MAPTEK™

R3 Series MkII Laser Scanner

Operator Manual

UR3, XR3, XR3 dual window, SR3
FieldHHC

www.maptek.com

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Revision History

Issue	Date	Summary
2024	June 2024	First release

IMPORTANT



Read this manual carefully before using the product.

Keep for future reference.

Explanation of symbols

The following symbols and labels are used throughout this document:

⚠	This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
⚠WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
Important:	Indicates important information not related to safety. Failure to pay attention could result in serious consequences such as physical damage to the system, data loss, or other material or financial loss.
Note:	Indicates a point of attention or supplementary information not related to safety.
Tip:	Indicates practical advice aimed at enhancing the efficient use of the product.
▸	Indicates an action that the user can or should perform.

Contents

Chapter 1: Important Information 1

1.1 Responsibilities and terms of use 1

1.1.1 Supplier of the product 1

1.1.2 Manufacturers of non-Maptek accessories 1

1.1.3 Person in charge of the product 1

1.1.4 Software terms of use 2

1.2 Intended use 2

1.2.1 Permitted use 2

1.2.2 Adverse use 2

1.3 Limits of use 3

1.3.1 Environment 3

1.3.2 Working in hazardous areas 3

1.3.3 Scanning in the vicinity of survey prisms 3

1.3.4 Maintenance, calibration, and servicing 3

1.4 Hazards of use 4

1.4.1 Warnings 4

1.4.2 Cautions 4

1.4.3 Safety precautions 5

Chapter 2: Product Description 7

2.1 Scanner kit 7

2.1.1 Unpacking the scanner kit 8

2.1.2 Accessories box contents (if supplied) 9

2.1.3 Backpack box items (if supplied) 9

2.1.4 Transit case 10

2.1.5 Shock indicators 10

2.1.6 Standard kit inclusions 11

2.2 System components 12

2.2.1 Scanner components 12

2.2.2 Scanner base 14

2.2.3 Onboard scanner controls 15

2.2.4 Scanning window variants 17

2.2.5 FieldHHC tablet 18

2.2.6 Cold climate option (XR3 M20 and UR3 M20) 18

Chapter 3: Care and Maintenance 19

3.1 Care instructions 20

3.1.1 Cleaning frequency 21

3.1.2 Keeping the transit case clean and dry 22

3.2 Transporting the scanner kit 22

3.2.1 Recommendations for using the transit case 22

3.2.2 Placing items in the transit case 22

3.2.3 Recommendations for using the backpack 23

3.3 Calibrating and servicing the scanner 23

Chapter 4: Preparing to Use the Scanner 25

4.1 Carrying and placing the scanner 25

4.1.1 Carrying the scanner with one hand 25

4.1.2 Removing or placing the scanner into its transit case 26

4.1.3 Placing the scanner onto a mount 26

4.1.4 Carrying the scanner using the transit case 27

4.1.5 Summary of recommendations for placing a scanner 27

4.2 Fitting scanner mounting hardware 28

4.2.1 Tribrach adapter 28

4.2.2 Scanner interface plate 28

4.3 Powering the scanner 29

4.3.1 Inserting the scanner battery 29

4.3.2 Checking the scanner battery state of charge 30

4.3.3 Charging the scanner battery 30

4.3.4 Connecting external power to the scanner 31

4.4 Scanning in cold conditions 31

4.4.1 Preparing to scan in cold climate with M20 scanners 32

4.4.2 Fitting the neoprene jacket to the scanner 32

4.4.3 Recovering a cold-soaked scanner 33

4.5 Attaching a GPS device to the scanner 33

4.6 Mounting the scanner to a tripod 34

4.7 Enabling or disabling Wi-Fi on the scanner 35

Chapter 5: Scanning Concepts 37

5.1 Scan basics 37

5.1.1 Scan composition 37

5.1.2 Position and orientation 37

5.1.3 Level correction 39

5.2 Physical setup 40
5.2.1 Fixed surveyed location 40
5.2.2 Tripod setup 40
5.2.3 Vehicle mount 41
5.2.4 Maptek Drive 42
5.2.5 Maptek Sentry 42
5.3 Defined name and survey job scans 43
5.4 Scanning settings 43
5.4.1 Scan mode 43
5.4.2 Point density 44
5.4.3 Scan point selection 45
5.5 Scan file naming 46
5.6 Dual window scanning 48

Chapter 6: Scanning to USB 51

6.1 Taking a pushbutton scan 52
6.2 Taking a scan with a mobile device 53

Chapter 7: Scanning with FieldHHC 57

7.1 Introduction 58
7.1.1 Starting FieldHHC 58
7.1.2 Main tabs 58
7.1.3 Status bar 59
7.1.4 Basic scanning workflow 60
7.2 File management 62
7.2.1 Transferring, archiving, and deleting scan files 62
7.2.2 Managing non-scan file types 64
7.3 Configuring FieldHHC 66
7.3.1 Settings tab 66
7.3.2 Calibrating the compass for vehicle use 71
7.3.3 Configuring scanner and Drive vehicle mount offsets 72
7.3.4 Calculating the GPS offset 74
7.3.5 Licensing advanced tools 76
7.3.6 Connecting to a Bluetooth GPS device 76
7.4 Connecting to a scanner 77
7.4.1 Connecting to a scanner wirelessly 77
7.4.2 Connecting to a scanner with an Ethernet cable 78
7.5 Setting up a scan job 79

7.5.1 Setting up a defined name scan job *79*
7.5.2 Setting up a survey job *80*
7.5.3 Setting up a survey job with multiple backsights *85*
7.5.4 Calculating the scanner height *87*
7.5.5 Backsighting a scanner *88*
7.6 Acquiring scans 91
7.6.1 Selecting scan settings *91*
7.6.2 Viewer controls *96*
7.6.3 Selecting a region to scan *98*
7.6.4 Taking a preview *98*
7.6.5 Taking scans *99*
7.7 Viewing scans 101
7.7.1 Viewing scans in panoramic mode *101*
7.7.2 Annotating scans *104*
7.7.3 Viewing scans in 3D *107*
7.8 Registering scans 112
7.8.1 Fixed origin registration *112*
7.8.2 Manually positioning scans *113*
7.8.3 Advanced registration *114*
7.9 Checking design conformance 121
7.9.1 Configuring design conformance settings *122*
7.9.2 Starting design conformance view mode *123*
7.9.3 Creating cross sections *126*
7.9.4 Creating a design conformance report *128*
7.10 Scanning with Maptek Drive 130
7.10.1 Connecting Drive to FieldHHC *130*
7.10.2 Performing the alignment routine *131*
7.10.3 Acquiring a driving scan *132*
7.10.4 Acquiring a stationary scan *134*
7.10.5 Viewing Drive scans *134*

Appendix A: Troubleshooting 137

Appendix B: Specifications 139

B.1 Scanner general specifications 140
B.2 Laser rangefinder 141
B.3 Range versus reflectivity 142
B.4 Scan point density 143

B.5 Digital camera 143
B.6 Laser aimer (SR3 only) 143
B.7 Telescope (XR3-CT only) 144
B.8 FieldHHC tablet 144
B.9 Network settings 145

Appendix C: Regulatory Compliance 147

C.1 Electromagnetic compatibility 147
C.2 Conformity to national regulations 148
C.3 Wi-Fi technical data 149
C.4 Laser classification 149
C.4.1 Laser rangefinder 149
C.4.2 Laser aimer (SR3 only) 150
C.5 Waste management 150
C.5.1 European Community Requirements 150
C.5.2 Alternative waste management 150

Appendix D: International Warranty 151

D.1 Warranty certificate 151
D.1.1 Warranty period 151
D.1.2 Application 151
D.2 Warranty Disclaimer 152

Appendix E: Optional Accessories 153

Appendix F: Support 155

F.1 Online resources 156
F.2 Contact information 156

Index 157

Chapter

1

Important Information



This chapter explains important information about the safe and proper use of the product. Read it thoroughly before using the product. Failure to do so could result in injury, damage to the system, or other material or financial loss.

1.1 Responsibilities and terms of use

The operation of the product is subject to the conditions outlined below.

1.1.1 Supplier of the product

Maptek Pty Ltd, 63 Conyngham St, Glenside, South Australia 5065, AUSTRALIA, hereafter referred to as Maptek, is responsible for supplying the product, including the operator manual and original accessories, in a safe condition.

1.1.2 Manufacturers of non-Maptek accessories

The manufacturers of non-Maptek accessories are responsible for developing, implementing, and communicating safety concepts for their products. They are responsible for the effectiveness of those safety concepts in combination with the Maptek product.

1.1.3 Person in charge of the product

The *person in charge of the product* is a designated supervisor, manager, or operator within the customer's organisation who is responsible for overseeing the safe operation, maintenance, and compliance of the scanner.

The person in charge of the product is responsible for the following:

- Understanding and adhering to the safety instructions on the product and the instructions in this operator manual
- Familiarising themselves with local regulations relating to safety and accident prevention
- Ensuring that all users of the product are suitably trained
- Ensuring that the scanner is maintained according to the directions in this operator manual
- Informing Maptek immediately if the product and its application become unsafe

1.1.4 Software terms of use

Use of the FieldHHC software or any Maptek software is under the terms of the Maptek Software End User Licence Agreement (EULA). The Agreement can be found at www.maptek.com/eula.

1.2 Intended use

1.2.1 Permitted use

Permitted use of the product includes the following:

- Measuring and recording distances and horizontal and vertical angles
- Capturing and recording images
- Searching for and identifying features
- Visualising the aiming direction and vertical axis
- Communicating with approved external devices

1.2.2 Adverse use

⚠WARNING Adverse use of the product can lead to injury, malfunction, or damage.

Adverse use of the product includes, but is not limited to, the following:

- Using the product without instruction
- Using the product outside of the intended limits
- Disabling safety systems
- Removing any panels
- Removing hazard notices
- Modifying or converting the product
- Using after misappropriation
- Using a product with obvious damage or defects
- Using with accessories from other manufacturers without the prior explicit approval of Maptek
- Using inadequate safeguards at the surveying site; for example, when measuring on roads
- Deliberate dazzling of third parties
- Controlling machines, moving objects, or similar monitoring applications without additional control and safety installations

Important: Do not unscrew or open the scanner casing. There are no user-serviceable parts within the scanner. Only Maptek-authorised service workshops are authorised to align, calibrate, or repair the product. Removing any panels will void the warranty.

Important: Invalid measurement may result if the product has been dropped, misused, modified, stored for long periods, or transported.

1.3 Limits of use

1.3.1 Environment

The scanner is suitable for use in an atmosphere appropriate for permanent human habitation. It is not suitable for use in hazardous or explosive environments. The scanner is designed to operate in rugged conditions, but environmental conditions such as precipitation, dust, or extreme heat or cold can affect its operation and the quality of results. See Appendix B Specifications on page 139 for technical data for your scanner model.

1.3.2 Working in hazardous areas

Local safety authorities and experts must be contacted before working in hazardous areas, or in close proximity to electrical installations or similar situations, by the person in charge of the product.

1.3.3 Scanning in the vicinity of survey prisms

Important

Survey prisms can damage the scanner. Do not scan survey prisms in the target area that are closer than 100 m. This includes survey prisms above and below the target elevations, since the scanner beam continues through these regions.

1.3.4 Maintenance, calibration, and servicing

The scanner system must be maintained according to the directions of this operator manual to prolong its operational lifespan. Maptek advises that the scanner should be serviced and calibrated by a Maptek service facility every 12 months to ensure that it retains its accuracy to within specifications. See Chapter 3 Care and Maintenance on page 19 for more information.

1.4 Hazards of use

1.4.1 Warnings

⚠WARNING

- The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial, and environmental consequences.
- Inadequate securing of the surveying site can lead to dangerous situations, for example in traffic, on building sites, and at industrial installations.
- The scanner is suitable for use in an atmosphere appropriate for permanent human habitation. It is not suitable for use in hazardous or explosive environments.
- Batteries not recommended by Maptek may be damaged if charged or discharged. They may burn and explode.
- Using a battery charger not recommended by Maptek can destroy the batteries, which can cause fires or explosions.
- High mechanical stress, high ambient temperatures, or immersion in fluids can cause battery leakage, fire, or explosion.
- Opening the product casing exposes you to the risk of electric shocks and to hazardous laser radiation.
- If the product is improperly disposed of, the following may occur:
  - If polymer parts are burned, poisonous gases are produced that may impair health.
  - If batteries are damaged or are exposed to sufficiently high temperatures, they can explode and cause poisoning, burning, corrosion, or environmental contamination.
  - If unauthorised persons gain possession of the scanner and use it in contravention of the regulations, they may expose themselves and third parties to the risk of severe injury and render the environment liable to contamination.

1.4.2 Cautions

⚠CAUTION

- If any accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people may sustain injury.
- During the transport or disposal of batteries, it is possible for inappropriate mechanical influences to constitute a fire hazard.

1.4.3 Safety precautions



- Always ensure that the survey site is adequately secured. Adhere to the regulations governing safety, accident prevention, and road traffic.
- When setting up the scanner, make sure that the accessories (for example the tripod, tribrach and connecting cables) are correctly adapted, fitted, secured, and locked in position.
- Avoid subjecting the product to mechanical stress.
- Protect batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids. Ensure the battery terminals do not come into contact with metallic objects.
- Scanner and tablet batteries contain Lithium. Prior to airfreight, consult with your freight forwarder to ensure compliance with regulations and guidelines regarding the transportation of Lithium batteries.
- The product must not be disposed of with household waste. Dispose of the product appropriately in accordance with the national regulations in your country.
- Always prevent access to the product by unauthorised personnel.

Chapter

2

Product Description

Maptek R3 Series MkII scanners are terrestrial laser scanners capable of capturing detailed and accurate 3D point clouds for surveying applications, including topographic and civil projects.

2.1 Scanner kit

Maptek R3 MkII laser scanner systems are supplied as a kit, inclusive of the selected scanner and accessories. Table 2-1 below lists each scanner system with available configurations and options, along with their respective part numbers.

Table 2-1 Scanner kits

Laser scanner system	Configuration name	Description	Kit part #
UR3	UR3	UR3 scanner	0990290
	UR3 M20	UR3 cold climate scanner	0990291
XR3	XR3-CT	XR3 scanner with camera and telescope	0990275
	XR3-C	XR3 scanner with camera	0990276
	XR3-CT M20	XR3 cold climate scanner with camera and telescope	0990278
	XR3-C M20	XR3 cold climate scanner with camera	0990279
XR3 dual window	XR3-D	XR3 dual window scanner	0990277
	XR3-CD	XR3 dual window scanner with camera	0990287
SR3	SR3-CL	SR3 scanner with camera and laser aimer	0990265

2.1.1 Unpacking the scanner kit

⚠CAUTION Risk of physical injury when handling heavy items. Avoid postures that strain the body or cause loss of balance. Seek assistance if needed.

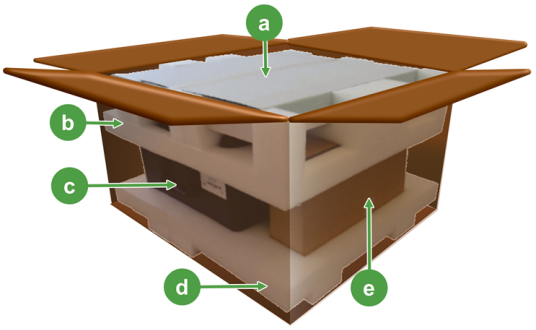
Referring to Figure 2-1 below, ensure the packing box is in the upright position before opening it. The top of the packing box has orange label tape marked “FRAGILE”. Also note the orientation of the Maptek product label on one side of the box.

To open the box, cut the straps and packing tape securing the lid.



a Fragile label tape
b Straps
c Maptek brand label

Figure 2-1 Packing box



a Accessories box (if supplied)
b Upper foam cage
c Transit case
d Lower foam cage
e Backpack box (if supplied)

Figure 2-2 Packaging arrangement

Figure 2-2 above illustrates a typical scanner kit as shipped.

To unpack the scanner kit, follow these steps:

1. Remove the accessories box (if supplied).
2. Remove the upper foam cage.
3. Remove the backpack box (if supplied).
4. Remove the transit case.

Tip: Please retain the box and foam cages to use when returning the scanner for service or repair, if possible.

2.1.2 Accessories box contents (if supplied)

The accessories box contains items that are used with the scanner and the FieldHHC tablet. Figure 2-3 below shows the items included.



a	AC power cable for FieldHHC tablet AC power adapter
b	AC power adapter for FieldHHC tablet
c	Scanner operator manual, Ethernet cable, tablet battery, and 6 mm T-handle hex key
d	Tribrach
e	Tribrach adapter
f	Scanner battery charging kit
g	12 V DC car adapter lead for tablet
h	12 V DC car adapter for tablet

Figure 2-3 Accessories box items

2.1.3 Backpack box items (if supplied)

The FieldHHC tablet and backpack are packaged in this box. You can also use the backpack to store any other accessories.

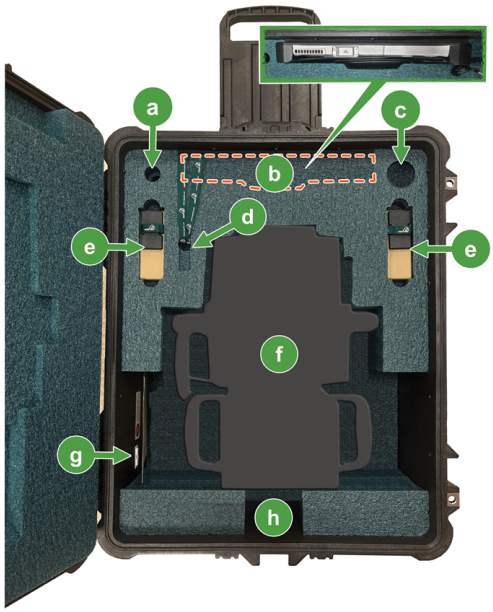
> **Note:** Always store the FieldHHC tablet inside the padded section in the backpack to best protect its touchscreen. You can optionally store the tablet in the transit case.



Figure 2-4 Backpack box contents

2.1.4 Transit case

Figure 2-5 below illustrates transit case items as shipped. The FieldHHC tablet can subsequently be stored in the transit case if the foam insert (b) is removed.



a	Recess for quick-release GPS mount adapter (not supplied)
b	Recess for FieldHHC tablet with removable foam insert
c	Telescope eyepiece cap (if supplied)
d	Compact USB keys (flash drives) with lanyards
e	Scanner battery recesses
f	Scanner recess (scanner is placed face down)
g	Internal shock indicator
h	Fitted tribrach recess

Figure 2-5 Transit case with supplied items

2.1.5 Shock indicators

Shock indicators detect possible rough handling by reacting to a predetermined amount of shock. They do not necessarily indicate damage. If damage is noted upon delivery, immediately contact the shipping company and Maptek for advice. There is an external and an internal shock indicator. Refer to Figure 2-6 below for their locations. Figure 2-7 below illustrates the contrast between undisturbed and triggered indicators.



Figure 2-6 Shock indicator outside (left) and inside (right) the transit case.



Figure 2-7 Undisturbed (left) and triggered (right) shock indicators.

2.1.6 Standard kit inclusions

Table 2-2 below lists the items that are included in each scanner kit.

Table 2-2 Standard kit items

Part				Kit			
Name	**Model**	**Part #**	**Qty**	**XR3**	**SR3**	**UR3**	**Acc.[1]**
UR3 scanner	UR3	0990290	1			●	
	UR3 M20	0990291					
XR3 scanner	XR3-CT	0990275	1	●			
	XR3-C	0990276					
	XR3-CT M20	0990278					
	XR3-C M20	0990279					
	XR3-D	0990277					
	XR3-CD	0990282					
SR3 scanner	SR3-CL	0990282	1		●		
Tribrach adapter		0102316	1	●	●	●	
6 mm T-shape hex key		0102385	1	●	●	●	
3 m shielded Ethernet cable		0160043	1	●	●	●	
Transit case (XR3, SR3)		0110083	1	●	●		
Transit case (UR3)		0110210	1			●	
Optical tribrach		0101000	1	●	●		●
Li-ion scanner battery		0061014	2	●	●		●
Scanner battery charging kit		0102275	1	●	●		●
FieldHHC tablet (Panasonic FZ-G2)		0103038	1	●	●		●
12 V car adapter for FieldHHC tablet		0102271	1	●	●		●
32 GB USB key		0102067	1	●	●		●
32 GB compact USB keys		0102028	2	●	●		●
Backpack		0102063	1	●	●		●
Operator manual		0110140	1	●	●	●	●
GPS off-centre mount		0081098	1		●		
Eyepiece cap		0050472	1	●[2]			
Neoprene jacket for XR3 M20		0102751	1	●[3]			
Neoprene jacket for UR3 M20		0103105	1			●[4]	

[1] UR3 accessories kit. The kit, sold separately, allows controlling UR3 scanners with the FieldHHC tablet.
[2] XR3-CT only
[3] XR3 M20 only
[4] UR3 M20 only

2.2 System components

The features and controls available on your scanner depend on the model. Figure 2-8 below illustrates the models available in the R3 MkII range of scanners.

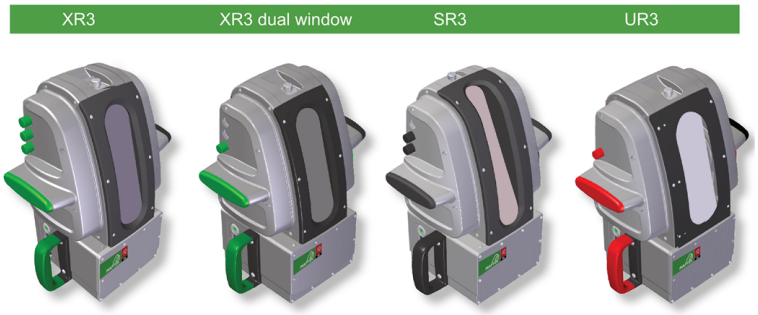


Figure 2-8 R3 MkII Scanners

2.2.1 Scanner components

Figure 2-9 below identifies the components of a scanner. Some components are model dependent.

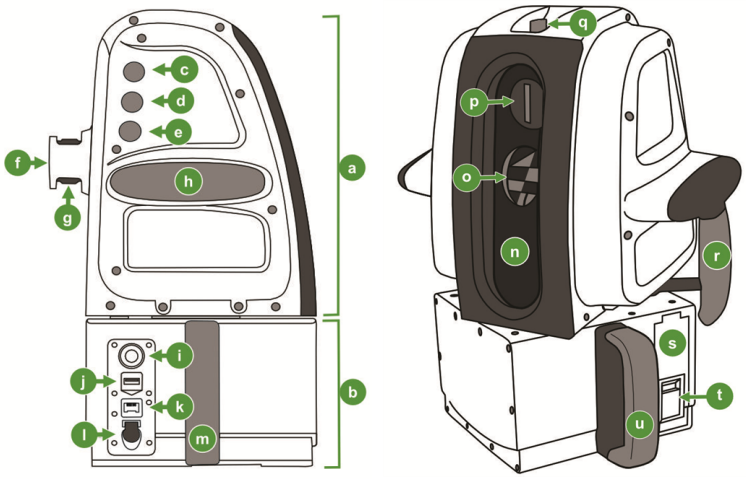


Figure 2-9 Parts of an R3 MkII scanner. An XR3-CT is used as an example.

a	**Scanner head** The scanner head turns around its vertical axis (up to 360°) to allow data acquisition.
b	**Scanner body** The scanner body is the fixed part of the scanner.
c	**Telescope focus knob (XR3-CT only)** Adjusts the focus of the objective lens when backsighting with the telescope.
d	**Elevation control knob (XR3-CT and SR3-CL only)** XR3-CT: Adjusts the elevation of the telescope viewing field. SR3-CL: Adjusts the elevation angle of the laser aimer.
e	**Azimuth control knob** Adjusts the azimuth position of the scanner head.

f **Telescope eyepiece (XR3-CT only)**
Used to locate backsight targets.

g **Telescope eyepiece dioptre focus bezel (XR3-CT only)**
Adjusts the eyepiece focus to your eye by focussing to the reticule inside the eyepiece.

h **Scanner rest**
Allows the scanner to be placed horizontally on a flat surface.

i **Scanner power button and status indicator**
For details, see Power button functions on page 15.

j **USB port**
Insert a USB key into this port to receive pushbutton and mobile device scans.

k **LAN port**
Connect the FieldHHC tablet to this port using the supplied Ethernet cable when not using Wi-Fi, or when using the scanner with Sentry DMS or a mobile scanning platform such as Maptek Drive.

l **24 V DC power input**
Supplies power to the scanner (instead of using a battery) via the scanner power cable (part # 0102062) when used with Sentry DMS, Sentry FMS, and Maptek Drive.

m **Right side handle**
Use this handle when carrying the scanner in its upright position or when placing the scanner into its transit case, with the other hand holding the left side handle (u). This handle also acts as a resting pad when placing the scanner horizontally.

n **Scanning window**
All optical data including lidar, camera, telescope image, and laser aimer beam, passes via this aperture. Scanning window configurations vary. To learn more, see 2.2.4 Scanning window variants on page 17.

o **Scanning mirror**
The scanning mirror directs and receives laser pulses as it rotates, resulting in the collection of scan data as a series of vertically arranged points.

p **Camera aperture (not applicable to XR3-D)**
The camera sensor allows photographic data to be associated with scan points.

q **GPS threaded adapter**
This mounting point allows you to fit GPS and radio devices to the scanner.

r **Carry handle**
Use this handle to carry the scanner with a single hand.

s **Battery bay cover**
The scanner battery bay is accessed via this cover.

t **Battery bay cover latch**
The latch secures and opens the battery bay cover.

u **Left-hand side handle**
Use this handle when carrying the scanner in its upright position or when placing the scanner into its transit case, with the other hand holding the right side handle (m).

2.2.2 Scanner base

The scanner base includes mounting points for the tribrach adapter, stairwell adapter bracket, or vehicle mount (where supplied).

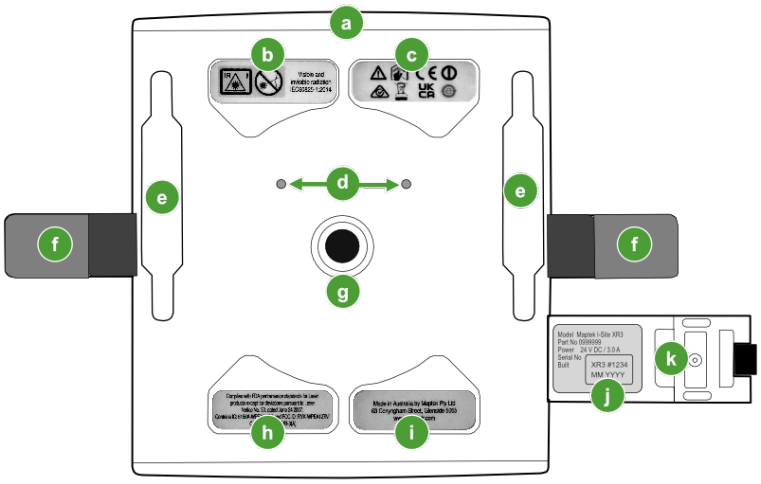


Figure 2-10 Scanner base features

a	**Front of scanner**
b	**Laser class and warning label**
c	**Compliance label**
d	**Tribrach adapter alignment sockets** The sockets align with matching pins on the tribrach adapter to ensure correct orientation during installation.
e	**Double-ended key T-bolt key hole slots** The slots fit a T-bolt at each end which secure the vehicle mount frame or stairwell bracket to the scanner base.
f	**Lower scanner handles** These handles allow you to carry the scanner upright, or when packing or placing the scanner on a mount.
g	**Capture bolt hole** The capture bolt on the tribrach adapter screws into this hole.
h	**FDA compliance label** This label displays laser performance compliance information.
i	**Manufacturer details**
j	**Serial number label** The serial number label is displayed inside the battery bay door. It also displays the scanner model, part number, and build date.
k	**Battery bay cover** The battery bay cover is shown in the open position.

2.2.3 Onboard scanner controls

Table 2-3 below lists the controls that apply to specific scanner models.

Table 2-3 Controls by scanner model

Scanner control	Scanner model				
	UR3	XR3-C	XR3-CT	XR3-D, XR3-CD	SR3
Power button	●	●	●	●	●
Azimuth control knob	●	●	●	●	●
Elevation control knob			●		●
Telescope focus knob			●		
Telescope dioptre bezel			●		

Power button functions

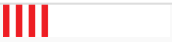
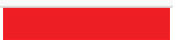
The power button performs several different functions, as follows:

Power the scanner on or off	Press the power button to turn the scanner on or off.
Start a pushbutton scan	A pushbutton scan only requires a scanner with no external controller. To learn more, see Chapter 6 Scanning to USB on page 51.
Enable and disable Wi-Fi	Wi-Fi is enabled by default. In cases where Wi-Fi is not a practicable option, it can be disabled. To learn more, see 4.7 Enabling or disabling Wi-Fi on the scanner on page 35.

Status indicator light

The power button displays sequences of green and red lights to indicate various states and operations. The meaning of each light sequence is explained in Table 2-4 below.

Table 2-4 Status indicator light sequences

When	Light sequence	Meaning
Inserting a battery		Battery has a good charge.
		Battery is spent.
Starting the scanner		Scanner starting with Wi-Fi enabled.
		Scanner starting with Wi-Fi disabled.
Scanner is powered		Scanner is idle.
Taking a preview		The scanner is acquiring a preview.
Taking a scan		The scanner head is moving to the start of scan position.
		Scanning is in progress.

Control knob functions

The control knobs have variable sensitivity based on how quickly you turn them. To reach your target location faster, turn the knob quickly. For precise adjustments, turn the knob slowly.

Table 2-5 Control knob actions

Action	Effect		
	Focus knob	**Elevation knob**	**Azimuth knob**
 Slow turn	Precisely adjust the telescope focus.	Precisely adjust elevation.	Precisely adjust azimuth.
 Fast turn	Roughly adjust telescope focus.	Roughly adjust elevation.	Traverse scanner head in larger increments.
 Fast flicking motion			Rotate scanner head continuously.

Tip: Spin the azimuth knob with a fast flicking motion in the intended direction of rotation to traverse the head continuously. To cancel its rotation, turn the azimuth knob in the opposite direction.

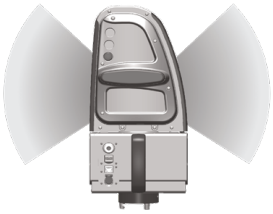
Note: The scanner head automatically stops traversing when it reaches either end of its rotation extent.

Note: The scanner head automatically returns to its home (forward-facing) position when turning off the scanner.

2.2.4 Scanning window variants

Table 2-6 below explains the scanning window configuration used by each scanner model.

Table 2-6 Scanner window configurations by model

Scanner model	Window configuration	Description
UR3 XR3-CT XR3-C	 **Single**	Standard window with model-specific scanning elevation extents.
XR3-CD XR3-D	 **Dual**	Dual front- and rear-facing scanning windows. The maximum elevation extent is model-specific.
SR3	 **Zenith scanning**	Single window permits scanning up to +90° from the scanner's level plane.

Consult Table B-2 on page 141 for the scanning elevation extents of your scanner model.

2.2.5 FieldHHC tablet

The FieldHHC tablet uses a touchscreen interface for performing all scanning tasks, including the following:

- Taking scans
- Configuring the tablet and the scanner
- Importing, exporting, viewing, and managing data
- Performing various scan post-processing tasks

Figure 2-11 below illustrates the main components used on the FieldHHC tablet.



Figure 2-11 FieldHHC tablet

a	Touchscreen	g	Stylus
b	Battery state indicator	h	Hand grip
c	Power ON-OFF button	i	Tablet battery
d	USB-C port	j	Battery latch
e	USB-A port	k	DC-in socket
f	LAN port		

Note: The tablet is supplied with the manufacturer's user manual.

2.2.6 Cold climate option (XR3 M20 and UR3 M20)

XR3 and UR3 scanners fitted with the cold climate option allow continuous operation in cold climate conditions. Cold climate scanners use an integrated active heating system and a removable neoprene jacket to maintain the system operating temperature.

To learn more, see 4.4 Scanning in cold conditions on page 31.



Figure 2-12 Views of an XR3-CT M20 scanner with its neoprene jacket.

Chapter

3

Care and Maintenance

3.1 Care instructions

Table 3-1 below outlines the measures you should take to protect and maintain the scanner, FieldHHC tablet, and other accessories[1] from various conditions and hazards.

Important: Never hose down the scanner. Water can enter and cause damage.

Important: Never use solvents to clean the scanner, FieldHHC tablet, or accessories.

Table 3-1 Recommended care instructions

Condition or hazard	Scanner	FieldHHC Tablet and Accessories
Shock	▸ Take care to prevent the scanner from falling. See 4.1 Carrying and placing the scanner on page 25 for recommended practices when carrying and placing the scanner. ▸ Use the transit case to keep the scanner protected.	▸ The tablet is ruggedised, but take reasonable care to protect if from being dropped. ▸ Store the tablet and required accessories in the transit case or the backpack when not in use.
Dust	▸ Use a clean damp cloth to clean dust from scanner panels. ▸ Use a wet soft cloth with clean water to remove dust from the scanning window. ▸ Use a separate cloth to dry the scanner.	▸ Follow the manufacturer's recommendations.
Dirt or mud	▸ Use a wet (but not soaked) cloth to remove debris from all surfaces. Use a cloth and mild detergent to clean all surfaces. ▸ Dry all surfaces with a clean, non-scratch microfibre cloth, particularly the scanning window.	**Tablet** ▸ Follow the manufacturer's recommendations. **Electrical accessories** ▸ Avoid exposure to dirt or mud. Follow the manufacturer's cleaning instructions.

[1] Accessories manufactured by Maptek and intended for outdoor or underground use can be treated in the same manner as scanners. Third-party accessories should follow the manufacturer's recommendations.

Condition or hazard	Scanner	FieldHHC Tablet and Accessories
Corrosive environments	▸ Use a wet (but not soaked) cloth and mild detergent to clean all surfaces. ▸ Dry with a clean non-scratch micro fibre cloth, particularly the scanning window.	**Mains-powered devices** ▸ Avoid exposure to corrosive environments. **Tablet** ▸ Follow the manufacturer's care instructions.
Rain	▸ Minimise long-term exposure to rain where possible. Immediately dry the scanner with a soft cloth after use. ▸ Avoid placing a wet scanner into its transit case.	**Mains-powered devices** ▸ Do not expose mains-powered electrical equipment to rain, unless otherwise instructed by manufacturer. **Tablet** ▸ Follow the manufacturer's care instructions.
Temperature	▸ Do not use the scanner outside the temperature ranges stated in Table B-1 on page 140.	▸ Follow the manufacturer's care instructions.
Humidity	▸ Minimise long-term exposure to high humidity, if practicable. ▸ Dry wet surfaces on the scanner exterior after use. ▸ Allow the scanner to equalise and dry in air-conditioned room for at least an hour. ▸ If condensation is observed inside the scanner, allow it to dissipate in a dry environment. **Tip:** Place desiccant bags in the transit case when storing a scanner that operates in humid conditions.	▸ Follow the manufacturer's care instructions.

3.1.1 Cleaning frequency

The scanner should be cleaned after its tasks have been completed and, where possible, before it is placed into its transit case. Concentrations of debris or fluids should be removed at first opportunity, particularly from optical surfaces.

3.1.2 Keeping the transit case clean and dry

The transit case best protects the scanner when its interior is clean and dry. Periodically remove loose debris using a vacuum cleaner. Clean the foam liner using a damp cloth and allow the case to dry before closing the lid.

Tip: A dry transit case helps prolong the health of the scanner by reducing the build-up of humidity. If a wet scanner is placed in the case—or one that has been working in humid conditions—promptly open the lid as soon as you are in a dry environment, remove all contents, and allow the case to thoroughly dry.

3.2 Transporting the scanner kit

Please adhere to the following recommendations to ensure the secure transportation of the scanner, its accompanying accessories, and batteries.

3.2.1 Recommendations for using the transit case

Maptek recommends using the transit case for the following purposes:

- Storing the scanner and accessories for any period of time
- Transporting the scanner to a destination
- Protecting the scanner on site whenever it is not in use

3.2.2 Placing items in the transit case

Place the items that belong in the transit case in their correct recesses. Follow the example illustrated in 2.1.4 Transit case on page 10.

Important: Always place the scanner face-down in the transit case.

Important: Transporting the scanner with a battery inserted or without placing it into its transit case may cause damage to occur and void the warranty.

Note: Remove the battery before packing the scanner. Leaving the battery in the scanner will gradually discharge it, even when the scanner is off. Store your batteries in the battery recesses in the transit case when not in use.

Tip: Other small items may be placed in the transit case provided they are packaged to prevent them from being damaged or damaging other items during transit.

3.2.3 Recommendations for using the backpack

The backpack provides convenient additional storage capacity when transporting your most-needed items, helping to leave your hands free. Use the backpack to carry the following items:

- FieldHHC tablet
- Ethernet LAN cable
- Battery chargers (for the scanner or FieldHHC tablet batteries)
- Sundry items or accessories

Important: Do not place loose or unprotected batteries in the backpack, particularly in the presence of metal parts that may cause a short circuit.

Tip: Leave the FieldHHC tablet battery installed during transit. There is no need to remove the battery, except for long-term storage.

3.3 Calibrating and servicing the scanner

The scanner is a precision instrument. To maintain its performance and accuracy, Maptek recommends that it is carefully maintained and regularly serviced. Servicing the scanner periodically ensures that the scanner and FieldHHC controller are kept up to date and warranty conditions comply with those stated in Appendix D International Warranty on page 151.

Maptek scanners are manufactured and serviced in a facility certified to the ISO 9001 quality standard and calibrated to the Australian National Association of Testing Authorities (NATA) standard.

To book a scanner service, visit www.maptek.com/support and click the link to the Laser Scanner Servicing page, or contact your nearest Maptek office.

Chapter

4

Preparing to Use the Scanner

This chapter describes practices and tasks to understand before using the scanner.

4.1 Carrying and placing the scanner

⚠CAUTION The scanner is heavy. Risk of strains and other physical injuries. Avoid postures that strain the body or cause loss of balance. Seek assistance if needed.

The scanner has handles to allow it to be lifted with either one or two hands. Follow the guidance below for each handling method.

Handling method	Situation
One hand	Carrying the scanner over short distances.
Two hands	Placing the scanner into its transit case, or removing it.
	Placing the scanner onto a mount, or removing it.

4.1.1 Carrying the scanner with one hand

When carrying the scanner with one hand, always use the carry handle attached to the scanner head with the scanning window facing towards your body (see Figure 4-1 on the next page). Additional care should be taken with dual-window scanners to prevent accidental damage to the rear window.

Ensure the scanner is always placed down on its scanner rest. Placing the scanner in other orientations without the use of an appropriate mount could cause it to topple.



Figure 4-1 Using a single hand to carry (left) or place (right) the scanner.

4.1.2 Removing or placing the scanner into its transit case

Hold the scanner by the handles on the scanner body as illustrated in Figure 4-2 below.



Figure 4-2 Using both hands to lift the scanner from its transit case.

Important: Never place the scanner face up in the transit case. This may cause damage to the scanner in the event of an impact.

4.1.3 Placing the scanner onto a mount



Figure 4-3 Using a two-handed grip to place the scanner onto a mount.

Important: Always hold the scanner using two hands when placing it onto a mount.

4.1.4 Carrying the scanner using the transit case

The transit case includes wheels that are ideal for use on smooth surfaces. Extend the pull-handle before use, as illustrated in Figure 4-4 below.



Figure 4-4 Using the pull handle to move the transit case.

4.1.5 Summary of recommendations for placing a scanner

To prevent damage to the scanner, follow the recommended methods as illustrated below when mounting or placing the scanner on a surface.



Figure 4-5 The scanner can be safely mounted on a tripod or vehicle mount, or placed sitting upright with no tribrach adapter fitted or horizontally on its resting pad.

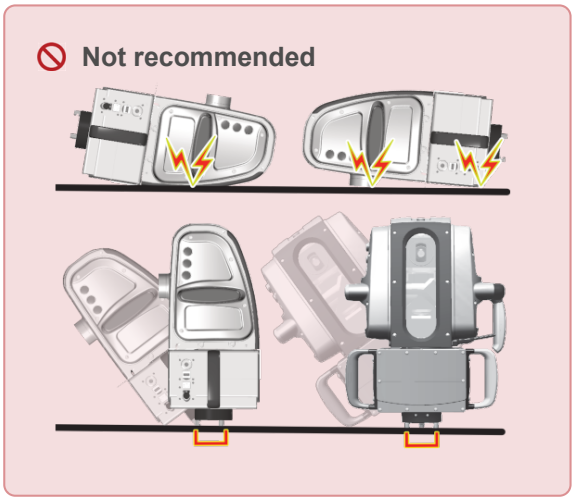


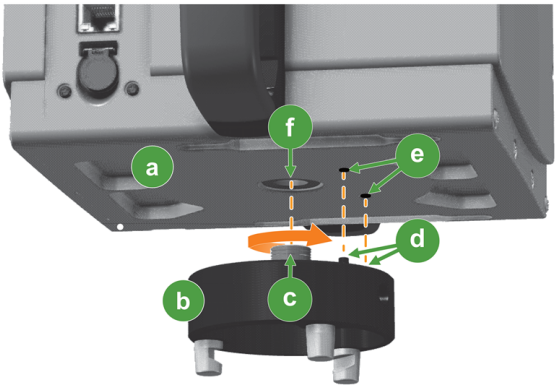
Figure 4-6 Never place the scanner on a surface with its front or back facing down. Do not stand the scanner on its tribrach adapter.

4.2 Fitting scanner mounting hardware

Mounting hardware allows the scanner to be securely mounted onto a scanning platform.

4.2.1 Tribrach adapter

The tribrach adapter allows the scanner to fit onto a standard tribrach (part # 0101000), or the optional tribrach adapter clamp (part # 0102230).



- a Scanner base
- b Tribrach adapter
- c Captive bolt
- d Pins
- e Tribrach adapter alignment sockets
- f 5/8″ threaded hole

Figure 4-7 Fitting the tribrach adapter.

To fit the tribrach adapter, refer to Figure 4-7 above and follow these steps:

1. Obtain the supplied 6 mm T-shaped hex key.
2. Place the scanner in a horizontal position (sitting on the resting pad and right-hand side handle).
3. Align the flat face of the tribrach adapter so the two pins d are oriented with the tribrach alignment sockets e on the scanner base.
4. Using the T-shaped hex key, turn the captive bolt c counter-clockwise to screw it into the 5/8″ threaded hole f on the scanner base.
5. Check that the tribrach adapter sits flat against the scanner base, then firmly tighten the captive bolt.
6. To remove the tribrach adapter, simply unscrew the captive bolt and pull the tribrach adapter free.

> **Tip:** The tribrach adapter can remain attached to the scanner when used with a mobile mount, and when stored in the transit case.

4.2.2 Scanner interface plate

The scanner interface plate (included with the Drive or Vehicle Mount kit) is an adapter that is fitted to the scanner to adapt it to the vehicle mount frame.

You must install the scanner interface plate if it is not already fitted. A field calibration must be performed before use. Factory-fitted plates are pre-calibrated.

To learn more, follow the instructions for fitting the interface plate and performing the Drive field calibration procedure in the *Maptek Drive Mount R3 Series Installation Manual*.

4.3 Powering the scanner

Depending on the use case, the scanner can be powered by an internal battery or using an external power source.

4.3.1 Inserting the scanner battery

Figure 4-8 below illustrates inserting the battery into the scanner. To insert the battery, pull the door latch a and open the battery door b. Orient the battery c so its connector matches with the battery bay connector d, then push the battery into place. Close the door, checking it is correctly latched shut.

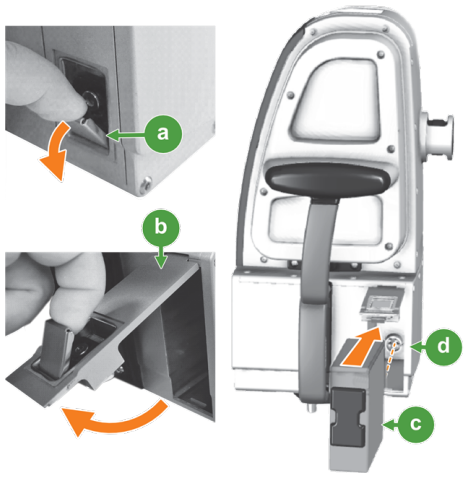
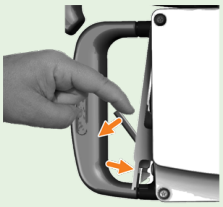


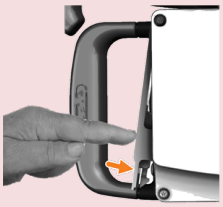
Figure 4-8 Inserting the scanner battery.

Important

Open the latch before closing the battery door. Do not force the door closed; doing so may damage the latch mechanism.



✓ **Correct:**



✕ **Incorrect:**

4.3.2 Checking the scanner battery state of charge

Always recharge the Li-ion battery as soon as possible when a low state of charge is reached. To check the battery state, you can view the battery level indicator on the battery, or if connected to the scanner with the FieldHHC tablet you can check the scanner power status in the status bar.

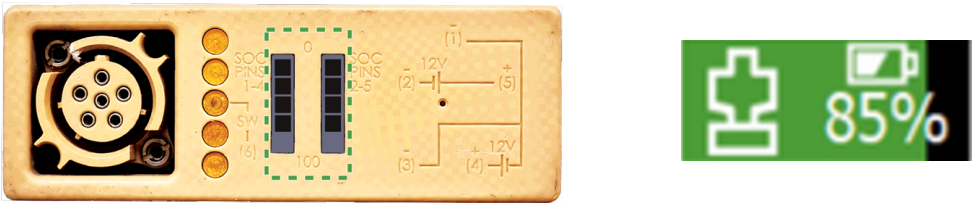


Figure 4-9 Left: State of change indicator on the battery. Right: Scanner battery level indicator in FieldHHC.

Tip: The battery indicator displays in 20% increments for each of the two internal battery sections. The FieldHHC tablet power state indicator displays the total battery level in 1% increments.

4.3.3 Charging the scanner battery

Connect the battery charger to the AC to DC power adapter, then connect the battery to the charger as illustrated in Figure 4-10 below.

To recharge the battery in the vehicle, use the 12 V DC car adapter supplied with your scanner charging kit.

Note: While recharging, a steady amber light is displayed on the battery charger. The light turns green when the battery is fully charged.

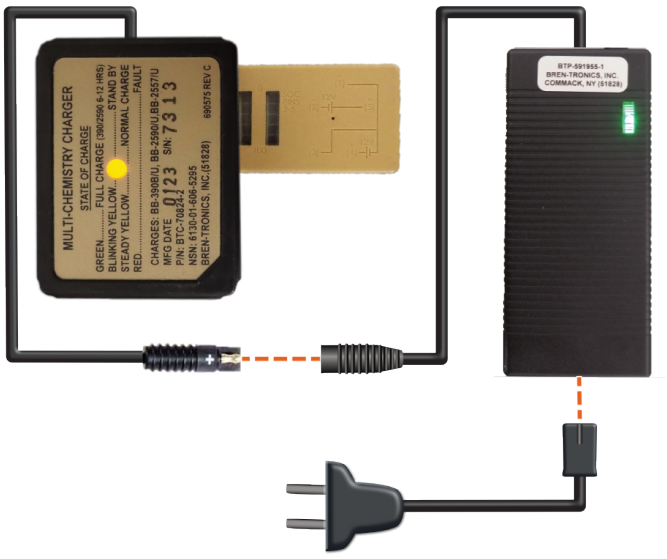


Figure 4-10 Charging setup for scanner batteries.

4.3.4 Connecting external power to the scanner

Connect the scanner using the 24 V DC port when using Maptek Drive, vehicle mount, or Sentry systems.

To connect the power lead to the scanner, lift the spring-loaded cap and orient the plug so that the red mark aligns with the matching mark on the socket, as illustrated in Figure 4-11 below.

Push the plug in until it clicks into place. To disconnect the plug, simply pull it out.

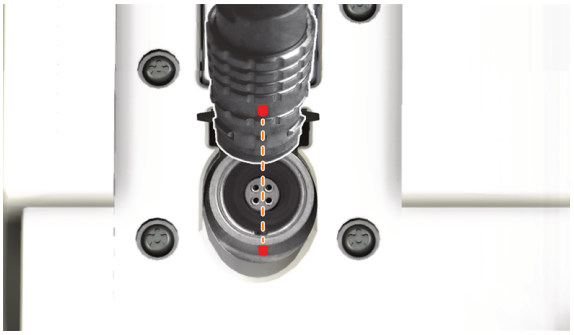


Figure 4-11 Connecting the external power connector to the scanner.

4.4 Scanning in cold conditions

Cold conditions are defined as temperatures that fall below the normal operating range of the scanner. Additional considerations apply for scanners operating at significantly lower temperatures or exposed to effects such as wind chill. Table 4-1 below explains the different operating conditions in which scanners may operate.

Table 4-1 Scanner operating temperature range definitions

	Regular scanners	Cold climate (M20) scanners
Normal temperature range The scanner can operate in this temperature range with no additional requirements.	0° to +50°C	-20° to +50°C
Limited exposure temperature The temperature range that the scanner can operate within its limited exposure time (see below).	-40° to +50°C	
Limited exposure time The time allowed for the scanner to operate at its limited exposure temperature (see above).	20 minutes (starting from +20°C)	8 hours (starting from +20°C with neoprene jacket and external power)

4.4.1 Preparing to scan in cold climate with M20 scanners

When preparing to scan in temperatures in the limited-exposure range, the following measures are recommended:

- Keep the scanner in the warmest possible location when not in use.
- Keep the scanner in its transit case whenever practicable.
- Place chemical hand warmers inside the transit case.
- Minimise the scanner's exposure to the elements whenever possible.
- Fit the neoprene jacket to the scanner before use.

4.4.2 Fitting the neoprene jacket to the scanner

The neoprene jacket provides thermal insulation. Always fit the jacket to the scanner before operating in limited exposure temperatures. To fit the jacket, follow the instructions as illustrated in Figure 4-12 below.

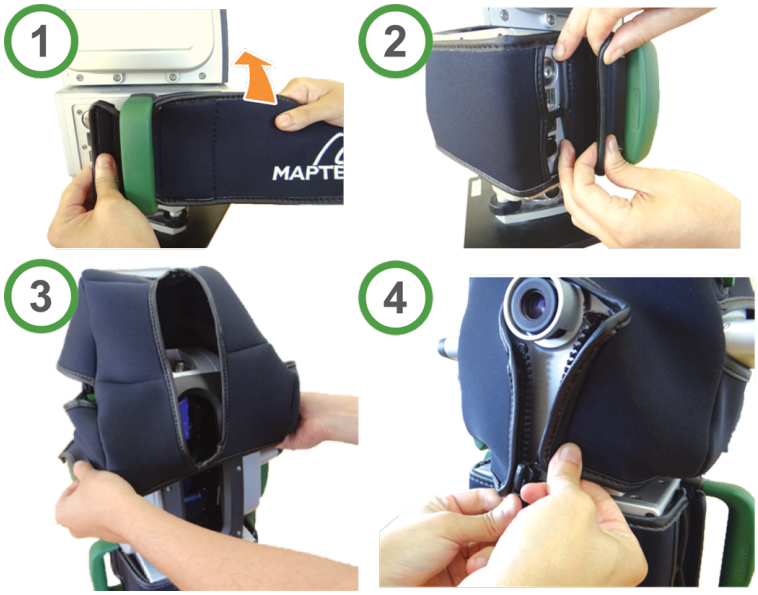


Figure 4-12 Fitting the neoprene jacket. (1) Wrap the lower piece around the lower chassis. (2) Align the cutouts with the scanner controls and press the Velcro tabs together. (3) Slide the top cover over the scanner head. (4) Close the zip at the back of the scanner head.

Note: Ensure that the cut-outs on the neoprene jacket align with the controls and ports on both the scanner body and scanner head. Ensure the jacket does not obstruct or interfere with the operation of the scanner head as it moves.

Important: Always fit the neoprene jacket when expecting cold to very cold conditions. Failure to do so could result in the scanner ceasing to operate or developing a fault, requiring repair. If the scanner is too cold to operate, the cold-climate indicator in the FieldHHC status bar will turn red (M20 only). An error message will display and be recorded in the log file.

Tip

- Remove the neoprene jacket before placing the scanner into its transit case.
- Where possible, use external power when operating in cold climates. Battery life is reduced in very cold weather.
- The neoprene jacket is not required when operating in warmer climates and can be removed when cold climate conditions are not expected.

4.4.3 Recovering a cold-soaked scanner

A scanner that has been exposed to cold temperatures to the extent of malfunctioning is considered cold soaked. To recover from this condition, immediately do the following:

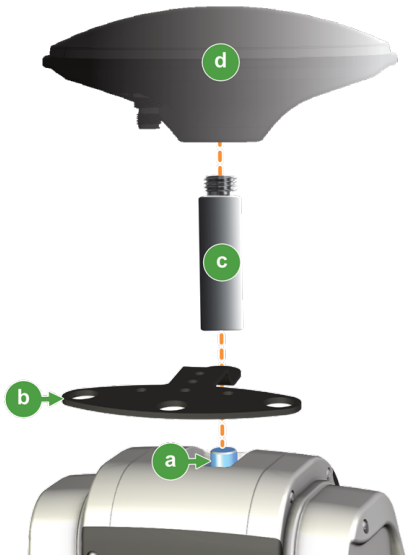
- Stop scanning and power the scanner off.

  Important: If the scanner head does not return to its at-rest position, *do not* manually rotate the scanner head—this may damage the scanner, requiring repair.

- Remove the scanner from the cold exposure environment. Keep the scanner in a protected environment and allow time for the scanner to warm up to ambient temperature—ideally, this should be at 20°C (68°F) or greater.

4.5 Attaching a GPS device to the scanner

The GPS antenna or rover should be attached to the GPS threaded adapter on the scanner. Maptek recommends using a spacer fitted to the GPS threaded adapter, as illustrated in Figure 4-13 below.



a GPS threaded adapter
b GPS cable guide (MkII version)
c GPS spacer with 5/8″ threaded male and female fittings
d GPS device

Figure 4-13 Exploded view of the mounting arrangement for GPS devices attached to an XR3 scanner.

4.6 Mounting the scanner to a tripod

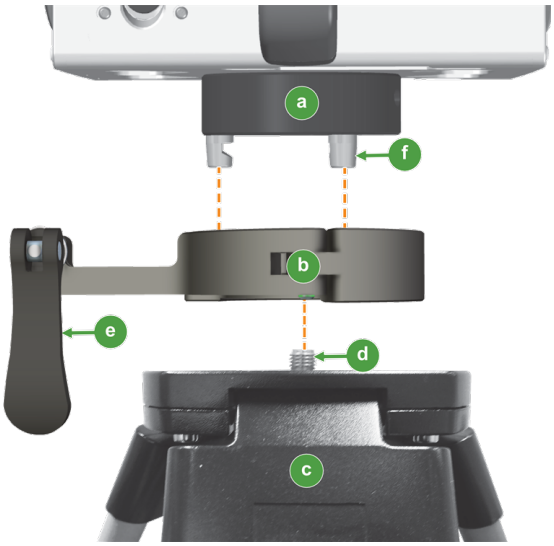
To fit the scanner to a surveyor's tripod, first attach the tribrach adapter by winding the 5/8″ mounting screw into the base of the tribrach. The procedure is the same if using the clamping plate. See Figure 4-14 below and Figure 4-15 below respectively.



- a Tribrach adapter (attached to the scanner)
- b Tribrach
- c Tripod head
- d 5/8″ mounting screw
- e Tribrach locking lever
- f Levelling screw(s)
- g Tribrach pegs

Figure 4-14 Exploded view of tribrach mounting components between the scanner and tripod.

Note: Ensure the tribrach locking lever is open before placing the scanner on to the tribrach. Ensure the tribrach pegs are located through the holes in the tribrach.



- a Tribrach adapter (attached to the scanner)
- b Tribrach clamp
- c Tripod head
- d 5/8″ mounting screw
- e Tribrach adapter clamping lever (set in the clamped position)
- f Tribrach pegs

Figure 4-15 Exploded view of tribrach adapter clamp mounting components between the scanner and tripod.

Note: Open the tribrach clamp before placing the scanner onto the tribrach clamp. Ensure the tribrach pegs are located through the holes in the tribrach clamp.

Note: For detailed mounting instructions, refer to the Maptek Drive Vehicle Mount R3 Series Installation Manual, supplied with the Maptek Drive or Vehicle Mount kit.

4.7 Enabling or disabling Wi-Fi on the scanner

The onboard Wi-Fi module is normally enabled so you can conveniently connect to it with the FieldHHC tablet or a mobile device. Where circumstances do not permit its use, it can be disabled, following these steps:

1. If the scanner is on, press the power button to turn it off.
2. Press the power button to turn the scanner on. When the power button starts blinking, press and hold the power button.
3. Release the power button when the scanner head starts to starts to move. Wi-Fi is now disabled on the scanner.

- To enable Wi-Fi, repeat steps 1–3.
- To check the Wi-Fi state, switch the scanner off then on and observe the blinking light on the power button as the scanner starts. If the last blinks are red, Wi-Fi is disabled. If the last blinks are green, Wi-Fi is enabled.

Chapter

5

Scanning Concepts

5.1 Scan basics

5.1.1 Scan composition

A scan acquired with an R3 MkII scanner consists of a set of points measured by the laser rangefinder. For each point, the following information is recorded:

- **Azimuth:** The direction the scanner head is facing when the point was acquired. This is also called the horizontal angle.
- **Elevation:** The vertical angle of the laser beam that produced the point.
- **Range:** The distance of the point from the scanner origin.
- **Intensity:** The strength of the laser return.
- **Colour:** A colour value mapped from the photographic image (if applicable; the scanner must be equipped with a camera and photographic capture must be enabled).

In addition, the following information about the scanner is stored with each scan:

- **Position:** The coordinates of the scanner origin (easting, northing, and elevation).
- **Bearing:** The angle of the scanner's forward direction relative to north.
- **Level correction:** A correction applied to account for the inclination or tilt of the scanner's vertical axis when its base is not perfectly level.

5.1.2 Position and orientation

The spatial relationships between points within a single stationary scan are fixed and correct to within the tolerances of the scanner, regardless of whether the scanner location and orientation are known. For most practical applications, however, it is necessary to know the scanner's precise position and bearing to locate and orient the scan correctly in a given coordinate system. This is especially critical in surveying applications where scans from multiple locations need to be integrated together, or where a scan needs to be compared against existing survey or design data.

There are multiple ways of locating and orienting scans correctly. These depend largely on the type of physical setup used to acquire scans. If a precise position and bearing are supplied when the scan is acquired (such as when scanning from a surveyed location and backsighting), the resulting scan will already be correctly located. If the position and bearing are inaccurate or unknown (such as when relying solely on the scanner's internal GPS and compass), the scan will not be correctly located and will need to be positioned and registered using software tools. Positioning and registration is a process that can use both manual and automated methods to locate and orient scans correctly in space. Maptek FieldHHC has tools to help position and register scans in the field. Alternatively, desktop software such as Maptek PointStudio can be used for this process.

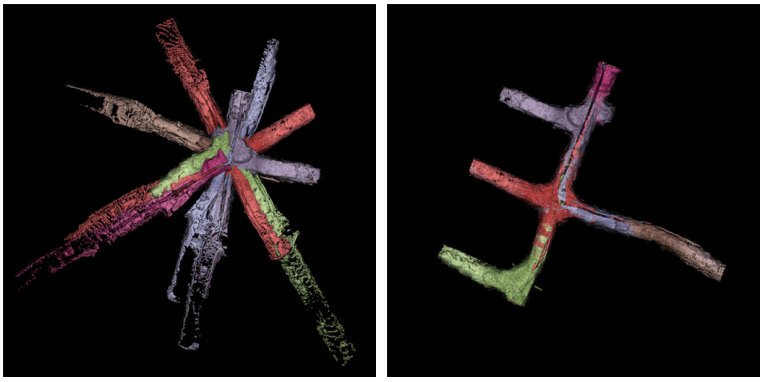


Figure 5-1 A set of underground scans before positioning (left) and after positioning and registration (right).

The position and bearing of a scanner can be provided from the following sources:

- **Scanner internal GPS and compass**
  R3 MkII scanners are equipped with an internal GPS receiver and an internal compass, which together are capable of approximating the scanner's position and bearing. The position and bearing are not generally accurate enough to rely on alone for surveying applications, but they can be used to roughly locate scans for subsequent adjustment using software tools.
- **Survey-grade GPS**
  An external survey-grade GPS receiver with an RTK fix can provide a more precise scanner position. When using FieldHHC to acquire scans, the GPS position can be obtained directly from a Bluetooth-connected GPS device mounted on top of the scanner, or can be manually entered. Position and bearing errors can be subsequently corrected using software tools. When using a survey-grade GPS, care must be taken to configure the GPS and FieldHHC to account for the vertical offset between the GPS position and the scanner reference level. See 7.3.4 Calculating the GPS offset on page 74 for detailed information.
- **Survey station database**
  A survey station database is a text file that contains a set of named coordinates corresponding to known reference locations. For typical survey jobs, the scanner is set up at a fixed surveyed location such as a bollard, and the bearing is established by backsighting to another surveyed location. For underground surveys, both the position and bearing of the scanner can be established by backsighting to three surveyed locations. To obtain an accurate backsight, the scanner must be equipped with a backsighting telescope (XR3-CT) or laser aimer (SR3).

- **Vehicle GPS track**
  If the scanner is mounted on a vehicle, a bearing for the scanner can be derived from the GPS track heading as the vehicle moves. Bearing errors can be subsequently corrected using software tools.
- **Maptek Drive**
  When scanning with Maptek Drive, an accurate position and bearing is provided in real time using the Drive INS and GPS systems.

Note: If no scanner positioning information is available, scans can still be acquired. The origin of scans will be recorded as [0, 0, 0]. Some applications (such as stability monitoring with Maptek Sentry) do not require the scanner position to be known. Scans without positioning information can be positioned as required using software tools.

5.1.3 Level correction

R3 MkII scanners automatically record the scanner's vertical inclination and apply a level correction to scans. The level correction can be either *fine* or *coarse*:

- **Fine levelling** provides precise levelling of scans where the scanner's inclination is within 5° of vertical. To achieve fine levelling, the scanner performs a highly accurate inclination check by traversing the scanner head in a specific sequence, shown in Figure 5-2 below. The resolution of fine levelling is 20″ increments.

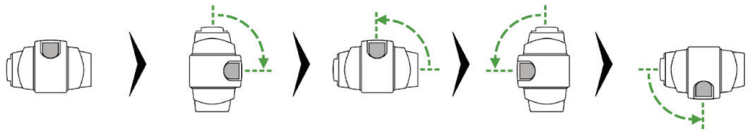


Figure 5-2 The scanner traverses the scanner head in this sequence to determine the inclination for fine levelling.

- **Coarse levelling** is used when the scanner is mounted at an oblique angle (greater than 5° from vertical). Typical situations include scanning into a stope or over the side of a gantry. When coarse levelling is applied, no inclination check is performed. The resolution of coarse levelling is 1° increments.

Note: Scanners mounted upside down and inclined within 5° of true vertical are automatically compensated in fine resolution.

Tip: You can choose between fine and coarse levelling when scanning with FieldHHC or with a mobile device. If fine levelling is selected but the scanner's inclination exceeds 5°, coarse levelling will be applied.

5.2 Physical setup

R3 MkII scanners can be used in variety of physical setups, with different methods used for obtaining position and bearing information. The basic setup types are described below.

5.2.1 Fixed surveyed location

Scanning can take place from a previously surveyed fixed reference location such as a bollard. This job type uses the **Survey Job** setup in FieldHHC. The scanner position is typically set from a survey station database, but it can also be set from a survey-grade GPS position, or manually entered. Because the scanner's reference level is usually offset vertically from the surveyed position, the scanner height needs to be entered in FieldHHC to correctly establish the scanner's position. The bearing can be established by backsighting to another surveyed location. If there are no surveyed locations available to backsight to, the scanner's internal compass can provide the bearing. See 7.5.2 Setting up a survey job on page 80 for how to set up a survey job in FieldHHC.



Figure 5-3 An XR3-CT mounted on a fixed bollard that has been previously surveyed.

5.2.2 Tripod setup

Scanning can be performed using a tripod. The position and bearing of the scanner can be provided in one of the following ways:

- **Survey mark.** If the tripod is set up over a survey mark, the setup is essentially the same as a fixed surveyed location as described above. The position can be supplied from a database and the bearing established by backsighting or using the scanner's internal compass. The vertical offset from the survey mark to the scanner's reference level needs to be entered as the scanner's height (see 7.5.4 Calculating the scanner height on page 87).
- **GPS.** The position can be supplied from either the internal or external GPS. The bearing is supplied from the scanner's internal compass. The setup type could be either a defined named setup or a survey job setup. See 7.5 Setting up a scan job on page 79 for more information.
- **Multiple backsights**. When scanning underground from an unknown location, the position and bearing of the scanner can be derived by backsighting to three surveyed locations such as survey marks. See 7.5.3 Setting up a survey job with multiple backsights on page 85 for more information.



Figure 5-4 An XR3-CT mounted on a tripod

5.2.3 Vehicle mount

A vehicle mount enables stationary scans to be acquired from a vehicle. In this setup, the scanner position can be provided from either the internal or external GPS. The bearing can be supplied from the scanner's internal compass, or alternatively the vehicle's GPS track. Vehicle-mounted scanning typically uses the **Defined Name** setup type in FieldHHC (see 7.5 Setting up a scan job on page 79).



Figure 5-5 A vehicle-mounted scanner with external GPS.

Note: The scanner's internal compass bearing can be affected by interference from the vehicle's metallic parts. When using the vehicle mount and relying on the scanner's internal compass, the *vehicle compass calibration factor* should be enabled to compensate for this interference. The compass needs to be periodically recalibrated (see 7.3.2 Calibrating the compass for vehicle use on page 71).

5.2.4 Maptek Drive

Maptek Drive is a system that allows scans to be acquired from a moving vehicle. Precise positioning and orientation information is provided in real time through the use of an INS (inertial navigation system). All Maptek R3 MkII scanners can be used with Maptek Drive; however, the XR3 dual window scanner is particularly well-suited for acquiring driving scans. When acquiring a driving scan, the scanner head does not traverse to acquire more points; instead, the scanner is mounted in a fixed position (usually facing out from the side of the vehicle) and acquires points as the vehicle moves. See 7.10 Scanning with Maptek Drive on page 130 for more information.



Figure 5-6 Maptek Drive system

5.2.5 Maptek Sentry

All Maptek R3 MkII scanners can be used with Maptek Sentry to perform stability monitoring. Sentry continuously scans a scene from a fixed location to detect movement. Sentry does not generally need to know the position or bearing of the scanner to operate, but positioning can be applied when required. Consult the Sentry documentation for more information about Sentry.



Figure 5-7 Maptek Sentry DMS (Deployable Monitoring System) utilising an R3 MkII scanner.

5.3 Defined name and survey job scans

There are two broad categories of scans, which depend on the physical setup of the scanner.

- **Defined name** scans are scans taken from an unsurveyed location without any backsights. The physical setup is usually on a tripod or a vehicle mount. The bearing can either be supplied from the internal compass or derived from a vehicle's GPS track. The position is supplied either by the scanner's internal GPS or an external Bluetooth GPS. Drive scans acquired using Maptek Drive are defined name scans with bearing and position provided by the Drive INS and GPS systems. The filename of a defined name scan is based on a name supplied by the user. Defined name scans typically require registration to correctly locate and orient them.

  See 7.5 Setting up a scan job on page 79 for more information.

- **Survey job** scans are associated with a set of known scanner locations that are stored in a survey station database. A typical survey job involves setting the scanner up at a known location such as a survey bollard and backsighting it to another known location to establish a precise bearing. A special kind of survey job for use in underground situations uses multiple backsights to establish both the position and bearing of the scanner. The filename of survey job scans is based on the survey job name, the location name, and the backsight name or type.

  See 7.5.2 Setting up a survey job on page 80 or 7.5.3 Setting up a survey job with multiple backsights on page 85 for more information.

5.4 Scanning settings

R3 MkII scanners have software-selectable settings that combine to affect the overall acquisition time and the quality of the resulting scan.

5.4.1 Scan mode

The *scan mode* sets the acquisition rate of the scanner. Physically speaking, it sets the frequency at which the laser pulses, which in turn affects the spinning speed of the scanning mirror and the traversal speed of the scanner head. Setting a faster scan mode reduces the overall scanning time, but at the cost of decreased range performance. See B.3 Range versus reflectivity on page 142 for the range performance of your scanner model at various acquisition rates.

There are four named scan modes: *normal*, *fast*, *rapid*, and *ultra*. **Normal** (or **fast** for SR3 scanners) is the baseline scan mode that provides the highest quality results and the maximum range performance. **Ultra** provides the quickest scanning speed, but at the expense of maximum range. Each successive scan mode has an acquisition rate that is twice as fast as the previous mode. Scan modes can be abbreviated to a number that indicates how many times faster the speed is compared to normal speed, so 2x (fast) is twice as fast as normal, 4x (rapid) is four times as fast as normal, and so on. The specific frequencies used for each scan mode depends on the scanner model. Table 5-1 on the next page summarises this information.

Table 5-1 Scan mode acquisition rates

	UR3	XR3	SR3
Normal (1x)	40 kHz	50 kHz	-
Fast (2x)	80 kHz	100 kHz	100 kHz
Rapid (4x)	160 kHz	200 kHz	200 kHz
Ultra (8x)	320 kHz	400 kHz	400 kHz

Tip

For long-range scans or when operating in sub-optimal conditions, consider using a scan mode with a lower acquisition rate (e.g. normal or fast) and increasing the point density to maximise performance.



Figure 5-8 (a) Reduced range resulting from a faster scanning speed and (b) Increased range resulting from a slower scan speed and higher point density.

Tip: Scanning a smaller azimuth extent significantly reduces the overall scanning time when using scan modes with lower acquisitions rates. The elevation extent has no impact on scanning times.

5.4.2 Point density

The *point density* is the resolution of the scan in terms of the horizontal and vertical angular spacing between neighbouring points. As with scan mode, the point density affects the traversal speed of the scanner head, so increasing the point density comes at the expense of overall scanning time. Increasing the point density increases the number of points and therefore increases the resulting scan file size.

Table 5-2 on the facing page summarises the horizontal and vertical resolutions corresponding to each point density setting, and the resulting theoretical maximum point counts. The maximum point counts vary due to the different elevation ranges supported by each scanner model. In practice, scans will always have fewer points than the theoretical maximum. This is because not every pulse of the laser results in a return recorded, due either to the absence of reflective objects (sky points), or poor reflectivity of objects at a given range.

Table 5-2 Comparison of scan point density settings

Point density setting	Azimuth resolution (° per step)	Elevation resolution (° per step)	Theoretical maximum point count (millions of points)*			
			UR3	XR3-C, XR3-CT, XR3-CD	XR3-D	SR3
1	0.2°	0.2°	0.72 M	0.81 M	0.9 M	1.17 M
2†	0.1°	0.1°	2.88 M	3.24 M	3.6 M	4.68 M
4	0.05°	0.05°	11.52 M	12.96 M	14.4 M	18.72 M
8	0.025°	0.025°	46.08 M	51.84 M	57.6 M	74.88 M
16‡	0.0125°	0.0125°	184.32 M	207.36 M	230.4 M	-

Figure 5-9 below gives a visual indication of the approximate point spacings of scan points using different point density settings.

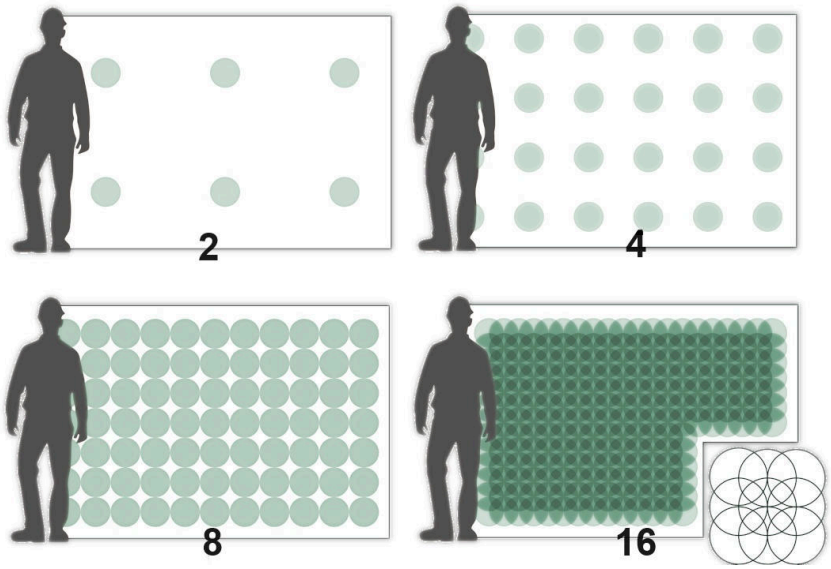


Figure 5-9 Approximate scan point spacings at a range of 500 m using different point density settings.

5.4.3 Scan point selection

Laser scanners work by measuring the time taken for a laser pulse emitted from the scanner to be returned after being reflected back by objects in its path. When the scanner emits a single laser pulse in a given direction, multiple returns can be received. This happens when the laser beam is partially obstructed by vegetation or airborne particles such as flying insects, dust, rain, or snow before reaching a terrestrial surface. The resulting scan can include points in space that are not associated with the surfaces intended for capture and are thus undesirable. To improve the clarity of

*Assumes a 360° scan using the maximum elevation extent of the scanner.
†Standalone scans use this point density setting.
‡Not available with SR3 scanners.

the resulting scan, the signals returned to the laser rangefinder can be selectively filtered based on the time between the first and last return.

The scan point selection options are as follows:

- **Best** uses an intelligent algorithm that selects the strongest returned point. This option is the default method and works well in most conditions.
- **First** selects the first or closest points returned. If present, foreground obstacles such as vegetation or dust may predominate in the resulting scan.
- **Last** selects only the last returned points. This option may improve results when scanning through vegetation, light dust, insects, or snow.
- **All** saves the first, best, and last returned points.

> **Note:** This option can produce scans with excessive data and large file sizes. Only use this setting when acquiring all points is necessary. Scans that save all points can be filtered in PointStudio using the **Multi-Return Type** filter.

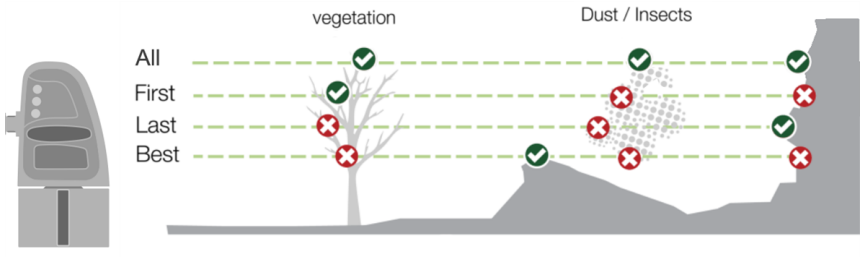


Figure 5-10 Scan point selection in various scenarios.

> **Tip:** When using FieldHHC, you can select which points are saved using the **Points** setting on the **Acquire** tab.

5.5 Scan file naming

When a scan is acquired from an R3 scanner, it is saved to a file named using a systematic scheme that encodes information about the scan.

The filename of a scan acquired from an R3 scanner has the following general form:

`<name>_<speed><data><resolution><levelling><points>_<iteration>.r3s`

where each component is defined as follows:

`<name>`	For defined name scans, this is simply the scan name supplied during setup. For survey jobs, this takes the following form: `<job>_<location>_<backsight>` where • `<job>` is the name of the survey job, and matches the name of the survey job file • `<location>` is the name of the scanner location, i.e. the survey station name in the given survey job • `<backsight>` is the backsight name or bearing type. If the scanner was backsighted to a survey station in the survey job, this will be the name of that backsight. For multiple backsight jobs, this will be set to `3BackSights`. Otherwise, this will be set to `compass` or `gpsTrack`. **Example** A scan filename with the prefix `20240321 mtcarbo_ss31_compass` indicates that the scan relates to the survey job named `20240321 mtcarbo`, with its location set to survey station `ss31`, and had its bearing set to the internal compass bearing.
`<speed>`	The acquisition speed, expressed as an abbreviation indicating how many times faster the speed is compared to normal speed. The possible values are as follows: • `1x` = Normal • `2x` = Fast (twice normal speed) • `4x` = Rapid (4 times normal speed) • `8x` = Ultra (8 times normal speed)
`<data>`	The type of data acquired, as follows: • `C` indicates a combination of range and photo data • `R` indicates range data only
`<resolution>`	The point density setting, either `1`, `2`, `4`, `8`, or `16`.
`<levelling>`	The type of level correction applied, as follows: • `L` means the scanner was level (within 5° of vertical), and fine levelling was enabled. • `U` mean the scanner was unlevel (more than 5° off vertical), or coarse levelling was enabled.
`<points>`	Scan point selection, as follows: • `-F` = First • `-B` = Best • `-L` = Last • `-A` = All
`<iteration>`	This is a numerical suffix to ensure unique filenames for repeat scans, starting at `01`.
`.r3s`	The filename suffix used to identify scans from R3 scanners.

Example

A scan file named `20240321 mtcarbo_ss32_ss21_4xC1L-B_01.r3s` indicates the following:

- The scan relates to the survey job named `20240321 mtcarbo`, with its location set to survey station `ss32`, and was backsighted to the survey station named `ss21`.
- `4x` means the scan was acquired with the **Scan Mode** set to *Rapid*.
- `C` means both range and photo data was acquired.
- `1` means the **Point Density** setting was set to *1*.
- `L` means fine levelling was applied.
- `-B` means the **Points** setting was set to *Best*.
- `_01` means it was the first scan taken with these settings.

Example

A scan file named `scan_2xR4U-F_02.r3s` indicates the following:

- The scan was a defined name scan using the name `scan`.
- `2x` means the scan was acquired with the **Scan Mode** set to *Fast*.
- `R` means only range data was acquired (no photographic image).
- `4` means the **Point Density** setting was set to *4*.
- `U` means either coarse levelling was applied, or the scanner was more than 5° off vertical.
- `-F` means the **Points** setting was set to *First*.
- `_02` means it was the second scan taken with these settings.

Note: If a scan could only be partially completed, for example, because the scanner lost power mid-scan, the suffix `_Incomplete` will be appended to the filename.

5.6 Dual window scanning

The XR3 dual window scanner (XR3-D and XR3-CD) features a second scanning window at the back of the scanner. Dual window scanning allows data to be acquired from both the front and back windows simultaneously, providing for more efficient scan acquisition. The data acquired from each window is integrated into a single scan.

Dual window scanning can be enabled or disabled depending on requirements. When enabled, data is acquired simultaneously from both windows, allowing more data to be acquired in a shorter amount of time. The maximum range is capped to 600 m in this mode. When dual window scanning is disabled, data is acquired from the front scanning window only. This is useful when maximum range performance is required, as it effectively doubles the maximum range of the scanner (see B.3 Range versus reflectivity on page 142 for details).

Tip: To enable dual window scanning in FieldHHC, tap the (dual window mode) button in the view window on the **Acquire** tab.

Note: (XR3-CD only) Photographic imagery from the camera can be received through the front window only. If photo capture is enabled, photographic data will be rendered only to scan points acquired through the front window.

Dual window scanners are versatile and can be used for both mobile scanning with Maptek Drive and stationary scans, as follows:

- **Driving scan, dual-window mode**
  This is the most efficient way to acquire driving scans with Maptek Drive. Because data is acquired from both windows as the vehicle moves, there is no need for the vehicle to double back to scan the other side of the vehicle's path.

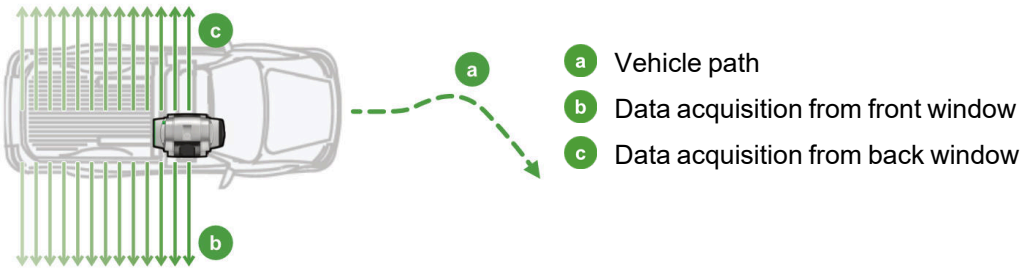


Figure 5-11 Acquiring a driving scan in dual-window mode

- **Driving scan, single-window mode**
  If dual-window scanning is disabled, data will only be acquired from the front scanning window. The maximum range performance increases, but backtracking may be required to capture the full scene.

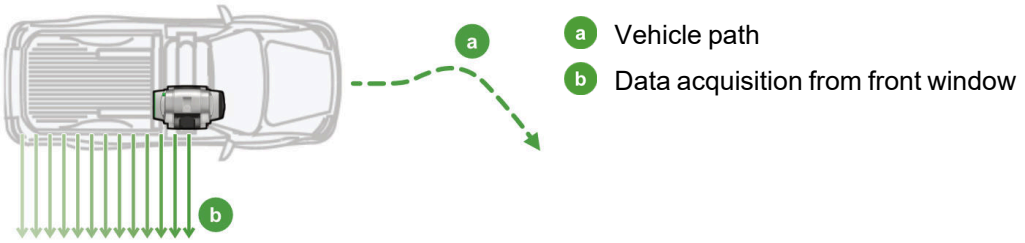


Figure 5-12 Acquiring a driving scan in single-window mode

- **Stationary scan, dual-window mode**
  Dual window scans can also be acquired from a stationary setup, such as a tripod or a stationary vehicle. In this case, the scanner head only needs to traverse 180° to capture a 360° scan, effectively halving the scan acquisition time.

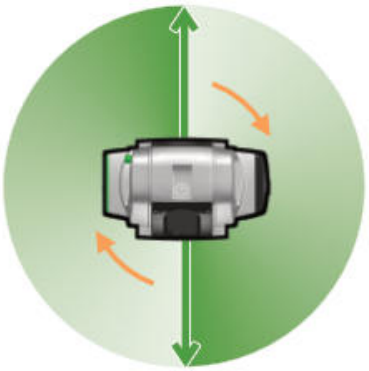


Figure 5-13 Acquiring a stationary scan in dual-window mode

- **Stationary scan, single-window mode**
  Dual-window scanning can be disabled when acquiring from a stationary setup to increase range performance. The scanner head traverses like an ordinary XR3 scanner to acquire data.

> **Note**
> XR3 dual window scanners are calibrated to provide close angular data matching between the front and rear window scan data, but the following factors should be noted that may affect data matching:
>
> - Environmental factors, including vibration and temperature, can cause a small degree of offset to calibration values. This is a normal characteristic of the scanner operating within its manufacturing tolerances.
> - Angular offset may be more evident for data approaching maximum distances. Use the front window only option if the 180-degree data seam created between the front and rear windows is an issue.

Chapter

6

Scanning to USB

FieldHHC provides the most extensive controllability and functionality for the majority of scanning scenarios. However, the scanner can also quickly acquire simple scans directly to a USB flash drive at the push of a button. Alternatively, it can be controlled via a Wi-Fi-enabled smartphone or tablet, allowing for basic settings adjustments.

If the FieldHHC tablet is not used to control the scanner and acquire scans, you can still use the scanner to capture points and photographic data using the following methods:

Pushbutton scan	A pushbutton scan is performed only with the scanner. It acquires a fast scan with a sufficient resolution for capturing stockpiles, pits, and moderately-sized features.
Mobile device scan	A Wi-Fi-enabled device such as a smartphone is used to connect to the scanner using a web browser. This method allows you to control various scan settings.

In both cases, a flash drive connected to the scanner is required to save scans. Scans are saved in the folder `Maptek scans`.

6.1 Taking a pushbutton scan

To take a pushbutton scan, simply place the scanner onto an appropriate mount, such as a tripod, then follow these steps:

> **Note**
> The scan settings for a pushbutton scan cannot be adjusted. The following settings are used:
> - **Scan mode:** Fast (2x)
> - **Point density:** 2

1. Insert a battery into the scanner.
2. Press the power button to turn the scanner on. Wait until the indicator light on the power button is a steady green.
3. Insert a FAT32-formatted flash drive with sufficient storage space into the scanner's USB port. For best results, use the 32 GB compact USB drive (Part # 0102028) supplied with the scanner kit.
4. Press and hold the power button until you see the light turn red, then release the power button. The scan will proceed.

   > **Note:** If the power button blinks red once when starting a pushbutton scan, the flash drive may either be full, not inserted, not formatted as FAT32, or damaged. If necessary, try an alternate flash drive.

   > **Note:** The photo exposure setting is set to the last-used FieldHHC setting. It can only be changed by connecting the scanner to FieldHHC or by a web browser on a smartphone, tablet, or PC with a Wi-Fi connection.

- To cancel scanning, press the power button once.
- To take additional scans, repeat step 4 as needed.
- You can remove the USB flash drive after scanning is completed.

6.2 Taking a scan with a mobile device

You can expand your scanning options with minimal setup by using a browser on your smartphone, tablet, or PC by connecting to the scanner over Wi-Fi. To connect to the scanner, follow these steps:

1. Power up the scanner and confirm Wi-Fi is enabled at the scanner by checking the power button status light.
2. Insert a FAT32-formatted USB flash drive into the scanner's USB port.
3. Open the Wi-Fi settings on your device to list them and select the item matching your scanner name. An example scanner name is `XR3_C60T_B01_XR3_1234`.
4. Tap to select the scanner and start the connection.
5. Open a browser on your device. In the navigation or search bar, type the following:

   `maptek.scanner/`

   Then tap off or press `Enter` to load the mobile controller web page. Figure 6-1 below illustrates the browser interface that opens.

   > **Note:** The available controls depend on the model of scanner.

To take a scan, adjust the required settings as needed. Note that the selected button or setting is highlighted in green.

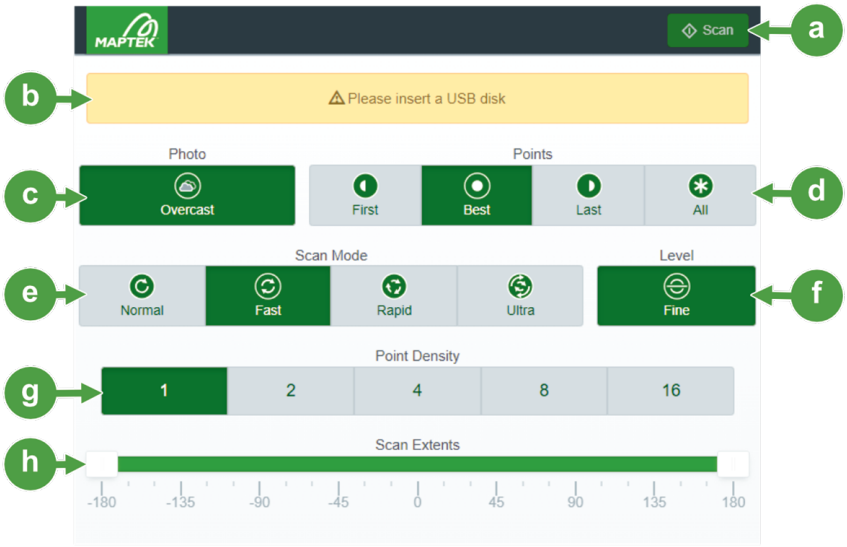


Figure 6-1 Mobile control interface

a	Tap Scan to begin scanning with the currently selected settings. Tap Cancel any at time to scan to stop.
b	The status bar displays notifications, prompts, or error conditions.

c Photo exposure mode (if equipped with a camera). Tap this button display the following options:

- **Off** turns the camera off. No image is saved with the scan.
- **Dim** (SR3 only) provides the maximum underground exposure when using the underground light.
- **Average** (SR3 only) sets a medium underground exposure when using the underground light.
- **Bright** (SR3 only) sets the minimum underground exposure when using the underground light.
- **Indoor** provides the maximum exposure for indoor lighting or poor outdoor light.
- **Sunset** sets the outdoor exposure for low-level lighting.
- **Overcast** sets the outdoor exposure for cloud-filtered light.
- **Sunny** (XR3, UR3) or **Clear** (SR3) sets the minimum exposure setting for light cloud and sunny conditions.

d **Points** determines which laser pulse returns are included in the scan if more that one return is detected in that pulse. To learn more, see 5.4.3 Scan point selection on page 45. Select from the following:

- **First:** The first point received is retained. All subsequent points are ignored.
- **Best:** The point retained is determined by an intelligent algorithm.
- **Last:** Only the last point picked up from a given return pulse is retained.
- **All:** All points are retained. They can later be filtered in PointStudio using the *Multi-return type* tool in PointStudio.

e **Scan mode** sets the scanning speed. To learn more, see 5.4.1 Scan mode on page 43. Select from the following:

- **Normal (except SR3 scanner):** Select normal speed to maximise the range of points received.
- **Fast:** Select fast speed to double the normal speed scan.
- **Rapid:** Select rapid speed to acquire scans at 3x the normal rate.
- **Ultra:** Select ultra speed to acquire scans at 4x the normal rate. The maximum range of points received is most affected at this speed setting.

f **Level** sets the precision of the scanner's self-levelling system. To learn more, see 5.1.3 Level correction on page 39. Tap the button to toggle between the following:

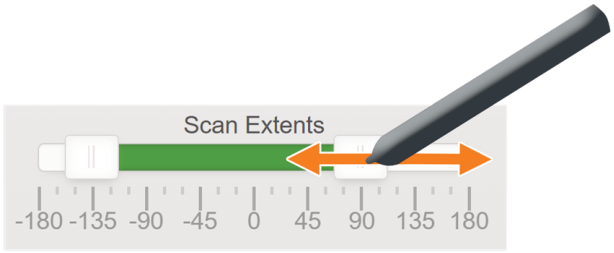
- Fine **Fine:** Applies accurate level compensation to scans.
- Coarse **Coarse:** Applies rudimentary level compensation to scans.

The default setting is **Fine**.

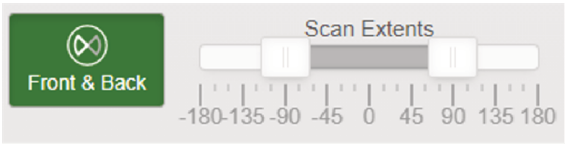
g **Point Density** sets the scan resolution. To learn more, see 5.4.2 Point density on page 44. Select from the following:

- 1 **1** is the lowest resolution producing the greatest point spacing.
- 2 **2** doubles the point density **1** scan resolution.
- 4 **4** doubles the point density **2** scan resolution.
- 8 **8** doubles the point density **4** scan resolution.
- 16 **16** (excludes SR3 scanner) doubles the point density **8** scan resolution, producing the smallest point spacing.

h **Scan extents:** Drag either handle on the extents bar to set the start and finish points of a scan as illustrated.



Front & Back **Front & Back** (XR3-D and XR3-CD scanners) enables dual-window scanning. When enabled, **Scan Extents** is disabled (greyed out), as illustrated.



Note: Photographic data is only captured across the 180° range of the front scanner head window (if equipped).

Tip: You can remove the flash drive any time after you have finished scanning.

Chapter

7

Scanning with FieldHHC

Maptek FieldHHC is a tablet-based system for controlling R3 MkII laser scanners. FieldHHC can be used to acquire scans for most stationary surveying tasks, and also for mobile scanning using Maptek Drive.

> **Note:** FieldHHC is not required where the scanner is controlled by another system, such as Maptek Sentry.

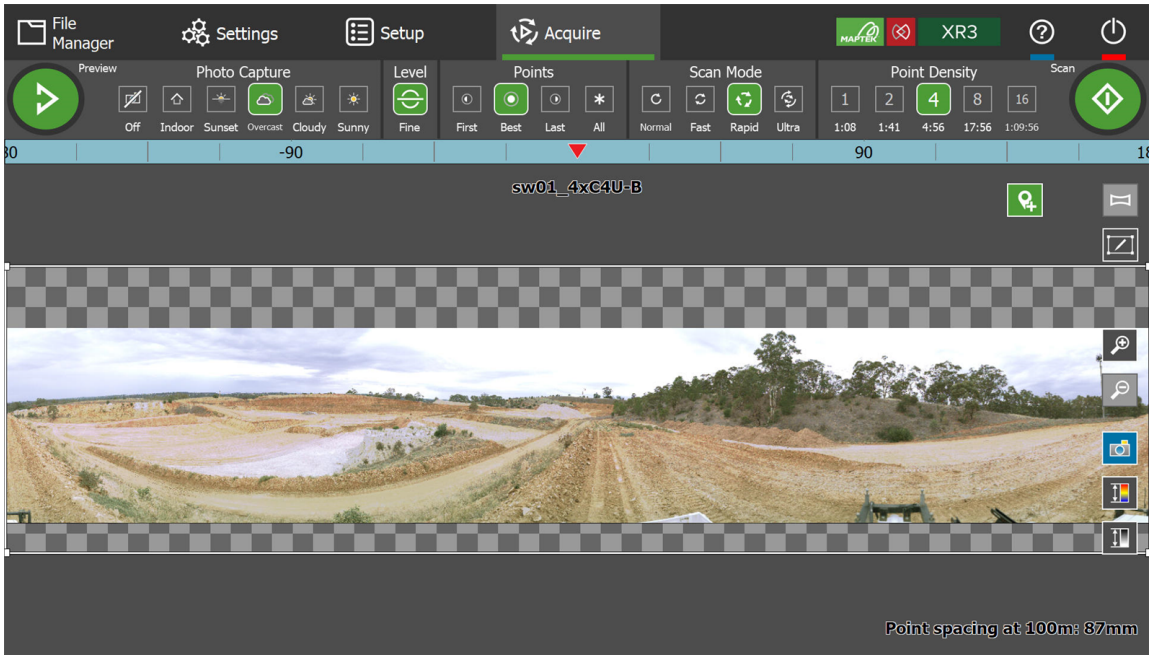


Figure 7-1 FieldHHC user interface

7.1 Introduction

7.1.1 Starting FieldHHC

- To start FieldHHC, press the power button on the FieldHHC tablet.

> **Note:** When connecting to a scanner for the first time, a warning about scanning survey prisms is displayed. Tap **OK** to dismiss the warning. Tap **Do not show this warning** to prevent the warning from appearing for 30 days.

7.1.2 Main tabs

FieldHHC consists of a series of tabs for managing different aspects of the scanning workflow.

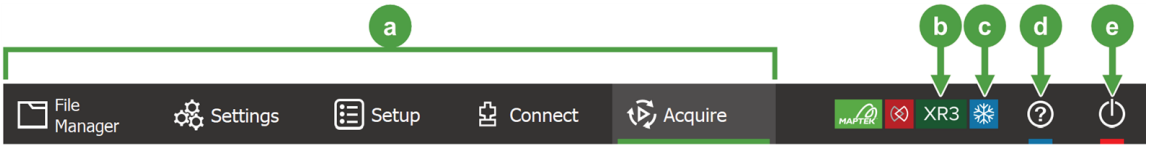


Figure 7-2 Main tabs on the FieldHHC user interface

a	Main tabs: • **File Manager:** View and manage scan files. Manage configuration files such as survey station databases, coordinate systems, and design data. See 7.2 File management on page 62 for more information. • **Settings:** Configure FieldHHC settings that affect your session, such as the coordinate system to use, Maptek Drive offsets, and connectivity settings. See 7.3 Configuring FieldHHC on page 66 for more information. • **Setup:** Set up the details of a single scan job. See 7.5 Setting up a scan job on page 79 for more information. • **Connect:** Connect to the scanner (enabled when a scanner connection is available). • **Acquire:** Set scan parameters and acquire scans and previews (replaces **Connect** after connecting to a scanner).
b	Connected scanner model indicator.
c	Cold climate scanner (M20) indicator.
d	Open this operator manual.
e	Power button. Choose from the following options: • **Quit:** Exit FieldHHC. • **Shutdown:** Power off the tablet. • **Hibernate:** Suspend FieldHHC and power off. Running programs will resume on next powerup but the scanner connection will be lost unless an Ethernet connection is used and Ethernet auto connect is enabled in **Settings** > **Connectivity**.

7.1.3 Status bar

The status bar displays messages and various status indicators.



Figure 7-3 Example status bar (appearance varies based on current status)

a	**Notification banner**		The most recent notifications and error messages appear here. Tap on the banner to display the full list of notifications.
b	**Maptek Drive status**	Az 12.6°	INS alignment incomplete with standard deviation of 12.6°.
		Az 0.03°	INS alignment complete with standard deviation of 0.03°.
c	**Bluetooth GPS status**	No fix.	No GPS fix available.
		GPS auto.	Autonomous GPS fix established.
		RTK fixed.	RTK fix established.
		12	Connected to 12 satellites.
		Pdop:0.9	PDOP (position dilution of precision) of 0.9.
		Trk σ 2.6°	GPS track with standard deviation of 2.6°.
d	**Cold climate scanner (M20) status**		Too cold to scan (scanning disabled).
			Cold warning (scanning enabled).
			Ready to scan.
e	**Internal GPS status**	- m 0	No GPS fix available.
		2.1m 11	Connected to 11 satellites with a standard deviation of 2.1 m.
f	**Network connection status**		Connected with Ethernet cable.
			Connected wirelessly with good signal strength.
g	**Data transfer status**		No data transfer occurring.
			Data transfer with buffering in progress.
			Data transfer in progress (no buffering).
h	**Scanner inclination**	≈	Scanner is level.
		3°	Scanner tilt at 3° from vertical.
i	**Scanner power status**	85%	Scanner battery at 85% charge.
			Scanner powered externally.
j	**FieldHHC tablet battery charge indicator**	100%	Tablet battery fully charged.
			Tablet charging.
k	**Clock**		

7.1.4 Basic scanning workflow

You can perform a basic scan job in FieldHHC by following this workflow:

1. **Turn on the FieldHHC tablet.**
2. **Import required files.**

   If you want to set a coordinate system or use a survey station database, you will first need to import them into FieldHHC. To do this, follow these steps:

   a. Insert a USB device containing the required files into the FieldHHC tablet.

   b. In the **File Manager** tab, expand the **Files** drawer.

   c. Tap  to show files on the USB device.

   d. Select the required files, then tap  to transfer them to the FieldHHC.

   See 7.2.2 Managing non-scan file types on page 64 for detailed instructions.

3. **Configure FieldHHC.**

   Switch to the **Settings** tab and configure any system settings required, such as:
   - Operator name
   - Coordinate system
   - Bluetooth GPS connection

   See 7.3 Configuring FieldHHC on page 66 for detailed instructions.

4. **Connect to the scanner.**

   a. Turn the scanner on.

   b. If using a wired connection, connect the scanner to the FieldHHC tablet by plugging the supplied Ethernet cable into the Ethernet port of each device.

   c. When the **Connect** tab becomes enabled, tap it to connect to the scanner.

   See 7.4 Connecting to a scanner on page 77 for detailed instructions.

5. **Set up the job.**

   a. Switch to the **Setup** tab.

   b. Select the kind of scan job you want to perform, either **Defined Name**, **Survey Job**, or **Multiple Back sights**.

   c. Configure the setup as required, for example, by setting a scan name or survey job.

   See 7.5 Setting up a scan job on page 79 for detailed instructions.

6. **Acquire a scan.**

   a. Switch to the **Acquire** tab.

   b. Choose the desired settings such as **Photo Capture**, **Level**, **Scan Mode**, and **Point Density**.

   c. To take a preview, tap  .

   d. Optionally select a region to scan by tapping  then drawing the desired region in the preview window.

   e. To acquire the scan, tap  .

   See 7.6 Acquiring scans on page 91 for detailed instructions.

7. **View the scan.**

   Switch to the **File Manager** tab to view the scan and perform other functions such as annotating scans and transferring scans to a USB key.

   See 7.7 Viewing scans on page 101 for more information.

8. **Take more scans.**

   You can take more scans by switching back to the **Acquire** tab. When you move to a new setup location, switch to the **Setup** tab to configure the details of the new setup location before acquiring the next scan.

See also: 7.10 Scanning with Maptek Drive on page 130

7.2 File management

You can manage files such as scan and configuration files from the **File Manager** tab. Scan files are managed in the **Scans** list located in the bottom left. All other file types are managed in the files drawer located in the bottom right.

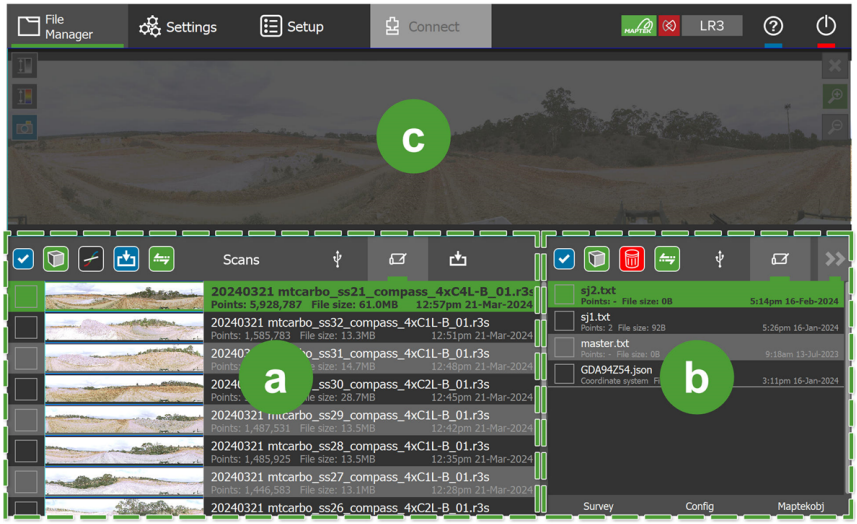


Figure 7-4 File Manager

a **Scans list**
View and manage scans in the selected repository. See 7.2.1 Transferring, archiving, and deleting scan files below for details.

b **Files drawer**
View and manage non-scan files in the selected drive. See 7.2.2 Managing non-scan file types on page 64 for details.

- Tap **Files** to show the files drawer.
- Tap to hide the files drawer.

c **Viewer**
View scans and perform other operations. See 7.7 Viewing scans on page 101 for more information.

7.2.1 Transferring, archiving, and deleting scan files

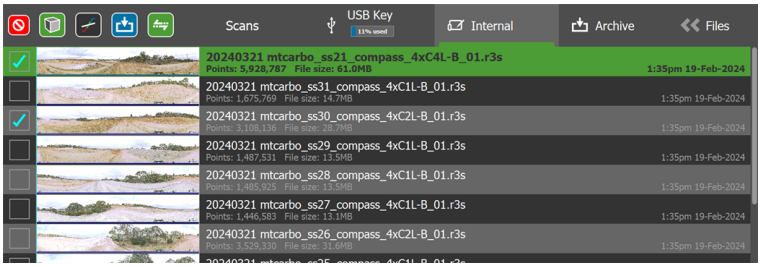


Figure 7-5 Scans list

The **Scans** list allows you to view and manage scans located in the following repositories:

USB key (appears when a USB key is inserted)
This repository corresponds to the folder `Maptek Scans` on the USB key.

- Transfer selected scans from here to the internal repository by tapping .
- Delete selected scans from here by tapping .

Internal
Scans acquired using FieldHHC initially appear here. This repository corresponds to `C:\Scans` on the tablet's internal hard drive.

- Transfer selected scans from here to the USB key by tapping . Scans transferred in this manner will be automatically archived and removed from the internal repository.
- Archive selected scans by tapping .

> **Note:** Scans cannot be deleted directly from the **Internal** repository tab. Instead, you must either transfer them to a USB key or archive them.

Archive
Archived scans allow you to keep a record of historical scans on the tablet without cluttering the internal repository. The archive repository corresponds to `C:\ScansBackup` on the tablet's internal hard drive. Scans can only be archived from the **Internal** repository tab.

- Transfer selected scans from here back to the internal repository by tapping .
- Delete selected scans permanently by tapping .

> **Note:** Scans acquired from R3 series scanners have the extension `.r3s` and are named using the naming scheme described in 5.5 Scan file naming on page 46. Scans are listed in descending time order; that is, the most recent scan appears at the top of the list.

7.2.2 Managing non-scan file types

You can manage supported non-scan file types from the files drawer located in the bottom-right of the **File Manager** tab.

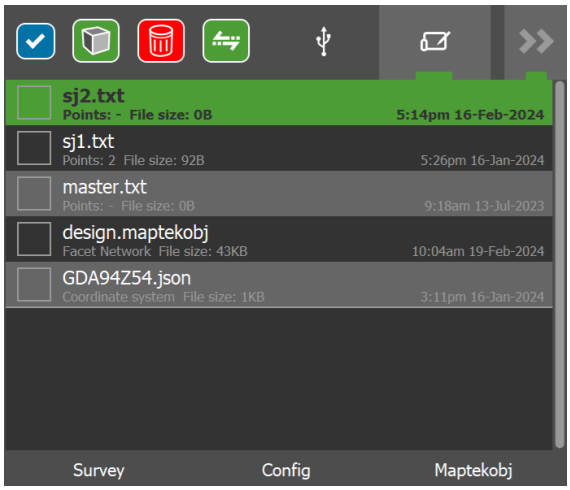


Figure 7-6 Files drawer

> **Note:** The files drawer is initially hidden. Tap **Files** to show it.

The files drawer supports the following file categories:

- **Survey job files** (`.txt`). These are text files containing survey station locations used in survey jobs.
- **Configuration files** (`.json`). This includes coordinate systems and registration sequences. These can be exported from PointStudio.
- **Maptek object files** (`.maptekobj`). These typically contain the following object types:
  - Pointsets or surfaces for use in scan registration
  - Polygons, colour legends, or design surfaces for use in conformance reporting

  These data types can be exported to Maptek object files from PointStudio.

> **Tip:** Tap the **Survey**, **Config**, or **Maptekobj** filter tabs at the bottom of the Files drawer to show only files that match that category. Tap the selected filter tab again to show all files.

The **Files** drawer displays supported non-scan files from the following locations:

	USB key. This corresponds to the folder named `Maptek Files` on the USB key.
	Internal hard drive. This corresponds to the folder `c:\SurveyStationFiles` on the tablet's internal hard drive.

Copying files from USB key

To copy non-scan files from a USB key to the FieldHHC tablet, follow these steps:

1. Make sure the desired files are located in a folder named `Maptek Files` on the USB key.
2. Insert the USB key into the tablet.
3. On the **File Manager** tab, make sure the **Files** drawer is open.
4. Switch to the USB drive view by tapping  .
5. Optionally tap **Survey**, **Config**, or **Maptekobj** to filter for the specific file category.
6. Select the files you wish to copy and tap  .

   You will be prompted to confirm the copy, after which the files will be copied to the internal hard drive.

   - Tap  to view the files on the tablet's hard drive.

Copying files from the tablet to USB key

To copy non-scan files from the FieldHHC tablet to a USB key, follow these steps:

1. Insert the USB key into the tablet.
2. On the **File Manager** tab, make sure the **Files** drawer is open.
3. Make sure the internal hard drive view is selected by tapping  .
4. Optionally tap **Survey**, **Config**, or **Maptekobj** to filter for the specific file category.
5. Select the files you wish to copy and tap  .

   You will be prompted to confirm the copy, after which the files will be copied to the folder `Maptek Files` on the USB key.

   - Tap  to view the files on the USB key.

Managing survey job files

A *survey station* is a named set of coordinates used to identify a fixed scanning location. Survey stations can be used to set the scanner location in survey jobs. A survey job stores associated survey stations in a survey file named `<job_name>.txt` in the tablet's internal hard drive (in `c:\SurveyStationFiles`). In addition, FieldHHC maintains a special survey job named **master**, which can be used to store the master set of survey stations.

FieldHHC requires survey job files (including `master.txt`) to be in a specific format. To create a survey job file from an external file (such as a CSV file) for use in FieldHHC, follow these steps:

1. In PointStudio, use the **Import** tool to import the survey file as *Survey points*.
2. Select the container of survey points that was imported and use the **Export** tool to export it as *Survey file (*.txt)*.
3. Copy the file to FieldHHC using the steps described in Copying files from USB key above.

7.3 Configuring FieldHHC

7.3.1 Settings tab

The **Settings** tab allows you to configure global FieldHHC settings. The tab is further split into the **General**, **Configuration**, and **Connectivity** subtabs.

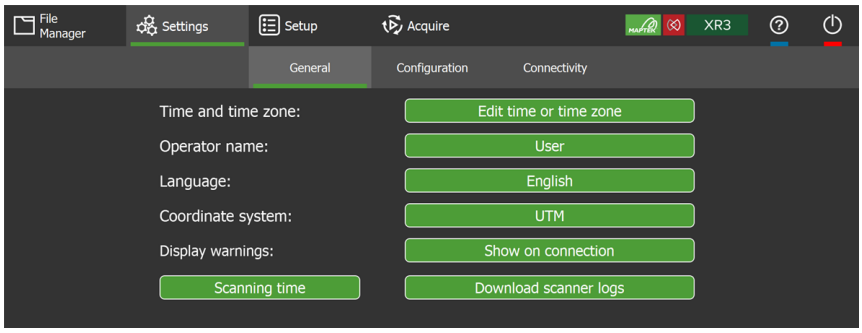


Figure 7-7 FieldHHC Settings tab

General settings

The **Settings** > **General** subtab allows you to configure general system settings such as time, language, and coordinate system.

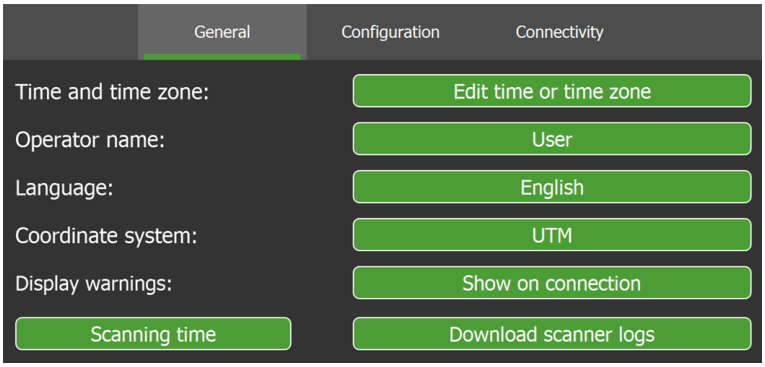


Figure 7-8 General settings subtab

Time and time zone	Set the system date and time.
Operator name	Select or manage operators. The selected operator name is recorded with new scans. • Tap to search for operators that match given text. • Tap to create a new operator name. • Tap to remove the selected operator. **Note:** The currently selected operator cannot be removed.

Language	Select the display language. FieldHHC supports the following languages: • English • Chinese • Spanish • Russian • Portuguese • Indonesian • French
Coordinate system	Select the coordinate system to apply to new scans. The default and only initial coordinate system is UTM. Additional coordinate systems can be exported from PointStudio and added to FieldHHC. See 7.2.2 Managing non-scan file types on page 64 for more information.
Display warnings	If the **Show on connection** button is active, it means one or more warning messages that usually appear on startup were disabled by choosing **Do not show this warning**. ▸ Tap **Show on connection** to display the warning on startup. If the button is not active, it means the warning messages are enabled and will be displayed periodically.
Scanning time	Display the following details of a connected scanner: • **Scanning time since last service:** This counter registers the scanning time since the last service. This counter is reset to zero after each service. • **Total scanning time:** This counter records the cumulative scanning hours over the scanner's lifetime.
Download scanner logs	Download logs from a connected scanner to USB. ▸ To download logs, plug a USB key into the tablet and tap **Download scanner logs**. The logs are copied into the folder `Maptek Scanner Logs` on the USB key.
Disconnect	Force a disconnection from a connected scanner without closing FieldHHC. The previously connected scanner serial number is displayed next to the button.

Configuration settings

The **Settings** > **Configuration** subtab allows you to perform configuration related to units, licences, feature codes, and scanner setup (including Maptek Drive mount offsets).

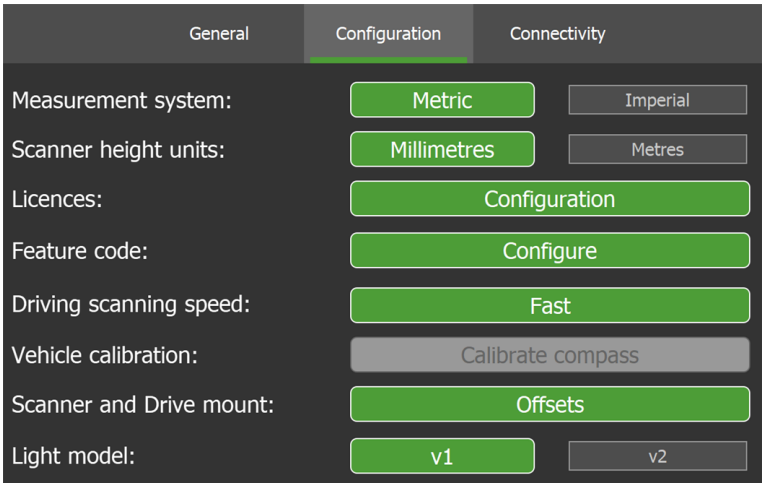


Figure 7-9 Configuration settings subtab

Measurement system	Select the preferred system of measurement.
Scanner height units	Select the unit of measurement to use when defining the scanner height.
Licences	Apply licences for advanced tools and configure settings for design conformance. • **Design Surface:** Set the surface to use for design conformance. • **Custom Legend:** Set the legend to use to when colouring design conformance. • **Report boundary:** Set a polygon to use to limit the extent of the design conformance report. • **Licences**: View the status of installed licences. If a licence is present. a dialog is displayed, showing the scanner's serial number, product, and the expiry date. See 7.3.5 Licensing advanced tools on page 76 and 7.9.1 Configuring design conformance settings on page 122 for more information.
Feature code	Select the active feature code set to use when making annotations. See Feature codes on page 105 for more information.

Driving scanning speed	Set the scanning speed (scan mode) to use when acquiring driving scans. The options are as follows: • **Normal:** This setting is recommended when operating in any combination of cold climate and rough terrain. The maximum recommended vehicle speed for this mode is 7 km/h (4 mph). • **Fast:** Use this setting when operating in cold conditions or where rough terrain is causing inconsistent scanning mirror speeds. This setting provides a speed advantage over Normal. The maximum recommended vehicle speed for this mode is 14 km/h (9 mph). • **Rapid:** This setting allows the fastest recommended vehicle speed of 28 km/h (17 mph). **Note:** Increasing the scanning speed while driving on rough terrain or operating in a cold climate (see 4.4 Scanning in cold conditions on page 31) may reduce the ability of the scanning mirror to maintain a constant rotation rate. Cold climate and sufficiently strong induced vehicle rolling and pitching motion may cause the error message “Elevation Error: Requested speed not reached” to be logged. If these errors are being frequently reported, reduce the scanning driving speed to a slower setting and decrease the vehicle’s speed accordingly.
Vehicle calibration	Perform compass vehicle calibration. See 7.3.2 Calibrating the compass for vehicle use on page 71 for details.
Scanner and Drive mount	Configure scanner and Drive vehicle mount offsets. See 7.3.3 Configuring scanner and Drive vehicle mount offsets on page 72 for details.
Light model	Select the lighting model to use with a Maptek underground lighting system. The light model setting optimises the camera to the type of underground lighting system used.

Connectivity settings

The **Settings** > **Connectivity** subtab allows you to configure connectivity settings including wireless scanner selection and Bluetooth GPS connection.

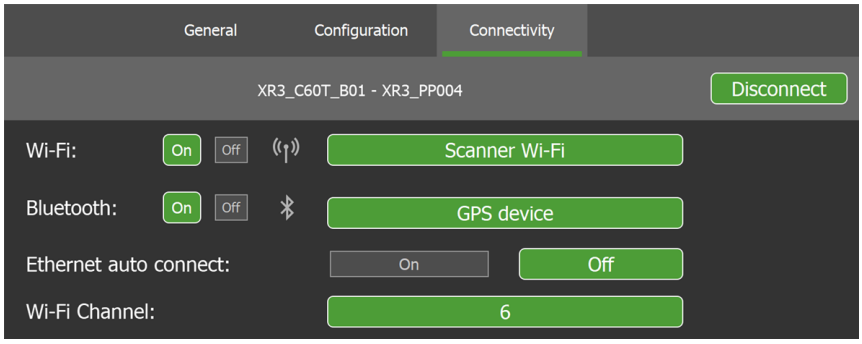


Figure 7-10 Connectivity settings subtab

Wi-Fi	Configure the FieldHHC tablet's Wi-Fi connectivity and select a wireless scanner. ▸ Tap **On** to enable tablet Wi-Fi. Tap **Off** to disable it. ▸ To select a Wi-Fi scanner, tap the button labelled **Scanner Wi-Fi**. Select a scanner from the list of available scanners and tap **Save**. The button's label will update with the name of the scanner. See 7.4.1 Connecting to a scanner wirelessly on page 77 for more details.
Bluetooth	Configure the FieldHHC's Bluetooth connection to an external GPS. ▸ Tap **On** to enable tablet Bluetooth. Tap **Off** to disable it. ▸ To connect to a Bluetooth GPS device, tap the button labelled **GPS device**. Select a device from the list of available devices and tap **Save**. FieldHHC will connect to the device. See 7.3.6 Connecting to a Bluetooth GPS device on page 76 for more details.
Ethernet auto connect	When enabled, this will automatically connect FieldHHC to a scanner plugged in with an Ethernet cable. ▸ Tap **On** to enable Ethernet auto connect. Tap **Off** to disable it.
Wi-Fi Channel	Select the Wi-Fi channel to use when connecting to a scanner with a wireless connection. This may improve signal quality when significant Wi-Fi traffic or radio interference is present.
Disconnect	Force a disconnection from a connected scanner without closing FieldHHC. The previously connected scanner serial number is displayed next to the button.

7.3.2 Calibrating the compass for vehicle use

R3 MkII scanners have a built-in magnetic compass for use in determining the scanner's bearing. Vehicle compass calibration is necessary for eliminating the vehicle's interference with the compass. Calibration is required prior to first use, with recalibration required at approximately six-monthly intervals.

To calibrate the compass for vehicle use, follow these steps:

1. Mount the scanner on the vehicle and connect to it with FieldHHC.
2. Ensure the vehicle is in a wide, flat area where the scanner can receive GPS signals.
3. In **Settings** > **Configuration**, tap **Calibrate compass**.The Vehicle Compass Calibration dialog opens.



Figure 7-11 Vehicle compass calibration panel

4. When prompted, begin driving in a tight circle. Maintain a constant speed of about 8 seconds per quarter circle until three full turns have been completed.

> **Tip:** During this process, listen for the chimes to aid in maintaining the correct turning rate as you drive. When calibration completes, the magnetic calibration profile is saved.

> **Note:** If the rate of rotation is not correctly maintained, magnetic interference sources are present, or the GPS signal is lost, the calibration will fail and an error notification is displayed. If so, remedy the cause and try again.

> **Important:** You will need to apply the compass calibration factor when acquiring vehicle mount scans that require the built-in compass. To enable the calibration factor, make sure the **Vehicle compass calibration** toggle on the **Setup** tab is enabled ( ).

7.3.3 Configuring scanner and Drive vehicle mount offsets

To configure scanner and Drive vehicle mount offsets, go to **Settings** > **Configuration** > **Scanner and Drive mount** and tap **Offsets**.

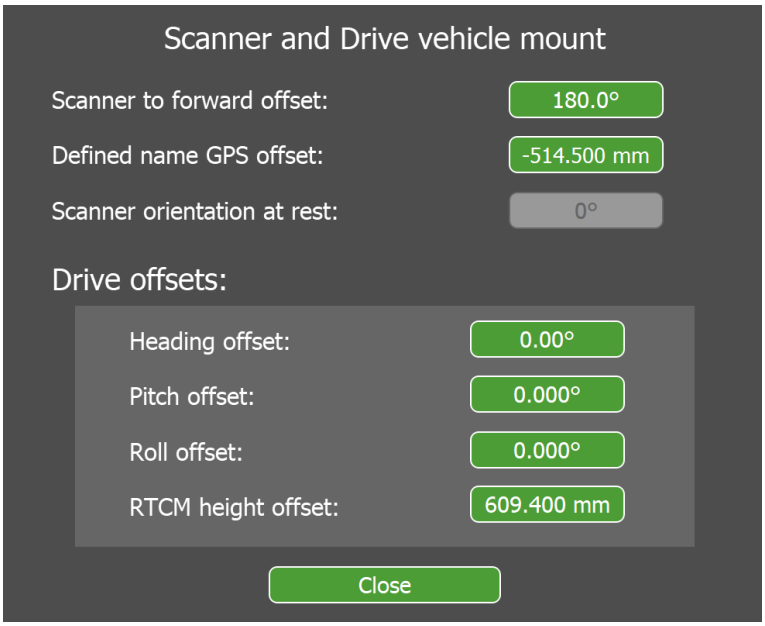
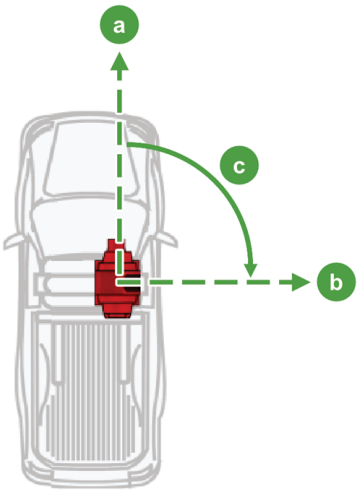


Figure 7-12 Scanner and Drive vehicle mount offsets panel

The settings are explained as follows:

- **Scanner to forward offset.** This informs both gpsTrack and the Drive system of the orientation of the scanner with respect to the forward direction of the vehicle. The scanner to forward offset is measured as the clockwise angle from the vehicle's forward direction to the scanner's zero azimuth position (see Figure 7-13 below). A negative value indicates a counterclockwise angle. If the scanner is mounted on the vehicle facing backwards, this value should be 180°.



a Vehicle forward direction
b Scanner zero azimuth position
c Scanner to forward offset

Figure 7-13 The scanner to forward offset is the angular offset between the scanner's zero azimuth position and the vehicle's forward direction.

- **Defined name GPS offset.** This defines the vertical offset of the *scanner reference level* relative to the GPS position. See 7.3.4 Calculating the GPS offset on the next page for more information.
- **Scanner orientation at rest.** This sets the direction the scanner head should face when powered on but not scanning. The value is relative to the scanner's zero azimuth position.

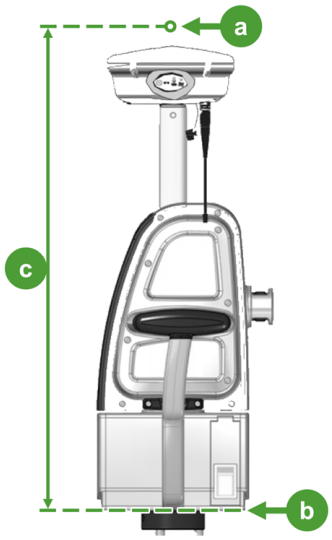
  > **Important:** To protect the scanning window from stone chips while driving at speed, it is recommend that single-window scanners face backwards, and dual-window scanners face out perpendicular to the vehicle's direction when not scanning. Assuming the scanner is mounted facing backwards, this means setting the **Scanner orientation at rest** value to 0° for single-window scanners and 90° for dual-window scanners.

- **Drive offsets.** These are needed by the Drive system to calibrate the scanner to the vehicle mount system. This is initially set up at the factory. Recalibration by the user is required if the mount plate is removed from the scanner or if a different scanner is to be used with the drive system.
  - **Heading, Pitch, and Roll offsets.** These are calibration factors generated with scans using the **Calibrate INS to scanner** orientation tool in PointStudio.
  - **RTCM height offset.** This compensates for some GPS base stations not sending the antenna reference point to phase centre correctly in the RTCM message.

7.3.4 Calculating the GPS offset

The *GPS offset* is the vertical distance offset of the scanner reference level relative to the GPS position output by an external GPS device. This offset is necessary to correctly position scans in defined name and survey job scan setups that use an external GPS. Since the GPS receiver is usually mounted on top of the scanner, the offset is typically supplied as a negative value to indicate that the scanner reference level is below the GPS position. The *scanner reference level* corresponds to the base of the scanner.

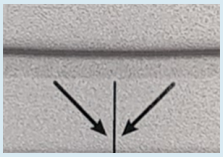
Note: The GPS position depends on how the GPS device has been configured. In the examples below, the GPS position is assumed to coincide with the GPS antenna phase centre. If the GPS device is configured to output the GPS position corresponding to a different point, the GPS offset needs to be calculated accordingly.



a GPS position (GPS antenna phase centre)
b Scanner reference level
c GPS offset

Figure 7-14 The GPS offset is the vertical distance between the GPS position and the scanner reference level.

Note
The scanner reference level (corresponding to detail b) is marked on the back side of the scanner base.



Example

In this example, we calculate the GPS offset for a typical configuration where the GPS unit is mounted on top of the scanner using a spacer (see Figure 7-15 below). The GPS position is assumed to correspond to the GPS antenna phase centre.



a GPS antenna phase centre offset
b Spacer height
c Scanner height to UNC thread
d GPS phase centre
e Bottom of GPS unit
f GPS mounting thread
g Scanner reference level

Figure 7-15 Example defined name GPS offset calculated from the antenna phase centre offset, spacer height, and scanner height.

The GPS offset is the sum of the GPS antenna phase centre offset (a), the spacer height (b), and the scanner height to UNC thread (c), expressed as a negative value:

```
GPS offset = -(a + b + c)
```

- From the GPS unit documentation, we find that the GPS antenna phase centre offset (a) measured from the bottom of the GPS unit (e) is 64.9 mm.
- The spacer height (b) is 139 mm.
- The scanner height to UNC thread (c) for this scanner is 375.5 mm (see Table B-1 on page 140).

So in this example, the GPS offset is given by:

`GPS offset = -(64.9 + 139 + 375.5) = -579.4 mm`.

In this example, we would enter the value `-579.4 mm` in one of the following fields as required:

- The **Defined name GPS offset** field under **Settings** > **Configuration** > **Scanner and Drive mount** > **Offsets**, if using a defined name scan setup.
- The **Scanner Height** field under **Setup** > **Survey Job**, if doing a survey job.

7.3.5 Licensing advanced tools

Some tools, including advanced registration and design conformance, require a licence before they can be used.

> **Note:** Licences are bound to a scanner's serial number and will not work with data acquired from other scanners.

> **Tip:** To check whether you have a licence, go to **Settings** > **Configuration** > **Licences** and tap **Configuration**. Tap **Licensed scanners** to inspect the details of the licence.

To licence advanced tools:

1. If you do not have a licence, request one from your Maptek representative. Please quote the scanner's serial number and request a "conformance licence". The licence will usually be delivered to you via email.
2. Save the licence file `license.mlf` to the root folder of a USB key.
3. Insert the USB key into the FieldHHC tablet. Installation occurs automatically and confirmation appears in the status bar.
4. To confirm licence installation, go to **Settings** > **Configuration** > **Licences** and tap **Configuration**. Tap **Licensed scanners** to inspect the details of the licence.

See also

- Configuration settings on page 68
- 7.8.3 Advanced registration on page 114
- 7.9 Checking design conformance on page 121

7.3.6 Connecting to a Bluetooth GPS device

To connect to a Bluetooth GPS device:

1. Turn on the Bluetooth GPS device.
2. In FieldHHC, go to **Settings** > **Connectivity** and do the following:
   a. Make sure **Bluetooth** is enabled by tapping **On**.
   b. Tap the button labelled **GPS device**.
   c. Select the GPS device from the list of available devices.
   d. Tap **Save**.

   FieldHHC will connect to the GPS device.

7.4 Connecting to a scanner

FieldHHC can connect to R3 MkII scanners wirelessly or with an Ethernet cable.

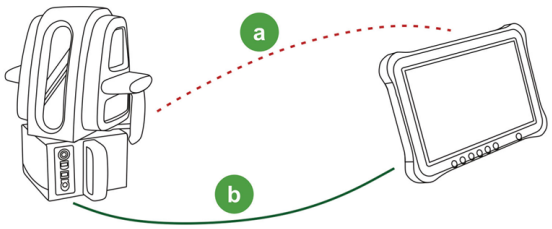


Figure 7-16 FieldHHC–scanner connection types

7.4.1 Connecting to a scanner wirelessly

FieldHHC can connect to R3 MkII scanners wirelessly using Wi-Fi.

To connect to a scanner wirelessly:

1. Make sure the scanner is turned on and has Wi-Fi enabled. See 4.7 Enabling or disabling Wi-Fi on the scanner on page 35 for details.
2. Select the Wi-Fi scanner in FieldHHC.
   a. Go to **Settings** > **Connectivity**.
   b. Make sure **Wi-Fi** is enabled by tapping **On**.
   c. Make sure the name of the Wi-Fi scanner appears in the button on the right. If not, tap the button, select the scanner from the list of available scanners, then tap **Save**.

   When FieldHHC detects that a connection is available, the **Connect** button will enable.
3. Tap **Connect** to establish the connection.

> **Tip:** FieldHHC remembers the last selected Wi-Fi scanner. On next startup, if a connection to the scanner is available, you can connect immediately by tapping **Connect**.

> **Tip:** If drop-outs and disconnections occur due to radio interference, you can try changing the Wi-Fi channel in **Settings** > **Connectivity**.

After a connection is established, the **Acquire** tab appears and replaces the **Connect** button.

- To force a disconnection to the scanner, go to **Settings** > **Connectivity** and tap **Disconnect**.

7.4.2 Connecting to a scanner with an Ethernet cable

To connect to a scanner with an Ethernet cable:

1. Plug the supplied Ethernet cable into the Ethernet ports of the scanner and the FieldHHC tablet.
2. Turn the scanner on. FieldHHC will detect that a connection is available and the **Connect** button will enable. The scanner will be ready to connect to when its power button light is solid green.
3. To establish the connection, tap **Connect**.

> **Note:** If Ethernet auto connect is enabled in **Settings** > **Connectivity**, FieldHHC will establish the connection automatically.

After a connection is established, the **Acquire** tab appears and replaces the **Connect** button.

- To force a disconnection to the scanner, go to **Settings** > **Connectivity** and tap **Disconnect**.

7.5 Setting up a scan job

Before you can acquire scans, you need to configure the physical setup parameters of the scan job. You can do this from the **Setup** tab.

There are three basic setup types to choose from, as follows:

- **Defined Name.** A *defined name* scan job allows you to take scans from an unsurveyed location without any backsights. The physical setup could be on a tripod or a vehicle mount. Maptek Drive scans also use the defined name setup. The bearing can be supplied either from the internal compass, or derived from a vehicle's GPS track. The position is supplied either by the scanner's internal GPS or an external Bluetooth GPS. The filename of a defined name scan is based on a name supplied by the user. See 7.5.1 Setting up a defined name scan job below for details.
- **Survey Job.** A *survey job* scan allows you to scan from a surveyed location such as over a survey mark or using a survey bollard. The surveyed location can either be set from a survey job file, set to the GPS position, or manually entered. The bearing is typically obtained by backsighting to another surveyed location, but the compass or vehicle GPS track can also be used if necessary. The filename of a survey job scan is based on the survey job name and the scanner location. See 7.5.2 Setting up a survey job on the next page for details.
- **Multiple Backsights.** A *multiple backsights* scan job uses multiple backsights to establish the scanner's position and bearing rather than GPS information. The typical use case is when scanning underground. See 7.5.3 Setting up a survey job with multiple backsights on page 85 for details.

7.5.1 Setting up a defined name scan job

This section will guide you through the process of setting up a defined name scan.

Defined name scan setup types

Defined name scans are set up according to three different scanner and accessory applications. These are summarised below:

- **Using compass and GPS:** High-precision GPS determines the scanner's location and the onboard compass provides a rudimentary bearing. Additional bearing accuracy is required using in-field registration by registering in PointStudio.
- **Vehicle mount using GPS track:** This type of scan is taken with a vehicle-mounted scanner. The vehicle is driven a short distance to determine a bearing prior to scanning.
- **Using Maptek Drive:** Position and bearing information are continuously updated using Maptek Drive's GPS and INS system. When connected to Maptek Drive, the **Defined Name** panel automatically switches to *Drive* configuration.

Setting up a defined name scan using compass or GPS track

To set up a defined name scan:

1. In the **Setup** tab, tap **Defined Name**.
2. Set a scan name.
   - Tap the button next to **Scan name** to show a list of previously used names.
   - Tap to add a new name to the list. The currently selected name will be used as the initial basis.
   - Select a name and tap **OK** to set it.
3. Select the **Heading** to use as follows:
   - **Compass:** Use the scanner's internal compass to set the heading.

     Important: If scanning from a vehicle, make sure the **Vehicle compass calibration** toggle is enabled to apply the calibration factor.

   - **GPS track:** The vehicle's GPS track will be used to define the scanner heading.

     Tip
     To obtain a heading from the vehicle's GPS track, drive in a straight line for 5 to 10 metres. The heading is determined by sampling multiple positions as the vehicle moves. For the best results, follow these recommendations:
     - Avoid driving over uneven surfaces.
     - Minimise any variations in the track heading.
     - Avoid letting the vehicle roll back when coming to a stop.

7.5.2 Setting up a survey job

To set up a survey job, go to **Setup** > **Survey Job**.

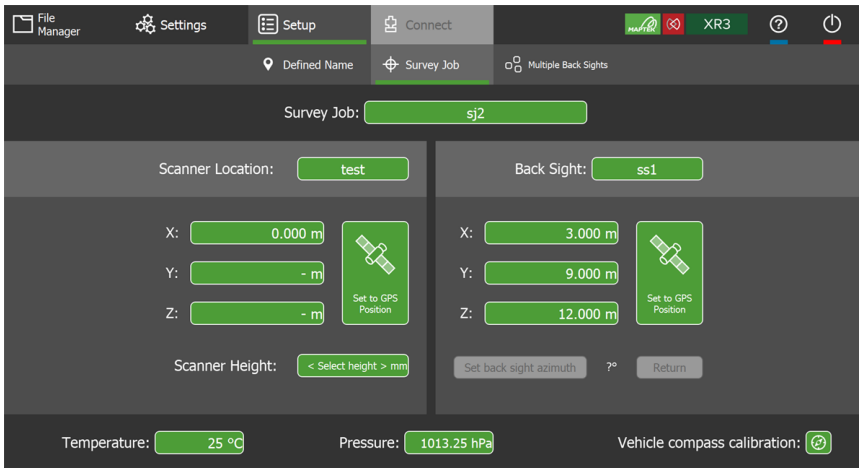


Figure 7-17 Survey job setup

This setup type requires you to define the scanner location (e.g. from a survey station location or GPS location) and then establish the scanner bearing through the use of a backsight location. You can also use this panel to define the survey locations in your survey job database.

Configure the fields as follows.

Survey Job

Select the name of the survey job.

Each survey job corresponds to a database of survey station locations stored as a text file (`.txt`). Tap the button to display a list of existing survey job files stored in FieldHHC.

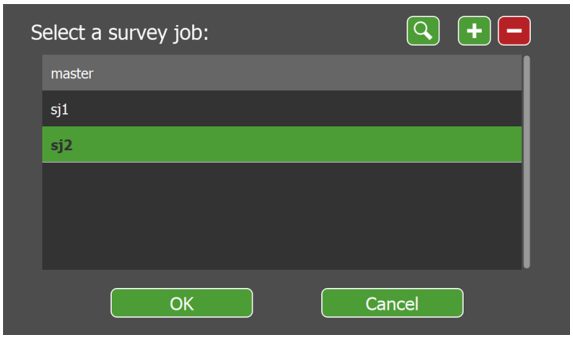


Figure 7-18 Survey job selection panel

- Select a database name and tap **OK** to set it as the survey job.
- Tap to search for survey jobs that match a given text string.
- Tap to create a new survey job.
- Tap to delete the selected survey job. This permanently deletes the associated survey job file from the tablet's internal drive.

Note

- Survey station locations found in the survey job file are used to populate the **Scanner Location** field (see Scanner Location below).
- The name of the selected survey job will be incorporated into the scan filename.

See also: Copying files from USB key on page 65 for how to transfer files including survey station files from a USB key to FieldHHC.

Scanner Location

Select the name of the scanner's setup location and set the location coordinates. Tap the button to display a list of scanner locations in the currently selected survey job.

Note: You do not have to set a scanner location to scan. An alternative workflow is to record the scanner coordinates on the GPS controller. When the job is complete, these locations can be exported to CSV and then imported into PointStudio for use in the **Register Scan by Time** tool.

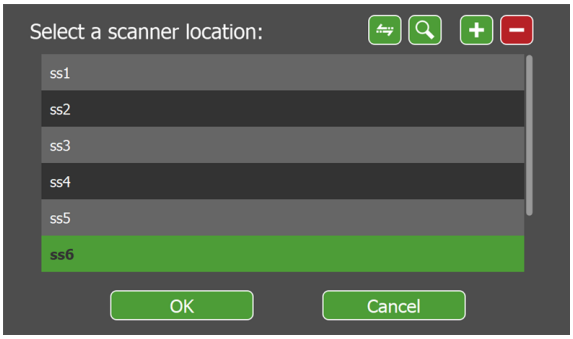


Figure 7-19 Scanner location selection panel

Tip: Survey stations in the master survey job file also appear at the end of the list. To make a scanner location available in other survey jobs, select it and tap . Copy to **master** to make the location available to all jobs.

- Select a scanner location and tap **OK** to set it as the current scanner location.
- Tap to search for scanner locations that match a given text string.
- Tap to create a new scanner location.
- Tap to delete the selected scanner location from the current survey job.

After selecting the scanner location, you can modify its coordinates as follows:

- If connected to an external GPS, tap **Set to GPS Position** to set the coordinates to the current GPS position.
- Tap any of the **X**, **Y**, or **Z** fields to manually set their values.

Scanner Height

Set the scanner height. This is the vertical offset of the **Scanner Location** coordinates relative to the *scanner reference level*. Tapping the button displays a list of previously saved scanner heights. See 7.5.4 Calculating the scanner height on page 87 for more information on the value to enter here.

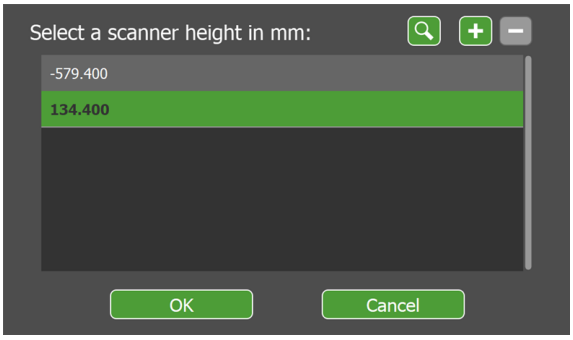


Figure 7-20 Scanner height selection panel

- Select an existing value and tap **OK** to set it as the scanner height.
- Tap + to define a new scanner height.
- Tap − to delete the selected scanner height.

Back Sight

Select the backsight location and set its coordinates. Tap the button to display a list of backsight locations in the currently selected survey job.

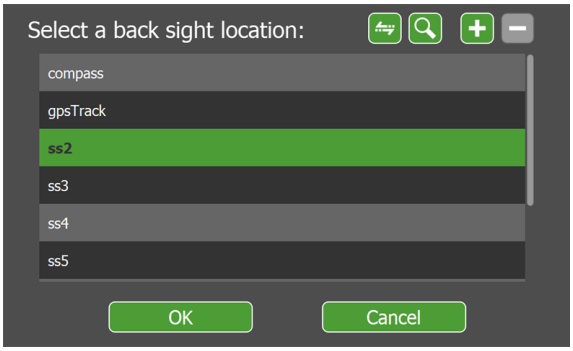


Figure 7-21 Back sight selection panel

- Select a backsight location and tap **OK** to set it as the current backsight.
- Select **compass** to use the internal compass for the bearing instead of a backsight.
- Select **gpsTrack** to use a vehicle's GPS track to establish the bearing instead of a backsight.

> **Tip**
> To obtain a heading from the vehicle's GPS track, drive in a straight line for 5 to 10 metres. The heading is determined by sampling multiple positions as the vehicle moves. For the best results, follow these recommendations:
> - Avoid driving over uneven surfaces.
> - Minimise any variations in the track heading.
> - Avoid letting the vehicle roll back when coming to a stop.

- Tap to copy the selected backsight location to another survey job.

- Tap to search for backsight locations that match a given text string.
- Tap to create a new backsight location.
- Tap to delete the selected backsight location from the current survey job.

After setting a backsight location, you can backsight the scanner (e.g. using the telescope, if fitted) by orienting the scanner head to point to the backsight location and then tapping **Set back sight azimuth**. See 7.5.5 Backsighting a scanner on page 88 for detailed instructions.

- Tap **Return** to return the scanner head to the previously set backsight azimuth. This can be used to check if the backsight is still valid.

> **Note:** If performing a subsequent scan, tap **Return** and then check the backsight validity using the scanner's telescope or aimer. If the backsight is not valid, it suggests the scanner was physically moved between backsighting and the completion of scanning. If this occurs, you will need to establish the backsight again before taking another scan.

Temperature

Set the current temperature. This value is stored with each scan.

Pressure

Set the current pressure. This value is stored with each scan.

> **Tip:** You can enter a pressure directly, or alternatively supply the current altitude and FieldHHC will give the corresponding nominal pressure.

Vehicle compass calibration

Enable this option to apply the compass bearing correction factor if scanning from a vehicle and using the internal compass to provide a bearing.

> **See also:** 7.3.2 Calibrating the compass for vehicle use on page 71.

7.5.3 Setting up a survey job with multiple backsights

To set up a survey job with multiple backsights, go to **Setup** > **Multiple Back Sights**.

This setup type requires you to backsight the scanner to three known locations (such as survey marks). FieldHHC triangulates the scanner location from the three known locations. This setup type is useful in situation where GPS signals are not available, such as in underground mines.

> **Note:** The multiple backsights setup requires a scanner with a laser aimer or backsighting telescope to accurately backsight the scanner.

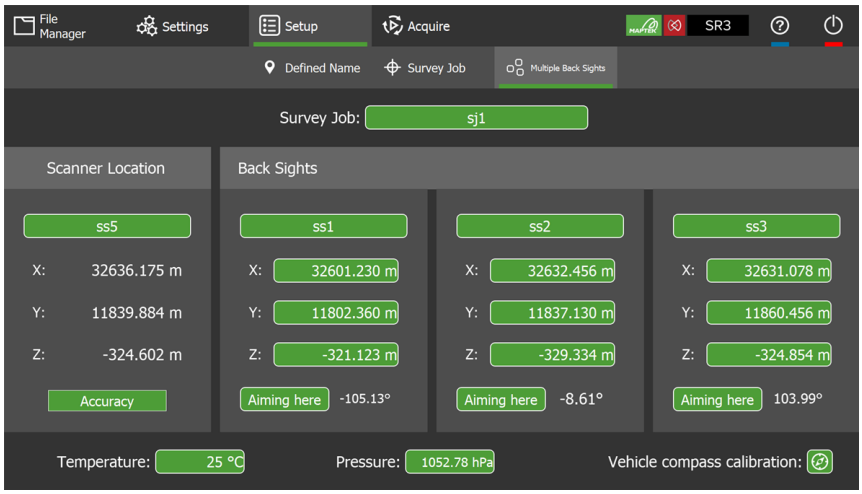


Figure 7-22 Multiple Back Sights setup panel

The recommended workflow for setting up a survey job with multiple backsights is as follows:

1. Before commencing the job, ensure that the surveyed coordinates for the site have been copied to FieldHHC. See 7.2.2 Managing non-scan file types on page 64 for more information.
2. Set up the scanner in a location where three backsights are within line of sight.

   > **Tip:** Greater azimuth separation between backsights will yield a more accurate scanner location. Backsights with an azimuth separation of less than 1° will produce an inaccurate scanner location.

3. Connect FieldHHC to the scanner.
4. Go to **Setup** > **Multiple Back Sights**.

5. Tap the **Survey Job** button to select the job containing your backsight locations.
   - Select a database name and tap **OK** to set it as the survey job.
   - Tap to search for survey jobs that match a given text string.
   - Tap to create a new survey job.
   - Tap to delete the selected survey job. This permanently deletes the associated survey job file from the tablet's internal drive.
6. Under **Scanner Location**, tap the **<Select location>** button to create a new a named scanner location or select an existing one.

   Note: If you select an existing location, its coordinates will be overwritten with the new triangulated position after backsighting.

7. For each of the three backsight locations under **Back Sights**, select a backsight location.
8. Backsight the scanner to each selected location by aiming the laser aimer or telescope to the survey mark, then tapping **Aiming Here**. See 7.5.5 Backsighting a scanner on page 88 for detailed instructions. The scanner bearing to the given backsight location will display.

   When you have completed backsighting the three locations, FieldHHC will record the calculated scanner location with an accuracy indication.

   Tip
   The **Accuracy** indicator should be green. This confirms good azimuth separation for accurate triangulation of the scanner location. An amber or red indicator indicates low accuracy. In these cases, consider using alternate backsight targets or repositioning the scanner.

Accuracy	Good backsight separation / high accuracy
Accuracy	Marginal backsight separation / low accuracy
Accuracy	Poor backsight separation / low accuracy

9. Optionally set the **Temperature** and **Pressure** fields.
10. Switch to the **Acquire** tab and set your desired **Photo Capture**, **Points**, **Scan Mode** and **Point Density** settings.
11. In the viewer, tap (Scan multiple backsights) to initiate scanning. FieldHHC will take a small window scan of each backsight target in sequence. You can then configure your scan settings and acquire more scans as required.

7.5.4 Calculating the scanner height

The **Scanner Height** parameter in survey jobs defines the vertical offset of the *scanner reference level* relative to the specified **Scanner Location**. This value is required to locate the origin of scans correctly with respect to the given scanner location.

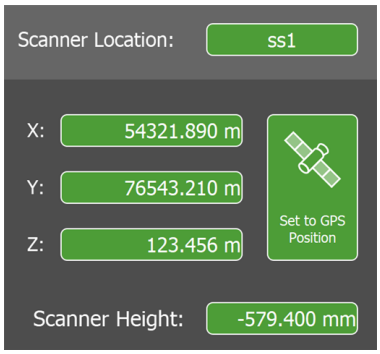
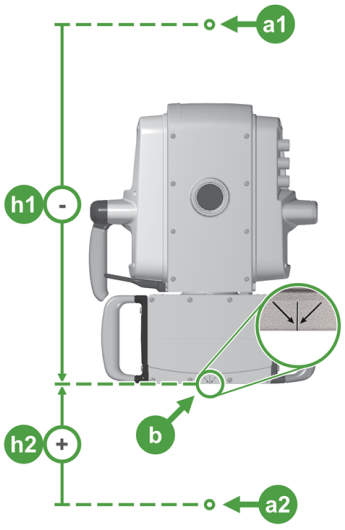


Figure 7-23 Example scanner height based on GPS position.

The scanner reference level corresponds to the base of the scanner and is indicated by a marker on the back of the scanner base (see detail b in Figure 7-24 below). The scanner location is a reference coordinate supplied from one of the following:

- The GPS position (e.g. when you tap **Set to GPS Position**)
- A survey station location (e.g. corresponding to a survey mark)
- Manually entered location coordinates

The value entered for **Scanner Height** in **Survey Job** setups will be positive if the scanner reference level is above the scanner location, or a negative value if it is below the scanner location (see Figure 7-24 below).



a1 Scanner location above scanner reference level

a2 Scanner location below scanner reference level

b Scanner reference level and marker

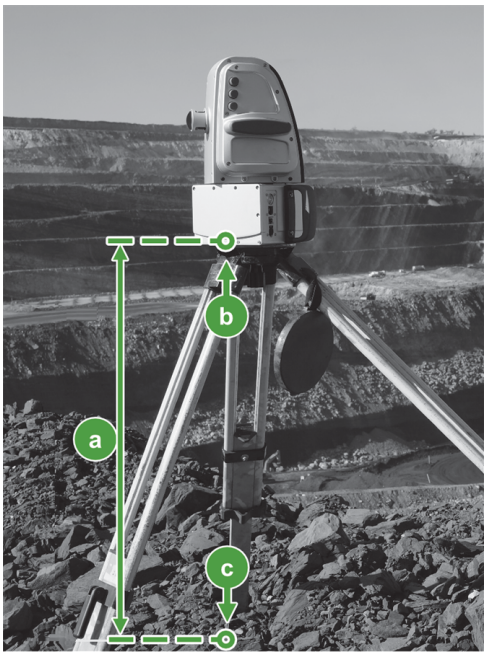
h1 Negative scanner height

h2 Positive scanner height

Figure 7-24 The scanner height is negative (h1) if the scanner location is above the scanner reference level (a1), and positive (h2) if it is below (a2).

By way of example, consider the two following common cases:

- **The scanner location is supplied from a GPS device mounted on top of the scanner.**
  In this case, the scanner height is equivalent to the *GPS offset* that defines the vertical offset of the scanner reference level relative to the GPS position. See 7.3.4 Calculating the GPS offset on page 74 for details. You can tap **Set to GPS Position** in the **Survey Job** panel and then enter a negative value for **Scanner Height**.
- **The scanner location is supplied from a survey mark located below a tripod-mounted scanner.**
  In this case, you specify the scanner location corresponding to the survey mark, either by selecting it from a survey job file, or by manually entering the coordinates. Then, measure the vertical distance from the survey mark to the scanner's reference marker and enter this as a positive value for **Scanner Height** (see Figure 7-24 on the previous page).



a Scanner height
b Scanner reference marker
c Survey mark location

Figure 7-25 Scanner height (a) calculated as the height of the scanner reference marker (b) above a survey mark (c).

7.5.5 Backsighting a scanner

Backsighting a scanner means orienting the scanner head to point in the direction of a known location or *backsight* for the purpose of establishing the correct orientation of scans in the XY plane.

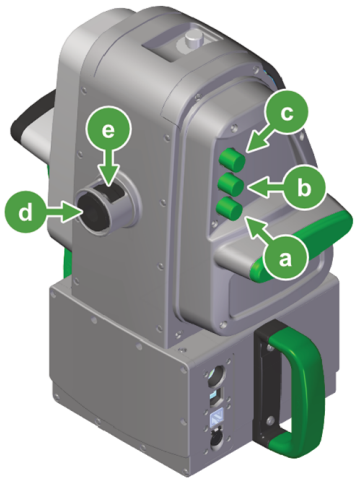
Note: All R3 MkII scanners have an azimuth knob located on the scanner head, which can be used to rotate the head to a desired azimuth position. For precise backsighting, a scanner with either a backsighting telescope (XR3-CT) or a laser aimer (SR3) is required.

To backsight a scanner equipped with either a telescope or laser aimer, follow these steps:

1. Flick the azimuth knob with a quick motion to traverse the scanner head until its window is pointing in the approximate direction of the backsight location. To stop the scanner head, turn the azimuth knob in the opposite direction.
2. Establish the backsight.

   If using a telescope:

   Refer to Figure 7-26 below to locate the relevant backsighting controls.



a Azimuth control knob
b Telescope elevation control knob
c Telescope focus knob
d Telescope eyepiece
e Eyepiece focus bezel

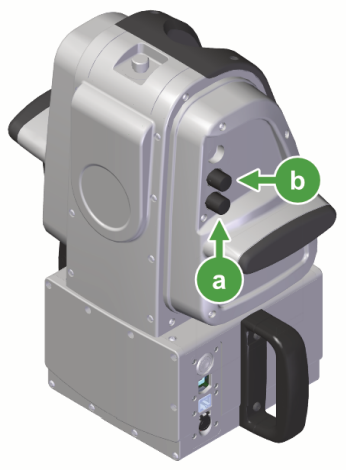
Figure 7-26 Backsighting controls on an XR3-CT

   a. Look through the telescope eyepiece (d) and use the focus bezel (e) to bring the crosshairs into sharp focus.
   b. Use the scanner's azimuth (a) and elevation (b) control knobs and to locate the backsight target within the crosshairs.
      - Use the telescope focus knob (c) on the scanner head to focus the backsight target as required.
      - Use the eyepiece focus bezel (e) to focus the crosshairs.

> **Tip:** By moving your eye across the eyepiece, you can determine if your eyepiece and objective focus have converged. If your focus is correct, the vertical crosshairs should be stationary. If the reticule moves left and right against the view, continue to adjust your focus.

If using a laser aimer:

Refer to Figure 7-27 below to locate the relevant controls on an SR3 scanner.



a Azimuth control knob
b Aimer elevation control knob

Figure 7-27 Laser aimer controls on an SR3

a. Rotate the elevation control knob (b) or tap in the **Setup** tab to turn on the aimer.
b. Use the scanner's azimuth (a) and elevation (b) controls to align the aimer's red laser beam to the backsight target.

3. Set the backsight in FieldHHC.

   This will be in the **Setup** tab, in one of the following setup types:

   - **Survey Job:** In the **Back Sight** section, tap **Set back sight azimuth**. See 7.5.2 Setting up a survey job on page 80 for the full procedure.
   - **Multiple Back Sights:** Tap **Aiming here** under the appropriate backsight location field. See 7.5.3 Setting up a survey job with multiple backsights on page 85 for the full procedure.

7.6 Acquiring scans

The **Acquire** tab appears after a connection to a scanner has been established and allows you to acquire scans based on the current setup configured in the **Setup** tab.

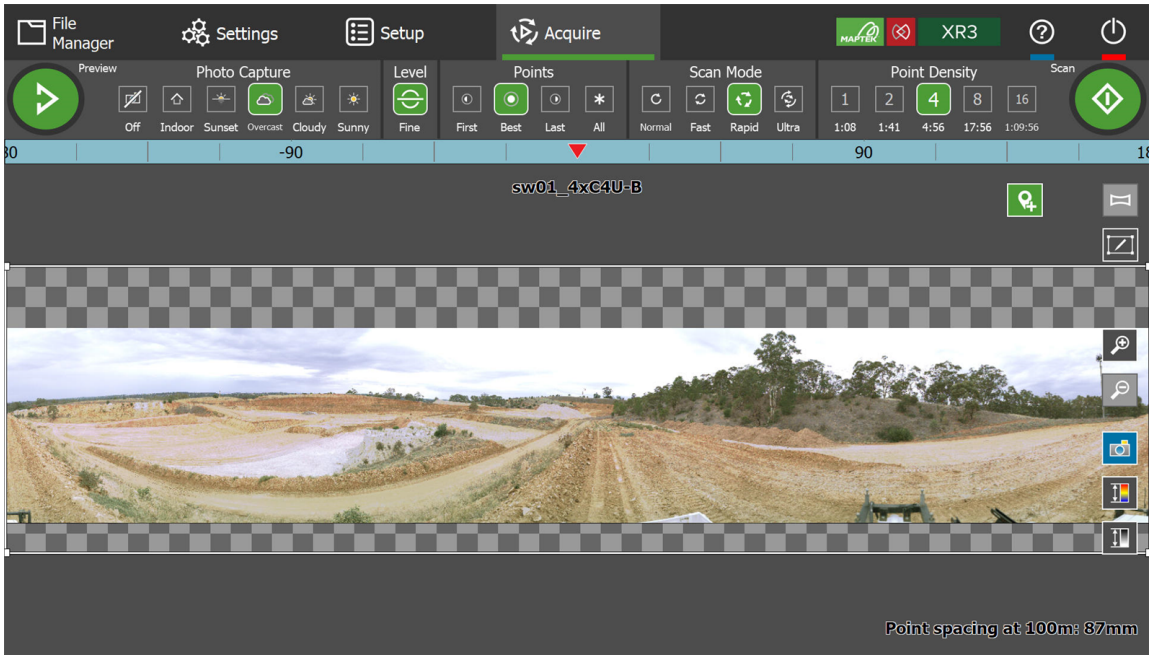


Figure 7-28 Acquire tab

A typical workflow for acquiring scans involves the following:

1. Selecting scan settings from the toolbar at the top. See 7.6.1 Selecting scan settings below for information on each setting.
2. Selecting a region to scan, either the full extents or a smaller region. See 7.6.3 Selecting a region to scan on page 98 for detailed instructions.
3. Taking a preview. See 7.6.4 Taking a preview on page 98 for details.
4. Acquiring scans. See 7.6.5 Taking scans on page 99 for details.

Additionally, the in-viewer controls can be used to perform special functions such as updating the GPS coordinates, taking multiple backsight scans, or dual-window scans. See 7.6.2 Viewer controls on page 96 for details.

7.6.1 Selecting scan settings

The following settings can be chosen in any order prior to taking a preview or scan.

Photo Capture

The **Photo Capture** settings control the camera exposure level.

Note: Photo capture controls are only displayed for scanners equipped with a camera. The options displayed vary between scanner models.

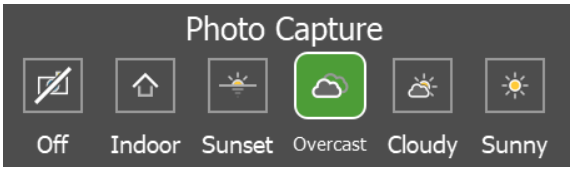


Figure 7-29 Photo capture setting for aboveground conditions

Scanners equipped with cameras for aboveground conditions provide exposure levels ranging from **Indoor**, which should be used for the dimmest lighting conditions, to **Sunny**, for the brightest conditions.

- Select the exposure level that best matches the current lighting conditions.

  Tip: If you are unsure which setting to use, take a preview to get an idea of the effect of the current exposure setting, then adjust the setting as required.

- Select **Off** to turn the camera off.

Photo capture with SR3 scanners

SR3 scanners use a dual-mode exposure system for aboveground and underground photo imaging.

- Switch between aboveground and underground settings by toggling the **Aboveground** / **Underground** button.

The underground settings range from range from **Dim** (highest exposure level) to **Indoor** (lowest exposure level). Depending on the point density selected, some options may be disabled. This is because lower point densities cause the scanner head to traverse too rapidly to allow sufficient light into the camera aperture.

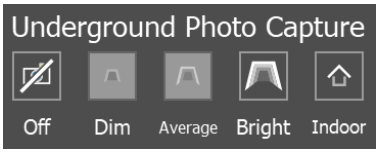


Figure 7-30 Underground photo capture settings for SR3 scanners.

Tip: In dim light conditions, use a higher point density and a slower scan mode for better exposures.

Level

The **Level** button toggles the levelling resolution, as follows:

	**Fine levelling enabled.** The scanner will perform a pre-scan head traversal to determine its inclination and apply a level correction. Fine level correction has a resolution of 20″ increments.
	**Fine levelling disabled; coarse levelling will be applied.** Scanning will commence directly after initiating the scan. Coarse levelling has a resolution of 1° increments.

Tip: Fine levelling is enabled by default. Ensure that the scanner isn't tilted more than 5° off the vertical axis to allow accurate auto-levelling.

Note

Scan filenames include a letter code to indicate the levelling applied, as follows:

- **L** (level): Scan acquired with **Fine** levelling.
- **U** (unlevel): Scan acquired with **Coarse** levelling, or the scanner was tilted more than 5° off its vertical axis.

See 5.5 Scan file naming on page 46 for more information on scan file naming conventions.

See also: 5.1.3 Level correction on page 39

Points

The **Points** setting controls which point returns are saved with the scan when more than one return is picked up along a given scanning beam path.

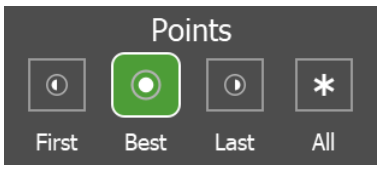


Figure 7-31 Points setting

Choose the setting that provides the cleanest point cloud for the site conditions, as follows:

- **First:** Store the first or closest point returns. Foreground occluders such as vegetation or dust may predominate in the resulting scan.
- **Best:** Store the strongest point return. This uses an intelligent algorithm to select the best return and works well in most conditions.

- **Last:** Store the last point return. This option may improve results when scanning through vegetation, light dust, insects, or snow.
- **All:** Save all point returns.

> **Note:** Selecting **All** may produce point clouds with excessive data and large file sizes. Use only when acquiring all points is necessary. Scans that save all points can be filtered in PointStudio using the **Multi-Return Type** filter.

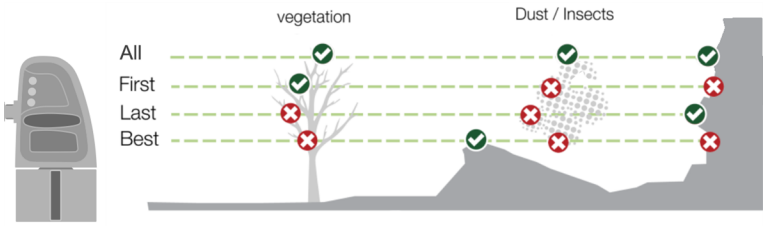


Figure 7-32 Scan point selection in various scenarios.

See also: 5.4.3 Scan point selection on page 45

Scan Mode

The **Scan Mode** setting sets the laser's pulse rate. The higher the pulse rate, the higher the scanning speed. You can consult the acquisition rates for you scanner model in B.2 Laser rangefinder on page 141.

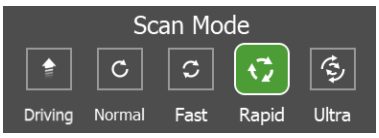


Figure 7-33 Scan mode setting

Select a scan mode that provides the best results for the distance or material being scanned:

- **Normal** (or **Fast** for SR3 scanners) provides the highest quality results and the maximum range performance.
- **Ultra** offers the highest speed at the expense of maximum range.
- **Driving** mode appears when connected to Maptek Drive. The scan mode speeds for driving scans are determined by the **Driving scanning speed** setting under **Settings** > **Configuration**.

> **Tip:** When you have selected a region to scan, an estimate of the scanning times for the given **Scan Mode** are displayed under the **Point Density** setting options.

See also

- 5.4.1 Scan mode on page 43 for more information on scan mode
- B.3 Range versus reflectivity on page 142 for graphs of range versus reflectivity at different acquisition rates for your scanner model

Point Density

The **Point Density** setting sets the scanning resolution.

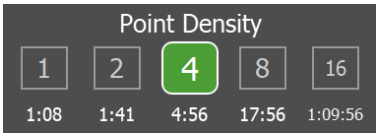


Figure 7-34 Points setting

The lowest point density (**1**) results in the quickest scans, but with the largest spacing between points. The highest point density (**16**) results in the highest resolution scans, but at the expense of scanning time. Higher point densities also result in larger scan files.

Tip: The horizontal and vertical spacing between points halves for each increase in point density. So a point density of 2 has twice as many points in both the horizontal and vertical directions as a point density of 1; a point density of 4 has four times as many points, and so on. See B.4 Scan point density on page 143 to get an indication of the theoretical maximum point count for each point density setting.

Tip: The approximate point spacing at 100 m resulting from the selected point density is displayed at the bottom of the viewer.

Note: SR3 scanners only support point densities 1, 2, 4, and 8.

Note: When **Scan Mode** is set to *Driving*, the point density is fixed to 2 and cannot be changed. **Scan Direction** is shown instead of **Point Density**.

See also: 5.4.2 Point density on page 44

Scan Direction

The **Scan Direction** setting sets the fixed orientation of the scanner head while acquiring a Driving scan.

> **Note:** This setting is only available when connected to Maptek Drive and **Scan Mode** is set to *Driving*.

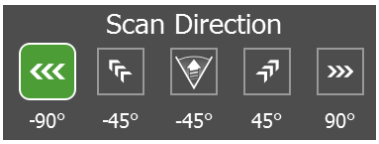


Figure 7-35 Scan direction setting

The scan direction is a clockwise angle relative to the forward direction of the vehicle. For example, to set the scanner to face out to the right side of the vehicle you would set a scan direction of **90°**.

- To set a custom scan direction, tap the button and enter a value.

> **Note:** The **Scanner to forward offset** setting determines the scanner direction relative to the vehicle's forward direction. See 7.3.3 Configuring scanner and Drive vehicle mount offsets on page 72 for details.

7.6.2 Viewer controls

The **Acquire** tab viewer allows you to define the area to scan and displays scan data as it is acquired. Figure 7-36 below identifies the main features and controls of the viewer.

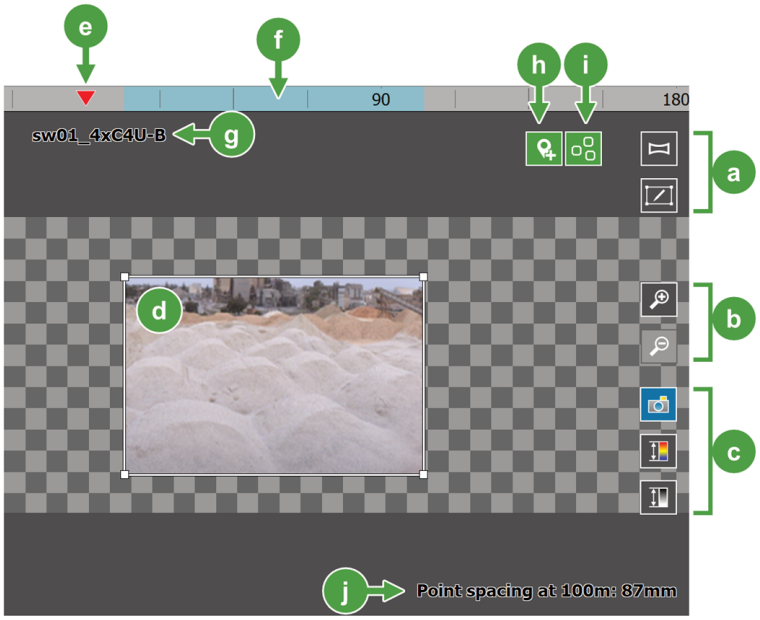


Figure 7-36 Acquire tab viewer controls

a	**Scan region selection modes**  Select full extent (360° horizontal, maximum vertical)  Select a scan window  Dual window (XR3 dual window scanners only)
b	**Zoom controls**  Zoom in  Zoom out
c	**Scan colour schemes**  Photographic colour  Colour intensity with a spectrum  Colour intensity with greyscale
d	**Scan window** Scan data acquisition will be restricted to the defined window.
e	**Zero azimuth indicator**
f	**Azimuth extents bar** This indicates azimuths relative to the scanner's direction. The azimuth extent of any current scanning window is highlighted in blue. You can also use this bar to define a scanning window.
g	**Scan name** This indicates what the scan's name will be based on current setup and acquisition settings.
h	**New GPS setup location** This button appears in stationary defined name setups. Tap it to update the survey-grade GPS coordinates after moving the scanner to a new setup location. This saves you having to switch back to the **Setup** tab. Any existing preview or scan will be cleared from the viewer.
i	**Scan multiple backsights** This button appears in multiple backsight setups. Tap it to take a small window scan of each backsight target.
j	**Point spacing indicator** This gives an indication of the approximate spacing between scan points at a range of 100 m based on the current settings.

7.6.3 Selecting a region to scan

You need to select a region before taking a preview or scan. You can either select the full extent, or define a smaller window.

Selecting the full extent

To select the full extent, tap the (Full extent) button in the viewer. The maximum scanning extent will be captured, i.e. 360° horizontally, and the maximum vertical extent supported by the scanner.

> **Tip:** Take a preview using the full extent, and then refine the region to a smaller window for the scan if required.

Defining a scanning window

To define a scanning window:

1. Tap the (Define window) button in the viewer.
2. Define a window in either of the following ways:
   - Drag a window on the scan area.
   - Drag an extent on the azimuth extents bar. A scanning window will be defined with the selected horizontal extent and the full vertical extent.
3. Adjust the window by dragging the edge or corners.

> **Tip:** To clear the scanning window, tap the azimuth extent bar or tap the button.

7.6.4 Taking a preview

A preview is a quickly acquired image of the scanning region, which can then be used to further refine the region to scan or adjust the camera exposure settings. For scanners equipped with a camera, a photographic image is acquired. For scanners without a camera, a low-resolution scan is acquired.

To take a preview:

1. If using a scanner equipped with a camera, select an appropriate exposure level from the **Photo Capture** (or **Underground Photo Capture**) settings. The other scan settings do not affect previews.
2. Select a region to scan.
   - Tap to select the full extent.
   - Tap to define a smaller scan window.

See 7.6.3 Selecting a region to scan on the previous page for more information.

3. Tap the **Preview** button to take the preview.

7.6.5 Taking scans

You can take a scan as soon as you have selected a region.

- Tap the **Scan** button to start scanning using the current scan settings.

> **Tip**
> When scanning, a progress indicator appears that includes the remaining time to complete the scan.
>
> 
>

After a scan has been acquired, it appears in the **Scans** list in the **File Manager** tab. From here you can view the scan and perform other operations including file management and queries. See 7.2 File management on page 62 and 7.7 Viewing scans on page 101 for more information.

Pausing, resuming, and cancelling scans

You can pause or cancel a scan (or preview) that is in progress. Pausing a scan can be helpful to allow obstacles such as vehicles or dust to disappear before resuming.

- Use the controls that appear on the progress indicator to control scanning, as follows:

	Pause scanning
	Resume scanning
	Cancel current scan

Adding scans

You can queue additional scans with different regions and settings while a scan is in progress. Scanning for each successive scan in the queue will commence when the previous scan is complete.

To queue scans while a scan is in progress:

1. Select a new region to scan.
2. Adjust the scan settings as required.
3. Tap the **Scan** button.

You can repeat this process multiple times while scanning is in progress.

Repeating scans

Any scan in the scan queue, including a scan in progress, can be duplicated and added to the scan queue.

To repeat a scan:

1. Select the scan in the queue that you want to repeat by tapping its progress indicator. The **Scan** button is replaced with the **Repeat Scan** button.
2. Tap **Repeat Scan** to duplicate the scan and add it to the queue. Tap repeatedly to add more duplicates to the queue.

Scanning from a new location

For stationary setups, you need to update your location information whenever the scanner moves.

- For survey jobs, switch to the **Setup** tab and update your location and backsight information as required.
- For defined name setups, you can simply tap the (New setup) button in the viewer on the **Acquire** tab. Alternatively, switch to **Setup** > **Defined name** and then switch back to the **Acquire** tab.

7.7 Viewing scans

Once scans have been acquired, you can view them on the **File Manager** tab. This section discusses the viewing tools. For information on file management operations such as transferring and archiving, see 7.2 File management on page 62.

7.7.1 Viewing scans in panoramic mode

Figure 7-37 below shows the panoramic scan viewer. It displays a panoramic image of the current highlighted scan from the perspective of the scanner.

- Tap a scan's row in the **Scans** list to highlight it and display it in the panoramic viewer.
- Drag anywhere on the image to pan.
- Tap the (Zoom in) button to zoom in on the scan. This hides the scans list and enables the annotation tools. Tap (Exit) to exit zoomed in mode.

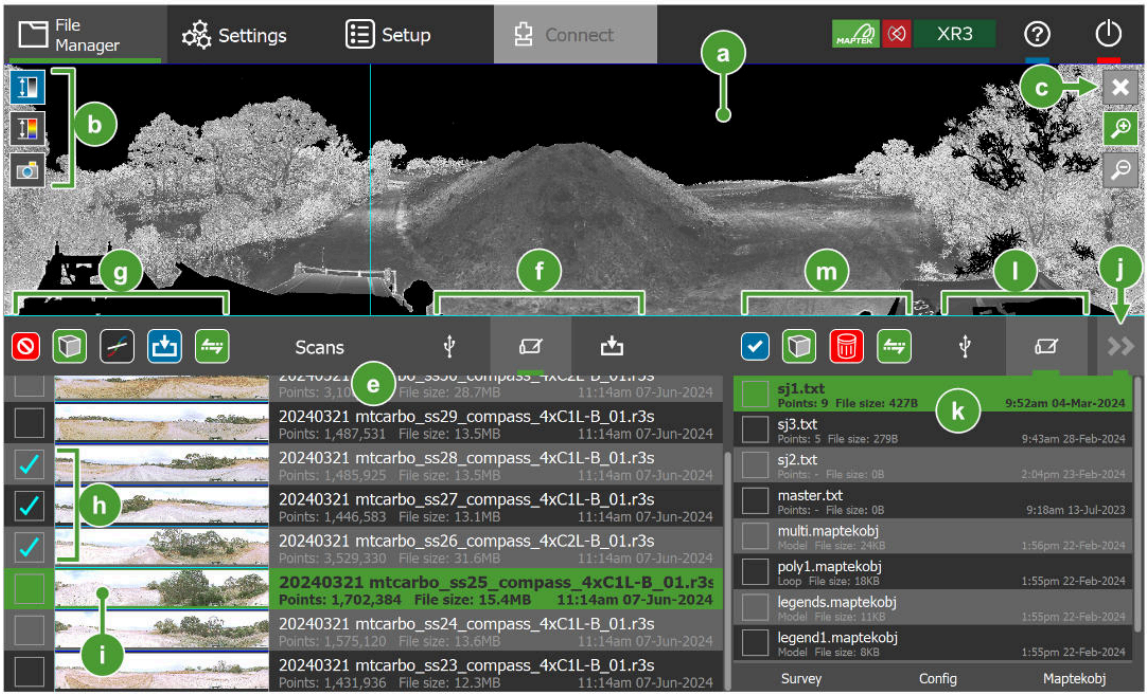


Figure 7-37 Panoramic scan viewer in File Manager.

a	**Panoramic scan viewer**	
b	**Scan colour schemes**	Photographic colour Colour intensity with a spectrum Colour intensity with greyscale
c	**Exit current view**	The button enables when zoomed in or in 3D view mode.
d	**Zoom controls**	Zoom in Zoom out

e	**Scans list**	This lists the scan files in the selected scan repository (f).
f	**Scan repository selectors**	See 7.2.1 Transferring, archiving, and deleting scan files on page 62 for more information.
g	**Scan selection tools**	Select all scans Deselect all scans View selected scans in 3D (see 7.7.3 Viewing scans in 3D on page 107 for details) Start design conformance Archive selected scans Transfer selected scans These tools operate on scans selected in the Scans list (h). If no scans are selected, they operate on the highlighted scan (i). See 7.2.1 Transferring, archiving, and deleting scan files on page 62 for more information on transferring and archiving.
h	**Selected scans**	
i	**Highlighted scan**	The highlighted scan appears in the panoramic viewer.
j	**Files drawer toggle button**	Tap to hide or show the files drawer.
k	**Files drawer**	Non-scan files appear here. See 7.2.2 Managing non-scan file types on page 64 for details on managing non-scan files.
l	**Non-scan file location selectors**	
m	**File selection tools**	Select all files Deselect all files View selected objects in 3D Transfer selected files

Scan colour schemes

Scans can be coloured in three ways, as follows:

Photographic colour

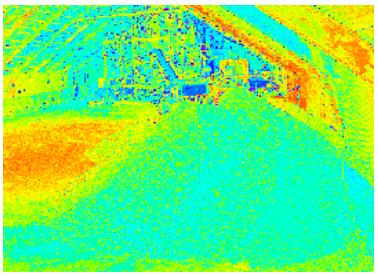
Colours each scan point with photographic colouring acquired from the camera (if available).



> **Note:** Photographic images do not cover the full vertical extents of the scan because of the camera's reduced field of view. This may be noticeable when viewing scans taken close to walls or other tall structures.

Colour intensity with a spectrum

Colours each scan point by the intensity of the result using a colour spectrum. The lowest intensities are coloured blue, while the highest intensities are coloured red.



Colour intensity with greyscale

Colours each scan point by the intensity of the result using greyscale. The lowest intensities are coloured white, while the highest intensities are coloured dark grey. The scale is not linear and may help bring out detail not evident using the other schemes.



> **Note:** If multiple scans are viewed in 3D view mode, a different uniform colour is applied to each scan viewed with the greyscale intensity option.

7.7.2 Annotating scans

The annotation tool allows you to draw freehand lines to identify features of interest on a scan. Annotations are stored with the scan, and can be viewed in FieldHHC's panoramic or 3D viewers, or in PointStudio.

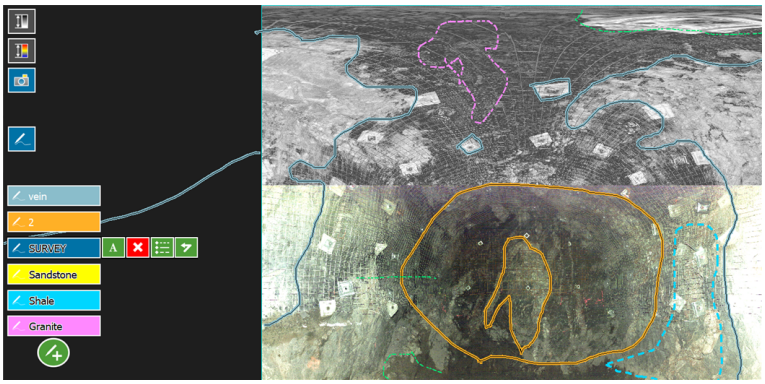


Figure 7-38 Annotations drawn on a scan in the panoramic viewer.

Tip: Annotations are drawn in the 'zoomed in' mode of the panoramic viewer. Tap the (Zoom in) button to view annotations and use the annotation tools. The (Add annotation) button should appear when you zoom in. If not, annotations may be hidden. Tap the (Show/hide annotations) toggle to show annotations and reveal the button.

Creating annotations

To create an annotation:

1. Make sure you are on the **File Manager** tab and the scan you wish to annotate is highlighted in the **Scans** list.
2. Tap the (Zoom in) button to show the annotation tools. If annotations are hidden, tap the (Show/hide annotations) toggle.
3. Tap the (Add annotation) button. A new annotation label appears on the screen.
4. If you have selected an active feature code set in **Settings**, a dialog will appear that allows you choose a style for your annotations. Select the desired feature code and tap **Apply**. If there is no active feature code set, the default feature code style will be used for annotations.
5. Use the stylus to draw an annotation on the scan. You can create more than one annotation line for a single label.

Note: Annotations are initially given a label based on the feature code name. If the default feature code is used, the label will be based on an increasing number starting at 1.

- Tap the annotation's label field to stop annotating and return the view to pan mode.

Editing annotations

After creating an annotation, you can edit it as follows:

- Tap an annotation's label field to select it for editing and show its controls, explained below.



A	Edit the annotation label.
	Delete the annotation.
	Set the annotation's feature code (change its style).
	Undo the previously drawn line.
	Redo a line that was undone.

- Continue drawing on the scan image to add new lines to the selected annotation.
- Tap the annotation's label field to stop annotating and return the view to pan mode.

Showing and hiding annotations

You can show or hide annotations in both the panoramic viewer and the 3D viewer.

- Tap the (Show/hide annotations) toggle to show or hide all annotations.
- In the 3D viewer, while annotations are showing, tap the A (Show/hide labels) toggle to show or hide annotation labels only.

Feature codes

Feature codes are named line styles that you can apply to annotations. By default, FieldHHC will create annotations as solid lines using a unique colour for each new annotation. By creating your own feature codes, you can use a consistent custom annotation style for a given feature type, such as a resource type or geological feature. You can have multiple sets of feature codes available in FieldHHC and set a single one as the active set to use for new annotations.



Figure 7-39 A example custom feature code set.

Creating feature codes

Features codes need to be created in PointStudio and then copied into FieldHHC.

To create feature codes in PointStudio:

1. Go to the **Features** tab in the PointStudio preferences.
2. Select **New...** from the **Profile** drop-down to create a new feature set.
3. Click **Add...** to create a new feature. Configure the following fields for the feature as desired:
   - **Name**
   - **Colour**
   - **Thickness**
   - **Style**

   > **Note:** The other feature fields are not used in FieldHHC.

4. Continue adding new features for every named style you want.
5. Click **Export...** to export the feature code set to a JSON file (`.json`).

Consult the PointStudio help for more information on feature codes.

Setting and using the active feature code set

After creating feature codes and exporting them from PointStudio, you can use them in FieldHHC as follows:

1. Copy the JSON file defining a feature code set into FieldHHC. See Copying files from USB key on page 65 for detailed instructions.
2. Set the active feature code set. The active feature code set affects which feature codes or styles are available for selection when creating new annotations.

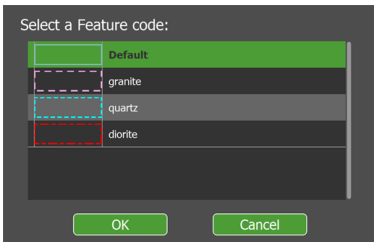
   To set the active feature code set:

   a. Go to **Settings** > **Configuration**.

   b. Tap the button next to **Feature code**.

   c. Select the filename containing the desired feature code set from the list and tap **Apply**.

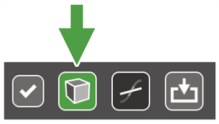
3. Create annotations as normal. When you create a new annotation, you will be prompted to select a feature code. The new annotation's initial label will be taken from the feature code name, and the feature code's style will be applied to the annotation lines.



7.7.3 Viewing scans in 3D

You can view scans and other data in 3D. The FieldHHC 3D viewer allows you to access other tools including design conformance, in-field registration and advanced registration.

- To view scans in 3D, select one or more scans in the **Scans** list, and then tap the (View in 3D) button.



- To view other object types in 3D, select them in the **Files** drawer, and then tap the (View in 3D) button.
- To exit the 3D viewer and return to the panoramic viewer, tap the button (see f in Figure 7-40 on the next page).

3D viewer and controls

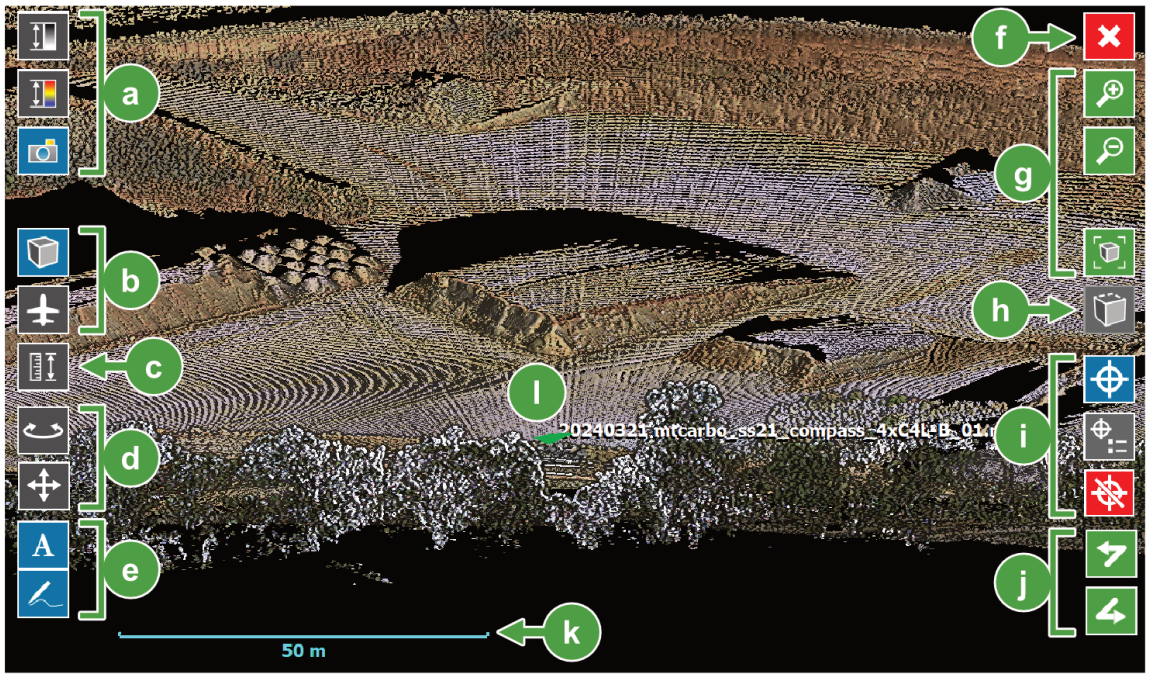
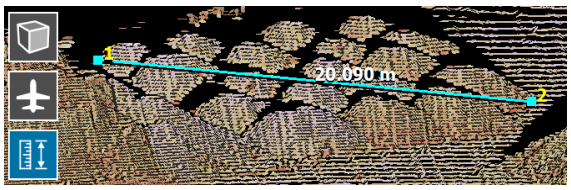


Figure 7-40 A scan viewed in the 3D viewer.

a	**Scan colour schemes**	Photographic colour Colour intensity with a spectrum Colour intensity with greyscale See Scan colour schemes on page 103 for more information.
b	**View modes**	Z-Up view Aerial view
c	**Measure tool**	Tap to turn on the measure tool. Drag a line between two points to measure the distance between them. 
d	**Manual positioning tools**	See 7.8.2 Manually positioning scans on page 113 for details.
e	**Annotation toggles**	Show or hide annotation text labels Show or hide annotations
f	**Exit 3D view**	Tap to exit the 3D view and return to the panoramic viewer.

g	**Zoom controls**	Zoom in Zoom out Zoom to data extents
h	**Back face points toggle**	See Hiding back face points on the next page for details.
i	**Registration tools**	See 7.8 Registering scans on page 112 for details.
j	**Undo and redo**	Undo last action (appears when undo possible) Redo last action (appears when redo possible)
k	**Scale bar**	Gives an indication of the scale of distances at the current zoom level.
l	**Compass and scan origin**	The scan origin is indicated in the view with an X symbol. In Z-up view mode, the axis of rotation is indicated with a 3D compass arrow. The axis of rotation compass turns blue when the measure tool is on. The axis of rotation compass turns red in manual rotation mode. The axis of rotation compass turns yellow in manual translation mode.

Panning, zooming, and rotating the view

Use the following methods to pan, zoom, and rotate the view, depending on the current view mode.

	Z-Up view	Aerial view
Pan	▸ Tap on a point relative to the compass to pan in that direction. ▸ Alternatively, pan by dragging the view with two fingers.	▸ Pan the view by dragging with the stylus or a single finger.
Zoom	▸ Use the and buttons to zoom in or out. ▸ Alternatively, zoom by pinching the view with two fingers. Pinch fingers apart to zoom in. Pinch fingers together to zoom out.	▸ Use the and buttons to zoom in or out. ▸ Alternatively, zoom by pinching the view with two fingers. Pinch fingers apart to zoom in. Pinch fingers together to zoom out.
Rotate	▸ Rotate the view around the compass by dragging with the stylus or a single finger.	(Rotation is disabled in aerial view mode.)

Hiding back face points

When scanning inside an enclosed space such as indoors or underground, the resulting scan contains points representing walls, roofs, and other surfaces that can obscure your view of the inside of the scanned space. These points are called *back face points* because they represent the back side of the surface when viewed from a given camera angle. You can hide these points to obtain a better view of the interior surface.

- Tap the (Show/hide back face points) button to toggle between showing or hiding back face points (see h in Figure 7-40 on page 108). When enabled, back face points are hidden. Because back face points are defined by the current camera angle, the points hidden or shown will change dynamically as you rotate the view.

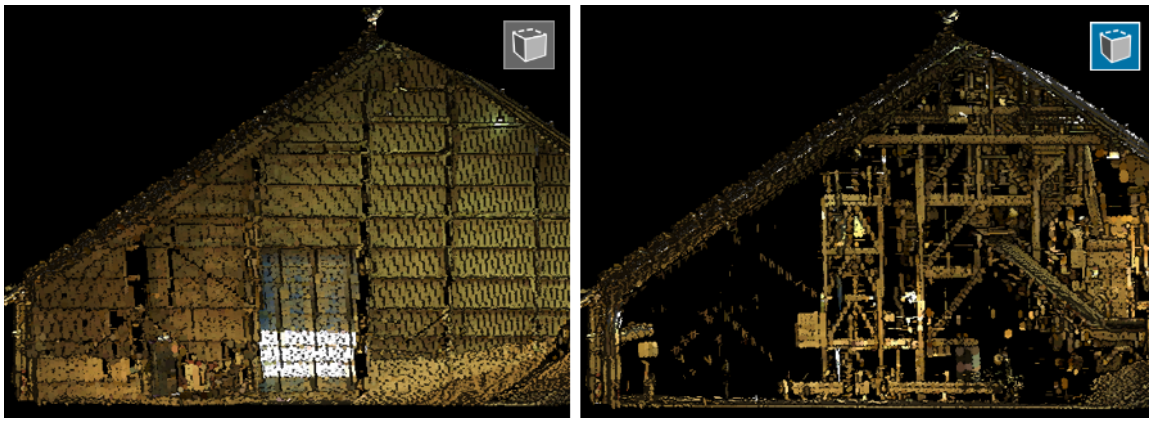


Figure 7-41 Comparison of a scan viewed with back face hiding disabled (left) and enabled (right).

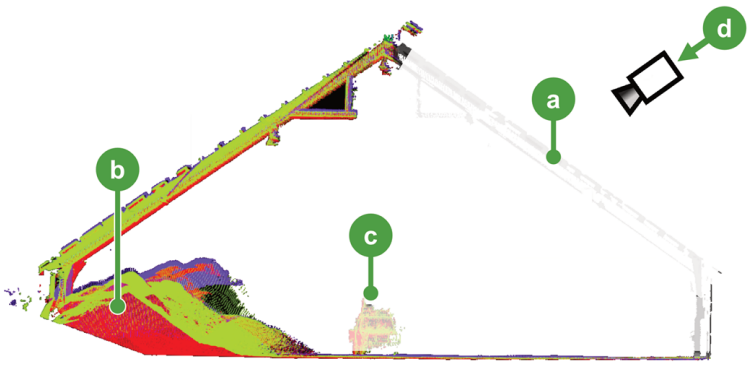


Figure 7-42 Hiding back face points (a) allows the interior parts of a scan (b) to be visible. The scanner origin (c) is used to determine which points are back-facing for the current camera angle (d).

7.8 Registering scans

FieldHHC features the following tools that can be used to register scans:

- **Fixed origin registration.** This tool corrects orientation errors in fixed origin scans. See 7.8.1 Fixed origin registration below for details.
- **Manual positioning tools.** These can be used to move unregistered scans into roughly the correct position and orientation, and can be used before applying advanced registration. See 7.8.2 Manually positioning scans on the facing page for details.
- **Advanced registration.** The advanced registration tools provide much greater control over the registration process and include auto-initial positioning and global registration. See 7.8.3 Advanced registration on page 114 for details.

> **Important:** Advanced registration is a licensed feature. You need a licence tied to the scanner that acquired the scans to use it. See 7.3.5 Licensing advanced tools on page 76 for details.

7.8.1 Fixed origin registration

You can use the fixed origin registration tool to correct orientation errors in fixed origin scans that were positioned using survey-grade GPS. The fixed scanner location can be from the Bluetooth GPS device, Maptek Drive (for stationary scans only), or manually entered. Fixed origin registration corrects inaccurate compass and GPS track headings that cause adjoining scans to have misaligned orientations.

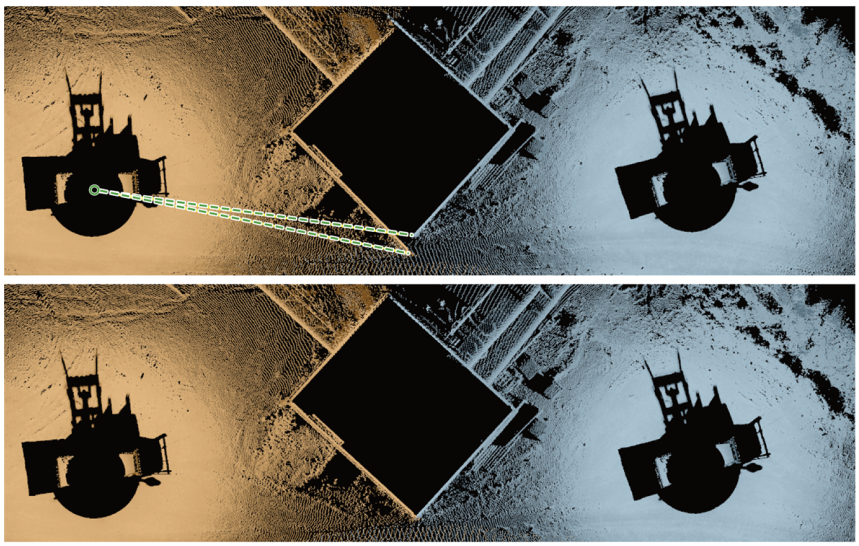


Figure 7-43 Example showing a scan registered using in-field registration. The top image shows a misalignment between the scans. The bottom image show the result after the tool rotates the left scan clockwise to align the scans.

Note: Scans located using the internal GPS are not considered fixed and cannot be registered using this tool.

To perform fixed origin scan registration, follow these steps:

1. Make sure you are on the **File Manager** tab.
2. Select at least two fixed origin scans from the **Scans** list. The scans must be from the same survey job.

   Note: The tool can process a maximum of 64 million points across all scans in a single run.

3. Enter 3D view mode by tapping the (View in 3D) button located above the **Scans** list.
4. Tap the (Fixed origin registration) button in the view to initiate the registration process.

If registration was successful, the scans should visually mesh together better. The registration information is stored in the scan file.

- To undo the registration, tap .
- To reset registration to its original state, tap (Revert registration).

Tip: In-field registration can register multiple scans at once. However, in some cases, one or more scans may fail to correctly align. The best approach is to register a pair of adjacent overlapping scans and confirm the result before proceeding with another subset of scans. When all subsets have been registered, select all scans and apply a final registration, checking that all the scans are correctly aligned.

7.8.2 Manually positioning scans

You can adjust the position of unregistered scans in space using the manual positioning tools (see d in Figure 7-40 on page 108). You can use these tools to move scans into roughly the correct position and orientation before using the advanced registration tools. There are two manual positioning tools, described below.

Manual rotation	Rotate a scan about its origin. ▸ Tap to enter manual rotation mode. ▸ Drag a scan to rotate it about its origin. ▸ Drag free space to rotate the view.

Manual translation Translate a scan in the plane defined by the current viewing angle.

- Tap to enter manual rotation mode.
- Drag a scan to translate it.
- Drag free space to rotate the view.

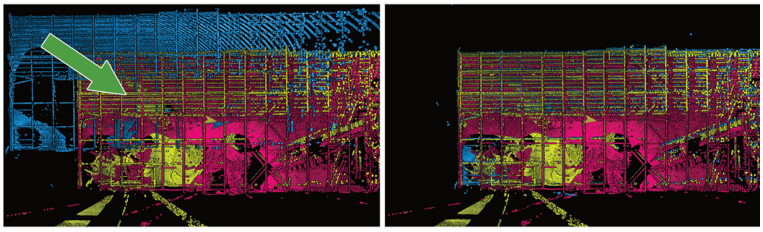


Figure 7-44 Example of manual translation.

- Tap the (Undo) button in the view to undo the translation or rotation and return the scan to its previous state.

Tip: To avoid accidentally moving scans, tap to exit the manual translation or rotation modes.

7.8.3 Advanced registration

The advanced registration tools provide a great deal of control over the registration process. They are based on the automated initial position and global registration tools available in PointStudio. You can perform registration by manually setting parameters and applying registration passes, or you can run a registration sequence that has been previously defined in PointStudio.

Important: Advanced registration is a licensed feature. You need a licence tied to the scanner that acquired the scans to use it. See 7.3.5 Licensing advanced tools on page 76 for details.

Advanced registration uses 3D feature matching to align scans to fixed reference data. The following methods can be applied:

- **Auto Initial Position.** Use auto initial position to place unregistered scans into roughly the right positions with respect to each other before applying global registration.
- **Registration.** Apply global registration to accurately register scans.

For registration to work, scans must have sufficient overlap between them providing common features to match. Registration processing can be further refined by applying constraints to limit how scans are allowed to move. In addition, filtering, bounding, and sampling parameters can be adjusted for the best possible results.



Figure 7-45 Advanced registration tools.

Opening the advanced registration tools

To start the advanced registration tools:

1. Make sure you are on the **File Manager** tab.
2. Select the scans in the **Scans** list you want to register. If using other fixed reference data such as a surface or pointset, select these from the **Files** drawer.

   > **Note:** Surfaces or pointsets must be stored in Maptek object files (`.maptekobj`). See 7.2.2 Managing non-scan file types on page 64 for more information.

3. Enter 3D view mode by tapping the (View in 3D) button located above the **Scans** list.
4. Tap the (Advanced registration) button located on the right side of the view. The scans are each assigned a unique colour and the advanced registration controls appear.

Managing registration data in the file list

The file list shows the scans and reference data files that were selected when you started the advanced registration tool. From here you can select scans to register and configure scan registration constraints.

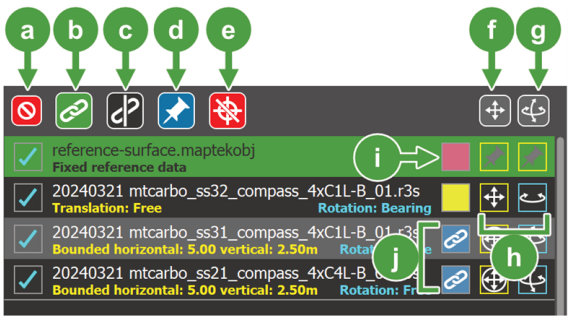


Figure 7-46 Advanced registration file list.

a	Select all / Deselect all
b	Link selected scans
c	Unlink selected scans
d	Set selected scans as fixed reference data
e	Remove registration from selected scans
f	Cycle translation constraints on selected scans
g	Cycle rotation constraints on selected scans
h	Translation and rotation constraints for an individual scan
i	Scan colour
j	Linked scans

Linking scans

Scans can be linked to other scans to form a single group. Groups of linked scans are treated as a single object in the view or when moved by a registration tool. This is useful where subsets of scans are already registered correctly with respect to each other and would not benefit from any further registration.

- To link two or more scans, select them in the file list and tap the (Link) button. Linked scans are given a single uniform colour and are indicated by a link icon in their row in the file list (see j in Figure 7-46 on the previous page).
- To unlink scans from a group, select the scans you want to unlink in the file list and tap the (Unlink) button.

Setting translation and rotation constraints

Registration is essentially a process of translating and rotating scans until they are correctly aligned in space with as little error as possible. However, excess freedom of movement can lead to false matches and incorrect registration results. You can set constraints on the type and extent of movement allowed on scans during registration to improve results.

The following translation constraints can be applied to scans:

	Free translation Horizontal and vertical translation by any distance are both allowed.
	Bounded translation Horizontal and vertical translation are both allowed, but limited to set distance bounds. The bounds are set in the **Manual bounds** setting (see Running registration manually on page 118).
	Fixed The scan's location is fixed; translation is not allowed.

The following rotation constraints can be applied to scans:

	Free rotation Rotation is unrestricted. A scan can be both rotated around its vertical axis, and also have the tilt of its vertical axis adjusted.
	Bearing-only rotation Rotation is only allowed around a scan's vertical axis; tilting of the vertical axis is not allowed.
	Fixed The scan's rotation is fixed; rotation is not allowed.

- To change the translation or rotation constraints of a single scan or linked scan group, tap the constraint button in a single row in the file list (see h in Figure 7-46 on page 115). The constraint will change to the next setting in the cycle. Tap the button until the desired constraint is set. The text beneath each scan in the list indicates the constraints that are currently set on it.

  Note: Some translation and rotation constraints are mutually exclusive. FieldHHC will change both constraints to avoid incompatible combinations.

- To change the translation or rotation constraints of multiple scans, select them in the list and tap the translation or rotation buttons located above the list (see f and g in Figure 7-46 on page 115). The relevant constraint of selected scans will be set to the next constraint indicated by the button's icon.

Fixed reference data

Fixed reference data is data that does not move during registration. Instead, it serves as the fixed reference to which the unregistered scans can be aligned to. Fixed reference data has both translation and rotation constraints set to (Fixed). Providing fixed reference data is optional, but it can aid in providing a better registration result.

- To set one or more scans as fixed reference data, select them in the file list and tap the (Set as fixed reference data) button located above the file list.

Note: Pointsets and surfaces can only be included as fixed reference data for registration.

Scan colour

Each scan or linked scan group is given a unique uniform colour to help differentiate objects in the view. The uniform colour is only applied when the greyscale intensity colour scheme ( ) is selected in the view.

- To change the uniform colour of a scan or linked scan group, tap the colour button in a scan's row in the file list.

Running registration manually

You can run registration passes manually on the **Manual** tab of the advanced registration tool.

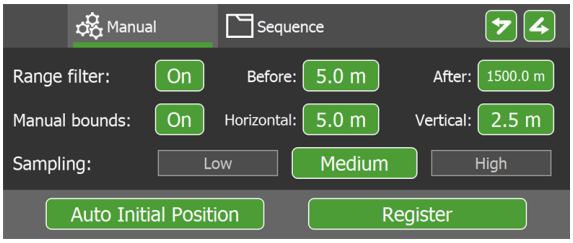


Figure 7-47 Manual registration panel.

Configure the parameters as follows:

Range filter	This setting can be used to define the range of point samples to use in the registration algorithm. When enabled, points outside the range defined by the **Before** and **After** fields are filtered (ignored).
Manual bounds	When enabled, this setting limits the degree of horizontal and vertical translation allowed for scans with a bounded translation constraint set (see Setting translation and rotation constraints on page 116).
Sampling	This setting determines how many points are used to register the scans. Choose from the following options: • **Low.** Use this setting when registering scans that have closely spaced points or consist of flatter surfaces with coarser data matching patterns. Low sampling provides faster initial results. • **Medium.** Use this setting in scenarios where nearby surface features are more prominent while also sampling sparse or distant scan points. • **High.** Use this to process the maximum amount of points. This mode is most often used in scenarios such as scanning from an elevated position or when scanning in voids where more detail is required to detect and combine matching features.

After configuring parameters, you can proceed with registration by tapping the **Auto Initial Position** or **Register** buttons.

Note: Only scans selected in the file list are registered. Be sure to select all scans you want included in the registration pass (including fixed reference data) before proceeding.

Auto Initial Position	This attempts to place selected scans into roughly their correct locations with respect to each other. It is best suited for initial iterations. For more precise registration after initial positioning, use **Register**. **Note:** Auto Initial Position ignores translation and rotation constraints set on scans, but it does not alter fixed reference scans.
Register	Register selected scans using the global registration algorithm. It is recommended that scans be placed in roughly their correct positions (either manually or using Auto Initial Position) before attempting final registration using this method. **Tip:** Take note of the final separation value indicated in the notification bar after running registration. A lower separation value indicates a better result. You may need to experiment with different scan constraints and other settings to achieve the best registration result. 5 - Completed scan registration with final separation: 42.123 mm.

- Tap the (Undo) button to undo the last registration action.
- Tap the (Redo) button to redo a registration action that was undone. By alternating between undo and redo, you can observe the performance of the registration in the view.
- Tap the (Remove registration) button to remove all registration information from selected scans and revert them to their original state.

Running a registration sequence

Achieving a good registration result often involves iteratively applying auto initial positioning and registration using different constraints and settings. A *registration sequence* is a predefined configuration of such registration passes. You can define customised registration sequences in PointStudio and run them in FieldHHC.

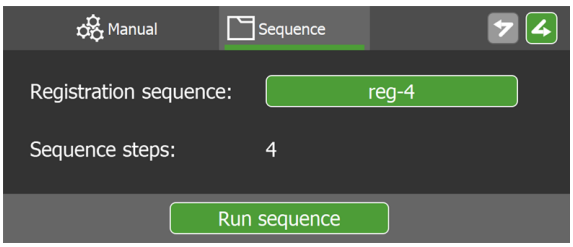


Figure 7-48 Registration sequence panel.

Creating a registration sequence

To create a registration sequence, open the **Create FieldHHC Registration Sequence** tool in PointStudio. You can access the tool by going to the **Position and Filter** tab and then selecting

Create FieldHHC Registration Sequence from the **Register** drop-down.

The tool allows you define a sequence of registration passes with different constraints and settings and then export this sequence as a JSON (`.json`) file.

Refer to the PointStudio help for more information.

Running a registration sequence

To run a registration sequence in FieldHHC:

1. Copy the registration sequence JSON file created in PointStudio to the FieldHHC internal drive. See 7.2.2 Managing non-scan file types on page 64 for detailed instructions.
2. In the **File Manager** tab, select the scans you want to register from the **Scans** list. If using other fixed reference data such as a surface or pointset, select these from the **Files** drawer.
3. Enter 3D view mode by tapping the (View in 3D) button located above the **Scans** list.
4. Tap the (Advanced registration) button located on the right side of the view.
5. Optionally set one or more scans to be fixed reference data by selecting them in the files list and tapping the button above the list.
6. Select all the scans you wish to register.
7. Switch to the Sequence tab located in the bottom-right.
8. Tap the button next to **Registration sequence**. A list of available registration sequences in FieldHHC displays.
9. Select a sequence and tap **OK**. **Sequence steps** identifies the number of steps in the sequence.
10. Tap **Run Sequence** to run the registration sequence.

- Tap the (Undo) button to undo the last registration action.
- Tap the (Redo) button to redo a registration action that was undone. By alternating between undo and redo, you can observe the performance of the registration in the view.
- Tap the (Remove registration) button to remove all registration information from selected scans and revert them to their original state.

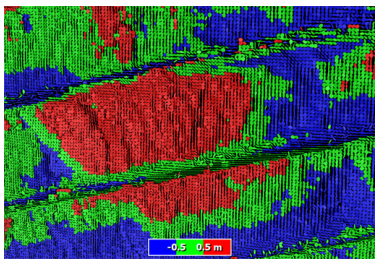
7.9 Checking design conformance

FieldHHC provides a set of design conformance tools as a licensed add-on. Design conformance allows you to compare registered as-built scan data against a design surface.

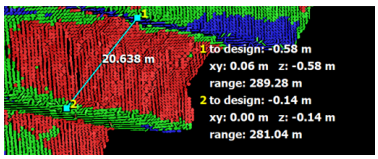
> **Important:** Design conformance is a licensed feature. You need a licence tied to the scanner that acquired the scans to use it. See 7.3.5 Licensing advanced tools on page 76 for details.

The following features are included in the add-on:

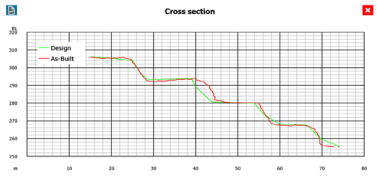
3D design conformance view mode
View scan data coloured by distance to design.



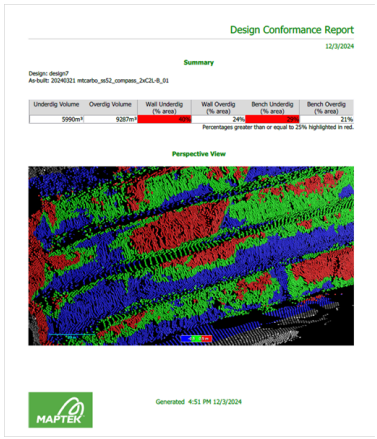
Distance to design point queries
Query the exact distance between the as-built and the design at any selected point.



Cross sections
See as-built conformance to design in a vertical 2D slice defined by one or two points. Export the results to a PDF report.



Conformance reports
Create a PDF report that summarises design conformance, including overdig and underdig tonnages.



7.9.1 Configuring design conformance settings

The design conformance tools require configuration before use. At a minimum, you need to supply a design surface to compare as-built scan data with. You also need a licence tied to the scanner that acquired the scans. You can also optionally supply a custom legend for colouring scans, and a report boundary to define the extent of conformance reports.

To configure design conformance, follow these steps:

1. Export the design surface and any additional objects such as custom legends or boundary polygons from PointStudio as Maptek object files (`.maptekobj`). Each object should be exported to a separate file.
2. Save the Maptek object files to a folder named `Maptek Files` on a USB key.
3. Insert the USB key into the FieldHHC tablet and transfer the files to FieldHHC. See Copying files from USB key on page 65 for details.
4. In FieldHHC, go to **Settings** > **Configuration** > **Licences** and tap **Configuration** to open the Conformance and licence configuration panel.

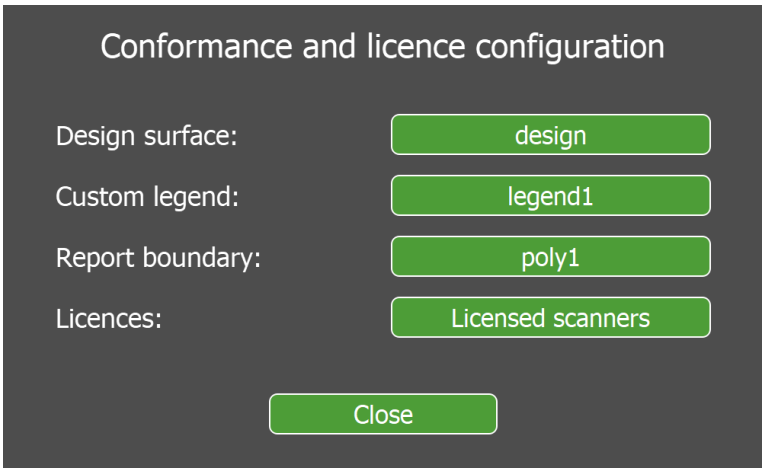


Figure 7-49 Configuration settings subtab

Configure the panel as follows:

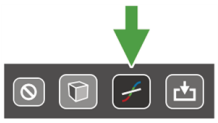
- **Design surface:** Set the surface to use for design conformance. The tool will list any surfaces that have been transferred to FieldHHC as Maptek object files (`.maptekobj`).
- **Custom legend:** Set the legend to use to when colouring design conformance. The tool will list any legends that have been transferred to FieldHHC as Maptek object files (`.maptekobj`).
- **Report boundary:** Set a polygon to use to limit the extent of the design conformance report. The tool will list any polygons that have been transferred to FieldHHC as Maptek object files (`.maptekobj`).

5. Confirm that you have a valid licence installed by tapping **Licensed scanners**. See 7.3.5 Licensing advanced tools on page 76 for details on licensing advanced tools.

7.9.2 Starting design conformance view mode

Once conformance has been configured you can enter design conformance view mode on the **File Manager** tab.

- To start working with the design conformance tools, select one or more scans in the **Scans** list and then tap the (Design conformance) button.



> **Tip:** You can also include other objects such as polygons and surfaces in the design conformance view by selecting them in the files drawer along with the scans.

The scans will open in a 3D design conformance view, with scan points coloured by their distance to the design surface.

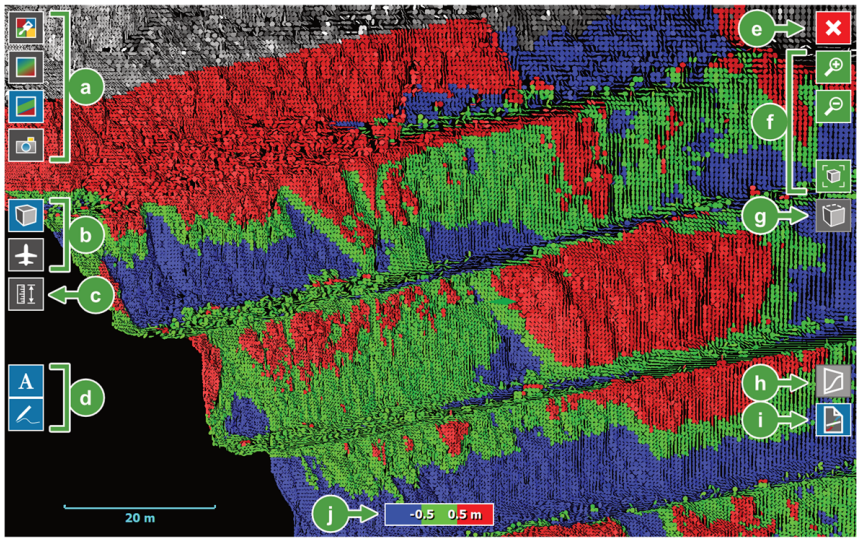


Figure 7-50 Design conformance view

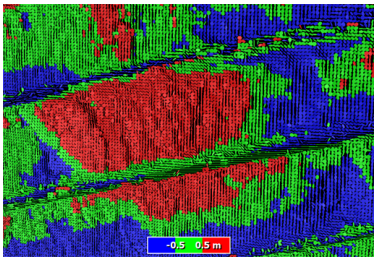
a	Colour schemes
b	View modes
c	Measure tool
d	Annotation toggles
e	Exit design conformance view
f	Zoom controls
g	Back face points toggle
h	Cross section view
i	Design conformance report tool
j	Legend

Colour schemes

When you enter design conformance view, scan points are coloured by their distance to the design surface. You can choose from the following colour schemes:

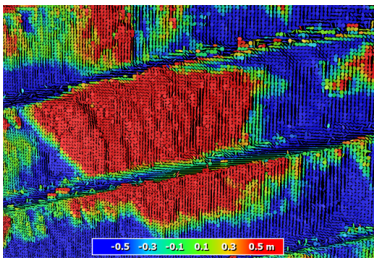
Solid colour

Use a predefined solid colour legend. This is the default colour scheme. Scan points above or in front of the design surface at a distance of 0.5 m (1.6 ft) or more are coloured red. Points below or behind the design surface at a distance of 0.5 m or more a coloured blue. Points within 0.5 m are coloured green.



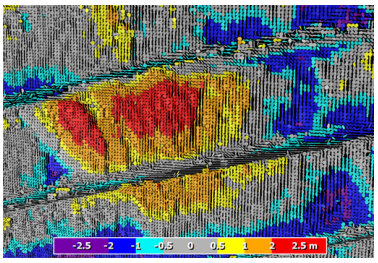
Smooth colour

Use a predefined smooth colour legend. The legend colours distances using fixed intervals in the range ±0.5 m (±1.6 ft). Smooth colouring means colours between interval boundaries are interpolated, resulting in a gradient effect.



Custom legend

Use a custom legend to colour scan points using colours and intervals of your choosing. You can define a custom legend in PointStudio and then transfer it to FieldHHC. See 7.9.1 Configuring design conformance settings on page 122 for more information.



Tip: When defining a custom legend's boundaries, negative distances indicate points that are below or behind the design surface, and positive distances indicate points that are above or in front of the design surface.

Photographic colour

This scheme uses the scan's photographic image to colour scan points. Distance to design colouring is not applied.



Measure tool

The measure tool allows to you query information at a point or between two points, and is also the starting point for creating cross sections.

- To turn the measure tool on, tap the (Measure) button.
- To query the distance to design of a single point, tap the point.

  The following values are displayed in the view:
  - **to design:** the shortest distance from the point to the design surface
  - **xy:** the XY component of the shortest distance vector from the point to the design surface
  - **z:** the Z component of the shortest distance vector
  - **range:** the distance from the scan origin to the point

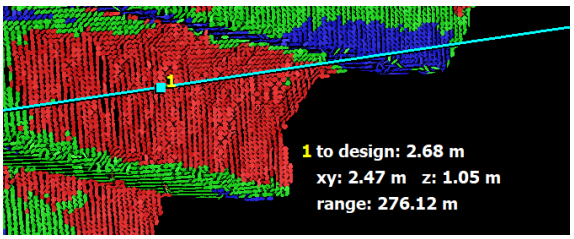


Figure 7-51 Single point query using the measure tool.

- To query the distance between two points, drag a line between the two points.

  Information about each point is displayed as per the single point query, and the distance between the two points is shown on the line.

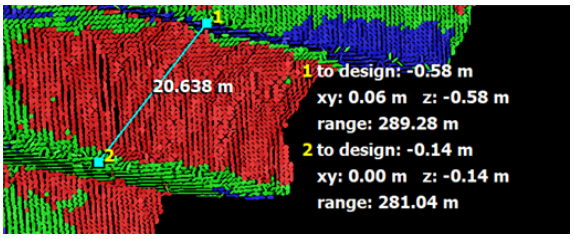


Figure 7-52 Two-point query using the measure tool.

> **Tip:** To cancel the current query, tap on a blank part of the view. Tap (Z-Up mode) to continue panning and rotating the view.

7.9.3 Creating cross sections

You can create a cross section at any point, or between two points, using the measure tool.

- Using a single point will create a cross section from the vertical plane that is perpendicular to the design surface at that point. The horizontal axis of the cross section will include the maximum extent of the data.

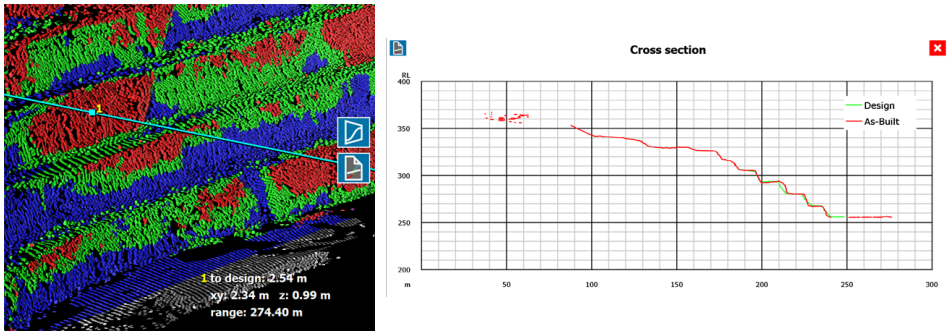


Figure 7-53 Single point query (left) and the resulting cross section (right)

- Using two points will create a cross section from the vertical plane that passes through the two points. The horizontal axis of the cross section will cover the extent of data between the two points.

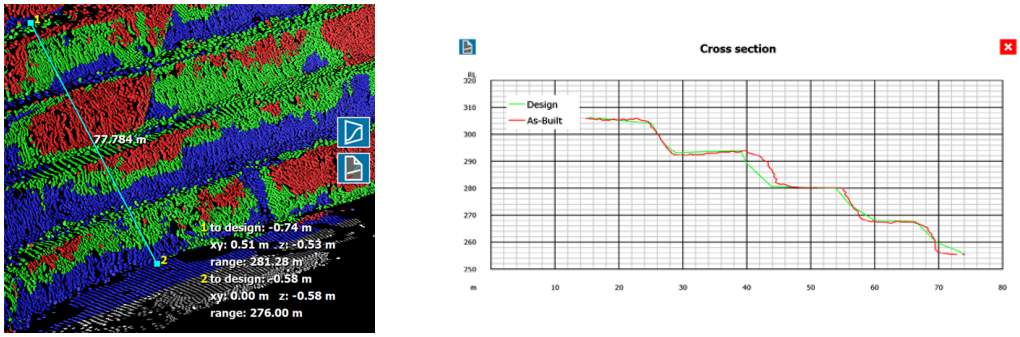


Figure 7-54 Two-point query (left) and the resulting cross section (right) showing only data between the two points.

To create a cross section:

1. Start by performing a single or two-point query using the measure tool ( ) .
   - Tap a single point to perform a single-point query.
   - Drag a line between two points to perform a two-point query.

2. Tap the (Cross section) button to generate the cross section.



- To generate a PDF cross section report, make sure a USB key is inserted, then tap the (Generate report) button located in the top-left corner of the cross section panel. The report PDF is saved to the folder `Maptek Files` on the USB key.

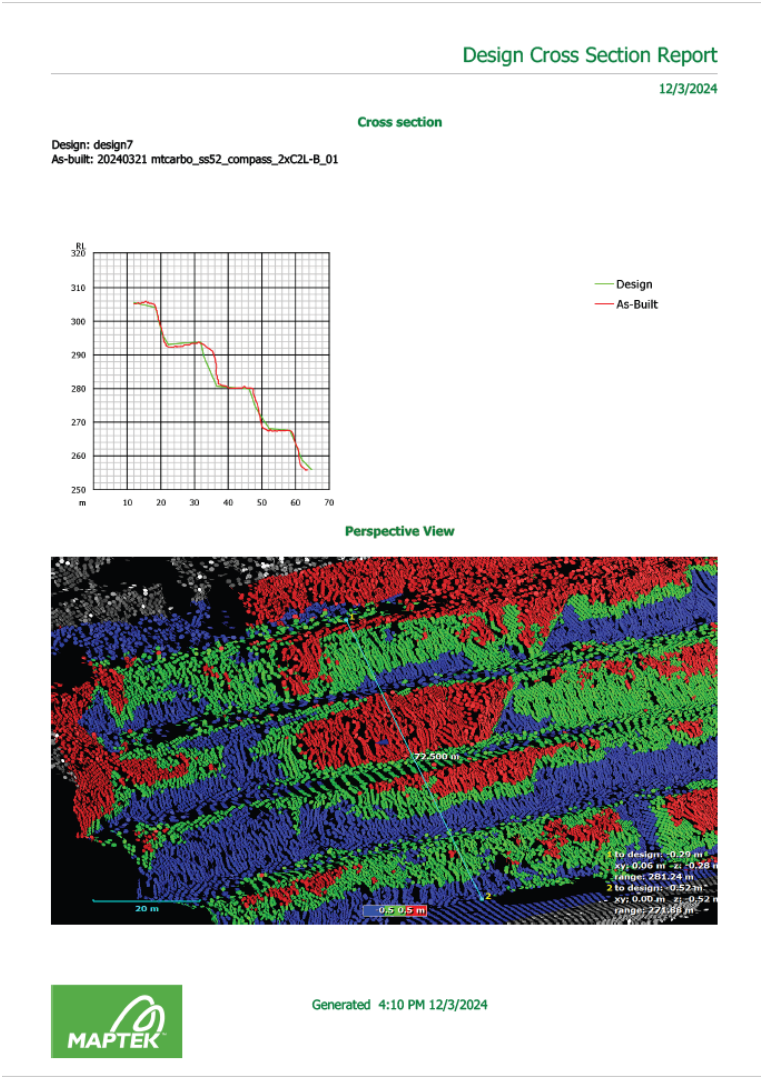


Figure 7-55 Example cross section report.

- Tap the button to close the cross section panel and return to the 3D design conformance view.

7.9.4 Creating a design conformance report

You can create a design conformance report by tapping the button in the design conformance view.

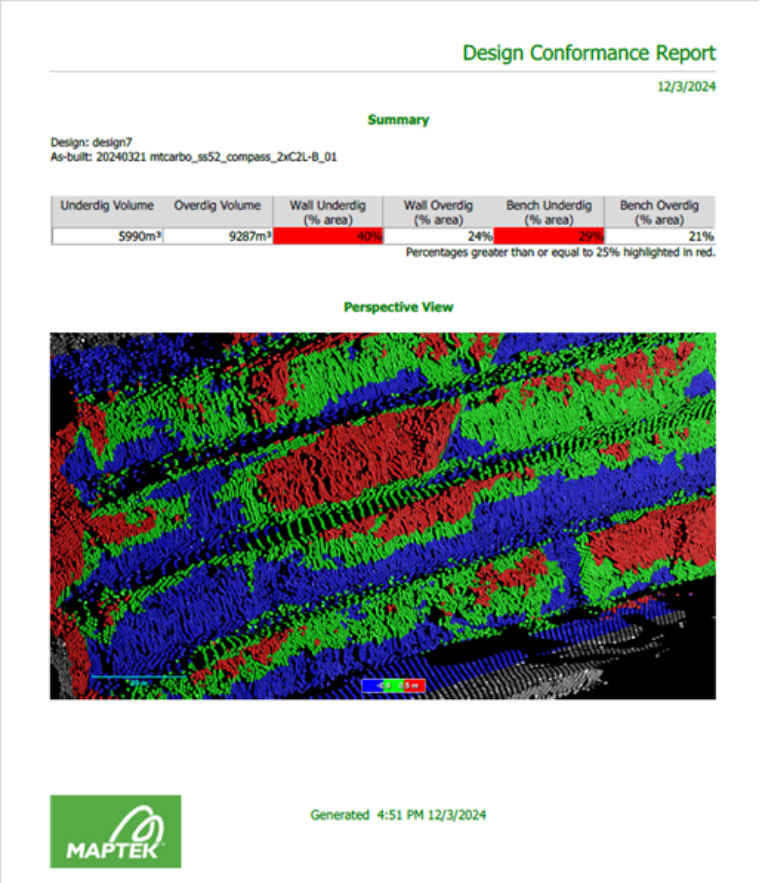
To create a design conformance report:

1. Configure the design conformance settings as explained in 7.9.1 Configuring design conformance settings on page 122.

   > **Note:** If you want to restrict the report to a boundary polygon, the polygon must be selected in the conformance settings. If no polygon is selected, the report will cover the entire extent of the design surface.

2. Switch to either (Z-Up view) or (Aerial view). Pan, zoom, and rotate the view until you have the desired view of the data for inclusion in the report.
3. Make sure a USB key is inserted.
4. Tap the (Design conformance report) button in the view to generate the report.

   The report PDF is saved to the folder `Maptek Files` on the USB key.


Design Conformance Report

12/3/2024

Summary

Design: design7
As-built: 20240321 mtcarbo_ss52_compass_2xC2L-B_01

Underdig Volume	Overdig Volume	Wall Underdig (% area)	Wall Overdig (% area)	Bench Underdig (% area)	Bench Overdig (% area)
5990m³	9287m³	40%	24%	29%	21%

Percentages greater than or equal to 25% highlighted in red.

Perspective View

Generated 4:51 PM 12/3/2024

Figure 7-56 Example design conformance report.

The report classifies each part of the as-built covered by the design surface as either wall and bench, and it reports on these as follows:

- **Underdig volume:** The total volume of the as-built surface above (or in front of) the design surface.
- **Overdig volume:** The total volume of the as-built surface below (or behind) the design surface.
- **Wall underdig:** The area of the as-built classified as both wall and underdig, expressed as a percentage of the total wall area.
- **Wall overdig:** The area of the as-built classified as both wall and overdig, expressed as a percentage of the total wall area.
- **Bench underdig:** The area of the as-built classified as both bench and underdig, expressed as a percentage of the total bench area.
- **Bench overdig:** The area of the as-built classified as both bench and overdig, expressed as a percentage of the total bench area.

Note: The volumes express total volumes above or below the design surface and do not take into account any tolerance value. The wall and bench underdig and overdig area calculations take into account a tolerance value of ±0.5 m. That is, parts of the as-built surface within 0.5 m of the design are considered to be within tolerance and are not classed as underdig or overdig.

7.10 Scanning with Maptek Drive

Maptek Drive is a vehicle-mounted mobile scanning platform that allows scans to be acquired while driving. Drive uses an inertial navigation system (INS), an RTK rover, and a GPS receiver to provide accurate position, orientation, and motion information as the vehicle moves.

> **Note:** The GPS receiver must be connected to a GPS base station to provide accurate positioning.

Maptek Drive can be used to acquire the following:

- **Driving scans.** These are conducted from a moving vehicle. The scanner head does not traverse around the base to acquire the scan. Instead, the scanner faces in a fixed direction acquiring vertical columns of data. The vehicle moves at a roughly constant speed to provide the horizontal component.
- **Stationary scans.** These are acquired while the vehicle is stationary. The scanner head traverses to acquire data as in a regular stationary scan, with the Drive system providing accurate position and orientation information.
- **Stop and go scans.** These are stationary scans normally conducted with the scanner on the vehicle mount, without using GPS and INS.

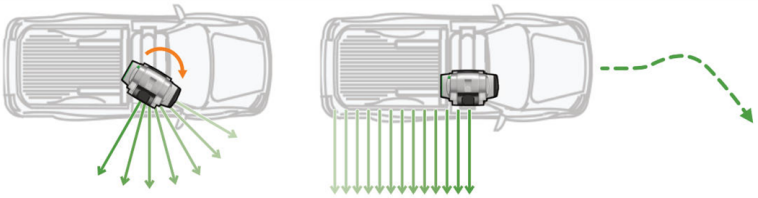


Figure 7-57 Left: A stationary scan acquires data from a traversing scanner head. Right: A driving scan acquires data from a fixed scanner direction while the vehicle is in motion.

7.10.1 Connecting Drive to FieldHHC

To connect Maptek Drive to FieldHHC, insert the Drive USB cable into the FieldHHC USB port. FieldHHC will detect that Drive is connected and enable Drive-specific features.

When connected, the FieldHHC status bar displays the Drive system status, giving the standard deviations for the INS azimuth and the GPS position. The background of these indicators change from red to yellow to green as the measurement accuracy improves.



Figure 7-58 INS azimuth and GPS position status indicators in the status bar.

The GPS typically establishes connections to available satellites quickly and is first to provide an accurate scanner position. The INS requires an alignment process to be completed before driving scans can be started.

7.10.2 Performing the alignment routine

The Drive INS system needs to undergo an alignment routine before you can acquire scans. The routine involves driving along a set course until the required accuracy is achieved. The area where the alignment is performed should:

- Be relatively flat
- Be well away from large obstacles that may affect GPS reception
- Allow you to drive uninterrupted in a square pattern approximately 50 m (160 ft) in length

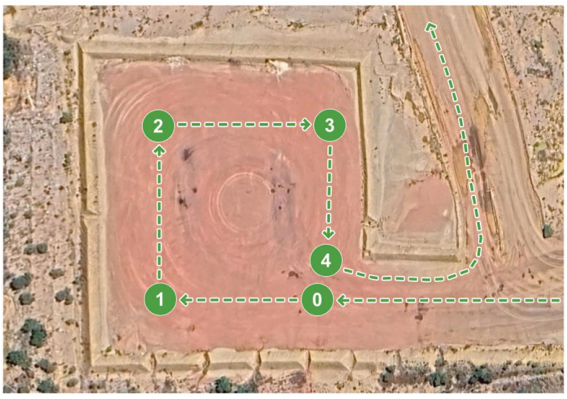
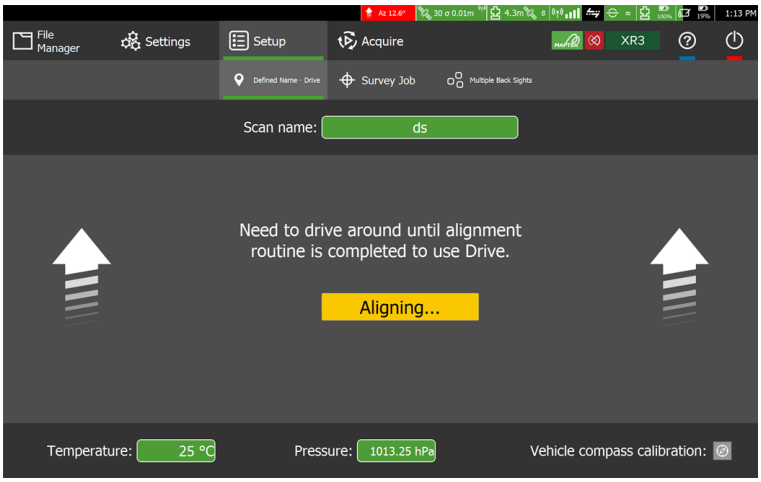


Figure 7-59 Example path for the alignment routine.

Follow these steps to carry out the alignment:

1. Ensure that the Drive system is installed correctly, powered on, and connected to FieldHHC.
2. Move the vehicle to the start position (position 0 in Figure 7-59 above) so that the vehicle is pointing in the direction of the first corner of the square (position 1).
3. In FieldHHC, switch to the **Setup** tab and make sure the **Defined Name - Drive** subtab is selected.



4. Remain stationary until the status bar indicates the following:
   - The GPS position has achieved a good fix.
   - The **Az** (azimuth) indicator has settled to 20° or less. If necessary, power cycle the Drive system and allow 45-60 seconds for the INS to settle.

   > **Important:** The vehicle must remain stationary until the azimuth indicator has settled, otherwise the alignment will not complete.

5. Begin driving in a straight line towards the next corner of the square, accelerating to 15-20 kph (9-12 mph), then come to a quick stop when you reach the corner.
6. Wait 10-15 seconds then turn the vehicle towards the next corner.
7. Repeat steps 4 and 5 for each leg of the square. When alignment is complete, the indicator should turn green and a message will display. The **Az** (azimuth) indicator should turn green and have a value of 0.04° or less.



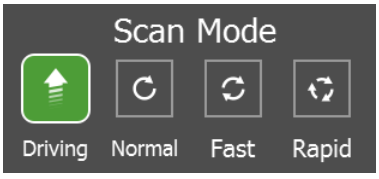
8. Once alignment is completed, proceed directly to the scanning site and commence scanning. If the INS falls out of accuracy at any time, continue driving around until it falls back within the required level of accuracy.

7.10.3 Acquiring a driving scan

A driving scan is acquired while the vehicle moves. Before commencing a driving scan, make sure that the relevant Drive settings have been configured on the **Settings** tab, and that the alignment routine has been completed.

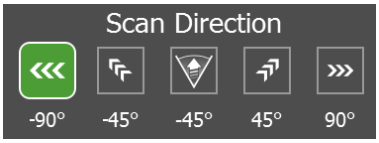
The basic procedure for acquiring a driving scan is as follows:

1. In FieldHHC, switch to the **Acquire** tab.
2. Set **Scan Mode** to **Driving**.



> **Note:** The scanning speed used for driving scans is set in the **Settings** tab under **Configuration**. See Configuration settings on page 68 for details.

3. Set **Scan Direction** to the desired direction the scanner should face while scanning.

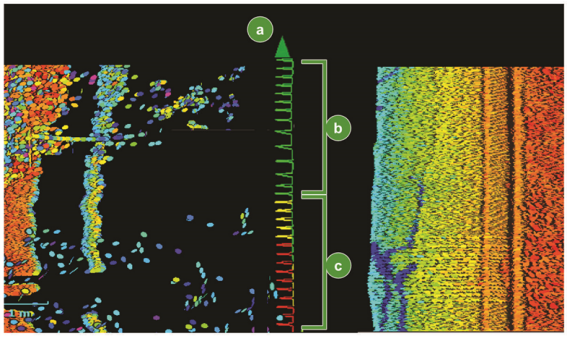


4. Configure other scanning settings as required. See 7.6 Acquiring scans on page 91 for detailed information.
5. Tap the **Scan** button to commence a countdown sequence. Begin driving your course. Scanning will commence when the countdown ends.
6. Maintain a constant vehicle speed while scanning. The recommended maximum vehicle speed depends on the **Driving scanning speed** (scan mode) configured in the **Settings** tab, as follows:

Scan mode	Maximum recommended vehicle speed
Normal	7 km/h (4 mph)
Fast	14 km/h (9 mph)
Rapid	28 km/h (17 mph)

See Configuration settings on page 68 for more information on scanning speeds for Drive.

Data will appear in the viewer as you scan (see Figure 7-60 below). The vehicle's path is indicated by a line consisting of spikes. These indicate your GPS and INS solutions, colour-coded to correspond with the azimuth and GPS indicators in the status bar (green = good, yellow = marginal, red = poor).



a Vehicle direction
b Good INS and GPS solutions
c Marginal/poor INS and GPS solutions

Figure 7-60 A driving scan displayed in the viewer during acquisition.

Tip: Scanning will automatically pause when the vehicle comes to a stop and will resume when the vehicle starts moving again. You can also manually pause and resume scanning using the **Pause scanning** and **Resume scanning** buttons.

> **Tip**
> While scanning, listen for audible beeps from FieldHHC. They sound in the following situations:
> - When scanning starts after the countdown ends
> - When the GPS position or Azimuth indicators lose accuracy
> - When scanning reaches its maximum running duration of 24 minutes

7. Tap the button to finish the scan.

7.10.4 Acquiring a stationary scan

You can take normal stationary scans while connect to Drive. These scans use the Drive GPS and INS systems to provide the position and bearing information.

> **Note:** INS tends to drift over time while stationary and needs regular realignment by driving around for a few minutes between scans.

> **Note:** The Drive system records a reference position just after the vehicle stops. Any subsequent movement after stopping may alter the position and alignment of the scanner with respect to this reference position.

For best results with stationary scans, ensure that the vehicle comes to a clean stop and does not move before or during scanning. Observe the following recommendations before taking a stationary scan:

- When coming to a stop, ensure the vehicle's direction does not change. This assists with maintaining INS accuracy.
- Do not allow the vehicle to roll forwards or backwards once stopped.
- Try not to move around inside the vehicle or exert any force that could make it tilt or sway.
- Check that the GPS position and azimuth indicators have good readings after stopping (indicators should be green).

To take a stationary scan:

1. In FieldHHC, switch to the **Acquire** tab.
2. Set **Scan Mode** to a setting other than *Driving*, for example, **Fast**.
3. Configure other scanning settings as required and take previews and scans as normal. See 7.6 Acquiring scans on page 91 for detailed information.

7.10.5 Viewing Drive scans

File Manager displays driving scans in the panoramic viewer showing vertical shifts in the scanned scene (see Figure 7-61 on the facing page). This is normal and corresponds to the pitching or rolling

motions experience by the scanner. Use the 3D viewer ( ) to view the scan with INS corrections applied.

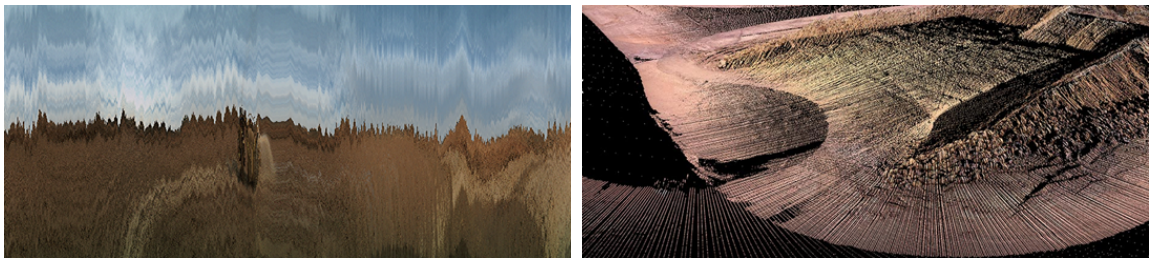


Figure 7-61 Left: A driving scan in the panoramic viewer showing characteristic vertical shifts. Right: A driving scan in the 3D viewer.

3D colour schemes

Driving scans can be coloured using the same colour schemes as regular scans, with the exception that the uniform colour scheme ( ) in the 3D viewer colours scans according to the accuracy of the INS azimuth and GPS position solutions. This colour scheme uses green to indicate good accuracy, yellow for marginal accuracy, and red for poor accuracy.

See Scan colour schemes on page 103 for more information on the regular colour schemes.

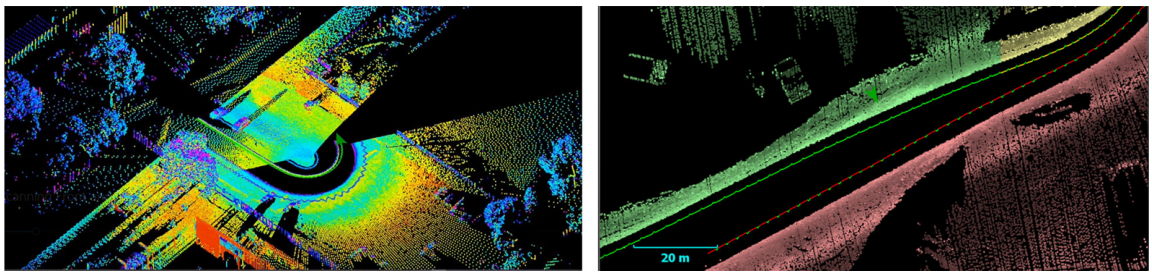


Figure 7-62 Driving scans coloured by spectrum intensity (left) and azimuth and position accuracy (right).

Appendix

A

Troubleshooting

The table below describes common problems and possible causes and actions to take to remedy the problem.

> **Note:** If a problem occurs that is not listed below, please contact Maptek support (see Appendix F Support on page 155).

Problem	Possible Cause	Solution
Scanner will not turn on.	No battery inserted.	Ensure a fully charged battery is inserted.
	Battery inserted while using an external power connection.	Remove battery when using an external power connection.
Power button flashes red after turning scanner on.	Battery insufficiently charged.	Ensure a fully charged battery is inserted.
	Inadequate external power supply.	Ensure the external power supply voltage falls within the range of 24–28 V DC.
Scanner not discoverable when connecting wirelessly from FieldHHC.	Wi-Fi is disabled on the scanner.	Ensure Wi-Fi is enabled on the scanner. See 4.7 Enabling or disabling Wi-Fi on the scanner on page 35 for instructions.
Scanner emits a rattling noise similar to a loose screw inside the body.	The backstop pin makes a noise when the scanner is tilted from side to side. *This is expected behaviour and not a fault.*	Confirm that the source of the noise is the backstop pin moving. The backstop pin is located on the underside of the scanner head, on the scanning window side. The pin will move as you tilt the scanner from side to side.

Problem	Possible Cause	Solution
The following error message displays: *Failed to connect to scanner.*	(If connecting wirelessly) Scanner out of Wi-Fi range.	Ensure the scanner is within the Wi-Fi range of the FieldHHC tablet. The maximum Wi-Fi range in ideal conditions is 50 m (160 ft).
	(If connecting wirelessly) Radio interference present.	Select a different Wi-Fi channel. See Connectivity settings on page 70 for instructions.
	(If using wired connection) Damaged Ethernet cable.	Replace authentic cable.
	Incorrect network settings.	Make sure the network settings on the FieldHHC tablet are correct. See B.9 Network settings on page 145 for details.
The following error message displays: *Elevation Error: Request speed not reached*	Scanner is too cold to operate.	Allow the scanner to return to room temperature before attempting to scan. If using an M20 scanner, make sure the cold climate status indicator is green () before attempting to scan.
	(If acquiring a driving scan) Driving over rough terrain, causing excessive sideways and vertical movement.	Select a lower Drive scanning speed. See Configuration settings on page 68 for instructions.
One of the following error or warning messages displays: *Azimuth Error: Encoder readhead cannot read ring.* *Azimuth Warning: Encoder ring or redhead dirty.*	Moisture ingress into the scanner.	If moisture ingress is likely, allow the scanner to dry out by leaving it out of its case for a few days. Place the scanner in a dry, warm room to assist evaporation. Remove any battery or external power connection while there is moisture inside the scanner. If the problem persists, please contact Maptek support.
The following error message displays: *Azimuth Warning: Motor fault.*	Something is obstructing the scanner head.	Check for objects such as cables that might be obstructing the scanner head.
	Scanner is too cold to operate.	Allow the scanner to return to room temperature before attempting to scan. If using an M20 scanner, make sure the cold climate status indicator is green () before attempting to scan.

Appendix

B

Specifications

B.1 Scanner general specifications

Table B-1 R3 MkII scanner general specifications

Specification		UR3	XR3-C, XR3-CT	XR3-D, XR3-CD	SR3
Type		Terrestrial laser scanner			
Dimensions	**Height**	390 mm	390 mm	390 mm	390 mm
	Depth	192 mm	192 mm	192 mm	192 mm
	Width	342 mm	318 mm	318 mm	318 mm
Height to UNC thread	**Scanner[1]**	375.5 mm	375.5 mm	375.5 mm	378.5 mm
	Off-centre mount[2]	-			405.5 mm
Weight[3]		12.1 kg	10.1 kg	10.3 kg	10.1 kg
Battery	**Type**	Li-ion			
	Run time	2.0 hours			
Levelling	**Fine**	20″			
	Coarse	1° over any tilt			
Normal temperature range	**Regular**	0° to +50°C			
	M20	-20° to +50°C			
Limited exposure temperature range		-40° to +50°C (according to limited exposure time below)			
Limited exposure time	**Regular**	20 minutes (starting from +20°C)			
	M20	8 hours (starting from +20°C with neoprene jacket and external power)			
Storage temperature		-40° to +70°C			
Magnetic compass		±1° (assumes no metallic objects or magnetic field interference)			
Internal GNSS receiver		L1 GPS + QZSS			
Reliability		ISO 9022			
Protection class		IP-65 (IEC 60529)			
Data recorder		Wireless ruggedised tablet controller plus onboard USB			
Mounting		Internal 5⁄8″ UNC thread and T-bolt slots			
GPS mount		External 5⁄8″ UNC thread			

[1] Vertical distance from the scanner reference level to the base of the UNC thread on the top of the scanner.
[2] Vertical distance from the scanner reference level to the base of the UNC thread on the off-centre mount attached to the top of the scanner.
[3] Weights given are for base models with camera, without telescope or battery.

B.2 Laser rangefinder

Table B-2 R3 MkII laser rangefinder specifications

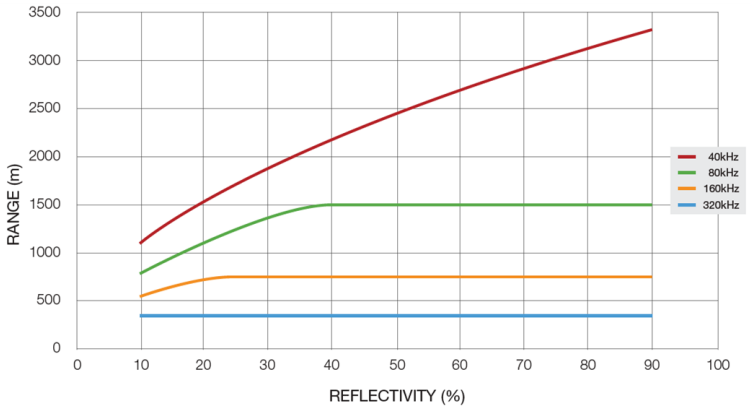
Specification		UR3	XR3-C, XR3-CT	XR3-D, XR3-CD	SR3
Type		Time of flight pulsed rangefinder			
Range*	**Maximum**	3500 m	2800 m	1200 m / 600 m (dual)	600 m off reflector
	Minimum	5 m	2.5 m	2.5 m	1 m
Performance†	**Accuracy**	5 mm	5 mm	5 mm	4 mm
	Repeatability	±4 mm			
Exit aperture		< 10 mm	< 8 mm	< 8 mm	< 8 mm
Beam divergence (1/e^2 radius)		0.4 mrad	0.25 mrad		
Acquisition rates	**Normal**	40 kHz	50 kHz	50 kHz	-
	Fast	80 kHz	100 kHz	100 kHz	100 kHz
	Rapid	160 kHz	200 kHz	200 kHz	200 kHz
	Ultra	320 kHz	400 kHz	400 kHz	400 kHz
Laser class		Class 1 (IEC 60825-1:2014)			
Wavelength		Near infrared			
Intensity measurement		Yes			
Angular step selectable		0.2° to 0.0125°	0.2° to 0.0125°	0.2° to 0.0125°	0.2° to 0.025°
Vertical scanning range	**Lower elevation**	-40°	-40°	-40°	-40°
	Upper elevation	+40°	+50°	+60° (D) +50° (CD) +40° (D dual) +30° (CD dual)	+90° (zenith)
	Total extent	80°	90°	100° (D) 90° (CD) 80° (D dual) 70° (CD dual)	130°
Horizontal scanning range		360°			

*Firing at lowest acquisition speed for high resolution scans. Based on returns from flat normal targets and good atmospheric conditions.

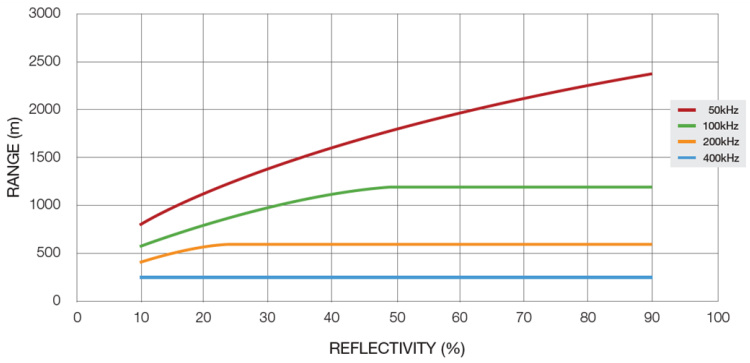
†Under Maptek test conditions at 65 metres.

B.3 Range versus reflectivity

UR3

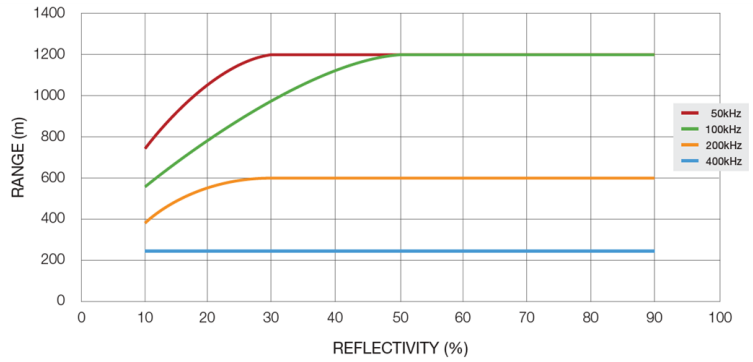


XR3



XR3 dual window

Note: Graph is indicative of single window scanning. For dual window scanning, the maximum range is capped to 600 m.



SR3

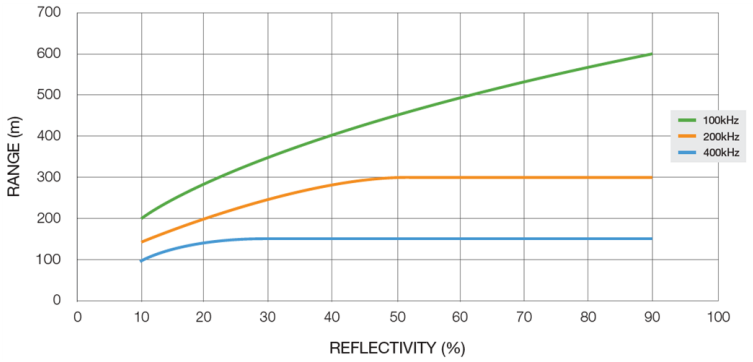


Figure B-1 Range vs reflectivity graphs for R3 MkII scanners

B.4 Scan point density

Table B-3 Comparison of scan point density settings

Point density setting	Azimuth resolution (° per step)	Elevation resolution (° per step)	Theoretical maximum point count (millions of points)*			
			UR3	XR3-C, XR3-CT, XR3-CD	XR3-D	SR3
1	0.2°	0.2°	0.72 M	0.81 M	0.9 M	1.17 M
2†	0.1°	0.1°	2.88 M	3.24 M	3.6 M	4.68 M
4	0.05°	0.05°	11.52 M	12.96 M	14.4 M	18.72 M
8	0.025°	0.025°	46.08 M	51.84 M	57.6 M	74.88 M
16‡	0.0125°	0.0125°	184.32 M	207.36 M	230.4 M	-

B.5 Digital camera

Table B-4 Digital camera specifications

Specification	UR3, XR3-C, XR3-CT, XR3-CD	SR3
Type	20 MP CMOS HDR digital panoramic camera	
Angular range	60° vertical, 360° horizontal	80° vertical, 360° horizontal
Lens	Zeiss 28 mm, with filter	Voigtländer 21 mm, with filter
Pixel resolution	147 MP	
Acquisition method	During laser scan	
Exposure control	User definable	
Depth of field	5 m to infinity	
Image render method	Corrected image automatically rendered to scan in PointStudio	

B.6 Laser aimer (SR3 only)

Table B-5 SR3 laser aimer specifications

Specification	Value
Type	635 nm red laser
Product laser class	Class 1

*Assumes a 360° scan using the maximum elevation extent of the scanner.
†Standalone scans use this point density setting.
‡Not available with SR3 scanners.

B.7 Telescope (XR3-CT only)

Table B-6 XR3-CT backsighting telescope specifications

Specification	Value
Angular range	80° vertical, 360° horizontal
Focal range	5 m to infinity
Focus control	Electronic motorised focus
Objective aperture	28 mm
Magnification	14x
Reticule	Crosshair
Field of view	3° in field
Resolving power	±5″
Minimum azimuth step	3.6″

B.8 FieldHHC tablet

Table B-7 FieldHHC tablet specifications

Specification		Value
Type		Panasonic Toughbook FZ-G2 ruggedised tablet PC
Durability		IP65 water and dust resistant, drop resistant
Operating temperature range		-29°C to +63°C
Dimensions (W x H x D)		279 mm x 188 mm x 23.5 mm
Weight		Approximately 1.19 kg
RAM		16 GB
Storage		512 GB
Display		10.1″ LCD 1920 x 1200 sunlight-viewable capacitive touchscreen
Camera		8 MP with autofocus and LED flash
Battery run time		Approximately 7.5 hours
AC adapter	**Input**	100 V – 240 V AC, 50 Hz / 60 Hz
	Output	15.6 V DC, 7.05 A

Note: Maptek acknowledges the use of various Third Party software and associated licences as part of the system components of the FieldHHC software. A full list of Third Party Software can be found at www.maptek.com/legal/.

B.9 Network settings

Table B-8 Network settings for scanner–FieldHHC tablet communications

Setting	Value
Ethernet IP address (tablet controller)	10.105.8.50
Ethernet IP address (scanner)	10.105.129.5
Wi-Fi IP address (tablet controller)	192.168.1.50
Wi-Fi IP address (scanner)	192.168.1.5
Subnet mask	255.255.0.0

Appendix

C

Regulatory Compliance

C.1 Electromagnetic compatibility

Electromagnetic Compatibility (EMC) refers to the ability of the scanner to function acceptably in the presence of electromagnetic radiation and electrostatic discharges. The scanner must operate without causing electromagnetic disturbances to nearby electronic equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules and ICES-003. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's own expense.

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Note: Interference can result in other equipment if the product is used in conjunction with accessories from other manufacturers, such as field computers, personal computers, two-way radios, non-standard cables or external batteries.

Note: Although the product meets strict regulations and standards that are in force, the possibility cannot be excluded that the product may be disturbed by very intense electromagnetic radiation, such as nearby radio transmitters, two-way radios or diesel generators. Interference caused by electromagnetic radiation can result in erroneous measurements. Check the plausibility of results obtained under these conditions.

Note: If the product is operated with connecting cables attached at only one of the two ends (e.g. external supply cables or interface cables), the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired. When the product is in use, cables must be connected at both ends.

Note: Use only the equipment and accessories recommended by Maptek. When combined with the product, they meet the strict requirements stipulated by the guidelines and standards. When using computers and two-way radios, follow the manufacturer's recommendations for managing electromagnetic compatibility.

C.2 Conformity to national regulations

The following regulatory conformance apply to this scanner:

- FCC Part 15 (applicable in the US and Industry Canada).
- This Class A digital apparatus complies with Canadian ICES-003.
- Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.
- Hereby, Maptek declares that this Maptek scanner complies with the essential requirements and other relevant provisions of Directive 2014/53/EU.
- Class 2 equipment according to European Directive 2014/53/EU (RandTTE) for which the following EEA Member States apply restrictions on the placing on the market or on the putting into service or require authorization for use:
  - France
  - Italy
  - Norway (if used in the geographical area within a radius of 20km from the centre of Ny-Ålesund)

The conformity for countries with other national regulations not covered by the FCC part 15 or European directive 2014/53/EU has to be approved prior to use and operation.

C.3 Wi-Fi technical data

Table C-1 Wi-Fi technical data

Parameter	Value
Standard	IEEE 802.11b/g/n 2
IC	6158A-WPEA127NI
Frequency band	2412–2462 MHz (Channels 1–11)
FCC ID	RYK-WPEA127NI

C.4 Laser classification

R3 MkII laser scanners can emit invisible and visible laser beams as described below. The product is a Class 1 Laser Product in accordance with *IEC 60825-1 (2014-05): Safety of Laser Products*

> **Note:** Class 1 laser products pose no risk to eyes or skin under normal operation and conditions.

C.4.1 Laser rangefinder

The laser rangefinder in all R3 MkII scanners emits an invisible laser beam. The beam parameters are described in Table C-2 below.

Table C-2 Rangefinder laser beam parameters

Parameter	UR3	XR3, SR3
Laser class	1	
Wavelength	1545 nm	
Laser pulse energy	22 µJ	10 µJ
Pulse duration	1.1 ns	
Beam divergence (1/e^2 radius)	0.4 mrad	0.25 mrad
NOHD[1]	0 m	
NOHDe[2]	1.25 m	0.6 m

[1]Nominal ocular hazard distance. This is the distance from the output aperture where the radiant exposure equals the maximum permissible value a person can be exposed to, without being a health risk.
[2]Extended nominal ocular hazard distance.

C.4.2 Laser aimer (SR3 only)

SR3 MkII scanners additionally incorporate a laser aimer that emits a visible red laser beam. The beam parameters are as follows:

Table C-3 Laser aimer parameters

Parameter	Value
Laser class	1
Wavelength	635 nm
Maximum average radiant power	< 0.3 mW
Pulse duration	Continuous
Beam divergence	0.3 mrad

C.5 Waste management

C.5.1 European Community Requirements

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Maptek offers all end users in the EC the possibility to return end-of-life units without incurring disposal charges.

If you wish to return a Maptek unit for waste recovery, please contact Maptek or your nearest dealer for further information.

C.5.2 Alternative waste management

If you do not return an end-of-life unit to Maptek, you must hand it to a company specialised in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Appendix

D

International Warranty

D.1 Warranty certificate

Maptek (hereafter referred to as the Supplier) warrants that at the time of sale to the Customer, the scanner will be in substantial accordance with the sales documentation supplied to the Customer for the duration of the warranty period.

D.1.1 Warranty period

The Product is provided with a twelve (12) month product warranty with the exception of the XR3 and UR3 scanner variants that are provided with a twenty-four (24) month warranty, subject to being serviced in the first year. Peripherals associated with the scanner are warranted for a period of twelve (12) months.

D.1.2 Application

If during this warranty period the Product is found to be defective in materials and/or workmanship and if the Customer notifies the Supplier of the defect within the warranty period specified in this paragraph, the Supplier will rectify, or if necessary to remedy the defect, replace the Product, at its own expense. This remedy, excluding freight costs back to the Supplier, will be the total liability of the Supplier.

This warranty shall not apply if:

i. the Product is not used in accordance with the Supplier's instructions,
ii. the Product is not returned to an authorised Maptek Service centre in the case in which it was originally supplied,

iii. any part of the Product has been altered, modified, converted or tampered with by the Customer or any other unauthorised party without the written approval of the Supplier,
iv. the Product was purchased from a party other than an authorised Maptek Reseller,
v. any of the Product's shock load sensors indicate extreme rough handling,
vi. damage or wear is caused by any of the Customer's equipment malfunctioning,
vii. damage or wear is due to any other cause within the control of the Customer that results in the Product becoming inoperative, or
viii. the Product is not returned to an authorised Service centre in the case in which it was originally supplied, for service and maintenance at recommended intervals at the Customer's expense.

D.2 Warranty Disclaimer

1. All freight costs associated with the return of the product to an authorised service centre for assessment and repair shall be borne by the Customer. In the event that repairs are deemed to be outside of the Supplier liability under this warranty all freight and handling costs associated with the return of the product to the Customer are to be borne by the Customer.
2. The foregoing is the only warranty made by the Supplier in relation to the product. The Supplier specifically disclaims all other warranties, express or implied, statutory or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose and non-infringement of third parties' rights.
3. This warranty applies to the original Customer only and is not transferable.
4. Limitation of liability:
    a. No action, regardless of form, arising out of the transactions under this warranty may be brought by either party against the other more than one (1) year after such party knew or should have known of the occurrence of the events which gave rise to the cause of action.
    b. Parties expressly exclude liability to the other party for economic loss (including but not limited to loss of profits, business revenue, goodwill, or anticipated savings) and for any other consequential loss claimed to have resulted from or be in any way related to the marketing, supply, implementation or support of the product or documentation and whether arising from negligence or howsoever.
    c. It is intended by both parties that the foregoing exclusions of liability shall be reasonable as between the Supplier and Customer, but in the event that any or all of the foregoing exclusions shall be held to be invalid for any reason, or either party shall otherwise become liable to the other for loss or damages, such liability shall not under any circumstances exceed the aggregate amount of original purchase cost.

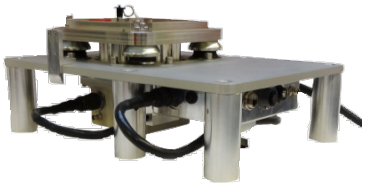
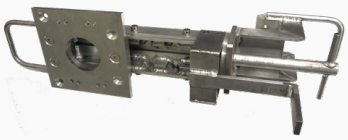
Appendix

E

Optional Accessories

Table E-1 includes a selection of accessories to use with Maptek scanners. To learn more about these and other accessories, visit Maptek online or contact your nearest Maptek office.

Table E-1 Selected optional accessories

Item	Description	Part Number
Tribrach adapter clamp 	An alternative method of mounting the scanner onto a tripod or bollard using a 5/8″, 11 TPI fixing bolt.	(Standard kit) 0102230 (Sentry kit) 0102235
Vehicle mount 	Vehicle mount adapts the scanner for use on a vehicle roof. It is used for stop-and-go scanning.	0102521
Drive mount 	Drive enhances mobile scanning by adding a radio and µIMU, providing precision geolocation data for static scanning and enabling scanning while driving.	0102522
Stair rail bracket 	The stair rail bracket allows a scanner to be suspended horizontally over gantries or rails to permit stockpile scanning from an elevated position.	0102027
Underground light 	The underground light attaches the SR3 scanner's GPS adaptor mount and provides a shaped beam that enhances light exposure for photographic imaging.	0103000

Appendix

F

Support

Maptek provides technical support across our range of products. If you need assistance, please contact your nearest office.

Australia

Eastern/central region
✉ support@maptek.com.au
☎ +61 7 3316 2828

Western region
✉ support@maptek.com.au
☎ +61 8 6211 0000

Mine measurement support
Laser Scanners, PointStudio, and Sentry
✉ isite.support@maptek.com.au
☎ +61 8 8338 9295

MineSuite support
✉ minesuite.support@maptek.com.au
☎ +61 2 4968 7150

Europe, North and West Africa, Middle East, Russia, and Central Asia

Edinburgh, UK
✉ support@maptek.co.uk
☎ +44 131 225 8447

Mexico and the Caribbean

Mexico City, Mexico
✉ soporte@maptek.com.mx
☎ +52 55 5250 8028

North America

Denver, USA
✉ support@maptek.com
☎ +1 303 763 4919

South America

Brazil
Support office: Belo Horizonte, Brazil
✉ suporte@maptek.com.br
☎ +55 31 3224 4888
☎ +55 31 2342 1203

Chile
Support office: Viña del Mar, Chile
soporte@maptek.cl
☎ +56 322 690 683
☎ +56 9 7878 5030
☎ +56 323 140 881

Peru
Support office: Lima, Peru
✉ soporte@maptek.com.pe
☎ +51 8017 0647

Southern Africa

Johannesburg, South Africa
✉ support@maptek.co.za
☎ +27 11 750 9660

F.1 Online resources

The following resources are available online:

Online help Access help documentation for Maptek products online, including this manual in other languages.	help.maptek.com
Support requests Submit a request for technical support.	maptek.com/support
Scanner servicing requests Book a service for your laser scanner.	maptek.com/support/scanner_servicing.html

F.2 Contact information

Hardware Servicing	Maptek Head Office
Maptek Pty Limited **Mine Measurement Solutions** 63 Conyngham Street Glenside SA 5065 AUSTRALIA Tel: +61 8 8338 9222 Fax: +61 8 8338 9229 Email: isite.support@maptek.com.au	**Maptek Pty Limited** 31 Flemington Street Glenside SA 5065 AUSTRALIA Tel: +61 8 8338 9222 Fax: +61 8 8338 9229 Email: info@maptek.com.au

Index

A

accessories box 8
Acquire tab 91
acquisition speed 43, 47, 94, 141
active heating 18
advanced registration 76, 112, 114
advanced tools 76
aerial view 108
annotations 104, 108
archive 63, 102
auto initial position 114, 119
azimuth 37
azimuth control 12, 15-16, 89-90
azimuth extents 97

B

back face points 109-110, 123
backpack 8-9, 11, 23
backsight 43, 47, 83, 88
backsighting 38, 40, 43, 88
battery 137, 140
  charging 30
  state of charge 30
  storage 22
battery charger 4, 23
bearing 40
  interference 41
Bluetooth 70, 76
bollard 43
boundary polygon 122

C

calibration 3
camera 7, 143
  photographic image 37
capture bolt 14
car adapter
  scanner 9
cautions 4
charging kit 11
  scanner battery 9
cold climate 7, 18, 32, 58-59
cold-soaked scanner 33
colour scheme 97, 101, 103, 108, 124, 135
compass 38, 40-41, 43, 71, 79-80, 83, 109, 112, 140
compliance 14, 147
  FDA 14
configuration files 64
conformance reports 64, 121, 128
Connect button 77
connectivity 70, 137
coordinate system 60, 64, 67
corrosion 21
cross section 121, 125-126

D

data seam 50
defined name
  scans 43
  setup 40-41, 79-80
defined name GPS offset 73, 75
design conformance 76, 102, 121
design surface 64, 122
dirt 20
distance to design 121
Drive offsets 73
driving mode 94-95
driving scan 42, 49, 130, 132
driving scanning speed 69, 94, 133
dual window 7, 48
  mode 49
dust 20, 45, 93

E

electromagnetic compatibility 147
elevation 37
elevation control 12, 15-16, 89-90
Ethernet auto connect 70
Ethernet cable 9, 11, 23, 78
EULA 2

F

feature code 68, 105
FieldHHC
  software
    configuring 66
    connectivity 70
    file management 62
    general settings 66
    setup 79
    status bar 59
    warnings 67
  tablet 9, 20, 140
    car adapter 9, 11
    power adapter 9
    power cable 9
    recess 10
File Manager 62
Files drawer 62, 102
fixed reference data 117
flying insects 45
foam cage 8

G

GPS
- adapter 13
- attaching 33
- base station 130
- connecting 76
- external 38
- internal 38
- off-centre mount 11
- phase centre 74-75
- spacer 33, 75
- status 59

GPS offset 74
GPS track 39, 79-80, 83, 112
greyscale 97, 103

H

handle 13
hazards 4
heading, pitch, and roll offsets 73
help (online) 156
hex key 9, 11, 28
horizontal angle 37
humidity 21

I

inclination 37, 59
incomplete scan 48
INS 39, 42, 130, 134
- alignment 131

insects 94
intensity 37, 103

J

jacket 11, 18, 31-32

L

language 67
laser 43
- beam 37
- class 14, 149
- radiation 4
- rangefinder 37, 141, 149

laser aimer 7, 38, 89-90, 143, 150
legend 64, 122-123
level correction 37, 39, 47, 55, 93, 140
- coarse 39
- fine 39, 93

licence 68, 76, 122
licensed scanners 76
light model 69

M

M20 32, 58-59
- neoprene jacket 11

maintenance 3
manual positioning tools 108
manufacturer 1, 14
Maptek Drive 29, 31, 39, 42, 72, 79, 130, 154
- alignment routine 131
- status 59

Maptek object file 64, 122
measure tool 108, 125
measurement system 68
mobile device 35, 51, 53
mud 20
multiple backsights 40, 47, 79, 85, 97

N

national regulations 148
network
- status 59

non-scan files 64, 102

O

offsets 69, 72
operator name 66
overdig 129

P

panoramic mode 101
person in charge of the product 1
photo 47
- capture 91
- exposure 54

point density 44, 47, 55, 95, 143
pointset 64, 115
PointStudio 38, 46, 64, 104, 119, 122
polygon 64, 122
power
- adapter 30
- battery 29
- external 31
- status 59

power button 15, 52
pressure 84
pushbutton scan 15, 51

R

rain 21, 45
range 37, 47-48
- vs. reflectivity 142

range filter 118
rangefinder 37
registration 43, 64, 109
- advanced 114
- fixed origin 112
- global 114
- manual positioning 112-113

registration sequence 64, 119
repeat scans 47
report boundary 122

repository 102
archive 63
internal 63
resolution 44
RTCM height offset 73
RTK rover 130

S

safety 5
sampling 118
scale bar 109
scan
acquisition 91, 99
annotating 104
bearing 37
composition 37
dual window 48, 55
extents 55, 97
file management 62
file naming 46, 97
file size 46
filename 43
origin 39
pausing 99
position 37
preview 98
queueing 99
registration 43, 112
repeating 100
resolution 44
rotation 113
settings 43, 91
stationary 50, 130, 134
stop and go 130
transferring 102
translation 114
viewing 101, 107
window 98
workflow 60, 85, 91
scan data 47
scan direction 96, 133
scan mode 43, 54, 94, 132
scan origin 109
scan point selection 45, 47, 54, 93
scanner
accessories 153
calibration 3, 23
carrying 25
cautions 4
cleaning 21
components 12
base 14
battery 10-11, 29
body 12
camera 7, 13
controls 16
handle 13-14, 25
head 12
LAN port 13, 78
laser aimer 7
mirror 13, 43
power button 13, 15
rest 13
status indicator 13, 15
telescope 7
USB port 13, 52
window 13, 17, 48
connecting to 77
elevation extents 17
logs 67
maintenance 3
model indicator 58
mounting 28, 34, 140
power input 13
powering 29
safety 5
scanning time 67
serial number 14
servicing 3, 23, 156
setup 40
specifications 140
SR3 11
transporting 22
UR3 11
XR3 11
scanner head 37
scanner height 40, 75, 82, 87
scanner height units 68
scanner interface plate 28
scanner kit 7, 11
scanner location 81
scanner orientation at rest 73
scanner reference level 40, 74
scanner to forward offset 72
Scans list 62, 102
Sentry 31, 42
Setup tab 79
shock 20
shock indicator 10
sky points 44
smartphone 51
snow 45, 94
spacer 75
spectrum 97, 103
SR3 7, 17, 38, 90, 92, 140, 142-143, 150
SR3-CL 7, 11
stability monitoring 42
stairwell adapter bracket 14, 154
supplier 1
support 155
surface 64, 115
survey job 47
files 64-65
scans 43
setup 38, 79-80
survey mark 40, 88
survey points 65
survey prisms 3
survey station database 38, 40, 43, 60, 65

T

tablet battery 9
T-bolt 14
telescope 7, 38, 89, 144
eyepiece 13, 89
eyepiece cap 10-11
focus bezel 13, 15, 89
focus knob 12, 15-16, 89
temperature 21, 50, 84, 140
cold conditions 31
time and time zone 66

transit case 8, 10-11, 22, 25, 27
tribrach 9, 11, 28, 34
tribrach adapter 9, 11, 14, 28
tribrach adapter clamp 28, 34, 154
tripod 34, 40, 43

U

underdig 129
underground light 154
underground scanning 92
undo and redo 109
UR3 7, 11, 17, 140, 142
UR3 M20 7, 11, 18
USB key 10-11, 63
  copying files to and from 65
  scanning to 51
use
  adverse 2
  hazards 4
  intended 2
  limits 3
  permitted 2

V

vegetation 46, 93
vehicle compass calibration factor 41, 69, 71, 80, 84
vehicle mount 28, 31, 41, 43, 72, 79, 154
  mounting 14
vertical angle 37
view mode 108
viewer 62, 96
volume 129

W

warnings 4
warranty 151
waste management 150
web browser 51
Wi-Fi 35, 53, 70, 77, 149
Wi-Fi Channel 70

X

XR3 7, 142
XR3 dual window 42, 48, 50, 142
XR3 M20 18
XR3-C 7, 11, 17, 140
XR3-C M20 7, 11
XR3-CD 7, 11, 17, 48, 55, 140
XR3-CT 7, 11-13, 17, 38, 89, 140, 144
XR3-CT M20 7, 11
XR3-D 7, 11, 17, 48, 55, 140

Z

zero azimuth 72, 97
zoom 97, 101, 108
Z-up view 108