

## ECHOGRAPH 1093

Multichannel UT Electronics for Automated Testing Systems

**KARL DEUTSCH**

# Test Electronics

The ultrasonic testing instrument ECHOGRAPH 1093 provides parallel working test channels which are controlled by a computer (PC). This master PC works as an operator interface for the set-up of the ultrasonic testing system. In the component testing mode, it is dedicated to collect data, to evaluate them and to store them if desired.

Each test channel has its own complete ultrasonic electronics with a maximum pulse repetition frequency up to 3000 Hz. So each channel can drive its individual inspection task with its own parameter set. The device is particularly suitable for small automated testing systems for a wide variety of testing tasks (e.g. longitudinal flaw testing, testing for transverse defects, lamination testing on pipes, flaw testing on forgings and weld testing on transmission parts).



**For automated testing systems the ECHOGRAPH 1093 basically offers two software versions:**

The **component testing mode** is designed for fast, controlled testing cycles on the parts to be tested, with a subsequent sorting device. In addition, after acquisition of the testing data the result can be displayed with or without test report, e.g. for testing of finished parts or forgings.

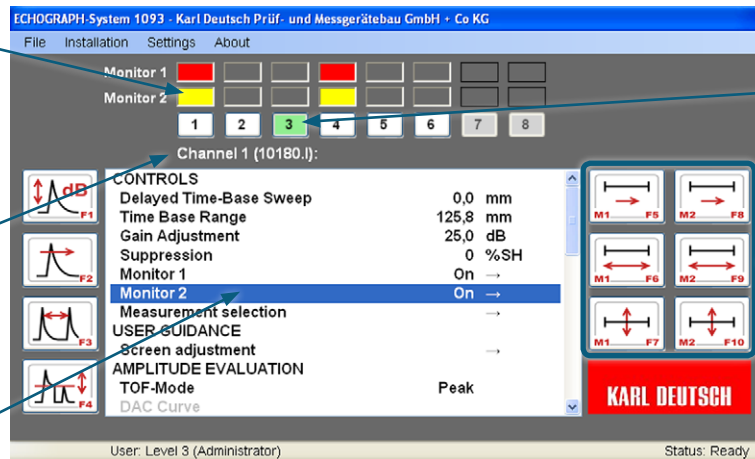
**Permanent testing** provides continuous test data evaluation with live outputs of the flaw monitors. This version comes with a signal holding time for paint markers or an option of stopping the test for reexamination (reversing operation), e.g. for testing of tubes and bars.

# User Interface

Clear representation of the monitor status, separately for each channel

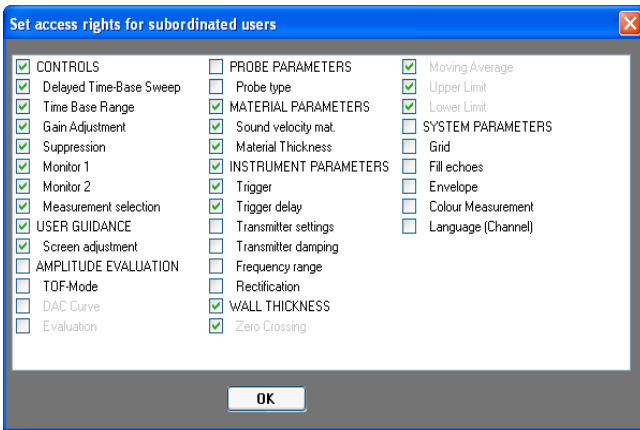
Description of the test task, editable separately for each channel

Additional set-up parameters are accessible via keyboard or mouse

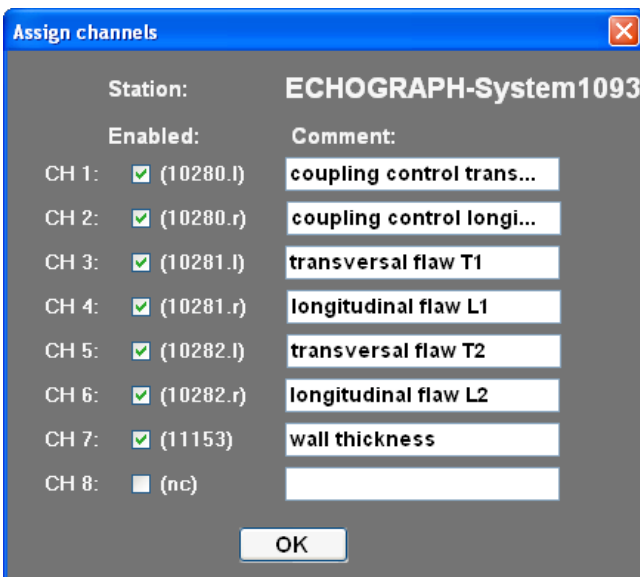
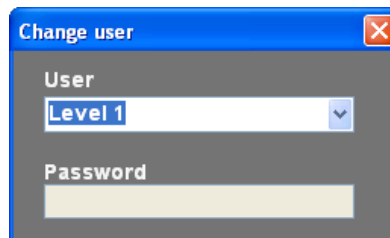


User interface for individual configuration of each channel (here channel/device 3, marked in green, from a total of 8 channels)

Frequently used setting parameters can also be reached via the function keys (F1 to F10)



The access rights are divided into 3 levels. The level 1 operator is the machine operator. The level 2 and level 3 operators can use this window to specify which parameters may be set by the level 1 operator. Thus, unintentional changes of test-relevant parameters are avoided.



Assignment of the devices to the individual test tasks: The text (comment) is freely editable and can be changed as desired, for instance, to tell the operator which task is assigned to each test channel. This text also appears during the set-up of the corresponding channel in the main menu (see above).

And...

- selectable colour scheme for the A-scan
- recording of an envelope or reference curve
- pulse repetition frequency of up to 3000 Hz for each testing channel
- transmitter trigger: synchronized channels, sequence control by cycle program
- receive trigger: starting with transmitter or 1st echo, with selectable blank time
- statistical clearing for each monitor gate
- external monitor (option)
- flaw evaluation according to the DAC method (option)
- compliance with DIN EN 12668-1

# Test Report and Evaluation (Option)

## Test report

The PC program "ProtGen93" converts the raw data that were generated during an inspection with an ECHOGRAPH 1093 system into a test report (PDF). "ProtGen93" works independently of the ECHOGRAPH 1093 device on any computer with a Windows® operating system (Windows® XP and higher). Thus, the offline generation of a test report is also possible. The test report of a batch consists of up to three parts, which can be activated or deactivated individually. An exemplary solution may provide the following (customization is possible as well):

## Batch summary

A table with information accompanying the test and specifications for each part under test, e.g. tube

## Detailed result

Graphical representation of the testing per channel (strip chart as amplitude vs test path)

## US parameter summary

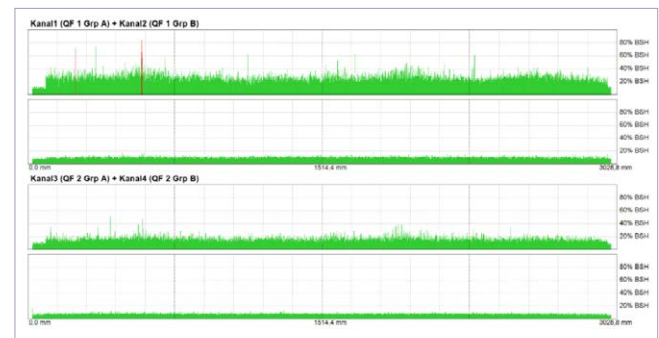
Batch-depending parameters, e.g. gain and monitor settings per channel

| Info             |                         |               |                       |
|------------------|-------------------------|---------------|-----------------------|
| Order no.        | KD 1a                   | System type:  | ECHOGRAPH-System 1093 |
| Date:            | 29.10.2016              | System name:  | US- check tube        |
| Examiner:        | Smith                   | System no.    | 1093.945              |
| Test norm:       | 10893-10                | Menu version: | V 1.1.10.8            |
| Calibrated with: | 40/5                    |               |                       |
| System setting:  | D:\setting E1093\*.adat |               |                       |

| Part no. | Date                  | Length | Remark | Result |
|----------|-----------------------|--------|--------|--------|
| 1        | 29.10.2016 – 14:08:17 | 3102mm |        | OK     |
| 2        | 29.10.2016 – 14:08:57 | 3104mm |        | OK     |
| 3        | 29.10.2016 – 14:09:27 | 3153mm |        | OK     |
| 4        | 29.10.2016 – 14:10:33 | 3112mm |        | NOK    |
| 5        | 29.10.2016 – 14:12:14 | 3207mm |        | OK     |
| 6        | 29.10.2016 – 14:14:02 | 3187mm |        | Ok     |

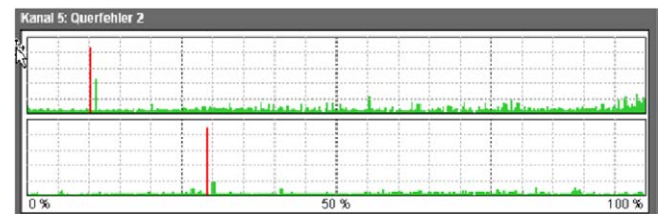
Example of batch summary in the test report



Strip chart example of the test report

## Recording

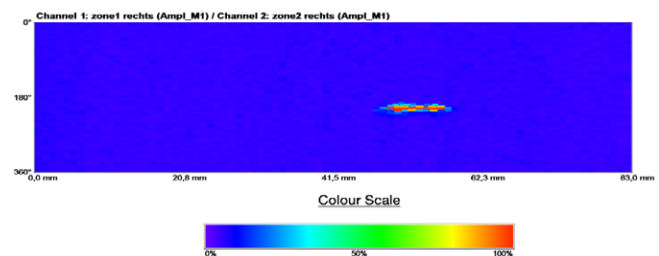
The presentation of test results can be executed as an amplitude vs path diagram, subsequent to the test data acquisition (offline). Each of the two monitor gates is recorded in conjunction with signals of travel sensors. The test data are stored as raw data. Customization is possible.



Result indication as line recording of an individual test channel (2 gates, e.g. inside and outside flaws)

## C-scan

The test data can be shown as a colour-coded display of echo levels following the test data acquisition. Colour options are adjustable for analog views. Customizations are possible.



C-scan representation (mapping of colour-coded echo heights)

# Variations of the Electronic Cabinet

## Customized and Application-Oriented Design of the Systems

### Examples



9 HU compact system incl. space for PLC panel



User interface with A-scan monitor and second monitor for set-up and representation of test results



12 HU compact system (8 channels)



38 HU switching cabinet with 19" monitor for channel depending representation of line recordings



38 HU switching cabinet with extra space for PLC components



38 HU switching cabinet with operating panel and PLC

# Technical Data

| Screen                                |   |
|---------------------------------------|---|
| Number                                | 2 (PC menu, A-scan)   |
| Screen type                           | TFT monitor   |
| Screen size                           | 7" diameter   |
| Resolution                            | 800 pixels x 480 pixels   |
| Scaling                               | generated electronically, can be switched off   |
| Scale division (A-scan)               | <ul style="list-style-type: none"> <li>coarse: 10-fold horizontal, 5-fold vertical</li> <li>fine: 50-fold horizontal, 25-fold vertical</li> </ul> |
| A-Scan Representation and Digitizing* |   |
| Image refresh frequency               | 50 Hz   |
| A-scan representation                 | <ul style="list-style-type: none"> <li>normal display (envelope)</li> <li>inverted (filled)</li> <li>echo dynamics curve</li> </ul>               |
| Representation                        | across the entire time-base range   |
| Rectification**                       | full wave, positive, negative, without (RF)   |
| Suppression                           | selectable: 0 - 99 % screen height in steps of 1 % (linear)   |
| A/D converter                         | 9-bit / 80 MHz  |
| Scan error with digitizing            | < +/- 0.5 % screen height   |
| Response time (image)                 | 20 ms   |
| Measuring Ranges*                     |   |
| Time-base range                       | 2.5 - 4850 mm steel   |
| Sound velocity                        | 100 - 15000 m/s in steps of 1 m/s   |
| Pulse shift                           | 0 - 3000 mm in steps of 0.1 mm  |
| Linearity of the time base            | ± 0.5 % of the screen width   |
| Transmitter*                          |   |
| Number of transmitters                | 1 (2 transmitter stages / resolution and power)   |
| Shape of transmitter pulse            | unipolar (negative) needle pulse  |
| Transmitter damping                   | 10, 50, 220, without [Ω]  |
| Pulse repetition frequency            | up to 3000 Hz   |
| Trigger                               | all channels synchronized by the measuring PC   |
| Amplifier and Filter*                 |   |
| Frequency ranges                      | 3 (LF, RF and broad band)   |
| Adjustable gain                       | 100 dB in steps of 0.1-1-2-6-12-20-dB   |

\* valid for each channel

\*\* in Basic software version full-wave and RF only

| Monitor Gates*   |  |
|--|--|
| Number of monitor gates  | 2  |
| Response time  | with pulse repetition frequency (max. 3000 Hz)   |
| Operating mode   | normal, inverted, off  |
| Adjustment range   | <ul style="list-style-type: none"> <li>gate start: 0 - 4000 mm in steps of 0.1 mm</li> <li>gate width: 0 - 3000 mm in steps of 0.1 mm</li> </ul>   |
| Statistical clearing   | 0 - 250 events   |
| Switching outputs per channel (connected internally to the PC) | <ul style="list-style-type: none"> <li>2 x flaw outputs TTL</li> <li>2 x analog outputs (assignable to either depth or amplitude or wall thickness)</li> </ul>                                       |
| Optical indication   | 2 LEDs on the front panel  |
| Flaw Evaluation (On the Display)*                              |  |
| Output of echo height (valid for both gates)                   | <ul style="list-style-type: none"> <li>% screen height (% SH)</li> <li>dBrel (for DAC-version)</li> </ul>  |
| Output of echo transit time                                    | <ul style="list-style-type: none"> <li>sound path</li> <li>depth</li> <li>projection distance and reduced projection distance</li> <li>resolution 0.1 mm steel</li> </ul>                            |
| Storage Options in the Measuring PC                            |  |
| Data sets  | <ul style="list-style-type: none"> <li>test settings for each test channel</li> <li>system's data set (overall configuration for all test channels)</li> </ul>                                       |
| Test results   | <ul style="list-style-type: none"> <li>generator for test report (offline)</li> <li>storage of raw data</li> </ul>   |
| Hard disk memory   | 500 GByte  |
| Inputs and Outputs   |  |
| Optocouplers   | <ul style="list-style-type: none"> <li>at the measuring PC</li> <li>16 signal inputs / 16 signal outputs</li> <li>50-pin SCSI, pluggable</li> <li>in the cabinet, led to a terminal block</li> </ul> |
| Interfaces   | <ul style="list-style-type: none"> <li>6 x USB 2.0, 4 x USB 4.0</li> <li>2 x DisplayPort</li> <li>2 x Ethernet LAN RJ45</li> <li>1 x COM RS232 interface</li> </ul>                                  |
| Miscellaneous  |  |
| Linear system  | mm   |
| Languages  | German, English, + national language (by arrangement)  |
| Number of channels   | 1 - 8  |
| Power supply   |  |
| Mains operation  | <ul style="list-style-type: none"> <li>85 - 264 VAC, 47 - 63 Hz</li> <li>operating temperature: 5 °C to +50 °C</li> <li>permissible humidity: 0 - 95 %</li> </ul>                                    |

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