



HC3 Ultimate Data Collector Quick Start Guide

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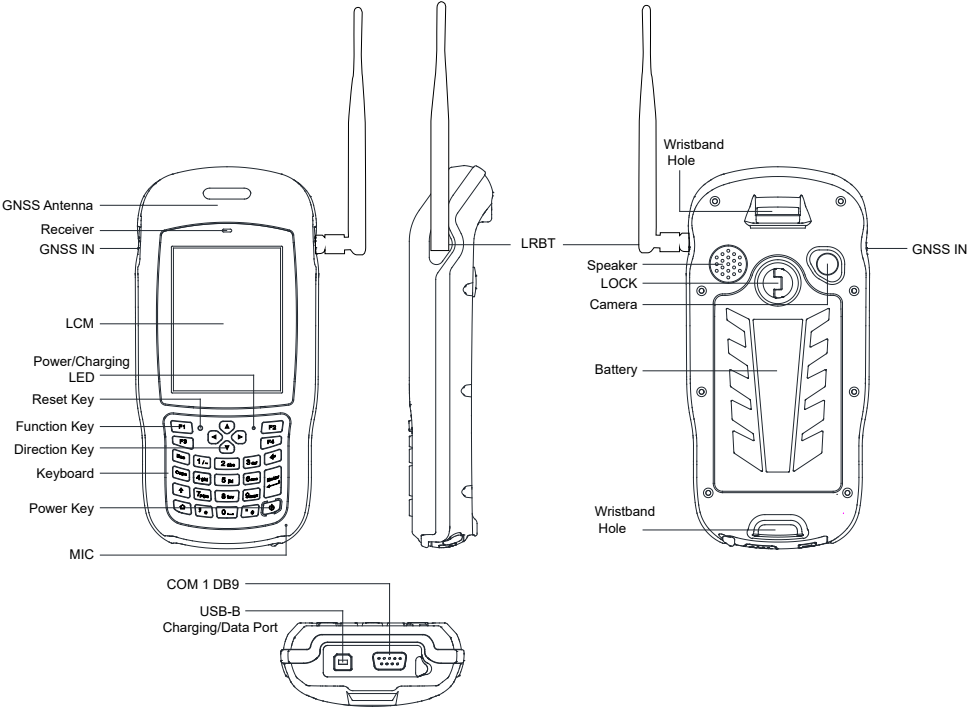
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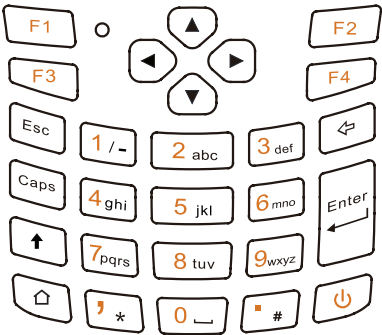
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1. Appearance

1.1. General Diagram











1.2. Keyboard



The yellow section is the system defaults, and the functions of the 4 hotkeys are below:

- F1:** Start menu.
- F2:** Off.
- F3:** Camera.
- F4:** System main interface.

The other keyboard operation:

System Default	System defaults to the digital input method
	 ,
	 #
Press ↑(Shift)	Lowercase letters
	 Switch between / and -
	 *
	 #
	Press ↑(shift) again, it will be digital input method
Press Caps	Capital letters
	 Switch between / and -
	 *
	 #
	Press the Caps button again for lowercase letters

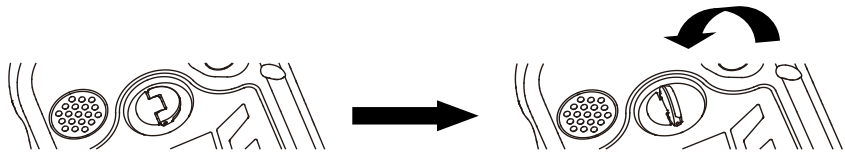
1.3. LED

Operation	Power off	Charging	Full of charge	Using
Light Status	Off	Red light on	Off	Green light on

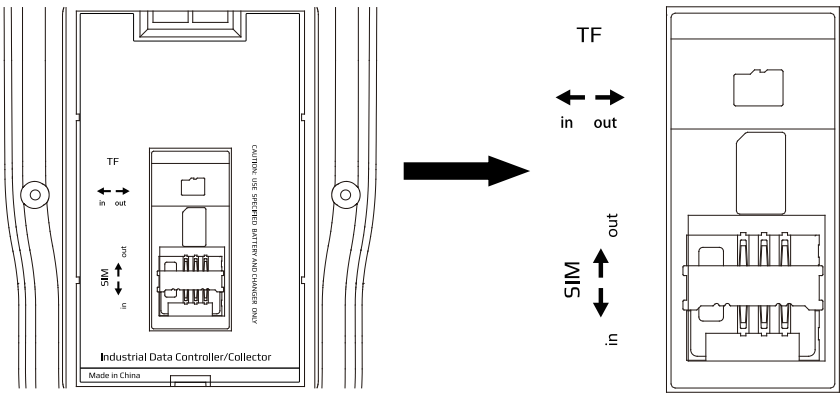
2. Operating Instructions

2.1. Installing the TF Card/SIM Card/Battery

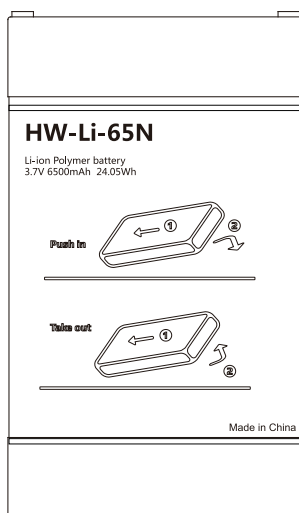
- a) Turn the back cover screw to the open position according to the instructions on the back cover, and take off the back cover.



- b) Insert the SIM card and TF card according to the instructions in the battery cabin.



- c) Insert the battery according to the instructions on the battery label.



- d) Close the back cover and turn the back cover screw to the lock position.

2.2. Charging


- a) The USB cable is used to charge the internal battery. It will charge while the unit is connected to a PC, or you can use the included wall adapter or any 5 volt cigarette lighter USB charging port.

2.3. Turning the Collector On/Off

- a) Make sure the battery has enough power, or connect the HC3 to the AC adapter.
b) Press the power button for 3~5 seconds to turn on.
c) Press the power button for 3~5 seconds to power off.

NOTE: Use the tip of the stylus to press the reset key to restart the HC3 if necessary.

2.4. Connecting to a PC

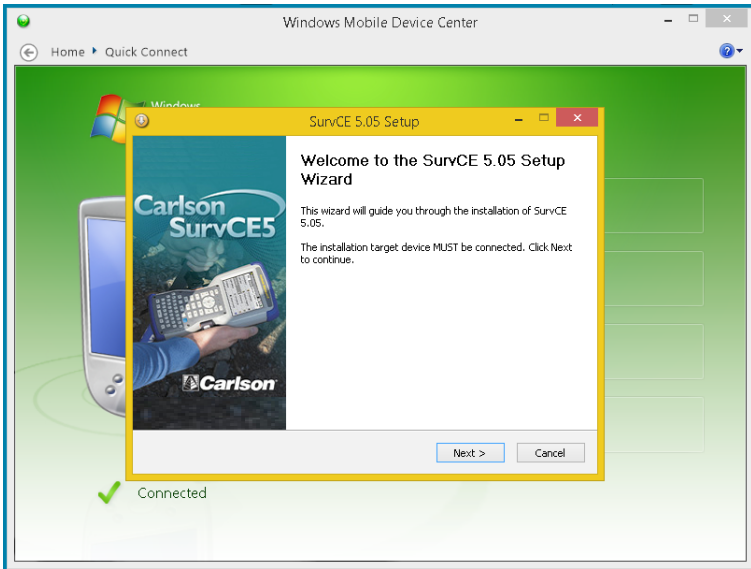
- a) Make sure WMDC (Windows Mobile Device Center) has been installed in Vista/Win7/Win8/Win10 PC.
- b) Connect the HC3 to a PC with the USB cable.
- c) ActiveSync/WMDC will connect the HC3 and PC automatically. The  icon will appear in the tool bar of the PC and also the 'Synchronization Setup Wizard'. Click 'Cancel' or 'Connect without setting up your device'.
- d) Click 'Browse' to check the files in the HC3 and then transfer data between your PC and the HC3.

2.5. Installing SurvCE

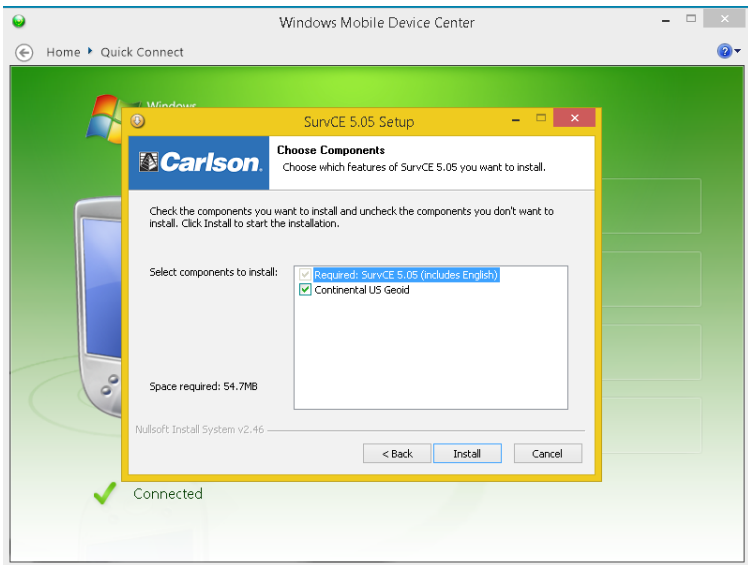
- a) Connect the HC3 to the USB port of a Windows computer and wait for the Windows Mobile Device Center to connect with the HC3.



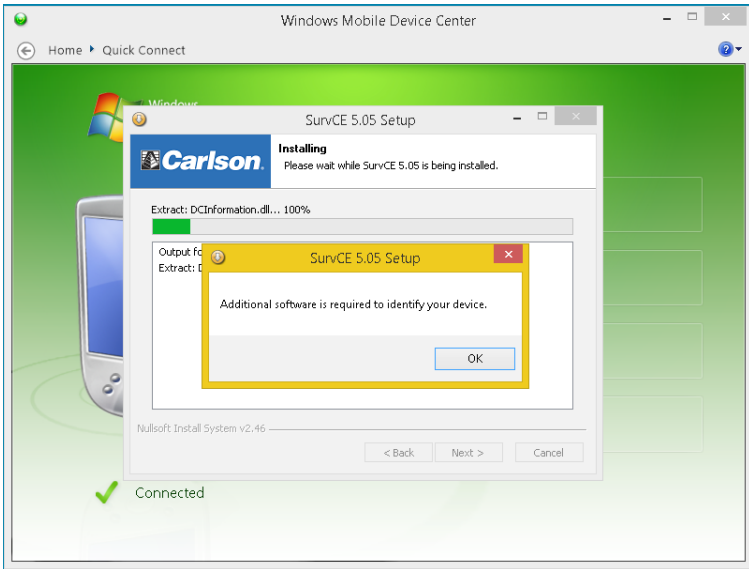
- b) Locate and run the SurvCE_Install.exe file to install SurvCE.



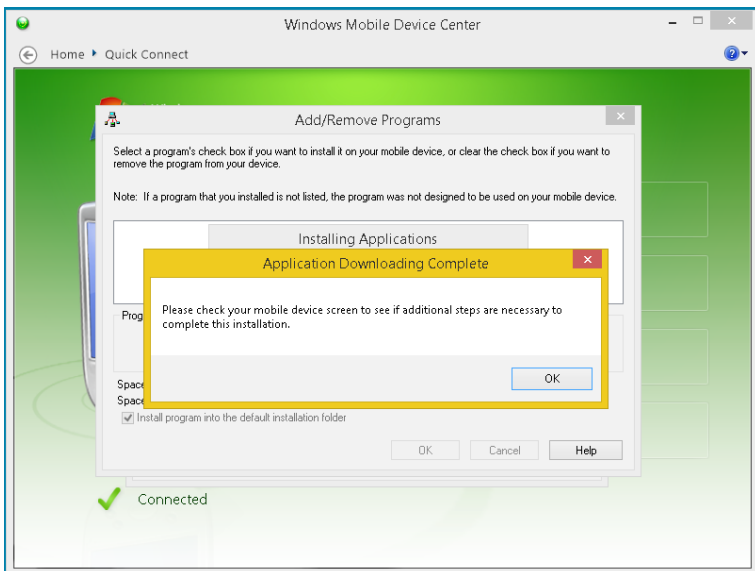
- c) Select the Next button and accept the default components to be installed.

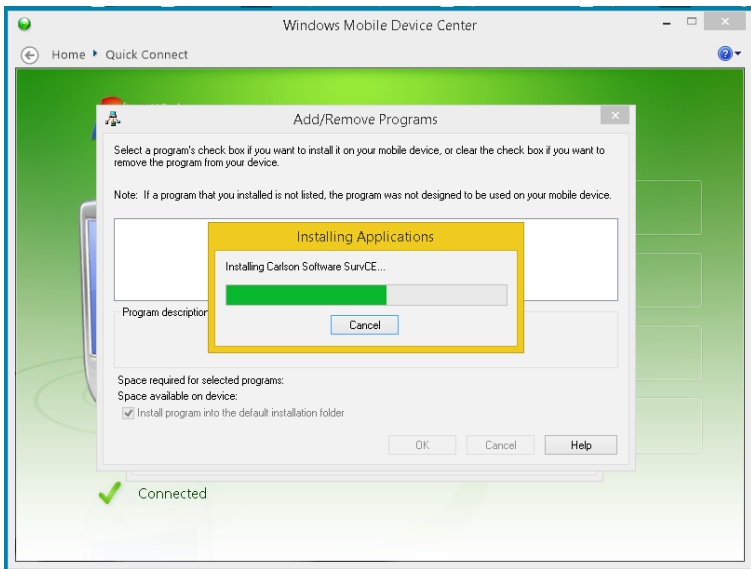


- d) The installer will prompt you to install a program to help it identify the HC3. Please OK this step and wait for the program to complete its installation by observing the screen on the HC3.

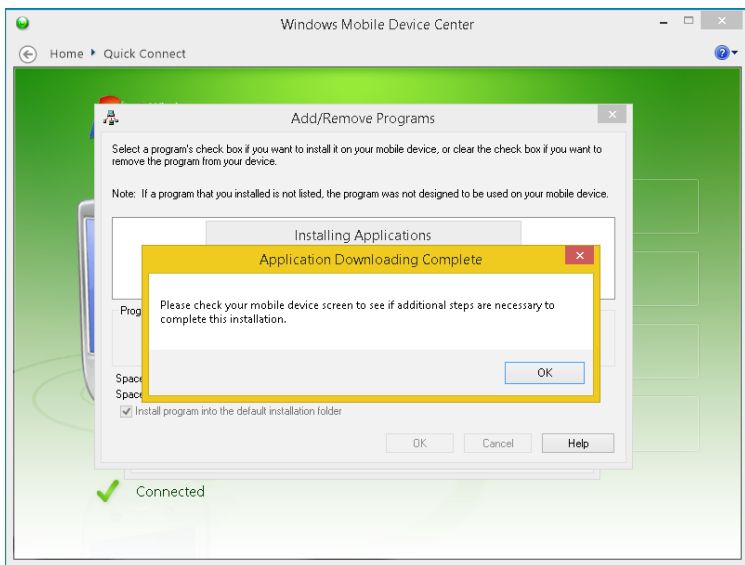


- e) Once you click OK telling the installer that the above software was installed, the SurVCE installation will begin.



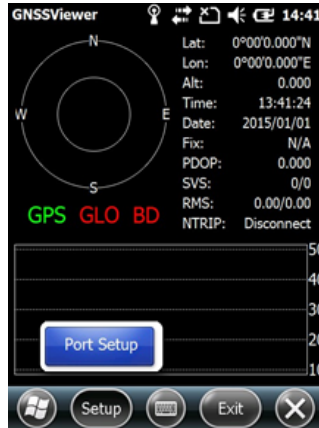


- f) When the installer finishes creating the install file, you will see the install program begin on the HC3. When it completes, there will be a SurvCE icon on the home screen.

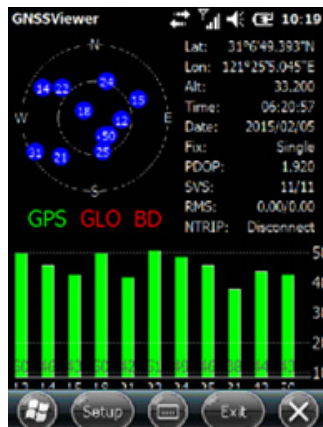


2.6. GNSS Status

- a) Go to \My Device\GNSSViewer and run GNSSViewer.exe.
- b) The HC3 supports COM3 and GNSS ports and its Baud Rate is 9600. Choose a GPS Port and Baud Rate by clicking Setup -> Port Setup as indicated below.



- c) Click 'OK'.



2.7. Camera


- a) Select 'Start->Picture & Video', select 'Camera' or the camera icon to take photos.
- b) Press the camera key (F3) to take photos.
- c) Click screen and select 'OK' to exit.

2.8. 9 Pin Serial Port


The 9 Pin serial port is COM1. Transfer data between the HC3 and other devices using the DB9 null modem serial cable.

2.9. Wireless Connection (Bluetooth/GPRS/WiFi)

2.9.1. Standard Bluetooth

- a) Select 'Start->Settings->Connections->Wireless Management', click the  icon to activate the Bluetooth device.
- b) Select 'Start-> Settings-> Bluetooth', click 'Add new device...'. Follow the tips shown on the screen to finish the operation of pairing the other BT Device.

2.9.2. Long Range Bluetooth (COM 2)

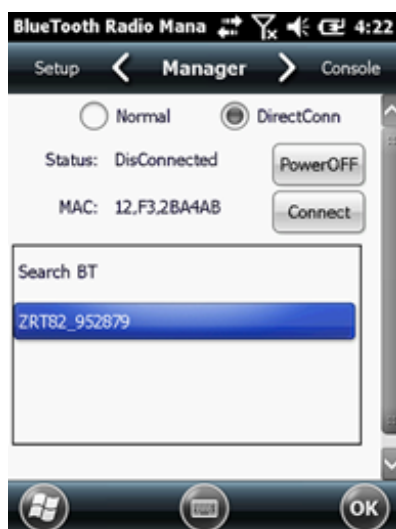
- a) Select 'Start', click 'BlueTooth Radio Manager' 
- b) Choose the mode of 'DirectConn', and press 'Power On'.
- c) Select 'Setup' from the top of the screen and select Baud Rate.

Continued on the next page

- d) Select AutoConn to automatically reconnect on startup.



- e) Select 'Manager' from the top of the screen and select 'Search BT'.



- f) After all BT devices have been found, select a device.
- g) Click 'Connect' to pair with a BT device of your choice. Your screen will display "Connect the BT device successfully" after BT pairs successfully.

2.9.3. WiFi

- a) Select 'Start->Settings->Connections->WiFi'.
- b) Click 'Search for Networks', select a network listed. Follow the installation guide to input a password and confirm the connection to WiFi.

2.9.4. GPRS/3G Data Connection

- a) Make sure there's an activated SIM card in the HC3.
- b) Select 'Start->Settings->Connections->Connections'.
- c) Click 'Add a new modem connection'.
- d) Input connection name "SimCard", select 'Cellular Line (GPRS)', click 'Next'.
- e) Input 'Access point name', click 'Next'.
- f) Click 'Finish' and add new connection successfully.
- g) Click 'Manage existing connections'.
- h) Click and hold on "SimCard" and select 'Connect'.
- i) If there is the identifier on the signal icon in the top right corner, this indicates a successful connection.

3. Useful Functions

3.1. Screen Response

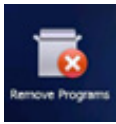
Select 'Start-> Settings-> System-> Screen', click the 'Align Screen' icon and follow the guide to align the screen.

3.2. Adjusting the Backlight

Select 'Start-> Settings-> System-> Backlight' to adjust backlighting according to the guide.

Continued on the next page

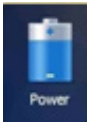
3.3. Removing Programs



Select 'Start-> Settings-> System-> Remove Programs'. Select the programs you wish to remove in the list and click 'OK' to remove.

3.4. Auto Power Off*

***NOTE:** The device does not support the Auto Power Off function, instead use Go-To-Sleep mode.



Select 'Start-> Settings-> System-> Power-> Advanced'. Set the power off time in different conditions. Backlight will be off according to selected settings.

3.5. Clean Boot

***NOTE:** The password is '1234'. Restoring factory settings will clear the system configuration. Please be cautious.



Select 'Start-> Settings-> System-> Clean Boot' to restore factory default settings according to the guide.

3.6. PWConfig

***NOTE:** While on "Screen Off" mode, the device won't hibernate.



Select 'Start-> Settings-> System-> pwconfig'.

4. Accessories

4.1. Standard Accessories

Item	Name	Description	Quantity
1	DC Adapter	110 V/DC 5 V/1 A	1
2	USB Cable	USB to B-TYPE USB cable	1
3	Serial Cable	DB9 null modem serial cable	1
4	Li-ion Battery	3.7 V/6500 mAh	1
5	Strap	Black, 180*12 mm	1
6	Stylus	Black, 127 mm	1
7	Screen Protection Film	57*76 mm, 3 H & screen microfiber cloth	2
8	User Guide	Paper version	1
9	Antenna	Long range Bluetooth antenna	1

4.2. Optional Accessories

Item	Name	Description	Quantity
1	TF Card	Memory capacity: 8G	1
2	Mounting Bracket and Pole (Claw) Clamp	HW-02	1
3	External Champion AS1-FS GNSS Antenna	GPS: L1 C/A, L2E, L2C, L5 GLONASS: L1 C/A, L1P, L2 C/A, L2P BeiDou: B1, B2, B3 SBAS: L1 C/A and QZSS L1 Galileo: E1, E5a, E5b Gain: 40dB, TNC Connector	1
4	External Antenna Cable	3' Fischer to TNC male cable	1
5	2 Meter GNSS Poll	Fixed height 2 m poll for external antenna	1
6	Bipod	Bipod for GNSS 2 m poll	1

5. Environmental Specifications

- a) Operating temperature: -20 °C ~ +60 °C
- b) Storage temperature: -30 °C ~ +70 °C
- c) Drop: 1.2 M drop tested on all surfaces
- d) Casing: Dustproof and resistant to heavy wind driven rain per IP54 standard
- e) Humidity: 5% ~ 95% (non-condensing)

6. Warranty Terms

The Champion HC3 series is guaranteed against defective material and workmanship under normal use and application consistent with this Guide. The equipment is guaranteed for the period indicated on the warranty card accompanying the product starting from the date that the product was sold to the original purchaser by an Authorized Champion Dealer.

During the warranty period, Champion will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized Champion warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as

provided above. In no event shall Champion be liable for any damages or other claim including any claim for lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, the product.

NOTE: Please use the original factory parts.

7. Contact Information

Champion Instruments
Suite 104
4317 Park Drive
Norcross, GA 30093
Telephone: (678) 386-2208
Web: www.ChampionInstruments.com
Email: Office@ChampionInstruments.com

8. Appendix – Product Safety Warnings

Safety and Compliance Information

- Use responsibly – Read all instructions and safety information before use to avoid injury.

Battery Safety

- Charge battery only in temperature ranging from 32 °F to 140 °F (0 °C to 50 °C)
- **CAUTION:** Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type of battery recommended by the manufacturer.
- The maximum operating ambient temperature of the switching power supply declared by the manufacturer is 50 °C.
- Dispose of used batteries according to battery manufacturer's instructions.

WiFi Safety

- Turn WiFi off in areas where WiFi use is prohibited or when it may cause interference or danger, such as in airplanes while flying.

Care and Maintenance

The HC3 is an electronic product and should be treated with care. To reduce the risk of fire, electronic shock, or product damage take the following advice:

- Do not expose this device to rain, moisture, or any type of liquid that corrodes electronic circuits. If your device gets wet, immediately turn the power off. Allow the device to dry completely before using it again.
- Clean the display with a soft cloth and be careful not to wipe the display with anything abrasive.
- Do not expose your device to extreme heat (60 °C) or cold (-20 °C). For example, do not leave it in the trunk of your car in high heat conditions.
- Do not attempt to open the device other than as instructed in this manual.
- Rough handling can break the internal circuitry.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the device.
- Use only the recommended accessories.

CAUTION!

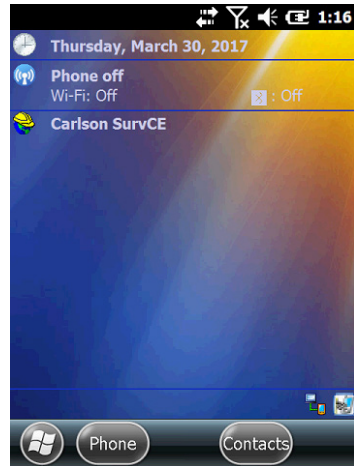
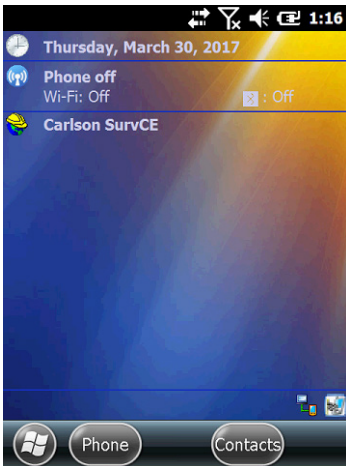
**CONNECTION TO A USB INTERFACE MUST BE LIMITED
TO USB VERSION 2.0 OR HIGHER
CONNECTION TO "POWER USE" MODE IS
PROHIBITED.**

9. Getting Started

9.1. HC3 RTK GNSS Bluetooth Base & Rover with Carlson SurvCE

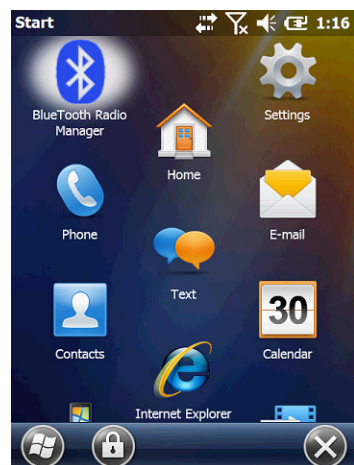
Step 1

The left images are the Base HC3 and the right images are the Rover HC3. Either unit can be a base or rover. Once the two units are powered on, pick the Windows icon on the lower left of the screen, and the Start menu icons will appear.



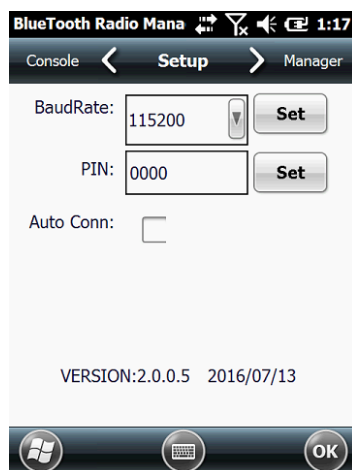
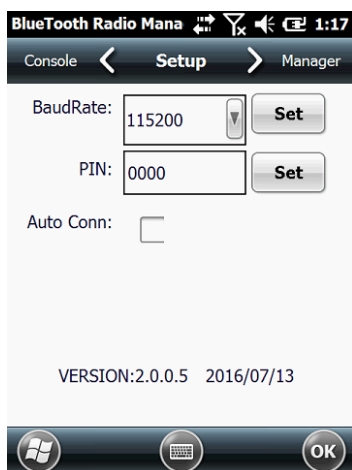
Step 2

Pick the BlueTooth Radio Manager icon to pair the units.



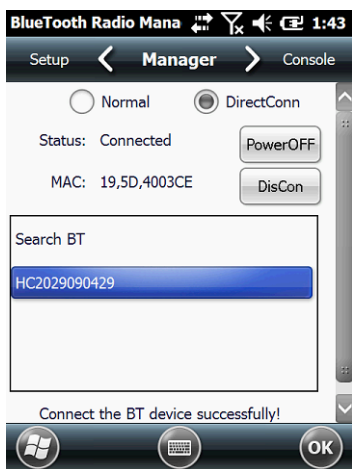
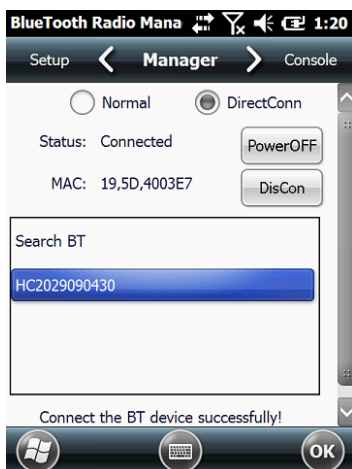
Step 3

Set the Baud Rate and PIN as shown.



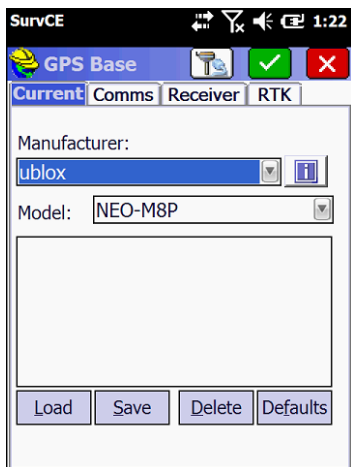
Step 4

From the Manager tab, search for the unit to bond with and press the Connect button. You will see "Connect the BT device successfully!" after each unit connects.



Step 5

After creating a new job and selecting the coordinate system and geoid separation file, select 2 GPS Base for the base unit and 3 GPS Rover for the rover unit. Match the settings below for each unit.



SurvCE 1:22

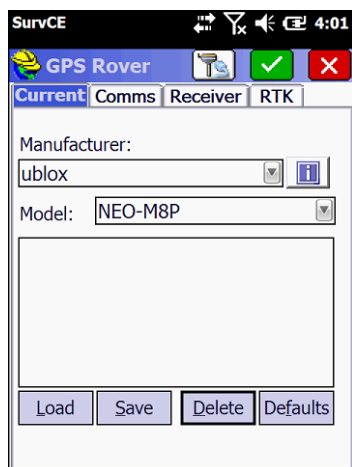
GPS Base

Current Comms Receiver RTK

Manufacturer: ublox

Model: NEO-M8P

Load Save Delete Defaults



SurvCE 4:01

GPS Rover

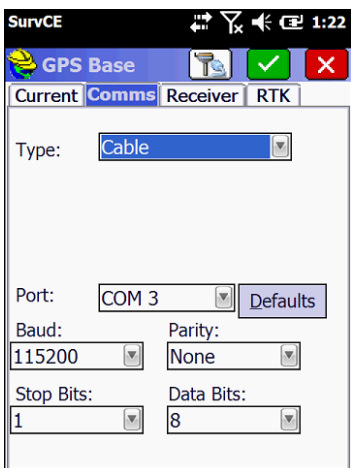
Current Comms Receiver RTK

Manufacturer: ublox

Model: NEO-M8P

Load Save Delete Defaults

Step 6



SurvCE 1:22

GPS Base

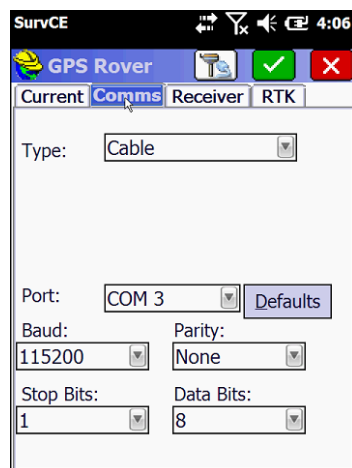
Current Comms Receiver RTK

Type: Cable

Port: COM 3 Defaults

Baud: 115200 Parity: None

Stop Bits: 1 Data Bits: 8



SurvCE 4:06

GPS Rover

Current Comms Receiver RTK

Type: Cable

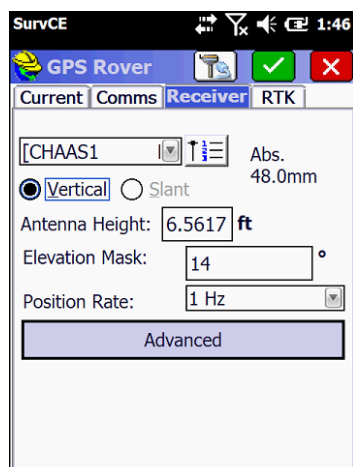
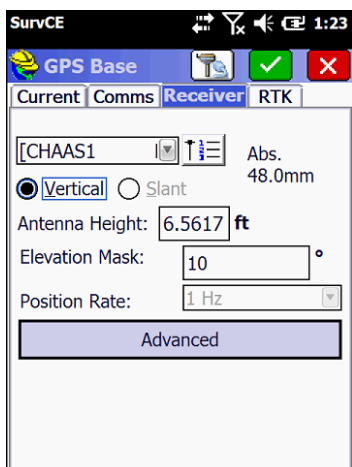
Port: COM 3 Defaults

Baud: 115200 Parity: None

Stop Bits: 1 Data Bits: 8

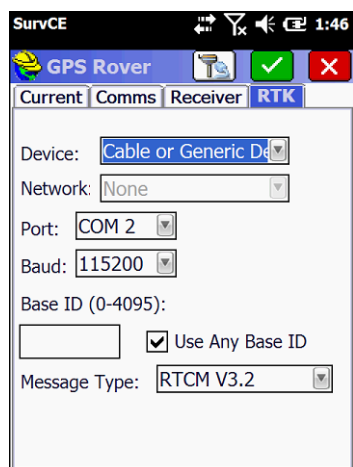
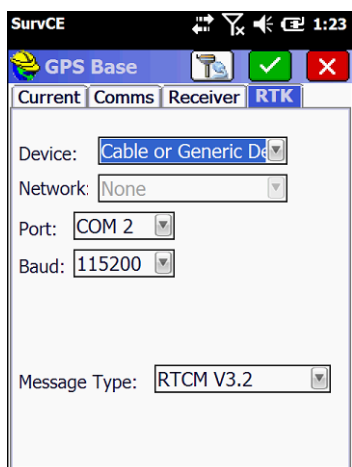
Step 7

The antenna shown in this configuration is the Champion AS1-FS full spectrum external antenna on a 2 meter prism pole.



Step 8

Note that all baud rates have been set to 115200. Selecting the green check mark on the base continues through the normal Base Configuration. On the rover, it completes the setup process and progresses to "RTK L1 Fixed" as shown on the Monitor/Skyplot screen.



Step 9

Select the "Read From GPS" button to establish a known base position.

SurvCE 1:23

Base Configuration

From Known Position

From New Position

Read From GPS

Enter Lat/Lon

Enter Grid System Coordinates

SurvCE 2:38

Monitor/Skyplot

SATView SATInfo Ref

Quality Position

Status: RTK L1 Fixed

Latency: 0.1 03/30/2017

Satellites: 18/22 14:37:59.0

Local Northing: 1432211.2273

Local Easting: 2301670.0462

Local Elev: 966.0982

HDOP: 0.58 TDOP: 0.59

VDOP: 1.08 GDOP: 1.36

PDOP: 1.23

HSDV: 0.046

VSDV: 0.033

Step 10

Average at least 10 positions.

SurvCE 1:24

Average GPS

By Number 10

By Time in min 30.000

GPS Monitor

Step 11

Select "Yes" to complete the base setup. Expect a line of site range of 3000'. Enjoy!

SurvCE

Base Configuration

RTK Broadcast ID:

Latitude: N 33°56'13.99304"

Longitude: W 84°09'00.11094"

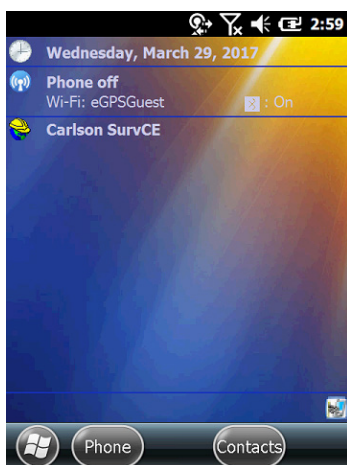
Ellipsoid Height: 634.5676

Continue with Base Setup?

9.2. HC3 RTK GNSS Network Rover with Carlson SurvCE

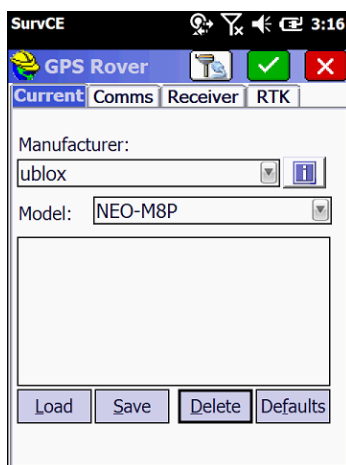
Step 1

Connect the HC3 to the internet using either a GSM SIM Card or a Wi-Fi hot spot. The picture below shows a WiFi connection to the "eGPSGuest" network. Once you see the name of the hotspot displayed on the screen, start Carlson SurvCE and create a job with the correct coordinate system and geoid separation file before configuring the rover. Next select the Equip tab and then the GPS Rover button.



Step 2

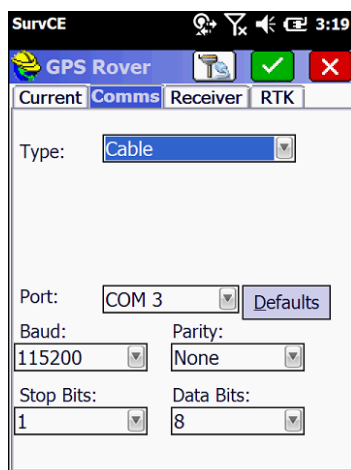
Under the Current tab, make the selections shown.



The screenshot shows the 'GPS Rover' application window with the 'Current' tab selected. The 'Manufacturer' dropdown is set to 'ublox' and the 'Model' dropdown is set to 'NEO-M8P'. There are four buttons at the bottom: 'Load', 'Save', 'Delete', and 'Defaults'. The status bar at the top shows 'SurvCE', signal strength, a checkmark, an 'X' button, and the time '3:16'.

Step 3

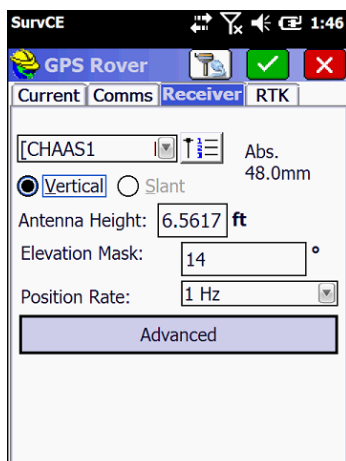
Under the Comms tab, make the selections shown.



The screenshot shows the 'GPS Rover' application window with the 'Comms' tab selected. The 'Type' dropdown is set to 'Cable'. The 'Port' dropdown is set to 'COM 3'. The 'Baud' rate is set to '115200', 'Parity' is set to 'None', 'Stop Bits' is set to '1', and 'Data Bits' is set to '8'. There is a 'Defaults' button next to the 'Port' dropdown. The status bar at the top shows 'SurvCE', signal strength, a checkmark, an 'X' button, and the time '3:19'.

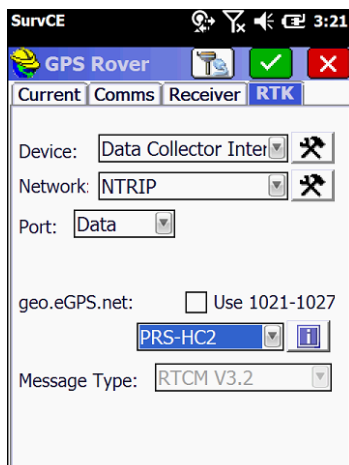
Step 4

The antenna shown in this configuration is the Champion AS1-FS full spectrum external antenna on a 2 meter prism pole.



Step 5

Under the RTK tab, make the selections shown. These selections assume that you have a network account with a corrections provider that provides a mount point for the u-blox-M8P-2 receiver. If one is not available, you may use another HC3 as a base and connect to it using long range Bluetooth or a GSM sim card with a static IP address.



Step 6

Once corrections are being received under good conditions, your HC3 will fix.

Only the following messages should be available through the reference mount point.

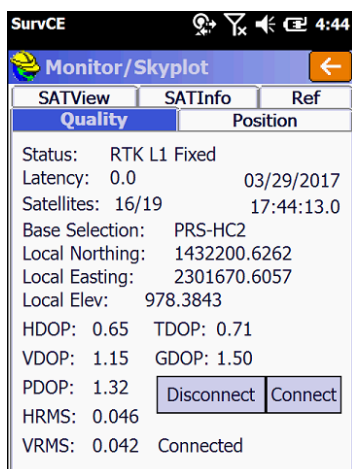
1005 Stationary RTK reference station ARP

1074 GPS MSM4

1084 GLONASS MSM4

1124 BeiDou MSM4

1230 GLONASS code-phase biases

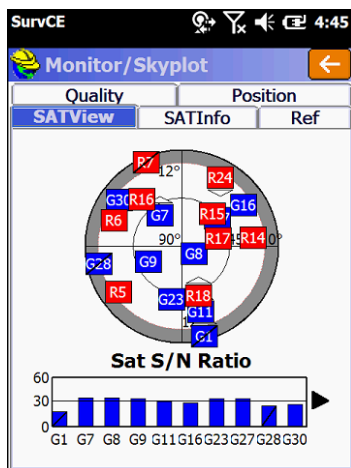


The screenshot shows the SurvCE application interface. At the top, the title bar reads "SurvCE" with various status icons and a clock showing 4:44. Below the title bar is a blue header with a yellow icon and the text "Monitor/Skyplot". The main content area is divided into two tabs: "SATView" and "SATInfo", with "SATInfo" selected. Under "SATInfo", there are two sub-tabs: "Quality" and "Position", with "Quality" selected. The "Quality" tab displays the following data:

Status:	RTK L1 Fixed
Latency:	0.0
Satellites:	16/19
Base Selection:	PRS-HC2
Local Northing:	1432200.6262
Local Easting:	2301670.6057
Local Elev:	978.3843
HDOP:	0.65
VDOP:	1.15
PDOP:	1.32
HRMS:	0.046
VRMS:	0.042

At the bottom right of the "Quality" tab, there are two buttons: "Disconnect" and "Connect". The "Connect" button is highlighted, indicating the current status is "Connected".

Step 7



Step 8

Thank you for your HC3 purchase!

The screenshot shows the SurvCE Monitor/Skyplot interface with the 'Position' tab selected. The 'Ref' sub-tab is active, displaying reference station coordinates and antenna information. The data is as follows:

Reference Station Coordinates	
Latitude:	N 33°56'14.05129"
Longitude:	W 84°09'00.41805"
Ellipsoid Hgt:	887.157ft
Ant Hgt:	6.562
Distance to Ref:	71.455ft
Antenna Type:	'NONE' (0.0mm)
Northing:	1432223.7236
Easting:	2301602.9718
Elevation:	977.4598

Buttons for 'Store' and 'Antenna' are visible next to the 'Ant Hgt' and 'Antenna Type' fields respectively.

9.3. HC3 RTK GNSS GSM Multi-Rover with Carlson SurvCE

Step 1

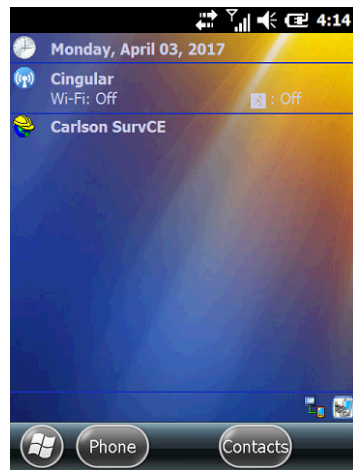
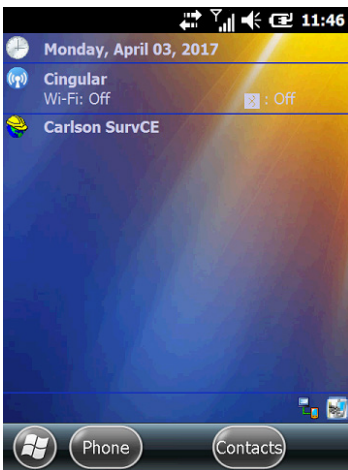
The left images are the Base HC3 and the right images are the Rover HC3. Either unit can be a base or rover.

Base:

The GSM network on the base must be started from Windows at this time but will be automatic after 5.06. Pick the Windows icon on the lower left corner of the screen to get to the start menu.

Rover:

Start SurvCE.



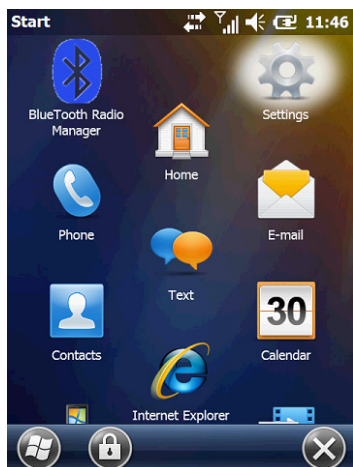
Step 2

Base:

Pick the Settings icon.

Rover:

Select the Equip tab and then the GPS Rover button as shown.



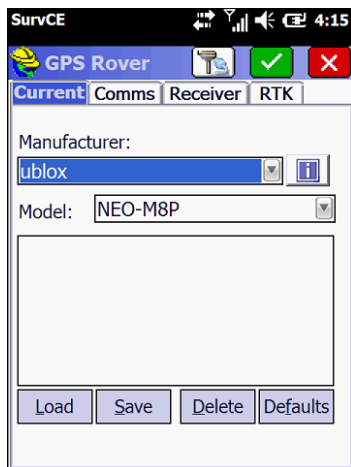
Step 3

Base:

Pick the Connections folder icon.

Rover:

Configure as shown.



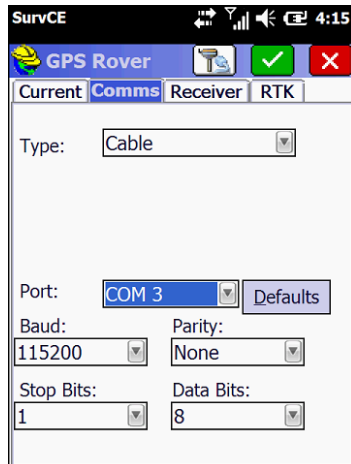
Step 4

Base:

Pick the connections icon to open the connection manager.

Rover:

Configure as shown.



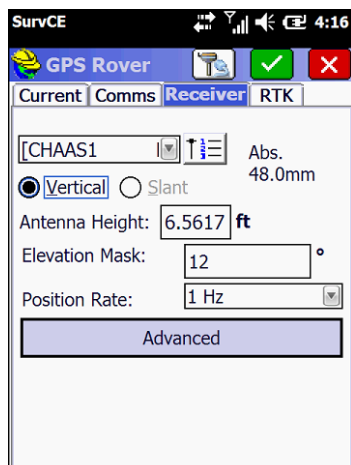
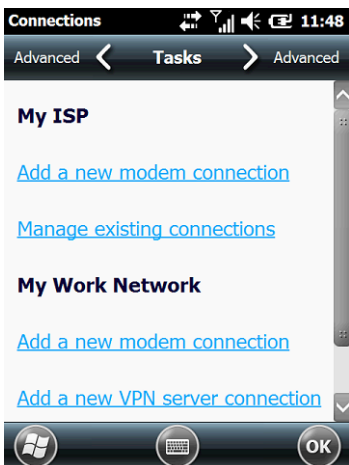
Step 5

Base:

Select **Manage existing connections**.

Rover:

Configure as shown.



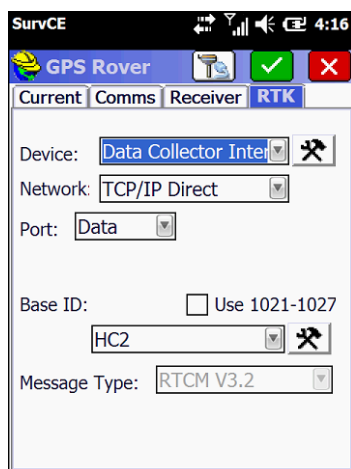
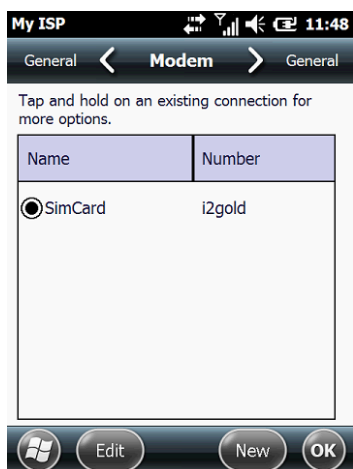
Step 6

Base:

Press and hold the SimCard modem connection previously configured to start the network connection.

Rover:

Configure as shown.



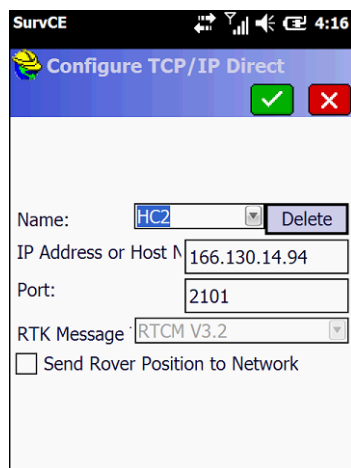
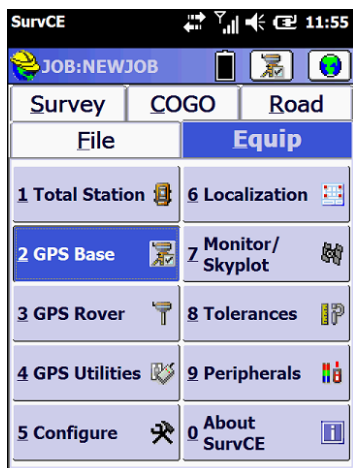
Step 7

Base:

Start SurvCE and begin the base configuration as shown.

Rover:

Configure as shown using the IP address of YOUR Base, not the one displayed.



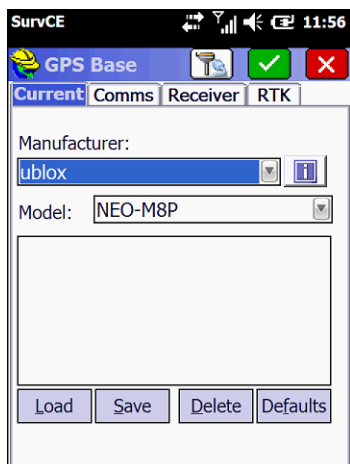
Step 8

Base:

Configure as shown.

Rover:

Configure as shown and press the green check mark.



SurvCE 11:56

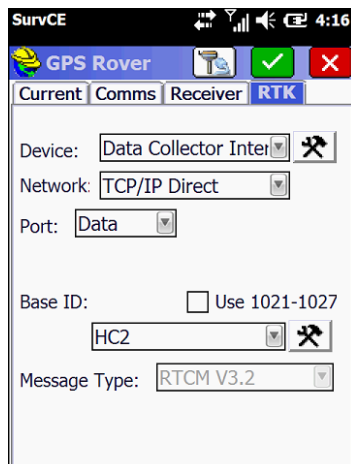
GPS Base

Current Comms Receiver RTK

Manufacturer: ublox

Model: NEO-M8P

Load Save Delete Defaults



SurvCE 4:16

GPS Rover

Current Comms Receiver RTK

Device: Data Collector Inter

Network: TCP/IP Direct

Port: Data

Base ID: ☐ Use 1021-1027 HC2

Message Type: RTCM V3.2

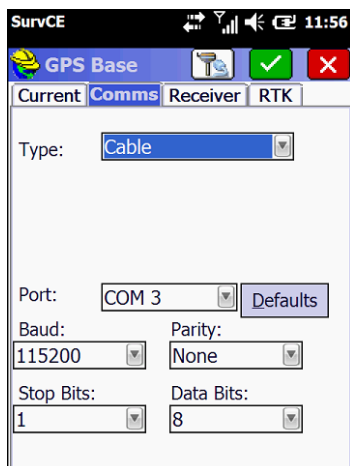
Step 9

Base:

Configure as shown.

Rover:

Be patient.



SurvCE 11:56

GPS Base

Current Comms Receiver RTK

Type: Cable

Port: COM 3 Defaults

Baud: 115200 Parity: None

Stop Bits: 1 Data Bits: 8



SurvCE 4:17

JOB:NEWJOB

Survey COGO Road

File Equip

Configuring rover

Connected!
Waiting for RTK messages.

Cancel

5 Configure 0 About SurvCE

Step 10

Base:

Configure as shown.

Rover:

Enjoy!

SurvCE 11:57

GPS Base

Current Comms Receiver RTK

[CHAAS1] Abs. 48.0mm

☒ Vertical ☐ Slant

Antenna Height: 6.5617 ft

Elevation Mask: 12 °

Position Rate: 1 Hz

Advanced

SurvCE 4:02

Monitor/Skyplot

SATView SATInfo Ref

Quality Position

Status: RTK L1 Fixed

Latency: 0.8 04/03/2017

Satellites: 15/18 17:00:36.0

Base Selection: HC2

Local Northing: 1432199.7625

Local Easting: 2301671.8260

Local Elev: 914.7007

HDOP: 0.66 TDOP: 0.78

VDOP: 1.23 GDOP: 1.60

PDOP: 1.40

HSDV: 0.046

VSDV: 0.033 Connected

Disconnect Connect

Step 11

Base:

Configure as shown.

SurvCE 12:00

GPS Base

Current Comms Receiver RTK

Device: Data Collector Inter

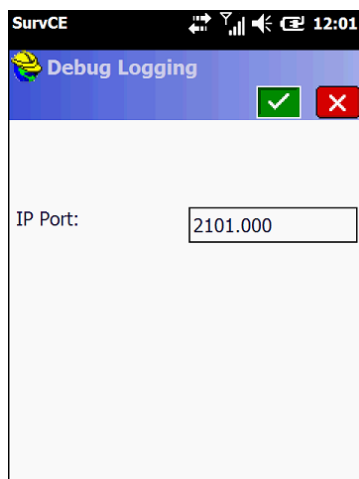
Network: TCP/IP Server

Message Type: RTCM V3.2

Step 12

Base:

Configure as shown.



SurvCE 12:01

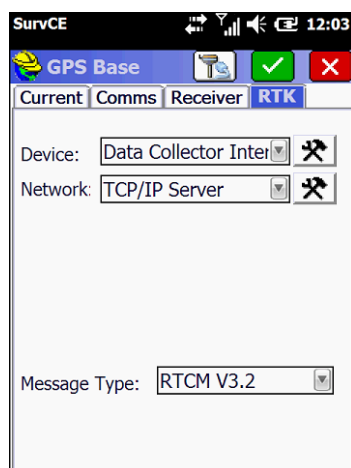
Debug Logging

IP Port: 2101.000

Step 13

Base:

Configure as shown.



SurvCE 12:03

GPS Base

Current Comms Receiver RTK

Device: Data Collector Inter

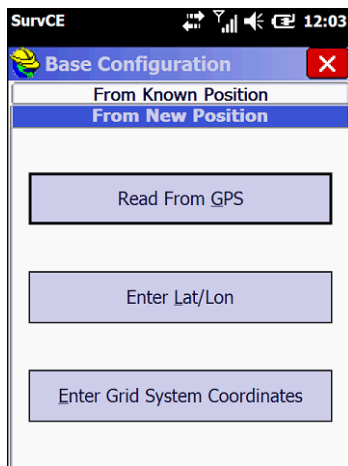
Network: TCP/IP Server

Message Type: RTCM V3.2

Step 14

Base:

Please select "Read From GPS" for the initial configuration.



SurvCE 12:03

Base Configuration

From Known Position

From New Position

Read From GPS

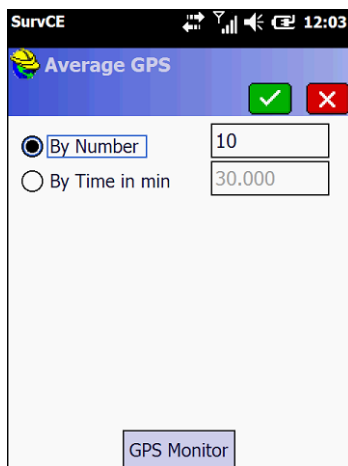
Enter Lat/Lon

Enter Grid System Coordinates

Step 15

Base:

Configure as shown.



SurvCE 12:03

Average GPS

☒ By Number 10

☐ By Time in min 30,000

GPS Monitor

Step 16

Base:

Configure as shown.

Step 17

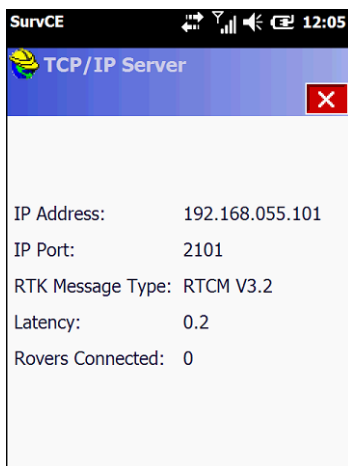
Base:

Select No for the initial configuration.

Step 18

Base:

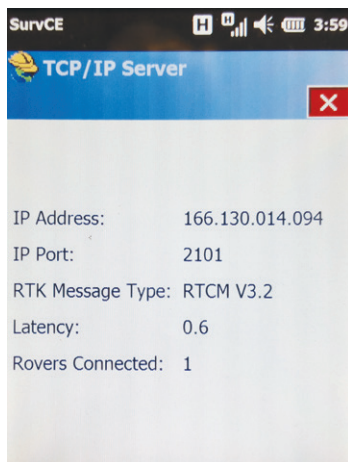
The TCP/IP Server screen will be displayed when the base is ready to broadcast corrections. Note that the number of rovers connected is 0 until 1 or more HC3's connect.



Step 19

Base:

Snapshot of an actual incoming connection showing 1 rover connected. The IP Address shown on YOUR screen is the IP Address you used to configure YOUR HC3's in step 7. You are now ready to configure your HC3 rover(s).



10. HC3 Specifications

Overview	
Processor	1 GHz
Storage	1GB (expandable to 33GB using a MicroSD card)
RAM	512MB
Operation System	Windows Embedded 6.5
Multi-Language	✓
Keypad	27 numeric + programmable keys
Mic	✓
Speaker	✓
Display	3.7" sunlight readable with integrated touchscreen
Display Resolution	480 x 640
Camera	5 megapixel
Dimension	7.87"(W) x 3.78"(H) x 1.26"(D)
Weight	1.2 lbs with battery
Communications and Data Storage	
Long Range Bluetooth	HC3 Base to HC3 Rover: 3000 ft; HC3 to Zoom90: 3050 ft
GSM/3G	3G
WiFi	✓
USB Port	Type B USB
Serial Port	DB9 (RS232)
Voice	✓
Power	
DC Input	DC 5 V, 1 A
Detachable Li-ion Battery	6500 mA, 3.7 V
Environmental Specifications	
Operating Temperature	-20 °C ~ +60 °C (-4 °F ~ 140 °F)
Storage Temperature	-30 °C ~ +70 °C (-22 °F ~ +158 °F)
Limited Dust and Water	IP54
Drop	1.2 m protection

Parameter	Specification			
Receiver Type	72 channel u-blox M8 engine GPS L1C/A, GLONASS L1OF, BeiDou B1I			
		GPS & GLONASS	GPS & BeiDou	GPS
Time-To-First-Fix ¹	Cold Start	26 s	28 s	29 s
	Hot Start	1 s	1 s	1 s
Sensitivity ²	Reacquisition	-160 dBm	-160 dBm	-160 dBm
	Cold Start	-148 dBm	-148 dBm	-148 dBm
	Hot Start	-157 dBm	-157 dBm	-157 dBm
Convergence Time ³	RTK	2 min ⁴	2 min ⁴	3.5 min ⁴
Horizontal Position Accuracy	Standalone ⁵	2.5 m CEP		
	RTK ^{3, 6}	0.025 m + 1 ppm CEP		

Table 1: NEO-M8P performance in different GNSS modes (default: concurrent reception of GPS and GLONASS)

¹ All satellites at -130 dBm

² Demonstrated with a good external LNA

³ Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry

⁴ Measured with 1 km baseline, patch antennas with ground planes; GPS+BeiDou measured in Singapore

⁵ Circular Error Probability (CEP), 50%, 24 hours static, -130 dBm, > 6 SVs

⁶ ppm limited to baselines up to 10 km

