



# **Instrument Reference Guide**

**Vibration and Temperature  
Measurement Instrument**

**Revision March 10<sup>th</sup> 2011**

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# Contents

<b>Section 1: Introduction</b> .....	<b>1</b>
Product Overview.....	2
Standard Features .....	3
Standard Kit Items .....	4
Precautions.....	5
Instrument I/O .....	6
Front Panel .....	7
The Battery Pack .....	8
Charging the Battery Pack.....	8
Removing the Battery Pack.....	9
<b>Section 2: Instrument Basics</b> .....	<b>10</b>
Powering On/Off .....	10
Using the Accelerometer Sensor.....	11
Sensor Guidelines .....	12
Using Vibration Overall Measurements .....	13
Displacement, Velocity and Acceleration .....	13
Take a Vibration Overall Measurement .....	14
Tips for Taking Measurements .....	15
Understanding ISO 10816-3 Vibration Alarms .....	16
Check the Status of a Bearing.....	19
Understanding Bearing Alarms .....	20
Take a Temperature Measurement.....	23
Laser Safety .....	25
<b>Section 3: Supplemental Reading</b> .....	<b>26</b>
ISO 10816-3 Machine Groups Overview.....	26
ISO 10816-3 Support Classes Overview .....	27
Assessing Bearing State .....	28

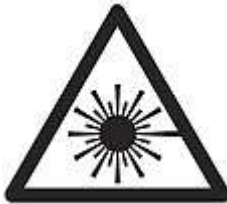
<b>Appendix: Specifications .....</b>	<b>29</b>
Spotcheck Specifications .....	29
Servicing and Maintenance .....	29
<b>Index .....</b>	<b>30</b>

# Section 1: Introduction

Please read this guide thoroughly before operating your new Spotcheck device, and retain for future reference.

Although this guide makes use of common vibration analysis and condition monitoring concepts, it is not intended as a comprehensive guide or training manual. Please ensure you have the relevant knowledge and experience to carry out the procedures described.

**It is essential to follow all appropriate safety precautions when working near rotating machinery!**



**LASER RADIATION  
DO NOT STARE INTO BEAM  
CLASS 2 LASER**

## **Product Support**

If you have questions that are not answered by this reference guide, please contact [help@commtest.com](mailto:help@commtest.com) for assistance. Alternatively, visit our website at <http://www.commttest.com> for additional resources and telephone contact details.

## **ISO 10816-3:2009 Category and Definition**

Mechanical vibration. Evaluation of machine vibration by measurements on non-rotating parts. Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 RPM and 15 000 RPM when measured in situ.

## Product Overview

The Spotcheck device is a microprocessor-controlled, handheld machinery condition monitoring tool capable of measuring mechanical vibrations using an attached accelerometer sensor and temperature via an integrated infrared thermal sensor.

By comparing vibration velocity levels (inches per second RMS) against the international ISO 10816-3:2009 standard, the device is also able to display simple machinery health alarms.



When measuring bearing vibrations, alarms may indicate existing or approaching bearing failures or seizures. These alarms are generated by analyzing velocity (BV, in ips RMS) or acceleration (BG, in g RMS) measurements at the higher frequencies typically associated with bearing defects (above 1 kHz).

In addition to its vibration measurement abilities, the Spotcheck device includes an integrated non-contact IR thermal sensor and laser pointer. This sensor allows temperature measurements to be taken from distances up to 2 meters (6.5 feet) away, locating potential mechanical problems before expensive failures occur.

These measurement capabilities allow users of the Spotcheck device to evaluate the condition of machinery in the field and determine whether further mechanical investigation is required.



## Standard Features

- **Overall Vibration Measurement.** The Spotcheck device measures overall vibration values for rotating machinery in velocity (ips RMS), acceleration (g peak) and displacement (mil peak-to-peak).

When measuring velocity, pressing the  **VIBRATION** key will 'hold' the current measurement value onscreen and indicate an alarm status according to the ISO 10816-3:2009 standard. Pressing the  **SELECT** key repeatedly will toggle between the 'machine groups' and 'support classes' that apply to this ISO standard (machine groups and support classes are explained in the 'Understanding ISO 10816-3 Vibration Alarms' section on page 16).

- **Bearing Status Check.** The Spotcheck device is able to measure bearing vibration levels in velocity (ips RMS) and acceleration (g RMS).

**NOTE:** Vibration acceleration and velocity levels for bearing measurements include only frequencies between 1 kHz and 12 kHz.

When measuring bearing acceleration or velocity, pressing the  **BEARING** key will 'hold' the current measurement value onscreen and indicate its alarm status. Pressing the  **SELECT** key repeatedly will toggle between bearing machine speeds, allowing the selection of a bearing speed that most closely approximates the speed of the bearing shaft.

- **Temperature Measurement.** The device's non-contact IR temperature sensor measures surface temperatures between -20 °C and 120 °C (-4 °F to 248 °F) from distances of up to 2 meters or 6.5 feet.

Temperature values are displayed in Celsius (°C) or Fahrenheit (°F) units. An integrated laser pointer is used to indicate the measurement location on the surface being tested. This feature is typically used to measure bearing temperatures.

## Standard Kit Items

- Spotcheck portable device
- 3.6 V, 1700 mA rechargeable Lithium battery pack
- 100 mV/g accelerometer sensor with integrated 80 cm cable (BNC connector)
- Magnetic accelerometer base
- Accelerometer stinger probe attachment
- Mains battery charger (AC 100-240 V, 50/60 Hz input; 4.2 V DC 600 mA output)
- In-car battery charger (DC 12-24 V input; 4.2 V DC 600 mA output)
- Instrument Reference Guide
- Hard carry case

**NOTE:** Thoroughly inspect your kit's contents upon receipt. If any kit items are missing, please contact Comntest customer support or your sales agent for assistance.

## Precautions

Please read and understand this section before operating your Spotcheck device. Heed all warnings and recommendations to prevent data inaccuracy, damage to the instrument, or injury.



Do not attach sensors to any object with a high potential voltage i.e. a voltage that exceeds 50 V DC or 32 V AC or the 'safety extra low voltage' (SELV) defined by your local power authority.



Do not stare directly into the laser pointer, or point the laser at others. Doing so may cause permanent eyesight damage.



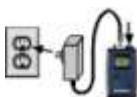
Ensure the accelerometer cable cannot become entangled with any rotating or moving machinery.



Do not bring any objects sensitive to magnetic fields near the magnetic mounting bases (e.g. credit cards, floppy disks, mechanical watches).



Do not operate the instrument in an explosive environment.



Use only an approved power adapter 4.2 V, 600 mA output, center positive.



Use a mild detergent diluted in warm water to clean the device. Do not use abrasive or polishing substances, hydrocarbons, petrochemicals or solvents, as they will degrade the plastic casing.



If the instrument malfunctions, return it to an authorized dealer. Do not attempt to repair the instrument yourself as this will void your warranty.

## Instrument I/O

The top panel of the instrument is equipped with the following I/O ports:



*Device Top Panel (I/O)*

1. BNC sensor input
2. Charger power input socket (4.2 Volt, 600 mA input)
3. Non-contact infrared temperature sensor
4. Laser pointer

## Front Panel



*Instrument Front Panel*



Turns the instrument on and toggles selected values.



Activates the device's vibration measurement mode. Holds or releases the current vibration reading on the LCD screen. When taking Velocity measurements, pressing this button will display an alarm value (see the 'Understanding ISO 10816-3 Vibration Alarms' section on page 16).



Activates the device's temperature sensor. Enables/disables the laser pointer and holds/releases the current temperature measurement on the LCD screen.



Activates the device's bearing measurement mode. When taking a BG measurement, pressing this button will display an alarm value (see the 'Understanding Bearing Alarms' section on page 20).

## The Battery Pack

The Spotcheck device is powered by a removable, rechargeable Lithium-Ion 3 V, 1700 mA battery pack. Once fully charged, the battery pack will allow the device to operate continuously for up to 48 hours.

The battery's current charge level is indicated by a battery icon in the upper right-hand corner of the LCD screen.



*Battery Level Indicator (Top Right)*

## Charging the Battery Pack

- Connect the AC power adapter included with the device to a powered outlet (100-240 Volt, 50/60 Hz).
- Connect the charger power output plug to the device's charger input socket.

The included DC in-car charger may be used to charge the battery pack in a vehicle with a 12 V negative-chassis power system.

- Connect the in-car charger's DC output to the device's charger power socket.

Bi-color LEDs on the battery chargers indicate the battery's charge state when connected and powered: orange when the battery is charging and green once the charge cycle has completed.

A full battery charge from empty will complete in approximately three hours.

**Use only the AC mains or DC in-car battery chargers included in your Spotcheck device kit. Other chargers may damage the device and/or battery pack and may void your warranty.**

Charge the battery pack for two hours before or during your first use of the device. Replacement battery packs (part number SPOT0503) are available from Commtest Instruments.

## Removing the Battery Pack

- Open the rear battery compartment by pressing the cover firmly then sliding downward.



- Set the battery cover aside and remove the battery from its compartment.
- Disconnect the power plug and socket (positive and negative are indicated by color and the socket and plug can be connected in only one direction).

### **WARNINGS:**

Power should not be supplied to the device when removing the battery. Unplug any connected charger before proceeding.

Damaged batteries should not be re-inserted into the Spotcheck device.

Dispose of damaged batteries responsibly and in accordance with local regulations.

Do not disassemble the battery pack or dispose of in fire.

## Section 2: Instrument Basics

This section describes how to use the measurement and analysis functions of your Spotcheck device.

You will learn to:

- Power up the instrument and turn it off
- Attach the accelerometer sensor and stinger probe
- Take a vibration overall measurement
- Evaluate a vibration overall measurement alarm
- Take a bearing BG and BV vibration measurement
- Evaluate a bearing BG and BV alarm
- Take a temperature measurement

### Powering On/Off

#### Powering On

- Press and hold the  **SELECT** key for more than 1 second to power on the Spotcheck device.

#### Powering Off

- Press and hold the  **SELECT** key then press either the  **BEARING** key or the  **VIBRATION** key to power off the Spotcheck device.

**NOTE:** The Spotcheck device will power down automatically if no keypad buttons are pressed for 3 minutes.

## Using the Accelerometer Sensor

The accelerometer sensor is connected to the device via BNC, then attached to the machinery being measured using the included magnetic mount or a stud.

- Attach the sensor cable plug to the BNC connector by inserting and gently turning clockwise. Remove by turning in an anti-clockwise direction then pulling away.

**WARNING:** Do not remove the connector by pulling the sensor cable. This may damage the cable. Always remove by gripping the BNC connector then gently twisting in an anti-clockwise direction for one quarter of a turn before pulling away.

- Screw the accelerometer in a clockwise direction onto the magnetic base. Attach the base and sensor to the measurement point.

If the measurement location is smaller than the magnetic base of the accelerometer, use the included stinger probe.



*Stinger Probe*

- Remove the accelerometer sensor from the magnetic base by unscrewing in an anti-clockwise direction.
- Screw the stinger probe onto the end of the accelerometer in a clockwise direction.
- Press the tip of the stinger probe firmly against the surface being measured.

## Sensor Guidelines

When attaching your accelerometer sensor using its magnetic base or a stud, the following guidelines should be observed:

- Attach the accelerometer to a sturdy, rigidly mounted and non-flexible structure, where vibration from the rotating part of the machine will be accurately transmitted. Do not attach sensors to sheet metal, guards, or any machine structure which is not closely coupled to the source of vibration in the spinning rotor, as the vibration of such a structure will be different to the vibration source.
- The attachment structure must be at least 10 times heavier than the accelerometer itself. Do not mount the accelerometer on lightweight motors or similar parts as the weight of the accelerometer will distort the vibration signal. Use the stinger probe for small structures or small/inaccessible measurement points.
- Attach the accelerometer as closely as possible to, and in line with, the centerline of the bearings in order to avoid distorted signals.
- The mounting surface should be flat and smooth where the accelerometer makes contact. Attach the accelerometer using the supplied magnetic accelerometer base or a threaded stud on the machine surface. The accelerometer should not move independently of the machine part it is attached to, nor should the accelerometer cable.
- Ensure the accelerometer is oriented correctly as vibration can differ greatly with respect to direction.
- If you are undertaking an ongoing study of a particular measurement point, always attach the accelerometer at exactly the same position used for previous measurements (mark the position if necessary).
- Keep the accelerometer clear from other cables, ensuring it is not twisted, kinked or tangled.

## Using Vibration Overall Measurements

The Spotcheck device measures broadband frequencies to generate a machine's 'overall' summed vibration level. High overall vibration levels are typically an indicator of unbalance, mechanical failure or wear.

If overall vibration measurements are taken at regular intervals (weekly, for example) and noted, an historical trend of typical or 'normal' machine vibration levels can be generated. This is called a 'baseline'. When new measurements are compared with this baseline value any significant increases in the overall vibration level of the component can more easily be identified.

As always, when determining the state of mechanical components you must use common sense. In addition to measured vibration levels you should visually inspect machinery for dirt, wear or movement; listen for unusual mechanical noises and vibrations, and feel for temperature changes.

**NOTE:** The Spotcheck device includes a temperature sensor that can be used to identify temperature baseline values. These temperature values can be used in conjunction with vibration baselines to more effectively monitor machinery condition over time. See the 'Take a Temperature Measurement' section on page 23 for more information.

## Displacement, Velocity and Acceleration

The Spotcheck device measures in displacement, velocity and acceleration.

**Displacement** is a measurement of the distance between two points in mil (thousandth of an inch). In this case between the resting position of the vibration sensor and its position of maximum excursion during movement (caused by motion of the machinery it is attached to).

**Velocity** is a measurement of the rate of change of displacement in inches per second, or the speed of the vibration sensor in a

particular direction. For example, if an object is moving Northward, the velocity of the object in the North direction is its speed, but its velocity in the East or West direction is zero, and its velocity in the South direction is the negative of its speed.

**Acceleration** is a measurement of the rate of velocity change of the vibration sensor around its rest location in g. That is, the rate at which the sensor is gaining or losing speed in a particular direction.

## Take a Vibration Overall Measurement

The steps below assume that you have already successfully connected and mounted the accelerometer sensor (or are holding the stinger probe tip against the machinery surface).



- Press and hold the  **SELECT** key for 1 second to power on the Spotcheck device.

The velocity measurement type will be selected ('Vel' will be displayed in the LCD screen's top left-hand corner). A vibration measurement numeric value will be shown in the center of the screen.

**NOTE:** If the sensor has not been connected to the device, or if a sensor fault is detected, the device will display a sensor query icon on the LCD screen.




*Sensor Alert Icon*




- Press the  **SELECT** key repeatedly to toggle between the device's available measurement types: 'Vel' (velocity in ips RMS), 'Disp' (displacement in mil peak-to-peak) and 'Acc' (acceleration in g peak).
- Press the  **VIBRATION** key to hold the value being shown onscreen, and again to return to the active measurement mode.

## Tips for Taking Measurements


- You should always take measurements using the machine operating mode that is typical for that machine (using a typical load and running speed). This will ensure that the loads on the components, such as bearings, are the same as those that define their wear. For multi-operating mode machines it is best to take measurements when the loads on the bearings are at a maximum and to take all future measurements in the same mode.
- When taking the measurement, try not to lean on the machine and do not put heavy objects (e.g. heavy tool boxes) on it since this will change the vibratory behavior of the machine.
- If there are machines operating nearby that might affect the vibration of the machine you are measuring, stop those surrounding machines if possible.
- In addition to the measurements that you will be taking, if possible, stop and listen to the sound of the machine; look for loose bolts and oil leaks; take note of any machine parts that are vibrating visibly; feel for hot bearings and manually ‘feel’ the vibration (e.g. with a screwdriver) to look for symptoms that might later aid vibration analysis. This should be done only if it is safe to do so.
- If you have a stroboscope you may wish to use it to ‘freeze’ rotating shafts, belts, couplings etc. to observe their operating shapes and relative speeds.

## Understanding ISO 10816-3 Vibration Alarms

If a velocity measurement is taken and the  **VIBRATION** key is then pressed, the measured value will be retained on the LCD screen (placed on 'hold'). A vibration alarm level using the ISO 10816-3:2009 standard will also be displayed on the LCD screen. Three alarm levels are possible and may be shown:

- **OK** (indicated by a  tick icon)
- **Alert** (indicated by a single  bell icon)
- **Danger** (indicated by two  bell icons)

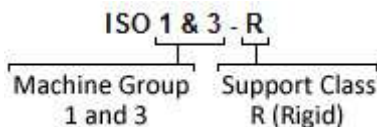
The alarm level displayed is only applicable to the machine group (determined by the machinery's size and power) and support class (determined by the support structure the machinery has been mounted to: rigid, or flexible) specified in the bottom left-hand corner of the screen.

You must manually cycle through the four machine group and support class options available. Press the  **SELECT** key repeatedly until the machine and support type combination most appropriate for the machinery being measured is displayed.

The four available combinations are:

- ISO 1 & 3 - R
- ISO 1 & 3 - F
- ISO 2 & 4 - R
- ISO 2 & 4 - F

The first two numbers indicate the machine group applicable to the alarm, and the last letter the support class.



## Machine Groups

- **Group 1.** These are large machines with rated power output above 300 kW and shaft diameters greater than or equal to 315 mm. These machines are typically equipped with sleeve bearings and operate at speeds between 120 RPM and 15 000 RPM.
- **Group 2.** These are medium sized machines with rated power output between 15 kW and 300 kW and shaft diameters of between 160 mm and 315 mm. These machines are typically equipped with element bearings and operate at speeds greater than 600 RPM.
- **Group 3.** Pumps with multi-vane impellers and separate drive motors (centrifugal, mixed flow or axial flow) with rated power above 15 kW.
- **Group 4.** Pumps with multi-vane impellers with integrated drive motors (centrifugal, mixed flow or axial flow) with rated power above 15 kW.

## Support Class

- **R (Rigid).** Appropriate for machinery mounted on rigid mountings, such as steel or concrete.
- **F (Flexible).** Appropriate for machinery mounted on flexible mountings, such as rubber or springs.



**NOTE:** A quick reference list of these values is printed on the device's rear label. For more information on machine groups and support classes, see the 'ISO 10816-3 Machine Groups Overview' section on page 26 and the 'ISO 10816-3 Support Classes Overview' section on page 27.

Using a combination of the vibration level, the machine group and the support class, alarms are generated as follows:

Vibration (velocity, mm/s or ips)	Group 1 & 3		Group 2 & 4	
	Rigid	Flexible	Rigid	Flexible
11 mm/s (0.43 ips) and Over	Danger	Danger	Danger	Danger
7.1 mm/s (0.28 ips) to 11 mm/s (0.43 ips)	Danger	Alert	Danger	Alert
4.5 mm/s (0.18 ips) to 7.1 mm/s (0.28 ips)	Alert	Warning	Alert	Warning
3.5 mm/s (0.14 ips) to 4.5 mm/s (0.18 ips)	Warning			
2.8 mm/s (0.11 ips) to 3.5 mm/s (0.14 ips)	Warning	OK	Warning	Warning
2.3 mm/s (0.09 ips) to 2.8 mm/s (0.11 ips)			Warning	
1.4 mm/s (0.06 ips) to 2.3 mm/s (0.09 ips)	OK		OK	Warning
0 to 1.4 mm/s (0.06 ips)		OK		OK

## Check the Status of a Bearing



The steps below assume you have already successfully connected and mounted the accelerometer sensor (or are holding the stinger probe tip against the machinery surface).

- Press and hold the  **SELECT** key for 1 second to power on the Spotcheck device.
- Press the  **BEARING** key. The BG measurement type will be selected ('Bg' will be displayed in the LCD screen's top left-hand corner). A vibration measurement numeric value will be shown in the center of the screen.


**NOTE:** If the sensor has not been connected to the device, or if a sensor fault is detected, the device will display a sensor query icon on the LCD screen.






*Sensor Alert Icon*

- Press the  **SELECT** key to toggle between the device's two available bearing measurement types: 'Bg' (acceleration in g RMS), 'Bv' (velocity in ips RMS).
- Press the  **BEARING** key to hold the value being shown onscreen, and again to return to the active measurement mode.

## Understanding Bearing Alarms


If a bearing vibration measurement is taken and the  **BEARING** key is then pressed, the measured value will be retained on the LCD screen (placed on 'hold'). A vibration alarm level will also be displayed on the LCD screen. Three alarm levels are possible and may be shown:

- **OK** (indicated by a  tick icon)
- **Alert** (indicated by a single  bell icon)
- **Danger** (indicated by two  bell icons)

Bearing alarm values displayed by the Spotcheck device are based on 'rule of thumb' tables and should therefore be used as simple indicators of potential problems. They should not be used as the sole determinant of a component's condition.

### Acceleration Alarms (BG)

When taking a BG (bearing acceleration) reading, the alarm level displayed by pressing the  **BEARING** key is only applicable to the bearing shaft speed specified in the bottom left-hand corner of the LCD screen.

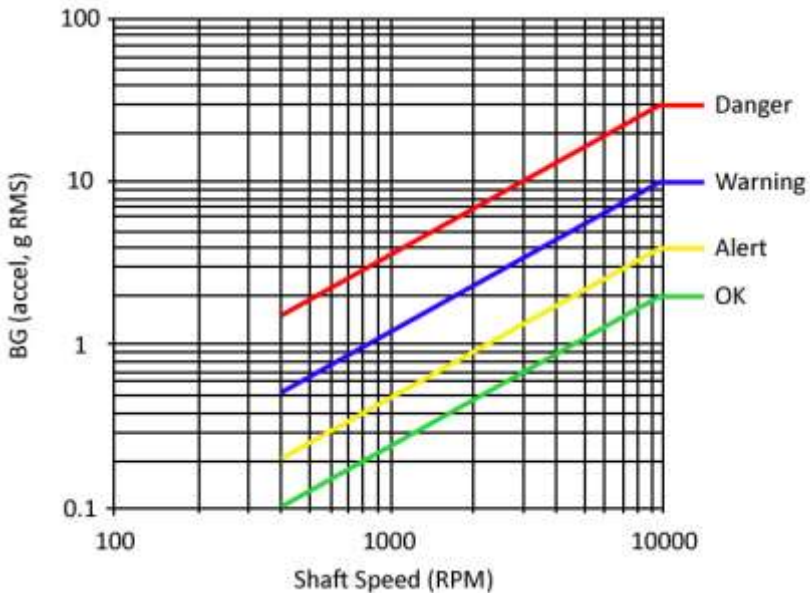
You must manually cycle through the five bearing shaft speed options available. Press the  **SELECT** key repeatedly until the shaft speed most appropriate for the machinery being measured is displayed.

The five available shaft speeds are:

- **RPM:<500**. Suitable for shafts rotating at below 500 RPM.
- **RPM:<1000**. Suitable for shafts rotating at between 500 RPM and 1000 RPM.
- **RPM:<2000**. Suitable for shafts rotating at between 1000 RPM and 2000 RPM.

- **RPM:<5000.** Suitable for shafts rotating at between 2000 RPM and 5000 RPM.
- **RPM:<10000.** Suitable for shafts rotating at between 5000 RPM and 10 000 RPM.

BG alarms are based on acceleration readings taken between 1 kHz and 12 kHz. These are the frequencies in which bearing failures are typically most easily detected. The alarms are generated using the following vibration level against shaft speed matrix:



### Velocity Alarms (BV)

BV alarms are based on velocity readings in ips RMS taken between 1 kHz and 12 kHz. Like BG alarms, BV alarms are based on established 'rule of thumb' measurement levels that have traditionally given reliable indications of a bearing's condition with up to 90% accuracy.

These alarms are generated using the following vibration levels:

- **OK.** Bearing velocity levels of less than 0.04 ips RMS suggesting correctly greased bearings operating normally.
- **Warning.** Bearing velocity levels of between 0.04 ips RMS and 0.08 ips RMS indicating the existence of internal surface wear that may not be detectable by the human eye, actual bearing damage or poorly/ungreased bearings.
- **Danger.** Bearing velocity levels above 0.08 ips RMS suggesting that a bearing failure may occur imminently.

## Take a Temperature Measurement



Heat is a strong indicator of a failing component or unbalance. Bearing heat is typically generated by friction between surfaces resulting from damage or poor lubrication. As surface contact increases, temperatures will rise until a bearing failure occurs.

By regularly monitoring and noting the temperature of a rotating component it becomes possible to 'trend' its temperature over time and identify when the component may require attention (as indicated by an unusual increase in temperature).

**NOTE:** If establishing a temperature trend it is important that the same physical location is sampled each time a measurement is taken, and that measurements are taken from the same distance.

If comparing the casing temperatures of several identical components (such as bearings or drives) under identical loads it is also possible to identify components that are notably warmer than their companions, suggesting mechanical deterioration.

**WARNING:** The Spotcheck device's laser pointer will energize automatically when measuring temperatures. Direct the laser lens away from yourself and others in the vicinity before proceeding with the steps below. Ensure you are familiar with the laser safety guidelines described in the 'Laser Safety' section on page 25.

- Press and hold the  **SELECT** key for 1 second to power on the Spotcheck device.
- Press the  **TEMPERATURE** key. The temperature measurement mode will be selected ('Temp' will be displayed in the screen's top left-hand corner). A temperature measurement numeric value will be shown in the center of the LCD screen. This is the temperature in front of the device's IR temperature sensor. Ambient temperature will be displayed in the bottom left-hand corner and the measurement unit in the bottom right-hand corner.

**NOTE:** The default temperature unit is degrees Celsius. To change to Fahrenheit, press the **SEL** **SELECT** key.

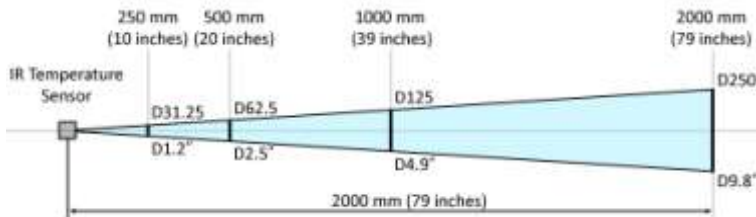
- Point the laser guide at the surface to be measured. The laser provides a visual indication of the field of view of the infrared thermometer sensor. Ensure the surface is within the device's 2 meter (6.5 foot) effective range. The LCD screen will display the surface temperature of the target surface.

**NOTE:** The temperature range supported by the IR sensor is  $-20\text{ }^{\circ}\text{C}$  to  $120\text{ }^{\circ}\text{C}$  ( $-4\text{ }^{\circ}\text{F}$  to  $248\text{ }^{\circ}\text{F}$ ).

- Press the **F**/**°C** **TEMPERATURE** key to hold the value being shown onscreen, and again to return to the active measurement mode. Pressing this key will also disable and re-energize the laser pointer.

Accurate temperature measurement using an IR sensor depends largely on the size of the target and the distance between the target and the thermal sensor. IR detectors have a circular, conical field of view: small and narrow directly in front of the sensor and gradually spreading wider as the distance between the sensor and the target increases.

For this reason it is important that you consider the distance between the Spotcheck device and the equipment being measured. At a distance of 250 mm or 10 inches the sensor's field of view is a small circle with a diameter of approximately 31.25 mm (1.2 inches). This is suitable for many smaller bearings. However, at a distance of 2000 mm or 79 inches (the device's maximum range) the field of view is a much larger 250 mm (9.8 inches) in diameter.



**NOTE:** For maximum accuracy, the IR sensor should include only the target surface in its field of view. For this reason measurements of smaller objects should, if possible, be taken at close range. Beyond 2 meters or 6.5 feet temperature readings of even large targets may become unreliable.

## Laser Safety

When using the Spotcheck device's laser pointer, please observe the following laser safety guidelines:

- Never point the laser beam at a person. The laser pointer is designed to target inanimate objects.
- Laser pointers are not toys. Keep out of reach of minors and children.
- Do not look into the laser beam or view directly with optical instruments. Eye damage may result.
- Do not direct the laser pointer at reflective surfaces. Reflected beams can act like direct beams.

## Section 3: Supplemental Reading

This section discusses suitable machine groups and support classes for the ISO 10816-3 standard and the significance of a machine's support structure. Additionally, this section includes a primer on assessing roller bearing states using vibration measurements.

### ISO 10816-3 Machine Groups Overview

The ISO 10816-3 standard encompasses a broad range of industrial plant machinery with nominal power above 15 kW and nominal speeds of between 120 RPM and 15 000 RPM when measured in situ. Machinery that this standard applies to includes:

- Steam turbines with nominal power of less than 50 MW
- Steam turbines with nominal power above 50 MW and speeds of less than 1500 RPM or over 3600 RPM (excluding machines included in ISO 10816-2)
- Rotating compressors
- Industrial gas turbines with nominal power of less than 3 MW
- Centrifugal, mix flow, or axial flow pumps
- Electric generators, excluding hydroelectric generators and pump stations
- Electric motors of all types
- Blowers and fans

## ISO 10816-3 Support Classes Overview

The ISO 10816-3 standard classifies machinery according to its mounting style, whether flexible or rigid. This is done as mounting type typically reflects the location of the machinery's rigid-structure resonances relative to basic machine running speed.

For example, a machine supported by flexible rubber mounts or a spring will typically have resonances at lower running speeds. Vibrations may be stronger at lower speeds, reducing as the machinery reaches its operating speed. This type of machine is regarded as flexible by the ISO standard.

Machinery mounted on flexible supports will also typically vibrate more during run-up and coast-down.

Modern machines often operate at high speeds and are equipped with flexible bearing supports and foundations. These can be treated as flexible even when not mounted on rubber or springs.

Although the ISO 10816-3 standard allows for slightly higher vibration limits when a machine's support is considered flexible rather than rigid, resonant conditions (even at operating speeds) are regarded as abnormal.

## Assessing Bearing State

When the rolling elements inside a bearing move, broadband noise and vibration is generated. Noise and vibration levels will increase if the bearing is not correctly greased, is overloaded (due to, for example, misalignment) or has a damaged surface.

As the vibrations generated by bearing wear and damage are broadband (that is, they cover a wide range of frequencies), any frequency could be regarded as suitable for measurement. However, if the chosen frequency band also contains low frequencies (below 1 kHz) the measurement will not consist only of bearing frequencies. The bearing condition may thereby become harder to interpret.

If the chosen frequency band contains only bearing frequencies the bearing condition assessment will be more accurate. For this reason the Spotcheck device measures only frequencies above 1 kHz when in its bearing measurement mode.

High bearing readings can also be found in gearboxes and other machines where steel meets steel and no bearing faults exist. The reason for this is that these components naturally produce frequencies in the same range as bearing faults.

Bearings should not typically be replaced only on the basis of a bearing value displayed by the Spotcheck device. A high bearing vibration value is merely an indicator that further analysis is required. Further analysis will determine whether the elevated levels at specific frequencies correspond with mathematically calculated bearing frequencies. More advanced tools such as the vb7 and vb8 data analyzers, when used in conjunction with the Ascent software, are ideal for this application.

Bearing condition values are influenced by bearing lubrication. If a high value is displayed, the bearing should in the first instance be re-greased. After greasing the bearing condition value will typically decrease. However, if there is mechanical damage the value will quickly rise again.

# Appendix: Specifications

## Spotcheck Specifications

Specifications	Spotcheck Device	Remarks
<b>Sensors</b> Sensor input Sensor Vibration	1 channel Accelerometer Acceleration 0 to 20 g Peak, 10 Hz to 12 kHz Velocity 0 to 200 mm/s RMS, 10 Hz to 1000 Hz Displacement 0 to 2000 $\mu\text{m}$ Pk-Pk, 10 Hz to 1000 Hz BG 0 to 20 g RMS, 1000 Hz to 12 kHz BV 0 to 200 mm/s RMS, 1000 Hz to 12 kHz	BNC 100 mV/g IIEPE/ICP® type. Top exit. Integrated 80 cm cable.
<b>Measurement Features</b> Accuracy Alarms Temperature	$\pm 5\%$ Automatic Velocity Alarm Check Automatic Bearing Alarm Check -20 °C to 120 °C (-4 °F to 248 °F)	ISO 10816-3 BG and BV (proprietary) Accuracy $\pm 2$ °C. Built in IR sensor with laser pointer
<b>Display &amp; Communications</b> Display Resolution Viewing area	Monochromatic LCD 128 x 64 pixels 30 mm x 16 mm (1.2" x 0.6")	LED backlight
<b>Laser</b> Type Frequency Class Power	Compact laser diode 650 nm 2 1 mW (max)	Red IEC60825-1:1993+A1:1997+A2:2001 compliant
<b>Battery &amp; Charger</b> Battery type Operating time Charger type Charge rate Charge time	Custom Lithium Ion pack 3.6 V, 1700 mAh >48 hours Internal charging, automatic control 600 mA nominal 3 hours	Rechargeable, user-replaceable External Power pack 12 V DC, 3 A output, included in kit For complete charge
<b>Mechanical</b> Size Weight	116 mm x 78 mm x 24 mm (4.6" x 3" x 0.9") 230 g (0.5 lb)	128 mm (5") including BNC connector Including battery, sensor and cable
<b>Environment</b> Operating temp Storage temperature Sealing Certification	-10 °C to 50 °C (14 °F to 122 °F) -20 °C to 60 °C (-4 °F to 140 °F) IP64 CE	Non-condensing atmosphere only Dust tight, splashed water

Revised 10 March 2011. While every effort has been made to provide the most accurate information we advise that information in this document may contain technical inaccuracies or typographical errors. Commtest Instruments Ltd may at any time and without notice make improvements and/or changes to the products described.

## Servicing and Maintenance

Servicing is not required to keep the Spotcheck device in proper operating condition. In the event of a malfunction, the device should be returned to Commtest Instruments for inspection and repair.

Do not open or disassemble. No user-serviceable parts.

# Index

## A

Acceleration • 13

Alarms

    Bearing • 20

    Vibration • 16, 28

Appendix

    Specifications • 29

Assessing Bearing State • 28

## B

Battery • 8, 9

Bearings • 19, 28

## C

Charging the Battery Pack • 8

Check the Status of a Bearing •  
    19

## D

Displacement • 13

Displacement, Velocity and  
    Acceleration • 13

## F

Front Panel • 7

## I

Instrument I/O • 6

ISO 10816-3 • 16, 26, 27

ISO 10816-3 Machine Groups  
    Overview • 17, 26

ISO 10816-3 Support Classes  
    Overview • 17, 27

## L

Laser

    Safety • 1, 5, 23, 25

Laser Safety • 23, 25

## P

Power • 10

Powering On/Off • 10

Precautions • 5

Product Overview • 2

## R

Removing the Battery Pack • 9

## S

Section 1

    Introduction • 1

Section 2

    Instrument Basics • 10

Section 3

    Supplemental Reading • 26

- Sensor Guidelines • 12
- Servicing and Maintenance • 29
- Spotcheck Specifications • 29
- Standard Features • 3
- Standard Kit Items • 4

## **T**

- Take a Temperature Measurement • 13, 23
- Take a Vibration Overall Measurement • 14
- The Battery Pack • 8
- Tips for Taking Measurements • 15

## **U**

- Understanding Bearing Alarms • 7, 20
- Understanding ISO 10816-3 Vibration Alarms • 3, 7, 16
- Using the Accelerometer Sensor • 11
- Using Vibration Overall Measurements • 13

## **V**

- Velocity • 13
- Vibration Overalls • 14, 16