

Multi-Channel ECHOGRAPH Electronics for Automated Ultrasonic Testing

Karl Deutsch has decades of experience on automated ultrasonic testing systems, mostly used for the inspection of bars, tubes, rails, billets, pressure cylinders and automotive components.

The newly presented digital multi-channel ultrasonic electronics, type ECHOGRAPH 1092, is of modular and cost-efficient but powerful design and perfectly suitable for small-scale systems. For each testing channel, one separate ultrasonic module with A-scan representation is used. The signal evaluation uses two independent flaw gates. An echo-trigger mode for immersion testing is provided. Fast testing applications can be realised due to the high PRF (pulse repetition frequency) of up to 4 kHz. Important measurement values such as amplitude and sound travel time are displayed on the right side within the A-scan. Various colour combinations for A-scan and the operator menus and also the possibility to fill the echoes allow for a high-contrast representation also for difficult viewing conditions.



Figure 1. Two-channel setup of ECHOGRAPH 1092 with a carrying handle. Two gates are active for each module (red and yellow horizontal bar). The corresponding measurement values (e.g. amplitude and flaw depth) are shown on the right side of the A-scan in large letters. The colours of the measured values correspond to the colours of the gates. A main power switch is provided for the rack-mount instrument.

A host-PC for data and test parameter processing and storage is provided if required. The PC-module and the ECHOGRAPH modules are all robust rack-mount versions.



Figure 2. Ultrasonic electronics with three channels and a host-PC. All modules are mounted into a 19" rack (in this example with a total height of 13 units).

A special software package, type DAV, for processing the test data is installed on the PC. The software stores all required test parameters for the ultrasonic ECHOGRAPH 1092-modules. Changing of the parameter set is done through the host-PC. During the inspection, the test results are presented online on the PC screen, e.g. as an amplitude strip chart (option). After finishing the inspection, the test results are stored together with the respective test parameters.

Technical Data

SCREEN

Screen type	<ul style="list-style-type: none"> ➤ colour-LC-display ➤ transmissive / transreflective ➤ daylight suitable ➤ background illumination
Screen size	143,4 x 79,3 mm ²
Resolution	400 x 240 pixels, 256 colours
A-scan size	142 x 73.5 mm ²
Grid	Electronically produced, switchable (on - off)
scales	<ul style="list-style-type: none"> ➤ coarse: 10-times horizontal, 5-times vertical ➤ fine: 50-times horizontal, 25-times vertical

A-SCREEN-DISPLAY AND DIGITISATION

Screen update rate	50 Hz
A-scan representation	<ul style="list-style-type: none"> ➤ normal mode ➤ filled echoes ➤ freeze mode ➤ record echo dynamics ➤ zoom for gate 1
RF.display	Possible for entire testing range
Rectification	Full-wave, without rectification (= RF)
Suppression	adjustable: 0 – 99% screen height in 1%-steps (linear)
Zoom	Spreading of gate 1 into full screen width
A/D converter	9-Bit
Digitisation	direct, with A/D-converter
Sampling rate	80 MHz
Quantisation error during digitisation	< ± 0.5 % screen height (4 MHz)
Response time	< 20ms

MEASURING RANGES

Testing range	2,5 – 4850 mm steel
Sound velocity	100 – 15000 m/s in 1m/s-steps
Zero delay	0 – 3000 mm in 0,1mm-steps
Linearity of time axis	+ 0.5 % of screen width
Pulse repetition frequency	max. 2600 Hz (less with increasing testing range, ± 50 % adjustable in 1%-steps)
Trigger	internal, external, first echo

TRANSMITTER

No of transmitters	2 (one for high power, one for high resolution)
Type of transmitter pulse	Unipolar (negative) spike pulse
Transmitter damping	10, 50, 220 [Ω], no damping

AMPLIFIER AND DAMPING

No. of frequency bands	3 (LF- und HF-range, broad band setting)
Gain setting	100 dB in 0,1-1-6-12-20-dB-steps, gain lock

ECHO EVALUATION, DEFECT SIZING

Output of echo height (for both gates)	% screen height
Output of travel time	<ul style="list-style-type: none"> ➤ sound path (straight-beam or angle beam testing) ➤ depth, projection distance, shortened projection distance (angle beam testing) ➤ resolution 0.1 mm steel

MONITORS (GATES)

No. of gates	2
Response time	Gate 1 and gate 2 with pulse repetition frequency
Operation modes	normal, inverse, off
Setting range	<ul style="list-style-type: none"> ➤ gate start: 0 – 3000 mm in 0,1mm-steps ➤ gate width: 0 – 1000 mm in 0,1mm-steps
Noise supression	0 – 250 events (both gates)
Outputs (both gates)	<ul style="list-style-type: none"> ➤ TTL-level (5V) , low active, ZA = 100 Ω ➤ response accuracy: ± 0.5% screen height ➤ switching hysteresis: < 0.5% screen height ➤ duration of output signal: max. 12 msec
Optical alarm (both gates)	2 LED's on front panel

IN- AND OUTPUTS

USB-interface*	USB 1 - interface for PC-connection and for printing via connected PC
Synchronizing input/-output*	TTL - level (5V), low active, trigger threshold approx. 2 V

OTHER FEATURES

Units	selectable mm, inch
Date and time	Built-in real-time clock
Languages	German, English, additional languages can be stored in instrument via a PC (menu texts can be freely edited on PC) *

POWER SUPPLY

Mains supply	Via transformer <ul style="list-style-type: none"> ➤ in: 85 – 264 VAC (AC) ➤ 47 – 63 Hz ➤ out: 10 VDC ➤ operating temperature: 0 to +50 °C ➤ storage: -40 to +85 °C ➤ humidity: 0 – 95%
Automated power off	In case of low voltage or low battery

HOUSING

Dimensions	19" rack module, 42 depth units, 3 height units
Probe connectors	2 x Lemo 1
Other connectors / plugs	<ul style="list-style-type: none"> ➤ PC: USB 1 ➤ 9 pole-plug for service, flaw output and trigger input ➤ Mains supply socket

* option