
# EDDY CURRENT TESTING

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Eddy Current
Technology


# eddyvisor® digital

Digital eddy current test instrument for nondestructive testing of components, mass produced parts and semi-finished products for cracks, pores and grinder burn using Preventive Multi-Filter Technology and for material properties such as hardness, case depth, structure, tensile strength, heat treatment or alloy using Preventive Multi-Frequency Technology.

High power modular instrument concept with max. 16 independent crack detection channels, max. 32 structure test channels and their combinations.

www.ibgndt.ch

# eddyvisor® digital


The eddyvisor distinguishes itself with its high performance modular concept with max. 16 independently working crack detection channels and max. 32 structure test channels all in a very compact design. Additionally, it offers unique features for the realization of sophisticated test tasks using the eddy current technique, combining that with the well known ibg test reliability and ease of operation.

The ergonomic interface enables easy and simple operation via touch screen. All functions and test results are captured at a glance. Digital processing of the measuring signal with unique processors, immediately after the pre-amplifier guarantees the greatest possible stability of test results.

The eddyvisor is based on the long proven ibg system concept. All coils, probes, rotating heads and other system components are standardized worldwide. So eddyvisor is the solution for new tasks and to upgrade existing production machines to equip them with state of the art eddy current technology.

In the field of crack and grinder burn detection, the need for trained experts to perform the sophisticated and time consuming tasks of manual determination and setting of suitable filter band, phase angle and gain is eliminated by ibg's exclusively developed Preventive Multi-Filter Technology (PMFT), which automatically creates tolerance zones by simply scanning good parts. This quantum leap in eddy current technology, unique to ibg worldwide, establishes a new standard for quality in crack and grinder burn detection by the eddy current method.

During material data recording (calibration) with PMFT, surface areas of several good parts are scanned. The good surface eddy current "noise" is recorded simultaneously in each of 30 band pass filters. Tolerance zones, enveloping 360 degrees, are automatically created within each filter band, capturing the allowable eddy current "noise" from good parts. Good part noise signals result from allowable variations in surface roughness and material properties. Thus, the thirty tolerance zones store the part specific fingerprint of the good parts. Edge effects, hardness profile run out, eccentricity, etc. of the good parts are calibrated during material data recording. Thus, pseudo rejects are reduced considerably without losing visibility to real flaws.

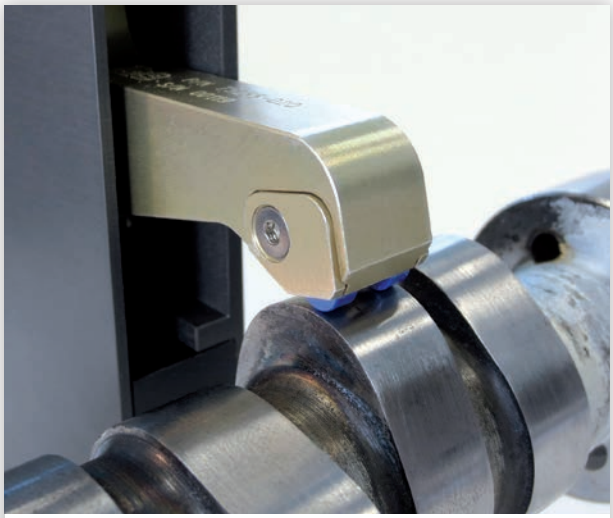
The unique "good-part-only-concept" enables setup within a few minutes. Simply scan and record an adequate number of good parts. Tolerance zones within each of the 30 PMFT filter bands are automatically generated capturing the allowable noise from the good parts to form good part finger prints in each of the 30 PMFT filter bands. After material data recording, one key press switches to Preventive Multi-Filter Test, and the test can start. Done! Faster starting yet more reliable eddy current testing is not possible.

## Crack and grinder burn detection

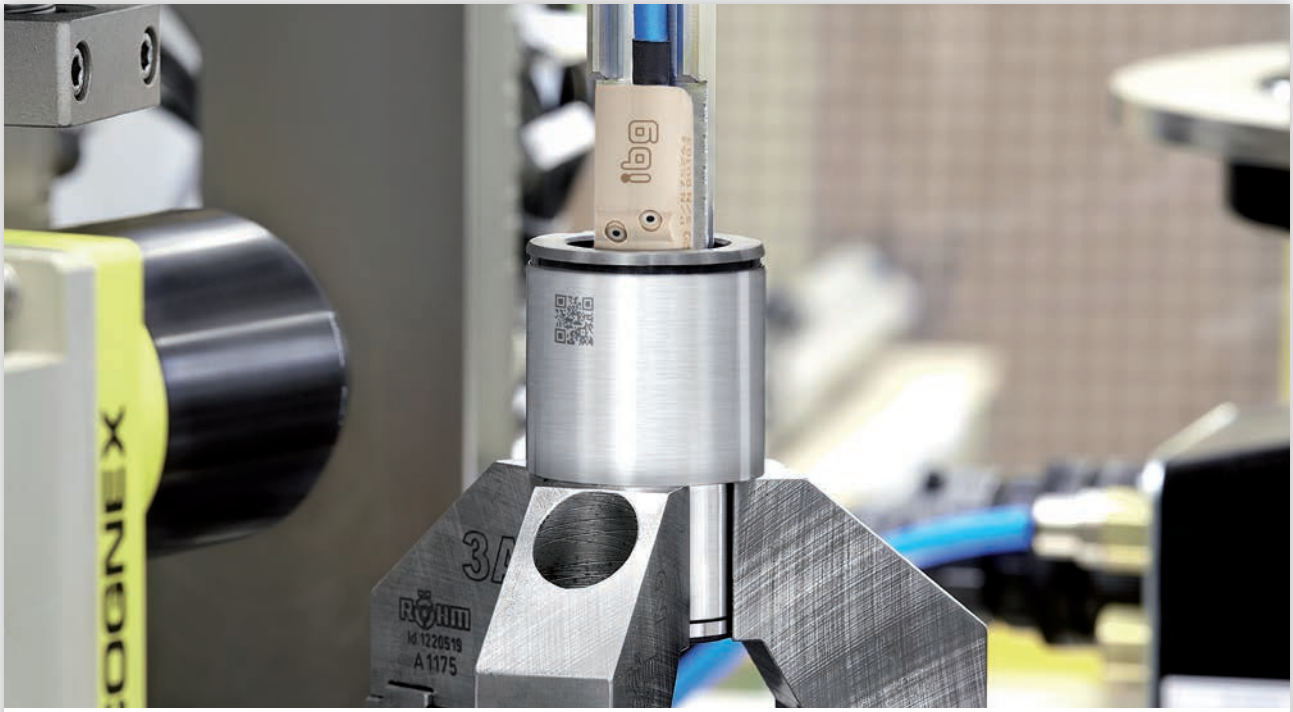
Efforts to reduce content of valuable raw materials and of energy bring reduced cross sections in high volume components in the fields of mechanical engineering and automobile components. The resulting reduced cross sections and stricter material properties requirements have incentivized manufacturers to guarantee correct structure and crack and grinder burn free condition by increased nondestructive testing.

The eddy current test method can be applied for all materials with electrical conductivity or magnetic conductivity (permeability). This includes all metallic materials. The eddy current crack and grinder burn test can be adapted to many test tasks by selecting the suitable crack detection probe and transmitter frequency. As a matter of principle, mainly surface open or flaws close to surface and pores are detected.

The test resolution and effective scan width of a crack detection probe is dependent on core size and type (between 0.5 and 5.0 mm). When testing, a relative movement of probe to surface of test part is always required. In order to test rotationally symmetrical parts for cracks, either the test part is rotated and the probe stands still or the test part stands still and the probe is rotated around the part by means of a rotating head. If more than one line shall be tested additional feed forward is needed. Thus complete surfaces can be scanned. More complicated surfaces require more complicated mechanical handling systems. Our own special machine manufacturing group is always pleased to work with you to design and build a test system for your 100 % testing.



Crack detection probe box for contacting testing on eccentric parts like camshaft lobes for cracks and grinder burn; large diameter range is covered; up to 300 rpm (depending of part geometry), ceramic supports for long life-time. Solutions for structure test on camshafts on request.



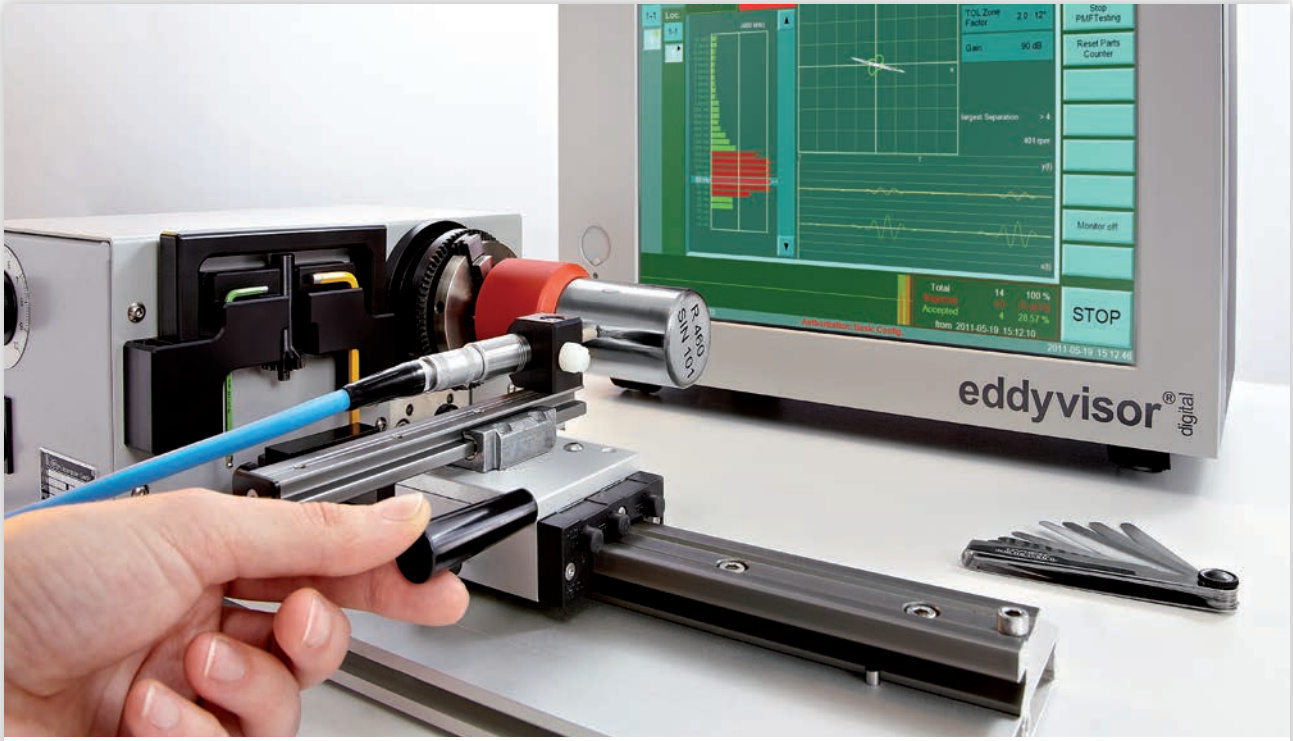

Steering nut in an automatic ibg test system. Detection of cracks and grinder burn defects on the race inside. With camera inspection system to capture part type specific QR-code.

In the past the eddy current crack test would be set to optimally detect an artificially generated (EDM) defect master. But artificial defect masters show different eddy current behaviour (i.e., phase shift, etc.) than natural defects. Thus, natural defects could go undetected. Now the ibg technique with its eddyvisor instrument family walks on new paths. Thanks to the Preventive Multi-Filter Technology the instrument is not set to an artificial defect anymore but to the eddy current pattern of "healthy" surfaces of several OK parts. Automatically 30 tolerance zones over the entire spectrum of filter bands are formed which in fact picture the "healthy" surfaces in the test instrument. As soon as one of these tolerance zones are exceeded by the eddy current signal a NG signal is triggered, no matter if caused by an artificial or by a natural defect.

For proof of test sensitivity, an artificial defect is put into an OK part by EDM processes. This defect must be 100 % detected by the instrument for validation of the method and of the test system. The limit defect of your application is determined beforehand in our lab during a feasibility study. It results in definition of direction and dimension of the smallest reproducible defect that must be 100 % detected without or without significant pseudo rejects.

The well-known note "surface to be free from cracks" on drawings suggests a wish for perfection of the part to be produced. However, there are physical limits of the eddy current crack detection relative to that wish. We have committed ourselves to move these limits further in the direction of smaller, detectable "discontinuities" without increases in pseudo rejects and under production conditions. The exploitable sensitivity of the eddy current crack test depends on several parameters:

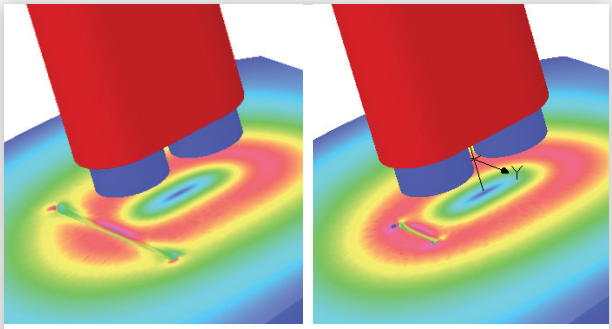
- Surface roughness - detection of small defects is better the smoother the surface is. The limit is at defect depth equal to 5 times roughness depth, but not less than 50 µm.
- Material - use of differential probes generally suppresses noise inherent to different materials. But the material tested is a factor. For example, the detection limit for lamellar cast iron can increase to approx. 150 µm due to carbon needles in this material.
- Distance probe to surface - increasing probe distance reduces sensitivity, while decreasing probe distance enhance sensitivity to surface roughness and eccentricity of the test part. A good compromise for most applications is the ibg standard probe distance of 0.7 mm.
- Direction of defects - the direction of a defect relative to the probe trace direction also influences the test sensitivity. This can be influenced by choosing the suitable ibg probe system.




ibg lathe for lab tests, feasibility studies and small series in crack detection with eddyvisor. Speed max. 850 rpm, chuck up to 68 mm diameter, with trigger sensor, flexible probe movement.

ibg mainly applies differential probes for crack detection. The differential principle reduces the very large receiver signal almost to zero by use of two compensating counter rotating receiver windings. This enables very high amplification of very small signals from flaws without overloading the input of the test instrument. Furthermore, ibg places high standards for precision for its own probe manufacturing, further enabling higher amplifications. On the noise side, ibg instruments employ extremely low noise signal processing, earliest possible digitalization and smart signal processes. Thus, ibg is able to combine very high flaw signal amplification with very low noise signal processing allowing larger distances between test probe and test surface without loss of test sensitivity. The advantage realized is that ibg test probes can be held 0.7 mm off of tested surfaces without sacrifice of test sensitivity and test resolution. The small flaws are detected. Other manufacturers only guarantee similar sensitivity with 0.2 - 0.3 mm probe distance. But probes so close see more good part noise, and there are more pseudo rejects of good parts. In general, differential probes are highly sensitive for local surface defects.

They are also relatively immune to variations in test part structure such as different batches, allowable heat teat variations, etc. These characteristics are important for avoidance of pseudo rejects when doing 100 % testing.

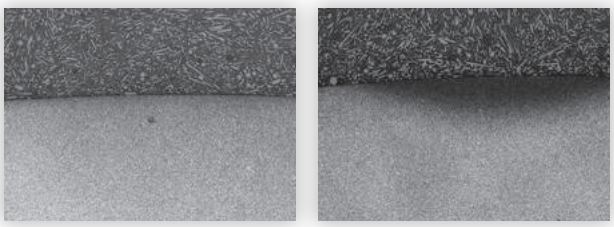


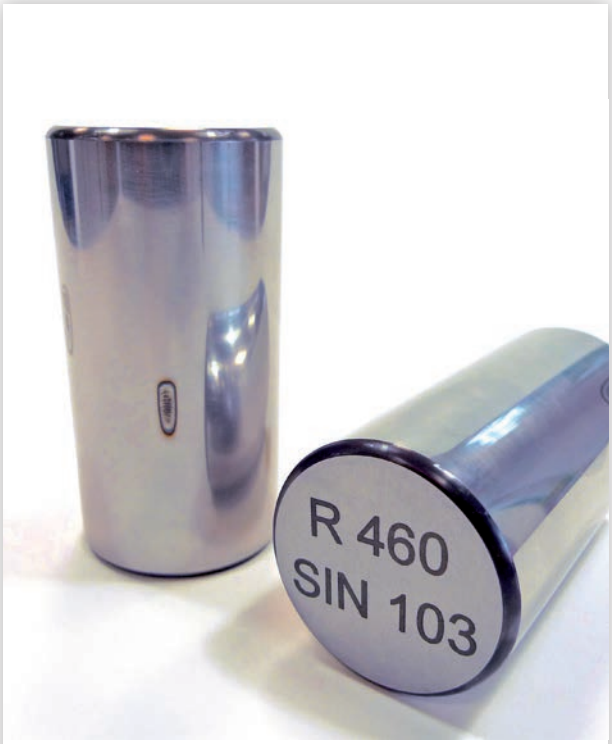
Simulation of the eddy current density generated by a differential probe on the surface of a roller. It shows disruption of the eddy current caused by an EDM crack as detected by a crack detection probe. Left: typical Spec crack with 3 x 0,1 x 0,1 mm. Right: same crack, but with a length of only 1 mm.

## Grinder burn detection

As per ISO 14104, grinder burn is a local overheating of surfaces. Heat impact during the grinding process was too much and effected localized annealing or, if heat impact was still stronger, there can be re-hardening zones. Depending on part surface quality and geometric influences, the ibg PMFT detects grinder burn with detection beginning at the level of mere change in residual stress or beginning of annealing zones in the microstructure.

A method applied by ibg to produce reference samples for grinder burn detection is laser burn: heat, defined and locally applied to the surface of the test part. Thus, producing defined artificial defects of different intensity in metallic parts which show analogue features like real damage. They can widely be produced and reproduced at defined spots according to requirements (kind and depth of structure change, spacial dimension) and they serve as master part for validation of automatic test machine as well as for determination of sensitivity of a test system.






ibg crack and grinder burn master with EDM cracks and pores for simulation of surface open defects and with laser defects for simulation of grinder burn; intensity mere residual stress (cutting far left) and beginning annealing zone (left).

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## Features crack and grinder burn detection

- **Probes**
  A selection of probes for crack detection is available which vary in trace width, sensitivity and shape. Customised probes for special applications are designed and manufactured in house. Compact and highly precise ibg rotating heads eddyscan H and eddyscan F are available, in many cases installed for optimization of cycle time. They work together with the test instrument eddyvisor. Cable break monitoring offers high security in continuous operation.

- **Probe distance**
  ibg probes are by default manufactured for a large probe/part distance of 0.7 mm. Thus, demands on part exactness and test mechanic are relaxed considerably.

- **Lift-off compensation**
  If a part is very eccentric, the distance of probe to test part may be additionally balanced electronically by use of the optional lift-off compensation. Special lift-off compensation probes are supplied for this function.

- **Suspend**
  The suspend function blanks out areas not to be tested like holes or similar.

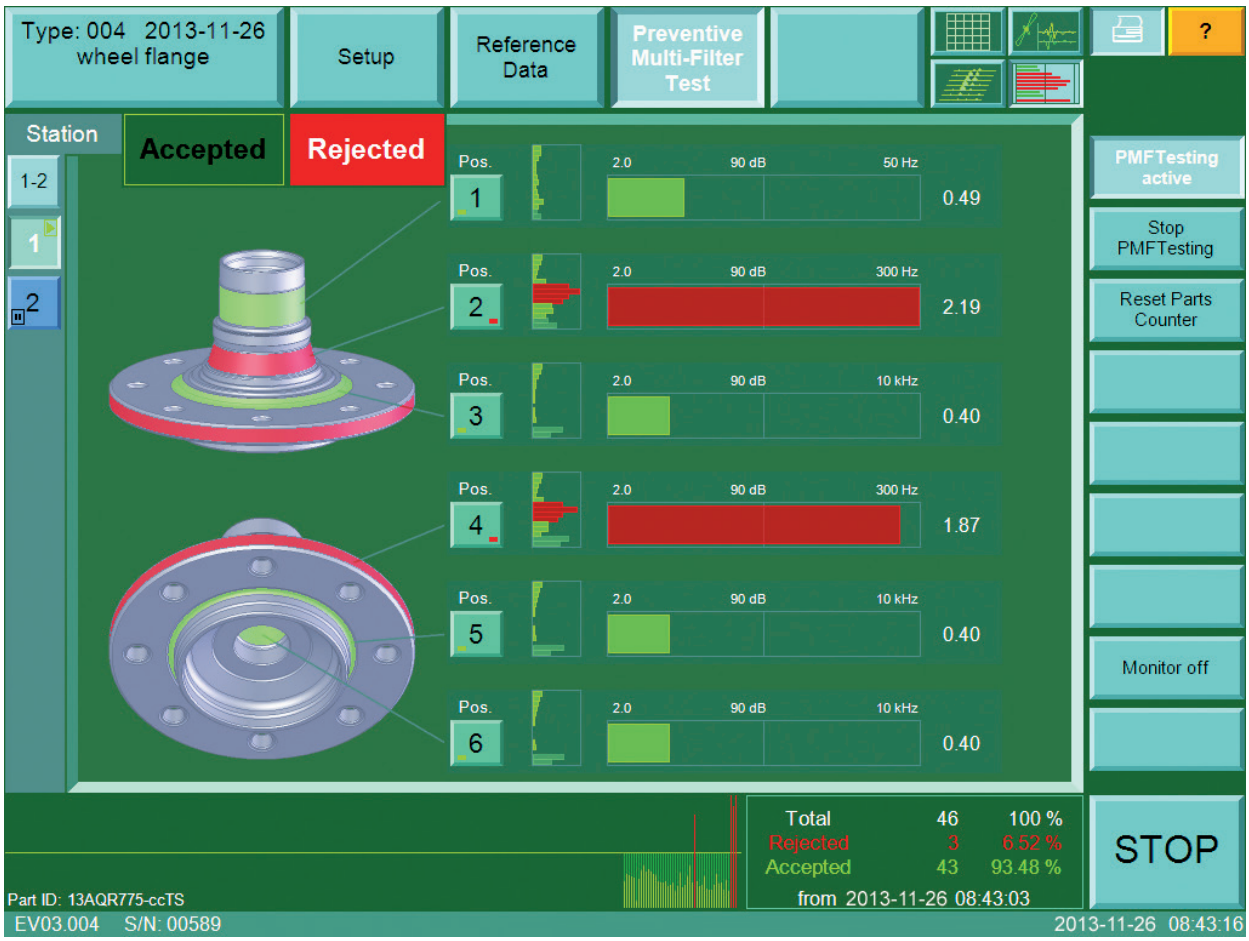
- **Displays**
  Display of test results as bargraph, xy-diagram with tolerance zones and x(t) and y(t) or three-dimensional C-scan display can be selected. The C-scan (or waterfall diagram) is a rotationally synchronized display of test signal from part circumference enabling local allocation of defects on the surface.

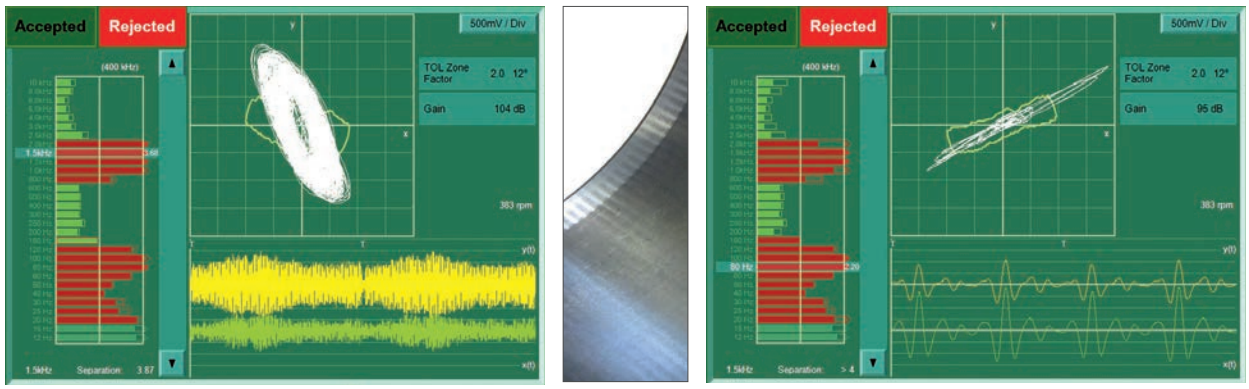
- **Frequency range**
  The carrier frequency is selectable within a range of 3 kHz to 10 MHz in 21 steps. The filter frequencies of the 30 band pass filters distribute in the range of 6 Hz to 20 kHz.

- **Trigger of test**
  Manually on the instrument, via PLC or by optional start button.


Highest test reliability and sensitivity - different kinds of probes for crack and grinder burn detection. Back left a rotating head eddyscan H for testing a string of parts and bars, back right a rotating head eddyscan F for testing of boreholes and surfaces.

Crack detection of a wheel hub at six locations on inside and outside. Each location has its own reference data generated from good parts. View of the test areas and their results colour highlighted on the screen.



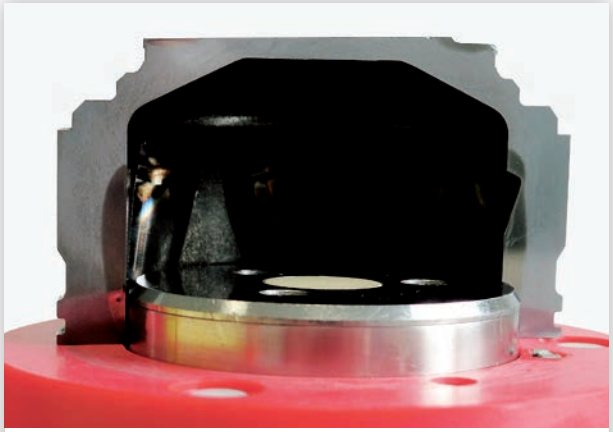




Left: eddy current signals from grinder burn chatter is detected in a high filter frequency range.Test is on bearing ring.

Right: signals of the same test on the same bearing ring but in a lower filter frequency range detect additional grinder burn signals at two opposite locations on part circumference. These signals are due to grinder burn caused by ovality of the inner diameter. Due to the Preventive Multi-Filter Technology with 30 simultaneously working band pass filters, unexpected as well as expected defects are detected. Such unexpected defects would be passed as OK by conventional instruments with only one frequency band.

## Structure test

A difficult problem for in process inspection of mass parts is supervision of heat treatment results. Verification of features like correct case depth and hardness are of prime importance for meeting the quality standards of the final product. These features can be monitored by destructive methods like sampling but with concurrent high personnel and financial effort. Moreover, a sampling inspection is sensible for statistically distributed defects only. During heat treat processes in furnaces or induction hardening, accidents involving single parts and that violate statistical distribution laws happen. These “unexpected” defects can be missed by sampling. 100% testing is required to reliably detect them.



ID coil for structure test on a continuous velocity joint for correct case depth and position of hardness zone.

Eddy current structure test utilizing the well known Preventive Multi-Frequency Technology (PMFT) by ibg guarantees maximum test reliability in 100 % testing. Heat treatment results in serial testing can be monitored cost efficiently, quickly and reliably, and unexpected defects are detected with highest reliability. The eight test frequencies of the fundamental wave as well as analysis of two harmonics of the PMFT guarantee highest reliability. The field of application for PMFT with simultaneous harmonic analysis is very wide and includes testing surface hardness, case depth, intermediate structure, material mix-up and others.

Setting of the instrument is done with good parts only. Ten to 20 parts are presented to the instrument, and tolerance zones are formed automatically. Eddy current signals from subsequent parts are now compared with these good parts. That means that no artificial defects are required for calibration, only known good parts. Due to the high test speed and the easy setup a new test task is ready to start within shortest time. Another advantage is the multi-dimensional analysis of ibg test instruments. An individual tolerance zone is formed for each test frequency. If all tolerance zones are satisfied, one can assume that the tested part is okay. Even one single not satisfied tolerance zone classifies the part as not good.

Eddy current tests are always comparative tests with yes/no answer. Very small deviations in the group of parts can be detected. Eddy current cannot answer why there is a deviation. In case of a bad part another test is recommended like metallurgical methods to inspect the structure (cut) or a classic hardness test.


Fixture for manual eddy current structure test in the lab.

## NEW: Simultaneous Harmonic Analysis iSHA

The relative permeability is strongly influenced by heat treatment processes. Hardened structures have a lower permeability than soft. Because the ibg Preventive Multi-Frequency Technology tests with small magnetic fields hardened OK parts show no saturation effects. It's within the linear range of the hysteresis curve.

Harmonics occur by each hysteresis of the magnetisation curve of a test part in the coil arrangement. The sinusoidal current in the exciter coil leads to a sinusoidal field strength which induces a magnetic flux in the test part. Its chronological sequence, however, is (depending on formation of permeability) not sinusoidal anymore. Therefore the sequence of the magnetic flux in the receiver coil induces a distorted voltage, deviating from the real sine even at small field strengths.

The fundamental waves, having been distorted by hysteresis, contain higher frequency harmonics. Fourier analysis of the distorted fundamental waves reveals the higher frequency harmonics, more precisely harmonics of the 3, 5, 7 or 9 times frequency. The analysis of these harmonics supplies a more detailed view of the magnetic features of the part and thus more exact information on the formation of microstructure. In addition, it offers significant advantages when suppressing interferences like batch scattering, part geometry and part temperature or positioning effects. Harmonic signals are very small. That's why immense electronic effort is needed in order to distinguish them from the basic noise. Such small signals can be detected clearly and processed robustly by ibg's unique digital eddyvisor instrument family.

An essential innovation is iSHA (ibg's Simultaneous Harmonic Analysis) - combined with ibg's PMFT it guarantees highest possible test reliability. It enables simultaneous calculation of vectors of the fundamental wave at eight frequencies and of two harmonics without extension of test time. It additionally uses high frequencies and their harmonics for a better solution of even smallest structure differences. Thus iSHA greatly enlarges the possibilities of the well-known Preventive Multi-Frequency Technology.

## NEW: Temperature adaptive structure test iTAS

Eddy current testing is based upon the electric conductivity and the magnetic permeability characterising the material to be tested. Different materials and microstructures have different conductivities and permeabilities that are detectible by eddy current. However, both properties also show a temperature dependency. Electric conductivity decreases by 4 % per 10°C. Variations of ambient temperature are compensated by ibg by means of the differential coil principle. Test coil is compensated by a separate compensation coil giving a differential test.

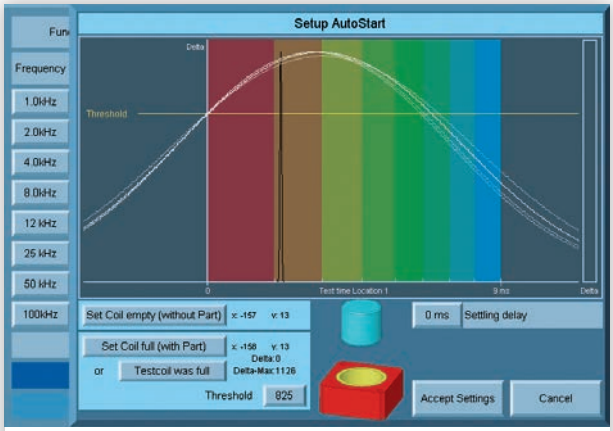
However, test parts are often heated up by production processes and cool down during pauses of production. Thus they have different temperatures when tested. This leads to an erroneous NG sorting.

ibg's new Temperature Adaptive Structure Test (iTAS) considers the influence of temperature fluctuation on the measuring values. If the temperature of the test parts can be captured by an external sensor that is directly connected to the eddyvisor, the influence of the temperature can almost be entirely compensated. Test parts appear as if tested at the same temperature. Pseudo reject is reduced and the test is more precise. The iTAS also enables quick visualisation of how big part temperature influence is in comparison with other parameter fluctuations (batch and dimension differences etc.) for a specific test application.

## Features of structure test

- **Tolerance zones**
  During material data recording the eddyvisor automatically generates elliptic tolerance zones calculated for reliable testing. A tolerance zone editor is integrated for special situations in the structure test field. A skilful operator may freestyle the fields as rectangle, or ellipse, reduced or expanded, rotated or moved, etc.

- **Test speed**
  High speed testing within milliseconds. Using eight test frequencies and standard setting (25 Hz - 25 kHz), only 141 milliseconds are needed for the test. In high speed mode only 1 ms is needed for each test frequency > 5 kHz, very useful for very high speed dynamic testing.




NEW: Rapid AutoStart enables much speedier and more precise automatic triggering. A graphic display eases set up for fast or dynamic tests.

- **iSHA harmonics analysis**
  Eight test frequencies of the fundamental wave plus two harmonics (2nd to 9th arbitrary) for each of the eight test frequencies can be utilized without extension of test time. The standard setting is evaluation of the 3rd and 5th harmonic on each of the eight fundamental waves.

- **Display**
  Display of test results as bargraph diagram, single ellipse or multiple ellipse display selectable.

- **Coils**
  A multitude of standard encircling coils up to a diameter of approx. 500 mm and probes for structure test are available for standard applications. Special applications may be solved by custom designed inner diameter I.D. coils or by rectangular coils which are designed and manufactured in house. Monitoring of coil and cable failure as well as 50/60 Hz noise suppression can be activated.

- **Triggering of test**
  Start of test can be done manually at touch screen, via PLC or optional start button. There is an auto-start function that detects the part in the test coil and activates testing immediately or after an adjustable delay time.

- **Test frequencies**
  Eight frequencies in a range of 5 Hz to 3 MHz are selectable.

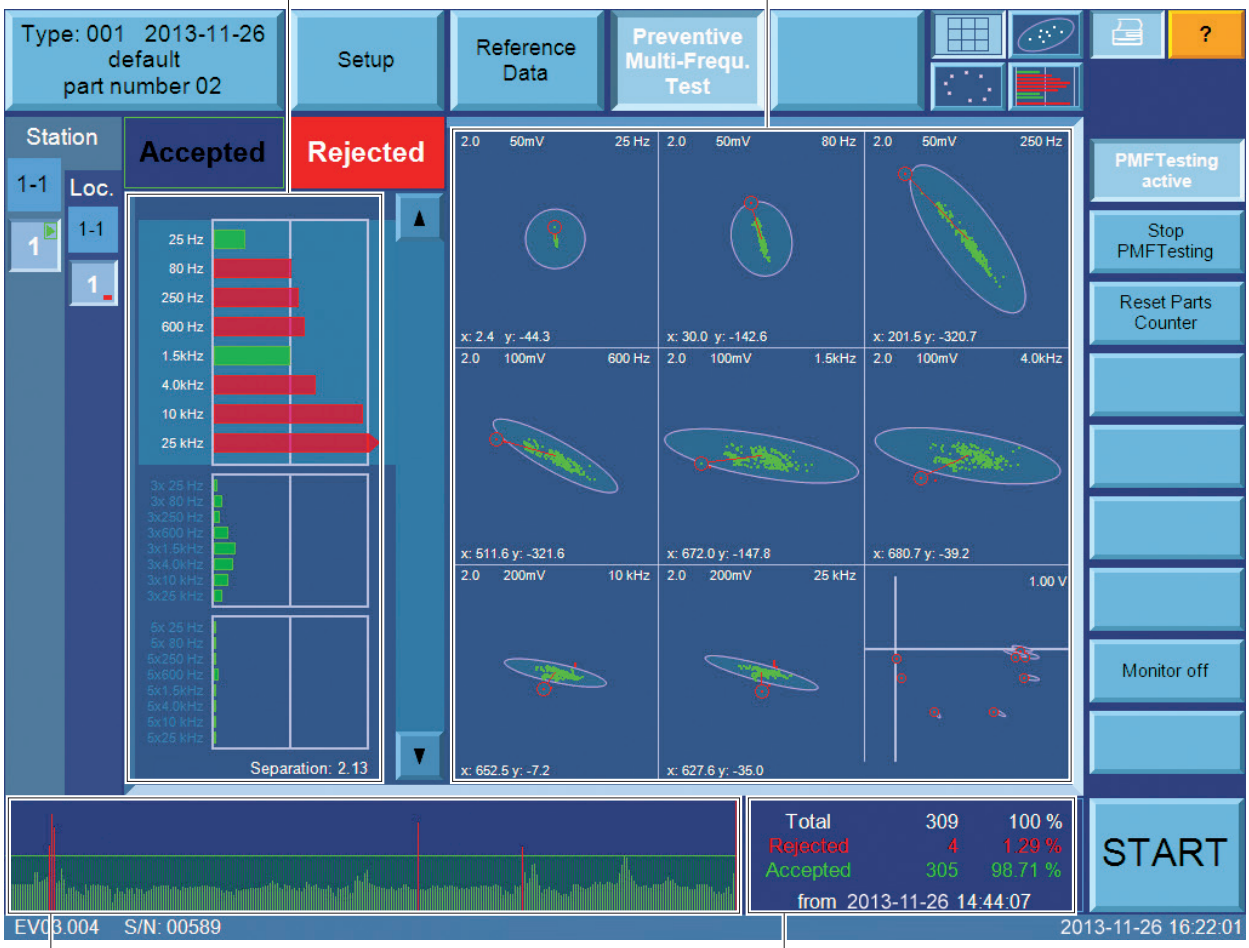
- **Classification**
  Sorting of different materials and testing of mixed batches can be accomplished with the ibg classification function (OR-conjunction). Up to seven good part types with different characteristic can be taught and during testing compared to the taught types and classified according to their part type.

- **Bar and tube test (option)**
  Bars, tubes and wire can be tested in line to verify material, heat treatment and density differences as well as structure changes. Two proximity switches are used to trigger start and end of test. Nearly the entire bar/tube length is tested. An integrated statistical evaluation of the good versus not good tests (absolute and percentage) is automatically updated. A threshold for an allowable percentage (adjustable) of not good tests can be utilized to eliminate rejects caused by irrelevant local material property variations (e.g. from cold working from handling).

Highest test reliability and temperature stability - coils and probes offered by ibg.

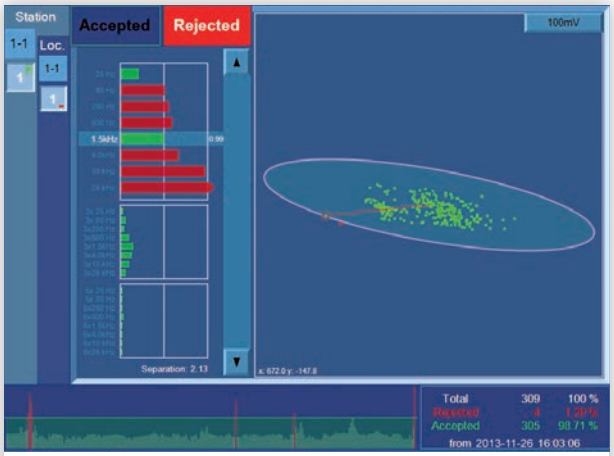
Bargraph display of the latest test result of eight fundamental waves (large) and the third and fifth harmonic (small)

Survey of all test results of eight fundamental waves in the relating tolerance zone




History of test results

Parts counter



Single ellipse display of all test results at one fundamental wave frequency

Bargraph display of test result

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## General features

- **Ergonomic design**
  All functions and test results including for complex systems are clearly arranged to be viewed at a glance. This enables correct and easy operation even for inexperienced operators.

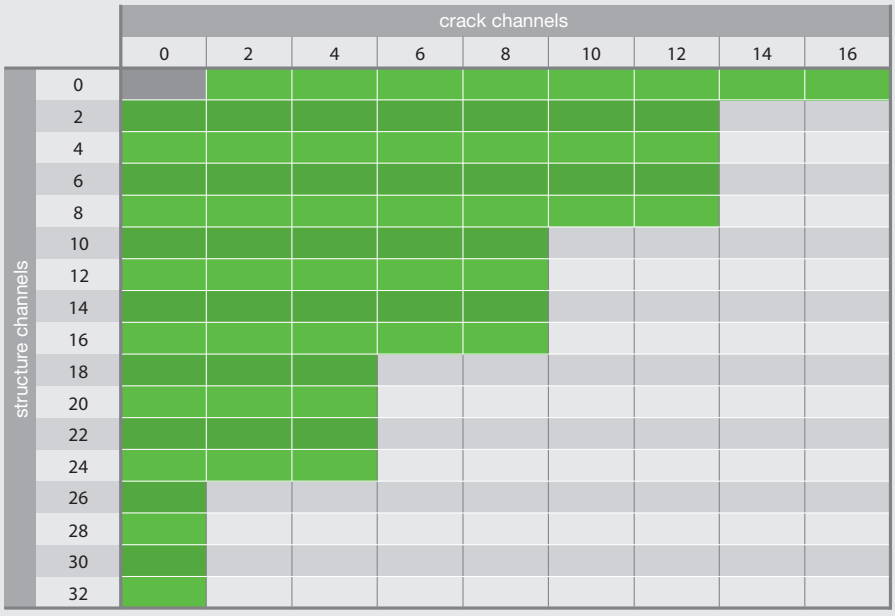
- **Stations and locations**
  The eddyvisor offers a unique station and location concept for solution of complex applications. Maximum eight stations can be defined which may include up to 32 locations. All test locations of one station belong to the same part and are summed up in a station result. This result can be taken for sorting. The part must be tested at all locations of that station in order to get a valid station result. Stations are independent from other stations. Different stations can take different operating conditions. For exapmle, one station can be testing parts, and another station can be recording new calibration data or being adjusted.

  In addition, each location has its own set of reference data and tolerance zones. For crack detection, for instance, it is possible to define different areas of a test part (faces, radii, undercuts etc.) and to test each of them with different settings switchable via PLC on the fly. So each area of a test part, including areas with high basic noise (e.g. radii) or with very low basic noise (e.g. high precision machined or super finished surfaces) can be tested with the setting optimised for that area without disturbing testing of the other areas.

- **View of test part**
  At stations with at least two and maximum 22 locations a picture of the test part created by customer may be included. The test result of the single locations of the station is visualised by colouration of the test part picture. A huge help for the operator especially in test system with complex setup. These test part pictures can be displayed in the survey of all stations as well (however, w/o colouration of result).

- **Part types**
  Maximum 100 part types (at more than eight locations max. 50) in crack detection and max. 250 part types in structure test with all settings and reference data can be stored in the device memory and switched over manually or via PLC for automated processes.

- **Part ID**
  Test data for individual parts can be allocated to the part. The eddyvisor can be informed before the test of an alphanumeric serial number from a PLC or another system (QR-code reader or similar). This identity is connected with the related test data, stored in the eddyvisor and additionally written via the eddyLogger Software or as Q-DAS compliant set of data. Indispensable for back tracing individual parts.




**Combination of channels eddyvisor**

realised with one eddyvisor
a second instrument is required

- **History of reference parts**
  The histogram displays the test results of all reference parts at a glance. When after recording of reference parts and afterwards crosschecking in the laboratory it is determined that a part is still not good, it can be removed from the reference parts with one keystroke.

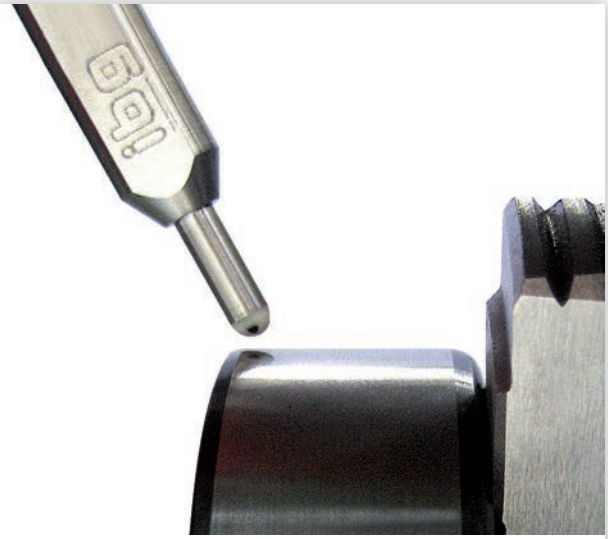
- **History of sorting parts**
  The multi-coloured histogram displays the test results of up to 1000 sorted parts and additionally the last 100 bad parts, so they can be observed at a glance and evaluated later. Test results of questionable rejected parts can be recorded as tentative reference parts and later destructively cross checked in the laboratory. If such questionable rejected parts are later found to be good, they can be added to the reference parts with one keystroke. Pseudo rejects can be diminished.

- **AQDEF quality data export**
  **QDAS standard compliant (option)**
  Test data are transferred after termination of each test part via Ethernet to a protocol computer where the free eddyLogger Q-DAS software receives the data and provides them AQDEF compliantly to the QS-STAT interface. The software allows the user an individual configuration. The following options are available per test station: selection of data to be stored; storage with K-field or abbreviated separator spelling; memory format as DFD/DFX or DFQ files; free choice of amount of test parts to be stored per file. The eddyLogger software may record and administrate parallel the test data of several ibg instruments within one Ethernet network so that one acquisition computer is able to supervise several eddyvisor and/or eddyliner instruments.

- **Data storage in general**
  Test results, part types and instrument settings are stored internally on a tough flash-memory and externally via USB stick. Test results may be additionally logged via network. A ring buffer logfile records all internal failures and allows fast debugging for service.

- **Automation without PLC**
  Direct control of sorting devices, paint marking systems or indicating lamps is possible with the integrated 24 Vdc (2.5 amps) power supply, together with the autostart function providing a low cost solution for small automated systems without an additional PLC.

- **Counter preset**
  The function “box counter” monitors the filling height of containers to avoid overfilling. Testing is paused automatically as soon as a preset value of tested parts is reached. The operator changes the containers and reset the counter, testing starts again automatically.




Crack and grinder burn detection on a bearing ring using a spherical X-type differential probe manufactured by ibg.

- **Remote control**
  The eddyvisor is remote controlled by each network PC via VNC viewer software.

- **Access protection**
  The instrument offers a multi-level access authorisation concept that operates by keyswitch.

- **Help function**
  The user always has access to a context sensitive help function on the device screen which often renders a look into the manual unnecessary.

- **Languages**
  Included are: German, English, Spanish, French, Italian, Czech, Polish, Portuguese, Chinese, Hungary, Japanese, Korean and Russian. Other languages as option.

- **Screen**
  Tough 15” TFT touch screen, colour display, resolution 1024 x 768 pixel, operable with gloves.

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## Connections

- **IO ports**
  An optically insulated interface with 32 in- and 32 outputs is available for PLC connection. As option, a further module with additional 32 in- and 32 outputs can be installed. An allocation of the signals to the IOs is free in the eddyvisor.

- **Gigabit-Ethernet network**

- **XVGA**
  The screen may be displayed on another screen by means of the XVGA-interface. Essential for trainings.

- **Printer**
  A usual printer can be connected via USB 2.0 or Ethernet to print screens or protocols.

- **USB 2.0**
  Two USB 2.0 ports at the front, one underneath for data storage.

## Housing

- Two models of eddyvisor are available: Desktop version eddyvisor D (with retractable feet, inclined) or as separated switch panel version with operating unit eddyvisor HMI and measuring unit eddyvisor M.

- completely sealed and thus suitable for rough production environment.

## Technical data

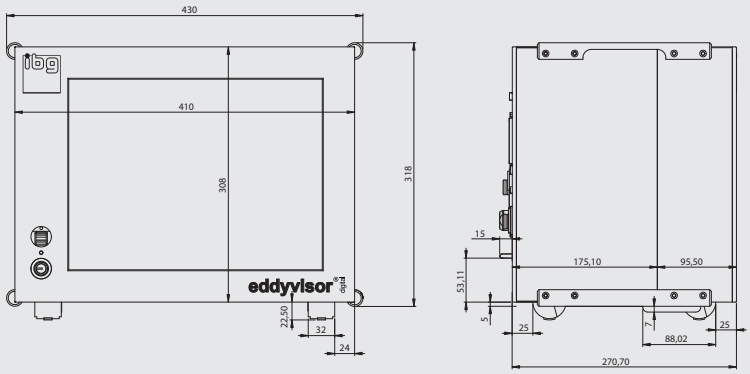
Mains: 100 - 240 V, 50/60 Hz
Ambient temperature: 0 - 45°C
(desktop version 0 - 40°C)
Relative humidity: max. 85 %, non-condensing

Dimensions (w x h x d) / Weight:

| | | |
|---|---|---|
| eddyvisor D | 430 x 335 x 271 mm | / 13 kg |
| eddyvisor HMI | 410 x 308 x 96 mm | / 6 kg |
| eddyvisor M | 410 x 308 x 175 mm | / 7 kg |

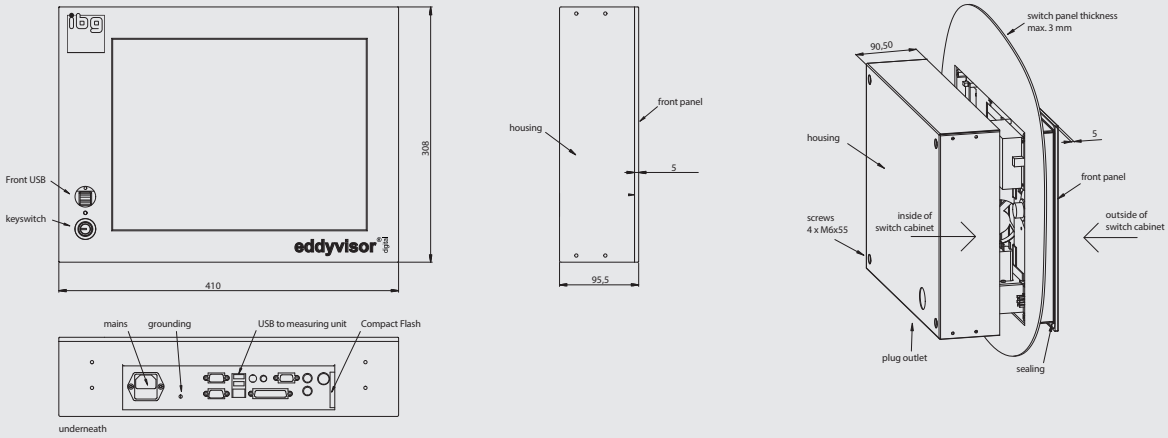

Rear side eddyvisor, equipped with (from left) crack detection module 4-channel, structure test module 8-channel, IO module, mains

## eddyvisor desktop version

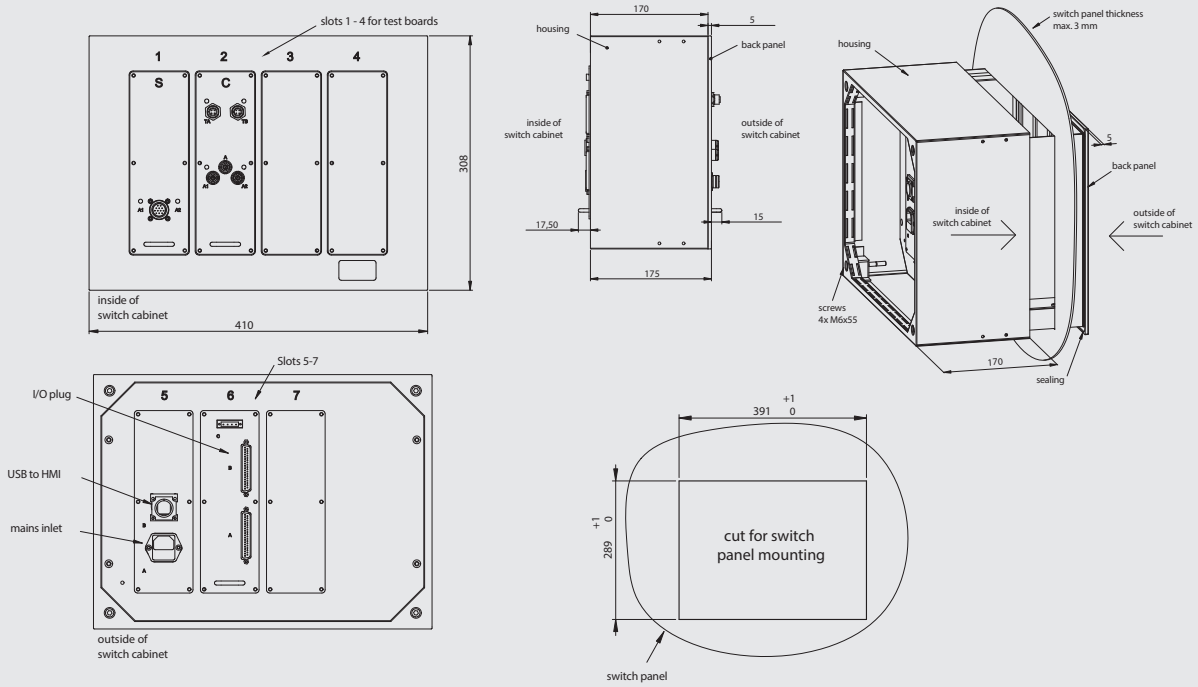



## eddyvisor switch panel version

### HMI




### measuring unit



# Eddy Current Technology


**Instruments**

**Coils and Probes**

**Automation**

For more than 30 years, the ibg group has been a market leader manufacturing eddy current test instruments and setting technology standards. Whether for multi-frequency structure verification, automatic tolerance zone generation or multi-filter crack and grinder burn detection - again and again innovations and inventions of the ibg developers shape the market and provide advanced testing solution.

The headquarters is situated in Ebermannstadt, Upper Franconia, and together with subsidiaries in the US, Switzerland and Great Britain as well as a competent worldwide partner network, we service our customers in industry and automotive engineering.

Quality Management ISO 9001

Made in Germany

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Eddy Current
Technology


# eddyliner® digital S

Digital eddy current test instrument for one channel nondestructive testing of metal components, mass produced parts and semi-finished products according to the Preventive Multi-Frequency Technology (PMFT).

Testing for material properties such as hardness, case depth, structure, tensile strength, heat treatment or alloy.

www.ibgndt.ch

# eddyliner® digital S


Selection of components - applications solved by ibg technology

The eddyliner digital S distinguishes itself with compact design and concentration on one channel structure applications with one coil at one location combining that with the well-known ibg test reliability and ease of operation. The ergonomic interface facilitates intuitive and simple operation via touch screen. All functions and test results are captured at a glance.

The eddyliner is based on the ibg system concept proven for decades. All coils and probes of the ibg system family can be used. The eddyliner is therefore recommended not only for the solution of new tasks but also as an upgrade for existing installations to be equipped with state-of-the-art eddy current technology.

Digital processing of the measuring signal with special processors immediately after the pre-amplifier guarantees highly stable test results.

Calibration with ibg's unique "good-part-only-concept" enables setup within a few minutes true to the motto: "Do you still calibrate or are you already testing?" An adequate number of good parts is recorded as reference parts. From the eddy current signals tolerance zones are automatically generated encompassing the metallurgical magnetic fingerprint of the group of good parts for all PMFT test frequencies. After recording of good parts, testing can be immediately started. Faster starting yet more reliable eddy current testing is not possible.

## Product features

- **Tolerance zones**
  When recording material data the eddyliner automatically generates elliptical tolerance zones for a reliable test. A tolerance zone editor is integrated for special applications enabling the skilled user to freely define the zones in rectangular or elliptical form.

- **Harmonics analysis**
  In addition to the eight fundamental test frequencies, two harmonics ($2^{nd}$ to $9^{th}$ harmonic selectable) for each test frequency can be turned on and simultaneously evaluated without increasing the test time.

- **Histogram**
  The ibg multi-coloured histogram displays the test results of all reference data. The last 100 bad parts and up to 1,000 good parts can be observed at a glance and evaluated later, an essential function when reference parts are first recorded and afterwards crosschecked in the laboratory. Questionable NG parts, later found to be good, can be added to the reference parts with one keystroke.

- **Display of results**
  Test results are shown as bargraph, single ellipse or multiple ellipses, selectable.

- **Coils**
  A multitude of encircling coils up to a diameter of 500 mm as well as structure test probes are available for standard applications. Customised coils (i.e. ID coils and rectangular coils) for special applications are designed and manufactured in-house. Test coils may be connected either as ibg recommended compensating pair of coils or as self-compensating single coil. Monitoring of coil and cable failure as well as a 50/60 Hz noise suppression can be activated.

- **Activating test**
  Start of test can be manually at touch screen, via PLC or optional start button. There is an autostart function that detects the part in the test coil and activates testing immediately or after an adjustable delay time.

- **Test speed**
  High speed testing within milliseconds. Using eight test frequencies, a cycle rate up to seven parts per second with encircling coils and 25 parts with probes can be realised with standard settings.

- **Part type**
  100 part types with all settings and reference data can be stored in the device memory and switched over manually or via PLC for automated processes.

- **Data storage & transfer**
  Test results, part types and device settings are stored internally on a robust flash memory and can be exported via an USB stick or Ethernet connection. A ring buffer logfile records all actions and allows fast debugging for service purpose.

- **Automation without PLC**
  Direct control of sorting devices, paint marking systems or indicating lamps is possible with the integrated 24 Vdc (2.5 amps) power supply, providing a low-cost solution for small automated systems without an additional PLC

- **Remote control**
  The eddyliner is remotely operable by every network computer via VNC viewer software.

- **Access protection**
  The instrument provides a multilevel access authorisation concept that operates by pin code.

- **Help function**
  The user always has access to a context sensitive help function on the device screen which often renders a look into the manual unnecessary.

- **Languages**
  Included are: German, English, Spanish, French, Czech, Chinese, Hungary, Italian, Japanese, Korean and Russian. Other languages as option.

- **Screen**
  Tough 10.2” TFT touch screen, colour display, resolution 1,024 x 768 pixel, operable with gloves.


Rear side eddyliner S

## Connections

- **IO-Ports**
  optically isolated interface for PLC connection with 32 Inputs and 32 outputs
- **Network**
  Gigabit Ethernet network interface
- **Printer**
  Commercially available printers may be connected via USB 2.0 or Ethernet to printout test results
- **XVGA**
  XVGA interface allows connection to a monitor or projector, an essential feature for training courses

## Housing

- completely sealed and thus can be used in a dusty production environment
- desktop housing, inclinable by folding feet
- 19” rack installation as option

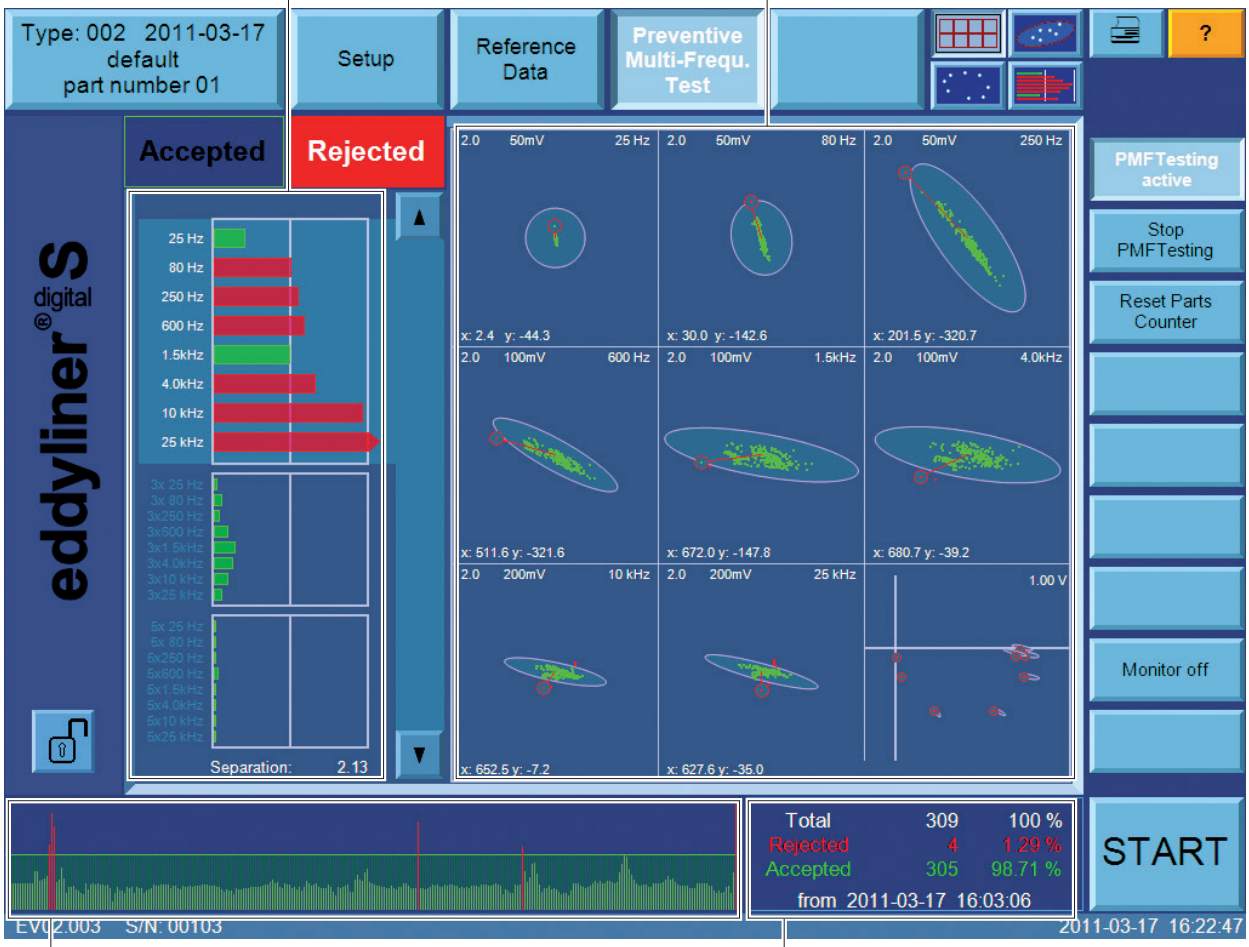
## Technical Data

Mains: 100 - 240 V, 50/60 Hz
Protection class: IP 41
Ambient temperature: 0 - 45°C
Relative humidity: max. 85 %, non condensing
Dimensions (w x h x d): 304 x 229 x 200 mm
Weight: 6 kg

High testing accuracy, sensitivity and temperature stability - a broad range of coils and probes provides excellent results in structure testing.

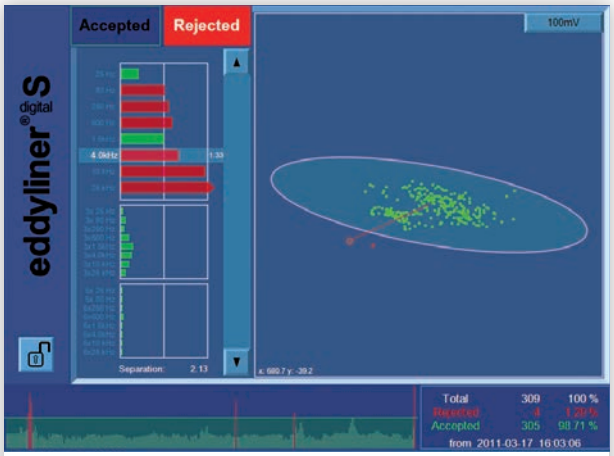
Bargraph display of the latest test result of the eight fundamental wave frequencies (large) and the third and fifth harmonic (small).

Survey of all test results of the eight fundamental wave frequencies in the relating tolerance zone.




Test result history

Parts counter




Single ellipse display of all test results at one fundamental wave frequency


Bargraph display of the test result

# Eddy Current Technology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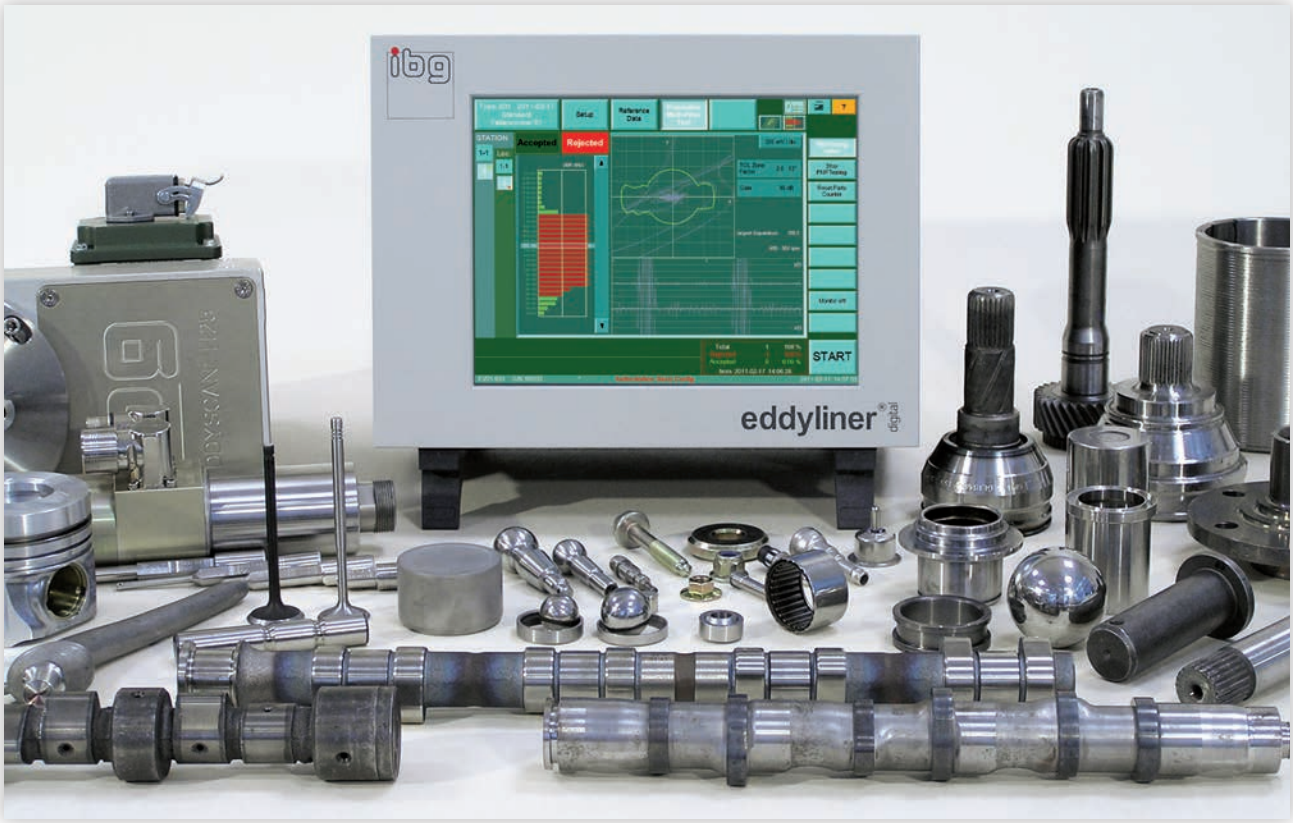
Eddy Current
Technology


# eddyliner® digital C

Digital eddy current test instrument for one channel nondestructive testing of metal components, including mass produced parts and semi-finished products for cracks, pores and grinder burn according to the Preventive Multi-Filter Technology (PMFT).

www.ibgndt.ch

# eddyliner® digital C




The eddyliner digital C distinguishes itself with compact design and concentration on one channel crack and grinder burn detection with one probe and combines that with the well known ibg test reliability and ease of operation. The ergonomic interface enables correct and simple operation via touch screen. All functions and test results are captured at a glance.

Digital processing of the measuring signal with unique processors, immediately after the pre-amplifier guarantees the greatest possible stability of test results.

The eddyliner is based on the ibg system concept proven for decades. All probes and rotating heads of the ibg system family can be used. The eddyliner is therefore recommended not only for the solution of new tasks but also as an upgrade for existing production machines to be equipped with state-of-the-art eddy current technology.

Up to now, competitive instruments require sophisticated and time-consuming manual determination and setting of suitable filter band, phase angle and gain. We replace that by the ibg exclusive development of Preventive Multi-Filter Technology (PMFT) with automatic tolerance zone creation. This quantum leap in the eddy current technology, unique to ibg worldwide, establishes a new standard for quality in crack and grinder burn detection.

During material data recording (calibration) with PMFT, surface areas of several good parts are scanned, and the good surface eddy current “noise” is recorded simultaneously in each of 30 band pass filters. Tolerance zones, enveloping 360 degrees, are automatically created within each filter band, capturing the allowable eddy current “noise” from good parts. The eddy current signals of good parts are the result of surface roughness and material properties. Thus, the thirty tolerance zones store the part specific fingerprint of the good parts. Additionally, edge effect, hardness profile run out, eccentricity, etc. of the good parts are calibrated during material data recording. Pseudo rejects are, therefore, reduced considerably without losing visibility to real flaws. Real flaws are now automatically detected no matter their frequency content or phase angle content. Even unexpected flaws that can be detected by eddy current are reliably detected.

This unique “good-part-only-concept” enables setup within a few minutes. Simply record an adequate number of good parts. One keypress switches to Preventive Multi-Filter Test and testing can start. That‘s all!

## Product features

- **Probes**
  A variety of crack detection probes are available with different scan width, sensitivity and design. Customised models for special applications are designed and manufactured in house. Our compact and precision rotating heads eddyscan H and eddyscan F, operated with our eddyliner, can be the solution for cycle time optimised crack tests. Monitoring of probe cable break guarantees maximum reliability for continuous operation.

- **Lift-off compensation**
  Eccentricity of a workpiece can be offset electronically thanks to lift-off compensation. This function requires special lift-off compensation probes.

- **Histogram**
  The ibg multi-coloured histogram displays the test results of all reference data, the latest 100 bad parts and up to 1,000 good parts at a glance. They can be evaluated later, an essential function when reference parts are first recorded and afterwards cross checked in the laboratory. If it turns out that some assumed NG parts need to be added to the reference parts it is just a matter of one keystroke.

- **Suspend**
  The suspend function enables areas on components such as holes not to be tested.

- **Part types**
  50 part types with all settings and reference data can be stored in the device memory and switched manually or via PLC for automated processes.

- **Displays**
  Test results are shown as bargraph, xy-diagram with tolerance zones, x(t) and y(t) or three-dimensional C-scan, selectable. The C-scan (or cascade diagram) provides a plannar display of a cylindrical surface to enable visualisation of defect position and length.

- **Frequency range**
  The carrier frequency is selectable within a range of 3 kHz and 10 MHz in 21 steps. The filter frequencies of the 30 band pass filters are spread in the range 6 Hz - 5 kHz.

- **Data storage**
  Test results, part types and device settings are stored internally on a robust flash memory and externally on an USB stick. Test results may additionally be logged via Ethernet. A ring buffer logfile records all actions and allows fast debugging for service purposes.

- **Activating test**
  Start of test manually at the touch screen, via PLC or an optional start button.

- **Automation without PLC**
  Direct control of sorting devices, paint marking systems or indicating lamps is possible with the integrated 24 Vdc (2.5 amps) power supply, providing a low cost solution for small automated systems without an additional PLC.

- **Remote control**
  The eddyliner is remotely operable by every network computer via VNC viewer software.

- **Access protection**
  The instrument provides a multilevel access authorisation concept that operates by pin code.

- **Help function**
  The user always has access to a context sensitive help function on the device screen which often renders a look into the manual unnecessary.

- **Languages**
  Included are: German, English, Spanish, French, Czech, Chinese, Hungary, Italian, Japanese, Korean and Russian. Other languages as option.

- **Screen**
  Tough 10.2” TFT touch screen, colour display, resolution 1,024 x 768 pixel, operable with gloves.


Rear side eddyliner C

## Connections

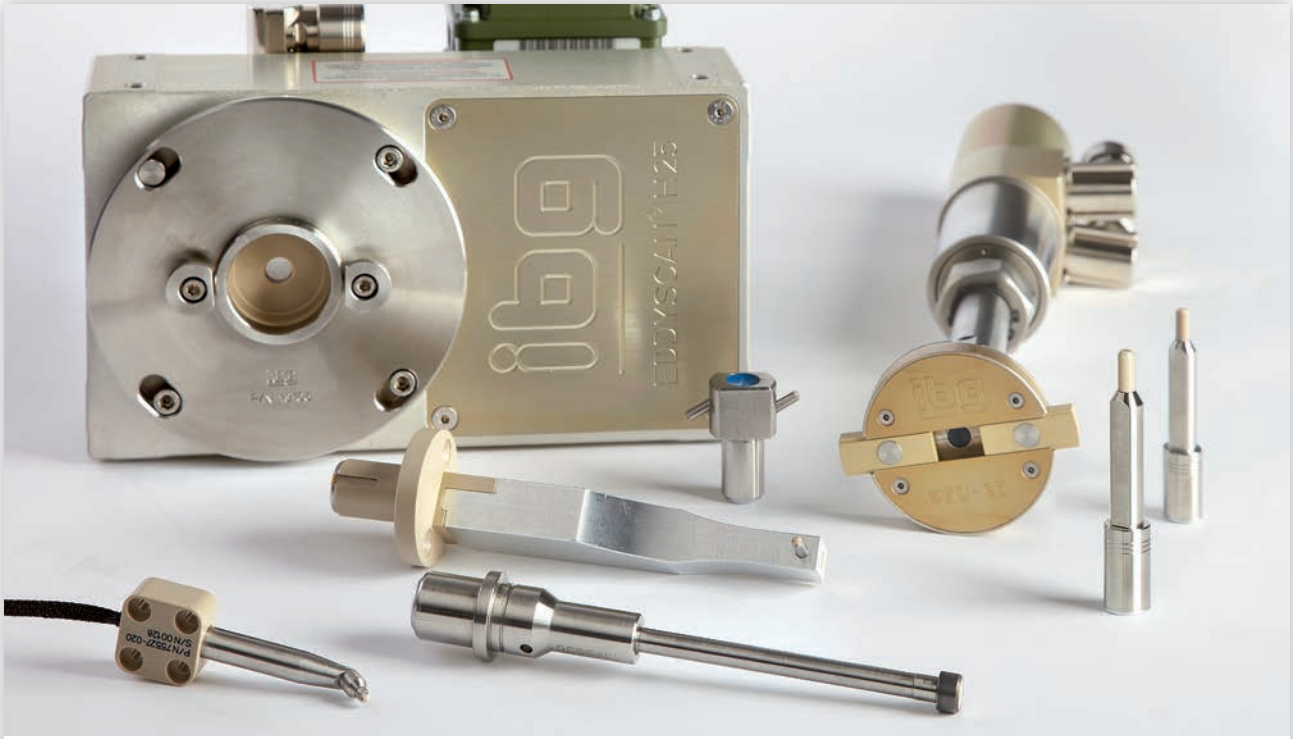
- **IO-Ports**
  optically insulated interface for PLC connection with 32 inputs and 32 outputs
- **Network**
  Gigabit Ethernet network interface
- **Printer**
  commercially available printers may be connected via USB 2.0 or Ethernet to printout test results
- **XVGA**
  XVGA interface allows connection to a monitor or projector, an essential feature for training courses

## Housing

- completely sealed and thus can be used in a dusty production environment
- desktop housing, inclinable by folding feet
- 19” rack installation as option

## Technical Data

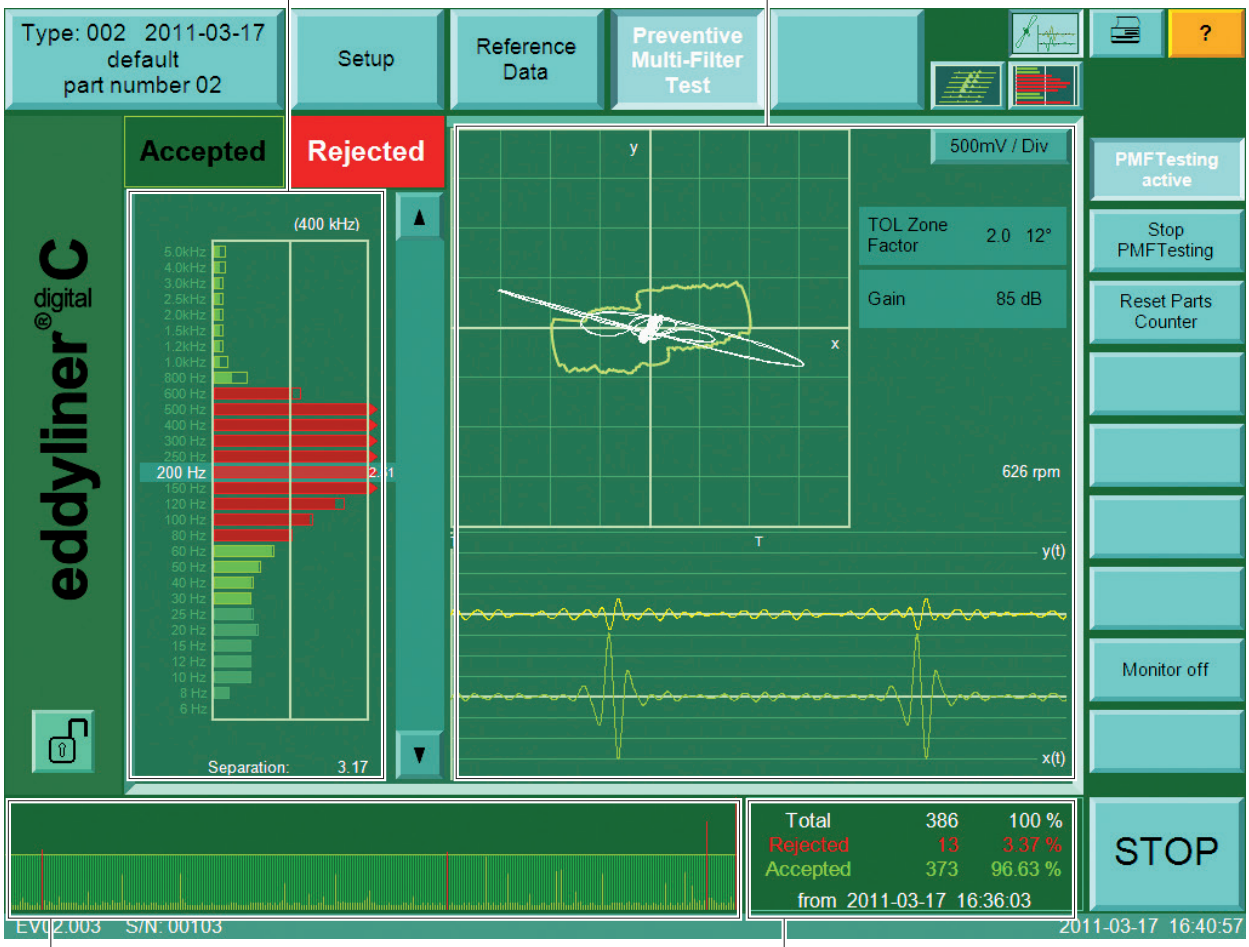
Mains: 100 - 240 V, 50/60 Hz
Protection class: IP 41
Ambient temperature: 0 - 45°C
Relative humidity: max. 85 %, non condensing
Dimensions (w x h x d): 304 x 229 x 200 mm
Weight: 6 kg



High testing accuracy, sensitivity and temperature stability - probes of different design for crack and grinder burn detection. Back-left an eddyscan H rotating head for testing parts in a line. Back-right an eddyscan F for testing boreholes and surfaces.

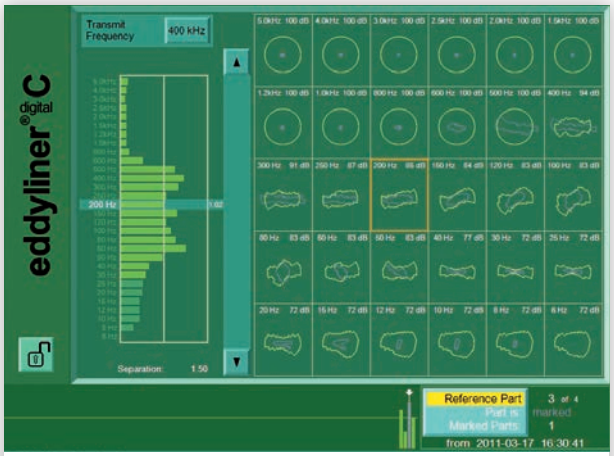
Bargraph display of the latest test results over all 30 band pass filters.

Classic signal curve display of a single band pass filter with relating good part tolerance zone.

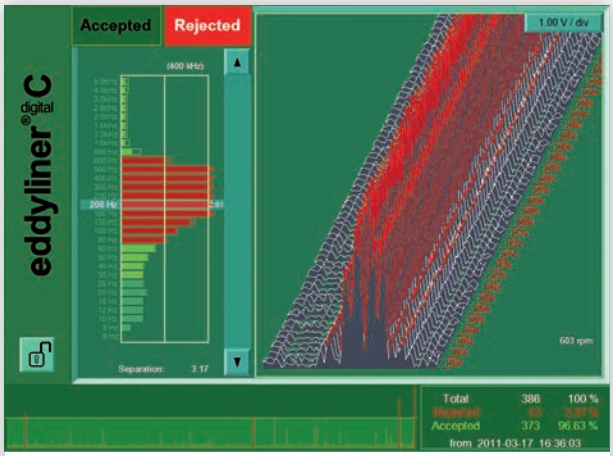



Test part history

Parts counter



Display of all 30 tolerance zones in material data recording



C-scan display of test result

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Testing for material properties such as hardness, case depth, structure, tensile strength, heat treatment or alloy.

www.ibgndt.ch

# eddyguard® digital S


Designed for the switching cabinet: eddyguard S in built-in situation.

The eddyguard S distinguishes itself with compact design and concentration on one channel structure applications with one coil at one location combining that with the well-known ibg test reliability and ease of operation. Configuration is effected by means of a PC or a laptop supplied by customer via the USB-port. The ergonomic interface of the PC-software facilitates intuitive and simple operation After configuration is finished the eddyguard may be disconnected from the PC/laptop. The eddyguard continues testing self-sufficiently.

The eddyguard is based on the ibg system concept proven for decades. All coils and probes of the ibg system family can be used. The eddyguard is therefore recommended not only for the solution of new tasks but also as an upgrade for existing installations to be equipped with state-of-the-art eddy current technology.

Digital processing of the measuring signal with special processors immediately after the pre-amplifier guarantees highly stable test results.

Calibration with ibg's unique "good-part-only-concept" enables setup within a few minutes true to the motto: "Do you still calibrate or are you already testing?" An adequate number of good parts is recorded as reference parts with connected PC/laptop. From the eddy current signals tolerance zones are automatically generated encompassing the metallurgical magnetic fingerprint of the group of good parts for all PMFT test frequencies of the fundamental wave and two harmonics. After recording of good parts, testing can be immediately started. Faster starting yet more reliable eddy current testing is not possible.

## Product features

- **Tolerance zones**
  When recording material data with a PC/laptop the eddyguard automatically generates elliptical tolerance zones for a reliable test. A tolerance zone editor is integrated for special applications enabling the skilled user to freely define the zones in rectangular or elliptical form.

- **iSHA Harmonic Analysis**
  In addition to the eight fundamental test frequencies, two harmonics ($2^{nd}$ to $9^{th}$ harmonic selectable) for each test frequency can be turned on and simultaneously evaluated without increasing the test time thanks to the iSHA-technology (ibg's Simultaneous Harmonic Analysis).

- **Display of results**
  (with connected PC/laptop only)
  Test results are shown as bargraph, single ellipse or multiple ellipses, selectable.

- **Coils**
  A multitude of encircling coils up to a diameter of 500 mm as well as structure test probes are available for standard applications. Customised coils (i.e. ID coils and rectangular coils) for special applications are designed and manufactured in-house. Test coils may be connected either as ibg recommended compensating pair of coils or as self-compensating single coil. Monitoring of coil and cable failure as well as a 50/60 Hz noise suppression can be activated. Ibg offers also a range of durable highspeed sorting devices for test parts up to 60 mm diameter.

- **Activating test**
  Start of test can be manually on the PC/laptop via PLC or optional start button. There is an autostart function that detects the part in the test coil and activates testing immediately or after an adjustable delay time.

- **Test speed**
  High speed testing within milliseconds. Using eight test frequencies, a cycle rate up to seven parts per second with encircling coils and 25 parts with probes can be realised with standard settings.

- **Part type**
  Maximum 20 part types with all settings and reference data can be stored in the device memory and switched over manually via PC/laptop or via PLC for automated processes.

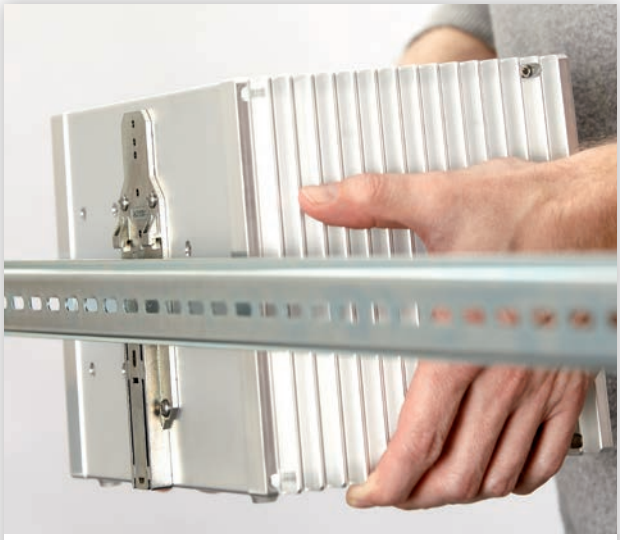
- **Data storage & transfer**
  Part types and instrument settings are stored on the PC/laptop and may additionally be saved e.g. onto an USB-stick.

- **Automation without PLC**
  Direct control of sorting devices, paint marking systems or indicating lamps is possible with merely an external voltage source 24Vdc, providing a low-cost solution for small automated systems without an additional PLC, too.

- **Operation / Configuration**
  by means of the delivered ibg operating software to be installed on a PC/laptop supplied by customer. System requirements: USB 2.0 and operating system MS Windows 7 (32 or 64 bit) or Windows XP (32 bit).

- **Help function**
  The software for the PC/laptop has a context sensitive help function which often renders a look into the manual unnecessary.

- **Languages**
  The software for the PC/laptop may be set to German, English, French, Spanish, Italian, Polish, Portuguese, Czech, Hungary, Chinese, Japanese, Korean and Russian. Other languages as option.



Installation on top hat rail

## Connections

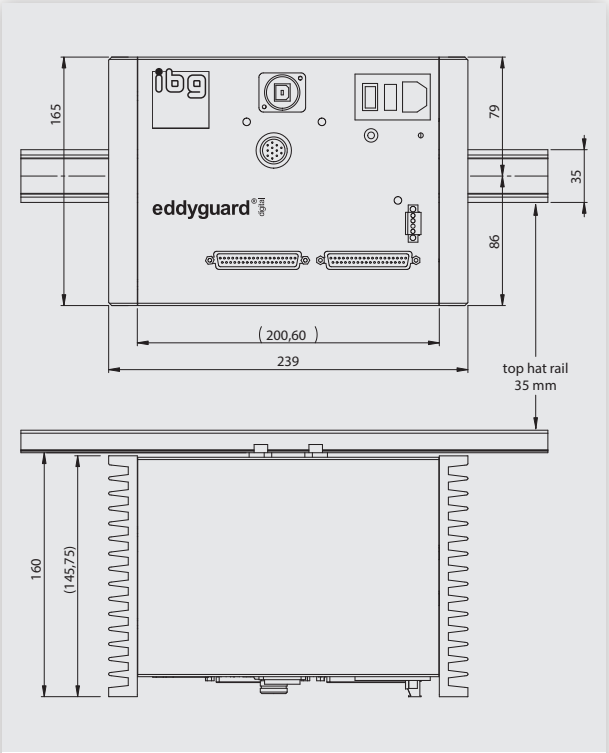
- **IO-Ports**
  optically insulated interface for PLC connection with 32 inputs and 32 outputs
- **USB 2.0**
  for connection of a PC/laptop supplied by customer

## Housing

- completely sealed and thus can be used in a dusty production environment
- for installation on top hat rail TH35 as per DIN EN 60715.

## Technical Data

Mains: 100 - 240 V, 50/60 Hz
Protection class: IP 41
Ambient temperature: 0 - 45°C
Relative humidity: max. 85 %, non condensing
Dimensions (w x h x d): 239 x 165 x 169 mm
Weight: 4 kg

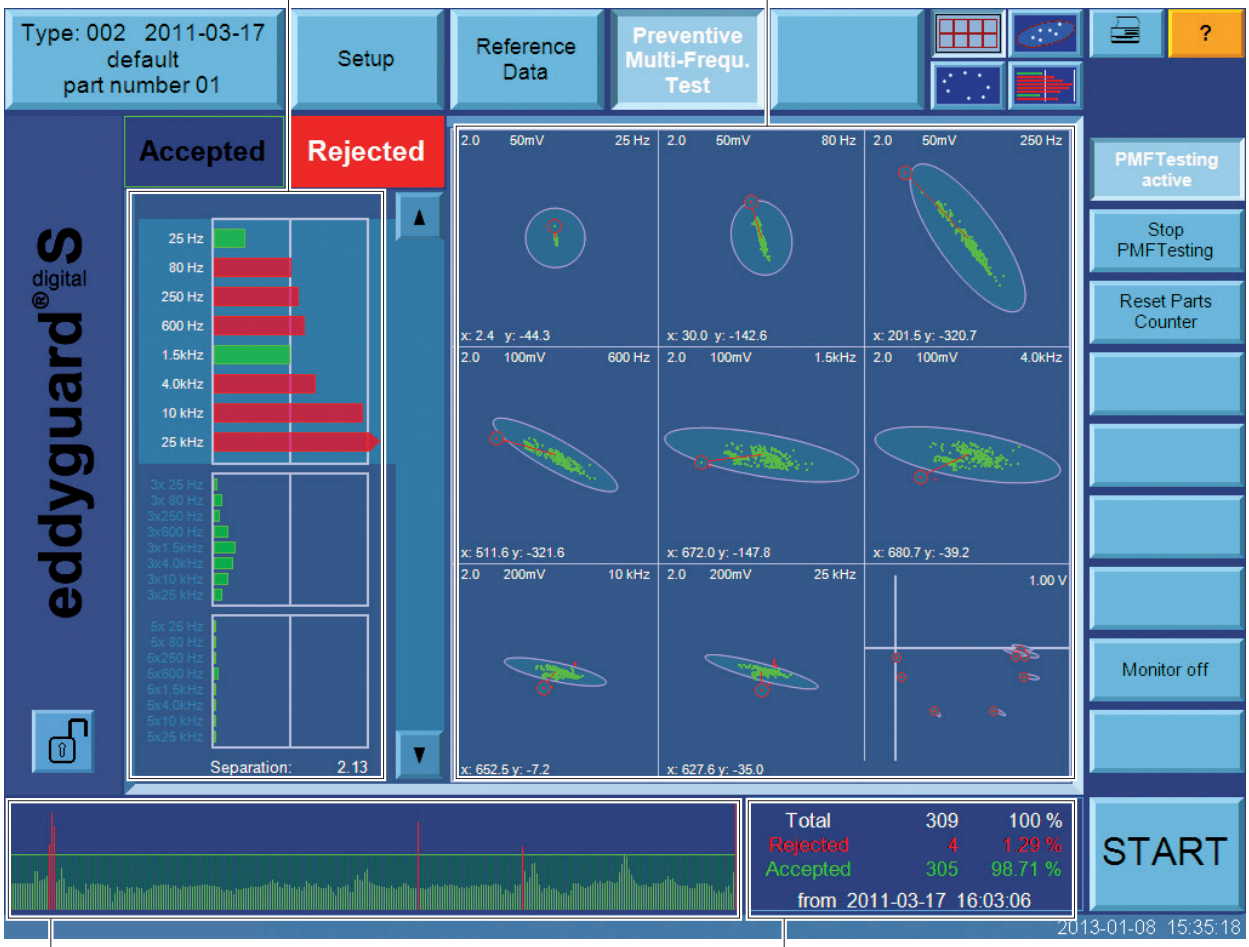



Dimensional drawing of the instrument

High testing accuracy, sensitivity and temperature stability - a broad range of coils and probes provides excellent results in structure testing.

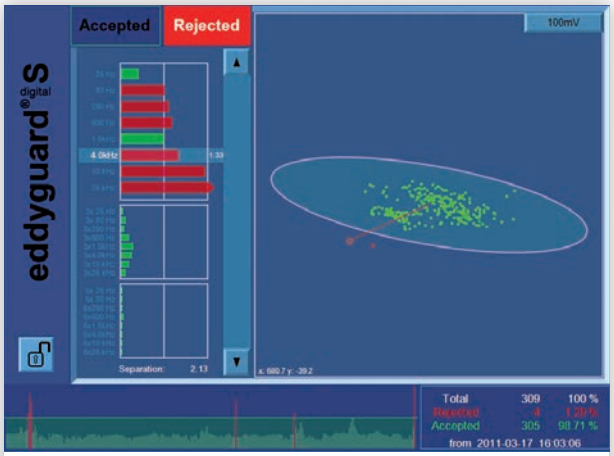
Bargraph display of the latest test result of the eight fundamental wave frequencies (large) and the third and fifth harmonic (small).

Survey of all test results of the eight fundamental wave frequencies in the relating tolerance zone.




Test result history

Parts counter




Single ellipse display of all test results at one fundamental wave frequency


Bargraph display of the test result

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Made in Germany

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Eddy Current
Technology


# eddyguard® digital C

Digital eddy current test instrument
for one channel nondestructive testing of
metal components, including mass produced parts
and semi-finished products for cracks,
pores and grinder burn according to the
Preventive Multi-Filter Technology (PMFT).

www.ibgndt.ch

# eddyguard® digital C


The eddyguard digital C distinguishes itself with compact design and concentration on one channel crack and grinder burn detection with one probe and combines that with the well known ibg test reliability and ease of operation. Configuration is effected by means of a PC or a laptop supplied by customer via the USB-port. The ergonomic interface of the PC-software facilitates intuitive and simple operation. After configuration is finished the eddyguard may be disconnected from the PC/laptop. The eddyguard continues testing self-sufficiently.

Digital processing of the measuring signal with unique processors, immediately after the pre-amplifier guarantees the greatest possible stability of test results.

The eddyguard is based on the ibg system concept proven for decades. All probes and rotating heads of the ibg system family can be used. The eddyguard is therefore recommended not only for the solution of new tasks but also as an upgrade for existing production machines to be equipped with state-of-the-art eddy current technology.

Up to now, competitive instruments require sophisticated and time-consuming manual determination and setting of suitable filter band, phase angle and gain. We replace that by the ibg exclusive development of Preventive Multi-Filter Technology (PMFT) with automatic tolerance zone creation. This quantum leap in the eddy current technology, unique to ibg worldwide, establishes a new standard for quality in crack and grinder burn detection.

During material data recording (calibration) with a PC/laptop with PMFT, surface areas of several good parts are scanned, and the good surface eddy current “noise” is recorded simultaneously in each of 30 band pass filters. Tolerance zones, enveloping 360 degrees, are automatically created within each filter band, capturing the allowable eddy current “noise” from good parts. The eddy current signals of good parts are the result of surface roughness and material properties. Thus, the thirty tolerance zones store the part specific fingerprint of the good parts. Additionally, edge effect, hardness profile run out, eccentricity, etc. of the good parts are calibrated during material data recording. Pseudo rejects are, therefore, reduced considerably without losing visibility to real flaws. Real flaws are now automatically detected no matter their frequency content or phase angle content. Even unexpected flaws that can be detected by eddy current are reliably detected.

This unique “good-part-only-concept” enables setup within a few minutes. Simply record an adequate number of good parts with a connected PC/laptop. One keypress switches to Preventive Multi-Filter Test and testing can start. That‘s all!

## Product features

- **Probes**
  A variety of crack detection probes are available with different scan width, sensitivity and design. Customised models for special applications are designed and manufactured in house.
  Our compact and precision rotating heads eddyscan H and eddyscan F, operated with our eddyguard, can be the solution for cycle time optimised crack tests. Monitoring of probe cable break guarantees maximum reliability for continuous operation.

- **Lift-off compensation**
  Eccentricity of a workpiece can be offset electronically thanks to the optional lift-off compensation. This function requires special lift-off compensation probes.

- **Suspend**
  The suspend function enables areas on components such as holes not to be tested.

- **Part types**
  Maximum 20 part types with all settings and reference data can be stored at the same time in the device memory and switched manually via the PC/laptop or via PLC for automated processes.

- **Displays**
  (with connected PC/laptop only)
  Test results are shown as bargraph, xy-diagram with tolerance zones, x(t) and y(t) or three-dimensional C-scan, selectable. The C-scan (or cascade diagram) provides a plannar display of a cylindrical surface to enable visualisation of defect position and length.

- **Probe distance**
  ibg probes are standard designed for a large distance between probe and test part of 0.7 mm. This considerably widens the scope for the requirements concerning parts preciseness and test mechanic.

- **Frequency range**
  The carrier frequency is selectable within a range of 3 kHz and 10 MHz in 21 steps. The filter frequencies of the 30 band pass filters are spread in the range 6 Hz - 5 kHz.

- **Data storage**
  Part types and device settings are stored on the PC/laptop and can additionally be stored on an USB stick.

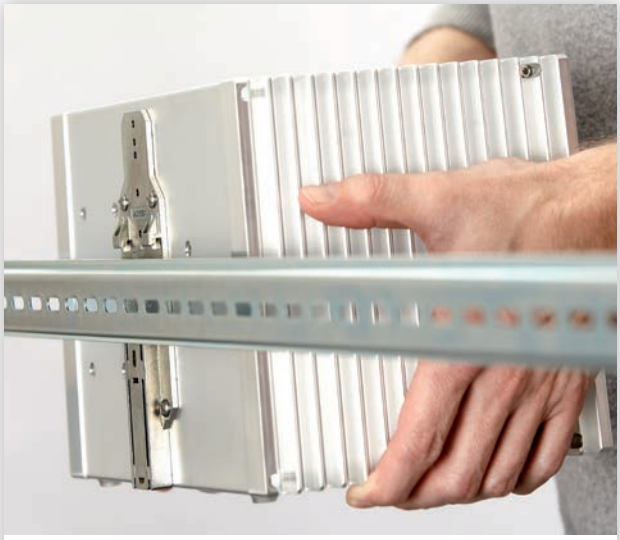
- **Activating test**
  Start of test manually on the PC/laptop, via PLC or an optional start button.

- **Automation without PLC**
  Direct control of sorting devices, paint marking systems or indicating lamps is possible with merely an external voltage source 24Vdc, providing a low cost solution for small automated systems without an additional PLC.

- **Operation / Configuration**
  by means of the delivered ibg operating software to be installed on a PC/laptop supplied by customer. System requirements: USB 2.0 and operating system MS Windows 7 (32 or 64 bit) or Windows XP (32 bit).

- **Help function**
  The software for the PC/laptop has a context sensitive help function which often renders a look into the manual unnecessary.

- **Languages**
  The software for the PC/laptop may be set to German, English, French, Spanish, Italian, Czech, Portuguese, Hungary, Polish, Chinese, Japanese, Korean and Russian. Other languages as option.



Installation on top hat rail

## Connections

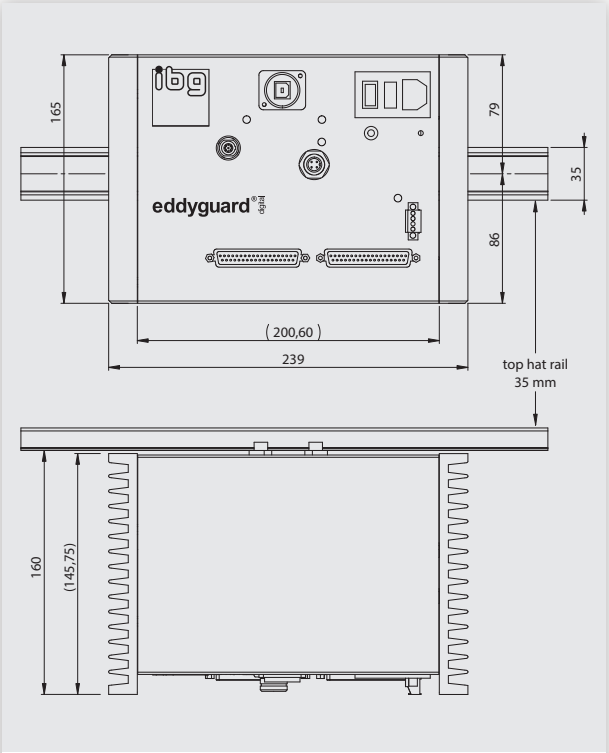
- **IO-Ports**
  optically insulated interface for PLC connection with 32 inputs and 32 outputs
- **USB 2.0**
  for connection of a PC/laptop supplied by customer

## Housing

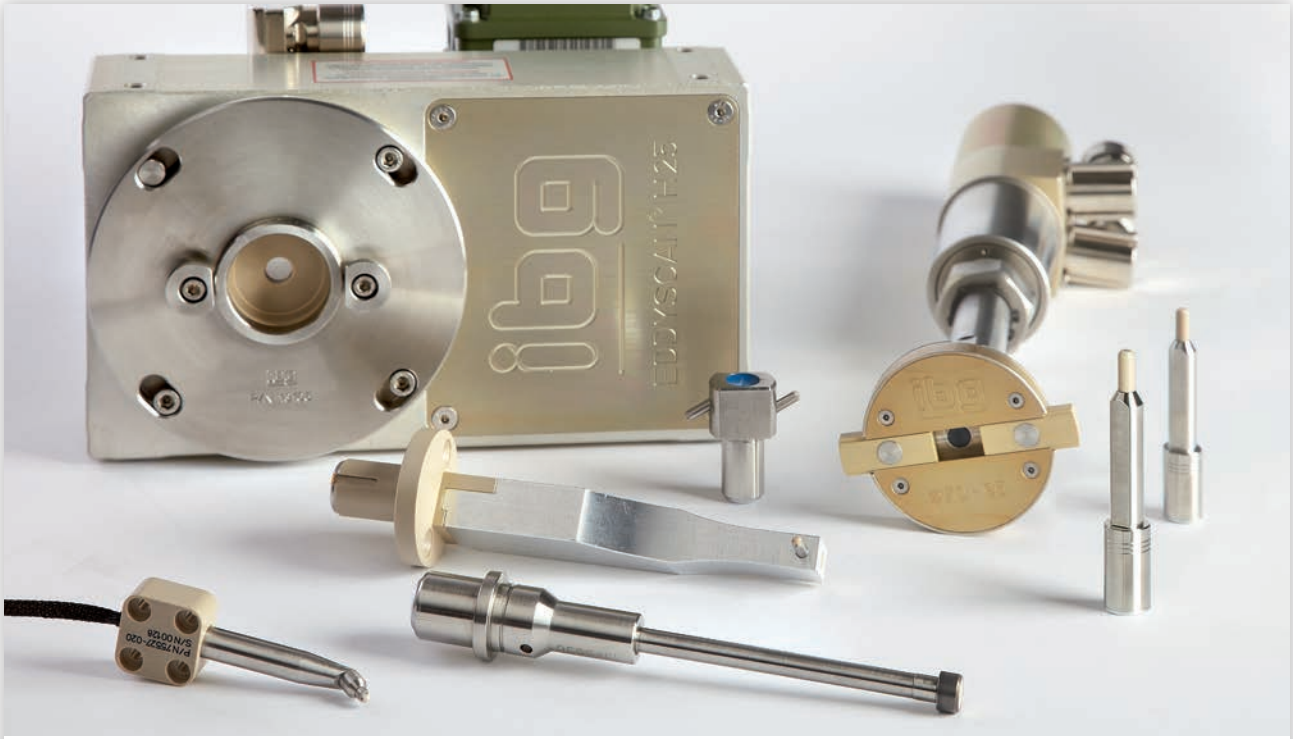
- completely sealed and thus can be used in a dusty production environment
- for installation on top hat rail TH35 as per DIN EN 60715.

## Technical Data

Mains: 100 - 240 V, 50/60 Hz
Protection class: IP 41
Ambient temperature: 0 - 45°C
Relative humidity: max. 85 %, non condensing
Dimensions (w x h x d): 239 x 165 x 169 mm
Weight: 4 kg



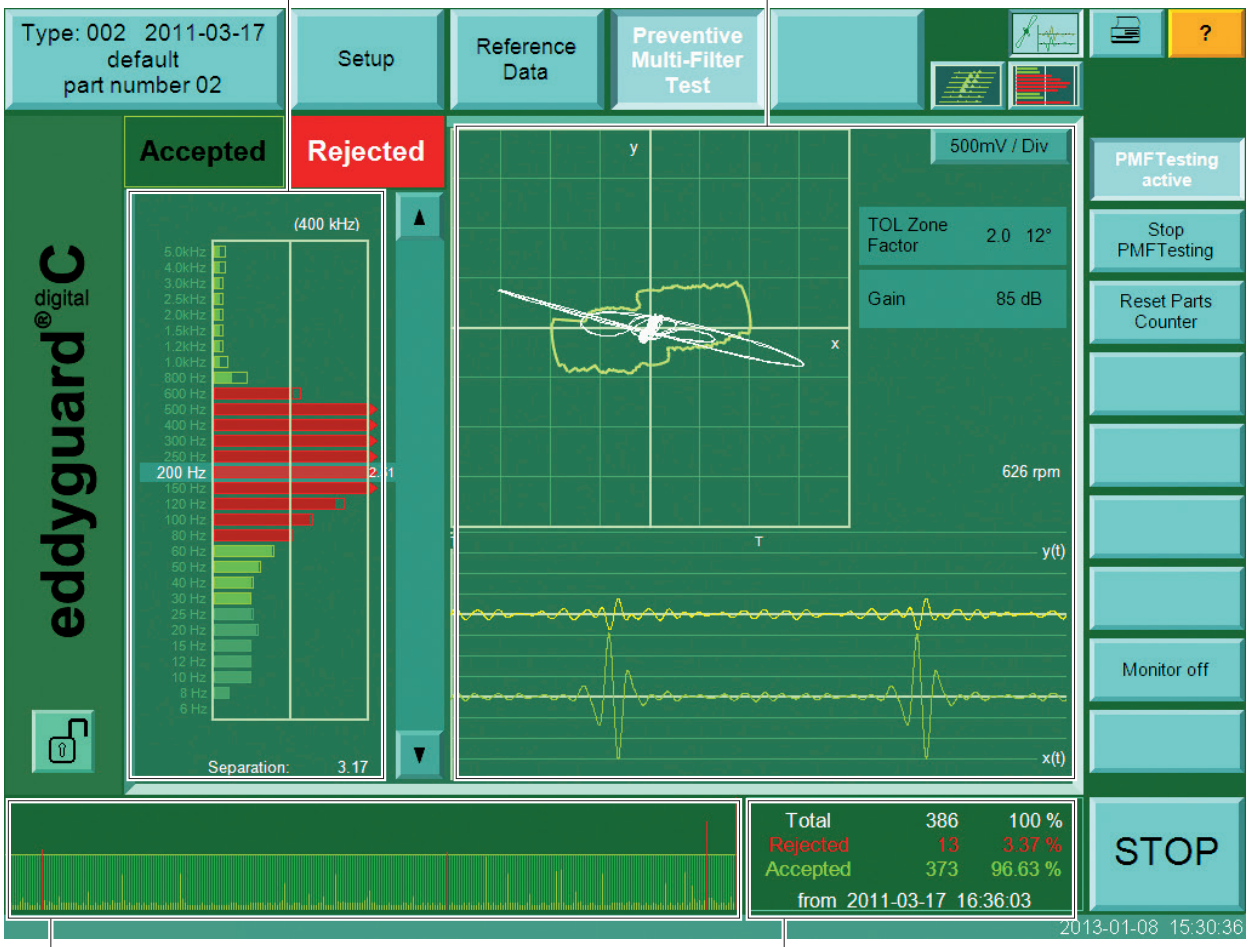

Dimensional drawing of the instrument



High testing accuracy, sensitivity and temperature stability - probes of different design for crack and grinder burn detection. Back-left an eddyscan H rotating head for testing parts in a line. Back-right an eddyscan F for testing boreholes and surfaces.

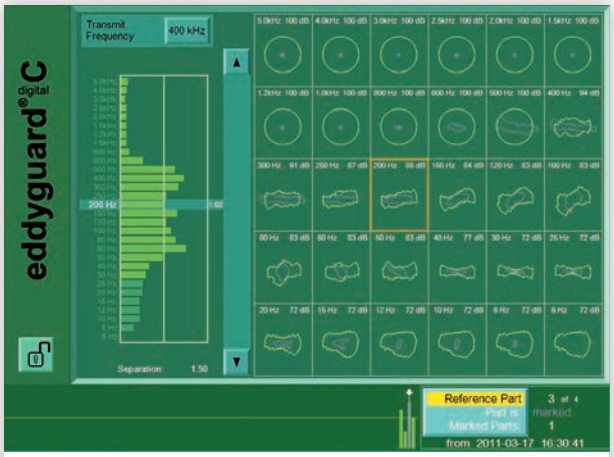
Bargraph display of the latest test results over all 30 band pass filters.

Classic signal curve display of a single band pass filter with relating good part tolerance zone.

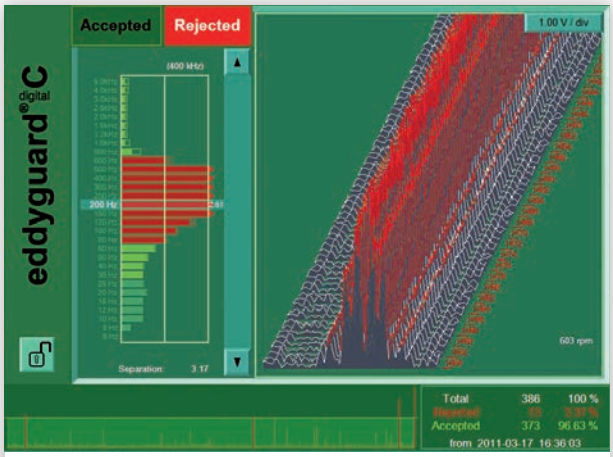



Test part history

Parts counter



Display of all 30 tolerance zones in material data recording



C-scan display of test result

# Eddy Current Technology


**Instruments**

**Coils and Probes**

**Automation**

For more than 30 years, the ibg group has been a market leader manufacturing eddy current test instruments and setting technology standards. Whether for multi-frequency structure verification, automatic tolerance zone generation or multi-channel crack and grinder burn detection - again and again innovations and inventions of the ibg developers shape the market and provide advanced testing solution.

The headquarters is situated in Ebermannstadt, Upper Franconia, and together with subsidiaries in the US, Switzerland and Great Britain as well as a competent worldwide partner network, we service our customers in industry and automotive engineering.

Quality Management ISO 9001

Made in Germany

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eddyliner®P, P2 / P3 / P4 / P16 – eddynomic® – eddysort®

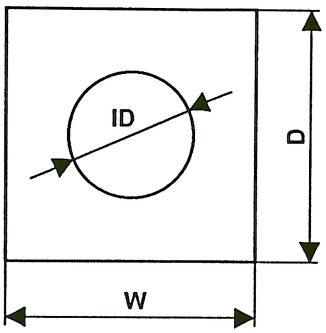
# Encircling Coils
# Probes
# Flat Coils

## Structure Testing with ibg:
## Maximum Test Reliability and Temperature Stability

- Wide range of standard accessories
- Suitable for all ibg structure testing instruments
- Coils and probes made to specification

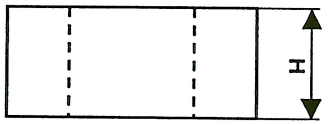
ibg
Zerstörungsfreie Werkstoffprüfung

**Standard encircling coils:**



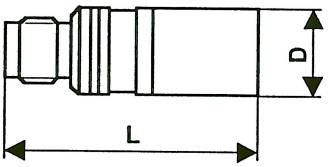

| Size | Dimensions W [mm] x D [mm] x H [mm] | Inner diameter ID [mm] |
|---|---|---|
| 1 | 80 x 80 x 35 | 10, 16, 25, 40 |
| 2 | 150 x 150 x 50 | 50, 63, 80, 100, 125 |
| 3 | 250 x 250 x 50 | 160, 200 |
| 4 | 380 x 380 x 50 | 250, 300 |

(Different inner diameters ID can be made to specification)




Frequency ranges: 25 Hz – 25 kHz (standard)
5 Hz – 5 kHz
100 Hz – 100 kHz

**Standard Probes:**




| Diameter D [mm] | Length L [mm] | Frequency range |
|---|---|---|
| 10 | 46 | 2,5 kHz – 250 kHz |
| 16 | 47 | 250 Hz – 25 kHz |
| 25 | 51 | 25 Hz – 2,5 kHz |

**Application References:**

| Operative range | Frequency range | Probe | Encircling coil | Encircling coil shielded | Rectangular coil | Flat coil |
|---|---|---|---|---|---|---|
| **Material mix** | | | | | | |
| ferritic | 25 Hz – 100 kHz | + | ++ | + | ++ | + |
| austenitic | 100 Hz – 100 kHz | ++ | + | o | + | ++ |
| NI-metals | 100 Hz – 100 kHz | ++ | + | o | + | ++ |
| Hard metals | 50 Hz – 100 kHz | ++ | ++ | + | ++ | ++ |
| **Heat treatment** | | | | | | |
| Tempering | 25 Hz – 25 kHz | + | ++ | ++ | ++ | + |
| Surface hardness | 100 Hz – 25 kHz | ++ | ++ | ++ | ++ | ++ |
| Case depth (of shafts) | 5 Hz – 400 Hz | – | ++ | + | ++ | – |
| Case depth | 5 Hz – 4 kHz | – | o | o | o | – |
| Carburization | 5 Hz – 25 kHz | + | ++ | + | ++ | + |
| Skin decarburization | 10 kHz – 100 kHz | ++ | + | + | + | ++ |
| **Cast iron** | | | | | | |
| Nodular cast iron | 5 Hz – 5 kHz | + | ++ | + | ++ | + |
| Ledeburite | 25 Hz – 25 kHz | ++ | + | + | + | ++ |
| **Surfaces** | | | | | | |
| Grinding abuse | 5 kHz – 100 kHz | ++ | o | o | o | ++ |

++ excellent suitability / + good suitability / o possible / – not possible

**Special coils and probes optimally adapted to the respective application can be developed to solve special problems. We would be pleased to inform you about the versatile technical possibilities.**

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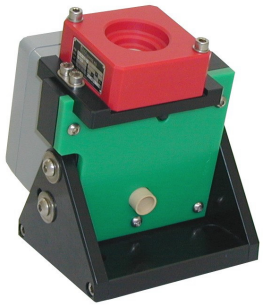
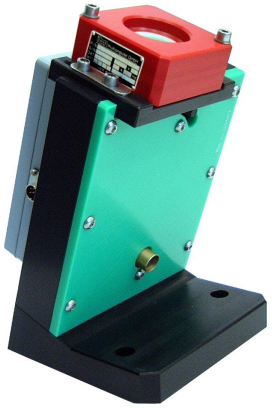
Zerstörungsfreie Werkstoffprüfung

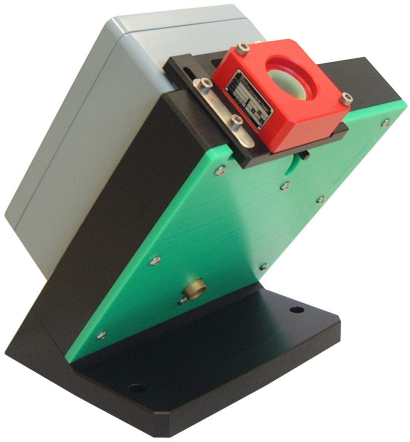
## Cost effective, universal and quick sorting:

# Universal Sorting Device

# UNISort 10 HD / 25 HD / 40 HD / 63 HD





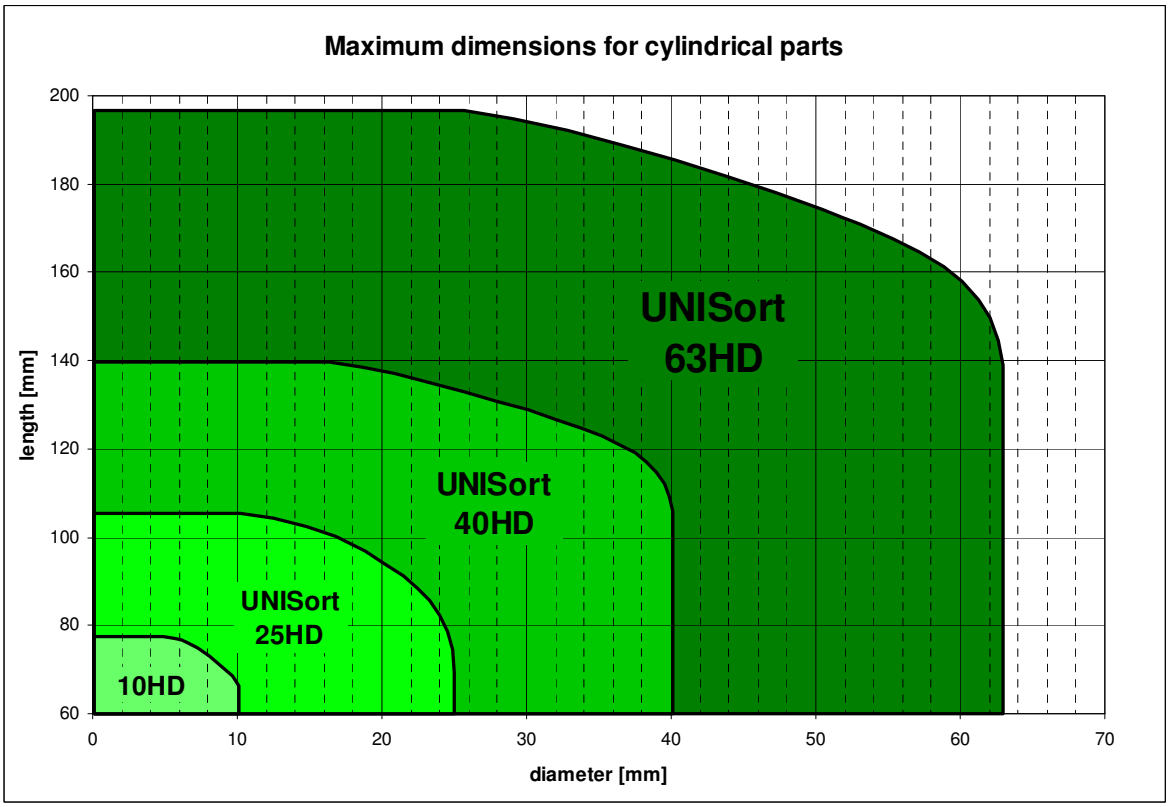


## Sorting of test parts with diameter up to 63 mm

- Works with all ibg structure test instruments
- Long service life due to high-performance components and easy exchange of wear parts
- Suitable for manual and continuous testing
- Integration into automatic test lines
- Designed for a wide spectrum of test parts
- Monitoring of sorting gate
- Immediate and universal use

ibg
Zerstörungsfreie Werkstoffprüfung

| | UNISort 10 HD | UNISort 25 HD | UNISort 40 HD | UNISort 63 HD |
|---|---|---|---|---|
| Weight | 3 kg | 4 kg | 8 kg | 13 kg |
| Supply voltage solenoids | 24 VDC | | | |
| Ambient temperature | - 10 up to + 60°C | | | |
| Protection class | IP 55 | | | |
| Max. temperature of parts | 50°C | | | |
| Part number | P/N 11095-10 | P/N 11095-25 | P/N 11095-40 | P/N 11095-63 |




The Universal Sorting Devices UNISort 10 HD, 25 HD, 40 HD and 63 HD are designed for operation with **eddyvisor®**, **eddyliner®P**, **eddynomic®** and **eddysort®**. UNISort is controlled by the ibg structure test instruments, a separate control is not needed.

Power for the UNISort 10 / 25 / 40 HD is supplied by the integrated power supply unit of the **eddyvisor®**, **eddyliner®P**, **eddynomic®** and **eddysort®**. The UNISort 63 HD has a separate power supply unit.

The UNISort is support for the test coil and sorting gate in one. It is designed for continuous testing and as a part of an automatic mass production line.

The sorting gate operation is monitored by a proximity switch, which in combination with coil monitoring by the ibg instruments ensures reliable and failsafe testing.

We would be pleased to help you to find the universal sorting device best suited for your application.

Furthermore we offer customised sorting devices to solve special applications and advice on the various technical possibilities - please contact us.

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Zerstörungsfreie Werkstoffprüfung

(Subject to technical changes.)

## Eddy current up-to-date

**STRUCTURE TESTING:**

**Preventive**

**Multi-Frequency Technology**

**PMFT**

Manfred Horndasch, March 2011



## Structure test with eddy current

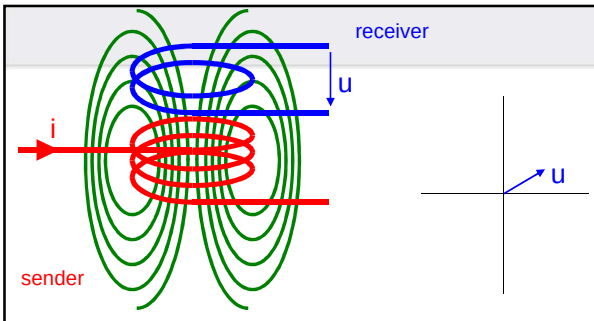

Multi-Frequency Technology



## Structure test with eddy current


Multi-Frequency Technology

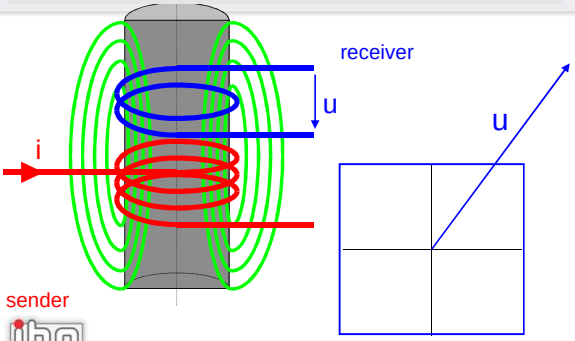




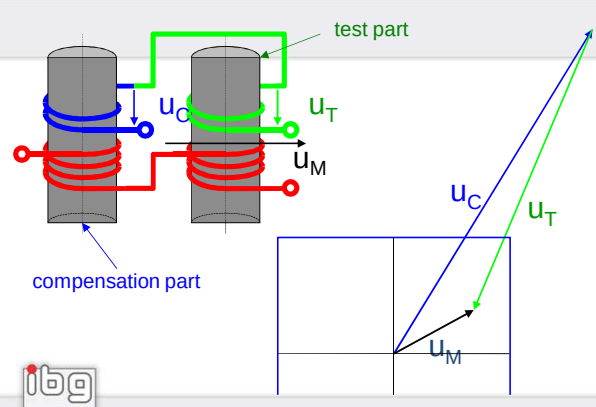

The induced voltage (u) depends on coupling.

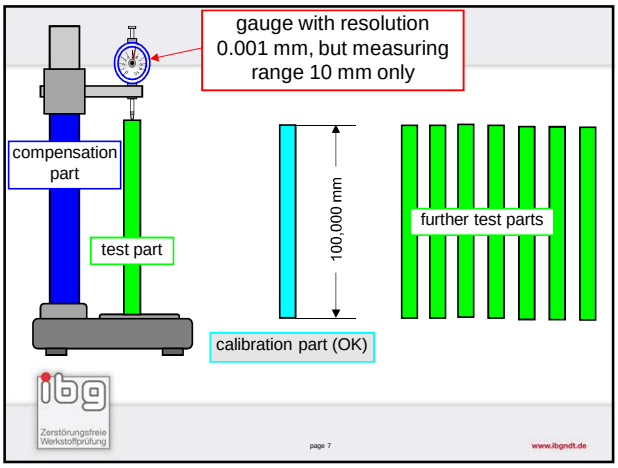


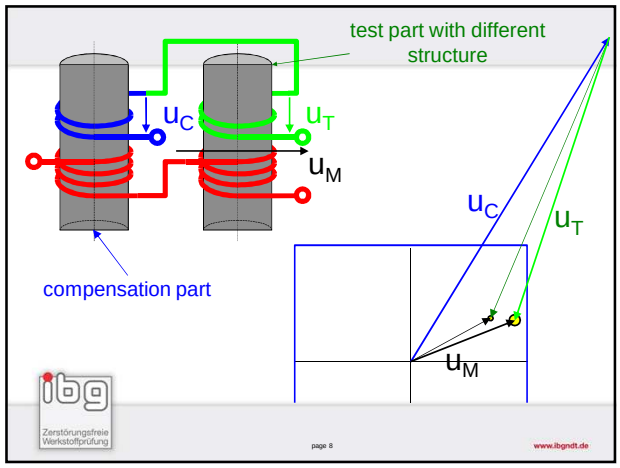
The magnetic flux induces the voltage vector **u**.



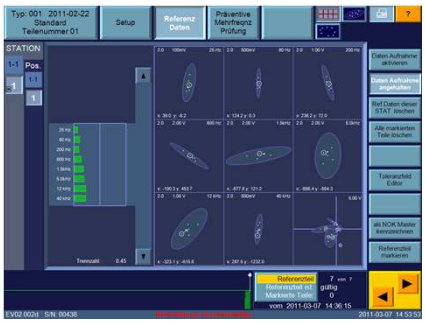


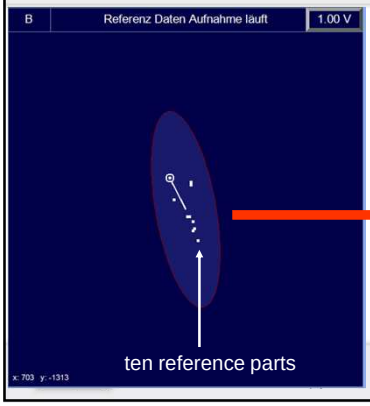


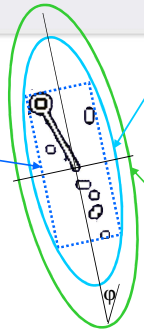

## Structure test with eddy current



## From reference data to tolerance zones:



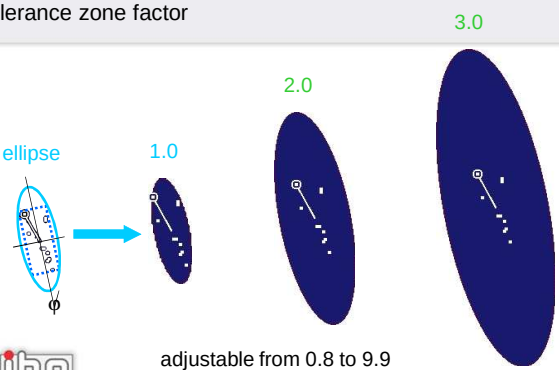

The vector tips are surrounded by the smallest possible rectangle.



The rectangle determines the ellipse with the axes a & b and the phase angle φ.

The tolerance zone is widened by the tolerance zone factor.

## Tolerance zone factor




adjustable from 0.8 to 9.9

Why do we need an adjustable tolerance zone factor?

General rule: the more reference parts are used the smaller the selected tolerance zone factor can be.

The reason is scattering within the OK parts group.

**Reasons for scattering:** dimensional tolerances, little differences in alloy, little deviation in heat treatment, positioning differences, etc.



Advantages of the Preventive
Multi-Frequency Test
PMFT:

Three steps only:

1. Record reference parts
2. Verify and Accept
3. Test



**Physical basics**

Preventive Multi-Frequency Technology

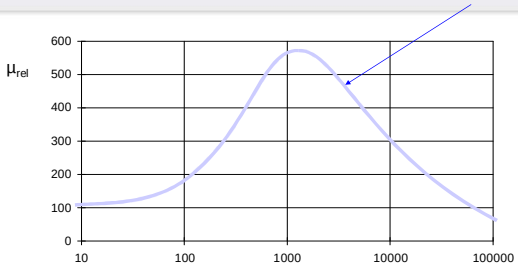
**PERMEABILITY (μ)**

is the relation between
**Field strength (H)**
and **Induction (B)**

Each material structure, each single alloy has its own PERMEABILITY CURVE



Permeability curve of steel **C35**





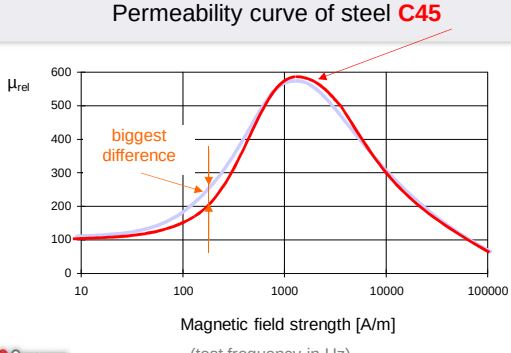

The eddy current structure test is basically a comparison of

**PERMEABILITY CURVES**

of test parts.



Permeability curve of steel **C45**



How can we find the largest difference automatically?

How can we find the optimum separation frequency (test frequency)?

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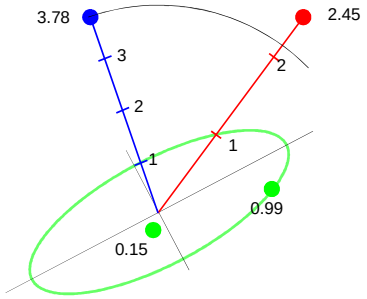
Via the separation value based on the tolerance zone.

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separation value

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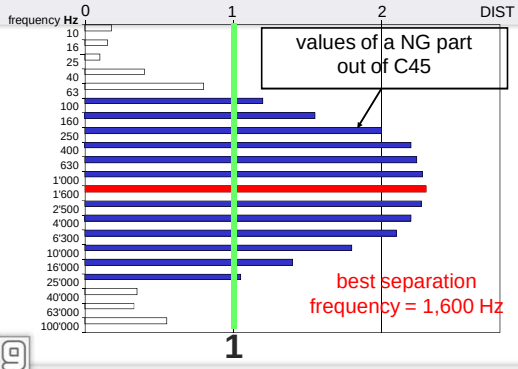


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What happens when there are two or more different wrong structures?

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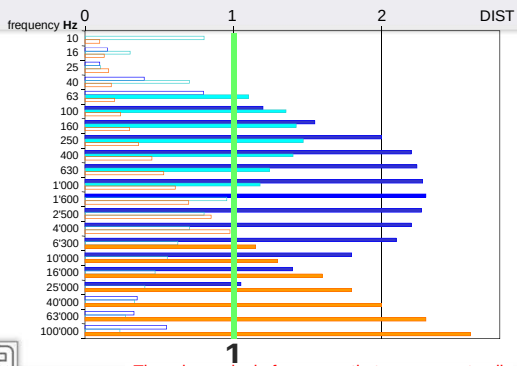


There is no single frequency that can separate all NG structures!

Preventive
Multi-Frequency Technology
widens the view.

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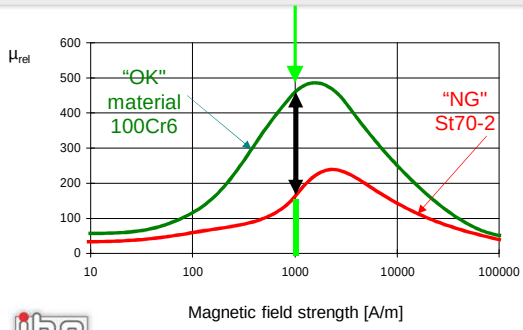
Setting for the **best separation** with one parameter is **here**

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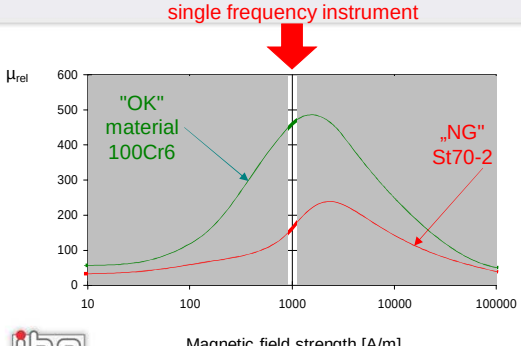
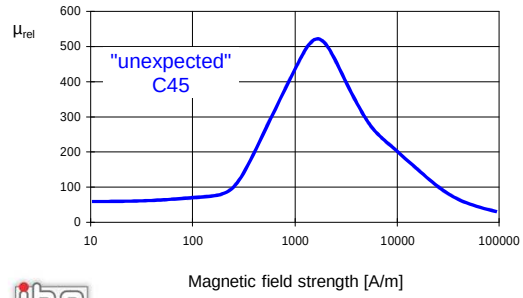
Typical limited view (curtains are closed) with a single frequency instrument



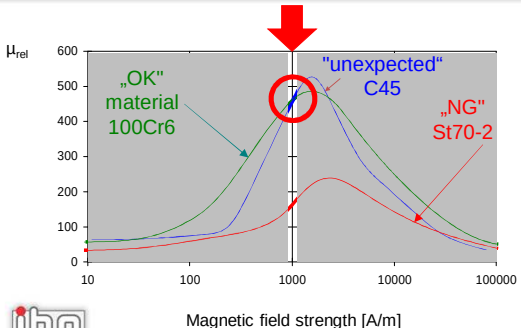

page 27

Permeability curve of an **unexpected** C45




page 28

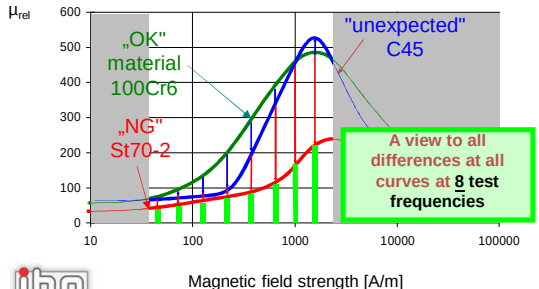
No difference between the
„OK" material 100Cr6 and the "unexpected" C45




page 29

Wide view with **Preventive Multi-Frequency Test**

Open the curtains to see all permeability curves.

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ibg
eddyvisor
Zerstörungsfreie Werkstoffprüfung
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www.ibgndt.de

## Eddy current up-to-date

**CRACK TESTING:**

**Preventive**

**Multi-Filter Technology**

**PMFT**

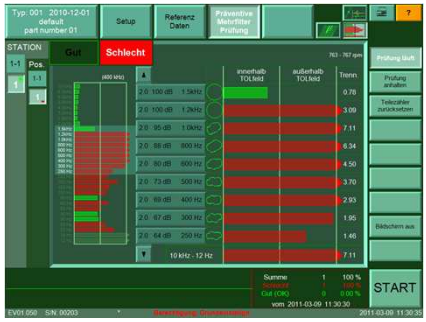
Manfred Horndasch, March 2011



## Crack detection with eddy current


Multi-Filter Technology






Multi-Filter Technology

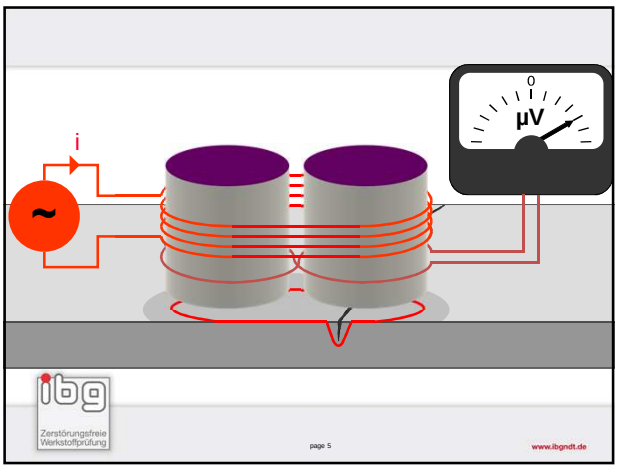


Detection of

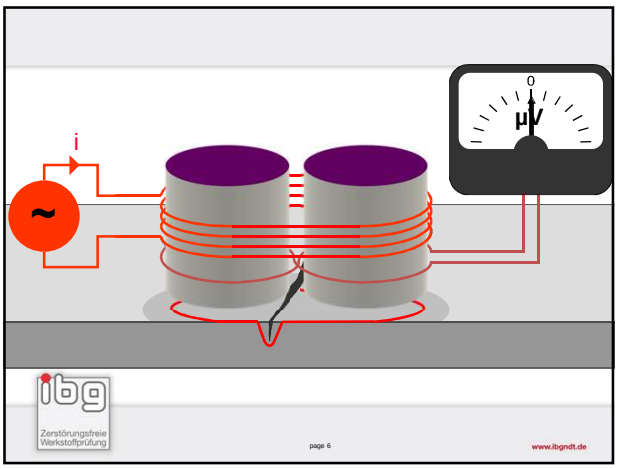
surface-open cracks and pores

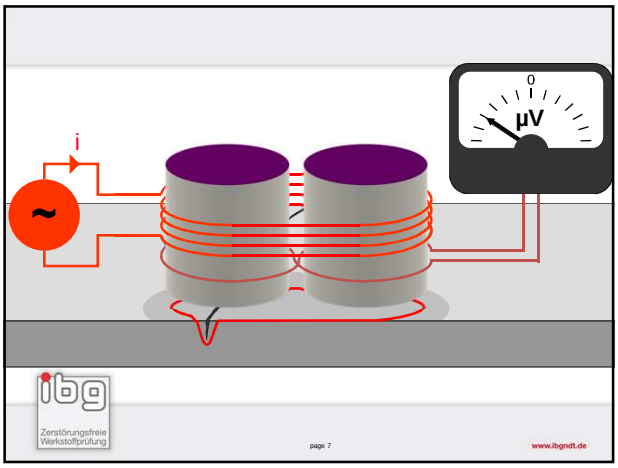
(and defects below the surface)

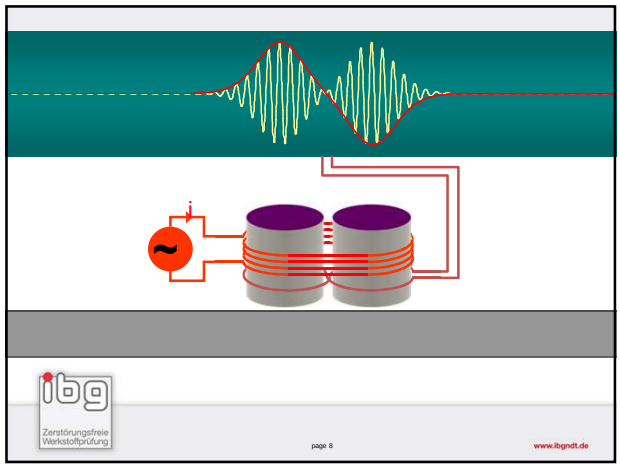


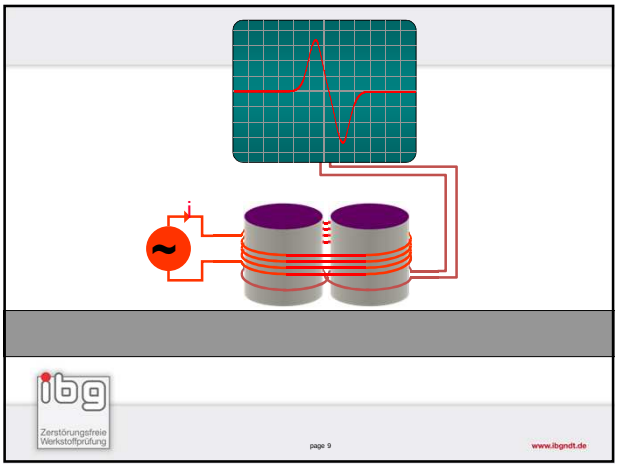






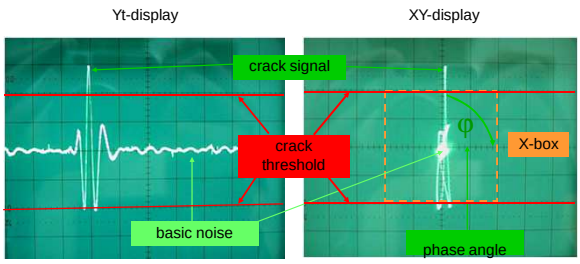




Evaluation and display of an

eddy current crack signal

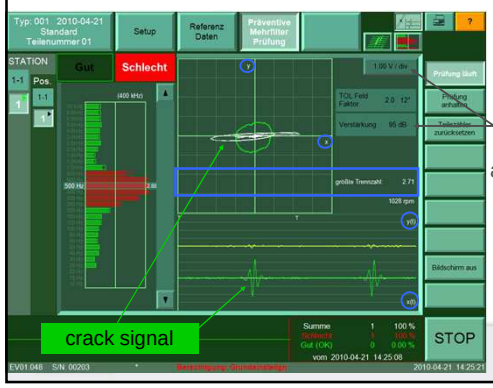


## „Conventional“ evaluation and display



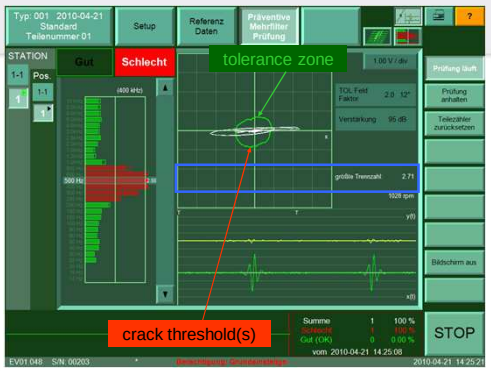



## Evaluation and display of a crack signal on the eddyvisor®C




oscilloscope settings (scale) and gain are set automatically

The tolerance zones are formed out of the reference data (fingerprint) of several OK parts.




30 complex tolerance zones



Each crack signal is evaluated with reference to the phase of 360°.

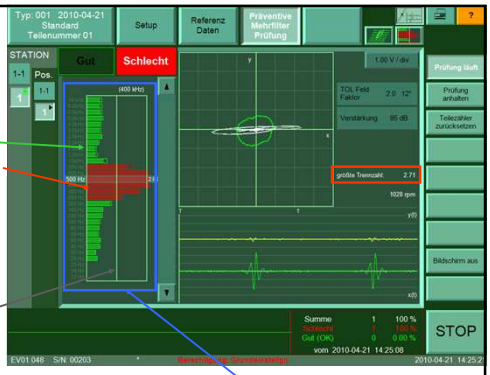
Thus defect signals in each phase (most different defects) are detected without any additional setting effort.


Evaluation of the eddy current signal happens regarding amplitude and phase at each of the 30 frequencies of the steep flank band pass filters contemporaneously and automatically in relation to the tolerance zones. Setting effort is limited to reference data recording (OK parts only).



The separation values show how far a signal at the respective band pass frequency corresponds to the reference data or deviates.

The limit of the tolerance zone has the separation value 1.




adjustable band pass frequencies in three bands (standard: 12 Hz to 10 kHz)



The sender frequency is stepwise adjustable.



## Simple evaluation and interpretation by bargraph display

The result of the evaluation is shown as green/red bargraph at each band pass filter frequency.


The relation of separation value of NG parts to the largest separation value of OK parts is the signal-noise-ratio.

The exact figure values are displayed in the enlarged section.

separation values (signal/noise-ratio)



The contemporaneous and automatic evaluation of the eddy current signals regarding amplitude and phase at 30 band pass filter frequencies

=

Preventive

Multi-Filter Technology

PMFT

Each test part is compared online with

30 complex tolerance zones.



## Basis of the tolerance zones:

- 30 very steep flank band passes
- signal phases are evaluated in 128 segments at 360°
- „selectivity“ adjustable by tolerance zone factors and phase widening



This results in

3,840 crack thresholds

which are automatically and contemporaneously generated during reference data recording.

Conventional eddy current crack detection instruments have 1 or 2 adjustable crack thresholds and phase angles only.



## Advantages of the Preventive Multi-Filter Test PMFT:

Three steps only:

1. Record reference parts
2. Verify and Accept
3. Test



ibg info Special No. 14

## ibg-Talk

For more than 30 years now, ibg develops and produces eddy current test instrument for testing components and worked out for an excellent reputation during that time.

Our instruments are specially designed for the requirements in components production environment, which means testing must be quick, reproducible, efficient and plain to operate - four features not easy to combine. ibg supplies successful and in practice frequently proven solutions.

Thanks to the Preventive Multi-Filter Technology developed by ibg it is now feasible to strike out in a new direction regarding grinding burn. The traditional methods for grinding burn detection are very const-intensive and subject to restrictions regarding automation. Whereas PMFT offers utter new chances as parts handling is effected according to the traditional eddy current crack detection.

Find out more about that topic on the next pages. Our sales partners and our offices are glad to assist you.

*Ihr*
*Herbert Baumgartner*

# Grinding burn detection

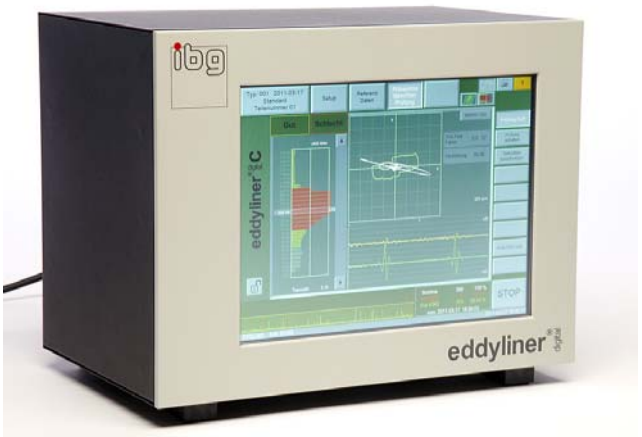
## with Preventive Multi-Filter Technology by ibg

During the grinding process, sometimes incidental or methodic damages on the surface occur due to machining with irregular cutting geometry. Those spot-like up to large-size thermal damage is usually called "grinding burn" and reaches from simple oxidation up to massive structure mutations which later on may cause a breakdown of the part. Traditional methods for grinding burn detection like e.g. nital etching or grinding burn test by means of Barkhausen Noise are cost-intensive and partially rather inefficient.

Source:
imq-Ingenieurbetrieb GmbH,
Crimmitschau

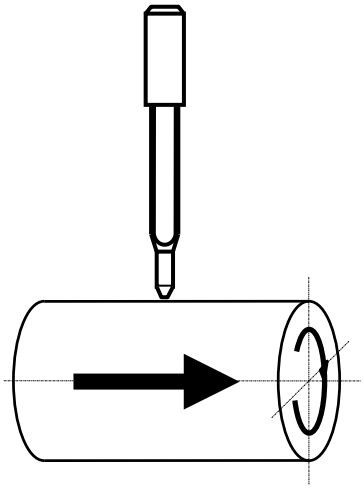
Now,
the Preventive Multi-Filter Technology (PMFT) developed by ibg offers a test method which is vast superior to the conventional grinding burn detection method on rotation-symmetric parts. PMFT can well be automated so that test parts may be scanned at production speed to 100 % non-destructive for grinding burn.

The decision good / bad is made by the instruments **eddyliner®C** resp. **eddyvisor®C**. Chemical auxiliaries are not needed at that method.

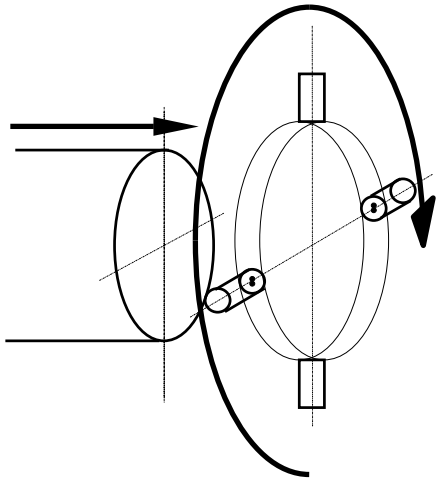


# Grinding burn with PMFT: Test sequence

Detection of surface defects using eddy current means a relative movement between probe and test part, i.e. either the test part rotates or the probe rotates (refer to the sketches) - the same is applied for grinding burn detection with PMFT.

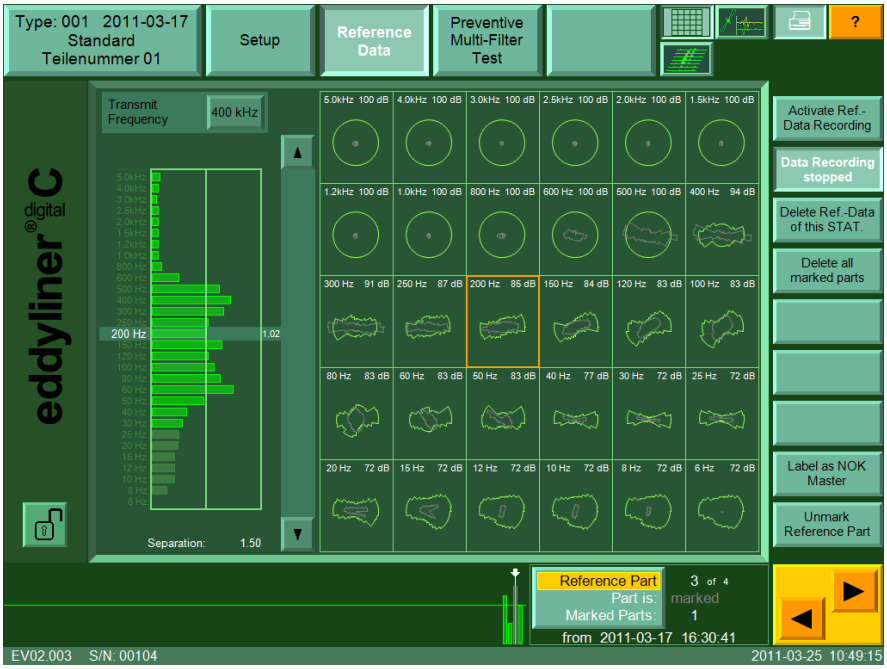


*part rotates, probe or test part are moved linearly*



*probes rotate, test part is moved linearly*

In calibration mode of the Preventive Multi-Filter Technology (PMFT), the magnetic features are simultaneously recorded with 30 different band pass filter settings of the "good" parts and 30 corresponding tolerance zones are generated. In test mode, the signals are compared with the generated tolerance zones and test parts with discrepancy are sorted out. Contrary to the traditional eddy current test method where always one setting only is used for testing (i.e. one filter setting, one gain, one phase angle as well as one crack threshold per channel), PMFT queries simultaneously 30 tolerance zones generated of polar fields. Testing for grinding burn, cracks and pores with one setting and one channel is thus feasible.




*30 tolerance zones*

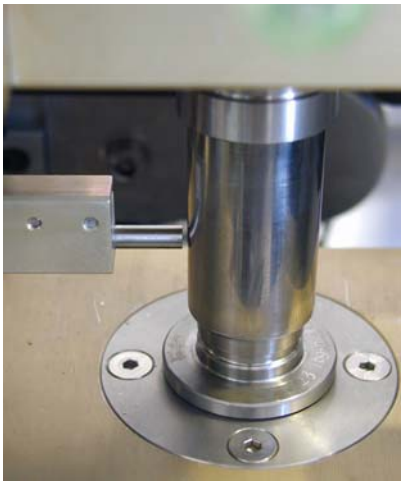
# Grinding burn with PMFT: Applications

*Example 1:*
*Grinding burn test on rollers (cylindrical rollers, spherical rollers, tapered rollers)*

Depending on customer requirements, concepts with rotating heads (**eddyscan®H**) as well as concepts with standard sensors may be realised. Rotating heads are preferably used for high-speed testing of cylindrical rollers and depending on diameter and length of test part up to 10 parts per second are managed. Different machine designs enable testing of a diameter range of 1.5 - 63 mm.

Options like e.g. automatic master part run, testing of both front faces, marking station etc. according to customer specification can be realised.

Larger or non-cylindrical rollers (tapered or spherical rollers), however, are individually clamped, rotated and scanned with a standard probe. Feeding and discharging of the test parts is effected by gripper systems, conveyor belt or robots.



The ibg-technology fulfils the requirements of the new DIN-EN 12080 "Railway applications - axle boxes - rolling bearings" which defines the quality requirements of all railway axle boxes and roller bearings and which among others includes the crack and grinding burn detection.

ibg offers customised solutions as per customer's request.

ibg - extra info

## ibg Technical Meetings

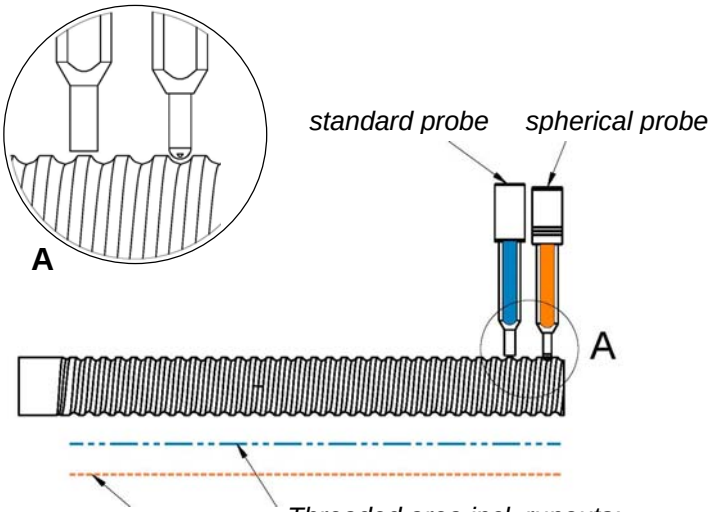
In Detroit, Peking and at the ibg headquarters in Ebermannstadt Workshops for our sales partners took place in the beginning of 2012.

Topic:
harmonic analysis and grinding burn.

Participants of totally 16 countries could be welcomed to the two-day meeting.

*Example 2:*
*Grinding burn test on steel ball races of nuts and rods*

The risk of grinding burn on ground steel ball races is extremely high. Due to a huge production quantity of such ball race modules (e.g. the newly developed EPS Electronic Power Steering in the automotive branch) it is very important that the testing procedure can properly be integrated into the automated production process. ibg offers suitable solutions and concepts.




*Threaded area incl. runouts: Spherical probe tests the complete gothic profile for grinding burn and cracks, pitch of probe trace 7 mm*

*Threaded area incl. runouts: standard probe tests the outer diameter of thread for cracks, pitch of probe trace 7 mm*

IMPRESSUM
Herausgeber: ibg Prüfcomputer GmbH
Pretzfelder Straße 27
D-91320 Ebermannstadt
Redaktion: Jochen Iwan

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ibg-Talk

ibg has now completed the test instruments of the "digital" series and has been successful on the market for several months with the instruments **eddyliner®** "digital" as well as **eddyvisor®** "digital" for both crack detection and structure test.

The resonance so far is overwhelming and fortifies our philosophy to develop the best instruments and test systems for our customers all over the world.

Developing of test instruments on the one hand - but also application technology on the other hand - ibg becomes the trendsetter in the component testing market. Since the existence of the Preventive Multi-Filter Technology it has been possible to detect grinding burn reliably and automated.

The newly developed simultaneous harmonics analysis in structure test enables new chances regarding test speed and rest reliability.

The new ibg Info informs you on further applications. Our offices and sales partners will be glad to assist you.

*Yours*
*Herbert Baumgartner*

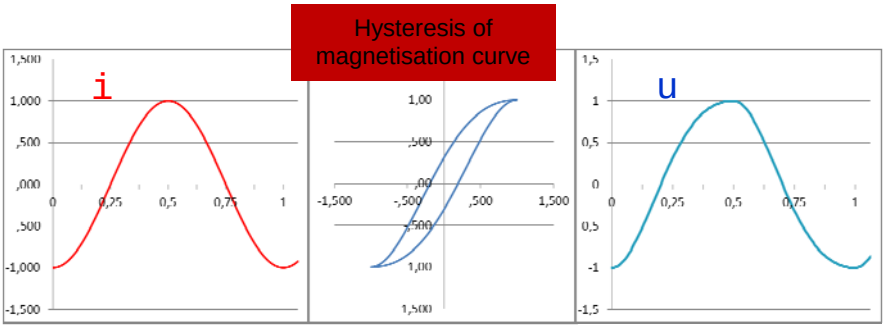
# iSHA

## ibg's Simultaneous Harmonic Analysis

### New test possibilities and Additional test reliability

The structure test instruments of the new instrument line **eddyliner®S** digital as well as **eddyvisor®S** digital are equipped with a very new and special feature:
iSHA = ibg's Simultaneous Harmonic Analysis.

Based on the fundamental wave of the eight test frequencies, two harmonics of odd order are additionally captured and analysed by the test software - and this simultaneously to the well-known Preventive Multi-Frequency Test. The harmonics result from a hysteresis of the magnetisation curve of the test part in the coil arrangement.




sinusoidal exciting current | Flux B | received non sinusoidal voltage

Source: Handbook Induction Heating by Herbert Baumgartner, 2012

The analysis of those harmonics gives a much more detailed sight of the magnetic features of the test part and thus more precise information on the structure.

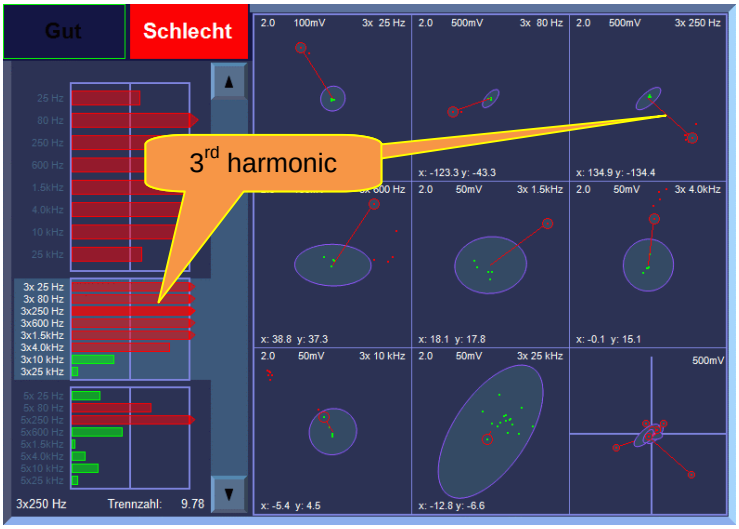
Thus it works out that by using harmonics material differences are now detected which have been hitherto undetected by using the fundamental wave.

The harmonic analysis is already active in **eddyliner®S** digital and **eddyvisor®S** digital in the standard setup and is displayed as bargraph diagram.



The 3rd and 5th harmonic are viewed as default, other combinations may also be set.

Typical applications for using harmonics are testing for hardness or detection of soft spots on the surface. Case depth as well as surface hardness provide very good signals to be evaluated at the harmonics when underrun the requested thickness.

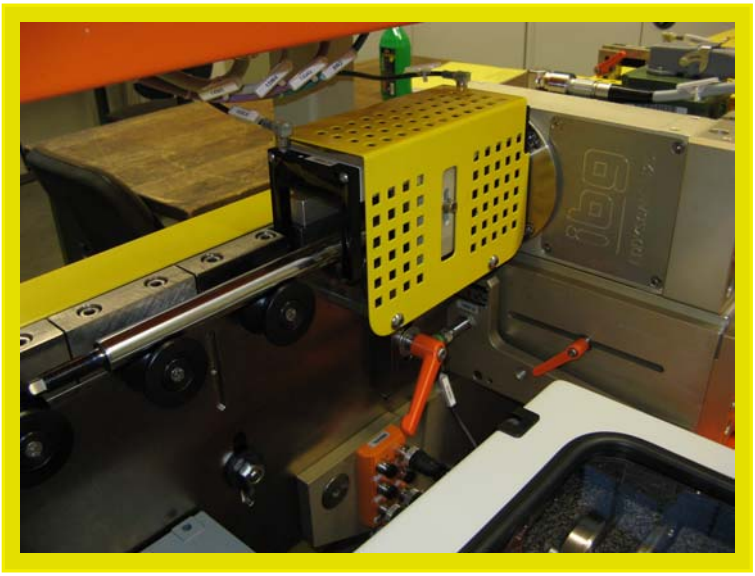



Characteristic test result of a part with too shallow case: the largest separation figure arise from the 3rd harmonic.

Source: Handbook Induction Heating by Herbert Baumgartner, 2012

# Testing of piston rods for surface defects

Piston rods mounted in e.g. shock absorbers can have cracks due to the complex production process with several heat treatment steps and grinding processes. More and more manufacturers replace the unreliable and cost-intensive visual inspection by the much more efficient and automatable eddy current test.



ibg offers suitable solutions fitting the production process. Usually, piston rods are tested by means of a rotating head **eddyscan®H**, the test part is moved through the rotating head where a probe disk with test probes rotates. Throughput of up to 800 mm/sec. is possible.

If small batches shall be tested the "classical" method could also be applied, where the test part is rotated and a probe scans the surface for surface-open defects.

Both methods, rotating probe or rotating test part, guarantee a 100 % test of the critical part's surface and this without any chemical auxiliaries and it can be automated. Test system are designed as per customer's requirements and may be integrated into to existing production lines.

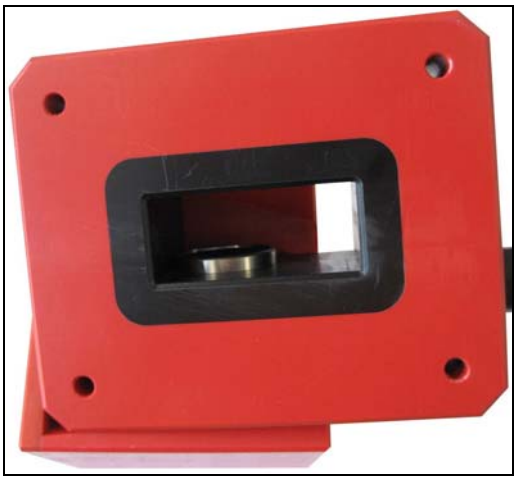
ibg - extra info

## ibg's new sales partner in France

Qualisco (www.qualisco.com) is ibg's new sales partner for the French market, with experience in the component branch. Mr. Romain Labroye-Schulte, managing director of Qualisco, to ibg:
"The automobile market economically plays a dominating role in France, furthermore. Local manufacturers of test systems and machines, however, often cannot keep up with customers' technical requirements. So ibg will be very successful in France."
Qualisco is the new contact for our French customers, and he has all necessary equipment like application laboratory, instruments and a choice of spare parts at his disposal.
In addition, Qualisco offers contract trials worldwide.

# A typical application for material mix up verification: Testing of valve seat rings

The valve seat rings must be tested for correct material before they are mounted in the cylinder head, otherwise there is the risk that geometrically identical rings but different in material alloy are mounted. For instance, motors which run with natural gas or petrol require rings of different alloy, in case of mixing up, the motor will fail.



valve seat ring in rectangular coil

ibg offers for this application different concepts, starting with semi-automatic solutions up to an automatic test station integrated in automatic assembly machines.

IMPRINT
Publisher: ibg Prüfcomputer GmbH
Pretzfelder Straße 27
D-91320 Ebermannstadt
Editor: Jochen Iwan

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## ibg-Talk

The new ibg temperature adaptive testing tool “iTAS” solidifies ibg’s leadership in the field of eddy current testing of components.

Producers and users of heat treatment systems will be delighted with this new technology, because it enables them to achieve much higher reliability and efficiency of the production process.

35 years of focused innovation forms the basis for the success and continuous growth of the ibg group. At three locations, over 50 highly qualified and motivated specialists continuously work on development and production of ibg’s eddy current systems for testing components for superficial cracks and for material properties/structure parameters.

A worldwide network of 26 sales and service partners offers you access to ibg’s know how. We look forward to hearing from you.

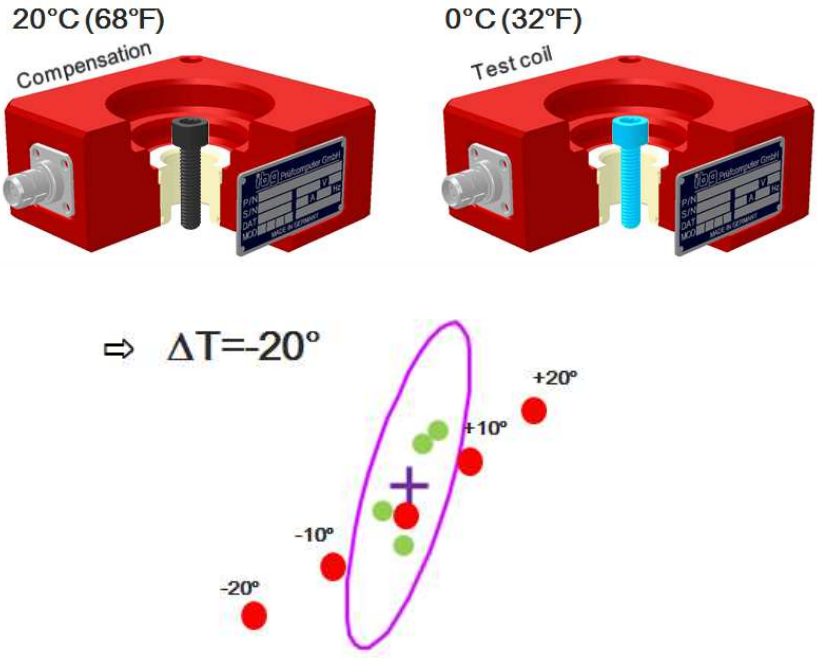
*Yours*
*Herbert Baumgartner*

# iTAS

## NEW: Temperature Adaptive Structure Testing iTAS

Eddy current tests are based on the electrical conductivity and magnetic permeability of the material of the parts that are being tested. Different materials or a change of micro-structure result in slightly different, but detectable characteristics. However, conductivity and permeability also vary with changing temperatures of the parts. Electrical conductivity changes approx. 4% per 10°C.

ibg already compensates for slow changes (e. g., of room temperature) by applying differential measurement with two coils, compensating the test part with a compensation part in a second coil.




Shift of the measured values in one impedance plane due to a +/- 20 ºC temperature change of the test part.

But parts are also typically heated up during industrial processes, and then they can subsequently cool down while in a queue before testing. Therefore, they might reach the test station at significantly different temperatures, causing false rejects (see diagram on page 1).

ibg's new Temperature Adaptive Structure Test (iTAS) takes the influence of the temperature into account. If the user measures the temperature of the test part in a sufficiently precise way by means of a sensor that it is directly connected to the **eddyvisor**®, it is possible to compensate almost completely the influence of the temperature. All tested parts now appear to have the same temperature. Test accuracy is enhanced and false rejects reduced. Visualization of iTAS on the instrument screen also allows comparison of the influence of part temperature changes to changes in other factors that influence the testing. Examples include influences of the batch, dimensional changes, etc.

As usual, the instrument is calibrated with only OK parts. Now, however, OK parts at different temperatures are also included in order to generate a temperature compensation curve.


Screen of the **eddyvisor**® with activated iTAS

# New eddyguard® S and eddyguard® C have definitively found their place in the market

**eddyguard**® S and **eddyguard**® C are being sold since early 2013 and are already firmly established in the market. The concept of these two price worthy instruments is that an external PC or notebook is utilized for setting up test parameters as well as for visualization of testing and test results. As soon as the configuration is finished, the PC or notebook may be disconnected from the **eddyguard**®, which continues to operate in an autonomous mode.

**eddyguard**® is available for structure tests (= **eddyguard**® S) as well as for crack tests (= **eddyguard**® C) and may be operated together with all exisiting ibg coils and probes. Both instruments run bg's proven Preventive Multi-Filter or Multi-Frequency Test (PMFT). The main applications for **eddyguard**® are standard tests on automatic test systems with limited part type changes. Our sales department will be glad to provide further information about these new instruments.



**eddyguard**® S and **eddyguard**® C

## Custom Made In House Workshops

The need to test components with eddy current is growing and, therefore, also the interest to know more about our technology and instruments. To inform large groups of people in your organization about our technology, we offer personalized half day or full day in house workshops at your location. These workshops will cover eddy current testing with ibg solutions, targeting specifically your products and needs.

We can organize these workshops on a worldwide basis in collaboration with our local sales partners. We look forward to hearing from you if you are interested!

ibg - short notice

# ibg Technical Meetings – 2014

## Technical Meetings in Detroit, Beijing and Stuttgart

This Spring ibg held “Technical Meetings” in Detroit, Stuttgart and Beijing, inviting the sales partners of our worldwide sales network.

The aim of these meetings is continuous training and development of the skills of our sales partners, the presentation of new products and features and the exchange of ideas. This year’s main topic was the presentation of our new temperature adaptive tool iTAS.

ibg Technical Meeting in Stuttgart

## CONTROL in Stuttgart

From May 6th to 9th, 2014 ibg exhibited at the Control with an impressive booth. Control is the leading international trade fair in our market segment and has become a mandatory appointment. We were pleased to welcome countless interested visitors to our booth.


IMPRESSUM
Publisher: ibg SWISS AG
Galgenried 6
CH-6370 Stans
Editor: Jochen Iwan

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