3.2 Data Memory Functions

Two data memory functions are provided : the function that allows data measurements to be stored into the internal memory of the R6871E/E-DC, and the function that allows the desired number of stored data measurements to be read out. The R6871E/E-DC can store up to a maximum of 1000 data samplings (measurements) into its internal memory.

This section describes the methods of storing data measurements into the memory and the methods of reading out stored data.

The data memory functions provide a wide variety of applications because they make it possible to capture high speed events, to capture single events due to pre-triggering and delayed triggering, and to make various types of computations on the same type of data prior to readout operations.

3.2.1 Data Numbers (Required for Storage of Measured Data)

The data numbers refer to the numbers that are automatically assigned to all sets of measured data prior to storage of the data into the internal memory (hereinafter referred to as the data memory).

With the data numbers, it becomes possible to read out the desired data from the data memory.

If data were stored without being numbered, it would become impossible to specify data since no distinction would be drawn between the desired data and other data.

Thus, data is automatically numbered by the corresponding function of the data memory prior to storage. Numbering of data makes it possible to read out the desired data directly from the data memory.

Please note that the manner of automatic data numbering differs according to the method of storing measured data into the data memory.

3.2.2 Methods of Storing Measured Data into the Data Memory

(1) When measured data is stored into the data memory :

If the [STORE] lamp is on at the occurrence of measured data, then the data is stored into the data memory.

The [STORE] lamp turns on when the [STORE] key is pressed.

The [STORE] lamp alternates between its 'on' and 'off' states each time the [STORE] key is pressed. It should be noted, however, that the data numbering manner differs according to the manner of data storage, that is, according to the type of sampling mode selected or the presence/absence of connected trigger inputs.

(2) When stored data disappears :

① Stored data disappears from the data memory if : Power is turned off.

② The [STORE] lamp is made to go out and then come back on.

(3) Parameters related to storage

Parameters related to storage of measured data into the data memory are listed in Table 3-1, in which the parameters are classified according to the type of sampling mode (RUN, SINGLE, or MULTI) and the presence/absence of connected trigger inputs.
Check the relationship between 'SI', 'DELAY', or 'NS' parameters and storage operation prior to setting these parameters.

(4) Parameters related to store operation
Parameters 'SI', 'TD', and 'NS' are related to store operation when measured data is stored into the data memory. These parameters, however, do or do not become concerned with store operation, depending on the sampling mode and the presence/absence of trigger inputs.
This relationship is shown in Table 3-1. Set these parameters only after checking their relationship to storage operation.
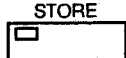
Table 3-1   Relationship Between the Parameters and Storage Operation

	RUN		SINGLE	MULTI
	Without trigger	With trigger		
SI	①	②	—	③
DELAY	—	—	④	⑤
NS	—	⑥	⑦	⑧

(Description)
The relationship between the three parameters and storage operation is described follows.

①②③   :   Measured data is stored into the data memory at the sampling interval that has been set using the 'SI' parameter.

④⑤   :   Storage operation starts after the trigger delay time that has been set using the 'DELAY' parameter elapses following input of the trigger signal.

⑥⑦⑧   :   The volume or measured data that corresponds to the number of sampling operations that has been set using the 'NS' is stored into the data memory after the trigger signal has been input.

In the RUN mode, however, storage operation starts when the [STORE] key lamp has come on. In this case, data numbers are involved.

In the above description, trigger input refers to the following cases :

①   When the [TRIG] key on the R6871E/E-DC front panel has been pressed

②   When an external signal has been input via the EXT.
TRIGGER connector located on the R6871E/E-DC rear panel

③   When the 'E' or 'GET' command, which corresponds to a trigger, has been input via GPIB
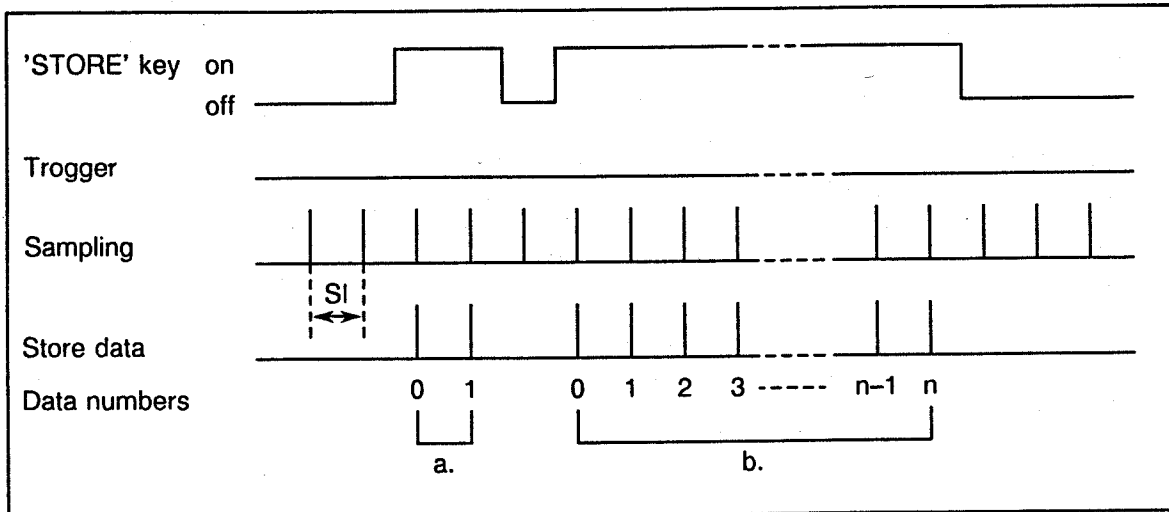
(5) Sampling mode : RUN
If the selected sampling mode is RUN, take care when reading out data from the data memory, because the data numbers that are assigned to data stored differ according to the presence or absence of trigger signal inputs.
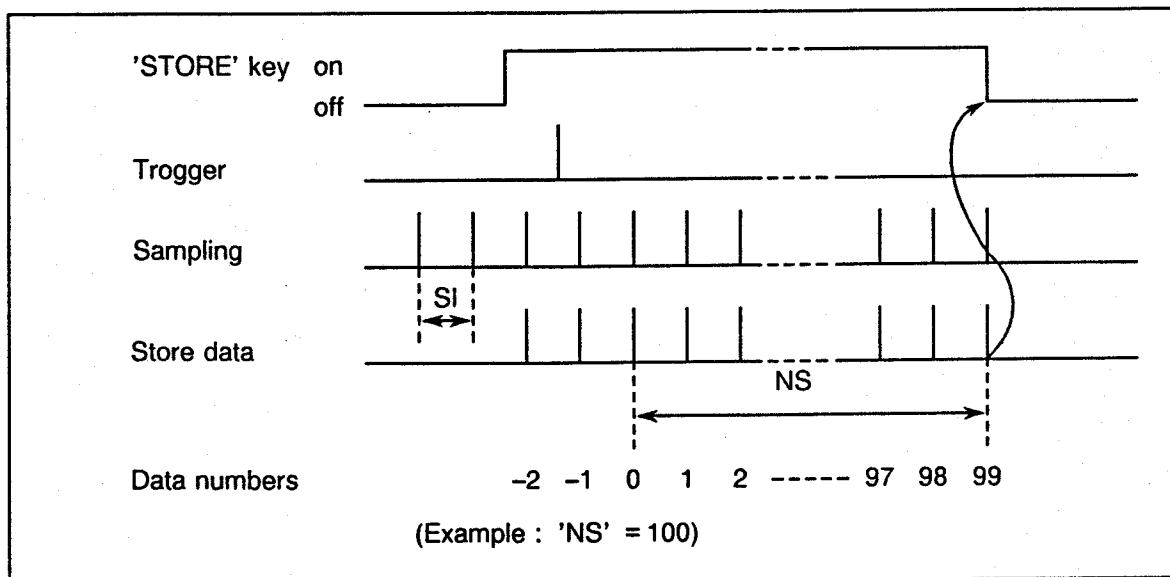
① If trigger signals are not input

(Description)

ⓐ In the RUN mode, data can be stored at any time while the [STORE ▢] key lamp stays on.

ⓑ If no trigger signal inputs are present, the first data stored when the [STORE ▢] key lamp has turned on is numbered "0".

ⓒ Data storage terminates immediately if the [STORE ▢] key is turned off.

ⓓ Data in the section, [STORE ▢] , disappears next time the [STORE ▢] key lamp turns on.

ⓔ If the total number of data samplings has exceeded 1000, then the excess amount of data disappears starting with the oldest data first.

ⓕ Data is stored at the interval that has been set using the 'SI' parameter.

② If trigger signals are input

(Example : 'NS' = 100)

(Description)

ⓐ In the RUN mode, data can be stored at any time while the [STORE ⬜] key lamp stays on.

ⓑ If trigger signal inputs are present, the first data that stored when the trigger signal has been input is numbered "0".

ⓒ Data storage terminates immediately if the [STORE ⬜] key is turned off.

ⓓ The [STORE ⬜] key lamp automatically turns off when the number of data samplings that has been set using the 'NS' parameter is stored into the data memory following input of the trigger signal.

ⓔ Data is stored at the interval that has been set using the 'SI' parameter.

[Applications]

This mode can be applied when it is desired that during data storage into the data memory, trigger signals be automatically input at the time of the occurrence of a storage error in order to make an error-cause check from the data existing before and after the error (that is, the data immediately preceding and succeeding the one numbered 0).

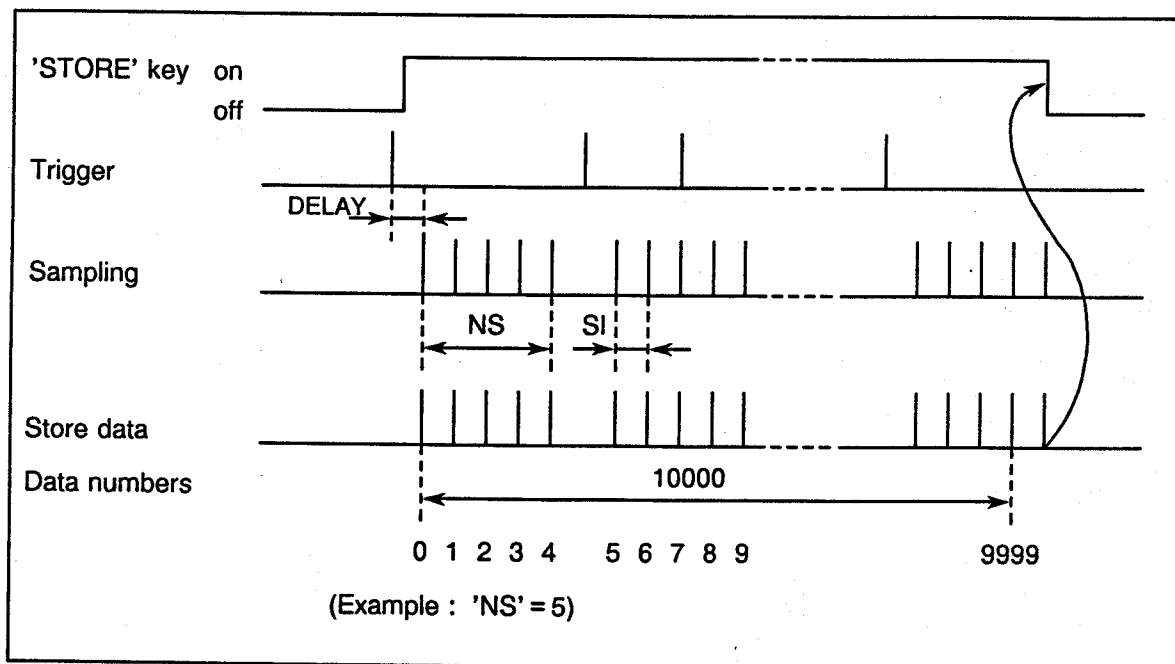(6)   Sampling mode :   SINGLE

(Example : 'NS' = 1000)

(Description)

ⓐ   If the [STORE □] key lamp is on, input of a trigger signal causes data firstly to be
     sampled after the trigger delay time that has been set using the 'DELAY' parameter has
     elapsed an then to be stored into the data memory.

ⓑ   One data sampling is stored by one trigger signal input.

ⓒ   The [STORE □] key lamp automatically turns off when trigger signals as many as there
     have been data samplings set using the 'NS' parameter are input and the corresponding
     volume of data is stored.

ⓓ   Data storage terminate immediately if the [STORE □] key is turned.

ⓔ   The data storage internal is the same as the trigger signal input interval.
     If the next trigger signal is input before the end of sampling, that signal will be ignored.

(7) Sampling mode: MULTI

(Example : 'NS' = 5)

(Description)

(a) If the [STORE] key lamp is on, input of a trigger causes data firstly to be sampled after the trigger delay time that has been set using the 'DELAY' parameter has elapsed and then to be stored into the data memory.

(b) The number of data sampling that has been set using the 'NS' parameter are stored by one trigger signal input.

(c) Data storage terminates immediately if the [STORE] key is turned off.

(d) Data is stored at the interval that has been set using the 'SI' parameter.

(e) The [STORE] key lamp automatically turns off when up to a maximum of 10000 data samplings are stored into the data memory.

If the next trigger signals is input before completion of sampling of the number of data sets that has been set using the 'NS' parameter is completed, that signal will be ignored.

## 3.2.3 Methods of Reading Out Data from the Data Memory

(1) Types of data readout modes available

Either the stepped output mode or the continuous output mode is available for reading out data from the data memory.

In the stepped output mode, the desired number of data samplings can be read out, one at a time, from the data memory.

In the continuous output mode, the desired number of data samplings can be read out continuously from the data memory.

(2) Data output in the stepped output mode
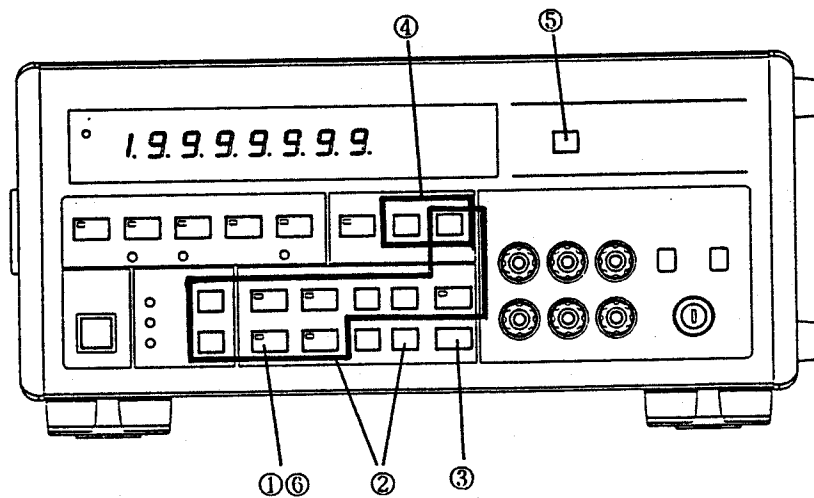
$$\left[\begin{array}{l} \text{These numbers indicate the} \\ \text{following procedure numbers} \end{array} \right]$$

Setting of the recall mode

(1) Press the [RECALL] key.

The [RECALL] key lamp will light the recall mode that allows data reading from the data memory will be set, and the existing number of data samplings stored within the data memory will be displayed on the LCD unit.

$$n \, n \, n \, n \, M \, R$$

nnnn: Number of stored data samplings (Integer from 1 to 10000)

Setting of the data number and display of the desired data

(2) Input the data number of the desired data.

(Example)
To input 23, press [SHIFT] 2[ ] 3[ ], in this order.

$$2 \, 3 \, N \, O$$

↑
Data number
Data number : −9999 to 9999

CAUTION

Be sure to press [SHIFT] before setting values (data number and the number of data sampling to be output.)

---

(3) Press the [ENTER] key.

The data that has the input data number will then be displayed on the LCD unit.

<u>Stepped output of data</u>

(4)

ⓐ If data that is larger by one data a number than that currently being displayed is to be displayed :

Press ⌷ (UP) just once.

Every keystroke of ⌷ (UP) causes display of the data that is larger by one data number than that being displayed at that time.

ⓑ If data that is smaller by one data number than that currently being displayed is to be displayed :

Press ⌷ (DOWN) just once.

Every keystroke of ⌷ (DOWN) causes display of the data that is smaller by one data number than that being displayed at that time.

<u>End of the stepped output mode</u>

(5) Press ⌷ (HO) .

The LCD display will then return to the state exiting when the recall mode was set, that is, the display of the existing number of data samplings stored within the data memory.

The ⌷ (HO) key functions as the HOME key while the recall mode remains set.

[Selection between data number display and data display]

While data stays on the display, press [CHANGE] if it is desired to know the data number of the displayed data or if is desired to change the data number display state over to the data display state.

Every keystroke of [CHANGE] causes the LCD display to alternate between data number display and data display.

[If data that is greatly different in data number is to be read out]

Readout of data that is greatly different in data number takes time if [UP] or [DOWN] are used. In such a case, therefore, first press HO[ ] just once (this causes the display procedural step (1) above to reappear) and then set the desired data number and read out the data.

End of the recall mode

(5) Press [RECELL] .
    The recall mode will end and the

    [RECELL] key lamp will go out.

[An example of operations in the stepped output mode]

An outline of the operation example given below :

ⓐ The method that has been described in the section of the sampling mode SINGLE is taken as an example.

ⓑ The number of data samplings that have been stored is 1000.

Key input and data display	Explanation

① Press [RECALL].

1 0 0 0 M R

The equipment enters the recall mode, and the total number of data samplings that have been stored is displayed on the LCD unit.

② Press [SHIFT].

N O

The data number input mode is set.

③ Press keys ¹[ ] ⁰[ ] ⁰[ ] [ENTER], in that order.

1 7. 8 9 0 0 1 V

Data that has data number "100" is read out.

④ Press [UP].

1 7. 8 9 0 0 0 V

Data that has data number "101" ("100" plus "1") is displayed.

⑤ Press [UP].

1 7. 8 9 9 9 9 V

Data that has data number "102" ("101" plus "1") is displayed.

⑥ Press [CHANGE].

1 0 2 N O

The display changes from data display over to data number display.

Key input and data display	Explanation

⑦ Press DOWN DOWN □ □ .

1 0 0 N O

Data that has data number "100" ("102" minus "2") is read out once again.

⑧ Press UP □ .

1 7 . 8 9 0 0 1   V

The display changes from data number display over to data display.

⑨ Press HO□ .

1 0 0 0 M R

The display state existing when the recall mode was set is resumed.

⑩ Press SHIFT □ .

N O

The data number input mode is set.

⑪ Press keys 1□ 0□ 0□ 0□
ENTER
□ , in that order.

E r r o r   8

Although an attempt has been made to read out data that has data number "1000", the data does not exist and thus an error message is displayed.

⑫ Press SHIFT □ .

N O

The data number input mode is set.

Key input and data display	Explanation

⑬ Press keys 9☐ 9☐ 9☐ [ENTER], in that order.

1 7. 8 9 0 1 0   V

Data that has data number "999" is read out.

⑭ Press ☐ (UP).

E r r o r   8

Although an attempt has been made to read out data that has data number "1000" ("999" plus "1"), the data does not exist and thus an error message is displayed. At this time, data number "999" stays on the display.

⑮ Press ☐ (DOWN).

1 7. 8 9 0 0 9   V

Data that has data number "998" ("999" minus "1") is read out.

⑯ Press [RECALL].

The recall mode ends.

(3)   Data output in the continuous output mode
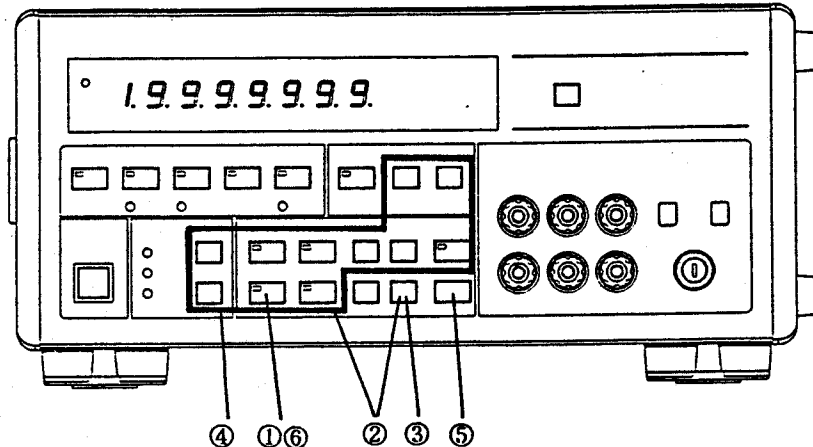
④ ①⑥   ② ③ ⑤

$$\begin{bmatrix} \text{These numbers indicate the} \\ \text{following procedure numbers} \end{bmatrix}$$

Setting of the recall mode

(1) Press the [RECALL □] key.

The [RECALL □] key lamp will light, the recall mode that allows data reading from the data memory will be set, and the existing number of data samplings stored within the data memory will be displayed on the LCD unit.
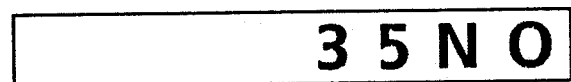
n n n n n M R

nnnn: number of stored data
         samplings
         (Integer from 1 to 10000)

Setting of the data number

(2) Input the data number of the desired data.

(Example)
To input 35, press [SHIFT □] ³[□] ⁵[□] ,
in this order.

3 5 N O

↑

Data number
Data number :   −9999 to 9999

```
┌──────────────────── CAUTION ──────────────────────────┐
│                  SHIFT                                 │
│                 ┌───┐                                  │
│ Be sure to press│   │ before setting values (data number and the number of data │
│                 └───┘                                  │
│ samplings to be output).                              │
└───────────────────────────────────────────────────────┘
```

(3) Press ┌───┐ SHIFT to set the desired number
         └───┘
of data samplings to be read out.

<u>Setting of the number of data samplings to be read out</u>

(4) Set the desired number of data samplings
to be read out.
This value must be input with either a
plus or a minus sign preceding the value.
If a plus value is input, data will be read
out starting sequentially with the input
data number through subsequent ones.
If a minus value is input, data will be read
out starting sequentially from the input
data number to preceding ones.

(Example)
To read out 10 data samplings from data
number 20 through 29 in that order, input
data number 20 in procedural step (2)
and then set 10 (or +10) as the number
of data samplings to be read out.

```
┌──────────────────────────┐
│          1 0 N S         │
└──────────────────────────┘
```

(Example)
To read out 10 data samplings from data
number 20 back to 11 in that order, input
data number 20 in procedural step (2)
and then set -10 as the number of data
samplings to be read out.

```
┌──────────────────────────┐
│        – 1 0 N S         │
└──────────────────────────┘
```

Data readout

(5) Press [ENTER] .

The specified number of data samplings
will then be read out starting sequentially
with the input data number first.
After completion of readout of the
specified range of data, the display state
becomes that which existed in procedural
step (1) above.

End of the recall mode

(5) Press [RECALL] .

The recall mode will end and the

[RECALL] key lamp will go out.

[An example of operations in the continuous output mode]

An outline of the operation example given below :

ⓐ The method that has been described in the section of the sampling mode RUN is taken
as an example.

ⓑ The 'NS' parameter has been set to 10 and trigger signals are have been input during
storage.

ⓒ The number of data samplings that have been stored is 103.

Key input and data display	Explanation

① Press [RECALL ▭]

$$1\ 0\ 3\ M\ R$$

The R6871E/E-DC enters the recall mode, and the total number of data samplings that have been stored is displayed on the LCD unit.

② Press [SHIFT □].

$$N\ O$$

The data number input mode is set.

③ Press keys - □ 2 □ , in that order.

$$-\ 2\ N\ O$$

Data number "-2" is set.

④ Press [SHIFT □].

$$N\ S$$

The display state changes from data number display to display of the number of data samplings to be read NS out. This allows setting of the number of data samplings to be read out.

⑤ Press keys 1 □ 0 □ [ENTER ▭] , in that order.

$$1\ 2\ 3\ .\ 4\ 5\ 6\ K\ \Omega$$

$$1\ 2\ 3\ .\ 4\ 5\ 0\ K\ \Omega$$

$$1\ 0\ 3\ M\ R$$

The total number of data samplings to be read out is set to 10 and the readout operation begins. Ten data samplings starting with data number "-2" (that is "-2", "-1", "0", "1", "2", - - - - , in that order) are read out continuously.
[Two data samplings (data number -2 and -1) existing before a trigger was input and eight data samplings (data number 0 through 7) existing after the trigger was input are read out continuously.] After complete of readout, the display state existing when the recall mode was entered (that is, the display of 103 as the total stored number of data samplings) will be resumed.
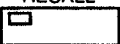
Key input and data display	Explanation

⑥ Press ☐ (SHIFT).

```
                    N O
```

The data number input mode is set.

⑦ Press 9☐ .

```
          9 N O
```

Data number "9" is set.

⑧ Press ☐ (SHIFT).

```
                    N S
```

The display state changes from data number display over to display of the number of data samplings to be read out. This allows setting of the number of data samplings to be read out.

⑨ Press keys -☐ 1☐ 0☐ 3☐
ENTER ☐ , in that order.

```
       - 1 0 3 N S
```

```
  1 2 3 . 4 5 0  K Ω
```

```
  1 2 3 . 4 5 7  K Ω
```

The total number of data samplings to be read out is set to -103 and the readout operation begins. 103 data samplings starting with data number (that is, "9", "8", "6", "5", – – –, in that order) are read out continuously. [10 data samplings (data number 9, 8, 7, – – –) existing after a trigger was input and 93 data samplings (data number –1, –2, – – –, up to –93) existing before the trigger was input are read out continuously.]

```
       1 0 3 M R
```

After completion of readout, the display state existing when the recall mode was entered (that is, the display of 103 as the total stored number of data samplings) will be resumed.

Key input and data display	Explanation

⑩ Press [RECALL] .

The recall mode terminates.