Brüel & Kjær Vibro
a spectris company

CV-110 / 116

Measuring and Monitoring of Absolute Bearing Vibrations using Velocity Sensor

VIBROCONTROL 1000

Single Channel Machine Monitoring Units

C102 848.002

Contents

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1 Description / Intended Use

The vibration monitoring system VIBROCONTROL 1000 series C, comprising the

- electronic system and the
- vibration velocity sensor VS - ...

is used for measuring and monitoring absolute bearing vibrations.

The vibration sensor converts the vibrations occuring at the bearing housing into electric signals. These electric signals are supplied to the measuring and monitoring electronics.

The electronic system can either generate

- the effective value of vibration velocity (v_{eff}) or
- the peak value of vibration displacement (s_p)

comparing either of these values with 2 preset limit values. If these limit values are exceeded the respective alarm relays are tripped. Via the potential-free relay contacts warnings (pre-alarm) or the disconnection of the machine (master alarm) can be triggered.

The instruments types CV-110 and CV-116 only differ in the power supply voltage.

CV-110 requires a power supply voltage of 230 V AC,

CV-116 requires a power supply voltage of 24 V DC.

Adhere to attached safety instructions!

1.1 Block diagram

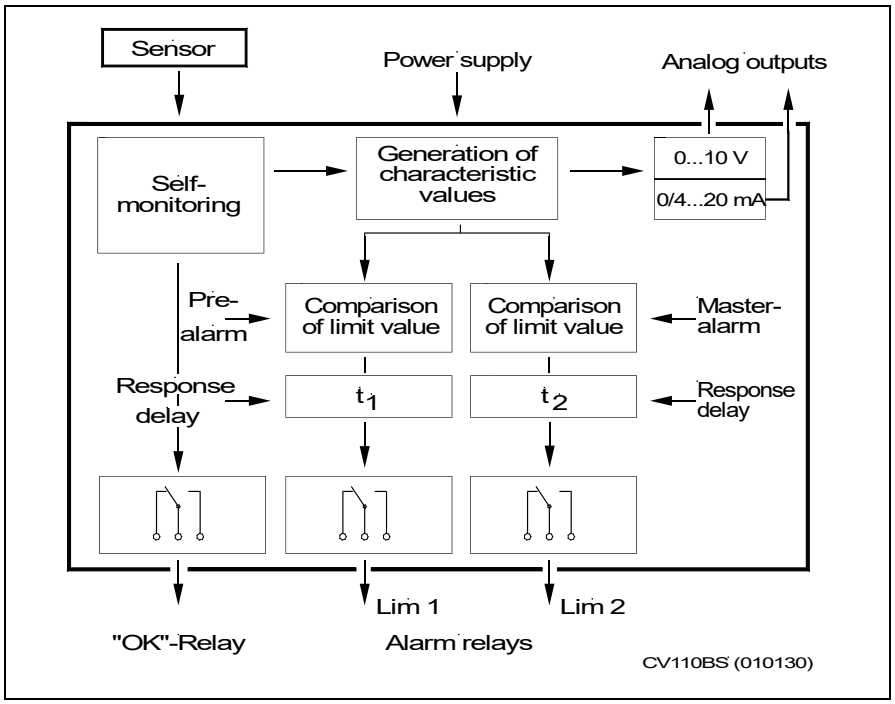


Figure 1 Block diagram

2 Technical Data

No. of measuring channels	1
Measuring Input	designed for a vibration velocity sesnor with a transmission factor of: 100 mV/mm/s, f_o = 8 Hz, Ri = 4 kΩ or 75 mV/mm/s, f_o = 15 Hz, Ri = 2,8 kΩ
Input resistor	R_{in} = 27 kΩ without linearization 100 kΩ with linearization The measuring input is adapted in the factory, according to the ordering code.
Working frequency range	sensor f_o = 8 Hz: 10 ... 1000 Hz or 1 ... 1000 Hz (with linearization) sensor f_o = 15 Hz 15 ... 1000 Hz or 2 ... 1000 Hz (with linearization) determined by jumpers

Measured variable	Effective value of vibration velocity v_{eff} (mm/s) or Peak value of the vibration displacement (μm) determined by jumpers
Measuring ranges	0 ... 2 mm/s 0 ... 20 μm 0 ... 5 mm/s 0 ... 50 μm 0 ... 10 mm/s 0 ... 100 μm 0 ... 20 mm/s 0 ... 200 μm 0 ... 50 mm/s 0 ... 500 μm 0 ... 100 mm/s 0 ... 1000 μm Measuring ranges are changed by means of jumpers

Analog outputs

Number	2 - for simultanious use
Voltage output	0 ... 10 V, $R_L \geq 100\ k\Omega$
Current output	0/4 ... 20 mA, $R_B \leq 500\ \Omega$ Current output is changed by means of jumpers
Error	5 % of the measured value 3 % of full scale 10 % for the whole measuring chain, including vibration sensor

System connection for instrument type CV-110

System voltage	230 V AC (196...253 V AC) 50 ... 60 Hz or 115 V AC (96...128 V AC) 50 ... 60 Hz
Power consumption	10 VA
Fuse	Power supply transformer has an in built thermal fuse

System connection for instrument type CV-116

System voltage	24 V DC (18 ... 32 V DC)
Power consumption	10 VA
Fuse F403	500 mA, 250 V, slow

Housing

Design	Aluminium casting
Type of protection	IP 65 as per DIN 40 050
Painting	RAL 7032 (grey)
Dimension	220 x 120 x 90 mm (L x W x H)
Weight	approx. 2 kg

Admissible ambient conditions

Storing temperature	-40 °C ... + 100 °C
Working temperature	0 °C ... + 65 °C
Air humidity	max 95 %, non condensing

EMC

EN 61326-1

Safety

EN 61010-1

WEEE-Reg.-No. 69572330

product category / application area: 9

Safety and reliability related values according to DIN EN ISO 13849-1

Safety and reliability related values MTTF, PL and Category according to DIN EN ISO 13849-1 have been evaluated with the following results:

Table 1: VC-1000 type CV-110

Parameter	**Value**	
MTTF	at 0 °C	at 65 °C
	7.866 E+06 h ~ 898 years	8.202 E+05 h ~ 94 years
PL	c	
Category	1	

Table 2: VC-1000 type CV-116

Parameter	**Value**	
MTTF	at 0 °C	at 65 °C
	7.343 E+06 h ~ 838 years	7.252 E+05 h ~ 83 years
PL	c	
Category	1	

Test conditions:

- Operating temperature: 0 °C, 65 °C
- Environmental conditions: Ground Benign, Controlled

Note:

The results of this assessment are valid when the following procedures are followed:

- The Relays of the VC-1000 have to be operated in the „normally energised" mode.
- The analog 4-20 mA signal industry-standard current loops must be used.
- The OK Relay has to be used as system function.
- The VC-1000 system must be protected against erroneous change in configuration

Abbreviations:

MTTF	Mean Time To Failure
PL	Performance Level From PL "a" (highest failure probability) to PL "e" (lowest failure probability)
Category	Category (CAT) Classification of the safety related parts of a control system in respect of their resistance to faults and their subsequent behaviour in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability
Ground Benign, Controlled	Nearly zero environmental stress with optimum engineering operation and maintenance.

Note:

The harmonized standard EN 954-1 is still valid (end of 2011), but it is considered technically outdated. It was replaced by the current harmonized standards DIN EN ISO 13849-1.

More detailed information about safety and reliability values can be obtained on request from Brüel & Kjær Vibro (info@bkvibro.com).

Limit values

Number	2
Setting range	10 % ... 100 % of full scale
Setting error	5 % of full scale
Response delay	limit value LIM1 (pre-alarm) 30 ms, 1 s, 3 s, 10 s, ± 5 % limit value LIM2 (main alarm) 30 ms, 1 s, 3 s, 10 s, ± 5 % response delay is changed by means of jumpers
Switching hysteresis	3 % of full scale

Alarm relay

Number	2
Design	monostable relay, optionally – normally de-energized or – normally energized – latching or – non latching determined by jumpers

Contact loading (ohmic load)

Switching voltage	AC max. 250 V, at max. 1 A DC max. 150 V: at max. 0.5 A
Switching capacity	AC max. 250VA at max. 1 A DC voltage dependent: .....at 150 V: P < 70 W .....at 48 V: P < 72 W .....at 24 V: P < 192 W

A spark suppressor must be provided in the case of inductive load !

Self-monitoring

Sensor system, signal line and mains supply are monitored as to interruption; fault message is signalled by the OK-relay (without response delay).

OK relay

Number	1
Design	monostable relay, generally in normally energized non-latching

2.1 Ordering code for instrument type CV-110

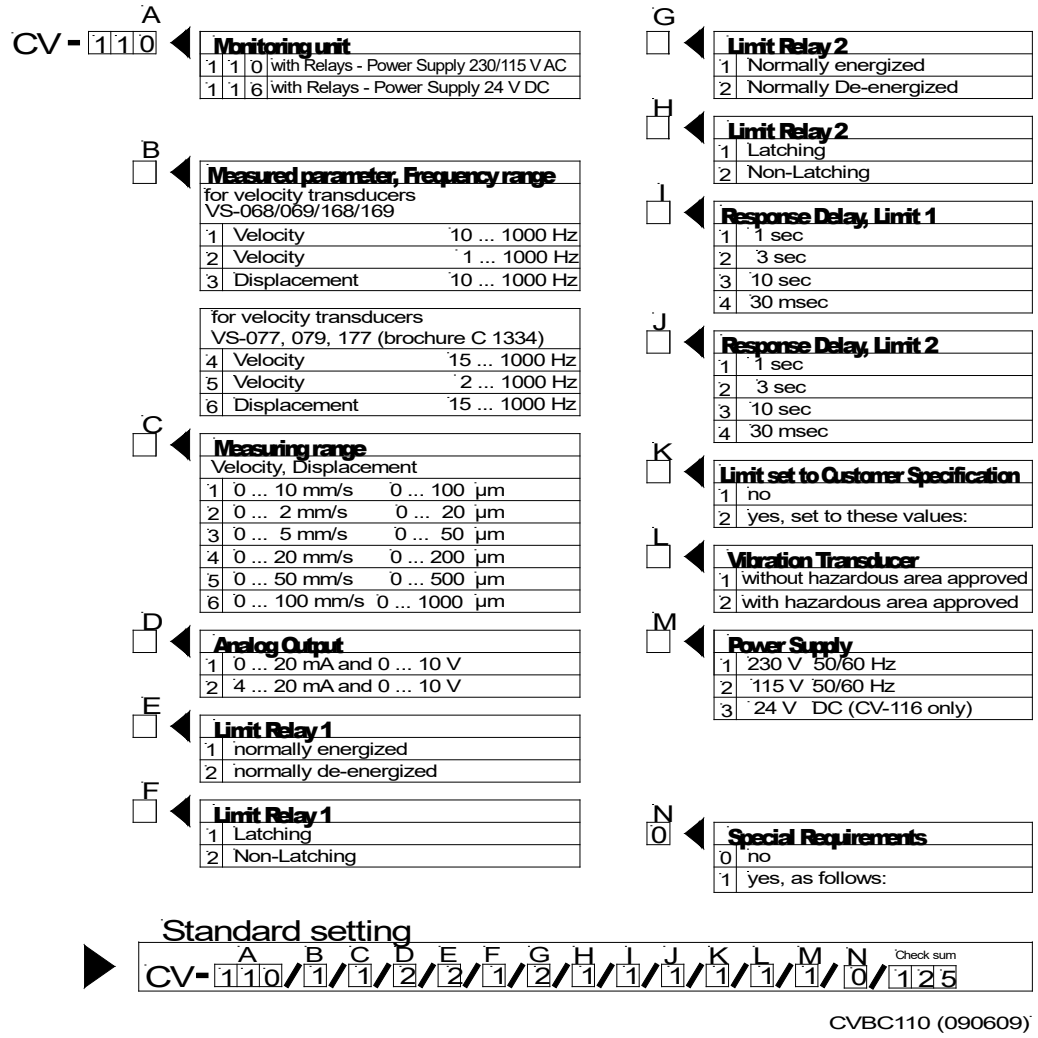


Figure 2 Ordering code

2.2 Ordering code for instrument type CV-116

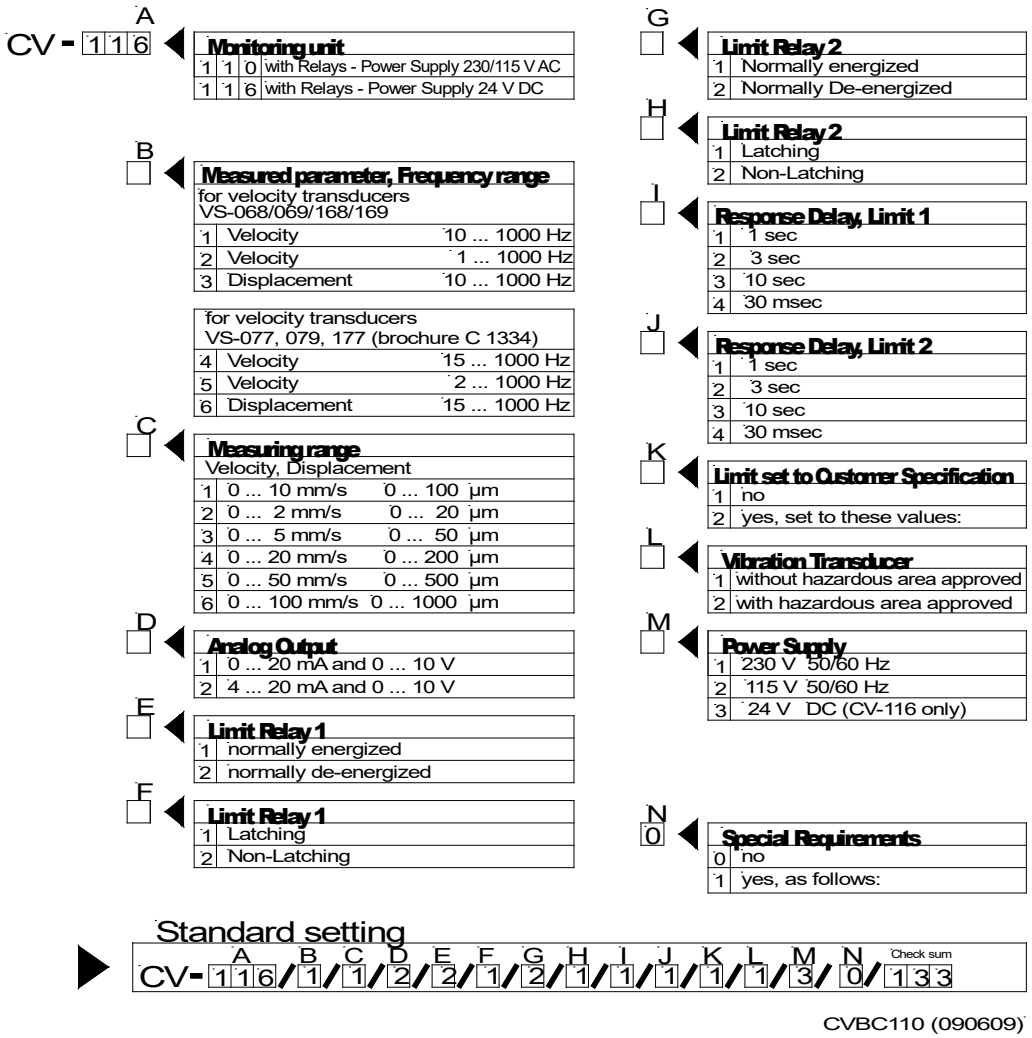


Figure 3 Ordering code

3 Commissioning

Adhere to attached safety instructions!

3.1 Installation

Remove housing cover and fix the base part by using 4 Phillips head screws M6.

Any installation position is accepted!

Replace unused conduit threads replaced by sealed metallic pegs to ensure type protection IP 65 and EMC.

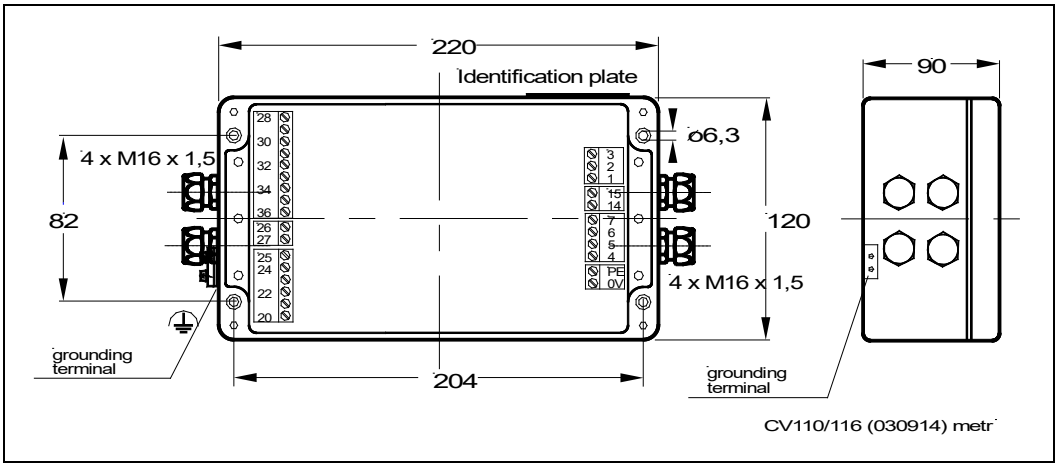


Figure 4 Dimensions

Note:

Installation (assembly) may only be performed by trained personnel!

Note:

The assembly of the VIBROCONTROL 1000 (CV-110/CV-116) must not be undertaken in areas with permanent vibrations. Possibly a vibration-isolated installation must be implemented.

3.2 Connections for instrument type CV-110

Removal of the housing enables access to the connection terminals.

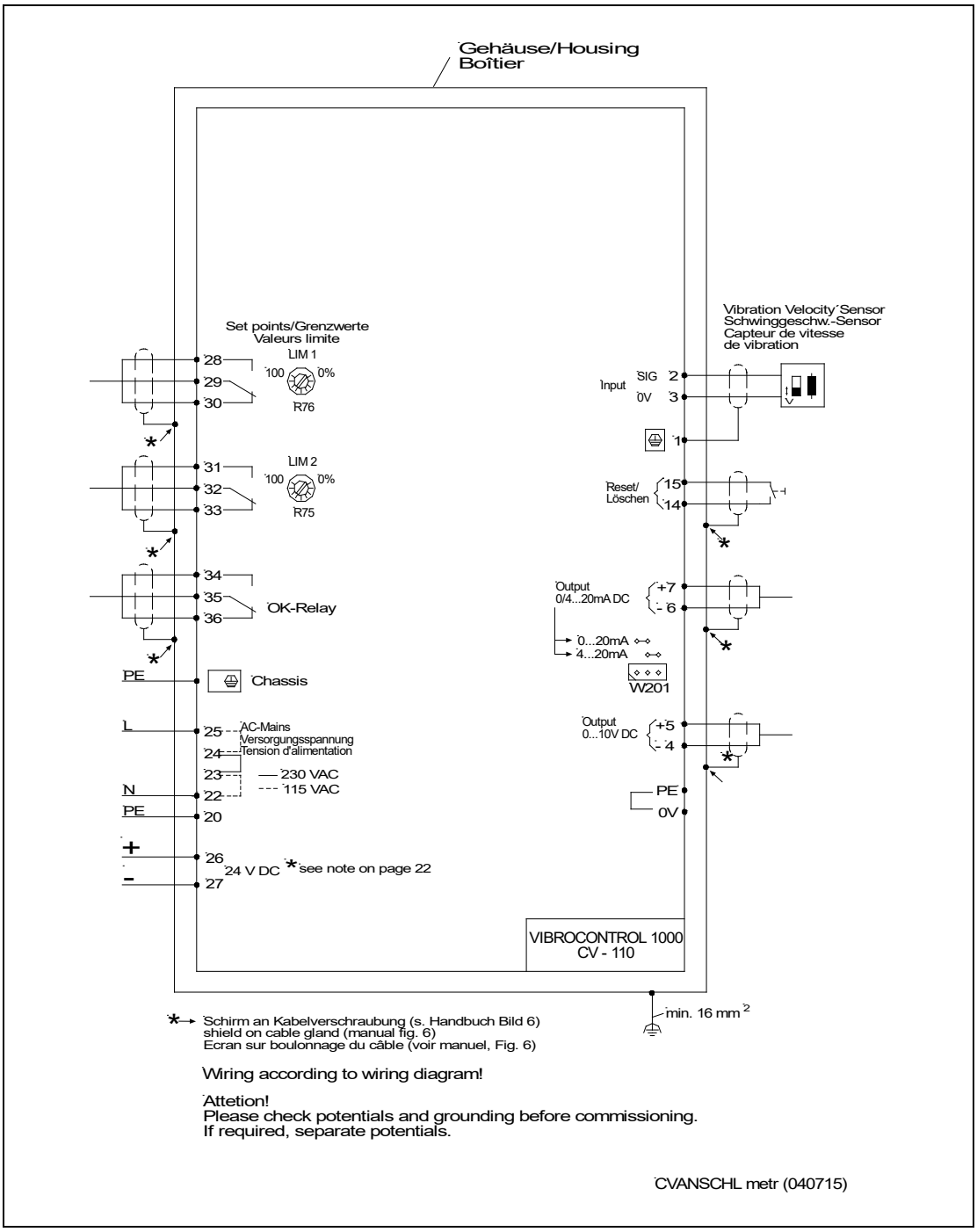


Figure 5 *Connection terminal diagram*
(The relay contacts are shown in de-energized condition)

3.3 Connections for instrument type CV-116

Removal of the housing enables access to the connection terminals.

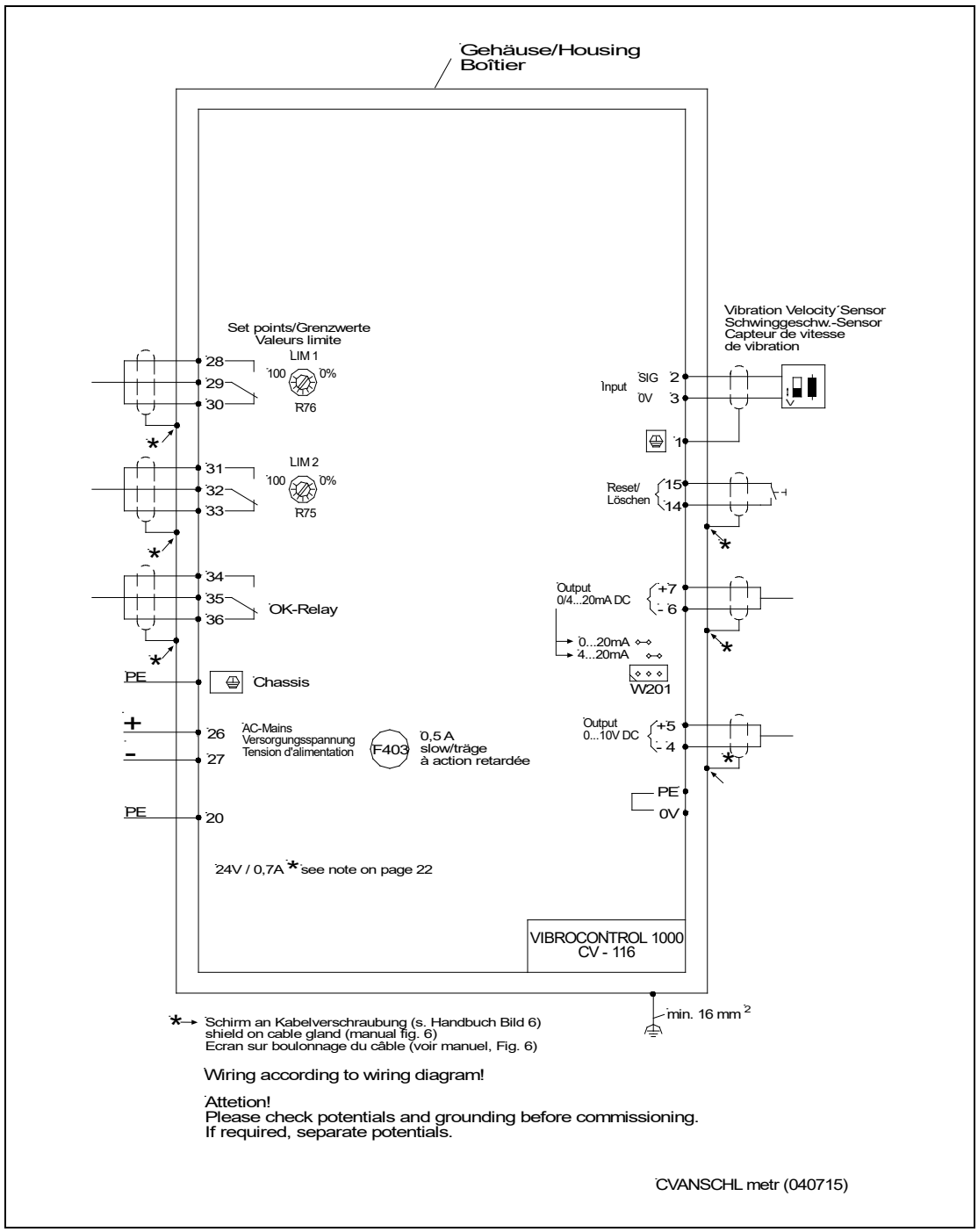


Figure 6 *Connection terminal diagram*
(The relay contacts are shown in de-energized condition)

Note:

*This chapter describes the connectiion terminals of **CV-110 and CV-116.** Possibly necessary changes of the device setting are described in the „Service“ chapter.*

Protective conductor

The protective conductor PE of the mains supply cable must be connected to earthing point 1 inside the housing (cf. fig. 7). Use the forked terminal which is already fixed at earthing point 1.

EMC

The external grounding screw (cf. fig. 7) must be grounded with the shortest possible length of cable having a minimum crosssctional area of at least 16 mm^2.

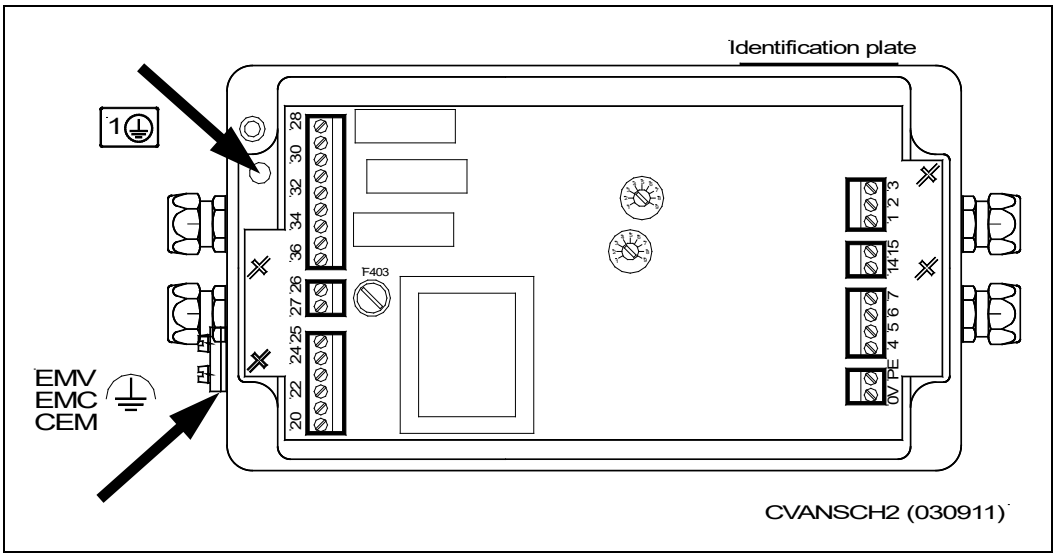


Figure 7 Position of the grounding points (arrows)

Screening

All cables connected to the electronic system must be screened!

There are two different cases:

- The screen of the sensor cable must be passed through the cable gland connection and is to connect with earthing point 1. Use the forked terminal which is already fixed at earthing point.
- The screens of all the other cables must be connected with the corresponding cable gland connection (cf. fig 8).

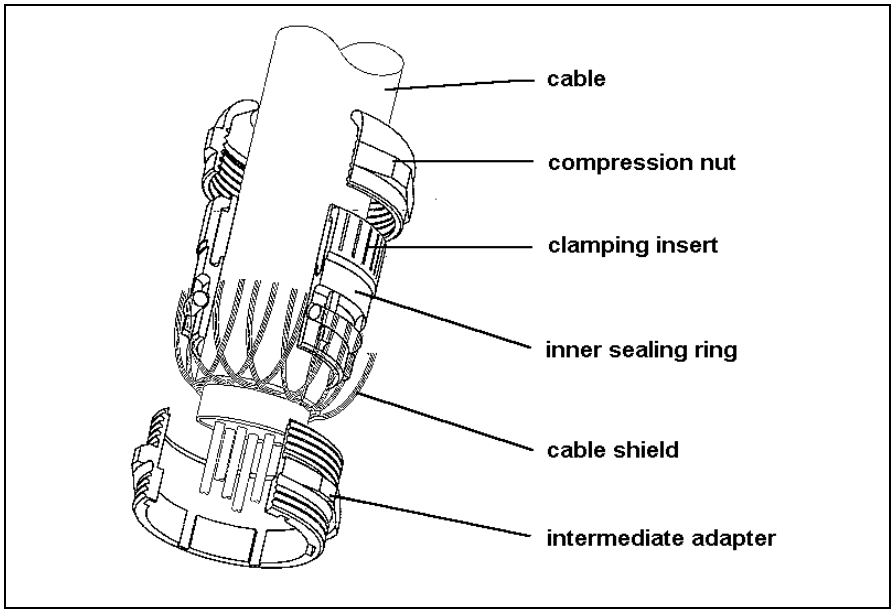


Figure 8 *Connecting the cable gland to the conduit thread*

3.4 Alarm relay

If the limit values are exceeded the corresponding alarm relays respond time-delayed, via the potential-free change-over contacts by means of which a warning signal or the disconnection of the machine can be triggered.

3.4.1 What you should know about alarm relays

Two switching variants are possible:

- Normally de-energized

  If the limit values are ***not exceeded*** (OK) the coil of the relay is de-energized, however, if the limit values are exceeded (alarm) the coil is current-carrying, the relay is energized.

- Normally energized

  If the limit values are ***not exceeded*** (OK) the coil of the relay is current-carrying, if the limit values are exceeded (alarm) the coil is de-energized, the relay is released.

The desired variant is determined by jumpers (cf. 5.1).

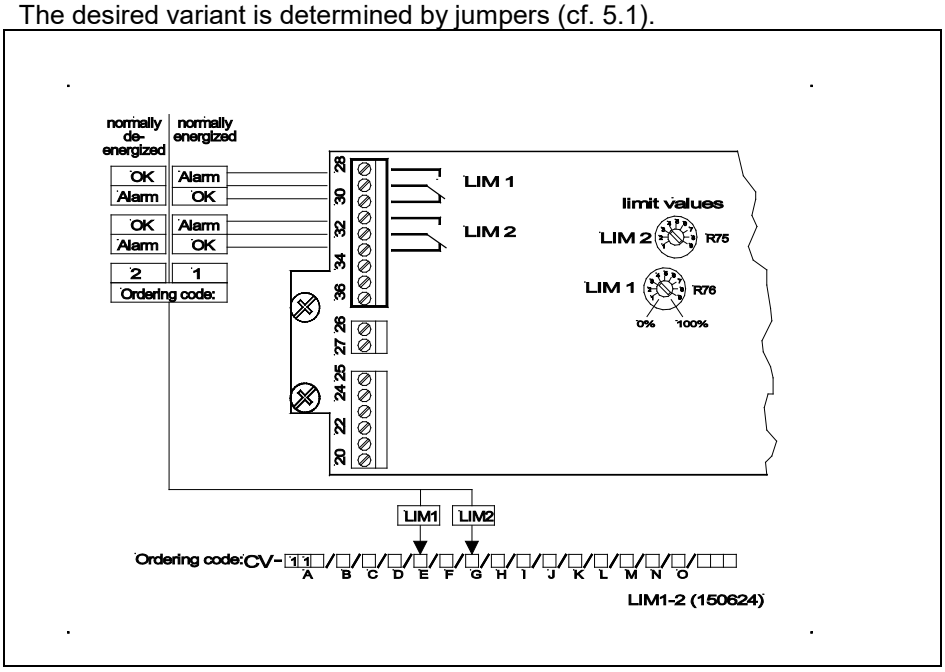


Figure 9 *Limit value relay*
The contacts are shown in dead condition

2 modes of operation are possible:

- latching
- non-latching

The adjusted mode of operation is stated on the information sheet inside of the housing.

3.4.2 Reset (acknowledging of relay messages)

Latching alarm relays must be reset after

- an alarm message has been given or

switching on the monitoring electronics

The jumper installed between terminal 14 and 15 causes a "permanent reset".

If required, the jumper can be removed and be replaced by an external reset pushbutton which bridges the terminals 14 and 15 only upon actuation of same (cf. fig.5 and 6).

Connect the reset button with ***screened*** line only!

3.4.3 Setting limit values

The limit values of both alarm relays are determined by means of the two potentiometers LIM 1 and LIM 2. The setting is performed in % related to the adjusted full scale value.

Example:

Requirement	Pre-alarm at 10 mm/s Main alarm at 14 mm/s
Setting	Measuring range: 20 mm/s (= 100 %)
	Pre-alarm: Potentiometer LIM1 10 mm/s = 50 %
	Main alarm: Potentiometer LIM2 14 mm/s = 70 %

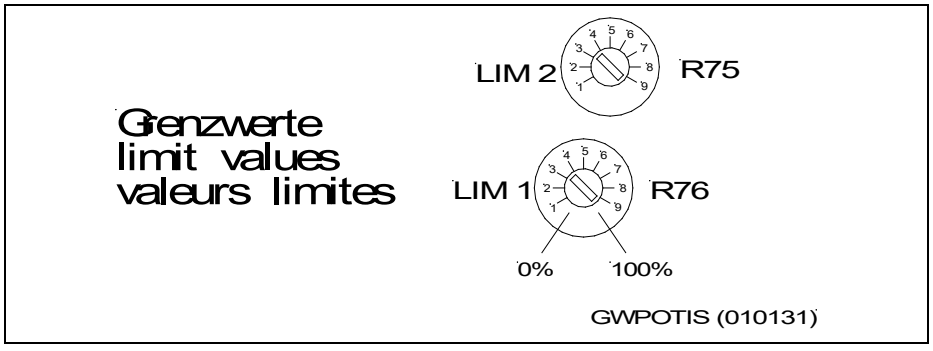


Figure 10 Alarm potentiometer

3.5 OK relay (self-monitoring)

By means of an integrated self-monitoring system interruptions in the sensor system or the signal line as well as the failure of mains voltage are signalled.

The message is effected ***without*** response delay via the OK-relay.

The OK-relay is ***always***

- Normally energized and
- Non-latching

Upon connection of the measuring and monitoring electronics and after the elimination of all malfunctions the OK-relay switches automatically from "ALARM" to "OK" (reset is not necessary).

Limit value messages are ***not*** influenced by the self-monitoring unit.

3.6 Readiness for operation

If all connections and adjustments have been carried out properly, the mains voltage can be applied; the OK-relay is energized and is switched to "OK".

For latching alarm relays the external reset pushbutton ***must*** be actuated - no alarm signal must be available!

During the accelleration phase the machine might reach vibration values that exceed the limit values (e.g. passing the resonance).

To avoid that the machine is disconnected during this phase the shut down system coupled with the monitoring electronics can be blocked until the operational speed is reached.

Upon reaching of the working order:

- actuate the reset pushbutton
- reactivate shut-down system

4 Explosion protection

By means of vibration monitoring system VIBROCONTROL 1000, series C, one can also monitor machines in hazardous areas.

The electronics must be installed outside the hazardous area !!!

Note:

For older devices, a fuse is installed in the measuring electronics. If necessary, ask if you want to use sensors for the hazardous area.

It is within the responsibility of the user to make sure that the installation is effected in accordance with the local regulation and the local acceptance authorities.

For further information please refer to the connecting diagram (fig. 5 and 6) and the description of the sensor.

5 Service

Adhere to attached safety instructions !

5.1 Changing settings

De-energize the electronic system before opening the housing!

Basic adjustments must not be changed but by authorized service personnel only !!! Unauthorized adjustments are forbidden!

The adjustments of the electronic system can be changed by different jumpers, which are accessable after the housing cover has beeen removed (cf. fig. 12).

Since external voltages can be connected to the relay contacts, hazardous contact voltage may still be present, even after disconnection of the power supply.

All settings may only be carried out by traind personnel!

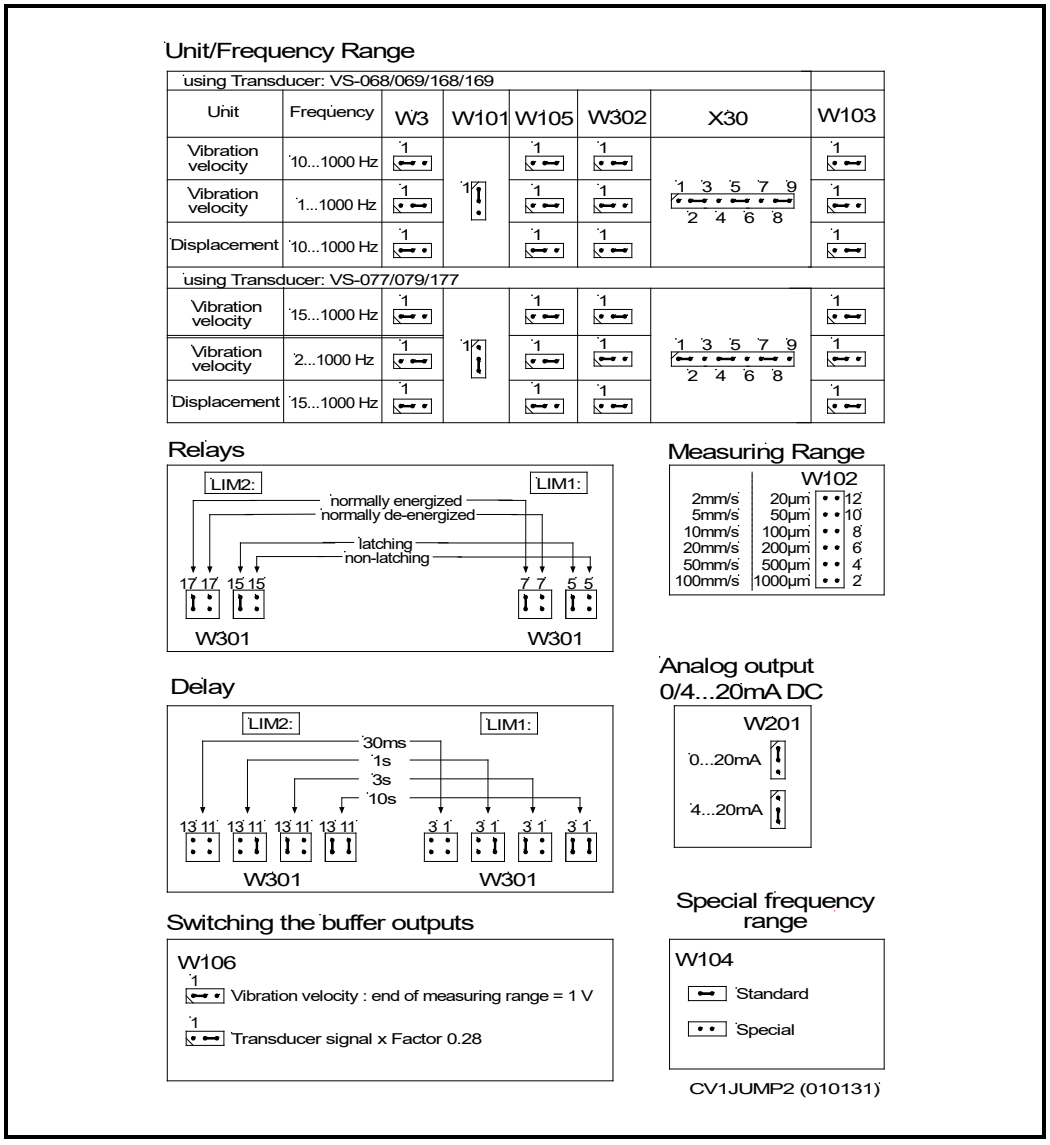
The following adjustments are possible:

- ***Measured variable***
  - ◊ Vibration velocity
  - ◊ Vibration displacement
- ***Frequency range*** (with/without linearization)
- ***Measuring range***
- ***Mode of the alarm relays***
  - ◊ Normally energized or normally de- energized
  - ◊ Latching or non-latching
  - ◊ Delay
- ***Analog output current***
  - ◊ 0 ... 20 mA
  - ◊ 4 ... 20 mA

The measuring and monitoring electronics have been set and tested according to the details given in your order.

The setting data are defined on insert sheet "Ordering code/device setting". The insert sheet is contained in the housing.

If the device setting is other than standard, you will find the setting data under the heading of "Factory setting". For your own safety you should write down each change of the setting data together with the serial no. in the insert sheet.



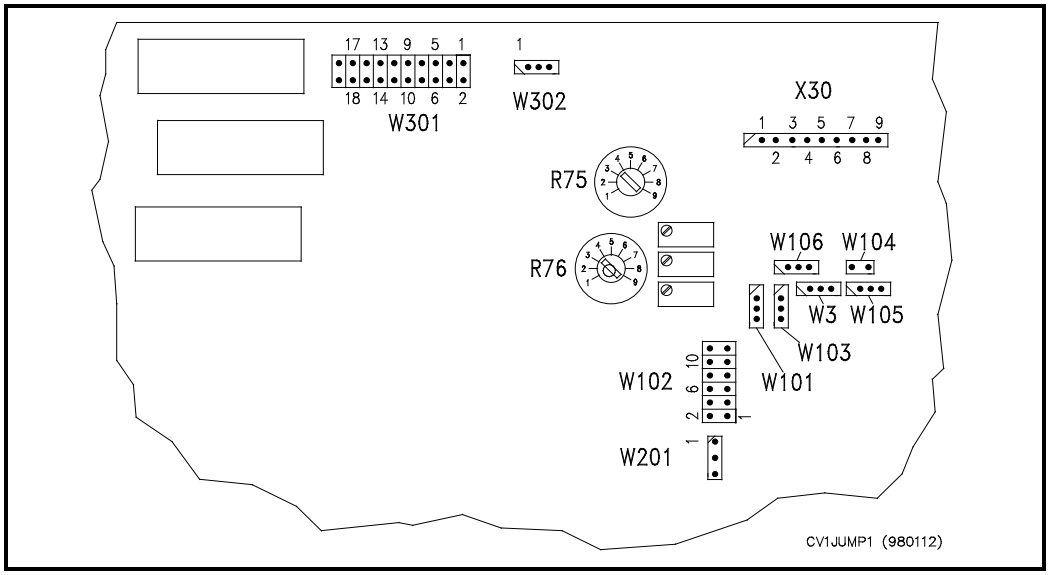


Figure 12 Table of adjustment (above) and position of the jumpers (below)

5.2 Trouble shooting

Adhere to attached safety instructions !

If the OK-relay signals a malfunction, proper functioning of the monitoring system cannot be guaranteed any longer.

We recommend to perform the following tests:

1. Checking voltage supply for instrument type CV-110

Deenergize the instrument!

- required voltage at the mains terminals?
- Power supply transformer thermal fuse has opened?
  Wait until the power supply transformer has cooled off.
  If upon retrying to switch the instrument on the fuse again opens, then the instrument should be sent to an authorised service centre and checked.

2. Checking voltage supply for instrument type CV-110

Deenergize the instrument!

- required voltage at the mains terminals
- Power supply fuse F403 ok?

3. Checking the transducer connection

- are the terminal connections of the signal line ok?
  is the terminal protective housing - if existent - installed correctly?
- cable fracture in the signal line or winding fracture in the sensor?

The self-monitoring unit only reacts if the signal circuit is interrupted; by bridging the signal input (terminals 2 and 3) proper working order can be simulated

If this jumper is positioned e.g. at the terminal protective housing, the source of malfunction can be determined much faster.

The self-monitoring unit does not detect a short-circuit occured in the sensor/sensor connection.

However, despite the existing vibration level, the following values can be measured at the analog outputs:

Analog output	0 ... 10 V:	→ 0 V
	0 ... 20 mA:	→ 0 mA
	4 ... 20 mA:	→ 4 mA

If these measures are not suited to eliminate this malfunction, the electronic system together with the sensor have to be returned for repair.

Further trouble shooting "on site" can be performed by authorized service personnel only.

Advantages and disadvantages of 24 VDC operation with the CV-110 resp. CV-116

24 V DC connection to CV-116

Advantages

The instrument has a DC/DC converter. Therefore the potential freedom of the power voltage is guaranteed. This makes the analog outputs also potential free.

A further advantage is in the large tolerance range for the 24 V power supply (18 … 36 VDC)

In addition, with this connection maintenance of the EMV guidelines of the manufacturer are also guaranteed

24 V DC connection to CV-110

Disadvantages

Under certain prerequisites the CV-110 can be operated with 24 V DC. When connecting the 24 V DC the following conditions must be met:

1. For such a connection the operator must guarantee maintenance of the EMV guidelines
2 The inputs and outputs are not potential-free; i.e. the 0 volt terminal of the analog output is always at the same potential as the 0 V of the operating power!
3. The tolerance range of the power supply is limited to
   + 24 V DC -20 % … + 10 %
4. Any disturbance on the 24 V power supply will directly affect the measurement electronics

Note:

The 24 V DC input is protected by a 0,5 A fuse.

6 Cleaning

The device can be cleaned externally using a slightly damp cloth.

Do not bring any moisture such as water and other liquids into contact with the device!

7 Disposal

Adhere to attached safety instructions !

8 Declaration of conformity

Brüel & Kjær Vibro

EU-Konformitätserklärung / *EU- Declaration of conformity*

Hiermit bescheinigt das Unternehmen / *The company*

CE

Brüel & Kjær Vibro GmbH
Leydheckerstraße 10
D-64293 Darmstadt

die Konformität des Produkts / *herewith declares conformity of the product*

Mess – und Überwachungsgerät / Measuring and monitoring equipment

VIBROCONTROL 1000

Typ / *Type*

CV-110, CV-116

mit folgenden einschlägigen Bestimmungen / *with applicable regulations below*
EU-Richtlinie / *EU-directive*

2014/30/EU EMV-Richtlinie / *EMC-Directive*
2014/35/EU Niederspannungsrichtlinie / *Low Voltage Directive*
2011/65/EU ROHS-Richtlinie / ROHS-*Directive**

***Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten /**
EU Directive for the restriction of the use of certain hazardous substances in electrical and electronic equipment

Angewendete harmonisierte Normen / *Harmonized standards applied*

EN 61326-1: 2013
EN 61010-1: 2010
EN 50581 : 2012

Bereich / Division
Brüel & Kjær Vibro GmbH

Unterschrift / Signature
CE-Beauftragter / *CE-Coordinator*

Ort/*Place* **Darmstadt**
Datum / *Date* **21.04.2017**

i.A.
(Niels Karg)