Introduction

This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "6 Safety Directions" for further information. Read carefully through the User Manual before you switch on the product.

Product identification
The type and serial number of your product are indicated on the type plate. Enter the type and serial number in your manual and always refer to this information when you need to contact your agency or Stonex® authorised service workshop.

Type: ___________
Serial No.: ___________

Symbols
The symbols used in this manual have the following meanings:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Danger</td>
</tr>
<tr>
<td>!</td>
<td>Warning</td>
</tr>
<tr>
<td>!</td>
<td>Caution</td>
</tr>
<tr>
<td></td>
<td>Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.</td>
</tr>
</tbody>
</table>
Trademarks

- Stonex® and the Stonex® logo are trademarks of Stonex® Limited
- CompactFlash and CF are trademarks of SanDisk Corporation
- Bluetooth is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.
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# Standard Limited Warranty

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</table>
1 Description of the System

1.1 System Components

Main components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R9 total station</td>
<td>• a total station for measuring, calculating and capturing data.</td>
</tr>
<tr>
<td></td>
<td>• combined with the RC9 radio field controller to conduct remote control surveys.</td>
</tr>
<tr>
<td>RC9 radio field controller</td>
<td>A radio field controller enabling the remote control of R9.</td>
</tr>
</tbody>
</table>

Terminology

The following terms and abbreviations may be found in this manual:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPS</td>
<td>Total Station Positioning System</td>
</tr>
<tr>
<td>RCS</td>
<td>Remote Control Surveying</td>
</tr>
<tr>
<td>EDM</td>
<td>Electronic Distance Measurement</td>
</tr>
</tbody>
</table>

EDM refers to the laser distancer incorporated into the instrument which enables distance measurement.
### Description of the System

Three measuring modes are available:

- **IR** mode. This mode refers to the ability to measure distances to prisms.
- **RL** mode. This mode refers to the ability to measure distances without prisms.
- **LO** mode. This mode refers to the visible red laser and the ability to measure extended distances to prisms.

**DR**

DR refers to the reflectorless EDM technology which enables an increased measuring range with a small laser spot size. Two options are available: DR400 and DR1000.

**SureBeam**

SureBeam assists with prism targeting. It consists of two differently coloured flashing lights located in the instrument telescope housing. The person holding the prism can align him/herself into the instrument’s line of sight.

**Motorised**

Instruments fitted with internal motors, enabling automatic horizontal and vertical turning are referred to as **Motorised**.

**iLock**

iLock refers to the instrument sensor which enables the automatic target aiming to a prism.

**Automated**

Instruments fitted with **Target aiming** are referred to as **Automated**.

Three automation modes are available with **Target aiming**:

- None: no **Target aiming** - no automation and no tracking.
- iLock: automatic target aiming to a prism.
- Robotic: automatic tracking of an already targeted prism.

**RadioHandle**

A component of RCS is the RH9 RadioHandle. It is an instrument carry handle with an integrated radio modem with attached antenna.
R9, Description of the System

R9 characteristics
Reflectorless EDM, Automated, Motorised.

1.2 System Concept
1.2.1 Software Concept

Software type

<table>
<thead>
<tr>
<th>Software type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System software</td>
<td>This software comprises the central functions of the instrument. It is also referred to as firmware.</td>
</tr>
<tr>
<td></td>
<td>No Survey and Setup programs are integrated into the firmware as the measurements are triggered from the RC9 radio field controller.</td>
</tr>
<tr>
<td></td>
<td>The English language is integrated into the firmware and cannot be deleted.</td>
</tr>
<tr>
<td>Language software</td>
<td>The system software enables a maximum of three languages which can be stored at any one time - the English language and two other languages. The English language is the default language and cannot be deleted. One language is chosen as the active language.</td>
</tr>
<tr>
<td>Application programs</td>
<td>No onboard applications are available for this instrument. The applications are available on the RC9 radio field controller.</td>
</tr>
</tbody>
</table>
**Software upload**

The instrument firmware is stored in the System RAM of the instrument. The firmware can be uploaded onto the instrument using the following method:

- By connecting the CompactFlash card directly to the computer either via an internal card slot housing or an external OMNI drive, the software is transferred to the card, which is then stored to the System RAM.

**1.2.2 Data Storage**

**Description**

Data is stored within a job in a database on a CompactFlash card.

**Memory device**

CompactFlash card: A CompactFlash card slot is standard. A CompactFlash card can be inserted and removed. Available capacity: 256 MB.

📢 Whilst other CompactFlash cards may be used, Stonex® recommends Stonex® CompactFlash cards and cannot be held responsible for data loss or any other error that may occur when using a non-Stonex® card.

🚫 Unplugging connecting cables or removing the CompactFlash card during the Check & Adjust routine may cause loss of data. Always return to the **Main Menu** before removing the CompactFlash card and switch off the instrument before removing cables.
1.2.3 Power Concept

General
Use the Stonex® batteries, chargers and accessories or accessories recommended by Stonex® to ensure the correct functionality of the instrument.

Power options
Instrument
Power for the instrument can be supplied either internally or externally. An external battery is connected to the instrument using a LEMO cable.
Internal battery: One SB21 battery fitted into the battery compartment.

1.3 Instrument Components

Instrument components part 1 of 2

a) Carry handle
b) Optical sight
c) Telescope, integrating EDM, iLock, SureBeam
d) SureBeam flashing diode - yellow and red
e) Coaxial optics for angle and distance measurement, and exit port of visible laser beam for distance measurements
f) CompactFlash card compartment
g) Horizontal drive
h) Tribrach securing screw
Instrument components part 2 of 2

i) Vertical drive
j) Focusing ring
k) Battery compartment
l) Stylus for touch screen
m) Screen
n) Circular level
o) Tribrach footscrew
p) Eyepiece
q) Keyboard

Instrument components for RCS

a) RadioHandle
b) Communication side cover
2 User Interface

2.1 Keyboard

Keyboard

a) Alphanumeric keys  
b) CE, ESC, USER, ON  
c) ENTER  
d) Arrow keys  
e) SHIFT  
f) Function keys F1-F6

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alphanumeric</td>
<td>• To type letters and numbers.</td>
</tr>
<tr>
<td>keys</td>
<td></td>
</tr>
<tr>
<td>CE</td>
<td>• Clears all entry at the beginning of user input.</td>
</tr>
<tr>
<td></td>
<td>• Clears the last character during user input.</td>
</tr>
<tr>
<td>ESC</td>
<td>• Leaves the current menu or dialog without storing changes made.</td>
</tr>
<tr>
<td>USER</td>
<td>• Calls the user menu.</td>
</tr>
<tr>
<td>ON</td>
<td>• If the instrument is off: to turn instrument on.</td>
</tr>
</tbody>
</table>
### Key combinations

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON plus USER</td>
<td>Turns instrument off.</td>
</tr>
<tr>
<td>SHIFT ▲</td>
<td>Pages up.</td>
</tr>
<tr>
<td>SHIFT ▼</td>
<td>Pages down.</td>
</tr>
</tbody>
</table>

### 2.2 Screen

**Screen**

- a) Time
- b) Caption
- c) Title
- d) Screen area
- e) Message line
- f) Icons
- g) ESC
- h) CAPS
- i) SHIFT icon
- j) Softkeys
**Elements of the screen**

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>The current local time is shown.</td>
</tr>
<tr>
<td>Caption</td>
<td>Shows location e.g. <strong>Main Menu</strong>.</td>
</tr>
<tr>
<td>Title</td>
<td>Name of the screen is shown.</td>
</tr>
<tr>
<td>Screen area</td>
<td>The working area of the screen.</td>
</tr>
<tr>
<td>Message line</td>
<td>Messages are shown for 10 s.</td>
</tr>
<tr>
<td>Icons</td>
<td>Shows current status information of the instrument. Refer to &quot;2.4 Icons&quot;. Can be used with touch screen.</td>
</tr>
<tr>
<td>ESC ▼</td>
<td>Can be used with touch screen. Same functionality as the fixed key <strong>ESC</strong>. The last operation will be undone.</td>
</tr>
<tr>
<td>CAPS</td>
<td>The caps mode for upper case letters is active. The caps mode is activated and deactivated by pressing <strong>UPPER(F5)</strong> or <strong>LOWER(F5)</strong> in some screens.</td>
</tr>
<tr>
<td>SHIFT icon</td>
<td>Shows the status of the <strong>SHIFT</strong> key; either first or second level of softkeys is selected. Can be used with touch screen and has the same functionality as the fixed key <strong>SHIFT</strong>.</td>
</tr>
<tr>
<td>Softkeys</td>
<td>Commands can be executed using <strong>(F1)-(F6)</strong> keys. The commands assigned to the softkeys are screen-dependent. Can be used directly with touch screen.</td>
</tr>
<tr>
<td>Scroll bar</td>
<td>Scrolls the screen area up and down.</td>
</tr>
</tbody>
</table>
2.3 Operating Principles

Keyboard and touch screen
The user interface is operated either by the keyboard or by the touch screen with supplied stylus. The workflow is the same for keyboard and touch screen entry, the only difference lies in the way information is selected and entered.

Turn instrument on
Press and hold ON for 2 s.

Turn instrument off step-by-step

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>The instrument can only be turned off in the Main Menu.</td>
</tr>
<tr>
<td>1.</td>
<td>Press and hold both USER and ON simultaneously. OR Press ESC for more than 2 s.</td>
</tr>
<tr>
<td>2.</td>
<td>Press YES (F6) to continue or NO (F4) to cancel.</td>
</tr>
</tbody>
</table>

Lock/Unlock keyboard

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock</td>
<td>To lock the keyboard press and hold SHIFT for 3 s. The message 'Keyboard locked' is momentarily displayed on the Message Line.</td>
</tr>
<tr>
<td>Unlock</td>
<td>To unlock the keyboard press and hold SHIFT for 3 s. The message 'Keyboard unlocked' is momentarily displayed on the Message Line.</td>
</tr>
</tbody>
</table>
## Selecting from a menu

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Menu</td>
<td>To select an item from a menu, do one of the following: Move the focus to the item. <strong>ENTER</strong> or <strong>CONT (F1)</strong>. OR Type the complete selection number in front of the item. <strong>ENTER</strong> or <strong>CONT (F1)</strong> are not required. OR Tap on the item with the stylus.</td>
</tr>
</tbody>
</table>

## Selecting a page

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>To select a page in a screen, do one of the following: <strong>PAGE (F6)</strong>. OR Tap on the page tab with the stylus.</td>
</tr>
</tbody>
</table>

## Edit an entire value in input fields

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Highlight the field. 2) Type numeric and/or alphanumeric characters to overwrite. 3) <strong>ENTER</strong> or tap outside of the field.</td>
<td></td>
</tr>
</tbody>
</table>
## Edit an individual character in input fields

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A character can be inserted or overwritten. The procedure is the same for both cases.</td>
</tr>
</tbody>
</table>
|            | 1) Highlight the field.  
2) For the keyboard: **ENTER**. The edit mode is activated where additional functions like insert and overwrite are available. For the touch screen: Highlight the characters to be changed.  
3) Type numeric and/or alphanumeric characters.  
4) **ENTER** or tap outside of the field. |

## Access special alphanumeric characters for input

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Highlight the input field.</td>
</tr>
<tr>
<td>2.</td>
<td>For the keyboard: <strong>ENTER</strong>.</td>
</tr>
<tr>
<td>3.</td>
<td>Toggle to the desired special character set by using the up/down arrow keys.</td>
</tr>
<tr>
<td>4.</td>
<td>Press the function key assigned to the required character group.</td>
</tr>
<tr>
<td>5.</td>
<td>Press the function key with the required character.</td>
</tr>
<tr>
<td>6.</td>
<td>Repeat step 4. and 5. for entering more special characters of the same character set.</td>
</tr>
<tr>
<td>7.</td>
<td><strong>ENTER</strong>.</td>
</tr>
</tbody>
</table>
Appearance and selection from a choicelist
Choicelists have various appearances.

Closed choicelist

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangles on the right indicate further available choices.</td>
<td>Use the arrow keys to change through the list or tap the triangles on the screen.</td>
<td></td>
</tr>
</tbody>
</table>

ENTER or tap on the field to access the choicelist. Opening a choicelist reveals either a simple listbox or a comprehensive listbox dialog.

Simple listbox

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choicelist shows items to select.</td>
<td>Highlight the item and ENTER.</td>
<td></td>
</tr>
<tr>
<td>A search field is shown if necessary.</td>
<td>To exit without changes ESC, tap or outside the simple listbox.</td>
<td></td>
</tr>
<tr>
<td>A scroll bar is shown if necessary.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Listbox dialog

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choicelist fills the whole screen.</td>
<td>Highlight the item and CONT (F1).</td>
<td></td>
</tr>
<tr>
<td>A search field is shown.</td>
<td>To exit without changes press ESC or tap</td>
<td></td>
</tr>
<tr>
<td>A scroll bar is shown if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The functionality comprises adding, editing and deleting of items.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listbox dialogs are explained in detail at appropriate places in the manuals.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.4 Icons

Description
The screen icons display the status information of the instrument.

Position of the icons on the screen

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflector</td>
<td>The currently active reflector is displayed.</td>
</tr>
<tr>
<td>EDM</td>
<td>The currently active EDM measurement settings are displayed.</td>
</tr>
<tr>
<td>Compensator/face I&amp;II</td>
<td>Compensator off, out of range or face I&amp;II icon is displayed.</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>The status of each Bluetooth port and any Bluetooth connection is displayed.</td>
</tr>
<tr>
<td>CompactFlash card</td>
<td>For the CompactFlash card, the capacity of used space is shown in seven levels.</td>
</tr>
<tr>
<td>Battery</td>
<td></td>
</tr>
<tr>
<td>SHIFT</td>
<td></td>
</tr>
</tbody>
</table>
The status and source of the battery is displayed. The percentage of remaining power capacity for all batteries is displayed numerically and graphically. For internal and external battery being attached at the same time the internal battery is used until it is empty and then the external battery is used.

The status of the **SHIFT** key is displayed.
3 Operation

3.1 Instrument Setup

Description
This topic describes an instrument setup over a marked ground point using the laser plummet. It is always possible to set up the instrument without the need for a marked ground point.

Important features
- It is always recommended to shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.
- The laser plummet described in this topic is built into the vertical axis of the instrument. It projects a red spot onto the ground, making it appreciably easier to centre the instrument.
- The laser plummet cannot be used with a tribrach equipped with an optical plummet.

Setup step-by-step

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☯</td>
<td>Shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.</td>
</tr>
</tbody>
</table>
### 3.2 Autodetect Behaviour

**Description**
- The instrument incorporates an autodetect behaviour and automatically detects the following device:
  - RadioHandle
- Whenever a device is attached, the instrument responds with two short beeps.
- Whenever a device is removed, the instrument responds with one long beep.
RadioHandle

- RadioHandle is automatically detected by the instrument when it is attached.
- When RadioHandle is attached, the appropriate port and device settings have to be set manually in the **CONFIGURE Interfaces** menu.

### 3.3 Instrument Setup for Remote Control

#### 3.3.1 Remote Control Setup

**Setup step-by-step**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![icon]</td>
<td>Refer to &quot;3.1 Instrument Setup&quot; for the initial instrument setup onto a tripod. Remove the instrument carry handle by simultaneously pressing and holding-in the four push buttons.</td>
</tr>
<tr>
<td>1.</td>
<td>Place the RadioHandle onto the instrument by simultaneously pressing and holding-in the four push buttons.</td>
</tr>
<tr>
<td>![icon]</td>
<td>Ensure that the interface connection on the underside of the RadioHandle is on the same side as the Communication side cover.</td>
</tr>
<tr>
<td>2.</td>
<td>Swing the RadioHandle antenna into an upright position.</td>
</tr>
<tr>
<td>![icon]</td>
<td>Refer to &quot;RC9 User Manual&quot; for additional information.</td>
</tr>
</tbody>
</table>
### 3.3.2 LED Indicators on RadioHandle

**Description**
The RadioHandle has Light Emitting Diode indicators. They indicate the basic RadioHandle status.

**Diagram of the LED Indicators**

![Diagram of the LED Indicators]

a) Power LED  
b) Link LED  
c) Data Transfer LED  
d) Mode LED

**Description of the LED Indicators**

<table>
<thead>
<tr>
<th>IF the</th>
<th>is</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power LED</td>
<td>off</td>
<td>power is off.</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>power is on.</td>
</tr>
<tr>
<td>Link LED</td>
<td>off</td>
<td>no radio link to remote controller.</td>
</tr>
<tr>
<td></td>
<td>red</td>
<td>radio link to remote controller.</td>
</tr>
<tr>
<td>Data Transfer LED</td>
<td>off</td>
<td>no data transfer to/from remote controller.</td>
</tr>
<tr>
<td></td>
<td>green or green flashing</td>
<td>data transfer to/from remote controller.</td>
</tr>
<tr>
<td>Mode LED</td>
<td>off</td>
<td>data mode.</td>
</tr>
<tr>
<td></td>
<td>red</td>
<td>configuration mode.</td>
</tr>
</tbody>
</table>
3.4 Batteries

3.4.1 Operating Principles

Charging / first-time use
- The battery must be charged prior to using it for the first time because it is delivered with an energy content as low as possible.
- The permissible temperature range for charging is between 0°C to +40°C/ +32°F to +104°F. For optimal charging, we recommend charging the batteries at a low ambient temperature of +10°C to +20°C/+50°F to +68°F if possible.
- It is normal for the battery to become warm during charging. Using the chargers recommended by Stonex®, it is not possible to charge the battery if the temperature is too high.
- For new batteries or batteries that have been stored for a long time (> three months), it is effectual to make only one charge/discharge cycle.
- For Li-Ion batteries, a single discharging and charging cycle is sufficient. We recommend carrying out the process when the battery capacity indicated on the charger or on a Stonex® product deviates significantly from the actual battery capacity available.

Operation / Discharging
- The batteries can be operated from -20°C to +55°C/-4°F to +131°F.
- Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery.
## 3.4.2 Instrument Battery

### Change battery step-by-step

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Face the instrument so that the vertical drive screw is on the left. The battery compartment is now on the left side of the instrument. Turn the knob to the vertical position, opening the lid of the battery compartment.</td>
</tr>
<tr>
<td>2.</td>
<td>Pull out the battery housing.</td>
</tr>
<tr>
<td>3.</td>
<td>Pull the battery from the battery housing.</td>
</tr>
<tr>
<td>4.</td>
<td>A pictogram of the battery is displayed inside the battery housing. This is a visual aid to assist in placing the battery correctly.</td>
</tr>
<tr>
<td>5.</td>
<td>Place the battery into the battery housing, ensuring that the contacts are facing outward. Click the battery into position.</td>
</tr>
<tr>
<td>6.</td>
<td>Place the battery housing into the battery compartment. Push the battery housing in until it fits completely into the battery compartment.</td>
</tr>
<tr>
<td>7.</td>
<td>Turn the knob to lock the battery compartment. Ensure that the knob is returned to its original horizontal position.</td>
</tr>
</tbody>
</table>
3.5 Working with the CompactFlash Card

- Keep the card dry.
- Use it only within the specified temperature range.
- Do not bend the card.
- Protect the card from direct impacts.

Failure to follow these instructions could result in data loss and/or permanent damage to the card.

Insert and remove a CompactFlash card step-by-step

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Face the instrument so that the vertical drive screw is on the left. The CompactFlash card compartment is now on the right side of the instrument. Turn the knob to the vertical position, opening the lid of the CompactFlash card compartment.</td>
</tr>
<tr>
<td>2.</td>
<td>Open the lid of the CompactFlash card compartment.</td>
</tr>
<tr>
<td>3.</td>
<td>Pull the front of the CompactFlash card up and take the card out of the lid.</td>
</tr>
<tr>
<td>4.</td>
<td>Place the lower end of the CompactFlash card at the lower end of the CompactFlash card compartment. The extended edge of the card has to be on the upper side as shown on the pictogram in the CompactFlash card compartment.</td>
</tr>
<tr>
<td>5.</td>
<td>Press the card down on the lid.</td>
</tr>
<tr>
<td>6.</td>
<td>Close the lid.</td>
</tr>
<tr>
<td>Step</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>7.</td>
<td>Turn the knob to lock the CompactFlash card compartment. The lid is closed correctly when the knob is turned to a horizontal position.</td>
</tr>
</tbody>
</table>

### Format a CompactFlash card step-by-step

Formatting the CompactFlash card before starting to store data is required if a completely new CompactFlash card is used or if all existing data needs to be deleted.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Main Menu: Tools...\Format Memory Device.</strong></td>
</tr>
</tbody>
</table>
| 2.   | **TOOLS Format Memory Device**  
*<Memory Device: CF Card>*  
*<Format Method: Format Quick>*  
Select the memory device to be formatted. |
|      | By activating the format command all data will be lost. Make sure that all important data on the CompactFlash card has been backed up before formatting the card. Before formatting the internal memory make sure that all important data is first transferred to the PC. |
|      | To exit the screen without formatting the memory device, press ESC. This returns to the previous screen without execution of any command. |
| 3.   | **CONT (F1).** |
| 4.   | **YES (F4) to complete the formatting of the CompactFlash card.**  
**NO (F6) to abort the formatting of the CompactFlash card and return to TOOLS Format Memory Device.** |
| 5.   | Once the formatting of the CompactFlash card is completed the system returns to the **Main Menu.** |
3.6 Guidelines for Correct Results

Very short distances may be measured reflectorless in IR mode to well reflecting targets. Note that the distances are corrected with the additive constant defined for the active reflector.

Distance measurement

When measurements are being made using the red laser EDM, the results can be influenced by objects passing between the EDM and the intended target surface. This occurs because reflectorless measurements are made to the first surface returning sufficient energy to allow the measurement to take place. For example, if the intended target surface is the surface of a building, but a vehicle passes between the EDM and the target surface as the measurement is triggered from a field controller, the measurement may be made to the side of the vehicle. The result is the distance to the vehicle, not to the surface of the building. If using the long range measurement mode (> 1000 m, > 3300 ft) to prisms, and an object passes within 30 m of the EDM as the measurement is triggered, the distance measurement may be similarly effected due to the strength of the laser signal.

Caution

Due to laser safety regulations and measuring accuracy, using the Long Range Reflectorless EDM is only allowed to prisms that are more than 1000 m (3300 ft) away.

Accurate measurements to prisms should be made in IR mode.
When a distance measurement is triggered, the EDM measures to the object which is in the beam path at that moment. If a temporary obstruction, for example a passing vehicle, heavy rain, fog or snow is between the instrument and the point to be measured, the EDM may measure to the obstruction.

Do not measure with two instruments to the same target simultaneously to avoid getting mixed return signals.

**iLock/Robotic**

Instruments equipped with an iLock sensor permit automatic angle measurements to prisms. The prism is sighted with the optical sight. After initiating a distance measurement, the instrument sights the prism centre automatically. Vertical and horizontal angles and the distance are measured to the centre of the prism. The Robotic mode enables the instrument to follow a moving prism.

As with all other instrument errors, the collimation error of the automatic aiming must be redetermined periodically. Refer to "4 Check & Adjust" about checking and adjusting instruments.

When a measurement is triggered from the RC9 radio field controller while the prism is still moving, distance and angle measurements may not be made for the same position and coordinates may vary.

If the prism location is changed too quickly, the target may be lost. Make sure that the speed does not exceed the figure given in the technical data.
4 Check & Adjust

4.1 Overview

Description
Stonex® instruments are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, shock or stress can cause deviations and decrease the instrument accuracy. It is therefore recommended to check and adjust the instrument from time to time. This check and adjust can be done in the field by running through specific measurement procedures. The procedures are guided and must be followed carefully and precisely as described in the following chapters. Some other instrument errors and mechanical parts can be adjusted mechanically.

Electronic adjustment
The following instrument errors can be checked and adjusted electronically:

- \( l, t \) Compensator longitudinal and transversal index errors
- \( i \) Vertical index error, related to the standing axis
- \( c \) Horizontal collimation error, also called line of sight error
- \( a \) Tilting axis error
- \( i\text{Lock} \) iLock zero point error for Hz and V - option

Every angle measured in the daily work is corrected automatically if the compensator and the Hz-corrections are activated in the instrument configuration. Select **Main Menu: Config...\Instrument Settings...\Compensator** to check if compensator and Hz collimation is activated.

View current adjustment errors
The currently used adjustment errors can be viewed under **Main Menu: Tools...\Check & Adjust...\Current Values.**
Mechanical adjustment
The following instrument parts can be adjusted mechanically:
• Circular level on instrument and tribrach
• Laser plummet
• Optical plummet - option on tribrach
• Allen screws on tripod

Precise measurements
To get precise measurements in the daily work, it is important:
• To check and adjust the instrument from time to time.
• To take high precision measurements during the check and adjust procedures.
• To measure targets in two faces. Some of the instrument errors are eliminated by averaging the angles from both faces.
• Refer to "4.2 Preparation" to find more important points.

During the manufacturing process, the instrument errors are carefully determined and set to zero. As mentioned above, these errors can change and it is highly recommended to redetermine them in the following situations:
• Before the first use
• Before every high precision survey
• After rough or long transportation
• After long working periods
• After long storage periods
• If the temperature difference between current environment and the temperature at the last calibration is more than 20°C
Summary of errors to be adjusted electronically

<table>
<thead>
<tr>
<th>Instrument error</th>
<th>Effects Hz</th>
<th>Effects V</th>
<th>Elimination with two face measurement</th>
<th>Automatically corrected with proper adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>c - Line of sight error</td>
<td>✓</td>
<td>---</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a - Tilting axis error</td>
<td>✓</td>
<td>---</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>l - Compensator index error</td>
<td>---</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>t - Compensator index error</td>
<td>✓</td>
<td>---</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>i - Vertical index error</td>
<td>---</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iLock Collimation error</td>
<td>✓</td>
<td>✓</td>
<td>---</td>
<td>✓</td>
</tr>
</tbody>
</table>

4.2 Preparation

Before determining the instrument errors, the instrument has to be levelled using the electronic level. Press USER, STAT (F3) to access the Status Menu. Select Level & Laser Plummet to access STATUS Level & Laser Plummet, Level page. The tribrach, the tripod and the underground should be stable and secure from vibrations or other disturbances.

The instrument should be protected from direct sunlight to avoid thermal warming. It is also recommended to avoid strong heat shimmer and air turbulence. The best conditions are early in the morning or with overcast sky.
Before starting to work, the instrument has to become acclimated to the ambient temperature. Approximately two minutes per °C of temperature difference from storage to working environment, but at least 15 min, should be taken into account.

Even after adjustment of the iLock, the crosshairs may not be positioned exactly on the centre of the prism after an iLock measurement has been completed. This outcome is a normal effect. The telescope is not normally positioned exactly on the centre of the prism, to speed up the iLock measurement. These small deviations/iLock offsets, are calculated individually for each measurement and corrected electronically. This means that the horizontal and vertical angles are corrected twice: first by the determined iLock errors for Hz and V, and then by the individual small deviations of the current aiming.

Next step

<table>
<thead>
<tr>
<th>IF the task is to</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>adjust a combination of instrument errors</td>
<td>Refer to &quot;4.3 Combined Adjustment (l, t, i, c and iLock)&quot;.</td>
</tr>
<tr>
<td>adjust the tilting axis</td>
<td>Refer to &quot;4.4 Tilting Axis Adjustment (a)&quot;.</td>
</tr>
<tr>
<td>adjust the circular level</td>
<td>Refer to &quot;4.5 Adjusting the Circular Level of the Instrument and Tribrach&quot;.</td>
</tr>
<tr>
<td>adjust the laser/optical plummet</td>
<td>Refer to &quot;4.6 Inspecting the Laser Plummet of the Instrument&quot;.</td>
</tr>
</tbody>
</table>

4.3 Combined Adjustment (l, t, i, c and iLock)

Description
The combined adjustment procedure determines the following instrument errors in one process:

- **l, t**: Compensator longitudinal and transversal index errors
- **i**: Vertical index error, related to the standing axis
- **c**: Horizontal collimation error, also called line of sight error
- **iLock Hz**: iLock zero point error for horizontal angle option
- **iLock V**: iLock zero point error for vertical angle option
### Combined adjustment procedure step-by-step

The following table explains the most common settings.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Main Menu: Tools...\Check &amp; Adjust...</td>
</tr>
<tr>
<td>2.</td>
<td>TOOLS Check &amp; Adjust Menu</td>
</tr>
<tr>
<td></td>
<td>Select the option: Combined (l,t,i,c,iLock)</td>
</tr>
<tr>
<td>3.</td>
<td>TOOLS Combined I</td>
</tr>
<tr>
<td></td>
<td><code>&lt;iLock Adjust: On&gt;</code> Includes the determination of the iLock Hz and V adjustment errors if an iLock is available.</td>
</tr>
<tr>
<td></td>
<td>It is recommended to use a clean circular prism as target.</td>
</tr>
<tr>
<td>4.</td>
<td>Aim the telescope accurately at a target at about 100 m distant. The target must be positioned within ± 9°/± 10 gon of the horizontal plane. The procedure can be started in any telescope face.</td>
</tr>
<tr>
<td>5.</td>
<td>MEAS (F1) to measure and to continue to the next screen. Motorised instruments change automatically to the other face.</td>
</tr>
<tr>
<td></td>
<td>The fine pointing has to be performed manually.</td>
</tr>
<tr>
<td>6.</td>
<td>TOOLS Combined II</td>
</tr>
</tbody>
</table>
If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and none of them is averaged with the results from previous runs.

7. **TOOLS Adjustment Accuracy**

<No.of Meas:> Shows the number of runs executed. One run consists of a measurement in face I and face II.

<σ I Comp:> and similar lines show the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.

It is recommended to measure at least two runs.

8. **MEAS (F5)** if more runs have to be added. Continue with step 3. OR

**CONT (F1)** to accept the measurements and to proceed to **TOOLS Adjustment Results**. No more runs can be added later.

**Next step**

<table>
<thead>
<tr>
<th>IF the results are</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>to be stored</td>
<td><strong>CONT (F1)</strong> overwrites the old adjustment errors with the new ones, if the <strong>Use</strong> status is set to <strong>Yes</strong>.</td>
</tr>
<tr>
<td>to be determined again</td>
<td><strong>REDO (F2)</strong> rejects all new determined adjustment errors and repeats the whole procedure. Refer to step 3. of paragraph &quot;Combined adjustment procedure step-by-step&quot;.</td>
</tr>
</tbody>
</table>
4.4 **Tilting Axis Adjustment (a)**

**Description**
This adjustment procedure determines the following instrument error:

a) Tilting axis error

**Determination of tilting axis error step-by-step**
The following table explains the most common settings.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>The Hz collimation error (c) has to be determined before starting this procedure.</td>
</tr>
<tr>
<td>1.</td>
<td><strong>Main Menu:</strong> Tools...\Check &amp; Adjust...</td>
</tr>
<tr>
<td>2.</td>
<td><strong>TOOLS Check &amp; Adjust Menu</strong> Select the option: <strong>Tilting Axis (a)</strong></td>
</tr>
<tr>
<td>3.</td>
<td><strong>TOOLS Tilting-Axis Adjustment I</strong> Aim the telescope accurately at a target at about 100 m distance or less if not possible. The target must be positioned at least 27°/30 gon above or beneath the horizontal plane. The procedure can be started in any telescope face.</td>
</tr>
</tbody>
</table>
4. **MEAS (F1)** to measure and to continue to the next screen. Motorised instruments change automatically to the other face.

   ![Diagram](https://via.placeholder.com/150)

   The fine pointing has to be performed manually.

5. **TOOLS Tilting-Axis Adjustment II**

   **MEAS (F1)** to measure the same target in the other face and to calculate the tilting axis error.

   ![Diagram](https://via.placeholder.com/150)

   If the error is bigger than the predefined limit, the procedure has to be repeated. The tilting axis measurements of the current run are then rejected and not averaged with the results from previous runs.

6. **TOOLS T-Axis Adjustment Accuracy**

   `<No.of Meas:>` Shows the number of runs executed. One run consists of a measurement in face I and face II.

   `<σ a T-axis:>` shows the standard deviation of the determined tilting axis error. The standard deviation can be calculated from the second run onwards.

   ![Diagram](https://via.placeholder.com/150)

   It is recommended to measure at least two runs.

7. **MEAS (F5)** if more runs have to be added. Continue with step 3.

   OR

   **CONT (F1)** to accept the measurements and to proceed to **TOOLS T-Axis Adjustment Result**. No more runs can be added later.
Next step

<table>
<thead>
<tr>
<th>IF the results are</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>to be stored</td>
<td><strong>CONT (F1)</strong> overwrites the old adjustment errors with the new ones, if the <strong>Use</strong> status is set to <strong>Yes.</strong></td>
</tr>
<tr>
<td>to be determined again</td>
<td><strong>REDO (F2)</strong> rejects all new determined adjustment errors and repeats the whole procedure. Refer to step 3. of paragraph &quot;Determination of tilting axis error step-by-step&quot;.</td>
</tr>
</tbody>
</table>

### 4.5 Adjusting the Circular Level of the Instrument and Tribrach

**Adjusting the circular level step-by-step**

1. Place and secure the instrument into the tribrach and onto a tripod.

2. Using the tribrach footscrews, level the instrument with the electronic level. Press **USER, STAT (F3)** to access the **Status Menu**. Select **Level & Laser Plummet** to access **STATUS Level & Laser Plummet**.

3. Check the position of the circular level on the instrument and tribrach.
4.6 Inspecting the Laser Plummet of the Instrument

The laser plummet is located in the vertical axis of the instrument. Under normal conditions of use, the laser plummet does not need adjusting. If an adjustment is necessary due to external influences, return the instrument to any Stonex® authorised service workshop.

Inspecting the laser plummet step-by-step

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. a)</td>
<td>If both circular levels are centered, no adjustments are necessary.</td>
</tr>
<tr>
<td>b)</td>
<td>If one or both circular levels are not centered, adjust as follows:</td>
</tr>
<tr>
<td>Instrument</td>
<td>If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws. Turn the instrument by 200 gon (180°). Repeat the adjustment procedure if the circular level does not stay centered.</td>
</tr>
<tr>
<td>Tribrach</td>
<td>If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws.</td>
</tr>
<tr>
<td>☢️</td>
<td>After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.</td>
</tr>
</tbody>
</table>
The following table explains the most common settings.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Place and secure the instrument into the tribrach and onto a tripod.</td>
</tr>
<tr>
<td>2.</td>
<td>Using the tribrach footscrews, level the instrument with the electronic level. Press <strong>USER, STAT (F3)</strong> to access the <strong>Status Menu</strong>. Select <strong>Level &amp; Laser Plummet</strong> to access <strong>STATUS Level &amp; Laser Plummet</strong>.</td>
</tr>
<tr>
<td>3.</td>
<td><strong>PAGE (F6)</strong> to access the <strong>Laser Plummet</strong> page. Switch on the laser plummet. Inspection of the laser plummet should be carried out on a bright, smooth and horizontal surface, like a sheet of paper.</td>
</tr>
<tr>
<td>4.</td>
<td>Mark the centre of the red dot on the ground.</td>
</tr>
<tr>
<td>5.</td>
<td>Turn the instrument through 360° slowly, carefully observing the movement of the red laser dot.</td>
</tr>
<tr>
<td>6.</td>
<td>The maximum diameter of the circular movement described by the centre of the laser point should not exceed 3 mm at a distance of 1.5 m. If the centre of the laser dot describes a perceptible circular movement or moves more than 3 mm away from the point which was first marked, an adjustment may be required. Inform your nearest Stonex® authorised service workshop. Depending on brightness and surface, the diameter of the laser dot can vary. At 1.5 m it is about 2.5 mm.</td>
</tr>
</tbody>
</table>
5 Care and Transport

5.1 Transport

Transport in the field
When transporting the equipment in the field, always make sure that you
• either carry the product in its original transport container,
• or carry the tripod with its legs splayed across your shoulder, keeping
  the attached product upright.

Transport in a road vehicle
Never carry the product loose in a road vehicle, as it can be affected by
shock and vibration. Always carry the product in its transport container
and secure it.

Shipping
When transporting the product by rail, air or sea, always use the complete
original Stonex® packaging, transport container and cardboard box, or its
equivalent, to protect against shock and vibration.

Shipping, transport of batteries
When transporting or shipping batteries, the person in charge of the
product must ensure that the applicable national and international rules
and regulations are observed. Before transportation or shipping, contact
your local passenger or freight transport company.

Field adjustment
After transport inspect the field adjustment parameters given in this user
manual before using the product.
5.2 Storage

Product
Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "7 Technical Data" for information about temperature limits.

Field adjustment
After long periods of storage inspect the field adjustment parameters given in this user manual before using the product.

Li-Ion batteries
• Refer to "7 Technical Data" for information about storage temperature range.
• At the recommended storage temperature range, batteries containing a 10% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged.
• Remove batteries from the product and the charger before storing.
• After storage recharge batteries before using.
• Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use.
• A storage temperature range of -20°C to +30°C/-4°F to 86°F in a dry environment is recommended to minimise self-discharging of the battery.

5.3 Cleaning and Drying

Product and accessories
• Blow dust off lenses and prisms.
• Never touch the glass with your fingers.
• Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these can attack the polymer components.
R9, Care and Transport

**Fogging of prisms**
Prisms that are cooler than the ambient temperature tend to fog. It is not enough simply to wipe them. Keep them for some time inside your jacket or in the vehicle to allow them to adjust to the ambient temperature.

**Damp products**
Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater than 40°C /104°F and clean them. Do not repack until everything is completely dry. Always close the transport container when using in the field.

![Diagram of a product being dried and closed in a vehicle]

**Cables and plugs**
Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

5.4 **Maintenance**

**Motorisation**
An inspection of the motorisation in motorised instruments must be done in a Stonex® authorised service workshop.
Following conditions:
- After about 4000 hours operation.
- Twice a year in case of permanent use of the instrument, for example in monitoring applications.
6 Safety Directions

6.1 General Introduction

Description
The following directions enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

6.2 Intended Use

Permitted use
- Measuring horizontal and vertical angles.
- Measuring distances.
- Recording measurements.
- Automatic target search, recognition and -tracking.
- Visualising the aiming direction and vertical axis.
- Remote control of product.
- Data communication with external appliances.
- Computing with software.

Adverse use
- Use of the product without instruction.
- Use outside of the intended limits.
- Disabling safety systems.
- Removal of hazard notices.
- Opening the product using tools, for example screwdriver, unless this is permitted for certain functions.
- Modification or conversion of the product.
- Use after misappropriation.
- Use of products with recognisable damages or defects.
- Use with accessories from other manufacturers without the prior explicit approval of Stonex®.
- Aiming directly into the sun.
• Inadequate safeguards at the working site, for example when measuring on roads.
• Deliberate dazzling of third parties.
• Controlling of machines, moving objects or similar monitoring application without additional control- and safety installations.

⚠️ Warning
Adverse use can lead to injury, malfunction and damage. It is the task of the person responsible for the equipment to inform the user about hazards and how to counteract them. The product is not to be operated until the user has been instructed on how to work with it.

6.3 Limits of Use

Environment
Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments.

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

6.4 Responsibilities

Manufacturer of the product
Stonex® Europe srl, IT-20052 Monza, hereinafter referred to as Stonex®, is responsible for supplying the product, including the user manual and original accessories, in a safe condition.

Manufacturers of non Stonex® accessories
The manufacturers of non Stonex® accessories for the product are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Stonex® product.
Person in charge of the product
The person in charge of the product has the following duties:
• To understand the safety instructions on the product and the instructions in the user manual.
• To be familiar with local regulations relating to safety and accident prevention.
• To inform Stonex® immediately if the product and the application becomes unsafe.
• To ensure that the national laws, regulations and conditions for the operation of radio transmitters are respected.

⚠️ Warning
The person responsible for the product must ensure that it is used in accordance with the instructions. This person is also accountable for the training and the deployment of personnel who use the product and for the safety of the equipment in use.

6.5 Hazards of Use

⚠️ Warning
The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can cause accidents with far-reaching human, material, financial and environmental consequences.

Precautions:
All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the product.

⚠️ Caution
Watch out for erroneous measurement results if the product has been dropped or has been misused, modified, stored for long periods or transported.

Precautions:
Periodically carry out test measurements and perform the field adjustments indicated in the user manual, particularly after the product has been subjected to abnormal use and before and after important measurements.
Danger
Because of the risk of electrocution, it is dangerous to use poles and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:
Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.

Caution
With the remote control of products, it is possible that extraneous targets will be picked out and measured.

Precautions:
When measuring in remote control mode, always check your results for plausibility.

Caution
Be careful when pointing the product towards the sun, because the telescope functions as a magnifying glass and can injure your eyes and/or cause damage inside the product.

Precautions:
Do not point the product directly at the sun.

Warning
During dynamic applications, for example stakeout procedures there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:
The person responsible for the product must make all users fully aware of the existing dangers.
**Warning**
Inadequate securing of the working site can lead to dangerous situations, for example in traffic, on building sites, and at industrial installations.

**Precautions:**
Always ensure that the working site is adequately secured. Adhere to the regulations governing safety and accident prevention and road traffic.

**Warning**
If computers intended for use indoors are used in the field there is a danger of electric shock.

**Precautions:**
Adhere to the instructions given by the computer manufacturer regarding field use with Stonex® products.

**Caution**
If the 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 can sustain injury.

**Precautions:**
When setting-up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position. Avoid subjecting the product to mechanical stress.

**Warning**
If the product is used with accessories, for example masts, staffs, poles, you may increase the risk of being struck by lightning.

**Precautions:**
Do not use the product in a thunderstorm.

**Warning**
Using a battery charger not recommended by Stonex® can destroy the batteries. This can cause fire or explosions.

**Precautions:**
Only use chargers recommended by Stonex® to charge the batteries.
**Caution**

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

**Precautions:**
Before shipping the product or disposing of it, discharge the batteries by running the product until they are flat.
When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping contact your local passenger or freight transport company.

**Warning**

High mechanical stress, high ambient temperatures or immersion into fluids can cause leakage, fire or explosions of the batteries.

**Precautions:**
Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.

**Warning**

If battery terminals come in contact with jewellery, keys, metallised paper or other metals, short circuited battery terminals can overheat and cause injury or fire, for example by storing or transporting in pockets.

**Precautions:**
Make sure that the battery terminals do not come into contact with metallic objects.

**Warning**

If the product is improperly disposed of, the following can happen:
- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorised persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
Precautions:
The product must not be disposed with household waste. Dispose of the product appropriately in accordance with the national regulations in force in your country.
Always prevent access to the product by unauthorised personnel.

⚠️ Warning
Only Stonex® authorised service workshops are entitled to repair these products.

6.6 Laser Classification
6.6.1 General

General
The following directions (in accordance with the state of the art - international standard IEC 60825-1 (2007-03) and IEC TR 60825-14 (2004-02)) provide instruction and training information to the person responsible for the product and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

👉 Products classified as laser class 1, class 2 and class 3R do not require:
- laser safety officer involvement,
- protective clothes and eyewear,
- special warning signs in the laser working area
if used and operated as defined in this user manual due to the low eye hazard level.

👉 Products classified as laser class 2 or class 3R may cause dazzle, flash-blindness and afterimages, particularly under low ambient light conditions.
6.6.2 Distancer, Measurements with Reflectors

General
The EDM module built into this product produces a visible laser beam which emerges from the telescope objective.

The laser product described in this section, is classified as laser class 1 in accordance with:

Class 1 laser products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with this user manual.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum average radiant power</td>
<td>0.33 mW</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>800 ps</td>
</tr>
<tr>
<td>Pulse repetition frequency</td>
<td>100 MHz - 150 MHz</td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm - 690 nm</td>
</tr>
</tbody>
</table>

Labelling

Class 1 Laser Product according to IEC 60825-1 (2007 - 03)

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
1) This device may not cause harmful interference, and
2) This device must accept any interference received, including interference that may cause undesired operation.

a) Laser beam
6.6.3  Distancer, Measurements without Reflectors

**General**
The EDM module built into the product produces a visible laser beam which emerges from the telescope objective.

The laser product described in this section, is classified as laser class 3R in accordance with:

Class 3R laser products:
Direct intrabeam viewing may be hazardous (low-level eye hazard), in particular for deliberate ocular exposure. The risk of injury for laser class 3R products is limited because of:

a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
b) inherent safety margin in the maximum permissible exposure to laser radiation (MPE),
c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value (DR400/DR1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum average radiant power</td>
<td>5.00 mW</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>800 ps</td>
</tr>
<tr>
<td>Pulse repetition frequency</td>
<td>100 MHz - 150 MHz</td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm - 690 nm</td>
</tr>
<tr>
<td>Beam divergence</td>
<td>0.2 mrad x 0.3 mrad</td>
</tr>
<tr>
<td>NOHD (Nominal Ocular Hazard Distance) @ 0.25s</td>
<td>80 m / 262 ft</td>
</tr>
</tbody>
</table>
Warning
From a safety perspective class 3R laser products should be treated as potentially hazardous.
Precautions:
Prevent direct eye exposure to the beam. Do not direct the beam at other people.

Warning
Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces etc.
Precautions:
Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.
Labelling

Laser Aperture

Laser Radiation
Avoid direct eye exposure
Class 3R Laser Product
according to IEC 60825-1
(2007 - 03)
Po ≤ 5.00 mW
λ = 650 - 690 nm

a) Laser beam

Type: R9...
Art.No.: ....
Equip.No.:.......
Power: 12V/6V = 1A max
S.No.: ....

STONEX EUROPE srl
I-20035 Lissone
Manufactured:....

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference;
and
(2) this device must accept any interference received,
including interference that may cause undesired operation.
6.6.4  iLock

General
The iLock built into this product produces an invisible laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 1 in accordance with:

Class 1 laser products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with this user manual.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum average radiant power</td>
<td>10 mW</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>11 ms</td>
</tr>
<tr>
<td>Pulse repetition frequency</td>
<td>37 Hz</td>
</tr>
<tr>
<td>Wavelength</td>
<td>785 nm</td>
</tr>
</tbody>
</table>

Labelling

Class 1 Laser Product
according to IEC 60825-1 (2007-03)

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

a) Laser beam
6.6.5 SureBeam

General

The integrated SureBeam produces a visible LED beam from the front side of the telescope.

The product described in this section, is excluded from the scope of IEC 60825-1 (2007-03): "Safety of laser products". The product described in this section, is classified as exempt group in accordance with IEC 62471 (2006-07) and does not pose any hazard provided that the product is used and maintained in accordance with this user manual.

Class 1 LED Product according to IEC 60825-1 (2001 - 08)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

a) LED beam red
b) LED beam yellow
6.6.6  Laser Plummet

General
The laser plummet built into the product produces a visible red laser beam which emerges from the bottom of the product.

The laser product described in this section, is classified as laser class 2 in accordance with:

Class 2 laser products:
These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum average radiant power</td>
<td>1.00 mW</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>0 - 100 %</td>
</tr>
<tr>
<td>Pulse repetition frequency</td>
<td>1 kHz</td>
</tr>
<tr>
<td>Wavelength</td>
<td>635 nm</td>
</tr>
</tbody>
</table>

⚠️  Warning
From a safety perspective class 2 laser products are not inherently safe for the eyes.

**Precautions:**
Avoid staring into the beam or pointing the beam at other people.
Labelling

Laser Radiation
Do not stare into the beam
Class 2 Laser Product
according to IEC 60825-1
(2007 - 03)
Po ≤ 1.00 mW
λ = 620 - 690 nm

a) Will be replaced by a class 3R warning label if applicable

a) Laser beam
b) Exit for laser beam
6.7 Electromagnetic Compatibility EMC

Description
The term Electromagnetic Compatibility is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances to other equipment.

⚠️ Warning
Electromagnetic radiation can cause disturbances in other equipment.

Although the product meets the strict regulations and standards which are in force in this respect, Stonex® cannot completely exclude the possibility that other equipment may be disturbed.

⚠️ Caution
There is a risk that disturbances may be caused in other equipment if the product is used with accessories from other manufacturers, for example field computers, personal computers, two-way radios, non-standard cables or external batteries.

Precautions:
Use only the equipment and accessories recommended by Stonex®. When combined with the product, they meet the strict requirements stipulated by the guidelines and standards. When using computers and two-way radios, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

⚠️ Caution
Disturbances caused by electromagnetic radiation can result in erroneous measurements.
Although the product meets the strict regulations and standards which are in force in this respect, Stonex® cannot completely exclude the possibility that the product may be disturbed by intense electromagnetic radiation, for example, near radio transmitters, two-way radios or diesel generators.

Precautions:
Check the plausibility of results obtained under these conditions.
**Warning**

If the product is operated with connecting cables attached at only one of their two ends, for example external supply cables, interface cables, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired.

**Precautions:**
While the product is in use, connecting cables, for example product to external battery, product to computer, must be connected at both ends.

**Radios or digital cellular phones**

Use of product with radio or digital cellular phone devices:

**Warning**

Electromagnetic fields can cause disturbances in other equipment, in installations, in medical devices, for example pacemakers or hearing aids and in aircraft. It can also affect humans and animals.

**Precautions:**
Although the product meets the strict regulations and standards which are in force in this respect, Stonex® cannot completely exclude the possibility that other equipment can be disturbed or that humans or animals can be affected.

- Do not operate the product with radio or digital cellular phone devices in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
- Do not operate the product with radio or digital cellular phone devices near to medical equipment.
- Do not operate the product with radio or digital cellular phone devices in aircraft.
6.8 **FCC Statement, Applicable in U.S.**

⚠️ The greyed paragraph below is only applicable for products without radio.

⚠️ **Warning**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

⚠️ **Warning**

Changes or modifications not expressly approved by Stonex® for compliance could void the user’s authority to operate the equipment.
Labelling R9

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Labelling internal battery SB21

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Labelling RadioHandle

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
7 Technical Data

7.1 Angle Measurement

Accuracy

<table>
<thead>
<tr>
<th>Available angular accuracies</th>
<th>Standard deviation Hz, V, ISO 17123-3</th>
<th>Display resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>[&quot;]</td>
<td>[mgon]</td>
<td>[&quot;]</td>
</tr>
<tr>
<td>2</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>1.0</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Characteristics
Absolute, continuous, diametric.

7.2 Distance Measurement with Reflectors

Range

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>360° prism (GRZ4)</td>
<td>800</td>
<td>2600</td>
<td>1500</td>
<td>5000</td>
<td>2000</td>
<td>7000</td>
</tr>
</tbody>
</table>

Shortest measuring distance: 1.5 m

Atmospheric conditions

Range A: Strong haze, visibility 5 km; or strong sunlight, severe heat shimmer
Range B: Light haze, visibility about 20 km; or moderate sunlight, slight heat shimmer
Range C: Overcast, no haze, visibility about 40 km; no heat shimmer

↪ Measurements can be made to reflector tapes over the entire range without external ancillary optics.
R9, Technical Data

Accuracy
Accuracy refers to measurements to standard prisms.

<table>
<thead>
<tr>
<th>EDM measuring mode</th>
<th>std. dev. ISO 17123-4, standard prism</th>
<th>std. dev. ISO 17123-4, tape</th>
<th>Measurement time, typical [s]*1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1 mm + 1.5 ppm</td>
<td>5 mm + 2 ppm</td>
<td>2.4</td>
</tr>
<tr>
<td>Fast</td>
<td>3 mm + 1.5 ppm</td>
<td>5 mm + 2 ppm</td>
<td>0.8</td>
</tr>
<tr>
<td>Tracking</td>
<td>3 mm + 1.5 ppm</td>
<td>5 mm + 2 ppm</td>
<td>&lt; 0.15</td>
</tr>
</tbody>
</table>

*1 does not include radio transfer time to the RC9 radio field controller. Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specified accuracy. The display resolution is 0.1 mm.

Characteristics

- Principle: Phase measurement
- Type: Coaxial, visible red laser
- Carrier wave: 658 nm
- Measuring system: System analyser basis 100 MHz - 150 MHz
### 7.3 Distance Measurement without Reflectors

#### Range

<table>
<thead>
<tr>
<th>Type</th>
<th>Kodak Gray Card</th>
<th>Range D</th>
<th>Range E</th>
<th>Range F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>[m]</td>
<td>[ft]</td>
<td>[m]</td>
</tr>
<tr>
<td>DR400</td>
<td>White side, 90% reflective</td>
<td>200</td>
<td>660</td>
<td>300</td>
</tr>
<tr>
<td>DR400</td>
<td>Grey side, 18% reflective</td>
<td>150</td>
<td>490</td>
<td>200</td>
</tr>
<tr>
<td>DR1000</td>
<td>White side, 90% reflective</td>
<td>800</td>
<td>2630</td>
<td>1000</td>
</tr>
<tr>
<td>DR1000</td>
<td>Grey side, 18% reflective</td>
<td>400</td>
<td>1320</td>
<td>500</td>
</tr>
</tbody>
</table>

Range of Measurement: 1.5 m - 1200 m
Display unambiguous: up to 1200 m

#### Atmospheric conditions

D: Object in strong sunlight, severe heat shimmer
E: Object in shade, sky overcast
F: Underground, night and twilight

#### Accuracy

<table>
<thead>
<tr>
<th>Standard measuring</th>
<th>std. dev. ISO 17123-4</th>
<th>Measure time, typical [s]</th>
<th>Measure time, maximum [s]*1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 m - 500 m</td>
<td>2 mm + 2 ppm</td>
<td>3 - 6</td>
<td>12</td>
</tr>
<tr>
<td>&gt;500 m</td>
<td>4 mm + 2 ppm</td>
<td>3 - 6</td>
<td>12</td>
</tr>
</tbody>
</table>

*1 does not include radio transfer time to the RC9 radio field controller. Object in shade, sky overcast. Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specified accuracy. The display resolution is 0.1 mm.
R9, Technical Data

Characteristics

Type: Coaxial, visible red laser
Carrier wave: 658 nm
Measuring system: System analyser basis 100 MHz - 150 MHz

Laser dot size

<table>
<thead>
<tr>
<th>Distance [m]</th>
<th>Laser dot size, approximately [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>at 30</td>
<td>7 x 10</td>
</tr>
<tr>
<td>at 50</td>
<td>8 x 20</td>
</tr>
</tbody>
</table>

7.4 Distance Measurement - Long Range (LO mode)

Range
The range of the long range measurements is the same for DR400 and DR1000.

<table>
<thead>
<tr>
<th>Reflector</th>
<th>Range A [m]</th>
<th>Range B [m]</th>
<th>Range C [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>STCPH1L SET-BR</td>
<td>2200</td>
<td>7500</td>
<td>&gt;10000</td>
</tr>
<tr>
<td></td>
<td>7300</td>
<td>24600</td>
<td>&gt;3280</td>
</tr>
</tbody>
</table>

Range of measurement: 1000 m to 12000 m
Display unambiguous: up to 12000 m

Atmospheric conditions

Range A: Strong haze, visibility 5 km; or strong sunlight, severe heat shimmer
Range B: Light haze, visibility about 20 km; or moderate sunlight, slight heat shimmer
Range C: Overcast, no haze, visibility about 40 km; no heat shimmer
**Accuracy**

<table>
<thead>
<tr>
<th>Standard measuring</th>
<th>std. dev. ISO 17123-4</th>
<th>Measure time, typical [s]</th>
<th>Measure time, maximum [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Range</td>
<td>5 mm + 2 ppm</td>
<td>2.5</td>
<td>12</td>
</tr>
</tbody>
</table>

*1 does not include radio transfer time to the RC9 radio field controller. Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specified accuracy. The display resolution is 0.1 mm.

**Characteristics**

- **Principle:** Phase measurement
- **Type:** Coaxial, visible red laser
- **Carrier wave:** 658 nm
- **Measuring system:** System analyser basis 100 MHz - 150 MHz

### 7.5 *iLock*

**Range iLock/Robotic**

<table>
<thead>
<tr>
<th>Reflector</th>
<th>Range iLock mode</th>
<th>Range Robotic mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[m]</td>
<td>[ft]</td>
</tr>
<tr>
<td>360° prism (GRZ4)</td>
<td>800</td>
<td>2600</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>2000</td>
</tr>
</tbody>
</table>

*The maximum range can be restricted by poorer conditions, for example rain.*

Shortest measuring distance: 360° prism iLock: 1.5 m
Shortest measuring distance: 360° prism Robotic: 5 m
System accuracy with iLock

- The accuracy with which the position of a prism can be determined with iLock depends on several factors such as internal iLock accuracy, instrument angle accuracy, prism type, selected EDM measuring program and the external measuring conditions. The iLock has a basic standard deviation level of ± 1 mm. Above a certain distance, the instrument angle accuracy predominates and takes over the standard deviation of the iLock.

- The following graph shows the iLock standard deviation based on the GRZ4 prism, different distances and instrument accuracies.

**Maximum speed in Robotic mode**

- Maximum tangential speed: 5 m/s at 20 m; 25 m/s at 100 m
- Maximum radial speed with <EDM Mode: Tracking>: 5 m/s
R9, Technical Data

Searching

Typical search time in field of view: 1.5 s
Field of view: 1°25'/1.55 gon
Definable search windows: Yes

Characteristics

Principle: Digital image processing
Type: Infrared laser

7.6 Conformity to National Regulations

7.6.1 Communication side cover with Bluetooth

Conformity to national regulations

- Hereby, Stonex® Europe srl, declares that the instrument with Communication side cover is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at http://www.stonexeurope.com/component/content/article/20.html.
  Class 1 equipment according European Directive 1999/5/EC (R&TTE) can be placed on the market and be put into service without restrictions in any EEA Member state.
- The conformity for countries with other national regulations not covered by the FCC part 15 or European directive 1999/5/EC has to be approved prior to use and operation.

Frequency band

2402 - 2480 MHz

Output power

Bluetooth: 5 mW
R9, Technical Data

Antenna

Type: Internal Microstrip antenna
Gain: 1.5 dBi

7.6.2 RadioHandle

Conformity to national regulations

- FCC Part 15 (applicable in US)
- Hereby, Stonex® Europe srl, declares that the RadioHandle is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at http://www.stonexeurope.com/component/content/article/20.html.

Class 2 equipment according European Directive 1999/5/EC (R&TTE) for which following EEA Member States apply restrictions on the placing on the market or on the putting into service or require authorisation 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 1999/5/EC has to be approved prior to use and operation.

Frequency band

Limited to 2409 - 2435 MHz

Output power

< 100 mW (e. i. r. p.)

Antenna

Type: Patch antenna (omnidirectional)
Gain: 2 dBi
Connector: SMB
7.7 General Technical Data of the Instrument

Telescope

Magnification: 30 x  
Clear objective diameter: 40 mm  
Focusing: 1.7 m / 5.6 ft to infinity  
Field of view: 1°30' / 1.66 gon.  
2.7 m at 100 m

Compensator

<table>
<thead>
<tr>
<th>Angular accuracy R9 [&quot;]</th>
<th>Setting accuracy</th>
<th>Setting range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[&quot;]</td>
<td>[mgon]</td>
</tr>
<tr>
<td>2</td>
<td>0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>1.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Level

Circular level sensitivity: 6’’ / 2 mm  
Electronic level resolution: 2”

Control unit

Display: 1/4 VGA (320 x 240 pixels), colour, graphics capable LCD, illumination, touch screen  
Keyboard: 28 keys  
including 6 function keys and 12 alphanumeric keys, illumination  
Angle Display: 360°’’, 360° decimal, 400 gon, 6400 mil, V %  
Distance Display: m, ft int, ft us, ft int inch, ft us inch  
Position: Face I only  
Touch screen if fitted: Toughened film on glass
Instrument Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| Port 1| Port 1| • 5 pin LEMO-0 for power, communication, data transfer.  
• This port is located at the base of the instrument. |
| Port 2| Handle| • Hotshoe connection for RadioHandle with RCS.  
• This port is located on top of Communication side cover. |
| Port 3| BT    | • Bluetooth module for communication.  
• This port is housed within Communication side cover. |

Instrument Dimensions

![Instrument Dimensions Diagram]

Weight

- Instrument: 4.8 - 5.5 kg
- Tribrach: 0.8 kg
- Internal battery SB21: 0.2 kg
**Recording**
Data can be recorded onto a CompactFlash card.

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity [MB]</th>
<th>Number of measurements per MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>CompactFlash card</td>
<td>256</td>
<td>1750</td>
</tr>
</tbody>
</table>

**Laser plummet**
- **Type:** Visible red laser class 2
- **Location:** In standing axis of instrument
- **Accuracy:** Deviation from plumb line: 1.5 mm (2 sigma) at 1.5 m instrument height
- **Diameter of laser point:** 2.5 mm at 1.5 m instrument height

**Drives**
- **Type:** Endless horizontal and vertical drives

**Motorisation**
- **Maximum rotating speed:** 50 gon/s

**Power**
- **External supply voltage:** Nominal voltage 12.8 V DC, Range 11.5 V-13.5 V

**Internal battery**
- **Type:** Li-Ion
- **Voltage:** 7.4 V
- **Capacity:** SB21: 4.4 Ah
**Environmental specifications**

**Temperature**

<table>
<thead>
<tr>
<th>Type</th>
<th>Operating temperature [°C]</th>
<th>Storage temperature [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>R9</td>
<td>-20 to +50</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>Stonex® Compact-Flash cards, all sizes</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
</tr>
<tr>
<td>Battery internal</td>
<td>-20 to +55</td>
<td>-40 to +70</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>-30 to +60</td>
<td>-40 to +80</td>
</tr>
</tbody>
</table>

**Protection against water, dust and sand**

<table>
<thead>
<tr>
<th>Type</th>
<th>Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>R9</td>
<td>IP54 (IEC 60529)</td>
</tr>
</tbody>
</table>

**Humidity**

<table>
<thead>
<tr>
<th>Type</th>
<th>Protection</th>
</tr>
</thead>
</table>
| R9   | Max 95 % non condensing  
The effects of condensation are to be effectively counteracted by periodically drying out the instrument. |

**Reflectors**

<table>
<thead>
<tr>
<th>Type</th>
<th>Additive Constant [mm]</th>
<th>iLock</th>
</tr>
</thead>
<tbody>
<tr>
<td>360° prism, GRZ4</td>
<td>+23.1</td>
<td>yes</td>
</tr>
<tr>
<td>Reflectorless</td>
<td>+34.4</td>
<td>no</td>
</tr>
</tbody>
</table>

There are no special prisms required for iLock.
SureBeam

Working range: 5 m to 150 m (15 ft to 500 ft)
Position accuracy: 5 cm at 100 m (1.97" at 330 ft)

Automatic corrections
The following automatic corrections are made:

- Line of sight error
- Tilting axis error
- Earth curvature
- Circle eccentricity
- Compensator index error
- Vertical index error
- Standing axis tilt
- Refraction
- iLock zero point error

7.8 Scale Correction

Use of scale correction
By entering a scale correction, reductions proportional to distance can be taken into account.
- Atmospheric correction.
- Reduction to mean sea level.
- Projection distortion.

Atmospheric correction \(\Delta D1\)
The slope distance displayed is correct if the scale correction in ppm, mm/km, which has been entered corresponds to the atmospheric conditions prevailing at the time of the measurement.
The atmospheric correction includes:
- Adjustments for air pressure
- Air temperature
- Relative humidity

For highest precision distance measurements, the atmospheric correction should be determined with an accuracy of 1 ppm. The following parameters must be redetermined:
- Air temperature to 1 °C
- Air pressure to 3 mbar
- Relative humidity to 20 %
Air humidity
The air humidity influences the distance measurement if the climate is extremely hot and damp.
For high precision measurements, the relative humidity must be measured and entered along with the air pressure and the temperature.

Air humidity correction

<table>
<thead>
<tr>
<th>ppm</th>
<th>+5</th>
<th>+4</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>+0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% Relative humidity [%]
C° Air temperature [°C]

Index n

<table>
<thead>
<tr>
<th>Type</th>
<th>Index n</th>
<th>carrier wave [nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>combined EDM</td>
<td>1.0002863</td>
<td>658</td>
</tr>
</tbody>
</table>

The index n is calculated from the formula of Barrel and Sears, and is valid for:

Air pressure p: 1013.25 mbar
Air temperature t: 12 °C
Relative air humidity h: 60 %
Formulas

Formula for visible red laser

\[
\Delta D_1 = 286.34 - \left[ \frac{0.29525 \cdot p}{(1 + \alpha \cdot t)} - \frac{4.126 \cdot 10^{-4} \cdot h}{(1 + \alpha \cdot t)} \cdot 10^x \right]
\]

\(\Delta D_1\) Atmospheric correction [ppm]

\(p\) Air pressure [mbar]

\(t\) Air temperature [°C]

\(h\) Relative humidity [%]

\(\alpha = \frac{1}{273.15}\)

\(x = (7.5 \ast t/(237.3 + t)) + 0.7857\)

If the basic value of 60% relative humidity as used by the EDM is retained, the maximum possible error in the calculated atmospheric correction is 2 ppm, 2 mm/km.

**Reduction to mean sea level** \(\Delta D_2\)

The values for \(\Delta D_2\) are always negative and are derived from the following formula:

\[
\Delta D_2 = -\frac{H}{R} \cdot 10^6
\]

\(\Delta D_2\) Reduction to mean sea level [ppm]

\(H\) Height of EDM above sea level [m]

\(R = 6.378 \ast 10^6\ m\)

**Projection distortion** \(\Delta D_3\)

The magnitude of the projection distortion is in accordance with the projection system used in a particular country, for which official tables are generally available. The following formula is valid for cylindrical projections such as that of Gauss-Krüger:

\[
\Delta D_3 = \frac{X^2}{2R^2} \cdot 10^6
\]

\(\Delta D_3\) Projection distortion [ppm]

\(X\) Easting, distance from projection zero line with the scale factor 1 [km]

\(R = 6.378 \ast 10^6\ m\)

In countries where the scale factor is not unity, this formula cannot be directly applied.
Atmospheric corrections °C
Atmospheric corrections in ppm with temperature [°C], air pressure [mb] and height [m] at 60 % relative humidity.
Atmospheric correction °F
Atmospheric corrections in ppm with temperature [°F], air pressure [inch Hg] and height [ft] at 60% relative humidity.

7.9 Reduction Formulas

Measurements

a) Mean Sea Level
b) Instrument
c) Reflector

\( \triangle \) Slope distance
\( \triangle \) Horizontal distance
\( \triangle \) Height difference
Reflector types
The reduction formulas are valid for measurements to all reflector types:
• measurements to prisms, to reflector tape and reflectorless measurements.

Formulas
The instrument calculates the slope distance, horizontal distance, height difference in accordance with the following formulas:

\[ D = D_0 \cdot (1 + \text{ppm} \cdot 10^{-6}) + \text{mm} \]

- \( D \): Displayed slope distance [m]
- \( D_0 \): Uncorrected distance [m]
- ppm: Atmospheric scale correction [mm/km]
- mm: Additive constant of the reflector [mm]

\[ h = Y - A \cdot X \cdot \sin \zeta \]

- \( h \): Height difference [m]
- \( Y \): \( \zeta \) * \sin \zeta
- \( X \): \( \zeta \) * \cos \zeta

\[ l = X + B \cdot Y^2 \]

- \( l \): Horizontal distance [m]
- \( X \): \( \zeta \)
- \( B \): \( (1 - k)/2R = 6.83 \times 10^{-8} \text{ [m}^{-1}] \)
- \( k \): 0.13 (mean refraction coefficient)
- \( R \): 6.378 \times 10^6 m (radius of the earth)

Earth curvature \((1/R)\) and mean refraction coefficient \((k)\) (if enabled on the Refraction page in Main Menu: Config...\Instrument Settings...\TPS Corrections) are automatically taken into account when calculating the horizontal distance and height difference. The calculated horizontal distance relates to the station height and not to the reflector height.
Distance measuring program Averaging

In the distance measuring program Averaging, the following values are displayed:

- \( D \) Slope distance as arithmetic mean of all measurements
- \( s \) Standard deviation of a single measurement
- \( n \) Number of measurements

These values are calculated as follows:

\[
\bar{D} = \frac{1}{n} \cdot \sum_{i=1}^{n} D_i
\]

\[
s = \sqrt{\frac{\sum_{i=1}^{n} (D_i - \bar{D})^2}{n - 1}} = \sqrt{\frac{\sum_{i=1}^{n} D_i^2 - \frac{1}{n} (\sum_{i=1}^{n} D_i)^2}{n - 1}}
\]

The standard deviation \( S_D \) of the arithmetic mean of the distance can be calculated as follows:

\[
S_D = \frac{s}{\sqrt{n}}
\]
8 STANDARD LIMITED WARRANTY

Version 2012

**General Warranty for Instruments.**
The terms and conditions of this Limited Warranty constitute the complete and exclusive warranty agreement between The Customer or Dealer and STONEX® for the Product and supersede any prior agreement or representation made in any STONEX® sales document or advice that may be provided to Customer by any STONEX® representative in connection with Customer's purchase of the Product. No change to the conditions of this Limited Warranty is valid unless it is made in written form and signed by an authorized STONEX® supervisor.

STONEX® Europe warrants that its Products:

1. are free from defects in materials or workmanship.
2. have been tested/calibrated in proper working status prior to shipment.

The warranty period starts from date of first sale of the instruments. At its sole discretion, under the warranty period, STONEX® Europe will repair the product or send parts for replacement at its expense. STONEX® Europe agrees to repair or replace the defected instrument within thirty (30) days only if STONEX® Europe recognizes that the defects of the instrument are not caused by human factors or no obvious damage to its surface is visible. STONEX® Europe warrants any new replaced parts or products are warranted to be free from defects in materials and workmanship for thirty (30) days or for the remainder of the Limited Warranty Period of the Product in which they are installed, whichever is longer. Faulty Parts or Products replaced under this Limited Warranty shall become property of STONEX® Europe.

All products that have to be repaired have to be returned to our technical representative office location via any delivery company the customer prefers, nevertheless STONEX® Europe is not accountable for the unlikely event that the Products gets lost in transit.

Any damage inflicted by the customer or by third party after the products has been delivered to the customer is excluded from the limited warranty as well any damage arising from an improper use, from any action or use not provided for in the enclosed user guides and/or manuals.

**Shipping policy.**
Customer or the dealer is required to pay for the charges for shipping of fault parts or instruments to STONEX® Europe representative office and STONEX® Europe will provide the shipping for return. Dealers needs to follow STONEX® Europe repair/service procedure to
R9, Standard Limited Warranty

achieve a better and prompt service result.

Return policy Dead On Arrival instruments.
All returned products have to be shipped to STONEX® Europe representative office. The original Purchaser has a period of seven (7) days starting from data of purchasing to signal the existence of a defect in the instrument for a full refund (less shipping and handling), provided the merchandise is in new, resalable condition and returned in the original, undamaged packaging. Customer has to pay for both the return and the original freight fees, regardless of the original freight paid by the Company. All warranty books, instruction manuals, parts and accessories must be included as well the original box in which the item was shipped. We recommend to place the original carton inside another box, to avoid any additional damage to the carton itself. In some cases, returns of special items will require a re-stock fee. Acceptance of returned merchandise is final only after inspection by STONEX® Europe.
Above terms and policy shall apply as for hardware. Dealers needs to follow STONEX® Europe repair/service procedure to achieve a better and prompt service result.

Firmware/Software warranty.
Stonex Europe doesn't warrant that operation of Firmware/Software on any instruments will be uninterrupted or error-free, or that functions contained in Firmware/Software will operate to meet your requirements. Stonex will forward the Software/Firmware Fix to the dealer or customer. Firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instruments specification.

Over Warranty repair(s) policy.
Customer shall pay the standard repair fees for any service (whether part replacement or repairs) and performed by STONEX® Europe under request and explicit authorization of the customer itself. In this case the customer is charged for return shipment's fees as well.

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One (1) year on STONEX® products.
Total Station: R9, Controller RC9.
For accessories provided by Stonex with the Total Station R9 the warranty time is one (1) year, excluding all power supply accessories and batteries that have 90 days of warranty time.

Repair/Service procedure for dealers.
(1) S/N of the instrument and a detailed description of the defect (sometimes pictures or video) will be required to indicate the cause and problem.
(2) If dealer wants to repair an instrument under warranty period on
their site:

1) If dealers don’t have the part in stock they have to send an official order to STONEX® Europe and pay for it and so STONEX® Europe will send the new part to them so they can repair the instrument.

2) When the repair is over dealer has to fill the “Spare Part Refund” module and send it to the dedicated mail address.

3) Wait for STONEX® Europe’s authorization SPR no;

4) When dealer receive the SPR authorization no they can send back to STONEX® Europe appointed office the broken part with attached the SPR module;

5) When STONEX® Europe receive the broken part STONEX® Europe shall verify it and if everything is ok the cost of the part shall be refund (refund will be done only after check of the failure part and final approval of STONEX® Europe).

(3) If the instrument needs to be sent back to STONEX® Europe for repair/replacement, dealer/customer has to send to STONEX® Europe a “Returned Merchandise Authorization (RMA)” before they send back the fault instrument. STONEX® Europe shall, at its sole discretion, decide on the place of performance for work under warranty.