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UTxx

Universal digital ultrasonic electronics

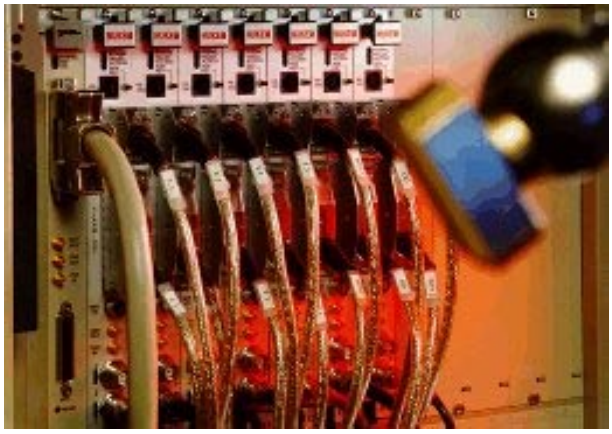
The UTxx electronic ultrasonic test system developed by NUTRONIK GmbH is a channel oriented digital electronic test system. It is modular oriented and achieves high test throughputs at low cost in automated inspection systems. Parallel multi channel as well as multiplexed systems with linear or logarithmic amplification can be designed.

Even the name of the system indicates its decisive advantage: »**xx**« signifies that this system is not restricted to a single range of operations but is instead designed for applications that match needs. The variable characters »xx« become during the practical application a dimension checking (DIM) function, a scarf monitor (SCM), a purity grade measurement (RGB) or a defect detection (FDU) function etc.

Since this function can be programmed at any time, with no modifications to the electronic system - the UTxx is genuinely a system which can be configured to meet the user's needs. In short: It is the user who specifies the meaning of »xx«.

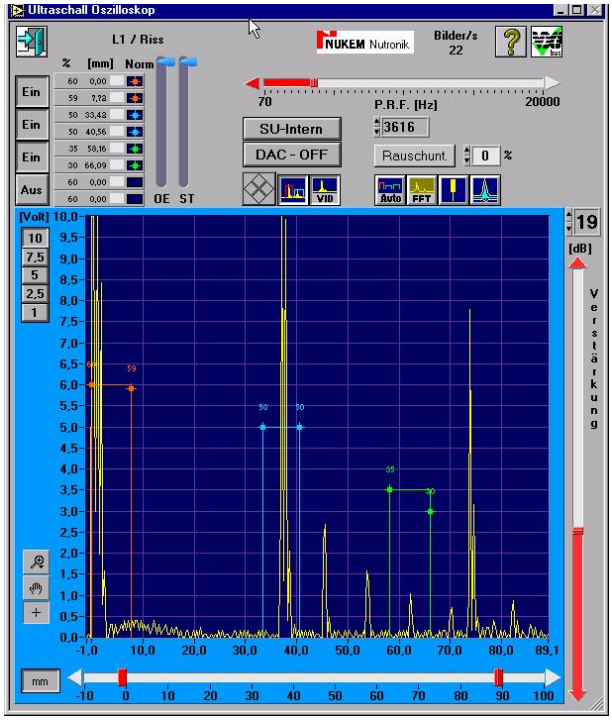
The UTxx can be delivered either with a linear or with a logarithmic amplifier.

As a subrack/cassette, the UTxx is indeed related in terms of conception to NUKEM's original systems but is at the same time, as a digital system based on the VXI bus, a further refinement. It has thus been possible to incorporate tried and proven cassette technology into digital systems. The UTxx therefore provides the answer for all users who prefer modern, purely digital and always extendable solutions.

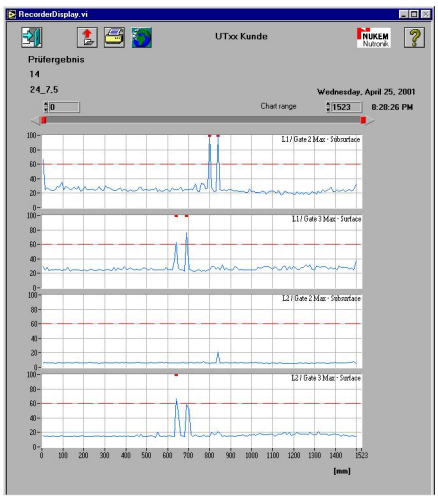


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UTxx-modules in VXI frame



display on the monitor screen



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The use of highly integrated digital modules in the UTxx made it possible to further reduce the number of analog circuits requiring intensive adjustment and calibration. The system thus minimizes adjustment and calibration work, achieves higher long-term stability and thus cuts overall costs significantly - both for manufacturing and for servicing and repair.

A mathematical procedure in measured-data processing, for which a patent has been received, also made it possible to significantly improve resolution and measuring accuracy. The UTxx can therefore be used both for crack detection and for high-resolution measurement of echo-time.

For a parallel system, each module represents a complete channel.

In a multiplexed system, up to four till eight channels are linked to one main module.

For applications requiring long cable distances between the probe and cassette or work in highly EMC-contaminated environments, the transmitter and receiver pre-amplifier can be removed and installed in a housing close to the probe mountings.

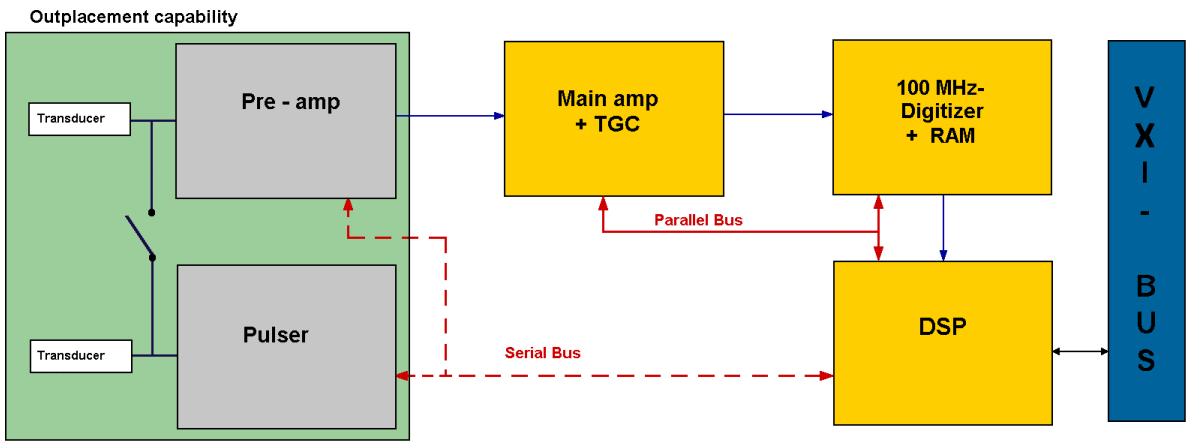
All facilities for connection of the probes and other instruments are located easily accessible on the front panel.

The standardized 19'' withdrawable module system incorporating the VXI bus accommodates thirteen cassettes, with one for the computer cassette and twelve vacant slots for UTxx cassettes or other VXI function cassettes. This arrangement guarantees maximum flexibility; the system can be augmented and upgraded with other measured-data evaluation systems at any time..

The configuration can be expanded by means of additional sub-racks with a bus link with no difficulty if the twelve slots are not sufficient for any particular application.

The computer cassettes available for the UTxx are based on standard PCs or, alternatively, standard work-stations. This standardization makes it possible to operate the UTxx under a Windows® user interface.

And this produces yet another advantage: The widespread familiarity with the Windows® user interface not only means significantly lower staff training costs, but also fewer operating errors.



Principal layout of a UTxx module

Technical Data

Transmitter

Transmitter location	for probes with 0.4 - 25 MHz frequency range; internal, optionally removable for local deployment
No-load voltage	approx. 300 Vss (negative square-wave pulse), bipolar transmitter with no-load voltage approx. 650 Vss, external, can be connected for through transmission testing
Pulser	150 V - 170 V to 50 Ω (negative square-wave pulse)
Initial pulse width at 50 % and increment	15 ns - 1.5 µs with 1 ns increments adjustable
rise and fall time	≤ 10ns / ≤ 12 ns
Initial pulse activation	serial, digital
Initial pulse triggering	internal, external
Synchronization of initial pulses	automatic, between all channels
Initial pulse delay	max. 16 ms with 1 ns increments adjustable
Initial pulse output impedance	50 Ω, additional pulser attenuation (for through transmission) 15 Ω - 650 Ω in 5 Ω or off switchable
Maximum pulse repetition frequency per channel	20 kHz (for standard defect detection) >10 kHz (for standard dimension checking)
Alternative pulser	bipolar burst pulse transmitter with 600V no-load voltage

Receiver in general

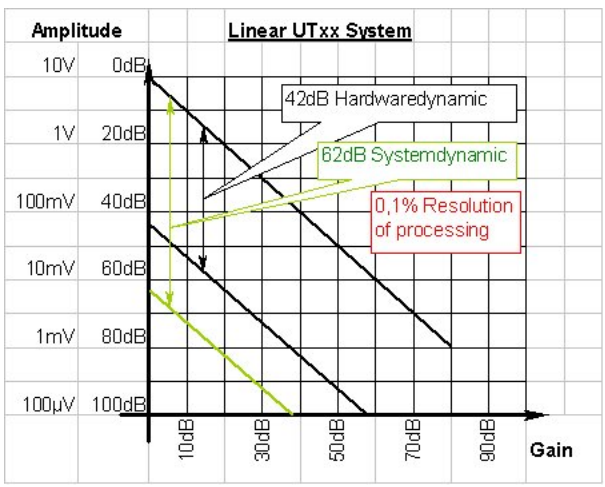
Receiver location	internal pre-amplifier and LIN or LOG main amplifier, pre-amplifier can be removed for local deployment (optional)
Maximum input voltage for echo signal	500 Vss
Processable input voltage range	≤ 10 Vss - > 1 mVss at 100 % indication
Adjustable gain	80 dB
Programmable distance amplitude correction	30 dB with 0,25 dB resolution with max. 1024 sampling points
Sampling point width for distance amplitude correction	60 ns ≅ approx. 0,04 mm in steel for longitudinal waves
Dynamic for distance amplitude correction	minimum 40 dB
Input impedance	15 Ω - 650 Ω with 5 Ω increments or switchable (parallel to preamplifier impedance)

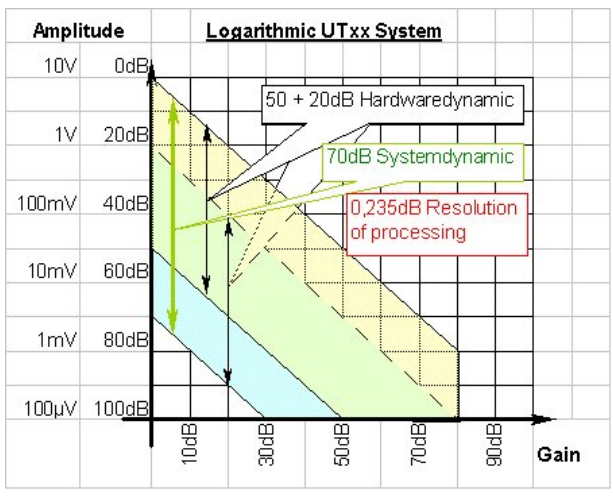
Receiver linear

Frequency response (without filter)	150 kHz to 25 MHz (-3 dB)
High-pass filter, passive, first order	none / 0,2 / 0,5 / 1 / 2 / 5 MHz ± 10 % (-3 dB)
Low-pass filters, passive, first order	1 / 2 / 5 / 10 / 20 MHz / none ± 10 % (-3 dB)
max. dynamic of hardware	42 dB
max dynamic of system	62 dB, resolution 0,1% using patented interpolation, note diagram

Receiver logarithmic

Frequency response (without filter)	200 kHz to 14 MHz (-3 dB)
High-pass filter, passive, first order	none / 0,2 / 0,6 / 1,2 / 2 / 4,8 MHz ± 10 % (-3 dB)
Low-pass filters, passive, first order	3 / 3,5 / 5,5 / 9 / 12,5 MHz / none ± 10 % (-3 dB)
max. dynamic of hardware	50 + 20 dB
max dynamic of system	70 dB, resolution 0,235 dB for data processing, note diagram





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Digital data processing

Evaluation	by means of DSP (Digital Signal Processor) and PLD's (programmable logic devices) for amplitude and time-of-flight measurement, slope or peak evaluation in freely selectable gates, accuracy enhancement by means of mathematical procedure (patent protected), statistical noise suppression, data compression, A - scan presentation
Parameter and measured - data output	by computer, via standard interfaces
Noise suppression	adjustable, 0 - 50 % indication
Gates (standard version)	4 defect/measuring gates
Thresholds	2 thresholds per measuring gate, programmable
Aperture trigger mode	occurrence dependent, on (for instance) initial pulse, surface echo, back - wall echo, etc.
Amplitude measuring accuracy of electronic channel for defect detection	≤ ± 1 % referred to a 10 MHz signal
Time-of-flight measuring accuracy of electronic channel for dimension measurement	± 1 µm referred to velocity of sound in steel with a frequency ≥ 15 MHz
A-scan display	in real time up to 50 frames / sec.; transient recorder function in real time envelope mode or single event

Standard assignments and functions of on-line signals

4 on-line INPUT signals:	parallel, Optocoupler, 3,5 V - 24 V
Crack detection and dimension checking:	❑ external trigger ❑ start/Stop measurement ❑ millimeter trigger ❑ revolution trigger
8 on-line OUTPUT signals:	parallel, Optocoupler, ≤ 5 mA / ≤ 35 V
Crack detection	❑ initial pulse monitoring (function checking) ❑ probe monitoring (echo checking) ❑ 6 alarm signals for threshold overshoot (3 gates, two thresholds per gate)
or Dimension checking: Wall thickness	❑ initial pulse monitoring (function checking) ❑ probe monitoring (echo checking) ❑ measuring gate monitoring (probe coupling wall) ❑ lamination ❑ wall-thickness change ❑ + tolerance for wall thickness exceeded ❑ – tolerance for wall thickness exceeded ❑ special function (e.g. variation in wall thickness, eccentricity, ovality)
or Dimension checking: external diameter (reference channel)	❑ initial pulse monitoring (function checking) ❑ Probe monitoring (echo checking ❑ + tolerance for external diameter exceeded ❑ – tolerance for external diameter exceeded ❑ + tolerance for internal diameter exceeded ❑ – tolerance for internal diameter exceeded ❑ 2 special functions (e.g. variation of external diameter, variation of internal diameter)

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