Technical Datasheet
AirScope

www.daselsistemas.com

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1 Channels

The AirScope system has 2/4 physical multiplexed channels for emission (connectors) and 2/4 physical multiplexed channels for reception (connectors).

The user can program an acquisition sequence with up to 32 virtual channels, these virtual channels are defined assigning one connector for emission of the pulse and other connector for reception of the signal, and it is possible to share connectors between virtual channels.

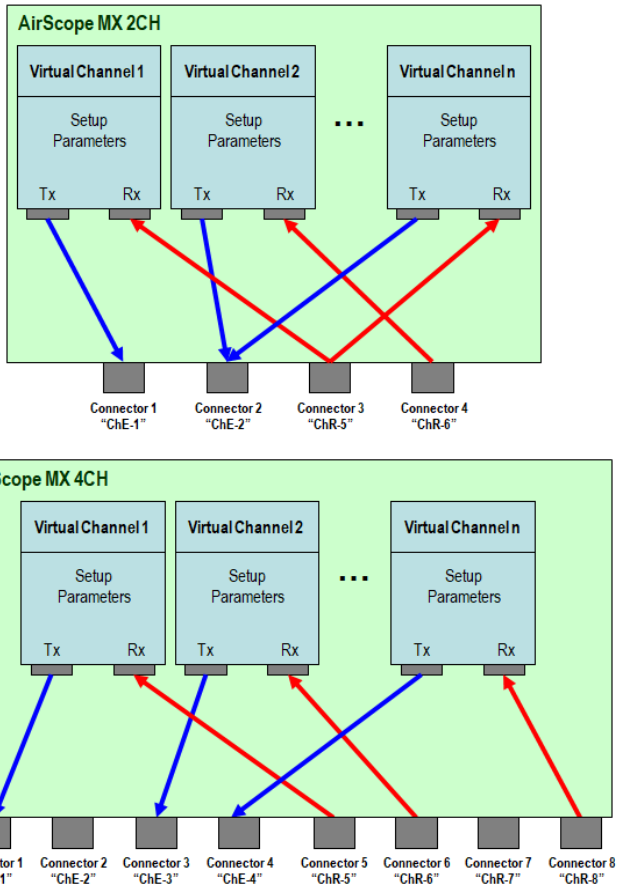


Fig 1.- Connection scheme of the virtual channels.
(Up) AirScope MX 2CH model. (Down) AirScope MX 4CH model

The acquisition parameters are independent for each virtual channel (emitter connector, receiver connector, pulser parameters, average, filters, range, etc.)

Channels:		
Emitter channels:	**(AirScope MX 2CH)** 2 channels **(AirScope MX 4CH)** 4 channels	(1)
Receiver channels:	**(AirScope MX 2CH)** 2 channels **(AirScope MX 4CH)** 4 channels	(1)

(1) Consult DASEL for other channel configurations.

2 Hardware Channels Assignment

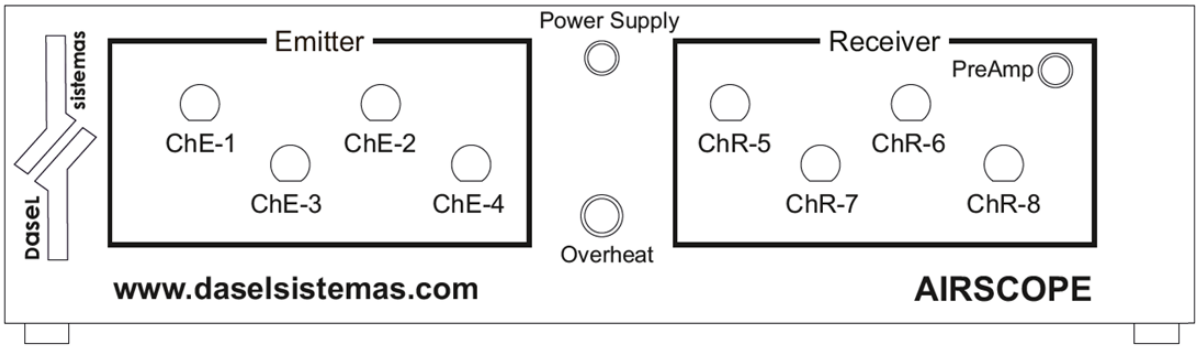


Fig 2.- UT Channels scheme.

The AirScope equipment has 4 or 8 connectors, depending on the model, and each connector is assigned to a internal channel of the UT hardware.

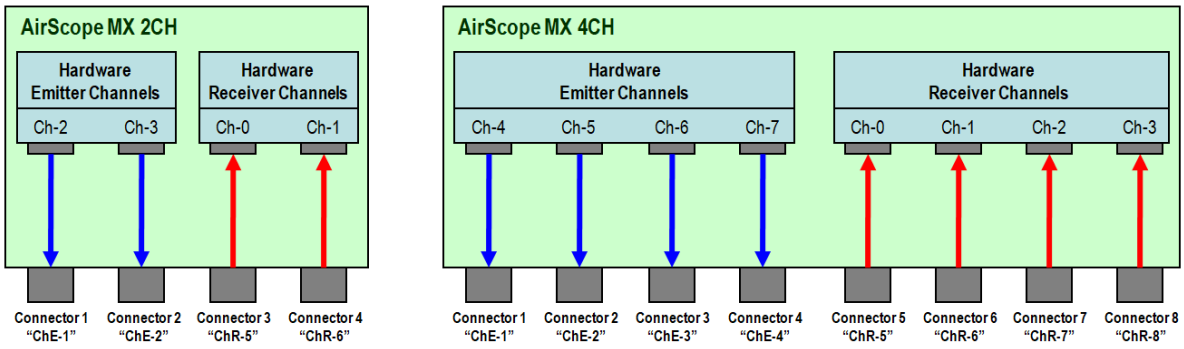


Fig 3.- Connection scheme of the hardware channels.
(Left) AirScope MX 2CH model. (Right) AirScope MX 4CH model

Connector	Id. Hardware Channel	
	AirScope MX 2CH	AirScope MX 4CH
"ChE-1"	2	4
"ChE-2"	3	5
"ChE-3"	-	6
"ChE-4"	-	7
"ChR-5"	0	0
"ChR-6"	1	1
"ChR-7"	-	2
"ChR-8"	-	3

Table 1.- Assigning the AirScope connectors to the internal hardware channels.

3 Pulser

Pulser:	Negative square wave pulse	
Excitation voltage	Programmable -20 V to -400 V	
Pulse width	Programmable from 25 ns to 25 µs, with resolution of 10 ns	
Fall time	< 8 ns.	
Pulse repetition frequency (PRF)	Up to 20 kHz	
Burst mode	Up to 256 consecutive pulses	

4 Trigger Modes

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

5 Time-Gain Compensation (TGC)

Time-Gain-Compensation function (TGC)		
Gain range	0 dB to 100 dB	
Time resolution	Programmable between 100 ns and 25.6 us, with resolution of 100 ns.	
Time range	Up to 105 ms depending on timing resolution.	

6 Control Connectors

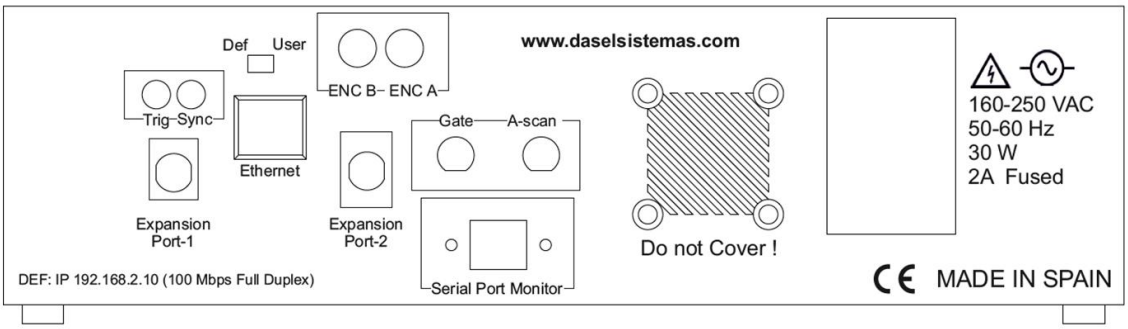
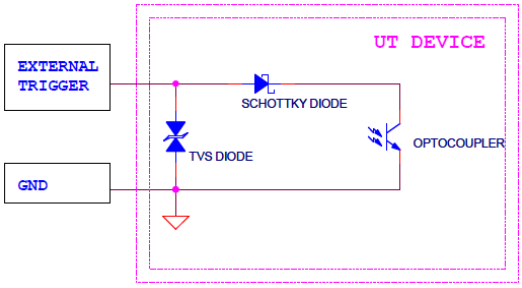


Fig 4.- Control connectors scheme.

Control Connectors	Description	
"ENC A", "ENC B"	2 quadrature encoder inputs and 5 VDC power supply (TTL non-optocoupled and non-differential inputs with 2K7 pull-up resistor)	(1)
"Trig"	External trigger input. (Optocoupled) Amplitude input range → 3.5 V to 10 V Pulse width minimum → 200 ns 	(2)
"Sync"	Sync output Amplitude pulse → 3,3 V	(3)
"Expansion Port-1" ***"Expansion Port-2"***	Expansion ports to increase the functionality of the AirScope connecting others IO modules	(4)
"Gate"	**(Optional)** Alarm output signal, this output generates a pulse when any gate detects a signal peak	(4)
"A-Scan"	**(Optional)** Analog output of the A-Scan signal	(4)
"Serial Port Monitor"	Serial port output to check maintenance operations	
IP Select ***"Def", "User"***	This control allow to select the AirScope network settings • **Def**: Default network settings IP address: 192.168.2.10 TCP Port: 5001 UDP Port: 6008 • **User**: Network settings that the user can change using the UT-View application.	

(1) **Default:** TTL non-optocoupled and non-differential inputs with 2K7 pull-up resistor (5 VDC power supply)
Option 1: Optocoupled and differential inputs (encoder with external power supply)
Option 2: Optocoupled and Non-differential inputs (encoder with external power supply)

(2) This input has two functions (configurable by software):
- External Trigger: AirScope acquires with each pulse.
- External Trigger Mask: AirScope is stopped while this input is not high level.

(3) This output generates a pulse and its duration is the acquisition time of all virtual channels.

(4) Contact DASEL for more information.

7 Receiver

Amplifier	Wide-band and low-noise amplifier	
Gain	Programmable from 0 dB to 100 dB	
Bandwidth (@-6 dB)	50 KHz to 4.7 MHz	
Input protection circuit	Active circuit with auto-blocking in emission and low impedance in reception.	
Maximum input signal	5 Vpp	
Input impedance	200 Ω	

Sampling (A/D Conversor):	Differential input A/D converters with LVDS output	
Resolution	14 bits	
Sampling frequency	20 MHz maximum, programmable from 500 KHz	

Acquisition Modes:	**(AirScope MX 2CH)** Transmission, with 2 emitter channels, and 2 receiver channels. **(AirScope MX 4CH)** Transmission, with 4 emitter channels, and 4 receiver channels.	
Automatic start of the acquisition with programmable threshold (echo-start)		
Acquisition depth	1. In VIDEO acquisition mode, EMI Filter or Average → 16.384 samples with any sampling frequency. (Air distance: 557 mm @ Sampling Frequency 10 MHz) 2. If it is not case 1 and with sampling frequency > 25 MHz → 21.846 samples. (Air distance: 743 mm @ Sampling Frequency 10 MHz) 3. In other cases→ 65.500 samples (Air distance: 2.230 mm @ Sampling Frequency 10 MHz)	
Start Delay (Inhibition Time)	Programmable up to 26 ms, with 100 ns of resolution	
Attenuator	Programmable 0 dB / - 20 dB	

Filters	
Anti-aliasing Low-Pass Filter (2.5 MHz)	
Band-Pass Digital Filter (see section 8)	

8 Signal Processing

Signal processing	Real-time signal processing of acquired scan lines (Hardware Implemented)	
Band-Pass filter with programmable cutoff frequencies 64 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		
3 hardware gates for the peak detection (Independent or linked): - gate type → Detection of the maximum, the minimum, the positive edge or negative 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 for the peak detection (Independent or linked): - gate type → Detection of the maximum, the minimum, the first peak over the threshold, the positive edge or negative 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 5 to 200 (equivalent sampling frequencies between 500 KHz and 20 MHz)		
Digital Envelope detection, implemented by Hilbert Transform.		
EMI Filter, 2 to 5 A-Scan signals - ***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***		
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 and 3 depends on the peak detected by the gate 1.
(3) Software processing

9 Other Specifications

Power consumption	30 W	
Power supply	160 - 250 Volt 50- 60 Hz	
Temperature range	0 ºC to 50 ºC (Ambient)	
Operative system	Microsoft Windows 32/64 bits (Windows 10 / Windows 7),	
Communication	Ethernet 100 Mbit/s. TCP/IP y UDP/IP. (Data Rate: >7 MBytes/s)	
Internal Memory	48 MB (24 Mega-Samples)	

10 Pinout Of Encoder Connector

Reference female socket: LEMO EGG.0B.306.CLL

Reference male connector: LEMO FGG.0B.306.CLAD56

There are two possible configurations for the encoder pinout depending on the type of the hardware configuration of the AirScope encoder inputs.

10.1 (Option 1) Non-differential encoder inputs

ENCODER Connector	Description
Pin 1	+ 5 VDC
Pin 2	GND
Pin 3	Channel A
Pin 4	GND
Pin 5	Channel B
Pin 6	Index
Connector Case	GND

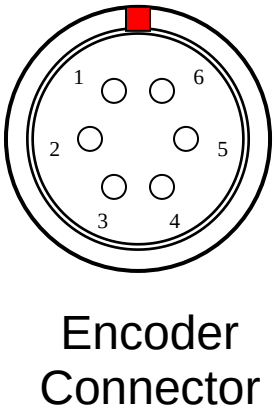


Table 2.- Encoder pinout with non-differential inputs configuration.
TTL Non-differential inputs with 2K7 pull-up resistor

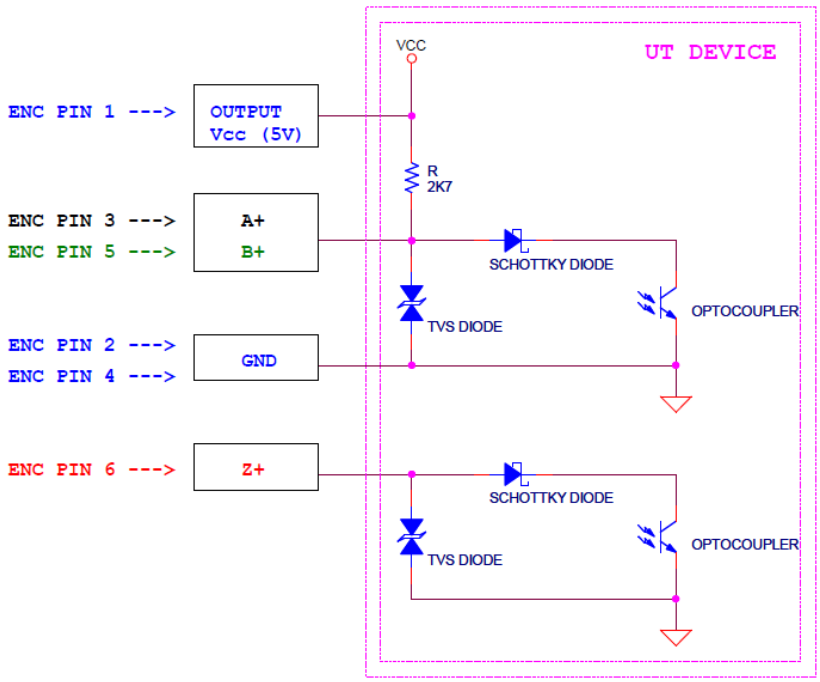


Fig 5.- Non-Differential encoders inputs scheme.

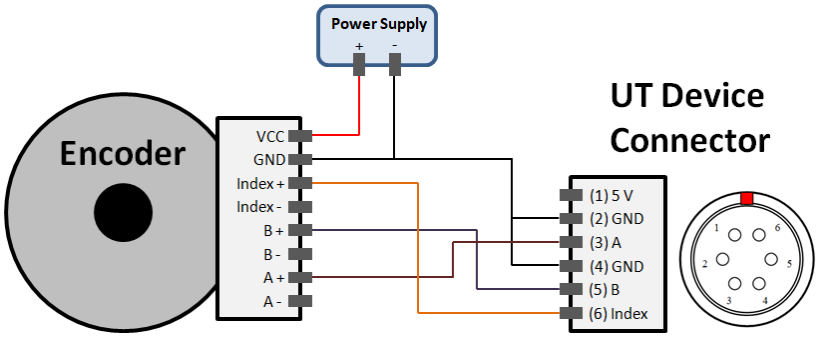


Fig 6.- Connection diagram of non-differential encoders and external power supply, with configuration option 1.

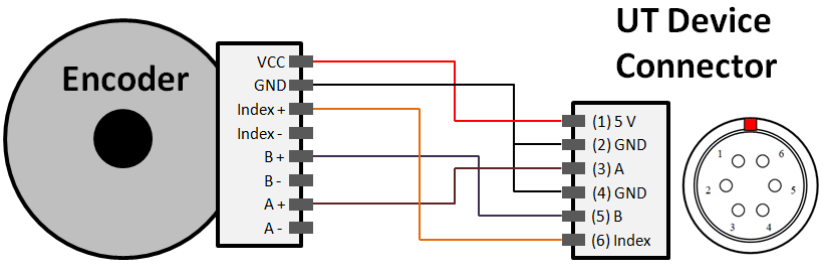
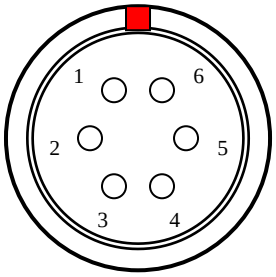


Fig 7.- Connection diagram of non-differential encoders using the internal power supply of the UT device, with configuration option 1.

10.2 (Option 2) Differential encoder inputs

ENCODER Connector	Description
Pin 1	Z (-)
Pin 2	A (-)
Pin 3	A (+)
Pin 4	B (-)
Pin 5	B (+)
Pin 6	Z (+)
Connector Case	GND

Table 3.- Encoder pinout with differential inputs configuration



Encoder Connector

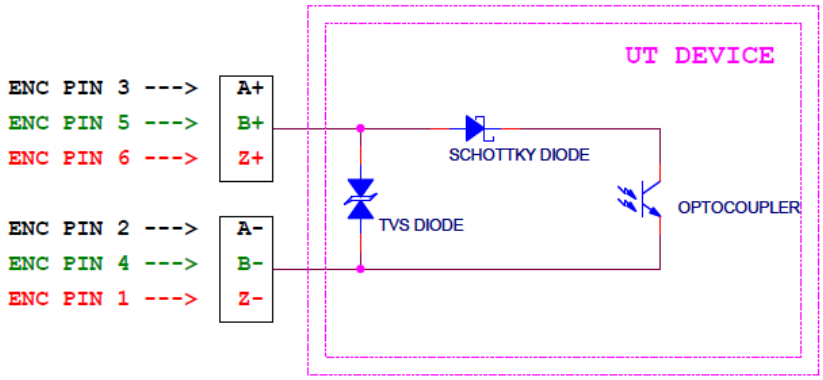


Fig 8.- Differential encoders inputs scheme.

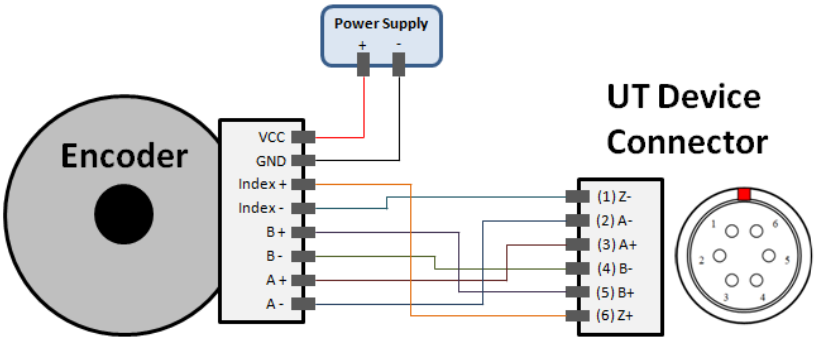


Fig 9.- Connection diagram of differential encoders with configuration option 2.

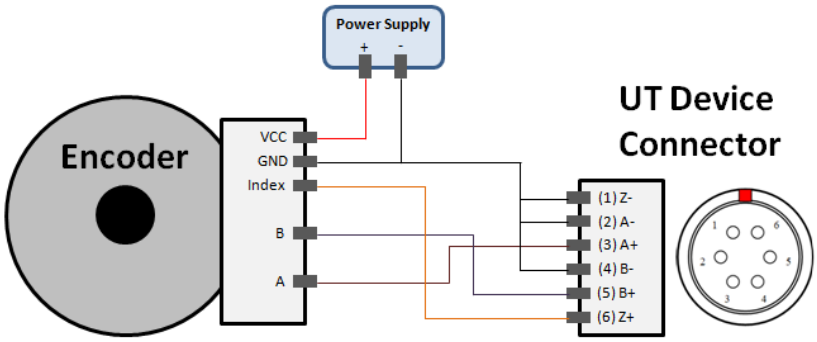


Fig 10.- Connection diagram of non-differential encoders with configuration option 2.

11 Software

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

- Simultaneous acquisition of multiple images CD-Scan
- Access to data cube (C, B, A-Scan), for post-processing.
- Registration of A-Scan signals, B-Scan and C-D-Scan images, position encoders and detection gates (pick and position).

All the data acquired with the "***UT-View***" 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.

The "***UT-View***" application and the programming library are available to run in Windows 32/64 bits (Windows 10 / Windows7)

This application also provides the necessary tools to analyze acquired images:

- Measurement cursors to get distances, time of flight, signal amplitude, etc.
- Different types of gates to generate different C-Scan images of position and amplitude.
- Frequency analysis of the signal in magnitude and phase.
- Reporting.

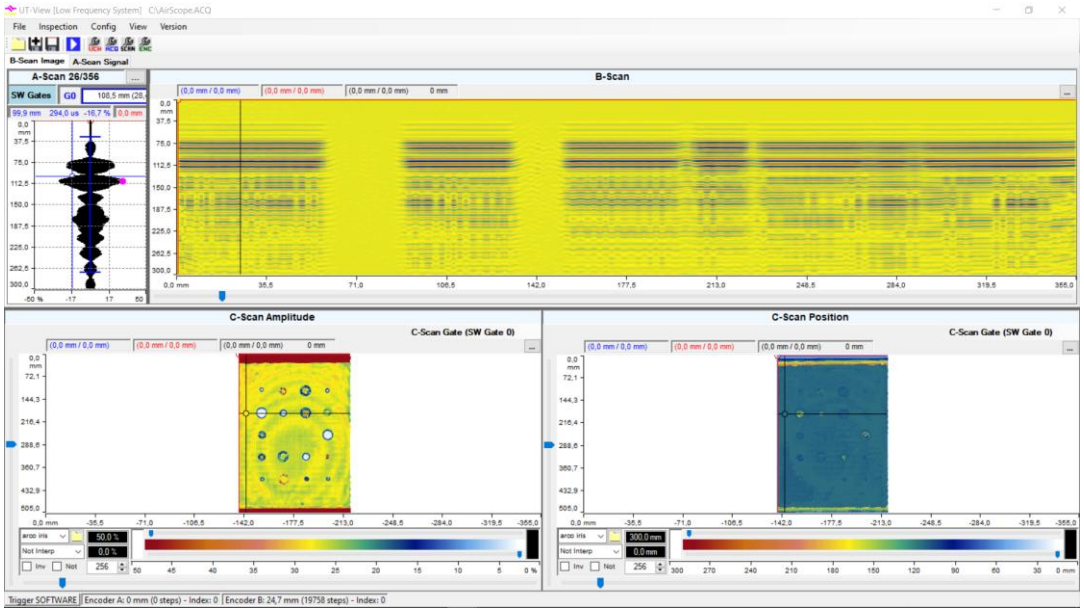


Fig 11.- UT-View Application.