# TRIMBLE TDC150

## GNSS HANDHELD

## USER GUIDE

Revision B2
May 2019



Trimble

## Legal information

Trimble Inc.
www.trimble.com

TDC150 User Guide, Rev B2, May 2019.

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## Limited Warranty Terms and Conditions

*Product Limited Warranty*. Subject to the terms and conditions set forth herein, Trimble Inc. ("Trimble") warrants that for a period of (1) year from date of purchase this Trimble product (the "Product") will substantially conform to our publicly available specifications for the Product and that the hardware and any storage media components of the Product will be substantially free from defects in materials and workmanship.

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## USA

Notices

*Class B Statement* - Notice to Users. 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 communication. 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.

Changes or modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.

**Canada**

The digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

**Europe**

CE

Hereby, Trimble, declares that the TDC150 GNSS handheld is in compliance with the following directives:

- RED 2014/53/EU
- RoHS Directive 2011/65/EU.

The products covered by this guide may be operated in all EU member countries (BE, BG, CZ, DK, DE, EE, IE, EL, ES, FR, HR, IT, CY, LV, LT, LU, HU, MT, NL, AT, PL, PT, RO, SI, SK, FI, SE, UK), Norway, and Switzerland.

Information about included radio modules:

- Bluetooth radio: BT 4.0 (BR/EDR+BLE), Frequency band 2402-2480MHz, max RF radiated output power +8dBm.
- WiFi radio : 802.11bgn, Frequency band 2400-2496 MHz, max RF radiated output power +15 dBm.
- 2G/3G/4G cell radio:
  - Frequency bands (2G) 850/900/1800/1900 MHz.
  - Frequency bands (3G) 800/850/900/1900/2100 MHz.
  - Frequency bands (4G) FDD B1 (2100) / B2 (1900) / B3 (1800) / B4 (1700) / B5 (850) / B7 (2600) / B8 (900) / B12/B13/B17/B28 (700) / B20 (800 MHz).
  - Frequency bands (4G) TDD B38 (2600) / B39 (1900) / B40 (2300) / B41 (2500 MHz).
  - Max RF radiated output power +35 dBm.

**European Union Customers: WEEE**

Recycling in Europe: To recycle Trimble WEEE (Waste Electrical and Electronic Equipment products that run on electric power), call +31 497 53 24 30 and ask for the "WEEE Associate". Or, mail a request for recycling instructions to:

*Trimble Europe BV*
*c/o Menlo Worldwide Logistics*
*Meerheide 45*
*5521 DZ Eersel, NL*

CE

# *Declaration of Conformity*

| | |
|---|---|
| **Issuer's name:** | **Trimble Europe BV**<br>Meerheide 45<br>5521 DZ Eersel<br>NETHERLANDS |
| **Object of declaration:** | **TDC150 Handheld GNSS Receiver**<br>P/n 115929-00, including 115930-00 and 109003-50 |

**This declaration of conformity is issued under the sole responsibility of the manufacturer. The object of declaration described above is in conformity with the essential requirements of directives 2014/53/EU (RED) and 2011/65/EU (RoHS) based on the following European harmonised standards:**

- **EN 50360:2001+A1:2012**
- **EN 50566:2013**
- **EN 60950:2006+A11:2009 + A1:2010 + A12:2011 + A2:2013**
- **EN 55032:2015**
- **EN 55024:2010+A1:2015**
- **EN 300 328 V2.1.1**
- **EN 301 908-1 V11.1.1**
- **EN 301 908-2 V11.1.2**
- **EN 301 908-13 V11.1.2**
- **EN 300 330 v2.1.1**
- **EN 301 511 V12.5.1**
- **EN 303 413 V1.1.1**
- **EN 300 328 v2.1.1**
- **EN 300 330 V2.1.1**

| | |
|---|---|
| **Signed for and on behalf of:** | Trimble Europe BV |
| **Date:** | December 7, 2018 |

.....
Igor Grechkin, Senior Director of Engineering

Trimble

Doc no. 118611 Rev. A

# Contents

# Safety Instructions

## Rechargeable Lithium-Ion Battery

**WARNING –** Do not damage the rechargeable Lithium-Ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature, or direct sunlight.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

**WARNING –** Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury or/and equipment damage. To prevent injury or damage:

- Do not charge a battery if it appears to be damaged or leaking.
- USE EXCLUSIVELY the AC/DC charger provided to charge the TDC150 Lithium-ion battery. The charger output specification is 5 V - 2 A. See instructions in this guide.

  CHARGE THE BATTERY ONLY IN THE TEMPERATURE RANGE 0° to +40°C (32° to 104°F), at a maximum altitude of 2,000 meters (6,562 feet).
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in Trimble equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.

## Disposing of Rechargeable Lithium-Ion Battery

Discharge Lithium-ion battery before disposing of it. When disposing of a battery, be sure to do so in an environmentally sensitive manner. Adhere to any local and national regulations concerning battery disposal or recycling.

# Receiver Use and Care

The receiver can withstand the rough treatment that typically occurs in the field. However, the receiver is a high-precision electronic instrument and should be treated with reasonable care.

**CAUTION –** Operating or storing the receiver outside the specified temperature range can damage it. For more information, see Physical Specifications in this guide..

**CAUTION –** High-power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. This does not harm the instrument, but it can prevent the receiver from functioning correctly. Do not use the receiver within 400 meters (1312 feet) of powerful radar, television or other transmitters. Low-power transmitters such as those used in cell phones and two-way radios do not normally interfere with receiver operations. For more information, contact your Trimble distributor.

# Bluetooth Radio

The radiated output power of the wireless radio is far below the FCC radio-frequency exposure limits. Nevertheless, the wireless radio shall be used in such a manner that the receiver is 20 cm or further from the human body.

The internal wireless radio operates within guidelines found in radio-frequency safety standards and recommendations, which reflect the consensus of the scientific community. Trimble therefore believes the internal wireless radio is safe for use by consumers.

The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as mobile phones. However, the use of wireless radios may be restricted in some situations or environments, such as on aircraft. If you are unsure of restrictions, you are encouraged to ask for authorization before turning on the wireless radios.

# COCOM Limits

The US Department of Commerce requires that all exportable GNSS products contain performance limitations so that they cannot be used in a manner that could threaten the security of the United States.

The following limitation is implemented on the receiver: Immediate access to satellite measurements and navigation results is disabled when the receiver's velocity is computed to be greater than 1000 knots, or its altitude is computed to be above 17,000 meters (59,055 feet). The receiver continuously resets until the COCOM situation is cleared.

# Introduction to Trimble TDC150 Handheld

The Trimble TDC150 GNSS handheld receiver is built for GIS users who demand maximum productivity and positioning accuracy out on the job. Offering a fully integrated, ultra-rugged solution that has the flexibility of a handheld, an intuitive Android-based user interface, and scalable high accuracy positioning, the high-performing TDC150 is your productive partner in the field.

The **TDC150 key features** are:

- **Integrated, high-accuracy GNSS** antenna and receiver complete with all communication devices (cellular modem, WiFi) for acquiring corrections when needed.
- **Ergonomic design**: High-performance, high-accuracy data collection in the palm of your hand.
- Powered by certified **Android 6 Operating System**. The additional, specific Android applications required are *GNSS Loader* and *SPace* (available for free). The first of these Android applications is required to update the GNSS firmware and install firmware or accuracy options (with permanent or temporary validity) and the second one is for interfacing the TDC150 with any third-party Android application so the app can utilize the TDC150's high-accuracy GNSS module.
- **Handheld accuracy**, **position accuracy on demand**. The TDC150 is available in different configurations providing different position accuracies:
  - Meter (default) (standalone GNSS+SBAS)
  - Sub-meter (30/30)
  - Decimeter (7/2)
  - Centimeter (full RTK)

**The TDC150 is fitted with two distinct GNSS location providers**:

- The *u-blox* Android GNSS
- The Trimble high-accuracy GNSS module.

⚠ CAUTION – **All location settings found in Android only impact the Android GNSS, not the high-accuracy GNSS module**.

When starting the TDC150, by default both the Android GNSS and the high-accuracy GNSS module are running. At this stage, any application you will be using will receive low-accuracy positions from the Android GNSS, and only from it.

High-accuracy positioning will be available for all those applications supporting direct access to the high-accuracy GNSS module.

As soon as this type of specific application is started, the Android GNSS is made idle and the displayed location settings in Android are all irrelevant.

# Discover Your Trimble TDC150 Handheld

## Description

Take a few minutes to discover your TDC150.


⚠ CAUTION – This recess is designed to ease battery door ejection using the battery door opener provided (see First Time Use section). Please use this tool. Using any other means might damage the battery door or the receiver case.

| | | | |
|---|---|---|---|
| [1] | Built-in, high-precision GNSS antenna and receiver | [10] | External GNSS antenna plug |
| [2] | Android platform's 5.3" color touch screen | [11] | Attachable/Detachable monopole adapter |
| [3] | Headphone plug (underneath protection flap) | [12] | Power button |
| [4] | Programmable button A | [13] | Camera lens (front) |
| [5] | Programmable button B | [14] | Camera lens (rear) and flash |
| [6] | Micro USB (underneath protection flap) | [15] | Speaker |
| [7] | Reset button (underneath same protection flap) | [16] | Lock button |
| [8] | Microphone | [17] | Battery door |
| [9] | Volume control buttons | [18] | Three attachment points for handstrap |

When the monopole is used, the antenna height (H) you need to specify in your application is the length of the monopole (read the graduation on the monopole; see above picture).

The application will automatically add to H the distance (d) from the base of the monopole adapter to the phase center so that the application uses the real height of the GNSS antenna phase center above the ground.

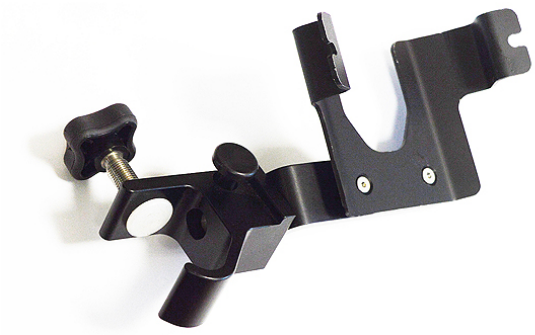
# Optional Accessories

Below is the list of optional accessories (Trimble reserves the right to make changes to this list without prior notice):

1. Monopole (also known as half-pole):


   Length is adjustable; three presettable lengths: 1.00 m (3.281 ft), 1.10 m (3.609 ft) and 1.20 m (3.937 ft).

2. Pole bracket:



3. External antenna cable (a coaxial cable):

# First-Time Use

## 1. Unpacking

The following items are delivered in the box:

- TDC150 unit
- Li-Ion battery
- Universal power adapter (includes a USB-to-micro-USB cable)
- Quick Start Guide
- 2 x screen protectors
- Monopole adapter (an attachable 5/8-inch female adapter + 4 x Philips head screws)
- Handstrap
- Battery door opener (a black, rigid pen-shaped accessory)
- Pouch.

***NOTE –*** *Trimble reserves the right to make changes to this list without prior notice.*

## 2. Inserting the SIM Card, Micro SD Card and Battery

Follow the instructions below:

1. Turn over the TDC150.
2. While exerting pressure on the battery door to ease the unlocking, slide out the lock using a finger or the tip of the battery door opener.

3. Insert the tip of the battery door opener into the recess (top-left corner of the battery door, see also Description, page 12) and gently push the opener to release the door out of the unit.

4. Put the battery door away.
5. If you are using a SIM card or/and a Micro SD card, insert these items now, BEFORE inserting the battery, making sure these are oriented as instructed on the label, contact side facing down for each of them. Insert the SD card first, then the SIM card.

[1]

[2]

> ⚠ **CAUTION –** For a micro or nano SIM card, please use a rigid, not a flexible SIM card adapter. Flexible SIM card adapters may damage the SIM card slot.

6. Insert the battery as shown below. Orientate the battery so that its electric contacts come first into contact with those at the bottom of the battery compartment. Insert the contacts side of the battery first, as shown, then push the battery in.

(If you insert the battery the wrong way, the battery door won't close.)

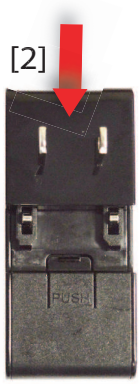
7. Put the battery door back into place by first inserting the two lugs located at the bottom of the door (opposite the lock).


8. Then push the battery door against the unit and lock it.

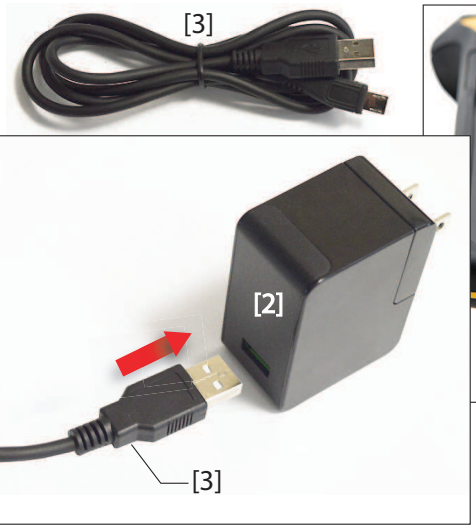
# 3. Charging the Battery With the Universal Power Adapter

Follow the instructions below.

1. Prepare the power adapter:
   - Choose the plug that fits your country's AC outlet standard (see **[1]**).


   - Slide it into the AC adapter **[2]**. (A "click" must be heard when fully inserted.)
2. Take the USB cable provided **[3]**.
3. Connect the end fitted with a standard USB connector to the power adapter.




4. Connect the other end (fitted with a micro-USB connector) to the bottom side of the TDC150 (open the flap **[4]** first).
5. Connect the power adapter to an electric outlet. After about 4 seconds, the TDC150 screen will light up showing a large battery icon being charged. The screen is then turned back off after about 10 seconds. After this time, battery charging will continue at the same rate until the battery is fully charged (charging time: 4 hours max.). The charger delivers a DC current of 2 A max. at 5 V DC.
6. To read the battery charging status, just press briefly the power button to re-activate the screen for the next 10 seconds.
7. Unplug the charger from the TDC150 when battery charging is complete.

# 4. Turning On the TDC150 for the First Time

1. Press the Power button **[12]** (see Description, page 12) for a few seconds until the TDC150 vibrates, then release the button.
2. Follow the on-screen instructions to initialize the receiver (choice of interface language, date, user name, protection, Google account, etc.; some of these steps may be skipped).

# 5. Installing GNSS Loader

(See also Using GNSS Loader, page 28.)

This application is required to upgrade theTDC150 GNSS firmware and install accuracy options.

1. Using your office computer, go to:

   https://www.trimble.com/globalTRLTAB.asp?nav=Collection-128273
2. From there, open the **Applications** menu and download this file:

   `GNSSLoader_Vx.x.xx.apk`
3. Save the file (an apk file) on your computer.
4. Using a USB connection between your office computer and the TDC150, copy the apk file to a folder on the TDC150.
5. From the File Manager application in Android, double-tap on the this apk file to install GNSS Loader. Let the receiver complete the installation procedure.

# 6. Checking/Updating TDC150 GNSS Firmware

Your TDC150 should always use the latest GNSS firmware.

1. On the TDC150, run GNSS Loader from the Android welcome screen.
2. Select **About**. GNSS Loader displays the version of the installed GNSS firmware on the third line. Write down the version number.

   Example: `Firmware version 3.64`
3. Using your office computer, go to:

   https://www.trimble.com/globalTRLTAB.asp?nav=Collection-128273
4. From there, open the **Firmware** menu, and read the version number of the latest TDC150 GNSS firmware available.

   Example: `Firmware TDC150_upgrade_v3.67.tar`

   If the version installed on the TDC150 is the same as the latest one available, skip the rest of this procedure. If they are not, proceed with the next steps below.
5. Click on the link of the latest firware version: `Firmware TDC150_upgrade_vx.xx.tar`
6. Save the file (a tar file) on your computer.

   Example: `Firmware TDC150_upgrade_v3.67.tar`
7. Still using the USB connection between your office computer and the TDC150, copy the tar file to the **Download** folder on the TDC150. (Copying to the **Download** folder is mandatory.)
8. On the TDC150, run GNSS Loader from the Android welcome screen.
9. Select **Upgrade firmware**.
10. Select the firmware upgrade file you have just downloaded and then touch  . Let the receiver complete the upgrade.

    The whole sequence takes about 15 minutes. It can be split into three different steps: file copy (longest step), firmware upgrade and receiver reset. Touch **OK** when the message **Complete** pops up.

# 7. Installing an Accuracy Option

If you purchased an accuracy option with your TDC150, make sure you have the POPN (Proof Of Purchase Number) ready as you will need it in the next steps. Still with GNSS Loader running:

1. Select **Install accuracy option**.
2. Touch **ADD**, and then enter the POPN. Touch **INSTALL** to complete the installation.

(See also Using GNSS Loader, page 28.)

# 8. Installing and Running your GIS Application

1. Using a USB connection between your office computer and the TDC150, copy the installation file (an apk file) of your GIS application to a folder on the TDC150.
2. From the File Manager application in Android, double-tap on the this apk file to install your application. Let the receiver complete the installation procedure.
3. Run your GIS application and start your work. You may need to use the handstrap (see below).

# 9. Attaching the Handstrap

The TDC150 can more safely be hand-held using the handstrap (provided). The handstrap gives a better grasp and eliminates the risk of accidentally dropping the unit to the ground.

First you should attach the two ends of the handstrap to the back of the TDC150. As shown below, there are two ways of attaching it. You'll choose one way or another, depending on whether you are left- or right-handed.

⚠ CAUTION – The ends of the handstrap are different. One is designed to be hooked to the center bottom of the unit, and the other to the right or left side of the unit.

# 10. Turning Off TDC150

We recommend you neatly turn off the TDC150 as explained below, which will avoid losing data.

After you have finished your work, turn off the TDC150 by holding the Power button **[12]** pressed until a dialog pops up, inviting you to either power off, reboot or switch the TDC150 to Airplane mode.

Touch **Power off** on the screen. This starts the power off procedure. Wait until the screen goes blank.

# How to Hold the TDC150

## In Your Hand

This requires that you hold the TDC150 in an appropriate manner. The TDC150 will have the best view of the sky if you hold it at waist level (or higher), at such an angle that the top of the unit (containing the GNSS antenna; see **[1]**, Description, page 12) is in horizontal position and not too close to your body.

## On Top of a Monopole

First attach the monopole adapter to the back of the unit. Use a Philips screwdriver and the four screws provided to secure the adapter. Mount the TDC150 on top of the monopole (optional accessory).

The TDC150 will have the best view of the sky if you hold it not too close to your body.

## GNSS Antenna Height with Monopole

When used on top of the monopole accessory (see picture; the monopole adapter is secured to the back of the TDC150, see also How to Hold the TDC150, page 22 ), the TDC150 can deliver accurate vertical coordinates because the monopole gives the TDC150 excellent vertical stability.

# On a Pole With External GNSS Antenna

In cases where you wish to use an external GNSS antenna mounted on top of a pole, the TDC150 will be inserted into a bracket (optional accessory) which you will fasten to the pole, approximately at mid-height.

You can freely orientate the TDC150 on its bracket since it is the external GNSS antenna, and not the TDC150's own antenna, that is used in this case.


Insert the TDC150 into the bracket so that it is pinched where you would normally hold it in your hand. That way you keep the rear camera clear and preserve access to the Power button.

You may use one of the two notches in the bracket to attach the coaxial cable connecting the TDC150 to the external GNSS antenna (see above picture), thus protecting the coaxial connector on TDC150 side from been accidentally pulled out.

To remove the TDC150 from the bracket, hold the external jaw of the bracket firmly in one hand and extract the TDC150 from the bracket using the other hand.

# Usual Android Settings

Literature about Android 6 can easily be found on the Internet. If you are new to Android, you may consult this information on line. Below are suggestions of links you may use to learn more about Android 6:

https://www.cnet.com/how-to/roasting-marshmallow-your-guide-to-android-6-0/

https://www.android.com/versions/marshmallow-6-0/

Many other sources of information exist on the Internet that you can find by yourself.

This section only describes a few basic Android functions you may need to use while working with your TDC150.

## Choosing the Interface Language

From the Android welcome screen, touch  then  .

Scroll down to the **Personal** section and once visible, touch the line containing this icon:  .

In the first field at the top of the screen, select your language.

Touch  repeatedly to return to the Android welcome screen.

## Setting Time & Date

Following a battery change in the field with no network connection, the Android time & date is likely to be wrong (because not automatically updated). Although as soon as GNSS reception is re-established, raw data (if recorded) will be properly time-tagged, on the other hand the creation time and date of the raw data file will remain wrong.

If however you can temporarily get a WiFi or GSM connection from your TDC150, then you will allow the Android time & date to be automatically updated.

But if this is not possible, we recommend you set the Android time and date manually before resuming your work so that the files you will subsequently create are all properly dated.

- From the Android welcome screen, touch then .
- Scroll down to the **System** section and once visible, touch the line containing this icon: .
- Momentarily disable the **Automatic date & time** parameter and then enter successively the current date and time in the fields located underneath.
- Then re-enable the **Automatic date & time** parameter.
- Touch  repeatedly to return to the Android welcome screen.

# Adjusting Time to Screen Sleep Mode

When using your TDC150 in the field, there may be long periods of time during which your TDC150 is collecting data but there is no need for you to touch the screen during this time (for example you are collecting a long line or polygon GIS feature). In this case you may want to keep the screen awake throughout the logging sequence.

The default time for the screen to switch to sleep mode being only 1 minute of inactivity, you will probably want to change this time. Here is how you can do this:

From the Android welcome screen, touch  then  .

- Scroll down to the **Device** section and once visible, touch the line containing this icon:  .
- Touch the fourth field (**Sleep**) and then choose the duration of inactivity at the end of which the screen will turn blank. The longest time you may choose is 30 minutes of inactivity.
- Touch  repeatedly to return to the Android welcome screen.

*NOTE – The fact that the screen switches to sleep mode has no impact whatsoever on any data collection sequence taking place in the TDC150.*

# Assigning Applications to the Programmable Buttons

(See programmable buttons A and B, Description, page 12.)

- From the Android welcome screen, touch  then  .
- Scroll down to the **Personal** section and once visible, touch the line containing this icon:  (**AB Key Set**).
- Touch button A or B at the top of the screen then tick one of the apps listed below that you want to assign to the corresponding key (e.g. Calculator). Repeat this action for the other key if you wish (e.g. E-compass).
- Touch  repeatedly to return to the Android welcome screen.

# Resetting TDC150

In the very unlikely case where your TDC150 would stop responding and a press on the power button would have no effect, then you might conveniently use the reset button for a fresh restart of the unit without having to temporarily remove the battery.

The reset button is that miniature button nested close to the USB connector (see **[7]**, Description, page 12). To press this button use a thin, long and pointy tool, like for example a pencil or an unfolded paper clip.

After pressing the button, the TDC150 will simply restart. This action has no effect whatsoever on your Android settings, your applications, files and personal data. It's just a hardware reset.

# Using GNSS Loader

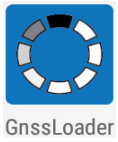
This application is required whenever you need to update the TDC150's GNSS firmware and/or if you have purchased the TDC150 with better than one meter position accuracy. GNSS Loader will be used in the latter case to install the corresponding firmware option.

To install GNSS Loader:

1. Using your office computer, go to:

   https://www.trimble.com/globalTRLTAB.asp?nav=Collection-128273
2. From there, open the **Applications** menu and download this file:

   `GNSSLoader_Vx.x.xx.apk`
3. Save the file (an apk file) on your computer.
4. Using a USB connection between your office computer and the TDC150, copy the apk file to a folder on the TDC150.
5. From the File Manager application in Android, double-tap on the this apk file to install GNSS Loader. Let the receiver complete the installation procedure.
6. Run GNSS Loader by touching this icon in the Android applications menu:




The GNSS Loader menu includes the following functions:

- **Reset GNSS**: Touch this option to reset the TDC150's built-in, high-accuracy GNSS receiver. When the sequence is complete, this message is displayed:

  ```
  Complete
  GNSS has been reset to the default settings
  ```

  Touch **OK** to close the message dialog box and return to the main menu.
- **Upgrade firmware**: Opens a window listing the possible GNSS firmware upgrades currently stored in the Download folder. These files use the following naming convention:

  `TDC150_upgrade_vx.xx.x.x.tar`

  Where vx.xx.x is the firmware version contained in the upgrade file.

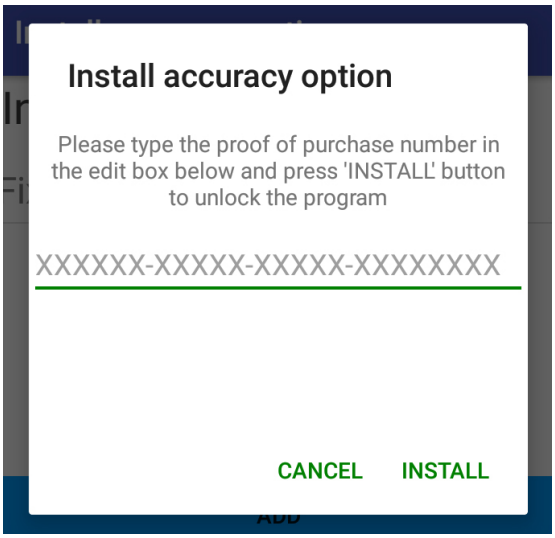
  (So you should have received your GNSS firmware upgrade before using the **Upgrade firmware** function.)

  To install an upgrade select the file and then touch  .

- **Install accuracy option**: Opens a window listing the currently installed accuracy options.

  The **ADD** button located at the bottom of the screen allows you to install a new option after entering the corresponding POPN.

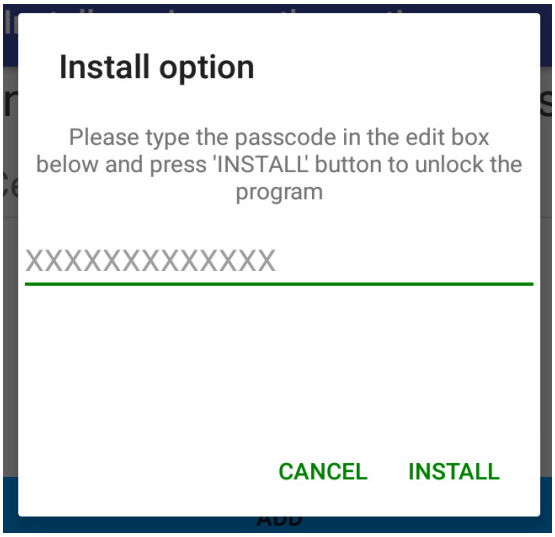
  The following screen appears after touching **ADD**:




  If you have purchased your TDC150 with sub-meter, decimeter or centimeter accuracy, you should have received the corresponding POPN via email.

  Enter the POPN and touch **INSTALL**.

- **Install service or other option**: Same as **Install accuracy option**. This function needs a passcode.




- **About**: Returns the software version of the installed GNSSLoader application, the TDC150 unit serial number and the version of the GNSS firmware currently installed in your TDC150. Touch OK to return to the main menu.

# Using SPace

SPace is the software interface required when running third-party Android applications on the TDC150.

SPace is mainly used to:

- Forward positioning information from the TDC150 high-accuracy GNSS module to any application running on the TDC150 and using the Android mock location server.
- Process incoming corrections.
- Monitor both GNSS reception, corrections reception and position accuracy.

## Installing SPace

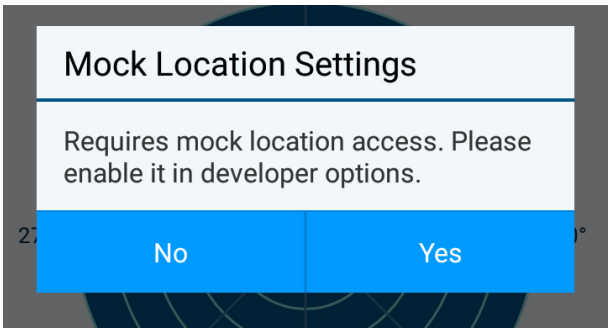
1. Using your office computer, go to:

   https://www.trimble.com/globalTRLTAB.asp?nav=Collection-128273
2. From there, open the **Applications** menu and download this file:

   `SPace_Vx.x.xx.apk`
3. Save the file (an apk file) on your computer.
4. Using a USB connection between your office computer and the TDC150, copy the apk file to a folder on the TDC150.
5. From the File Manager application in Android, double-tap on the this apk file to install SPace. Let the receiver complete the installation procedure.

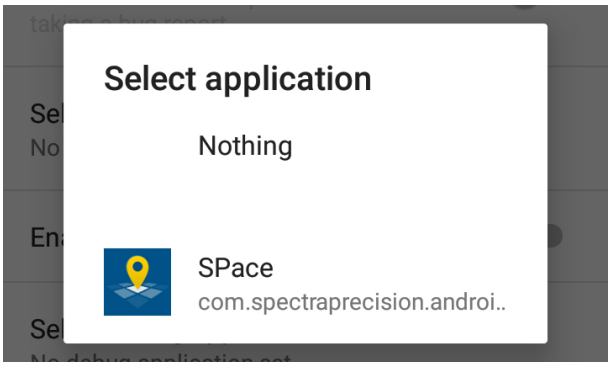
## Starting SPace for the First Time

When launching SPace for the first time, a message will first ask you to read and accept the EULA agreement. Another message will follow asking you to choose the application providing Android with position information:

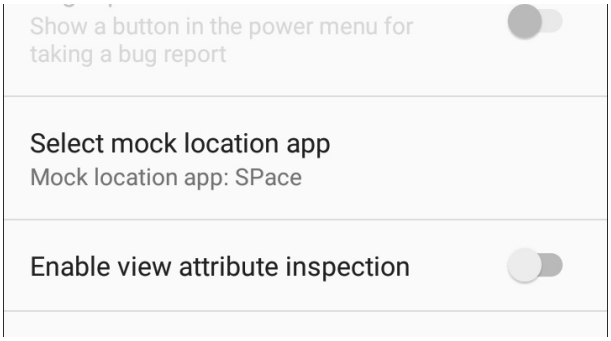


Touch **Yes**. This will open the list of developer options. Scroll down the screen until you find **Select mock location app** in the **Debugging** section.

Touch **Select mock location app**. This opens a dialog listing the apps that can be used for this purpose.




Touch **SPace**. The screen then shows that your choice is now active.




Touch  to return to SPace (SKYPLOT tab displayed).

***NOTE –*** *You need to do this setting only once.*

---

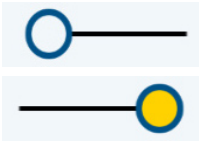
⚠ CAUTION – Whenever you launch SPace, including the first time you do it, it takes about 4 seconds before the TDC150 gets initialized. Meanwhile, the antenna icon in the SPace status bar looks like this:

When initialization is complete, this icon changes aspect to look like this:

---

# Notes about the User Interface

You will find the following graphic objects in SPace. The table below explains what they are for and when and how to use them:

| Object | Function |
|---|---|
|  | This is a switch: An empty circle stuck to the left means the concerned parameter is disabled while an orange circle stuck to the right means it is enabled. To switch from one state to the other, just touch the line including this graphic object or simply drag the circle to the left or right. |
|  | This object is associated with the previous one. After making a choice with the above switch, touch this button in the lower-right corner of the screen to save the change or changes you've just made. This will take you to the previous screen. |
|  | Please wait when this animated object is displayed. That means the TDC150is being interrogated and it takes a while before the requested information is returned. Normally this item disappears after a few seconds. |

# Setting TDC150 to Receive Corrections

After the TDC150 has initialized, do the following to set it up (see also SPace Settings on page 13 to have a global view of all the settings you can make in SPace):

- In the status bar, touch 
- Touch the **Correction Information** field. You are then requested to choose between different sources of corrections:

| Source of Corrections | Meaning |
|---|---|
| SBAS | Corrections will be received from an SBAS satellite. |
| NTRIP | Corrections will be received from a particular mount point part of an NTRIP network, via the Internet. |
| DIP | Corrections will be received from a base via the Internet. |
| RTX IP | Not available. |
| RTX L-BAND | Not available. |

- Choose the desired source of corrections, and then touch the horizontal right arrow in the lower-right corner of the screen.
  1. **If you chose SBAS**: No additional setting is required.
  2. **If you chose NTRIP**: The first time you want to make an NTRIP connection, there is no predefined connection profile available. Touch the "+" symbol in the lower-left corner of the screen and then enter the parameters of your NTRIP provider:

     **Friendly Name (max 20 chars)**: Freely choose a convenient name for this connection profile.

     **Host Name or IP Address** (The host name should contain a valid domain name.)

     **Port Number**

     Touch the **Get Source Table** button to list the mount points available from this provider and select one. If you remember the name of the mount point you want to use, you don't need to acquire the source table: Just touch the **Enter Mount Point** button and type in the name of the desired mount point.

     Then enter your NTRIP credentials (**User Name** and **Password**).

     Touch **Connect** at the bottom of the screen. At this point, SPace will initiate a network connection to allow the TDC150 to receive corrections from the chosen NTRIP provider.
  3. **If you chose DIP**: The first time you want to make a DIP connection, there is no predefined connection profile available. Touch the "+" symbol in the lower-left corner of the screen and then

enter the parameters of your DIP provider:

**Friendly Name (max 20 chars)**: Freely choose a convenient name for this connection profile.

**Host Name or IP Address** (The host name should contain a valid domain name.)

**Port Number**

Touch **Connect** in the lower part of the screen. At this point, SPace will initiate a point-to-point network connection to allow the TDC150 to receive corrections from the chosen static IP address.

***NOTE –*** *Next time you turn on the TDC150 for a new working session, the last NTRIP or DIP network connection made will be re-established automatically, provided you still have the required environment (modem, Wi-Fi) to establish a network connection.*

# SPace Settings

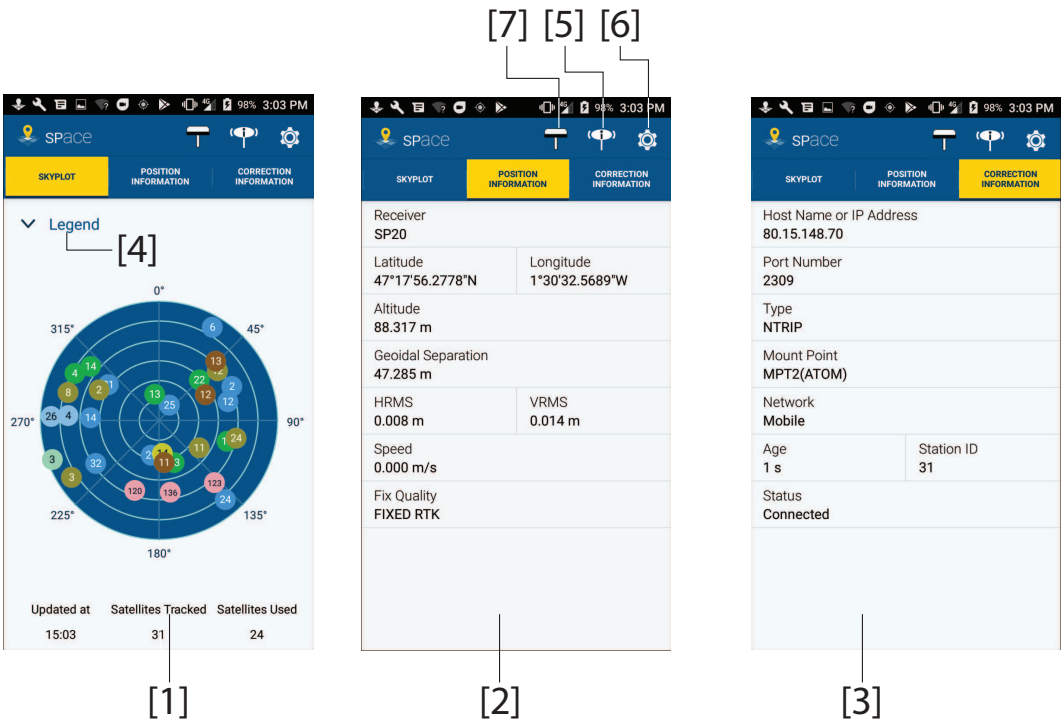
- In the status bar, touch  .
- Set the following parameters:
  - **Autostart application at boot**: Enabling this parameter means SPace will be started automatically next time you power on your TDC150. This way, you don't have anything else to do at power up, but start your application as soon as the TDC150is ready to operate. If you disable this parameter, SPace will run only if you start it manually.
  - **Receiver** (a read-only field): Displays the product name ("TDC150").
  - **Correction Information**: Source of corrections currently used. If you touch this line, you may change the type of connection through which corrections enter the TDC150 (SBAS, NTRIP, DIP; see Setting TDC150 to Receive Corrections, page 33 for all the details). By touching the "+" symbol after selecting "NTRIP" or "DIP", you may add a new NTRIP or DIP provider respectively.
  - **Use monopole**: By activating this function, you allow the TDC150 to deliver 3D positioning, the height of the TDC150 above the ground being accurately known in that case.
  - **External antenna model** (only if an external GNSS antenna is connected to the TDC150 via plug **[10]** (see Description, page 12): Choose the model of external GNSS antenna used from the available list (possible antenna models are 111660, 111661, SPGA Rover, Zephyr 3 Rover).

    Logically, when this option is visible in **Settings**, then **Use monopole** (above) is not.
  - **Configuration File**: Allows you to run a file containing a set of commands intended to modify the configuration of the high-accuracy GNSS module. The file should be a text file with the "txt" extension and should have been saved to the Download folder. To have the receiver executing the desired set of commands, just touch the txt file containing this set of commands. The response of the high-accuracy GNSS module to the set of commands will be returned in a file named "<file_ name>.txt.log", also visible in the Download folder.

- **RF Band selection**: Touch this parameter to choose which GNSS frequencies to receive (L1, L2, L-Band). L1 and L2 are enabled by default and L-Band is disabled by default. L1 cannot be disabled.
- **Constellation tracking**: Touch this parameter to choose which constellations to receive (GPS, GLONASS, Galileo, SBAS, BeiDou, QZSS). By default, all constellations are used (enabled).
- **Debug Data Recording**: Enable or disable the automatic recording of ATL data (debug data). Enabling this function makes sense only if Technical Support requires that you do so. Otherwise keep it disabled. Debug data will be saved as an ATL_yymmdd_hhmmss.log file stored in folder:
  `.../Download/ATL Data/`
  `e.g. ATL180524_141126.log created at 2:11:26pm on May 23, 2018.`
- **Keep NMEA outputs running**: When enabled, this option makes sure all the NMEA messages delivered by the GNSS receiver to SPace continue to be output while SPace is running and after SPace has stopped running.
- **Help**: Touch this line to open the Help page. Use the Back key on the TDC150 to close the Help page.
- **About**: Touch this line to read the installed SPace software version.

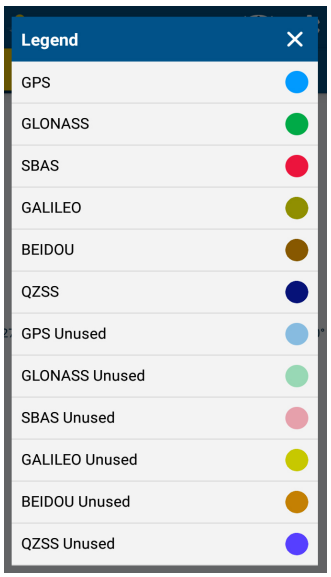
# Monitoring TDC150 Operation

## Operating Status Screens




The **SKYPLOT** tab (**[1]**) is a polar diagram showing the location in the sky of each tracked satellite.

Touch **Legend** (**[4]**) to read the color convention used for each constellation to represent satellite locations on the skyplot view:



In the lower part of the screen, you can read the total number of currently tracked satellites and total number of satellites currently used.

The **POSITION INFORMATION** tab (**[2]**) provides the following information, from top to bottom:

- Receiver name (TDC150)
- Latitude and Longitude of current position
- Altitude of current position
- Geoidal separation (vertical distance between datum used and geoid used)
- HRMS, VRMS: Horizontal and vertical errors
- Speed: TDC150 speed, in meters/second
- Fix quality: Position computation mode (**AUTONOMOUS**, **DGPS**, **FLOAT RTK**, **FIXED RTK**).

The **CORRECTION INFORMATION** tab (**[3]**) provides the following information, from top to bottom:

- **Host Name or IP Address**: Identification of the NTRIP or DIP server providing the corrections used.
- **Port Number**: IP port number of the NTRIP or DIP server providing the corrections used (blank for SBAS) (the presence of a hyphen in any field means "Blank").
- **Type**: Type of connection used (SBAS, NTRIP or DIP) to let the TDC150 acquire corrections.
- **Mount Point**: Name of mount point used in NTRIP (blank for SBAS and DIP).
- **Network**: Indicates which medium (**Mobile** or **Wi-Fi**) is used to make a network connection (blank for SBAS).
- In the same line:
  - **Age**: Age of the corrections received, in seconds.
  - **Station ID**: Identification number of the station, or PRN of satellite in SBAS, providing the corrections used.
- **Status**: Network connection status (**Connected** or **Disconnected**) (Blank if SBAS).

## Receiver Profile Status

 : Touch this icon (see **[5]** Description, page 12) to read information about the TDC150:

- **Receiver Type**: “TDC150”.
- **GNSS Connection Status**: “Connected” necessarily. At power up, as long as this connection is not active, you cannot open this window. The receiver icon then looks like this:

  *NOTE – After launching SPace, it takes about 4 seconds before this connection is active.*
- **RTX Subscription**: Not available.
- **MSL version**: Software version of TDC150 Micro Service Layer. (This piece of software is used to interface TDC150 with Android).
- **RTK Option**: Indicates the level of precision available from your TDC150:
  - **Full RTK** (centimeter accuracy): Centimeter-accurate 3D position
  - **7/2** (decimeter accuracy): Accuracy is 7 cm in horizontal and 2 cm in vertical
  - **30/30** (sub-meter accuracy): Accuracy is 30 cm in both horizontal and vertical.
- **RTX Option**: (“None” is displayed).

*NOTE – RTK options may have temporary validity (1 month).*

## Settings

See SPace Settings, page 34.

## External GNSS Antenna

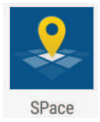
 : This icon (see **[7]** Operating Status Screens, page 36) is shown only if an external GNSS antenna has been connected to the TDC150 (see plug **[10]** Description, page 12).

If you touch this icon, you will be able to read the connection status and the signal level, as received by this antenna.

# SPace vs. GNSS Loader

Start GNSS Loader[1] (see Using GNSS Loader, page 28) which be possible only if SPace is NOT running. If SPace is currently running, do the following to quit SPace:

- Touch the SPace icon (below left) in the Android applications menu, or touch this icon (see below right) in the Android notification bar. This opens the SPace window on the TDC150 screen.




- Quit SPace by touching  .

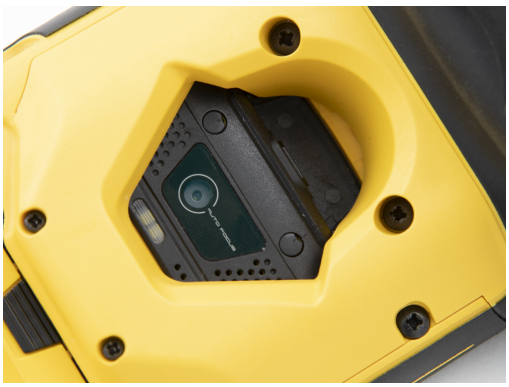
[1] Or any other application having direct control over the TDC150 high-accuracy GNSS module.

# Using CamCal

## Why is TDC150 Rear Camera Calibration Required?

The main purpose of the TDC150 rear camera is to provide an accurate view of the ground below the TDC150.

*TDC150 Rear Camera*



However a misalignment of the camera with the body of the TDC150 unit usually exists introducing a bias in all measurements made. This will be the case for example when using the rear camera to log data from within the TerraFlex GIS application.

What's more, the degree of misalignment varies from TDC150 to another, thus making the bias a quantity specific to each TDC150 unit.

For this reason, Trimble has developed the CamCal application so that users can eliminate the biases specific to their own TDC150 units. CamCal has to be run individually on each TDC150 to make the bias determination accurate.

*CamCal Icon*

The calibration process has to be performed once, but needs to be repeated every 3 or 6 months, depending on how often you use your TDC150.

The overall calibration process only takes a few minutes.

# Required Accessory

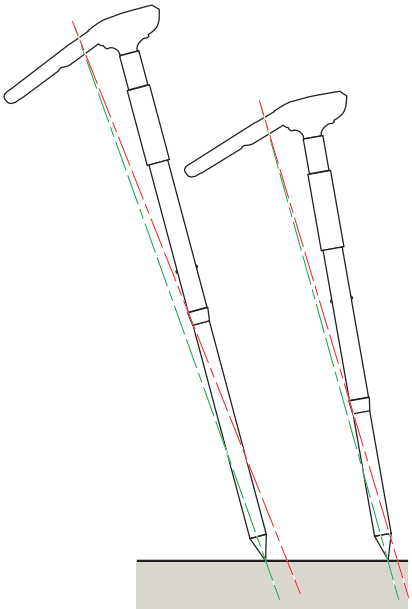
The Trimble monopole, or any other pole, is required to perform the calibration.

You will have to change the monopole length twice during the process and the difference between the two lengths should be at least 20 cm.

With its four preset lengths, from 1.00 m to 1.30 m, the Trimble monopole (see picture) appears to be the best option for this procedure.


# Calibration Principle

During the calibration process, you will have to take two pictures using the rear camera. These will be taken at two different lengths of the monopole, onto which you will have first installed your TDC150 unit.



After shooting each of the two pictures, CamCal will ask you to drag it on the screen so that the tip of the monopole appears at the center of a cross-hair, which occupies a fixed, central position on the screen.

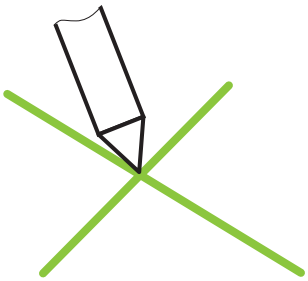
After you have made this adjustment for each of the two pictures, CamCal will be able to determine the bias, which will subsequently allow your application to correct all their measurements for this bias.

## What is Required for Calibration

- The two pictures should be shot in portrait orientation to make them usable in the calibration process.

  For some reason, the picture you will shoot may mistakenly be interpreted as a landscape image. In that case, reject the picture and take a new one after giving more tilt to the monopole.
- The camera lens must be focused on the tip of the monopole. Before taking the picture touch the tip, where seen on the screen, so that the camera can focus on this point. This is to make sure the picture will not be blurred around this point.
- The tip of the monopole should be put down on the ground. This will give better mechanical stability to the assembly and therefore better quality for your pictures.

  To help you locate the tip of the monopole on the two pictures, it is a good idea to draw two intersecting and perpendicular lines on the ground. By placing the tip of the monopole precisely at their intersection point, it will be easier to place the tip (hidden on the pictures) at the center of the cross-hair (more details in step 12, page 5).



## What is not Required for Calibration

- You don't need to hold the monopole in vertical position. On the contrary, giving some angle to the monopole is recommended to prevent the camera from mistakenly interpreting the picture as one in landscape format.

# Camera Calibration Steps

CamCal can be downloaded through this link:

https://www.trimble.com/globalTRLTAB.asp?nav=Collection-128273

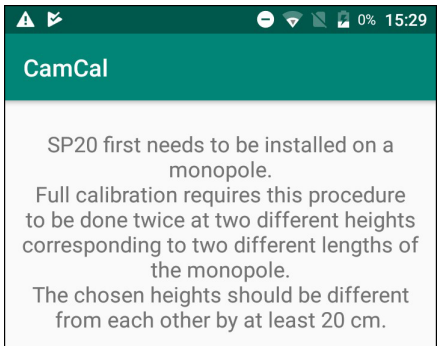
From there, open the **Applications** menu and download `CamCal-x.xxx.apk`.

After downloading and installing CamCal on your TDC150, do the following:

1. Secure the adapter onto the back of the TDC150. This accessory is part of the standard supply. Then fasten the TDC150 with its adapter onto the monopole.
2. Set the monopole length to one of the possible four height values. Keep in mind the value you have just set.

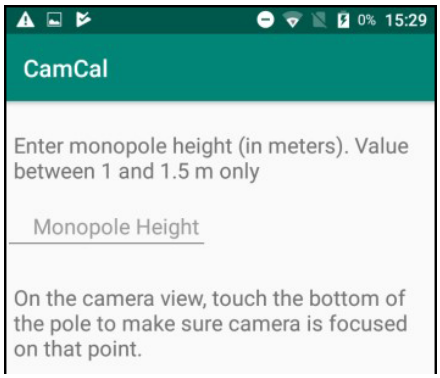
3. Turn on the TDC150 and then put down the monopole on the ground, its tip placed exactly at the intersection of two intersecting and perpendicular lines drawn on the ground.
4. On the Android applications screen, touch  .

   This starts CamCal. A message then shows up (see below) recalling you to first install the TDC150 on a monopole, which you have just done.

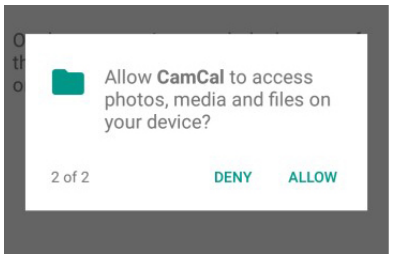


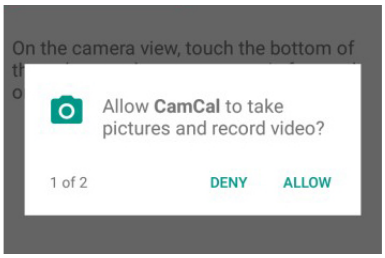

   The second part of the message explains the two steps of the process.

5. Click  located in the lower-right corner of the screen. A new screen is displayed.



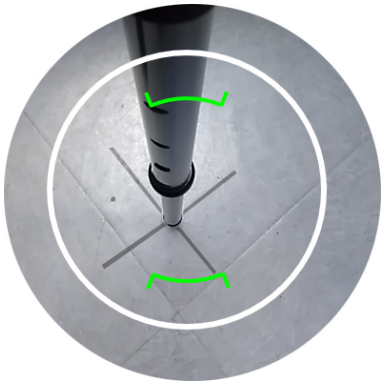

6. Enter the height value you've just set for the monopole.
7. Touch  located in the lower-right corner of the screen.
8. Accept the two settings that follow, each time by touching **ALLOW** (You will be asked only once).



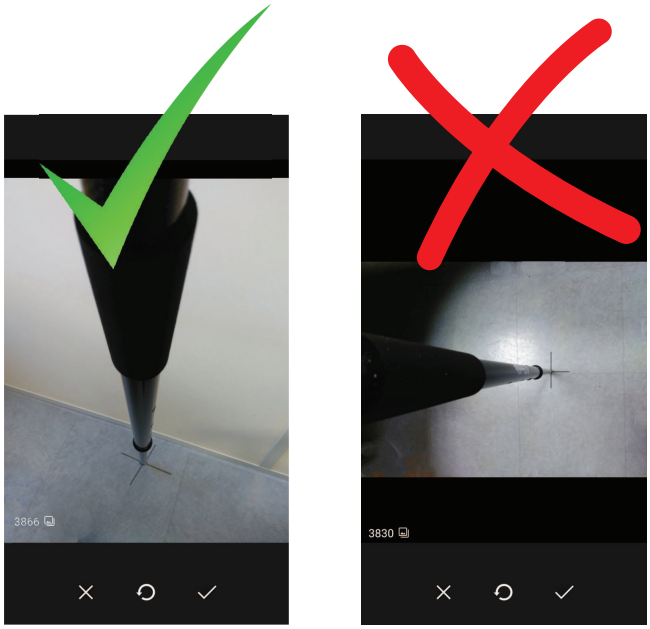




   Then the screen shows what the rear camera really sees.

9. Touch the screen where the tip of the monopole is located in order to let the camera focus on that point. A symbol shows where the camera is focusing on:



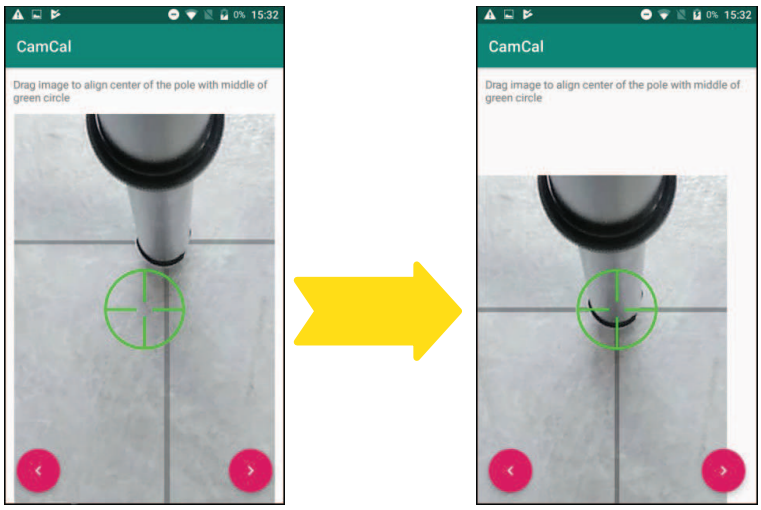
10. Take the first picture by touching . As a result, CamCal shows the picture you've just taken. CamCal will show either a picture taken in portait or landscape format.



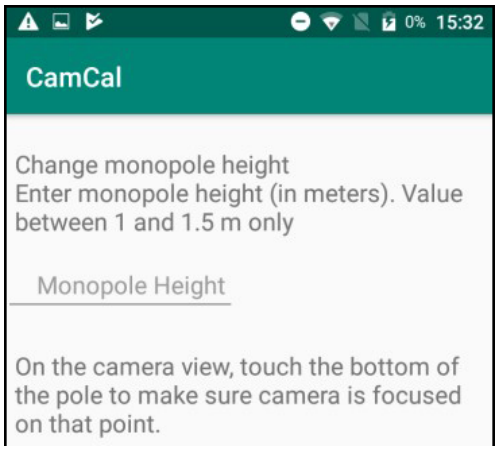

11. Touch to accept the portrait format, or to reject the picture in landscape format. In the latter case, change the tilt of the monopole and/or make a step to get a different view on the camera and then take another picture to get a valid one.

    With a valid picture, the next screen shows the picture you have just taken with a superimposed green cross-hair at the center of the screen.

12. Touch the screen with a finger and drag the picture so that the monopole tip appears at the center of the cross-hair. Use the lines drawn on the ground to make this adjustment as accurate as possible (see example below).



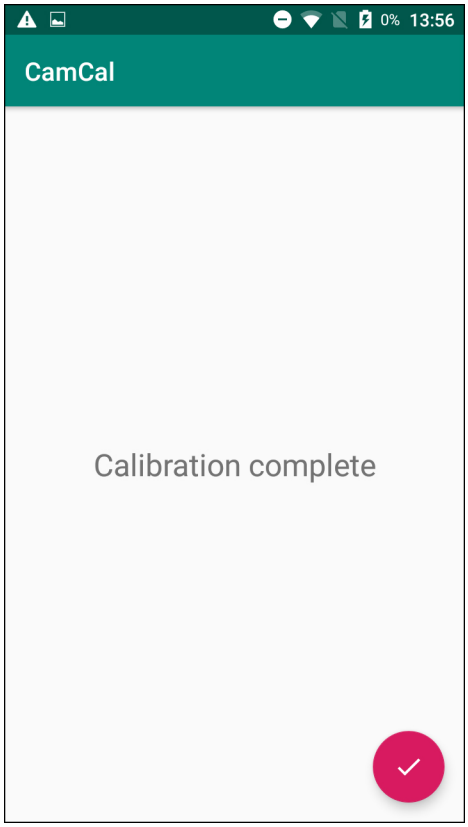

13. Touch  after you have been able to place the monopole tip within the cross-hair. A new screen is displayed:




14. Change the length of the monopole (by more than 20 cm compared to the first height setting).
15. Resume the procedure from step 6 above. In step 6, enter the new height value, different from the first one by more than 20 cm.

    Step 8 will be skipped this time as the two questions of step 8 only have to be answered once.

After the second picture has been taken, you have repositioned the monopole tip at the center of the cross-hair and touched the to-the-right red arrow, a message will appear to inform you that the "**Calibration [is] complete**".




From now on, all data collection performed using the camera view will be corrected for the bias due to bad camera alignment.

16. Touch  to quit CamCal.

Once the calibration is complete, you can be sure the view provided by the rear camera and the antenna height entered in the application match up. This will guarantee that the accuracy of all your measurements only depend on the accuracy of the GNSS position calculation.

# Specifications

## GNSS Characteristics

- 240 GNSS channels:
  - GPS L1, L2 (L1 C/A, L1P, L2P/ L2C
  - GLONASS G1, G2 FDMA
  - BeiDou B1 (phase 2 and phase 3), B2 (phase 2)
  - Galileo E1, E5b
  - QZSS L1C/A, L2C, L1Z
  - SBAS L1C/A
  - L-Band: 2 channels
- Scalable accuracy, from meter to centimeter [meter, sub-meter (30/30), decimeter (7/2), centimeter (full RTK)].
- Patented Z-Blade technology for optimal GNSS performance:
  - Full utilization of signals from all 6 GNSS systems (GPS, GLONASS, BeiDou, Galileo, QZSS and SBAS).
  - Enhanced GNSS-centric algorithm: fully-independent GNSS signal tracking and optimal data processing, including GPS-only, GLONASS-only or BeiDou-only solution (autonomous to full RTK).
  - Fast search engine for quick acquisition and re-acquisition of GNSS signals.
- Patented SBAS ranging for using SBAS code & carrier observations and orbits in RTK Processing.
- Patented Strobe™ Correlator for reduced GNSS multi-path.
- Supported data formats: ATOM, CMR, CMR+, RTCM 2.1, 2.3, 3.0, 3.1 and 3.2 (including MSM), CMRx and sCMRx.

## Real-Time Accuracy

(RMS) (1) (2)

SBAS (WAAS/EGNOS/MSAS/GAGAN):

- Horizontal: < 50 cm
- Vertical: < 85 cm

Real-Time DGPS position):

- Horizontal: 25 cm + 1 ppm
- Vertical: 50 cm + 1 ppm

Real-Time Kinematic Position (RTK) [3]:

- Horizontal: 10 mm + 1 ppm
- Vertical: 15 mm + 1 ppm

## Real-Time Performance

- Instant-RTK® Initialization:
  - Typically 2 sec for baselines < 20 km
  - Up to 99.9% reliability
- RTK initialization range: over 40 km.

## Post-Processing Accuracy

(RMS) [1] [2]

Static & Fast Static:

- Horizontal: 3 mm + 0.5 ppm
- Vertical: 5 mm + 0.5 ppm

High-Precision Static [4]:

- Horizontal: 3 mm + 0.1 ppm
- Vertical: 3.5 mm + 0.4 ppm

## Data Logging Characteristics

Recording interval:

- 1 - 999 seconds

# Processor

- Qualcomm Snapdragon 410
- Quad-core
- Clock frequency: 1.2 GHz

# Operating System

- Android® 6.0 (Google certified)
- Languages available: Afrikaans, German, English, Spanish, French, Italian, Portuguese (Portugal and Brazil), Japanese, Korean, Simplified Chinese, Greek, Russian, Azebaijani, Czech, Danish, Lithuanian, Hungarian, Dutch, Norwegian (Bokmal), Romanian, Finnish, Swedish, Turkish, Bulgarian, Serbian (Cyrillic), Hindi, Polish.
- Software package includes Google Mobile Services.

# Memory

- 2 GB SDRAM
- Storage: 16 GB (non volatile).
- MicroSDHC™ memory card (up to 64 GB, SanDisk®, KingstonR recommended).

# Communications

- Cellular:
  - GSM (850,900,1800,1900), GPRS, EDGE, UMTS, WCDMA (B1, B2, B5, B8), HSPA, TDSCDMA (B34, B39), LTE-FDD (B1, B3, B4, B5, B7, B8, B20), LTE-TDD (B38/B39/ B40/B41)
- Wi-Fi (IEEE) 802.11 b/g/n
- Bluetooth 4.0 dual mode
- USB (micro B USB connector)
- NFC.

# Interface

- USB 2.0 (micro)
- External GNSS antenna connector (TNC)
- Audio jack 2.5 plug (CTIA/AHJ standards).

# Environmental Characteristics

- Operating temperature: -20° to +60°C (-4 to 140°F)
- Storage temperature: -30° to +70°C without battery (-22 to 158°F) (5)
- Humidity: 95% non condensing
- Water & dust proof: IP67
- Free drop: 1.2 m on concrete
- Shocks: MIL STD 810 (fig 516.5-10) (01/2000)
- Vibration: MIL-STD-810F (fig 514.5C-17) (01/2000)

# Power Characteristics

- Battery Li-Ion, 6400mAh
- Battery life: > 8 hrs @ 20 °C with GNSS on
- Charging time: 4 hours
- Removable battery.

# Physical Characteristics

Size

- 29.5 x 12 x 4.5 cm (11.6 x 4.7 x 1.8 in)

Weight

- 850 g (1.87 lb)

User Interface

- 2 volume keys, on/off/reset key, 2 programmable keys, standard Android touch panel buttons
- On screen keyboard display

- Size: 5.3” capacitive multi touch
- Resolution: 1280 x 720 pixels
- Brightness: 450 Cd/m²
- Gorilla Glass damage-resistant
- Auto-rotate between Portrait and Landscape.

## Multi-Media & Sensors

- Rear camera, 13 megapixels, with flash light
- Front camera, 2 megapixels
- E-Compass
- G-sensor
- Speaker
- Microphone
- Light sensor.

## Standard Accessories

- Handstrap
- Screen protectors (x2)
- A/C charger
- USB cable
- Pouch
- Battery door opener
- Monopole adapter

## Optional Accessories

- External GNSS antenna
- Pole bracket
- Monopole.

# Operating Modes

- RTK rover: Direct IP, NTRIP (VRS, FKP, MAC networks)
- Post-processing.

# Field Software

- TerraFlex
- PenMap

(1) Accuracy and TTFF specifications may be affected by atmospheric conditions, signal multipath, satellite geometry and corrections availability and quality.

(2) Performance values assume minimum of five satellites, following the procedures recommended in the product manual. High multipath areas, high PDOP values and periods of severe atmospheric conditions may degrade performance. Real-time accuracy depends on the TDC150 accuracy option installed. Post-processing (PP) accuracy obtained with ATOM files processed by SPSO.

(3) TDC150 used with monopole accessory.

(4) Long baselines, long occupations, precise ephemeris used.

(5) Battery can be stored up to +70°C.

(6) Receiver convergence time varies based on GNSS constellation health, level of multipath, and proximity to obstructions such as large trees and buildings. Convergence can be improved in RAM enabled regions.