SOKKIA

SDR4E

3-D COORDINATE MEASURING SYSTEM

(Ver:1.00E)

OPERATION MANUAL

3-D COORDINATE MEASURING SYSTEM

SDR4E

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Introduction

Congratulations on your purchase of the 3-D Coordinate Measuring System SDR4E.

The SDR4E can collect, store, analyze and print out measured three dimensional data, when connected with the measuring instrument manufactured by SOKKIA. It is designed so that the stored data can be transferred to user's personal computers when required.

The data transfer format of the SDR4E is adaptive to all the data processed by SDR4C. So, SDR4E can interchange data with any of the portable Control Terminals of SDR4C (Refer to Chap. 7-2, Sec. 6-4 "Transfer Data").

The hardware of the SDR4E is manufactured by Symbol Technologies, Inc., model PDT3300. So please refer to the attached operator's guide of the PDT3300 when you replace the worn batteries or when you carry out the usual maintenance of the hardware.

Cautions:

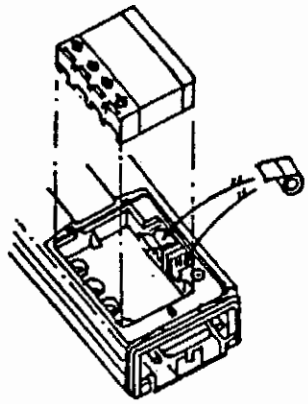
SOKKIA is not responsible for monetary losses or degressions in profits arising from the sale or usage of system software nor for claims from a third party.

Constant research and development is being carried out to offer an easy-to-use product for the users.

Please note that the software of SDR4E, catalog and instruction manual is liable to change on account of constant improvements.

1.Before operating

1.1 Maintenance of battery;



The Control Terminal SDR4E is provided with a unit of rechargeable nickel-cadmium battery pack (BDC32) as a main power source and two lithium batteries as backups.

To maintain the normal conditions of SDR4E and BDC32, please closely follow the instructions below.

Caution:
When the electricity of BDC32 is used up, the lithium batteries relieve.

After that, if the lithium batteries, too, completely run out of electricity, all the measured data held within SDR4E will be lost.

Type	Duration	Charge time required	Q'ty
Rechargeable nickel-cadmium(BDC32)	15 hours(key-in)	12 - 16 hours	1
Lithium (backups)	300 - 400 hours		2

1.2 Data missing;

When the following handling's are carried out the saved data within SDR4E will be erased. So do not carry out them unless required.

1) Hard-reset of SDR4E
2) Using up electricity of every battery
3) Taking off the lithium batteries without plugging in the AC adaptor to power source.

1.3 Maintenance during suspension;

1) To avoid the data missing, please try to transfer all the necessary measured data to your personal computer before you stop the operation of SDR4E.
2) If you keep SDR4E not used for a relatively short period, please charge BDC32 battery before you stop the operation and recharge it once 3 - 4 weeks.
3) If you have to leave SDR4E not used for long, please remove all batteries and keep them in custody.
4) Please recharge BDC32 surely before you start the operation again.

1.4 Charge of the nickel-cadmium battery (BDC32)

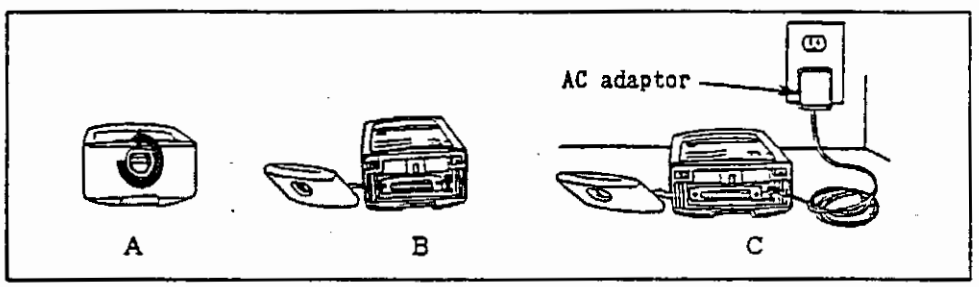
When the message shown left is displayed, charge BDC32 according to the steps below.

Main Battery is Low Press[Enter]

Charging steps:

1) Confirm that SDR4E is powered off.
2) Remove the bottom cap of SDR4E by loosening the latch.
3) Plug in the AC adaptor (CDC34A/E) to 120V/220V outlet.
4) Connect the terminal of AC adaptor (CDC34A/E) to the jack for charge of BDC32.
5) Keep charging for 12 - 16 hours.

Caution: Before charging, please confirm that BDC32 is being put on. BDC32 have to be charged or be kept in custody under the condition of temperature range between -0°C and +45°C. Either deficiency or excess of charge may shorten the battery life. Do not leave it charging over 24 hours and leave it discharging for a long time.



1.5 Replacement of lithium battery (back-ups)

Lithium Batterys are Low or Dead Press[Enter]

If the message shown left is displayed, the voltage of the lithium batteries lower. Please replace the lithium batteries with new ones as follows:

Replacing steps:

1) Confirm that SDR4E is powered off.
2) Remove the bottom cap of SDR4E by loosening the latch.
3) Plug in the AC adaptor (CDC34A/E) to 120V/220V outlet.
4) Connect the terminal of AC adaptor (CDC34A/E) to the jack for charge of BDC32.
5) Remove the cover of BDC32 battery pack.
6) Remove the lithium batteries housed in the socket at the side of BDC32.
7) Checking on the anode and cathode, fit the new lithium batteries into the socket with their ribbons upward.

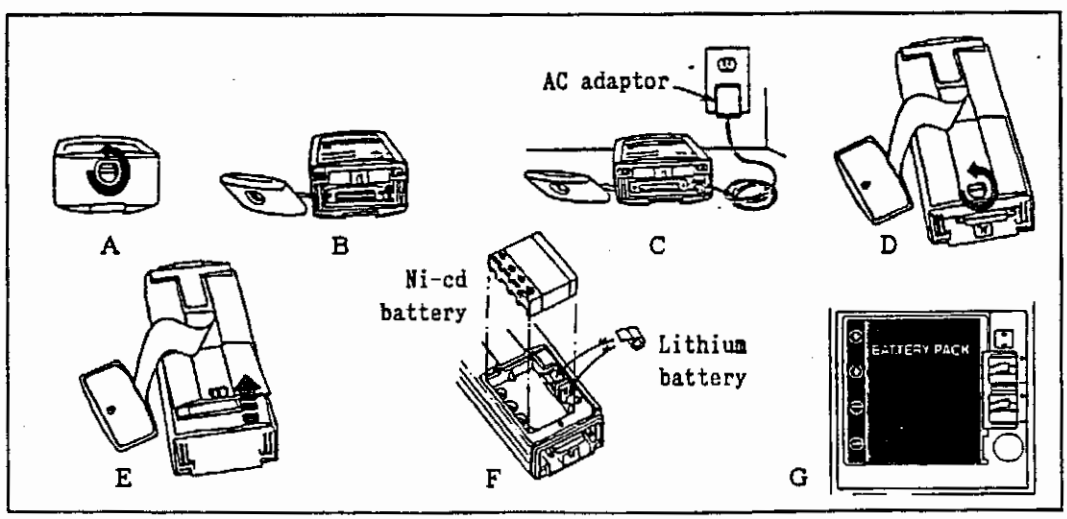
Caution:

Before replacing lithium batteries, please surely plug in the AC adapter (CDC34A/E) to both outlet and inlet of power.

Please check on the anode and cathode of batteries and put them in according to the directions.

You might as well wind a tape made of any stout material around the batteries to make it easy to pick them out next time.

Lithium batteries model CR1/3N or equivalent are available.



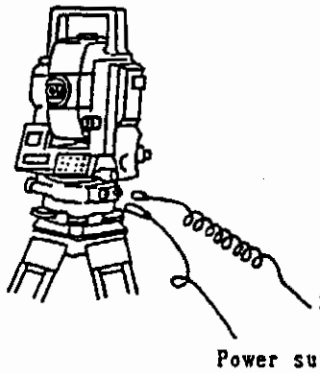
1.6 Heat-sensitive type roll paper for the printer

Reorder No. TP058-07L (Seiko Instruments, Inc. make)
(Paper: 58mm in breadth, Roll: 25 mm in diameter, 7 m in length, coreless)

Please use the above TP058-07L or equivalent heat-sensitive type roll paper for the printer.

1.7 Interfacing with the other devices

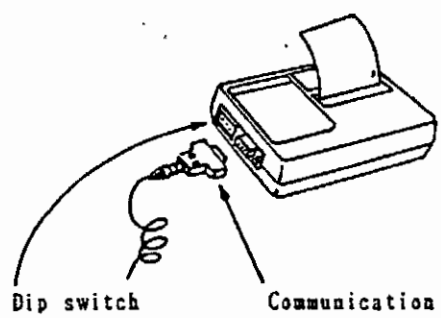
1. Measuring instrument



Baud rate: 1200 bps
Checksum : YES
Parity : NO

Please set up measuring instrument as the above.

2. Printer



Baud rate: 1200 bps
Data bit : 8 bit
Stop bit : 1 bit

Please set up the dip switch of the printer as follows.

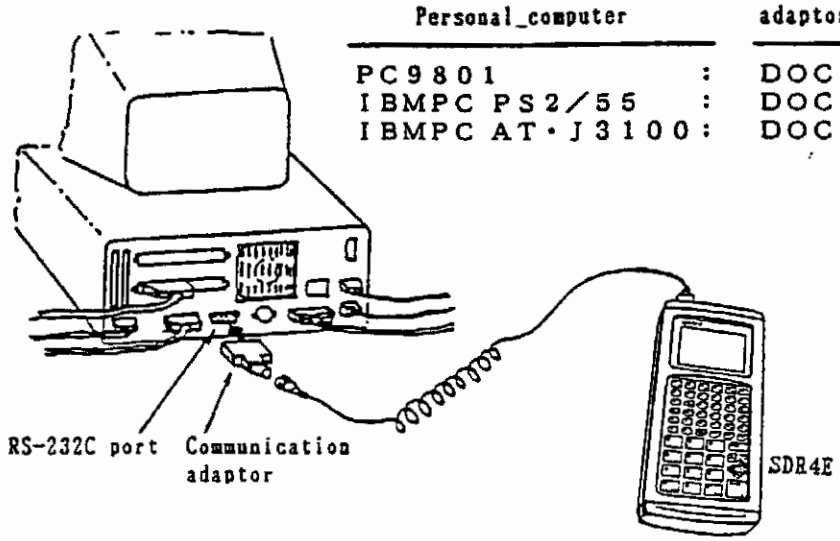
SW	1	2	3	4	5	6
	ON	ON	ON	ON	OFF	OFF

DOC38

3. Personal computer

On transferring data between SDR4E and a personal computer, please use communication adaptor, DOC 35, 36 or 37 according to the model of your personal computer, plugging in to the RS-232C port.

Personal_computer		Communication adaptor
PC9801	:	DOC35
IBMPC PS2/55	:	DOC36
IBMPC AT・J3100	:	DOC37



Condition of data transfer from SDR4E to personal computer

Baud rate : 1200 / 4800 baud
Data bit : 8 bits
Stop bit : 1 bit
Parity : NONE
X parameter: ON

Condition of data transfer from personal computer to SDR4E

Baud rate : 1200 baud
Data bit : 8 bits
Stop bit : 1 bit
Parity : NONE
X parameter: ON

2. Specifications

2.1 Specifications of Control Terminal

1) Hardware

Mainframe: PDT3300(RAM:2.2Mbytes NVM:256Kbytes) made by Olympus Symbol Inc.
Printer : DPU-201GS made by Seiko Instruments Inc.

2) Display unit

Display Format : Liquid crystal dot matrix
Display Capacity : Alphanumeric, 20 characters x 8 lines

3) Input unit

Numeric keys, function keys and character keys : 56

4) Interface Unit

Interface : RS232C

5) Power supply unit

Main power : Rechargeable nickel-cadmium battery with capacity of continuous usage for 15 hours

Memory protection: 2 lithium batteries with a capacity of continuous usage for 300 - 400 hours

6) Size and weight

Size : 90 x 205 x 50 mm
Weight : 650 g approximately

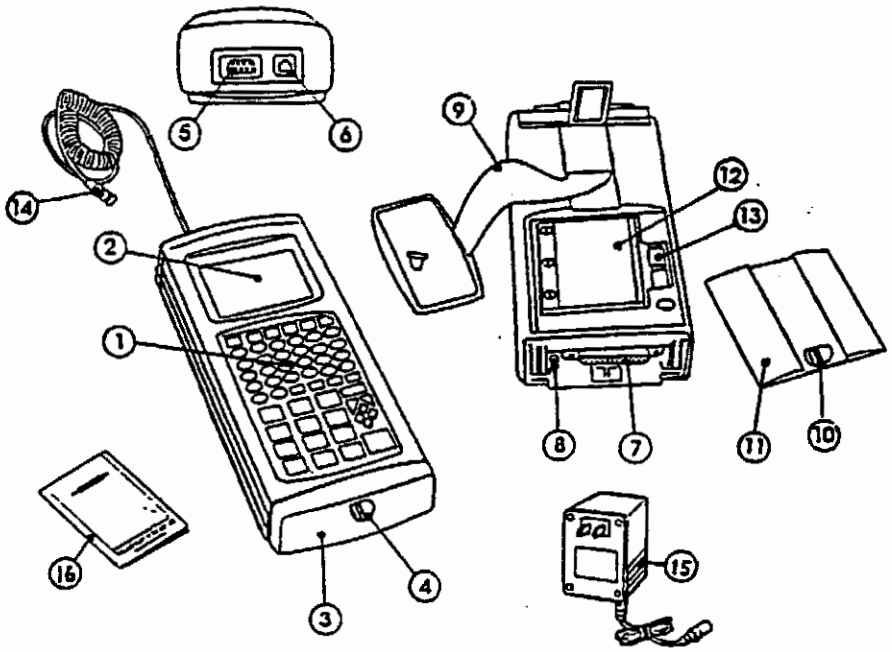


Fig. 2.1 Data collector

2.2 Names and functions of parts

1 Keyboard

2 Liquid crystal display : All contents of programs and various operation procedures related to display are displayed here.

3 End cover

4 End cover fastener

5 Scanner port (not used)

6 RS232C port (I) : RJ41 (device name: COM2)

7 RS232C port (II) : DB25 (device name: COM1)

8 Nickel-cadmium battery charging port

9 Hand strap

10 Battery housing cover fastener

11 Battery housing cover

12 Nickel-cadmium battery pack

13 Lithium batteries : to save the data stored in memory

14 Connection cable to the measuring instrument

15 AC adapter

16 Operator's guide

2.3 Power supply

1) Battery pack

An error message indicating low main power supply voltage is displayed when the voltage of the Ni-Cd battery is low. Stop the operation temporarily, turn off the power switch and charge or replace the battery. When the voltage of the auxiliary battery is low, replace it with a new back-up battery.

2) Auto power off function

The power is turned off automatically if there is no key operation within 5 minutes when executing. Switch off the power and switch on once again, and the conditions before switching off will restore.

2.4 Memory & Drive configuration

1. Main Memory TPA (Transient Program Area

Memory : 640Kb
Application: Area to execute program

2. EPROM (Erasable Programmable Read)

Drive : A
Memory : 128Kb
Application: Area to save OS software (DR-DOS)

3. NVM (Non-Volatile Memory)

Drive : B
Memory : 256Kb
Application: Area to save SDR4E software

4. RAM Disk

Drive : D
Memory : 156Mb
Application: Area to save SDR4E executive module, coordinate data file and environment setting file

2.5 Manageable number of files and measuring points

1. Names of Data Files

SDR4E takes up 5 types of files for measuring and analyzing data as follows:

a) Environment Data File (EVIRON)
A file which is sat up conditions related to the environment and precision before starting measurement.

b) Measurement Data File (* DT1)
A file which is stored each coordinate data point measured by the measuring instrument, and it will be made every new measurement.

c) Edited Data File (* DT2)
When Measurement Data File is recorded, another file which has the same name and data will be stored. And the stored file will be changed and edited into the file which has the latest data when the coordinate transformation and the point addition or deletion are carried out.

d) Linked Data File (* DT2)
A file which is linked two or more Edited Data Files into one. After linking files, each file name is made by adding mark @ automatically before the initial of the file name.

e) Designed Data File (* DES)
A file which is stored the designed data and the full-scale data for the operation of Designed Data Measurement and Position Measurement.

2. Maximum manageable number of files

During carrying out measurement or linking data, if the total number of Environment Data File, Measurement Data Files, Edited Data Files, Linked Data Files and Designed Data Files excess 401, the error message will be displayed, and the operation which is being carried out will be stopped (See Chapter 7 [5-1] 4). The total number of the data files, which is being recorded, will be confirmed on the screen of each data file.
And it is possible to link files one after another up to 9 files.

3. Maximum manageable number of measuring points

Type of File	Extension	Maximum manageable number of measuring points per file
Measurement Data File	DT1	400
Edited Data File	DT2	999
Linked Data File	DT2	999
Designed Data File	DES	400

During carrying out measurement or linking data, if the measuring points exceed the above manageable number, an error message will be displayed and the operation which is being carried out will be stopped.

2.6 Environmental performance

1. Operating temperature : 0°C - 50°C (32°F - 122°F)
2. Operating humidity : 0% - 90% RH (No dew condensation)
3. Resistance to static electricity : Under 25 KV

2.7 Specifications and functions of printer unit

1. Specifications

Print format	:	Thermal serial dot impact
Print digit	:	27 digits/line (166 dots/line) 13 digits/line (binal size character)
Characters	:	Alphanumeric characters
Printing speed	:	0.8 lines/second approximately
Paper	:	Roll (58 mm width)
Size	:	135 mm x 100 mm x 35 mm (excluding protruding portions)
Weight of mainframe	:	370 g approximately
Endurance	:	MCBF 500 thousand lines
Operating temperature	:	0˚C - 40˚C
Operating humidity	:	30% - 80% RH

2. Composition

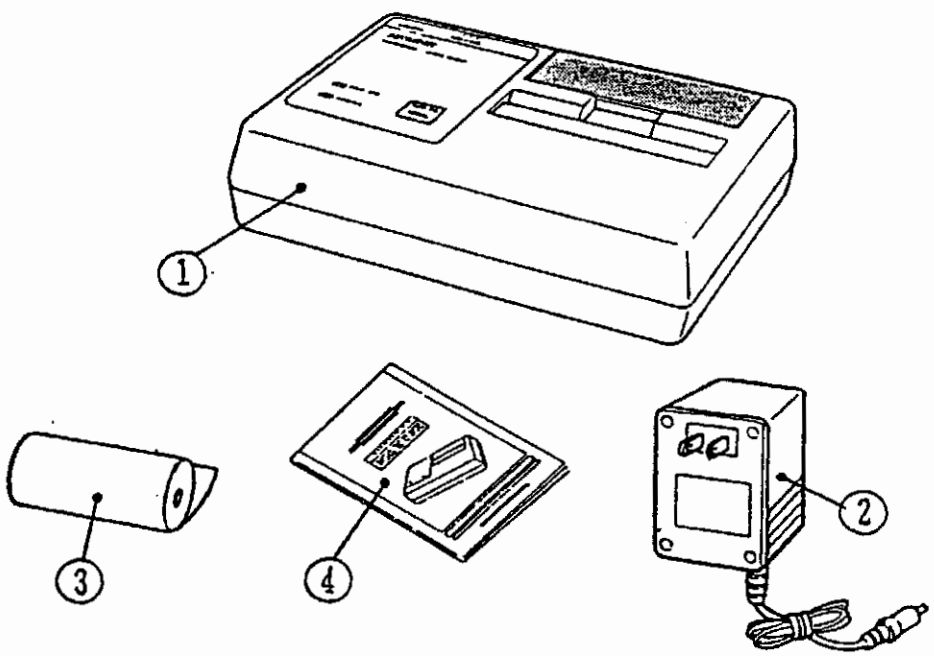


Fig. 1.2

1 Printer (DPU-201GS)

2 AC adapter

3 Roll paper

4 Printer operation manual

3. Names and functions of parts

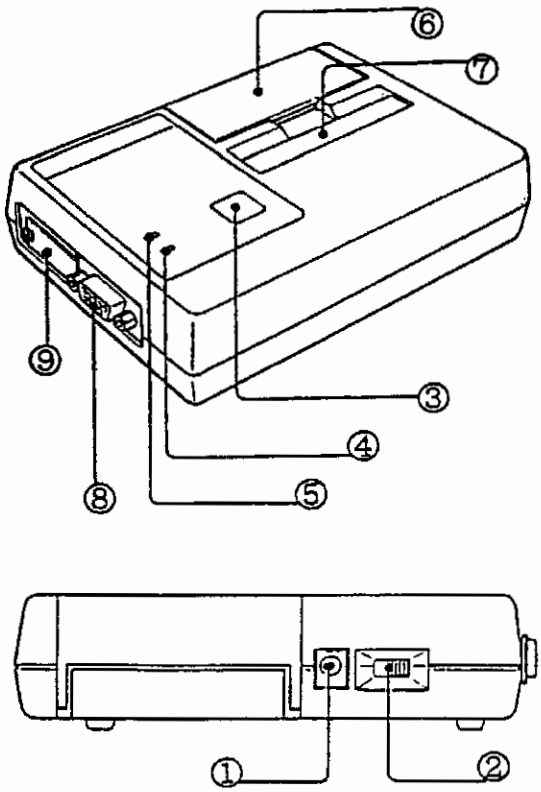


Fig. 1.3

1	Jack for power supply	: AC adapter terminal
2	Power switch	: OFF ON1: Built-in battery power is on. ON2: AC power is on through AC adapter while charging battery
3	Switch for paper feeding	: while being pressed, paper is feeded.
4	Power lamp	: lights up when power is on.
5	Alarm lamp for battery lowering	: (If it lights up, please connect AC adapter. It may also light up when paper jammed.)
6	Paper holder cover	: -
7	Paper cutter	: -
8	Connector for serial input	: Terminal for serial input signal from SDR4E
9	Dip switch cover and dip switches	: set up the RS232C interface

3. Standard equipment and preparations for measurement

3.1 Standard equipment

1) SDR4E Unit	:	PDT3300	1
2) Measuring instrument connection cable	:	Commonly used as printer cable	1
3) Nickel-cadmium battery pack unit	:	BDC32	1 (built-in)
4) Lithium batteries	:	CR-1/3N	2 (built-in)
5) Main unit AC adapter	:	CDC34A	1
Used for power supply and for charging the nickel-cadmium battery			
6) Soft case of SDR4E	:	SC105	1
7) SDR4E operation manual	:		1
8) PDT3300 operator's guide	:		1
9) Printer	:	DPU-201GS	1
10) AC adapter for printer	:	DPU-201G-05	1
11) Printer operation manual	:		1
12) Soft case of printer	:	SC106	1
13) Communication adapter for IBM-PC (PS2/PS55)	:	DOC36	1
14) Communication adapter for printer	:	DOC38	1
15) Communication adapter for PC9801	:	DOC35	1 (option)
16) Communication adapter for IBM-PC (AT)	:	DOC37	1 (option)
17) Alkaline battery holder	:		1 (option)
18) Alkaline batteries (9V)	:	S-006P	2 (option)

Please carry out the following steps to check whether the SDR4E acts normally.

1. Attach the battery pack.
2. Turn on the power switch. If the opening menu is displayed, the SDR4E is functioning normally.

3.2 Configuration of equipments for measurements

Connect the measuring instrument and the SDR4E with the prepared cable as shown in Fig.3.1. If the power switch is turned on, and the Opening menu appears the equipment is ready for operation.

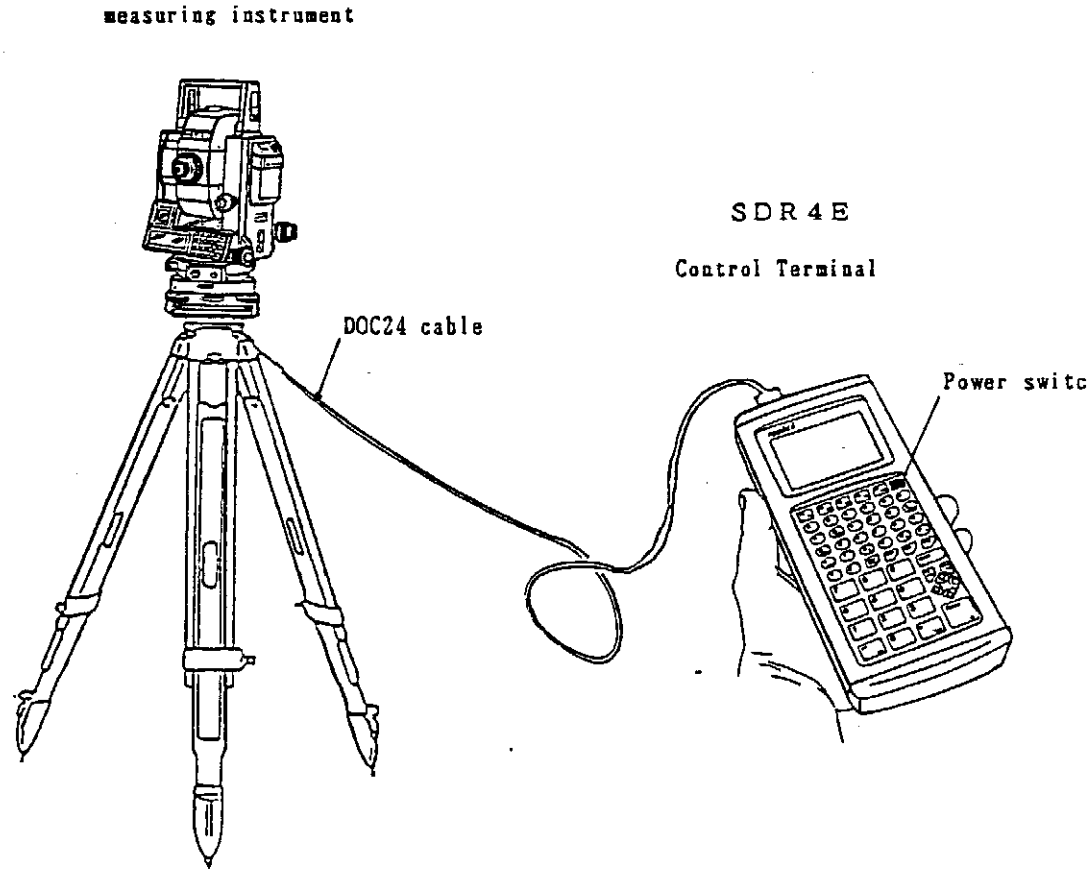


Fig. 3.1 Configuration of equipments for measurements

4.SDR4E operating method

4.1 Starting and finishing of SDR4E operations

When you turn on the power switch, the opening menu is displayed. You can start different operations from this opening menu.

You can finish SDR4E operations, the power switch is turned off with press <On·Off>key when the opening menu is displayed.

4.2 Number of files and measuring points

The number displayed on the screen of CRT61-1 (see Chapter 7 [6-1]) is the maximum manageable number of files, which is up to 401.
The maximum number of points which can be measured per file is 400. However, 999 points or 9 files can be confirmed in case of linked data.
As for details, please refer to 2.5 "Manageable number of files and measuring points".

4.3 Basic operations

a) The basic methods of changeover of screens and execution are as indicated below.:
In the control menu when numerals and alphabets are displayed in reverse and the cursor is positioned on them, shift the cursor to the desired location, on the item you wish to execute, by using <⇧> <⇩> keys and press <Enter>key or input the number displayed at the head of the item to be executed.
If you press <Clear> key, you return to the previous menu in principle.
In case of ending the operation of a menu, return to the basic menu using this <Clear> key, then after pressing <On·Off> key in the opening menu, switch off the power.

b) Regarding input of numerals and alphabets:
When the numerals and alphabets are correctly displayed on the screen, press <Enter> key.
The changeover of numerals and alphabets is done by means of the arrow key, to shift the cursor to the correcting position, and correction is possible only at this location. For deleting, press <Sp> key or <Bksp> key.

c) Working file name:
The file name displayed on the screen or selected is executable file.
Calculations can be executed and these files can be printed out when required.

d) To select file name or point number:
On the file name/point number select screen, the list of file names/point numbers(memo) can be displayed by pressing F5 key.
Using <⇧> or <⇩> key move cursor to the file name or point number which you are going to work with, and then press <Enter> key.
If the list contains two or more pages, press <⇧> or <⇩> key to jump to next or previous page and you can speedily select the aiming file or point from the list.
When displaying the file name list or point number list is to be canceled, please press <Clear>key.

4.4 Key unit

The SDR4E key unit consists of fifty-six (56) keys (See Fig. 4.1)

1. Numeric keys : Numeral input keys
   <0> ~ <9> , <.> , <->

2. Control keys : Keys having special functions

1. <Enter>	:	Execution of data input
2. <⇧><⇩><⇦><⇨>	:	Cursor moves up, down, left or right and jumps to next or previous page as indicated by the arrow of the pressed key
3. <Sp>	:	Space of one character width
4. <Bksp>	:	Back space of one character width
5. <Clear>	:	Screen changes over to previous screen or ... screens before the current screen
6. <Caps Lock>	:	Change the typing letters in capital or small
7. <Func>	:	Special symbol (refer to [9.Special characters in memo column])
8. <Ctrl>	:	Not used
9. <Shift>	:	Special symbol (refer to [9.Special characters in memo column])
10. <dark> (<Func>+<dark>)	:	Screen contrast darkens
11. <light> (<Func>+<light>)	:	Screen contrast brightens
12. <lamp> (<Func>+<lamp>)	:	Screen backlight switches on/off
13. <send> (<Func>+<send>)	:	Not used
14. <menu> (<Func>+<menu>)	:	Not used
15. <help> (<Func>+<help>)	:	Same function as that of <F1> mentioned in [3.Function keys]
16. <Yes>	:	Areas are integrated
17. <No>	:	Areas are not integrated

3. Function keys

1. <F1> : Changeover single/paired target measurement

2. <F2> : Switch on/off reverse measurement

3. <F3> : Display the measurement menu
   1. Set offset
   2. Setting-out

4. <F4> : Display the selecting menu of measuring method in standard measurement

5. <F5> : List of file names/point numbers is displayed to select one from them

6. <F6> ~ <F10>
   (<Func>+<F6> ~ <Func>+<F10>) : Not used

4. On, Off key

<On·Off> : Power turns on/off by every press

5. Soft-reset key
<Shift>·<L>+<On·Off>

During measurement or other menu operations, key input may become unable, though it might seldom happen, because of influences of noise or others. In that case, hit <On·Off> key while pressing <Shift>·<L> together to reset the program. Then you can restart operation from the opening menu. Even if resetting is executed, the coordinate data stored in RAM will not be lost.

6. Hard-reset key
<F1>·<F4>·<Enter>+<On·Off>

If the system cannot be recovered with the above resetting, or when all the data stored in RAM must be erased, please execute hard-reset. However, you had better execute it carefully because all the measured data stored in RAM will be lost at once.
To execute hard-reset, hit <On·Off> key while pressing <F1> . <F4> . <Enter> at the same time.

7. Other key shortcuts

By pressing the keys indicated in Fig 4.1 in combination, more special characters and symbols can be displayed and printed.

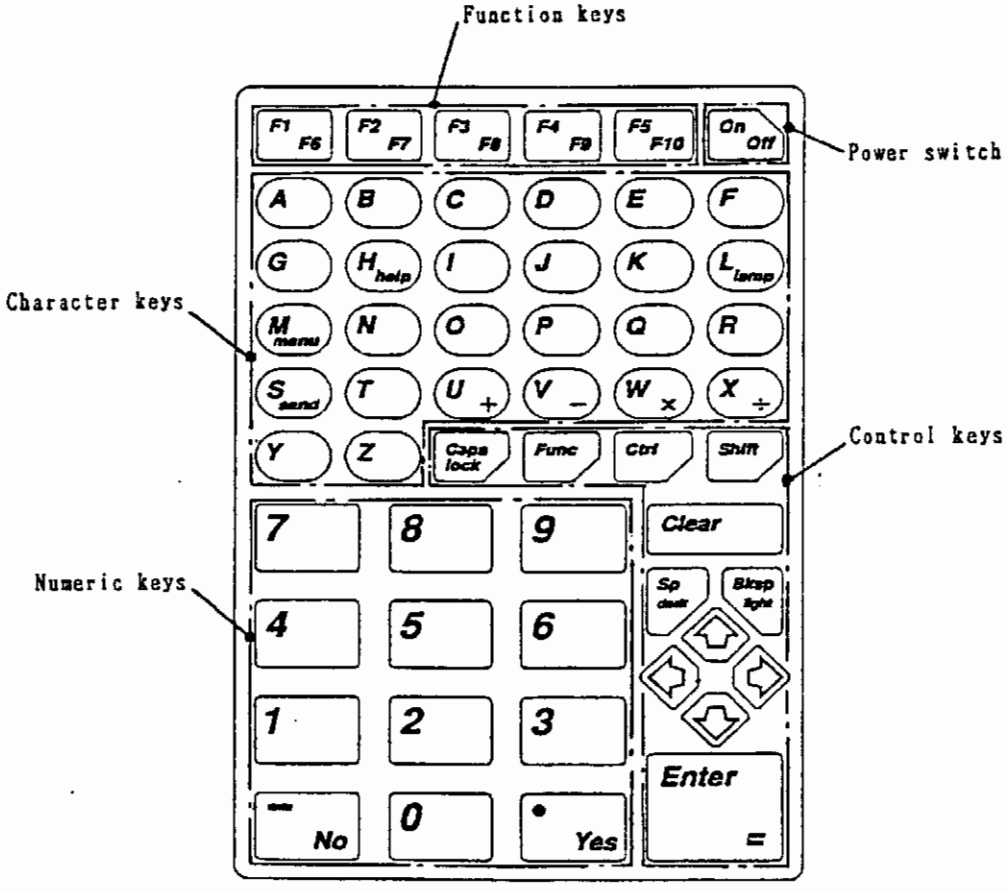


Fig. 4.1 Layout of keys

8. Numerals lock key
<Func>+<Caps lock>

When numeral locks is on, the cursor keys, <⇧> <⇦> and <⇩> <⇨> , are assigned function of numeral keys and they are locked to act as numerals <8>,<4>,<2> and <6> respectively. When numeral locks is off, press <Func>+ <Caps lock> once again.

9. Special characters in memo column

The list below shows the symbols and functions to be used to input to the memorandum column provided to each measurement point display. By combining control keys with general keys, these characters can be displayed and these functions can be carried out as shown in the list below.

Functions of special symbols of memo column and how to display them

Combination keys	Control keys		
	<Shift>key	<Func>key	<Shift>key + <Func>key
<0>	)		0
<1>	!	□	□
<2>	@	□	<
<3>	#	/	?
<4>	$	[	{
<5>	%	]	}
<6>	□	;	:
<7>	&	□	□
<8>	*	=	+
<9>	(	¥	¦
<->	_	-	_
<. >	>	DEL	□
<⇩>	2		3
<⇦>	4		7
<⇨>	6		1
<⇧>	8		9
<H>		Same as <F1>	
<L>		*1	*1
<U>		+	+
<V>		-	-
<W>		*	
<X>		/	?

*1 Backlight ON/OFF

4.5 Precautions during Operation of SDR4E

1. To preserve the correspondence of conditions in communication between the measuring instrument and the SDR4E, you might as well use the measuring instrument with its mechanical conditions unchanged as they are set when delivered.

2. If the backlight is left being turned on for 1 minute, it is automatically turned off.

3. During operation, error messages are displayed on the screen when any malfunctions happen due to, besides mistakes by operator, the excess of the displaying number of the calculated data or the low voltage of battery, and so forth. When messages appear, please follow the corresponding instructions (see Chapter 8).

4. If the message that the voltage of the main (nickel-cadmium) battery or the back-up (lithium) battery lowers is displayed during operation, please replace the said battery immediately. And as the nickel-cadmium battery will be consumed faster than the other, you might as well use it connecting with AC adapter charger and prepare a spare battery usually.

5. When the system becomes out of control during operation of measurement, transform or coordination because of an external factor such as noise or an internal factor such as software error, the SDR4E can be reset restoring its functions of the program without destruction of the data which it has collected.

6. If the SDR4E is switched on/off while it is connected to the printer which is being powered on, a framing error will happen to the printer. To avoid this error, please surely power off the printer before you switch on/off the SDR4E.

7. If you read in the file that is storing many data (measured points), it takes 5 - 10 seconds to access it.

8. For the protection of the data, never turn off the SDR4E during communication with the host computer or the measuring instrument and during accessing to files (to read or to save data).

4.6 SDR4E basic specifications

1) Managing capacity for files	:	Maximum 401 files (Included Environmental Data File)
2) Managing capacity for measured points	:	Maximum 999 points
3) Capability to measure points	:	Maximum 400 points
4) Capability to link data	:	Maximum 9 files
5) Data sending format	:	SDR4E/SDR4C
6) Data receiving format	:	SDR4E/SDR4C
7) Data receiving speed	:	1200bps
8) Data sending speed	:	1200bps/4800bps
9) Filename	:	8 letters
10) Memorandum	:	12 letters
11) Coordinate values	:	-9999.9999 ~ 9999.99990 m -9999999.9 ~ 9999999.90 mm
12) Measurement method	:	Origin 1 X-axis 2 (Fix the Z-axis vertically) X-axis 1,2 Y-axis 3 X-axis 1,2 Z-axis 3 Any 3 points of design data Position measurement (Fix the Z-axis vertically)
13) Number of points when new measurement	:	Origin 1 X-axis 2 — 2 points X-axis 1,2 Y-axis 3 — 3 points X-axis 1,2 Z-axis 3 — 3 points Any 3 points of design data — 3 to 6 points Position measurement — 2 to 6 points
14) Number of link coordinates points	:	2 to 6 points
15) Allowable range of link points error	:	0 ~ ±99 mm
16) Allowable range of design data error	:	0 ~ ±99 mm
17) Allowable range of reverse measurement	:	0 ~ 9.9 mm (slant distance) 0 ~ 59'(horizontal angle · vertical angle)
18) Allowable range of design data	:	0 ~ ±999 mm
19) Times of measurement	:	1 ~ 9 times
20) Distance between paired target points	:	0 ~ 99.99990 m 0 ~ 99999.90 mm
21) Measured offset value	:	-9.9999 ~ 9.99990 m -99999.9 ~ 99999.90 mm
22) Material temperature	:	-99.99 ~ 99.999 °C -147.9 ~ 211.99 °F
23) Coefficient of linear expansion	:	0 ~ 0.999999
24) Temperature for the measuring instrument	:	-30 ~ 60 °C -22 ~ 140 °F
25) Atmospheric pressure for the measuring instrument	:	500 ~ 1400 hPa 375 ~ 1050 mmHg 14.8 ~ 41.3 inchHg
26) Prism constant of NET	:	-99.9 ~ 99.90 mm
27) Prism constant of SET	:	-99 ~ 99 mm
28) Scaling constant	:	0.000001 ~ 99.90000
29) Rate of enlargement/reduction	:	-1000.00 ~ 1000.000 times
30) Parallel shift	:	-9999.9999 ~ 9999.99990 m -9999999.9 ~ 9999999.90 mm

31) Rotation	:	-359°59'59" ~ 359°59'59" (-359.5959 ~ 359.59590) -399.9999 ~ 399.99990 gon -1599.999 ~ 1599.9990 mil
32) Display of areas	:	0 ~ 99999999.9999 m² 0 ~ 99999999999.9 mm²
33) Display of distance between two points	:	0 ~ 99999.9999 m 0 ~ 99999999.9 mm

6.Fundamental procedures of measuring operations

6.1 How to set the measuring instrument

1. Installation :
   For details of installation, refer to the Measuring instrument Instruction Manual.

2. Installation of target on object to be measured:
   For this measurement system, you need to install the target (micro-prism reflector) on the point of the object to be measured.
   The limit of installation angle of surface of target is about (=)45° when seen from a position directly opposite to it from the measuring instrument. This angle is the limit for reflecting light; when the reflected light intensity is inadequate, a measuring error message is displayed on the SDR4E display, therefore set the target at a suitable angle.

3. Connection of measuring instrument and SDR4E (See Fig. 2.1) and preparations for operation :
   Switch on the relevant switches so that measurement can be started.

6.2 Start of measurements

Before starting measurement, you are required to take aim origin target with set level of the measuring instrument and to reset height and horizontal indicators. After these initial operations, all the other operations are executed by SDR4E, which proceeds with measurements. The flow charts of the measurement are given in Fig. 6.1 ~ 6.3, and the method of operating SDR4E is described on Chapter 7.

3.Type and Conducting Method of Measurement

3.1 Types of Measurements

1.Standard Measurement

(1) Origin 1, X-axis 2 Measurement
(X-axis and Y-axis are horizontal, and Z-axis is vertical)
(2) X-axis 1,2 Y-axis 3 Measurement
(The plane including 3 points as X Y plane)
(3) X-axis 1,2 Z-axis 3 Measurement
(The plane including 3 points as X Z plane)

2.Design Data Measurement
Design data measurement, based on the coordinate system of the design data. Used for the actual measurement of all points corresponding to 3 to 6 arbitrary points of design data.(Z-axis meets at a right angle to X Y plane)

3.Position Measurement
Position measurement, based on the coordinate system of the design data, used for the actual measurement of all points corresponding to 2 to 6 arbitrary points of design data.(X-axis and Y-axis are horizontal, and Z-axis is vertical)

3.2 Subsidiary Measuring Functions

1.Link Measurement Function
In this function, if the position of the measuring instrument is shifted in sequence, you can link the points with reference to the same coordinate axes and continue to carry out measurement by re-measuring the 2 to 6 arbitrary points (3 to 6 points in the design data measurement) measured before the measuring instrument is moved.

2.Offsets Measurement Function
In this function, you can take the default values as a result of the adding coordinates by inputting the offsets (dX, dY, dZ) to each point previously.

3.Setting-out Measurement Function
In this function, the accurate horizontal and vertical angles from the position where the measuring instrument is directing at to the measuring point are calculated by inputting the coordinate values of design data or specifying the point number or inputting the coordinate values every points. Therefore, you can obtain the position of the specified coordinate points by measuring the distance at the expected direction.

4.Reverse Measurement Function
Re-measuring the same measuring point with reversing the measuring instrument to 180 degree at the horizontal and vertical direction for making less the error of accuracy due to shifting of the shaft of the measuring instruments that you can obtain the average coordinate values of reverse.

5.Paired Target Measurement Function
Measuring the point impossible to see directly due to an obstacle between the measuring instrument and the measuring point by using two combinable tools of the targets without shifting the measuring instrument that you can obtain the coordinate values of that invisible point.

6.3 Combinable Limits of Types and Functions of Measurement

It is necessary to carry out measurement using the measuring methods indicated [6.1] and [6.2] combined with the necessary functions indicated [6.3].
The combinable limits is indicated as follows:

The combinable limits of types and functions of measurement

	Link coordinate measurement	Input offsets	Setting-out	Reverse measurement	Paired targets
Standard measurement					
① Origin=1 X-axis=2 <F4>	○	※1 ○	※2 ○	○	※1 ○
② X=pts.1,2 Y=pt.3 <F4>	○	※1 ○	※2 ○	○	※1 ○
③ X=pts.1,2 Z=pt.3 <F4>	○	※1 ○	※2 ○	○	※1 ○
Design data measurement	○	※1 ○	※3 ○	○	※1 ○
Position measurement					
Memo is set	○	×	※3 ○	×	×
Memo is not set	○	×	×	×	×
Link coordinate measurement	−	×	×	○	×
Input offset() <F3>		−	×	○	○
Input offset <F3>			−	×	×
Reverse measurement <F2>				−	○
Paired targets <F1>					−

Attention : (1) *1, *2 and *3 can not use at the time of the setting of coordinate system

(2) *2 is to input the coordinate values of each point *3 is to input the coordinate values of the points specified the point names. And it is possible to input the numbers of point.

6.4 New Measurement and Link Measurement

If you determine a new file name and measure the object by using any 3 types of measurement indicated 6.1, firstly, measure the datum point (Origin, the point of X-axis, etc.) for setting of coordinate axis. In SDR4E, a new file is recorded when the measurement of all datum points fixed in each measuring method is finished, and then the environmental setting can be conducted on that new file name.
If you return back the screen before all data of the datum points is not finished to record, the data file is not recorded as a measured data file even the new file name is displayed on the screen. Therefore, the environmental setting is fixed on the same default as before conducting new measurement.
In case of new measurement, when the measurement of all datum points is finished, the next measured point is automatically shifted to the screen for the measurement of general every points. After that, measuring every points in sequence which need at the time of measurement that you can record the points as the data of coordinate values.
If you stop carrying out measurement temporarily and re-measure from the initial screen, the screen for choosing whether additional measurement or link measurement will be displayed with reconfirming the file name. If the position of the measuring instrument is not shifted, the additional measurement will be continued to carry out. But the position of the measuring instrument is shifted, the link measurement should be carried out. When the link measurement is carried out, you can measure and take the coordinate values of all points fixed in the same coordinate system by re-measuring the 2 to 6 arbitrary measured points as the datum points with the same measurement as before stopping new measurement.
The flow charts of type and conducting method of measurement are given in Fig. 6.1 ~ 6.3.

Fig. 6.1 Type and Operating Method of Measurement

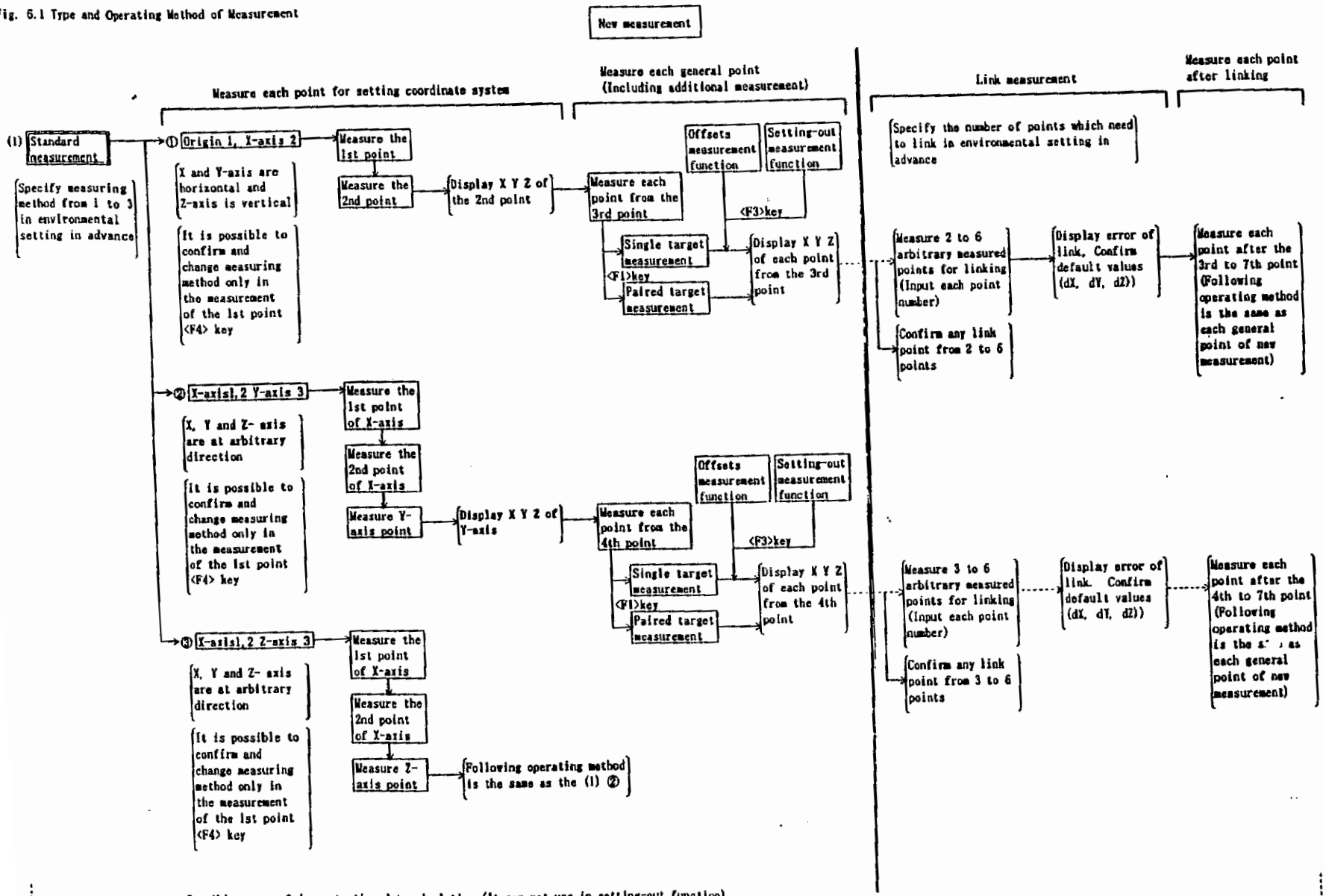


Fig. 6.2 Type and Operating Method of Measurement

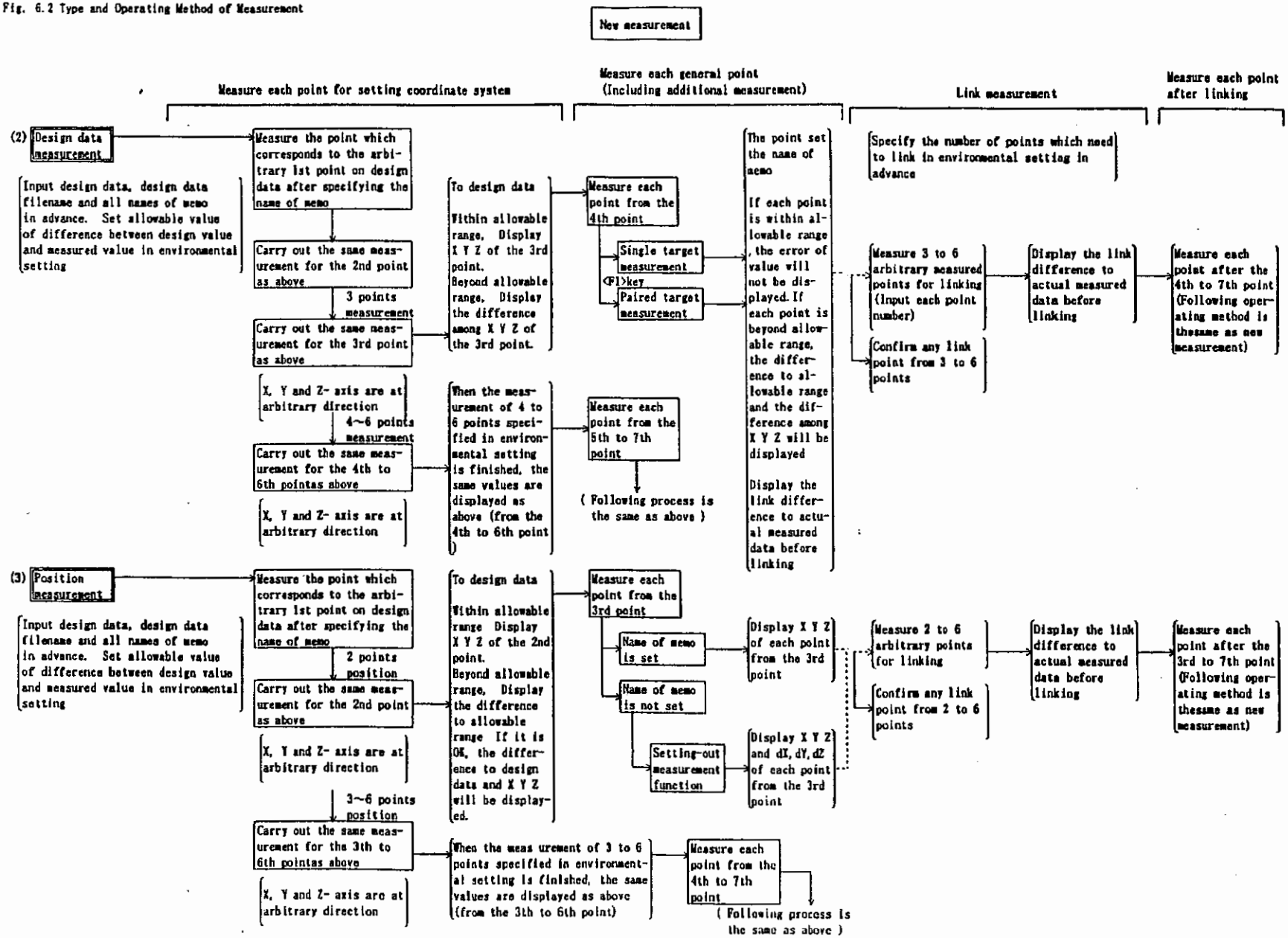
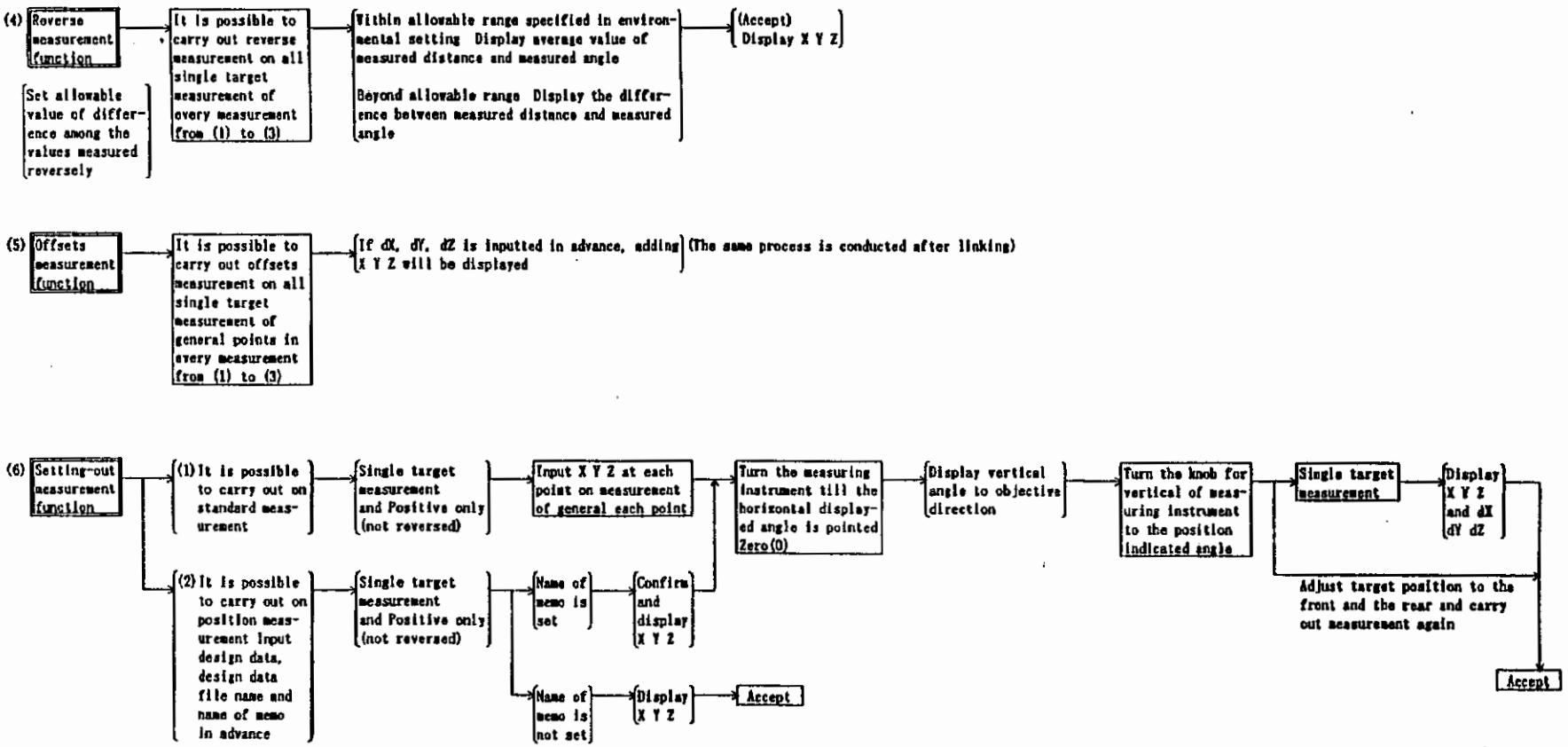


Fig. 6.3 Type and Operating Method of Measurement



6.5 Standard Measurement Conducting Method

1.Origin 1, X-axis 2 Measurement

In the conducting method of standard measurement, the setting method of the coordinate system (Display Origin 1, X-axis 2) that the first measured point as origin and the horizontal direction in the vertical plane included the second point as x-axis is the basic for all of the conducting methods of measurement. Therefore, the conducting method of measurement on the above method will be explained in this paragraph. (Other conducting methods of measurement will be explained later in detail)

Setting of coordinate system for each measuring point:

Firstly, the setting of coordinate axes is necessary the measurements. Set the measuring instrument at an arbitrary position and take the first measured point as the origin (0,0,0). Take the next measured point as X (Xa, 0, Za) and fix the direction of the X axis. Now the Z axis is along a line vertical to the measuring instrument, therefore, the Y axis is fixed in a direction perpendicular to the X and Z axis.

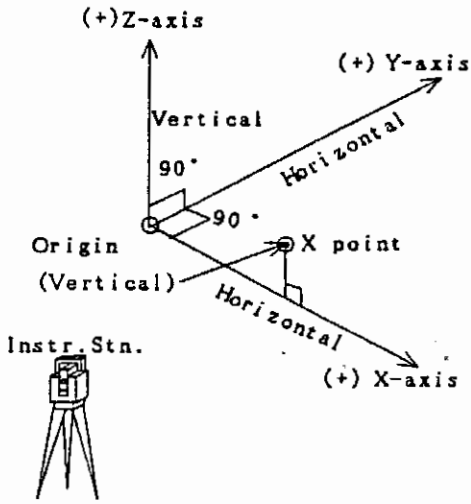


Fig. 6.3

The origin and point X can be arbitrarily selected, even on the structural item, but for maintaining accuracy, select two points which are separated as far as possible.
In the SDR4E, positive coordinates are displayed, with the coordinate axes as shown in the figure on the left, but with the function of transformation coordinates, explained later, the coordinate system can be transferred arbitrarily. After fixing the coordinate axes, collimate the arbitrary target which has been set on the object to be measured. As you proceed with measurements, the data of these points are saved in the RAM disk and the coordinates of the measured point can be output, when required.

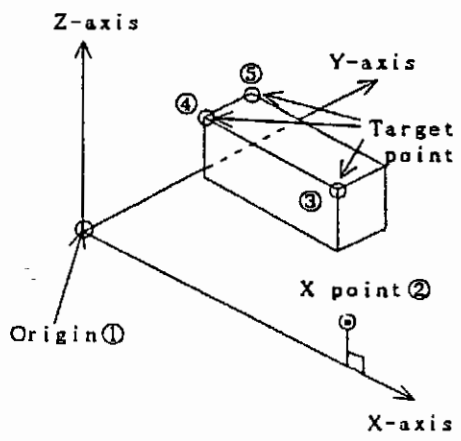


Fig. 6.4

Although it is OK to measure in an arbitrary sequence, it is preferable to denote each point by numbers, as indicated in the figure on the left, and then process, so that there is no mistake during the measuring operation. Input of memos such as features and position names for each measured point is also possible.

Linking of coordinate system with sequential shift of instrument station:

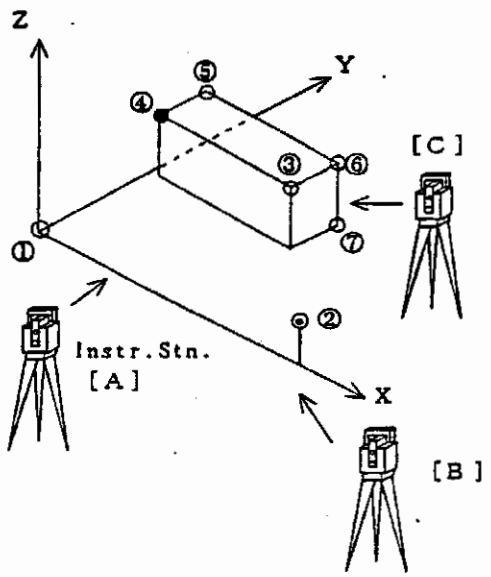


Fig. 6.5

Often, the measuring point on the structural item cannot be sighted at one shot after positioning the instrument arbitrarily, and it becomes necessary to move the instrument location while measuring.
For instance in Fig. 6.5, points 1 - 4 can be measured from Stn. [A]. If any two points of them can also be measured from Stn. [B], numbers of other 3 points measured from Stn. [B] are set to be 5 , 6 & 7 in the same coordinates system. For Stn. [C] too, if any of the 2 points of Stn. [A] or Stn. [B] are used, the point can be expressed in the same coordinate axes. Thi function can be utilized even when the instrument is shifted slightly by mistake.
By these functions, the dimensions of the entire object to be measured can be represented by coordinate values in the solid coordinate system which is arbitrarily selected, therefore shift of the distance between two points or origin of coordinate system, and other transformation and calculation processes, which will be described later, become possible.

In case of the standard measurement [Origin 1, X-axis 2], measurements are carried out by using fundamental procedures and methods as mentioned above, but in practice, measurement is carried out by following the instructions on the screen of SDR4E.

2.X-axis 1, 2 Y-axis 3 Measurement

The standard measurement [X-axis 1, 2 Y-axis 3] is based on the setting method of the coordinate system that the 1st measured point ① as origin, the axis pierced through the 2nd measured point ② (Xa, 0, 0) as X-axis, the plane including that X-axis and the 3rd measured point (Xb, Yb, 0) as X Y plane. And the Z-axis is fixed in a direction perpendicular to the each X and Y-axis Therefore, all points from the 4th point can be output as the values of that coordinate system.

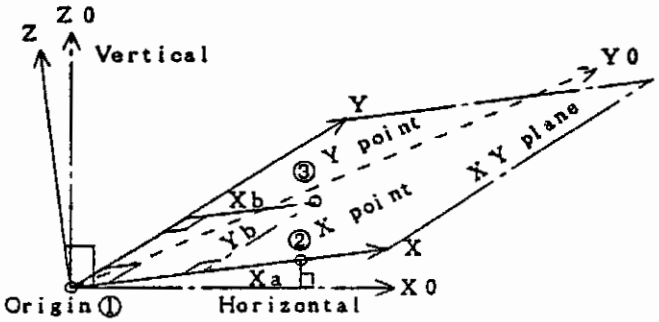
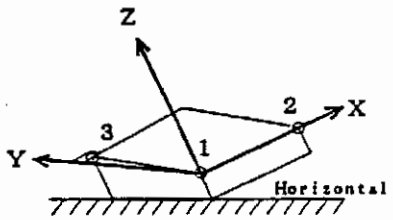


Fig. 6.6



X-axis 1,2 Y-axis 3 coordinate (Example)

Fig. 6.7

3.X-axis 1, 2 Z-axis 3 Measurement

In the standard measurement [X-axis 1, 2 Z-axis 3] is based on the setting method of coordinate system that the 1st measured point ① as origin, the axis pierced through the 2nd measured point ② (Xa, 0, 0) as X-axis, the plane including that X-axis and the 3rd measured point ③ (Xc, 0, Zc) as X Z plane. And the Y-axis is fixed in a direction perpendicular to the each X and Z-axis

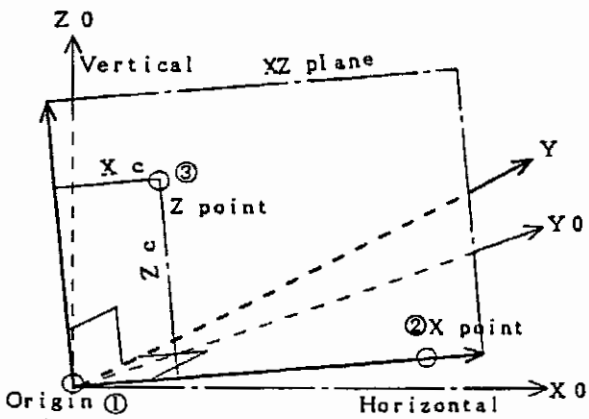
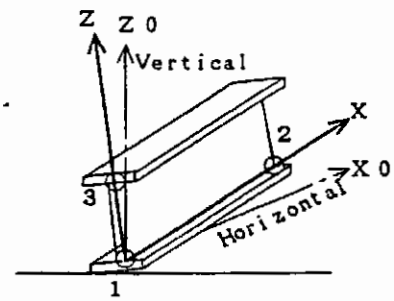


Fig. 6.8

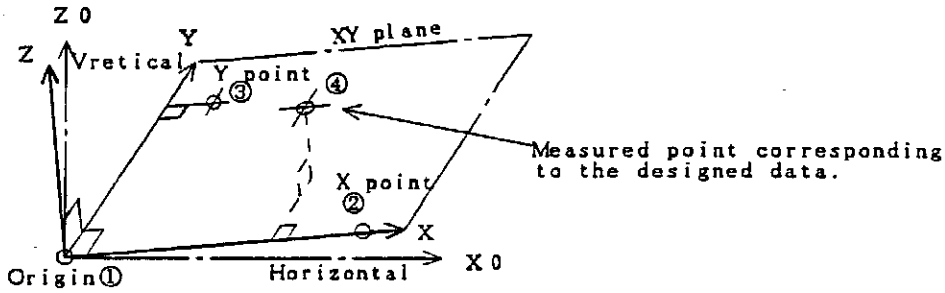


X-axis 1,2 Z-axis 3 coordinate (Example)

Fig. 6.9

6.6 Design Data Measurement Conducting Method

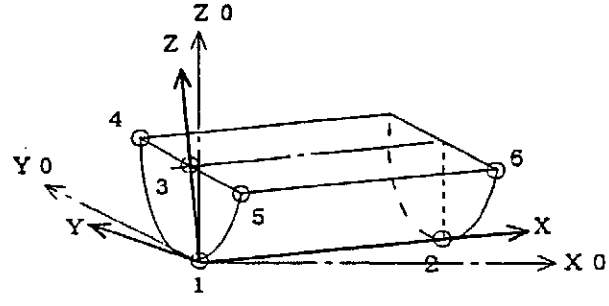
In the design data measurement, record the data of the position, the size (coordinate values), the number and the name of all points on the design data, and store these sorts of data in the design data file of SDR4E previously.
The coordinate system of design data is created by measuring the first 3 to 6 points corresponded to every arbitrary points of design data at the location of measurement , and all measured value after the 3rd to 6th point will be taken as the coordinate values based on design data system. At that time, the actual measured data that the measured values after the 3rd point displayed as coordinate values can be recorded in sequence with displaying the difference to the design data values and the caution when the value is beyond the allowable range specified at the time of environmental setting.



(Design data)

Fig. 6.10

In the design data measurement, it is impossible to measure the point not have design data, due to comparison all points which needs to measure with the number and the name of all points on the design data is necessary to continue measurement.
Also link measurement will be conducted by using the points carried out re-measurement of 3 to 6 arbitrary points measured before linking and seeking the coordinate space having the most similar value of relative relations among all points.



X-axis 1,2 Z-axis 3 coordinate(Example)

Fig. 6.11

6.7 Position Measurement Conducting Method of

In the position measurement, it is necessary to record the design data the same as the design data measurement in advance. Measuring the first 2 to 6 points corresponded to design data creates the coordinate system of design data and takes all of the measuring values after the next point as the coordinate values of design data. In this position measurement, the first measured point is recognized as origin and the Z-axis is always vertical. To display the difference between the coordinate values of all measured points and the design values and to judge and output whether the values is within the allowable range or beyond are the same process as the design data measurement. Moreover, in the position measurement, if the name and the coordinate values of the points are inputted, the actual coordinate values are recorded with specifying the points in the setting-out function, and if the name and the coordinate values of the points are not inputted, the coordinate values are recorded on the measurement of general points in standard measurement.

In the link measurement, it is possible to link the coordinate by re-measuring the 2 to 6 arbitrary measured points.

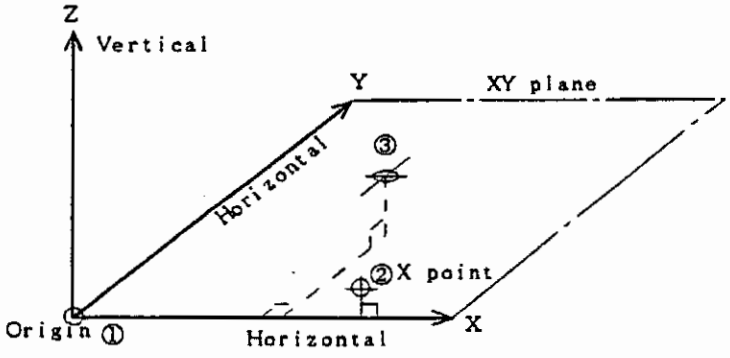


Fig. 6.12

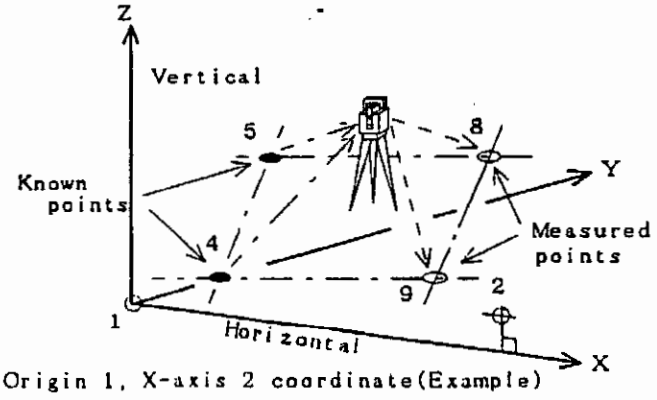
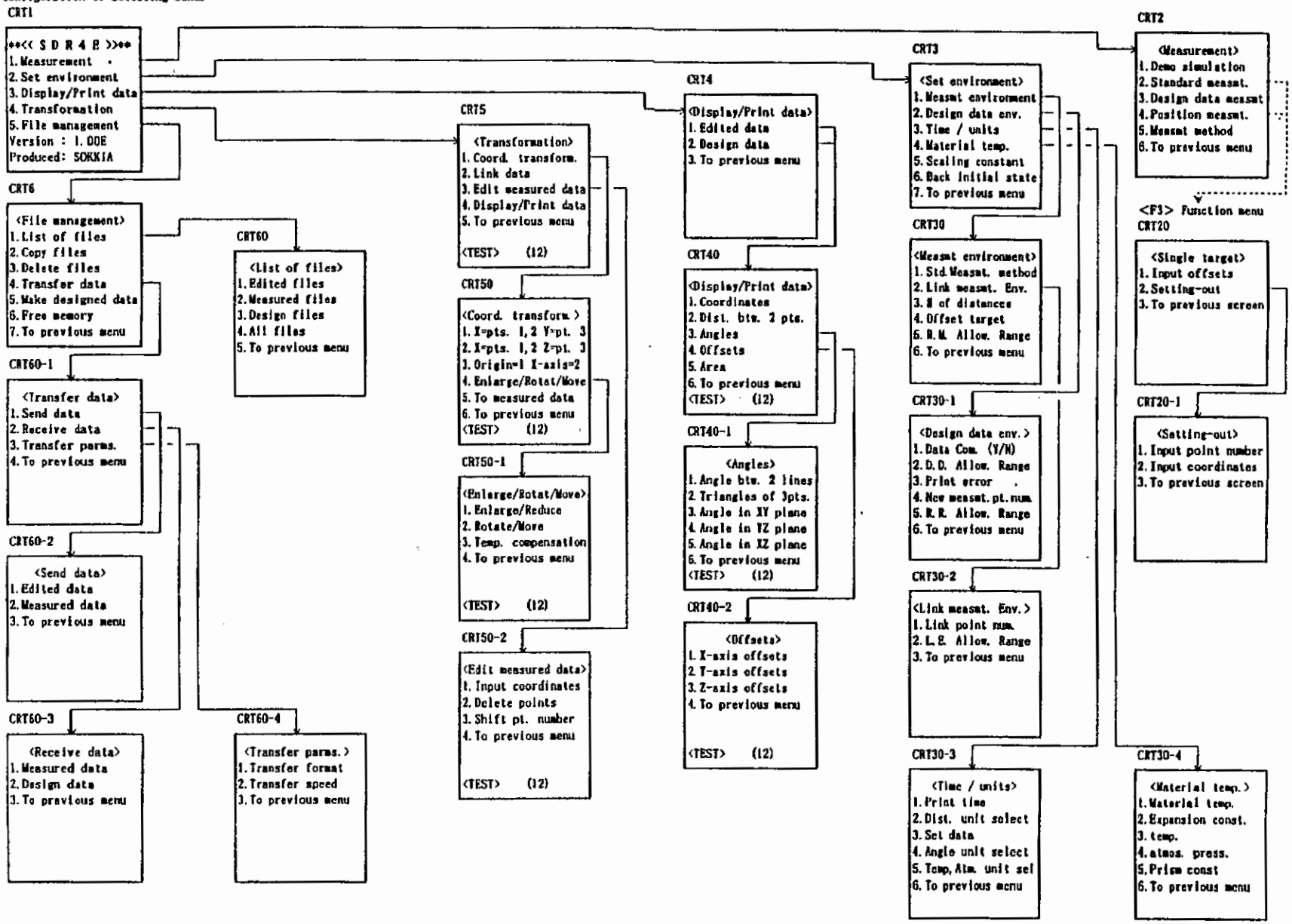


Fig. 6.13

7. Operation of menus

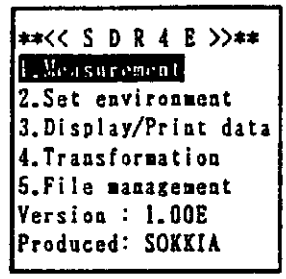
7.1 Configuration of Selecting Menus



7.2 Operation of menus

[1] Opening Menu

CRT1

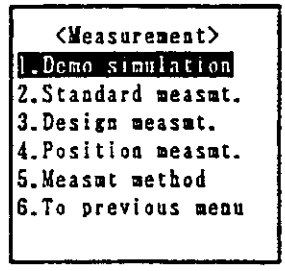


If you turn on the power switch of the SDR4E, the following menu is automatically displayed.
You can select to start an operation among those on the menu , such as measurement, setting the conditions of environment or processing the data collected by the measurement.
For this menu, select an item by its number using <1>, <2>, <3> or <4> keys, or <↑> or <↓> keys to move the cursor on the item to be selected, and then <Enter> key.

[2] Measurement

[2-1] Measurement Demonstrational Operations without Instrument Set

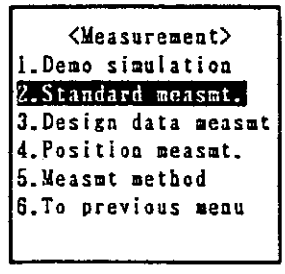
CRT21



If <1> is selected in the opening menu, the menu "Demonstration data file setting" appears as shown on the left. To operate the demonstration data, press <Enter> key in this menu when the cursor is on any item, for starting.
In the normal measuring, operation for the actual measurement, if there is no data input from the measuring instrument, you can not proceed beyond this menu (CRT22-9), but in the demonstration, the menus beyond this menu can be observed and you can practice all the operations at the time of standard measurement. The procedure for operation is the same as [2-2] Standard Measurement.
The number of measurements at the time of using the demonstration data is fixed in 1 and points of data is up to 20.

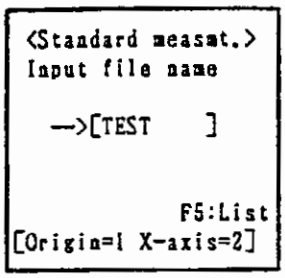
[2-2] Standard Measurement, New Measurement and Link Measurement

CRT22



The method of standard measurement (In the case of new measurement) which are [Origin 1 X-axis 2], [X-axis 1,2 Z-axis 3} etc. are specified at the time of environment setting.
When <2> Standard measurement is selected in the menu, the measurement method specified at the time of environment setting will be used automatically.
However, in the case of coordinate link or additional measurement, the coordinate system based on loaded measurement data (*DT1) will be used instead of the method specified at the time of environment setting.

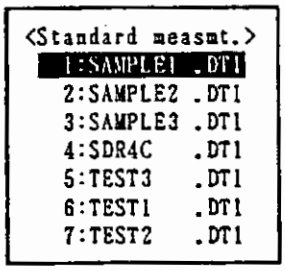
CRT22-1



On the left screen, what is displayed within the brackets is the file name used at the last measurement. If this is OK, press <Enter> key. If you have to revise the file name, move the cursor using arrow keys or space key to the file name and change it.
For the file name, you may use any one character or characters up to 8 in any combination, but try to use simple and easily understandable file names.
When you input file name to that bracketed area for the file name, please fill it from the left side position to the right side.
The characters can be used in file names are as given be' <A> ~ <Z>(capital letter only) <0> ~ <9> <->(for No and hyphen)
As for the linked data file name (having "@" as its initial letter), it can not be accepted here even if it is input.
If you press <Clear>, you will return to the measurement menu (CRT22).

Press [f.5] to display the list of file name and select a file

CRT22-2



When you press <F5> key, a file name list can be displayed, and you can select the file to be processed from the list.
If there are too many files are stored to be displayed within a single page, the list will have plural pages.
In that case, press page up key <⇧> or page down key <⇩> to jump to the next or previous page so that you can speedily select aiming file.
For printing out the file names, go to [6-1] List of File Names.

CRT22-3

When the file name input does not exist, this screen is displayed. After confirming the new file name, select according to the procedure mentioned below:

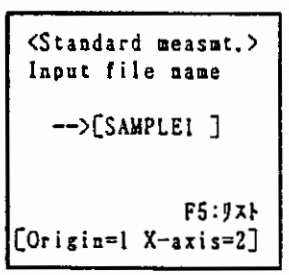
<1> Selection of YES : Select if you wish to input a new file name.
The menu changes over to the menu (CRT22-7).

<2> Selection of NO : Select if the file name is not new. You will return to the menu (CRT22-1).

If you press <Clear>, you will also return to the menu (CRT22-1) as in <2> "No" above.

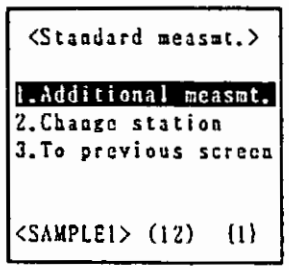
In the case of new measurement, the screen of measurement method specified in environment setting will be displayed after the screen (CRT22-7).
At the bottom line, the method of measurement specified at present will be displayed.

CRT22-4



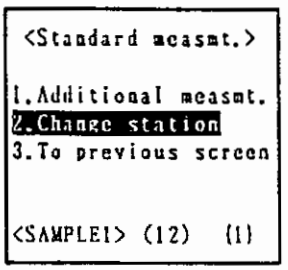
When a old file is specified in the screen "file name input" (CRT22-2), this system decide the coordinate system of file ([Origin 1 X-axis 2], [X-axis 1,2 Y (Z)-axis 3]), and enter the screen of linking coordinate system automatically.

CRT22-5



To (5)Additional Measurement

CRT22-6



To (6) Link Measurement
(Shift of instrument station)

CRT22-7

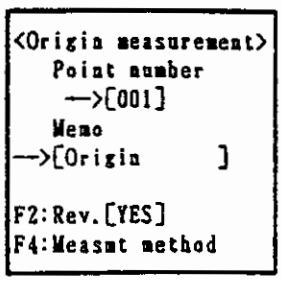
If <Enter> is selected in the menu (CRT22-3), a screen shown left is displayed, which can function to check whether the measuring instrument is ready for measurement or not.
If the measuring instrument is not ready, the left screen will appear in 15 - 20 seconds after the screen (CRT22-8).

CRT22-8

If the screen (CRT22-8) shown left is displayed, please check whether the measuring instrument is set properly.
In the case that the measuring instrument is ready, a tone which indicates that the signals are received will sound immediately on the measuring instrument side and the menu [Origin measurement] or [X-1st pt measurement] in the screen (CRT22-9 or CRT22-88) will be displayed.

1. Origin 1, X-axis 2 Measurement

CRT22-9



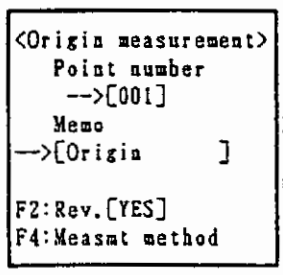
For new files, the menu as indicated on the left is always displayed. In a new file, the first measured point is displayed as the origin (Point No. 1).

Memo : Any alphabets can be input. It is OK even if there is no input for memo.
Switching capitals/small letters can be made with a touch of <Caps Lock> key.

Press [f.2] to specify whether the reverse measurement is performed or not

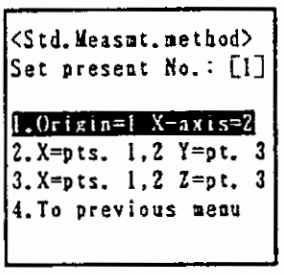
This is the simplest method to create a coordinate system used in SDR4C.
In SDR4E, it is possible to conduct reverse measurement.
In case of the first measured point in a new file, you can change the method of measurement if you press <F4> key.

CTR22-10



Press <F4>key to specify the measuring method that you want to change.

CRT22-11



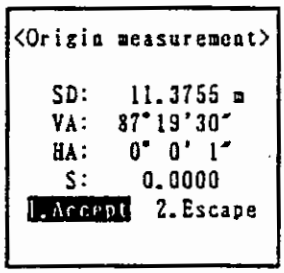
CRT22-12

Press <Enter> key after confirming each data or after input of each data for modification, finally press <Enter> key for finishing the operations to enter the next menu "measure origin", so that you can input measurement commands for the measuring instrument.
If you press <Clear> key, you will return to the previous menu.

CTR22-13

If you select <1>, the measurement starts immediately, and the display changes to the screen indicated on the left. Excepting the operations in the demonstration data file, if the input data signals from the measuring instrument are not received or if there is a cable disconnection during measurement or if operation has been started without connecting the measuring instrument, the system gives a message that as measurement error happens, restarting measurement is required. In this case, press <Enter> key to reset.
If the measured data are received in order, the messages "Measuring ...." and "Receiving data ..." continue to be displayed.

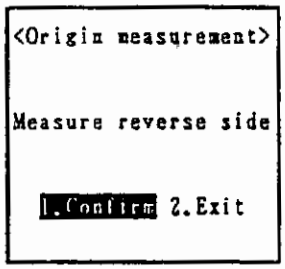
CRT22-14



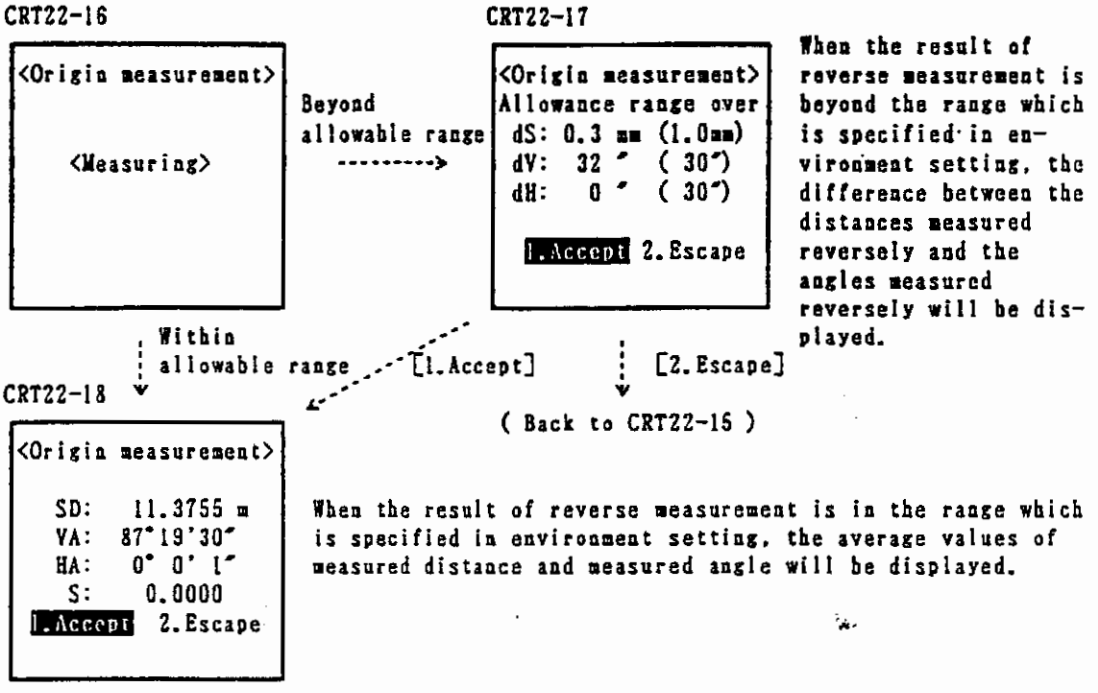
---------->When the reverse measurement is not performed, enter to CRT22-19.

After the measured data have been received, the display is as indicated in the figure on the left, with the slope line distance from the center of the measuring instrument to the origin (SD), vertical angle (VA), horizontal angle (HA) and deviation of measuring instruments due to the number of measurements (S), as data of the measuring point.
However, in the SDR4E, each XYZ is automatically calculated and saved as 0.0000m coordinate origin. When print command after each measurement has been input, the coordinate data as indicated in the figure on the next page, is printed.

CRT22-15



When the reverse measurement is performed,


CRT22-16
<Origin measurement>
<Measuring>
Beyond
allowable range
CRT22-17
<Origin measurement>
Allowance range over
dS: 0.3 mm (1.0mm)
dV: 32 " (30")
dH: 0 " (30")
1.Accept 2.Escape
When the result of reverse measurement is beyond the range which is specified in environment setting, the difference between the distances measured reversely and the angles measured reversely will be displayed.
Within
allowable range
[1.Accept]
[2.Escape]
CRT22-18
(Back to CRT22-15)
<Origin measurement>
SD: 11.3755 m
VA: 87°19'30"
HA: 0° 0' 1"
S: 0.0000
1.Accept 2.Escape
When the result of reverse measurement is in the range which is specified in environment setting, the average values of measured distance and measured angle will be displayed.

CRT22-19 ↓

```
<X-axis measurement>
   Point number
    —>[002]
   Memo
—>[X-axis    ]

F2:Rev.[YES]
<TEST>      (1)   (1)
```

CRT22-20

```
<X-axis measurement>


  Create X-axis


 1.Confirm  2.Escape
<TEST>      (1)   (1)
```

When the measurement of coordinates of origin is completed, by measuring the coordinates of a point along the X direction, the XZ coordinate plane, including the X coordinate (namely (+)X) is fixed.
In the same manner as measurement of origin, when the preparations for measurement of the second point (X direction) is completed, start the measuring operation.

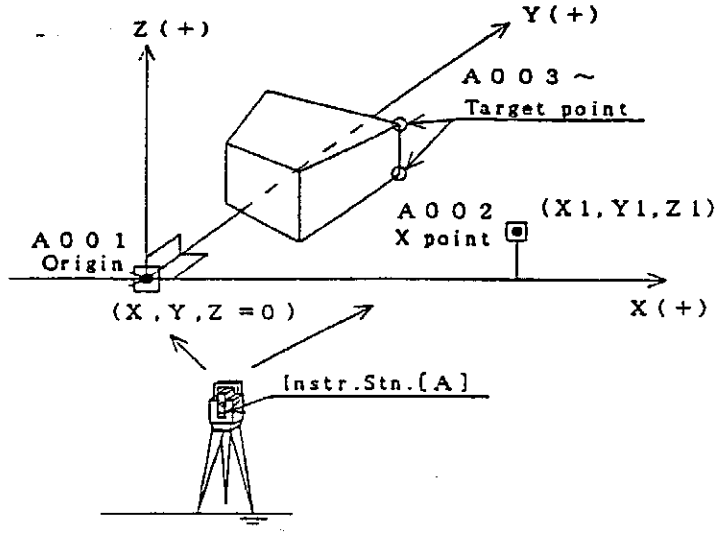
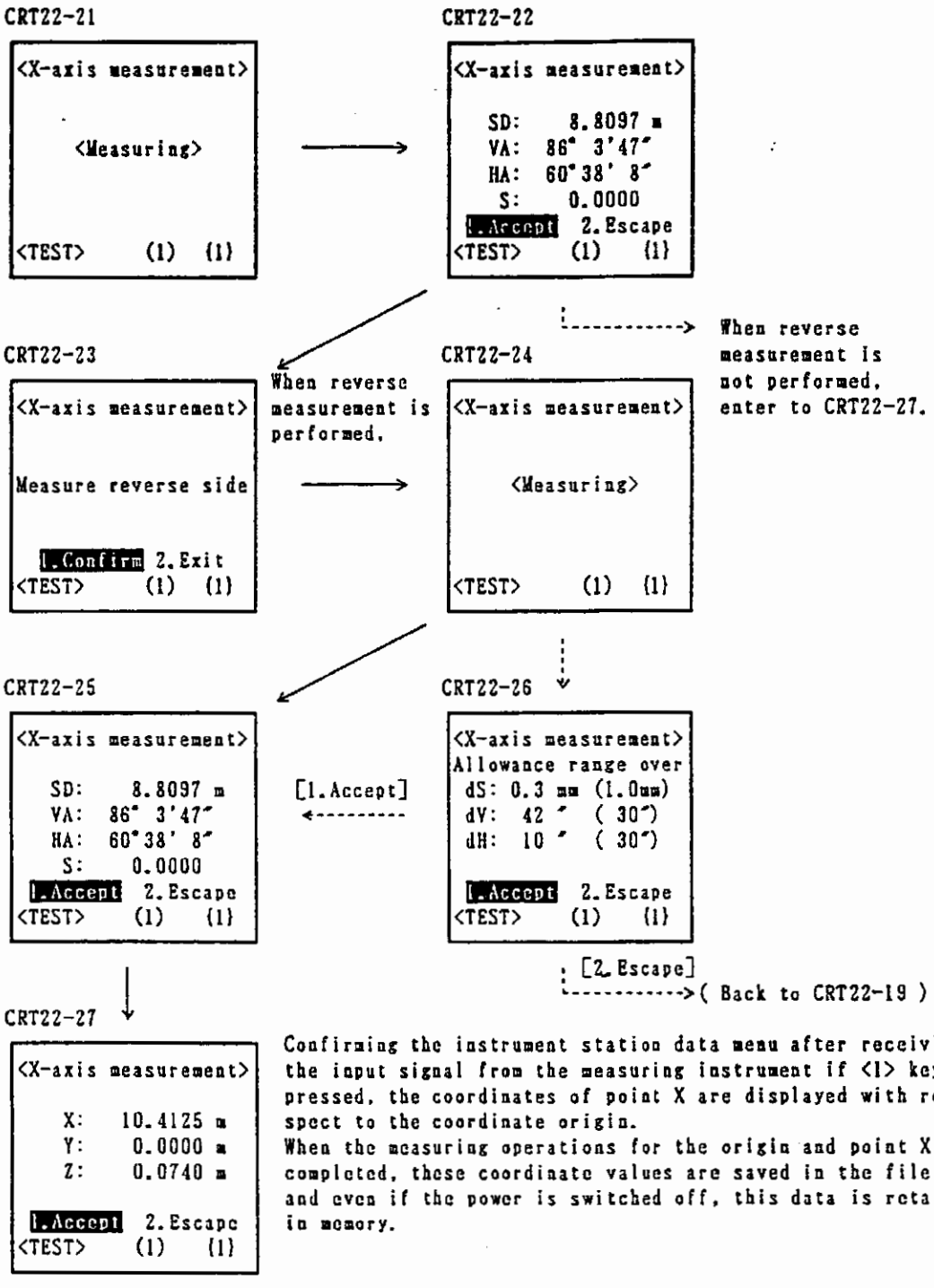


Fig. 7.1



Confirming the instrument station data menu after receiving the input signal from the measuring instrument if <1> key is pressed, the coordinates of point X are displayed with respect to the coordinate origin.
When the measuring operations for the origin and point X are completed, these coordinate values are saved in the file, and even if the power is switched off, this data is retained in memory.

Print out sample of the coordinates of origin and X points

```
<TEST>

   PT=2 ------------------ Number of measured points
   [Origin=1 X-axis=2]
   REP.        1 ---------- Times of measurement
   2TRG(1)     0.0000 m ---- Distance between the paired points (1)
   2TRG(2)     0.0000 m ---- Distance between the paired points (1)
   TEMP.      20.000 °C ---- Set value of temperature
   EP.         0.000012 ---- Set value of expansion rate
   SCL.       -1.000000 ---- Scaling constant
START:10/29/1995 13:15:14 -- Starting time of measurement

[001] MEMO:Origin point
      X=    0.0000 m
      Y=    0.0000 m
      Z=    0.0000 m
[002] MEMO:X point
      X=   10.4125 m
      Y=    0.0000 m
      Z=    0.0740 m

END:  10/29/1995 13:16:07 -- Finishing time of measurement
```

(1) Target Point Measurement (Single target)

CRT22-28

```
 <Single target>
  Point number
    —>[003]
  Memo
—>[Single      ]
F1:Target    F3:Menu
F2:Rev.[YES]
<TEST>   (2)   {1}
```

CRT22-29

```
 <Single target>


  Single target
  Measurement

 1.Confirm 2.Exit
<TEST>   (2)   {1}
```

CRT22-30

```
 <Single target>

  SD:   11.9341 m
  VA:  92°46'46"
  HA:  15° 3'29"
   S:    0.0000
 1.Accept 2.Escape
<TEST>   (2)   {1}
```

CRT22-31

```
 <Single target>

   X:    2.0001 m
   Y:   -0.0168 m
   Z:    0.0035 m

 1.Accept 2.Escape
<TEST>   (2)   {1}
```

The measurement of each coordinate of object to be measured is started after setting the coordinate axes. (If the origin and X point can be set on the object to be measured, the measuring operations can be greatly reduced)
In this case, measure the targets already arranged, one by one in the usual way, then measure the single target for finding the respective coordinates. Measure two targets as a set, using the system of measuring paired target to find the third point. You can proceed with the measurement of single target normally. If you select the single target measurement, you can proceed with the measurement in sequence for the points after this third point, exactly the same way as for the first point (origin) and second point (X point).

The letters and figures in the brackets on the bottom line of each display mean as follows;

- <>: Name of current file.
- () : Number of coordinates saved in the file.
- [] : Times of measurement by the measuring instrument is set with environment per one target point.

On the left screen, for example, it is indicating that the file named <TEST> stores the data of 2 target points which have been measured and the times of measurement by the measuring instrument is set 3times per one target point.

(2) Target Point Measurement (Paired Target)

CRT22-32

```
<Paired targrts>
 Point number
    —>[004]
 Memo
—>[Paired      ]
F1:Target    F3:Menu
F2:Rev.[NO]
<TEST>   (3)  (1)
```

↓

CRT22-33

```
<Dist. btw. target>

  1:Equal distance
  2:    0.2500 m
  3:    0.0500 m

Number—>[1]
<TEST>   (3)  (1)
```

↓

CRT22-34

```
<Paired targrts>


1st pt measurement


 1.Confirm 2.Exit
<TEST>   (3)  (1)
```

↓

CRT22-35

```
<Paired targrts>

  SD:    7.3166 m
  VA:  89°50' 2"
  HA: 343°32'49"
  S:     0.0000
1.Accept  2.Escape
<TEST>   (3)  (1)
```

↓

To CRT22-36

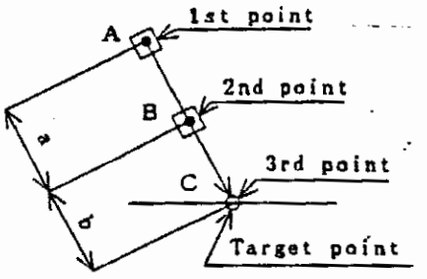


Fig. 7.2

If direct measurement of a point is not possible due to difficulty in setting the targets or because of an obstacle between the measuring instrument and the measuring point, then as indicated in the figure above, three points at a same spacing on an arbitrary axis are taken and two targets are measured to determine the coordinates of the third point . In this case, the paired target <F1> in the above screen must be selected. (See [3-2], Measurement Environment). When the paired target is selected, the paired targets menu appears as shown left uppermost. In case the spacing between target points have been determined in the set environment(default)menu for new files, the spacing will be displayed as the left screen. However, if the spacing have not been predetermined, they will be automatically set equal without displaying the left screen. If <Clear> key is pressed on the left uppermost screen, the single target menu will be displayed.

The method of measuring each point is exactly the same as in the case of a single target, but make sure you measure from the target which is the farthest from the point whose coordinates are to be measured.
Pressing <F1> key works to switch over the menu from single target to paired target, or vice versa, so please press <F1> key to repeat paired targets mode. If you finish all of the operation of paired target, the screen will return to the single target menu, and if <2> is selected, the paired targets menu will be displayed again.

The screen on the left is an example of the display of coordinates of the first point. These values will not be saved as final data, just as in the case of data of instrument station, therefore if this data is required, please take notes at this stage before you press key <1>.
The screen of the display of coordinates of the second point is the same as the first point.

CRT22-36

```
 <Paired targrts>

2nd pt measurement

 1.Confirm 2.Exit
<TEST>    (3)    {1}
```

CRT22-37

```
 <Paired targrts>

  SD:    7.3093 m
  VA:  90°22' 9"
  HA: 343°27'52"
   S:    0.0000
 1.Accept  2.Escape
<TEST>    (3)    {1}
```

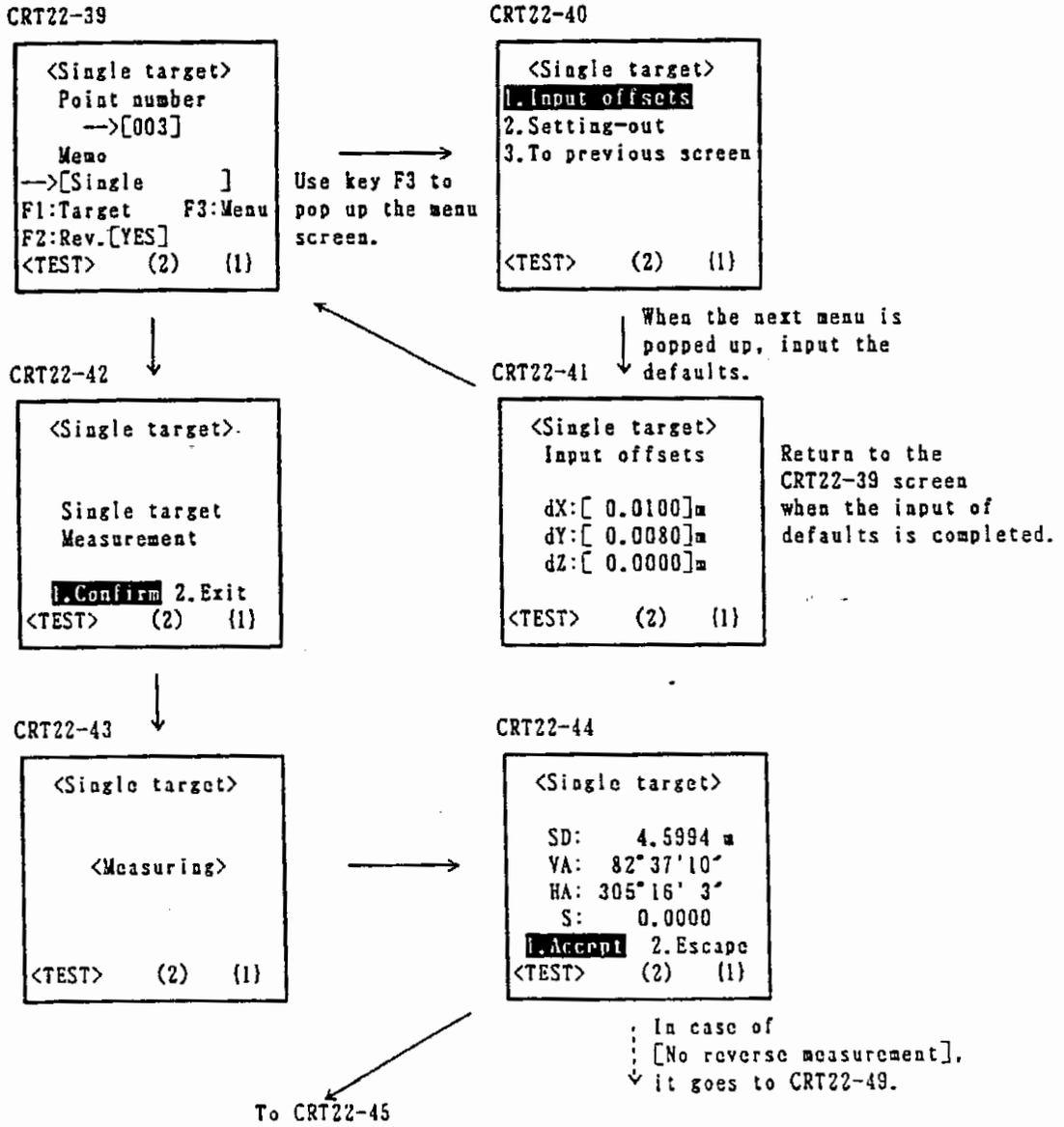
CRT22-38

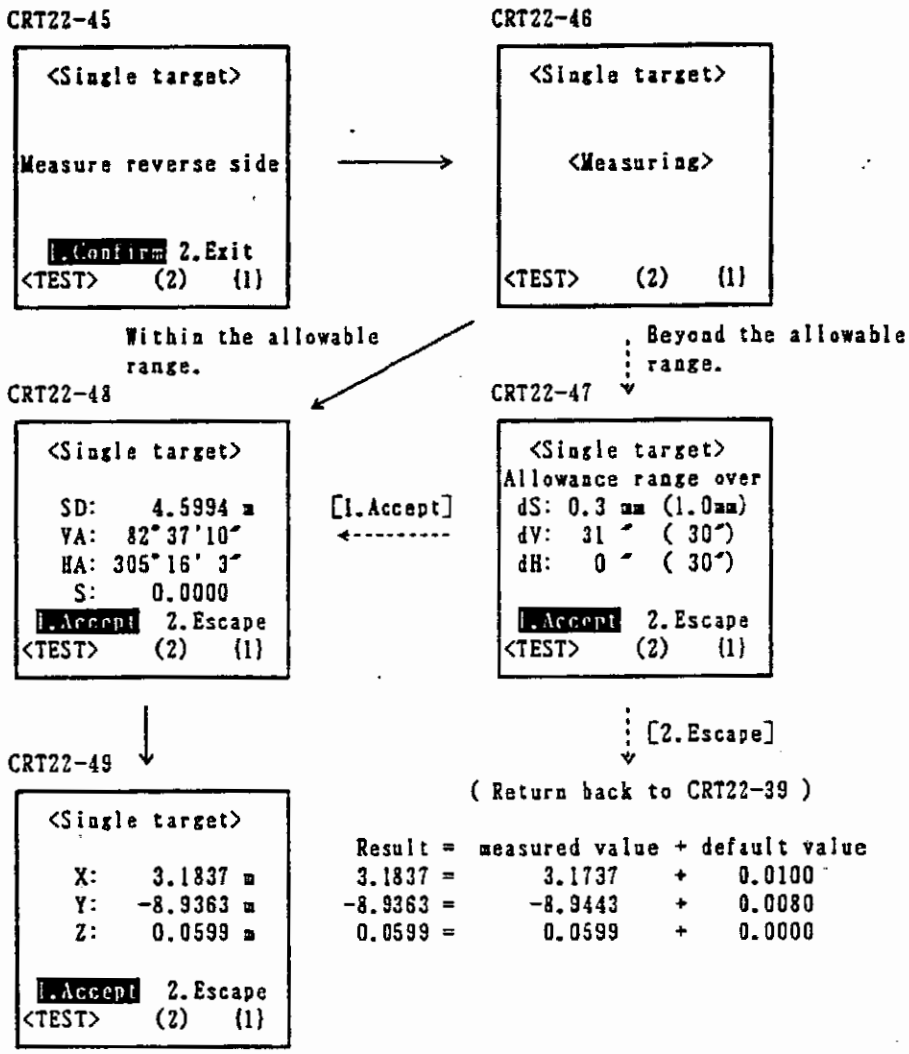
```
 <Paired targrts>

   X:   -0.6757 m
   Y:   -0.7297 m
   Z:   -0.6031 m
   L:    0.0650 m
 1.Accept  2.Escape
<TEST>    (3)    {1}
```

The screen on the left is an example of the display of coordinates of the third point.
After measurements are completed, only the values of this third point will be saved as coordinates for this point number.
The L value in the figure indicates the distance measured between the first point and second point of the paired target.

(3) Measurement Based on Offsets

The measurement based on offsets is to determine the final coordinates of a measured point by the addition of the defaults values (dX, dY, dZ) to its measured coordinates.
The defaults must be inputted every one point. When the measurement of one point is completed, the default values are initialized zero (0).
During the input of defaults, if <Clear> key is selected, the default values will be initialized zero (0), and the function based on offsets will be deleted.




CRT22-45
<Single target>
Measure reverse side
1.Confirm 2.Exit
<TEST> (2) (1)
CRT22-46
<Single target>
<Measuring>
<TEST> (2) (1)
Within the allowable range.
Beyond the allowable range.
CRT22-48
<Single target>
SD: 4.5994 m
VA: 82°37'10"
HA: 305°16' 3"
S: 0.0000
1.Accept 2.Escape
<TEST> (2) (1)
[1.Accept]
CRT22-47
<Single target>
Allowance range over
dS: 0.3 mm (1.0mm)
dV: 31 " (30")
dH: 0 " (30")
1.Accept 2.Escape
<TEST> (2) (1)
[2.Escape]
(Return back to CRT22-39)
CRT22-49
<Single target>
X: 3.1837 m
Y: -8.9363 m
Z: 0.0599 m
1.Accept 2.Escape
<TEST> (2) (1)
Result = measured value + default value
3.1837 = 3.1737 + 0.0100
-8.9363 = -8.9443 + 0.0080
0.0599 = 0.0599 + 0.0000

(4) Setting-out Function

Setting-out function is to input the horizontal and vertical angle from the position where the measuring instrument is directing at, to the position of the designed coordinate (X, Y, Z), and the measuring instrument become the specified value. Under this condition, measure the slope distance several times and determine the position for design by setting the target at the expected position.
But setting-out function can not be used in the methods of 2 targets measurement and reverse measurement.

CRT20-50

```
  <Single target>
   Point number
     -->[004]
   Memo
-->[Single     ]
F1:Target     F3:Menu
F2:Rev.[NO ]
<TEST>   (3)   {1}
```

Use key F3 to display the menu screen.

CRT22-51

```
  <Single target>
1.Set offset
2.Setting-out
3.To previous screen


<TEST>     (3)    {1}
```

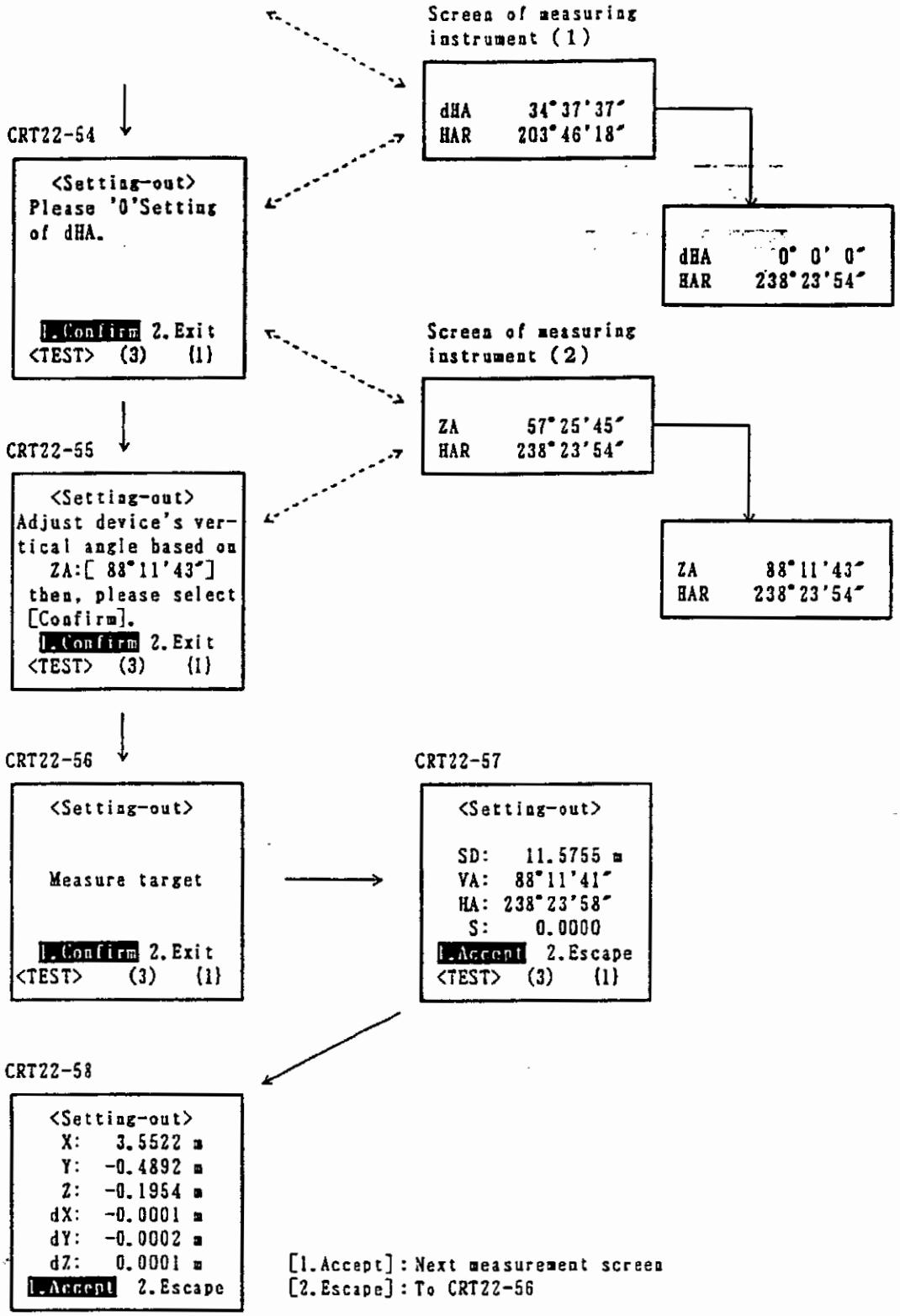
CRT22-52

```
   <Setting-out>
1.Input point number
2.Input coordinates
3.To previous screen


<TEST>     (3)    {1}
```

CRT22-53

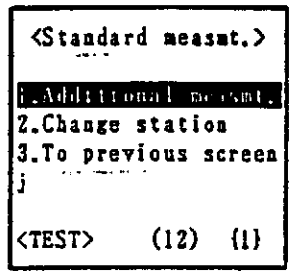
```
   <Setting-out>
 Input coordinates

  X =   10.3052 m
  Y =   -9.0857 m
  Z =    0.0000 m

<TEST>     (3)    {1}
```

In case of standard measurement, <1> "Input point number" can not be used because the point number, the point named and the coordinate values are not loaded.
If <2> "Input coordinate" in the screen (CRT22-53) is selected, you can obtain the accurate position by inputting the coordinate value of the coordinate every point.


Screen of measuring instrument (1)
dHA 34°37'37"
HAR 203°46'18"
dHA 0° 0' 0"
HAR 238°23'54"
CRT22-54
<Setting-out>
Please '0'Setting of dHA.
1.Confirm 2.Exit
<TEST> (3) (1)
Screen of measuring instrument (2)
ZA 57°25'45"
HAR 238°23'54"
ZA 88°11'43"
HAR 238°23'54"
CRT22-55
<Setting-out>
Adjust device's vertical angle based on
ZA:[88°11'43"]
then, please select [Confirm].
1.Confirm 2.Exit
<TEST> (3) (1)
CRT22-56
<Setting-out>
Measure target
1.Confirm 2.Exit
<TEST> (3) (1)
CRT22-57
<Setting-out>
SD: 11.5755 m
VA: 88°11'41"
HA: 238°23'58"
S: 0.0000
1.Accept 2.Escape
<TEST> (3) (1)
CRT22-58
<Setting-out>
X: 3.5522 m
Y: -0.4892 m
Z: -0.1954 m
dX: -0.0001 m
dY: -0.0002 m
dZ: 0.0001 m
1.Accept 2.Escape
[1.Accept] : Next measurement screen
[2.Escape] : To CRT22-56

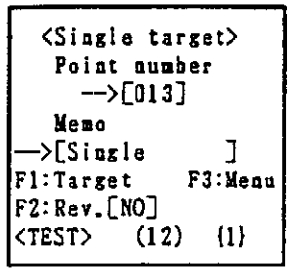
(5) Additional Measurements

CRT22-59



In case of re-measurement after stopping the measuring operation once by switching off the power or in case of returning back to the opening menu, if the same file name is input in the (CRT22-1) menu, then the menu indicated on the left is displayed.
When it is confirmed that there is no change in the position of the measuring instrument, select <1> Old instrument station, and you can continue with the same measuring operation as before, with additional point numbers.
After the break, if a considerable amount of time has elapsed, and if there is a suspicion of a change in the position of the measuring instrument, then follow the procedure outlined in <2> New instrument station (Link Measurement) on the next page.

CRT22-60



(6) Link Measurement (Shift of instrument station)

When conducting SDR4E link measurement, in order to improve the accuracy, the number of points used for the link can be set to be 2 to 6 at the time of environment setting.

The lower-limit number of points (minimum number) used for link is different due to different methods of new measurement (Coordinate creation). For example, the minimum number of points is 2 for link with the coordinate which is determined after the new measurement using the method [Origin 1, X-axis 2], while no link with a coordinate is possible when [X-axis 1, 2 Y(or Z) -axis 3] is applied unless there are 3 points for link. In this case, if 2 points are supposed to be set at the time environment setting, a 3-point link will be conducted automatically in this system.

To shift the position of the measuring instrument in sequence and to measure with reference to the same coordinate axes as before, it is necessary to measure the 2 previously measured arbitrary points once again and calculate the link with the coordinate axes.

In menu (CRT22-59), if you select <2> New instrument station, first the message for measuring the already known 2 to 6 points is displayed, therefore finish the measurement of these 2 to 6 points before starting with the measurement of the 3rd to 7th point.

Input the point numbers of the 2 to 6 arbitrary points which are already known and which have been measured prior to shifting the measuring instrument, without making any mistake. However, any sequence of measurement of point numbers can be used.

CRT22-61

```
<Origin=1 X-axis=2>

1.Additional measmt.
2.Change station
3.To previous screen


<SAMPLE1> (12)  (1)
```

CRT22-62

```
 <Link coordinates>
Link point num.[  3]

 Input 1st point
 number
        -->[5  ]
F2:Rev.[YES] F5:List
<SAMPLE1> (12)  (1)
```

<---------> Use key F5 to display and select point numbers.

CRT22-63

```
<Link coordinates>
   1 Origin
   2 X-axis
   3 Blk No. 1- 1
   4 Blk No. 1- 2
   5 Blk No. 1- 3
   6 Blk No. 2- 1
   7 Blk No. 2- 2
```

List of point numbers with memos, if they have been input before the instrument position is shifted, can be displayed by pressing <F5> key. If you press <Enter> key on a point number with memos which you want to select, it is automatically set in the input field of point number.

CRT22-64

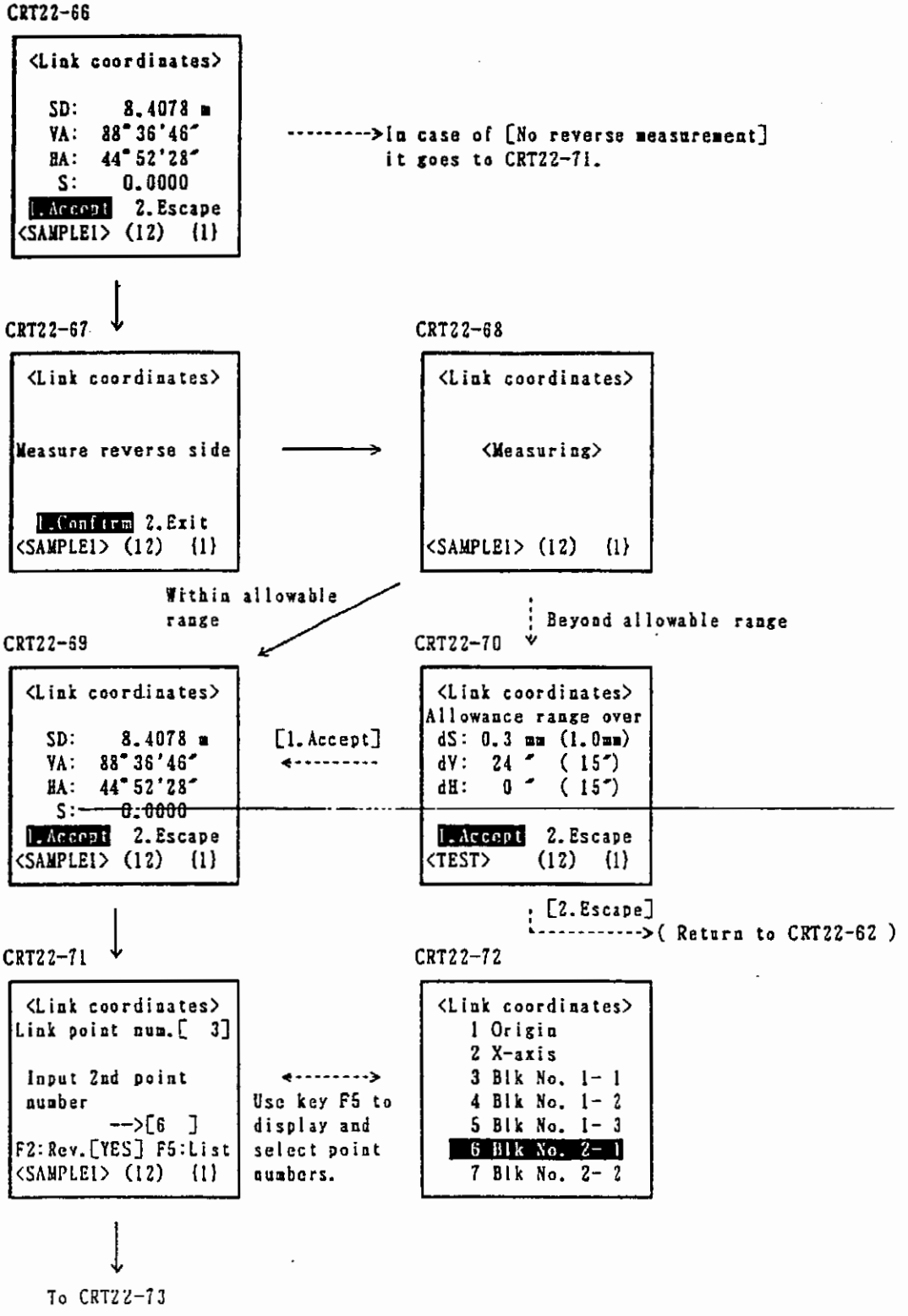
```
 <Link coordinates>
 1st point No. [  5]

    Measure 1st
    point

  1.Confirm 2.Exit
<SAMPLE1> (12)  (1)
```

--------->

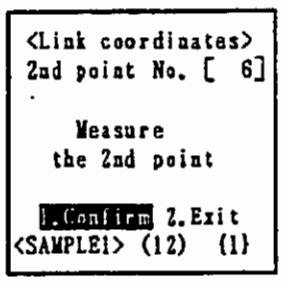
CRT22-65

```
 <Link coordinates>


     <Measuring>


<SAMPLE1> (12)  (1)
```

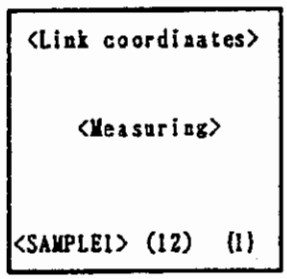
To CRT22-66


CRT22-66
<Link coordinates>
SD: 8.4078 m
VA: 88°36'46"
HA: 44°52'28"
S: 0.0000
1.Accept 2.Escape
<SAMPLE1> (12) {1}
--------->In case of [No reverse measurement]
it goes to CRT22-71.
CRT22-67
<Link coordinates>
Measure reverse side
1.Confirm 2.Exit
<SAMPLE1> (12) {1}
CRT22-68
<Link coordinates>
<Measuring>
<SAMPLE1> (12) {1}
Within allowable range
Beyond allowable range
CRT22-69
<Link coordinates>
SD: 8.4078 m
VA: 88°36'46"
HA: 44°52'28"
S: 0.0000
1.Accept 2.Escape
<SAMPLE1> (12) {1}
[1.Accept]
CRT22-70
<Link coordinates>
Allowance range over
dS: 0.3 mm (1.0mm)
dV: 24 " (15")
dH: 0 " (15")
1.Accept 2.Escape
<TEST> (12) {1}
[2.Escape]
(Return to CRT22-62)
CRT22-71
<Link coordinates>
Link point num.[3]
Input 2nd point number
-->[6]
F2:Rev.[YES] F5:List
<SAMPLE1> (12) {1}
Use key F5 to display and select point numbers.
CRT22-72
<Link coordinates>
1 Origin
2 X-axis
3 Blk No. 1- 1
4 Blk No. 1- 2
5 Blk No. 1- 3
6 Blk No. 2- 1
7 Blk No. 2- 2
To CRT22-73

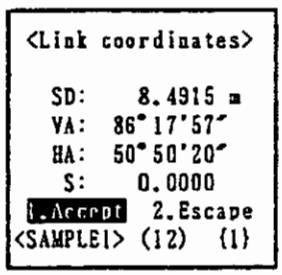
CRT22-73

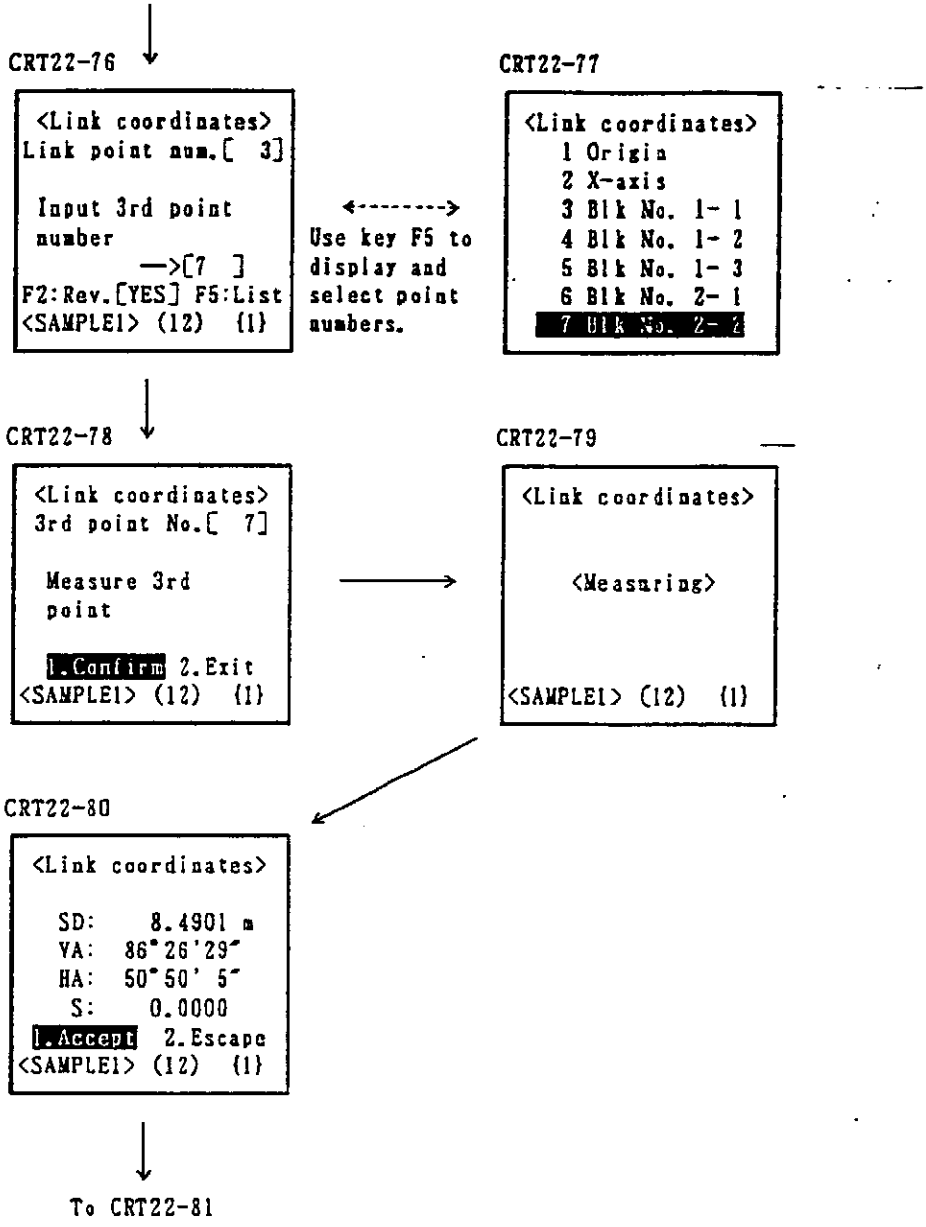


CRT22-74

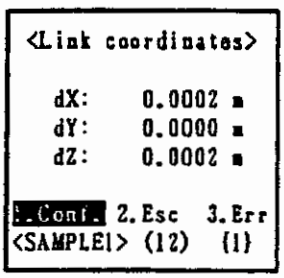


CRT22-75




CRT22-76
<Link coordinates>
Link point num.[3]
Input 3rd point number
—>[7]
F2:Rev.[YES] F5:List
<SAMPLE1> (12) {1}
<--------->
Use key F5 to display and select point numbers.
CRT22-77
<Link coordinates>
1 Origin
2 X-axis
3 Blk No. 1- 1
4 Blk No. 1- 2
5 Blk No. 1- 3
6 Blk No. 2- 1
7 Blk No. 2- 2
CRT22-78
<Link coordinates>
3rd point No.[7]
Measure 3rd point
1.Confirm 2.Exit
<SAMPLE1> (12) {1}
CRT22-79
<Link coordinates>
<Measuring>
<SAMPLE1> (12) {1}
CRT22-80
<Link coordinates>
SD: 8.4901 m
VA: 86°26'29"
HA: 50°50' 5"
S: 0.0000
1.Accept 2.Escape
<SAMPLE1> (12) {1}
To CRT22-81

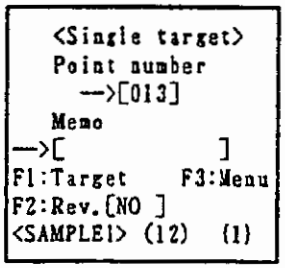
CRT22-81



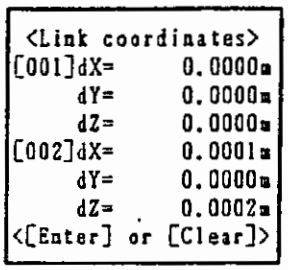
If the re-measuring operations of the 2 to 6 already known points are completed, the difference in values of the coordinates from the previous measurement is displayed, as indicated in the figure on the left, therefore judge whether these values will cause any problems in the next measurements and then proceed with the measuring operations.
The link error per point differs from each other, and the average error of all points is displayed in this screen.

Select <3> error to display the link error of all points.

CRT22-82



CRT22-83



The methods of measurements after the fourth point are exactly as mentioned before but the instrument station ID and point number will change progressively and automatically.

2. X-axis 1, 2 Y-axis 3 Measurement

CRT22-83

```
<Standard Measmt.>
Input file name

  —>[TEST    ]

This is a new file
   1.YES   2.NO
[X=pts. 1,2 Y=pt. 3]
```

If [X-axis 1, 2 Y-axis 3] is specified as a new method of measurement at the time of environment setting, the selection of "Standard measurement" from the menu will result in the processing shown in the following screens (After CRT22-84).

The measurement of [X-axis 1, 2 Y-axis 3] is a method of coordinate determination based on the first 3 measured point.

Thus, the Z-axis will no longer be a vertical axis just as in case of [Origin 1, X-axis] measurement.

It will be directed in an arbitrary angle determined by the 3 measured point.

When reverse measurement is not performed, the processing method is exactly the same with "1. Origin 1 X-axis 2 Measurement" except the subjects mentioned above.

CRT22-84

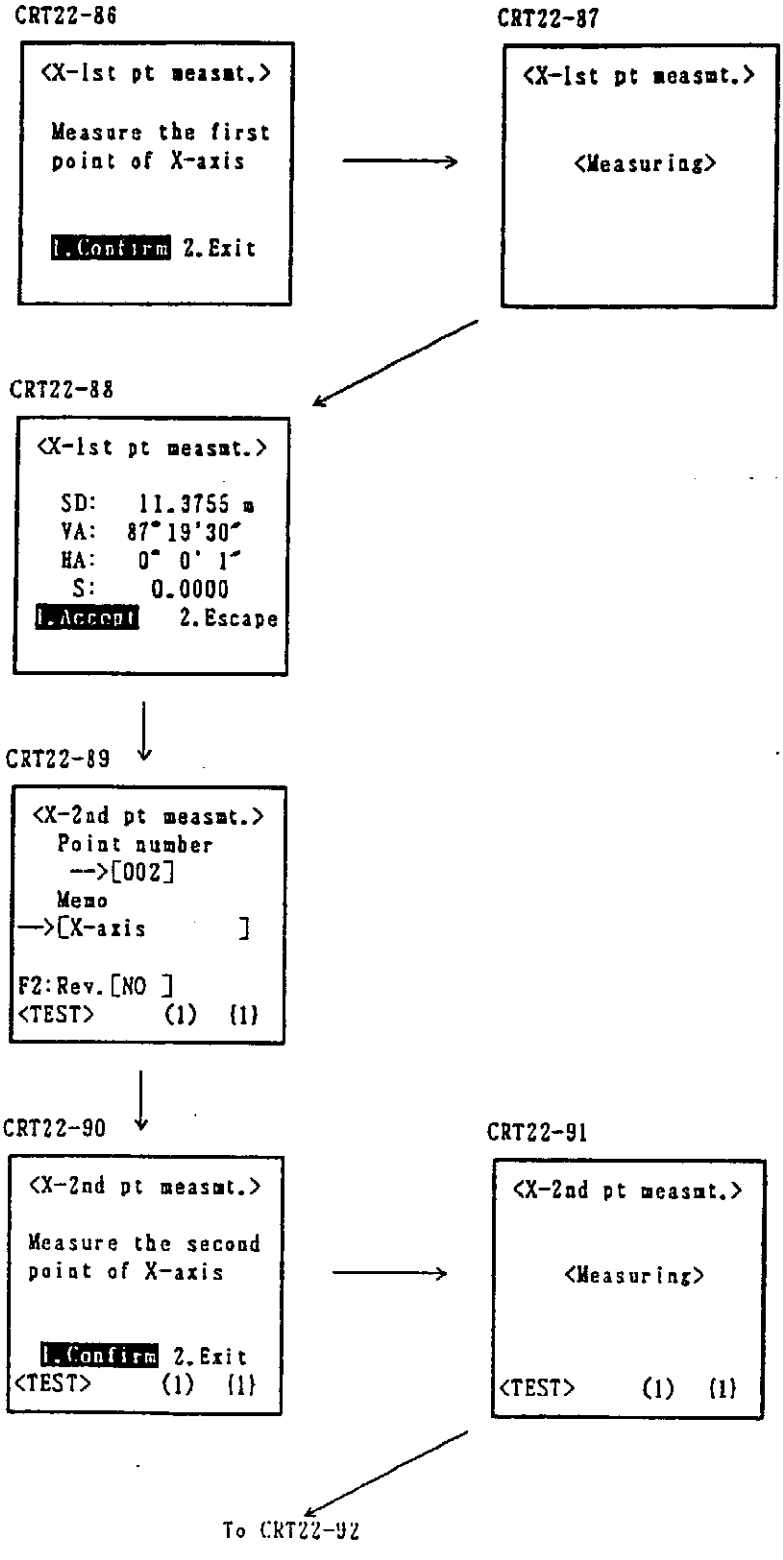
```
<X-1st pt measmt.>
  Point number
   —>[001]
  Memo
—>[Origin     ]

F2:Rev.[NO ]
F4:Measmt method
```

In case of the first measured point in a new file, you can change the method of measurement if you press <F4> key.

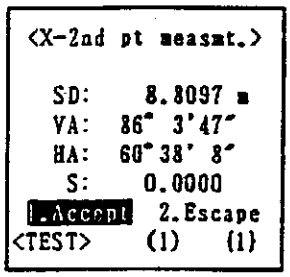
To CRT22-86

Measuring method setting screen
CRT22-85

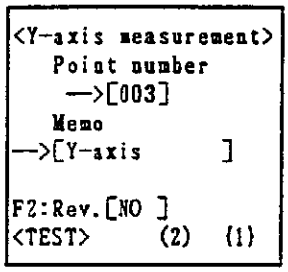
```
<Std.Measmt.method>
Set present No.: [2]

1.Origin=1 X-axis=2
2.X=pts. 1,2 Y=pt. 3
3.X=pts. 1,2 Z=pt. 3
4.To previous menu
```


CRT22-86
<X-1st pt measmt.>
Measure the first point of X-axis
1.Confirm 2.Exit
CRT22-87
<X-1st pt measmt.>
<Measuring>
CRT22-88
<X-1st pt measmt.>
SD: 11.3755 m
VA: 87°19'30"
HA: 0° 0' 1"
S: 0.0000
1.Accept 2.Escape
CRT22-89
<X-2nd pt measmt.>
Point number
-->[002]
Memo
-->[X-axis]
F2:Rev.[NO]
<TEST> (1) {1}
CRT22-90
<X-2nd pt measmt.>
Measure the second point of X-axis
1.Confirm 2.Exit
<TEST> (1) {1}
CRT22-91
<X-2nd pt measmt.>
<Measuring>
<TEST> (1) {1}
To CRT22-92

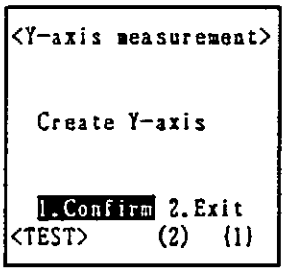
CRT22-92



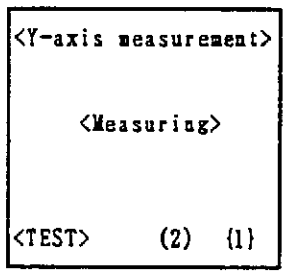
CRT22-93



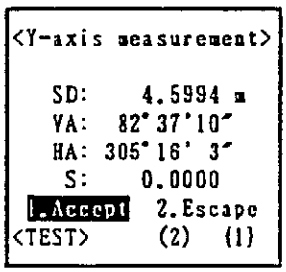
CRT22-94



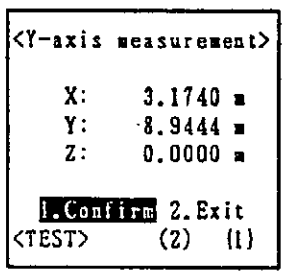
CRT22-95



CRT22-96



CRT22-97



When the measurement of [Y-axis 3] is completed, the coordinate of the 3rd point is only displayed.

The measurement of any points from the 4th point will be the same with "1. Origin 1 X-axis 2 Measurement" from the 3rd point.

3. X-axis 1, 2 Z-axis 3 Measurement

CRT22-98

```
<Standard Measmt.>
Input file name

  —>[TEST    ]

This is a new file
   1.YES   2.NO
[X=pts. 1,2 Z=pt. 3]
```

If [X-axis 1, 2 Z-axis 3) is specified as a new method of measurement at the time of environment setting, the selection of "Standard measurement" from the menu will result in the processing shown in the following screen (After CRT22-99).

The processing method is exactly the same with "2. X-axis 1, 2 Y-axis 3".

CRT22-99

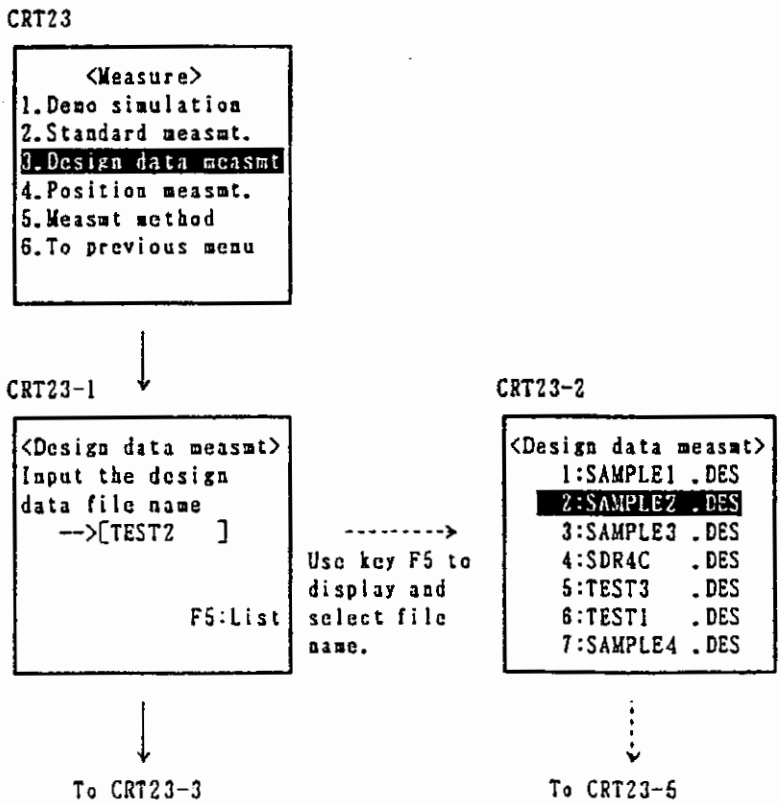
```
<X-1st pt measmt.>
  Point number
   —>[001]
  Memo
—>[Origin     ]

F2:Rev.[NO ]
F4:Measmt method
```

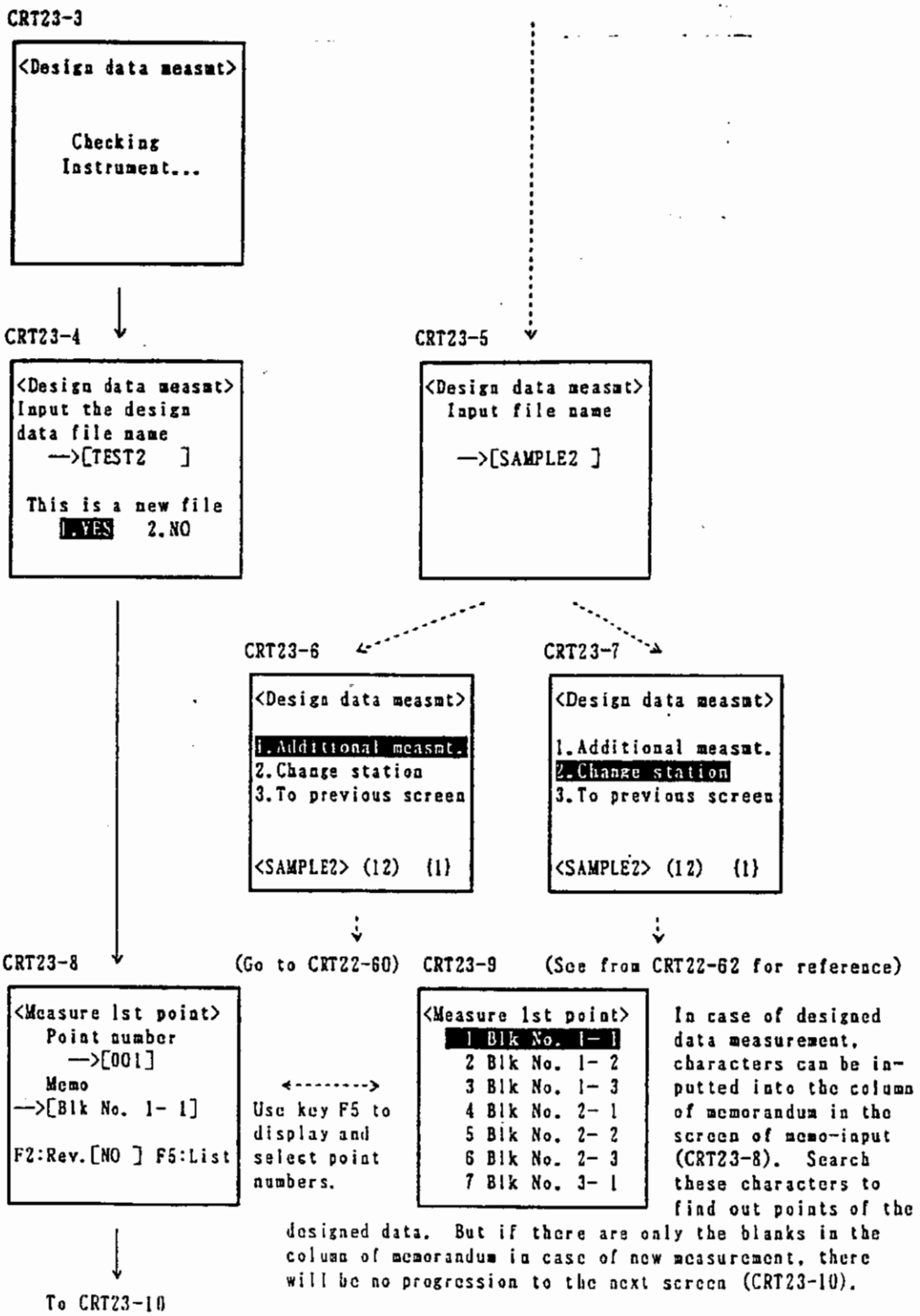
[2-3] Designed Data Measurement

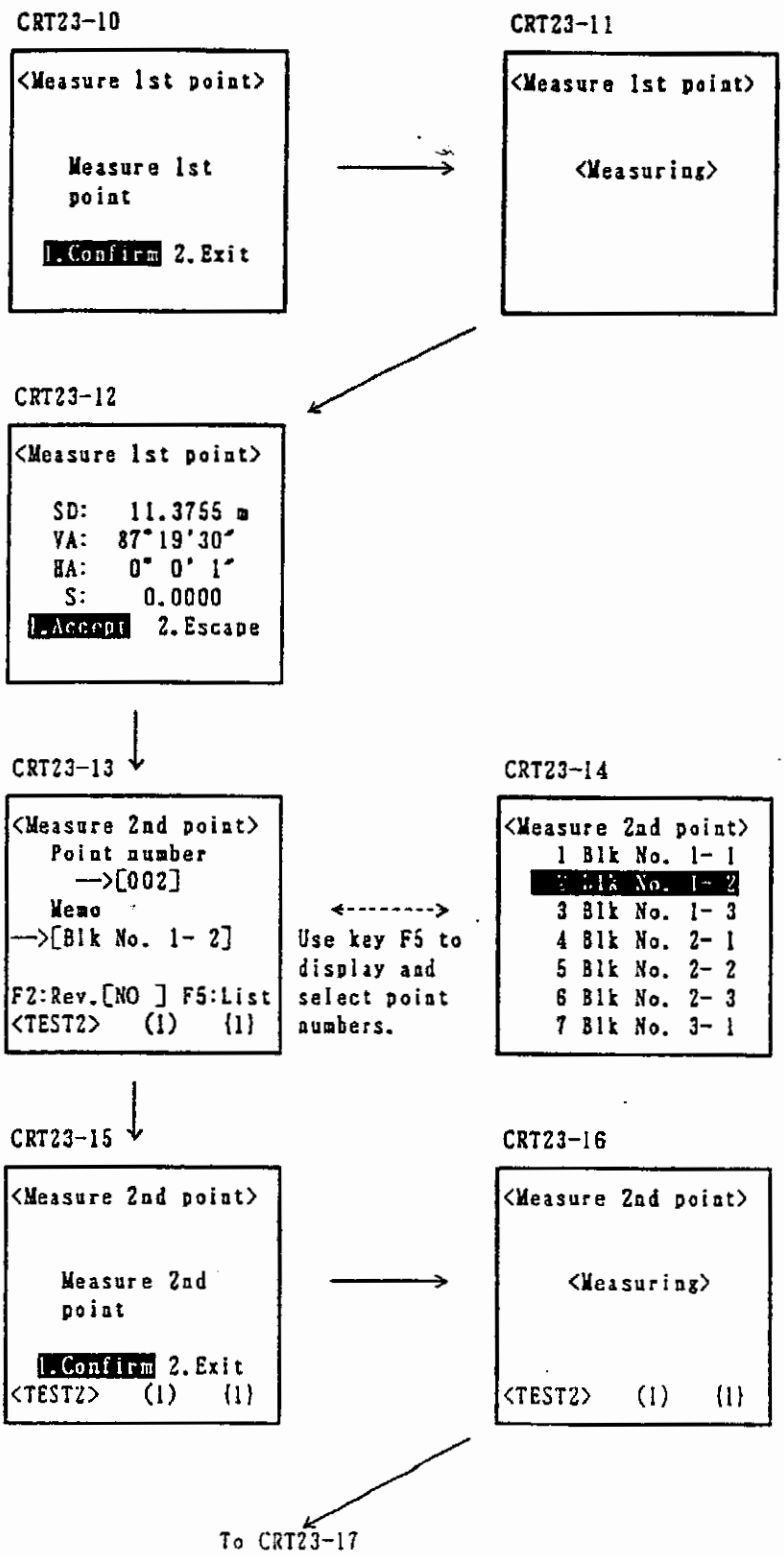
It is necessary to load the designed data before conducting a measurement method based on these designed data. No measurement is possible if there is no designed data.
When conducting the measurement, be sure to specify those points of designed data and measure a point corresponding to a designed point using the measuring instrument.
Hence, it is possible to make comparison between the designed data and the measured data.

1. New Measurement and Link Measurement

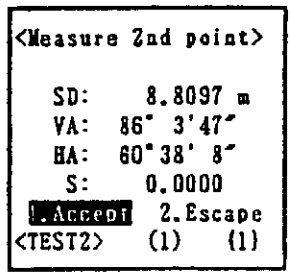
When conducting a new measurement based on designed data, first measure poir corresponding to 3 to 6 arbitrary points of designed data. Hence, any measured point (distance measurement or angle measurement) after the 4th to 7th point will be of coordinates (X, Y, Z) inside this designed coordinate system.
When conducting a link measurement, it is similar with the case of new measurement, i.e. you can use either the 3 to 6 designed points or 3 to 6 arbitrary measured points for link. When the designed data are used for link, data before the link and the measured data after the link will be of entirely different contents. Hence, 3 to 6 arbitrary measured points are used for SDR4E link.



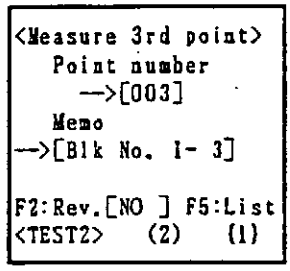

CRT23-3
<Design data measmt>
Checking
Instrument...
CRT23-4
<Design data measmt>
Input the design
data file name
—>[TEST2]
This is a new file
1.YES 2.NO
CRT23-5
<Design data measmt>
Input file name
—>[SAMPLE2]
CRT23-6
<Design data measmt>
1.Additional measmt.
2.Change station
3.To previous screen
<SAMPLE2> (12) {1}
CRT23-7
<Design data measmt>
1.Additional measmt.
2.Change station
3.To previous screen
<SAMPLE2> (12) {1}
(Go to CRT22-60)
(See from CRT22-62 for reference)
CRT23-8
<Measure 1st point>
Point number
—>[001]
Memo
—>[Blk No. 1- 1]
F2:Rev.[NO] F5:List
Use key F5 to display and select point numbers.
CRT23-9
<Measure 1st point>
1 Blk No. 1- 1
2 Blk No. 1- 2
3 Blk No. 1- 3
4 Blk No. 2- 1
5 Blk No. 2- 2
6 Blk No. 2- 3
7 Blk No. 3- 1
In case of designed data measurement, characters can be inputted into the column of memorandum in the screen of memo-input (CRT23-8). Search these characters to find out points of the designed data. But if there are only the blanks in the column of memorandum in case of new measurement, there will be no progression to the next screen (CRT23-10).
To CRT23-10


CRT23-10
<Measure 1st point>
Measure 1st point
1.Confirm 2.Exit
CRT23-11
<Measure 1st point>
<Measuring>
CRT23-12
<Measure 1st point>
SD: 11.3755 m
VA: 87°19'30"
HA: 0° 0' 1"
S: 0.0000
1.Accept 2.Escape
CRT23-13
<Measure 2nd point>
Point number
—>[002]
Memo
—>[Blk No. 1- 2]
F2:Rev.[NO] F5:List
<TEST2> (1) {1}
Use key F5 to display and select point numbers.
CRT23-14
<Measure 2nd point>
1 Blk No. 1- 1
2 Blk No. 1- 2
3 Blk No. 1- 3
4 Blk No. 2- 1
5 Blk No. 2- 2
6 Blk No. 2- 3
7 Blk No. 3- 1
CRT23-15
<Measure 2nd point>
Measure 2nd point
1.Confirm 2.Exit
<TEST2> (1) {1}
CRT23-16
<Measure 2nd point>
<Measuring>
<TEST2> (1) {1}
To CRT23-17

CRT23-17

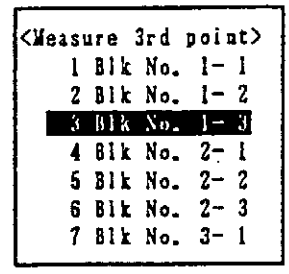


CRT23-18

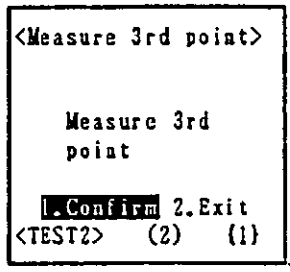


Use key F5 to display and select point numbers.

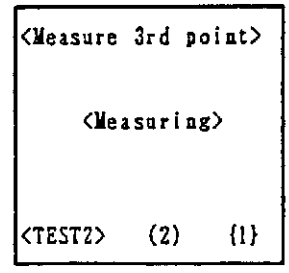
CRT23-19



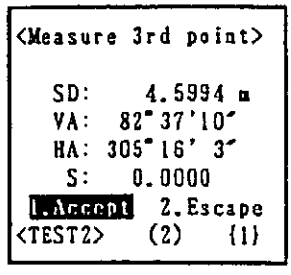
CR23-20



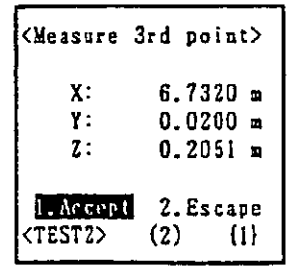
CRT23-21



CRT23-22



CRT23-23



2. Comparison with Designed Data and Measured Data

When measuring each point based on designed data measurement, the difference between the designed data and the measured data is displayed.
By Specifying [Comparison (Yes)] at the time of environment setting, data can be compared with the designed data.
Basically, it is needed to specify before the measurement, the memo of designed data corresponding to the measured point. If the memo-column is blank or inputted '$' (<Shift>+<4>) on the first character, no comparison with the designed data will be done.

CRT23-24

```
  <Single target>
   Point number
     —>[013]
   Memo
—>[Blk No. 5- 3]
F1:Target     F3:Menu
F2:Rev.[NO ] F5:List
<TEST2>   (12)   (1)
```

<---------> Use key F5 to display and select.

CRT23-25

```
<Single target>
 15 Blk No. 5- 2
 16 Blk No. 5- 3
 17 Blk No. 5- 4
 18 Blk No. 6- 1
 19 Blk No. 6- 2
 20 Blk No. 6- 3
 21 Blk No. 6- 4
```

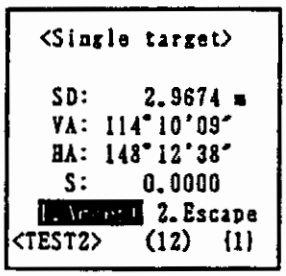
CRT23-26 ↓

```
  <Single target>


    Single target
    Measurement

  1.Confirm 2.Exit
<TEST2>   (12)   (1)
```

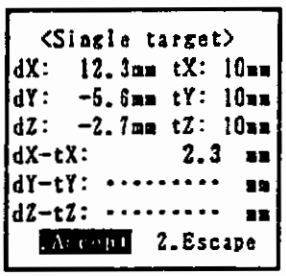
In SDR4E, it is possible to compare the measured data with the data and to see whether the measured data is within the allowable range specified at the time of environment setting by selecting <F5> key in the screen (CRT23-24). If the result of comparison is within the allowable range, the result of measurement will be accepted unconditionally. On the other hand, if the result of comparison is beyond the allowable range, a warning sound will be given, and the following information will be displayed.

① The error between the designed data and measured data.
② The allowable range specified at the time of environment setting
③ The value obtain from "1." is reduced by the value obtained from "2."

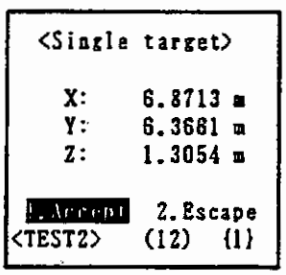
CRT23-27



CRT23-28



CRT23-29



The above screen (CRT23-28) is displayed only in such cases when the measurement error between the measured data and the designed data excess the allowable range specified at the time of environment setting or when the allowable range is set to be zero (0). Hence, there is no display if the error is within the allowable range.

What Is displayed is shown as follows:

- dX, dY, dZ : Subtraction of designed data from the measured data (error)
- tX, tY, tZ : Allowable range specified at the time of environment setting (it is of ±)
- dX-tX, dY-tY, dZ-tZ : Subtraction of the allowable range from the error. (If the error is within the range, [••••••••••] will be shown.

[2-4] Position Measurement

CRT24

```
   <Measurement>
1.Demo simulation
2.Standard measmt.
3.Design data measmt
4.Position measmt.
5.Measmt method
6.To previous menu
```

The designed data must be loaded before conducting position measurement.
If the designed file name is inputted into the column of memo in the screen (CRT24-1), the coordinate value of each point specified the position by the setting-out function will be measured and stored. If the column of memo is blank, the point will be measured directly. However, the Z-axis always sets vertical.
It must be specified at the time of environment setting whether 2 or 3 points are used for the new measurement.
Link measurement based on position measurement applies to "1. Origin 1 X-axis 2 Measurement" in standard measurement.

CRT24-1

```
<Position measmt.>
Input the design
data file name
  -->[TEST2    ]

                F5:List
```

<--------> Use key F5 to display and select file names.

CRT24-2

```
<Position measmt.>
  1:SAMPLE1 .DT1
  2:SAMPLE2 .DT1
  3:SAMPLE3 .DT1
  4:SDR4C   .DT1
  5:TEST3   .DT1
  6:TEST1   .DT1
  7:SAMPLE4 .DT1
```

CRT24-3

```
<Position measmt.>
Input the design
data file name
  -->[TEST2    ]

This is a new file
  1.YES   2.NO
```

CRT24-4

```
<Position measmt.>
 Input file name

  -->[SAMPLE2 ]
```

CRT24-5

```
<Position measmt.>

1.Additional measmt.
2.Change station
3.To previous screen


<SAMPLE2> (12)  (1)
```

CRT24-6

```
<Position measmt.>

1.Additional measmt.
2.Change station
3.To previous screen


<SAMPLE2> (12)  (1)
```

CRT24-5 ----->To CRT24-16

CRT24-6 ----->To CRT22-62

CRT24-7

```
<Measure 1st point>
   Point number
     -->[001]
   Memo
-->[Blk No. 1- 1]

F2:Rev.[NO ] F5:List
```

<---------> Use key F5 to display and select point numbers.

CRT24-8

```
<Measure 1st point>
  1 Blk No. 1- 1
  2 Blk No. 1- 2
  3 Blk No. 1- 3
  4 Blk No. 2- 1
  5 Blk No. 2- 2
  6 Blk No. 2- 3
  7 Blk No. 3- 1
```

CRT24-9

```
<Measure 1st point>


     Measure 1st
     point

  1.Confirm 2.Exit
```

In case of position measurement, characters can be inputted into the column of memorandum in the screen of memo-input (CRT24-7). Search these characters to find out the points. However, when the new measurement is conducting, if there are only the blanks in the column of memorandum, there will be no progression to the next screen (CRT24-9).

CRT24-10

```
<Measure 1st point>

   SD:    11.3755 m
   VA:   87°19'30"
   HA:    0° 0' 1"
    S:     0.0000
 1.Accept  2.Escape
```

CRT24-11

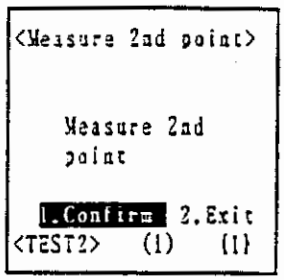
```
<Measure 2nd point>
   Point number
     -->[002]
   Memo
-->[Blk No. 1- 2]

F2:Rev.[NO ] F5:List
<TEST2>   (1)   (1)
```

<---------> Use key F5 to display and select point numbers.

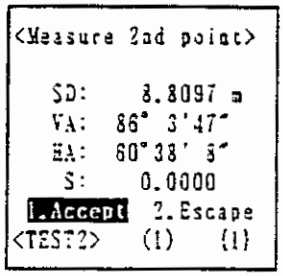
CRT24-12

```
<Measure 2nd point>
  1 Blk No. 1- 1
  2 Blk No. 1- 2
  3 Blk No. 1- 3
  4 Blk No. 2- 1
  5 Blk No. 2- 2
  6 Blk No. 2- 3
  7 Blk No. 3- 1
```

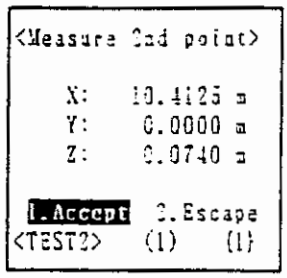
CRT24-13



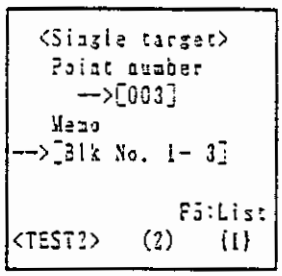
CRT24-14



CRT24-15



CRT24-16



CRT24-17

Use key F5 to display and select point numbers.

To CRT24-18 or CRT24-19

Notice: In case of target point measurement with single target based on position measurement, the following functions can not be used.

1. Target point measurement with paired target
2. Reverse measurement
3. Measurement based on offsets
4. Setting-out function (The column of memo is not inputted.)

The point name is inputted in the column of memorandum

CRT24-18 ↓

```
 <Single target>
Is this coordinate
value O.K. ?
   X=   3.5523 m
   Y=  -0.4690 m
   Z=  -0.1355 m
   1.YES   2.NO
<TEST>    (2)    (1)
```

↓

CRT24-20 ↓

```
 <Single target>
Please '0'Setting
of dHA.


  1.Confirm 2.Exit
<TEST>    (2)    (1)
```

↓

CRT24-22 ↓

```
 <Single target>
Adjust device's ver-
tical angle based on
 ZA: 88°11'43"
then, please select
 Confirm .
  1.Confirm 2.Exit
<TEST>    (2)    (1)
```

↓

CRT24-24 ↓

```
 <Single target>


  Measure target


  1.Confirm 2.Exit
<TEST2>   (2)    (1)
```

↓

To CRT24-26

The column of memorandum is blank, or the first character of memorandum is inputted with 'S'

CRT24-19 ↓

```
 <Single target>


  Single target
  measurement

  1.Confirm 2.Exit
<TEST2>   (2)    (1)
```

↓

CRT24-21 ↓

```
 <Single target>


  <Measuring>


<TEST2>   (2)    (1)
```

↓

CRT24-23 ↓

```
 <Single target>

  SD:   11.5752 m
  VA:  88°11'42"
  HA: 236°23'59"
   S:    0.0000
  1.Accept  2.Escape
<TEST>    (2)    (1)
```

↓

CRT24-25 ↓

```
 <Single target>

  X:   3.5522 m
  Y:  -0.4690 m
  Z:  -0.1351 m

  1.Accept  2.Escape
<TEST>    (2)    (1)
```

[1.Accept] : Next measurement screen.
[2.Escape] : To CRT24-19

CRT24-26

```
 <Single target>

  SD:   11.5755 m
  VA:  88°11'41"
  HA: 238°23'58"
   S:    0.0000
 1.Accept  2.Escape
<TEST>   (2)      (1)
```

CRT24-27

```
 <Single target>
  X:   3.5522 m
  Y:  -0.4892 m
  Z:  -0.1954 m
 dX:  -0.0001 m
 dY:  -0.0002 m
 dZ:  -0.0001 m
 1.Accept  2.Escape
```

"dX", "dY" and "dZ" indicate the error between the designed data and the measured data.

[1.Accept] : Next measurement screen.
[2.Escape] : To CRT24-19

[2-5] Confirmation of the Method of Measurements

In the measurement menu, you can confirm the present method of measurement.

CRT25-1

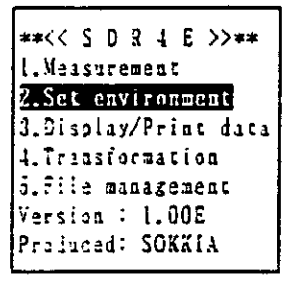
```
<Measmt. method>
Input file name
please
   —>[TEST    ]


          F5:List
```

CRT25-2

```
  <Measmt. method>
The measmt.method of
  <TEST>
is
 [Position measmt.]

    Press[ Enter ]
```

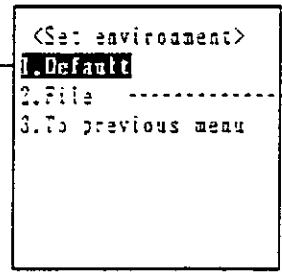
[3] Set Environment

CRT3-1

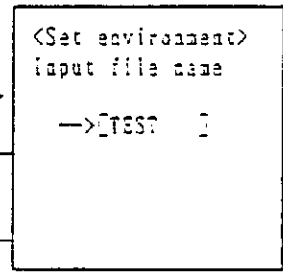


The screen (CRT3-1) shown left indicates the menu to set up conditions for measurement and analysis of the measured results before starting measurement. If <2> "Set environment" is selected, the menu screen with <1> "Default" and <2> "File" appears shown as the figure below.
If <1> "Default" is selected, you can set up conditions of a new file to be created.
On the other hand, if <2> "File" is selected, the names of files which have been created already are listed up. You can confirm or change the conditions of any file which you pick up from the file list. When either of the two is selected, the basic menu of set environments is displayed.

CRT3-2



CRT3-3



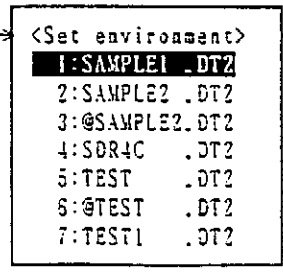
2.File

1.Default

To CRT31

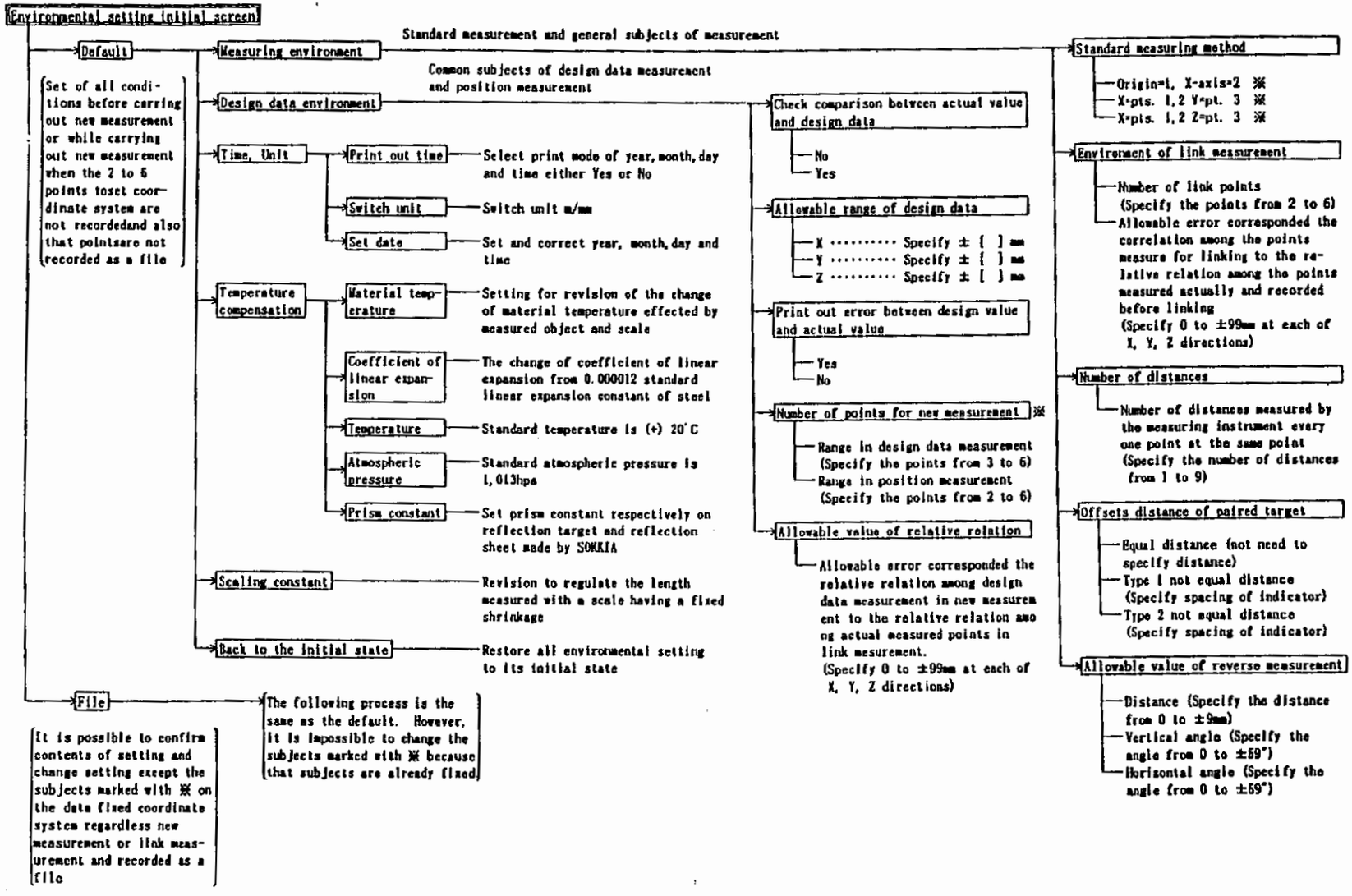
When <2> "File" is selected, the name of the last processed file is displayed as the default. If it is not the file you want, input the correct file name or press <F5> key to display the file list so that you can select the file from the list pointing by the cursor and pressing <Enter> key.
When the displayed file list is to be canceled, press <Clear> key.

CRT3-4



[3-1] Type and Content of Environmental Setting

Type and content of all conditions used in measurement and analysis of result are as follows



[3-2] Environment of Measurement

CRT31

```
<Set environment>
1.Measmt environment
2.Design data env.
3.Time / units
4.Material temp.
5.Scaling constant
6.Back initial state
7.To previous menu
```

1. Method for Standard Measurement

CRT31-1

```
<Measmt environment>
1.Std.Measmt. method
2.Link measmt. Env.
3.= of distances
4.Offset target
5.R.M. Allow. Range
6.To previous menu
```

→

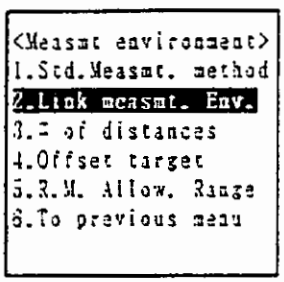
CRT31-2

```
<Std.Measmt. method>
Set present No.: [1]

1.Origin=1 X-axis=2
2.X=pts. 1,2 Y=pt. 3
3.X=pts. 1,2 Z=pt. 3
4.To previous menu
```

"1. Standard measurement method" in this menu of the screen (CRT31-1), the method of standard measurement can be inputted of modified.

2. Environment for Link Measurement

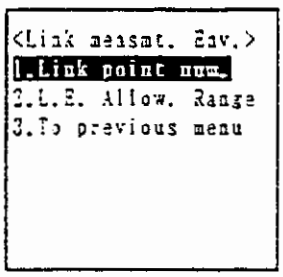
CRT31-3



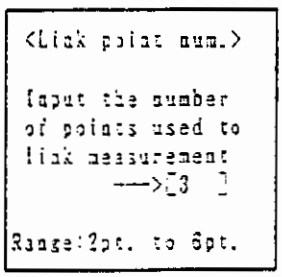
"2. Link measurement environment" in this menu, it is possible to set up number of link points and allowable value of relative relation of link points when link measurement is conducting.

(1) Number of Link Points

CRT31-4



CRT31-5

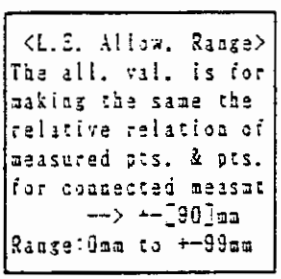


"1. Link point number" in this menu, the number of points (2 to 6) used for link measurement can be inputted or modified.

(2) Allowable Value of Relative Relation

CRT31-6

CRT31-7

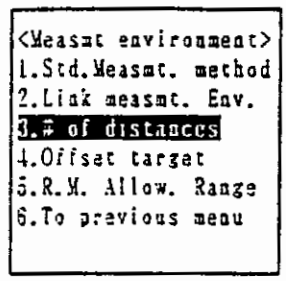


"2. Relative Allowable value" in this menu, the error between the relative relation value of points measured for link measurement and the relative relation value of points measured before linking can be inputted and modified.

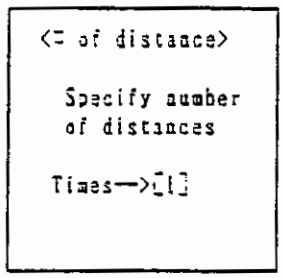
The relative allowable value is used for an aim of warning when the point not specified for linking is measured. And the accuracy of measurement will not be effected. Therefore, specify the relative allowable value as large as possible.

3. Number (#) of Distances

CRT31-8



CRT31-9



"# of distances" in this menu means how many times the measuring instrument shall automatically measure the distance to one and the same point.

When the measuring instrument starts the measuring operation, it measures the same point continuously for a few seconds. SDR4E is normally set so that the measuring operation is ended after the measuring instrument finishes one measurement. However, if you select <3> "# of distances" in the menu on the left, and input a number between 1 to 9 as the number of distances the measurements will be carried out, then this data is read by the SDR4E, which saves the average value of the data automatically.

In normal measurements of an object, a one-time measurement is considered to be adequate but if the accuracy of measurements is to be further enhanced, the same point can be measured several times.

The number of distances in a measurement is displayed in the extreme right bottom corner of the menu, therefore confirm this during measurement.

4. Offset Distance of Paired Target

CRT31-10

```
<Measmt environment>
1.Std.Measmt. method
2.Link measmt. Env.
3.# of distances
4.Offset target
5.R.M. Allow. Range
6.To previous menu
                    j
```

CRT31-11

```
  <Offset target>

   Input distance
   between B-C

Type1-->[0.25     ]m
Type2-->[0.05     ]m
```

CRT31-12

```
<Dist. btw. target>

   1:Equal distance
   2:    0.2500 m
   3:    0.0500 m

Number-->[1]
<TEST>    (3)   (1)
```

When a direct view of target points is impossible, the paired target measurement is applied. When the spacing between A and B is not equal to that between B and C, please input the offset distance between B and C.

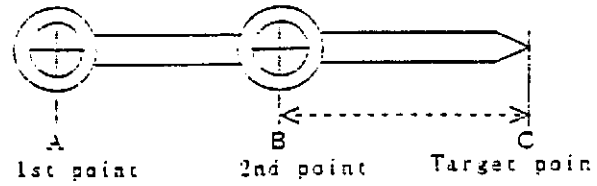


Fig. 7.3

The screen on the left is an example of the display when 2 types of B-C spacing, 0.25M and 0.05M, are inputted.
In the case that the spacings have been inputted in the set environment menu of new file (default) or the additional measurement menu of the measured point, the screen shown below is displayed with a touch of <F1> key during measurement (paired target).
However, in the case of equal spacing only, this screen is not displayed.
The input values are rounded to four decimals in meter unit, one decimal in millimeter unit, four decimals in feet unit and three decimals in inch unit and cut away those of less.

5. Allowable Range of Reverse Measurement

CRT31-13

```
<Measmt environment>
1.Std.Measmt. method
2.Link measmt. Env.
3.# of distances
4.Offset target
5.R.M. Allow. Range
6.To previous menu
```

CRT31-14

```
<R.M. Allow. Range>

Dis(SD)   -->[3  ]mm
Range: 0mm to 9.9mm

Ang.(VA,HA)-->[10]"
Range: 0" to 59"
```

"5. Reverse Measurement Allowable Range" in this menu, the allowable range of the error among the value measured reversely can be inputted or modified when the reverse measurement is carried out.

[3-3] Design Data Environment

CRT32

```
<Set environment>
1.Measmt environment
2.Design data env.
3.Time / units
4.Material temp.
5.Scaling constant
6.Back initial state
7.To previous menu
```

When design data measurement and position measurement are carried out, set up design data environment for providing allowable value of relative relation of each point used for link measurement before starting measurement.

1. Comparison with Design Data (Yes/No)

CRT32-1

```
<Design data env.>
1.Data Com. (Y/N)
2.D.D. Allow. Range
3.Print error
4.New measmt.pt.num.
5.R.R. Allow. Range
6.To previous menu
```

CRT32-2

```
<Data Com. (Y/N)>
Set present No.: [1]

1.Data Com. (N)
2.Data Com. (Y)
5.To previous menu
```

"1. Data comparison (Y/N)" in this menu, you can select whether to make comparison between the designed data and the measured data.

2. Allowable Range of Design Data

CRT32-3

```
<Design data env.>
1.Data Com. (Y/N)
2.D.D. Allow. Range
3.Print error
4.New measmt.pt.num.
5.R.R. Allow. Range
6.To previous menu
```

CRT32-4

```
<D.D. Allow. Range>
  X --> -[  5]mm
        +[  5]mm
  Y --> -[  5]mm
        +[  5]mm
  Z --> -[  5]mm
        +[  5]mm
Range:0 to +-999mm
```

"2. Designed data allowable range" in this menu, the allowable range of comparison between the designed data and the measured data can be inputted and modified.
The allowable range of designed data must be inputted both plus (+) and minus (-).

3. Print out of Errors

CRT32-5

```
<Design data env.>
1.Data Com. (Y/N)
2.D.D. Allow. Range
3.Print error
4.New measmt.pt.num.
5.R.R. Allow. Range
6.To previous menu
```

CRT32-6

```
<Print error>
Set present No.: [1]

1.Print (Y)
2.Print (N)
3.To previous menu
```

"3. Print error" in this menu, you can select whether or not to print out the error when compared with the designed data at the time of coordinate printing.

4. Number of Points for New Measurement

CRT32-7

```
<Design data env.>
1.Data Com. (Y/N)
2.D.D. Allow. Range
3.Print error
4.New measmt.pt.num.
5.R.R. Allow. Range
6.To previous menu
```

CRT32-8

```
<New measmt.pt.num>
Design data measmt.
      —>[3]
Range:3pt. to 6pt.

Position measmt.
      —>[2]
Range:2pt. to 6pt.
```

"4. New measurement point number" in this menu, you can specify the number of points used for new designed data measurement from 3 to 6 points and for new position measurement from 2 to 6 points.

5. Allowable Value of Relative Relation

CRT32-9

```
<Design data env.>
1.Data Com. (Y/N)
2.D.D. Allow. Range
3.Print error
4.New measmt.pt.num.
5.R.R. Allow. Range
6.To previous menu
```

CRT32-10

```
<Relative all. val.>
The all. val. is for
making the same the
relative relation of
measured pts. & pts.
for connected measmt
     —> +—[5 ]mm
Range:0mm to +—99mm
```

"5. Relative allowable value" in this menu, the error among the designed data use for new measurement can be inputted or modified when designed data measurement or position measurement is conducting.

[3-4] Print of the Time and Switching the Units

CRT33

```
<Set environment>
1.Measmt environment
2.Design data env.
3.Time / units
4.Material temp.
5.Scaling constant
6.Back initial state
7.To previous menu
```

All measurements are executed, the time clocks when the measurement is started and finished are recorded in the measurement data file. On the left menu, you can select whether to display or not to display the time clocks of starting and finishing of the measurement, on the occasion of printing the coordinate data at [5] "Data transformation" and on the occasion transferring the coordinate data at the operation of "Data transfer".
You can select the unit either meter or millimeter in this menu.
Even if the mode "Print (N)" is selected during the measurement, it is possible to print the time clocks after correcting the mode to "Print (Y)".
Setting the date/time can be performed in the menu "5. Set date" on the next page.

1. Print of Time

CRT33-1

```
<Time / units>
1.Print time
2.Dist. unit select
3.Set date
4.Angle unit select
5.Temp,Atm. unit sel
6.To previous menu
```

→

CRT33-2

```
<Print time>
Set present time
Print-->[ON ]
1.Print (Y)
2.Print (N)
3.To previous menu
```

2. Selection of Distance Unit

CRT33-3

```
<Time / units>
1.Print time
2.Dist. unit select
3.Set date
4.Angle unit select
5.Temp,Atm. unit sel
6.To previous menu
```

→

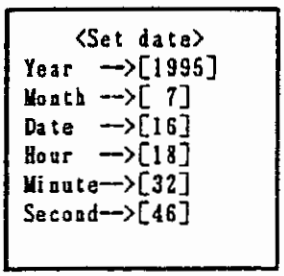
CRT33-4

```
<Dist. unit select>
Set present unit
Unit-->[m ]
1.Meter
2.Millimeter
3.To previous menu
```

On this manual, explanations and examples are described in the metric unit, however length can be displayed or printed in any unit selected among m (meter), mm (millimeter), feet and inch.
And in the operation of "Data transfer", the data is output in the same unit that is selected above.
The selected unit is displayed in [ ] on the screen as shown on the left. After that, the all values are displayed and printed in this unit.

3. Set Date

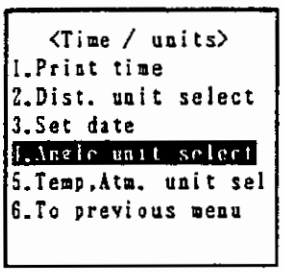
CRT33-5



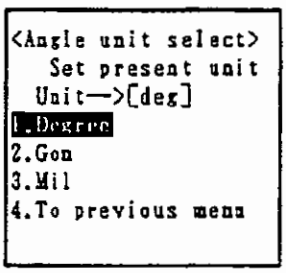
The date set here will appear when the measured data is printed out.
When the date is not correct or when you wish to reset the date, use this menu.
For resetting the date, hit <Enter> key, correct the item on which the cursor is located, press <Enter> key and repeat this procedure until all the items have been corrected, and return to the previous menu.
In the midst of correction, if you press the <Clear> key, and return to the previous menu, the corrected values will not be saved.

4. Selection of Angle Unit

CRT33-6



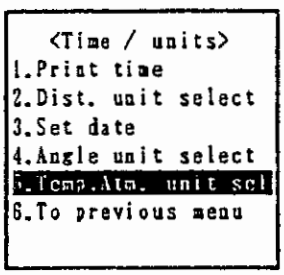
CRT33-7



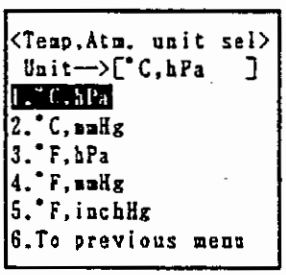
The angles can be displayed and printed in any unit selected among Degree, Goon and Mil.

5. Selection of Temp. & Atm. Unit

CRT33-8



CRT33-9



Temperature and atmospheric value can be displayed and printed in any unit selected among °C.hPa, °C.mmHg, °F.hPa, °F.mmHg or °F.inchHg.
If the unit is corrected here, the unit system of the measuring instrument is corrected concurrently.

[3-5] Correction of Temperature

1. Material Temperature

CRT34-1

```
<Material temp.>
1.Material temp.
2.Expansion const.
3.temp.
4.atmos. press.
5.Prism const
6.To previous menu
```

↓

```
<Material temp.>

 Input material
 temperature

Temp—>[20.000]°C
```

In SDR4E, it is required that the set value of material temperature is 20°C and that the linear expansion constant is 0.000012.
This is applied to regulate the calculated result from coordinate data and the measurement result using the standard scale such as steel tape that has the same linear expansion constant.
In the case of the correction with temperature, it is required to set the material temperature at the measuring temperature. If the material linear expansion constant is different from the standard constant , it is required to set the constant in actual.
If the correction with temperature is not desirable, it is required that the set value of material temperature is 20°C or that of the material linear expansion constant is zero.

$$\text{<correction coefficient>} = \frac{1}{\text{<linear expansion const.>} \times (\text{<material temp.>} - 20.0) + 1}$$

2. Expansion Constant

CRT34-3

```
<Expansion const.>

 Input expansion
 constant

Expansion const.
     —>[0.000012]
```

3. Temperature of the Measuring Instrument

CRT34-4

```
  <Material temp.>
1.Material temp.
2.Expansion const.
3.temp.
4.atmos. press.
5.Prism const
6.To previous menu
```

The measuring instrument is designed so that its correction coefficient to be 0 ppm under the condition of atm. pressure is 1013 mb and temperature is +15°C. To correct the atmospheric conditions, all you have to do is to input temperature and pressure, with which the measuring instrument calculate the correction coefficient of atmospheric conditions. As for detail, please refer to the measuring instrument operation manual.
However, the above-mentioned operation for correction is not necessary in case of measurement of ordinary structures. So, please do not input numbers here if corrections are not necessary.

CRT34-5

```
   <temperature>

  Input instrument
  temperature

Temp.—>[15 ]°C

 Range:-30 to 60 °C
```

4. Atmospheric Pressure of the Measuring Instrument

CRT34-6

```
  <Material temp.>
1.Material temp.
2.Expansion const.
3.temp.
4.atmos. press.
5.Prism const
6.To previous menu
```

CRT34-7

```
  <Atmos. press.>

Input instrument
atmospheric pressure

 Pres—>[1013]hPa

Range:500to1400 hPa
```

5. Prism Constant of the Measuring Instrument

CRT34-8

```
  <Material temp.>
1.Material temp.
2.Expansion const.
3.temp.
4.atmos. press.
5.Prism const
6.To previous menu
```

Each target has an individual prism constant. These prism constants can be corrected on the menu of the material temperature inputting values to be revised. The prism constant correction values of the reflection target and reflection sheet made by SOKKIA are as follows.

CRT34-9

```
    <Prism const>

Input prism constant
of instrument

  Const.—>[0.000]

Range:-99.9 to 99.9
```

RS-series	RT50M (RT90M, RT1A, 2RT310A)	CPS12
		
0mm→Input "0"	0mm→Input "0"	27mm→Input "-27"

Fig. 7.4

[3-6] Scaling Constant

CRT35

```
<Set environment>
1.Measmt environment
2.Design data env.
3.Time / units
4.Material temp.
5.Scaling constant
6.Back initial state
7.To previous menu
```

Scaling constants are the parameters to be used for correcting the distance between targets.
They are recorded in one place of whole number with three places of decimals.
The functions of scaling constants is to regulate between the length measured with a scale having a fixed shrinkage and that which is calculated by SDR4E.

<Distance between targets> =
<calculated length based on the coordinate data> ×
<scaling constant>

To set scaling constant, there are two ways as follows.

1. Manual Input

CRT35-1

```
<Scaling constant>
1.Input
2.Measurement
3.To previous menu
```

Scaling constant is set with manual input here.
If correction is not necessary, please input "1".

↓

CRT35-2

```
<Magnification>

Specify magnifica-
tion constant

Const.-->[1.000000]
```

2. Input Measurement

CRT35-3

```
 <Scaling constant>
1.Input
2.Measurement
3.To previous menu
```

After the values of graduation found from the sheet target which laid on the scale are input to the SDR4E, the measuring instrument performs practical measurement.
Then the SDR4E finds a scaling constant calculating the result of measurement. And it is necessary to input material temperature and linear expansion rate of the scale because the temperature correction of the scale itself is needed.

<Scaling constant> =

$$\frac{\text{<2nd value of graduation>} - \text{<1st value of graduation>}}{\text{<2nd value of measurement>} - \text{<1st value of measurement>}}$$

CRT35-4

```
  <Magnification>
Input 1st. value of
graduation
   value—>[1.0 ]m

 Measure the point
  1.Confirm 2.Exit
```

CRT35-5

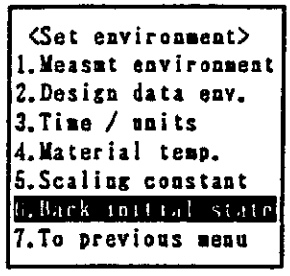
```
  <Magnification>
Input 2nd. value of
graduation
   value—>[2.0 ]m

 Measure the point
  1.Confirm 2.Exit
```

CRT35-6

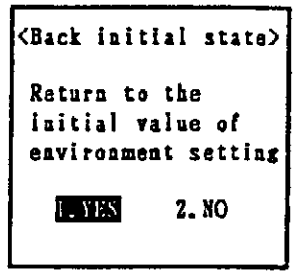
```
  <Magnification>

 Input  —>    1.0
 Measure—>    1.0
 Magnif.—>    1.0

   Press[ Enter ]
```

[3-7] Back to the Initial State

CRT36



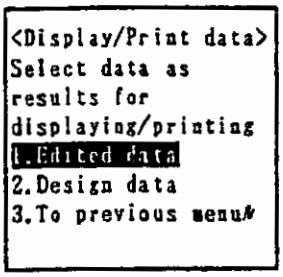
CRT36-1



"6. Back initial state" in this menu, all environment setting can be restored to its initial setting.

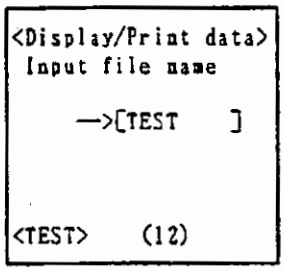
[4] Data, Display/Print

CRT4-1



The results of measured data saved in SDR4E can be displayed on the screen in various forms or can be printed out when required.
First, if you select <3> in the opening menu, then the display indicated left, appears and select the data you want to display or print.

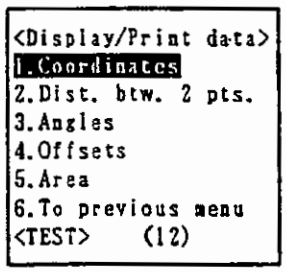
CRT4-2



When you select the data, display/print, then the display of <Input file name>, indicated left appears. If you select this menu, the last processed file name is displayed. When you want to work with other file, input correct file name or press <F5> key to select from the file list.

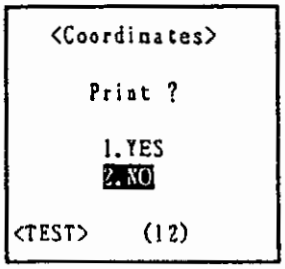
[4-1] Coordinate Data, Display/Print

CRT41



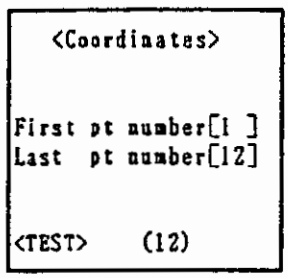
After input of the file name, if you press <Enter> key, then the menu (CRT41) as indicated in the figure on the left, is displayed. Select the item you require from this menu.
The method of selection is exactly the same as in "Measurement".
The last line in the menu displays the file name and total number of measured points, respectively.

CRT41-1



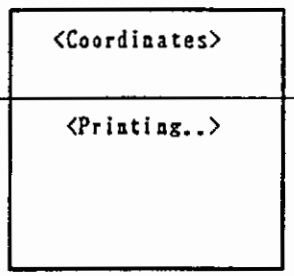
If you select Coordinate data in menu <1>, you are asked whether you wish to print or not. If you select <1>, then printing starts after input of start and end point Nos. without displaying the coordinate data.

CRT41-3

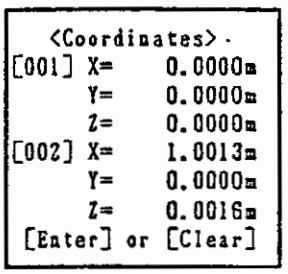


After you have decided whether to print or not, the start point number and end point number of the file indicated at the extreme left of the last line of the display, are displayed. Input the point numbers within this range.
If the memos have been input and saved, they can be displayed along with the point numbers in the list displayed by pressing <F5> key. And it is possible to determine the point number by selecting the memo column.
To cancel displaying the list, press <Clear> key.

CRT41-2

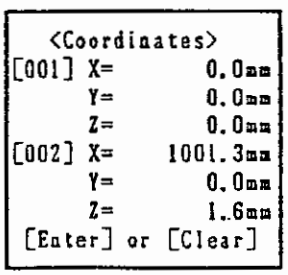


CRT41-4



After you enter the point number with selection <2>, the coordinates of the first two points are displayed.
Further, as you press <Enter> key successively, the coordinate values of a set of two points are progressively displayed. When all the coordinate data have been displayed and if you press <Enter> key, you return to the screen (CRT41).
If you press <Clear> key in the midst of these operations, you can return to the screen (CRT41) immediately.

CRT41-5



The figure shown left is an example of display when millimeter is selected on "2. Selection of distance unit".

Print out sample of the coordinates error between measured data and designed data

When printing out coordinates, the error between measured data and designed data is printed out only when the designed data used in the measurement its result. Concerning the choice of whether to print out the error or not, you can make this decision at the time of environment setting.

Print error: [ON]

```
<TEST>
   PT=4
   [Origin=1 X-axis=2]
   REP          1
   2TRG.(1)     0.0000 m
   2TRG.(2)     0.0000 m
   TEMP.       20.000 °C
   EP.          0.000012
   SCL.         1.000000
START:04/03/1995 09:39:49

[001] MEMO:BLK1-001
       X=     0.0003 m
       Y=     0.0012 m
       Z=     0.0001 m
      dX=     0.0003 m
      dY=     0.0012 m
      dZ=     0.0001 m
[002] MEMO:BLK1-002
       X=    10.4125 m
       Y=     0.0000 m
       Z=     0.0740 m
      dX=     0.0013 m
      dY=     0.0010 m
      dZ=     0.0008 m
[003] MEMO:BLK1-003
       X=     3.1737 m
       Y=    -8.9443 m
       Z=     0.0599 m
      dX=     0.0006 m
      dY=     0.0011 m
      dZ=     0.0007 m
[004] MEMO:BLK1-004
       X=     2.6029 m
       Y=     0.1364 m
       Z=    -0.1340 m
      dX=     0.0005 m
      dY=     0.0002 m
      dZ=     0.0000 m

END:   04/03/1995 09:47:16
```

Print error: [OFF]

```
<TEST>
   PT=4
   [Origin=1 X-axis=2]
   REP          1
   2TRG.(1)     0.0000 m
   2TRG.(2)     0.0000 m
   TEMP.       20.000 °C
   EP.          0.000012
   SCL.         1.000000
START:04/03/1995 09:39:49

[001] MEMO:BLK1-001
       X=     0.0003 mm
       Y=     0.0012 mm
       Z=     0.0001 mm
[002] MEMO:BLK1-002
       X=    10.4125 mm
       Y=     0.0000 mm
       Z=     0.0740 mm
[003] MEMO:BLK1-003
       X=     3.1737 mm
       Y=    -8.9443 mm
       Z=     0.0599 mm
[004] MEMO:BLK1-004
       X=     2.6029 mm
       Y=     0.1364 mm
       Z=    -0.1340 mm

END:   04/03/1995 09:47:16
```

[4-2] Distance between Two Points, Display/Print

CRT42

```
<Display/Print data>
1.Coordinates
2.Dist. btw. 2 pts.
3.Angles
4.Offsets
5.Area
6.To previous menu
<TEST>    (12)
```

The straight line distance between any two measured points can be immediately calculated, displayed and printed. The operations here are the same as those of [4-1] "Coordinates", however, the distance between two points can be displayed while being printed if the printer is on-line when <1> YES in the Print menu is selected.

CRT42-1

```
<Dist. btw. 2 pts.>

     Print ?

      1.YES
      2.NO

<TEST>    (12)
```

CRT42-2

```
<Dist. btw. 2 pts.>
  Input two point
  numbers

   [1  ]    [  2]

     =    1.0013 m
<TEST>    (12)
```

When inputting the number of two points, the contents of memo of each point can be selected by pressing <F5> key (display the list and select by cursor pointing), and you can decide the point number.

Print out sample of
the distance between 2 points

```
[D i s t.   2 p t s.]

    TEMP.      20.000 °C
    EP.         0.000012
    SCL.        1.000000
(  1,  3)=    5.1036 m
(  2,  1)=    2.7757 m
(  3,  4)=    7.6139 m
(  1,  4)=    6.8676 m
```

[4-3] Angles, Display/Print

CRT43

```
<Display/Print data>
1.Coordinates
2.Dist. btw. 2 pts.
3.Angles
4.Offsets
5.Area
6.To previous menu
<TEST>    (12)
```

The angles formed by intersections of any straight lines which are made by connecting any two measured points respectively can be instantly calculated, displayed and printed.

1. Angle between Two Lines

CRT43-1

```
      <Angles>
1.Angle btw. 2 lines
2.Triangles of 3pts.
3.Angle in XY plane
4.Angle in YZ plane
5.Angle in XZ plane
6.To previous menu
<TEST>    (12)
```

Concerning the included angles of vectors made by intersecting two lines which are connecting any two measured point respectively, the calculation and display/print can be executed instantly. If those two lines are not intersecting (in case of space distortion), they are parallel moved so that they can intersect each other, then the included angles at the planes made by intersecting two lines are calculated. The operations here are all the same as those of [4-1] Coordinate data, display/print, except that the angles can be displayed while being printed if <1> YES is input answering to the message asking whether the angles are to be print out or not when the printer is on-line.

CRT43-2

```
<Angle btw. 2 lines>

  A[1  ]  B[2  ]

  C[4  ]  D[5  ]

    —> 11° 5'25"
<TEST>    (12)
```

Print out sample of the included angles made by intersecting two lines

```
[Ang.  2 lines]

 AB( 1, 2) CD( 3, 4)
   = 165°31'28"
 AB( 1, 2) CD( 43 3)
   = 14°28'31"
 AB( 1, 2) CD( 5, 6)
   = 100°18'10"
 AB( 3, 4) CD( 6, 5)
   = 106°46'27"
```

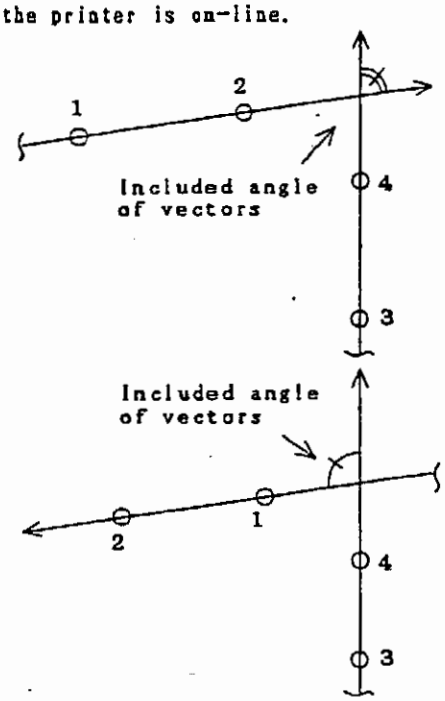


Fig. 7.4

2. Triangles of 3 Points

CRT43-3

```
      <Angles>
1.Angle btw. 2 lines
2.Triangles of 3pts.
3.Angle in XY plane
4.Angle in YZ plane
5.Angle in XZ plane
6.To previous menu
<TEST>    (12)
```

The angle formed by any 3 points already measured, and the projected angle on the XY, YZ and XZ planes can be calculated, then displayed and printed. The method is similar to the case on the previous page.

CRT43-4

```
<Triangles of 3pts.>
  Input three point
  numbers

  [1  ] [2  ] [3  ]

     -->179° 2'18"
<TEST>    (12)
```

CRT43-5

```
      <Angles>
1.Angle btw. 2 lines
2.Triangles of 3pts.
3.Angle in XY plane
4.Angle in YZ plane
5.Angle in XZ plane
6.To previous menu
<TEST>    (12)
```

CRT43-6

```
<Angle in XY plane>

   Angle B

A[1  ] B[2  ] C[3  ]

     -->179° 2'18"
<TEST>    (12)
```

Print out sample of
the triangles of 3 points

```
[Ang.  3pts.]]

( 1, 2, 3) =  89°46'55"
( 2, 4, 3) =  28°31'58"
( 1, 3, 4) =  61°41'28"
( 1, 3, 2) =  32°56'51"
```

[4-4] Offsets of Measured Point, Display/Print

CRT44

```
<Display/Print data>
1.Coordinates
2.Dist. btw. 2 pts.
3.Angles
4.Offsets
5.Area
6.To previous menu
<TEST>    (12)
```

The distance between the origin of the coordinate system and the measured point along the X, Y or Z direction can be calculated and displayed/printed, enabling a check on each offset of the measured point. The operation method is just the same as that of [4-1] "Coordinate Data, Display/Print", so either print or display which is selected is executed.

CRT44-1

```
     <Offsets>
1.X-axis offsets
2.Y-axis offsets
3.Z-axis offsets
4.To previous menu


<TEST>    (12)
```

If you select the X Offset in the above menu, and press <Enter> key, the value of X of each point from the YZ plane is displayed, otherwise these values can be printed out if required.
The method for display and print of Y and Z offsets is also the same.

CRT44-2

```
  <X-axis offsets>
 [001] X=    0.0000m
 [002] X=    1.0013m
 [003] X=    2.0001m
 [004] X=    3.0211m
 [005] X=    4.0235m
 [006] X=    5.0223m
 [Enter] or [Clear]
```

Print out sample of the X-axis offsets

```
[X  O f f s e t s]]

[001] MEMO:
      X=     0.0000 m
[002] MEMO:
      X=     2.7757 m
[003] MEMO:
      X=     2.7579 m
[004] MEMO:
      X=    -4.6128 m
[005] MEMO:
      X=     8.6634 m
[006] MEMO:
      X=     8.1699 m
```

[4-5] Area, Display/Print

CRT45

```
<Display/Print data>
1.Coordinates
2.Dist. btw. 2 pts.
3.Angles
4.Offsets
5.Area
6.To previous menu
<TEST>     (12)
```

The area formed by any 3 points in space can be calculated, then displayed and printed.
Input the point numbers of the 3 points.

CRT45-1

```
        <Area>
  Input three point
  numbers

  [1  ] [2  ] [3  ]
Area        0.0084m2
 Add area? (Y/N)
<TEST>     (12)
```

When the area of the 3 points calculated, is to be added up with the area of the next 3 points which is to be calculated, then after the area is calculated, press <Y> or <Yes>.
The subsequently calculated area will be added to the previous area progressively, and can be displayed or printed simultaneously. If <N> or <No> key is pressed, the addition of areas will not be carried out.
The result of addition will be preserved until you close the left screen.

CRT45-2

```
        <Area>
  Input three point
  numbers

  [1  ] [2  ] [3  ]
Area        0.0084m2
Add         0.0084m2
<TEST>     (12)
```

Print out sample of the area formed by three points

```
[A r e a]

( 1,  2,  3)
Area=       5.9586 m2
Add =       5.9586 m2
( 2,  3,  4)
Area=      16.3129 m2
Add =      22.2715 m2
( 3,  4,  5)
Area=      10.2941 m2
Add =      32.5655 m2
( 4,  5,  6)
Area=      17.9332 m2
Add =      50.4987 m2
```

[5] Data Transformation
[5-1] Coordinate Transformation

CRT51

```
<Transformation>
1.Coord. transform.
2.Link data
3.Edit measured data
4.Display/Print data
5.To previous menu

<TEST>    (12)
```

If you select <4> Data transformation in the opening menu and input the file name, then the menu as indicated on the left, is displayed.
With this menu you can make changes, such as changes in the order and deletion of points, and shift/rotation/linking of coordinate systems for the coordinate data or origin already measured, and other editing operations.

1. X-axis 1, 2/Y-axis 3 Transformation

CRT51-1

```
<Coord. transform.>
1.X=pts. 1,2 Y=pt. 3
2.X=pts. 1,2 Z=pt. 3
3.Origin=1 X-axis=2
4.Enlarge/Rotat/Move
5.To measured data
6.To previous menu
<TEST>    (12)
```

If you select <1> Transform coordinates in the above menu, then the menu as shown in the figure on the left is displayed.
Firstly, regarding items <1> ~ <3>, you can easily transform from the basic coordinate axes system with the first origin and point X on the X axis to another coordinate system on the measured point. For instance, as indicated in the Fig. 7.6, if the axis which passes through measured points 4 and 5 is to be taken as the X axis, and the axis perpendicular to this X axis and passing though point 6 is to be taken as the & axis, then select <1> X axis 1, 2. Y Axis 3 from the menu.

CRT51-2

```
<X=pts. 1,2 Y=pt. 3>

 X-axis1 -->[  4]
 X-axis2 -->[  5]
 Y-axis3 -->[  6]
  (No origin = 0)
 Origin  -->[0  ]
<TEST>    (12)
```

If you select <1>, the menu as shown on the left is displayed. Input the corresponding point numbers. Then all the coordinates of the coordinate system in the previous figure canbe transformed to a new coordinate system with its origin at the intersection of the x and y axis, and the new data canbe displayed or printed.
And if X-axis 1 (4 on Fig. 7.6) is specified as an origin the origin of the coordinate system is replaced by this point as a new origin. In this case, z-axis meets at right angles with the xy plane.

Next

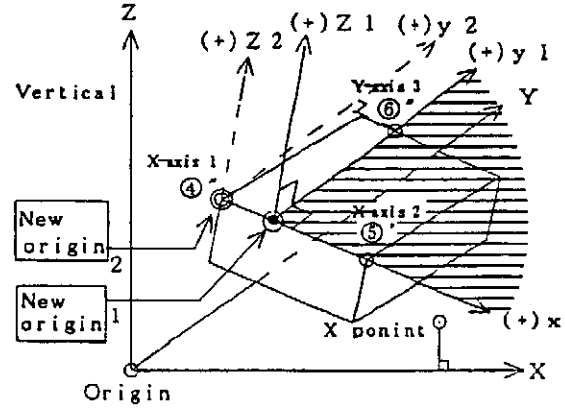


Fig. 7.6

CRT51-3

```
<X=pts. 1,2 Y=pt. 3>

      Print ?

        1.YES
        2.NO

<TEST>     (12)
```

CRT51-4

```
<X=pts. 1,2 Y=pt. 3>
[001] X=    -2.0001m
      Y=    -0.0045m
      Z=    -0.0447m
[002] X=    -4.0208m
      Y=    -0.0046m
      Z=    -0.0413m
 [Enter] or [Clear]
```

Now, if the x axis is specified in the order 5, 4 without specifying an origin, the (+)x and (+)y axis direction become as shown in the Fig. 7.7, and the (+)z axis tends toward the direction rotated by 180° around y axis with its inclination as it stands.

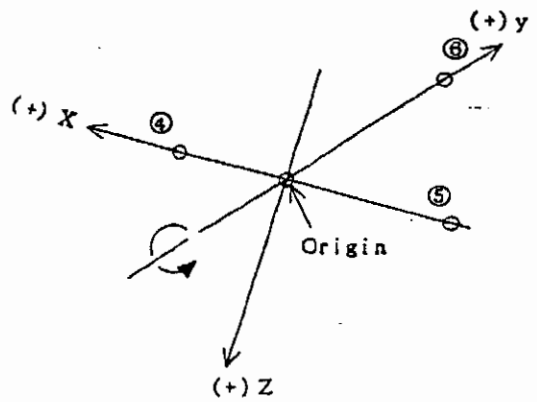


Fig. 7.7

Print out sample of X-axis 1,2/Y-axis 3

```
   <TEST>
    PT=6
    [Origin-1 x-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)      0.0000 m
    TEMP.        20.000 °C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
       X=     0.0000 m
       Y=     0.0000 m
       Z=     0.0000 m
[002] MEMO:
       X=     2.7757 m
       Y=     0.0000 m
       Z=    -0.0028 m
[003] MEMO:
       X=     2.7579 m
       Y=    -3.9999 m
       Z=    -1.5626 m
[004] MEMO:
       X=    -4.6128 m
       Y=    -5.0878 m
       Z=     0.0064 m
[005] MEMO:
       X=     8.6634 m
       Y=    -4.6567 m
       Z=    -0.4818 m
[006] MEMO:
       X=     8.1899 m
       Y=    -7.3507 m
       Z=    -0.8057 m

END:  08/29/1995 11:04:15
```

```
[X=1, 2  Y=3]

X pt.1=[  4]
X pt.2=[  5]
Y pt.3=[  6]
Origin=[  0]
    <TEST>
    PT=6
    [Origin-1 x-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)      0.0000 m
    TEMP.        20.000 °C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
       X=    -7.9513 m
       Y=    -4.9185 m
       Z=     0.4635 m
[002] MEMO:
       X=    -5.1788 m
       Y=    -4.8398 m
       Z=     0.3537 m
[003] MEMO:
       X=    -5.2891 m
       Y=    -0.8753 m
       Z=     1.3939 m
[004] MEMO:
       X=   -12.7238 m
       Y=     0.0000 m
       Z=     0.0000 m
[005] MEMO:
       X=     0.5884 m
       Y=     0.0000 m
       Z=     0.0000 m
[006] MEMO:
       X=     8.1899 m
       Y=    -7.3507 m
       Z=    -0.8057 m

END:  08/29/1995 11:04:15
```

The above figure is an example showing the coordinate values of the measured points placed on a plane as illustrated Fig. 7.8 when they are transformed in " X-axis 1,2/Y-axis 3" during measurement. The above values are in the case without specified origin.

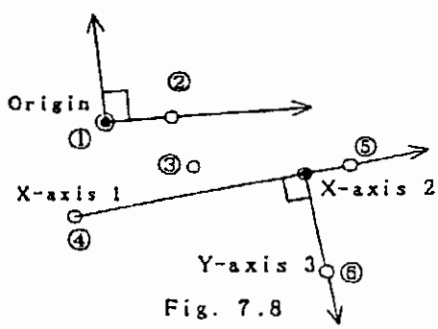


Fig. 7.8

2. X Axis 1,2 Z Axis 3 Transformation

CRT51-5

```
<X=pts. 1,2 Z=pt. 3>

 X-axis1 —>[4  ]
 X-axis2 —>[5  ]
 Z-axis3 —>[6  ]
  (No origin = 0)
 Origin  —>[4  ]
<TEST>    (12)
```

If you select <2> in the menu (CRT51-1), then the menu as shown in the figure on the left, is displayed. The creation of the coordinate system is the same as in "1." but as indicated in the Fig. 7.9 when the new origin is to be located on the origin, if you input the origin point number in menu (CRT51-5) you can obtain the coordinate axes system you require.

Now in the example indicated in the figure on the left, the z axis, including the point 6 is in the x, z plane.

CRT51-6

```
<X=pts. 1,2 Z=pt. 3>

      Print ?

      1.YES
      2.NO

<TEST>    (12)
```

CRT51-7

```
<X=pts. 1,2 Z=pt. 3>
[001] X=   -5.0221m
      Y=    0.0045m
      Z=   -0.0447m
[002] X=   -4.0208m
      Y=    0.0046m
      Z=   -0.0413m
 [Enter] or [Clear]
```

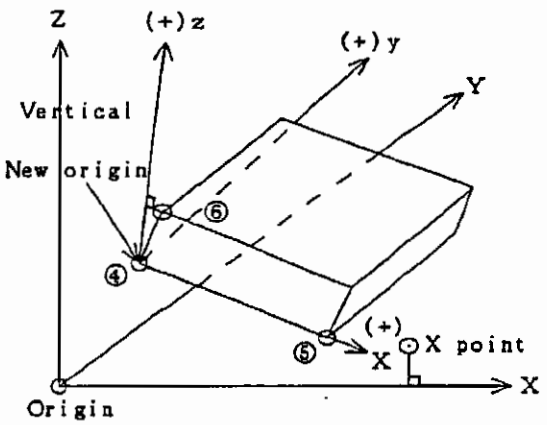


Fig. 7.9

3. Origin 1 X Direction 2 Transformation

CRT51-8

```
<Origin=1 X-axis=2>

 Original —>[4  ]
 X-axis2 —>[5  ]



<TEST>     (12)
```

If you select <3> in the menu (CRT51-1), then the figure as shown on the left, is displayed.
In case of shifting the coordinate axes to an arbitrary point with a new origin and with the x direction changed, while maintaining the original z direction, use this menu.

CRT51-9

```
<Origin=1 X-axis=2>

      Print ?

       1.YES
       2.NO

<TEST>     (12)
```

the example of the Fig. 7.10 below, the x axis is horizontal and is in the xz plane along with the point number 5.

CRT51-10

```
<Origin=1 X-axis=2>
[001] X=    -3.0209m
      Y=     0.0450m
      Z=    -0.0043m
[002] X=    -2.0197m
      Y=     0.0416m
      Z=    -0.0027m
 [Enter] or [Clear]
```

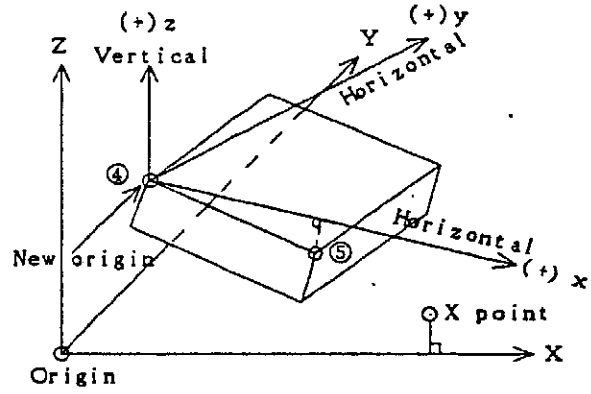


Fig. 7.10

Print out sample of
Origin 1 X axis 2
transformation

```
[Orig. =1, X=2]

Origin 1=[  4]
X-axis 2=[  5]
     <TEST>
     PT=6
     [Origin-1 x-axis=2]
     REP.          1
     2TRG. (1)     0.0000 m
     2TRG. (1)     0.0000 m
     TEMP.        20.000 'C
     EP.           0.000012
     SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
        X=    4.7755 m
        Y=    4.9354 m
        Z=   -0.0084 m
[002] MEMO:
        X=    7.5498 m
        Y=    4.8453 m
        Z=   -0.0082 m
[003] MEMO:
        X=    7.4021 m
        Y=    0.8481 m
        Z=   -1.5690 m
[004] MEMO:
        X=    0.0000 m
        Y=    0.0000 m
        Z=    0.0000 m
[005] MEMO:
        X=   13.2832 m
        Y=    0.0000 m
        Z=   -0.4882 m
[006] MEMO:
        X=   12.7025 m
        Y=   -2.8762 m
        Z=   -0.8121 m

END:  08/29/1995 11:04:15
```

The print out sample on the left is the output data corresponding to the input of origin 4 and x axis along 5.

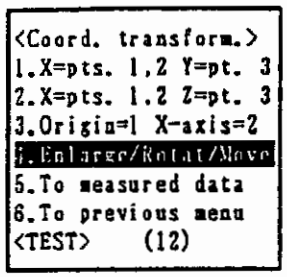
CRT51-11

```
<Coord. transform.>

      Save data?

        1.YES
        2.NO

<TEST>     (12)
```

After transforming the coordinates, if you select <Clear>key or item <6> in the menu (CRT51), then a message as indicated in the figure on the left will be displayed.
This is a message asking whether the data of the new coordinate axes system obtained after transformation, is to be saved or not. In case you wish to print out the data or re-use this data at a later stage, save this data.

4. Enlargement/Rotation/Move

CRT51-12



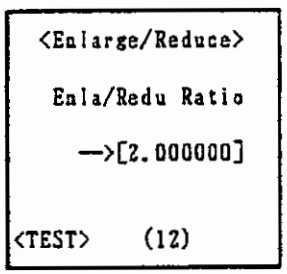
If you select <4> Enlarge/Rotate/Move in menu (CRT51-12), the menu as shown on the left is displayed and you can transform all the coordinate values without specifying the measuring point numbers.

(1) Enlargement

CRT51-13

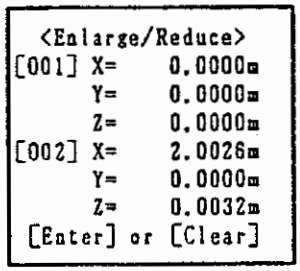
For the coordinates axes for which a revised output is necessary, if all the coordinates are to be enlarged or reduced by a constant factor, use the menu on the left and input the enlargement/reduction factor.
For instance, for a material whose coefficient of linear expansion is different from standard one, if an appropriate enlargement/reduction factor is input, you can find the enlarged/reduced coordinate values and distance between two points, etc. by returning to the menu [5-4] Data display/print.

CRT51-14



Please be careful when you input a factor of enlargement or reduction. If '0' is entered as a factor, all the coordinate values will be changed to '0'. Therefore, when '0' is input, a message will be displayed to confirm whether it is intended or not before it is entered in SDR4E.

CRT51-15



Print out sample of the enlarged coordinate values

The figures below indicate displays of the coordinate values before and after the enlargement factor (2.0000) is used.

```
   <TEST>
    PT=4
    [Origin-1 X-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)      0.0000 m
    TEMP.        20.000 'C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
       X=     0.0000 m
       Y=     0.0000 m
       Z=     0.0000 m
[002] MEMO:
       X=     2.7757 m
       Y=     0.0000 m
       Z=    -0.0028 m
[003] MEMO:
       X=     2.7579 m
       Y=    -3.9999 m
       Z=    -1.5628 m
[004] MEMO:
       X=    -4.6128 m
       Y=    -5.0878 m
       Z=     0.0064 m

END:  08/29/1995 11:04:15
```

```
[Magnifiat.]

SCALE     2.000000
    <TEST>
    PT=4
    [Origin-1 X-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)      0.0000 m
    TEMP.        20.000 'C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
       X=     0.0000 m
       Y=     0.0000 m
       Z=     0.0000 m
[002] MEMO:
       X=     5.5515 m
       Y=     0.0000 m
       Z=    -0.0056 m
[003] MEMO:
       X=     5.5157 m
       Y=    -7.9999 m
       Z=    -3.1252 m
[004] MEMO:
       X=    -9.2256 m
       Y=   -10.1755 m
       Z=     0.0128 m

END:  08/29/1995 11:04:15
```

(2) Rotate/Move

CRT51-16

```
   <Rotate/Move>
Rot.X=[29.595900]°'″
Rot.Y=[0         ]°'″
Rot.Z=[0         ]°'″
Mov.X=[0         ]m
Mov.Y=[0         ]
Mov.Z=[0         ]m
<TEST>     (12)
```

If you select <2> in the menu (CRT51-13), then the menu as shown on the left is displayed.
If you wish to directly rotate the coordinate values around the X axis by an arbitrary angle, then input the angle of rotation of the axis. However, input a value which is less than 59' and 59″ corresponding to MM (minute) and SS (second). If the input value is 60 or more in minute and second respectively, the value is calculated being altered to an upper unit value, namely minute to degree and second to minute. The value of rotation is rounded off the fractions to four decimal places. The same is true for rotation around Y axis and Z axis. In rotation of the coordinate point, the positive rotation direction of each point is anticlockwise looking to the origin.

CRT51-17

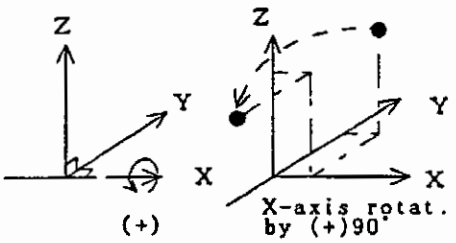
```
   <Rotate/Move>
[001] X=    10.0000m
      Y=    20.0000m
      Z=    30.0000m
[002] X=    11.0013m
      Y=    19.9986m
      Z=    30.0008m
 [Enter] or [Clear]
```

Next

Print out sample of the rotated coordinate values

```
[R o t a t e/M o v e]

RX=     90.3000°'"
RY=      0.0000°'"
RZ=      0.0000°'"
dX=      0.000000000 m
dY=      0.000000000 m
dZ=      0.000000000 m
    <T E S T>
    P T =4
    [Origin-1 X-axis=2]
    REP.          1
    2TRG. (1)     0.0000 m
    2TRG. (1)     0.0000 m
    TEMP.        20.000 °C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
       X=     0.0000 m
       Y=     0.0000 m
       Z=     0.0000 m
[002] MEMO:
       X=     2.7757 m
       Y=     0.0028 m
       Z=     0.0000 m
[003] MEMO:
       X=     2.7579 m
       Y=     1.5992 m
       Z=    -3.9858 m
[004] MEMO:
       X=    -4.6128 m
       Y=     0.0390 m
       Z=    -5.0878 m

END:   08/29/1995 11:04:15
```

X-axis rotat. Ex:Rotat.by(+)90°



Y-axis rotat. Z-axis rotat.

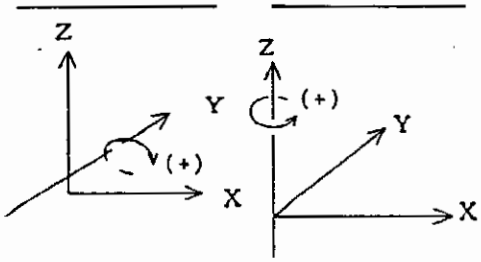


Fig. 7.11

On the above sample, the figures on the left column are the values before rotation, and those on right column are the values after rotation around the X axis by (+)90°30'.

CRT51-18

```
   <Rotate/Move>
Rot.X=[0          ]°'"
Rot.Y=[0          ]°'"
Rot.Z=[0          ]°'"
Mov.X=[10         ]m
Mov.Y=[20         ]m
Mov.Z=[30         ]m
<TEST>     (12)
```

For shifting the last saved coordinate axes system from the origin to an arbitrary point along the X, Y to Z direction, input the corresponding shift distances.
You can also check the offsets of each measured point by using this menu.

CRT51-19

```
   <Rotate/Move>
[001] X=    20.0000m
      Y=    40.0000m
      Z=    60.0000m
[002] X=    21.0013m
      Y=    30.9986m
      Z=    60.0008m
 [Enter] or [Clear]
```

In the example of the figure below, the shift along the Y-axis only is displayed. When the shift distance is input, all the coordinate data values along the Y axis take up new values by adding the distance shifted to the original values.

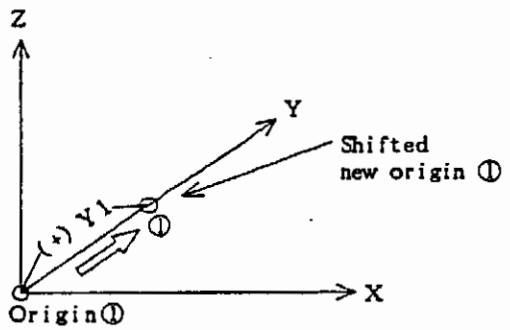


Fig. 7.12

Print out sample of the coordinate value movement

```
[Rotate/Move]

RX=      0.0000°'"
RY=      0.0000°'"
RZ=      0.0000°'"
dX=     10.000000000 m
dY=     20.000000000 m
dZ=     30.000000000 m
    <TEST>
    PT=4
    [Origin=1 X-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)    . 0.0000 m
    TEMP.        20.000 °C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
       X=    10.0000 m
       Y=    20.0000 m
       Z=    30.0000 m
[002] MEMO:
       X=    12.7757 m
       Y=    20.0028 m
       Z=    30.0000 m
[003] MEMO:
       X=    12.7579 m
       Y=    21.5992 m
       Z=    28.4374 m
[004] MEMO:
       X=     5.3872 m
       Y=    14.9122 m
       Z=    30.0064 m

END:  08/29/1995 11:04:15
```

(3) Temperature Compensation

When the distance of object to be measured is required, normally, the temperature at the location where the object is place and other environmental conditions, cause the measurement to fluctuate. On the other hand, the measuring instrument measures distances absolutely, therefore, the distances is modified by parameters (Material temperature, Line expansion coefficient) such as the scale of steel measure tape or object to be measured.
Temperature compensation modifies the measured coordinates based on the [Material temperature], [Line expansion coefficient] which are specified at the time environment setting.
Temperature compensation is done after the edited data (DT2) are changed back to the measured data. Hence, data of the coordinate transformation before the compensation are lost. Notice that the basic temperature of SDR4E is se to be 20°C.

CRT51-22

```
<Enlarge/Rotat/Move>
1.Enlarge/reduce
2.Rotate/Move
3.Temp. compensation
4.To previous menu


<TEST>     (12)
```

CRT51-23

```
<Temp. compensation>
 Transformed data
 will be lost when
 temp. compensation
 is done after meas.
 data are recovered.
   1.YES     2.NO
<TEST>     (12)
```

CRT51-24

```
<Temp. compensation>
Temp. —>[15.000]°C
Expansion const.
       —>[0.000012]

Compensate as above.
   1.YES     2.NO
<TEST>     (12)
```

CRT51-25
Before compensation

```
<Temp. compensation>
[003] X=     3.1737m
      Y=    -8.9443m
      Z=     0.0599m
[004] X=     2.6029m
      Y=     0.1364m
      Z=    -0.1340m
<TEST>     (12)
```

CRT51-26
After compensation

```
<Temp. compensation>
[003] X=     3.1739m
      Y=    -8.9448m
      Z=     0.0599m
[004] X=     2.6031m
      Y=     0.1364m
      Z=    -0.1340m
<TEST>     (12)
```

CRT51-27

```
<Expansion const.>

 Input expansion
 constant

Expansion const.
     -->[0.000012]
```

5. Return to Measured Data

CRT51-28

```
 <To measured data>

Recover measud data

       1.YES
       2.NO

<TEST>     (12)
```

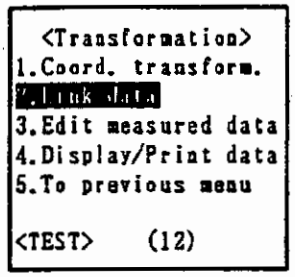
When coordinates are transformed, the data is maintained but when further transformation is carried out, only the final coordinate values remain, therefore, each time a transformation is carried out, you should save the data after returning to the previous menu and copy the file in menu (CRT62) or you have to start from the original measured data.
In the menu (CRT51-1) if you select <5>, you can return to the original measured data.
However, as for the linked data, the original measured data cannot be recovered because they do not exist in one body.
If the original measured data have deleted for any reason. you cannot return to them.

CRT51-29

```
 <To measured data>
[001] X=     0.0000m
      Y=     0.0000m
      Z=     0.0000m
[002] X=     1.0013m
      Y=     0.0000m
      Z=     0.0016m
 [Enter] or [Clear]
```

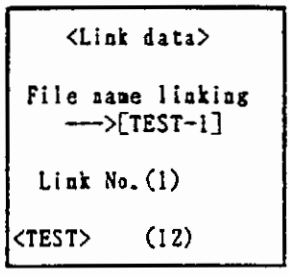
[5-2] Data Linking

CRT52

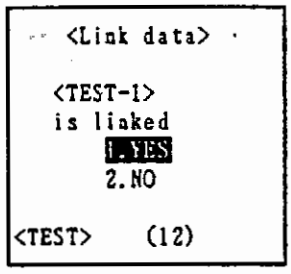


In this menu, it is possible to link files one after another up to 9 files and to save the whole files linked as one file . If the coordinate systems of files to be linked are different each other, it is necessary to make them coincide before linking.
Also, if the number of measured points are more than one file can hold and the points are to be saved in another file , these files can also be linked after ward.
When all the coordinate axes systems of the linked data coincide, the results obtained by analysis such as distances between any two points or areas made by connecting points on the integrated coordinate system can be displayed and printed.After linking, a new file is created, whose file name is made by adding mark @ automatically before the initial of the file name of the first accessed data to be linked. And the values of environment set data for the new created file are the same as those of the first linked file.
The file name can be selected from the file list which is displayed by pressing <F5> key.

CRT52-1

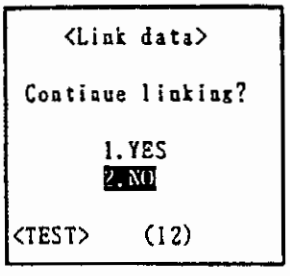


CRT52-3



If you select <1> YES in the left menu, the display shown below appears.

CRT52-4



Next

CRT52-5

```
    <Link data>
Saved linked file
   <@TEST>
with its name
        1.YES
        2.NO

<TEST>     (12)
```

CRT52-6

```
  <Transformation>
1.Coord. transform.
2.Link data
3.Edit measured data
4.Display/Print data
5.To previous menu

<@TEST>    (24)
```

Sample of a print out of the coordinate values of the linked data

The first linked data the whose file name having '@' as its initial letter will be created as a new data file displayed the first values at the time of environmental setting.

```
   <@TEST>
    PT=6
   [Origin=1 X-axis=2]
   REP.          1
   2TRG. (1)     0.0000 m
   2TRG. (1)     0.0000 m
   TEMP.        20.000 'C
   EP.           0.000012
   SCL.          1.000000
START:08/28/1995 15:40:36

[001] MEMO:
      X=     0.0000 m
      Y=     0.0000 m
      Z=     0.0000 m
[002] MEMO:
      X=    10.1425 m
      Y=     0.0000 m
      Z=     0.0740 m
[003] MEMO:
      X=     3.1737 m
      Y=    -8.9443 m
      Z=     0.0599 m
[004] MEMO:
      X=     2.6028 m
      Y=     0.1364 m
      Z=    -0.1340 m
[005] MEMO:
      X=     5.2870 m
      Y=     0.0904 m
      Z=    -0.0034 m
[006] MEMO:
      X=     8.0249 m
      Y=     0.0400 m
      Z=    -0.3274 m

END:  08/28/1995 11:04:15
```

[5-3] Data Editing

CRT53

```
<Edit measured data>
1.Input coordinates
2.Delete points
3.Shift pt. number
4.To previous menu


<TEST>    (12)
```

If you select <3> in the Data transformation menu, the menu shown on the left will be displayed.
By selecting this menu, you can add the coordinate data by manual input in the coordinate axes system, or you can delete any measuring point or change the order of display of any point.

1. Manual input of coordinate data

CRT53-1

```
<Input coordinates>

  Input pt number
       —>[13 ]



<TEST>    (12)
```

If you select <1> in the above menu, the menu shown on the left will be displayed.
The display is giving a point number to be added after the last one in the measured data sequence. If you press <Enter> key and input the new coordinate data, these data will be added to the coordinate axes system.
If you want to advance the order of any point, please execute [4-3] 3. Shift point number. And, if you want to revise the coordinate data of any measured data, please input the point number corresponding to the order of the sequence to be revised, then input new coordinate data.

↓

CRT53-2

```
<Input coordinates>
Pt. number:[13]
 X(m )=[6.047     ]
 Y(m )=[2.209     ]
 Z(m )=[0.600     ]
 MEMO :
    [Single       ]
<TEST>    (12)
```

↓

CRT53-3

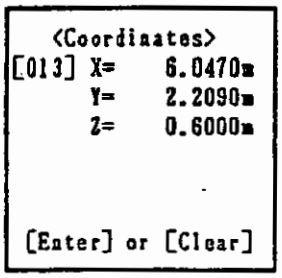
```
<Edit measured data>

     Save data?

       1.YES
       2.NO

<TEST>    (13)
```

In case of editing the measured data, if you select <5> To previous menu in the menu (CRT51) and specify <Clear>, then the menu as indicated below with "Save edited Data?" will appear. If you wish to re-use this data at a later stage, you must save it.
If you save this data, the previous data will be written over and the new data will be saved.

↓

Next

CRT53-4



In the coordinate data input manually, the point number will be automatically saved as "Final point number (+)1" before adding the point, and by execution of [6-4] Data display/ print results data can be displayed or printed, as indicated on the left.

2. Delete points

CRT53-5

```
 <Delete points>

 Input pt number
       -->[13 ]



<TEST>    (12)
```

If you select <2> in the menu (CRT53), then the menu as shown on the left is displayed.
If you wish to delete coordinate data of a measured point, input the point number and it will be deleted. The point numbers after this deleted point, will be automatically stepped up by 1.

3. Shift point number

CRT53-6

```
 <Shift pt. number>

 Old pt. number
       -->[3 ]
 New pt. number
       -->[1 ]

<TEST>    (12)
```

If you select <3> in the menu (CRT53), the menu as shown on the left will be displayed.
If you wish to change the order of arrangement of the measured points, input the new order of arrangement in this menu

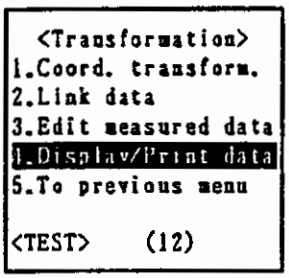
The print out example of the coordinate data indicated below, shows point number (3) has replaced point number (1), and the sequence (1), (2) has been automatically changed to (2), (3).

```
   <TEST>
    PT=4
    [Origin=1 X-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)      0.0000 m
    TEMP.        20.000 °C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:38

[001] MEMO:
       X=     0.0000 m
       Y=     0.0000 m
       Z=     0.0000 m
[002] MEMO:
       X=     2.7757 m
       Y=     0.0000 m
       Z=    -0.0028 m
[003] MEMO:
       X=     2.7579 m
       Y=    -3.9999 m
       Z=    -1.5828 m
[004] MEMO:
       X=    -4.8128 m
       Y=    -5.0878 m
       Z=     0.0084 m

END:  08/29/1995 11:04:15
```

```
   <TEST>
    PT=4
    [Origin=1 X-axis=2]
    REP.          1
    2TRG.(1)      0.0000 m
    2TRG.(1)      0.0000 m
    TEMP.        20.000 °C
    EP.           0.000012
    SCL.          1.000000
START:08/28/1995 15:40:38

[001] MEMO:
       X=     2.7579 m
       Y=    -3.9999 m
       Z=    -1.5828 m
[002] MEMO:
       X=     0.0000 m
       Y=     0.0000 m
       Z=     0.0000 m
[003] MEMO:
       X=     2.7757 m
       Y=     0.0000 m
       Z=    -0.0028 m
[004] MEMO:
       X=    -4.8128 m
       Y=    -5.0878 m
       Z=     0.0084 m

END:  08/29/1995 11:04:15
```

[5-4] Data, display/print

CRT54



If you execute items <1> ~ <3> in the Data transformation menu (CRT54) indicated on the left, you will need the display or print out of results.

Select <4> in the same menu, and operate in exactly the same way as in 3. " Data, display/print " mentioned before (for display or print out at the time of actual measurements).

After execution of items <1> ~ <3> in the above mentioned menu, for Data, display/print, you have to return once to the Data transformation menu but prior to this, make sure you have pressed <1> YES to the question "Save Data?". If you do not save the transformed data and return to the 3D measurement and input the same file once again, then, print out results will be the data before transformed.

As the data is saved, the previous data will be written o and only the finally saved data will remain in memory.

[6] File Management

[6-1] List of Files

CRT61

```
 <File management>
1.List of files
2.Copy files
3.Delete files
4.Transfer data
5.Make designed data
6.Free memory
7.To previous menu
```

If you select <5> in the opening menu (CRT1), the file management menu will be displayed as shown left.
If you select <1> "List of files" in this menu, all the names of the files currently saved will be displayed or printed out.

CRT61-1

```
 <List of files>
1.Edited files
2.Measured files
3.Design files
4.All files
5.To previous menu
```

CRT61-2

```
 <List of files>

    Print ?

     1.YES
     2.NO
```

CRT61-3

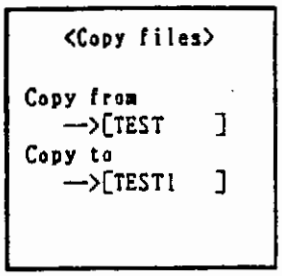
```
 <List of files>
 1:[ TEST    .DT2 ]
 2:[ TEMP1   .DT2 ]
 3:[ TEMP2   .DT2 ]



[Enter] or [Clear]
```

Sample of a list of files printed out

```
[A l l  d a t a]

  1: [ENVIRON    ]
  2: [TEST   .DT1]
  3: [TEST   .DT2]
  4: [TEST1  .DT1]
  5: [TEST1  .DT2]
  6: [@TEST1 .DT2]
  7: [TEST2  .DT1]
  8: [TEST2  .DT2]
  9: [TEST2  .DES]
 10: [AAA    .DT1]
 11: [AAA    .DT2]
 12: [1      .DT1]
 13: [1      .DT2]
```

[6-2] Copy Files

CRT62



If you execute [5-1] "Transform coordinates" or [5-3] "Edit measured data" in the menu <5> "Data Transformation", the data changes sequentially, therefore, you should save the data during these operations, in a file. Use this function to save the data under a new file name.

When you copy a linked data, '@' is automatically added to what you input as the file name of the copied result. If the file name input by you has eight (8) letters without '@', please delete the 8th letter and add '@' before initial letter. If you press <F5> key when the cursor is on the field to input file name you intent to copy, the file name list will be displayed. But on the destination side of copying, the list is neve displayed to prevent overwriting by careless mistake.

Generally, measurement data (*.DT1) and edited data file (*.DT2) are copied as a set. If designed data file (*.DES) is existed, these 3 files will be copied as a whole.However, it is impossible to copy designed data only, so refer to "4. Transfer data"or "5. Set data".

If there is the same file name on the destination side of copying, the file name will be overwritten according to the overwriting pattern for copying as follows:

Overwriting pattern for copying

The existing files	The existing files		
	○○○.DT1 ○○○.DT2	○○○.DES	○○○.DT1 & ○○○.DT2 ○○○.DES
△△△.DT1 △△△.DT2	①	②	③
△△△.DT1 △△△.DT2 △△△.DES	④	⑤	⑥

① : Overwrite the new files "△△△.DT1" and "△△△.DT2" to the existing files "○○○.DT1" and "○○○.DT2".

② : After deleting the existing file "○○○.DES", copy the new files "△△△.DT1" and "△△△.DT2".

③ : After deleting the existing files "○○○.DT1", "○○○.DT2" and "○○○.DES", copy the new files "△△△. DT1" and "△△△. DT2".

④ : Overwrite the new files "△△△.DT1" and "△△△.DT2" to the existing files "○○○.DT1" and "○○○.DT2", and then copy the new file "△△△.DES".

⑤ : After deleting the existing file "○○○.DES", copy the new files "△△△.DT1", "△△△.DT2" and "△△△.DES".

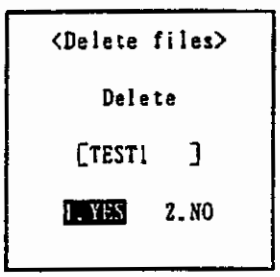
⑥ : Overwrite the new files "△△△.DT1", "△△△.DT2" and "△△△.DES" to the existing files "○○○.DT1", "○○○.DT2" and "○○○.DES".

[6-3] Delete Files

CRT63

During operation, a message such as "No enough disk area" may be displayed. In that occasion, use this function to delete files which are not necessary.

CRT63-1



[6-4] Data Transfer

CRT64

```
  <Transfer data>
1.Send data
2.Receive data
3.Transfer parms.
4.To previous menu
```

Through the RS232C, the SDR4E can output the coordinate data to the external computers having large capacity and also can receive the input data from the external systems.
SDR4E can send data to and receive from SOKKIA's Control Terminal SDR4C.
SDR4E can send both of the measured data and edited data, however the receivable data are limited to the measured data only.

1. Send Data

CRT64-1

```
    <Send data>
1.Edited data
2.Measured data
3.To previous menu
```

The measured or transformed coordinate data can be transferred to the personal computers.
However, the following conditions are necessary to provided before you transfer data:

Baud rate	:	1200 / 4800 baud
Data bit	:	8
Stop bit	:	1
Parity check	:	Nil
X parameter	:	Effective
Sending format	:	SDR4E/SDR4C

RS232C cable should be used.
Get the personal computer ready for receiving, before you start transferring data. Examples of the data formats of the measured and edited data to be sent from SDR4E and SDR4C are given in the following pages. (Remark: The data format of SDR4C and that of SDR4 are the same.)

CRT64-2

```
   <Send data>
 Input file name

   —>[TEST1   ]
  Format:<SDR4E>
  Speed :<1200>
```

The file name can be selected from the file list which is displayed by pressing <F5>key.

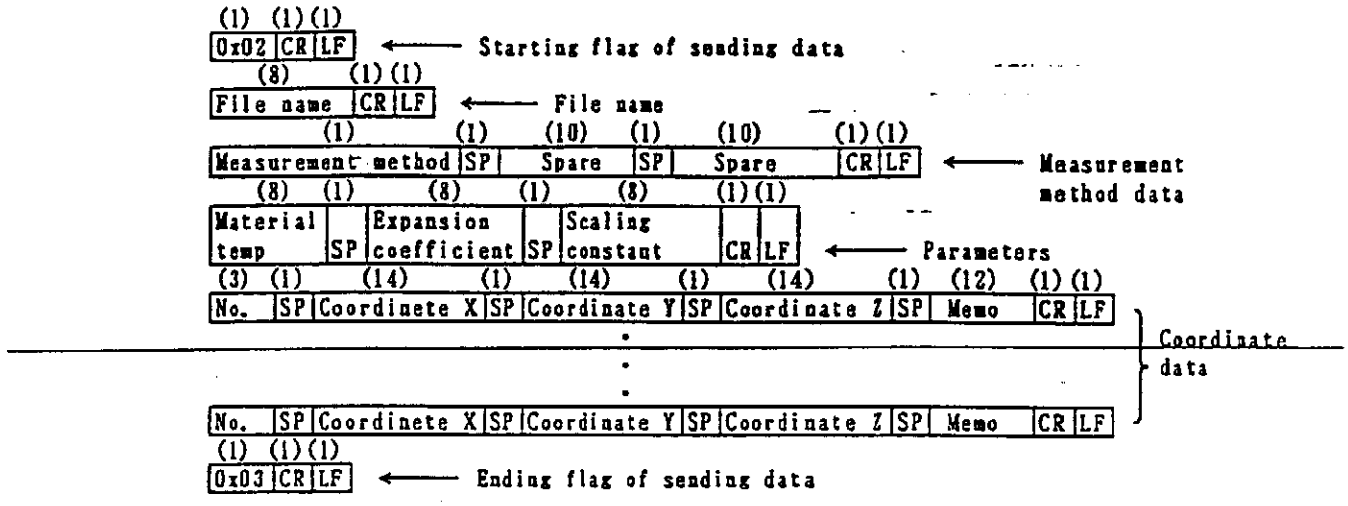
CRT64-3

```
   <Send data>
       Send
     [TEST1   ]

  Format:<SDR4E>
  Speed :<1200>
    1.YES   2.NO
```

CRT64-4

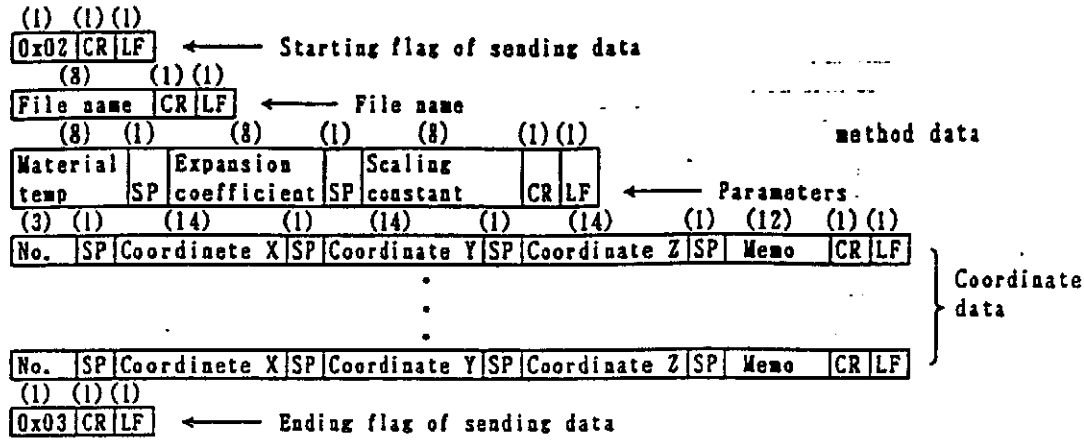
```
   <Send data>


   <Sending>
     [6]
```

●SDR4E data sending format (edition data)



* As for the edited data, the Date/time of starting/ending of measurement are not sent.

●SDR4C data sending format (edition data)

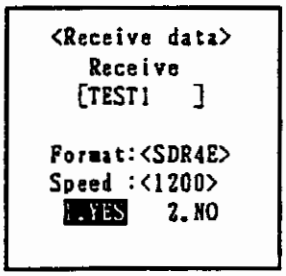


* As for the edited data, the Date/time of starting/ending of measurement are not sent.

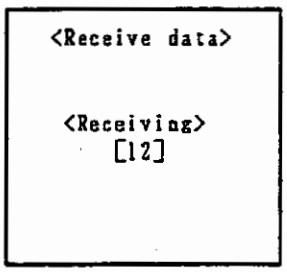
●Sample program (for SDR4E / SDR4C)

```
1000 OPEN "COM1:N81XN" AS #1
1010   COLOR 1 :LOCATE 3, 4 :PRINT STRING$( 75,"=" )
1020           :LOCATE 3,20 :PRINT STRING$( 75,"=" )
1030   CONSOLE 5,15,0,1
1040   DIM DT$(100)
1050   LOCATE 0,5 :COLOR 7
1060   I%=0
1070   *AQU
1080     I%=I%+1
1090     LINE INPUT #1,DT$(I%)
1100     PRINT DT$(I%)
1110     IF LEFT$(DT$(I%),1)=CHR$(&H3) THEN GOTO *FIN.SDR
1120   GOTO *AQU
1130   *FIN.SDR
1140 CLOSE
1150 END
```

CRT64-9



CRT64-10



When SDR4E starts receiving data, the display shown left appears. The displayed numerical values will be increased every time the coordinate data are received.

●SDR4E data receiving format

* The receiving format is the same as sending format in general. However, the data that can be received are only those which are sent in the format of measured data and edited data, therefore the data sent in the format of edited data can not be received.

* Generally, the file name of the received data will be substituted by the user input name, and the name used when sending will be abolished.

* As for the environment set parameters, the default values which have been set on the SDR4E side on receiving will be adopted except the received parameters.

* All the coordinate values are received in the same unit that has been selected in the menu of Set environment.

●SDR4C data receiving format

* The receiving format is the same as sending format, equally in the case of the SDR4E.

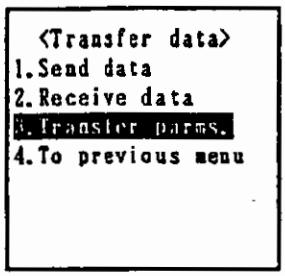
* All the default values are adopted as environment conditions except the received linear expansion coefficient.

* The measured date which is received is treated as the starting date of measurement by SDR4E. The ending date of measurement as "00/00/0000" and the time of starting/ending of measurement as "00:00:00" are saved.

* All the coordinate values are received in the same unit that is selected in the menu of Set environment.

3. Data Transfer Parameter

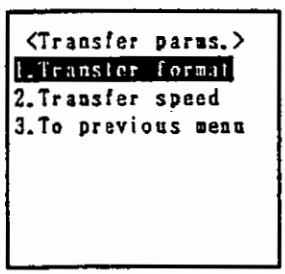
CRT64-11



Data transfer parameters are pre-set and fixed except data format and transfer speed.

4. Data Transfer Format

CRT64-12



The data transfer parameters are as follows:

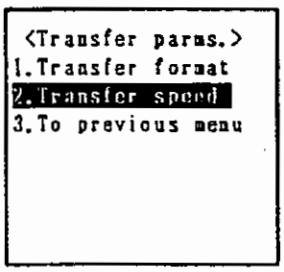
1. Either of the following two data transfer formats software can be chosen beforehand.
   (1) The SDR4E's data transfer software
   (2) The SDR4C's data transfer software

2. The data transfer speed is selected according to the capacity of the personal computer being used.
   (1) 1200 baud rate
   (2) 4800 baud rate

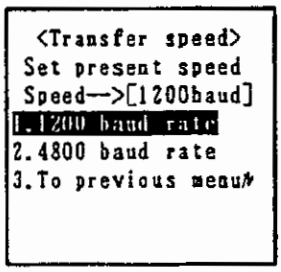
CRT64-13

5. Data Transfer Speed

CRT64-14



CRT64-15



Overwriting pattern for receiving data

SDR4E only receives measured data and design data which have been sent to the personal computer.
If there is the data which have the same name as the receiving data, the data will be managed according to the overwriting pattern shown below.

The receiving data	The existing data		
	○○○.DT1 ○○○.DT2	○○○.DES	○○○.DT1 & ○○○.DES ○○○.DT2
△△△.DT1 △△△.DT2	①	②	③
△△△.DES	④	⑤	⑥

① : Delete the existing data "○○○.DT1" and "○○○.DT2", and then store the receiving data "△△△.DT1" and "△△△.DT2".

② : The existing data "○○○.DES" must not be deleted because of the possibility of using as a set with the receiving data. Make the existing data "○○○.DES" and the receiving data "△△△.DT1" and "△△△.DT2" in a set. At that time, the integration between the existing data "○○○.DES" and the receiving data "△△△.DT1" and "△△△.DT2" is not checked.

③ : Delete the existing data "○○○.DT1", "○○○.DT2" and "○○○.DES", and then store the receiving data "△△△.DT1" and "△△△.DT2".

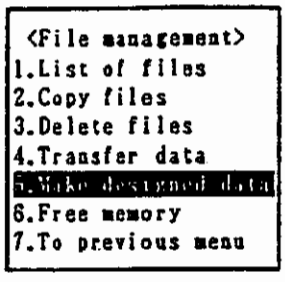
④ : The receiving data "△△△.DES" can not be stored due to existing of the measured data "○○○.DT1" and "○○○.DT2".

⑤ : Delete the existing data "○○○.DES", and then store the receiving data "△△△.DES".

⑥ : The receiving data "△△△.DES" can not be stored due to existing of the measured data "○○○.DT1", "○○○.DT2" and "○○○.DES".

[6-5] Method of Making Designed Data

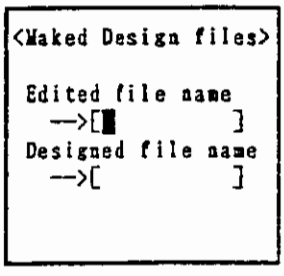
CRT65



The method of taking in the designed data to SDR4E as follows:

1) Duplicate the designed data file (*.DES) directly from the edited data file in SDR4E
2) Receive the designed data (*.DES) from personal computer by using data transfer function.

CRT65-1



If you need to duplicated the designed data file directly from the edited edited file in SDR4E, choose the file name you decide to duplicate in the edited data displayed by pressing <F5> key shown on the left screen, and input the file name not to used both in the edited data file and the designed data file, you can make a new designed data automatically.

[6-6] Free Memory

CRT66

```
<File management>
1.List of files
2.Copy files
3.Delete files
4.Transfer data
5.Make designed data
6.Free memory
7.To previous menu
```

CRT66-1

```
  <Free memory>
Total memory
     1573376 bytes

Free memory
     1318912 bytes

[Enter] or [Clear]
```

If <6> is selected in the menu (CRT66), the screen on the left is displayed. It gives the memory space in bytes on RAM and that which remains free not-used.

8.Display of error message

The following message appear in the event of mistakes during measurement or data transformation.

Massage	Application	Ref. page
Main Battery is Low Press[Enter]	If the voltage of the Ni-Cd battery drops,the printer does not function effectively. Either charge the battery or replace it, or connect the AC adapter and supply power.	-22- 4.5.4
Lithium Batterys are Low or Dead Press[Enter]	Replace the Lithium batteries. However, prior to replace them, make sure that the main power source(Ni-Cd battery or AC adapter) is working effectively. If you replace the lithium battery when the Ni-cd battery voltage is low, the entire memory may be wiped out.	-22- 4.5.4
No enough disk area Press[Enter]	If the stored data file becomes too large while saving the data after linking/editing this message is display.	-134-

5. Return to Measured Data

CRT51-28

```
 <To measured data>

Recover measud data

       1.YES
       2.NO

<TEST>     (12)
```

CRT51-29

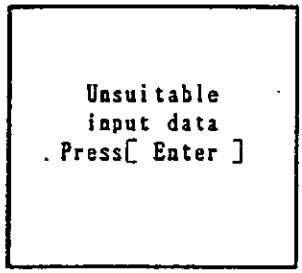
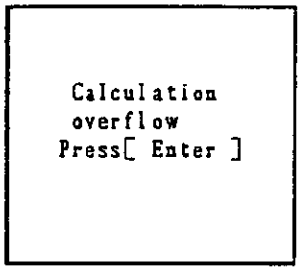
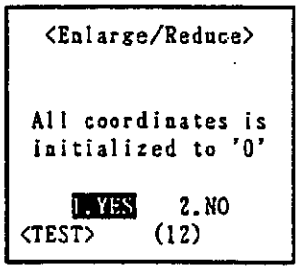
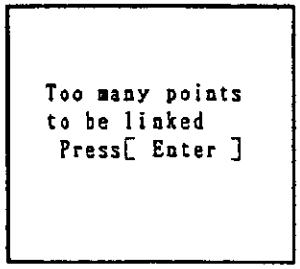
```
 <To measured data>
[001] X=     0.0000m
      Y=     0.0000m
      Z=     0.0000m
[002] X=     1.0013m
      Y=     0.0000m
      Z=     0.0016m
 [Enter] or [Clear]
```

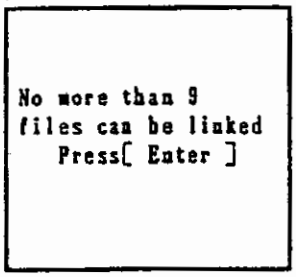
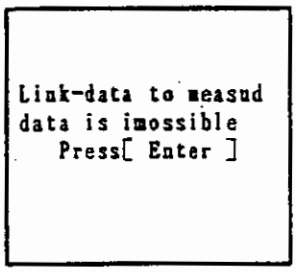
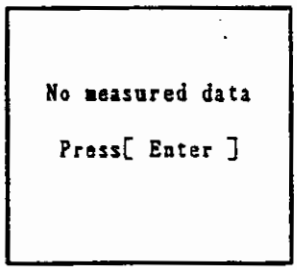
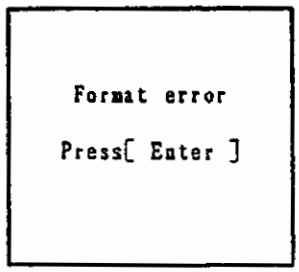
When coordinates are transformed, the data is maintained but when further transformation is carried out, only the final coordinate values remain, therefore, each time a transformation is carried out, you should save the data after returning to the previous menu and copy the file in menu (CRT62) or you have to start from the original measured data.
In the menu (CRT51-1) if you select <5>, you can return to the original measured data.
However, as for the linked data, the original measured data cannot be recovered because they do not exist in one body.
If the original measured data have deleted for any reason. you cannot return to them.

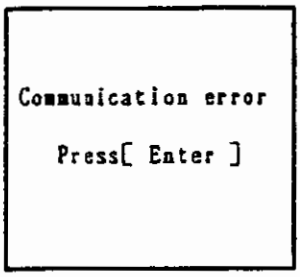
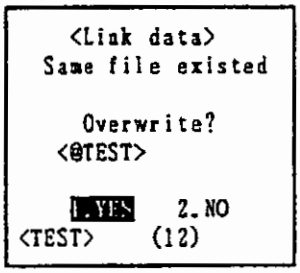
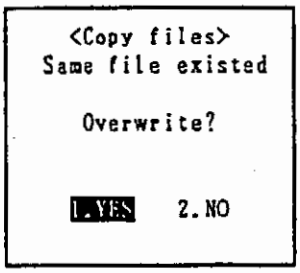
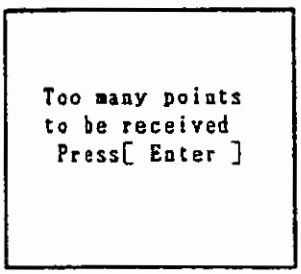
Massage	Application	Ref. page
File open error Press[Enter]	This message is displayed in occasion that errors happen during the stored data files are saved or read in or during the from the external system.	-22- 4.5.3
Measuring instrument is not ready Press[Enter]	This message is displayed when such occasions that the measuring instrument is not switched or, its horizontality is not settled or resetting of its vertical and horizontal angle is not yet completed.	-41-
No demo data Press[Enter]	In the menu [2-1]Measurement(Demo), number of points saved in the data for use of sequential measurement are 20. if the 21st point is input to be measured, this message is displayed.	-38- (2-1) display
Unsuitable 2nd point or 3nd point Press[Enter]	During a new measurement or moving the station point, this message will be displayed when you measured twice the same point by mistake.	-46- -55- -59-

Massage	Application	Ref. page
Cannot create file for envimt. setting Press[Enter]	When the file for environment settings cannot be created since the file capacity is full, this message is displayed.	—
Error in measurement Error code:[E200] Enter: Re-measure Clear: previ. screen	If there is an obstacle between the measuring instrument and target during measurements, or if the reflected light is insufficient, then this message will be displayed. If <Enter>key is pressed measurement can be started again. if <Clear>key is pressed, you can turn to the menu just before measurement and repeat the measurement.	-43- CRT22-13
Data error Enter: Re-measure Clear: previ. screen	When receiving error of measuring data from measuring instrument is occurred during the measurement of each point, this message is displayed. If <Enter>key is pressed, measurement can be started again. If <Clear>key is pressed, you can turn to the menu just before measurement and repeat the measurement.	The same as the above.
Too many measured points Press[Enter]	If the total number of measuring point in one(1) file exceeds 400, this message is displayed. teh preasant data file is full. Create a new data file.	-12- -17-

Massage	Application	Ref. page
coordinate is overflow Press[Enter]	On data transfer, if the received coordinate data exceed a range between -9999.9999 and 9999.9999 m, this message is displayed.	-23-
No such file Press[Enter]	After recalling the first file in the Data linking menu [5-2], if you input the file name of a file which has not been saved as the first linked file name, then this message is displayed. Check the file name in the File name list menu [6-1].	-94-
<Angle in XY plane> Angle B A[1] B[2] C[3] Same coordinate is re-defined Press[Enter]	When you input 3 point number for calculations of angle, area or coordinate transformation, if the data of two points out of the three are the same, then this message will be displayed, indicating input error.	-99- -101- -102-
Graduation overflow Press[Enter]	If the constant which was input in [3-6] Scaling constant menu, exceeds the specified range of constant, this message is displayed.	-23- -91-

Massage	Application	Ref. page
	The input data such as coordinates, distance or angle exceed the specified range, this message is displayed. Hit <Enter>key and input valid data.	-23-
	If the result calculated, based on the input values for the calculations of area, enlargement/reduction, parallel shift, etc., exceeds the permissible area, than this message is displayed.	-23-
	In execution of Enlarge/Reduce in [5-1-4] menu, if '0' is selected as a ratio of enlarge/reduce, all data will be set too . This message is displayed to confirm whether 0 is valid value to be input.	-107-
	If the total number of data points in the Data linking menu [5-2] exceeds 999, this message is displayed. Make sure that the total number of data points per link file is less than maximum of 999.	-113-

Massage	Application	Ref. page
	In [5-2] Data linking menu, when the total number of files to be linked exceeds 9, this message is displayed.	-11- -113-
	After operation of link data in [5-2], if you execute return to measured data in menu [5-1-5], this message is displayed.	-112-
	On execution return to measured data in [5-1-5] menu, if the object data have been deleted in any other operation, this message is displayed.	-112-
	In data transfer menu, when the format of the transferred data is different from that of SDR4E/4C, this message is displayed.	-128-

Massage	Application	Ref. page
	When any communication error happens in the middle of sending/receiving data during the operation of measurement, print or transfer, if no response to the transmission is given within 15~20 seconds, this message is displayed.	—
	When you try to save the linked data as the existing file, this message is displayed. Decide whether to overwrite or to abandon as mistake.	-114-
	If you try to copy a file to another file which already exists, this message will be displayed. Decide whether to overwrite or not.	-120-
	When the total number of the received coordinate data exceeds 999 that is the maximum number can be supported in data transfer menu, this message is displayed.	-23-

Massage	Application	Ref. page
Full of RAM disk!! delete unnecessary files. Press[Enter]	The SDR4E can manage files up to 401 within its RAM disk. When files are saved in RAM disk, if the total number of files which have been saved reaches to this limits, this message is displayed. The above total number of files means that of all files that are saved in the RAM disk of which contents can be displayed in [6-1-4] menu.	-119-
Same coordinate is re-defined Press[Enter]	If the newly defined designed data coordinate is the same as that of existing one, this message is displayed.	-67-
Meas. method cann't be changed because there are measured data in the env. file being edited. Press[Enter]	If the default environmental setting is not used, when "Std Measmt method [3-2]" menu is selected, this message is displayed.	-42-
Relieve setting of offsets Press [Enter]	While measuring the data, if <Clear> key is pressed in off-set setting menu, this message is displayed and every setting is abandoned. Input offset and press <Enter>key, then above setting is got to be valid.	-51-

Massage	Application	Ref. page
No coordinates of designed data which has the same memo as specified. Press [Enter]	In designed data measurement or position measurement, if there was no designed data which has the same memo specified while measurement, this message is displayed.	-66- -72-
Impossible to create the rotation matrix for lack of enough points. Press [Enter]	In designed data measurement or position measurement, if the specified designed data was less than three(3) or two(2), this message is displayed. When the same designed data was assigned more than once, it is counted as one(1) point.	The same as the above.
Relative relation of points is beyond the allowable. Press [Enter]	In designed data measurement or position measurement, if the error between relative relations of designed data and measured data during new measurement or linking measurement exceeds the allowable one defined in the environmental settings, this message is displayed.	-68- -74-
Relative relation of points appoaches linear. Press[Enter]	In designed data measurement or position measurement, if the measured data points are on-line (linear relation) during new measurement or linking measurement, this message is displayed.	The same as the above.

Massage	Application	Ref. page
This filename is not using. Press [Enter]	If there exists the same file name of which you input in a newly standard measurement or a file copy function, this message is displayed.	-39- -61- -64- -120-
There isn't design data file. Design data file is necessary for this data. Press[Enter]	In designed data measurement or position measurement, if there is not the designed data file which is assigned, this message is displayed.	-65- -71-
There is the data file for measuement Please use another file name. Press[Enter]	While receiving the data file, if there exists the designed data file which has the same file-name that is assigned, this message is displayed.	-129-
Impossible to use setting-out function when conducting measurement based on demonstration data. Press[Enter]	In the simulation of a measurement using the demonstration data, if you try to use the setting-out function, this message is displayed.	-38-

Massage	Application	Ref. page
Impossible to change number of points for standard measurement Press[Enter]	In the standard measurement, if you try the setting-out function assigning the numbers of the points, this message is displayed.	-53-
<Enlarge/Rotat/Move> Notice that data are possible to be tem-peatue compensated when they are to be merged. 1.YES 2.NO <@TEST> (12)	When a temperature compensation is applied to the merged data, this message is displayed.	-111-
The link points is more than measmt. points,adjust it please. Press[Enter]	In the linking measurement, if the number of the measured data is smaller than that of the link points assigned in environmental settings, this message is displayed.	-60-
There is no enough points of designed data. Press[Enter]	If the number of the designed data is smaller than three(3) or two(2), this message is displayed.	-65- -71-

Massage	Application	Ref. page
There is no enough points of measuement data. Press[Enter]	In receiving the data file, if the number of the received data is smaller than three(3) or two(2), this message is displayed.	-129-
Designed-data to measud data is imossible Press[Enter]	While editing the designed data in [5] analysis function, if [5-1-5] menu is selected, this message is displayed.	-112-
Designed-data is not tempeatue compensation. Press[Enter]	While editing the designed data in [5] analysis function, if "4-3" menu is selected, this message is displayed.	-111-