LoopChecker

Dynamic testing of vibration monitoring systems
by means of simulation of shaft vibrations

Instruction Manual © January 2019

CONTENTS:

1 Warnings

The instruction manual is an integrative part of the product delivery and the overall security concept of the product. Please read the instruction manual carefully before using the product, and keep it available for future reference. Non-observance of warning information excludes the manufacturer from liability! The measuring system is only allowed to be put into operation by qualified personnel who have previously read the information provided in this instruction manual. In case of doubt, the prevailing conditions of the area of application and the resulting requirements have to be examined by an expert before operation can be commenced.

Switch off the supply voltage before commencing any work on live parts! Ensure that the signal lines are correctly connected at the terminals! The simulation unit should never be put into operation as long as the housing is still open. As a precaution, it is pointed out that appropriate safety measures must be implemented to ensure protection against electrostatic charging!

Correct transportation, appropriate storage and professional assembly, operation and maintenance must be provided in order to ensure perfect functioning. Safety instructions concerning the battery can be found under section 5 on page 8 of this manual!

2 Standard Scope of Delivery

- Handheld control unit with battery
- Vibration simulator
- USB charger cable
- Instruction manual

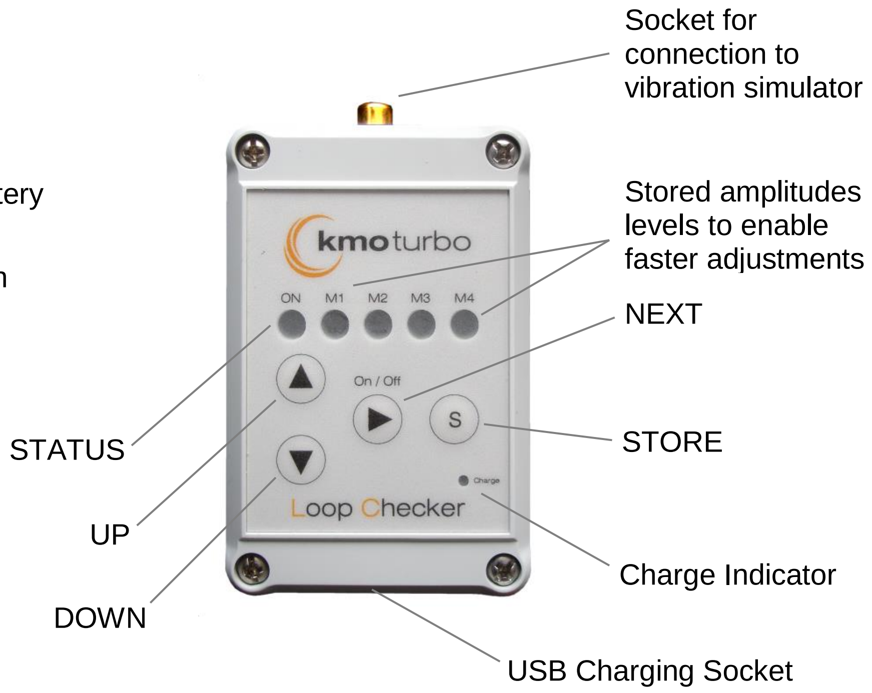
3 Technical Data

3.1 Handheld Control Unit

The device has to be fully charged before the first operation. In order to do this, connect the power adapter to the control unit with the aid of the charging cable. When the device is fully charged, the charge indicator lamp goes off.

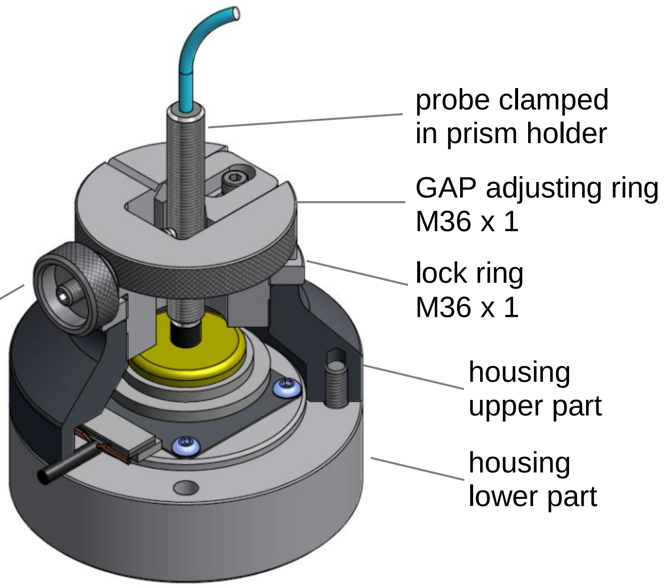
The battery should always be charged when storing the device over longer periods of time. When the battery is discharged, the simulation unit can be operated via the provided USB power adapter.

Dimensions:	98 x 64 x 40 mm
Weight:	150 g without battery
Protective class:	IP 54
Battery:	3,7 volt 1000 mAh LiPoly battery
Charging socket:	USB Mini-B



3.2 Vibration Simulator

Material:	stainless steel / aluminum
Weight:	approx. 2 kg
Cable:	coaxial cable, PVC coating
Dimensions:	94 mm x Ø 90 mm
Probe mounting:	prism holder for D = 8 … 22 mm, M6 locating screw



4 Description of Test Procedure

4.1 General

Rotor or shaft vibrations are usually measured by means of non-contact eddy-current displacement probes. You measure the relative motion between rotor and the installed probe. With the **LoopChecker** the functionality of such systems can be tested on the basis of realistic simulations of vibrations.

The **LoopChecker** consists of a compact housing which contains an electrically driven vibrator. After the probe to be tested is clamped in the existing prism holder, with the GAP adjustment ring the needed measuring gap (typically 8 to 10 VDC) can be adjusted exactly. In combination with the compact, battery driven, handheld control unit the vibrator can be set into defined oscillations between 105 and 125 Hz and different amplitudes.

With this, the **LoopChecker** enables a function test of the entire loop (that is transmitter function, wiring, indications and alarms) in one step.

The battery-powered handheld control unit can be attached comfortably by means of the magnet on the back of the device. The rechargeable batteries enable operation of up to several hours.

4.2 Vibration Amplitudes

After having determined the loop sensitivity (probe, cable, driver) by means of a suitable static calibration unit (e.g. the **SensiChecker**) and a calibrated voltmeter, with the **LoopChecker** vibration amplitudes can be simulated precisely. The accuracy of the simulation goes hand-in-hand with the accuracy of the used voltmeter! With this, the complete system (transmitter function, wiring, indications, alarms) gets tested.

Basic description of the measuring principle:

The **LoopChecker** creates a clean sinus signal with constant frequency (within 105 and 125 Hz) and variable amplitude, which is picked up by the vibration probe. At the buffered-out of the oscillator, transmitter or monitor this vibration can be measured as RMS value by means of a common voltmeter set to "AC".

This RMS value can be converted accurately into a peak to peak value, using following formula:

$$\boldsymbol{S}\,[\mu] = \frac{\boldsymbol{RMS}\,[\boldsymbol{mV}] * \mathbf{2} * \sqrt{\mathbf{2}}}{\boldsymbol{sensitivity}\,\left[\frac{\boldsymbol{mV}}{\mu}\right]} \qquad\qquad \boldsymbol{RMS}\,[\boldsymbol{mV}] = \frac{\boldsymbol{S}\,[\mu] * \boldsymbol{sensitivity}\,[\boldsymbol{mV}/\mu]}{\mathbf{2} * \sqrt{\mathbf{2}}}$$

Example:

Reading buffered-out:	0.2263 V AC = 226.3 mV AC
Typical sensitivity:	8 mV/µ
Vibration amplitude [µ$_{ptp}$]:	226.3 * 2 *1.414 / 8 = **80**

RMS [mV] = 2.83 * S-ptp [µ]

Simplified formula for the typical measuring loop sensitivity of 8 mV/µ:

S-ptp [µ] = 0.3535 * RMS [mV]

As alternative to this calculating procedure, correspondingly calculated values can be taken from the following table or diagram!

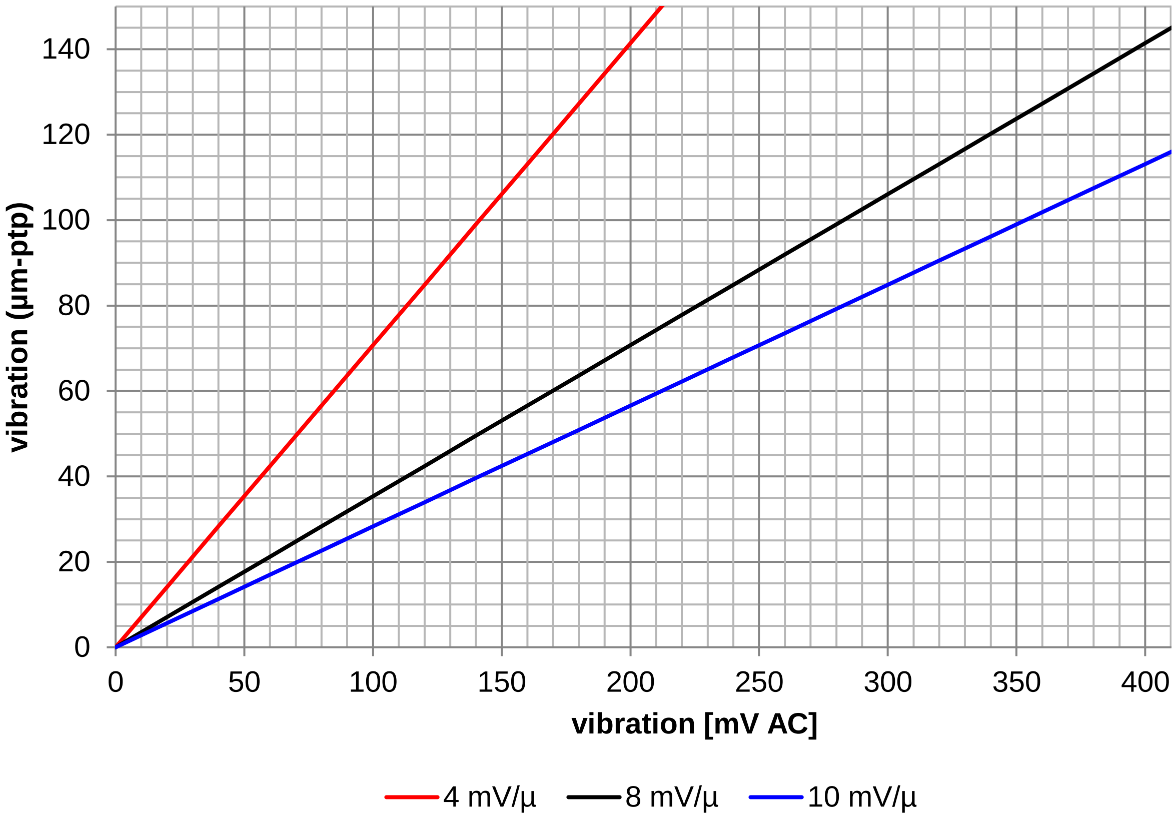
Conversion Table

Valid for 8 mV/µ

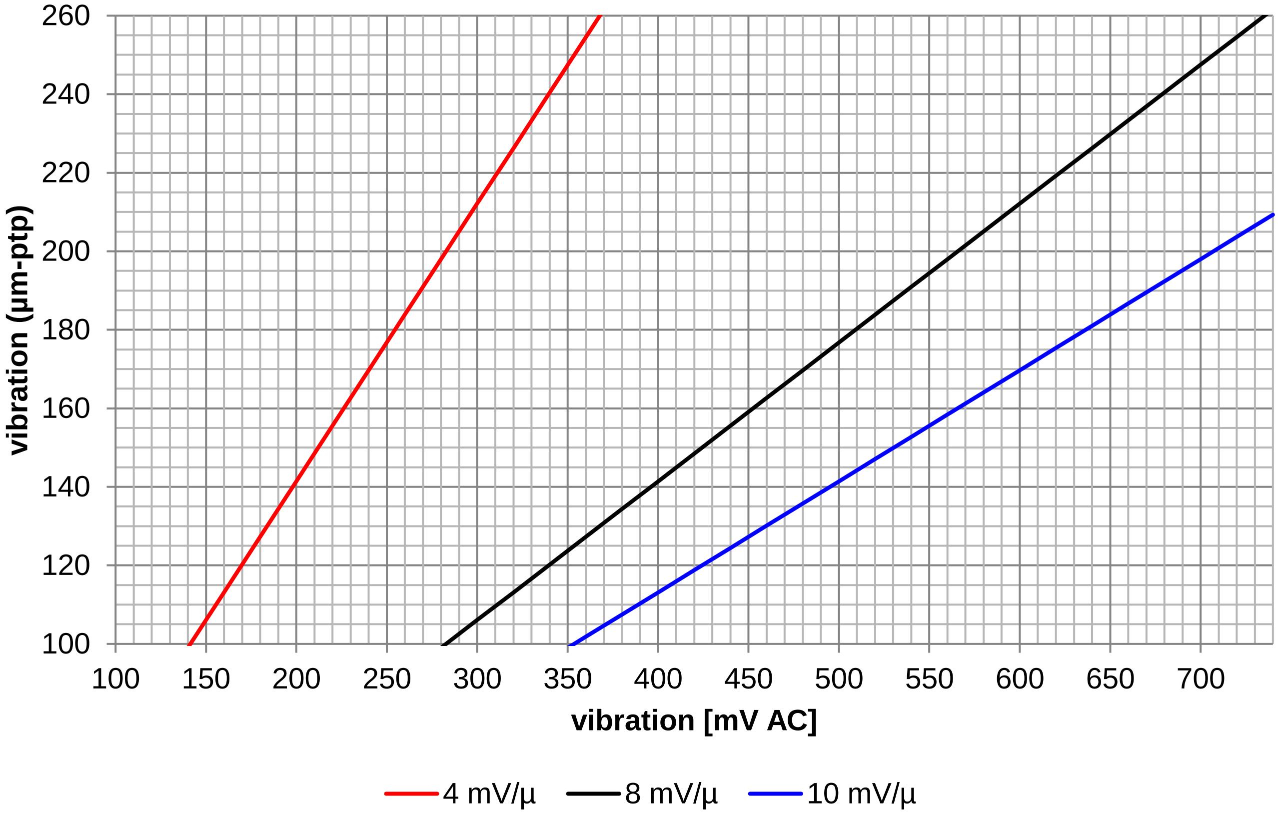
Vibration µ - ptp	Vibration mV RMS	Vibration mil - ptp	Vibration mV RMS
0	0	0,0	0
5	14	0,2	14
10	28	0,4	29
15	42	0,6	43
20	57	0,8	57
25	71	1,0	72
30	85	1,2	86
35	99	1,4	101
40	113	1,6	115
45	127	1,8	129
50	141	2,0	144
55	156	2,2	158
60	170	2,4	172
65	184	2,6	187
70	198	2,8	201
75	212	3,0	216
80	226	3,2	230
85	240	3,4	244
90	255	3,6	259
95	269	3,8	273
100	283	4,0	287
105	297	4,2	302
110	311	4,4	316
115	325	4,6	330
120	339	4,8	345
125	354	5,0	359
130	368	5,2	374
135	382	5,4	388
140	396	5,6	402
145	410	5,8	417
150	424	6,0	431
155	438	6,2	445
160	453	6,4	460
165	467	6,6	474
170	481	6,8	489
175	495	7,0	503
180	509	7,2	517
185	523	7,4	532
190	537	7,6	546
195	552	7,8	560
200	566	8,0	575

Vibration mV RMS	Vibration µ - ptp	Vibration mil - ptp
0	0	0,0
20	7	0,3
40	14	0,6
60	21	0,8
80	28	1,1
100	35	1,4
120	42	1,7
140	49	1,9
160	57	2,2
180	64	2,5
200	71	2,8
220	78	3,1
240	85	3,4
260	92	3,6
280	99	3,9
300	106	4,2
320	113	4,5
340	120	4,7
360	127	5,0
380	134	5,3
400	141	5,6
420	148	5,8
440	156	6,1
460	163	6,4
480	170	6,7
500	177	7,0
520	184	7,2
540	191	7,5
560	198	7,8
580	205	8,1
600	212	8,4
620	219	8,6
640	226	8,9
660	233	9,2
680	240	9,5
700	247	9,7
720	255	10,0

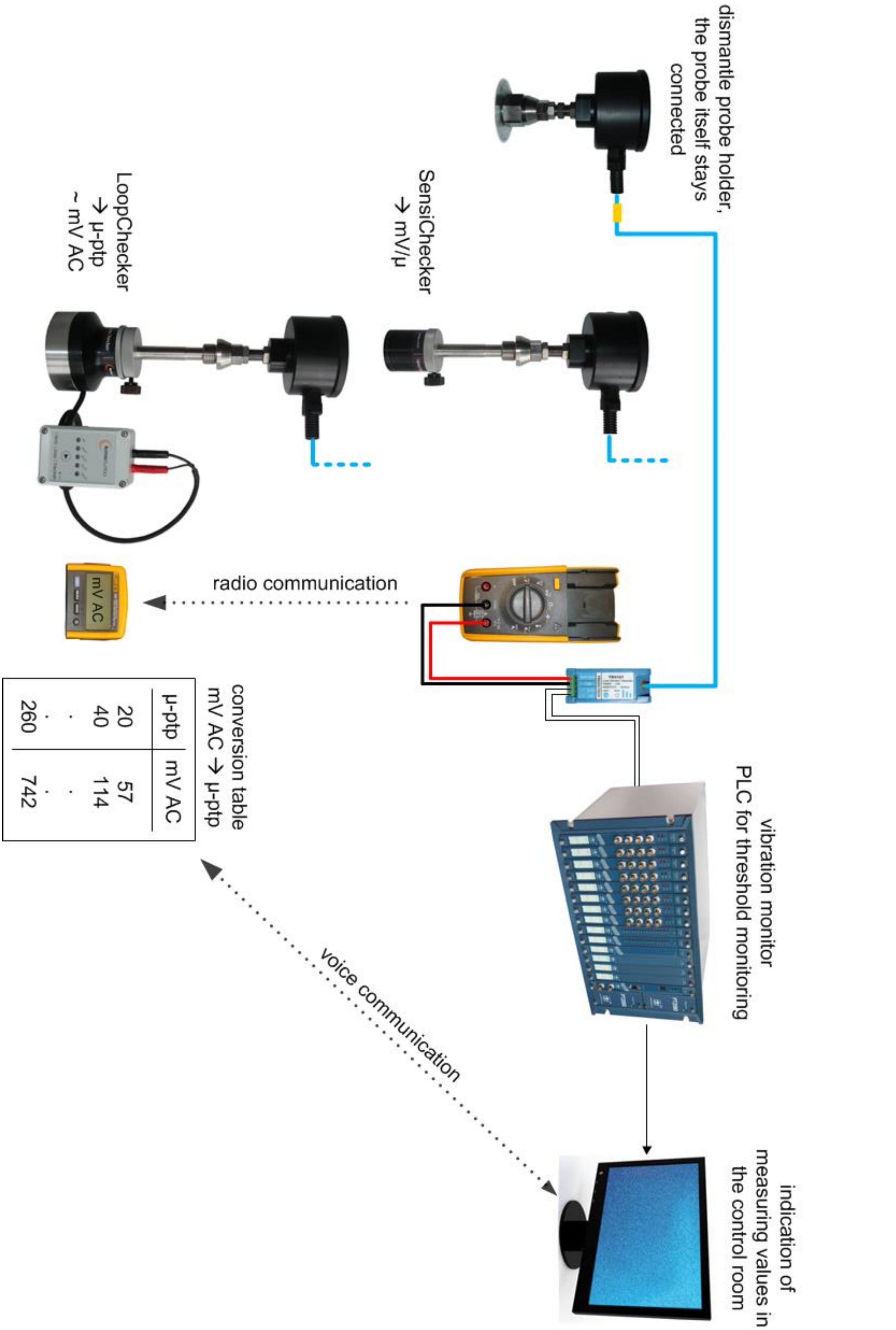
Conversion "mV AC" ↔ "peak-to-peak [µ]"



Conversion "mV AC" ↔ "peak-to-peak [µ]"



4.3 Test Setup



4.4 Test Procedure

1. Before the dynamic test with the **LoopChecker** the measuring loop sensitivity has to be determined, since deviations from the specified sensitivity influence the accuracy of limit adjustment and indication. Using the **SensiChecker** and a calibrated voltmeter you can verify that probe, cable and driver match the specification (typically: 8 V/mm resp. 4 V/mm).
2. Place the **LoopChecker** on solid ground.
3. Screw the GAP adjusting ring + lock ring up to about 1 mm into the upper part of the housing.
4. Connect probe including extension cable with oscillator resp. transmitter.
5. Connect the calibrated voltmeter with oscillator resp. transmitter. Set the voltmeter on "DC" in order to read out the GAP voltage.
6. Carefully insert the probe resp. the probe holder with reverse-mount probe from above into the GAP adjustment ring and clamp it in the prism holder at a gap signal of about 10 VDC. **Avoid massive contact with the vibrator in order to not damage vibrator or probe tip!** Fine adjustment can be achieved by turning of the adjusting ring; then fix it with the lock ring.

   The prism holder is suitable for diameters of 8 … 22 mm.
7. Connect the simulation unit to the handheld control unit.
8. After pressing of the ON/OFF ("▶") button once, the device performs a self-test (flashing of all 5 LEDs). As soon as the "ON" status indicator lights up, the device is ready for operation.
9. By further pressing of the "▶" button one by one up to 4 stored default amplitude values (see 11. for adjustment) can be selected. The amplitude can be read from the voltmeter as RMS voltage signal [mV] and converted to [µ-ptp] via calculation formula (p. 3), conversion table (p. 4) or diagram (p. 5).
10. If the exceeding of a threshold or the vibration indicated in the control room doesn't correspond with the mV signal of the voltmeter, this may especially be due to one of the following causes:
    - The wiring of the measuring loop is not correct or even broken.
    - The vibration transmitter is defective or calibrated with a wrong measuring range.
    - The limit monitoring in the PLC downstream the transmitter is calibrated with a wrong measuring range.
    - The input card of the vibration monitor is defective or falsely adjusted, thus a wrong value is transferred to the limit monitoring.
    - The measuring range of the vibration indication is falsely adjusted.
11. In order to adjust individual default values (possible within the range of 0 … 250 µm) following steps are necessary:
    - Connect a calibrated voltmeter to the buffered-out of the existing oscillator, transmitter or monitor and set it to "V~". Hint: a voltmeter with removable display makes the handling even more comfortable!
    - Read the corresponding mV value of the desired vibration amplitude from the table (p. 4) or diagram (p. 5).
    - Adjust the vibration amplitude according to the mV value by means of pushing the buttons "▲" resp. "▼". You can choose between holding the buttons (fast change of values) or just tipping the buttons (slow change of values for rather sensitive adjustment).
    - The adjusted value is to be compared with the operation indications.
    - In order to save the individually adjusted value as shortcut level for future adjustments, select one of the 4 storage positions (green LEDs) with the button "▶". By pressing of the button "**S"** the stored value will be replaced by the new selected value. **Note that, depending on the battery status (14.) and the position (2.) of the LoopChecker the actual amplitude corresponding to the stored values may slightly differ over time.** The correct setting can be updated anytime.
12. In order to switch the device off manually, the ON/OFF ("▶") button has to be pressed for > 2 seconds. If no operation is performed over a period > 30 minutes, the device switches off automatically.
13. If the "ON" indicator blinks, the device has to be charged. Before damaging exhaustive discharge starts, the device is automatically switched off; 5 seconds ahead all LEDs start blinking.

    In case of low battery the device can be powered using the USB charging cable.

5 Rechargeable Battery

In order to charge the device, connect the charging socket with the provided USB power adapter. As soon as the battery has reached its full capacity, the charge indicator lamp goes off. The battery should always be charged when storing the device for longer periods of time.

SAFETY INSTRUCTIONS FOR LITHIUM ION POLYMER BATTERIES (LiPoly batteries)

LiPoly batteries are rechargeable accumulators that feature an extremely high level of energy density. This type of battery has to be handled with particular care when in use and when charging/discharging. Mis-handling can lead to a premature wear out or defect, or even cause fire or explosion in extreme cases.

Self-Discharge:

LiPoly cells have an extremely low self-discharge rate (approx. 0.2% per day), which is why they can be stored over longer periods of time without any problems. If the voltage drops below 2.5 volt/cell, it is imperative that the cell is recharged.
An exhaustive discharge is to be avoided, otherwise the cell can suffer permanent damage in the form of capacity loss or, if the worst comes to the worst, the battery can be destroyed.

Durability:

The theoretical durability or lifespan of a cell with low levels of discharge currents lies at around approx. 500 charging/discharging cycles. A used battery has to be disposed of correctly!

Battery Disposal:

Never throw used batteries in the regular garbage! In order to help protect the environment, defective and used batteries have to be handed in at the appropriate collection points and in a discharged condition! Collection points can be found at the sales outlets for batteries or at municipal collection points for hazard-ous waste. Please mask the bare contacts with adhesive tape in order to avoid short circuiting!

DISCLAIMER

Due to the fact that **kmo turbo** cannot monitor the handling of the batteries, any liability and warranty is expressly disclaimed with regard to incorrect charging / discharging or handling.

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