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BEARING CHECKER

bearing monitoring
made easy™

SPM

User Guide

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Contents

Document Outline

This User Guide contains useful information about the BearingChecker, beginning with general information about instrument parts, user interface, battery and settings.

A chapter explaining the theories of shock pulse measurement follows. It is advisable that you read this as it is valuable in order to understand measurement results and to evaluate them correctly.

The shock pulse theories chapter is followed by chapters describing the hands-on use of the instrument and how to confirm and evaluate measurement results.

References to icons, displays and modes in the instrument are in **bold** text. References to instrument keys are in capital letters.

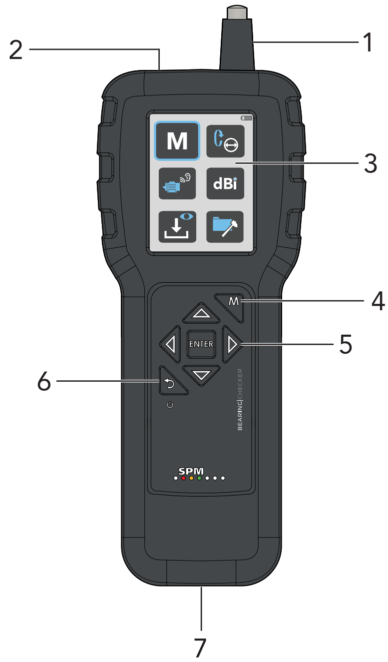
Safety notes

- The instrument is intended for professional, industrial process, and educational use only while taking into consideration the technical specifications. The accessories may only be used for their respective intended purpose as defined in this User Guide.
- The instrument must not be used in environments outside of the temperature range specified under "*Technical specifications*" in this User Guide, as the battery may be damaged and may cause harm or danger.
- When measuring, ensure that no cables, etc. can be caught in rotating parts which can cause injury.
- For safety reasons, the measurement device must only be operated and maintained by properly trained personnel.
- The battery should be charged in a dry office environment with a temperature range within 0 to +45 degrees °C (0 to 113 °F). If the battery is charged in an environment outside of specified temperatures, it may be damaged.
- The service and repair of the measurement device may only be performed by SPM authorized service technician.

Instrument Overview

Instrument parts

1 Measuring probe (BC200)
2 Transducer input (BC200/BC250)
3 Graphical display with LED backlight
4 MEASURE key
5 Navigation keys
6 BACK key and power on
7 Mini-B USB communication output



General description

The BearingChecker is a shock pulse meter based on the well-proven SPM method for quick and easy identification of bearing faults. The instrument has a built-in microprocessor programmed to analyze shock pulse patterns from all types of ball and roller bearings and display evaluated information on the operating condition of the bearing.

BearingChecker is lithium-ion battery powered and designed for use in harsh industrial environments. The graphical display (3) displays the condition readings and provides an immediate evaluated bearing condition in green-yellow-red, with a short explanation regarding the evaluation.

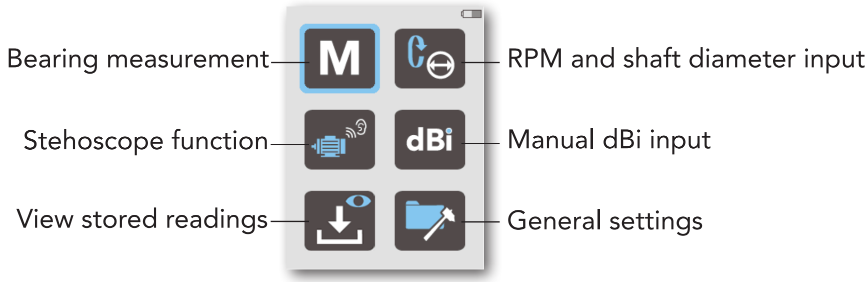
For BC200, the probe type shock pulse transducer (1) is built-in. For BC200 and BC250, external SPM shock pulse transducers of types 40000 and 42000 for adapters and permanent installation can be used as well, connected to the transducer input (2). The dBi value is programmed into the instrument and measurement is started with the 'M' key (4). The actual condition reading is displayed on the graphical display (3) as a carpet value (dBc), and a maximum value (dBm). The evaluated bearing condition is indicated in the form of a green, yellow or red status icon, with a condition code on a scale from 1 to 6. Headphones for listening to the shock pulse pattern can be connected to the USB output (7) using a headphone adapter (optional).

The BearingChecker can also be used for detecting machine sound irregularities via headphones using the **Stethoscope** function.

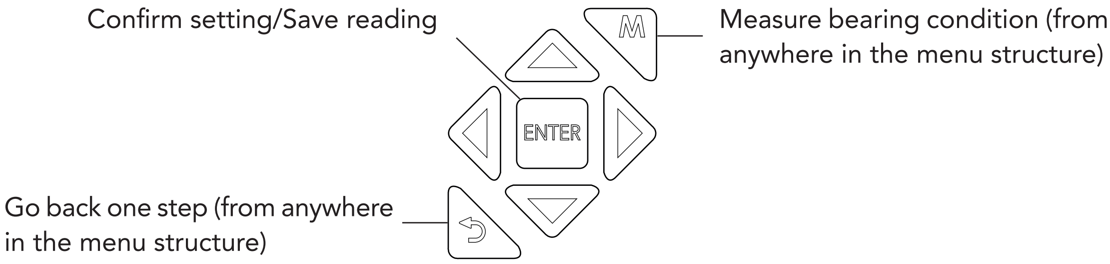
Built-in or external probes can be used for listening.

Displays and icons

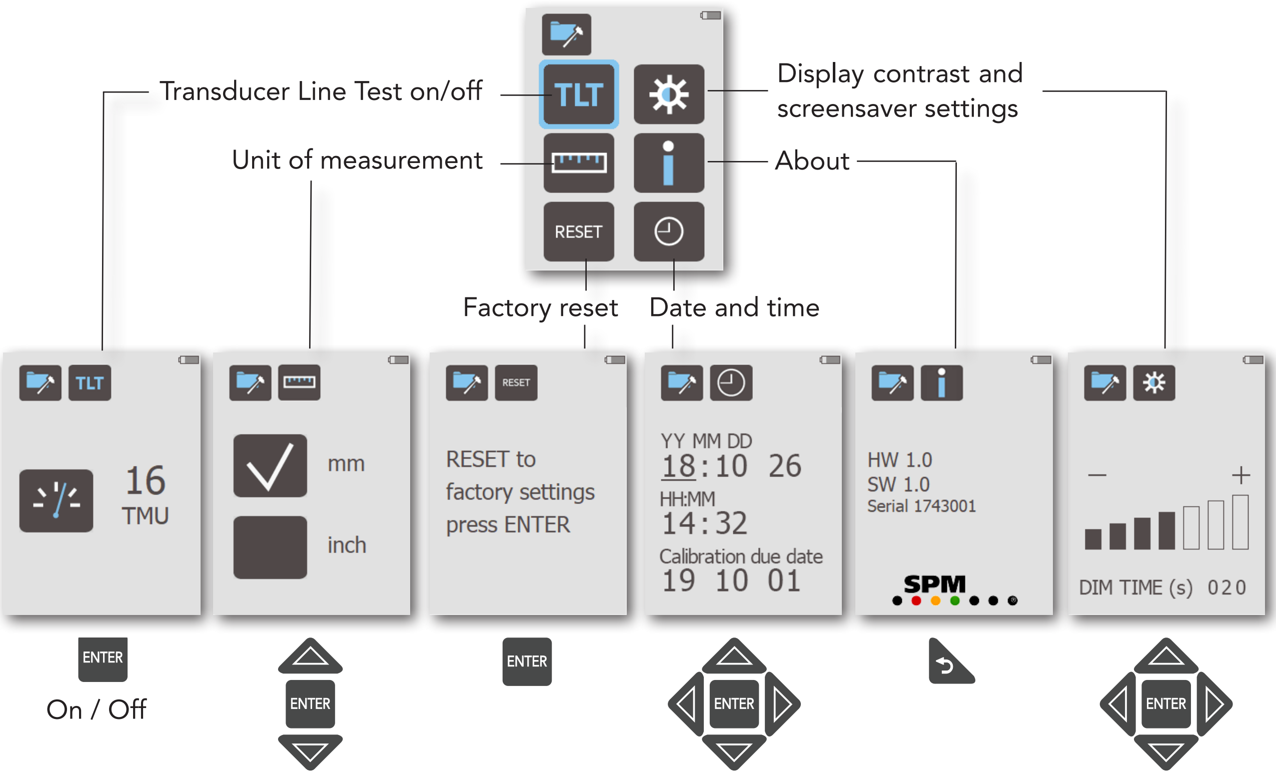
Main display



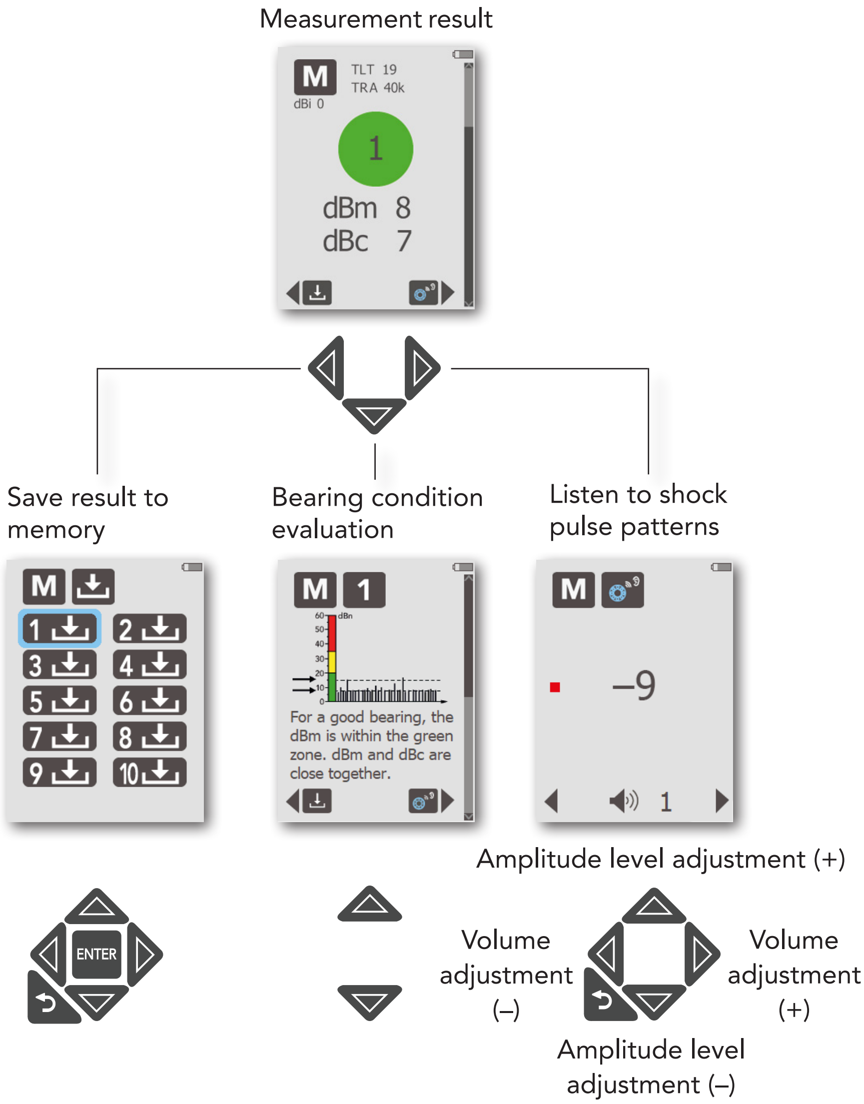
Navigation keys



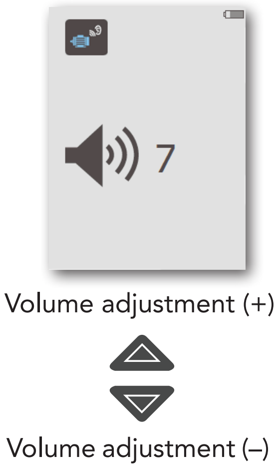
General settings



M Bearing Measurement



Stethoscope Function



Start up

Press and hold the **BACK** key (A) to switch on the instrument. BearingChecker always starts in the **Main** display.

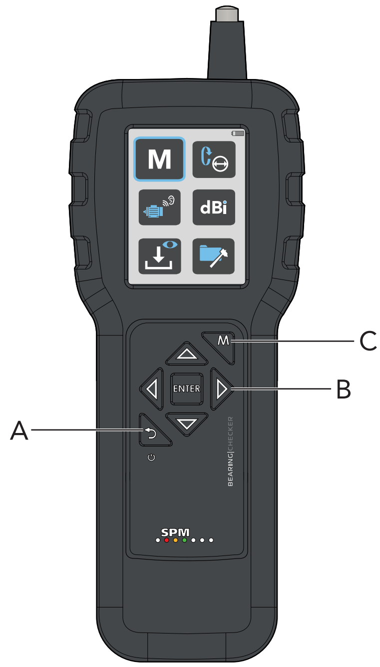
Setup and instrument functions are selected with the arrow and **ENTER** keys (B).

For all BearingChecker versions, measurement is started manually by pressing the **MEASURE** key (C) from anywhere in the menu structure.

To indicate that a shock pulse measurement cycle has started, a single blue pixel briefly appears at the bottom of the **Measurement** display, after which the display backlight turns off until the measurement completes.

When idle, the instrument automatically and successively goes into energy saving mode, first by dimming the display backlight according to the user-defined screensaver timeout (for more information, see chapter "*Display contrast and screensaver timeout*" in this user guide). Next, after another twenty seconds, the backlight turns off entirely, with the instrument still running. At this stage, reactivate the backlight by pressing any key. Finally, after a further two minutes of inactivity, BearingChecker automatically turns off completely. Restart the instrument with the **BACK** key. The exception is when using the listening function, in which case the display backlight remains turned on.

The instrument can also be shut off manually by briefly pressing and holding the **BACK** key.



Forcing instrument reset

Should the instrument have a lockup problem, prompt a reset by pressing the **ENTER** key for approximately five seconds.

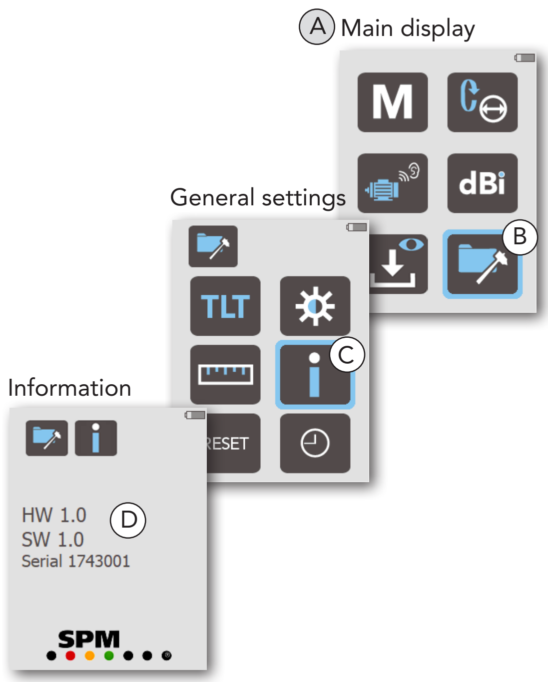
NOTE: This action does not initiate an instrument reset back to factory settings.

Serial number and software version

To find out the software version and instrument serial number:

1. Go to the **Main** display (A).
2. Use the arrow keys to navigate to the **General Settings** menu (B), then press **ENTER**.
3. In the **General settings** display, select the **Information** icon (C) and press **ENTER**.
4. The **Information** display opens (D), showing the software version and serial number.

To return to the **Main** display, press the **BACK** key twice.



Battery

The instrument is powered by a lithium-ion battery, which is charged by connecting a charger to the instrument's USB communication output (or other USB output with the specifications 5V/500 mA).

Please note that the instrument must be sent to a certified SPM service and calibration partner for replacement of a discharged battery.

⚠ Do not replace the battery!

Refer servicing to your local SPM dealer.

Charging the battery

The battery charge icon in the upper right corner of the **Main** display (A) shows the current battery status. The icon turns red when the battery is low (<10%) and needs recharging.

The battery should be charged in a dry office environment with a temperature range within 0 to +45 degrees °C (0 to 113 °F). If the battery is charged in an environment outside of specified temperatures, it may be damaged.

A flash symbol to the left of the battery charge icon indicates that a charging cable is inserted. When the battery charge icon is green, the battery is charging. When it turns gray, the battery is fully charged.

Should the battery charge icon be full but in red color, something is wrong with the charging system or circuitry, and the instrument needs to be sent to SPM Instrument for service.

(A) Main display

- Battery low
- Battery charging
- Battery full
- Faulty charging system/circuitry

Extending battery life

Avoid deep cycling of the battery. Each cycle wears the battery down by a small amount and a partial discharge is better than a full discharge. Lithium-ion is maintenance-free and the battery lasts longest when operating between 30 and 80 percent. Store the instrument partially charged in a cool and dry place.

The battery will gradually self-discharge even if stored in a partially charged state. Self-discharging increases with age, usage, and elevated temperature.

The battery life may vary depending on how the instrument is used; most battery-consuming are the **Stethoscope** and **Listening** functions.

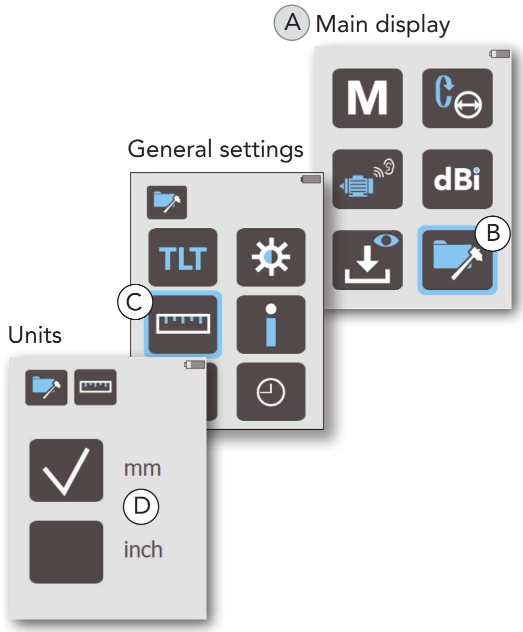
Settings

Unit for bearing diameter

Bearing diameter can be displayed in either **mm** or **inch**. To select your unit of measurement:

1. Go to the **Main** display (A).
2. Use the arrow keys to navigate to the **General Settings** icon (B), then press **ENTER**.
3. In the **General Settings** menu, select the **Units** icon (C) and press **ENTER**.
4. In the **Units** display (D), use the **UP/DOWN** keys to select millimeters or inch as the unit of measurement.
5. Press the **ENTER** key to save your setting.

To return to the **Main** display, press the **BACK** key.

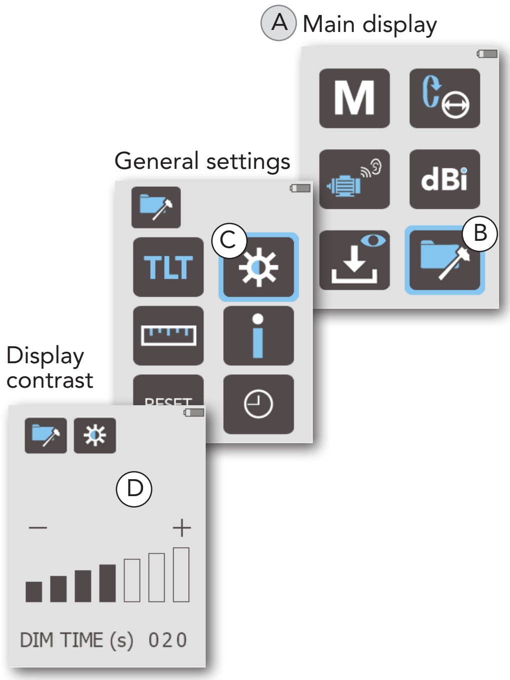


Display contrast and screensaver timeout

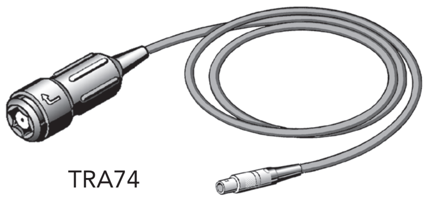
To set the display contrast and the amount of idle time that should elapse before the screensaver is activated:

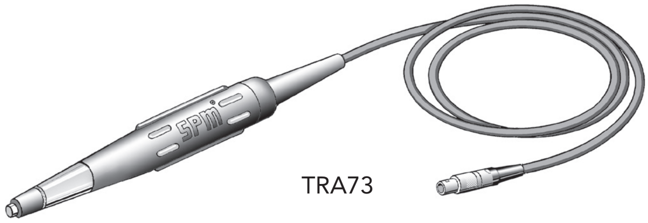
1. Go to the **Main** display (A).
2. Use the arrow keys to navigate to the **General Settings** icon (B), then press **ENTER**.
3. In the **General Settings** menu, select the **Display contrast** icon (C) and press **ENTER** to open the display contrast and screensaver settings (D).
4. Use the **UP/DOWN** arrow keys to set the time to wait (5 - 600 seconds) before the screensaver dims the display backlight.
5. Use the **LEFT/RIGHT** arrow keys to set the display contrast.
6. Press the **ENTER** key to save your settings and return to the **General settings** menu.

To return to the **Main** display, press the **BACK** key.



Accessories


TRA74



TRA73


EAR12

Options

CAB52 Measuring cable, 1.5 m, mini coax -BNC slip-on

CAB94 Charger cable, USB type A to Mini-B USB, 1.5 m

CAS24 Carrying case, plastic with foam inlay set for 1 BC/VC instrument, 326x222x116 mm

CAS29 Carrying case, plastic with foam inlay set for 2 BC/VC instruments, 437x379x130 mm

EAR12 Headphones with eardefenders

TRA73 External sensor with probe

TRA74 Sensor with quick connector for adapters

18103 Cable adapter, Mini-B USB to 3.5 mm stereo jack

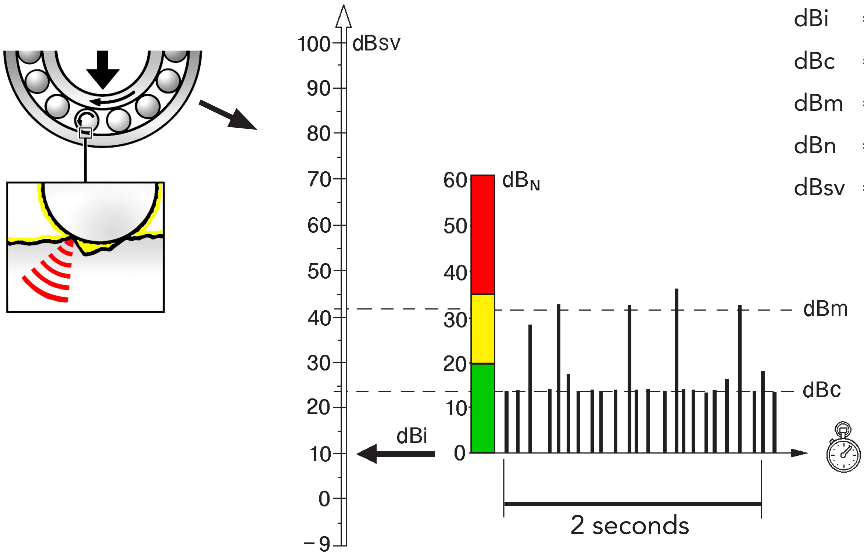
18226 Kit for screen protection (2 pcs screen protector)

90647 Charger, 100-240 V, 50-60 Hz, 6 W

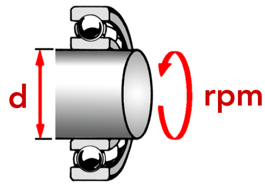
93363 Cable adapter, mini coax -BNC

93062 Cable adapter, BNC-TNC, plug-jackstrument

Shock Pulse Measurement



dBi = Initial value of a bearing
dBc = Carpet value (weak pulses)
dBm = Maximum value (strong pulses)
dBn = Unit for normalized shock level
dBsv = Unit for absolute shock level



The initial value dBi depends on rpm and shaft diameter d.

The Shock Pulse Method

The BearingChecker is based on the Shock Pulse Method. Measurements with the SPM method give an indirect measure of impact velocity, i.e. the difference in velocity between two bodies at the moment of impact. At the point of impact, a mechanical compression wave (a shock pulse) arises instantly in each body. The peak value of the shock pulse is determined by the impact velocity and is not influenced by the mass or the shape of the colliding bodies. Shock pulses in rotating ball and roller bearings are caused by impacts between raceways and rolling elements. From the points of impact the shock pulses travel through the bearing and the bearing housing. Extensive experience proves that there is a simple relationship between the bearing's operating condition and the value of the shock pulses.

A transducer detects the shock pulses in the bearing. The transducer signals are processed in the bearing detector's microprocessor and the measured shock pulse values are shown on the display. An headphone can be connected to the instrument for listening to the shock pulse pattern. Please note that this instrument cannot be used for plain bearings.

Shock pulses are short duration pressure pulses which are generated by mechanical impacts. Mechanical impacts occur in all rotating rolling bearings because of irregularities in the surfaces of the raceways and the rolling elements. The magnitude of the shock pulses depends on the impact velocity.

Carpet value dBc

Surface roughness (small irregularities) will cause a rapid sequence of minor shock pulses which together constitute the shock carpet of the bearing. The magnitude of the shock carpet is expressed by the carpet value dBc (decibel carpet value). The carpet value is affected by the oil film between rolling elements and raceways. When the film thickness is normal, the bearing's carpet value is low. Poor alignment and installation as well as insufficient lubrication will reduce the thickness of the oil film in the whole or parts of the bearing. This causes the carpet value dBc to rise above normal.

Maximum value dBm

Bearing damage, i.e. relatively large irregularities in the surfaces, will cause single shock pulses with higher magnitudes at random intervals. The highest shock pulse value measured on a bearing is called its maximum value dBm (decibel maximum value). The maximum value dBm is used to determine the operating condition of the bearing. The carpet value dBc helps to analyze the cause of reduced or bad operating condition.

Normalized and unnormalized readings

The BearingChecker measures impact velocity over a large dynamic range. In order to simplify readout and evaluation, a logarithmic measuring unit is used: decibel shock value (dBsv).

dBsv is the general measuring unit for shock pulses. By measuring the shock pulses from a bearing in dBsv a value for their magnitude is obtained, for instance 42 dBsv. However, this value is only part of the information needed to judge the operating condition of the bearing. We also need a standard of comparison, i.e. a norm value for identical or similar bearings.

Such norm values have been obtained empirically, by measuring the shock pulses from a large number of new, perfect ball and roller bearings. They are called "initial values" **dBi** (decibel initial). The dBi value can be set manually or calculated by the instrument after input of rpm and shaft diameter (see chapter "*Input data*"). The highest dBi value that can be entered is +60, the lowest –9. Any attempt to enter values below this will result in dBi "- -" and an unnormalized shock pulse reading (see below).

By subtracting the dBi from the dBsv value we obtain the "normalized" shock pulse value or dBn (decibel normalized) of the bearing, for example: 42 dBsv–10 dBi = 32 dBn". The normalized shock pulse value dBn is the measuring unit for the operating condition of bearings. A maximum value of 32 dBn means "32 dB above normal", which implies "reduced operating condition" for the measured bearing. By programming the BearingChecker with the dBi before taking a reading, the bearing condition will be indicated directly on the condition display in green-yellow-red for "good", "reduced" or "bad" operating condition for the measured bearing. "Bad operating condition" can be synonymous with "bearing damage", but the term also includes a number of other "bearing faults" which can be detected by shock pulse measurement. The initial value dBi of a bearing is directly related to its rotational speed and shaft diameter.

The absolute shock pulse level of a bearing, measured in dBsv (decibel shock value), is both a function of rolling velocity and of bearing condition. The dBi value of the bearing must be entered in order to neutralize the effect of rolling velocity on the measured value.

The BearingChecker takes a sample count of the shock pulses occurring over a period of time and displays:

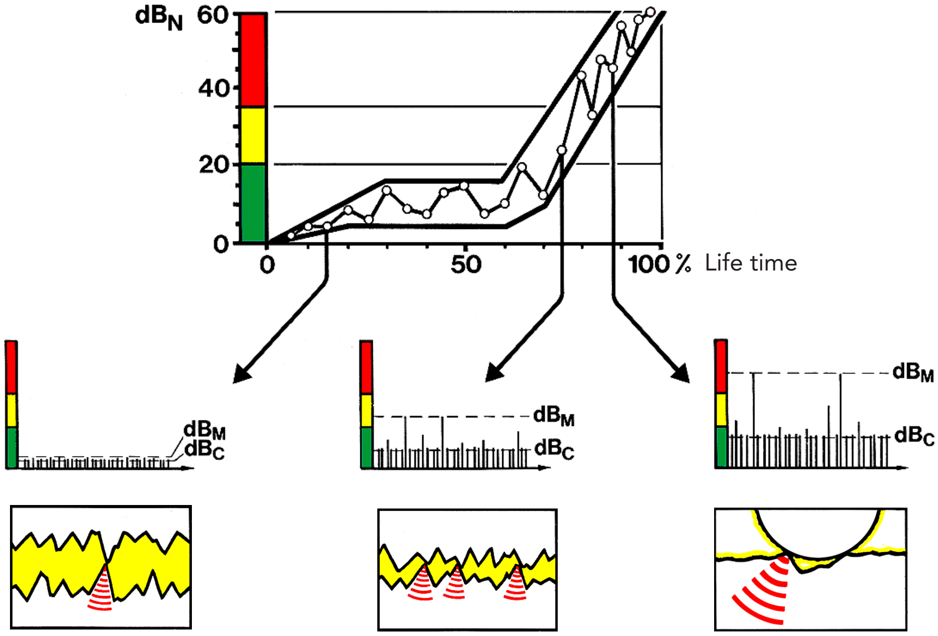
- the **maximum value dBm** for the small number of strong shock pulses.
- the **carpet value dBc** for the large number of weaker shock pulses.
- a condition indicator on the condition scale (for normalized readings only): green for dBn up to 20 dBn = good condition, yellow for 21-34 dBn = caution, red for 35 dBn and more = bad condition.

The maximum value dBm defines the bearing's position on the condition scale. The difference between dBm and dBc is used for a finer analysis of the causes for reduced or bad condition.

Unnormalized readings

For unnormalized readings, set the dBi value to "- -" (see chapter "*Input data*"). You will then measure in dBsv (absolute shock values) and get **no condition indication**, as the condition scale is graded in normalized shock values, dBn. This method is used for comparative readings on different bearings and/or other shock pulse sources.

The dBm/dBc technique



The dBm/dBc technique is well established and well suited for industrial condition monitoring, working with few, easy to understand in- and output data.

Even on a logarithmic scale, there is normally a large, distinct difference between the maximum values from good and bad bearings. Thus, minor inaccuracies in the input data (rpm and shaft diameter) have little effect on the evaluated measuring result.

Lubrication condition is indicated by the delta value, i.e. the difference between dBm and dBc. High readings and a small delta value indicate poor lubrication or dry running. This is sufficient for maintenance purposes.

dBm and dBc are measured in a fixed time window and automatically displayed.

The headphone is used to listen to the shock pulse pattern in case of suspect or high readings. This, and the possibility to search for shock pulse sources with the probe transducer, are means to verify the measuring result and its cause.

Guidelines for measuring points

The guidelines for the selection of shock pulse measuring points have a very practical purpose. The aim is to capture low energy signals, which are getting weaker the farther they travel and the more they are bounced about inside a piece of metal. We know that they lose strength when they cross over from one piece of metal to another. We cannot know, for all bearing applications, how much of the strength of the signal emitted by the bearing will reach the measuring point. However, by necessity we try to apply general evaluation rules, i. e. treat all measured signals as if they were of the same quality.

The rules for shock pulse measuring points try to assure that most of them are "within tolerance" and that the green-yellow-red condition zones are valid:

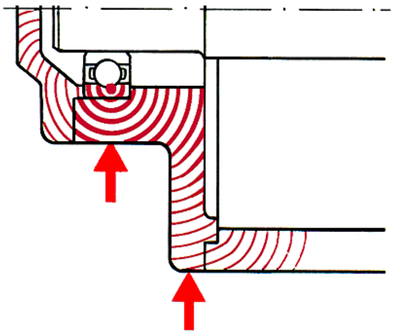
1 **The signal path between bearing and measuring point shall be as short and straight as possible.**

2 **The signal path must contain only one mechanical interface: that between bearing and bearing housing.**

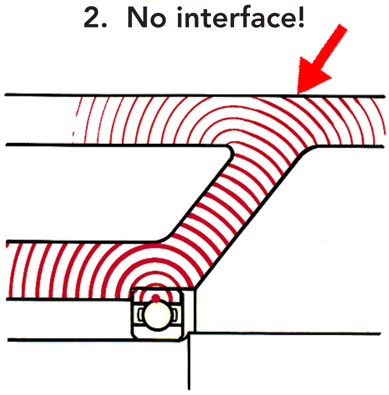
3 **The measuring point shall be located in the load zone of the bearing.**

"Short" means up to 75 mm (3 in.), but that depends also on how straight the path is: bends cause re- and deflections whose effects are hard to judge. The load zone is the load carrying half of the bearing housing, normally the lower one. Allow for the pull of belts or other forces which can shift the load to one side. Use the probe to find the spot yielding the strongest signal. When a measuring point cannot conform to the rules (because an ideal spot cannot be reached), make allowance for a weaker signal.

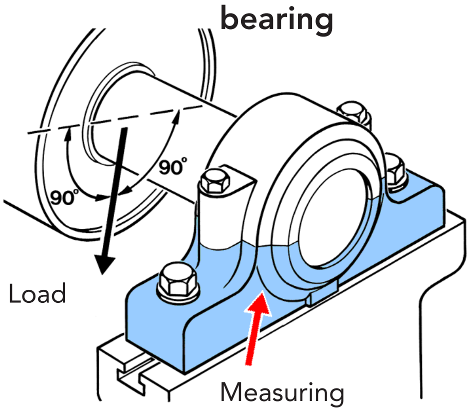
1. Straight and short path



2. No interface!



3. In the load zone of the bearing

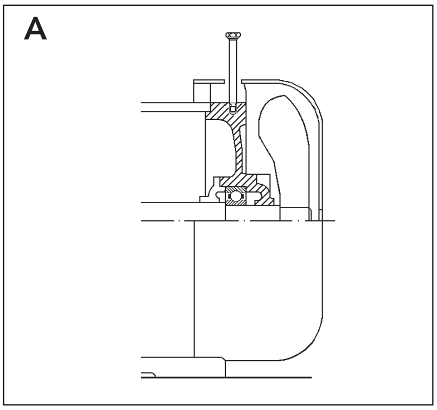


Measuring points, examples

The following two pages show measuring points and possible adapter or transducer installations. How to install measuring equipment is described in the SPM installation manual.

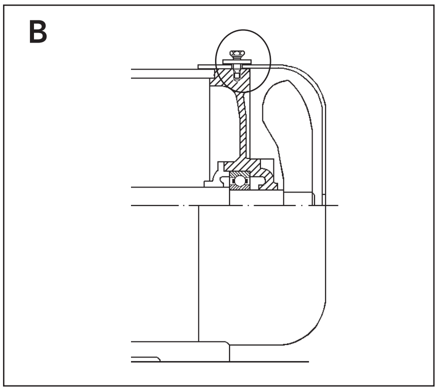
Through hole for long adapter

Figure A shows how a measuring point beneath a fan cover can be reached with a long adapter, through a hole in the cover.



Adapter with lock nut

In figure B, the fan cover is fastened directly to the motor shield, which is also the bearing housing. One of the cover's holding screws can be replaced by an adapter with lock nut.



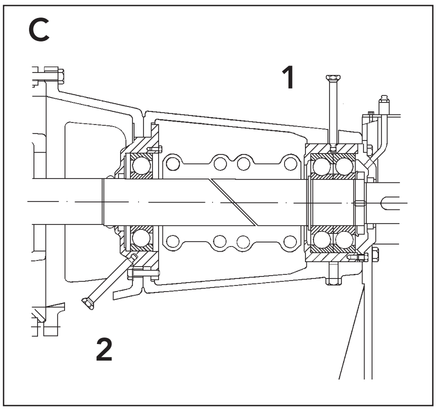
Bearing housings beneath brackets

Consult machine drawings and identify the bearing housing before selecting a measuring point.

In figure C, showing a pump, the bearings are placed in two separate housings inside the bearing bracket.

The bearing pair at measuring point 1 can be reached with a long adapter through a clearance hole in the bracket. The hole must be large enough to allow bearing adjustment and still prevent metallic contact between bracket and adapter.

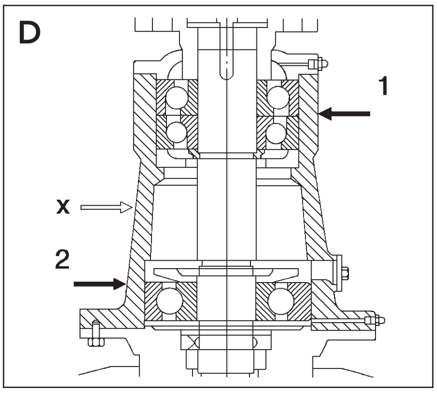
Measuring point 2, placed below and opposite to the pump outlet (load direction!) can be reached with a long adapter through an opening in the pump shield.



Multiple bearings in one housing

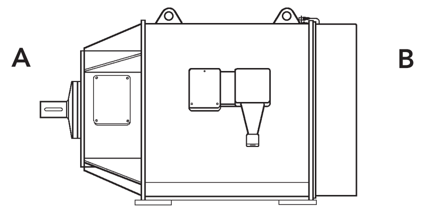
If there are several bearings in the same housing, they are normally treated as a single bearing. Figure D shows the bearing arrangement for a vertical pump. It is not possible to distinguish between the shock pulses from the paired bearings in point 1.

There is also a risk for cross talk between point 1 and point 2, which means that the shock pulses from the bearing in worst condition are picked up at both points. Check signal strength with the probe. Use one measuring point only if readings are identical in both points. This point (x) can be placed halfway between points 1 and 2.



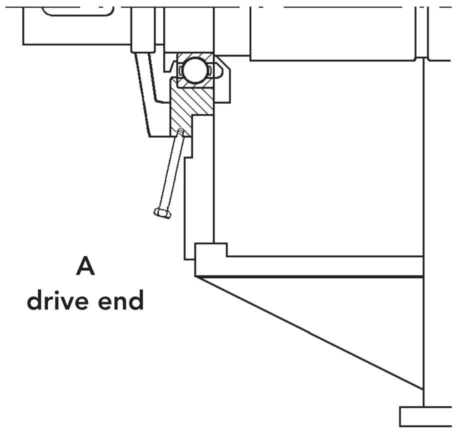
On large electric motors, the bearings are often mounted in housings which are welded or bolted to the motor shields. Because of the damping in the interface between the bushing and the shield, the measuring point should be on the bushing.

The bearing housing at the drive end (A) is usually within reach. A long adapter is installed at an angle to the shield, so that there is enough space for connecting the transducer.



Installed transducer

The bearing at the fan end (B) requires a permanent transducer installation. The transducer is installed in the bushing. The coaxial cable is run through a slit in the fan cover to a measuring terminal on the stator frame.



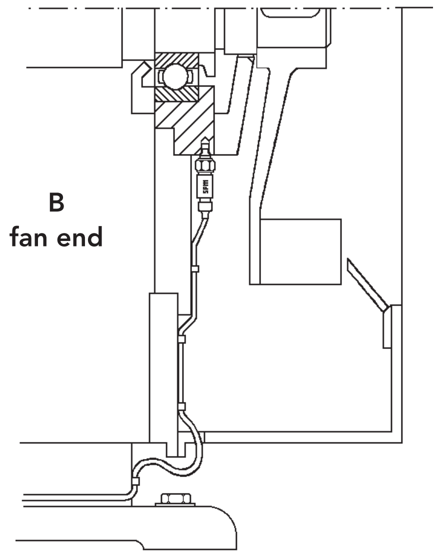
Check installed equipment

Incorrectly installed adapters or transducers can cause a significant damping of the shock pulse signal.

Check all installations. Make sure that mounting holes are correctly countersunk and that the seat surfaces of adapters have good contact with the material of the bearing housings.

Any metallic machine part knocking or rubbing against the adapter will produce a disturbance. This must be avoided by making large clearance holes and using soft, elastic sealing material.

Use high-temperature cables and moisture-proof equipment where required, and protect installations against damage. Adapters should be fitted with protective caps.



Mark the measuring points

Measuring points for the probe transducer should be clearly marked. To get comparable readings, one must always use the same measuring point.

Measuring range

The measuring range of the BearingChecker is large and covers most bearing applications, but there are a few cases where shock pulse monitoring should only be attempted with installed measuring equipment, or not at all.

High-speed bearings: BearingChecker accepts max. 30,000 rpm, 2,000 mm shaft diameter, and a dBi of 40. The upper part of the table contains examples of possible combinations of shaft diameter and rpm giving a maximum dBi of 40. The lower part of the table exemplifies combinations that give dBi = 0. The instrument calculates the dBi up to 40. However, it is possible to set the dBi to max. 60 manually. A reason for setting dBi > 40 is when measuring on e.g. turbochargers, high-speed gearboxes etc.

Low-speed bearings: The lowest acceptable dBi is –9 dB. However, it is nearly impossible to get a meaningful reading from bearings in the extremely low speed ranges. The practical limit are bearings with a dBi around 0 dB (see lower half of the table).

A heavy load with a well defined direction and a low interference level make it easier to get readings from low speed bearings. Successful shock pulse monitoring has been carried out on bearings with dBi = –3 (54 rpm, shaft diameter 260 mm). Note that the dynamic measuring range decreases when dBi values get below 0. For example, a bearing with dBi = –3 showed very heavy damages at dBn = 40.

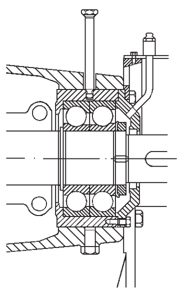
Installed adapters required: The installation of adapters is strongly recommended for all systematic shock pulse monitoring. In some cases it is a requirement:

- on bearings with dBi below 5
- on heavily vibrating bearing housings
- on covered bearing housings.

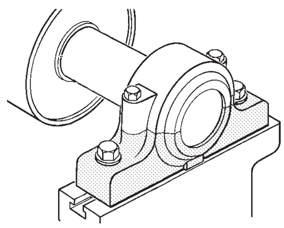
Low speed: Do not use a handheld probe on low speed bearings. As a rule, the measurement should cover at least 10 full revolutions of the shaft. A single damaged part in the raceway will cause a strong pulse only when hit by a rolling element while passing through the load zone. It can take several revolutions before that event occurs or is repeated.

Shaft, mm	rpm	dBi
25	30 000	40
50	20 000	40
100	13 000	40
180	10 000	40
300	6 000	40
500	5 000	40
1 000	3 400	40
1 999	2 200	40
1 999	24	0
1 000	35	0
650	45	0
500	52	0
300	72	0
180	100	0
100	140	0
50	210	0

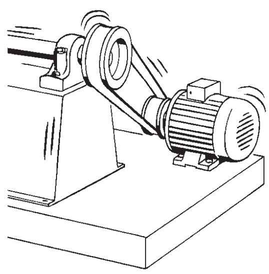
Adapters required!



Covered housing

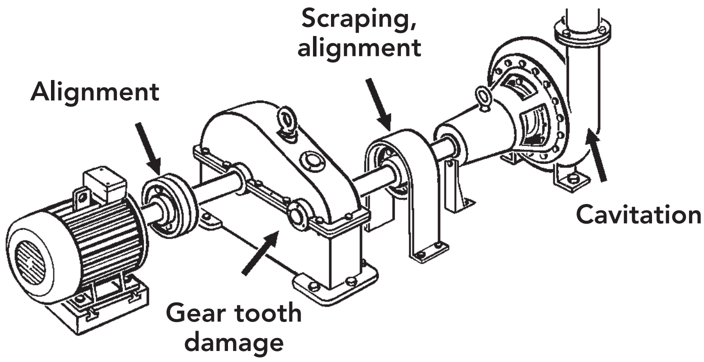


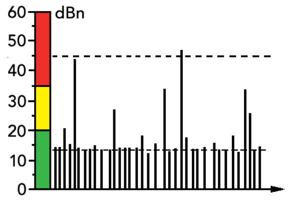
dBi < 5



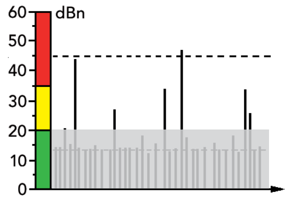
Heavy vibration

Creating acceptable measurement conditions

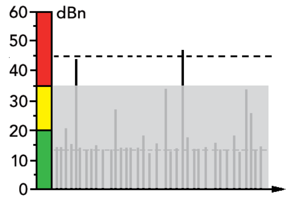




No interference



Low level interference



High level interference

The clicking of valves, high pressure steam flow, mechanical rubbing, damaged or badly adjusted gears, and load shocks from machine operation can cause a general high shock level on the machine frame. This interference can mask the bearing signal in cases where he shock level measured outside of the bearing housings is as high or higher than the shock level on the bearing housings.

Remove sources of interference

In most cases, interference is the result of bad machine condition. For example – cavitation in a pump is due to flow conditions for which the pump was not designed. Cavitation does more than interfere with bearing monitoring – it slowly erodes the material of the pump.

Monitoring the bearings is pointless if the machine breaks down or requires frequent repairs because of other poorly maintained parts or badly adjusted operating parameters. Therefore, do not accept interference – try to remove the cause.

Coping with interference

If the source of interference cannot be removed, there are several possibilities:

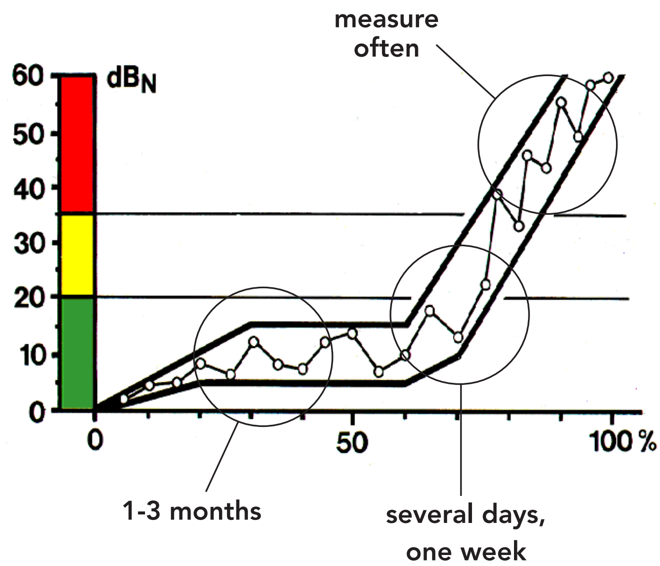
- If it is intermittent, measure while there is no interference.

If interference is persistent, measure its shock pulse level with the same dBi setting as the bearing and compare it with the condition zones:

- If interference masks the green zone, you can get true bearing condition readings in the yellow and red zone.
- If interference masks the yellow zone, you can get true bearing condition readings in the red zone, i.e. find a damaged bearing.

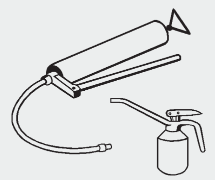
If the interference level is persistently higher than the shock level, that would be caused by bad bearing condition (35 to 40 dB above the dBi), do not try to monitor the bearing.

Measurement intervals



Measuring personnel should know about:

- **lubricant type**
- **maximum quantity**
- **lubricating intervals**



Unpredicted, very rapid damage development is rare. Normally, surface damage develops slowly, over a period of many months. These are the general guidelines for selecting the interval between periodic readings:

- The bearings should be checked at least once every three months.
- The bearings in critical machinery and heavily preloaded bearings (e.g. spindle bearings) should be measured more often than other bearings.
- The bearings should be measured more frequently when their condition is unstable (rising or irregular readings).
- Damaged bearings should be closely watched until they can be replaced.

This implies that one has to allow time for extra checks on bearings in dubious or bad condition.

Check stand-by equipment

Vibration and corrosion can damage the bearings in stand-by machines. Check bearing condition each time such machines are being tested or used.

Synchronize with lubrication

It may be necessary to synchronize regreasing and measuring intervals. Grease lubricated bearings should not be measured until they have run for approximately one hour after regreasing (except when doing a lubrication test).

Keep in mind that bad bearing condition is often connected with lubrication problems. For grease lubricated bearings, a lubrication test usually provides the final proof of bearing damage. Make sure that the right type and quantity of grease is used.

Shock pulse transducers

Built-in transducer with probe

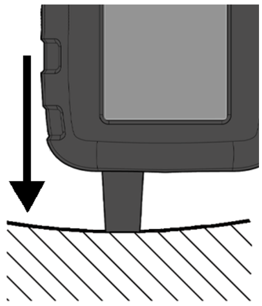
Measuring points for the built-in probe should be clearly marked. Always measure in the same spot. In addition, the probe is used to measure elsewhere on the machine, in case it is necessary to search for other shock pulse sources such as pump cavitation or rubbing parts.

The probe tip is spring loaded and moves within a sleeve of hard rubber. To maintain a steady pressure on the tip, press the probe tip against the measuring point until the rubber sleeve is in contact with the surface.

Hold the probe steady to avoid rubbing between its tip and the surface.

The probe is directionally sensitive. It must be pointed straight at the bearing.

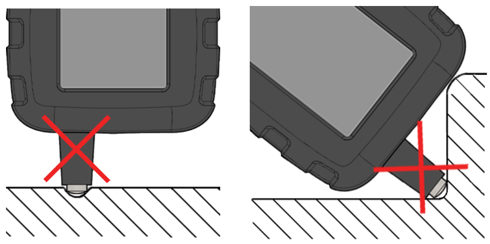
The centre of the probe tip should touch the surface. Avoid pressing the probe tip against cavities and fillets which are smaller than the probe tip.



Rubber sleeve in contact with the surface

Point at the bearing

Hold steady

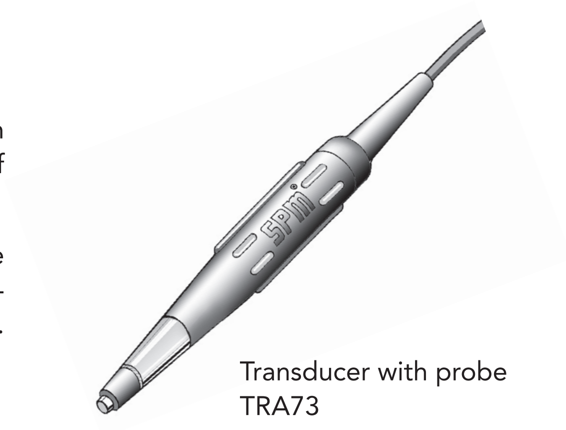


Avoid small cavities and fillets

Shock pulse transducer with handheld probe

The handheld probe can be used to reach measuring points in narrow spaces and has the same construction and method of operation as the built-in transducer (see above).

The only part likely to wear out is the rubber sleeve for the probe tip. It is made of chloroprene rubber (neoprene) and tolerates 110° C (230° F). Spare sleeves have part number 18128.



Transducer with probe TRA73

Transducer with quick connector

External shock pulse transducers are connected to the transducer input at the top of the instrument. The choice of transducer type depends on how the measuring point is prepared. For systematic shock pulse monitoring, SPM recommends the use of permanently installed adapters and quick-connect transducer wherever possible.

Adapters are solid metal bolts of different length and thread sizes, tuned for correct signal transmission. They are installed in threaded, countersunk mounting holes on the bearing housings. Glue-on adapters are available.

To attach the transducer with quick connector, press it against the adapter and twist clockwise. Twist counter-clockwise to remove it.

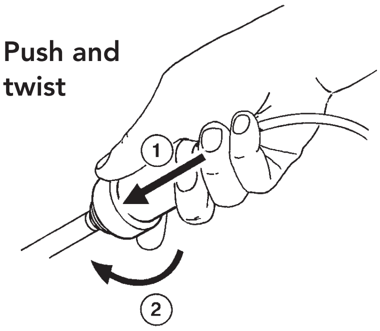
Adapter surfaces must be clean and plane. Use an adapter cap to protect them.

Check that installed transducers and adapters are properly mounted (see the instruction on SPM installations) and in good condition. You cannot expect a useful signal by attaching the quick connect transducer to a rusty lump of metal, or from a transducer that is rolling on the floor on the other side of a partition.

TRA74

Standard adapter

Push and twist

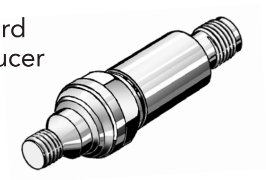


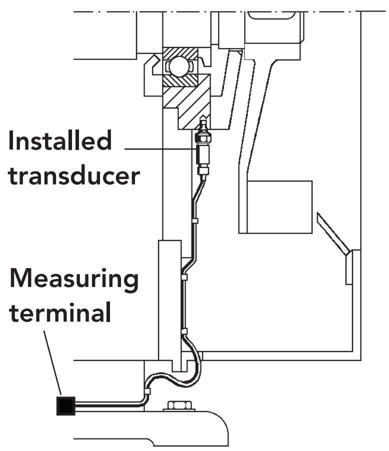
Permanently installed transducers and measuring terminal

A permanently installed transducer and a measurement terminal (BNC or TNC connector) are used when the bearing cannot be reached directly. Use a measuring cable to connect instrument and terminal. Use SPM dust caps to protect the connector.

Check that installed transducers and adapters are properly mounted (see the instruction on SPM installations) and in good condition. You cannot expect a useful signal by attaching the quick connect transducer to a rusty lump of metal, or from a transducer that is rolling on the floor on the other side of a partition.

Standard transducer

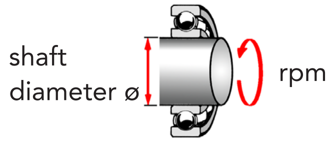




M Bearing Measurement

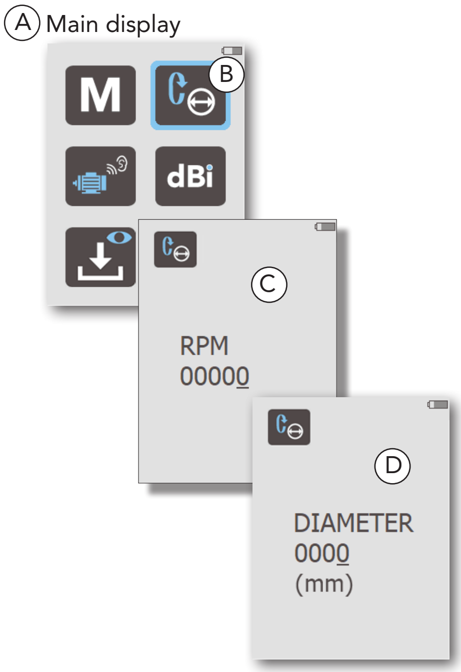
Input data

For a reading of bearing condition with BearingChecker, you need the initial value, dBi. If you do not know the bearing´s dBi, BearingChecker will calculate and display the dBi given the rotational speed (rpm) and the shaft diameter. **Neglecting to enter this information will produce incorrect measurement results.**



NOTE: Remember that, since this information often differs between machines, it must be updated as you go from one machine to another.

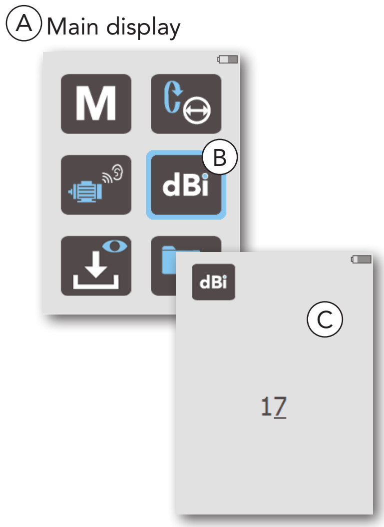
Entering shaft diameter and rpm for dBi calculation



To enter shaft diameter and rpm:

1. Go to the **Main** display (A).
2. Use the arrow keys to navigate to the **Shaft diameter and rpm** settings (B), then press **ENTER**.
3. The **Shaft diameter and rpm** display opens (C). Use the **LEFT/RIGHT** arrow keys to position the cursor, and the **UP/DOWN** arrow keys to increase or decrease the rpm value, respectively.
4. Press the **ENTER** key to save the rpm setting.
5. The display now shows the shaft diameter setting (D). Use the arrow keys to position the cursor, and the **UP/DOWN** arrow keys to increase or decrease the diameter value.
6. Press the **ENTER** key to save the settings and return to the **Main** display.

Entering dBi manually



Changing the dBi directly is faster, if you know it from your records:

1. Go to the **Main** display (A).
2. Use the arrow keys to navigate to the **dBi** setting (B), then press **ENTER**.
3. The **dBi** display opens (C). Use the **LEFT/RIGHT** arrow keys to position the cursor, and the **UP/DOWN** arrow keys to increase or decrease the dBi value, respectively.
4. Press the **ENTER** key to save the dBi setting and return to the **Main** display.

The highest dBi value that can be entered is +60, the lowest –9. Any attempt to enter values below this results in dBi = "- -" and an unnormalized shock pulse reading (see also chapters "*Normalized shock pulse values with dBi*" and "*Readings on gearboxes*").

The dBi value, whether calculated by the instrument or manually input, is shown in the upper left corner of the **Measurem**ent display.

Shock pulse measurement

To perform a shock pulse measurement, follow these steps:

1. In the **Main** display (A), select the **Measure** icon and press **ENTER**.

   Before taking a measurement, make sure that the shaft diameter and rotational speed of the bearing, or its dBi, have been entered (se chapter "*Input data*"), or the reading will be incorrect**.** The **Measurement** display opens, showing the most recent reading (B).

2. For a new measurement, press the probe tip (or connect the external transducer) to the measuring point, then briefly press the **MEASURE** key. A single blue pixel briefly appears at the bottom of the display, indicating that a measurement cycle is in progress. The display backlight is then turned off until the measurement is completed.

When the display lights up again, it shows two measurement results (C): the maximum value, dBm, and the carpet value, dBc. Depending on the dBm value, the display shows a green, yellow or red condition indicator.

When an external transducer is used, the instrument displays a **TLT** warning sign if the transducer line test result is unsatisfactory. The TLT value for the current reading is shown at the top of the display, along with the probe/transducer type used:

TRA INT PROBE = internal probe

TRA EXT PROBE = external probe

TRA 40K = 40000 type transducer

TRA 42K **=** 42000 type transducer

For further information about TLT, please see chapter "*Transducer Line Test*".

3. When measurement is completed, the condition indicator (D) shows the evaluated bearing condition (for normalized readings). Press the **DOWN** arrow key to scroll down to the evaluation code (E). This code (between 1 and 6) refers to the Evaluation Flowchart on pages 34-35, which must be used to further evaluate bearing condition.

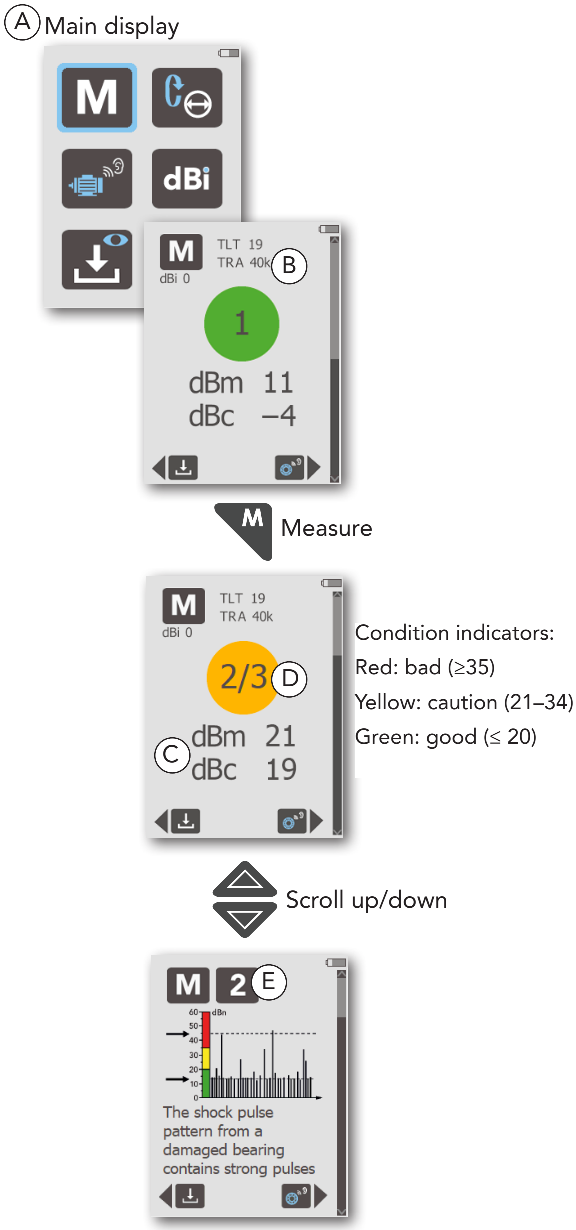
When the instrument shows high readings (yellow or red condition indicator), immediately verify their nature and probable cause. Do not conclude that there is bearing damage without further investigation. As first measures:

- use the headphones to identify the shock pulse pattern; for more information, see chapter "*Listening to the shock pulse pattern*"
- measure on and outside of the bearing housing to identify the shock pulse source.

4. To scroll back up to the measuring result, press the **UP** arrow key.

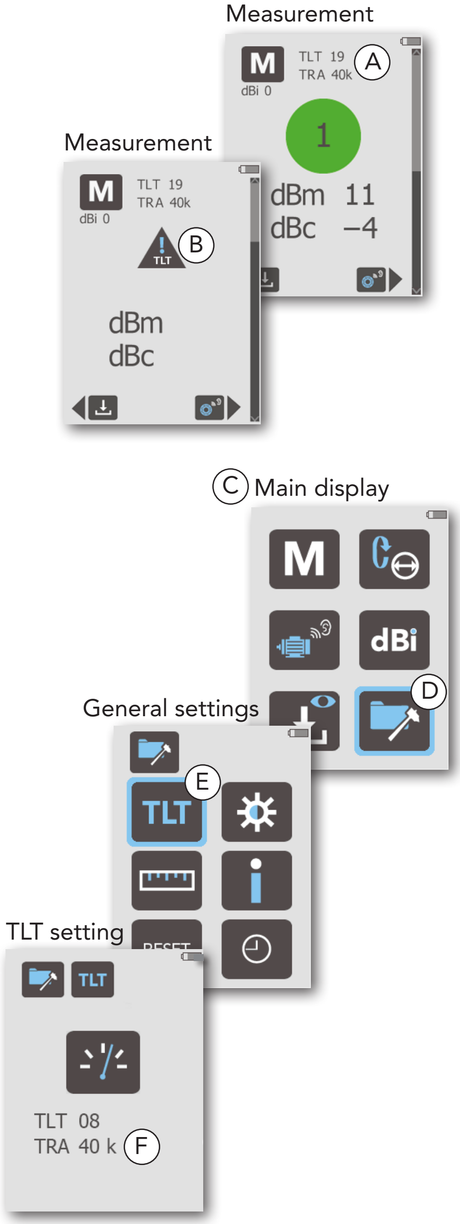
To return to the **Main** display from the **Measurement** display, press the **BACK** key.

Check:
- Shaft diameter and rpm, dBi setting
- Measuring point in the load zone
- Probe pointed straight at the bearing
- Adapter (transducer) properly mounted
- Adapter surface clean, undamaged
- Quick connect transducer firmly attached



Transducer Line Test

When using BearingChecker for measurement with external transducers, a transducer line test (TLT) automatically checks the quality of the signal transmission between transducer and instrument. The TLT value and transducer/probe type for the latest reading is saved and shown in the **Measure** (A) and **TLT** (F) displays, respectively. Part of the signal will be lost in a poor transducer line, so the measurement results will be lower than they should be. If a shock pulse measurement is made with a poor transducer line, the instrument will display a TLT warning sign (B).



Manual transducer line test

To perform a manual transducer line test, follow these steps:

1. Connect the external transducer to the instrument.
2. From the **Main** display (C), navigate to the **General settings** menu (D) and press **ENTER** to open it.
3. In the **General settings** display, press **ENTER** to open the **TLT** display (E).
4. Press the **MEASURE** key briefly. The resulting TLT reading and transducer/probe type is shown in the display (F):

   TRA INT PROBE = internal probe
   TRA EXT PROBE = external probe
   TRA 40K = 40000 type transducer
   TRA 42K **=** 42000 type transducer

   ‘40K’ is also displayed in case of a cable breakdown. In case of a short circuit, ‘42K’ and the value 0 (normally) is displayed.
5. To return to the **Main** display from the **TLT** display, press the **BACK** key twice.

At TLT values from 15 upward, there is normally no signal loss due to poor transmission between transducer and instrument. If the value is below 15, or if it is deteriorating from a previously higher value, check the cables, connectors, and transducers for poor connections and moisture.

From the **TLT** display, a manual transducer line test can also be done for the built-in probe, if malfunction is suspected.

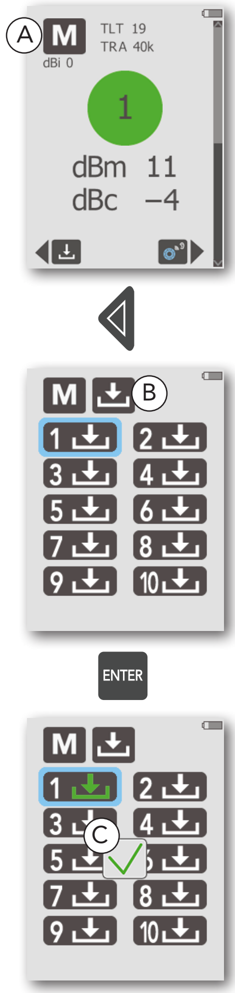
Turning the transducer line test off temporarily

By default, a TLT test is automatically performed for every bearing measurement with an external transducer. It can, however, be temporarily turned off to force measurement results on transducers with TLT below 15, e.g. when measuring via coupling transformers:

1. In the **TLT** settings display (G), press **ENTER** to turn the TLT test off (pressing **ENTER** again turns it back on).
2. Press the **BACK** key twice to return the **Main** display.
3. Press **ENTER** to open the **Measurement** display, then perform the forced bearing measurement.
4. Go back to the **TLT** display and press **ENTER** to turn the automatic TLT test back on.

Storing measurement results

Using the **Save** function to store measurement results is useful for easy comparison of readings from different points in time, thus making it possible to see a "trend" in the bearing condition for individual measuring points. BearingChecker can store up to ten shock pulse measurement results.



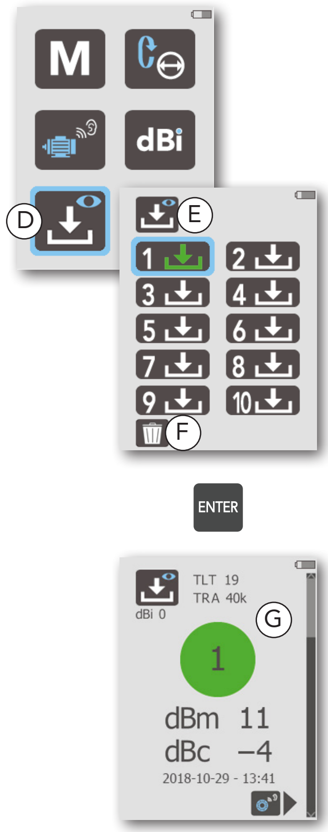
Saving a reading

To save a reading after completed measurement:

1. In the **Measurement** display (A), press the **LEFT** arrow key to enter the **Save** function (B).
2. Use the arrow keys to select a memory location (1-10).
3. Press the **ENTER** key to store the reading. This action will overwrite any previously stored value in the memory address selected. A checkmark symbol (C) confirms the save operation, and the current memory location turns the same color as the condition evaluation of the reading just saved.
4. To return to the **Measurement** display, press the **BACK** key.

The stored measurement results can be transferred from BearingChecker to a Microsoft Excel file using a downloadable SPM program (https://downloads.spminstrument.com). The data in the Excel file can be imported into a CMMS or other software for follow-up. For further instructions, please see information in the delivery package.

As an alternative, the last page of this User Guide contains a follow-up form which can be copied and used to manually record measurement results over time.



Viewing a stored reading

To view a stored reading:

1. In the **Main** display, select the **View stored readings** icon (D) and press **ENTER**.
2. In the **View stored readings** display (E), use the arrow keys to highlight a memory location.
3. Press the **ENTER** key to view the stored reading (G).
4. To return to the **View stored readings** display, press the **BACK** key.

Deleting stored readings

To delete the stored readings:

1. In the **Main** display, select the **View stored readings** icon (D) and press **ENTER**.
2. In the **View stored readings** display (E), use the arrow keys to highlight the trash can (F).
3. Press the **ENTER** key to delete all of the stored readings.
4. To return to the **View stored readings** display, press the **BACK** key.

Listening to the shock pulse pattern

The stream of shock pulses from a rotating bearing is continuous. They vary in strength, depending on the relative positions of rolling elements and raceways.

The **headphone** is a means to verify and trace shock pulse sources. The headphones allow you to listen to the shock pulse pattern. In the headphone, the noise carpet is represented by a continuous tone. The dBc level is approximately where you can start to distinguish between an even sound and individual pulses. Typical for bearing signals is a random sequence of strong pulses with no discernable rhythm, best heard a few dB below the dBm level.

A spot of surface damage causing a strong shock pulse will only register if a roller hits it during the measurement cycle. Especially at low rotational speeds, the instrument can miss the strongest pulse, simply because it does not occur during the measurement cycle.

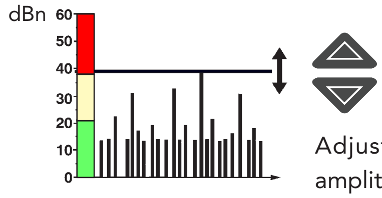
To listen to the shock pulse pattern after taking a shock pulse reading:

1. Connect your headphones to the USB output connector via the adapter.
2. From the **Measurement** display (A), press the **RIGHT** arrow key to enter the **Listening** function, where the dBm value of the latest reading is displayed.
3. In the **Listening** display (B), use the **UP**/**DOWN** arrow keys to adjust the amplitude level at which to listen; anything below this level will be filtered out.
4. To adjust the headphone volume, use Use the **LEFT**/ **RIGHT** arrow keys to adjust the volume (0-7). NOTE! Setting the volume to the maximum level may harm your hearing.

NOTE: BearingChecker automatically adjusts the display backlight to full brightness when using the **Listening** function. When leaving the function, the backlight automatically returns to the user-defined (or default) settings (see also "*Display contrast and screensaver timeout*").

To return to the **Measurement** display, press the **BACK** arrow key.

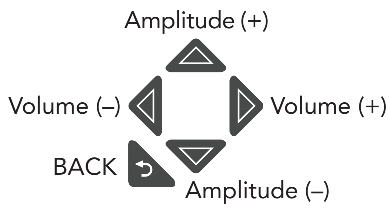
Headphones



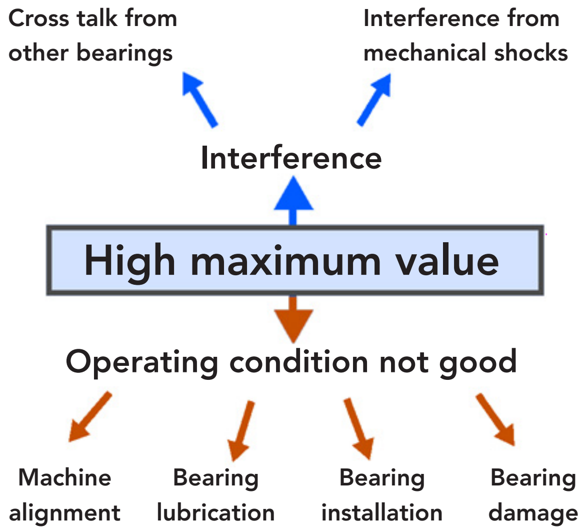
Adjustment of amplitude level

Measurement

Listening



Evaluating Bearing Condition



1. **Reading correct ? Check!**
   Measuring point? Installation ? Correct dBi ? dBm?
   Look, feel, check data.

2. **Shock pulse source? Search!**
   Bearing ? Interference? Signal pattern? Loose parts?
   Look, listen. Use probe transducer, headphone.

3. **Bearing fault? Analyze!**
   Lubrication? Alignment? Installation?
   Bearing damage?

   Identify shock pulse pattern.
   Check trend. Test lubrication.

NOTE! A reading taken with an incorrect dBi value causes an incorrect evaluation of the bearing condition! Always check that the correct dBi for the bearing in question has been entered!

Evaluation simply means that you make sure that the information you pass on to the maintenance personnel is as correct as possible and as detailed as necessary. Always remember that

- some machines can contain many types of shock pulse sources other than the bearing, and
- there can be a number of different causes for bad bearing condition other than damage.

Evaluation requires only normal care and common sense. Use the probe transducer and the headphone, and also use your senses: look, touch, listen. By being thorough you can avoid raising false alarms or missing damaged bearings.

Initial readings and changes

There are only two situations where an evaluation is necessary. The first is when you start with bearing monitoring:

- **Always evaluate the first readings on new measuring points and newly installed bearings.**

The purpose is to establish a reliable base for routine measurements. You want to be quite sure that you are measuring shock pulses from the bearing and that the reading itself is correct. If you find that bearing condition is good, you do not have to evaluate the following readings on that measuring point as long as there is no significant change.

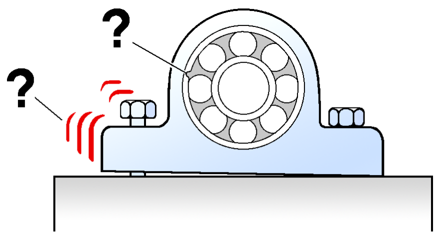
The other situation is when you notice a change in the readings (or get high readings from the start):

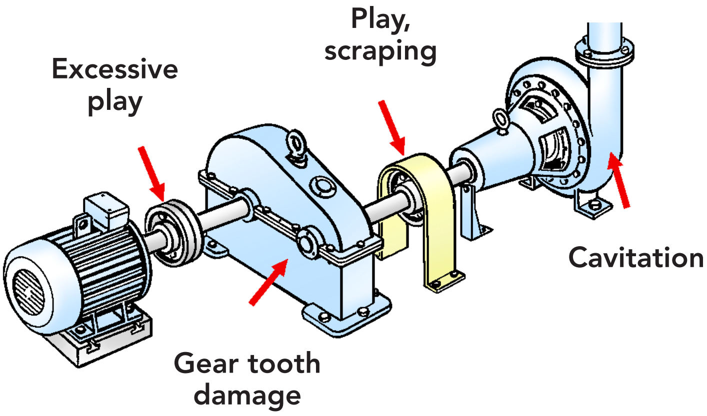
- **Investigate any significant increase or decrease of the shock pulse level.**

Again, you want to be quite sure that you are measuring shock pulses from the bearing and that the reading itself is correct.

If you find that bearing condition is not good, you have to distinguish between bad installation, poor lubrication, overload and damage, in order to decide what kind of maintenance work is needed. If you are getting an interference signal, it is probably caused by machine faults which have to be reported and repaired.

Identifying the shock pulse source





Shock pulses are strongest close to the source. They spread through the material of all machine parts, but are dampened (loss of signal) with distance and when passing through interfaces in the material.

- Measure on and near the bearing housing to find the strongest shock pulse source.
- Listen for unusual noises.

Sources of interference

Any kind of metallic clatter, hard impacts or scraping produces shock pulses which may interfere with the measurement on the bearings. Some of the more common sources of interference are:

- Shocks between poorly fastened machine feet and foundation.
- Rubbing between shafts and other machine parts.
- Loose parts striking the machine frame or the bearing housing.
- Excessive play and misalignment of couplings.
- Vibration in connection with loose parts and excessive bearing play (vibration alone does not affect the reading).
- Cavitation in pumps.
- Gear tooth damage.
- Load and pressure shocks arising during the normal operation of certain machines.

Shock pulse patterns – condition codes

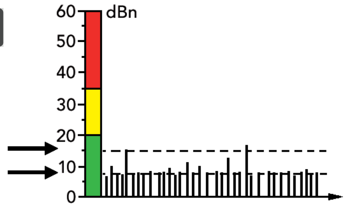
The headphone is a means to verify and trace shock pulse sources. The signal from a bearing should be highest on the bearing housing. If you get a higher signal outside of the bearing housing (across an interface in the material), you are most likely measuring shock pulses from another bearing or some other source. Typical for bearing signals is that the stronger shock pulses, best heard a few dB below the peak level, appear at random intervals.

The codes refer to the Evaluation Guide, or the Flowchart on pages 34-35, which must be used to further evaluate the bearing condition.

If the instrument displays "**2/3**" or "**4/5**", use the headphones to determine the condition code.

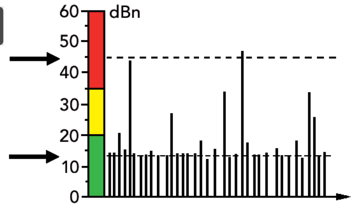
1 For a good bearing, the dBm is within the green zone. dBm and dBc are close together.

M 1



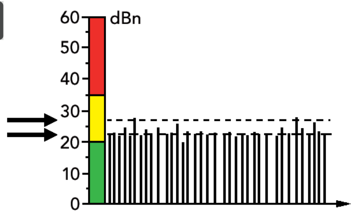
2 The shock pulse pattern from a damaged bearing contains strong pulses in the red zone, a random sequence, and a large difference between dBm and dBc. When you lubricate the bearing, the values should drop but rise again.

M 2



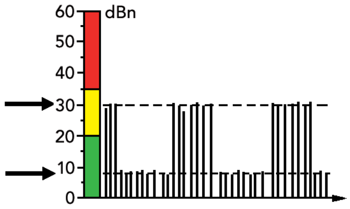
3 A dry running bearing has a high carpet value very close to the dBm. When you lubricate the bearing, the values should drop and stay low. A similar pattern is caused by pump cavitation, in which case readings on the pump housing are stronger than those taken on the bearing housing, and are not influenced by lubricating the bearing.

M 3



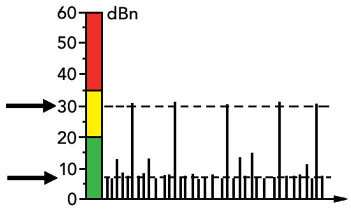
4 A regular pattern, containing bursts of strong pulses in a rhythmic sequence, is caused by e.g. scraping parts.

M 4



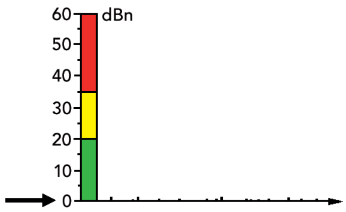
5 Individual pulses in a regular sequence are cause by clicking valves, knocking parts, regular load shocks.

M 5



6 A sudden drop in the shock pulse level is suspicious. Check your measuring equipment. If the reading is correct, you may have a slipping bearing ring.

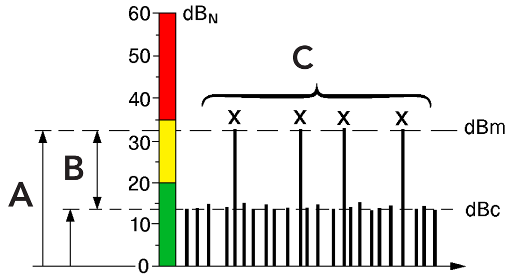
M 6



Typical shock pulse patterns from rolling bearings

A shock pulse pattern is a sequence of either random or rhythmical strong pulses (dBm level) above a carpet of very rapid weaker pulses (dBc level). You have to be aware of:

- the dBm value
- the difference between dBm and dBc
- the rhythm of the strongest pulses.

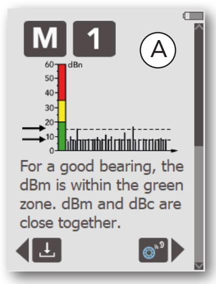


A) Maximum value dBm
B) Difference between dBm and dBc
C) Rhythm of the strongest pulses

The rhythm of the strongest pulses is best discerned by listening with the headphone at a setting a few dB below the dBm level. Typical for bearing signals is a **random** sequence of strong pulses (no discernable rhythm). Rhythmical shocks can come from a bearing but are more often a sign of interference. Typical patterns are described on the next pages.

The BearingChecker recognizes the pattern of the reading taken and determines which of the six patterns below is a match. The matching number is displayed in the condition evaluation part of the **Measurement** display (A) when the measurement is completed and you scroll with the **DOWN** arrow key. This number corresponds to the pattern numbers below.

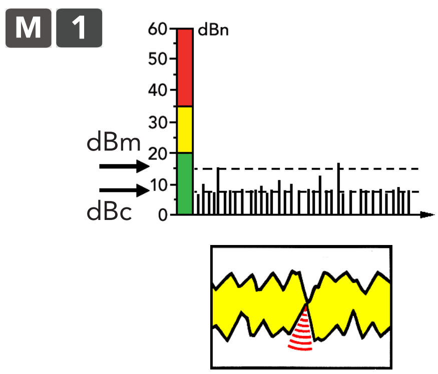
Measurement



There may be times when the instrument displays a combination of the numbers "**2/3**" or "**4/5**", in which case the instrument can not distinguish between the two codes. Use the headphones and listen to the pattern to determine condition code.

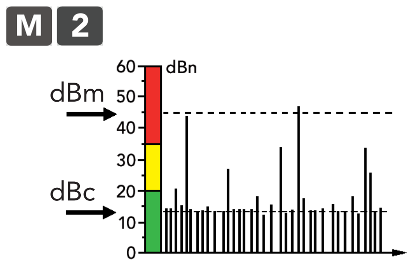
1 Pattern from a good bearing

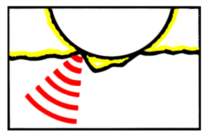
A bearing in good condition should have a dBm value below 20 and a dBc value approximately 5 to 10 dB lower. Once you have verified the reading, there is no need for any further evaluation.



The maximum value can be lower than 0. However, be suspicious when the measured value is very low. The cause is often a bad measuring point or an incorrectly installed adapter or transducer. If the reading is very low, check the installation. Measure on other parts of the bearing housing and try to pick up a stronger signal. Another possible reason for a very low reading is that there is no load on the bearing. This can happen with well balanced fans and similar rotating machines.

2 Signal from a damaged bearing





The pattern shown is typical for damaged bearing surfaces: a dBm above 35 dB, a large gap between dBm and dBc, and a **random** pattern of strong pulses. The strength of the maximum value dBm indicates the degree of damage:

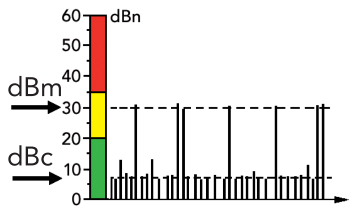
35 – 40 dB_N	Slight damage
40 – 45 dB_N	Severe damage
> 45 dB_N	High breakdown risk

First signs of damage

dBm values between 20 and 35 dB (in the yellow zone) and a moderate increase of the carpet value are a sign of stress in the bearing surfaces or minor damage. Note that the gap between dBm and dBc gets larger.

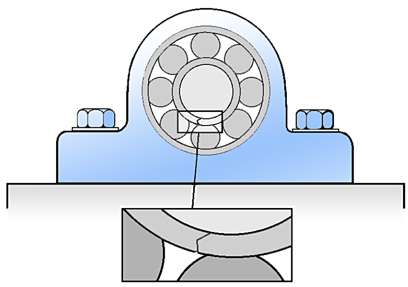
Bearings with dBm values in the yellow zone should be measured more frequently, to determine if their condition is stable or deteriorating.

Note: a similar pattern is caused by contaminations in the lubricant (metal or dirt). The particles either originate from parts of the bearing itself, for instance from a damaged cage, or they are transported by the lubricant into the (undamaged) bearing. Test bearing and lubricant according to the description "*Confirming bearing damage*" in this manual.



Cracked inner ring

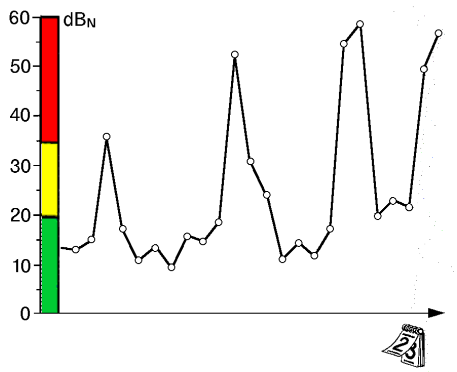
A clean crack in the inner ring of a bearing is difficult to detect, especially at a low rpm. You may get low readings through most of the bearing's rotation, then one or two peaks while the crack is in the load zone. Signal strength can differ considerably as the crack opens or closes depending on bearing temperature. In time, the surface tends to spall along the crack, leaving sharp edges and metal particles which cause high shock values until they are rolled out.



Irregular measuring results

Large variations between consecutive readings are a danger sign. Damaged bearings do not improve with time, although their shock values may temporarily drop.

Make sure the measuring interval is established according the variations in production load (e.g. air compressors). Always measure under the same production conditions.

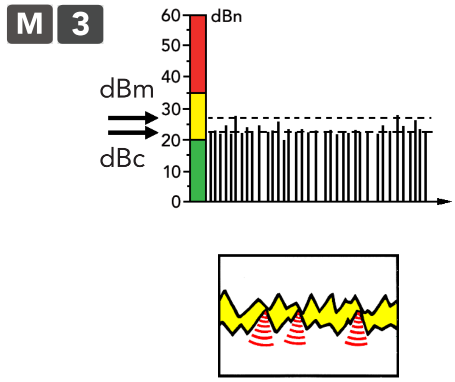


Wide variations in the readings taken at different times can occur on heavily loaded roller bearings with surface damage. The high readings are caused by metal particles breaking off the surfaces and by the sharp edges of new spallings. When particles and edges are rolled out, the readings will drop again.

3 Patterns from poorly lubricated bearings

A high carpet value, very close to the maximum value, is typical for dry running bearings. The dBm does not always reach the red zone – typical for poor lubrication is that the gap between dBm and dBc is very small. If the signal is strongest on the bearing housing, it can have several causes:

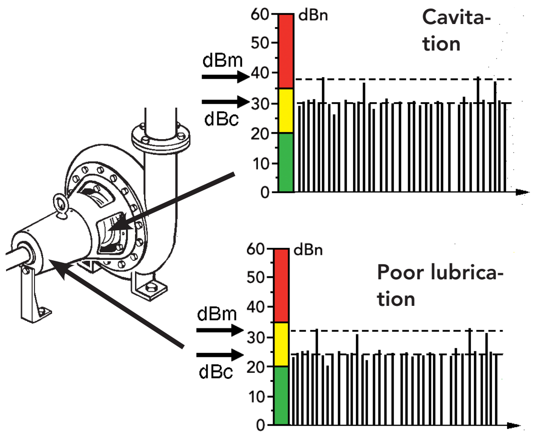
- insufficient lubricant supply to the bearing (poor oil flow; old , caked, or cold grease)
- very low or very high bearing speed (preventing the build-up of an oil film separation between the loaded rolling elements and the raceway)
- installation fault (excessive preload) or out-of-round bearing housing
- misalignment or bent shaft.



If possible, lubricate the bearing or increase the oil flow. Measure immediately afterwards, and again a few hours later. If the problem was insufficient lubricant supply, the shock pulse level should drop and stay low.

In the case of very low or very high bearing speed, one can try lubricants of a different viscosity or use additives to prevent metal to metal contact between the bearing surfaces.

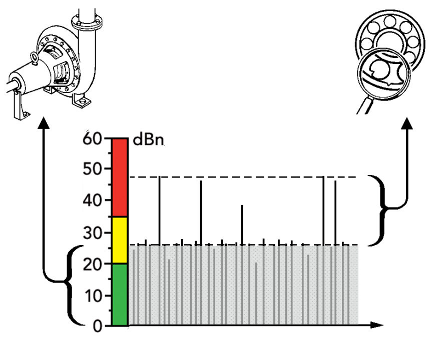
In cases of installation faults, unround housings, and misalignment) the shock pulse level may drop after lubrication but will soon rise again. Misalignment normally affects the bearings on both sides of the coupling or at both ends of the shaft.



Cavitation and similar interference

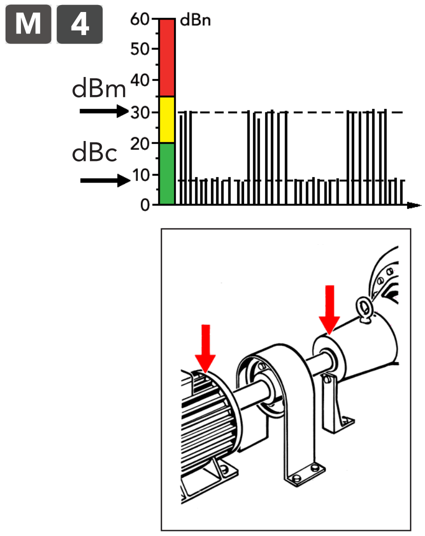
The shock pulse pattern caused by a cavitating pump or by persistent rubbing is identical with that from a dry running bearing. You have an interference signal when the shock pulse level is highest outside of the bearing housing and is not affected by lubricating the bearing.

If you cannot remove the cause of interference, you have a “blind spot”: up to a certain level, the interference signal will mask the signal from one or more bearings. However, you may still be able to detect bearing damage. When the dBm rises above the interference level, it must be caused by something else – probably bad bearing condition. In that case, lubricating the bearing should cause the value to drop, at least temporarily.



4 Periodic bursts

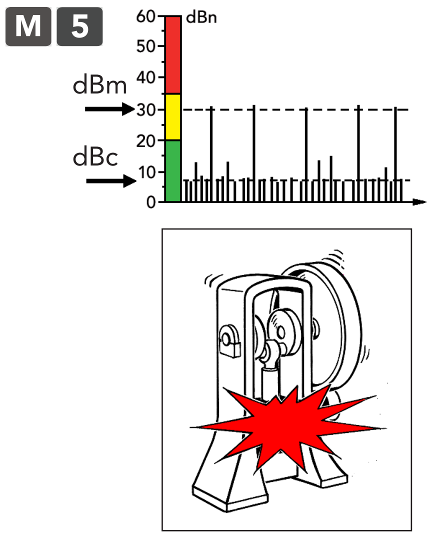
Periodic bursts are a typical interference signal, caused by rubbing between machine parts, e.g. shaft against bearing housing or seal. The burst occurs at an rpm related frequency.



5 Rhythmical peaks

Single, rhythmical peaks can be caused by load and pressure shocks which occur during the machine's normal operation. Other possible causes are clicking valves or loose parts knocking regularly against the machine frame.

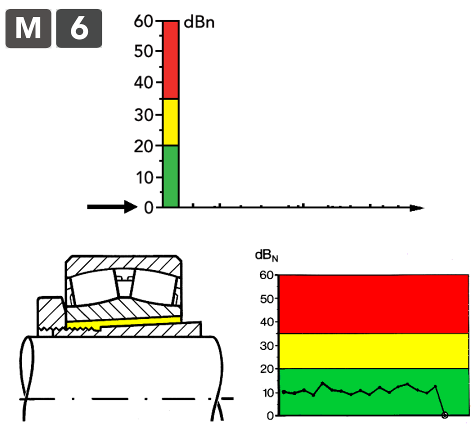
If the signal is strongest on the bearing housing, you can suspect a cracked inner ring.



6 Large drop in the readings

If the shock pulse level drops after a sequence of normal readings, you have either a malfunction of the instrument, a failure in a transducer installation, or a serious bearing fault.

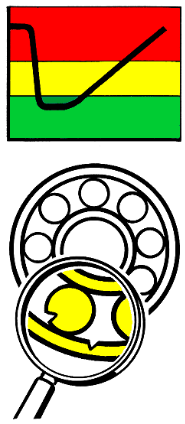
Check the instrument by measuring on some other bearing. In case of an installed transducer, try to get a reading by tapping on the bearing housing. If your reading is correct, it is possible that one of the bearing races is slipping, either on the shaft or in the housing. In case of a heavily loaded bearing with previous readings in the red zone, suspect cage failure.



Confirming bearing damage

On receiving the typical bearing damage signal – high dBm, large difference between dBm and dBc, random peaks, strongest signal on the bearing housing – you must confirm one of the following causes for the reading:

- tapping of loose parts against the bearing housing
- excessive bearing play in combination with vibration
- particles in the lubricant
- bearing damage

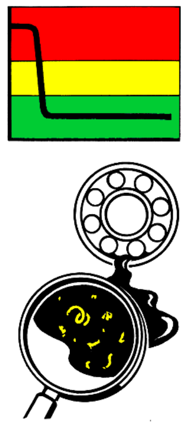


Interference can usually be detected by a careful inspection.

Lubrication test

A lubrication test is the best means to reach a conclusive verdict:

- Make sure that the lubricant is clean and not contaminated.
- Lubricate the bearing and repeat the measurement. Measure immediately after lubricating and again a few hours later.

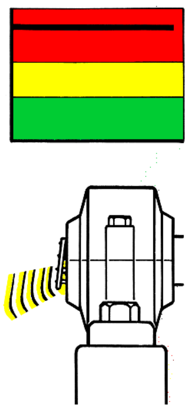


Make sure that the lubricant reaches the bearing. Typically, you will get the following results:

A The shock pulse level remains constant. The signal is caused by interference or cross talk from another bearing.

B The shock pulse level drops immediately after lubricating and remains low. Foreign particles in the bearing were removed by the fresh lubricant.

C The shock pulse level drops immediately after lubricating but rises again within a few hours. The bearing is damaged.



Note that metal particles in the lubricant can originate from the bearing itself. Measure the bearing again over the next few days and make sure that the values stay low.

Readings on gearboxes

Shock pulses can sometimes spread through a machine housing without significant damping. This means that the shock pulses from the bearing with the highest shock pulse level can, under unfavourable circumstances, interfere with the readings on all the other bearings.

The problem is aggravated when the bearings are of different sizes and rotating at different speeds, as in a gearbox. A bearing with high rotational speed has a high dBi value and generates relatively strong pulses even when its operating condition is good. The same shock pulse level measured on a bearing with a low dBi may indicate bad bearing condition.

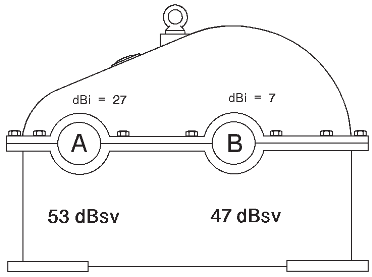
In such cases, you must proceed as follows:

1. Take a reading with dBi set to "--" on all bearings. This will reveal the strongest shock pulse source on the machine. In the example in the figure, you get a reading of 53 dBsv for bearing A and 47 dBsv for bearing B.

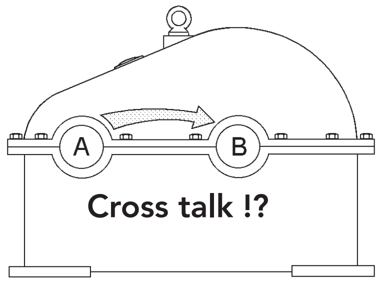
   NOTE! When taking readings with dBi set to "--" the evaluation in green - yellow- red does not apply! See also chapters "*Normalized shock pulse values with dBi*" and "*Input data*".
2. Work out the direction of possible cross talk. You know that the stronger source can mask the signal of the weaker source. In this case, cross talk must go from bearing A to bearing B.
3. Subtract the dBi values from the dBsv values. In the example, you get 26 dB_N for bearing A, 40 dB_N for bearing B.

You can now draw two conclusions: The reading for bearing A, coming from the stronger source, is probably accurate. The bearing condition is reduced (26 dB = yellow zone) but not seriously so.

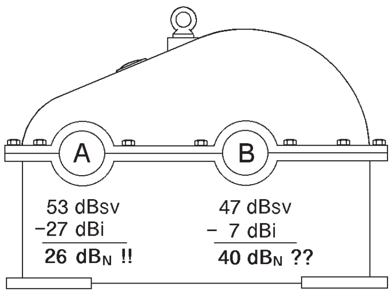
The reading from bearing B is either true or false. If true, it indicates bad bearing condition (40 dB = red zone), but you cannot confirm that with the instrument before condition gets worse and bearing B becomes the stronger shock pulse source. Your solution is to take frequent readings and compare the results from both bearings.



1 Readings with dBi = "--" reveal the stronger source



2 Cross talk must go from the stronger to the weaker source

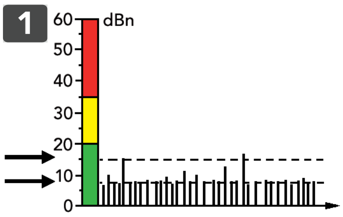


3 The reading from the stronger source is normally accurate

The reading from the weaker source cannot be confirmed

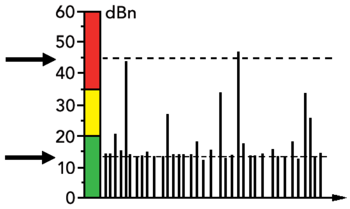
Evaluation Flowchart

M 1



Good bearing condition, installation and lubrication.

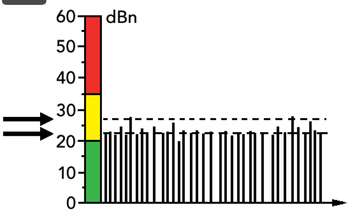
M 2



Where do you get the highest reading?

- Adjacent to the bearing housing → Locate the signal source. The reading can be caused by cross talk from other defective bearings or disturbances from other mechanical shocks. If possible, isolate the source of disturbance and test again.
- On the bearing housing → Check the value of adjacent bearings. Are the signals from these bearings similar to the tested bearing?

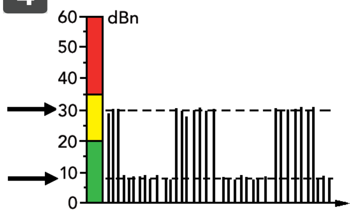
M 3



Where do you get the highest reading?

- Adjacent to the bearing housing → Locate the signal source. The reading can be caused by interference from other defective bearings, cavitation in pumps or mechanical rubbing. If possible, isolate the source of disturbance and test again.
- On the bearing housing → Newly installed bearing?

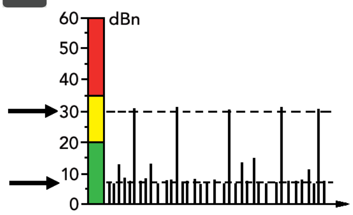
M 4



Where do you get the highest reading?

- Adjacent to the bearing housing → Locate the signal source. If possible, isolate the source of disturbance and test again.
- On the bearing housing → Probable causes:
  - The shaft rubs against the bearing housing or the end of the shaft rubs against the bearing cap.
  - Gear tooth damage
  - Other mechanical rubbing

M 5

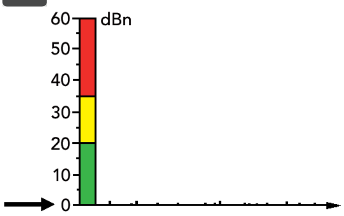


Where do you get the highest reading?

- Adjacent to the bearing housing → Locate the signal source.
  Probable causes:
  - Load or pressure shocks from equipment installed on the machine frame.
  - Other mechanical shocks from the machine's operation

  If possible, isolate the source of disturbance and test again.
- On the bearing housing → Probable causes:
  - Load or pressure shocks in the machine's operation causing mechanical shocks in the bearing.
  - Individual gear tooth damage
  - Bearing damage

M 6



No signal or only a very low value can be obtained.

No

Probable causes:

- Bearing damage.

Measure in shorter intervals, follow the progress of the damage .

- Foreign particles in the lubricant.

Can also be caused by disturbance from loose bearing cap, protecting cover or similar items.

If possible, isolate the source of disturbance and test again.

If possible, lubricate the bearing and check the reading at the same time.

When lubricating, check that the lubricant penetrates into the bearing.

The reading drops but increases again within a few hours.

Cause: bearing damage.

Shorten measuring intervals to follow the progress of the damage.

The reading drops to normal level and does not increase again. Cause: foreign particles in the bearing which have been removed by the new lubricant.

The reading does not drop.

Probable causes: disturbances from loose bearing cap, protecting cover or similar items.

Can also be caused by: Large bearing damage.

Yes

Probable causes: axial shocks, load shocks, defective shaft coupling, gear tooth damage, cross talk from other defective bearings.

No

Probable causes:

- Insufficient lubrication, possibly in combination with minor bearing damage
- Cavitation in pumps
- Mechanical rubbing
- Gear tooth damage

If possible, lubricate the bearing and check the reading at the same time.

When lubricating, check that the lubricant penetrates into the bearing.

The reading drops but the max. value increases again within a few hours.

Probable causes: insufficient lubrication which probably has caused minor bearing damage.

The reading drops to normal level and does not increase again. Cause: insufficient lubrication.

The reading does not drop.

Probably causes:

- Cavitation in pumps
- Mechanical rubbing
- Gear tooth damage

Yes

Probable causes:

- Incorrect bearing installation
- Insufficient lubrication possibly in combination with minor bearing damage
- Cavitation in pumps
- Mechanical rubbing
- Gear tooth damage

If possible, lubricate the bearing and check the reading at the same time.

When lubricating, check that the lubricant penetrates into the bearing.

The reading drops but the dBm increases again within a few hours.

Probable causes: insufficient lubrication which probably has caused minor bearing damage.

The reading drops to normal level and does not increase again. Cause: insufficient lubrication.

The reading does not drop.

Probably causes:

- Incorrect bearing installation
- Cavitation in pumps
- Mechanical rubbing
- Gear tooth damage

- Is the instrument and the transducer working ok?
- Is the measuring point correct?
- Is the adapter or the transducer correctly installed?
- Is the machine in operation?

Have normal values been previous observed?

NOTE: Be suspicious when sudden drastic changes in readings occur.

Yes

Probably causes:

- The bearing's inner ring is slipping on the shaft.
- The bearing's outer ring is slipping in the housing.
- The reading has been taken just after lubricating a grease lubricated bearing.

Using the Stethoscope Function

The **Stethoscope** function is useful for detecting machine sound irregularities, such as load shocks and scraping.

1. Connect your headphones to the output connector (A) via the cable adapter (option 18103).
2. From the **Main** display (B), use the arrow keys to enter the **Stethoscope** function (C).
3. Hold the probe tip or external transducer against the object.
4. In the **Stethoscope** function, use the **UP**/**DOWN** arrow keys to adjust the volume (1-7).

To return to the **Main** display, press the **BACK** key.

NOTE! Setting the volume to the maximum level may harm your hearing.

Technical specifications

Material, casing:	Copolyester/TPE
Size:	BC200: 207x74x41 mm (8.1x2.9x1.6 in) BC250: 184x74x41 mm (7.2x2.9x1.6 in)
Weight:	BC200: 335 g (11.8 ounces) BC250: 300 g (10.6 ounces)
Protection class:	IP65
Keypad:	Sealed, snap action
Display:	2.4” color TFT LCD display, LED backlight
Power supply:	3.63 V Lithium Ion, USB rechargeable
Battery life:	> 25 hrs of normal use
Operating temperature:	–10° to +50 °C (14° to 122 °F)
Input connector:	mini coax, for external shock pulse transducers (probe or quick connector)
Output connector:	USB (adapter allows 3.5 mm stereo jack for headphones)
General functions:	Battery status display, transducer line test, metric or Imperial units of measurement, language independent menus with symbols, storage of up to 10 measurement values

Shock pulse measurement

Measurement technique:	dBm/dBc, measuring range –9 to 90 dB_{SV}, $\pm$3 dBsv
Transducer type:	Built-in probe transducer or external transducer type 40000 or 42000, TRA73 or TRA74

Stethoscope/listening

Earphone mode:	7 level amplification
Transducer type:	Built-in probe transducer or external transducer type 40000

Part numbers

BC200	BearingChecker with built-in probe
BC250	BearingChecker for use with external probe/transducer only

Options

CAB52	Measuring cable, 1.5 m, mini coax -BNC slip-on
CAB94	Charger cable, USB type A to Mini-B USB, 1.5 m
CAS24	Carrying case, plastic with foam inlay set for 1 BC/VC instrument, 326x222x116 mm
CAS29	Carrying case, plastic with foam inlay set for 2 BC/VC instruments, 437x379x130 mm
EAR12	Headphones with eardefenders
TRA73	External sensor with probe
TRA74	Sensor with quick connector for adapters
18103	Cable adapter, Mini-B USB to 3.5 mm stereo jack
18226	Kit for screen protection (2 pcs screen protector)
90647	Charger, 100-240 V, 50-60 Hz, 6 W
93363	Cable adapter, mini coax -BNC
93062	Cable adapter, BNC-TNC, plug-jackstrument

Maintenance and calibration

Maintenance

If needed, use a soft cloth lightly dampened with a mild detergent to clean the display. Avoid abrasive cleaners or solvents that may damage the display.

Calibration

An instrument calibration, e.g. for the purpose of compliance with ISO quality standard requirements, is recommended once a year. Please contact your SPM representative for service, upgrading the software or calibration.

EU Directive on waste electrical and electronic equipment

WEEE is EU Directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment.

The purpose of this directive is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.

This product must be disposed of as electronic waste and is marked with a crossed-out wheeled bin symbol in order to prevent it being discarded with household waste.

Once the life cycle of the product is over you can return it to your local SPM representative for correct treatment, or dispose of it together with your other electronic waste.

SPM Follow-up form

SPM

BEARING|CHECKER

dBi
d
n
dB_N 50 40 30 20 10 0
dB_M
dB_C

dBi
d
n
dB_N 50 40 30 20 10 0
dB_M
dB_C

dBi
d
n
dB_N 50 40 30 20 10 0
dB_M
dB_C

dBi
d
n
dB_N 50 40 30 20 10 0
dB_M
dB_C