

# **Technology Design**

## **ADVANCED ULTRASONIC HARDWARE**

### **FocusScan RX II**



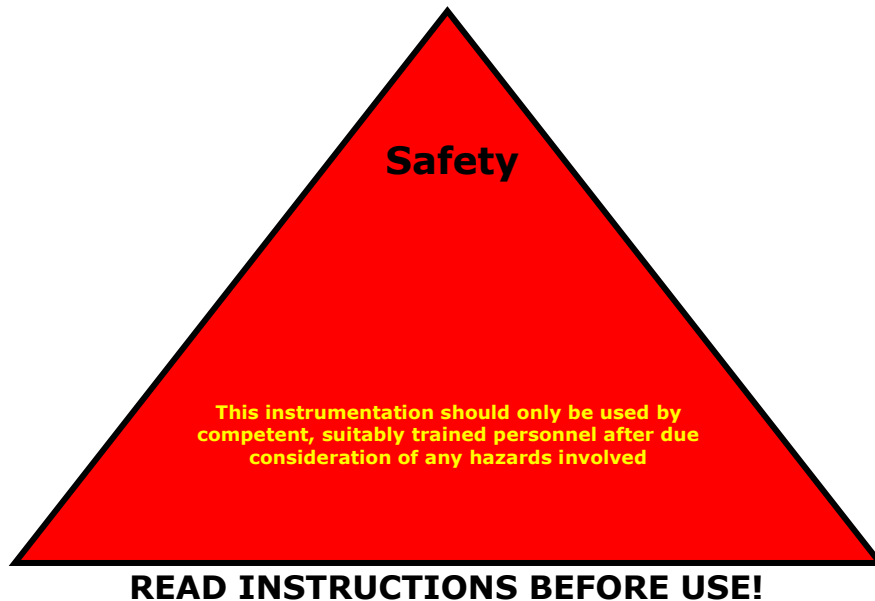
Designed & Manufactured in Great Britain

## **USER GUIDE AND TECHNICAL REFERENCE MANUAL**



**TECHNOLOGYDESIGN.COM**

## Important Safety Information



Due to the potential hazards associated with any electrical equipment it is important that the user is familiar with the instructions covering the capabilities and operation of the instrument. The user should ensure that all reasonable safety precautions are followed and if in any doubt, should seek advice from a suitably qualified and trained person before proceeding.



NO attempt should be made to remove protective covers or access the internals of the system unless the equipment is isolated from the electrical supply and then only by a suitably trained and qualified technician. Failure to comply with these instructions may expose the user to electrical hazard.



All equipment supplied MUST only be used in dry conditions and is not suitable for operation in damp or wet environments.



Your TD ultrasonic system is equipped with lithium-ion (Li-ion) batteries. All suitable precautions for storage and use MUST be applied.

## Regulatory Information

The TD range of equipment conforms to the following European and International Directives and Specifications:

- 2006/95/EC (Low Voltage Directive)
- 2004/108/EC (Electromagnetic Compatibility Directive)
- 93/68 / EEC (CE-Marking Directive).
- EN55022 Class B and EN 50082-1 for use in the following areas: residential, business, and light industry
- BS/EN 61326: 2006 Electrical equipment for measurement, control, and laboratory use. EMC requirements, General requirements.

## Intellectual Property

The following trademarks are owned by the respective organisations:

- The *Technology Design* logo, *FocusScan RX II* and *FSRX II* and trademarks of Technology Design Limited, in the United Kingdom and other countries.
- *ESBeamtool* is a trademark of Eclipse Scientific Inc. registered in Canada and other countries.
- *Lemo* is a trademark of Interlemon Holding S.A. (Interlemon Holding AG) (Interlemon Holding Ltd.)
- *Windows* is a trademark of the Microsoft Corporation, registered in the U.S. and other countries.
- *Inspired Energy* is a trademark of Inspired Energy LLC., registered in the U.S. and other countries.

# Contents

Important Safety Information.....	2
Regulatory Information.....	3
Intellectual Property.....	3
Contents.....	4
USER GUIDE - HARDWARE.....	5
1. FocusScan RX II.....	5
1.1. Description.....	5
1.2. Identification of Components.....	5
1.3. Description of Parts, Buttons and Connectors.....	6
1.4. Starting and Stopping the System.....	6
1.5. Basic Operation.....	6
1.6. Power.....	7
1.6.1. AC Power - Mains.....	7
1.6.2. DC Power - Batteries.....	7
1.7. Connecting Probes.....	7
1.8. Connecting Scanners and Encoders.....	8
1.9. USB.....	8
1.10. Ethernet.....	8
Appendix 1.....	9
Important Information about Lithium-Ion Batteries.....	9
1. Usage Instructions.....	9
2. Battery Storage instructions.....	9
5. General Warnings.....	10
6. Contact Technology Design.....	10
Appendix 2.....	11
Scroll wheel controls – Touchscreen.....	11
Appendix 3.....	12
Technical Specifications.....	12
TD Focus-Scan RX II.....	12
Appendix 4.....	13
TD Focus-Scan RX connectors.....	13
1. Power Connector.....	13
2. Motor Connector Axis 1 & 2.....	13
3. 15 Way D-Type - Encoder 1 & 2.....	13
4. Probe Connector 1 & 2.....	13

## USER GUIDE - HARDWARE

Thank you for choosing Technology Design's advanced TD Ultrasonic systems. This document will guide you to recognise and understand the various components and controls that will enable you to use the system effectively and safely.

The FocusScan RX II is supplied in an immediately usable state. All the electronic modules and connectors required to operate this equipment are fully integrated. No separate peripheral Ultrasonic or motion modules are required. All required software is pre-installed and accessed from the touch screen.

Accessories for application specific procedures may be supplied separately. These accessories could include transducers, wedges, splitters, scanners, and GPS modules.

### 1. FocusScan RX II

#### 1.1. Description

The FocusScan RX II (FSRX II II) is a portable multifunctional industrial ultrasonic data acquisition and processing system. The FSRX II is equipped to acquire and store different types of ultrasonic data using its advanced hardware and software. Versatility is assured with Phased Array, Time of Flight Diffraction and Pulse Echo technologies bundled in an integrated package that requires no additional hardware or software modules.

The FSRX II is capable of acquiring data using the Full Matrix Capture (FMC) technique. FMC data is processed by the TDScan software using the Total Focus Method (TFM) and displayed in realtime. TFM data may be stored for later analysis using TDScan's extensive analysis toolset.

#### 1.2. Identification of Components



### 1.3. Description of Parts, Buttons and Connectors

1	Protective Bumper	The bumper is made of soft polymer material. It is compartmentalised for added support.
2	Carry Handle	Covered in soft polymer material. The carry handle is spring loaded and returns to its standard position automatically.
3	Protective Enclosure	The enclosure is made of a durable polymer material. The enclosure is a sealed unit designed to IP66 standard.
4	Display Screen (Touchscreen)	The display a sun-readable industrial type 12.1" colour TFT with 1280 x 800 resolution. All controls are accessed by screen touch.
5	On Button	When depressed for 3 seconds the button flashes blue and the system starts. Windows® 10 starts after which the TDScan software may be started by tapping the shortcut on the Desktop or from the Window® Start Menu. The system is switched off by tapping the <b>Switch Off</b> button on the Window® Start Menu.
6	Side bays for USB Ports	There are three USB 2.0 ports. The lower USB port is slightly recessed to allow the cover to be closed with a miniature Bluetooth or WiFi device inserted into the socket.
7	Protective Covers	The hinged covers may be latched down to protect the Phased array connectors from damage and ingress of debris.
8	Side Bays for Pulse Echo Probe Connectors	Each connector bay contains four Lemo® 00 connectors. The upper bay contains connectors 1-4 and the lower bay contains connectors 5-8. ToFD probes are connected here as well. The instrument may be supplied with an additional 4 connectors. In the 12-connector version, the side bays are reconfigured such that the Ethernet connector is moved to the opposite side top bay with the loss of one USB connector.
9	Ethernet Connector	Standard RJ45 connector for 10/1000 Gigabit ether net communications. Ethernet may be used to access the Internet as well Networks for access to file servers and network based remote storage locations.
10	Carry Strap Attachment Loops	The loops are made of sheathed stainless-steel cable, securely bolted to an internal steel chassis.
11	Protective covers	The hinged covers are made of soft polymer material and may be latched down to protect the accessory connectors from damage and ingress of debris.
12	Cooling Fan Protection Cover	The metal cover is secured with six screws and protects the external cooling fan and heat sink.
13	Air Vents	The vents allow cool air to pass over the heat sink and warm air to be exhausted. No air enters or leaves the sealed system enclosure.
14	Battery Bay Covers	The covers protect the two hot-swappable Lithium Ion batteries.
15	Stand	The stand is made of polymer coated hardened steel that may be positioned at different angles.
16	Phased Array Connectors	There are two Phased array connectors, Connector 1 contains pins 1 to 64 and connector 2 contains pins 65 to 128. The system may be used with probes connected to one or both connectors simultaneously. <b>IPEX</b> connectors are supplied as standard with the choice of <b>D-78</b> connectors as an alternative.
17	Video Out	Connector for external display devices such as a monitor or projector.
18	Encoder	2-Axis encoders may be connected to ensure accurate XY positional encoding of data. Compatible encoders:TTL compatible, 5V @ 1A, 12V @ 0.4A
19	Power Supply Input	Mains power may be used to power the system and recharge the batteries. Power requirements are: Input - 90 to 260VAC @ 40 to 60Hz. Output - 20V to 24VDC @ 40W.
20	Motor Drive Outputs	Scanning devices with one or two servo motors may be powered from the FocusScan RX II. Compatible motors:24V DC, 5A continuous.
21	Emergency Stop	This button is used to cut power to the scanner outputs in case a scanning device needs to be immediately halted.
22	GPIO	General Purpose Input/Output provides analogue output for use with external analogue devices.
23	Service Port	This connector is used to attach diagnostic equipment used by TD service engineers.

### 1.4. Starting and Stopping the System

To start the FocusScan RX II, press the **On Button** (5) for at least 3 seconds. The button will flash blue until the system is fully started after which the blue light will display continuously.

To switch the system off, use Windows® onscreen power buttons in the **Start Menu**. Pressing the On Button (5) will **not** activate system shutdown. If, for any reason, the system is unable to shut down using Windows®, remove the power supply and batteries.

### 1.5. Basic Operation

After starting the system wait for Windows® to start and log on, if Logon has been activated. When the Windows® desktop appears, tap/click the desktop shortcut to start the TDScan software. TDScan may also be started from the **Start Menu**.

The Focus Scan RX is equipped with a sun-readable industrial type 12.1" colour TFT screen with 1280 x 800 resolution. All controls are accessed by screen touch.

ESBeamtool® may also be started from the desktop shortcut.

Ultrasonics is a highly specialised Non-Destructive Inspection method and requires structured training in both theory and product operation. Guidance on the TDScan software controls may be found in the software user manual.

## 1.6. Power

The FocusScan RX II is powered either by AC mains electricity through a DC power adapter or Lithium-Ion batteries.

### 1.6.1. AC Power - Mains

The FocusScan RX II is supplied with an AC/DC power converter.

The adapter input is autosensing and can operate from 90VAC to 260VAC @ 40Hz to 60Hz.

The adapter output is 20VDC to 24VDC @ 40W (Operating).

Connect power cable from power adapter to the Power Supply input (19)

### 1.6.2. DC Power - Batteries

The FocusScan RX II is equipped with two hot-swappable Lithium-Ion batteries. After the system has been started, either of the batteries may be replaced without affecting the FSRX II's operation ensuring uninterrupted operation.

The batteries may be recharged while in the system by attaching the power adaptor to a mains supply or using an external battery charger supplied by Technology Design Ltd.

The batteries are Lithium-Ion type that need to be handled and maintained according to the manufacturer's recommendations. Appendix 1 provides guidance for safe and trouble-free use of the batteries.

#### 1.6.2.1. Removing & Replacing Batteries

- i. Open the battery bay cover (14) by sliding the clasp up and with one finger and simultaneously exerting outward pressure from the side of the door.
- ii. Grasp the lifting tab attached to the battery and pull outward. The battery will disengage from the compartment and may be removed.
- iii. The charge status of individual batteries may be determined from the LCD display on each battery. The status bars represent 20% segments.

Capacity	LCD Segments				
	1	2	3	4	5
<b>Below 1%</b>					
<b>1% - 20%</b>	■				
<b>21% - 40%</b>	■	■			
<b>41% - 60%</b>	■	■	■		
<b>61% - 80%</b>	■	■	■	■	
<b>81% - 100%</b>	■	■	■	■	■

- iv. To insert a battery, slide the connector side of the battery into the compartment ensuring the connector engages correctly with the pins. Gently press the battery into the compartment and close the cover ensuring the latch engages fully.

## 1.7. Connecting Probes

Transducers may be safely connected to the system while it is on.

Multiple transducers may be connected and used to acquire data simultaneously.

Combinations of Phased Array, ToFD and/or Pulse Echo transducers may be used. The system may be used with any piezoelectric transducer between 0.25Mhz and 25Mhz (-3dB) designed for NDT applications.

Connected transducers may be referenced to the same software channel (group) or to different channels (groups).



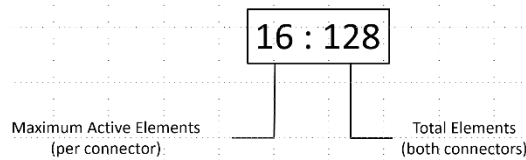
### ▲WARNING

When connecting High frequency transducers above 10Mhz ensure that the system's high-tension voltage is reduced in the TDScan software to eliminate the danger of damaging the piezoelectric crystal by over-stimulation.

### 1.7.1. Phased Array

The standard FocusScan RX II is equipped with IPEX connectors. Optional D78 connectors may be retrofitted by Technology Design.

Phased Array transducers with an element count up to 64 elements may be connected to each of the two connectors (16). This arrangement enables the inspection of welds from both sides simultaneously. The FocusScan RX II is supplied with three possible Phased array element configurations: 16:128, 32:128 or 64:128.



Standard IPEX connectors (with fixing screws) and 'Easy Latch' connectors (with adapter) may be used to secure transducer connectors.

### 1.7.2. Pulse Echo/ToFD

The FocusScan RX II is equipped with eight Lemo® 00 connectors (8).

## 1.8. Connecting Scanners and Encoders

Manual and automated scanners may be used with the FocusScan RX II. Scanners are external devices that carry ultrasonic probes and may incorporate positional encoders to ensure accuracy in determining data position, location of defects and sizing of defects. Scanners may be manually propelled or driven by servo motors.

The FocusScan RX II delivers 24 Volts, 5 Ampere (continuous) to the Motor Drive outputs (20). A scanner with servo motors may be driven in a single axis (X) or dual axis (X/Y).

### 1.8.1. Manually Propelled Scanners with Encoder

- i. Attach probe/probes to scanner.
- ii. Attach positional encoder to scanner.
- iii. Connect cable/s to transducer/s if needed.
- iv. Connect transducer cable/s to FocusScan RX II (8 and/or 16).
- v. Connect encoder to FocusScan RX II (18).

### 1.8.2. Automated Scanners

- i. Attach probe/probes to scanner.
- ii. Attach positional encoder to scanner. Most automated scanners have integrated encoders.
- iii. Connect cable/s to transducer/s if needed.
- iv. Connect transducer cable/s to FocusScan RX II (8 and/or 16).
- v. Connect scanner umbilical cable/s to FocusScan RX II (20)

## 1.9. USB

External storage devices may be connected to the FocusScan RX II using the USB ports (6). Data storage capacity may be increased by connecting external Hard Disk drives (HDD), Solid State Drives (SSD) or any other USB storage medium.

Cabled input devices with USB connectors may be used to control the system as an alternative to the touchscreen (4). These devices include keyboard, mouse, and joystick.

USB Bluetooth and Wi-Fi adapters may be connected to the FocusScan RX II to wirelessly control short range input devices and enable high speed wireless internet and LAN access.

USB compatible NMEA 0183 GPS receivers may be connected to the FocusScan RX II. Technology Design can advise and supply suitable units.

## 1.10. Ethernet

Access to remote networks provides a convenient method of transferring data files or providing remote access to the FocusScan RX II when needed. Data files may be directly transferred to and retrieved from secure storage facilities. The ability to access the FocusScan RX II through a network from a remote PC facilitates effective direct support from a remote location.

The Internet and private networks may be accessed from the FocusScan RX II using a wired Ethernet connection (9). The system can access fast (Gigabit) networks and transfer Ethernet frames at a rate of up to 1 Gigabit/second. Slower networks may also be accessed at transfer rates of 100 Mb/second or 10Megabits/second. The FocusScan RX II Ethernet connection may be described as 10/100/1000.

When communication with another PC using a direct cable connection, both *cross-over* and *straight-through* Ethernet cables may be used.



## Appendix 1

### **Important Information about Lithium-Ion Batteries**

Your TD ultrasonic system is equipped with lithium-ion (Li-ion) batteries manufactured by Inspired Energy®. Do not use these batteries for any purpose other than to power the TD system for which they were intended. Spare batteries may be purchased from Technology Design or Inspired Energy.

#### **1. Usage Instructions**

Following the guidance contained in this document will ensure optimum life, performance and safe use of the Li-ion batteries supplied with your TD system. Please read this guide before using the new batteries and retain the document for future reference.

Under normal usage the system can run on batteries until it switches off and then be recharged. Windows® will issue a warning message from the Tool Tray when the battery levels are low. Do not leave the battery dormant for long periods of time. The battery should be used at least once a month (every 3-4 weeks). If a battery is not used for a longer period, perform the "New Battery" procedure described later in this document.

#### **2. Battery Storage instructions**

- If your TD system will not be used on battery power for a period longer than 1 week, charge the battery to between 40% and 60% (3 LCD segments) then remove and store at room temperature (20-25°C) in a dry environment. Note that TD systems draw battery power even when switched off and will deplete the batteries completely after a few weeks.
- Lithium-ion batteries self-discharge over time, therefore, check the remaining charge of stored batteries once per month and recharge any batteries that have depleted to below 30% (1 LCD Segment).
- When batteries are returned to service after storage, fully recharge before use.
- Batteries obtained directly from Inspired Energy are shipped with between 30% and 50% capacity to give at least 6 months shelf life at room temperature.

#### **3. New Batteries**

- When new batteries are used recalibration is recommended to ensure that battery fuel gauge is accurate.
- After 12 to 15 uses or every 3-4 weeks cycle or "exercise" the battery. This practice will contribute to maintaining the battery's good 'health'.
- A good rule of thumb is that Li Ion batteries lose 5% capacity per full 100 cycles and 5% per year, therefore it is recommended to perform recalibration every 2 months.
- If fuel gauge recalibration is needed, the red LED on a calibrating charger provided with the unit will flash.
- Battery 'health' and life expectancy may also be maximised by running the battery to discharge before recharging. The battery can then be swapped for a charged one or recharged in the TD unit while the unit is switched off but connected to the mains power. The battery may be recharged while the TD unit is on but at a reduced rate.



During an inspection, if the system shuts down because of battery discharge, the current setup will be lost. It is therefore important to save the system setup before allowing the battery to run to discharge.

#### **4. Battery Disposal**



Lithium-ion batteries must be disposed of in accordance with local regulations. Charged Li-ion batteries may generate enough heat to cause combustion; therefore, batteries must be discharged before disposal.

## 5. General Warnings



- Do not force open, drop, crush, puncture or subject batteries to undue abuse. Serious injury may be incurred.
- The contents of battery cells are corrosive and explosive. Any attempt to tamper with batteries could cause serious injury.
- Do not short-circuit the battery terminals. Doing so may cause irreparable damage to the battery and/or injury.
- Do not expose batteries to moisture. Electric shock may occur.
- Do not incinerate batteries. Fire and other heat sources above 80°C could result in explosion and/or injury.
- Use only a supplier approved charger or the appropriate TD system to charge batteries. Any other charging device may damage the battery.
- Always recharge batteries before storage. Failure to follow this advice may shorten the battery life.
- Do not leave the battery in a TD unit during storage if it is removable.
- During storage, keep the battery charged by recharging every 3-4 weeks.

## 6. Contact Technology Design

If in any doubt regarding the above instructions, contact Technology Design:

**Telephone:** +44 (0)1606 590123

**E-mail:** [tdsupport@technologydesign.com](mailto:tdsupport@technologydesign.com)

**Website:** [Technologydesign.com](http://Technologydesign.com)

**Address:** Dalton House, 40 Hardwick Grange,  
Woolston  
Warrington, Cheshire,  
WA1 4RF,  
United Kingdom



## 7. Inspired Energy® Contact

For information relating specifically to batteries, contact Inspired Energy LLC:

**Telephone:** +1 352 472 4855

**Website:** [www.inspiredenergy.com](http://www.inspiredenergy.com)

**Address:** 25440 NW 8<sup>th</sup> Place  
Newberry  
FL 32669  
United States

## Appendix 2

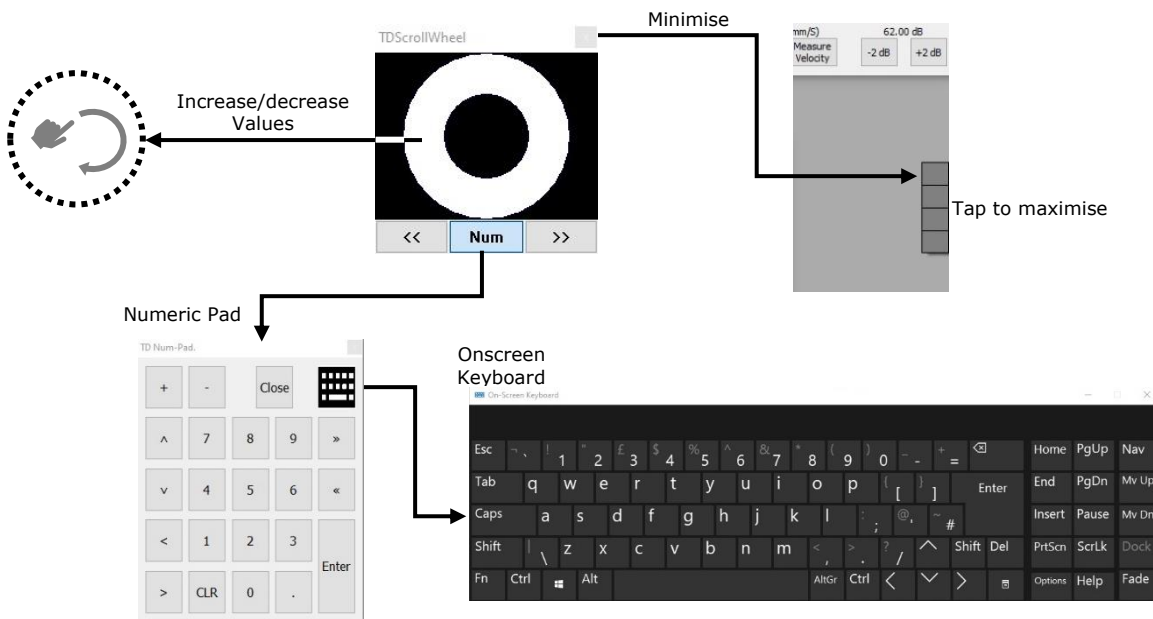
### Scroll wheel controls – Touchscreen

**NOTE:** The *Scroll-wheel* is a software device.

The TDScan touchscreen interface features a unique floating *Scroll-wheel* widget that is the hub of all input for numbers and letters. When TDScan is activated the scroll-wheel is displayed on the opening page below the A-Scan display and may be used to open the numeric keypad and full onscreen keyboard.

The Scroll-wheel opens on the left lower side of the screen and may then be re-positioned anywhere on the screen by dragging it to the desired location.

If the user prefers hardware input, a Bluetooth enabled keyboard and mouse may be attached to the USB ports (6). The Scroll-wheel may be controlled using a mouse.



## Appendix 3

### Technical Specifications

#### TD Focus-Scan RX II

<b>System Options</b>		<b>A-Scan Digitisation</b>	
128/16/8	128 Elements, 16 Active, 8 Conventional	A-Scan Points Per Channel	8000
128/32/8	128 Elements, 32 Active, 8 Conventional	Sampling delay	0 - 10ms, in 10ns steps @ 100MHz sampling rate
128/64/8	128 Elements, 64 Active, 8 Conventional	Number Of Gates Per Channel	3 hardware Gates
<b>General</b>		Gate Start/Width	User definable in 10 ns steps
Number Of Elements	Up to 128 Elements + 8 Conventional	Gate Reference Points	Transmit Pulse or Material Interface Echo
Number Of Active Channels	Up to 128	Storage Modes Per Gate	A-Scans, Peak Depth and Amplitude
Number Of Focal Laws	Up to 890	Data Storage Rates	6MByte/sec
Dynamic Depth Focusing	Yes	<b>Signal Averaging</b>	
<b>Digitisation</b>		Number Of Channels	All
A/D Sampling Frequency	Phased Array = 10Bit, 14Bit @ 100MHz Conventional = 10Bit, 14Bit @ 100MHz	Averaging Performance	100Mhz
System Bandwidth	(-3dB) Phased Array = 0.25MHz to 25MHz Conventional = 0.25MHz to 50MHz	Averaging Rates	Real-time averaging 1-256, user definable
Pulse Repetition Frequency	Up to 10KHz	<b>Peak Processing</b>	
<b>Pulsar</b>		Peak Storage Modes	All Peaks, First Peak, Largest Peak/s, Loss of Signal
Number of Pulsars	16 / 32 / 64 / 128	Thickness Measurement Modes	Thinnest/Thickest/Between Peaks
Number of Active Pulsars	1 to 128	Threshold Setup	5 to 100% in 1% steps per hardware Gate
Pulsar Delays	0us to 20us in 2.5nS steps	Number Of Peaks Per Gate	16
Output Impedance	6 Ohms	<b>FMC/TFM</b>	
HT Pulse Shape	Negative square wave	Data Acquisition mode	Full matrix capture, Half matrix capture, Custom
HT Pulse Voltage	Phased Array = 5 to 190V in 1V Steps	Wave Propagation	Any combination of T & L
HT Pulse Width Range	20ns to 500ns in 2.5nS steps	Amplitude Fidelity	Yes
Rise/fall time	< 5nS	Encoded TFM	Yes
<b>Receiver</b>		TFM Data Storage	Yes
Number Of Receivers	16 / 32 / 64 / 128	<b>Scanner Interface Ports</b>	
Number of Active Receivers	1 to 128	Input Type	Encoder, Video Camera
Receiver Delays	0us to 20/40us in 1nS steps	Number Of Axis	2 TTL compatible
Signal Bandwidth (-3dB)	Phased Array = 0.25MHz -25MHz Conventional = 0.25MHz -50MHz	Number Of Limit Inputs	4, TTL compatible
Gain Range	0dB to 100dB's controllable in 0.1dB steps	Encoder Interface	TTL compatible, 5V @ 1A, 12V @ 0.4A
Gain Linearity	0.5dB (typical)	Video Input	1Vpp Composite
Input Noise Level	2nV/(Hz) 1/2 (typical) across full system band width	<b>Motor Drive (Internal)</b>	
Input Impedance	50 Ohms	Motor Types	DC Servo, 24Volts
<b>Dynamic Depth Focussing</b>		Current Drive	5 Amp
Operation	Dynamically optimises receive focus delays	Current Limit	Software definable
Range Of Operation	User specified depth/range in mm or us	<b>PC (Internal)</b>	
Performance	100MHz real time	Operating System	Windows 10 Professional
<b>Time Corrected Gain (TCG)</b>		Processor	Intel® Atom™ 3845
Number Of Curves	Conventional - 1 per Channel Phased Array – 1 per Focal law	Memory	4GByte
Gain Range	0 to 80dB in 0.1dB steps	Display Colour	TFT (Industrial type)
Rate Of Gain Change	Up to 40dB/μs	TFT Display Resolution	1280x800
<b>Analogue Signal Filtering</b>		Storage SSD	128GBytes
High Pass Filters	User definable	Ports	3 x USB, 1 x 10/100/1000 Ethernet, 1 x Video
Low Pass Filters	User definable	<b>Size, Weight &amp; Environmental</b>	
Post Rectification Filters	(-3dB) No filter, 1, 2, 3, 4, 5, 6, 7MHz	Unit Dimensions	370mm x 294mm x 114mm
		Weight	7.3Kg
		Rating	Designed to IP66
		Temperature	0°C to 40°C operating, -25°C to 85°C storage
		<b>Power Requirements</b>	
		DC Input	19VDC
		AC Input	90 to 260VAC @ 40 to 60Hz
		<b>3rd Party Software</b>	
		ESBeamTool®	From Eclipse Scientific Inc.

## Appendix 4

### TD Focus-Scan RX connectors

#### 1. Power Connector

Pin	Function
1	+19V
2	GND

Mating connector:

Manufacturer: Fischer ( [www.fischerconnectors.com](http://www.fischerconnectors.com) )

Part Number: S 104Z051 - 130+ with clamp set E3 104.2/8.7 + B

#### 2. Motor Connector Axis 1 & 2

Pin	Function
1	Motor +
2	Motor -
5	GND
6	Encoder Ph A, TTL
7	Encoder Ph B, TTL
8	GND
9	Limit B, TTL
10	Limit A, TTL
11	+12V @ 100mA max
12	+5V @ 100mA max
13	GND
14	Servo Output
15	GND
16	Video Input

Mating connector:

Manufacturer: Fischer ( [www.fischerconnectors.com](http://www.fischerconnectors.com) )

Part Number: SC 105 A110-130+ with clamp set E31 105.2/10.7 + B | SE

#### 3. 15 Way D-Type - Encoder 1 & 2

Pin	Function
1	Video I/P
2	5V (100mA)
3	Axis 2, Limit B
4	Axis 2, Phase B
5	GND
6	Axis 1, Servo O/P
7	Axis 1, Limit A
8	Axis 1, Phase A
9	GND
10	Axis 2, Servo O/P
11	Axis 2, Limit A
12	Axis 2, Phase A
13	5V (100mA)
14	Axis 1, Limit B
15	Axis 1, Encoder B

Mating connector:

Manufacturer: LORLIN ( [www.lorlin.co.uk](http://www.lorlin.co.uk) )

Part Number: SDP15Z - Standard 15 Way D-Type Plug

#### 4. Probe Connector 1 & 2

##### 4.1. IPEX Connector

Pin	Element	Pin	Element
1	GND	61	GND
2	GND	62	GND
7	PROBE63	67	PROBE57
8	PROBE47	68	PROBE41
9	PROBE31	69	PROBE25
10	PROBE15	70	PROBE9
12	GND	75	PROBE56
17	PROBE62	76	PROBE40
18	PROBE46	77	PROBE24
19	PROBE30	78	PROBE8
20	PROBE14	79	GND

21	GND	80	GND
22	GND	81	GND
27	PROBE61	82	GND
28	PROBE45	87	PROBE55
29	PROBE29	88	PROBE39
30	PROBE13	89	PROBE23
31	GND	90	PROBE7
32	GND	95	PROBE54
37	PROBE60	96	PROBE38
38	PROBE44	97	PROBE22
39	PROBE28	98	PROBE6
40	PROBE12	99	GND
41	GND	100	GND
42	GND	105	PROBE53
47	PROBE59	106	PROBE37
48	PROBE43	107	PROBE21
49	PROBE27	108	PROBE5
50	PROBE11	109	GND
51	GND	110	GND
52	GND	115	PROBE52
57	PROBE58	116	PROBE36
58	PROBE42	117	PROBE20
59	PROBE26	118	PROBE4
60	PROBE10	119	GND
		120	GND

Mating connector:  
DAIICHI SEIKO 30056-160-T-F

#### 4.2. 78 Way D-Type Connector (optional)

Pin	Element	Pin	Element
1	1	40	33
2	2	41	34
3	3	42	GND
4	4	43	GND
5	5	44	GND
6	6	45	GND
7	7	46	GND
8	8	47	GND
9	9	48	GND
10	10	49	35
11	11	50	36
12	12	51	37
13	13	52	38
14	14	53	39
15	15	54	40
16	16	55	41
17	17	56	42
18	18	57	43
19	19	58	44
20	20	59	45
21	21	60	46
22	22	61	47
23	23	62	48
24	24	63	49
25	25	64	50
26	26	65	51
27	27	66	52
28	28	67	53
29	29	68	54
30	30	69	55

31	GND	70	56
32	GND	71	57
33	GND	72	58
34	GND	73	59
35	GND	74	60
36	GND	75	61
37	GND	76	62
38	31	77	63
39	32	78	64

Mating connector:

Manufacturer: Conec ([www.conec.com](http://www.conec.com))

Part Number: 4HDD78PCM99A10X - High Density 78 Way D-Type Plug