CHAPTER

3

Getting Started

In this chapter:

Turning the Instrument On and OFF

Turning on the instrument

Press [Power] key to turn on the instrument, and the application program will start up.

Refer to the operation manual for how to use the application program.

***Note** – Check the batteries are correctly inserted into the slot if the application program doesn't start up even after pressing [power].*

Turning off the instrument

Press [Power] key, and the "Power Key!" window shown on the right appears.

Tap [Stanby] button on the window to turn off the instrument.

Tap [OK] button, and the window disappears. The display returns to the screen shown before pressing [Power] key.

***Note** – Stanby*
"Stanby" is the function which stops the program running and turns off the instrument.
Pressing [Power] key again returns to the screen displayed before the instrument is turned off.

Basic Operation

Turning on and off the Backlight

Press [Power] key, and the “Power Key!” window shown on the right appears.

Tapping [Backlight On/Off] button on the window switches on/off the back light.

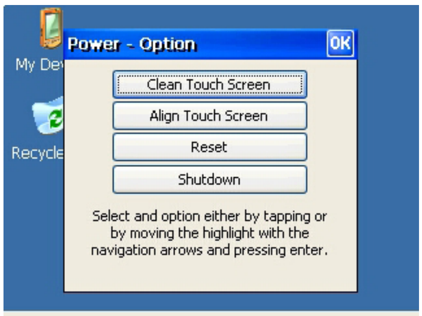
Tap [OK] button, and the window disappears. The display returns to the screen shown before pressing [Power] key.

Other functions

Press [Power] key, and the “Power Key!” window shown on the right appears.

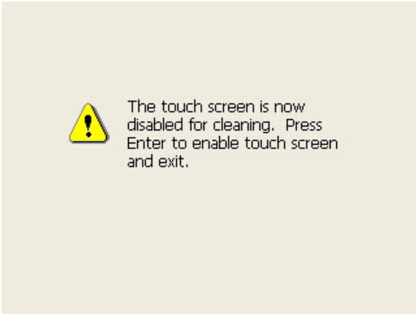
Press [Options] button on the window to display option menu.

Tap [OK] button, and the window disappears. The display returns to the screen shown before pressing [Power] key.



Cleaning of touch screen

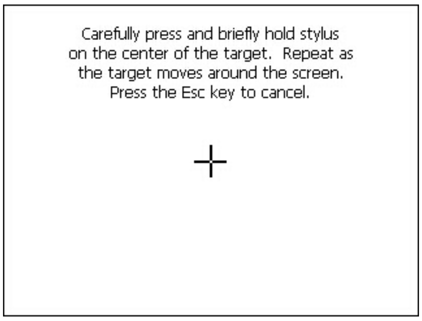
Tapping the menu button [Clean Touch Screen] disables the touch screen. Use this menu button for cleaning the touch panel.



Press ↵ (Enter) key, and the display returns to the screen shown before pressing [Power] key.

Adjustment of touch screen

Tapping the menu button [Adjust Touch Screen] shows the touch panel adjustment window.



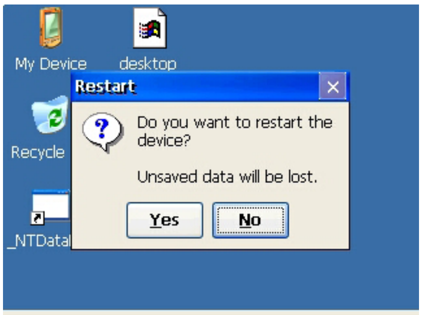
By following the instruction in this window, a gap between the actual tapping point and button on the window will be corrected.

Press [+] (plus) sign on the screen by stylus pen over 1 second. The [+] (plus) sign will move to a corner of the screen when you remove the stylus pen. Pressing ↵ (Enter) key after you press [+] (plus) sign on center and four corners completes the adjustment of touch screen.

Press [ESC] key to cancel the adjustment.

Reset

Tap the menu button [Reset], and the window shown on the right is displayed.



[Reset] stops the program in process and initializes the Total Station. Use this menu when the application program does not run normally because of an unexpected reason.

Tap [Yes] button to execute Reset.

Tap [No] button to cancel Reset and return to the screen shown before pressing [Power] key.

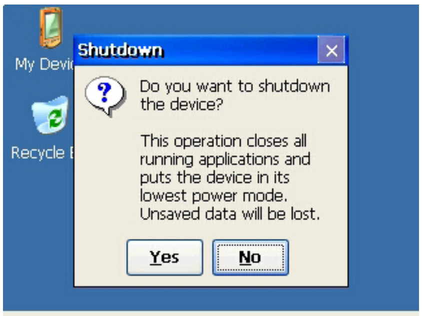
Note – *Once the Reset is executed, data that are not stored in the application program will be lost.*

Shut down

Tap the menu button [Shutdown], and the warning window shown on the right is displayed.

Tap [Yes] button to execute Shut down.

Tap [No] button to cancel Shut down and return to the screen shown before pressing [Power] key.



Note – *Executing Shut down completely turns off the Total Station.*

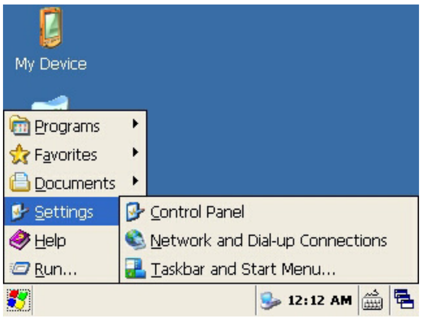
Note – *Executing Shut down ends the application program and the data that are not stored in the program will be lost.*

Auto power off setting

Auto power off function saves the consumption of electricity by switching the Total Station to the standby mode when it is not operated for a certain time.

Tap [Windows] button to display the menu.

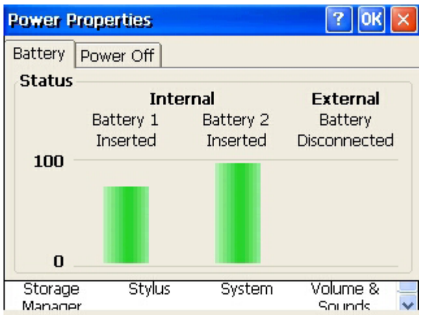
Select [Settings] to display the sub-menu. Choose [Control Panel].



Double click [Power] icon.

The latest battery status is displayed.

Choose [Power Off] tab.



Time setting window is displayed.

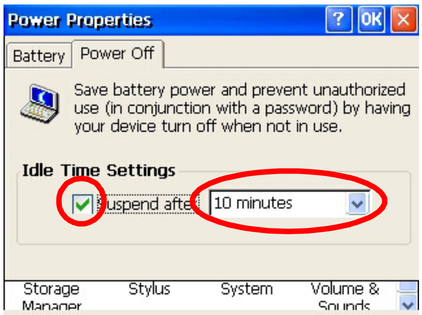
Check the check box of [Suspend after] in the “Idle Time Settings” field.

Select time from the pull down menu.

Selectable time is 5/10/30 minutes.

The suspend mode check box will be cleared if time is not selected from the pull down menu.

Tap [OK] button to complete the setting.



***Note** – Suspend mode and standby mode are the same status.*

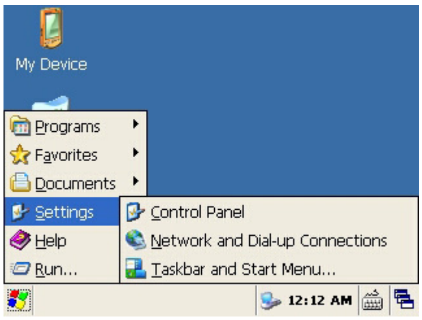
Date/Time settings

This function allows date and time setting of the Total Station

Tap [Windows] button to display the menu.

Select [Settings] to display the sub menu.

Choose [Control Panel].



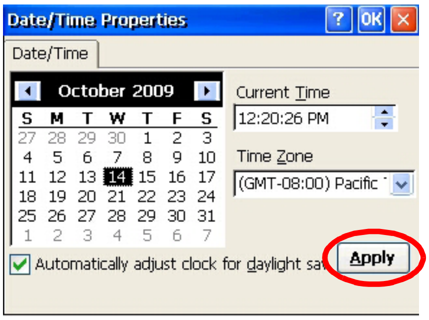
Double click [Date/Time] icon.

Current set date and time are displayed.

Set date, time and time zone.

Tap [Apply] button to fix the set values.

Tap [OK] button to complete the setting process.



CHAPTER

4

Checking and Adjustment

In this chapter:

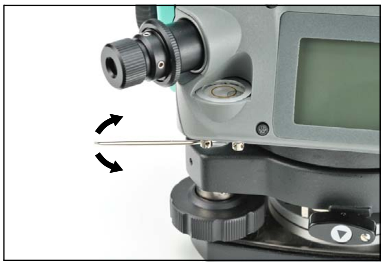
Adjusting the Electronic Level

Adjustment of the electronic level is done by Zero point errors of vertical scale and horizontal angle corrections. For detailed instruction, please see page 31.

Checking and Adjusting the Circular Level

Once you have checked and adjusted the electronic level, check the circular level.

If the bubble is not in the center of the level, use the adjusting pin to rotate the three adjustment screws of either circular level on the instrument main body or tribrach until the bubble is centered.



Checking and Adjusting the Optical/Laser Plummet

The optical axis of the plummet must be aligned with the vertical axis of the instrument.

To check and adjust the optical/laser plummet:

1. Place the instrument on the tripod. You do not have to level the instrument.
2. Place a thick sheet of paper marked with an X on the ground below the instrument.

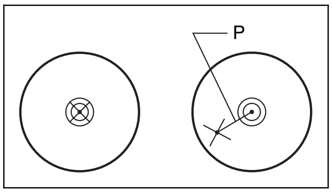
   While you are looking through the optical plummet, adjust the leveling screws until the image of the X is in the center of the reticle mark ◎.

   For laser plummet, adjust the laser pointer to the X.

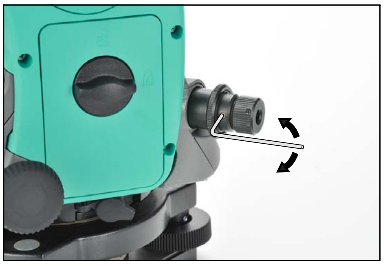
3. Rotate the alidade 180°.

   If the marked image is in the same position in the center of the reticle mark, no adjustment is required

   For laser plummet, if the laser pointer is on the X, no adjustment is required.



4. If the image or laser pointer is not in the same position, adjust the optical or laser plummet:



   a. Use the supplied hexagonal wrench to turn the adjustment screws until the image of the X is in Position P. Position P is the center point of the line connecting the X and the center of the reticle mark ⊙.

   b. Repeat from Step 2.
      For laser plummet adjustment, a cap needs to be removed.

Zero Point Errors of Vertical Scale and Horizontal Angle Corrections

Checking

1. Set up the instrument on the tripod.
2. Follow the leveling procedures described in Leveling, page 15.
3. Flip the telescope to the Face-1 position.
4. Sight a target that is within 45° of the horizontal plane.
5. Read the vertical angle from the VA1 field in the Basic Measurement Screen (BMS).
6. Rotate the instrument 180° and flip the telescope to the Face-2 position.
7. Read the vertical angle from the VA2 field.
8. Add the two vertical angles together, VA1 + VA2.
   – No adjustment is required if the zero reference for vertical angles (VA zero setting) is set to Zenith, and VA1 + VA2 equals 360°.
   – No adjustment is required if the zero reference for vertical angles (VA zero setting) is set to Horizon, and VA1 + VA2 is either 180° or 540°.
   – An adjustment is required if VA1 + VA2 is not one of the values listed above.

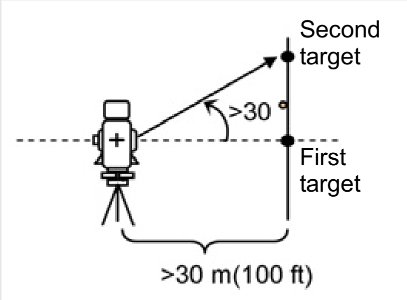
Note – *The difference between the vertical angle reading the relevant angle (either 360° for Zenith, or 180° or 540° for Horizon) is called the* ***altitude constant****.*

Adjusting

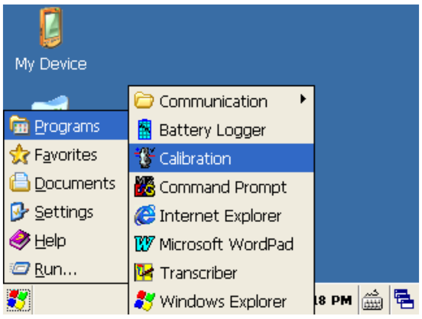
There are two steps in the calibration program. Usually you only complete the first step that is described below, because the trunnion axis is finely adjusted mechanically.

To make a major adjustment to the trunnion axis error compensation, however, you can complete the second step that is described below and make three sets of observations.

To set the parameters for trunnion axis error compensation, establish two targets at a horizontal distance of at least 30 m from the instrument. The first target should be placed on the horizontal plane and the second should be more than 30° above the horizontal plane. Before you set the trunnion axis compensation value, you must complete three sets of F1/F2 observations to these two points. Even if you complete the second step, the instrument cannot store a trunnion axis error compensation of more than 30". If the error is more than 30", the instrument needs a mechanical check.



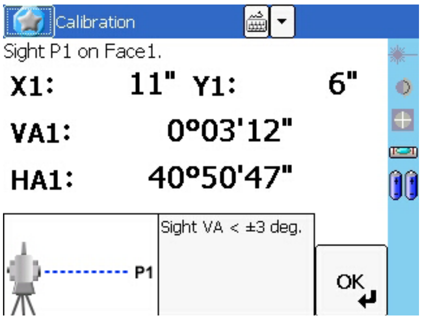
To enter the calibration program, tap [Windows] button to display the menu. Select [Program] to show the sub-menu. Choose [Calibration].



First step

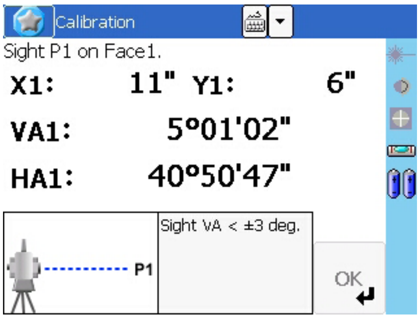
1. Take an F1 measurement to a target on the horizon. Tap [OK] button.

   The vertical angle is shown in the V0 dir= Horiz setting.

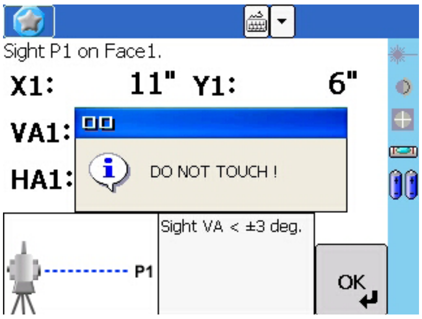


VA1	Face-1 vertical angle (tilt-off value)
HA1	Face-1 horizontal angle (tilt-off value)
X1	Face-1 X axis tilt value
Y1	Face-1 Y axis tilt value

If you sight a target that has a VA of more than 3°, a warning message appears and [OK] button becomes disabled.

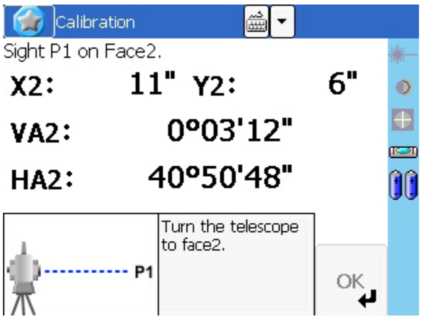


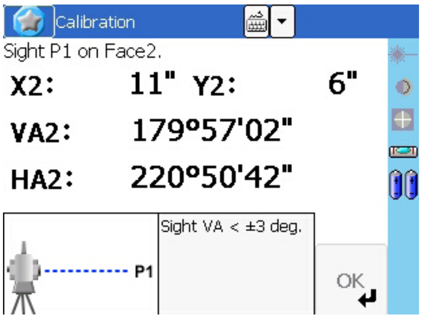
When you have taken the measurement, the message changes from `DO NOT TOUCH!` to `Turn to F2`.



2. Take an F2 measurement to the same target. Tap [OK].

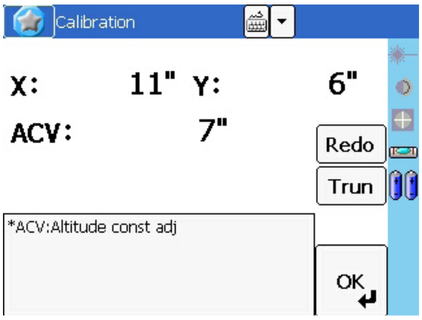
VA2	Face-2 vertical angle (tilt-off value)
HA2	Face-2 horizontal angle (tilt-off value)
X2	Face-2 X axis tilt value
Y2	Face-2 Y axis tilt value



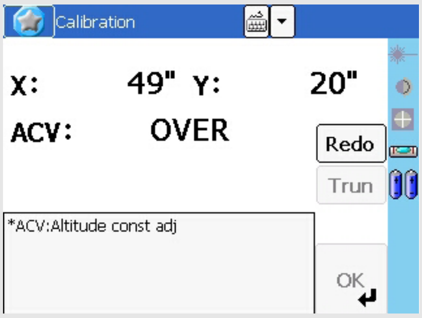


When the observation on F2 is completed, three parameters are displayed.

3. Do one of the following:
   - To return to the first observation screen, tap [Redo].
   - To set parameters on the instrument, tap [OK].
4. To go to the second step (trunnion axis compensation), tap [Trun].

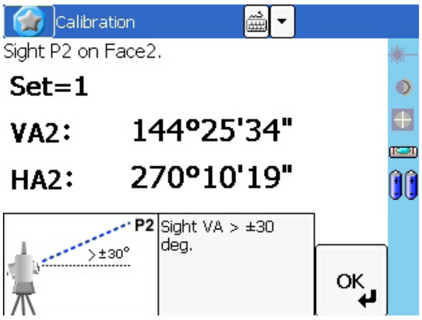


If the HA corr. setting is set to OFF, the ACH parameter is not applied to horizontal angle readings. If this setting is set to ON, both of the ACH and trunnion-axis parameters are applied to HA. If you do not complete the second step, the trunnion-axis parameter remains set to zero, and only the ACH parameter is applied. If ACV, ACH, X, or Y is out of range, OVER appears. Press any key to return to the first observation screen.

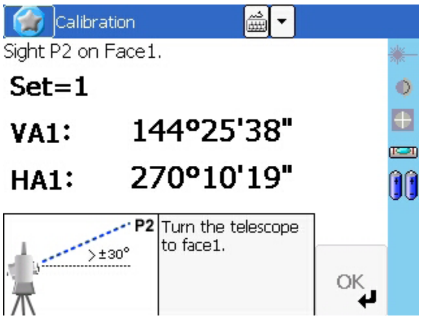


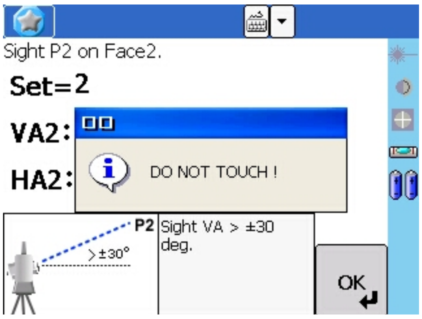
Second step

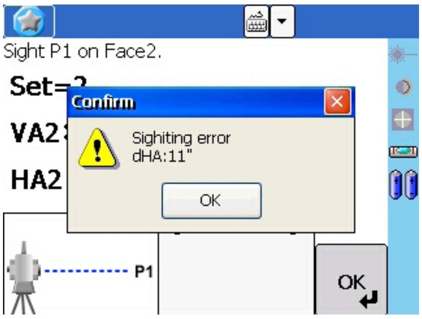
1. Sight the second target that is placed more than 30 degrees above the horizontal plane.



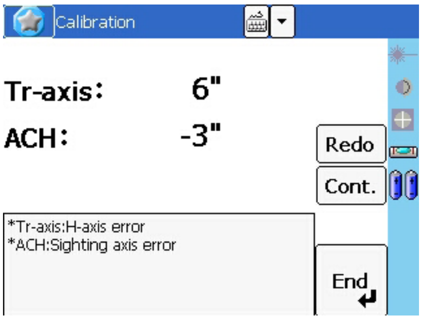
2. Tap [OK] to take angle measurements in the following order:
   - Face-2 to P2
   - Face-1 to P2
   - Face-1 to P1 (Horizontal)
   - Face-2 to P1 (Horizontal)
   - Face-2 to P2
   - Face-1 to P2
   - Face-1 to P1 (Horizontal)
   - Face-2 to P1 (Horizontal)
   - Face-2 to P2
   - Face-1 to P2







The tolerance in angle reading to each direction is 10". To maintain the accuracy of the instrument, you must take shots with extreme care. If the dHA to the same direction is more than 10", an error message appears, and you must remeasure all three sets of points.

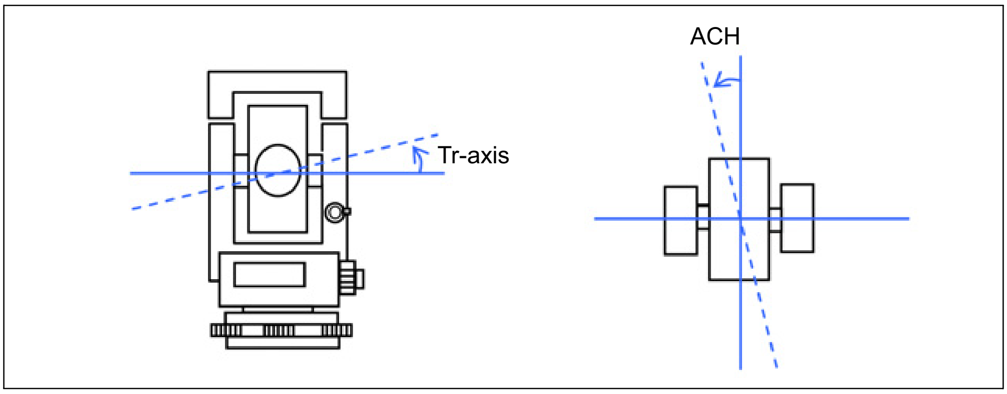


After three sets of F1/F2 observations, the instrument calculates the trunnion axis parameter and the updated ACH (the average of each set).

3. Do one of the following:
   - To return to the measurement screen for the first set of F1 measurements, tap [Redo].
   - To go to the next set of observations for a more accurate result, tap [Cont.]. You can record up to ten sets.
   - To store the parameter and return to the BMS, tap [End].
4. If HA corr. is set to OFF when you finish updating the trunnion axis parameter, a message appears. The message asks if you want to change the setting. To change the setting, tap [Yes].

Trunnion axis compensation

The trunnion axis error is reported when the vertical axis and the trunnion axis (horizontal axis) are not perpendicular to each other. The sighting axis error is from the sighting and the trunnion axes. These two errors can be compensated by applying the Tr-axis and ACH parameters on this instrument to horizontal angle readings.

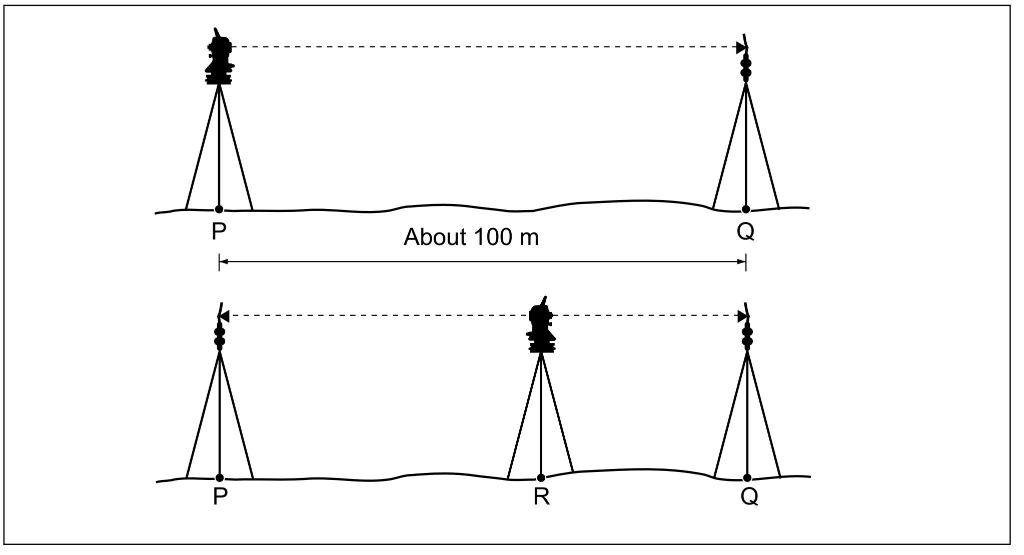


Because the amount of compensation changes according to the vertical angle, when compensation is enabled there is a slight movement in horizontal angle even if you clamp the tangent screw.

Checking the Instrument Constant

The instrument constant is a numerical value used to automatically correct for the displacement between the mechanical and electrical centers when measuring distances. The instrument constant is set by the manufacturer before the instrument is shipped. However, to ensure the highest operational accuracy, we recommend that you check the instrument constant several times a year.

To check the instrument constant, you can either compare a correctly measured base line with the distance measured by the EDM, or follow the procedure below.



To check the instrument constant:

1. Set up the instrument at Point P, in as flat an area as possible.
2. Set up a reflector prism at Point Q, 100 m away from Point P. Make sure that you take the prism constant into account.
3. Measure the distance between Point P and Point Q (PQ).
4. Install a reflector prism on the tripod at Point P.
5. Set up another tripod at Point R, on the line between Point P and Point Q.
6. Transfer the Nivo series instrument to the tripod at Point R.
7. Measure the distance from Point R to Point P (RP), and from Point R to Point Q (RQ).
8. Calculate the difference between the value of PQ and the value of RP + RQ.
9. Move the Nivo series instrument to other points on the line between Point P and Point Q.
10. Repeat Step 5 through Step 9 ten times or so.
11. Calculate the average of all the differences.

    The error range is within 3 mm. If the error is out of range, contact your dealer.

Checking the Laser Pointer

The Nivo series total station uses a red laser beam to a laser pointer. The laser pointer is coaxial with the line of sight of the telescope. If the instrument is well adjusted, the red laser pointer coincides with the line of sight. External influences such as shock or large temperature fluctuations can displace the red laser pointer relative to the line of sight.

CHAPTER

5

Specifications

In this chapter:

Main Body

Telescope

Tube length	125 mm (4.91 in.)
Magnification	30 X
Effective diameter of objective	
Nivo$^{2.C}$	40 mm (1.57 in.) EDM 45 mm (1.77 in.)
Nivo$^{3.C}$/Nivo$^{5.C}$	45 mm (1.77 in.) EDM 50 mm (1.97 in.)
Image	Erect
Field of view	1°20' 2.3 m at 100 m (2.3 ft at 100 ft)
Resolving power	3.0"
Focusing distance	1.5 m to infinity (4.92 ft to infinity)

Measurement range

Distances shorter than 1.5 m (4.92 ft) cannot be measured with this EDM.

Measurement range with no haze, visibility over 40 km (25 miles)

Nivo$^{2.C}$	
Prism mode	
Reflector sheet (5 cm x 5 cm)	270 m (886 ft)
Standard prism (1P)	3,000 m (9,840 ft)
Reflectorless mode	
Reference target	300 m (984 ft)

Nivo$^{3.C}$/Nivo$^{5.C}$	
Prism mode	
Reflector sheet (5 cm x 5 cm)	300 m (984 ft)
Standard prism (1P)	5,000 m (16,400 ft)
Reflectorless mode	
Reference target	300 m (984 ft)

- The target should not receive direct sunlight.
- “Reference target” refers to a white, highly reflective material. (KGC90%)
- The maximum measurement range of Nivo$^{2.C}$ is 500 m in the reflectorless mode.

Distance precision

Nivo$^{2.C}$

Precise mode	
Prism	± (2 + 2 ppm × D) mm (–20 °C to +50 °C)
Reflectorless	± (3 + 2 ppm × D) mm (–20 °C to +50 °C)
Normal mode	
Prism	± (10 + 5 ppm × D) mm
Reflectorless	± (10 + 5 ppm × D) mm

ISO17123-4 for Prism measurement

Nivo$^{3.C}$/Nivo$^{5.C}$

Precise mode	
Prism	± (3 + 2 ppm × D) mm (–10 °C to +40 °C) ± (3 + 3 ppm × D) mm (–20 °C to –10 °C, +40 °C to +50 °C)
Reflectorless	± (3 + 2 ppm × D) mm (–10 °C to +40 °C) ± (3 + 3 ppm × D) mm (–20 °C to –10 °C, +40 °C to +50 °C)
Normal mode	
Prism	± (10 + 5 ppm × D) mm
Reflectorless	± (10 + 5 ppm × D) mm

Measurement intervals

Measurement intervals may vary with the measuring distance or weather conditions.

For the initial measurement, it may take few more seconds.

Nivo$^{2.C}$	
Precise mode	
Prism	1.6 sec.
Reflectorless	2.1 sec.
Normal mode	
Prism	1.2 sec.
Reflectorless	1.2 sec.
Prism offset correction	–999 mm to +999 mm (1 mm step)

Nivo$^{3.C}$/Nivo$^{5.C}$	
Precise mode	
Prism	1.5 sec.
Reflectorless	1.8 sec.
Normal mode	
Prism	0.8 sec.
Reflectorless	1.0 sec.
Prism offset correction	–999 mm to +999 mm (1 mm step)

Angle measurement

Reading system	Absolute encoder Diametrical reading on HA/VA
Minimum display increment	
360°	1"/5"/10"
400G	0.2 mgon/1 mgon/2 mgon
MIL6400	0.005 MIL/0.02 MIL/0.05 MIL
DIN18723 accuracy	
Nivo$^{2.C}$	2"/0.6 mgon
Nivo$^{3.C}$	3"/1.0 mgon
Nivo$^{5.C}$	5"/1.5 mgon

Tilt sensor

Method	Liquid-electric detection (Dual axis)
Compensation range	±3'

Tangent screw

Type	Friction clutch endless fine motion

Tribrach

Type	Detachable

Level

Electronic level	Displayed on the LCD
Circular level vial	Sensitivity 10'/2 mm

Optical plummet

Image	Erect
Magnification	3×
Field of view	5°
Focusing range	0.5 m (1.6 ft) to infinity

Optional laser plummet

Wave length	635 nm
Laser class	Class 2
Focusing range	∞
Laser diameter	Approx. 2 mm

Display and keypad

Face 1 display	QVGA,16 bit color, TFT LCD, backlit (320 x 240 pixel)
Face 2 display	Backlit, graphic LCD (128 x 64 pixel)
Face 1 keys	14 keys
Face 2 keys	4 keys

Connections in the instrument

Communications	
RS-232C	Maximum baud rate 38400 bps asynchronous
USB Host and Client	
Class 2 Bluetooth 2.0 EDR+	
External power supply input voltage	4.5 V to 5.2 V DC

Battery pack

Output voltage	3.8 V DC rechargeable
Continuous operation time	
Nivo$^{2.C}$	
Continuous distance/angle measurement	approx 12 hours
Distance/angle measurement every 30 seconds	approx 26 hours
Continuous angle measurement	approx 28 hours
Nivo$^{3.C}$/Nivo$^{5.C}$	
Continuous distance/angle measurement	approx 7.5 hours
Distance/angle measurement every 30 seconds	approx 16 hours
Continuous angle measurement	approx 20 hours

Tested at 25 °C (nominal temperature). Operation times may vary depending on the condition and deterioration of the battery.

Environmental performance

Operating temperature range	–20 °C through +50 °C (–4 °F through +122 °F)
Storage temperature range	–25 °C through +60 °C (–13 °F through +140 °F)

Dimensions

Main unit	149 mm W x 145 mm D x 306 mm H
Carrying case	435 mm W x 206 mm D x 297 mm H

Weight

Main unit w/o battery	
Nivo2.C	3.9 kg (8.6 lbs)
Nivo3.C/Nivo5.C	3.8 kg (8.4 lbs)
Battery	0.1 kg (0.2 lbs)
Carrying case	2.3 kg (5.1 lbs)
Charger and AC adapter	0.4 kg (0.99 lbs), approx.

Environmental protection

Watertight/dust-proof protection	IP66

Standard Components

- Instrument main body
- Battery pack (X 2)
- Battery charger
- AC adapter
- Adjustment pin, Allen wrench
- Objective lens cap
- Vinyl cover
- *Total Station Nivo Series Instruction Manual* (this document)
- Carrying case
- Shoulder strap (X 2)

External Device Connector

This connector can be used to connect to an external power source or to communicate with an external device.

Before using the external device connector, make sure that the external device meets the specifications below.

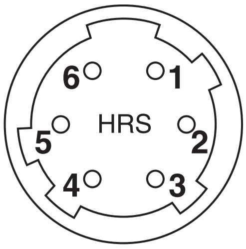
Input voltage	4.5 V to 5.2 V DC
System	RS-232C
Signal level	±9 V standard
Maximum baud rate	38400 bps asynchronous
Compatible male connector	Hirose HR10A-7P-6P or HR10-7P-6P

CAUTION – Except for the connection shown in Figure 6.1on page 50, use of this connector is at your own risk.

CAUTION – Use only the male connectors specified above. Using other connectors will damage the instrument.

The external device connector is a Hirose HR 10A-7R-6S female connector. The pinouts for connecting it to an external device connector are shown below:

Pin	Signal	Description
1	RXD	Receive data (Input)
2	TXD	Send data (Output)
3	NC	No connection
4	V	Power
5	GND	Ground
6	NC	No connection



CAUTION – Use only the pin connections shown above. Using other connections will damage the instrument.

CAUTION – The Nivo series total station has different pin assignment from other models of Nikon total station.

To connect to an external power source, supply power to Pin 4 (power terminal) and Pin 5 (ground terminal) on the instrument. The instrument will use the external power source even if the internal battery packs are attached.

CAUTION – Make sure that the power supplied is within the rated input range (4.5 V to 5.2 V DC, 1 A maximum). Power supplied outside this range will damage the instrument.

To communicate with an external device, connect the RS-232C signal from the external device to Pin 1 (input terminal) and to Pin 2 (output terminal) on the instrument.

Cap the data output/external power input connector securely while not in use. The instrument is not watertight if the cap is not attached or not attached securely, and when the data output/external power input connector is in use.

The instrument can be damaged by static electricity from the human body discharged through the data output/external power input connector. Before handling the instrument, touch any other conductive material once to remove static electricity.

CHAPTER

6

System Diagrams

In this chapter:

System Components

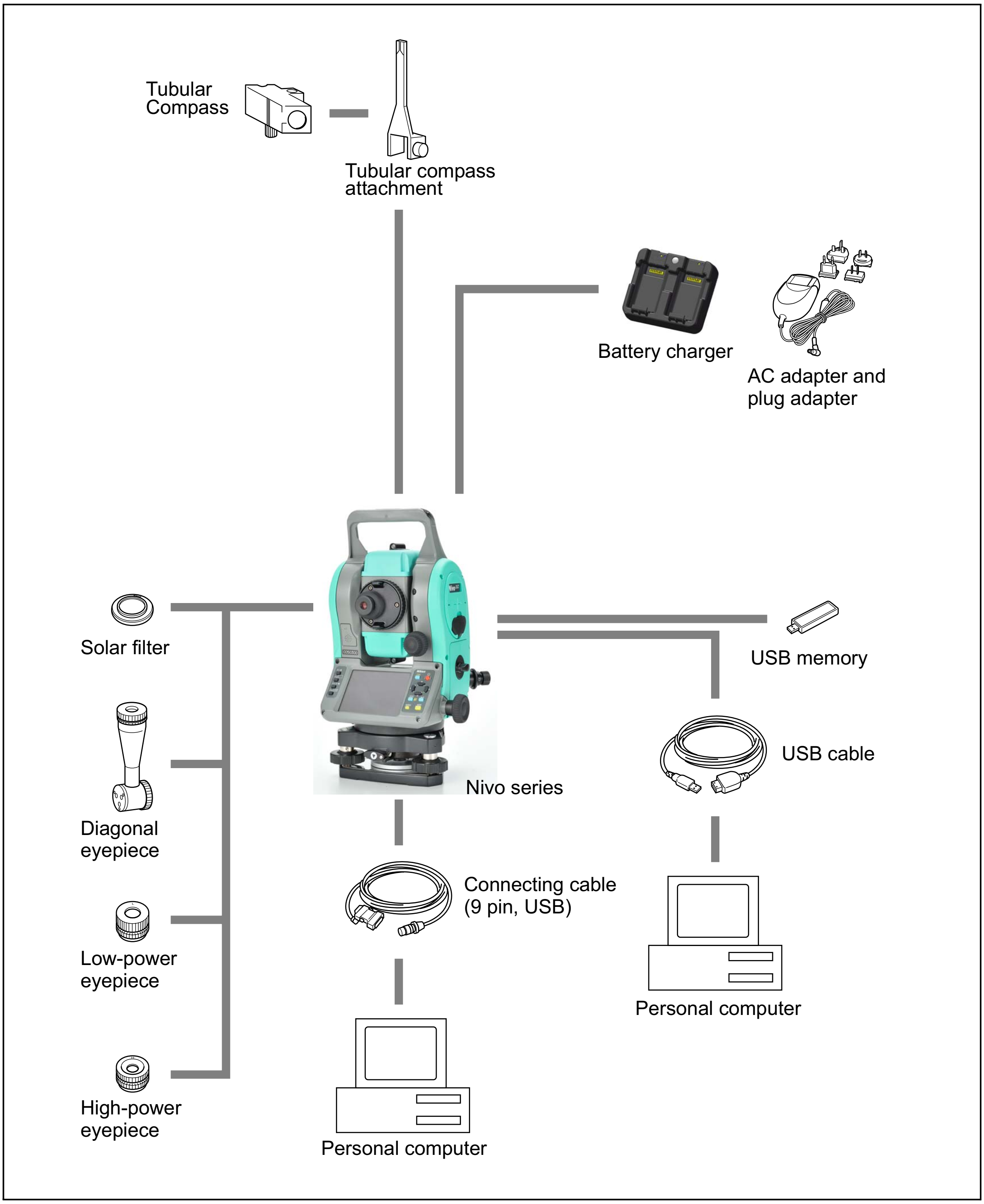


Figure 6.1 Measurement side

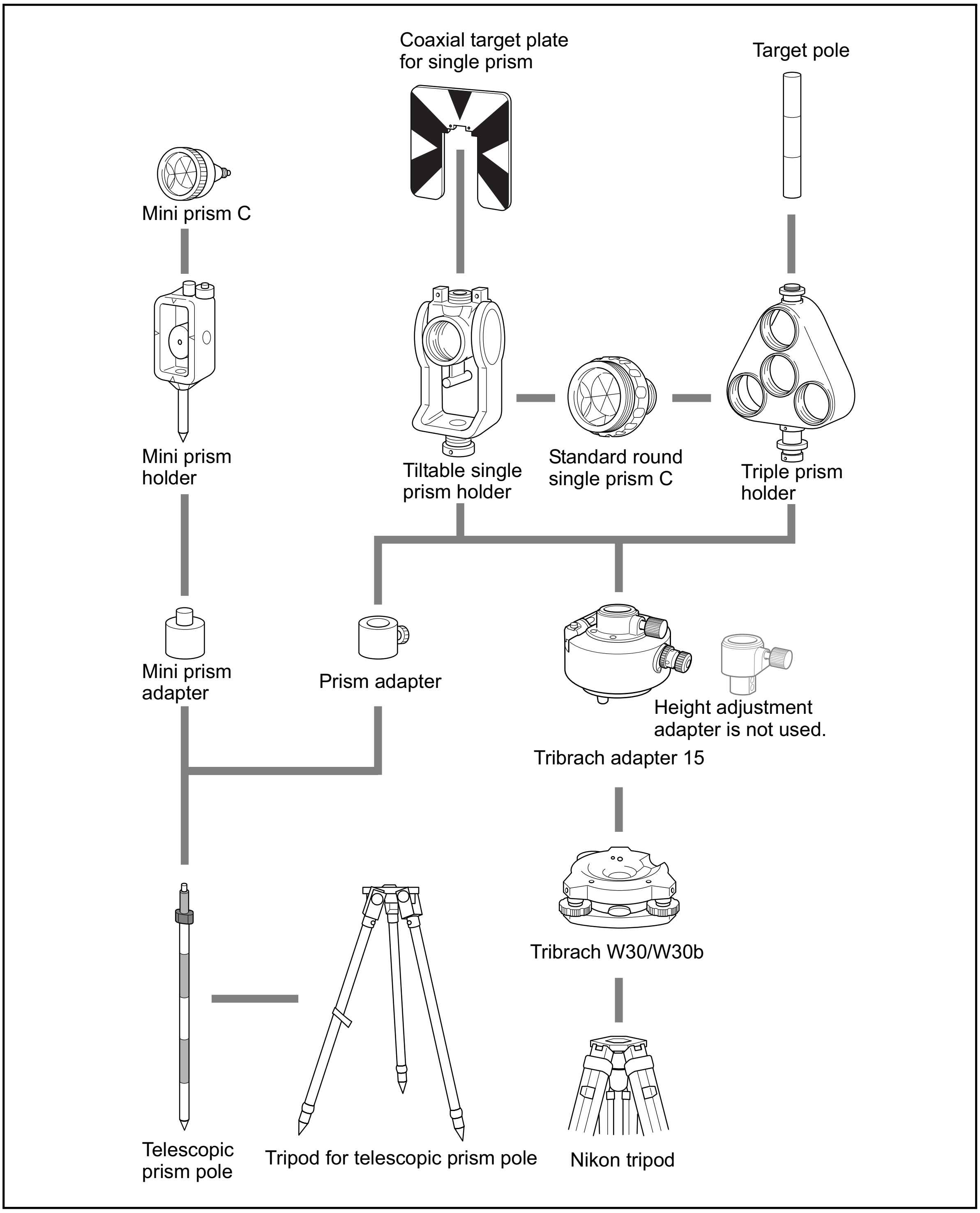


Figure 6.2 Prism reflector side

***Note –** Nivo series must be used with the Tribrach W30 or W30b.*

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