SpotChecker

Technical Reference and Operating Manual

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Subject to change without notice.

Introduction 1

1.1 Safety information

The SpotChecker has been designed and tested according to DIN EN 61 010 Part 1, Safety requirements for electrical measuring, control and lab equipment, and was technically in perfectly safe and faultless condition when leaving the manufacturing works.

In order to maintain this condition and to ensure a safe operation, you should urgently read the following safety information before putting the instrument into operation. When connecting other equipment to the SpotChecker, such as the power supply unit, follow particularly all safety instructions that apply to these devices.

⚠ **Attention:**

The SpotChecker is an instrument for materials testing. Any use for medical applications or other purposes is not allowed!

The SpotChecker may only be used in industrial environments!

Power supply

The power supply for the SpotChecker is carried out via one or two batteries or via a connected power supply unit. The power supply unit may only be used inside buildings and may not be exposed to moisture or liquids. Follow all safety instructions that are applicable for the power supply unit used.

⚠ **Attention:**

Never open the housing of the power supply unit. The power supply unit does not contain any user-serviceable parts.

Software

According to the current state of the art, software is never completely free from errors. Before using any software-controlled test equipment, please make sure that the required functions operate perfectly in the intended combination.

Defects/errors and exceptional stresses

If you have reason to believe that a safe operation of your SpotChecker is no longer possible, you have to disconnect the instrument and secure it against unintentional reconnection.

A safe operation is e.g. no longer possible

- if the instrument shows visible damages,
- if the instrument no longer operates perfectly,
- after prolonged storage under adverse conditions (e.g. exceptional temperatures and/or especially high air humidity, or corrosive environmental conditions),
- after being subjected to heavy stresses during transportation.

Further information

Attention:

Observe the documentation for the other equipment connected to the SpotChecker, such as computer or power supply unit. The documentation contains important safety instructions and information about permitted uses.

The SpotChecker software provides extensive online help which is always available to you when working with the system. In this operating manual you will find any additional information that you might require.

If you have any questions about the use of your test equipment, please contact your nearest representative of GE Sensing & Inspection Technologies.

If you install additional software on the computer, GE Sensing & Inspection Technologies will not bear any responsibility regarding the influence this may have on SpotChecker operation. The existing software drivers may be overwritten in such a case.

1.2 Important information on ultrasonic testing

Please read the following information before using your SpotChecker. It is important that you understand and observe this information to avoid any operator errors that might lead to false test results. This could result in personal injuries or damages to property.

Preconditions for testing with ultrasonic test equipment

In this operating manual you will find essential information on how to operate your test equipment. In addition, there are a number of factors that affect the test results. A description of these factors would go beyond the scope of an operating manual. Let us therefore only mention the three most important requirements for a safe ultrasonic inspection in this connection:

- the operator training,
- the knowledge of special technical test requirements and limits,
- the choice of appropriate test equipment.

Operator training

The operation of an ultrasonic test device requires a proper training in ultrasonic test methods.

A proper training comprises for example adequate knowledge of:

- the theory of sound propagation,
- the effects of sound velocity in the test material,
- what happens to the sound wave at the interface between two different materials,
- the propagation of the sound beam,
- the influence of sound attenuation in the test object, and the influence of surface quality of the test object.

Lack of such knowledge could lead to false test results with unforeseeable consequences. You can contact for example NDT societies or organizations in your country (DGZfP in Germany; ASNT in the USA), or GE Sensing & Inspection Technologies, for information concerning existing possibilities for the training of ultrasonic inspectors as well as on the qualifications and certificates that can finally be obtained.

Technical test requirements

Every ultrasonic test is subject to specific technical test requirements. The most important ones are:

- the definition of the scope of inspection,
- the choice of the appropriate test method,
- the consideration of material properties,
- the determination of the limits for recording and evaluation.

It is the task of those with overall responsibility for testing to ensure that the inspector is fully informed about these requirements. The best basis for such information is experience with identical test objects. It is also essential that the relevant test specifications are clearly and completely understood by the inspector.

GE Sensing & Inspection Technologies organizes specialized training courses in the field of ultrasonic testing at regular time intervals. The scheduled dates for these courses will be given to you on request.

Limitations of testing

The information obtained from ultrasonic tests only refers to those parts of the test object which are covered by the sound beam of the probe used.

Any conclusions from the tested parts to be applied to the untested parts of the test object should be made with extreme caution.

Such conclusions are generally only possible in cases where extensive experience and proven methods of statistical data acquisition are available.

The sound beam can be completely reflected from boundary surfaces within the test object so that flaws and reflection points lying deeper remain undetected. It is therefore important to make sure that all areas to be tested in the test object are covered by the sound beam.

Ultrasonic wall thickness measurement

All ultrasonic wall thickness measurements are based on a time-of-flight measurement. Accurate measurement results require a constant sound velocity in the test object. In test objects made of steel, even with

varying alloying constituents, this condition is mostly fulfilled: the variation in sound velocity is so slight that it is only of importance for high-precision measurements. In other materials, e.g. nonferrous metals or plastics, the sound velocity variations may be even larger and thus affect the measuring accuracy.

Effect of the test object's material

If the test object's material is not homogeneous, the sound may propagate at different sound velocities in different parts of the test objects. In this case, an average sound velocity should be taken into account for the range calibration. This is achieved by means of a reference block whose sound velocity corresponds to the average sound velocity of the test object.

If substantial sound velocity variations are to be expected, then the instrument calibration should be readjusted to the actual sound velocity values at shorter time intervals. Failure to do so may lead to false thickness readings.

Effect of temperature variations

The sound velocity within the test object also varies as a function of the material's temperature. This can cause appreciable errors in measurements if the instrument has been calibrated on a cold reference block and is then used on a warm or hot test object. Such measurement errors can be avoided either by warming the reference block to the same temperature before calibrating, or by using a correction factor obtained from tables.

Measurement of remaining wall thickness

The measurement of the remaining wall thickness on plant components, e.g. pipes, tanks and reaction vessels of all types which are corroded or eroded from the inside, requires a perfectly suitable gauge and special care in handling the probe.

The inspectors should always be informed about the corresponding nominal wall thicknesses and the likely amount of wall thickness losses.

Ultrasonic evaluation of flaws

In present-day test practice, there are basically two different methods of flaw evaluation:

If the diameter of the sound beam is smaller than the extent of the flaw, then the beam can be used to explore the boundaries of the flaw and thus determine its area.

If, however, the diameter of the sound beam is larger than the size of the flaw, the maximum echo response from the flaw must be compared with the maximum echo response from an artificial flaw provided for comparison purposes.

Flaw boundary method

The smaller the diameter of the probe's sound beam, the more accurately the boundaries (and therefore the flaw area) can be determined by the flaw boundary method. If, however, the sound beam is relatively broad, the flaw area determined can substantially differ from the actual flaw area. Care should therefore be taken to select a probe which will give a sufficiently narrow beam at the position of the flaw.

Echo display comparison method

The echo from a small, natural flaw is usually smaller than the echo from an artificial comparison flaw, e.g. circular disc flaw of the same size. This is due, for instance, to the roughness of the surface of a natural flaw, or to the fact that the beam does not impinge on it at right angles.

If this fact is not taken into account when evaluating natural flaws, there is a danger of underestimating their magnitude.

In the case of very jagged or fissured flaws, e.g. shrink holes in castings, it may be that the sound scattering occurring at the boundary surface of the flaw is so strong that no echo at all is produced. In such cases, a different evaluation method should be chosen, e.g. by using the backwall echo attenuation in the evaluation.

The distance sensitivity of the flaw echo plays an important part when testing large components. Attention should be paid here to choosing artificial comparison flaws which are as far as possible governed by the same "distance laws" as the natural flaws to be evaluated.

The ultrasonic wave is attenuated in any material. This sound attenuation is very low, e.g. in parts made of fine-grained steel, likewise in many small parts made of other materials. However, if the sound wave travels larger distances through the material, a high cumulative sound attenuation can result even with small attenuation coefficients. There is then a danger that echoes from natural flaws appear too small. For this reason, an estimate must always be made of the effects of attenuation on the evaluation result and taken into account if applicable.

If the test object has a rough surface, part of the incident sound energy will be scattered at its surface and is not available for the test. The larger this initial scattering, the smaller the flaw echoes appear, and the more errors occur in the evaluation result.

It is therefore important to take the effect of the test object's surfaces on the height of the echo into account (transfer correction).

Limitations of software

Based on the present state of the art, software cannot be completely free of faults. Any software-controlled equipment should therefore be checked before and after use in order to ensure that the necessary functions operate perfectly.

Always carry out a check by means of a calibration standard both before and after the test.

1.3 The SpotChecker

The SpotChecker is a compact ultrasonic instrument for manual testing. The consistent use of large-scale integrated components enables to carry out essential functions of the system in a purely digital and consequently reproducible mode.

The gates can be set either to echo flank or peak value of the positive or negative half-wave to make the measurement settings easier with wall thickness measurements.

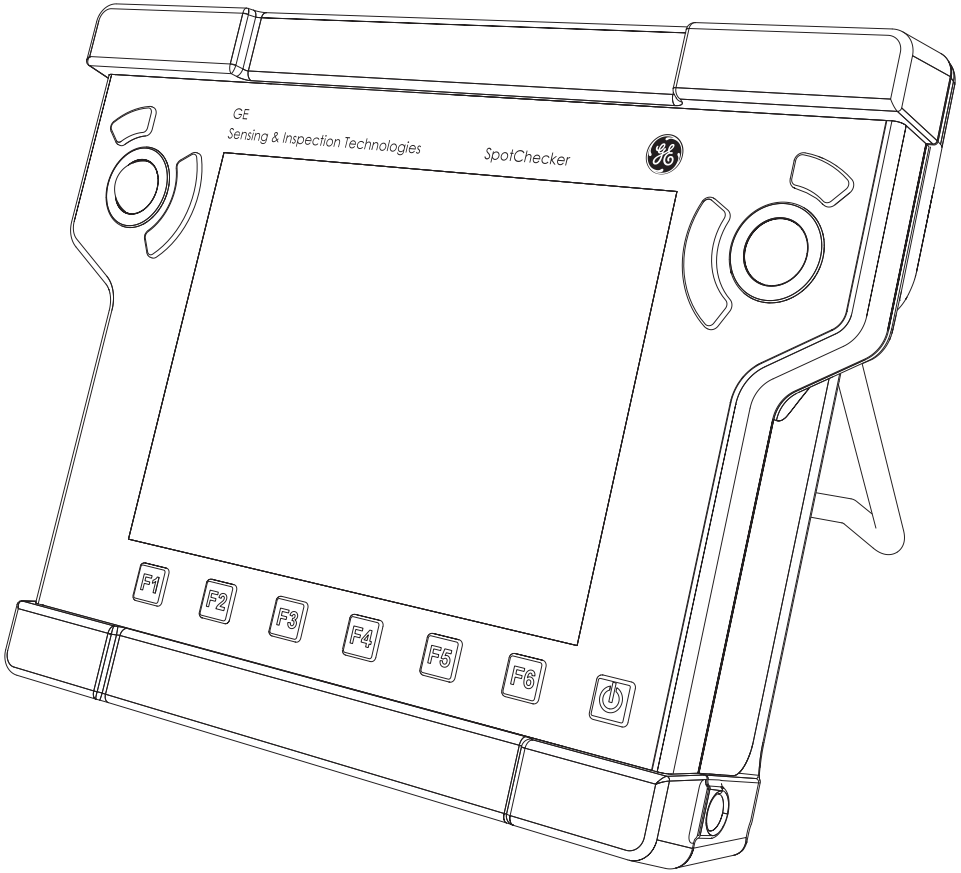
The provided application software runs under the powerful operating system Windows XP. An operator interface optimized for use with detailed Online Help enables you to master the function range of the system in no time at all.

The software for the user interface is supplied additionally on a CD-ROM for the case of a possible computer failure or a necessary new installation.

The system uses standard and dialog probes: the latter are automatically recognized.

Special features

- No additional computer hardware required, USB interfaces for printer, external mouse/keyboard and data communication with a computer
- Easy to operate via touchscreen and two trackballs for both left- and right-handed operation
- 8.4" TFT color display (SVGA, 800 × 600 pixels)
- Operating time approx. four hours by means of two lithium-ion batteries with internal and external charging possibilities
- Program-specific assignment of functions to function keys and remote control
- Optional integrated radio receiver for remote control
- Optional integrated WLAN interface
- Optional Bluetooth interface
- Flexible use with handle and prop-up stand
- Compact housing dimensions
- Weight: 3,2 kg with two batteries


GE
Sensing & Inspection Technologies
SpotChecker
F1
F2
F3
F4
F5
F6

1.4 Standard package

Product code	Description	Order No.
SpotChecker	Portable ultrasonic flaw detector SpotChecker,	36 763
	incl.	
	Carrying case	36 764
	Lithium-ion battery 10.8 V, 4.8 Ah	109 412
	Power supply unit	36 777
	USB cable B-A, 1 m	109 397
	Product CD SpotChecker	36 778
	Driver CD	36 779
	Windows multilanguage CD	35 602
	Operating manual German/English, Manufacturer’s certificate	49 131

1.5 Required accessories

Product code	Description	Order No.
Spot-BAT	Lithium-ion batteries 10.8 V, 4.8 Ah	109 412
Spot-Chrg	External battery charger	36 748

1.6 Spare parts requirements

Product code	Description	Order No.
	Housing, upper part	
	Housing, upper part Spotchecker	36 767
	Keypad Spotchecker	36 738
	Backlight inverter	109 413
	Cable, backlight inverter	36 775
	Trackball, left 6 p.	109 407
	Cable, trackball left 6 p.	36 772
	Trackball, right 10 p.	109 408
	Cable, trackball right 10 p.	36 773
	LCD module 800 × 600	109 411
	Cable, LCD module	36 776

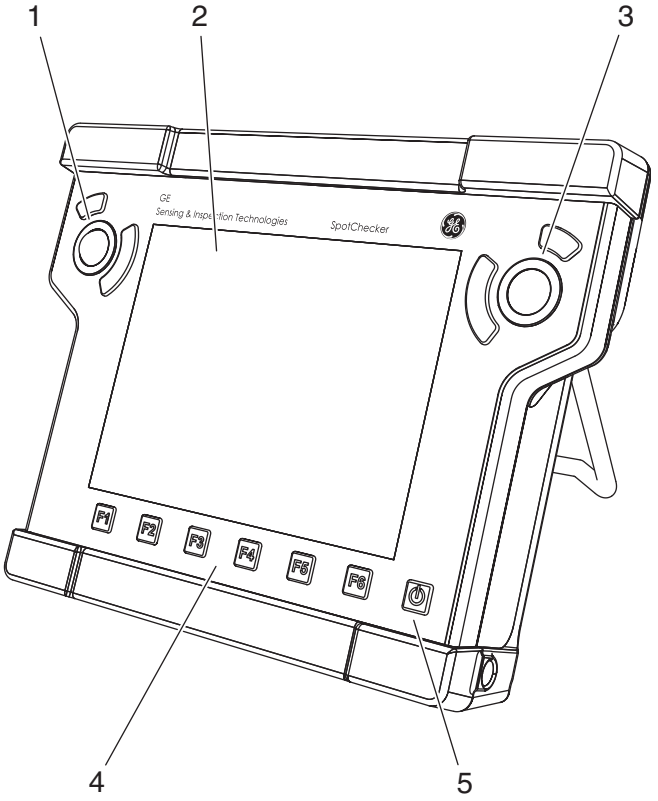
Product code	Description	Order No.
	Housing, lower part	
	Housing, lower part	36 766
	Battery cover	36 768
	Gasket, battery cover	36 770
	Knurled screw, battery cover	36 806
	Shaft, battery cover	36 805
	Cover interfaces	36 769
	Gasket, cover interfaces	36 771
	Knurled screw, cover interfaces	36 807
	Handgrip, Spotchecker	36 741
	Locking disk, USM 20	34 796
	Holder, handgrip Phasor XL	36 585
	Washer, red (Receiver)	35 651
	Washer, black (Transmitter)	36 652

Product code	Description	Order No.
	PCB Touchview main	
	PCB, Touchview main	36 667
	Harddisk MHW2040AC-20°	104 457
	Cable, harddisk IDE	109 492
	Embedded PC	109 352
	DDR SDRAM module	109 373
	Heat cunductive foil, thin	36 753
	Heat cunductive foil, thick	36 754
	Battery, backup, CR2032	14 452
	Cable battery	36 774
	Cable, main-USLT	36 797
	Jack RJ45/2 × USB/LAN/2 × USB pulse	109 268

Product code	Description	Order No.
	PCB USLT-Spotchecker:	
	PCB, USLT USB Spotchecker	36693
	Spacer for LEMO 00	36695
	Miscellaneous:	
	Power supply/Charger (Standard)	36777
	Charger (external)	36748
	Battery	109412
	Adaptor, Bluetooth (external, USB)	109523
	Module WLAN (internal)	36823
	Remote control, transmitter	36818
	Remote control, receiver (internal)	36819
	Cable USB A/B, 1 m	109397

Initial start-up and basics 2

2.1 Overview of instrument



Front panel

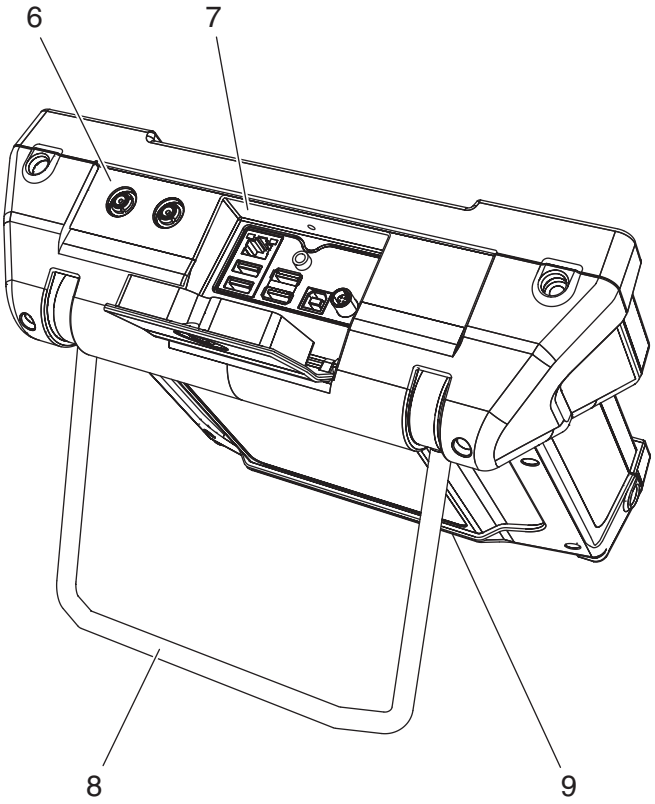
1 Trackball with two keys,
for operation of the software

2 Touch-sensitive screen (touchscreen),
for direct operation of the graphic interface

3 Trackball with two keys,
for direct operation of the graphic interface

4 Function keys **F1** to **F6**,
function assignment programmable via software

5 Key for switching on and off



Back panel

6 LEMO 00 TRIAX sockets,
for connecting the transmitter probe and the receiver probe

7 Interfaces **USB**, **Ethernet** and **+15V**,
for connecting further instruments, network connection and for connecting the power supply unit

8 Prop-up stand and handle,
for transportation and inclined installation

9 Battery compartment at the bottom,
for holding one or two lithium-ion batteries

2.2 Installing the instrument

The SpotChecker has a prop-up stand and handle at the rear that in different positions locks into place. Completely folded out it serves for the transport of the instrument. You can install the SpotChecker with different inclinations to have the best possible view of the screen.

Attention:

Place the SpotChecker on a stable flat surface.

The device is intended for indoor use. Select a suitable location for installation that guarantees to meet the environmental conditions. The ambient temperature must be between 0 and +45 °C. The relative humidity must not exceed 95 %.

The SpotChecker generates heat during operation, ensure that there is adequate ventilation and enough clearance between the unit and heat-sensitive objects or equipment.

Avoid direct heat, heat accumulation and overheating by direct sunlight or other heat sources. Ensure there is adequate and unhindered circulation of air.

Ensure that no dirt or only dry, nonconducting dirt appears on the instrument, in particular at the connectors. The following conditions must be met at installation:

- The instrument must not show any sign of moisture condensation inside. Moisture and condensation water reduce the functional safety. Avoid quick or intense changes in temperature. If the instrument has been exposed to temperature change of more than 10 °C, you must wait two hours or three before switching-on the SpotChecker.
- No iron or steel dust must penetrate into the instrument, in particular at the connectors. Apply protective caps on the connectors that are not in use.

2.3 Connecting a probe

A wide range of probes manufactured by GE Sensing & Inspection Technologies may be used in combination with the SpotChecker, provided the suitable connecting cable is available.

In addition, the dialog probes of GE Sensing & Inspection Technologies can also be connected, and they are automatically recognized by the USLT system. This requires the use of the probe connecting cables MPKL2X or SEKL2X.

The probe connecting cable must be equipped with a LEMO 00 plug at the instrument end. Existing cables can also be used by means of a probe adapter.

The connector sockets for one or more probes are located on the top side of the SpotChecker.

When connecting probes having only one transducer element, both connector sockets are equally suitable (connected in parallel) so that it does not matter which one of the two sockets is used.

The connectors for transmitter and receiver are marked with red ring (= receiver) and black ring (= transmitter).

Attention:

Wrong connections lead to a mismatching which may result in considerable power losses or distortions of the echo waveform.

When connecting a dual-element (TR) probe (having one transmitter element and one receiver element), or two probes (of which one is transmitting and the other one receiving), attention should be paid to the following assignment:

– Connect the transmitter element to the socket marked with the black ring.

– Connect the receiver element to the socket marked with the red ring.

2.4 Power supply

The SpotChecker can be powered using an external power supply or by up to two lithium-ion batteries.

You can connect the SpotChecker to the mains supply system when the battery is in the instrument. A discharged battery will be charged in this case, parallel to the instrument operation.

The power supply unit provided is only intended for indoor operation.

Operation using external power supply

The external power supply is delivered with two different power cables – for European and for US standard specifications. The external power supply automatically adjusts to any AC voltage between 90 V and 240 V (nominal voltage).

Connect the SpotChecker to the mains socket-outlet using the external power supply with the appropriate power cable. The socket connector is under the cover on the top side of the SpotChecker.

Attention:

Be sure not to overexpand the cover when opening.

– Loosen the knurled screw in the cover on the top side of the instrument and open the cover completely.

– Plug the Lemo connector of the external power supply unit into the socket connector **+15V** until it snaps into place with a clearly audible click.

– When pulling off the Lemo plug, withdraw the metal bushing on the plug first in order to release the lock.

– When transporting the SpotChecker always shut the cover and fasten the knurled screw.

Note:

When powering from mains operation, it is recommended to use a battery in the SpotChecker in order to prevent a system crash and data loss in the case of a power failure.

Operation using batteries

Use either one or preferably two lithium-ion batteries for the battery operation mode (option). These have a high capacity each. Consequently two lithium-ion batteries ensure a long operating time of the instrument.

Inserting batteries

The battery compartment is located at the bottom of the instrument and the cover is fixed with one knurled screw.

– Loosen the knurled screw in the cover on the bottom side of the instrument.

– Fold the cover down. You will see two battery compartments.

– Insert a battery into the left-hand or into the right-hand battery compartment. Observe the accurate position of the battery: the contacts have to point back- and downwards.

– Close the cover and fasten the knurled screw.

Checking the battery charge level

The lithium-ion battery is equipped with a battery charge indicator. The battery charge indicator is located at the front of the battery. Five LCD segments indicate the battery charge level. The number of filled LCD segments show the charging level as follows:

- 5 segments – battery charge level 100 ... 81 %
- 4 segments – battery charge level 80 ... 61 %
- 3 segments – battery charge level 60 ... 41 %
- 2 segments – battery charge level 40 ... 21 %
- 1 segments – battery charge level 20 ... 1 %

Exchanging batteries

Attention:

If you remove both batteries during operation and the instrument is not connected to mains supply, all unsaved data will get lost.

You can exchange one battery during operation.

– First insert a fully charged battery into an empty compartment.

– Subsequently remove the other battery.

Charging batteries

You can charge the lithium-ion battery either directly in the instrument or by means of an external battery charger. Several batteries are charged in succession.

If there is a battery in the instrument, the charging process starts automatically as soon as you connect the external power supply. You can carry out ultrasonic tests and charge a battery at the same time.

The charging time is approx. 6 hours per battery. The charging time is not reduced if the instrument is not simultaneously used for ultrasonic tests. The charging time applies to ambient temperatures from 25 °C to 30 °C. Please keep in mind that the batteries are not charged to their full capacity at high temperatures.

Charging lithium-ion batteries is also possible with the external battery charger recommended and delivered by GE Sensing & Inspection Technologies.

Note:

You will find information on how to handle the external charger in the documentation of your battery charger.

2.5 Power on/Power off

Starting the operation

To start the SpotChecker press the switch-on button at the down right of the display. The instrument is switched on and the operating system Windows XP boots up. The green LED illuminates during operation.

After start of the software the SpotChecker is ready for testing operation.

Closing the operation and shutting down

Attention:

Always close the software first before shutting down the instrument. Not following this sequence may result in a loss of data.

– Select the menu item **Exit** from the menu **File**. All current settings are saved and the program is closed.

– Click the button **Start** in the taskbar and select the menu item **Shut Down** to shut down the Windows operating system.

– After Windows is closed down, the SpotChecker will switch off automatically.

Note:

To switch off the SpotChecker without shutting down the software or the operating system, you have to keep the button on the front panel depressed for at least 4 seconds.

Switching off without shutting down the software may be required as severe exception, e.g. if the instrument does no longer react. All unsaved data are lost in such a case.

2.6 Interfaces

Five USB sockets and one network interface are located behind the cover on the top side of the SpotChecker.

USB

The four USB Type A sockets offer multifunctional connection possibilities, e.g. a mouse, keyboard, printer or external data carriers.

The USB Type B socket you can use to connect the SpotChecker with a computer.

Note:

You will find information on the installation of the peripherals under Windows XP and the relevant software in the documentation of the respective manufacturer.

Network

You can connect the SpotChecker with an Ethernet network, e.g. for data transfer. The basic network functions are already set up, but have to be adapted and configurated to specific local-dependent conditions.

Note:

You will find information on the network functions under Windows XP in the documentation for the operating system Windows.

WLAN

The SpotChecker optionally features an internal WLAN adapter. If it is installed, connections via WLAN are possible.

Bluetooth

The SpotChecker optionally features an external Bluetooth adapter. If included in the delivery, connections via Bluetooth are possible.

Attaching and initializing of the Bluetooth adapter is also possible during program run.

– Loosen the knurled screw in the cover on the top side of the instrument and open the cover completely.

– Plug the Bluetooth adapter in a free USB connector. If the SpotChecker is switched on, the adapter is initialized and immediately ready for operation.

– Shut the cover and fasten the knurled screw.

In order to communicate via Bluetooth the involved instruments have to establish a connection with each other (Pairing). The method depends on the instrument used in each case and is not described here.

2.7 Trackballs and touchscreen

Trackballs

The SpotChecker features two trackballs to operate the graphical software interface. Both trackballs work independently of each other and independently of a connected mouse.

Each trackball has a big and a small button. The big one of the respective trackball is equivalent to the left mouse button, the small button of each trackball to the right mouse button.

You can operate both trackballs simultaneously, e.g. move the mouse pointer with the right trackball and trigger functions with the buttons of the left trackball.

Touchscreen

The SpotChecker is equipped with a touchscreen enabling a direct operation of the menus appearing on the screen.

The operation by means of a mouse (selecting and clicking) is in this case replaced with direct touch on the screen. A mouse pointer is therefore not necessary.

To select or to mark an element of the user interface, just touch the corresponding point of the screen briefly with your finger.

Attention:

Do not touch the touchscreen with any hard or sharp-edged objects (e.g. ball-point pen or screw driver). The touch-sensitive surface may be severely damaged by them. Do not apply any high pressure to the screen, the touchscreen needs only slight pressure to react.

2.8 Remote control

The wireless remote control is not included with the standard package of the SpotChecker. It is available as an accessory. The remote control consists of a transmitter with eight keys and the receiver integrated in the SpotChecker.

The inspector can easily operate the inspection-relevant functions via a wireless radio control if required. The user has eight keys at his disposal to which he can assign the functions most frequently required, e.g. gain setting, A-scan freeze on/off, saving.

Thanks to the radio link, the remote control is non-directional; it has a radius of approx. 10 meters.

The remote control is automatically recognized. Several remote control systems can also be simultaneously operated without any mutual interferences. This independence of several remote control systems is automatically ensured by a special code.

Notes:

Remote control operation can be influenced by external interference (e.g. welding robot in the production line). Therefore, especially before storing, check to see whether the transmitted commands (e.g. evaluation) have been correctly recognized by the program.

The assignment of the transmitter (coding) to the required receiver is made after the system start-up by pressing the keys 1 and 8 of the transmitter unit simultaneously.

It must be ensured at this moment that no other instruments are waiting for a receiver assignment in the neighborhood, otherwise several instruments are controlled by one transmitter.

Assigning the remote control to a receiver

– In order to establish the first-time connection hold the remote control as close as possible to the desired SpotChecker.

– Press key **1** of the remote control, hold it down and press key **8** simultaneously for approx. 2 seconds. The transmitter will be assigned to the receiver.

After this, the remote control is ready for operation.

Key assignment

You can assign program-specific function to the eight keys of the radio remote control.

– Select **Options** in the menu **Configuration** and then click the tab **Function keys**.

– Select the program function you want in the respective list box for the keys and activate the appropriate tag.

– Confirm the changes you have made with **OK**.

2.9 Software installation

The SpotChecker is completely configurated and ready for testing operation.

The software SpotChecker is installed as well as all required drivers.

Note:

You will find basic information on how to use the Windows operating system in the documentation for Windows and in the Windows Online Help (**Start** – **Help**).

Re-installation SpotChecker

The software has to be re-installed e.g. in the case of a system failure. For re-installing you need the supplied software CD.

Note:

Subsequent to the installation of the software you will need a valid license file to start the program.

Updates

If you install an update, don't delete the old version. Install the new version in the directory suggested by the installation program. The old program version is automatically deleted; the old database is maintained and automatically copied into the correct directory.

Installation procedure

For a new installation or an update, please follow the procedure outlined below. In each case you have to connect the SpotChecker with an adequate external USB CD drive.

– Switch the SpotChecker on. Windows will start.

– Insert the software CD into the CD drive. The installation program will start automatically.

Follow the instructions of the installation program. During the program run, please observe the following:

- Enter your name and the name of your company in the window **Registration**.

- When installing the update you will be asked if you wish to convert the old database. Normally you would want to keep and process your data, therefore select **Yes**. The database is then automatically converted and can be used in the updated version. If you select **No**, then a new empty database will be created.

License after re-installation

With the first-time start of the software after a re-installation you will be asked for a valid license.

To obtain the license key you must send the MAC address (unique physical address) of one of the network interface cards installed in the computer to GE Sensing & Inspection Technologies. After this you will be given a license file valid for the corresponding computer.

The MAC address normally consists of six groups of two hexadecimal digits. You can detect it as follows:

– Switch on the computer. Windows will start.

– Click the button **Start** in the Windows taskbar and choose **Programs** – **Accessories** – **Command Prompt**. The window **Command Prompt** will be opened.

– Enter the command **ipconfig/all** and press the Enter key. Depending on the number of installed network interface cards one or more MAC addresses will be shown, each in the parameter line **Physical Address** (example: 00-14-22-48-57-BB).

– Send the detected MAC addresses to GE Sensing & Inspection Technologies. After this you will be given a license file.

– Copy the license file **license.txt** into the installation directory **SpotChecker**.

2.10 Basic settings

Selecting language

The SpotChecker is available in multiple languages. All program texts are displayed in the selected language.

– Select the menu item **Dialog** in the menu **Setup**. A menu containing the selectable language options is displayed. The currently selected language is marked with a tick.

– Click the language of your choice. The selected language is marked with a tick. All texts are now displayed in the selected language.

Restricting program access

You should restrict access to the software SpotChecker by assigning passwords. After a password has been entered and the password protection has been activated, a name together with a valid password must be entered every time the program is started. The entered password determines the allowed operating possibilities. A master password allows access to all functions including the entry or deletion of passwords. After an inspector password has been entered, the processing of inspection plans is possible but settings and views (A-scan and Racer) cannot be changed, and access to the database is denied.

Attention:

Without a master password, access to the system settings is no longer possible. If the master password is lost, please contact your nearest GE Sensing & Inspection Technologies representative.

Activating the password protection

Please pay attention to correct spelling using capital and small letters as well as blanks with names and passwords.

– Choose the menu item **Options** from the menu **Settings**.

– Click the tab **Program access**.

– Enter at least one name and one password in the table on the left.

– If necessary, enter one or several inspector names and passwords in the table on the right.

– Click the check box **Activate** to activate the password protection. If the password protection is activated, the box is marked with a tick.

– A registered name must be entered, together with a valid password, when the system is started the next time.

Deactivating the password protection

– Choose the menu item **Options** from the menu **Settings**.

– Click the tab **Program access**.

– Click the check box **Activate** in order to deactivate the password protection. If the password protection is deactivated, the box is not marked with a tick.

The system allows free access when it's started the next time.

2.11 Data backup

With normal program exit, the last setup is saved; all data are filed in the database of the system (**UltraLog.mdb**). The adjustment parameters are restored when the system is restarted.

Note:

With **Always create database backup copy** on the **General** tab of the **Options**, you can additionally create a backup copy of the database with the suffix **.bak** on each program exit. If necessary, you can recopy this file.

Apart from this, you should save the data generated to external data carriers (e.g. CD-ROM) at regular time intervals. In addition to the quick restoring of the setting in the case of a possible computer failure, this method gives the opportunity to create a library for different inspections which can be loaded as required.

We recommend the Windows **Backup** tool for for the data backup.

It is absolutely necessary that you also make a backup of your data prior to any software updates. Please observe the special information on this.

You should always make a backup of the following file: **UltraLog.mdb**

Note:

In order to reduce the volume of the database as far as possible and to make access as quick as possible, it's advisable to compress the database at regular intervals. Unnecessary entries are deleted during this process, and the data are reorganized.

Saving data to external data media

Attention:

Quit working with the SpotChecker before starting with the data backup.

The data backup on CD or DVD requires a corresponding external USB drive with appropriate recording software.

– Close the program SpotChecker.

– Insert an CD into the drive.

– Click the **Start** button in the Windows taskbar.

– Choose **Backup** in the folder **System Tools** – **Accessories**.

– Follow the instructions of the Backup program.

Uploading data from external data media

Loading data from CD or DVD requires a corresponding external USB drive connected to the SpotChecker.

Attention:

When uploading files to the computer, an overwrite will occur if any files of the same name already exist. Quit working with the SpotChecker before uploading any data.

– Insert a CD containing backup files into the drive.

– Click the **Start** button in the Windows taskbar.

– Select **Backup** in the folder **System Tools** – **Accessories** and click the **Restore** tab.

– Follow the instructions of the Backup program.

2.12 Online Help

Context-sensitive Help

The SpotChecker software contains a context-sensitive Help. This is the fastest way to get information on individual elements of the program interface. The context-sensitive Help is always active and does not have to be started separately.

Proceed as follows:

– Start the SpotChecker software. You will see the program interface. In the title bar of each window you will see the **?** symbol at the right.

– Click **?**. The mouse pointer now also receives a **?**.

– Move the **?** mouse pointer to an element of the operator interface, e.g. a button.

– Briefly press the left mouse button. A window containing information on the program element where the mouse pointer is placed appears.

Starting the Online Help

The Online Help for the SpotChecker consists of several chapters and individual sections just like a manual. To view the required information, you have to start Help, choose a topic, and then have the page displayed in the Help window.

Proceed as follows:

– Start the SpotChecker software. You will see the program interface.

– Click the button with the question mark. The window for selecting the Help topics appears.

– Choose a Help topic as in the General Help for Windows.

Note:

In all windows or panels, please pay attention to the information on how to select and display Help topics.

After a topic has been selected, the Help window for displaying the selected page appears. Every Help window has a button bar. By clicking one of the buttons you can move within the Online Help, e.g. to the

list of Contents or to the next section of a sequence of topics.

Buttons:

Contents	Back to Contents
Index	Move to Index
Back	Back to the page that was opened last
Print	Print currently active page
<<	Move to the previous section of a sequence of topics (not always active)
>>	Move to the next section of the sequence of topics (not always active)

Some elements of a Help page refer to related Help topics. These cross-references are highlighted green and underlined in the text. Other cross-references are made via icons or buttons. When you move the mouse pointer over to a cross-reference, the mouse pointer is shown as a pointing hand.

In that case you can press the left mouse button and call another Help topic.

Starting the Online Help without the software

The Online Help for the SpotChecker can be opened without activating the program itself beforehand. To do this, you have to call the Help file.

Proceed as follows:

– Click the icon of the Help file on the Windows desktop,

  or

– start the Windows Explorer and click the icon of the file **ultralog_en.hlp** in the folder **C:\UltraLog**.

The Online Help will start and windows will appear for selecting the Help topics.

Printing

All information displayed in the Help window may be printed via a connected printer.

Proceed as follows:

– Choose a Help topic. The Help window appears, and the required page is displayed.

– Click the **Print** button to print out the page.

Printing a complete chapter

You can print out individual chapters of the Online Help completely if required.

Proceed as follows:

– Click the **Contents** button of the Help window. The window **Help Topics** appears.

– Click a chapter (book symbol) or a topic (**?** symbol) and then the **Print** button.

Note:

All topics that can be clicked in the list of Contents are printed out (individually or as a book). If there are links (underlined words or phrases) to other topics on the printed pages, they are not automatically included in the printout. If you want to have a printout of them, click the topics and print out the displayed pages one by one.

Individual inspection reports 3

3.1 Ultrasonic inspection of spot welds within automotive industry

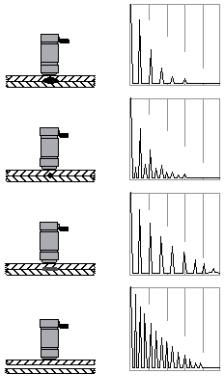
Basic principle

Spot-welded joints of two and three sheets are nowadays inspected using the pulse-echo method. Due to the non-uniform surface quality, the inspection is most reliably carried out in manual mode.

Special probes are used for inspecting spot welds. They contain a water delay path with a flexible rubber membrane. This ensures that the sound wave can be perfectly introduced even with the typically curved surfaces of spot welds without any problem. The sound frequency usually chosen is 20 MHz. The transducer element diameters vary between 3.6 and 10 mm.

The sound waves introduced into the plate produce a repetitive echo sequence from the inspection object. In this connection, the weld quality is derived from the shape of this echo sequence.

1. In the case of a perfectly sound spot weld, the amplitudes of the successive echoes drop relatively quickly because the welding structure is coarse-grained and therefore presents a high sound attenuation. The echo distances correspond to the total thickness of the welded plates less the electrode mark.
2. In the case of a too small spot weld, the inspector observes small intermediate echoes originating from the interface between the plates in addition to the normal echo sequence. This makes it possible to determine whether a nugget diameter is smaller than the diameter of the sound beam. This is the reason why probes having corresponding element diameters are chosen for different nominal diameters of weld nuggets.
3. If there is a cold weld or a “stick weld”, an extended echo sequence is received from the double plate. However, a fine-grained structure is given in the case of the cold weld, and this leads to a flatter echo drop with a lower sound attenuation.
4. Finally, a non-existing weld produces a long echo sequence with small echo distances corresponding to the single plate thickness.



Good spot weld (OK)

Too small nugget

Stick weld

Loose joint

To determine a too small weld nugget diameter, the nugget diameter is compared with the diameter of the sound beam: if the nugget diameter is too small, intermediate echoes are produced. This is on the one hand on the condition that the inspector positions the probe at the spot weld center. If the probe is not exactly at the center, intermediate echoes will likewise be produced. This means that an adequately large weld nugget may be evaluated as being “too small”. Conversely, however, it is not possible that a too small nugget be evaluated as being “OK”. The inspection result is consequently always on the safe side with regard to the nugget diameter, provided the inspector does not make any fundamental mistakes, e.g. use a wrong gain setting or a wrong probe.

On the other hand, the comparison of the nugget diameter with the sound beam diameter requires a high quality of the probes. Probe certificates are issued to prove the sound beam properties.

Comparison of ultrasonic inspection with other inspection methods

The shop methods include the button test, the destructive chipping test and the nondestructive chipping test using hammer and chisel. In the case of the button test and the destructive chipping test, the spot welds are subjected to stress load until breakage occurs using simple test equipment, without recording any reading. Used as evaluation criteria are the type of breakage and the size of the torn spot weld. The volume of test scrap causes considerable amount of cost.

The advantage of the chipping test using chisel is that it can also be applied to a finished component, e.g. a body shell. In these cases it is nevertheless mainly

applied as a nondestructive inspection, i.e. the joint is not subjected to load until breakage occurs. The costs for this inspection are comparatively low, but so is also the value of its inspection results. This especially applies to the nondestructive chipping test using chisel. It can only be used for detecting defective spot welds whose strength already lies way below the permissible minimum value, e.g. so-called “stick welds”. Added to this is the fact that the inspection results vary within wide limits due to the relatively indefinite inspection conditions that cannot be kept constant.

The inspection methods using testing machines include the shearing test, the peeling tensile test, the top tensile test and the torsional test as standardized inspection methods. Their advantage is that the strength tested under defined conditions in each case, e.g. shearing load at the breakage of the welded joint, is reliably determined. This statement should be qualified by saying that only information on the strength under the selected load can be obtained, e.g. the pure top tension, and not the mixed loads generally occurring. A disadvantage of these methods is the fact that an inspection on the finished component is not possible.

The micrographic examination enables information to be obtained on the nugget geometry, on the internal flaws, and assessments to be made about the structure. The good correlation between the nugget geometry and the results of destructive tests using standardized inspection methods makes the results of the micrographic examination an important and reliable, if only indirect, assessment scale for the strength of the spot weld.

Three disadvantages limit the application of this inspection method:

a) The spot has to be destroyed.

b) The inspection cannot be carried out on the finished car body to be further used.

c) The inspection costs are relatively high in comparison with all other inspection methods.

With the exception of the nondestructive inspection methods mentioned above, all other inspection methods are used in the production. A 100 % volume inspection is nevertheless not possible for economic reasons and, in the case of destructive inspection methods, also for technical reasons. As a result of

this, sampling tests are carried out. It goes without saying that the frequency with the low-cost, nondestructive chipping tests producing unreliable inspection results is higher than with the micrographic examination giving reliable inspection results, yet requiring a lot of cost and energy.

If we look at the inspection methods usually applied to in-process inspections at a higher inspection frequency and acceptable with regard to the costs involved, only the chipping test using chisel and the ultrasonic inspection are competitive in principle.

This rough overview of the current inspection possibilities already reveals the reasons for the high motivation with which the well-known, unsolved problem of nondestructive inspection of spot welds using ultrasonics has been extensively taken up again for some years now.

3.2 The software SpotChecker

Overview

The software SpotChecker is used for recording inspection results from ultrasonically inspected spot welds, e.g. within the automotive industry. In addition, results of destructive/nondestructive inspections can also be documented. The software consists of several modules and can therefore be adapted to special application requirements. The modular design of the software enables to realize the most different inspection philosophies:

- Mobile single-station system (one or several users)
- Stationary single-station system (one or several users)
- Mobile multi-station system (network) with or without host computer interface
- Stationary multi-station system (network) with or without host computer interface

The basic version already offers various possibilities for inspection, evaluation, documentation and (statistical) further processing of inspection-relevant data. The basic version was developed in cooperation with the automotive industry, and it is especially suitable for use within the production (e.g. body shell construction) and for quality assurance purposes. The access to the various program functions is only possible using the specifically assigned passwords for inspectors and methods engineers/inspection planners.

SpotChecker is a database program especially developed for the automated implementation and evaluation as well as documentation of spot weld inspections. SpotChecker stores and manages inspection results and helps you with the evaluation of echo displays. For this purpose, you have a large choice of detailed flaw classifications directly at your disposal (for example loose or burnt spot weld, bad through-welding, inadequate nugget diameter).

You can create inspection plans containing detailed descriptions of the spot weld location, material data, test sketches and complete instrument settings of the test system. All you have to do is to select predefined inspection plans in the inspection mode, and you can

immediately start inspecting. With a corresponding configuration, the inspection results are immediately displayed in color after coupling.

During the inspection, you can adjust the most important ultrasonic parameters to your requirements at any time, or use stored instrument settings if you like.

SpotChecker provides

- the greatest ease of program operation according to Windows standards
- storage of inspection data and program information in a standard database
- definition of inspection plans including any chosen spot weld name for individual applications
- true-to-location inspection according to the individual inspection plan
- entry of comments
- automatic evaluation assistance tools (Evaluation Assistance I/II/III/IV) to support the inspection according to a maximum of six different criteria
- adaptation possibility of Evaluation Assistance II, III and IV to varying requirements in daily inspection situations (material/plate thickness)
- support of “intelligent” dialog probes
- special remote control with user-programmable functions
- export of inspection results to MS-Excel and MS-Access, e.g. for statistical further processing
- classification of ultrasonic inspection results according to six inspection criteria
- display and printout of stored data sets

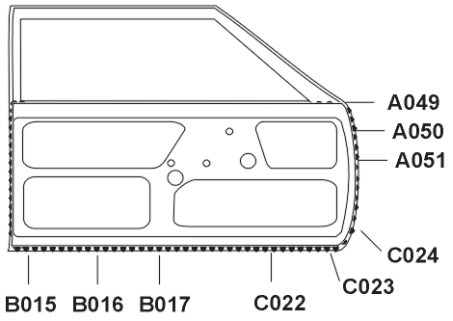
Application ranges

SpotChecker can be used for mobile or stationary spot weld inspections. It likewise supports the joint management of several inspection stations, for one or several inspectors each.

SpotChecker can be immediately used for simple, non-standardized inspections, without any further preparations. Corresponding inspection plans must be created beforehand for structured inspection se-

quences (standardized processes, repeated inspections). An inspection plan is called by the inspector at the location of the spot weld inspection. The inspection plan contains all the necessary information for the inspection and guides the inspector through the inspection sequence. Inspection results are saved to the SpotChecker database together with the inspection plan they were based on.

Linear inspection plans describe the inspection of a group of spot welds of the same type. These simple inspection plans can be directly created and managed using SpotChecker quickly and reliably.



Example (please see figure on the left):

Linear inspection plan:

Top door
1 A049 – 3 plates – setting A
2 A050 – 3 plates – setting A
3 A051 – 3 plates – setting A
...

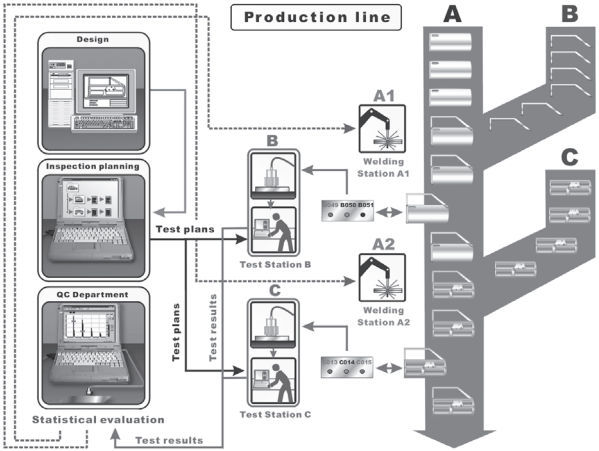
Structured inspection plan:

1 right side/top door/A051 – 3 pl. – setting A
2 right side/mid door/C024 – 2 pl. – setting B
3 right side/mid door/C023 – 2 pl. – setting B
4 right side/mid door/C022 – 2 pl. – setting C
5 right side/bottom door/B017 – 2 pl. – setting D
6 right side/bottom door/B016 – 2 pl. – setting D
...

Structured inspection plans are created on the basis of a structural description of the inspection object (assemblies, subassemblies, plate joints). These structured inspection plans enable a high degree of specification of the inspection sequence and a splitting-up of complete vehicles according to hierarchical levels. This means that SpotChecker meets the re-

quirements of complex organizational processes within the automobile manufacture (please see figure).

Structured inspection plans can only be created by means of the **Database Manager**. But they can be loaded and used by the means of SpotChecker.



Evaluation with UltraCAR

UltraCAR is a program from GE Sensing & Inspection Technologies for the statistical evaluation and documentation of ultrasonic inspection results from spot-welded joints determined and saved using SpotChecker.

The measurement and statistical tracking of parameters are integral parts of the continuous improvement of processes and included as a proof of the improvement of quality in the state-of-the-art quality management concepts.

UltraCAR can integrate the results from the different inspection stations into a centralized database system. This enables to use the program for the collection and the evaluation all inspection results obtained over a certain period of time (e.g. day/week/year) or for the corresponding inspection object (spot, component, car body).

For more details, please contact your local representative of GE Sensing & Inspection Technologies or directly one of the addresses mentioned in chapter 6.

General procedure – linear inspection plans

The inspection using SpotChecker generally includes the following steps:

- creating an inspection plan,
- calling and starting an inspection plan,
- if necessary, recalibration of the instrument settings,
- carrying out the inspection on the basis of the data in the inspection plan,
- manual or automatic saving of and commenting on the inspection results,
- ending the inspection plan,
- documentation of the inspection (printout of inspection reports, saving as ASCII file, or exporting to an Excel file).

Inspection plans are used for defining standardized default data and settings as well as a uniform sequence for repetitive inspections on components of the same type. The inspection of a large number of components of the same type can in each case be carried out using one and the same inspection plan which has once been created.

An inspection plan contains all the data and settings for a standardized inspection sequence. This provides a high degree of reliability, both for the inspection process and for the inspector.

When creating an inspection plan, the program provides forms to guide through the required data step by step so that nothing is missed or forgotten. The inspector can fully concentrate on carrying out the inspection after starting an inspection plan. Among other things, the inspection plan contains data

- on the inspection object,
- on instrument settings,
- on evaluation methods and tolerances,
- on the use of automatic evaluation assistance tools,
- on the selection of automated sequences (e.g. automatic A-scan freeze after successful coupling),
- on the classification of inspection results and
- on the envisaged spot weld locations (if available, together with a drawing).

The access to program functions can be protected by passwords. By this means it is possible to ensure for example that inspections are only carried out according to the required inspection plans if necessary.

The evaluation assistance tools

SpotChecker makes three different evaluation assistance tools available to support the inspection according to a maximum of six criteria. Using the algorithms of the evaluation assistance tools, SpotChecker calculates the inspection results after coupling and A-scan freeze. With Evaluation Assistance III, SpotChecker compares the currently active A-scan with a collection of model scans which are characterized with the help of gates. Up to 20 reference scans can be filed for each evaluation criterion for this purpose.

By using the evaluation assistance tools, SpotChecker is able to carry out an automatic evaluation and to selectively save the required data (e.g. only certain flaw types).

A visual evaluation by the inspector is also always possible by pressing a key.

Evaluation Assistance I

The following fixed inspection criteria are filed in the program for the Evaluation Assistance I:

- OK
- Small nugget
- Stick weld
- Burnt
- Bad through-welding
- Loose

The evaluation and allocation of the inspection criteria are carried out on the basis of the currently active A-scan from the backwall echo sequence, and from the flaw echoes if necessary. SpotChecker has an empirically determined table containing typical echo sequences for the range of 1 to 5 mm total plate thickness.

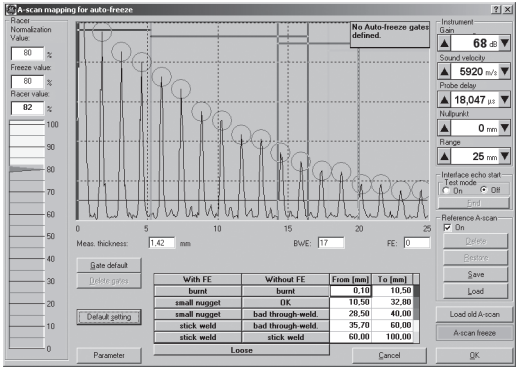
Advantage: The Evaluation Assistance I provides a simple method requiring no additional data entries by the user. It is particularly well suited for steel alloys (deep-drawing steel plates).

Evaluation Assistance II

The Evaluation Assistance II is applicable to two- and three-plate inspections (total wall thickness 1 to 12 mm). The sound path (round trip) is determined for all echoes exceeding the evaluation threshold. The corresponding inspection criterion is calculated for the sound path intervals filed in the table “Sound path ranges”. In this connection, the evaluation criteria take the drop in the echo sequence due to the sound attenuation in the spot weld structure into account.

The default setting of the table can be changed by the user in order to adapt the evaluation assistance tool to individual material conditions. For this purpose, it is necessary to carry out a sufficient number of corresponding comparison measurements. The evaluation results depend on the occurrence of flaw echoes.

Simultaneously with the definition of the evaluation ranges in tabular form, SpotChecker presents the graphical display and setting of the ranges. The ranges shown by different colors can be easily edited and moved by means of the mouse. The graphical representation makes the setting easier together with the clear marking of the backwall and flaw echoes.



Note:

The allocation of sound paths to evaluation criteria must be based on a sufficient number of exact comparison measurements in order to avoid any measurement errors in the automatic evaluation as far as possible.

Advantage: The Evaluation Assistance II is well suited for steel alloys. The evaluation criteria can be adapted to specific local or material-dependent conditions by an ultrasonic specialist.

Example:

The Evaluation Assistance is based on the following calculation of sound paths:

2 × total plate thickness × number of bw echoes

If the total plate thickness is 3.46 mm, as is the case in the example shown, and the number of backwall echoes (above the set evaluation threshold 10 % screen height) is 6, the following calculation results:

2 × 3.46 × 6 = 41.52

The calculated sound path falls into the range from 35.7 to 60 mm in the table filed, i.e. the results “stick weld” or “bad-through welding” would match the values. However, as intermediate echoes (flaw echoes) between the backwall echo sequence likewise exceed the evaluation threshold, the left result column (“with FE”) applies in this case. The indicated result is consequently “stick weld”.

Note:

Double evaluations or non-evaluation (symbol: evaluation not possible) can occur if the evaluation ranges overlap. We therefore recommend that the ranges be set so that no overlapping occurs. Range gaps are unacceptable.

Evaluation Assistance III

The Evaluation Assistance III is likewise applicable to two- and three-plate inspections (total thickness min. 1 mm, max. 12 mm). Any chosen inspection criteria can be filed for this evaluation assistance tool.

The evaluation is based on a complex A-scan comparison. The user files a typical A-scan for each evaluation criterion in the database. It is possible to file a maximum of 20 typical A-scans per criterion which can have 20 (max.) two-dimensional gates each, recording as exactly as possible the characteristic curve of the backwall or flaw echo sequence for the evaluation.

During the inspection process, SpotChecker compares the currently active A-scan with all A-scan characteristics stored in the database and carries out the evaluation after this, i.e. if the characteristics match, the corresponding inspection criterion is displayed.

The gate logic can be set for each gate: coincidence (match) or anticoincidence (non-match).

An overview shows the number of the sets of gates already stored for each evaluation criterion during the configuration. At the same time, the number of reference scans matching the currently frozen A-scan is indicated. If an A-scan is frozen, all stored sets of gates are immediately checked against this A-scan. The numbers of the matching reference scans are marked. This enables a fast, intuitive, and optimum configuration of the Evaluation Assistance.

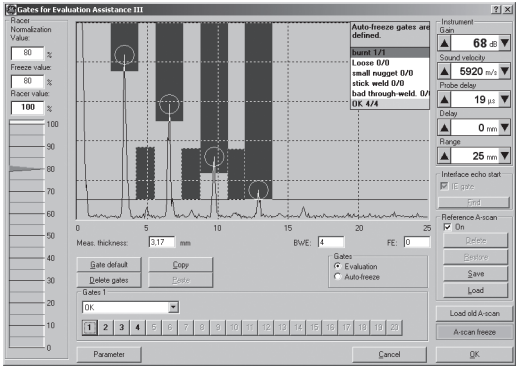
Note:

The description of typical echo sequences by the two-dimensional gates must be based on a sufficient number of exact comparison measurements using reference spot welds in order to avoid any measurement errors in the automatic evaluation as far as possible.

Advantage: Model results can be filed for any chosen materials. The system can be trained and is open to future applications.

Example:

Definition of a model scan for inspection criterion OK.



Note:

If, during evaluation, no result is obtained (symbol: evaluation not possible) then there is no comparable model scan for the active A-scan, i.e. not all cases were acquired during recording of the model scans.

Evaluation Assistance IV

The Evaluation Assistance IV has been developed for special process requirements in spot weld inspections.

It is based on the thickness measurement in correlation with the evaluation of the echo sequence. The total wall thickness is subdivided into zones whose limits can be individually defined by you. An evaluation class has been assigned to each thickness zone in correlation with the number of backwall echoes. The zones may be overlapping in this connection in order to allow several evaluation possibilities in limit zones.

The evaluation classes do not specify the flaw (e.g. “burnt”) but indicate any production interventions required.

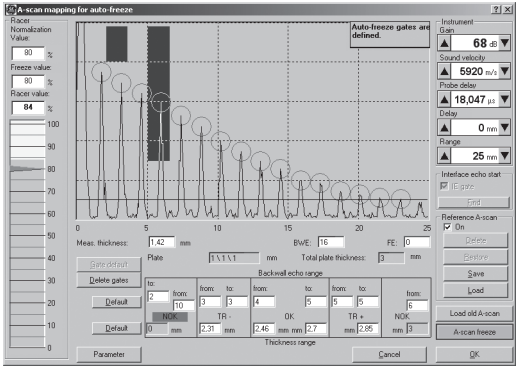
The following evaluation classes are permanently filed in the memory:

- OK (No flaw)
- NOK (Flaw)
- TR + (Upper tolerance range)
- TR – (Lower tolerance range)

You can individually define the evaluation ranges by entering the required values.

Note:

The individual configuration of Evaluation Assistance IV should in any case only be made in agreement with the Service of GE Sensing & Inspection Technologies.



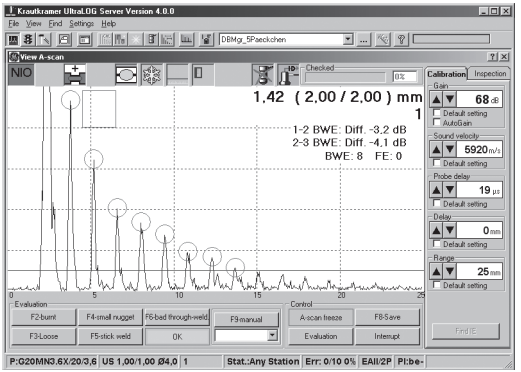
A-scan and Racer view

As an alternative to the view with the A-scan and the most important ultrasonic settings, the operator can use the Racer view. The Racer view is a simplified user interface only showing the most important information for the inspection. All the operator has to do

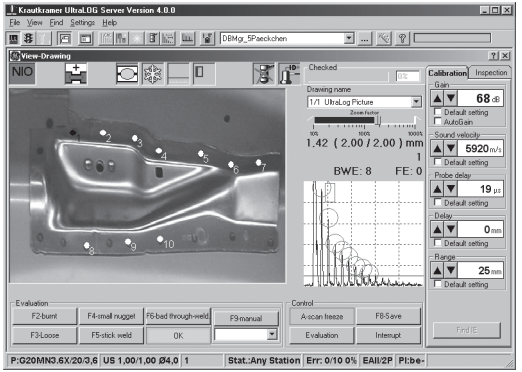
is to observe a vertical color cursor bar indicating the quality of the echoes.

There is no additional evaluation of the A-scan. Analogously to the A-scan view, the evaluation in the Racer view can be carried out in fully automatic mode, in partly automatic mode, or in manual mode.

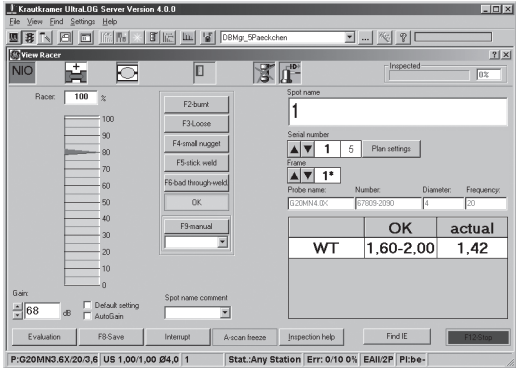
A-scan view



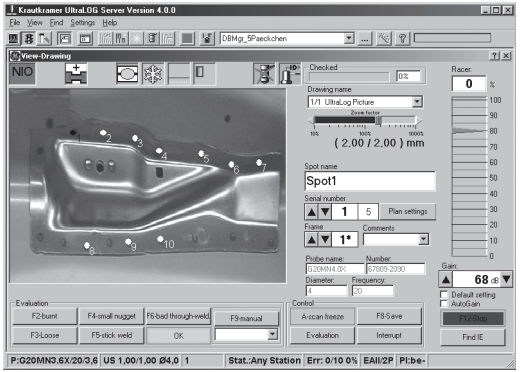
A-scan view with test sketch



Racer view



Racer view with test sketch

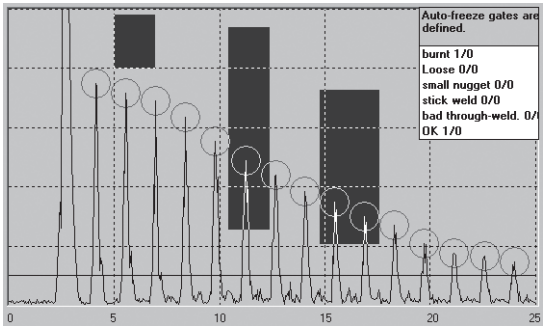


Automatic A-scan freeze

SpotChecker can automatically freeze the A-scan by means of two-dimensional gates. Up to three gates can be set up for this purpose. As soon as the echoes of the currently active A-scan are situated within these gates, the A-scan is automatically frozen. The position of the first gate must ensure that the first backwall echo reaches 80 % screen height.

Note:

More information on the positioning of gates are given in the on-line help supplied with SpotChecker.

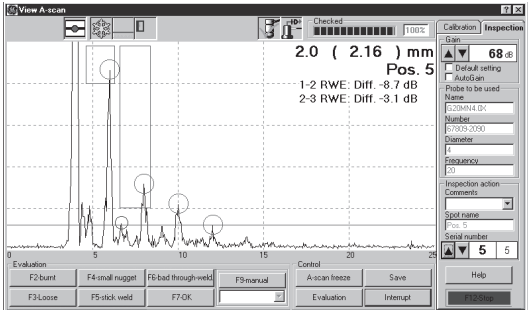


Graphical marking of relevant echoes

During the inspection by means of SpotChecker, and during the configuration of the Evaluation Assistances, the positions of all backwall echoes and flaw echoes, if any, are determined and graphically highlighted by clear markings (red and blue circles).

This function operates dynamically and is particularly useful when positioning gates and when carrying out a visual evaluation of A-scans. The markings ensure a faster recognition of the characteristic curve of an echo sequence.

Apart from this, the markings make the coupling and the peaking of A-scans easier.



Interface echo gate

Special probes are used for the spot weld inspection whose delay block consists of a lens filled with water. The delay line is not defined due to this design, and it varies along with every variation of the probe position as well as with every variation of the load applied to the probe.

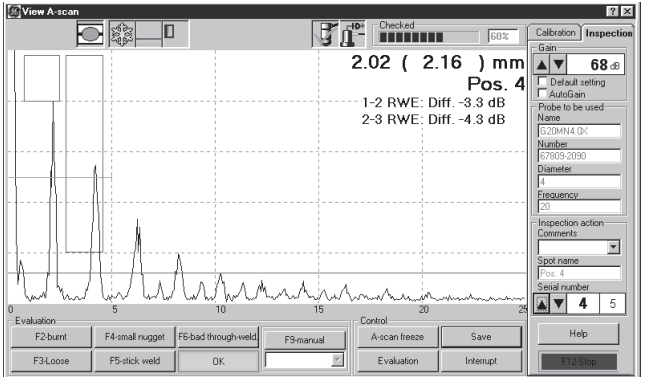
These constant variations of the delay line cause an alternating horizontal shift of the display in the A-scan with every movement of the probe – the A-scan “wobbles”.

SpotChecker is provided with an additional interface echo gate by means of which the display is continuously aligned with the position of the interface echo. In this process, the display zero is set to the point of intersection of the interface echo with the gate and tracked in real time. The result is a “steady” A-scan.

During the inspection, the operator can change between this “Interface echo start” function and the normal display mode any time. The ultrasonic settings are dynamically converted during this. The gates and reference scans filed in the inspection plan are likewise automatically converted and displayed in the corrected

version. An automatic evaluation of the A-scan by one of the Evaluation Assistances is carried out after the conversion.

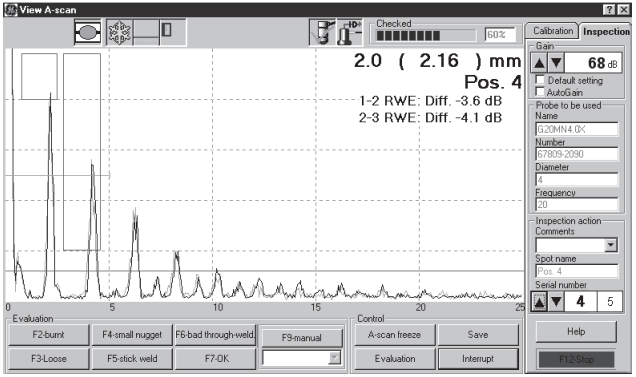
Inspection plans may be created with or without the function “Interface echo start”. In both cases, the corresponding parameters are adapted to the prevailing conditions at the time of each inspection.



Reference A-scan

A reference A-scan stored in the database can be used in connection with the Evaluation Assistances. The reference A-scan is generated during the definition of the Evaluation Assistances and stored in the inspection plan, and it can be displayed in addition to the live A-scan in the background during the inspection.

The reference A-scan presents an easy way of visual evaluation to the operator by means of a direct A-scan comparison.



The reference A-scan can be generated on the basis of the following data during the creation of an inspection plan:

- from a currently frozen real A-scan,
- from an external graphics file that has been created using a plotting program or by scanning,
- from an ASCII file describing graphics by means of numerical values (position and height of amplitudes).

The reference A-scan can be scaled and in that way adapted to the individual test environment.

Other inspection methods

Besides the ultrasonic inspections, SpotChecker can also be used for the documentation of other shop methods (e.g. chipping test using chisel, button test, or micrograph).

3.3 Dialog probes

The use of dialog probes is fully supported by SpotChecker. This helps to avoid any errors in the description and selection of probes.

When creating inspection plans (even by means of the Database Manager), the necessary probe data are retrieved from the probe at the press of a key. The following data can be read from the probe:

- Type
- Serial number
- Name
- Identification number
- Frequency
- Delay velocity
- Manufacturing date
- Probe diameter

Most of all the probe type and number – as well as the parameters probe diameter and frequency which are important for the inspection – can be defined as default inspection settings for the individual actions in the inspection plan.

The probe monitoring feature included in SpotChecker simplifies every probe change to be carried out by using dialog probes. Especially when using several different probe types in one and the same inspection plan, it's no longer necessary to enter any specific probe data.

At the end of the inspection, the dialog probe enables to produce a complete, reproducible set of documentation, including a report printout of the probes used and of those supported by the inspection plan (database).

Care, maintenance, errors 4

4.1 Cleaning the instrument

The care of the SpotChecker is limited to the regular outside cleaning. Use a moist cloth to clean the housing and the accessories.

If the instrument is very dirty, use a mild domestic cleanser.

⚠ **Attention:**

Do not use any methyl alcohol, solvents, or dye penetration cleaners for cleaning! The plastic parts may be damaged.

Clean the power supply unit and the cables using only a dry cloth.

4.2 Maintenance

Check the pins of the connectors at regular intervals. The pins must not be damaged.

No other maintenance work is in principle required on the SpotChecker.

4.3 Care of batteries

The capacity and life of batteries depends on their correct handling. Pay attention to the following information.

You should charge the batteries in the following cases:

- prior to the system start-up,
- after a storage time of 3 months or longer.

Charging batteries

Charge the lithium-ion battery either directly in the instrument or by means of the recommended external battery charger. Pay attention to the instructions for use included with the battery charger.

Attention:

Only use the recommended batteries and the corresponding battery charger. There is a danger of explosion if batteries and the battery charger are not handled properly.

Storage of batteries

The batteries should be stored at room temperature. Higher temperatures reduce the possible storage time.

The batteries are delivered with a minimum residual capacity of 20 %. This boosting charge enables a storage period of at least six months at room temperature before the electronic system goes to shut-down mode. This mode extends the storage time to approximately one year; after that, the batteries can no longer be charged.

4.4 Errors

Attention:

Do not open the housing of the SpotChecker. The unit does not contain any user-serviceable parts. If you are unable to resolve a malfunction, please contact the technical service of GE Sensing & Inspection Technologies.

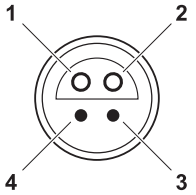
Repair work may only be carried out by members of authorized Service staff of GE Sensing & Inspection Technologies.

Technical specifications 5

5.1 Specification of the interfaces

4-pin LEMO 0S connection +15V

Top view of the interface



Pin assignment and signals

Pin	Signal	Function	Level	Direction
1	GND_EXT	ground		
2				
3	+15V_EXT_IN	power	+15 V ±5 %	input
4				

5.2 Specifications SpotChecker

Note:

The availability of particular technical features is dependent on the installed software.

Enclosure

Storage temperature	–20 ... +60 °C
Operating temperature	0 ... +45 °C
Dimensions (W × H × D)	225 × 314 × 94 mm
Weight incl. batteries	approx. 3.2 kg
Protection rating	IP 65
Shock resistance	according to EN 600 68-2-27
Vibration resistance	according to IEC 600 68-2-6 Fc
Display	8,4" TFT, SVGA, touchscreen
Control devices	2 × trackball with 2 buttons each, 6 function keys, touchscreen

Connections

Probes	2 × LEMO 00 Triax
Power supply unit	1 × LEMO 0S, 4-pin socket
Network	1 × RJ45
USB	4 × USB type A socket, 1 × USB type B socket

Power supply

Operating voltage	15 V DC
Power consumption	approx. 22 W
Batteries	2 × lithium-ion 10.8 V, 4.8 Ah
Operating time	approx. 4.0 h with 2 batteries
Power supply unit	external power supply unit 100 ... 230 V AC, max. 70 W

Ultrasound

Pulser type	Spike pulse
Pulse repetition frequency (PRF)	max. 1,000 Hz, 3 settings (depending on the calibration range), continuous setting approx. 8 ... 1,000 Hz., no continuous pulse sequence
Voltage	max. 400 V
Charging capacitor	1 nF, 220 pF
Initial pulse rise time	< 15 ns
Damping	50 Ohm, 500 Ohm, 1 kOhm
Probe mode (TR)	On/Off, through-transmission

Settings and evaluation

Calibration ranges	min. 0 ... 2.5 mm; 0 ... 0.1" (steel); max. 0 ... 9,700 mm; 0 ... 381" (steel)
Sound velocity range	500 ... 15,000 m/s; 0.02 ... 0.59 "/µs; integrated, editable material table
Pulse shift	–10 ... 1,500 mm; –0.39 ... 50" (steel)
Probe delay	0 ... 100 µs
Frequency range	0.5 ... 20 MHz (–3 dB); 4 filter ranges
Gain	110 dB, adjustable in steps of 0.5/1/2/6 dB

Rectification	full-wave, positive half-wave, negative half-wave, RF display (up to 150 mm/5.9" steel)
Suppression	0 ... 90 % linear
DAC/TCG	DAC with up to 16 curve points (reference reflectors), dynamic range 37 dB, maximum slope 6 dB/µs; 3 additional curves at adjustable dB distances, can be changed to TCG (time-corrected gain) mode (horizontal recording threshold); meets national and international test specifications
DGS	recording curves for all valid equivalent reflector sizes and probes with DGS capability; setting as DAC or TCG; evaluation in dB related to curve, ERS or class (JIS); sound attenuation and transfer correction; reference reflectors used: backwall, circular disk reflector and side-drilled hole
Monitor gates	2 independent monitor gates, adjustable over the entire maximum calibration range; evaluation on the basis of A-scan at display refresh rate; gate alarm: off, coincidence, anticoincidence; visual and/or acoustic alarm
Distance measurement	individually selectable for each gate at the echo flank or peak, in the RF mode additionally at the zero transition of the increasing or decreasing echo flank – initial pulse and measurement point in gate A or B – measuring points: gate B – gate A (differential measurement)
Measurement resolution	sound path/time of flight: up to 12.6 mm: 0.01 mm; otherwise 0.2 % of display width
Amplitude	0.5 % screen height or 0.2 dB

A-scan digitization	1,024 × 1,024 pixels
Display freeze	static A-scan freeze, dynamic A-scan freeze (peak value, echo dynamics + real-time signal), average freeze via 2 to 32 ultrasonic pulse cycles
Echo comparison	simultaneous display of the currently active signal and a stored A-scan
Dialog languages	German, English, French, Spanish, Italian, Chinese, Japanese
Units	mm, inch, µs
Data storage	database for storing and managing instrument settings, test jobs and test results, including A-scan, DAC and alphanumeric comments, export to Microsoft Excel; limited only by the hard disk size

Annex 6

6.1 EC declaration of conformity

EC Declaration of Conformity

Manufacturer:

GE
Sensing & Inspection Technologies GmbH
Robert-Bosch-Str. 3
50354 Hürth
GERMANY

Name:
Dipl. Ing. Johannes Büchler

Position:
Manager UT Development

Signature:

Name:
Dr. Stefan Frank

Position:
Product Manager

Signature:

Date: 17.02.2009

We, the undersigned, declare that the following instruments confirm with the essential requirements of the following directives:

• 2004/108/EC, EMC Directive
The accordance with the requirements of the directive 2004/108/EC is proved by compliance of following standards:

• EN 61000-6-2:2005
• EN 55011:2007 + A2:2007 Group 2, Class A

Remark:
„Group 2 contains all ISM equipment in which radio-frequency energy is intentionally generated and/or used in the form of electromagnetic radiation for the treatment of material and EDM and arc welding equipment.

Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Class A equipment is only for use in industrial environment."

• 2006/95/EC, Low Voltage Directive
The accordance with the requirements of the directive 2006/95/EC is proved by compliance of following standard:

• EN 60950-1:2001 + A11

Device:	
Type	**Id-No.**
USLT USB IO	036751
USLT USB	036752
SpotChecker	036763

6.2 Manufacturer/Service addresses

The instrument SpotChecker is manufactured by:

GE Sensing & Inspection Technologies GmbH
Robert-Bosch-Straße 3
50354 Hürth
GERMANY

Phone +49 (0) 22 33 - 601 111
Fax +49 (0) 22 33 - 601 402

Should you detect an error on your product, inform your local GE Sensing & Inspection Technologies service indicating the error and describing it.

If there is anything special that you would like to know about the use, handling, operation and specifications of the instrument, please contact your nearest GE Sensing & Inspection Technologies representative or directly:

GE Sensing & Inspection Technologies GmbH

Service-Center
Robert-Bosch-Straße 3
50354 Hürth
GERMANY

or:

Postfach 1363
50330 Hürth
GERMANY

Phone +49 (0) 22 33 - 601 111
Fax +49 (0) 22 33 - 601 402

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68, Chemin des Ormeaux
69578 Limonest-Cedex
FRANCE

Phone +33 47 - 217 92 20
Fax +33 47 - 847 56 98

Great Britain

GE Inspection Technologies Limited
892 Charter Avenue
Canley
Coventry CV4 8AF
GREAT BRITAIN

Phone +44 845 - 130 3925
Fax +44 845 - 130 5775

USA

GE Inspection Technologies, LP
50 Industrial Park Road
Lewistown, PA 17044
USA

Phone +1 717 - 242 03 27
Fax +1 717 - 242 26 06

6.3 Disposal

GE Inspection Technologies is an active participant in Europe's Waste Electrical and Electronic Equipment (WEEE) take-back initiative, directive 2002/96.

The equipment you purchased required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment. In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Visit

http://www.geinspectiontechnologies.com/en/aboutus/ehs/index.html

for take-back instructions and more information about this initiative.

General view of the device

In the following you find an instrument overview as well as guidelines and notes for recycling and waste disposal of the components.

Pos.	Recycling/materials code	Important information
1	LCD display	The fluorescent tubes of the LCD display contain small (0 ... 0,5 mg) of mercury (Hg)
2	Aluminium	Battery respective interface cover fastened with milled screws
3	Aluminium	Heat sink
4	Stainless steel	Handle complete
5	ABS/PC-TPE/Ms	Upper & lower housing with press fitted brass sockets
6	Li Ion battery	The battery is located in the battery case in the bottom. To open the case use the milled screws.
7	EPG	2 × printed boards inside of the instrument

Recycling data of SpotChecker

Recycling/materials code	Weight approx. (kg)	Important information
Materials/components, that have to be treated and disposed separately		
LCD display	0.35	The fluorescent tubes of the LCD display contain small amounts of mercury (Hg)
Lithium Ion battery	0.30	Located in battery case
Lithium Ion battery	0.05	On the PCB main-board
Materials/components that can lead to perturbation of different recycling processes		
>ABS/PC-TPE< / brass	0.90	Housing top & bottem case with press fitted brass socket
EPG	0.50	Var. printed boards

Recycling/materials code	Weight approx. (kg)	Important information
Materials/components that are in general advantageous		
Stainless steel	0.15	Carry handle
Aluminium	0.05	Battery interfase cover
Aluminium	0.20	Heat sink
Composite		
Key pad	0.35	Consisting of: Foil/aluminium/glass/spring steel
Mounting parts, cable	0.35	
Total weight including battery	3.2	

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