Technical Data ECHOGRAPH 1095

DISPLAY

Type of display	Colour TFT- LCD, transmissive, with LED display illumination
Size of display	152.4 mm x 91.44 mm
Resolution	800 x 480 pix, 256 from 262144 colours
Size of A-scan	152 mm x 76.2 mm
Scaling	Electronically generated
Scale division	Coarse: 10-fold horizontal, 5-fold vertical Fine subdivision: 25-fold vertical
Image repetition frequency	60 Hz

A-SCAN REPRESENTATION AND DIGITIZING

Image refresh frequency	60 Hz
A-scan representation	- Normal image (envelope or filled) - Frozen - Zoom across gate 1 or gate 2
RF representation	Across the entire time-base range
Rectification	Positive, negative, full-wave, without rectification (RF)
Suppression	Merely adjustable: 0 - 99 % screen height in steps of 1% (linear)
Zoom	Gate range (gate 1/2) to full screen (grid) width
A/D converter	16 bit
Digitising method	direct, with A/D converter
Sampling rate	100 MHz
Digitisation sampling error	< +/- 0.5% screen height
Response time	< 16.7 ms

MEASUREMENT RANGES

Time base range	0.5 – 17760 mm steel
Time base range with TOFD and B-Scan	0.5 – 343.4 mm steel
Time base range with signal averaging	0.5 – 1000.5 mm steel
Sound velocity	200 – 15000 m/s in steps of 1 m/s
Probe delay	0 – 650 µs
Pulse shift	0 – 3000 mm in steps of 0.1 mm
Linearity of time base	+/- 0.5 % of screen width
Pulse repetition frequency (PRF)	Automatic optimization 10 – 700 Hz (Auto high and Auto low), manual (depending on the transmitter) 10 – 5000 Hz [Spike Pulser], 10 – 1000 Hz [Square Wave Pulser]
Trigger	internal, 1st echo, external, external 1st echo
DAC (option)	Min. distance of the DAC support points: 0.3 mm steel
Encoder range	3000 mm max.

TRANSMITTER

Type of transmitters	Square Wave Pulser, Spike Pulser
Shape of transmitter pulse	Uni-directional (negative) Square Wave Pulse
Transmitter setting Specification according to EN 12668-1: td, tr, Vr, V50	
SP = Spike Pulser	Legend:
SWP = Square Wave Pulser	td | tr | Vr | V50
SP, 320 V	36 ns ±10% | < 10 ns | < 12.8 V | 320 V ±10%
SP, 80 V	57 ns ±10% | < 4 ns | < 3.2 V | 80 V ± 10%
SWP, 80 V, 100 ns	125 ns ±10 % | < 5 ns | < 2.4 V | 80 V ± 10%
SWP, 80 V, 3000 ns	3000 ns ±10 % | < 5 ns | < 2.4 V | 80 V ± 10%
SWP, 320 V, 50 ns	66 ns ±10 % | < 5 ns | < 12.8 V | 320 V ± 10%
SWP, 320 V, 850 ns	850 ns ±10 % | < 5 ns | < 12.8 V | 320 V ± 10%
Transmitter pulse voltage V50	60 V – 320 V in steps of 1 V
Pulse length td	Min.: 31 ns Max.: 5000 ns (manual, auto depending on the probe)
Pulse rise time tr	Min.: 3 ns, Max.: 15 ns
Max Volt after the pulse Vr	Vr < 4 %
Frequency spectrum	See below: additional data according to EN 12668-1
Effective output impedance	< 4 Ω
Transmitter damping	50, 75, 220, 1000* [Ω] *w/o active damping (input resistance 1000 Ohm approx.)

AMPLIFIER and ATTENUATOR

Number of frequency ranges	8 (low pass LP, 2 MHz, 4 MHz, 5 MHz, broadband BB, 10 MHz, high pass HP, 0.8 MHz – 8.0 MHz)	
Nominal frequency ranges (- 3 dB)	LP:	0.20 – 2.03 MHz
	2 MHz:	1.03 – 3.03 MHz
	4 MHz:	2.30 – 7.00 MHz
	5 MHz:	2.10 – 8.10 MHz
	BB:	1.30 – 14.00 MHz
	10 MHz:	4.67 – 16.67 MHz
	HP:	4.9 – 22.50 MHz
	0.8 - 8 MHz:	0.87 – 7.8 MHz
Response	LP:	fo = 0.64 MHz +/- 5% Δf = 1.83 MHz +/- 10%
	2 MHz:	fo = 1.77 MHz +/- 5% Δf = 2.00 MHz +/- 10%
	4 MHz:	fo = 4.01 MHz +/- 5% Δf = 4.70 MHz +/- 10%
	5 MHz:	fo = 4.1 MHz +/- 5% Δf = 6.3 MHz +/- 10%
	BB:	fo = 4.42 MHz +/- 5% Δf = 12.70 MHz +/- 10%
	10 MHz:	fo = 9.2 MHz +/- 5% Δf = 10.30 MHz +/- 10%
	HP:	fo = 10.38 MHz +/- 5% Δf = 17.30 MHz +/- 10%
	0.8 – 8 MHz:	fo = 2.6 MHz +/- 5%, Δf = 6.93 MHz +/- 10%
Temporal resolution	tA1 = <110 ns +/-10 % at 4.4 MHz (broadband setting BB) tA1 = <390 ns +/-10 % at 4.4 MHz (broadband setting BB)	
Receiver dynamics	LP:	102 dB
	2 MHz:	105 dB
	4 MHz:	106 dB
	5 MHz:	106 dB
	BB:	101 dB
	10 MHz:	102 dB
	HP:	101 dB
	0.8 – 8 MHz:	103 dB
Equivalent input impedance	TR Mode: Rmax = 415 Ω, Rmin = 455 Ω, Cmax = 129 pF, Cmin = 134 pF (IR) IR Mode: Rmax = 120 Ω, Rmin = 129 Ω, Cmax = 148 pF, Cmin = 147 pF	
Equivalent noise level	< 80 nV/$\sqrt{Hz}$	
Linearity of vertical display	Nominal value ± 2% screen height	
Dead time after transmitter pulse	<= 1 µs [measured with the following settings: Gain: 50 dB, damping: 50 Ohm, pulse type: spike, volt pulser: 320 V]	
Adjustable attenuation	Dynamics range 110 dB in steps of 0.1 / 1 / 6 / 12 dB	
Cross-talk attenuation	> 80 dB	

MEASURED VALUES

Output of echo amplitude is stated in...	% screen height dBabs in dBµV DGS/DAC/TCG/JIS/AWS: dBrel (relative to reference echo (line) in dB) AWS: D = Rating in dB C = Attenuation B = Reference A = Indication (following the standard AWS D1.1/D1.1M, only for gate 1) JIS: class (follow the standard JIS Z3060-2002, only for gate 1) DGS: mmFBH in equivalent flat bottom hole size
Output of echo transit time is stated in...	mm sound path (with straight probes) mm depth and projection distance or reduced projection distance (with angle incidence) Resolution: 0.1 mm steel
Output of wall thickness	Distance between trigger points in gate 1 and 2 (the trigger point can be selected from either edge or peak, with RF representation also zero crossing after first edge can be selected). Optional min. or max. wall thickness or sound velocity. Resolution 0.01 mm steel, averaging with RF representation can be selected either from 1 to 16 measurements.

MONITOR GATES

Number of gates	3
Response time	By pulse repetition frequency
Measurement modes	Peak, edge, zero crossing
Operation modes	Normal or inverted
Range	Gate start: 0 – 20000 mm in steps of 0.1 mm Gate width: 0 – 3000 mm in steps of 0.1 mm (independent gates, controlled by skip distance, gate 2 position follows gate 1)
Statistical clearing	0 – 250 events
Switching outputs	Level: TTL (5V) , low active, ZA = 100 Ohm Response accuracy: +/- 0.5% screen height Switching hysteresis: < 0.5% screen height Holding time of the switching output: 0.5/PRF with internal triggering, 1 ms with external triggering
Optical indication	3 LEDs on the front panel
Acoustical flaw alarm	Duration is 50 ms approx. (re-fresh with PRF)

INPUTS and OUTPUTS

Probe connection	2 x Lemo 1
USB interface	LEMO-0B, 4 Pin (optionally: adapter cable with USB Type A)
Flaw outputs	LEMO-1B, 10 Pin: TTL - level (5 V), low active, trigger level 2 V approx.
Synchronising input and output	LEMO-1B, 10 Pin: TTL - level (5 V), low active, trigger level 2 V approx. Max. PRF = 5 kHz , min. pulse length = 2 µs, delay between trigger and transmitter pulse: 50.8 µs approx., max. jitter between trigger and transmitter pulse: +/- 10 ns
Encoder	LEMO-1B , (I/O), 10 pin: square or pulse signal: TTL level (5 V), power supply via ECHOGRAPH 1095 (5 V, max. 200 mA)
External monitor	Via standard VGA connector (D-sub-HD 15 pin)
Connector for interface box	LEMO 1B, 14 pin
Digital inputs	LEMO 1B, (D/A), 14 pin, TTL level (5 V), low: active, trigger threshold 2 V approx.
Analog outputs	LEMO 1B, (D/A), 14 pin: 2.5 Vpo, signal for SH and wall thickness in gates 1, 2, 3 Impedance: 100.5 Ohm Linearity: error < 4% Δfg (fgu - fgl) = 21 MHz, fgo = $\sqrt{}$(fgu x fgl) = 23.2 MHz 0 dB to 92 dB ==> noise level < 1V Monitor position: no influence on the output signal Influence of the pulse shape: error < 4% (at 80% SH) Min. hold time: 2/(pulse repetition frequency)

MISCELLANEOUS

Linear measuring system	Selectable mm or Inch
Date and time	Built-in real time clock
Languages	DE, ES, FR, HU, IT, JP, NL, PL, RO, RU, SV, EN, CN, CZ The language of the user interface may be selected by the operator.

STORAGE

Memory card	SD card slot
Memory size	8 GB, SD card
Report file	CSV format in ASCII
Screenshot	BMP format
Types of report	Individual report, report of measurem. series, corrosion testing (matrix memory), reference
Data recorder	up to 10,000 readings plus important parameters per file, each with assigned A-scan bitmap file (optionally)

POWER SUPPLY

Mains operation	Via power supply unit (input: 100 – 240 V, 50/60 Hz, output: 12 V, 4 A Permissible operat. temperature: 0 °C to 50 °C
Battery operation	Built-in (replaceable) Li-Ion batteries
Operating time (battery operation)	9 h (with standard settings)
Data of rechargeable batteries	7.6 Ah – 7.4 V - 56 Wh
Charging method for batteries	internally with charger unit (optional external charger unit available)
Indication of battery capacity	4-stage display symbol, about 15 minutes before low voltage condition (battery operation), the blue LED will start flashing
Automatic voltage cut-off	If there is a low voltage condition both with mains or battery operation
Stability at voltage changes	< ±1% screen height and < ±0.5 % screen width (with voltage variations within the permissible range)

PERMISSIBLE AMBIENT CONDITIONS

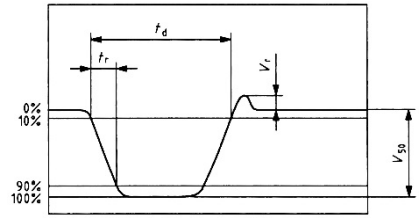
Permissible operating temperature (with battery) / storage	-10 to +50 °C / -20 to +60 °C
Dust and humidity	protection class IP65

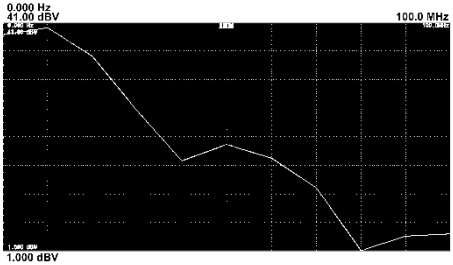
MECHANICS

Size (HxWxD)	138 mm x 249 mm x 52 mm w/o rubber holster 149 mm x 262 mm x 54 mm with rubber holster
Weight	2.0 kg (with Li-Ion battery and protective holster)

ADDITIONAL DATA ACCORDING TO EN 12668-1

Transmitter (definitions)





Linearity of vertical display

Attenuator	nominal value echo height [%]	permissible echo height [%]
+2	100	98 – 100
+1	90	88 – 92
0	80	80
-2	64	62 – 66
-4	50	48 – 52
-6	40	38 – 42
-10	25	23 – 27
-12	20	18 – 22
-18	10	8 – 12
-24	5	3 – 7

Stability (after warm-up period) at temperature changes
Echo height < +/- 2%
Echo position < +/- 0.5% screen width per 10 °C temperature change

Display diffuseness (jitter of the screen display)
Echo height max. 1% screen height, echo position max. +/- 0.2% of screen width

Accuracy of the calibrated attenuator
a) Deviation of fine adjustment:
accumulated max. +/- 0.5 dB
within a 20 dB interval
b) Deviation of coarse adjustment:
accumulated max. +/- 1 dB
within a 60 dB interval

REVISION HSITORY

Rev. A	initial version
Rev. B	digital switching outputs, trigger in/out, encoder
Rev. C	analog outputs, digital inputs