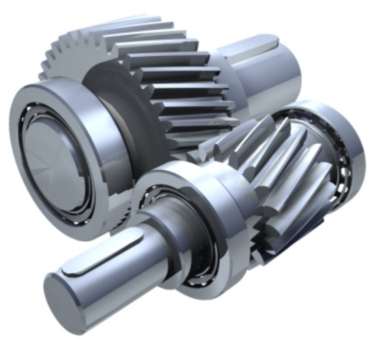
We keep your drive running!

Peakanalyzer

Installation Manual Version 2.6



www.maschinendiagnose.de

Content

1 General Notes

1.1 Symbols on the device

This symbol is a warning of the danger of an electrical stroke. The warning applies to the 220 V supply voltage connection of the Peakanalyzer in an IP65 box. The measurement equipment itself does not generate dangerous voltages.

This symbol is a warning of the danger of injury by crush. It is meant the crushing of fingers during the mounting of the Peakanalyzer with the optional mounting magnets.

This symbol is a warning of the magnetic field of the optional mounting magnets. One magnet has a drag force of about 45 kg.

1.2 CE-Labeling

We declare herewith,

GfM Gesellschaft für Maschinendiagnose mbH

Köpenicker Straße 325, Haus 40, D-12555 Berlin,

that our product

peakanalyzer

in all product variations[1]

complies to the following relevant regulations: [2],[3]

EG-Niederspannungsrichtlinie 73/ 23/EWG*

(applied in Germany by 1. Verordnung zum Gerätesicherheitsgesetz)

Elektromagnetische Verträglichkeit 89/336/EWG* und **92/31/EWG***

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[1] This applies to complete measurement systems. For individual components the conformity has to be proven in the target system. If applied correctly it is not expected to have affects according to device safety or EMV.

[2] This conformity declaration applies only the systems supplied by GfM. Changes or extensions are in the responsibility of the operator and thus has to ensure the conformity with the corresponding EG-Directive.

[3] Harmonised Norms:
DIN EN 61326:2002 (Produktnorm): Es werden die Störfestigkeits-Prüfanforderungen an Betriebsmittel, die zum Gebrauch in industriellen Bereichen vorgesehen sind (gemäß EN 61326/A1 Tabelle A1 und Tabelle 3) sowie die Störaussendungsgrenzwerte (gemäß EN61326/Tab.3) eingehalten.
DIN EN 61000-4-2:2001, -4-3:2001, -4-4:2002, -4-5:2001, -4-6:2001
DIN EN 61010-1:2002
DIN EN 55011:2000 (Funkstörfeldstärke Klasse A)

(applied in Germany by the EMV-Gesetz)

*) changed by CE-Kennzeichnungsrichtlinie 93/68/EWG

The measurement system is developed and manufactured by the following guidelines:

Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte DIN EN 61 010-1: 2002

It was tested with greatest care before delivery and was shipped in perfect condition.

1.3 Notes to radio interference suppression

The Peakanalyzer fulfills the EMV-policy for unlimited usage in living area and industrial area in a regular installed state. The Peakanalyzer in an IP65 box must have the door closed when it is in operational state.

All additional products that are connected to the device must be also suppressed by radio interference according to BMPT-Vfg. Nr. 1046/84 or Nr. 243/91 or EG-Richtlinie 89/336/EWG. Products that fulfill the requirement are labeled with a CE-Label or a label describing the suppression of radio interference by the manufacture.

Products that do not fulfill the requirements can only be used with an individual license of the BZT.

All signal cables that are connected to the Peakanalyzer must be shielded and the shield must be connected to protected earth. If the Peakanalyzer is delivered in an IP65 box, the shield of the signal cables must be connected to the bulkhead receptacle. If the signal cable is directly connected to the measurement terminal, the shield can alternatively be connected to the clamp with a black S on yellow ground.

Please consider that all signal inputs and outputs except the power connection is shielded and must be connected to protected earth on one side. Only in this case a high interference immunity and interference emission can be achieved.

1.4 FCC-Note

This device has fulfilled all thresholds in tests that are formalized in chapter 15 of the FCC-Guideline (in 47 CFR 15.105)[4] for digital devices of the class B. These thresholds have sufficient protection of harmful radiation for the installation in living areas. Devices of this class generate and use high frequency electromagnetic waves and may emit these. Thus if the instructions are not realized properly it is possible to disturb the radio reception. However in exceptional cases certain installations can cause disturbances. If the radio or TV reception is disturbed and it can be backtracked to the device by switching it off and on it can be corrected by the following actions:

- Adjust the direction of the receiver
- Increase the distance between the device and the receiver
- Plug in the power connector of the device in another socket so that the device is connected to a different electrical circuit than the receiver.

4 FCC - United States Federal Communications Commission

- If necessary contact our support or contact an experienced radio or TV technician.

1.5 Changes

According to FCC-Guidelines it is not permitted to operate the device with changes that are not approved by GfM.

1.6 Cables

To fulfill the thresholds of class B devices according to part 15 of the FCC-Guidelines it must be ensured that all signal cables that are connected to the Peakanalyzer are shielded.

1.7 Accident Prevention

It is confirmed that the delivered product is procured according to accident prevention regulation "Elektrische Anlagen und Betriebsmittel" (BGV-A3 der Sammlung der Einzel- und Unfallverhütungsvorschriften der gewerblichen Berufsgenossenschaften in Deutschland)[5].

This confirmation has only the purpose to release the company of verifying the device before the first installation (§ 5 Abs. 1, 4 der BGV-A3). Civil warranty and liability claims are not regulated by this confirmation.

1.8 After unpacking

After unpacking the device it should be checked for mechanical damages or loose parts in the inner. If a transport damage is occured, contact GfM and do not install the device.

1.9 Transportation

Transport the Peakanalyzer in the original package or in a package that ensures an adequate protection. Transport damages are excluded from guarantee claims.

1.10 Before Installation

The Peakanalyzer is assembled with different rail components, like the Industry-PC, terminals and the power supply. These components are mostly assembled in an IP65 steel box. But they may are also delivered as separate components for installation in a control cabinet.

If the device was carried from a cold environment to the operating area, condensation may occur. In this situation wait until the temperature adopted to the environment and it is absolutely dry before putting it in operation. If there is condensation due to transport or storage wait at least 2 hours for acclimation. It must be ensured that there is no condensation water in the IP65 steel box. Devices in the IP65 steel box must not be set into direct sunlight.

The rail components are generally intended for usage in clean and dry rooms especially for installation in control cabinets. They must not operate under conditions with high dust or humidity in the air, as well as conditions with explosion danger or aggressive chemical influence.

The operational condition of the rail components is approved for ambient temperatures up to 40°C. They must be installed in a control cabinet in a way to allow free convection. If the

[5] *Former VBG-4, also see http://www.bgfe.de/pages/gesetze/bgv.htm*

ambient temperature is above 40°C an active cooling via a fan may be required. The amount of the exceeding temperature depends on the efficiency of the cooling.

1.11 Protected Earth, Shield, Power Supply

The device has to be connected to protected earth to fulfill the thresholds for devices of class B according to part 15 of the FCC-Guidelines. The same counts as a requirement for the specified technical data.

The Peakanalyzer in an IP65 steel box (240 V_{AC} / 110V_{AC}) is connected to protected earth via the PE signal of the power supply connector that is also connected to the ground of the steel box. A connection of protected earth to the lightning or overvoltage protection is in general not possible with the PE connection of the power supply. In this case it is recommended to connect the steel box or a conductive screw connection with an earthed machine part.

If the rail components are delivered in individual components for assembling in a control cabinet, the user is responsible for the professional execution of the DC supply and earth connection.

All connected signal cables to the Peakanalyzer must be shielded and the shield must be connected to protected earth. Thus the shield must have a galvanic contact with the chassis.

The Peakanalyzer in the IP65 steel box operates with an AC power supply of 110 V_{AC} to 240 V_{AC} at 50/60 Hz. A cable with 3 wires for L, N and PE must be used for the power supply connection of the Peakanalyzer with IP65 steel box. The connection is done at the power supply clamp 52 as depicted in the circuit diagram and labeled in the device.

The rail components for assembling in a control cabinet are power supplied with 24 V_{DC} ± 10%. The power consumption depends on the amount of used rail components.

1.12 Accumulator und Battery

The system contains a lithium long term battery that does not need any special maintenance (Type BR2032). The long term battery is accessible behind the protective cover of the industry PC. An exchange of the battery should be done by the manufacturer or user in the scope of a system inspection or maintenance. The exchange is recommended every 4 to 7 years depending on the application.

1.13 Fuses and wire sizes

The power supply input of the Peakanalyzer is equipped with a fine wire fuse 2 A T / 250 V_{AC}. The 230 V_{AC} wire must have a size that is suitable for the maximum current of the fine wire fuse. The breaking capacity of the supplied fine wire fuse has an amount of 1500 A. If the current is above 1500 A there is a danger of a permanent lighting bow over the contacts of the fine wire fuse. This can lead to a fire in the power supply unit. Furthermore the fuse body can be destroyed.

If the Peakanalyzer operates on a 230 V_{AC} voltage where the maximum current between L and N is limited to 1500 A, this danger is not existent. This is the normal case. If the maximum current of the 230 V_{AC} voltage input is above 1500 A, the user has to apply an additional fuse of the electrical circuit to reduce the maximum current to 1500 A or below between N and L wire.

The 24 V_{DC} supply voltage of the E-Bus supplies the individual terminals with the required operating voltage to drive the EtherCAT system bus. The current through these input voltage clamps must be limited to 2 A. If the power supply source has a greater output current than 2 A, each +24V branch of the E-Bus supply must be protected by a 2 A T fine wire fuse. The fused wire sizes must be designed to at least 3 A current.

The 24 V_{DC} supply voltage of the power contacts for external sensors is available at the clamps with a black + on red ground and black - on blue ground. These clamps allow a maximum current of 10 A. If the power supply source delivers more than 10 A, the input source has to be protected by a separate fuse of 10 A. If the power supply source delivers a current of 10 A or less, the additional fuse can be omitted. In all cases the wire size must have at least a cross section of 1.5 mm^2. In most cases a power supply source with 2.5 A or 3 A is sufficient. This than serves as fuse for the power contacts.

If there are external sensors used that are not supplied by GfM it is recommended to additionally protect the + branch by a fine wire fuse. This fuse should have an amount of 3 times of the nominal current but a maximum of 2 A T. An example is shown in Picture 11.

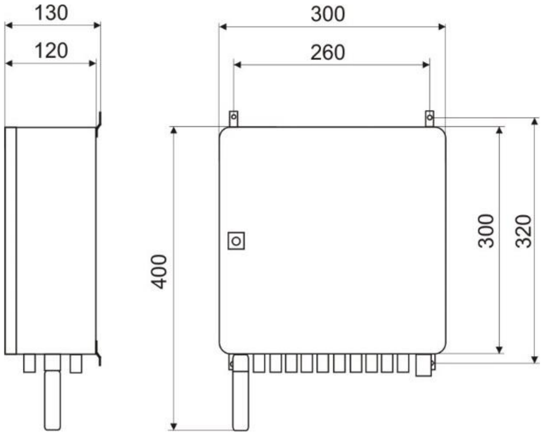
2 Installation of hardware

2.1 Variants of the Peakanalyzer

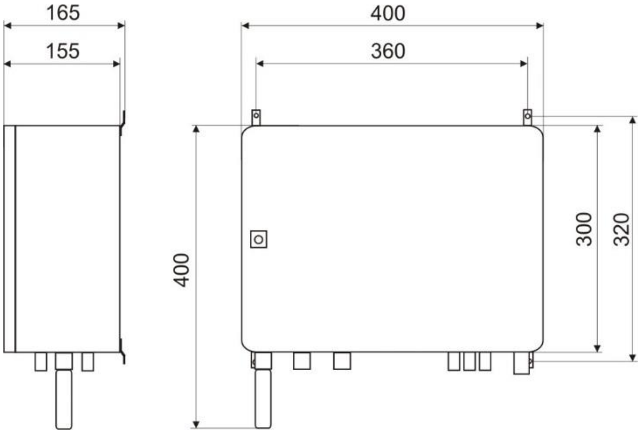
The Peakanalyzer is delivered as a complete device in an IP65 steel box. The steel box exists with two different dimensions. Alternatively the rail components are delivered as individual components for assembling in a control cabinet. Furthermore it may be practical to distribute the measurement terminals in the field in separate boxes. The concrete type depends on the local requirements and the contractual agreement. The installation of the hardware is described for the variant as complete device in an IP65 steel box. The installation in a control cabinet and the distributed systems should be based on this description.

2.2 Mechanical mounting of the Peakanalyzer

The Peakanalyzer should be installed as close as possible to the measurement object. Thus there is no need for additional signal amplifier or shielding action.



Picture 1: Physical dimensions Peakanalyzer width 300 mm



Picture 2: Physical dimensions Peakanalyzer width 400 mm

The Peakanalyzer should be mounted as vibration free as possible. Besides a fan, the Peakanalyzer does not contains any moveable parts. However strong, permanent vibrations can lead to mechanical damages or contact problems.

The Peakanalyzer with IP65 steel box can be mounted with 4 angle brackets on a suitable surface, e.g. a wall. The screws should have a diameter of 6 mm. Depending of the type of the steel box the holes must match the sizing in Picture 1 or Picture 2.

Alternatively it is possible to mount the Peakanalyzer via magnets. This method is depicted in the title picture. This method has the danger of injury due to crushed fingers by mounting the Peakanalyzer. Thus a cautious mounting is recommended.

2.3 Electrical connection of the Peakanalyzer

All signal inputs from sensors or other encoder are lead through the bulkhead receptacle into the Peakanalyzer IP65 steel box and connected to the intended clamps. The same applies to the power supply cable, the LAN cable and the cable for the optional PROFIBUS slave terminal or PROFINET device terminal. If some terminals are distributed in the field (see 0 to 2.3.19.4) the cable for the EtherCAT branch is also lead through the bulkhead receptacle into the steel box.

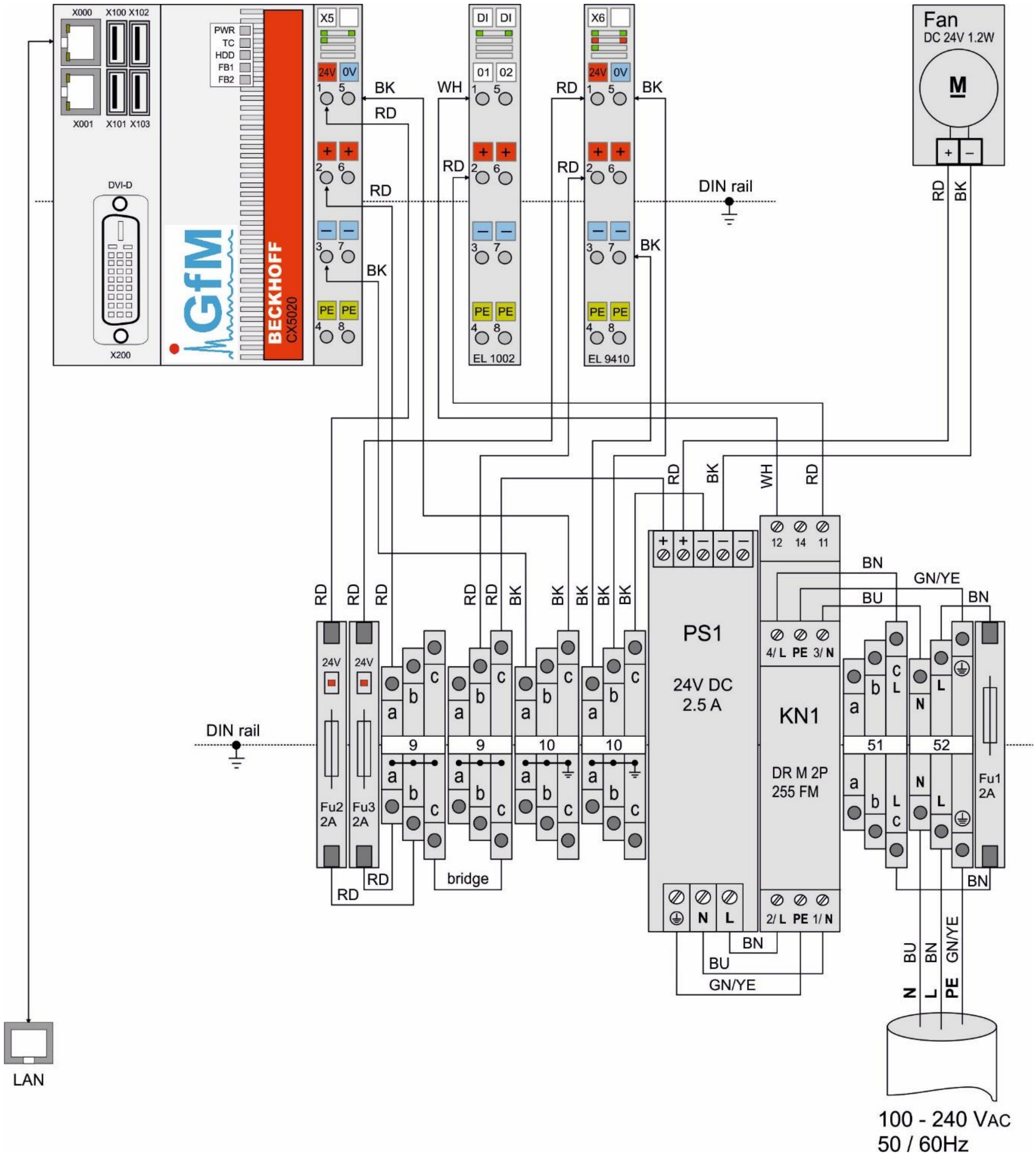
The shield of all signal inputs should be connected in the bulkhead receptacle to the steel box. If the signal inputs are directly connected to the measurement terminals the shield can alternatively be connected to the clamp with the black S on yellow ground.

2.3.1 Internal connection in the Peakanalyzer

If the Peakanalyzer is supplied in a steel box, the internal connection is already existent. If the Peakanalyzer is supplied as individual components for a control cabinet, the internal connection has to be done in the control cabinet. The internal connection consists of the 100 to 240 V_{AC} power supply connection with the fuse Si1 and the overvoltage protection clamp KN1 for the 24 V_{DC} power supply source NT1. The power supply source NT1 supplies the industry PC (IPC) through the clamps 9 and 10 as well as the fan. Dependent on the use case of the bus terminals it is possible to use one power supply source (NT1) or two (NT1, NT2) to connect the system supply voltage Us and the supply voltage for external consumers Up. The power supply source NT1 also supplies the terminals X6, X7 and X8 of type EL9410 if they are equipped. Also see Picture 4 und Picture 7. If a separate power supply NT2 is equipped, it is also connected to the power supply terminals X6, X7 and X8 of type EL9410. The Chapters

1.13 and 2.3.13 describe the connection of the terminals EL9410 to the power supply sources Us and Up and points out important notes for the protection of the input supply.

The failure monitoring of the overvoltage protection clamp KN1 is done via the digital input terminal DI-01 of type EL1002. The internal connection of the Peakanalyzer is shown in Picture 3.



Picture 3: Internal connections in the Peakanalyzer, power supply and LAN connection

2.3.2 Power supply connection

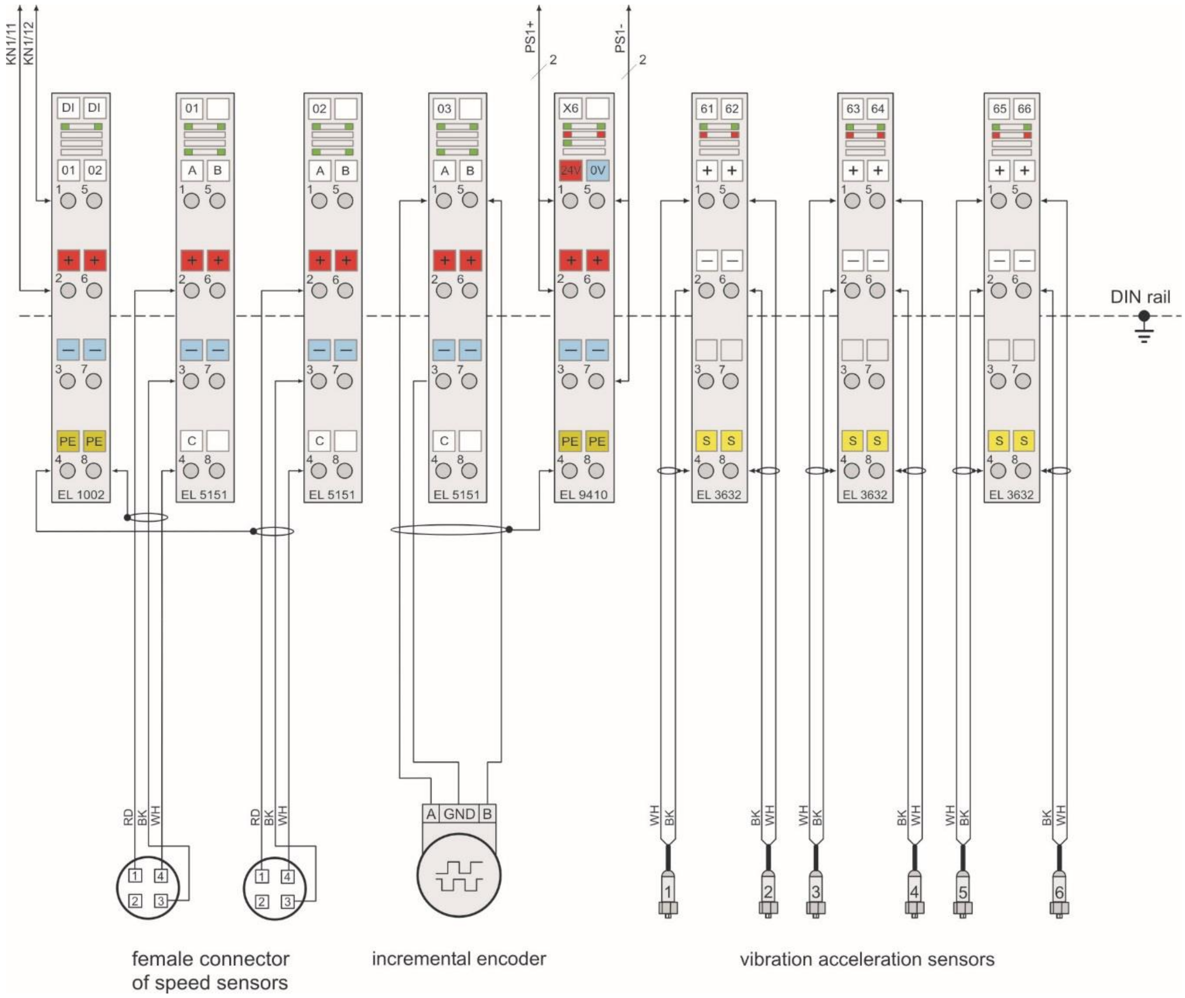
The power supply connection of 100 to 240 V_{AC} is connected on the clamp 52. The clamps are labeled with blue – N, gray – L and green-yellow – PE. The power supply frequency should be 50 or 60 Hz. The external power supply connection is shown in Picture 3.

2.3.3 Network connection (LAN) of the Peakanalyzer

The network connection of the Peakanalyzer is connected through the RJ45 network socket X000 via a twisted pair cable to a PC or to a network (see Picture 3). For functional operation the network interface must be configured appropriate or can be ordered preconfigured (see chapter 4). The communication of the Peakanalyzer Manager with the Peakanalyzer is done via this connection.

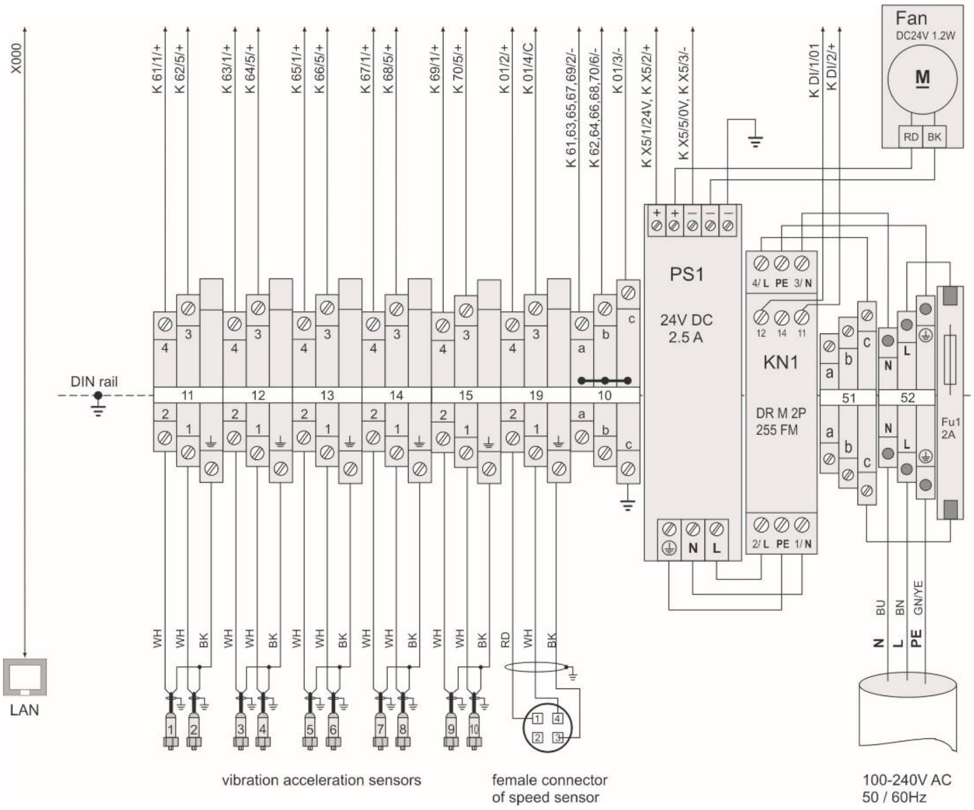
2.3.4 Connection of IEPE vibration acceleration sensors to terminals of type EL3632

The vibration acceleration sensors are directly connected to the terminals with the label 61, 62 to 99. This are in any cases IEPE terminals of the type EL3632 that are suitable for connecting two vibration acceleration sensors. The supplied vibration acceleration sensors are connected with the white wire to the clamp labeled with a black + on white ground and with the black wire to the clamp labeled with a black - on white ground.



Picture 4: Connection of vibration acceleration sensors and speed sensors

Picture 4 shows the direct connection of the shielded connections of the vibration acceleration sensors to the measurement terminals EL3632. It is shown that the shield is connected to the clamp labeled with a black S on yellow ground. Alternatively the shield can be connected in the bulkhead receptacle to the steel box.



Picture 5: Connection of external sensors via overvoltage protection to the Peakanalyzer

If the Peakanalyzer is equipped with optional overvoltage protection for external sensors, the connection of signal inputs is done at the overvoltage protection clamps 11, 12 and following as shown in Picture 5.

2.3.5 Connection of speed sensors to terminals of type EL5151

The speed sensors are directly connected to the terminals 01, 02, 03 or 04. These are incremental encoder terminals of the type EL5151.

The output signal of the speed sensor is connected to the clamp labeled with a black C on white ground. The Peakanalyzer then works with a very accurate impulse time measurement with an accuracy of 1 ns. This measurement method also results in a very accurate speed value if there a multiple impulses per rotation and not equidistant distributed. This is the recommended measurement method. This method works until a maximum impulse frequency of 1 kHz. Picture 4 shows the connection of two speed sensors to the terminals 01 and 02 in the impulse time measurement method.

If the maximum impulse frequency is above 1 kHz, the speed signal has to be connected to the clamp labeled with a black A on white ground.

If the speed signal is given from an incremental encoder that delivers a gray code signal and additionally the direction of rotation should be measured, the phase shifted tracks A and B should be connected to the clamps labeled with a black A or B. This is shown on terminal 03 in Picture 4.

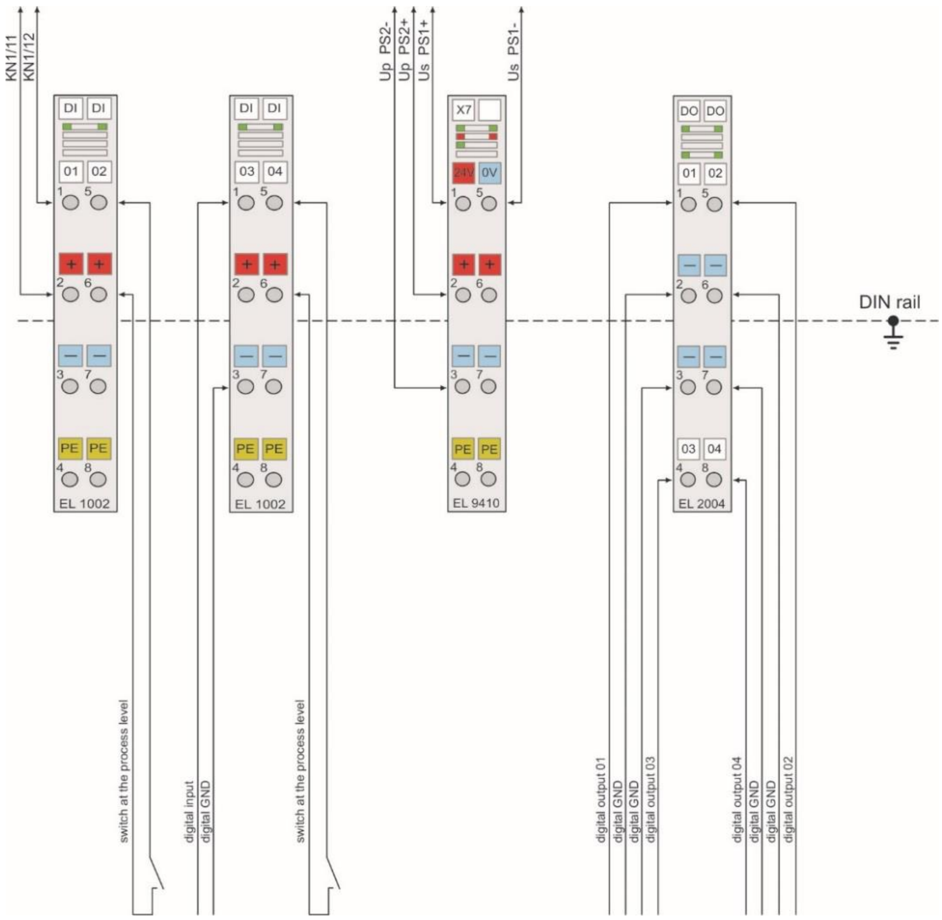
The supply voltage for the speed sensors is also provided by these terminals. The clamp with a black + on red ground delivers +24 V and the clamp with a black - on blue ground provides the ground for the speed sensor. The supplied speed sensors require this supply voltage as shown in Picture 4.

Further methods for measuring a speed value from a voltage signal or provided speed values via PROFIBUS or PROFINET are not described in this chapter. For further information see chapter 2.3.8 – Connection of analog input terminals of type EL3702 or chapter 2.3.15 – Connection of PROFIBUS to terminal of type EL6731-0010 or chapter 2.3.16 – Connection of PROFINET to terminal of type EL6631-0010.

If the Peakanalyzer is equipped with optional overvoltage protection clamps, the electrical connection of the speed sensors is done via the overvoltage protection clamps 19, 20 and following as shown in Picture 5.

2.3.6 Connection of digital input signals to terminals of type EL1002

The digital input terminals are realized with the type EL1002 providing two channels per terminal. Internally the failure monitoring of the overvoltage protection clamp KN 1 is connected to the clamp DI-01 (see Picture 3). External digital input signals from a process system can be connected to the clamps DI-02, DI-03 to DI-16. These signals can be used as trigger signals to directly start a measurement. Furthermore the digital input signals can be used as process channels for the classification. The classification can be used as tool to have class dependent threshold monitoring of online characteristic values of vibration acceleration signals. The connection of digital input signals is shown in Picture 6.

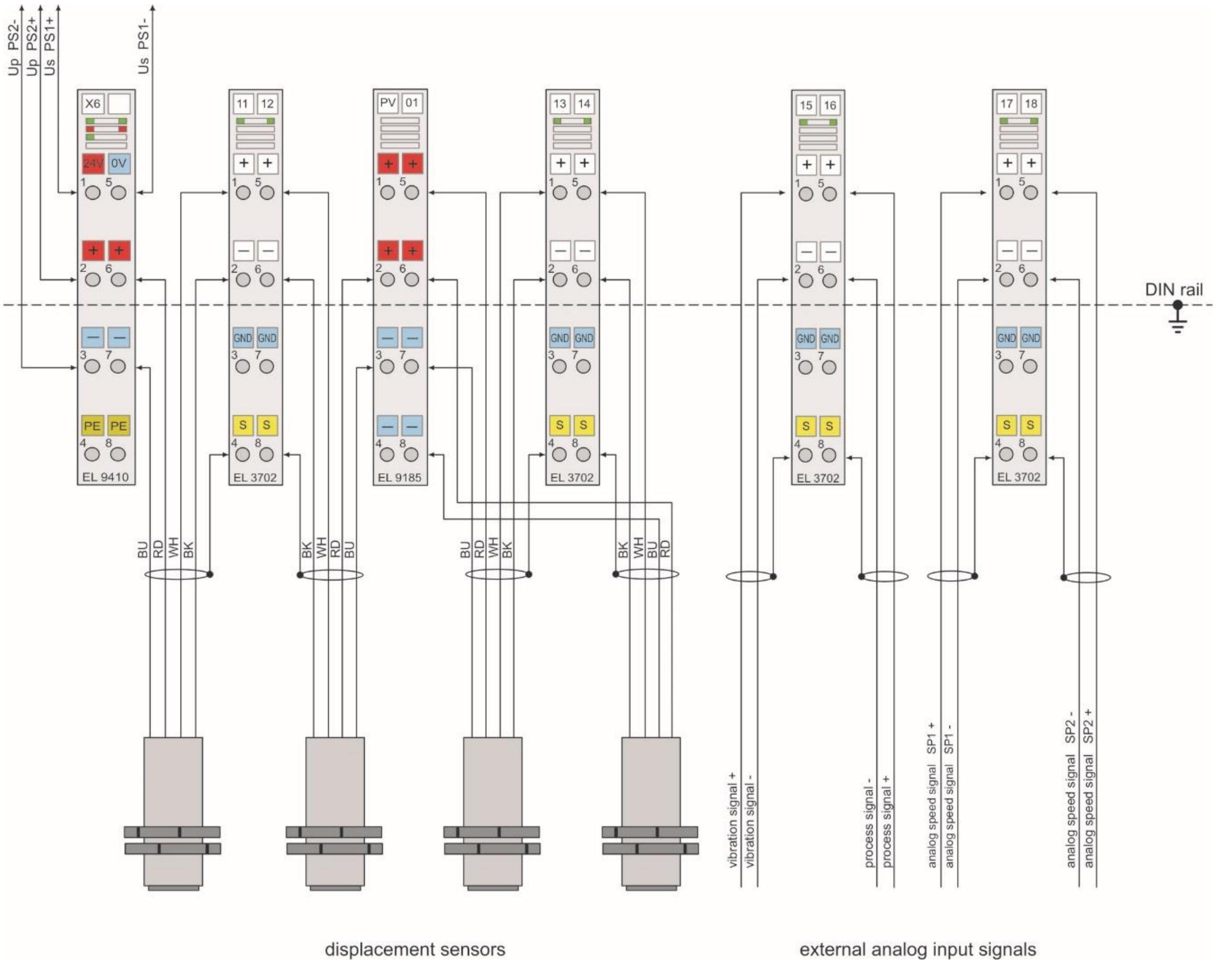


Picture 6: Connection of digital input and output signals

2.3.7 Connection of digital output signals to terminals of type EL2004

The digital output terminals are realized with the type EL2004 providing four output channels per terminal. In high state each channel provides an output voltage of 24 V_{DC} with a maximum current of 500 mA relative to ground. The digital output signals are connected on the clamps labeled with DO-01, DO-02 up to DO-16. The clamp with a black - on blue ground is the corresponding ground connection. A digital output can signalize configured characteristic value or process factor alarms. The connection of digital output signals is shown in Picture 6.

2.3.8 Connection of analog input terminals of type EL3702



Picture 7: Connection of analog input terminals of type EL3702

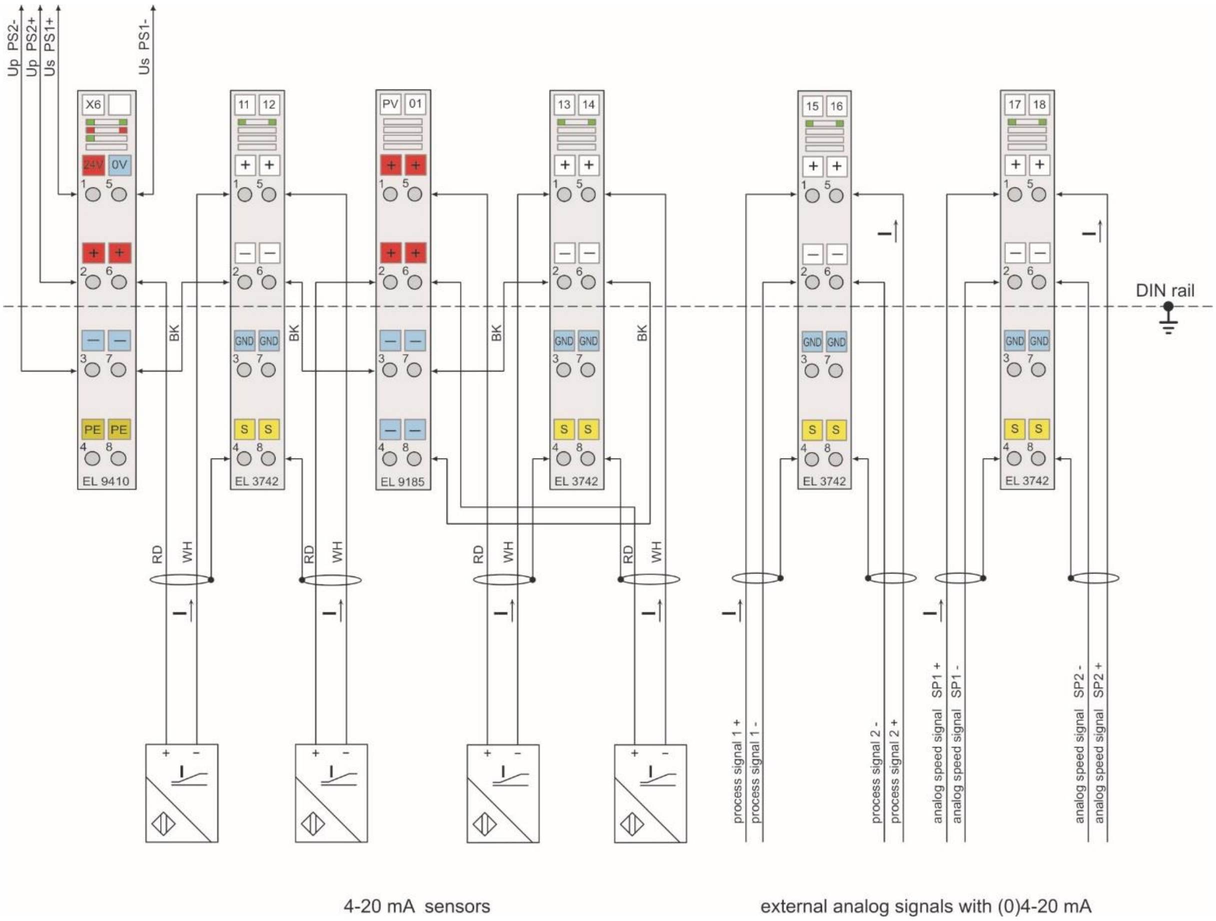
The input terminal of type EL3702 is used to measure external analog input signals. This can be signals from displacement sensors, process signals or analog speed signals. The channels can measure voltage inputs in the range -10 V_{DC} to +10 V_{DC} as differential signals. The differential inputs are labeled with a black + and - on white ground. The channel itself is labeled in the range 11 to 49. Picture 7 shows the connection of displacement sensors and other possible external analog signals. The circuit also shows that the supply voltage for displacement sensors is connected to the potential distribution terminal PV01 or the power supply terminals X6 to X8. A connection to the power supply terminal X9 is not possible since it does not provide the required supply voltage of 24 V_{DC}.

Note: The clamp labeled with black GND on blue ground is the signal ground for the analog inputs. These serve **not** as supply for external consumer or reference potential. They should not be confused with the clamps labeled with black - on blue ground.

2.3.9 Connection of analog 0-20 mA input terminals of type EL3742

The two channel analog input terminal EL3742 provides the possibility to connect 4-20 mA sensors. This can be proximity sensors or pressure sensors. Furthermore external analog signals with 4-20 mA or 0-20 mA can be connected. Commonly these are process factors like power, torque, wind speed, pressure or temperature if provided as (0)4-20 mA signals. Additionally the input terminal of type EL3742 can be used as speed input.

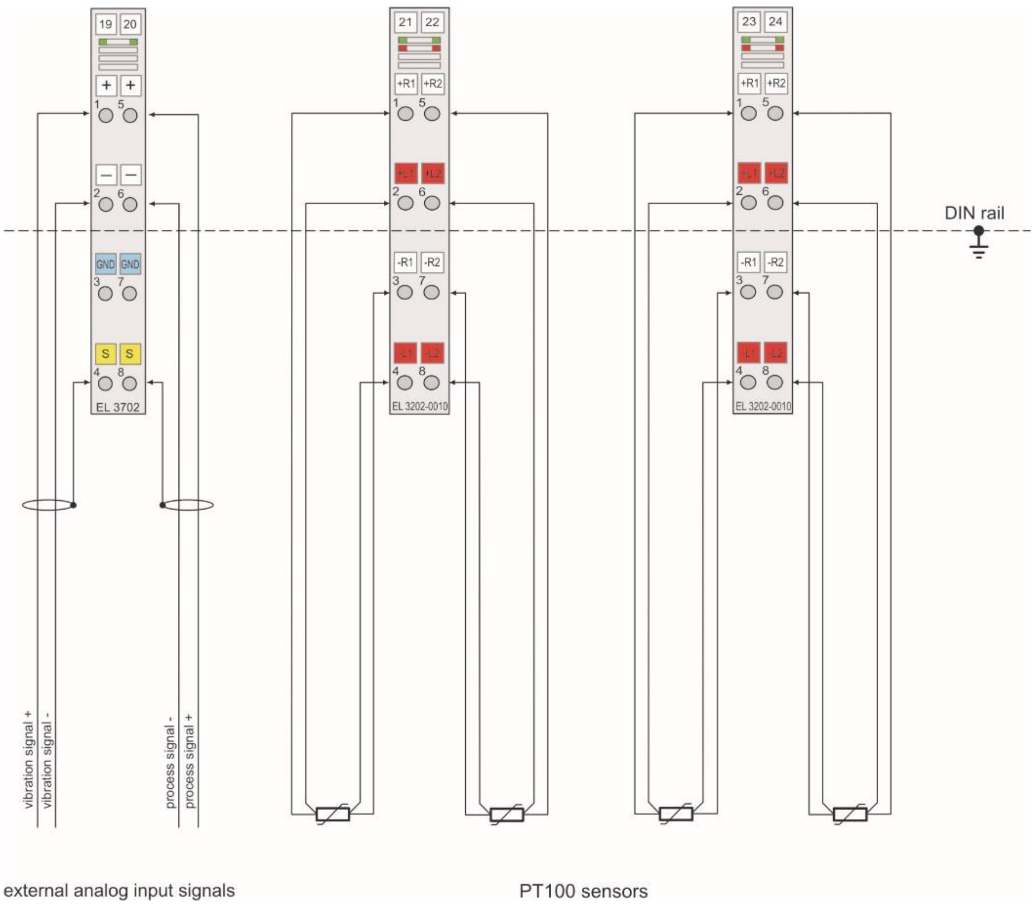
The current signal inputs are galvanically isolated from the control unit. The signal inputs are connected to the clamps labeled with black + or - on white ground and are differential inputs. The label of the measurement channel itself is in the range of 11 to 49. Picture 8 shows the connection of sensors and other external current signals to the analog input terminal EL3742.



Picture 8: Anschluss von 4-20 mA Sensoren oder von (0)4-20 mA Signalen

Note: The clamp labeled with black GND of blue ground is the signal ground for the analog inputs. These serve **not** as supply for external consumer or reference potential. They should not be confused with the clamps labeled with black - on blue ground.

2.3.10 Connection of PT100 resistor sensors to terminals of type EL3202-0010



Picture 9: Connection of PT100 sensors

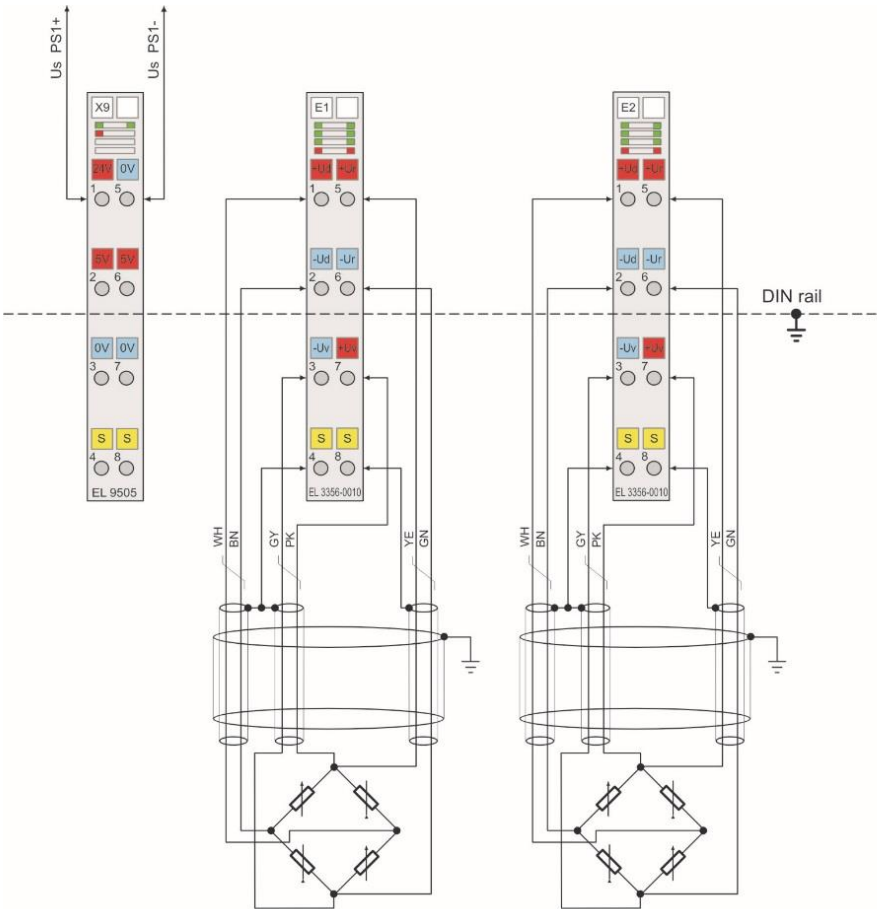
The analog input terminal of the type EL3202-0010 provides two input channels for the connection of two PT100 resistor sensors for temperature measurement. The Peakanalyzer drives these channels with PT100 sensors in a 4-wire connection mode. This connection mode provides the maximal accuracy. The current input and the high-resistance voltage measurements of the PT100 sensors is done by separate wire pairs. Thus the cable cannot distort the measurement by its internal resistance. The current drive is done via the wire pairs that are connected to the clamps labeled with +R1 and -R1 as well as +R2 and -R2. The high-resistance voltage measurement is done via the wire pairs that are connected to the clamps labeled with +L1 and -L1 as well as +L2 and -L2. Failure of a sensor or a broken wire are signalized by a red LED. The input channels itself are labeled in the range of 11 to 49. The connection of four PT100 resistor sensors is shown in Picture 9.

2.3.11 Connection of resistance measuring bridges to terminals of type EL3356-0010

The analog input terminal EL3356-0010 allows the direct connection of a resistance measuring bridge for example a strain gauge. This terminal is typically used in the Peakanalyzer variation Baseanalyzer. Left of the terminal for the resistance measuring bridge has to be a power supply terminal of the type EL9505 with the label X9. This terminal supplies the following measuring bridge terminals with 5 V_{DC} supply voltage at the power clamps. This voltage is provided via the clamps labeled with $+U_V$ and $-U_V$ for the strain gauges. In order that the wires with its internal resistance do not distort the voltage measurement, an additional high-resistance reference voltage is measured via the wires that are connected to the clamps labeled with +Ur and -Ur. The wire pair for the high-resistance differential voltage measurement is connected to the clamps labeled with +Ud and -Ud.

Note: The differential voltage Ud must not exceed 25 mV! If the differential voltage is higher than 25 mV the functionality of the resistance measuring bridge is not guaranteed.

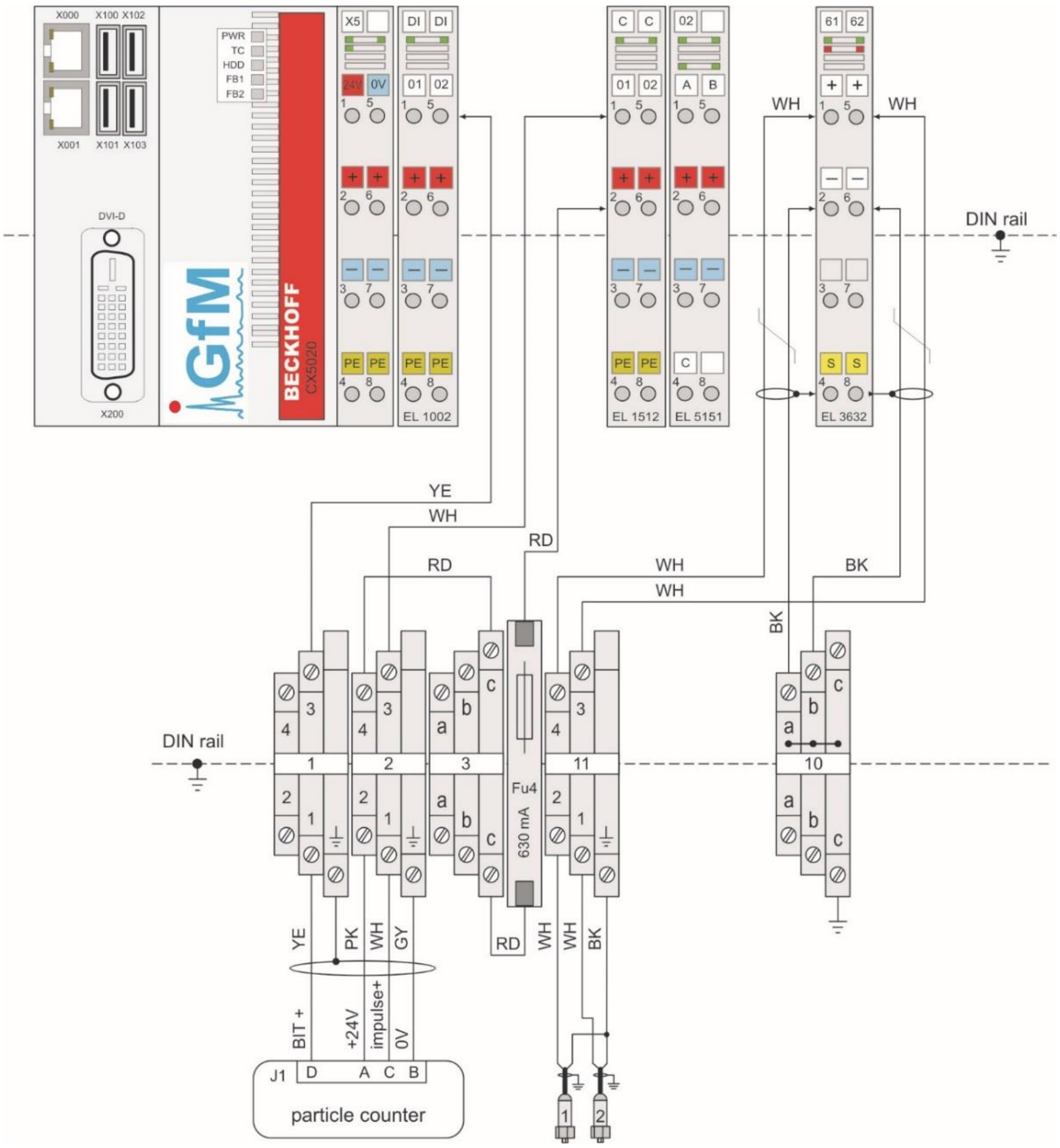
The connection of two resistance measuring bridges is shown in Picture 10.



Picture 10: Connection of a resistance measuring bridge – strain gauge

It is strongly recommended to set the input terminal EL3356-0010 at the end of the hardware configuration on the right side of the Peakanalyzer or Baseanalyzer. The resistance measuring bridge terminal must follow an end cap EL9011. The label of the terminals is in the range E1 to E9.

2.3.12 Connection of a metal particle counter to terminals of type EL1512



Picture 11: Connection of a metal particle counter

One Peakanalyzer can drive up to 4 metal particle counter. The 2 channel counter input terminal of type EL1512 is used for this application. The first terminal of EL1512 measures the counter impulses at the clamps C-01 and C-02. A possibly second EL1512 terminal provides the inputs C-03 and C-04. Parallel to the counting functionality a self-test signal of the metal particle counter can be recorded and analyzed. These digital input signals are then connected to the digital input channels DI-02, DI-03, DI-04 or DI-05. Furthermore the Peakanalyzer provides the supply voltage of 24 V_{DC} for the metal particle counter.

Picture 11 shows examplary the connection of a MetalSCAN sensor of the series MS3000 of the company momac. There the impulse of the particle counter is connected to the overvoltage protection clamp 2-1. The result of the Built-in Test (BIT) is connected to the overvoltage protection clamp 1-1. The fused supply voltage for the metal particle counter is connected on the overvoltage protection clamps 2-2 and GND.

A MetallicContamination sensor of the series MCS 1000 of the company HYDAC can be connected in a similar way. If the user omits the self-test functionality it is possible to count the ferromagnetic particles on channel C-01 and the non-ferromagnetic particles on channel C-02.

2.3.13 Internal connection of power supply terminals of type EL9410 and EL9505

The power supply terminals of the Peakanalyzer are labeled in the range of X6 to X9.

If the system current Is of the IPC connection has reached a capacity of 2 A, additional supply terminals of type EL9410 are used to increase the system current. The power supply voltage Us is connected to the clamps labeled with 24V and 0V at the power supply terminals labeled with X6, X7 or X8. The power supply voltage is always 24 V_{DC}. It supplies the EtherCAT bus system of the Peakanalyzer with the operating voltage. The EtherCAT bus connects the individual terminals with the system and ensures the data exchange.

The power supply terminal of type EL9410 suffers as supply and refresh of the EtherCAT bus. One E-Bus supply branch can only be equipped with terminals that do not exceed 2 A maximum current in sum. If the sum of 2 A is exceeded a power supply terminal of type EL9410 is used to increase the maximum current by 2 A. The clamps labeled with 24V and 0V can only drive a current of 2 A. If one or more terminals of type EL9410 are used the input power supply has to deliver more than 2 A. Thus each individual +24V branch of the E-Bus supply must be protected by a 2 A T fine wire fuse. The fused wires must have a cross section to drive at least 3 A.

Furthermore the power supply terminal of type EL9410 is connected to the voltage Up for the supply of external sensors on the I/O-terminals. This is done via the clamps labeled with a black + on red ground and black - on blue ground. The voltage Up is limited to +24 V_{DC} and is connected to the power contacts of the I/O-terminals. A maximum current of 10 A is allowed for these power contacts. If the power supply source can drive more than 10 A, the wires must be protected with a 10 A fuse. If the power supply source supplies less than 10 A, the fuse can be omitted. In all cases the cross section of the wire must be at least 1.5 mm^2. In a normal case the power supply source has a capacity of 2.5 A or 3 A. This than serves as fuse for the power contacts.

Dependent on the use case and the amount of equipped terminals that follows the power supply terminal of type EL9410 one or two power supply sources can be used to connect the system supply Us and the supply for external sensors Up. The variants for internal connection of the power supply terminal EL9410 are shown in Picture 4 and Picture 7.

The power supply terminal of type EL9505 with the label X9 converts the input voltage of 24 V_{DC} to an output voltage of 5 V_{DC} for external consumers. The input voltage Us is connected to the clamps labeled with 24V and 0V. The output voltage is available via the clamps labeled with 5V and 0V. Furthermore the following terminals are supplied with 5 V_{DC} via the power contacts. The terminal is short circuit proofed and can provide a maximum current of 500 mA. There is no galvanic isolation between the input voltage and the output voltage. Two green Power-LEDs are showing the operating state of the input and output voltage. A red LED shows an overvoltage or short circuit case. The internal connection of the power supply terminal of type EL9505 is shown in Picture 10.

2.3.14 Supply of external sensors via the terminals of type EL9185

The potential distribution terminal of type EL9185 allows to provide 4 power supply connections. The supply voltage is provided by the power supply terminal EL9410. It transmits the voltage Up via the power contacts to the potential distribution terminal. If the supply voltage Up of the power contacts of the power supply terminal EL9410 is galvanic isolated from the supply voltage Us of the control supply, the same applies to the voltage of the potential distribution terminal. The potential distribution terminal serves as a provider of supply voltage for external sensors. Normally the clamps labeled with black + on red ground and black - on blue ground provide +24 V_{DC}. The label of the terminal is in the range of PV01 and PV09. Picture 7 shows the potential distribution terminal PV01 for supplying displacement sensors with its supply voltage.

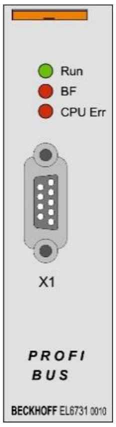
Note: The EtherCAT terminal EL9185 is a passive terminal that does not take an active part in the data exchange process of the terminal block. A current consumption form the E-Bus does not take place. Thus it is a passive terminal. **It is not allowed to put two passive terminals directly next to each. An optimal data exchange is not guaranteed in this case.**

2.3.15 Connection of PROFIBUS to terminal of type EL6731-0010

The Peakanalyzer can optionally be equipped with a PROFIBUS slave terminal of type EL6731-0010. This terminal provides the possibility of an integration in an existing PROFIBUS system. Thus the Peakanalyzer can receive process factors and speed information. Furthermore the Peakanalyzer can provide alarm information of process factors, characteristic values or kinematic alarms. Information about warn and alarm threshold exceeding are also send. The PROFIBUS slave terminal can operate in the following protocols: PROFIBUS DP (Standard), PROFIBUS DP-V1, PROFIBUS DB-V2 as well as PROFIBUS MC. With this terminal there are DP cycle times of 200 µs at a transmit rate of 12 MBaud possible. In the hardware configuration there must be a power supply terminal of type EL9410 directly after the PROFIBUS slave terminal on the right side or an end cap EL9011 (Picture 14).

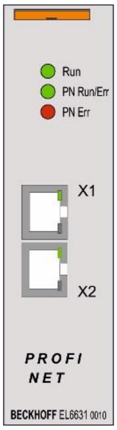
The PROFIBUS is connected through the galvanic decoupled 9-pin D-Sub socket. It is recommended to use the 9-pin D-Sub-PROFIBUS connector ZB3100 with switchable end resistor. Thus the first and last participant in the bus can be operate with an active end resistor as required. The end resistor can be activated by a switch in the connector.

The connection of the two wire cable is done with the red standard wire at pin 3 (RxD/TxD – P, A) and with the green standard wire at pin 8 (RxD/TxD – N, B). These two contacts are for the communication. An installation description for the mounting of the cable to the PROFIBUS connector ZB3100 can be found in the supply material of the connector. It is recommended to use a PROFIBUS cable of type ZB3200 with 2 x 0.64 mm² for a fixed installation. If the installation has to be done in a drag chain, the PROFIBUS cable ZB3300 is recommended.



Picture 12: View of a PROFIBUS slave terminal

2.3.16 Connection of PROFINET to terminal of type EL6631-0010



Picture 13: View of a PROFINET-RT-Device terminal

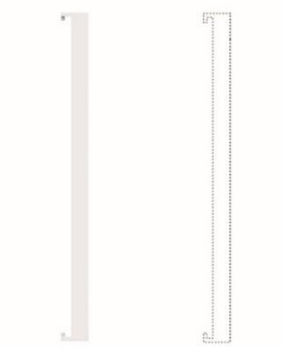
The Peakanalyzer can be equipped with a PROFINET-RT-Device terminal of type EL6631-0010 for the integration of a Peakanalyzer in a PROFINET-RT system. The terminal allows the data exchange between the internal EtherCAT network and the PROFINET network. There are two RJ45 ports available on the terminal labeled with X1 and X2.

It is recommended to connect the PROFINET network via the RJ45 port labeled with X1. The port X2 can be for example used to connect multiple Peakanalyzer in series to a PROFINET network and therefore reduce the wiring effort. The maximum cable length between two PROFINET devices should not exceed 100 m. The PROFINET cable should be labeled uniquely. Thus a confusion between the PROFINET connection and the LAN connection on the RJ45 port X000 (Picture 3: Internal connections in the Peakanalyzer, power supply and LAN connection) is avoided. In the hardware configuration there must be a power supply terminal of type EL9410 directly after the PROFINET-RT device terminal on the right side or an end cap EL9011 (Picture 14).

With this terminal the Peakanalyzer can receive speed signals or process factors via the PROFINET-RT system. Furthermore the Peakanalyzer can send process factors, characteristic values or kinematic alarms via the PROFINET. Information about warn and alarm threshold exceeding can also be send. The PROFINET-RT device can realise RT cycle times of 1 ms.

2.3.17 End cap of type EL9011

The end cap EL9011 serves as a cap for the E-Bus contacts at the right side of the last terminal in the Peakanalyzer. If the terminals are distributed in the field, each subsystem has to be completed by one end cap after the last terminal.



Picture 14: View of end cap

2.3.18 Connection of external sensors via overvoltage protection clamps

A Peakanalyzer can be optionally equipped with overvoltage protection clamps for the connection of external sensors. These serve as connection clamps for vibration acceleration sensors, speed sensors or input signals form external sensors. They are internally wired with the intended measurement terminals (see Picture 5).

2.3.19 Distributed Peakanalyzer terminals in the field

For machines that have a greater local dimension it is useful to distribute the measurement terminals in the field in several steel boxes. Thus the sensor cables must be only connected to the closest steel box and not to one central Peakanalyzer. The steel boxes are than connected via LAN cable or fibre optic glass cable to the central Peakanalyzer module. The distributed steel boxes can be connected via EtherCAT-Coupler in series. From one central Peakanalyzer module it is possible to build star, bus or tree topologies. The restrictions of 32 analog vibration channels, 32 process channels as well as 16 digital inputs and 16 digital outputs for one Peakanalyzer must be considered.

The outgoing EtherCAT branches are labeled for unique identification. The labeling is done according to the following scheme:

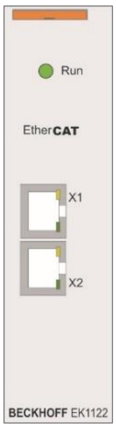
The number of the Peakanalyzer in the system is always starting with 1 . Number of the EtherCAT-branch on the Peakanalyzer . Number of the EtherCAT-branch in the subsystem.

Example: The first Peakanalyzer basis module is labeled with 1., the following are labeled with 2. and following. The EtherCAT branch that is closest to the IPC is labeled with 1.1. The next one with 1.2 and so on. The LAN or fibre optic cables are labeled according to the branch they are connected to.

2.3.19.1 Connection of EtherCAT junction of type EK1122 for LAN cable

The EtherCAT junction of type EK1122 is preferably installed in the central Peakanalyzer module.

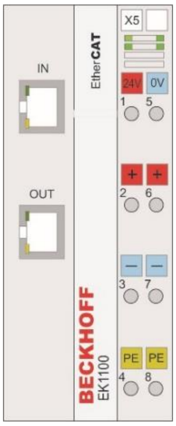
The EtherCAT junction of type EK1122 shown in Picture 15 allows a distributed installation of Peakanalyzer terminals in the field with LAN cables up to 100 m length. The connection of the EtherCAT junction is done via the RJ45 socket. The Link- and Activity status is shown directly at the socket. The run LED shows the status of the EtherCAT branch. The central Peakanalyzer module can have multiple EtherCAT junctions of type EK1122 equipped. Each terminal has two branching ports X1 and X2 that can be connected to an EtherCAT-Coupler of type EK1100 (see Picture 16). The junction port and the coupler are connected via LAN cable and all are labeled in a unique identifiable schema. The chapter 2.3.19 describes in more detail the labeling schema.



Picture 15: View of EtherCAT junction EK1122

2.3.19.2 Connection of EtherCAT-Coupler of type EK1100 for LAN cable

The EtherCAT-Coupler of type EK1100 is used for the EtherCAT signal transmission in an Ethernet network (100BASE-TX). The EtherCAT-Coupler of type EK1100 connects a steel box with distributed Peakanalyzer terminals of type ELXXXX via LAN to a central Peakanalyzer base module.



Picture 16: View of EtherCAT-Coupler EK1100 for LAN-cable

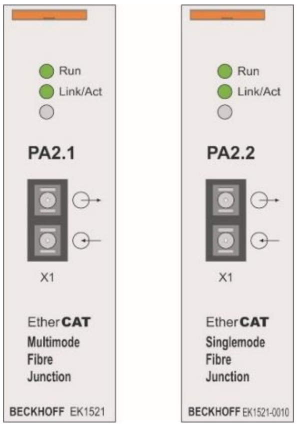
A Peakanalyzer station that is distributed in the field consists of a coupler of type EK1100, several EtherCAT terminals, an end cap and a power supply. The coupler transforms the telegrams from the Ethernet-100BASE-TX to the E-Bus representation.

The connection to the central Peakanalyzer base module is done via the IN interface on the coupler. The LAN cable must have the same label as the coupler input IN. The RJ45 socket OUT below the IN socket can be used to optionally branch a further Peakanalyzer station. The outgoing EtherCAT branch must be also labeled on the corresponding LAN cable. The incoming and outgoing branches are also labeled on the coupler and the junction. The schema of the labels is described in chapter 2.3.19.

The power supply terminal labeled with X5 has to be connected to a power supply source according to chapter 2.3.1, 2.3.2 and 2.3.13.

2.3.19.3 Connection of EtherCAT junction of type EK1521 for fibre optic cable

The EtherCAT junction as shown in Picture 17 of type EK1521 or EK1521-0010 or preferably installed in the central Peakanalyzer base module. The EtherCAT junction with fibre optic of type EK1521 allows a distributed mounting of Peakanalyzer terminals in the field with multimode fibre optic cables 50/125 µm up to a distance of 2 km. The EtherCAT junction with fibre optic of type EK1521-0010 allows distances up to 20 km with singlemode fibre optic cable 9/125 µm.



Picture 17: View of EtherCAT junction of type EK1521 left and EK1521-0010 right for fibre optic cable

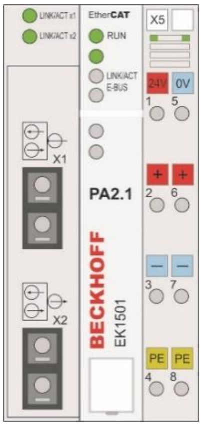
The connection of the EtherCAT branch is done via a SC-Duplex connector at socket X1. The run LED shows the state of the EtherCAT branch. A further LED shows the Link and Activity state. One Peakanalyzer base module can have multiple EtherCAT junction terminals of type EK1521 equipped. At the port X1 one branched EtherCAT-Coupler of type EK1501 can be connected as shown in Picture 18. The junction and the coupler must be connected with a fibre optic cable.

The EtherCAT junctions, coupler and cables must be labeled for unique identification as described in chapter 2.3.19.

2.3.19.4 Connection of EtherCAT-Coupler of type EK1501 for fibre optic cable

If the analog sensor signals should not be connected on the central Peakanalyzer, they can be connected on a distributed station in a separate steel box in the field. The subsystem than has to be connected via fibre optic cable to the central Peakanalyzer base module.

The Coupler EK1501 is used for the Ethernet signal transmission in the EtherCAT network.



Picture 18: View of EtherCAT-Coupler of type EK1501 for fibre optic cable

The EtherCAT-Coupler EK1501 connects the branched Peakanalyzer terminals of type ELXXXX in a separate steel box with the central Peakanalyzer base module via fibre optic cable.

Such a Peakanalyzer station consists of the Coupler of type EK1501, a number of EtherCAT terminals, a bus end cap and a power supply. The coupler transforms the telegrams of the Ethernet-100Base-FX to the E-Bus signal representation.

The SC-Duplex connector of the fibre optic cable from the central Peakanalyzer base station is connected to the upper EtherCAT input X1. The fibre optic cable must have the same unique identification label as the coupler input IN.

The SC-Duplex output X2 can be optionally used to connect a further branched Peakanalyzer station. The outgoing EtherCAT branch from port X2 must be labeled on the coupler and the corresponding fibre optic cable. Chapter 2.3.19 describes in more detail the labeling schema of the unique identifier for junction, coupler and cable.

For better understanding an example for the labeling:

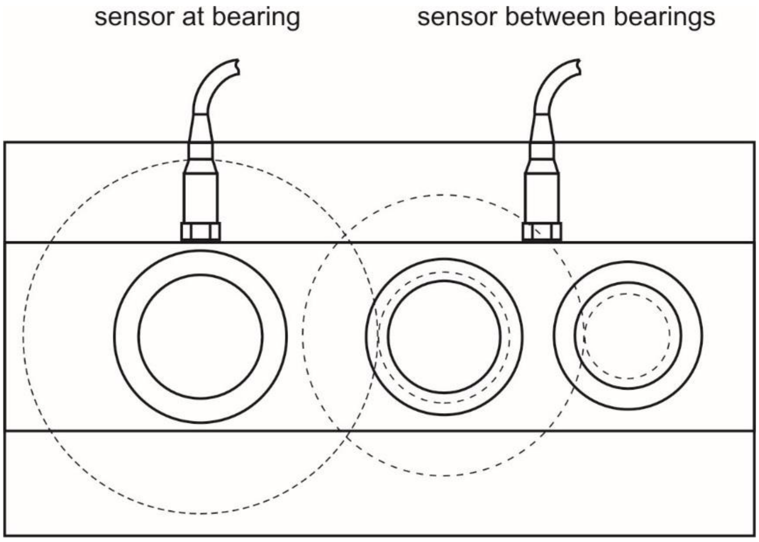
The first coupler of type EK1501 of the first Peakanalyzer as well as the corresponding junction port X1 and the fibre optic cable have the label 1.1.

The second coupler of type EK1501 of the second Peakanalyzer as well as the corresponding junction port X1 and the fibre optic cable have the label 2.2.

The clamp labeled with X5 is the power supply for the coupler and has to be connected as described in chapter 2.3.1, 2.3.2 and 2.3.13.

2.4 Mechanical mounting of vibration acceleration sensors

Vibration acceleration sensors must be mounted on the machine in a way that the vibrations that are needed for the machine diagnostic are measurable.



Picture 19: Sensor positions with an example of 3 shafts

Generally there are ideal measurement points that can be deduced from the concrete constructive conditions. Normally these positions are chosen by a mechanical engineer or machine diagnostician. Picture 19 shows the recommended sensor positions for two vibration acceleration sensors of a two-stage gear drive.

Depending on the intended sensor positions the vibration acceleration sensor with angled or straight connection cable has to be preferred.

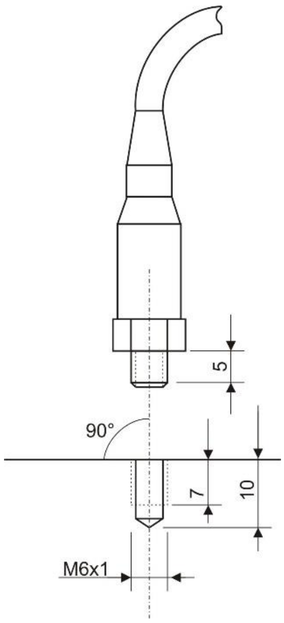
Picture 20: Vibration acceleration sensor with straight connection cable

Picture 21: Vibration acceleration sensor with angled connection cable and mounting bolt

The permanent mounting of a vibration acceleration sensor can be done by a screw connection or by a glue connection. For both connection types it is required to have a smooth and flat surface. There should be no color or rust on the contact surface.

The screw connection between sensor and surface is relatively simple. A blind hole for the mounting bolt has to be drilled on a suitable point on the machine surface. Normally this is a metric thread M6 with 1 mm slope. The blind hole has to be absolutely perpendicular to the surface to avoid tensions of the sensor chassis during tightening the screw. After deburring and cleaning the surface the sensor is tightened at the mounting bolt with screw lock by hand. For the screw lock it is recommended to use Loctite 243. If a torque wrench is available, the sensor can be tightened with 3 to 6 Nm. Screw lock is not needed in this case.

Note: The maximum torque of 6 Nm must not be exceeded. A Torque above this level can result in a destroyed thread or a failure of the sensor.



Picture 22: Blind hole for screw connection between sensor and surface

If a screw connection between sensor and surface is not possible, a mounting base with an integrated thread hole can be glued on the machine surface. The sensor itself is then screwed on the mounting base. An absolute requirement for gluing a mounting base is a clean, color free and grease free surface. Commercial two component epoxy resin glue is suitable for the permanent installation of a mounting base. It is recommended to use an epoxy resin glue with metal. These glues are applicable up to 120 °C. The gluing process depends on the glue and has to be done according to the manual.

Picture 23: Vibration acceleration sensor glued on a mounting base

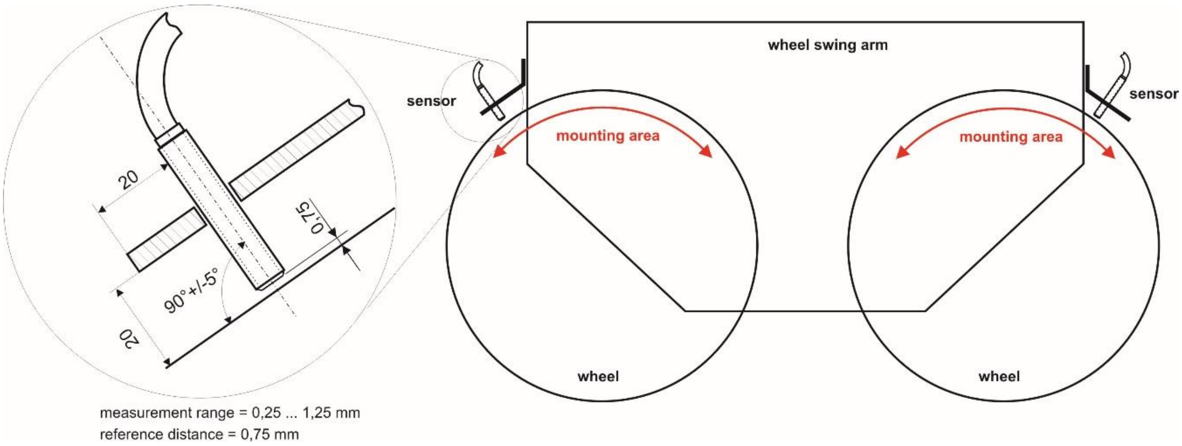
If the glue of the mounting base is hardened, the sensor can be tightened as described in the screw connection chapter. It is recommended to use sensor cable as short as possible. A bending of the sensor cable must be avoided.

2.5 Mechanical installation of displacement sensors

A displacement sensor measures the displacement of its mounting position to the surface of the measurement object. The sensor should be adjusted perpendicular to the measurement object. The reference distance can be adjusted with the help of the housing nuts. A fine adjustment is recommended with a gauge. Afterwards the housing nut has to be screwed with a torque wrench to 5 Nm and finally rechecking the reference distance.

Note: The maximum torque of 10 Nm must not be exceeded. A Torque above this level can result in a destroyed thread or a failure of the sensor.

Picture 24 shows the installation of two displacement sensors of type S-Bi1,5-EG08-LU at a wheel swing arm of a swiveling bolster. In this case the sensor should be adjusted in the middle of the track, ideally vertically to the wheel. Deviations up to 45° from the vertical position are tolerable.



Picture 24: Installation of displacement sensors at a wheel swing arm

2.6 Installation of speed sensors

Normally the speed is measurement by an inductive speed sensor. For an accurate measurement of the speed it is recommended to measure the speed at the shaft with the highest speed.

Picture 25: Radial installation of a speed sensor

If the installation on the shaft with the highest speed is not possible, the installation can also take place on a shaft with lower speed. In this case it is recommended to use multiple impulses per rotation. One possibility to measure multiple impulses per rotation is shown in Picture 25. If the output signal of the speed sensor is connected to input C of the speed terminal, the impulses must not be equidistant distributed (see chapter 2.3.5).

During the adjustment of the speed sensor it has to be taken into consideration to not exceed the required switching distance. The supplied speed sensor as shown in Picture 25 has a switching distance of 9.5 mm.

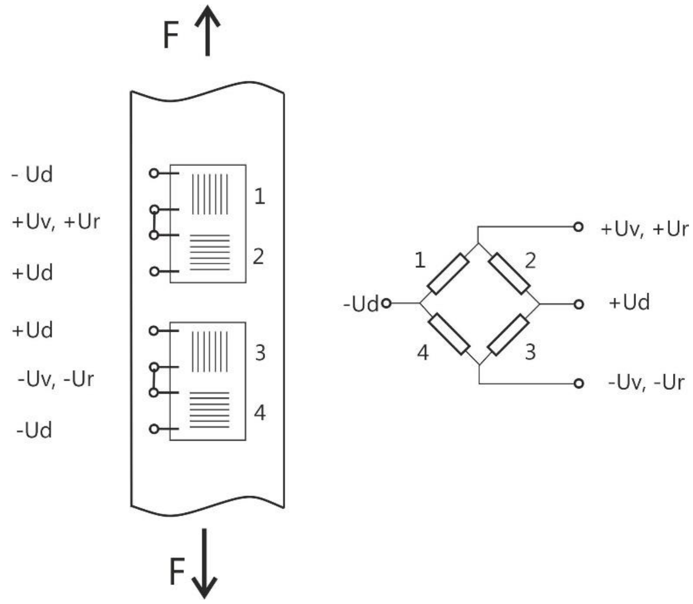
2.7 Application of strain gauges

Strain gauges are for the measurement of the stretching of a material surface. They change their electrical resistance proportional to the stretching of the surface.

The Baseanalyzer has the functionality to measure and analyze the movement and stretching of the basement of a wind energy turbine in vertical direction. For this a strain gauge is applied to the basement section and connected to the Baseanalyzer. Also see chapter 2.3.11.

Below is a short description of the application of a strain gauge. If a strain gauge is included in the supply, a detailed step by step description for the handling of the glue and covering material can be found in the package.

The applicable full bridge in Picture 26 consists of two double strain gauges (T-Rosette). It requires two additional electrical connections between the resistors 1 and 4 as well as 2 and 3 in the form of a steel wire bridge.



Picture 26: Arrangement of a strain gauge to measure the normal strain on one layer

Description of a strain gauge application:

1. Extensive cleaning of the application surface (brake cleaner, alcohol)
2. Removal of color in the range of the strain gauge 3x6 cm
3. Gluing the strain gauge according to description
4. Solder the steel wire bridges between the resistor 1 and 4 as well as 2 and 3 (steel wire, soldering iron, tin solder, flux)
5. Connect measure cables (soldering iron, tin solder, flux)
6. Test functionality, Ud < 25 mV
7. Clean the measurement object and cover it according to the detailed description (the last layer is the aluminum foil)

The cleaning of the measuring point also includes the removal of flux with Rosin Solvent or alcohol (Isopropyl alcohol 70%). The careful application according to the description by avoidance of any pollution and a careful covering of the strain gauge is very important for a reliable functionality of the strain gauge.

3 Software installation

This chapter of the manual refers to the software Peakanalyzer Manager to control and manage one or multiple Peakanalyzer in one network.

The following operating systems are supported:

- Windows 7
- Windows 8
- Windows 10

For the installation of Peakanalyzer Manager the installation CD has to inserted into a suitable drive. If the setup does not start automatically, the file „Peakanalyzer Manager Setup.exe“ can be started manually from the installation CD. For the installation process administrative privileges are necessary.

It is recommended to follow the instructions of the installation process. It is also recommended to install the Peakanalyzer Manager in the suggested directory.

During the setup it will be checked whether the current .NET-Framework and DirectX 9.0c is installed on the PC. If this is not the case, both programs will be updated.

Furthermore the free of charge program Microsoft® SQL Server® 2012 Express will be installed on the PC. It serves as data storage for measurement data and analyzed data of the Peakanalyzer.

After the installation process the Windows start menu contains a link in the program group GfM to start the Peakanalyzer Manager.

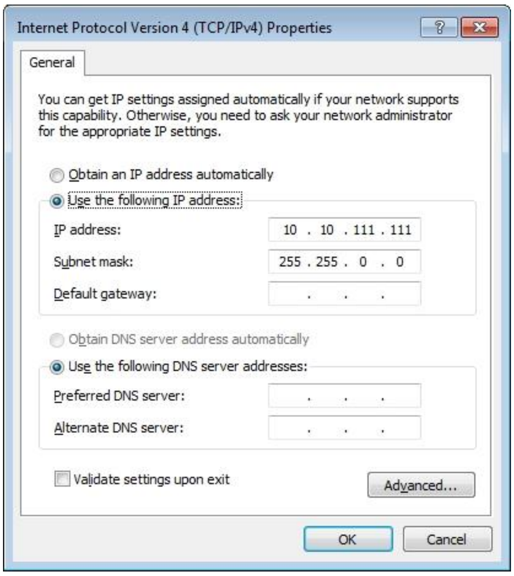
4 Connection to the Peakanalyzer

When the Peakanalyzer is delivered, the preconfigured interface configuration can be found in the delivery note. During the order of a Peakanalyzer the desired configuration can also be specified.

4.1 Change network settings of the PC

The following settings should be made by a network administrator or the configured settings should be obtained from a network administrator to avoid conflicts in the network.

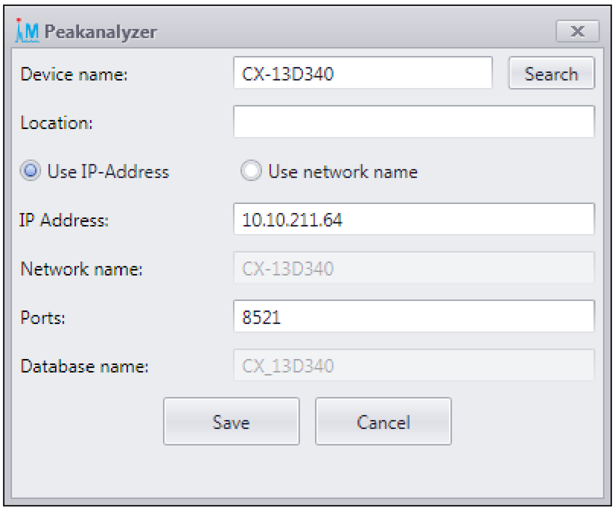
To establish a connection to the Peakanalyzer the network settings of the PC may be adopted. The Peakanalyzer must be in the same subnet as the Peakanalyzer or an active route to the subnet of the Peakanalyzer must be present.



Picture 27: Adjust network settings of the PC

4.2 Add Peakanalyzer

A new Peakanalyzer can be integrated in the system by selecting diagnosis system → New → Peakanalyzer in the menu or context menu in the hierarchical tree view. The Peakanalyzer will be added to the current selected hierarchical layer.

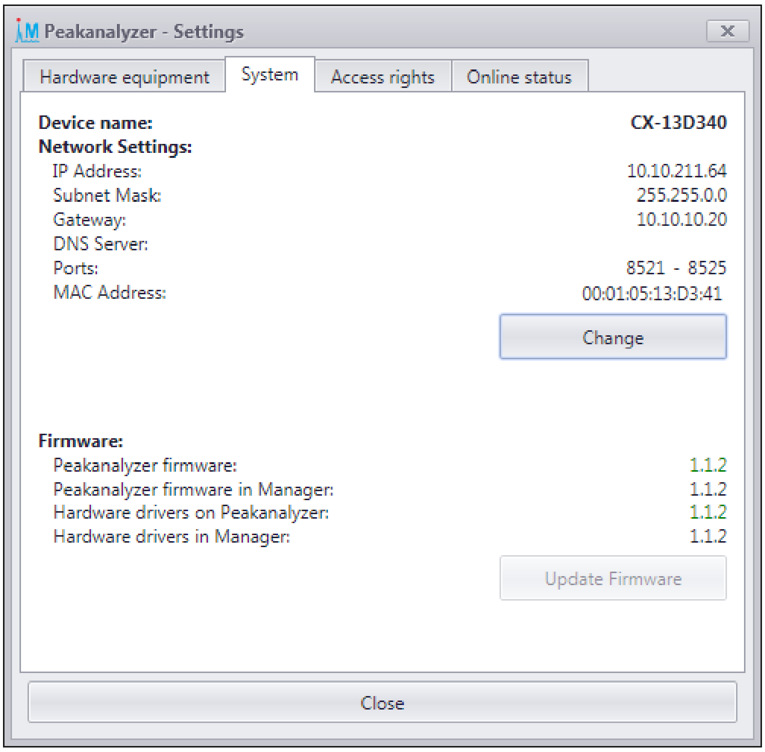


Picture 28: Add Peakanalyzer

The local network can be searched for existing Peakanalyzer. If one Peakanalyzer is taken, all needed settings will be set. If the Peakanalyzer is not in the list, the settings can be set manually.
The following information are required:

- Device name of the Peakanalyzer: The name has the following schema: CX-123ABC. This information can be found on the Peakanalyzer
- Location: An optional description for the location of the Peakanalyzer
- IP-Address of the Peakanalyzer
- Alternatively a network name can be set. This network name must be resolved to the correct IP-Address of the Peakanalyzer by a reachable name server
- Port for the communication to the Peakanalyzer: Furthermore the following 4 ports are used for the communication to the Peakanalyzer. The default ports are 8521-8524
- Database name: The database name is set automatically when the device name is changed and usually must not be changed.

4.3 Change network settings of a Peakanalyzer



Picture 29: Change network settings of a Peakanalyzer

The properties of the Peakanalyzer can be queried by selecting the menu point "Diagnosis system" → Properties or the button Properties in the navigation bar at the bottom. For this action an active LAN connection to the Peakanalyzer must be established.

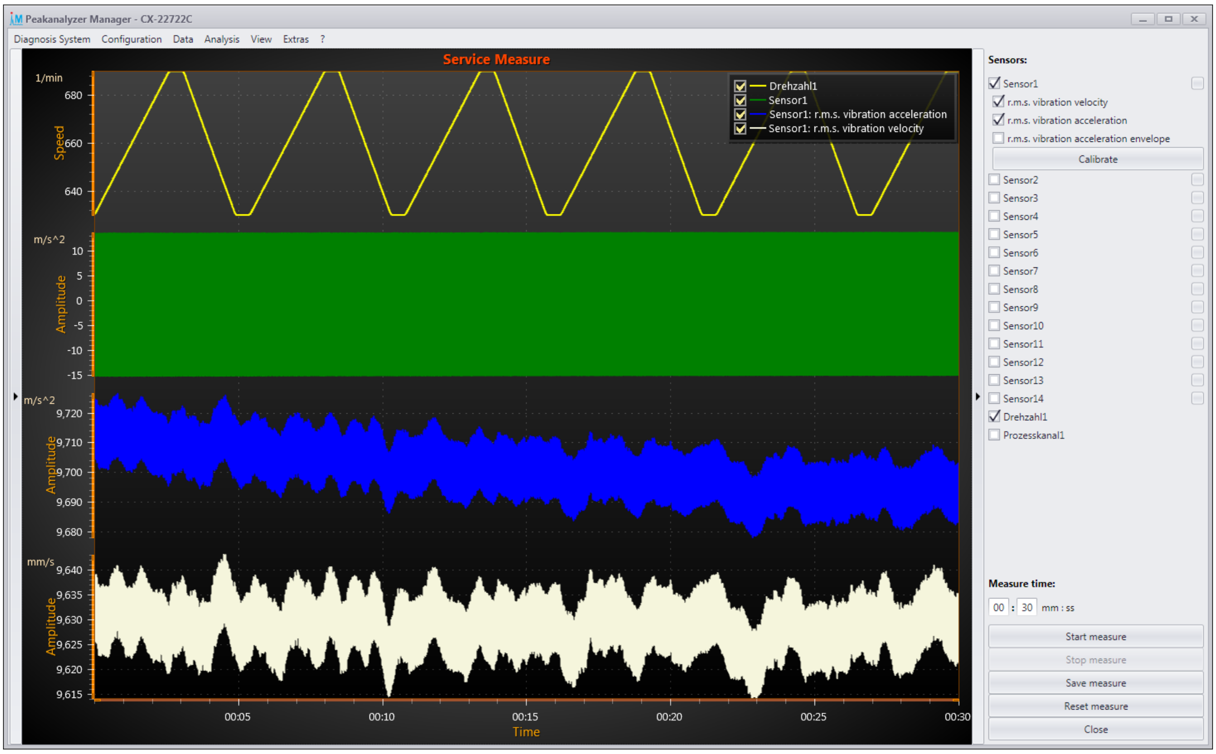
On the tab system the network configuration of the Peakanalyzer is listed. By clicking on the button Change the network settings of the Peakanalyzer can be modified. A new window will open where the following information can be set:

- *Resolve IP Address automatically* The Peakanalyzer requests the network configuration from an existing DHCP-Server
- IP-Address
- Subnet mask
- Gateway
- DNS-Server
- *Ports* TCP and UDP Ports for the communication to the Peakanalyzer

5 Completion of the Installation

This chapter describes how the correct connection of all sensors can be verified via a service measurement triggered in Peakanalyzer Manager.

The service measurement allows a simultaneously measurement of 8 channels on the Peakanalyzer. The desired sensors can be selected on the right side bar besides the curve window. The time signals produced by the sensors are shown in the curve window after the start of a measurement and thus can be verified.



Picture 30: service measure

One requirement for the start of a service measurement is an active monitoring configuration on the Peakanalyzer. Normally this is the case since the delivered Peakanalyzer at least contains a configuration with the corresponding sensor settings. These sensor settings are also used for the service measurement. Mostly there is also a complete monitoring configuration on the Peakanalyzer with complete kinematic data of the machine.

The setup and handling of the software Peakanalyzer Manager is described in detail in the Manual Peakanalyzer Manager. The chapter 6 describes the creation and transmission of a monitoring configuration whereas chapter 7 provides detailed information of a service measurement.

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