Brüel & Kjær Vibro

Instruction

VIBROCONTROL 1800 Series

Four channel vibration monitors

- VC-1850 Accelerometers
- VC-1860 Velocity Sensors
- VC-1870 Displacement Sensors

Extension Modules:

- VC-1801 additional relays
- VC-1803/04 communication and data storage

CE

Keep it accessible for future reference

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Content

WARNING!

This symbol warns of dangerous situations, which can result from misuse of the product.

NOTE!

This symbol provides general and useful information for using the product.

1 Applications

The VIBROCONTROL 18xx Vibration Monitor is maintenance free device mounted in a DIN rail enclosure. It is used to monitor vibration parameters and protect machines like pumps, blowers, ventilators, decanters, separators, centrifuges, mills and milling equipment.

The VIBROCONTROL 18xx Vibration Monitor continuously keep track of the vibration level in maximum four measuring points in each of which an external sensor is positioned. In addition, the VIBROCONTROL 18xx also have one Tachometer Input for machine speed detection and synchronization, as well as one Process Input for measuring a pressure or a temperature, or similar.

With the help of a PC, having the Compact Setup Software installed, it is possible to read-out the different vibration parameter levels and status information. In addition, the use of this software enables the possibility to carry out a remote parameter setup of one device (at the time) out of a number of VIBROCONTROL 18xx devices.

The VIBROCONTROL 18xx also includes an USB interface for direct access from PC to the VIBROCONTROL 18xx device on a point-to-point basis. The USB interface is used if the device is not connected to a fieldbus, LAN or if the data transmission speed (= Baud rate) with RS-485 is slow.

2 VIBROCONTROL 1800 Series Types

VIBROCONTROL 1800 Series enables cost effective protection for all critical rotating equipment with rolling element bearings as well as sleeve bearings.

Dedicated solutions via these three basic independent protection units:

- **VIBROCONTROL 1850**
  Acceleration Sensors (CCS)
- **VIBROCONTROL 1860**
  Velocity Sensors

- 4-vibration channels for case vibration (CV)
- 1-channel process data (4-20 mA)
- 1-channel speed

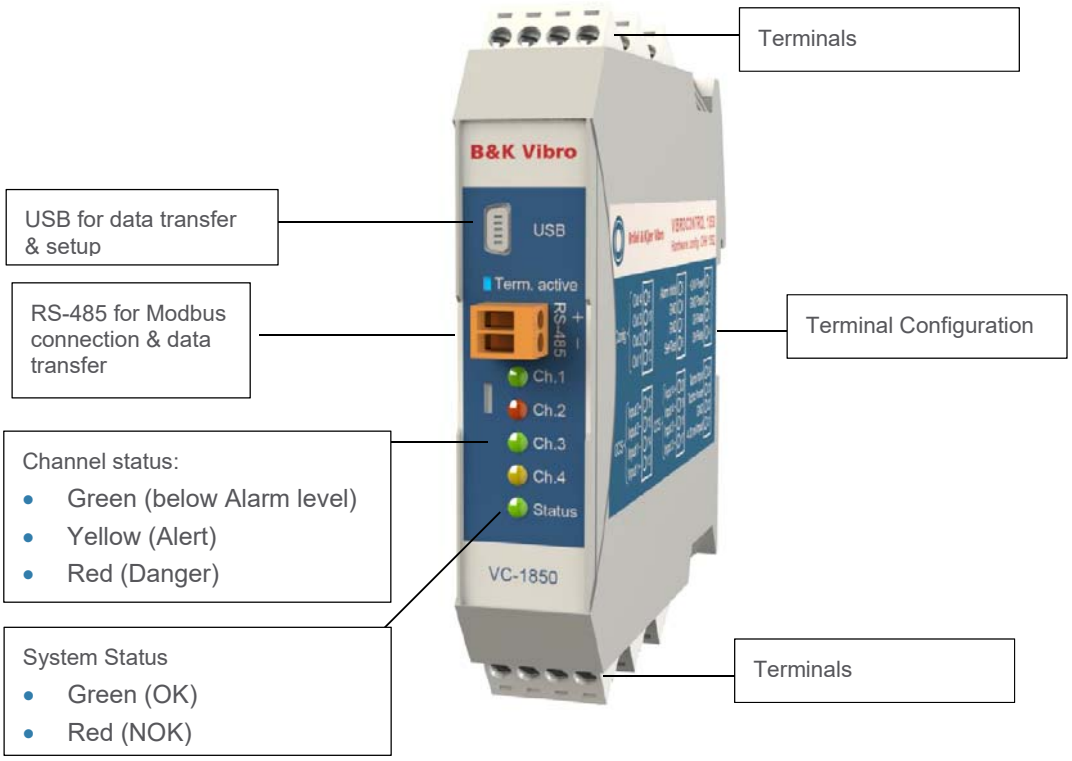
- **VIBROCONTROL 1870**
  Displacement Sensors

- 4-vibration channels for relative shaft vibration (RSV)
- 1-channel **axial position** (trust position)
- 1-channel speed

Extension modules

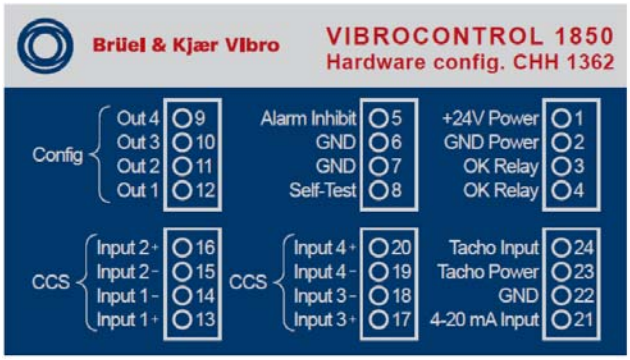
- **VIBROCONTROL 1801**
  Relais Module (12 Relais)
- **VIBROCONTROL 1803 / 1804**
  Communication Modules / Ethernet Bridge / Data storage

2.1 VIBROCONTROL 18xx module layout



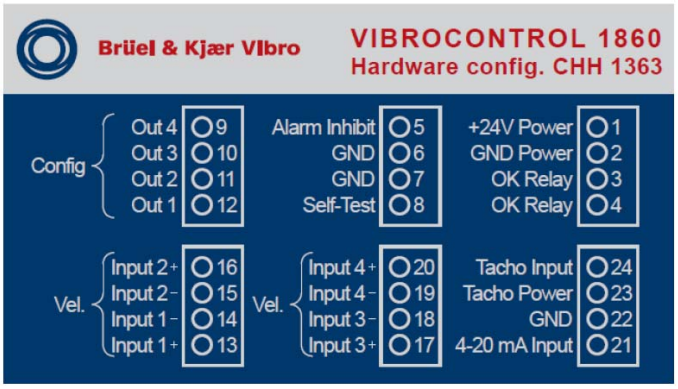
2.2 VIBROCONTROL 1850 (Accelerometer CCS)

Terminal Configuration



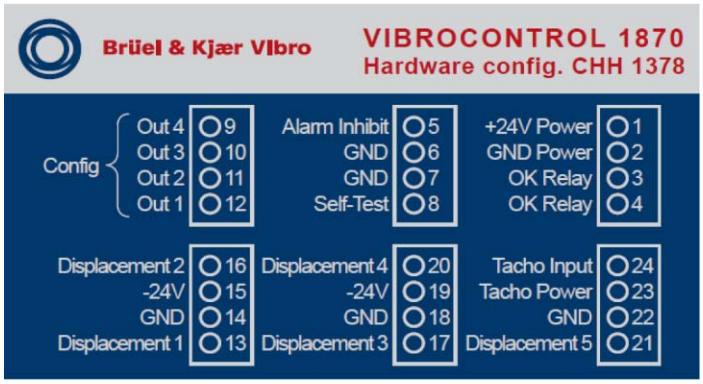
2.3 VIBROCONTROL 1860 (Velocity Sensors)

Terminal Configuration



2.4 VIBROCONTROL 1870 (Displacement Sensors)

Terminal Configuration



Please note displacement sensor input 1-4 is used for relative shaft vibration; displacement 5 is used for axial position only.

3 Hints for safe operation of VIBROCONTROL 18xx devices

Safety:

This User Manual contains information, which should be followed by the user in order to ensure safe operation.

If the VIBROCONTROL 1800 Monitors develops a fault, switch it off and secure it against unintended use.

General:

Please carefully read the operating instructions prior to set-up of the device. Make sure that your VIBROCONTROL 18xx device is suitable for your application without any restrictions.

Improper use:

Any improper or non-intended use may lead to malfunctions of the VIBROCONTROL 18xx device or to unwanted effects in your application. If the VIBROCONTROL 18xx is used in a way not described in the relevant user manuals, function and protection may be impaired and serious personal damage, death or serious, irreversible injuries may result.

Installation and operation:

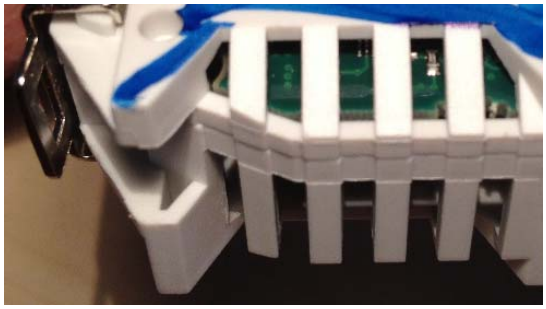
Installation, electrical connection, set-up, operation and maintenance of your VIBROCONTROL 18xx device(s) must only be carried out by qualified/trained personnel (electrician) authorized by the machine operator in accordance with local- and national regulations for the installation of electrical equipment.

Changing the setup parameters:

Before applying a new set of setup parameters to the VIBROCONTROL 18xx device, please make sure that doing so cannot cause any damage to persons and/or machinery.

Connecting the sensor(s):

Please make sure to meet the safe extra-low voltage (SELV) criteria when any sensors are connected to the VIBROCONTROL 18xx device so that no dangerous contact voltages are applied to the sensor and/or transferred to the device. The sensor and the power supply of the VIBROCONTROL 18xx device are not galvanic isolated.



Electromagnetic compatibility (EMC)
The VC-18xx complies with the relevant requirements of the Electromagnetic Compatibility Directive 2014/30 / EU. The EMC has been tested according to EN 61326-1, with the reduction of the requirement for static electricity (ESD).
When handling the VC-18xx, attention must be paid to protective measures against electrostatic discharge. This applies in particular to the area of ventilation slots.
Electrostatic discharges in this area can destroy the device.

Sensor cable mounting:

To prevent negative effects on the functioning of the VIBROCONTROL 18xx device caused by noise voltages, please lay shielded sensor cables and load cables separately.

Cable break, cable short and sensor overload:

For a detailed description of how a VIBROCONTROL 18xx device reacts to a shortening/breakage of the sensor cable or an overload of the sensor signal, please read section 6.16 of this manual.

Ingress protection:

The VIBROCONTROL 18xx has an ingress protection of IP20. The VIBROCONTROL 18xx device must be mounted in a control cabinet with an ingress protection of at least IP54. The control cabinet should be installed in accordance with local- and national rules and regulations.

Mounting:

Mount the VIBROCONTROL 18xx device on a 35 mm DIN rail inside the control cabinet. Mount the device vertically but make sure to leave enough space between the unit and the top and/or bottom of the control cabinet. Only this way the air circulation will be sufficient to avoid excessive heating of the device.

Connecting to a power supply:

The VIBROCONTROL 18xx device has a voltage tolerance of +24 VDC ±5 %
Before connecting the VIBROCONTROL 18xx device to a +24 VDC supply voltage, please make sure that all terminal blocks are completely inserted.
The external +24 VDC supply voltage must be generated and supplied according to the SELV requirements. Protect the +24 VDC supply voltage externally with max. 2A.The ground (GND) of the DC supply is directly connected with the ground (GND) of the sensor supply, if any. The SELV criteria must therefore be met for the DC supply (safety extra-low voltage, circuit electrically isolated from other circuits, not grounded). If the DC circuit is to be grounded (e.g. due to national regulations), the protective-extra-low-voltage (PELV) criteria must be adhered to (SELV with circuit galvanic isolated from other circuits).

Maintenance:

If used correctly no maintenance and repair measures are necessary. Only the manufacturer is allowed to repair the unit.

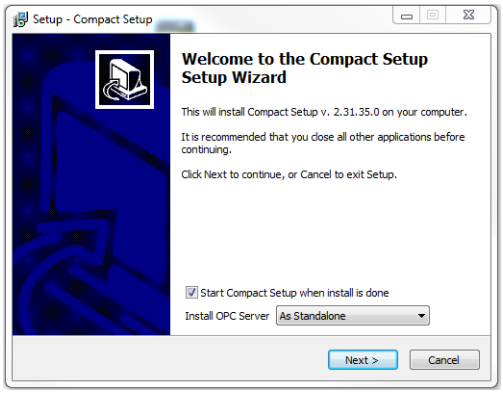
4 Getting started

Connect the VIBROCONTROL 18xx to a (notebook) PC with the Compact Setup Software installed, using one of its interfaces (USB, RS-485 or LAN via VIBROCONTROL 1803 Ethernet-Bridge) with the appropriate cable.

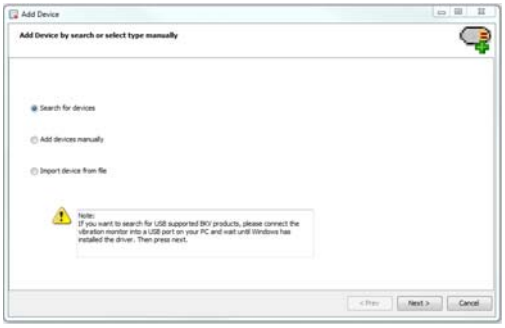
4.1 Connecting the VIBROCONTROL 18xx

Figure 4-1) Connection picture

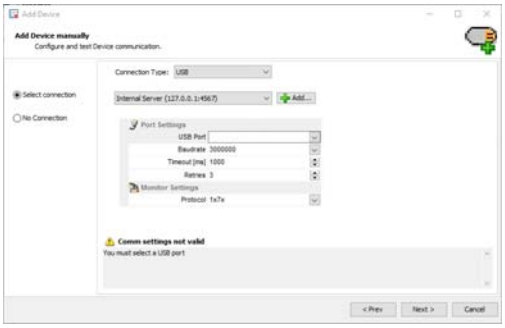
Install the Compact Setup Software from the CD.



Follow the installation wizard

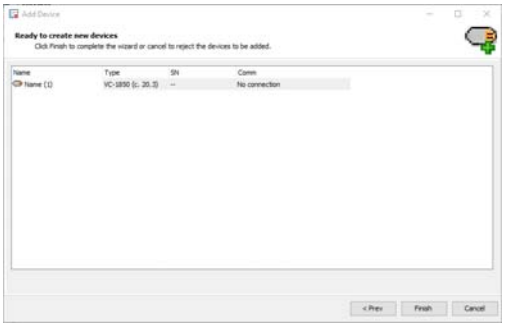


In the Add Device window, please choose “Search for devices” (= automatic search).

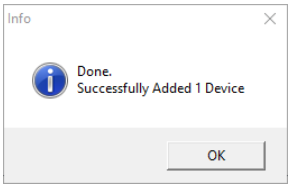


Successful search will result in a VIBROCONTROL 18xx with a serial number (S/N).

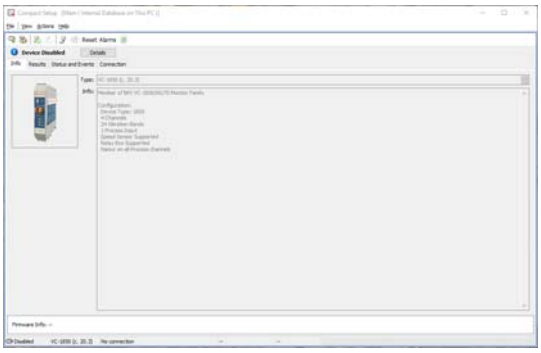
Click on “Next”.



Click on “Finish” to end the search.



The information at the right indicates that your VIBROCONTROL 18xx is successfully connected to the PC.
Click on “OK” to get to the Compact Setup Software main window.



Find your VIBROCONTROL 18xx device in the listing of devices at the left side of the main window.

4.2 Cable Connections

Connect the different terminals on the VIBROCONTROL18xx in the following sequence:

- Sensor input at terminals #13 to #20. If required, please observe polarity.
- Relay(s) relative to GND, current and/or voltage output(s) at terminals #9 to #12.
- Tacho power and Tacho Input signal terminals #23 and #24.
- Process input (relative to GND) at terminals #21 and #22.
  (VIBROCONTROL 1870: This input is used for axial position measurement)
- Highly reliable redundant (= 2x) Failure galvanic insulated relay(s) at terminals #3 and #4.
- Main Power (+24 VDC) and ground (GND) at terminals #1 and #2.
- Optional external connection to terminals #5 and #8 to initiate respectively “Alarm Inhibit” or Self-Test by connecting these terminals to ground.
- Connect the VIBROCONTROL18xx to a PC so that communication between these two devices can be established. For communications, the VIBROCONTROL 18xx has RS-485 and USB interfaces. Optional it is possible to communicate via a LAN connection using a VIBROCONTROL 1803 Ethernet-Bridge module.

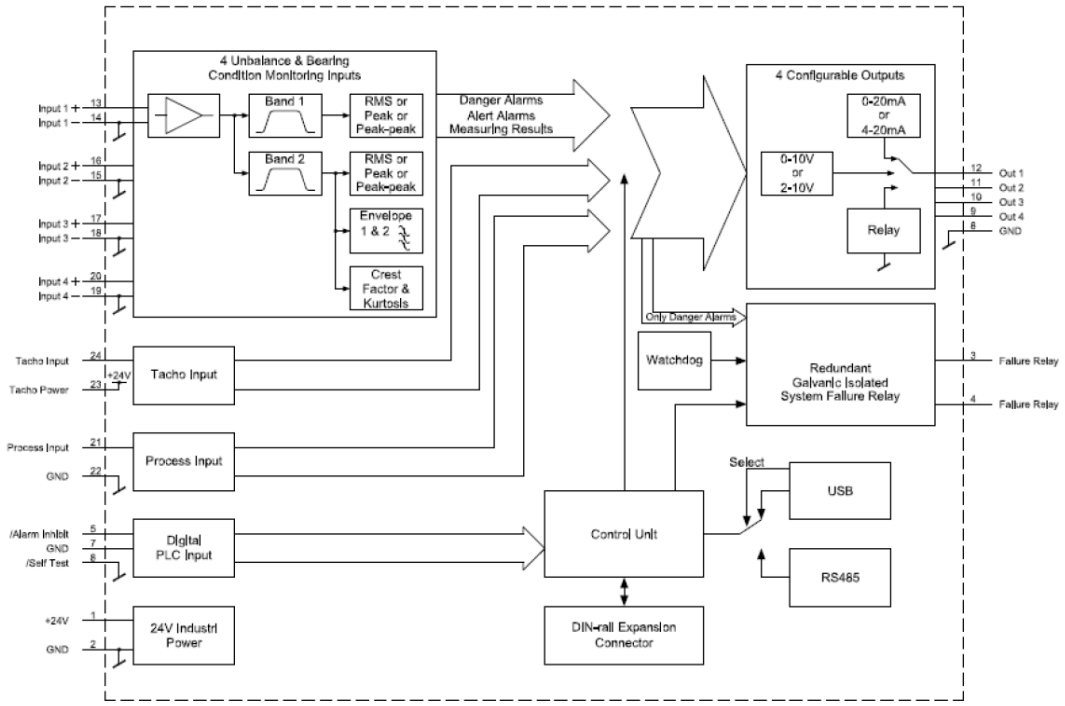
4.3 Powering and Start-up

After connecting to Power or changing setup the instruments is proceeding a startup program, which is indicated by red, or blinking Channel LEDs and/or blinking OK LEDs. This procedure takes up to 30 seconds. In case there is no violation of alert and danger levels or any OK failure, all LEDs should turn to green.

5 Functionality

5.1 General for VIBROCONTROL 1850

The VIBROCONTROL 1850 Vibration Monitor has four 2-wire CCS accelerometer inputs.



5.2 Features of VIBROCONTROL 1850

The VIBROCONTROL 1850 Vibration Monitor is a device with four sensor input channels, each having two independent bands (Band 1 and Band 2) with the following specifications:

Band 1 and Band 2:

- Full scale in True RMS, Peak or Peak-to-Peak values of the momentary vibration parameters acceleration (m/s^2), velocity (mm/s) or displacement (µm);
- Many band-pass filters within the ranges:
  Band 1
  0.1 to 1500.0 Hz or 5.0 to 11500.0 Hz; 10 Hz – 1000 Hz
  Band 2
  2 kHz – 10 kHz
- Alert and Danger alarm limits can be configured.
  Default setup
  Alert is 7.1 mm/s
  Danger 11.0 mm/s.

Band 2 (only):

- Two separate envelope detectors. Each envelope detector has its own band-pass filter. Each envelop analyser has its own Alert and Danger alarms.
- Crest factor detector with Alert and Danger alarms
- Kurtosis detector with Alert and Danger alarms

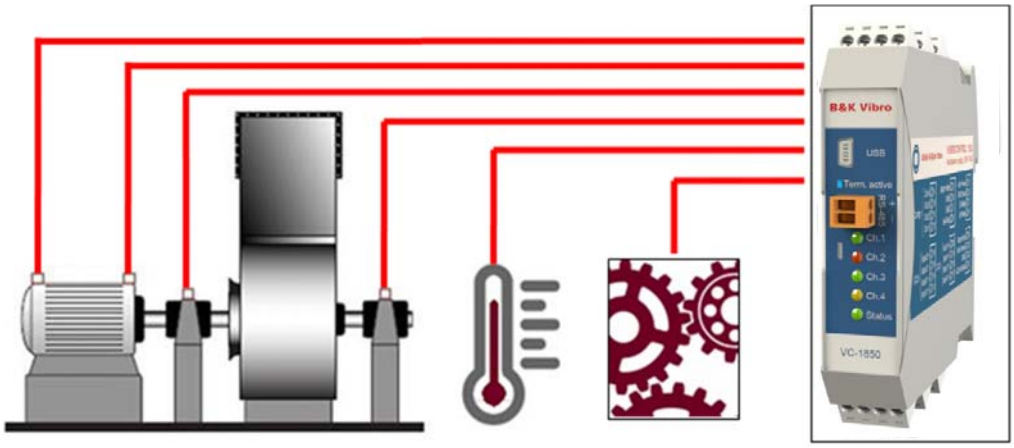
General for All VIBROCONTROL VC-18xx:

- Each vibration parameter may have an individual alert and/or danger alarm trigger level assigned. If an alert and/or danger alarm is activated, the associated channel LED(s) at the front of the enclosure will illuminate:
  Green = No alarm, Yellow = Alert alarm and Red = Danger alarm
- The Alert and/or Danger alarms can be configured as “Low Level” or “High Level” alarms
- The Alert and/or Danger alarms can be latched individually.
- Four independent configurable outputs (terminals #9, #10, #11 and #12) that can be assigned to any Alert or Danger alarm. Each of the outputs may have any (but only one at the time) of the following functions:
  ~ Solid-state relay. When activated the relay will “break”, the corresponding enabled alarm relay(s) will become activated and thereby inform the user, e.g. via a connected rotor light, beeper, PLC or by directly shutting down the machine.
  ~ Analog dc current output : 0-20 mA or 4-20 mA; The default is 4-20 mA
  ~ Analog dc voltage output : 0-10 V or 2-10 V
- An internal watchdog continuously monitors the functionality of the complete monitor. When a **non-critical** system failure is detected, the „OK“ LED at the front of the enclosure lights Red.
  In case of the occurrence of a critical system failure, the same LED flash Red instead. Using two mechanical relays in series for the same event adds redundancy to the system failure output and thus considerable increases the reliability that a system failure alarm will be detected.

- Possibility to start a complete self-test of the vibration monitor by connecting the “Self-Test” terminal #8 to ground. A flashing Yellow „OK“ LED at the front of the enclosure indicates an ongoing self-test.
- Possibility to inhibit (all) alarms by assigning the “Alarm Inhibit” digital I/O terminal #5 on the enclosure to ground
- A Process input (terminal #21) can be used to analyse an analog current (0-20 mA) or voltage (0-10 VDC) input signal.
- A tachometer input (terminal #24).

The VIBROCONTROL 18xx Vibration Monitor is provided with a RS-485 and an USB interface, which allow it to to connect it to a PLC or to be configured from a PC.

Using a VIBROCONTROL 1803 Ethernet-Bridge enables remote communication via a LAN cable.



6 Setup and Operation of VIBROCONTROL 18xx

6.1 General

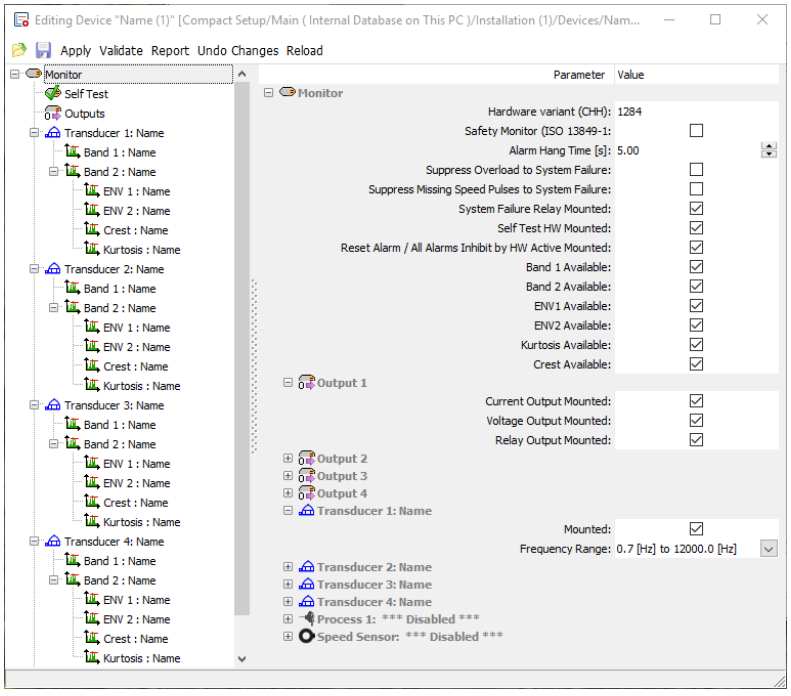
The setting of the measuring parameters of the VIBROCONTROL 18xx can be carried out with Compact Setup Software:

- It is possible to change one or more setup parameter. The change of VIBROCONTROL 18xx setup parameters can only be carried out for one device at the time.

The measuring parameter setup for channels with an accelerometer (CCS) VIBROCONTROL 1850 or a velocity sensor VIBROCONTROL 1860 is very much similar.

6.2 View “Monitor”

In the Compact Setup Software “Monitor” page it is possible to see those features/functions that are available for use.



6.3 Self-Test

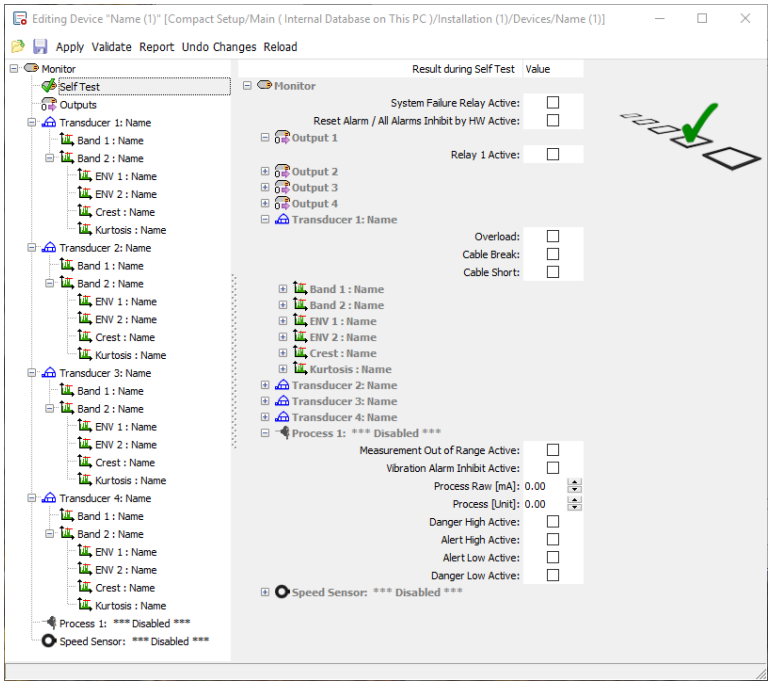
The VIBROCONTROL 18xx includes a “Self-Test” function that can be activated externally by connecting a ground (GND) signal to terminal #8 on the enclosure. Alternatively the self-test can be activated using the Compact Commander Software.

Only individual functions/features can be addressed during a self-test. But there are NO consequences, i.e. no alarms will be triggered if a certain vibration level set during self-test exceeds an alarm trigger level. If an alarm must be triggered during self-test the alarm in question must be marked. The behaviour of outputs during a self-test must also be specified separately.

Thus, the user will have to specify/set the following in connection with a self-test:

- The measurement result scalar level for each vibration parameter in its own units, e.g. mm/s.
- The status of alarms during a self-test.
- All four outputs, either as a status of relays or a certain scalar level of
  - dc current (mA) or
  - dc voltage (V).
- The Process Input must be specified in detail, i.e. signal scalar levels and alarms.

For the duration of thy self-test the „OK“ LED will flash **Yellow.**

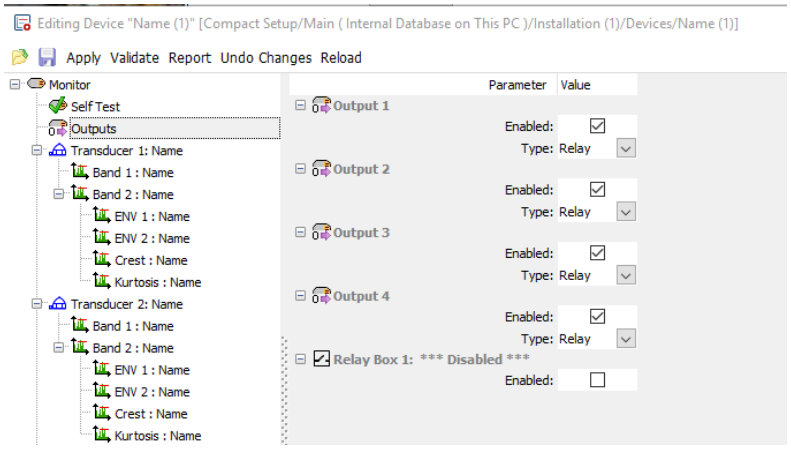


6.4 Output selection (4-20 mA or Relay)

The VIBROCONTROL 18xx has four configurable outputs at terminals #9, #10, #11 and #12. Each of the available outputs can be enabled or disabled.
An enabled output can have any of five output functions:

- A solid-state relay, which is closed and connected to ground (GND) when not activated. When activated the relay breaks.
- An analog dc current output of 0-20 mA or 4-20 mA, direct proportional to the measured parameter between 0 and full scale.
- An analog dc voltage output of 0-10 Volt or 2-10 Volt, direct proportional to the measured parameter between 0 and full scale.

In the example below output type “Relay” is selected, it can be changed to Analog Output.



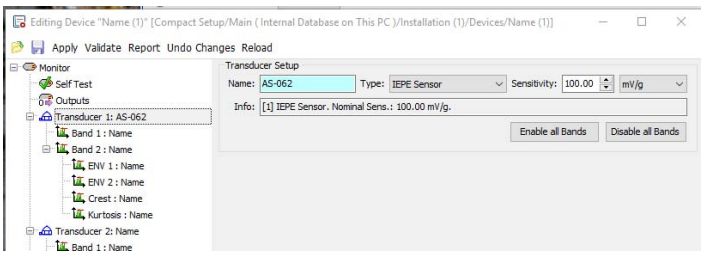
If output 1 – 4 is defined as analog output, the OK relay can be used as a collection relay for all danger alarms (Setup Monitor: Safety Monitor (ISO 13849-1).

Please note that all configurable outputs refer to common ground (GND). Outputs selected to be a current source or voltage will have an output value that can be directly measured between the respective output terminal and GND.

Please be aware that each of the four (4) outputs can have only one (1) function attached to it. If e.g. all four outputs are selected to be 4-20 mA current outputs there will be NO relays available, unless:
The Protection System feature has been enabled (see section 6.14), which will cause that ALL Danger Alarms will trigger the Protection System (= System Error relay).
The extension module VC-1801 will provide 12 additional relays.

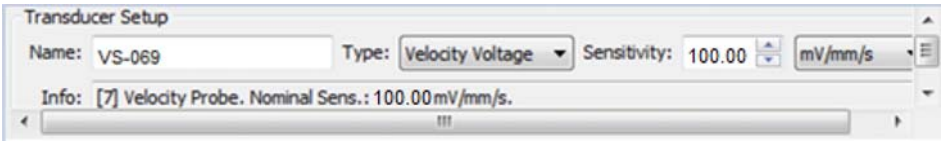
6.5 Sensors

VIBROCONTROL 1850 with CCS accelerometers:



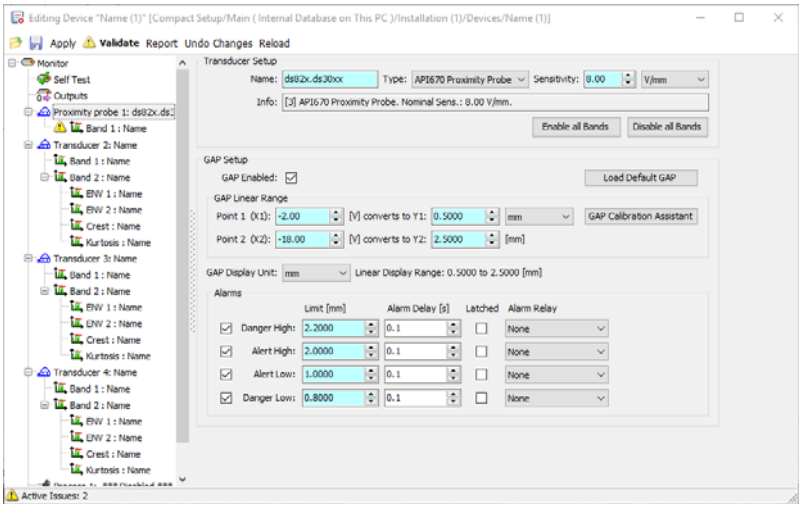
For CCS (IEPE) accelerometer you have to enter its actual sensitivity, which is a value normally provided by the manufacturer of the sensor. A typical value for standard CCS accelerometers is 100 mV/g.

VIBROCONTROL 1860 with velocity sensors:



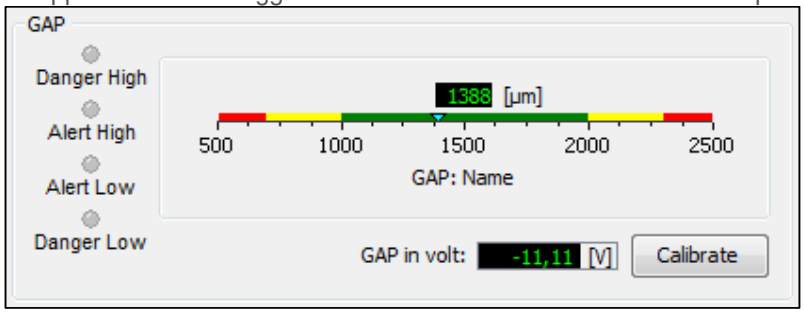
For velocity sensor you have to enter its sensitivity, which is a value normally provided by the manufacturer of the sensor. A typical value for standard velocity sensors is 100 V/mm/s.
Please note: Using velocity sensor of Brüel & Kjær Vibro the frequency linearization for a VS-068/69 is implemented.

VIBROCONTROL 1870 with displacement sensors:



For displacement sensor you have to enter its sensitivity, which is a value normally provided by the manufacturer of the sensor. A typical value for standard displacement sensor is 8 V/mm.

The setup of the displacement sensor also includes the setup of the GAP analyser (if enabled) that gives an overall view whether the sensor is operating in its usable range.
The sensitivity of the sensor normally is given in V/mm or mV/µm.
Low-level and High-level GAP alarms are available to indicate that something is wrong with the setup of the displacement sensor in the application. Each triggered alarm can activate one of the four outputs.



6.6 VIBROCONTROL 1850: Setup of Band 1 and Band 2

When a band is disabled, the respective vibration parameter will disappear from the main result display of the Compact Setup Software.

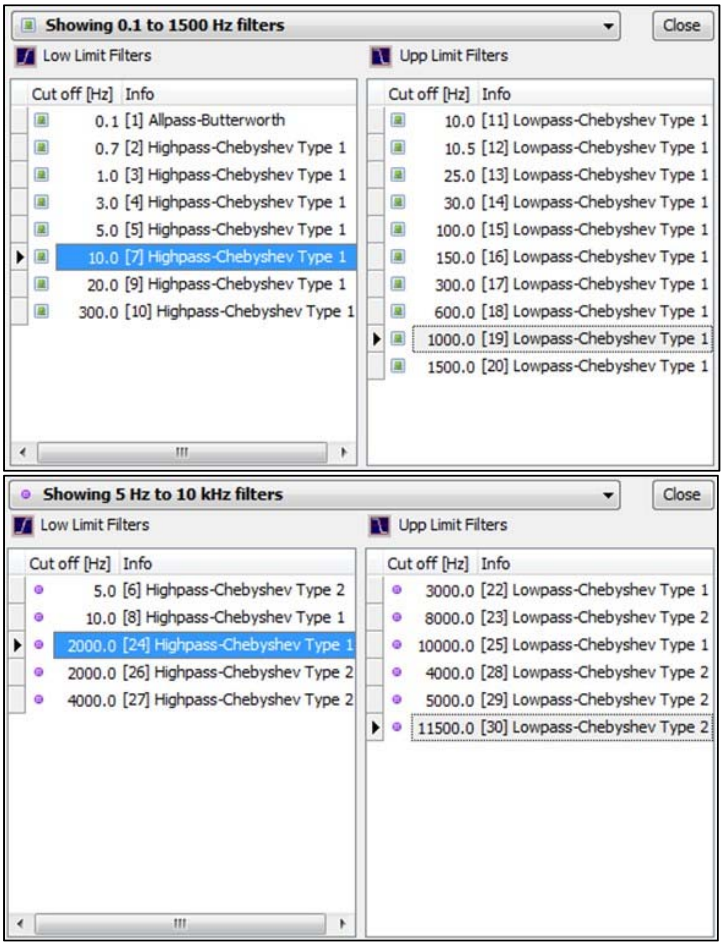
There are the following possibilities with regard to measuring units:

- CCS accelerometer : g, m/s2, mm/s, mm or µm

There are two main filter ranges to choose from:

- 0.1 Hz to 1500 Hz:
This filter range is mainly used in Band 1 for classic vibration monitoring with all three sensor types, including channels with a displacement sensor as sensor. The default value is: 10.0 Hz – 1000.0 Hz.

- 5 Hz to 10 kHz:
This filter range is mainly used in Band 2 for high frequency vibration monitoring of bearings with an CCS accelerometer. Channels having a velocity sensor or displacement sensor as sensor cannot use these high frequency band-pass filters. But these sensors can still be used simultaneously in Band 2 at a frequency below 1.500 Hz, but different from the one earlier chosen in Band 1.
The default value is a band-pass filter of 2000.0 Hz to 10000.0 Hz.



Depending on the application, the VIBROCONTROL 18xx has three signal detectors to select from:

- **True RMS detector:**
  By default the detector for any Band will be pre-set to “RMS”
  The only additional parameter that will have to be set is the RMS Averaging Time (in seconds), which may have a value between 0.1 and 60.0 seconds.
  By default the value of the RMS Averaging Time is pre-set to: 3 seconds.
- **Peak detector:**
  The Peak detector has two additional parameters that will have to be set:
- **Attack Time (in milliseconds):**
  The attack time may have a value between 0.1 and 1000.0 milliseconds
  Typical Attack Time 1.0 millisecond
- **Decay Time (in seconds):**
  The Decay Time may have a value between 0.1 and 20.0 seconds
  Typical Decay Time 3 seconds

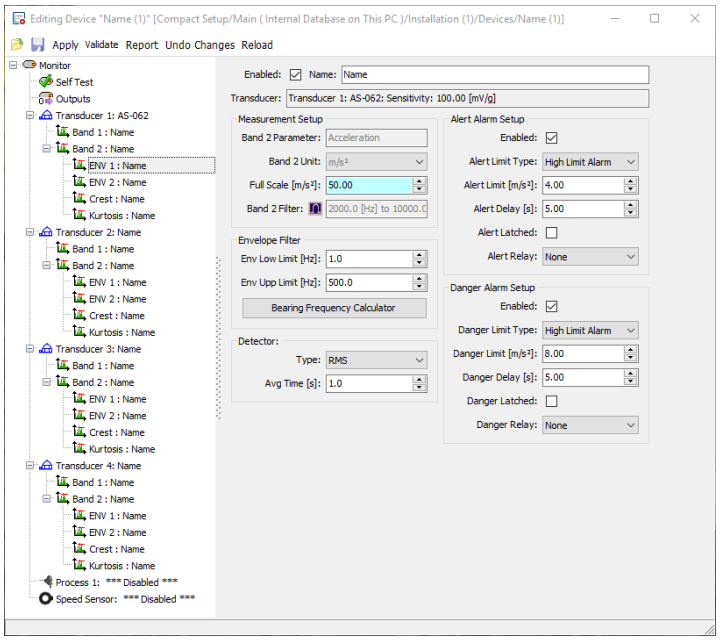
6.7 VIBROCONTROL 1850: Setup of the Envelope 1 and Envelope 2 detectors

Bearing failures are one of the most common faults with industrial machines and the envelope detector is primarily used to detect and diagnose Rolling Element Bearing (REB) faults. When a fault develops, the vibration becomes amplitude modulated due to periodic changes in the forces. The low frequency vibrations are filtered away in order only to extract the modulated periodic information from the more sensitive and pure envelope signal.

The envelope spectrum has shown several major advantages over other methods in very early detection and fault symptom identification.

The VIBROCONTROL 18xx has two on-board Envelope detectors that may be setup individually. However, the envelope detectors are part of Band 2 and as such associated to the bandwidth of the band-pass filter selected in Band 2. Please note that the choice of bandwidth in Band 2 affects the Crest Factor and Kurtosis as well.

To include an Envelope detector as a part of the general vibration analysis, this function must be enabled by marking: “Enabled”.



The Envelope is measured in m/s^2 RMS of the type of unit selected in Band 2. Therefore m/s^2 must be pre-defined in Band 2, if envelope analysis is to be used.

The user may set/change the following parameters related to the Envelope detector using the Compact Setup Software:

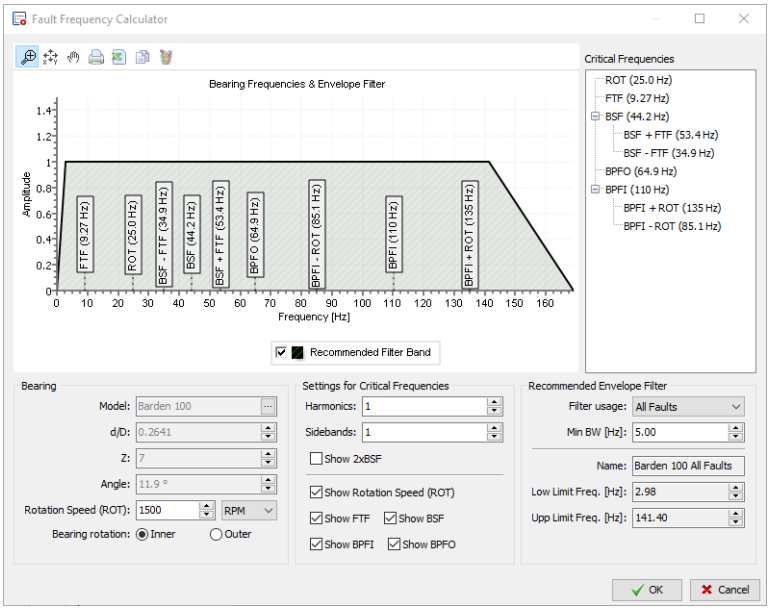
- Full scale in m/s2
- RMS Averaging Time in seconds:
  This value may vary between 0.1 and 10.0 seconds.
  The default value for this parameter is: 3 seconds
- Envelope Low Limit in Hz:
  This value may vary between 0.9 Hz and 500.0 Hz.
  Use: Bearing Frequency Calculator
  The default value for this parameter is: 1 Hz
- Envelope High Limit in Hz:
  This value may vary between 4.5 Hz and 500.0 Hz.
  Use: Bearing Frequency Calculator
  The default value for this parameter is: 500 Hz
  Please note that the High Limit must be set at a higher value than the Low Limit.

There are two independent Envelope detectors that each may have a different Envelope Low/High Limit. The Bearing Frequency Calculator can provide suggestions for Envelope filter settings.

6.8 Bearing Frequency calculator

For this purpose, the Compact Setup Software includes a huge database with numerous well- known bearing manufacturers plus a large number of those bearing models are the most-sold by each manufacturer.

To initiate the Bearing Frequency Calculator please select “Bearing Calculator” in the pop-up menu “Tools” at the front of the Main Window of Compact Commander Software. This will result in a window similar to that on the next page to appear:



Once the manufacturer and the bearing model have been selected a number of parameters that are proprietary for this particular bearing will be calculated and displayed:

- d/D:
  d/D is the ratio between the diameter of the balls (d) and the diameter of the circle formed by the centre-points of the balls in the bearing.
- Z:
  Z is the total number of balls or rollers in the bearing.
- Angle**:**
  Angle is the contact angle.

Listing of predominant critical frequencies in ball bearings:
- BPFO: Ball Pass Frequency – Outer = Bearing Outer Race Frequency
- BPFI: Ball Pass Frequency – Inner = Bearing Inner Race Frequency
- FTF: Fundamental Train Frequency – Cage Fault
- BSF: Bearing Spin Frequency – Ball Fault

To evaluate the damage frequencies the Bearing Frequency Calculator needs a few additional parameters:

- **Bearing Rotation:**
  Rolling **E**lement **B**earings (REB) usually have two circular rings (inner and outer ring), with balls or other types of rolling elements in between them.
  Please determine whether it is the inner ring or the outer ring of the bearing that is rotating.
  Indicate the correct movement by marking either “Inner ring rotation” or “Outer ring rotation” in the Bearing Frequency Calculator setup window.

- Rotation speed:
Next enter the rotation speed (ROT) of the bearing (= shaft). The value entered must be in either revolutions per minute (RPM) or revolutions per second (Hz).

- Settings for Critical Frequencies:
Critical frequencies are the bearing specific vibration frequencies that will be induced on the whole machine as the result of a fault in the ball bearing.

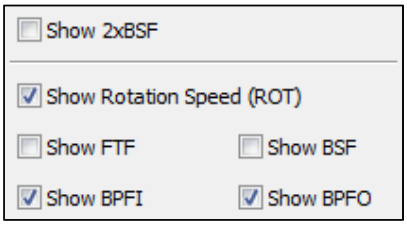
- **Harmonics**
Please tell the program how many harmonics must be taken into consideration when calculating the critical frequencies.
The number of harmonics considered should not exceed the number of balls in the ball bearing. The number of harmonics can be an integer number between 1 and 10. Default is 1.

- Sidebands
Please tell the program how many sidebands must be taken into consideration when calculating the critical frequencies.
The number of sidebands can be an integer number between 0 and 10. Default is 1.
When all parameters related to the critical frequencies are selected/entered a listing of the calculated critical frequencies will become visible in the left top corner of the Bearing Frequency Calculator window.

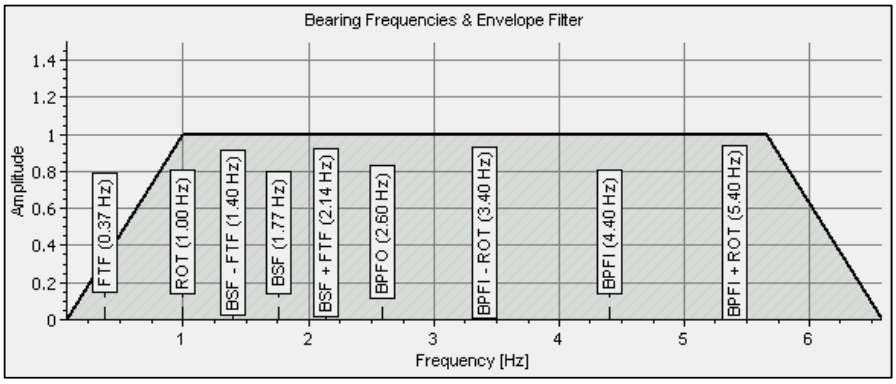
- Recommended envelope filter:

- Calculating all critical frequencies at once leaves an untidy and difficult to read graph. Study each predominant critical frequency and its harmonics as well as sidebands on an individual basis, it is necessary to use a number of narrow band-pass filters. Two of them can be analyzed simultaneously. By sending the same CCS accelerometer input signal to more than one channel the same VIBROCONTROL 18xx can produce up to eight different bearing analysis simultaneously.
  Under Filter Usage the critical frequency of interest can be chosen and the relevant filters will be set automatically calculated by the Compact Setup Software.

- - **Minimum Bandwidth (in Hz):**
  Under Minimum Bandwidth the most suitable bandwidth for the narrow band-pass filters mentioned above will be calculated and be set automatically by the Compact Commander Software.
- **- Name:**
  Compact Setup Software will automatically select a name for you: “bearing model” + “filter usage”.
- **- Low Limit Frequency (in Hz):**
  Depending on the parameter settings in the Bearing Frequency Calculator section, the Compact Commander Setup Software program will automatically set the Lower Frequency of the recommended band of the envelop filter.
- **- High Limit Frequency (in Hz):**
  Depending on the parameter settings in the Bearing Frequency Calculator section, the Compact Setup Software program will automatically set the Upper Frequency of the recommended band of the envelop filter.
- **- Bearing Frequencies & Envelope Filter graph:**
  The calculated critical frequencies can be displayed in a graph. To have a clear overview it is once again recommended to display the rotation speed (ROT) and one or only a few critical frequencies in the graph. Critical frequencies to be displayed in the graph must be marked in the Bearing Frequency Calculator.



Depending on the parameter setup vertical markers indicate critical frequencies where ball bearing problems are expected.



A number of small icons at the top of the window can be used to manipulate the graph with:

Zoom, Zoom reset, Pan, Print graph, Export to CSV file in Microsoft Excel, Copy to Clipboard and Copy to Microsoft Paint.

When Recommended Filter Band is marked, a shaded area will become visible in the plot indicating a filter band recommended by the ball bearing manufacturer covering all selected critical frequencies for the critical frequencies selected under Filter usage.

When leaving the "Bearing Frequency Calculator", the set parameters are saved with OK.

6.9 Crest Factor

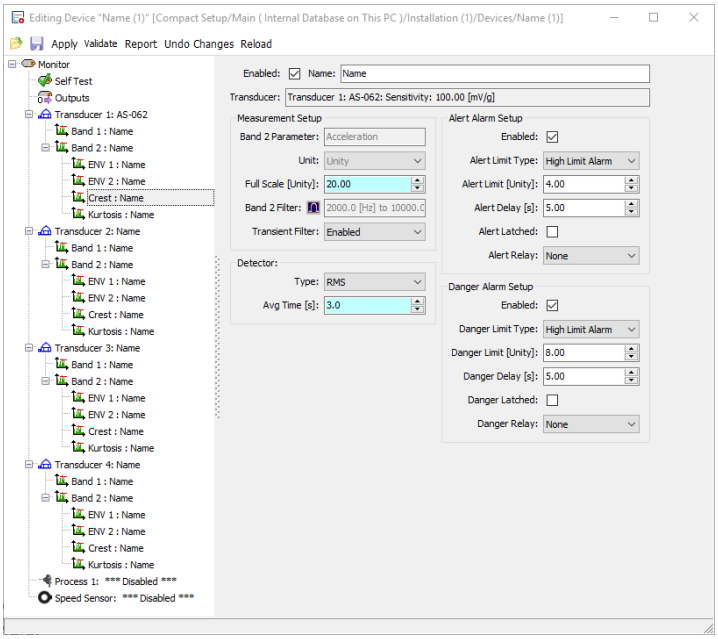
The “Crest Factor” is the ratio of the peak value to the RMS value of the vibration signal.

To include the Crest Factor as part of the general vibration analysis, this function must be enabled by marking: “Enabled”. The Crest Factor of a signal is a unit-less entity.

The calculation of the Crest Factor is carried out within the bandwidth of the band-pass filter selected in Band 2. Please keep in mind that the Crest Factor function only makes sense for high frequency analysis, i.e. with a Band 2 band-pass bandwidth starting at 2 kHz.

A transient filter is used to remove unwanted non-periodical noise spikes in the vibration signal that might else corrupt the measuring result and cause false alarms.

For the Crest Factor the RMS detector is automatically selected and cannot be changed.



The user may set/change the following parameters related to the Crest Factor using the Compact Commander Software:

- Full scale (unit-less)
  This value depends on the application but should never be set below: 10.0 The default value for this parameter is: 20.00
- RMS averaging time (in seconds). Selectable between 0.1 and 10.0 seconds This value should never be set below 3 seconds
  The default value for this parameter is: 3 seconds
- - Transient filter: enabled or disabled. This function is by default: enabled.

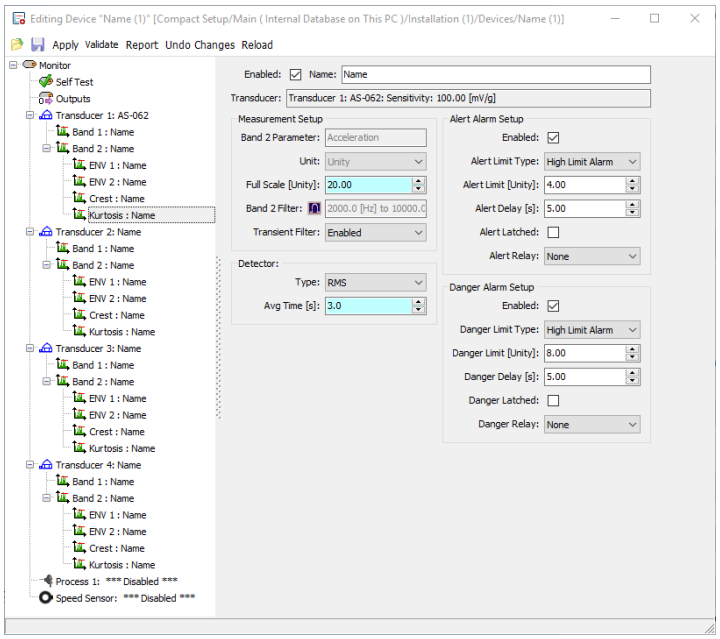
6.10 Kurtosis

The unit-less statistic index “Kurtosis” represents a very good indicator for the analysis in low speed machineries. To include the Kurtosis as part of the general vibration analysis, this function must be enabled by marking: “Enabled”. The Kurtosis of a signal is a unit-less entity.

A transient filter is used to remove unwanted non-periodical noise spikes in the vibration signal that might else corrupt the measuring result and cause false alarms.
The user may set/change the following parameters related to the Kurtosis using the Compact Commander Software:

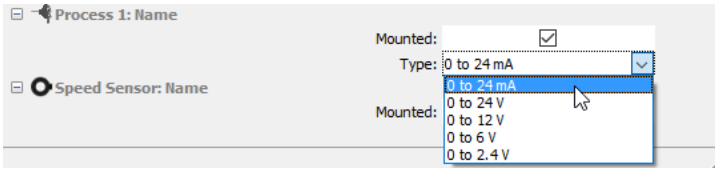
- Full scale (unit-less)
  This value depends on the application but should never be set below: 10.0 The default value for this parameter is: 20.00
- RMS averaging time (in seconds). Selectable between 0.1 and 10.0 seconds This value should never be set below 3 seconds
  The default value for this parameter is: 3 seconds
- Transient filter: enabled or disabled. This function is by default: enabled

The calculation of the Kurtosis is carried out within the bandwidth of the band-pass filter selected in Band 2. Please keep in mind that the Kurtosis function only makes sense for high frequency analysis, i.e. with a Band 2 band-pass bandwidth starting at 2 kHz.

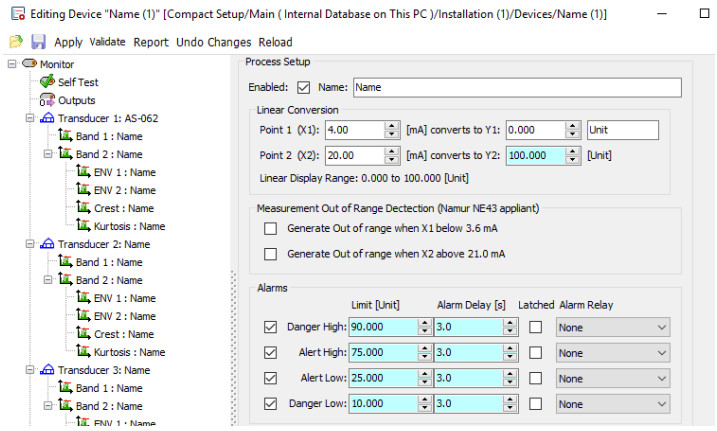


6.11 Process input (VC-1870 input for axial position)

Each VIBROCONTROL 18xx has one embedded Process Input. The input signal is a current or voltage that represents a linear relationship between voltage/current and a physical parameter like pressure, temperature, etc... Select Process Input type:



General setup of the Process Input under "Process 1: Name"
The parameter settings of the Process input (Process Setup) is performed under "Edit/Process 1: Name". The Process Input must be enabled.



The actual parameter settings of the Process input (Process Setup) is performed under "Edit/Process 1: Name" and carried out in four (4) stages:

- **Linear Conversion**

Under Linear Conversion the operator defines the linear (only) relationship between the input voltage/current and the corresponding value of the physical parameter measured by the connected external Transducer in either in the units belonging to that sensor, e.g. °C or Pa. A straight line between two points X1Y1 and X2Y2 represents the linear conversion.

- **Measurement Out of Range Detection (Namur NE43 appliant)**

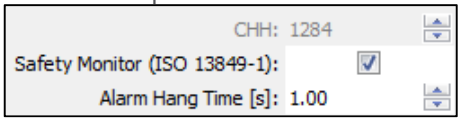
The sensor is considered to be out of range, if:

- the input at the Process 1 terminal has a value of 10 % below X_1
- the input at the Process 1 terminal has a value of 5 % above X_2

- **Alarms**

Set four (4) alarms within the values Y1 and Y2:

- Danger High: whenever the Y value exceeds an absolute maximum value that requires action
- Alert High: whenever the Y value exceeds a maximum value that requires attention
- Alert Low: whenever the Y value drops below a minimum value that requires attention
- Danger Low: whenever the Y value drops below an absolute minimum value that requires action



Activation of the “Protection System” feature:

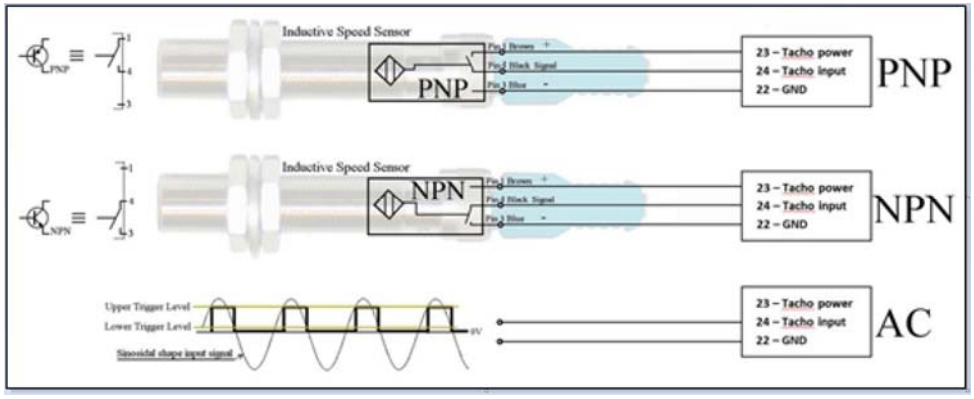
Selecting this feature will cause any Danger Low or Danger High alarm to activate the highly reliable System Failure relay

6.12 Speed Sensor (Tacho) input

General setup of the Tacho Input under “Speed Sensor: Name”
The parameter settings of the Tacho Input (Speed Sensor Setup) is performed under “Edit/Speed Sensor: Name”.
To start with the Tacho Input must be enabled by marking the small square field next to “Enabled:”
The actual parameter settings of the Tacho Input (Speed Sensor Setup) is performed under “Edit/Speed Sensor: Name” and carried out in four (4) stages:

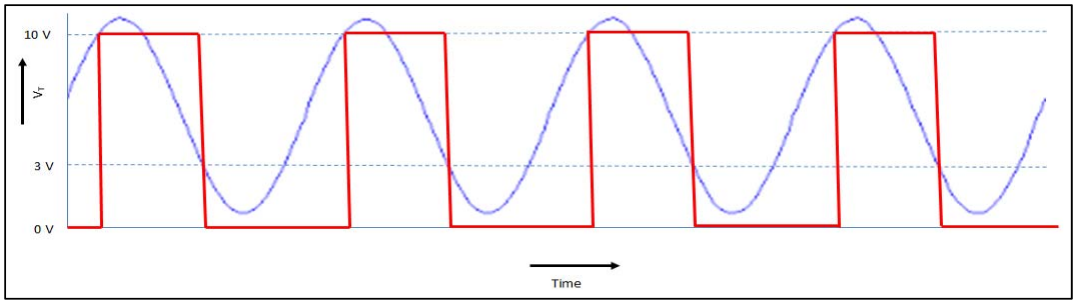
- **Properties**:
  Under “Properties” the operator first defines the type of speed sensor that will be connected to the Tacho terminal of the VIBROCONTROL 18xx.

Please refer to the drawing below to see how the VIBROCONTROL 18xx speed sensor input is connected to the different types of sensors.



The signal presented by the speed sensor (tachometer) to the VIBROCONTROL 18xx terminal #24 should comply to:
- Low level: 0 - 3 VoltPP
- High level: 10 - 24 VoltPP

The drawing below explains the function of the AC-triggered type of speed sensor:



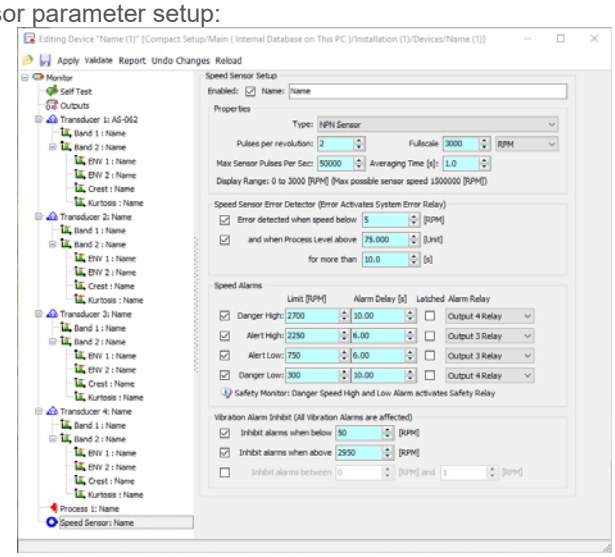
- The next step is to define the unit of rotation to be used:
  - ~ number of rotations per second (RPS)
  - ~ number of rotations per minute (RPM).
- The number of “Pulses per revolution (PPR)” is the number of pulses presented to the Tacho Input per one (1) revolution of the application.
- The value for the full scale in the display is chosen in the field “Fullscale” (FS). FS should have a value of at least 1 RPS/RPM and the value of PPRxFS may never exceed 50000 for RPS or 3000000 for RPM.

Alarm Inhibit (All vibration Alarms are effected)
In order to suppress alarms in certain speed ranges, speed intervals, speed overruns or speed underruns can be defined for which no alarm is to be triggered.

Speed Sensor Error Detector (Error Activates System Error Relay), when:

1) the sensor speed reaches a low value below a certain RPS/RPM.
2) the value of another parameter, e.g. temperature or gas pressure, connected to the “Process 1: Name” terminal exceeds a certain pre-set high level
3) the dangerous situation described under 1) and 2) lasts for at least a certain pre-set number of seconds

Example of a typical speed sensor parameter setup:



6.12.1 Speed sensor selection

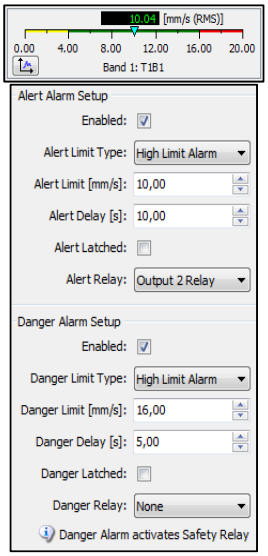
It is recommended to use either a NPN or PNP type, i.e. a standard interface that all Speed sensor suppliers meet with a variety of different probes.
Only 3-wires are needed: sensor DC supply, Signal and ground.
Some suppliers refer to NPN and PNP type Speed sensors as “3 Wire DC”.

6.13 Alert and Danger alarms

The final task associated with setting the parameters of each function, such as vibration, process and RPM measurement, is to set the alarm values. There are two alarms attached to each vibration measuring function: an Alert alarm and a Danger alarm.
Only enabled alarms will have a function in the safety task of the VIBROCONTROL 18xx device.
The parameter setup of the Alert alarm and the Danger alarm are very similar and consists of setting the following parameters:

- **Alert Limit Type**
  High Limit Alarm or Low Limit Alarm is the possible choice here. For normal operation (= default) the High Limit Alarm function is selected. The alarm will get triggered as soon as the value of the vibration parameter exceeds the pre-set trigger level for that particular alarm for a period longer than the Danger delay time.

However, if the end-user would like to have an alarm that instead triggers on a value below the pre-set trigger level for that particular alarm, the Low Limit Alarm function should be selected.



- **Alert Delay and Danger Delay time:**
  The delay time is the minimum continuous time that must have passed before the alarm in question is activated.
- **Alert Latched and Danger Latched:**
  A latched alarm will not be deactivated once the conditions for triggering a particular alarm in place. The alarm latch function can be initiated by marking the Alert Latched and/or Danger Latched.
- **Alert Relay and Danger Relay:**
  When an alarm is triggered, it can be signalled by one of the 4 outputs through one of the relays. For increased functional safety the Danger alarm can also be associated with the highly reliable System Failure redundant mechanical relays. See section 6.14 of this manual. By default the alarm relays will be pre-set to “None”.

6.14 System Failure (OK)

The VIBROCONTROL 18xx has an internal surveillance system, including a watchdog. This surveillance system will constantly monitor the correct functioning of the unit. As soon as an internal fault is detected, such as a sensor bias error, a processor error, or a not-passed self-test, this is considered to be a very serious situation and a system failure procedure will be activated.

The system failure safety relay has a “break” function so that a power failure will also be detected and considered to be a system failure as well.

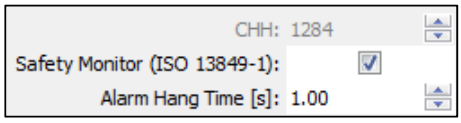
Whenever a system failure is detected the following actions are taking place:

- System failure safety relay will be activated (break)
- The analog output drops to 0 mA
- The „OK“ LED at the front panel of the enclosure will either flash **Red** for critical errors or light continuously **Red** for non-critical errors.

The action of the System Failure relay outputs at terminal #3 and terminal #4 are both insulated from ground (GND) and therefore galvanic insulated from the rest of the VIBROCONTROL 18xx device.

The System Failure output of the VIBROCONTROL 18xx consists of two mechanical relays that are coupled in series. This redundancy considerably increases the reliability of the System Failure safety relay.

During the configuration procedure of the VIBROCONTROL 18xx it is possible under Edit/Monitor to mark the feature “Protection System (ISO 13849-1)” and set its alarm hang time.



Selecting this feature will cause any danger alarm to activate the highly reliable System Failure relay. “Borrowing” the system failure safety relay for Danger alarms drastically increases the reliability of any Danger alarm function and thus the level of functional safety of the machine of which the VIBROCONTROL 18xx monitors the vibration.

An enabled Protection System Feature will be indicated by “Danger Alarm activates OK Relay.

In case of a persistent system failure, please return your device to the manufacturer for repair.

The system failure relays are mechanical relays. Excessive current and/or voltage will damage the relay. For this reason, please do not apply any power source directly to the relay. Protect the relay with a resistor in series that will limit the current.

The following conditions for the OK relay output should not be exceeded in your application:

- Insulation 100 V
- Maximum current load 100 mA
- Max load voltage ±28 V Further specifications:
- ON resistance < 12.9 Ω
- Off state leakage current max. 10 µA

6.15 Alarm Hang Time

The “Alarm Hang Time” is the time an alert or danger alarm remains activated even though the vibration level has decreased to below the trigger level.
The system failure relay has no hang time, but will remain activated until the system failure condition has ended.

6.16 Overload, Cable Short and Cable Break

The VIBROCONTROL 18xx watchdog surveys each pair of input terminals where the sensors are connected to the device:

- Terminals #13 and #14 for sensor 1
- Terminals #15 and #16 for sensor 2
- Terminals #17 and #18 for sensor 3
- Terminals #19 and #20 for sensor 4

The detection of an overload condition generates a system failure (NOK status). The OK relay is active. The OK LED shows NOK.

The DC analog output will move to 0 mA to indicate the overload condition as a failure.

6.17 Over range

The VIBROCONTROL 18xx Vibration Monitor is provided with an over range detection system that detects the occurrence of an over range situation, i.e., when the vibration level exceeds the maximum vibration level of the measuring range.

The detection of an over range will not generate a system failure.

The DC analog output will move to 20,5 mA to indicate the over range condition.

The status of the alarm relays will not change.

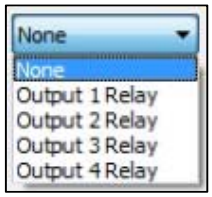
6.18 Output configuration

The VIBROCONTROL 18xx has four independent outputs at terminals #9, #10, #11 and #12 that can be configured to have either the function of a relay, or become a DC analog output, which is direct proportional to the vibration level of the function the Analog DC output is assigned to. The selection of the four outputs is described in section 6.4.

6.18.1 Relays

The VIBROCONTROL 18xx Vibration Monitor has four solid state alarm relays that can be attached to any of the alert and danger alarms. Relays must be enabled in order to become activated, if triggered.
One alarm relay can serve more than one alarm thus making it not always possible to immediate determine exactly which vibration measuring function caused an alarm relay to become activated.

The “contacts” of all alarm relays are closed (= make) while in standby and open (= break) when activated. Therefore the alarm relay(s) also appear to be activated whenever the main power of the VIBROCONTROL 18xx fails.

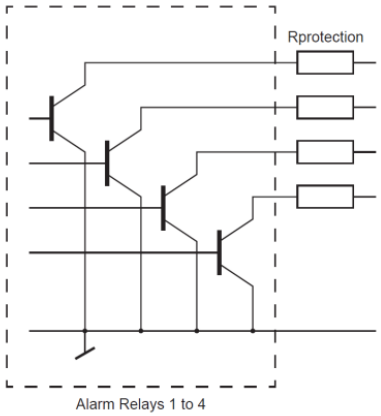


The four VIBROCONTROL 18xx solid-state alarm relays are named respectively: “Output 1 Relay” (terminal #12), “Output 2 Relay” (terminal #11), “Output 3 Relay” (terminal #10) and “Output 4 Relay” (terminal #9). Relays will only be available at a particular output (terminal), if a relay was selected during the configuration of that output. For a detailed description about how to configure the outputs of the VIBROCONTROL 18xx, please read section 6.4 of this manual.

The alarm relays are non-insulated MOSFET relays that only will work with positive voltages. Excessive current and/or voltage will damage the relay. For this reason please do not apply any power source directly to the relay. Protect the relay with a resistor in series that will limit the current.

The following conditions for the relays should not be exceeded in your application:

- Type:	Open drain
Insulation	30 V
- Maximum current load	100 mA
- Max load voltage	+28 V
Further specifications:	
- ON resistance	< 12.9 Ω
- Off state leakage current max.	10 µA



6.18.2 Analog outputs

There are four different analog dc output configurations that can be selected:

- 0 – 20 mA
- 4 – 20 mA, which is the default configuration of an Analog DC output
- 0 – 10 V
- 2 – 10 V

For example:
An output current of 4 mA at the dc output represents a minimum value of 0, e.g. 0 mm/s, while 20 mA at the output represents full scale, e.g. 100 mm/s.
Any value between 0 mm/s and 100 mm/s will then be positioned directly linear between 4 mA and 20 mA at the analog output.

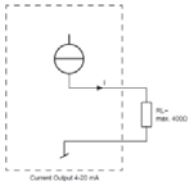
Example 1: the vibration level is a known 60 mm/s. The analog output should show:

$$I_{\text{out}} = 4\,mA + \frac{Velocity}{Full\ scale} * (16\,mA) = 4\,mA + \frac{60\ \frac{mm}{s}}{100\ \frac{mm}{s}} * (16\,mA) = 13.6\,mA$$

Example 2: the analog output shows 15 mA. The velocity is:

$$Velocity = Full\ scale + \frac{I_{\text{out}} - 4\,mA}{16\,mA} = 100\frac{mm}{s} * \frac{15\,mA - 4mA}{16\,mA} = = \ 68{,}75\,\frac{\text{mm}}{s}$$

The load impedance on the analog dc current output should not exceed 400 Ω.



6.19 Light Emitting Diodes (LEDs)

Status

Green:

- Normal operation. No events.

Yellow-flashing:

- Selftest

Red - flashing:

- System Failure

Red:

- Cable short / Break , together with flashing Red Channel LED

Ch. 1/2/3/4

Green:

- Normal operation. No events.

Yellow:

- Alert alarm

Red-flashing (50/100%):

- Danger alarm
- Cable Short, together with Red Status LED
- Cable Break, together with Red Status LED

Term. active

A Blue LED marked “Term. active” at the front panel of the VIBROCONTROL 18xx enclosure indicates whether a 120 Ω termination resistor is in place between the contacts of the yellow RS-485 connector. This is required in case the VIBROCONTROL 18xx in question is the last device in a chain of devices on a RS-485 bus. The termination resistor is (de-)activated by sliding (left/right) a very small button that can be found behind a small hole at the front of the enclosure.

6.20 Reset of Alarms

An active non-latched Alert or Danger alarm will automatically be cleared when the vibration level is reduced below its trigger level for a period longer than the hang time of typical 1 second.

An active non-latched Alert or Danger alarm will automatically be cleared when the vibration level is reduced below its trigger level for a period longer than the hang time of typical 1 second. Alarms that are latched can be reset by connecting the “Alarm Inhibit” (at terminal #5) to ground (GND) for a short while. This procedure will reset all Alert and Danger alarms at once.

When an alarm is cleared the corresponding channel LED at the front panel of the VIBROCONTROL 18xx will turn **Green**.

6.21 Inhibit Alarms

Alarms can be inhibited (disabled) under certain process conditions (for example, for certain speed ranges).

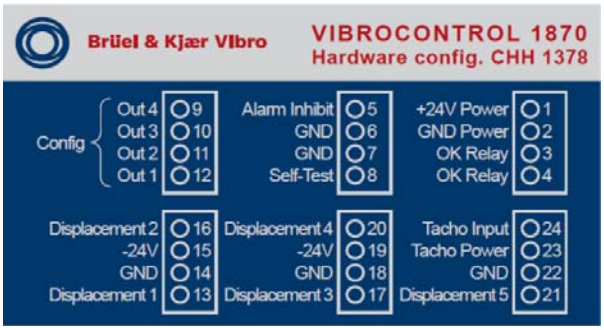
Inhibit is activated by connecting terminal #5 on the enclosure (marked: “Alarm Inhibit”) to ground (GND), e.g. terminal #6. This procedure will inhibit all Alert and Danger alarms at once, but NOT a System Failure alarm.

Please note that inhibit overrules the latch function. Any latched alarms (except the system failure alarm) will be reset after “Alarm Inhibit” has ended.

Inhibit should be used with care. Leaving the vibration monitor with “Inhibit” ON would disable all Alert and Danger alarms.

7 VIBROCONTROL 1870 - Displacement measurement

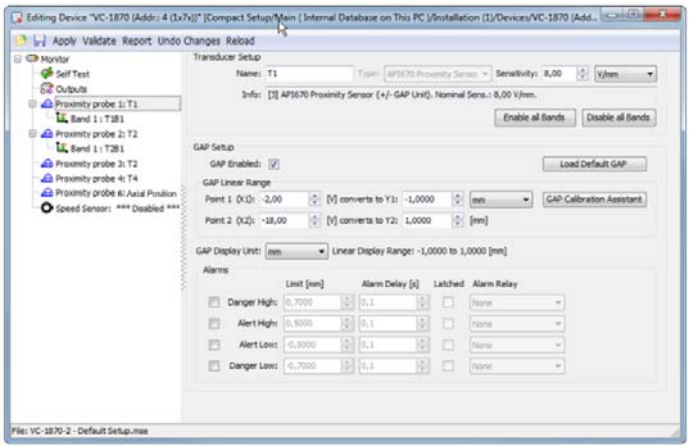
- Relative shaft vibration 4 channels (Input Terminals 13 – 20)
- Axial shaft position 1 channel (Input Terminals 21 – 23)
- Speed 1 channel (Input 23 – 24)



7.1 VIBROCONTROL 1870 – 4-channel - relative shaft vibration

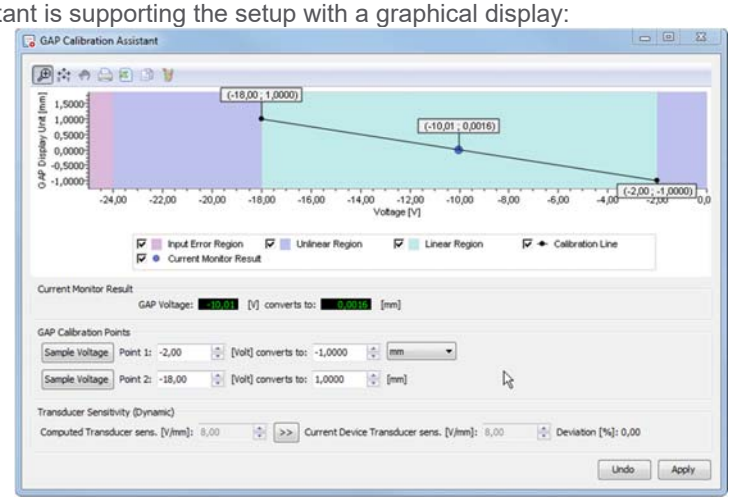
Specific setup of VIBROCONTROL 1870 relative shaft vibration

The setting of the measuring parameters of the VIBROCONTROL 1870 can be carried out with Compact Setup Software:

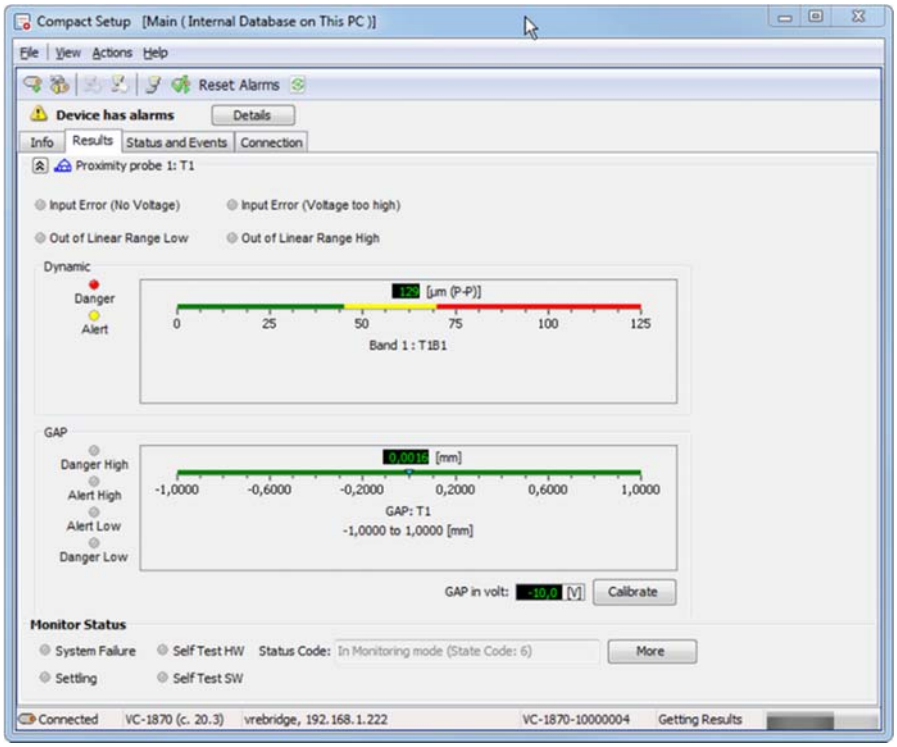


Four displacement sensors can be connected to monitor relative shaft vibration. For setup the gap voltage needs to be adjusted with in a range from -2 to -18 V DC. Ideally the sensor positioning should be close to -10 V DC to allow maximum of relative shaft vibration in both direction.

The GAP Calibration Assistant is supporting the setup with a graphical display:

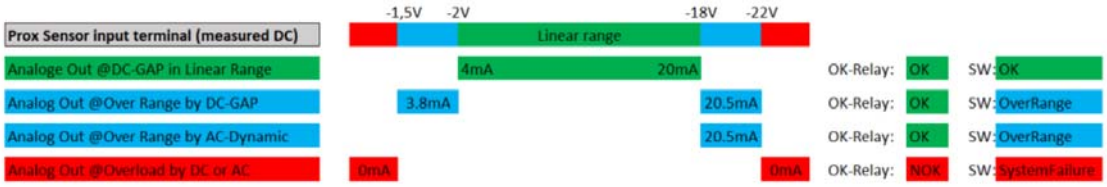


The measurement results for the relative shaft vibration and corresponding GAP value are displayed via results button:



Overload and Over range detection

The graphic below is describing the instrument behavior during over range and overload situations.



Over range detection
When AC Dynamic (relative shaft vibration) is in Over Range:

- the corresponding analog output is set 20.5 mA.

When DC-GAP (sensor GAP position) is in Over Range:

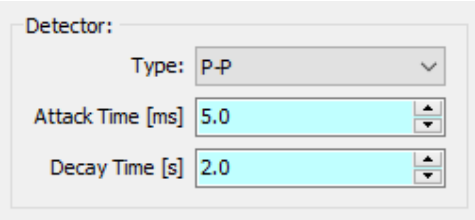
- analog output will saturate at either 3.8mA (lower) or
- analog output will saturate at 20.5mA (upper)

-see the blue colour in graphics above.

Overload Detection
When AC (relative shaft vibration) or DC (sensor GAP position) Overload is detected:

- the analog output is set to 0 mA
- the system error relay is activated (red LED)

Special Hint for Peak to Peak measurements:



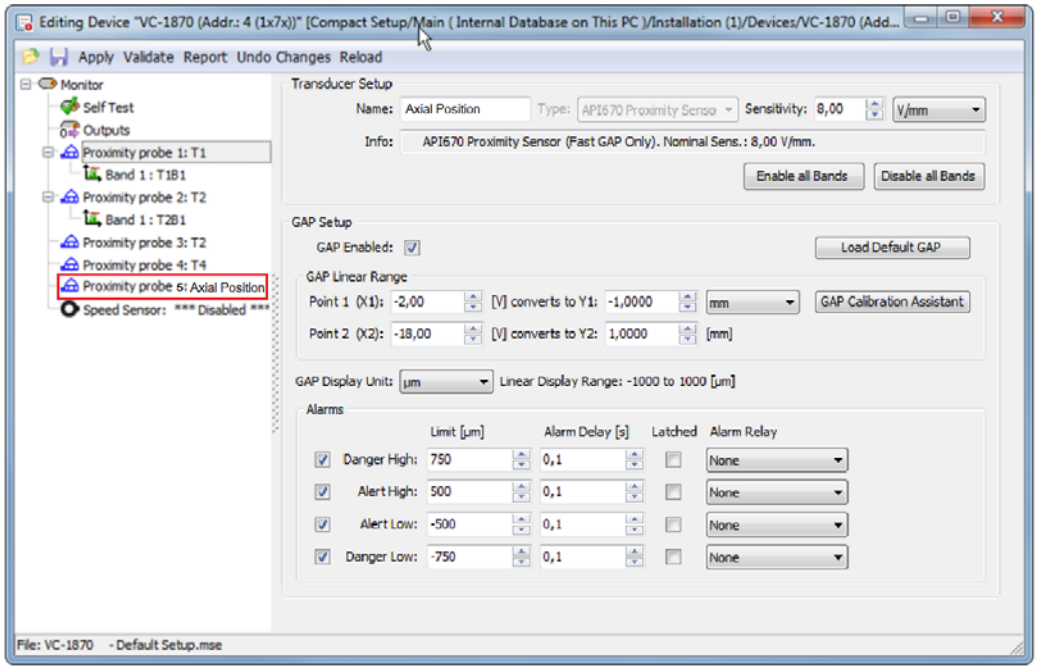
The default setup for Peak to Peak Measurements shows Attack Time of 5.0 ms and the Decay time shows of 2,0 s.
Shorter attack and decay times may lead to a reduced accuracy of the measurements. This is also valid for peak measurements.

7.2 VIBROCONTROL 1870 – Axial shaft position

Specific setup of VIBROCONTROL 1870 - One Channel - Axial shaft position (via Terminal 21 & 22)

PLEASE NOTE:
For VIBROCONTROL 1850 & 1860 terminal 21 & 22 are labelled and used for process input.

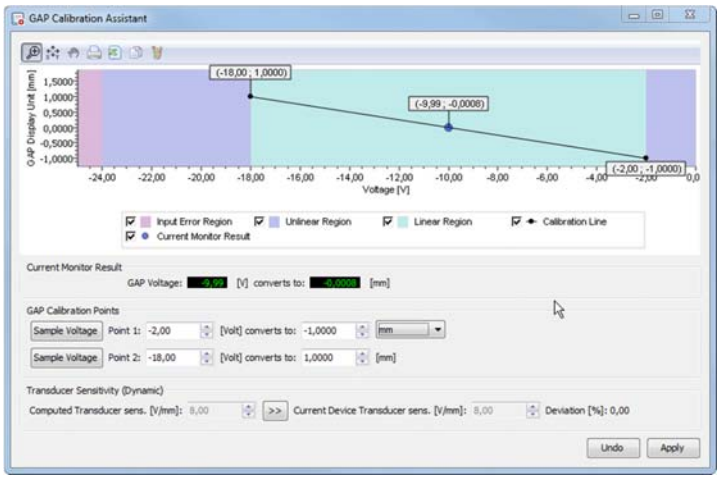
The setting of the measuring parameters of the VIBROCONTROL 1870 for axial shaft position measurement can be carried out with Compact Setup Software:



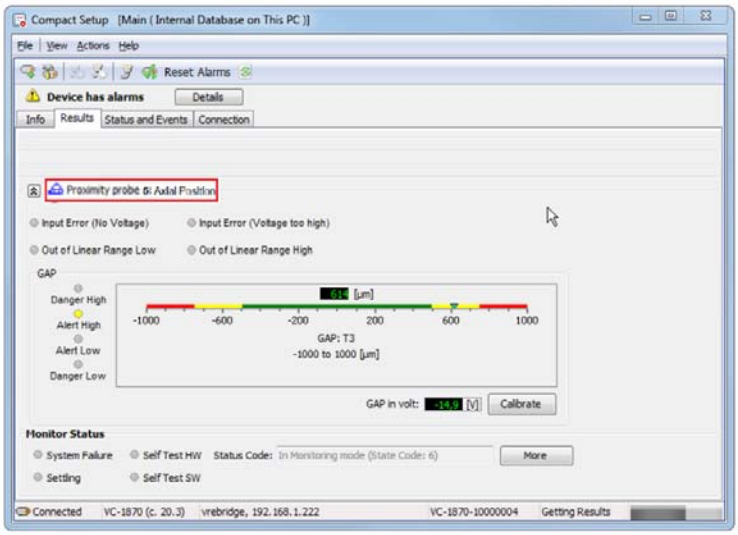
One displacement sensor can be connected to monitor axial shaft position (Terminal 21 to 23).
For setup the gap voltage needs to be adjusted with in a range from -2 to -18 V DC.

- For monitoring axial position in both direction (towards and away from the sensor) ideally the sensor positioning should be close to -10 V DC to allow maximum of relative shaft vibration in both direction (in this case + 1mm and – 1 mm).
- For monitoring axial position only in one direction the GAP position for the sensor should be closed to either -2 V DC or -18 V DC.

The GAP Calibration Assistant is supporting the setup with a graphical display:



The measurement results for the axial shaft position and corresponding GAP value are displayed via results button:



Overload and Over range detection

See VIBROCONTROL 1870 above.

8 Extension Modules for VIBROCONTROL 1850/1860/1870

8.1 VIBROCONTROL 1801 Relay Module- 12 relays

8.1.1 General

With four alarm relays inside each VIBROCONTROL 18xx it will be necessary to associate more than one alarm to at least one relay (i.e. “overlapping” alarms) if relay outputs are chosen for five or more different alarms.
If one or more outputs of a VIBROCONTROL 18xx are configured not to be a relay but e.g. an analog output such output cannot be configured to have a relay function simultaneously. This means that if each of the four available VIBROCONTROL 18xx outputs is associated with a sensor analog input signal there will not be any relay(s) available for alert or danger alarms of any vibration parameter monitored. By attaching a VIBROCONTROL 1801 Relay Module to a VIBROCONTROL 18xx there will be always twelve alarm relays available.

8.1.2 VIBROCONTROL-1801 Relay Module

VC-1801 Relay Modules to one VIBROCONTROL 18xx. This will increase the number of relays with 12 additional.

Relay box select switch:

The front panel of the VC-1801 Relay Module has a small switch that has two positions:

- Relay-Module: Default switch position (1) when a VC-1801 is connected to a VIBROCONTROL 18xx (switch position (2) dedicated for future expansion).

8.1.3 Make/Break of relays

All solid-state relays of a VC-1801 Relay Module are by default configured to go from the “make” to the “brake” status when the associated alarm in a VIBROCONTROL 18xx is activated. This has the advantage that the relay(s) will act as being activated in case of a power failure.

8.1.4 Mounting

The VIBROCONTROL 18xx and the VC-1801 relay Module(s) must be positioned next to each other with both 5- pin DIN-rail bus connectors in place.

It does NOT matter at which side of the VIBROCONTROL 18xx the VC-1801 Relay Module is positioned.

There may NOT be more than one (1) VIBROCONTROL 18xx on the same DIN-rail bus connection.

8.1.5 External connections

Power:

The VC-1801 Relay Module gets its main power from an adjacent VIBROCONTROL 18xx via the 5-pin DIN-rail bus connector at the bottom of the DIN-rail enclosures.

Before connecting the VIBROCONTROL 18xx and VC-1801 together by joining the DIN-rail connector at the bottom of both devices we strongly recommend:
PLEASE, FIRST DISCONNECT THE VIBROCONTROL 18xx FROM THE MAIN POWER.
Although there have been taken sufficient measures to allow a hot-swap of the VIBROCONTROL 18xx and VC-1801 devices there is still a remote chance that one of the devices will get damaged in the process.

Data:
The dataflow between the VIBROCONTROL 18xx and the VC-1801 Relay Module takes (also) place via the 5-pin DIN-rail bus connector at the bottom of the DIN-rail enclosures.

Relays:
The “contacts” of the twelve relays are pairwise present at the screw terminals at the side of the VC-1801 enclosure.
A label on the VC-1801 Relay Module clearly indicates the relationship between the relays and the terminals.

8.1.6 Front panel status LED

The front panel of the VC-1801 Relay Module has a multi-coloured LED that indicates the current status of the device:

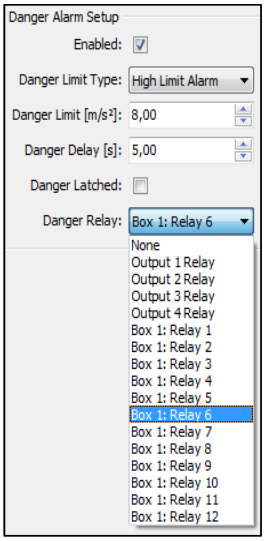
- **Green:** Indicates that the main power (+24 VDC) is connected and that the VC-1801 is in good working condition.
- **Yellow:** Upon initialisation after start-up the LED turns yellow for a very short time to indicate a system boot up.
- **Red:** Indicates that there is something wrong and that the VC-1801 is not in a good working condition. Most of the time the cause is a communication- or configuration error between the VIBROCONTROL 18xx and the VC-1801. Whenever there the LED on the VC-1801 is **red** the „OK“ LED on the VIBROCONTROL 18xx will show **red** light as well (System Error).

8.1.7 Configuration of VC-1801 using the Compact Setup Software

In Compact Setup make sure that the Relay Module feature is enabled: Edit / Monitor / Outputs / Relay Module 1 / Enabled – Mark box (= Yes). The LED on the front plate of the VC-1801 Relay Module should show green light indicating that the VIBROCONTROL 18xx and the VC-1801 are communicating.

To set-up a stand-alone VIBROCONTROL 18xx there will be a listing of zero to four relays depending on how many outputs have been assigned to be a relay.
As soon as a VC-1801 Relay Module has been connected to a VIBROCONTROL 18xx the above mentioned listing is increased by twelve more relays.

One vibration parameter alarm can only have one relay associated with this alarm. An alarm relay can be associated with one or more vibration parameter alarms.



8.1.8 Connecting of a VIBROCONTROL 18xx and a VC-1801

The procedure is as follows:

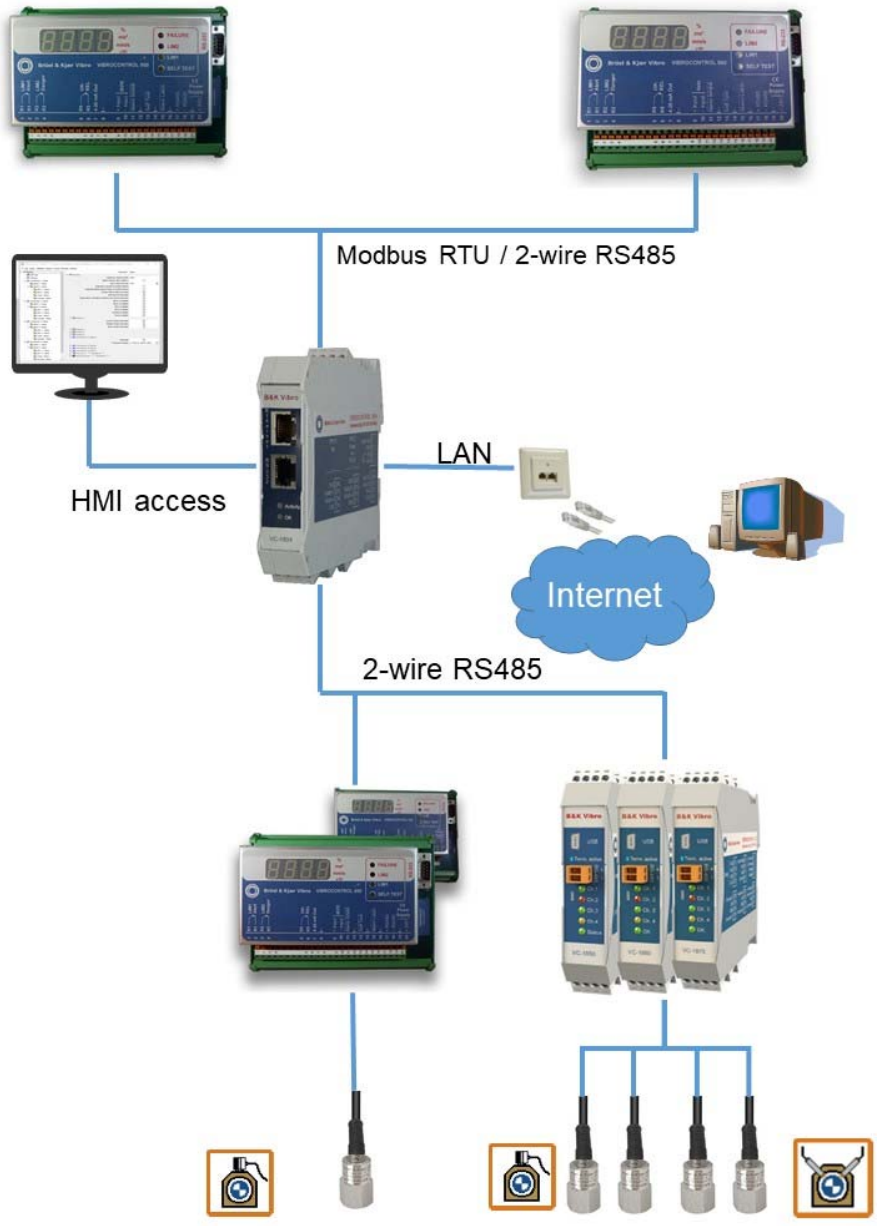
- Set the relay box select switch on the front panel of the VC-1801 to “Module 1” (or “Module 2”)
- Mount the VIBROCONTROL 18xx and VC-1801 Relay Module together using the DIN-rail bus connectors
- Place the two modules on a 35 mm DIN rail
- Connect the VIBROCONTROL 18xx to the 24 VDC main power
- You will now see that the status LED on the front panel of the VC-1801 has a red colour
- Connect the VIBROCONTROL 18xx to a PC that has the Compact Setup software installed using e.g. a USB connection cable
- In Compact Setup enable the Relay Module: Edit / Monitor / Outputs / Relay Module 1 / Enabled – Mark box (= Yes)
- In Compact Setup press “Apply”:
  Edit / Apply, even though you have NOT changed any parameters
- Note that the VC-1801 status LED changes colour from red to green.

One In the unlikely event that there is a loss of communication between the VIBROCONTROL 18xx and the VC-1801 Relay Module, the above described procedure may also be used to re-establish the communication between the two devices.

8.2 VIBROCONTROL 1803/1804 Communication Module - Etherbridge

8.2.1 Network

The VIBROCONTROL 1803/1804 is the interface between vibration monitor(s) that have their communication ability (using RS232C or RS485) enabled and a remote PC (using LAN and/or the internet).



8.2.2 Applications

The VIBROCONTROL 1803/1804 allows communication between one or more vibration monitor(s) and one or more remote PC(s) or PLC(s) in a local network (LAN) or – if required – over long distances via the internet. Furthermore, the VIBROCONTROL 1804 includes data logging of measurement data and alarms for off-line post analysis in Compact Commander Analyzer. Data logging is especially useful when an internet connection and/or a local PC are not present.
Permanent cable installation is easily done by means of screw terminals. LAN and RS 232 connectors are positioned in the front for better accessibility for frequent download of data or for later connection while in operation.
Either of two COM-ports on the side of the device can be used for communications with each its own daisy chain of Vibration monitors using a proprietary RS485 protocol.

8.2.3 Features

Communication hardware

- RS 485, RS 485/232(Shared) and Ethernet

Communication protocols

- Modbus RTU over Ethernet to RS 485/232
- Modbus TCP converted to Modbus RTU
- Modbus TCP converted to VC-18xx

OPC UA

- Read/Write/Browse

Data storage (only VIBROCONTROL 1804)

- Storage capacity 3 GB

Administrative features

- Firmware upload
- SLP Discovery (Service Local Discovery)
- Configuration/Administration of the VIBROCONTROL 1803/1804 via HTTP (the device has its own “homepage”)

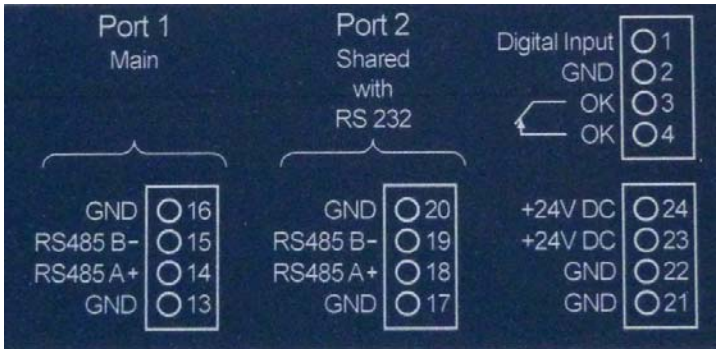
- **Power supply:** +24 VDC
- **Mounting:** on a DIN Rail in an enclosure (recommended)
- **Dimensions:** 120x110x23 mm
- **Housing:** hard plastic, light grey RAL 7031

8.2.4 Functionality

VIBROCONTROL 1803/1804 connects multiple Vibration Monitors to Ethernet and offers communication protocols like Modbus TCP and OPC UA for HMI devices.

The screw terminals on the side are numbered from #1 to #24:

Terminal #	Function
1	Digital input
2	GND
3	Relay A
4	Relay B
5	NC
6	NC
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC
13	GND
14	COM1 – RS485; A+
15	COM1 – RS485; B-
16	GND
17	GND
18	COM2 – RS485; A+
19	COM2 – RS485; B-
20	GND
21	GND
22	GND
23	+ 24 VDC
24	+ 24 VDC



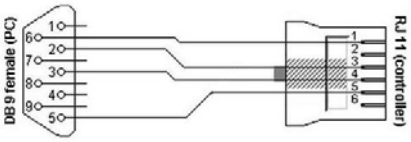
As described later in this manual the VIBROCONTROL 1803/1804 has two serial ports: COM1 (terminals #14 and #15) and COM2 (terminals #18 and #19). Both are used for RS485 communication with vibration monitors.

Screw terminals #21 to #24 are used to connect the VIBROCONTROL 1803/1804 to the 24 VDC of the main power supply. There are two pairs of 24 VDC connections: “#21 and #22” plus “#23 and #24”.
We suggest to use one pair for connection to either the main power supply or the nearest powered module on the DIN-rail. Use the second pair for connection to the nearest still unpowered module on the DIN-rail – if any.

In addition, there are two connectors on the top plate marked “Ethernet” and “RS232” respectively.

The Ethernet (LAN) connection is used for the permanent communication channel between the PC and the VIBROCONTROL 1803/1804. The recommended connection cable is a standard LAN cable (CAT.5E).

For the connection of measuring devices with RS232 connectors (VIBROCONTROL 950/960) use a female 9-pin DB connector on one side (RS232 connector on vibration monitor) and a RJ11 connector on the other side (RS232 connector on VIBROCONTROL 1803/1804).



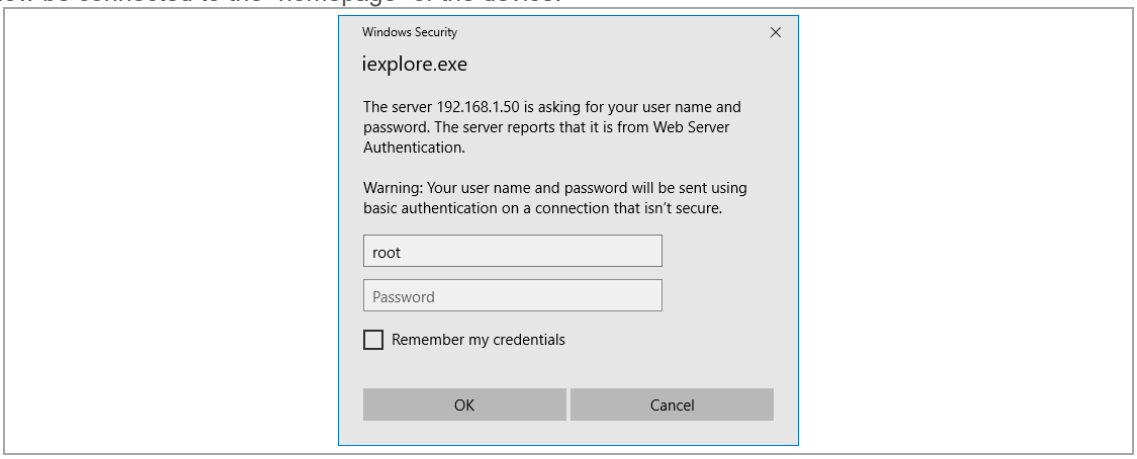
DB9	RJ11	Function
2	3	RxD ← TxD
3	4	TxD → RxD
5	5	Signal ground
6	1	DSR ← DTR

8.2.5 Configuration of VIBROCONTROL 1803/1804

Upon delivery, the setup parameters of the VIBROCONTROL 1803/1804 are set to factory default values.
Connect the device to your local network (LAN) using a LAN-cable.
The device is default set to DHCP, which means that it will automatically get an IP address within the boundaries related to the local network.
Any PC attached to the same network should now be able to “see” this device.
Any software capable of finding devices on a local network should be able to find the VIBROCONTROL 1803/1804 and disclose the actual IP address.
For configuration the Compact Setup Software is necessary.

8.2.5.1 Access to Webpage of VIBROCONTROL 1803/1804

To find out the IP address of VIBROCONTROL 1803/1804 use one of these methods.
If the IP address e.g. is 192.168.1.50, please use a web browser and enter the URL: http://192.168.1.50.
You will now be connected to the “homepage” of the device:



Enter the following data:

- User name : root
- Password : password

Click on OK to bring you to the next “Info” window.
If you mark “Remember my credentials”, you will be brought to the next Info window without re-typing the user name and password.

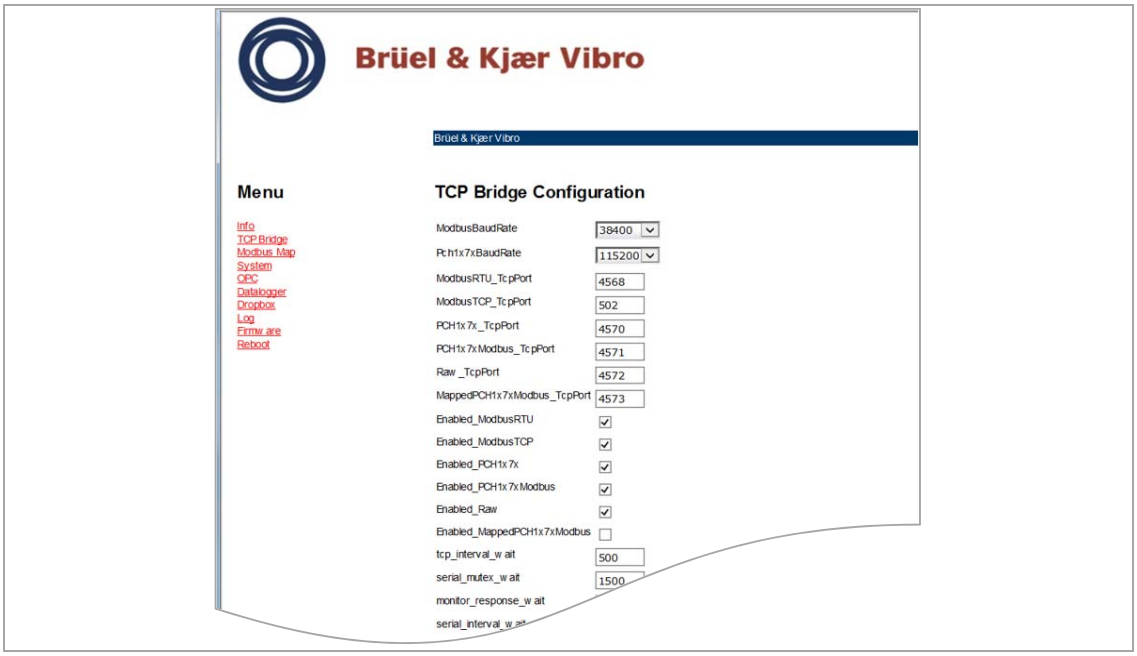
8.2.5.2 Menu: Info

This information window lists a number of the current parameters used by the device.

The MAC Address is a given value that can be changed only by the manufacturer

The IPv4 Address is the address provided by the DCHP procedure of set earlier under IPv4 Settings in the System chapter of this manual.

8.2.5.3 Menu: TCP Bridge



The VC-1803/04 has basically two paths to communicate with the outside world:

- Modbus
  Modbus communication covers the data transfer between the VC-1803/04 and the PC via a LAN connection

The ModbusBaudRate is the speed of the communication between the LAN (PC) and the VC-1803/04. It is default set to 38400 and should only be changed if absolutely necessary.

There are two possible ways of Modbus communication each having their own PCP-port:

- ModbusRTU: Enabled by setting a mark at Enabled_ModbusRTU and using TCP-port ModbusRTU_TcpPort, which is 4568 by default
- ModbusTCP: Enabled by setting a mark at Enabled_ModbusTCP and using TCP-port ModbusTCP_TcpPort, which is 502 by default

Please make sure that the default choice of TCP-ports is not in conflict with the ports of any other device already connected to the local network.

- Serial (PCH1x7x)
  Serial communication covers the data transfer between the VC-1803/04 and the vibration monitor(s) via a RS232C connection (one vibration monitor only) or a RS485 connection (one or more vibration monitors).

The Pch1x7xBaudRate is the speed of communication between the “slowest” vibration monitor and the VC-1803/04. It is default set to 115200 and should only be changed if absolutely necessary.

There are two possible ways of serial communication each having their own PCP-port:

- PCH1x7x: Enabled by setting a mark at Enabled_PCH1x7x and using TCP-port PCH1x7x_TcpPort, which is 4570 by default
- PCH1x7xModbus: Enabled by setting a mark at Enabled_PCH1x7xModbus and using TCP- port PCH1x7xModbus_TcpPort, which is 4571 by default

Please make sure that the default choice of TCP-ports is not in conflict with the ports of any other device already connected to the local network.

The tcp_interval_wait indicates the maximum time (ms) allowed between the data packs in TCP mode. If this value is exceeded a time-out error will be the result.

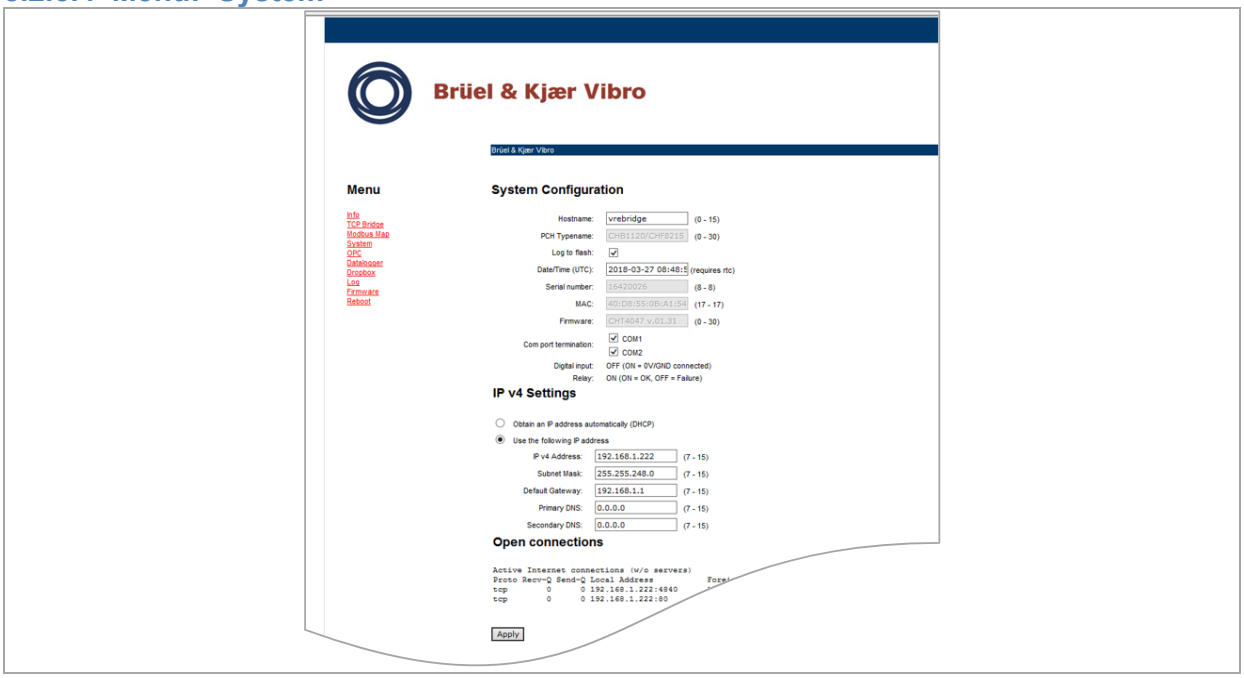
The serial_mutex_wait indicates the maximum time (ms) allowed for the UART (RS232 or RS485) before it is ready for action (again). If this value is exceeded a time-out error will be the result.

The monitor_response_wait indicates the maximum time (ms) the VC-1803/04 will wait for a response from a certain attached vibration monitor after the device has sent a data-request to this monitor. If this value is exceeded a time-out error will be the result.

The modbus_interval_wait indicates the maximum time (ms) allowed between the data packs in serial mode. If this value is exceeded a time-out error will be the result.

The VC-1803/04 has two COM-ports available for serial communication with the vibration monitors. Only one COM-port may be used at any time. By choosing “None”, the COM- port on the top panel will act as a RS232C connection.

8.2.5.4 Menu: System



The System page of the VC-1803/04 “homepage” allows the setting or reading of a few general parameter settings:

- Hostname: At this position the user is free to enter a relevant name for the device
- PCH Typename: The name given to the device by the manufacturer. The user has no influence on this read-only parameter
- Log to flash: By marking Log to flash the log file will be stored in the internal flash memory of the device
- Date/Time: At this position the user can set the date and time that will be displayed in connection with data logging. Please note that Date/Time will be reset to its default value (2007-01-01 00:00:24) each time the power has been removed from the device.
- Serial number: The number shown here is the serial number of the device as it was set by the manufacturer prior to shipment. The user has no influence on this read-only parameter
- MAC: The unique number of the device in cyber space entered by the manufacturer. The user has no influence on this read-only parameter
- Firmware: Here the firmware version of the device is shown. It is possible to change the firmware of the device using a procedure described in the chapter Firmware.

In addition this page is also used to control the IP v4 address of the device. By default the unique IP address is provided automatically by the host of the local network (DHCP).
However, the user has the possibility to force the device to have a certain fixed IP v4 address. This requires that the following parameters must be entered:

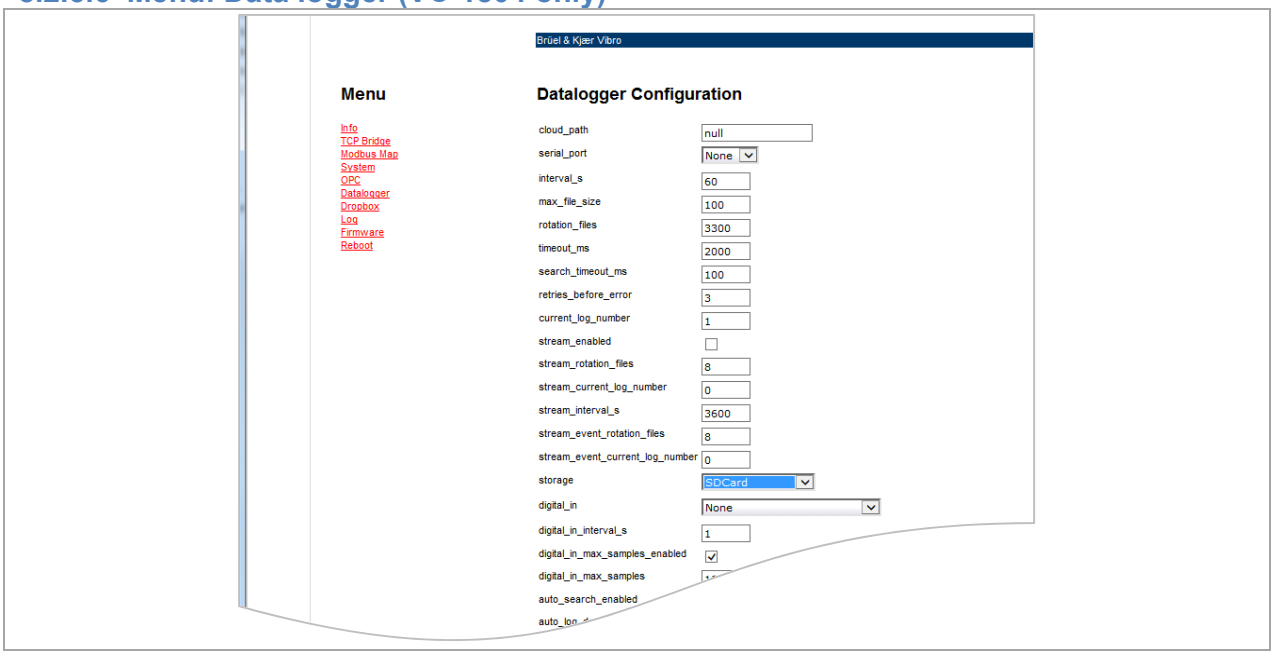
- IP v4 address: “A.B.C.D” is the unique address of the device in the local network, where A, B and C are the same as for the Gateway. “D” may be any number between 2 and 255, but NOT be equal to any other device in the local network. Please check available numbers for “D” before entering a value her
- Subnet Mask: Normally “255.255.255.0”

- Default Gateway: “A.B.C.1” is the address of the host in the local network. If you don’t know this address, please ask your IT Manager
- Primary DNS: The default value of “0.0.0.0” is usually adequate
- Secondary DNS: The default value of “0.0.0.0” is usually adequate

8.2.5.5 Menu: OPC

The VC-1803/04 can be used in an OPC environment. The parameter settings on this page are provided by the manufacturer upon shipment of the device and should not be changed unless advised by the manufacturer after consultation.

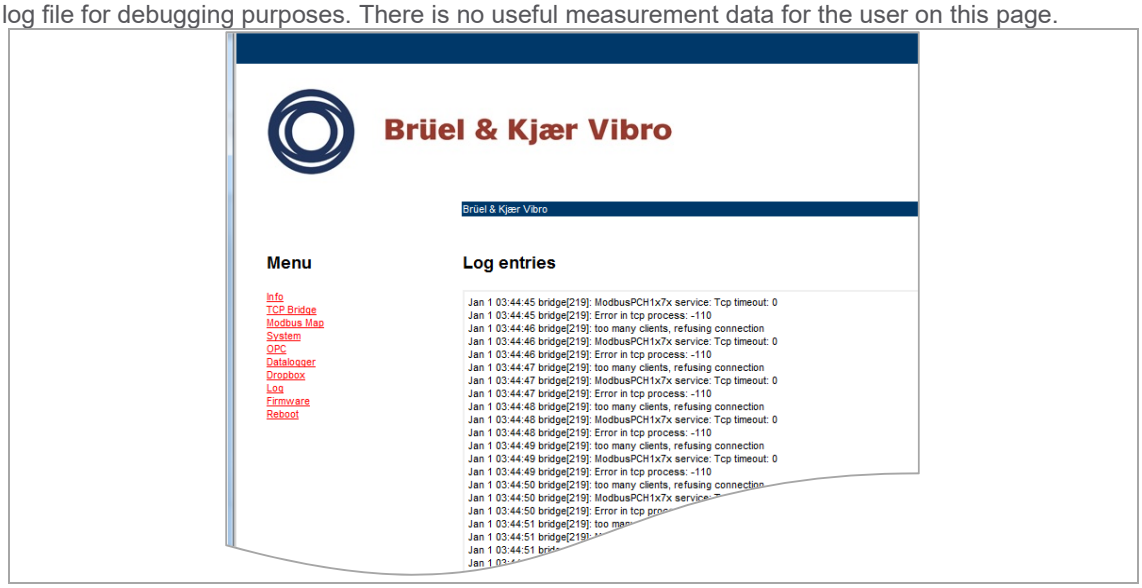
8.2.5.6 Menu: Data logger (VC-1804 only)



Only the VC-1804 has a data logging feature that allows storage of data from either the RS232 port, the COM1 port or the COM2 port. The data logging is enabled by marking Log to flash in the System window.

8.2.5.7 Menu: Log

This is a log file for debugging purposes. There is no useful measurement data for the user on this page.



8.2.5.8 Menu: Firmware

The firmware page should only be visited if the user must upload a new firmware version for the VC-1803/04 and has received a bundle of necessary (.BDL and/or .MSE) files from the manufacturer. Store these files on your HDD for later use.
There are two different files available for an update:

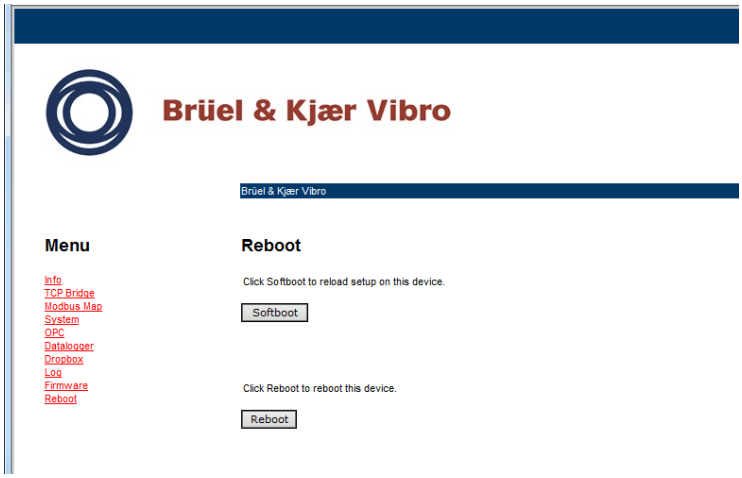
- Bundle (pch): Enter here the path where you stored the .BDL firmware data file from the manufacturer
- MSE (pch): Enter here the path where you stored the .MSE parameter setup data file from the manufacturer or one you stored earlier

If the device is functioning properly the user may store the current parameter settings of the device under “Downloads” to generate a .MSE parameter setup data file using the following procedure:

- Click on Generate MSE
- You will now see the complete content of the .MSE file
- Mark the entire text content

- Click on the “Send to OneNote” icon on the top of the screen
- Select the OneNote section where to put the .MSE file

8.2.5.9 Menu: Reboot



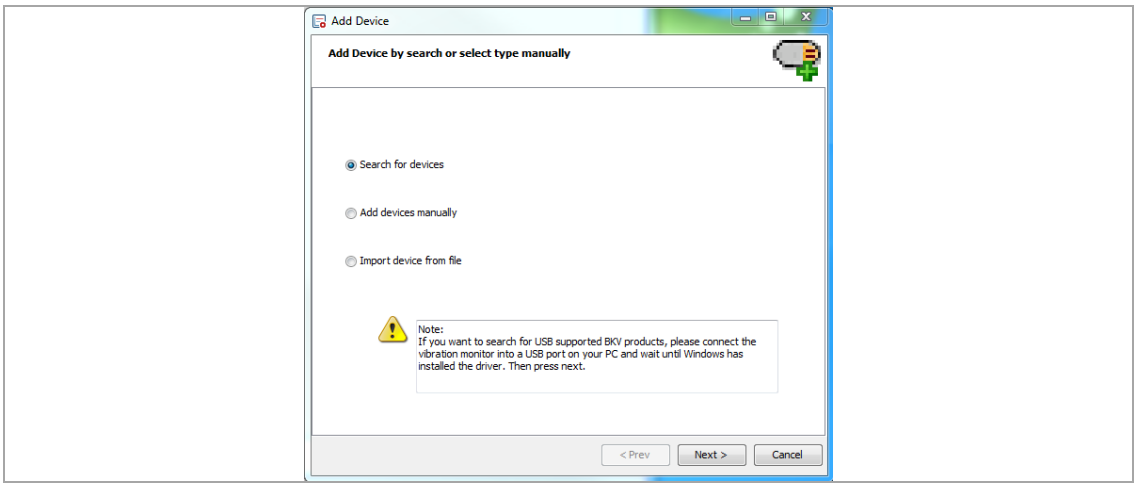
Any changes made to the parameter setup of the VC-1803/04 will only be implemented after a forced reboot of the device.
To initialise the reboot process, please click on the Reboot button. You will see that the green Status LED on the top of the enclosure flashes during the reboot process. As soon as the Status LED stops flashing the new parameters have been uploaded and now are implemented in the device.

8.2.6 VIBROCONTROL 1803/04 with Compact Setup

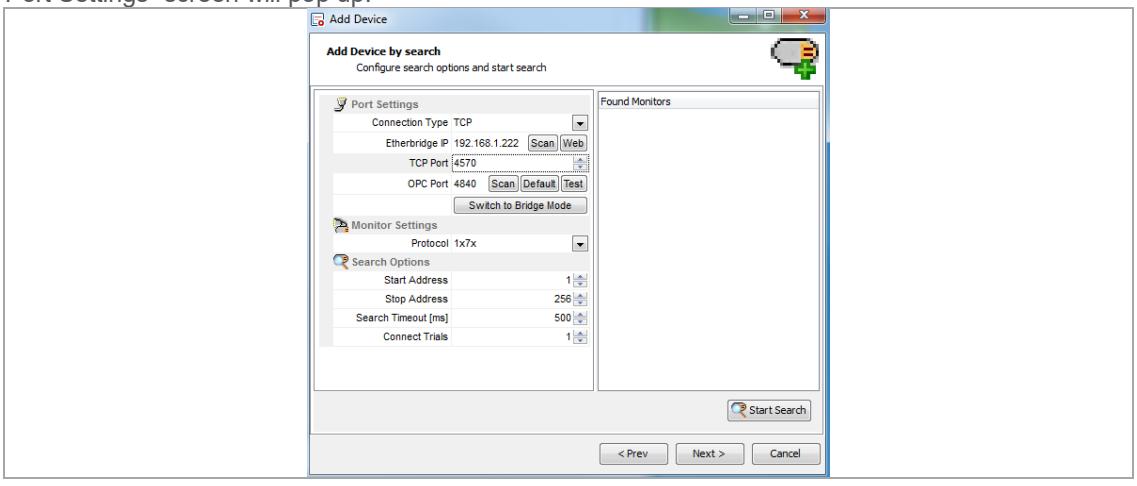
The VIBROCONTROL 1800 vibration monitors can be connected to the PC running the software in different ways:

- Directly to a PC via USB port or RS-485. This method is mainly used for temporary connection of a fixed mounted VC-1800 and a (notebook PC) in the field, e.g. to upgrade (new firmware) or to update (new setup parameter(s)). This way the PC can only control one monitor at the time.
- As part of a PC controlled RS485 chain of VC-1800 vibration monitors
- Through a local network (LAN) via a VC-1803/04

After start-up of the Compact Setup Software, please use “Add Device”:



If it does not show the correct communication type, mark this line and press the “Next” button for editing. The “Edit Port Settings” screen will pop up.



Click on the “Communication Type” field and chose “Etherbridge”

When the search is finished you will see a listing of all VC-1803/04s in the local network.

Click on the line with the relevant device, which then will turn blue. Click the “Select” button.

Before it is possible to find the vibration monitors via their RS232 connector it is necessary to make sure that the RS232 feature of the VC-1803/04 is enabled.
Click on the “Etherbridge Web” button, which will bring you to the Windows Security screen.

RS232 is enabled together with RS485 on COM2. Therefore click on “com_port” and choose COM2. Click on the “Apply” button.

RS485 is enabled either on COM1 or COM2 (not both at the same time!) Therefore click on “com_port” and choose “COM1” or “COM2”.
Click on the “Apply” button.

For final implementation it is not enough to “Apply” the new settings. It is essential to reboot the VC-1803/04 in order to implement any applied new settings.
To initialise the reboot procedure, please click on “Reboot” and wait until the green “Status” LED has stopped flashing.

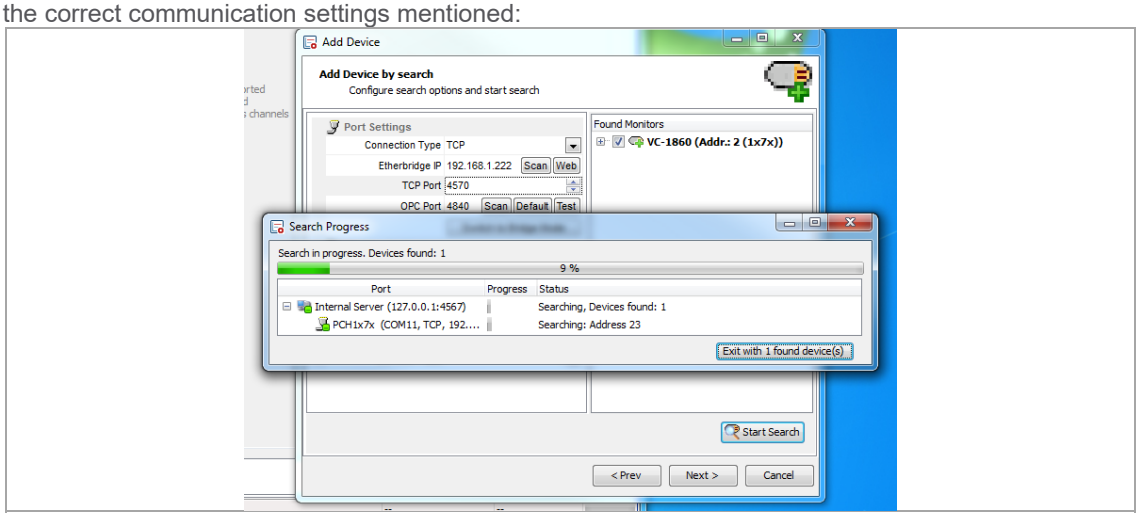
RS232: Connect your vibration monitor (“RS232” marked DB9 connector) to the VC-1803/04 (“RS232” marked RJ11 connector on the top cover plate).
RS485: Connect your RS485 chain of vibration monitors to either the screw terminal COM1 or COM 2 on the side of the VC-1803/04 enclosure.

If COM2 is used for RS485, please leave the RS232 connector on the top plate free (= unattached) and vice versa. To use both serial modes simultaneously is not official supported by the manufacturer.

Leave the “Bridge Configuration” screens and return to the edit port settings screen of the software.

Make sure that the Etherbridge IP is the correct one.

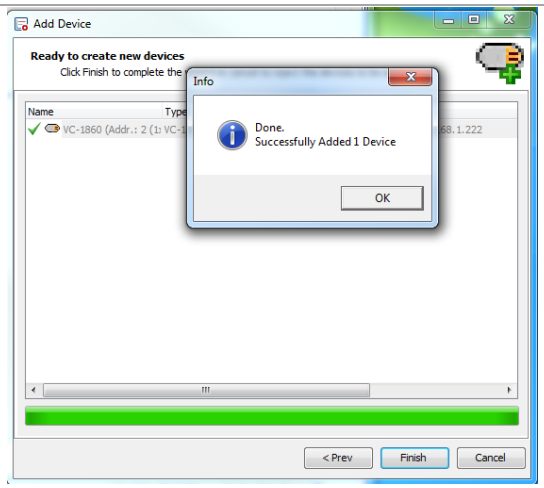
Press the “Apply” button followed by pressing the “OK” button to return to the “Monitor Initialization Wizard”, but now with the correct communication settings mentioned:



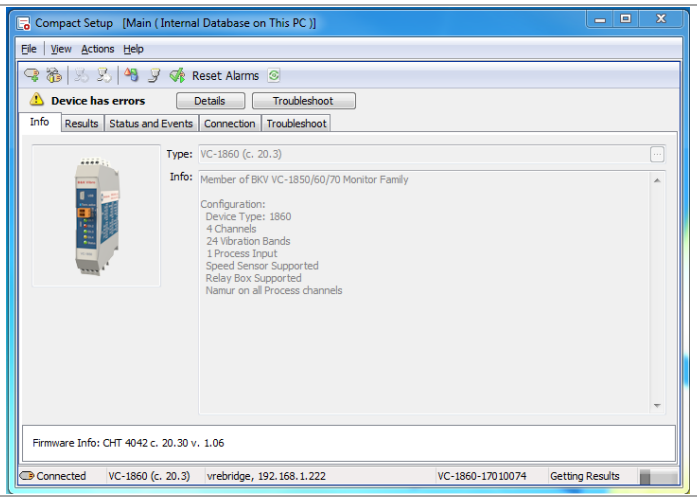
Mark “Search for Monitor” and click the “Next” button. The next screen is the “Search for Monitor” screen.

Start the search for attached vibration monitor(s) by pressing the “Start Search” button.

At first the Baud rate is fixed to an appropriate speed. Fixing the Baud rate might take some time.



Now measuring units VIBROCONTROL-18xx are connected through the VC-1803/04.



9 Connecting the VIBROCONTROL 18xx to a PLC/PC

The VIBROCONTROL 18xx Vibration Monitor is provided with a RS-485 and an USB 2.0 interface, which allows the user to change many of the setup parameters if connected to a PLC or PC with suitable software installed. The same interfaces can also be used to read out a number of registers inside the vibration monitor with status information or the actual level of a large number of vibration measuring functions. The PC software used for this purpose is called Compact Setup Software.

The VIBROCONTROL 18xx Vibration Monitor is delivered with a pre-configured setup. The Compact Setup Software will overwrite this setup when it is used to change the changeable parameters in the device.

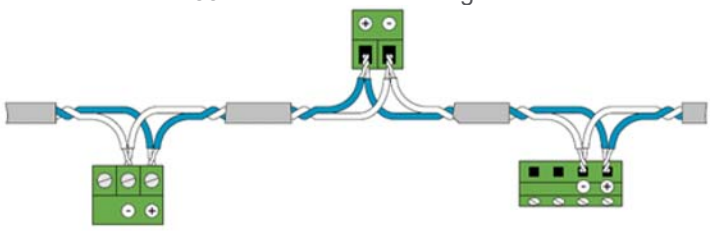
9.1 USB 2.0 interface

To use the USB 2.0 interface, connect the USB cable between the VIBROCONTROL 18xx Vibration Monitor and a USB port on the computer. The maximum data transfer speed between a PC and a VIBROCONTROL 18xx device is 3 MBaud.

9.2 RS-485 interface

The VIBROCONTROL 18xx Vibration Monitor allows “multi-drop”, i.e. up to 255 devices can be addressed individually in a RS-485 chain of devices.

To use the RS-485 interface, connect the yellow connector (marked: “RS-485”) at the front panel of the VIBROCONTROL 18xx enclosure to the RS-485 chain of devices using a two wire twisted and shielded cable.



The cable must be terminated with a 120 Ω resistor in both ends, i.e. on the PC side and at the last device on the RS-485 chain of devices. The VIBROCONTROL 18xx Vibration Monitor has a built-in 120 Ω termination resistor, which can be used for this purpose. To switch the termination resistor ON, use the small left/right sliding switch behind a small hole at the front panel of the VIBROCONTROL 18xx enclosure. Soon after the termination resistor has been switched, ON a **Blue** LED at the front panel of the VIBROCONTROL 18xx will indicate that the 120 Ω termination resistor is in place.

The maximum data transfer speed between the PC and the VIBROCONTROL 18xx is 115 kBaud.

Please make sure that you do not add a new device to your FieldBus that has an address occupied by another device already present in the RS-485 chain of devices.

9.3 VIBROCONTROL 1803/04 LAN interface

The VIBROCONTROL 18xx can also be remotely operated using a LAN connection. This requires the use of an additional VIBROCONTROL 1803 communication module.

The VIBROCONTROL 1803 module is on one side connected to a PC Ethernet network with a LAN cable. The other side of VC-1803 is connected to the yellow RS-485 connector at the front panel of the VIBROCONTROL 18xx enclosure marked “RS-485” using a two wire twisted and shielded cable.

9.4 Modbus Connection for VIBROCONTROL 18xx via 1803/04 Modbus Address and Register

The following tables specify the ModbusTCP address for the registers contained in a given VIBROCONTROL 18xx monitor. A register consists of 2 bytes. Please notice that an address can also be halved. e.g. address "1000,5". This means that the register will not start at the first byte, but at the second. The “second” byte is the LSB in a Big Endian Word. Proper conversion will also make it the LSB in Little Endian, thereby converting it to the “first” byte instead. Be mindful of this.

Flash data (Read only)

status				
Modbus address	**Register length**	**Register type**	**Register name**	
General critical registers, must be read:				
40000	0.5	U8	status_code [OK: Monitoring_state=6]	Error_state = 3 Settling_state = 4 Self_test_state=5 Monitoring_state=6
29738	2	s32	ccw_flash [OK: 0x20300]	CCW = 0x2030
40006	0.5	u8	system_failure_relay [OK: state = 0]	No Alarm = 0 Alarm = 1
40019.5	0.5	u8	transducer_input_1.overload [OK: Overload_state=0]	Overload_state = 0 Overload_state = 1

40046.5	0.5	u8	transducer_input_2.overload [OK: Overload_state=0]	Overload_state = 0 Overload_state = 1
40073.5	0.5	u8	transducer_input_3.overload [OK: Overload_state=0]	Overload_state = 0 Overload_state = 1
40100.5	0.5	u8	transducer_input_4.overload [OK: Overload_state=0]	Overload_state = 0 Overload_state = 1
Optional registers to be read:				
Transducer 1:				
40021	2	float	transducer_input_1.band_1.vibration_detector.measuring_result	
40023	0.5	u8	transducer_input_1.band_1.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40023.5	0.5	u8	transducer_input_1.band_1.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40024	2	float	transducer_input_1.band_2.vibration_detector.measuring_result	
40026	0.5	u8	transducer_input_1.band_2.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40026.5	0.5	u8	transducer_input_1.band_2.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40027	2	float	transducer_input_1.band_2.envelope_detector_1.measuring_result	
40029	0.5	u8	transducer_input_1.band_2.envelope_detector_1.alert_alarm	No Alarm = 0 Alarm = 1
40029.5	0.5	u8	transducer_input_1.band_2.envelope_detector_1.danger_alarm	No Alarm = 0 Alarm = 1
40030	2	float	transducer_input_1.band_2.envelope_detector_2.measuring_result	
40032	0.5	u8	transducer_input_1.band_2.envelope_detector_2.alert_alarm	No Alarm = 0 Alarm = 1
40032.5	0.5	u8	transducer_input_1.band_2.envelope_detector_2.danger_alarm	No Alarm = 0 Alarm = 1
40033	2	float	transducer_input_1.band_2.crest_factor_detector.measuring_result	
40035	0.5	u8	transducer_input_1.band_2.crest_factor_detector.alert_alarm	No Alarm = 0 Alarm = 1
40035.5	0.5	u8	transducer_input_1.band_2.crest_factor_detector.danger_alarm	No Alarm = 0 Alarm = 1
40036	2	float	transducer_input_1.band_2.kurtosis_detector.measuring_result	
40038	0.5	u8	transducer_input_1.band_2.kurtosis_detector.alert_alarm	No Alarm = 0 Alarm = 1
40038.5	0.5	u8	transducer_input_1.band_2.kurtosis_detector.danger_alarm	No Alarm = 0 Alarm = 1

Transducer 2:				
40048	2	float	transducer_input_2.band_1.vibration_detector.measuring_result	
40050	0.5	u8	transducer_input_2.band_1.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40050.5	0.5	u8	transducer_input_2.band_1.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40051	2	float	transducer_input_2.band_2.vibration_detector.measuring_result	
40053	0.5	u8	transducer_input_2.band_2.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40053.5	0.5	u8	transducer_input_2.band_2.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40054	2	float	transducer_input_2.band_2.envelope_detector_1.measuring_result	
40056	0.5	u8	transducer_input_2.band_2.envelope_detector_1.alert_alarm	No Alarm = 0 Alarm = 1
40056.5	0.5	u8	transducer_input_2.band_2.envelope_detector_1.danger_alarm	No Alarm = 0 Alarm = 1
40057	2	float	transducer_input_2.band_2.envelope_detector_2.measuring_result	
40059	0.5	u8	transducer_input_2.band_2.envelope_detector_2.alert_alarm	No Alarm = 0 Alarm = 1
40059.5	0.5	u8	transducer_input_2.band_2.envelope_detector_2.danger_alarm	No Alarm = 0 Alarm = 1
40060	2	float	transducer_input_2.band_2.crest_factor_detector.measuring_result	
40062	0.5	u8	transducer_input_2.band_2.crest_factor_detector.alert_alarm	No Alarm = 0 Alarm = 1
40062.5	0.5	u8	transducer_input_2.band_2.crest_factor_detector.danger_alarm	No Alarm = 0 Alarm = 1
40063	2	float	transducer_input_2.band_2.kurtosis_detector.measuring_result	
40065	0.5	u8	transducer_input_2.band_2.kurtosis_detector.alert_alarm	No Alarm = 0 Alarm = 1
40065.5	0.5	u8	transducer_input_2.band_2.kurtosis_detector.danger_alarm	No Alarm = 0 Alarm = 1

Transducer 3:				
40075	2	float	transducer_input_3.band_1.vibration_detector.measuring_result	
40077	0.5	u8	transducer_input_3.band_1.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40077.5	0.5	u8	transducer_input_3.band_1.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40078	2	float	transducer_input_3.band_2.vibration_detector.measuring_result	
40080	0.5	u8	transducer_input_3.band_2.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40080.5	0.5	u8	transducer_input_3.band_2.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40081	2	float	transducer_input_3.band_2.envelope_detector_1.measuring_result	
40083	0.5	u8	transducer_input_3.band_2.envelope_detector_1.alert_alarm	No Alarm = 0 Alarm = 1
40083.5	0.5	u8	transducer_input_3.band_2.envelope_detector_1.danger_alarm	No Alarm = 0 Alarm = 1
40084	2	float	transducer_input_3.band_2.envelope_detector_2.measuring_result	
40086	0.5	u8	transducer_input_3.band_2.envelope_detector_2.alert_alarm	No Alarm = 0 Alarm = 1
40086.5	0.5	u8	transducer_input_3.band_2.envelope_detector_2.danger_alarm	No Alarm = 0 Alarm = 1
40087	2	float	transducer_input_3.band_2.crest_factor_detector.measuring_result	
40089	0.5	u8	transducer_input_3.band_2.crest_factor_detector.alert_alarm	No Alarm = 0 Alarm = 1
40089.5	0.5	u8	transducer_input_3.band_2.crest_factor_detector.danger_alarm	No Alarm = 0 Alarm = 1
40090	2	float	transducer_input_3.band_2.kurtosis_detector.measuring_result	
40092	0.5	u8	transducer_input_3.band_2.kurtosis_detector.alert_alarm	No Alarm = 0 Alarm = 1
40092.5	0.5	u8	transducer_input_3.band_2.kurtosis_detector.danger_alarm	No Alarm = 0 Alarm = 1

Transducer 4:				
40102	2	float	transducer_input_4.band_1.vibration_detector.measuring_result	
40104	0.5	u8	transducer_input_4.band_1.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40104.5	0.5	u8	transducer_input_4.band_1.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40105	2	float	transducer_input_4.band_2.vibration_detector.measuring_result	
40107	0.5	u8	transducer_input_4.band_2.vibration_detector.alert_alarm	No Alarm = 0 Alarm = 1
40107.5	0.5	u8	transducer_input_4.band_2.vibration_detector.danger_alarm	No Alarm = 0 Alarm = 1
40108	2	float	transducer_input_4.band_2.envelope_detector_1.measuring_result	
40110	0.5	u8	transducer_input_4.band_2.envelope_detector_1.alert_alarm	No Alarm = 0 Alarm = 1
40110.5	0.5	u8	transducer_input_4.band_2.envelope_detector_1.danger_alarm	No Alarm = 0 Alarm = 1
40111	2	float	transducer_input_4.band_2.envelope_detector_2.measuring_result	
40113	0.5	u8	transducer_input_4.band_2.envelope_detector_2.alert_alarm	No Alarm = 0 Alarm = 1
40113.5	0.5	u8	transducer_input_4.band_2.envelope_detector_2.danger_alarm	No Alarm = 0 Alarm = 1
40114	2	float	transducer_input_4.band_2.crest_factor_detector.measuring_result	
40116	0.5	u8	transducer_input_4.band_2.crest_factor_detector.alert_alarm	No Alarm = 0 Alarm = 1
40116.5	0.5	u8	transducer_input_4.band_2.crest_factor_detector.danger_alarm	No Alarm = 0 Alarm = 1
40117	2	float	transducer_input_4.band_2.kurtosis_detector.measuring_result	
40119	0.5	u8	transducer_input_4.band_2.kurtosis_detector.alert_alarm	No Alarm = 0 Alarm = 1
40119.5	0.5	u8	transducer_input_4.band_2.kurtosis_detector.danger_alarm	No Alarm = 0 Alarm = 1

Additional parameters, optional:				
40009.5	0.5	u8	configurable_output_1.relay [OK: Relay closed=0]	Relay closed = 0 Relay open = 1
40010	2	float	configurable_output_1.analog	
40012	0.5	u8	configurable_output_2.relay [OK: Relay closed=0]	Relay closed = 0 Relay open = 1
40012.5	2	float	configurable_output_2.analog	
40014.5	0.5	u8	configurable_output_3.relay [OK: Relay closed=0]	Relay closed = 0 Relay open = 1
40015	2	float	configurable_output_3.analog	
40017	0.5	u8	configurable_output_4.relay [OK: Relay closed=0]	Relay closed = 0 Relay open = 1
40017.5	2	float	configurable_output_4.analog	
40130.5	2	float	process_input_1.measuring_result	
40132.5	0.5	u8	process_input_1.danger_alarm_low	No Alarm = 0 Alarm = 1
40133	0.5	u8	process_input_1.alert_alarm_low	No Alarm = 0 Alarm = 1
40133.5	0.5	u8	process_input_1.alert_alarm_high	No Alarm = 0 Alarm = 1
40134	0.5	u8	process_input_1.danger_alarm_high	No Alarm = 0 Alarm = 1
40136	2	float	tacho_input_1.measuring_result	
40138	0.5	u8	tacho_input_1.danger_alarm_speed_low	No Alarm = 0 Alarm = 1
40138.5	0.5	u8	tacho_input_1.alert_alarm_speed_low	No Alarm = 0 Alarm = 1
40139	0.5	u8	tacho_input_1.alert_alarm_speed_high	No Alarm = 0 Alarm = 1
40139.5	0.5	u8	tacho_input_1.danger_alarm_speed_high	No Alarm = 0 Alarm = 1

10 Mounting/installation of the VIBROCONTROL 18xx

Accident prevention

Improper opening of the product or removal of components, improper use, incorrect installation or operation may result in personal injury or property damage.

If the VIBROCONTROL 18xx device is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. The safety of any machine/system incorporating the VIBROCONTROL 18xx device is the sole responsibility of the assembler of the system

10.1 Assembly / disassembly of the device:

The VIBROCONTROL 18xx Vibration Monitor comes in a DIN rail enclosure ready to be clipped on a standard DIN rail.

Before mounting, please note:

- Provide sufficient air circulation above and below the unit.

To avoid fading of the text on the label, please try to keep the device out of direct sunlight.

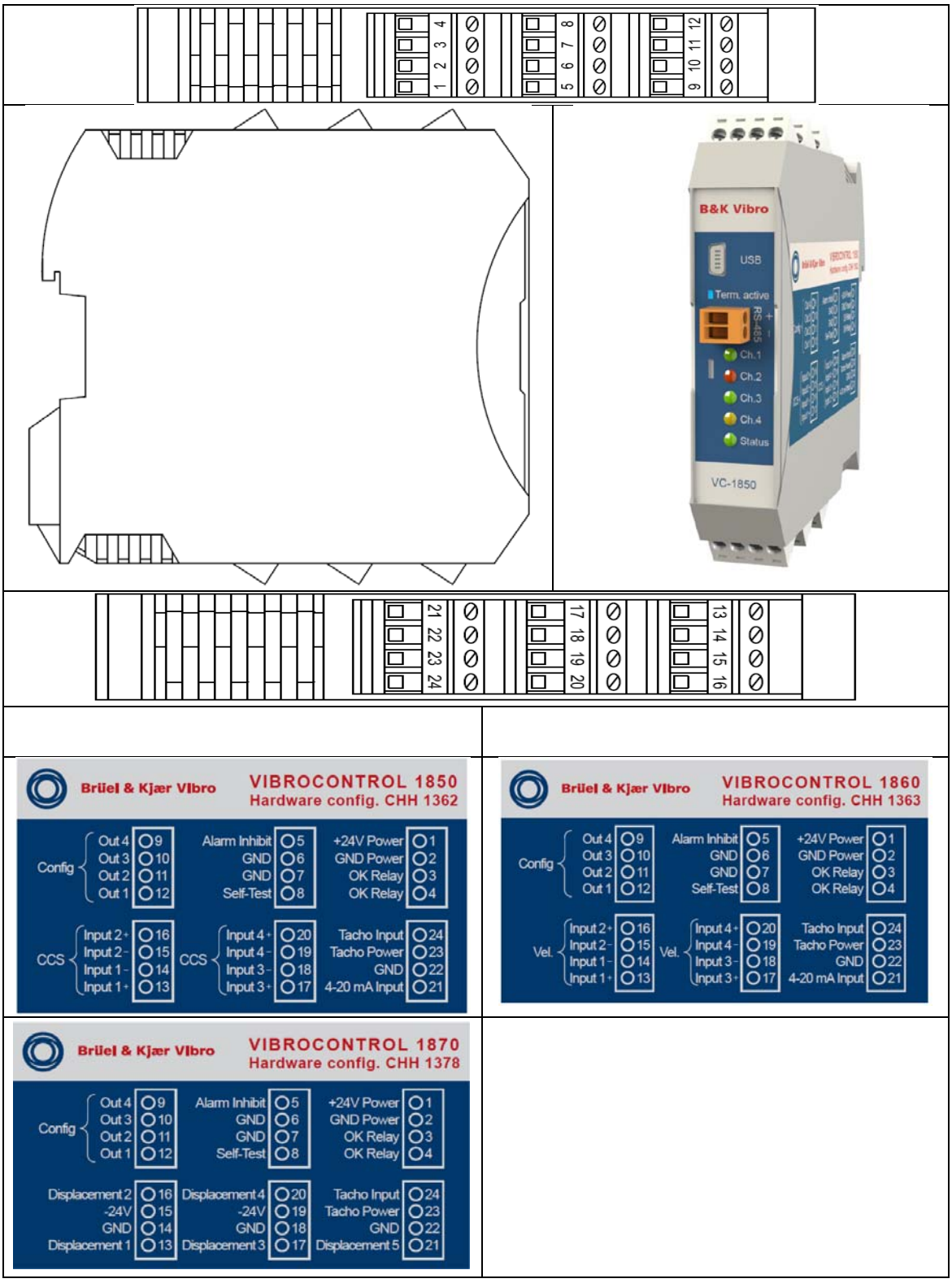
The assembly may only be carried out in a de-energized state!

- A metal clip at the rear of the enclosure is used to (un-)mount the device from/to the DIN- rail.
- The device is mounted on a DIN rail by simply clicking on it.

10.2 Terminal marking

Each device is equipped with six numbered 4-pin connections, i.e. equipped three on each side of the case.

A label on the side of the VIBROCONTROL 18xx enclosure indicates the function of the terminals of the device. The connection to the power supply and other interfaces is made via these terminals:


1 2 3 4
5 6 7 8
9 10 11 12
B&K Vibro
USB
Term. active
RS-485
Ch.1
Ch.2
Ch.3
Ch.4
Status
VC-1850
21 22 23 24
17 18 19 20
13 14 15 16
Brüel & Kjær Vibro
VIBROCONTROL 1850
Hardware config. CHH 1362
Config
Out 4 9
Out 3 10
Out 2 11
Out 1 12
Alarm Inhibit 5
GND 6
GND 7
Self-Test 8
+24V Power 1
GND Power 2
OK Relay 3
OK Relay 4
CCS
Input 2+ 16
Input 2- 15
Input 1- 14
Input 1+ 13
CCS
Input 4+ 20
Input 4- 19
Input 3- 18
Input 3+ 17
Tacho Input 24
Tacho Power 23
GND 22
4-20 mA Input 21
Brüel & Kjær Vibro
VIBROCONTROL 1860
Hardware config. CHH 1363
Config
Out 4 9
Out 3 10
Out 2 11
Out 1 12
Alarm Inhibit 5
GND 6
GND 7
Self-Test 8
+24V Power 1
GND Power 2
OK Relay 3
OK Relay 4
Vel.
Input 2+ 16
Input 2- 15
Input 1- 14
Input 1+ 13
Vel.
Input 4+ 20
Input 4- 19
Input 3- 18
Input 3+ 17
Tacho Input 24
Tacho Power 23
GND 22
4-20 mA Input 21
Brüel & Kjær Vibro
VIBROCONTROL 1870
Hardware config. CHH 1378
Config
Out 4 9
Out 3 10
Out 2 11
Out 1 12
Alarm Inhibit 5
GND 6
GND 7
Self-Test 8
+24V Power 1
GND Power 2
OK Relay 3
OK Relay 4
Displacement 2 16
-24V 15
GND 14
Displacement 1 13
Displacement 4 20
-24V 19
GND 18
Displacement 3 17
Tacho Input 24
Tacho Power 23
GND 22
Displacement 5 21

10.3 Installation

Cables connected to the VC-18xx must be suitable for an ambient temperature of -10 ° C to + 80 ° C.

External strain relief of the cables is recommended

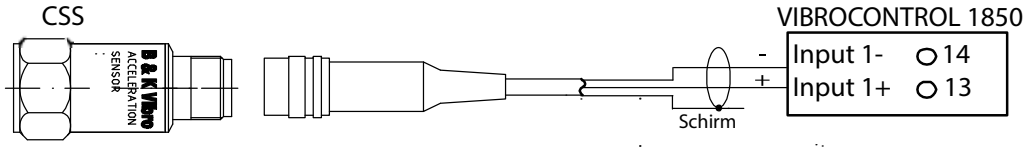
The following order is recommended during installation:

- Make the sensor connections
- Make the relays and power outlets
- Establish power supply

10.3.1 Sensor connection

The shields of the incoming and outgoing cables must be laid on suitable equipotential bonding.

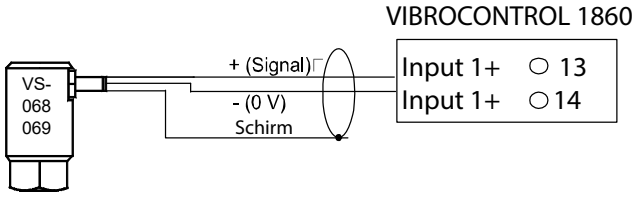
CCS accelerometer (VIBROCONTROL 1850)
The acceleration sensors are connected to the terminals as 2-wire connections (plus and minus) (see sticker). Up to 4 accelerometers can be connected to the VC-1850:



Further sensor connections are:

- 16 (Input 2+) / 15 (Input 2-)
- 17 (Input 3+) / 18 (Input 3-)
- 20 (Input 4+) / 19 (Input 4-)

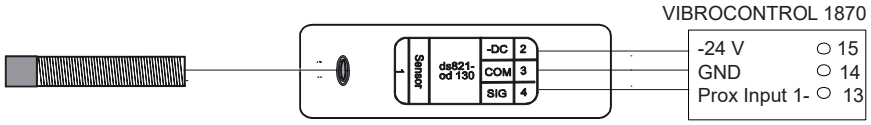
Velocity sensor (VIBROCONTROL 1860)
The acceleration sensors are connected as 2-wire connections (plus and minus) to terminals 16-20 (see sticker). Up to 4 accelerometers can be connected to the VC-1850.



Further sensor connections are:

- 16 (Input 2+) / 15 (Input 2-)
- 17 (Input 3+) / 18 (Input 3-)
- 20 (Input 4+) / 19 (Input 4-)

Displacement sensor (VIBROCONTROL 1870)



- Further sensor connections are:
- 16 (Displacement 2) / 15 (-24 V) / 14 (GND)
- 17 (Displacement 3) / 19 (-24 V) / 18 (GND)
- 20 (Displacement 4) / 19 (-24 V) / 18 (GND)
- 21 (Displacement 5) / 23 (-24 V) / 22 (GND)

Tacho connections
The tacho connections are on the same terminals on all three VC-18xx units. The connection to the tacho sensor is described in chapter 6.12 Speed sensor (tacho) input.

10.3.2 Analog outputs

The connections of the analog outputs are described in chapter 6.18 Configuration of the analog outputs.

10.3.3 Power Supply

Power supply of the power supply unit may only be carried out via disconnecting device (switch or circuit breaker)!

10.4 Powering and Start-up

After connecting to Power or changing setup the instruments is proceeding a startup program, which is indicated by red, or blinking Channel LEDs and/or blinking OK LEDs. This procedure takes up to 30 seconds. In case there is no violation of alert and danger levels or any OK failure, all LEDs should turn to green.

10.5 DIN-rail bus module connection

At the backside of the enclosure there is a 5-pin DIN-rail bus connector that can be used to pass common power or certain signal(s) to adjacent module(s) that have the same type of DIN-rail enclosure like the VC-1803/04, and/or other VIBROCONTROL 18xx Vibration Monitor(s). This could be main power, tacho signal, RS-485 connection, etc.

The DIN-rail bus module is connected with spring contacts to five conductive pads at the rear edge of the printed circuit board inside the VIBROCONTROL 18xx enclosure. The DIN-rail bus module can easily be removed by gently pulling the DIN-rail bus module down in the direction of the length axis of the VIBROCONTROL 18xx enclosure and can easily be remounted by carrying out the reverse action.

At the front of the enclosure there are two connectors marked “RS-485” and “USB” for connection to their respective interfaces on a PLC, PC or VIBROCONTROL 1803.

The VIBROCONTROL 18xx device has no internal forced ventilation. This devices has no external ventilation requirements as long as the surface temperature during operation does not exceed the maximum ambient temperature value Ta stated elsewhere in this manual in section 11: “Technical Data”

11 Technical data

Input channels:	Up to 4 dynamic vibration sensors: **VIBROCONTROL 1850:** accelerometers (CCS), **VIBROCONTROL 1860:** velocity sensors • 1 Process input 4-20 mA, 0-20 mA or 0-22 V • 1 Tacho input with NPN, PNP or AC
Sensor type:	Accelerometer, 10-500 mV/g, type CCS : Maximum input: ..... ± 1.8 Vpk Input overload: ..... ± 1.8 Vpk Sensor Bias Current: .....5 mA Maximum voltage input: .....-2 to -22 V Peak detector, attack time: ..... 1-1000 ms Peak detector, decay time: ..... 0.1-100 s
Band 1 (per input channel):	Detectors: ..... rue RMS, Pk-Pk or Pk Filter ranges: Velocity: ..... 0.7 to 1200 Hz Acceleration: .....0.7 Hz to 10 kHz Displacement: ..... 7 to 1200 Hz Measuring parameter: ..... .mm/s, m/s2,µm,mm, mils *Selectable through user software Compact Setup*
Band 2 (per input channel, CCS only):	Detectors: True RMS, 2 Envelope detectors with user defined filters from 1 - 500 Hz, Kurtosis and Crest Factor (top factor) according to VDI 3832: Filter ranges: Velocity: .....0.7 to 1200 Hz Acceleration: .....0.7 Hz to 10 kHz Displacement: .....0.7 to 1200 Hz Measuring parameter: ..... mm/s, m/s2,µm,mm, mils *Selectable through software Compact Setup*
Standard measuring ranges:	10 or 20 or 50 or 100 mm/s, 2.5 or 6 or 12 or 24 m/s^2 *Other ranges are available through software Compact Setup*
Standard frequency range:	10 Hz - 1000 Hz, -1 dB, 24 dB/oct. Optional: ..... 1-300, 1-1000, 0.7-10.5 Hz High frequency band: ..... 2-10 kHz Non-linearity: ± 1.2% = 0.2 dB (typical, depending on type of filter) *More filter bands are available through software Compact Setup*
Alarm detectors:	Alert and Danger alarm per each detector with adjustable alarm limits. Alarm delay time: Alert delay time .....0-100 s Danger delay time .....0-100 s Hang time for Alert and Danger.....0-100 s *Selectable through software Compact Commander*

Process input	Linear conversion of input signal at Process Input terminal. Out of Range detection (Namur NE43 appliant) Alert and Danger Low/High latchable speed alarms, each with a user selectable alarm delay time (s) and an alarm relay Total vibration alarm inhibitation if below or above certain RPM value
Speed Sensor Input	User selectable: NPN, PNP or 0-30 VAC Choice of display in RPS or RPM User selectable multiple pulses per revolution Maximum number of pulses per second: 50000 Averaging time: 1-60 s Total vibration alarm inhibitation if below or above certain RPM value Alert and Danger Low/High latchable speed alarms, each with a user selectable alarm delay time (s) and an alarm relay Conditional speed sensor error detector, which activates the VIBROCONTROL 18xx system error relay
Configurable outputs:	The user can configure up to 4 analog DC outputs or alarm relays in total. DC outputs can be configured as 4-20 mA, 0-20 mA, 2-10 V or 0-10 V. Each output can be assigned to any of the measuring parameters. Output is relative to measuring range. Tolerance:..... max. ±0.3% Voltage load: ..... min. 10 kΩ Current load: ..... max. 400 Ω Alarm Relays: Relays with break-function, can be user configured as Alert or Danger relays with latch function or auto reset. Type:..... Open Drain (non isolated) Max voltage: ..... 28 V Max current:..... 100 mA ON resistance:..... 12.9 Ω Max OFF state leakage current:..... 10 µA If the power is cut, all relays will become activated, i.e. break, thus **FAIL SAFE**. Standby: MAKE mode; Triggered: BREAK mode.
OK relay:	1 redundant safety relay with break-function (power fail-safe). All system failures, like cable short, cable break and internal system failure, will automatically trip the safety relay. Type: ..... Mechanical (isolated) Max voltage: ..... 28 V Max current:..... 100 mA Max insulation voltage..... 100 V ON resistance:..... 12.9 Ω Max OFF state leakage current: ..... 10 µA
Self-test:	Can be activated digitally (by connecting ground (GND) to terminal #8 on the enclosure) or by PC using Compact Setup software.

Alarm inhibit:	Can be activated digitally (by connecting ground (GND) to terminal #5 on the enclosure). Alarm inhibit also works as an alarm reset that affects all Alert and Danger alarms, but NOT System Failure alarms.
Alarm latch:	Activated individually when configuring the Alert and danger alarm setup(s) using the Compact Commander software. Deactivated by short-time Alarm Inhibit.
Time waveform recording:	Up to 4 input channels can record digital raw data (time waveform) simultaneously to a PC running Compact Commander. The recording can be done through: RS-485/LAN (buffered) .....Up to 10 kHz Mini USB (real-time).....Up to 10 kHz Time waveform recording can be either user or event activated.
Trending of measuring data:	All input channels can be trended and alarms can be stored when connected to either VIBROCONTROL 1803 Ethernet-Bridge or directly to a PC running Compact Analyzer software. It's also possible to make an off- line FFT of recorded time stream signals.
Communication:	RS-485 interface: • 2 screw terminals on the front panel. • Daisy chain, up to 255 units. • Possibility to activate built-in 120 Ω termination resistor. • Speed up to 115.2 Kbaud (3 Mbaud over short distance). USB interface: • Mini USB/B on the front panel. • Speed at 3 Mbaud. • Can be used for Direct contact to PC for configuration or post-analysis of data with Compact Analyzer software. LAN (option; requires VC-1803 Ethernet-Bridge): • Remote control by PC for configuration or post-analysis of data with Compact Analyzer software
Modularity:	VIBROCONTROL 18xx Vibration Monitors can be interconnected to adjacent VIBROCONTROL 1803/1804 Ethernet-Bridge as well as VC-1801 Relay Modules by means of DIN rail bus connectors
Status LED's:	5 light diodes indicate channel status (green, yellow, red) for each of the 4 vibration input channels, as well as for general system status. **Channel LED's 1 to 4:** Green.....Normal operation Yellow ..... Alert alarm Red .....Danger alarm or cable error **System LED:** Green.....Normal operation Green flash ..... Settling on all channels Yellow flash .....Self test Red .....Cable error Red flash ..... Critical system error

Power supply:	+24 V DC, ±5 %, max. power consumption; 10 W
Ambient temperature range	In operation:..... -10 °C ≤ Ta ≤ +50 °C In storage:..... -40 °C ≤ Ta ≤ +85 °C
Maximum relative humidity	95 % RH (non-condensing at +40 °C)
Pollution degree	2 (indoor use)
Maximum altitude	4000 m
Mounting	Standard 35-mm DIN-rail

Temperature	EN 60068-2-1:2007 Cold EN 60068-2-2:2007 Dry heat Operating: –10 to +50°C Storage: –40 to +85°C
Maximum Humidity	EN 60068-2-78:2001 ; 95% RH (non-condensing at +40 °C)
Enclosure	EN 60529 + A1:2002 ; Ingress Protection IP20 with screw terminals

12 Maintenance

The VIBROCONTROL 18xx Vibration Monitor is in principle maintenance free.

12.1 Cleaning

The device can be cleaned on the outside with a slightly damp cloth.

Do not introduce moisture such as water or other liquids into the device!

If you experience a **Red** LED for one of the channels and a **Red** LED for “Status”, this means that the connection between the vibration monitor and the sensor for that particular channel is disconnected. Please check the integrity of the connection cable on both sides, i.e. at the side of the sensor and at input terminals on the enclosure of the vibration monitor.

In the unlikely event that you experience erroneous behaviour of the device, e.g. a continuous **Red** flashing „OK“ LED (System Failure), we advise you to carry out a complete self-test for a couple of minutes. In case the system failure is still present after such a complete self-test we strongly recommend you to contact the manufacturer for a repair of the device.

Whenever you contact the manufacturer for a repair of the device you are kindly requested to have the following information at hand:
The type number of the vibration monitor: VIBROCONTROL 1850, VIBROCONTROL 1860.
The serial number of the device, visible on a label on the enclosure.
The colour of the status indicators in the Compact Commander Software that are active, if any. Indicators, that show a malfunction, are usually coloured **Red**.

13 Disassembly and Disposal

Dismantling may only be carried out in the de-energized state!

The driver is subject to the Waste Disposal Act for Electrical and Electronic Equipment.
Do not dispose of the device in the regular household waste and observe local waste disposal regulations.
You may also return the device to

Brüel & Kjaer Vibro
Leydheckerstraße 10
64293 Darmstadt
Germany.

WEEE Reg. No. DE 69572330

14 Appendix A: Backup Battery PSDS

The VIBROCONTROL 1804 includes RAM and contains a backup battery with this Product Safety Data Sheet:

Panasonic

Energy Device Business Division
Automotive & Industrial Systems Company
Panasonic Corporation

Lithium Battery
Ref. No. CBRAE-PSDS-01
Effective Date: Jan. 1, 2018

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This product is a consumer product which is used in a hermetically sealed state. So, it is not an object of the SDS system. This document is provided to customers as reference information for the safe handling of the product. The information and recommendations set forth are made in good faith and are believed to be accurate at the date of preparation. Panasonic Corporation makes no warranty expressed or implied.

PRODUCT SAFETY DATA SHEET

1 Chemical product and company identification

Name of Product	:	Poly-carbonmonofluoride lithium battery
Name of Company	:	Panasonic Corporation Automotive & Industrial Systems Company
Address	:	1-1 Matsushita-cho, Moriguchi-city, Osaka, 570-8511, Japan
		Telephone +81-6-6994-4560
Division		Energy Device Business Division
Department		Engineering Department
Emergency Contact (call CHMTREC)	:	Outside the United States +1-703-527-3887
		in the United States 1-800-424-9300

2 Hazards identification

GHS Classification	:	Not applicable
Toxicity	:	Vapor generated from burning batteries, may irritate eyes, skin and throat.
Hazard	:	Electrolyte and lithium metal are inflammable. Risk of explosion by fire if batteries are disposed in fire or heated above 125 degrees C. Stacking or jumbling batteries may cause external short circuits, heat generation, fire or explosion.

3 Composition/information of ingredients

Component	Material	CAS No.	Content (%)
Positive electrode	Poly-carbonmonofluoride	51311-17-2	8 - 24
Negative electrode	Lithium metal	7439-93-2	0.9 - 5
Electrolyte	Organic electrolyte	-	9 - 25
Others	Steel	7439-89-6, 7440-47-3	45 - 80
(Steel or Plastic parts)	Polypropylene	9003-07-0	1 - 15

Lithium content per cell

Model Number	Lithium content(g)	Model Number	Lithium content(g)	Model Number	Lithium content(g)	Model Number	Lithium content(g)
BR1225A	0.01	BR2330A	0.08	BR2450A	0.16	BR2777A	0.28
BR1632A	0.04			BR2477A	0.29		

Contact

Brüel &Kjaer Vibro GmbH
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64293 Darmstadt
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