Technical Datasheet

SITAU MX / FP LF
(Low Frequency)

www.daselsistemas.com

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1 AVAILABLE SYSTEM

The following table shows the available models, other configurations can be custom made.

Multiplexed Systems (SITAU MX)				
Model	**Active Channels**	**"Phased Array" Probe elements**	**"Phased Array" Probe Connectors**	
ST-311	32	128	1 pulse-echo	
ST-312	32	128	1 pulse-echo 1 pitch-catch	
ST-334	32	32	4 pulse-echo	Rack Industrial 19"
Full Parallel Systems (SITAU FP)				
Model	**Active Channels**	**"Phased Array" Probe elements**	**"Phased Array" Probe Connectors**	
ST-331	32	32	1 pulse-echo	
ST-332	32	32	1 pulse-echo 1 pitch-catch	
ST-661	64	64	1 pulse-echo	
ST-991	96	96	1 pulse-echo	
ST-111	128	128	1 pulse-echo	

Table 1.- Channels number of the available systems.

		Total Channels Numbers			
		32	**64**	**96**	**128**
Active Channels	**32**	FP			MX
	64		FP		
	96			FP	
	128				FP

FP: Full Parallel - MX: Multiplexed

2 ACQUISITION MODES

The SITAU systems allow to acquire with two different modes.

"Phased Array" Mode	In emission, the hardware applies the programmed focal laws for each line of the B-Scan image, allowing focusing at any depth and deflecting the beam at any angle. In reception, the hardware applies the programmed focal laws, getting, for each line of the B-Scan image, an A-Scan signal obtained by applying the focal law delays to each one of the elements of the active aperture.
"Multichannel" Mode	In emission, the hardware applies the programmed focal law for each line of the B-Scan image, allowing focusing at any depth and deflecting the beam at any angle. In reception, no processing is performed with the signals received by each element of the active aperture, for each acquisition, the SITAU system returns all the A-Scan signals received by each element of the active aperture. In this mode the SITAU system operates as a multi-channel system allowing access to the A-Scan signals from each channel.

3 TRIGGER MODES

Trigger Modes	
Software Trigger.	
Encoder Trigger.	
External Input Signal Trigger.	

4 CONTROL SIGNALS

Control Signals	Trigger sources and I/O signals	
Trigger sources	Internal, external and encoder	
Encoder inputs	4 quadrature encoder inputs	(1)
Input-Output	External trigger input, sync output	

(1) Optional configuration with up to 8 encoders.

5 FILTERS

Filters		
Analog Band-Pass Filter	-3 dB Bandwidth: 30 KHz a 2 MHz	
Digital Band-Pass Filter	In "Phased Array" acquisition mode (See section 0)	

6 PULSER

Pulser (each channel):	Negative square wave pulse	
Excitation voltage	-100 V Programmable from -20 V to -190 V	(1)
Pulse width	Programmable from 100 ns to 25.5 us, with a resolution of 100 ns	
Fall time	< 10 ns	
Pulse repetition frequency (PRF)	Up to 20 kHz	
Burst mode	Up to 256 consecutive pulses	
Coded excitation	Programmable codes of 16 bits length	(2)
Damping	3.6 KΩ (Nominal)	

(1) Optional for Full Parallel Systems (SITAU FP). Not available for Multiplexed Systems (SITAU MX)

(2) Available with the programming library.

7 RECIVER AMPLIFIER

Receiver (each channel):	Wide-band and low-noise amplifier	
Gain	Programmable between 0 and 100 dB	
TGC	Arbitrary Time-Gain-Compensation curve (2048 points)	
Bandwidth (-3 dB)	30 KHz to 2 MHz	
Equivalent input noise	1.1 μV rms	
Input protection circuit	Low resistance MOSFET active circuit	
Anti-aliasing filter	Low-pass, f_C = 2 MHz	
Maximum input signal	1.4 Vpp	
Input impedance	1.6 KΩ	
Channel Cross-Talk	-40 dB at 5 MHz	

8 A/D CONVERSOR

Sampling (each channel):	Differential input A/D converters with LVDS output	
Resolution	12 bits	
Sampling frequency	40 MHz maximum, programmable from 157 KHz	
Hardware interpolation	160 MHz (Lagrange filter bank)	

9 TIME-GAIN COMPENSATION (TGC)

Time-Gain-Compensation function (TGC)		
Gain range	0 to 100 dB	
Time range	Up to 820 µs depending on timing resolution	
Time resolution	Programmable between 50 ns and 400 ns in steps of 25 ns	
Number of TGC points	Up to 2048	

10 SPECIFIC FEATURES OF THE ACQUISITION MODE "Phased Array"

10.1 BEAMFORMER

The following features are available only in the acquisition mode "Phased Array".

Beamformer	Hardware implemented real-time beamformer	
Focusing delays	Programmable for each channel (up to 409 µs, with a resolution of 6.25 ns). Independent for emission and reception.	
Single Focus	Programmable and independent for emission and reception. Independent for each scan line.	
Dynamic Depth Focusing (real-time)	Focal laws per each sample of each A-Scan of the B-Scan image (hardware implemented).	
Number of scan lines per Image	Up to 256	
Delay resolution	± 3.125 ns (timing resolution equivalent to 160 MHz)	
Apodization	Programmable per channel and scan line, with 16 bits resolution.	
Dynamic aperture	Programmable per channel and scan line	
Active aperture	Programmable from 1 up to the maximum number of active channels (see ***Table 1***).	
Sparse apertures	Arbitrary configuration of emitting and receiving elements within the active aperture. Independent for each scan line. (Using the programming library)	
Dual Aperture (Pitch & Catch)	Arbitrary configuration of emitting and receiving elements within the active aperture. (Using the programming library)	
Linear Scan	Active aperture movement among scan lines	
Angular Scan	Scan lines at different angles for a fixed active aperture position	

Acquisition depth	Programmable up to 20.000 samples per scan line.	

10.2 SIGNAL PROCESSING

The following features are available only in the acquisition "Phased Array" mode.

Signal processing	Real-time signal processing of acquired scan lines (Hardware Implemented)	
Band-Pass filter with programmable cutoff frequencies 63 coefficients FIR implementation. - Constant response in the pass band (ripple< 0.1 dB) - High attenuation in the stop band (typ. > -50 dB)		(1)
Signed 16 bits format data		
Acquisition information data in real-time: A-scan, B-scan, peak position and amplitude (gates), encoders count		
4 hardware gates for the peak detection (Independent or linked): - gate type → Detection of the maximum, the minimum and the positive edge - start / end gate → Programmable from the first acquired sample to the last acquired sample. - threshold gate → Programmable (0 to 100 % screen)		(2)
3 software gates for the peak detection. - gate type → Detection of the maximum, the minimum the falling and the rising edge - start / end gate → Programmable from the first acquired sample to the last acquired sample. - threshold gate → Programmable (0 to 100 % screen)		(3)
Scan compression with Non-Peak-Loss compression algorithm, up to 128:1 compression rate.		
Programmable down-sampling factor from 1 to 256 (equivalent sampling frequencies between 157 KHz and 40 MHz)		
Digital Envelope detection, implemented by Hilbert Transform.		
EMI Filter. - ***Removes, in real-time, the impulsive noise*** - ***Improves flaw detection and reduces the production of false alarms*** - ***Keeps a high dynamic range in noisy environments for C and D-scans***		
Grain Noise Reduce Filter. - ***Removes, in real-time, the material grain noise using the Phase Coherence Technique.***		
Auto-focus - ***Immersion, the system auto-detects the material surface, and auto-configures the focal laws to get the image focused into the material.*** - ***With wedge, the SITAU system auto-detects the wedge geometry, and auto-configures the focal laws.***		
Average (2, 4, 8, 16, 32, 64, 128, 256)		

(1) The cut-off frequency resolution depends of the sampling frequency.
(2) When the gates are linked, the start time of the gates 2, 3 and 4 depends on the peak detected by the gate 1.
(3) Software processing

11 SPECIFIC FEATURES OF THE ACQUISITION MODE "Multichannel"

11.1 BEAMFORMER, ONLY FOR EMISSION

The following features are available only in the acquisition "Multichannel" mode.

Beamformer		
Focusing delays (emission)	Programmable for each channel (up to 409 µs, with a resolution of 6.25 ns). Independent for emission and reception.	
Single Focus (emission)	Programmable and independent for emission and reception. Independent for each scan line.	
Delay resolution	± 3.125 ns (timing resolution equivalent to 160 MHz)	
Active aperture	Programmable from 1 up to the maximum number of active channels (see ***Table 1***)	
Sparse apertures	Arbitrary configuration of emitting and receiving elements within the active aperture. Independent for each scan line. (Using the programming library)	

Acquisition depth	Programmable up to 4096 samples per channel.	

11.2 SIGNAL PROCESSING

The following features are available only in the acquisition mode "Multichannel".

Signal processing	Real-time signal processing of acquired scan lines (Hardware Implemented)	
Signed 16 bits format data		
Programmable down-sampling factor from 1 to 256 (equivalent sampling frequencies between 157 KHz and 40 MHz)		

12 OTHER SPECIFICATIONS

Power consumption	[**ST-311, ST-312, ST-331, ST-332, ST-334**] 58 W [**ST-661**] 95 W [**ST-991**] 132 W [**ST-111**] 166 W	
Power supply	100- 220 Volt 47- 63 Hz , Fuse 3 A.	
Dimensions	[**ST-311, ST-331, ST-661, ST-991, ST-111**] 360 x 150 x 390 mm [**ST-312, ST-332**] 470 x 150 x 450 mm [**ST-334**] 480 x 130 x 420 mm	
Temperature range	0 ºC to 50 ºC (Ambient)	
Operative system	Microsoft Windows 32 bits 7 / VISTA / XP / 2000 / 98SE	
Programming Library	C++ / Visual Studio / Borland / MatLab / LabView / Python	
Interface	USB 2.0 480 – MBITS/s	

13 SOFTWARE

Mode "Phased Array"

To operate the SITAU systems in "Phased Array" mode, DASEL provides the "***ScanView***" application to configure all the acquisition parameters, as well to show, save and load the A-Scan signals and B-Scan images acquired by the system. This application also allows getting C-Scan images triggering with an encoder or an external signal.

All the data acquired with the "***ScanView***" application can be loaded from MatLab, to make a post processing.

DASEL also provides a programming library to operate the system from MatLab, LabView, Python, Visual Studio, Borland C++, etc.

This library offers the functions set to configure all the acquisition parameters, and get the acquisition data.

Mode "Multichannel"

To operate the SITAU systems in "Multichannel" mode, DASEL provides a programming library to operate the system from MatLab, LabView, Python, Visual Studio, Borland C++, etc.

This library offers the functions set to configure all the acquisition parameters, and get the acquisition data for doing other kind of signal processing as S.A.F.T (Synthetic Aperture Focusing Technique).

The "***ScanView***" application and the programming library are available to run in Windows 32 bits 7 / VISTA / XP / 2000 / 98SE.