

SOKKIA

SET2100 SET3100 SET3100S SET4100 SET4100S

Electronic Total Station



OPERATOR'S MANUAL



Ni-Cd

- [English] CONTAINS NICKEL-CADMIUM BATTERY. MUST BE RECYCLED OR DISPOSED OF PROPERLY.
- [Deutsch] MIT NiCd AKKU. EFORBERT RECYCLING ODER FACHGERECHTE ENTSORGUNG.
- [Français] CONTIENT UNE BATTERIE AU CADMIUM NICKEL. DOIT ÊTRE RECYCLÉE OU DONNÉE A UN ORGANISME DE RETRAITEMENT.
- [Italiano] CONTIENE NiCd BATTERIA. DEVE QUINDI ESSERE RICICLATA O ELIMINATA IN MODO APPROPRIATO.
- [Nederlands] BEVAT EEN NiCd BATTERIJ. DIENT GERECYCLEERD TE WORDEN OF OP EEN CORRECTE MANIER VERNIETIGD TE WORDEN.
- [Español] CONTIENE UNA NiCd BATERÍA. DEBE RECICLARSE O ELIMINARSE ADECUADAMENTE.
- [Português] CONTEM BATERIA DE NÍQUEL CÁDMIO. DEVERÁ SER RECICLADA OU DECARTEADA CONVENIENTEMENTE.
- [Svensk] INNEHÅLLER NiCd BATTERI. BÖR ÅTERVINNAS ELLER FÖRSTÖRAS PÅ ETT SÄKERT SÄTT.
- [Suomi] SISÄLTÄÄ NIKKELI-KADMIUM AKUN. HÄVITETTÄESSÄ KÄSITELTÄVÄ ONGELMAJÄTTEENÄ.
- [Norsk] NiCd BATTERIER MÅ RESIRKULERES ELLER KASTES PÅ EN FORSVARLIG MÅTE.
- [Dansk] INDEHOLDER NiCd BATTERI. SKAL GENVINDES ELLER KASSERES PÅ FORSVARLIG MÅDE.
- [Ελληνικά] ΠΕΡΙΕΧΕΙ ΜΠΑΤΑΡΙΑ ΝΙΚΕΛΙΟΥ-ΚΑΔΜΙΟΥ. ΠΡΕΠΕΙ ΝΑ ΑΝΑΚΥΚΛΩΝΕΤΑΙ Η ΝΑ ΚΑΤΑΣΤΡΕΦΕΤΑΙ ΜΕ ΤΟΝ ΚΑΤΑΛΛΗΛΟ ΤΡΟΠΟ.

For U.S.A. ATTENTION:

The product that you have purchased contains a rechargeable battery. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local solid waste officials for details in your area for recycling options or proper disposal. Use the standard battery charger.

Die Schweiz: Nach Gebrauch der Verkaufsstelle zurückgeben.

La Suisse: Après usage à rapporter au point de vente.

Swizzera: Ritornare la pila usate al negozio.

SET2100
SET3100
SET3100S
SET4100
SET4100S

Electronic Total Station

OPERATOR'S MANUAL

- Thank you for selecting the **SET2100**, **SET3100**, **SET3100S**, **SET4100**, or **SET4100S**.

- Please read this manual carefully before starting to use the instrument. Keep this manual near the instrument for easy reference.
- Verify that all equipment is included by referring to "28. Standard Equipment".
- Sokkia is continuously conducting research and development in order to make its products easier to use and enhance their precision. The specifications and general appearance of the instrument may be altered without prior notification.
- Sokkia bears absolutely no responsibility for any profits or losses created through the use of this system.
- Some of the diagrams and screen displays shown in this manual are simplified for easier understanding.

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Always Follow Precautions for Safe Operation

- For the safe use of the product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this operator's manual.

The definitions of the indications are listed below.

Be sure you understand them before reading the manual's main text.

Definition of Indication



WARNING

Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.



CAUTION

Ignoring this indication and making an operation error could possibly result in personal injury or property damage.

General



WARNING

- Do not use the unit in areas exposed to high amounts of dust or ash, in areas where there is inadequate ventilation, or near combustible materials. An explosion could occur.
- Do not perform disassembly or rebuilding. Fire, electric shock or burns could result.
- Never look at the sun through the telescope. Loss of eyesight could result.
- Do not look at reflected sunlight from a prism or other reflecting object through the telescope. Loss of eyesight could result.
- Direct viewing of the sun during sun observation will cause loss of eyesight. Use solar filter (option) for sun observation.



CAUTION

- Secure handle to main unit with locking screws. Failure to properly secure the handle could result in the unit falling off while being carried, causing injury.
- Tighten the adjustment tribrach clamp securely. Failure to properly secure the clamp could result in the tribrach falling off while being carried, causing injury.
- Do not use the carrying case as a footstool. The case is slippery and unstable so a person could slip and fall off it.

-
- Do not place the instrument in a case with a damaged catch, belt or handle. The case or instrument could be dropped and cause injury.
 - Do not wield or throw the plumb bob. A person could be injured if struck.

Tripod

CAUTION

- When mounting the instrument to the tripod, tighten the centering screw securely. Failure to tighten the screw properly could result in the instrument falling off the tripod, causing injury.
- Tighten securely the leg fixing screws of the tripod on which the instrument is mounted. Failure to tighten the screws could result in the tripod collapsing, causing injury.
- Do not carry the tripod with the tripod shoes pointed at other persons. A person could be injured if struck by the tripod shoes.
- Keep hands and feet away from the tripod shoes when fixing the tripod in the ground. A hand or foot stab wound could result.
- Tighten the leg fixing screws securely before carrying the tripod. Failure to tighten the screws could lead to the tripod legs extending, causing injury.

Power Supply

WARNING

- Do not use voltage other than the specified power supply voltage. Fire or electric shock could result.
- Use only the specified battery charger to recharge batteries. Other chargers may be of different voltage rating or polarity, causing sparking which could lead to fire or burns.
- Do not place articles such as clothing on the battery charger while charging batteries. Sparks could be induced leading to fire.
- Do not use damaged power cords, plugs or loose outlets. Fire or electric shock could result.
- Do not use batteries or the battery charger if wet. Resultant shorting could lead to fire or burns.
- Do not use power cords other than those designated. Fire could result.
- To prevent shorting of the battery in storage, apply insulating tape or equivalent to the terminals. Otherwise shorting could occur, resulting in fire or burns.
- Do not heat or throw batteries into fire. An explosion could occur, resulting in injury.

 **CAUTION**

- Do not touch liquid leaking from batteries. Harmful chemicals could cause burns or blisters.
- Do not connect or disconnect power supply plugs with wet hands. Electric shock could result.

Before Using the Instrument

- The Lithium Battery

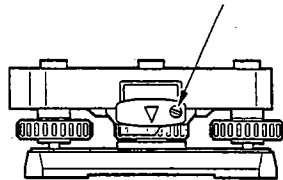
The lithium battery, a backup battery which retains data in the internal memory of the **SET**, can back up data for approximately 5 years of normal use, but its lifetime may be shorter depending on circumstances. Therefore be sure to replace the lithium battery after the instrument has been used for 4 years. Ask your Sokkia service center to replace the battery for you. When the lithium battery is replaced all stored data is cleared. If the voltage supplied by the lithium battery either declines or is completely discharged, the message "Exchange sub bat." is displayed. If the lithium battery completely fails, the data is entirely cleared. We recommend that you store data you must retain to your computer.

- Battery

The battery (nickel hydrogen storage battery) is not charged when the instrument is shipped. Before using it, read the battery and charger operating manual and be sure to fully charge the battery.

- Loosening the Locking Screw on the Tribrach Shifting Clamp

Screw Holding the Tribrach Shifting Clamp in Place



When the instrument is shipped, the tribrach shifting clamp is held firmly in place with a locking screw to prevent the instrument from shifting on the levelling base. Before using the instrument the first time, loosen this screw with a screw-driver. And before transporting it, tighten the locking screw to fasten the tribrach shifting clamp in place so that it will not shift on the levelling base.

How to Read the Manual

- This operating manual contains all information concerning your SET.
Read it in the following sequence when you use the instrument the first time.
 - STEP 1** : Read "Introduction" and "Measurement Preparation."
 - STEP 2** : Read "Basic Measurements" as you actually operate the instrument to become accustomed to the operating method.
 - STEP 3** : Before performing measurements, try to perform the series of operations: external observation, data recording, etc.
 - STEP 4** : Read "Applied Measurements" as necessary.
- Using this instrument, it is possible to freely assign the functions using the soft key in MEAS Mode. It is, therefore, not possible to specify which function is displayed at which location on which page of the screen. The operations explained in this manual are basically the settings at the time the instrument leaves the factory.
- Functions corresponding to softkeys **F1** to **F4** are enclosed by brackets [] in this manual.
- See "Input Range of Data Categories" for the input range of various data categories.

Special Features

- Your SET instrument displays easily understood measurement data, operating messages, and error indicators using numerals and letters of the alphabet.
- The internal memory can store 3,000 data items.
- The data stored in the internal memory can be transmitted to a computer.
- In addition to a reflective prism, it is possible to also use a reflective sheet as the target during measurements.
- Because the telescope is extremely compact, it is possible to easily collimate the target.

CONTENTS

INTRODUCTION

1. Precautions	3
2. Parts of the Instrument	4
3. Key Functions	5
4. Character Entry	7
5. Display Symbols	8
6. Mode Configuration	9
6.1 Mode Diagram	9
6.2 Menu Table	10

PREPARATION FOR MEASUREMENT

7. Mounting the Battery	15
8. Setting Up the Instrument	16
8.1 Centering	16
8.2 Levelling	17
9. Power on and Preparation for Measurement	19
9.1 Power on/off	19
9.2 Indexing the Horizontal and Vertical Circles	21
9.3 Focussing and Target Sighting	23
9.4 Display and Reticle Illumination	24
9.5 Setting the Instrument Options	25
9.6 Setting Date and Time	27
9.7 Restoring Set Items to Initial Settings	28
9.8 Initializing of the Data	28
9.9 Explanations	29

BASIC MEASUREMENTS

10. Angle Measurement	35
10.1 Measuring the Horizontal Angle Between Two Points (Horizontal Angle 0)	35
10.2 Setting the Horizontal Circle to a Required value (Horizontal Angle Hold)	37
10.3 Horizontal Angle Display Selection <Right/Left>	39
10.4 Horizontal Angle Repetition	40
10.5 Slope in %	43
11. Distance Measurement	44
11.1 Settings For Distance Measurements	44
11.2 Returned Signal Checking	48
11.3 Distance and Angle Measurement	49
11.4 Review of Measured Data	51
11.5 Measuring Distance and Outputting the Data to a Computer	52
12. Coordinate Measurement	53
12.1 Entering Instrument Station Data	54
12.2 Azimuth Angle Setting	57
12.3 3-D Coordinate Measurement	59

ADVANCED MEASUREMENT

13. Resection Measurement	65
14 Setting-out Measurement	72
14.1 Distance Setting-out Measurement	72
14.2 REM Setting-out Measurement	76
14.3 Coordinates Setting-out Measurement	79
15. Offset Measurement	83
15.1 Single-distance Offset Measurement	84
15.2 Angle Offset Measurement	87
15.3 Two-distance Offset Measurement	89
16. Missing Line Measurement	92
16.1 Measuring the Distance Between Multiple Targets	93
16.2 Changing the Starting Position	95
17. REM Measurement	97

DATA RECORDING

18. Settings in Memory Mode	103
18.1 JOB Selection	104
18.2 Deleting a JOB	106
18.3 Registering Coordinate Data in Memory	108
18.4 Clearing Coordinate Data from Memory	111
18.5 Reviewing Coordinate Data	114
18.6 Inputting Codes	116
18.7 Deleting Codes	117
18.8 Reviewing Codes	118
18.9 Outputting JOB Data to Host Computer	119
18.10 Outputting JOB Data to a Printer	121
19. Recording in Record Mode	123
19.1 Recording Distance Measurement Data	123
19.2 Recording Angle Measurement Data	126
19.3 Recording Coordinates Data	128
19.4 Recording Instrument Station Data	130
19.5 Recording Notes	132
19.6 Reviewing JOB Data	133

TROUBLESHOOTING

20. Error Messages	137
21. Checking and Adjustments	141
21.1 Plate Level	141
21.2 Circular Level	143
21.3 Tilt Offset Setting	144
21.4 Setting the Collimation Line Error Correction Constant	146
21.5 Reticle	148
21.6 Optical Plummet	150
21.7 Distance Measurement Check Flow Chart	152
21.8 Additive Distance Constant	153

MEASUREMENT OPTIONS SELECTION

22. Changing Instrument Parameters	175
23. Key Function Allocation	164
23.1 Allocation and Registration	165
23.2 Recalling an Allocation	169
24. Power Supplies	170
25. Reflecting Prisms	172

ADDITIONAL DETAILS

26. Manually Indexing the Vertical Circle 177
27. Atmospheric Correction for High Precision Distance
measurements 179

APPENDIX

28. Standard Equipment 183
29. Optional Accessories 185
30. Maintenance 187
- Specifications 188
- Atmospheric correction chart 191
- Data Entry Ranges 192
- Regulations 193

INTRODUCTION

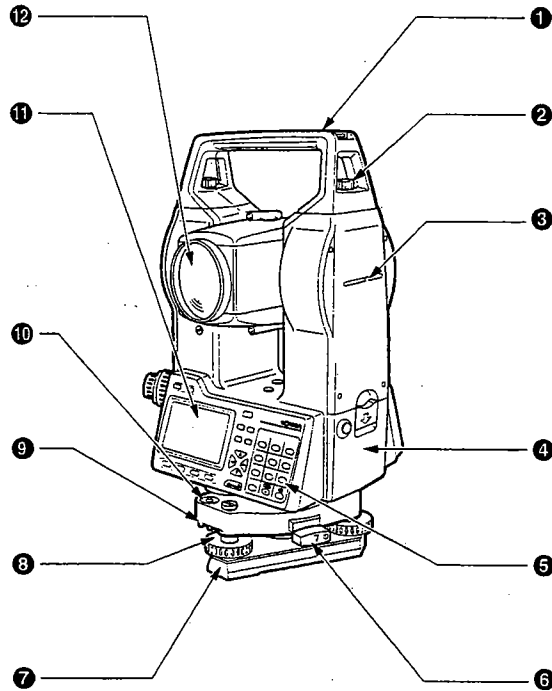
- This section of the manual explains precautions and the names of the parts of your **SET**. Please read this carefully before using the instrument.

1.	Precautions	3
2.	Parts of the Instrument	4
3.	Key Functions	5
4.	Character Entry	7
5.	Display Symbols	8
6.	Mode Configuration	9
6.1	Mode Diagram	9
6.2	Menu Table	10

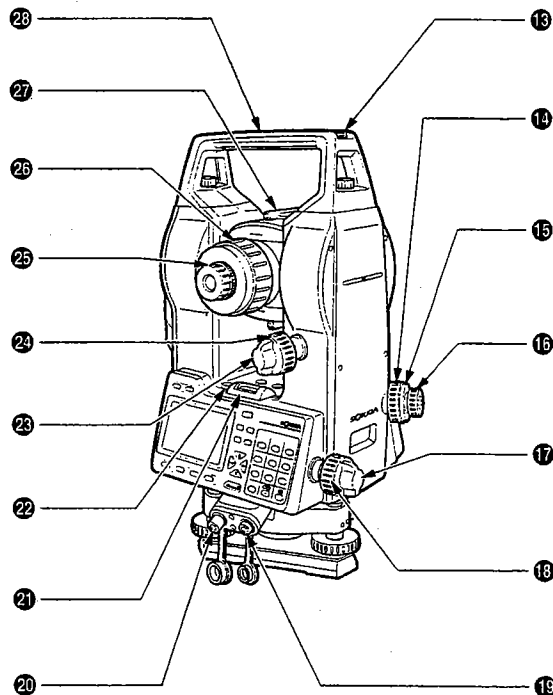
1. PRECAUTIONS

- Never place the **SET** directly on the ground.
Sand or dust may cause damage to the screw holes or the centering screw on the base plate.
- Do not aim the telescope at the sun.
Doing so may damage the interior of the instrument.
- Protect the **SET** from direct sunlight, rain, or mist with an umbrella.
Exposure could affect the precision of the instrument or cause corrosion and other damage.
- Never carry the **SET** on the tripod to another site.
- The **SET** is a precision instrument; it must be handled carefully. Protect it from heavy shocks or vibration.
- When the adaptor leaves the **SET**, the vinyl cover should be placed on the instrument.
Dust or rain might cause an instrument malfunction.
- Turn the power off before removing the battery.
If you do not, the internal circuits of the **SET** could be damaged.
- When placing the **SET** in its case, first remove its battery and place it in the case in accordance with the layout plan.
If it is stored with its battery still in place, the power could come on, causing improper operation and completely discharging the battery.
- Before closing the cover on the case, make sure that the interior of the case and the **SET** are both completely dry. If any moisture remains inside the case, the instrument could rust.

2. PARTS OF THE INSTRUMENT



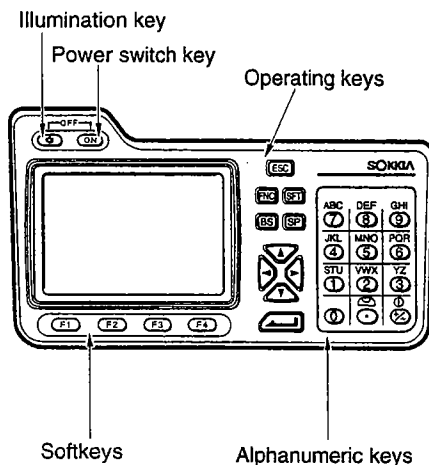
- ① Handle
- ② Handle securing screw
- ③ Instrument height mark
- ④ Battery
- ⑤ Keyboard
- ⑥ Tribrach shifting clamp
(SET4100S/3100S: Shifting clamp)
- ⑦ Base Plate
- ⑧ Levelling foot screw
- ⑨ Circular level adjusting screws
- ⑩ Circular level
- ⑪ Display
- ⑫ Objective lens



- ⑬ Tubular compass slot
- ⑭ Optical plummet focussing ring
- ⑮ Optical plummet reticle cover
- ⑯ Optical plummet eyepiece
- ⑰ Horizontal clamp
- ⑱ Horizontal fine motion screw
- ⑲ Data output connector
- ⑳ External power source connector
- ㉑ Plate level
- ㉒ Plate level adjusting screw
- ㉓ Vertical clamp
- ㉔ Vertical fine motion screw
- ㉕ Telescope eyepiece
- ㉖ Telescope focussing ring
- ㉗ Peep sight
- ㉘ Instrument center mark

3. KEY FUNCTIONS

- The **SET** has a 28-key keyboard. The keys are a power switch key, an illumination key, 4 softkeys, 10 operating keys, and 12 alphanumeric keys.



Power switch key

To switch the power on, press **ON** .
 To switch the power off, press **☀** while pressing **ON** .

Illumination key

To switch the display and the telescope reticle image illumination on/off, press **☀** .

Softkeys

The bottom line of the **SET** display lists softkeys which vary depending on the screen. Use the keys **F1** to **F4** at the bottom left of the keyboard to select the corresponding softkey on the display. To view softkeys displayed on pages 2 and 3, press **FNC** .

As an example, the following shows the settings of the softkeys displayed in MEAS Mode when the instrument is shipped from the factory.

Page 1

[SDIST] : Start distance measurement
[▲SHV] : Change distance measurement category
[H.ANG] : Set the horizontal circle to a required value
[EDM] : Set the EDM











Page 2

[OSET] : Set horizontal angle to 0
[COORD] : Find coordinate values of the target
[S-O] : Start setting-out measurement
[REC] : Record observed data





Page 3

- [MLM] : Start missing line measurement
- [RESEC] : Start resection measurement
- [MENU] : Display measurement menu
- [HT] : Set the height of instrument station and the target






Operating keys

-  : Cancel previous operation and transfer from MEAS Mode to status screen
-  : Change softkey display page
-  : Turn shift mode on or off
-  : Delete character/left
-  : Input a space
-  : Move cursor/selected option up
-  : Move cursor/selected option down
-  : Move cursor to the left/select other options
-  : Move cursor to the right/select other options
-  : Confirm entry or store data on that line and move the cursor to the next line

Alphanumerical keys with shift mode off

-  to  : Numerical input/selection of menu item
-  : Input decimal point
-  : Change symbol

Alphanumeric keys with shift mode on

-  STU to  GHI : Alphabet input (a letter above each key is input when that key is pressed.)
-  : Start up the circular level display function (See "9.9 Explanations: Levelling Using the Tilt Angle Display")
-  : Start up the return signal check function (See "11.2 Returned Signal checking")
-  : Change symbol

Read the following section for detailed alphanumeric input instructions.

4. CHARACTER ENTRY

- Job names, data numbers, codes, etc. are entered to the **SET** using letters of the alphabet and numerals.
- Change between alphabetic and numerical entry by pressing **SFT**.
An **S** is displayed on the right side of the screen when the **SET** is in alphabet entry mode.

Alphabet entry mode ← **SFT** → Numeral entry mode

Entry in alphabet and numeral mode is performed as follows.

► PROCEDURE Character entry

```

Mem. / JOB
JOB : JOBM1

```

S

- Three letters are assigned to each key.
Each time a key is pressed, one of the three letters is displayed successively at the cursor position.
- When the letter which must be entered is displayed, press **◀** to move the cursor to the position where the next letter will be entered.
- Press **SFT** to switch to numeral entry mode.
- When the entry is completed, press **▶**.
The original screen is restored.

5. DISPLAY SYMBOLS

- A number of symbols are used in MEAS Mode.
Their meanings are presented below.

PC : Prism constant
ppm : Atmospheric correction
S : Slope distance
H : Horizontal distance
V : Height difference
ZA : Zenith angle (zenith 0°)
VA : Vertical angle (Horizontal 0°/Horizontal 0° ± 90°)
V/% : Slope in %
HAR : Horizontal angle right
HAL : Horizontal angle left
HAh : Horizontal angle hold
┆ : Tilt angle compensation on

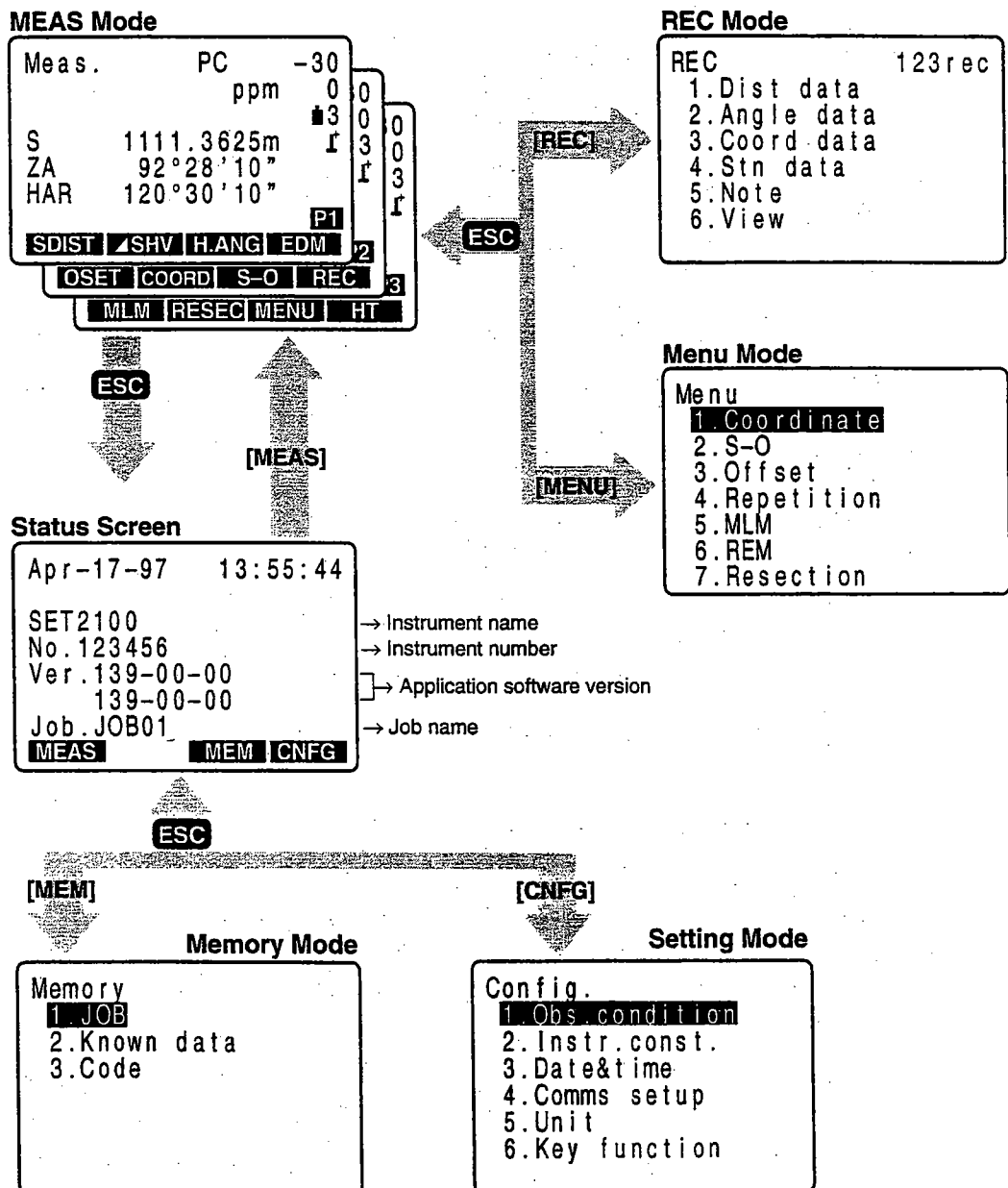
Remaining battery power (BDC35, Temp. = 25 °C, EDM on)

■ 3 : 90 to 100%
■ 2 : 50 to 90%
■ 1 : 10 to 50%
■ 0 : 0 to 10%

6. MODE CONFIGURATION

- The SET operates in a number of modes depending on your measurement needs. This section explains the relationship between the various SET modes and presents tables of the menus for each mode.

6.1 Mode Diagram



6.2 Menu Table

• Status Screen

- [MEAS] : To MEAS Mode
- [MEM] : To Memory Mode
- [CNFG] : To Setting Mode

• MEAS Mode

- [_DIST] : Distance measurement
- [▲SHV] : Select distance mode (S=Slope distance/H=Horizontal distance/V=Height difference)
- [0SET] : Set horizontal angle to 0
- [H.ANG] : Set required horizontal angle
- [R/L] : Select horizontal angle right/left
- [REP] : Repetition measurement
- [HOLD] : Hold horizontal angle/release horizontal angle
- [ZA/%] : Switch between zenith angle/slope in %
- [HT] : Set the instrument station height and target height
- [REC] : Data recording
- [REM] : REM measurement
- [MLM] : Missing line measurement
- [RCL] : Display final measurement data
- [VIEW] : Display observation data for the selected JOB
- [EDM] : Setting EDM (atmospheric correction and target, distance measurement method setting)
- [COORD] : Coordinates measurement
- [S-O] : Setting-out measurement
- [OFFSET] : Offset measurement
- [MENU] : To Menu Mode
- [RESEC] : Resection measurement
- [F/M] : Switch between meters/feet
- [D-OUT] : Output measurement results to external instrument

• Memory Mode

1. JOB To "JOB Management Screen"
2. Known data To "Known Point Menu Screen"
3. Code To "Code Setting Screen"

• Setting Mode

1. Obs. condition Observation condition setting
2. Instr. const. Instrument constant setting
3. Date & time Date & time setting
4. Comms setup Communication conditions setting
5. Unit Unit setting
6. Key function Key setting

<REC Mode>

1. Dist data Distance measurement data recording
2. Angle data Angle measurement data recording
3. Coord data Coordinates data recording
4. Stn data Instrument station data recording
5. Note Note data recording
6. View Review

<Menu Mode>

1. Coordinate Coordinates measurement
2. S-O Setting-out measurement
3. Offset Offset measurement
4. Repetition Repetition measurement
5. MLM Missing line measurement
6. REM REM measurement
7. Resection Resection measurement

PREPARATION FOR MEASUREMENT

7.	Mounting the Battery	15
8.	Setting Up the Instrument	16
	8.1 Centering	16
	8.2 Levelling	17
9.	Power on and Preparation for Measurement	19
	9.1 Power on/off	19
	9.2 Indexing the Horizontal and Vertical Circles	21
	9.3 Focussing and Target Sighting	23
	9.4 Display and Reticle Illumination	24
	9.5 Setting the Instrument Options	25
	9.6 Setting Date and Time	27
	9.7 Restoring of Set Items to Initial Settings	28
	9.8 Initializing of the Data	28
	9.9 Explanations	29

7. MOUNTING THE BATTERY

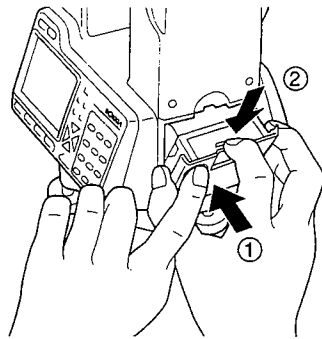
- Fully charge the battery before measurement. See the battery operating manual and “24. Power Supplies” for details concerning the battery.

NOTE: Switch off power to the **SET** before removing the battery.

► PROCEDURE Mounting the battery

1. Insert the battery by aligning the battery guide with the guide hole in the instrument.
2. Press the top of the battery until you hear a click.

► PROCEDURE Removing the battery



1. While pressing the round button ①, press the release button ② downward.
2. Remove the battery by pulling it towards yourself.

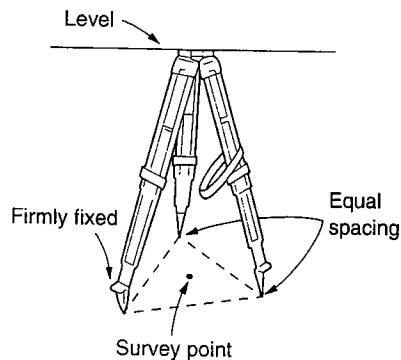
- To turn on the power immediately after this step, see “9. Power On and Preparation for Measurement”.

8. SETTING UP THE INSTRUMENT

- If the battery is mounted after the instrument is set up, the instrument will tilt. First mount the battery, then do this operation.

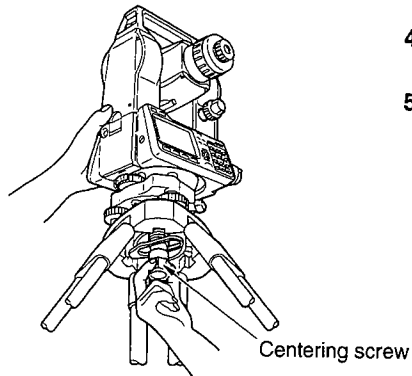
8.1 Centering

► PROCEDURE Setting up the tripod



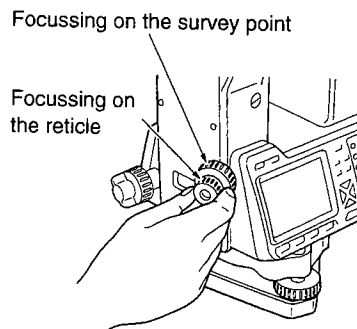
1. Make sure the legs are spaced at equal intervals and the head is approximately level.
2. Set the tripod so the center of the head is directly over the surveying point.
3. Step on the tripod shoes to make sure the tripod is firmly fixed in the ground.

Installing the instrument on the tripod



4. Place the instrument on the tripod head.
5. Supporting the instrument with one hand, tighten the centering screw to fix it to the female screw on the base plate of the instrument.

Focussing on the survey point

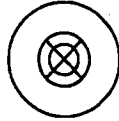


6. Looking through the optical plummet, turn the optical plummet eyepiece to focus on the concentric rings on the reticle.
7. Turn the optical plummet focussing ring to focus on the surveying point.

8.2 Levelling

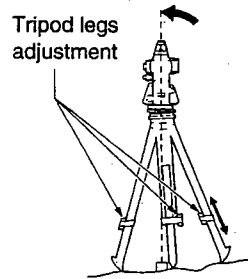
- If you require higher precision levelling after completing the following procedure, please refer to "9.9 Explanations: Leveling using the tilt angle display".

► PROCEDURE Centering the survey point in the reticle



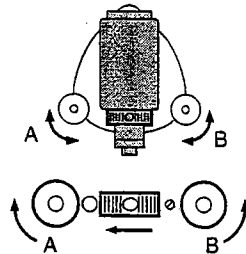
1. Adjust the levelling foot screws to center the surveying point in the optical plummet reticle.

Centering the bubble in the circular level



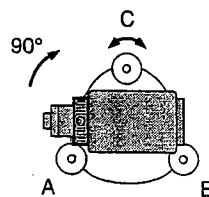
2. Center the bubble in the circular level by either shortening the tripod leg closest to the off center direction of the bubble or by lengthening the tripod leg farthest from the off center direction of the bubble.
3. Adjust one more tripod leg to center the bubble.

Centering the bubble in the plate level



4. Loosen the horizontal clamp to turn the upper part of the instrument until the plate level is parallel to a line between levelling foot screws A and B.
5. Use levelling foot screws A and B to center the bubble.
NOTE: The bubble moves towards a clockwise rotated levelling foot screw.

Turn 90° and center the bubble



6. Turn the upper part of the instrument through 90°. The plate level is now perpendicular to a line between levelling foot screws A and B.
7. Use levelling foot screw C to center the bubble.

