Owner's Guide

Energy test

Flight test

Vehicle test

Industrial

DEWE-3210/3211 and DEWE-3213 battery powered data acquisition systems

worldwide
DEWETRON

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Printed in USA

10 9 8 7 6 5 4 3 2 1

Contents

1 Introduction

The DEWE-3000 series from Dewetron, Inc. are PC-based data acquisition instruments.

DEWE-3000 series instruments are a unqiue combination of a state-of-the-art computer which has been ruggedized for field applications in industrial applications, plus a signal conditioning front-end system for interfacing with sensors and interfaces, an A/D card for digitizing the conditioned signals, and powerful data acquisition software that allows you to set up and initiate data acquisition, as well as to analyze data that has been replayed.

Training

DEWETRON offers training at various offices around the world several times each year. DEWETRON headquaters in Austria have a very large and professional conference and seminar center, where training classes are conducted on a regular basis starting with sensors and signal conditioning, A/D technology and software operation. For more information about training services, please visit: http://www.dewetron.com/support/training

Dewetron Inc. in the USA also has a dedicated training facility connected to its headquarters, located in Rhode Island. For more information about training services in the US, please visit:

http://www.dewamerica.com/support/training

Support

DEWETRON has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or DEWETRON directly.

For North and South America, please contact:

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Calibration

Every measuring instrument should be calibrated at regular intervals. The norm across nearly every industry is annual calibration, although this can vary according to the industry, environment, government regulations, and other regulations.

Before your Dewetron data acquisition system is delivered, it is calibrated at our factory in the USA. Dewetron utilizes a NIST traceable metrology system based on the Fluke 5500 series calibrator and other industry leading instruments. We have created numerous Met/CAL® procedures and specialized calibration hardware and software to allow the automation of calibration check and adjustment of nearly every signal conditioner and A/D card that we manufacture. These procedures are proprietary to Dewetron, although they are available for purchase. Customers who have the same Fluke hardware can use them to similarly automate their calibration of Dewetron instruments.

Calibration services are available directly from Dewetron, on whatever frequency you require. We do not subcontract calibration services, and perform it ourselves in house.

Contact Dewetron for further information about calibration services and calibration equipment that is available for purchase.

Certificate included

Each system is delivered with a certificate of compliance with our published specifications.

However, if you require a traceable calibration certification with data, calibration reports are available for purchase with each order. We retain them for at least one year, so calibration reports can be purchased after your system was delivered.

Models Covered

This owner's guide covers the following model(s):

- DEWE-3210 (DAQ modules version)
- DEWE-3211 (MDAQ modules version)
- DEWE-3213 (DEWE-43 input version)

What's in this Guide

This guide is intended to serve as the top level reference document for the models listed above. As such, it contains the following key information:

- Support and calibration contact info
- Safety precautions
- System overview and block diagram
- Overview of all models
- Detailed specs for each model
- Quick start guide operation

And what is not in this guide:

As a top-level reference, This manual is not meant to replace the comprehence reference manuals related to Dewetron sensors, signal conditioners, A/D cards, interfaces, and software.

Please see those manuals for complete details.

2 Safety precautions

Your safety is our primary concern! Please be safe at all times.

GENERAL SAFETY AND HAZARD WARNINGS FOR ALL DEWETRON SYSTEMS:

Symbols used in this manual:

Indicates hazardous voltages

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

CAUTION

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

⇒ **These notices are sometimes indicated in this graphical motif.**

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

- **Use this system under the terms of the specifications only to avoid any possible danger. Maintenance should be performed by qualified personnel only.**
- **During the use of the system, it might be possible to interact with non-Dewetron systems. 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.**
- **The system is grounded via a protective conductor in the power supply cord. To avoid electric shocks, the protective conductor must be connected with the ground of the power network. Before connecting the input or output connectors of the system, make sure that there is a proper grounding to guarantee potential free usage. For countries, in which there is no proper grounding, please refere to your local legally safety regulations for safety use.**
- **DC systems: Every DC system has a grounding connected to the chassis (yellow/green safety banana plug).**
- **Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please carefully read the corresponding specifications in the product manual.**
- **The inputs are not, unless otherwise noted (CATx identification), for connecting 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 authorized personnel only.**
- **Any use in wet rooms, outdoors or in adverse environmental condition is not allowed! Adverse environmental**

conditions are: moisture or high humidity, dust, flammable gases, fumes or storms. et al.

- **The measurement category can be adjusted depending on module configuration.**
- **Any direct voltage output is protected with a fuse against short cut and reverse-polarity, but is not galvanically isolated (except when explicitly marked on the system).**
- **The system must be connected and operated to a properly grounded wall socket at the AC mains power supply only (except for DC systems).**
- **Any other use than described above may damage your system and is attended with dangers like shortcut, fire or electric shocks.**
- **The whole system must not be changed, rebuilt or opened (except for changing DAQP, HSI, PAD, CPAD2, and EPAD2 modules).**
- **If you believe for any reason that the system cannot be used without risk, the system must be rendered inoperative and should be protected against inadvertant operation. You should assume that riskless operation is not possible if the system is: visibly damaged; emits unusual noises, smoke, or flames; if it does not function anymore; if the system has been exposed to long storage in adverse environmental conditions; if the system has been exposed to heavy stresses.**
- **Do not touch any exposed connectors or components if they are carrying voltage and/or current. The use of non-insulated wires with the system is never allowed. There is a risk of short circuit 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). Exception: changing modules like DAQ, DAQP or PAD.**
- **The assembly of the system is equivalent to protection class I. For power supply, only the correct power socket of the public power supply must be used, except the system is DC powered.**
- **Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a dangerous electric shock by touching the wiring.**
- **The system heats up during operation. Make sure there is adequate ventilation. Ventilation slots must not 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 cut and fire hazard!**
- **DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy overvoltage). 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 curcuits 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 refere 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. Acclimate the unpowered system to room temperature.**
- **Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors may still be charged, even the system has been disconnected 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 observerd by skilled personnel.**
- **The measuring systems are not designed for use on human beings or 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 even low levels may damage the batteries, or the whole system. For exact values please refere to enclosed specifications.**
- **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 proper condition. In order to maintain this condition and guarantee safety use, the user must observe the security advice, protocols, and warnings in this manual.**

BIOS notification:

The system BIOS is protected by password. Any change in the BIOS may cause a system crash. When the system is booting, do not press ESC-button on keyboard. This may clear the BIOS settings and cause system faults.

Any change in the file structure as deleting or adding files or directories might cause a system crash.

Before installing software updates contact Dewetron or your local distributor. Use only software packages which are released by DEWETRON. Further informations are also available in the internet (http://www.dewetron.com).

After power off the system wait at least 10 seconds before switching the system on again. Otherwise the system may not boot correct. This prolongs also the life of all system components.

Windows updates and antivirus/security software

- **Before installing Windows software updates consult with Dewetron for compatibility guidance. Please also keep in mind that the use of any antivirus or other security software may slow down your system and may cause data loss.**

Problematic network stacks

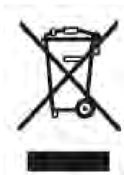
- **Often intrusive IT software or network processes can interfere with the primary function of the Dewetron system: to record data. Therefore we recommend strongly against the installation of IT/MIS software and running their processes on any Dewetron data acquisition system, and cannot guarantee the performance of our systems if they are so configured.**

Product End-of-Life Handling

Observe the following guidelines when recycling a Dewetron 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). Please find further informations about recycling on the DEWETRON web site www.dewetron.com

Restriction of Hazardous Substances

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

Model **DEWE-3211** with MDAQ-SUB-BNC/DSUB module

Left side, screen closed

Model **DEWE-3210** with 8 DAQ modules

Left side, screen open

Model **DEWE-3213**

Top cover, screen open

3 DEWE-3210 Series Specifications

ANALOG INPUT SPECIFICATIONS

Parameter	DEWE-3210 model	DEWE-3211 model	DEWE-3213 model
Max on-board dynamic input channels	8	16	8
Compatible modules	All DAQ, PAD, and HSI series plug-in signal conditioning modules	All MDAQ series modules	DEWE-43 is built in
Module configuration	Any combination of 8 DAQ, PAD, and HSI modules can be plugged in at any time. (See DAQ, PAD, and HSI tables)	One MDAQ-BASE-5 holds any two MDAQ-SUB modules (See MDAQ table)	DEWE-43 is built in
Modularity	DAQ, PAD, and HSI modules can be plugged / unplugged from the system by the user, even when the system is powered on. These modules can be changed freely.	MDAQ modules are factory installed only	DEWE-43 is built in
Input configuration	Differential, isolated (See DAQ, PAD, and HSI tables)	Differential, not isolated (See MDAQ tables)	Differential, not isolated (See DEWE-43 info)
Signal / Sensor compatibility	Voltages, currents, strain, pressure, acceleration, sound pressure, temperature, force, displacement, and more. DAQ, PAD and HSI modules are available which are compatible with virtually all sensors in common use today.	Voltages, currents, strain, pressure, acceleration, sound pressure, temperature, force, displacement, and more. MDAQ modules (when combined with MSI adapters) are available which are compatible with virtually all sensors in common use today.	Natively handles full bridge gages, and voltages up to ±10V. When MSI-BR series adapters are added, inputs can handle higher voltages, currents, 1/4 and 1/2 bridge sensors, charge and IEPE accelerometers, thermocouples, RTDs, and more.
Detailed input specifications	According to the installed signal conditioners and installed A/D cards (see tables for DAQ, MDAQ, PAD, HSI, EPAD2, CPAD2 conditioners, and ORION and AD series A/D cards)		See DEWE-43 information
Max A/D cards installable	3	3	DEWE-43 is built in
Channel expansion, internal	Block of 16 MDAQ channels can be installed permanently to the bottom of the DEWE-3210/3211. This block also provides 4 more battery slots for longer running times.		N/A

COUNTER/ENCODER SPECIFICATIONS

Parameter	DEWE-3210 series	DEWE-3211 series	DEWE-3213 series
Number of counter channels	According to the A/D card installed (see tables)		8
Counter modes	ORION cards: Event counting, waveform timing, encoder, tacho, geartooth sensor AD series cards: Event counting, waveform timing, tacho		
Counter input signal level	Standard: TTL level Optional: user adjustable trigger level (when ORION cards whose model names end in 4 or 5 are ordered. See A/D card tables)		Standard: TTL level
Counter input connectors	Standard: Two LEMO connectors on the left side panel, one for each counter input Optional: More LEMO connectors, or alternative connectors, for the counters		Standard: Eight LEMO connectors
Number of Digital input/outputs	According to the A/D card installed (see tables)		24 digital inputs
Digital input signal level	Standard: TTL, non-isolated Optional: Wider range, isolated digital input According to the A/D card installed (see tables)		TTL level, non-isolated
Digital input connector	DSUB37 connector on the left side panel, which has the digital I/O lines, counter, and trigger line from the first installed A/D card.		Each of the 8 LEMOs has three digital inputs

CAN BUS SPECIFICATIONS

Parameter	DEWE-3210 series	DEWE-3211 series	DEWE-3213 series
Number of CAN bus interfaces	According to the A/D card installed (see tables below)		2 x high speed CAN ports
Interface type	CAN 2.0B, up to 1 MBit/sec		
Special protocols supported	J1939 (standard) OBDII PLUGIN-OBDII option) CAN output (DEWESoft-OPT-CAN option)		
Isolation	not isolated, however, CAN-OPT-ISO adapters are available optionally, which will isolated the CAN BUS interfaces.		

ADDITIONAL INTERFACES

Parameter	DEWE-3210 series	DEWE-3211 series	DEWE-3213 series
EPAD2 interface	Standard, via LEMO connector. See signal conditioner tables below for EPAD2 details.		Use CPAD2 modules with either or both standard CAN bus ports
Video camera interfaces	Firewire (IEEE-1394), USB 2.0, and ethernet may be used for optional VIDEO camera sensors		
GPS interfaces	RS232C and USB 2.0 may be used for optional GPS interfaces/sensors		
ARINC 429 / 1553	Optional ARINC 429 and MIL-STD-1553 interfaces may be added either as PCI cards or as external USB 2.0 or ethernet-connected boxes.		

COMPUTER SYSTEM SPECIFICATIONS

Parameter	DEWE-3210 series	DEWE-3211 series	DEWE-3213 series
CPU	Intel® Core2Duo® 2 GHz CPU		
RAM	2 GB RAM standard (up to 4 GB optionally)		
Hard disk drive	500 GB removable S-ATA spinning drive standard, plus internal 160 GB fixed drive for Windows OS and applications Optional drives: 32, 64, or 128 GB removable flash drive (no moving parts) Internal spinning or flash drive added in addition to the removable drive Larger removable drive (up to 1 TB)		
Operating System	Microsoft® Windows 7 Professional® (32-bit)		
Keyboard and pointing device	Built-in Cherry brand QWERTY keyboard with touchpad		
Display	Built-in 17" XGA display 1280x1024 pixels, with resistive touchscreen as stanard		
Interfaces	2 x Ethernet interfaces (1 Gb/s max. transfer speed) 4 x USB 2.0 interfaces 1 x IEEE-1394 Firewire interface 1 x RS232C serial interface 1 x VGA interface Audio and video I/O connectors		
PCI slots	Three half-length 32-bit PCI slots. The first slot always used by an A/D card. The other slots may be used for additional A/D cards, or additional interfaces.		One half length PCI slot available for additional cards, interfaces, etc.
Power system	SideHAND® battery power system installed 2 x Lithium Ion smart batteries are included Three battery slots are built into the left side panel DPS-2410 external AC/DC adapter/charger is included Built-in 2 line LCD display shows the battery status at all times		
Battery running time	Approximately 2 hours of battery operation (depends on workload of the system)		
AC running time	Unlimited. With the DPS-2410 connected, the system will run indefinitely. Batteries are recharged automatically when power is connected.		
Dimensions:	425 x 340 x 191 mm (16.7 x 13.4 x 7.5 in.) (with screen closed)		
Weight:	Without batteries: 10 kg (22 lb.) Battery weight: approx. 1.5 lbs each		
Temperature & humidity	0 to +50 °C (-20 when pre-warmed) (10 to 80 % non cond., 5 to 95 % rel. humidity)		
Shock and vibration	Shock: EN 60068-2-27, MIL-STD-810F Vibration: EN 60068-2-6, EN 60721-3-2 class 2M2		

ACCESSORIES INCLUDED

Carrying bag	3200-BAG, soft sided carrying bag made from ballistic nylon, black. Pouches for accessories, cords, DPS-2410, straps and adjustable shoulder strap
System restore DVD	DVD allows the system to be reloaded to factory conditions, including Windows configuration and Dewetron software configuration

Data Acquisition Software Specifications

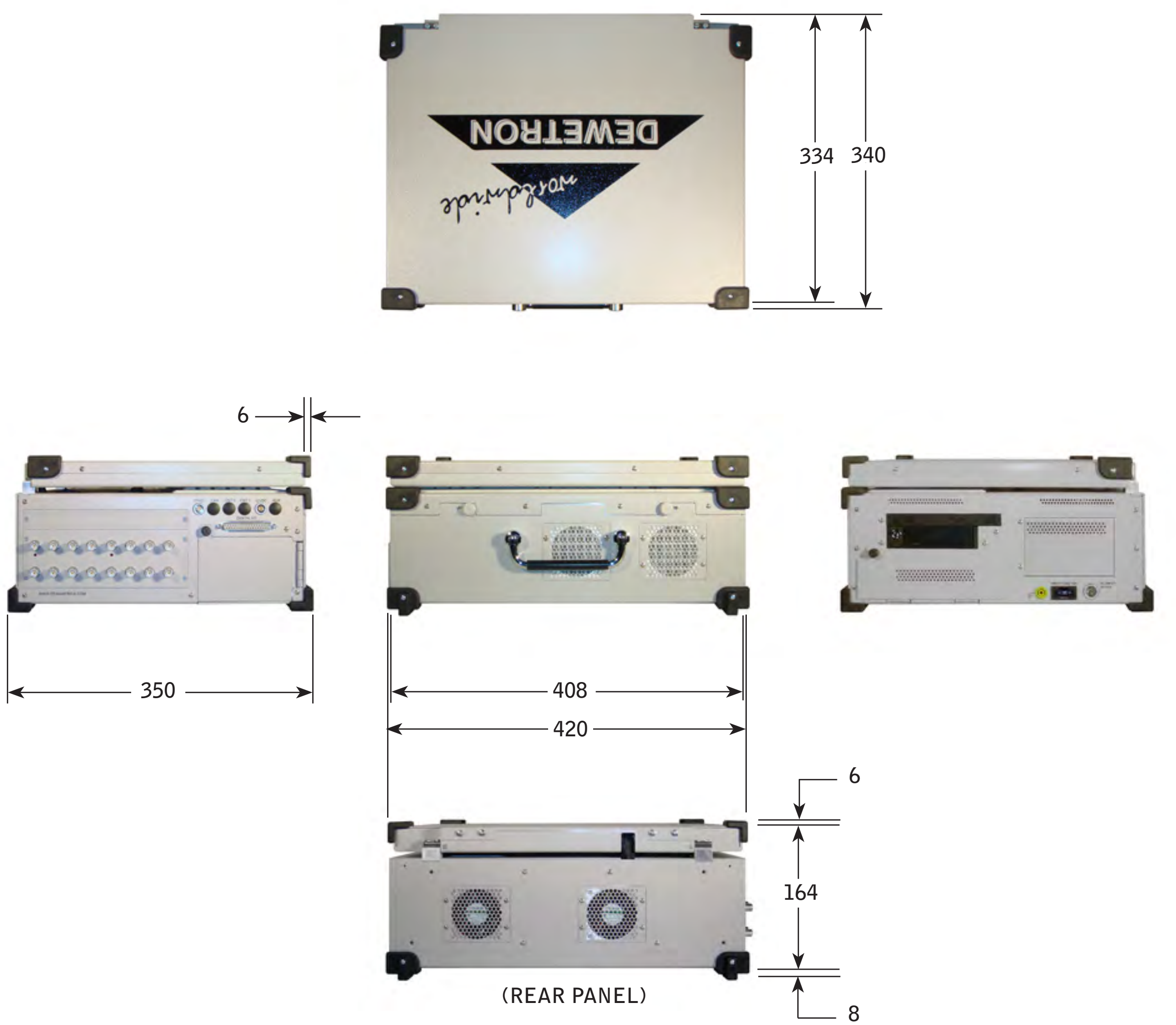
DEWESoft software specifications	
General	
Compatibility	Microsoft® Windows XP® and Windows 7® (32-bit operating systems)
Computer requirements	Recommended: Intel® Core2Duo® 2 GHz CPU with 2 GB RAM and S-ATA HDD with 100 GB of free space Minimum: Intel® Atom® 1.2 GHz CPU with 1 GB RAM and IDE HDD with 50 GB of free space
Licensing requirements	A valid license is required for data acquisition operation No license is required to use the software in analysis mode
Software name and edition	DEWESoft 7 SE (standard edition) is included with the DEWE-321x system. Upgrades from SE to PROF or DSA or EE editions are available for purchase at any time.
Hardware compatibility	Controls all programmable aspects of the integrated DEWE-43 acquisition module
TEDS	Supports TEDS sensors, and includes TEDS compatible sensor database
Input scaling	Channel setup screen: supports linear scaling of analog channels via 2-point method and funtional method (y=mx+b) Math formula and sensor database: support both linear and non-linear (polynomial) scaling, via multi-sectional coefficients or look-up table scaling
Counter setup	Counter/encoder channel setup screen supports graphical configuration of all counter and encoder decoding modes.
Recording setup	
Recording modes	Always fast (continuous recording to disk at the dynamic sample rate) Fast on trigger (dynamic sample rate recording when one or more trigger conditions are true) Always slow (reduced rate storage of min/max/ave/rms values at a user-selectable decimation of the dynamic sample rate Fast on trigger, slow otherwise (combination of fast triggering and slow recording in between triggers)
Pre-trigger time	Pre-trigger time can be entered when using any triggered recording mode. Pretrigger time limited to the amount of physical RAM available divided by the number of samples per second being streamed across the PCI bus
Post-trigger time	Post-trigger time may be selected without limit When one or more channels are being used to stop recording, any selected post-trigger time will be added to the end of the acquisition
File naming	Data files may be named freely within Windows file naming constraints
File protection	Files canno be over-written accidentally due to a warning screen, which provides a way to cancel recording, continue and overwrite the existing file, or rename the new file (preserving the existing file)
Multi-file naming	Selectable automatic numbering of files. Software will append an underscore and four digits to the end of the user-entered filename. Subsequent recordings are increased one digit at a time. Alternatively the date and/or time (hh:mm:ss) can be added to the filename.

DEWESoft software specifications	
Data file size	No restrictions, however we suggest to keep files to within 8 GB for your convenience
Setup files	A setup file contains all hardware settings and all display settings that can be configured within the software. An unlimited number of setup files may be saved for easy loading and re-use any time in the future
Setup file format	XML data format is used with D7s extension or XML extension
Data file format	Binary file with XML header portion containing the entire setup file, with D7d extension. A library DLL is available for adding Dewesoft 7 data file importation into any software program under your control. Several commercially available analysis programs have added direct reading of Dewesoft 7 data files in this way, including Matlab®, Flexpro®, and nCode®.
Data display	
Built-in screens	Scope, Overview, Recorder, FFT, Video, Power
Screen design	Every display screen can be modified by the user Screens can be deleted, and new screens added Subscreens may be added below main screens Screens may be renamed and moved on the toolbar
Data display widgets (standard)	Recorder (y/t strip chart) graph, horizontal, up to 16 channels/graph Recorder (strip chart) graph, vertical, 1 channels/graph Scope y/t graph, up to 32 channels/graph Digital meter with color coded alert levels, user programmable Analog meter with color coded alert levels, user programmable Bar graph, horizontal or vertical, with color coded alert levels, user programmable X-Y graph, X-YYY or 4 x X-Y, linear or angle based X-Y modes supported FFT graph, up to 4 channels/graph 2D array graph 3D array graph Background image container Video display container GPS track display container, compatible with map background images Discrete display, LED with color change, user programmable Discrete display, Alphanumeric, user programmable messages based on discrete levels Text container, user programmable Line tool, for drawing connections from meters/graphs to other widgets
Data display widgets (optional)	Vectorscope, harmonic FFT for voltage and current (included with DEWESoft-OPT-POWER) Third-octave display (included with DEWESoft-OPT-SNDLVL)
On-line and Off-line MATH	
Function blocks included	Formula editor: user-programmable arithmetic, algebra, trigonometry, boolean logic, measuring functions (time distance and ampltitude delta), and more. Filtering: IIR, FIR, FFT, and Envelope Integration, Double integration, Derivation and Double derivation (IIR filter module) Polynomial / coefficient scaling (IIR filter module) Basic statistics, array statistics, Latch math, counting functions, classification Reference curves: Y/T, X/Y, and FFT Constant function

DEWESoft software specifications	
Function blocks (continued)	Exact frequency calculation CA noise (included with DEWESoft-OPT-CA combustion analyzer) Angle sensor (user definable angle-based sensor toolkit) FFT, SFFT, CPB Scope trigger math function Strain gage rosette calculator
Math channel operation modes	Math channels can be created before or after recording Math channels created before recording may be set to not process until after recording, or may be set to process during recording Math functions created after recording can be processed on a subset of the data, or all of the data New channels resulting from math channels are saved to the data file, both before and after recording
On-screen analysis capabilities	
Cursor measurements	Recorder graphs have selectable cursors which can be used to take precise measurements anywhere within the data, or any channels Delta ampltidue and delta time are calculated, displayed, and printable Cursors can be locked individually Graph may still be zoomed/unzoomed when cursors are locked Cursors and their readings appear on the paper when screen is printed
Data zoom in/out	Any recorder graph can be used to zoom the data in or out, as many times as necessary
Data replay	Data can be replayed to make it look like it did when recording
Replay speed and direction	Replay can be increased or decreased in speed up to 8000x Replay can be forward or reverse
Data export capabilities	
Export file formats available	Matlab®, Flexpro, Excel®, delimited ASCII text Diadem®, Universal 58, FAMOS®, nsoft time series, Sony log, RPC III, Comtrade®, ATI®, Technical Data Management TDM, Impression Diadem®, Standard Data File, WFT, Replay RPL, Wave (audio wav), Google Earth® KML
Export selection	The area zoomed using the cursors will be exported. If no zooming has been done, the entire data file will be exported
Export channel selection	Any combination of channels may be exported, from 1 to all
Export mode	Data may be exported at the full acquisition rate, or at the reduced storage rate. When reduced is chosen, user may select to export up to four columns per channel: min, max, ave, rms
Export timebase	User selectable absolute time, relative time, or trigger (zero) time
Software licensing and distribution	
Acquisition mode	A valid DEWESoft license is required to RECORD (acquire) data
Analysis mode	No license is required to use DEWESoft to analyze data DEWESoft may be given to third parties for installation and use to analyze data files Off line math, zooming, printing, and data export are all supported

DEWESoft software specifications	
Input sensor types supported	
Analog sensors	Virtually all analog type sensors are supported (see Conditioners section for compatibility details), abbreviated list: Strain gages, accelerometers, microphones, RTDs, thermocouples, load cells, force sensors, voltages, currents, string potentiometers, LVDTs, resistive sensors
Digital inputs	Digital I/O "discrete" lines, position encoders, tachometers, frequency meters
Video sensors	USB and Firewire webcams which support DirectShow/DirectX under Windows7® Gig-E ethernet video camera (DEWE-CAM-GIG-E-50 option) Synchronized Firewire camera (DEWE-CAM-01 option) NSTC and PAL video streams (VIDEO-FG-4 option)
Sound sensors	IEPE and charge type microphones (see analog sensors)
GPS sensors	Compatible with: DEWE-VGPS-200C, NMEA compatible GPS stream, Leane V-SAT®, Racelogic VBOX II® GPS, Javad® GPS, Microsat® GPS
Inertial sensors	Compatible with: XSENS MTI® and MTI-G® series MEMS based sensors (requires PLUGIN-XSENS software option) Genesys ADMA® series gyro / GPS platforms (requires PLUGIN-ADMA software option)
BUS interfaces supported	
CAN BUS	CAN 2.0B, with several additional protocols, including J1939 and OBD II (optional interface and software option DEWESoft-OPT-CAN) Importation of Vector DBC files is included with this option Note: CAN output is available via option DEWESoft-OPT-CAN-OUT) This option also includes a Vector license for the export of Vector DBC files Hardware supported: All Dewetron CAN hardware, Softing® CAN PCI and USB, Vector® CAN, National Instruments® PCI-CAN/2 card
ARINC 429	Internal half-length PCI card and external USB ARINC 429 interfaces optionally available. Requires also DEWESoft-OPT-ARINC/1553
MIL-STD-1553	Internal half-length PCI card and external USB ARINC 429 interfaces optionally available. Requires also DEWESoft-OPT-ARINC/1553
PCM data	Internal full-length PCI format bit-sync/decom interface optionally available Requires also DEWESoft-OPT-PCM Requires a model with a full length PCI slot available, or external expansion chassis with PCI slot(s).

System Dimensions

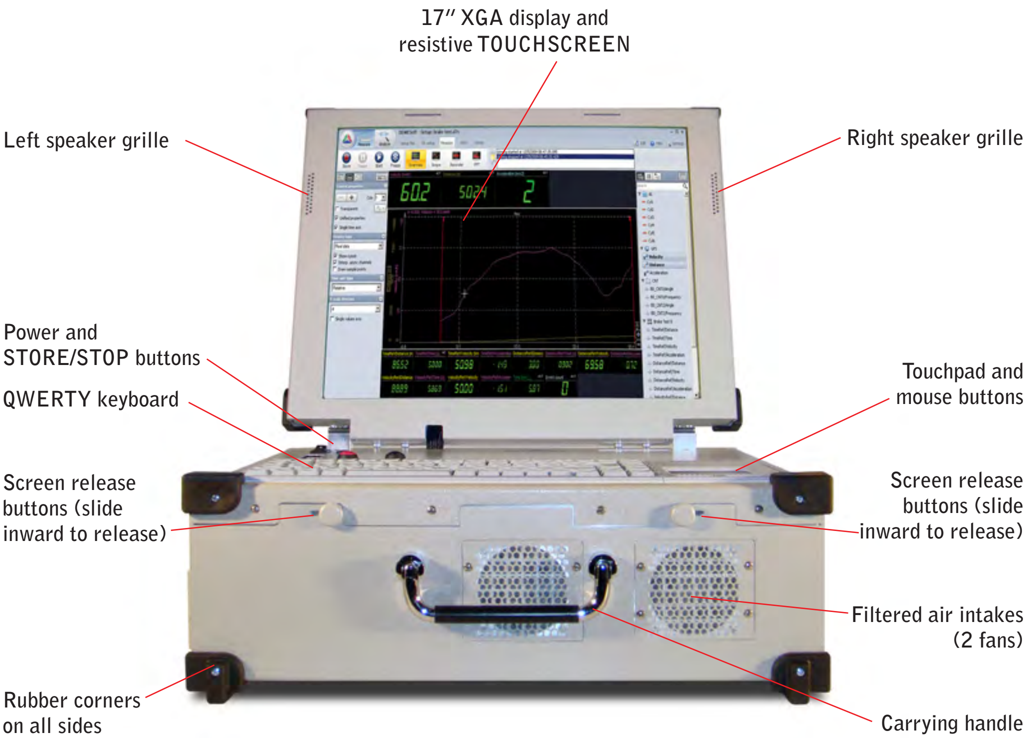


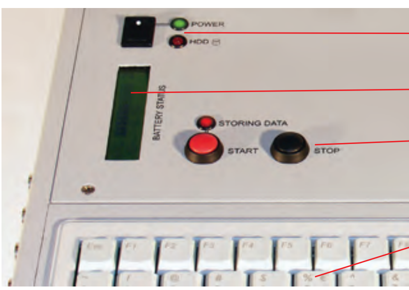
Dimensions in millimeters (mm)

Divide by 25.4 for inches

Top-level call-outs

DEWE-321x, head on view, with the screen open



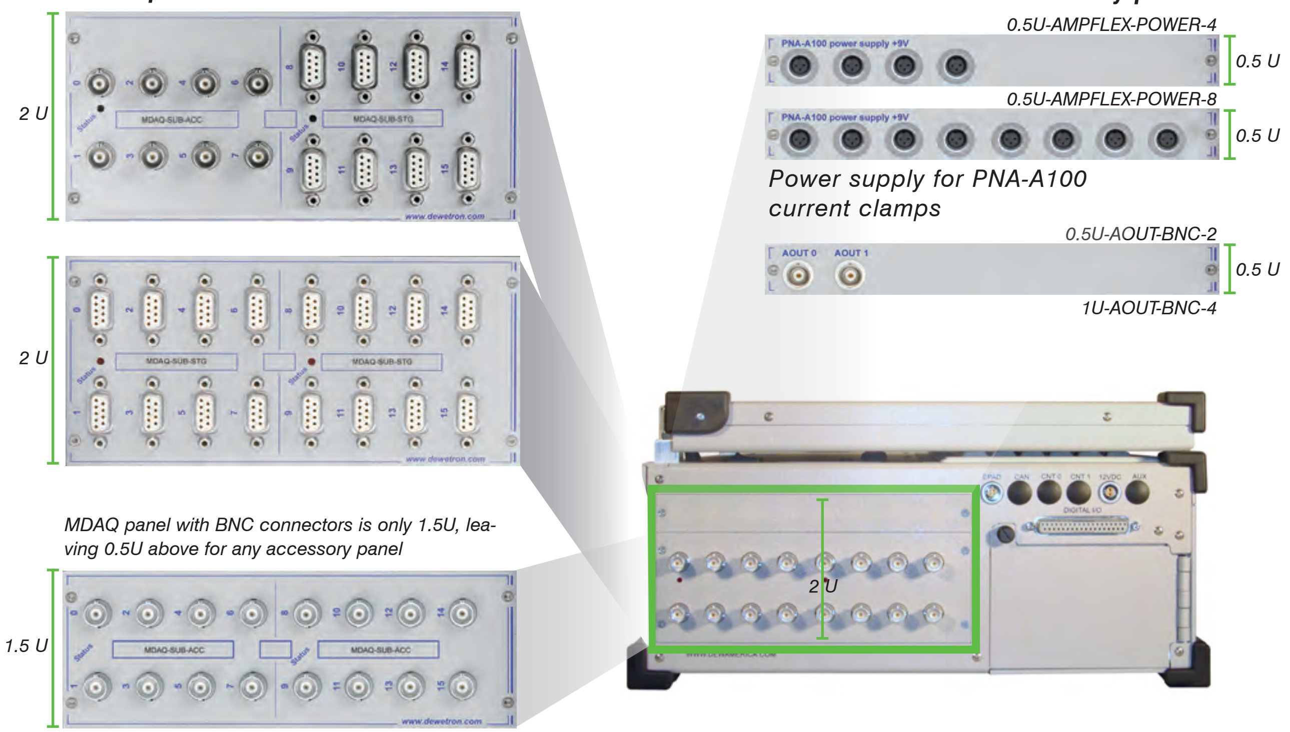


* STORE/STOP buttons may not be present in all models

Configuration guide, DEWE-3211 model

The DEWE-3211 has a 2U height space on its left side panel, which can accept either a 2U high MDAQ panel, such as either the DSUB connector panel or half BNC/half DSUB9 panel ... or a 1.5U panel plus any of the 0.5U accessory panels, as shown below:

MDAQ panels ***Accessory panels***



Note - if your system is ordered with any 1.5U MDAQ panel (MDAQ-SUB-V200-BNC or MDAQ-SUB-ACC-BNC are perfect examples), and you do not order a 0.5U accessory panel, we will install a blank panel in the 0.5U space.

Configuration guide, DEWE-3210 model

The DEWE-3210 has a fixed configuration: there is a RACK-8 built into the side panel, so all you need to do is choose any any of our DAQ, PAD, or HSI series plug-in modules to fill the slots.

Both models accept optional EPAD2 series external PAD modules for adding many channels of slower temperature signals, voltage, current, and RTD inputs.

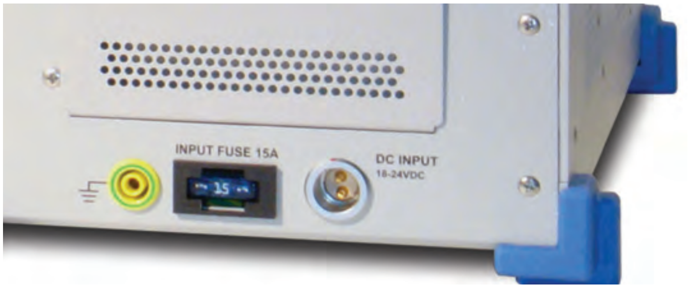
4 System Connectors

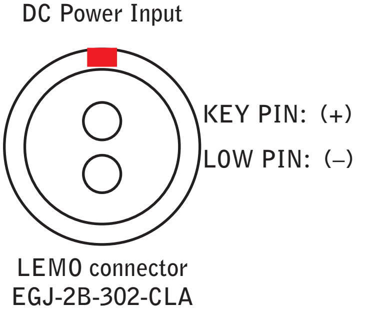
System/PC connectors

Ground (earth) Connector

Connector: insulated banana jack, marked with the ground/earth symbol, yellow with green stripe
Mating connector: insulated banana plug, yellow with green stripe

Function: Depending on your electrical environment, it may be necessary to give the system an additional ground connection. This is an international standard mini-banana jack, color coded yellow/green, located near the DC power input.





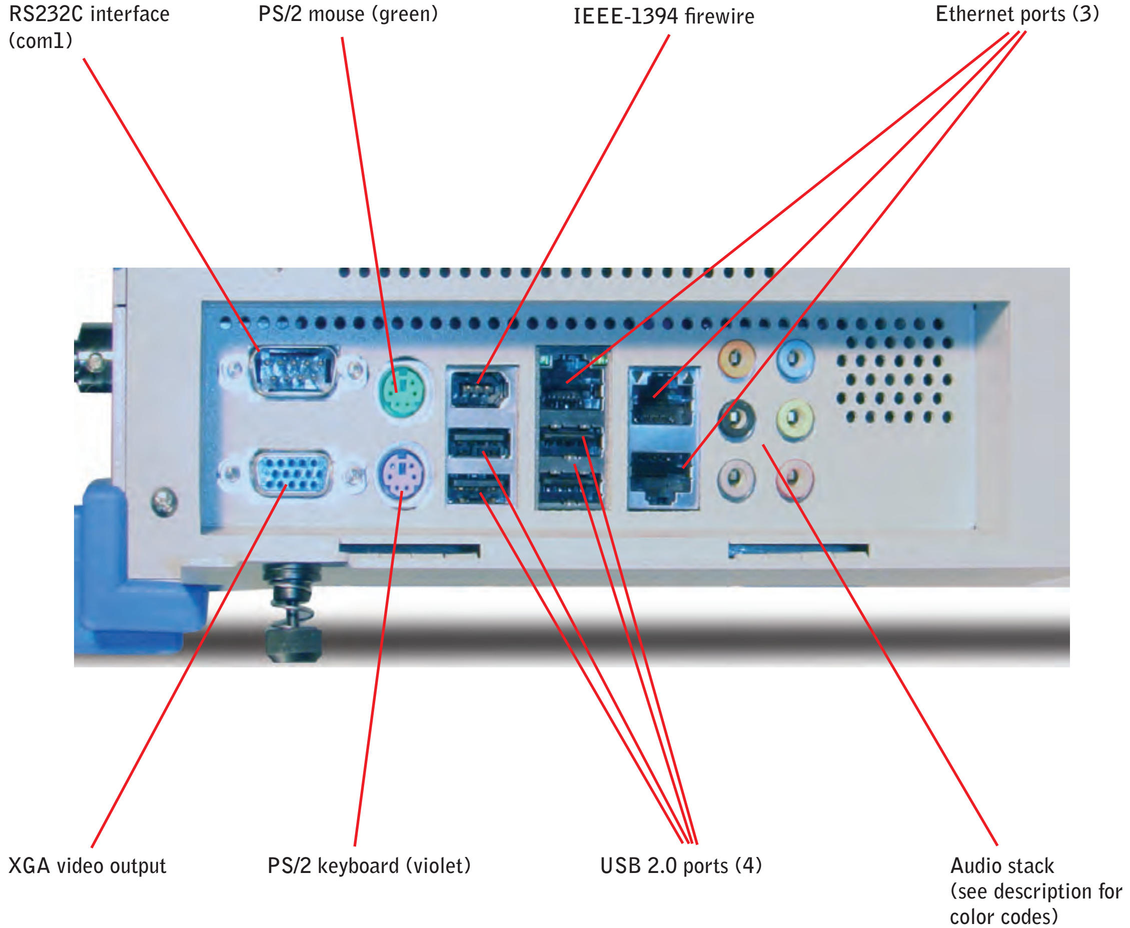
DC power input

Connector: LEMO power connector, as shown in the picture above. The connector is this LEMO model: EGJ-2B-302-CLA. The appropriate mating connector is LEMO FGJ.302.CLLD-XX (where XX is the cable size).

The mating cable called CBL-DPS-2410 is provided to connect the DEWE-3210 to the DPS-2410 power supply. This cable is 2 meters long. It has FGJ.302.CLLD-XX on the side that plugs into the DEWE-3210, and FGG.2B.302-CLAD-XX on the side that plugs into the DPS-2410 AD/DC power supply.

Permissable power inputs are 18-24VDC.

⇒ **Important note - power input must not exceed 24VDC! System damage will occur.**


RS232C interface
(com1)
PS/2 mouse (green)
IEEE-1394 firewire
Ethernet ports (3)
XGA video output
PS/2 keyboard (violet)
USB 2.0 ports (4)
Audio stack
(see description for
color codes)

Fuse

The system DC power is fused using a REGULAR ATO 15A fast-acting blade fuse. Blue is the ATO standard color code for a15 amperes fuse rating. ISO 8820-3:2002 standard.

⇒ **Replace this fuse only with exactly the same type, or equipment damage, injury or even death can result.**

Computer Connectors

The door on the right side of the chassis opens to allow access to a collection of computer interface connections, as follows:

RS232C interface connector (com1)

Connector: 9-pin DSUB (male)
Mating connector: 9-pin DSUB (female)

Function: Can be used to connect devices which utilize the RS232C serial interface.

The typical interpretation of the signals in the COM ports is as follows:

Signal	Description
TxD	Transmitte Data, sends serial data to the device. The signal is set to a marking state on hardware reset when the transmitter is empty or when loop mode operation is initiated.
RxD	Receive Data, receives serial data from the communication link.
DTR	Data Terminal Ready, indicates to the device that the on-board UART is ready to establish a communication link.
DSR	Data Set Ready, indicates that data set is ready to establish a communication link.
RTS	Request To Send, indicates to the device that the on-board UART is ready to exchange data.
CTS	Clear To Send, indicates that the modem or data set is ready to exchange data.
DCD	Data Carrier Detect, indicates that the modem or data set has detected the data carrier.
RI	Ring Indicator, indicates that the modem has received a telephone-ringing signal.

The connector pin-out is defined here:

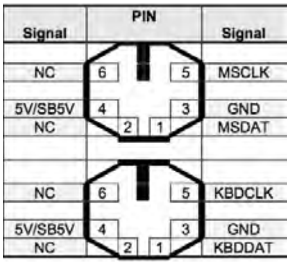
Signal	PIN		Signal
GND	5	9	RI
DTR	4	8	CTS
TxD	3	7	RTS
RxD	2	6	DSR
DCD	1		

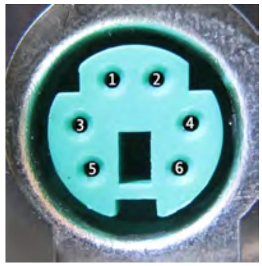
PS/2 mouse (green) and PS/2 keyboard (violet)

Connectors: Standard PS/2 green (mouse) and violet (keyboard)
Mating connectors: Standard PS/2 keyboard and mouse plugs or USB-PS/2 adapters

Function: Attachment of a keyboard or PS/2 mouse adapter via the stacked PS/2 mouse and keyboard connector (MSE & KBD).

Description: Both interfaces utilize open-drain signaling with on-board pull-up. The PS/2 mouse and keyboard is supplied from 5V_STB when in standby mode in order to enable keyboard or mouse activity to bring the system out from power saving states. The supply is provided through a 1.1A resetable fuse.





Above left: Stacked PS/2 connector pinning and call-outs
Above right: view of a typical PS/2 connector, showing the pin numbering schema

Signal	Description
MSCLK	Bi-directional clock signal used to strobe data/commands from/to the PS/2 mouse.
MSDAT	Bi-directional serial data line used to transfer data from or commands to the PS/2 mouse.
KDBCLK	Bi-directional clock signal used to strobe data/commands from/to the PC-AT keyboard.
KBDDAT	Bi-directional serial data line used to transfer data from or commands to the PC-AT keyboard.

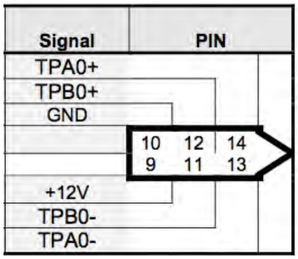
☺ **Note: PS/2 devices should be connected before the system is powered on. PS/2 mice in particular will typically not be recognized by Windows if connected after Windows has loaded.**

IEEE-1394 Firewire interface

Connector: Standard 6-pin full size IEEE-1394b female connector
Mating connector: Standard 6-pin IEEE-1394b male plug

Function: Can be used to connect devices which utilize the IEEE-1394 firewire interface.

Description: This port is an IEEE Std 1394a-2000 fully compliant cable port which provides interfacing at 100M bits/s, 200M bits/s, and 400M bits/s.



☺ **Note: The DEWE-CAM-01 high speed video camera from Dewetron connects via firewire. However, it is highly recommended to add a dedicated firewire card to your system to get the best performance from the DEWE-CAM-01 sensor. The full speed may not be achievable using the on-board interface shown above.**

Ethernet interfaces (3)

Connectors: RJ45 CAT5e standard jack
Mating connectors: RJ45 CAT5e or CAT6 plugs

Function: for connecting the DEWE-321x to a local area network (LAN), or for connecting ethernet peripherals (printers, cameras, etc.).

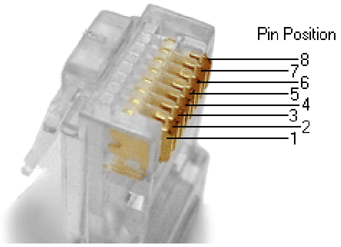
Description: The DEWE-321x provides three channels of 10/100/1000Mb Ethernet RTL8111B LAN controllers. In order to achieve the specified performance of the Ethernet port, Category 5 twisted pair cables must be used with 10/100MB and Category 5E, 6 or 6E with 1Gb LAN networks.

The signals for the Ethernet ports are as follows:

Signal	Description
MDI[0]+ MDI[0]-	In MDI mode, this is the first pair in 1000Base-T, i.e. the BI_DA+/- pair, and is the transmit pair in 10Base-T and 100Base-TX. In MDI crossover mode, this pair acts as the BI_DB+/- pair, and is the receive pair in 10Base-T and 100Base-TX.
MDI[1]+ MDI[1]-	In MDI mode, this is the second pair in 1000Base-T, i.e. the BI_DB+/- pair, and is the receive pair in 10Base-T and 100Base-TX. In MDI crossover mode, this pair acts as the BI_DA+/- pair, and is the transmit pair in 10Base-T and 100Base-TX.
MDI[2]+	In MDI mode, this is the third pair in 1000Base-T, i.e. the BI_DC+/- pair.
MDI[2]-	In MDI crossover mode, this pair acts as the BI_DD+/- pair.
MDI[3]+	In MDI mode, this is the fourth pair in 1000Base-T, i.e. the BI_DD+/- pair.
MDI[3]-	In MDI crossover mode, this pair acts as the BI_DC+/- pair.

The pinout of the RJ45 connector is as follows:

Signal	PIN	Type	Ioh/Iol	Note
MDI0+	1			
MDI0-	2			
MDI1+	3			
MDI2+	4			
MDI2-	5			
MDI1-	6			
MDI3+	7			
MDI3-	8			
	8 7 6 5 4 3 2 1			



Above right: typical mating plug, showing the pin outs

On top of Ethernet connectors there is a Green LED (to the left) turning on when a 100MHz connection is made and it is flashing when 100MHz traffic is ongoing. The Yellow LED (to the right) turns on when a 1GHz connection is made and it is flashing when traffic is ongoing.

Please refer to the CAT5e, CAT6, and structured cabling standards for computer networks when interfacing to the DEWE-321x.

CRT/VGA video output

Connector: three-row 15-pin DE-15 (female) connector
Mating connector: 15-pin DE-15 video (male) plug

Function: For connecting an additional display to the DEWE-321x, which will show an exact duplicate of the built-in display.

Description: The DEWE-321x has two basic types of interfaces to a display: Analog CRT interface and a digital interface typically used with flat panels. The digital interface to flat panels is connected internally to the built-in flatpanel display. The CRT interface is available externally to the user.

Signal	PIN			Signal
		6		ANA-GND
RED	1		11	NC
		7		ANA-GND
GREEN	2		12	DDCDAT
		8		ANA-GND
BLUE	3		13	HSYNC
		9		5V
NC	4		14	VSYNC
		10		DIG-GND
DIG-GND	5		15	DDCCLK

Signal	Description
HSYNC	CRT horizontal synchronization output.
VSYNC	CRT vertical synchronization output.
DDCCLK	Display Data Channel Clock. Used as clock signal to/from monitors with DDC interface.
DDCDAT	Display Data Channel Data. Used as data signal to/from monitors with DDC interface.
RED	Analog output carrying the red color signal to the CRT. For 75 Ohm cable impedance.
GREEN	Analog output carrying the green color signal to the CRT. For 75 Ohm cable impedance.
BLUE	Analog output carrying the blue color signal to the CRT. For 75 Ohm cable impedance.
DIG-GND	Ground reference for HSYNC and VSYNC.
ANA-GND	Ground reference for RED, GREEN, and BLUE.

⇒ **Note: The 5V supply in the CRT connector is fused by a 1.1A resetable fuse.**

Left: typical mating cable for connecting an external VGA/XGA monitor

☺ **Note: the CRT output cannot be used in a "multiple monitors" setup under Windows. To support multiple monitors with different images on them requires that a separate video card be added to the system.**

☺ **Note: DEWE-321x's with 15" displays (made in 2010) have a max resolution of 1024x768; DEWE-321x (made in 2011 or later) with 17" displays have a max resolution of 1280x1024 . The CRT output is set to the same resolution as the built-in flatpanel display.**

USB 2.0 interfaces (4)

Connector: USB2.0 Standard-A receptacle
Mating connector: USB2.0 Standard-A plug

Function: For the connection of peripheral devices which utilize the USB 2.0 or USB 1.1 interface.

Signal	PIN	Signal
	1 2 3 4	
5V/SB5V		GND
USB0-		USB0+
	1 2 3 4	
5V/SB5V		GND
USB2-		USB2+

USB 1.x/2.0 standard pinning

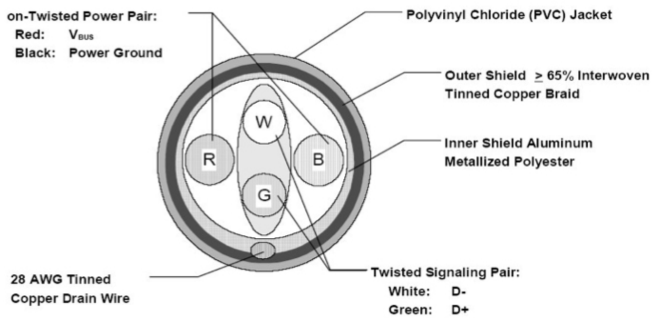
Pin	Name	Cable color	Description
1	VCC	Red	+5 V
2	D–	White	Data –
3	D+	Green	Data +
4	GND	Black	Ground

Description: The DEWE-321x's mainboard contains an Enhanced Host Controller Interface (EHCI) host controller that supports USB 2.0 allowing data transfers up to 480Mb/s. There are four user-accessible Universal Host Controller Interface (UHCI Revision 1.1) controllers that support USB full-speed and low-speed signaling. All ports are high-speed, full-speed, and low-speed capable and USB Legacy mode is supported.

Over-current detection on all four USB ports is supported.

USB ports 0 and 2 are supplied on the combined ETHER1, USB0, USB2 connector. USB ports 4 and 5 are supplied on the combined IEEE1394_0, USB4, USB5 connector.

Note: It is recommended to use only High-/Full-Speed USB cable, specified in USB2.0 standard:



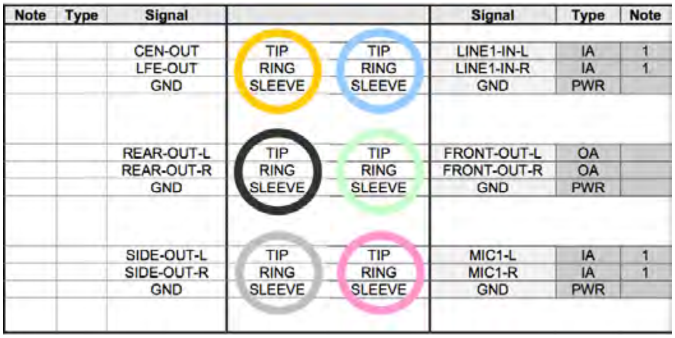
☺ **Note: USB is most often used to connect webcams for recording video in sync with the data in your Dewetron data acquisition system. It is also used to connect inertial sensors such as the XSENS MTI series of sensors.**

Audio stack connectors (6)

Connectors: 3.5 mm (~1/8 in.) TRS jacks, color coded
Mating connectors: 3.5 mm (!1/8 in.) TRS plugs

Function: for outputting or inputting audio

Description: Audio Line-in, Line-out and Microphone are available in the stacked audio jack connector. Below is shown audio stack configuration when configured for 8-channel audio.



Port	2-channel	4-channel	6-channel	8-channel
Light Blue	Line in	Line in	Line in	Line in
Lime	Line out	Front speaker out	Front speaker out	Front speaker out
Pink	Mic in	Mic in	Mic in	Mic in
Gray	-	-	-	Side speaker out
Black	-	Rear speaker out	Rear speaker out	Rear speaker out
Yellow Orange	-	-	Center/ Subwoofer	Center/ Subwoofer

⇒ **Note: Always use industry standard plugs and cables when connecting to any part of the DEWE-321x**

Signal Input Connectors

Analog input connectors (8 or 16)

Connector: Varies according to the signal conditioning module(s) installed
See the signal conditioning tables for further details about the module(s) installed within your system.

Function: to input analog signals to the dynamic measuring inputs of the DEWE-3210 or DEWE-3211.

Above: typical DEWE-3210 showing 8 DAQ modules plugged in

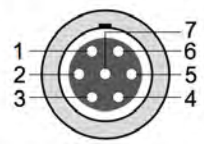
Counter/encoder connectors (2)

Connector: LEMO EGG.1B.307CLAD52
Mating connector: LEMO FGG.1B.307CLAD52
Mating cable available: CTR-CABLE-05 (includes connector)

Function: used to input tachometer, TTL level pulse train, or encoder outputs for measuring and conversion.

Counter/Encoder connector for all panel options

1: Source Ex_CNT(n)
2: Aux_Ex_CNT(n)
3: Gate Ex_CNT(n)
4: Power GND
5: +5 V (max. 500 mA)
6: +12 V (max. 500 mA)
7: Signal GND
n .. channels 0 to 1 of counter board



7-pin female LEMO connector EGG1B307CLL

☺ **Note: see the COUNTER configuration section later in this guide.**

CAN BUS interface connector (installed when you order CAN BUS option)

Connectors: LEMO EGG.1B.306.CLL
Mating connector: LEMO FGG.1B.306.CLL
Mating cable: CAN-CBL-Y

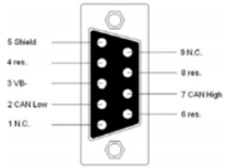
Female receptacle mating view LEMO EGG.1B.306.CLL

PIN	Function	Comment
1	CAN0 Lo	First CAN port
2	CAN0 Hi	First CAN port
3	D GND	
4	CAN1 Lo	Second CAN port

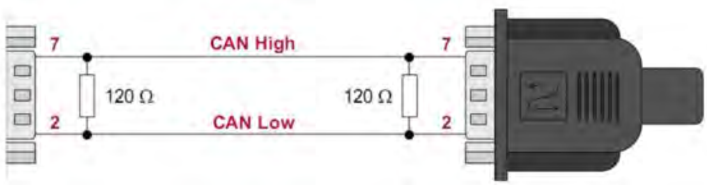
PIN	Function	Comment
5	CAN1 Hi	Second CAN port
6	GND	

Function: used to connect to vehicle CAN BUS interfaces. Also can be used to read data from sensors which have a CAN BUS output, such as Dewetron's own CPAD2 series signal conditioning modules.

When the CAN option is installed, this single LEMO connector will contain two CAN BUS interfaces. The CAN-CBL-Y mating cable is optionally available to split the single LEMO connector to two standard CAN DB-9 (female) connectors. Both DB-9 connectors are wired the same way, as shown below:



When you connect either CAN bus interface to your vehicle or other CAN network, it is necessary to add termination resistors (not included) at each end of the cable:



☺ **Note: this connector does not provide power for CPAD2 series modules.**

Expansion connector (DEWE-3210 model)

ANALOG INPUT connector

Connector: LEMO 19-pin LEMO EGG.2B.319.CLL, marked ANALOG INPUT
Mating cable: 3210-EXP8-L

Function: The DEWE-3210 can be configured with a 16 channel A/D card inside. The first eight channels are wired to the DAQ modules on the left side panel. Therefore, the other eight channels are brought to this ANALOG INPUT connector on the left side panel, whereby you may connect an expansion rack such as the DEWE-30-8, in order to address these eight channels.

DC Power & control cable

Pin	Signal	Pin	Signal
1	AI 8+	2	AI 8 GND
3	AI 9+	4	AI 9 GND
5	AI 10+	6	AI 10 GND
7	AI 11+	8	AI 11 GND
9	AI 12+	10	AI 12 GND
11	AI 13+	12	AI 13 GND
13	AI 14+	14	AI 14 GND
15	AI 15+	16	AI 15 GND
17	N.C.	18	N.C.
19	N.C.		

The DEWE-30-8 expansion rack needs two connections to the DEWE-3210 mainframe:

1. The analog connection as shown above via the 3210-EXP8-L cable as shown above, and

2. POWER and MODULE CONTROL are carried to the DEWE-30-8 expansion rack via the EPAD connector. Therefore, the additional modules in the expansion rack will be controllable within the software just as if the inputs were physically installed within the DEWE-3210 mainframe.

DEWE-30-8-EXPANSION Rack (Optional)

5 Operation Guidelines

System Startup Protocol

Installing the Smart Batteries

Systems are shipped with the hot-swappable batteries removed. You should install them, connect power, and charge up the batteries. Please follow these guidelines:

- Open the battery door on side of DEWE-321x and insert one battery into the top slot, and the other into the bottom slot. Leave the center slot open unless you have a third battery!
- When inserting the first battery you may notice that the system LEDs and fans will turn on for a second, this is normal when the battery module "wakes up."

⇒ **Never use any battery which appears to be damaged, or which is cracked, broken, hot to the touch, or unusual in any way. Lithium batteries can be dangerous if mistreated or improperly charged.**

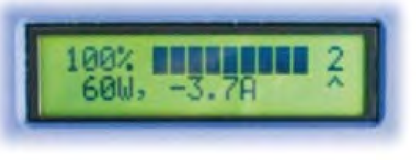
Please locate the BATTERY STATUS LCD, located on the panel just above the keyboard.

- With batteries in place, the LCD screen will display the charge level, charge/discharge state, power consumption and total current.
- The LCD (and battery module circuit) will always be ON, unless the batteries are removed

Please locate your DPS-2410 external power supply. This is included with each DEWE-321x system.

- Connect the included AC power cord to the DPS-2410, and then to a 120VAC power receptable.

The battery door on the side of the DEWE-321x is hinged, allowing you to access the battery compartment. Batteries can be removed by pulling on their flexible tabs.



The battery status LCD keeps you informed of how many batteries are installed (2 above), the charge level (100% above), and whether the system is charging or discharging.

The DPS-2410 AC/DC converter/power supply is fused with an automotive type power fuse. Please replace only with the same type and rating of fuse.

- Connect the included DC power cord to the DPS-2410 and then to the DEWE-3031's DC power input jack.
- Turn on the DPS-2410 power switch. A power LED will confirm that that it is receiving AC power and operating properly.

⇒ **Do not block the cooling fan of the DPS-2410! Overheating any electrical component is dangerous.**

☺ **NOTE: The DEWE-321x can be operated without batteries simply by connecting the DPS-2410.**

☺ **This can also help you refresh batteries which have become 100% discharged, which can happen over time. If the mainframe will not start up, simply remove all of your batteries, then power up the system using the DPS-2410. When the system is up and running, insert only one battery into the top slot. Wait 30 minutes and then insert a second battery into the second slot.**

For faster recharging, do NOT power up the DEWE-3xxx mainframe, but make certain that the DPS-2410 is powered on.

☺ **There are also one, two, and four slot external battery chargers optionally available. For an easy to use desktop charger for a single battery, please order the BAT-CHARGER-1. For a more robust four battery charger which can also be used as a DC power source, choose the Neutrino-4.**

Using the smart batteries

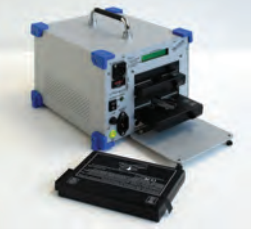
The "smart batteries" supplied with your Dewetron battery powered system are equipped with an integrated circuit which stores information such as manufacturer, serial number, production date, etc., and monitors the current battery status in terms of discharge rate, predicted remaining capacity, temperature, voltage etc.

BATT-95WH "smart batteries" are capable of displaying their charge state even when not plugged into anything.

With the push of a button, an LED display on the battery pack shows the current charge state in 25%

The DPS-2410 has a POWER SWITCH - be sure to turn it on, otherwise, DC power will not flow from it.

Optional BAT-CHARGER-1 is ideal for desktop usage.



Optional NEUTRINO-4 is a ruggedized four battery charger that also serves as a DC power supply

Press the white dot on the battery and the charge percentage indicator will show the approximate remaining charge, in 25% steps.

steps. An intelligent battery controller, integrated in our DEWETRON systems, takes care of the charging and discharging process in order to ensure maximum battery performance and lifetime.

Turning on the System

Locate the power switch on the front panel above the main screen. This is a momentary rocker type switch, where the white dot indicates the ON direction.

- Press ON and hold for one second to power the system on.
- Press ON and hold for 3 seconds to power OFF.
- Green POWER LED: lit when the system is powered on

☺ **The LCD battery display is ALWAYS on when any batteries are installed. This does not indicate that the system is powered on! Only the green POWER LED indicates system power on/off status.**

- Red HDD LED: lit when there is hard disk activity.

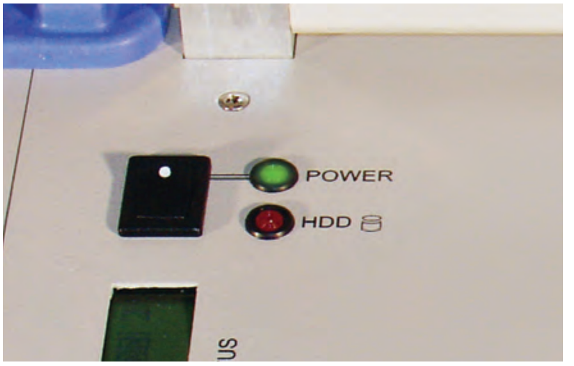
You will notice that the main screen's backlight will come on when power is applied. After a few moments the BIOS and Windows operating system messages and graphics will appear.

⇒ **If the system does not power on, ensure that you have batteries with at least 30% charge, or that the DPS-2410 is properly connected and TURNED ON.**

Hardware Protocols

Using the removable hard disk drive

The right side of the DEWE-321x has a 2.5" removable drive bay. This single bay has two separate hard drives inside it: a C drive for Windows and applications, and a D drive for data.



The DEWE-321x power switch is a momentary type, located on the front panel near the LED battery status display. To its right are LEDs for system power (green) and HDD activity (red).

⇒ **If this is the only hard drive in the system, do NOT remove it when the system is powered on! This will cause Windows to crash very badly. If you have an internal hard drive which has the Windows operating system, then removing the external drive is permitted when power is on, because you are not writing to it at that time.**

To remove the hard drive, you must have access to the keylock. Turn the key into the lock and then press the large button beside the lock to eject the drive. To insert another drive, reverse these steps.

The DEWE-321x right side panel contains the removable HDD and the optical media drive as standard.

Using the Optical read/write drive

Directly above the removable HDD is an optical drive which can read and write many formats of DVD and CD media. Note that DVD and CD authoring tools which are standard within the installed Windows operating system are available. No additional authorizing tools are included as standard.

A standard slimline optical drive, you open it by pressing the single button on the drive door beside the LED. Gently press-fit a compatible disk onto the spindle and then close the door.

If your system has Windows XP operating system installed, CD authoring software is built into Windows already. However, Windows XP does not include a DVD authoring utility, so you must purchase one separately

However, if your system has Windows 7 operating system installed, authoring capability for both CD and DVD media are included with the operating system.

Of course, in all cases, you are free to install whatever authoring software you prefer. There are some very nice third party utilities which are superior to the ones built into Windows.

☺ **Windows 7 Professional, 32-bit mode, was installed on these models starting in December 2010.**

The optical drive is located above the computer access door. Press the EJECT button to open the optical drive.

6 Connecting your Signals

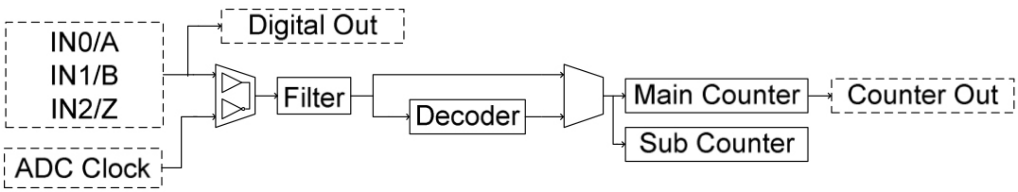
Analog input connections

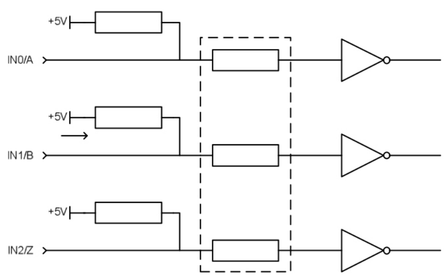
Because your DEWE-3210 and DEWE-3211 are compatible with so many different DAQ, MDAQ, PAD, EPAD, CPAD, and other Dewetron modules, please refer to those signal conditioners in the Appendix for complete details about how to connect your signals to them.

Counter/Encoder input connections

The DEWE-321x is suited with synchronous 32-bit advanced counter and digital inputs. In addition to the basic counter function like simple event counting, up/down counting and gated event counting also period time, pulse width, two-edge separation, frequency and all encoder measurements are supported.

All counter inputs can also be used as digital inputs. In addition to the basic counter input selections, the ADC clock can also be used as counter source. The figure below shows the block diagram of the counter and input overvoltage protection.



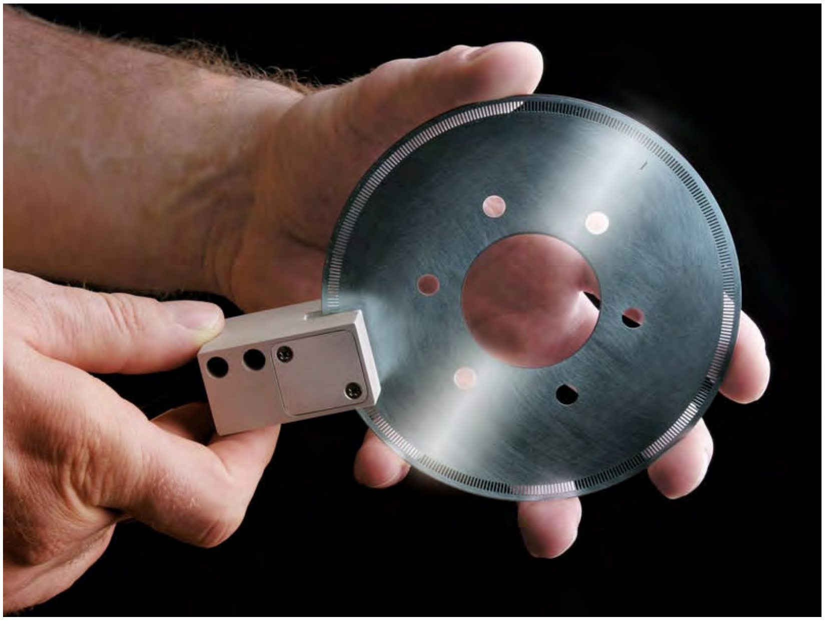


1) Pull-up resistors 2) Over-voltage protection 3) Buffers

Counter Applications

each counter block is equipped with three inputs. With this three inputs the following applications can be done:

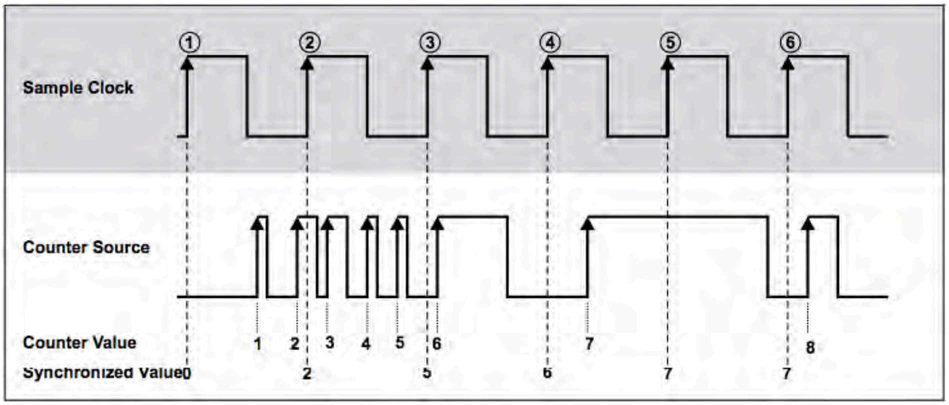
- Event Counting
- Gated Event Counting
- Up/Down Counter
- Frequency Measurement
- Period Time Measurement / Pulse Width Measurement
- Two Pulse Edge Separation
- Quadrature Encoder (X1, X2, X4, A-Up/B-Down)



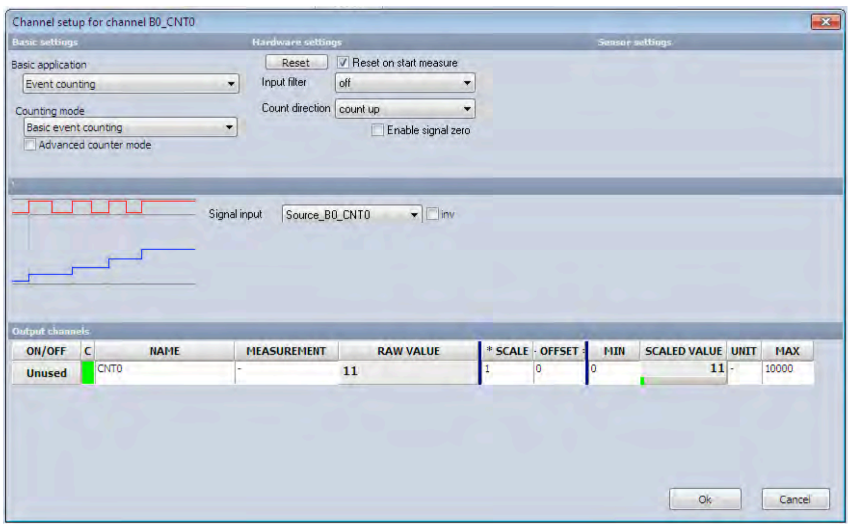
Event Counting

In Event Counting the counter counts the number of pulses that occur on counter source. At each sample clock the counter value is read without disturbing the counting process. The figure below shows an example of event counting where the counter counts eight events on Counter Source. The synchronized value is the value read at the sample clock (see the encircled numbers in the figure, e.g. (1), (2), (3)...).

Event counting figure :



Software setup:



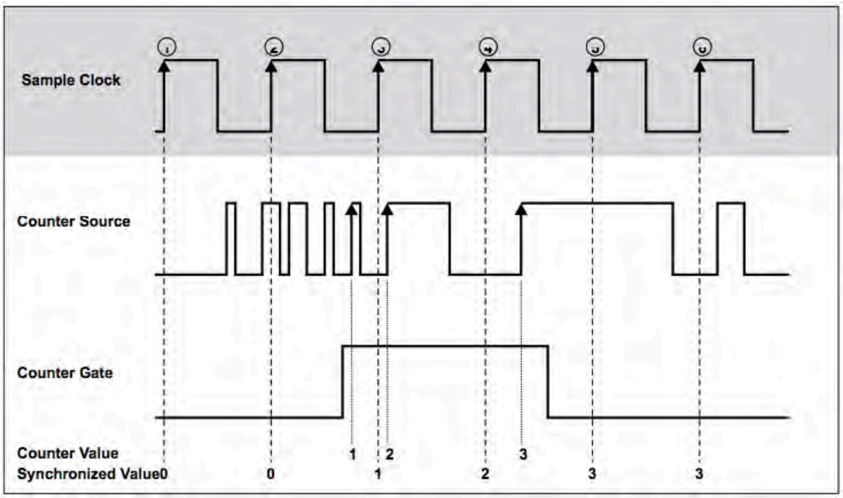
☺ **If counting the falling edges is necessary, the input signal can be inverted.**

Gated Event Counting

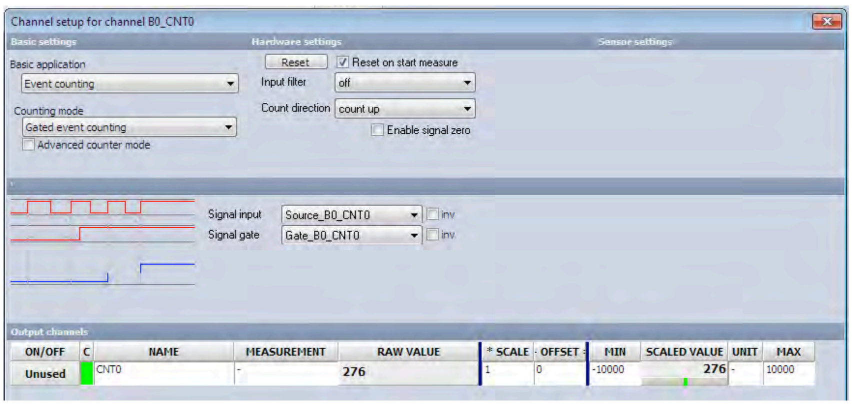
Gated Event Counting is similar to Event Counting except that the counting process is gated. When the counter gate is active, the counter counts pulses which occur at the counter source. When the counter gate is inactive the counter retains the current count value. At each sample clock interval the current value is read.

The figure below shows an example of gated event counting where the counter counts three events on the counter source. At (1) and (2) the counter value is zero, because the gate signal is inactive. At sample clock (3), (4) and (5) the actual counter value is read out. At (6) the same value as at (5) is output.

Gated event counting figure:



Software setup:

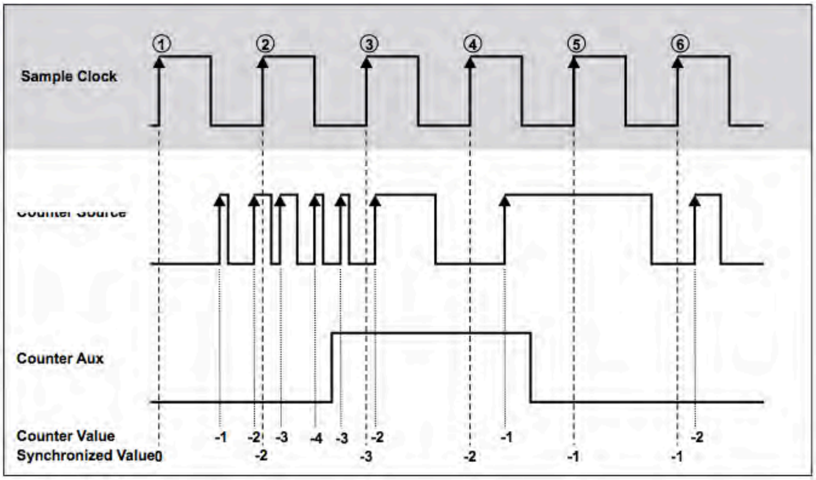


☺ **If counting the falling edges is necessary, the input signal can be inverted.**

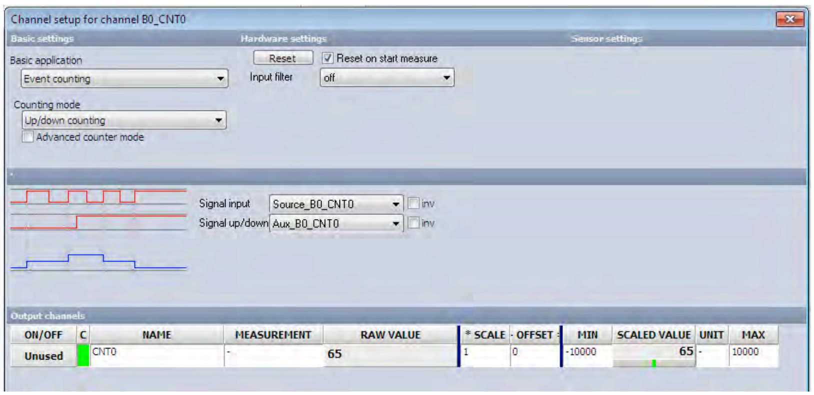
Up/Down Counter

The Up/Down Counter counts the rising edges on the counter source. The direction of the counting depends on the signal state on the counter aux pin. If counter aux is active (high level), the counter value increases; if counter aux is inactive (low level), the counter value decreases.

Up/Down counting figure:



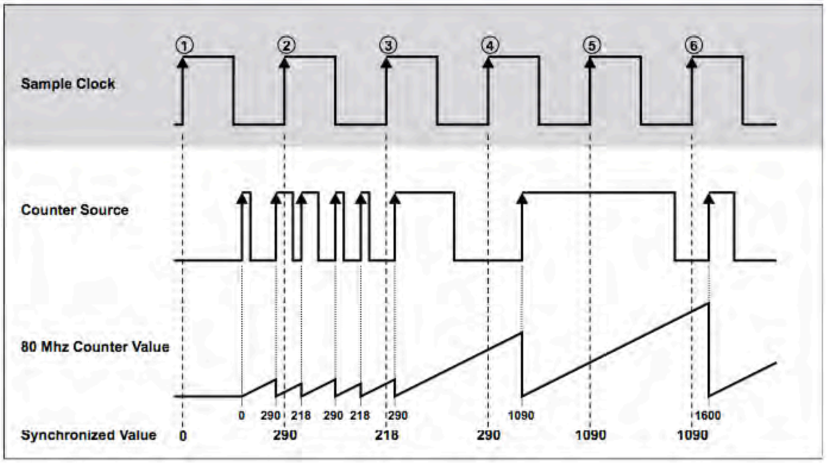
Software setup:



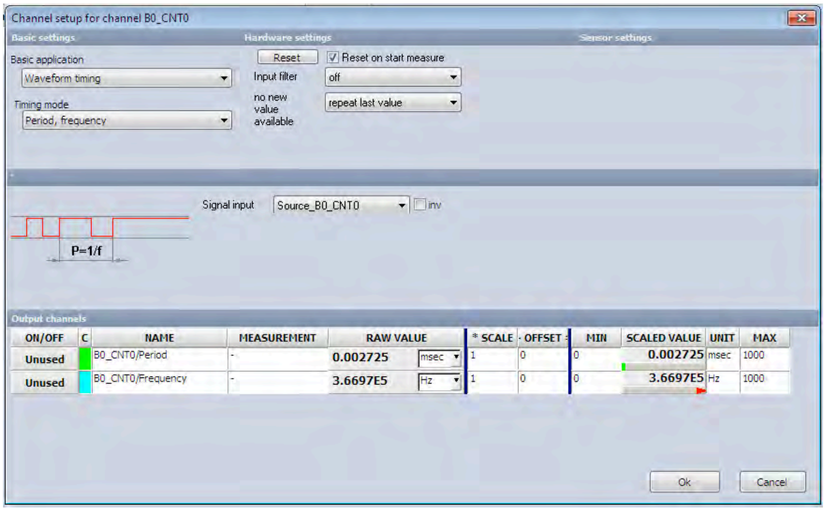
Period Time Measurement

In Period Time Measurement the counter uses the internal time base to measure the period time of the signal present on Counter Source. The counter counts the rising edges of the internal time base which occurs between two rising edges on Counter Source. At the completion of the period interval the counter value is stored in a register and the counter starts counting from zero. At every Sample Clock ((1), (2), ... (6)) the register value is read out.

Period time measurement figure:



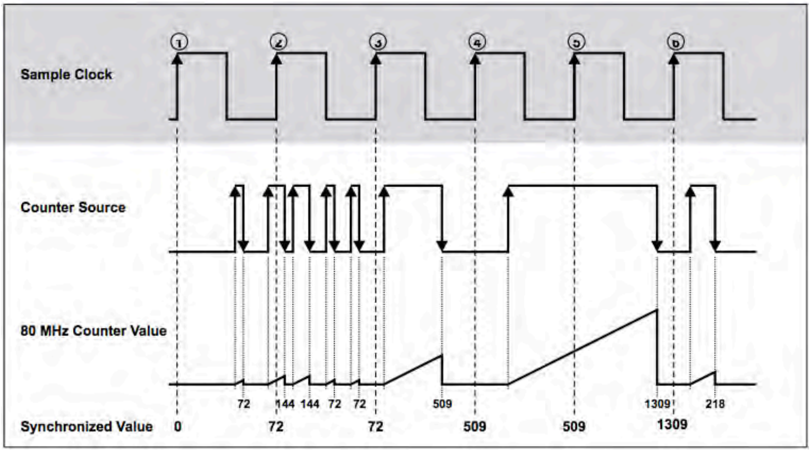
Software setup:



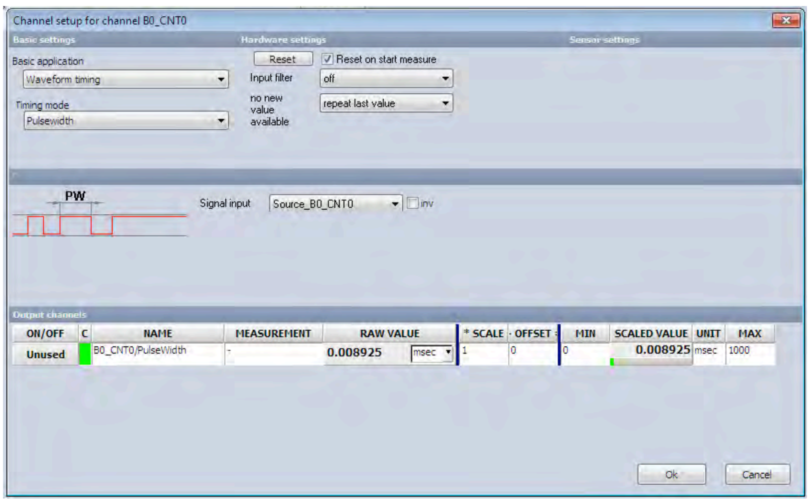
Pulse Width Measurement

In Pulse Width Measurement the counter uses the internal time base to measure the pulse width of the signal present on Counter Source. The counter counts the rising edges of the internal time base after a rising edge occurs on counter source. At the falling edge on Counter Source the counter value is stored in a reg- ister and the counter is set to zero. With the next rising edge on Counter Source the counter starts counting again. At every Sample Clock ((1), (2), ... (6)) the register value is read out.

Pulse width measurement figure:



Software setup:

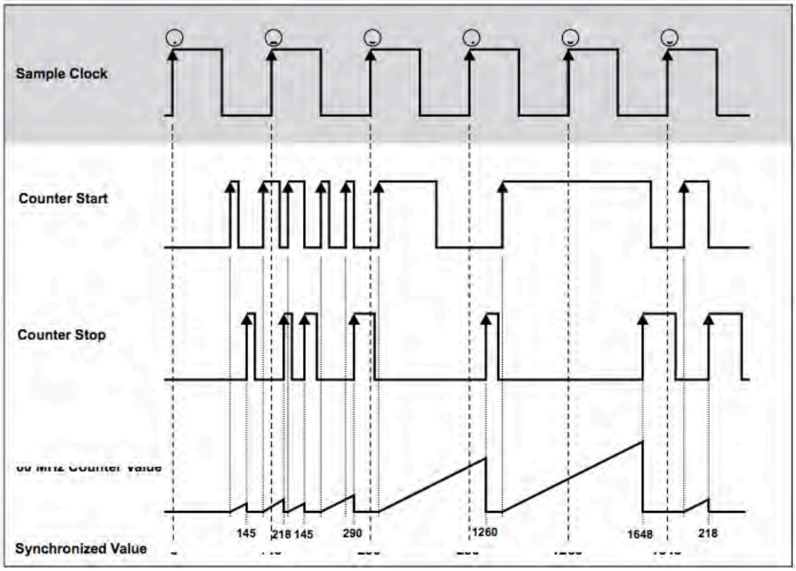


☺ **Note: to measure the LOW time of the signal, invert the input.**

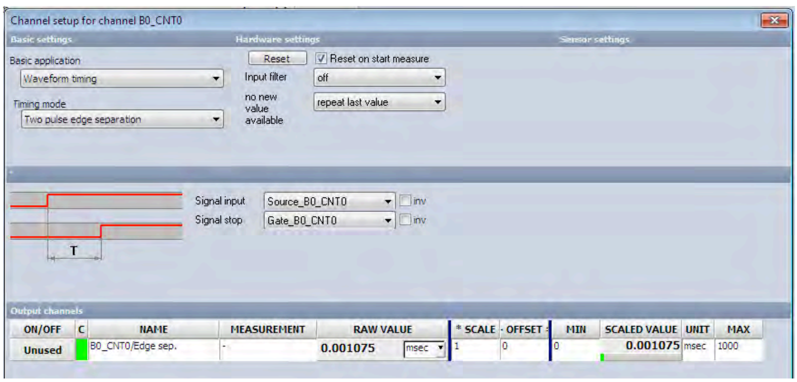
Two Pulse Edge Separation Measurement

The two pulse edge separation measurement is similar to the pulse width measurement, except that there are two input signals: Counter Start and Counter Stop. After a rising edge has occurred on Counter Start the counter counts rising edges of the internal time base. Additional edges on signal start are ignored. After a rising edge has occurred on Counter Stop the counter stops counting and the value is stored in a register. At the next rising edge on Counter Start the counter starts counting from zero again. At every Sample Clock ((1), (2), ... (6)) the register value is read out.

Two Pulse Edge Separation Measurement figure:



Software setup:



☺ **If the input signals are inverted, the falling edges will be used for counting.**

Motion Encoders

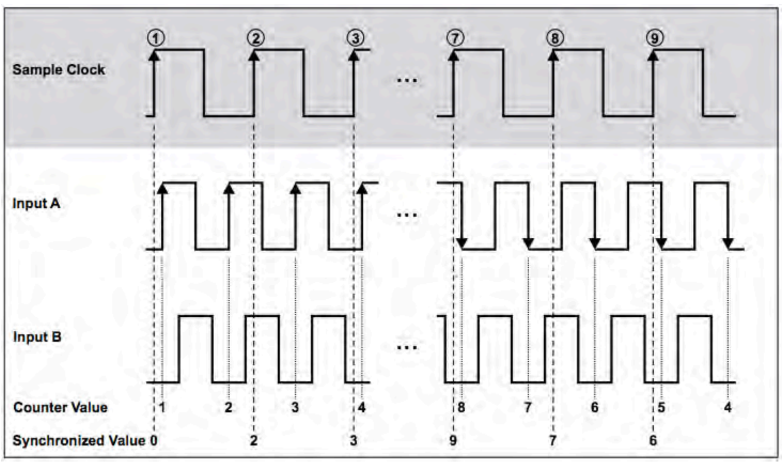
Motion encoders have usually three channels: channel A, B and Z. Channel A and channel B provide the square signals for the counter, and have a phase shift of 90°. From this phase shift the decoder is able to recognize the rotation direction of the motion encoder. The third channel outputs one pulse at a certain position at each revolution. This pulse is used to set the counter to zero. The number of counts per cycle at a given motion encoder depends on the type of decoding: X1, X2, or X4. Some motion encoders have two outputs, which work in a different way. Either channel A or channel B provides the square signal, depending on the direction of the rotation.

The next sections illustrate the basic encoder modes that are supported:

Quadrature Encoder

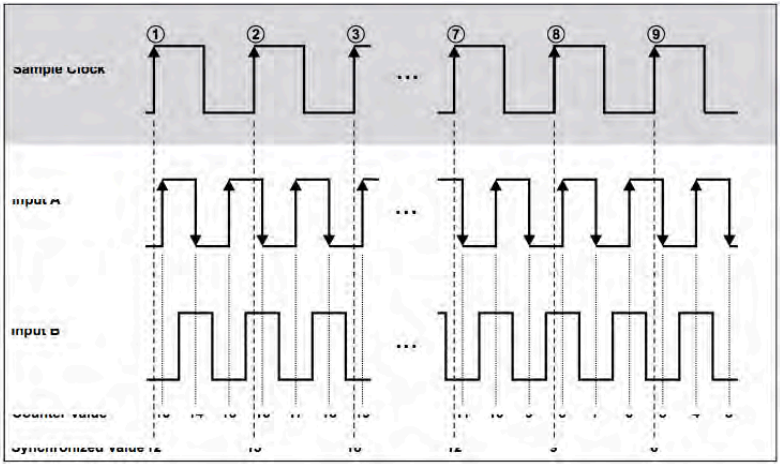
In the first case, X1 decoding is explained. When Input A leads Input B in a quadrature cycle, the counter increments on rising edges of Input A. When Input B leads Input A in a quadrature cycle, the counter decre- ments on the falling edges of Input A. At every Sample Clock ((1), (2), ... (9)) the counter value is read out.

Quadrature Encoder X1 Mode figure:



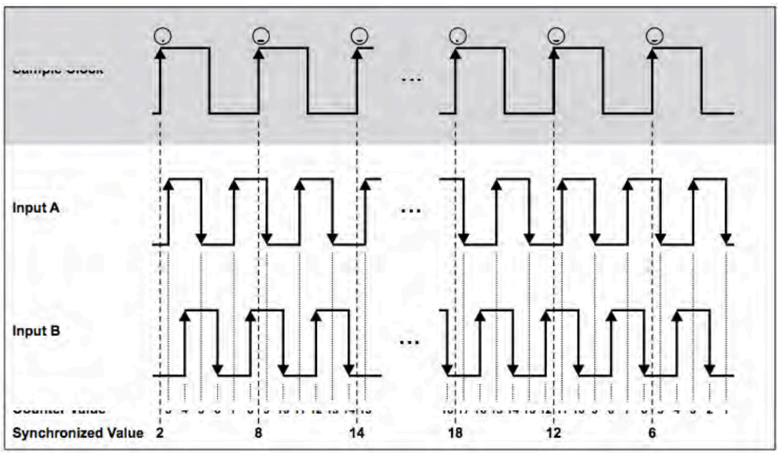
For X2 encoding the rising edges and the falling edges of Input A are used to increment or decrement. The counter increments if Input A leads Input B and decrements if Input B leads Input A.

Quadrature Encoder X2 Mode figure:



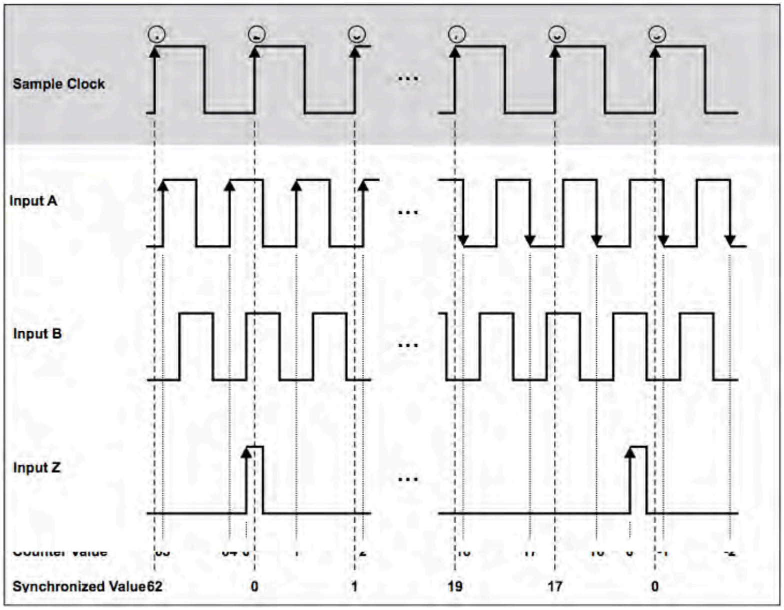
Similarly, the counter increments or decrements on each edge of Input A and Input B for X4 decoding. The condition for increment and decrement is the same as for X1 and X2.

Quadrature encoder X4 figure:

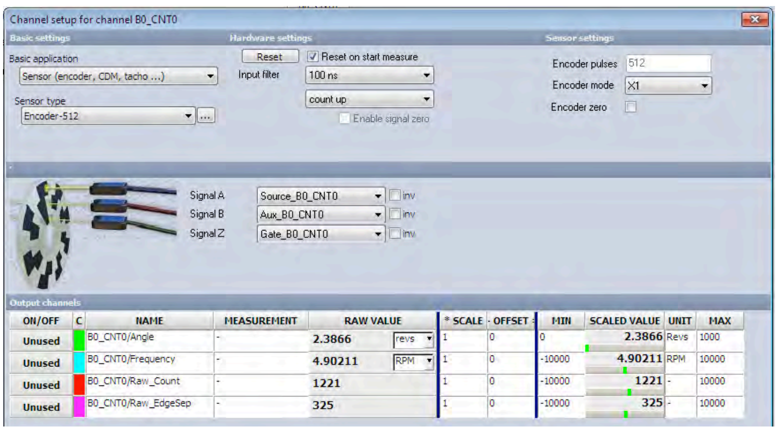


The third channel Input Z, which is also referred as the index channel, causes the counter to be reloaded with zero in a specific phase of the quadrature cycle. The figure below shows the results for X1 encoding with input Z.

Quadrature Encoder with channel Z figure:



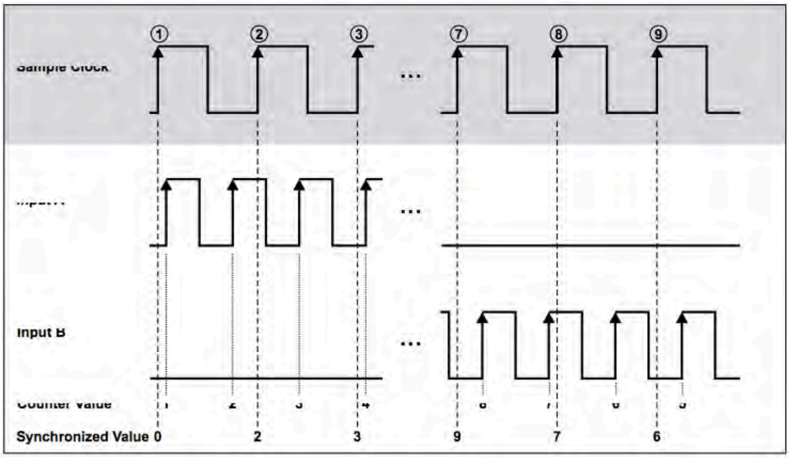
Software setup:



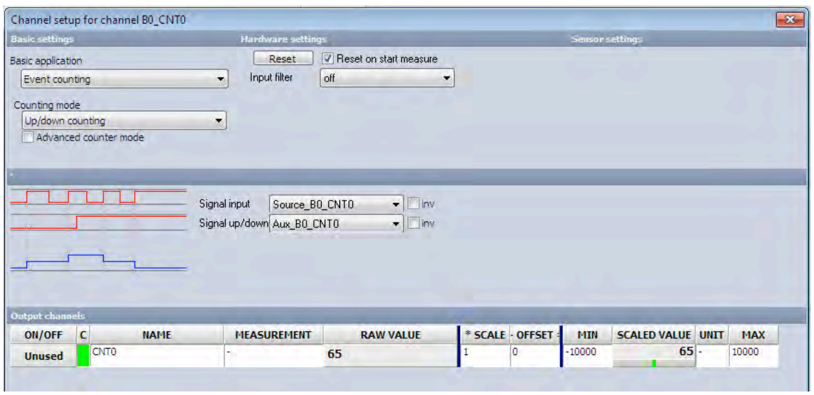
A-Up/B-Down Encoder

The A-Up/B-Down Encoder supports two inputs, A and B. A pulse on Input A increments the counter on its rising edges. A pulse on Input B decrements the counter on its rising edges. At every Sample Clock ((1), (2), ... (9)) the counter value is read out.

A-up/B-down Encoder figure:



Software setup:



Frequency Measurement

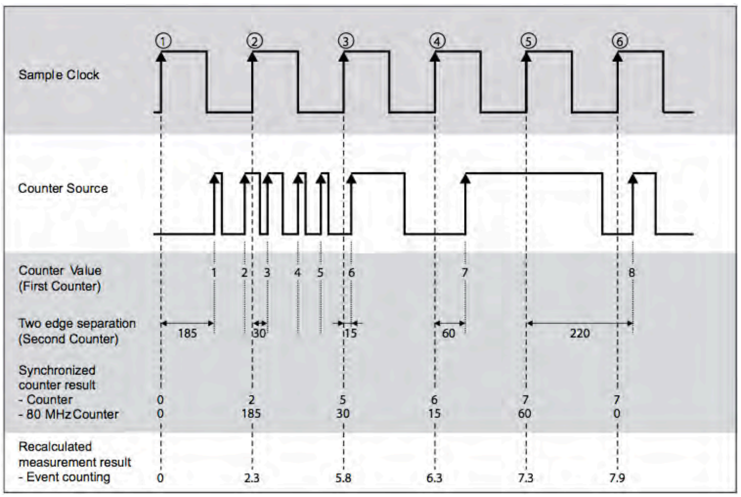
In general it is possible to take the inverse of a period measurement to get the frequency of the input signal. If the period time measurement is done an inaccuracy of counted internal time base cycles of ±1 cycle ap- pears, because the counted cycles of the internal time base depends on the phase of the input signal with re- spect to the internal time base. For long period times, and therewith low frequencies, the measurement error is negligible. At high frequencies, and therewith short period times, few cycles are counted. In this case the error of ±1 cycle becomes significant.

Accuracy at period time measurement figure:

Input Frequency	Number of internal time base cycles	Measurement error of -1 cycle	Measurement error of +1 cycle	Calculated frequency with error of -1 cycle	Calculated frequency with error of +1 cycle
40 kHz	2000	1999	2001	39,98 kHz	40,02 kHz
10 MHz	8	7	9	8,75 MHz	11,25 MHz

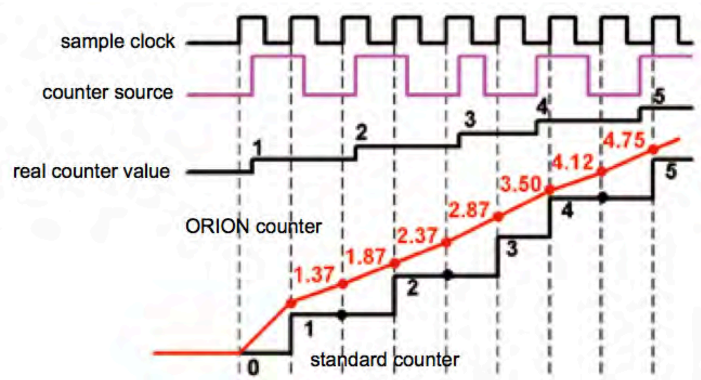
For higher precision result the frequency measurement is done with two counters. In each case two counters are paired, i.e. it have to be used counter 0 and counter 1 or counter 2 and counter 3 or counter 4 and counter 5 or counter 6 and 7 for the frequency measurement. The first coun- ter counts the rising edges on Counter Source. The second counter counts the rising edges of the internal time base. At every rising edge on Counter Source the counter value of the second counter is stored in a register. At every Sample Clock ((1), (2), ... (6)) the values of both counters are read out.

Frequency measurement figure:



With these both measurement results not only the frequency can be calculated in a precise way. Also the event counter result can be show in fractions because the exact time when the event occurs at the input is known. The event counting result is recalculated with interpolation to the exact sample point like shown in the diagram above.

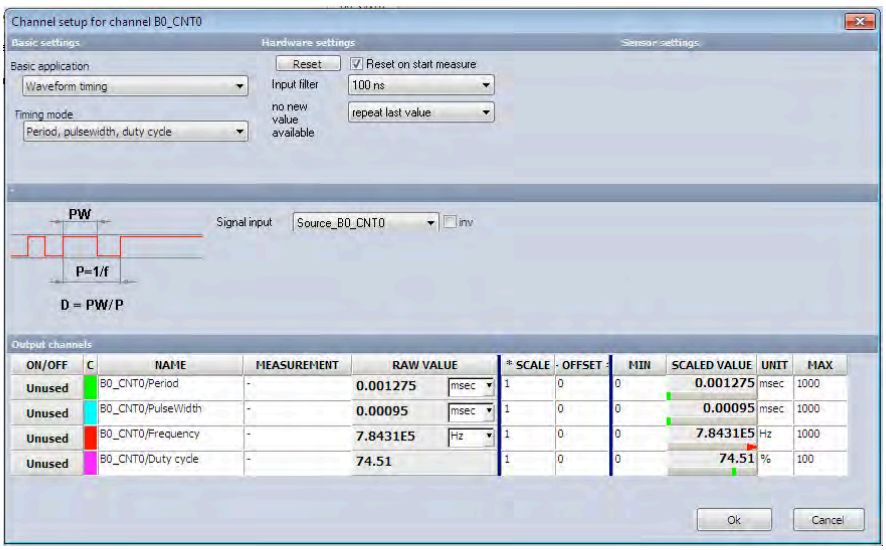
In the next figure, the difference of the measurement result is shown. While a standard counter input shows the value up to one sample delayed, the counter input of the counter calculates the counter result at the exact sample point:



☺ **For low frequency input signals the frequency also can be obtained by measure the period time and take its inverse without more inaccuracy.**

Period, pulsewidth, and duty cycle

Software setup:



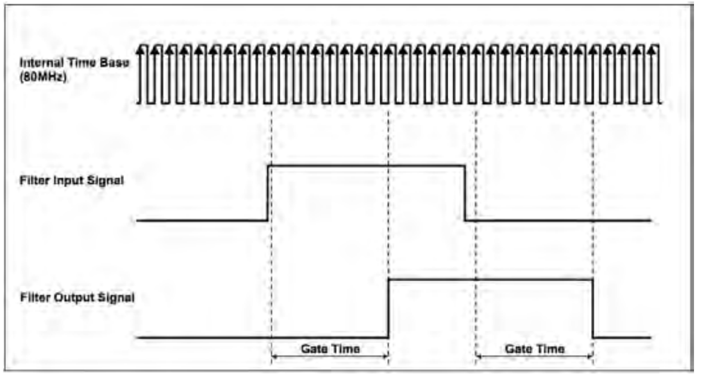
Miscellaneous counter functions

Filters

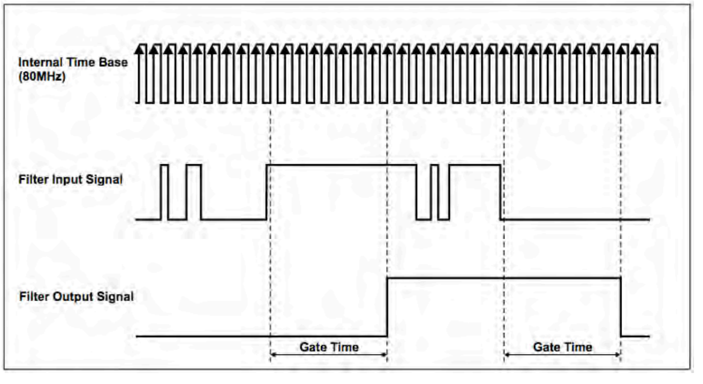
Each counter input has a digital filter, which can be set to various gate times. If the gate time is set to "Off", no filter is on the input signal. The purpose of filtering is to eliminate unstable states, e.g. glitches, chatter,et al, which may appear on the input signal. Noise can be mis-counted, and should therefore be eliminated.

The filter circuit samples the input signal on each rising edge of the internal time base. If the input signal maintains his state for at least the gate time, the new state is propagated. As an effect the signal transition is shifted by the gate time.

The figure demonstrates the function of the filter:



Below, input signal with chatter, before and after filtering:



The filter can be chosen between eight filter settings:

Off, 100 ns, 200 ns, 500 ns, 1 µs, 2 µs, 4 µs and 5 µs.

Two examples of filter settings:

The 100 ns filter will pass all pulse widths (high and low) that are 100 ns or longer. It will block all pulse widths that are 75 ns or shorter. The 5 µs filter will pass all pulse widths (high and low) that are 5 µs or longer and will block all pulse widths that are 4.975 µs or shorter.

The internal sampling clock (time base) is 80 MHz, so the period time amounts 12.5 ns. Pulse widths be- tween gate time minus two internal time base period times may or may not pass, depending on the phase of the input signal with respect to the internal time base.

Properties of all filter settings:

Filter settings	Pulse width to pass	Pulse width to be blocked
100 ns	100 ns	75 ns
200 ns	200 ns	175 ns
500 ns	500 ns	475 ns
1 µs	1 µs	975 ns
2 µs	2µs	1.975 µs
4 µs	4 µs	3.975 µs
5 µs	5 µs	4.975 µs
Off	-	-

Reset on start measure

Usually all counters are reset at the start of data acquisition, i.e., the counter value is set to zero at the start of data acquisition. In some applications this is not required. For example, an angle encoder is adjusted to the physical zero position at the beginning of a test procedure. By resetting the counter at every start of the measurement this adjustment will be lost. Without this reset the counter is also active if the acquisition is interrupted between the test cycles. As a result the counter types out the absolute angle position at the measurement output all the time.

Count Direction

As default setting the count direction is in up-counting mode. Every rising edge at the input will increase the counter value. The DEWE-ORION-1616-10x supports also down counting without the need of an additional input like in the up/down counting mode.

No new value available

Especially in every kind of input period time measurement mode (also pulse width or two pulse edge separation measurement) there may be new information between two samples. Also measuring the line frequency of about 50 Hz with a sample rate of 10 kSamples/sec means, that only after every 200th measurement new input frequency information is available. Another example is the measurement on rotating machines if the sensor output frequency is lower than the sample rate. Depending on the application you can choose between two different output data settings:

- Repeat last value: last measured cycle time is taken until a new measured cycle time is available
- Make zero value: as soon as no input information is available the output is set to zero

7 Quick start guide to operation

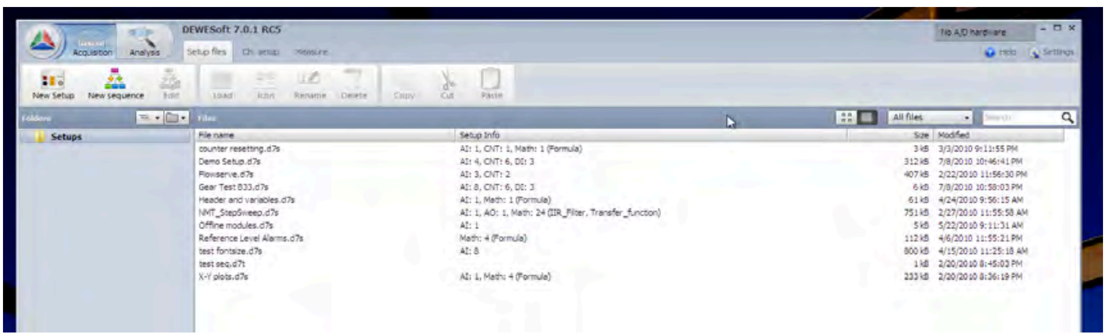
Using DEWESOFT data acquisition software to record and analyze data.

Part 1: Acquisition and Analysis

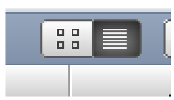
Where to Start?

Turn on your Dewetron system. When Windows is loaded, find the DEWESoft icon on the desktop. It looks like this:

Double-click it. When DEWESoft loads, it will be in the ACQUISITION mode by default, showing any existing SETUP FILES that you have created. It should look like this:



The files might also look like icons. This is selectable near the top right corner of the window using these buttons:



You can load any setup file by simply double-clicking it from this page. But don't do that yet: let's make a new setup file. Before doing anything, we need to cover some questions that you might have already:

What kind of files are these?

These are SETUP files. In the ACQUISITION mode you create a system setup, which is used to record a DATA file.

Are these my data files?

No, these are not data files. You cannot see or load your data files in the ACQUISITION mode!

Why can't I see my data files?

You can if you change to the ANALYSIS mode. But DEWESoft starts up in the ACQUISITION mode by default.

What is the difference between ACQUISITION and ANALYSIS modes? Why do I need them?

ACQUISITION - in this mode you set up the system and store (record) your data

ANALYSIS - in this mode you can see your stored data, print it out, export it, and analyze it further

Where is my data stored? How do I get to it?

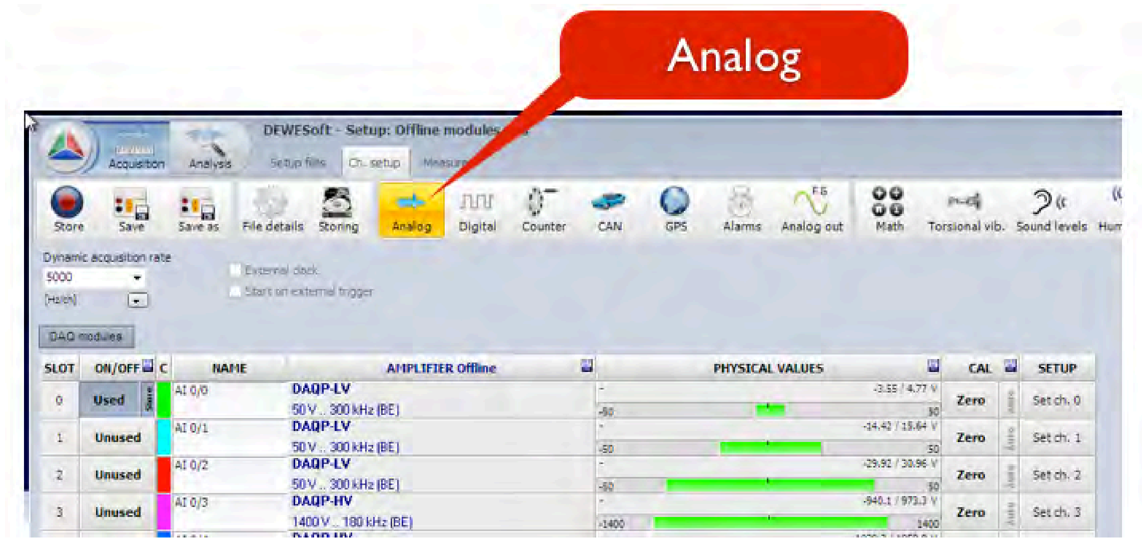
It's stored on the hard drive. And don't worry, we will be loading and replaying captured data files in a few minutes!

Start with a Blank Setup

Click [Ch. Setup] in the ribbon:

When you do this, you will be on the ANALOG setup screen first. This is where you set up the analog inputs of your system. You might have other setup screens for DIGITAL, COUNTER, CAN, VIDEO and more inputs... but let's focus on the analog inputs in this QuickStart. Notice that the Analog screen is highlighted in yellow when selected.

Below it you will see your channels. How this looks will vary according to which kinds of signal conditioners your system has, and how many channels. Here is a system with eight DAQ modules:

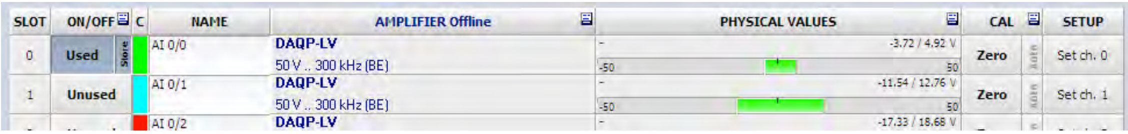


Notice that DEWESoft automatically activates the first channel for you. You need to activate the ones that you want to store when you record data.

Each channel is shown on one row which has these fields: Slot, On/Off, (Color), Name, Amplifier, Physical Values, CAL, and SETUP:

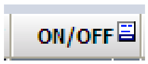
Activate the Channels

All channels that are set to USED will be stored when you press STORE. It does not matter whether the channel is shown on the display screen or not! If it is activated here as USED, it will be stored. It is possible to activate a channel but not store it - this is an advanced feature not covered here.

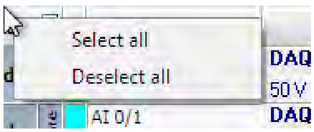


To turn on more channels, simply press their [Unused] buttons, and they will change to [Used].

☺ **HINT: to turn on (or off) all channels at once, click the top of the column and select from the menu that will appear:**

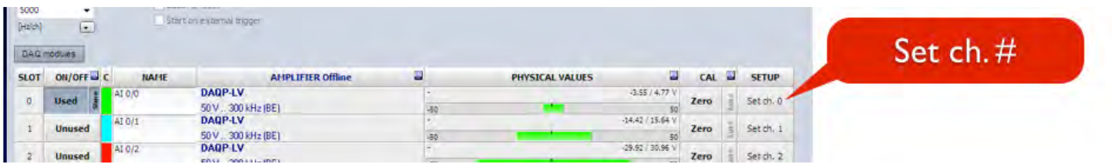


"Select all" will turn ON all channels, while "Deselect all" will turn them all OFF.

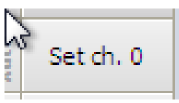


Set Up Your Channels

The easiest and most direct way to configure a channel is to click the "Set ch. #" button all the way to the right:



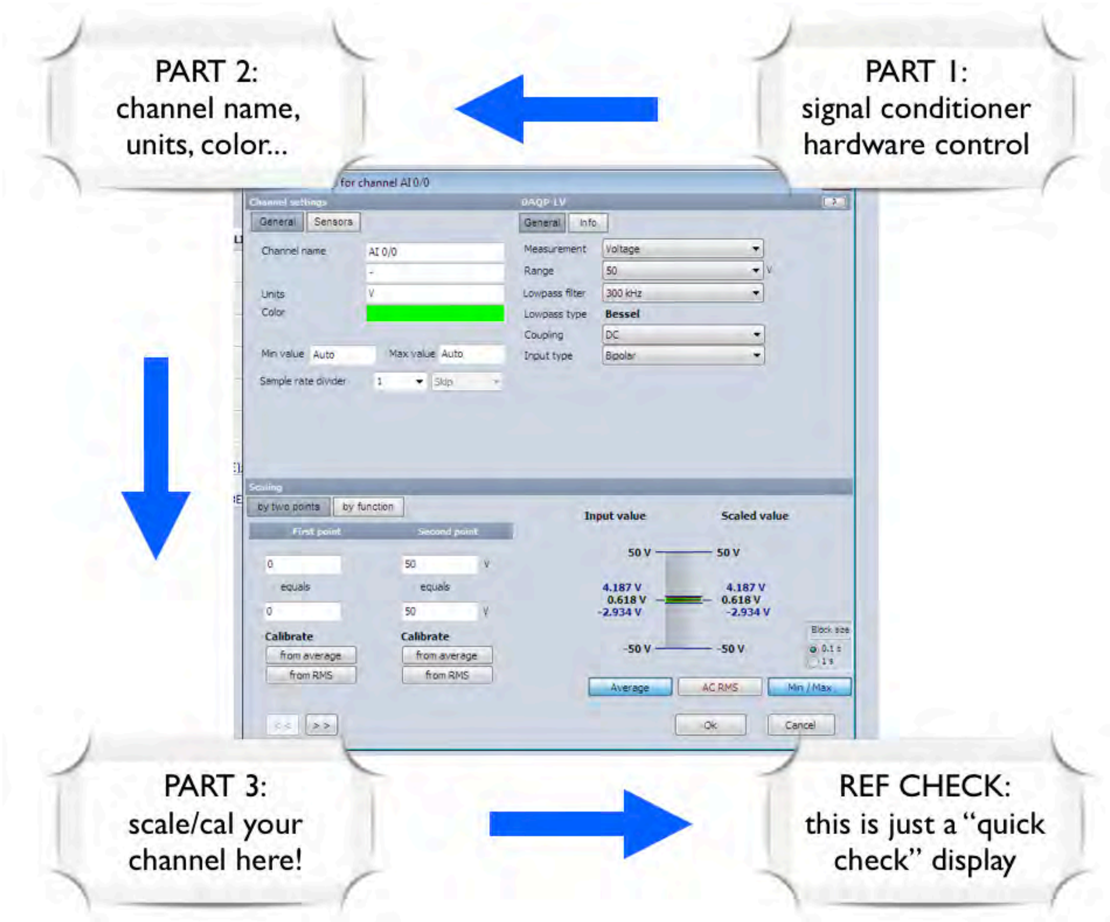
To configure channel 0, for example, click the [Set ch. 0] button.



The channel setup dialog will appear. This is a critical screen to learn about, so let's take a close look at what it does and how to use it.

Channel Setup Dialog

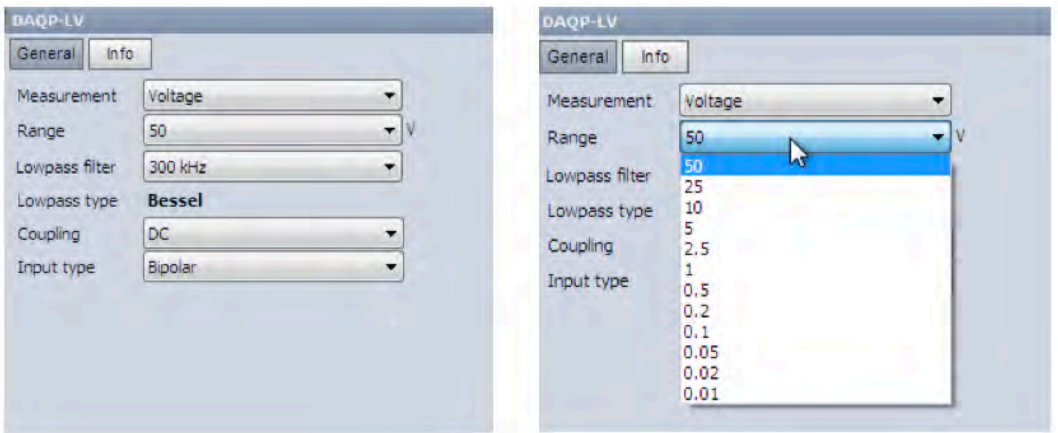
This dialog seems complex at first, but it's really quite simple once you understand what it contains and how to use it. There are four sections:



PART 1: signal conditioner hardware control (top-right quadrant)

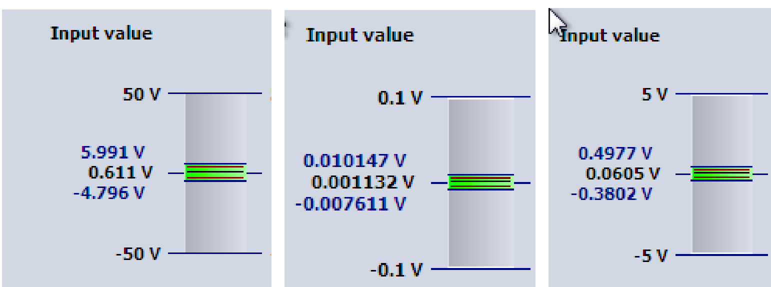
It is best to configure this section first, because this actually controls the signal conditioning HARDWARE. In the example above, we have a DAQP-LV low voltage module, which has two basic input types: voltage and current.

Assuming we want to measure voltage, simply set the RANGE using the selector:



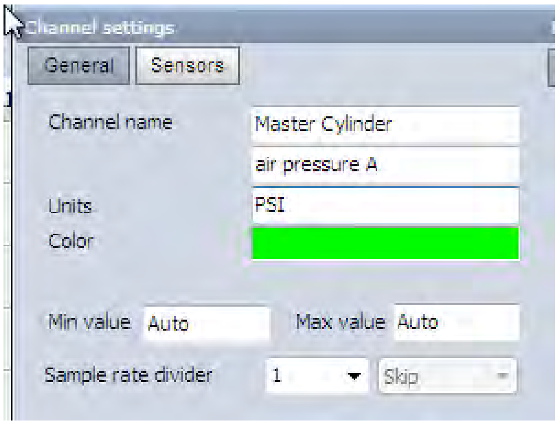
Now set the filter (if you have an MDAQ system, you may or may not have the filter option). Different signal conditioners have different settings, so please refer to the details about them. In this quick start we will just use voltage modules and keep it simple.

In our example we set the range to 50V. Have a look at the reference section and you will see this on the LEFT SIDE of the bar graph. Note that if you change the range, this will change directly below on the bar graph:



PART 2: channel name, units, color… (top-left quadrant)

Now enter a short name for this input channel, any additional info you want into the next field, and then the UNIT OF MEASURE. This is important to do before moving to the next section.



In the example above, we are configuring a channel which will be used to measure air pressure in PSI.

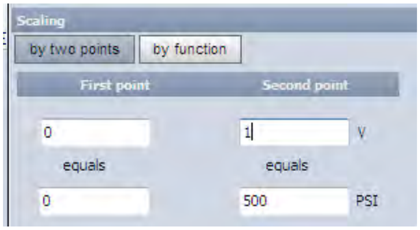
You can also set the color here. The "Min value" and "Max value" and "Sample rate divider" fields will be explained later. These are more advanced, so please ignore them for now.

PART 3: Scale/CAL your channel (bottom-left quadrant)

In this section you enter whatever scaling your input needs.

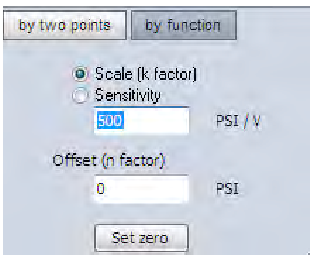
☺ **NOTE : If you are simply measuring voltage from a voltage module, you don't need to do any scaling (unless the voltage has been stepped down before being input to the Dewetron system).**

Let's say that your transducer outputs 1V for 500 PSI. All you need to do is enter these values into the "by two points" fields, as shown here:

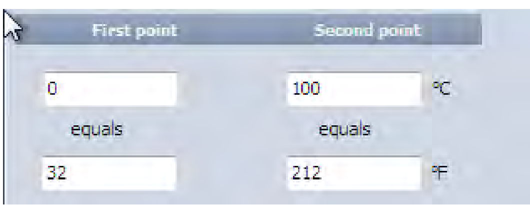


In other words, when your sensor outputs 0V, this represents 0 PSI. But when it outputs 1V, that represents 500 PSI.

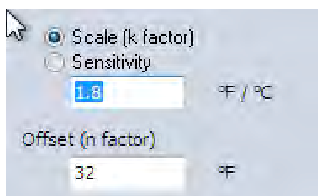
This simply establishes the slope of the scaling. In this case it is a linear function which multiplies the input by 500 and changes the UM from V to PSI. You can click the [by function] button and see this algebraically:



This slope is the famous y = mx + b equation from high school. The scaling is created by a multiplier and an offset. In our example, the offset is zero (none). But there are times when the offset is not zero. For example, if you are scaling from Celcius to Fahrenheit. These two temperature measurement systems have placed ZERO at different places: 0° C = 32° F. So to scale from C to F you would set it up like this:



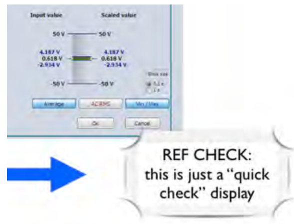
or…

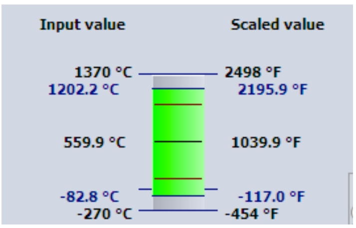


It doesn't matter whether you use the 2-point scaling method or the function scaling method to scale your channel! Use whichever one is more comfortable to you and the scaling factor that you prefer. Both of the methods above are the same. They both express the equation C x 1.8 + 32 = F

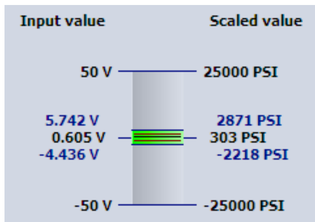
Reference Check (bottom-right quadrant)

This fourth quadrant of the channel setup screen provides a handy reference, where the ACTUAL input scale is shown on the left side of the bar graph, and the result of your scaling is shown on the right side of the bar graph:



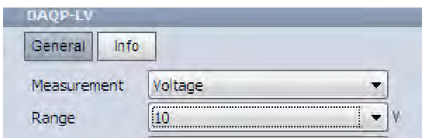


or …

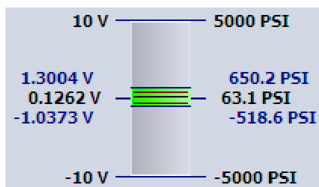


☺ **NOTE : DEWESoft will show the data in your scaled units of measurement from this point forward! Of course, the data are really stored unscaled, to preserve all of their resolution, but they are always shown scaled according to what you do here, during and after recording. They are also exported in scaled engineering units.**

Look at the channel above on the right, our PSI channel. It shows ±25,000 PSI. But this is too much: your sensor will output only 8 volts max, so the 50V range is too much. No problem! Change the ACTUAL measuring range from 50 to 10V, and look what happens:

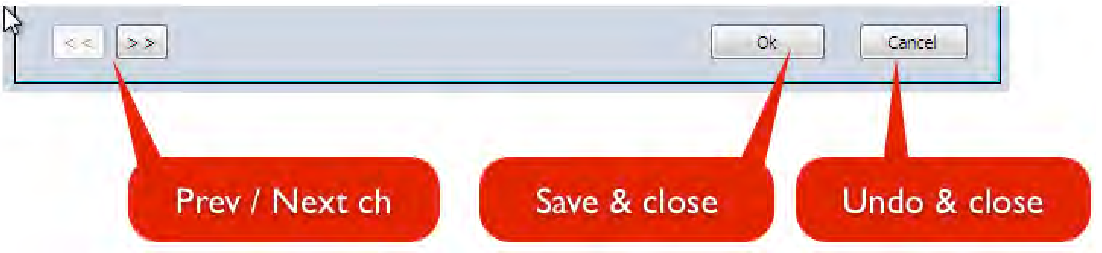


>> results in >>



Now the measurement range of 10V yields a scaled measurement range of ±5000 PSI, which is what you were looking for. In this way you can see the relationship between the ACTUAL hardware measuring range and the SCALED measuring range.

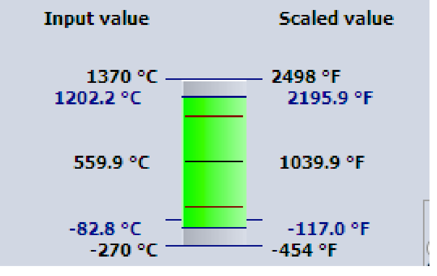
If everything looks good, then you are ready to move on to the next channel. You can either click [OK] at the bottom of the setup dialog, or click the [> >] button to move to the next channel:



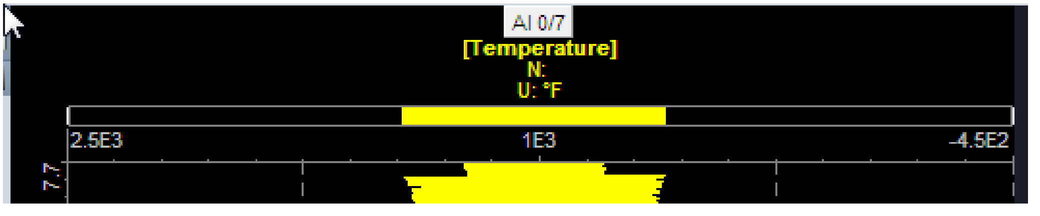
Change the Display Scale

One very important thing to note is that the scaled range shown on the right side of the bar graph on the setup screen sets the DEFAULT DISPLAY RANGE for this channel. Therefore, if you were to put this channel into a strip chart, scope, or analog meter gauge on the display screens, the scale will be taken from this bar graph.

Let's take the example of the thermocouple channel, which is scaled like this:



So, if we put this channel into a strip chart, DEWESoft will set the scale to match the right side of the bar graph, like this:



Note that DEWESoft set the channel's display scale from -4.5e2 (-454°F) to 2.5e3 (+2498°F).

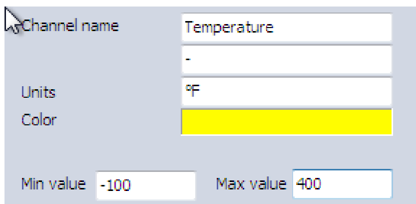
But what if this range is too much? Let's say that you expect to only really measure from -100°F to +400°F?

You can change it right here on the graph, which we will cover later. But even better would be to PRE-set the display scale of this channel, so that when you put it into a graph or meter which has a scale, it will automatically be set to the desired span. How to preset this default display scale? It is back on the channel's setup screen, in section 2:

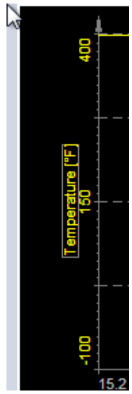
Setting the Default Display Range

If you refer back to PART 2: channel name, units, color..., you will find two fields that we skipped over before. They are labeled "Min value" and "Max value". By default they say "Auto" in them, which means that the display range of this channel will be set to the same min and max values of the reference bar graph. But you can override that by entering numbers into either or both of these fields!

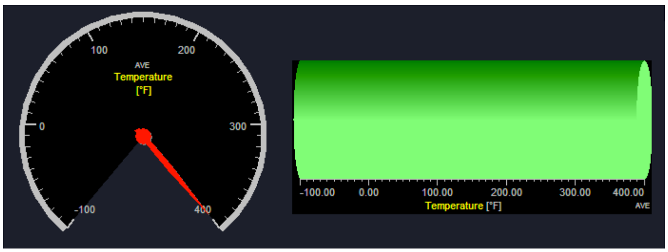
So in our example, we want the temperature channel's default range to be -100°F to ±400°F, therefore we would enter that like this:



Note that making this change will not CHANGE the range of any existing graph, but you can coax them to defer to these settings by right-clicking on the channel name within the graph:

after right-clicking on the channel name inside the graph:


And when you add this channel into graphs for the first time, they will be scaled at -100°F to ±400°F automatically!

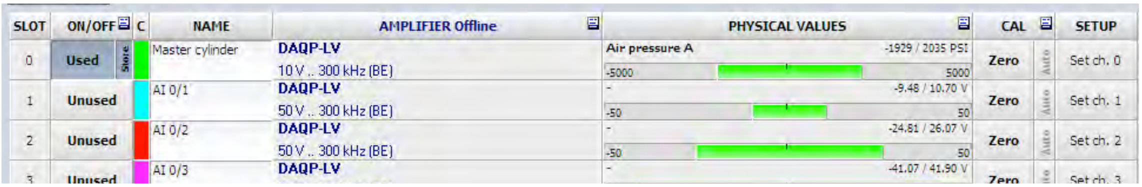


Above, the same temperature channel shown in several different kinds of graphs and meters, they all have the default -100°F to +400°F display scale, because you have preset the display scale back on the setup screen for that channel.

Copying Channel Settings

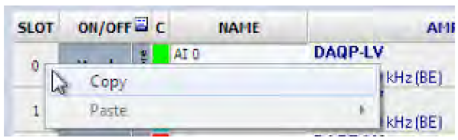
You just learned a lot in setting up that channel. You set the actual hardware range/filter, then moved left to the channel name, description, units, and possibly set the display range, then moved down to do the scaling… all the while keeping an eye on the reference bar graph to ensure that this channel was set correctly. At this point you might be worrying that this is a lot of work to do on every single analog channel. Is there a shortcut you can take to speed up the process?

Yes! Normally you will have several channels whose configurations are very similar. Here is our set up screen:



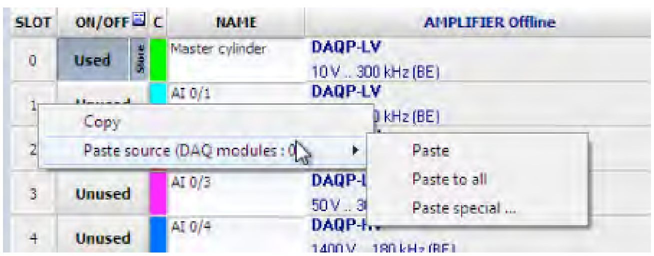
OK, you just set the first channel up … and the next three channels are going to be very similar. Their hardware settings will be the same, and possibly even their scaling, display scale settings, etc. How do you copy those settings from channel 0 to the next three channels?

Easy. Click the first box in the SLOT column of the channel that you want to copy:



When you click the SLOT box of any channel, it pops up the Copy/Paste menu. Only Copy is active, since there is nothing to paste yet. Click Copy.

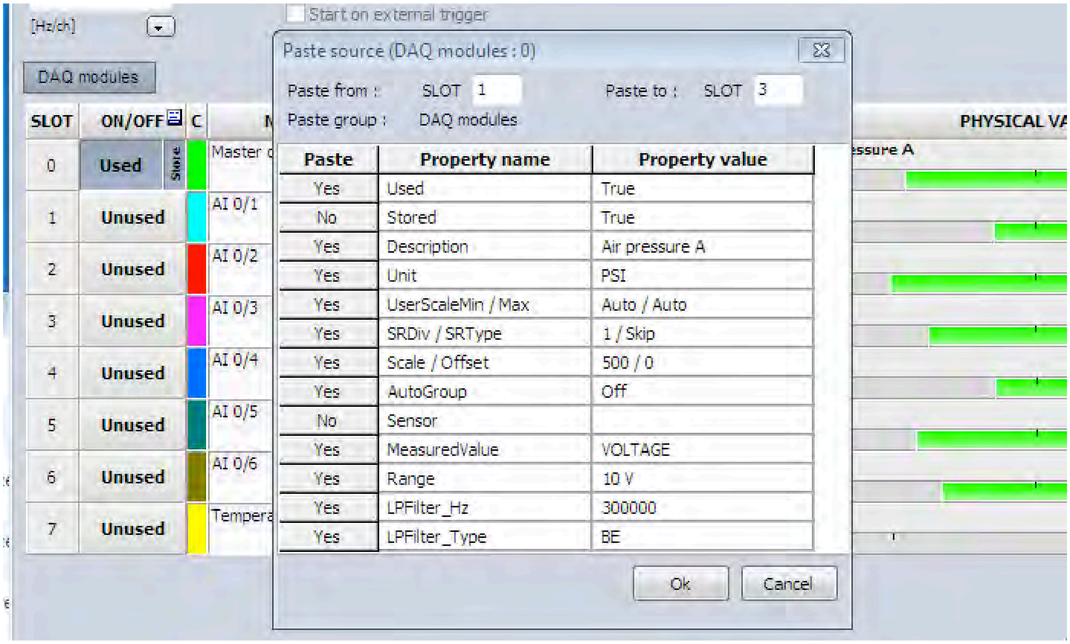
Now click on the SLOT box of channel 1, the next channel down. Suddenly the Paste menu item is active, so click it to paste the settings from Channel 0 to Channel 1:



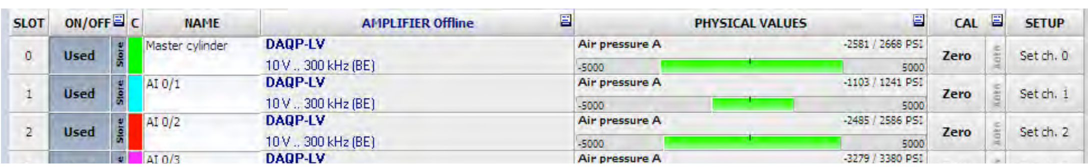
Now you get some very nice choices, which make the copy/paste process very flexible. Here is what each of the three sub choices under Paste source (<module type> : <channel>) means:

- **Paste** - it will simply paste the settings from the channel you copied to this channel, EXCEPT that it will not paste the channel name, channel color, or the Used/Unused status to this channel.
- **Paste to all** - it will paste the settings from the channel you copied to ALL channels, EXCEPT that it will not paste the channel name, channel color, or the Used/Unused status to the other channels.
- **Paste special...** - here you can choose exactly which parameters it will paste from the channel you copied to this channel, or even a range of channels. So if you wanted to really make them all the same color, or paste to a range of channels (example: copy channel 14 and then paste it to channels 23 to 31).

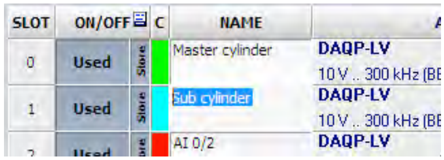
If you select the Paste special... option, you get this screen where you can control what gets pasted, and to which range of channels:



You can click the boxes in the PASTE column to toggle whether this parameter gets pasted or not. As mentioned, the Used/Unused status is not normally pasted from one channel to another, but here we can override that and paste that, too, as well as the channel name, etc. At the top we told it to paste from Slot 1 to Slot 3, so that channels 1, 2, and 3 will receive this paste simultaneously. Click OK to execute the paste, and see what happens:



The Paste Special function turned those three channels on and pasted every parameter except the channel names and colors from channel 0 to channels 1, 2, and 3. Now you can just modify the channel names right here, and you're ready to go.

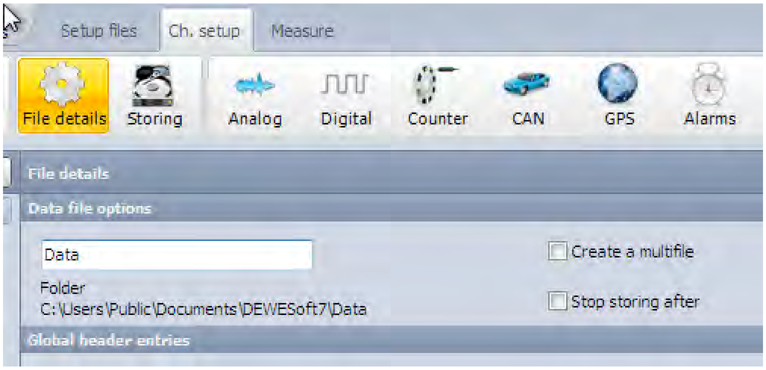


Just double-click in the white field under the Name column to directly edit any channels' name. You don't need to open up the [Set ch. #] dialog box to enter a name or pick a color.

OK, our analog channels are all set up - let's make the final adjustments and then record some data.

Set the Data File Name

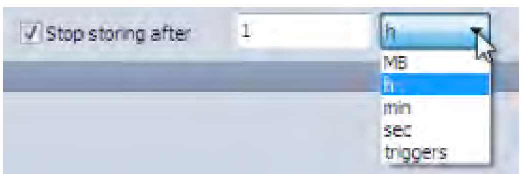
You need to tell DEWESoft what to NAME your captured data file. In other words, you need to set the file name. For this function, please click the File details button in the toolbar:



By default, DEWESoft will put a name like Data into this field. Type in whatever you want, avoiding characters that are illegal to use in Windows filenames, such as $ <> {} [] / \ | ; : , -- you know the list! If you stick with numbers, letters, underscores and hyphens you will be OK.

Automatic Recording STOP function

Let's say that you want to start storing, and then have DEWESoft record for one hour automatically. Or stop after a certain file size is reached. These functions are easy to control using the Stop storing after checkbox that you can see here. Check it, and some settings controls will appear automatically for you:



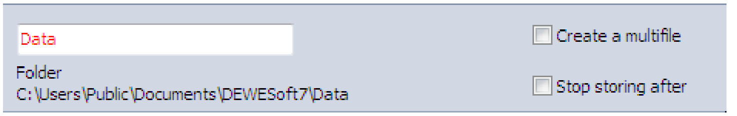
With Stop storing after checked, you can set DEWESoft to stop storing automatically based on time (hours, minutes, or seconds), or file size (in MB), or number of triggers within the file.

Automatic File Numbering

Notice the checkbox called Create a Multifile. This means that DEWESoft will automatically name your files for you, so you don't have to keep entering a new name each time you want to record data.

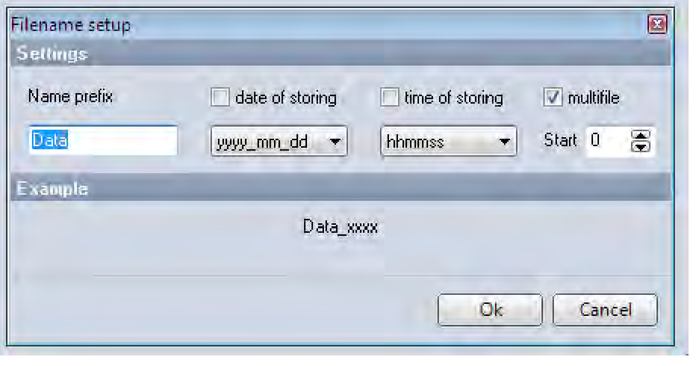
If you don't use multifile, and you stored data right now, it would be stored to the filename Data.d7d.

If you come back here, this screen would look different. Do you notice the difference?



If you saw that the filename "Data" is now written in RED, then you were correct. DEWESoft shows a filename in RED here if this file already exists! So if you were to try and store again, DEWESoft would stop and tell you that this file exists, and give you the chance to either overwrite it with new data, or enter a new name.

To avoid this, check the Multifile box, and then use the setup button that will appear to pre-configure how DEWE-Soft will automatically name your files, like so:



The way it is set above, the base part of the filename will be Data, and each time you store data, DEWESoft will add an underscore and then four digits, starting at zero. So you will get a series of data files called:

Data_0000.d7d

Data_0001.d7d

Data_0002.d7d

Data_0003.d7d

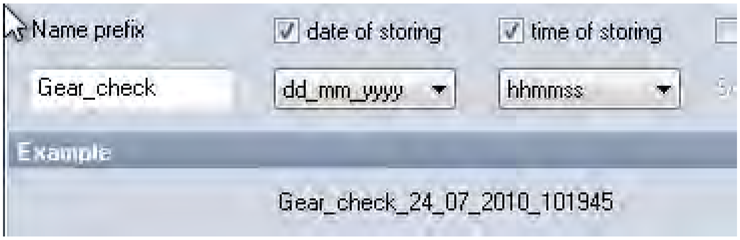
Data_0004.d7d

...

and so on.

Notice also that you could elect to start numbering the files at something higher than 0000. Simply select or enter a starting file number.

Of course, you can change the base part of the filename to anything supported by the Windows OS. In the example below we entered Gear_check as the base part of our filename.



You may also turn on the DATE to be added to the filename. You could also turn on the TIME, which will disable the number at the end (you cannot have both).

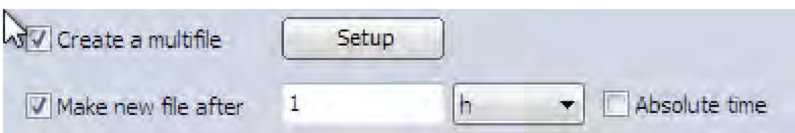
In the gray example area, you will see a preview of how your files will be named (as shown above).

Automatic file SWITCHING function

When multifile is not checked, the box below it is called Stop storing after, and as we saw, it allows you to set DEWESoft to stop storing according to how big the file is, or when a certain amount of time has elapsed.

But when multifile is checked, the Stop storing after function changes slightly to be called Make new file after. In this case, DEWESoft will not stop recording per se, but it will close the current data file and immediately open a new one, which will be named according to the active multifile settings. In other words, instead of STOPPING storage outright, DEWESoft will switch to the next file in the series automatically.

Check the box and you will get similar configuration controls as before:



As before, DEWESoft can switch files automatically based on time (absolute or relative), file size, or trigger count. If you want one triggered event per data file, this is the way to do it, for example. Set it to triggers and set the quantity to 1.

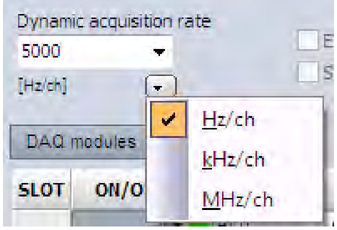
Set the Sample Rate

You need to select a sample rate. This is the number of samples per second that DEWESoft will store for each of your active analog channels. If you have four channels active, and you select a sample rate of 10 kS/s for example, DEWESoft will stored 10 thousand samples per second for each of the four channels. This means that 40,000 samples will be stored each second. In a 16-bit system that means 80,000 bytes of data per second. In a 22 or 24-bit system, it is 160,000 bytes of data per second.

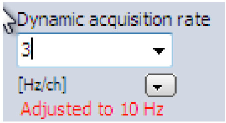
☺ **Note : Typically you should select a sample rate which is at least twice as high as the highest frequency that you want to measure. The higher the rate, the more time axis resolution you will get, but the bigger the file will get!**

You set the rate right here on the ANALOG setup screen, just above the channel list:

Use the Dynamic acquisition rate to set the sample rate. Using the small triangle at the bottom of the field you can change the units of the sample rate, as shown here. So if you think in kiloHertz, for example (kSamples per second per channel), you can select that instead of Hz/ch). You can work in Hz, kHz, or even MHz if you have a really fast system. When you change sample rate units, the value shown in the box will also change accordingly.

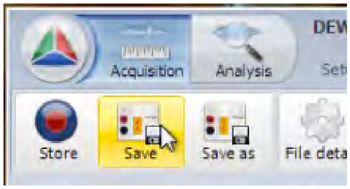


To select a rate, either choose one from the list that drops down from the little triangle, or simply type one into the field and press ENTER on the keyboard. If DEWESoft cannot do this range, it will correct it and show you what it can do:



There are several storing modes in DEWESoft, but in this first example we are simply going to store manually, by pressing STORE then STOP. Later in this QuickStart guide we will come back and learn how to use reduced storage mode and the triggered modes.

Save Your Setup



Everything that you can set up in DEWESoft is saved to a setup file that you can name freely (according to Windows file naming restrictions of course). It is ALWAYS a good idea to save your setup before moving on from here.

You need to be in the SETUP mode (as we have been for many pages now). On the left side of the toolbar are large buttons for [Save] and [Save as]. If you have not yet named this setup file and you click [Save], DEWESoft treat this the same as if you had clicked [Save as].

Use [Save as] to save the current setup configuration to a new name. So you can open an existing setup that you like, use [Save as] to make a copy of it under a new name, then change it freely! No need to start from the beginning each time.

WHAT'S NEXT?

Yes, there are many other kinds of channels that Dewetron systems typically have, such as digital inputs, counter/encoders, video cameras, CAN BUS interfaces, and more… but this is a quickstart guide and we will focus on making simple analog input recordings.

There are also several storing methods, such as triggering and reduced data. But for the quickstart we will focus on the ALWAYS FAST mode, which is like a tape recorder: you manually press STORE and DEWESoft records your active input channels at the selected dynamic acquisition rate, until you press STOP.

Are you ready to record some data?

It is better if you have some real signals connected to your channels. Even a simple 9VDC transistor battery, or a function generator that can output a sine wave, is a great way to input signals. If you have nothing but straight lines on the screen, it is impossible to learn how to zoom in, for example.

So please take a moment and connect at least one real signal to your dewetron system, and then let's move forward to the MEASURE screen, where we will use the default displays and STORE some data.

After that we will learn how to replay it.

Using the Acquisition Screens

When you click ACQUISITION from the ribbon at the top of the DEWESoft window, the default displays will appear: Overview, Scope, Recorder, and FFT:

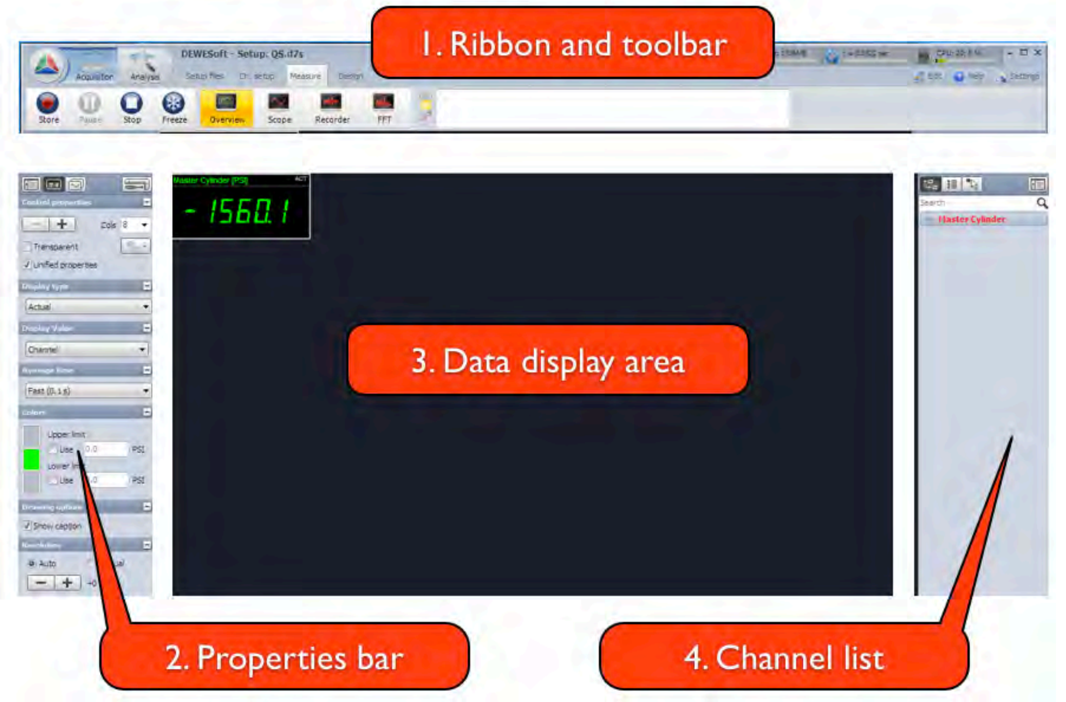
If this is your first visit to Overview, there will be a digital meter group containing any channels that are set to USED back on the analog setup screen.

In the example above, just one channel is active.

☺ **Note : going back and activating more channels will not automatically add them to this screen - you have to do that manually.**

Elements of the Acquisition screen

What exactly do the Acquisition screens contain? It might seem complex at first, but there are really just four main functional groups of objects, as shown here:



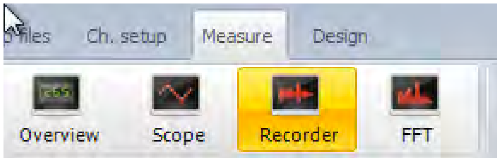
Notice that four screens are created for you by default. click on the Scope, Recorder, and FFT screens and see how they are set up by default. You can change everything about these screens as mentioned earlier, but for now let's use them as they are, and then come back to the design functions later.

1. RIBBON AND TOOLBAR - contains the DEWESoft ribbon, where you can navigate among the setup screens, display screens, and design mode. Also contains the toolbar, which has buttons to start and stop storing data, and select which screen to display.

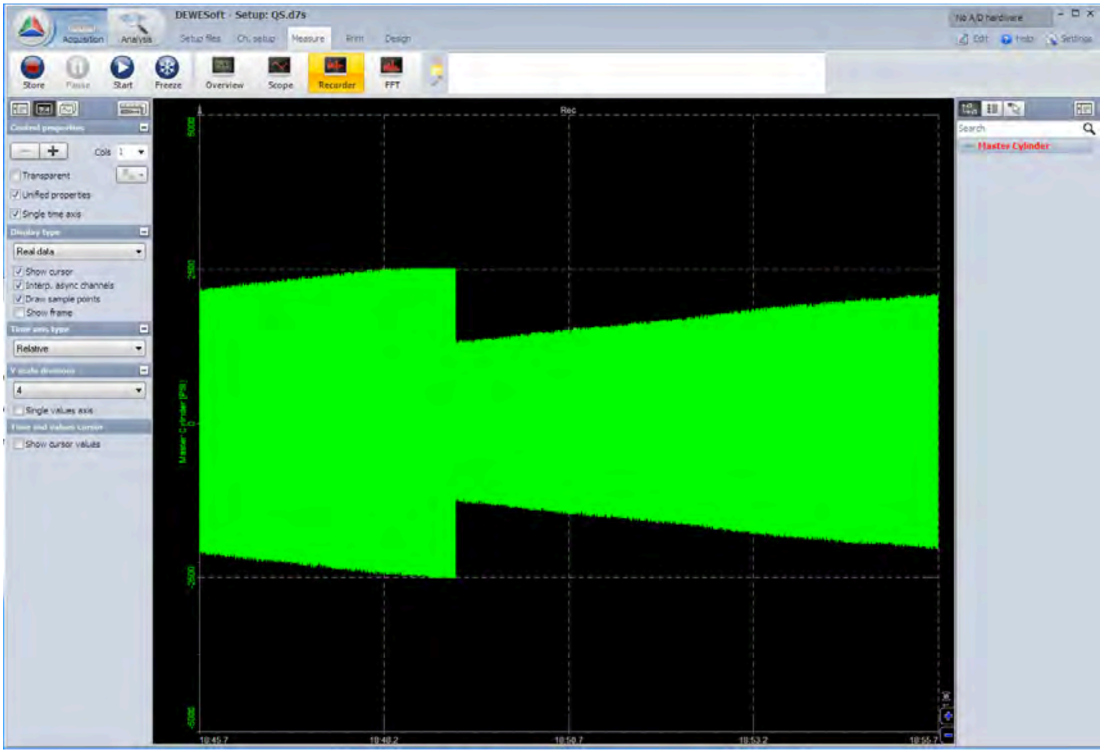
2. PROPERTIES BAR - where you can set the properties of any display widget in the Data display area, as well as the properties of each display screen

3. DATA DISPLAY AREA - where your signals are shown, according to which display screen has been selected from the toolbar

4. CHANNEL LIST - shows your channels, and allows you to assign them into graphs and widgets.



Please click on the Recorder button in the toolbar to activate that display:



The recorder shows you one big graph by default. Or perhaps more graphs depending on how many channels were set to USED when you first come here after leaving the setup screen. We had only one channel USED, so DEWE-Soft gave us one graph with our one channel on it. Common questions at this point:

Is my data being stored already? I see it moving on the screen!

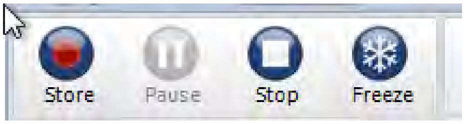
No. It is being monitored but not yet stored, because we did not click the STORE button yet.

I see some data that just went by, but I want to save it to disk. Is this possible?

No, data being monitored is not stored. It is not possible to capture it now.

Can I freeze this display right now? What about when I am storing data?

To freeze the display when just monitoring data (not storing), press the STOP button. It will change to say START when you do that, so that you can re-start it moving on the screen.

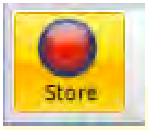


If you are STORING data, and you press STOP, the recording will STOP and the screen will stop moving.

If you want to freeze the display while DEWESoft continues to store data in the background, use the FREEZE button instead! This is limited by a RAM buffer, so you cannot freeze the display and look back in time beyond the amount of RAM that is available for this function.

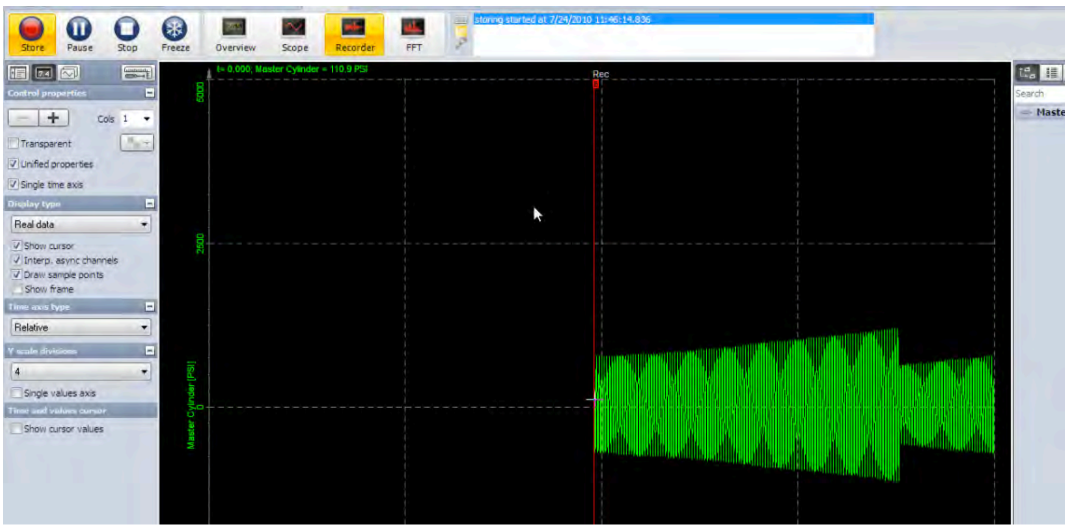
Speed up/Slow down the recorder graph

If the data are scrolling past too slowly or too fast, use the blue [+] and [-]

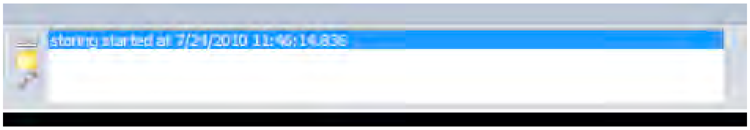


STORE SOME DATA

Let's get down to business and record some data. Press the STORE button and the screen will be cleared. A red vertical line appears and your data is now storing to disk. This is also indicated in the LOG in the toolbar area:



Close-up view of the recording log:



Marking your recordings with EVENTS

During recording, you can mark your data in three ways:

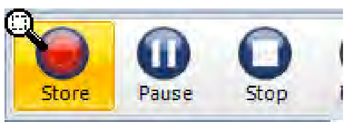
- Notice event - just hit the spacebar on the keyboard, and a gray line will be time-stamped and added to the recorder graph. This is like the simple event marker of an old fashioned chart recorder.
- Text event - press the N key on the keyboard. Click on the log area if necessary to open the log for typing. Just type in whatever you like. The text event will be time-stamped according to when you pressed N, not when you finish typing, so there is no rush!
- Voice event - (requires that sound events be activated in the project configuration, and that your Dewetron system has a usable sound card installed) press and hold V on the keyboard, and talk into your PC mic (not included by Dewetron). A short voice message will be added to the data file.

You will see all of these events later when you reload this captured data to the screen. More about that later.

Each event type is indicated on the screen with a vertical line of a different color. You can also activate them using the little icons near the log area instead of the keyboard shortcuts, as shown here.

Stop storing...

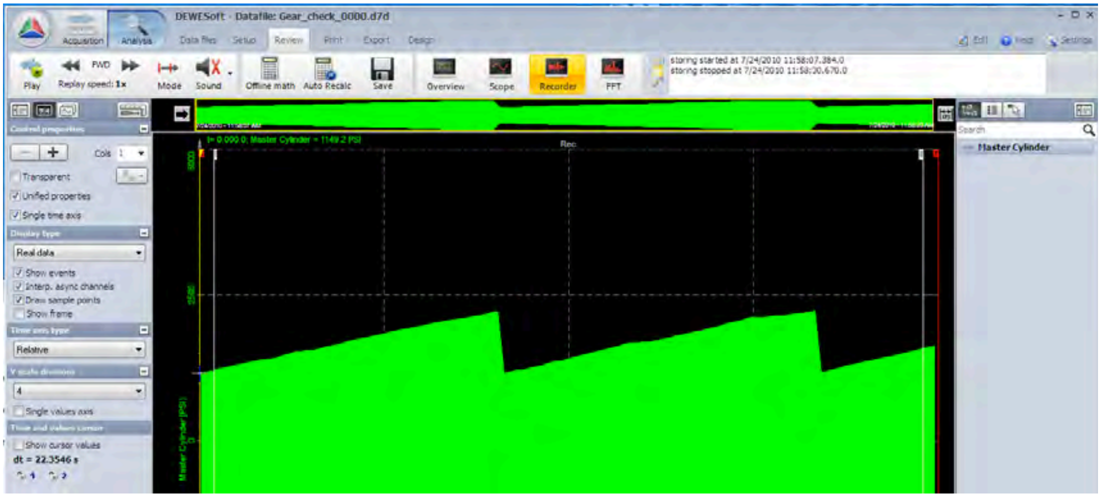
Press the STOP button and the recording will be closed. The screen will freeze.



☺ **Note: there are also hardware STORE and STOP buttons on the front panel of the DEWE-3210 and DEWE-3211 models, with an adjacent LED STORING DATA indicator. It doesn't matter whether you use the hardware or software buttons.**

Reloading your Data Files

This is as simple as pressing the ANALYSIS button near the top-left of the screen! If you have not gone to any other screen since stopping the recording, DEWESoft will automatically load the last data file that you recorded. Here it is!



Replay reference strip

Across the top of the DISPLAY AREA is something new: the display reference bar. By default, DEWESoft puts the first channel into this reference strip. When you load a data file, the entire file is displayed.

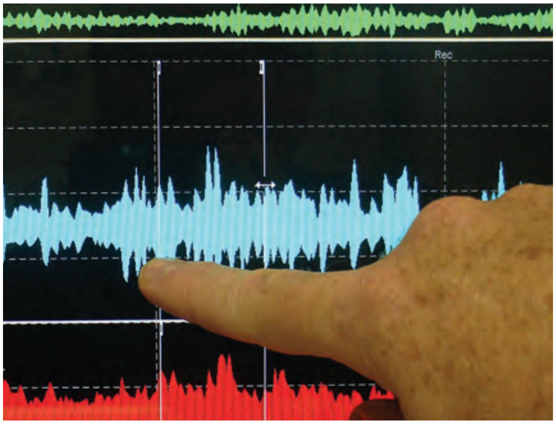
The beginning of the data is on the left, and the end is on the right.

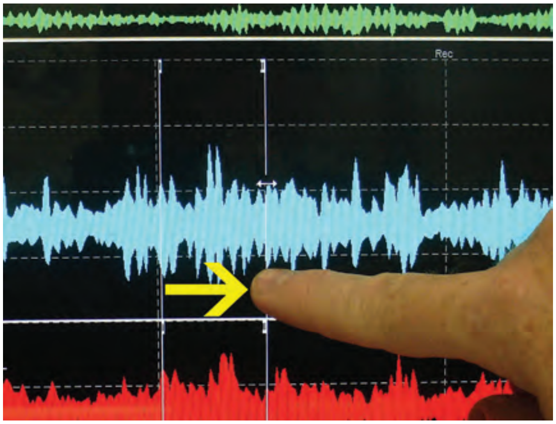
This reference strip will become very useful when you ZOOM IN on the data. Let's learn how to do that now.

Zooming in and zooming out

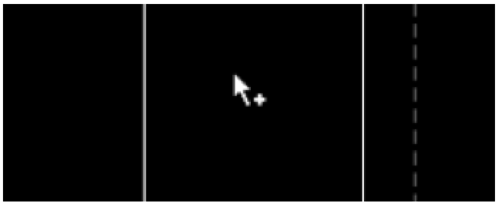
It is important to know how to zoom in and out on various parts of your data, to look closer and make measurements. Notice that when you are in the Analysis mode, there are two grey cursors and one yellow cursor on the screen. The yellow cursor is also shown in the reference strip at the top.

But let's use the gray cursors to zoom. Simply drag them into position around the area that you want to zoom. Or, you can simply click and drag to the right, then release, to set the cursors.



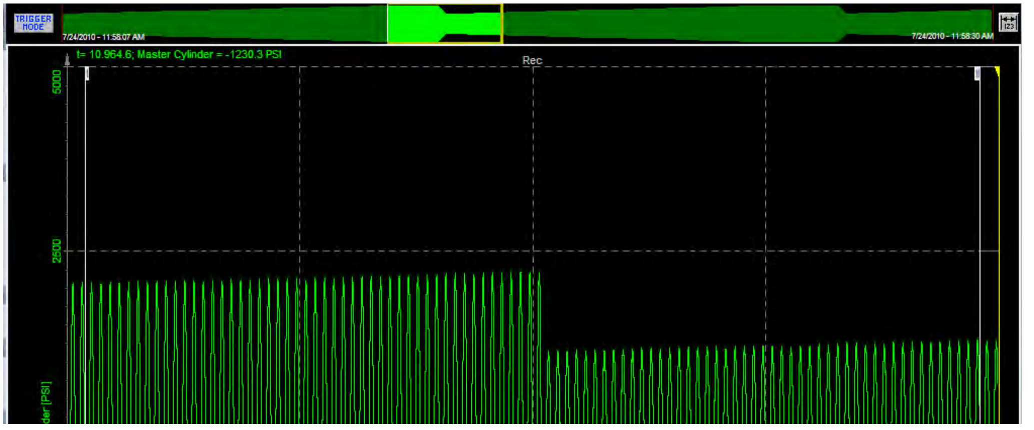


Now move the pointer between them, and you will notice that it changes to a pointer with a small PLUS symbol below it:



To zoom this area, simply CLICK with your mouse (or touch with your finger, if you have a touchscreen) between these cursors!

Notice what the screen looks like now:



See how the area that you zoomed has been highlighted into a little box? This is done to show you WHERE in the data file you are looking on the recorder, and roughly how much of the data is being shown. This is a great reference, and is needed once you start zooming in.

Zoom in again and again!

You can zoom in as many times as you like.

How to unzoom?

There are two ways:

1. Simply RIGHT-CLICK onto the recorder graph, and each zoom that you have done will be un-zoomed in reverse order. So you can step backward through your zooms perfectly.

2. Use the blue MINUS button at the bottom right corner of the recorder graph to reduce the amount of time shown on the graph.

Move the zoom box

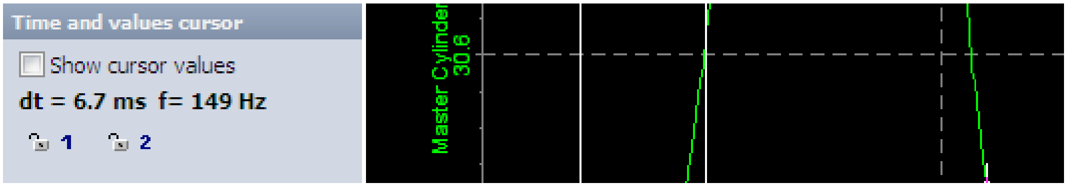
The small zoom box shown in the reference strip can be directly moved. Use the mouse and drag it left or right. Or, use the PAGE+UP and PAGE+DOWN buttons on your keyboard to move it in whole steps. You can also move it in half steps by using the left and right arrow keys on your keyboard.

Make direct measurements on any channel

Simply by moving the pointer along any waveform, DEWESoft will show you a color-coded X and Y values in engineering units in the top-left corner of the recorder graph. The pointer turns into a crosshairs when you move it along a waveform. Notice the values shown at the top of the graph:

Using the Cursors

DEWESoft uses these cursors in two ways: to zoom as shown above, and to make measurements on the signals. To make full use of them, activate the cursor checkbox in the properties panel on the left, when your recorder graph is active:

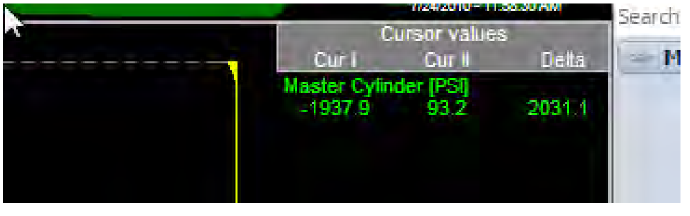


Before you check the box Show cursor values, the delta-T is already shown here. In the screen shot above, notice the label:

dt = 6.7 ms f = 149 Hz

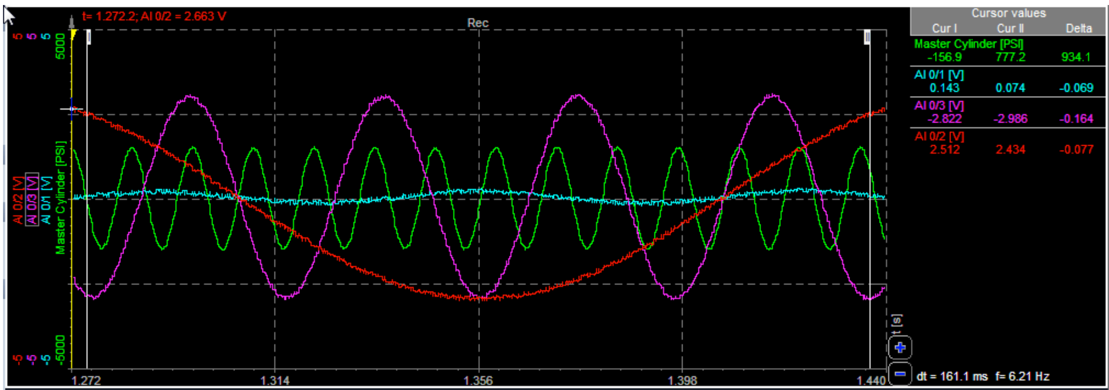
Therefore, the delta time between the cursors is less than 7 ms (<0.007 s), and the reciprocal of that time interval is 149 Hz.

Now check the Show cursor values box, and notice that the recorder graph will get a new panel on its right side, which shows the cursor I and cursor II values in a table:

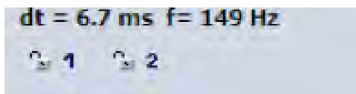


So we see the value of the channel called Master Cylinder at cursor I, cursor II, and then the calculated delta amplitude value.

If a recorder graph has more than one channel in it, cursor readings for the other channels will also be shown here, like in this example:

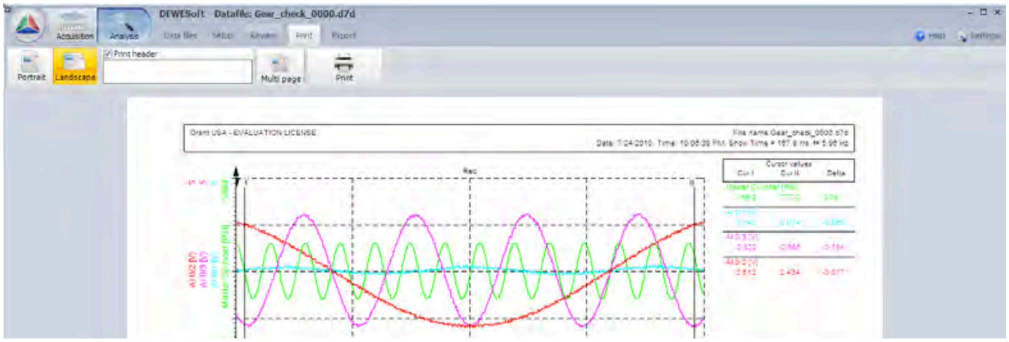


You can also move the cursors and take readings at exact locations. Simply drag each cursor into position. To prevent accidentally zooming because you clicked in between them, you can LOCK each cursor using the little padlock icons on the properties panel.



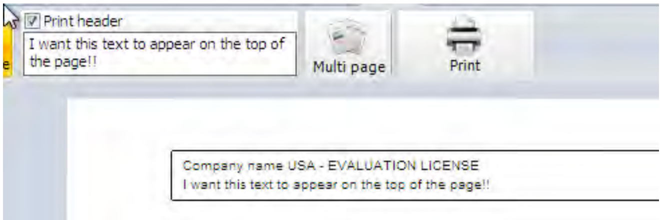
Print Out Your Data

You might want to make a print out on paper after recording data. To do this, make the screen look how you want it to appear on the paper by zooming and using the cursor controls. Next, click the PRINT item from the ribbon along the top of the DEWESoft window.



You can turn the page to portrait or landscape orientation using the buttons in the toolbar.

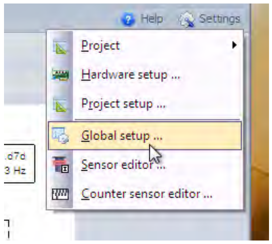
Want to add some text to the page? Simply type it into the text field in the toolbar, and it will appear on the header of the printed page.



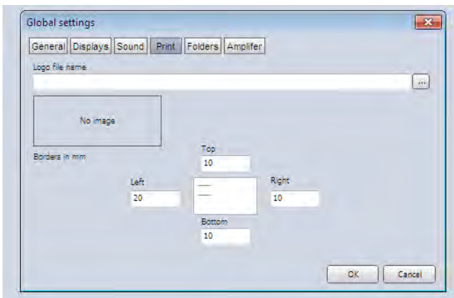
Add your company logo to printouts

You can associate a BMP image to DEWESoft, so that it will be printed in the header when you print your data.

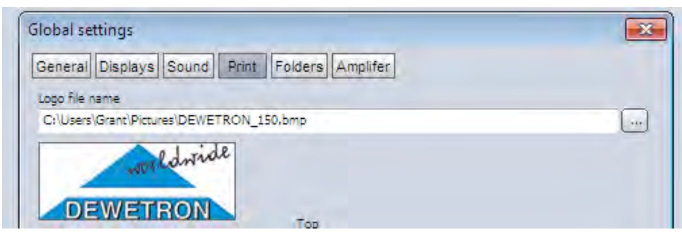
Click the Settings menu near the top right corner of the DEWESoft screen. Click on Global setup... to open the dialog box.



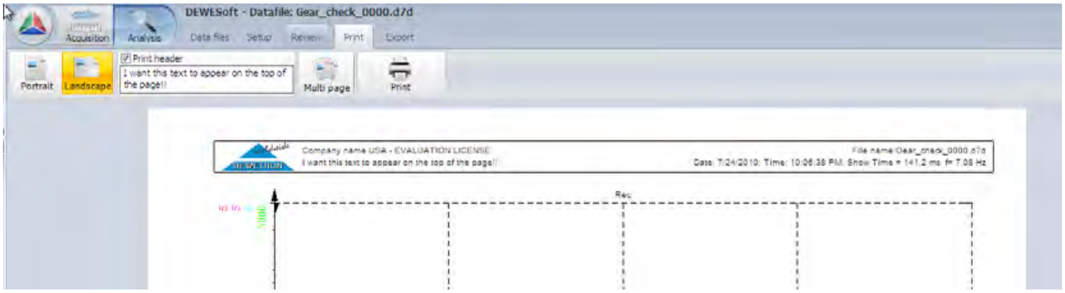
When the dialog opens, click on the Print tab to see those settings:



Click on the ellipsis [...] button and then choose the bitmap (*.bmp) image that you want to appear on your printed output.



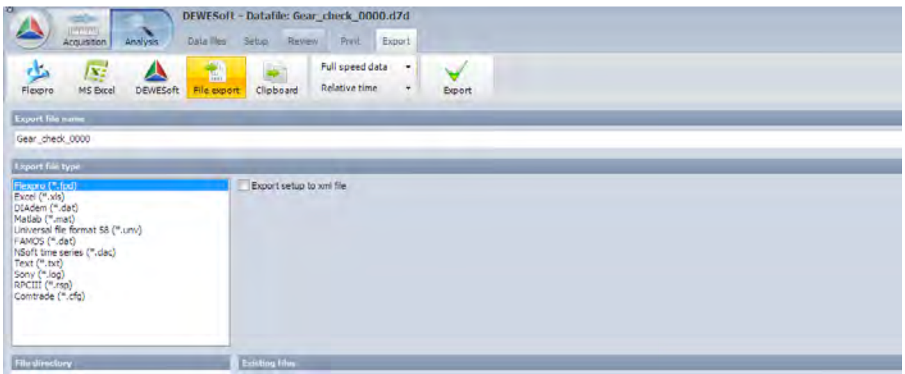
Next time you print something, it will have your logo at the top-left.



Export Your Data

You might need to convert the DEWESoft data file to another format, so that you can open it in a different analysis program. You can do this from the Analysis mode. Open a data file, and then zoom in if you want to export only a certain portion of the data file. If you want to export it all, do not zoom in.

After opening a data file, click the EXPORT item from the ribbon near the top of the DEWESoft screen:

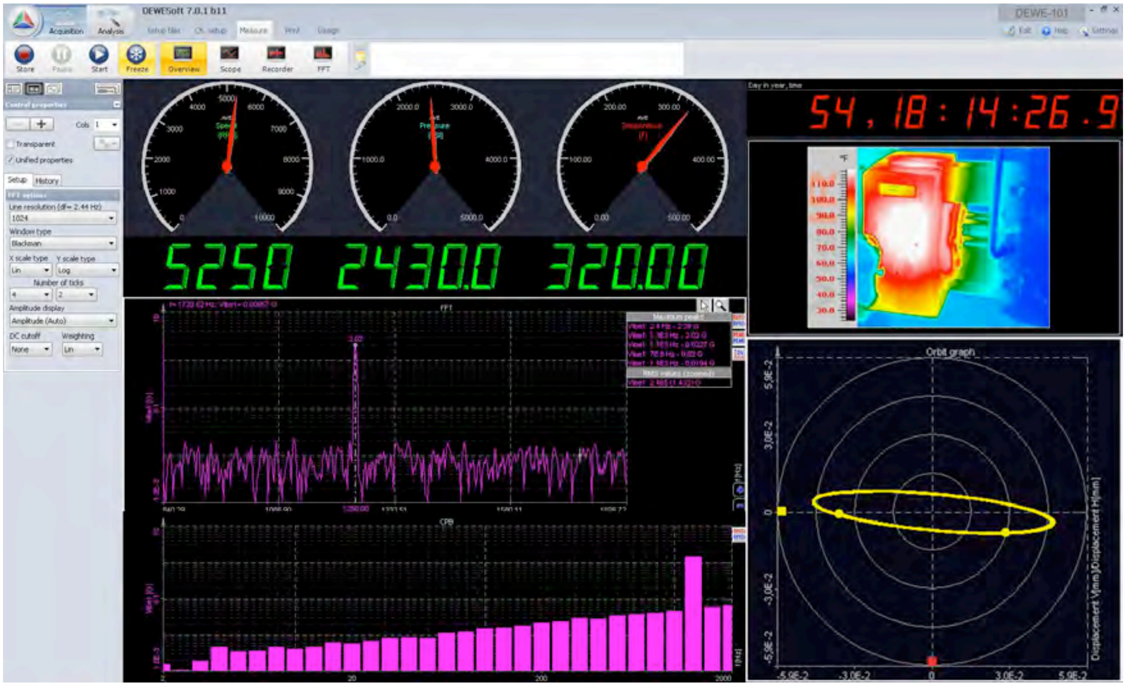


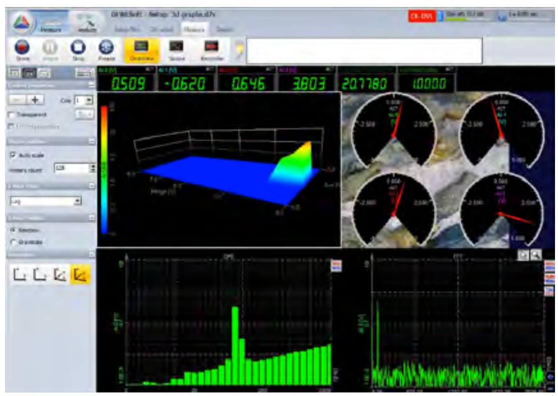
Now click the File export button from the toolbar. When you do, you will see a list of file formats that you can convert this data file to. Select any one of them. DEWESoft will put the name of this data file into the Export file name field automatically - however, you can change it to whatever you like. But please do not add the file extension, because DEWESoft will add it automatically.

☺ **NOTE : to export to either Excel or Flexpro formats, you need to have these applications on this computer! Otherwise, exporting will not work! This is because DEWESoft needs to communicate with these programs to export to them properly.**

Modify the Screens

It is not possible to do this subject justice in such a short manual. But you should know that you can enter the Design mode by clicking the Design button in the ribbon near the top of the DEWESoft screen, and then change virtually every aspect of each screen. This is one of the most powerful and popular features of DEWESoft. Have a look at just a few of the screens that you can make in a matter of moments:





Use the hardware STORE and STOP buttons

Unlike most Dewetron instruments, the DEWE-3210 and DEWE-3211 include hardware buttons for starting and stopping recording. You may use them just like you use the on-screen buttons labeled the same: STORE and STOP. These hardware buttons are active at the same time that the software buttons are active.

The built-in LED will illuminate when data is storing. When you press STOP, the LED will go dark, and the storing will stop.

Part 2 - Projects and Global settings

This is part 2 of our QuickStart Guide to DEWESoft 7! It was written at the time of DEWESoft version 7.0.1, however it will remain largely compatible with higher versions of the software. It is meant to help you reach the next level of knowledge with DEWESoft. Part 1 focused 100% on the analog inputs, and using the measure screens as they are. In Part 2, you will see how to configure DEWESoft the way that you like it both at the highest possible level (Global level) as well as at the Project level -- and explain the difference. The Project level is especially important to learn about, since it never existed before DEWESoft7.

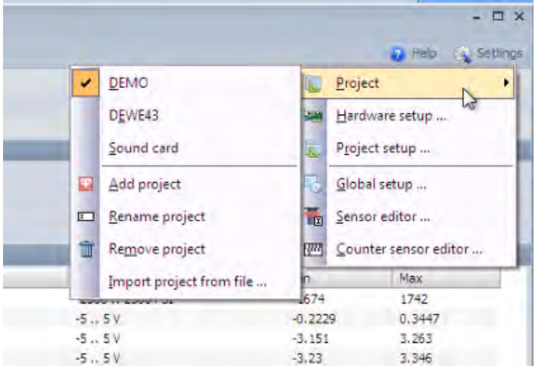
NOTE : In this manual we will refer to DEWESoft as "DEWESoft" as shorthand.

What is a Dewesoft Project?

You can consider a Project to be like a "hardware profile," in that it defines the hardware that you will be using with DEWESoft. It also contains flexible settings that control how the system behaves. Let's say that you have a computer that you sometimes use a DEWE-43-V (USB connection), and other times you connect a DEWESoft-NET ethernet based system, or other times yet, you use an ORION A/D card and rack of DAQ modules outside your computer.

In DEWESoft6, there was only one global hardware setup, which you would have to change each time you wanted to connect these different pieces of hardware to. But now with "Projects," you can make and name a hardware profile for each possibility. But a project defines more than just the hardware setup, as we will learn in this Quick-Start Guide.

To see your Projects, click the [Settings] button near the top-right corner of the DEWESoft window:



The first item is called Project >

Click it to open the submenu, where you can see your existing Projects, and then some controls below them for adding a new Project, renaming the active Project, removing a Project, etc.

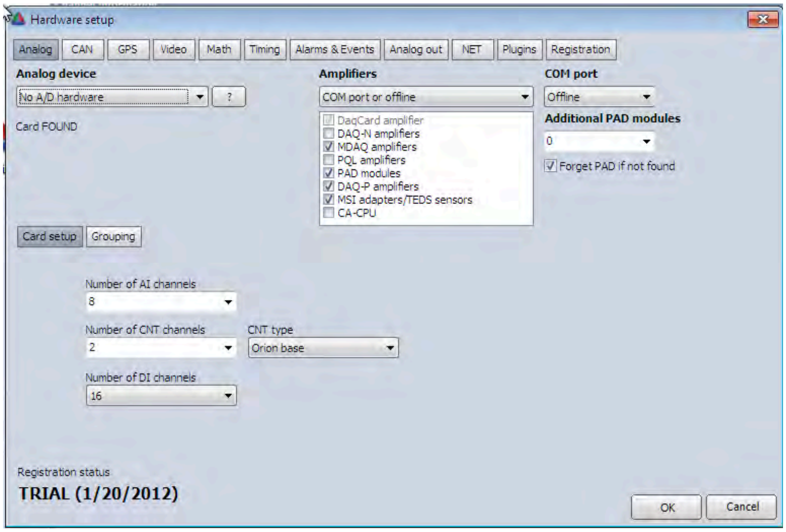
If you have not visited here before, you probably have a single Project called Default (you always need to have at least one Project, otherwise you would have no hardware setup!).

In our case, we have a Project called "DEMO," in which there is no data acquisition hardware defined, and DEWESoft creates waveforms for demo and training purposes. The checkbox tells us that this is the currently active Project. There is also another project called "DEWE43," which is used when we connect our DEWE-43-V unit, and a third Project called "Sound card," in which we use the computer's sound card as a two channel sound recorder.

Hardware setup screen

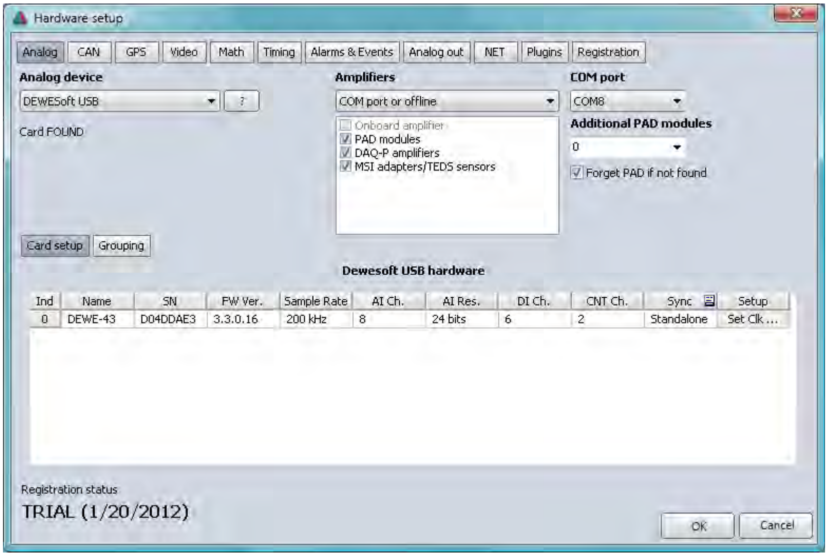
Let's check the hardware settings of the active Project. Simply click the Hardware setup… menu item. This menu will close and the hardware setup dialog will open.

Hardware setup is where you control all of the hardware connected to your system, as well as the options that you might have purchased for DEWESoft. Your license info is also stored here. There are several screens, starting with ANALOG.



You can see that we have selected No A/D Hardware, since we want this project to be purely for demo and training purposes, even when there is no hardware connected. But we have selected the Amplifiers to be COM port or offline, so that we can use them in the setup mode for training.

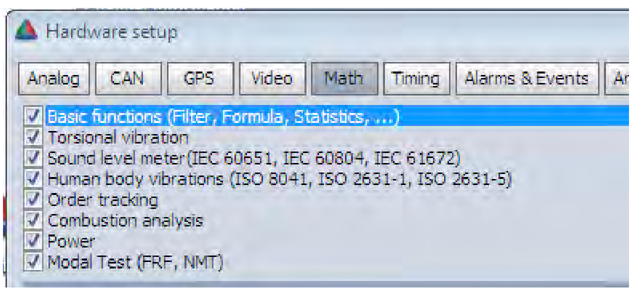
In our other Project where we connect the DEWE-43-V and DAQ modules to make real measurements, the hardware setup screen looks different, of course:



There are other tabs for setting up other input types, such as CAN, GPS, VIDEO...and more. The Plugins tab is where you activate software plugins that you have purchased for DEWESoft (some plugins are free). Registration is where you enter your license information.

One source of potential confusion is the Math tab, so it is worth mentioning here:

MATH Options



It is important to note that the Basic functions (Filter, Formula, Statistics...) box can be checked. These functions are included with all versions of DEWESoft. It should be checked for you already, but if it isn't, go ahead and check it.

However, the additional features below that are OPTIONAL - i.e., they have to be paid for. If you check their boxes, and you do not have a license, you will not be able to click OK and use DEWESoft!

☺ **Note : The DEWESoft-DEWESoftA version includes most of these options. However, Power requires the additional option called DEWESoft-OPT-POWER.**

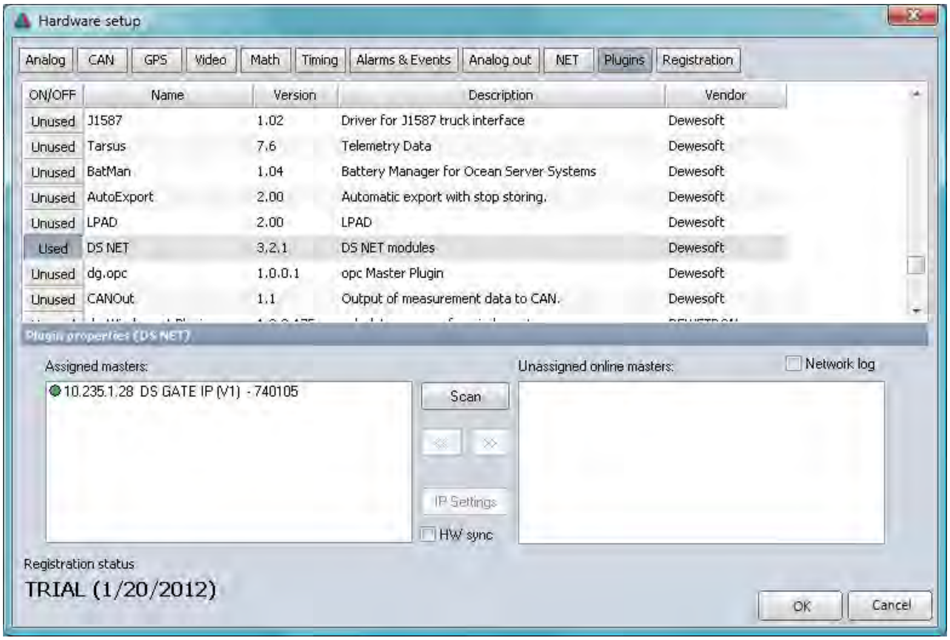
BUT if you want to try them before buying them, the solution is simple: create a new project called DEMO and then set it up with NO A/D HARDWARE like we did, and then you can turn on every option in the world! No license is needed for the demo mode! In demo mode, DEWESoft will generate sinusoidal waveforms that you can use to test any function that you want, without any license.

And now with the ability to have different projects, you don't have to take a risk by changing your "real" hardware setup -- just make a project called DEMO and then set up the hardware for this demo/testing mode, where every option is turned on. The only thing you cannot do is try these functions with real data coming in (unless you purchase the option of course).

These options are called "built-ins" because they are included already in the DEWESoft source code - they simply require a valid license to be used for real.

DEWESoft Plugins

Then there are options which can be added in to DEWESoft as little snippets of code, or quick large chunks, called PLUGINS. These plugins are easy to install - you simply copy them into the \addons directory under the DEWESoft program file location on the hard disk. Then restart DEWESoft, and all installed plugins will be shown in the Plugins tab here on hardware setup. For example:



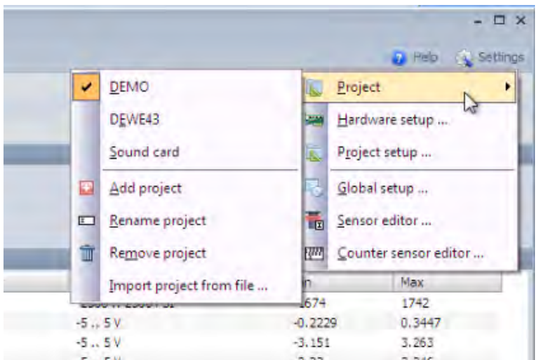
Above you can see that we have a bunch of plugins installed. Some of them are free of charge, while others are included with the hardware option that you have purchased from us, or are an extra cost option.

To activate a plugin you need to toggle it to Used, as you can see we have done above with the DEWESoft-NET plugin. When you click some plugins, they may have some additional features or configuration selections that will appear in the Plugin properties area at the bottom of the dialog box. Not all plugins have this.

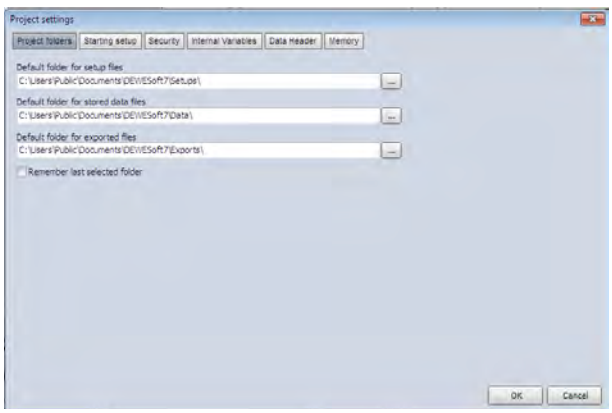
Please consult with your Dewetron sales person to learn more about which plugins are available for DEWESoft.

More Project Properties

In addition to the hardware and licensing configuration that you set up on the Hardware setup dialog, each project also contains several other properties that you can configure according to your needs. Click again on the [Settings] button near the top-right corner of the DEWESoft window:



Notice now the item called "Project setup...". Please click it to open the dialog box:



This dialog has several subsections, including:

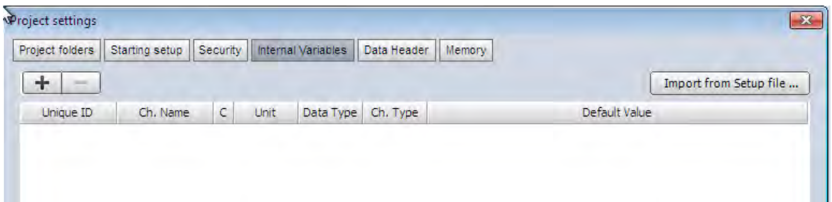
- Project folders - where you can set your default folders for setup files, data files, and exported data files
- Starting setup - where you can force DEWESoft to load a particular setup and screen when it loads
- Security - where you can establish password protection of the setup mode
- Internal variables - where you can define project level variables which can be used in Math channels, displayed on the screen, etc. These can be text or numeric variables.
- Data header - where you can set up a data entry box that will appear automatically before or after data storage, to force the operator to enter whichever test parameters you want added to the data file
- Memory - top level control of DEWESoft's use of physical RAM

The settings that you make here will apply to only the active Project! This is a lot of flexibility.

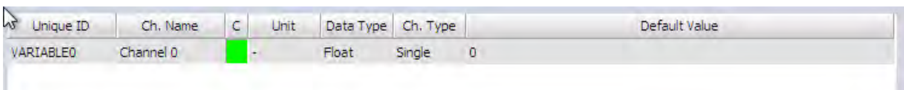
Most of the project subsections are obvious how to use, so we won't get into them here in the QuickStart. But there are two subsections worth a closer look: Internal Variables and Data Header, so we will do that now!

Internal Variables

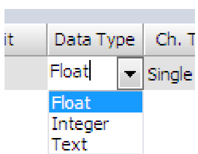
Here you can define variables which will exist at the Project level. That means that they will be available to all setups which are created when this project is active. Variables can be in the form of TEXT or NUMERIC values.



To create a variable, click the [+] symbol, and a default channel will be added, which you can directly edit.



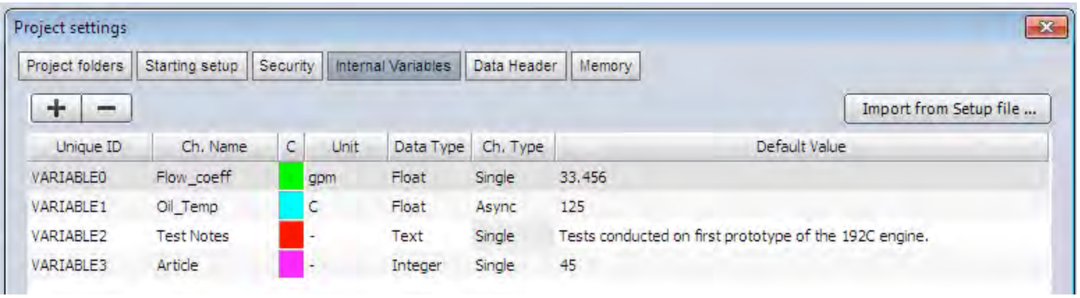
You can rename the variable's ID, channel name, and even give it a unit of measurement and color, if it will be used as a channel. Next you can set the TYPE of data that it should contain: whether a floating, integer, or text value.



If it is a numeric type, you can set the channel type to single or async. This does not apply to text data types.

- A "single" value means that it is treated like a static number in DEWESoft.
- An "Async" value is treated more like a channel in DEWESoft. This means that it could be processed in a series of calculations, like a filter. But there is no way to filter a static value. As a result of this distinction, both async and single value numeric variables can be used within the FORMULA kind of math channel. However, only an async value could be processed by a FILTER math channel. Do you see the difference?

Finally, you can set the default value. This field is quite wide, which is useful when this variable will hold some text.



Unique ID	Ch. Name	C	Unit	Data Type	Ch. Type	Default Value
VARIABLE0	Flow_coeff		gpm	Float	Single	33.456
VARIABLE1	Oil_Temp		C	Float	Async	125
VARIABLE2	Test Notes		-	Text	Single	Tests conducted on first prototype of the 192C engine.
VARIABLE3	Article		-	Integer	Single	45

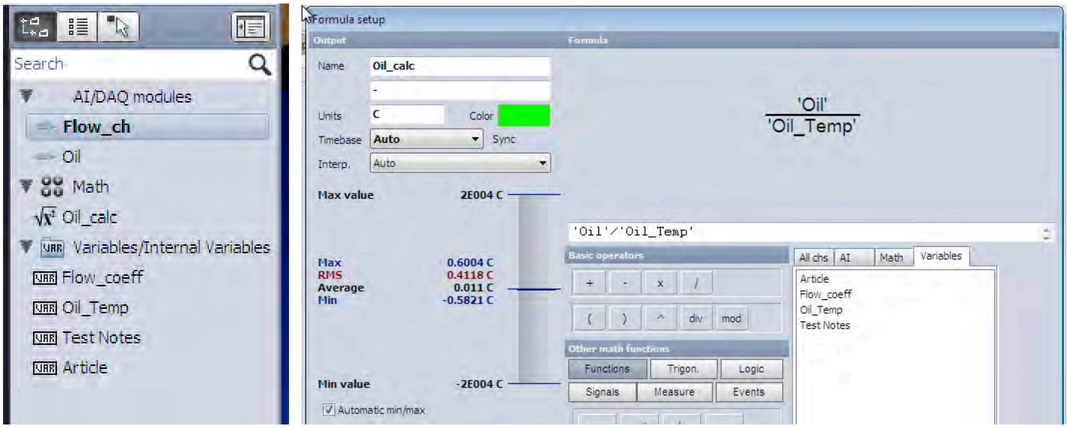
Above we have created four variables - one of each basic type: text, floating number, and integer number. In addition, there are two versions of floating numbers: one which is async and another which is a single value.

So now what can we do with these variables? Well basically, we can use them in MATH channels, and we can also simply put them on the screen in any setup that is active when this Project is active! These values will be stored with any data files that are created when this project is active.

Using variables in Math channels

Numeric variables can be used within your MATH channels, which is their primary purpose after all. You can use these variables to hold constants, for example, which are needed in your calculations.

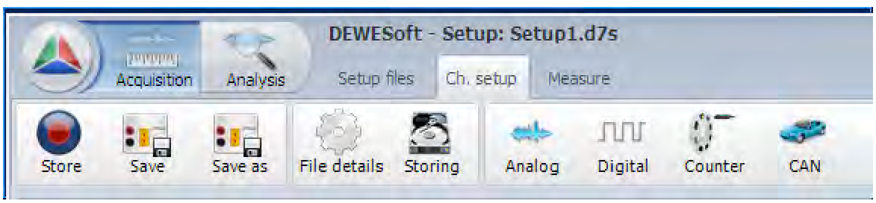
If you create a new FORMULA math channel, you will see how you can use them:



Above you can see that in the formula math setup, there is a tab called Variables, which will appear as soon as there is at least one variable created for the current Project! So you can use these values within your MATH formulas, as shown above… we are dividing the real analog signal called 'Oil' by the variable called 'Oil_Temp."

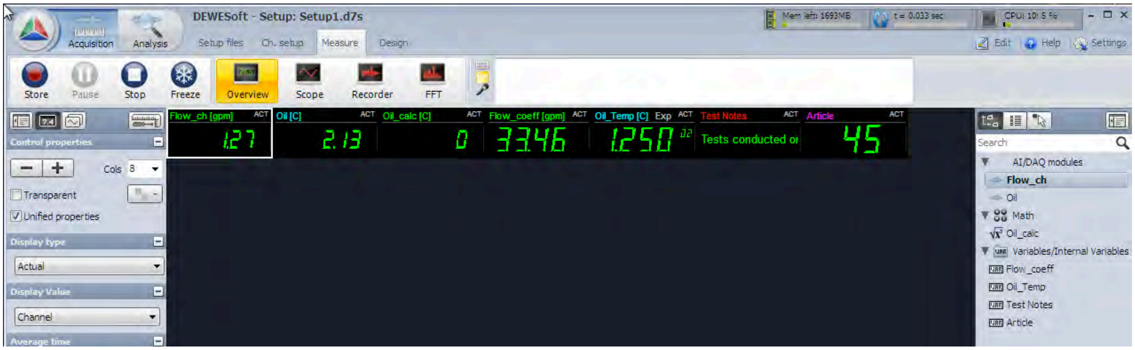
This formula creates a new virtual channel called 'Oil_calc' with the units 'C' (notice how we entered those parameters near the top-left corner of the screen above).

So now this new math channel is available to be placed on the screen. Let's take a look at that by clicking the Measure button near the top of the DEWESoft window:



Click Measure from the ribbon...

After clicking Measure you will see the first display screen, called Overview. If this is the first time you have visited the Overview screen with this setup, DEWESoft will automatically put your USED channels onto the screen in the form of digital meters, like this:



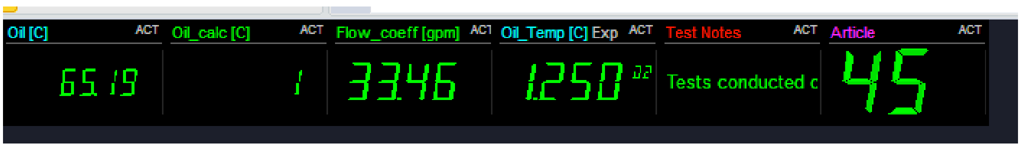
Looking at the right side of the display, you can see a list of channels shown in the grey, vertical task bar. By default these channels are GROUPED according to type.

In this setup we have analog channels, then the one Math channel, then our Variables.

Each channel is shown within its group. Each group is collapsible.

In the first DEWESoft QuickStart Guide we showed you the channel list, but we did not show you how to get the most from it. We will do that in a future QuickStart Guide.

For now just have a look at the screen -- and notice how your channels appear within the digital meters:



Even your text variable can be shown in a digital meter! Basically every kind of channel can be displayed in this meter (there are very few exceptions, and not worth mentioning at this point).

Data header

In this subsection of the Project setup, you can define a form that will appear when you record data, in order to collect some additional information from the operator about the test.

When you first come to this subsection, it will look like the screen shot above. The main part of the dialog box will be completely empty, as shown here. This is your workspace, where you can create data input fields that the test operator will use later. There are three things that you can add to this workspace:

- Info - This is basically just a section header, which you can freely name.
- Input - A field which will collect alphanumeric input from the user
- Selection - A control that allows the user to pick from a list that you have predefined

OK, let's see how all these work. It is normally a good idea to start by writing down on paper what you want to collect from the user. Just use a piece of paper, and then refer to it as you duplicate it in the software. Let's say that you want to collect this information, arranged in these groups:

Test operator info:
- name
- ID number

Test article info:
- model name (could be model A, model B, or model C)
- serial number
- lot number

Test procedure info:
- ATP number (could be 1-1, 1-2, 1-3, or 22a)
- ATP step (could be any number from 1 to 100)

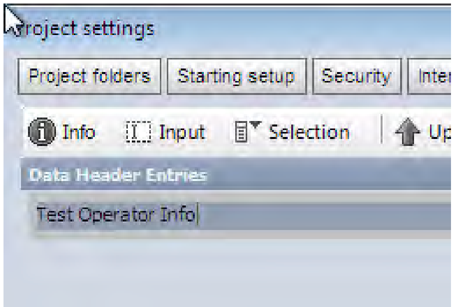
How would you create this? It's quite simple. Let's start with the first group of info:

Test operator info:

name

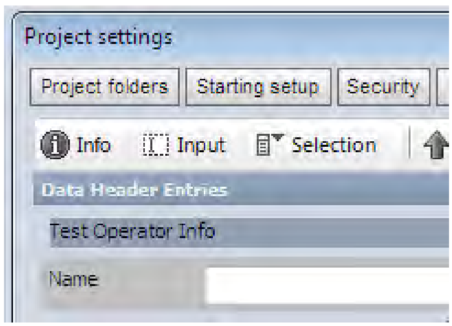
ID number

First we create the group, by clicking the Info icon, then editing its label below, like this:

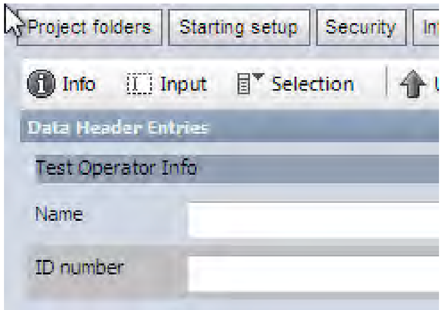


Now we have a section, and we can add the fields below it. The first field we want to collect is the operator's name. If you have a lot of operators and it is not practical to predefine them all, just use an Input field, so that the user can type his or her name freely.

Click the Input icon, then edit the label, as shown here:



Now we want to add the ID number field. Repeat the same step: click the Input icon, then edit the label:



Great! Section 1 is done. We have created a category, and then defined two input fields that the operator can type into when data is recorded. Let's move on and create the next section, and learn how to create a selection field. As a reminder, here is what we need to create:

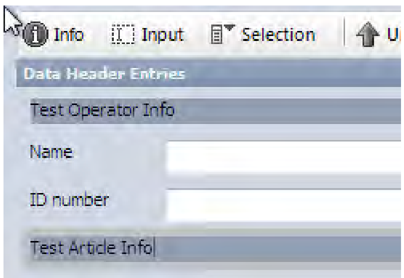
Test article info:

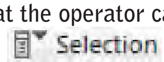
model name (could be model A, model B, or model C)

serial number

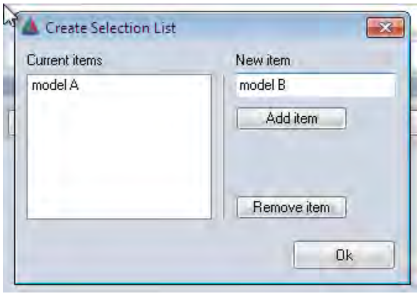
lot number

So first we create the category header by clicking the  icon, then editing its label below:



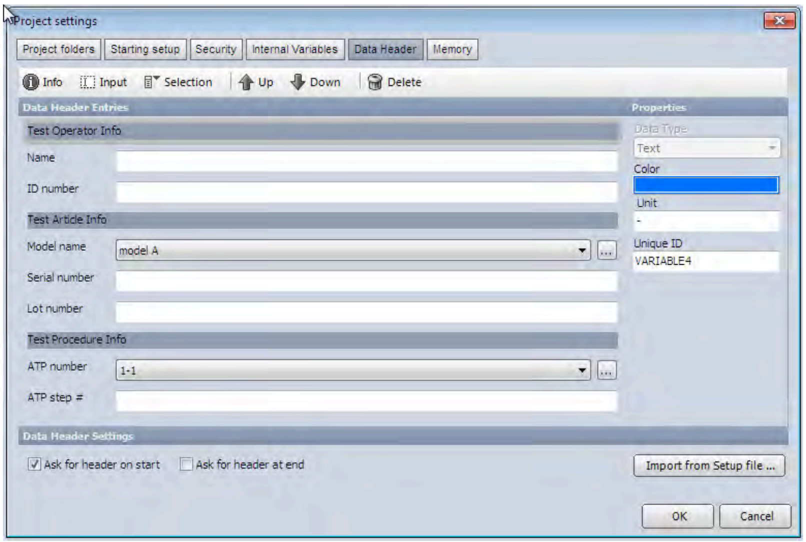
Easy enough. But now we need to create a selector so that the operator can simply choose from model A, model B, or model C (and nothing else). To do that, you click the  icon, and then edit its label:

But this field looks different than the simpler Input fields that we created before. A selector control requires that you define the selections right now. To do that, click the  (ellipsis) button:



The selection list dialog opens, where you can add new items to the list. Above we have typed "model A" into the new item field, then clicked the Add item button below, to move it into the list. Do the same for "model B" and "model C," then click OK.

At this point you have the idea, right? Please continue along and add the rest of the items from our checklist, until it looks like this:



If you change your mind and want to delete a field, or rearrange the order of them, there are controls exactly for those functions:

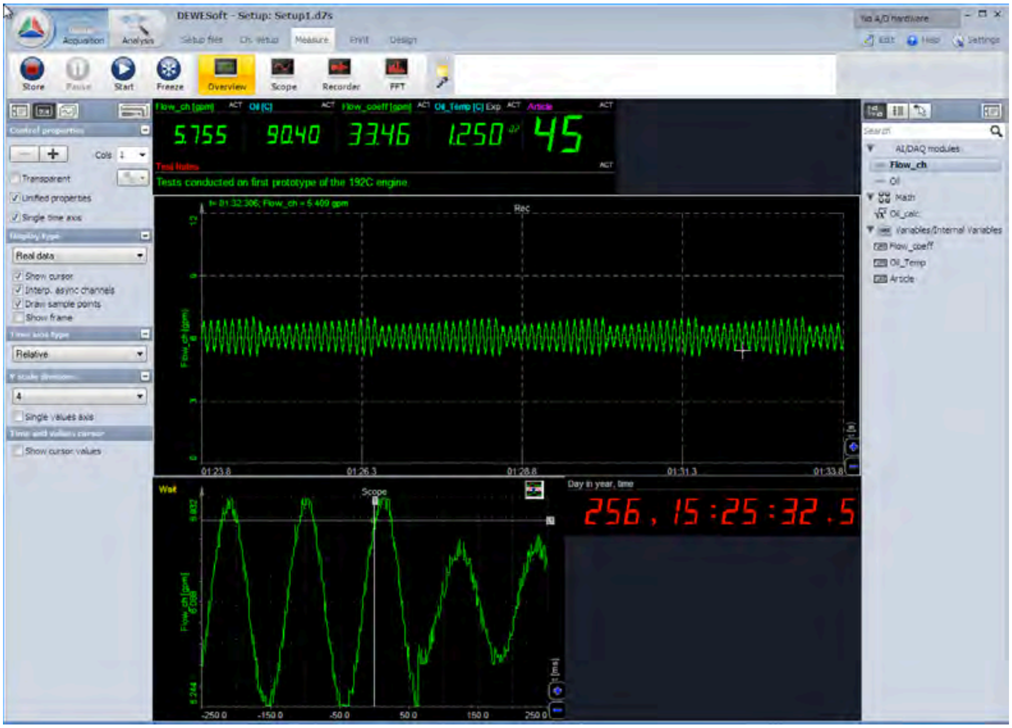
To move a field up or down, use the icons shown here. Also, you can use the Delete icon to remove a field completely. To select **WHICH FIELD** to move or delete, simply click on the field, and it will get a darker color field behind it, like the one called "Rabbits" here:

With this field selected, click the Delete icon and it will go away. There is no UNDO, so be careful.

If your form is ready, there is still one very important step left: you must tell DEWESoft WHEN to show this form to the operator! There are checkboxes near the bottom, where you can tell DEWESoft to pop up this form at the start of acquisition, or at the end, or both.

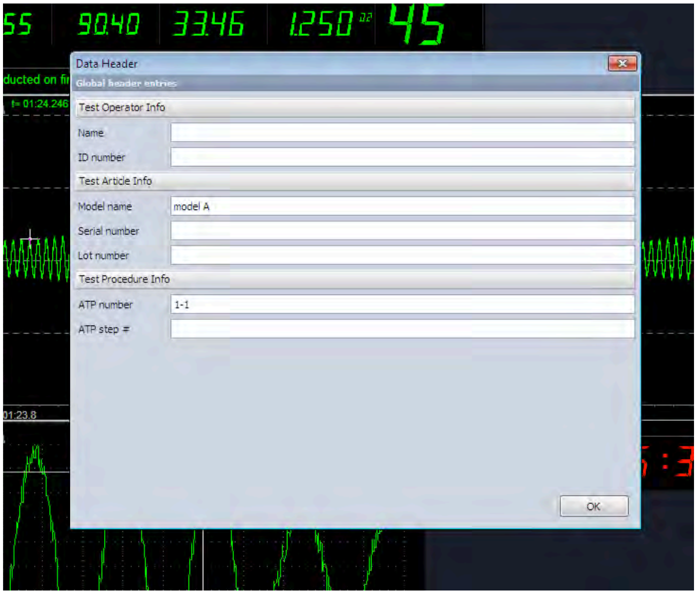
It is critical to check at least ONE of these boxes, otherwise the form will never appear! Remember that this data header exists at the PROJECT LEVEL. Therefore, it does not matter which setup you use when storing data: when this project is active, the data header and internal variable settings that you establish here will be applied during recording.

Let's see how this works.

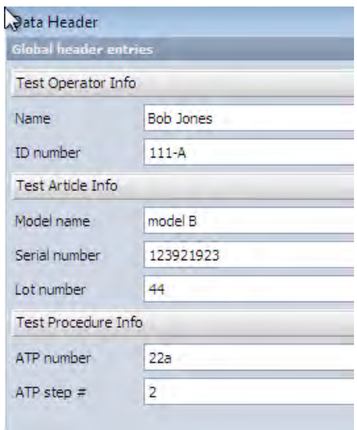


OK, we have our system set up and ready to record. Using the info in DEWESoft QuickStart-1 you learned how to set up and scale your channels, and in QuickStart-2 you have learned how to create internal variables and a data header. You have combined variables and real data in the MATH section to create virtual channels, which will be displayed and recorded, too. The sample rate is set up and you have a nice screen to look at.

Press STORE and watch what happens:



Congratulations! When you press STORE, the Data Header dialog will instantly appear, and your operator can fill in the fields and then click OK to continue.



Selectors that you have predefined will show their first value by default, so if you want to force the operator to make a choice, you can create a first selection like "--" or "choose" when you define the selection.

If you think that your operators will be annoyed by this data header and will skip over it, you could also check the box to have it appear at the end of storing, when they have more time to fill it out.

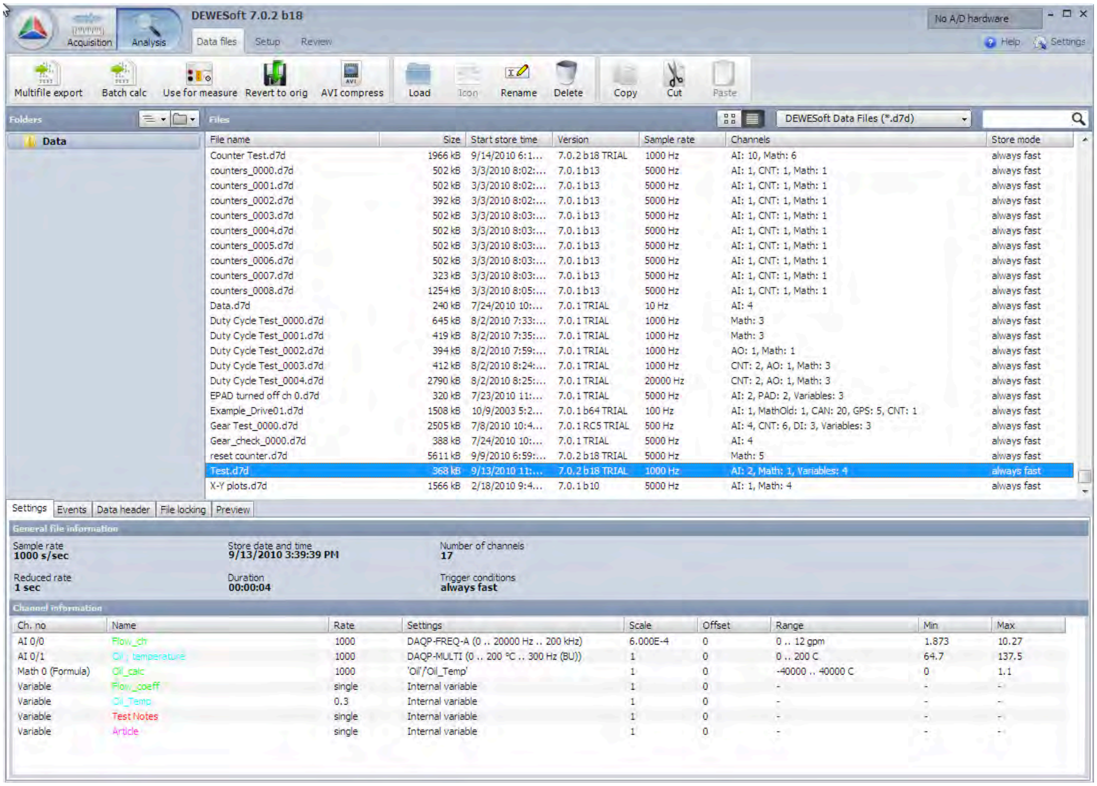
Data headers can be as long as you like. If you create many fields, the screen will automatically create NEXT and PREV buttons to navigate through multiple pages of fields. But take care: few people want to fill out so many fields, and will quickly grow tired of it.

If you store data, stop, and then store again, the data header will appear again -- with the fields already filled in from the first run. So the operator just needs to change any fields which might have a different value now… the other fields can be left alone.

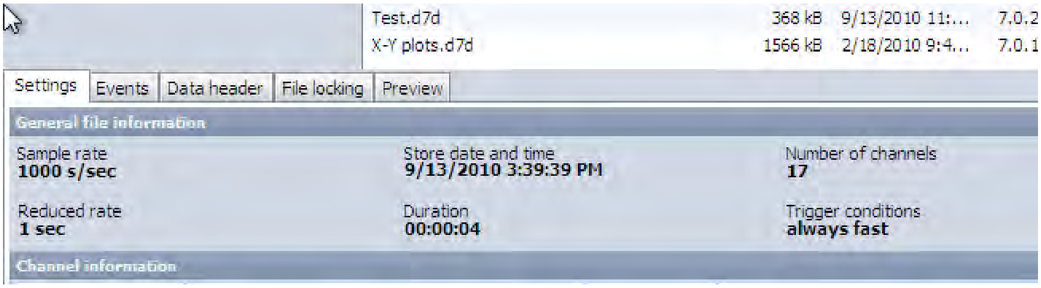
Looking at the data header information later

Data header values, and all variables from the project that was active when a given data file was created, are stored within the header of the data file. This is crucial for documentation purposes! How can you see this info?

In the Analyze mode, click ONCE on any data file. In our case, we just captured some data called Test.d7d, so let's have a look:

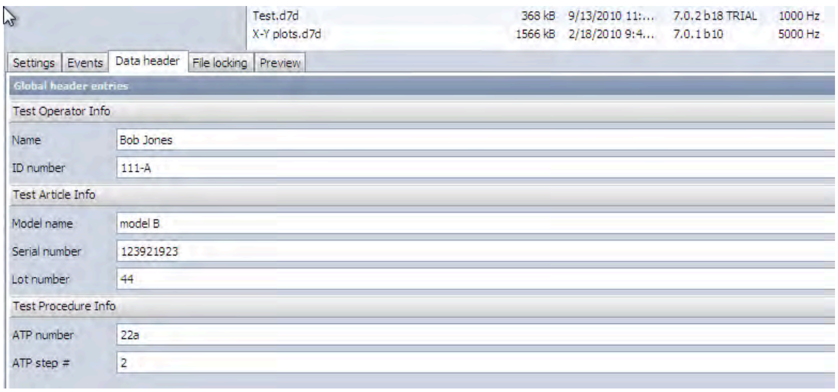


When you click on the name of a data file here, you will see the header information from this file below, in several tabbed areas:



- Settings - shows the basic settings of the data file (sample rate, date and time of storing, duration, and many more elements about each of the captured channels)
- Events - there are always at least two events in any data file: the date and time storing started, and the date and time when it stopped.
- Data header - what we just created! The fields are captured here
- File locking - whether this file is protected against post-processing or not
- Preview - a simple look at one of the display screens

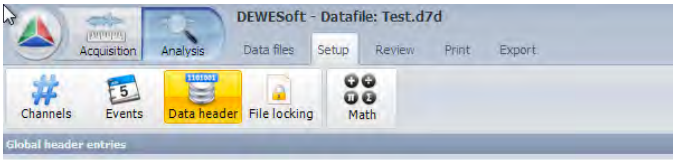
We cover all of this in more detail in the manual, but for now click the Data header tab and see what is captured here:



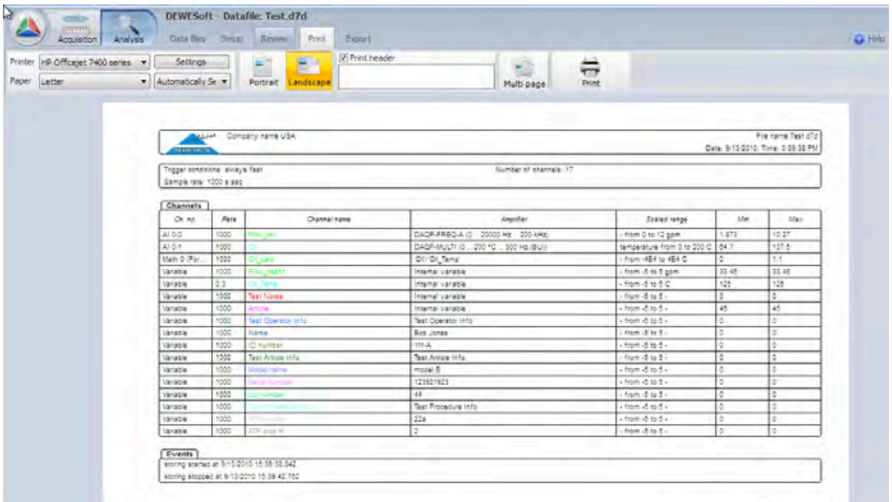
Yes, your inputs are safely stored within the data file, for documentation purposes! What else can you do with these values? Can you print them out or show them on the screens?

To print out the data header info:

First, load the data file by double-clicking its name from the list. Then click the SETUP button in the ribbon:

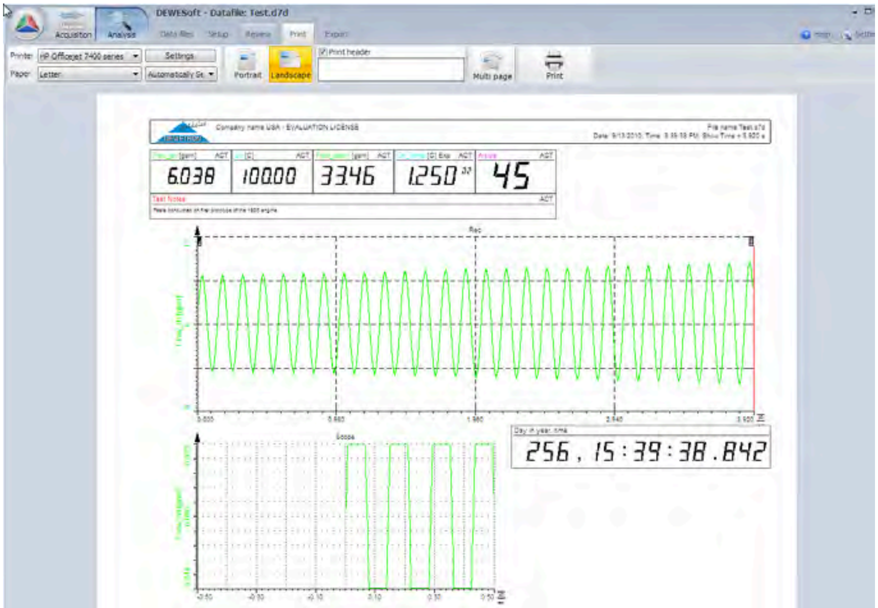


At this point you can review the various elements contained within the header by clicking their icons: Channels, Events, Data header, File locking, etc. But if you just want to make a print-out, click the PRINT button in the ribbon, and you will get a preview of what the paper will look like:



When you do a print preview from captured data, with the SETUP clicked in the ribbon, you will see a preview of the entire header section of the data file.

To get a preview of the DATA itself, i.e., any of your display screens, simply click REVIEW from the ribbon, then click PRINT in the ribbon:

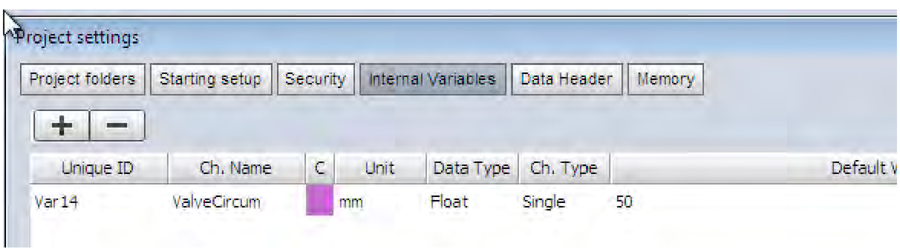


Variables within the data header

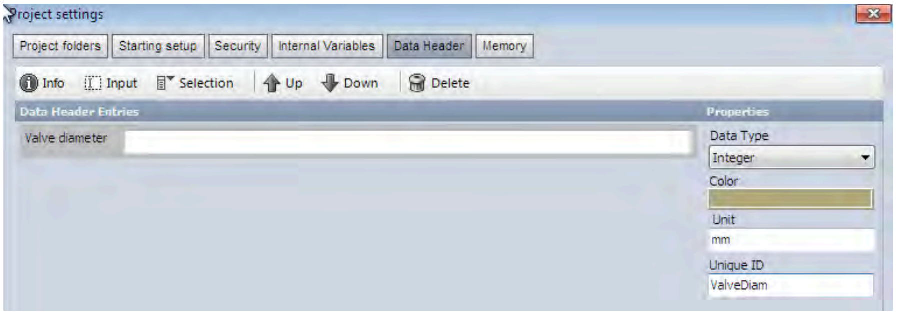
You might have noticed that DEWESoft creates a variable from each of the fields that you create in your data header. These variables can be displayed and used in processes, just like the internal variables that you created earlier!

For example, let's say that each time you run a test you need to input a variable that will be used in a math channel. Like doing repetitive valve tests, where different valve diameters are used all the time, as one example. You could ask the operator to simply enter the valve diameter using the Data header pop-up, and then this value will be processed mathematically in whatever way you want!

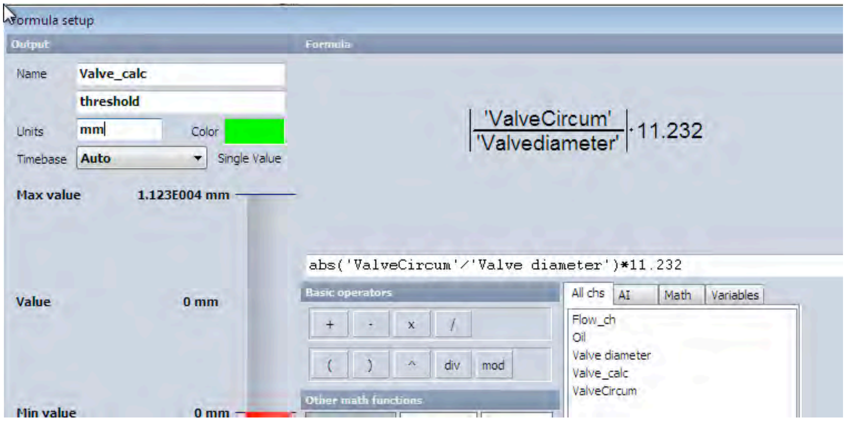
Imagine a situation where a tolerance is calculated by multiplying a constant value by another value which might change from test to test? This is not a problem: you can use the Internal Variables that we learned about earlier to hold a constant value, and use the Data header field to collect a second value at run time from the operator.... then put them together in a math channel.



Above - we add an internal variable to hold the valve circumference, which will not change from test to test...



Above - then we create a data header question that the operator needs to respond to at the beginning of each recording, called Valve diameter. DEWESoft automatically assigns it a unique ID - but let's change it to "Valve-Diam" to make it easier to identify this parameter later. Now you should also define the TYPE of data that can be entered: text, integer, or floating number. Since a number is absolutely required here, you should not allow the operator to enter text, for example! You may also define the units and color of this channel.



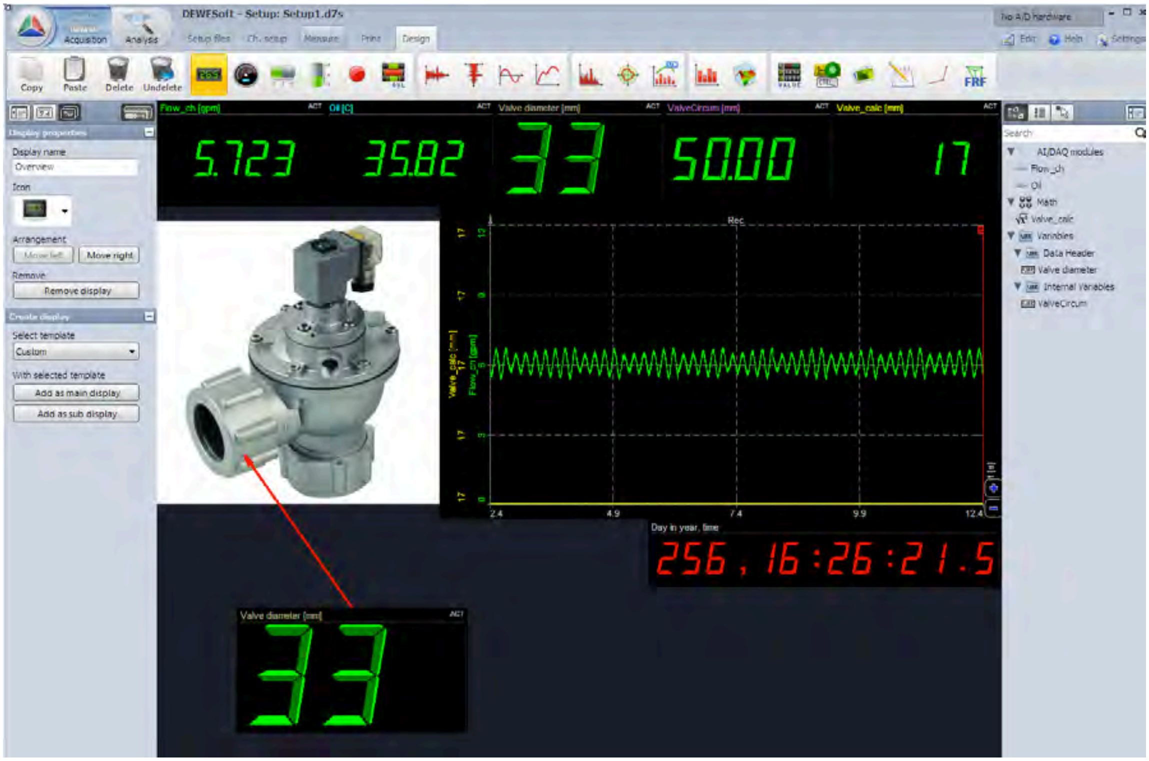
Above - we create a MATH channel that we named 'Valve_calc' which will combine these two values and give you the output that you need to test against!

This particular math channel doesn't really make any sense: it is just one hypothetical example of how you can use these variables in DEWESoft.

Displaying variables on the screen

So now you can see that project variables - whether they are predefined or collected from the operator at run time, can be quite powerful. Importantly, they are captured within the header of the data file, and are thus a permanent part of the documentation.

You can use them mathematically, or simply show them on the screen. How to do that? Let's see:



Did you notice that in the channel list, ALL VARIABLES are shown? If your variables are not showing, then perhaps you are clicked on a display object which cannot hold them, like a scope or FFT graph. To reveal all of them, click on a digital meter ... then look at the channel list. You can see in the example above that there is a group of variables, and within it, there are now two sub-groups, labeled 'Data Header' and 'Internal Variables', and they contain exactly the variable names that we defined above.

In the screen above we have simply put these variables, as well as the real and math channels into meters.

Note that the data header variable is unknown until you press STORE and then the operator enters a number! Then that value will be known to DEWESoft, and also will be used in the MATH channel that calls for it. This is what has happened above.

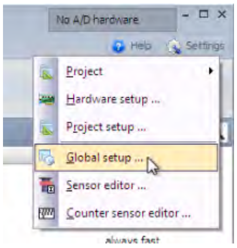
Projects Summary

You can make as many Projects as you require. This is a handy way to quickly configure the system for different test scenarios, and different hardware configurations. A great example is when you have a channel expansion box: sometimes you need it, and sometimes you don't You can therefore make a different Project for each configuration.

But that's only the beginning: you might have only one hardware configuration, but you can use Projects for different test scenarios, since the data header and internal variables exist at the project level, and they are a great source of automation and documentation, as you have seen above.

We suggest that you make a Project called DEMO that you can use for training, as well as to try all of the options that are available as built-ins and plug-ins.

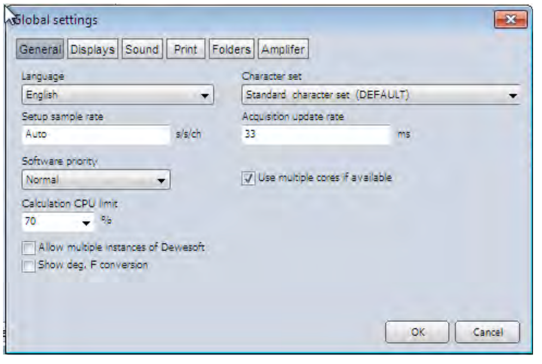
Global Setup



In the previous section you learned how to create Projects, which will set up the system in a certain configuration. But then there are some configuration parameters that you can at the highest level, i.e., above the level of any particular Project. This is the Global setup, and by definition there can be only one.

Referring again to the [Settings] button, click it and then select the "Global setup..." item.

When you select this item you will get the Global setup dialog box:



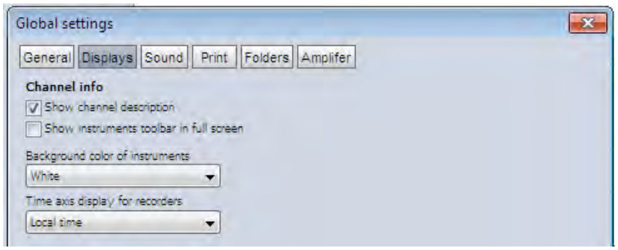
There are several tabs on this dialog, which allow you to configure these parameters:

- General - where you can set the language, character set, default sample rate, and similar
- Displays - where you can control which screens are active by default, and set the display background color
- Sound - where you can active VOICE EVENTS for data storing, and trigger sounds from the PC sound card
- Print - where you can define several aspects of printing, and link to your company's logo to print on reports
- Folders - where you can set up the default folders for top level settings and the sensor database
- Amplifier - (Infrequently used) top level Amplifier setting. Please leave this alone unless instructed otherwise

The most often-used features at this top level are: Changing the DEWESoft background color

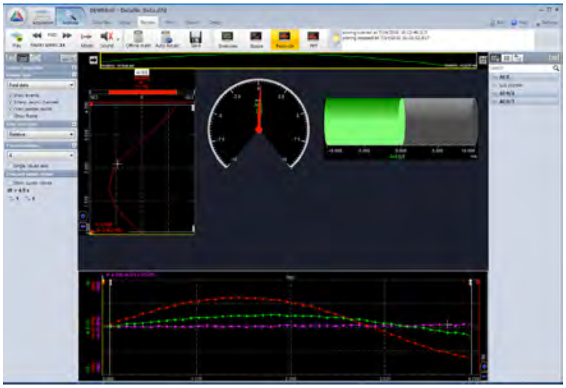
The default background color is dark blue. However, if you plan on printing reports frequently directly from DEWESoft, you might want to change the background to WHITE, because then the screen and paper output will match. Also, this will prevent you from using really light colors like yellow (or white), which look great against dark blue, but which are impossible to see when printed on white paper.

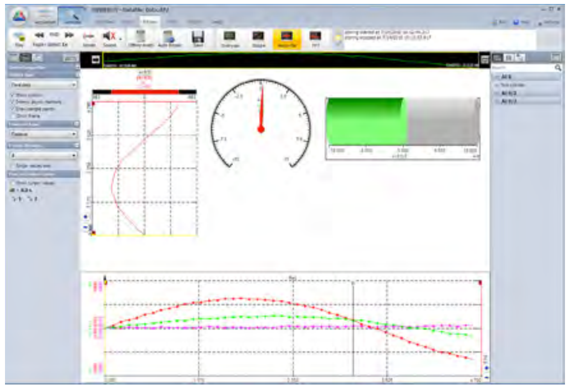
To change the background color to white, click the [Displays] button on the Global settings dialog box:



Here you can simply set the color to white using the selector.

Here is the difference:





Adding a logo to your printouts

To add a logo, click the [Print] button on the Global settings dialog box:

Now click the [...] button and then choose a BMP logo file that will be printed when you print stored data onto paper.

Summary

This concludes Part 2 of the DEWESoft QuickStart Guide. We have still only scratched the surface of this amazing data acquisition software program. There are more input types, more math functions, and ... well, it's a long list.

Please refer to the DEWESoft 7 Manual and DEWESoft 7 Tutorials for further information about how to use these advanced capabilities, or make arrangements to attend a Dewetron training class, where you can really learn a lot.

Finally, please experiment with DEWESoft and try everything. The software is quite intuitive once you get started.

100~250 VAC @ 50/60 Hz
AC Mains input
Standard 3-pin power connector
When the power switch is in the OFF position, no power will be output from the DPS-2410. If you plug the DPS-2410 into your DEWE-321x to recharge its batteries, or to power the DEWE-321x, the DPS-2410 power switch must be in the ON position.

⇒ Filtered air intake

⇒ **DO NOT BLOCK THE FAN PORT! Blocked or dirty fans can cause the DPS-2410 to overheat and shut down, or become damaged.**

24 VDC output
LEMO EGG.2B.302.CLL
(mate FGG.2B.302.CLAD82)

☺ **A mating cable is included with the DPS-2410, to connect it to the DEWE-321x power input**

DPS-2410 AC/DC
power supply

Yellow/green ground connector

☺ **Note - It is considered a "best practice" to connect the ground point to the test stand and to the DEWE-321x, to prevent ground loops.**

LED green POWER
ON indicator

Fuse: standard ATO "regular" fuse, 10A (red color code), reference ISO 8820-3

⇒ **Always replace the fuse with the same exact kind as provided from the factory! Damage to the DPS-2410, or personal injury or even death can result from using the wrong fuse value or type. Replacement fuses are available from Dewetron if you have any questions or concerns.**

8 Power Related Accessories

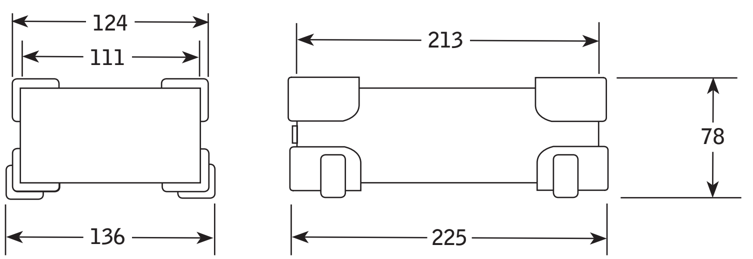
DPS-2410 external AC/DC power supply

The DEWE-3210 and DEWE-3211 include a Dewetron Power Supply (DPS) which outputs 24VDC at 10 amps (2410). Thus, the model name is DPS-2410. The DPS-2410 is used to power your system from 120/240VAC. When connected and powered on, it will also recharge any batteries which are installed within the system at the same time.

Here are the relevant specifications for this power supply:

Parameter	DSP-2410
Power input:	100~250 VAC, 50/60 Hz standard worldwide power from AC mains
Power output:	24 VDC nominal level, up to 10.5A absolute max (10A nominal and fused)
Ground:	yellow/green stripe color coded mini banana jack referenced to ground.
Switch:	AC mains power switch, turns off the DPS-2410 completely (there is no hot standby mode)
Indicator:	Green LED indicates that the DPS-2410 is connected to power and turned ON.
Fan:	Built into the top cover. Series 1 models: black plastic fan bezel. Series 2 models: flush metal fan grille.
Construction:	Aluminum with rubber shock protection corners

DPS-2410 Dimensions



Dimensions in millimeters (mm)

Divide by 25.4 for inches

Neutrino-4

The Neutrino-4 is an optional external battery charger and additional DC power supply unit. It can recharge four Dewetron standard batteries (model BATT-95WH) simultaneously when powered from 120/240 VAC. The Neutrino-4 has a built-in LCD display exactly like the one which is on the DEWE-321x mainframe, so it will show you the number of batteries inside and their aggregate charge status.

Using a special power cable, the Neutrino-4 can also be unplugged from AC and plugged into the DC input of the DEWE-321x to provide an additional power source. With a full loaded and charged Neutrino-4 plus the two batteries already within the DEWE-321x, you then have the power of six Dewetron BATT-95WH batteries. Since a rule of thumb is that you typically get one hour of data acquisition time per battery, this means your system can run practically an entire work day without being connected to external power.

Above left: with the door open and batteries partially or completely removed
Above right: with the door closed

Like the DEWE-321x mainframe itself, the Neutrino also supports hot-swapping of its batteries, so you can feed in fresh batteries at regular intervals, to keep it supplying DC power indefinitely.

What's included with the Neutrino-4, when ordered with your DEWE-321x:

- The Neutrino-4 mainframe
- AC mains input power cord
- DC - DC power cord, to connect the Neutrino-4 to your DEWE-321x
- One (1) BATT-95WH smart battery (please order additional batteries separately if you require them)

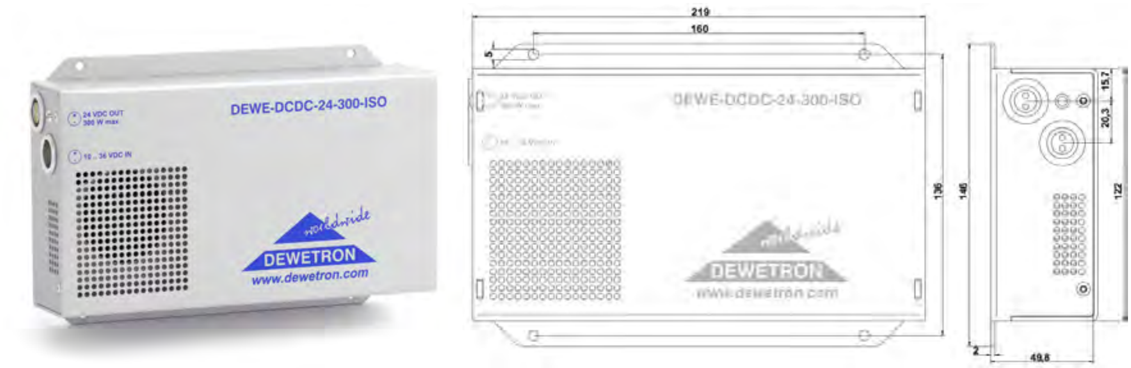
The Neutrino-4 has the CE Mark

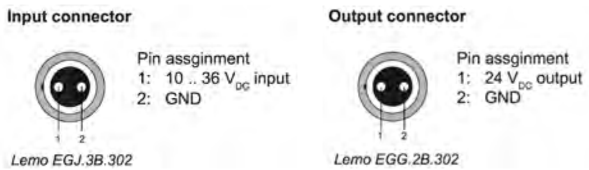
DEWE-DCDC-24-300-ISO

This is an isolated DC-DC converter that will power your Dewetron battery powered instrument from a wide ranging DC input power source, and also isolate it from that source.

This option is very popular in automotive applications, due to its isolation. And of course, it runs from such a wide range of DC input power: 10 VDC to 36 VDC, that it is very convenient for use in cars, trucks, busses, and even aircraft.

You can order the DEWE-DCDC-24-300-ISO as an accessory for any Dewetron instrument which runs from DC power, as long as that instrument accepts 24 VDC.





Parameter	DEWE-DCDC-24-300-ISO
Input: Input voltage: Max. input current: Input connector:	 10 to 36 VDC (the input is protected against wrong polarity) 36 A @ 10 VDC input voltage (15 A @ 24 VDC) 2-pin LEMO connector male, type: EGJ.3B.302
Output: Output voltages: Output power: Output current: Output connector:	24 V 300 W 12.5 A 2-pin LEMO connector female, type: EGG.2B.302
Operating temperature: Derating above 45 °C:	-20 °C to 60 °C 8 Watt/°C
Isolation voltage:	500 VDC
Status LED:	Green LED indicates an output voltage > 21 VDC
Dimensions: (W x D x H):	~219 x 122 x 50 mm (8.6 x 4.8 x 2 in.)
Weight:	1.3 kg (2.9 lbs)
Power on sequence:	First: Connect the system and the DCDC! Followed by the DCDC and the power supply connection.

The DEWE-DCDC-24-300-ISO has the CE Mark

MSI Compatibility chart

MSI Modular Smart Interfaces for MDAQ and DAQ series modules							
	MDAQ-SUB-STG-D	MDAQ-SUB-BRIDGE-D	MDAQ-SUB-V200-D	DAQP-STG	DAQP-BRIDGE-A*	DAQP-BRIDGE-B	DAQP-LV-D
MSI-BR-ACC	√	√	--	√	--	--	--
	Isotron (constant current powered) adapter for MDAQ-SUB-BRIDGE / -STG modules with DB9 connector Excitation current 4 mA at 21 V, High pass filter 1.5 Hz, BNC connector Bandwidth and ranges are defined by connected amplifier Automatic identification via TEDS						
MSI-BR-V-200	√	√	--	√	--	--	--
	200 V input adapter for MDAQ-SUB-BRIDGE / -STG modules with DB9 connector Differential input configuration, BNC connector Bandwidth and ranges are defined by connected amplifier Automatic identification via TEDS						
MSI-BR-RTD	√	√	--	not needed	--	--	--
	Pt100, Pt200, Pt500, Pt1000 and Pt2000 adapter for MDAQ-SUB-BRIDGE / -STG modules with DB9 connector 2, 3 and 4 wire connection methods, 5-pin Binder 710 series connector Automatic identification via TEDS						
MSI-BR-CH-50	√	√	--	√	--	--	--
	Charge input interface for DAQP-STG and MDAQ-SUB-BRIDGE / -STG with DB9 connector Range up to 50000 pC, AC coupled with 0.07 Hz, BNC signal connection Max. 100 kHz bandwidth (dependent on the max. bandwidth of the amplifier) Automatic identification via TEDS						
MSI-BR-TH-X	√	√	--	√	√	√	--
	Thermocouple type K / J / T adapter for DAQP-BRIDGE-x and MDAQ-SUB-BRIDGE / -STG modules For use with isolated thermocouple sensors only ! (except in combination with DAQP-STG-D or DAQP-BRIDGE-A*, which are isolated) High accuracy cold junction reference measurement, 1 m thermo cable with Mini TC connector Automatic identification via TEDS*						
MSI-V-ACC	--	--	√	--	--	--	√
	Isotron (constant current powered) adapter for DAQP-V-D and MDAQ-SUB-V200-D Excitation current 4 mA at 21 V, High pass filter 1.5 Hz, BNC connector Bandwidth and ranges are defined by connected amplifier Automatic identification via TEDS						
MSI-V-RTD	--	--	√	--	--	--	√
	Pt100, Pt200, Pt500 and Pt1000 adapter for DAQP-V-D and MDAQ-SUB-V200-D 2, 3 and 4 wire connection methods, 5-pin Binder 710 series connector Automatic identification via TEDS						
MSI-V-CH-50	--	--	√	--	--	--	√
	Charge input interface for DAQP-LV-D and MDAQ-SUB-V200-D Range up to 50000 pC, AC coupled with 0.07 Hz, BNC signal connection Max. 100 kHz bandwidth (dependent on the max. bandwidth of the amplifier) Automatic identification via TEDS						

* DAQP-BRIDGE-A does not have TEDS, therefore it cannot recognize MSI interfaces

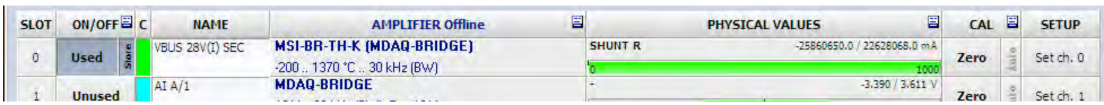
9 Options and Interfaces

MSI series interfaces

The DEWE-321x is compatible with MSI series intelligent sensor interfaces. Exactly which MSI interfaces can be used depends entirely on which signal conditioners are installed within your system. The table on the opposite page cross references the compatibility of each MSI with various Dewetron DAQ and MDAQ series signal conditioners, so please refer to that table when choosing MSIs for your system.

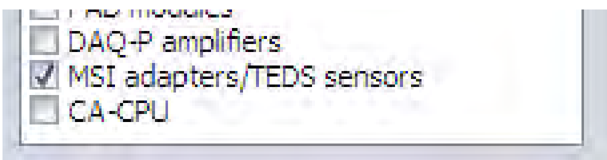
Several MSIs are available for both bridge series modules and voltage input modules, namely the ACC, V200, and charge adapters.

When you plug in an MSI interface to any of the analog inputs, it should show up automatically on the SETUP screen within DEWESoft, within the AMPLIFIER column.



☺ **Note - if your MSI interfaces are NOT showing up on the screen as shown above, then there are two possible explanations:**

1. You have not upgraded your software to DEWESoft 7.0 or higher
2. Perhaps MSIs are not activated at the hardware setup level. To remedy this, please click the SETTINGS menu then select HARDWARE SETUP. On the analog page, ensure that the checkbox for MSIs is checked, then click OK to save this setting.

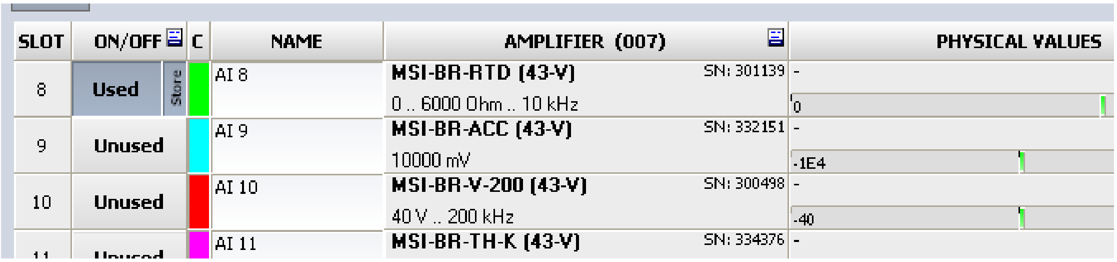


☺ **Note - please make sure that any conditioners that you have are checkmarked on this screen.**

If you are using DEWESoft 7 and have activated MSI interface as described above, and MSI interfaces are still not showing up when plugged into your analog inputs, please contact us for technical support. Be sure to try more than one MSI interface, to rule out a defective MSI interface being the cause of this problem.

MSI Compatibility

When you plug any one of them into the analog inputs, the software will detect it and show its name and serial number on the main channel setup screen, as shown here:



SLOT	ON/OFF	C	NAME	AMPLIFIER (007)	PHYSICAL VALUES
8	Used Store		AI 8	MSI-BR-RTD (43-V) SN: 301139 0 .. 6000 Ohm .. 10 kHz	- 0
9	Unused		AI 9	MSI-BR-ACC (43-V) SN: 332151 10000 mV	- -1E4
10	Unused		AI 10	MSI-BR-V-200 (43-V) SN: 300498 40 V .. 200 kHz	- -40
11	Unused		AI 11	MSI-BR-TH-K (43-V) SN: 334376	-

⇒ **The only exception to automatic identification within DEWESoft is the DAQP-BRIDGE-A module, which does not have TEDS interface. Therefore, although they will literally work, it is not convenient to use MSI adapters with that signal conditioner. The DAQP-STG-D is a much better choice.**

Adapters

ADAP series interfaces are passive adapters, available for various types of signal inputs. Unlike MSI interfaces, they are not controlled under the software, nor do they have a TEDS interface inside. They are strictly passive adapters. A popular one, for example, has a precision 50Ω resistor inside it, wired across the inputs, which serves as a current shunt for 0-20 mA applications.

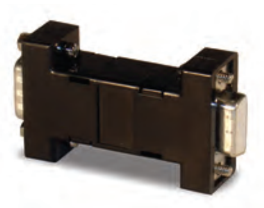
Following these single function adapters is a table with the most popular adapters for wider applications.

ADAP-BNC-MICRODOT

The DAQP-CHARGE-A module comes with an adapter from microdot connector to BNC, allowing you to connect charge sensors with the small 10-32 microdot connectors to the BNC input. This adapter is also available for purchase for the DAQP-CHARGE-A, or to be used in conjunction with the MSI-BR-CH-50 and MSI-V-CH-50 charge interfaces.

ADAP-CAN-OPT-ISO

Isolation adapter for one CAN BUS interface. This small interface plugs into a standard DSUB9 CAN BUS interface connector, and provides real isolation between the vehicle CAN bus and the Dewetron CAN interface. This is very often needed in electrically noisy environments, and on military vehicles.



☺ **Being passive, ADAP series adapters do not show up on the DEWESoft setup screen. However, you can select them manually in many cases, as we will show below.**

Adapters for various MDAQ and DAQ series modules								
	MDAQ-SUB-STG-D	MDAQ-SUB-BRIDGE-D	MDAQ-SUB-V200-D	MDAQ-SUB-V200-BNC	DAQP-LV-B	DAQP-LV-BNC	DAQP-LV-D	DAQP-STG-D
DAQ-SHUNT-1	--	--	--	--	√	--	--	--
	Shunt adapter for 0-20 mA or 4-20 mA measurements, internal precision 50Ω shunt resistor 100 mA input range, 1 W maximum, 1% accuracy banana plug to Dewetron module / banana jacks on sensor side							
DAQ-SHUNT-1-BNC	√	√	√	--	--	--	√	√
	Shunt adapter for 0-20 mA or 4-20 mA measurements, internal precision 50Ω shunt resistor 100 mA input range, 1 W maximum, 1% accuracy 9-pin DSUB to Dewetron module / BNC jack on sensor side							
DAQ-SHUNT-3	--	--	--	--	√	--	--	--
	Shunt box for measurements up to 5A (0.1 Ω, ±0.1%, 3W) Current input via 2 x 0.3 meter cables with banana plugs Voltage output via 2 x 0.3 meter cable with banana plugs							
DAQ-SHUNT-4	--		--	--	√	--	--	--
	Shunt box for measurements up to 5A (0.1 Ω, ±0.1%, 3W) Current input via 2 x safety banana jacks Voltage output via 2 x 0.3 meter cable with banana plugs							
DAQ-SHUNT-5	--		--	--	√	--	--	--
	Shunt box for measurements up to 5A (0.1 Ω, ±0.1%, 3W) Current input via 2 x safety banana jacks Voltage output via 2 x safety banana jacks							
CONN-DSUB-9	√	√	√	--	--	--	√	√
	Mating connector for 9-pin DSUB connectors with convenient screw terminals inside Eliminates soldering/desoldering							
ADAP-MDAQ-BNC	√	√	√	--	--	--	--	--
	Converter from 9-pin DSUB to BNC input connector, for MDAQ series modules (pin-outs are the same as ADAP-DAQ-BNC, but there is an additional isolation resistor in this adapter to improve noise performance of differential MDAQ series modules)							
ADAP-DAQ-BNC	--	--	--	--	--	--	√	√
	Converter from 9-pin DSUB to BNC input connector, for DAQ series modules							

Adapters for various MDAQ and DAQ series modules								
	MDAQ-SUB-STG-D	MDAQ-SUB-BRIDGE-D	MDAQ-SUB-V200-D	MDAQ-SUB-V200-BNC	DAQP-LV-B	DAQP-LV-BNC	DAQP-LV-D	DAQP-STG-D
ADAP-BAN-BNC	--	--	--	√	not needed	√	--	--
	Adapter from banana jack to BNC. Allows you to connect your cables with banana plugs into Dewetron modules which have BNC input connectors.							
ADAP-MIC-BNC-CBL	--	--	--	√	--	√	--	--
	Microphone adapter and 6 ft BNC cable. Allows the use of standard unpowered mics with your Dewetron system. Adapter: 3 Pin XLR Male to BNC Female Audio Adapter Contacts (XLR) : 3 Genders: BNC (Female) / XLR (Male) Wired: Pin 1 & 3 = Ground / Pin 2 = Hot Includes 6 ft BNC-BNC cable (not shown in picture here)							
ADAP-BR-1/4-120	not needed	√	--	--	--	--	--	not needed
	Bridge completion terminal, 1/4 bridge @ 120 Ω DSUB9 input and output connectors							
ADAP-BR-1/4-350	not needed	√	--	--	--	--	--	not needed
	Bridge completion terminal, 1/4 bridge @ 350 Ω DSUB9 input and output connectors							

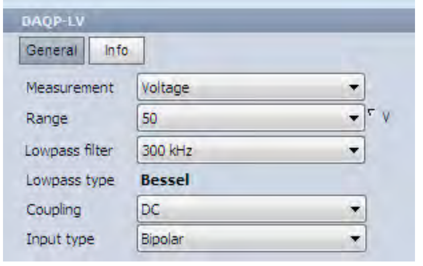
Using Adapters in DEWESoft

Since ADAP adapters do not have any kind of electronic interface, they do not show up in the software automatically - you have to set them up yourself. But DEWESoft makes this easy. Simply access the SETUP screen for any channel that you have an adapter plugged into, and enter the appropriate settings and scaling information there.

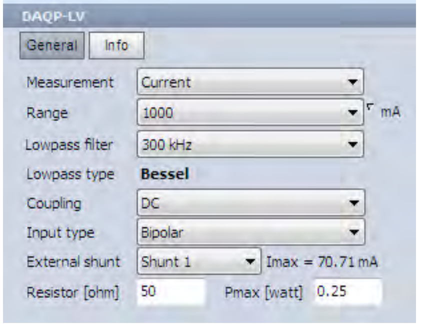
In the next section we will look at setting up a few popular adapters in the most commonly requested scenarios.

Using the DAQ-SHUNT-1 adapter

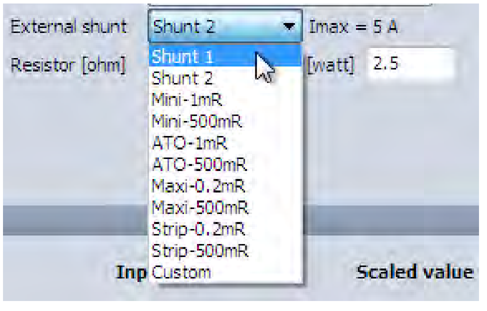
Let's take the case of the DAQ-SHUNT-1, which is a 50Ω shunt adapter for making 4-20 mA current measurements. Let's see how to set it up within a DAQP-LV-B module. When you first open the SETUP dialog for this channel, by default it will be set to the VOLTAGE measurement mode, like this:



Therefore, it is necessary to change the mode from voltage to current, as shown here:

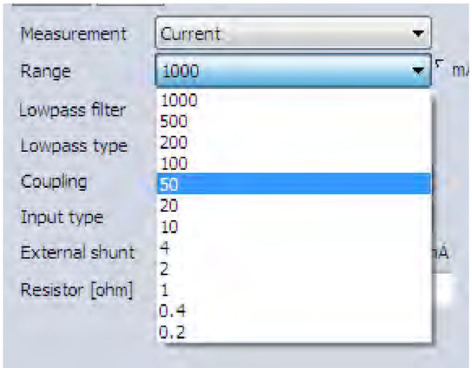


When you do this, the software changes the unit of measure from V to mA, and also presents you with the ability to select Shunt 1, Shunt 2 (Shunt 2 applies to Shunt 3, Shunt4, and Shunt 5, which are the same electrically, but which only have different I/O connector configurations), as well as a variety of Dewetron specialized shunts for automotive applications:

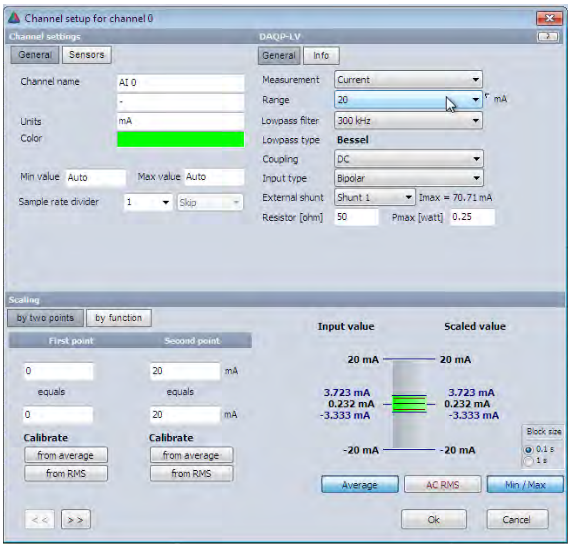


Simply select the shunt that is appropriate. In this case, when you choose Shunt 1, DEWESoft will automatically scale the input. And notice that the measuring ranges are now given directly in mA instead of voltage units.

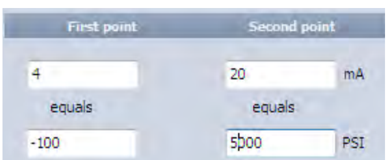
Have a look at the range selector:



Therefore you can simply select the 20 mA range, and there is no need to do any other scaling unless you need to convert the 20 mA signal to something else.



For instance, if your 4 - 20 mA signal really represents -100 to 5000 PSI, you could enter these scaling values quite easily on this same screen. First change the Units from mA to PSI, then below in the Scaling area, enter these values:

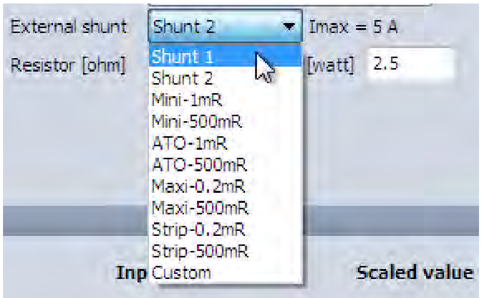


That's all you would have to do! Any scaling parameters which are linear can be entered in this way.

☺ **Note: the ranges shown above apply to the DAQP-LV module. When you use the DAQ-SHUNT-1 with other modules, the ranges will be different according to which module is being used.**

Using custom Shunt resistors

After selecting CURRENT input type you can also select CUSTOM instead of one of the preset current adapters, at the end of the list:

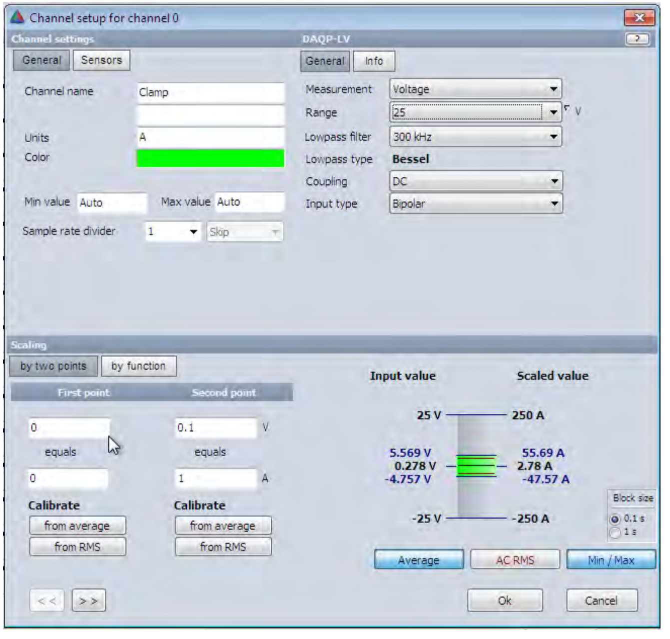


When you do this, the software allows you to enter the value of the shunt resistor that you are using, as well as the maximum wattage. The software will do the appropriate ohm's law calculations to amperage for you automatically.

☺ **Note - Dewetron conditioners such as the MDAQ-SUB-BRIDGE and MDAQ-SUB-STG also support the direct selection of CURRENT as a measuring type. Therefore you can use them with shunts as shown above. You simply need to adapt the input connector to handle a shunt resistor. An idea choice is the CONN-DSUB-9 mating connector, which makes it easy to insert your own shunt resistor into the mating connector and plug it into the DSUB 9-pin input connector of the module.**

Using Current sensors

In this case we recommend that you leave the Measurement type to Voltage, and simply enter the appropriate engineering units and scaling factor. For example, if you were using a current clamp that could measure 250 Amps, but which output 0.1 V/A, you would simply set up this channel like this:

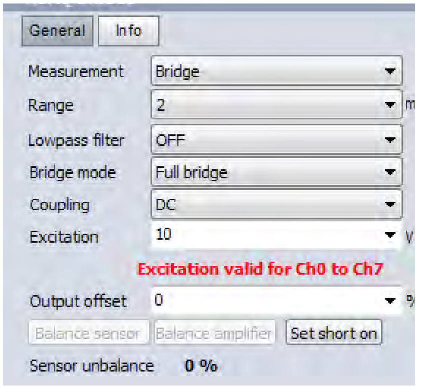


After you set the Units to A, then enter the scaling factors as shown above so that 0.1 V = 1 A, simply use the Range selector to choose the appropriate current measuring range. Keep an eye on the right side of the scaling BAR in the bottom left corner of the screen. Notice that when you select the 25V measuring range, you will get a full scale 250 A measuring range. This is perfect. You can select smaller ranges if you expect that the current input will not really reach 250 A. Choose the range that best fits to your current sensor AND the desired measuring range.

Using the ADAP-BR-1/4-120 or 350 bridge completion adapters

These adapters are only needed for Dewetron bridge conditioners which do not have internal completion for 1/4 bridge sensors. Therefore they are not needed by the DAQP-STG, DAQP-BRIDGE-A, DAQP-BRIDGE-A, or MDAQ-SUB-STG-D, because these all support full bridge, half bridge and quarter bridge with internal completion for many bride wiring scenarios.

However, these adapters to apply to Dewetron conditioners that lack 1/4 bridge completion, including the MDAQ-SUB-BRIDGE-D (full and half bridge inputs), as well as the inputs of the DEWE-43, DEWE-101, and DEWE-3213 (full bridge inputs).



Select the full bridge mode of the MDAQ-SUB-BRIDGE, and then plug in the completion adapter.

This is less convenient than using a more capable signal conditioner, not only because of the external adapter, but because you cannot use the balance buttons in this mode. But it serves to adapt this less capable conditioner to handle 1/4 bridge sensors.

General DAQ/PAD module specifications

Module dimensions:	20 x 65 x 105 mm (0.79 x 2.56 x 4.13 in.) (W x H x D without front cover and connectors)
Front cover:	20 x 87 x 2 mm (0.79 x 3.43 x 0.08 in.) (W x H x D without connector)
Environmental:	
Temp. range storage:	-30 °C to +85 °C (-22 °F to 185 °F)
Temp. range operating:	-5 °C to +60 °C (23 °F to 140 °F)
Rel. humidity (MIL202):	0 to 95 % at 60 °C, non-condensing
RFI susceptibility:	±0.5 % span error at 400 MHz, 5 W, 3 m

All specifications within this manual are valid at 25 °C.

All modules are produced according to ISO9001 and ISO14001.

DAQ Series Common Information

Calibration information

All DEWETRON modules are calibrated at 25°C after a warmup time of 30 minutes and meet their specifications when leaving the factory. The time interval for recalibration depends on environmental conditions. Typically, the calibration should be checked once a year.

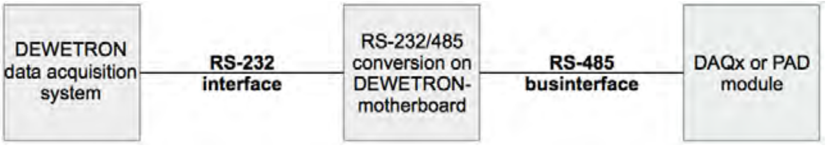
Calibration certificates are available from DEWETRON as an option. DEWETRON offers several types:

- NIST traceable DEWETRON calibration certificate (USA CAL LAB only)
- ISO traceable DEWETRON certificate (European CAL LAB only)
- Calibration certificate according to ÖKD (equivalent to DKD)

RS-232/485 interface

DAQP modules can be configured via RS-485 interface, PAD modules require this interface for all data transfers The DEWE-3210 and DEWE-3211 include an internal RS-232/485 converter and interface. This converter allows communication with all Dewetron signal conditioning modules. To communicate with the modules, the RS-232 interface must be set to the following parameters:

baud rate:	9600
data bits:	8
parity:	no parity
stop bits:	1
handshake:	not required



10 Signal Conditioners

There are several series of Dewetron signal conditioners that may be installed in your system in many possible combinations. This section presents technical information about each of these series:

Module series	DEWE-3210 series	DEWE-3211 series	DEWE-3213 series
DAQ series Modules	Directly plug in, user exchangeable	Can be added externally	Can be added externally
PAD series Modules	Directly plug in, user exchangeable	Can be added externally	Can be added externally
MDAQ series Modules	Can be added externally	Factory installed, not user exchangeable	Can be added externally
EPAD2 series Modules	Can be added externally	Can be added externally	Can be added externally
CPAD2 series Modules	Can be added externally	Can be added externally	Can be added externally
DEWE-43 Modules	N/A	N/A	Can be added externally (up to 4)

Above: cross reference of module types and chassis compatibility

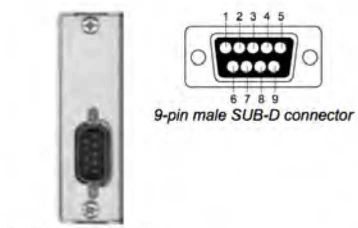
Further technical information can be found in the Dewetron Modules Technical Reference, a separate document.

DAQ Series Modules

DAQ Module Connectors

Front Panel Connector — Accessible to the user. The connector type and pin assignment varies from module to module. Detailed pin assignment of each module is shown in the appropriate module description.

Rear Connector — Not user accessible. 9-pin male SUB-D, interface to the Dewetron System.



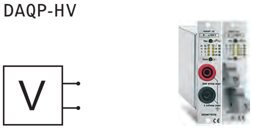
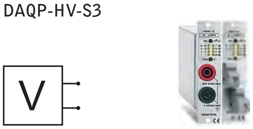
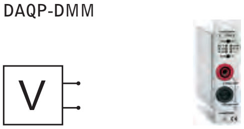
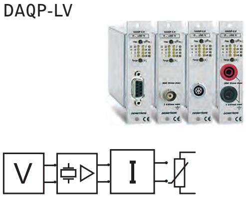
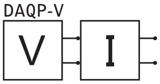
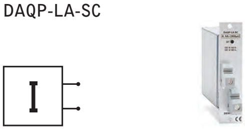
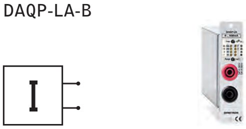
DAQx and PAD module rear view

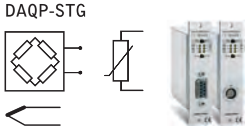
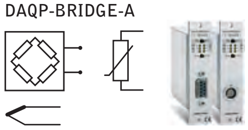
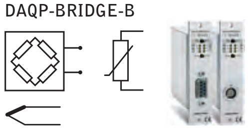
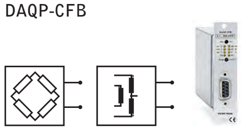
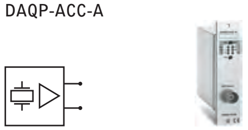
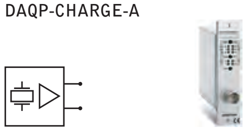
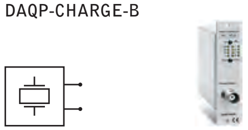
9-pin male SUB-D connector

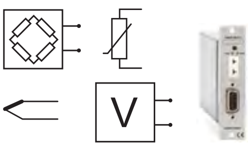
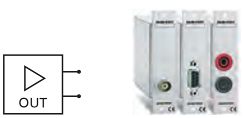
Interface pin assignment:

1 Module output (±5 V)
2 RS-485 (A)
3 RS-485 (B)
4 GND
5 +9 V power supply
6 +12 V power / sensor supply
7 Module input (from D/A converter of the A/D board)[1)]
8 reserved
9 -9 V power supply

[1)] Triggerout at DAQP-FREQ-A

MODULE	INPUT TYPE	RANGES	TEDS	BANDWIDTH (BW) FILTERS (LP / HP)	ISOLATION (ISO) OVER-VOLTAGE PROTECTION (OP)
High Voltage Measurement					
DAQP-HV 	High voltage	±20, ±50, ±100, ±200, ±400, ±800, ±1400 V	N/A	BW: 300 kHz LP: 10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 300 kHz	ISO: 1.8 kVrms (line-to-line)
DAQP-HV-S3 	High voltage	±20, ±50, ±100, ±200, ±400, ±800, ±1400 V	N/A	BW: 700 kHz	ISO: 1.8 kVrms (line-to-line)
DAQP-DMM 	High voltage	±10, ±40, ±100, ±200, ±400, ±1000 V	N/A	BW: 20/30 kHz LP: 10, 100, Hz 1, 2, 20/30 kHz	ISO: 1.5 kVrms
Low/Medium Voltage & Current Measurement					
DAQP-LV 	Voltage, current with external shunt or current sensor	±10, ±20, ±50, ±100, ±200, ±500 mV ±1, ±2.5, ±5, ±10, ±25, ±50 V	N/A	BW: 300 kHz LP: 10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 300 kHz	ISO: up to 1 kVrms (with banana jacks) OP: 350 VDC
	IEPE via MSI-V-ACC	±10, ±20, ±50, ±100, ±200, ±500 mV ±1, ±2.5, ±5, ±10 V			
	PT100, Pt200, Pt500, Pt1000, Pt2000 and resistance via MSI-V-RTD	-200 to 1000 C and 0 to 6.5 kOhm			
DAQP-V 	Voltage, current with external shunt or current sensor	±10, ±100 mV ±1, ±5, ±10, ±50 V	N/A	BW: 50 kHz LP: 10, 100 Hz 1, 10, 50 kHz	ISO: up to 1 kVrms OP: ±500 VDC or 350 Vrms
DAQP-LA-SC 	Current Note: 5Arms continuous	±0.1, ±0.3, ±1, ±3 A ±10 A peak, ±30 A peak max 5Arms continuous current	N/A	BW: 300 kHz LP: 10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 300 kHz	ISO: 1.4 kVrms
DAQP-LA-B 	Current Note: intended for 4-20 mA applications	±2, ±6, ±20 mA ±60 mA, ±200 mA, ±0.6A max 0.6 A	N/A	BW: 300 kHz LP: 10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 300 kHz	ISO: 1.4 kVrms

MODULE	INPUT TYPE	RANGES	TEDS	BANDWIDTH (BW) FILTERS (LP / HP)	ISOLATION (ISO) OVER-VOLTAGE PROTECTION (OP)
Bridge / Strain Gage Measurement					
DAQP-STG 	Strain gages, bridge sensors, voltages	Bridge: Voltage:		BW: 300 kHz LP: 10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 300 kHz	ISO: 350 VDC OP: ±10 VDC
	Pot/Ohmic sensors	Resistance/ohms			
	Thermocouple via MSR-BR-TH series	Full range of thermocouple type			
DAQP-BRIDGE-A 	Strain gages, bridge sensors	±1, ±2, ±5, ±10, ±20, ±50 mV/V (@ 5 Vdc excitation)	N/A	BW: 20 kHz LP: 10, 100 Hz 1, 5, 20 kHz	ISO: 350 VDC OP: ±50 VDC
	Pot/Ohmic sensors	200 ohm to 10 kohm			
	Thermocouple via MSR-BR-TH series	Full range of thermocouple type			
DAQP-BRIDGE-B 	Strain gages, bridge sensors	±0.1, ±0.2, ±0.5, ±1, ±2, ±5, ±10, ±20, ±50, ±100 mV/V (@ 5 Vdc excitation)	Yes	BW: 200 kHz LP: 10, 30, 100, 300 Hz 1, 3, 10, 30, 100, 200 kHz	ISO: N/A OP: ±10 VDC
	Pot/Ohmic sensors	200 ohm to 10 kohm			
	Thermocouple via MSR-BR-TH series	Full range of thermocouple type			
DAQP-CFB 	AC bridge, strain gage, carrier sensors	Bridge: 0.1 to 1000 mV/V Inductive: 5 to 1000 mV/V	N/A	BW: dc to 2.3 kHz LP: 10, 30, 100, 300 Hz 1 kHz	ISO: N/A OP: ±10 VDC
	Inductive/ LVDT sensors	Voltage: 0.2 to 1000 mV/ vrms			
Charge / IEPE Measurement					
DAQP-ACC-A 	IEPE sensors	±50, ±166, ±500 mV; ±1.66, ±5 V (Gain: 1, 3, 10, 30, 100)	Yes	BW: 0.5 Hz to 300 kHz LP: 1, 10, 100, 300 kHz HP: 0.5 Hz, 5 Hz	N/A
DAQP-CHARGE-A 	IEPE and charge sensors Note: selectable integration and double integration	Charge: 5, 50, 500, 5000, 50000 pC IEPE: ±5, ±50, ±500 mV, ±5 V (0, 20, 40, 60 dB)	N/A	BW: 0.1 Hz to 50 kHz LP: 100 Hz; 1, 3, 10, 50 kHz HP: 0.1 Hz, 1 Hz, 10 Hz	N/A
DAQP-CHARGE-B 	Charge sensors Note: selectable time constant for static charge sensors	±100, ±500, ±2 000, ±10 000, ±40 000, ±200 000, ±1 000 000 pC	N/A	BW: 0.5 Hz to 100 kHz LP: 10, 30, 100, 300 Hz; 1, 3, 10, 30, 100 kHz HP: DC, 0.0001 Hz to 0.5 Hz	ISO: 350 VDC

MODULE	INPUT TYPE	RANGES	TEDS	BANDWIDTH (BW) FILTERS (LP / HP)	ISOLATION (ISO) OVER-VOLTAGE PROTECTION (OP)
Temperature and Universal Measurement					
DAQP-THERM 	Thermocouple (universal)	K, J, T, R, S, N, E, B, L, C, U freely programmable within the maximum range of the selected thermocouple type, internal linearization, internal CJC	N/A	BW: 3 kHz LP: 3Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz Butterworth or Bessel; 2nd, 4th, 6th, or 8th order (programmable)	ISO: ±1000 Vrms continuous
DAQP-MULTI 	Thermocouple (universal)	K, J, T, R, S, N, E, B, L, C, U type, internal linearization, freely programmable range, internal CJC	Yes	BW: 3 kHz LP: 3Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz Butterworth or Bessel; 2nd, 4th, 6th, or 8th order programmable	ISO: 1000 Vrms continuous (for input, excitation and TEDS interface)
	RTD	Pt100, Pt200, Pt500, Pt1000 and Pt2000 sensors, programmable range (2-wire and 4-wire only)			
	Voltage	10 ranges from ±5 mV to ± 5 V			
	Resistance	freely programmable range from 1 Ohm to 1 MOhm			
	Bridge (constant current)	4-wire full bridge sensors, 13 ranges from ±0.5 to 5000 mV/mA			
Frequency to Voltage Measurement					
DAQP-FREQ-A 	Frequency to voltage	100, 1k, 5k, 20k, 100k and 200 kHz ranges; Trigger level range 0 to 130 V, Additional TTL output (isolated pulse output of input signal)	N/A	BW: 200 kHz Selectable input and output filters (range-dependent)	ISO: 350 Vrms
Output modules					
DAQN-V-OUT 	Analog output	1:1 output module, from 0 to ±10 V; Accuracy ±0.05 % Connector choices: banana, BNC, or 9-pin DSUB connector	N/A	BW: 400 Hz	ISO: CMV output to input, continuous: 1500 VRMS max

Adding DAQ (or HSI) modules to your Dewtetron system:

DAQ modules can be plugged directly into the DEWE-3210, because it has 8 slots for DAQ/PAD/HSI series plug-in modules. But if you don't want to add more DAQ modules, you can simply add a DEWE-30 series chassis. The typical DEWE-3210 has a 16-channel A/D card inside it already, and the first 8 channels are wired to the 8 x DAQ slots on the left side of the DEWE-3210.

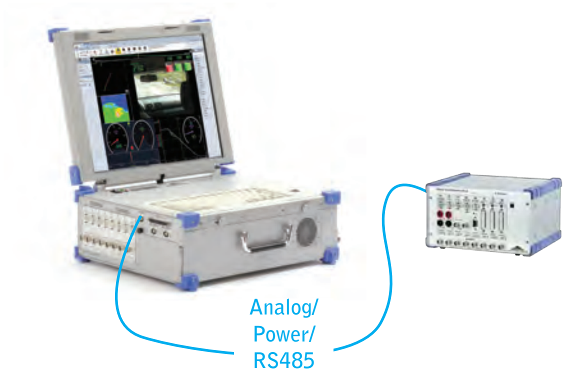
The other 8 channels are wired to the EXPANSION LEMO connector on the side of the DEWE-3210 near the modules. Therefore, you may easily connect a DEWE-30-8 chassis with 8 more DAQ (or PAD or HSI) modules in it, using the appropriate cable. It is expecially convenient to use the expansion version of the DEWE-30-8 chassis, because then it will also be powered from the DEWE-3210 mainframe, and a single cable will connect power, the analog outputs from the external modules, and the RS485 interface for module control. When you run the software, all 16 modules will show up on the SETUP screen just as if they were all built into the DEWE-3210!

This method also allows the DEWE-3211 to utilze DAQ series modules, since this model does not have any slots on its chassis. DEWE-30 series chassis are available with 4, 8, 16, 32, 48, or 64 slots, while DEWE-50-PCI series chassis are available with 16, 32, or 64 slots.

Typical DEWE-3210 hook-ups:

- Installing 8 modules directly into the DEWE-3210:

- Adding a DEWE-30-8 expansion rack, for accessing 16 total channels:



- Adding a DEWE-30-8 expansion rack, plus another 16 slot DEWE-30-16 rack, for a total of 32 DAQ modules:

The DEWE-30-16 requires that an additional 16-ch A/D card be added into the DEWE-3210 mainframe!

Addressing DAQ modules

Each DAQ module must have a unique address (just like HSI, PAD, and other modules). The address is stored inside the DAQ module in non-volatile memory. Therefore, if you remove a DAQ module from one system, where it was set to address 31, and plug it into a different Dewetron chassis, it will still report itself on the bus at address 31.

This can cause a conflict if you already have a module at this address. In addition, it will be confusing to you when you hook up your signals to what you believe is DAQ module at address 16, but the channels show up on address 31. Therefore, it is vitally important that you set the addresses of any DAQ, PAD, or HSI modules that you plug into your Dewetron system.

☺ There is no need to set the addresses of MDAQ modules, except when initially installed at the factory.

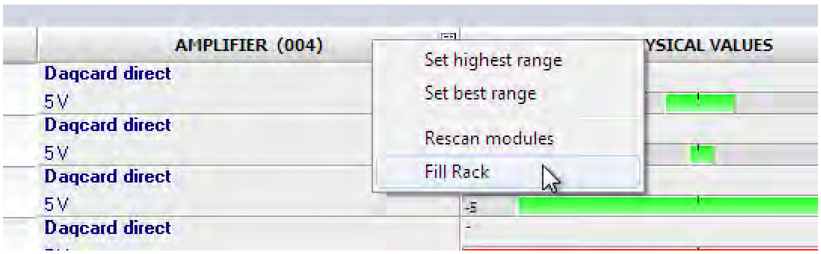
There are essentially two ways to address your modules:

- FILL RACK PROCEDURE - this addresses all of your modules in sequence. This is what you should do if you have been changing more than one module around, to ensure that every module is at the appropriate and unique address.
- FILL ONE MODULE PROCEDURE - easier and faster, when you simply want to exchange one module.

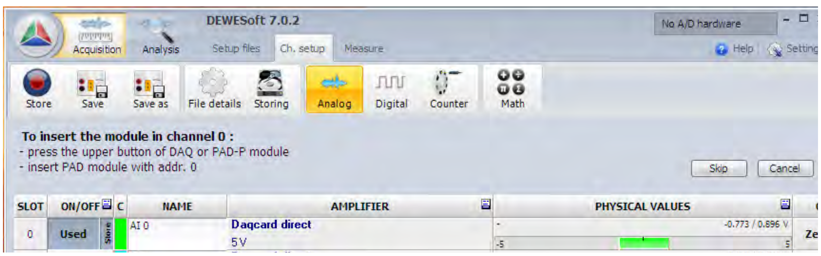
Let's look at how to do each one of the above procedures:

Fill Rack (all Modules) Procedure

Within DEWESoft, go to the ACQUISITION MODE and select the SETUP screen, where you can see your list of modules. Now click on the top of the AMPLIFIER COLUMN and you will see this menu:



Select the FILL RACK option, and the software will prompt you like this:

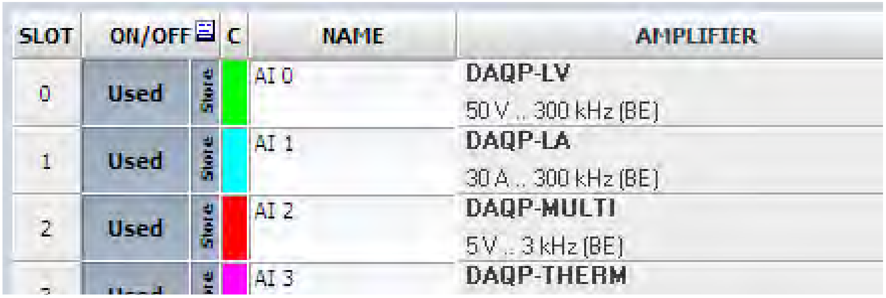


Follow the instruction to press the TOP black button on the module in the first slot, which is always SLOT 0 in the case of doing a FILL RACK, since you are starting at 0 and going all the way up, filling all modules.

When you press this button on the module, the system will beep and prompt you to press the next module's button, and so on. Continue all the way through until you have done the last module, then press CANCEL to complete and save your changes.

If you get to the position where there is an empty module slot, or a non-programmable module from the old days in that slot, press the SKIP button to move past it to the next module. You can do this as many times as needed.

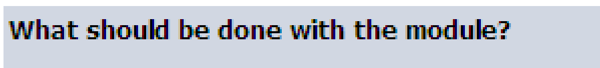
When you're done, the rack should be filled with all of the modules that are physically installed within this system, like this:



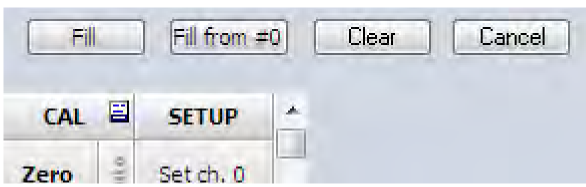
FILL (or CLEAR) One Module Procedure

FILL RACK is a great way to ensure that your modules are all addressed correctly, and we highly recommend it if you make several module exchanges at once. But there are times when you simply want to exchange one module with a different one, or perhaps to just remove a module. This is also quite easy once you know how.

Within DEWESoft, go to the ACQUISITION MODE and select the SETUP screen, where you can see your list of modules. This time, instead of clicking on the top of the AMPLIFIER COLUMN, double-click the amplifier column for the one module that you want to add, delete, or exchange. When you do this, the software will give you a similar choice as before:



And your choices are:



- If you have plugged a new module into this slot, choose FILL, then follow the prompts.
- If you change you mind and want to do a FILL RACK anyway, starting at slot 0, choose FILL FROM #0, then follow the prompts.
- If there is a module in this slot that you have removed, but it continues to show up in RED (because the software cannot really find it), choose CLEAR to remove it from the list.
- If you have clicked this by accident and want to cancel without making any changes, choose CANCEL

Module Installation Trouble-shooting

There may be times when you have trouble addressing your modules, for a variety of reasons. Here are some good tips for solving these issues:

Problem: some or all modules are showing up in RED letters.

Analysis: a module shown in RED letters on the setup screen tells you that the software cannot find this module. Or, it can mean that there is a conflict with another module, like when you plug two modules with the same address into the system at the same time and don't do a FILL RACK or FILL (or CLEAR) one of them. A very rare condition might be that a module is defective and cannot communicate properly.

Solution: the trusty FILL RACK is always a great and easy way to solve nearly all these issues.

If the FILL RACK does not solve them, remove any modules shown in RED and add them back in one at a time, using the FILL ONE MODULE procedure. Fill one module at a time until the offending modules' addresses have been resolved.

Problem: you plug in a new module into a previously unused slot, but it does not show up.

Analysis: more than likely it was already set to an address that you were using, and it has either taken another module's address, or is conflicting with it.

Solution: the trusty FILL RACK is always a great and easy way to solve nearly all these issues.

If the FILL RACK does not solve them, remove any modules shown in RED and add them back in one at a time, using the FILL ONE MODULE procedure. Fill one module at a time until the offending modules' addresses have been resolved.

Problem: you want to use a very old PAD module which does not have the upper black button on it, so you don't know how to address it

Analysis: These modules have been out of production for a long time, but there are still some around, and they are still perfectly good modules.

Solution: Start with the old PAD module in the slot, but NOT PRESSED IN!! Make sure the connector on the inside is not mated or making contact in any way. Now double click on the amplifier slot where you want to install this module. Select FILL when prompted. Then when the next prompt appears to press the black button or push in the module... PUSH IN THE MODULE. The green LED on its front panel should light up, and it should show up on the list on your SETUP screen.

Problem: some modules show up with the SERIAL NUMBERS in the amplifier column, and some do not.

Analysis: There is nothing wrong here. With each Dewetron module there is a certain revision before which the serial number was not available for external query, so these modules will not show this information on the setup screen.

Solution: N/A

DAQP-HV (and -S3) Isolated High Voltage module (300/700 kHz)

Input ranges:	7 ranges (±20 V to ±1400 V)
Bandwidth:	300 kHz (version DAQP-HV-S3: 700 kHz)
Isolation:	1.8 kVRMS line to line 1.4 kVRMS line to ground
Signal connection:	Banana sockets (S3 = Screw terminals)

DAQP-HV Specifications

Parameter	DAQP-HV
Input ranges unipolar and bipolar:	20 V, 50 V, 100 V, 200 V, 400 V, 800 V, 1400 V
DC accuracy: 20 V and 50 V 100 V to 1400 V	 ±0.05 % of reading ±40mV ±0.05 % of reading ±0.05 % of range
Gain linearity:	0.03%
Gain drift range:	Typically 20 ppm/°K (max. 50 ppm/°K)
Offset drift: 20 V to 100 V 200 V to 1400 V	 typical 0.5mV/°K max. 4mV/°K typical 5ppm/°K max. 20 ppm of Range/°K
Long term stability:	100 ppm/sqrt (1000 hrs)
Input resistance:	10 MΩ
-3dB Bandwidth:	300 kHz
Filter selection:	Push button or software
Filter (lowpass):	10, 30, 100, 300, 1k, 3k, 10k, 30k, 100k, 300 kHz [1)]
Filter type:	Bessel or Butterworth 40 dB/decade
Typical SFDR and SNR:	300 kHz: SFDR / SNR; 100 kHz: SFDR / SNR; 10 kHz: SFDR / SNR
50 V:	98 / 76 dB; 101 / 81 dB; 108 / 90 dB
200 V:	98 / 84 dB; 101 / 89 dB; 108 / 91 dB
1400 V:	98 / 86 dB; 102 / 91 dB; 107 / 92 dB
Typical CMRR:	>80 dB @ 50 Hz 70 dB @ 400 Hz 60 dB @ 1 kHz 48 dB @ 10 kHz
Isolation voltage	Line to Ground 1.4kVrms Line to Line 1.8kVrms
Protection: Surge (1.2/50) Burst(5kHz)	CAT III 600 CAT IV 300 ±4000V ±4000V
Output voltage:	±5 V
Output resistance:	<10 Ohm
Output current:	5 mA
Output protection:	Short to ground for 10 sec.
Power supply:	±9 VDC ± 1%

Parameter	DAQP-HV
Power consumption:	0.7 W
Power On default settings:	Software programable
RS485 interface for module control:	Yes
TEDS support:	N/A
MSI support:	N/A

1) The 300 kHz filter setting applies only to the Bessell filter type

Signal hook-up

DAQP-HV: The insulated banana jacks are the signal connection point. Use only mating cables which have molded insulated/safety type plugs. These plugs should be the kind which prevent you from coming into contact with high voltages or currents.

DAQP-HV-S3: The insulated screw terminal panels are the signal connection point. Always make your connections before applying voltage to them.

⇒ **Use only insulated cables and the appropriate mating plugs or connectors when using this module!**

⇒ **Never handle cables when high voltage is applied! Connect your signal points before applying high voltage!**

⇒ **Failure to observe safety protocols can result in equipment damage, and personal injury or even death!**

⇒ **Always check that positive and negative lines are connected with the correct polarity on the DAQP-HV and DAQP-HV-S3 module, and at the signal source side.**

⇒ **Use of red (+) and black (-) color coded cables is highly recommended.**

⇒ **High voltages can be lethal! Observe all safety protocols at all times.**

DAQP-DMM Isolated High Voltage Module (20/30 kHz)

Voltage input:	6 ranges (±10 V to ±1000 V)
Bandwidth:	30 kHz maximum
Isolation:	1500 VRMS
Signal input:	Insulated banana jacks

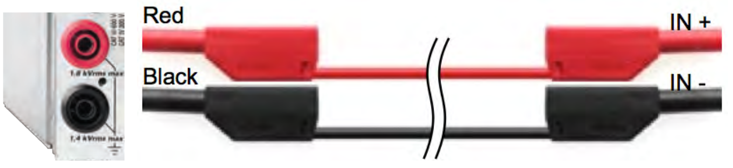
DAQP-DMM Specifications

Parameter	DAQP-DMM
Input ranges:	±10, ±40, ±100, ±200, ±400, ±1000 V
Range selection:	Pushbutton or software command
DC accuracy:	0.1 % of reading ±0.1 % of range
Gain linearity:	Better than ±0.03 %
Gain drift range:	Typ. 20 ppm/°K, max. 40 ppm/°K
Input resistance:	10 MOhm (±0.1 %)
Bandwidth (-3 dB ±1.5 dB @ f0) 10 V to 40 V range 100 V to 200 V range 400 V to 1000 V range	 Typical 20 kHz Typical 25 kHz 30 kHz
Filter selection:	Pushbutton or software command
Filter:	10 Hz, 100 Hz, 1 kHz, 3 kHz (±1.5 dB @ f0)
Filter characteristics @ 0.01, 0.1, 1, 3 kHz @ 30 kHz	 Butterworth 40 dB / decade (12 dB / octave) 100 dB / decade (30 dB / octave)
Typ. SNR @ max. bandwidth 10 V range 100 V range 1000 V range	 60 dB 76 dB 81 dB
Typical CMRR:	73 dB @ 0 Hz 70 dB @ 50 Hz 57 dB @ 400 Hz
Isolation voltage:	1.5 kVRMS
Output voltage:	±5 V
Output resistance:	<10 Ohm
Output current:	5 mA max.
Output protection:	Continuous short to ground
Power supply voltage:	±9 VDC ± 1%
Power consumption:	0.65 W typical
RS-485 interface for module control:	Yes

Parameter	DAQP-DMM
TEDS support:	N/A
MSI support:	N/A

Signal hook-up

DAQP-DMM: The insulated banana jacks are the signal connection point. Use only mating cables which have molded insulated/safety type plugs. These plugs should be the kind which prevent you from coming into contact with high voltages or currents.



⇒ **Use only insulated cables and the appropriate mating plugs or connectors when using this module!**

⇒ **Never handle cables when high voltage is applied! Connect your signal points before applying high voltage!**

⇒ **Failure to observe safety protocols can result in equipment damage, and personal injury or even death!**

⇒ **Always check that positive and negative lines are connected with the correct polarity on the DAQP-DMM module, and at the signal source side.**

⇒ **Use of red (+) and black (-) color coded cables is highly recommended.**

⇒ **High voltages can be lethal! Observe all safety protocols at all times.**

DAQP-LV Isolated Low Voltage Module (300 kHz)

Voltage input:	12 ranges (10 mV to 50 V)
Current input:	±20 mA using DAQ-SHUNT-1 (option) ±5 A using DAQ-SHUNT-4 or DAQ-SHUNT-5
Bandwidth:	300 kHz
Isolation:	350 VDC (1 kVRMS with banana connector)

Additional signal input types using MSI interfaces:

IEPE	Constant current powered sensors (accels,mics); 12 ranges (10 mV to 5 V); requires MSI-V-ACC
RTD	Resistance Temperature Detector (Pt100 to Pt2000) 9 resistance ranges (8 to 4000 Ω); requires MSI-V-RTD
CHARGE	Charge up to 50000 pC requires MSI-V-CHA-50

DAQP-LV Specifications

Parameter	DAQP-LV
Input ranges unipolar and bipolar:	10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V
Push button selectable ranges:	10 mV, 50 mV, 200 mV, 1 V, 5 V, 10 V, 50 V
DC accuracy:	Range / Accuracy
Bipolar:	10 mV to 50 mV: ±0.02 % of reading ±40 µV 100 mV to 50 V: ±0.02 % of reading ±0.05 % of range
Unipolar:	10 mV to 50 mV: ±0.04 % of reading ±40 µV 100 mV to 50 V: ±0.04 % of reading ±0.05 % of range
Input coupling:	DC or AC software selectable (1.5 Hz standard, cust.on request down to 0.01 Hz)
Gain linearity:	0.01 % of full scale
Gain drift range:	Typically 10 ppm/°K (max. 20 ppm/°K)
Offset drift:	Uni- and bipolar
10 mV to 200 mV:	3 µV/°K
500 mV to 50 V:	10 ppm of Range/°K
Long term stability:	100 ppm/sqrt (1000 hrs)
Input resistance:	1 MOhm
-3dB Bandwidth:	300 kHz
Filter selection:	Push button or software
Filter:	10, 30, 100, 300, 1k, 3k, 10k, 30k, 100k, 300 kHz [1)]
Filter type:	Bessel or Butterworth 40 dB/decade

Typical SFDR and SNR:	300kHz bandwidth SFDR	300kHz bandwidth SNR	100 kHz bandwidth SFDR	100 kHz bandwidth SNR	10 kHz bandwidth SFDR	10 kHz bandwidth SNR
20 mV	100 dB	72 dB	98 dB	76 dB	97 dB	84 dB
1V	102 dB	82 dB	99 dB	93 dB	97 dB	96 dB
50 V	102 dB	82 dB	99 dB	93 dB	97 dB	96 dB

Parameter	DAQP-LV
Typical CMRR:	10 mV to 1 V range: >100 dB @ 50 Hz, >100 dB @ 1 kHz, 83 dB @ 10 kHz 2.5 V to 50 V range: 90 dB @ 50 Hz, 65 dB @ 1 kHz, 55 dB @ 10 kHz
Input overvoltage protection:	350 VDC
Isolation voltage:	350 VDC (1 kVRMS with banana connector)
Sensor supply:	±9 V (±1 %), 12 V (±5 %), 200mA resettable fuse protected [2)]
Output voltage:	±5 V
Output resistance:	<10 Ohm

maximum Output current:	5 mA
Output protection:	Short to ground for 10 sec.
Power On default settings	Software programable
Power supply:	±9 VDC ± 1%
Power consumption:	0.8 W without sensor supply
RS-485 interface for module control:	Yes
TEDS support:	Yes, compatible with TEDS chips DS2406, DS2430A, DS2432, DS2433, DS2431[3)]
MSI support:	MSI-V-ACC; MSI-V-RTD; MSI-V-CHA-50

(1) 300 kHz exclusively for Bessel filter characteristic (2) Overall current should not exceed Dewetron mainframe's maximum power.
(3) TEDS is only available on the -D and -L versions

DAQP-LV Signal Hook-up

DAQP-V-B model with banana jacks

Hot: IN+

Shield: IN-

DAQP-V-BNC model with BNC connector

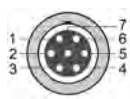
Hot: IN+

Shield: IN-

DAQP-V-D model with DSUB connector

See table >

DAQP-V-L model with LEMO connector



DAQP-LV-D pin-outs Standard 9-pin DSUB connector	
Pin	Description
1	TEDS
2	IN +
3	Reserved for custom sensor supplies
4	GND (not isolated)
5	+9 V (200 mA max.)
6	+12 V (200 mA max.)
7	IN -
8	Reserved for custom sensor supplies
9	-9 V (200 mA max.)

DAQP-LV-L pin-outs LEMO EGG.1B.307	
Pin	Description
1	IN +
2	IN -
3	+9 V (200 mA max.)
4	-9 V (200 mA max.)
5	GND
6	+12 V (200 mA max.)
7	TEDS

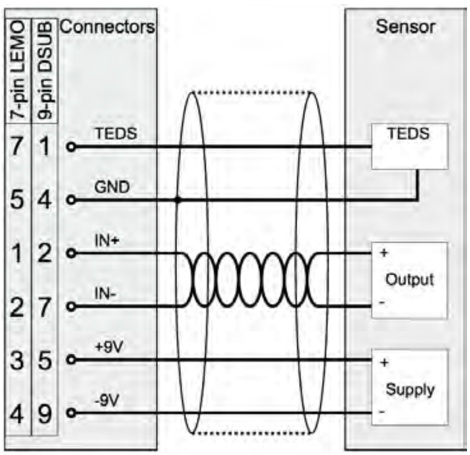
⇒ **IMPORTANT: Always observe all safety protocols when handling live voltages!**

⇒ **Use pins 4, 5 and 9 only as NON-ISOLATED sensor supply voltages**

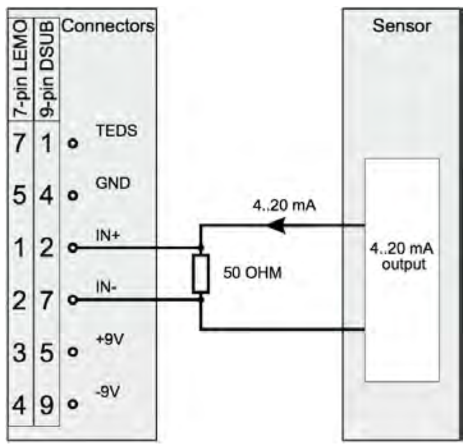
⇒ **If signals above 60 V may appear, don't use the metal housing of SUBD connector**

DAQP-LV: Typical sensor connections

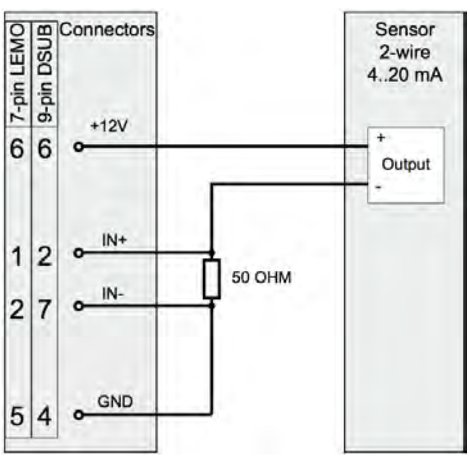
Sensor with differential output, module powered



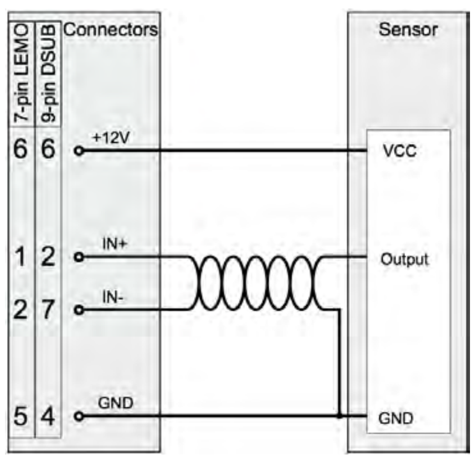
Current measurement using external shunt



Current loop-powered measurement with external shunt



Sensor with common ground



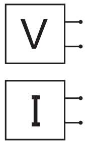
DAQP-LV: Shunt Options

There are several current shunts that are available for this module, which can handle currents up to 5A. For higher currents, please use a rated CLAMP or FLEX COIL or other current transformer which has a voltage output.

Model	Input Range	Accuracy	Description
 DAQ-SHUNT-1	100 mA	0.1%	50 Ω shunt adapter (1 W) Compatible with all Dewetron voltage modules and break-out boxes with banana jacks
 DAQ-SHUNT-1R	100 mA	0.1%	50 Ω shunt adapter (1 W) (This is the resistor from the **DAQ-SHUNT-1** option above - for user mounting/integration)
 DAQ-SHUNT-4	5A	±0.1% < 10 ppm	100 mΩ Shunt box Current input via 2x safety banana jacks Voltage output via 2x 0.3 meter cable with banana plugs
 DAQ-SHUNT-5	5A	±0.1% < 10 ppm	100 mΩ Shunt box Current input via 2x safety banana jacks Voltage output via 2x safety banana jacks

DAQP-V Isolated Low Voltage Module (50 kHz)

Input ranges:	6 ranges from ±10 mV to ±50 V
Bandwidth:	50 kHz
Isolation:	350 VDC (1 kVRMS with banana connector)
Signal connectors:	-B: Safety banana sockets -BNC: BNC connector -D: 9-pin SUB-D connector -L: 8-pin LEMO connector (option)



DAQP-V Specifications

Parameter	DAQP-V
Input ranges:	±10, ±100 mV, ±1, ±5, ±10, ±50 V
Range Selection:	Push button or software
DC accuracy: 10 mV range 100 mV range 1 V to 50 V ranges	 0.05 % of reading ±40 µV 0.05 % of reading ±100 µV 0.05 % of reading ±0.05 % of range
Input coupling:	DC fixed
Gain linearity:	Better than ±0.03%
Gain drift range:	Typically 20 ppm/°K (max. 40 ppm/°K)
Input resistance:	1 MOhm (±0.1 %)
Bandwidth (-3 dB):	50 kHz (±1.5 dB @ f0)
Filters (low-pass):	10 Hz, 100 Hz, 1 kHz, 10 kHz (±1.5 dB @ f0)
Filter selection:	Pushbutton or software command
Filter characteristics: @ 0.01, 0.1, 1, 10 kHz @ 50 kHz	Butterworth 40 dB / decade (12 dB / octave) 100 dB / decade (30 dB / octave)
Typ. SNR @ max. bandwidth 10 mV range 10 V range 50 V range	 61 dB 78 dB 78 dB
Typical CMRR:	90 dB @ 0 Hz 78 dB @ 50 Hz 60 dB @ 400 Hz
Isolation voltage:	350 VDC (1 kVRMS with banana connector)
Sensor supply:	±9 V (±1 %), 12 V (±5 %)
Output voltage:	±5 V
Output resistance:	<10 Ohm
maximum Output current:	5 mA
Output protection:	Continuous short to ground
Power supply:	±9 VDC ± 1%
Power consumption:	0.85 W typical without sensor supply
RS-485 interface:	Yes

Parameter	DAQP-V
TEDS:	N/A
Supported TEDS chips:	N/A
Supported MSI	N/A

DAQP-V Signal Hook-up

DAQP-V-B model with banana jacks

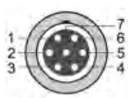
DAQP-V-BNC model with BNC connector

Hot: IN+

Shield: IN-

DAQP-V-D model with DSUB connector

DAQP-V-L model with LEMO connector



DAQP-V-D pin-outs Standard 9-pin DSUB connector	
Pin	Description
1	Not connected
2	IN +
3	Not connected
4	GND (not isolated)
5	reserved for +9 V sensor supply
6	+12 V sensor supply (200 mA max.)
7	IN -
8	Not connected
9	reserved for -9 V sensor supply

DAQP-V-L pin-outs LEMO EGG.1B.307	
Pin	Description
1	IN +
2	IN -
3	+9 V sensor supply
4	-9 V sensor supply
5	GND
6	+12 V sensor supply
7	not connected

⇒ **IMPORTANT: Always observe all safety protocols when handling live voltages!**

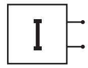
⇒ **Use pins 4, 5 and 9 only as NON-ISOLATED sensor supply voltages**

⇒ **If signals above 60 V may appear, don't use the metal housing of SUBD connector**

☺ **For sensor hook-up guidance and shunt resistor information, please refer to the DAQP-LV module (except that TEDS is not available on the DAQP-V module)**

DAQP-LA and LA-SC Isolated Current Module

Input ranges:	DAQP-LA-SC: 0.1 A, 0.3 A, 1 A, 3 A, 10 A peak, 30 A peak DAQP-LA-B-S1: 2 mA, 6 mA, 20 mA, 60 mA, 200 mA, 0.6 A
Bandwidth:	300 kHz
Isolation:	1.4 kVRMS Input to ground
Signal connection:	-SC: screw terminals -B-S1: insultated banana jacks



DAQP-LA Specifications

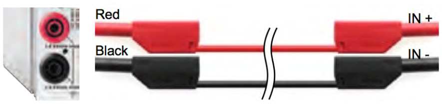
Parameter	DAQP-LA-SC	DAQP-LA-B-S1
Input resistance (Shunt):	0.1 Ω	5 Ω
Shunt inductance:	<10 nH	<10 nH
Input ranges:	0.1 A, 0.3 A, 1 A, 3 A, 10 A peak, 30 A peak	2 mA, 6 mA, 20 mA, 60 mA, 200 mA, 0.6 A
Continuous current:	max. 5 Arms	max. 0.6 A
Peak current:	30 A max. 10 ms; 10 A max. 100 ms	
DC accuracy: 100 mA and 300 mA 1 A to 30 A 2 mA and 6 mA 20 mA and 600 mA	 ±0.05 % of reading ±200 µA ±0.05 % of reading ±0.05 % of range	 ±0.05 % of reading ±4 µA ±0.05 % of reading ±0.05 % of range
Offset drift 100 mA and 300 mA 1 A to 30 A 2 mA and 6 mA 20 mA to 600 mA	typ. max. 12 20 µA/°K 20 40 ppm of Range/°K	 typ . max. 0.24 0.4 µA/°K 20 40 ppm of Range/°K
Gain linearity:	0.03 %	
Gain drift range:	Typically 20 ppm/°K (max. 50 ppm/°K)	
Long term stability:	100 ppm/sqrt (1000 hrs)	
-3dB Bandwidth:	300 kHz	
Filter selection:	Push button or software	
Filter:	10, 30, 100, 300, 1k, 3k, 10k, 30k, 100k, 300 kHz [1)]	
Filter type:	Bessel or Butterworth 40 dB/decade	
Typical SFDR and SNR:		
	300kHz bandwidth SFDR / SNR; 100 kHz bandwidth SFDR / SNR; 10 kHz bandwidth SFDR / SNR	
100 mA	95 dB, 64 dB; 95 dB, 67dB; 95 dB, 77 dB	
1A	102 dB, 82 dB; 103 dB, 85 dB; 113 dB, 90 dB	
30 A	104 dB, 89 dB; 103 dB, 89 dB; 117 dB, 91 dB	
Protection:	CAT III 150 V CAT IV 100 V	
Isolation voltage:	Input to Ground 1.4 kVRMS	
Output voltage:	±5 V	
Output resistance:	<10 Ohm	
Output current:	5 mA	

Output protection:	Short to ground for 10 sec.
Power On default settings	Software programable
Power supply:	±9 VDC ± 1%
Power consumption:	0.7 W
RS-485 interface:	Yes
TEDS:	N/A
Supported TEDS chips:	N/A
Supported MSI	N/A

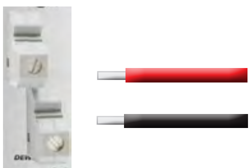
(1) 300 kHz exclusively for Bessel filter

DAQP-LA Signal Hook-up

DAQP-LA-B-xx model with banana jacks



DAQP-LA-SC model with screw terminal connectors

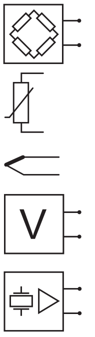


Hot: IN+

Shield: IN-

⇒ **IMPORTANT: Always observe all safety protocols when handling live voltages!**

DAQP-STG Isolated Universal Input Module



Strain gauge, bridge sensors:	±0.1 to ±1000 mV/V (@ 5 VDC excitation)
Piezoresistive bridge:	±0.5 to ±10000 mV/mA (@ 1 mA excitation)
Voltage input:	±500 µV to ±10 V
RTD:	Resistance Temperature Detector (Pt100 to Pt2000) 9 resistance ranges (8 to 4000 Ω)
Resistance:	25 mΩ to 100 kΩ
Isolation:	350 VDC
Signal input connection:	9-pin SUB-D connector (standard) or LEMO (optional)

Additional signal input using MSI interfaces:

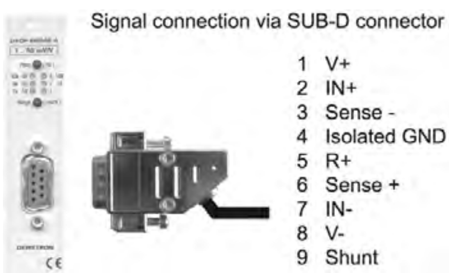
IEPE	Constant current powered sensors (accelerometers, mics); 12 ranges (±2.5 mV to 10 V); requires MSI-V-ACC
THERMOCOUPLE	Popular T/C types; requires MSI-BR-TH-J, -K, or -T
CHARGE	Charge sensors up to 50000 pC requires MSI-V-CH-50
VOLTAGE	up to ±200 V requires MSI-BR-V-200

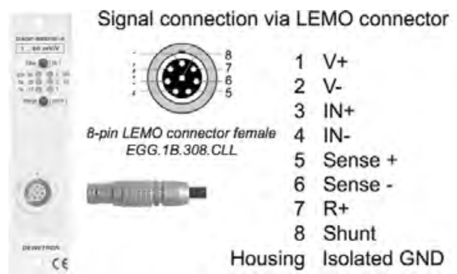
DAQP-STG specifications

Parameter	DAQP-STG
Gain:	0.5 to 10 000
Voltage Input ranges: Sensitivity @ 5 VDC excitation:	±0.5 , ±1, ±2.5, ±5, ±10, ±25, ±50, ±100, ±250, ±500 mV, ±1 V, ±2V, ±5 V,±10 V ±0.1 , ±0.2, ±0.5, ±1, ±2, ±5, ±10, ±20, ±50, ±100, ±200, ±400, ±1000 mV/V
Resistance:	25 mOhm to 100 kOhm
Input impedance:	>100 MOhm (power off: 50 kOhm)
Input noise:	3.5 nV * √Hz
Voltage Input Accuracy: Gain drift Offset drift Linearity	±0.05 % of reading ± 0.02 % of range ±10 µV typical 10 ppm/°K max. 20 ppm/°K typical 0.3 µV/°K + 10 ppm of range, max 2 µV/°K + 20 ppm of range typical 0.02 %
Excitation voltage: Accuracy Drift Current limit Protection	0, 0.25, 0.5, 1, 2.5, 5,10 and 12 VDC software programmable (16 Bit DAC) ±0.03 % ±1 mV ±10 ppm/K ±50 µV/K 100 mA Continuous short to ground
Excitation current: Accuracy Drift Compliance voltage Output impedance	0.1, 0.2, 0.5, 1, 2, 5, 10 and 20mA software programmable (16 Bit DAC) 0.05% ±2µA 15ppm/°K 12V >1 MOhm
Supported Sensors:	4- or 6-wire full bridge 3- or 5-wire 1⁄2 bridge with internal completion (software programmable) 3- or 4-wire 1⁄4 bridge with internal resistor for 120 and 350 Ohm (software programmable)1) 4-wire full bridge with constant current excitation (piezoresistive bridge sensors) Potentiometric Resistance Resistance Temperature Detection: PT100 PT200 PT500 PT1000
Bridge resistance:	80 Ohm to 10 kOhm @ ≤ 5 VDC excitation
Shunt calibration:	Two internal shunt resistors 59.88 kOhm and 175 kOhm
Shunt and completion resistor accuracy:	0.05% ±15ppm/°K
Automatic bridge balance:	Input range 500µV to 1V: ±200 % of Range 2.5V to 5V: ±40% of Range
Bandwidth (-3dB):	300 kHz
Filters (low pass):	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz (±1.5 dB @ f0)

Parameter	DAQP-STG
Filter characteristics:	10Hz to 100Hz: Butterworth or Bessel 40 dB/dec (2nd order) 300kHz: Bessel 60 dB/dec (3rd order)
Typical SNR @ 100 kHz [1 kHz] and 5 VDC excitation:	66 dB [84 dB] @ 1 mV/V 82 dB [100 dB] @ 50 mV/V
Typical CMRR @ 0.1 mV/V [1 mV/V] and 5 VDC excitation:	160 dB [160 dB] @ DC 115 dB [110 dB] @ 400 Hz 110 dB [105 dB] @ 1 kHz
Isolation	±350 VDC continuous (for input, excitation and TEDS interface)
Common mode Voltage	±350 VDC input to housing
Over voltage protection:	±50 VDC input (+) to input (-)
Output voltage:	±5 V
Output resistance:	< 1 Ohm
Output current:	Max. 5 mA; short to ground protected for 10 seconds
RS-485 interface:	Yes
TEDS support:	Yes, compatible with TEDS chips DS2406, DS2430A, DS2431, DS2432, DS2433
MSI support:	MSI-BR-TH-x, MSI-BR-ACC, MSI-BR-V-200 ,MSI-BR-CH-50
Power supply voltage:	±9 VDC (±1 %)
Power consumption:	Typ. 1.7 W @ 350 Ohm, 2.15 W @ 120 Ohm (both full bridge @ 5 VDC excitation) Absolute max.: 3 W (maximum excitation @ maximum current)

Module Pin-outs





⇒ **CAUTION: The sensor shield can be connected to either pin 4 (SUB-D version only) or the housing of the 9-pin SUB-D / 8-pin LEMO connector, depending on your application.**

DAQP-STG-D Cables and Shielding

To reduce the influence of electromagnetic disturbances, shielded twisted pair cables are recommended. Connect the shield to the isolated GND (Pin4) to get the best result.

The twisted pairs for full bridge, half bridge, voltage and resistance mode are:

Twisted pair 1	EXC+	PIN1	EXC-	PIN8
Twisted pair 2	Sense+	PIN6	Sense-	PIN3
Twisted pair 3	IN+	PIN2	IN-	PIN7
Twisted pair 4	R +	PIN5	GND(isolated)	PIN4

If TEDS is used also the shield could be used as GNDisolated

For quarter bridge mode:

Twisted pair 1	IN+	PIN2	Sense1	PIN3
Twisted pair 2	R +	PIN5	EXC-	PIN8

DAQP-STG Operation Notes

Free variable gain and excitation

The gain, excitation and offset values of this module are free programmable. So it is possible to normalize any physical sensor input signal to the ±5V output of the module. By using these settings as power on default, standalone solutions could be easily realized.

Gain: from 0.5 to 10000. The module input ranges are based on predefined gain values. The module automatically chose the best gain combination of the internal amplifiers to keep the overall noise and drift as low as possible.

Output offset: Could be programmed from the positive to the negative full scale range except on the input ranges above 1V. Due to internal structure here the offset could be set from +20 % to – 20 %.

Excitation Voltage: The excitation voltage is programmable from 0 to 12 V in 185 µV steps. Setting the excitation to 0 V for example allows you to determine the noise of the sensor cabling. The sense terminals have to be connected to the excitation terminals all the time. Even if the remote sensing is not required.

Excitation current: The current could be programmed from 0.1 mA to 20 mA in 0.3 µA steps. The maximum compliance voltage is 12 V. The compliance voltage is automatically balanced around the internal GND. This minimizes the common mode error.

Power On Default function

You can store the latest settings of the module in the internal EE-Prom memory. Once the module restarts, it comes up automatically with these setting. This is important for stand alone applications and for fail-safe reasons.

Filter

The Module has nine selectable low-pass filters from 10 Hz to 100 kHz. The filter characteristic can be set to Butterworth 2nd order or Bessel 2nd order. An additional fixed filter inside this module is a 3rd order Bessel filter with a guaranteed -3 dB bandwidth of 300 kHz.

DAQP-STG Amplifier balance

The amplifier balance allows eliminating automatically all internal amplifier offsets. It switches the differential amplifier inputs IN+ and IN- to the internal isolated GND reference point. Then the output offset of the module is automatically adjusted to zero for all ranges. This function takes up to 8 seconds. Automatically previous stored sensor offset values are cleared.

Sensor Balance

Typically every strain gage sensor has a certain offset. That comes from manufacturing tolerances or because of sensor mounting. By performing a bridge balance this sensor offset could be completely removed on the analog side up to 200 % of the actual range. This allows using the full dynamic of the AD-board instead of losing resolution because of digital offset shifting. Output offset and sensor balance may not exceed 200 % of range (20 % for ranges above 1 V).

Internal Completion Resistors

The DAQP-STG has an internal half bridge completion and two internal quarter bridge completions for 120 Ohm and 350 Ohm strain gages. The used high precision resistors with low temperature drift allow a long- time stable measurement of almost every strain gage type without using an external completion network.

Internal Shunt

With two internal shunt resistors (59.88 kOhm and 175 kOhm) and one spare socket for a customised shunt, the DAQP-STG has wide flexibility in case of shunt calibration. A jumper network gives the possibility to connect the internal shunts to either Sense+ Sense – IN+ or IN- to be compatible to existing sensor types and correction calculation methods. This technology is used to correct the complete measurement chain gain error from the sensor input to the digital signal output. It is based on the known ratio between the shunt resistor and the strain gage resistance.

Short

It switches the differential amplifier inputs IN+ and IN- from the input terminals to the internal isolated GND reference point. With this function the absolute sensor offset could be determined.

CAL

It applies a high precision internal reference signal with 80% of the full scale value to the module. For ranges above 1V the reference signal level is 20 % of range.

Self Test

The self test function is a software controlled procedure that checks in the first step the amplifier itself. In the second step a basic sensor check will be performed. This test is only available in DeweSoft if an AD-Card is installed.

Part 1: Amplifier Test

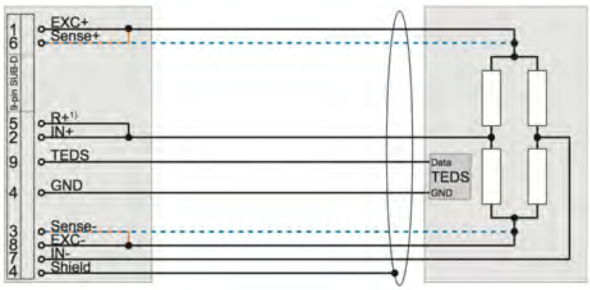
The amplifier offset is checked by using the Short function The 80% Cal signal is applied to the amplifier. The complete isolation amplifier including the AD-Card is checked by using this test signal. The self test circuit switches the amplifier input to the positive excitation voltage, so also the input amplifier is checked. Warning: if there is a short circuit on the excitation this test will fail.

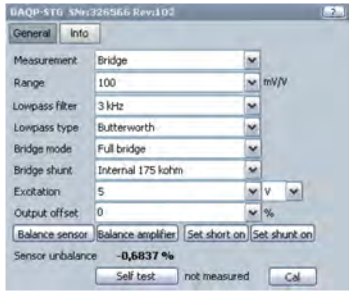
Part 2: Basic Sensor Test

Bridge Sensor: It is checked if the supply current doesn't exceed the maximum value, and if the excitation voltage is within the predefined value.

Full bridge signal connection

6-wire and 4-wire sensor connection



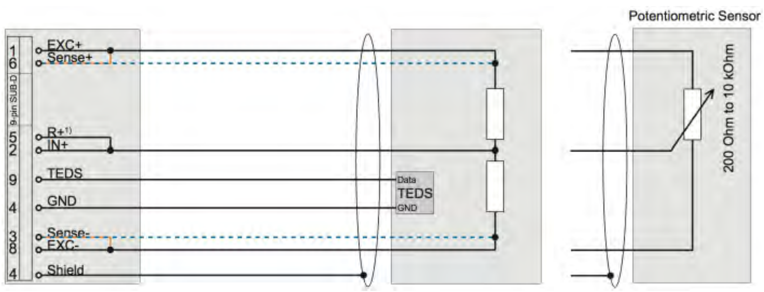


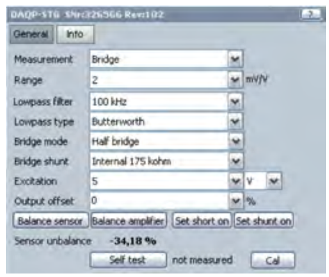
— 4-wire connection
----- 6-wire connection

Voltage or Current excitation are allowed.
Sense lines MUST be connected to the excitation also when 4-wire connection is used.
6-wire sensor connection: Sense+ is connected to EXC+ at the sensor
4-wire sensor connection: Sense+ is connected to EXC+ at the connector

Half bridge signal connection

5-wire and 3-wire sensor connection, and potentiometric sensors





— 3-wire connection
----- 5-wire connection

5-wire sensor connection: Sense+ is connected to EXC+ at the sensor
3-wire sensor connection: Sense+ is connected to EXC+ at the connector

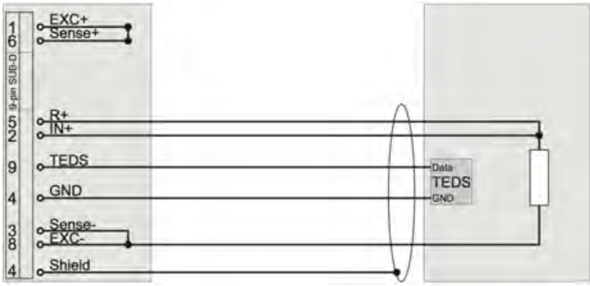
Voltage or Current excitation are allowed.

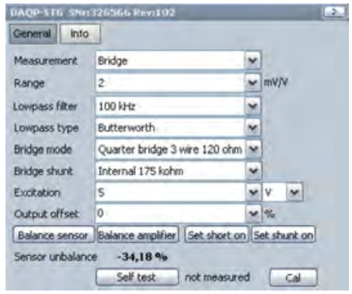
Sense lines MUST be connected to the excitation also when 4-wire connection is used. A potentiometer can be seen similar to a half bridge sensor with ±500 mV/V sensitivity. Therefore potentiometric sensors can be measured with bridge amplifiers. The advantages of using the DAQP-STG for potentiometric measurements is by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution. The scaling is ±500 mV/V equals ±50 % of potentiometer position.

1) 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

Quarter bridge signal connection

3-wire sensor connection
(Sense+ is connected to EXC+ at the sensor)

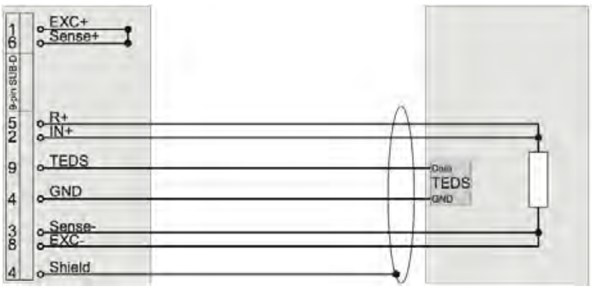


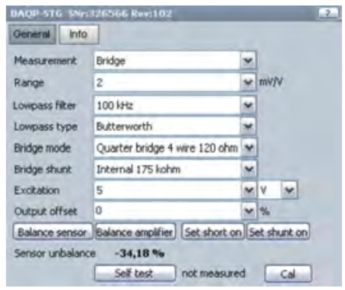


⇒ **Sense leads (SUB-D: pin 3 and 6 must be connected!**

☺ **The 3-wire quarter bridge is only able to compensate symmetrical wire resistance**

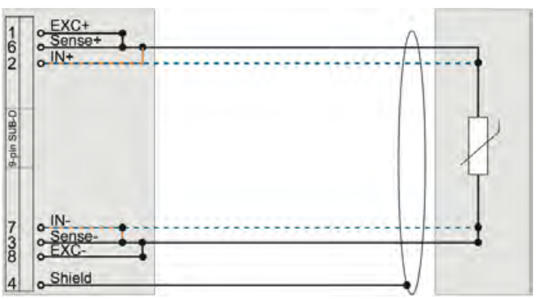
4-wire sensor connection
(Sense+ is connected to EXC+ at the sensor)





In the quarter bridge 4-wire mode the DAQP-STG internally adjusts its excitation so that on the gage the resistor terminates exactly on the half of the excitation voltage. All wire resistances are compensated.

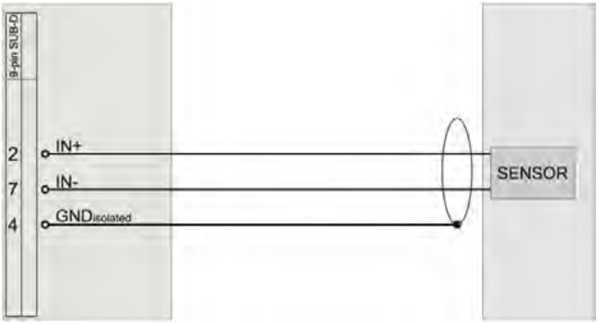
Resistance, RTD 2-wire and 4-wire

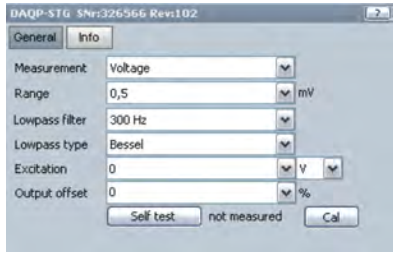


For resistance and RTD mode, 4-wire connection is recommended (2-wire connection will not compensate wire resistance).

Other measurement modes and hook-ups

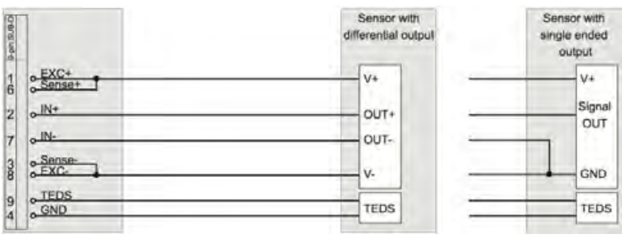
Voltage and microvolt measurement signal connection

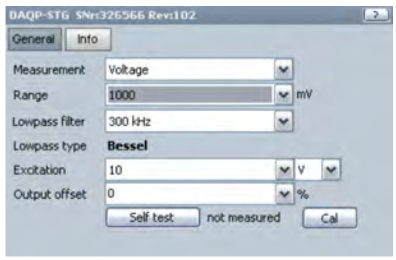




⇒ **CAUTION: If the excitation is not used for sensor supply it has to be deactivated by setting it to 0 V. This will internally connect the IN- to the GNDisolated to improve the common mode rejection.**

Sensor with supply, and voltage output





In the quarter bridge 4-wire mode the DAQP-STG internally adjusts its excitation so that on the gage the resistor terminates exactly on the half of the excitation voltage. All wire resistances are compensated.

Why More Wires are Better...

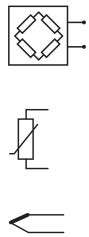
Sensitivity: For sensor wiring typically copper cables are used. For example a 120 Ω full bridge connected with four 0.14 mm2 cables will have an sensitivity error of 2.1 % due to the 1.27 Ω wire resistance. But with 6-wire technology this can be completely compensated!

Temperature drift:

	Intial error		Drift after 10°C warm up	
	Offset	Sensitivity	Offset	Sensitivity
2-wire	25183 µm/m	-4.97 %	956 µm/m	-0.18 %
3-wire	0 µm/m	-2.6 %	0 µm/m	-0.01 %
4-wire	0 µm/m	0.0 %	0 µm/m	0.00 %

DAQP-BRIDGE-A Isolated Strain Gage Module

Protection:	Fully isolated (input and excitation)
Input sensitivity:	0.5 mV/V to 1000 mV/V
Ranges and filter:	Button or software selection
Bridge offset:	Automatic bridge offset adjustment (approx. ±200 % of range)
Bridge completion:	Internal completion for 1⁄2 and 1⁄4 bridge (120 and 350 Ohm)
Shunt calibration:	Two internal shunts or external shunt calibration possible
Custom range:	Programmable range for sensitivity, excitation and offset
Signal connection:	9-pin SUB-D or 8-pin LEMO connector (optional)

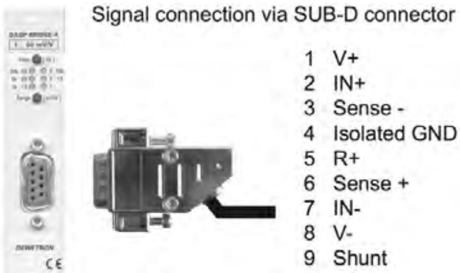


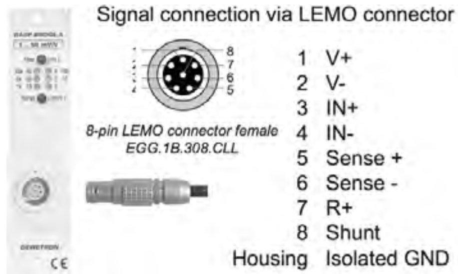
DAQP-BRIDGE-A specifications

Parameter	DAQP-BRIDGE-A
Gain:	20 to 1000
Input ranges: @ 5 VDC excitation:	±5, ±10, ±25, ±50, ±100, ±250 mV ±1, ±2, ±5, ±10, ±20, ±50 mV/V
Range selection:	Push button or software
Input impedance:	> 100 MOhm
DC accuracy:	±0.1 %
Gain linearity:	±0.05 %
Excitation voltage: Accuracy: Drift: Protection:	0.25, 0.5, 1, 2.5, 5 and 10 VDC software programmable (5 VDC = default setting) 0.05 % ±1 mV typ. 20 ppm (max. 40 ppm) Continuous short to ground
Bridge types:	Full bridge 1⁄2 bridge with internal completion (software programmable) 1⁄4 bridge with internal resistor for 120 and 350 Ohm (software programmable)
Bridge resistance:	120 Ohm to 10 kOhm (down to 87 Ohm on request)
Shunt calibration:	Two internal shunt resistors or external resistor for shunt calibration (175k & 59k88)
Zero adjust:	Full automatic, ±200 % of F.S. (via push button or software)
Bandwidth (-3dB):	20 kHz (±1.5 dB @ f0)
Filters (lowpass):	10 Hz, 100 Hz, 1 kHz, 5 kHz, 20 kHz (±1.5 dB @ f0)
Filter selection:	Push button or software
Filter characteristics:	Bessel or Butterworth (software programmable) 40 dB / decade (12 dB / octave)
Typ. SNR @ max. bandwidth:	71 dB @ Gain 1000 79 dB @ Gain 20
Typical CMRR:	73 dB @ 0 Hz 71 dB @ 400 Hz 70 dB @ 1 kHz
Overvoltage protection:	±10 VDC
Isolation:	350 VDC (for input and excitation)
Output voltage:	±5 V
Output resistance:	< 10 Ohm
Output current:	Max. 5 mA
Output protection:	Continuous short to ground
RS-485 interface:	Yes

Parameter	DAQP-BRIDGE-A
TEDS support:	No
MSI support:	Manually support of MSI-BR-TH-x adapter
Power supply voltage:	±9 VDC (±1 %)
Power consumption:	Typ. 1.44 W @ 350 Ohm, 1.83 W @ 120 Ohm (both full bridge @ 5 VDC excitation) Max: 3 W (depending on sensor) *

Module Pin-outs

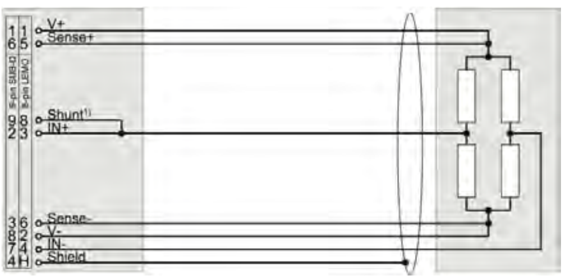




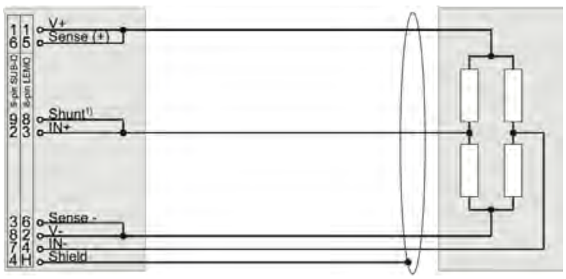
⇒ **CAUTION: The sensor shield can be connected to either pin 4 (SUB-D version only) or the housing of the 9-pin SUB-D / 8-pin LEMO connector, depending on your application.**

Full bridge signal connection

6-wire sensor connection



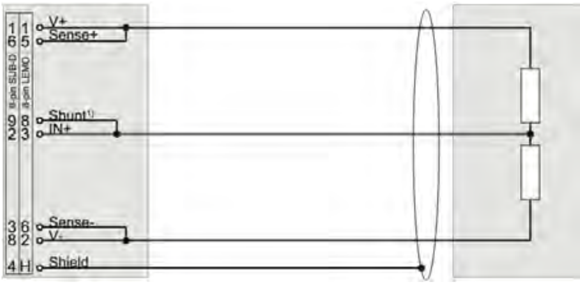
4-wire sensor connection



⇒ **Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) MUST be connected!**

Half bridge signal connection

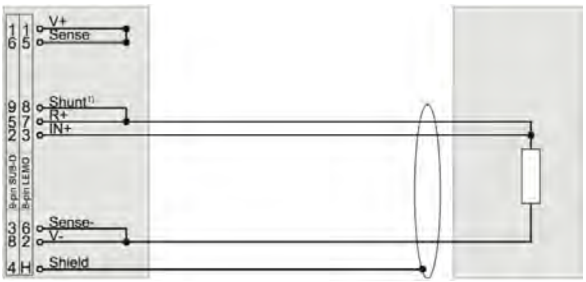
3-wire sensor connection



⇒ **Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) MUST be connected!**

Quarter bridge signal connection

3-wire sensor connection



⇒ **Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) MUST be connected!**

⇒ **1) 'Shunt' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.**

Potentiometric and µV measurements

The differential amplifier of the DAQP-BRIDGE-B module is designed to measure small voltages (with very low offset drift and high amplification). These are exactly the same requirements than for µV amplifiers.

By setting the bridge input type to Voltage you can select input ranges from ±0.5 mV to ±500 mV. The advantages of using bridge amplifiers for µV measurements: only one multifunctional module with high bandwidth, a lot of input and filter ranges and a programmable offset (Auto Zero).

The correct hook-up is simply connecting your µV signal to the IN+ and IN- pins of the this module, and be sure to use a shielded cable and connect the drain to the ground pin of the DSUB connector on the DAQ module.

A potentiometer can be seen similar to a half bridge sensor with ±500 mV/V sensitivity. Therefore potentiometric sensors can be measured with bridge amplifiers.

The advantages of using bridge amplifiers for potentiometric measurements: only one multifunctional module with high bandwidth and a programmable offset (by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution).

Module configuration

DAQP-BRIDGE-A: Excitation: 0.5 V
Range: 500 mV/V

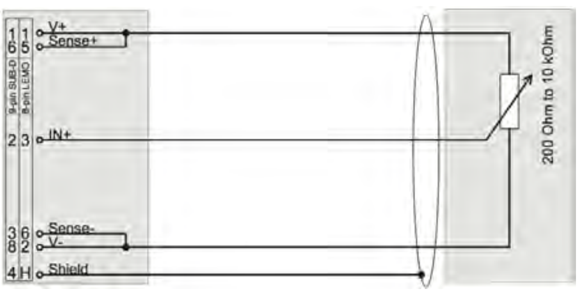
The following table shows how the mV/V ranges are calculated. The ranges depend on the gain and the excitation voltage (note that commas indicate decimal points in this table):

Excitation	0,25 V	0,50 V	1,00 V	2,50 V	5,00 V	10,00 V
Input Range	Bridge module range [mV/V]					
±500 mV	2000	1000	500	200	100	50
±250 mV	1000	500	250	100	50	25
±100 mV	400	200	100	40	20	10
±50 mV	200	100	50	20	10	5
±25 mV	100	50	25	10	5	2,5
±10 mV	40	20	10	4	2	1
±5 mV	20	10	5	2	1	0,5
±2.5 mV	10	5	2,5	1	0,5	0,25
±1 mV	4	2	1	0,4	0,2	0,1
±500 µV	2	1	0,5	0,2	0,1	0,05

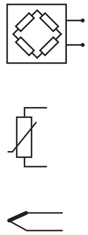
⇒ **Always change the excitation voltage before changing the input range, otherwise you will not get the required 500 mV/V range.**

Potentiometer sensor connection

The left side shows the connections on the signal conditioner, while the right side represents your potentiometric sensor:



DAQP-BRIDGE-B Strain Gage Module



Input sensitivity:	0.05 mV/V to 1000 mV/V
Bandwidth, filter:	200 kHz, 9 selectable lowpass filters (10 Hz to 100 kHz)
Bridge offset:	Automatic offset adjustment (approx. ±200 % of range)
Bridge completion:	Internal completion for 1⁄2 and 1⁄4 bridge (120 and 350 Ohm) Supports 3- and 4-wire 1⁄4 bridge connection
Shunt calibration:	Two internal shunts or external shunt calibration possible
Custom range:	Programmable range for sensitivity, excitation and offset
TEDS:	Support for TEDS sensors
Signal connection:	9-pin SUB-D or 8-pin LEMO connector (optional)

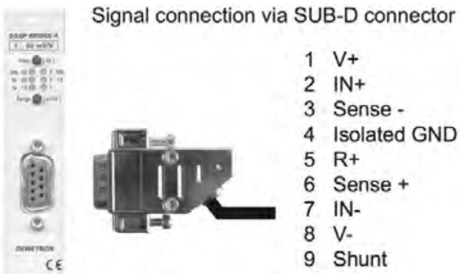
DAQP-BRIDGE-B specifications

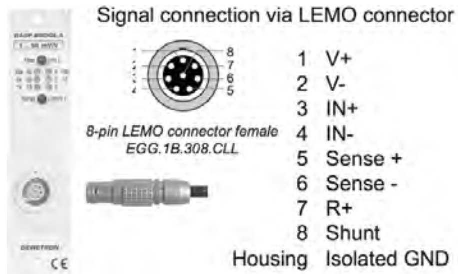
Parameter	DAQP-BRIDGE-B (revision 2)
Gain:	10 to 10 000
Input ranges: @ 5 VDC excitation:	±0.5 1), ±1, ±2.5, ±5, ±10, ±25, ±50, ±100, ±250, ±500 mV ±0.1 1), ±0.2, ±0.5, ±1, ±2, ±5, ±10, ±20, ±50, ±100 mV/V
Range selection:	Push button or software
Input impedance:	> 100 MOhm
Input noise:	3.5 nV * √Hz
Accuracy @ 5 VDC excitation:	±0.05 % F.S.
Gain drift @ 5 VDC excitation:	10 ppm/K of range ±0.02 µV/V/K
Excitation voltage: Accuracy: Drift: Protection:	0.25, 0.5, 1, 2.5, 5 and 10 VDC software programmable (5 VDC = default setting) ±0.05 % ±0.7 mV ±10 ppm/K ±50 µV/K Continuous short to ground
Bridge types:	4- or 6-wire full bridge 3- or 5-wire 1⁄2 bridge with internal completion (software programmable) 3- or 4-wire 1⁄4 bridge with internal resistor for 120 and 350 Ohm (software programmable) 1)
Bridge resistance:	87 Ohm to 10 kOhm @ ≤ 5 VDC excitation (120 Ohm to 10 kOhm @ 10 VDC excitation)
Shunt calibration:	Two internal shunt resistors
Zero adjust:	Full automatic, ±200 % of F.S. (via push button or software)
Bandwidth (-3dB):	200 kHz (±1.5 dB @ f0) 1)
Filters (lowpass):	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz (±1.5 dB @ f0)
Filter selection:	Push button or software
Filter characteristics:	Bessel or Butterworth (software programmable) 40 dB / decade (12 dB / octave)
Typ. SNR @ 100 kHz [1 kHz] and 5 VDC excitation:	66 dB [84 dB] @ 1 mV/V 82 dB [100 dB] @ 50 mV/V
Typ. CMRR @ 0.1 mV/V [1 mV/V] and 5 VDC excitation:	125 dB [120 dB] @ DC 115 dB [110 dB] @ 400 Hz 110 dB [105 dB] @ 1 kHz
Max. common mode voltage:	±6 V
Overvoltage protection:	±10 VDC
Output voltage:	±5 V
Output resistance:	< 10 Ohm
Output current:	Max. 5 mA

Parameter	DAQP-BRIDGE-B (revision 2)
Output protection:	Continuous short to ground
RS-485 interface:	Yes
TEDS: Supported TEDS chips	Hardware support for TEDS (Transducer Electronic Data Sheet) DS2406, DS2430A, DS2432, DS2433
MSI support:	Automatic MSI-BR-TH-x support
Power supply voltage:	±9 VDC (±1 %)
Power consumption:	Typ. 1 W @ 350 Ohm, 1.3 W @ 120 Ohm (both full bridge @ 5 VDC excitation) Max: 2 W (depending on sensor)

1) 4-wire 1⁄4 bridge or ±0.5 mV input range will limit the bandwidth to 30 kHz

Module Pin-outs

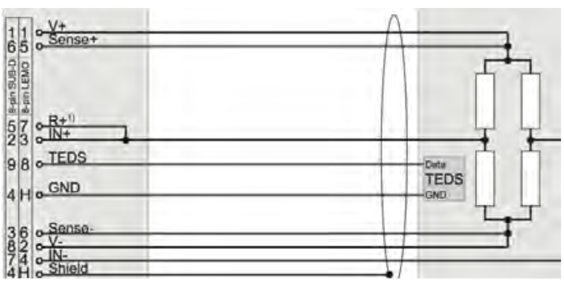




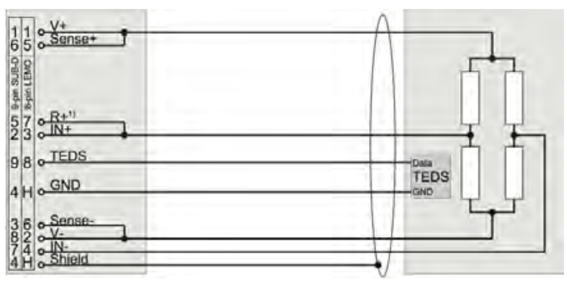
⇒ **CAUTION: The sensor shield can be connected to either pin 4 (SUB-D version only) or the housing of the 9-pin SUB-D / 8-pin LEMO connector, depending on your application.**

Full bridge signal connection

6-wire sensor connection



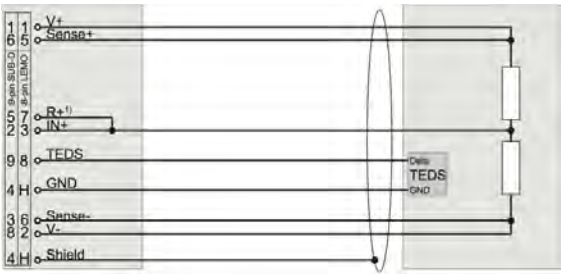
4-wire sensor connection



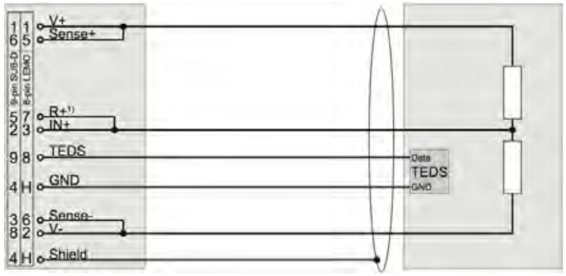
⇒ **Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) MUST be connected!**

Half bridge signal connection

5-wire sensor connection
(sense wired at the sensor)



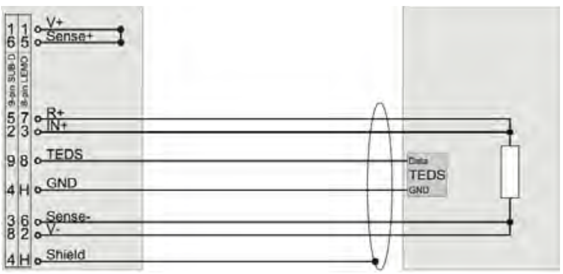
3-wire sensor connection
(sense wired at the connector)



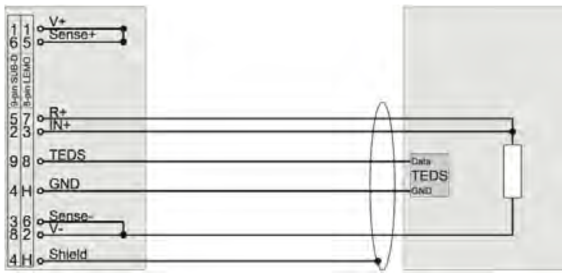
⇒ **Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) MUST be connected!**

Quarter bridge signal connection

4-wire sensor connection
(sense wired at the sensor)



3-wire sensor connection
(sense wired at the connector)



⇒ **Sense leads (SUB-D: pin 3 and 6; LEMO: pin 5 and 6) MUST be connected!**

⇒ **1) 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.**

Potentiometric and µV measurements

The differential amplifier of the DAQP-BRIDGE-B module is designed to measure small voltages (with very low offset drift and high amplification). These are exactly the same requirements than for µV amplifiers.

By setting the bridge input type to Voltage you can select input ranges from ±0.5 mV to ±500 mV. The advantages of using bridge amplifiers for µV measurements: only one multifunctional module with high bandwidth, a lot of input and filter ranges and a programmable offset (Auto Zero).

The correct hook-up is simply connecting your µV signal to the IN+ and IN- pins of the this module, and be sure to use a shielded cable and connect the drain to the ground pin of the DSUB connector on the DAQ module.

A potentiometer can be seen similar to a half bridge sensor with ±500 mV/V sensitivity. Therefore potentiometric sensors can be measured with bridge amplifiers.

The advantages of using bridge amplifiers for potentiometric measurements: only one multifunctional module with high bandwidth and a programmable offset (by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution).

Module configuration

DAQP-BRIDGE-B: Excitation: 1 V
Range: 500 mV/V

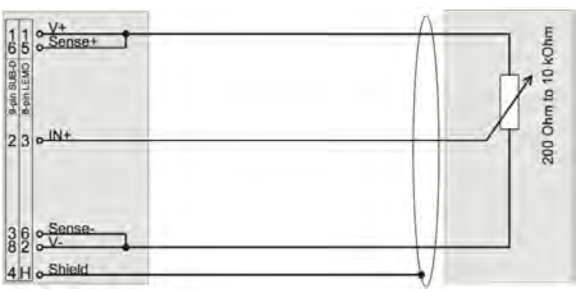
The following table shows how the mV/V ranges are calculated. The ranges depend on the gain and the excitation voltage (note that commas indicate decimal points in this table):

Excitation	0,25 V	0,50 V	1,00 V	2,50 V	5,00 V	10,00 V
Input Range	Bridge module range [mV/V]					
±500 mV	2000	1000	500	200	100	50
±250 mV	1000	500	250	100	50	25
±100 mV	400	200	100	40	20	10
±50 mV	200	100	50	20	10	5
±25 mV	100	50	25	10	5	2,5
±10 mV	40	20	10	4	2	1
±5 mV	20	10	5	2	1	0,5
±2.5 mV	10	5	2,5	1	0,5	0,25
±1 mV	4	2	1	0,4	0,2	0,1
±500 µV	2	1	0,5	0,2	0,1	0,05

⇒ **Always change the excitation voltage before changing the input range, otherwise you will not get the required 500 mV/V range.**

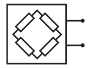
Potentiometer sensor connection

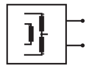
The left side shows the connections on the signal conditioner, while the right side represents your potiometric sensor:



DAQP-CFB Carrier Frequency/LVDT module

Ideal for these kinds of sensors:	full bridge; half bridge; quarter bridge 120 Ω; quarter bridge 350 Ω inductive full bridge; inductive half bridge (such as most LVTD Sensors)
Special features:	Automatic balancing up to 400% of range Internal completion for 1⁄2 and 1⁄4 bridge Two internal shunts for completion
Input ranges:	0.1 mV/V to 1000 mV/V
Bandwidth:	2.3 kHz
Isolation:	N/A
Signal connection:	9-pin SUB-D





DAQP-CFB specifications

Parameter	DAQP-CFB
Input ranges:	0.1 mV/V to 1000 mV/V
Inductive input ranges:	5 mV/V to 1000 mV/V (inductive range is limited from 20 mVRMS to 1000 mVRMS input voltage)
Input voltage ranges:	0.2 mVRMS to 1000 mVRMS
Bridge resistance:	60 - 1,000 Ohm depending on excitation voltage
Excitation voltage level:	1, 2, 5 VRMS
Excitation voltage frequency:	5 kHz sine wave ±20 Hz
Maximum excitation current:	30 mARMS short circuit protected
Excitation voltage synchronization:	Internal or external
Excitation voltage accuracy:	5 VRMS ±5 mVRMS; 2 VRMS ±2.5 mVRMS; 1 VRMS ±2.5 mVRMS
Excitation voltage drift:	typically 50 ppm/°K
Excitation frequency drift:	typically 20 ppm/°K
Nonlinearity:	±0.02 % FS
Accuracy:	±0.2 % of reading ±0.1 % of range
Offset drift:	±0.003 µV/V/K ±40 ppm of Range/°K
Gain drift:	within ±30 ppm/°K
Balance adjusting range:	±400 % of Range (±200 % at 1 V excitation)
Capacitive imbalance compensation:	Approx. 1000 pF
Phase adjustment range:	±40° (inductive mode only)
Balance adjusment accuracy:	within ±0.1 % FS
Supported sensors:	full bridge; half bridge; quarter bridge 120 Ω; quarter bridge 350 Ω inductive full bridge; inductive half bridge (typically LVTD Sensors)
Shunt calibration:	internal 50 kOhm and 100 kOhm Shunt
Completion and shunt resistor accuracy:	±0.05 %
-3 dB Bandwidth:	DC - 2.3 kHz

Parameter	DAQP-CFB
Filters (lowpass):	10, 30, 100, 300, 1 kHz
Filter characteristics:	2nd order Bessel, 2nd order Butterworth (40 dB/ decade)
Typ. SNR @ 1000 Hz [100 Hz] and 2 VRMS excitation:	78 dB [85 dB] @ 1 mV/V 80 dB [87 dB] @ 100 mV/V
Over voltage protection	±10 V
Output voltage:	±5V
Output current:	±5 mA
Output protection:	Continuous short to ground
Power consumption:	max. 1.5 W
Supported TEDS chips:	DS2406, DS2430, DS2432, DS2433, DS2431 1)
Weight:	within 250 (±30) g

1) TEDS only supported by revision 2 of this module (or higher)

Module Pin-outs

☺ **Pins 6 and 8 can be left unconnected**

Software controlled functions

Amplifier balance

Amplifier balance allows elimination of the amplifier offset. The input is shorted and all ranges are balanced by within the module. Any previously stored sensor offset values are cleared.

Sensor balance

Sensor balance is similar to the amplifier balance. Because the input is not shorted, the sensor offset is automatically adjusted to zero.

Short

When measuring the absolute strain it is possible to disconnect the sensor via software and short the input.

Shunt

Two different internal shunts resistors (50 kΩ and 100 kΩ) can be connected for easy function or calibration check. With this technique the whole measurement chain (sensor, amplifier and analog to digital conversation) are checked. The table below shows the shunt calibration result for typical strain gage resistor values.

Strain gage resistor	Shunt resistor	Result
120Ω	50k	0.6 mV/V
120Ω	100k	0.3 mV/V
350Ω	50k	1.74 mV/V
350Ω	100k	0.87 mV/V

The shunt resistor check is not possible in inductive bridge operation mode.

Cal

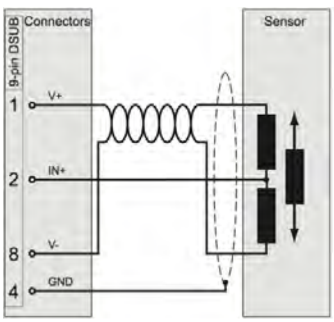
Independent of the value of the input signal, the CAL function sets the output to 80% of the actual range. The base of this calibration signal is the excitation voltage. Therefore this is an easy check of the excitation voltage. The typical reasons why the excitation is not working are short curcuit of the excitation at the cabling or sensor defects, too high a load for the excitation amplifier (please decrease the excitation level), or wrong settings of the synchronization mode (no master assigned).

Synchronizing multiple amplifiers

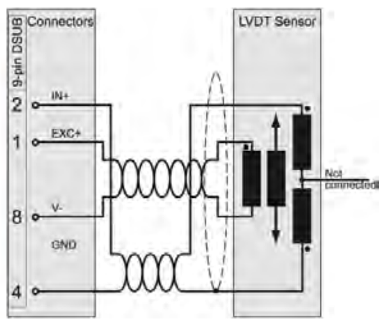
Due the high amplification of strain gage amplifiers it is needed to synchronize the excitation voltage if multiple channels are used. This is done with Pin 8 of the back plane connector. See the detailed DAQ modules manual for details about how to set up the synchronization of multiple DAQP-CFB modules.

Sensor connections

Inductive half bridge sensors

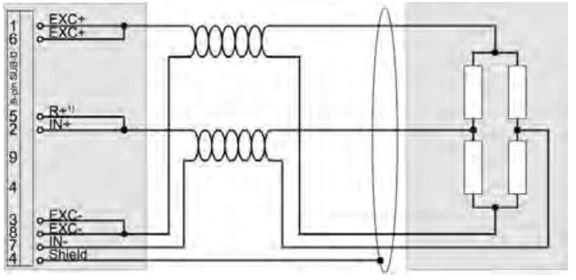


LVDT sensors



Full bridge signal connection

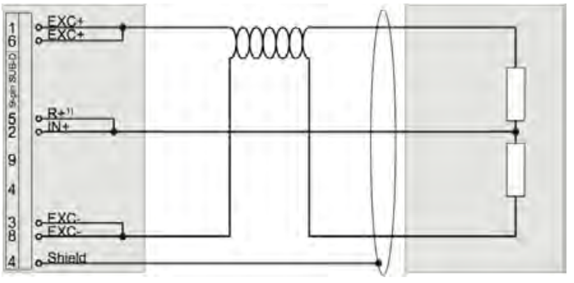
4-wire sensor connection for standard bridge & inductive bridge
(Sense wired at the connector)



☺ Sense leads (SUB-D: pin 3 and 6) could be connected to be compatible to other modules.

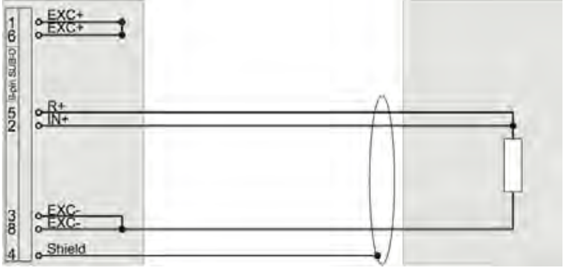
Half bridge signal connection

3-wire sensor connection for standard bridge
(Sense wired at the sensor)



Quarter bridge signal connection

3-wire sensor connection for standard bridge
(Sense wired at the connector)

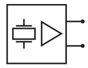


☺ Sense leads (SUB-D: pin 3 and 6) could be connected to be compatible to other DEWE-BRIDGE amplifier.

☺ 1) 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

DAQP-ACC-A IEPE Accelerometer module

Ideal for these kinds of sensors:	Constant current type accelerometers, aka IEPE, ICP, I.C.P.®, or Piezotronic
Input ranges:	±5 V, ±1.66 V, ±500 mV, ±166 mV, ±50 mV
Bandwidth:	300 kHz
Isolation:	N/A
Signal connection:	BNC connector



DAQP-ACC-A specifications

Parameter	DAQP-ACC-A
Input ranges:	±5 V, ±1.66 V, ±500 mV, ±166 mV, ±50 mV
Gain:	1, 3, 10, 30, 100
Range/gain selection:	Pushbutton or software selection
Gain error:	0.5 %
Sensor types:	IEPE (constant current) only
Sensor excitation:	4 or 8 mA (software selection), 10 %, up to 28 VDC
Input impedance:	5 or 7 MOhm (depending on time constant), in parallel with 1.2 nF
Input voltage range: Voltage < 4 V Voltage > 19 V	4 to 19 V "Shortcut" detection "No sensor" detection
-3 dB Bandwidth:	From selected highpass filter to 300 kHz (+2 to -5 dB @ fg)
Filters (high-pass) 0.5 Hz filter 5 Hz filter	0.5 Hz and 5 Hz (software selection) 0.32 s time constant 0.032 s time constant
Filters (low-pass):	1 kHz, 10 kHz, 100 kHz, 300 kHz other filter steps available as an option upon request
Filter selection:	Pushbutton or software selection
Filter characteristics up to 100 kHz 300 kHz	Butterworth 100 dB / decade (30 dB / octave) 80 dB / decade (24 dB / octave)
Typ. SNR @ max. bandwidth Gain 1 and 3 Gain 10 Gain 30 Gain 100	 94 dB 91 dB 80 dB 73 dB
Output voltage:	±5 V
Output resistance:	<10 Ω
Output current:	5 mA maximum
Output protection:	Continuous short to ground
Power supply voltage:	±9 VDC (±10 %)
RS-485 interface for module control:	Yes

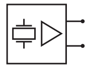
Parameter	DAQP-ACC-A
TEDS support:	N/A
Power consumption:	Typical 0.8 to 1.0 W (depending on sensor)

Sensor connection

Standard IEPE accelerometer or microphone connector and cable. Use a standard BNC plug on the Dewetron module side. The sensor side may be molded into the sensor, or a modular connector with BNC, 10-32, etc.

DAQP-CHARGE-A Charge/IEPE module

Handles both of these sensors:	Charge type accelerometers and microphones, plus IEPE (Piezotron) accelerometers and mics
Special features:	Directly outputs acceleration, velocity or displacement
IEPE sensitivity:	0, 20, 40 and 60 dB (±5 V, ±500 mV, ±50 mV, ±5 mV)
Charge sensitivity:	5, 50, 500, 5000 and 50000 pC
Bandwidth:	0.1 Hz to 50 kHz
Isolation:	N/A
Signal connection:	BNC (10-32 microdot adapter included)



DAQP-CHARGE-A specifications

Parameter	DAQP-CHARGE-A
Input sensitivity: IEPE mode: CHARGE mode:	 0, 20, 40, 60 dB (±5 V, ±500 mV, ±50 mV, ±5 mV) 5, 50, 500, 5000, 50000 pC
Supported sensor types:	Dynamic CHARGE and IEPE (constant current)
Sensor type selection:	Pushbutton or software selection
Gain accuracy:	1% full scale
Input range fine tuning:	Software selectable
Range selection:	Pushbutton: fixed ranges Software: every range
Integration on-board:	Single (velocity) or double (displacement), 0 dB at 15.9 H
LED indicators: Range and filter: ICP LED: OVL LED: A, V and D LED:	 5 LEDs Active with connected ICP® sensor, inactive for charge input Overload control (output voltage > 5 V) Indicator for acceleration, velocity and displacement output
Constant current source:	3.2 to 5.6 mA, > 24 V
Filters (high-pass):	0.1 Hz, 1 Hz, 10 Hz (±2 dB @ f0)
Filters (low-pass):	100 Hz, 1, 3, 10, 50 kHz (±2 dB @ f0)
Filter selection:	Push button or software selection
Filter characteristics:	Butterworth 80 dB / decade (24 dB / octave)
-3 dB Bandwidth:	0.1 Hz to 50 kHz (±2 dB @ f0)
Typ. SNR @ max. bandwidth 5000 pC 500 pC 50 PC 5 pC 5 pC	 90 dB 87 dB 73 dB 54 dB 60 dB @ 10 kHz
Output voltage:	±5V
Output noise:	< 8 mV (all ranges with 50 kHz filter)
Power consumption:	0.6 W to 1.2 W (depending on sensor)

Parameter	DAQP-CHARGE-A
Power supply voltage:	±9 VDC (±10 %)
TEDS support:	N/A
RS-485 interface for module control	Yes

Sensor connection

Standard charge or IEPE accelerometer or microphone connector and cable. Use a standard BNC plug on the Dewetron module side. The sensor side may be molded into the sensor, or a modular connector with BNC, 10-32, etc.

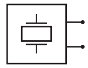
BNC to Microdot adapter

This adapter is included for no additional cost with the DAQP-CHARGE-A module.

- ☺ **Using an IEPE® sensor with charge input selected (or a Charge sensor with IEPE® input selected) will not destroy the module or the sensor, but the measured values will be incorrect.**
- ☺ **When using the fine tuning option of the input range (3686 steps per decade), the module is no longer in a calibrated state. In this case the input range LED's are not active!**

DAQP-CHARGE-B Isolated Static/Dynamic Charge module

Ideal for these kinds of sensors:	Charge sensors, dynamic or static
Special capability:	Selectable time bases for long settling time sensors Charge drift < 0.03 pC/sec
Input ranges:	±100 to ±1 000 000 pC
Bandwidth:	100 kHz
Isolation:	350 VDC
Signal connection:	BNC connector



DAQP-CHARGE-B specifications

Parameter	DAQP-CHARGE-B
Input ranges:	±100, ±500, ±2 000, ±10 000, ±40 000, ±200 000, ±1 000 000 pC
Supported sensor types:	Dynamic and static CHARGE accelerometers and microphones
Gain accuracy:	0.5 % of range (1 % of range for 100 and 500 pC)
Gain linearity:	±0.5 %
-3 dB Bandwidth:	100 kHz (±1.5 dB @ f0)
Range selection:	Pushbutton or software selection
Filters (low-pass):	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz (±2 dB @ f0)
Filter selection:	Push button or software selection
Filter characteristics:	Bessel or Butterworth (software selectable) 40 dB / decade (12 dB / octave)
Time constant: Long Highpass filter on	 DC mode 2 to 1000 sec.
Drift input current @ 25 °C:	< ±0.03 pC/s
Offset drift:	50 ppm of Range/°K
Amplifier reset:	Push button or software
Offset after reset:	±2 mV or ±1 pC (greater value is valid)
Typ. SNR @ max. bandwidth: Range 100 pC Range > 2000 pC	 76 dB (82 dB @ 30 kHz / 85 dB @ 10 kHz) 81 dB (89 dB @ 30 kHz / 93 dB @ 10 kHz)
Ouput noise: @ 100 kHz @ 30 kHz	 0.3 mVRMS + 0.01 pCRMS 0.12 mVRMS + 0.008 pCRMS
Output voltage:	±5V
Output noise:	< 8 mV (all ranges with 50 kHz filter)
Cable noise:	< 10-5 pCRMS/pF
CMR:	< 0.02 pC/V (difference between input and output ground)
Input overvoltage protection:	1 kV ESD
Isolation:	350 VDC

Parameter	DAQP-CHARGE-B
Power consumption:	1.5 W to 3.5 W (depending on signal range and frequency)
Power supply voltage:	±9 VDC (±1 %)
TEDS support:	N/A
RS-485 interface for module control	Yes

Sensor connection

Standard charge accelerometer or microphone connector and cable. Use a standard BNC plug on the Dewetron module side. The sensor side may be molded into the sensor, or a modular connector with BNC, 10-32, etc.

BNC to Microdot adapter

This adapter is available as an option with the DAQP-CHARGE-B module.

High pass filter

The time constant of the internal highpass filter depends on the used input range. For range 1 (100 pC, 500 pC and 2,000 pC) the time constant is 2 seconds (or 0.07 Hz), for range 2 (10,000 pC and 40,000 pC) the time constant is 40 seconds (or 3.9 mHz). For the highest both ranges (200,000 pC and 1,000,000 pC) the time constant is 1,000 seconds or 0.16 mHz).

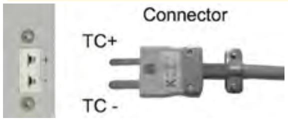
DAQP-THERM Isolated Thermocouple module

Ideal for these kinds of sensors:	Thermocouple types K, J, T, R, S, N, E, B, L, C, U
Special feature:	Freely programmable measuring range!
Cold junction compensation:	On-board and automatic
Linearization:	On-board and automatic
Bandwidth:	3 kHz
Isolation:	350 VDC
Signal connection:	Standard mini T/C connector, universal white

DAQP-THERM specifications

Parameter	DAQP-THERM
Thermocouple types:	K, J, T, R, S, N, E, B, L, C, U
Range selection:	Min. to max. of the input range is freely programmable within the full thermocouple input span
CJC absolute accuracy:	±0.2 °C
CJC stability:	0.01 °C/°C ambient temperature change
Linearization:	DSP based linearization
Accuracy:	Typical 0.3° for type K including CJC error; details see table below
Nonlinearity:	> 0.01°C
Input resistance:	> 1 MΩ
-3 dB Bandwidth:	3 kHz
Filters:	3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz
Filter characteristics:	Butterworth or Bessel, 2nd, 4th, 8th order programmable
Isolation:	±1000 VRMS continuous (for input excitation and TEDS interface)
Typ. CMRR @ 3kHz:	> 160 dB
Open thermocouple detection:	100 MΩ pull up; software selectable
Output voltage:	±5 V; 0 to 5 V; (±10 V and 0 to 10 V possible only with special DEWE-30)
Output resistance:	100 Ω
Output protection:	Continuous short to ground
Power supply voltage:	±9 VDC (±1 %)
Power consumption:	1 W typical
TEDS support:	N/A
Connector:	Universal mini termocouple connector, white color code

Standard MINI thermocouple connector



DAQP-THERM Input ranges and detailed specifications

Thermocouple

Type	Standard	Input range		Accuracy					
		min [°C]	max [°C]	-270 to -200 °C [°C]	-200 to -100 °C [°C]	-100 to 0 °C [°C]	0 to 100 °C [°C]	100 °C to fullscale [% of reading + °C]	
J	DIN EN 60584-1	-270	1372	6.70	0.70	0.35	0.26	0.027	0.26
K	DIN EN 60584-1	-210	1200	0.68	0.60	0.32	0.25	0.019	0.25
T	DIN EN 60584-1	-270	400	4.37	0.69	0.37	0.26		0.23
R	DIN EN 60584-1	-50	1760			0.85	0.59	0.009	0.44
S	DIN EN 60584-1	-50	1760			0.77	0.58	0.012	0.45
N	DIN EN 60584-1	-270	1300	9.14	0.77	0.37	0.28	0.017	0.27
E	DIN EN 60584-1	-270	1000	4.25	0.60	0.33	0.24	0.018	0.23
L	DIN 43710	0	900				0.25		0.33
C	ASTM E988-96	0	2310				0.36	0.045	0.33
U	DIN 43710	-200	600		0.64	0.37	0.26		0.24
							0 to 500°C	> 500°C	
B	DIN EN 60584-1	0	1820				0.26		0.44

All values given in Celcius on these pages.

Software programmable module range

Regardless which input mode is selected, the module measurement range is completely free programmable. Simply by entering the lower and upper limit the amplifier adjusts its gain and offset factors automatically. The amplifier output is scaled to either ±5 V or 0 to 5 V. Converting a nonlinear temperature signal from a thermocouple to a linear analog output is one of the key features of this amplifier.

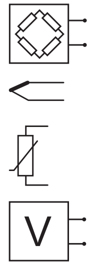
Open thermocouple detection

The open thermocouple detection of the DAQP-THERM consists of an 100 MΩ pull-up resistor. That typically drives a 50 nA current through the sensor which normally does not take effect on the measurement, but is enough to generate an input overflow if the sensor breaks. Despite of this small current, there are sensors available where this current generates a big error. These sensors are typically non-contact infrared thermocouples and fast response thermocouples. In that case the open thermocouple detection can simply be deactivated in the software. Sensors with up to 50 kΩ output impedance can be measured in this way.

CJC

The DAQP-THERM comes with an integrated cold junction compensation sensor with an absolute accuracy of ±0.2 °C. In order to archieve this accuracy the sensor has to be connected for at least 5 minutes to the thermocouple connector (CJC equilibrium time).

DAQP-MULTI Isolated Multifunction module



Thermocouple:	Freely programmable ranges within full thermocouple input span
Bridge:	±0.5 to ±1000 mV/mA
Voltage input:	±5 mV to ±5 V (free programmable within ±5 V)
RTD:	Resistance Temperature Detector (Pt100 to Pt2000), freely programmable ranges within full RTD input span
Resistance:	1 Ω to 1 MΩ (free programmable between 1 Ω and 1 MΩ)
Bandwidth:	3 kHz
Isolation:	1000 VRMS continuous
Signal connection:	Standard miniature thermocouple connector, and 9-pin SUB-D connector

DAQP-MULTI specifications

Parameter	DAQP-MULTI
Input types:	Thermocouple (TC); Resistance Temperature Detector (RTD); Voltage; Resistance; Bridge with constant current excitation
Thermocouples	
Sensor types:	K, J, T, R, S, N, E, B, L, C, U, others on request
Range:	Min. to max. of the input range is free programmable within the full thermocouple input span
CJC absolute accuracy:	±0.2 °C
CJC stability:	0.01 °C/°C ambient temperature change
Accuracy:	Typical 0.3° for type K including CJC error; details see table below.
Linearization:	DSP based linearization on-board
Non-linearity:	> 0.01°C
Open thermocouple detection:	100 MΩ pull up; software selectable
Connector:	Mini thermocouple connector with integrated cold junction compensation sensor
RTD	
Sensor types:	Pt100, Pt200, Pt500, Pt1000, Pt2000, others on request
Range:	Min. and max. of the input range is free programmable within the full RTD input span
Constant current:	Pt100: 1 mA; Pt200, Pt500: 0.5 mA; Pt1000, Pt2000: 0.2 mA
Accuracy:	Typical accuracy 0.15 °C for Pt100, details see table below
Linearization:	DSP based linearization on-board
Non-linearity:	> 0.01 °C
Voltage	
Input ranges:	±5 mV, ±10 mV, ±20 mV, ±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, free programmable within ±5V
Accuracy:	0 to ±100 mV Range: 0.02 % of reading ±0.01 % of Range ±5 µV >±100mV to ±5V Range: 0.02 % of reading ±0.01 % of Range ±100 µV
Offset drift:	Typical ±0.3 µV/°K ±10 ppm of range/°K
Gain drift:	Typical 15 ppm/°K
Input impedance:	> 100 MΩ (power off: 50 kΩ)

Parameter	DAQP-MULTI
Input noise:	8 nV * √Hz
Resistance	
Ranges:	1, 3, 10, 30, 100, 300, 1k, 3k, 10k, 30k, 100k, 1M, free programmable between 1 Ω and 1 MΩ
Accuracy:	See table below
Drift:	Typical 15 ppm/°K
Constant current:	From 5 μA to 5 mA depending on range
Bridge	
Ranges:	0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000 mV/mA
Accuracy:	0.02 % of reading ±0.01 % of Range ±5 μV
Offset drift:	typical ±0.3 μV/°K ±10 ppm of range/°K
Gain drift:	typical 15ppm/°K
Input impedance:	> 100 MΩ (power off: 50 kΩ)
Input noise:	8 nV * √Hz
Automatic bridge balance:	±200 % of range
Supported sensors:	4 wire full bridges
Connector:	DSUB 9, standard Dewetron bridge pin-outs
Excitation current:	1, 2, 4 mA; software programmable
Accuracy: 0 to 200 μA 200 μA to 5 mA	 0.02 % ±50 nA 0.02 % ±1 μA
Drift:	15 ppm/°K
Compliance voltage:	15 V
Source resistance:	> 150 kΩ
General Specifications	
-3dB Bandwidth:	3 kHz
Filters:	3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz
Group delay:	300 μs with highest filter
Filter characteristics:	Butterworth or Bessel, 2nd, 4th, 8th order programmable
Typ. CMRR @ 3kHz	>160 dB
Isolation:	±1000 VRMS continuous (for input excitation and TEDS interface)
Over-voltage protection:	±100 V between inputs (clamping voltage: 5 V @ TC input; 11 V @ Voltage input)
Output voltage:	±5 V; 0 to 5V; (±10 V and 0 to 10 V with special DEWE-30)
Output resistance:	22 Ω
Output current:	Max. 5 mA
Output protection:	Continuous short to ground
RS485 interface for module control:	Yes

Parameter	DAQP-MULTI
Supported TEDS chips:	DS2406, DS2430A, DS2431, DS2432, DS2433,DS28EC20
MSI support:	No
Power supply voltage:	±9 VDC (±1 %)
Power consumption:	1 W typical

DAQP-MULTI Input ranges and detailed specifications for THERMOCOUPLES

Thermocouple									
Type	Standard	Input range		Accuracy					
		min [°C]	max [°C]	-270 to -200 °C [°C]	-200 to -100 °C [°C]	-100 to 0 °C [°C]	0 to 100 °C [°C]	100 °C to fullscale [% of reading + °C]	
J	DIN EN 60584-1	-270	1372	6.70	0.70	0.35	0.26	0.027	0.26
K	DIN EN 60584-1	-210	1200	0.68	0.60	0.32	0.25	0.019	0.25
T	DIN EN 60584-1	-270	400	4.37	0.69	0.37	0.26		0.23
R	DIN EN 60584-1	-50	1760			0.85	0.59	0.009	0.44
S	DIN EN 60584-1	-50	1760			0.77	0.58	0.012	0.45
N	DIN EN 60584-1	-270	1300	9.14	0.77	0.37	0.28	0.017	0.27
E	DIN EN 60584-1	-270	1000	4.25	0.60	0.33	0.24	0.018	0.23
L	DIN 43710	0	900				0.25		0.33
C	ASTM E988-96	0	2310				0.36	0.045	0.33
U	DIN 43710	-200	600		0.64	0.37	0.26		0.24
							0 to 500°C	> 500°C	
B	DIN EN 60584-1	0	1820				0.26		0.44

DAQP-MULTI Input ranges and detailed specifications for RTDs

RTDs								
Type	Standard	Input range		Current	Accuracy			
		min [°C]	max [°C]	[mA]	-200 to -100 °C [°C]	-100 to 0 °C [°C]	100 °C to full-scale [% of reading + °C]	
Pt100 (385)	DIN EN 60751	-200	850	0.2	0.14	0.21	0.07	0.21
Pt200 (385)	DIN EN 60751	-200	850	0.1	0.18	0.27	0.10	0.27
Pt500 (385)	DIN EN 60751	-200	850	0.2	0.34	0.42	0.09	0.42
Pt1000 (385)	DIN EN 60751	-200	850	0.2	0.22	0.29	0.09	0.29
Pt2000 (385)	DIN EN 60751	-200	850	0.2	0.25	0.35	0.12	0.36
Pt100 (3926)		-200	850	0.2	0.14	0.21	0.07	0.21

DAQP-MULTI Input ranges and detailed specifications for RESISTANCE

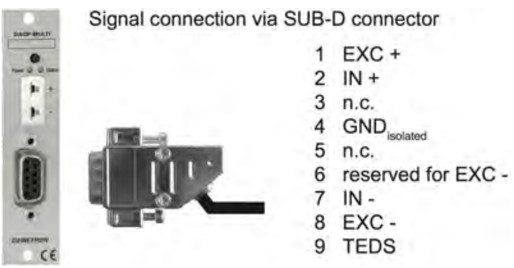
Resistance			
Range	Current	Accuracy	
[Ω]	[mA]	% of reading	% of range
1,000,000	0.005	0.04	1.02
300,000	0.015	0.04	0.35
100,000	0.05	0.04	0.11
30,000	0.1	0.04	0.07
10,000	0.1	0.04	0.08
3,000	0.2	0.04	0.07
1,000	0.5	0.04	0.25
300	1	0.04	0.18
100	1	0.04	0.12
30	2	0.04	0.08
10	4	0.04	0.06
3	5	0.04	0.10
1	5	0.04	0.23

DAQP-MULTI detailed specifications for EXCITATION CURRENT

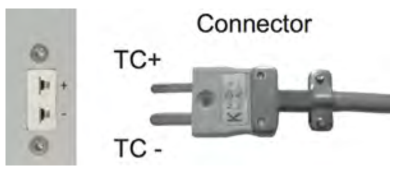
Excitation		
	% of reading	[µA]
0 to 200 µA	0.02	0.05
>0.2 to 5 mA	0.02	1

Sensor connections

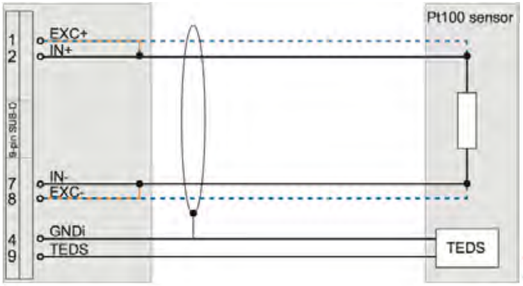
9-pin DSUB connector



Mini thermocouple connector

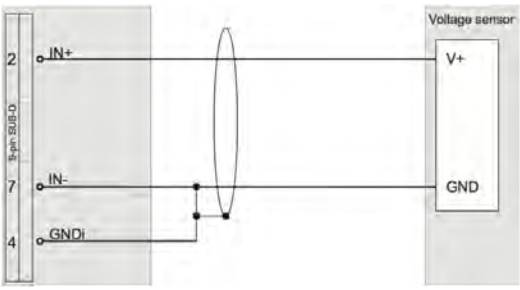


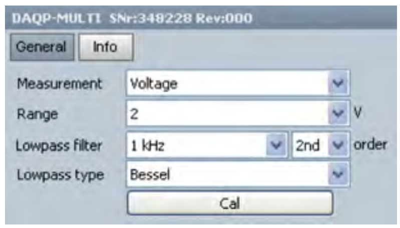
Resistance, RTD 2-wire and 4-wire



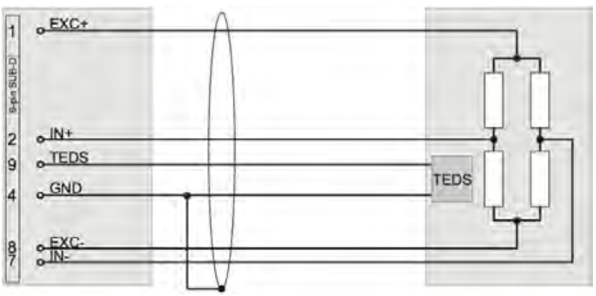
☺ For resistance and RDT mode the 4-wire connection is recommended. The 2-wire connection will not compensate the wire resistance.

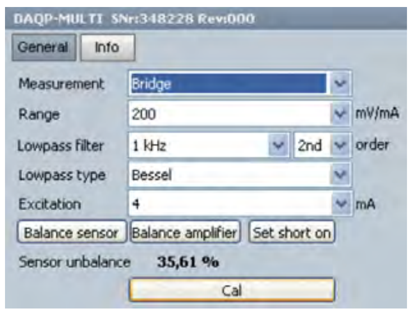
Voltage Measurement



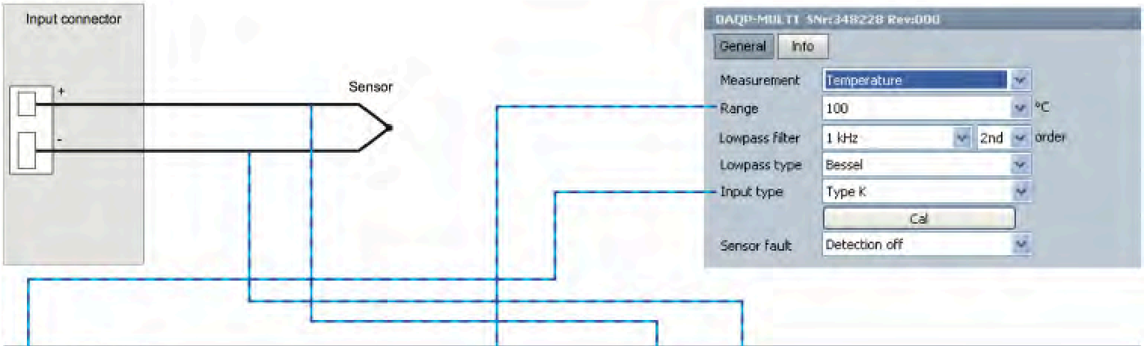


Bridge sensor





Thermocouple sensor



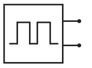
Thermocouple types

Type	IEC color code	ANSI color code	Temperature range °C [°F]	Alloy combination +	Alloy combination -	Comments
K	green	yellow	-270 to 1372 [-454 to 2501]	Ni	CrNi	Wide temperature range, most popular calibration
J	black	black	-210 to 1200 [-346 to 2193]	Fe	CuNi	Used in vacuum, reduced and inert atmosphere
T	brown	blue	-270 to 400 [-454 to 752]	Cu	CuNi	Low temperature & cryogenic applications
R	orange	green	-50 to 1760 [-58 to 3214]	Pt13Rh	Pt	High temperature
S	orange	green	-50 to 1760 [-58 to 3214]	Pt10Rh	Pt	High temperature
U	orange	green	-200 to 600 [-328 to 1112]	Cu	CuNi	Also known as RX & SX extension wire.
N	rose	orange	-270 to 1300 [-450 to 2372]	NiCrSi	NiSi	Alternative to type K. More stable at high temp.
E	purple	purple	-270 to 1000 [-454 to 1832]	NiCr	CuNi	Highest EMF change per degree
B	grey	grey	0 to 1820 [32 to 3308]	Pt30Rh	Pt6Rh	High temperature. Common use in glass industry
L	blue		-200 to 900 [-328 to 1652]	Fe	CuNi	Similar to type J
C*	no standard IEC color	red*	0 to 2310 [32 to 4208]	W5Re	W26Re	Highest temperature range

*) no official symbol or standard designation

DAQP-FREQ-A Frequency to Voltage module

Ideal for these kinds of sensors:	Frequency and tachometer sensors, hall effect F/V, optical speed sensors, and more
Frequency ranges:	100 Hz, 1 kHz, 5 kHz, 20 kHz, 100 kHz, 200 kHz
Special feature:	Second output from module: TTL clock mirror of input frequency
Input ranges:	100 Hz, 1 kHz, 5 kHz, 20 kHz, 100 kHz, 200 kHz
Isolation:	350 VDC
Signal connection:	9-pin SUB-D connector



DAQP-FREQ-A specifications

Parameter	DAQP-FREQ-A
Input ranges:	100 Hz, 1 kHz, 5 kHz, 20 kHz, 100 kHz, 200 kHz
Minimum input frequency:	2 % of selected range
Range selection:	Pushbutton or software selection
Accuracy:	±0.05 % (from 4 % to 100 % of range)
Input signal:	10 mV to 300 V Note: the DSUB connector is only specified up to 250 V For signals above 60 V do not use the metal housing of the provided DSUB connector
Input resistance:	1 MΩ
Input filters:	100 Hz, 1 kHz, 5 kHz, 20 kHz, 100 kHz, 200 kHz
Filter selection:	Pushbutton or software selection
Input coupling:	DC or AC (software selectable)
Trigger level:	10 mV to 130 V (software programmable)
Sensor supply:	+12 VDC, ±9 VDC (not isolated)
Input isolation:	350 VDC
Over-voltage protection:	±500 V peak / 350 VRMS
Output filter: Filter characteristics Selection	3 ranges with 1.5, 30 and 500 ms (10 - 90 %) Butterworth, 60 dB / decade (18 dB / octave) Automatically according to input range Slow (default) or fast output filter selectable within the input range
Output signals: Main output Secondary output	 ±5 V according to input frequency Secondary: TTL level trigger output signal
Output resistance:	< 10 mΩ
Output current:	5 mA max.
Output protection:	Continuous short to ground
Power consumption:	1 W max.
TEDS support:	N/A
Power supply voltage:	±9 VDC (±5 %)

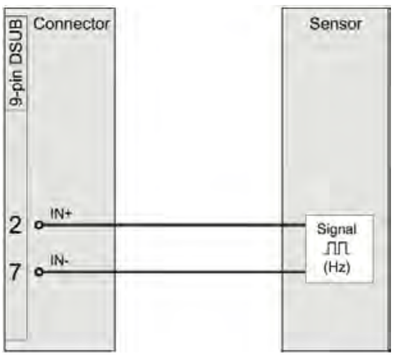
Sensor connection

1 Reserved for custom sensor supply
2 IN +
3 +12 V (sensor supply)
4 GND (shield)
5 +9 V (sensor supply)
6 Not connected
7 IN -
8 Trigger output (TTL)
9 -9 V (sensor supply)

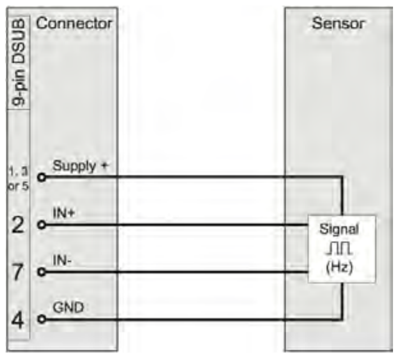
⇒ **Sensor supply voltages are not isolated - only the input (pin 2 and 7)!**

⇒ **For signals above 60 V don't use the metal housing of SUBD connector!**

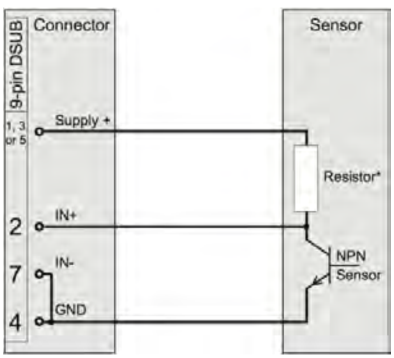
Sensors without power supply



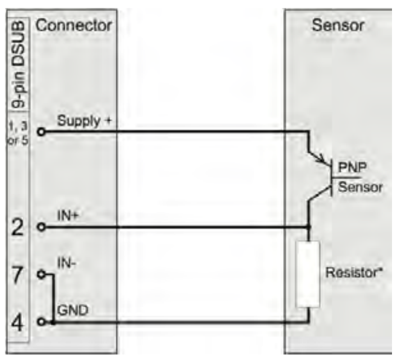
Sensors with power supply



Open collector sensors (NPN)



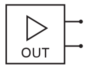
Open collector sensors (PNP)



☺ **The value of the resistor depends on the sensor supply voltage and the open collector sensor.**

DAQN-V-OUT Isolated Voltage Output module

Module purpose:	1:1 (unity gain) isolation module, compatible with AD series cards which have analog outputs
Input/Output range:	±10 V
Bandwidth:	400 Hz
Isolation:	1500 VRMS
Signal connection:	-B: Banana plugs -BNC: BNC connector -D: 9-pin SUB-D connector



DAQN-V-OUT specifications

Parameter	DAQN-V-OUT
Input range:	±10 V
Input range maximum:	±36 V maximum (damage will occur above ±36 V)
Input resistance:	50 MΩ
Output voltage range:	±10 V
Over range capability:	5 % @ 10 V output
Output drive:	50 mA max.
Output resistance:	0.5 Ω
Output current during fault, maximum:	75 mA
Output protection, transient:	ANSI/IEEE C37.90.1-1989
CMV, output to input, continuous: Transient CMRR (50 / 60 Hz)	1500 VRMS max. ANSI/IEEE C37.90.1-1989 110 dB
Accuracy:	±0.05 % span (0 to 5 mA load)
NMR (-3 dB @ 400 Hz):	100 dB per decade above 400 Hz
Non-linearity:	0.02 % span
Stability: Offset Span	 ±25 ppm/°C ±20 ppm/°C
Noise: Output ripple, 1 kHz bandwidth	 2 mVpp
-3 dB Bandwidth:	400 Hz
Power supply voltage:	9 VDC ±5 %
Over voltage protection	±10 V
Power supply current:	350 mA full load, 135 mA no load
Power supply sensitivity:	±12.5 ppm/%

Output signal connections

DAQN-V-OUT-B module
Voltage output via banana plug cables

DAQN-V-OUT-BNC module
Voltage output via BNC cable

DAQN-V-OUT-B module
Voltage output via DSUB 9-pin cable

Pin	9-pin DSUB connector
1	Not connected
2	Not connected
3	Not connected
4	GND (not isolated)
5	+9 V (not isolated)
6	Not connected
7	OUT + (-10 to +10 V, isolated)
8	OUT - (-10 to +10 V, isolated)
9	-9V (not isolated)

⇒ **Use pin 4, 5 and 9 only as sensor supply (not isolated)!**

⇒ **For signals above 60 V don't use the metal housing of SUB-D connector!**

PAD Series Modules

PAD Series Common Information

Calibration information

All DEWETRON modules are calibrated at 25°C after a warmup time of 30 minutes and meet their specifications when leaving the factory. The time interval for recalibration depends on environmental conditions. Typically, the calibration should be checked once a year.

Calibration certificates are available from DEWETRON as an option. DEWETRON offers several types:

- NIST traceable DEWETRON calibration certificate (USA CAL LAB only)
- ISO traceable DEWETRON certificate (European CAL LAB only)
- Calibration certificate according to ÖKD (equivalent to DKD)

This manual contains no calibration information. There is a separate calibration kit available for DAQ series modules manual calibration. The CAL-KIT contains the required cables, software and instructions that you need to add to your own calibration lab. It does not include a calibrator or volt meter.

General PAD module specifications

Module dimensions:	20 x 65 x 105 mm (0.79 x 2.56 x 4.13 in.) (W x H x D without front cover and connectors)
Frontcover:	20 x 87 x 2 mm (0.79 x 3.43 x 0.08 in.) (W x H x D without connector)

Environmental:

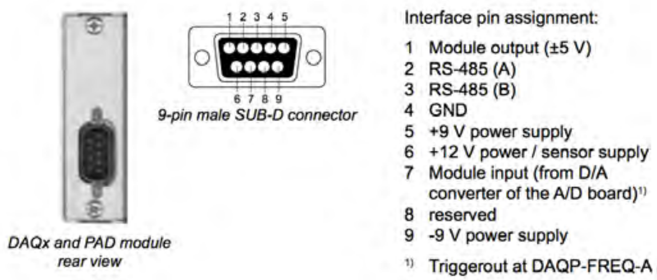
Temp. range storage:	-30 °C to +85 °C (-22 °F to 185 °F)
Temp. range operating:	-5 °C to +60 °C (23 °F to 140 °F)
Rel. humidity (MIL202):	0 to 95 % at 60 °C, non-condensing
RFI susceptibility:	±0.5 % span error at 400 MHz, 5 W, 3 m

All specifications within this manual are valid at 25 °C.

All modules are produced according to ISO9001 and ISO14001.

PAD Module Connectors

Front Panel Connector	Accessible to the user. The connector type and pin assignment varies from module to module. Detailed pin assignment of each module is shown in the appropriate module description.
Rear Connector	Not user accessible. 9-pin male SUB-D, interface to the Dewetron System.



RS-232/485 interface

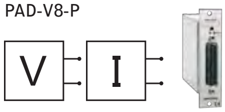
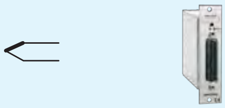
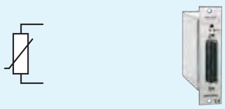
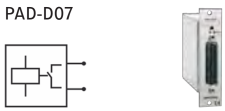
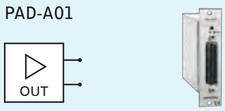
PAD modules can be configured via RS-485 interface, and they require this interface for all data transfers.

The DEWE-3210 and DEWE-3211 include an internal RS-232/485 converter and interface. This converter allows communication with all Dewetron signal conditioning modules.

To communicate with the modules, the RS-232 interface must be set to the following parameters:

baud rate:	9600
data bits:	8
parity:	no parity
stop bits:	1
handshake:	not required

PAD Modules Table

Module	Chs	Input type	Ranges	Bandwidth (BW) Filters (FILT)	Isolation (ISO) Overvoltage protection (OP)	Special functions
Voltage measurement						
PAD-V8-P 	8	Voltage	±100 mV to ±50 V	BW: 6 Hz FILT: 1 / 4 / 8 values	ISO: 350 VDC OP: 150 VDC	Separate 24-bit ADC per channel
		Current	±20 mA			
Temperature and ohmic measurement						
PAD-TH8-P + PAD-CB8-J/K/T 	8	Voltage	±15, ±50, ±100, ±150 mV -150 mV to +1.5V	BW: 6 Hz FILT: 1 / 4 / 8 values	ISO: 350 VDC OP: 15 VDC	Separate 24-bit ADC per channel
		Thermocouple	Types J, K, T with PAD-CB8 breakout box			
PAD-TH8-P + PAD-CB8-RTD 	8	RTDs	Pt100, Pt200, Pt500, Pt1000, Pt2000, Ni120	BW: 6 Hz FILT: 1 / 4 / 8 values	ISO: 350 VDC OP: 15 VDC	Separate 24-bit ADC per channel
		Resistors	up to 2 MΩ			
Analog and digital outputs						
PAD-DO7 	7	Digital output	Relay outputs (dry contacts)	--	ISO: 300 VDC	Max load: 0.5 A @ 60 VAC, 1 A @ 24 VDC
PAD-AO1 	1	Voltage output	0 to 10V	--	ISO: 300 VDC	--
		Current output	0 to 20 mA, 4 to 20 mA			

Please see the following pages for details about each of the available PAD series modules and accessories.

Adding PAD modules to your Dewtetron system:

PAD modules can be plugged directly into the DEWE-3210, because it has 8 slots for DAQ/PAD/HSI series plug-in modules. But if you don't want to give up one of these eight dynamic input slots, you can simply add a DEWE-30 series chassis.

This method also allows the DEWE-3211 to utilze PAD series modules, since this model does not have any slots on its chassis. When only PAD modules are installed into it, the DEWE-30 series expansion box connects easily via either RS485 connected to the Dewetron chassis' EPAD interface, or via RS232C using the Dewetron chassis' COM port. DEWE-30 chassis are available with 4, 8, 16, 32, 48, or 64 slots.

☺ **Note: if you want to also use DAQ or HSI series modules in this expansion rack, then you must also have an analog cable connecting it to the DEWE-3210 or DEWE-3211. In addition, there must be an A/D card inside the DEWE-321x chassis with the appropriate number of ADCs available.**

Typical hook-ups

PAD modules can plug directly into the DEWE-3210 via any of its 8 slots, or...

PAD modules can plug into a DEWE-30 chassis (4 to 64 slots), and connect to a DEWE-3210 or DEWE-3211 via RS232 com

If you connect a DEWE-30 chassis (with only PAD modules in it) to your DEWE-3210 or DEWE-3211, you may connect it via EITHER RS232 (com port) or RS485 (EPAD).

Do not connect both interfaces at the same time.

If using RS232 com port, you must configure the port used for additional PAD modules in the DEWESoft hard-ware setup, analog tab.

Make sure the PAD modules are checked

When adding external PAD modules, enter the number of them under "Additional PAD modules"

If adding a DEWE-30 via RS232, select the appropriate com port here for the additional PAD modules.

Addressing PAD modules

Each PAD module must have a unique address (just like DAQ modules). The address is stored inside the PAD module in non-volatile memory. Therefore, if you remove a PAD module from one system, where it was set to address 31, and plug it into a different Dewetron chassis, it will still report itself on the bus at address 31.

This can cause a conflict if you already have a module at this address. In addition, it will be confusing to you when you hook up your signals to what you believe is PAD module at address 16, but the channels show up on address 31. Therefore, it is vitally important that you set the addresses of any DAQ, PAD, or HSI modules that you plug into your Dewetron system.

☺ There is no need to set the addresses of MDAQ modules, except when initially installed at the factory.

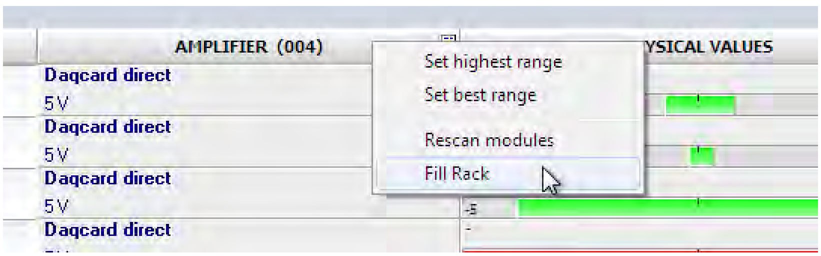
There are essentially two ways to address your modules:

- FILL RACK PROCEDURE - this addresses all of your modules in sequence. This is what you should do if you have been changing more than one module around, to ensure that every module is at the appropriate and unique address.
- FILL ONE MODULE PROCEDURE - easier and faster, when you simply want to exchange one module.

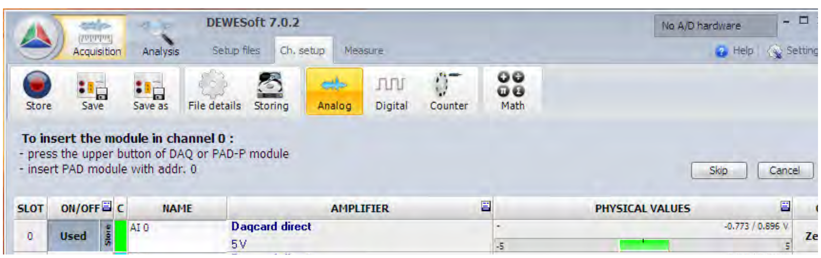
Let's look at how to do each one of the above procedures:

Fill Rack (all Modules) Procedure

Within DEWESoft, go to the ACQUISITION MODE and select the SETUP screen, where you can see your list of modules. Now click on the top of the AMPLIFIER COLUMN and you will see this menu:



Select the FILL RACK option, and the software will prompt you like this:

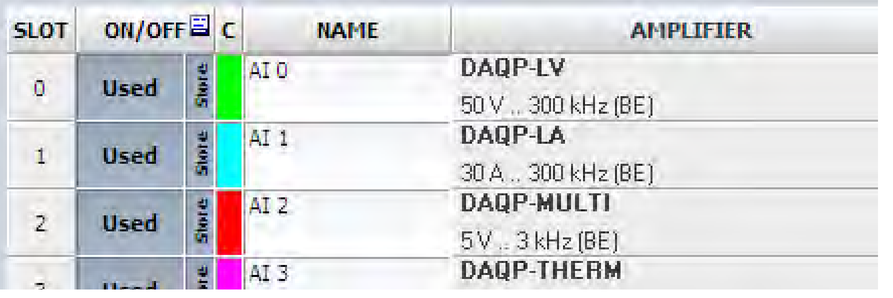


Follow the instruction to press the TOP black button on the module in the first slot, which is always SLOT 0 in the case of doing a FILL RACK, since you are starting at 0 and going all the way up, filling all modules.

When you press this button on the module, the system will beep and prompt you to press the next module's button, and so on. Continue all the way through until you have done the last module, then press CANCEL to complete and save your changes.

If you get to the position where there is an empty module slot, or a non-programmable module from the old days in that slot, press the SKIP button to move past it to the next module. You can do this as many times as needed.

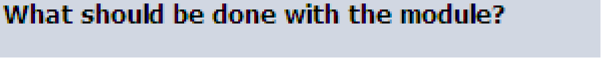
When you're done, the rack should be filled with all of the modules that are physically installed within this system, like this:



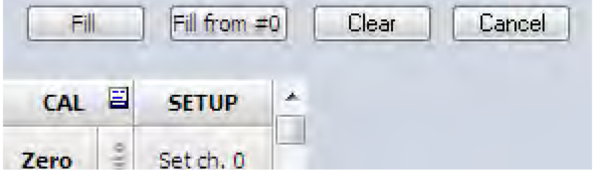
FILL (or CLEAR) One Module Procedure

FILL RACK is a great way to ensure that your modules are all addressed correctly, and we highly recommend it if you make several module exchanges at once. But there are times when you simply want to exchange one module with a different one, or perhaps to just remove a module. This is also quite easy once you know how.

Within DEWESoft, go to the ACQUISITION MODE and select the SETUP screen, where you can see your list of modules. This time, instead of clicking on the top of the AMPLIFIER COLUMN, double-click the amplifier column for the one module that you want to add, delete, or exchange. When you do this, the software will give you a similar choice as before:



And your choices are:



- If you have plugged a new module into this slot, choose FILL, then follow the prompts.
- If you change you mind and want to do a FILL RACK anyway, starting at slot 0, choose FILL FROM #0, then follow the prompts.
- If there is a module in this slot that you have removed, but it continues to show up in RED (because the software cannot really find it), choose CLEAR to remove it from the list.
- If you have clicked this by accident and want to cancel without making any changes, choose CANCEL

Module Installation Trouble-shooting

There may be times when you have trouble addressing your modules, for a variety of reasons. Here are some good tips for solving these issues:

Problem: some or all modules are showing up in RED letters.

Analysis: a module shown in RED letters on the setup screen tells you that the software cannot find this module. Or, it can mean that there is a conflict with another module, like when you plug two modules with the same address into the system at the same time and don't do a FILL RACK or FILL (or CLEAR) one of them. A very rare condition might be that a module is defective and cannot communicate properly.

Solution: the trusty FILL RACK is always a great and easy way to solve nearly all these issues.

If the FILL RACK does not solve them, remove any modules shown in RED and add them back in one at a time, using the FILL ONE MODULE procedure. Fill one module at a time until the offending modules' addresses have been resolved.

Problem: you plug in a new module into a previously unused slot, but it does not show up.

Analysis: more than likely it was already set to an address that you were using, and it has either taken another module's address, or is conflicting with it.

Solution: the trusty FILL RACK is always a great and easy way to solve nearly all these issues.

If the FILL RACK does not solve them, remove any modules shown in RED and add them back in one at a time, using the FILL ONE MODULE procedure. Fill one module at a time until the offending modules' addresses have been resolved.

Problem: you want to use a very old PAD module which does not have the upper black button on it, so you don't know how to address it

Analysis: These modules have been out of production for a long time, but there are still some around, and they are still perfectly good modules.

Solution: Start with the old PAD module in the slot, but NOT PRESSED IN!! Make sure the connector on the inside is not mated or making contact in any way. Now double click on the amplifier slot where you want to install this module. Select FILL when prompted. Then when the next prompt appears to press the black button or push in the module... PUSH IN THE MODULE. The green LED on its front panel should light up, and it should show up on the list on your SETUP screen.

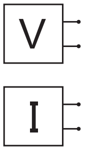
Problem: some modules show up with the SERIAL NUMBERS in the amplifier column, and some do not.

Analysis: There is nothing wrong here. With each Dewetron module there is a certain revision before which the serial number was not available for external query, so these modules will not show this information on the setup screen.

Solution: N/A

PAD-V8-P Isolated 8-channel Voltage module

Module purpose:	Voltage input module for DC/quasi-static signals
Input ranges:	Selectable from ±100 mV to ±50V full-scale
Bandwidth:	6 Hz
Isolation:	350 VDC
Signal connection:	25-pin D connector
Interface boxes:	PAD-CB8-BNC: 8 channel connector block, BNC
	PAD-CB8-B: 8 channel connector block, banana jacks



PAD-V8-P specifications

Parameter	PAD-V8-P
Input channels:	8 differential input channels
Input ranges:	
Voltage	±100 mV, ±150 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V, ±50 V, -0.15 to +1.5 V
Current	With external shunt resistor
Resolution:	10 μV for all ranges
Sample rate:	12 Hz for all channels, maximum
Read-out speed:	Typical 80 channels/s [1)]
DC accuracy:	±0.02 % of reading ±900 μV
-3 dB Bandwidth:	6 Hz (±1.5 dB @ f0)
Input isolation:	350 VDC (channel to channel, and input to output)
Over-voltage protection	150 VDC
Common mode voltage:	350 VDC / 250 VAC @ 50 Hz
NMR:	120 dB @ 50/60 Hz
CMRR:	140 dB @ DC, 120 dB @ 50 Hz
RS485 interface for module control/data:	Yes
Power supply voltage:	9 VDC ±10 %
Power consumption:	0.6 W typical

1) Depending on system and number of channels

PAD-CB8-B and PAD-CB8-BNC break-out boxes

High quality break-out boxes are available for the PAD-V8-P module. The PAD-CB8-B provides eight banana jacks, while the PAD-CB8-BNC provides eight BNC connectors. Each one features a 2 meter long cable and connector that plugs into the face of the PAD-V8-P module. There are no electronics inside these break-out boxes.

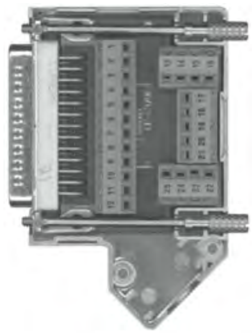
Connector pin-outs

Pin	Function	Pin	Function
1	Channel 0 (+)	13	Channel 6 (+)
2	Channel 0 (-)	14	Channel 6 (-)
3	Channel 1 (+)	15	Channel 7 (+)
4	Channel 1 (-)	16	Channel 7(-)
5	Channel 2 (+)	17	Digital input 1*
6	Channel 2 (-)	18	Digital input 2*
7	Channel 3 (+)	19	Digital input 3*
8	Channel 3 (-)	20	+12 VDC
9	Channel 4 (+)	21	Reset / Digital input 4*
10	Channel 4 (-)	22	GND
11	Channel 5 (+)	23	Reserved
12	Channel 5 (-)	24	Reserved
		25	Reserved

* not supported in Dewesoft software

Mating connector

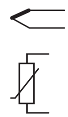
PAD-OPT2
25-pin SUB-D connector with screw terminals (optional)



Low cost alternative to the PAD-CB8-B and -BNC breakout boxes, or as a building block to making your own cable without soldering. Metal shell covers included.

PAD-TH8-P Isolated 8-channel Temperature module

Module purpose:	Thermocouples and RTD input module for DC/quasi-static signals
Bandwidth:	6 Hz
Isolation:	350 VDC
Signal connection:	25-pin D connector
Interface boxes:	PAD-CB8-TH8-K-M: T/C K mini connectors, 2 meter cable PAD-CB8-TH8-K-P2: T/C J mini connectors, 2 meter cable PAD-CB8-TH8-J-P2: T/C J mini connectors, 2 meter cable PAD-CB8-TH8-T-P2: T/C J mini connectors, 2 meter cable PAD-CB8-RTD: RTD, 9-pin DSUB, 2 meter cable



PAD-TH8-P specifications

Parameter	PAD-TH8-P
Input channels:	8 differential input channels
Input voltage:	±1.5 V
Input resistance:	1.4 MΩ
Gain linearity:	0.001%
Temperature drift:	30 ppm/°K
Typical noise:	2 µV
Resolution:	10 µV for all ranges
Sample rate:	12 Hz for all channels, maximum
Read-out speed:	Typical 80 channels/s 1)
DC accuracy:	Better than ±0.05 % ±200 µV (typ. ±0.03 % F.S. ±20 µV)
-3 dB Bandwidth:	6 Hz (±1.5 dB @ f0)
Input isolation:	350 VDC (channel to channel, and input to output)
Over-voltage protection	15 VDC
Common mode voltage:	130 VDC / 250 VAC @ 50 Hz
NMR (50/60 Hz):	120 dB
CMRR (50/60 Hz):	130 dB
RS485 interface for module control/data:	Yes
Power supply voltage:	9 VDC ±10 %
Power consumption:	0.6 W typical

1) Depending on system and number of channels

PAD-CB8-K-xx series break-out boxes

Above left: standard size PAD-CB8-K-P2 break-out box
Above right: miniature size PAD-CB8-K-M

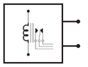
Parameter	PAD-CB8-J (or K or T)-P2 and PAD-CB8-J (or K or T)-M		
Input channels:	8 thermocouple sensors (J, K, or T) with built-in CJC (cold junction compensation)		
Accuracy:	Thermocouple type J: ±1.0 °C @ -200 to -100 °C ±0.3 °C @ -100 to 150 °C ±0.4 °C @ 150 to 400 °C ±1 °C @ 400 to 1200 °C	Thermocouple type K: ±1.0 °C @ -200 to -25 °C ±0.4 °C @ -25 to 120 °C ±0.6 °C @ 120 to 400 °C ±1 °C @ 400 to 1372 °C	Thermocouple type T: ±1.0 °C @ -200 to -150 °C ±0.4 °C @ -150 to 400 °C
Typical noise:	±0.1 °C @ 6 Hz sampling; no average		
Operating temperature:	-25 to +80 °C		
Cable length:	2m (up to 12 m on request)		
Dimensions:	approx. 196 x 57 x 32.2 mm (7.7 x 2.2 x 1.3 in.)		

PAD-CB8-RTD break-out box

Parameter	PAD-CB8-RTD
Input channels:	8 RTD sensors
Constant current:	1250 µA (CB8-RTD-S3: 250 µA)
Constant current drift:	5 ppm/°K
Connection types:	2-, 3-, and 4-wire
Standard input ranges:	Resistor 0 to 999,99 Ohm, Pt100 a = 0.00385; Pt100 a = 0.003916; Pt200; Pt500; Ni120
CB8-RTD-S3:	Resistor 0 to 999,99 Ohm, Pt100 a = 0.00385; Pt100 a = 0.003916; Pt200; Pt500; Pt1000; Pt2000

PAD-DO7 Isolated 7-channel Relay Output module

Module purpose:	Driving dry contact relays
Isolation:	300 VDC
Signal connection:	25-pin D connector
Important note:	This module is not supported by DEWESoft data acquisition software



PAD-DO7 specifications

Parameter	PAD-D07
Output channels:	7 relay output channels
Relay type:	Form "A" relay SPST N.O. with dry contacts
Max load:	0.5 A (60 VAC) 1 A (24 VDC)
Gain linearity:	0.001%
Input isolation:	300 VRMS
Relay on-time:	5 mS typical
Common mode voltage:	130 VDC / 250 VAC @ 50 Hz
RS485 interface for module control/data:	Yes
Power supply voltage:	+12 VDC (±10%)
Power consumption:	1.0 W typical

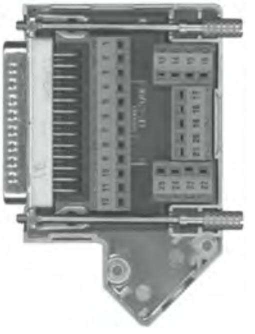
Connector pin-outs

Pin	Function	Pin	Function
1	R1 NO	13	R7 NO
2	R1 COM	14	R7 COM
3	R2 NO	15	Not connected
4	R2 COM	16	Not connected
5	R3 NO	17	Not connected
6	R3 COM	18	Not connected
7	R4 NO	19	Not connected
8	R4 COM	20	+12 VDC
9	R5 NO	21	Init
10	R5 COM	22	GND
11	R6 NO	23	Not connected
12	R6 COM	24	Not connected
		25	Not connected

* not supported in Dewesoft software

Mating connector

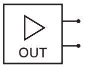
PAD-OPT2
25-pin SUB-D connector with screw terminals (optional)



Convenient building block to making your own cable without soldering. Metal shell covers included.

PAD-AO1 Isolated 1-channel Analog Output module

Module purpose:	Driving a DC analog output
Isolation:	300 VDC
Signal connection:	25-pin D connector
Important note:	This module is not supported by DEWESoft data acquisition software



PAD-AO1 specifications

Parameter	PAD-A01
Output channel:	1 analog VDC output channel
Output signals: Voltage Current	 0 to 10 V 0 to 20 mA or 4 to 20 mA
Resolution:	12-bits
Accuracy:	±0.1 % of FSR
Read-back accuracy:	±1 % of FSR
Rad-back resolution:	±0.02 % of FSR
Zero drift: Voltage output Current output	 ±30 µV/°C ±0.2 µA/°C
Span temp. coefficient:	±25 ppm/°C
Programmable output slope:	0.125 to 1024 mA/sec or 0.0625 to 512 V/sec
Current load resistor:	500 Ω
Isolation:	300 VDC
RS485 interface for module control/data:	Yes
Power supply voltage:	+12 VDC (±10%)
Power consumption:	1.2 W typical

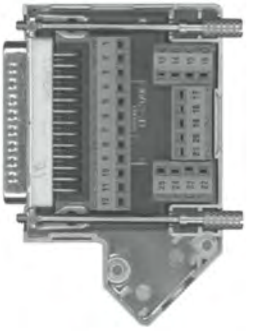
Connector pin-outs

Pin	Function	Pin	Function
1	Not connected	13	Not connected
2	Not connected	14	Not connected
3	Not connected	15	Reserved
4	Not connected	16	Reserved
5	Not connected	17	IOUT (+)
6	Not connected	18	IOUT (-)
7	Not connected	19	VOUT (+)
8	Not connected	20	VOUT (-)
9	Not connected	21	Not used
10	Not connected	22	GND
11	Not connected	23	Not connected
12	Not connected	24	Not connected
		25	Not connected

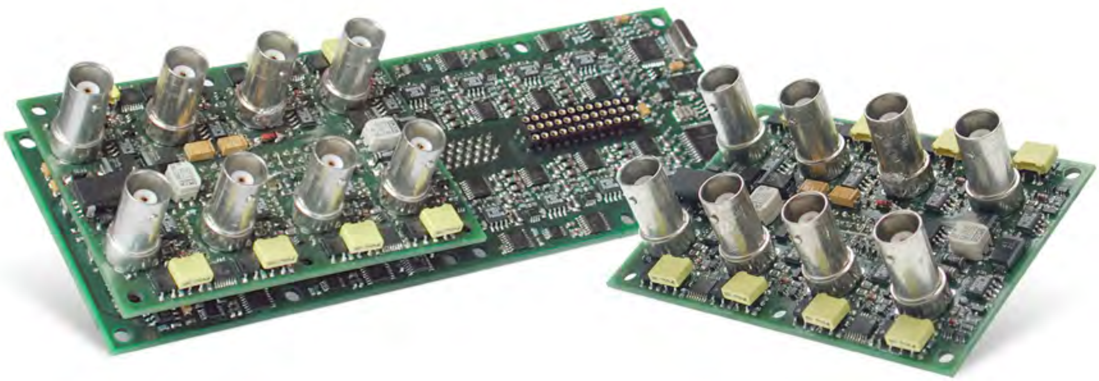
* not supported in Dewesoft software

Mating connector

PAD-OPT2
25-pin SUB-D connector with screw terminals (optional)



Convenient building block to making your own cable without soldering. Metal shell covers included.



MDAQ Series Modules

MDAQ Series Common Information

Calibration information

All DEWETRON modules are calibrated at 25°C after a warmup time of 30 minutes and meet their specifications when leaving the factory. The time interval for recalibration depends on environmental conditions. Typically, the calibration should be checked once a year.

Calibration certificates are available from DEWETRON as an option. DEWETRON offers several types:

- NIST traceable DEWETRON calibration certificate (USA CAL LAB only)
- ISO traceable DEWETRON certificate (European CAL LAB only)
- Calibration certificate according to ÖKD (equivalent to DKD)

This manual contains no calibration information. There are separate resources optionally available for MDAQ series modules for automated calibration under Met/CAL®. The CAL-KIT contains the required cables, software and instructions that you need to add to your own calibration lab. It does not include a calibrator or volt meter.

General MDAQ module specifications

MDAQ modules are factory installed within your Dewetron system. From the outside you see only the input connectors. But inside, there is a BASE card which can hold any two 8-channel MDAQ-SUB modules on one side, and any MDAQ-FILT filter card on the other side. The result is a system which can be configured to suit a wide variety of applications.

All specifications within this manual are valid at 25 °C.

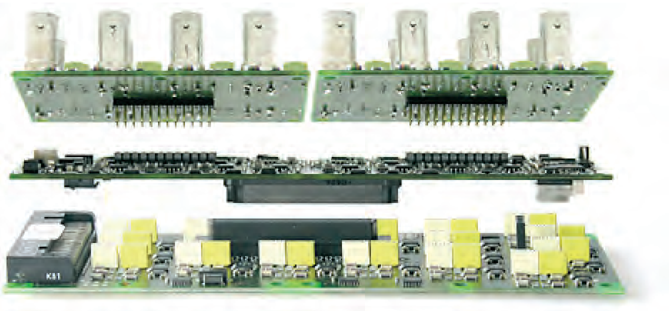
All modules are produced according to ISO9001 and ISO14001.

MDAQ-BASE-5 Mother Board

Every MDAQ assembly consists of a 16-channel MDAQ-BASE mother board and at least one MDAQ-SUB series 8-channel daughter card. Each MDAQ-BASE card can accept any two MDAQ-SUB cards, which are mounted next to each other on one side of the MDAQ-BASE. The other side of the MDAQ-BASE can accept any single Dewetron MDAQ-FILT series 16-channel filter card.

MDAQ-BASE-5 Details

The MDAQ assembly is factory installed according to your purchase order. Unlike DAQ modules, which can be freely plugged/unplugged by the system user, MDAQ assemblies are not user-exchangeable. When your system is constructed at Dewetron, the MDAQ assembly will be completely installed and tested.



TOP: MDAQ-SUB DAUGHTER CARDS (2)

MIDDLE: MDAQ-BASE MOTHER BOARD

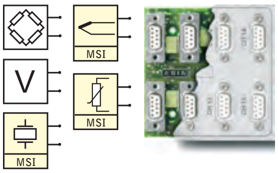
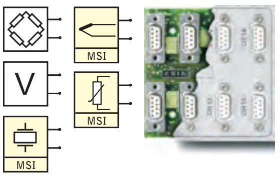
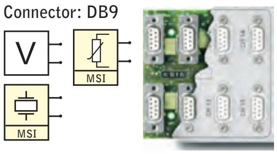
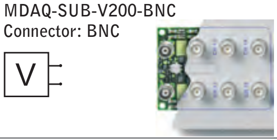
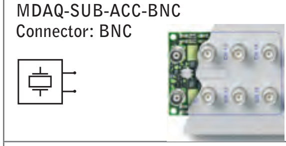
BOTTOM: MDAQ-FILT CARD (OPTIONAL)

MDAQ-SUB module dimensions:

Modules with BNC connectors:	175 x 61 x 30 mm (6.9 x 2.4 x 1.2 in.)
Modules with DSUB connectors:	175 x 82 x 22 (6.9 x 3.2 x 0.9)

MDAQ-SUB output connector (for MDAQ-BASE mother board)

68-pin amplimite series (AMP Nr. 174339-6)

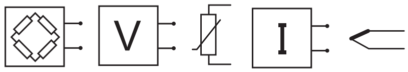
Module	# Chs	Input type	Ranges	TEDS	Bandwidth High-pass Filter Excitation
MDAQ-SUB-STG-D Connector: DB9 	8	Strain gage (full, half, and 1/4 bridge, incl. shunt cal and balance) for strain gage applications	14 ranges from ±0.5 to 1000 mV/V (@ 5V excitation)	√	BW: 30 kHz HF: -- EX: 0 to 12 VDC
		Voltage up to ±10V	15 ranges from ±2.5 V to ±10 V		
		IEPE via MSI-BR-ACC	7 ranges from ±0.25 mV to ±10V		
		Voltage via MSI-BR-V200	6 ranges from ±10 to ±200 V		
		Thermocouples via MSI-BR-TH-J, -K, -T	Full range of thermocouple type		
		RTD via MSI-BR-RTD	-200° to 1000°C, and 0 to 6.5 kΩ		
MDAQ-SUB-BRIDGE-D Connector: DB9 	8	Strain gage (full and half bridge) for strain gage sensors	14 ranges from ±0.5 to 1000 mV/V (@ 5V excitation)	√	BW: 30 kHz HF: 0.16 Hz EX: 0 to 12 VDC EX: ±15 VDC
		Voltage up to ±10V	15 ranges from ±2.5 V to ±10 V		
		IEPE via MSI-BR-ACC	7 ranges from ±0.25 mV to ±10V		
		Voltage via MSI-BR-V200	6 ranges from ±10 to ±200 V		
		Thermocouples via MSI-BR-TH series	Full range of thermocouple type		
		RTD via MSI-BR-RTD	-200° to 1000°C, and 0 to 6.5 kΩ		
MDAQ-SUB-V200-D Connector: DB9 	8	Voltage up to ±200V	13 ranges from ±0.125 to ±200 V [2]	√	BW: 300 kHz EX: 0 to 12 VDC EX: ±15 VDC
		IEPE via MSI-BR-ACC	7 ranges from ±0.25 mV to ±10V		
		RTD via MSI-BR-RTD	-200° to 1000°C, and 0 to 6.5 kΩ		
MDAQ-SUB-V200-BNC Connector: BNC 	8	Voltage up to ±200V	13 ranges from ±0.125 to ±200 V	--	BW: 300 kHz HF: -- EX: --
MDAQ-SUB-ACC-BNC Connector: BNC 	8	IEPE or voltage up to ±10V	8 ranges from ±125 mV to ±10 V	√	BW: 300 kHz HF: 0.16 Hz EX: 4/8 mA
MDAQ-SUB-ACC-A-BNC Connector: BNC (same image as above)	8	IEPE or voltage up to ±10V	8 ranges from ±125 mV to ±10 V	√	BW: 300 kHz HP: 0.16 and 3.4 Hz EX: 4/8 mA

☺ 1) When excitation is chosen on any channel of an MDAQ-SUB module, it is the same for all 8 channels of that module.

⇒ 2) We recommend not exceeding 50Vrms on the DSUB input connector for safety reasons

MDAQ-SUB-STG 8-channel Strain Gage/Bridge module

Sensor compatibilty:	Full bridge sensors, 1/2 bridge sensors, 1/4 bridge sensors, Voltages up to ±10V, Potentiometric/ohmic sensors
Special functions:	Built-in bridge completion, built-in shunt resistors, Software selectable auto-balance Excitation programmable in 1 mV steps from 0 to 12VDC Sense lines for the most accurate measurements
Ranges:	15 input ranges from ±2.5mV to ±10V
Bandwidth:	30 kHz
Input configuration:	Differential (not isolated)
Compatibility:	Plugs into any MDAQ-BASE card
Signal connection:	-D: Banana plugs (standard) -L: 8-pin LEMO connector (optional)



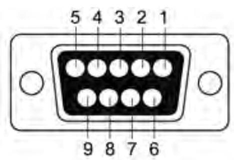
MDAQ-SUB-STG specifications

Parameter	MDAQ-SUB-STG	
Gain:	0.5 to 2000	
Input ranges @ 5VDC excitation:	±2.5, 5, 10, 20, 25, 50, 100, 200, 250, 500, 1000, 1250, 2500, 5000, 10 000 mV ±0.5, 1, 2, 4, 5, 10, 20, 40, 50, 100, 200, 250, 500, 1000 mV/V	
Input impedance:	>100 MΩ	
Input noise:	3.5 nV * √Hz	
Typ. input offset drift:	0.5 µV/K (for ranges < 200 mV)	
DC Accuracy (High Gain) ±2.5mV;5mV/V;10mV/V;±25mV 20mV 50mV ±100mV to ±200mV	(with correction table applied) ±0.03% of reading ±15µV [±3µV/V @5 Vexc] ±0.03% of reading ±0.12% of range ±0.03% of reading ±0.06% of range ±0.03% of reading ±0.03% of range	(no correction table applied) ±0.15% of reading ±15µV [±3µV/V @5 Vexc] ±0.03% of reading ±0.12% of range ±0.03% of reading ±0.06% of range ±0.03% of reading ±0.03% of range
DC Accuracy (Low Gain) ±0.250 to ±1V ±1.25V; ±2.5V ±5; 10V	(with correction table applied) ±0.03% of reading 400µV [±80µV/V @5 Vexc] ±0.03% of reading ±1mV ±0.03% of reading ±0.03% of range	(no correction table applied) ±0.15% of reading 400µV [±80µV/V @5 Vexc] ±0.15% of reading ±1mV ±0.15% of reading ±0.03% of range
Gain drift @ 5VDC excitation:	10 ppm/K of range ±0.02 µV/V/K	
Excitation voltage:	0 to 12 VDC, programable in 1 mV steps. (5 VDC default)	
Excitation accuracy:	±0.05 % ±0.7 mV	
Excitation drift:	±10 ppm/K ±50 µV/K	
Excitation protection:	Continuous short to ground	
Excitation current limit:	50 mA/channel	
Bridge types:	4- or 6-wire full bridge 3- or 5-wire 1/2 bridge with internal completion (software selectable) 3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software selectable)	
Shunt resistor:	Internal 100 k and 50 k Resistor (software selectable)	
Completion and Shunt resistor accuracy:	0.05% 5ppm/°K	
Bridge resistance:	120 Ohm to 10 k Ohm	

Parameter	MDAQ-SUB-STG		
Automatic bridge balance:	Absolute Voltage	mV/V @ 5V EXC	µm/m @ 5VEXC (k=2 quarter bridge)
2.5mV to 20mV	±10mV	±2mV/V	±4,000µm/m
25mV to 200mV	±100mV	±20mV/V	±40,000µm/m
250mV to 1V	±0.5V	±100mV/V	±200,000µm/m
2V to 10V	±5V	±1000mV/V	±2,000,000µm/m
-3 dB Bandwidth:	30 kHz		
Filters (low-pass):	See MDAQ-FILT specification (option)		
Typ. SNR @ 30 kHz [1 kHz] and @ 5 VDC excitation	64 dB [82 dB] @ 1 mV/V 82 dB [96 dB] @ 50 mV/V		
Typ. CMR @ 0.1 mV/V [1 mV/V] and @ 5 VDC excitation	125 dB [120 dB] @ DC 115 dB [110 dB] @ 400 Hz 110 dB [105 dB] @ 1 kHz		
Input isolation:	N/A (input is differential but not isolated)		
Common Mode Voltage:	12V maximum		
Input over-voltage protection:	±25 VDC		
Output voltage:	±5 V		
Output resistance:	< 10 Ω		
Output current:	5 mA max.		
Output protection:	Continuous short to ground		
TEDS compatible 1)	Yes, compatible with TEDS chips DS2406, DS2430A, DS2432, DS2433		
Power consumption: @ 5 VDC excitation @ 5 VDC excitation @ 10 VDC excitation	 350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W 350 Ohm 16 Channels typ. 15 W		
Standard operating temperature:	0 °C to 70 °C (32 °F to 158 °F)		

1) When MSI modules are used, the TEDS interface is used by the MSI, and is not available to any sensor that you may connect

Module Pin-outs (all 8 inputs are the same)



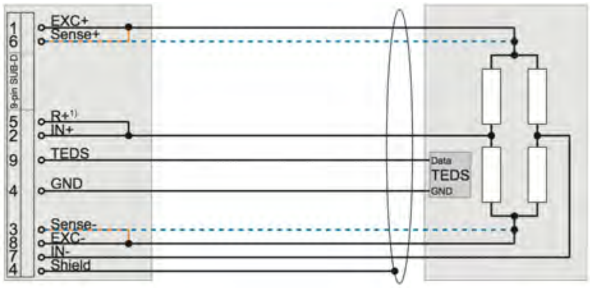
PIN	Function
1	EXC+
2	IN+
3	Sense -
4	GND
5	+15VDC (50 mA)
6	Sense +
7	IN-
8	EXC-
9	TEDS

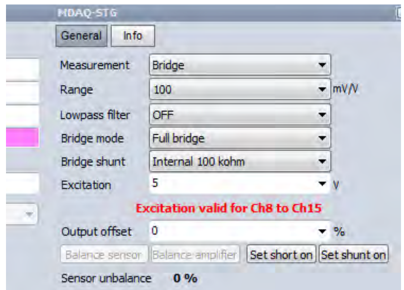
⇒ **CAUTION: The sensor shield can be connected to either pin 4 (SUB-D version only) or the housing of the 9-pin SUB-D / 8-pin LEMO connector, depending on your application.**

⇒ **If signals above 60 V may appear, don't use the metal housing of SUBD connector.**

Full bridge signal connection

6-wire and 4-wire sensor connection



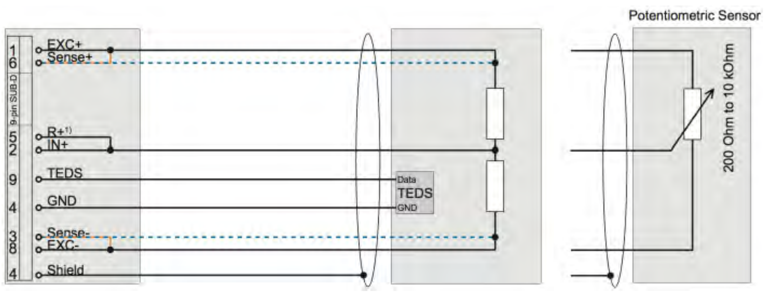


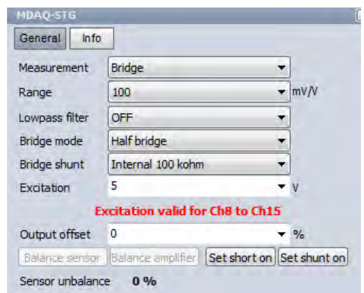
— 4-wire connection
----- 6-wire connection

Voltage or Current excitation are allowed.
Sense lines MUST be connected to the excitation also when 4-wire connection is used.
6-wire sensor connection: Sense+ is connected to EXC+ at the sensor
4-wire sensor connection: Sense+ is connected to EXC+ at the connector

Half bridge signal connection

5-wire and 3-wire sensor connection, and potentiometric sensors





— 3-wire connection
----- 5-wire connection

5-wire sensor connection: Sense+ is connected to EXC+ at the sensor
3-wire sensor connection: Sense+ is connected to EXC+ at the connector

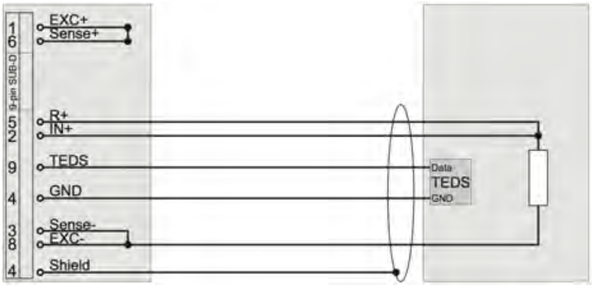
Voltage or Current excitation are allowed.

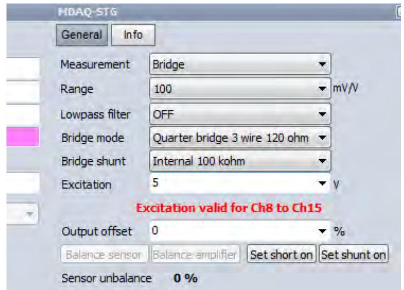
A potentiometer can be seen similar to a half bridge sensor with ±500 mV/V sensitivity. Therefore potentiometric sensors can be measured with bridge amplifiers. The advantages of using the MDAQ-STG for potentiometric measurements is by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution. The scaling is ±500 mV/V equals ±50 % of potentiometer position.

☺ 1) 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

Quarter bridge signal connection

3-wire sensor connection
(Sense+ is connected to EXC+ at the sensor)





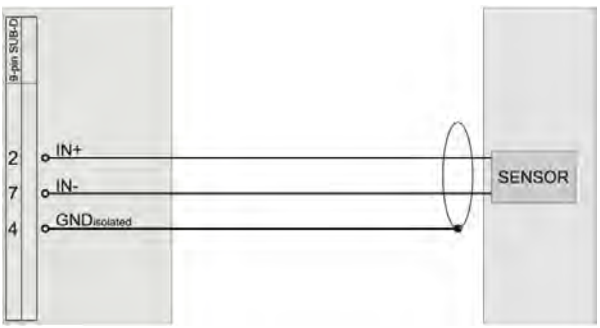
⇒ **Sense leads (SUB-D: pin 3 and 6 must be connected!**

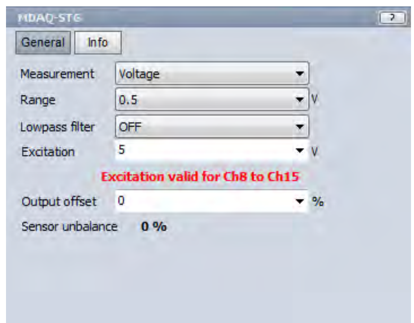
☺ **'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.**

☺ **The 3-wire quarter bridge is only able to compensate symmetrical wire resistance**

Other measurement modes and hook-ups

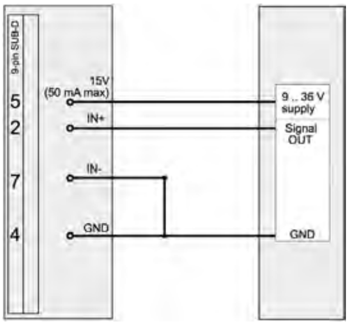
Voltage and microvolt measurement signal connection

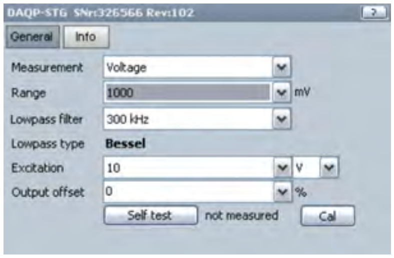




⇒ **CAUTION: If the excitation is not used for sensor supply it has to be deactivated by setting it to 0 V.**

Sensor with 15VDC supply, and voltage output





Why More Wires are Better...

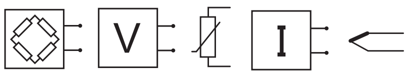
Sensitivity: For sensor wiring typically copper cables are used. For example a 120 Ω full bridge connected with four 0.14 mm2 cables will have an sensitivity error of 2.1 % due to the 1.27 Ω wire resistance. But with 6-wire technology this can be completely compensated!

Temperature drift:

	Intial error		Drift after 10°C warm up	
	Offset	Sensitivity	Offset	Sensitivity
2-wire	25183 µm/m	-4.97 %	956 µm/m	-0.18 %
3-wire	0 µm/m	-2.6 %	0 µm/m	-0.01 %
4-wire	0 µm/m	0.0 %	0 µm/m	0.00 %

MDAQ-SUB-BRIDGE 8-channel Bridge module

Sensor compatibilty:	Full bridge sensors, 1/2 bridge sensors Voltages up to ±10V, Potentiometric/ohmic sensors
Special functions:	Built-in bridge completion for half bridge AC/DC coupling software selectable Software selectable auto-balance Several selectable excitation voltages Sense lines for the most accurate measurements
Ranges:	15 input ranges from ±2.5mV to ±10V
Bandwidth:	30 kHz
Input configuration:	Differential (not isolated)
Compatibility:	Plugs into any MDAQ-BASE card
Signal connection:	-D: Banana plugs (standard) -L: 8-pin LEMO connector (optional)



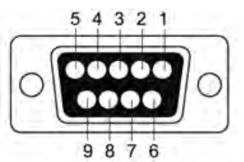
MDAQ-SUB-BRIDGE specifications

Parameter	MDAQ-SUB-BRIDGE	
Gain:	0.5 to 2000	
Input ranges @ 5VDC excitation:	±2.5, 5, 10, 20, 25, 50, 100, 200, 250, 500, 1000, 1250, 2500, 5000, 10 000 mV ±0.5, 1, 2, 4, 5, 10, 20, 40, 50, 100, 200, 250, 500, 1000 mV/V	
Input impedance:	1 MΩ	
Input noise:	3.5 nV * √Hz	
Typ. input offset drift:	0.5 µV/K (for ranges < 200 mV)	
DC Accuracy (High Gain) ±2.5mV;5mV/V;10mV/V;±25mV 20mV 50mV ±100mV to ±200mV	(with correction table applied) ±0.03% of reading ±15µV [±3µV/V @5 Vexc] ±0.03% of reading ±0.12% of range ±0.03% of reading ±0.06% of range ±0.03% of reading ±0.03% of range	(no correction table applied) ±0.15% of reading ±15µV [±3µV/V @5 Vexc] ±0.03% of reading ±0.12% of range ±0.03% of reading ±0.06% of range ±0.03% of reading ±0.03% of range
DC Accuracy (Low Gain) ±0.250 to ±1V ±1.25V; ±2.5V ±5; 10V	(with correction table applied) ±0.03% of reading 400µV [±80µV/V @5 Vexc] ±0.03% of reading ±1mV ±0.03% of reading ±0.03% of range	(no correction table applied) ±0.15% of reading 400µV [±80µV/V @5 Vexc] ±0.15% of reading ±1mV ±0.15% of reading ±0.03% of range
Gain drift @ 5VDC excitation:	10 ppm/K of range ±0.02 µV/V/K	
Excitation voltage:	0.25, 0.5, 1, 2.5, 5V (default) and 10 VDC (software selectable)	
Excitation accuracy:	±0.05 % ±0.7 mV	
Excitation drift:	±10 ppm/K ±50 µV/K	
Excitation protection:	Continuous short to ground	
Excitation current limit:	50 mA/channel	
Bridge types:	4- or 6-wire full bridge 3- or 5-wire 1⁄2 bridge with internal completion (software selectable)	
Completion and Shunt resistor accuracy:	0.05% 5ppm/°K	
Bridge resistance:	120 Ohm to 10 k Ohm	

Parameter	MDAQ-SUB-BRIDGE		
Automatic bridge balance: 2.5mV to 20mV 25mV to 200mV 250mV to 1V 2V to 10V	Absolute Voltage ±10mV ±100mV ±0.5V ±5V	mV/V @ 5V EXC ±2mV/V ±20mV/V ±100mV/V ±1000mV/V	µm/m @ 5VEXC (k=2 quarter bridge) ±4,000µm/m ±40,000µm/m ±200,000µm/m ±2,000,000µm/m
-3 dB Bandwidth:	30 kHz		
Filters (low-pass):	See MDAQ-FILT specification (option)		
Typ. SNR @ 30 kHz [1 kHz] and @ 5 VDC excitation	64 dB [82 dB] @ 1 mV/V 82 dB [96 dB] @ 50 mV/V		
Typ. CMR @ 0.1 mV/V [1 mV/V] and @ 5 VDC excitation	125 dB [120 dB] @ DC 115 dB [110 dB] @ 400 Hz 110 dB [105 dB] @ 1 kHz		
Input isolation:	N/A (input is differential but not isolated)		
Common Mode Voltage:	12V maximum		
Input over-voltage protection:	±25 VDC		
Output voltage:	±5 V		
Output resistance:	< 10 Ω		
Output current:	5 mA max.		
Output protection:	Continuous short to ground		
TEDS compatible 1)	Yes, compatible with TEDS chips DS2406, DS2430A, DS2432, DS2433		
Power consumption for 16 channels: @ 5 VDC excitation @ 5 VDC excitation @ 10 VDC excitation @ 10 VDC excitation	 350 Ohm @ 10V Exc. typ. 15 W 120 Ohm @ 5V typ. 15 W 350 Ohm max. @ 15 W max. 120 Ohm @ 15 W		
Standard operating temperature:	0 °C to 70 °C (32 °F to 158 °F)		

1) When MSI modules are used, the TEDS interface is used by the MSI, and is not available to any sensor that you may connect

Module Pin-outs (all 8 inputs are the same)



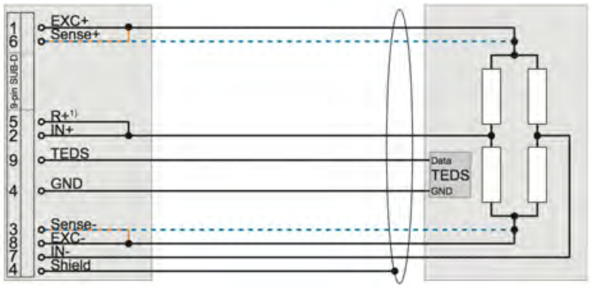
PIN	Function
1	EXC+
2	IN+
3	Sense -
4	GND
5	+15VDC (50 mA)
6	Sense +
7	IN-
8	EXC-
9	TEDS

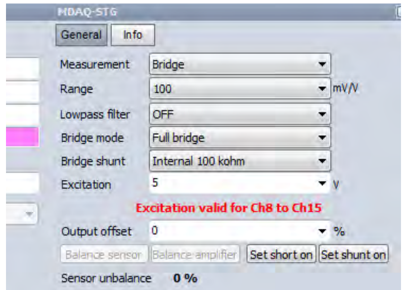
⇒ **CAUTION: The sensor shield can be connected to either pin 4 (SUB-D version only) or the housing of the 9-pin SUB-D / 8-pin LEMO connector, depending on your application.**

⇒ **If signals above 60 V may appear, don't use the metal housing of SUBD connector.**

Full bridge signal connection

6-wire and 4-wire sensor connection



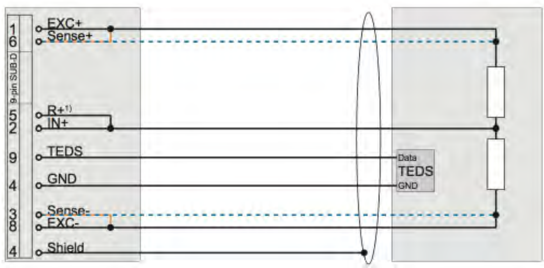


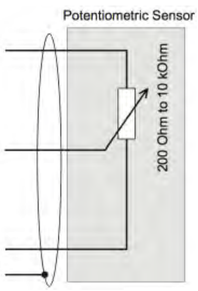
— 4-wire connection
----- 6-wire connection

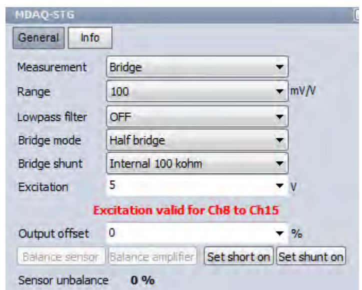
Voltage or Current excitation are allowed.
Sense lines MUST be connected to the excitation also when 4-wire connection is used.
6-wire sensor connection: Sense+ is connected to EXC+ at the sensor
4-wire sensor connection: Sense+ is connected to EXC+ at the connector

Half bridge signal connection

5-wire and 3-wire sensor connection, and potentiometric sensors







— 3-wire connection
----- 5-wire connection

5-wire sensor connection: Sense+ is connected to EXC+ at the sensor
3-wire sensor connection: Sense+ is connected to EXC+ at the connector

Voltage or Current excitation are allowed.

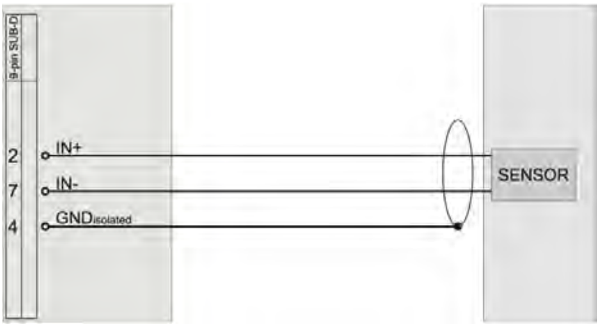
A potentiometer can be seen similar to a half bridge sensor with ±500 mV/V sensitivity. Therefore potentiometric sensors can be measured with bridge amplifiers. The advantages of using the MDAQ-STG for potentiometric measurements is by adjusting the offset and range, you can focus on a certain potentiometer position with higher resolution. The scaling is ±500 mV/V equals ±50 % of potentiometer position.

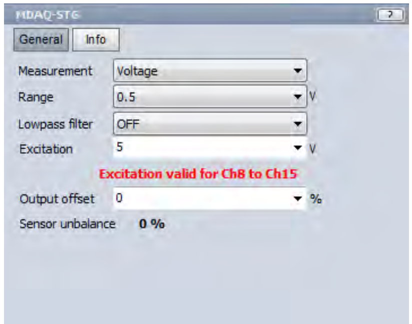
☺ 1) 'R+' has to be connected only if shunt calibration is required, otherwise it can be left unconnected.

☺

Other measurement modes and hook-ups

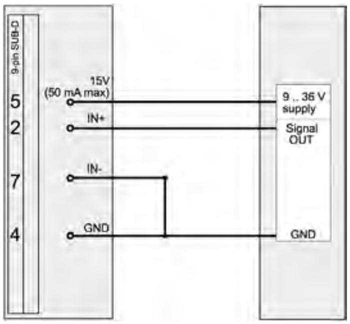
Voltage and microvolt measurement signal connection

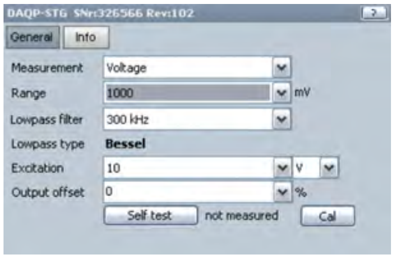




⇒ **CAUTION: If the excitation is not used for sensor supply it has to be deactivated by setting it to 0 V.**

Sensor with 15VDC supply, and voltage output





Why More Wires are Better...

Sensitivity: For sensor wiring typically copper cables are used. For example a 120 Ω full bridge connected with four 0.14 mm2 cables will have an sensitivity error of 2.1 % due to the 1.27 Ω wire resistance. But with 6-wire technology this can be completely compensated!

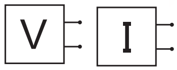
Temperature drift:

	Intial error		Drift after 10°C warm up	
	Offset	Sensitivity	Offset	Sensitivity
2-wire	25183 µm/m	-4.97 %	956 µm/m	-0.18 %
3-wire	0 µm/m	-2.6 %	0 µm/m	-0.01 %
4-wire	0 µm/m	0.0 %	0 µm/m	0.00 %

MDAQ-SUB-V200 Differential Voltage Input module

Sensor compatibilty:	Voltages, and low currents with appropriate shunt
Special features:	The DSUB version has sensor power on board, and is TEDS compatible
Measuring ranges:	Low and high ranges from ±0.125 V to ±200 V
Bandwidth:	300 kHz
Input configuration:	Differential (not isolated)
Compatibility:	Plugs into any MDAQ-BASE card
Signal connection:	-BNC: BNC jacks (standard) -D: 9-pin DSUB connector

MDAQ-SUB-V200 specifications



Parameter	MDAQ-SUB-V200
Input ranges: Divider OFF (higher voltage ranges) Divider ON lower voltage ranges)	 ±0.125 V, 0.25 V, 0.5 V, 1 V, 1.25 V, 2.5 V, 5 V, 10 V (12 V max CMV) ±2.5 V, 5 V, 10 V, 20 V, 25 V, 50 V, 100 V, 200 V (250 V max CMV)
Input impedance:	1 MΩ to GND, 2 MΩ differential
DC accuracy: (Divider OFF) ±0.125 to ±1V ±1.25V; ±2.5V ±5; ±10V	(with correction table applied) / (without correction table applied) ±0.03% of reading ±400 µV / ±0.15% of reading 400 µV ±0.03% of reading ±1 mV / ±0.15% of reading 1 mV ±0.02% of reading ±0.03% of range / ±0.15% of reading ±0.03% of range
DC accuracy: (Divider ON) ±2.5 to ±20V ±25V; ±50V ±100; ±200V	(with correction table applied) / (without correction table applied) ±0.06% of reading ±8 mV / ±0.25% of reading 8 mV ±0.03% of reading ±20 mV / ±0.25% of reading 20 mV ±0.02% of reading ±0.03% of range / ±0.25% of reading ±0.03% of range
Gain drift:	typ. 15 ppm/K (max. 40 ppm/K)
Input offset drift: 125 mV to 10 V (Divider OFF) 2.5 V to 200 V (Divider ON)	 typ. 10 µV/K (max. 20 µV/K) typ. 100 µV/K (max. 200 µV/K)
Over voltage protection:	±250 VDC
-3 dB Bandwidth: (Divider OFF) (Divider ON)	300 kHz (200 kHz at range 0.125 V and 1.25 V) 300 kHz (200 kHz at range 2.5 V and 25 V)
Channel separation @ 10 kHz:	> 80 dB
CMRR @ 50 Hz (@ 1 kHz) (Divider OFF) (Divider ON)	> 94 dB (> 80 dB) > 70 dB (> 56 dB)
Typ. SNR @ 50 kHz BW (Divider OFF) ±0.125 V and ±0.25 V ±0.5 V to ±10 V ±2.5 V and ±10 V (Divider ON) ±10 V to ±25 V ±25 V to ±200 V	 > 87 dB > 96 dB > 84 dB > 88 dB < 93 dB
Programmable sensor supply (1) Sensor supply accuracy(1) Fixed sensor supply (1)	0 to 12 V short circuit protected; 50mA current limmitation ±0.05 % ±2 mV ±15 V (50 mA)
Output voltage:	±5 V
Output impedance:	5 Ω
Output current:	±20 mA

Parameter	MDAQ-SUB-V200
RS485 interface for module control:	Yes
Power supply:	±15 VDC
Power consumption:	typ. 4.5 W / 10 W
Sensor connection:	-BNC: BNC connector, female -D: 9-pin DSUB connector, female
TEDS support:	Yes (-D model only!), compatible with chips DS2406, DS2430A, DS2432, DS2433
Standard operating temperature:	0 °C to 70 °C (32 °F to 158 °F)

1) Applies to the MDAQ-SUB-V-200-D model only (DSUB connector)

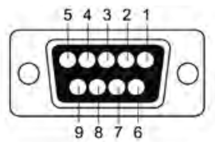
Module Pin-outs (all 8 inputs are the same)

MDAQ-SUB-V-200-BNC version

Hot: IN+

Shield: IN-

MDAQ-SUB-V-200-D version



See table >

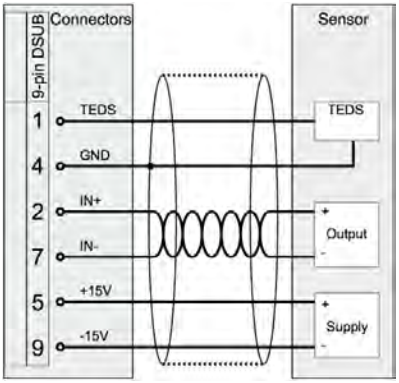
PIN	DSUB-9 connector MDAQ-SUB-V-200-D module (typ x 8)
1	TEDS
2	IN+
3	Reserved
4	GND
5	+15V sensor supply
6	0 - 12VDC sensor supply (software programmable)
7	IN-
8	Reserved
9	-15V sensor supply

⇒ **If signals above 60 V may appear, don't use the metal housing of SUBD connector.**

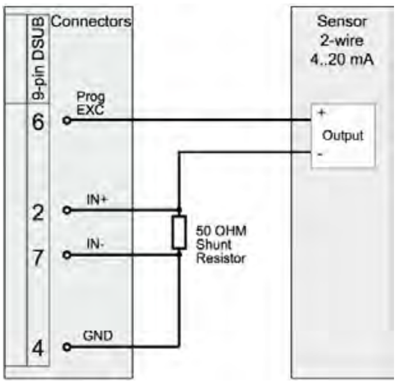
⇒ **Note - for safety reasons, refer to your local/government regulations about the maximum voltage that may be applied to BNC or DSUB connectors!**

MDAQ-SUB-V200 sensor connections

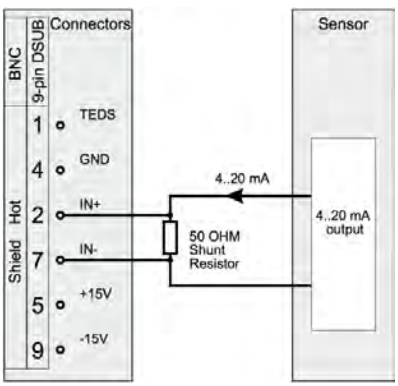
Sensor with differential output, module powered



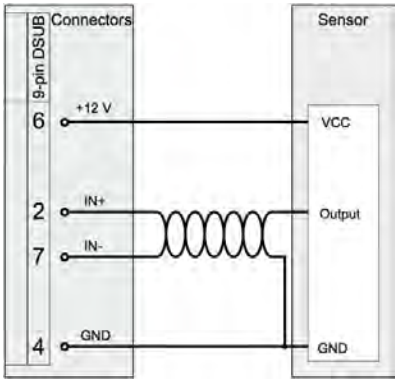
Loop-powered sensor, ext. shunt



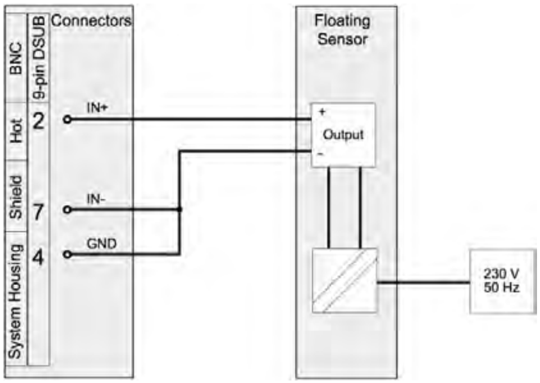
Current measurement, external shunt



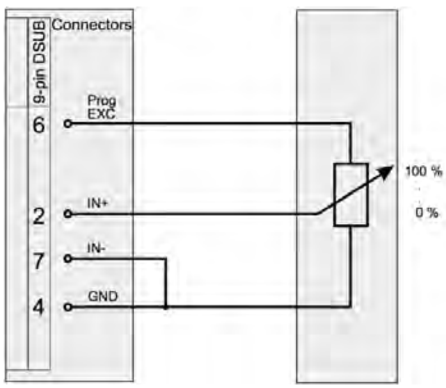
Sensor with common ground



Single-ended connection

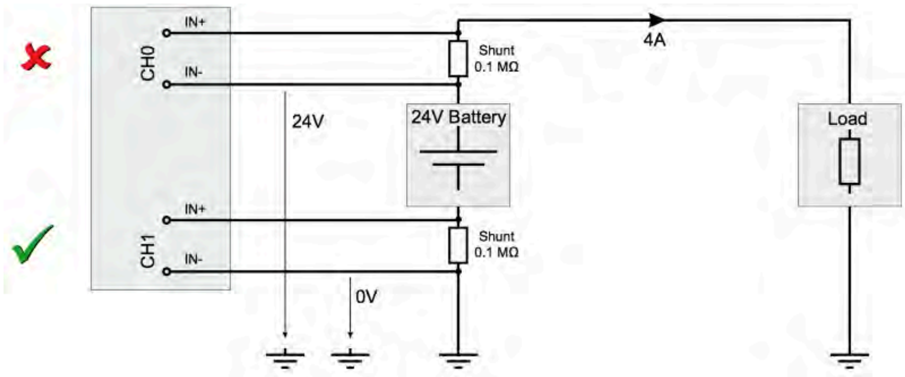


Potentiometric connection



Avoiding Common Mode Issues

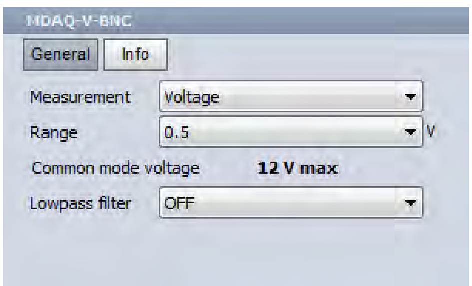
In contrast to isolated amplifiers the input common voltage range is limited at differential amplifiers. The measurement configuration below shows the possibilities to measure the current of a 24 V supplied system.

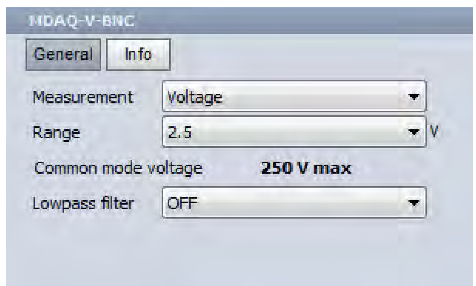


The optimum input range in that case is 500 mV. That will work fine for CH1 in the picture, but not for the CH0. This channel will exceed the maximum common mode voltage and go into overflow.

With the MDAQ-SUB-V-200 module, there are several ranges which overlap between the 12V and 250V max CMV ranges. This is intentionally done to provide you with more options when it comes to choosing the best possible fit of range/resolution/common mode.

The max. CMV is shown here within the software (analog channel setup dialog):



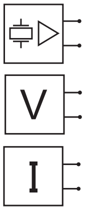


Notice that in the screen shot above left, the CMV is shown to be 12V max, whereas it is 250V max in the screen shot above right.

⇒ **Always pay attention to the max CMV which is listed on the channel setup screen, when you select a given range within the software.**

MDAQ-SUB-ACC IEPE Accelerometer module

Sensor compatibilty:	IEPE constant current accelerometers and microphones, and ±10V max. signals
Special features:	Single ended or differential input mode
Modes:	AC/DC coupling
Bandwidth:	300 kHz
Isolation:	N/A
Compatibility:	Plugs into any MDAQ-BASE card
Signal connection:	BNC connector



MDAQ-SUB-ACC specifications

Parameter	MDAQ-SUB-ACC
Input voltage ranges:	±0.125 V, 0.25 V, 0.5 V, 1 V, 1.25 V, 2.5 V, 5 V, 10 V
Gain:	0.5, 1, 2, 4, 5, 10, 20, 40
Input modes: Voltage modes	IEPE or low voltage Single-ended or differential AC or DC coupling
Input impedance:	1 MΩ
DC Accuracy: ±0.125 to ±1V ±1.25V; ±2.5V ±5;10V	(with correction table applied) ±0.03% of reading ±400 µV ±0.03% of reading ±1 mV ±0.02% of reading ±0.03% of range (without correction table applied) ±0.15% of reading 400 µV ±0.15% of reading 1 mV ±0.15% of reading ±0.03% of range
Gain drift:	typ. 10 ppm/K (max. 20 ppm/K)
Input offset drift:	typ. 3 µV/K (max. 12 µV/K)
Over voltage protection:	IN+ differential ±40 V IN- differential: max ±40 V IN- Single ended: max 300 mA
Max common mode voltage:	12 V (differential mode)
-3 dB Bandwidth:	300 kHz (200 kHz at range 1.25 V and 0.125 V)
Channel separation @ 10 kHz:	> 96 dB
CMR @ 50 Hz (@ 1 kHz):	> 94 dB (> 80 dB)
Typ. SNR @ 50 kHz bandwidth: Range ±0.125 V Range ±0.25 V Range ±0.5 V to ±1.25 V Range ±2.5 V to ±10 V	 > 87 dB > 93 dB > 96 dB > 100 dB
Sensor excitation:	4 or 8 mA, 5 % up to 24 VDC
Current noise:	150 nA * sqrt (Hz)
RS485 interface for module control:	Yes
Power supply voltage:	±15 VDC
Output voltage:	±5 V
Output impedance:	5 Ω

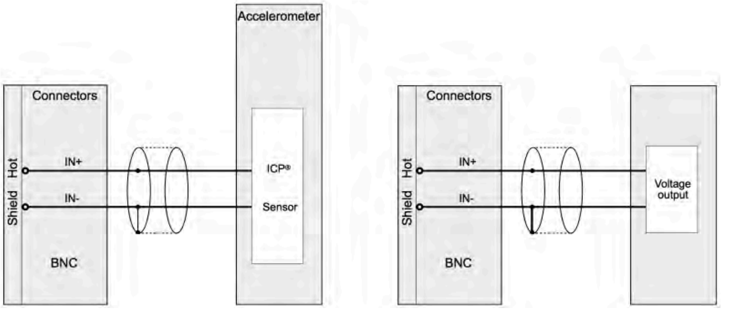
Parameter	MDAQ-SUB-ACC
Power consumption:	typ. 10 W (max 12 W @ 8 mA sensor excitation)
TEDS support:	Yes, compatible with TEDS chips DS 2406, DS 2430A, DS 2432, DS2433
Standard operating temperature:	0 °C to 70 °C (32 °F to 158 °F)

Module Pin-outs (all 8 inputs are the same)

MDAQ-SUB-ACC-BNC version

HOT: IN+
SHIELD: IN-

Typical Sensor Hook-ups



Above left: IEPE sensor mode Above right: Voltage input mode

For constant current powered sensors (IEPE) the current source is switched on and the minus input of the BNC is connected to GND. The input coupling is switched to AC. In this mode the TEDS interface circuit is activated so that it can read the sensor information from IEEE 1451.4 compliant sensors (the TEDS interface is disabled in the voltage mode).

In all voltage measurement modes the current source is disconnected from the input signal.

The position of the GND switch defines if the amplifier is used for differential or singled-ended input configuration. The allowed input voltage range (common mode voltage) is limited to 12 V.

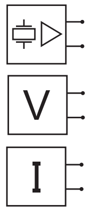
☺ **NOTE: If floating input sources (like batteries) are connected to the MDAQ-SUB-ACC the amplifier has to be used in single ended configuration (GND-switch ON)! Otherwise the input may be out of the maximum input voltage range!**

☺ **In differential mode as well as in single ended mode AC or DC coupling is possible. The standard high pass filter frequency is 3 Hz in AC-mode. Please contact DEWETRON for other frequencies.**

⇒ **The constant current supply (4 or 8 mA) that you set on one channel, will apply to all 8 channels of this MDAQ-SUB module. However, other MDAQ-SUB modules may be set to different constant current levels.**

MDAQ-SUB-ACC-A IEPE Accelerometer module

Sensor compatibilty:	IEPE constant current accelerometers and microphones, and ±10V max voltages
Special features:	Two selectable high-pass filters
Modes:	Single ended, AC/DC coupling
Bandwidth:	300 kHz
Isolation:	N/A
Compatibility:	Plugs into any MDAQ-BASE card
Signal connection:	-BNC: BNC connector



MDAQ-SUB-ACC-A specifications

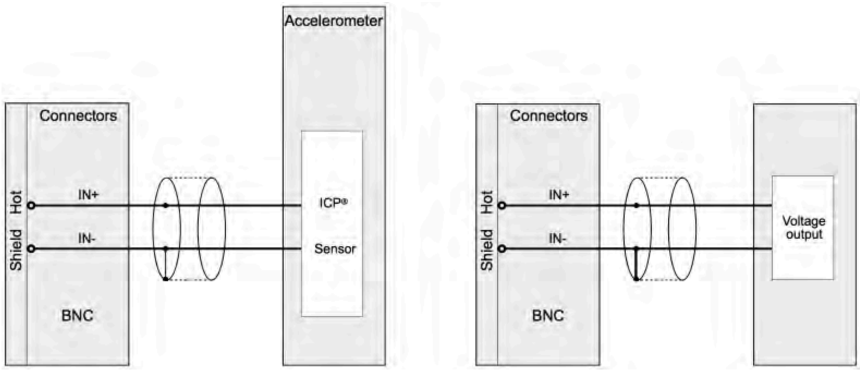
Parameter	MDAQ-SUB-ACC-A			
Input voltage ranges:	±0.125 V, 0.25 V, 0.5 V, 1 V, 1.25 V, 2.5 V, 5 V, 10 V			
Gain:	0.5, 1, 2, 4, 5, 10, 20, 40			
Input modes: Voltage modes	IEPE or low voltage Single-ended only AC or DC coupling			
Input impedance:	1 MΩ			
DC Accuracy:	(with correction table applied)		(without correction table applied)	
±0.125 to ±1V	±0.03% of reading	±400 µV	±0.15% of reading	400 µV
±1.25V; ±2.5V	±0.03% of reading	±1 mV	±0.15% of reading	1 mV
±5;10V	±0.02% of reading	±0.03% of range	±0.15% of reading	±0.03% of range
Gain drift:	typ. 10 ppm/K (max. 20 ppm/K)			
Input offset drift:	typ. 3 µV/K (max. 12 µV/K)			
Over voltage protection:	IN+ ±40 V IN- Single ended: max 300 mA			
Max common mode voltage:	±12 V (differential mode)			
-3 dB Bandwidth:	300 kHz (200 kHz at range 1.25 V and 0.125 V)			
Channel separation @ 10 kHz:	> 96 dB			
CMR @ 50 Hz (@ 1 kHz):	> 94 dB (> 80 dB)			
Typ. SNR @ 50 kHz bandwidth:				
Range ±0.125 V	> 87 dB			
Range ±0.25 V	> 93 dB			
Range ±0.5 V to ±1.25 V	> 96 dB			
Range ±2.5 V to ±10 V	> 100 dB			
Sensor excitation:	4 or 8 mA, 5 % up to 24 VDC			
Current noise:	150 nA * sqrt (Hz)			
RS485 interface for module control:	Yes			
Power supply voltage:	±15 VDC			
Output voltage:	±5 V			
Output impedance:	5 Ω			
Power consumption:	typ. 10 W (max 12 W @ 8 mA sensor excitation)			

Parameter	MDAQ-SUB-ACC-A
TEDS support:	Yes, compatible with TEDS chips DS 2406, DS 2430A, DS 2432, DS2433
Standard operating temperature:	0 °C to 70 °C (32 °F to 158 °F)

Module Pin-outs (all 8 inputs are the same)

MDAQ-SUB-ACC-A-BNC version

Typical Sensor Hook-ups



Above left: IEPE sensor mode Above right: Voltage input mode

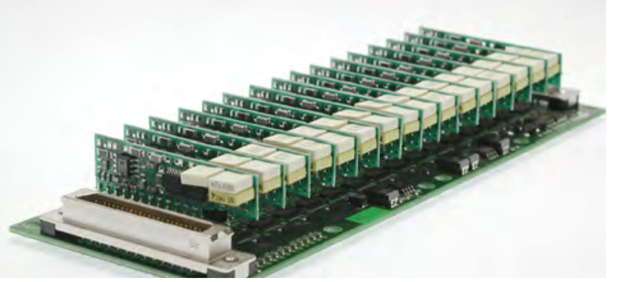
For constant current powered sensors (IEPE) the current source is switched on and the minus input of the BNC is connected to GND. In this mode the TEDS interface circuit is activated so that it can read the sensor information from IEEE 1451.4 compliant sensors (the TEDS interface is disabled in the voltage mode).

In all voltage measurement modes the current source is disconnected from the input signal.

The position of the GND switch defines if the amplifier is used for differential or singled-ended input configuration. The allowed input voltage range (common mode voltage) is limited to 12 V.

⇒ **The constant current supply (4 or 8 mA) that you set on one channel, will apply to all 8 channels of this MDAQ-SUB module. However, other MDAQ-SUB modules may be set to different constant current levels.**

MDAQ-FILT-5-Bx Filter card

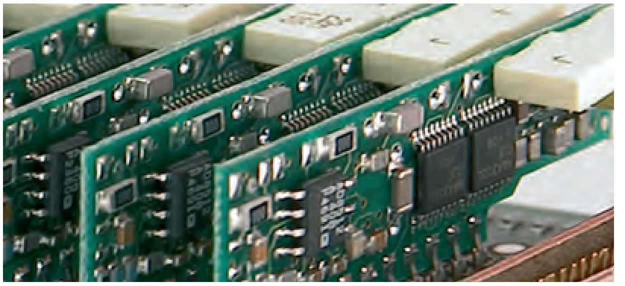


MDAQ-FILT-5-BE: Bessel characteristics
MDAQ-FILT-5-BU: Butterworth characteristics
16 Channel 2nd order low pass filter
5 selectable filters including bypass function
5 different cut off frequencies
Discrete low noise filter design
Independent filter settings for each channel
Direct control from MDAQ-xx Amplifier series

MDAQ-FILT-5-Bx specifications

Parameter	MDAQ-FILT-5-Bx
Filter range (-3 dB): Version MDAQ-FILT-5-BU Version MDAQ-FILT-5-BE Version MDAQ-FILT-5-BU-S1	 30 Hz, 100 Hz, 300 Hz, 1 kHz, 10 kHz, bypass 30 Hz, 100 Hz, 300 Hz, 1 kHz, 10 kHz, bypass 100 Hz, 1 kHz, 10 kHz, 30 kHz, 100 kHz, bypass other frequencies optionally available
Bypass bandwidth:	> 700 kHz
Filter characteristics: -BE model -BU model	 2-Pole Bessel 2-Pole Butterworth
Attenuation slope:	40 dB/decade (12 dB/octave)
Filter Accuracy:	±1.5 dB @ fc
DC gain:	1 (0 dB)
Offset error:	Max. 1 mV (typ <0.2 mV) Max. 0.02% of range with MDAQ-BASE-5
Input voltage range:	±10 VPP
Channel separation @ 50 kHz:	> 96 dB
CMR @ 50 Hz (@ 1 kHz):	> 94 dB (> 80 dB)
Input configuration:	Designed to work with MDAQ-BASE-5 mother board
Output configuration:	Single-ended
S/NR @ bandwidth:	> 100 dB
Output impedance:	5 Ω
Output current:	20 mA max.
Output connector:	68-pin Amplimite series (AMP Nr. 174339-6), SCSI II Type
Power supply:	±7.5 V to ±15 V direct via MDAQ-BASE
Power consumption:	typ. 3 W
Dimensions:	175 x 61 x 14 mm (6.9 x 2.4 x 0.9 in.)

MDAQ-AAF4-5-Bx Filter card



- MDAQ-AAF4-5-BE: Bessel characteristics
- MDAQ-AAF4-5-BU: Butterworth characteristics
- 16 Channel 4th order low pass filter
- 5 selectable filters including bypass function
- 5 different cut off frequencies
- Discrete low noise filter design
- Independent filter settings for each channel
- Direct control from MDAQ-xx Amplifier series

MDAQ-AAF4-5-Bx specifications

Parameter	MDAQ-AAF4-5-Bx
Filter range (-3 dB): version MDAQ-AAF4-5-BU version MDAQ-AAF4-5-BU-S1 version MDAQ-AAF4-5-BU-S2 version MDAQ-AAF4-5-BE-S1	 100 Hz, 1 kHz, 10 kHz, 30 kHz, 100 kHz, bypass 163 Hz, 500 Hz, 2.5 kHz, 10 kHz, bypass, bypass 10 Hz, 100 Hz, 1 kHz, 10 kHz, 20 kHz, bypass 100 Hz, 1 kHz, 10 kHz, 20 kHz, 30 kHz, bypass other frequencies optionally available
Bypass bandwidth:	> 700 kHz
Filter characteristics: -BE model -BU model	 4-Pole Bessel 4-Pole Butterworth
Attenuation slope:	80 dB/decade (24 dB/octave)
Filter Accuracy:	±1.5 dB @ fc
DC gain:	1 (0 dB)
Offset error:	Max. 1 mV (typ <0.2 mV) Max. 0.02% of range with MDAQ-BASE-5
Input voltage range:	±10 VPP
Channel separation @ 50 kHz:	> 96 dB
CMR @ 50 Hz (@ 1 kHz):	> 94 dB (> 80 dB)
Input configuration:	Designed to work with MDAQ-BASE-5 mother board
Output configuration:	Single-ended
S/NR @ bandwidth:	> 100 dB
Output impedance:	5 Ω
Output current:	20 mA max.
Output connector:	68-pin Amplimite series (AMP Nr. 174339-6), SCSI II Type
Power supply:	±7.5 V to ±15 V direct via MDAQ-BASE
Power consumption:	typ. 3 W
Dimensions:	175 x 61 x 14 mm (6.9 x 2.4 x 0.9 in.)

General EPAD2/CPAD2 module specifications

Environmental:

Temp. range storage:	-30 °C to +85 °C (-22 °F to 185 °F)
Temp. range operating:	-5 °C to +60 °C (23 °F to 140 °F)
Enhanced temperature range:	upon request and special order
Rel. humidity (MIL202):	0 to 95 % at 60 °C, non-condensing
RFI susceptibility:	±0.5 % span error at 400 MHz, 5 W, 3 m

All specifications within this manual are valid at 25 °C.
All modules are produced according to ISO9001 and ISO14001.

EPAD2/CPAD2 Series Common Information

Calibration information

All DEWETRON modules are calibrated at 25°C after a warmup time of 30 minutes and meet their specifications when leaving the factory. The time interval for recalibration depends on environmental conditions. Typically, the calibration should be checked once a year.

Calibration certificates are available from DEWETRON as an option. DEWETRON offers several types:

- NIST traceable DEWETRON calibration certificate (USA CAL LAB only)
- ISO traceable DEWETRON certificate (European CAL LAB only)
- Calibration certificate according to ÖKD (equivalent to DKD)

EPAD2 RS-232/485 interface

EPAD2 series modules are controlled via RS-485 interface, and they require this interface for all data transfers The DEWE-3210 and DEWE-3211 include an internal RS-232/485 converter and interface. This converter allows communication with all Dewetron signal conditioning modules. To communicate with the modules, the RS-232 interface must be set to the following parameters:

baud rate:	9600
data bits:	8
parity:	no parity
stop bits:	1
handshake:	not required

CPAD2 CAN BUS interface

CPAD2 series modules are controlled via the industry standard CAN BUS over CAN 2.0b protocol, and they require this interface for all data transfers. CAN BUS is an option for both the DEWE-3210 and DEWE-3211 instruments, and must be installed at the factory in order for this interface to be available for CPAD2 connection.

EPAD2 and CPAD2 series Modules

EPAD2 and CPAD2 overview

EPAD2 modules are external signal conditioning modules which connect to virtually any Dewetron system via the RS485 interface, normally marked EPAD on your Dewetron system. It is marked this way on both the DEWE-3210 and DEWE-3211 mainframes. However, EPAD2 series modules may also be connected to any computer using a small interface box called the EPAD-BASE2, which allows you to connect one or more EPAD2 modules to your computer's RS232 or USB 2.0 interface.

CPAD2 modules are external modules which connect to any Dewetron system which has at least one CAN BUS interface. Unlike EPAD2 series modules which employ the RS485 bus for communication and data transfer, CPAD2 modules employ the CAN BUS for these functions.

Both EPAD2 and CPAD2 modules are 100% compatible with Dewetron software. The following pages will show you how to connect and control these modules from within your system, as well as provide detailed specifications about these modules.

EPAD2 and CPAD2 modules are available for measuring voltage, current, and temperature. Each module provides 8 inputs. They have a separate 24-bit ADC for each input channels, and provide galvanic isolation to avoid ground loops and common mode problems. They can be daisy-chained to add more and more channels to a single interface (CPAD2 and EPAD2 modules cannot be chained together).

EPAD2 and CPAD2 modules are not meant for dynamic/AC signals, but are intended for slowly changing (quasi-static) and DC signals. They are the ideal way to add a moderate or even large number of slow channels to your Dewetron system in an affordable and convenient way.

Further technical details can be found within the xPAD technical reference manual, a separate document.

All specifications within this manual are valid at 25 °C.

All modules are produced according to ISO9001 and ISO14001.

xPAD2 Series Calibration Information

All DEWETRON modules are calibrated at 25°C after a warmup time of 30 minutes and meet their specifications when leaving the factory. The time interval for recalibration depends on environmental conditions. Typically, the calibration should be checked once a year.

Calibration certificates are available from DEWETRON as an option. DEWETRON offers several types:

- NIST traceable DEWETRON calibration certificate (USA CAL LAB only)
- ISO traceable DEWETRON certificate (European CAL LAB only)
- Calibration certificate according to ÖKD (equivalent to DKD)

This manual contains no calibration information. There are separate resources optionally available for MDAQ series modules for automated calibration under Met/CAL®. The CAL-KIT contains the required cables, software and instructions that you need to add to your own calibration lab. It does not include a calibrator or volt meter.

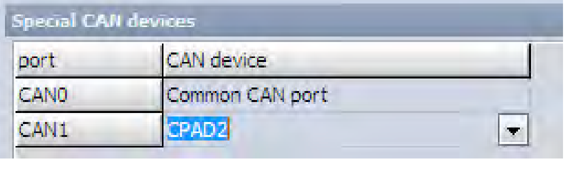
Cross-reference of EPAD2 / CPAD2 modules

MODULE	INPUT TYPE	INPUT RANGES	ISOLATION	COMMENTS
EPAD2-TH8-x CPAD2-TH8-x (where x = J, K, T, U)	8 thermocouple connectors Type J: xPAD2-TH8-P-J Type K: xPAD2-TH8-P-K Type T: xPAD2-TH8-P-T Type U: UNIVERSAL	Type J: -210 to 1200 °C Type K: -270 to 1372 °C Type T: -270 to 400 °C Type U: includes types K, J, T, E, R, S, B, N, C, and U	350 VDC (channel to channel and channel to BUS, power and chassis)	Overvoltage protection: 15 VDC Types J, K, T have typical accuracy of ±0.4°C Type U (universal) has typical accuracy of ±1.4°C
EPAD2-V8 CPAD2-V8	8 isolated voltage input channels	Physical input range: ±50 V Software selectable: ±100 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V	350 VDC (channel to channel and channel to BUS, power and chassis)	Overvoltage protection: 350 VDC DSUB25 connector - please order PAD-CB8-B or -BNC breakout boxes to complete this module
EPAD2-RTD8 CPAD2-RTD8	8 isolated Resistance Temperature Detector (RTD) channels	Resistor: 0 to 999.99 Ω RTD: PT100(385), PT200 (385), PT500(385), PT1000 (385), PT2000(385), PT100 (3961)	350 VDC (channel to channel and channel to BUS, power and chassis)	Overvoltage protection: 15 VDC LEMO connectors
EPAD2-TH8-P CPAD2-TH8-P	8 isolated voltage inputs Supported breakout boxes: PAD-CB8-x-P2 PAD-CB8-x-M PAD-CB8-RTD	±1.5 V fixed	350 VDC (channel to channel and channel to BUS, power and chassis)	Overvoltage protection: 15 VDC DSUB25 connector - please order PAD-CB8-J, K, T or -RTD breakout boxes to complete this module
EPAD2-LA8 CPAD2-LA8	8 isolated current inputs	0 to 20 mA, ±20 mA, ±30 mA	350 VDC (channel to channel and channel to BUS, power and chassis)	Overcurrent protection: 70 mA cont. LEMO connectors

Installing CPAD2 modules

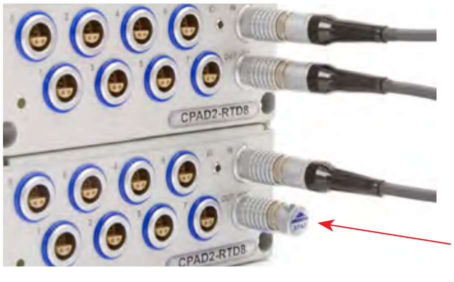
After connecting a CPAD2 module to an unused CAN BUS interface on your Dewetron system, run DEWESoft and go to the HARDWARE SETTINGS screen, accessed under the SETTINGS button. Then click on the CAN button.

Select the CAN interface that you connected the CPAD2 module to on that screen and set it to work with CPAD2 modules, as shown in the screen shot here.



If your software does not have this selection on the CAN screen, please obtain the CPAD2 plugin from Dewetron. This is a software addon that is free of charge with your CPAD modules. It was included on a DVD/CD disk when you purchased your CPAD2 module(s). Or it can be downloaded from our FTP site.

Additional CPAD2 series modules can be daisy-chained to the first module. The last CPAD2 module must have the terminator plugged into the last open connector to ensure stable bus communications.



Terminator

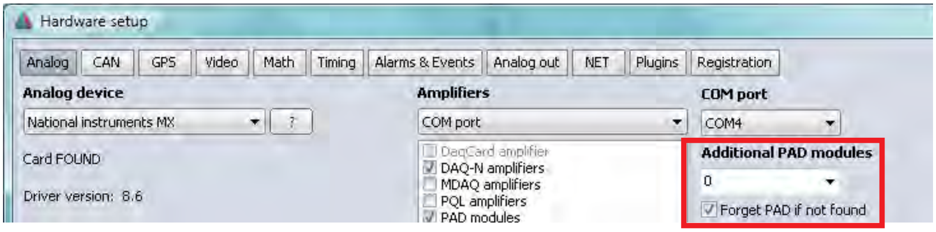
Installing EPAD2 modules

When you purchase an EPAD2 module for an existing Dewetron system, you need to make a small change to the hardware setup of your system so that the EPAD2 is recognized by the software.

First, connect the EPAD2 to the EPAD connector on your system. If you plan to connect multiple EPAD2 modules, start with one first and then add the others one at a time.

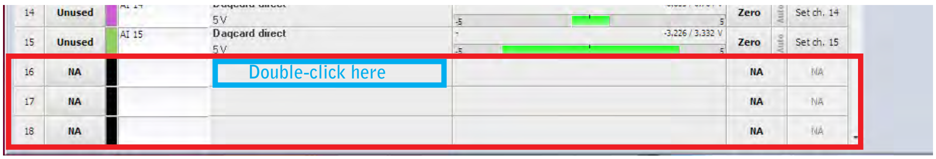
When connected properly, the EPAD2 LED should light up, indicating that it is powered. If this does not happen, check your cabling and verify it with Dewetron if necessary.

Now run DEWESoft. Click the SETTINGS button near the top right of the screen and then click HARDWARE SETUP. Make sure you are looking at the ANALOG page of this dialog box. It looks like this:

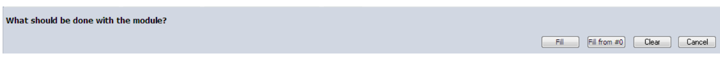


Notice the area that we have drawn a red rectangle around in the screen shot above: this is where you need to input the number of EPAD2 modules that you want to add. Enter that number here. Then click OK to close this dialog box.

Click Ch Setup to see the list of ANALOG channels in DEWESoft. Scroll to the very bottom of this list and you will see that four empty channels have been added. Assuming that one EPAD2 module is connected already to the bus, double-click the first empty EPAD2 channel in the list within the AMPLIFIER column:



The new empty channels are outlined in red above. Now DOUBLE-CLICK on the first amplifier button, that we have outlined in blue above. That will cause DEWESoft to pop up the question "what should be done with the module?", at which point you should click the FILL button.



When you click FILL, DEWESoft will prompt you to press the black button on the EPAD2 module. Use a paperclip or thin pencil lead to do that, and the module will be addressed to this slot number, and it will show up here on the Setup screen. Use the SET CH. button on the far right to configure the eight channels of this module.

Now connect the next EPAD2 module and repeat these steps, moving down to the next empty amplifier button, and so on, until all EPAD2 modules have been installed.

Be sure to plug the terminator into the last EPAD2 module (even if there is only one EPAD2 module).

EPAD2-TH8-X and CPAD2-TH8-X

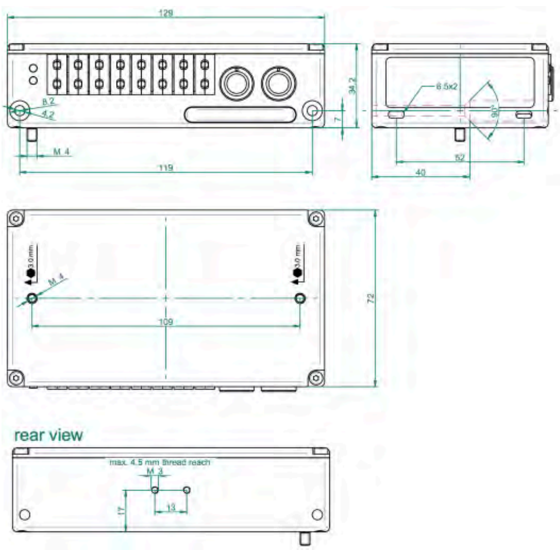
- Intelligent amplifier with integrated 24-bit A/D conversion
- 8 input channels for thermocouple types J, K, T, and U (universal)
- Inputs isolated to 350 VDC
- Modules daisy-chain together to add more and more channels
- EPAD2 series uses RS485 interface
- CPAD2 series uses CAN 2.0B interface

Specifications

Parameter	EPAD2-TH8-x and CPAD2-TH8-x
Input channels:	8 isolated thermocouple channels
Input signals:	thermocouple types depending on module J: -210 °C to 1200 °C K: -270 °C to 1372 °C T: -270 °C to 400 °C U: Supports types K, J, T, E, R, S, B, N, C, and U
Sample rate:	12.5 S/s/ch maximum
-3 dB bandwidth:	6 Hz
ADC type:	Sigma delta ADC per channel, 24-bit (Note: CPAD2 outputs CAN data at 16-bits)
Input connector:	Standard "mini" thermocouple connector, polarized, color coded Type K: yellow Type J: black Type T: blue Type U: white
Resolution:	0.01 °C for all types
Input impedance:	typically 1.4 MΩ
Bias current:	typically 10 nA
Open thermocouple detection:	module indicates fullscale if input is open
Accuracy: Thermocouple type J Thermocouple type K Thermocouple type T Thermocouple type U	 ±1.0 °C @ -210 to -100 °C ±0.3 °C @ -100 to 760 °C ±0.4 °C @ 760 to 1200 °C ±1.0 °C @ -200 to -25 °C ±0.4 °C @ -25 to 1000 °C ±0.5 °C @ 1000 to 1372 °C ±1.0 °C @ -250 to -150 °C ±0.4 °C @ -150 to 400 °C Varies according to the T/C type and range, but accuracy ±1.4 °C, typ. ±0.7 °C
Temperature drift:	typically 20 ppm/°C
Isolation voltage:	350 VDC (channel to channel and channel to Bus, Power and Chassis)
Over-voltage protection:	15 VDC
CMRR @ 50/60 Hz:	130 dB
Interface:	EPAD2 series: RS485 CPAD2 series: CAN BUS 2.0B protocol
Read-out speed:	EPAD2 series: typ. 80 ch/sec. CPAD2 series: 12.5Hz, 10Hz, 5Hz, 2Hz, 1Hz, 0.5Hz, 0.2Hz or 0.1 Hz programmable
Bus power connector:	LEMO EGG.1B.304
Power supply voltage:	7 to 40V

Parameter	EPAD2-TH8-x and CPAD2-TH8-x
Power consumption:	0.5 W maximum
Dimensions: Base module (W x D x H) Mounting holes distance:	 129 x 72 x 34.2 mm (5.1 x 2.8 x 1.3 in.) incl. mounting holes 119 x 7 mm (4.7 x 0.3 in.), 4.2 mm (0.165 in.) diameter
Weight:	360 g typical

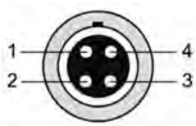
xPAD2-TH8-X Dimensions



xPAD2 interface connector

There are two identical interface connectors for power and control. One is used to interface with either the Dewetron system, or another xPAD2 module in a series. The other can be used to extend the daisy-chain another xPAD2 module from this one. The two connectors are interchangeable.

PIN	EPAD2	CPAD2
1	RS485 (A)	CAN high
2	RS485 (B)	CAN low
3	+15V supply	+15V supply
4	GND	GND



LEMO EGG.1B.304

Connecting sensors

Use thermocouple sensors with standardized "mini" thermocouple connectors. This is a polarized connector with two flat blades, and one blade is wider than the other. Insert the plug correctly, and do not force the plug in the wrong way.

☺ **Connecting the thermocouple backwards will result in wrong readings.**

Above: typical thermocouple mini connectors, image courtesy of Omega.com

Use the correct type

Thermocouples are color coded according to international conventions.

Type	Color	+	-
Type K	yellow	NiCr	NiAl
Type J	black	Fe	CuNi
Type T	blue	Cu	CuNi

☺ **Note: Our "universal" thermocouple input is cowwhite, to indicate that it is compatible with multiple thermocouple types.**

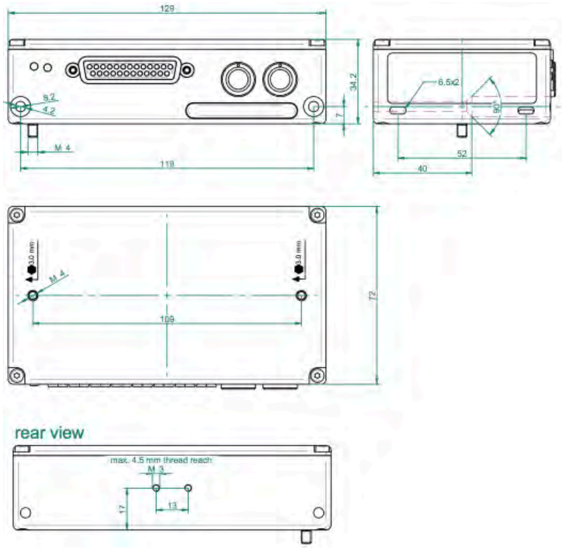
EPAD2-V8-X and CPAD2-V8-X

Intelligent amplifier with integrated 24-bit A/D conversion
8 input channels for voltages
Inputs isolated to 350 VDC
Modules daisy-chain together to add more and more channels
EPAD2 series uses RS485 interface
CPAD2 series uses CAN 2.0B interface

Specifications

Parameter	EPAD2-V8-x and CPAD2-V8-x
Input channels:	8 isolated voltage channels
Input ranges:	Physical input range: ±50 V Software selectable: ±100 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V
Sample rate:	12.5 S/s/ch maximum
-3 dB bandwidth:	6 Hz
ADC type:	Sigma delta ADC per channel, 24-bit (Note: CPAD2 outputs CAN data at 16-bits)
Input connector:	Standard "mini" thermocouple connector, polarized, color coded Type K: yellow Type J: black Type T: blue Type U: white
Resolution:	1µV for all ranges
Input impedance:	typically 1.4 MΩ
Bias current:	typically 10 nA
Linearity:	0.001 %
DC accuracy:	±0.02 % of reading ±900 µV
Temperature drift:	typically 25 ppm/°C
Isolation voltage:	350 VDC (channel to channel and channel to Bus, Power and Chassis)
Over-voltage protection:	15 VDC
CMRR @ 50/60 Hz:	130 dB
Interface:	EPAD2 series: RS485 CPAD2 series: CAN BUS 2.0B protocol
Read-out speed:	EPAD2 series: typ. 80 ch/sec. CPAD2 series: 12.5Hz, 10Hz, 5Hz, 2Hz, 1Hz, 0.5Hz, 0.2Hz or 0.1 Hz programmable
Bus power connector:	LEMO EGG.1B.304
Power supply voltage:	7 to 40V
Power consumption:	0.5 W maximum
Dimensions: Base module (W x D x H) Mounting holes distance:	 129 x 72 x 34.2 mm (5.1 x 2.8 x 1.3 in.) incl. mounting holes 119 x 7 mm (4.7 x 0.3 in.), 4.2 mm (0.165 in.) diameter
Weight:	310 g typical

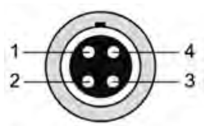
xPAD2-V8-X Dimensions



xPAD2 interface connector

There are two identical interface connectors for power and control. One is used to interface with either the Dewetron system, or another xPAD2 module in a series. The other can be used to extend the daisy-chain another xPAD2 module from this one. The two connectors are interchangeable.

PIN	EPAD2	CPAD2
1	RS485 (A)	CAN high
2	RS485 (B)	CAN low
3	+15V supply	+15V supply
4	GND	GND



LEMO EGG.1B.304

xPAD2-V8 signal interface connector

Normally this is where you plug in a break-out box, such as the PAD-CB8-B (banana jacks) or PAD-CB8-BNC (BNC connectors). But in the event that you want to make your own cable, the pin-outs are here, and there is a convenient mating connector with screw terminals available for purchase.

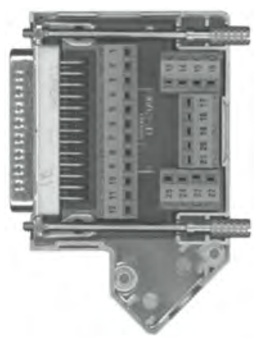
Connector pin-outs

Pin	Function	Pin	Function
1	Channel 0 (+)	13	Channel 6 (+)
2	Channel 0 (-)	14	Channel 6 (-)
3	Channel 1 (+)	15	Channel 7 (+)
4	Channel 1 (-)	16	Channel 7(-)
5	Channel 2 (+)	17	Digital input 1*
6	Channel 2 (-)	18	Digital input 2*
7	Channel 3 (+)	19	Digital input 3*
8	Channel 3 (-)	20	+12 VDC
9	Channel 4 (+)	21	Reset / Digital input 4*
10	Channel 4 (-)	22	GND
11	Channel 5 (+)	23	Reserved
12	Channel 5 (-)	24	Reserved
		25	Reserved

* not supported in Dewesoft software

Mating connector

PAD-OPT2
25-pin SUB-D connector with screw terminals (optional)



Low cost alternative to the PAD-CB8-B and -BNC breakout boxes, or as a building block to making your own cable without soldering. Metal shell covers included.

EPAD2-RTD8 and CPAD2-RTD8

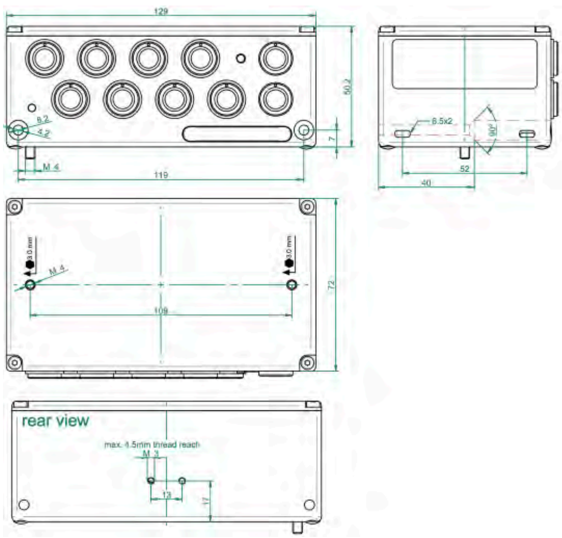
- Intelligent amplifier with integrated 24-bit A/D conversion
- 8 input channels for RTD sensors
- Supports 2-wire and 4-wire hook-ups
- Inputs isolated to 350 VDC
- Modules daisy-chain together to add more and more channels
- EPAD2 series uses RS485 interface
- CPAD2 series uses CAN 2.0B interface

Specifications

Parameter	EPAD2-RTD8 and CPAD2-RTD8		
Input channels:	8 isolated RTD channels		
Input ranges:	Resistor: 0 to 999.99 Ω RTD: PT100(385); PT200(385); PT500(385); PT1000(385); PT2000(385); PT100(3961)		
Sample rate:	12.5 S/s/ch maximum		
-3 dB bandwidth:	6 Hz		
ADC type:	Sigma delta ADC per channel, 24-bit (Note: CPAD2 outputs CAN data at 16-bits)		
Input connector:	ERA.1S.304		
Resolution:	0.01 °C for all types		
Input impedance:	typically >100 MΩ		
Bias current:	typically 10 nA		
Connection type:	2-wire, 4-wire (see diagrams on opposite page)		
Accuracy:	Pt100 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 800 °C Pt500 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 250 °C	Pt100 a = 0.003916 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 800 °C Pt1000 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 600 °C	Pt200 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 800 °C Pt2000 a = 0.00385 ±0.25 °C @ -200 to 100 °C ±0.4 °C @ 100 to 400 °C ±0.8 °C @ 400 to 600 °C
Temperature drift:	typically 25 ppm/°C		
Isolation voltage:	350 VDC (channel to channel and channel to Bus, Power and Chassis)		
Over-voltage protection:	15 VDC		
CMRR @ 50/60 Hz:	130 dB		
Interface:	EPAD2 series: RS485 CPAD2 series: CAN BUS 2.0B protocol		
Read-out speed:	EPAD2 series: typ. 80 ch/sec. CPAD2 series: 12.5Hz, 10Hz, 5Hz, 2Hz, 1Hz, 0.5Hz, 0.2Hz or 0.1 Hz programmable		
Bus power connector:	LEMO EGG.1B.304		
Power supply voltage:	7 to 40V		
Power consumption:	0.5 W maximum		

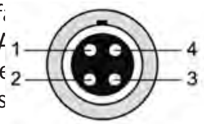
Parameter	EPAD2-RTD8 and CPAD2-RTD8
Dimensions: Base module (W x D x H) Mounting holes distance:	 129 x 72 x 34.2 mm (5.1 x 2.8 x 1.3 in.) incl. mounting holes 119 x 7 mm (4.7 x 0.3 in.), 4.2 mm (0.165 in.) diameter
Weight:	310 g typical

xPAD2-RTD8 Dimensions



xPAD2 interface connector

There are two identical interface connectors for power and control. One is used to interf… Dewetron system, or another xPA… series. The other can be used to e… in another xPAD2 module from this … c-tors are interchangeable.



LEMO EGG.1B.304

PIN	EPAD2	CPAD2
1	RS485 (A)	CAN high
2	RS485 (B)	CAN low
3	+15V supply	+15V supply
4	GND	GND

xPAD2-RTD8 signal interface connector

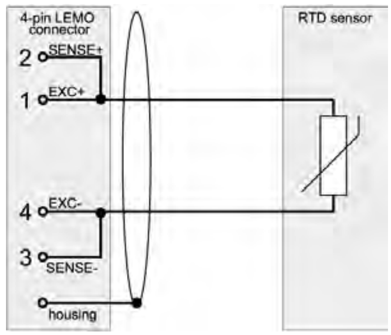
Pin	Function
1	Excitation +
2	Sense +
3	Sense -
4	Excitation -

ERA.1S.304.CLL

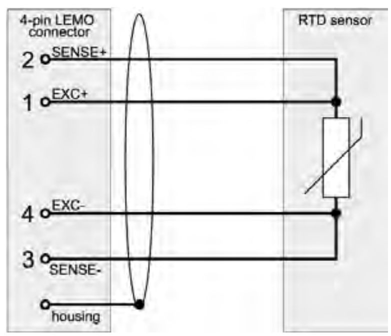
* Shield is on the housing

RTD connections

2-wire hook-up



4-wire hook-up



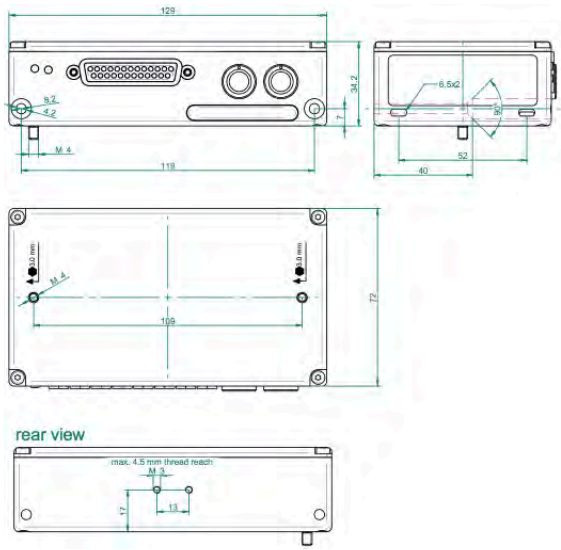
EPAD2-TH8 and CPAD2-TH8

Intelligent amplifier with integrated 24-bit A/D conversion
8 input channels for thermocouples or RTDs via PAD-CB8 series break-out boxes
Inputs isolated to 350 VDC
Modules daisy-chain together to add more and more channels
EPAD2 series uses RS485 interface
CPAD2 series uses CAN 2.0B interface

Specifications

Parameter	EPAD2-TH8 and CPAD2-TH8
Input channels:	8 isolated voltage channels (prepared for thermocouple or RTD interface boxes)
Input range:	±1.5 V (fixed)
Sample rate:	12.5 S/s/ch maximum
-3 dB bandwidth:	6 Hz
ADC type:	Sigma delta ADC per channel, 24-bit (Note: CPAD2 outputs CAN data at 16-bits)
Input connector:	SUBD 25-pin connector - please order your choice of PAD-CB8-TH or RTD series break-out boxes
Resolution:	1µV
Input impedance:	typically 1.4 MΩ
Supported break-out boxes:	PAD-CB8-x-P2 standard thermocouple breakout box (where x = J, K, or T) PAD-CB8-x-M miniature size thermocouple breakout box (where x = J, K, or T) PAD-CB8-RTD RTD breakout box
Temperature drift:	typically 20 ppm/°C
Isolation voltage:	350 VDC (channel to channel and channel to Bus, Power and Chassis)
Over-voltage protection:	15 VDC
CMRR @ 50/60 Hz:	130 dB
Interface:	EPAD2 series: RS485 CPAD2 series: CAN BUS 2.0B protocol
Read-out speed:	EPAD2 series: typ. 80 ch/sec. CPAD2 series: 12.5Hz, 10Hz, 5Hz, 2Hz, 1Hz, 0.5Hz, 0.2Hz or 0.1 Hz programmable
Bus power connector:	LEMO EGG.1B.304
Power supply voltage:	7 to 40V
Power consumption:	0.5 W maximum
Dimensions: Base module (W x D x H) Mounting holes distance:	 129 x 72 x 34.2 mm (5.1 x 2.8 x 1.3 in.) incl. mounting holes 119 x 7 mm (4.7 x 0.3 in.), 4.2 mm (0.165 in.) diameter
Weight:	310 g typical

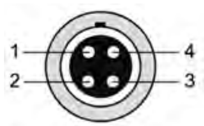
xPAD2-TH8 Dimensions



xPAD2 interface connector

There are two identical interface connectors for power and control. One is used to interface with either the Dewetron system, or another xPAD2 module in a series. The other can be used to extend the daisy-chain another xPAD2 module from this one. The two connectors are interchangeable.

PIN	EPAD2	CPAD2
1	RS485 (A)	CAN high
2	RS485 (B)	CAN low
3	+15V supply	+15V supply
4	GND	GND



LEMO EGG.1B.304

xPAD2-V8 signal interface connector

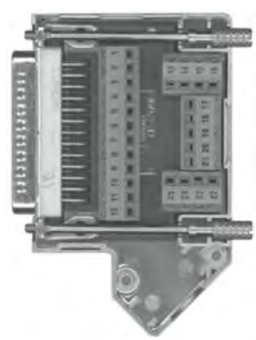
Normally this is where you plug in a break-out box, such as the PAD-CB8-B (banana jacks) or PAD-CB8-BNC (BNC connectors). But in the event that you want to make your own cable, the pin-outs are here, and there is a convenient mating connector with screw terminals available for purchase.

Connector pin-outs

Pin	Function	Pin	Function
1	Channel 0 (+)	13	Channel 6 (+)
2	Channel 0 (-)	14	Channel 6 (-)
3	Channel 1 (+)	15	Channel 7 (+)
4	Channel 1 (-)	16	Channel 7(-)
5	Channel 2 (+)	17	Reserved
6	Channel 2 (-)	18	Reserved
7	Channel 3 (+)	19	Reserved
8	Channel 3 (-)	20	+12 VDC
9	Channel 4 (+)	21	Reserved
10	Channel 4 (-)	22	GND
11	Channel 5 (+)	23	Reserved / CJC
12	Channel 5 (-)	24	Reserved / CJC
		25	Reserved / CJC

Mating connector

PAD-OPT1
25-pin SUB-D connector with screw terminals (optional)



Low cost alternative to the PAD-CB8-B and -BNC breakout boxes, or as a building block to making your own cable without soldering. CJC chip and metal shell covers included. CJC chip will be preinstalled for you on pins 23-24-25 (not shown in image above).

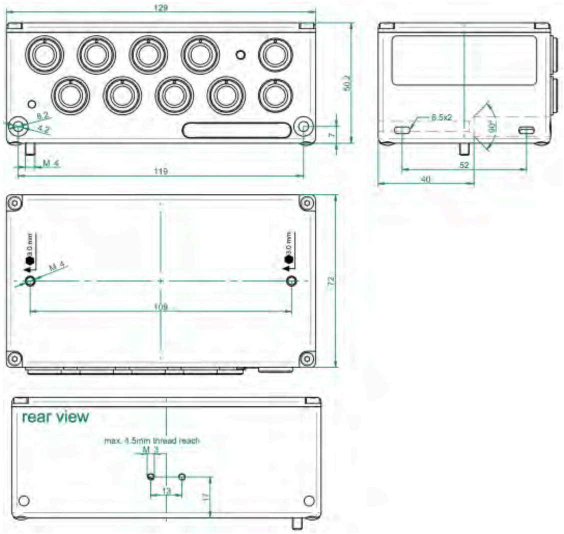
EPAD2-LA8 and CPAD2-LA8

Intelligent amplifier with integrated 24-bit A/D conversion
8 input channels for current measurements
Supports 0 to 20 mA, ±20 mA, and ±30 mA
Inputs isolated to 350 VDC
Modules daisy-chain together to add more and more channels
EPAD2 series uses RS485 interface
CPAD2 series uses CAN 2.0B interface

Specifications

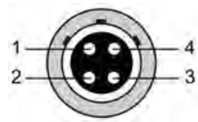
Parameter	EPAD2-LA8 and CPAD2-LA8
Input channels:	8 isolated current input channels
Input ranges:	0 to 20 mA, ±20 mA; and ±30 mA
Sample rate:	12.5 S/s/ch maximum
-3 dB bandwidth:	6 Hz
ADC type:	Sigma delta ADC per channel, 24-bit (Note: CPAD2 outputs CAN data at 16-bits)
Input connector:	LEMO EGB.1B.304
Resolution:	0.3 µA
Input impedance:	50 Ω 0.1 %
Connection type:	2-wire, 4-wire (see diagrams on opposite page)
Temperature drift:	typically 20 ppm/°C
Isolation voltage:	350 VDC (channel to channel and channel to Bus, Power and Chassis)
Over-current protection:	70 mA continuous
CMRR @ 50/60 Hz:	130 dB
Interface:	EPAD2 series: RS485 CPAD2 series: CAN BUS 2.0B protocol
Read-out speed:	EPAD2 series: typ. 80 ch/sec. CPAD2 series: 12.5Hz, 10Hz, 5Hz, 2Hz, 1Hz, 0.5Hz, 0.2Hz or 0.1 Hz programmable
Bus power connector:	LEMO EGG.1B.304
Power supply voltage:	7 to 40V
Power consumption:	0.5 W maximum
Dimensions: Base module (W x D x H) Mounting holes distance:	 129 x 72 x 34.2 mm (5.1 x 2.8 x 1.3 in.) incl. mounting holes 119 x 7 mm (4.7 x 0.3 in.), 4.2 mm (0.165 in.) diameter
Weight:	360 g typical

xPAD2-LA8 Dimensions



xPAD2-LA8 signal interface connector

Pin	Function
1	Power supply +
2	Current +
3	Current -
4	Power supply -



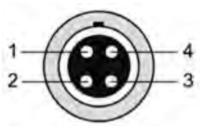
EGB.1B.304

* Shield is on the housing

xPAD2 interface connector

There are two identical interface connectors for power and control. One is used to interface with either the Dewetron system, or another xPAD2 module in a series. The other can be used to extend the daisy-chain another xPAD2 module from this one. The two connectors are interchangeable.

PIN	EPAD2	CPAD2
1	RS485 (A)	CAN high
2	RS485 (B)	CAN low
3	+15V supply	+15V supply
4	GND	GND



LEMO EGG.1B.304


DEWETRON
www.dewamerica.com
www.dewetron.com

11 DEWE-3213 Specifications

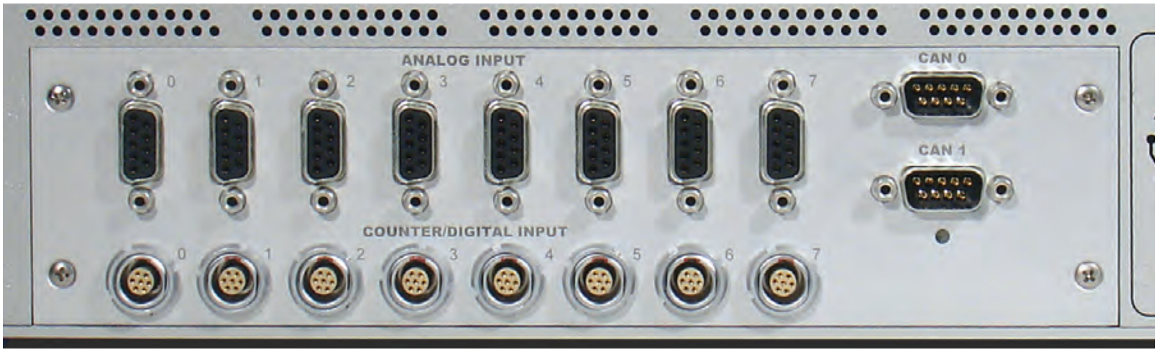
DEWE-3213 Input Specifications

Number of analog input channels	8
Input types directly supported	Full bridge and voltages up to ±10V
Input types supported via "smart" MSI interfaces	IEPE accelerometers: MSI-BR-ACC Charge accelerometers: MSI-BR-CHA-50 Higher voltages: MSI-BR-V200 RTD sensors: MSI-BR-RTD Thermocouples: MSI-BR-TH-J, K, and T
Input types supported by passive adapters	Half bridge: ADAP-BR-1/2-120, and -350 (Ω) Quarter bridge: ADAP-BR-1/4-120, and -350 (Ω) 20 mA: ADAP-BR-SHUNT-20mA 5A: ADAP-BR-SHUNT-5A
Sample rate	Selectable from 1 kS/s/ch to 200 kS/s/ch simultaneous all 8 channels
Input type	Differential, not isolated
Input ranges (voltage mode)	±0.01, ±0.1, ±1, ±10 V (AC or DC)
Over-voltage protection	±70V input protection
Sensor supply voltages	12V, 400mA sensor supply (voltage mode) ±5V ±0.1% bridge sensor supply (bridge mode)
Dynamic range	107 dB @ ±10V range
DC Accuracy	±10 V range: ±0.05 % of reading, ±1 mV ±1 V range: ±0.05 % of reading, ±0.2 mV ±100 mV range: ±0.05 % of reading, ±100 μV ±10 mV range: ±0.05 % of reading, ±100 μV
Input impedance	20MΩ || 47 pF (differential) 10MΩ| | 33pF (common mode)
CMRR	> 80 dB (see separate CMRR section for further details)
Maximum CMV	±13 V common mode voltage
Signal to noise	0.1kS/s to 51.2kS/s : 105 dB 51.2ks/s to 102.4kS/s: 100 dB 102.4kS/s to 200kS/s: 75 dB

DEWE-43 EXPANSION MODULE SPECIFICATIONS

Power requirements	6-36 VDC
Maximum sensor power supply	6 W

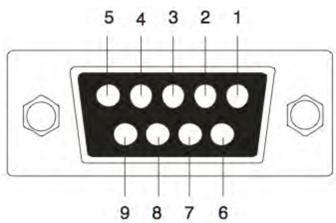
Signal Input Connectors



Analog input connectors (8)

Connector: 9-pin D-SUB (female)
Mating connector: 9-pin D-SUB (male)

Function: to input analog signals to the eight dynamic measuring inputs of the DEWE-3213. Note that mating connectors are available from Dewetron, from simple adapters from DSUB to BNC, to passive converters such as shunt adapters for current measurement and bridge completion adapters for 1/4 and 1/2 bridge measurements, as well as intelligent active interfaces for IEPE sensors, charge sensors, higher voltages, RTDs, and thermocouples. See the MSI-BR series for details about active interfaces. See the ADAP series for details about passive adapters of various kinds.



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

Above right: a typical MSI-BR series smart interface.

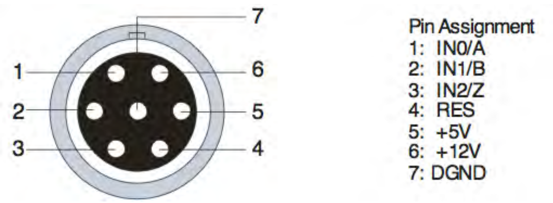
⇒ **Note: TEDS is available on the DEWE-3213 analog input connectors, for sensor interfacing. However, MSI interfaces utilize the TEDS for MSI identification, therefore when an MSI interface is used, TEDS is no longer available for sensor use on that channel.**

☺ **See the separate list of MSI and ADAP options available for the DEWE-3213's analog inputs**

Counter/encoder connectors (8)

Connector: LEMO EGG.1B.307CLAD52
Mating connector: LEMO FGG.1B.307CLAD52

Function: used to input tachometer, TTL level pulse train, or encoder outputs for measuring and conversion.

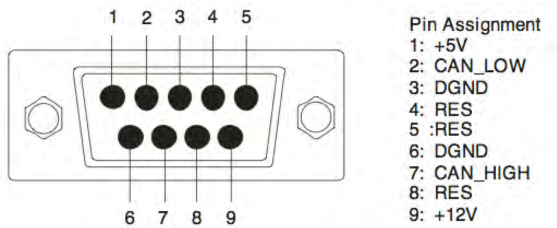


☺ **Note: see the COUNTER configuration section later in this guide.**

CAN BUS interface connectors (2)

Connectors: 9-pin D-SUB (male)
Mating connector: 9-pin D-SUB (female)

Function: used to connect to vehicle CAN BUS interfaces. Also can be used to read data from sensors which have a CAN BUS output.



☺ **Note: In addition to the CAN 2.0b protocol, the DEWE-3213 also supports J1939 and OBD II protocols.**

SYNC/Expansion connectors

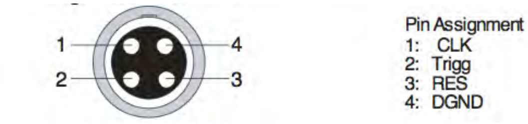
There are sync and USB 2.0 connectors located in the EXPANSION group. Connections to at least USB and SYNC are required required to connect a DEWE-43 expansion module.

⇒ **The DEWE-43 can be powered separately, but it must be powered**

⇒ **The ground reference does not have to be connected, but it might improve noise performance**

Sync connector (1)

Connector: LEMO EGG.00.304.CLL
Mating connector: FGG.00.304CLAD27Z)
Function: required to allow a DEWE-43-V to be added as an expansion module, to the DEWE-3213. If you don't connect the sync, the DEWE-43-V inputs will not show up in the hardware setup screen.



Power

Connector: LEMO EGJ.1B.302.CLA with spring loaded plastic cover
Mating connector: LEMO FGG.00.304CLAD27Z
Function: provides conditioned power to the DEWE-43-V expansion module only. 12VDC, 1.8A max.

USB 2.0 interface for DEWE-43-V only!

Connector: USB2.0 Standard-A receptacle
Mating connector: USB2.0 Standard-A plug, provided with the DEWE-43-V expansion module

Function: provides the USB interface to the DEWE-43-V expansion module

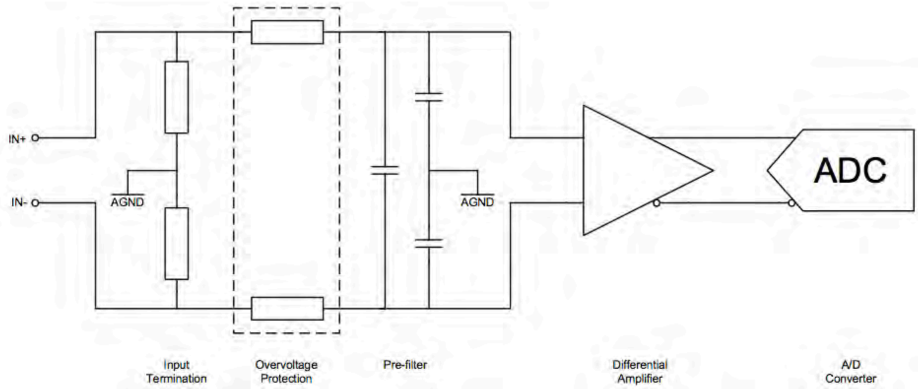
☺ **Note: use of the DEWE-43-V expansion module requires an upgrade of the data acquisition software within the DEWE-3213 from DEWESoft-7-SE to DEWESoft-7-PROF (or higher).**

⇒ **Note: Do not use these ports for anything EXCEPT connecting a DEWE-43-V expansion module!**

⇒ **When connecting a DEWE-43-V expansion module to the DEWE-3213, do NOT use the other USB connectors on the other side of the system. Use only this connector.**

Analog input configuration:

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



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

ADC:

The DEWE-3213 uses eight (8) delta-sigma A/D converters. If you sample with a data rate of 102.4 kS/s, the ADC actually samples the input signal with 13.1072 MS/s (multiply the data rate with 128) and produces 1-bit samples which are applied to the digital filter. The filter expands the data to 24-bits and rejects signal parts greater than 51.2 kHz (Nyquist frequency). It also re-samples the data to the more conventional rate of 102.4 kS/s.

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

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

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

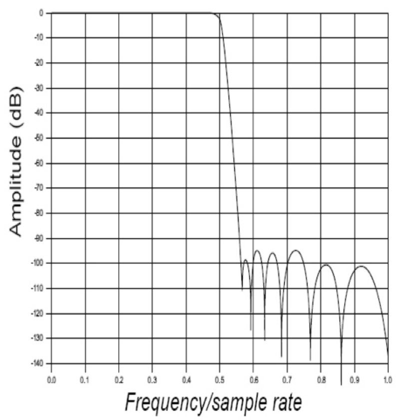
When the sampler modulates frequencies out of the Nyquist bandwidth back to the 0 to 500 Hz baseband it is called aliasing. Signals which are not pure sine wave can have many components (harmonics) above the Nyquist frequency. These harmonics are erroneously aliased back to the baseband, added to parts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

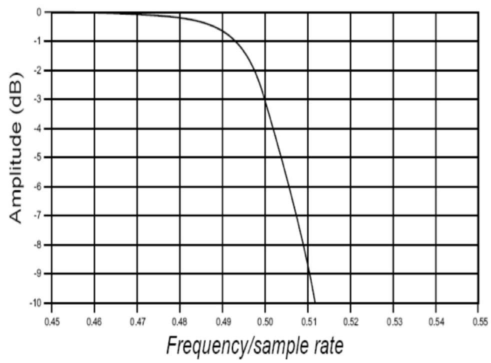
Each input channel has its two pole anti-alias lowpass filter with a cutoff frequency of about 250 kHz. The very high cutoff frequency allows an extremely flat frequency response in the bandwidth of interest and a small phase error. The analog filter precedes the analog sampler. The analog sampler operates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

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

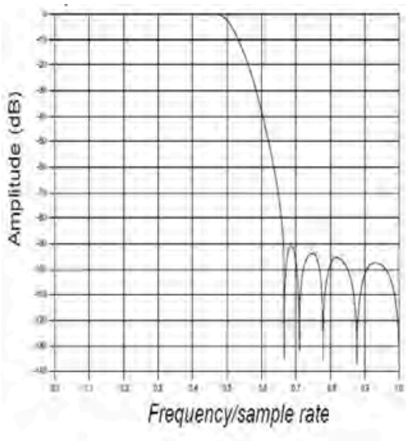
The digital filter passes only signal components within the Nyquist bandwidth or within multiples of the Nyquist bandwidth of 64, 128 or 256 times (depending on sampling rate). The analog filter rejects most noise near these multiples. The following diagrams show the frequency response of the input circuitry.

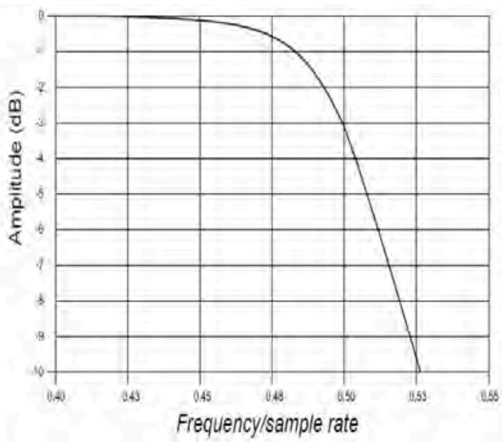
Sample rate 0.1kS/s to 51.2kS/s:



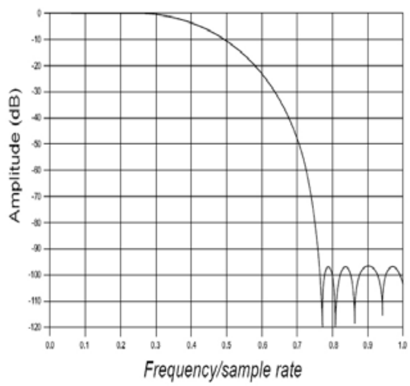


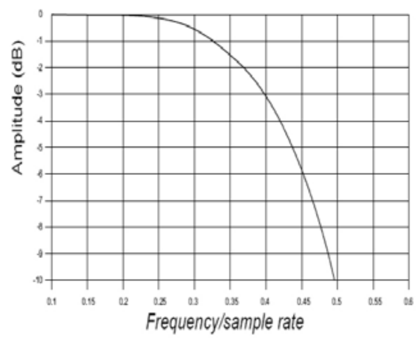
Sample rate 51.2kS/s to 102.4kS/s:





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

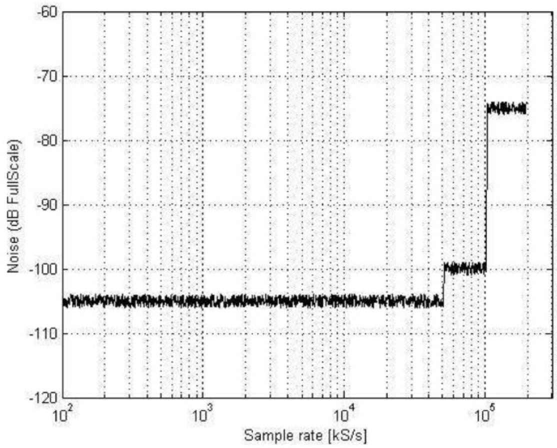




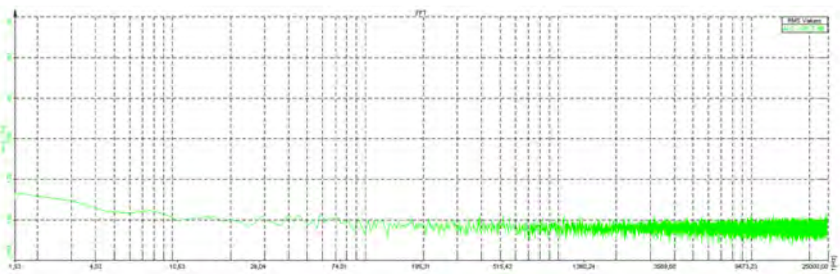
The ADC samples at 64, 128 or 256 times the data rate (depending on the adjusted sample rate). Frequency components above one half of the oversampling rate (> 32, 64 or 128) can alias. Most of this frequency range is rejected by the digital filter. The filter can not reject components that lie close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

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

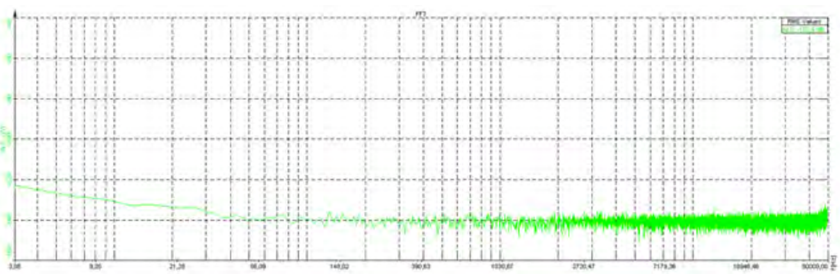
Idle channel noise (input terminated with 50Ω):



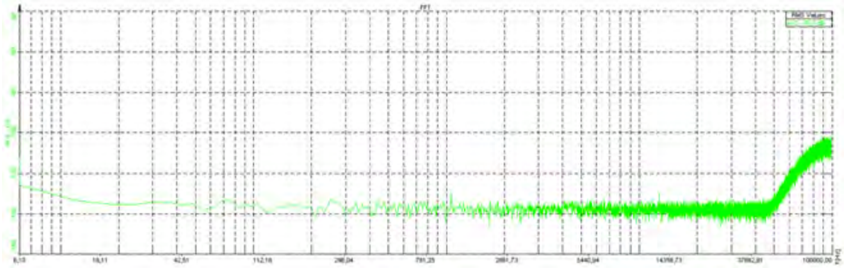
Spectral noise - 50Ω termination – 8 averages – 16k lines@50kS/s:



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

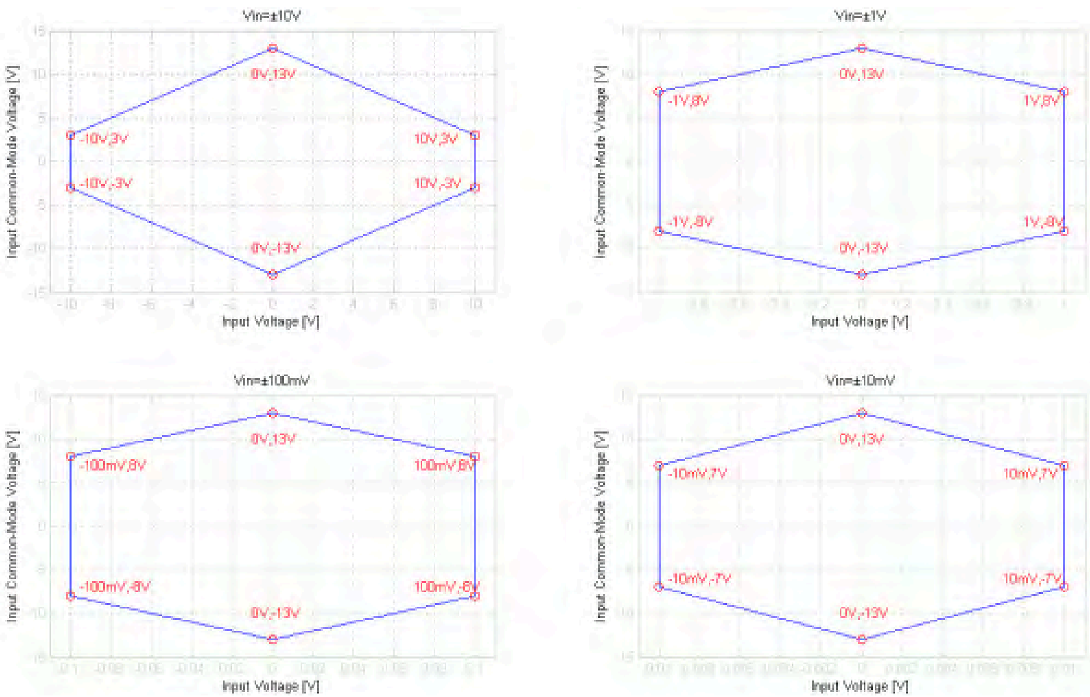


Spectral noise - 50Ω termination – 10 averages – 16k lines@200kS/s:



CMRR:

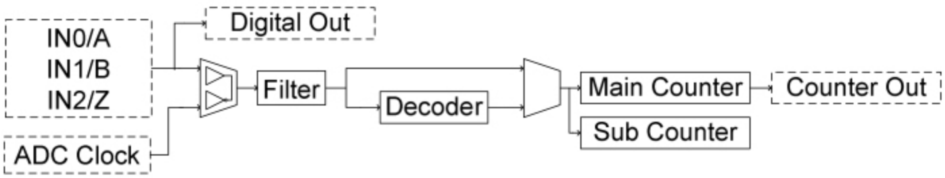
All eight analog channels of the DEWE-3213 are fully differential inputs with resistance of 10MΩ || 10pF. The input voltage range is ±10V, ±1V, ±100mV and ±10mV. Because of the differential input structure, the difference of the input (Ch x(+) – Ch x(-)) will be shown as the result of the measurement. Although the input is protected for input voltages to ±70V, the common voltage range of each input is limited to about ±13V. If the input voltage exceeds this range, the result is not valid even when the difference input voltage is lower than current input range. These voltage ranges will be clipped and introduced as large errors that can be easily identified in frequency spectrum. The figure bellow show the allowable common-mode input voltages for various input voltages and measurement ranges.

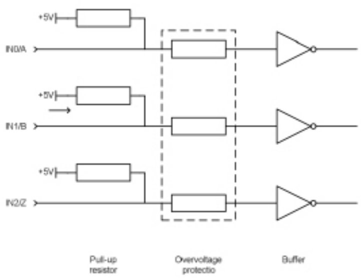


For example: Many signal sources (function generators) and power supplies are floating sources. That means that they are isolated from each other and from AC power line. If we connect a sensor with differential output and floating power supply to measurement device, then GND of sensor and measurement device can have different voltage potential. This is what the measurement device see as common- mode voltage. This common-mode voltage can range from few volts to few hundred volts, but in almost all cases this renders the measurement. To prevent this effect, GND signals of the sensor and measurement device need to be directly connected. That way we eliminate common-mode voltage. On DEWE-3213 this connection is possible over connector GND wire or over "Common GND" receptacle on the housing.

Counter and digital inputs:

The DEWE-3213 is suited with synchronous 32-bit advanced counter and digital inputs. In addition to the basic counter function like simple event counting, up/down counting and gated event counting also period time, pulse width, two- edge separation, frequency and all encoder measurements are supported. All counter inputs can also be used as digital inputs. In addition to the basic counter input selections, ADC Clock can also be used as counter source. The figure bellow shows the block diagram of the counter and input overvoltage protection.





⇒ **Detailed technical specifications for data acquisition components, such as ORION series A/D cards, DAQ and MDAQ series signal conditioning, and various other interfaces, can be found in their respective technical reference manuals.**

ORION Overview

To create instruments with dozens or even hundreds of dynamic channels, multiple ORION cards can be installed within a single unit. All cards are synchronized via the internal sync-bus to ensure absolute simultaneous sampling of all channels.

Key Features

- Simultaneous sampling
- Separate A/D converter channel
- Dozens of different models
- Synchronized analog, digital, counter and CAN inputs
- Clock output for synchronizing external devices, e.g. video cameras
- Sync option for synchronizing multiple systems or synchronize to IRIG or GPS

Multiple Dewetron instruments can be hardware-synchronized using the ORION-SYNC option. Depending on distance and local preconditions there are several choices how to use this option.

You can connect your instruments via standard CAT6 cables, over short distances. The maximum length depends on the sampling rate and the A/D technology, and ranges between 30 m to 200 m. This requires that the ORION-SYNC option was factory installed when each system was made.

For large distances which do not allow physical connection of the instruments, synchronization can be achieved using GPS or IRIG time codes. This requires that the Dewetron systems have either the IRIG-CLOCK or GPS-CLOCK option installed internally, or connected externally (order IRIG-CLOCK-INT or GPS-CLOCK-INT for factory-installed internal interfaces, or the IRIG-CLOCK-EXT or GPS-CLOCK-EXT for field-installed external interfaces).

The driver design enables total continuous gap-free disk storing rates of more than 100 MB/s. Today standard computers with a single hard disk reach continuous gap-free storing rates between 50 MB/s and 80 MB/s.

A/D Technologies within the ORION series

Delta-Sigma Converter

This technique is used in the ORION cards with 22 and 24-bit A/D converters. Of course, 24-bit converters offer highest dynamic range (up to 120 dB).

Whenever you choose a sampling rate, the used internal sampling rate is up to 512 times higher. Using this over-sampling technique full anti-aliasing protection is guaranteed. These boards can not be external clocked, but synchronized from board to board and also synchronized to GPS clock using the DEWE-GPS-CLOCK or to IRIG time using DEWE- IRIG-CLOCK.

Flash Converter

This technique is used in all ORION cards with 16-bit A/D converters, as well as MI and AD series boards.

Flash converters offer the fastest sampling rates (up to 1 MS/s/ch) as well as the possibility for external clocking. This is required for external clocked applications like distance related A/D conversion, combustion analysis as well as order tracking applications (using hardware order tracking clocked by an encoder).

11 A/D Cards

There are several A/D cards which may be installed into your Dewetron system, depending on how it was ordered from the factory. For traditional data acquisition applications, there are essentially two series of A/D cards available:

ORION series - simultaneous sampling, high-end performance, including synchronous counter/encoder inputs on board, and offering options such as CAN BUS interfaces, isolated counters and digital input lines, and more. ORION series cards represent the state of the art within the Dewetron family. They were designed from the ground up to allow 100% synchronization, not just within one system but across multiple systems, whether they are physically connected, or separated by thousands of miles.

AD series - multiplexed sampling, medium performance, with basic counters and digital input lines. No options (if CAN BUS interfaces are needed, for example, they can be added via a separate PCI card within your system).

This section will present the basic specifications for all commonly installed ORION and AD series cards. Additional information is available in Dewetron manuals specific to these cards, available as separate documents.

ORION series Cards

ORION cards cross-reference

Series	Chs	Voltage ranges	Res.	Max kS/s/ch	ADC type	DI chs	DI/Os	Ctr/Enc	CAN
ORION-0424-200	4	±0.1 V, ±0.5 V, ±2 V, ±10 V IEPE®: 4 mA / 8 mA excitation	24-bit	204.8	D/Sigma	--	--	1 (ADV)	--
ORION-0824-200	8	±0.1 V, ±0.5 V, ±2 V, ±10 V IEPE®: 4 mA / 8 mA excitation	24-bit	204.8	D/Sigma	8 to 40	8	2 to 10 (ADV)	0 or 2
ORION-1624-200	16	±10 V	24-bit	204.8	D/Sigma	8 to 40	8	2 to 10 (ADV)	0 or 2
ORION-1622-100	16	±10 V	22-bit	100	D/Sigma	8 to 40	8	2 to 10 (ADV)	0 or 2
ORION-3222-100	32	±10 V	22-bit	100	D/Sigma	8 to 24	8	2 to 10 (ADV)	0 or 2
ORION-0816-1000	8	±1.25 V, ±2.5 V, ±5 V, ±10 V	16-bit	1000	SAR	8 to 40	8	2 to 10	0 or 2
ORION-1616-100	16	±1.25 V, ±2.5 V, ±5 V, ±10 V	16-bit	100	SAR	8 to 40	8	2 to 10	0 or 2
ORION-3216-100	32	±1.25 V, ±2.5 V, ±5 V, ±10 V	16-bit	100	SAR	8 to 24	8	2 to 10	0 or 2
ORION-1616-500	16	±1.25 V, ±2.5 V, ±5 V, ±10 V	16-bit	500	SAR	8 to 40	8	2 to 10	0 or 2

ORION card implementation notes

Combining various ORION cards

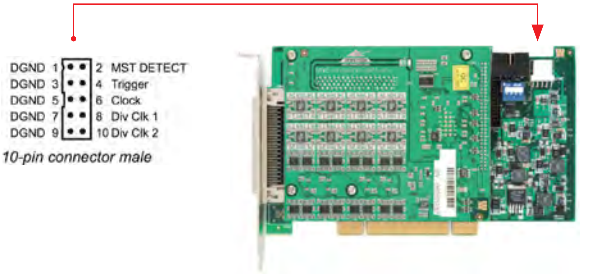
ORION cards with different bit resolutions, or different max sample rates, cannot be mixed within the same system. In other words, you cannot install an ORION-0816-1000 and an ORION-1616-100 in the same system, because they have different max sample rates. Nor can you mix ORION-1616-100 with ORION-1622-100.

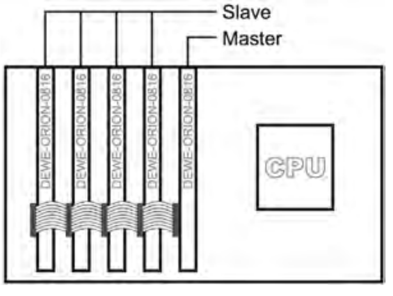
However, there is no problem to mix the ORION-3216-100 with ORION-1616-100 cards, because they have the same bit resolution and the same max sample rate. (The ORION-3216-100 is an ORION-1616-100 card with an add-on of 16 more channels, so they are essentially the same card anyway).

Also there is no problem to mix multiples of the same card, but which have different last digits. Therefore you may install an ORION-1624-200, ORION-1624-202, and ORION-1624-205 in the same system.

Synching ORION cards

If multiple compatible ORION cards are installed in the same system, they must be interconnected with a sync cable. A standard 10-pin connector with 1.27 mm flat ribbon cable is available for easy connection between the boards.





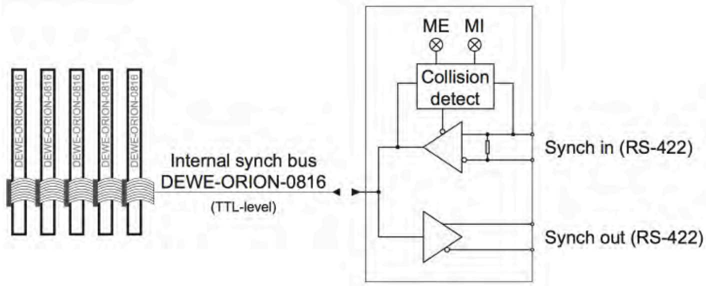
☺ **One card must be set as the master, and the others as slaves. This is done at the driver level.**

Synching Multiple systems

If multiple systems or PCI expansion systems are used, a sync bus option must be installed. This option decouples the internal sync bus with the external sync I/O connector. By changing the internal TTL sync bus levels from TTL to RS-422 level, the distance between two systems can be increased by up to 50 meters using by using standard CAT5/CAT6 Ethernet cables (greater distances are possible - please contact Dewetron to discuss).

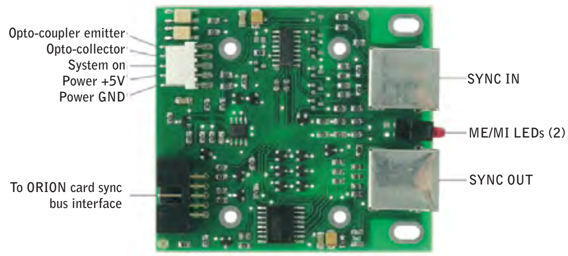
- The ORION-DAQ-SYNC option is required for Dewetron 16-bit ORION cards.
- The ORION-DSA-SYNC option is required for Dewetron 22- and 24-bit ORION cards.

The SYNC option also includes the security circuit if two master systems have to be connected together over the sync bus connection. As soon as the system is configured to a master system the external sync is ignored by disabling the SYNC-IN amplifier. The LED labeled MI (master internal) indicates if the system is configured to a master system. ME (master external) will light up if a valid sync signal is being received on the SYNC-IN connector.



Above: schematic of ORION-XXX-SYNC option

☺ **Note - if you plan on adding more compatible Dewetrons and hardware synchronizing them like this, it is highly recommended to have the sync option installed at the factory. It is difficult to add later.**

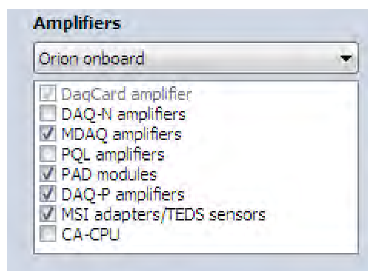


In addition to the synchronization function the ORION-xxx-SYNC allows also the remote power-on of any connected slave system. When the master is powered on, an opto coupler output (PC817) is activated to switch on the power supply of the slave system. The remote power on also can be controlled with an external control voltage (+5 V@Sys-On). Systems with this option typically have a three way power switch labeled ON, OFF, and SLAVE ON. In this third mode, the system can be powered on remotely if connected to a master. This is very convenient for powering on everything at once, and in the correct order.

On-board RS-485 interface

ORION cards are equipped with an RS-485 interfaced as standard. The baud-rate is fixed to 9600, 8 data, 1 stop bit and no parity. This interface is used for configuration of DAQ, MDAQ, and HSI signal conditioning modules. In addition, PAD and EPAD2 series modulescan also be handled. Therefore there is no need for an additional serial interface for module control when ORION cards are used within your system.

In DEWESoft you need to access the HARDWARE SETUP screen, and make sure that "ORION onboard" is selected as the module control interface, as shown in the screen shot at right.



ORION-0424-200

- 4 simultaneous sampled channels, BNC connection
- Voltage or IEPE® mode (4 mA or 8 mA source)
- 4 input ranges (from ±0.1 V to ±10 V)
- Input coupling DC or AC (0.15 Hz or 3.4 Hz)
- 204.8 kS/s per channel
- 24 bit resolution, anti-aliasing filter
- TEDS (IEEE 1451) sensor support

Model Overview

Model	Analog chs	Max kS/s/ ch	Digital input chs	Digital I/O	Ext clock	Ext. trigger	Counter/ encoder TTL	Counter/ Encoder ADJ	CAN BUS
ORION-0424-200	4	204.8	--	--	--	1	--	1	--

Top Level Specifications

Parameter	Specification
Number of analog input channels:	4, simultaneously sampled
Input configuration:	Symmetric, differential or single ended
Resolution:	24 bit, nominal
Type of ADC:	Delta-sigma
Sample rate:	204.8 kS/s/ch maximum
Input signal range:	±10V, ±2V, ±0.5V, ±0.1V peak
Input impedance (ground ref.): Positive to negative input	 1 MΩ each with 60 pF to GND
Over-voltage protection:	±30V on both positive and negative inputs
Alias-free bandwidth (passband): 1 kS/s ≤ fs ≤ 51.2 kS/s 51.2 kS/s < fs ≤ 102.4 kS/s 102.4 kS/s < fs ≤ 200 kS/s	 DC (0 Hz) to 0.42 fs DC (0 Hz) to 0.32 fs DC (0 Hz) to 0.22 fs
Dimensions:	17.5 x 10.7 cm (6.9 x 4.2 in.) (not including connectors)
Form factor:	Half length PCI card
Analog input connector:	BNC
Counter input connector:	DSUB 9-pin connector, male
Environmental:	$T_{.OP}$: 0 to 50°C, $T_{.STORE}$: -20 to 70°C; RH: 10 to 90 %, non-condensing

For complete details, please see the detailed manual for this card, available as a separate document.

ORION-0824-200

- 8 simultaneous sampled channels
- Voltage or IEPE® mode (4 mA or 8 mA source)
- Synchronous digital inputs
- 204.8 kS/s per channel
- 24 bit resolution, anti-aliasing filter
- 6 models available with many options

Model Overview

Model	Analog chs	Max kS/s/ch	Digital input chs	Digital I/O	Ext clock	Ext. trigger	Counter/ encoder TTL	Counter/ Encoder ADJ	CAN BUS
ORION-0824-200	8	204.8	2 (8*)	8	--	1	--	2	--
ORION-0824-201	8	204.8	2 (8*)	8	--	1	--	2	2
ORION-0824-202	8	204.8	10 (40*)	8	--	1	8	2	--
ORION-0824-203	8	204.8	10 (40*)	8	--	1	8	2	2
ORION-0824-204	8	204.8	10 (40*)	8	--	1	--	2 + 8	--
ORION-0824-205	8	204.8	10 (40*)	8	--	1	--	2 + 8	2

Top Level Specifications

Parameter	Specification
Number of analog input channels:	8, simultaneously sampled
Input / Resolution / ADC type:	Symmetric, differential or single ended / 24 bit, nominal / Sigma-delta
Sample rate:	204.8 kS/s/ch maximum
Input signal range:	±10V, ±2V, ±0.5V, ±0.1V peak
Input impedance (ground ref.):	1 MΩ each with 60 pF to GND (Positive to negative input)
Over-voltage protection:	±30V on both positive and negative inputs
Alias-free bandwidth (passband): 1 kS/s ≤ fs ≤ 51.2 kS/s 51.2 kS/s < fs ≤ 102.4 kS/s 102.4 kS/s < fs ≤ 200 kS/s	 DC (0 Hz) to 0.42 fs DC (0 Hz) to 0.32 fs DC (0 Hz) to 0.22 fs
Form factor:	Half length PCI card
Analog input connector:	68-pin SCSI male (AMP 174341-5)
Environmental:	T_{OP}: 0 to 50°C, T_{STORE}: -20 to 70°C; RH: 10 to 90 %, non-condensing

For complete details, please see the detailed manual for this card, available as a separate document.

ORION-1624-200

- 16 simultaneous sampled channels
- ±10V input range
- Synchronous digital inputs
- 204.8 kS/s per channel
- 24 bit resolution, anti-aliasing filter
- 6 models available with many options

Model Overview

Model	Analog chs	Max kS/s/ ch	Digital input chs	Digital I/O	Ext clock	Ext. trigger	Counter/ encoder TTL	Counter/ Encoder ADJ	CAN BUS
ORION-1624-200	16	204.8	2 (8*)	8	--	1	2	--	--
ORION-1624-201	16	204.8	2 (8*)	8	--	1	2	--	2
ORION-1624-202	16	204.8	10 (40*)	8	--	1	2 + 8	--	--
ORION-1624-203	16	204.8	10 (40*)	8	--	1	2 + 8	--	2
ORION-1624-204	16	204.8	10 (40*)	8	--	1	2	8	--
ORION-1624-205	16	204.8	10 (40*)	8	--	1	2	8	2

Top Level Specifications

Parameter	Specification
Number of analog input channels:	16, simultaneously sampled
Input / Resolution / ADC type:	Symmetric, differential / 24 bit, nominal / Sigma-delta
Sample rate:	204.8 kS/s/ch maximum
Input signal range:	±10 V
Input impedance:	10 MΩ in parallel with 60 pF (both positive and negative inputs)
Over-voltage protection:	±30V on both positive and negative inputs
Alias-free bandwidth (passband): 1 kS/s ≤ fs ≤ 51.2 kS/s 51.2 kS/s < fs ≤ 102.4 kS/s 102.4 kS/s < fs ≤ 200 kS/s	 DC (0 Hz) to 0.42 fs DC (0 Hz) to 0.32 fs DC (0 Hz) to 0.22 fs
Form factor:	Half length PCI card
Analog input connector:	68-pin SCSI male (AMP 174341-5)
Environmental:	T_{OP}: 0 to 50°C, T_{STORE}: -20 to 70°C; RH: 10 to 90 %, non-condensing

For complete details, please see the detailed manual for this card, available as a separate document.

ORION-1622-100 and ORION-3222-100

- 16 or 32 simultaneous sampled channels
- ±10 V inputs
- Synchronous digital inputs
- 100 kS/s per channel
- 22 bit resolution, anti-aliasing filter
- 8 models available with many options

Model Overview

Model	Analog chs	Max kS/s/ch	Digital input chs	Digital I/O	Ext clock	Ext. trigger	Counter/ encoder TTL	Counter/ Encoder ADJ	CAN BUS
ORION-1622-100	16	102.4	2 (8*)	8	--	1	2	--	--
ORION-1622-101	16	102.4	2 (8*)	8	--	1	2	--	2
ORION-1622-102	16	102.4	10 (40*)	8	--	1	2 + 8	--	--
ORION-1622-103	16	102.4	10 (40*)	8	--	1	2 + 8	--	2
ORION-1622-104	16	102.4	10 (40*)	8	--	1	2	8	--
ORION-1622-105	16	102.4	10 (40*)	8	--	1	2	8	2
ORION-3222-100	32	102.4	18 (24*)	8	1	1	2	--	--
ORION-3222-101	32	102.4	18 (24*)	8	1	1	2	--	2

Top Level Specifications

Parameter	Specification
Number of analog input channels:	16 or 32, simultaneously sampled
Input / Resolution / ADC type:	Symmetric, single ended w/remote sense / 22 bit nominal / Sigma-delta
Sample rate:	102.4 kS/s/ch maximum
Input signal range:	±10 V
Input impedance (ground ref.):	1 MΩ each with 60 pF to GND
Over-voltage protection:	±30V
Alias-free bandwidth (passband): 1 kS/s ≤ fs ≤ 51.2 kS/s 51.2 kS/s < fs ≤ 102.4 kS/s	 DC (0 Hz) to 0.42 fs DC (0 Hz) to 0.32 fs
Form factor:	Half length PCI card
Analog input connector:	68-pin SCSI male (AMP 174341-5)
Environmental:	T_{OP}: 0 to 50°C, T_{STORE}: -20 to 70°C; RH: 10 to 90 %, non-condensing

For complete details, please see the detailed manual for this card, available as a separate document.

ORION-0816-1000

- 8 simultaneous sampled channels
- Four input ranges ±1.25, ±2.5, ±5 or ±10 V
- Synchronous digital inputs
- 1 MS/s per channel
- 16 bit resolution
- 6 models available with many options

Model Overview

Model	Analog chs	Max kS/s/ch	Digital input chs	Digital I/O	Ext clock	Ext. trigger	Counter/ encoder TTL	Counter/ Encoder ADJ	CAN BUS
ORION-0816-1000	8	1000	2 (8*)	8	1	1	2	--	--
ORION-0816-1001	8	1000	2 (8*)	8	1	1	2	--	2
ORION-0816-1002	8	1000	10 (40*)	8	1	1	10	--	--
ORION-0816-1003	8	1000	10 (40*)	8	1	1	10	--	2
ORION-0816-1004	8	1000	10 (40*)	8	1	1	10	--	--
ORION-0816-1005	8	1000	10 (40*)	8	1	1	10	--	2

Top Level Specifications

Parameter	Specification
Number of analog input channels:	8, simultaneously sampled
Input / Resolution / ADC type:	Single ended w/remote sense / 16 bit (14.7 bit effective) / Successive approximation
Sample rate:	1000 kS/s/ch maximum
Input signal range:	±1.25, ±2.5, ±5 or ±10 V
Input impedance:	10 MΩ parallel (3.9 kΩ + 10 pF)
Over-voltage protection:	±30V
-3 dB Bandwidth:	600 kHz
Form factor:	Half length PCI card
Analog input connector:	68-pin SCSI male (AMP 174341-5)
Environmental:	$T_{.OP}$: 0 to 50°C, $T_{.STORE}$: -20 to 70°C; RH: 10 to 90 %, non-condensing

For complete details, please see the detailed manual for this card, available as a separate document.

ORION-1616-100 and ORION-3216-100

- 16 or 32 simultaneous sampled channels
- Four input ranges ±1.25, ±2.5, ±5 or ±10 V
- Synchronous digital inputs
- 100 kS/s per channel
- 16 bit resolution
- 8 models available with many options

Model Overview

Model	Analog chs	Max kS/s/ch	Digital input chs	Digital I/O	Ext clock	Ext. trigger	Counter/ encoder TTL	Counter/ Encoder ADJ	CAN BUS
ORION-1616-100	16	100	2 (8*)	8	1	1	2	--	--
ORION-1616-101	16	100	2 (8*)	8	1	1	2	--	2
ORION-1616-102	16	100	10 (40*)	8	1	1	2 + 8	--	--
ORION-1616-103	16	100	10 (40*)	8	1	1	2 + 8	--	2
ORION-1616-104	16	100	10 (40*)	8	1	1	2	8	--
ORION-1616-105	16	100	10 (40*)	8	1	1	2	8	2
ORION-3216-100	32	100	18 (24*)	8	1	1	2	--	--
ORION-3216-101	32	100	18 (24*)	8	1	1	2	--	2

Top Level Specifications

Parameter	Specification
Number of analog input channels:	16 or 32, simultaneously sampled
Input / Resolution / ADC type:	Single ended w/remote sense / 16 bit (14.7 bit effective) / Successive approximation
Sample rate:	100 kS/s/ch maximum
Input signal range:	±1.25, ±2.5, ±5 or ±10 V
Input impedance:	10 MΩ parallel (3.9 kΩ + 10 pF)
Over-voltage protection:	±30V
-3 dB Bandwidth:	100 kHz
Form factor:	Half length PCI card
Analog input connector:	68-pin SCSI male (AMP 174341-5)
Environmental:	T_{OP}: 0 to 50°C, T_{STORE}: -20 to 70°C; RH: 10 to 90 %, non-condensing

For complete details, please see the detailed manual for this card, available as a separate document.

ORION card Windows driver

Every PCI card requires a driver so that Windows knows how to implement it. 99% of the time, ORION cards are factory installed, and thus we install the drivers for you. If you are adding a second compatible ORION card to your system, then the drivers are already installed. However, if you are installing one or more ORION cards into a new computer, please contact Dewetron for the latest Windows driver.

Installing ORION cards

Please see the manual provided with your new ORION card for complete installation instructions. It is beyond the scope of this manual to describe that for all of the different ORION cards that we offer.

AD series Cards

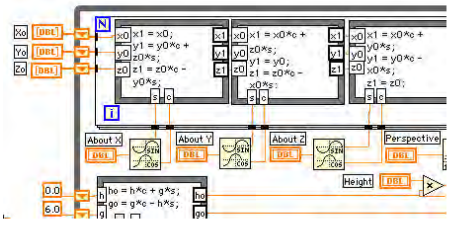
AD cards Cross-reference

Series	Chs	Voltage ranges	Res.	Max kS/s/ch	ADC type	DI chs	DI/Os	Counters (simple)	Analog outs
AD16-1000-16	16	±100 mV to ±10 V	16-bit	62.5	Flash/MUX	8	8	2	--
AD16-1000-16-OUT2	16	±100 mV to ±10 V	16-bit	62.5	Flash/MUX	8	8	2	2
AD32-1000-16	32	±100 mV to ±10 V	16-bit	31.25	Flash/MUX	8	8	2	--
AD32-1000-16-OUT4	32	±100 mV to ±10 V	16-bit	31.25	Flash/MUX	8	8	2	4
AD64-1250-12	64	±50 mV to ±10 V	12-bit	19.5	Flash/MUX	--	--	--	2
AD64-100-16	64	±100 mV to ±10 V	16-bit	1.5	Flash/MUX	--	--	--	--

All AD series cards are standard half-length size PCI cards. They are factory installed within your Dewetron system when it is made. Since it is not possible for them to also have CAN BUS interfaces on them, if you require CAN BUS interfaces, please order the PCI-CAN/2 option, which is a two channel high-speed CAN BUS interface card.

AD series cards are much lower cost and thus lower performance than the ORION series. The counters, for example, are simpler and less capable than ORION counter/encoder inputs.

Still, AD series cards are perfectly adequate for many data acquisition applications, when interchannel phase match does not have to be perfect via simultaneous sampling, and multiplexed A/D performance is acceptable.



100% LabVIEW compatibility

AD series cards are 100% supported in LabVIEW, since they are made by National Instruments. Therefore, these are the ideal cards if you are planning to develop your own software for the Dewetron platform, and we strongly recommend them.

Calibration

When it comes time to calibration your AD series cards, this can be done by Dewetron, or you can send the card to National Instruments.

AD cards technical information

Since AD series A/D cards are made by National Instruments, please refer to the website www.ni.com for technical details related to these cards.

12 Interface Cards

There are several key interface cards that are available for your Dewetron instrument. These include time code interfaces based on IRIG or GPS, as well as BUS interface cards for popular data busses such as ARINC 429, MIL-STD-1553, NTSC/PAL video input, and more.

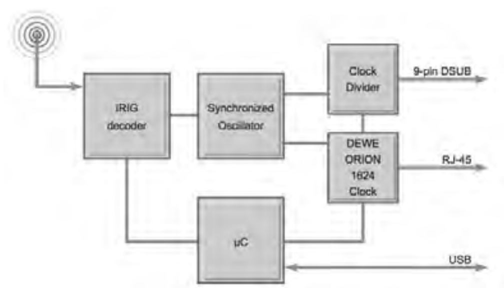
Please see the next pages for basic information about these interface cards. Additional details can be found in the manuals specific to each card, as provided with your system.

IRIG-CLOCK time code interface card

The purpose of the IRIG-CLOCK is to synchronize the data acquisition performed by your Dewetron system with an absolute time reference widely used by the US military and NASA known as IRIG (Inter Range Instrumentation Group).

The IRIG-CLOCK-INT is a small printed circuit board that is factory installed within the Dewetron chassis, and wired internally to the USB interface, power, and to the clock input of the master A/D card. There is also an external version of this IRIG interface known as the IRIG-CLOCK-EXT. This section will focus on the internal version, since this is far more common, and the architecture is identical between the two.

The following block diagram gives a basic overview of the functionality of this interface:

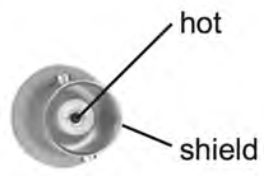


The IRIG-DECODER engine generates one pulse per second (PPS) which is used to synchronize a 40 MHz oscillator with software PLL (phase locked loop). The result is an ultra stable 40 MHz clock source which is completely free of drift over time.

Out of this 40 MHz base clock, the programmable clock divider generates the clock frequency for the data acquisition system. Due to the over-clocking of delta sigma converters, a special output clock is required for synchronized sampling. This is available on a RJ45 connector for clocking ORION-xx24 and ORION-xx22 series cards. The communication to the host is provided over native USB interface.

Connect the IRIG signal

When this option is installed within your Dewetron system, you will find a BNC input labeled IRIG or IRIG IN. This is where you need to connect the IRIG time code signal to the system.

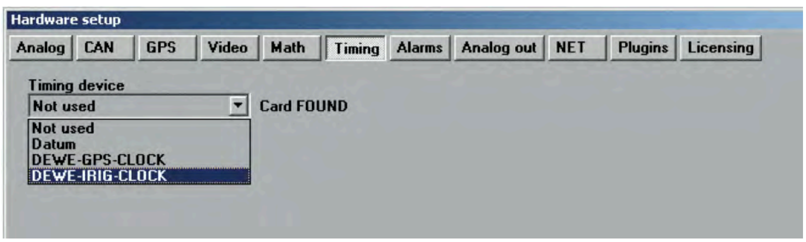


This is an industry standard BNC connector, female. A mating BNC cable is not included with the IRIG-CLOCK option.

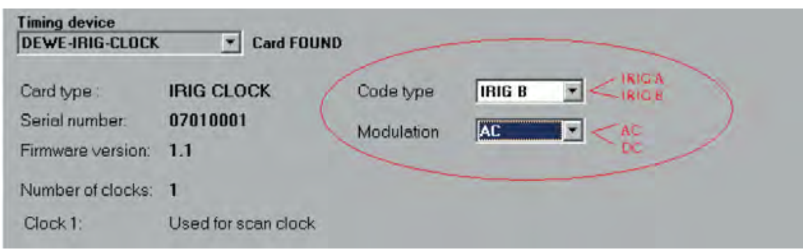
Configure the software

It is also necessary to configure DEWESoft to look for the IRIG card, and to properly format the time in its display to the IRIG standard. This should be done for you at the factory, but in the event that you need to reconfigure your system or create a new PROJECT under DEWESoft, please make sure that these settings are in place:

- Under the SETTINGS menu of DEWESoft 7, click HARDWARE SETUP, then click the TIMING button.
- On the selector, choose the DEWE-IRIG-CLOCK option



The interface should then be located and shown on this screen. When hardware is successfully found, you can select either IRIG A or IRIG B as Coding type and AC modulated or DC signal type:



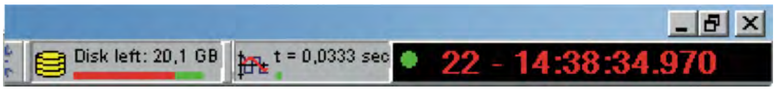
When this option is installed and configured, DEWESoft will behave a little differently than normal when you go to aquire data. For example, since every acquistion should be precisely synchronized to the absolute time provided by IRIG, when you press STORE to start recording, you may briefly see the message:

WAITING FOR PPS...

This is the pulse per second which precedes each IRIG time message. This PPS is extremely precise in its location, and we use it to identify the exact beginning of the next second. The software reads the previous full time and date string from the IRIG interface via USB, then awaits the next PPS in order to begin the acquisition at an exactly known time.

In addition, the top right corner of the DEWESoft screen will show the IRIG TIME like this:

Above - the RED dot indicates flywheel mode



Above - the GREEN dot indicates LOCKED mode

If IRIG is lost for whatever reason, the system will "fly wheel," meaning that it will continue to count the time using the clock on the A/D card. In this case, the IRIG time will be shown with a RED DOT in front of it. Of course, this mode is not locked to any absolute time reference, so over time, the time will drift. However, when time code is restored, the IRIG-CLOCK will lock on again and the time will be updated.

When the IRIG interface has a lock onto the time code, the date and time message will be shown with a GREEN DOT in front of it.

When the IRIG signal is lost (indicated by the status light) during measurement, the IRIG-CLOCK will switch into "Fly Wheel Mode". When the IRIG signal is received again, the IRIG-CLOCK switches into "Normal Operation Mode" and automatically creates a new data file. The nomenclature of the created datafile indicates that the IRIG signal was lost during measurement: <Original_Filename>.lostXXX. DSD where XXX represents a continuous number.

There are times when playing data back from tape, that suddenly a new section of tape has older data on it, and the time on the tape suddenly jumps backwards or forwards. DEWESoft will automatically close the current data file and open a new one, as mentioned above, and continue recording without interruption.

IRIG-CLOCK basic specifications

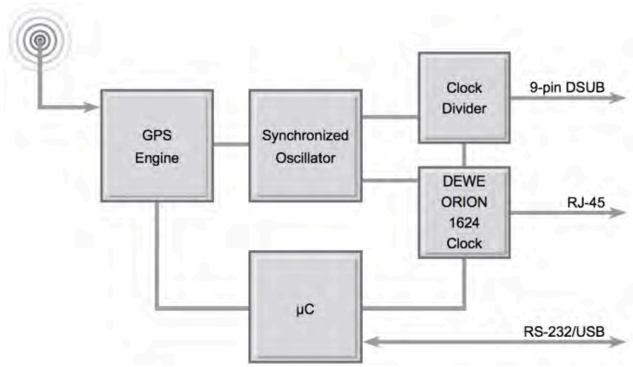
IRIG-CLOCK	IRIG synchronized time base generator
Timing specs	
Adjustment range:	±150 ppm
Clock acc. IRIG locked:	without drift
Clock acc. IRIG unlocked:	< 1 ppm
System specifications	
Input AM code Ratio (AM) Impedance Compatibility Connector	IRIG code A or B; AM or DC 0.5 Vp-p to 10 Vp-p 3:1 ±10 % 20 kΩ DC Level Shift TTL / CMOS Compatible BNC female
Output: Trigger Scan clock ORION-1624-SYNC	Clock and Trigger for DAQ-systems PPS (pulse per second), rising edge on time, 75 msec high time, TTL level compatible 10 Hz to 10 MHz, rising edge synchronized, 50 % duty cycle, TTL level compatible LVDS compatible synchronisation bus for ORION-xx24 series
Power supply:	Powered via USB interface, max current 250 mA
Operating temperature:	+5 °C to +70 °C
Storage temperature:	-20 °C to +85 °C
Humidity:	10 to 85 %, non condensing
Vibration test: Shape Frequency Power spectral density Duration	EN 600068-2-6 Sine 10 Hz to 150 Hz 1 m/s2 / Hz from 10 – 200 Hz 30 Minutes per axis
Vibration test: Shape Frequency Power spectral density Duration	EN 60721-3-2 Class 2M2 Random 10 Hz to 200 Hz 1 m/s2 / Hz from 10 – 200 Hz 30 Minutes per axis
Shock: Shape Acceleration amplitude Duration Test in 3 axis, 3 shocks in each axis and direction	 EN 60068-2-27 Half-sine 15 g 11 ms

GPS-CLOCK time code interface card

The purpose of the GPS-CLOCK is to synchronize the data acquisition performed by your Dewetron system with an absolute time reference known as UTC (Universal Time Code), as qcuired from the GPS (Global Positioning Satellites) circling the Earth.

The GPS-CLOCK-INT is a small printed circuit board that is factory installed within the Dewetron chassis, and wired internally to the USB interface, power, and to the clock input of the master A/D card. There is also an external version of this GPS time code interface known as the GPS-CLOCK-EXT. This section will focus on the internal version, since this is far more common, and the architecture is identical between the two.

The following block diagram gives a basic overview of the functionality of this interface:



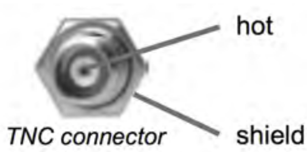
The base of any GPS receiver is precise time measurement. In addition to the position information a precise PPS (pulse per second) is generated by the GPS engine. This pulse is used to synchronize a 40 MHz oscillator with software PLL (phase locked loop). The result is an ultra stable 40 MHz clock source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

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

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

Connect the antenna

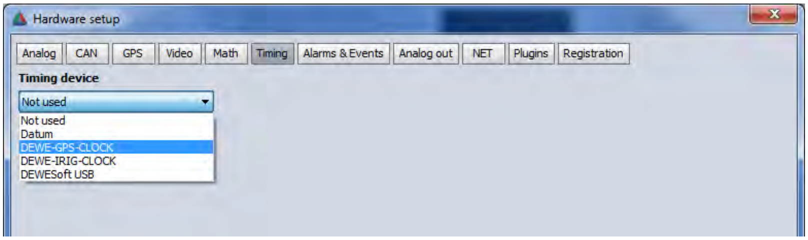
Your Dewetron system will have a TNC connector mounted on a side panel. Please use the included cable to connect the antenna to the Dewetron system via this connector:



Configure the software for TIMING

It is also necessary to configure DEWESoft to look for the GPS card, and to properly format the time in its display to the UTC standard. This should be done for you at the factory, but in the event that you need to reconfigure your system or create a new PROJECT under DEWESoft, please make sure that these settings are in place:

- Under the SETTINGS menu of DEWESoft 7, click HARDWARE SETUP, then click the TIMING button.
- On the selector, choose the DEWE-GPS-CLOCK option



The interface should then be located and shown on this screen.

Mounting the GPS antenna

The antenna supplied with the GPS-CLOCK is designed to be mounted with the included mounting kit. The positioning of the antenna is critical to the correct operation of the system.

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

In order to fix your antenna on a tube, use the provided universal mounting adaptor. The image on the left shows you, how you have to fix the tube with the screws (1) , (2).

☺ **Note: the maximum diameter is limited to 43 mm (1.7 Inch). Otherwise the universal mounting adapter will not fit on the tube.**

The GPS-CLOCK is shipped with a 6 m antenna cable as standard. However, 15 and 25 m antenna cables are available optionally:

- PC-GPS-CBL15 cable - 15 m
- PC-GPS-CBL25 cable - 25 m

Warm-Up time

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

GPS-CLOCK Notes

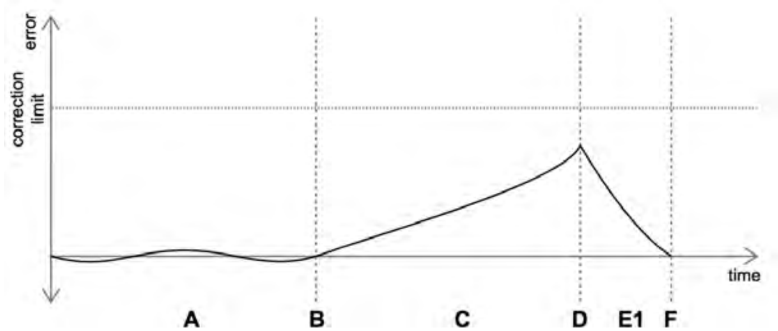
Max. freq: The maximum output frequency of the GPS-CLOCK is 10 MHz for standard clock output and 200 kHz for ORION-xx24 and ORION-xx22 card operation.

No. of clocks: If an ORION-xx24 or ORION-xx22 series card is installed, a synchronized clock source is available for clocking the A/D board. In the standard operation mode a second clock source is available (reserved for future use).

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

☺ **The maximum allowed correction limit is 500 ms.**

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



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

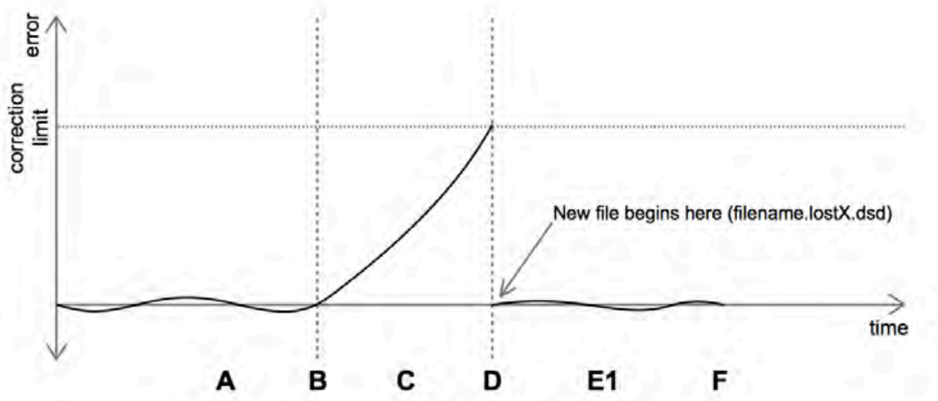
B) At this point the number of acquired satellites is lower than 4. The unit stops automatically looking for the GPS time.

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

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

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

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

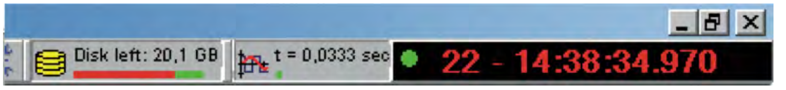


As soon the timing device is selected DEWESoft automatically sets the data acquisition hardware to external clocking for receiving the sample frequency out of the GPS-CLOCK. In addition to this each measurement starts synchronized with the PPS signal. The time information of the data file is taken out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

GPS time display

During measurement, the top right corner of the DEWESoft screen will show the UTC TIME like this:

Above - the RED dot indicates that the number of USED SATELLITES is lower than the minimum required.



Above - the GREEN dot indicates that the number of USED SATELLITES is equal to or greater than than the minimum required.

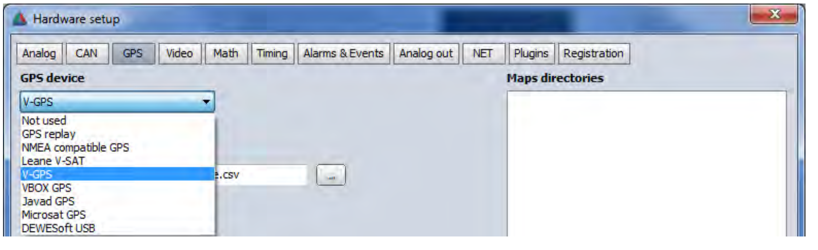
Additionally recording speed, position, distance

In addition to providing a precise alignment of your data to the UTC time, the GPS-CLOCK can be used as a GPS sensor, providing speed, distance, latitude, longitude, and several other useful parameters. These values can be easily displayed and recorded into the data file. But you need to configure the GPS-CLOCK for this to be possible.

Configure the software for GPS

This should be done for you at the factory, but in the event that you need to reconfigure your system or create a new PROJECT under DEWESoft, please make sure that these settings are in place:

- Under the SETTINGS menu of DEWESoft 7, click HARDWARE SETUP, then click the GPS button.
- On the selector, choose the VGPS option



You will need to also configure the interface that these parameters are coming across. Typically this will be a COM port with a relatively high number. There is no harm in starting with the highest com port number and working your way down until you find the correct one. The screen will show all of the parameters available for setting when the GPS-CLOCK interface is correctly identified here.

Be sure to press in USED for any channel that you want to be recorded and visible when you store data. The satellite map also shows you a repsentation of the sky, according to how the antenna is positioned. The total number of satellites (maximum is 12) as well as the number of satellites whose signals are strong enough to be used by the GPS-CLOCK are shown. The relative darkness of the green color indicates their strength.

X absolute: Longitude component of position in degrees, minutes and fraction of minutes
Y absolute: Latitude component of position in degrees, minutes and fraction of minutes
Z: Altitude in meters above sea level
Velocity: Speed over ground (vector of all 3 dimensions) (can be scaled in miles or km or knots)
Velocity Z: Vertical component of the speed vector
Direction: True track over ground, from 0 to 360 degrees
Distance: Integration of speed for getting the displacement.
☺ **Note: Only speed levels above 0.5 km/h are used to calculate the distance**
Used sat: Numbers of satellites used for calculation of position and speed

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

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

GPS-CLOCK basic specifications

DEWE-GPS-CLOCK	GPS synchronized time base generator	
Timing specs		
Trigger accuracy:	250 ns	
Clock acc. GPS locked:	without drift	
Clock acc. GPS unlocked:	< 1 ppm	
Clock/Trigger signal level:	TTL (LVDS for ORION-1624)	
GPS specs		
General:	12 channel , L1 frequency receiver	
PPS accuracy:	250 ns	
Refresh rate:	1 Hz	
Position accuracy:	Horizontal CEP	Horizontal 95 %
Autonomous	3.0 m	5 m
Differential	1.0 m	3m
System specifications		
Input:	TNC connector for GPS antenna	
Outputs:	Speed, displacement, RS-232, USB, Timebase generator	
Power supply:	8 to 18 VDC	
Operating / storage temp / humidity:	-30 °C to +80 °C / -40 °C to +85 °C / 95 % RH non condensing @ +60 °C	
Vibration:	0.008 g2/ Hz	5 to 20 Hz
	0.05 g2/ Hz	20 to 100 Hz
	3 dB/octave	100 to 900 Hz

VIDEO-FG-4 interface card

This is a PCI card with four NTSC/PAL video inputs on it, presented on standard BNC connectors on the side of your Dewetron system. With this option and DEWESoft-PROF level software, you can acquire and display up to four video streams simultaneously in sync with your data.

It accepts standard composite colors (PAL, NTSC) or monochrome video formats (CCIR, EIA).

The supported resolution is programmable and includes square-pixel (640 x 480 or 768 x 576) and broadcast resolution. Before captured images are transferred to the PC's memory, images can be scaled down using available selectable ratios.

Image Acquisition

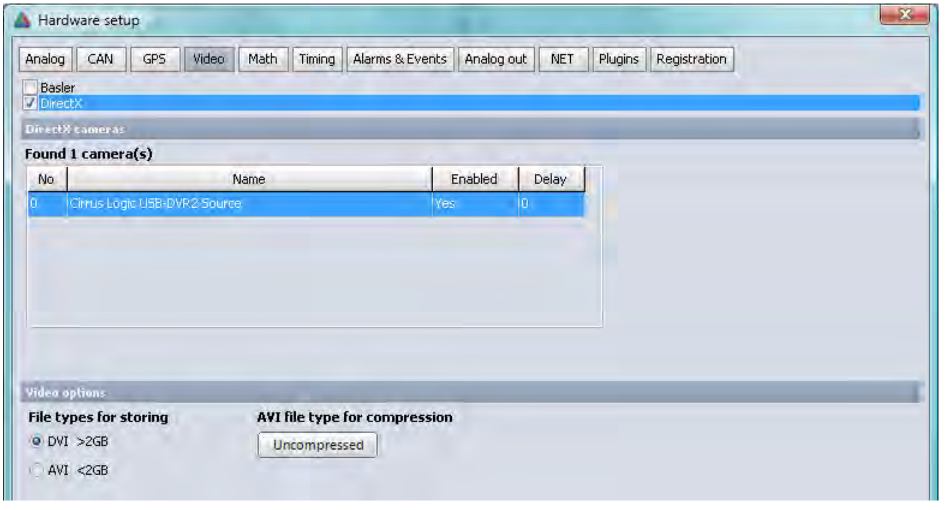
- Frame Rate: 30 full-frame images acquired per second for each channel.
- Color Image: Color video format is compatible with the following composite video input formats:
- NTSC-M, NTSC-Japan, PCL-B, PALD, PAL-G, PAL-H, PAL-I, PAM-M, PAL-N and SECAM
- Monochrome Image: The monochrome video acquisition is compatible with CCIR and EIA (RS-170).
- Optional Scaling: The acquire images or portions of images can be optionally scaled:
- Acquisition of a programmable area of interest
- Scaling of the image (down to 1:16)
- Adjustment of hue (for NTSC signals), contrast (0 to 200%), brightness and saturation (0 to 200%
- for U and V signals)
- Automatic chrominance gain control

It is necessary to install the driver for this card under Windows before it can be used within DEWESoft. Additionally, each of the inputs must be configured as a DirectShow video channel. This must be done for each of the four video inputs by following the instructions in the manual for this product.

The OEM source for this card is Adlink, part number PCI-RTV24. Please refer to that technical information for details.

Video interface setup

Once the card is installed and configured for DirectShow under Windows, run DEWESoft and then go to hardware setup under the SETTINGS button. Click the VIDEO button to see the setup for your cameras and video inputs:

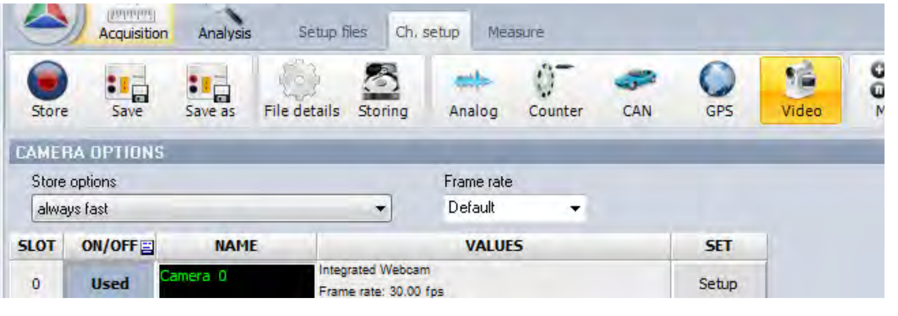


You need to enable DIRECTX video via the checkbox. When you do, the VIDEO-FG4 card should show up automatically, and four video channels should appear in the list. If this does not happen, then the card is not set up properly under Windows, because DEWESoft will always see any properly configured DirectX video sources that are available under Windows.

Be sure that the ENABLED column is set to YES for each of the video streams that you want to be able to display and record.

In the bottom section you can choose the type of video files that will be created, and the compression format.

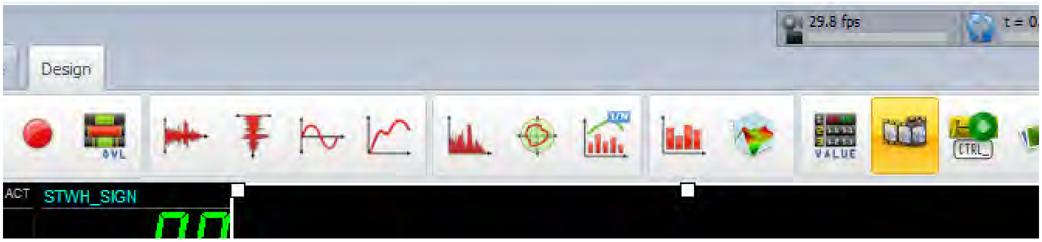
Once this is done, and you return to the SETUP screens, you will have a new button called VIDEO in the toolbar. Click it to access the video streams, preview them, and activate them for display and recording.



As always, be sure to press in as USED any of the video streams or cameras that you want to be able to display and record with your data files.

Displaying video channels

Video streams are displayed almost like any other channel, except that there is a special video display widget that is used. Enter the design mode and find the icon that looks like a roll of film, and click it to add one video display widget to your screen:



The video widget is shown highlighted in yellow, above. After you click it to add a video window, you can select any USED video streams from the channel list to put them onto your screen. The video widget can be scaled and moved freely into an attractive arrangement on your display:

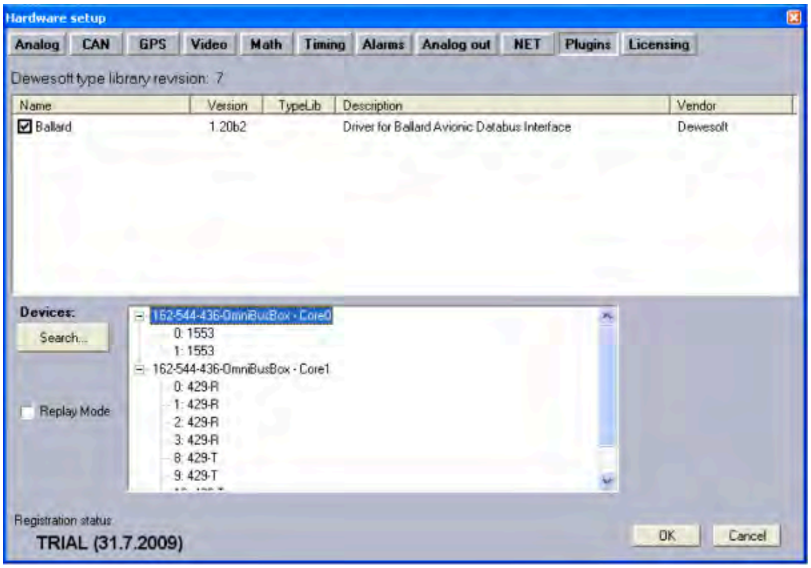
☺ **Note: video streams also create a channel which contains the frame count. You can display this count in a digital meter as a convenience.**

ARINC-429 and MIL-STD-1553 interfaces

ARINC 429 and 1553 bus interfaces are available for your Dewetron system, in both PCI card and external USB box format. The OEM supplier of these interfaces is Ballard Technologies. Dewetron systems support the Omnibus line of cards and rack-mounting boxes, as well as the so-called "fifth generation" of lower cost Ballard PCI cards. The software interface into DEWESoft is in the form of a software plugin, which is an option called DEWESoft-OPT-ARINC/1553.

☺ **With the Omnibus series you can have a single card with both ARINC 429 and 1553 interfaces on it. In the USB and 5th generation PCI series, there is one bus type maximum per interface.**

The plugin will be installed and configured at the factory, however, if you need to reinstall the plugin, please copy Ballard.dll to the Addons folder of DEWESoft. If you are running Windows 7, plugins need to be registered, and there is a button for that on the plugins page of the DEWESoft hardware setup screen.



When this is done, the Ballard plugin will appear in Hardware setup plugin list.

Refer to Ballard manual for installation of Ballard drivers and connecting Ballard devices.

First checkmark the Ballard plugin to enable it. If any devices will be found they will be shown at Devices panel. If hardware configuration changes, just press the Search button and system will be rescanned.

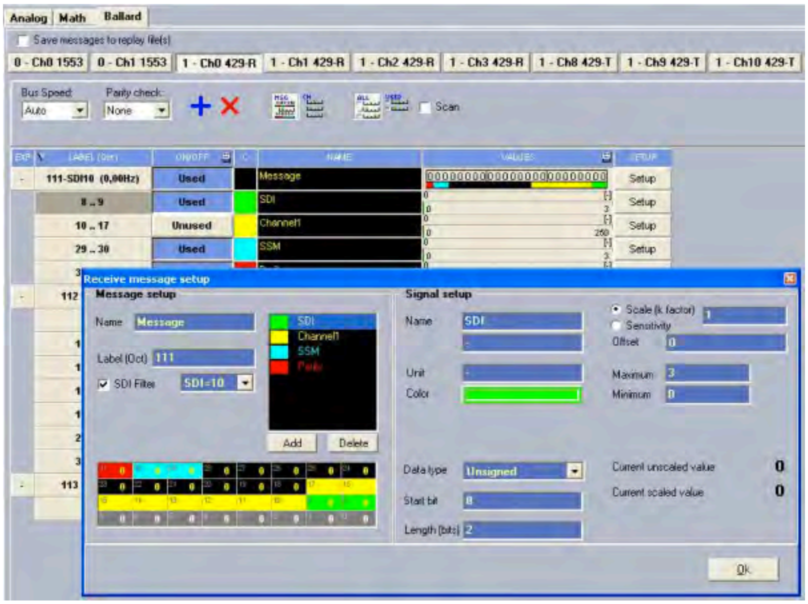
If you want to use previous recorded data or/and don't have hardware, you can use a replay mode. Checkmark it and select any csv file with device definition and bus data.

At the top you have save messages check box for saving replay files. Just check it and one csv file for each device (core) will be created along with DEWESoft data file when recording (on the same folder with the same name).

Under it is one button for each bus. Short name on the button is composed of device number, channel number and channel type. MIL-STD-1553 buses have two tabs, one for receive and one for transmit.

ARINC 429 receive setup

In addition to standard buttons for adding and deleting messages or channels and display options there is a scan check box. If it is checked every unhandled message coming through the bus will be added automatically to the list. On start every message already had standard channels (SDI, SSM and Parity). They can be deleted if you do not need them. Bus speed and Parity check are there for ARINC 429 bus control. Messages that do not have proper parity will be ignored.

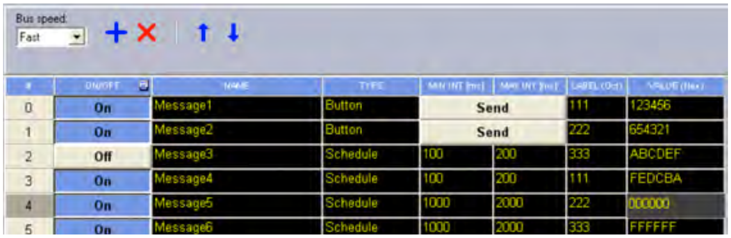


In the table you can see all messages and channels and live data. Labels are always in octal notation, and for the message value you can choose between hex and binary (right click on the VALUES column). Messages are always ordered by their labels. Some properties like color and name can be changed directly on the table and for others you must open SETUP. In the SETUP dialog you can add channels and manage their properties.

There is no problem to have more messages with the same label (and SDI filter) and/or more channels using same bits. When the message will come through the bus all that messages and channels will catch its data.

ARINC 429 transmit setup

Here you have buttons for adding and deleting messages and for sorting them. Bus speed is for ARINC 429 bus setup.



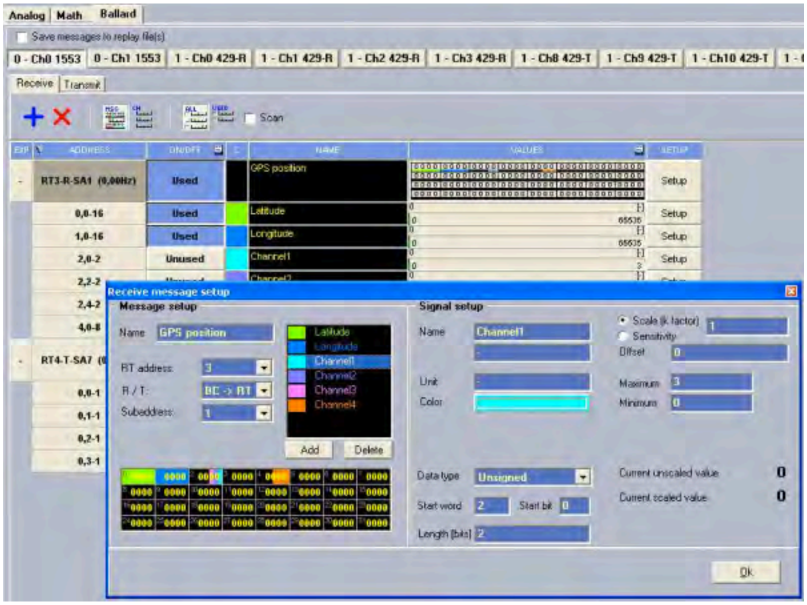
Two types of messages can be created. Button and Schedule.

Schedule messages will be send automatically in intervals which are defined with MIN INT and MAX INT values. The schedule is created and scheduled messages start to transmit after you leave the tab by entering some other tab or entering the measure mode.

Button messages are never sent automatically. You get a button to send them manually. In setup mode the button for each Button message is on the table, and in Measure mode you get the special window with buttons for all that messages.

MIL-STD-1553 receive setup

As in the ARINC 429 setup there are standard buttons for adding and deleting messages or channels and display options. There is also a scan check box. If SCAN is checkmarked, every unhandled message coming through the bus will be added automatically to the list.

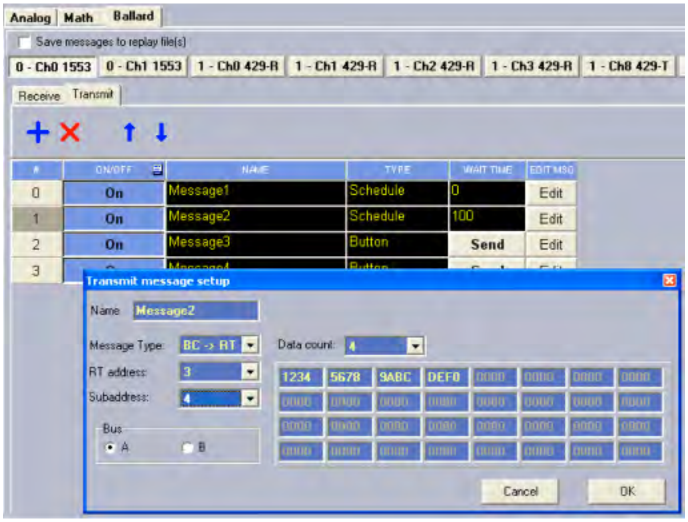


In the table you can see all messages, channels and live data. Messages are always ordered by their addresses. Some properties like color and name can be change directly on the table and for others you must open SETUP. In the SETUP dialog you can add channels and manage their properties.

There is no problem to have more messages with the same address and/or more channels using same word/bits. When the message will come through the bus all that messages and channels will catch its data.

MIL-STD-1553 transmit setup

Here you have buttons for adding and deleting messages and for sorting them.



Every message has the Edit button which opens Transmit message setup form where all message properties and data can be set.

Two types of messages can be created. Button and Schedule.

Schedule messages will be send automatically in the same order they have in the list. After each message there can be wait time which can be defined in Wait time column. After last message is sent the schedule starts will the first message again. The schedule is created and scheduled messages start to transmit after you leave the tab by entering some other tab or entering the measure mode.

Button messages are never sent automatically. You get a button to send them manually. In setup mode the button for each Button message is on the table, and in Measure mode you get the special window with buttons for all that messages.

Storing ARINC/1553 data

ARINC and 1553 channels pressed in as USED on the setup screen will be stored into the data file when you store data. It does not matter if the channels are shown on a display screen or not.

Processing ARINC/1553 data in MATH

ARINC and 1553 channels can be used within your MATH channels just like any other channel.

CAN BUS interfaces

In terms of hardware, Dewetron systems are available with several different CAN BUS interfaces. However, 90% of the systems delivered have the 2 CAN BUS interfaces that are provided as options from a Dewetron ORION series A/D card. If you look at the model numbering of our ORION cards, you will see that the last digit changes according to which options are installed on the card, like this:

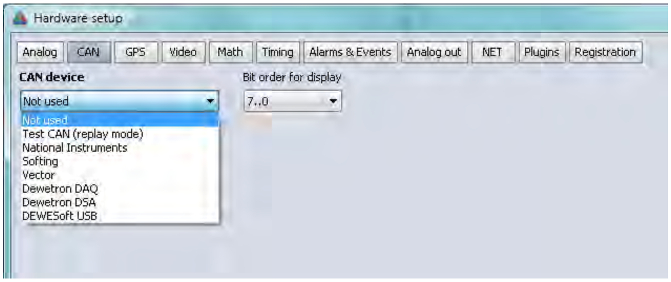
model name	last digit	description
ORION-1616-100	0 (even)	the standard card
ORION-1616-101	1 (odd)	Adds 2 x CAN BUS interfaces
ORION-1616-102	2 (even)	The standard card plus more counters + digital inputs
ORION-1616-103	3 (odd)	The standard card plus more counters + digital inputs + 2 x CAN BUS interfaces
ORION-1616-104	4 (even)	The standard card plus ADVANCED counters + digital inputs
ORION-1616-105	5 (odd)	The standard card plus ADVANCED counters + digital inputs + 2 x CAN BUS interfaces

You can see from the table above that basically any ORION card whose model name ends in an odd number has the CAN interfaces on it. In addition to the hardware option, you must have the software option called DEWE-Soft-OPT-CAN installed.

The actual CAN bus interface connectors installed on your unit are shown in SECTION 4, SIGNAL INPUT CONNECTORS in this document. That page also shows you how to connect to the CAN BUS, including using termination resistors if needed.

If you want to use either one of the CAN bus interfaces to connect a Dewetron CPAD2 series module, please see SECTION 10, CONDITIONERS, CPAD2 within this document.

Your CAN interfaces should be set up already at the factory, however, if you need to check or reconfigure the settings, please check the HARDWARE SETUP under the SETTINGS menu. Then click the CAN button to see the CAN hardware interface setup:



Use the selector to choose the CAN device that is installed within your system. Here is a basic description of what each entry refers to:

Test CAN (replay mode) - for demonstration and training purposes, you may select this even if you do not have the CAN software option, and point the software to a CAN bus data file (CSV), which it will replay through the system for you.

National Instruments - select this if your system has a National Instruments brand PCI-CAN/2 interface card.

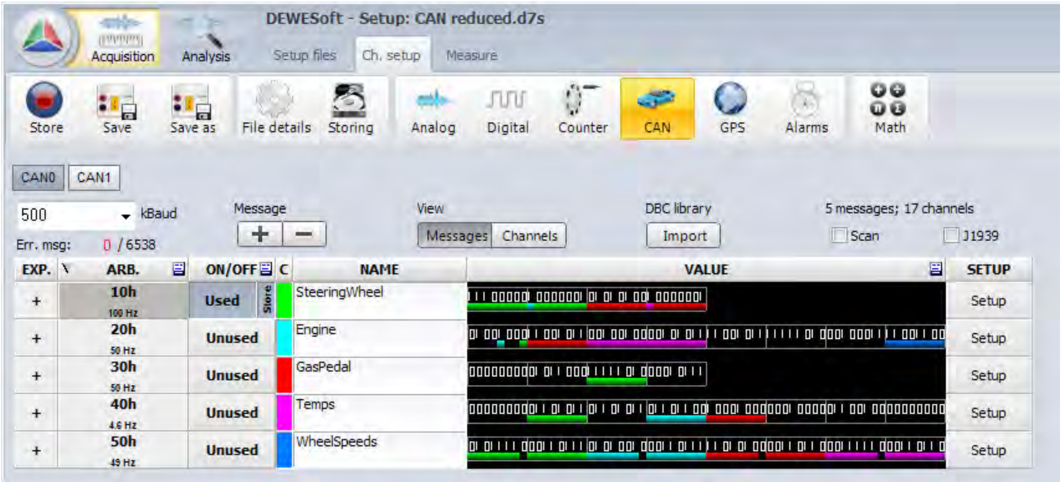
Softing - select this if you are using a compatible Softing brand CAN BUS interface card

Vector - select this if you are using a compatible Vector brand CAN BUS interface card

Dewetron DAQ - select this option if your system has any 16-bit ORION card with the CAN option

Dewetron DSA - select this option if your system has any 22- or 24-bit ORION card with the CAN option

⇒ **Note - if your DEWESoft license does not include the CAN option, you will not be able to proceed with hardware setup after selecting a real CAN interface card. Please contact Dewetron for a license upgrade.**



After doing the hardware setup, please visit the CH SETUP screens and click on the CAN icon, which will appear there in the toolbar.

At first you will have no channels or messages being shown. This is normal.

Notice that there are buttons for CAN0 and CAN1. That is because there are two CAN interfaces in nearly every system. Your system could even have more -- in which case you will have additional buttons for CAN2, CAN3, etc. The maximum is 8 interfaces in one Dewetron system.

It is essential to select the correct SPEED of the bus, in kBaud. Dewetron CAN hardware supports speeds up to 1 Mb (1,000,000 bits per second). 500 kb is the default.

⇒ **Selecting a wrong SPEED of the CAN bus can actually interfere with certain systems, so please take care to select the correct one.**

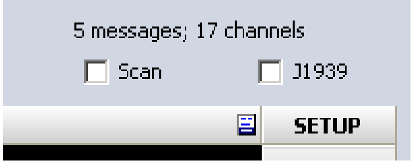
Setting up your channels

It is important to know that the CAN data stream does not contain any information about the channels that are being conveyed within the 64-bit messages. Therefore you need to know the configuration. Most car companies are very secretive about the CAN message layout, and do not release this information. Dewetron does not have any information about the CAN message layout from any car maker. However, there are third party programs such as CANALYZER which you could use to help in this area. This product is not affiliated with Dewetron in any way.

A great invention of Vector corporation is the DBC file. This is essentially a standardized flat file which contains the information about a given CAN messaging layout. If you have a DBC file, you may import it right here and set up all of your channels instantly. Click the IMPORT button under the label DBC library, and then select the DBC file that you would like to apply.

Scan for messages

Another approach is to checkmark the SCAN button. When you do this, DEWESoft will "listen" on this bus and identify all of the CAN messages that are coming across, and create messages for them here. DEWESoft will show you how many messages it has found above the SCAN button.



- ☺ **SCAN can only find messages that appear during the time the system is scanning. Not all CAN messages are coming across the bus all the time! Some messages only report errors, for example, so you might have to scan for days or weeks to see them all this way. Yet other messages will only appear based on a specific query, and will thus never appear unless you cause them to report on the bus.**
- ☺ **SCAN can only find messages; it cannot identify the channels within the messages**

Of course, since each message might contain any number of channels, starting at various bits and running any bit length, and with any scaling factors, it is still impossible to know just from the messages, what the bits represent, but it gives you a starting point. As mentioned, the easiest way is by importing a DBC file, which contains everything already.

But if you need to configure channels manually, the procedure is quite simple.

Configuring message and channels manually

You can add messages manually by clicking the Message + button (or using SCAN as mentioned above). To configure the channels contained within a message, click the SETUP button for a message, and the CAN CHANNEL SETUP box will open:

In the top half of this dialog you set up the message itself, where in the bottom half you can configure the channels contained within this message.

Message setup

Looking at the top half, message configuration, here are the key things to know about:

Name — The name of the message

Arb ID# — ID number of your message on the CAN bus

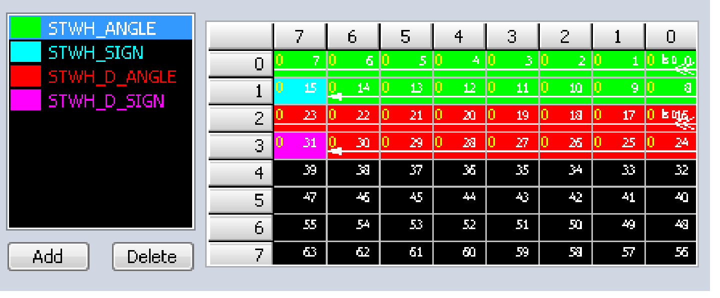
Type — Select between CAN standard and CAN extended from drop down list. Those two differs in identifier length. The standard length is 11 bits, and extended is 29 bits.

DLC — DLC is the length of the message. It ranges from 1 to 8. As a standard, the DLC is set to 8.

Delay — We can also enter the message delay in millisecond which shifts the time stamp of the message back in time. This can be used to perfectly synchronize the analog data with CAN data with compensating the delays in digital data transmission.

Channel setup

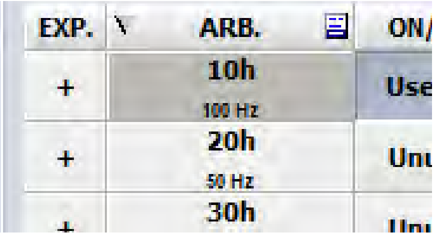
Now we need to add the channel(s) contained within this message. Click the ADD button and DEWESoft will create a default channel and color code the first 16 bits of the CAN message. Please enter the name and units of this channel, and the scale factor (multiplier and offset). Also, make sure that the start bit and length (in bits) are correct. Then click OK. You can see that in the screen shot below, four channels have been set up within this one message. Two of the channels are just one bit long, whereas the other ones are



Or, if this message contains multiple channels, repeat the procedure starting with the ADD button mentioned above, and create more channels. Within a message, there can be numerous channels, and each one can be absolutely unique in terms of its bit length, scaling, name, units… CAN is really quite flexible.

Arbitration IDs and CAN message rates

CAN messages are identified via hex IDs known as "Arbitration IDs." This is what DEWESoft shows on the message list, in the ARB column:



Below the Arbitration ID, the rate at which this message is coming across the bus is also shown in Hz. You will notice that each message can come across at a different rate.

J1939 support

J1939 is used to enable special decoding of arbitration ID which includes the sender, receiver and the message ID itself. Arb ID is always extended in this case. This is most widely used on trucks, busses and certain military vehicles. Please make sure that the bus type is really J1939 before enabling this option.

OBD II support

DEWESoft additionally supports the protocol for reading in data from the OBD II port, required on all US cars. In this case, the messages are standardized, and a DBC file is not needed. This feature requires that an optional plugin be purchased and installed into DEWESoft.

Select messages / channels for storage

Notice the buttons near the top of the CAN setup window labeled VIEW:

It is important to go to the CHANNELS view, and then press USED for the channels that you want to really record and display next time you store data.

⇒ **If you press USED only on the MESSAGES view, the actual message ID itself will be stored, but not the channel(s) that it contains!!! Always go to CHANNELS view and press in USED for all channels that you want to display and store.**

After clicking CHANNELS, you will see a list of all of the channels contained within the various CAN messages that you have set up:

Make sure to press USED in on the channels that you want to store and display. We cannot emphasize that enough.

OK, your CAN interface is set up.

When you save this Dewesoft SETUP, all of the CAN parameters are saved into the setup file, of course. But sometimes it is useful to be able to save this CAN setup as a DBC file. This is possible, as described in the next section.

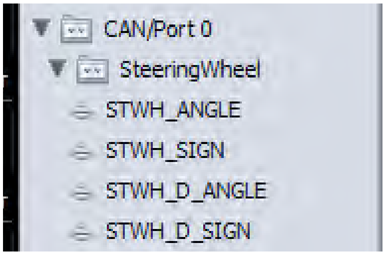
Saving DBC files

Saving your CAN setup to a stand-alone DBC file requires a software option called DEWESoft-OPT-CAN-OUT. This option is needed because the DBC file format is proprietary to Vector, a company not affiliated with Dewetron. With this software option, we include a license from Vector, which we purchase from them and transfer to you, so that you gain the ability to export your CAN setup to a standard Vector DBC file. This DEWEsoft-CAN-OUT option also includes the ability to transmit CAN messages onto the bus. Please see the separate documentation about these capabilities for further details.

Displaying CAN channels

Whichever CAN channels are pressed in as USED on the CAN setup screen, will be displayed on the measure screens, as shown below. We made a simple screen which populates the CAN channels into digital meters. Below that, each of the four wheel speed channels are shown in a recorder graph.

Notice that the CAN channels are shown on the right side of the screen in the CHANNEL LIST. A nice feature is that the channels contained within each message are collapsed into a group whose name is the same as the message name:



So you can see that the message called SteeingWheel has four channels within it.

The CAN messages and channels will disappear from this list if you click on a display type which is incompatible. For example, CAN is too slow to show in a SCOPE or FFT graph. So if you click on a SCOPE or FFT graph, the CAN channels will disappear from the channel list. This is the same with other very slow data, like from PAD, EPAD2 or CPAD2 modules, for example.

Storing CAN data

Any CAN channels pressed in as USED on the CAN setup screen will be stored into the data file when you store data. It does not matter if the channels are shown on a display screen or not.

Processing CAN data in MATH

CAN channels can be used within your MATH channels just like any other channel.

Appendix

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Documentation about your system:

Model: (check)	◊ DEWE-3210	◊ DEWE-3211	
Serial number:		Reference number:	
Date shipped:		Order ref. number:	
A/D card settings:			
A/D card model name:	◊ ORION-	◊ AD-	◊
A/D card(s) details:		D/I:	CTR:
Conditioner settings:			
Conditioner type(s): (check)	◊ DAQ modules	MDAQ modules	Other (list)
Specific modules (list all):	Slot 0:	MDAQ-BASE-5	
	Slot 1:	MDAQ-SUB-	
	Slot 2:	MDAQ-SUB-	
	Slot 3:		
	Slot 4:		
	Slot 5:		
	Slot 6:		
	Slot 7:		
Expansion rack/modules (list):			
DEWESoft settings:			
CAN device:		Settings:	
VIDEO device:		Settings:	
GPS device:		Settings:	
ALARM OUT settings:		ANALOG OUT settings:	
DEWESoft edition:	◊ SE, ◊ PROF, ◊ DSA, ◊ EE		version 7.__ . ______
Amplifier interface: (check)	◊ ORION Onboard, ◊ ORION Onboard		COM:
Additional xPAD modules:		COM port:	
Hardware key:			
Software license:	DW7-		
Software options (list):			
Interfaces/settings:			
Optional interfaces installed:	◊ PCI-ARINC card	◊ PCI-1553 card	◊ PCI-CAN/2
	◊ VIDEO-FG-4	◊	◊
Comments/more information:			

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