

# SUPOR



*Super Idea for Ultrasonic Inspection*

# SIUI



# Ultrasound Inspection

Ultrasound phased array (PA) and Time Of Flight Diffraction (TOFD), two of the new NDT technologies, have become one important development trend in current industrial ultrasound flaw detection.

The SUPOR ultrasonic flaw detector represents SIUI's continuous pursuit and innovation in ultrasound phased array (PA) and Time Of Flight Diffraction (TOFD) technologies, which incorporate many latest technologies such as ultrasound flaw detection, computer, electronics, mold tooling and craftwork, with which a perfect combination is achieved on the system.

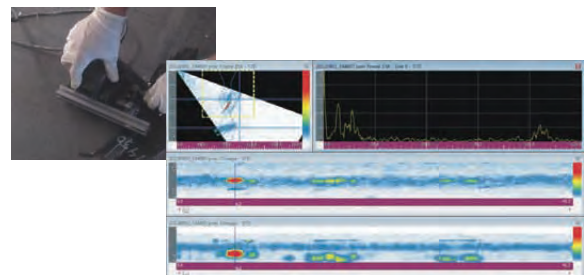
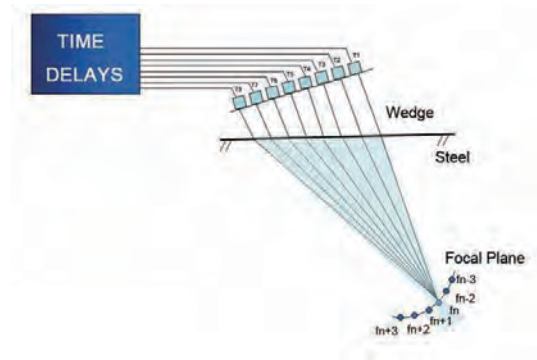
## Phased Array Technology

### About PAUT

The Phased Array technology is based on the use of probes made up of individual elements that can be independently driven. By electronically shifting the timing of phased array probe elements, the ultrasound beam can be steered and focused.

### Benefits of PAUT

- High Inspection Sensitivity
- Fast Inspection Efficiency
- Strong Inspection Capacity
- Accurate Flaw Positioning
- Visual Inspection Result



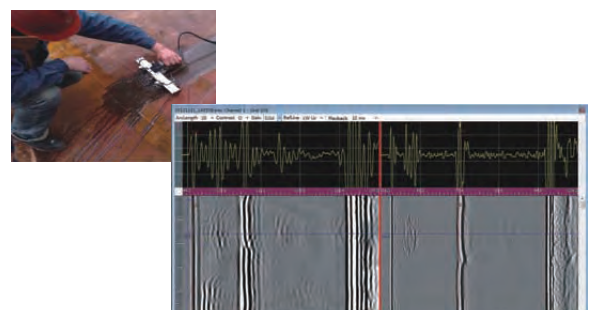
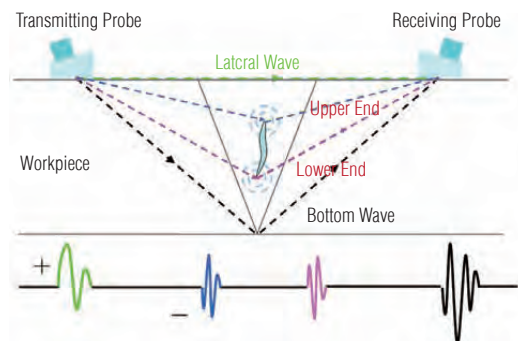
## TOFD Technology

### About TOFD

TOFD (Time of Flight Diffraction): It is an ultrasound inspection method based on ultrasound diffraction, instead of wave amplitude. The basic feature is working with T/ R probes.

### Benefits of TOFD

- Accurate sizing of defects
- Detection is independent of type and orientation of flaws
- Rapid scanning
- High probability of detection



## In Continuous Pursuit of Excellence, SIUI Releases Phased Array and TOFD Ultrasonic Flaw Detector



**TOFD with Conventional UT**



**PA & TOFD with Conventional UT**



**PA with Conventional UT**

New generation of ultrasonic flaw detector from SIUI, with modular design and more powerful functions. The SUPOR represents the persistent fine tradition of SIUI: innovative technology, advanced process, small size, lightweight, powerful functions and easy operation.

### Superior Features

- Grouping Scanning: It can be divided into up to six groups for one PAUT probe for different inspections.
- Support two PAUT probes working simultaneously with grouping function.
- Modular design: Phased array module (16/32 channels), Phased array + TOFD module, Multi-channel TOFD module or conventional UT module...
- Simultaneous Inspection of PA & TOFD
- TKY software (Optional)
- Velocity, Sensitivity, Delay, TCG calibration
- Weld simulation
- Scan setup wizard
- Real time A/B/C/D scan
- 8.4" touch screen LCD with resolution 800×600 pixels

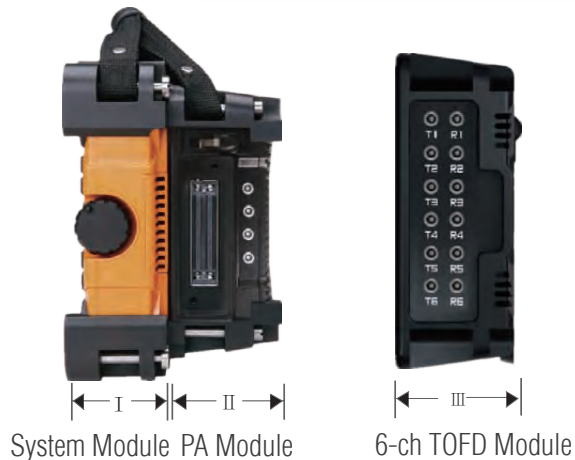







\*Specific functions are subject to final order.

# Modular Design

## SUPOR can work with multiple ultrasound imaging modules:

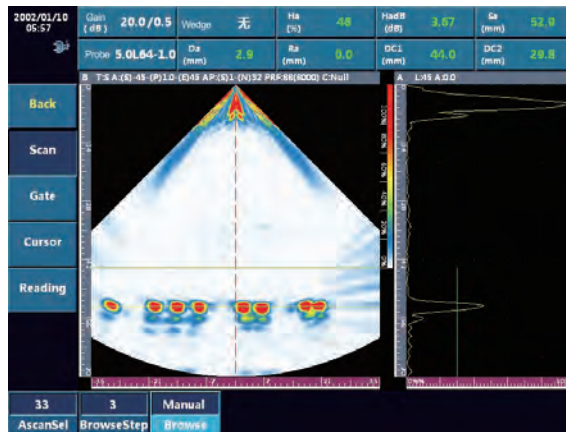
16:64 Phased Array with 2-ch conventional UT module+ optional 1 or 2-ch TOFD function;  
 32:128 Phased Array with 2-ch conventional UT module+ optional 1 or 2-ch TOFD function;  
 2/4/6 TOFD modules with conventional UT functions...



-  Alarm output port for alarm signal output
-  Dual axis encoder port for crawler connection
-  Ethernet port for network data transmission
-  USB port for connecting USB device or storage
-  VGA port for VGA monitor or projector connection

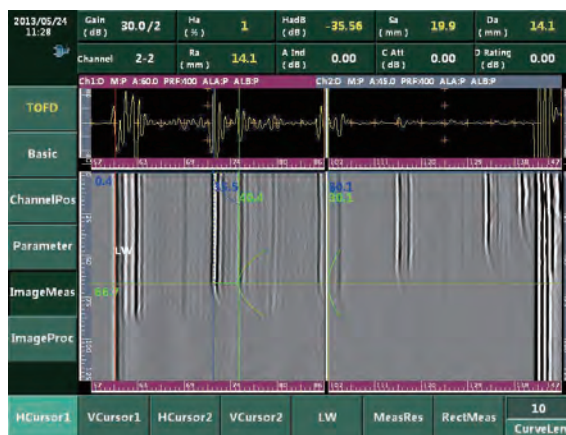
## Features of Phased Array Module

- 16/32 channels for selection
- Bipolar transmit square wave, adjustable transmit voltage and pulse width
- Continuous receive dynamic focusing
- Multiple view display modes
- Data Analysis: image gate dynamic reconstruction

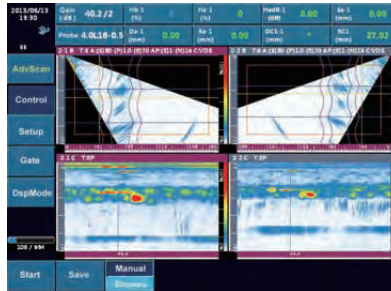


## Features of TOFD Module

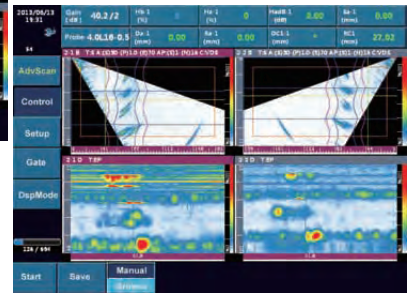
- Multi-channel TOFD function with 2/4/6 channels for selection
- 0.5MHz-20MHz band width
- Negative square wave transmit pulse, adjustable transmit voltage and pulse width
- Data Analysis: Lateral Wave / Bottom Wave Straightening,
- Lateral Wave/ Bottom Wave Filtering, Contrast Correction,
- Gain Correction, Flaw Height and Length Measurement



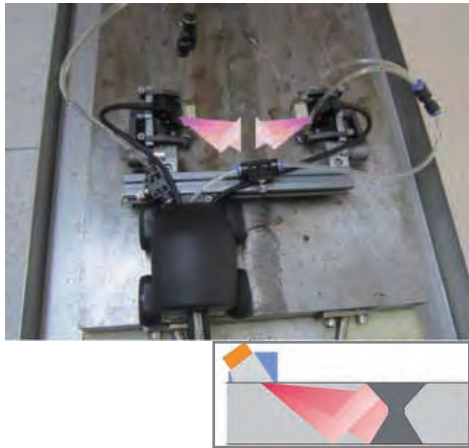
# Multi-Group Scanning



Two Groups of B+C Scans



Two Groups of B+D Scans



For one phased array probe, multi groups of element and multi angles can be applied for scanning at the same time, fully covering the welding area and enhancing the inspection efficiency.

In SUPOR, one phased array probe can be divided up to six groups for different inspection.



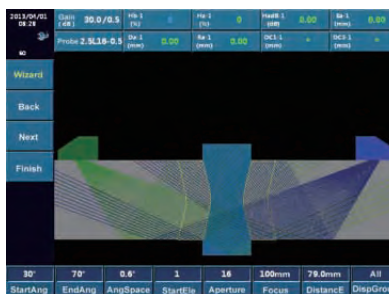
Two phased array probes can work simultaneously with grouping function to inspect from both sides of the welding, therefore enhancing the inspection efficiency and speed.

SUPOR with External Connector

## Weld Simulation

Weld Simulation is to simulate how phased array ultrasound propagates in type V, Y or X flat panel butt weld, so as to help users know the beam coverage status and finish test process setup.

This function is used to complete testing process design for the specific testing of work pieces, including the beam coverage simulation and phased-array imaging parameter settings. By using this function, the user will find it easier to analyze, locate flaw signals and make sure each part of the test pieces meet the industrial welding standards.

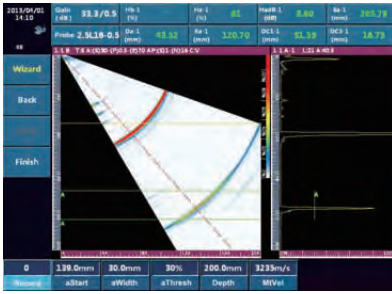


Beam Coverage Simulation Wizard

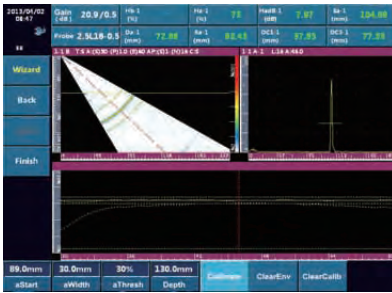


Weld Overlay Simulation

# Scan Setup Wizard

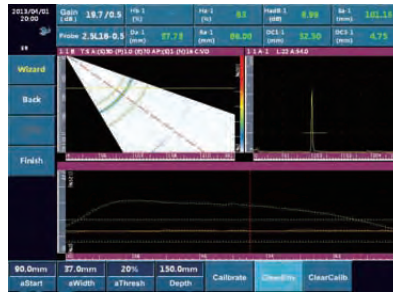


Velocity Calibration

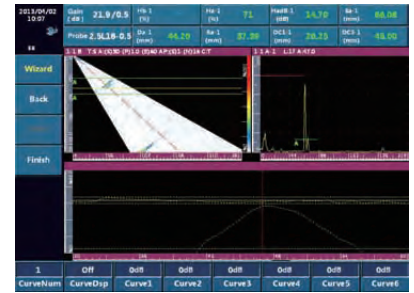


Sensitivity Calibration

- Smart wizard, which can guide users to finish imaging setup easily and improve inspection speed.
- Calibration wizard is to calibrate key performance parameters of phased-array, including velocity, delay, sensitivity and TCG.
- The step-by-step menu guides users to perform all the calibration procedures easily.

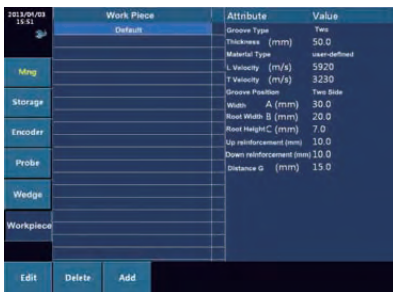


Delay Calibration



TCG Calibration

## Management



Work Piece Management



Probe Management



Wedge Management



Encoder Management



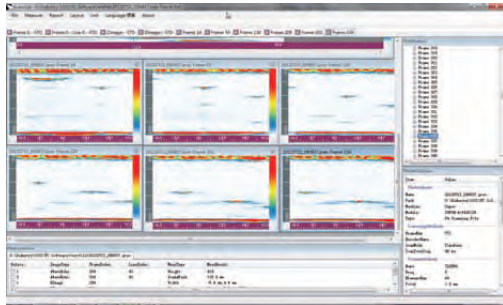
Storage Management

- Easy-to-use interface to make work piece, probe, wedge, encoder and storage managements more convenient.
- In the work piece management, the shape of the work piece is simulated and detailed parameters are listed for reference.
- The user may manage probe and wedge parameters via probe and wedge management.
- Follow the wizard, the user can finish encoder simple operation, calibration and test quickly.
- Parameters, screenshot and data can be easily managed in the storage management to enhance the inspection efficiency.

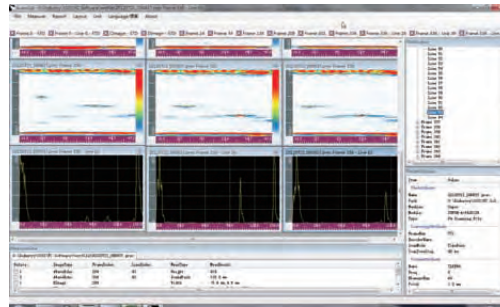
# SuporUp PC Software

SuporUp is a PC-based software for

- Checking data file: check the phased array or TOFD files transferred from SUPOR.
- Measuring data analysis: measure and analyze the phased array or TOFD files.
- Generating measurement reports: input the file information and the measurement result of phased array or TOFD files to a specific file to generate the test report.



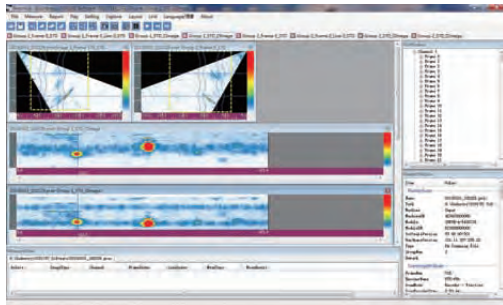
Multiple B-scan



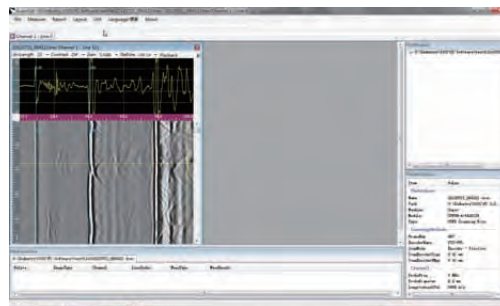
Multiple A+B Scan

## Display Mode

SuporUp provides several display modes for selection; users can use different display modes during inspection or analysis with flexibility. Change the size and position of the region of interest, and the software will re-construct C/D scan images automatically.



Phased Array Measurement



TOFD File Measurement

## Management

For phased array files, SuporUp can

- Perform width, height and rectangle measurement on the phased-array B/C/D image.
- Perform height, sound path, vertical distance and horizontal distance measurement on the A-scan echo.

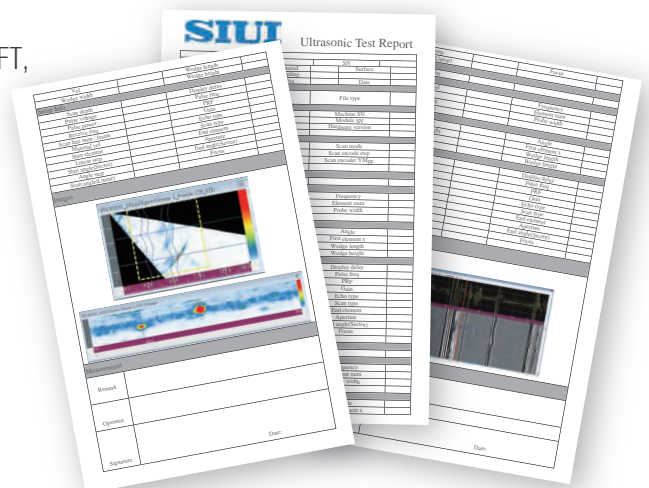
For TOFD files, SuporUp can

- Perform length measurement, straightening, filter, recovery, local zoom, SAFT, contrast adjustment and gain post processing on the TOFD image.

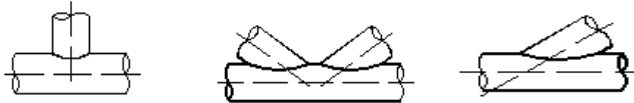
## Reporting

Detection echoes, curves or parameters may be losslessly stored to SuporUp facilitating report editing and data management.

Screenshot and detailed info can be transferred to Microsoft Word for customized reporting. The user can add company logos and inspection specific information including all relevant inspection settings to make a full report.



# TKY Software (Optional)



T-K-Y Weld Joints



## TKY Software Introduction

With benefits like high strength, light weight and simple structure, T-K-Y weld joints structures are widely adopted in construction and offshore oil engineering. As main force bearing structures in the offshore oil engineering, T-K-Y weld joints not only bear their own weight, but also face other extreme loads such as wind load, wave, and equipment vibration. Therefore, the safety and reliability of weld joints determine the offshore platform structure and safety of oil and gas production.

Conventional ultrasonic inspection on T-K-Y weld joints face these problems: complicate procedure, difficult defect position, heavy workload, low defection efficiency and so on.

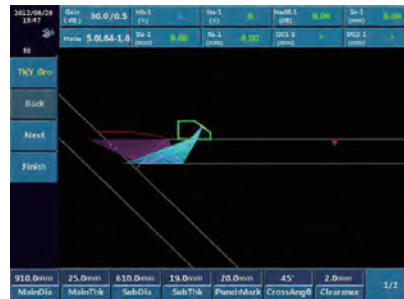
In order to solve problems above, SIUI combines phased array technology with computer-aided technology and develop our unique TKY software, which is perfectly used for PAUT of critical T-K-Y weld joints.



## TKY Software Interface



Workpiece Setup



Simulation Interface

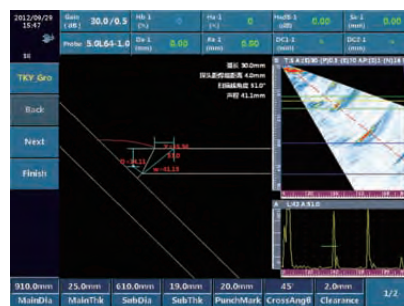


Scan Interface

## TKY Software On-site Application



Y-shape weld joints cut from a huge pipe



Sample with short cross-drilled holes of different diameters along the weld direction



On-site application in the offshore oil engineering

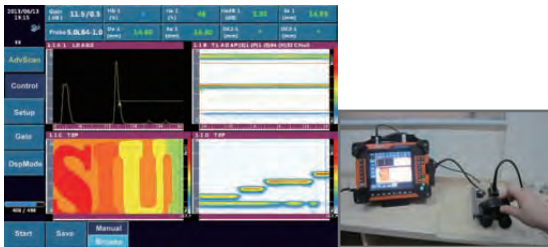


# Typical Applications

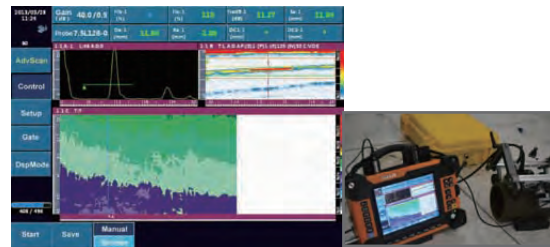


SUPOR is designed to increase productivity in various inspection situations. It is suitable for inspection flaw position and size, which can be widely used for various detection demands, such as weld inspection, gas pressure welding on rail, pressure vessel inspection, stainless steel and PE pipe inspection...

## Corrosion Inspection



● Linear Scan Image on Flat Panel Engraved with SIUI logo.

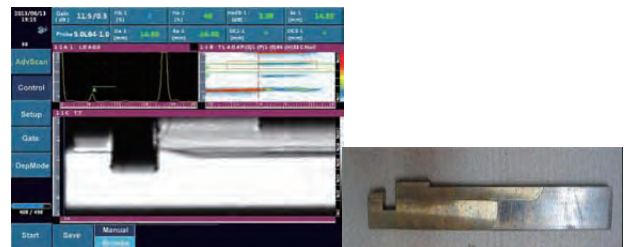


● Corrosion Inspection on Oil Drill Pipe (Thickness: 9-10mm, diameter: 79mm)

## Copper Bar Inspection

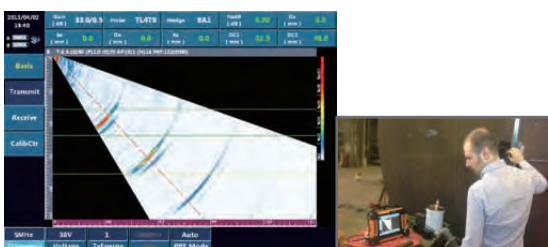


● C-scan on copper bar with two  $\phi$  1 short cross-drilled holes (depth: 0.5mm)

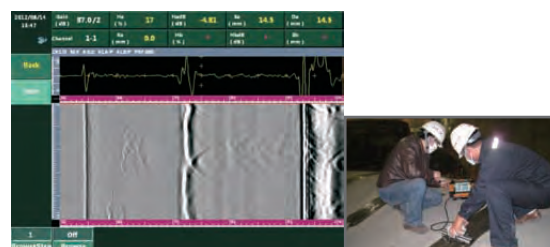


● C-scan on copper bar with groove

## Weld Inspection



## TOFD Inspection



# Specifications



General Technical Specification	
Display Screen	8.4" TFT LCD, 800×600 pixels, 60Hz refresh rate, touch screen
Dimension (W×H×D)	310mm×220mm×150mm
Weight	6 kg with battery
Battery	Smart lithium battery, 2 pcs.
Battery Capacity	7.5 Ah/pc, operation time more than 4 hours.
External Power Supply for Adaptor	AC 100V~240V 50Hz/60Hz
Adaptor Output	15V DC
Power	70VA
Data Storage	2GB internal memory
Input / Output	
USB Connector	2 pcs
Ethernet Connector	1 pc
Video Output	VGA port
Encoder Connector	1 pc
Alarm Connector	1 pc
WIFI	1 pc
Environment Tests	
Operation Temperature	0°C~40°C
Storage Temperature	-20°C~60°C

## Technical Specification for 32:128 Phased Array + 2-ch TOFD

	Conventional UT	Phased Array
System		
No. of Channel	2	32
Probe Connector	LEMO 00	Tyco
No. of Probe Connector	4 pcs	1 pc
Max. Supporting Elements	4	128
Pulsar		
Pulsar	Spike, Square	Bi-polar square
PRF	100Hz~2000Hz	100Hz~8000Hz
Pulse Voltage	50V~500V, min. step 1V	2V~110V, min. step 2V
Pulse Energy	—	4 levels
Pulse Width	10ns~600ns	2~10MHz
Damping	4 levels	—
Pulsar Delay	—	0µs~20µs, resolution 2ns
Pulsar Focusing	—	Single point focusing
Receiver		
Gain	0dB~110dB, step: 0.5/2/6/12	0~80dB, step: 0.5/2/6/12
Bandwidth	0.5MHz~20MHz	0.5MHz~15MHz
A/D Sampling Rate	200MHz	100MHz
Rectification	Positive, negative, full, RF	Full wave
Receiver Delay	—	0µs~20µs, resolution 2ns
Receiver Focusing	—	200MHz hardware real-time dynamic focusing, maximum range: 1008 foci per scan line
Filter	16 levels	Auto-adjustment subject to transmit pulse width
Reject	0%~80%	—
Scan		
Scan Type	A / TOFD	A/S/L/C/D
Image Wizard	Available	Available
Trigger Mode	Time - based /Encoder	Time - based /Encoder
Scan Length	Max. 2m	Max. 5m
Scan Line Number	—	Max. 512 lines
Scan Angle Range	—	-89°~+89°
Calibration		
Range	0 mm~15000 mm	0 mm~1000 mm
Material Velocity	500 m/s~15000 m/s	500 m/s~15000 m/s
Display Delay	0 mm~10000 mm	0 mm~1000 mm

	Conventional UT	Phased Array
Calibration		
Probe Delay	0 µs~19.99 µs	—
Auto Calibration	Velocity, probe, delay, angle	Velocity, delay, sensitivity, TCG
Gate		
Test Point Selection	Peak / Flank / J Flank	Peak / Flank / J Flank
Measurement	Dual gates: to measure echo amplitude, sound path, horizontal distance, vertical distance, distance between gates.	Three gates: to measure echo amplitude, sound path, horizontal distance, vertical distance. Two measurement cursors: It can measure horizontal & vertical position and distance between cursors on the image.
Gate Start	Full range	—
Gate Width	Full range	—
Gate Height	10~90%	—
Measurement		
Curve Function	DAC/AVG(DGS)	TCG
Auxiliary Function	A-scan echo freeze, auto calibration, angle measurement, parameter output, AWS, USB storage, curve surface correction.	—
Alarm Signal	sound alarm	sound alarm
Display Measure Value	8 positions can be user-defined.	
Data Analysis	LW/BW straightening, LW/BW removal, defect height and length measurement, contrast adjust, gain adjust.	Image gate dynamic reconstruction
Testing Index		
Time Base Linearity	≤0.5%	—
Vertical Linearity	≤3%	—
Attenuator Precision	12dB±1dB	—
Dynamic Range	≥36dB	—

# Specifications

## Technical Specification for 6-ch TOFD or 6-ch Conventional UT

Imaging Mode	Conventional UT
<b>System</b>	
Channel	6
Probe Connector Type	LEMO 00
Probe Connector Number	12 pcs
Max. Supporting Elements	12
<b>Pulser</b>	
Pulser	Spike, square
PRF	100Hz~2000Hz
Pulse Voltage	50V~500V, min. step 50V
Pulse Width	10ns~600ns
Damping	4 levels
<b>Receiver</b>	
Gain	0dB~110dB, step: 0.5/2/6/12
Bandwidth	0.5MHz~25MHz
A/D Sampling Rate	200MHz
Rectification	Positive, Negative, Full, RF
Filter	16 levels available
Reject	0%~80%
<b>Scan</b>	
Scan Type	A/TOFD
Image Wizard	Available
Trigger Mode	Time-based / Encoder
Scan Length	Max. 2m
<b>Calibration</b>	
Range	12 mm~15000 mm
Material Velocity	1000 m/s~10000 m/s
Display Delay	-10 mm~10000 mm
Probe Delay	0 $\mu$ s~200 $\mu$ s
Auto Calibration	Velocity, probe delay
Manual Calibration	Velocity, probe delay
<b>Gate</b>	
Test Point Selection	Peak / flank / J flank
Measurement	Dual gates: to measure echo amplitude, sound path, horizontal distance, vertical distance, distance between gates.
Gate Start	Full range
Gate Width	Full range
Gate Height	10~90%
<b>Measurement</b>	
Curve Function	DAC
Auxiliary Function	A-scan echo freeze, auto calibration, angle measurement, peak memory, parameter output, AWS D1.1/D1.5, USB storage, curve surface correction.
Alarm Signal	Signal and sound alarm
Display Measure Value	8 positions can be user-defined.
Data Analysis	LW/ BW straightening, LW/ BW removal, defect height and length measurement, contrast adjust, gain adjust
<b>Testing Index</b>	
Time base Linearity	$\leq 0.5\%$
Vertical Linearity	$\leq 3\%$
Attenuator Precision	12dB $\pm$ 1dB
Dynamic Range	$\geq 36$ dB

Software
<b>SuporUp PC Software</b>
Basic version and advanced version available. Basic version function: For Phased Array or TOFD measurement, analysis, report generation.
<b>TKY Software (Optional)</b>
For PAUT of critical T-K-Y weld joints



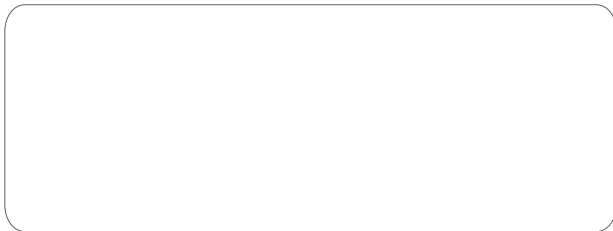
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