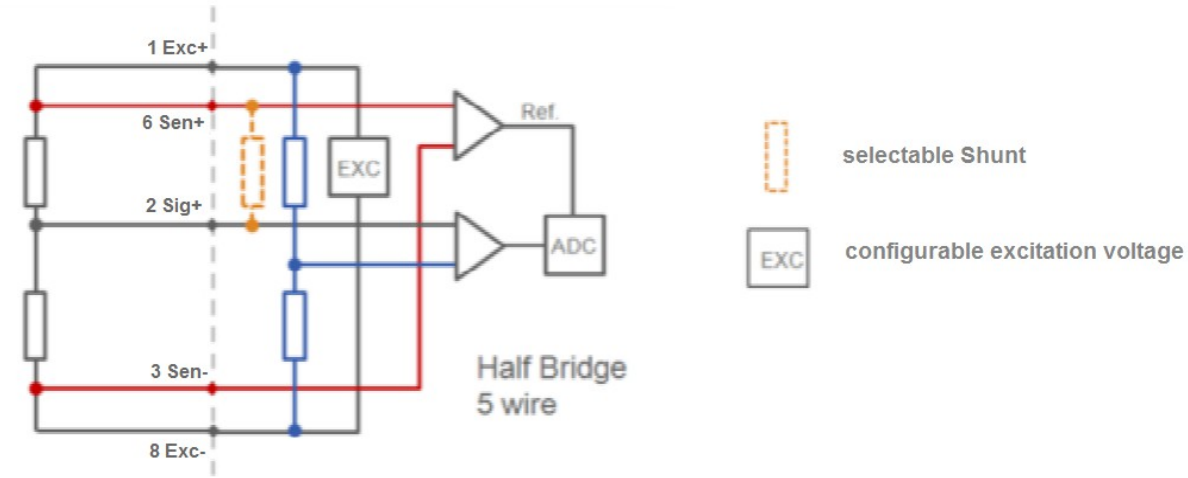



*Illustration 201: BR8 Half-bridge 5 wire*

## 5.6.4 Half-bridge 3 wire

I

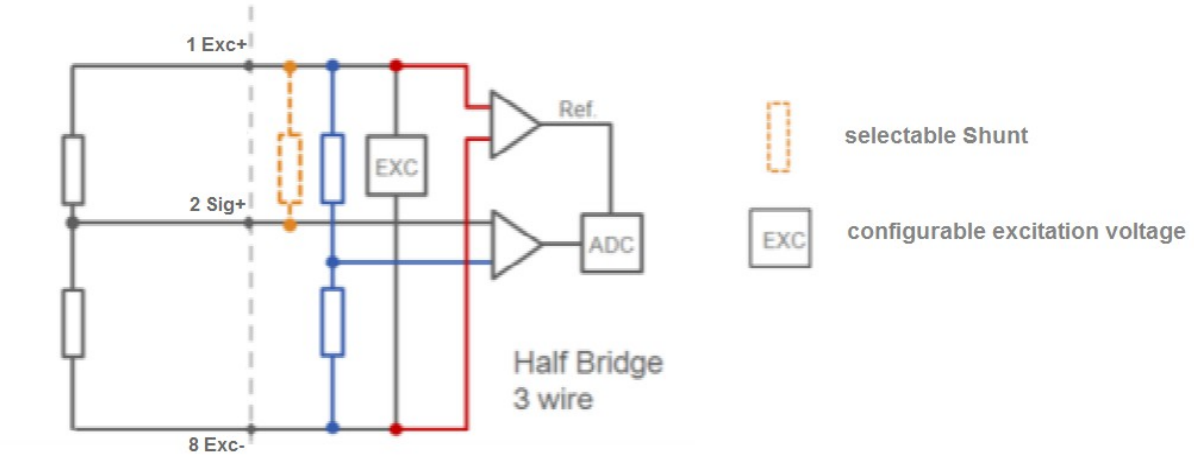



*Illustration 202: BR8 Half-bridge 3 wire*

## 5.6.5 Quarter-bridge

I

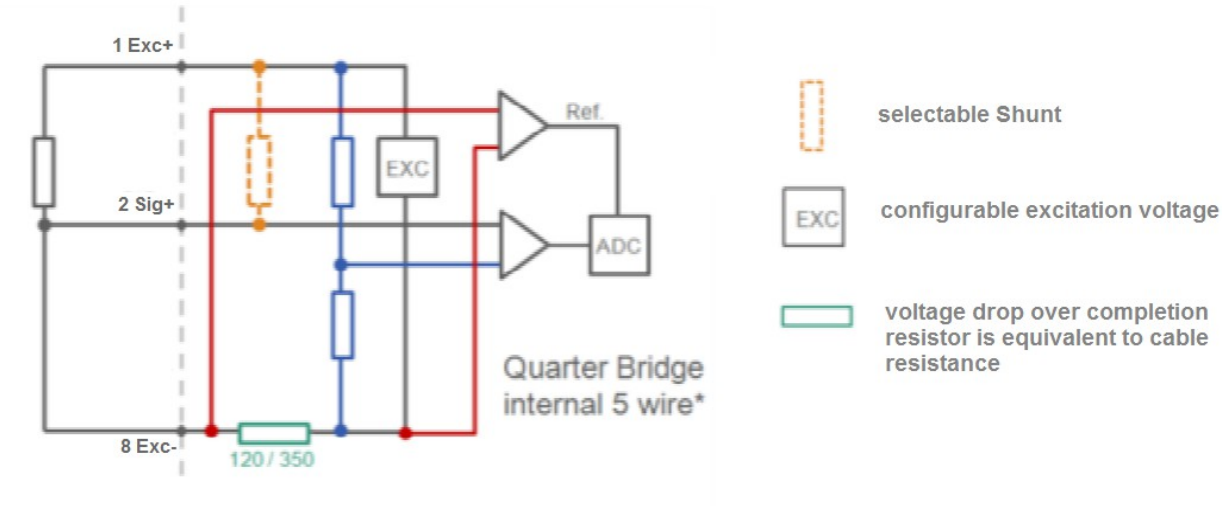



*Illustration 203: BR8 Quarter-bridge*

## 5.6.6 BR8: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | |
|---|---|
| **ANALOG INPUTS** | |
| Number of channels | 8 |
| Accuracy | 0.02 % typical<br>0.05 % in controlled environment[30]<br>0.1 % in industrial area[31] |
| Repeatability | 0.01 % typical (within 24 h) |
| Input resistance | >10 MΩ |
| Isolation voltage | 500 $V_{DC}$[32] channel to channel to power supply to interface |
| **BRIDGE MEASUREMENT** | |
| Bridge type | resistive full bridge (4/6 wire),<br>resistive half bridge (3/5 wire),<br>resistive quarter bridge 120 Ω and 350 Ω (3 wire incl. cable compensation) |

30 according EN 61326: 1997, appendix B
31 according EN 61326: 1997, appendix A
32 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | | |
|---|---|---|
| Permitted sensor cable length | <300 m full and half bridge<br><100 m quarter bridge | |
| Sensor excitation | 2 $V_{DC}$ and 4 $V_{DC}$ selectable | |
| Permitted sensor resistance | full bridge >300 Ω<br>half bridge >200 Ω<br>quarter bridge>100 Ω | |
| Measurement range | ±1 mV/V, ±5 mV/V | |
| | **On zero** | **On sensitivity** |
| Temperature influence | <0.2 µV/V/10 K | <0.05 %/10 K |
| Long term drift | <0.2 µV/V / 24 h , <2 µV/V / 8000h | |
| Linearity Error | <0.02 % of the final value typical | |
| Noise voltage @ 10 Hz | <0.3 µV/V | |
| | <1 µV/10 K | <0.02%/10 K |
| **ANALOG/DIGITAL CONVERSION** | | |
| Resolution | 24 bit | |
| Sample rate | 10 kHz | |
| Conversion method | Sigma-Delta (group delay time 600µs) | |
| Antialiasing filter | 1kHz, 3rd order | |
| Digital filter | IIR, low pass, high pass, band pass, 4th order<br>1 Hz up to 1kHz in steps, 1, 2, 5 | |
| Averaging | configurable or automated according the selected data rate | |
| **POWER SUPPLY** | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | |
| Power consumption | approx. 2.5 W | |
| Influence of the voltage | <0.001 %/V | |
| **ENVIRONMENTAL** | | |
| Operating temperature | -20°C up to +60°C | |
| Storage temperature | -40°C up to +85°C | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | |
| Vibration | MIL-STD 810F 514.5, procedure I | |
| Shock | MIL-STD 810F 516.5, procedure I | |
| **MECHANICAL** | | |
| Case | Aluminium | |
| Dimensions (W x H x D) | approx. 62 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 | |
| Weight | approx. 800g<br>for details see: 6.1.1 Physical Dimensions on page 154 | |
| **CONNECTION** | | |
| Standard | 8x DSUB9 | |

*Table 15: BR8 specifications*

# 5.7 DS NET BR4

The DS NET BR4 module has four electrically isolated analogue inputs.

The pin assignment of the two blue 10-pin connectors is identical. On the left of these blue 10-pin connectors, you can see numbers identifying the connector (1/2) and the pin-numbers (1-10). If several connections are possible (e.g. to measure 2 voltage channels on one of the blue 10-pin connectors), you will find the associated pin-numbers comma-separated in the circuit diagram.

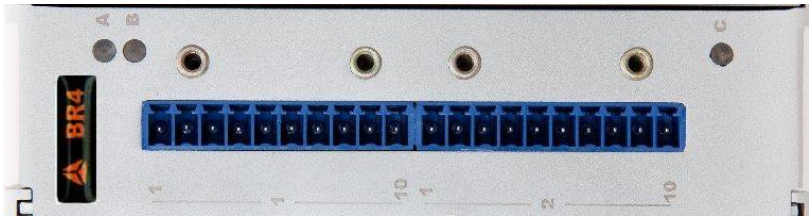



*Illustration 204: BR4*

## 5.7.1 DS NET BR4-D

The BR4 module is optionally also available with D-SUB connectors:


*Illustration 205: BR4-D (option)*

With the DSUB connectors we have more pins available (compared to the standard 10-pin screw connectors) and so these modules can provide an additional sensor power supply voltage for the sensors on pins 4 and 5.
The standard BR4 module with screw connectors has less pins and does not have this sensor power supply voltage.

Illustration 206 shows the pin connection of the D-SUB connectors:

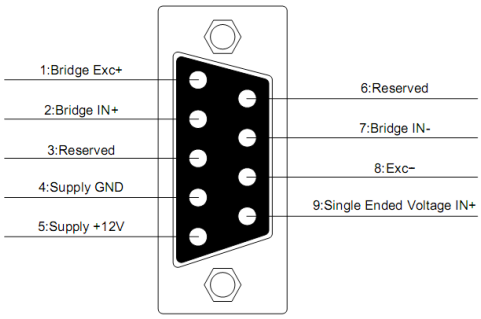



*Illustration 206: BR4 D: pinout*

**HINT**

The supply voltages of the D-SUB connectors (on pins 4 and 5) are not galvanically isolated from each other.
Also note, that this supply voltage is always guaranteed to be <= $12V_{DC}$.[33]
The maximum current per BR4-D module is approximately 100mA.

33 This is depending on the supply voltage. If you need exactly 12 V, make sure that the supply voltage is >= 15 V.

The following table shows the relation between the screw connectors and the D-SUB connectors:

| 10-pin screw connector | D-SUB connector / pin | 10-pin screw connector | D-SUB connector / pin |
|---|---|---|---|
| 1/1 | 0/1 | 2/1 | 2/1 |
| 1/2 | 0/9 | 2/2 | 2/9 |
| 1/3 | 0/2 | 2/3 | 2/2 |
| 1/4 | 0/7 | 2/4 | 2/7 |
| 1/5 | 0/8 | 2/5 | 2/8 |
| 1/6 | 1/1 | 2/6 | 3/1 |
| 1/7 | 1/9 | 2/7 | 3/9 |
| 1/8 | 1/2 | 2/8 | 3/2 |
| 1/9 | 1/7 | 2/9 | 3/7 |
| 1/10 | 1/8 | 2/10 | 3/8 |

*Table 16: BR4-D: relation of pins between screw connector and D-SUB connector*

For the BR4-D module, you can also use an optional DSUB-BNC adapter (see page 91).

## 5.7.2 DS NET BR4-L

The BR4 module is optionally also available with 10 pin LEMO connectors.

With the LEMO connectors we have more pins available (compared to the standard 10-pin screw connectors) and so these modules can provide an additional sensor power supply voltage for the sensors on pins 9 and 10.
The standard BR4 module with screw connectors has less pins and does not have this sensor power supply voltage.

Illustration 206 shows the pin connection of the 10 pin LEMO connectors:

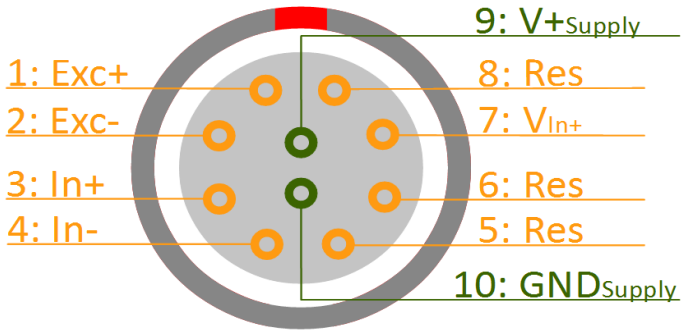



*Illustration 207: BR4-L pinout*

**HINT**

The supply voltages of the LEMO connectors (on pins 9 and 10) are not galvanically isolated from each other. This is the supply voltage that you connect to the DS NET GATE.
The maximum current per BR4-L module is approximately 200mA.

## 5.7.3 BR4: Voltage

The BR4 module can measure voltages of up to 10 V.

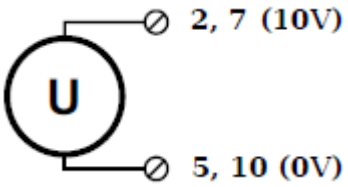



*Illustration 208: BR4 Voltage*

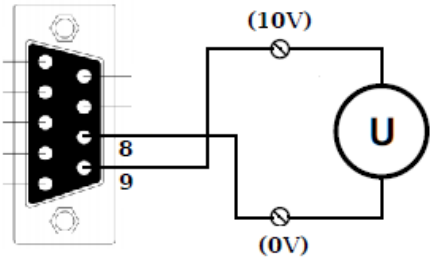



*Illustration 209: BR4-D Voltage*

**IMPORTANT**

Voltages which exceed the permissible limits produce incorrect measurement data, because the inputs are protected against over voltages and limit the input voltage.

## 5.7.4 BR4: Current

A shunt resistance of 50 Ω is integrated for current measurement. This facilitates the measurement of currents up to 25 mA. For higher currents use a voltage measurement with an external shunt (see 5.2.6.2 Current measurement with an external shunt on page 94).

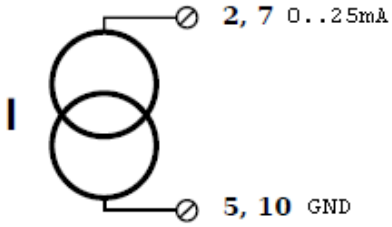



*Illustration 210: BR4 Current*

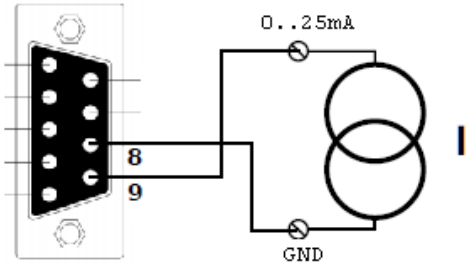



*Illustration 211: BR4-D Current*

**IMPORTANT**

The internal shunt will only be active when the DS-NET system is powered up and initialized. When the system is powered off (and during start-up, reboot, etc.) the internal shunt will not be connected and thus the circuit will not be closed.

## 5.7.5 BR4: Potentiometer

Potentiometers with resistances between 1 kΩ and 10 kΩ are connected in a three-wire configuration.

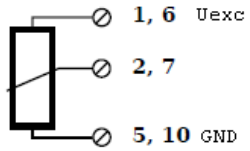



*Illustration 212: BR4 Potentiometer*

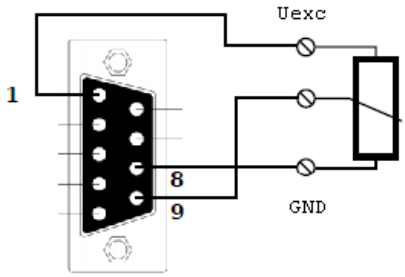



*Illustration 213: BR4-D Potentiometer*

## 5.7.6 BR4: Resistance, Pt100, Pt1000

You can connect resistances and Pt100/1000 probes in two-, three- or four-wire circuits. You specify the selected type of circuit during the module configuration.
see also 5.2.6.1 Connecting sensors with sensing leads on page 93

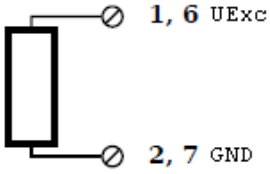



*Illustration 214: BR4 res. 2 wire*

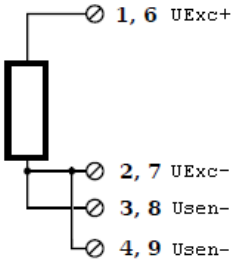



*Illustration 215: BR4 res. 3 wire*

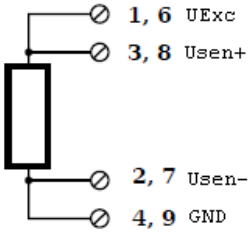



*Illustration 216: BR4 res. 4 wire*

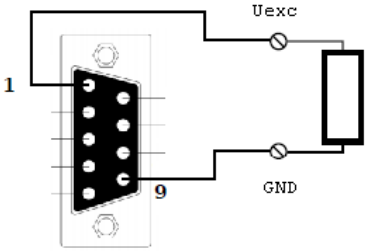



*Illustration 217: BR4-D res. 2 wire*

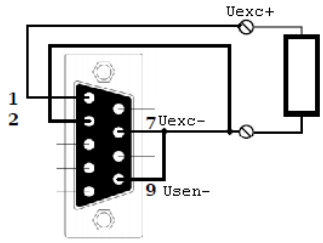



*Illustration 218: BR4-D res. 3 wire*

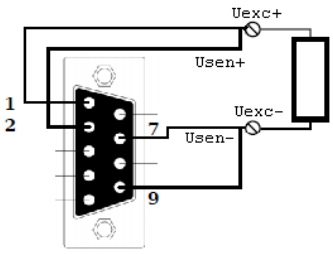



*Illustration 219: BR4-D res. 4 wire*

## 5.7.7 BR4: Thermocouple

You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U.

See also 5.2.6.3 Measuring with thermocouples on page 94.

For connecting thermocouples you need a special connecting plug which contains the comparative measuring point (cold junction compensation) required for thermocouples.

The plug can be obtained under the designation BR4-CJC (see page 91).

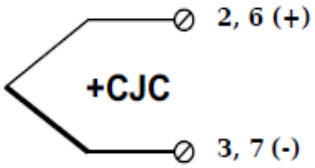



*Illustration 220: BR4 Thermocouple*

The pin-numbers in the illustration refer to the pins of the CJC adapter (see BR4-CJC on page 91) that the sensor is connected to (not the pins of the DS-NET module).

Alternatively, you can also use two thermocouples or a reference temperature source.

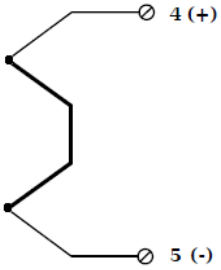



*Illustration 221: ACC2 differential thermocouple measurement*

## 5.7.8 BR4: Full bridge transducer

With (resistive) full bridges (strain-gauge full bridges) four connections are occupied. If the sensor has sensing leads, connect these with the excitation terminals (1 and 5 or 6 and 10).
see also 5.2.6.1 Connecting sensors with sensing leads on page 93

The bridge excitation voltage is between 2.5 and 3 V (the actual value is not important since the module will measure the excitation voltage and correct the measured values).

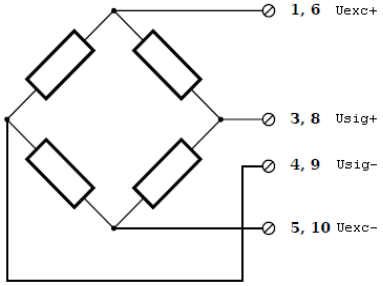



*Illustration 222: BR4 full bridge*

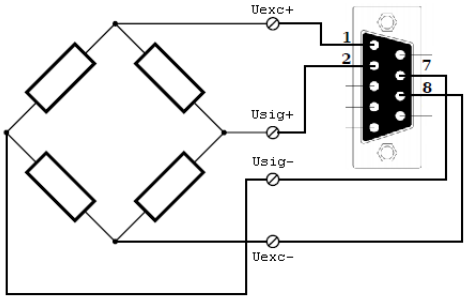



*Illustration 223: BR4-D full bridge*

The shield of the cable should be connected to the housing of the module (i.e. to the screw-holes to the right of the blue 10-pin connectors, or to the screws of the D-SUB9 connector in case of a BR4-D).

## 5.7.9 BR4: Strain-gauge half and quarter-bridges

For the connection of strain-gauge half and quarter-bridges you need a special connecting plug which contains the completion resistances. For the BR-4 module, the plug can be obtained under the designation BR4-120 for 120 Ω (see page 91) and BR4-350 for 350 Ω (see page 91).

For the BR-4-D module, the bridge completion adapters can be obtained under the designations: BR4-D-120 for 120 Ω (see page 91) or BR4-D-350 for 350 Ω (see page 91).

see also 5.2.6.1 Connecting sensors with sensing leads on page 93

The bridge excitation voltage is between 2.5 and 3 V (the actual value is not important since the module will measure the excitation voltage and correct the measured values).

**IMPORTANT**

For strain-gauge quarter bridges the connecting plug must have the same resistance values as the strain gauges used, because otherwise no measurement is possible.
Strain-gauge half bridges can also be connected with other resistance values.

The pin-numbers in the illustrations below refer to the pins of the bridge completion connector (BR4-120/BR4-350 or BR4-D-120/BR4-D-350) that the sensor is connected to (not the pins of the DS-NET module).

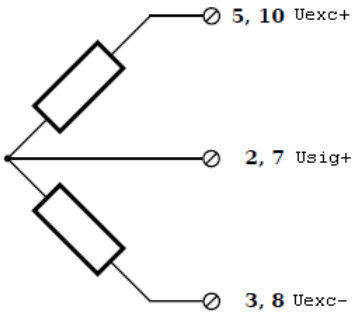



*Illustration 224: BR4 Strain gauge with half bridge completion adapter BR4-120/BR4-350*

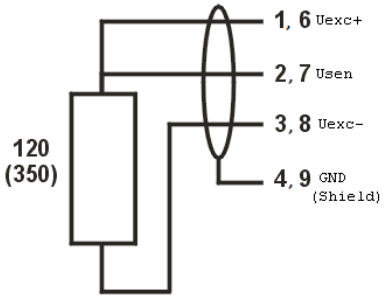



*Illustration 225: BR4 Strain gauge with quarter bridge completion adapter: BR4-120/BR4-350*

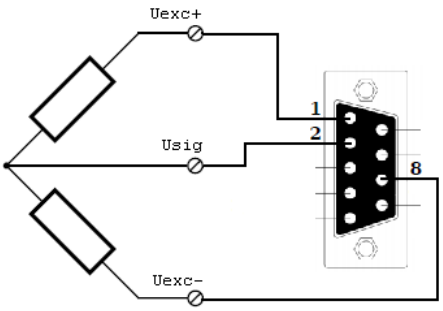



*Illustration 226: BR4-D Strain gauge with half bridge completion adapter BR4-D-120/BR4-D-350*

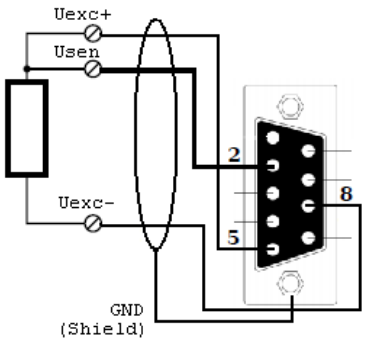



*Illustration 227: BR4-D Strain gauge with quarter bridge completion adapterBR4-D-120/BR4-D-350*

The shield of the cable should be connected to the housing of the module (i.e. to the screw-holes to the right of the blue 10-pin connectors, or to the screws of the D-SUB9 connector in case of a BR4-D).

## 5.7.10 BR4: Specifications

All declarations are valid after a warm up time of 45 minutes.

| ANALOG INPUTS | | | |
|---|---|---|---|
| Number of channels | 4 | | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[34]<br>0.05 % in industrial area[35] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 500 $V_{DC}$[36] channel to channel to power supply to interface | | |
| **VOLTAGE MEASUREMENT** | | | |
| | **Range** | **max. Deviation** | **Resolution** |
| | ±10 V | ±2 mV | 1.2 µV |

34 according EN 61326: 1997, appendix B
35 according EN 61326: 1997, appendix A
36 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | | | |
|---|---|---|---|
| | ±1 V | ±0.2 mV | 120 nV |
| | ±100 mV | ±20 µV | 12 nV |
| Input resistance | >10 MΩ (@ range ±10 V = 1 MΩ) | | |
| Noise voltage | <50 $\mu V_{pp}$ | | range ±10 V |
| Long term drift | <1 µV/24 h | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <1 µV/10 K | <0,05 %/10 K | |
| Signal-noise-ratio | >90 dB @ 1 kHz | >120 dB @ 1 Hz | |
| **CURRENT MEASUREMENT** | | | |
| (internal shunt 50 Ω) | **Range** | **max. Deviation** | **Resolution** |
| | 0…25 mA | ±5 µA | 3.0 nA |
| Long term drift | <0.1 µA/24 h | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| Temperature influence | **On zero** | **On sensitivity** | |
| | <0.1 µA / 10 K | <0.03 % / 10 K | |
| **RESISTANCE / RTD MEASUREMENT** | | | |
| | **Range** | **max. Deviation** | **Resolution** |
| Resistance, 2-wire | 100 kΩ | ±100 Ω | 12 mΩ |
| Resistance, 2- and 4-wire | 4 kΩ | ±1 Ω | 0.5 mΩ |
| Resistance, 2- and 4-wire | 400 Ω | ±0.1 Ω | 48 µΩ |
| Pt100, 2- and 4-wire | -200 up to +850°C | ±0.25°C | 0.2 m°C |
| Pt1000, 2- and 4-wire | -200 up to +850°C | ±1°C | 0.2 m°C |
| Linearity error | <0.05% of final value at range 100 kΩ | | |
| **BRIDGE MEASUREMENT** | | | |
| Accuracy class | 0.05 | | |
| Bridge Type | full bridge, 4-wire connection, half and quarter bridge with completion terminal | | |
| Sensor resistance | >100 Ω | | |
| Supply | 2.5 V – 3 V | | |
| Sensor power supply voltage | only available for BR-4-D: <= 12V | | |
| Measurement range | ±2.5 mV/V, ±50 mV/V, ±500 mV/V | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <10 µV/V/10 K | <0.05 %/10 K | |
| Long term drift | <0.1 µV/V/24 h | | |
| **THERMOCOUPLE MEASUREMENT** | | | |
| | **WHOLE RANGE** | **-100°C...UPPER LIMIT** | |
| Type B | better than ±5°C | better than ±2.5°C | |
| Type E, J, K, L, T, U | better than ±1°C | better than ±0.5°C | |
| Type N | better than ±2°C | better than ±1°C | |
| Type R, S | better than ±3°C | better than ±1.5°C | |
| Input resistance | > 10 MΩ | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| Temperature influence | **On zero** | **On sensitivity** | |
| | <1 µV/10 K | <0.02%/10 K | |
| **ANALOG/DIGITAL CONVERSION** | | | |
| Resolution | 24 bit | | |
| Sample rate | 10 kHz<br>thermocouple measurement 8Hz | | |
| Conversion method | Sigma-Delta | | |
| Antialiasing filter | 20kHz, 5th order | | |
| Digital filter | IIR, low pass, high pass, 4th order<br>1 Hz up to 10kHz in steps, 1, 2, 5, automated sample reduction for lower frequencies | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2.5 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |

| | |
|---|---|
| Storage temperature | -40°C up to +85°C |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing |
| Vibration | MIL-STD 810F 514.5, procedure I |
| Shock | MIL-STD 810F 516.5, procedure I |
| **MECHANICAL** | |
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| Weight | approx. 400g/ 450g for BR4-D<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| **CONNECTION** | |
| Standard | 2x10 pin screw terminal |
| Option | 4x DSUB 9 pin connectors (module type BR4-D)<br>BNC (only for voltage measurement) with optional adapter DSUB-BNC (see DSUB-BNC on page 91) |

*Table 17: BR4 specifications*

# 5.8 DS NET V8

The DS NET V8 module has eight electrically isolated analogue inputs and two digital inputs and outputs.

The pin assignment of the two blue 10-pin connectors is identical. On the left of these blue 10-pin connectors, you can see numbers identifying the connector (1/2) and the pin-numbers (1-10). If several connections are possible (e.g. to measure 2 voltage channels on one of the blue 10-pin connectors), you will find the associated pin-numbers comma-separated in the circuit diagram.


*Illustration 228: V8*

## 5.8.1.1 DS NET V8-B

The V8 module is optionally available with BNC connectors:


*Illustration 229: V8-B (option)*

## 5.8.2 V8: Voltage

You can measure voltages of up to 10 V.

**IMPORTANT**

Voltages which exceed the permissible limits produce incorrect measurement data, because the inputs are protected against over voltages and limit the input voltage.

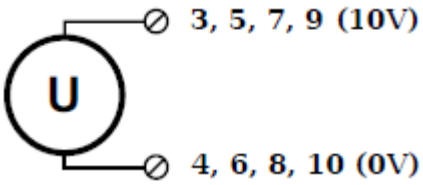



*Illustration 230: V8 Voltage*

## 5.8.3 V8: Current

For current measurement you need the connection plug V8-SHUNT (see page 91) containing the 100 Ω shunt resistances. This facilitates the measurement of currents of up to 25 mA.
For the V8-B module, no shunt adapter is available (see also 5.2.6.2 Current measurement with an external shunt on page 94).

When you use the SHUNT adapter, make sure to select *Measurement Current* in the channel configuration setup of the module (see Channel configuration setup on page 72), so that the module will automatically calculate the correct scaling. Also note, that the default *Min value* is 4 mA, so that you can easily detect if the sensor connection breaks (see also: Module Range/Range Error on page 73): in that case the current would drop to 0mA, and since this is lower than the allowed minimum the corresponding error LED of the module will become active.

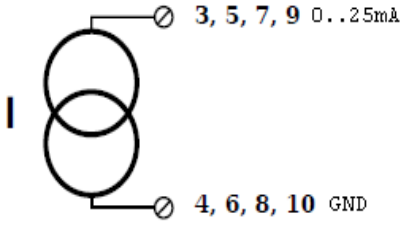



*Illustration 231: V8 Current*

The pin-numbers in the illustration refer to the pins of the SHUNT adapter (see V8-SHUNT on page 91) that the sensor is connected to (not the pins of the DS-NET module).

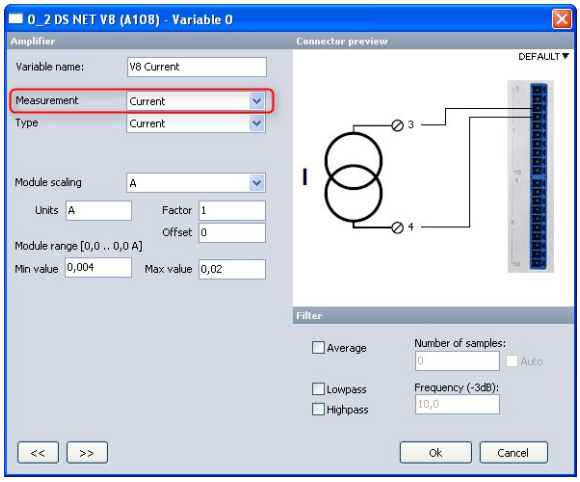



*Illustration 232: V8 Channel Setup For Current Measurement*

## 5.8.4 V8: Digital input and output

On each connecting plug two contacts are available in each case for an input and an output.


*Illustration 233: V8 digital input and output*

**HINT**

The digital input and output channels are not available for the V8-B module.

*+V* will be the input voltage that you connect to the DS-GATE power supply (see Illustration 170 on page 95).

*0V* is the *GND* connector of the DS-GATE module (see Illustration 170 on page 95) or the module housing.

## 5.8.5 V8: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | | |
|---|---|---|---|
| **ANALOG INPUTS** | | | |
| Number of channels | 8 | | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[37]<br>0.05 % in industrial area[38] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 500 $V_{DC}$[39] channel to channel to power supply to interface | | |
| **VOLTAGE MEASUREMENT** | | | |
| | **Range** | **max. Deviation** | **Resolution** |
| | ±10 V | ±2 mV | 40 µV |
| Input resistance | >10 MΩ | | |
| Long term drift | <1 µV/24 h | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| Max. Overvoltage | 50 $V_{DC}$ permanent | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <50 µV/10 K | <0.05 %/10 K | |
| Signal-noise-ratio | > 100 dB @ 100 Hz | > 120 dB @ 1 Hz | |
| **ANALOG/DIGITAL CONVERSION** | | | |
| Resolution | 24 bit | | |
| Sample rate | 10 kHz at 8 active channels | | |
| Conversion method | Sigma-Delta | | |
| Antialiasing Filter | Low pass 2kHz 5$^{th}$ order per channel (-3 dB at 2 kHz) | | |
| Digital filter | IIR, low pass, high pass, 4$^{th}$ order<br>1 Hz up to 10kHz in steps, 1, 2, 5, automated sample reduction for lower frequencies | | |
| **DIGITAL IN/OUTPUTS (not for V8-BNC)** | | | |
| Number | 4 (1 digital input and 1 digital output per connector) | | |
| Input | state, tare, reset | | |
| Input voltage | max. 30 $V_{DC}$ | | |
| Input current | max. 0.5 mA | | |
| Upper threshold | >10 V (high) | | |
| Lower threshold | <2 V (low) | | |
| Output | state, alarm | | |
| Contact | open drain p-channel MOSFET | | |
| Load | 30 $V_{DC}$/100 mA (ohmic load) | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |
| Storage temperature | -40°C up to +85°C | | |

37 according EN 61326: 1997, appendix B
38 according EN 61326: 1997, appendix A
39 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | |
|---|---|
| Relative humidity | 5 % up to 95 % at 50°C, non condensing |
| Vibration | MIL-STD 810F 514.5, procedure I |
| Shock | MIL-STD 810F 516.5, procedure I |
| **MECHANICAL** | |
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| Weight | approx. 400g / 500g for V8-B<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| **CONNECTION** | |
| Standard | 2x10 pin screw terminal |
| Option | 8 BNC connectors (module type V8-B) – no digital IOs |

*Table 18: V8 Specifications*

# 5.9 DS NET V8-200

The DS NET V8-200 module has eight electrically isolated analogue inputs.

The pin assignment of the two blue 10-pin connectors is identical. On the left of these blue 10-pin connectors, you can see numbers identifying the connector (1/2) and the pin-numbers (1-10). If several connections are possible (e.g. to measure 2 voltage channels on one of the blue 10-pin connectors), you will find the associated pin-numbers comma-separated in the circuit diagram.


*Illustration 234: V8-200*

| | |
|---|---|
| **WARNING** | High-Voltage module, danger of personal injury with improper use! Handling by skilled staff only! System must be connected to protective ground when signals higher than 47V are connected! Connect only touch-protected BNC leads to modules with BNC-connectors! During installation, the terminal must not be connected to the supply, or the fundamental safety rules for live working must be observed. |

## 5.9.1 V8-200: Voltage

You can measure voltages of up to 200 V.

| | |
|---|---|
| **IMPORTANT** | Voltages which exceed the permissible limits produce incorrect measurement data, because the inputs are protected against over voltages and limit the input voltage. |

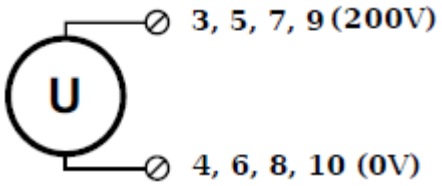



*Illustration 235: V8-200 Voltage*

## 5.9.2 V8-200: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | | |
|---|---|---|---|
| **ANALOG INPUTS** | | | |
| Number of channels | 8 | | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[40]<br>0.05 % in industrial area[41] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 500 $V_{DC}$[42] channel to channel to power supply to interface | | |
| **VOLTAGE MEASUREMENT** | | | |
| | Range | max. Deviation | Resolution |
| | ±200 V | ±40 mV | 800 µV |
| Input resistance | >10 MΩ | | |
| Long term drift | <20 µV/24 h | | |
| Common mode voltage | 500 $V_{DC}$ permanent (input isolation) | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <1 mV/10 K | <0.05 %/10 K | |
| Signal-noise-ratio | > 100 dB @ 100 Hz | > 120 dB @ 1 Hz | |
| **ANALOG/DIGITAL CONVERSION** | | | |
| Resolution | 24 bit | | |
| Sample rate | 10 kHz at 8 active channels each | | |
| Conversion method | Sigma-Delta | | |
| Antialiasing Filter | Low pass 3rd order per channel (-3 dB at 4 kHz) | | |
| Digital filter | IIR, low pass, high pass, 4th order<br>1 Hz up to 10kHz in steps, 1, 2, 5, automated sample reduction for lower frequencies | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |
| Storage temperature | -40°C up to +85°C | | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | | |
| Vibration | MIL-STD 810F 514.5, procedure I | | |
| Shock | MIL-STD 810F 516.5, procedure I | | |
| **MECHANICAL** | | | |
| Case | Aluminium | | |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| Weight | approx. 400g<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| **CONNECTION** | | | |
| Standard | 2x10 pin screw terminal | | |

*Table 19: V8-200 Specifications*

40 according EN 61326: 1997, appendix B
41 according EN 61326: 1997, appendix A
42 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

## 5.10 DS NET V4

The DS NET V4 module has four electrically isolated analogue inputs with high isolation voltage.

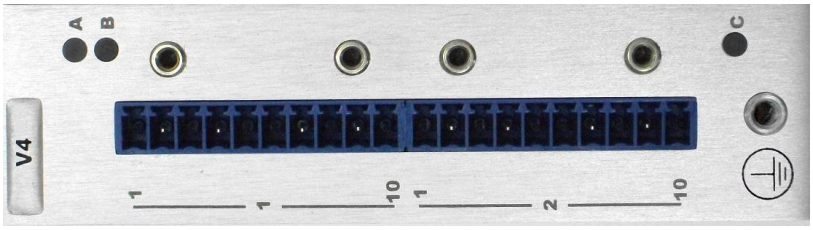



*Illustration 236: V4*

### 5.10.1 DS NET V4-B

This module is also available with BNC connectors under the designation V4-B:

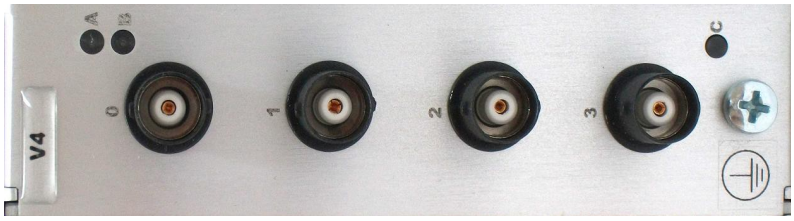



*Illustration 237: V4-B (option)*

| | |
|---|---|
| **WARNING** | High-Voltage module, danger of personal injury with improper use! Handling by skilled staff only! System must be connected to protective ground when signals higher than 47V are connected! Connect only touch-protected BNC leads to modules with BNC-connectors! During installation, the terminal must not be connected to the supply, or the fundamental safety rules for live working must be observed. |

### 5.10.2 V4: Voltage

The V4 module can measure voltages of up to 10 V.

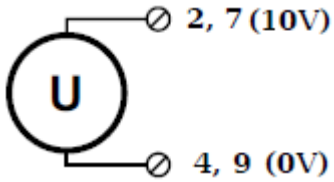



*Illustration 238: V4 Voltage*

### 5.10.3 V4: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | | |
|---|---|---|---|
| **ANALOG INPUTS** | | | |
| Number of channels | 4 | | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[43]<br>0.05 % in industrial area[44] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 1200 $V_{DC}$[45] permanent, channel to channel to power supply to interface | | |
| **VOLTAGE MEASUREMENT** | | | |
| | Range | max. Deviation | Resolution |
| | ±10 V | ±2 mV | 1.2 µV |
| | ±1.25 V | ±0.2 mV | 120 nV |
| | ±100 mV | ±20 µV | 12 nV |
| Input resistance | >10 MΩ | | |
| Long term drift | <1 µV/24 h; 2.5 µV/8000h | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <50 µV/10 K | <0.05 %/10 K | |
| Signal-noise-ratio | > 100 dB @ 100 Hz | | |
| Common mode voltage | 250 $V_{DC}$ permanent (input isolation) | | |
| Max. over-voltage | 100 $V_{DC}$ permanent | | |
| **ANALOG/DIGITAL CONVERSION** | | | |
| Resolution | 24 bit | | |
| Sample rate | 10kHz each channel | | |
| Conversion method | Sigma-Delta | | |
| Antialiasing Filter | 2 kHz, 5th order | | |
| Digital filter | IIR, low pass, high pass, band pass, 4th order<br>1 Hz up to 1kHz in steps, 1, 2, 5 | | |
| Averaging | configurable or automated according to the selected data rate | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |
| Storage temperature | -40°C up to +85°C | | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | | |
| Vibration | MIL-STD 810F 514.5, procedure I | | |
| Shock | MIL-STD 810F 516.5, procedure I | | |
| **MECHANICAL** | | | |
| Case | Aluminium | | |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| Weight | approx. 400g/500g V4-B<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| **CONNECTION** | | | |
| Standard | 2x10 pin screw terminal | | |
| Option | 4 BNC connectors (module type V4-B) | | |

*Table 20: V4 Specifications*

43 according EN 61326: 1997, appendix B
44 according EN 61326: 1997, appendix A
45 5kV peak

# 5.11 DS NET V4-HV

The DS NET V4-HV module has four electrically isolated analogue inputs and is suitable for high voltage measurements.

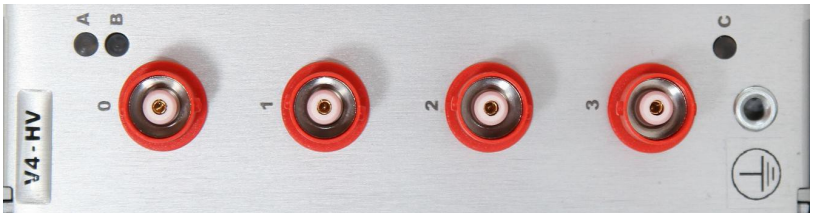



*Illustration 239: V4-HV*

| | |
|---|---|
| **WARNING** | High-Voltage module, danger of personal injury with improper use! Handling by skilled staff only! System must be connected to protective ground when signals higher than 47V are connected! Connect only touch-protected BNC leads to modules with BNC-connectors! During installation, the terminal must not be connected to the supply, or the fundamental safety rules for live working must be observed. |

## 5.11.1 V4-HV: Voltage

The V4-HV module can measure voltages of up to 1000 V.

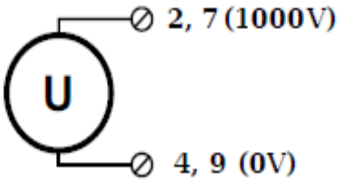



*Illustration 240: V4-HV Voltage*

## 5.11.2 V4-HV: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | | |
|---|---|---|---|
| **ANALOG INPUTS** | | | |
| Number of channels | 4 | | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[46]<br>0.05 % in industrial area[47] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 1200 $V_{DC}$[48] permanent, channel to channel to power supply to interface | | |
| Max. over-voltage | 1000 $V_{DC}$ permanent | | |
| **VOLTAGE MEASUREMENT** | | | |
| | Range | max. Deviation | Resolution |
| | ±1000 V | ±300 mV | 6 mV |
| | ±400 V | ±100 mV | 2 mV |
| | ±120 V | ±30 mV | 600 µV |
| | ±40 V | ±10 mV | 200 µV |
| Input resistance | >10 MΩ | | |
| Long term drift | <1mV/24 h; <2.5 mV/8000h | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <5 mV/10 K | <0.05 %/10 K | |
| Signal-noise-ratio | > 100 dB @ 100 Hz | | |
| Common mode voltage | 1.2k$V_{DC}$ permanent (input isolation) | | |
| **ANALOG/DIGITAL CONVERSION** | | | |
| Resolution | 24 bit | | |
| Sample rate | 10kHz each channel (50kHz internally) | | |
| Conversion method | Sigma-Delta | | |
| Antialiasing Filter | 20 kHz, 5th order per channel | | |
| Digital filter | IIR, low pass, high pass, band pass, 4th order<br>1 Hz up to 10Hz in steps, 1, 2, 5 | | |
| Averaging | configurable or automated according to the selected data rate | | |
| **POWER SUPPLY** | | | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | | |
| Power consumption | approx. 2 W | | |
| Influence of the voltage | <0.001 %/V | | |
| **ENVIRONMENTAL** | | | |
| Operating temperature | -20°C up to +60°C | | |
| Storage temperature | -40°C up to +85°C | | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | | |
| Vibration | MIL-STD 810F 514.5, procedure I | | |
| Shock | MIL-STD 810F 516.5, procedure I | | |
| **MECHANICAL** | | | |
| Case | Aluminium | | |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| Weight | approx. 600g<br>for details see: 6.1.1 Physical Dimensions on page 154 | | |
| **CONNECTION** | | | |
| Standard | 4 BNC connectors | | |

*Table 21: V4-HV Specifications*

# 5.12 DS NET TH8

The DS NET TH8 module has eight electrically isolated analogue inputs for thermocouples or voltages.

46 according EN 61326: 1997, appendix B
47 according EN 61326: 1997, appendix A
48 5kV peak

The pin assignment of the two blue 10-pin connectors is identical. On the left of these blue 10-pin connectors, you can see numbers identifying the connector (1/2) and the pin-numbers (1-10). If several connections are possible (e.g. to measure 2 voltage channels on one of the blue 10-pin connectors), you will find the associated pin-numbers comma-separated in the circuit diagram.


*Illustration 241: TH8*

## 5.12.1 DS NET TH8-C

The TH8 module is optionally available with thermocouple connectors and internal CJC:

*Illustration 242: TH8-C (option)*

## 5.12.2 TH8: Voltage

You can measure voltages from -80 mV up to 80 mV (not for TH8-C).

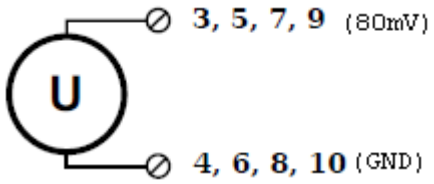



*Illustration 243: TH8 Voltage*

**IMPORTANT**

Voltages which exceed the permissible limits produce incorrect measurement data, because the inputs are protected against over voltages and limit the input voltage.

## 5.12.3 TH8: Thermocouple

You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U with a sample frequency of 100Hz (8Hz with activated mains rejection).

See also 5.2.6.3 Measuring with thermocouples on page 94.

For connecting thermocouples you need a special connecting plug which contains the comparative measuring point (cold junction compensation) required for thermocouples.

The plug can be obtained under the designation TH8-CJC (see page 91).

These connectors are not needed for the TH8-C module, because it has an internal CJC.

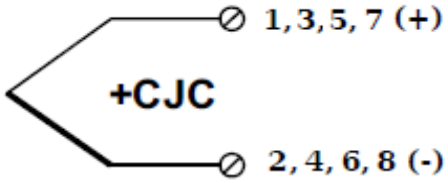



*Illustration 244: TH8 Thermocouple*

The pin-numbers in the illustration refer to the pins of the CJC adapter (see TH8-CJC on page 91) that the sensor is connected to (not the pins of the DS-NET module).

Alternatively, you can also use two thermocouples or a reference temperature source.

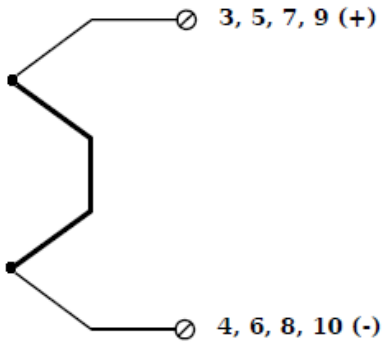



*Illustration 245: TH8 differential thermocouple measurement*

## 5.12.4 TH8: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | | |
|---|---|---|---|
| **ANALOG INPUTS** | | | |
| Number of channels | 8 | | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[49]<br>0.05 % in industrial area[50] | | |
| Linearity error | 0.01 % of the final value typical | | |
| Repeatability | 0.003 % typical (within 24 h) | | |
| Isolation voltage | 500 $V_{DC}$[51] channel to channel to power supply to interface | | |
| Common mode voltage | 100 $V_{DC}$ permanent (input isolation) | | |
| Max. over-voltage | 15 $V_{DC}$ permanent | | |
| **VOLTAGE MEASUREMENT** | | | |
| | Range | max. Deviation | Resolution |
| | ±80 mV | ±10 µV | 320 nV |
| Long term drift | <1 µV/24 h | | |
| | **On zero** | **On sensitivity** | |
| Temperature influence | <1 µV/10 K | <0.005 %/10 K | |
| Signal-noise-ratio | 100 dB @ 100 Hz | | |
| **THERMOCOUPLE MEASUREMENT** | | | |
| Type B | better than ±5°C[52] | | |
| Type E, J, K, L, T, U | better than ±1°C[52] | | |
| Type N | better than ±2°C[52] | | |
| Type R, S | better than ±3°C[52] | | |
| Long term drift | <0.025 °C/24 h | | |
| Temperature influence (Type K) | **On zero** | **On sensitivity** | |
| | <0.025 K/10 K | <0.005 %/10 K | |
| Uncertainty cold junction compensation | 0.3 K | | |
| **ANALOG/DIGITAL CONVERSION** | | | |

49 according EN 61326: 1997, appendix B
50 according EN 61326: 1997, appendix A
51 1kVDC peaks, 500VDC for some minutes, 250VDC permanent
52 with activated mains rejection 50Hz resp. 60 Hz

| | |
|---|---|
| Resolution | 24 bit |
| Sample rate | 100 Hz at 8 active channels<br>with activated mains rejection about 8Hz |
| Conversion method | Sigma-Delta |
| Antialiasing filter | low pass 3rd order per channel (-3 dB @ 20 Hz) |
| Digital filter | variable digital low pass filter 1st order<br>sliding averaging for precision measurements (n = 10)<br>in addition optional filter for mains rejection 50 Hz/60 Hz |
| **POWER SUPPLY** | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) |
| Power consumption | approx. 2 W |
| Influence of the voltage | <0.001 %/V |
| **ENVIRONMENTAL** | |
| Operating temperature | -20°C up to +60°C |
| Storage temperature | -40°C up to +85°C |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing |
| Vibration | MIL-STD 810F 514.5, procedure I |
| Shock | MIL-STD 810F 516.5, procedure I |
| **MECHANICAL** | |
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| Weight | approx. 400g/500g for TH8-C<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| **CONNECTION** | |
| Standard | 2x10 pin screw terminal |
| Option | 8x thermocouple connector (TH8-C) |

*Table 22: TH8 specifications*

## 5.13 DS NET TH4

The DS NET TH4 module has 4 electrically isolated analogue inputs for high speed thermocouple measurement with high isolation voltage.


*Illustration 246: TH4*

| | |
|---|---|
| **WARNING** | High-Voltage module, danger of personal injury with improper use! Handling by skilled staff only! System must be connected to protective ground when signals higher than 47V are connected! Connect only touch-protected BNC leads to modules with BNC-connectors! Thermocouple connectors are not touch protected.<br>During installation, the terminal must not be connected to the supply, or the fundamental safety rules for live working must be observed. |

## 5.13.1 TH4: Thermocouple

You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U. This module has an internal cold-junction-compensation – no external adapter is needed.

See also 5.2.6.3 Measuring with thermocouples on page 94.

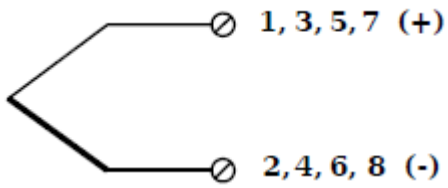



*Illustration 247: TH4 Thermocouple*

## 5.13.2 TH4: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | |
|---|---|---|
| **ANALOG INPUTS** | | |
| Number of channels | 4 | |
| Accuracy | 0.01 % typical<br>0.02 % in controlled environment[53]<br>0.05 % in industrial area[54] | |
| Linearity error | 0.01 % of the final value typical | |
| Repeatability | 0.003 % typical (within 24 h) | |
| Input resistance | >10 MΩ | |
| Isolation voltage | 1.2kV$_{DC}$[55] permanent, channel to channel to power supply to interface | |
| **THERMOCOUPLE MEASUREMENT** | | |
| Type | whole range including cold junction compensation | |
| Type B | better than ±5°C | |
| Type E, J, K, L, T, U | better than ±1°C | |
| Type N | better than ±2°C | |
| Type R, S | better than ±3°C | |
| | | |
| Long term drift | <0.025 K//24 h; <0.075°C/8000h | |
| Temperature influence (Type K) | **On zero** | **On sensitivity** |
| | <0.025 °C/10 K | <0.005 %/10 K |
| Uncertainty cold junction compensation | <0.5 °C | |
| Common mode voltage | 100V$_{DC}$ permanent (input isolation) | |
| **ANALOG/DIGITAL CONVERSION** | | |
| Resolution | 24 bit | |
| Sample rate | 10kHz each channel | |
| Conversion method | Sigma-Delta | |
| Antialiasing filter | 1kHz, 2$^{th}$ order | |
| Digital filter | IIR, low pass, high pass, band pass, 4$^{th}$ order,<br>1 Hz up to 100 Hz in steps 1, 2, 5 | |
| Averaging | configurable or automated according to the selected data rate | |
| | in addition optional filter for mains rejection 50 Hz/60 Hz | |
| **POWER SUPPLY** | | |
| Power supply | 10 up to 30 V$_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) | |
| Power consumption | approx. 2 W | |
| Influence of the voltage | <0.001 %/V | |
| **ENVIRONMENTAL** | | |
| Operating temperature | -20°C up to +60°C | |
| Storage temperature | -40°C up to +85°C | |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing | |
| Vibration | MIL-STD 810F 514.5, procedure I | |
| Shock | MIL-STD 810F 516.5, procedure I | |

53 according EN 61326: 1997, appendix B
54 according EN 61326: 1997, appendix A
55 5kV peak

| MECHANICAL | |
|---|---|
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| Weight | approx. 400g for standard measurement modules<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| **CONNECTION** | |
| Standard | Spring Terminal |

*Table 23: TH4 specifications*

# 5.14 DS NET DIO8

The DS NET DIO8 module has eight digital inputs and eight digital outputs.

The pin assignment of the two blue 10-pin connectors is identical. On the left of these blue 10-pin connectors, you can see numbers identifying the connector (1/2) and the pin-numbers (1-10). If several connections are possible (e.g. to measure 2 voltage channels on one of the blue 10-pin connectors), you will find the associated pin-numbers comma-separated in the circuit diagram.

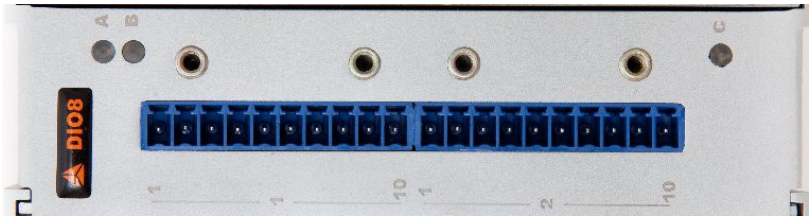



*Illustration 248: DIO8*

## 5.14.1 DIO8: Digital input and output

On each connecting plug contacts for four inputs and four outputs are available. Since the inputs and outputs of this module are electrically isolated from the power supply voltage, you must also connect the ground (*0 V, GND*) for the inputs and a supply voltage (*+V*) for the outputs. Note that the supply voltage of the outputs must be between *10 V* and *30V.*

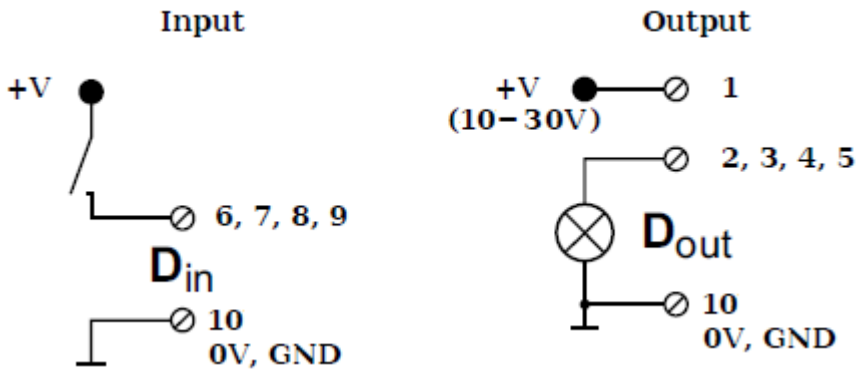



*Illustration 249: DIO8 digital input and output*

The digital input is active (high level) when the applied signal voltage lies above the (programmable) threshold:

### 5.14.1.1 Threshold

The threshold for signal voltage *0* and *1* is programmable: you can choose between *TTL* and *10V* levels (per connector):

| Threshold-designation | Signal voltage „0“ | Signal voltage „1“ |
|---|---|---|
| **TTL** | *0* to *0.8* $V_{DC}$ | *2* to *30* $V_{DC}$ |
| **10V** | *-3* to *5* $V_{DC}$ | *11* to *30* $V_{DC}$ |

*Table 24: DIO8 threshold levels*

You can change the threshold in the channel configuration setup (see Channel configuration setup on page 72).

Use the *Connector 1* and *Connector 2* check-boxes to change the threshold for each of the corresponding connectors (the connectors are marked with ❶ and ❷ in Illustration 250).

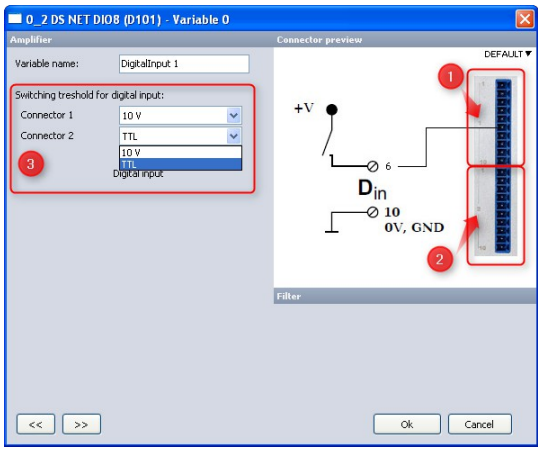



*Illustration 250: DIO8: Switch Threshold*

## 5.14.1.2 Contact combinations

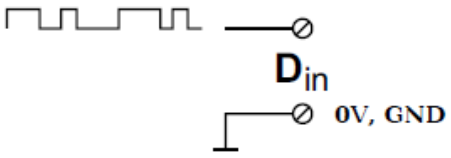
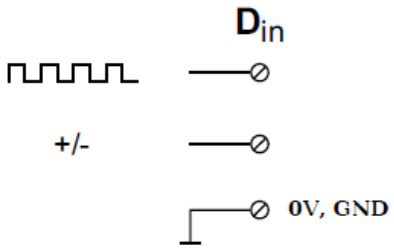
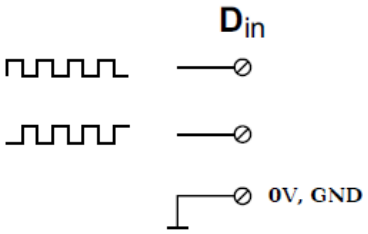
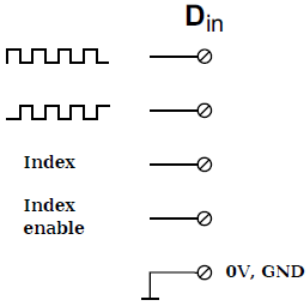
Possible combinations for input contact usage are shown in the following table:

| Plug.Contact | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1.6** | **1.7** | **1.8** | **1.9** | **2.6** | **2.7** | **2.8** | **2.9** |
| State | State | State | State | State | State | State | State |
| State | State | State | State | State | State | 2 channel signal[56] | |
| State | State | State | State | 2 channel signal[56] | | 2 channel signal[56] | |
| State | State | State | State | 4 channel signal[57] | | | |
| State | State | 2 channel signal[56] | | 2 channel signal[56] | | 2 channel signal[56] | |
| State | State | 2 channel signal[56] | | 4 channel signal[57] | | | |
| 2 channel signal[56] | | 2 channel signal[56] | | 4 channel signal[57] | | | |
| 2 channel signal[56] | | 2 channel signal[56] | | 2 channel signal[56] | | 2 channel signal[56] | |
| 4 channel signal[57] | | | | 4 channel signal[57] | | | |

*Table 25: DIO8 plug contact combinations*

56 all digital input functionalities except *state* and *quadrature counter with reference zero and reset/enable*
57 for *quadrature counter with reference zero and reset/enable*

The following block diagrams give you an overview of the possible input contact combinations listed in Table 25.

| Measurement of status, time, frequency or PWM (Pulse-Width Modulation), 1 signal | Up/down counter or measurement of frequency and direction with static direction signal, 2 signals |
|---|---|
|  *Illustration 251: DIO8 example 1 signal* |  *Illustration 252: DIO8 example 2 signals* |
| **Measurement of frequency and direction or up/down counter with 2-channel frequency signal (90° phase delay)** | **Measurement of frequency and direction or up/down counter with 4-channel frequency signal** |
|  *Illustration 253: DIO8 example 2 frequency signals* |  *Illustration 254: DIO8 example 4 frequency signals* |

## 5.14.2 DIO8: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | |
|---|---|
| **DIGITAL INPUTS** | |
| Input voltage | max. 30 $V_{DC}$ |
| Input current | max. 2 mA |
| Threshold (programmable) | TTL or<br>Signal voltage „0“: -3…5 $V_{DC}$ (EN61131-2, Type1)<br>Signal voltage „1“: 11…30 $V_{DC}$ (EN61131-2, Type1) |
| Isolation voltage | 500 $V_{eff}$[58] group/group and against power supply and interface |
| **FUNCTION** | |
| **STATE** | |
| Reaction time | 10 µs |
| 8-fold Bit-Set | specification such as simple state-input, but the BCD coded information of 8 inputs can be transmitted as a single variable. This functionality covers all 8 inputs even if they are already used by other functionalities such as counter or frequency measurement. In case of a conflict the Bit-Set has the lower priority. |
| **FREQUENCY MEASUREMENT** | |
| Method | Chronos<br>optimized by combination of time measurement and pulse counting.<br>Recognition of the direction of rotation (0°, 90°). |
| Frequency range | 1 Hz up to 1 MHz |
| Time base | 0.001 up to 1 s |
| Counter frequency (reference) | 48 MHz |
| Resolution | 0.002 % |
| Frequency measurement with recognition of the direction of rotation | specification like frequency measurement.<br>For the recognition of the direction of rotation the phasing of both inputs is being used. |

58 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | |
|---|---|
| **PWM MEASUREMENT** | |
| Input frequency | 1 Hz up to 1 MHz |
| Resolution | 21 ns |
| Configuration of the measurement type | Counter for duty cycle, frequency |
| **COUNTER** | |
| Counter | 32 bit |
| Counter frequency | 1 MHz |
| For/backward counter | Specification like counter but with an additional input for the direction of counting |
| Quadrature counter | Specification like counter.<br>For the recognition of the direction the phasing of both inputs is being used. |
| Quadrature counter with zero reference and reset/enable | Specification like Quadrature counter but with an additional input for the „0“ reference recognition and an additional input to activate the counter functionality individually |
| **TIME MEASUREMENT** | |
| Function | Measuring of time between two edges, measuring of high time, low time and high/low relation |
| Time range | 1 µs up to 32 s |
| Resolution | 21 ns |
| **DIGITAL OUTPUTS** | |
| Number | 8 |
| Contact | open drain p-channel MOSFET (short circuit proof) |
| Load (per channel) | 30 $V_{DC}$/500 mA (ohmic Load) |
| **FUNCTION** | |
| **STATE** | |
| Reaction time | 10 µs |
| 8-fold Bit-Set | Specification such as a simple state output but 8 outputs can be set with only one variable in BCD coding. This functionality covers all 8 outputs even if they are used by other functionalities such as frequency or PWM output. In case of a conflict the Bit-Set has the lower priority. |
| **FREQUENCY OUTPUT** | |
| Frequency range | 0.1 Hz up to 10 kHz |
| Accuracy | 0.01 % |
| **PWM OUTPUT** | |
| Frequency range | 0.1 Hz up to 10 kHz |
| Resolution | 21 ns |
| With a DIO8 eight channels for digital output are available. Those will accept all mentioned signals as it is required. The functionalities *frequency output* and *PWM* output can be used 4 times in maximum. | |
| **POWER SUPPLY** | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) |
| Power consumption | approx. 2 W |
| Influence of the voltage | <0.001 %/V |
| **ENVIRONMENTAL** | |
| Operating temperature | -20°C up to +60°C |
| Storage temperature | -40°C up to +85°C |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing |
| Vibration | MIL-STD 810F 514.5, procedure I |
| Shock | MIL-STD 810F 516.5, procedure I |
| **MECHANICAL** | |
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| Weight | approx. 400g for standard measurement modules<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| **CONNECTION** | |
| Standard | 2x10 pin screw connectors |

*Table 26: DIO8 specifications*

## 5.15 DS NET AO4

The DS NET AO4 module has four electrically isolated analogue outputs, four digital inputs and four digital outputs. The assignment of both connector strips is not identical. The plug number is specified in this chapter.

The connection terminals have numbers for identifying the connections. If several connections are possible, you will find the associated ones in each case at the same place in the circuit diagrams, for example the figures quoted in the second place belong in each case to one possible connection method.


*Illustration 255: AO4*

## 5.15.1 AO4: Digital input and output, plug 1

On the first blue 10-pin connector there are contacts for 4 inputs and 4 outputs available. Since the inputs and outputs of this module are electrically isolated from the power supply voltage, you must also connect the ground (*0 V, GND*) for the inputs and a supply voltage (*+V*) for the outputs.

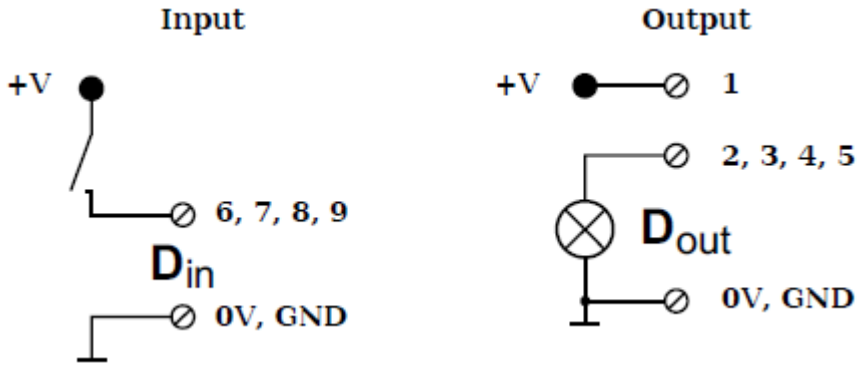



*Illustration 256: AO4 digital input and output*

The digital input is active (high level) when the applied signal voltage lies above the threshold (1…30 $V_{DC}$).

Possible combinations of contact assignments for the inputs are shown in the following table:

| 6 | 7 | 8 | 9 |
|---|---|---|---|
| Status | Status | Status | Status |
| Status | Status | 2 channel signal[59] | |
| 2 channel signal[59] | | 2 channel signal[59] | |
| 4 channel signal[60] | | | |

*Table 27: AO4 possible contact assignments*

59 e.g. counter with additional input for direction of counting or two signals with a 90° phase shift of frequency measurement with direction sensing (torque transducer)

60 e.g. counter with additional input for direction, zero reference signal and reset/enable for reference zero

## 5.15.2 AO4: Analogue output, plug 2

The analogue outputs on plug 2 supply voltage or current. Selection is made via software.

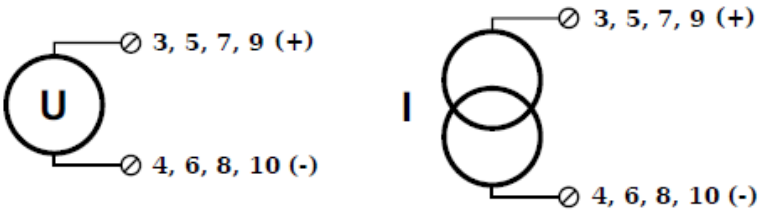



*Illustration 257: AO4 analogue output*

## 5.15.3 AO4: Specifications

All declarations are valid after a warm up time of 45 minutes.

| | | |
|---|---|---|
| **ANALOG OUTPUTS** | | |
| Number | 4 | |
| Accuracy | 0.02 % | |
| Output type | configurable voltage or current output | |
| Isolation voltage | 500 $V_{DC}$[61] channel/channel against power supply and interface | |
| **VOLTAGE** | | |
| Output voltage | ±10 $V_{DC}$ | |
| Acceptable load resistance | >2 kΩ | |
| Long term drift | <1 mV/48 h | |
| | **On zero** | **On sensitivity** |
| Temperature influence | <2 mV/10 K | <0.05 %/10 K |
| Noise voltage | <10 mV @ 1000 Hz | <2 mV @ 10 Hz |
| **CURRENT** | | |
| Output current | 4…20 mA | |
| Acceptable load | <400 Ω | |
| Long term drift | <2 µA/48 h | |
| | **On zero** | **On sensitivity** |
| Temperature influence | <4 µA/10 K | <0.05 %/10 K |
| Noise current | <20 µA @ 1000 Hz | <4 µA @ 10 Hz |
| **DIGITAL/ANALOG CONVERSION** | | |
| Resolution | 16 bit | |
| Sample rate | 10 kHz per channel | |
| Settling time | 3 µs | |
| **DIGITAL INPUTS** | | |
| Number | 4 | |
| Input voltage | max. 30 $V_{DC}$ | |
| Input current | max. 2 mA | |
| Threshold | Signal voltage „0“: -3…5 $V_{DC}$ (EN61131-2, Type1) | |
| | Signal voltage „1“: 11… 30 $V_{DC}$ (EN61131-2, Type1) | |
| **DIGITAL OUTPUTS** | | |
| Number | 4 | |
| Contact | open drain p-channel MOSFET (short circuit proof) | |
| Load | 30 $V_{DC}$/500 mA (ohmic Load) | |
| **FUNCTION DIGITAL INPUTS** | | |
| **STATE** | | |
| Reaction time | 10 µs | |
| **FREQUENCY MEASUREMENT** | | |
| Method | Chronos<br>Optimized by combination of time measurement and pulse counting<br>Recognition of the direction of rotation (0°, 90°) | |

61 1kVDC peaks, 500VDC for some minutes, 250VDC permanent

| | |
|---|---|
| Frequency range | 1 Hz up to 1 MHz |
| Time base | 0.001 up to 1 s |
| Counter frequency (reference) | 48 MHz |
| Resolution | 0.002 % |
| Frequency measurement with recognition of the direction of rotation | specification like frequency measurement. For the recognition of the direction of rotation the phasing of both inputs is being used. |
| **PWM MEASUREMENT** | |
| Input frequency | 1 Hz up to 1 MHz |
| Resolution | 21 ns |
| Configuration of the measurement type | Counter for duty cycle, frequency |
| **COUNTER** | |
| Counter | 32 bit |
| Counter frequency | 1 MHz |
| For/backward counter | specification like counter but with an additional input for the direction of counting |
| Quadrature counter | specification like counter. For the recognition of the direction the phasing of both inputs is being used |
| Quadrature counter with zero reference and reset/enable | specification like quadrature counter but with an additional input for the „0“ reference recognition and an additional input to activate the counter functionality individually. |
| **FUNCTION DIGITAL OUTPUTS** | |
| **STATE** | |
| Reaction time | 100 µs |
| **FREQUENCY OUTPUT** | |
| Frequency range | 0.1 Hz up to 10 kHz |
| Accuracy | 0.01 % |
| **PWM OUTPUT** | |
| Input frequency | 0.1 Hz up to 10 kHz |
| Resolution | 21 ns |
| **POWER SUPPLY** | |
| Power supply | 10 up to 30 $V_{DC}$ , over voltage and overload protection<br>(for details see: 5.2.7 Power supply requirements on page 95) |
| Power consumption | approx. 2 W |
| Influence of the voltage | <0.001 %/V |
| **ENVIRONMENTAL** | |
| Operating temperature | -20°C up to +60°C |
| Storage temperature | -40°C up to +85°C |
| Relative humidity | 5 % up to 95 % at 50°C, non condensing |
| Vibration | MIL-STD 810F 514.5, procedure I |
| Shock | MIL-STD 810F 516.5, procedure I |
| **MECHANICAL** | |
| Case | Aluminium |
| Dimensions (W x H x D) | approx. 31 x 125 x 120 mm<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| Weight | approx. 400g for standard measurement modules<br>for details see: 6.1.1 Physical Dimensions on page 154 |
| **CONNECTION** | |
| Standard | 2x10 pin screw connectors |

*Table 28: AO4 specifications*

# 5.16 DS NET SUPPLY

The DS NET SUPPLY module offers 4 galvanically isolated DC sensor supply voltages.
Each supply voltage is galvanically isolated with 1.5kV from the other voltages and each one can provide a maximum power of 5 W.

**HINT**

The voltages on the 2nd connector are connected in parallel to the corresponding voltage on the first connector.
i.e. the +5V on the 1st connector and the +5V on the 2nd connector provide a maximum of 5W, since they come from the same DC/DC converter.

It is possible to connect voltages on the same connector together to create any possible sensor supply voltage combination (e.g. 17V, 20V, ..).

Supported Voltages:

- +5V
- +12V
- +15V
- +24V


*Illustration 258: DS NET SUPPLY*

**IMPORTANT**

Note, that the DS NET SUPPLY module is not a a measurement module, and will not communicate with the DS GATE. Thus, the following facts apply:

- you do not need to configure any of the sockets DIP-switches (all DIP-switches can remain down) – this module also has no relevance related to termination (6.2.3 Terminating resistances)
- you must make sure, that the power supply of the DS NET system, is strong enough for the whole system
- the position relative to the DS GATE or to the other modules does not matter
- this module is not available for the rack line
- this module will not show up in DEWESoft™ or `test.commander`
- the LEDs have no meaning and are not even connected

| Connector 1 | | Connector 2 | |
|---|---|---|---|
| **Pin #** | **Connection** | **Pin #** | **Connection** |
| 1 | NC | 1 | NC |
| 2 | +5V | 2 | +5V |
| 3 | GND (5V) | 3 | GND (5V) |
| 4 | +12V | 4 | +12V |
| 5 | GND (12V) | 5 | GND (12V) |
| 6 | +15V | 6 | +15V |
| 7 | GND (15V) | 7 | GND (15V) |
| 8 | +24V | 8 | +24V |
| 9 | GND (24V) | 9 | GND (24V) |
| 10 | NC | 10 | NC |

*Table 29: DS NET SUPPLY pin assignment*

# 5.17 DS NET WiFi

The DS NET WiFi module allows you to have wireless secure connections up to 150Mbps.

It is not possible (nor logical) to have a DS NET WiFi module and a DS NET CPU module in one system (since the DS NET CPU module also has WiFi).

The WiFi module is integrated in the left handle. It must be connected with a short LAN-cable (connection labelled *to gate*) to the DS-GATE module (connection labelled *NET*).

At the side of the WiFi module, there are the following items:

❶ LED indicators: Link, Activity, Power
❷ Reset button

*Illustration 259: DS NET WiFi system*

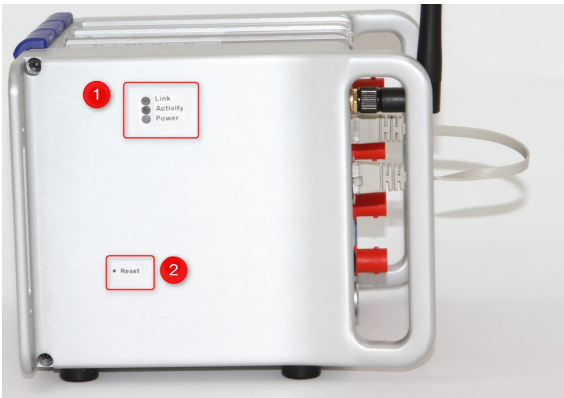



*Illustration 260: DS NET WiFi side-view*

## 5.17.1 LED indicators

You find the LED indicators of the DS NET WiFi module at the left side of your DS NET system: see ❶ in Illustration 260 above.

| LED name | LED Status | Description |
|---|---|---|
| **Power** | on | The device is on and ready. |
| | off | The device is off. |
| **Activity** | on | The device is on and ready. |
| | off | The device is off. |
| | flashing | The device is transmitting or receiving data. |
| **Link** | on | The device is connected to an Ethernet network. |
| | off | The device is off or there is no Ethernet connection. |

*Table 30: DS NET WiFi LED indicators*

## 5.17.2 Reset button

The *Reset* button (see ❷ in Illustration 260 above) can restore device to factory default settings by press this button for more than 10s.

| | | | |
|---|---|---|---|
| **Operation Mode** | ✗ Access Point<br>✗ Router<br>✗ WISP Client<br>☑ AP Client | **SSID** | *SparkLAN_11N_AP* |
| **Username** | *admin* | **Channel** | *8* |
| **Password** | *admin* | **Mode** | *11b/g/n mixed mode* |
| **IP Address** | *192.168.1.250* | **Encryption** | *disabled* |
| **Router Mode IP Address** | *172.32.1.254* | **WPS Function** | *disabled* |
| **Subnet Mask** | *255.255.255.0* | **DHCP Server** | *disabled* |

*Table 31: Default factory settings of WiFi module*

## 5.17.3 WiFi: Specifications

| | |
|---|---|
| **HARDWARE** | |
| Standard | 802.11b/g/n |
| Data Rate | up to 150Mbps<br>150 Mbps is the maximum wireless signal rate derived from IEEE Standard 802.11 specifications. Actual data throughput and range will vary depending upon network conditions and environmental factors, including volume of network traffic, building materials and construction, and network overhead. Maximum speed and range is achievable when used with same enhanced mode technology. |
| Chipset | Ralink RT3050 |
| System Memory | 16MB SDRM<br>4MB Flash |
| Interface | 1 x 10/100 Base-T Ethernet port |
| Button | Reset: 1~3 sec<br>Reboot: 5~10 sec<br>>10 sec: reset to default (see 5.17.2 Reset button on page 141) |
| LED Indicator | Power, Activity, Link (see 5.17.1 LED indicators on page 141) |
| Environmental | Operating temperature: 0°C to +60°C<br>Storing temperature: -20°C to +70°C<br>Operating Humidity: 5~90% non-condensing<br>Storing Humidity: 5~95% non-condensing |
| Antenna | 1 x RSMA connector |
| Certification | FCC,CE |
| Operating Voltage | DC 5V ± 5%, 500mA |
| Power Consumption | Continue TX 500mA<br>Continue RX 350mA |
| **SOFTWARE** | |
| Operation Modes | AP, AP Client, WISP Client, Router |
| DHCP | support for Client and Server |
| Security | 64/128-bits WEP, WPA, WPA2, WPS |
| Management | Web-based management |
| Operating Frequency | 2.412~ 2.4835GHz ISM Band |
| Modulation | 802.11b: DSSS (DQPSK, DBPSK, CCK)<br>802.11g: OFDM (BPSK, QPSK,16-QAM, 64-QAM)<br>802.11n: OFDM (BPSK, QPSK,16-QAM, 64-QAM) |
| Media Access Protocol | CSMA/CA with ACK |
| Output Power | 802.11b: 18dBm ± 2dBm@11Mbps<br>802.11g: 15dBm ± 2dBm@54Mbps<br>802.11n HT20: 15dBm ± 2dBm@MCS7<br>802.11n HT40: 14dBm ± 2dBm@MCS7 |
| Receive Sensitivity | 802.11b: -85dBm ± 2dBm@11Mbps<br>802.11g: -68dBm ± 2dBm@54Mbps<br>802.11n HT20: -68dBm ± 2dBm@MCS7<br>802.11n HT40: -68dBm ± 2dBm@MCS7 |

*Table 32: WiFi specifications*

## 5.17.4 Configuration

To configure the WiFi module, you need to connect the *to gate* connector (see Illustration 259 on page 141) of the WiFi module via a LAN cable directly to your PC's LAN connector (make sure that the DS-NET is powered on).

In order for the PC to find the WiFi module, the IP address of the PC must be in the same subnet-range as the WiFi module. e.g. if the WiFi module uses the default IP `192.168.1.250` (and the default subnet-mask `255.255.255.0`), you could assign a fixed IP of `192.168.1.220` to your PC. You should also make sure, that no security software (Firewall, Antivirus, etc.) is blocking the TCP/IP communication and that the IP addresses that you use are not already assigned to any other device in the network.
For more details about the Ethernet connection and the IP setup see chapter 3.3 Ethernet connection on page 29.

The WiFi module can be configured easily via a web-browser (Internet Explorer 8 and Firefox 4 will work for sure, other browsers should also work) – no driver installation is required on your PC.

| | |
|---|---|
| Open your Internet browser and enter the IP of the device. The default IP is `192.168.1.250`.<br>Note: If it does not work, also input the `http://` prefix. | After you have pressed the *Enter* key, the browser asks you for the login credentials. The default *User name* is `admin` and the default *Password* is also `admin`.<br>You can check the *Remember my password* check-box so that you need not enter the password again, next time you log in. |
|  |  |
| *Illustration 261: Enter IP address* | *Illustration 262: Enter credentials* |

### 5.17.4.1 Connection to a WLAN

In this chapter we will configure the WiFi module to automatically connect to an existing WLAN network. Then you can access the DS-GATE like any other device on this LAN or WLAN.

#### Preconditions for this example

The WiFi module is supposed to be in the default state. If it's not, you should perform a reset (see 5.17.2 Reset button on page 141).

Also the DS-GATE module is supposed to be in it's default state: the IP should be `192.168.1.28`.

The PC (or laptop) that we use to configure the devices has the fixed IP address `192.128.1.220` and the subnet-mask `255.255.255.0`, so that we can access both the DS-GATE and the WiFi module (for detailed instruction how to set a fixed IP address for your PC see: 3.3.4.4 Setting a fixed IP on page 34).

The WLAN network that we want to connect to has the following properties:

| | |
|---|---|
| **Networkname (SSID)** | DEWEsoft_extern |
| **Networkauthentication** | WPA2-PSK |
| **Encryption** | AES |
| **Networkkey (Password)** | dewesoft |
| **WLAN Router IP address** | `10.0.0.1` |
| **WLAN Subnet-mask** | `255.255.255.0` |

*Table 33: WLAN properties*

## Expected result

When we are done with the configuration the DS-GATE will have the IP address `10.0.0.28` and the WiFi module will have the IP address `10.0.0.250`, so that both devices are in the same subnet as the WLAN. When the DS-NET is powered up, the WiFi module will automatically connect to the WLAN network and you can access the DS-GATE from any PC that is also connected to this network.

## Procedure instruction

First we want to change the IP address of the DS-GATE, thus we need a LAN cable to connect the DS-GATE directly to the PC's Ethernet connector.

In the Hardware setup of DEWESoft™ select the DS-GATE in the list and then press the **IP Settings** button to open the *IP Settings* dialogue:

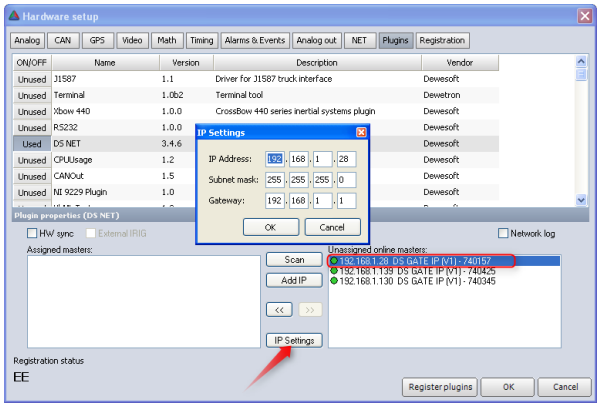



*Illustration 263: IP settings*

Then enter the new IP address for the DS-GATE: `10.0.0.28` and press **OK** to apply the changes.

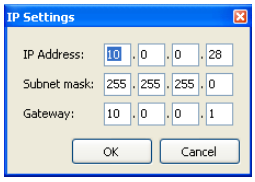



*Illustration 264: IP settings dialogue*

Now you can see that the device already has the new IP address (`10.0.0.28`) and that the indicator has changed its colour from green to orange, because the device is now in another sub-net (`10.0.0.x`) than the PC (`192.168.1.x`).

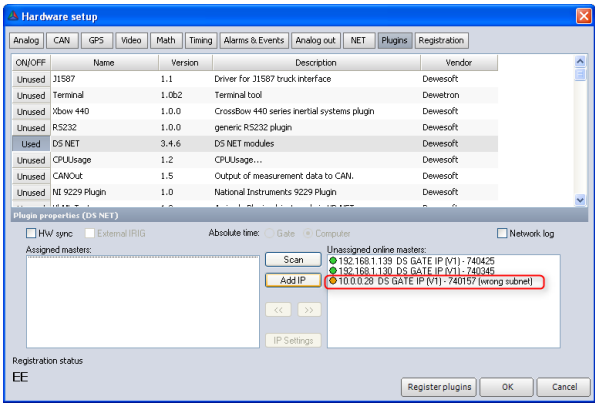



*Illustration 265: WLAN IP of the DS-GATE*

The next step is to setup the WiFi module. You can disconnect the LAN cable from the DS-GATE and connect it to the WiFi module, so that the WiFi module is now directly connected to the Ethernet connector of your PC.
Open the WiFi module's maintenance page in your Internet browser (for details see: 5.17.4 Configuration on page 143).

First we check that the device mode is set to *AP Client*.
In the left menu click on *Device Mode*.
If it is set to anything else than *AP Client* , select the *AP Client* radio button and then click the **Apply** button.

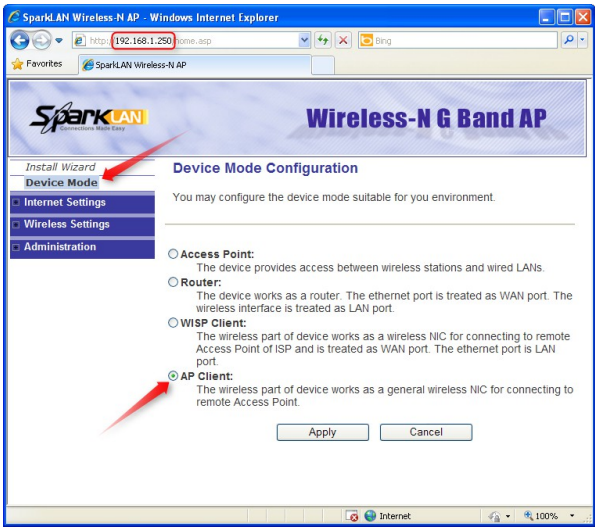



*Illustration 266: Device mode AP Client*

The next step is to add a *Profile* for the WLAN connection:

1. click on the little square to open the *Wireless Settings* menu
2. Then click on the *Site Survey* menu entry and wait for a moment until the device has finished to search for available WLAN networks
3. From the list, select the WLAN network that we want to connect to. In this example it is: .DEWEsoft_extern
4. Finally click the **Add Profile** button

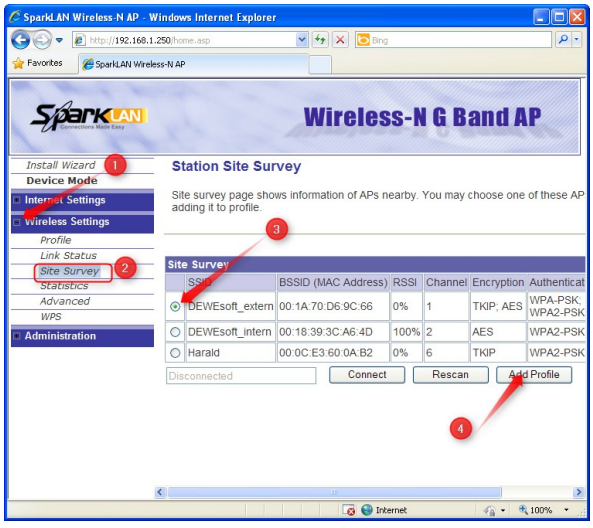



*Illustration 267: Site Survey*

In the *Add Profile* dialogue enter the settings for the WLAN network. In our example (see also Table 33):

- Profile Name: *Default*
- Security Mode: *WPA2-PSK*
- WPA Algorithms: *AES*
- Pass Phrase: *dewesoft*

When you are done, press the **Apply** button.

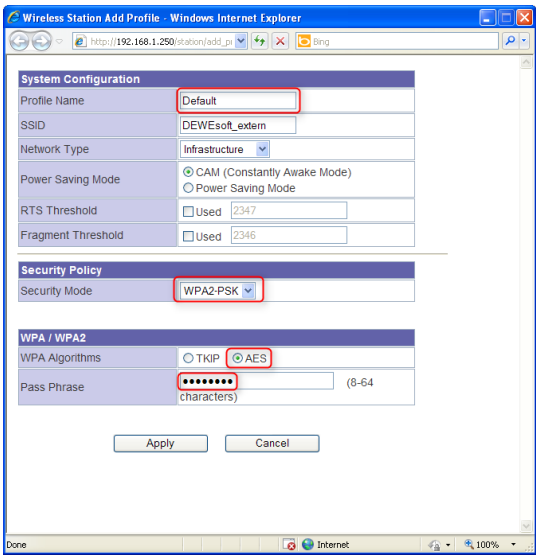



*Illustration 268: Add Profile*

Now click on the *Profile* menu entry (❷). You should see the new profile called *Default* that we have just created:

❸ Click the radio-button to select the profile

❹ Finally click the **Activate** button

Whenever the WiFi module is powered on, it will automatically activate this profile and connect to our WLAN network.

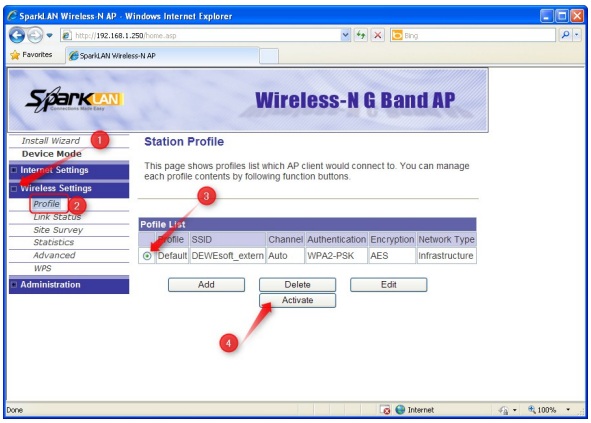



*Illustration 269: Activate Profile*

When we now go back to *Site Survey*(❷), we can see that the device has an active connection to the DEWEsoft_extern WLAN network (❸ see the blue symbol near the radio button).

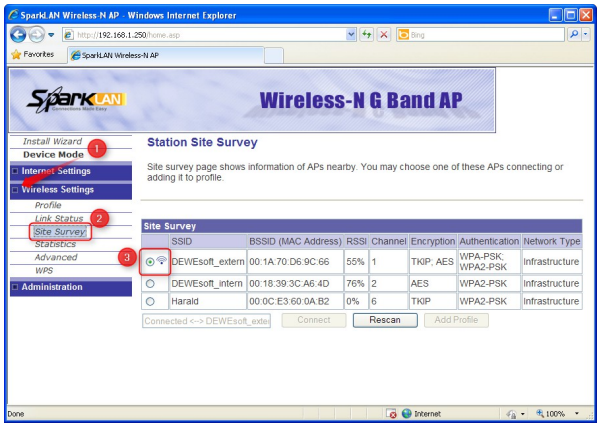



*Illustration 270: WLAN connection active*

The last step for the WiFi configuration is to change the IP address of the WiFi module.
Open the Internet Settings menu and click on the LAN menu entry. You can see the current IP Address of the device.

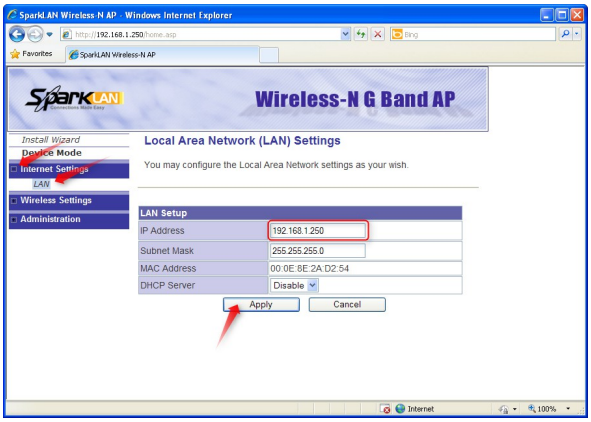



*Illustration 271: WiFi module LAN settings*

Change the *IP Address* to 10.0.0.250 (the *Subnet Mask* is okay) and press the **Apply** button.

After the IP address has been changed, the Internet browser will of course lose the connection to the device, because the IP of the PC (`192.168.1.x`) is not in the same subnet as the device (`10.0.0.x`) any more.

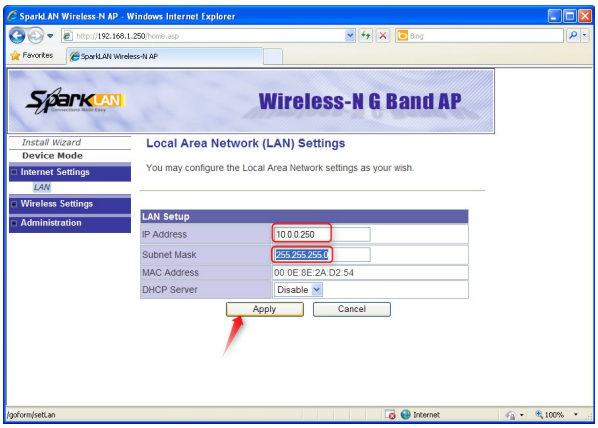



*Illustration 272: Change WiFi IP address*

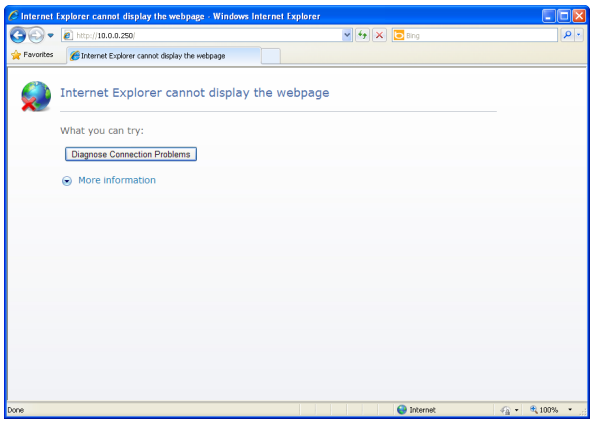



*Illustration 273: IP address has been changed*

That's it! Now we can test the connection.

Connect the DS-GATE modules Ethernet connector (labelled *NET*) with a short Ethernet cable directly to the WiFi modules Ethernet connector (labelled *to gate*). So that there is no direct cable connection from the PC to the DS-NET system – only the wireless connection is active.

Then start DEWESoft™ from any PC that has access to the WLAN network (either through WiFi or cable connection) – the IP address of this PC must then of course be in the `10.0.0.x` subnet: e.g. `10.0.0.220`. You can see the DS-NET device in the list, and since the PC is in the same subnet as the DS-NET, the indicators colour is green.

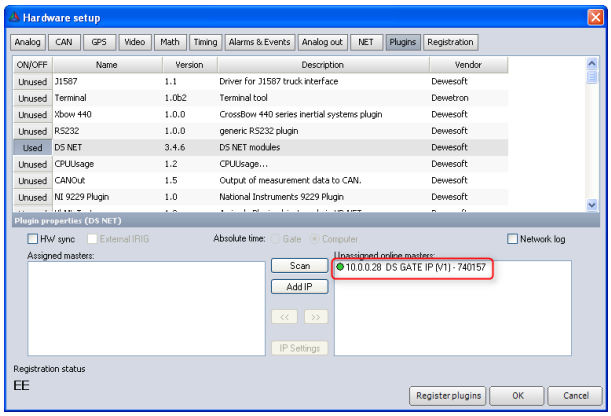



*Illustration 274: WiFi connected DS-NET*

## 5.17.4.2 Provide WLAN

In this chapter we will configure the WiFi module to provide a WLAN network that other PCs can connect to and access the connected DS-NET system. Moreover we will configure the WLAN to act as an DHCP server, so that PC's that connect to it will automatically be assigned an IP address.

### Preconditions for this example

The WiFi module is supposed to be in the default state. If it's not, you should perform a reset (see 5.17.2 Reset button on page 141).

Also the DS-GATE module is supposed to be in it's default state: the IP should be `192.168.1.28`.

The PC (or laptop) that we use to configure the devices has the fixed IP address `192.128.1.220` and the subnet-mask `255.255.255.0`, so that we can access both the DS-GATE and the WiFi module (for detailed instruction how to set a fixed IP address for your PC see: 3.3.4.4 Setting a fixed IP on page 34).

The WLAN network that we want to create has the following properties:

| | |
|---|---|
| **Networkname (SSID)** | DSNET_WLAN |
| **Networkauthentication** | WPA2-PSK |
| **Encryption** | AES |
| **Networkkey (Password)** | dewesoft |
| **WLAN Router IP address** | `10.10.10.1` |
| **WLAN Subnet-mask** | `255.255.255.0` |

*Table 34: WLAN properties*

## Expected result

When we are done with the configuration the DS-GATE will have the IP address `10.10.10.28` and the WiFi module will have the IP address `10.10.10.250`, so that both devices are in the same subnet as the WLAN. When the DS-NET is powered up, the WiFi module will automatically provide a WLAN network that other PCs can connect to (and will get an IP address via DHCP) and thus can access the DS-GATE.

## Procedure instruction

First we want to change the IP address of the DS-GATE, thus we need a LAN cable to connect the DS-GATE directly to the PC's Ethernet connector.

In the Hardware setup of DEWESoft™ select the DS-GATE in the list and then press the **IP Settings** button to open the *IP Settings* dialogue:

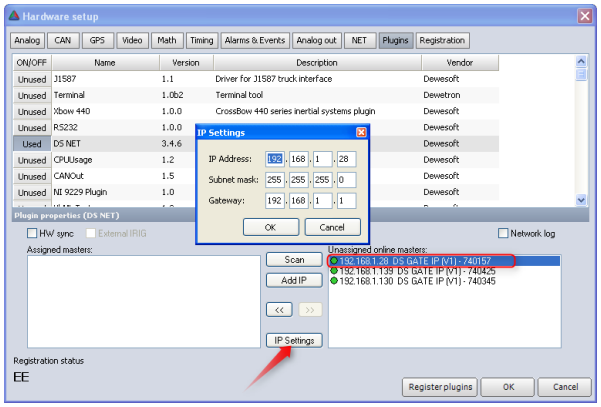



*Illustration 275: IP settings*

Then enter the new IP address for the DS-GATE: `10.10.10.28` and press **OK** to apply the changes.

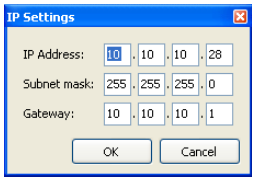



*Illustration 276: IP settings dialogue*

Now you can see that the device already has the new IP address (`10.10.10.28`) and that the indicator has changed its colour from green to orange, because the device is now in another sub-net (`10.0.0.x`) than the PC (`192.168.1.x`).

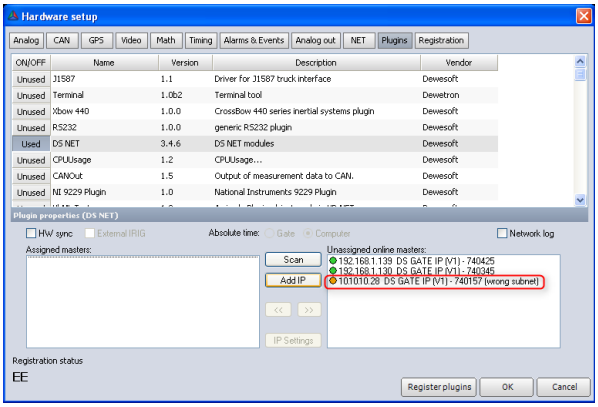



*Illustration 277: WLAN IP of the DS-GATE*

The next step is to setup the WiFi module. You can disconnect the LAN cable from the DS-GATE and connect it to the WiFi module, so that the WiFi module is now directly connected to the Ethernet connector of your PC.

Note: In this example we will use Firefox 4 instead of Internet explorer (like we did in 5.17.4.1 Connection to a WLAN).

Open the Firefox browser and enter the IP address of the WiFi module.
Then enter the login credentials for the WiFi module.

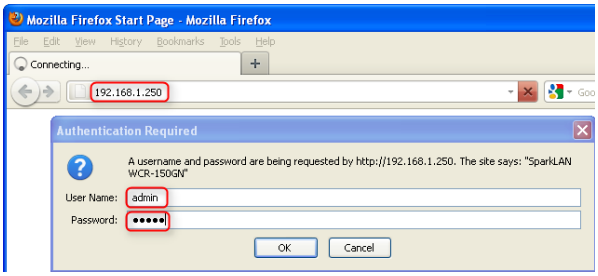



*Illustration 278: WiFi login (Firefox)*

First we change the *Device Mode* to *Access Point*:

❶ click on the *Device Mode* menu item in the menu on the left

❷ Make sure, that *Access Point* is selected. If not, click the radio button.

❸ Then click the **Apply** button

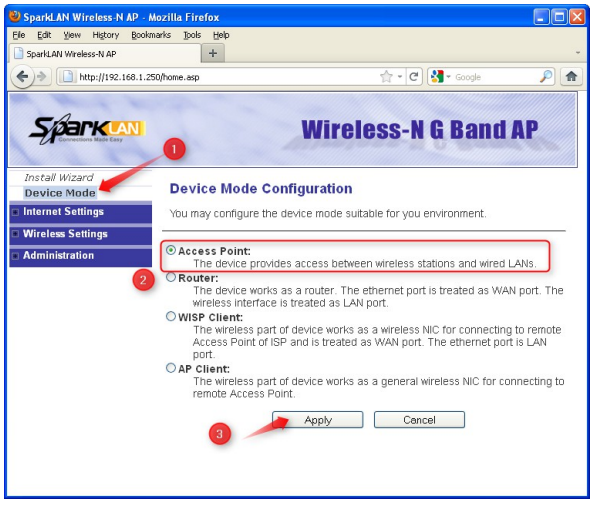



*Illustration 279: Device mode: Access Point*

Now we change the *Basic* settings:

❶ you may need to click on the little square to open the *Wireless Settings* menu

❷ Then click the *Basic* menu item

❸ Now enter the *Network Name(SSID)* that we want to use: `DSNET_WLAN` in this example

❹ Finally click the **Apply** button

❺ Also make sure that you see the Turn OFF button (which means, that the WLAN function is currently turned on)


*Illustration 280: Access Point: Basic settings*

Let's add some security and encryption to our wireless network:

❶ click the *Security* menu item

❷ Select the *Security Mode*: *WPA2-PSK*

❸ Select the *WPA Algorithms*: *AES*

❹ Enter a *Pass Phrase*: `dewesoft` (in this example)

❺ Finally click the **Apply** button


*Illustration 281: Access Point: Security settings*

The last step of the WiFi setup are the LAN settings:

❶ you may need to click on the little square to open the *Internet Settings* menu

❷ Then click the *LAN* menu item

❸ Now enter the LAN settings:
*IP Address*: `10.10.10.1`
set *DHCP Server* to `Enable`
*Start IP Address*: `10.10.10.50`
*End IP Address*: `10.10.10.200`
*Primary DNS Server*: `10.10.10.1`
*Default Gateway*: `10.10.10.1`

❹ Finally click the **Apply** button

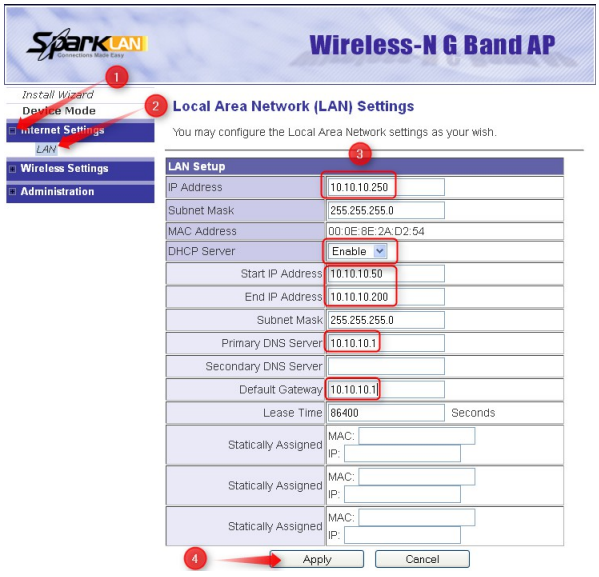



*Illustration 282: Access Point: LAN settings*

After the IP address has been changed, the Firefox browser will of course lose the connection to the device, because the IP of the PC (`192.168.1.220`) is not in the same subnet as the device (`10.10.10.x`) any more.

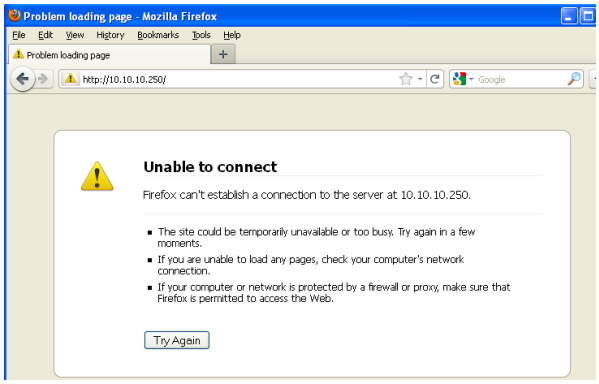



*Illustration 283: IP address has been changed*

That's it! Now we can test the connection.

Connect the DS-GATE modules Ethernet connector (labelled *NET*) with a short Ethernet cable directly to the WiFi modules Ethernet connector (labelled *to gate*). So that there is no direct cable connection from the PC to the DS-NET system – only the wireless connection is active.

Then we can configure a PC (or laptop) which has a WiFi adapter to open a connection to the DS-NET (Note: since we have activated DHCP, the the wireless adapter must also have DHCP enabled, which is usually the default for wireless connections anyway):

First open the *Wireless Network Connection* dialogue.

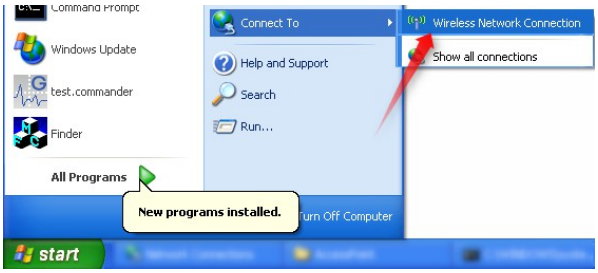



*Illustration 284: Open the Wireless Network Connection dialogue*

Simply select our new wireless network called DSNET_WLAN in the list of wireless networks and click the **Connect** button.

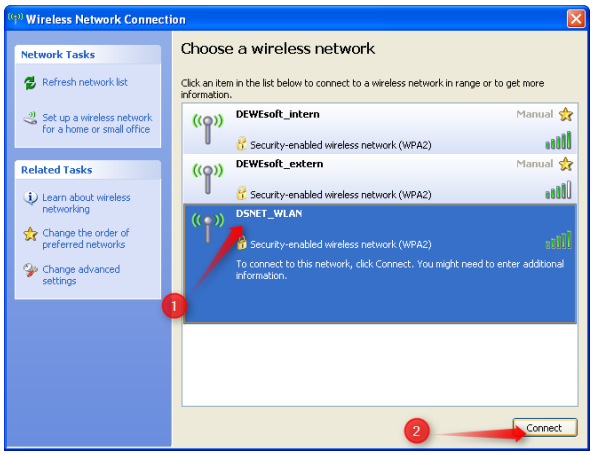



*Illustration 285: Connect to the wireless network*

Since we have enabled security for your wireless network, you must enter the network key that we have chosen:
`dewesoft`
Note: for some strange reason (that is completely beyond the knowledge of the author), you must enter the network key twice.
Press the **Connect** button to continue.

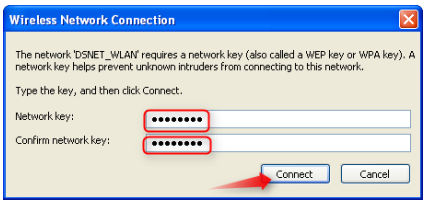



*Illustration 286: Enter the Network Key*

The PC is now connected to the DSNET_WLAN wireless network:

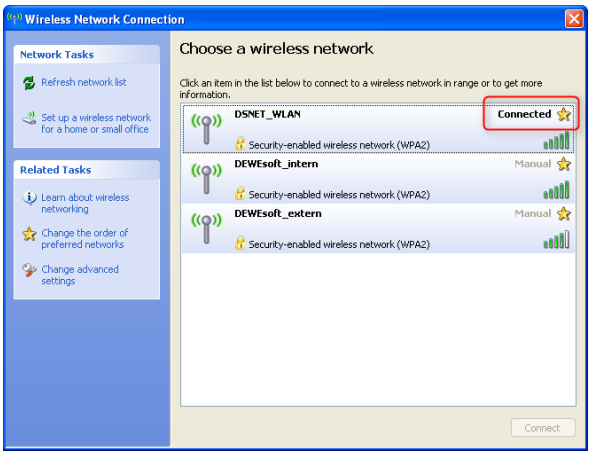



*Illustration 287: Wireless network is connected*

Now you can start DEWESoft™ and will see the DS-NET device in the list, and since the PC is in the same subnet as the DS-NET, the indicators colour is green:

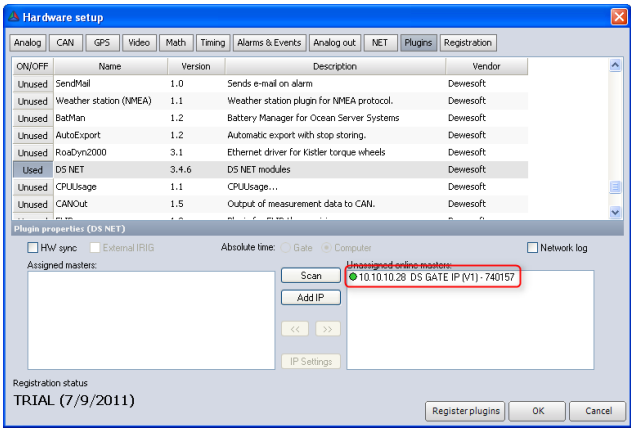



*Illustration 288: Hardware setup*

# 6 DS NET hardware

This chapter contains the description of the connection variants and pin assignments.

The DS NET system (portable line or 19 inch rack line) comes completely built according to your initial order. The modular nature of the DS NET system makes it very flexible and it is really easy to change your existing configuration (add, replace or even remove modules).

*Illustration 289: DS NET assembly*

## 6.1 Skeletal structure

The skeletal structure of the DS NET system consists of:

- the left handle
- the left backplane: note that his backplane does not have internal screws (compared to the standard backplanes)
- a variable number of standard backplanes (note that you can have a maximum of 16 measurement modules)
- and the right handle

All these parts are connected via hex screws – you will need a 2.5 mm hex key.


*Illustration 290: DS NET Skeletal Structure*

## 6.1.1 Physical Dimensions

Every DS-NET system consists of a left handle, a number of modules and a right handle. The left handle comes in 3 flavours: a standard handle, a WiFi handle and a CPU handle (see also 5.2.1 Special modules on page 88).

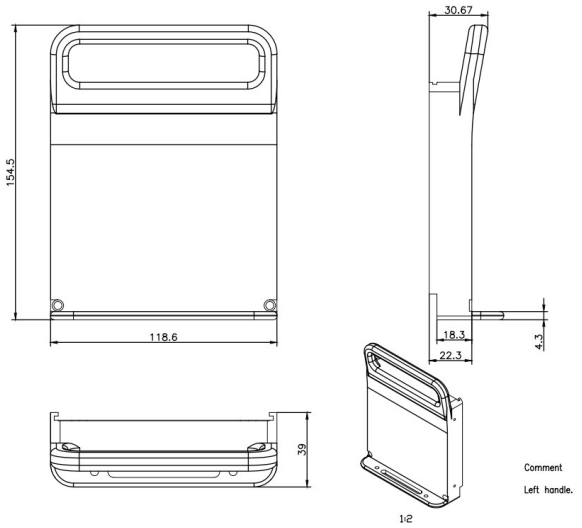



*Illustration 291: Left handle: Standard*

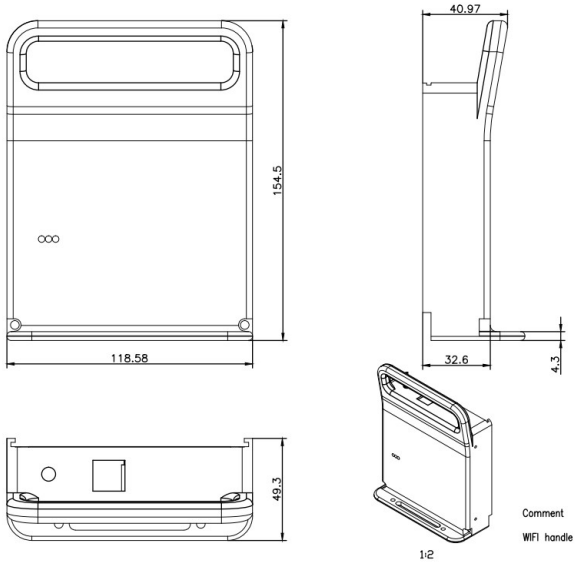



*Illustration 292: Left handle: WiFi*

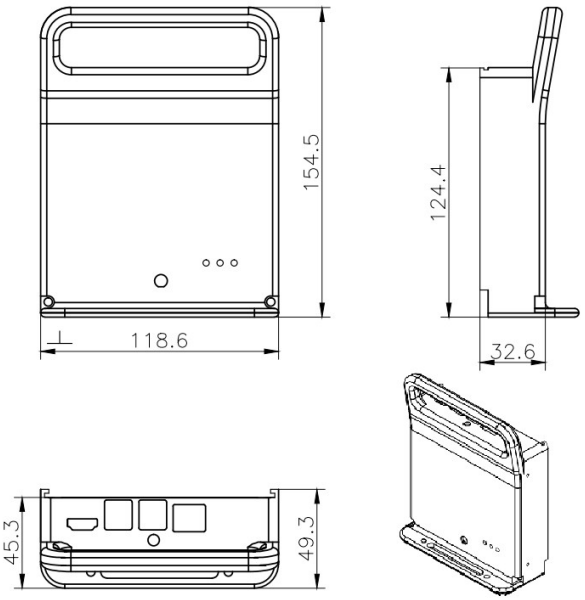



*Illustration 293: Left handle: CPU*

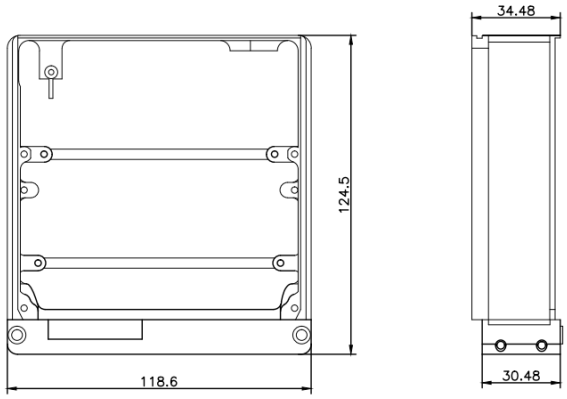



*Illustration 294: Standard module handle*

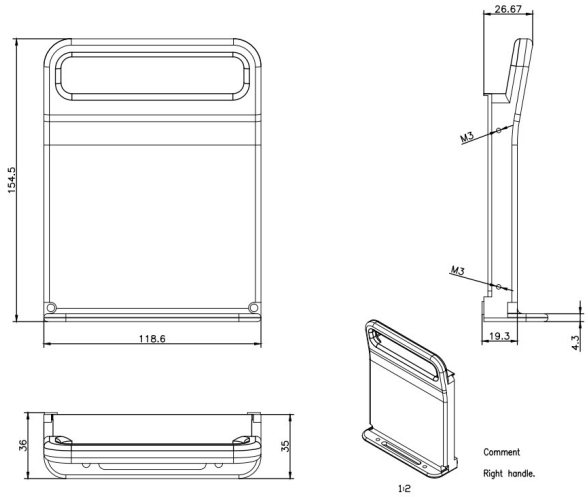



*Illustration 295: Right handle*

## 6.1.2 Weight & Power Consumption

| Item | Approx. weight [g] | Approx. power consumption [W] |
|---|---|---|
| Left Handle Standard | 250 | - |
| Left Handle: DS NET WiFi | 400 | <=5 |
| Left Handle: CPU | 500 | <=8 |
| DS GATE | 400 | 3 |
| DS-CAN2 | 400 | 2 (+ max. 16 W sensor supply) |
| Standard measurement modules<br>DS NET ACC2, DS NET V8, DS NET V8-200,<br>DS NET V4, DS NET TH8, DS NET TH4,<br>DS NET DIO8, DS NET AO4 | 400 | 2 |
| DS NET CFB2 | 400 | 2.5 |
| DS NET BR8 | 800 | 2.5 |
| DS NET BR4 | 400 | 2.5 |
| DS NET BR4-D | 450 | 2.5 |
| DS NET V8-B | 500 | 2 |
| DS NET V4-B | 500 | 2 |
| DS NET V4-HV | 600 | 2 |
| DS NET TH8-C | 500 | 2 |
| DS NET SUPPLY | 450 | <=20 |
| Right Handle | 250 | - |

# 6.2 DIP Switches

This chapter describes in detail the meaning of the DIP switches of the sockets.

The 10 pin DIP switch (on the left of Illustration 296) is used for addressing, the hot swap function and for the bus termination.

| Pin | Description |
|---|---|
| 1..6 | module address[62]: see 6.2.1 Setting the address |
| 7 | unassigned |
| 8 | hot swap function: see 6.2.2 Hot swap |
| 9,10 | termination: see 6.2.3 Terminating resistances |

*Table 35: 10 pin DIP switch*

The 4 pin DIP switch (on the right of Illustration 296) is used for the selection of the UART:

| Pin | Description |
|---|---|
| 1,2 | First UART |
| 3,4 | Second UART |

*Table 36: 4 pin DIP switch*

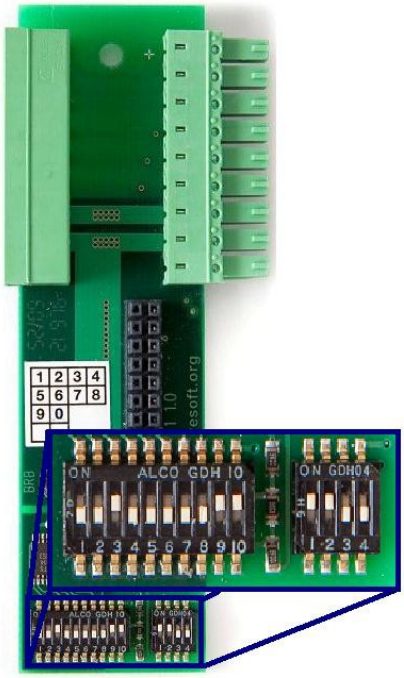



*Illustration 296: Socket DIP switches*

## 6.2.1 Setting the address

The address is set in binary form with the first six switches, where the first switch is the LSB (least significant bit).

The address *0* corresponds to no configuration (the first 6 DIP switches down), i.e. an inserted module retains the address assigned via software.

With new modules fresh from the factory you always have to assign an address, either via the DIP switches or via software. Otherwise several modules use the same address (default: *1*) and are therefore not capable of measuring within a data bus.

### 6.2.1.1 DIP switch configuration table

Table 37 provides the default configuration of a sample DS NET system that has one DS GATE and 16 measurement modules.

Noteworthy:

- By default the hot swap (6.2.2 Hot swap) is enabled (DIP switch 8)
- the first eight modules (1-8) are configured to use the first UART for communication and the second eight (9-16) are configured to use the second UART to provide maximum data throughput and performance
- the terminating resistances are set for the very last module on each UART
  see also 6.2.3 Terminating resistances

**HINT**

Note that module *1* and module *9* have the same address: *1*. But since they are on different UARTs, there is no address conflict.

62 since you can only connect up to 8 modules to each of the 2 UARTs, DS NET actually only uses 4 of the 6 address DIP switches

| | 10 DIP switch | | | | | | | | | | 4 DIP switch | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Module** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **1** | **2** | **3** | **4** | **Notes** |
| **GATE** | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **1** | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | Note that UART1 is selected for this module and all the following modules |
| **2** | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **3** | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **4** | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **5** | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **6** | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **7** | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **8** | | | | ■ | | | | | ■ | ■ | ■ | ■ | | ■ | Note that the termination resistances are activated for the last module of UART1 |
| **9** | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | Note that UART2 is now selected for this module and all the following modules |
| **10** | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **11** | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **12** | | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **13** | ■ | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **14** | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **15** | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **16** | | | | ■ | | | | | ■ | ■ | ■ | ■ | | ■ | Note that the termination resistances are activated for the last module of UART2 |

*Table 37: DIP Switch Configuration Table*

## 6.2.2 Hot swap

If hot swap is enabled, then you can replace a module during measurement with a new module of the same type (e.g. a DS NET TH8 module can be replaced with another DS NET TH8 module, but not with a DS NET ACC2 module).

The hot swap functionality can be controlled with the 8th DIP switch of the 10 DIP switch element on the backplane.

| **DIP switch** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|---|---|
| **deactivated** | | | | | | | | ■ | | |
| **(default) activated** | | | | | | | | | | |

*Table 38: DIP switch 8: hot swap status*

### 6.2.2.1 Behind the scenes

The module configuration is stored in the module and also in the backplane. Thus we must decide, what should happen when you attach a new module to an existing backplane:

- hot swap activated: the configuration from the backplane (which is the same as the configuration from the last module that was attached to this backplane), will be transferred to the new module
  Thus, after swapping the modules, the new one will have the very same settings as the old one and you did not have to run any configuration software!
- hot swap deactivated: in this case, the configuration of the module will be transferred to the backplane.

**HINT**

Whenever you leave the configuration mode in DEWESoft™ or *test.commander*, the current configuration (including any changes) is automatically transferred to the backplane and the module, so that they are always in sync..

### 6.2.2.2 Troubleshooting

If hot swap is activated and the module blinks SOS (see 5.2.5.1 SOS) after swapping, it could have the following reasons:

#### Module has been replaced

This can happen, if you did not adhere to the procedure described in 6.10 Replacing a module when you replaced the module (e.g. if you replaced a TH8 module with an ACC2 module).

In this case, follow these steps to fix the problem:

- Unscrew the module (see 6.6 Fixation of a module) and remove it: see 6.7 Insert/remove a module
- Deactivate hot-swapping: DIP switch 8 of the socket must be ON (see 6.2.2 Hot swap)
- Reattach the module (see 6.7 Insert/remove a module):
  Now the module configuration will be written to the socket.
  Wait until the modules LEDs stop to flash and then:
- Optionally (RECOMMENDED): If you want to switch on hot-swapping (see 6.2.2 Hot swap) for this socket:
  - Remove the module again: see 6.7 Insert/remove a module
  - Activate hot-swapping: DIP switch 8 of the socket must be OFF (see 6.2.2 Hot swap)
  - Reattach the module (see 6.7 Insert/remove a module)
- Fix the module (see 6.6 Fixation of a module for details)

## 6.2.3 Terminating resistances

The terminating resistances must be activated on the last socket of each UART-interface-line (and only there), because the end of the line must be terminated with resistors. Otherwise reflections occur on the line and may lead to disturbances, or even to the loss of data transmission.

In the backplane of the DS GATE, the terminating resistances must not be activated, because the DS GATE has it's own resistances which are always activated.

Push the DIP switches 9 and 10 upwards to activate the terminating resistances:

| Terminating resistances | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| activated | | | | | | | | | ■ | ■ |
| deactivated | | | | | | | | | ■ | ■ |

*Table 39: DIP switches 9 and 10: terminating resistances*

**IMPORTANT**

The terminating resistances must be activated at the end points and only at the end points of the interface line.
If resistances are also activated in between, the signal is weakened and interference or even failure of the data transmission occurs for the modules located after the additional resistances.

## 6.3 Fixation of the rubber feet

Each DS NET system has 4 rubber feet: 2 of them attached to each of the handles. For the screw connection you need a Torx T10 screw driver.:

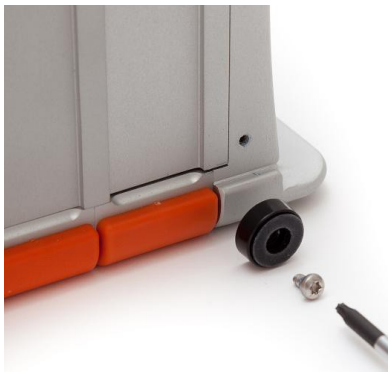


*Illustration 297: Rubber Feet*

## 6.4 Fixation of the right handle

To attach/detach the right handle of the DS NET system, open the two hex screws at the bottom of the handle with a 2.5 mm hex key:

*Illustration 298: Remove right handle*

| HINT | |
|---|---|
|  | Since the right handle is entangled with the last module, you can only completely remove the right handle after you have removed the last module. |

## 6.5 Interconnecting 2 backplanes

Before you add the new backplane, you must deactivate the terminating resistances of the module that is currently the last one (this is the one on the very right side – farthest away from the DS GATE): see 6.2.3 Terminating resistances.

Inside the threaded hole of the backplane, there is a a screw for connecting it to the next module.

**HINT**

If there is no screw inside the hole, then the backplane can only be connected to the left handle and not to another backplane.

Use a 2.5 mm hex key to screw the new backplane to the most left backplane of the DS NET system:

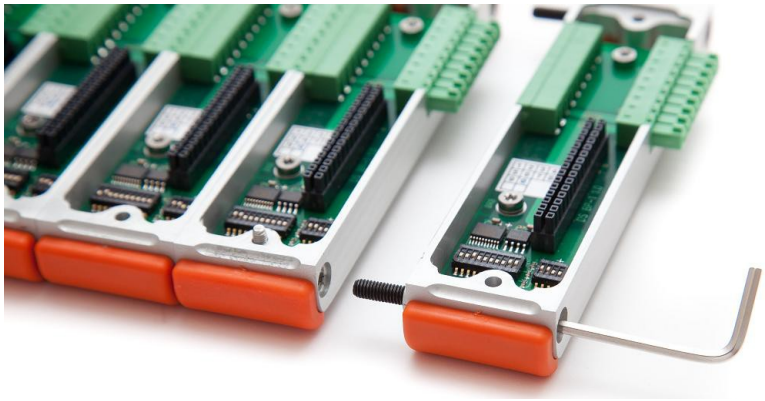


*Illustration 299: Interconnecting 2 backplanes*

Make sure that you have correctly set the DIP switches of the new socket (see 6.2 DIP Switches), especially the terminating resistances (see 6.2.3 Terminating resistances).

## 6.6 Fixation of a module

The module is connected to the backplane via 2 screws (use a Torx T10 screwdriver) that can be accessed from the backplanes bottom side:

*Illustration 300: Module-Backplane screw connection*

## 6.7 Insert/remove a module

Before you insert a module check that the DIP switches are set correctly (see 6.2 DIP Switches).

Before you remove a module you must unscrew the backplane Torx screws (see 6.6 Fixation of a module): for the last module (the module at the very right of the system, that is farthest away from the DS GATE), you may also need to loosen the rubber feet (see 6.3 Fixation of the rubber feet).

Each module can be inserted/removed individually.

*Illustration 301: DS NET: insert/remove module*

## 6.8 Adding a new module

Check list for adding a new module to an existing DS NET system:

- Remove the rubber feet from the right handle: see 6.3 Fixation of the rubber feet for details
- Remove the last module: see 6.6 Fixation of a module and 6.7 Insert/remove a module for details
- Remove the right handle: see 6.4 Fixation of the right handle for details
- Now attach the new backplane including the new socket to the last backplane of the existing system (this is backplane on the right, which is farthest away from the DS GATE): see 6.5 Interconnecting 2 backplanes
- Make sure that the DIP switches are set correctly see 6.2 DIP Switches - especially note:
  - the terminating resistances of the socket that has been the last module before must be deactivated
  - the terminating resistances of the new socket (which is now the last one) must be activated
  - take care to use the correct hot-swap settings: see 6.2 DIP Switches
- Reattach the right handle: see 6.4 Fixation of the right handle for details
- Insert and fix all modules from left to right: see 6.6 Fixation of a module and 6.7 Insert/remove a module for details
- Fix the new module: see 6.6 Fixation of a module for details
- Reattach the rubber feet: see 6.3 Fixation of the rubber feet for details

After you have physically connected the new module, you must also adapt the configuration in the DS NET plugin: see 4.3.4.2 Resolving configuration issues.

## 6.9 Exchanging a module (hot-swap)

Exchanging a module means, that you want to replace an existing module with a new module of the same type (e.g. replace a broken DS NET TH8 module with a new module of type DS NET TH8) and want to keep all the settings that have been used before: see also 6.2.2 Hot swap.

If you want to replace an existing module with a module of another type (e.g. replace a DS NET TH8 module with a module of type DS NET ACC2), see 6.10 Replacing a module.

| **HINT** | If you want to exchange the last module (this is backplane on the right, which is farthest away from the DS GATE), you may also need to remove the rubber feet of the right handle first: see 6.3 Fixation of the rubber feet for details |
|---|---|

Check list for exchanging a module of a DS NET system:

- Unscrew the old module (see 6.6 Fixation of a module) and remove it: see 6.7 Insert/remove a module
- Make sure, that hot swap is activated: DIP switch 8 of the socket must be DOWN (see 6.2.2 Hot swap)
- Insert the new module (see 6.7 Insert/remove a module) and fix it (6.6 Fixation of a module for details)

The new module should now read the configuration from the socket and start up right away. If you have any problems, see 6.2.2.2 Troubleshooting.

## 6.10 Replacing a module

Replacing a module means, that you want to replace an existing module with a new module of another type (e.g. replace a DS NET TH8 module with a module of type DS NET ACC2).

If you only want to exchange a module (e.g. replace a broken DS NET TH8 module with a new module of type DS NET TH8), and keep all the settings of the original module: see 6.9 Exchanging a module (hot-swap).

Check list for replacing a module of a DS NET system:

- Unscrew the old module (see 6.6 Fixation of a module) and remove it: see 6.7 Insert/remove a module
- Make sure, that hot swap is deactivated: DIP switch 8 of the socket must be UP (see 6.2.2 Hot swap)
- Insert the new module (see 6.7 Insert/remove a module)
    - Optionally: switch on hot-swapping (see 6.2.2 Hot swap)
- Fix the new module (6.6 Fixation of a module for details)

The settings of the new module that you have inserted will be transferred to the backplane.

After you have physically replaced the new module, you must also adapt the configuration in the DS NET plugin: see 4.3.4.2 Resolving configuration issues.

## 6.11 Exchanging a socket

If you ever need to exchange a socket with a new one (and keep the settings of the current module), follow these steps:

- Deactivate hot swap in the new socket: push DIP switch 8 up (ON)
  see also 6.2.2 Hot swap
- Power off the DS NET system
- Unscrew (see 6.6 Fixation of a module) and remove (see 6.7 Insert/remove a module) the module which is currently attached to to the backplane that you want to replace, so that you can access the socket.
  You will also have to remove all modules and backplanes right of the module in question, so that you can physically disconnect the socket from the socket to the right.
- Unscrew the 2 Torx screws that connect the socket to the backplane (use a Torx T10 screwdriver), replace the old socket with the new one and fix the screws again.
- Now you can reassemble the DS NET system (and attach the original module to the new socket)
- Switch on the power supply: since hot swap is deactivated the configuration of the the module is automatically transferred to the new socket (flashing LEDs)
- Wait until the loading process has finished (until the LEDs no longer flash)
- Switch off the power supply
- Remove the module again and reactivate hot swap: push DIP switch 8 downwards (OFF)
  see also 6.2.2 Hot swap
- Insert the module again (see 6.7 Insert/remove a module) and fix the screws (see 6.6 Fixation of a module).

The backplane has been replaced and hot swap is active again.

# 7 Data Logger

Your DS NET system can be used as a standalone data logger (no PC required – just power up the DS-NET and log to the USB stick) to store the measurement data continuously on a USB stick with a data rate of up to 20kS/s.

Even better, it supports double-buffering, so that you can view the online data in DEWESoft™ and at the same time log the data to a USB stick. This can be used for redundant data acquisition: e.g. even if the LAN connection to DEWESoft™ is lost during measurement, you will not lose any data – it will be stored on the USB stick.

All enabled channels (see Enabling/Disabling channels on page 71) will be stored in the datafiles on your USB stick.

*Illustration 302: DS NET as data logger*

## 7.1 Continuous Logging via DEWESoft™

### 7.1.1 Enable logging

To enable continuous data logging, go to the *Configuration Mode* (see 4.3 Channel setup on page 62) of the DS NET plugin and simply click the **Enable** button:

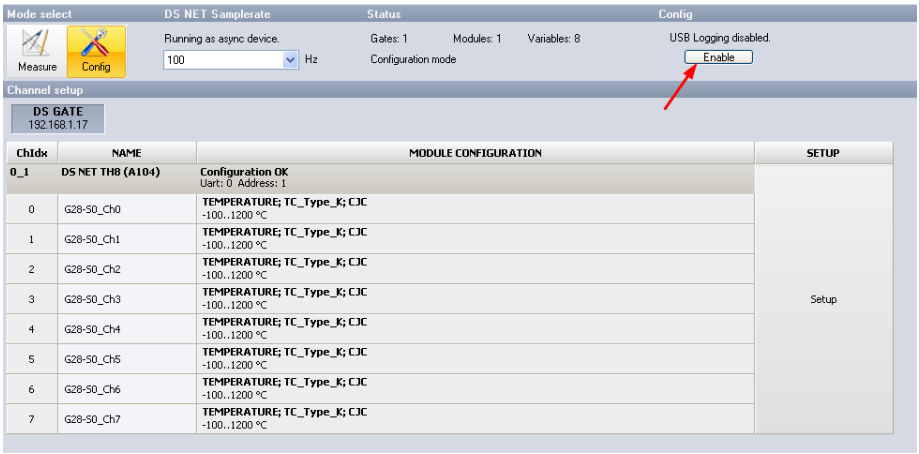



*Illustration 303: DS NET plugin: Enable USB logging*

Then select the size of your log files:

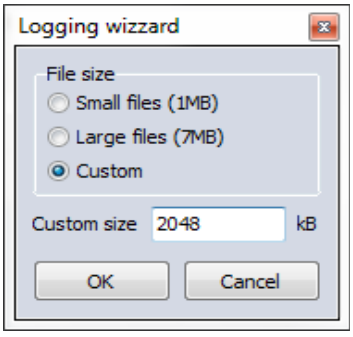



*Illustration 304: DS NET plugin: USB Logging - File Size*

Note: this dialogue is only available in the DS NET plugin version 4.4 or higher.

When you leave the *Configuration Mode* the changes will be stored in the DS GATE: That's all you have to do.

When the logging function is enabled, you will notice that there are 2 new channels (*LA_SaveEvent_#1* and *LA_SaveCtrl_#1*) in the *Channel setup*:

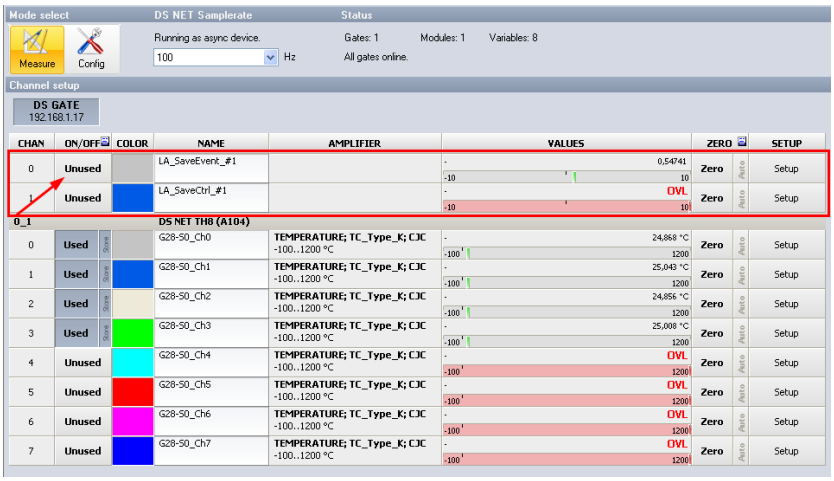



*Illustration 305: DS NET plugin: Logger control channels*

These 2 channels control the data logging function and make sure, that the data from the internal buffer is written to the USB stick correctly. Since these channels do not have any meaning for your measurement, you can set them to **Unused** (the logging will still work, but these 2 internal control channels do not show up in the channel selection of the measure mode).

When the logging function is enabled and you have not attached a USB stick to the DS GATE, the red error-LED of the DS GATE will start to blink after some time, to warn you that it could not write the measurement data to a USB device.

## 7.1.2 Attach a USB stick

Attach a USB stick to the MEM USB connector of the DS GATE.
When you attach the USB stick (and the logging function is enabled), the DS GATE will read the file-system of the USB stick: the blue LED of the DS GATE will flash fast: while it is accessing the file system of the USB stick (see 5.3.2.2 USB access on page 96).

**HINT**

Make sure, that the physical connection of the USB stick is okay. Some USB sticks with short front connectors may not be suitable.

**IMPORTANT**

The files system of the USB stick must be FAT32.

*Illustration 306: USB stick attached*

## 7.1.3 Logging

When logging is enabled and the USB stick is attached, the DS GATE will periodically write the measurement data to the USB stick. While the data is written to the USB stick, the blue LED of the DS GATE will flash fast. You should not remove the stick while data is written.

The time, how often a file is written to the USB stick is dependant on the sample rate and the number of channels that you have configured.

### 7.1.3.1 Redundancy in data acquisition

You can connect both, the USB stick and your measurement PC (via Ethernet), to the DS NET system in parallel. The data will still be logged to the USB stick while you can use DEWESoft™ to analyse the very same data at the same time. This feature is also known as *double-buffering* and requires DS GATE firmware V0.55 (or higher) and DS NET plugin V3.3.1 (or higher).

So, even if your Ethernet connection is lost during the measurement, your data is not, since it will be logged to the USB stick.

## 7.2 Logging controlled by digital input signal

This example shows how you can start/stop logging via a digital input pulse.

Prerequisite is that USB Logging has been enabled in the DS NET plugin (see 7.1.1 Enable logging).

The example system consists of an ACC2 and of a DIO8 module. The ACC2 module is used to gather the measurement data. One input of the DIO8 will be used to start/stop logging to USB and one digital output will be used to switch a LED on/off when the data is being logged.

Illustration 307 shows what we want to achieve:

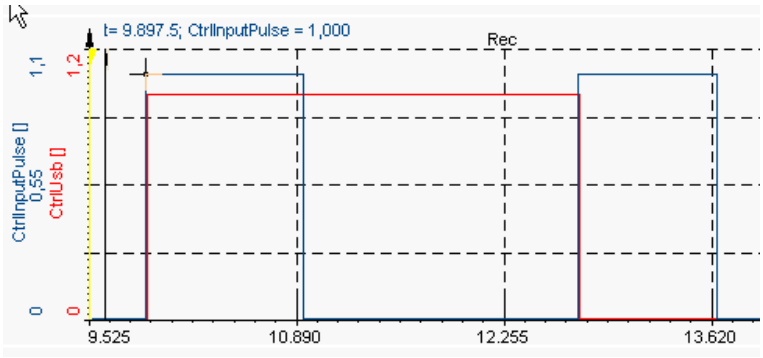



*Illustration 307: Log on DI: Result*

The blue signal `CtrlInputPulse` is the input signal that is attached to a digital input connector of the DIO8 module. We want to start logging the data to the USB stick on the first pulse (when the `CtrlInputPulse` rises from `0` to `1`) and we want to stop on the next pulse (when the CtrlInputPulse rises from `0` to `1` the next time).
The red signal `CtrlUsb` is an internal variable that we will setup in `test.commander`, so that it is `0` when we don't log the data and `1` if we log the data.

## 7.2.1 Variables in test.commander

First we will take a look at the overview of all variables that we will need to define in `test.commander`. All those variables will be explained in detail later. Note, that the order of the variables is important, so make sure, that you create them in the correct order. The rest of this section will explain the variables in logical order – not in the order you need to create them.

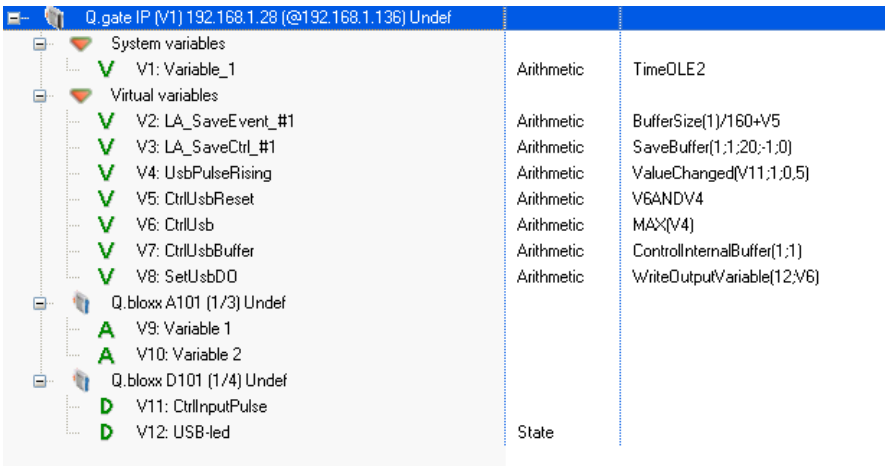



*Illustration 308: Log on DI: Variables*

When USB-logging has been enabled in the DS NET plugin, we can see that 2 buffers have been set:

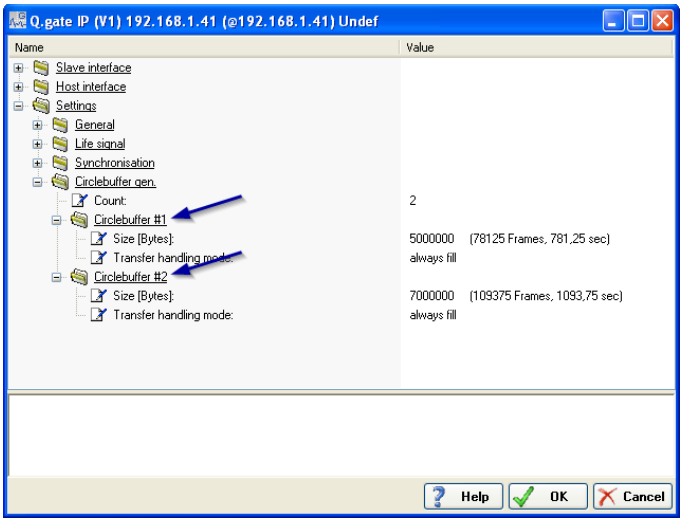



*Illustration 309: test.commander: 2 circlebuffers*

Circle-buffer #1 is used by DEWESoft™ to read the data (in the fast block-transfer mode) and circle-buffer #2 will gather the data that we will store on the USB stick.

### 7.2.1.1 UsbPulseRising

The first problem that we have, is that the input signal connected to the DIO8 module will not be a perfect pulse and that we only want to react to the rising edge of the input signal. We can create one single variable called `UsbPulseRising` that solves both problems. The formula that we use is: `ValueChanged(V11;1;0,5)`

This function will monitor `V11` which is our digital input signal and only when the value of the input signal changes (for more than `0.5`) will this variable be `1` (logical `true`), otherwise it will always be `0` (logical `false`).

Since the input signal is digital it can only be `0` or `1` and thus a change by `+0.5` means the rising edge of the signal: exactly what we want.

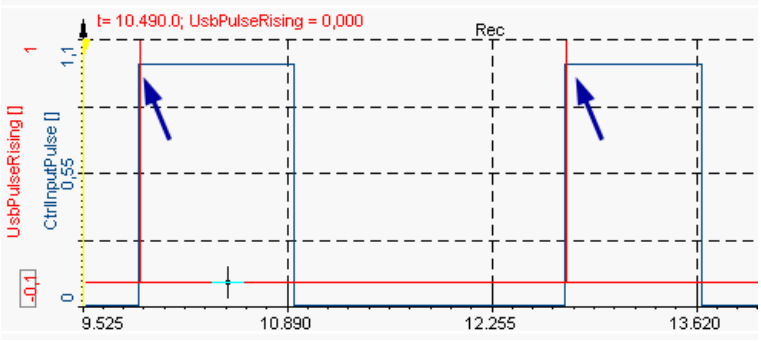



*Illustration 310: Log on DI: UsbPulseRising*

The blue arrows in Illustration 310 show that `UsbPulseRising` (the red signal) is a pulse signal that is only then active (`1`, logical `true`), when the digital input signal `CtrlInputPulse` (the blue signal) goes from `0` to `1`.

### 7.2.1.2 CtrlUsb

Now we need another variable that goes to `1` on the first pulse and back to `0` on the next pulse. We create a variable called `CtrlUsb` with this formula: `max(V4)`

`V4` is `UsbPulseRising` – so this formula would go to `1` on the first pulse, but it would never return back to `0`! Thus, we must somehow reset this variable on the second pulse:

### 7.2.1.3 CtrlUsbReset

We use this variable to reset `CtrlUsb` back to `0` when the next pulse is detected. But how do we distinguish the first from the second pulse? We can use the `CtrlUsb` variable for this. At the beginning `CtrlUsb` will be `0` and when the first pulse arrives it will be set to `1`. That means, when the next pulse arrives `CtrlUsb` will still be `1` and that's the difference we are going to use.

So the formula for `CtrlUsbReset` is this logical *AND* connection: `V6 AND V4`

Where `V6` is `CtrlUsb` and `V4` is `UsbPulseRising`.

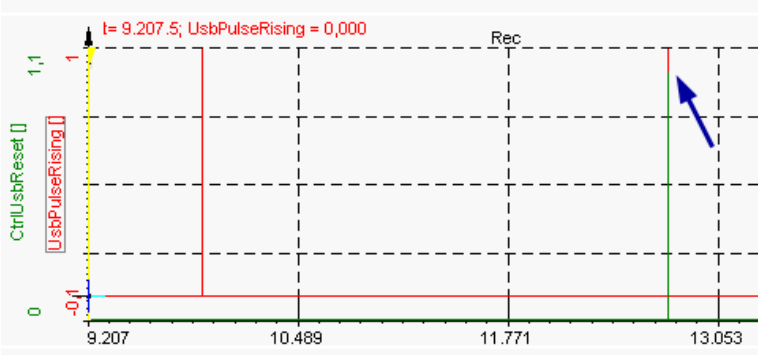



*Illustration 311: Log on DI: CtrlUsbReset*

You can see that the green signal `CtrlUsbReset` only goes to `1` on the second pulse (see blue arrow in Illustration 311).

Now we can use this variable to reset the `CtrlUsb` variable:

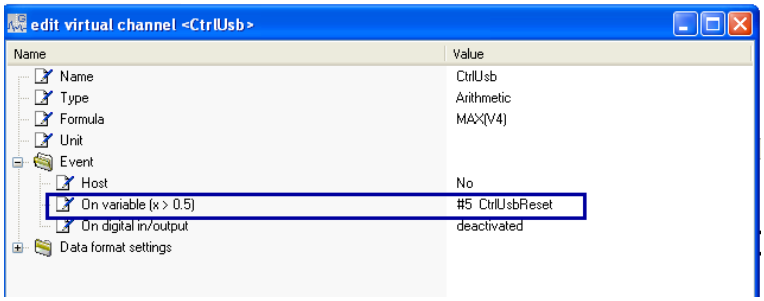



*Illustration 312: Log on DI: CtrlUsb Event*

`CtrlUsb` will be reset to `0` when `CtrlUsbReset` is greater than `0.5`. And we get the desired result for our `CtrlUsb` variable:

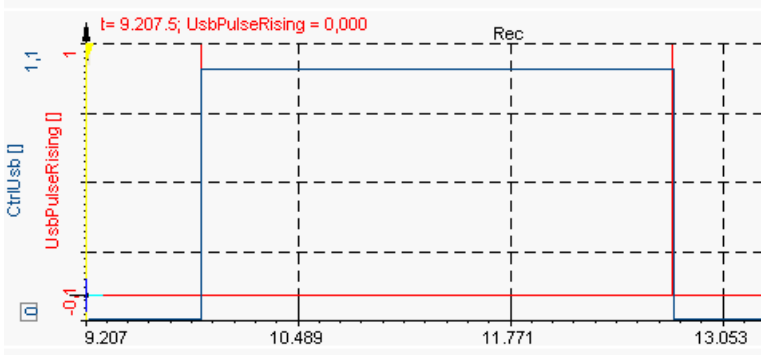



*Illustration 313: Log on DI: CtrlUsb*

You can see that `CtrlUsb` goes to `1` on the first pulse and goes back to `0` on the second one.

## 7.2.1.4 CtrlUsbBuffer

The formula for this variable is: `ControlInternalBuffer(1;1)`

The first argument is the command selector and the second one specifies to which internal buffer the function should be applied. When USB-logging is enabled in DEWESoft™, two buffers will be created: buffer `0` for DEWESoft™ data and buffer `1` for USB-logging data (see Illustration 309 on page 166).

In short, this function tells the controller to write all measurement-data to the USB-buffer. Since we do not want to fill the buffer all the time, we must set another event:

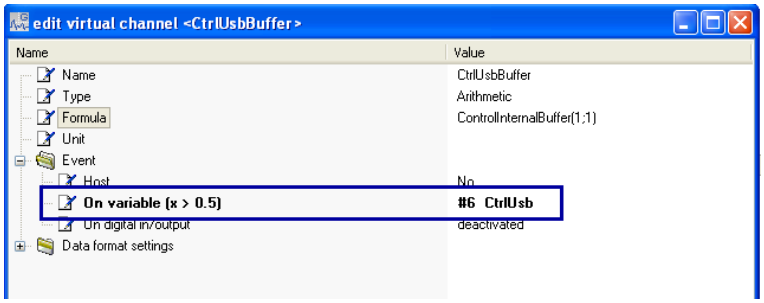



*Illustration 314: Log on DI: CtrlUsbBuffer Event*

With this event in place the data will only be stored to the USB buffer, when `CtrlUsb` is active – that means between the first and the second pulse.

## 7.2.1.5 LA_SaveCtrl_#1

This variable has been created by DEWESoft™ when the USB logging function has been enabled.

The formula is: *SaveBuffer(1;1;20;-1;0)*

This formula will copy the contents of buffer *1* (1st argument, which is our USB-logging buffer: (see Illustration 309 on page 166)) to a file on data drive *1* (2nd argument, which is the USB stick).

But since it makes no sense to call this function all the time (we would get a lot of very small files), DEWESoft™ has set an event to control this function (see next topic):

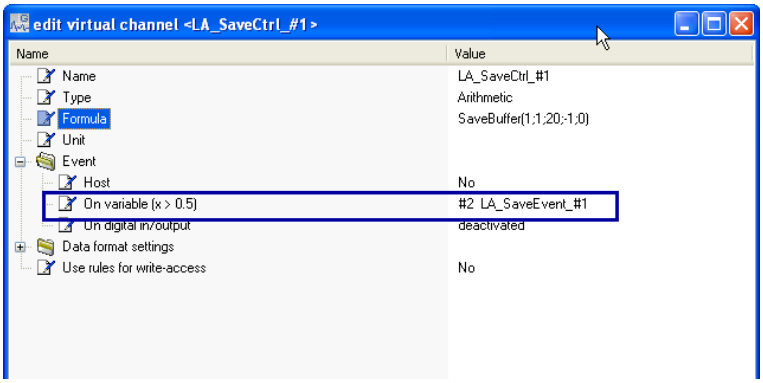



*Illustration 315: Log on DI: LA_SaveCtrl_#1 Event*

## 7.2.1.6 LA_SaveEvent_#1

This variable has been created by DEWESoft™ when the USB logging function has been enabled. It will control when *LA_SaveCtrl_#1* (see previous topic) will be executed; that means: when the data from the USB-logging-buffer will be written to the USB-stick.

The default formula for this variable is: *BufferSize(1)/160*

This formula will evaluate to *0.5* when the USB-logging-buffer is filled to 80% - and then the *LA_SaveCtrl_#1* function will be executed (and finally save the buffer data to the USB-stick).

This is fine for the case of continuous logging, but in our case, it may be a problem.
Imagine that the buffer is filled to only 25% when USB-logging is turned off. This last data would never be saved to the stick and would be lost.

Thus we must alter this variable to this formula: *BufferSize(1)/160+V5*

Where *V5* is the *CtrlUsbReset* variable that will only then be *1* when the USB logging is turned off. So now everything's fine: whenever USB-logging is turned off the value of *LA_SaveEvent_#1* will for sure be greater than *0.5*, so that *LA_SaveCtrl_#1* will be executed.

## 7.2.1.7 SetUsbDO

This formula will simply set the digital output channel *V12* to the current value of *V6* (*CtrlUsb*). This means, whenever data is being written to the USB-logging-buffer, the digital output will be active.

Formula of variable SetUsbDO: *WriteOutputVariable(12;V6)*

| **HINT** | Note, that the first argument of `WriteOutputVariable` is not a variable reference, but only an index number (which refers to the variable in place).<br>Imagine, you insert another arithmetic variable between `V9` and `V10` of the ACC2 module. All variables with an index of `10` or higher would be increased by one: thus the digital output variable `USB-led` would now be `V13` (instead of `V12`). test.commander will automatically adjust all variable references (all the `V12` references that you used would be corrected to `V13`), but it cannot adjust index numbers:<br>That means, you have to manually change the first argument of `WriteOutputVariable` from `12` to `13`! |
|---|---|

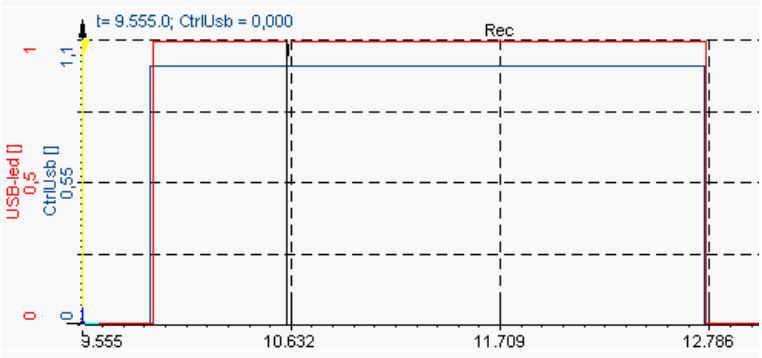



*Illustration 316: Log on DI: USB-led*

In Illustration 316 you can see that the digital output `USB-led` will be `1` as long as `CtrlUsb` is `1`. If you look close enough, you can see that it is a little bit delayed (by about 13ms). This is the time it takes the DS GATE to calculate the value of the formula and then set it back to the DIO8 modules output channel.

# 7.3 Working with the logged data

Attach the USB stick with the logged data to your PC. Now go to *Analysis* mode – *Data files* and select the `DS NET USB log files (*.dat)` filter.

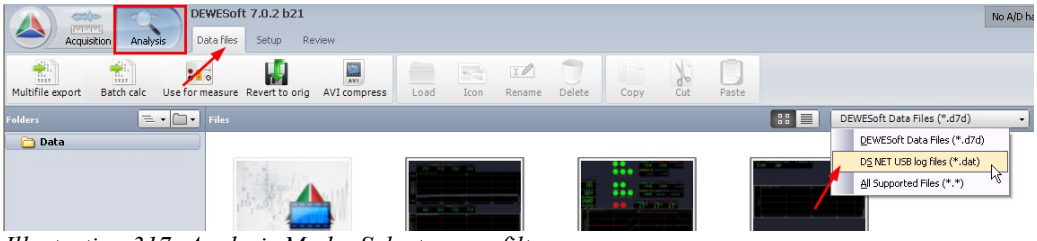



*Illustration 317: Analysis Mode: Select `*.dat` filter*

If you don't see the `*.dat` filter entry in the list, checkout the troubleshooting section of this chapter: 7.4 Troubleshooting.

Now navigate to the file system of your USB stick:

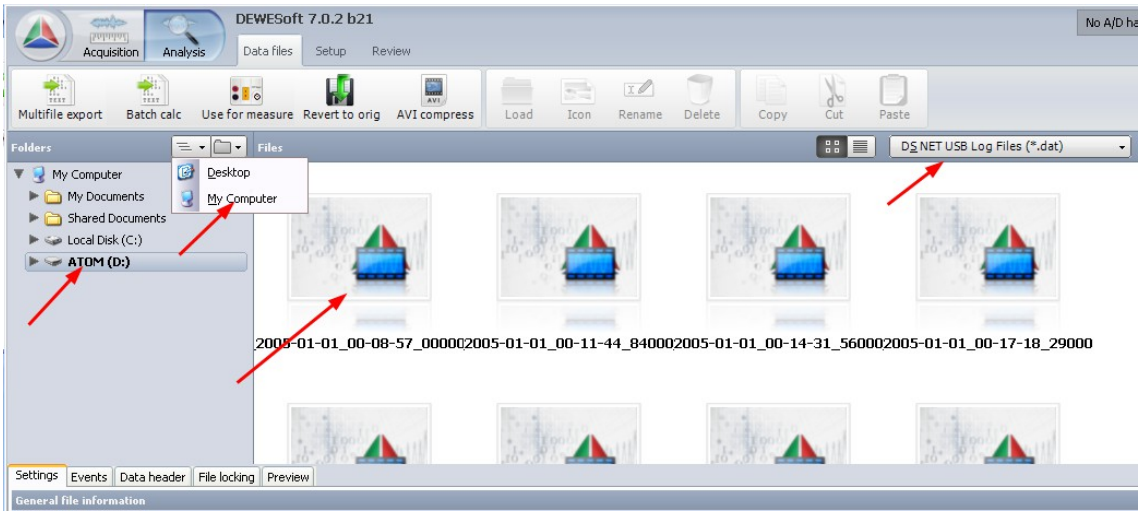



*Illustration 318: Analysis Mode: Select `*.dat` file*

In order to see all drives connected to your computer, you may have to click this icon  and select *My Computer* first. Then you see all drives and folders of your PC, including the connected USB drive on the left *Folders* list. Select the USB drive (`D:` in this case) and then you should see all the `*.dat` files that have been logged to the USB stick.

Double click the first file to open the DS NET USB Log Files dialog:

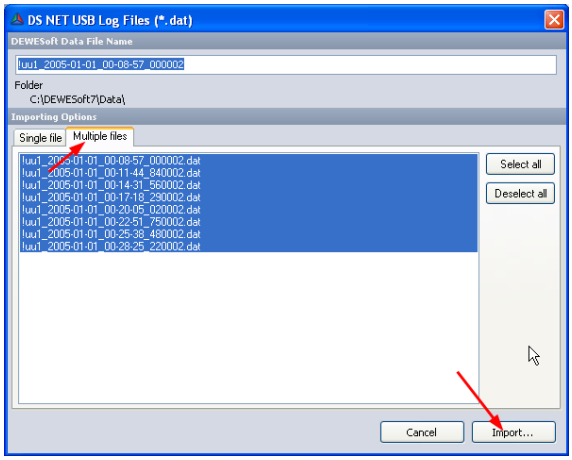



*Illustration 319: DS NET USB Log Files dialog*

Now you can switch to the Multiple files tab sheet (all files will be selected by default) and then click **Import...**:

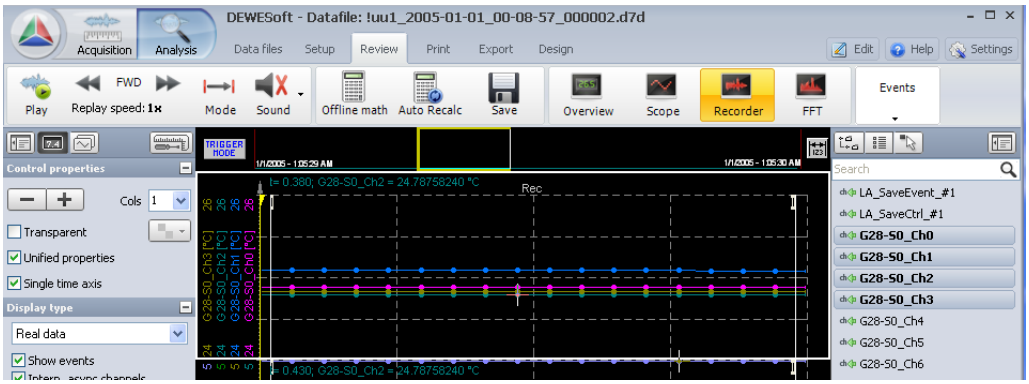



*Illustration 320: Analysis view*

You can see on the channel list at the right, that all channels have been stored in the USB files, even those that you have set to **Unused** in DEWESoft™.

Just select the channels that are interesting (the internal channels: *LA_SaveEvent_#1* and *LA_SaveCtrl_#1* may not be interesting) and do your analysis.

| HINT | |
|---|---|
|  | If you are using the import add-on version 2.1 or lower and the evaluation copy of DEWESoft™, only the first few samples of the data file will be imported. |

# 7.4 Troubleshooting

## There are no datafiles on the USB stick

In this case, please check the following points:

- The DEWESoft™ version must be 7.0.2b21 or higher
- The DS NET plugin version must be 3.3.1 or higher
- The firmware of your DS GATE module must be V0.55 or higher
- The logging function must be enabled: see 7.1.1 Enable logging
- Check the physical connection between the USB stick and the *MEM* connector of the DS GATE. Most USB sticks have a LED indicating, that the connection is okay
- The file format of your USB stick must be FAT32
- The USB stick must have enough space left for storing the data files

## I cannot import the datafiles on the USB stick in DEWESoft™

In this case, please check the following points:

- The DEWESoft™ version must be 7.0.2b21 or higher
- The file `DSNETImport.imp` must exist in the `Addons` directory of your DEWESoft™ installation. If this file does not exist, you have to copy it there (on Windows 7 you may also need to run the Plugin Registration: see 3.1.1.2 Windows® 7: DEWESoft™ plugin registration on page 18). You can get the file from
  - the USB stick that was included with your DS NET shipment (in the directory: `Extended\Bin\Addons`)
  - The homepage (*Download – Plugins* section) http://www.dewesoft.com/download/section/6 Search for: *DS NET Import* in the *DS-NET Plugin* section
- The USB stick must be attached correctly to your PC

## There are only about 1000 files on my USB stick, although there is enough space left

When you are doing slow measurements the DS NET will automatically delete old files, and only keep the 1000 newest files. Thus you have a circle buffer and the most recent 1000 data files will always be available.

With the current version of the firmware V0.55 it is not possible to deactivate this feature or to change the 1000 file limit.

## There are only 128 datafiles on my USB stick, although there is enough space left

Most likely your USB stick is formatted with the FAT file-system. The FAT file system can only store 128 files in one directory. Format the USB stick with the FAT32 file-system (make a backup of your data first).

# 8 Service guide

## 8.1 Add-on update

Describes what you have to do if you want to update the *DS NET plugin* (see 4 DS NET plugin of page 43) or the *DS NET Import* add-on (see chapter 7 Data Logger on page 163).

The newest version of the DS NET plugin can be downloaded from our homepage: www.dewesoft.com. Go to *Download* – *Plugins* (or use this direct link: http://www.dewesoft.com/download/section/6) and then download the add-on you wish to update: see the blue arrows in Illustration 321.

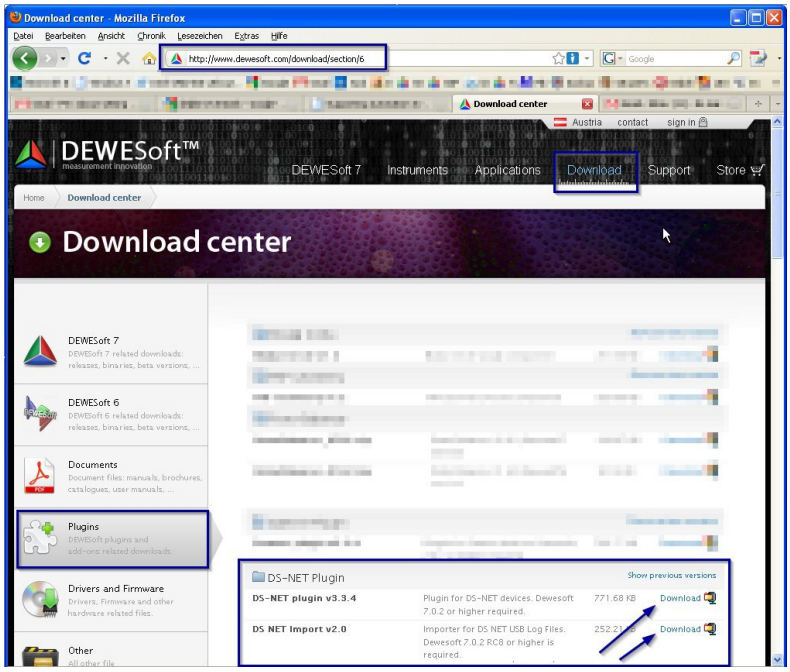



*Illustration 321: Download add-ons*

When you have downloaded the file, extract the files and folders in the archive and copy them to the `Addons` directory of your DEWESoft™ installation (replace any existing files if necessary).

The default path of the `Addons` directory is `D:\DEWESoft7\Bin\V7_0\Addons`

The path may vary dependant on your installation (see 3.1.3.2 Installing new DEWESoft™ version for details).

Then you should see the following files and folders in the `Addons` directory:

- `DSNET` (folder)
- `DSNET.dll`
- `DSNETImport.imp`

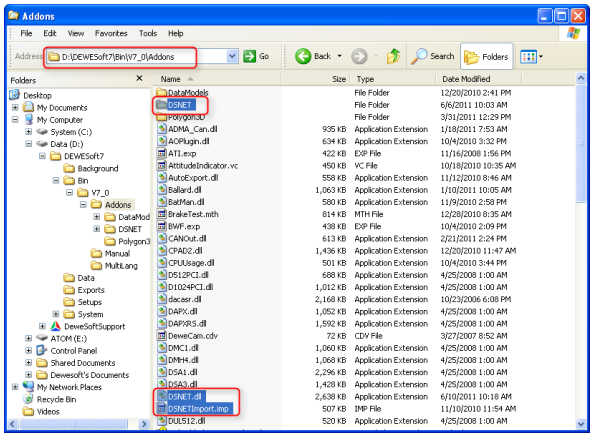



*Illustration 322: DS-NET plugin files and folders*

## 8.2 Firmware update

When you get your DS NET system the DS-GATE module and the measurement modules will always include the latest firmware.

But in the following situation it may be necessary for you to update the software of the DS GATE or of the modules:

- If a newer version of the software is available that includes new features or bug-fixes that you need
- If you want to combine older modules, with a newer system, it is essential that you update the software of the old modules, because otherwise disturbances in operation due to a communication failure may occur.

The `test.commander` installation (including `ICP100`), also includes the firmware for the DS GATE and for all measurement modules.

**IMPORTANT**

Firmware update should only be done by DEWESoft™ personnel.
It is very important that the communication during all firmware updates is NOT interrupted!
Otherwise your system may be broken and you may need to send it back for repair.

## 8.2.1 Firmware update for modules (aka. slaves)

### 8.2.1.1 Note on old versions

Note: When your modules have very old firmware versions, you should update step by step to the next major firmware versions (i.e. do not skip major versions and update to the most current version directly).

For example, your module may have the old firmware version 0090 (see image below).
When you press the update Module(s) button, ...

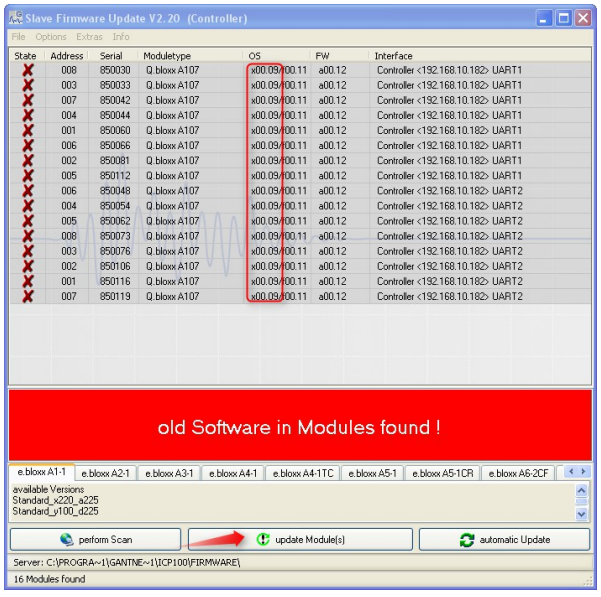



*Illustration 323: Slave Firmware Update: Old Version*

you will see a list of all firmware versions that are currently available on your PC.
In the example below you we have the newer firmware versions: 0020, 0030, 0032.
So you should first update the version 0009 to 0020 (the most current next major version) and then update from 0020 to 0032 (the most current next major version).
If a major version step is missing, please contact our support to get more information.

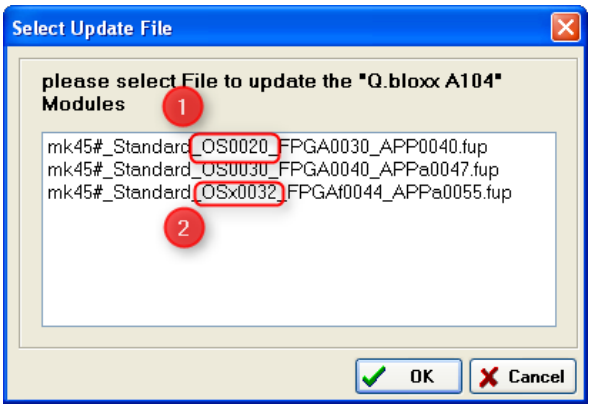


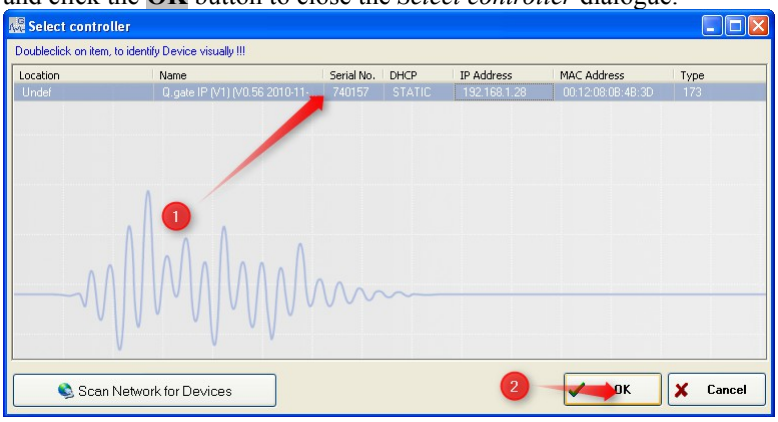

*Illustration 324: Slave Firmware Update: Select Version*

### 8.2.1.2 Updating the slave firmware

1. In the program `test.commander` select *Utilities* - *Slave Firmware Update*.

2. Make sure that the communications settings are correct:
   In *Options* - *Communication Settings* select *TCP-IP over controller* for *Interface Kind* and activate the *use Scan for IP Address check box*.
   see also Error scanning Bus!<Port not opened> on page 175

3. Click the **Perform Scan** button to search for the DS NET system that you want to update, select the system and click the **OK** button to close the *Select controller* dialogue.

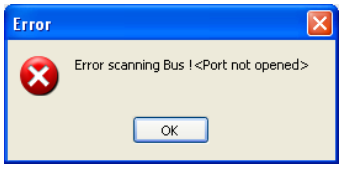
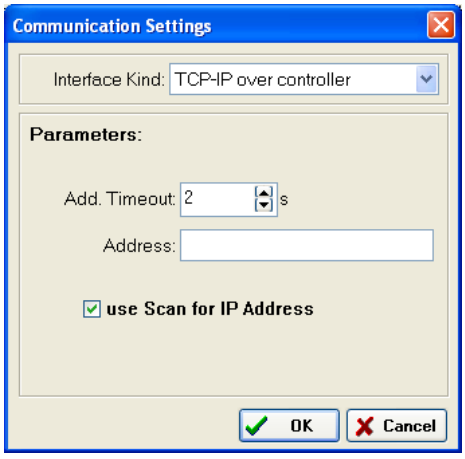



4. Then select the modules you want to update and press the **update Module(s)** button and select the firmware version that you want to update to (see also Note on old versions on page 174)

5. Be patient and wait for the process to continue. This can take quite long (e.g. for a DS-NET system with 16 modules up to one hour).

## 8.2.1.3 Troubleshooting

### Error scanning Bus!<Port not opened>

| | |
|---|---|
| If you see the error message below in the *Slave Firmware Update* dialog, you must check the communication settings of the *Slave Firmware Update* dialog. | Go to *Options* – *Communication Settings* and make sure, that you have selected *TCP-IP over controller* for *Interface Kind* and that the *use Scan for IP Address check box* is activated. Then try again. |
|  *Illustration 325: Slave Firmware Update: Error scanning Bus* |  *Illustration 326: Slave Firmware Update: Communication Settings* |

### Error checking Software Version!

When the *Slave Firmware Update* dialog shows the error message below, it means that the firmware on your PC cannot be found.

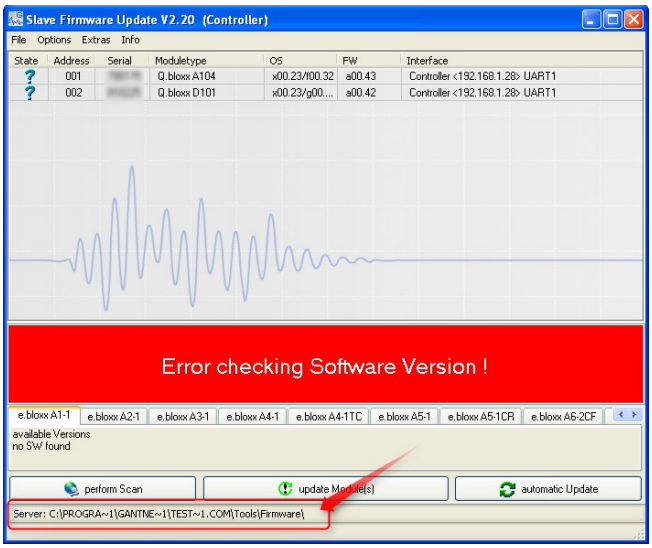



*Illustration 327: Slave Firmware Update: Error checking Software Version*

Please double-click the *Server path* in the status bar (or go to *Extras* - *set new Firmware Directory*) and select the ICP100 firmware directory: e.g. `C:\Programme\Gantner Instruments\ICP100\Firmware`

## 8.2.2 Firmware update for DS-Gate

### 8.2.2.1 Prepare DS-Gate firmware update

**IMPORTANT**

Before you update the firmware of the DS-GATE, you should update the firmware of all modules (see 8.2.1 Firmware update for modules (aka. slaves) on page 174).
It is recommended that you read the current configuration with `test.commander` and save a backup of this project.
If your DS NET system has no access to a DHCP server (e.g. when you connect the DS-NET directly to your PC), then you must deactivate DHCP in the DS-GATE (under *Settings – Host interface – ETHERNET – Use DHCP server*: select *No*)
Do not forget to write the changes to the DS-GATE: *File – Write Project (All)…*

Open `test.commander` and select
*Open new project and read online system…*

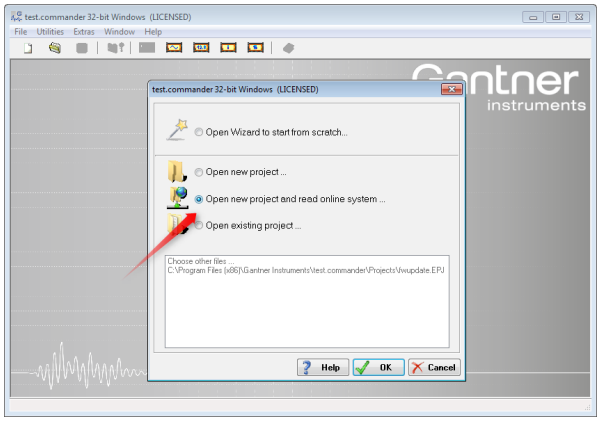



*Illustration 328: New Project*

Select a name for the new project: e.g. `FwUpdate`

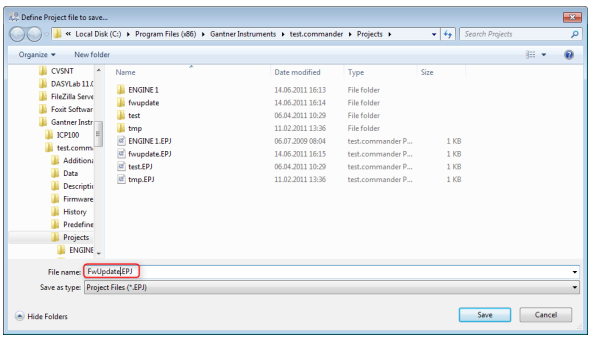



*Illustration 329: Project Name*

In the DLL Scanning Network select the DS-NET device that you want to update. The red rectangle in Illustration 330 shows the current firmware version of the DS-NET device: in this case it's *V0.56*.

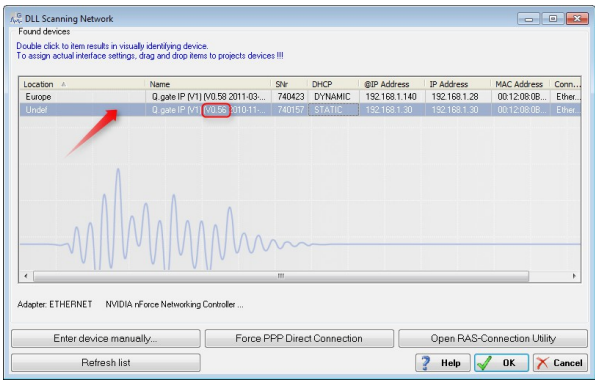



*Illustration 330: Select DS-GATE*

Whenever a DS-GATE with an old firmware version is connected, `test.commander` will show the following warning dialog. During this update procedure you will see this dialog several times – you can always confirm the dialog by clicking the **Yes** button.

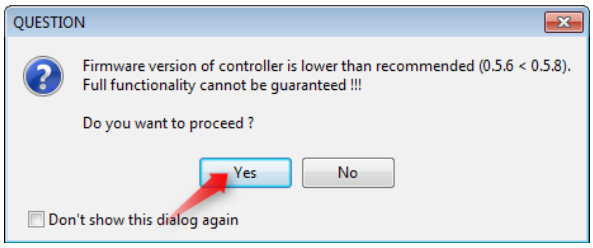



*Illustration 331: Firmware version warning dialogue*

When the information from the DS-GATE has successfully been read, you will see the following confirmation dialogue:


*Illustration 332: Controllers successfully read*

Now we can open the DS-GATE settings by:

❶ right-clicking on the Q.gate IP entry and then
❷ clicking on the Settings item in the pop-up menu

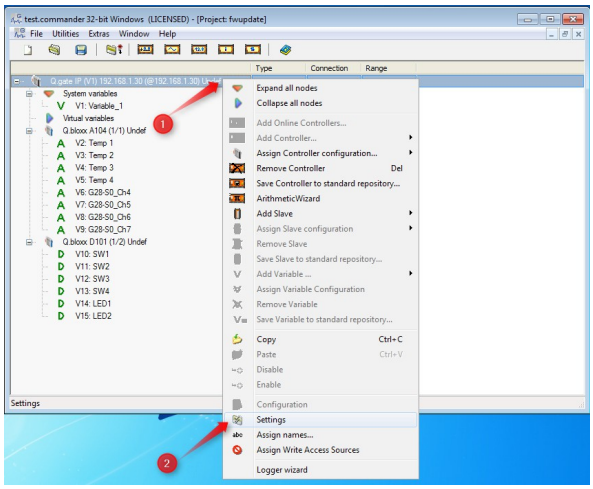



*Illustration 333: Open DS-GATE settings*

If your DS-NET system is connected directly to your PC, make sure, to deactivate DHCP:
Navigate to *Host interface* – *ETHERNET* and make sure that *Use DHCP server* is deactivated (select *No* from the drop-down)

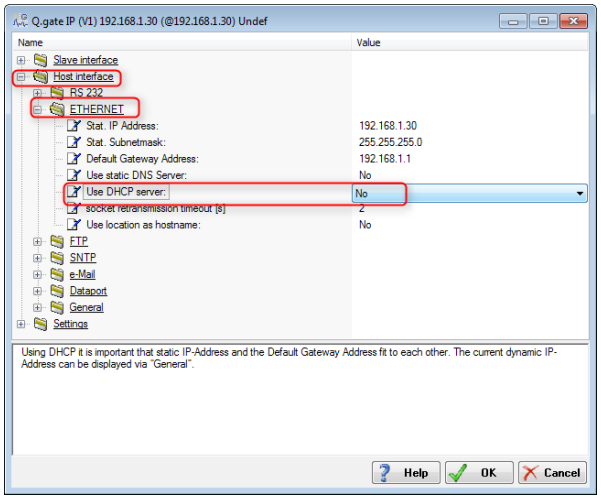



*Illustration 334: DHCP settings*

Now close the settings dialogue. If anything has been changed, you will see a red asterisk (*) left from the Q.gate IP entry (see marker ❶ in Illustration 335 below). In this case press the *Write Project (Update)…* icon (see marker ❷ in Illustration 335 below)

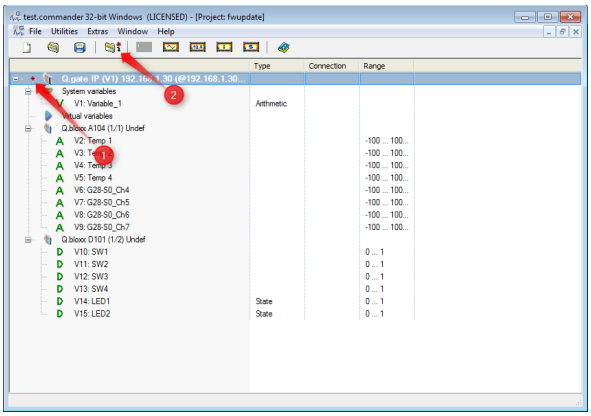



*Illustration 335: Write Project (Update)…*

and wait until the update is complete:

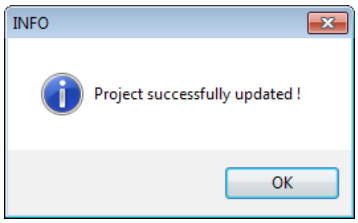



*Illustration 336: Project update compelete*

## 8.2.2.2 Perform DS-Gate firmware update

In `test.commander` open the *Controller Firmware Update…* tool

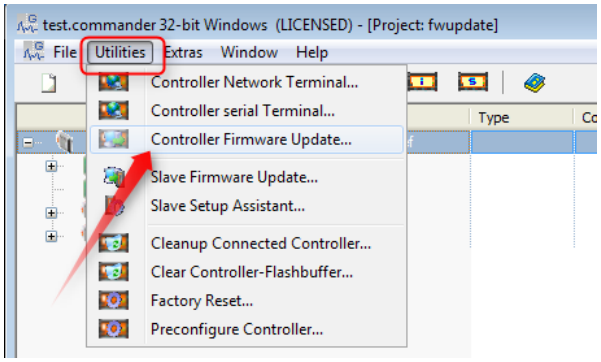



*Illustration 337: Open Controller Firmware Update tool*

Select the DS-GATE that you want to update. The red rectangle in Illustration 338 shows the current firmware version of the DS-NET device: in this case it's *V0.56*.


*Illustration 338: Select the DS-GATE to update*

Select the newest firmware available. In this case it's V0.58

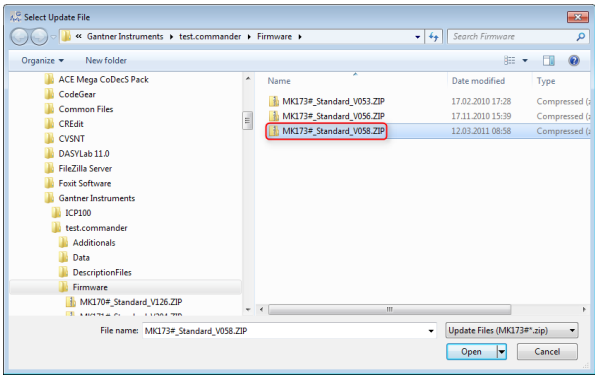



*Illustration 339: Select the newest firmware version*

Now be patient and wait until the update has finished. Make sure that the connection is NOT interrupted during the firmware update!

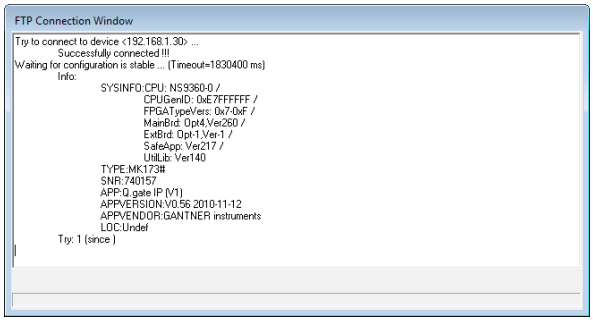



*Illustration 340: DS-GATE firmware update in progress*

When the update has completed, you will see the following information dialogue:

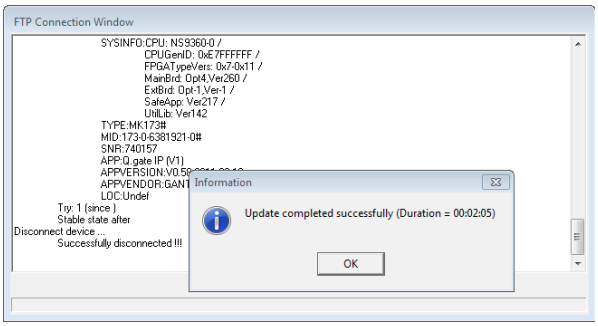



*Illustration 341: DS-GATE firmware update complete*

After confirming the dialog you will be back in the main screen of the *Controller Update Tool*, which will still show the old firmware version. Press the **refresh List** button to update the list.

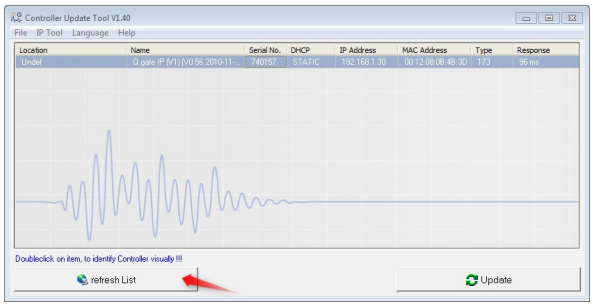



*Illustration 342: Press **refresh List** button*

After the refresh you can see that the DS-GATE is now running the new firmware version (in this case *V0.58*).

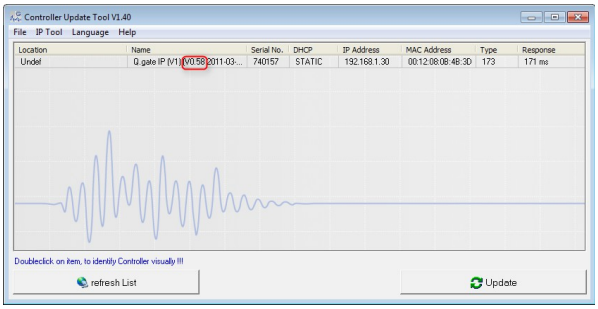



*Illustration 343: New firmware version*

# 8.3 DEWESoft™ update

This chapter will show you how to update an existing DEWESoft™ installation.

## 8.3.1 Release version

In our download section (http://www.dewesoft.com/download) under *DEWESoft 7* you will always find the latest release version of DEWESoft™. Just download the and run the *Installer.* The installation packet will also include the most current versions of the standard DEWESoft™ add-ons.

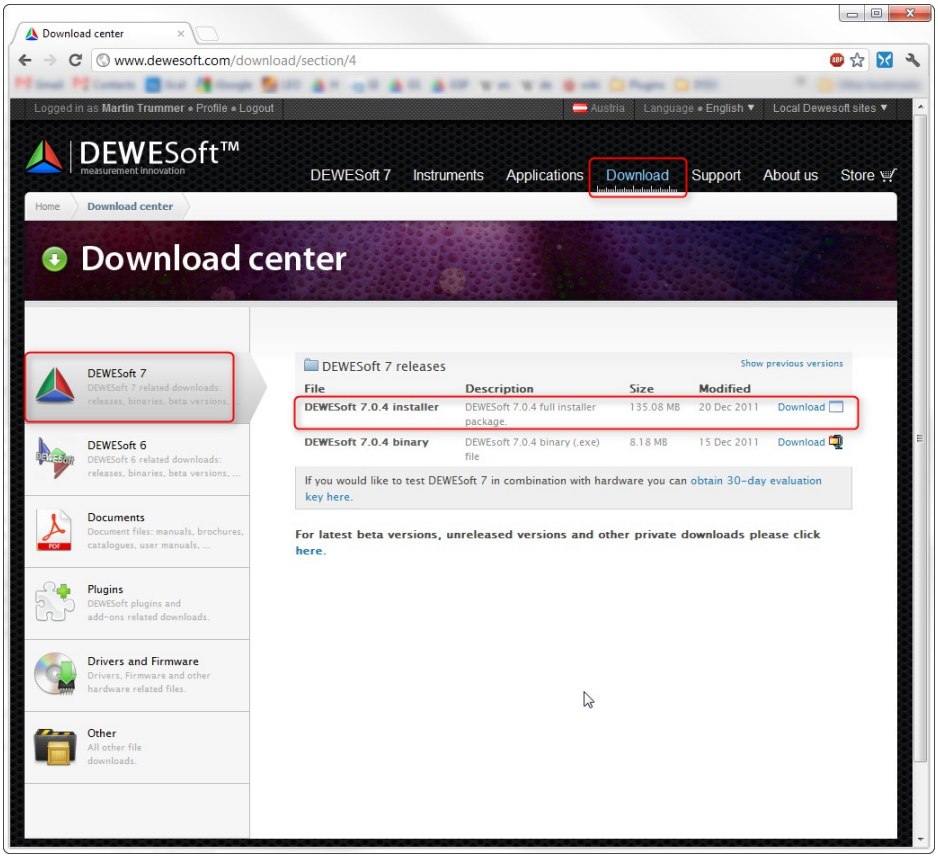



*Illustration 344: Download DEWESoft™ release*

## 8.3.2 Beta versions

Sometimes you may need to use a beta version of DEWESoft™.

| CAUTION | |
|---|---|
|  | Beta versions undergo only minimal testing and are thus not recommended for production use. You should always use the well-tested release versions (see 8.3.1 Release version above) instead. |

Beta versions can be downloaded from the developers section of our homepage:
http://www.dewesoft.com/dewesoft7/developer-downloads.
Note: before you can download beta-versions you must sign in on our homepage (if you don't have a user account yet, you must register to create one).

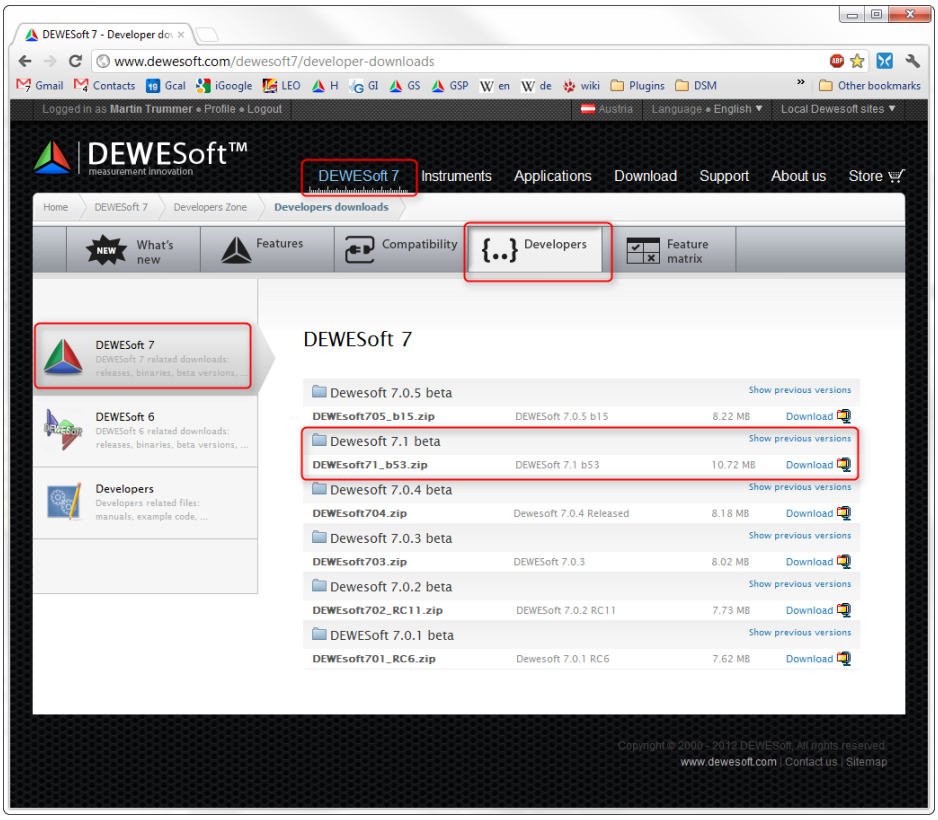



*Illustration 345: Download DEWESoft™ beta-version*

Note, that the downloaded zip-archive contains only the `Dewesoft.exe` file. You just need to replace the existing `Dewesoft.exe` file of your current installation with the new one (you should consider to rename the original file instead of replacing it – just in case that you want to revert to the last original version).
The default location of the `Dewesoft.exe` is: `D:\DEWESoft7\Bin\V7_0\` (for DEWESoft™ version *7.0.x*) and `D:\DEWESoft7\Bin\V7_1\` (for DEWESoft™ version *7.1.x*).
The location may vary depending on your installation settings (see 3.1.3.2 Installing new DEWESoft™ version on page 21 for details).

# 8.4 Dewesoft USB devices firmware upgrade

You can find detailed instructions about the Dewesoft USB devices firmware upgrade in the support section of our homepage: http://www.dewesoft.com/support (click on *Firmware and drivers* on the left side):

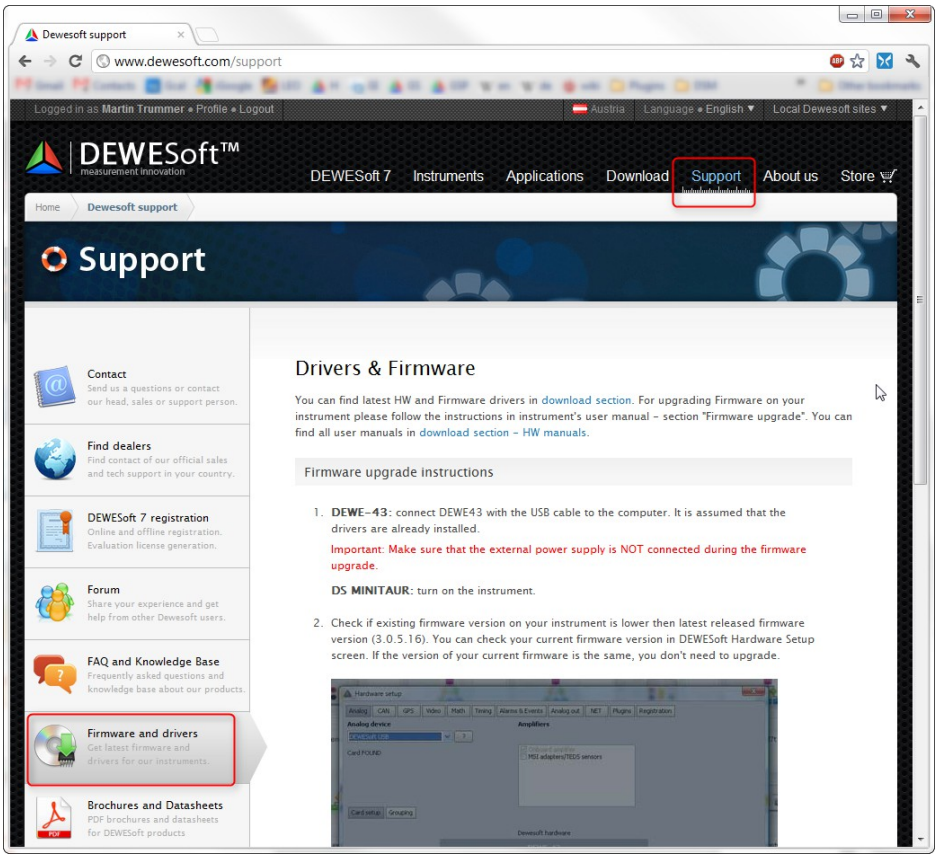



*Illustration 346: Firmware and drivers*

# 9 Advanced topics

## 9.1 Offline setup

In DEWESoft™ it is not possible to create a DS-NET setup when the device is not connected and activated (offline). But you can use `test.commander` to create a complete `test.commander` setup even when your DS-NET hardware is not connected. The easiest way to do this, is to connect the DS-NET once, read it's configuration and then modify this project.
You can then copy the `test.commander` project to any other PC (maybe in a remote location), open it in `test.commander` and write this prepared setup to a DS-NET device that is currently connected to this PC. This is of course only then possible, if the DS-NET has the same number and types of DS-NET modules, than the setup that you have prepared.

### 9.1.1 Prepare the test.commander project

When you have configured your `test.commander` project, just save it and close `test.commander`. Then open Windows Explorer and go to the `Projects` directory of your `test.commander` installation (e.g.: `C:\Programme\Gantner Instruments\test.commander\Projects`).

Select all files and directories that have the same name as the `test.commander` project that you have just saved (in this example it is '`Factory_Setup`'). Then right-click on the '`Factory_Setup`' directory and select *Send To* – *Compressed (zipped) folder*.

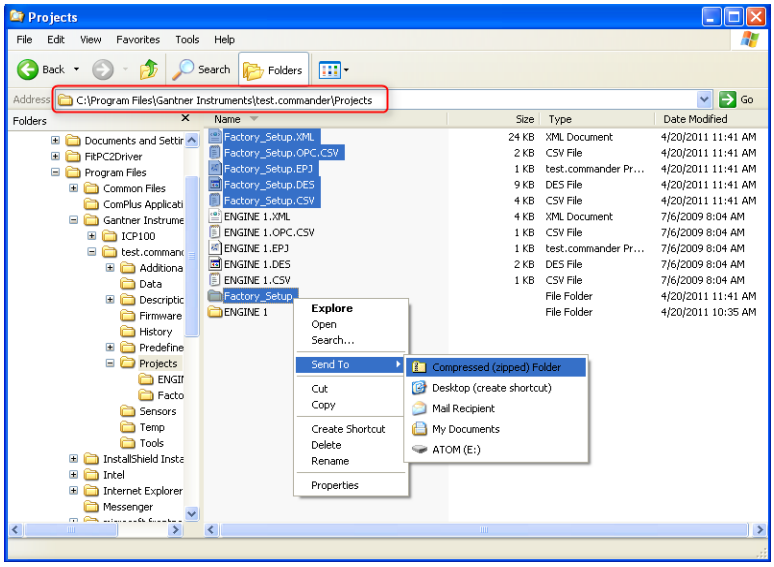



*Illustration 347: Create archive of the test.commander project*

Then you can already see the zip-archive file (in this case it is called `Factory_Setup.zip`):

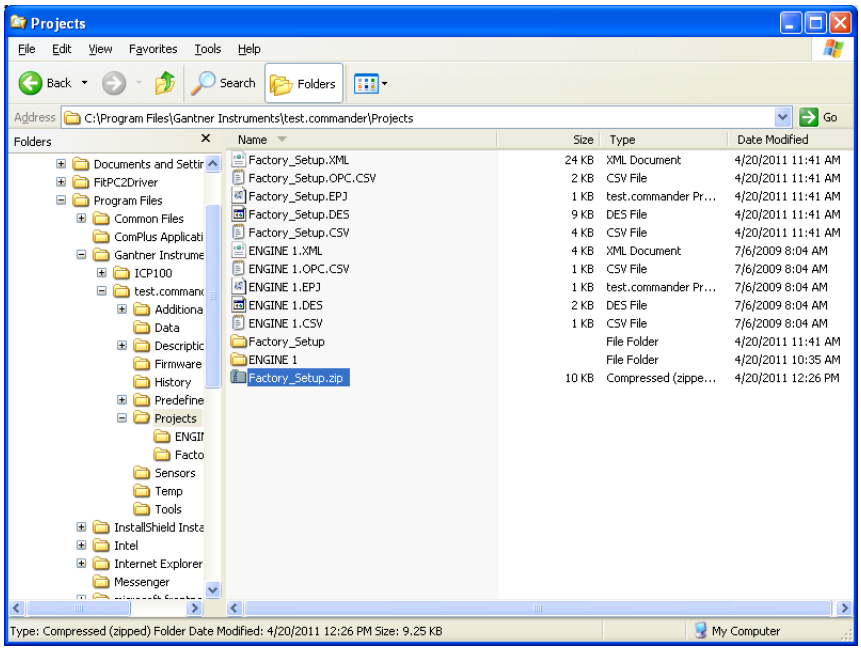



*Illustration 348: Archive of test.commander project*

Now you can copy this file to any remote location (or send it via e-mail, etc.) where you have the DS-NET system that you want to configure.

## 9.1.2 Assign the offline setup

On the remote location where you have the DS-NET system (and now also the archive of the `test.commander` project), you can assign this project to your DS-NET system/s.

First extract the archive which includes the `test.commander` project files and directories. We recommend to extract it to the `Projects` directory of your `test.commander` installation – then the file-structure after extracting the archive will be the same as in Illustration 347.

Now just open the project in `test.commander` and select *File* – *Write Project (All)*. If the IP-address of your DS-NET device does not match the IP-address in your `test.commander` project (which is very likely in the case of an offline setup), you must tell `test.commander` which DS-NET device to use:

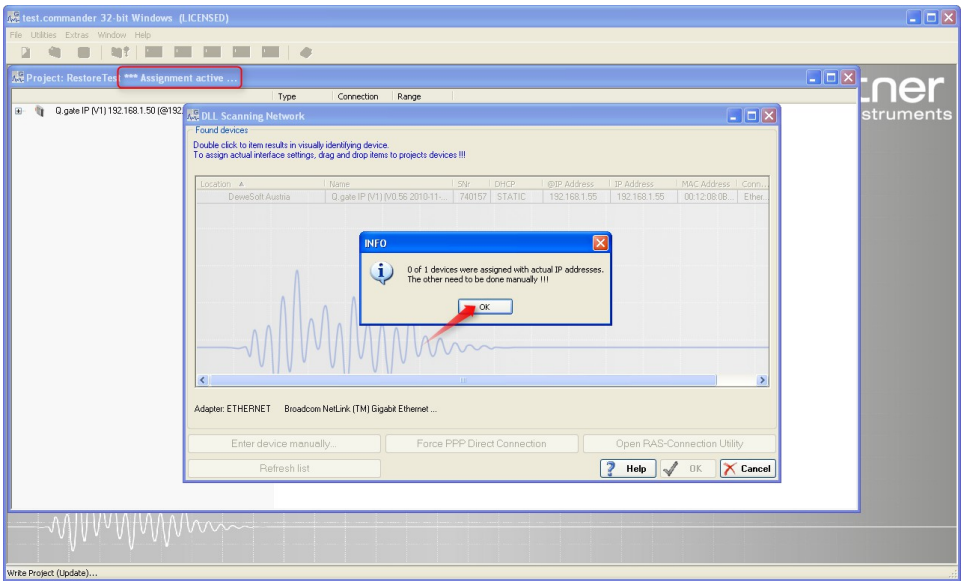



*Illustration 349: Assign device in test.commander*

Note that the title of the project window says: '*Assignment active*' and that the IP-address of the project (in this case `192.168.1.50`) does not match the IP-address of the connected device (in this case `192.168.1.55`).

Now drag & drop the device to the project. Click on the row in the '*DLL Scanning Network*' dialog and keep the left mouse button pressed. You can see that the cursor icon has changed to indicate that the drag & drop operation has started. While still holding down the left mouse button, move the cursor over the '*Q.gate IP*' entry in the *Project* window (the colour of the *Q.gate IP* entry will then change) and finally release the left mouse button.

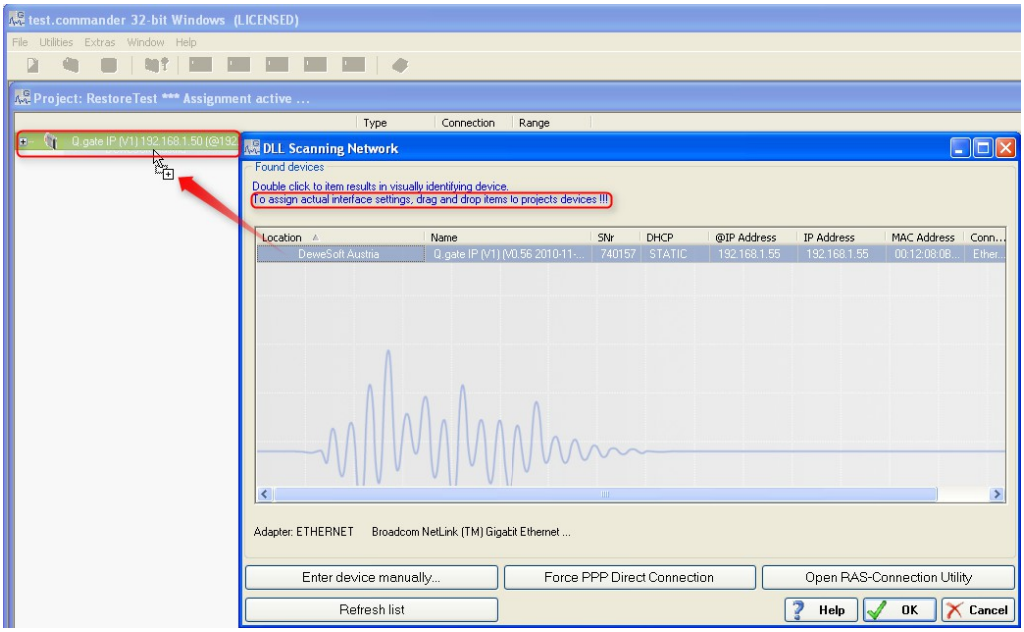



*Illustration 350: Drag & Drop the device to assign it to the project*

If everything is okay, the entry in the *DLL Scanning Network* dialogue has a green check mark at the left side, and the actual IP address of the *Q.gate IP* entry in the *Project* window now shows the correct IP-address (in this case `192.168.1.55`).

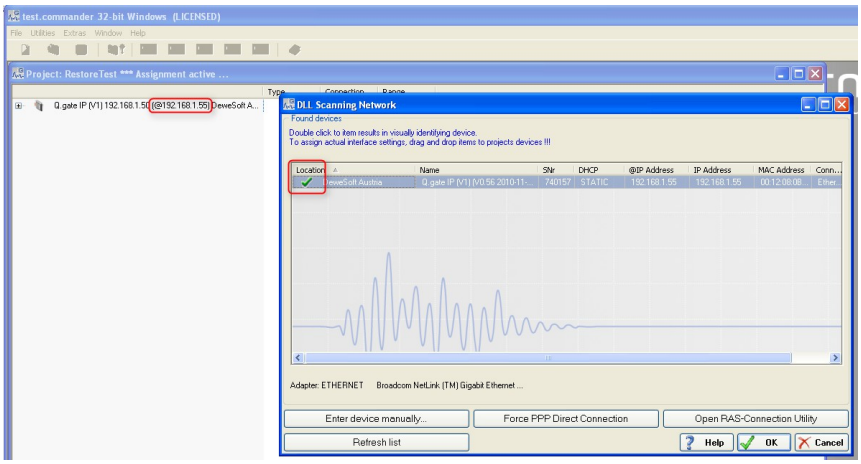



*Illustration 351: Assignment finished*

Finally press the **OK** button to write the project to the DS-GATE and finish the offline-setup.

# 9.2 Controlling digital outputs

## 9.2.1 DEWESoft™ control channels

When you have configured a digital output channel of type *State* (*Status indicator*: see 4.3.4.4 Digital inputs/outputs on page 81)

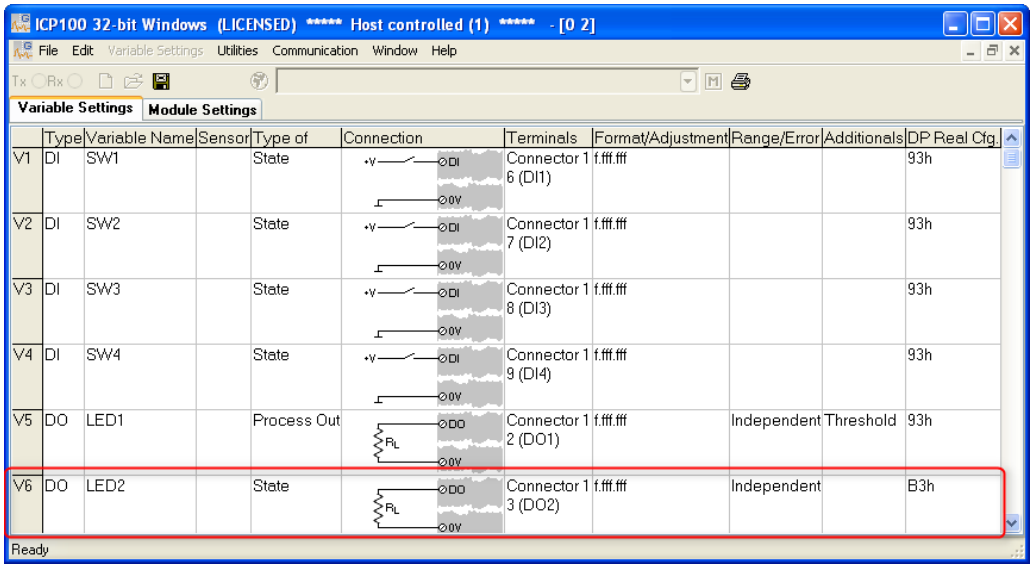



*Illustration 352: Digital Output of type State*

the channel can be used as *control channel* in DEWESoft™. The next chapters will explain how to use a control channels manually or automatically in the DEWESoft™ *Sequencer*.

**IMPORTANT**

Keep in mind, that setting output signals from the PC to the measurement system should only be used for non-critical data: e.g. as status indication.
Never use it for critical purposes: e.g. to switch off a circuit in case of an alarm condition:

1) the reaction time of setting the output from the PC to the measurement system is slow and no guarantees about the timing can be made
2) the PC could crash and thus alarm would never be set

### 9.2.1.1 Manually controlled

Manually controlling the digital output is easy. Just go to the Design modus and:

1) add a control channel GUI element to your measurement screen
2) select this new GUI element and select the *Display type*: *Control Channel* and *Switch* (instead of *Input Field*)
3) and also do not forget to select the correct control channel in the channel list

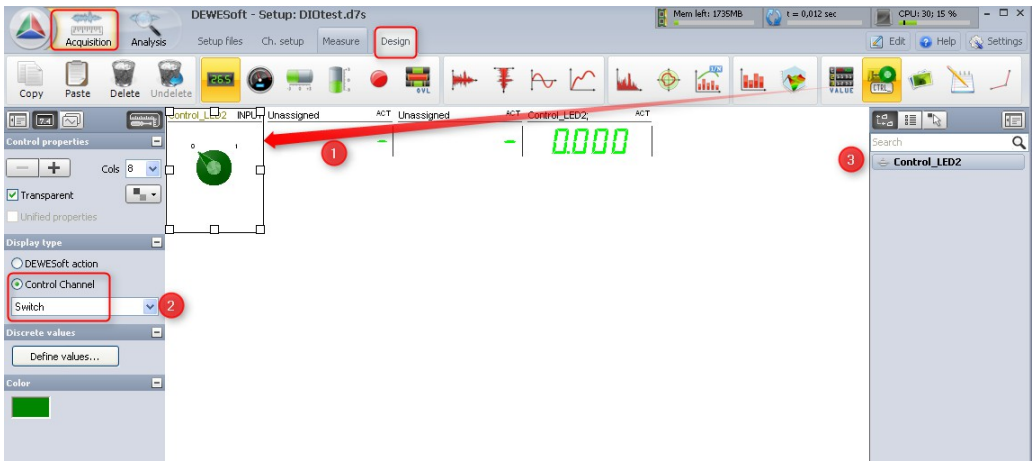



*Illustration 353: Control Channel Manually Controlled*

After you have switched back to *Measure Mode* , you can simple change the status of the digital output channel by clicking on the *Switch*.

### 9.2.1.2 Sequencer controlled

Using the DEWESoft™ *Sequencer* gives you full control of the digital output channel. In the *Event* block of the sequence you can use a *Calculation* item to assign every result of all possible mathematical formulas to the channel.

We will demonstrate this with a simple example.

We have a DS-NET system with a TH8 and a DIO8 module. The TH8 module has a channel called 'Temp 1' which shows the temperature of an attached sensor. The DIO8 module has a channel called 'LED2' where a LED is connected to. In this example we want to activate the LED when the temperature is higher than 26°C.
We will add a *Math* channel called 'TriggerCondition' that will output `0` whenever the temperature is lower than the 26°C and `1` otherwise. The formula for this is easy: it's just a comparison:

```
'Temp 1' > 26
```

We save this channel setup under the name: *DIOtest.d7s* (we will need this later in our sequence).

Create a new simple sequence:


*Illustration 354: Create New Sequence*

Then add and connect all items so that the final result looks like the following image:

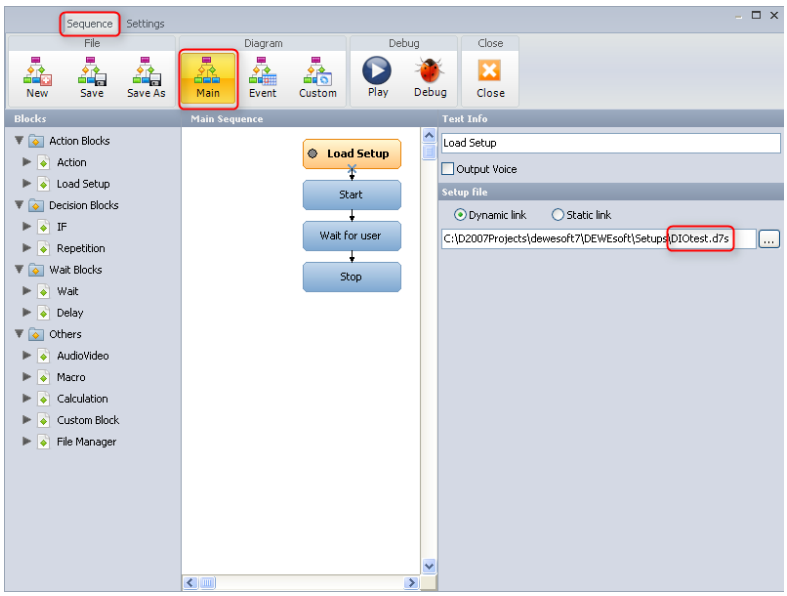



*Illustration 355: Simple Sequence Main*

**HINT**

If you need help for the sequencer just press the `F1` key in the Sequencer editor window to open the DEWESoft™ online help (this will only work with DEWESoft™ version 7.0.3 or higher)

Then switch to the *Event* block and add a *Calculation* item where you assign the *Math channel* 'Trigger Condition' to the *control channel* 'Control_LED2':

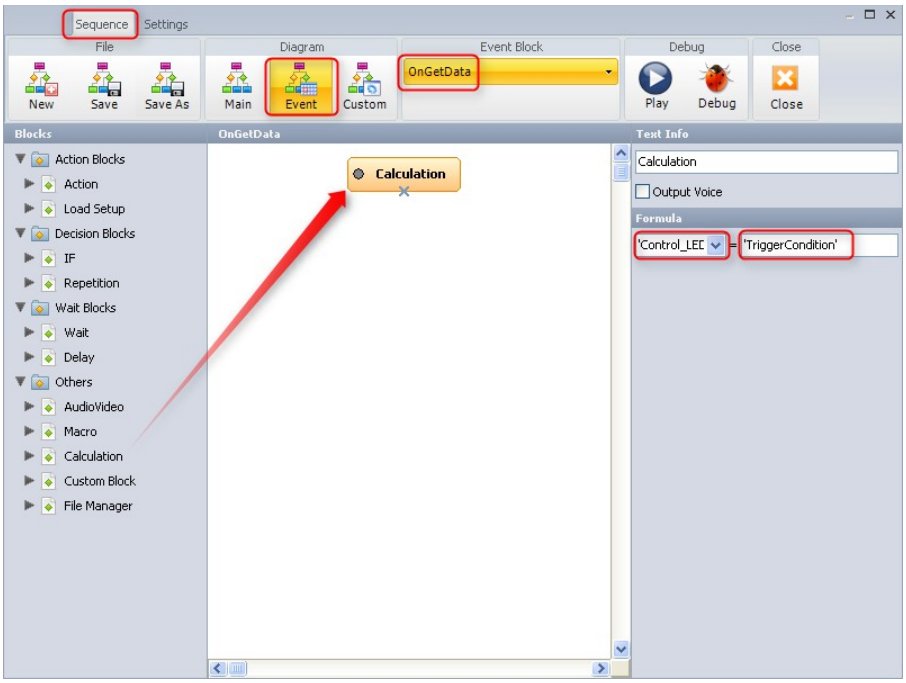



*Illustration 356: Simple Sequence Event*

This *OnGetData Event* will be called frequently by DEWESoft™ while the sequence is running and always compute the formula; i.e. assign the value of our *Math* channel 'TriggerCondition' to the *control channel* 'Control_LED2'.

That's it. Now save the *Sequence* and start it. When you touch the temperature sensor to make the temperature rise over 26°C, the LED will be activated, when the temperature falls below the 26°C again, it will be deactivated.

## 9.2.2 Alarms inside DS-NET

This section will show you how to setup an alarm condition that is evaluated directly inside the DS-NET and will switch on a digital output channel.

The DS-NET system has 6 modules.
Module 6 is a digital input/output module (DS NET DIO8). We will connect a LED to the 2nd output channel. This LED should be switched on when the alarm is active.
Module 3 is a thermocouple module (DS NET TH4). We will use the 2nd channel of this module to measure the temperature. If the temperature rises above 30°C we want to switch on the alarm. The alarm should be switched off if the temperature then falls below 27°C.

Let's take a look at the configuration of the modules:

### 9.2.2.1 TH4 module

The setup of the temperature channel is straight forward – we select *Measurement type TC Type K* and connect a type K thermocouple to the module.

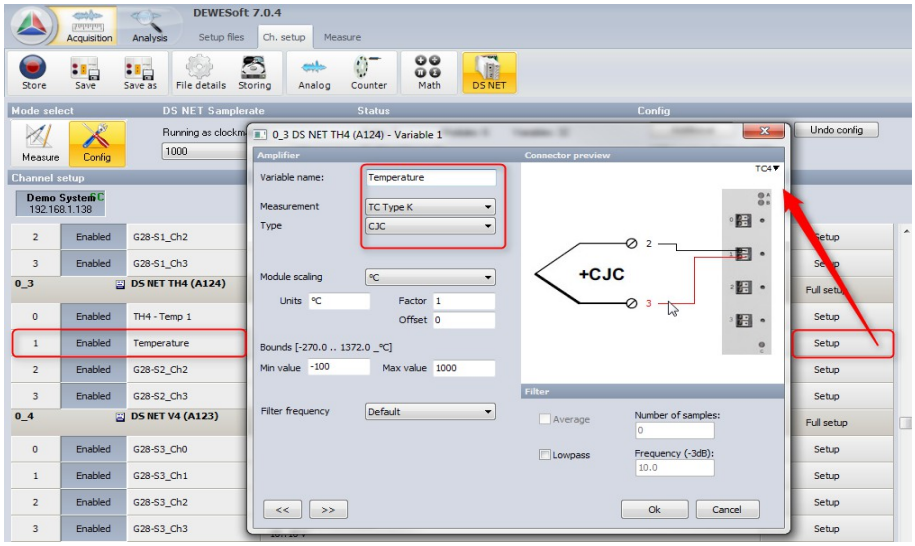



*Illustration 357: Alarm: Temperature Channel*

## 9.2.2.2 DIO8 module

The alarm handling that we want to setup in the DIO8 module is an advanced feature and thus we have to open the **Full setup** and do the configuration in the program *ICP100*.

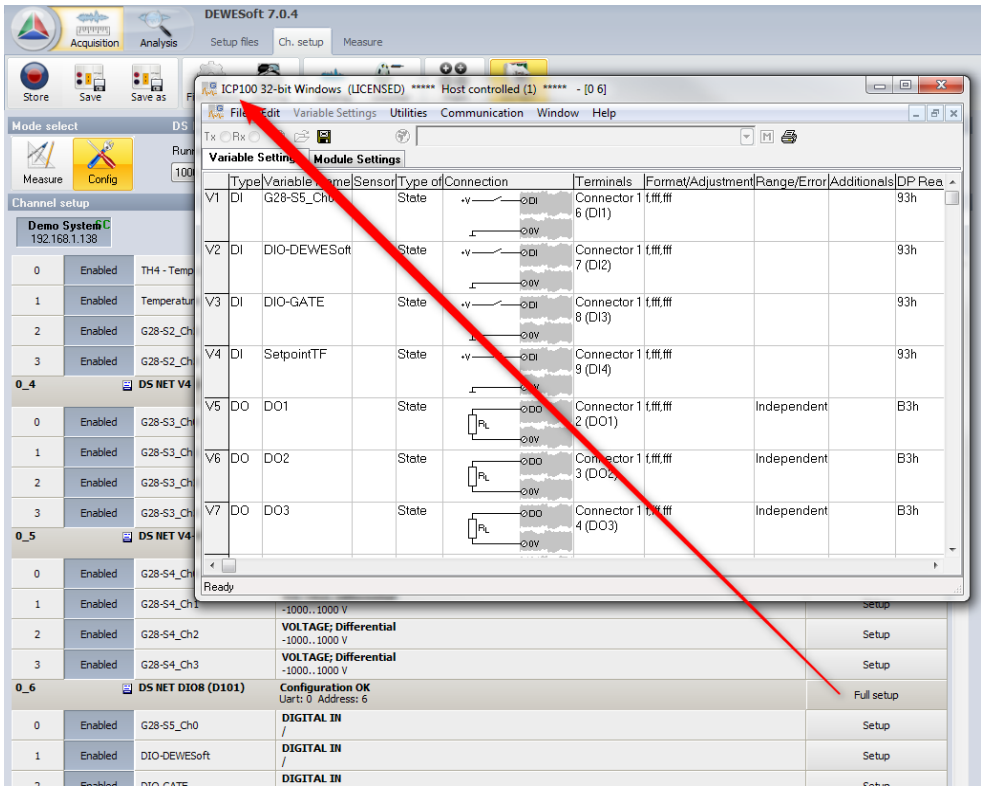



Illustration 358: DIO8 Full setup

### Import data from TH4 module

The first thing we need to do in the DIO8 module is to get the current value of our *Temperature* channel (which is the 2nd channel of the TH4-module). This is done via a so called *Setpoint*:

To create a new *Setpoint*, click the *Type* cell of an empty row (in our case *V9* is the first empty row[63]). Then select *Setpoint* from the pop-up menu.

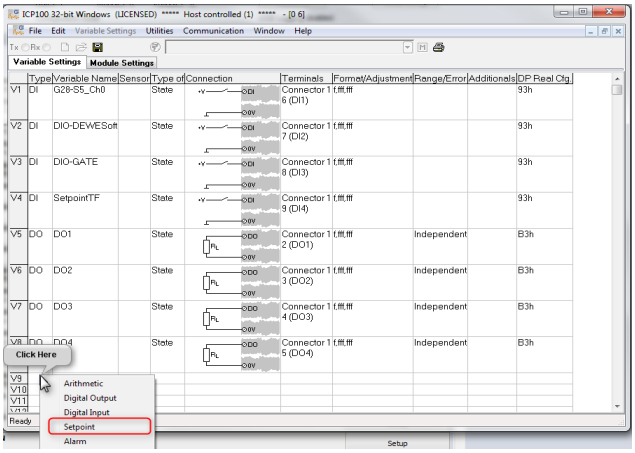


Illustration 359: Create *Setpoint*

Next, click on the *Variable Name* cell of our *Setpoint* row and give it a meaningful name: e.g. *Temp. Import*
And then click on the *Additionals* cell of our *Setpoint* row to define the value of the *Setpoint*:

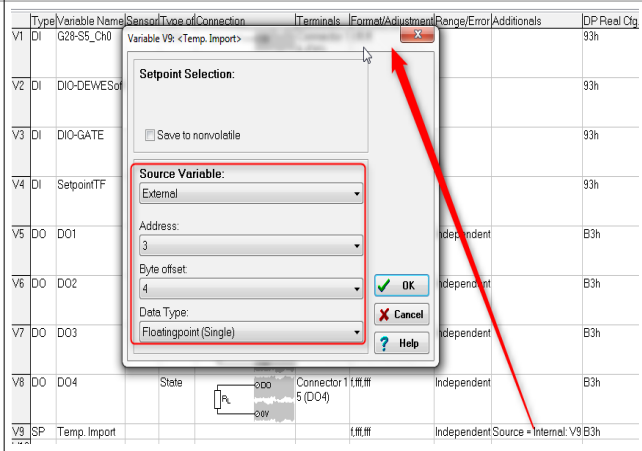



Illustration 360: Create *Setpoint*

The settings in detail:

- *Source Variable*: defines where to get the value from. We select *External*, because the value that we want to access (the temperature channel of the TH4 module) is external (relative to the current DIO8 module)
  i.e. *Internal* means that we can use data from the same module and *Constant* means, that we use a constant value instead.
- *Address*: this is the address of the module where we want to get the data from (the TH4 module), starting at `1`.
  In our case the TH4 is the 3rd module (1st is a TH8, 2nd is a BR4-D).
- *Byte offset*: this defines which channel from the TH4 module we want to use. It is simply the channel number (starting at `0`) multiplied with `4` (since all channels store their data in a `4` byte variable).
  In our case we want to get the data of the 2nd channel of the TH4 module: thus we enter: `4`.
  Other examples for the byte offset:
  - the 1st channel has byte offset `0` (`0x4`)
  - the 2nd channel has byte offset `4` (`1x4`)
  - the 3nd channel has byte offset `8` (`2x4`)
  - and so on
- *Data Type*: you always have to select *Flaotingpoint (Single)* – it's the only available option anyway.

## Configure the Digital Output

63 If there is no empty row, you can select any row that you don't need and delete it (in the menu select: *Edit* - *Delete*)

First we choose the digital out channel that we want to use (in this example we use the first one in row *V5*, named *DO1*) and change it's type (*Type of* column) to *Process Out*.

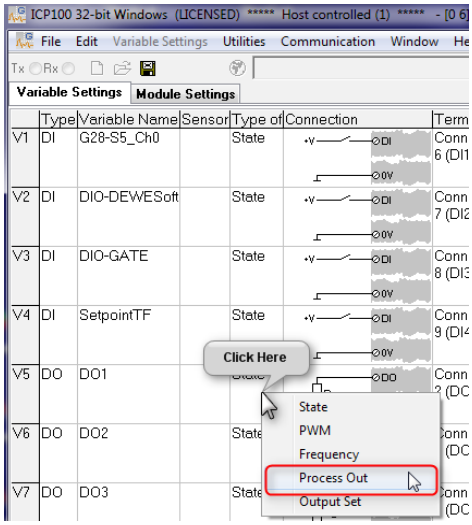



*Illustration 361: Process Out*

Next, click on the *Additionals* cell of the *DO1* row, which will open a dialogue where we can define the alarm condition:

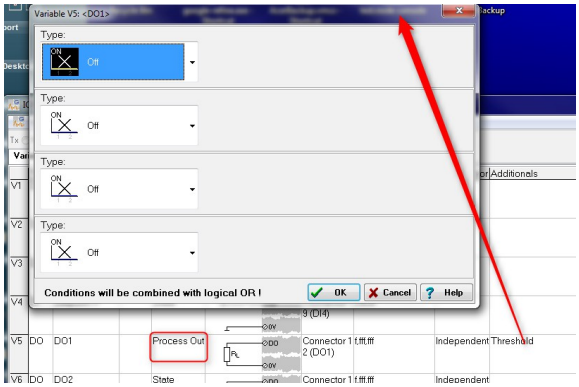



*Illustration 362: Define Threshold*

In this example we want to setup a hysteresis condition like this:

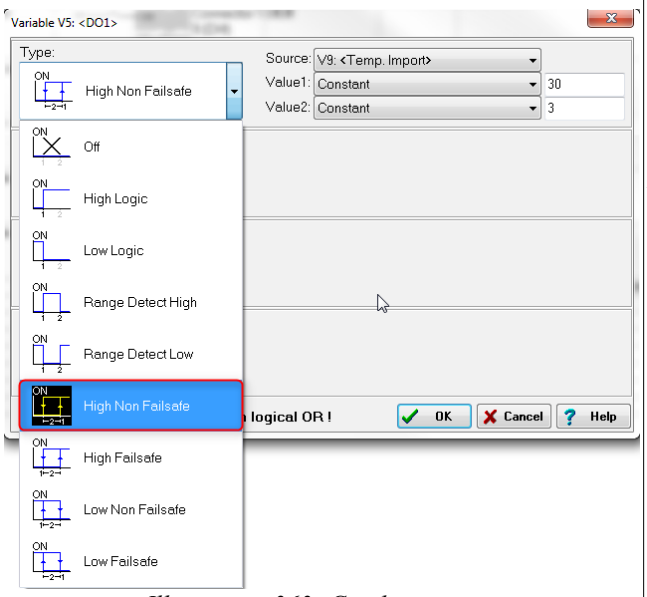



*Illustration 363: Condition setup*

From the *Type* column, select the suitable condition type (you can press the **Help** button at the right bottom of the dialogue to get a detailed description of all the types).

We choose *High Non Failsafe*.

Now we must select the *Source*: the value for our alarm condition. In our example we want to use *V9 <Temp. Import>* which is the temperature value that we have imported from the TH4 module.

*Value1* is the level at which the alarm will become active: in our case we enter the constant value of *30*°C; i.e. when the value of the temperature channel increases over *30*°C, the alarm alarm condition becomes true and the digital output channel DO1 will become active.

*Value2* is the hysteresis range: we enter *3*°C. i.e. when the value of the temperature channel drops below *27*°C (Value1-Value2: *30*°C-*3*°C), the alarm will be reset.

## Result

In DEWESoft™ we can now display the function that we have setup in a recorder screen:

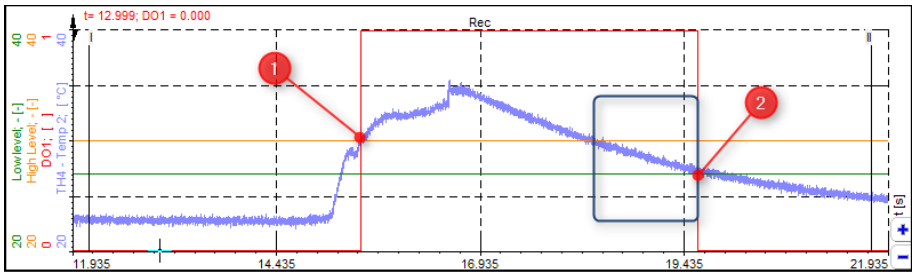



*Illustration 364: Alarm condition: Recorder Screen*

The blue signal is the temperature of the TH4 module. At the start it's about *24*°C (the room air temperature). After about 15 seconds I touched the thermocouple it and the temperature rises over the *30*°C level (orange line). When this is the case, the *Digital out* channel *DO1* (red signal) is switched on.
Then I stop touching the thermocouple, so that the temperature starts do decrease to the room air temperature again. After about 18 seconds, the temperature falls below the *30*°C line – and you can see that the alarm is still active (blue rectangle), until the temperature ultimately drops below the *27*°C level.

### Alarm-handling comparison

You might know that you can also setup alarm conditions directly in DEWESoft™. Here we give a short comparison of the DEWESoft™ alarm handling and the alarm handling in DS-NET.

| | DEWESoft™ alarms | DS-NET alarms |
|---|---|---|
| **Setup** | **convenient** and easy-to-use DEWESoft™ like setup | more complicated setup via ICP100 program |
| **Offline** | Not possible – only works when DEWESoft™ is running | Can work completely **offline**.<br>Will work immediately after the DS-NET has booted up (which only takes some seconds)<br>No need for DEWESoft™ to run you don't even need a PC to be connected. |
| **Response time** | Variable<br>due to the nature of the Windows operating systems a fixed response time cannot be guaranteed.<br>e.g. if Windows is busy running other tasks, DEWESoft™ might not get a chance to evaluate the alarm conditions in that time. | **Fixed**<br>there's no Windows involved – the DS-NET system can guarantee fixed response times – in the range of milliseconds (depending on the sample rate) |
| **Robustness** | Windows could crash or freeze and so could DEWESoft™. | No Windows involved. The internal OS of the DS-GATE is very **reliable**. |

# 9.3 Multiple DEWESoft™ instances

This chapter will show you how to setup DEWESoft™, so that you can 2 DEWESoft™ instances.

When you have several DS-NET systems you may want to run multiple instances of DEWESoft™ at the same time on the same PC. To use this feature you need DEWESoft™ Version 7.0.4 (or higher) and DS-NET plugin version 4.3 (or higher).

**IMPORTANT**

Note, that there may be DEWESoft™ functions or plugins that do not support multiple instances. You can still use those functions in one of the DEWESoft™ instances but you must disable them in all other DEWESoft™ instances.
The DS-NET plugin supports multiple instances, but you must make sure to access each DS-NET system from only ONE DEWESoft™ instance (see 5.3.3 Reading data on page 97 for details).

## 9.3.1 Noteworthy

### using only one DEWESoft™ instance for all your DS-NET systems

- easier to setup
- the data of all DS-NET systems will end up in one data file
- needs less resources (CPU, memory) than multiple DEWESoft™ instances

### using multiple DEWESoft™ instances on one PC for your DS-NET systems

- needs extra steps to setup
- needs more resources (CPU, memory) than a single DEWESoft™ instance
- you will have completely separate datafiles
- some features/plugins may not work when used in multiple instances at the same time

## 9.3.2 System description

In this example, we have 3 DS-NET systems (*A*, *B*, *C*). We have one powerful PC on which we plan to run 2 DEWESoft™ instances:

- default instance: should use the DS-NET systems A and B which use hardware-synchronisation cables
- instance 2: will use DS-NET system C only

At the beginning we have only one DEWESoft™ instance with one DEWESoft™ project (called: *'default'*) where all 3 DS-NET systems are used:

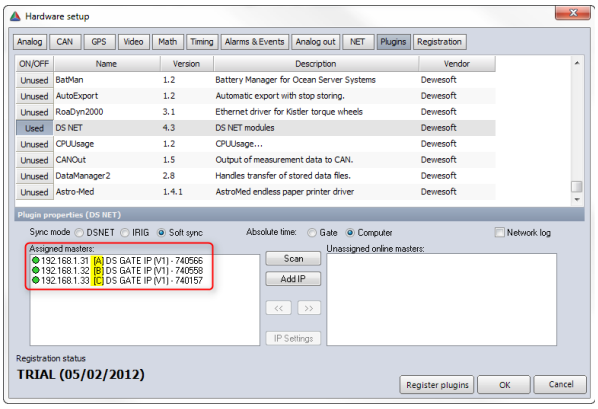
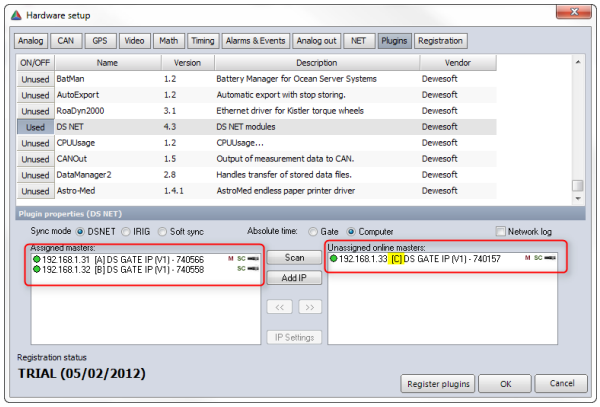


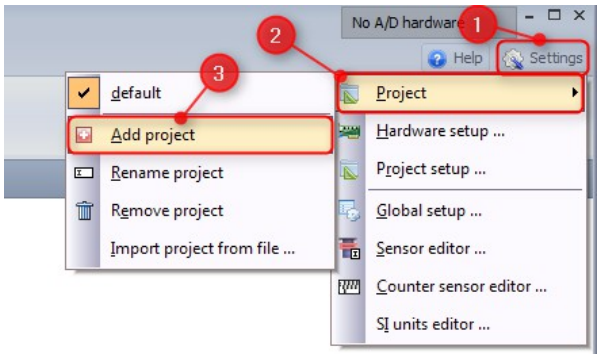
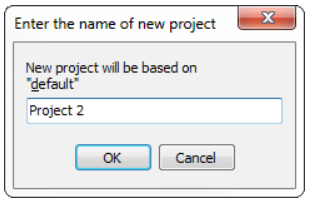

*Illustration 365: Initial project (3 DS-NET)*

## 9.3.3 Preparation

### 9.3.3.1 Create DEWESoft™ projects

First, we will create a 2nd DEWESoft™ project. The goal is to have project *'default'* for the DS-NET systems *A*, *B* and project *'Project 2'* for DS-NET system *C*.

| | |
|---|---|
| Since we currently use all 3 DS-NET systems in project *'default'*, we go to *Hardware setup* and unassign the DS-NET system *C*: | Click **OK** to close the hardware setup. |
|  <br>*Illustration 366: DS-NET A and B* | |

| | |
|---|---|
| Now we create the new project: | In the dialogue enter the project name: e.g. *'Project 2':* |
|  <br>*Illustration 367: Add project* |  <br>*Illustration 368: Enter project name* |

The new project is now an exact copy of the last project that was active (project *'default'* in our case). Thus we need to go to *Hardware setup*, and assign only the DS-NET system *C*:

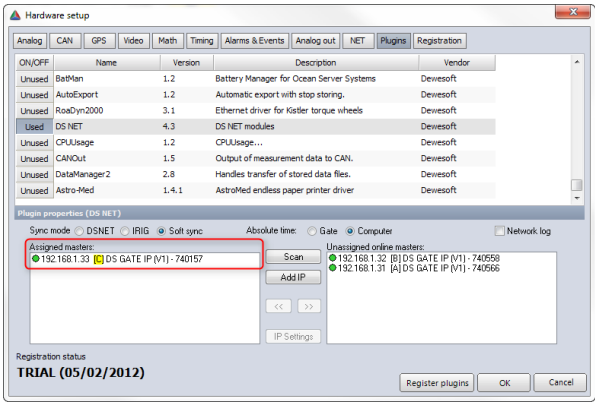



*Illustration 369: DS-NET system C*

**HINT**

You may also want to use different folders for the *Setup*, *Data* and *Export* files of the 2 projects. In this case, just go to *Settings* – *Project* settings and select the desired folders in the Project folders tab-sheet (Note that the folders must exists, so you may want to create new folders)

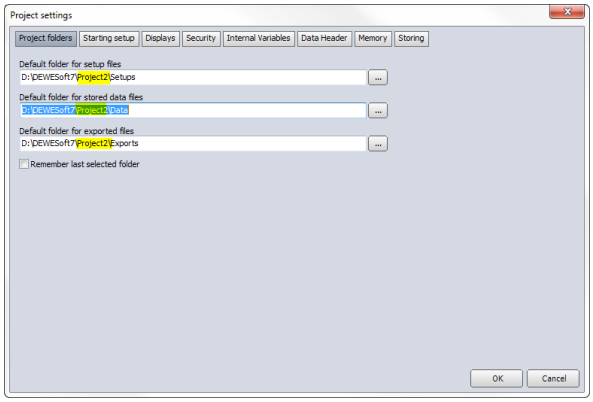



*Illustration 370: Project Folders*

You can switch between the 2 projects by clicking on the project name in Settings – Project. Note that the currently active project is checked (*'Project 2'* in this case).

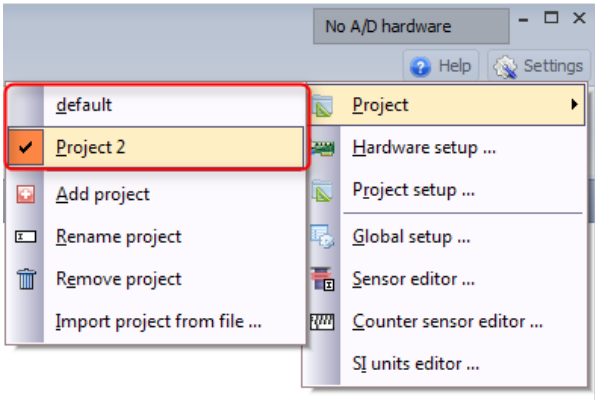



*Illustration 371: Projects*

## 9.3.3.2 Global settings

Goto *Settings* – *Global setup* and activate the *'Allow multiple instances of Dewesoft'* check-box on the General tab-sheet:

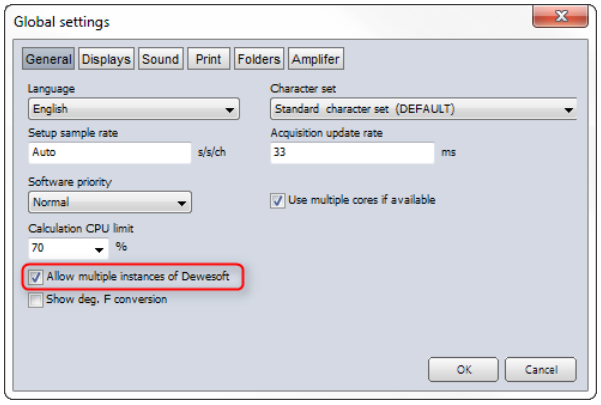



*Illustration 372: Allow multiple instances*

Now close DEWESoft™, open the Windows Explorer and navigate to the System folder of your DEWESoft™ installation: e.g. to `D:\DEWESoft7\System\V7_0` (see also: 3.1.3.2 Installing new DEWESoft™ version on page 21). Make a copy of the `Setup7.ini` file and rename it to `Setup7_Project2.ini`.

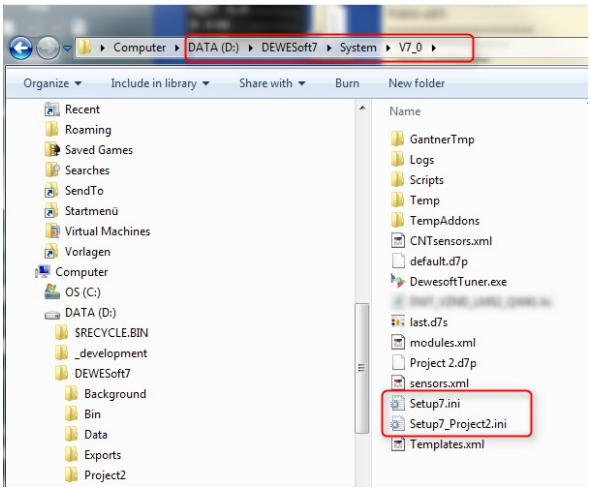



*Illustration 373: Copy Setup7.ini*

Now create a shortcut on your Desktop for DEWESoft™:

- Navigate to the `Bin` directory of your DEWESoft™ installation: e.g. `D:\DEWESoft7\Bin\V7_0`. (see also: 3.1.3.2 Installing new DEWESoft™ version on page 21)
- Right-click on `DEWEsoft.exe` and drag it to the Desktop
- Now release the right mouse button and you have created a shortcut

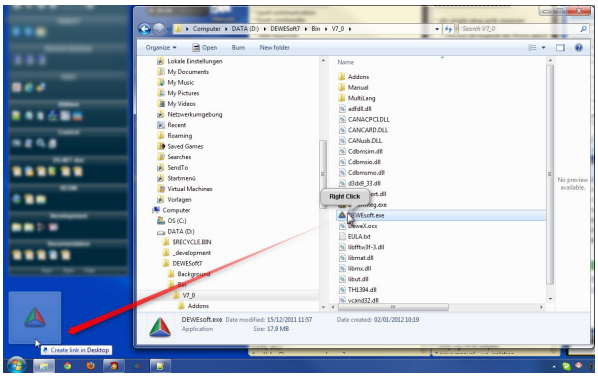


*Illustration 374: Create Shortcut*

Do the same again to create another shortcut and then right-click on the new shortcut and select *Properties*. In the *Properties* dialogue (tab-sheet 'Shortcut') we add a parameter to the *Target* ( */ini Setup7_Project2.ini*), so that DEWESoft™ will be started with the 2nd setup ini file that we have created before.

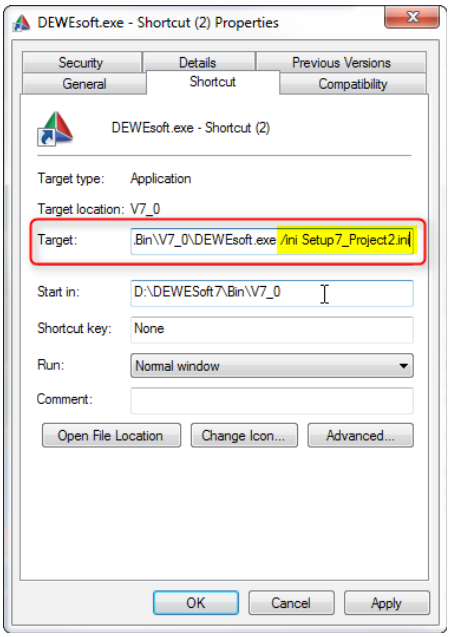



*Illustration 375: Shortcut properties*

## 9.3.3.3 Start the instances

Now we are ready to start the instances.
1st we start the default instance called: `DEWEsoft.exe - Shortcut (2)`:


*Illustration 376: Start instances*

…and activate *Project 2*:

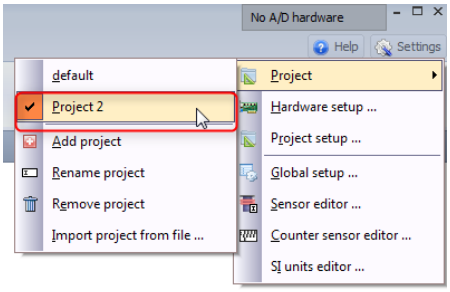



*Illustration 377: Activate Project 2*

Now we start the default instance. Project *default* should already be active:

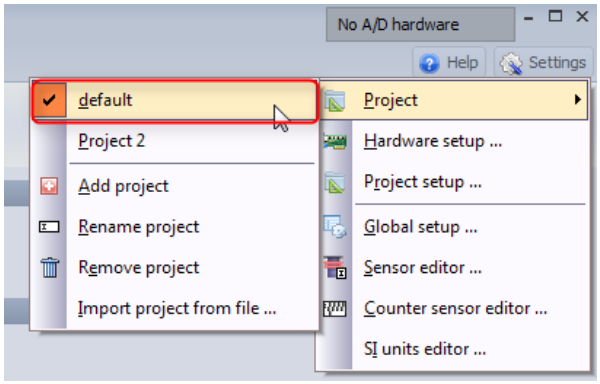



*Illustration 378: Project default*

That's it. Now we have 2 *DEWESoft™* instances running at the same time: Instance one uses DS-NET systems *A*, *B* and instance 2 uses DS-NET system *C*:

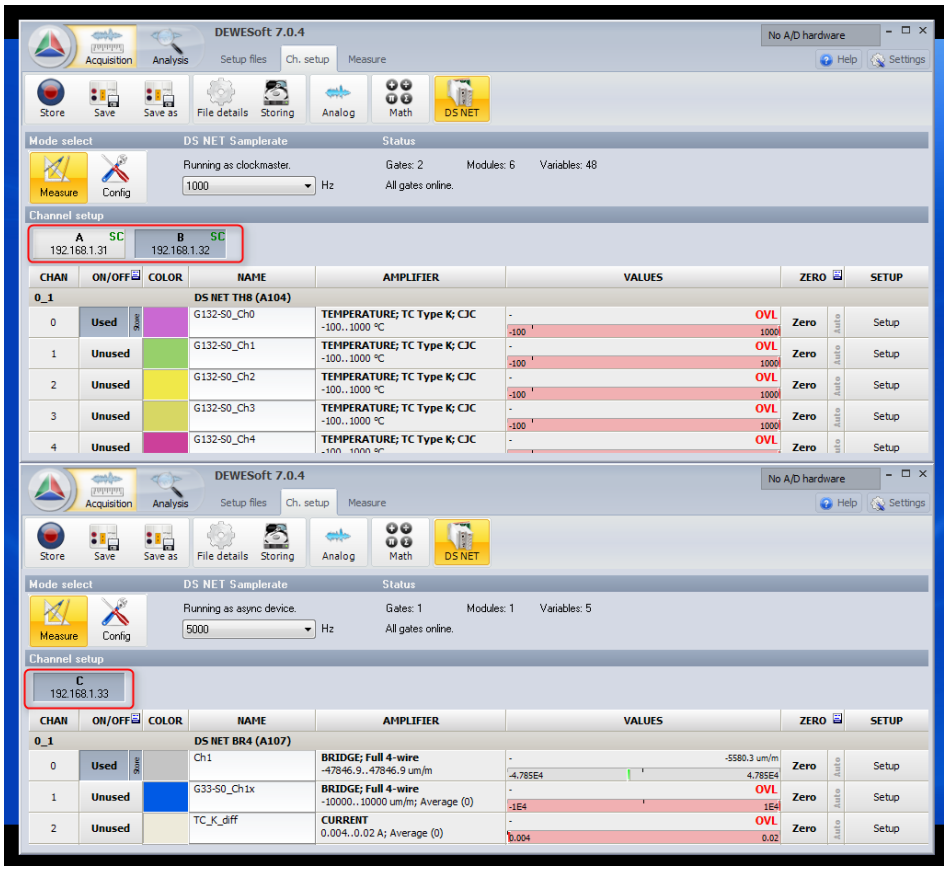



*Illustration 379: 2 DEWESoft™ instances*

# 9.4 IRIG sync with Dewesoft USB devices

This chapter describes how to use hardware-synchronisation between a DS-NET and other Dewesoft USB devices (e.g. DEWE-43, MINITAUR).

## 9.4.1 Prerequisites

In order to use the hardware-synchronisation you need the following hard/software:

- You need DEWESoft™ version 7.1.x (e.g. at the time of writing the version 7.1-b53 is the most current one: this is required because older versions (7.0.x) do not support IRIG master for Dewesoft USB devices. See 8.3.2 Beta versions on page 180
- Use the DS-NET plugin version 4.3 or higher (see 8.1 Add-on update on page 173)
- The Dewesoft USB device (e.g. DEWE-43 ) needs firmware version 5.4.0.16 or higher: see 8.4 Dewesoft USB devices firmware upgrade on page 182
- The DS-GATE needs firmware version 0.59 or higher (see 8.2.2 Firmware update for DS-Gate on page 176)
- You need a special sync cable between the DS-NET (2 pin sync connector) and the Dewesoft USB device (4 pin sync connector): contact sales@dewesoft.org

*Illustration 380: sync cable connectors between DS-NET and Dewesoft USB devices*

## 9.4.2 Hardware setup

This chapter will show the required hardware settings for IRIG synchronisation.

### 9.4.2.1 Analog setup

In the *Hardware setup* go to the Analog tab-sheet, select `DEWESoft USB` as *Analog device* and then set the *Sync* mode to `IRIG Master`.

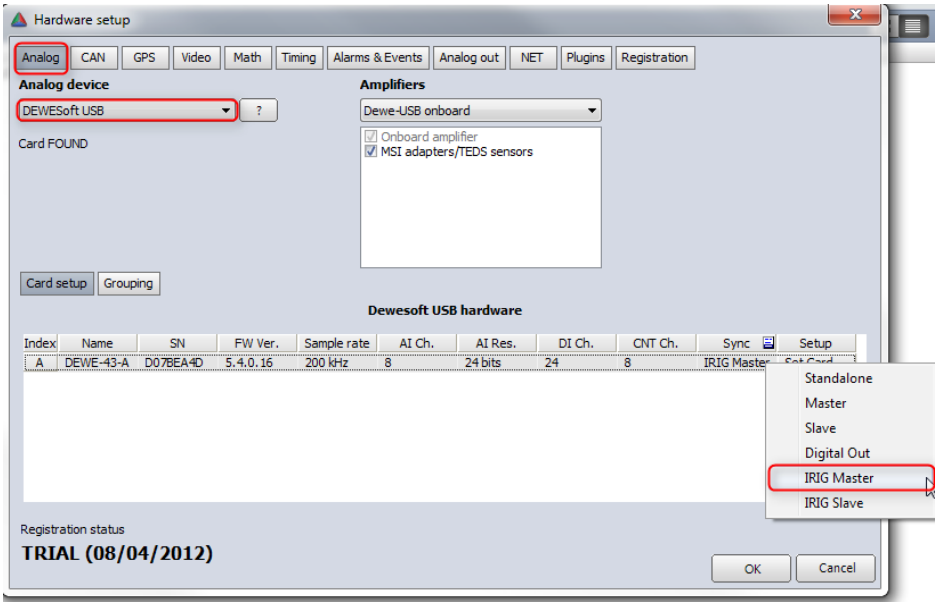



*Illustration 381: DEWE-43 IRIG Master*

### 9.4.2.2 Timing setup

In the *Hardware setup* go to the Timing tab-sheet, select `DEWESoft USB` as *Timing device* and then set the *time source* to `IRIG B DC`.

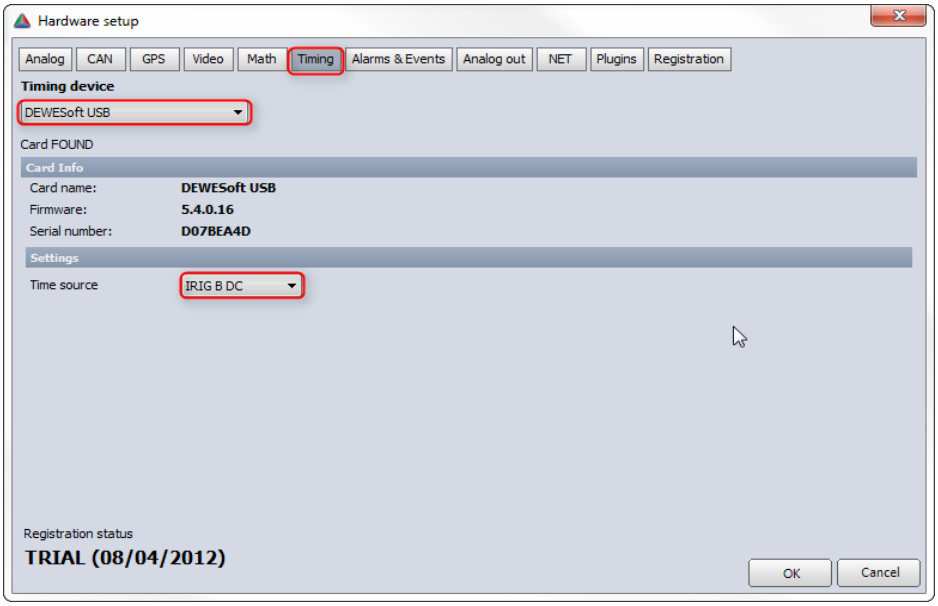



*Illustration 382: Timing source: IRIG B DC*

### 9.4.2.3 DS-NET plug-in setup

In the *Hardware setup* go to the Plugins tab-sheet, select `DS NET` from the list and then set the *Sync mode* to `IRIG`.

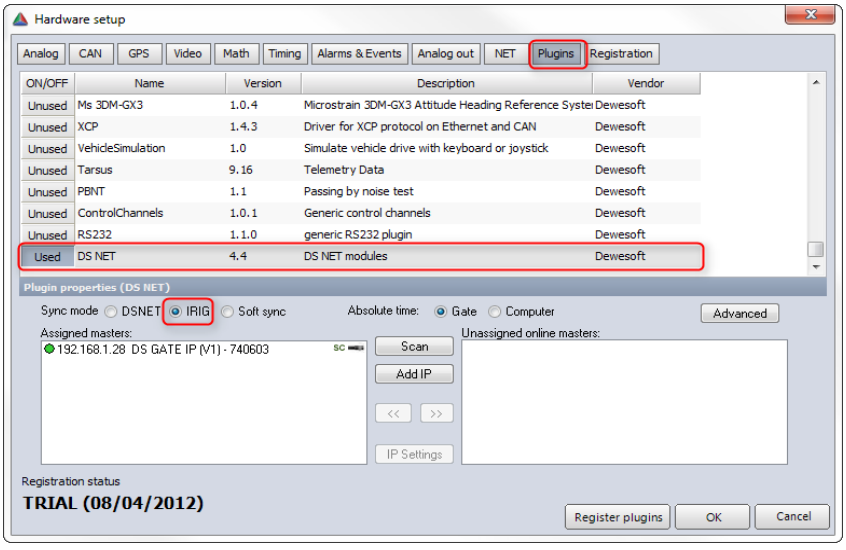



*Illustration 383: Timing source: IRIG B DC*

That's it. Now the *DEWE-43* will output the *IRIG* signal on it's *Sync* connector and the DS-GATE will use this signal to synchronize it's internal clock. Since we have also setup the *Timing* device, DEWESoft™ will use the same signal as masterclock.

# 10 Appendix

## 10.1 Documentation version history

| Version | Date [dd.mm.yyyy] | Notes |
|---|---|---|
| 3.0.0 | 24.08.2010 | ☑ initial revision (rewrite of word file: `DS_NET_User Manual_V2.doc`) |
| 3.0.1 | 09.09.2010 | ☑ improved Table 12: BR4-D: relation of pins between screw connector and D-SUB modules<br>☑ updated and improved Module Types Table<br>☑ added description of *HW sync* check box |
| 3.0.2 | 08.10.2010 | ☑ Corrected DIP-Switch settings of *Table 23: DIP switch 8: hot swap status*<br>☑ Page numbers have been reset after chapter 3 |
| 3.1.0 | 11.11.2010 | ☑ corrected pining of the following illustrations:<br>☐ BR4: Resistance 4 wire circuit<br>☐ BR4: Strain gauge with half bridge<br>☐ ACC2: Full- and Halfbridge 4 wire<br>☐ ACC2: Full- and Halfbridge 6 wire<br>☐ V8: digital input and output<br>☑ corrected specification data of measurement modules<br>☑ added chapter for V8-200<br>☑ added chapter 4.1 Synchronisation<br>☑ added chapter: 7.2 Logging controlled by digital input signal<br>☑ extended 7.4 Troubleshooting<br>☑ added chapter 8.1 Add-on update<br>☑ added chapter Threshold for DIO8 module<br>☑ added 5.3.1 DS GATE Specifications<br>☑ added chapter 3.1.1 Windows 7 (related to the installation and configuration)<br>☑ corrected hot-swap DIP switch setting in chapter 6.2.2.2 Troubleshooting<br>☑ Module has been replaced<br>☑ improved chapter 3.2.1 DS NET licensing<br>☑ improved wiring diagrams<br>☑ clarified bridge excitation voltage<br>☑ Firmware update for Gate: added warning about DHCP settings<br>☑ some formatting and layout improvements |
| 3.1.1 | 02.12.2010 | ☑ improved wiring diagrams of ACC2 and BR4 Potentiometer<br>☑ improved chapter 4.3 Channel setup<br>☑ added chapter 4.3.4 Setup explained<br>☑ corrected hot-swap DIP switch settings in:<br>☐ 6.9 Exchanging a module (Hot-Swap)<br>☐ 6.10Replacing a module |
| 3.1.2 | 10.02.2011 | ☑ added specifications for: V4, V4-HV, TH4, CFB2 |
| 3.2.0 | 28.06.2011 | ☑ added chapter *9.1 Offline Setup*<br>☑ clarified 'V8 Specifications' table: digital in-/outputs are per connector (not per channel)<br>☑ minor improvements to chapter *4.3.3. Digital Inputs/Outputs*<br>☑ added chapter *9.2 Controlling Digital Outputs*<br>☑ improved and corrected chapter *Measurement Module Types*<br>☑ added chapter *Optional Connector Adapters*<br>☑ added hints about 8 Hz thermocouple measurement rates<br>☑ added chapter *5.3.1 Reading Data* |

| Version | Date [dd.mm.yyyy] | Notes |
|---|---|---|
| | | ☑ improved chapter *8.2.2 Firmware Update For Modules (aka. Slaves)*<br>☑ improved chapters of the following modules: CFB-2, V4, V4-HV, TH4<br>☑ added wiring of differential temperature measurement (for TH8)<br>☑ improved wiring diagrams<br>☐ added pin description<br>☐ BR-4 resistance: corrected pinning (exchanged position of 1,6 and 3,8)<br>☐ the wiring diagrams now show the pin numbers of the adapter (instead of the pin numbers of the DS-NET module)<br>☑ reformatted specification tables<br>☑ replaced image of LEMO connectors (in the Glossary)<br>☑ added chapter *4.3.3.1 Module configuration screen*<br>☑ added chapter *4.1.1 Absolute Time*<br>☑ added chapter *4.3.2.1 DS-GATE pop-up menu*<br>☑ added **Zero** button in *Measure mode*<br>☑ improved *Safety instructions*<br>☑ improved *Firmware update for DS-Gate*<br>☑ added chapter *5.3.2 LED flash codes (DS-GATE)*<br>☑ added chapter *5.2.1 DS-GATE connectors*<br>☑ added chapter: *3.3.1 Port numbers*<br>☑ added chapter *5.16 DS-NET WiFi*<br>☑ updated/improved *8.1 Add-on update*<br>☑ corrected values of Sample Rate (10kHz) and Antialiasing filter (1kHz) of TH4 module<br>☑ added chapter: *3.1.1.3 Windows® 7: Ethernet communication*<br>☑ CFB2 has no current output<br>☑ AO4 has 4..20mA current output<br>☑ now showing the DS-NET screenshots instead of *ICP100* for:<br>☐ DIO8: *5.13.1.1 Threshold*<br>☐ *5.4.1 ACC2: Voltage*<br>☐ *5.7.3 V8: Current* |
| 3.3.0 | 21.09.2011 | ☑ “Table 9: DS NET Module Types” now shows the number of possible channels for each signal type<br>☑ “5.7.4 V8: Digital input and output”: added some hints<br>☑ improved chapter “4.1 Synchronisation”<br>☑ updated to plugin version 4.1.0<br>☑ improved and clarified chapter “4.1.5 Several PCs and DS NET systems”<br>☑ “5.2.7 General module specifications”: corrected physical dimensions<br>☑ added “6.1.1 Physical Dimensions”<br>☑ updated “4.3.3.1 DS GATE pop-up menu”: Renaming a DS-GATE<br>☑ removed index of tables and index of illustrations |
| 3.3.1 | 27.10.2011 | ☑ Updated to plugin version 4.1<br>☑ Fixed broken links<br>☑ updated info regarding the selection of different connector types for modules<br>☑ corrected images of BR4-12 and BR4-350 adapters<br>☑ “5.2.2 Measurement Modules”: separate columns for BR4-D, V8-B, V4-B, TH8-C<br>☑ added “6.1.2 Weight & Power Consumption”<br>☑ improved pin captions of “Illustration 211: BR4-D Strain gauge with quarter bridge completion adapter BR4-D-120/BR4-D-350”<br>☑ updated “Table 25: DIO8 plug contact combinations”<br>☑ explanation of NMEA timing and GPS activation in Config mode<br>☑ added diagrams for 3-wire resistance measurement for ACC2 and BR-4<br>☑ corrected sync mode *None* to *Soft sync* in “4.2.2.1 Sync mode: Soft sync” |

| Version | Date [dd.mm.yyyy] | Notes |
|---|---|---|
| | | ☑ improved 5.2.4.1 Back side connector<br>☑ small improvements to 8.2 Firmware update<br>☑ doc 3.3.0 was missing the blank pages (caused problems with printed version) |
| 3.3.2 | 04.11.2011 | ☑ added chapter 4.3.5.6 Similar Systems<br>☑ improved data for galvanic isolation and common mode voltages |
| 3.3.3 | 14.02.2012 | ☑ Reformatted specification tables<br>☑ BR4-D: added note about max. current of power supply<br>☑ added chapter: 9.3 Multiple DEWESoft™ instances |
| 3.3.4 | 23.04.2012 | ☑ added chapter 8.3 DEWESoft™ update<br>☑ added chapter 8.4 Dewesoft USB devices firmware upgrade<br>☑ added chapter 9.4 IRIG sync with Dewesoft USB devices<br>☑ improved *Module Specification* sections:<br>☐ improved *Isolation Voltage* information (was missing in some module specification sections)<br>☐ removed *General module specifications* section and added the detailed information to each module<br>☐ corrected power consumption of CFB2 and BR-4<br>☑ Updated time-delay info (chapter 4.1.2.3 Software synchronisation) which has been improved since plugin version 4.1<br>☑ Updated Anti-aliasing filter data of V8 module<br>☑ Updated to DS-NET plugin V 4.4 |
| 3.3.5 | 20.06.2012 | ☑ new chapter: *9.2.2 Alarms inside DS-NET*<br>☑ TH-8 specification: removed old information about ±0.5°C accuracy<br>☑ chapter *6 DS-GATE* had the wrong topic level |
| 3.3.6 | 13.08.2013 | ☑ added BR8 module<br>☑ added values for over-voltage to specifications of modules<br>☑ 5.2.4.1 Back side connector: illustration was missing<br>☑ 5.15 DS NET SUPPLY: improved description<br>☑ added information about shield connection of bridge measurement with BR4<br>☑ corrected info in “5.5.3 CFB2: Strain gauge quarter bridge”: “Half-bridge 3 wire” (instead of “Full 4 wire”)<br>☑ TOC now has clickable links<br>☑ added BR4-L pinning<br>☑ removed 3-wire for ACC2 Pt100/Pt1000<br>☑ clarified load specs of DIO8 (per channel)<br>☑ 5.2.4.1 5.2.4.1 Back side connector: Illustration was missing<br>☑ ACC2 and BR-4: RTD max. Deviation is now ±0.25°C (was ±0.5°C) |

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Last modified: Tue 13 Aug 2013, 17:03