

Technology Design

ADVANCED ULTRASONIC HARDWARE

HandyScan RX



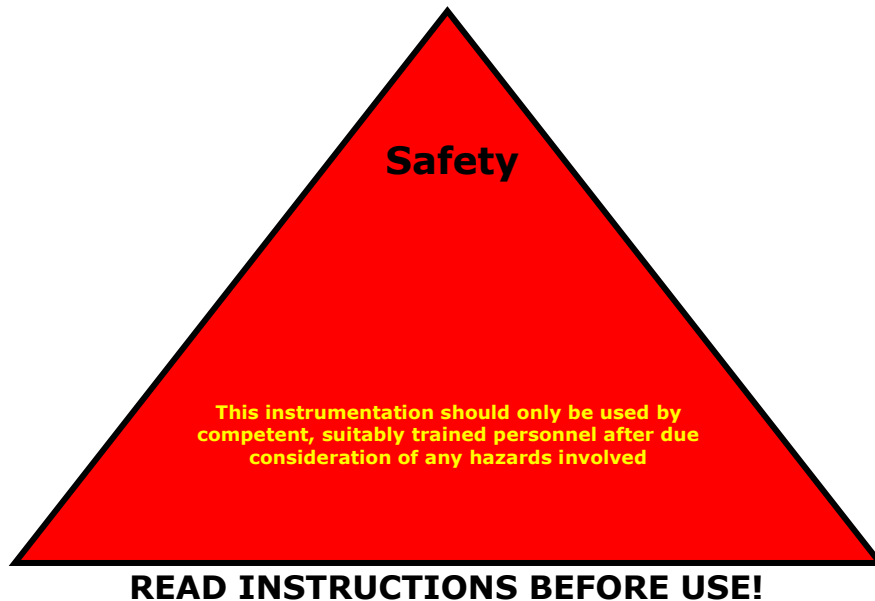
Designed & Manufactured in Great Britain

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, HandyScan RX* and *HSRX* and trademarks of Technology Design Limited, in the United Kingdom and other countries.
- *Lemo* is a trademark of Interlema Holding S.A. (Interlema Holding AG) (Interlema 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.

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USER GUIDE - HARDWARE

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

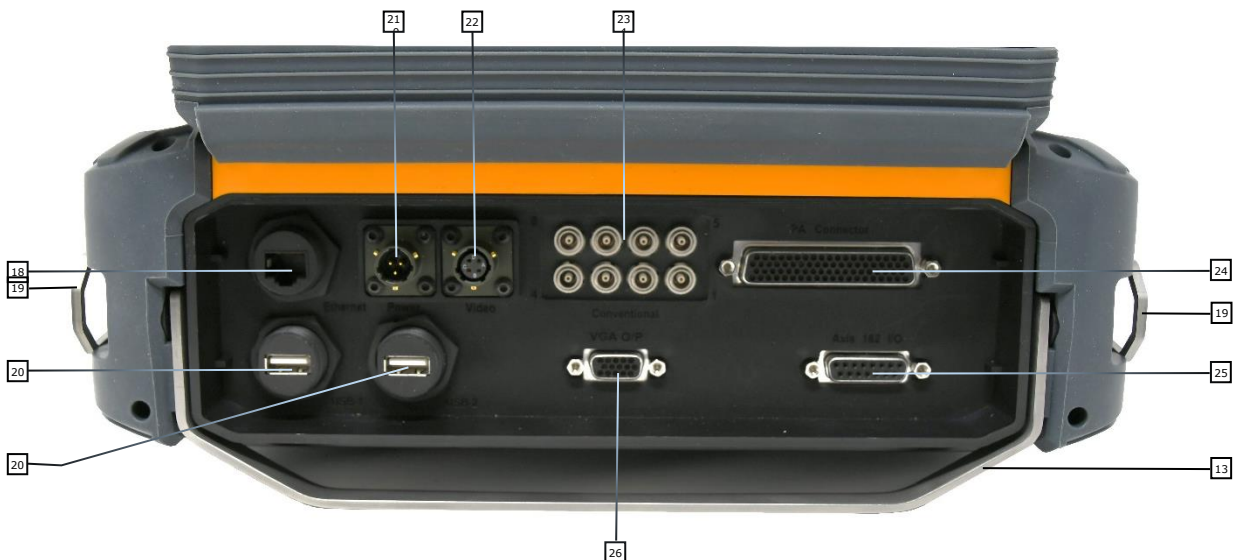
The HandyScan RX is supplied in a fully usable state. All electronic modules and connectors required to operate this equipment are fully integrated. No separate peripheral Ultrasonic modules are required. The TDScan advanced Ultrasonic software is pre-installed and accessed using the water-resistant keypad, TrackPoint, and shortcut keys.

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

1. Description

The HandyScan RX (HSRX) is a portable multifunctional industrial ultrasonic data acquisition and processing system. The HSRX 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.

1.1. Identification of Components



1.2. Description of Parts, Buttons and Connectors

1	Protective cover	The soft rubberised cover protects the probe and other device connectors from damage and ingress of debris.
2	Front panel	The panel is a soft rubberised water-resistant polymer with integrated tactile keypad, TrackPoint and other control buttons/keys.
3	Display Screen	The display a sun-readable Industrial 8.4" colour TFT with 800x600 resolution.
4	Protective Enclosure	The enclosure is made of a durable polymer material. The enclosure and front panel are sealed form a water-resistant barrier.
5	On/Off Button	When depressed for 3 seconds the <i>Power</i> light flashes while the system starts. After starting the light stops flashing and illuminates steadily. The system may be powered down by pressing the <i>On/Off</i> button for 10 seconds.
6	Keypad	The Keypad has a telephone key arrangement with additional controls. Pressing the keys repeatedly will cycle through lower case letters, upper case letters and numbers. There are also TAB, Escape, Clear, Enter and Space buttons.
7	Protective Bumpers	The bumpers are made of soft polymer material. The bumpers provide an additional layer of protection against shock and abrasion.
8	Shortcut Keys	These keys provide shortcuts to different menus and commands in the TDScan software. The keys execute different actions depending on whether TDScan is in setup, acquisition, or analysis mode. To see an onscreen menu guide, press the <i>Menu On/Off</i> key (9)
9	Menu On/Off Key	Pressing this key activates or deactivates an onscreen visual guide to the shortcut keys.
10	NAV Key	<i>Not used.</i> This key is redundant and has no associated action.
11	Course/Fine Key	Toggles between larger and smaller numeric increments when using adjustable text boxes in TDScan, e.g. the gain control in the <i>Hardware Tab</i> will increase by 1dB in <i>Course</i> mode and 0.1dB in <i>Fine</i> mode.
12	TrackPoint	The TrackPoint consists of a miniature joystick, left mouse key and right mouse key. It controls onscreen cursor movement and context menu actions.
13	Carry Handle	Made of hardened metal the carry handle folds down when not in use.
14	Battery Securing Screws	The knurled thumb screws are used to secure the battery pod into the battery bay.
15	Air Vents	There are 2 inlet and 2 exhaust air vents. The vents are covered with a damp-resistant filter material to inhibit the ingress of light moisture and humidity. The membranes are not water resistant when immersed.
16	Battery Pod	Two batteries are protected and held securely in position by the pod that fits into the recessed battery compartment.
17	Stand	The stand is made of polymer coated hardened steel wire that may be folded out to support the HandyScan TX at an angle.
18	Ethernet Connector	Standard RJ45 connector for 10/100 Ethernet communications. Ethernet may be used to access the Internet and other Networks for access to file servers and network based remote storage locations.
19	Carry Strap Attachment Loops	The loops are made of sheathed stainless-steel cable, securely bolted to an internal steel chassis.
20	USB Ports	There are two USB ports. Any USB enabled input, storage or communications devices may be used to enhance the capability and user experience of the HSRX.
21	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 - 19VDC.
22	Video I/O	A CCTV camera may be connected to the HSRX for tracking probe position while using a <i>Video Tracking Corrosion Mapping Kit</i> .
23	Pulse Echo Probe Connectors	Eight Lemo® 00 connectors may be used to connect ToFD and Pulse Echo transducers to the HSRX. Single crystal and dual crystal transducers may be connected in any logical combination.
24	Phased Array Connector	The D-78 type connector allows any phased array transducer with an element count, up to 64 elements to be used with the HSRX. Multiple transducers may be connected using and external 'splitter' with consequently lower element counts per transducer.
25	Encoder	2-Axis encoders may be connected to ensure accurate XY positional encoding of data. Compatible encoders: TTL compatible, 5V @ 1A, 12V @ 0.4A
26	VGA Out	Connector for external display devices such as a monitor or projector.

2. Starting and Stopping the System

To start the HandyScan RX, press the **ON/Off Button** for 3 seconds. The Power light flashes while the system starts. After starting the light stops flashing and illuminates steadily.

The system may be powered down by pressing the **On/Off Button** for 10 seconds.

3. Basic Operation

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

ESBeamtool® may 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

4. Screen Resolution

The HandyScan RX is equipped with a sun-readable industrial type 8.4" colour TFT with 800x600 resolution. At this resolution, when the TDScan software is displayed, certain menu items and values are truncated and displayed as abbreviations.

5. Power

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

5.1.AC Power - Mains

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

The adapter input is autosensing and can operate from 100VAC to 260VAC @ 40Hz to 60Hz.

The adapter output is 19VDC to 24VDC @ 40W (Operating).

Connect the power cable from the power adapter to the Power Supply input (21)

5.2.DC Power - Batteries

The HandyScan RX is equipped with two Lithium Ion batteries contained in a battery pod (16).

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.

5.2.1. Removing & Replacing Batteries

- i. Unscrew the knurled thumb screws on the back panel of the HSRX. Remove the battery pod by gently levering the screw tabs away from the unit's body, grasp both tabs with the fingers and lift the pod out of the battery compartment.
- ii. To remove the batteries from the battery pod, slide the batteries out of the pod.
- 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
Below 1%					
1% - 20%	■				
21% - 40%	■	■			
41% - 60%	■	■	■		
61% - 80%	■	■	■	■	
81% - 100%	■	■	■	■	■

- iv. To insert the batteries into the HSRX, slide the batteries into the pod. Gently but firmly press the battery pod into the battery compartment until the rubber gasket engages fully and tighten the knurled thumb screws.

6. 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 designed for NDT applications between 0.75Mhz and 25Mhz (-3dB).

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



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.

6.1. Phased Array

The HandyScan RX is equipped with one D-78 connector.

Phased Array transducers with an element count of up to 64 elements may be connected to connector (24). If simultaneously inspection from both sides of a weld is required, an external splitter may be used to accommodate up to 32 elements per connector. Splitters may be acquired from Technology Design.

6.2. Pulse Echo/ToFD

The HandyScan RX is equipped with eight Lemo® 00 connectors (23). Single and dual crystal transducers may be connected in any logical combination.

7. Connecting Encoders

1 or 2 encoders may be connected through a single connector to ensure accurate X and X/Y positional encoding of data.

Compatible encoders: TTL compatible, 5V @ 1A, 12V @ 0.4A

8. Using Scanners

Scanners are external devices that carry ultrasonic probes and may incorporate positional encoders to ensure accuracy in identifying data position, location of defects and sizing of defects. Scanners may be manually propelled or driven by servo motors. To use a motorised scanner with the HandyScan RX, an external Motor Drive Control unit is required.

Technology Design can supply scanners from third party suppliers.

8.1. Manually Propelled Scanners with Encoder

- i. Attach probe/probes to scanner.
- ii. Attach positional encoder to scanner.
- iii. Connect co-axial cable/s to transducer/s if needed.
- iv. Connect co-axial cable/s to HandyScan RX (23).
- v. Connect encoder to HandyScan RX (25).

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 HandyScan RX (23).
- v. Depending on the design of the scanner, connect the encoder to the HSRX as per the scanner manufacturer's instructions.

9. USB

External storage devices may be connected to the HandyScan RX using the USB ports (20). 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 keypad and TrackPoint (6, 12). These devices include keyboard, mouse, and joystick.

USB Bluetooth and Wi-Fi adapters may be connected to the HandyScan RX 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 HandyScan RX. Technology Design can advise on and supply suitable units.

10. Ethernet

Access to remote networks provides a convenient method of transferring data files or providing remote access to the HandyScan RX when needed. Data files may be directly transferred to and retrieved from secure storage facilities using Ethernet. The ability to access the HandyScan RX 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 HandyScan RX 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 HandyScan RX Ethernet connection may be described as 10/100/1000.

When communicating with another PC using a direct connection, a *cross-over* Ethernet cable must be used.

11. Using the Keypad

The *Keypad* (6) allows numbers and letters to be entered into text boxes and documents. The *TAB, Esc, Enter and Space* keys have the same functionality as any conventional keyboard. The *Clear* key is the same as *Backspace* on a conventional keyboard.

Use of the telephone style Keypad (6) requires TDScan to be running. If preferred the Windows® onscreen keyboards may be used as an alternative.

Each key has a number 0 to 9 and three letters assigned to it. Repeatedly pressing a key will cycle through the number followed by all the letters in lower case, then upper case and back to the number again.

12. To repeat numbers, after entering a number, wait 2 seconds before pressing the key again.

The *TrackPoint* (12) consists of a raised round pressure pad, left mouse button and right mouse button. Applying finger pressure in any direction, moves the cursor to the desired screen location. Press the left or right mouse buttons to execute the same actions as similar buttons on a conventional mouse.

The sensitivity of the pressure pad/cursor may be adjusted using the Windows® *Mouse Properties* controls.

A conventional mouse may be used as an alternative to the TrackPoint.

13. Shortcut Keys

Pressing a *Shortcut Key* opens a Window or executes a command in TDScan. Each *Shortcut Key* will execute different commands based on which state the TDScan software is in when the key is pressed. The states that affect the function of the keys are: *Setup, Data Acquisition and Data Analysis*.

To view an onscreen guide of *Shortcut Key* functions, press the *Menu On/Off Key*.

14. C/F Key

The *C/F Key* (11) is used to toggle between greater or smaller numerical increments in TDScan. *C/F* are abbreviations for *Course* and *Fine*

Wherever there is a *Spinner Control*, the rate of increase and decrease in values may be controlled by pressing the *C/F* key.

15. Data storage

The HandyScan RX is equipped with a 128Gb Solid State Drive (SSD). Users can set up a folder structure as desired.

Data may be stored on external devices directly connected to the USB ports (20).

Private Network and Internet based storage devices may be accessed from wired and wireless networks using Ethernet and Bluetooth. USB Wi-Fi adapters may be connected to the USB ports (20).

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.

3. 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.

4. General Warnings



WARNING

- 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.

5. Contact Technology Design

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

Telephone: +44 (0)1606 590123

E-mail: tdsupport@technologydesign.com

Website: Technologydesign.com

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



6. Contact Inspired Energy®

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

Telephone: +1 352 472 4855

Website: www.inspireenergy.com

Address: 25440 NW 8th Place
Newberry
FL 32669
United States

Appendix 2

Technical Specifications - TD HandyScan RX

System Options				
64 Elements (D Type 78 way)	64 Elt, 32 Active, 8 Conventional (Lemo 00)			
General				
Number of Focal Laws	1700 max			
Dynamic Depth Focusing	Yes			
Digitization				
A/D Sampling Frequency	Phased Array = 8Bit & 14Bit @ 100MHz Conventional = 8Bit & 14Bit @ 100MHz			
System Bandwidth(-3dB)	Phased Array = 0.75MHz to 25MHz Conventional = 0.75MHz to 25MHz			
Max Pulse Repetition Frequency	Variable up to 5KHz			
Pulsar				
Number of Pulsers	64			
Number of Active Pulsers	1 to 32			
Pulsar Delays	0µs to 20µs in 2.5ns steps			
Output Impedance	6 Ohms			
HT Pulse Shape	Square wave			
HT Pulse Voltage	Phased Array = 5 to 200V in 1V Steps Conventional = 5 to 200V in 1V steps			
HT Pulse Width Range 2	0ns to 500ns in 2.5ns steps			
Rise/fall time	< 5ns			
Receiver				
Number of Receivers	64			
Number of Active Receivers	1 to 32			
Receiver Delays	0µs to 20µs in 1ns steps			
Gain Range	P/E=0 to 90dB in 0.1dB steps, P/A=0 to 72dB in 0.1dB steps			
Input Noise Level	2.5nV/(Hz) ^{1/2} across full system bandwidth			
Input Impedance	50 Ohms			
Dynamic Depth Focusing				
Operation	Dynamically optimizes receive focus delays			
Range Of Operation	User specified depth/range in mm or µs			
Performance	100MHz real-time			
Receiver DAC Curves				
Number of Curves	1 to 8			
Rate of Gain Change	Up to 40dB/ µs			
Digital Signal Filtering				
	Probe Frequency (MHz)	Narrow Band (MHz)	Wide Band (MHz)	Broad Band (MHz)
	1	0.75 - 1.5	0.75 – 4.0	0.75 – 25.0
	2	1.0 - 3.0	0.75 – 4.0	0.75 – 25.0
	4	2.0 – 6.0	0.75 – 8.0	0.75 – 25.0
Band Pass Filters(-3dB)	5	2.5 – 7.5	0.75 – 10.0	0.75 – 25.0
	7.5	1.5 – 11.25	07.5 -15.0	0.75 – 25.0
	10	5.0 – 15.0	2.5 – 20.0	0.75 – 25.0
	15	10.0 – 20.0	5.0 -25.0	0.75 – 25.0
	20	15.0 – 25.0	0.75 – 25.0	0.75 – 25.0
Post Rectification Filters (-3dB)	No filter, 1-15MHz in 1MHz steps			
A-Scan Points Per Channel	8000 samples per channel			
Number of Gates Per Channel	3 overlapping hardware Gates			
Gate Start/Width	User definable in 40ns steps			
Gate Reference Points	Transmit Pulse or Material Interface Echo			
Storage Modes Per Gate	A-Scans, Peak Depth and Amplitude, both			
Number of Channels	All (128 software channels)			
Averaging Rates	Real-time averaging 2 - 256, user definable			
Peak Storage Modes	All Peaks, First Peak, Largest Peak/s, Loss of Signal, Between			
Threshold Setup	5 to 100% in 1% steps per hardware Gate			
Number of Peaks Per Gate	16 (maximum)			
Input Type	Encoder, Potentiometer, Video Camera			
Number of Axis	2 axis, TTL compatible			
Encoder Interface	TTL compatible, 5V @ 1A, 12V @ 0.4A			
Potentiometer Interface	0 to 2.5V, sampled at 100Hz			
Video Input	1Vpp Composite			
Operating System	Windows® 7			
3rd Party Software	AVG Antivirus® ESBeamToo® (Eclipse Scientific)			
Processor	Intel Atom N270			
Memory	2GB			
Display Colour	TFT (Industrial type) 8.4"			
TFT Display Resolution	800 x 600 - Sunlight Readable Screen			
Storage	60GB SSD			
Ports	2 x USB, 1 x 10/100 Ethernet, 1 x Video			
Unit Dimensions	270 x 300 x 110mm			
Weight	5Kg			
Rating	Designed to IP65			
Temperature	0°C to 40°C operating, -25°C to 85°C storage			
Operating Time	4 Hours (approx.)			
DC Input	19V			
AC Input	90 to 260VAC @ 40Hz to 60Hz			

Appendix 3

Connectors - HandyScan RX

1. 3 Way Military (Power)

Pin	Function
A	+19V DC (80W)
B	NC
C	GND

Manufacturer: Amphenol (www.amphenol.com)
 Description: Military Circular Connector
 Part Number: 62GB-16F08-03SN

2. 4 Way Military (Video)

Pin	Function
A	GND
B	+12V DC
C	GND
D	Video I/P

Manufacturer: Amphenol (www.amphenol.com)
 Description: Military Circular Connector
 Part Number: 62GB-16F08-04PN

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

Manufacturer: LORLIN (www.lorlin.co.uk)
 Description: Standard 15 Way D-Type Plug
 Part Number: SDP15Z

4. 78 Way D-Type Connector

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

Manufacturer: Conec (www.conec.com)
Description: High Density 78 Way D-Type Plug
Part Number: 4HDD78PCM99A10X