FOREWORD

Thank you for purchasing GOWIN TKS-200 Serial Electronic Total Station.For the best performance of the instruments, please carefully read these instructions and keep them in a convenient location for future reference.

General Handling Precautions

Before use of this instrument.It is necessary to check and confirm that each function of this instrument is working normally.

Do not submerge the instrument into water.

The instrument can not be submerged underwater.

The instrument is designed based on the International Standard IP54, therefore it is protected from the normal rainfall.

Setting the instrument on a tripod.

When setting the instrument on the tripod, the wood tripod should be used as much as possible, since the metallic tripod will generate vibration, which will effect the measurement precision.

Installing the tribrach.

If the tribrach is not properly installed, the measurement accuracy will be effected; the adjustment screw on the tribrach should be frequently checked to ensure that the fixing lever is locked and the base fixing screws are tightened.

Guarding the instrument against shocks.

During general transportation process, the shocks should be alleviated as much as possible, since a serious shock would lead to damage of surveying function.

Carrying the instrument

Always carry the instrument by its handgrip.

Exposing the instrument to extreme heat.

Do not leave the instrument in extreme heat for longer than necessary. It could adversely affect its performance.

Sudden changes of temperature.

Any sudden change of temperature to the instrument or prism may result in a reduction of measuring distance range, i.e when taking the instrument out from a heated vehicle.Let instrument acclimate itself to ambient temperature.

Battery level check.

Confirm battery level remaining before operating.

Taking the battery out.

It is recommended not to take the battery or external battery out during the power is on. All the data stored is possible gone at that time. So please do your assembling or taking the battery out after the power is off.

Do not hold the lower part of display unit.

When you take out the instrument from a carrying case, or keep into the case, please hold the hand grip and base of the instrument, do not hold the lower part of display unit.

Handling of battery.

The battery should be handled safely, for power supply please use the recommended battery, if the battery we recommended is not used, which will result in damage to the instrument

Display for Safe Use

In order to encourage the safe use of GOWIN products and prevent any danger to the operator and others or damage to properties, important warnings are put on the products and inserted in the instruction manuals.We suggest that everyone understand the meaning of the following displays and icons before reading the Safety Cautions and use instructions.

Display	Meaning
⚠WARNING	Ignoring or disregard of this display may lead to the danger of death or serious injury.
⚠CAUTION	Ignoring or disregard of this display may lead to personal injury or physical damage.

•Injury refers to hurt, burn, electric shock, etc.

•Physical damage refers to extensive damage to buildings or equipment and furniture.

Safety Cautions

⚠ WARNING
·**There is a risk of fire, electric shock or physical harm if you attempt to disassemble or repair the instrument by yourself.** This is only to be carried out by GOWIN or an authorized dealer, only!
·**Cause eye injury or blindness.** Do not look at the sun through a telescope.
·**High temperature may cause fire.** Do not cover the charger while it is charging.
·**Risk of fire or electric shock.** Do not use damaged power cable, plug and socket.
·**Risk of fire or electric shock.** Do not use a wet battery or charger.
·**May ignite explosively.** Never use an instrument near flammable gas, liquid matter, and do not use it in a coal mine.
·**Battery can cause explosion or injury.** Do not dispose in fire or heat.
·**Risk of fire or electric shock.** Do not use any power voltage except the one given on manufacturers instructions.
·**Battery can cause fire.** Do not use any other type of charger other than the one specified.
·**Risk of fire.** Do not use a power supply cable that is not specified by the manufacturer.
·**The short-circuit of a battery can cause a fire.** Do not short circuit a battery when storing it.

⚠ CAUTION
·Do not connect or disconnect equipment with wet hands, you are exposed to electric shocks if you do like this!
·Risk of injury by overturn the carrying case. Do not stand or sit on the carrying cases.
·Please note that the tips of tripod can be hazardous, be aware of this when setting or carrying the tripod.
·Risk of injury by falling down the instrument or case. Do not use a carrying case with a damaged which belts, grips or latches .
·Do not allow skin or clothing to come into contact with acid from the batteries, if this does occurthen wash off with copious amounts of water and seek medical advice.
·It could be dangerous if the instrument falls over, please ensure you attach a handle to the instrument securely.
·Ensure that you mount the Tribrach correctly, failing to do so may result in injury if the tribrach were to fall over. ·It could be dangerous if the instrument falls over, please check that you fix the instrument to the tripod correctly.
·Risk of injury by falling down a tripod and an instrument. Always check that the screws of tripod are tightened.

User

1)This product is for professional use only!
The user is required to be a qualified surveyor or have a good knowledge of surveying, in order to understand the user and safety instructions, before operating, inspecting or adjusting.
2)Wear the required protectors (safety shoes, helmet, etc.) when operating.

Exceptions from Responsibility

·The user of this product is expected to follow all operating instructions and make periodic checks of the product's performance.
·The manufacturer, or its representatives, assumes no responsibility for results of any faulty or intentional usage or misuse including any direct, indirect, consequential damage, and loss of profits.
·The manufacturer, or its representatives, assumes no responsibility for consequential damage, and loss of profits by any disaster (earthquake, storms, floods etc.)
A fire, accident, or an act of a third party and/or a usage any other usual conditions.
·The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits due to a change of data, loss of data, an interruption of business etc., caused by using the product or an unusable product.
·The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits caused by extra usage that is not according to the user manual.
·The manufacturer, or its representatives, assumes no responsibility for consequential and profit loss caused by wrong movement, or action due to connecting with other products.

How to Use The Straps

1 Carry on the back

2 Carry in the hand

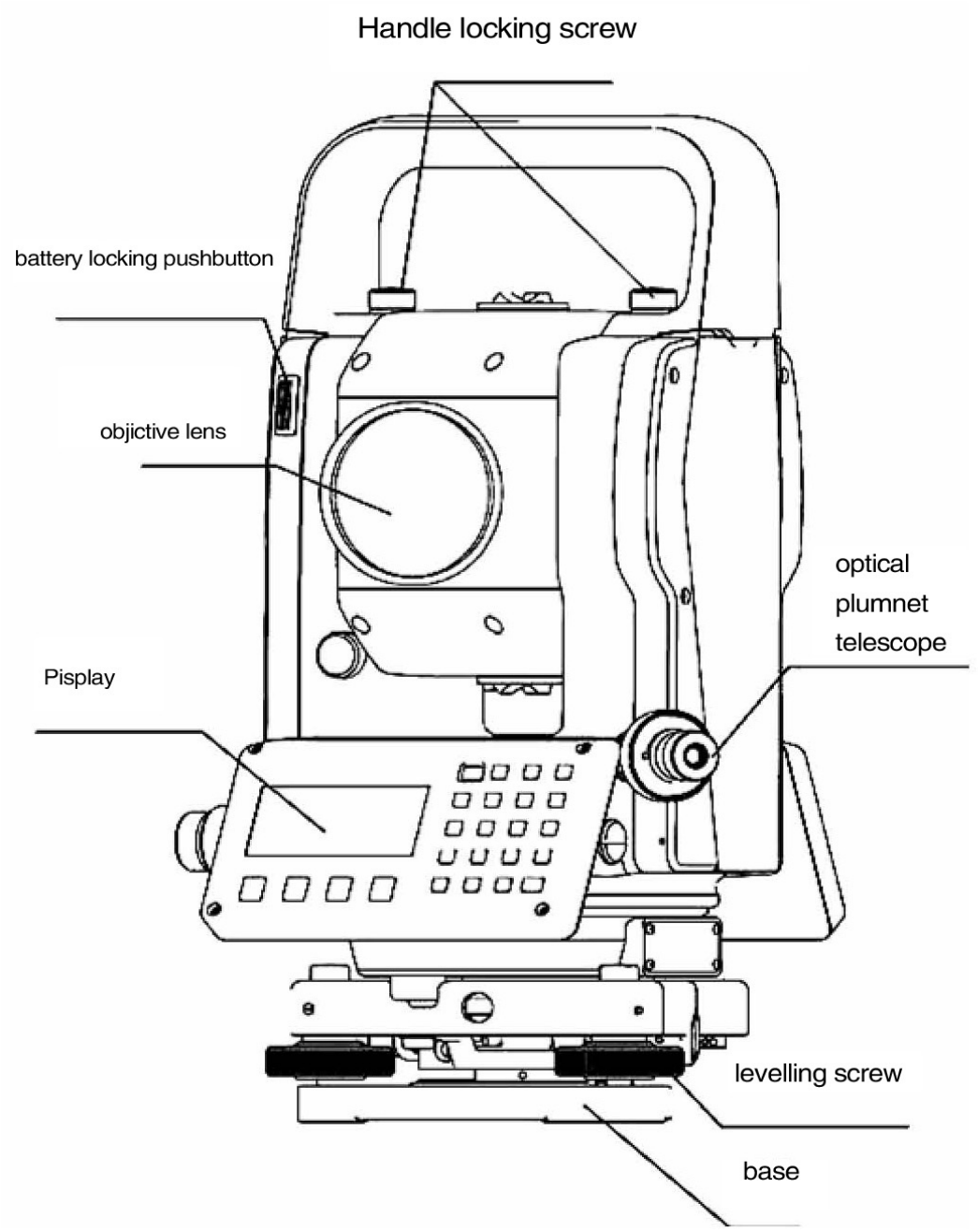
INDEX

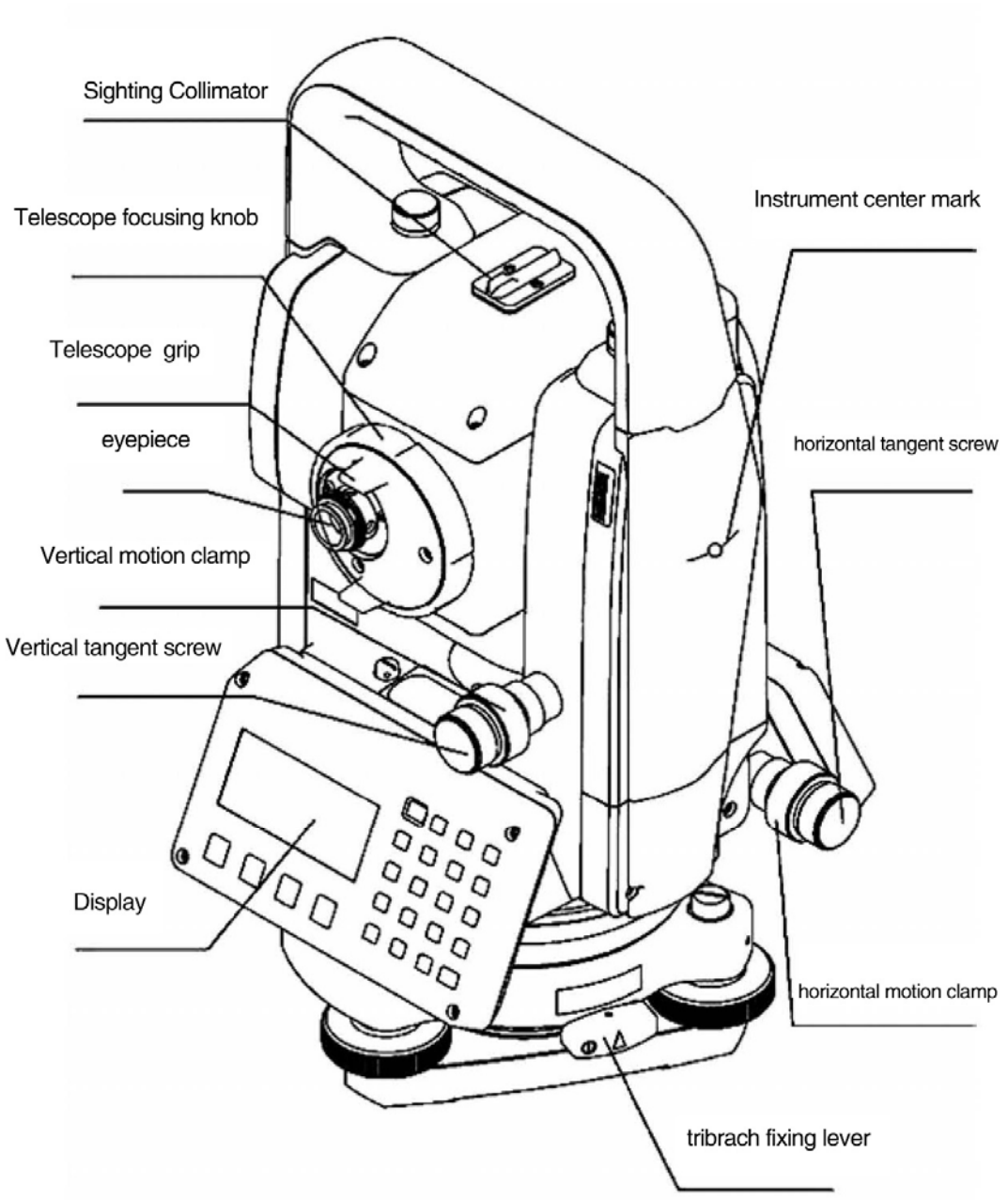
Standard Supporting Equipment:

1. TKS-200 serial(with lens cap)
2. Plastic carrying box (with the belt)
3. One on－board battery
4. One battery charger
5. One Instruction Manual
6. One tool pack (with one screwdriver, One rod pin and hex key wrench-set)
7. Silicon cloth
8. One Rain Cover

1. NOMENCLATURE AND FUNCTIONS

1.1 Nomenclature





The position of vertical motion clamp and Vertical tangent screw will differ depending on the market.

1.2 Display

·Display unit

The display uses a dot matrix LCD which has 4 lines and 20 characters per line. In general, the upper three lines display measured data, and the bottom line displays the soft key function which changes with the measuring mode.

·Contrast and illumination

The contrast and illumination of display window are adjusted. see Chapter 6 “SPECIAL MODE(Menu Mode)” or section 1.5 “Star key mode”.

·Example

V : 90° 10′ 20″
HR : 120° 30′ 40″
0SET HOLD HSET P1↓

Angle measurement mode

HR : 120° 30′ 40″
HD* 65.432m
VD : 12.345m
MEAS MODE S / A P1↓

Distance measurement mode

V-angle: 90°10′20″
H-angle: 120°30′40″

Horizontal angle : 120°30′40″
Horizontal distance: 65.432m
Relative elevation : 12.345m

Feet unit

HR : 120°30′40″
HD* 123.45 f
VD : 12.34 f
MEAS MODE S / A P1↓

Horizontal Angle : 120°30′40″
Horizontal distance:123.45ft
Relative elevation :12.34ft

Feet and inch unit

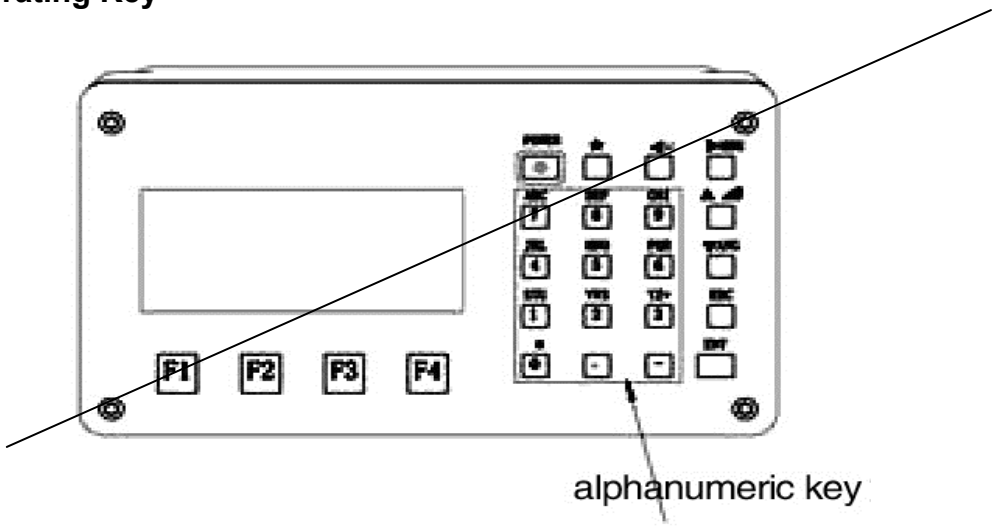
HR* 120°30′40″
HD* 123.04.6 f
VD : 12.03.4 f
MEAS MODE S / A P1↓

Horizontal Angle : 120°30′40″
Horizontal distance :123ft4in6/8in
Relative elevation :12ft3in4/8in

·Display marks

Display	Contents	Display	Contents
V%	V-angle	✻	EDM working
HR	H-angle(Right)	m	Meter unit
HL	H-angle(Left)	f	Feet and inch unit
HD	Horizontal Distance		
VD	Relative elevation		
SD	Slope distance		
N	N Coordinate		
E	E Coordinate		
Z	Z Coordinate		

1.3 Operating Key



Keys	Name of Key	Function
★	Star Key	Star key mode is used for each setting or displaying as follows. 1 Contrast of the display 2 Back Light 3 Tilt correction 4 set audio mode
	Coordinate meas.key	Coordinate measurement mode.
	Distance meas.key	Distance measurement mode
ANG	Angle meas.key	Angle measurement mode
POWER	Power source key	ON/OFF of power source
MENU	Menu key	Switches menu mode and normal mode. To set application measurements and adjust in the menu mode.

ESC	Escape key	• Returning to the measurement mode or previous layer mode from the mode set. • To be DATA COLLECTION mode or LAYOUT mode directly from the normal measurement mode. • It is also possible to use as Record key in normal measurement mode. **To select function of Escape key, see Chapter 16 “SELECTING MODE”**
ENT	Enter key	Press at the end of inputting values.
F1-F4	Soft key (Function key)	Responds to the message displayed.

1.4 Function Key (Soft Key)

The Soft Key message is displayed at the bottom line of display. The functions are according to the displayed message.

Angle Measurement Mode

```
V  :     90°10′20″
HR :    120°30′40″

0SET    HOLD     HSET    P1↓
————————————————————
TILT     REP      V%     P2↓
————————————————————
H-BZ     R / L    CMPS   P3↓
  |        |        |      |
[F1]     [F2]     [F3]   [F4]
```

Distance Measurement Mode

```
HR :    120°30′40″
HR*    [ r ]          << m
VD:                     m
MEAS     MODE    S / A   P1↓
————————————————————
OFSET     S.O    m / f / i  P2↓
```

Coordinates measurement mode

```
N:    123.456m
E:    34.567m
Z:    78.912m
MEAS   MODE    S / A    P1↓
————————————————————
R.HT   INSHT   OCC     P2↓
————————————————————
OFSET   ---    m / f / i  P3↓
```

Angle measurement

Page	Soft key	Display mark	Functions
1	F1	0SET	Horizontal angle is set to 0°00′00″
	F2	HOLD	Hold the horizontal angle
	F3	HSET	Sets a required horizontal angle by entering numerals
	F4	P1↓	The function of soft keys is shown on next page (P2).
2	F1	TILT	Setting Tilt Correction If ON, the display shows tilt correction value.
	F2	REP	Repetition angle measurement mode
	F3	V%	Vertical angle percent grade(%) mode
	F4	P2↓	The function of soft keys is shown on next page (P3).
3	F1	H-BZ	Sets the buzzer sound for every horizontal angle 90°.
	F2	R / L	Switches R / L rotation of horizontal angle.
	F3	CMPS	Switches the COMPASS ON/OFF of vertical angle.
	F4	P3↓	shown on next page (P1).

Distance measurement mode

1	F1	MEAS	Start measuring
	F2	MODE	Sets a measuring mode, Fine/Coarse/Tracking
	F3	S/A	Select set audio mode
	F4	P1↓	The function of soft keys is shown on next page (P2).
2	F1	OFSET	Select Off-set measurement mode
	F2	S.O	Select stake out measurement mode
	F3	m/f/i	Switches meter, feet or feet and inch unit.
	F4	P2↓	The function of soft keys is shown on next page (P1).

Coordinate measurement mode.

1	F1	MEAS	Start measuring
	F2	MODE	Sets a measuring mode, Fine/Coarse/Tracking
	F3	S/A	Select set audio mode
	F4	P1 ↓	The function of soft keys is shown on next page (P2).
2	F1	R.HT	Sets a prism height by input values.
	F2	INSHT	Sets an instrument height by input values.
	F3	OCC	Sets an instrument coordinate point by input values.
	F4	P2 ↓	The function of soft keys is shown on next page (P3).
3	F1	OFSET	Select Off-set measurement mode
	F3	m/f/i	Switches meter, feet or feet and inch unit.
	F4	P3 ↓	The function of soft keys is shown on next page (P1).

1.5 Star key mode

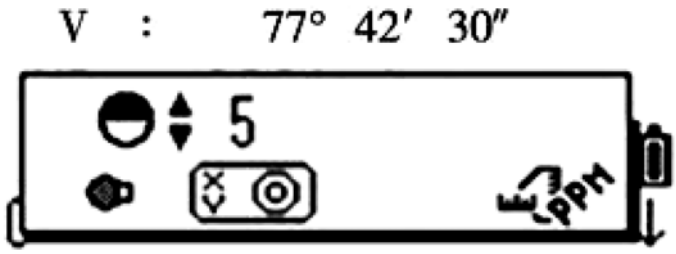
Press the (★) to view the following instrument options.

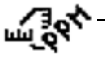
1. Adjustment the contrast of the display (0 to 9) [▲or▼]
2. Turn the backlight of the display ON/OFF [F1]
3. Setting Tilt Correction [F2]
4. Set audio mode [F4]

Note: Star key mode does not function when the same function as the function assigned to the star key mode is performed from the main routine.

V :	77°42′30″
HR :	120°30′40″
0SET HOLD HSET P1↓	

↓ Press the star(★) key



FI		Turn the backlight of the display ON/OFF
F2		Set the tilt correction; if on, the display shows tilt correction value.
F4		The light acceptance quantity level for the EDM (SIGNAL), the atmospheric correction value (PPM) and correction value of prism constant (PSM) are displayed.
▲or▼		Adjust contrast of display (0~9 steps)

·**Adjustment the contrast (0 to 9) of the display**

Push up/down arrow key(▲or▼) can adjust contrast of display

·**Turn the display back light ON/OFF**

Press the [F1] kev to switch the back light ON/OFF

·Set audio mode

The light acceptance quantity level (Signal level) is displayed in this mode. When reflected light from the prism is received, a buzzer sounds. This function is good for easy collimation when the target is difficult to find.

Press the [F4] key to view the set audio screen.

(1) To stop the buzzer, refer to Chapter 16 “SELECTING MODE”.

(2) Also, it is possible to display the signal level in Distance Measuring Mode.

The temperature, pressure, PPM, and PSM can be viewed in set audio mode. Refer to Chapter 10 “SET AUDIO MODE”, Chapter 11 “SETTING THE PRISM CONSTANT VALUE” and Chapter 12 “SETTING ATMOSPHERIC CORRECT-ION” , for further instructions.

1.6 Serial signal RS-232C connector

The serial signal connector is used for connecting the TKS-200 series with a computer or GOWIN Data Collector, which enables the computer to receive measured data from the TKS-200 series or to send preset data of horizontal angle, etc. to it.

·The following data will be output at each mode.

MODE	Output
Angle mode(V,HR or HL) V is expressed with a percentage)	V, HR (or HL)
Horizontal distance mode (HR, HD, VD)	V, HR, HD,VD
Slope distance mode (V,HR,SD)	V, HR, SD,HD
Coordinate mode	N, E, Z,HR (or V, HR, SD, N, E, Z)

·The display and the output at the coarse mode are the same as the contents above:

·Output at the tracking mode is displayed as distance data only.

The details necessary for the connection with the TKS-200 series are obtained from its Interface Manual which is optionally available. please refer to this manual.

2. PREPARATION FOR MEASUREMENT

2.1 Setting Instrument Up For Measurement

Mount the instrument to the tripod, level and center the instrument precisely, in order to obtain a best performance, the TOPCON wide-frame wooden tripod with a tripod screw of 5/8 in. diameter should be used.

Reference: Leveling and Centering the Instrument

1. Setting up the tripod

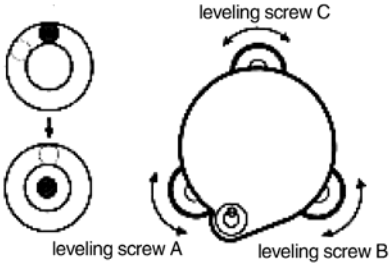
First, extend the extension legs to suitable lengths and tighten the screws on their midsections.

2. Attaching the Instrument on the Tripod Head

Place the instrument carefully on the tripod head and slide the instrument by loosening the tripod screw. If the plumb bob is positionnnned right over the center of the point, slightly tighten the tripod screw.

3. Roughly Leveling the Instrument by Using the Circular Level

1)Turn the leveling screws A and B to move the bubble in the circular level. The bubble is now located on a line perpendicular to a line running through the centers of the two leveling screws being adjusted.



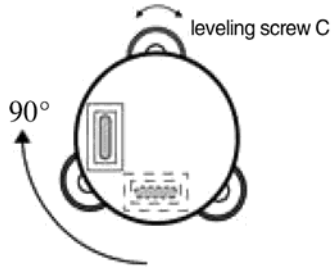
2) Turn the leveling screw C to bring the bubble to the center of the circular level.

4. Centering by Using the Plate Level

1)Rotate the instrument horizontally by using the Horizontal motion/clamp screw and place the plate level parallel with the line connecting leveling screws A and B, and then bring the bubble to the center of the plate level by turning leveling screws A and B.

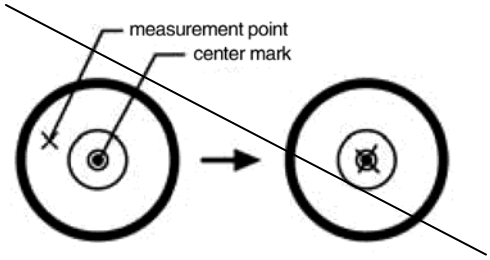
2) Rotate the instrument 90° (100g) around its vertical axis and turn the remaining leveling screw or C to center the bubble once more.

3) Repeat the procedures 1) and 2) for each 90° (100g) rotation of the instrument and check whether the bubble is correctly centered for all four points.



5. Centering by Using the Optical Plummet Telescope

Adjust the eyepiece of the optical plummet telescope to your eyesight.



Slide the instrument by loosening the tripod screw, place the point on the center mark, and then tighten the tripod screw. Sliding the instrument carefully not to rotate that allows you to get the least dislocation of the bubble.

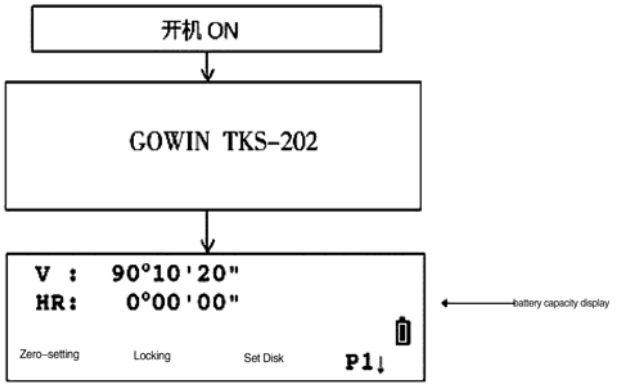
6. Completely Leveling the Instrument

Leveling the instrument precisely in a similar way to 4. Rotate the instrument and check to see that the bubble is in the center of the plate level, then tighten the connection screw.

2.2 Power Switch Key ON

1. Confirm the instrument is leveled.

2. Turn the power switch ON (POWER key)



·Confirm the battery power remaining display. Replace with charged battery or charge when battery level is low or indicates “Battery empty”.

·Contrast adjustment

You can confirm prism constant value (PSM),atmospheric correction value (PPM) and you can also adjust the contrast of the display when the instrument is turned on.

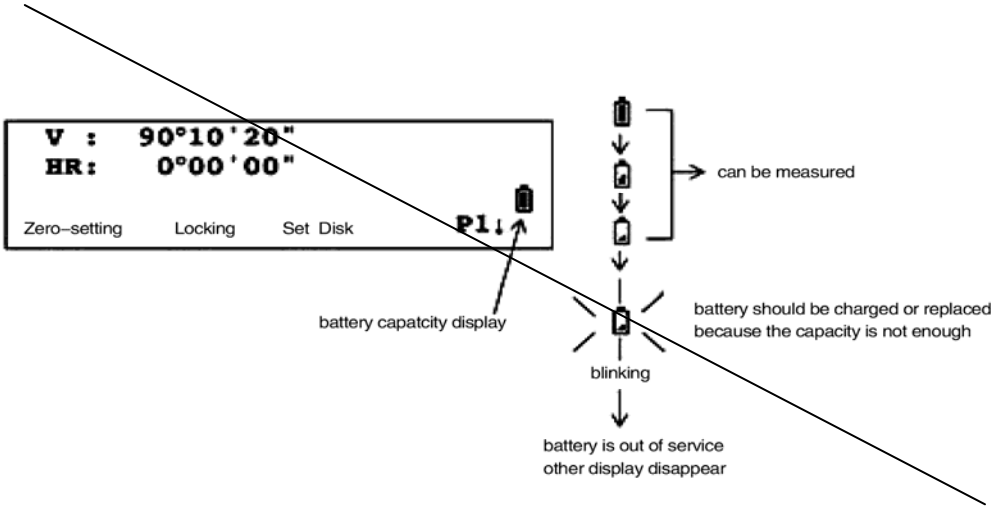
To display this screen, see Chapter 16 “SELECTING MODE” ..

CONTRAST ADJUSTMENT			
PSM :	0.0	PPM	0.0
↓	↑	---	ENTER

This enables you to adjust the brightness by pressing the [F1](↓) or [F2](↑) key.

To memorize the setting value after powering off, press [F4](ENTER) key.

2.3 Battery Power Remaining Display



Note:

1)The battery operating time will vary depending on the environmental conditions such as ambient temperature, charging time, the number of times of charging and discharging etc.It is recommended for safety to charge the battery beforehand and prepare fully charged spare batteries

2)For general usage of the battery, see Chapter 14 “POWER SOURCE AND CHARGING”.

3)The battery power remaining display shows the power level regarding to the measurement mode now operating.The safety condition indicated by the battery power remaining display in the angle measurement mode does not necessarily assure the battery’s capacity to be used in the distance measurement mode.It may happen that the mode change from the angle mode to the distance mode will stop the operation because of insufficient battery power for the distance mode which consumes more power than angle mode.

2.4 Vertical Angle Tilt Correction

Under angle measurement mode, you can select the tilt ON/OFF function on Page 2, this setting is not memorized after power is OFF.

[Example] Setting X Tilt Correction OFF

Operating procedure	Option	Display
1 Press [F4] key to get the function page 2.	[F4]	V : 90°10′20″ HR : 120°30′40″ 0SET HOLD HSET P1↓ TILT REP V% P2↓
2 Press [F1](TILT) key. In case ON is already selected, the display shows tilt correction value.	[F1]	TILT SENSOR : [ON] X: -0°00′25″ TILT --- OFF ---
3 Press [F3](OFF) key.	[F3]	TILT SENSOR : [OFF] TILT --- OFF ---
4 Press [ESC] key.	[ESC]	V : 90°10′20″ HR : 120°30′40″ 0SET HOLD HSET P1↓
The setting mode performed here will not be memorized after powering OFF. To set TILT correction in the initialized setting (it is memorized after powering OFF), see Section 6.4.3“Vertical Angle Tilt correction (Tilt ON/OFF)” .		

2.5 How to Enter Alphanumeric Characters

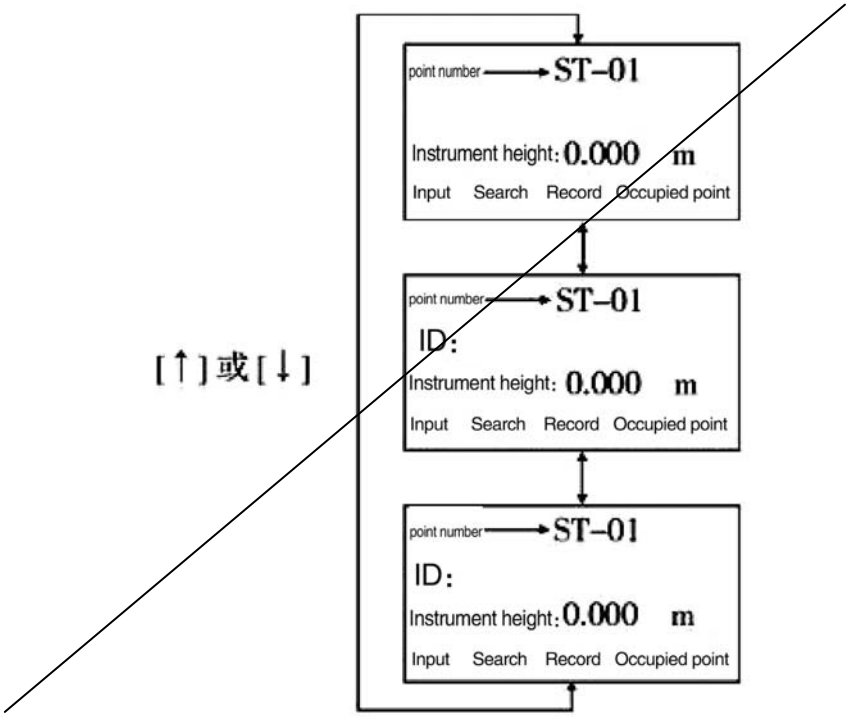
In this section, the entry of alphanumeric charcters is introduced, such as instrument height, prism height, occupied point and backsight point etc.

• How to select a item

[Example] Occupied point in the data collection mode.

The arrow indicates the entry to be entered

The arrow line moves up or down when the[↓] key or [↑] key is pressed.



• **Enter characters**

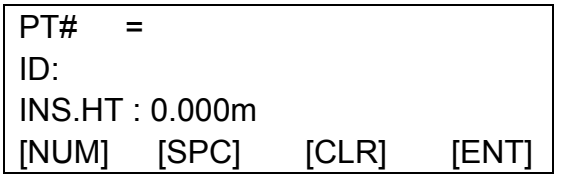
1 Move the arrow to enter a item using the [↓]or [↑] key.

```
PT#    →
ID     :
INS.HT :  0. 000m
INPUT   SRCH    REC   OCNEZ
```

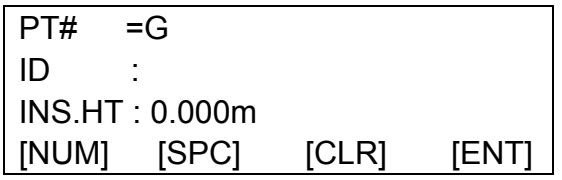
2 Press[F1](INPUT)key,arrow(→) Is changed into equal (=)

```
PT#    =
ID:
INS.HT.:  0.000m
[NUM]   [SPC]    [CLR]  [ENT]
```

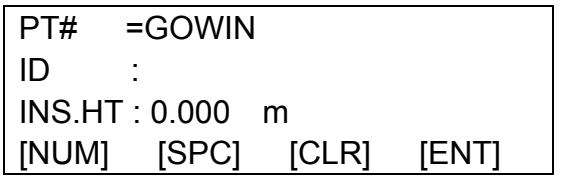
3 Press[F1][ALP]key. The instrument will switch to alphanumeric enter mode



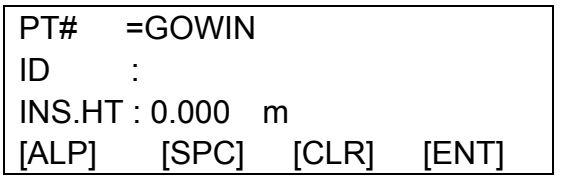
4 Enter letters of the alphabet by pressing the alphanumeric characters key.Example: [9] (GHI) key is pressed onece.



5 to enter other alphanumeric characters with the same method

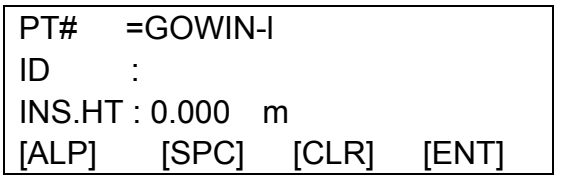


6 Press the [F1] (NUM) key, again.The instrument switches back to numerical input mode.



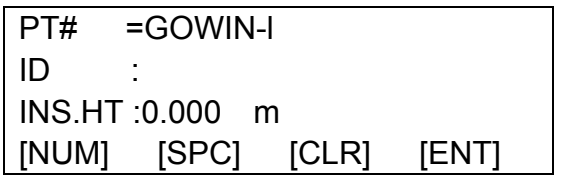
7 Enter numbers by pressing the alphanumeric characters key.

Example: press[-],[1]key



8 press[F4] (ENT)key,the arrow will move To next item

Select next character in the same manner.



·To correct a character, move the cursor to correct character by pressing [←] or [→] key and enter again.

3. ANGLE MEASUREMENT

3.1 Measuring Horizontal Angle Right and Vertical Angle

Make sure the mode is in Angle measurement.

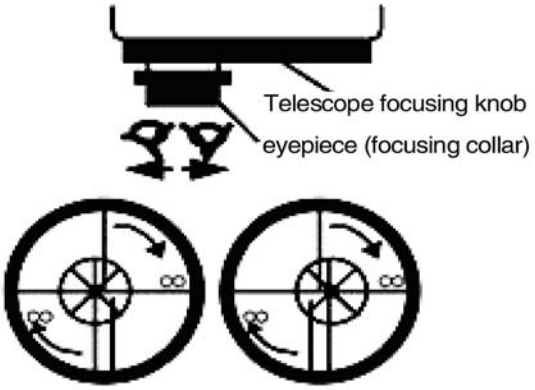
Operating procedure	Operation	Display
1 Collimate the first target A	Collimate A	V : 90°10′20″ HR : 120°30′40″ 0SET HOLD HSET P1↓
2 Set horizontal angle of target A at 0° 00' 00". Press the [F1](0 set) key and press the [F3](YES) key.	[F1]	H ANGLE 0 SET > 0K? □ □ [YES] [NO]
	[F3]	V : 90°10′20″ HR : 0°00′00″ 0SET HOLD HSET P1↓
3 Collimate the 2nd target (B).The required V/H angle to target B will be displayed.	Collimate target B	V : 98°36′20″ HR : 160°40′20″ 0SET HOLD HSET P1↓

Reference : How to Collimate the target

1 Point the telescope toward the light. Turn the diopter ring and adjust the diopter so that the cross hairs are clearly observed.(Turn the diopter ring toward you first and then backward to focus)

2 Aim the target at the peak of the triangle mark of the sighting collimator. Allow a certain space between the sighting collimator and yourself for collimating.

3 Focus the target with the focusing knob.



*If parallax is created between the cross hairs and the target when viewing vertically or horizontally while looking into the telescope, focusing is incorrect or diopter adjustment is poor，which will effect the viewing precision, this adversely affects precision in measurement or survey, Eliminate the parallax by carefully focusing and using diopter adjustment.

3.2 Switching Horizontal Angel (Right/Left)

Make sure that it is under the Angle measurement mode.

Operating procedure	Operation	Display
1 Press[F4](↓)key twice to get the function on P3.	[F4] Twice	V : 90°10′20″ HR : 120°30′40″ 0SET HOLD HSET P1↓ TILT REP V% P2↓ H-BZ R / L CMPS P3↓
2 Press[F2] (R / L)key. The mode Horizontal angle Right (HR) switches to Left (HL) mode. 3 measure as HL mode	[F2]	V : 90°10′20″ HL : 239°29′20″ H-BZ R / L CMPS P3↓

• Every time pressing the [F2](R/L) key, HR/HL mode switches.

3.3 Measuring from the Required Horizontal Angle

3.3.1 Setting by Holding the Angle

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
1 Set the required horizontal angle, using Horizontal tangent screw.	Display angle	V : 90°10′20″ HR : 130°40′20″ 0SET HOLD HSET P1↓
2 press[F2](HOLD)key	[F2]	H ANGLE HOLD HR = 130°40′20″ >SET? □ □ [YES] [NO]
3 Collimate the target		
4 press[F3](yes)key to finish holding horizontal angle.*1），the display turns back to normal angle measurement mode	Collimate [F3]	V : 90°10′20″ HR : 130°40′20″ 0SET HOLD HSET P1↓
*1) To return to the previous mode, press the [F4](NO) key.		

3.3.2 Setting a Horizontal Angle from the Keys

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
1 Collimate the target	Collimate	V : 90°10′20″ HR : 170°30′20″ 0SET HOLD HSET P1↓
2 press[F3](HSET)key	[F3]	H ANGLE SET HR= □ □ [CLR] [ENT]
3 Input the required horizontal angle by using keys. *1) *1) such as: 70°40′20″	70.4020 [F4]	V : 90°10′20″ HR : 70°40′20″ 0SET HOLD HSET P1↓
Then normal measurement can be done from the required horizontal angle Refer to Section 2.5 “How to Enter Alphanumeric characters”		

3.4 Vertical Angle Percent Grade (%) Mode

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
1 Press[F4](↓)key twice to turn to P2	[F4]	V : 90°10′20″ HR : 170°30′20″ 0SET HOLD HSET P1↓ －－－－－－－－－－－－ TILT REP V% P2↓
2 Press[F3](V%)key *1)	[F3]	V : - 0. 30 % HR : 170°30′20″ TILT REP V% P1↓

*1)Whenever press[F3](V%)key, the display mode will switch over alternatively.

• When the measurement is carried out over ±45° (±100%) from the horizontal, the display shows<OVER>.

3.5 Repetition Angle Measurement

• Repetition angle measurement can be done by horizontal angle right measurement mode.

Make sure the mode is Horizontal Angle Right measurement.

Operating procedure	Operation	Display
1 Press[F4](↓)key to get the function on P2.	[F4]	V : 90°10′20″ HR : 170°30′20″ 0SET HOLD HSET P1↓ －－－－－－－－－－－－ TILT REP V% P2↓
2 press[F2](REP)key.	[F2]	REPETITION ANGLE >OK? □ □ [YES] [NO]
3 Press[F3](YES) key.	[F3]	REP-ANGLE COUNT[0] Ht： 0°00′00″ Hm： 0SET V/H REL HOLD

4 Collimate target A and press[F1] (0SET)key	Collimate A [F3]	REPETITION ANGLE INITIALIZE >OK? --- --- [YES] [NO]
5 press[F3](YES)key	[F3]	REP-ANGLE COUNT[0] Ht : 0°00′00″ Hm : 0SET V/H REL HOLD
6 Collimate the target B using the horizontal clamp and tangent screw.Press the [F4](HOLD) key.	Collimate B [F4]	REP-ANGLE COUNT[1] Ht : 45°10′00″ Hm : 45°10′00″ 0SET V/H REL HOLD
7 Recollimate target A using the horizontal clamp and tangent screw, and press the [F3] (REL) key.	Collimate Target A [F3]	REP-ANGLE COUNT[1] Ht: 45°10′00″ Hm: 45°10′00″ 0SET V/H REL HOLD
8 Recollimate target B using the horizontal clamp and tangent screw, and press the [F4] (HOLD)key.	Collimate B [F4]	REP-ANGLE COUNT[2] Ht : 90°20′00″ Hm : 45°10′00″ 0SET V/H REL HOLD
9 Repeat ***7*** to ***8*** to measure the desired number of repetitions.		REP-ANGLE COUNT[4] Ht: 180°40'00" Hm: 45°10′00″ 0SET V/H REL HOLD
10 To return to the normal angle mode, press the [F2](V/H) key or [ESC] key.	[ESC] Or [F2]	REPETITION ANGLE Exit >OK? □ □ [YES] [NO]
11 Press[F3](YES)key	[F3]	V : 90°10′20″ HR : 170030′20″ 0SET HOLD HSET P1↓

·Horizontal angle can account to(3600°00′00″-minimum reading)(horizontal angle(right angle)))
In case of 5 second reading, horizontal angle can be accumulated up to +3599° 59'55".
·Error will be displayed when the results differ from first measurement by more than ±30".

3.6 Buzzer Sounding for Horizontal Angle 90° Increments

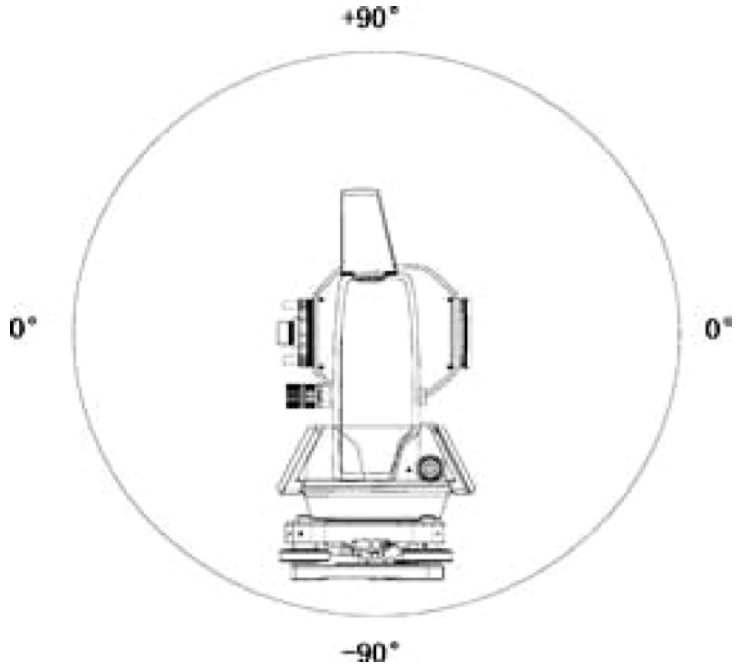
When the horizontal angle falls in the range of less than ± 1°of 0°, 90°, 180°or 270°, the buzzer sounds. Buzzer stops only when the horizontal angle is adjusted to 0°00′00″, 90°00′00″, 180°00′00″or 270°00′00″.
This setting is not memorized after powering off. Refer to 16 “SELECTING MODE“ to set the initial setting (memorized after powering off).

Make sure the mode is Angle measurement.

Operating procedure	Operation	Display
1 Press[F4](↓)key twice, enter enter P3 function	[F4] Twice	V : 90°10′20″ HR : 120°30′20″ 0SET HOLD HSET P1↓ －－－－－－－－－－－－－－－－ H-BZ R／L CMPS P3↓
2 Press[F1](H-BZer)key, to show last setting status	[F1]	H-ANGLE BUZZER [OFF] [ON] [OFF] --- ENTER
3 Press the [F1](ON) key or [F2](OFF) key to select the buzzer ON/OFF.	[F1]Or[F2]	H-ANGLE BUZZER [ON] [ON] [OFF] --- ENTER
4 press[F4](ENTER)key	[F4]	V : 90°10′20″ HR : 170°30′20″ 0SET HOLD HSET P1↓

Compasses (vertical angle)

Vertical angle is displayed as shown below.



Operating procedure	Operation	Display
1 Press the [F4](↓) key twice to get the function on page 3	[F4] Twice	V : 98°10′20″ HR : 170°30′20″ 0SET HOLD HSET P1↓ －－－－－－－－－－－－ H-BZ R / L CMPS P3↓
2 press[F3](CMPS)key *1	[F3]	V : - 8°10′20″ HR : 170°30′20″ H-BZ R / L CMPS P3↓
*1) Every time pressing the [F3](CMPS) key, the display mode switches.		

4. DISTANCE MEASUREMENT

4.1 Setting of the Atmospheric Correction

When setting atmospheric correction, the correction value can be acquired by measurement of temperature and air pressure,
Refer to 12.2 “setting of atmospheric correction value ”.

4.2 Setting of the Correction for Prism Constant

If the prism is of another manufacturer,the appropriate constant shall be set beforehand,Refer to 11 "Setting the prism contstant value", even the power is off, The setting value is kept in the memory.

4.3 Distance Measurement (Continuous Measurement)

Make sure that it is under the angle measurement mode.

Operating procedure	Operation	Display
1 Collimate the center of prism.	Collimate P	V : 90°10′20″ HR : 120°30′40″ 0SET HOLD HSET P1↓
2 Press the [ ] key. Distance measurement starts. *1), *2)	[◢]	HR : 120°30′40″ HD* [r] ＜＜m VD : m MEAS MODE S / A P1↓
The measured distances are shown. *3)~*5)		HR : 120°30′40″ HD* 123.456m VD : 5.678m MEAS MODE S / A P1↓
• Pressing the [ ] key again, the display changes to horizontal (HR) and vertical (V)angle and slope distance(SD). *6)	[◢]	V : 90°10′20″ HR : 120°30′40″ SD : 131.678m MEAS MODE S / A P1↓

*1)When EDM is working, the ″＊" mark appears in the display.
*2)To change mode from Fine to Coarse or Tracking, refer to section 4.5 “Fine Mode/Tracking Mode/Coarse Mode”.To set the instrument power supply that when it is on, it will enter distance measurement mode, refer to Mode 16”Selecting mode”. ”
*3)The distance unit indicator "m" (for meter) , "f" (for feet or feet inch) appears and disappears alternatively with buzzer sounds at every renewal of distance data.
*4)Measurement may repeat automatically in the instrument if the result is affected by shimmer etc.
*5)To return to the normal measuring angle mode from a distance measuring mode, press the [ANG] key.
*6)It is possible to choose the display order (HR, HD, VD) or (V, HR, SD) for initial measuring distance mode. Refer to Chapter 16 “SELECTING MODE”.

4.4 Distance Measurement (N-time Measurement/Single Measurement)

When the number of times measurement is preset, the TKS-200 series measures the distance the set number of times. The average distance will be displayed. When presetting the number of times as 1, it does not display the average distance, because of single measurement. Single measurement is set at the factory.

Make sure that it is under angle measurement mode.

Operating procedure	Operation	Display
1 Collimate the prism center	Collimate	V : 90°10′20″ HR : 120°30′40″ 0SET HOLD HSET P1↓
2 press [◢] key,continuous measurement starts.*1)	[◢]	HR : 120°30′40″ HD* [r] <<m VD : m MEAS MODE S / A P1↓
3 Press [F1](MEAS) key while continuous measuring is exceeding. *2). The average value is displayed and "*" mark disappears.	[F1]	HR : 120°30′40″ HD* [n] <<m VD : MEAS MODE S / A P1↓ ↓

• While EDM is working, press [F1](MEAS) key again, the mode will be changed to continuous measuring mode.		HR : 120°30′40″ HD : 123.456m VD : 5.678m MEAS MODE S / A P1↓

*1) It is possible to set the measurement mode for N-times measurement mode or continuous measurement mode when the power is turned on. Refer to Chapter 16 “SELECTING MODE”.

*2) For setting the number of times (N-times) in the measurement, refer to Chapter 16 “SELECTINGMODE”.

·Choose meter /feet / feet+inch unit by soft key

It is possible to change the unit for distance measurement mode by soft key. This setting is not memorized after power off. Refer to 16 “SELECTING MODE” to set at the initial setting (memorized after power off).

Operating procedure	Operation	Display
1 Press[F4](↓)to skip to P2 function	[F4]	HR : 120°30′40″ HD*: 2.000m VD : 3.000m MEAS MODE S / A P1↓ ---------- OFSET S.O m/f/i P2↓
2 Every time pressing the [F3](m/f/i) key, the display unit will be changed.		
• Every time pressing the [F3](m/f/i) key, the unit mode switches.	[F3]	HR : 120°30′40″ HD*: 6.560f VD : 9.845f OFSET S.O m/f/i P2↓

4.5 Fine Mode/Tracking Mode/Coarse Mode

This setting is not memorized after power is off. Refer to Chapter 16 ”SELECTING MODE” to set at the initial setting (memorized after power is off).

●Fine Mode: This is a normal distance measuring mode.
The unit to be displayed: 0.2mm or 1mm. (0.001ft or 0.005ft)
Measurement time 0.2mm mode: approx. 2.8 sec.
1mm mode: approx. 1.2 sec.

●Tracking Mode: This mode measures in shorter time than in fine mode.
It is very useful when tailing the moving object or carrying out stake-out work.
The unit to be displayed: 10mm
Measuring time: approx. 0.4 sec.

●Coarse Mode : This mode measures in shorter time than in fine mode.
The unit to be displayed: 10mm or 1mm
Measuring time: approx. 0.7 sec.

Operating procedure	Operation	Display
1 Press the [F2](MODE) key from the distance measuring mode.*1)	[F2]	HR : 120°30′40″ HD*: 123.456m VD : 5.678m MEAS MODE S/A P1↓
The initial character (F/T/C) of set mode isdisplayed . (F:Fine, T:Tracking, C:Coarse)		HR : 120°30′40″ HD*: 123.456m VD : 5.678m FINE TRACK COARSE F
2 Press the [F1](FINE) key, [F2](TRACK) key, or [F3](COARSE) key.	[F1]～[F3]	HR : 120°30′40″ HD*: 123.456m VD : 5.678m MEAS MODE S/A P1↓
*1)If want to delete the setting, press[ESC]key		

4.6 Stake Out (S.O)

The difference between the measured distance and the input stake out distance is displayed.

Measured distance - Stake out distance = Displayed value

In stake out operation, you can select either horizontal distance (HD), relative elevation (VD) and slope distance (SD)

Operating procedure	Operation	Display
□Press the [F4](↓) key in the distance measuring mode to get the function on page 2.	[F4]	HR : 120°30′40″ HD*: 123.456m VD : 5.678m MEAS MODE S /A P1↓ ー ー ー ー ー ー ー ー ー ー ー OFSET S.O m/f/i P2↓
□Press the [F2](S.O) key. The data previously set is shown.	[F2]	STAKE OUT HD : 0.000m HD VD SD ---
□Select the measuring mode by pressing the [F1] to[F3] key.	[F1]	STAKE OUT HD : 0.000m --- --- [CLR] [ENT]
□Enter the distance for stake out. *1)	Enter data [F4]	STAKE OUT HD : 100.000m INPUT --- --- Enter
□Collimate the target (prism) measurement starts. The difference between the measured distance and the stake out distance is displayed.	Collimate P	HR : 120°30′40″ dHD* [r] 23.456m VD : 5.678m MEAS MODE S/A P1↓
□Move the target until the difference becomes 0m.		HR : 120°30′40″ dHD* [r] 23.456m VD : 5.678m MEAS MODE S/A P1↓

1) Refer to section 2.5 “How to Enter Alphanumeric characters”.
- To return to normal distance measurement mode, stake out distance to "0" m or turn the power off.

4.7 Offset Measurement

- There are four offset measurement modes in the Offset Measurement.
- Angle Offset
- Distance Offset
- Plane Offset
- Column Offset
- To show the offset measurement menu, press the [OFSET] soft key from distance or coordinate measurement mode.

Example:

Distance measurement

```
HR :      120°30′40″
HD :        123.456 m
VD :          5.678 m
MEAS  MODE  S/A   P1↓
－－－－－－－－－－－－
OFSET S.O   m/f/i P2↓
```

↑

Press[F1](OFSET)key

Coordinate measurement

```
N:       123.456  m
E:        34.567  m
Z:        78.912  m
MEAS   MODE   S/A   P1↓
－－－－－－－－－－－－－－
R.HT   INSHT  OCC   P2↓
－－－－－－－－－－－－－－
OFSET    ---    m/f/i  P3↓
```

↑

Press[F1](OFSET)key

Offset Measurement Menu

```
OFFSET                  1/2
F1：ANG. Offset
F2：DIST. Offset
F3：PLANE Offset        P↓
```

↑

↓ [F4]

```
OFFSET                  2/2
F1：COLUMN OFFSET

                        P↓
```

• **Outputting the Measurement Data**

The results of offset measurement can be output to external device.
Setting the function of the [ESC] key to (REC), the [F3] soft key which assigned (REC) will appear in measured result display.
Refer to Chapter 16 “SELECTING MODE” to set this option..

OFFSET-MEASUREMEN
HR: 120°30′40″
SD: 123.456m
Next --- REC ---

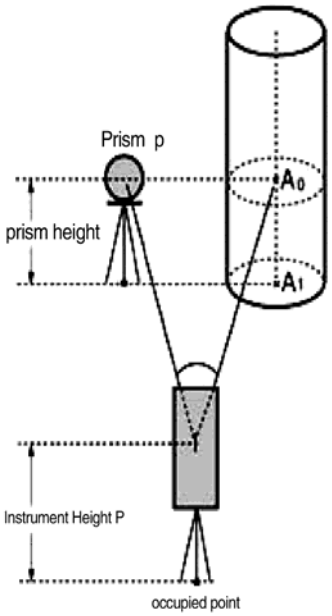
↑
[F3]

• **Distance measurement mode in offset measurement**

Offset measurement will be done by N-time fine measurement mode.
For setting measuring times refer to Chapter 16 “SELECTING MODE”.

4.7.1 Angle Offset

This mode is useful when it is difficult to set up the prism directly, for example at the center of a tree.Place the prism at the same horizontal distance from the instrument as that of point A0 to measure.To measure the coordinates of the center position, operate the offset measurement after setting the instrument height/prism height.



• When measuring coordinates of ground point A1 :Set the instrument height/prism height.

When sighting to A0, you can select one of two ways. One is to fix vertical angle to the prism position even updown the telescope position, and the other is to gear vertical angle to the updown of telescope movement. In case following the vertical angle to the movement of

• When measuring coordinates of point A0 : Set the instrument height only. (Set the prism height to 0).

telescope,SD(Slope Distance) and VD(Vertical Distance) will be changed according to the movement of telescope. To set this option, refer to Chapter 16

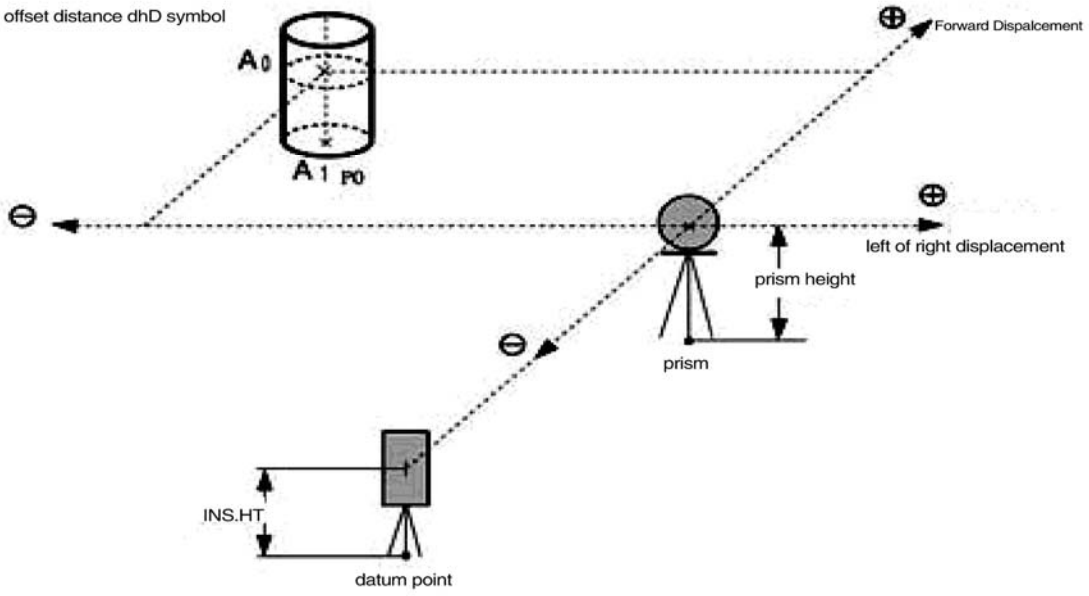
- Set the instrument height/prism height before proceeding to the offset measurement mode.
- When setting the coordinate value for the occupied station, refer to Section 5.1 “Setting Coordinate Values of Occupied Point”.

Operating procedure	Operation	Display
□Press the [F4](P1↓) key from distance measuring mode to get the function on page 2.	[F4]	HR : 120°30′40″ HD : 123.456 m VD : 5.678 m MEAS MODE S/A P1↓ －－－－－－－－－－－－ OFSET S.O m/f/i P2↓
□press F1(OFSET)key	[F1]	OFFSET 1/2 F1 ANG.OFFSET F2 DIST. OFFSET F3 PLANE OFFSET P1↓
□press F1 ANG.OFSET key	[F1]	OFFSET-MEASUREMENT HR : 120°30′40″ HD : m MEAS --- --- ---
□Collimate prism P.press F1(MEAS)key	Collimate[P] [F1]	OFFSET-MEASUREMENT HR : 110°30′40″ HD* [n] <<m >Measuring……
The horizontal distance from the instrument to the prism will be measured.		OFFSET-MEASUREMENT HR : 110°20′30″ HD* 56.789m >Measuring……

After measuring, the result added offset value will be shown.		OFFSET-MEASUREMENT HR : 110°20′30″ HD : 56.789m NEXT --- --- ---
□Collimate point A0 using the horizontal motion clamp and horizontal tangent screw.	Collimate A0	OFFSET-MEASUREMENT HR : 113°30′50″ HD : 56.789m NEXT --- --- ---
□Show the relative elevation of point A0.	[◢]	OFFSET-MEASUREMENT HR : 113°20′30″ VD : 3.456m NEXT --- --- ---
□Each time pressing the [◢] key, horizontal distance, relative elevation and slope distance are shown in sequence. □Show N coordinate of point A0 or A1.	[◢]	OFFSET-MEASUREMENT HR : 113°20′30″ SD： 56.894m NEXT --- --- ---
• Each time pressing [↑N] key, N,E and Z coordinate are shown in sequence.	[↑N]	OFFSET-MEASUREMENT HR : 113°20′30″ N： -12.345m NEXT --- --- ---
• To return to procedure □, press [F1](NEXT) key. • To return to the previous mode, press [ESC] key.		

4.7.2 Distance Offset Measurement

The measurement of a place apart from a prism is possible by inputting offset horizontal distance of front and back / right and left.



When measuring coordinates of ground point A1: Set the instrument height/prism height.

When measuring coordinates of point A0: Set the instrument height only. (Set the prism height to 0).

- When setting coordinate values of occupied point, see Section 5.1 “Setting Coordinate Values of Occupied Point”

Operating procedure	Operation	Display

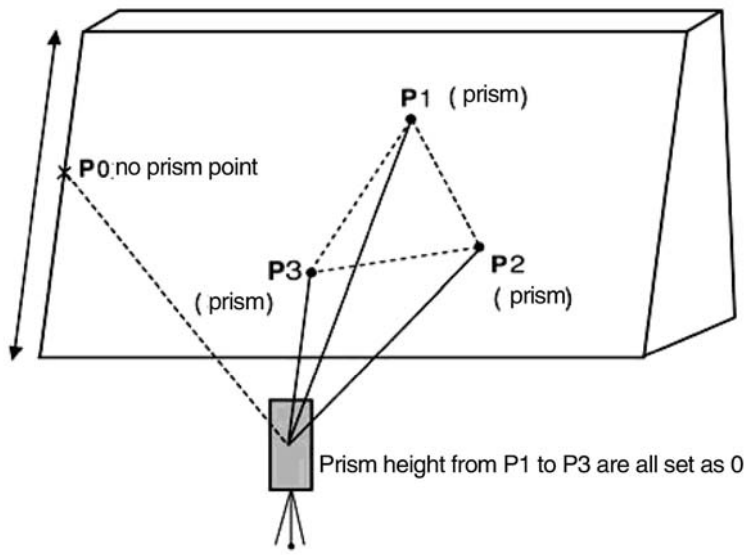
□Press the [F4](P1↓) key from distance measuring mode to get the function on page 2.	[F4]	HR : 120°30′40″ HD* 123.456m VD : 5.678m MEAS MODE S/A P1↓ －－－－－－－－－－－－ OFSET S.O m/f/i P2↓
②press F1(OFSET)key	[F1]	OFFSET 1/2 F1 ANG.OFFSET F2 DIST. OFFSET F3 PLANE OFFSET P1↓
③press[F2](DIST.OFSET) key	[F2]	DISTANCE OFFSET HR : 80°30′40″ HD : m >Measurement - - -
④Enter Right and Left direction offset value, and press the [F4] (ENTER)key.	Enter HD [F4]	DISTANCE OFFSET INPUT RorL HD oHD= m --- --- [CLR] [ENT]
⑤Enter a Forward direction offset value, and press the [F4] (ENTER) key.	Enter HD [F4]	DISTANCE OFFSET INPUT FORWARD HD OHD : m --- --- [CLR] [ENT]
⑥Collimate prism P, and press the [F1](MEAS) key. Measuring will start. After measuring, the result added offset value willbe shown.	Collimate P [F1]	DISTANCE OFFSET HR : 80°30′40″ HD* [n] <<m >Measurement - - -
⑦Show the relative elevation of point P0. Each time pressing	[◢]	DISTANCE OFFSET HR : 80°30′40″ HD* 10.000m NEXT --- --- ---

the[ ]key, horizontal distance, relative elevation and slope distance are shown in sequence. • Show coordinate of point P0.	[ ]	DISTANCE OFFSET HR : 80°30′40″ SD : 11.789m NEXT --- --- --- DISTANCE OFFSET HR : 80°30′40″ VD : 11.789m NEXT --- --- --- N: 12.345m E: 23.345m Z: 1.345m NEXT --- --- ---
· To return to procedure ④, press [F1](NEXT) key. · To return to the previous mode, press [ESC] key.		

4.7.3 Plane Offset Measurement

Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for a edge of a plane.

Three random prism points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane. Collimate the measuring target point (P0) then the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



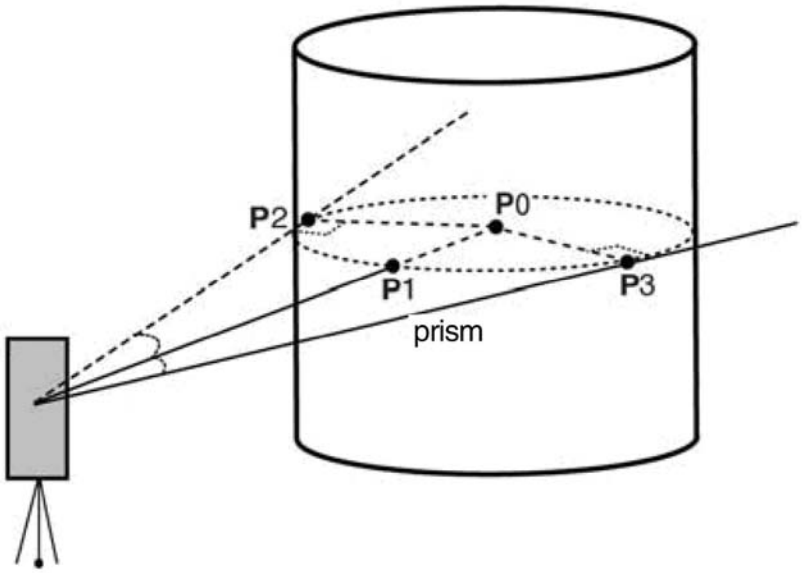
Operating procedure	Operation	Display
□Press the [F4](P1↓) key from distance measuring mode to get the function on page 2.	[F4]	HR : 120°30′40″ HD : 123.456m VD : 5.678m MEAS MODE S/A P1↓ －－－－－－－－－－－－ OFSET S.O m/f/i P2↓
□press F1(OFSET)key	[F1]	OFFSET 1/2 F1 ANG.OFFSET F2 DIST. OFFSET F3 PLANE OFFSET P1↓
□press[F3](PLANE OFFSET)key	[F3]	PLANE N001# SD: m MEAS --- --- ---
□Collimate the center of the column (P1) and press the [F1](MEAS) key. N-time measuring will start.	Collimate P1 [F1]	PLANE N001# SD* [n] <<m >Measurement - - -
□ carry out the measurement of 2nd and 3rd point with the same method	Collimate P2 [F1]	PLANE N002# SD： m MEAS --- --- ---
The instrument will compute and display the coordinate and distance value*1) *2)of cross point between collimation axis and plane	Collimate P3 [F1]	↓ Plane N003# SD： m MEAS --- --- ---
		HR :80°30′40″ HD : 54.321m VD : 10.000m EXIT

□Collimate plane edge(P0)*3)4) □To show the slope distance (SD), press the [ ] key. • Each time pressing the [ ] key, horizontal distance, relative elevation and slope distance are shown in sequence. • To show coordinate of point P0, press the [ ] key. ⑧To escape the measuring, press the [F1](EXIT) key. The display returns to the previous mode.	Collimate P0	HR : 75°30′40″ HD :54.600m VD : -0.487m EXIT V : 90°30′40″ HR : 75°30′40″ SD： 56.602m EXIT

*1)In case the calculation of plane was not successful by the measured three points, error information displays. Start measuring over again from the first point.
*2)Data display is the mode beforehand of offset measurement mode.
*3)Error will be displayed when collimated to the direction which does not cross with the determined plane.
*4)The refrector height of the target point P0 is set to zero automatically.

4.7.4 Column Offset Measurement

If it is possible to measure circumscription point (P1) of column directly, the distance to the center of the column (P0), coordinate and direction angle can be calculated by measured circumscription points (P2) and (P3).The direction angle of the center of the column equals to average value of the direction angle of circumscription points (P2) and (P3).



• When setting coordinate values of occupied point, refer to Section 5.1”Setting Coordinate Values of Occupied Point

Operating procedure	Operation	Display
①Press the [F4](P1↓) key from distance measuring mode to get the function on page 2.	[F4]	HR : 120°30′40″ HD : 123.456m VD : 5.678m MEAS MODE S/A P1↓ ———————————— OFSET S.O m/f/i P2↓
□press[F1](OFSET)key	[F1]	OFFSET 1/2 F1 ANG.OFFSET F2 DIST. OFFSET F3 PLANE OFFSET P1↓
③press[F4](P↓)key	[F4]	OFFSET 2/2 F1: COLUMN OFFSET P↓
□press[F1](COLUMN OFSET) key	[F1]	COLUMN OFFSET Center HD : m MEAS --- --- ---

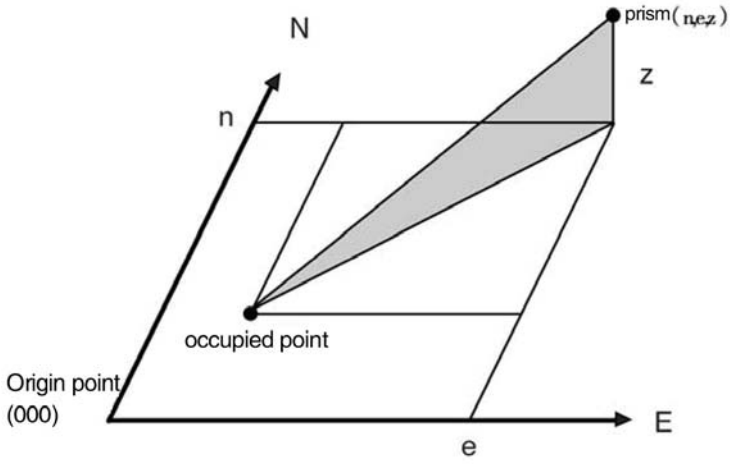
⑤Collimate the center of the column (P1) and press the [F1](MEAS) key. N-time measuring will start. After the measurement, angle measuring display of the left side (P2) will be shown.	Collimate P1 [F1]	COLUMN OFFSET Center HD* [n] <<m > Measurement - - - ↓ COLUMN OFFSET Left HR : 120°30′40″ --- --- --- SET
□Collimate the left side of the column (P2) and press the [F4](SET) key. after the measurement, angle measuring display of the right side (P3) will be shown.	Collimate P2 [F4]	↓ COLUMN OFFSET Right HR : 180°30′40″ --- --- --- SET
⑦Collimate the right side of the colume(P3) and press the [F4](SET) key.	Collimate P3 [F4]	↓ COLUMN OFFSET HR : 150°30′40″ HD : 43.321m NEXT --- --- ---
⑧If you want to show vertical distance(VD), you can press [ ] key, Each time pressing the [ ] key,horizontal distance, relative elevation and slope distance are shown in sequence. To show coordinate of point P0, press the[ ] key. ⑨To escape the measuring, press the [ESC] key. The display returns to the previous mode.	[ ]	COLUMN OFFSET HR : 150°30′40″ VD : 2.321 m NEXT --- --- ---

5. COORDINATE MEASUREMENT

5.1 Setting Coordinate Values of Occupied Point

Set the coordinates of the instrument (occupied point) according to coordinate origin and the instrument automatically converts and displays the unknown point (prism point) coordinates following the origin.

It is possible to retain the coordinates of the occupied point after the power is off. Refer to Chapter 16 “SELECTING MODE”.



Operating procedure	Operation	Display
□Under coordinate measurement mode press[F4](↓)key,enter P2 function	[F4]	N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE S/A P1↓ ———————————— R.HT INSHT OCC P2↓
□Press[F3](OCC)key	[F3]	N= 0.000 m E: 0.000 m Z: 0.000 m --- --- [CLR] [ENT]

□Enter N coordinate value *1） □Enter E and Z coordinate enter data with same method, the display backs to coordinate measurement show	Enter data [F4]	N: -72.000 m E= 0.000 m Z: 0.000 m --- --- CLR] [ENT] N: 51.456 m E: 34.567 m Z: 78.912 m MEAS MODE S/A P1↓

*1) Refer to 2.5 “How to Enter Alphanumeric characters”.

● Input Range -99999999.9990 ≤ N.E.Z ≤ + 99999999.9990 m
-99999999.999 ≤ N.E.Z ≤ + 99999999.999 ft
-99999999.11.7 ≤ N.E.Z ≤ +99999999.11.7 ft+inch

5.2 Setting Height of the Instrument

It is possible to retain the instrument height after the power is off. Refer to Chapter 16 “SELECTING MODE”.

Operating procedure	Operation	Display
①Under coordinate measurement mode press[F4](↓)key,enter P2 function	[F4]	N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE S/A P1↓ ———————————— R.HT INSHT OCC P2↓
②Press the [F2](INSHT) key. The current value is displayed.	[F2]	Instrument Height Enter INS.HT. 0.000m --- --- [CLR] [ENT]
③Enter instrument height*1)	Enter Inst.HT [F4]	N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE S/A P1↓

*1)Refer to 2.5 “How to Enter Alphanumeric characters”.

● Enter range -999.9999≤ INS.HT.≤+ 999.9999 m
-999.999 ≤ INS.HT.≤ - 999.999 t
-999.11.7 ≤ INS.HT.≤+ 999.11.7 ft+inch

5.3 Setting Height of Target (Prism Height)

This mode can be used to obtain Z coordinate values . It is possible to retain the height of target after turning the power off. Refer to Chapter 16 “SELECTING MODE”.

Operating procedure	Operation	Display
□Under coordinate measurement mode press[F4](↓)key,enter P2 function	[F4]	N:123.456m E:34.567m Z:78.91 2m MEAS MODE S/A P1↓ －－－－－－－－－－－－ R.HT INSHT OCC P2
□Press the [F1](R.HT) key. The current value is displayed.	[F2]	REFLECTOR HEIGHT INPUT R.HT= 0.000 m --- --- [CLR] [ENT]
□Enter prism height*1）	Enter R.HT [F4]	N: 123.456 m E: 34.567 m Z: 78.91 2 m MEAS MODE S/A P1↓

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.

- Input Range -999.9999 ≤ Prism Height ≤ + 999.9999 m
  -999.999 ≤ Prism Height ≤ - 999.999 ft
  -999.11.7 ≤ Prism Height ≤ +999.11.7 ft+inch

5.4 Execution of Coordinate Measuring

Measure the coordinates by entering the instrument height and prism height, coordinates of unknown point will be measured directly.

- When setting coordinate values of occupied point, refer to Section 5.1 “Setting Coordinate Values of Occupied Point”
- To set the instrument height and target height, refer to 5.2 “Setting of instrument height” and 5.3 “Setting of target height (prism height)”.
- The coordinates of the unknown point are calculated anc shown by following formula:

  Coordinate of occupied point: (No,Eo,Zo)

  Instrument Height :INS.HT

  Prism height: R.HT

Vertical distance (Relative elevation) : z (VD)

Coordinates of the center of the prism,

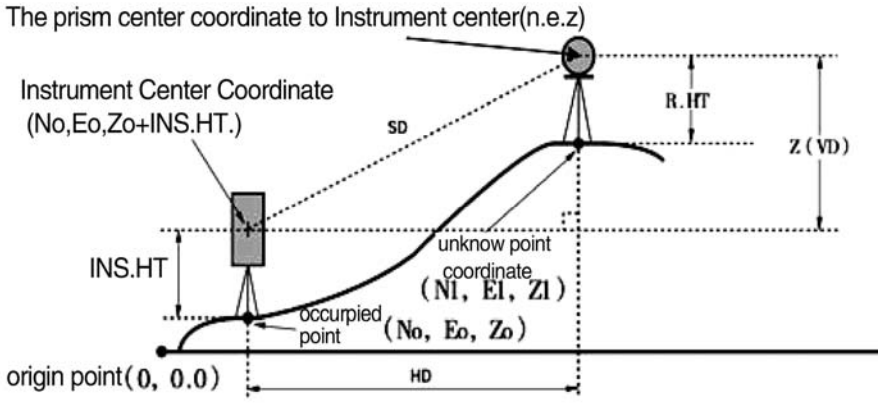
originated from the center point of the instrument : (n,e,z)

Coordinates of unknown point : (N1,E1,Z1)

N1=No + n

E1=Eo + e

Z1=Zo + INS. HT + z - R.HT



Operating procedure	Operation	Display
□To set the directional angle of known point A*1)	set directional angel	HR : 120°30′40″ V : 90°10′20′ 0SET HOLD HSET P1↓
□Collimate target B ③press[ ]key, to start measurement The result will be shown.	Collimate P [ ]	N*[r] << m E: m Z: m MEAS MODE S/A P1↓ N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE S/A P1↓

*1)Refer to 3.3 Setting of horizontal angle

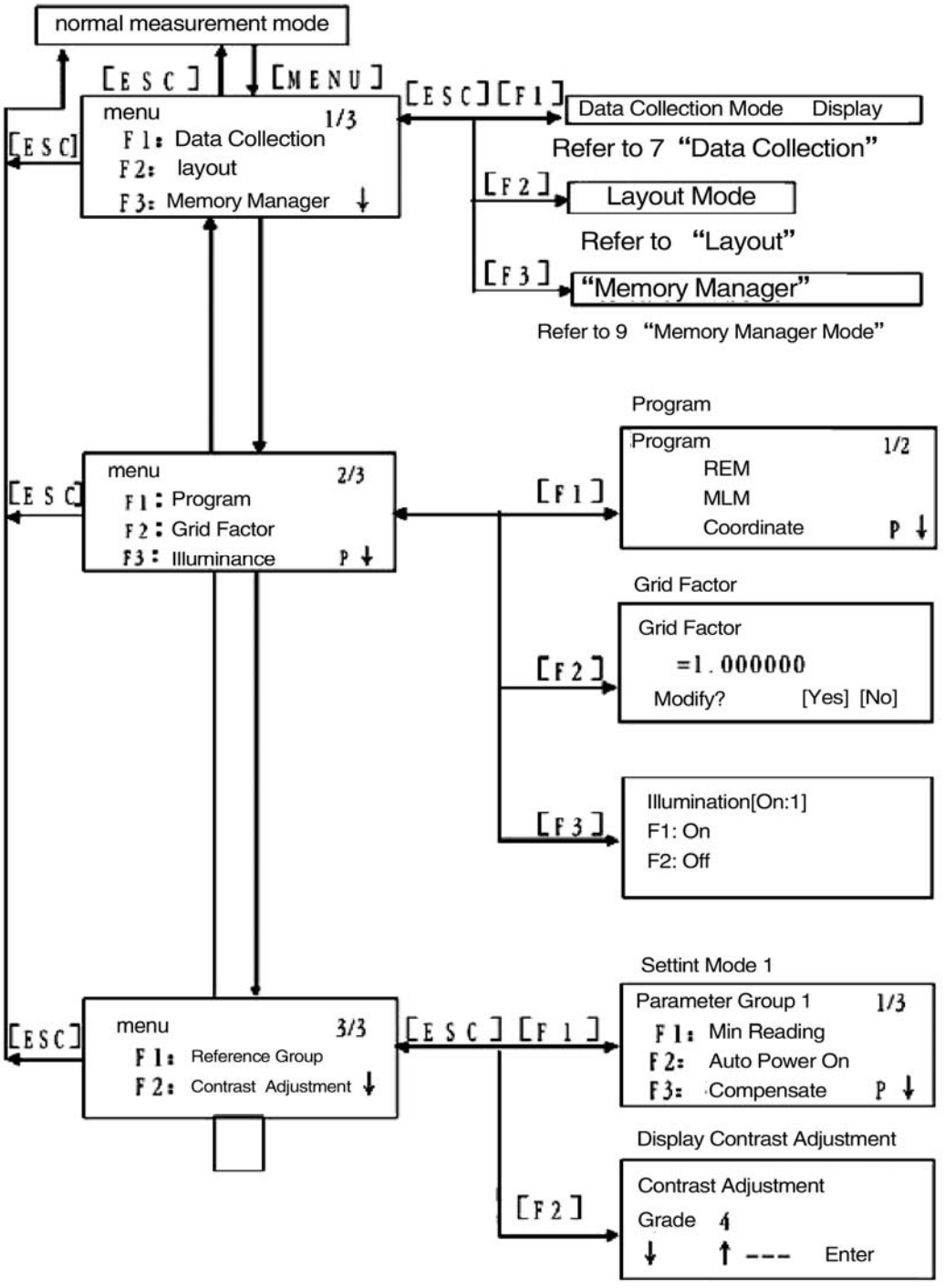
●In case that the coordinate of occupied point is not entered, (0,0,0) will be the default occupied pint coordinate; ●The instrument height will be calculated as 0 when the instrument height is not entered.

●The prism height will be calculated as 0 when the prism height is not set.

6. SPECIAL MODE (MENU MODE)

By pressing the [MENU] key, the instrument will be in MENU mode.

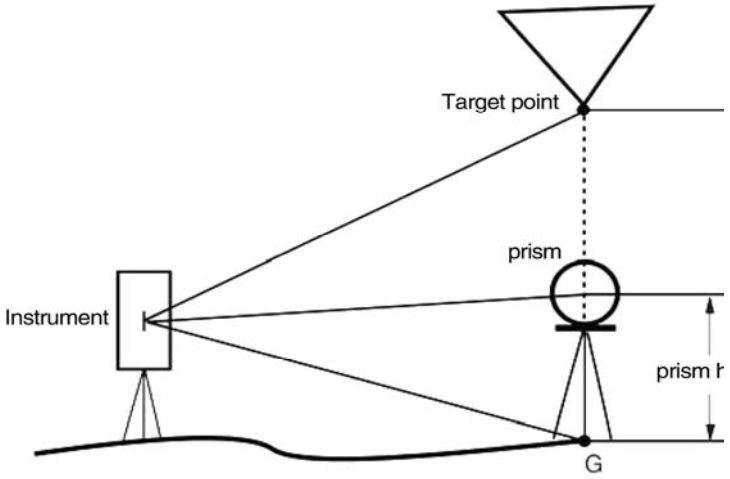
In this mode, special measuring , setting and adjustment are possible.



6.1 Application measurement (program)

6.1.1 Remote Elevation Measurement (REM)

To obtain elevation of the point at which setting the target prism is not possible, place the prism at any point on the vertical line from the target then carry out REM procedure as follows.



1）When there is prism height(h)input(example:h=1.5m)

Operating procedure	Operation	Display
□After pressing the [MENU] key, press the [F4](P↓) key to get the menu on page 2.	[MENU] [F4]	menu 2/3 F1: Program F2: Grid Factor F3: Illumination P↓
□press[F1]key	[F1]	PROGRAM 1/2 F1: REM F2: MLM F3: Z COORD. P↓

□Press[F1](REM)key	[F1]	REM F1: INPUT R.HT F2: NO R.HT
□press[F1]key	[F1]	REM-1 <STEP 1> R.HT = 0.000 m --- --- [CLR] [ENT]
□enter prism height*1	ENTER R.HT [F4]	REM-1 <STEP 2> HD : m MEAS --- --- SET
⑥Collimate the prism	Collimate P [F1]	
⑦press[F1](MEAS)key the measurement starts.		REM-1 <STEP 2> HD * [n] <<m Measurement ……
		↓
Horizontal distance (HD) between the instrument and prism will be shown.		REM-1 <STEP 2> HD* 123.456m Measurement…….
□After measuring, the prism position will be decided. *2)		REM-1 VD : 1.500 m --- R.HT. HD ---
□Collimate target K. Vertical distance (VD) will be shown. *3)	Collimate K	REM-1 VD : 10.456 m --- R.HT. HD ---

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*2) press[F2](R.HT.)key, back to Step ⑤:
press[F3](HD)key, back to Step ⑥.
*3) press[ESC]key, back to program menu.

2) Without prism height input

Operating procedure	Operation	Display
□press[MENU]key, press [F4],enter P2 menu	[MENU] [F4]	MENU 2/3 F1: PROGRAMS F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F1]key	[F1]	PROGRAM 1/2 F1: REM F2: MLM F3: Z COORD. P↓
□Press[F1](REM)key	[F1]	REM 1/2 F1: enter R.HT F2: R.HT. is unnecessary
□press[F2]key	[F2]	REM-2 <STEP-1> HD : m MEAS --- --- ---
□Collimate the prism □press[F1](MEAS)key measurement starts. to show the Horizontal distance (HD) between the instrument and prism will be shown.	Collimate P [F1]	REM-2 <STEP-1> HD* [n] <<m > Measurement …….. REM-2 <STEP-1> HD* 123.456 m > Measurement ……..
□After measuring, the prism position will be decided.		REM-2 <STEP-2> V : 604550 --- --- --- SET

□Collimate the ground point G	CollimateG	REM-2 <STEP 2> V : 123°45'50" --- --- --- SET
□Press the [F4](SET) key. The position of point G will be decided. *1)	[F4]	REM-2 VD : 0.000 m --- V HD ---
□Collimate target K. Vertical distance (VD)will be shown.*2)	Collimate K	REM-2 VD : 10.456 m --- V HD ---

*1) To return to procedure □, press the [F3](HD) key.
To return to procedure □, press the [F2](V) key.
*2) To return to PROGRAMS Menu, press the [ESC] key.

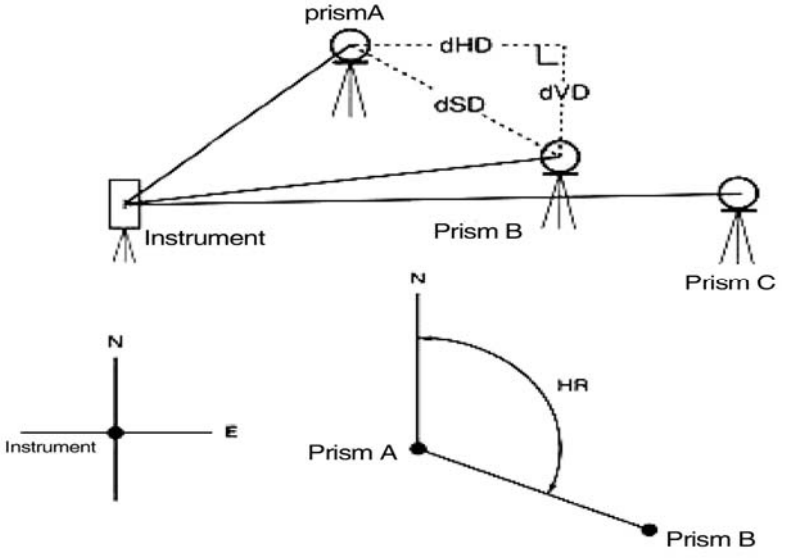
6.1.2 Missing Line Measurement (MLM)

Measurement for horizontal distance (dHD), slope distance (dSD), elevation (dVD) and horizontal angle (HR) between two target prisms.It is possible to enter the coordinate value directly or calculate from coordinate data file.

MLM mode has two functions.

1.MLM-1 (A-B，A-C): measure A-B,A-C,A-D,……

2.MLM-2 (A-B，B-C): measure A-B,B-C,C-D,……



• must set the directional angle of instrument

[Example]MLM-1(A-B,A-C)

• Procedure of MLM-2 (A-B, B-C) mode is completely same as MLM-1 mode

Operating procedure	Operation	Display
□press[MENU]key,then press[F4]P1↓key to enter P2 menu	[MENU] [F4]	MENU 2/3 F1: PROGRAMS F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F1]key	[F1]	PROGRAM 1/2 F1: REM F2: MLM F3: Z COORD. P↓
□Press[F2](MLM)key	[F2]	MLM F1: USE FILE F2: DON`T USE
□Press the [F1] or [F2] key to select using coordinate file. [Example:F2 : DON'T USE]	[F2]	GRID FACTOR F1: USE FILE F2: DON`T USE
□Press the [F1] or [F2] key to select using GRID FACTOR. [Example:F2 : DON'T USE]	[F2]	MLM F1: MLM-1(A-B,A-C) F2: MLM-2(A-B,B-C)
□Press[F1]key	[F1]	MLM-1 (A-B,A-C) <STEP 1> HD : m MEAS R.HT NEZ ---
□Collimate prism A, press[F1] (MEAS)key. (HD) between the instrument and prism A will be shown.	Collimate A [F1]	MLM-1(A-B，A-C) <STEP 1> HD*[n] <<m >Measurement…

□After measuring, the prism position will be decided.		MLM-1(A-B, A-C) <STEP 2> HD : m MEAS R.HT NEZ ---
□Collimate prism B,press[F1] (MEAS)key. (HD) between the instrument and prism B will be shown.	CollimateB [F1]	MLM-1(A-B, A-C) <Step 2> HD*[n] <<m MEAS R.HT NEZ --- ↓
□After measuring, the horizontal distance (dHD) and relative elevation (dVD) between prism A and B will be shown.		MLM-1(A-B, A-C) dHD : 123.456m dVD : 12.345m --- --- HD ---
11 To show slope distance (dSD) , press [◢] key.	[◢]	MLM-1 (A-B, A-C) dSD: 234.567 m HR : 12°34'40" --- --- HD ---
12 To measure the distance between points A and C, press the [F3](HD). *1)	[F3]	MLM-1(A-B, A-C) <Step 2> HD : m MEAS R.HT NEZ ---
13 Collimate point C (Prism C) and press the[F1](MEAS) key.Horizontal distance (HD)between the instrument and prism C will be shown.	Collimate Prism C [F1]	□ □ □ □ □
14 After measuring, the horizontal distance (dHD) and relative elevation (dVD) between prism A and C will be shown.	[F4]	MLM-1 (A-B, A-C) dHD: 234.567 m dVD: 23.456 m --- --- HD ---

15 To measure the distance between points A and D, repeat procedure 12 to14. *1)		
*1)press[ESC]key can back to previous mode		

• **How to use coordinate data**

It is possible to input coordinate value directly or calculate from coordinate data file

Operating procedure	Operation	Display
To use coordinate data file, select “USE FILE” in step 4. After procedure 6.		MLM-1(A-B, A-C) <STEP 1> HD : m MEAS R.HT NEZ ---
□Press the [F3](NEZ) key. Direct key input display will be shown.	[F3]	N> 0.000 m E: 0.000 m Z: 0.000 m INPUT □ PT# ENTER
②Press the [F3](PT#) key to use coordinate data file. Point number input display will be shown. Pressing the [F3](HD) key, the display will return to procedure ⑥ After selecting coordinate input mode by pressing the [F3](NEZ or PT# or HD) key, press the [F1](INPUT) key and enter the data.	[F3]	MLM-1 (A-B,A-C) PT#:_____ INPUT LIST HD ENTER

6.1.3 Setting Z Coordinate of Occupied Point

Occupied point coordinate data and known point actual measuring data are utilized, z coordinate of occupied point is calculated and reset again.

Known point data and coordinate data can use the coordinate data file.

1) Setting occupied coordinate

[Example setting] Using coordinate data file.

Operating procedure	Operation	Display
□press[MENU]key, then press[F4](P)↓ Show main menu 2/3	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F1]key	[F1]	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
□Press[F3](Z COORD.)key	[F3]	Setting Z COORD F1: input from OCC PT F2: datum point measurement
□press[F1](use a file)key	[F1]	OCC.PT FN: _____ INPUT LIST NEZ ENTER
□[F1](INPUT)key, after enter the filename, ress[F4] onfirm	[F1] Input FN [F4]	Setting of Coordinate Z F1: input from occupied point F2: datum point measurement
□press[F1]key	[F1]	OCC.PT PT# : _____ INPUT LIST NEZ ENTER
□Press the [F1](INPUT) key and enter the Point number. Instrument height setting display will be shown.	[F1] Input PT# [F4]	INSTRUMENT HEIGHT INPUT INS.HT = 0.000 m --- --- [CLR] [ENT]

□Enter the height. The display returns to Z coordinate menu.	[F1] Input HT [F4]	Setting of Coordinate Z F1: input from occupied point F2: datum point measurement
• For data file details, refer to 9 “Memory Manager Mode”		

2) Z Coordinate Calculation from Known Point Measuring Data

[Example] use a coordinate data file

Operating procedure	Operation	Display
□After pressing [MENU] key, press [F4](P↓) key to get the menu on page 2.	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F1]key	[F1]	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
□Press[F3](Z COORD)key	[F3]	Z COORD.SETTING F1: USE FILE F2: DON`T USE
④press[F1](USE FILE)key	[F1]	SELECT A FILE FN: _____ INPUT LIST --- ENTER
⑤Press the [F1](INPUT) key and enter the File Name.	[F1] Input FN [F4]	Z COORD.SETTING F1: OCC.PT INPUT F2: REF.MEAS
⑥press[F2]key	[F2]	N001# PT#:_____ INPUT LIST NEZ ENTER

⑦Press the [F1](INPUT) key and enter the Point Number in coordinate data file.	[F1] Input PT# [F4]	N: 4.356m E: 16.283m Z: 1.553m >OK? [YES] [NO]
□Press the [F3](YES) key and enter the Point Number in coordinate data file.	[F3]	REFLECTOR HEIGHT INPUT: R.HT: 0.000m --- --- [CLR] [ENT]
□Enter the height.	Inputs R.HT [F4]	REFLECTOR HEIGHT INPUT: R.HT: 0.000 m >Sight ? [YES] [NO]
□Collimate a prism on the F3](YES) key. Measuring starts. *1)	Collimate P [F3]	HR :120°30′40″ HD* [n] < <m VD : m >Measurement……..
		HR : 120°30′40″ HD : 12.345 m VD : 23.456m NEXT --- --- CALC
11 press[F4] (CALC)key*2) Z:Z coordinate dZ:standard deviation	[F4]	Z COORD.SETTING Z: 1.234 m dZ: 0.002 m --- --- BS SET

12 press[F4](SET)key*3), Z Coordinate of occupied point is set, to show backsight point measurement screen	[F4]	BACKSIGHT HR : 120°30′40″ >OK? [YES] [NO]
13 press[F3](YES)key, the horizontal angle is set, the display will back to program menu 1/2	[F3]	PROGRAM 1/2 F1: REM F2: MLM F3: Z COORD. P↓
*1) Measurement is Fine N-times measurement mode. *2) To measure other points, press the [F1](NEXT) key. *3) Pressing the [F3] key, the display will be changed alternately.		

6.1.4 Area Calculation

This mode calculates the area of a closed figure.

There are two methods for area calculation:

1) Area Calculation from Coordinate data file

2) Area Calculation from Measured data

•Area is not calculated correctly if enclosed lines cross each other.

•It is impossible to calculate with a mix of coordinate file data and measured data.

•If the coordinate data file does not exist, the area calculation from measured data is done automatically.

•The numbers of points used to calculate the area are not limited.

1) Area Calculation from Coordinate Data File

Operating procedure	Operatin	Display
□press[MENU]key, then press [F4](P↓)key to show main menu 2/3	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P ↓

□Press[F1]key	[F1]	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
□press[F4] (P↓)key, to enter program menu 2/2	[F4]	PROGRAM 2/2 F1: AREA F2:POINT TO LINE P↓
□press[F1](AREA)key	[F1]	AREA F1: FILE DATA F2: MEASUREMENT
□press[F1](FILE DATA)key	[F1]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
□Press the [F1](INPUT) key and enter the File Name. Initial display will be shown.	[F1] Input FN [F4]	AREA 0000 m.sq NEXT# : DATA-01 PT# LIST UNIT NEXT
□Press the [F4](NEXT) key. *1),2) The top of the file data (DATA-01) will be set and the second point number will be shown.	[F4]	AREA 0001 m.sq NEXT# : DATA-02 PT# LIST UNIT NEXT

□Repeat pressing the [F4](NEXT) key to set required number of points. When 3 or more points are set, the area surrounded by the points is calculated and the result will be shown.	[F4]	AREA 0021 123.456 m.sq NEXT# : DATA-22 PT# LIST UNIT NEXT
*1) To set specify point, press the [F1](PT#) key. *2) To show the list of the coordinate data in the file, press the [F2](LIST) key.		

2) Area Calculation from Measured data

Operating procedure	Operatin	Display
□press[MENU]key, then press [F4](P↓)key to show main menu 2/3	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F1]key	[F1]	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
□Press[F4] (P↓)key, to enter program menu 2/2	[F4]	PROGRAM 2/2 F1: AREA F2:POINT TO LINE P↓
□press[F1](AREA)key	[F1]	AREA F1: FILE DATA F2: MEASUREMENT
□Press[F2](MEASUREMENT)key	[F2]	AREA F1: USE G.F F2: DON`T USE

⑥Press the [F1] or [F2] key to select using GRID FACTOR. [Example:F2 : DON'T USE]	[F2]	AREA 0000 m.sq MEAS --- UNIT ---
⑦Collimate a prism and press the [F1](MEAS) key. Measuring starts. *1)	Collimate P [F1]	N* [n] <<<m E: m Z: m >Measurement…
		↓
⑧Collimate next point and press the [F1](MEAS) key. When 3 or more points are measured, the area surrounded by the points is calculated and the result will be shown.	Collimate [F1]	AREA 0001 m.sq MEAS --- UNIT --- | | | | AREA 003 234.567m.sq MEAS --- UNIT ---
*1) Measurement is Fine N-times measurement mode.		

·To change the display unit

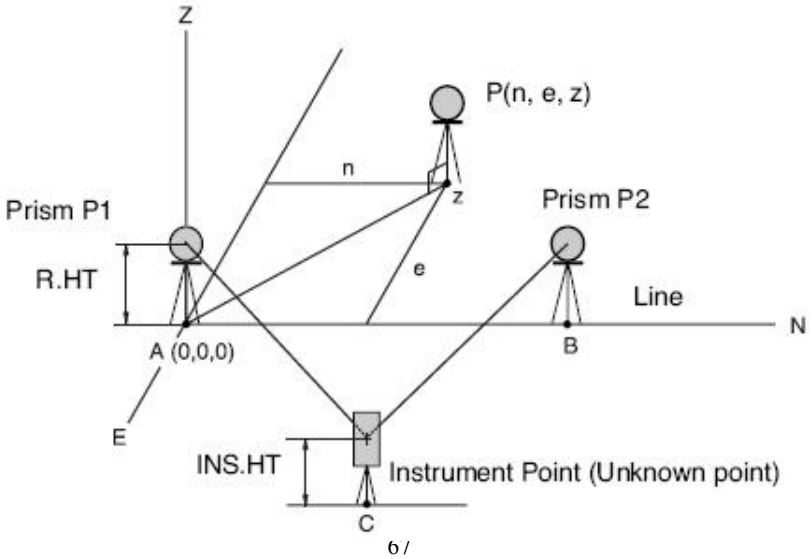
It is possible to change the displayed area unit.

Operating procedure	Operation	Display
□Press[F3]（UNIT）key	[F3]	AREA 0003 100.000 m.sq MEAS --- UNIT ---
		AREA 0003 100.000 m.sq m.sq ha ft.sq acre
□Select a unit by pressing the [F1] to [F4] key. Example: [F2](ha) key.	[F2]	AREA 0003 0.010ha MEAS --- UNIT ---
• m.sg: square meter ha: hectare ft.sg: square feet acre:acre		

6.1.5 Point to Line Measurement

This mode is used to obtain the coordinate data with the origin point A(0,0,0) and the line AB as N axis.

Place the 2 prisms at the points A and B on the line, and place the instrument at unknown point C. After measuring the 2 prisms , the coordinate data and the direction angle of the instrument will be calculated and restored.



Operating procedure	Operation	Display
□press[MENU]key, then press [F4](P↓)key to show main menu 2/3	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F1]key	[F1]	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
③press[F4] (P↓)key, to enter program menu 2/2	[F4]	PROGRAM 2/2 F1: AREA F2:POINT TO LINE P↓
□press[F2]key	[F2]	INSTRUMENT HEIGHT INPUT INS.HT.= 0.000 m --- --- [CLR] [ENT]
□Enters instrument height	Input INS.HT [F4]	REFLECTOR HEIGHT INPUT R.HT = 0.000 m --- --- [CLR] [ENT]
□Enter reflector A(P1) height.	Input R.HT [F4]	POINT TO LINE MEAS . P1 HD: m >Sight ? [YES] [NO]
□Collimate prism P1(origin point), press[F3](yes)key to carry out measurement *1)	Colimate P1 [F3]	POINT TO LINE MEAS . P1 HD* [n] << m >Measurement……

Input display of reflector B(P2) height will be shown.		REFLECTOR HEIGHT. INPUT R.HT = 0.000 m --- --- [CLR] [ENT]
□Enter reflector B(P2) height.	ENTER R.HT [F4]	POINT TO LINE MEAS . P2 HD* m >Sight ? [YES] [NO]
□Collimate prism B (P2) (Origin) and press the [F3](YES) key. Measuring starts. *1)	Collimate P2 [F3]	POINT TO LINE MEAS . P2 HD* [n] << m >Measurement……
The coordinate data and the direction angle of the instrument are calculated and restored. The result (The distance between A and B) will be displayed. dHD: Horizontal distance dVD:Vertical distance dSD:Slope distance *2) ,3)		DIST (PI-P2) 1/2 dHD : 10.000 m dVD : 0.000 m NEZ S.CO --- P↓
□press[F1](NEZ)key, to measure Other target points	[F1]	N: 0.000 m E: 0.000 m Z: 0.000 m EXIT --- HT MEAS ー ー ー ー ー ー ー ー ー ー ー >Measurement…..

11 Collimate a prism and press [F4](MEAS) key. Coordinate measurement starts. *4) The result will be shown. *5)	Collimate P [F4]	N: 3.456m E: 5.432m Z: 0.000m Exit --- HT MEAS
*1) Measurement is Fine N-times measurement mode. *2) To show dSD, press [F4](P↓) key. *3) To show the new occupied data, press [F2](S.CO) key. *4) Measurement is Fine N-times measurement mode. *5) To return to previous mode, press [F1](EXIT) key.		

6.2 Setting the GRID FACTOR

GRID FACTOR can be reset under this mode

For details, refer to 8.1.1 “Setting the GRID FACTOR”

Grid Factor can be applied to the following applications

Can also choose”do not use” in the "Selecting mode" to cancel the setting of grid factor, the selection and setting of grid factor will be omitted.

●Data collection mode

When the NEZ automatic calculation (NEZ AUTO. CALC) is ON, Grid factor will be applied to the coordinate data (Including PTL data) recorded into a coordinate data file when the RAW data is measured and recorded.(In this case, Grid Factor is not applied to the RAW data recorded into the measured data file.)

●PTL (Point To Line measurement)

When executing PTL measurement mode, the NEZ Auto Calculation wil be turned on compulsorily and Grid factor will be applied to the coordinate data.

●LAYOUT

During Layout (Including PTL measurement mode)

1. When displaying the difference (dHD) between grid horizontal distance to a layout point (HDg) on the projection plane and measured ground horizontal distance to a prism point (HD) Grid factor will be applied to grid distance (HDg) in order to reverse-convert grid distance to ground distance.

2. After completion of a layout point, the displayed coordinate data will be applied to grid factor in order to compare with surveying data and calculated data on the projection plane.

(NEW POINT-Side Shot)
In side shot mode, a new point coordinate data will be applied to grid factor and the new point coordinate data will be recorded into a coordinate data file.
(NEW POINT - Resection)
In resection method, when a new point calculated coordinate data is displayed or recorded, the new point coordinate data will be applied to grid factor and the coordinate data will be recorded into a coordinate data file.

●MLM (Missing Line Measurement)
When selecting grid factor "USE G.F.", measured data will be applied to grid factor.At this time, the horizontal distance(dHD) and slope distance(dSD) will be shown on the projection plane.
●AREA (Area measurement / Measurement mode)
When select grid factor”USE G.F”,the measured data will be applied in the grid factor,then,the computed area will be shown on the projection plane.

Note:Calculation of Z coordinate is not influenced whether if it is applied to grid factor.

Operating procedure	Operation	Display
□Press[MENU]key, then press [F4](P↓)key to show main menu 2/3	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P↓
□press[F2](GRID FACTOR)key	[F2]	GRID FACTOR = 0.998843 >MODIFY? [YES] [NO]

□Press[F3](YES)key □Enter Elevation. *1) Press the [F4](ENT) key. □Enter Scale Factor in the same way. Grid factor shows 1-2 seconds, the display backs to menu	[F3] Input ELEV [F4] Input Scale [F4]	GRID FACTOR ELEV. = 1000 m SCALE: 0.999000 □ □ [CLR] [ENT] GRID FACTOR ELEV. = 2000 m SCALE: 1. 001000 □ □ [CLR] [ENT] GRID FACTOR =1.000686
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters” • Input Range :Elevation : –9,999 to +9,999 meter (–32,805 to +3,2805 ft, ft+in) Scale Factor: 0.990000 to 1.010000		

6.3 Setting Illumination of Display and Cross Hairs

Set on/off for display LCD illumination

Operating procedure	Operation	Display
□press[MENU]key, then press [F4](P↓)key to show main menu 2/3	[MENU] [F4]	MENU 2/3 F1: PROGRAM F2: GRID FACTOR F3: ILLUMINATION P ↓
□press[F3]key,to show original setting status	[F3]	ILLUMINATION [OFF] F1: On F2: Off
□press[F1]on,the backlight Illumination light on	[F3]	ILLUMINATION [ON]

□press[F2]key,off, backlight illumination light off	[F2]	ILLUMINATION [OFF] F1: On F2: Off F3: Contrast
·press[ESC)key to back to previous mode		

6.4 Setting Mode 1

In this mode, the following settings are possible.

1. Minimum reading
2. Auto Power off
3. Vertical Angle Tilt Correction (Tilt ON/OFF)
4. Setting for RS-232C communication

• this selection will be saved after power is off

6.4.1 Setting Minimum Reading

Select minimum display unit for angle measurement, coarse distance measurement mode.

Instrument type	Angle unit			Coarse mode Distance unit
	Degree	Gon(400 system)	MIL	
TKS-202	5″/1″			

[Example] Minimum angle : 5”, Coarse : 1mm

Operating procedure	Operation	Display
□press[MENU]key, then press [F4](P↓)key twice to show main menu 3/3	[MENU] [F4] [F4]	MENU 3/3 F1: PARAMETER 1 F2: CONTRAST ADJ P ↓
□press[F1]key	[F1]	Parameter 1 1/2 F1: Minimum reading F2: Auto Power off F3: TILE P↓

□press[F1]key	[F1]	Minimum reading F1: Angle F2: Coarse
□press[F1]key	[F1]	Minimum angle [F1: 1″] F2: 5″ Enter
⑤press[F2] (5″)key, then press[F4](Enter)key	[F2] [F4]	Minimum reading F1: Angle F2: Coarse
□press[F2]key	[F2]	Coarse reading F1: 1 mm [F2: 10mm] Enter
□press[F1] (1mm)key, then press[F4](Enter)key	[F1] [F4]	Minimum reading F1: Angle F2: Coarse
• press[ESC]key to back to previous mode		

6.4.2 Auto Power Off

If no key operation is given or no process of measurement is performed for 30 minutes (No change exceeding 30″has occurred during vertical angle measurement),The power will automatically turn off, If the instrument is set at distance measurement mode, (No change in distance exceeding 10cm has occurred during distance measurement), the mode changes to angle measurement automatically in case that the instrument does not operate for

approximately 10 minutes, the power will automatically turn off in the following 20 minutes.

Operating procedure	Operation	Display
□press[MENU]key, then press [F4](P↓)key twice to show main menu 3/3	[MENU] [F4] [F4]	MENU 3/3 F1: PARAMETER 1 F2: CONTRAST ADJ P↓
□press[F1]key	[F1]	PARAMETER 1 1/3 F1: Minimum reading F2: Auto Power off F3:TILT P↓
□press[F2] to show original setting status	[F2]	AUTOPOWEROFF[OFF] F1: ON F2: OFF Enter
□press[F1] (ON)key or[F2](OFF)key,then press[F4](Enter)key	[F1]or[F2] [F4]	

6.4.3 Tilt correction (TILT ON/OFF)

In case the instrument is used in an unstable situation, constant indexing of vertical and horizontal angle may be impossible; in this case, the function of tilt correction can be stopped by selecting TILT OFF, it has been set to TILT ON ex-works.

• This setting is memorized after powering off.

Operating procedure	Operation	Display
□press[MENU]key, then press [F4](P↓)key twice to show main menu 3/3	[MENU] [F4] [F4]	MENU 3/3 F1: PARAMETER 1 F2: CONTRAST ADJ P↓

□press[F1]key	[F1]	PARAMETER 1 1/2 F1: Minimum reading F2: Auto Power off F3: TILT P↓
□press[F3] to show tilt correction value if original setting status is ON	[F3]	TILT SENSOR: 〔On〕 X: 0°02′10″ ON --- OFF Enter
□press[F1](ON) or[F3](OFF)key,then press[F4](Enter)key	[F1] - [F3] [F4]	

6.4.4 Setting RS-232C communication with external device

You can set the parameters for RS-232C communication with external device from parameters setting menu.

The specific set parameters is as follows:

Item	Selecting items
BaudRate	1200，2400，4800，9600，19200，38400
Character bit/Parity	7/Even，7/Odd，8/None
Stop bit	1, 2
ACK mode	Standard , Omitted
CR.LF	ON, OFF
REC type	REC-A，REC-B
Factory setting	Baud rate:1200 baud, Character bit/Parity:7/Even, CRLF:OFF, REC type: REC-A, ACK:Standard

ACK mode,CR,LF,REC type are correlative each other,refer to Chapter 16 “Selecting mode”

EXAMPLE:STOP BIT = 2

Operating procedure	Operation	Display
□press[MENU]key, then press[F4](P↓)twice	[MENU] [F4] [F4]	MENU 3/3 F1: PARAMETER 1 F2: CONTRAST ADJ P ↓
□press[F1]key	[F1]	Parameter 1 1/3 F1: Minimum reading F2: Auto Power off F3: TILT P↓
□Press[F4]twice	[F4] [F4]	Parameter Group 1 1/3 FI:RS-232C P1
□press[F1] to show previous setting value and previous setting status	[F1]	RS-232C 1/3 F1:Baud Rate F2: Character/parity F3: Stop bits P1
□press[F3]to select stop bit, to show previous equipment value	[F3]	
□press[F2]to select stop bit 2, then press[F4](Enter)	[F2] [F4]	Stop bit F1: 1 [F2: 2] Enter

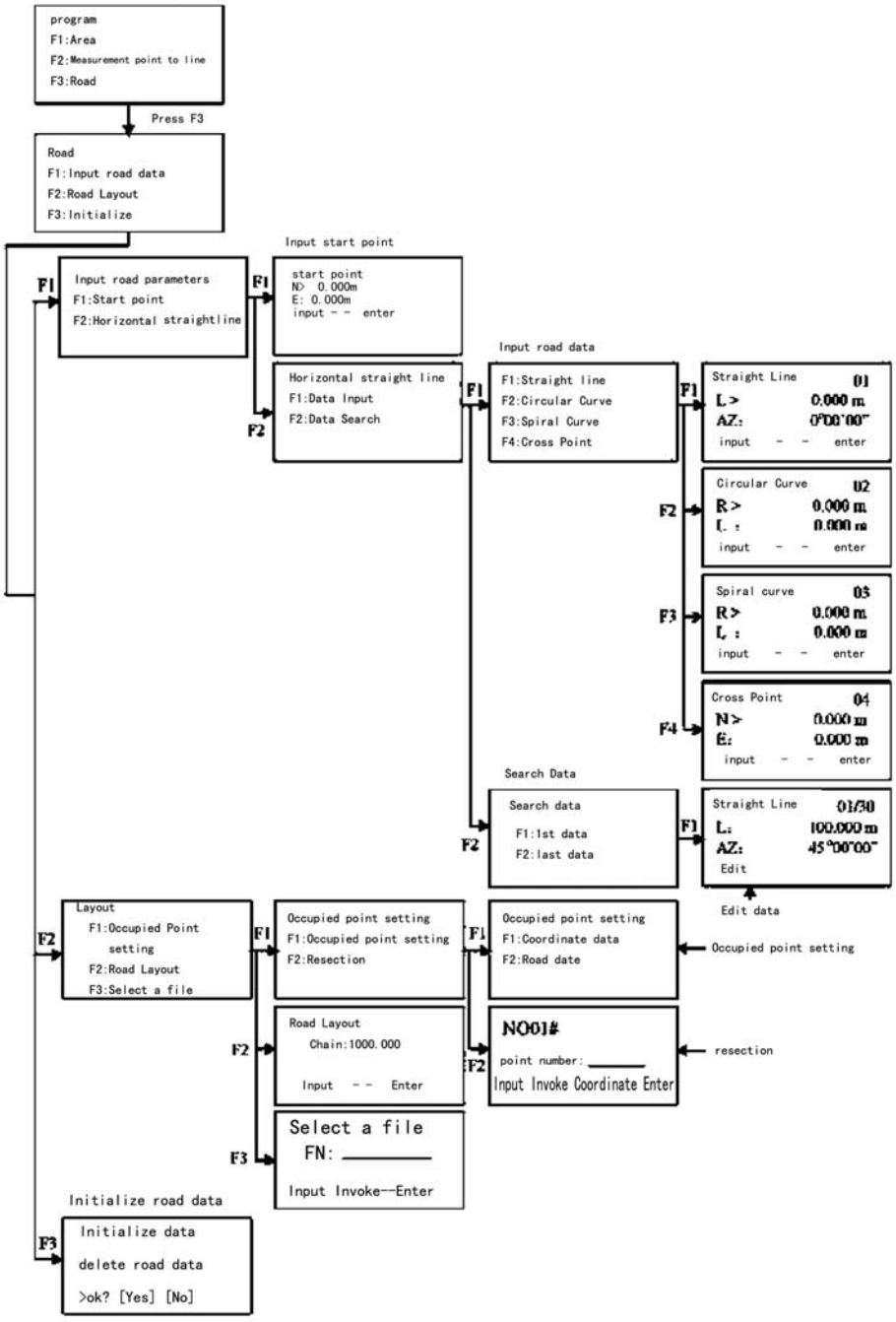
6.5 Setting Contrast of Display

Setting LCD's contrast level

Operating procedure	Operation	Display
□press[MENU]key, press [F4](P↓)key twice to enter P3 menu	[MENU] [F4] [F4]	MENU 3/3 F1: PARAMETER 1 F2: CONTRAST ADJ P ↓
□press[F2]key	[F2]	Contrast Adjustment LEVEL: 5 ↓ ↑ --- ENTER
③press[F1](↓)key or [F2](↓)key, then press[F4] (Enter)key	[F1]or[F2] [F4]	

6.6 ROAD

・Road menu operation



6.6.1 Input Start Point

To input the start point, carry out the following operating procedure:

Operating procedure	Operation	Display
□press[MENU]key, then press[F4](P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1: AREA F2: POINT TO LINE F3:ROAD P↓
□press[F3],[F1],[F1]key	[F3] [F1] [F1]	START POINT N = 0.000 m E : 0.000 m --- --- [CLR] [ENT]
□input coordinate N,E □press[ENT]key	Input coordinate [ENT]	Start point Chain〉0.000m Interval:100.000m □ □ [CLR] [ENT]
□input chain, interval □press[ENT]key	Input data [ENT]	〈SET!〉 INPUT DATA F1: START POINT F2: H ALIGNMENT

- For [ROAD], in addition to the “Start Point”and “Road Data” input files, other files necessary for the calculations are created; consequently, if the free area of the memory reaches 10% or less, a“MEMORY POOR”warning message is displayed.(at this moment the instrument is still operable)
- CHAIN and INTERVAL input range
  -50,000m≤ CHAIN ≤ +500,000m
  0m<INTERVAL ≤ +5,000m

6.6.2 Input Road Data

[ROAD] is made up of four types of components: LINE, CURVE, SPIRAL and POINT.To input the required components, carry out the following operating procedure.

Operating procedure	Operation	Display
□press[MENU]key, then press[F4] (P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
□press[F3],[F1], [F2],[F1] key (refer to P71 “input road data”)	[F3] [F1] [F2] [F1]	F1:LINE F2:CURVE F3:SPIRAL F4:POINT

- The amount of input data varies depending on the type of data, up to a maximum of 30. (In the case of POINT input only, the maximum is 9 points including end point)
- An error may occur when entering a combination of POINT and other components if the amount of data entered exceeds the maximum amount allowed for internal calculations. If this happens, please reduce the amount of input data.

● Input LINE data

Operating procedure	Operation	Display
□press[F1], to enter straight line input page*1	[F1]	F1:LINE F2:CURVE F3:SPIRAL F4:POINT
□input LENGTH □press[ENT]key	Input LENGTH [ENT]	LINE 01 L = 0.000 m AZ: 0°00′00″ --- --- [CLR] [ENT]

□input AZIMUTH □press[ENT]key		〈SET!〉
*1) The number at the top right of the screen shows the amount of data currently entered.		

●Input CURVE data

Operating procedure	Operation	Display
□To input CURVE data, press the [F2] key. *1)	[F2]	F1:LINE F2:CURVE F3:SPIRAL F4:POINT
□input RADIUS □press[ENT]key	Input RADIUS [ENT]	CURVE 02 R = 0.000 m L : 0.000 m --- --- [CLR] [ENT]
□input L(arc length) □press[ENT]key	input[ENT]	CURVE 02 TURN >RIGHT LEFT RIGHT --- ENTER
□ Select TURN(direction of turn): RIGHT or LEFT. □Press the [ENT] key.	[F1]or[F2] [ENT]	〈SET !〉
*1: CURVE cannot be input as the firs data.		

●Input SPIRAL data

Operating procedure	Operation	Display
		F1:LINE F2:CURVE F3:SPIRAL F4:POINT
□To input SPIRAL data, press the [F3] key. *1)	[F3]	SPIRAL 03 R = 0.000 m L : 0.000 m --- --- [CLR] [ENT]
□input RADIUS □press[ENT]key	Input RADIUS [ENT]	
□input LENGTH □press[ENT]key	Input LENGTH [ENT]	SPIRAL 03 R: 0.000 m L : 0.000 m --- --- [CLR] [ENT]
□Select TURN(direction of turn): RIGHT or LEFT.	[F1]or[F2]	SPIRAL 03 TURN >RIGHT DIR : IN LEFT RIGHT --- ENTER
□press[ENT]key	[ENT]	
□Select DIR(direction): IN(entrance) or OUT(exit).	[F1]or[F2]	SPIRAL 03 TURN >RIGHT DIR > IN IN OUT --- ENTER
□press[ENT]key	[ENT]	
		〈SET !〉
*1) : SPIRAL cannot be input as the first data.		

● Input POINT data

Operating procedure	Operation	Display
		F1:LINE F2:CURVE F3:SPIRAL F4:POINT
□To input POINT data, press the [F4] key.	[F4]	POINT 04 N = 0.000 m E : 0.000 m --- --- [CLR] [ENT]
□input N coord □press[ENT]key	Input N coord [ENT]	POINT 04 N : 0.000 m E = 0.000 m --- --- [CLR] [ENT]
□input E coord □press[ENT]key	Input E coord [ENT]	R > 0.000 m A1. 0.000 A2: 0.000 INPUT --- SKIP ENTER
□input RADIUS *1) □press[ENT]key	Input RADIUS [ENT]	R : 100.000 m A1> 0.000 A2: 0.000 INPUT --- SKIP ENTER
□Input parameter A1 *1) □press[ENT]key	Input parameter A1 [ENT]	R> 100.000m A1: 80.000 A2> 0.000 INPUT --- SKIP ENTER
□Input parameter A2.*1) 11 press[ENT]key	Input parameter A2 [ENT]	〈SET!〉

*1) If the data input is not required, press the [SKIP] key.

● When inputting POINT data, if the next data isn`t point data, ROAD is calculated as a straight line irrespective of the values for RADIUS, A1 and A2.

6.6.3 Search Data

To search for input data, carry out the following operating procedure.

Operating procedure	Operation	Display
□press[MENU]key, then press [F4](P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
□press[F3],[F1],[F2],[F2]key	[F3] [F1] [F2] [F2]	DATA SEARCH F1: THE FIRST DATA F2: LAST DATA
□To search from the first data, select [F1] (FIRST DATA).	[F1]	LINE 01/30 L : 100,000 m AZ : 45°00′00″ EDIT ↓
□To switch to different data, press the [↓] or [↑] key.	[↑]or[↓]	…… Spiral 30/30 R: 200.000 m L: 200.000 m EDIT ↓

6.6.4 Edit Data

To edit input data, carry out the following operating procedure.

Operating procedure	Operation	Display
□in the data search page, press[F1]key	[F1]	LINE 01/30 L : 100.000 m AZ : 45°00′00″ EDIT ↓
□edit the data	Edit data	LINE 01 L = 100.000 m AZ : 45°00′00″ --- --- [CLR] [ENT]

6.6.5 Set OCC and BS

To set the Occupied Point and Backsight Point, carry out the following operating procedure.

Operating procedure	Operation	Display
□press[MENU]key, then press[F4](P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
□press[F3],[F1],[F1]key	[F3] [F2] [F1]	OCC & BS F1: OCC & BS F2: RESECTION
□press[F1]key*1	[F1]	OCC & BS F1: COORD. DATA F2: ROAD DATA
□To input OCC. PT, press the [F1](COORD. DATA)or [F2](ROAD DATA) key. COORD. DATA: Choose the data from Coord Data and set the Occupied Point. ROAD DATA: Create the data from Road Data and set the Occupied Point. (Example : ROAD DATA)	[F2]	OCC.PT CHAIN = --- --- [CLR] [ENT]
□input OCC.PT, press[ENT]key	input OCC.PT [ENT]	Chain: 1000.00 >CENTER LEFT RIGHT --- ENTER

□press[ENT]key LEFTT OR RIGHT: use the offset point. CENTER : use the center point (Example:CENTER)	[ENT]	CHAIN: 1000.00 N: 0.000 m E: 0.000 m >OK? [YES] [NO]
□press[F3](yes)key	[F3]	BACKSIGHT CHAIN= --- --- [CLR] [ENT]
□input backsight point □press[ENT]key	input backsight point press[ENT] key	CHAIN: 0.000 >CENTER LEFT RIGHT --- ENTER
□Collimate the backsight point	Collimate the backsight point	BACKSIGHT H(B) = 45°00′00″ >Sight? [YES] [NO]
		〈SET !〉
11 Press[F3](YES)	[F3]	SETOUT F1: OCC & BS F2: SETOUT ROAD F3: SELECT A FILE

*1: When setting the Occupied Point and Backsight Point using Resection method, select [F2](RESECTION).
For details of the Resection method, refer to Section 8.3.2 “Resection Method”.

6.6.6 Road Layout

To setout the road, carry out the following operating procedure.

Operating procedure	Operation	Display
□press[MENU]key, then press[F4](P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
□press[F3],[F2],[F2]key	[F3] [F2] [F2]	SETOUT ROAD CHAIN = --- --- [CLR] [ENT]
□input data	Input data	SETOUT ROAD CHAIN = 1200 --- --- [CLR] [ENT]
□press[ENT]key	[ENT]	Chain: 1200 >CENTER LEFT RIGHT ---ENTER
□Select offset. Example: RIGHT)Press the [F2] key. *1)	[F2]	CHAIN: 1200 :RIGHT = m --- --- [CLR] [ENT]
□input the offset value	Input offset Value [ENT]	
□Press the [ENT] key. The setout point coordinates are displayed.	[ENT]	CHAIN: 1200 N: 0.000 m E: 0.000 m >OK? [YES] [NO]

□press[F3]key The distance to the setout point and the backsight are displayed. HR: Calculated horizontal angle of the layout point HD: Calculated horizontal distance from the instrument to the layout point	[F3]	CALCULATED HR=60° 00′ 00″ HD=100.000m ANG DIST --- ---
□Press the [F1](ANG) key. CHAIN: Layout point HR: Measured (Actual) horizontal angle. dHR: Horizontal angle to be turned to the layout point = Actual horizontal angle - Calculated horizontal angle. Correct direction when dHR = 0° 00'00"	[F1]	CHAIN:1200 HR: 60°00'00" dHR: 0°00'00" DIST --- NEZ ---
⑩Press the [F1](DIST) key. HD: Measuring (Actual) horizontal distance dHD: Horizontal distance to be turned to the layout point = Actual horizontal distance – Calculated horizontal distance.	[F1]	HD * : 100.000 m dHR : 0.000 m Mode Ang Nez Next
11 Press the [F3](NEZ) key. The coordinate data is shown.	[F3]	N: 70.000 m E: 50.000 m MODE ANG --- NEXT
12 Press the [F4](NEXT) key to set next layout point.	[F4]	
*1) If not choose displacement, press[ENT]key.		

6.6.7 Select a File

To set the coordinates to be used for the Occupied Point and Backsight Point, carry out the following operating procedure.

Operating procedure	Operation	Display
□Press[MENU]key, then press [F4] (P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
□Press[F3],[F2]key	[F3] [F2]	SETOUT F1: OCC & BS F2: SETOUT ROAD F3: SELECT A FILE
□Press[F3]key □Enter the name of the file being used (or select it from the list). □Press[ENT]key	[F3] Select a file [ENT]	SELECT A FILE FN:_____ INPUT LIST --- ENTER

6.6.8 Initialize ROAD data

To initialize the data, carry out the following operating procedure.

Operating procedure	Operation	Display
①press[MENU]key, then press[F4](P↓),[F1],[F4]key to enter program menu page 2/2	[MENU] [F4] [F1] [F4]	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
②press[F3],[F3]key	[F3] [F3]	INITIALIZE DATA ERASE ROAD DATA >OK? [NO] [YES]

③When the [F4] (YES) key is pressed, all ROAD DATA with the exception of the coordinate data file is erased.	[F4]	

7. DATA COLLECTION

Measured data can be saved in the memory in TKS-200 serial
The internal memory is shared by the measured data files and the coordinate data files. Maximum 30 files can be generated.

- **Measured data**
  The collected data is memorized into a measurement data file
- **The number of measurement points**
  (In case not using the internal memory in layout mode)

  MAX 24000 POINTS

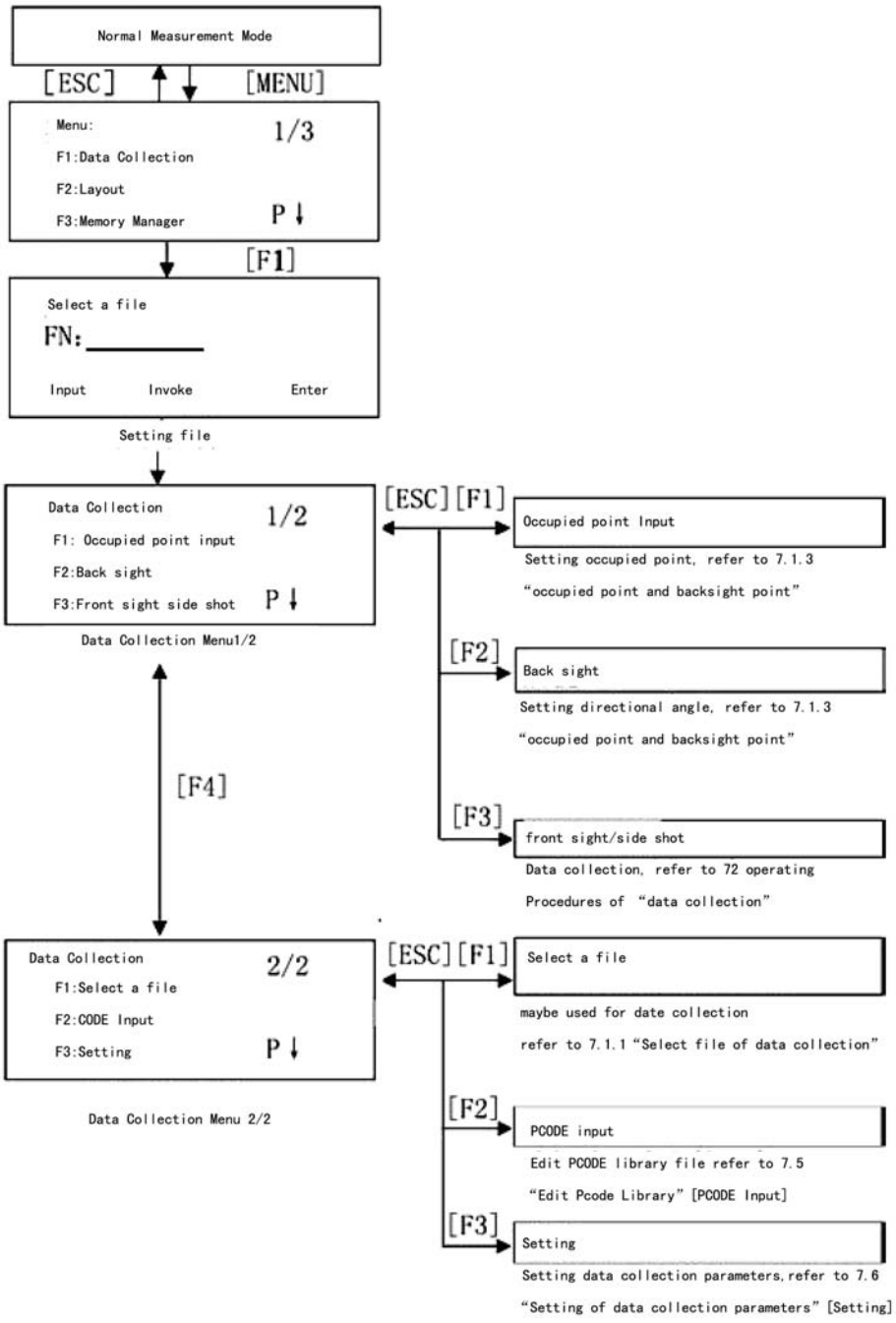
  Because the internal memory covers both data collection mode and layout mode, the number of measurement points will be decreased when the layout mode is used.
  For relevant memory details refer to 9 ”Memory Manager Mode”.

1)When turning off the power, ensure that you are in the main menu screen or main angle measurement mode.
this ensures completion of the memory access process and avoids possible damage to the stored data.
2)It is recommended for safety to charge the battery (BT-L1W) beforehand and prepare fully charged spare batteries.

• **Data collection menu operation**

By pressing the [MENU] key, the instrument will be in MENU 1/3 mode.

Press the [F1](DATA COLLECT) key, the menu of data collect 1/2 will be shown.



7.1 Preparation

7.1.1 Selecting a File for Data Collection

A file used by data collection mode must be selected at first.

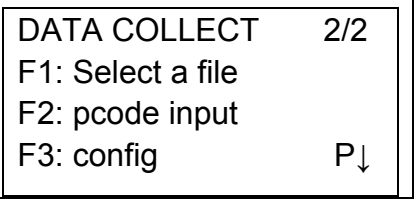
Select a file before beginning data collection mode because selection screen of a file is displayed.

Selection of a file can be done data collection menu under this mode Operating procedure operation display

Operating procedure	Operation	Display
□From main menu1/3 press [F1] (DATA COLLECT)key	[F1]	MENU 1/3 F1: DATA COLLECT F2: LAYOUT F3:MEMORY MGR. ↓P SELECT A FILE FN:_____ INPUT LIST --- ENTER
□Press [F2](LIST) key to display the list of file. *1)	[F2]	AMIDATA /M0123 →*HILDATA /M0345 TOPDATA /M0789 --- SRCH --- ENTER
□Scroll file list by pressing [▲] or [▼] key and select a file to use. *2), *3)	[▲]or[▼]	TOPDATA /M0789 →RAPDATA /M0564 SATDATA /M0456 --- SRCH --- ENTER
□Press [F4](ENTER) key. The file will be set and data collect 1/2 menu will be shown.	[F4]	DATA COLLECT 1/2 F1: OCC.PT# INPUT F2: BACKSIGHT F3: FS/SS P↓

*1) If you want to make a new file or input file name directly, press [F1](INPUT) key and enter a file name.
*2) When a file has been selected already, * mark is indicated on left of current file name.
*3) Data in a file shown with arrow can be searched by pressing [F2](SRCH) key.

• It is possible to select a file from DATA COLLECT 2/2 menu in the same way.



7.1.2 Selection of Coordinate File for Data Collection

When coordinate data in a coordinate data file are used for occupied point or backsight point, select a coordinate file from the data collect menu 2/2 beforehand.

Operating procedure	Operation	Display
□From data collection menu 2/2 press[F1](select a file)fil	[F1]	DATA COLLECT 2/2 F1: SELECT A FILE F2: PCODE INPUT F3: CONFIG P ↓
□Press[F2]coordinate data key	[F2]	SELECT A FILE F1: MEAS. DATA F2: COORD. DATA
□Select a coordinate file as per the method introduced by 7.1.1"Selection of data collection file"		SELECT A FILE FN:_____ INPUT LIST --- ENTER

7.1.3 Occupied Point and Backsight Point

The occupied point and direction angle in the data collect mode are linked with the occupied point and direction angle in normal coordinate measurement.

It is possible to set or change the occupied point and direction angle from the data collect mode

Occupied point can be set by two setting methods as follow:
1) Setting from the coordinate data stored in the internal memory:
2) Direct key input.

The following three setting methods for backsight point can be selected.
1) Setting from the coordinate data stored in the internal memory.
2) Direct key input of backsight coordinate
3) Direct key input of set direction angle.

Note: how to make the coordinate data to be memorized into internal memory, refer to 9.4”Direct key input of coordinate data”and 9.7.2”Loading data”

- **Example for setting the occupied point:**

  In case of setting occupied point from the coordinate data stored in the internal memory.

Operating procedure	Operation	Display
□Press the [F1](OCC.PT# INPUT) key from the data collect menu 1/2. The previous data is shown.	[F1]	PT# →PT-01 ID : INS.HT: 0.000 m INPUT Srch Rec OCNEZC
□press[F4](OCNEZ) key	[F4]	OCC.PT PT# : PT-01 INPUT LIST NEZ ENTER
□press[F1](INPUT)key	[F1]	OCC.PT PT# : PT-01 [ALP] [SPC] [CLR] [ENT]

□InputPT#, press[F4] (ENT)key*1)	Input PT# [F4]	PT# : →PT-11 ID : INS.HT: 0.000 m INPUT Srch Rec OCNEZ
□Enter ID, INS.HT in the same way. *2),3)	Input ID, INS.HT	PT# : →PT-11 ID : INS.HT→ 1.335 m INPUT Srch Rec OCNEZ
□Press[F3]（REC）key	[F3]	———————————— >REC? [YES][NO]
□Press[F3](YES)key The display returns to the data collect menu 1/2.	[F3]	DATA COLLECT 1/2 F1: OCC.PT# INPUT F2: BACKSIGHT F3: FS / SS P↓

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*2) ID can be input by inputting a register number linked with PCODE Library.To show the list of PCODE library, press the [F2](SRCH) key.
*3)Press the [F3](REC) key when you do not input the INS.HT.
• The data recorded in data collect is Point Number, ID and INS.HT.
• If point is not found in internal memory, "PT# DOES NOT EXIST" is displayed.

•Example for setting the direction angle

The following is to memorize the data of the backsight after setting the backsight point from point number.

Operating procedure	Operation	Display
□Press the [F2] (BACKSIGHT) key from the data collect menu 1/2. The previous data is shown.	[F2]	BS# → PCODE : R.HT : 0.000 m INPUT 0SET MEAS BS
□press[F4](BS) key *1)	[F4]	BACKSIGHT PT# = INPUT LIST NE/AZ NET
□press[F1](INPUT)key	[F1]	BACKSIGHT PT# = [ALP] [SPC] [CLR] [ENT]
□input PT4#, press[F4] (ENT)key*2), input PCODE, reflector height*3)4)	Input PT# [F4]	BS# →PT-22 PCODE : R.HT: 0.000 m INPUT 0SET MEAS BS
□press[F3](MEAS)key	[F3]	BS# →PT-22 PCODE : R.HT: 0.000 m *VH SD NEZ ---
⑥Collimate back sight point. Select one of the measuring mode and press the soft key. EXAMPLE : [F2](Slope Distance) key. Measuring starts. Horizontal circle is set to calculated direction angle. Measuring result ismemorized and the display returns to the data collect menu 1/2.	Collimate BS [F2]	V : 90°00′0″ HR : 0°00′0″ SD * [n] <<<m >Measurement… DATA COLLECT 1/2 F1: OCC.PT# INPUT F2: BACKSIGHT F3: FS / SS P↓

*1) Pressing each time the [F3] key, the input method changes as Coordinate value, Angle, Coordinate point number alternatively.
*2) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*3) PCODE can be input by inputting a register number linked with PCODE Library, to show the list of PCODE library, press the [F2](SRCH) key
*4) Data collect sequence can be set to [EDIT→Measurement]. Refer to Section 7.6 “Setting Parameter of Data Collect [CONFIG.]”.
• If point is not found in internal memory, "PT# DOES NOT EXIST" is displayed.

7.2 Operational Procedure of “DATA COLLECT”

Operating procedure	Operation	Display
		DATA COLLECT 1/2 F1: OCC.PT# INPUT F2: BACKSIGHT F3: FS / SS P↓
□Press the [F3](FS/SS) key from the data collect menu 1/2. The previous data is shown.	[F3]	PT# : = PT-01 PCODE : R.HT : 0.000 m INPUT SRCH MEAS ALL
□Press the [F1](INPUT) key and enter PT#. Press the [F4](ENT) key. *1)	[F1] Input point number [F4]	PT# : = PT-01 PCODE : R.HT.: 0.000 m [ALP] [SPC] [CLR] [ENT]
□Enter PCODE, R.HT in the same way. *2),3)	[F1] Input PCODE [F4] [F1] Inputs R.HT [F4]	PT# : = PT-01 PCODE : R.HT : 1.200 m INPUT SRCH MEAS ALL －－－－－－－－－－－－ VH *SD NEZ OFSET
□press[F3](measurement)key	[F3]	

□Collimate target point □press any key from[F1] to [F3]*4 Example:[F2](SD) to start measurement The measuring data is memorized and the display changes to the next point. *5) PT# is automatically incremented. □Enter the next point data and collimate the next point. □Press [F4](ALL) key. Measuring starts in the same measuring mode of the previous point. Data is recorded. Continue the measuring in the same way. To finish the mode , press [ESC] key.	Collimate [F2] Collimate [F4]	V : 90°10′20″ HR : 120°30′40″ SD* [n] <m >Measurement…….. －－－－－－－－－－－－ <complete> ↓ PT# → PT-02 PCode: GOWIN R.HT: 1.200 m INPUT SRCH MEAS ALL V : 90°10′20″ HR : 120°30′40″ SD * [n] <m >Measurement……. －－－－－－－－－－－－ <complete> ↓ PT# → PT-03 PCode: GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”
*2) PCODE can be input by inputting a register number linked with PCODE Library. to show the list of PCODE library, press the [F2](SRCH) key.
*3) Data collect sequence can be set to [MEAS→ EDIT]. See to Section 7.7 “Setting Parameter of Data Collect [CONFIG.]”.
4)The mark“”indicates the previous measuring mode.
*5)You can confirm the measurement data as follows, See Section 7.6 “Setting Parameter of Data Collect [CONFIG.]”

V : 90°10′20″
HR : 120°30′40″
SD : 98.765 m
>OK? [YES] [NO]

● **Searching record data**

While executing the DATA COLLECT mode, you can search the recorded data.

Operating procedure	Operation	Display
1 While executing the DATA COLLECT mode, press [F2] (SRCH) key. *1) The using file name will appear on the top of the right side of the display. ***2*** Select one of three search methods by pressing [F1] to [F3] key. *2)	[F2] [F1] to [F3]	PT# → PT-02 PCode: R.HT : 1.200 m INPUT SRCH MEAS ALL SEARCH [GOWIN] F1: FIRST DATA F2: LAST DATA F3: PT# DATA
*1) It is possible to see the PCODE list when the arrow is located beside PCODE or ID. *2)The operation is same as the "SEARCH" in the MEMORY MANAGER mode, the details refer to 9.2 ”Searching data”.		

● **Entering PCODE / ID using PCODE Library**

While executing the DATA COLLECT mode, you can enter PCODE /ID from PCODE Library.

Operating procedure	Operation	Display
Move the arrow to the PCODE or ID in the DATA COLLECT mode, press the [F1](INPUT) key. □Enter a register number linked with PCODE library and press the [F4] (ENT)key Example: registration number, 32=GOWIN	[F1] Input registration number [F4]	PT# → PT-02 PCode: R.HT : 1.200 m INPUT SRCH MEAS ALL Point Number: PT-02 Code = 32 R.HT : 1.200m [ALP] [SPC] [CLR] [ENT] PT# → PT-02 PCode: GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL

● Entering PCODE / ID from the list of PCODE

You can input PCODE / ID with PCODE list

Operating procedure	Operation	Display
□Move the arrow to the PCODE or ID in the DATA COLLECT mode, press the [F2](SRCH) key.	[F2]	Point Number: PT-02 Code: → R.HT.: 1.200m Enter Search Measure same with previous
□By pressing the following keys, the register number will increase or decrease. [▲]or[▼]:Increasing or Decreasing one by one [►]or[◄]:By ten Increasing or Decreasing. *1)	[▲]or[▼] [►]or[◄]	→001:PCODE0l 002:PCONE02 Edit Clear Enter 031:PCODE31 →032:GOWIN 033:HILTOP Edit - - - Clear Enter
□press[F4](Enter)key	[F4]	Point Number: PT-02 Code: GOWIN R.HT.→ 1.200m Enter Search Measure same with previous

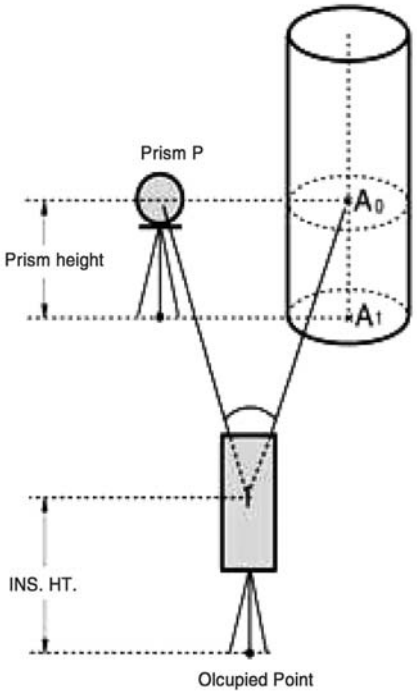
*1) To edit the PCODE library, press the [F1](EDIT) key.
To delete the PCODE registered shown by an cursor, press the [F3](CLR) key. PCODE can be edited in DATA COLLECT menu 2/2 or MEMORY MANAGER menu 2/3.

7.3 Data Collection Offset Measurement Mode

This mode is useful when it is difficult to set up the prism directly, for example at the center of a tree. Data Collect . Offset Measurement has four measuring methods.

- Angle offset measurement
- Distance offset measurement
- Plane offset measurement
- Column offset measurement

7.3.1 Angle Offset Measurement



Place the prism at the same horizontal distance from the instrument as that of point A0 to measure.

When measuring coordinates of ground point A1: Set the instrument height/prism height.

When measuring coordinates of point A0: Set the instrument height only. (Set the prism height to 0).

When sighting to A0, you can select one of two ways. One is to fix vertical angle to the prism position even up down the telescope position, and the other is to gear vertical angle to the up down of telescope movement. In case following the vertical angle to the movement of telescope, SD (Slope Distance) and VD (Vertical Distance) will be changed according to the movement of telescope.
To set this option, refer to Chapter 16 “SELECTING MODE”.

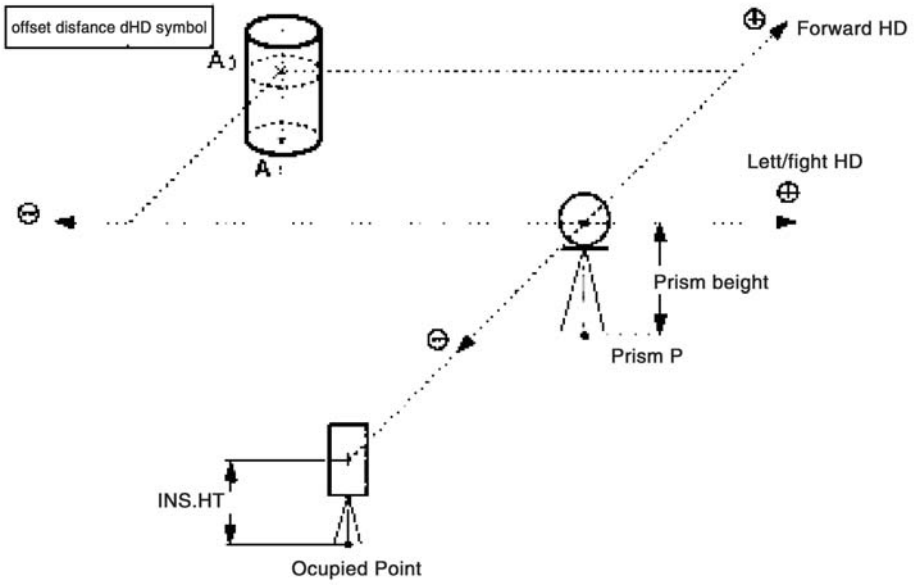
Operating procedure	Operation	Display
□Press[F3](MEAS) key	[F3]	PT# : →PT-11 PCODE : GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL ——————————— VH *SD NEZ P1↓ ——————————— OFSET PTL P2↓

□Press[F4](P1↓)key, [F1](OFSET)key	[F4] [F1]	OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓
□Press[F1]key	[F1]	OFFSETMEASUREMENT HR :120°30′40″ HD : m >Sight ? [YES] [NO]
□Collimate the prism	Collimate P	OFFSETMEASUREMENT HR :120°30′40″ HD*[n] <m >Measurement…
⑤Press[F3](yes)key to carry out Continuous measurement	[F3]	↓ OFFSETMEASUREMENT HR : 120°30′40″ SD* 12.345 m >OK? [YES][NO]
□Collimate point A0 using the horizontal motion clamp and horizontal tangent screw.	Collimate A0	OFFSETMEASUREMENT HR :120°30′40″ SD: 12.345 m >OK? [YES][NO]
□Show the horizontal distance of A0	[◢]	OFFSETMEASUREMENT HR :120°30′40″ HD: 6.543 m >OK? [YES][NO]
□Show the relative elevation of point A0 ·Each time press[◢] Key, can show horizontal distance, relative elevation and slope distance in turn	[◢]	OFFSETMEASUREMENT HR :120°30′40″ VD: 0.843 m >OK? [YES][NO]

□Show point A0 orA1 N coordinate(north coordinate) ·Each time press[↑↳] Key, it will show N, E and Z coordinate in turn	[↑↳]	OFFSETMEASUREMENT HR : 120°30′40″ N : -12.345m >OK? [YES][NO]
□Press[F3](YES)key The data is recorded and the next measuring point is displayed.	[F3]	PT# → PT-12 PCODE : GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL

7.3.2 Distance Offset Measurement

The measurement of a place apart from a prism is possible by inputting offset horizontal distance of front and back / right and left.



When measuring coordinates of ground point A1: input the instrument height/prism height.

When measuring coordinates of point A0: input the instrument height only. (Set the prism height to 0).

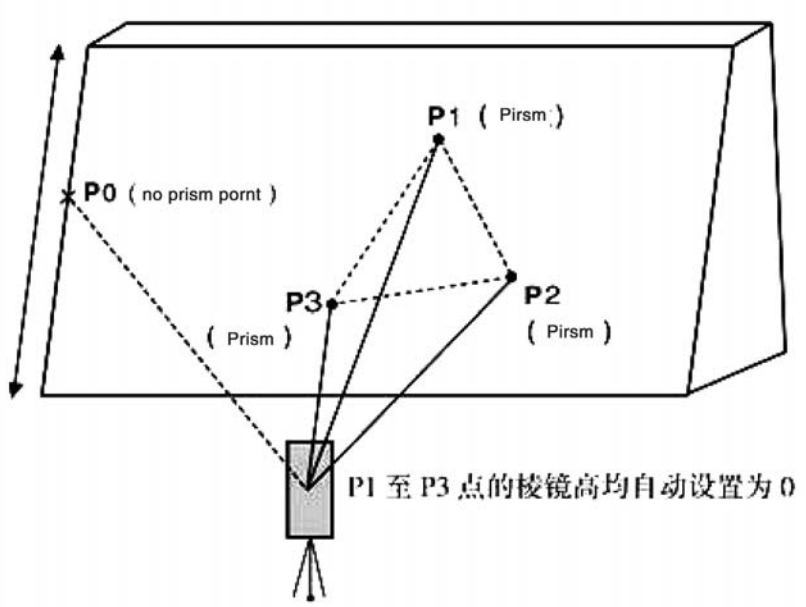
Operating procedure	Operation	Display
□ press[F3](MEAS)key	[F3]	PT# → PT-11 PCODE : GOWIN R.HT : 1.200 m INPUT RCH MEAS ALL ———————————— VH *SD NEZ P1↓ ———————————— OFSET PTL P2↓
②press[F4](P1↓)key, [F1](OFSET)key	[F4] [F1]	OFFSET 1/2 F1: ANGLE OFFSET F2: DIST OFFSET F3: PLANE OFFSET P↓
□press[F2]key	[F2]	DISTANCE OFFSET INPUT R or L HD oHD : 0.000 m --- --- [CLR] [ENT]
□Enter Right and Left direction offset value.*1)	Input HD [F4]	DISTANCE OFFSET INPUT FORWARD HD oHD : 0.000 m --- --- [CLR] [ENT]
□Enter Forward direction offset value. *1)	Input HD [F4]	PT# : PT-11 PCODE : GOWIN R.HT : 1.200 m --- *SD NEZ ---
⑥Collimate the prism ⑦press[F2]or[F3] Key Example:[F3][NEZ] key To carry out measurement	Collimate P [F3]	N * [n] <<<m E : m Z : m >Measurement…….. ———————————— >Calculating……

Measurement data is recorded into next target point Measurement display		PT# → PT-12 PCODE : GOWIN R.HT : 1.200 m INPUT RCH MEAS ALL

*1) To skip entering, press the [F3](SKP) key.

7.3.3 Plane Offset Measurement

Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for a edge of a plane.
three random prism points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane. Collimate the measuring target point(P0).then the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



Operating procedure	Operation	Display
□ press[F3](MEAS)key	[F3]	PT# → PT-11 PCODE : GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL ———————————— VH *SD NEZ P1↓ ———————————— OFSET PTL P2↓
□press[F4](P1)key, [F1](OFSET)key	[F4] [F1]	OFFSET 1/2 F1: ANGLE OFFSET F2: DIST OFFSET F3: PLANE OFFSET P↓
□press[F3](PLANE OFFSET) key	[F3]	PLANE N001 # : SD : m >Measurement……
□collimate prism P1, press[F1] (MEAS)key to start After it is finished, the display prompts for 2nd point measurement	Collimate P1 [F1]	PLANE N001 # : SD* [n] <<m >Measurement……..
		↓
□Measure 2nd point and 3rd point with same method,the display changes into plane offset measurement down	Collimate P2 [F1]	PLANE N002 # : SD: m MEAS --- --- ---
		↓
	Collimate P3 [F1]	PLANE N003 # : SD : m MEAS --- --- ---
		↓

The display changes to PT# input in the plane offset measurement. *1) Input point number if necessary.	[F4]	PLANE PT# → PT-11 PCODE : GOWIN INPUT SRCH --- MEAS
□Press the [F4](MEAS) key. The instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane. *2)	Collimate P0	HR : 80°30′40″ HD : 54.321m VD : 10,000m >0K? [YES] [NO]
□Collimate the edge (P0) of the plane. *3), 4)		HR : 75°30′40″ HD : 54.600 m VD : -0.487 m >0K? [YES] [NO]
□If want to show slope distance (SD), press[◢]key · Each time pressing the [◢] key, horizontal distance, relative elevation and slope distance are shown in sequence. To show coordinate value of point P0, press the [⌐] key.		V : 90°30′40″ HR : 75°30′40″ SD: 54.602 m >0K? [YES] [NO]
□press[F3](YES)key. The measured data will be recorded and the next offset point number will be displayed.	[F3]	PLANE PT# → PT-12 PCODE : GOWIN INPUT SRCH --- MEAS
□To escape the measuring, press the [ESC] key. The display returns to the next point number in data collect mode.	[ESC]	PT# → PT-12 PCODE : GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL

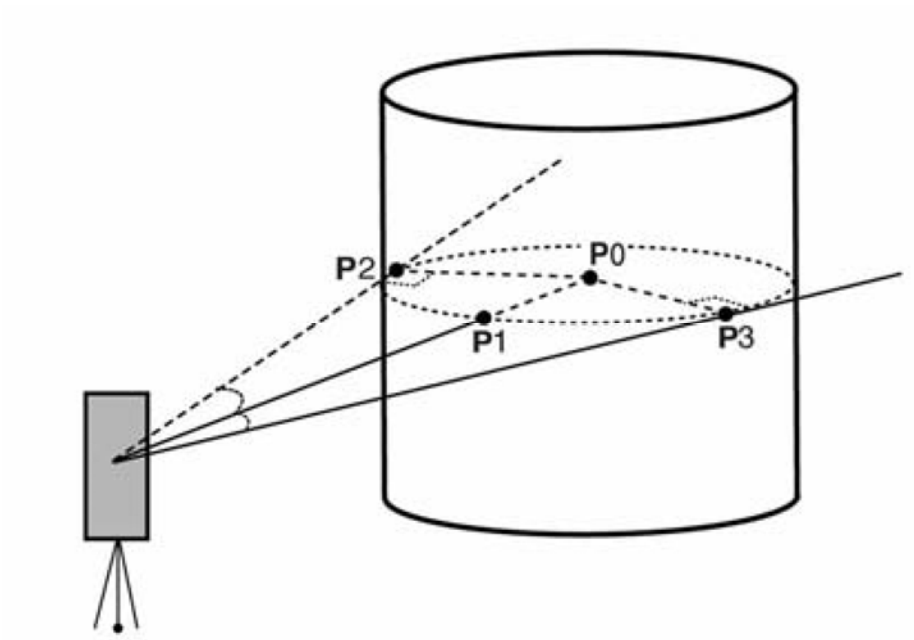
*1)In case the calculation of plane was not successful by the measured three points, error information displays. Start measuring over again from the first point.

*2)Data display is the mode beforehand of offset measurement mode.

*3)Error will be displayed when collimated to the direction which does not cross with the determined plane.
*4)The reflector height of the target point P0 is set to zero automatically.

7.3.4 Column Offset Measurement

If it is possible to measure circumscription point (P1) of column directly, the distance to the center of the column (P0), coordinate and direction angle can be calculated by measured circumscription points (P2) and (P3).
The direction angle of the center of the column is 1/2 of total direction angle of circumscription points (P2) and (P3).



Operating procedure	Operation	Display
①Press[F3](MEAS)key	[F3]	PT# → PT-11 PCODE : GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL VH *SD NEZ P1↓ OFSET PTL P2↓

②Press[F4](P1↓)key, [F1](OFSET)key	[F4] [F1]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET P↓
③Press[F4](P↓)key	[F4]	OFFSET 2/2 F1:COLUMN OFFSET P↓
④Press[F1] (COLUMNOFFSET) key	[F1]	COLUMN OFFSET Center HD : m MEAS --- --- ---
⑤Collimate the center of the column (P1) and press the [F1](MEAS) key. Measuring will start.	Collimate P1 [F1]	COLUMN OFFSET Center HD* [n] <<m >Measurement……
		↓
After the measurement, angle measuring display of the left side (P2) will be shown.		COLUMN OFFSET Left HR : 120°30′40″ --- --- --- SET
⑥Collimate the left side point (P2) of column and press[F4] (set)key. After the measurement, angle measuring display of the right side (P3) will be shown.	Collimate P2 [F4]	COLUMN OFFSET Right HR : 180°30′40 --- --- --- SET

⑦Collimate the right side of the column (P3) and press the [F4](SET) key. The distance between the instrument and center of the column (P0) will be calculated	Collimate P3 [F4]	COLUMN OFFSET HR : 150°30′40″ HD : 43.321 m >OK? [YES] [NO]
To show the relative elevation (VD), press the[◢] key. Each time pressing the [◢] key, horizontal distance, relative elevation and slope distance are shown in sequence. To show coordinate of point P0, press the [⦜] key.	[◢]	COLUMN OFFSET HR : 150°30′40″ HD : 2.321 m >OK? [YES] [NO]
⑧press[F3](yes)key, The display will be back to next measurement point number Under data Collection mode	[F3]	PT# → PT-12 PCODE : GOWIN R.HT : 1.200 m INPUT SRCH MEAS ALL

7.4 NEZ Auto Calculation

As measured data is collected, coordinates are calculated and stored for traverse or topo collection. Automatic making out function of coordinate data sets up in CONFIG of data collect. Refer to Section 7.7 “Setting Parameter of Data Collect [CONFIG.]”.

As a default, coordinate data calculated will be saved in a file of the same name as the measurement data file.

When the coordinate data file of the same name as the measurement data file does not exist, it will be generated automatically. It is possible to change a file for saving coordinate data in the DATA COLLECT Menu 2/2 (F1:SELECT A FILE).

To calculate a coordinate data, it is necessary to add a point number in Data Collect execution.

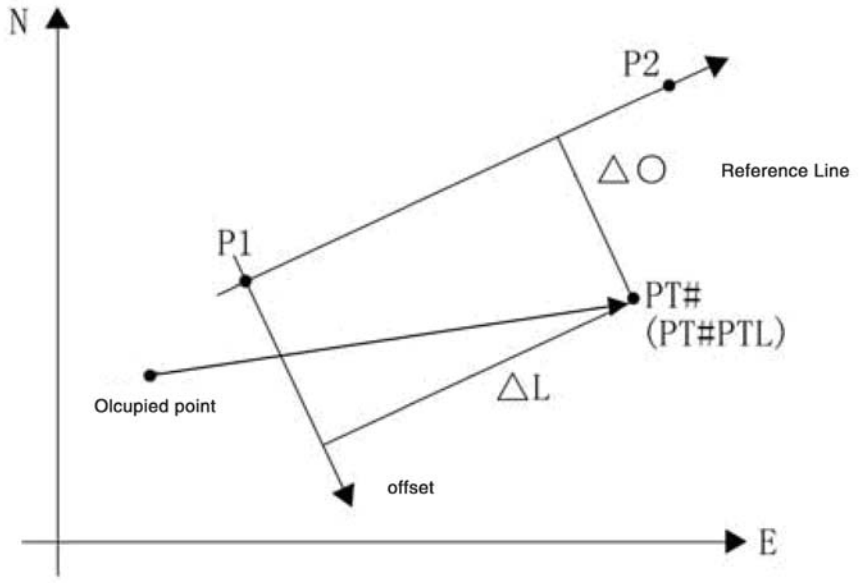
When a coordinate data of the same point number exist already, it can be replaced with the new data by confirming display.

- **Coordinates will be calculated using the grid factor.**

  To set the grid factor, see Section 6.2 ”Setting the GRID FACTOR”.

7.5 Point to Line Measurement

In this mode, a offsetting point from a certain determined line can be measured.



7.5.1 To change to the point to line measurement

Operating procedure	Operation	Display
		PT# → PT-01 PCODE : GOWIN R.HT : 1.500 m INPUT SRCH MEAS ALL
□Press[F3](MEAS) Press[F4]	[F3] [F4]	PT# →PT-01 PCODE: GOWIN R.HT.: 1.500 m VH * SD NEZ P1↓ ———————————— OFSET PTL P2↓
□press[F2](PTL)	[F2]	POINT TO LINE MODE [F1:ON] F2:OFF ENTER

□Press the [F1](ON) key and press the [F4](ENTER) key. The input screen of a reference point 1 will appear.	[F4]	REF. Point 1 PT# :_____ INPUT LIST ENTER
□Enter the point 1 data and press the [F4](Enter).The input screen of a reference point 2 will appear.	Input data [F4]	REF. Point 2 PT# :_____ INPUT LIST ENTER
□Enter the point 2 data and press the [F4](Enter). The screen will return to data collect measurement. If the PTL measurement mode is available, 'PTL' will appear next to PT#.	Input data [F4]	PT# PLT→ PT-01 PCODE : GOWIN R.HT : 1.500 m INPUT SRCH MEAS ALL

7.5.2 Execute "Measurement from point to line"

Operating procedure	Operation	Display
Conduct data measurement according to the same procedure as with ordinary FS/SS (ALL can also be selected). However, when you conduct observation in the angle mode, PTL data will not be displayed (only the raw data will be recorded, upon which the operation will end).		PT# PLT→ PT-01 PCODE : GOWIN R.HT : 1.500 m INPUT SRCH MEAS ALL

□press[F3](MEAS)	[F3]	PT# PLT→ PT-01 PCODE : GOWIN R.HT : 1.500 m VH *SD NEZ
□Press the [F2](SD) key. If the PTL mode is on, then, after the coordinate data is calculated, the PTL data will be displayed regardless of the coordinate check setting, etc.	[F2]	V : 90°30′20″ HR : 120°30′40″ SD * <m >Measurement……
□ PTL measurement data will display. Confirm the data and press [F3](YES) key. The recorded data are measured data and coordinate data generated at the same time as a PTL data.	[F3]	L: 44.789m O: 33.456m E: 2.321m >REC? [YES][NO]
		PT# PLT→ PT-02 PCODE : GOWIN R.HT : 1.500 m INPUT SRCH MEAS ALL

• In the PTL measurement mode, NEZ Auto Calculation wil be turned on compulsorily and the coordinate data will be stored into a coordinate file.

7.6 EDIT PCODE LIBRARY [PCODE INPUT]

PCODE data can be entered into PCODE Library in this mode.

A PCODE is linked with a number of 1 to 50.

PCODE can be edited with same method under Memory Manager menu 2/3

Operating procedure	Operation	Display
		DATA COLLECT 2/2 F1: SELECT A FILE F2: PCODE INPUT F3: CONFIG P ↓
□Press the [F2](PCODE INPUT) key from Data Collect menu 2/2.	[F2]	→001:GOWIN 002:BEIJING EDIT --- CLR ---
□By pressing the following keys, the list will increase or decrease. [▲]or[▼]:Increase or Decreasing one by one [►]or[◄]By ten Increasing or Decreasing.	[▲]or[▼] [►]or[◄]	011:URAH →012:AMIDAT 013:HILLTO EDIT --- CLR ---
□press[F1](EDIT)key	[F1]	011:URAH →012:AMIDAT 013:HILLTO 1234 5678 90.-[ENT]
□Input PCODE, press[F4](ENT)key*1)	Input code [F4]	011:URAH →012:AMIDAT 013:HILLTO [ALP] [SPC] [CLR] [ENT]
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”		

7.7 Setting Parameter of Data Collect [CONFIG.]

In this mode, the following settings of data collect mode are possible.

● **Setting Items**

Menu	Choose items	Contents
F1:DIST MODE	FINE / CRS(1) / CRS(10)	Select Fine /Coarse(1) /Coarse(10) mode in distance measurement mode. The unit to be displayed is as follows. Fine mode: 1mm (0.2mm) Coarse (1) mode: 1mm Coarse (10) mode: 10mm
F2:HD/SD	HD/SD	Select the distance measurement mode Horizontal distance or Slope distance.
F3:MEAS. SEQ.	N-TIMES / SINGLE / REPEAT	Select to set measurement mode for distance measurement.
F1:DATA CONFIRM	YES/NO	It is possible to confirm the result of measuring data before the data is recorded.
F2:COLLECT SEQ.	[EDIT→MEAS] / [MEAS→EDIT]	Select the procedure of data collection. [EDIT→MEAS] :Measurement is carried out after entering other data. [MEAS→EDIT] :Measurement is carried out before entering other data.
F3:NEZ AUTO. CALC	ON/OFF	It is possible to calculate coordinate value of data collected and store it into coordinate data file in every data collection.

● **How to Set Items**

Example Setting: DATA CONFIRM : YES

Operating procedure	Operation	Display
		DATA COLLECT 2/2 F1: SELECT A FILE F2: PCODE INPUT F3: CONFIG P↓
□Press the [F3] (CONFIG.) key from the data collect menu 2/2. The CONFIG menu 1/2 is shown.	[F3]	CONFIG 1/2 F1: DIST A FILE F2: HD/SD F3: MEAS. SEQ P↓
□Press the [F4](P↓) key to display the CONFIG menu 2/2.	[F4]	CONFIG 2/2 F1: DATA CONFIRM F2: COLLECT SEQ F3: NEZ AUTO. CALC P↓
□press[F1](data confirm) key [ ]indicating the paraters currently set.	[F1]	DATA CONFIRM 1/2 F1:YES [F2:NO] ENTER
□press[F1](YES)key.		
□press[F4](Enter)key.	[F1] [F4]	DATA CONFIRM 1/2 [F1:YES] F2:NO ENTER

8. LAYOUT

LAYOUT mode has two functions which are setting of layout points and setting new points using coordinate data in the internal memory.
Also, if the coordinate data is not stored in the internal memory, this can be input from key board.The coordinate data is loaded from PC to the internal memory via RS-232C.

- The coordinate data
  The coordinate data is memorized into a file.

For the internal memory, refer to Chapter 9 “MEMORY MANAGER MODE”.
TKS-200 can memorize the data into interal memory and dividing it into measurement data and coordinate data for layout.

- **The number of coordinate data**

(In case not using the internal memory in the data collect mode)

MAX. 24,000 POINTS

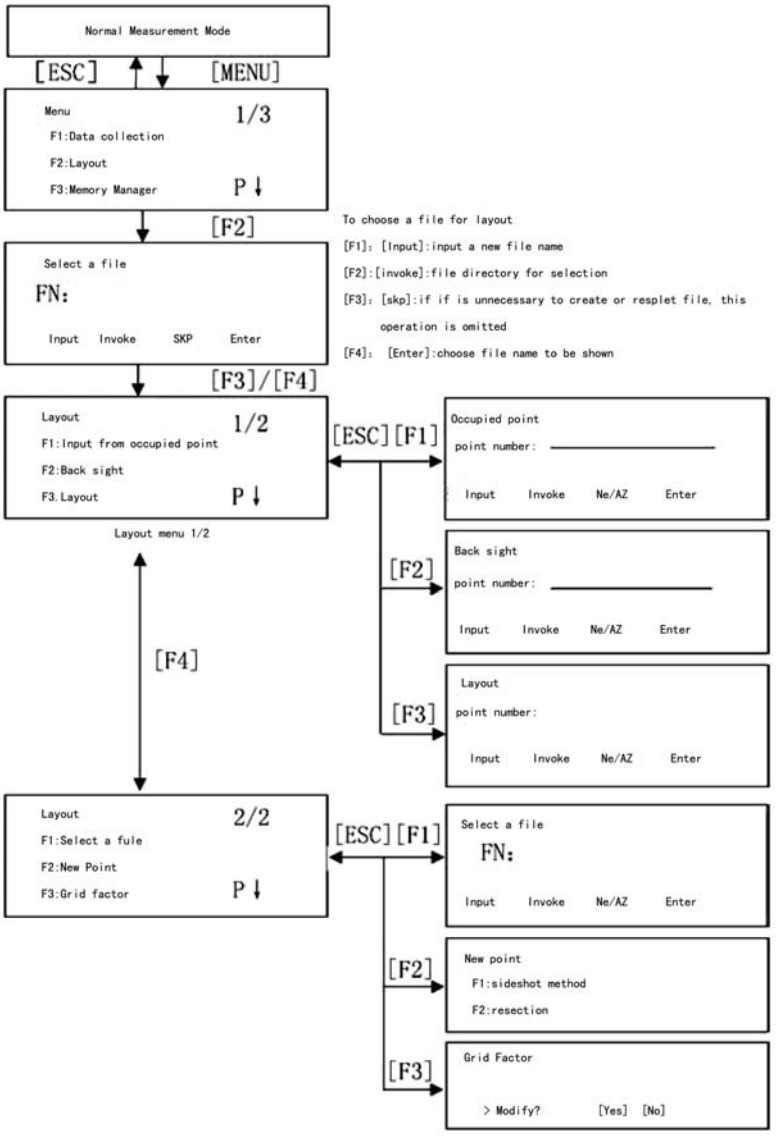
Because the internal memory covers both data collection mode and layout mode, the number of coordinate data will be decreased when the data collection mode is used.

1）**When turning off the power, ensure that the instrument is in the main menu display or angle measurement mode, this ensures completion of the memory access process and avoids possible loss of the stored data.**
2) It is recommended for safety to charge the battery (BT-L1W) beforehand nd prepare fully charged spare batteries.
3) When recording new point data, remember to consider the amount of internal memory available

• Layout menu operation

Press[MENU]key, the instrument enters menu NEMU1/3 mode.

Press[F2](LAYOUT)key, key show layout menu 1/2.



8.1 Preparation

8.1.1 Setting the GRID FACTOR

• Calculation Formula

1) Elevation Factor

$$\textit{Elevation Factor} = \frac{R}{R+ELEV.}$$

R : The average radius of the earth

ELEV. : The elevation above mean sea level

2) Scale Factor

Scale Factor: *Scale Factor at the surveying station*

3) Grid Factor

Grid Factor= Elevation Factor X Scale Factor

Distance Calculation

1) Grid Distance

$$HDg = HD \times Grid\ Factor$$

HDg: Grid Distance

HD: Ground distance

2) Ground Distance

$$HD = \frac{HDg}{Grid\ Factor}$$

·How To Set Grid Facto

Operating procedure	Operation	Display
		LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓
□Press the [F3](GRID FACTOR) key from the Layout menu 2/2.	[F3]	GRID FACTOR =0.998843 >MODIFY? [YES][NO]

□press[F3](YES)key	[F3]	GRID FACTOR ELEV.= 1000 m SCALE=0.999000 --- --- [CLR] [ENT]
□Enter Elevation. *1) Press the [F4](ENT) key.	Input ELEV [F4]	GRID FACTOR ELEV.= 2000 m SCALE=1.001000 --- --- [CLR] [ENT]
□Enter Scale Factor in the same way. Grid Factor is displayed for 1 to 2 second and display returns to Layout menu 2/2.	input SCALE [F4]	GRID FACTOR =1.000686

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.

- Input range, elevation: -9,999 to +9，999m(-32，805+32，805ft，ft +in)
  Scale factor: 0.990000 to 1.010000

8.1.2 Selecting Coordinate Data File

You can execute a Layout from selected coordinate data file, also you can record New point measured data into the selected coordinate data file.

- The only coordinate data file existing can be selected and you can not create a new file in this mode.For more information about file, refer to Chapter 9 “MEMORY MANAGER MODE”
- When LAYOUT MODE is begun, a file can be selected in the same way.

Operating procedure	Operation	Display
		LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P ↓

□Press the [F1](SELECT A FILE) key from the Layout menu 2/2.	[F1]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
□Press the [F2](LIST) key to display the list of coordinate data file.*1)	[F2]	COORDDATA /C0123 →*TOKBDATA /C0345 TOPCDATA /C0789 --- SRCH --- ENTER
□Scroll file list by pressing the [▲]or[▼] key and select a file to use. *2),3)	[▲]or[▼]	*TOKBDATA /C0345 →TOPCDATA /C0789 SATIDATA /C0456 --- SRCH --- ENTER
□Press the [F4](ENTER) key. The file will be set .	[F4]	LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓

*1) If you want to input file name directly, press the [F1](INPUT) key and enter a file name.
2) When a file has been selected already, '' mark is indicated on left of current file name. For the file discrimination mark (*, @, &), refer to Section 9.3 "FILE MAINTENANCE".
*3) Data in a file shown with arrow can be searched by pressing the [F2](SRCH) key.

8.1.3 Setting Occupied Point

There are two methods to set the occupied points as follows

1) Setting from the coordinate data file stored in the internal memory
2) Direct key input of coordinate data

● Example: setting :Setting the occupied point from the internal coordinate data file.

Operating procedure	Operation	Display
□ Press the [F1] (OCC.PT INPUT) key from the Layout menu 1/2.	[F1]	OCC.PT PT# : _____ INPUT LIST NEZ ENTER
□ Press the [F1] (INPUT) key , enter PT# and press the [F4](ENT) key. *1)	[F1] Input PT# [F4]	INSTRUMENT HEIGHT INPUT INS.HT = 0.000 m --- --- [CLR] [ENT]
□press[F2](invoke) key to show data file directory*1	Input INS.HT [F4]	LAYOUT 1/2 F1: OCC.PT INPUT F2: BACKSIGHT F3: LAYOUT P↓
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”		

●Example setting :Setting Instrument point coordinates directly

Operating procedure	Operation	Display
□ Press the [F1](OCC.PT INPUT) key from the Layout menu 1/2.	[F1]	OCC.PT PT# :_____ INPUT LIST NEZ ENTER
□press[F3](NEZ) key	[F3]	N→ 0.000m E: 0.000m Z: 0.000m INPUT --- PT# ENTER
□press[F1](input)key,input coordinate value press[F4] (ENT)key *1)、*2)	[F1] Input coord [F4]	COORD.DATA INPUT PT# : INPUT --- --- ENTER

□ Press the [F1](INPUT) key and enter PT#. Press the [F4](ENT) key. *2)	[F1] Input PT# [F4]	INSTRUMENT HEIGHT INPUT : INS.HT = 0.000 m --- --- [CLR] [ENT]
□ Enter Instrument Height in the same way. The display returns to layout menu 1/2.	[F1] Input INS.HT [F4]	LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters” *2)The coordinate value can be memorized into instrument, refer to 16 ”Selecting mode”		

8.1.4 Set Backsight Point

Following three backsight point setting methods can be chosen.

1) Set backsight point by utilizing coordinate data file in the internal memory.

2) Direct key input of coordinate data.

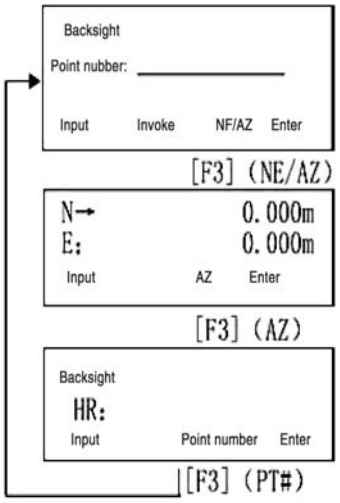
3) Direct key input of setting angle.

- Example setting :Setting the backsight point from the internal coordinate data file

Operating procedure	Operation	Display
□from layout menu: l/2press[F2](backsight)key	[F2]	BACKSIGHT PT# :_____ INPUT LIST NE/AZ ENTER
□press[F1](input) key to input point number press[F4](ENT) key*1)	[F1] Input PT# [F4]	BACKSIGHT H (B) = 0°00′00″ >Sight ? [YES] [NO]
□ Sight the backsight point and press the [F3](YES) key.	Sight BK [F3] [F3]	

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”

- Whenever press[F3]key, the method to input backsight point varies in turn.



Operating procedure	Operation	Display
□From layout menu1/2 press[F2](backsight)key to show original data	[F2]	BACKSIGHT PT# :_____ INPUT LIST NE/AZ ENTER
□press[F3](NE/AZ)key	[F3]	N→ 0.000 m E : 0.000 m INPUT --- AZ ENTER
□press[F1](input)key,input coordinate value press[F4](ENT)key*1)、*2)	[F1] Input coord [F4]	BACKSIGHT H(B) = 0° 00′ 00″ >SIGHT? [YES] [NO]

□Sight the backsight point □Press[F3](yes)key Display backs to layout menu 1/2	Sight BK [F3]	LAYOUT 1/2 F1: OCC.PT INPUT F2: BACKSIGHT F3: LAYOUT P↓
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters” *2)The coordinate value can be memorized into instrument, refer to 16 ”Selecting mode”		

8.2 Executing a Layout

Two methods can be selected for executing a Layout:

1) Recalling points from internal memory by point number.

2) Direct key input of coordinate values

Example:Recalling point from internal memory.

Operating procedure	Operation	Display
		LAYOUT 1/2 F1: OCC.PT INPUT F2: BACKSIGHT F3: LAYOUT P↓
□ Press the [F3](LAYOUT) key from the layout menu 1/2.	[F3]	LAYOUT PT#:_____ INPUT LIST NEZ ENTER
②Press the [F1](INPUT) key, and enter PT#. *1) Press the [F4](ENT) key. *2)	[F1] Input PT# [F4]	REFLECTOR HEIGHT INPUT R.HT= 0.000 m --- --- [CLR] [ENT]

□ Enter reflector height in the same way. When the layout point is set, the instrument will start layout calculation. HR: Calculated horizontal angle of the layout point HD: Calculated horizontal distance from the instrument to the layout point	Input R.HT [F4]	CALCULATE HR= 90°10′20″ HD= 123.456 m ANGLE DIST --- ---
□ Collimate prism,press[F1] (angle)key. PT#: Layout point HR: Measured (Actual) horizontal angle. dHR: Horizontal angle to be turned to the layout point = Actual horizontal angle – Calculated horizontal angle. Correct direction when dHR = 0°00'00"	Colimate P [F1]	PT# : LP-100 HR= 6°20′40″ dHR= 23°40′20″ DIST --- NEZ ---
⑤Press the [F1](DIST) key. HD: Measuring (Actual) horizontal distance dHD: Horizontal distance to be turned to the layout point = Actual horizontal distance – Calculated horizontal distance. dZ: Vertical distance to be turned to the layout point = Actual vertical distance – Calculated vertical distance.	[F1]	HD* [t] <m dHD : m dZ: m MODE ANGLE NEZ NEXT ↓ HD* 143.84 m dHD : -13.34 m Dz : -0.05 m MODE ANGLE NEZ NEXT

⑥press[F1](mode)key to carry out fine mode	[F1]	HD* [r] <m dHD : m dZ : m MODE ANGLE NEZ NEXT ↓ HD* [r] 156.835 m dHD : -3.327 m dZ: -0.046 m MODE ANGLE NEZ NEXT
⑦When display value dHR，dHD and dZ are all 0, the measurement and setting of layout point has been completed *3)		
□ Press the [F3](NEZ) key. The coordinate data is shown.	[F3]	N * 100.000 m E : 100.000 m Z : 1.015 m MODE ANGLE --- NEXT
□ Press the [F4](NEXT) key to set next layout point . PT# is automatically incremented.	[F4]	LAYOUT PT# : LP-101 INPUT LIST NEZ ENTER

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*2) Point number could not be entered when data to comply with the coordinate value does not exist in the file.
*3) Cut & Fill displaying function is available . Refer to Chapter 16 “SELECTING MODE”.

8.2.1 Layout of Coordinates of Point to Line

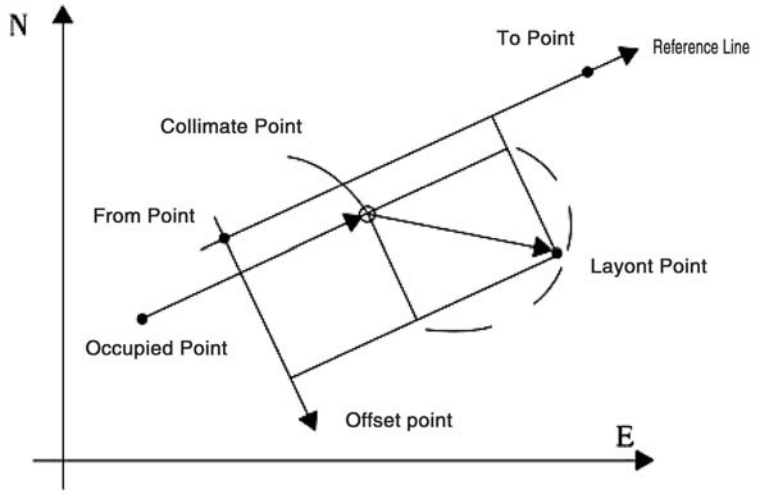
The coordinate data of point to line can be used during execution of layout.

When a point name including PTL coordinates (including 'From' and 'To' data) is specified, the mode will

change to PTL mode automatically.

There are two ways to enter the PTL coordinate data, Direct key input and Data transfer.

Refer to 9.4.2 "PTL (Point to Line) data input" and 9.7 "Data Communications".



Operating procedure	Operation	Display
		LAYOUT PT# : PT-21 INPUT LIST NEZENTER
□Press the [F1](INPUT) key, and enter PT#. Press the [F4](ENT) key.	[F1] Input PT# [F4]	REFLECTOR HEIGHT INPUT R.HT : 1.500 m --- --- [CLR] [ENT]
□ Enter reflector height in the same way. when the layout point is set, the instrument will start layout calculation.The function key is designated as [F3](PTL)key.	Input R.HT. [F4]	CALCULATE HR = 45°10′20″ HD = 1.500 m ANGLE DIST PTL ---

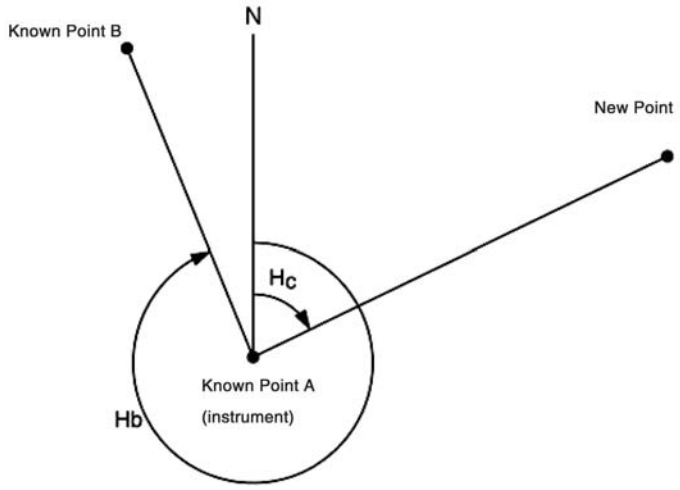
□Collimate the prism, and press the [F1](ANGLE) key.	Collimate P [F1]	PT# : LP-100 HR : 45°00′00″ dHR : 0°00′00″ DIST --- PTL ---
□Press the [F1](DIST) key. HD: Measuring (Actual) horizontal distance dHD: Horizontal distance to be turned to the layout point = Actual horizontal distance – Calculated horizontal distance. dZ: Vertical distance to be turned to the layout point = Actual vertical distance – Calculated vertical distance.	[F1]	HD : 143.8 m dHR : -13.34 m dz: -0.05 m MODE PTL NEXT
□press[F2](PTL)key to show the coordinate difference between collimating point and layout point which is corresponding to selected reference line reference frame. NEZ:coordinate data PTL:Point To Line Coordinate Data	[F2]	dL: 0.005 m dO: 0.327 m dE: 0.046 m MODE ANGLE NEXT

8.3 Setting a New Point

New point is required for example when a layout point cannot be sighted from existing control points.

8.3.1 Side Shot Method

Set up the instrument at a known point, and measure the coordinate of the new points by the side shot method



Operating procedure	Operation	Display
		LAYOUT 1/2 F1: OCC.PT INPUT F2: BACKSIGHT F3: LAYOUT P↓
□Press the [F4](↓) key from the layout menu 1/2 to get the layout menu 2/2.	[F4]	LAYOUT 1/2 F1: SELECT A FILE F2: NEW POINT F3: GRID FACTOR P↓
□PRESS[F2](NEW POINT)KEY	[F2]	NEW POINT F1: SIDE SHOT F2: RESECTION
□PRESS[F1](SIDE SHOT)KEY	[F1]	SELECT A FILE FN :_____ INPUT LIST --- ENTER
□Press the [F2](LIST) key to display the list ofcoordinate data file. *1)	[F2]	COORDDATA /C0123 →*TOKBDATA /C0345 TOPCDATA /C0789 --- SECH --- ENTER

□Press[▲]or[▼]key, the file list can roll up and down to choose a file*2)*3)	[▲]or[▼]	*TOKBDATA/ C0345 →TOPCDATA /C0789 SATIDATA /C0456 --- SECH --- ENTER
□Press the [F4](ENTER) key. The file will be set .	[F4]	SIDE SHOT PT# : _____ INPUT SRCH --- ENTER
□Press[F1](INPUT)key to input new point name.*4） Press[F4](ENT)key	[F1] Input PT# [F4]	REFLECTOR HEIGHT INPUT R.HT : 1.235 m --- --- [CLR] [ENT]
□Enter reflector height with the same method	Input R.HT [F4]	REFLECTOR HEIGHT INPUT R.HT : 1.235 m >Sight ? [YES] [NO]
□Collimate the new point, and press the [F3](YES) key. Distance measuring starts.	Collimate [F3]	HR : 123°40′20″ HD* [n] <m VD : m >Measurement… －－－－－－－－－－ <complete> ↓ N : 1234.567 m E : 123.456 m Z : 1.234 m >REC ? [YES] [NO]
□Press the [F3](YES) key.*5) The name and coordinate value are stored into COORD.DATA. The input menu for next new point is displayed. PT# is automatically incremented.	[F3]	SIDE SHOT PT# : NP-101 INPUT SRCH --- ENTER

*1) If you want to input file name directly, press the [F1](INPUT) key and enter a file name.
2) For the file discrimination mark (, @, &), refer to Chapter 9.3 “FILE MAINTENANCE” When a file has been selected already, a “*” mark is indicated on left of current file name.
*3) Data in a file shown with arrow can be searched by pressing [F2](SRCH) key.
*4) Refer to Section 2.5 “How to Enter Alphanumeric characters”
*5) An error will be displayed when the internal memory is full.

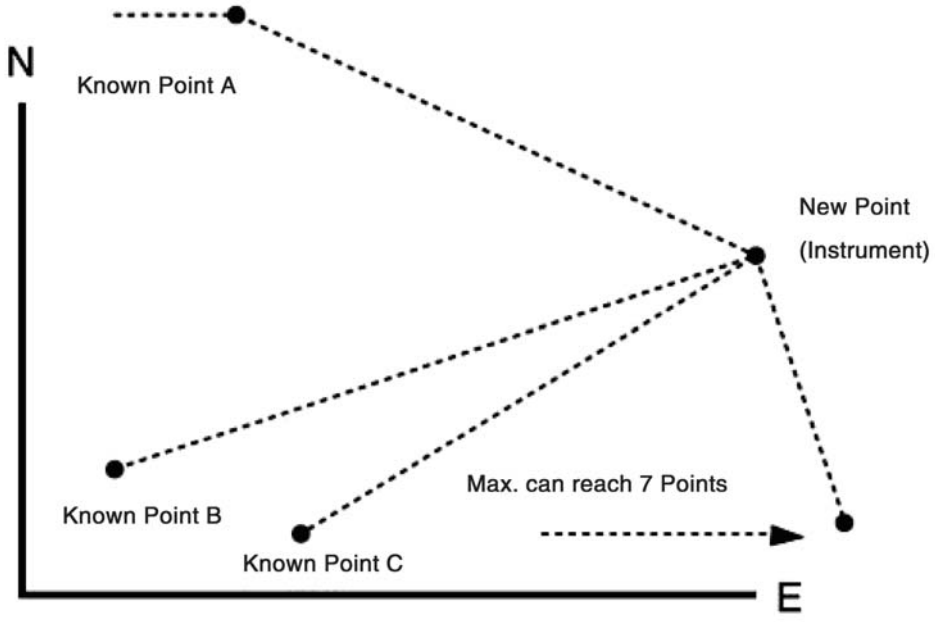
8.3.2 Resection Method

Set up the instrument at a new point, and calculate the coordinate of the new point using the coordinate data of maximum seven known points and the measurements made to these points.By following observation, resection is possible.

·Resection by distance measurement:2 or more points must be measured

•Resection by angle measurement only:3 or more points must be measured

In case that 3 known points are measured by angle measurement only, the value would not be calculated by the method of least squares.



Operating procedure	Operation	Display
		LAYOUT 1/2 F1: OCC.PT INPUT F2: BACKSIGHT F3: LAYOUT P↓
1 From layout menu1/2 press[F4] (P↓), enter layout menu 2/2	[F4]	LAYOUT 1/2 F1: SELECT A FILE F2: NEW POINT F3: GRID FACTOR P↓
2 Press[F2](NEW POINT)key	[F2]	NEW POINT F1: SIDE SHOT F2: RESECTION
3 Press[F2](RESECTION)key	[F2]	NEW POINT PT#:_____ INPUTSRCH SKP ENTER
4 Press the [F1](INPUT) key, and enter the new point name. *1) ,2) Press the [F4](ENT) key.	[F1] Input PT# [F4]	INSTRUMENTHEIGHT INPUT INS.HT = 0.000 m --- --- [CLR] [ENT]
5 Enter instrument height in the same way.	Input INS.HT [F4]	N001# PT# :_____ Input List NEZ Enter
6 Enter the known point A number. *3)	[F1] Input PT#	REFLECTOR HEIGHT INPUT R.HT = 0.000 m --- --- [CLR] [ENT]
7 input reflector height	Input R.HT [F4]	REFLECTOR HEIGHT INPUT R.HT = 0.000 m >Sight ? ANG DIST

8 Collimate the known point A, and press the [F3](ANG) or [F4](DIST) key. Example:[F4](DIST) Distance measuring starts. Known point B entering display will be shown.	Collimate A [F4]	HR : 123°40′20″ HD* <m VD : m >Measurement… — — — — — — — — — <complete> ↓ N002# PT#:_____ Input List NEZ Enter
9 Same as procedure ***6*** to ***8*** proceed to the known point B. When two points have been measured by the [F4](DIST) key, the RESIDUAL ERROR will be calculated. *4)		Select Grid Factor F1: USE LAST DATA F2: CALC MEASDATA
10Select GRID FACTOR for calculation of RESIDUAL ERROR by pressing [F1] or [F2] key. *5) Example: [F1]	[F1]	RESIDUAL ERROR dHD= 0.015 m dZ = 0.005 m NEXT --- G.F CALC
11Press the [F1](NEXT) key to measure other points. Maximum seven points can be measured.	[F1]	N003# PT# :_____ Input List NEZ Enter
12 Same as procedure ***6*** to ***8*** proceed to the known point C.		HR : 123°40′20″ HD* <m VD : m >Measurement… — — — — — — — — — <complete> ↓

		HR : 123°40′20″ HD : 123.456 m VD. 1.234 m NEXT --- --- CALC
13 Press the [F4](CALC) key. *6) Standard Deviation will be shown. Unit : (sec.) or (mGON) or (mMIL)	[F4]	Standard deviation = 1.23 sec. --- ↓ --- NEZ
14 Press the [F2](↓) key. Standard Deviations of each coordinate will be shown. Unit : (mm) or (inch) The display will be changed alternately by pressing [F2](↓) or (↑) key.	[F2]	SD(n): 1.23 mm SD(e): 1.23 mm SD(z): 1.23 mm --- ↑ --- NEZ
15 Press the [F4](NEZ) key. Coordinate data of the new point will be shown.	[F4]	N : 65.432 m E : 876.543 m Z : 1.23 m >REC? [YES][NO]
16 Press the [F3](YES) key. *7) The new point data will be stored into the coordinate data file and the value of occupied coordinate data will change to that of the calculated NEW POINT. The display returns to new point menu.	[F3]	NEW POINT F1: SIDE SHOT F1: RESECTION

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*2) When there is no need to memorize the new point data, press the [F3](SKP) key.
*3) To enter the known point coordinate data by direct key inputting, press the [F3](NEZ) key.
*4) RESIDUAL ERROR;
dHD (Horizontal distance between two known points) =Measured value – Calculated value
dZ=(Z coordinate of the new point calculated from known point A) – (Z

coordinate of the new point calculated from known point B)

*5) [F1:USE LAST DATA]; RESIDUAL ERROR is calculated with GRID FACTOR already set.
[F2:CALC MEAS.DATA]; RESIDUAL ERROR is calculated without GRID FACTOR already set. In this case, new GRID FACTOR is calculated from measured data and reset."
•To see the GRID FACTOR value, press the [F3](G.F.) key.

*6) In case that the all points are measured by angle measurement only, the following display will be shown.
You can select Z coordinate calculation.

CALC. Z COORD
F1:YES
F2:NO

F1(YES) : :N,E,Z coordinates will be calculated with measured angle data.
F2(NO) : :N and E coordinates will be calculated with measured horizontal angle data. Z coordinate would not be calculated. (Z coordinate value =0.000m)
When the distance measurement is done even one point, Z coordinate will be calculated as a mean value of relative distance (vertical distance data).

*7)The display shows ">SET ?" when [F3](SKP) key pressed in step 4. In this case, the new point data is not stored into the coordinate data file, only the value of occupied coordinate data changes to that of the calculated NEW POINT.

● **Viewing PT# LIST**

You can see the PT# List and enter the data from the List, also you can see coordinate data of a point. [Example: Executing Layout Mode]

Operating procedure	Operation	Display
		LAYOUT PT# :_____ Input List Nez enter
□While executing the LAYOUT mode, press the [F2](LIST) key. The arrow (→) indicates selected data.	[F2]	[GOWIN] →DATA-01 DATA-02 VIEW SRCH --- ENTER
□By pressing the following keys, the list will increase or decrease [▲]or[▼]: Increasing or Decreasing one by one. [◄]or[►]: By ten Increasing or Decreasing.	[▲]or[▼]	DATA-49 →DATA-50 DATA-51 VIEW SRCH --- ENTER
□To show the coordinate of the selected data, press the [F1] (VIEW) key. It is still possible to scroll the PT# data by pressing [▲]or[▼] key.	[F1]	PT# 」DATA-50 N」 100.234 m E」 12.345 m Z」 1.678 m
□Press the [ESC] key. The display returns to the List.	[ESC]	DATA-49 →DATA-50 DATA-51 VIEW SRCH --- ENTER
□Press the [F4] (ENTER) key. The selected point number is set as PT#.	[F4]	REFLECTOR HEIGHT INPUT R.HT = 0.000 m --- --- [CLR] [ENT]

● The operation of [F2](SRCH) is same as the "SEARCH" in the MEMORY MANAGER MODE.
For details please refer to 9”Memory Manager Mode”.

9. MEMORY MANAGER MODE

The following items for internal memory are available in this mode.

1) FILE STATUS: Checking the number of stored data / Remaining internal memory capacity.

2) SEARCH: See the recorded data.

3) FILE MAINTAN. : Deleting files / Editing file name

4) COORD. INPUT : Inputting and storing coordinate data into Coord. data file.

5) DELETE COORD. : Deleting coordinate data from Coord. data file

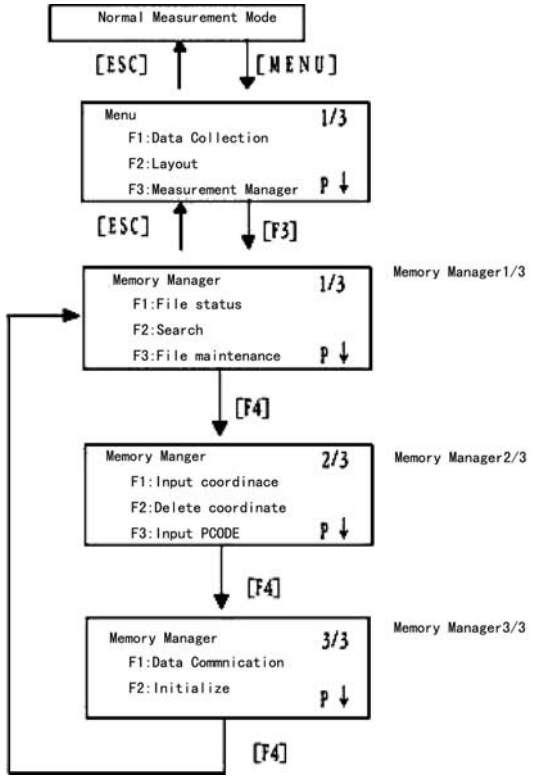
6) PCODE INPUT : Inputting PCODE DATA into PCODE Library

7) DATA TRANSFER: Sending measured data or coordinate data or PCODE Library data /Uploading coordinate data or PCODE Library data / Setting communication parameters

8) INITIALIZE: Initializing internal memory.

●Memory Manager Menu operation

By pressing the [MENU] key, the instrument will be in MENU 1/3 mode. Press the [F3](MEMORY MGR.) key, the menu of MEMORY MGR. 1/3 will be shown.



9.1 Display Internal Memory Status

This mode is used to check internal memory status

Operating procedure	Operation	Display
①Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTEN P↓
②Press the [F1](FILE STATUS) key. The total number of stored measured data files and coordinate files are shown.	[F1]	FILE STATUS 1/2 MEAS FILE : 3 COORD. FILE : 6 [・・・・・・] P↓ ↑ Remaining memory capacity
③Press the [F4](P↓) key. The total number of stored measured data and coordinate data in all files are shown.*1)	[F4]	DATA STATUS 2/2 MEAS. DATA : 0100 COORD. DATA: 0050 [・・・・・・] P↓

*1) Each coordinate file has one extra data for working area

- The FILE/DATA STATUS display will change alternately by pressing [F4](P↓) key.
- To return to MEMORY MGR. Menu, press [ESC] key.

9.2 Searching Data

This mode is used to search the recorded file data in the DATA COLLECT or LAYOUT mode.

The following 3 search methods in each type of files can be selected:

1: First data search
2: Last data search
3: Point number search(MEAS.DATA, COORD.DATA)
Number search (PCODE LIB.)

MEAS. DATA : Measured data in the data collect mode.

COORD. DATA : Coordinate data for layout, control points and new point data measured in the layout mode.

PCODE LIB. : The data which was registered with a number from 1 to 50 in Point code library.

Point name (PT#, BS#) , ID, PCODE and Height data (INS.HT, R.HT) can be corrected in the searching mode，measured value can not be corrected.

9.2.1 Measured Data Searching

Example:search as per point number

Operating procedure	Operation	Display
①Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTEN P↓
□Press the [F2](SEARCH) key.	[F2]	SEARCH F1: MEAS. DATA F2: COORD. DATA F3: PCODE LIB. P↓
□PRESS THE [F1](MEAS. DATA) KEY.	[F1]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
④Press the [F1](INPUT) key and enter File Name. Press the [F4](ENT) key. *1),2)	[F1] Input FN [F4]	MEAS. DATA SEARCH F1: first data F2: Last data F3: PT# DATA
□Press the [F3](PT# DATA) key.	[F3]	PT# DATA SEARCH PT# : _____ INPUT --- --- ENTER

□Press the [F1](INPUT) key and enter PT#. Press the [F4](ENT) key. *1) □Press the [F4](↓) key to scroll data for selected point.	[[F1] Input PT# [F4] [F4]	PT# TOP-104 2/2 V」 98°36′20″ HR」 160°40′20″ TILT」 0°00′00″ ↓ PT# TOP-104 1/2 PCODE」 R.HT.」 1.200 m EDIT ↓

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”
*2) Press[F2](invoke)key to show file directory·
- “」” indicates that the shown data is the one that memorized already
- press[▲]or[▼]key to show the next or last point
- To search the measurement data with same point number, press[◄]or[►]

● To edit the data in searching mode

Point name (PT#, BS#) , ID, PCODE and Height data (INS.HT, R.HT) can be corrected in the searching mode,but the measurement value can not be modified.

Operating procedure	Operation	Display
		PT#」TOP-104 2/2 PCODE」 R.HT」 1.000 m EDIT ↓
□Press the [F1](EDIT) key from last page of displayed data.	[F1]	PT# →TOP-104 PCODE : R.HT → 1.000 m INPUT --- --- ENTER
□Select the item to correct by pressing [▲]or[▼] key.	▲or▼	PT# : TOP-104 PCODE : R.HT → 1.000 m INPUT --- --- ENTER

□Press the [F1](INPUT) key and enter data. *1) Press the [F4](ENT) key. □Press[F4](ENTER)key □Press[F3](YES)key	[F1] Input data [F4] [F4] [F3]	PT# →TOP-104 PCODE : R.HT → 1.200 m >SAVE ? [YES] [NO] PT#」TOP-104 2/2 PCODE」 R.HT」 1.200 m EDIT ↓

*1)Refer to Section 2.5 “How to Enter Alphanumeric characters”.

- During editing, ID and PCODE are not related with the PCODE Library.
- Though the height data(INS.HT., R.HT.)can be corrected, the measurement value can not be changed.

9.2.2 Coordinate Data Searching

Example searching :Point number searching

Operating procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F2](SEARCH)key	[F2]	SEARCH F1: MEAS. DATA F2: COORD. DATA F3: PCODE LIB. P↓
□Press the [F2](COORD. DATA) key.	[F2]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
④Press the [F1](INPUT) key and enter File Name. Press the [F4](ENT) key. *1)	[F1] Input FN [F4]	PCOORD. DATA SEARCH F1: FIRST DATA F2: LAST DATA F3: PT# DATA

□Press the [F3](PT# DATA) key.	[F3]	PT# DATA SEARCH PT#:_____ INPUT --- --- ENTER
□Press the [F1](INPUT) key and enter PT#. Press the [F4](ENT) key. *1)	[F2] Input Point number [F4]	Point number」 TOP-104 N」 100.234m E」 12.345m Z」 1.678m ↓
⑦Press the [F4](↓) key to get the next page.	[F4]	PCODE 」□ TOPS 2/2 STR. 」 ↓

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”
• “」”indicates that the shown data is the memorized data
•press[▲]or[▼]key to show the next or last point
•To search the measurement data with same point number, press[◄]or[►]key.

9.2.3 Searching of PCODE library

Example: search as per PCODE number

Operating procedure	Operation	Display
□From menu 1/3 press[F3] (MEMORY MGR)key	[F3]	MEMORY MGR 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F2](SEARCH)key	[F2]	SEARCH F1: MEAS. DATA F2: COORD. DATA F3: PCODE LIB. P↓

□Press[F3](PCODE LIB.)key	[F3]	PCOORD. DATA SEARCH F1: FIRST DATA F2: LAST DATA F3: No. SEACH
□Press the [F3](No. SEARCH) key.	[F3]	PCODE No.SEARCH No. = --- --- [CLR] [ENT]
□Enter number.Press the [F4](ENT) key. *1) The number and linked data will be shown. *2)	Input PT# [F4]	011:NAKADAI →012:HILLTOP 013:ITABASH EDIT --- CLR ---

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”

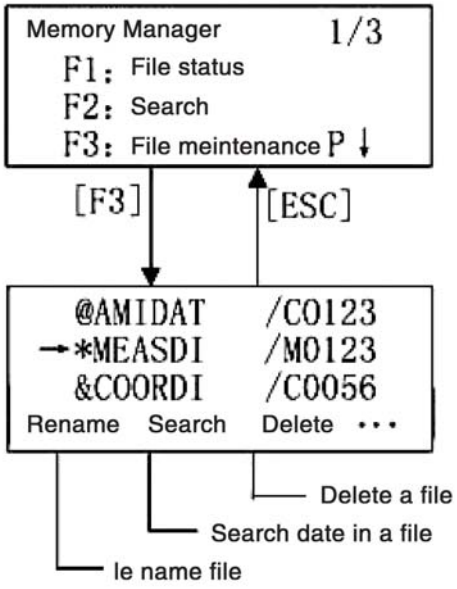
- press[▲]or[▼key to show the next or last PCODE data.

*2) To correct the PCODE data, press [F1](EDIT) key.
To delete PCODE data, press[F3](Clear)key.

9.3 File Maintenance

In this mode, the following items are available.
Renaming file name / Searching data in a file / Deleting files

- **File Maintan. menu**



Pressing [F3](FILE MAINTAN.) key from MEMORY MANAGER menu 1/3, file list will be shown.

● File discrimination mark(*、@、＆)

File discrimination mark before the file name indicates the status of this file.

For measurement data file,

"*": the file chosen under data collection mode

For coordinate data file,

"*": the file chosen under layout mode

"@": the coordinate file chosen under data collection mode

"＆": the coordinate file chosen used for layout and data collection mode

● Data type discrimination mark(M,C)

Data type discrimination mark before 4-digit number indicates the type of this data

"M" Measurement data

"C" coordinate data

● Four-digit number indicates the total of data in the file

(Each coordinate file has one extra data for working area)

Press[▲]or[▼]key to show the next or last point

9.3.1 Rename a File

An existing file in internal memory can be renamed.

Operating procedure	Operation	Display
□Press the [F3](FILE MAINTAN.) key from the Memory manager menu 1/3.	[F3]	→MEASD1 /M0123 COORD1 /C0056 REN SRCH DEL ---
□Select a file by pressing [▲]or[▼] key.	[▲]or[▼]	MEASD1 /M0123 →COORD1 /C0056 COORD2 /C0098 REN SRCH DEL ---
□Press the [F1](REN) key.	[F1]	MEASD1 /M0123 →COORD1 /C0056 COORD1 /C0098 [ALP] [SPC] [CLR] [ENT]

□Enter new file name. Press the [F4](ENT) key. *1)	Input FN [F4]	→MEASD1 /M0123 →COORD1 /C0056 COORD1 /C0098 REN SRCH DEL ---
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters” • Existing file name can not be used. • press[ESC]key to back to file maintenance menu.		

9.3.2 Search the Data in the File

An existing file in internal memory can be searched.

Operating procedure	Operation	Display
□Press the [F3](FILE MAINTAN.) key from the Memory manager menu 1/3.	[F3]	→MEASD1 /M0123 COORD1 /C0056 REN SRCH DEL ---
□Select a file to search by pressing [▲]or[▼] key.	[▲]or[▼]	MEASD1 /M0123 →COORD1 /C0056 COORD2 /C0098 REN SRCH DEL ---
□Press the [F2](SRCH) key.	[F2]	SEARCH [COORD1] F1: FIRST DATA F2: LAST DATA F3: PT# DATA
□Select searching method by pressing the [F1] to [F3] key. *1)	[F1]to[F3]	
*1) Because procedures from next are same as procedures of Section 9.2 "Searching Data", refer to Section 9.2 “Searching Data” To return to the FILE MAINTAN. Menu , press the [ESC] key.		

9.3.3 Deleting a File

This mode erases a file from internal memory. Only one file can be erased at a time.

Operating procedure	Operation	Display
□Press the [F3](FILE MAINTAN.) key from the Memory manager menu 1/3.	[F3]	→MEASD1 /M0123 COORD1 /C0056 Change name Search Delete - - -
②press[▲]or[▼]key to choose the file to be deleted	[▲]or[▼]	MEASD1 /M0123 →COORDl /C0056 COORD2 /C098 Change name Search Delete - - -
□press[F2](delete)key	[F3]	MEASDl /M0123 →COORDl /C0056 COORD2 /C098 >Delete [no] [yes]
□If it is confirmed to delete this file, press[F4](yes)key	[F4]	MEASD1 /M0123 →COORD2 /C0098 COORD3 /C0321 Change name Search Delete - - -
·press[ESC]key to back to file maintenance menu		

9.4 Coordinate Data Direct Key Input

9.4.1 Coordinate data input

Coordinate data for the layout point or control point can be input directly from the keyboard. This data can be stored into a file in the internal memory.

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key.	[F4]	MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓
□Press[F1](COORD. INPUT)key	[F1]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
□Press the [F1](INPUT) key and enter File Name you want to input. Press the [F4](ENT) key. *1)	[F1] Input FN [F4]	COORD. DATA INPUT F1:NEZ F2:PTL
□Select the kind of coordinates. NEZ: Coordinate data PTL: The coordinate data for point to line	[F1]	COORD. DATA INPUT PT#:_____ INPUT --- --- ENTER
□Press[F1](input)key to input PT#. Press[F4](Enter)key.	[F1] Input PT# [F4]	N → 100.234 m E: 12.345 m Z: 1.678 m INPUT --- --- ENTER
□Enter Coordinate data. Press the [F4](ENT) key. *1)	Input data [F4]	COORD. DATA INPUT PCODE:_____ INPUT LIST --- ENTER

□Enter PCODE and press the [F4](ENTER). Next input display is shown, point number (PT#) is automaticall incremented.	[F1] Input PCODE [F4]	COORD. DATA INPUT PT#:GOWIN-102 INPUT --- --- ENTER
*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”		

9.4.2 PTL(Point To Line) data input

The PTL coordinate data of layout point or control point can be directly input by keyboard and can be memorized into a file in internal memory

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key.	[F4]	MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓
□Press[F1](COORD.INPUT) key.	[F1]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
□Press the [F1](INPUT) key and enter File Name you want to input. Press the [F4](ENT) key. *1)	[F1] Input FN [F4]	COORD. DATA INPUT F1:NEZ F2:PTL
□Select the kind of coordinates. NEZ: Coordinate data PTL: The coordinate data for point to line	[F2]	COORD. DATA INPUT PT# : _____ INPUT --- --- ENTER

□Press[F1](input)key to input point number, Press[F4](Enter)key*1).	[F1] Input PT# [F4]	L→ m D: m E: m INPUT --- --- ENTER
□Enter PTL data. Press the [F4](ENT) key. *1) L: Line O: Offset E: Elevation	Input data [F4]	PCODE→_____ From : _____ To : _____ INPUT LIST --- ENTER
Enter PCODE , FROM and TO data and press the[F4] (ENTER).*2) Next input display is shown, point number (PT#) is automatically incremented.	[F1] Input PCODE [F4]	COORD. DATA INPUT PT#:GOWIN-102 INPUT --- --- ENTER

*1)Refer to 2.5 “How to Enter Alphanumeric characters”
*2)When the input point name is FROM or TO, no same files exist, the error will display.

9.5 Deleting the Coordinate Data in the File

The coordinate data in the file can be deleted.

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key.	[F4]	MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓
□Press the [F2](DELETE COORD.) key.	[F2]	SELECT A FILE FN:_____ INPUT LIST --- ENTER
□Press the [F1](INPUT) key and enter File Name. Press the [F4](ENT) key. *1)	[F1] Input FN [F4]	DELETE COORD. PT# :_____ INPUT LIST --- ENTER
□Press the [F1](INPUT) key and enter PT#. Press the [F4](ENT) key. *1)	[F1] Input PT# [F4]	N: 100.234 m E: 13.345 m Z: 1.678 m >DELETE? [YES] [NO]
□Confirm the data and press the [F3](YES) key. Deleting starts. The display will return to the previous display.	[F3]	

*1)Refer to 2.5 “How to Enter Alphanumeric characters”

9.6 Editing PCODE Library

PCODE data can be input into PCODE Library in this mode.

A PCODE is linked with a number of 1 to 50.

PCODE can be also edited in DATA COLLECT menu 2/3 in the same way.

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key	[F4]	MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓
□Press the [F3](PCODE INPUT) key.	[F3]	→001:GOWIN 002:TOKYO EDIT --- CLR ---
□Press following arrow key to make PCODE number increase or decreas [▲]or[▼]: increase or decrease every 1 [◄]or[►]:increase or decrease every 10	[▲]or[▼] [◄]or[►]	011:URAH →012:AMIDAT 013:HILLTO EDIT --- CLR ---
□Press[F1](EDIT)key	[F1]	011: URAH →012=AMIDAT 013: HILLT0 [ALP] [SPC] [CLR] [ENT]
□Input PCODE, press[F4] (ENT) key*1)	Input PCODE [F4]	011: URAH →012: AMIDAT 013: HILLT0 EDIT --- CLR ---

*1)Refer to 2.5 “How to Enter Alphanumeric characters”

9.7 Data Communications

You can send a data file stored in the internal memory to a computer directly. Also, you can directly load a coordinate data file and PCODE Library data to the internal memory from the computer.

9.7.1 Sending Data

Example: Sending a Measured data file

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key twice	[F4] [F4]	MEMORY MGR. 3/3 F1: DATA TRANSFER F2: INITIALIZE P↓
□Press[F1](DATA TRANSFER) key	[F1]	DATA TRANSFER F1: GTS FORMAT F2: SSS FORMAT
□Select data format. GTS format: The conventional data SSS format: Including PCODE data , 'From' and 'To' data for Point to Line.	[F1]	DATA TRANSFER F1: SEND DATA F2: LOAD DATA F3: COMM..PARAMETERS
□Press[F1]key	[F1]	SEND DATA F1:MEAS. DATA F2:COORD. DATA F3:PCODE DATA
□Select the type of data to send by pressing [F1]-[F3] key. Example : [F1](MEAS. DATA)	[F1]	SELECT A FILE FN:_____ INPUT LIST --- ENTER

□Press the [F1](INPUT) key and enter File Name you want to send. Press the [F4] (ENT) key. *1),2)	[F1] Input FN [F4]	SEND MEAS. DATA >OK? --- --- [YES] [NO]
□Press the [F3](YES) key .*3) The sending starts. The display will return to menu.	[F3]	SEND MEAS. DATA <SENDING DATA !> STOP

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*2) To scroll the data, press the[▲]or[▼] key.
● To show the file list, press the [F2](LIST) key.
*3) To cancel the sending, press the [F4](STOP) key.

9.7.2 Loading Data

Coordinate data files and PCODE Library data can be loaded from PC.

Example: Loading a coordinate data file

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key twice	[F4] [F4]	MEMORY MGR. 3/3 F1: DATA TRANSFER F2: INITIALIZE P↓
□Press[F1](DATA TRANSFER) key	[F1]	DATA TRANSFER F1: GTS FORMAT F2: SSS FORMAT
□Press[F1](GTS FORMAT) key	[F1]	DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM..PARAMETERS

□Press[F2]key	[F2]	LOAD DATA F1: COORD. DATA F2: PCODE DATA.
□ Select the type of data to load by pressing [F1] or [F2] key. Example : [F1](COORD. DATA)	[F1]	COORD. FILE NAME FN:_____ INPUT --- --- ENTER
□ Press the [F1](INPUT) key and enter New File Name you want to receive. Press the [F4](ENT) key. *1)	[F1] Input FN [F4]	LOAD COORD. DATA >OK ? --- --- [YES] [NO]
□ Press the [F3](YES) key. *2) The loading starts. The display will return to menu.	[F3]	LOAD COORD. DATA <LOADING DATA!> STOP

*1) Refer to 2.5 “How to Enter Alphanumeric characters”
*2) To delete loading data, press[F4](Stop)key.

9.7.3 Setting of Data Communication Parameters

● Items of the Parameter

ITEM	Selecting Item	Contents
F1: Protocol	[ACK/NAK], [ONE WAY]	Setting Protocol [ACK/NAK] or [ONE WAY] communication
F2: Baud rate	1200, 2400, 4800, 9600, 19200,38400	Setting transfer speed 1200/2400/4800/9600 /19200/ 38400 baud rate
F3: Char./ Parity	[7/EVEN], [7/ODD], [8/NON]	Setting data length and parity. [7bit, even], [7bit, odd], [8bit,none]
F1: Stop Bits	1, 2	Setting Stop 1 bit or 2bits

● **Example Setting** Baud rate : 19200

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key twice	[F4] [F4]	MEMORY MGR. 3/3 F1: DATA TRANSFER F2: INITIALIZE P↓
□Press[F1](DATA TRANSFER) key	[F1]	DATA TRANSFER F1: GTS FORMAT F2: SSS FORMAT

□Press[F1](GTS FORMAT) key	[F1]	DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM..PARAMETERS
□Press the [F3](COMM. PARAMETERS) key.	[F3]	COMM. PARAMETERS 1/2 F1: PROTOCOL F2: BAUD RATE F3: CHAR./PARITY P↓
□Press the [F2](BAUD RATE) key. [ ] indicates present setting.	[F2]	BAUDRATE [1200] 2400 4800 9600 19200 38400 ENTER
□Select the items by pressing [▲]or[▼] , [►] and [◄] keys. *1)	[►] [▼]	BAUDRATE 1200 2400 4800 9600 [19200] 38400 ENTER
□Press[F4](Enter)key	[F4]	COMM. PARAMETERS 1/2 F1: PROTOCOL F2: BAUD RATE F3: CHAR./PARITY P↓
*1 To delete setting, press[Enter]key		

9.8 Initialization

This mode is used to initialize the internal memory. Following data can be initialized.

FILE DATA :All files of measuring data and coordinate data

PCODE DATA: PCODE LIST.

ALL DATA: FILE DATA and PCODE DATA

Note that the following data are not initialized even if initialization is executed.

: Coordinates of the instrument, Instrument height and Reflector height.

Example:Initialization: ALL DATA (FILE data and PCODE data)

Operation procedure	Operation	Display
□Press the [F3](MEMORY MGR.) key from the menu 1/3.	[F3]	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
□Press[F4](P↓)key twice	[F4] [F4]	MEMORY MGR. 3/3 F1: DATA TRANSFER F2: INITIALIZE P↓
□Press[F2] (INITIALIZE)key	[F2]	INITIALIZE F1: FILE AREA F2: PCODE LIST F2: ALL DATA
□Select the data to initialize by pressing one of the [F1] to [F3] key. Example : [F3](ALL DATA)	[F3]	INITIALIZE DATA ERASE ALL DATA ! >0K? [NO][YES]
□Confirm the erase data, press the [F4](YES) key. Initializing will start. The display returns to menu.	[F4]	INITIALIZE DATA 〈INITIALIZING ! 〉
		MEMORY MGR. 3/3 F1: DATA TRANSFER F2: INITIALIZE P↓

10. SET AUDIO MODE

The light acceptance quantity level for the EDM (SIGNAL), the atmospheric correction value (PPM) and correction value of prism constant (PSM) are displayed in this mode.

When reflected light from the prism is received a buzzer sounds. This function is good for easy collimation when the target is difficult to find.

Operation procedure	Operation	Display
□Make sure the mode is in the distance measurement mode on page 1.		HR : 120°30′40″ HD : 123.456 m VD : 5.678 m MEAS MODE S/A P1↓
□Pressing the [F3](S/A) key, mode changes to set audio mode. The display indicates correction value of prism constant (PSM), atmospheric correction (PPM) and reflection light level (SIGNAL).	[F3]	SET AUDIO MODE PSM:0.0 PPM 0.0 SIGNAL: [▮ ▮ ▮ ▮ ▮] PRISM PPM T-P ---

- When receiving reflected light, buzzer sounds.
  It is possible to stop the sound, see Chapter 16 “SELECTING MODE” .
- The [F1] to [F3] keys are used for setting atmospheric correction and prism constant.
- To return to normal measuring mode, press the [ESC] key.

11. SETTING THE PRISM CONSTANT VALUE

The prism constant value of GOWIN is set to zero. When using prisms other than GOWIN, it is necessary to set the prism constant correction value of that specific prism.Once you set the correction value for prism constant, it is retained after power is OFF.

Operation procedure	Operation	Display
□Press the [F3](S/A) key from distance measurement or coordinates measurement mode.	[F3]	SET AUDIO MODE PSM:0.0 PPM 0.0 SIGNAL: [▮ ▮ ▮ ▮ ▮] PRISM PPM T-P ---
□Press[F1](PRISM)key	[F1]	SET AUDIO MODE PRISM: 0.0 mm --- --- [CLR] [ENT]
□Input the Prism constant correction value. *1) The display returns to set audio mode.	Input data [F4]	SET AUDIO MODE PSM:14.0 PPM 0.0 SIGNAL: [▮ ▮ ▮ ▮ ▮] PRISM PPM T-P ---

*1)Refer to 2.5 “How to Enter Alphanumeric characters”

• Input range: -99.9mm to +99.9mm 0.1mm step

12. SETTING ATMOSPHERIC CORRECTION

The velocity of light through air is not constant and depends on the atmospheric temperature and pressure,This instrument can carry out atmospheric correction to distance measurement result automatically once the atmospheric correction value is set, the standard atmospheric status of this instrument is temp.15□/59□, air pressure 1013.25hPA/760mmHg ／29.9inHg, atmospheric correction is 0ppm. The values are kept in the memory even after power is OFF.

12.1 Calculation of Atmospheric Correction

Correction formula is as follows:

Calculation unit: meter

$Ka=\{279.85-\frac{79.585_{xp}}{273.15+1}\} \times 10^{-6}$

Ka:Atmospheric correction value

P:ambient atmospheric pressure(hPa)

t:ambient atmospheric temperature(□)

Distance L(m) after atmospheric correction is obtained from following formular:

L=1(1+Ka)　I:Distance measurement value without atmospheric correction

Example: set air temperature as +20□, air pressure is 847hPa,1=1000m

$Ka=\{279.85-\frac{79.585\times 847}{273.15+1}\} \times 10^{-6}$

≈5010-6(50ppm)

$L=1000(1+50\times 10^{-6})=1000.050m$

12.2 Setting of the Atmospheric Correction

- **How to Set Temperature and Pressure Value Directly**

Measure the temperature and air pressure surrounding the instrument beforehand.

Example:Temperature:+26□, Pressure:1017hPa

Operation procedure	Operation	Display
□ Press the [F3](S/A) key to set Set Audio Mode from distance or coordinate measurement mode.	[F3]	SET AUDIO MODE PSM:0.0　PPM　0.0 SIGNAL: [▮ ▮ ▮ ▮ ▮] PRISM　PPM　T-P　---

□Press[F3](T-P)key	[F3]	TEMP. & PRES. SET TEMP. = 15.0 °C PRES. : 1013.2 hPa --- --- [CLR] [ENT]
□ Input Temp.value and Pressure value.*1) Mode returns to Set Audio mode.	Input Temp.,pres.	TEMP. & PRES. SET TEMP. = 26.0 °C PRES. : 1017.0 hPa --- --- [CLR] [ENT]

*1)Refer to 2.5 “How to Enter Alphanumeric characters”.

- Range: Temp.-30□ to +60□(0.1 step) or -22□to +140□(0.1□step), air pressure 560 to 1066.0hPa(0.1hPa step), 420 to 800mmHg (0.1mmHg step)16.5 or 31.5inHg(0.1inHg step).
- When the atmospheric correction value which is calculated from the input temperature and pressure values exceeds the range 999.9ppm, the operating procedure returns to step 3 automatically. Input values again.

●How to Set the Atmospheric Correction Value Directly

Measure the temperature and air pressure to find atmospheric correction value (PPM) from the chart or correction formula.

Operating procedure	Operation	Display
①Press the [F3](S/A) key to set Set Audio Mode from distance or coordinate measurement mode.	[F3]	SET AUDIO MODE PSM:0.0 PPM 0.0 SIGNAL: [▮ ▮ ▮ ▮ ▮] PRISM PPM T-P ---
□Press the [F2](PPM) key. Current setting value is displayed.	[F2]	PPM SET PPM = 0.0 ppm --- --- [CLR] [ENT]
□Enter atmospheric correction value. *1) Mode returns to Set Audio mode.	Inputdata [F4]	

*1)Refer to 2.5 “How to Enter Alphanumeric characters”

●Input range: -999,9ppm to +999.9ppm step 0.1ppm

Atmospheric Correction Chart (For your reference)

The atmospheric correction value is obtained easily with the atmospheric correction chart.Find the measured temperature in horizontal, and pressure in vertical on the chart.

Read the value from the diagonal line, which represents the required atmospheric correction value.

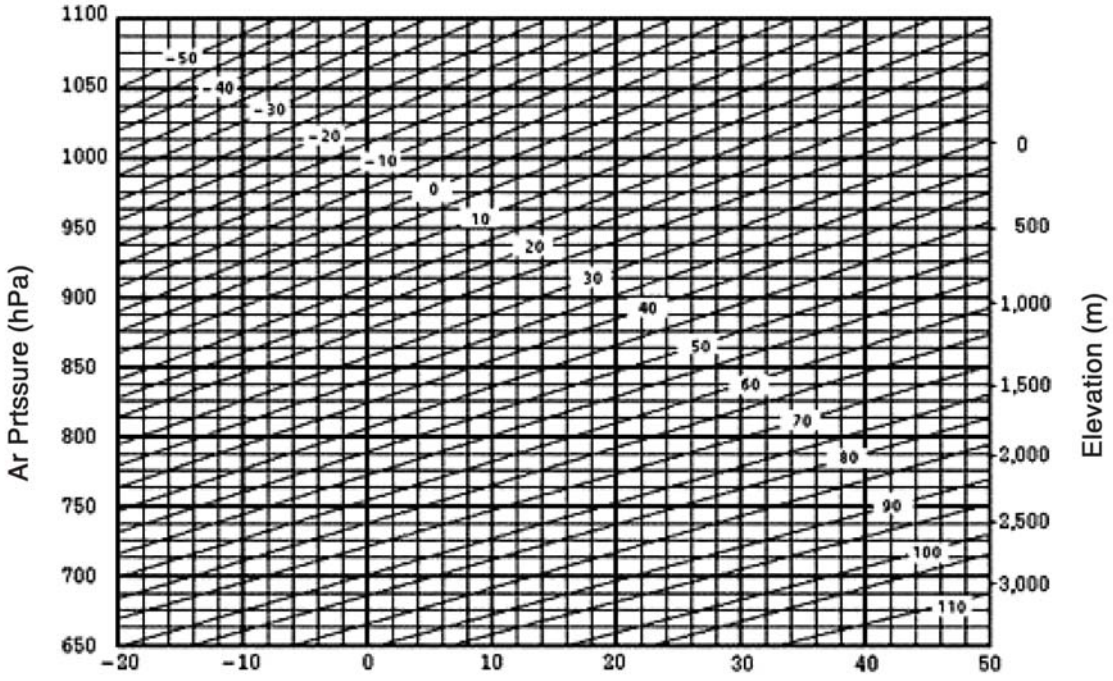
Example:

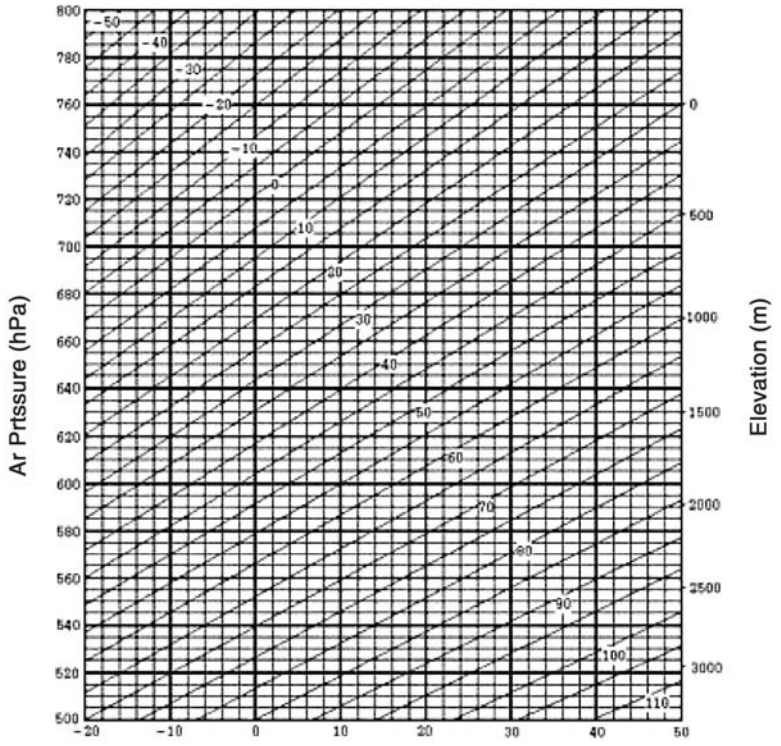
The measured temperature is +26□

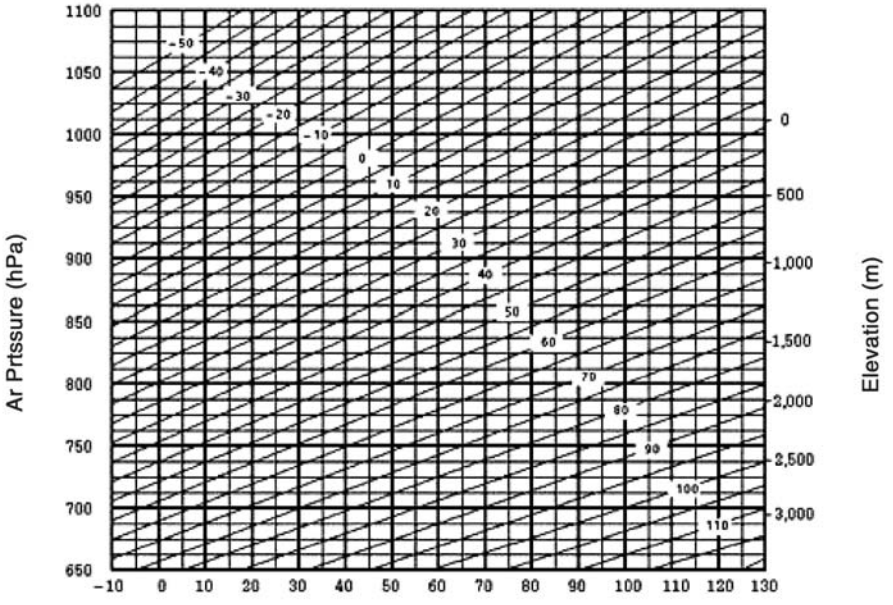
The measured air pressure is 1013 hPa

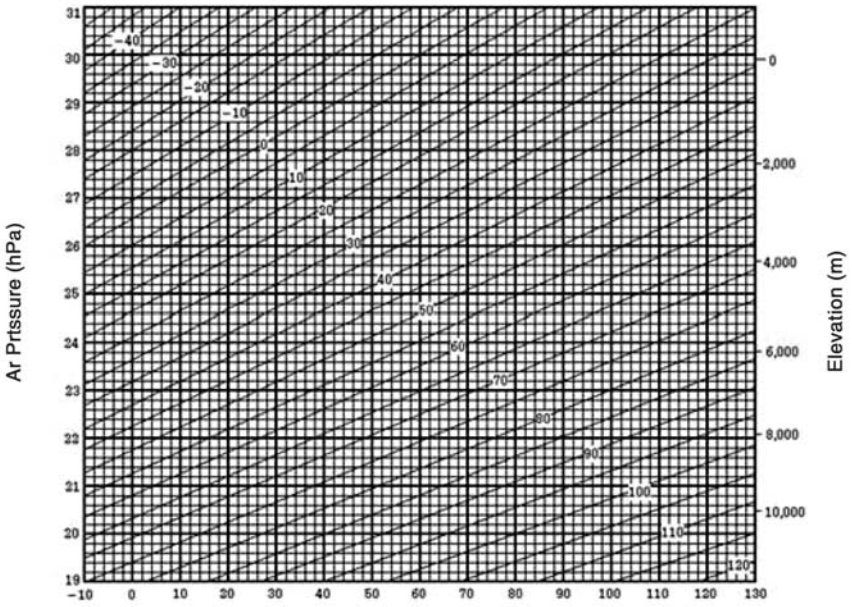
then

The correction value is +10ppm




Ar Prtssure (hPa)
Elevation (m)
Temperature(□)


Ar Prtssure (hPa)
Elevation (m)
Temperature(□)


Ar Prtssure (hPa)
Elevation (m)
Temperature(□)

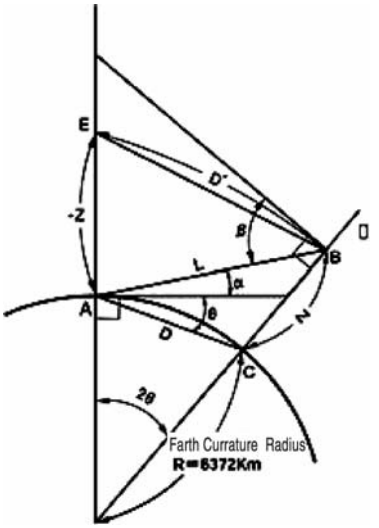
13. CORRECTION FOR REFRACTION AND EARTH CURVATURE

The instrument measures distance, taking into account correction for refraction and earth curvature.

13.1 Distance Calculation Formula

Distance Calculation Formula; with correction for refraction and earth curvature taken into account.

Follow the Formula below for converting horizontal and vertical distances.



HD and Height Difference is calculated as per following formula

Horizontal Distance D=AC(α)or BE(β)

Height Difference Z=BC(α)or EA(β)

D=L{cosα-(2θ-γ)sinα)}

Z=L{sin α+(θ-γ)cosα)}

θ=Lcosα／2R　Earth Curvature Correction Item

γ=KLcosα／2R Refraction Correction Item…

K=0.14 或 0.2……Refraction Coefficient

R=6372km Earth Curvature Radius…

α(or β) Altitude angle…

L……Tilt Distance

·if no refraction and earth curvature correction is done, the horizontal distance and height difference calculation formular is

D=L·cos α

Z=L·sina α

Note: the ex-works setting of refraction coefficient is K=0.14, if you want to change K value, please see 16 “Selecting mode”

14. POWER SOURCE AND CHARGING

14.1 On-board Battery BT-L1W

●Taking the battery out

It should be confirmed that the power is off before taking the battery out.As shown in following diagram, press battery locking lever to take the on-board battery BT-L1W out.

●Charging of battery

1 Plug the charger into the outlet. Use an AC cable compatible with the power supply voltage in use.

2 Connect the charger connector to the battery, then charging will start. (the red light on the charger illuminate),

3 Charging will take approximately 3 hours. (The green lamp will illuminate).

4 After charging, remove the battery from the charger.

5 Remove the charger from the outlet.

15. DETACH/ATTACH OF TRIBRACH

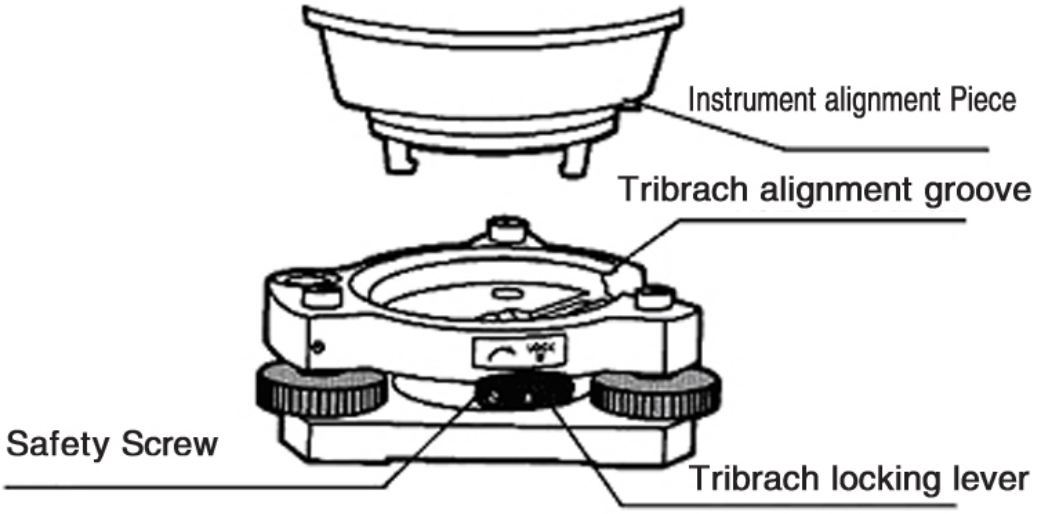
The instrument is easily detached or attached to the tribrach, with a tribrach locking lever loosened or tightened for this purpose.

● Detachment

- Loosen the tribrach locking lever, by revolving it 180°or 200g in the counterclockwise direction (which will point the triangle mark upwards).
- Grip the carrying handle firmly with one hand while holding the tribrach with the other. Then lift the instrument straight upwards and off.

● Attachment

- Hold the instrument by the carrying handle, with one hand, and carefully lower it on top of the tribrach while, at the same time, coinciding the alignment piece with the tribrach alignment groove on the instrument and tribrach respectively.
- When fully seated, revolve the tribrach locking lever 180° or 200g clockwise (which will point the triangle mark downwards again).



● Locking the Tribrach Locking Lever

The tribrach locking lever can be locked, to prevent it be accidentally removed, especially if the upper instrument section is not being detached very often. Simply tighten the securing screw on the locking lever with the accessory screwdriver, found in the case.

16. SELECTING MODE

16.1 Items of the Selecting Mode

The following modes are available.

Menu	Items	Selecting item	Display
1: UNIT SET	TEMP. & PRES.	°C / °F hPa / mmHg / inHg	Select the unit of temperature for atmospheric correction. Select the unit of air pressure for atmospheric correction .
	ANGLE	DEG(360°) / GON(400G) / MIL(6400M)	Choose degree, gon or mil unit for measuring angle.
	DISTANCE	METER / FEET / FEET and inch	Choose measuring unit for distance meter , feet or feet and inch
	FEET	US SURVEY / INTERNATIONAL	Select the meter / feet conversion factor. US SURVEY feet 1m=3.280833333333333 ft. INTERNATIONAL feet 1m=3.280839895013123 ft.
2: MODE SET	POWER ON MODE	ANGLE MEAS./ DISTANCE MEAS.	Select to set the measurement mode for angle or distance when the power is turned on.
	FINE/CRS/ TRK	FINE / COARSE / TRACK	Select Fine /Coarse / Tracking mode in distance measurement mode, when the power is turned on.
	HD&VD/SD	HD&VD /SD	Specify which is displayed first, horizontal and vertical distance or slope distance, when the power is turned on.
	V ANGLE Z0/H0	Zenith 0 / Horizontal 0	Choose the vertical angle reading from zenith or from level.

2: MODE SET	N-TIMES / REPEAT	N-TIMES / REPEAT	Select the measurement mode for distance when the power is turned on.
	TIMES OF MEAS.	0~99	Set N (number of times) for times of distance measurement. When setting number of times as 1, it is single measurement.
	NEZ / ENZ	NEZ / ENZ	Select a coordinate displaying order either NEZ or ENZ.
	HA MEMORY	ON / OFF	Horizontal angle set can be retained after the power is turned off.
	ESC KEY MODE	DATA COLLECT / LAYOUT / REC / OFF	You can select a function of the [ESC] key. DATA COLLECT / LAYOUT: It is possible to enter data input mode (in DATA COLLECT) or Layout Menu from normal measuring mode directly. REC: While executing normal or offset measuring, the measuring data can be output. OFF: Returns to normal function.
	COORD. CHECK	ON / OFF	Select coordinate displaying ON or OFF when setting a point.

2: MODE SET	EDM OFF TIME	0-99	The time when EDM is cut off from distance measurement is completed can be changed. This function is effective for shortening the first time measuring time when distance measurement is started from distance measurement completing state. (Default:3minutes) 0 :After completing distance measurement, EDM is cut off immediately. 1-98 :EDM is cut off after 1~98 minutes. 99 :EDM is always switched ON.
	FINE READING	0.2/1mm	Select 1mm or 0.2mm for the minimum reading unit in the distance mode (FINE mode).
	OFFSET V ANG	FREE / HOLD	Select Vertical angle setting in the Angle Offset measurement mode. FREE: Vertical angle varies by the angle of the telescope. HOLD: Vertical angle is fixed even if the angle of the telescope changes.
3: OTHERS SET	H-ANGLE BUZZER	ON / OFF	Specify whether the buzzer sounds or not for every horizontal angle 90°.
	S/A BUZZER	ON / OFF	Specify whether the buzzer sounds or not in the set audio mode.
	W-CORRECTION	OFF / K=0.14 / K=0.20	Set correction for refraction and earth curvature,coefficient of refraction as ; K=0.14, K=0.20 or no correction.

3: OTHERS SET	NEZ MEMORY	ON / OFF	It is possible to retain the coordinate of instrument point, the instrument height and prism height after power off.
	REC TYPE	REC-A / REC-B	Select REC-A or REC-B for data output. REC-A :The measurement is made again and this new data is output. REC-B : The data being displayed is output.
	CR,LF	ON / OFF	It is possible to output the data with carriage return and line feed.
	NEZ REC FORM	STANDARD / STANDARD (12dig) / with RAW with RAW (12dig)	Select the format of the record coordinates data STANDARD: 11 digits standard data STASNDARD (12dig):12 digits standard data with RAW:11digits standard data with raw data with RAW (12dig):12digits standard data with raw data
	MANUAL NEZ REC	ON/ OFF	In the layout mode or data collect mode, it is possible to record coordinates entered directly from the keyboard.
	LANGUAGE *	ENGLISH/ OTHER *	Select the displaying language.
	ACK MODE	STANDARD / OMITTED	Set the procedure of the communication with external device. STANDARD:Normal procedure OMITTED:Even though the [ACK] is omitted from the external device, the data is not sent again.
	GRID FACTOR	USE G.F. / DON'T USE	Select using GRID FACTOR in calculation of measurement

			data.
	CUT & FILL	STANDARD / CUT&FILL	In the layout mode, CUT & FILL can be displayed instead of dZ.
3: OTHERS SET	ECHO BACK	ON / OFF	It is possible to output the data of echo back type.
	CONTRAST MENU	ON / OFF	When the instrument is turned ON, it is possible to display the screen which you can adjust contrast of the display and confirm the prism constant (PSM) and atmospheric correction

*__Language__ selection varies along with countries

16.2 How to Set Seleting Mode

<Example> : Setting unit in hPa, °F, NEZ MEMORY:ON

Operating procedure	Operation	Display
□While pressing [F2] key, turn power ON.	[F2] + Power ON	PARAMETERS 2 F1: UNIT SET F2: MODE SET F3: OTHER SET
□Press [F1](UNIT SET) key.	[F1]	UNIT SET 1/2 F1: TEMP. & PRES. F2: ANGLE F3: DISTANCE P↓
□Press [F1](TEMP. & PRES.) key.	[F1]	TEMP. & PRES. UNIT TEMP. : °C PRES. : mmHg °C °F --- ENTER
□Press [F2](°F) key, and press F4](ENTER) key.	[F2] [F4]	TEMP. & PRES. UNIT TEMP. : °F PRES. : mmHg hPa mmHg inHg ENTER
□Press [F1](hPa) key, and press [F4] (ENTER) key. Returns to unit set menu.	[F1] [F4]	UNIT SET 1/2 F1: TEMP. & PRES. F2: ANGLE F3: DISTANCE P↓

□Press [ESC] key. Returns to PARAMETERS 2 menu.	[ESC]	PARAMETERS 2 F1: UNIT SET F2: MODE SET F3: OTHER SET
□Press[F3](OTHER SET) key	[F3]	OTHERS SET 1/5 F1:H-ANGLE BUZZER F2:S/A BUZZER F3:W-CORRECTION P↓
□Press [F4](P↓) key, to get the function in page 2 .	[F4]	OTHERS SET 2/5 F1:NEZ MEMORY F2:REC TYPE F3:CR,LF P↓
□Press[F1]key	[F1]	NEZ MEMORY [OFF] [ON] [OFF] —— ENTER
□Press [F1](ON) key, and press [F4] (ENTER) key. Returns to OTHERS SET menu.	[F1] [F4]	OTHERS SET 2/5 F1:NEZ MEMORY F2:REC TYPE F3:CR,LF P↓
11 Power off	Power off	
● Up or down arrow key can be used when there are four or more selection items.		

17. CHECKING AND ADJUSTMENT

17.1 Checking and adjusting of instrument constant

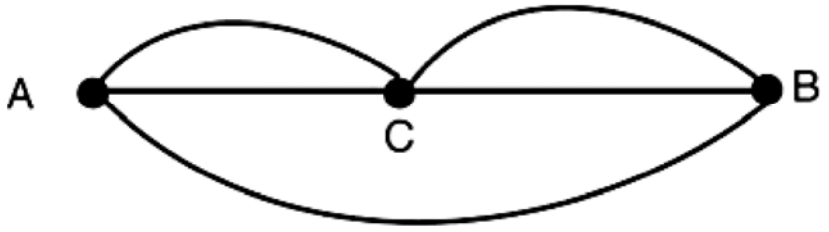
Normally, the instrument constant does not have discrepancy.It is recommended you measure and compare with an accurately measured distance at a location where the precision is specifically monitored on a consistent basis.If such a location is not available, establish your own base line over 20m (when purchasing the instrument) and compare the data measured with the newly purchased instrument.

In both cases please note that the setup displacement of the instrument position over the point, the prism, baseline precision, poor collimation, atmospheric correction, and correction for refraction and earth curvature determine the inspection precision. Please keep in mind these points.

Also, when providing a base line in a building, please note that differences in temperature greatly affect the length measured.

If a difference of 5mm or over is the result from the comparative measurement, the following procedure as shown below could be used to change the instrument constant.

1) Provide point C on a straight line, connecting straight line AB which is almost level and about 100m long.Measure straight lines AB, AC and BC.



2) Obtain the instrument constant by repeating above several times.Instrument constant = AC+BC-AB

3) When there is error between written instrument constant value and calculated value, refer to Section 17.4”How to Set the Instrument Constant Value”.

4) Once again, measure at a calibrated baseline and compare results.

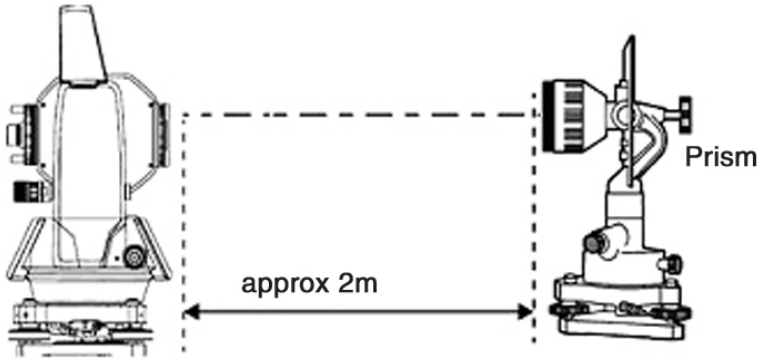
5) If using above procedure and no difference is found from the instrument constant at the factory or a difference of over 5mm is found, contact dealer.

Note: The seal with which the value is written is stuck on the lower part of the instrument, or the battery removal side of the instrument.

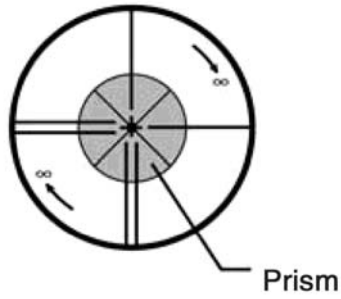
17.2 Checking the Optical Axis

To check if the optical axis of EDM and theodolite are matched, follow the procedure below. It is especially important to check after adjustment of the eyepiece reticle is carried out.

- Position the Instrument and prism with about 2m apart and face them at each other.(At this time, the power is ON.)



- Sight through the eyepiece and focus to the prism. Then center the prism on the cross hairs.



- Set to the measure mode to distance measurement or set audio.
- Sight through the eyepiece and focus the (blinking) red light spot by turning the focusing knob in the direction of infinity (clockwise).If displacement of the reticle

cross hairs is within one-fifth of the diameter of the round red light spot both vertically and horizontally, adjustment will not be required.

Note: If displacement is more than one-fifth in the above case, and still remains so after rechecking the original line of sight, the instrument must be adjusted by competent technicians. Please contact dealer or agent for adjustment.

17.3 Checking and adjusting of theodolite

● Points on the Adjustment

□Adjust the eyepiece of the telescope properly prior to any checking operation which involves sighting through the telescope.
Remember to focus properly, with parallax completely eliminated.·

□Carry out the adjustments in the order of item numbers, as the adjustments are dependent one upon another. Adjustments carried out in the wrong sequence may even nullify previous adjustment.

□Always conclude adjustments by tightening the adjustment screws securely (but do not tighten them more than necessary, as you may strip the threads, twist off the screw or place undue stress on the parts).Furthermore, always tighten by revolving in the direction of tightening tension.

□The attachment screws must also be tightened sufficiently, upon completion of adjustments.

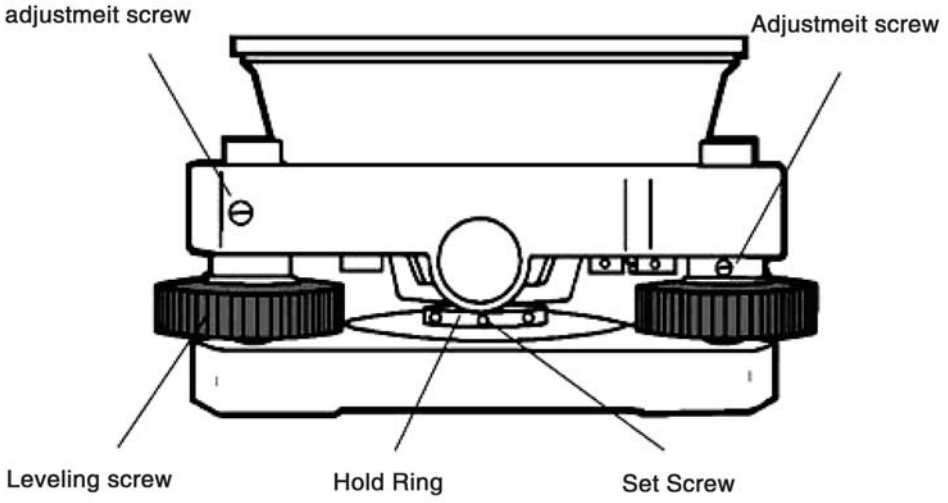
□Always repeat checking operations after adjustments are made, in order to confirm results.

● Notes on the Tribrach

Note that the angle measuring precision may be effected directly if the tribrach has not been installed firmly.

□If any leveling screw becomes loose and slack or if collimation is unstable due to the looseness of leveling screws, adjust by tightening the adjusting screws (in 2 places) installed over each leveling screw with a screwdriver.

□If there is any slack between the leveling screws and the base, loosen the set screw of the holding ring and tighten the holding ring with adjusting pin, until it is properly adjusted. Re-tighten the set screw on completing the adjustment.



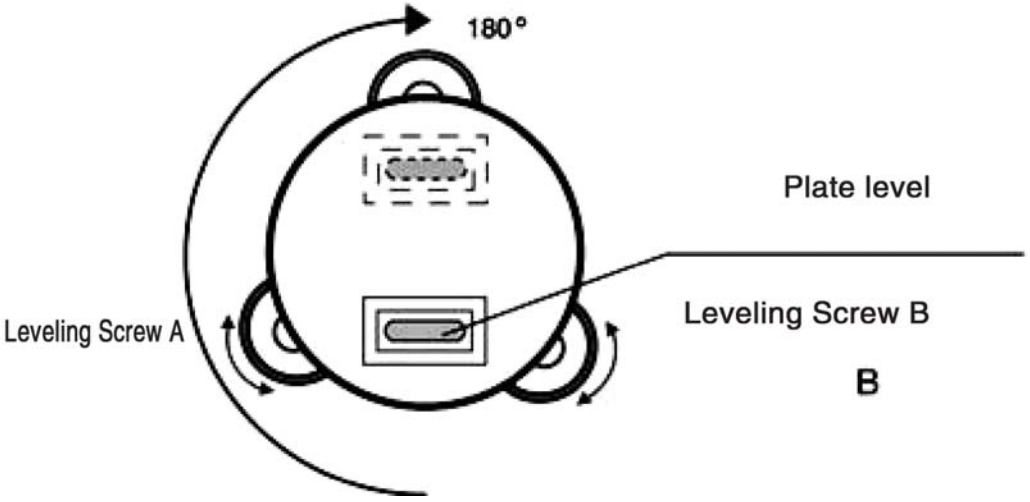
17.3.1 Checking /Adjusting the Plate Level

Adjustment is required if the axis of the plate level is not perpendicular to the vertical axis.

● Check

□Place the plate level parallel to a line running through the centers of two leveling screws, say, A and B.Use these two leveling screws only and place the bubble in the center of the plate level.

□Rotate the instrument 180¡ã or 200g around the vertical axis and check bubble movement of the plate level.If the bubble has been displaced, then proceed with the following adjustment.

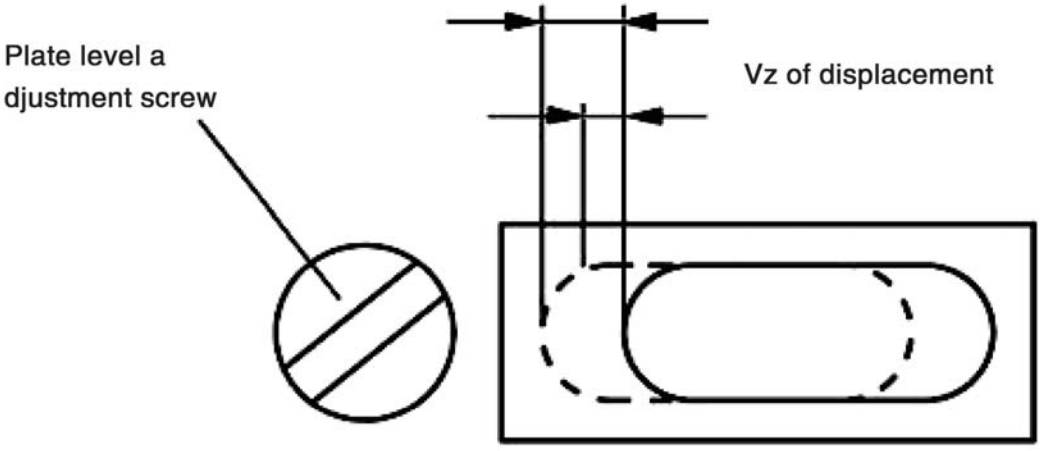


● **Adjustment**

□Adjust the level adjustment capstan screw, with the accessory adjusting pin and return the bubble towards the center of the plate level. Correct only one-half of the displacement by this method.

□Correct the remaining amount of the bubble displacement with the leveling screws.

□Rotate the instrument 180°or 200g around the vertical axis once more and check bubble movement.If the bubble is still displaced, then repeat the adjustment.



17.3.2 Checking / Adjusting the Circular Level

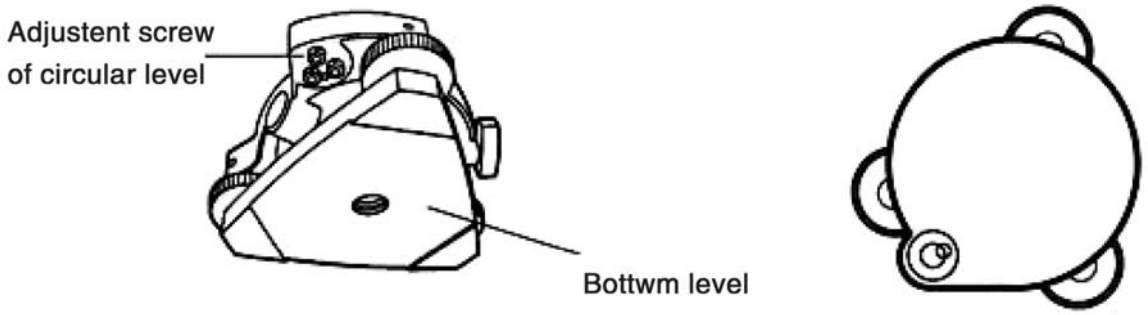
Adjustment is required if the axis of the circular level is not perpendicular to the vertical axis.

● **Check**

Carefully level the instrument with the plate level only. If the bubble of the ircular level is centered properly, adjustment is not required. Otherwise, proceed with the following adjustment.

● **Adjustment**

Shift the bubble to the center of the circular level, by adjusting three capstan adjustment screws on the bottom surface of the circular level, with the accessory adjusting pin



17.3.3 Adjustment of the Vertical Cross-hair

Adjustment is required if the vertical cross-hair is not in a place perpendicular to the horizontal axis of the telescope (since it must be possible to use any point on the hair for measuring horizontal angles or running lines).

● **Check**

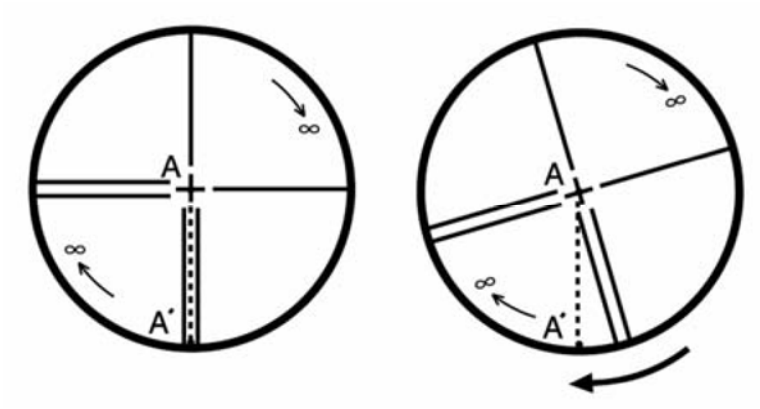
□Set the instrument up the tripod and carefully level it.

□Sight the cross-hairs on a well defined Point A at a distance of, at least, 50 meters (160ft.) and clamp horizontal motion.

□Next swing the telescope vertically using the vertical tangent screw, and check whether the point travels along the length of the vertical cross-hair.

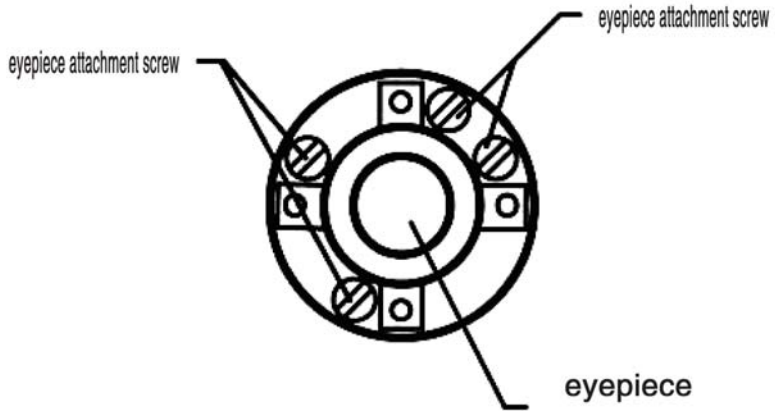
□If the point appears to move continuously on the hair, the vertical cross-hair lies in a plane perpendicular to the horizontal axis (and adjustment is not required).

□However, if the point appears to be displaced from the vertical cross-hair, as the telescope is swung vertically, then proceed with the following adjustment.



● **Adjustment**

□Unscrew the cross-hair adjustment section cover, by revolving it in the ounterclockwise direction, and take it off. This will expose four eyepiece section attachment screws.



□Loosen all four attachment screws slightly with the accessory screw-drive (while taking note of the number of revolutions).Then revolve the eyepiece section so that the vertical cross-hair coincides to Point A′. Finally, re-tighten the four screws by the amount that they were loosened.

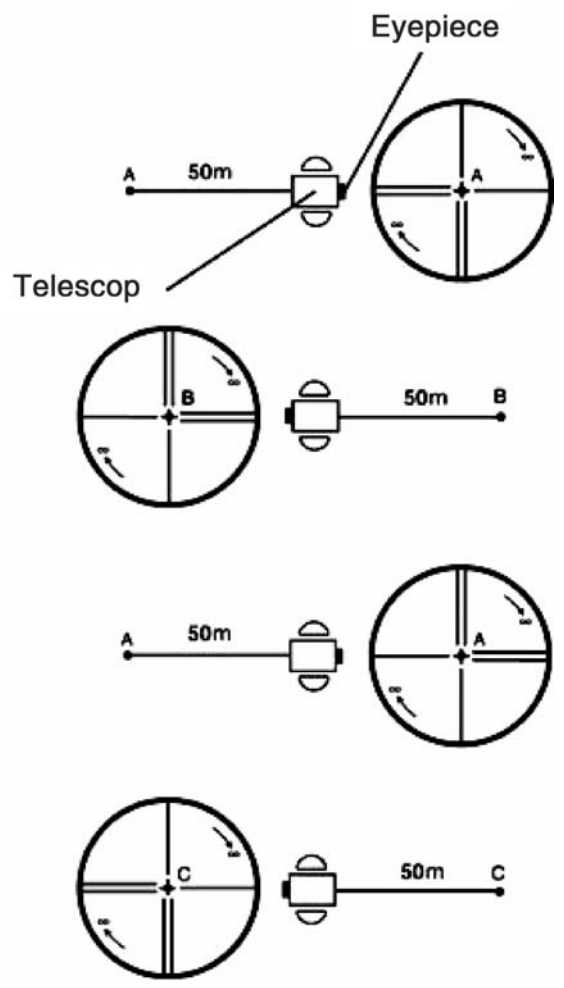
□Check once more and if the point travels the entire length of the vertical cross-hair, further adjustment is not required.

Note:Perform following adjustment after completing the above adjustment, i.e. Section 17.3.4 “Collimation of the Instrument”, Section 17.3.6 “Adjustment of Vertical Angle 0 Datum”.

17.3.4 Collimation of the Instrument

Collimation is required to make the line of sight of the telescope perpendicular to the horizontal axis ofthe instrument, otherwise, it will not be possible to extend a straight line by direct means.

● **Check**



Set the instrument up with clear sights of about 50 to 60meters (160 to 200 ft.) on both sides of the instrument.

Level the instrument properly with the plate level.

Sight Point A at approximately 50 meters (160 ft.) distance.

Loosen the vertical motion clamp only, and rotate the telescope 180°or 200g around the horizontal axis, so that the telescope is pointed in the opposite direction.

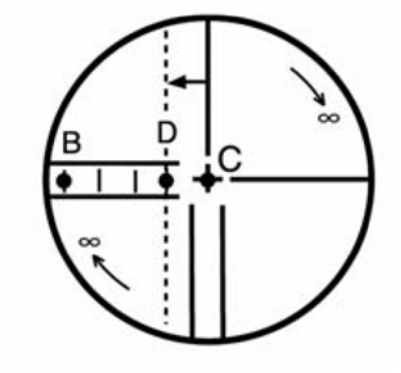
Sight Point B, at equal distance as Point A and tighten the vertical motion clamp.

Loosen the horizontal motion clamp and rotate the instrument 180°or 200g around the vertical axis. Fix a sight on Point A once more and tighten the horizontal motion clamp.

Loosen the vertical motion clamp only and rotate the telescope 180°or 200g around the horizontal axis once more and fix a sight on Point C, which should coincide with previous Point B.

If Points B and C do not coincide, adjust in the following manner

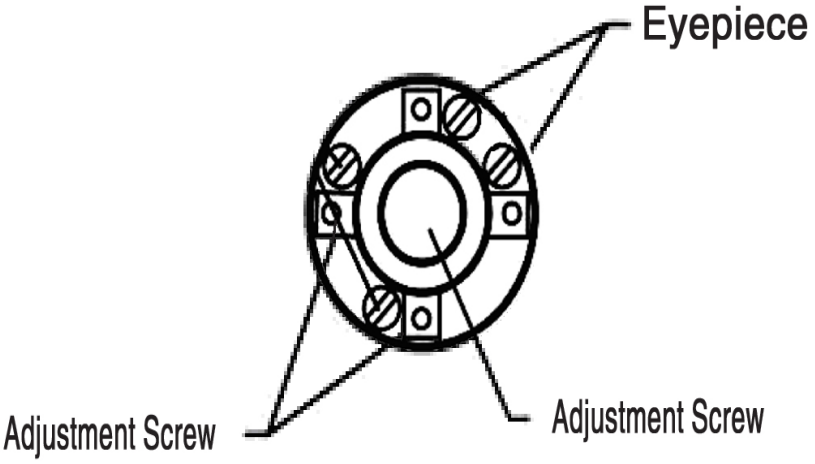
·Adjustment



Unscrew the cross-hair adjustment section cover.

Find Point D at a point between Points C and B, which should be equal to 1/4th the distance between Points B and C and measured from Point C.This is because the apparent error between Points B and C is four times the actual error since the telescope has been reversed twice during the checking operation.

Shift the vertical cross-hair line and coincide it with Point D, by revolving the left and right capstan adjustment screws with the adjusting pin.Upon completing the adjustment, repeat the checking operation once more. If Points B and C coincide, further adjustment is not required. Otherwise , repeat the adjustment.



Note: 1 First, loosen the capstan adjustment screw on the side to which the vertical cross-hair line must be moved.Then tighten the adjustment screw on the opposite side by an equal amount which will leave the stress of the adjustment screws unchanged.Revolve in the counterclockwise direction to loosen and in the clockwise direction to tighten, but revolve as little as possible

2 Perform following adjustment after completing the above adjustment, i.e. Section 17.3.6 “Adjustment of Vertical Angle 0 Datum”,17.2 Checking the Optical Axis

17.3.5 Checking / Adjusting the Optical Plummet Telescope

Adjustment is required to make the line of sight of the optical plummet telescope coincide with the vertical axis(otherwise the vertical axis will not be in the true vertical when the instrument is optically plumbed).

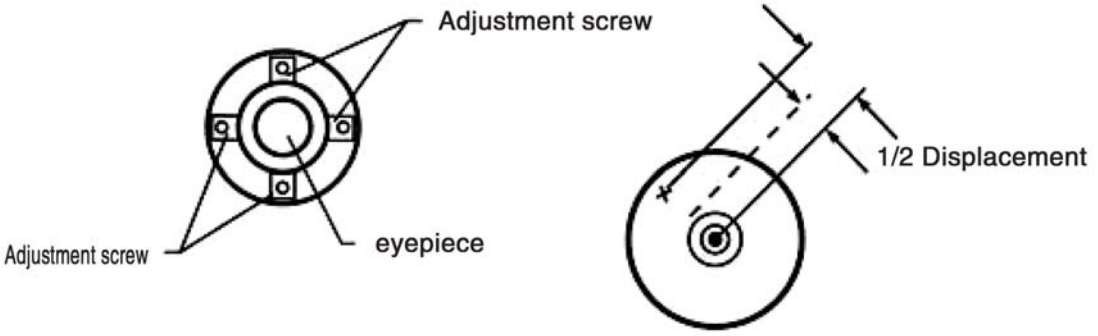
● **Check**

□Coincide the center mark and the point. (See Chapter 2 “PREPARATION FOR MEASUREMENT”)

□Rotate the instrument 180°or 200g around the vertical axis and check the center mark. If the point is properly centered in the center mark, adjustment is not required. Otherwise, adjust in the following manner.

● **Adjustment**

□Take off the adjustment section cover of the optical plummet telescope eyepiece. This will expose four capstan adjustment screws which should be adjusted with the accessory adjusting pin to shift the center mark to the point. However, correct only one-half of the displacement in this manner.



Optical Plummet Telescope

□Use the leveling screws and coincide the point and center mark.

□Rotate the instrument 180°or 200g around the vertical axis once more and check the center mark. If it is coincided to the point, then further adjustment is not required. Otherwise, repeat the adjustment.

Note: First, loosen the capstan adjustment screw on the side to which the vertical cross-hair line must be moved.Then tighten the adjustment screw on the opposite side by an equal amount which will leave the tension of the adjustment screws unchanged.Revolve in the counterclockwise direction to loosen and in the clockwise direction to tighten, but revolve as little as possible.

17.3.6 Adjustment of Vertical Angle 0 Datum

If when measuring the vertical angle of target A at telescope position normal (direct) and reverse settings, the amount of normal and reverse measurements combined is other than 360° (ZENITH-0), half of the difference from 360¡ã is the error amount from corrected 0 setting. Carry out adjustment.As adjustment for vertical angle 0 setting is the criteria for determining instrument coordinate origin, use special care for adjustment.

Operating procedure	Operation	Display
□Level the instrument properly with the plate level. □While pressing the [F1]key, turn power switch ON.	[F1] + Power ON	ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:INST. CONSTANT F3:FRQ CHECK MODE
□Press[F1]key	[F1]	V0 ADJUSTMENT <STEP-1> FRONT V: 90°00'00" ENTER
□Collimate target A from the telescope properly in normal setting. □Press[F4](Enter)key □Collimate target A in reverse telescope setting.	Collimate A (telescope direct) [F4]	V0 ADJUSTMENT <STEP-2> REVERSE V: 270°00'00" ENTER
□Press the [F4](ENTER) key. Measured value is set and carry out normal angle measurement.	[F4]	〈SET!〉 ↓
□Check that the total amount of normal and reverse angular travel is 360° collimating the target A by normal and reverse positions.		V : 270°00'00" HR: 120°30'40" 0SET HOLD HSET P1↓

17.4 How to Set the Instrument Constant Value

To set the Instrument constant which is obtained in Section 17.1 “Check and adjusting of instrument constant”, follow as below.

Operating procedure	Operation	Display
□While pressing the [F1] key, turn power switch ON.	[F1] + Power ON	ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:INST. CONSTANT F3:FRQ CHECK MODE
□Press[F2]key	[F2]	INST. CONSTANT SET INST. CONSTANT = - 0.6 mm --- --- [CLR] [ENT]
□Enter the constant value. *1),2)	Input value [F4]	INST. CONSTANT SET INST. CONSTANT : - 0.7 mm INPUT --- --- ENTER
□Turn power switch OFF	POWER OFF	

*1) Refer to Section 2.5 “How to Enter Alphanumeric characters”.
*2) To cancel the setting, press the [ESC] key.

17.5 Reference frequency check mode

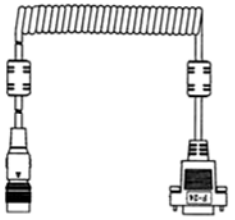
The beam modulated by the reference frequency of EDM is emitted continuously. This mode is used for frequency test mainly.

Operating procedure	Operation	Display
□While pressing the [F1] key, turn power switch ON.	[F1] + Power ON	ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:INST. CONSTANT F3:FRQ CHECK MODE
□Press the [F3](FRQ CHECK MODE) key.	[F3]	FRQ CHECK MODE EXIT
□Press the [F1](EXIT) key. The display will return to Adjustment mode menu 2/2.	[F1]	ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:INST. CONSTANT F3:FRQ CHECK MODE

18. PRECAUTIONS

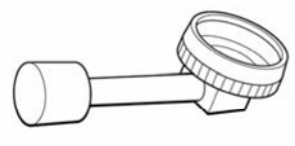
1. For transportation, hold by the handle or yoke of the instrument. Never hold by the lens barrel as it can affect the fixing bracket inside and reduce the accuracy of the instrument.
2. Never expose the instrument without a filter to direct sunlight. It may damage the components inside the instrument.
3. Never leave the instrument unprotected in high temperature. The temperature inside instrument may easily reach up to 70¡ãC or above and will reduce the service life.
4. The instrument should be stored in the room temperature range of minus 30□ to plus 60□.
5. When a high degree of precision is required for measurement, provide shade against direct sunlight for the instrument and tripod.
6. Any sudden change of temperature to the instrument or prism may result in a reduction of measuring distance range, i.e. when taking the instrument out from a heated vehicle.
7. When opening the carrying case and taking out the instrument, place the case horizontally, then open the case.
8. When returning the instrument to its case, be sure to match the white positioning marks provided with the case and place the instrument with the eyepiece upward.
9. For transportation, provide dampening or a cushion appropriately to avoid sudden shock or vibration.
10. For cleaning the instrument after use, remove dust using a cleaning brush, then wipe off with a cloth.
11. For cleaning the lens surface, use a cleaning brush to remove the dust, then use a clean lintless cotton cloth. Moisten it with alcohol (or mixture with ether) to wipe gently in a rotational motion from the center out.
12. Even if any abnormality occurs, never attempt to disassemble or lubricate the instrument yourself. Always consult with GOWIN or your dealer.
13. To remove the dust on the case, never use thinner or benzine. Use a clean cloth moistened with neutral detergent.
14. Check each part of the tripod after extended use. Parts (screws or clamps) may work themselves free.

19. SPECIAL ACCESSORIES



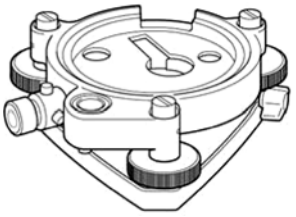
FC-24 interface cable
·Cable for communicating an external instrument and 100N by the serial signal connector

Solar reticle, Model 6
A reticle designed for collimation of the sun,can be used together with Solar Filter.Observation in an easy posture will be provided up to the zenith position

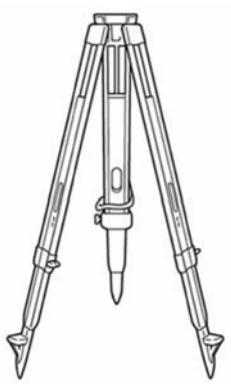


Observation in an easy posture will be provided up to the zenith position

A filter designed exclusively for direct collimation of the sun.Solar filter of flap-up type.



Optical plummet tribrach
This is detachable tribrach having built-in optical plummet telescope



Wide-frame extension leg tripod, Type E (Wood)
·Flat top,5/8 inch，11 treads per inch connection screw,adjustable tripod leg.

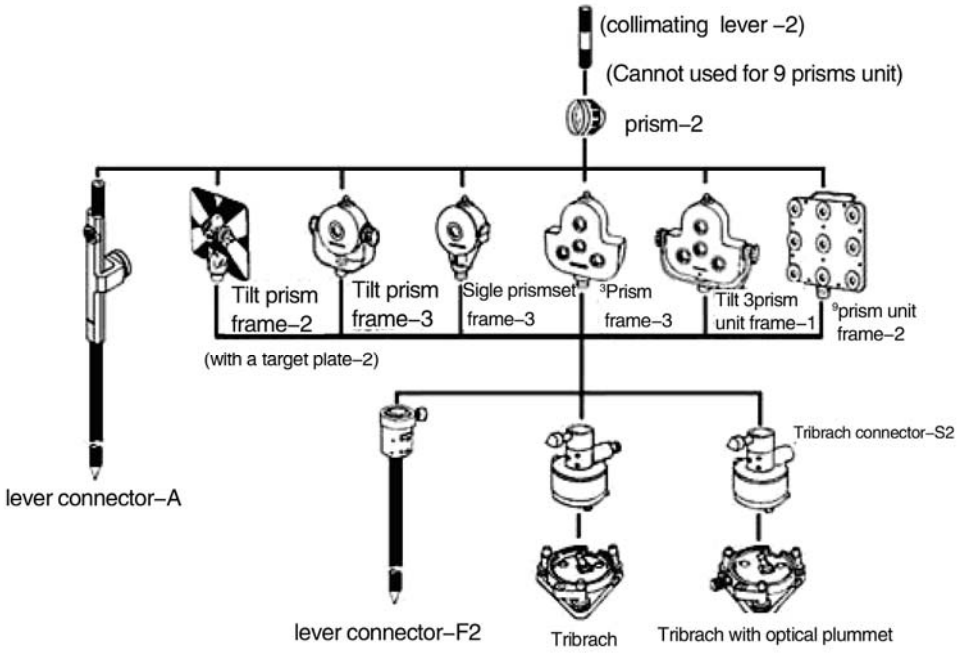
Prism unit case, Model 5
prisms unit or fixed 3 prisms unit can be stored in this caseEspecially, this is a very easy case to carry. Soft material is used.
·External dimensions
200(L)x200(W)x350(H)mm
·Weight:0.5kg

Wide-frame extension leg tripod, Type E (Wood)
·Flat top,5/8 inch，11 treads per inch connection screw,adjustable tripod leg.

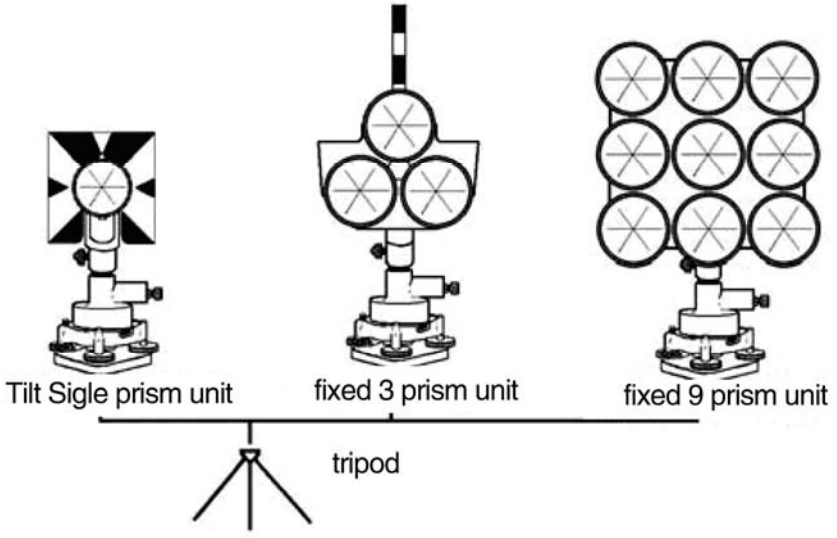
Accessory case, model 1
The case for storage and carrage various accessories
·External dimensions
300(L)x145(W)x220(H)mm
·Weight:1.4Kg

20. PRISM SYSTEM

It is possible to change the combination according purpose.



It is possible to change the combination according purpose.



Use the above prisms after setting them at the same height as the instruments.
To adjust the height of prism set, change the position of 4 fixing screws.

21. ERROR DISPLAY

Error code	Description	Countermeasures
3 points required	When area calculating, there are less than 3 points coordinate data in selected file.	Confirm the file data and calculate again.
CALC ERROR	Calculation is impossible from the data input.	Confirm the input data.
DELETE ERROR	When deleting coordinate data, it can not be done successful.	Confirm
E35	Displayed when REM measurement carried out to the range from zenith or nadir ±6° .	Operate in the r zenith or nadir.
E60's	Any abnormality occurs with EDM (distance measuring system).	Repair is required.
E71	Displayed when vertical angle 0 position is set with incorrect procedure.	Confirm
E72	Displayed when Vertical angle -position is adjusted in wrong position.	Repair is required.
E73	The instrument was not leveled when Vertical angle 0-position is adjusted.	Level the instrument then carr adjustment work.
E80's	Mainly at the time data transmission between TKS-200 series and external instrument.	Confirm oper connection cables are correct.
E90's	Abnormality in internal memory system.	Repair is required.
FILE EXISTS	The same file name exists.	Use another file name.
FULL FILES	When making a file, 30 files already exist.	If necessary, send or delete files.

FAILED INITIALIZE	Initializing can not be done successful.	Confirm initializing data and try to initialize again.
LIMIT OVER	Limit of input data exceeded.	Input again.
MEMORY ERROR	Any abnormality occurs with internal memory.	Initialize the internal memory.
MEMORY POOR	Shortage of capacity of the internal memory.	Download data from internal memory to PC.
NO DATA	The data is not found in the search mode	Confirm the data and search again.
NO FILE	There is no file in internal memory.	If necessary, make files.
FILE NOT SELECTED	When using a file, no file is selected.	Confirm the file and select a file.
P1-P2 distance too short	When in point to line measurement, the horizontal distance between first point and second point is within 1m.	The horizontal distance between first point and second point must be more than 1m.
CIRCULAR ERROR	Known points and occupied point are on the same circle at the resection mode.	Take the different point.
PT# EXIST	Same new point name is already memorized in the memory.	Confirm the new point name and input again.
PT# DOES NOT EXIST	When you enter incorrect name or PT# does not exist in the internal memory.	Enter the correct name or enter point in the internal memory.
RANGE ERROR	When setting a new point, calculation is impossible from the measured data.	Measure again.
Tilt Over	Instrument tilts over more than 3 minutes.	Level the instrument properly.
V ANGLE ERROR H ANGLE ERROR VH ANGLE ERROR	Abnormality in angle measuring system.	If this error code continues to display, repair is required.

·If the error information still exist after treatment, you can contact with local dealer.

22. SPECIFICATIONS

Telescope

Length :150 mm
Objective lens :45 mm(EDM50 mm)
Magnification :30x
Image :Erect
Field of view :1°30′
Resolving power :3.0″
Minimum focus :1.3 m

Distance measurement

Measurement range

	Prism	Atmospheric conditions	
		Condition 1	Condition 2
TKS-202	Mini prism	900m(3,000ft)	---
	1 prism	2,000m(6,600ft)	2,300m(7,500ft)
	3 prisms	2,700m(8,900ft)	3,100m(10,200ft)
	9 prisms	3,400m(11,200ft)	4,000m(13,200ft)

Condition 1:Slight haze with visibility about 20km (12.5miles) moderate sunlight with light heat shimmer.
Condition 2:No haze with visibility about 40km(25 miles), overcast with no heat shimmer.
measurement accuracy : ±(2mm +2ppm × D) m.s.e.
D : Measuring distance (mm).

Minimum reading

Fine mode :1mm(0.005ft)/0.2mm(0.001ft)
Coarse mode :10mm(0.02ft)/1mm(0.005ft)
Tracking mode :10mm(0.02ft)
Measurement display : 12 digits, max. display 99999999.9999

Measuring time

Fine measurement mode	:1mm :1.2 sec. (Initial 4 sec.) 0.2mm :2.8 sec. (Initial 5 sec.)
Coarse measurement mode	: 0.7 sec. (Initial 3 sec.)
Tracking measurement mode	: 0.4 sec. (Initial 3 sec.) (The initial time will be different by a condition and setting EDM off time)
Atmospheric Correction Range	:-999.9ppm to+999.9ppm, in 0.1ppm increments
Prism constant correction range	: -99.9mm to+99.9mm, in 0.1mm increments
Coefficient Factor	: Meet / Feet International feet 1m=3.2808398501 ft. US SURVEY feet1m = 3.2808333333 ft.

Electronic Angle Measurement

Method	: Absolute reading
Accuracy (Standard deviation based on DIN 18723)	
TKS-202	: 2″

Tilt Correction (Automatic index)

Tilt sensor TKS-202	:automatic compensator
Method	:Liquid compensator
Compensating Range	:± 3′
Correction unit	:1″ (O.1mgon)

Others

Instrument height	:176mm(6.93 inch), base unit detachable (Height from the tribrach dish to the center of telescope)

Level sensitivity

Circular level	: 1 0′/2 m
Plate level	: 30″/2 mm

Optical Plummet Telescope

Magnification	:3 x
Focusing range	:0.5 m～∝
Image	: Erect
Field of view	:3°

Dimension	:336(H)×184(W)×172(L)mm (13.2H 7.2W 6.8L in)

Weight

Instrument	
(with battery)	:4.8 kg
(without battery)	:4.6 kg
Plastic carrying case	:3.7 kg

Durability

Protection against water and dust	:TP54(based on international standard IEC60529)
(with battery: BT-L1W)	
Ambient temp.range	:-20□～+50□(-4□～+122°)

Battery BT-L1W

Capacity	:3.0AH
Longest use time(fully charged)at +20□(+68□)	
Inclu. Distance measurement	: 14 hrs
Only for angle measurement	: 60 hrs
Weight	:0.2kg

Battery Charger BC-LIW

Working temp.	:+10□～+40□(50□～104□)
Charging signal	: Red light illumination
Finishing signal	: Green light illumination
Weight	: 0.2kg

- Battery using time will vary depending on environmental conditions and operations done with TKS- 200N series.

SERVICE PARTS LIST

ISSUED . . . . . JUN. 2009
REVISED . . . . . .

ELECTRONIC TOTAL STATION

TKS-202

Topcon（Beijing）Technology Co., Ltd.

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CONTENTS

ILLUSTRATION (FOR FINDING THE REQUIRED PART NUMBER AND NAME)

PARTS LIST (FOR FINDING THE REQUIRED ILLUSTRATION FROM THE PARTS NUMBER)

Note:

1. This product has a fully waterproof construction. It is requested to understand the repair manual before replacing the parts or repairing the product.
2. When ordering parts, include model numbers, illustration numbers, parts numbers, names of parts and quantities.

Example

Model	Illust. No.	Parts No.	Name of Parts	Q'ty
TKS-202	2-6	81001 10010	Cover	2

3. Screws and washers must always be ordered in quantities of 10.
4. Marked (※) are not supplied as spare parts but as optional accessories.
5. Parts marked with an asterisk (※※) are not sold as service part for production reason.
6. Number plates are not available for order. Damaged number plates, however, can be exchanged for new ones.
7. It is requested to understand that a unit price is variable.

Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
2-1	CR2×3.5B BNi	CR-screw	4		
2-2	81001 12010	Sighting collimeter unit	2		
2-3	71001 10510	Packing	2		
2-4	T2.6×8B Cr	T-screw	8		
2-5	31280 10230	Teflon washer	8		
2-6	81001 10010	Cover	2		
2-7	————	Packing	2		φ1.5×330mm
2-8	71001 10220	Plate	1		
2-9	CR2×3S Ni	CR-screw	14		
2-10	7100142000	EDM AMP unit	1		
2-11	81001 10230	Plate	1		
2-12	710014100B	EDM D-OSC unit A	1		
2-13	71001 4000B	Digital-analogue unit	1		
2-14	64522 10150	Bushing	1		
2-15	81001 46010	Cable A	1		

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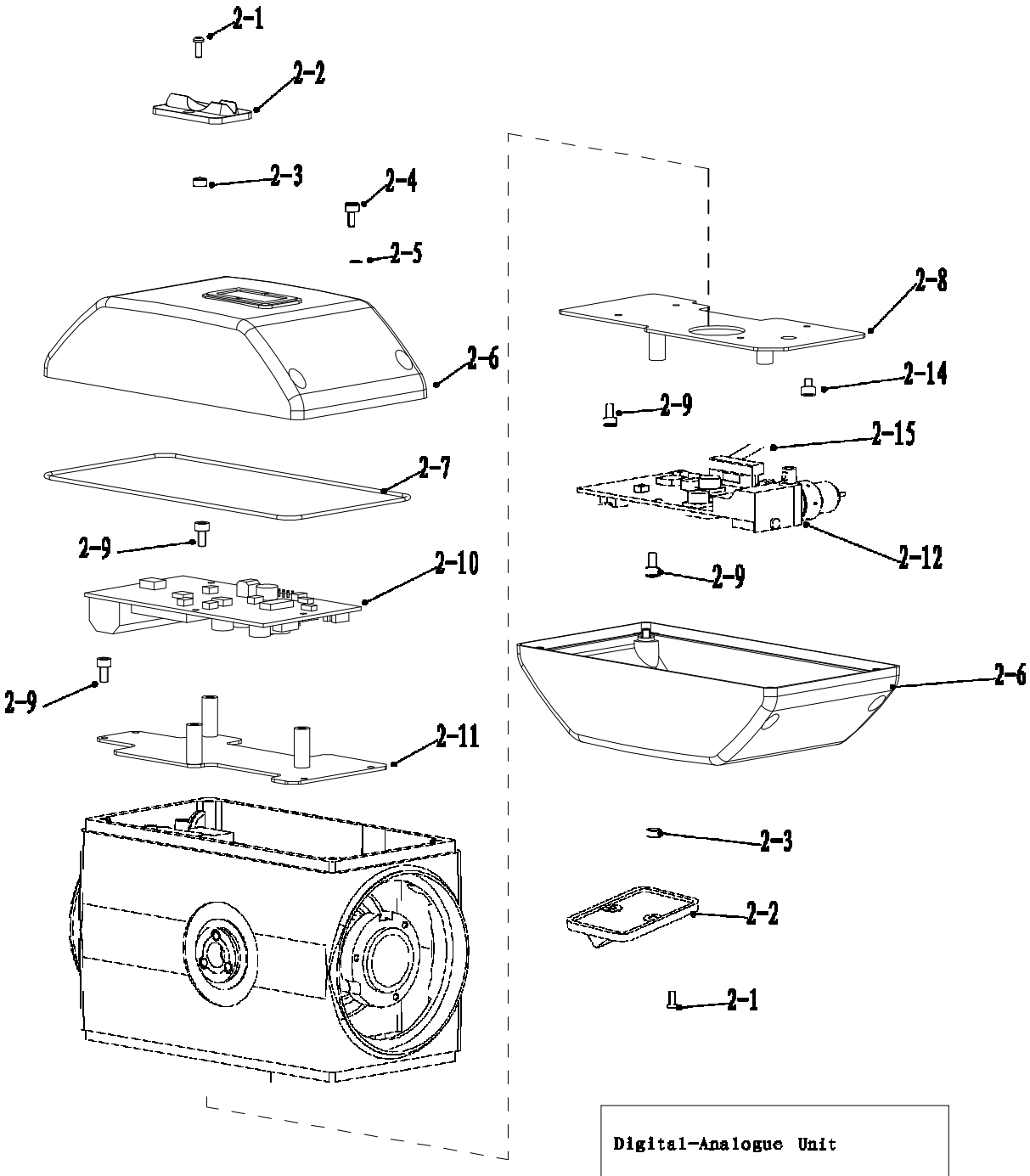
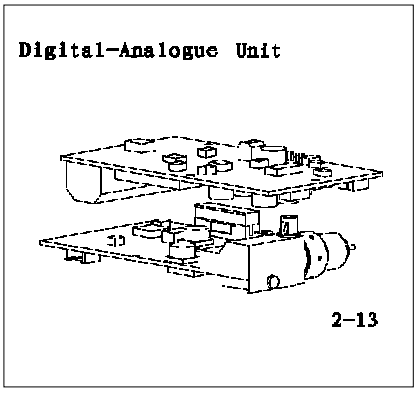
DISTANCE MEASUREMENT ANALOGUE ASSEMBLY





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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
4-1	71001 11300	Receiving cell optical assembly	1		
4-2	71001 11440	Washer	2		
4-3a	71001 16000	EDM base assembly (without fiber)	1		
4-3b	71001 11500	EDM base assembly (with fiber)	1		
4-4	CRs1.7×5B BNi	CRs-screw	4		
4-5	71001 10900	Emitting cell optical assembly	1		
4-6	CR2×8S-SW+FwBNi	CR-screw	3		

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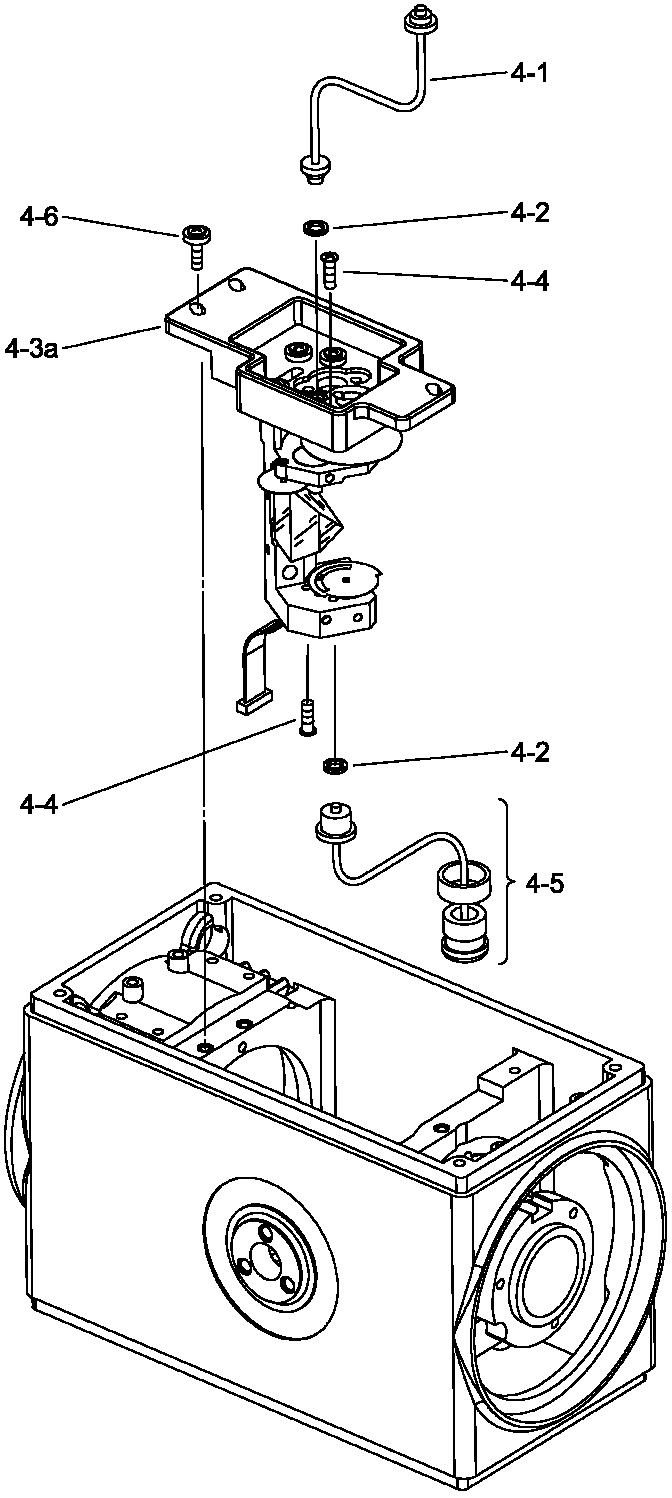
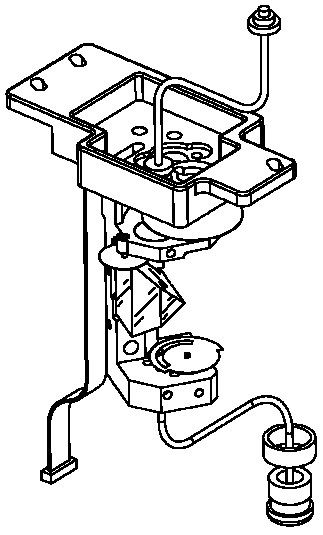
EDM BASE ASSEMBLY



EDM Base Assembly (With Fiber)

4-1～5



4-3b

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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
6-1	81001 10070	Cap	1		
6-2	71001 10350	Decoration ring	1		
6-3	64501 11300	Objective lens barrel unit	1		
6-4	71001 10060	Stopper plate	1		
6-5	CR2×4B BNi	CR-screw	2		
6-6	64411 10220	Screw	2		
6-7	FWs2B	Washer	2		
6-8	71001 10800	Dichroic prism assembly	1		
6-9	U2×4B BNi	U-set screw	2		
6-10	64519 10290	Cap	2		
6-11	CQs2×4B BNi	CQs-screw	1		
6-12	30000 10610	Lead pin collar	1		
6-13	64411 10240	Lead pin	1		
6-14	64501 11800	Internal assembly	1		
6-15	64501 10590	Internal spring	1		
6-16	CRs1.4×1.6S BNi	CRs-screw	1		
6-17	81001 11010	Telescope tube	1		
6-18	64411 10320	Washer	1		
6-19	64524 10170	V ring	1		
6-20	64524 10190	Spacer	1		
6-21	CQs2×6B BNi	CQs-screw	2		
6-22	64530 10020	Focusing ring	1		
6-23	81001 10050	Rubber ring	1		
6-24	64524 10160	V ring	1		
6-25	64524 10180	Spacer	1		
6-26	64530 10030	O ring	1		
6-27	64530 10040	Focusing ring retainer	1		
6-28	CR2×5B BNi	CR-screw	3		
6-29	81001 10200	Eyepiece lens base assembly	1		
6-30	31280 10230	Teflon washer	3		
6-31	CR2.6×6B BNi	CR-screw	3		
6-32	64519 10440	Washer	1		
6-33	64529 15330	Eyepiece frame	1		
6-34	30000 10340	Washer	4		
6-35	64501 10610	Adjustment screw	4		
6-36	R2×3B Cr	R-screw	4		
6-37	64501 17700	Reticle mount assembly	1		
6-38	64530 12900	Eyepiece lens assembly	1		
6-39	64529 15380	O ring	1		
6-40	64529 15370	Eyepiece lens cover	1		
6-41	81001 10100	Eyepiece lens base unit	1		
6-42	64529 15300	Eyepiece lens unit	1		

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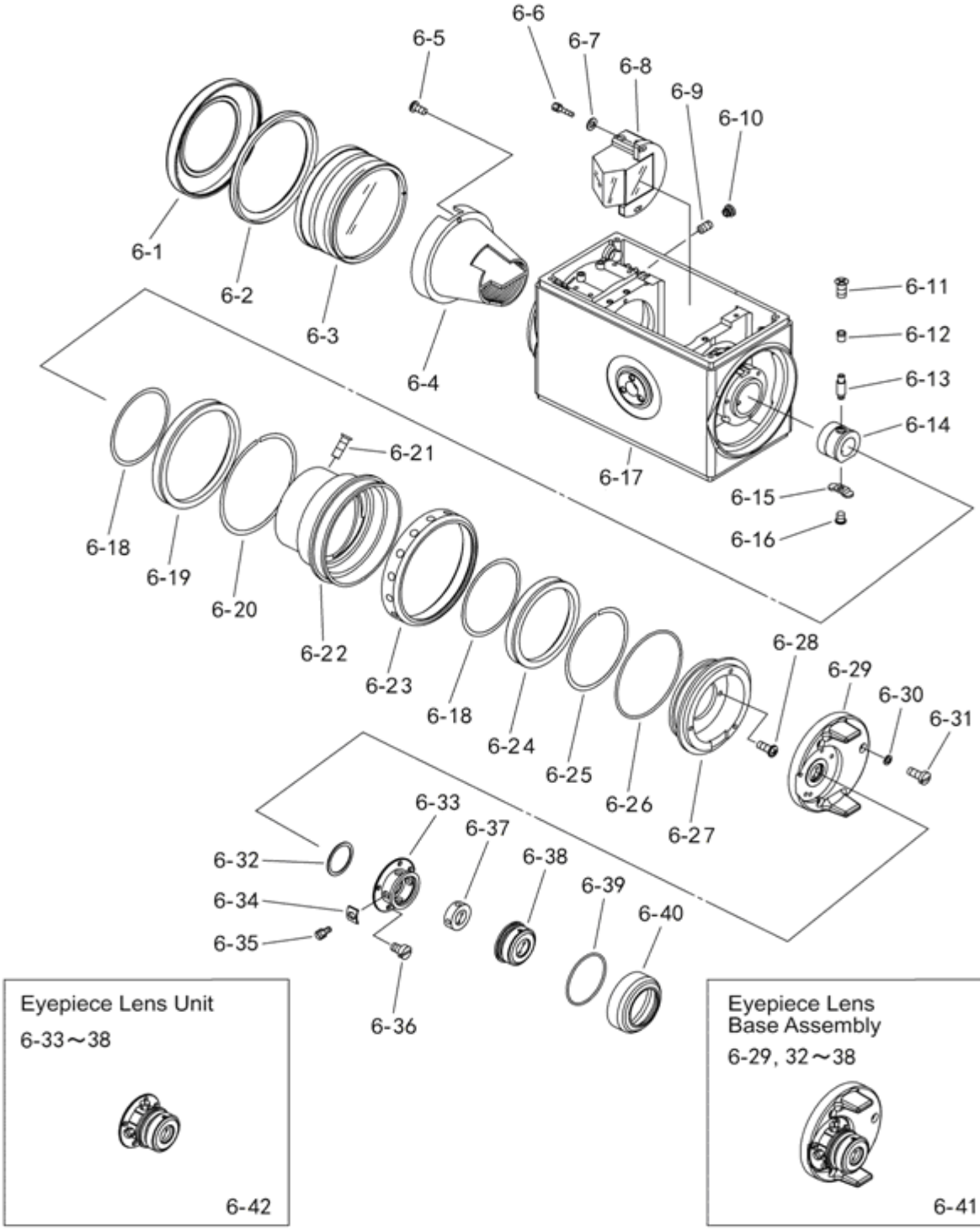
TELESCOPE ASSEMBLY



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
8-1	81001 20200	Handle	1		
8-2	64519 20780	Screw	2		
8-3	81001 20770	Center cover	1		
8-4	81001 20420	Tubular vial cover	1		
8-5	71001 20410	Packing	1		
8-6	71001 20790	V-ring shaft	2		
8-7	71001 20930	O ring	2		
8-8	71001 20080	Horizontal axis right holder	1		
8-9	71001 20070	Horizontal axis (right)	1		
8-10	R3×7S Cr	R-screw	3		
8-11	R3×5S Cr	R-screw	4		
8-12	71001 20210	Nut	1		
8-13	7100120700	Vertical clamp assembly	1		
8-14	71001 20090	Cam	1		
8-15	6SU2.6×6S	6SV-set screw	1		
8-16	71001 20190	Cam	1		
8-17	71001 1034S	Cam shaft	1		
8-18	71001 20110	Pin	1		
8-19	U2×5s BNi	U-set screw	1		
8-20	71001 20110	Cam shaft	1		
8-21	71001 20870	Middle pad (center)	1		
8-22	71001 20880	Clamp pad (left/right)	2		
8-23	71001 20340	Adjustment screw	1		
8-24	71001 20250	O ring	1		
8-25	71001 20430	Spring	1		
8-26	71001 25100	Plate level assembly (30")	1 1		
8-27	71001 20840	Spacer	1		
8-28	71001 20190	Screw	1		
8-29	81001 20010	Standard	1		
8-30	71001 2180S	Vertical scale ring	1		
8-31	FWs2.6S Cr	Washer	3		
8-32	R2.6×16S Cr	R-screw	3		
8-33	71001 20390	Spacer	1		
8-34	R3×7 CR	R-screw	4		
8-35	81001 22400	V slipring unit	1		
8-36	CR2×8B BNi	CR-screw	3		
8-37	PTP 2×5 BNi	P tight CR-screw	2		
8-38	81001 22300	V brush unit	1		

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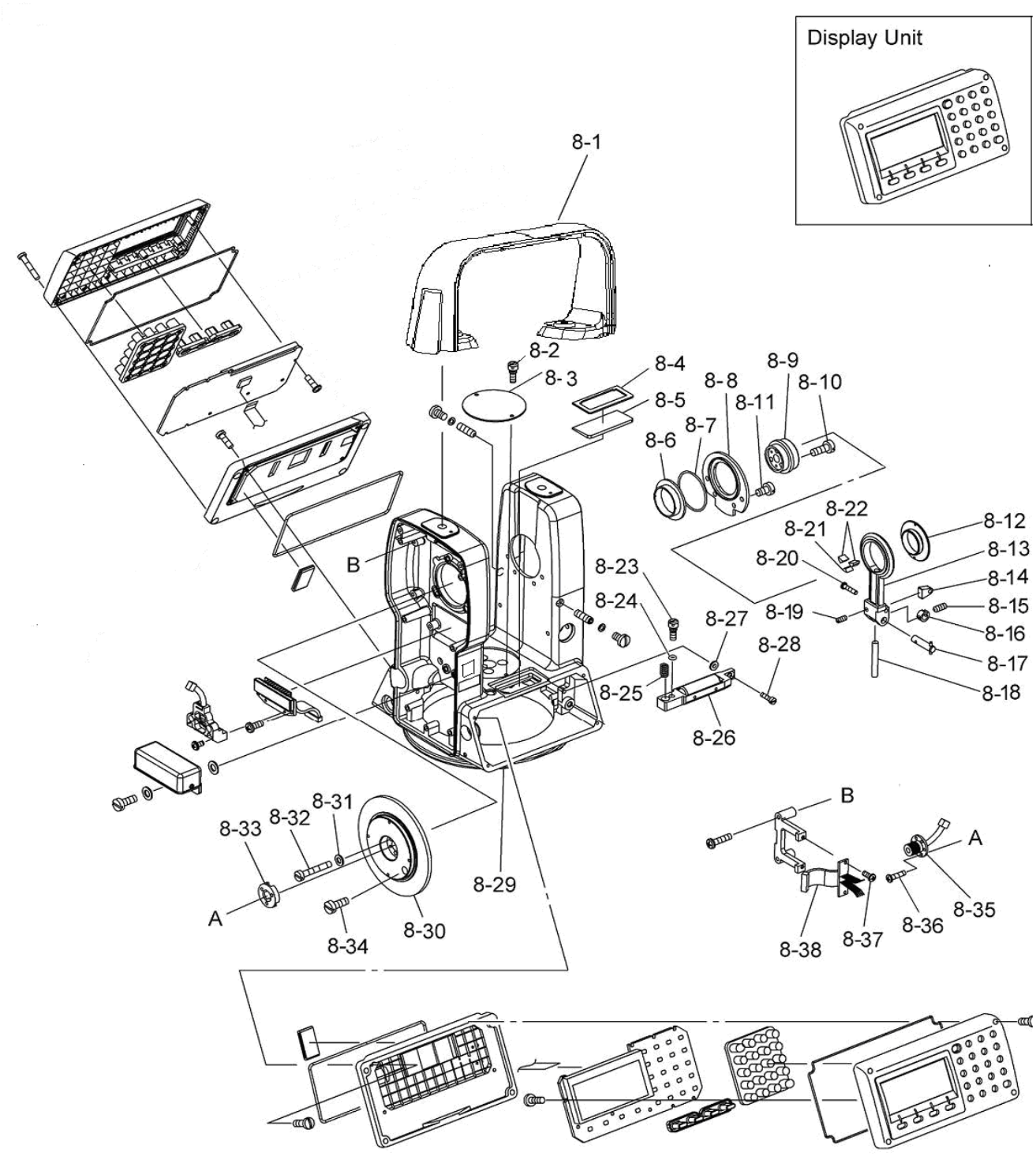
STANDARD, PLATE LEVEL AND HANDLE ASSEMBL



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
8-39	81001 20190	Brush-mount	1		
8-40	CR2.6×15B Cr	CR-screw	2		
8-41	6SU3×10S	6SU-set screw	2		
8-42	64519 20380	Teflon washer	2		
8-43	T3×5B Cr	T-screw	2		
8-44	71001 70000	Tilt unit	1		
8-45	6S3×8S Cr	R-screw	2		
8-46	FWS3B	Washer	4		
8-47	71001 10050	Washer	2		
8-48	T2×10B Cr	Screw	8		
8-49	81001 20760	Number key panel	2		
8-50	————	Number panel packing	2		φ1.5×365mm
8-51	81001 20030	F Key	2		
8-52	81001 20780	Number rubber key	2		
8-53	81001 39020	LCD unit	2		
8-54	PTP2×5S Ni	Screw	8		
8-55	71001 20170	Display FFC-F	1		
8-56	71001 20180	Display FFC-R	1		
8-57	Cr2×5S Ni	Screw	18		
8-58	81001 20040	Number key base	2		
8-59	————	Packing 1	2		φ1.5×390mm
8-60	71001 208900	Ferrite core	2		
8-61	81001 33300	V-CCD unit	1		
8-62	CR2.6×6B BNi	CR-Screw	2		
8-63	71001 23300	Angle measurement LED unit(V)	1		
8-64	CR2×4-FW BNi	CR-screw	2		
8-65	81001 39200	Display unit	2		
8-66	71001 20800	Vertical clamp assembly	1		
8-67	31311 20310	Recycling label	1		

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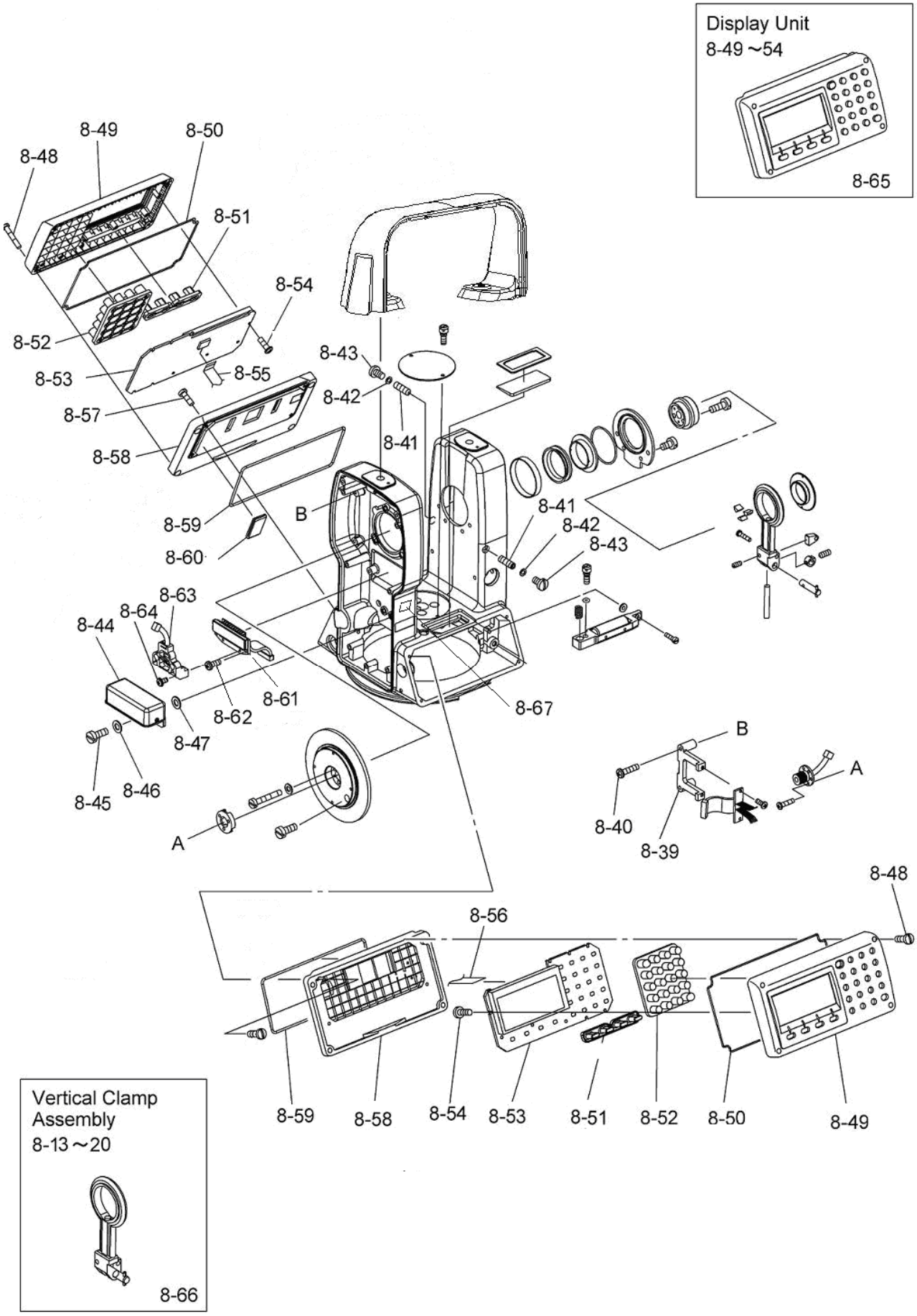
STANDARD, PLATE LEVEL AND HANDLE ASSEMBLY



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
12-1	6S4×14s Cr	Hexagon socket cap screw	3		
12-2	CR2.6×5B BNi	CR-screw	4		
12-3	81001 33200	Angle measurement unit (H2)	1		
12-4	81001 33100	Angle measurement unit (H1)	1		
12-5	CR2.6×3B BNi	CR-Screw	2		
12-6	71001 20310	Roter cover	1		
12-7	71001 26000	Vertical axis assembly	1		
12-8	71001 1034S	Cam shaft	1		
12-9	71001 22610	Middle pad (center)	1		
12-10	71001 21310	Clamp pad (left/right)	2		
12-11	71001 20080	Horizontal clamp ring (A)	1		
12-12	6SU2.6×6S Ni	6SU-set Screw	1		
12-13	71001 10330	Cam	1		
12-14	71001 21320	Pin	1		
12-15	6S3×16S Cr	Hexagon socket cap screw	4		
12-16	6452920140	V ring	1		
12-17	81001 20400	Lower tangent assembly	1		
12-18	81001 28200	Bearing plate assembly	1		
12-19	81001 20830	Washer plate	1		
12-20	81001 20810	Spring washer	1		
12-21	71002 20530	Stopper ring	1		
12-22	71001 20350	O ring	1		
12-23	81001 23600	Cover	1		With lend
12-24	R2×5B Cr	R-screw	3		
12-25	64519 20380	Teflon washer (M2)	3		
12-26	71001 20800	Horizontal clamp ring assembly	1		

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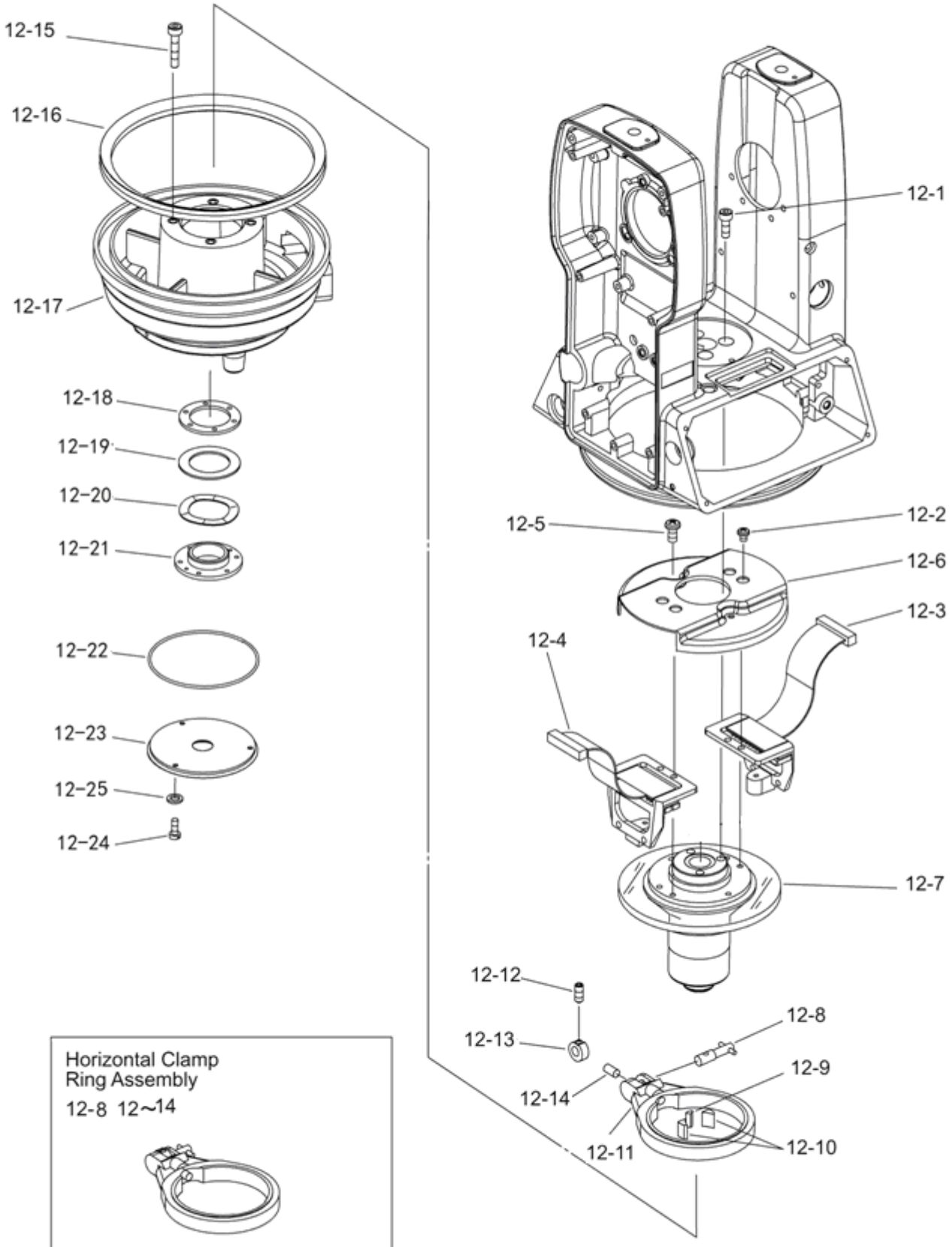
VERTICAL AXIS ASSEMBLY



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
14-1	81001 24100	Horizontal adjusting screw Unit	1		
14-2	71001 20230	Piston	1		
14-3	71001 21080	Spring	1		
14-4	71001 20730	O ring	1		
14-5	71001 20720	Spring cell	1		
14-6	6SU3×3S BZn	6SU-set screw	2		

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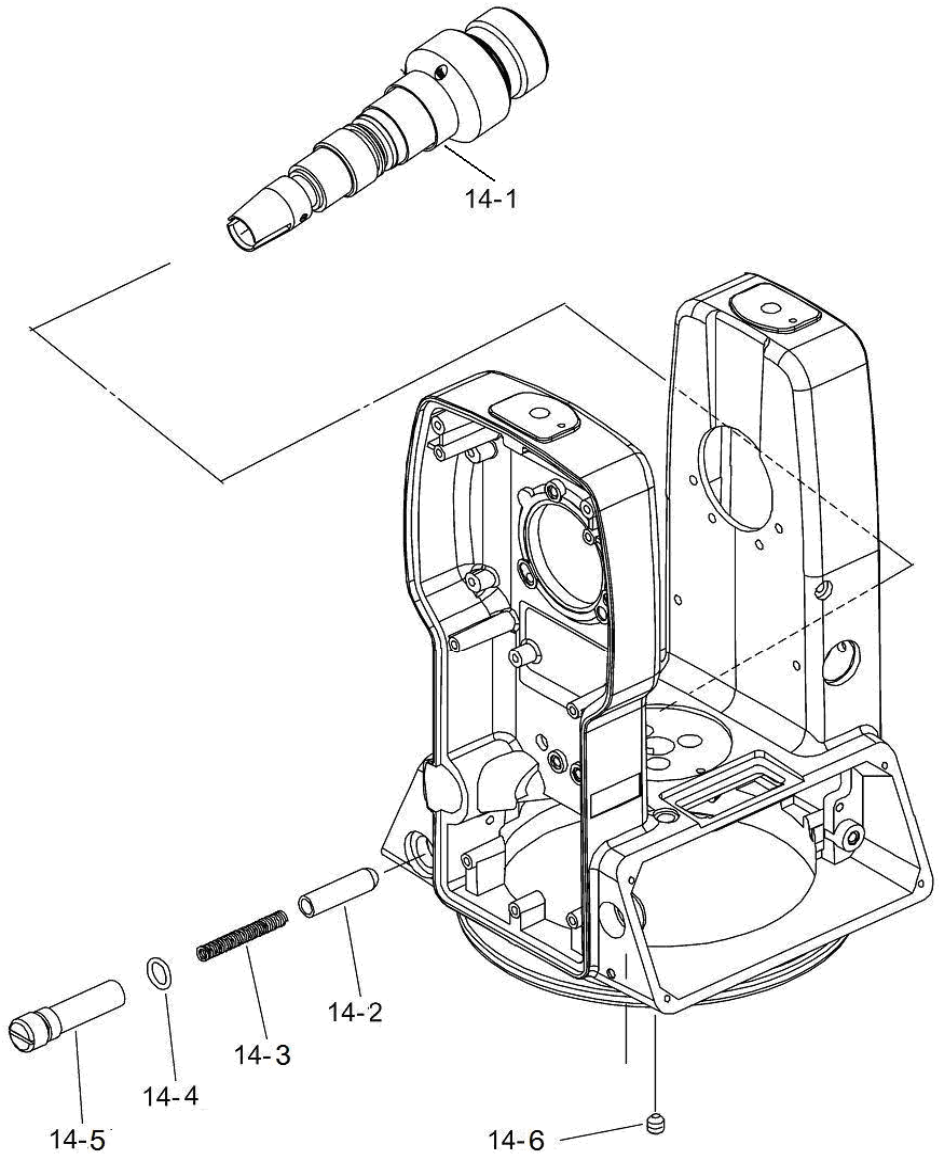
HORIZONTAL ADJUSTING SCREW ASSEMBLY



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
16-1	81002 20420	Fine adjustment cylinder	1		
16-2	71001 20270	O ring	1		
16-3	71001 20640	Coil spring	1		
16-4	71001 20530	Piston	1		
16-5	6SV3×5B Cr	6SV-set screw	2		
16-6	81001 26100	Vertical fine adjustment unit	1		
16-7	71001 60000	Optical plummet telescope assembly Fixed knob	1		
16-8	6SV3×3S Cr	6SV-set screw	1		
16-9	6SU3×3S Cr	6SU-set screw	1		

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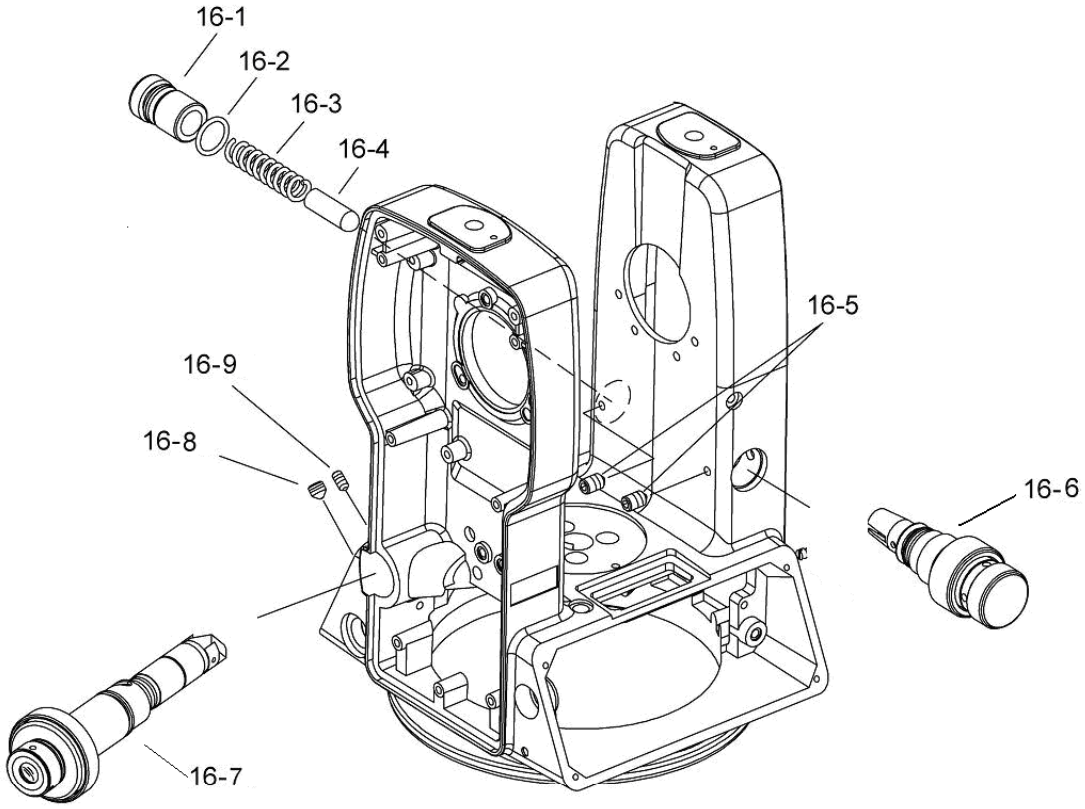
OPTICAL PLUMMET TELESCOPE ASSEMBLY AND VERTICAL MOVEMENT UNIT



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
18-1	T2.6×5B Cr	T-screw	4		
18-2	T2.6×8B Cr	T-screw	2		
18-3	81001 20440	Cap	1		
18-4	64511 10060	Sticker	1		
18-5	T2.6×12B Cr	T-screw	1		
18-6	T2.6×25B Cr	T-screw	1		
18-7	81001 23100	Right cover unit	1		
18-8	T3×5B Cr	T-screw	1		
18-9	71002 36000	External communication unit	1		
18-10	81001 20380	Blanck cap A	1		
18-11	64630 20960	Spacer bolt	4		
18-12a	81001 3000A	CPU unit	1		For Chinese market
18-12b	81001 3000B	CPU unit	1		For American market
18-12c	81001 3000C	CPU unit	1		For European market
18-12d	81001 3000D	CPU unit	1		For Asian market
18-13	CR2.6×4B Cr	CR-screw	4		
18-14	T2.6×16B Cr	T-screw	2		
18-15	T2.6×20B Cr	T-screw	3		
18-16	81001 22100	Left cover unit	1		
※18-17	————	Battery (BT-L1(W))	1		For production

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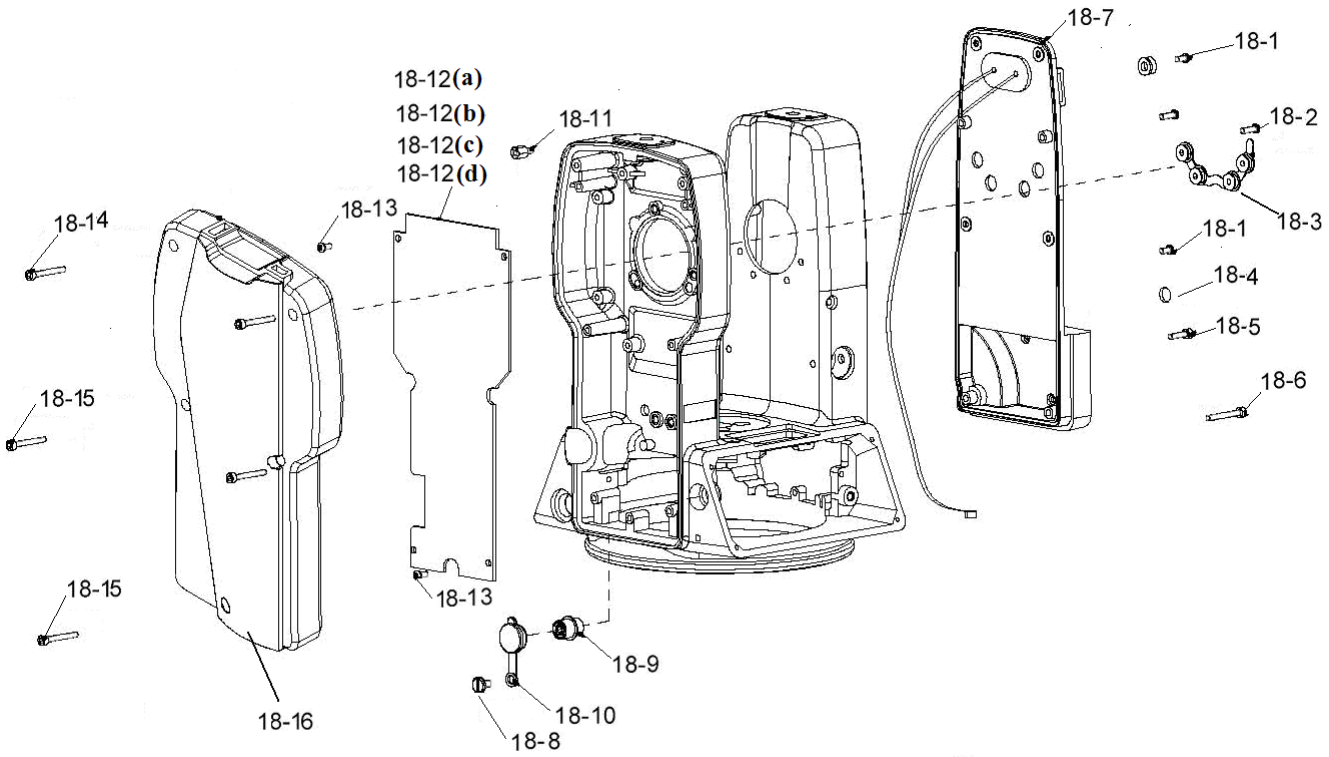
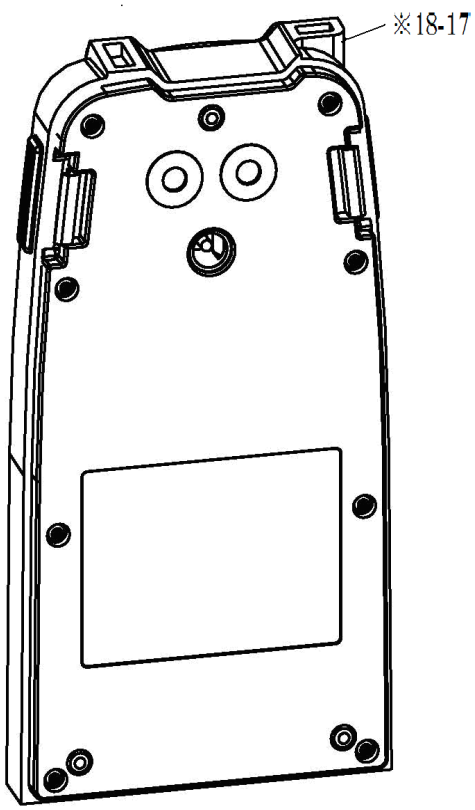
EFT AND RIGTH COVER ASSEMBLY · ON-BOARD BATTERY





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Illust. No.	Parts No.	Name of Parts	Q'ty	News N.	Remarks
※20-1	————	Leveling base	1		For production

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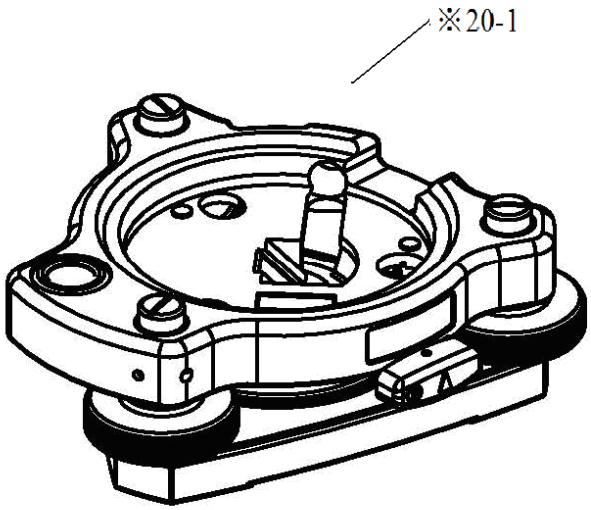
SWITCHING TYPE LEVELING BASE ASSEMBLY



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Illust. No.	Parts No.	Name of Parts	Q'ty	News No.	Remarks
22-1	81001 90260	Shoulder belt	2		
22-2	81001 90015	Name plate	1		
□22-3(a)	————	Charger (BC-L1W/A)	1		For production(230V)
□22-3(b)	————	Charger (BC-L1W/B)	1		For production(120V)
22-4	71001 92490	Silicon cloth	1		
22-5	71001 90120	Vinyl cover	1		
22-6	71001 92480	Silica gel	1		
			1		
22-7	71001 92470	BCA gel	1		
22-8	81001 91075	Housing condition figure	1		
22-9	71001 90090	Tool case	1		
22-10	31087 20030	Cleaning brush	1		
22-11	31604 10060	Screw driver	1		
22-12	31087 20100	Adjusting pin	1		
22-13	64352 90160	Hexagon wrench (nominal dimension 1.5)	1		
22-14(a)	81001 90010	Instruction manual	1		
22-14(b)	81001 90020	Instruction manual(WW)	1		
22-15	81001 93000	Carrying case unit	1		

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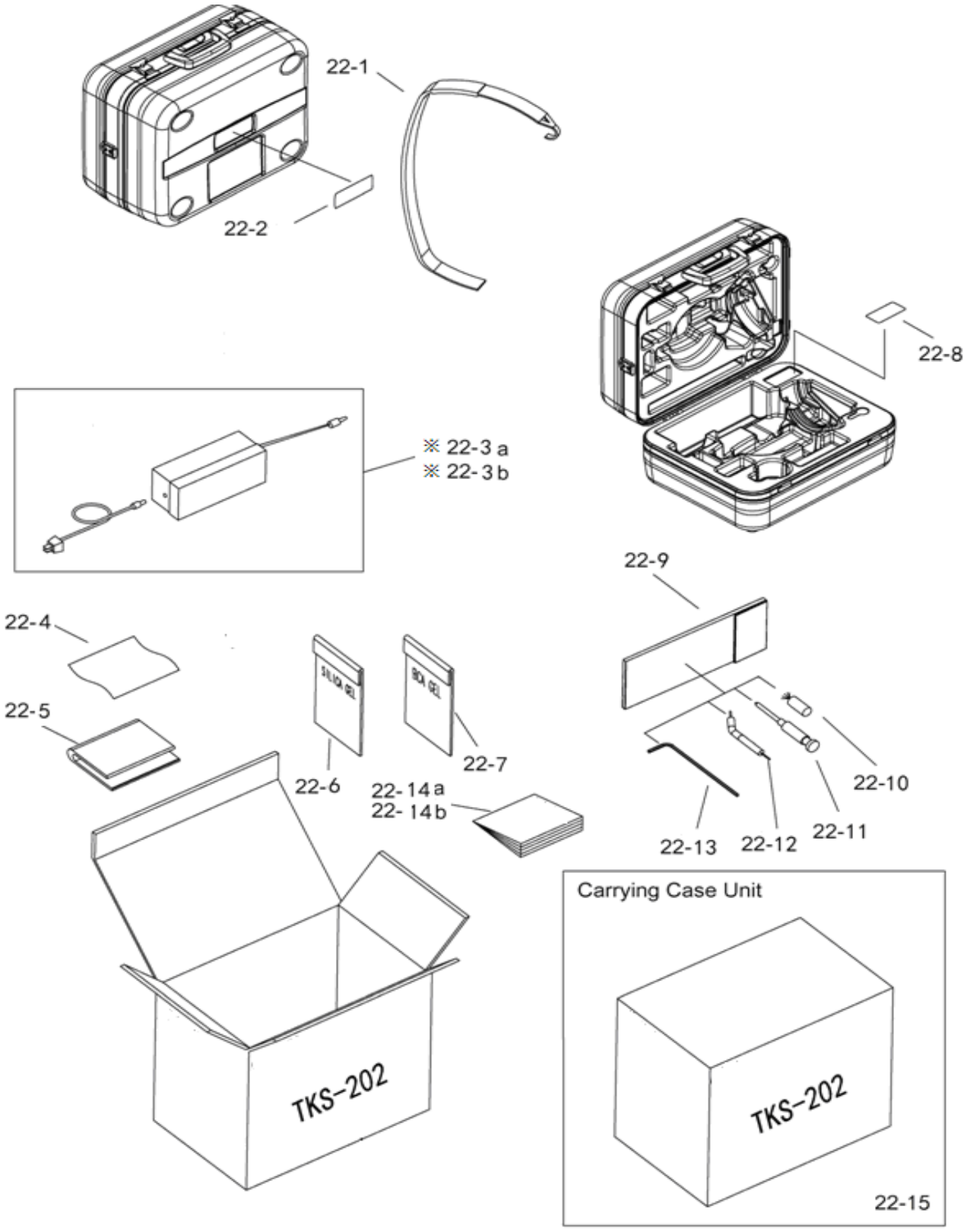
CARRYING CASE ACCESSORIES (ABS TYPE)



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