

OM.MEB/MEM7102.02

# *OPERATOR'S MANUAL*

## **Neuropack 2 EMG/Evoked Response Examination Guide**

**MEB-7102**

**MEM-7102**

**MEB-7102A  
MEB-7102K  
MEM-7102A  
MEM-7102K**

**2076-000722A**

 **NIHON KOHDEN**

# GENERAL HANDLING PRECAUTIONS

*This device is intended for use only by qualified medical personnel.*

Please read these precautions thoroughly before attempting to operate the instrument.

**1. To satisfy and effectively use the instrument, its operation must be fully understood.**

**2. When installing or storing the instrument, take the following precautions:**

- (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dusty saline or sulphuric air.
- (2) The instrument should be placed on an even, level floor. Vibration and mechanical shock should be avoided even during moving.
- (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
- (4) The power line source to be applied to the instrument should correspond in frequency and voltage to specifications, and have allowable current capacity.
- (5) Choose a room where a proper grounding facility is available.

**3. Before Operation**

- (1) Check that the instrument is in perfect operating order.
- (2) Check that the instrument is grounded properly.
- (3) Check that all cords are connected properly.
- (4) Pay extra attention when the instrument is in combination with other instruments to avoid misdiagnosis or other problems.

(5) All circuitry used for direct patient connection must be doubly checked.

(6) Check that battery voltage and battery condition are perfect when using battery-operated models.

**4. During Operation**

- (1) Both the instrument and the patient must receive constant, careful attention.
- (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
- (3) Avoid direct contact between the instrument and the patient.

**5. To Shutdown After Use**

- (1) Turn power off with all controls returned to their original positions.
- (2) Remove the cords gently; do not use force to remove them.
- (3) Clean the instrument together with all accessories to keep them ready for their next use.

**6. The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

**7. The instrument must not be altered or modified in any way.**

#### **8. Maintenance and Inspection:**

- (1) The instrument and parts should undergo regular maintenance inspection at least every 6 months.
- (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

**9. When the instrument is used with an electrosurgical instrument, careful attention should be paid to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.**

**10. When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.**

## **WARRANTY POLICY**

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for NKC's products. NKC will not recognize any other warranty, either implied or in writing. In addition, service performed by someone other than NKC or its authorized agents or technical modification or change of products without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

In the USA and Canada other warranty policies may apply.

## ELECTRIC STIMULATOR HANDLING PRECAUTION

Do not stimulate a PATIENT with an implanted electronic device (for example a cardiac pacemaker) unless the medical opinion of a specialist has first been obtained.

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- 1 **EMG** (Spontaneous potential EMG : 不随意筋電図)
- 2 **MUAP** (Motor Unit Action Potential : 運動単位活動電位)
- 3 **INTERF** (Interference Pattern : 干涉波形)
- 4 **SURFAC** (Surface EMG : 表面筋電図)

## 1 EMG (Spontaneous Potential EMG)

### ◆ Description of Examination

This menu is used to measure an insertion action potential and an EMG at rest with a needle electrode inserted into the muscle to be examined.

The menu permits not only continuous EMG recording but also EMG observation on cascaded waveform display and MUAP analysis of stored waveforms.

### ◆ Electrodes Required

**EMG needle electrode:** Concentric needle electrode or bipolar needle electrode

**Ground electrode:** NM-511S, NM-522S or NM-531S

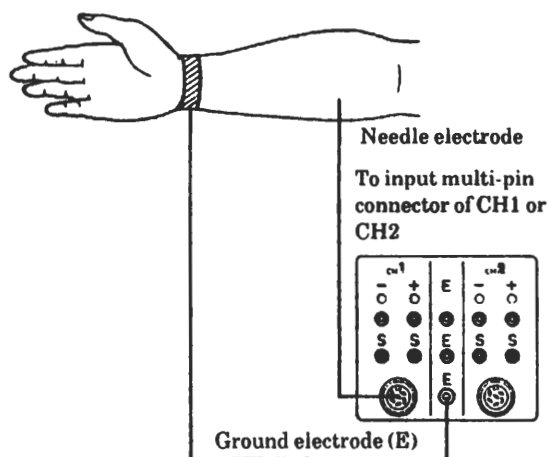
**Extension cord:** BM-111S (for concentric needle electrode) or BM-211S (for bipolar needle electrode, optional)

### ◆ Preparing the Patient

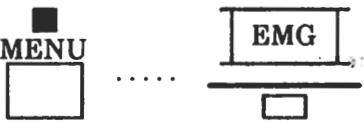
- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Fully sterilize the electrode. Insert it after wiping the insertion location with alcohol.
- Put the electrode insertion location under a surface anesthetic beforehand if necessary.
- Have the patient relax during the examination so that contractions will occur only in the examined muscle.

### ◆ Electrode Placement

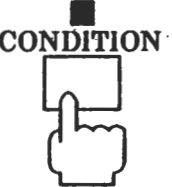
1. Connect the fully sterilized needle electrode to the extension cord and connect the input connector of the cord to the electrode junction box. Insert the needle electrode into the muscle to be examined.
2. Immerse the ground electrode in a physiological saline solution and wind it around the extremity near the inserted needle electrode location.
3. When using the needle electrode, do not make any impedance check.



◆ Measurement

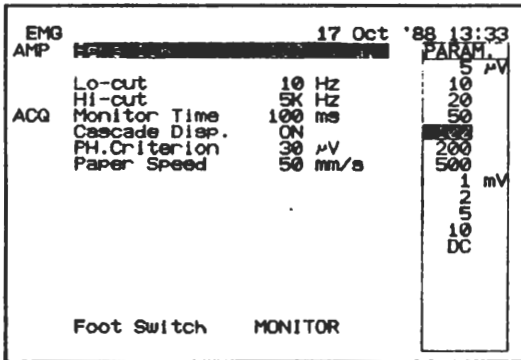
- 

Press the MENU key to display the menu screen.  
Select the EMG mode according to the procedure of menu selection.

- 

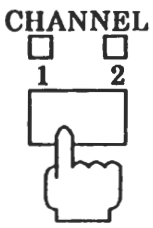
Check the condition by pressing the CONDITION key.

Condition Screen

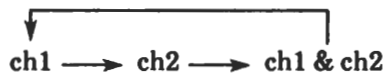



\* Foot switch operation

- Press the foot switch for MONITOR screen.
- Release the foot switch for STOP screen.


- 

Select a channel to be used by pressing the CHANNEL key.  
In the EMG mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

Monitor the input waveform by pressing the MONITOR key (by engaging the foot switch).

- 

Set the monitor sound volume with the monitor volume control.

- Insert the needle electrode into the muscle to be examined.

[NOTE]

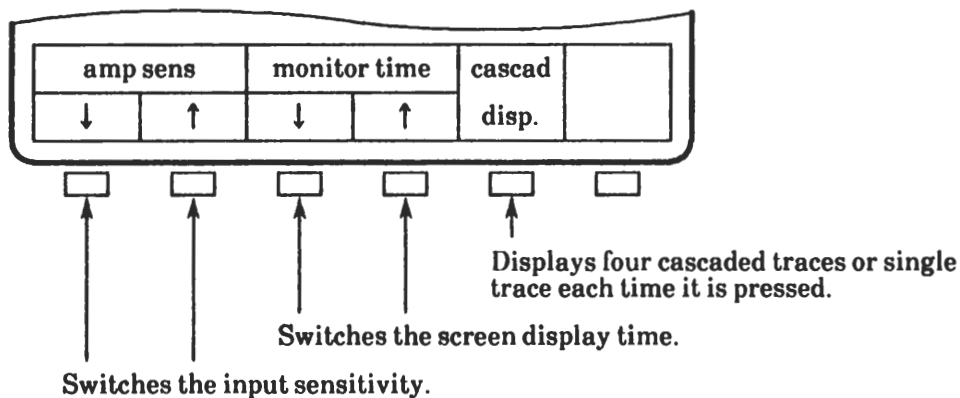
To record the insertion potential, start direct recording by pressing the RECORD key beforehand.



7. With the patient's cooperation, adjust the electrode location in the muscle being examined and observe the action potential when muscle is relaxed and when it is voluntarily contracted with the monitor screen and monitor sound.


### ◆ Monitor Screen


#### Function keys



#### Panel key

POSITION ↓ ↑: Moves the displayed trace up and down.

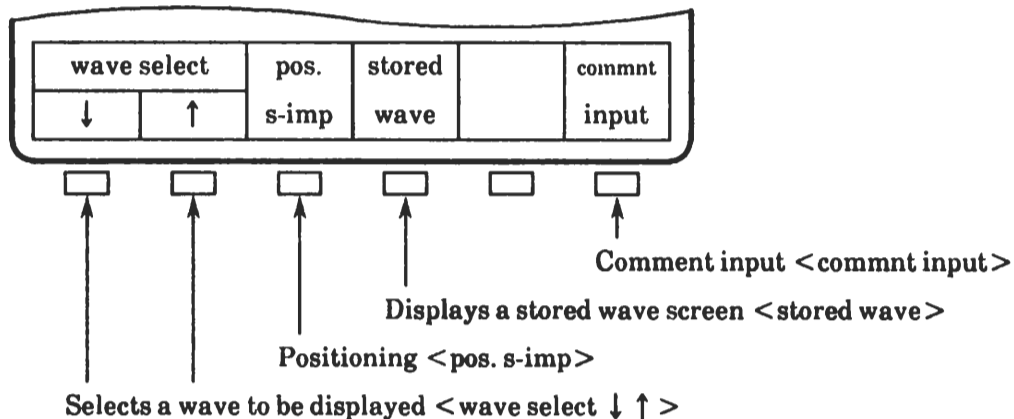
8.  When an appropriate waveform appears, record it by pressing the RECORD key.
- Direct recording: Continuously records the monitor waveform.

9.  Press the STOP key to store a waveform or make a hard copy of the screen. (Foot switch operation: Release the foot switch for STOP screen.)

- \* When the cascaded display is not selected on the MONITOR screen, the last one trace appears and freezes on the STOP screen. When it is selected, the last four continuous traces appear and freeze on the STOP screen. The trace at the top on the screen is the last one and the subsequent is the second last, and so on.
- \* Sixteen waveforms are stored in the instrument. When the < wave select ↓ > key is continuously pressed, the screen is scrolled up so that all the waveforms can be observed.
- \* When the RECORD key is pressed, a hard copy of the screen is made.

◆ Stop Screen

Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

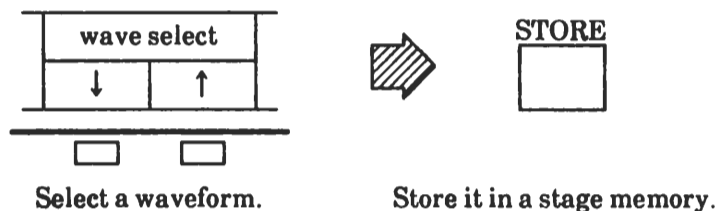
STORE: Stores a waveform.



: LTNCY and AMPTD measurement

(Cursor movement dial)

\* Storing a waveform:



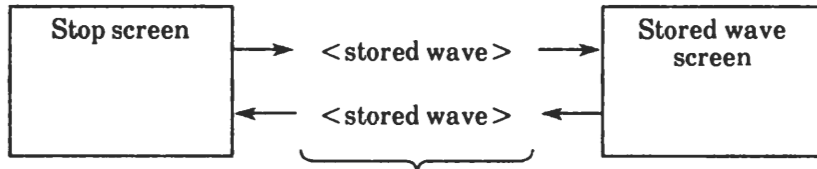
• Eight stages, A – H, are available. One stage is used when a waveform is stored once. Up to eight waveforms can be stored.

\* If the next measurement is made without using the STORE function, the displayed waveform is erased.

\* Observing only stored waveforms:

When the <stored wave> key is pressed, only stored waveforms are displayed. (Stored wave screen)

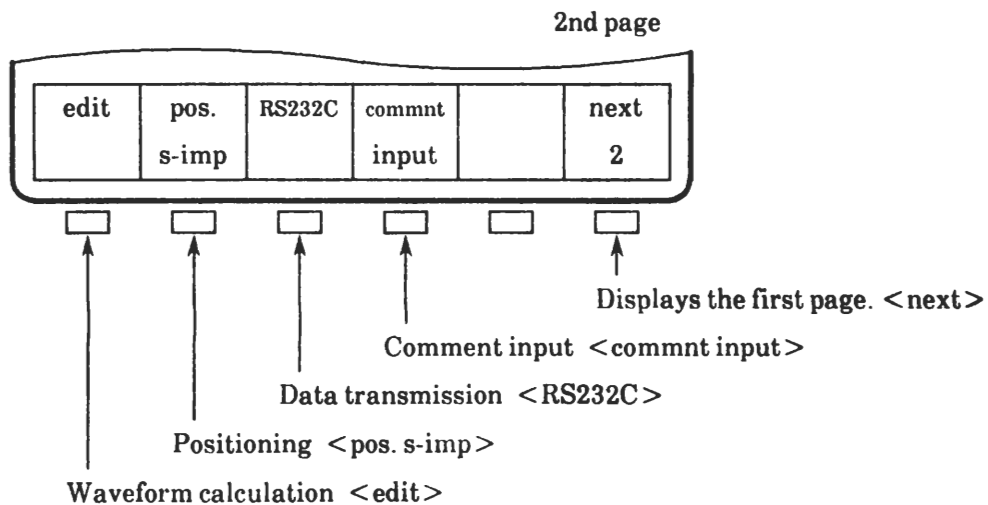
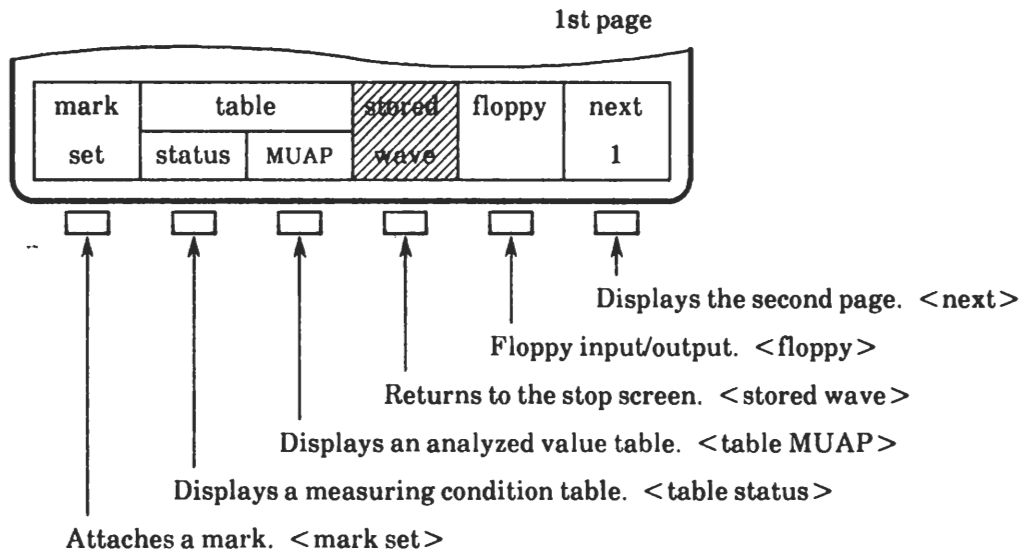
When the same key is pressed again on the stored wave screen, this screen is returned to the stop screen.



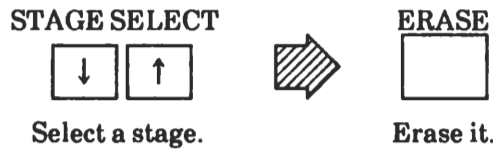
The indication of the <stored wave> key is reverse shaded while the stored wave screen is displayed.

◆ Stored Wave Screen

Function keys



\* Erasing a stored waveform

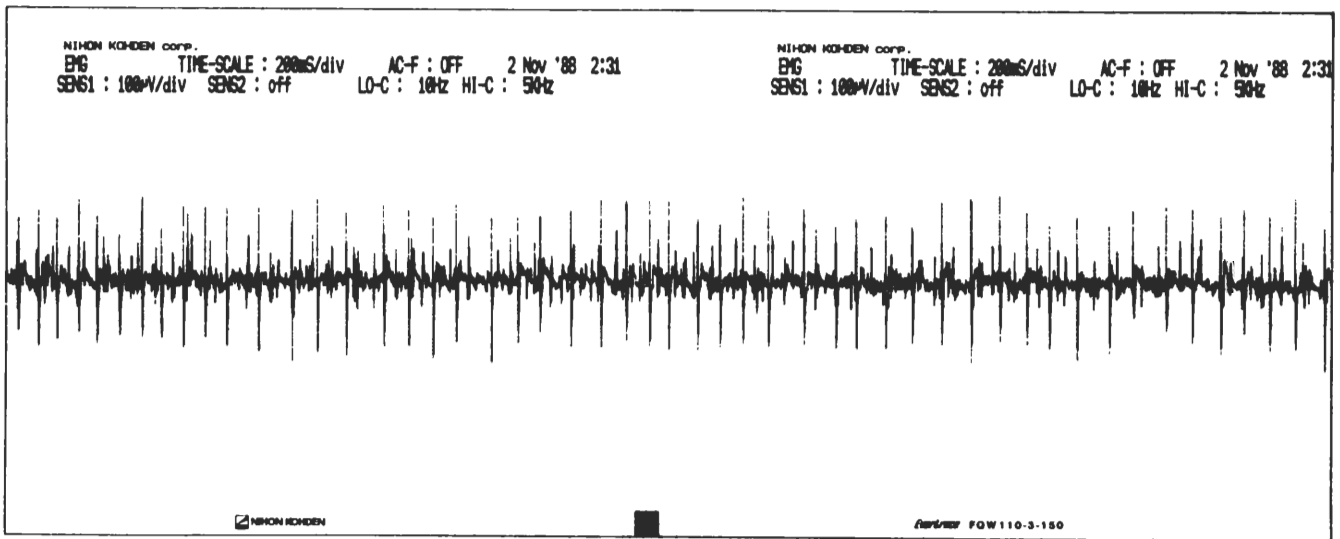


\* On the stored wave screen, an MUAP analysis can be made by using the <mark set> function.

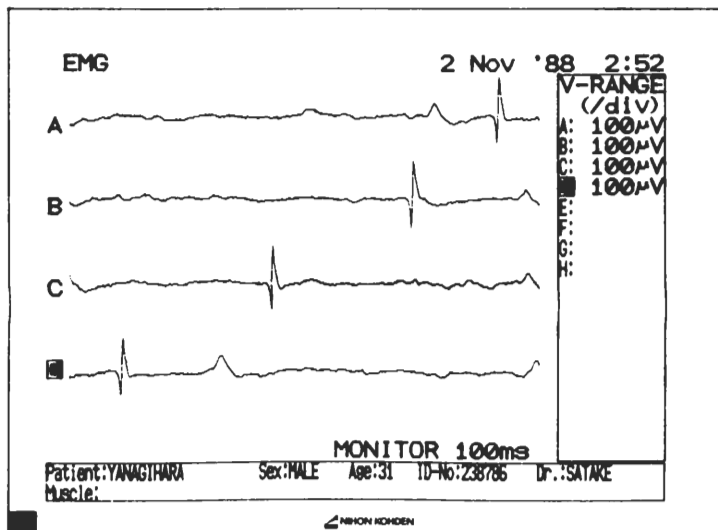
10. Termination of Examination

When EMG or MUAP is selected as the next examination menu, all waveforms are saved. If any menu other than EMG or MUAP is selected, all the waves are erased.

Recording sample: Direct recording



Recording sample: Hard copy



## 2 MUAP (Motor Unit Action Potential)

### ◆ Description of Examination

This menu, used to measure a single MUAP (Motor Unit Action Potential), trigger-sweeps the CRT screen with an MUAP waveform emitted synchronously during a weak voluntary muscle contraction caused by the needle electrode.

This menu permits cascaded waveform display of the trigger-swept MUAP waveform and analysis of the stored MUAP waveform.

### ◆ Electrodes Required

**EMG needle electrode:** Concentric needle electrode or bipolar needle electrode

**Ground electrode:** NM-511S, NM-522S or NM-531S

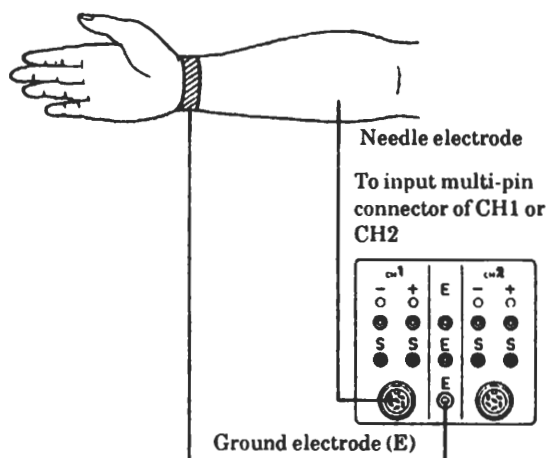
**Extension cord:** BM-111S (for concentric needle electrode) or BM-211S (for bipolar needle electrode, optional)

### ◆ Preparing the Patient

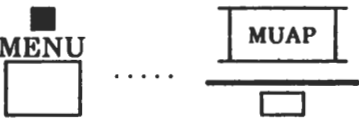
- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Fully sterilize the electrode. Insert it after wiping the insertion location with alcohol.
- Put the electrode insertion location under a surface anesthetic beforehand if necessary.
- Have the patient relax during the examination so that contractions will occur only in the examined muscle.

### ◆ Electrode Placement

1. Connect the fully sterilized needle electrode to the extension cord and connect the input connector of the cord to the electrode junction box. Insert the needle electrode into the muscle to be examined.
2. Immerse the ground electrode in a physiological saline solution and wind it around the extremity near the inserted needle electrode location.
3. When using the needle electrode, do not make any impedance check.

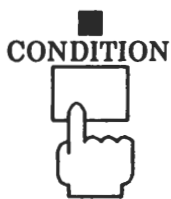


◆ Measurement

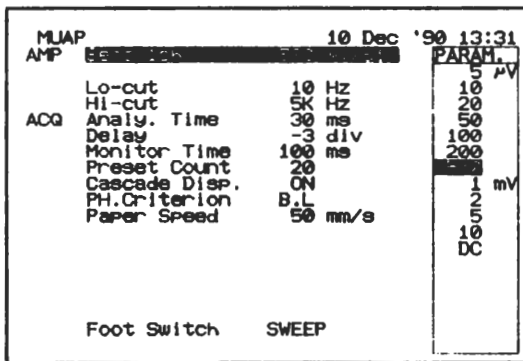
- 

Press the MENU key to display the menu screen.  
Select the MUAP mode according to the procedure of menu selection.

- Check the condition by pressing the CONDITION key.

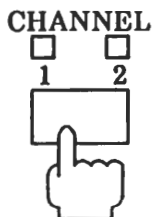


Condition Screen

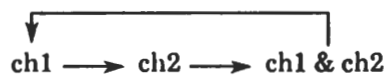


\* Foot switch operation

- Press the foot switch for SWEEP screen.
- Release the foot switch for STOP screen.

- 

Select a channel by pressing the CHANNEL key.  
In the MUAP mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- Monitor the input waveform by pressing the MONITOR key.



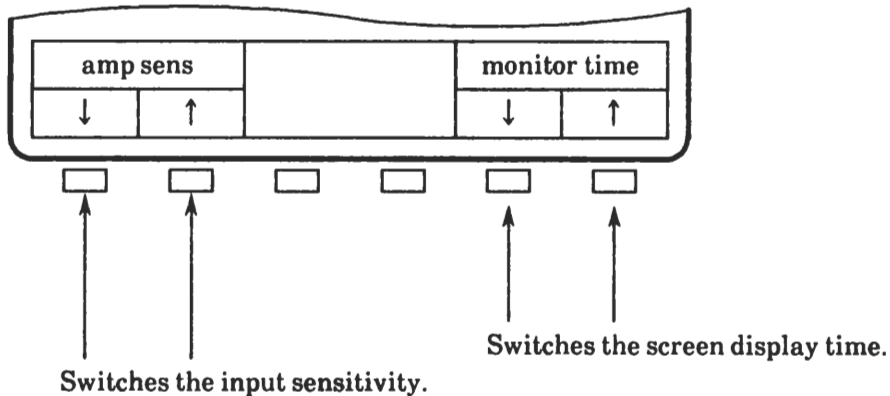
- Set the monitor sound volume with the monitor volume control.



- Insert the needle electrode into the muscle to be examined.

7. With the patient's cooperation, adjust the electrode location in the muscle being examined.

◆ **Monitor Screen**  
Function keys



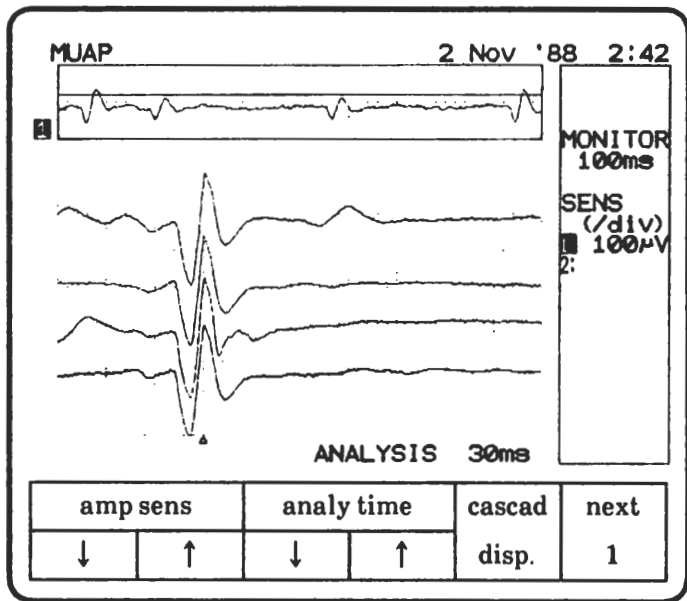
Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

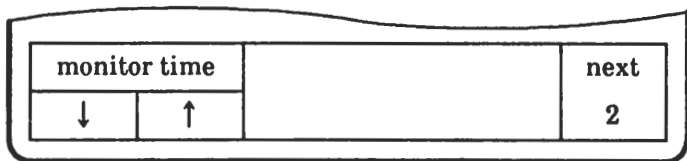
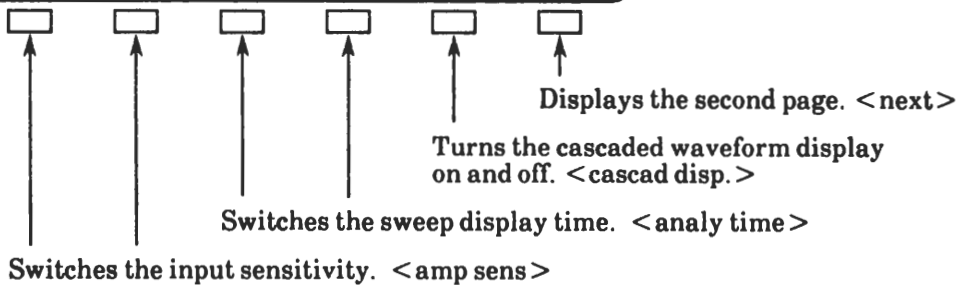
8. Display the sweep screen by pressing the STIM/SWEEP key (engaging the foot switch).



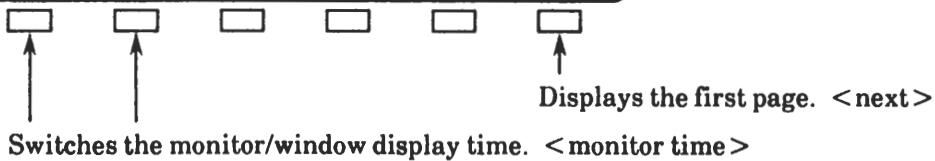
◆ Sweep Screen



1st page



2nd page





On the front panel

VERTICAL GAIN ↓ ↑ : Changes the monitor window display amplitude.



: Moves the level cursor up and down.

(Cursor movement dial)

- \* Set the level cursor near the peak of the monitor waveform in the monitor window. When the monitor waveform exceeds the level cursor, it is triggered and its waveform (MUAP) is displayed as a sweep waveform.

9.



When an appropriate waveform appears, record it by pressing the RECORD key.

- Direct recording: Continuously records the monitor waveform.

10.



Press the STOP key to store a waveform or make a hard copy of the screen. (Foot switch operation: Release the foot switch for STOP screen.)

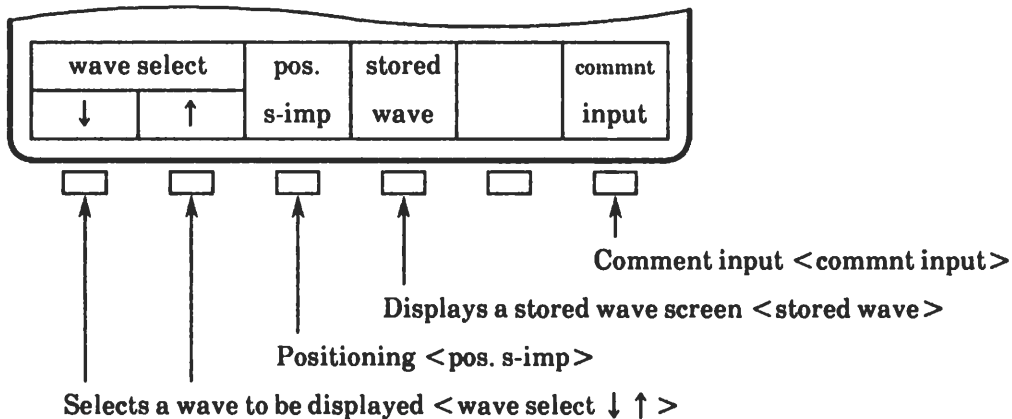
- \* The last four traces triggered by the level cursor appear and freeze on the STOP screen. The first trace at the top on the screen is the last one and the subsequent is the second last, and so on.
- \* Sixteen waveforms are stored in the instrument. When the <wave select ↓ ↑ > key is continuously pressed, the screen is scrolled so that all the waveforms can be observed.
- \* When the RECORD key is pressed, a hard copy of the screen is made.

**[NOTE]**

When the ANALYSIS key is pressed, the MUAPs triggered by the level cursor can be averaged. Before pressing the ANALYSIS key, set the preset count for averaging on the CONDITION screen.

◆ Stop Screen

Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

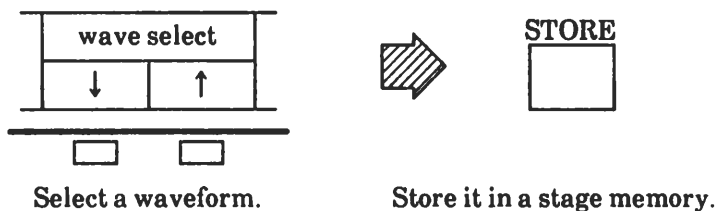
STORE: Stores a waveform.



: LTNCY and AMPTD measurement

(Cursor movement dial)

\* Storing a waveform:



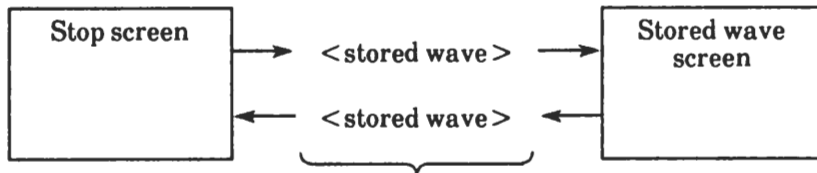
- Eight stages, A – H, are available. One stage is used when a waveform is stored once. Up to eight waveforms can be stored.

- \* If the next measurement is made without using the STORE function, the displayed waveform is erased.

\* Observing only stored waveforms:

When the <stored wave> key is pressed, only stored waveforms are displayed. (Stored wave screen)

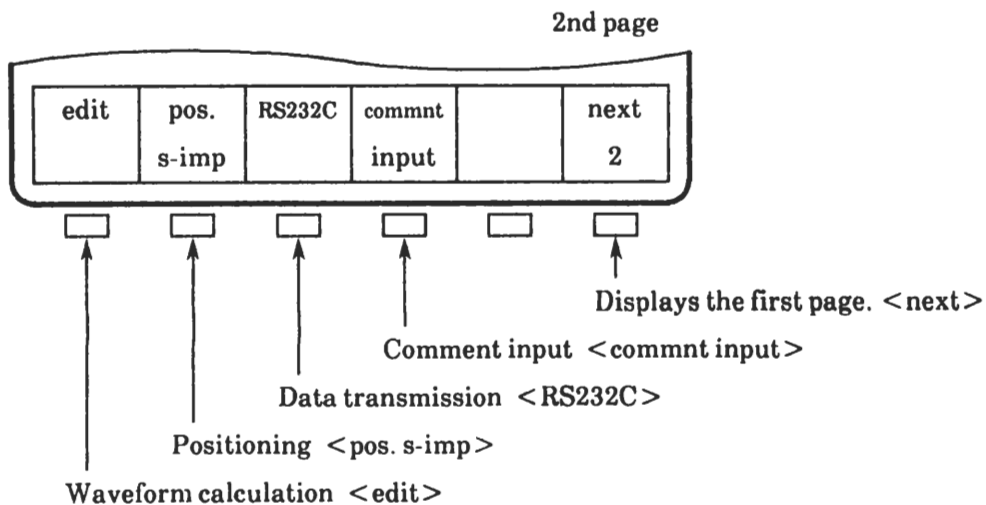
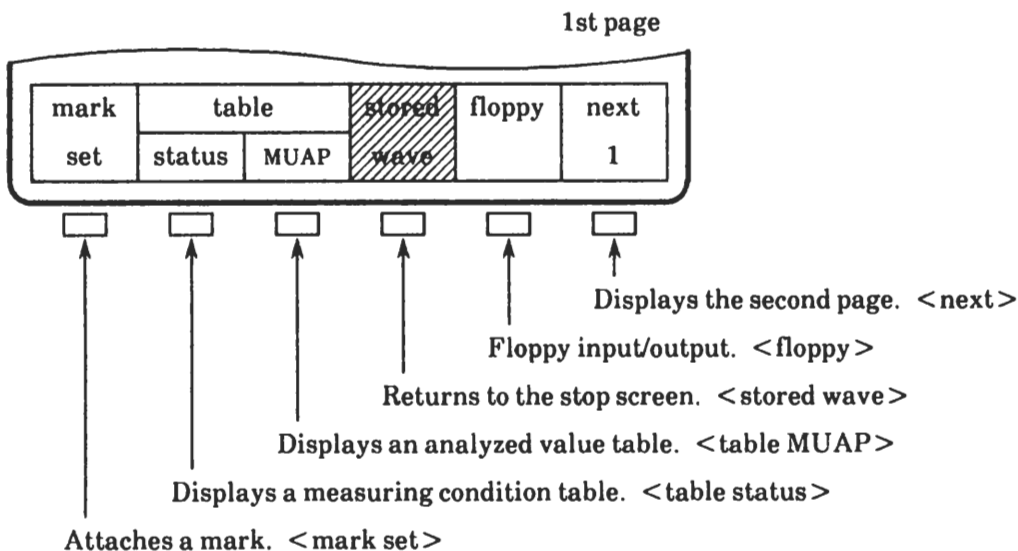
When the same key is pressed again on the stored wave screen, this screen is returned to the stop screen.



The indication of the <stored wave> key is reverse shaded while the stored wave screen is displayed.

◆ Stored Wave Screen

Function keys



\* Erasing a stored waveform

STAGE SELECT



Select a stage.



ERASE



Erase it.

- \* On the stored wave screen, an MUAP analysis can be made by using the <mark set> function.

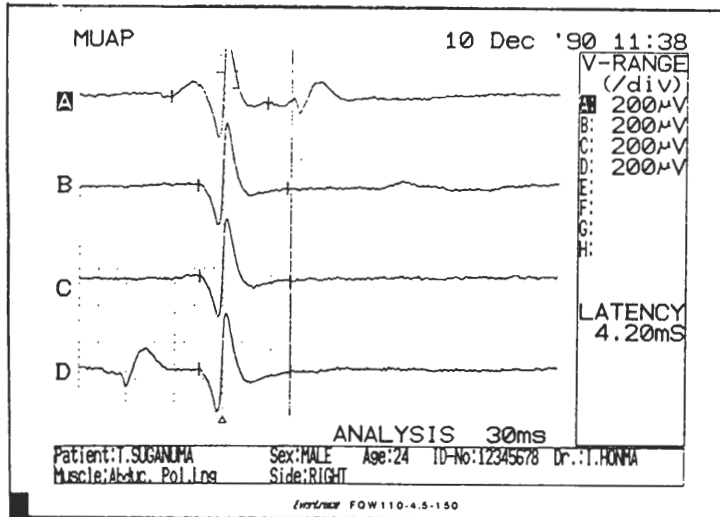
11. Termination of Examination

When EMG or MUAP is selected as the next examination menu, all waveforms are saved. If any menu other than EMG or MUAP is selected, all the waves are erased.

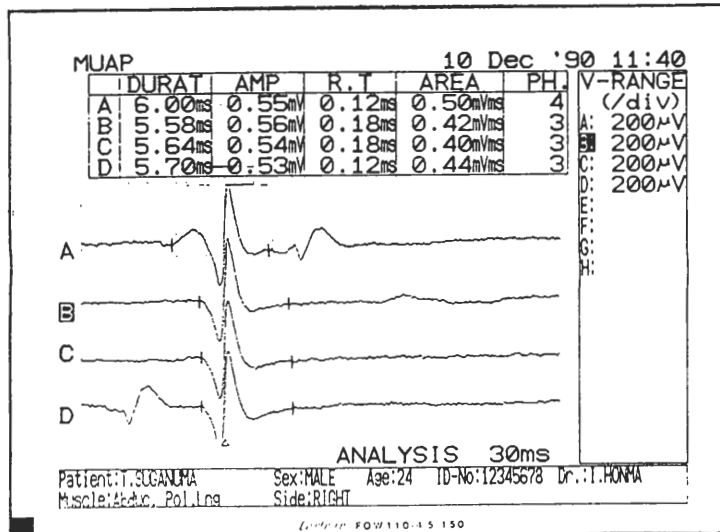
Recording sample: Direct recording



Recording sample: Hard copy



Recording sample: Hard copy of the MUAP table



### 3 INTERF (Interference Pattern)

#### ◆ Description of Examination

This menu is used to record an interference waveform that appears during tetanic contraction of the muscle by using the needle electrode.

The peak/bottom function permits display and recording without degrading the amplitude of fast MUAP frequency components.

#### ◆ Electrodes Required

EMG needle electrode: Concentric needle electrode or bipolar needle electrode

Ground electrode: NM-511S, NM-522S or NM-531S

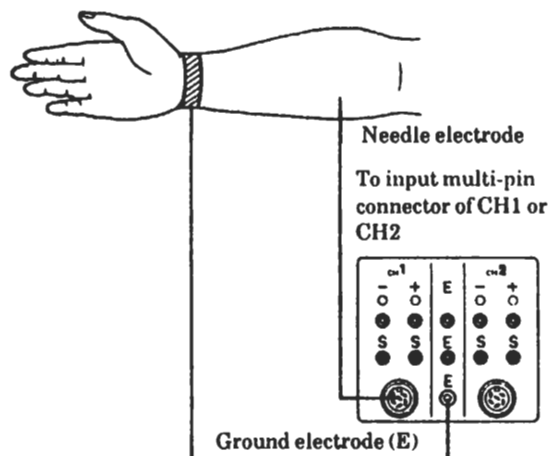
Extension cord: BM-111S (for concentric needle electrode) or BM-211S (for bipolar needle electrode, optional)

#### ◆ Preparing the Patient

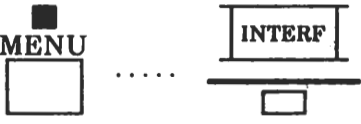
- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Fully sterilize the electrode. Insert it after wiping the insertion location with alcohol.
- Put the electrode insertion location under a surface anesthetic beforehand if necessary.
- Have the patient relax during the examination so that contractions will occur only in the examined muscle.

#### ◆ Electrode Placement


1. Connect the fully sterilized needle electrode to the extension cord and connect the input connector of the cord to the electrode junction box. Insert the needle electrode into the muscle to be examined.
2. Immerse the ground electrode in a physiological saline solution and wind it around the extremity near the inserted needle electrode location.
3. When using the needle electrode, do not make any impedance check.



◆ Measurement

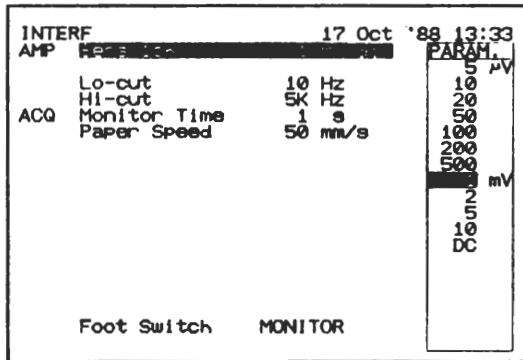
- 

Press the MENU key to display the menu screen.  
Select the INTERF mode according to the procedure of menu selection.

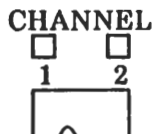
- 

Check the condition by pressing the CONDITION key.

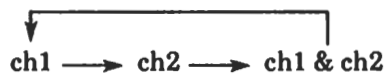
Condition Screen




- \* Foot switch operation
  - Press the foot switch for MONITOR screen.
  - Release the foot switch for STOP screen.


- 

Select the channel to be used by pressing the CHANNEL key.  
In the INTERF mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

Monitor the input waveform by pressing the MONITOR key (by engaging the foot switch).

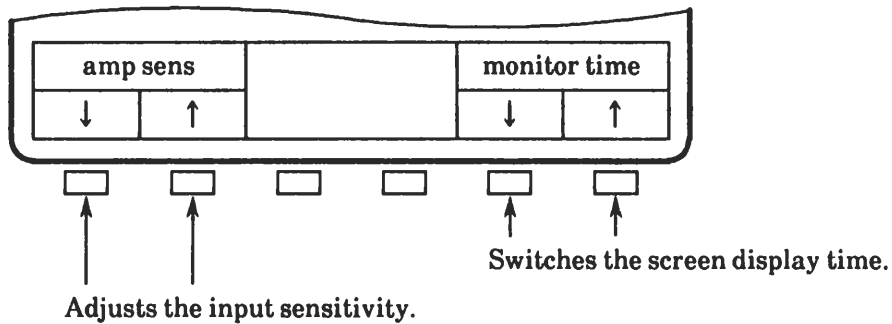
- 

Set the monitor sound volume with the monitor volume control.

- Insert the needle electrode into the muscle to be examined.

7. Instruct the patient to tetanically contract the muscle to be examined. At this time, observe the action potential of the muscle with the monitor screen and monitor sound.

◆ **Monitor Screen**  
Function keys



Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

8.



When an appropriate waveform appears, record it by pressing the RECORD key.

- Direct recording: Continuously records the monitor waveform.

9.

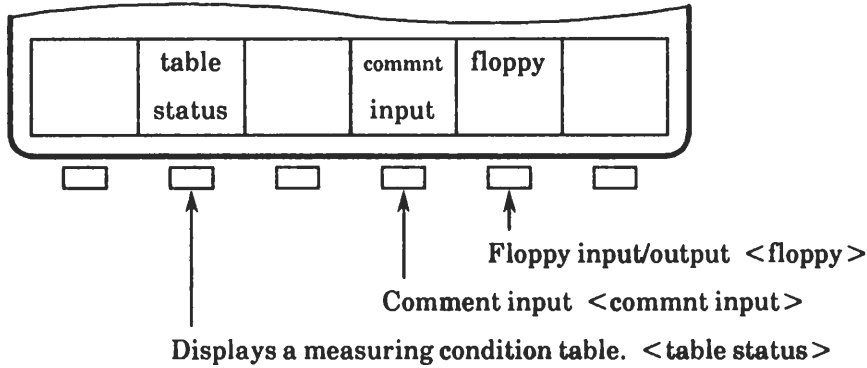


Press the STOP key (releasing the foot switch) as required.

- \* When the RECORD key is pressed, a hard copy of the screen is made.



◆ Stop Screen  
Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



(Cursor movement dial)

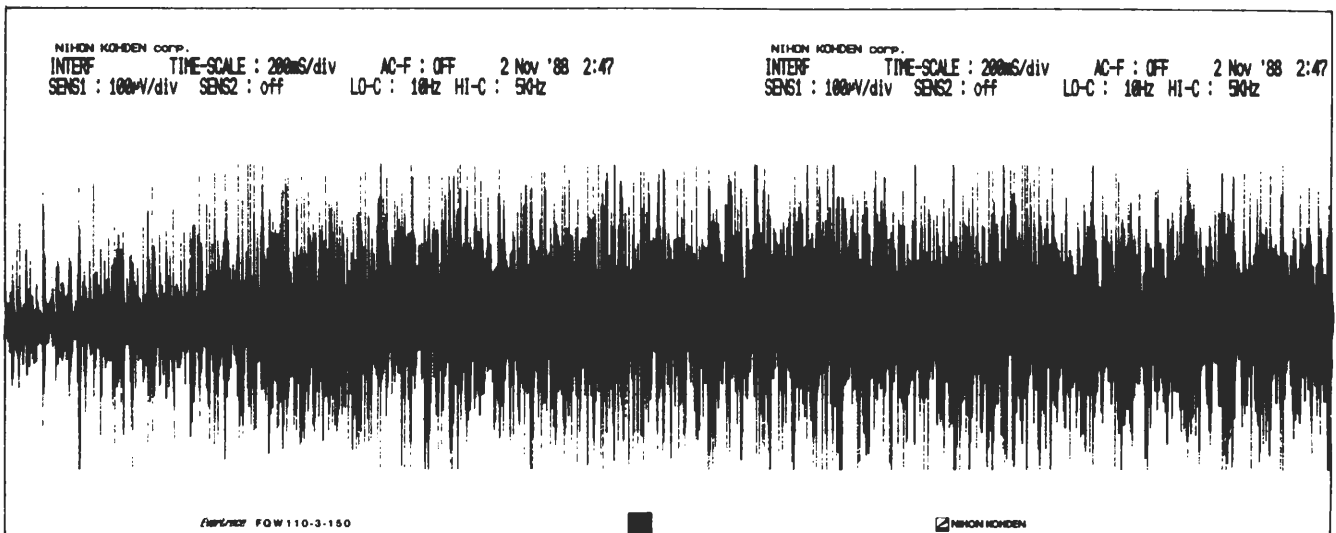
: LTNCY and AMPTD measurement

10. Termination of Examination

When INTERF, SURFAC or EOG is selected as the next examination menu, all waveforms are saved.

If any menu other than INTERF, SURFAC and EOG is selected, all the waveforms are erased.

Recording sample: Direct recording



## 4 SURFAC (Surface EMG)

### ◆ Description of Examination

This menu is used to continuously record an EMG using a surface electrode. Continuous observation of the action of the whole muscle allows data useful for finding or determining dyskinesia to be obtained.

### ◆ Electrodes Required

Active electrode: EEG disc electrode  
NE-121J  
Surface electrode NM-312S  
(optional)

Ground electrode: NM-522S,  
NM-511S (optional),  
NM-531S (optional)

### ◆ Preparing the Patient

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Wipe the electrode placement location with alcohol. Rub the location with Skinpure to decrease the contact resistance of the electrode if required.
- Have the patient relax during the examination so that contractions will occur only in the examined muscle.

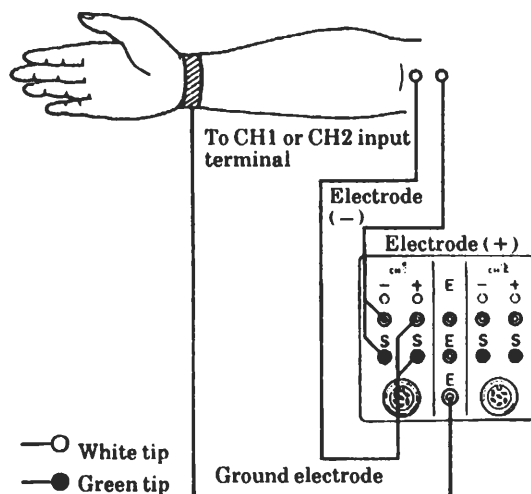
### ◆ Electrode Placement

1. Place the active electrode on the skin in the central part of the belly of the muscle to be examined at intervals of 3 – 4 cm.

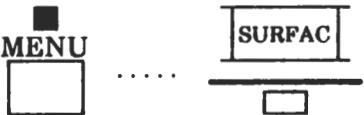
Usually, for the appendicular muscle, place the active electrode on a pair of extensor and flexor muscles that are antagonistic.

For the neck and trunk muscle, place it at a location of bilateral symmetry. In both cases, 2 channels are recorded at the same time.

2. After wetting the ground electrode with water or a physiological saline solution, wind it around the extremity near the active electrode location.
3. Make an impedance check, and adjust the contact resistance of the electrode so it is 5 k $\Omega$  or less.

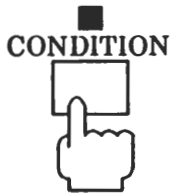


◆ Measurement

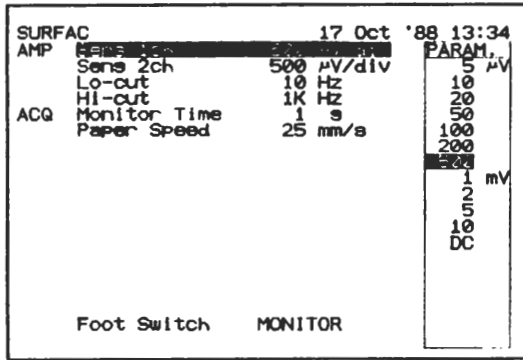
- 

Press the MENU key to display the menu screen.  
Select the SURFAC mode according to the procedure of menu selection.

- Check the condition by pressing the CONDITION key.

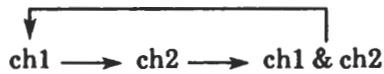
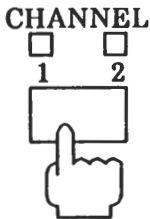


Condition Screen



- \* Foot switch operation
  - Press the foot switch for MONITOR screen.
  - Release the foot switch for STOP screen.

- Select a channel to be used by pressing the CHANNEL key.  
In the SURFAC mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- Monitor the input waveform by pressing the MONITOR key (by engaging the foot switch).

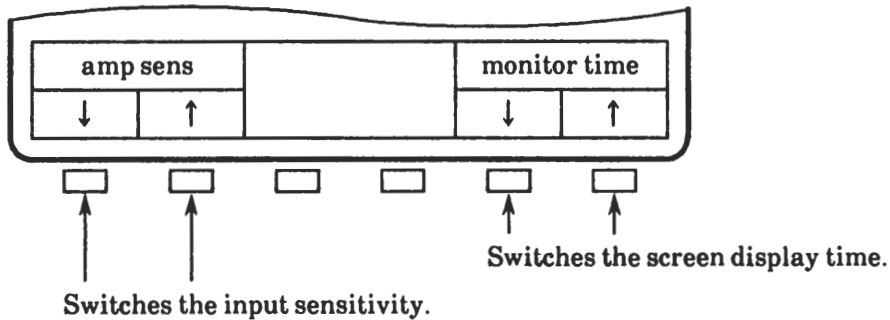


- Set the monitor sound volume with the monitor volume control.



6. With the patient's cooperation, instruct the patient to contract and relax or to bend and stretch the muscle to be examined. At this time, observe the action potential of the muscle with the monitor screen and monitor sound.

◆ **Monitor Screen**  
Function keys



Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

7.



When an appropriate waveform appears, record it by pressing the RECORD key.

- Direct recording: Continuously records the monitor waveform.

8.

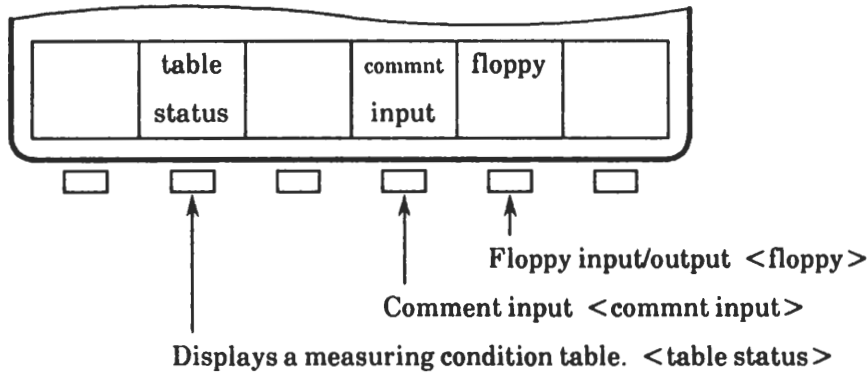


Press the STOP key (releasing the footswitch) as required.

- \* When the RECORD key is pressed, a hard copy of the screen is made.

## 4. SURFAC

### ◆ Stop Screen Function keys



### Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



(Cursor movement dial)

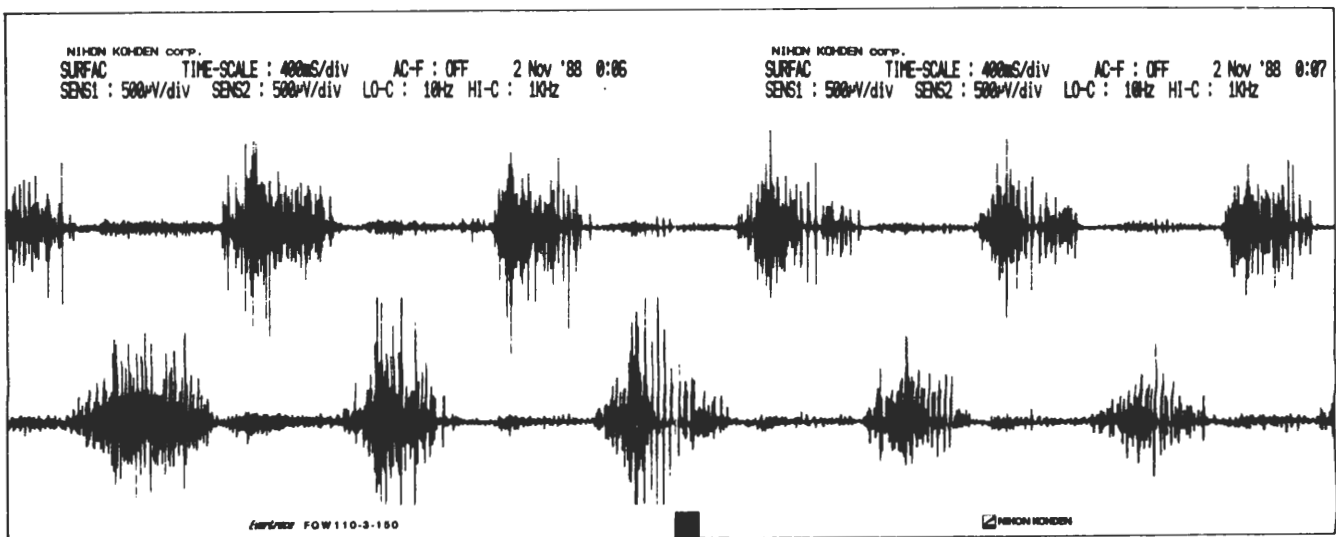
: LTNCY and AMPTD measurement

## 9. Termination of Examination

When INTERF, SURFAC or EOG is selected as the next examination menu, all waveforms are saved.

If any menu other than INTERF, SURFAC and EOG is selected, all the waveforms are erased.

### Recording sample: Direct recording





# Evoked EMG

- 5 NCV 1 (Nerve Conduction Velocity1: 神経伝導速度 1)
- 6 NCV 2 (Nerve Conduction Velocity2: 神経伝導速度 2)
- 7 REP. ST (Repetitive Stimulation: 反復刺激)
- 8 H-RFLX (H-REFLEX: 単シナプス反射)
- 9 F-WAVE (F-WAVE: 後期合成活動電位)
- 10 BLINK (BLINK REFLEX: 瞬目反射)

## 5 NCV1 (Nerve Conduction Velocity 1)

### ◆ Description of Examination

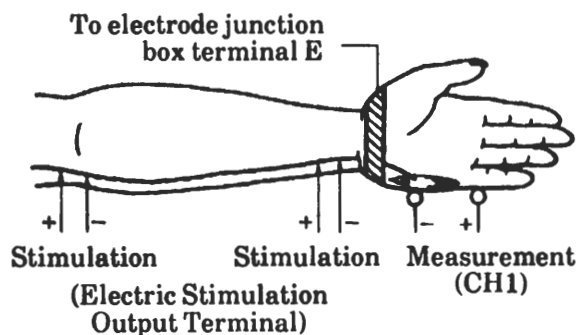
This menu is used for MCV measurement. This menu allows a motor nerve conduction velocity from the evoked electromyogram to be obtained.

The obtained velocity serves as a high-objective index for peripheral nerve disorders, nerve organic disorders, metabolic disorders, electrolyte disorders, etc.

### ◆ Electrode Placement

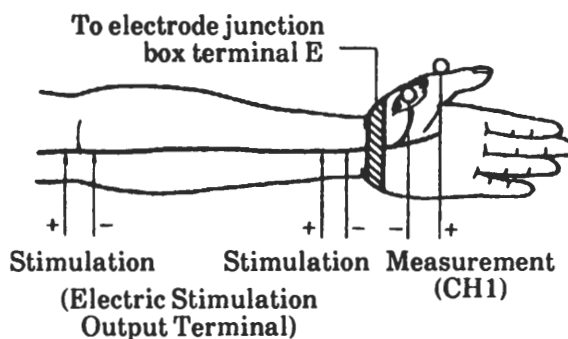
Standard electrode positions for MCV measurement are shown below.

#### (a) Ulnar nerve



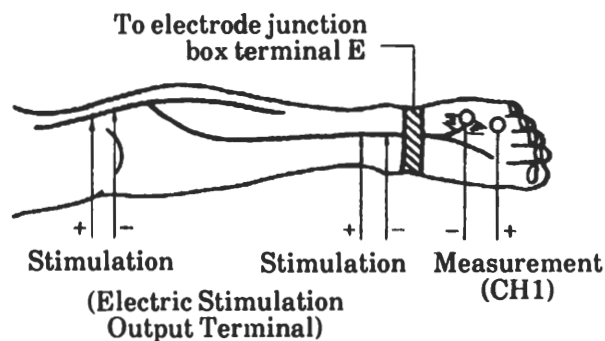
Measurement: Abductor digiti minimi muscle  
Stimulation: Wrist (distal location)  
Elbow ulnar nerve groove (proximal location)

#### (b) Median nerve



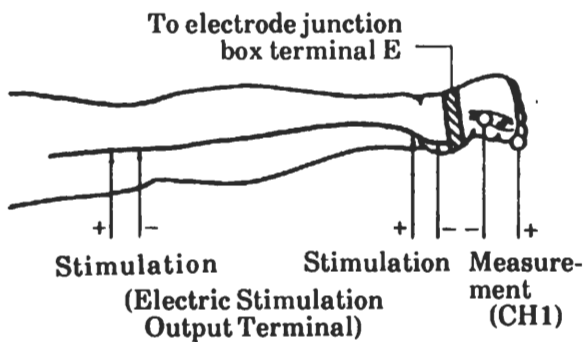
Measurement: Abductor pollicis brevis muscle  
Stimulation: Central part of wrist (distal location)  
Elbow just inside the brachial artery (proximal location)

#### (c) Peroneal nerve



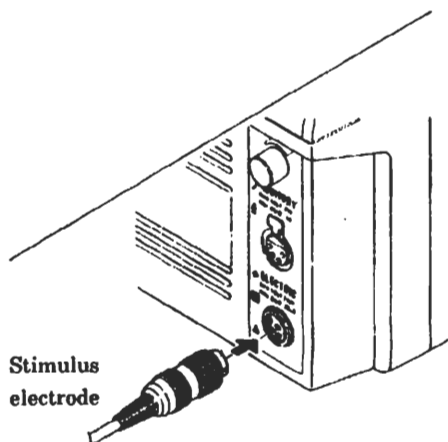
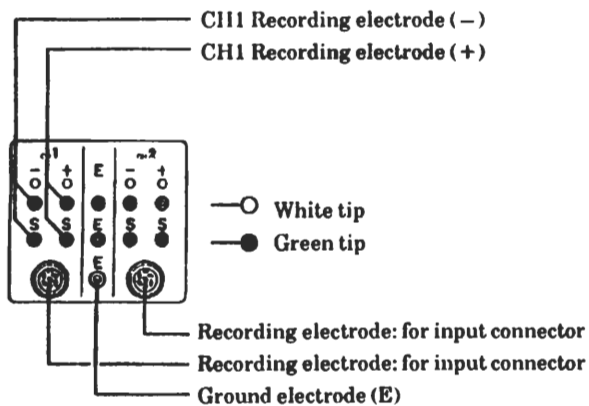
Measurement: Extensor digitorum brevis muscle  
Stimulation: Frontal part of crural periphery, 4 - 6 cm from the internal malleolus toward the central nerve (distal location).  
Just inside the biceps femoris tendon part and the popliteal (proximal location)

(d) Tibial nerve



**Measurement:** Extensor digitorum communis muscle

**Stimulation:** Upper part behind the internal malleolus (distal location)  
Central part of popliteal (proximal location)



Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

- (1) Immerse the ground electrode in water or physiological saline solution and wind it around the wrist or foot between the active electrode and stimulating location. The opposite-side connector is connected to the E terminal of the electrode junction box.
- (2) Place the active electrode on the muscle controlled by the motor nerve to be examined. In SCV measurement, be sure to lower the impedance by using Skinpure.
- (3) Use the surface stimulating electrode for stimulation. Be sure to wet the felt tip of the electrode with water or physiological saline solution before use. The negative side (-) is indicated with a black mark.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 kΩ or less.

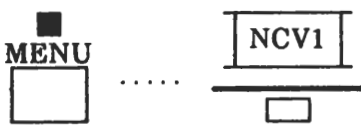
**CAUTION**  
Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.

◆ **Preparing the Patient**

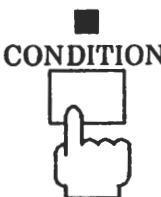
- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode if necessary.
- Make the patient to be relax and avoid the appearance of EMG.



◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the NCV1 mode according to the procedure of menu selection.

- 

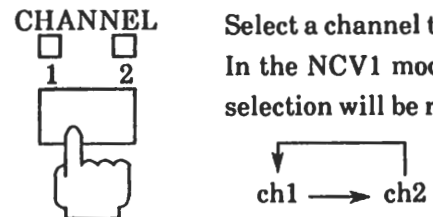
Check the condition by pressing the CONDITION key.

Condition Screen


NCV1	MCV	10 Dec '90	13:32
AMP			PARAM
	Lo-cut	20 Hz	5 μV
	Hi-cut	3K Hz	10
ACQ	Anal. Time	20 ms	20
	Delay	0 div	50
	Monitor Time	200 ms	100
	Preset Count	20	200
	Auto Mark	ON	500
	Amp Measure	MARK-P	1 mV
	Paper Speed	25 mm/s	5
STIM	Trigger Mode	RECUR	10
	Stim Mode	SINGLE	DC
	Stim Rate	1 Hz	
	Duration	0.2 ms	
	Fast Recov.	OFF	
	Foot Switch	SWEEP	

\* Foot switch operation

- Released immediately after being engaged:  
Single-shot stimulation is output.
- While engaged:  
Stimulation is output, and sweep waveforms synchronized with the stimulation are displayed.
- Released: Stimulation is stopped and the reaction waveform is displayed.

- 

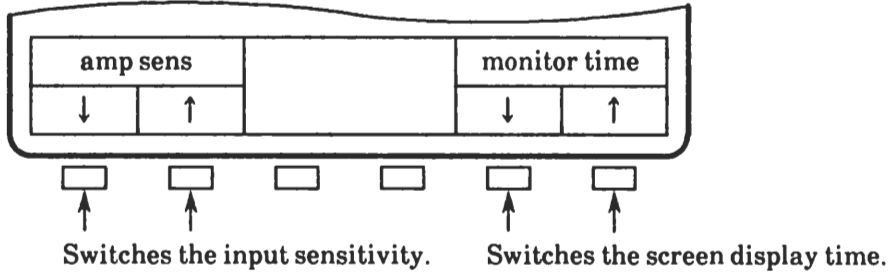
Select a channel to be used by pressing the CHANNEL key.  
In the NCV1 mode, each time the CHANNEL key is pressed, the following selection will be repeated.

- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.

◆ **Monitor Screen**

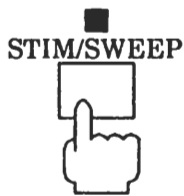
Function keys



Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

5.



Start stimulation by pressing the **STIM/SWEEP** key (stepping on the foot switch). A sweep screen is displayed.  
Place the stimulating electrode to the stimulating point on the distal (proximal) side.

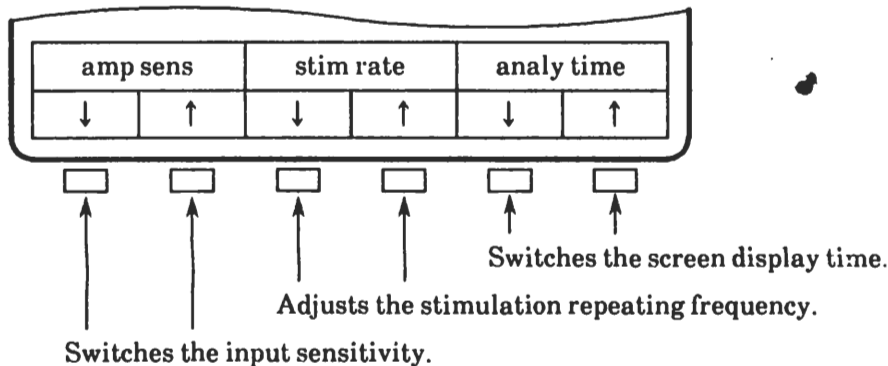
6.



Adjust the stimulation current value to the maximum stimulation value with the Stimulation Value Set knob.  
\* The reaction waveform varies greatly with stimulating locations. Find the optimum point.

◆ **Sweep Screen**

Function keys



## Panel keys

POSITION ↓ ↑ : Moves the displayed waveform up and down.

MONITOR: Checks the monitor waveform during stimulation.  
(Sweep status is restored when the STIM/SWEEP key is pressed.)

ANALYSIS: Starts averaging.



: LTNCY and AMPTD measurement

(Cursor movement dial)

7.



When an appropriate waveform appeared, press the STOP key (releasing the foot switch).

The latest sweep waveform is displayed and the screen stops.

8.



Store the displayed waveform before measurement of the proximal (distal) side.

When the STORE key is pressed, the displayed waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used for each stored waveform. Up to four waveforms can be stored.

- \* If the next measurement is made without the STORE function, the displayed waveform is erased.

- \* Erasing the stored waveform

STAGE SELECT



Select a stage.

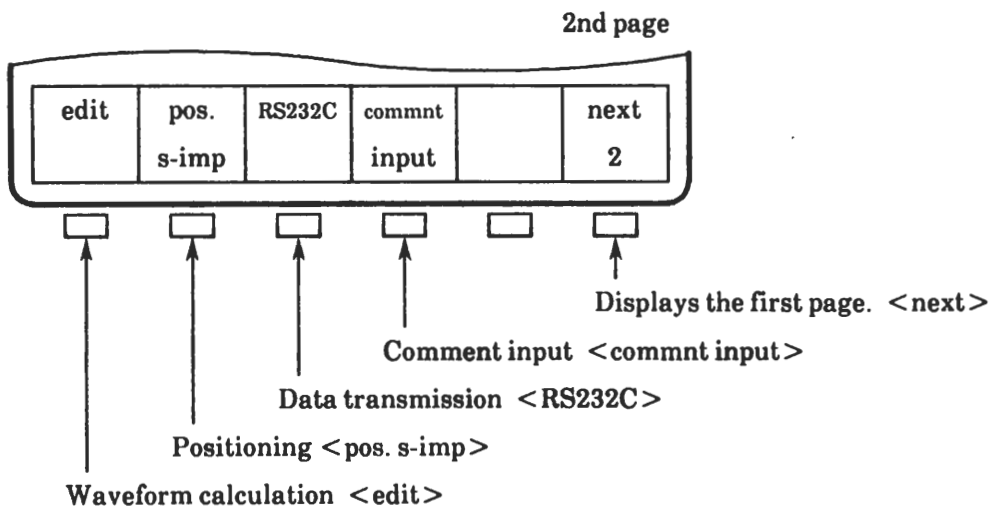
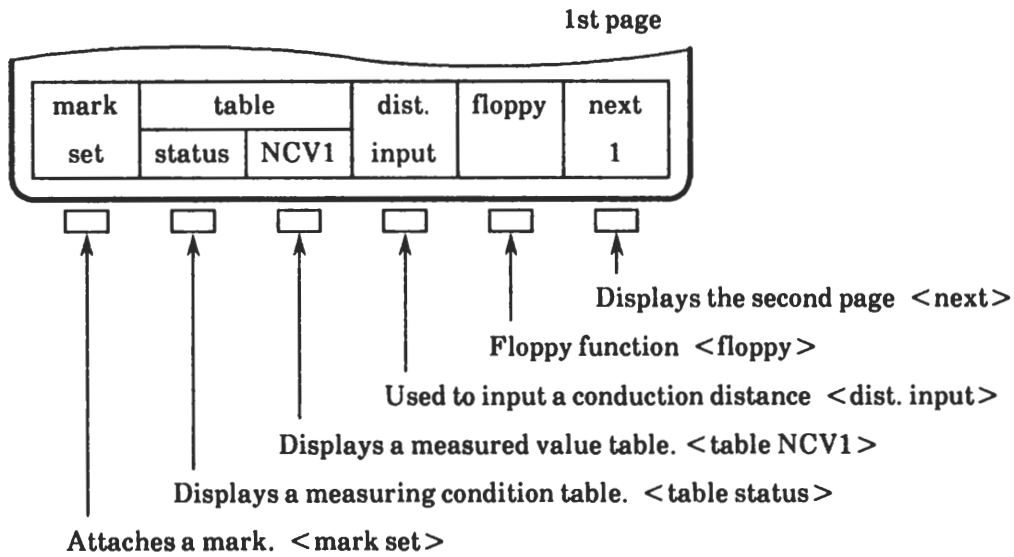


ERASE



Erase the waveform.

◆ **Stop Screen**  
Function keys



**Panel keys**

STAGE SELECT ↓ ↑: Select a stage.

POSITION ↓ ↑: Moves the displayed waveform up and down.

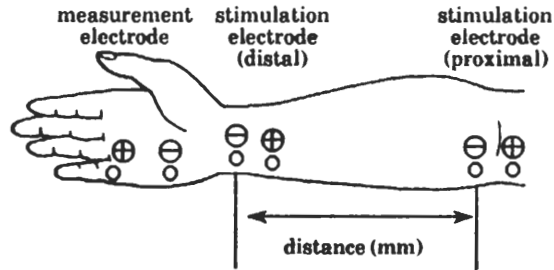
VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



(Cursor movement dial)

: LTNCY and AMPTD measurement  
Conduction velocity measurement

9. Shift the stimulating point to the proximal (distal) side and make a measurement.
10. Measure the conduction distance between the stimulating points of the proximal and distal side.



Measure the distance between negative electrodes.

a) Conduction velocity measurement on the NCV table

mark	table		dist.	floppy	next
set	status	NCV1	input		1



- (1) Press the < table NCV1 > key on a stop screen. A character table is displayed and the function display changes.

enter	letter select			recall	end
dist.	set	←	→		input



- (2) Move the cursor to the desired character by using the < letter select ← → > key or the cursor movement dial.

enter	letter select			recall	end
dist.	set	←	→		input



- (3) Set the character moved with the cursor by pressing the < letter select set > key.

\* Repeat the above operations to input the distance.

enter	letter select			recall	end
dist.	set	←	→		input



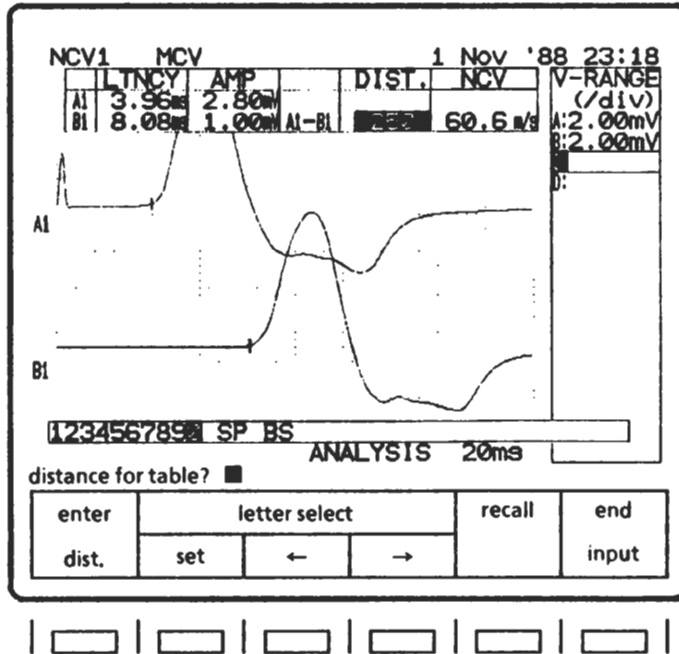
- (4) When the < enter dist. > key is pressed, the conduction velocity is calculated and is displayed in the NCV table on the screen.

enter	letter select			recall	end
dist.	set	←	→		input

(5) Press the <end input> key to terminate the distance input.

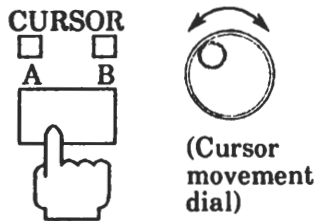


\* When the "Auto Mark" is set to ON on the condition screen, a mark is automatically set to the onset point of the waveform in stop status, and the system is ready to input the conduction distance. (Step (2))



\* <recall> key is used to call back the previous input distance.

b) Conduction velocity measurement with the cursor



(1) Move cursors A and B to the onset point of the waveform by using the cursor movement dial.

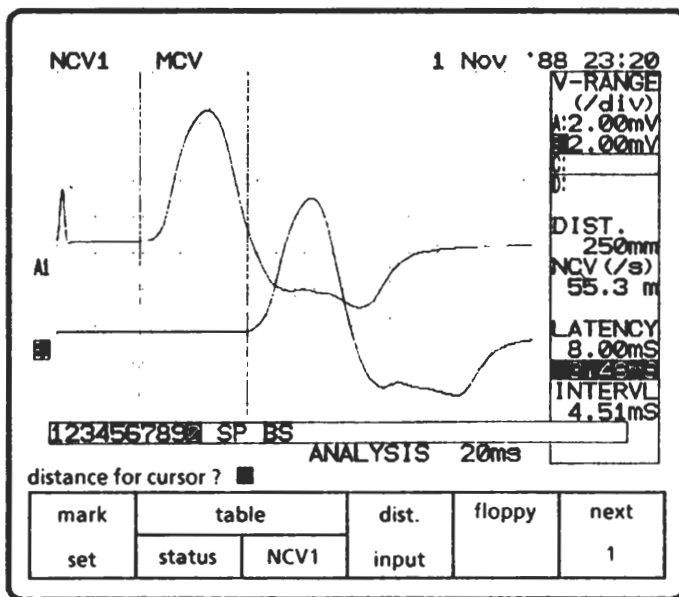
mark	table		dist.	floppy	next
set	status	NCV1	input		1

(2) Press the <dist. input> key to call the conduction distance input screen and the cursor.



(3) Enter the conduction distance. The input procedure is the same as for the NCV table.

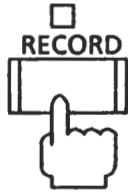
\* When the "Auto Mark" is set to OFF on the condition screen, the cursor is automatically displayed in stop status. Follow the above procedures (1), (2) and (3).



\* When the full keyboard (optional) is connected, refer to " ♦How to use the full keyboard" described in the MEB/MEM-7102A/K Operator's Manual.

\* A mark can be automatically attached to the onset point of the waveform with the auto mark function in stop status.

11.

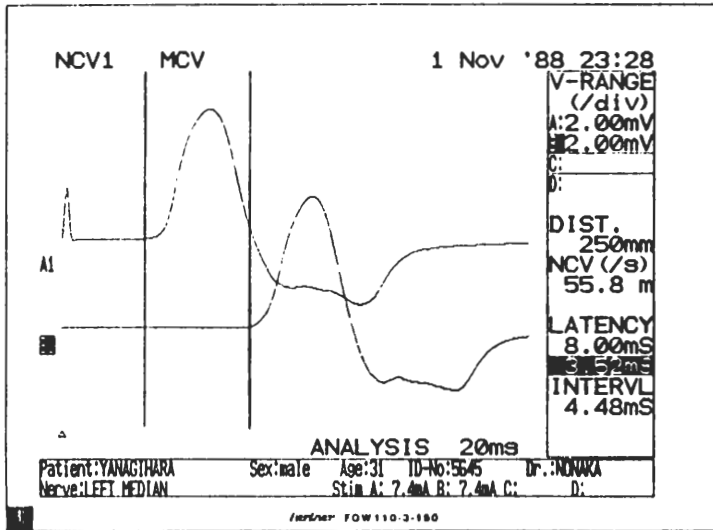


Press the RECORD key to start recording.

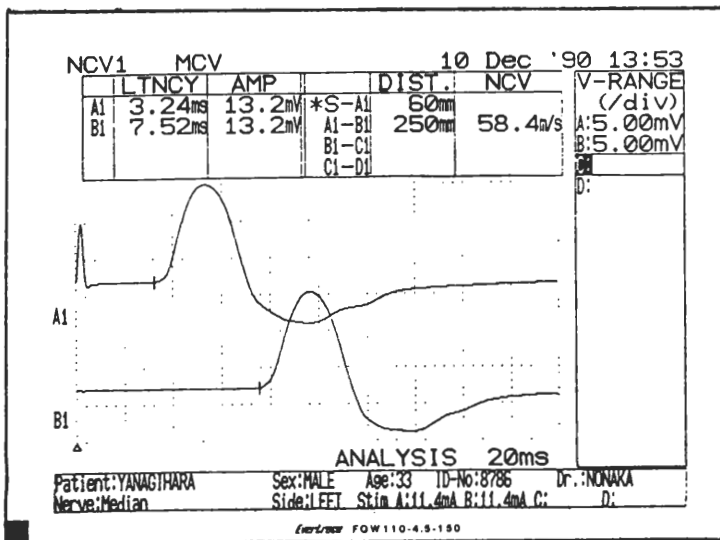
12. Termination of Examination

When a menu other than NCV1 is selected, all waveforms are erased.

Recording sample



Recording sample: Hard copy of the NCV1 table





## 6 NCV2 (Nerve Conduction Velocity 2)

◆ **Description of Examination**

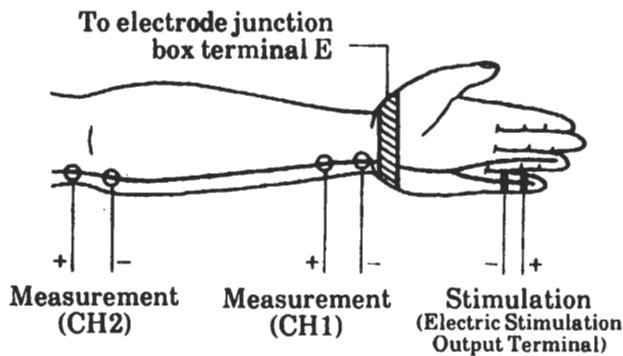
This menu is used for SCV measurement. This menu permits a sensory nerve conduction velocity to be obtained from the evoked electromyogram.

The obtained velocity serves as a high-objective index for peripheral nerve disorders, nerve organic disorders, metabolic disorders, electrolyte disorders, etc.

◆ **Electrode Placement**

The standard electrode positions for SCV measurement are shown below.

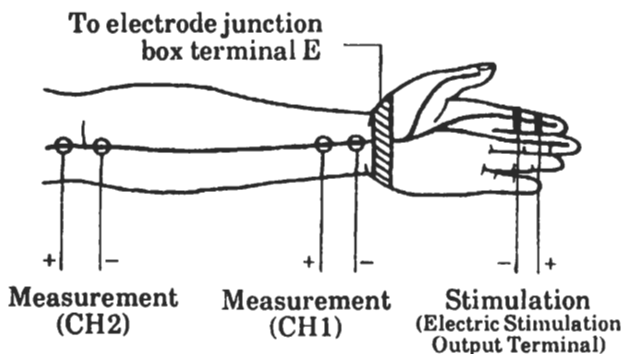
(a) Ulnar nerve (orthodromic conduction)



**Measurement:** Same as the place to be stimulated in MCV measurement.

**Stimulation:** Little finger

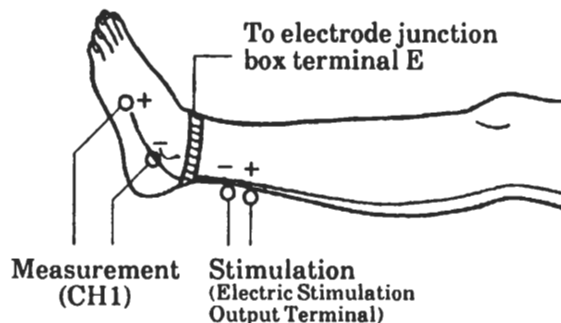
(b) Median nerve (orthodromic conduction)



**Measurement:** Same as the place to be stimulated in MCV measurement.

**Stimulation:** Forefinger or middle finger

(c) Sural nerve (antidromic conduction)



**Measurement:** 1 – 2 cm lower backward from the lateral malleolus

**Stimulation:** Slightly lateral to the midline in the lower third of the posterior aspect of the leg.

- (1) Immerse the ground electrode in water or physiological saline solution and wind it around the wrist or foot between the active electrode and stimulating location. The opposite-side connector is connected to the E terminal of the electrode junction box.
- (2) In general, use the surface stimulating electrode for lower limb stimulation and the finger electrode for upper limb stimulation. Apply paste on the finger electrode before use. The negative side (-) is indicated with black mark.
- (3) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.

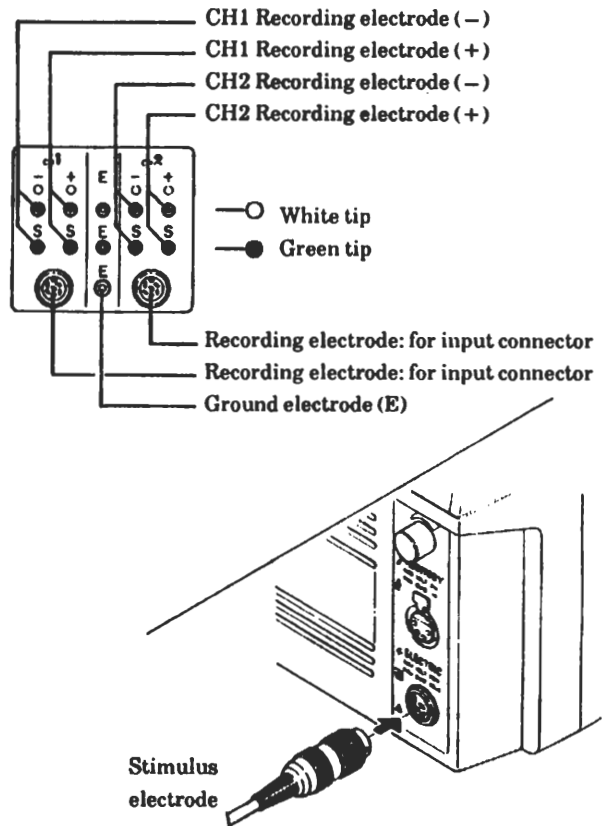
**CAUTION**

If paste is not applied on the finger electrode before use, this may cause a thermogram.

Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.

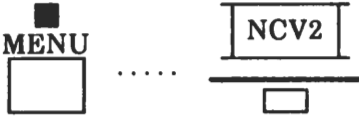
◆ **Preparing Patient**

- Keep the patient and the electrode junction box 1m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode if necessary.
- Make the patient to be relax and avoid the appearance of EMG during examination.
- Be sure to avoid short circuits of the stimulation current from paste.

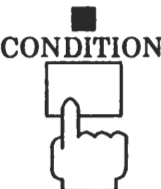


Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the NCV2 mode according to the procedure of menu selection.

- 

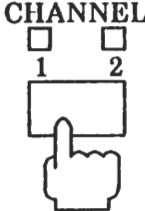
Check the condition by pressing the CONDITION key.

Condition Screen

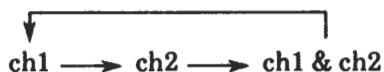
NCV2		SCV	10 Dec '90 13:54
AMP	Sense 2ch	10 $\mu$ V/div	PARAM. 5 $\mu$ V
	Lo-cut	20 Hz	20
	Hi-cut	3K Hz	50
ACQ	Anal. Time	20 ms	100
	Delay	0 div	200
	Monitor Time	200 ms	500
	Preset Count	20	1 mV
	Auto Mark	ON	1600
	Amp Measure	MARK-P	DC
	Paper Speed	25 mm/s	
STIM	Trigger Mode	RECUR	
	Stim Mode	SINGLE	
	Stim Rate	1 Hz	
	Duration	0.2 ms	
	Fast Recov.	OFF	
	Foot Switch	SWEEP	


\* Foot switch operation

- Released immediately after being engaged:  
Single-shot stimulation is output.
- While engaged:  
Stimulation is output, and sweep waveforms synchronized with the stimulation are displayed.
- Released: Stimulation is stopped, and the reaction waveform is displayed.

- 

Select a channel to be used by pressing the CHANNEL key.  
In the NCV2 mode, each time the CHANNEL key is pressed, the following selection will be repeated.

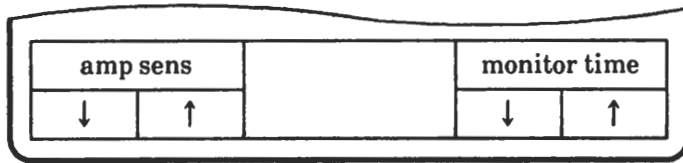


- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

◆ **Monitor Screen**

Function keys



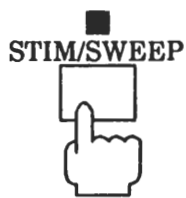
Switches the input sensitivity.

Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

5.



Start stimulation by pressing the **STIM/SWEEP** key (stepping on the foot switch). A sweep screen is displayed.  
Place the stimulating electrode to the stimulating point.

6.



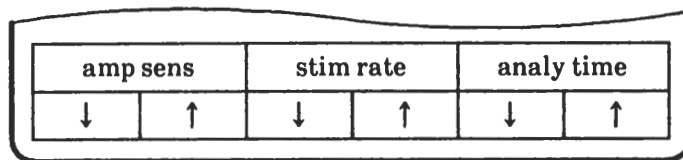
(Stimulation value set knob)

Adjust the stimulation current value with the Stimulation Value Set knob.

\* The reaction waveform varies greatly with stimulation locations.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity.

Adjusts the stimulation repeating frequency.

Switches the screen display time.

**Panel keys**

- POSITION** ↓ ↑: Moves the displayed waveform up and down.
- MONITOR:** Checks the monitor waveform during stimulation.  
(Sweep status is restored when the STIM/SWEEP key is pressed.)
- ANALYSIS:** Starts averaging.



: LTNCY and AMPTD measurement

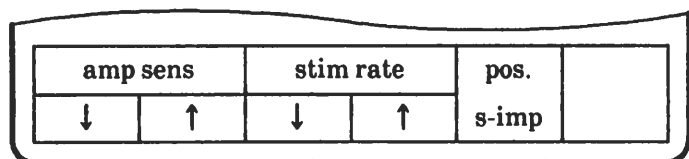
(Cursor movement dial)

7.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

◆ **Analysis Screen**

**Function keys**

Switches the input sensitivity.

Adjusts the stimulation repeating frequency.

Positioning

Panel keys

- POSITION ↓ ↑: Moves the displayed waveform up and down.
- VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.
- MONITOR: Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)
- STIM/SWEEP: Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)



(Cursor movement dial)

: LTNCY and AMPTD measurement

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

- \* Stopping averaging
  - When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
  - While averaging is stopped, the input waveform can be checked with the MONITOR key.
- \* Reattempting averaging
 

If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

8.



Stores the averaging waveform as required.  
When the STORE key is pressed, the latest averaging waveform is stored in the stage (memory).

- Four stages A – D are available. One stage is used for each stored waveform. Up to four sets of waveforms can be stored.
  - ( 1 ch measurement:  $4 \times 1 \text{ ch} = 4 \text{ waveforms}$  )
  - ( 2 ch measurement:  $4 \times 2 \text{ ch} = 8 \text{ waveforms}$  )

\* Erasing the stored waveform

STAGE SELECT



Select a stage.



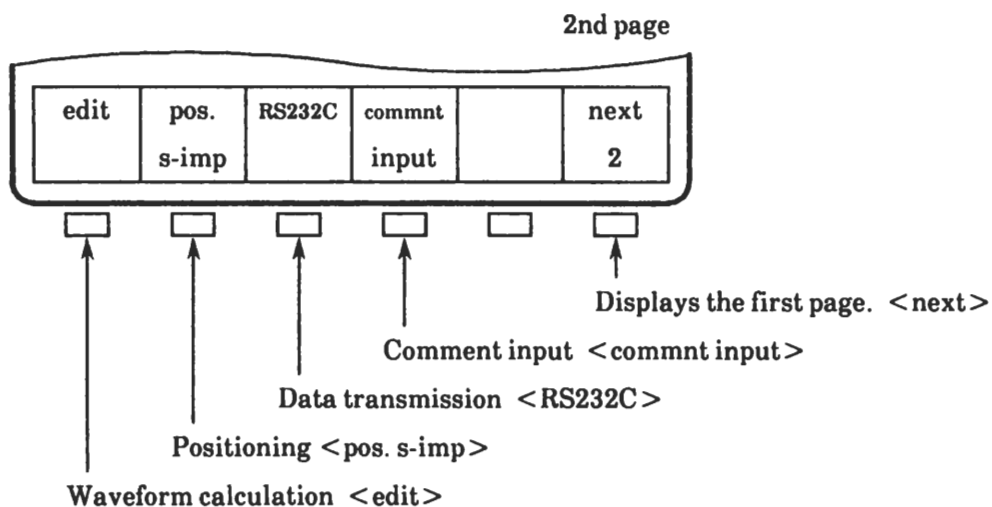
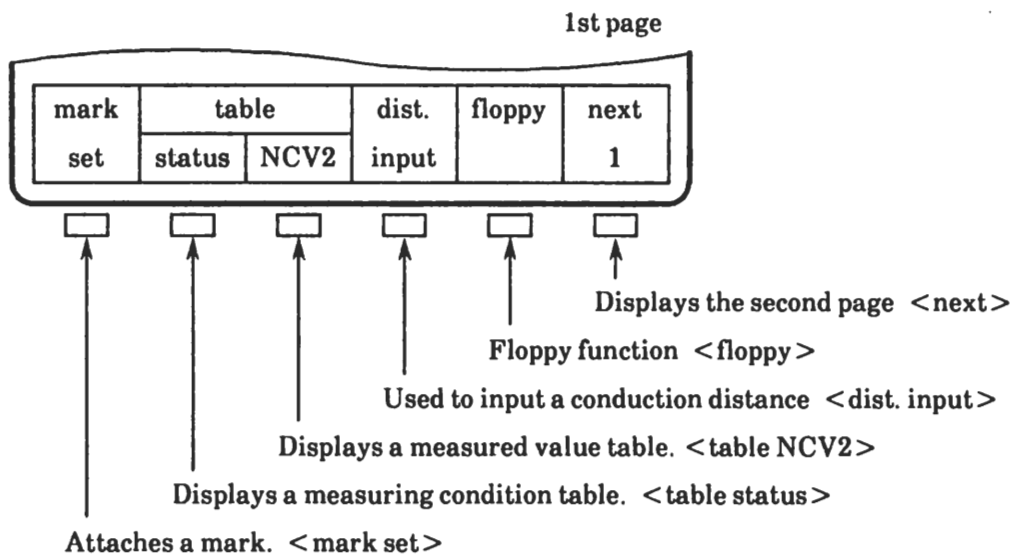
ERASE



Erase the waveform.

## ◆ Stop Screen

### Function keys



### Panel keys

STAGE SELECT ↓ ↑: Select a stage.

POSITION ↓ ↑: Moves the displayed waveform up and down.

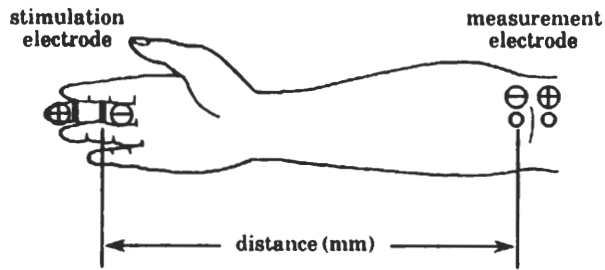
VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



(Cursor movement dial)

: LTNCY and AMPTD measurement  
Conduction velocity measurement

9. Measure the conduction distance between the stimulating point and measurement point.



Measure the distance between negative electrodes.

a) Conduction velocity calculation on the NCV table

mark	table		dist.	floppy	next
set	status	NCV2	input		1



- (1) Press the <table NCV2> key on the stop screen. A character table is displayed and the function display changes.

enter	letter select			recall	end
dist.	set	←	→		input



- (2) Move the cursor to the desired character by using the <letter select ← →> key or the cursor movement dial.

enter	letter select			recall	end
dist.	set	←	→		input



- (3) Set the character moved with the cursor by pressing the <letter select set> key.

\* Repeat the above operations to input the distance.

enter	letter select			recall	end
dist.	set	←	→		input



- (4) When the <enter dist.> key is pressed, the conduction velocity is calculated and is displayed in the NCV table on the screen.

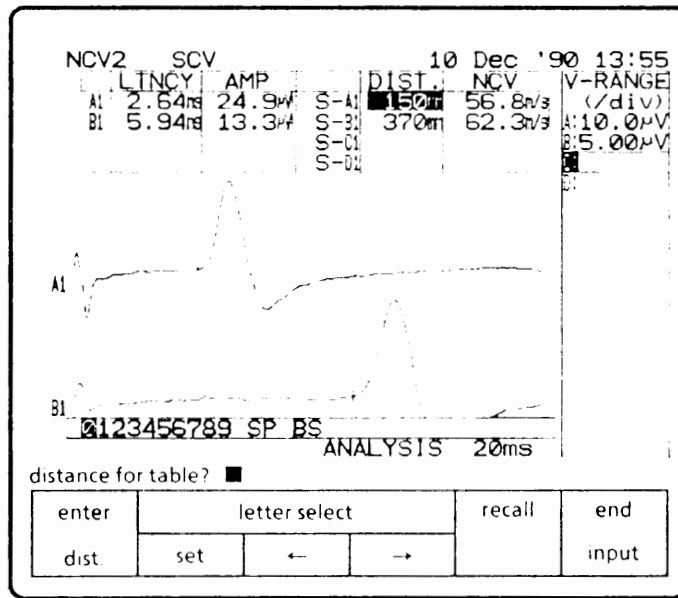


enter	letter select			recall	end
dist.	set	←	→		input

(5) Press the <end input> key to terminate the distance input.

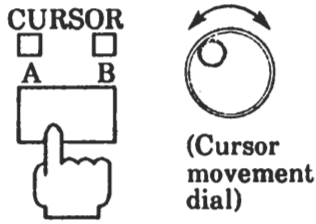


\* When "Auto Mark" is set to ON on the condition screen, a mark is automatically set to the onset point of the waveform in stop status, and the system is ready to input the conduction distance (Step (2)).

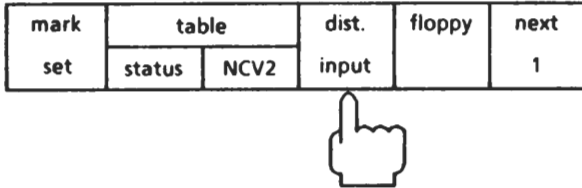


\* <recall> key is used to call back the previous input distance.

b) Conduction velocity calculation with the cursor



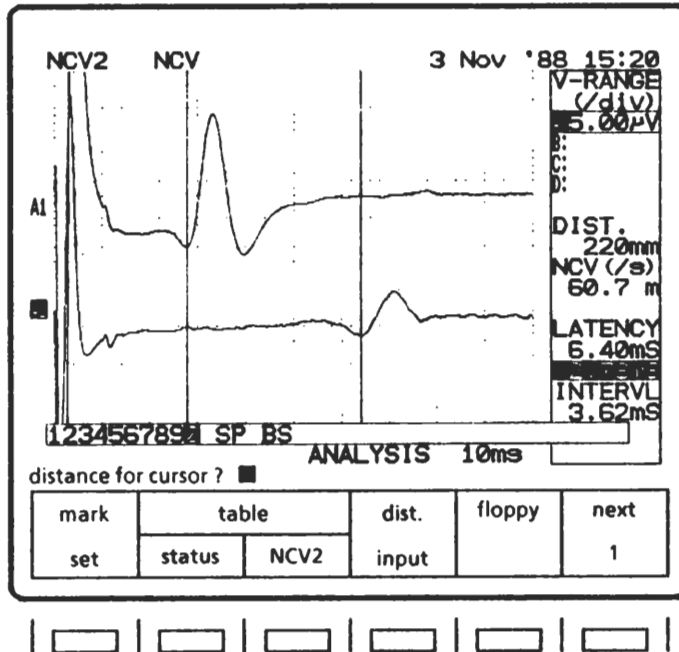
(1) Move cursors A and B to the onset point of the waveform by using the cursor movement dial.



(2) Press the <dist. input> key to call up the conduction distance input screen and the cursor.

(3) Enter the conduction distance. The input procedure is the same as the NCV table.

\* When "Auto Mark" is set to OFF on the condition screen, the cursor is automatically displayed in stop status. Follow the above procedures (2) and



\* When the full keyboard (optional) is connected, refer to " ♦How to use the full keyboard" described in the MEB/MEM-7102A/K Operator's Manual.

\* A mark can be automatically attached to the onset point of the waveform with the auto mark function in stop status.

10.

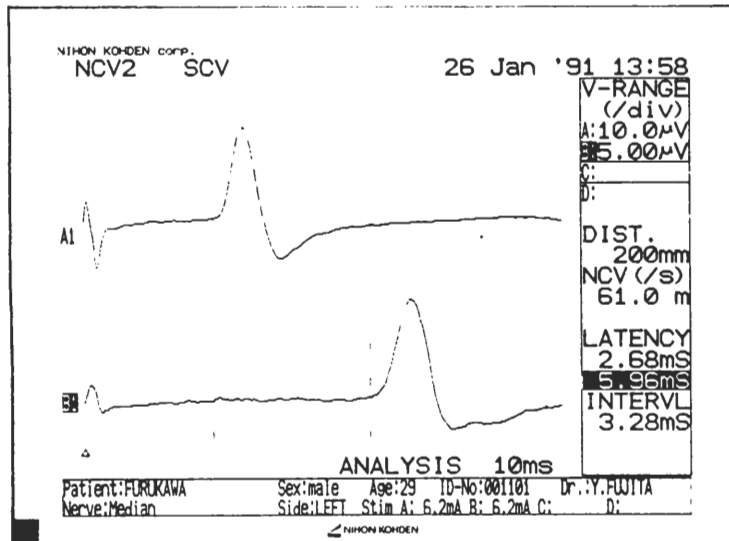


Press the RECORD key to start recording.

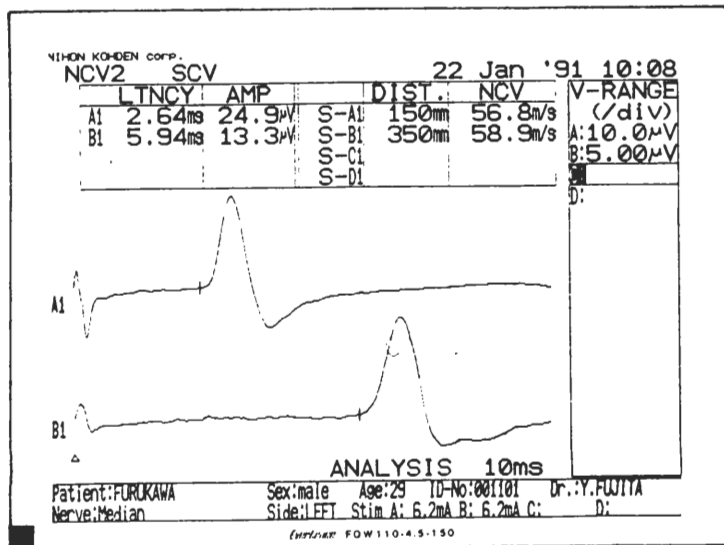
11. Termination of Examination

When a menu other than NCV2 is selected, all waveforms are erased.

Recording sample



Recording sample: Hard copy of the NCV2 table



## 7 REP. ST (Repetitive Stimulation)

### ◆ Description of Examination

This examination is essential for examining the function of neuromuscular junctions for diagnosis of myasthenia gravis and myasthenia syndrome.

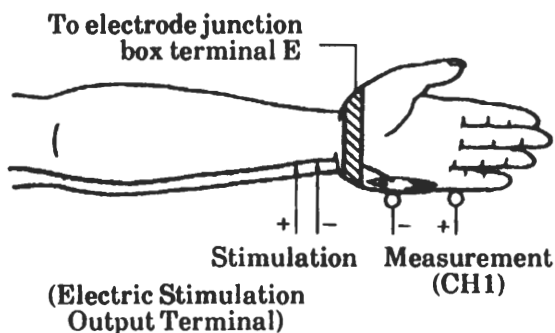
The amplitude decrease or increase in muscle action potential due to repetitive stimulation is examined.

The operator needs only to press the ANALYSIS key, and a compressed waveform is displayed. The waning rates for 10 waveforms are automatically calculated.

### ◆ Electrode Placement

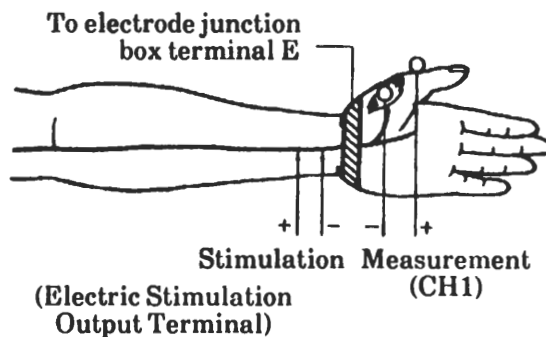
The electrode positions are the same as those of MCV measurement.

#### (a) Ulnar nerve



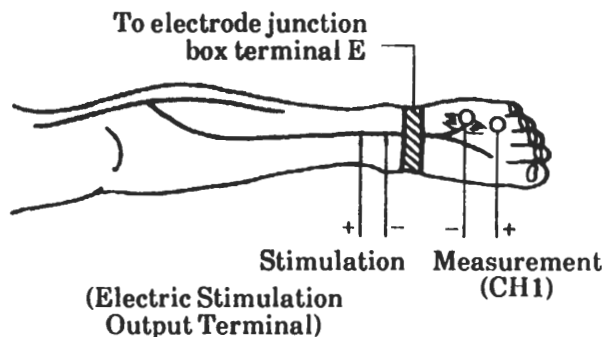
Measurement: Abductor digiti minimi muscle  
Stimulation: Wrist

#### (b) Median nerve



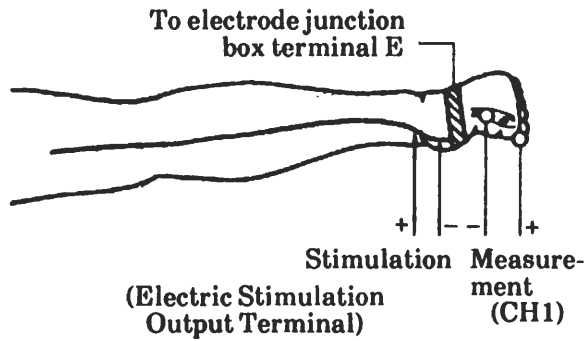
Measurement: Abductor pollicis brevis muscle  
Stimulation: Central part of wrist

#### (c) Peroneal nerve



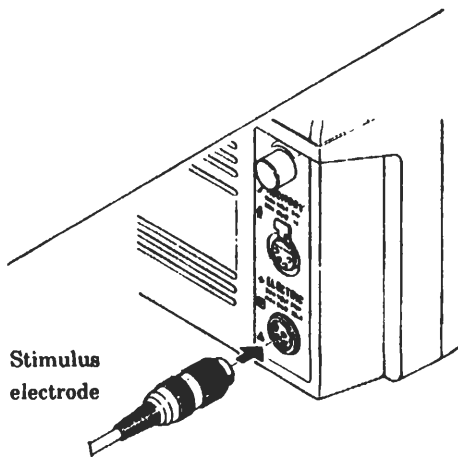
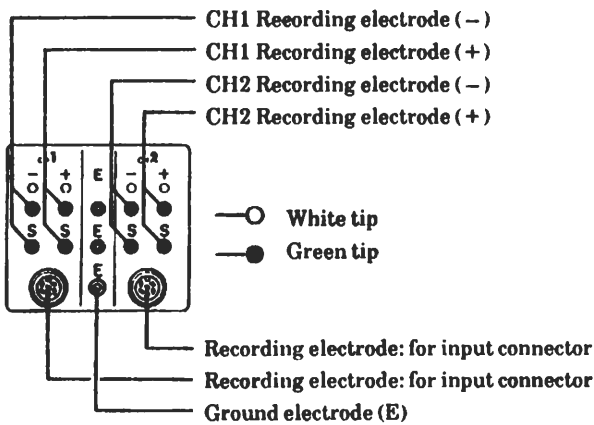
Measurement: Extensor digitorum brevis muscle  
Stimulation: Frontal part of crural periphery, 4 – 6 cm from the internal malleolus toward the central nerve

(d) Tibial nerve



Measurement: Extensor digitorum communis muscle

Stimulation: Upper part behind the internal malleolus



Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

- (1) Immerse the ground electrode in water or physiological saline solution and wind it around the wrist or foot between the active electrode and stimulating location. The opposite-side connector is connected to the E terminal of the electrode junction box.
- (2) Place the active electrode on the muscle controlled by the motor nerve to be examined.
- (3) Use the surface stimulation electrode for stimulation. Be sure to wet the felt tip at the end of the electrode with water or a physiological saline solution before use. The negative side (-) is indicated with black mark.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 kΩ or less.

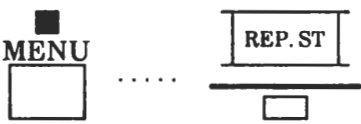
**CAUTION**

**Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.**

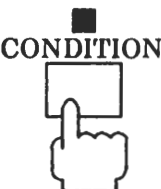
◆ **Preparing the Patient**

- Keep the patient and the electrode junction box 1m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode if necessary.
- Fix the extremity to be examined to prevent artifacts from electrode movement.
- Make the patient to be relax and avoid the appearance of EMG during examination.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the REP. ST mode according to the procedure of menu selection.

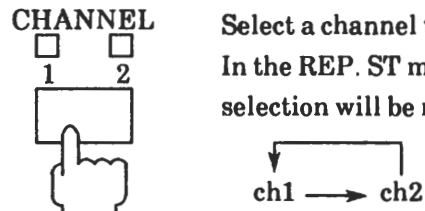
- 

Check the condition by pressing the CONDITION key.


Condition Screen

REP. ST	17 Oct '88 13:35	
AMP	SE	PARAM
	Lo-cut 20 Hz	5 $\mu$ V
	Hi-cut 3K Hz	10
ACQ	Analy. Time 50 ms	20
	Delay 0 div	50
	Monitor Time 200 ms	100
	Paper Speed 25 mm/s	200
STIM	Stim Rate 3 Hz	500
	Duration 0.2 ms	1 mV
	Train Number 10	5
		10
		DC
Foot Switch	SWEEP	

- \* Foot switch operation
- Released immediately after being engaged:  
Single-shot stimulation is output.
  - While engaged:  
Stimulation is output, and sweep waveforms synchronized with the stimulation are displayed. (Stim rate is fixed at 0.5Hz.)
  - Released: Stimulation is stopped and the reaction waveform is displayed.

- 

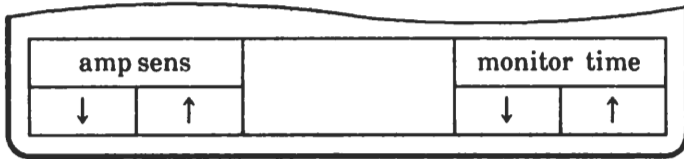
Select a channel to be used by pressing the CHANNEL key.  
In the REP. ST mode, each time the CHANNEL key is pressed, the following selection will be repeated.

- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

◆ **Monitor Screen**

Function keys

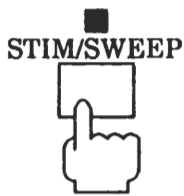


Switches the input sensitivity. Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

5.



Start stimulation by pressing the STIM/SWEEP key (stepping on the foot switch). A sweep screen is displayed.

\* Stim Rate is fixed at 0.5 Hz.

6.

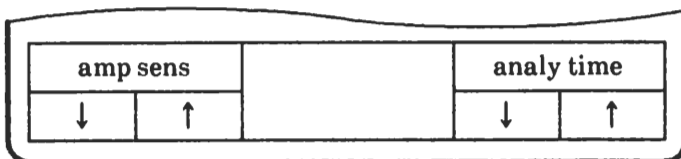


Place the stimulating electrode to the stimulating point. Adjust the stimulation current value to the maximum stimulation value with the Stimulation Value Set knob.

\* The reaction waveform varies greatly with stimulating locations. Find the optimum point.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity. Switches the screen display time.


## Panel keys


POSITION ↓ ↑ : Moves the displayed waveform up and down.



: LTNCY and AMPTD measurement

(Cursor movement dial)

7.  After confirming that the waveform is suitable, fix the stimulating electrode with the attached band and press the STOP key to stop stimulation (releasing the foot switch).  
Wait a bit for the muscle to recover from fatigue.

8.  Start a measurement by pressing the ANALYSIS key. The measurement is performed according to the train number set on the condition screen. All the waveforms are displayed in compressed style on the upper part of the screen, and ten waveforms among them are selected and displayed on the lower part of the screen.  
When the measurement terminates, stimulation is automatically stopped.

\* Train No. (total stimulation count) and order of waveforms to be taken

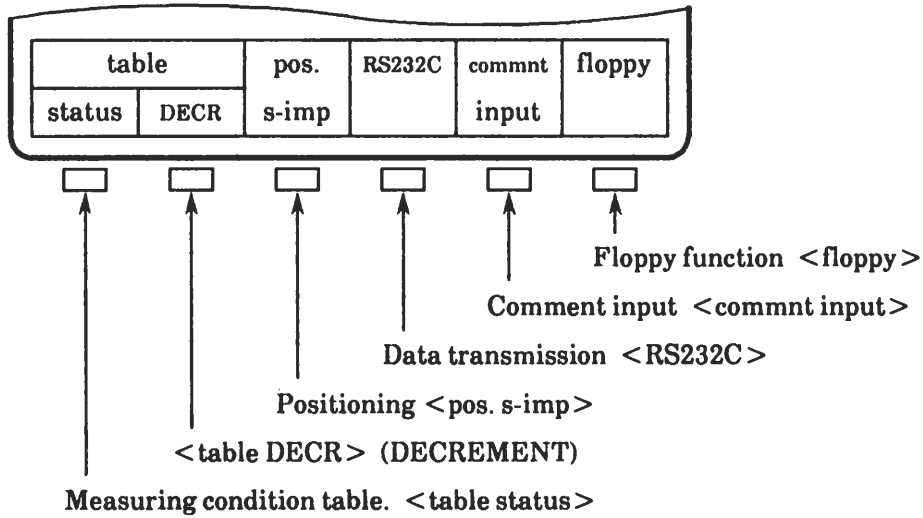
Waveform No. Train No.	1	2	3	4	5	6	7	8	9	10
200	1	2	3	4	5	10	20	50	100	200
100	1	2	3	4	5	10	20	30	50	100
50	1	2	3	4	5	10	20	30	40	50
20	1	2	3	4	5	6	8	10	15	20
10	1	2	3	4	5	6	7	8	9	10
5	1	2	3	4	5	-	-	-	-	-

## Panel keys

STOP: Stops measurement (When the ANALYSIS key is pressed, the measurement is reattempted.)



◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

 : LTNCY and AMPTD measurement  
(Cursor movement dial)

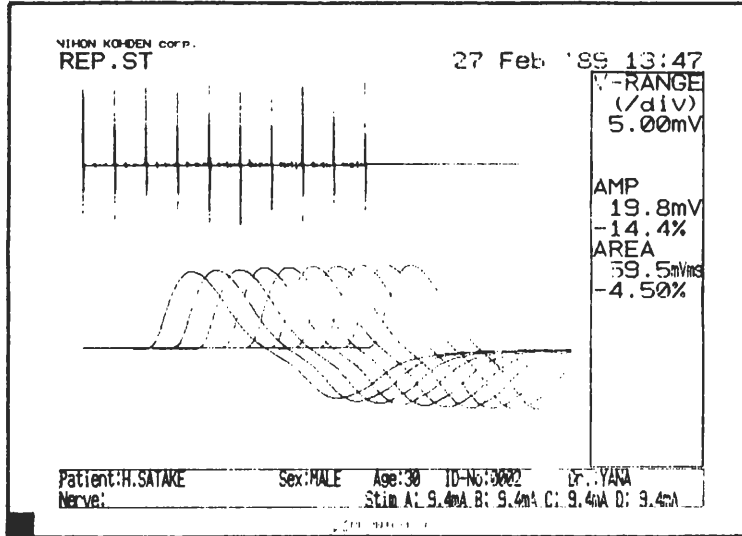
\* **Recording**

When the RECORD key is pressed, a hard copy of the screen is made.

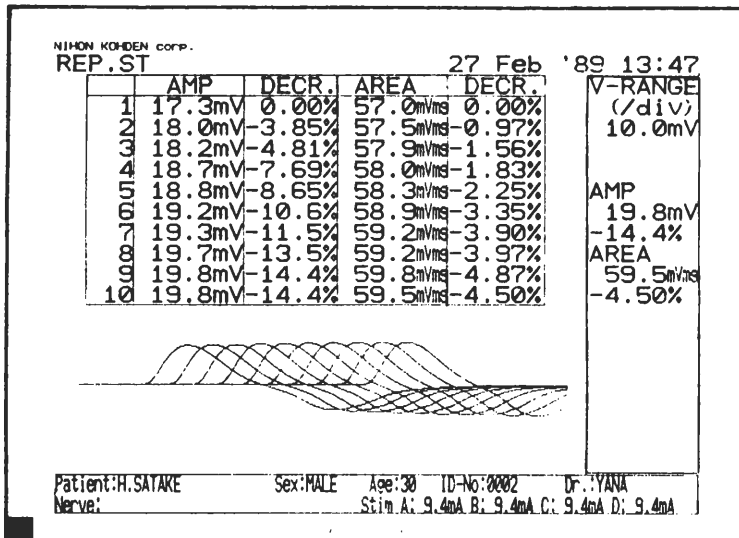
9. **Termination of Examination**

When a menu other than REP. ST is selected, all waveforms are erased.

Recording sample



Recording sample: Hard copy of the DECR table



## 8 H-RFLX (H-REFLEX: Single Synapse Reflex)

### ◆ Description of Examination

This mode is used to measure the H-wave caused by a spinal cord reflex owing to electric stimulation given to the peripheral nerve.

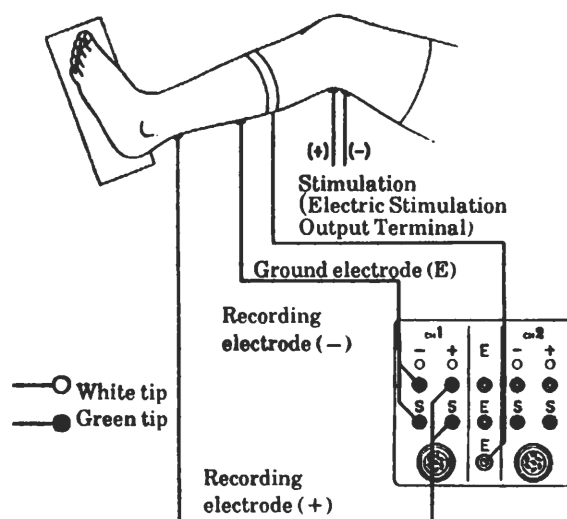
This menu permits not only H-wave observation on cascaded waveform display but also continuous storage of up to 16 reaction waveforms.

### ◆ Electrode Placement

Normally the H-wave appears in the lower limbs but not frequently in the upper limbs. Therefore, the posterior tibial nerve is often stimulated by the poples to derive the H-wave from the triceps of the lower limbs.

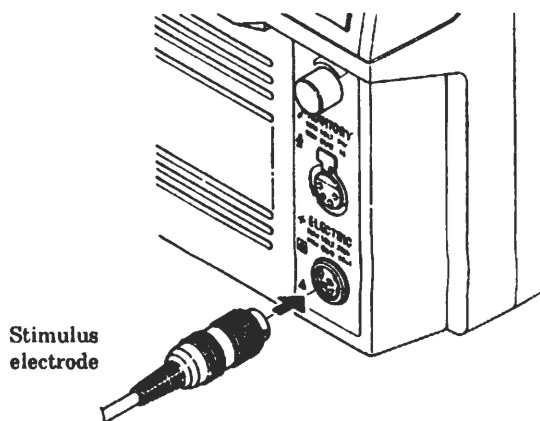
The H-wave can be easily separated from the M-wave by derivation from the soleus rather than from the gastrocnemius. For this reason, place the active electrode on the soleus.

<Posterior tibial nerve>



Measurement: On the soleus and just inside the tibia

Stimulation: Central part of the popliteal



- (1) Place the active electrode on the muscle controlled by the motor nerve to be examined.
- (2) Immerse the ground electrode in water or physiological saline solution and wind it around the leg between the active electrode and stimulating location. The opposite-side connector is connected to the E terminal of the electrode junction box.
- (3) Use the surface stimulation electrode for stimulation. Be sure to wet the felt tip at the end of the electrode with water or physiological saline solution before use. The negative side (–) is indicated with black mark.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.

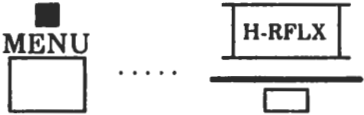
**CAUTION**

**Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.**

**◆ Preparing the Patient**

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode if necessary.
- Make the patient to be relax and avoid the appearance of EMG artifact during examination.

◆ Measurement

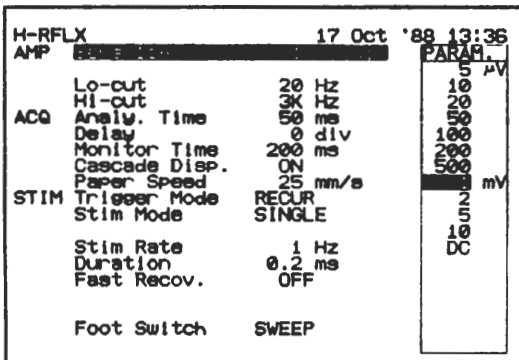
- 

Press the MENU key to display the menu screen.  
Select the H-RFLX mode according to the procedure of menu selection.

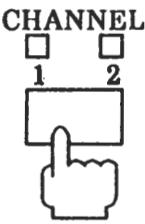
- 

Check the condition by pressing the CONDITION key.

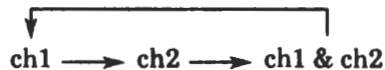
Condition Screen



- \* Foot switch operation
- Released immediately after being engaged:  
Single-shot stimulation is output.
  - While engaged:  
Stimulation is output, and sweep waveforms synchronized with the stimulation are displayed.
  - Released: Stimulation is stopped and the reaction waveform is displayed.

- 

Select a channel to be used by pressing the CHANNEL key.  
In the H-RFLX mode, each time the CHANNEL key is pressed, the following selection will be repeated.

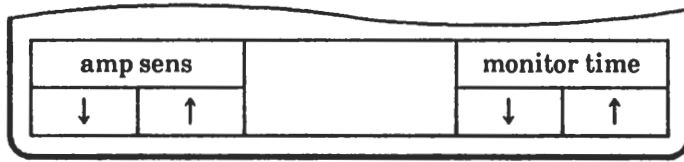


- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

◆ **Monitor Screen**

Function keys



Switches the input sensitivity.

Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

5.



Start stimulation by pressing the **STIM/SWEEP** key (engaging the foot switch). A sweep screen is displayed.

6.



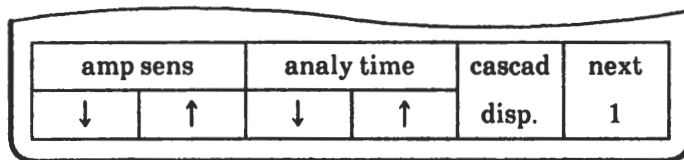
Place the stimulating electrode to the stimulating point. Adjust the stimulation current value with the Stimulation Value Set knob.

\* The reaction waveform varies greatly with stimulating locations and stimulation current value.

◆ **Sweep Screen**

Function keys

1st page



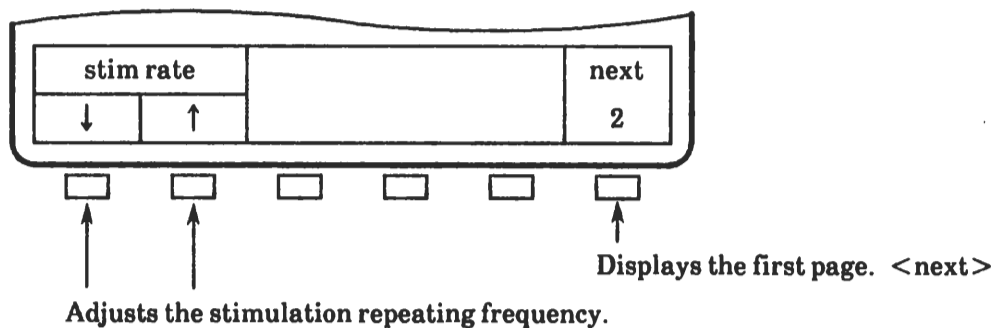
Switches the input sensitivity.

Switches the screen display time.

Turns the cascaded waveform display on and off. <cascad disp.>

Displays the second page <next>

2nd page

**Panel keys**

**POSITION ↓ ↑:** Moves the displayed waveform up and down.

**VERTICAL GAIN ↓ ↑:** Switches the waveform display amplitude.

**MONITOR:** Checks the monitor waveform during stimulation.  
(Sweep status is restored when the STIM/SWEEP key is pressed.)



(Cursor movement dial)

: LTNCY and AMPTD measurement

7.

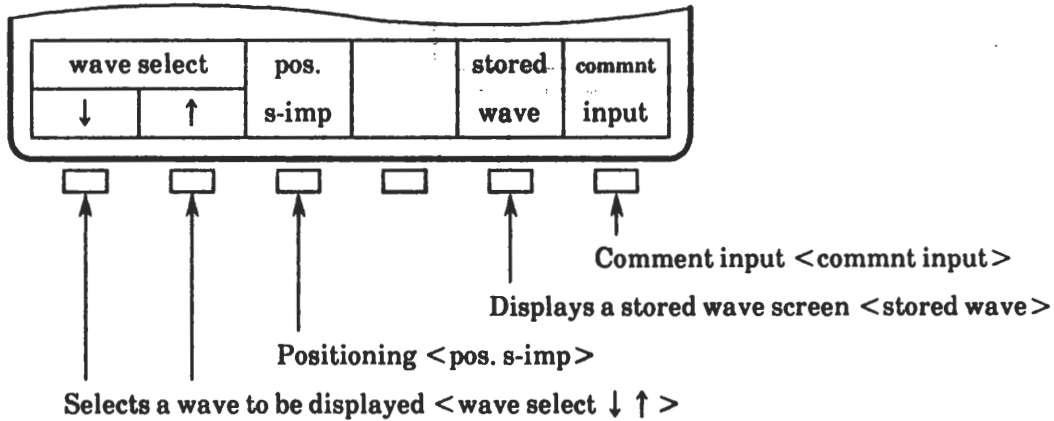


When a suitable waveform appears, press the STOP key.

- \* Four waveforms are then displayed on the screen and the screen stops. This display is called STOP screen. The waveforms are displayed newest to oldest from top to bottom.
- \* Sixteen waveforms are stored in the instrument. While the <wave select ↓ ↑ > key is pressed, the screen is scrolled so that all the waveforms can be observed.

◆ Stop Screen

Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

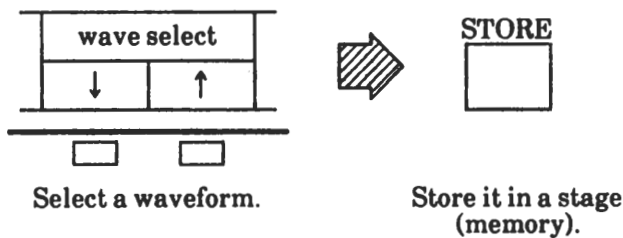
STORE: Stores a waveform.



: LTNCY and AMPTD measurement

(Cursor movement dial)

\* Storing a waveform



- Four stages A – D are available. One stage is used for each stored waveform. Up to four sets of waveforms can be stored.

$$\left( \begin{array}{l}
 \text{1 ch measurement: } 4 \times 1 \text{ ch} = 4 \text{ waveforms} \\
 \text{2 ch measurement: } 4 \times 2 \text{ ch} = 8 \text{ waveforms}
 \end{array} \right)$$

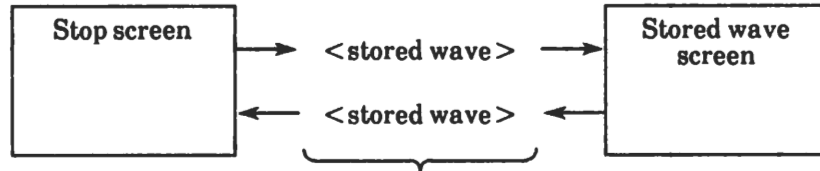
- \* If the next measurement is made without using the STORE function, the displayed waveform is erased.



\* Observing only the stored waveform

When the <stored wave> key is pressed, only the stored waveform is displayed (stored wave screen).

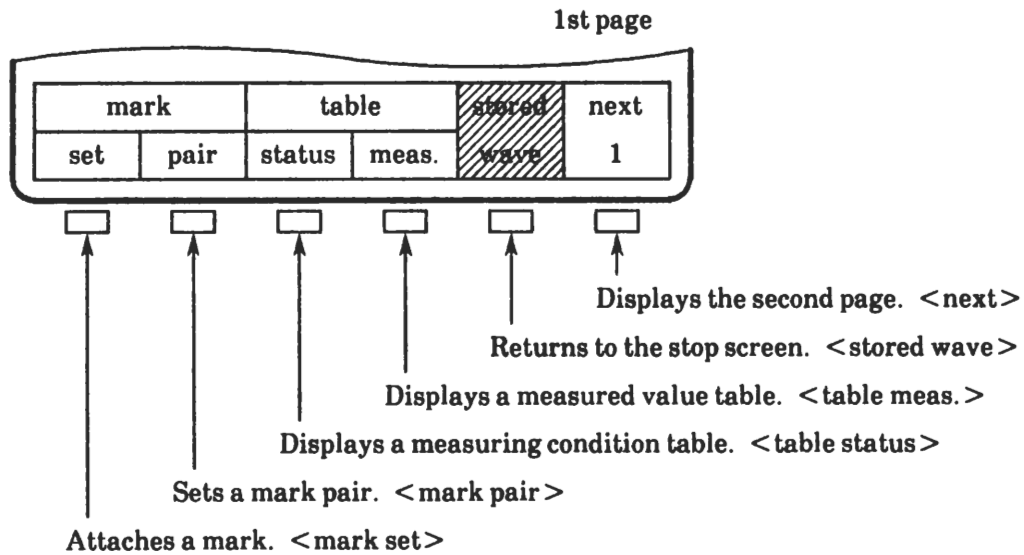
When the same key is pressed again on the stored wave screen, this screen is returned to the stop screen.

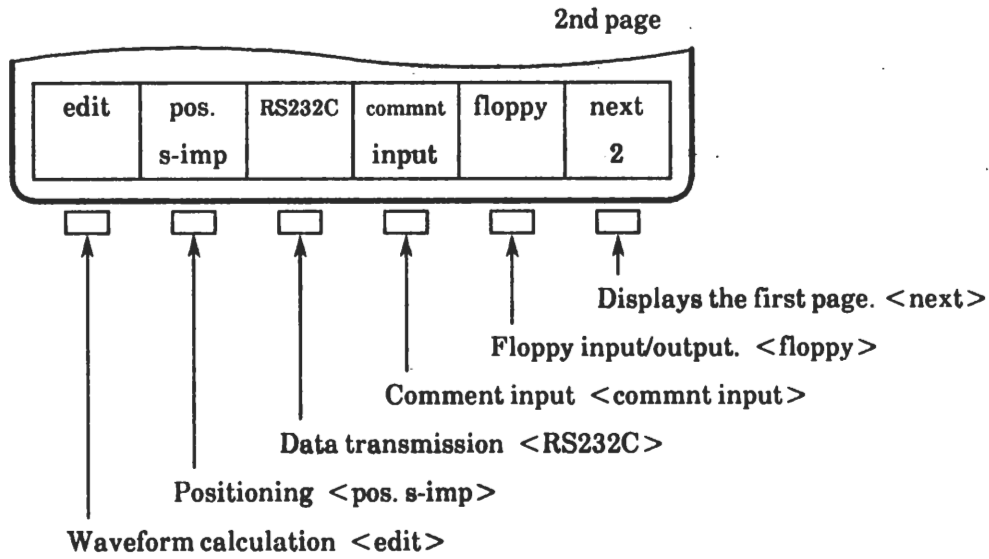


The <stored wave> key indication is reverse shaded while the stored wave screen is displayed.

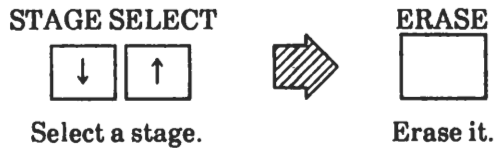
◆ Stored Wave Screen

Function keys





\* Erasing a stored waveform



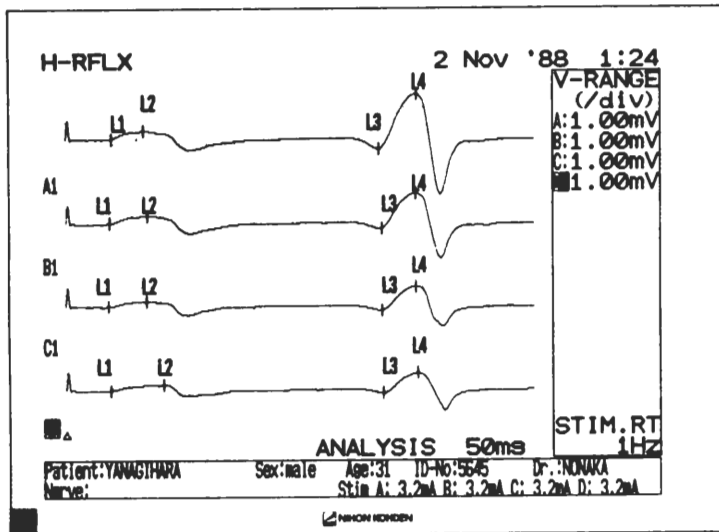
\* Recording

When the RECORD key is pressed, a hard copy of the screen is made.

9. Termination of Examination

When a menu other than H-RFLX is selected, all waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

H-RFLX 2 Nov '88 1:24

	L1	L2	L3	L4	L5	AREA
A1	4.80	8.19	33.2	37.2		ms
B1	4.59	8.60	33.0	37.2		ms
C1	4.50	8.50	33.0	37.2		ms
D1	4.70	10.3	33.7	37.4		ms

INTERVAL			AMPLITUDE		
	L1-L2			L1-L2	L3-L4
A1	28.5	ms	A1	0.23	1.53
B1	29.0	ms	B1	0.20	0.96
C1	29.1	ms	C1	0.13	0.66
D1	29.0	ms	D1	0.16	0.56

Patient: YANAGIHARA Sex: male Age: 31 ID-No: 9545 Dr.: NONAKA  
 Nerve: Stim A: 3.2mA B: 3.2mA C: 3.2mA D: 3.2mA

Model: FOW110-3-150

## 9 F-WAVE (F-WAVE: Later Compound Action Potential)

### ◆ Description of Examination

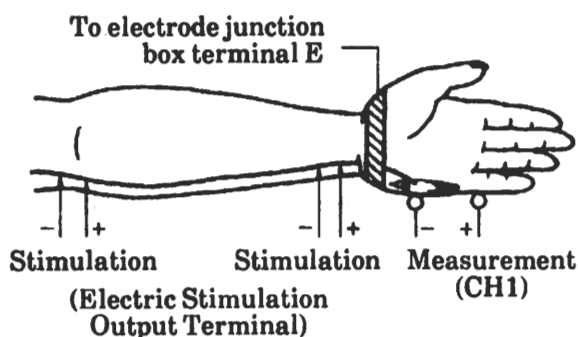
This menu is used to measure the F-wave evoked from the muscle when a maximum electric stimulus is given to the peripheral nerve.

This menu permits F-wave observation via the cascaded waveform display and measurement of MAX, MIN and MEAN latency at the rise of the F-wave while continuously storing sixteen (eight) reaction waveforms.

### ◆ Electrode Placement

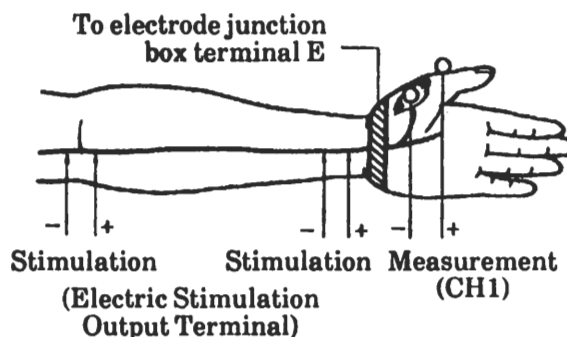
The standard electrode positions for F-wave measurement are the same as those for MCV measurement. However, the negative stimulation electrode is positioned on the proximal side in relation to the positive.

#### (a) Ulnar nerve



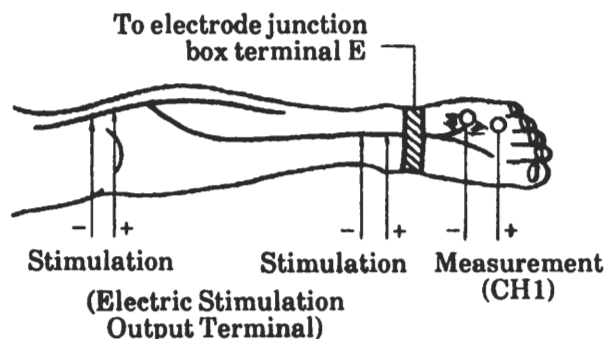
**Measurement:** Abductor digiti minimi muscle  
**Stimulation:** Wrist (distal location)  
 Elbow ulnar nerve groove (proximal location)

#### (b) Median nerve



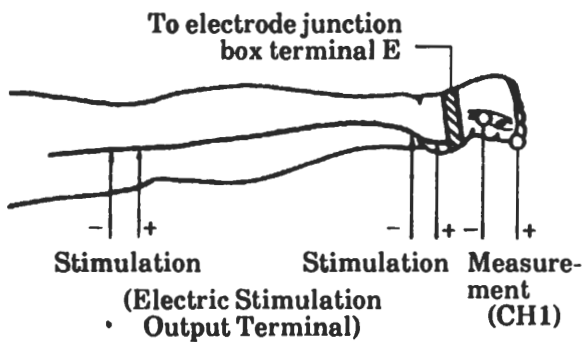
**Measurement:** Abductor pollicis brevis muscle  
**Stimulation:** Central part of wrist (distal location)  
 Elbow just inside the brachial artery (proximal location)

#### (c) Peroneal nerve



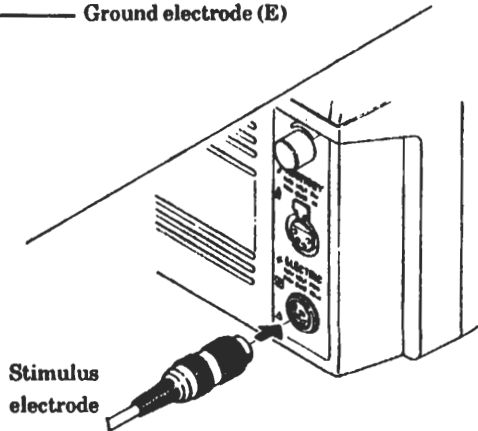
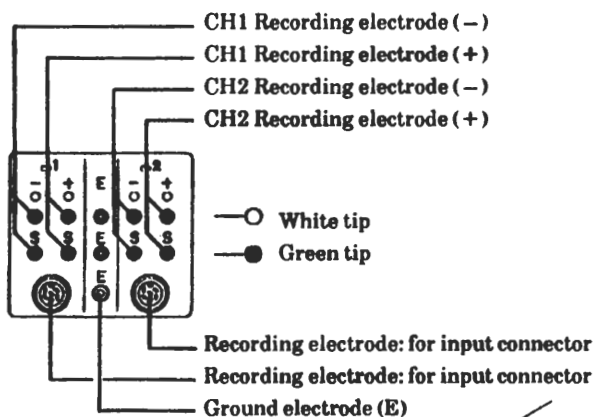
**Measurement:** Extensor digitorum brevis muscle  
**Stimulation:** Frontal part of crural periphery, 4-6 cm from the internal malleolus toward the central nerve (distal location)  
 Just inside the biceps femoris tendon part and the popliteal (proximal location)

(d) Tibial nerve



**Measurement:** Extensor digitorum communis muscle

**Stimulation:** Upper part behind the internal malleolus (distal location)  
Central part of popliteal (proximal location)



Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

(1) Immerse the ground electrode in water or physiological saline solution and wind it around the wrist or foot between the active electrode and stimulating location. The other side connector is connected to the E terminal of the electrode junction box.

(2) Place the active electrode on the muscle controlled by the motor nerve to be examined.

(3) Use the surface stimulation electrode for stimulation. Be sure to wet the felt tip at the end of the electrode with water or physiological saline solution for use.

The negative side (-) is indicated with black mark.

(4) Make an impedance check and adjust the contact resistance of the electrode to 5 kΩ or less.

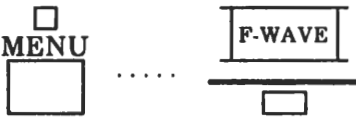
**CAUTION**

Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.


◆ **Preparing the Patient**

- Keep the patient and the electrode junction box 1m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode if necessary.
- Make the patient to be relax and avoid the appearance of EMG during examination.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the F-WAVE mode according to the procedure of menu selection.

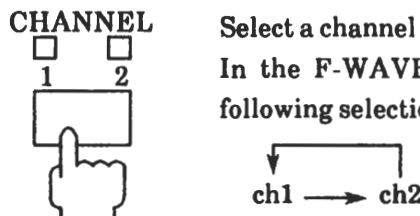
- 

Check the condition by pressing the CONDITION key.


Condition Screen

F-WAVE		17 Oct	'88 13:35
AMP			PARAM.
Lo-cut	50	Hz	5
Hi-cut	50	Hz	10
ACQ Analy. Time	50	ms	20
Delay	0	div	50
Monitor Time	200	ms	100
Cascade Disp.	ON		200
Memory Wave	8		1
Auto Mark	ON		1 mV
Paper Speed	25	mm/s	2
STIM Trigger Mode	RECUR		5
Stim Rate	1	Hz	10
Duration	0.2	ms	DC
Foot Switch	SWEEP		

- \* Foot switch operation
  - Released immediately after being engaged: Single-shot stimulation is output.
  - While engaged: Stimulation is output, and sweep waveforms synchronized with the stimulation are displayed.
  - Released: Stimulation is stopped and the reaction waveform is displayed.

- 

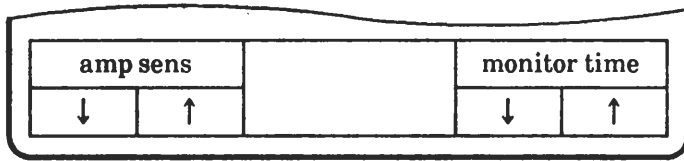
Select a channel to be used by pressing the CHANNEL key.  
In the F-WAVE mode, each time the CHANNEL key is pressed, the following selection will be repeated.

- 

Monitor the input waveform by pressing the MONITOR key.

◆ **Monitor Screen**

Function keys



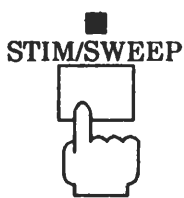
Switches the input sensitivity.

Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

5.



Start stimulation by pressing the **STIM/SWEEP** key (engaging the foot switch). A sweep screen is displayed.

6.

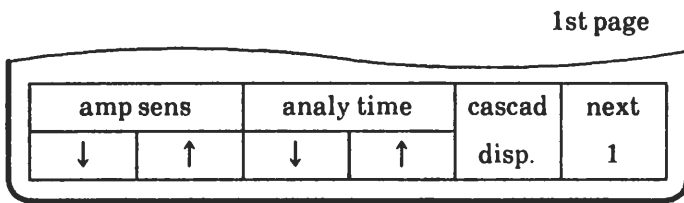


(Stimulation value set knob)

Place the stimulating electrode on the stimulating point. Adjust the stimulation current value to the maximum stimulation value with the Stimulation Value Set knob.

◆ **Sweep Screen**

Function keys

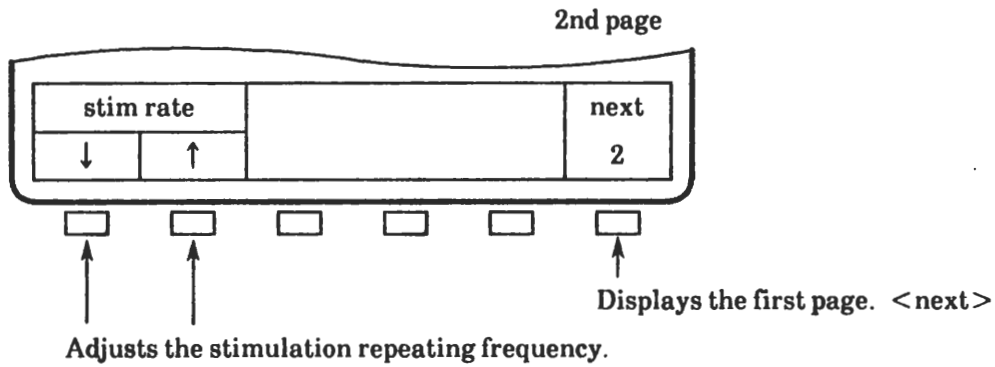


Switches the input sensitivity.

Switches the screen display time.

Turns the cascaded waveform display on and off. < cascad disp. >

Displays the second page < next >



**Panel keys**

**POSITION ↓ ↑:** Moves the displayed waveform up and down.

**VERTICAL GAIN ↓ ↑:** Switches the waveform display amplitude.

**MONITOR:** Checks the monitor waveform during stimulation.  
(The status is recovered to the sweep status by pressing the STIM/SWEEP key.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

7.

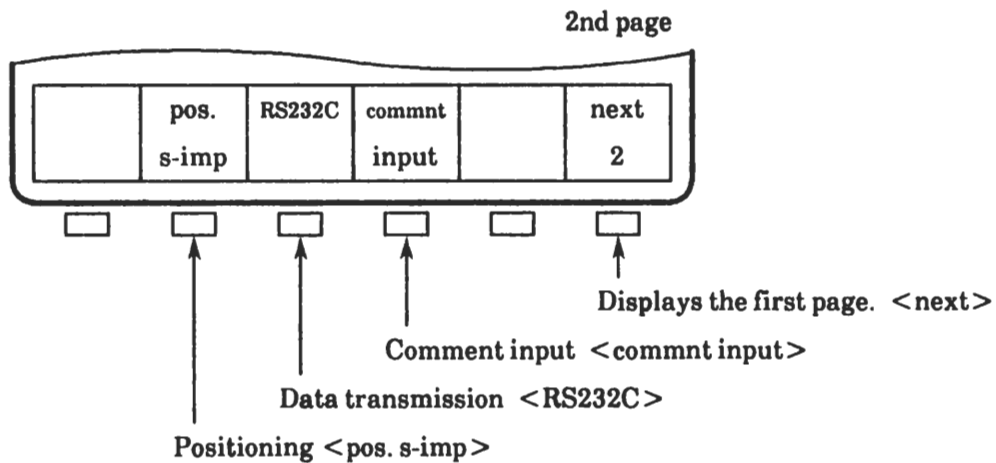
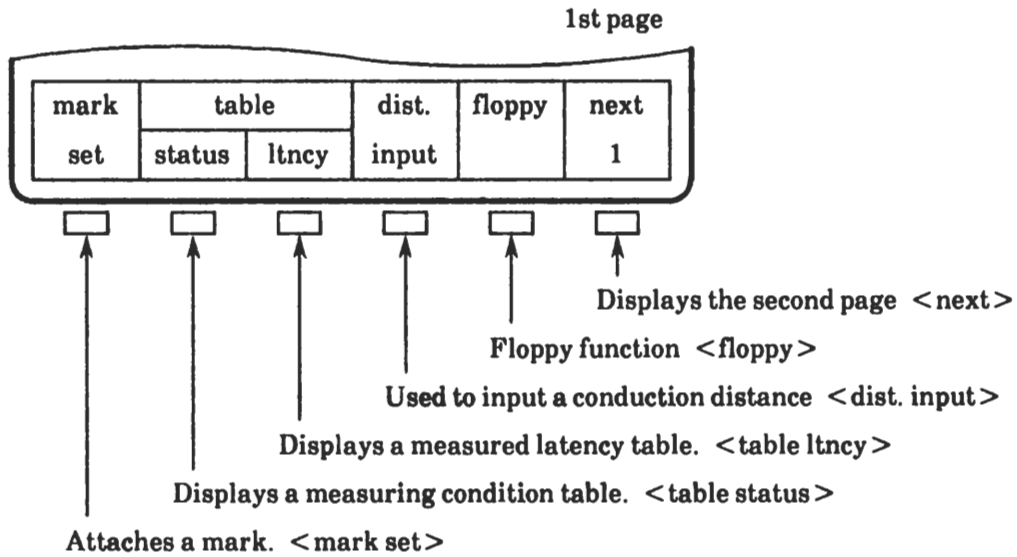


When an appropriate waveform appears, press the STOP key.

- \* At this time, 8 or 16 waveforms are displayed on the screen and this screen stops. This display is called the cascaded waveform display. The latest waveform is displayed at the top and the other waveforms are displayed newest to oldest from top to bottom.
- \* When the "Auto Mark" is set to ON on the condition screen, a mark is automatically attached to the onset point of the waveform, and MAX, MIN, and MEAN latency are displayed.



◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

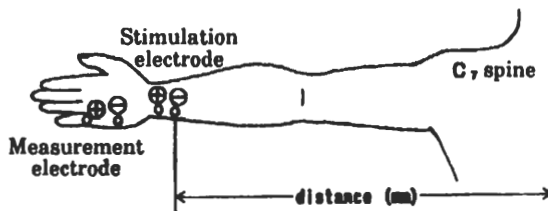
VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



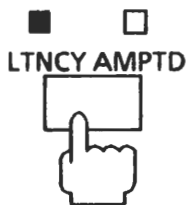
(Cursor movement dial)

: LTNCY and AMPTD measurement  
Conduction velocity measurement.

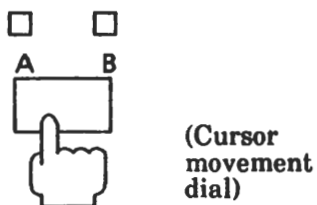
8. Measure the distance between the stimulating electrode  $\ominus$  and C7 spine.  
 \* During calculation, the apparatus doubles it automatically.



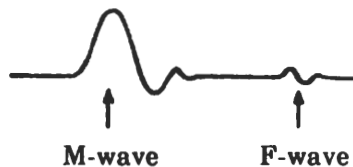
9. Conduction velocity measurement with the cursor



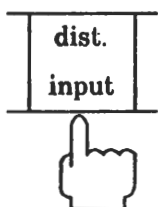
(1) Select "LTNCY" of the Cursor Mode Select key.



(2) Move the A and B cursors to the onset points of the M-wave and F-wave.



10.



(1) Press the <dist. input> key to display the distance input screen.  
 A character table is displayed and the functions change.

enter	letter select			recall	end
dist.	set	←	→		input

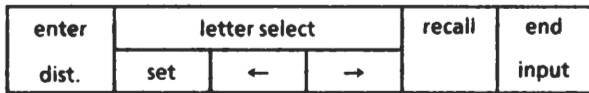
(2) Move the cursor to the desired character by using the <letter select ← →> key or the cursor movement dial.

The same character table as above, but with a hand icon pointing to the 'set' key.

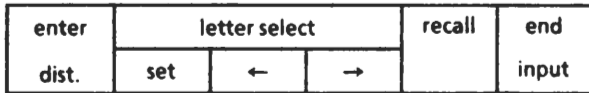
enter	letter select			recall	end
dist.	set	←	→		input

(3) Set the character moved with the cursor by pressing the <letter select set> key.

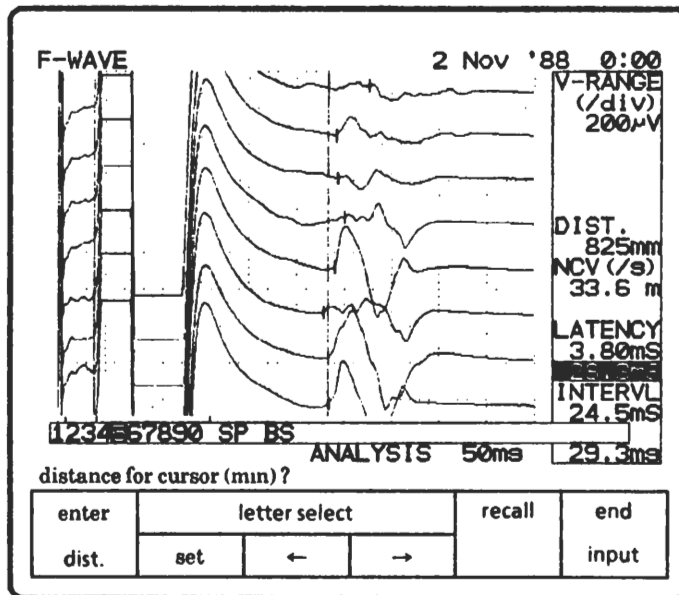
\* Repeat the above operations to input the distance.



(4) Press the <enter dist.> key. The conduction velocity is calculated and recorded on the right side of the screen.



(5) Press the <end input> key to terminate the distance input.



- \* The <recall> key is used to call back the previous input distance.
- \* To correct the distance input, press the <recall> key , or re-enter the correct value.
- \* When the full keyboard (optional) is connected, refer to “◆ How to use the full keyboard” described in the MEB/MEM-7102A/K Operator’s Manual.

10.



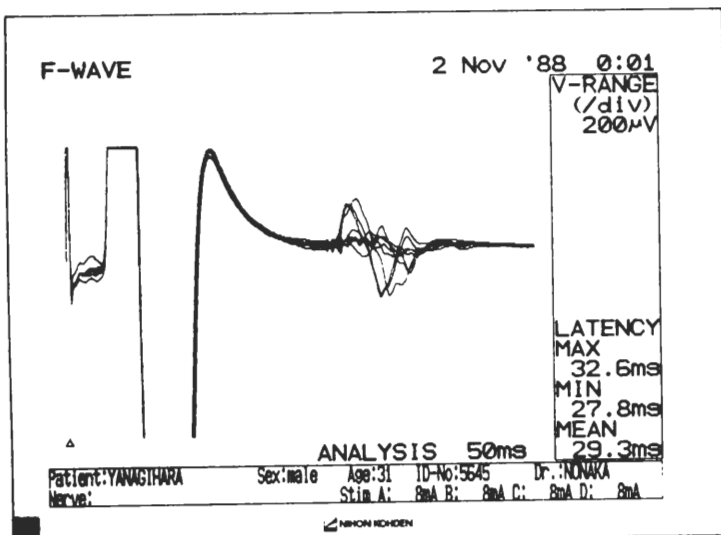
Press the RECORD key to start recording.

11.

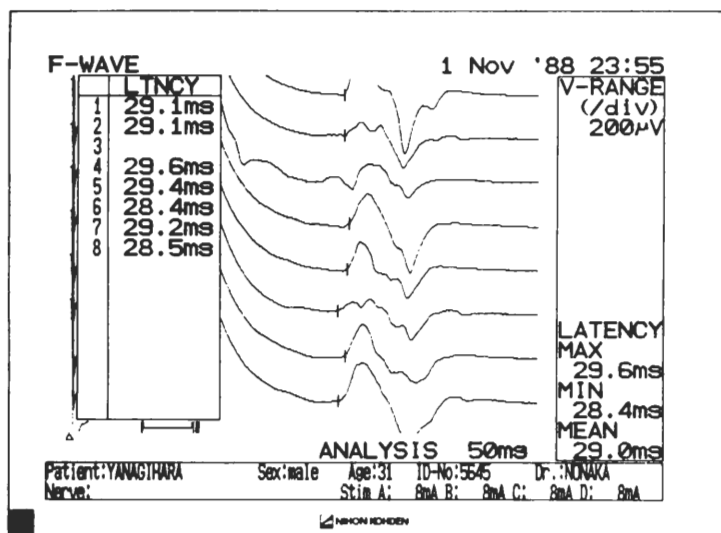
**Termination of Examination**

When a menu other than F-WAVE is selected, all waveforms are erased.

Recording sample



Recording sample: Hard copy of the latency table



PARANES

## 10 BLINK (BLINK REFLEX)

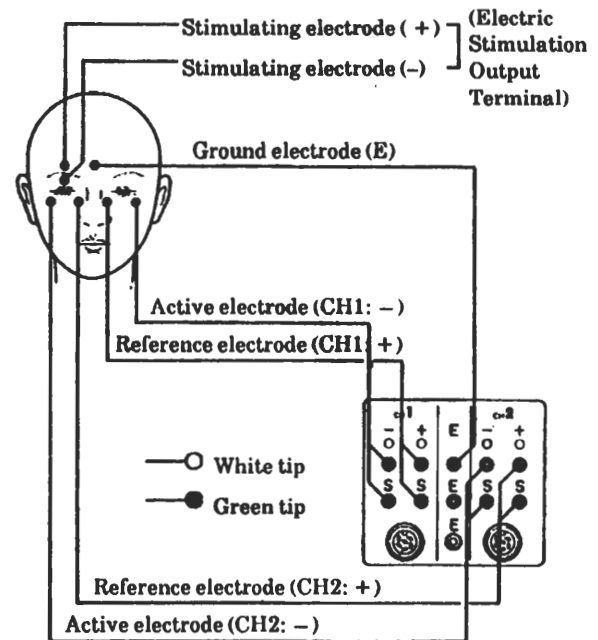
### ◆ Description of Examination

This mode is used to measure the polysynaptic reflex (orbicularis oculi muscle reflex) consisting of two components, i.e., the afferent of the trigeminal sensory branches and the efferent of facial nerve motor fibers.

### ◆ Electrode Placement

Electrical stimulation is given to the lower orbital nerve on the orbita. The active electrode is placed one-third of the distance from the outer edge of the lower orbicular muscle, and simultaneous recording is performed at the part of bilateral symmetry. Stimulation is given to each side. The latency values of both sides are compared. The latency is measured up to the first rise.

- (1) Use the evoked EEG disc electrode as the active electrode, reference electrode and ground electrode, and fix it with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (2) Use the EMG surface stimulation electrode as a stimulating electrode. Be sure to wet the felt tip of the electrode with water or physiological saline solution before use. The negative side (-) is indicated with a black mark.
- (3) The green tip from the ground electrode is not connected.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.



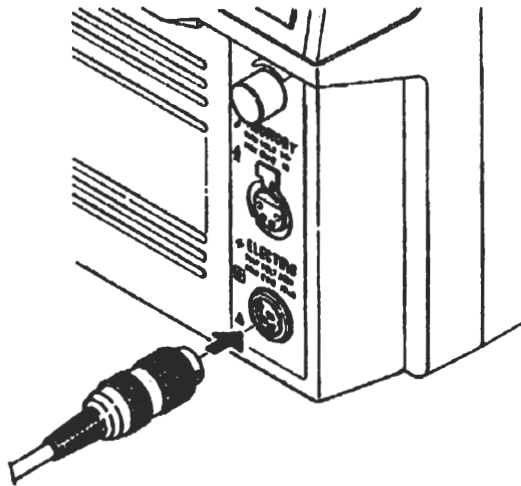
Active electrode: Lateral part of the upper eyelid

Reference electrode: Lateral part of the nose wing

Ground electrode: Nose tip or forehead

### CAUTION

Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.

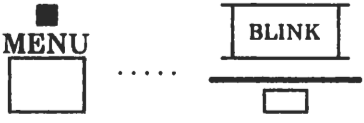


Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

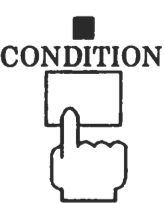
◆ **Preparing the Patient**

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Have the patient lie in a reclining chair or on a bed, and instruct him to close his eyes without blinking while staying awake.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode if necessary.
- Make the patient to be relax and avoid the appearance of EMG.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the BLINK mode according to the procedure of menu selection.

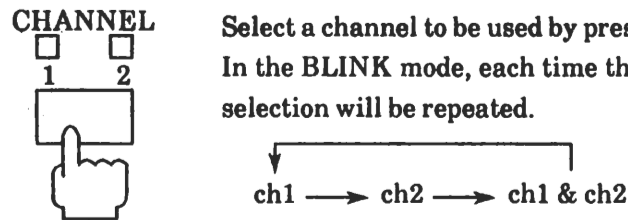
- 

Check the condition by pressing the CONDITION key.


Condition Screen

BLINK		17 Oct '88 13:36	
AMP	Sens 2ch	200 $\mu$ V/div	PARAM. 5 $\mu$ V
	Lo-cut	20 Hz	10
	Hi-cut	3K Hz	20
ACQ	Analy. Time	100 ms	50
	Delay	0 div	100
	Monitor Time	200 ms	500
	Paper Speed	25 mm/s	1 mV
STIM	Trigger Mode	MANUAL	2
	Duration	0.2 ms	10
	Fast Recov.	ON	DC
	Foot Switch	SWEEP	

- \* Foot switch operation  
In the BLINK mode, when the foot switch is engaged, a single-shot stimulation is given. The reaction waveform is displayed and the stimulation stops.
- \* When "FAST RECOVERY" is set to ON on the condition screen, this is effective against stimulation artifacts.

- 

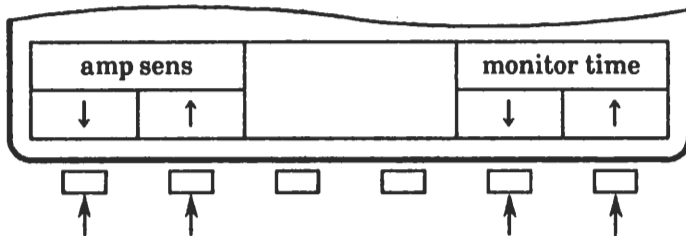
Select a channel to be used by pressing the CHANNEL key.  
In the BLINK mode, each time the CHANNEL key is pressed, the following selection will be repeated.

- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

◆ **Monitor Screen**

**Function keys**



Switches the input sensitivity.

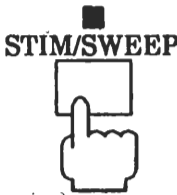
Switches the screen display time.

**Panel key**

**POSITION** ↓ ↑: Moves the displayed waveform up and down.

5.  Adjust the stimulation current value with the Stimulation Value Set knob.


(Stimulation value set knob)

6.  Give single-shot stimulation by pressing the STIM/SWEEP key (engaging the foot switch). The reaction waveform is stored and the stimulation stops automatically.

\* The reaction waveform varies greatly with the stimulation locations.

\* Give stimulation to the patient while it is not expected for more effective measurements.

\* **Storing waveform**

7.  When the STORE key is pressed, the displayed waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

$$\left( \begin{array}{l} 1 \text{ ch measurement: } 4 \times 1 \text{ ch} = 4 \text{ waveforms} \\ 2 \text{ ch measurement: } 4 \times 2 \text{ ch} = 8 \text{ waveforms} \end{array} \right)$$

\* **Erasing the stored waveform**

**STAGE SELECT**



Select a stage.



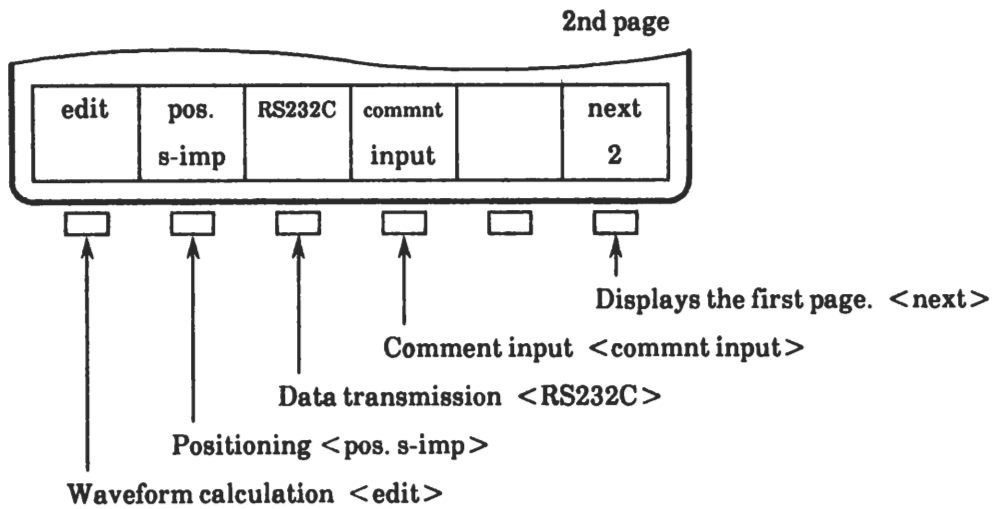
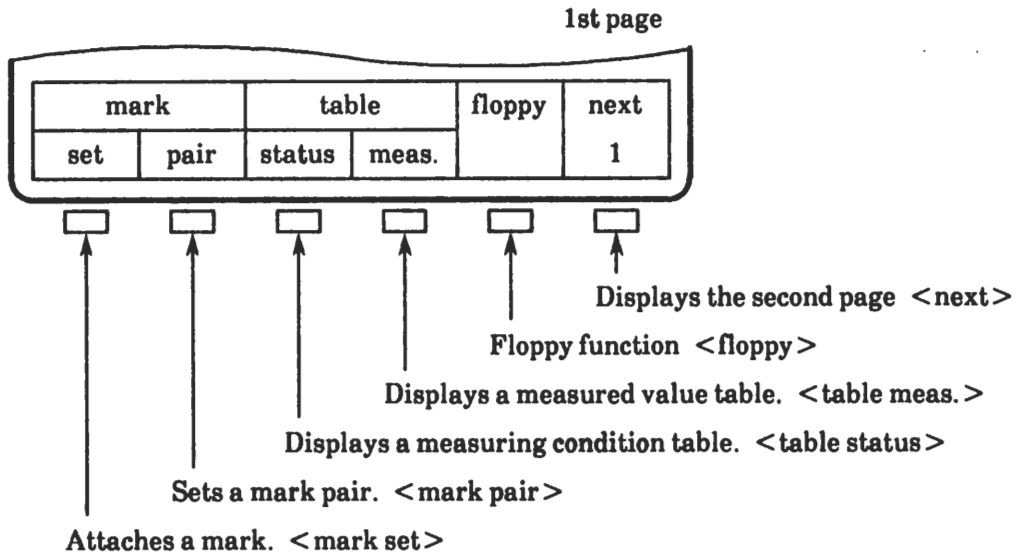
**ERASE**



Erase the waveform.



◆ Stop Screen  
Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



(Cursor movement dial)

: LTNCY and AMPD measurement

10. BLINK

8.

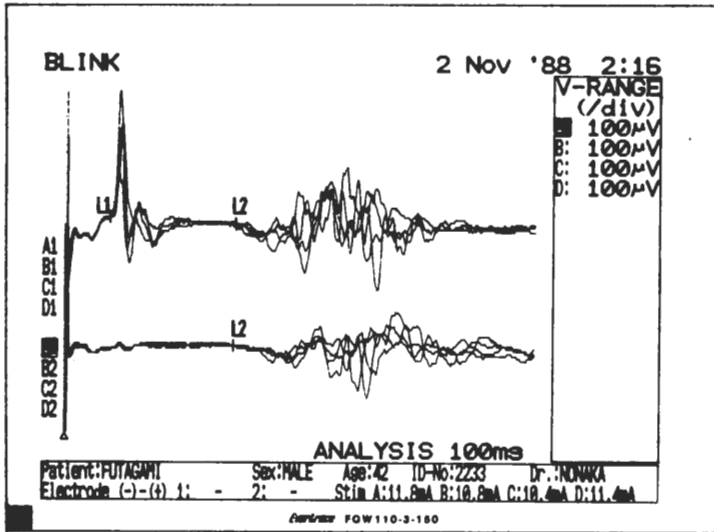


Press the RECORD key to start recording.

9. Termination of Examination

When BLINK, SEP, SSEP or TR-SEP is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

BLINK		2 Nov '88 2:16					AREA		
	I1	I2	I3	I4	I5	ms			
A1	9.40	36.0				ms			
A2		35.0				ms			
B1									
B2									
C1									
C2									
D1									
D2									
INTERVAL				AMPLITUDE					
A1				A1					
A2				A2					
B1				B1					
B2				B2					
C1				C1					
C2				C2					
D1				D1					
D2				D2					
Patient: FUTAGAMI		Sex: MALE		Age: 42		ID-No: 2233		Dr.: HONAKA	
Electrode (-)-(+) 1: - 2: -		Stim A: 11.8mA		B: 10.8mA		C: 10.4mA		D: 11.4mA	



# Somato

**11 SEP (Somatosensory Evoked Potential : 体性感觉誘発電位)**

**12 SSEP (Short Latency Somatosensory Evoked Potential : 短潜時SEP)**

## 11 SEP (Somatosensory Evoked Potential)

### ◆ Description of Examination

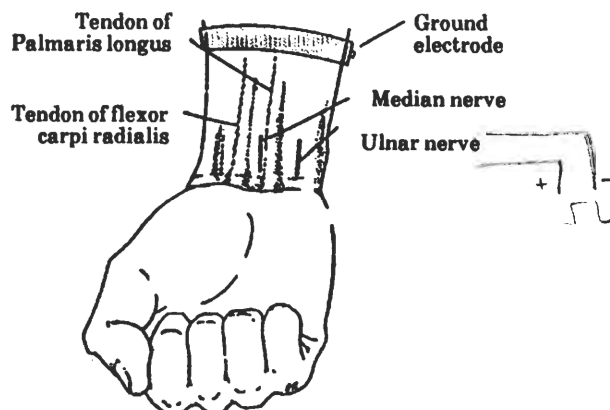
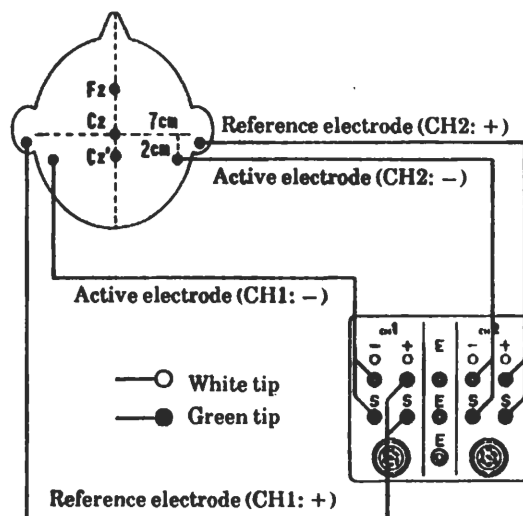
SEP, a cerebral evoked potential, can be measured through the stimulation of the peripheral sensory nerves in the area of the scalp corresponding to the somatosensory field. Both short latency (50 ms or less) and medium/long latency components appear. This menu is used to measure medium and long latency components.

### ◆ Electrode Placement

- (1) Use the EEG disk electrode as an active electrode and reference electrode, and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (2) Immerse the ground electrode in water or physiological saline solution and wind it between the active electrode and stimulating location. The opposite-side connector is connected to the E terminal of the electrode junction box.
- (3) Use the EMG surface stimulation electrode as a stimulating electrode. The negative side (-) is indicated with a black mark.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.

### CAUTION

Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.



### <Upper limb stimulation>

#### Active electrode:

7 cm laterally from the vertex (Cz) on the line connecting the vertex and the external auditory foramen and 2 cm posteriorly from the line. (Shagass' point on the contralateral side of stimulation)

#### Reference electrode:

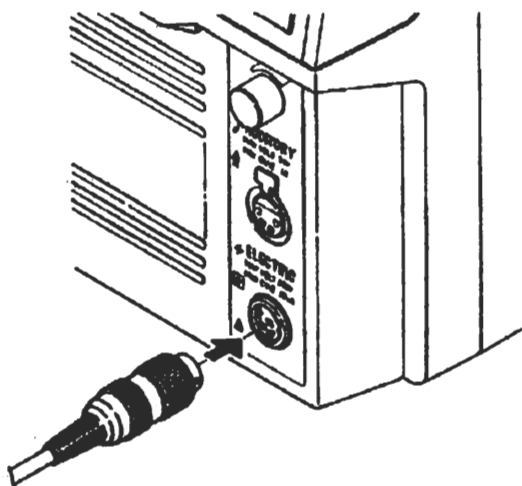
Earlobe on the contralateral side of stimulation (A1 or A2) or Fz

#### Ground electrode: Wrist

#### Stimulating electrode:

Wrist (median or ulnar nerve)

\*When the electrodes are placed as shown above, the measurement result becomes negative up.

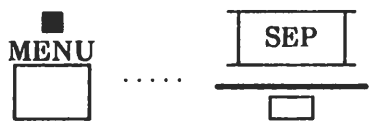


Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

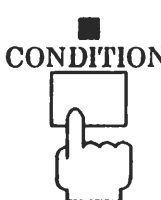
#### ◆ Preparing the patient

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode.
- Have the patient lie on a reclining chair or bed quietly.
- Fix the patient's head to prevent neck EMGs from appearing. Instruct him to keep the mouth slightly open to prevent chin EMGs from appearing.
- Keep the patient at rest with the neck and chin in a comfortable, relaxed position, and the eyes closed for examination.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the SEP mode according to the procedure of menu selection.

- 

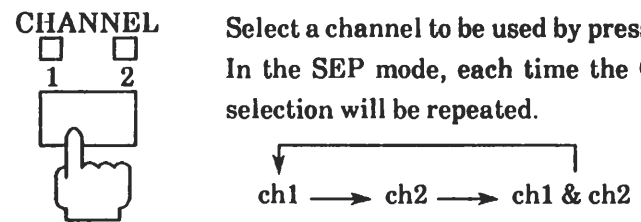
Check the condition by pressing the CONDITION key.

Condition Screen


SEP	17 Oct '88 13:36	PARAM.
AMP	20 µV/div	5 µV
Sens 2ch	1 Hz	10
Lo-cut	500 Hz	20
Hi-cut	100 ms	50
ACQ Delay	0 div	100
Monitor Time	200 ms	200
Preset Count	200	500
Paper Speed	25 mm/s	1 mV
STIM Trigger Mode	RECUR	10
Stim Rate	2 Hz	DC
Duration	0.2 ms	
Foot Switch	SWEEP	

\* Foot switch operation

- Released immediately after being engaged: Single-shot stimulation is output.
- While engaged: Stimulation is output, and sweep waveforms synchronized with the stimulation are displayed.
- Released: Stimulation is stopped and the reaction waveform is displayed.

- 

Select a channel to be used by pressing the CHANNEL key.  
In the SEP mode, each time the CHANNEL key is pressed, the following selection will be repeated.

- 

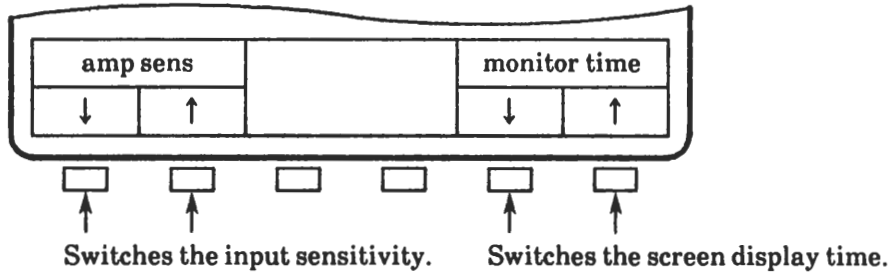
Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.

◆ **Monitor Screen**

**Function keys**



**Panel key**

POSITION ↓ ↑ : Moves the displayed waveform up and down.

5.

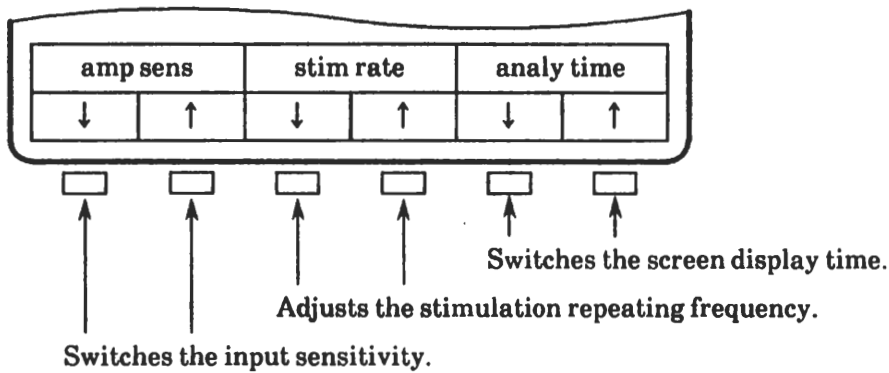


Start stimulation by pressing the **STIM/SWEEP** key.

Place the stimulating electrode at the stimulating point. A sweep screen is displayed. Adjust the stimulation current value with the Stimulation Value Set knob so that the controlling muscle contracts slightly.

◆ **Sweep Screen**

**Function keys**



**Panel keys**

POSITION ↓ ↑ : Moves the displayed waveform up and down.

**MONITOR:** Displays the monitor waveform during stimulation.  
(Pressing the **STIM/SWEEP** key restores sweep status.)



: LTNCY and AMPTD measurement

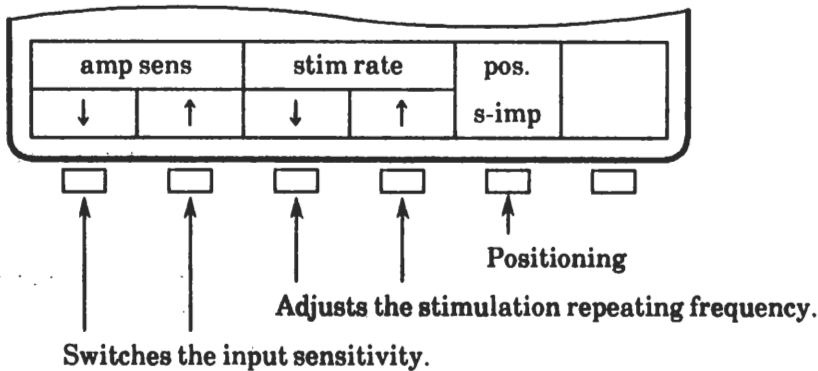
(Cursor movement dial)

6.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

◆ **Analysis Screen**  
Function keys



**Panel keys**

**POSITION** ↓ ↑: Moves the displayed waveform up and down.

**VERTICAL GAIN** ↓ ↑: Switches the waveform display amplitude.

**MONITOR:** Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)

**STIM/SWEEP:** Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.



- \* **Stopping averaging**
  - When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
  - While averaging is stopped, the input waveform can be checked with the MONITOR key.
- \* **Reattempting averaging**
  - If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

7.



Stores the averaging waveform.

When the STORE key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

$$\left( \begin{array}{l} \text{1ch measurement: } 4 \times 1\text{ch} = 4 \text{ waveforms} \\ \text{2ch measurement: } 4 \times 2\text{ch} = 8 \text{ waveforms} \end{array} \right)$$

- \* **Erasing the stored waveform**

**STAGE SELECT**



Select a stage.



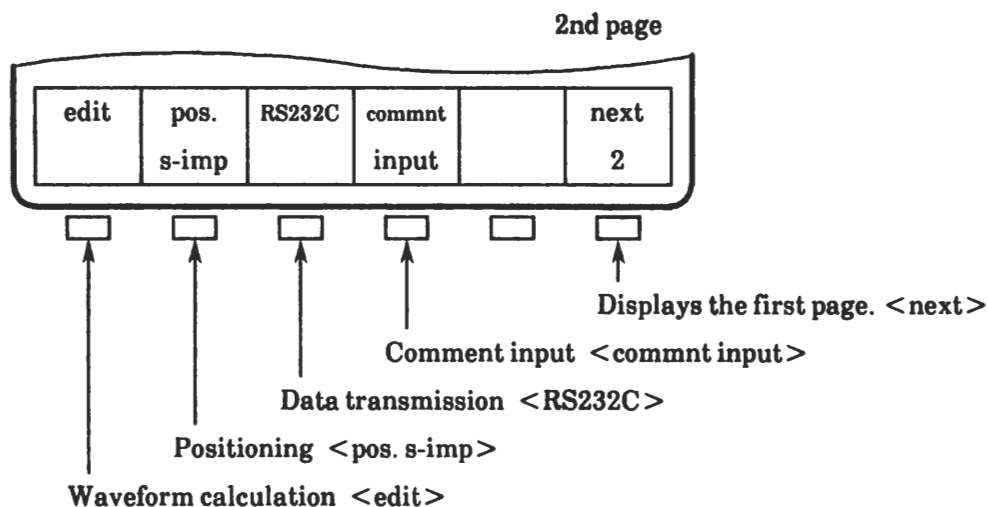
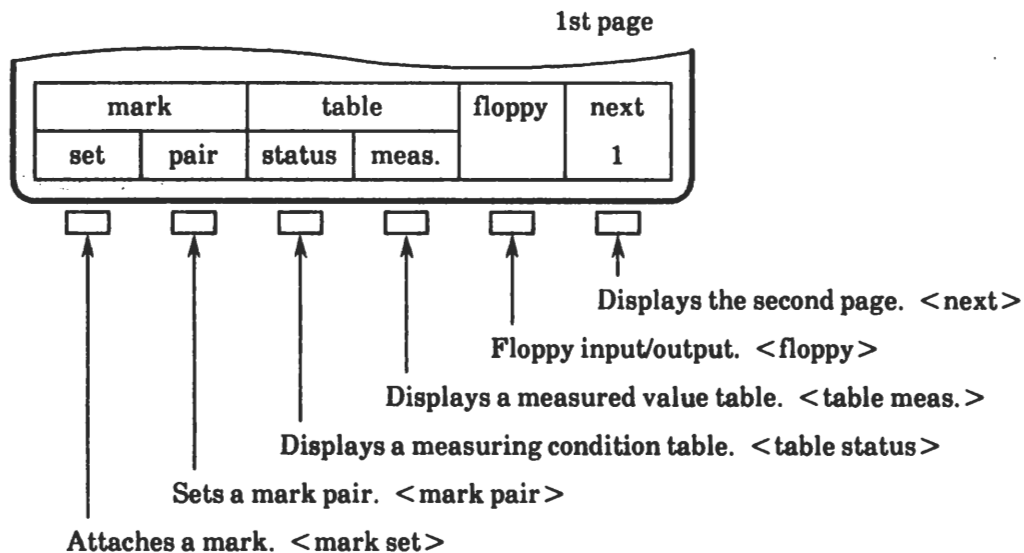
**ERASE**



Erase the waveform.

8. **Make another measurement to confirm the reproducibility of the waveform.**

◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑ : Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑ : Switches the waveform display amplitude.



(Cursor movement dial)

: LTNCY and AMPTD measurement

9.

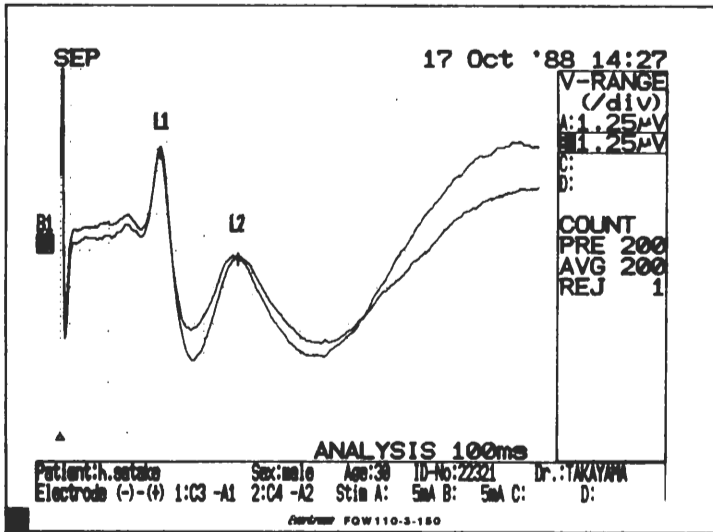


Press the RECORD key to start recording.

10. Termination of Examination

When BLINK, SEP, SSEP or TR-SEP is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waves are erased.

Recording sample



Recording sample: Hard copy of the measure table

SEP 17 Oct '88 14:29

	L1	L2	L3	L4	L5	AREA
AL	20.6	37.0				
BL						ms

INTERVAL			AMPLITUDE		
	L1-L2			L1-L1	
AL	16.3		ms	3.12	
BL					μV

Patient: h. osaka Sex: male Age: 30 ID-No: 22321 Dr.: YAKAYAMA  
 Electrode (-)-(+) 1:C3 -A1 2:C4 -A2 Stim A: 5mA B: 5mA C: D:

Hardware FQW110-3-150

## 12 SSEP (Short Latency Somatosensory Evoked Potential)

### ◆ Description of Examination

Somatic dysesthesia can be detected by the said SEP examination, but the affected part cannot be satisfactorily located.

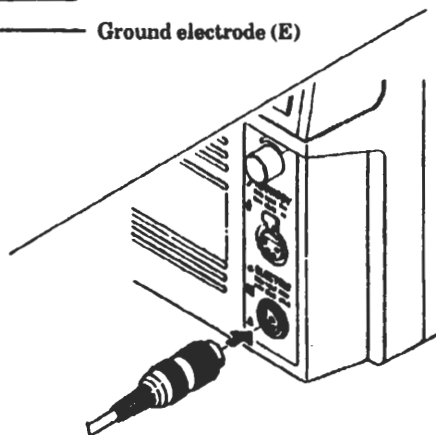
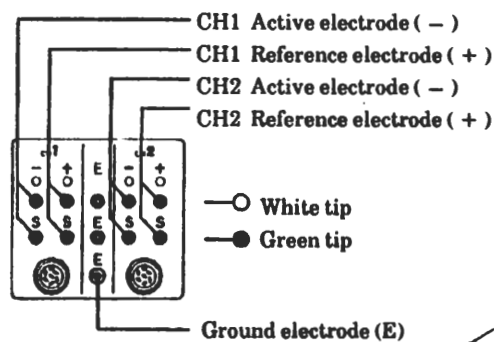
This menu, used to measure short latency components, permits examination of the sensory conduction status; the electrodes are placed at the supraclavicular fossa and vertebrae cervicales for upper limb stimulation or the vertebrae lumbales and vertebrae thoracicae for lower limb stimulation, as well as on the scalp. The waveforms of short latency components that are little affected by the patient's conscious level, sleep and medicines and have high reproducibility can be used for intra-operative monitoring.

### ◆ Electrode Placement

- (1) Use the EEG disk electrode as an active electrode and reference electrode, and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (2) Immerse the ground electrode in water or physiological saline solution and wind it between the active electrode and stimulating location. The opposite-side connector is connected to the E terminal of the electrode junction box.
- (3) Use the EMG surface stimulation electrode as a stimulating electrode. The negative side (–) is indicated with a black mark.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.

#### CAUTION

Do not use the needle electrode for stimulation, as it may be damaged if a stimulation current flows into it after insertion.

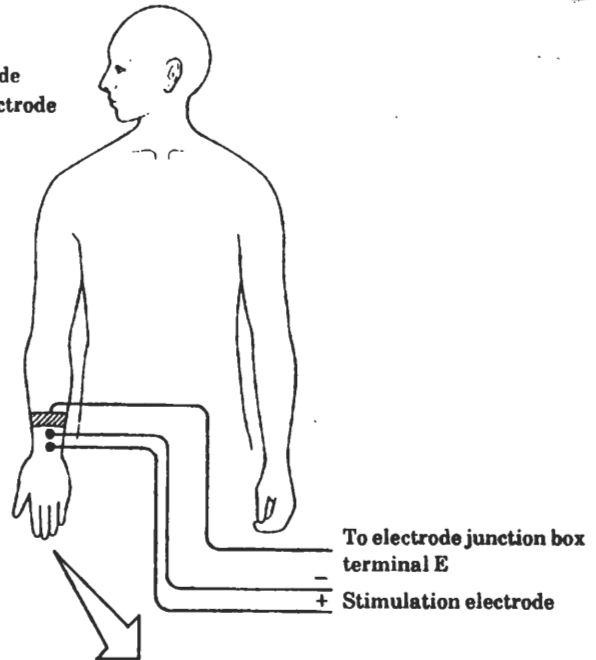
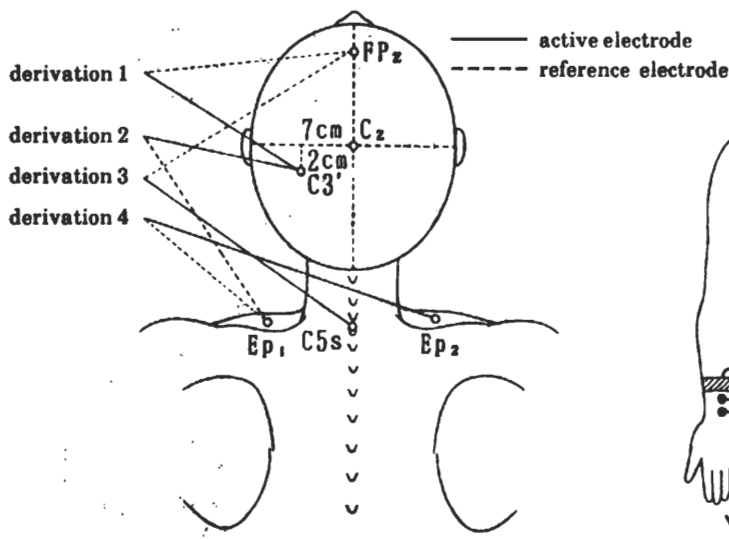


Connect the stimulating electrode to the electrical stimulation output terminal of the main unit.

### ◆ Preparing the patient

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the stimulating electrode a sufficient distance from the recording electrode and the electrode junction box.
- Wipe the electrode placing location with alcohol. Rub it with Skinpure to decrease the contact resistance of the electrode.
- Have the patient lie on a reclining chair or bed quietly. Fix his head to prevent neck EMGs from appearing. Instruct him to keep the mouth slightly open to prevent chin EMGs from appearing.
- Keep the patient at rest with the neck and chin in a comfortable, relaxed position, and the eyes closed for examination.

● Upper right limb stimulation



[Active electrode and reference electrode placement]

<Derivation 1>

Active electrode (-):

7 cm laterally from the vertex on the line connecting the vertex and external auditory foramen and 2 cm posteriorly from the line (Shagass' point, C3' or C4', contralateral side of stimulation)

Reference electrode (+): Forehead (Fpz)

<Derivation 2>

Active electrode (-): Shagass' point (C3' or C4')

Reference electrode (+):

Supraclavicular fossa, Erb's point, contralateral side of stimulation (EP1 or EP2)

<Derivation 3>

Active electrode (-):

Fifth vertebral spinous process (C5S)

Reference electrode (+): Forehead (Fpz)

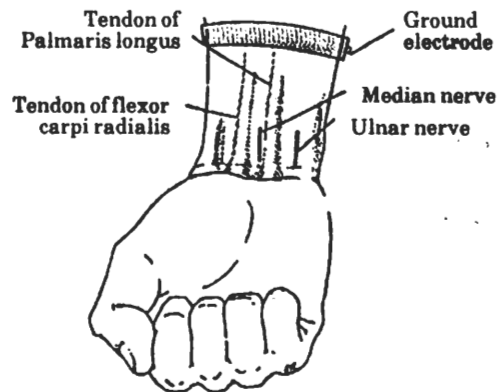
<Derivation 4>

Active electrode (-):

Supraclavicular fossa, Erb's point, stimulation side

Reference electrode (+):

Supraclavicular fossa, Erb's point, contralateral side of stimulation



[Ground electrode and stimulating electrode placement]

Stimulating electrode:

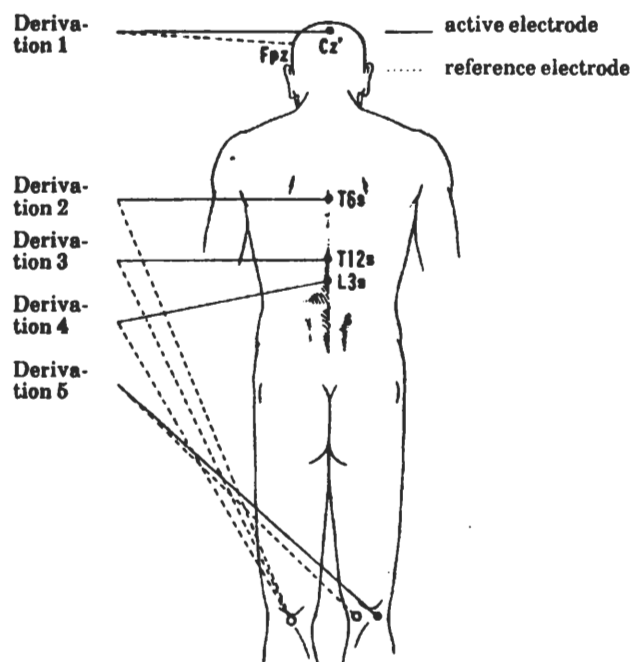
Wrist (median or ulnar nerve)

Ground electrode:

Immerse the ground electrode in water or physiological saline solution and wind it between the active electrode and stimulating location.

\* When the electrodes are placed as shown above, the measurement result becomes negative up.

● Lower limb stimulation



[Active electrode and reference electrode placement]

< Derivation 1 >

Active electrode (-) :

2 cm posterior from Cz (Cz')

Reference electrode (+) : Forehead (Fpz)

< Derivation 2 >

Active electrode (-) :

6th vertebrae thoracicae (T6S). Second upper spinous process from the line connecting the lower ends of both shoulder blades, with the shoulders and arms relaxed.

Reference electrode (+) :

On the stifle bone on the contralateral side of stimulation.

< Derivation 3 >

Active electrode (-) :

12th vertebrae thoracicae (T12S). 3rd upper spinous process from L3 spinous process.

Reference electrode (+) :

On the stifle bone on the contralateral side of stimulation.

< Derivation 4 >

Active electrode (-) :

3rd vertebrae lumbales (L3S). 1st upper spinous process from the horizontal line connecting both iliac crests.

Reference electrode (+) :

On the stifle bone on the contralateral side of stimulation.

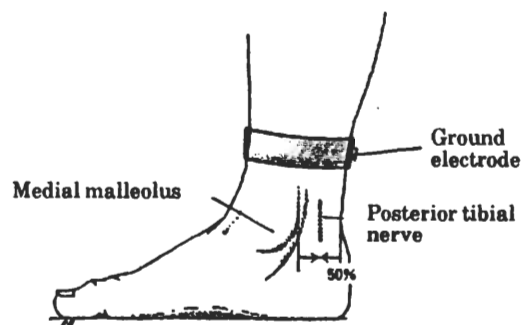
< Derivation 5 >

Active electrode (-) :

On the tibial nerve trunk of the popliteal space of the stimulation side.

Reference electrode (+) :

Inside the popliteal space of the stimulation side.



Stimulating electrode:

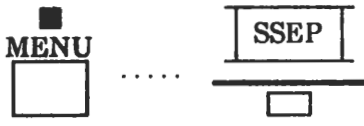
Articulation of the leg (posterior tibial nerve)

Ground electrode:

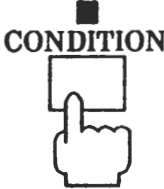
Be sure to wet the ground electrode with water or physiological saline solution and then place it at the ankle (a little toward the central part, rather than stimulation)

\* When the electrodes are placed as shown above, a measurement result becomes negative up.

◆ Measurement

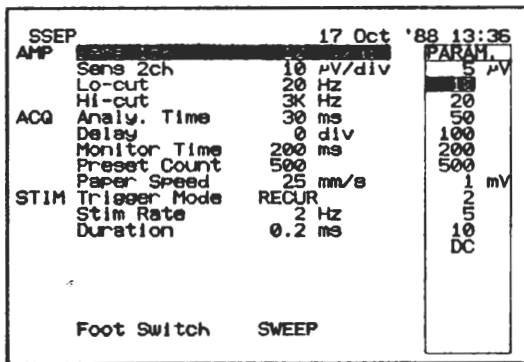
- 

Press the MENU key to display the menu screen.  
Select the SSEP mode according to the procedure of menu selection.

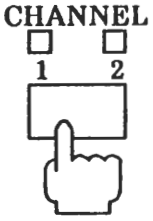
- 

Check the condition by pressing the CONDITION key.

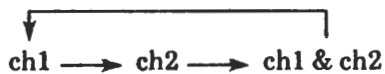
Condition Screen




- \* Foot switch operation
- Released immediately after being engaged: Single-shot stimulation is output.
  - While engaged: Stimulation is output and sweep waveforms synchronized with the stimulation are displayed.
  - Released: Stimulation is stopped and the reaction waveform is displayed.

- 

Select a channel to be used by pressing the CHANNEL key.  
In the SSEP mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

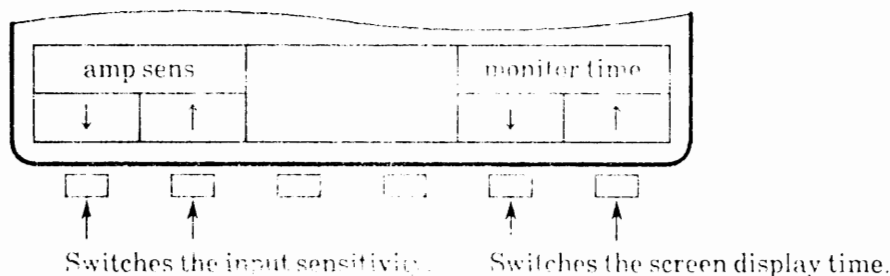
Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.

[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.

## ◆ Monitor Screen

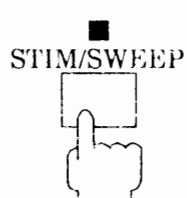
Function keys



Panel key

POSITION ↓ ↑      Moves the displayed waveform up and down.

5.

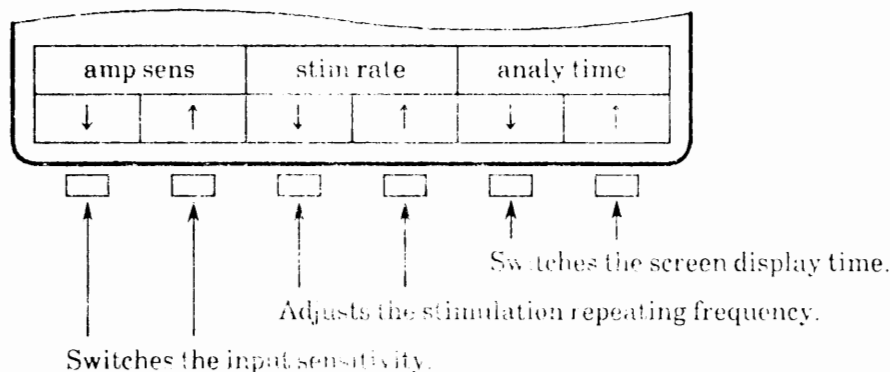


Start stimulation by pressing the STIM/SWEEP key.

Place the stimulating electrode at the stimulating point. A sweep screen is displayed. Adjust the stimulation current value with the Stimulation Value Set knob so that the controlling muscle contracts slightly.

## ◆ Sweep Screen

Function keys



Panel keys

POSITION ↓ ↑      Moves the displayed waveform up and down.

MONITOR:      Displays the monitor waveform during stimulation.  
(Pressing the STIM/SWEEP key restores sweep status.)



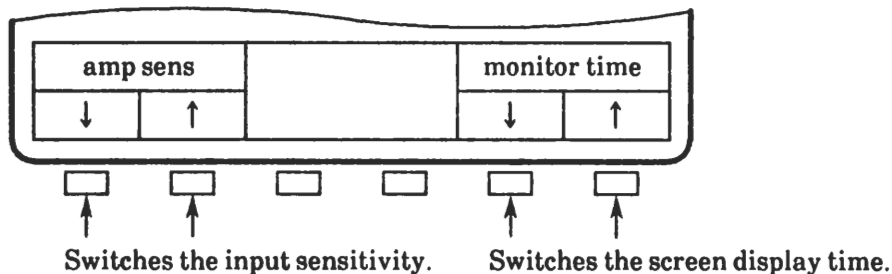
FREQUENCY and AMPTD measurement

(Cursor movement dial)



◆ **Monitor Screen**

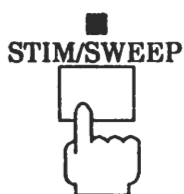
Function keys



Panel key

POSITION ↓ ↑ : Moves the displayed waveform up and down.

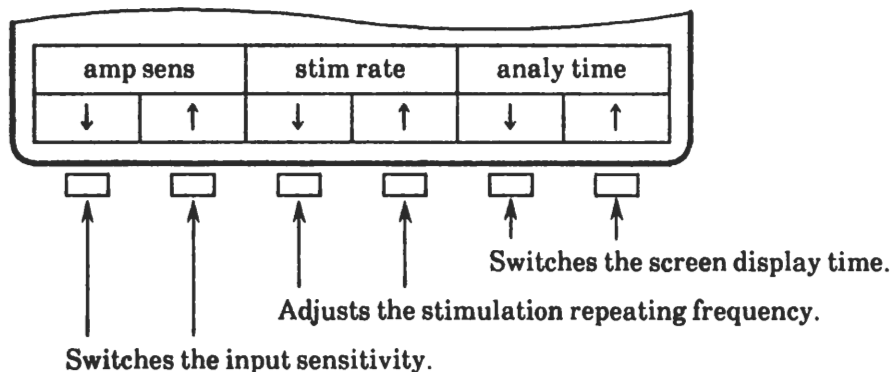
5.



Start stimulation by pressing the **STIM/SWEEP** key. Place the stimulating electrode at the stimulating point. A sweep screen is displayed. Adjust the stimulation current value with the Stimulation Value Set knob so that the controlling muscle contracts slightly.

◆ **Sweep Screen**

Function keys



Panel keys

POSITION ↓ ↑ : Moves the displayed waveform up and down.

**MONITOR:** Displays the monitor waveform during stimulation. (Pressing the **STIM/SWEEP** key restores sweep status.)



(Cursor movement dial)

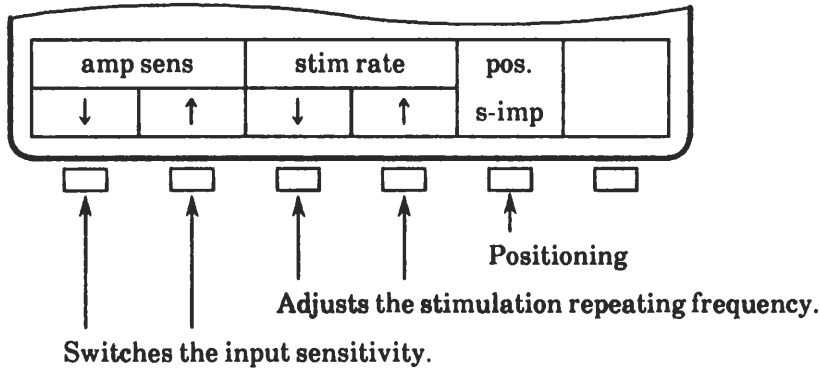
: LTNCY and AMPTD measurement

6.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

◆ **Analysis Screen**  
Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

MONITOR: Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)

STIM/SWEEP: Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

\* **Stopping averaging**

- When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
- While averaging is stopped, the input waveform can be checked with the MONITOR key.

\* **Reattempting averaging**

- If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

7.



Stores the averaging waveform.

When the STORE key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A - D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

( 1ch measurement:  $4 \times 1\text{ch} = 4$  waveforms  
 2ch measurement:  $4 \times 2\text{ch} = 8$  waveforms )

\* **Erasing the stored waveform**

STAGE SELECT



Select a stage.

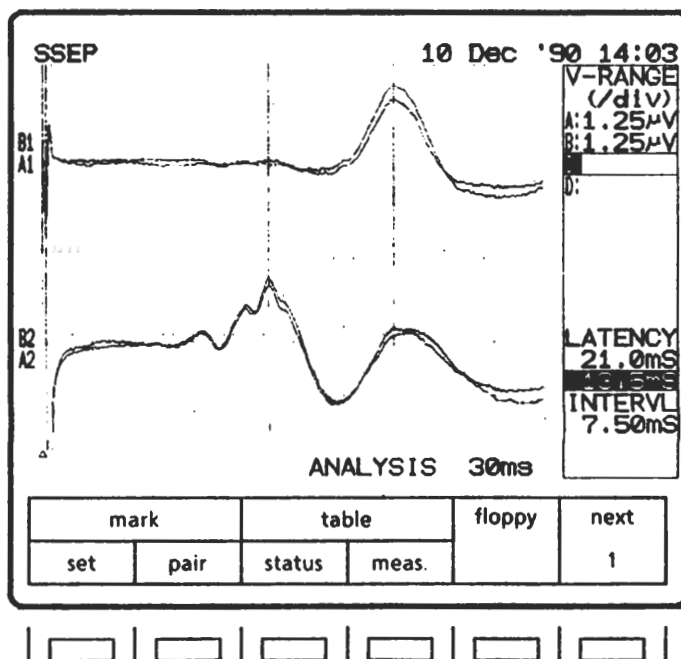


ERASE

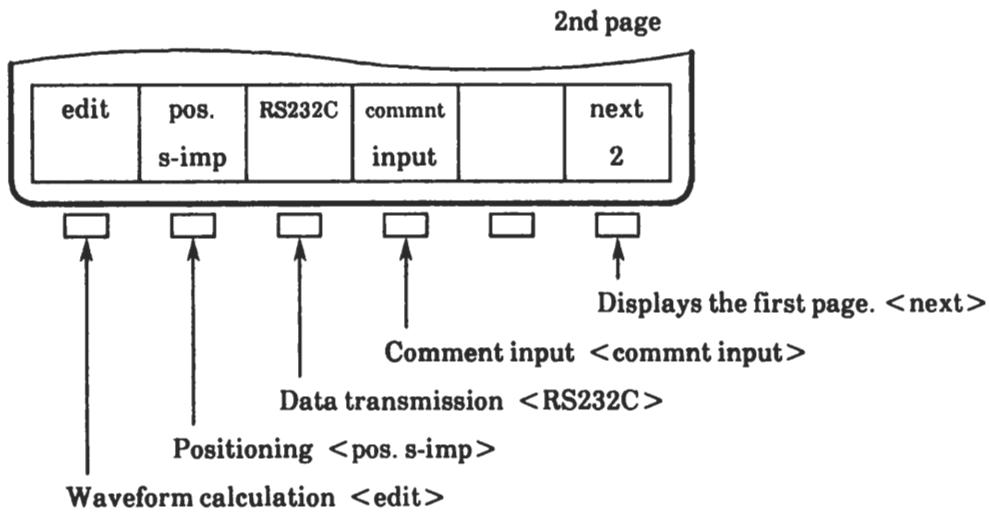
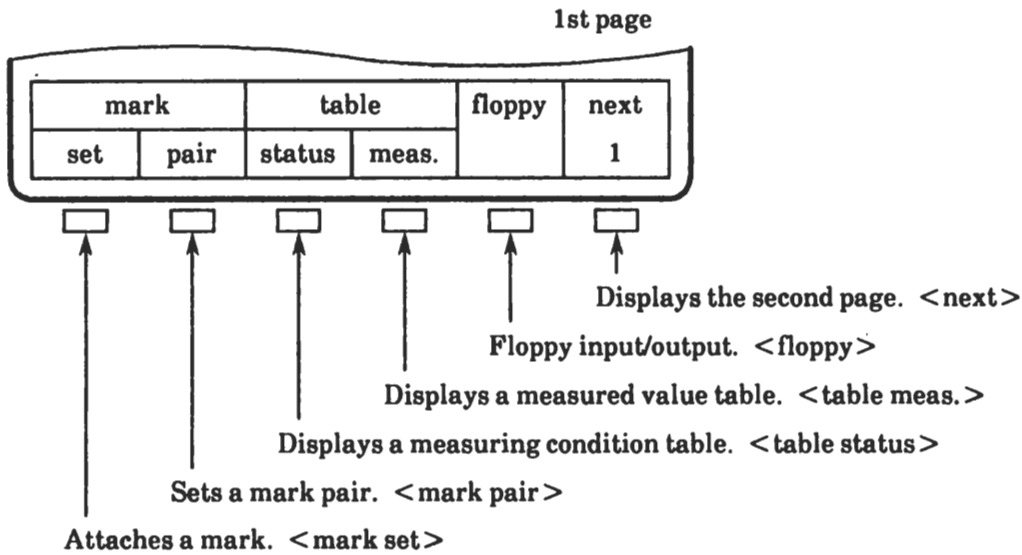


Erase the waveform.

8. **Make another measurement to confirm the reproducibility of the waveform.**



◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑ : Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑ : Switches the waveform display amplitude.

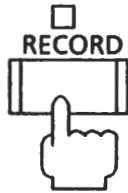


: LTNCY and AMPTD measurement

(Cursor movement dial)



9.

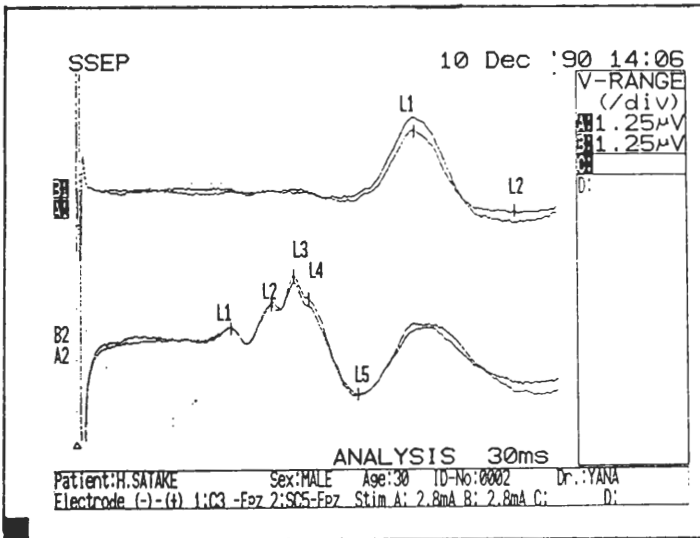


Press the RECORD key to start recording.

10. Termination of Examination

When BLINK, SEP, SSEP or TR-SEP is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

10 Dec '90 14:08

SSEP	L1	L2	L3	L4	L5	AREA
A1	21.1	27.2				
A2	9.54	12.1	13.5	14.4	17.5	
B1						
B2						

	INTERVAL			ms	AMPLITUDE		µV
	L1-L2	L2-L3	L3-L4		L1-L2	L3-L5	
A1	6.18				2.77		
A2	2.58	1.38	0.90		0.77	4.05	
B1							
B2							

Patient: H.SATAKE Sex: MALE Age: 30 ID-No: 0002 Dr.: YANA  
Electrode (-)-(+) 1: C3-Fpz 2: SCS-Fpz Stim A: 2.8mA B: 2.8mA C: D:



# Auditory

13 ABR (Auditory Brain Stem Response: 聽性腦幹反應)

14 MLR (Middle Latency Response: 中間潛時反應)

15 SVR (Slow Vertex Response: 頭頂部緩反應)

16 Ecoch G (Electrocochleogram: 蝸電圖)

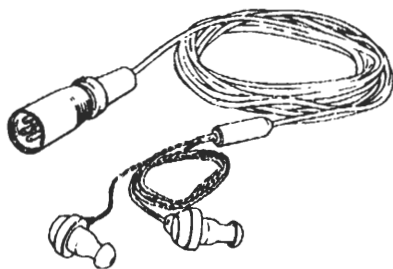
## 13 ABR (Auditory Brain Stem Response)

### ◆ Description of Examination

Auditory brain stem response (ABR) provides 6-7 peaks within 10 msec after stimulation, and is an early-stage component of the auditory evoked response obtained by giving auditory stimulation via the ears. This ABR is now used widely because of its numerous merits such as the presentation of stable waveforms, high reproducibility, easy recording and no effect from sleep and drugs. The wide auditory conduction path ranging from the nuclei cochleares to the colliculus inferior is regarded as a source, and the transit colliculus originating in them has been completely clarified. Accordingly, the ABR is used for the diagnosis and recuperation of cerebral disorders and the monitoring of conscious levels by catching abnormal phenomena such as the abnormal extension of I to V wave latency and the disappearance of subsequent waves.

### ◆ Related Equipment

- Earphone stimulator YE-102J (optional) (for intraoperative and postoperative monitoring)

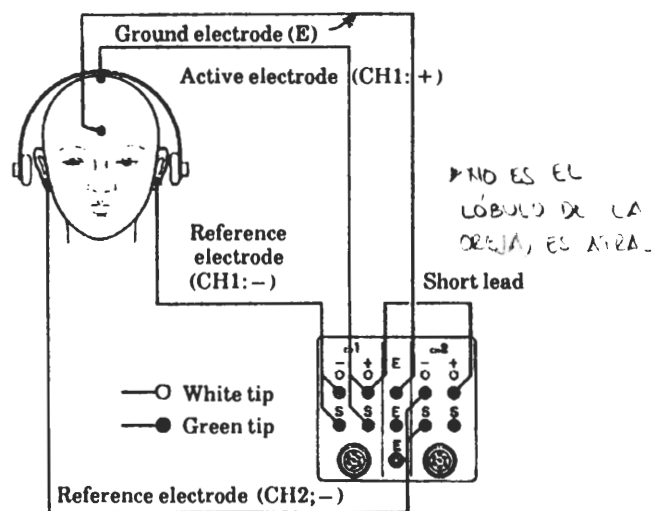


- Headphone



### ◆ Electrode Placement

- (1) For connection to the electrode junction box, use the short lead provided with the electrode set.
- (2) The green tip from the ground electrode (Fpz) is not connected.
- (3) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 kΩ or less.



Active electrode (+): Vertex (Cz)

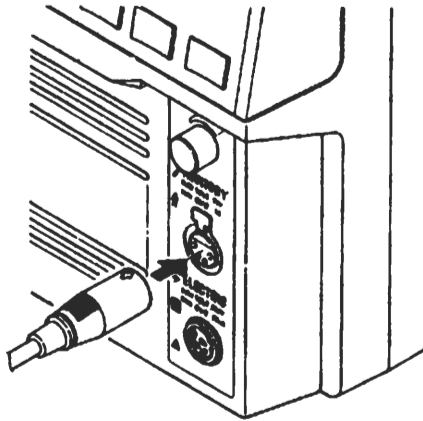
Reference electrode (-): Earlobe on the stimulation side (A1 or A2), or mastoid process

Ground electrode: Forehead (Fpz)

- \* When the electrodes are placed as shown above, the measurement result becomes positive up.
- \* The active electrode and the reference electrode may be connected to - and +, respectively. In this case, waveforms appear upside down. (NEGATIVE up)
- \* Set the headphone so that its speaker may be applied correctly to the porus acusticus externus.

Right ear: red; Left ear: blue



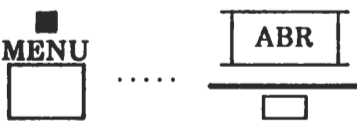


Connect the headphone to the Auditory Stimulation Output connector of the main unit.

◆ **Preparing the patient**

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the headphone a sufficient distance from the recording electrode and the electrode junction box.
- Have the patient lie on a reclining chair or bed quietly. Fix his head to prevent neck EMGs from appearing. Instruct him to keep the mouth slightly open to prevent chin EMGs from appearing.
- Keep the patient at rest with the neck and chin in a comfortable, relaxed position, and the eyes closed for examination.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the ABR mode according to the procedure of menu selection.

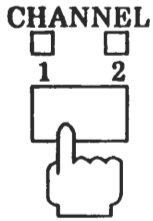
- 

Check the condition by pressing the CONDITION key.

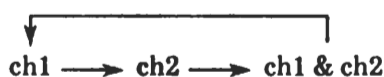
Condition Screen

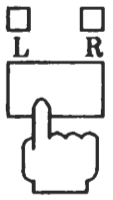
ABR	10 Dec	'90 14:08	
AMP	Sens 2ch	5 $\mu$ V/div	PARA
	Lo-cut	50 Hz	10
	Hi-cut	3K Hz	20
ACQ	Anal. Time	10 ms	50
	Delay	0 div	100
	Monitor Time	200 ms	200
	Preset Count	2000	500
	Auto Mark	ON	1 mV
	Paper Speed	25 mm/s	2
STIM	Trigger Mode	RECUR	5
	Stim Rate	10 Hz	10
	Duration	0.1 ms	DC
	Intensity	90 dB	
	Mask Level	-40 dB	
	Side	BOTH	
	Phase	ALT	

\* When "Phase" is set at ALT on the condition screen, the phase of stimulation sound is reversed each time and the artifacts from the stimulating headphone can be suppressed.

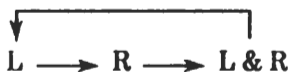
- 

Select a channel to be used by pressing the CHANNEL key.  
In the ABR mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

Select a side to be stimulated by pressing the L/R key.  
Each time the L/R key is pressed, the following selection will be repeated.



- 

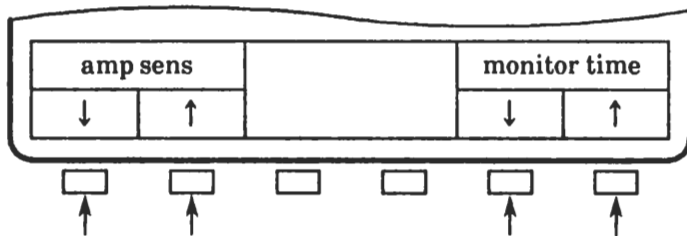
Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.

[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.

◆ **Monitor Screen**

Function keys



Switches the input sensitivity.

Switches the screen display time.

Panel key

POSITION ↓ ↑ : Moves the displayed waveform up and down.

6.

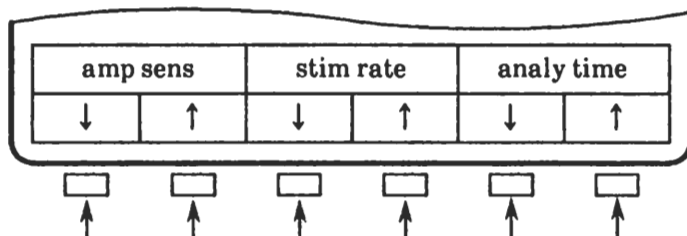


Start stimulation by pressing the STIM/SWEEP key.

A sweep screen is displayed. Adjust the stimulation sound intensity with the Stimulation Value Set knob.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity.

Adjusts the stimulation repeating frequency.

Switches the screen display time.

Panel keys

POSITION ↓ ↑ : Moves the displayed waveform up and down.

MONITOR: Displays the monitor waveform during stimulation.  
(Pressing the STIM/SWEEP key restores sweep status.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

7.



Press the ANALYSIS key to start averaging.  
An averaging waveform is displayed on the screen.

\* Stopping averaging

- When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
- While averaging is stopped, the input waveform can be checked with the MONITOR key.

\* Reattempting averaging

- If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

8.



Stores the averaging waveform.

When the STORE key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

\* Auto mark function

When the Auto Mark is set to ON on the condition screen, the I – V marks are attached at the peak of the waveform concurrently with the termination of averaging, and the latency from trigger to each mark can be displayed with the <table meas.> key. Refer to the auto mark function.

\* Erasing the stored waveform

STAGE SELECT



Select a stage.



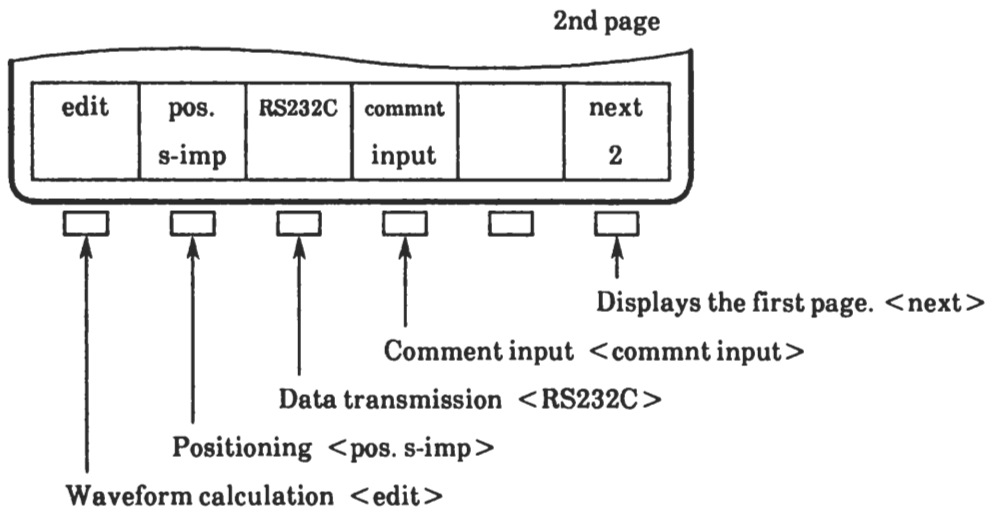
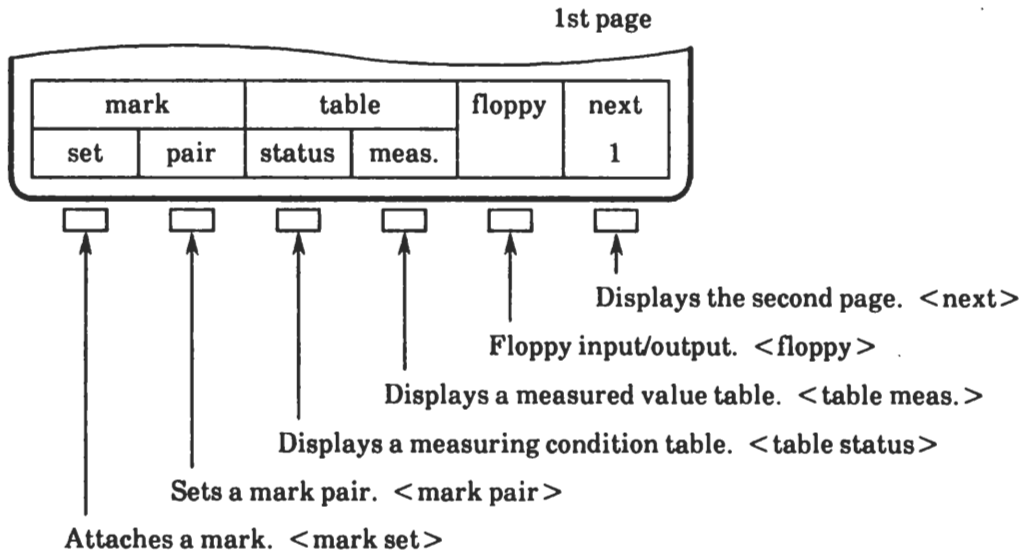
ERASE



Erase the waveform.

9. Make another measurement to confirm the reproducibility of the waveform.

◆ Stop Screen  
Function keys



Panel keys

POSITION ↓ ↑ : Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑ : Switches the waveform display amplitude.



: LTNCY and AMPTD measurement

(Cursor movement dial)

## 14 MLR (Middle Latency Response)

### ◆ Description of Examination

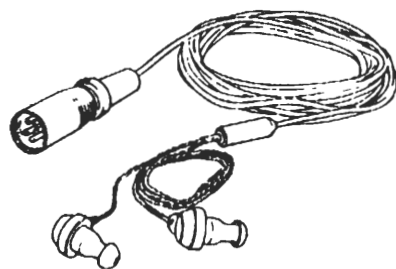
The auditory middle latency response (MLR) is recorded from the cerebrum with an auditory stimulus and appears between 10 and 50 msec after ABR.

The MLR has been thought to be derived from the auditory nerve system, but its precise origin is unknown.

Future development of clinical application is anticipated.

### ◆ Related Equipment

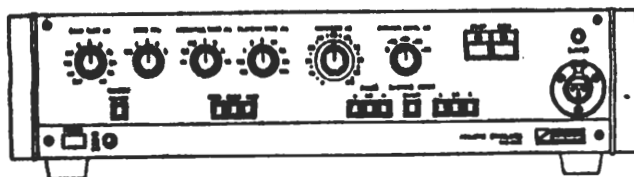
- Earphone stimulator YE-102J (optional)  
(for intraoperative and postoperative monitoring)



- Headphone

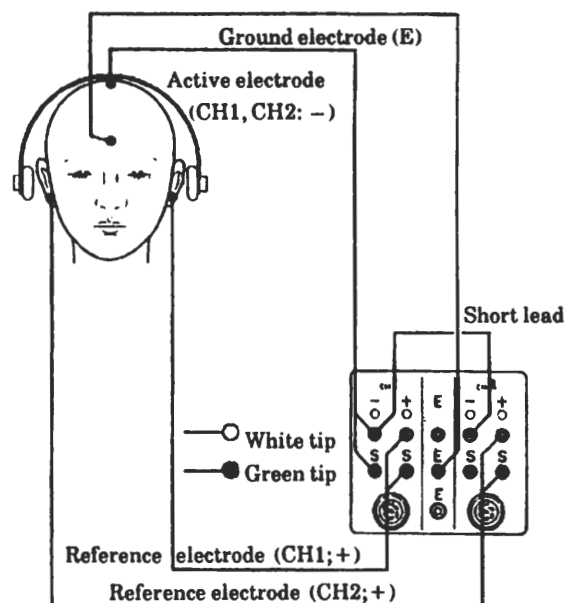


- Auditory stimulator SSS-3200 (optional)  
Used to give stimulation with tone pip.



### ◆ Electrode Placement

- (1) For connection to the electrode junction box, use the short lead provided with the electrode set.
- (2) The green tip from the ground electrode (Fpz) is not connected.
- (3) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.



Active electrode (-): Vertex (Cz)

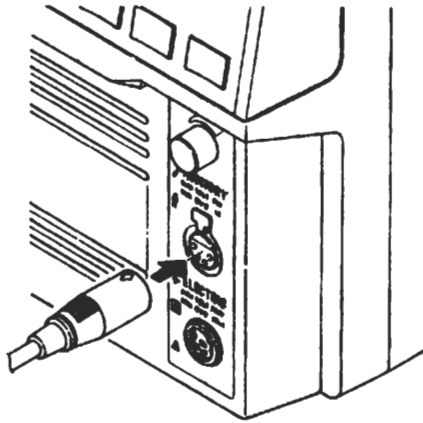
Reference electrode (+): Earlobe on the stimulation side (A1 or A2), or mastoid process

Ground electrode: Forehead (Fpz)

\* When the electrodes are placed as shown above, a measurement result becomes negative up.

\* Set the headphone so that its speaker may be applied correctly to the porus acusticus externus.

Right ear: red; Left ear: blue

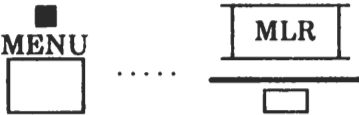


Connect the headphone to the Auditory Stimulation Output connector of the main unit.

◆ **Preparing the patient**

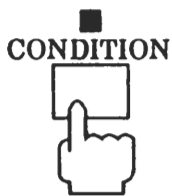
- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the headphone a sufficient distance from the recording electrode and the electrode junction box.
- Have the patient lie on a reclining chair or bed quietly. Fix his head to prevent neck EMGs from appearing. Instruct him to keep the mouth slightly open to prevent chin EMGs from appearing.
- Keep the patient at rest with the neck and chin in a comfortable, relaxed position, and the eyes closed for examination.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the MLR mode according to the procedure of menu selection.

- Check the condition by pressing the CONDITION key.

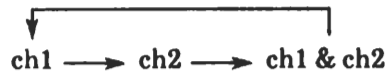
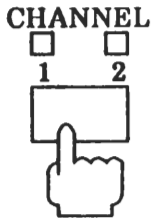


Condition Screen

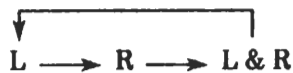
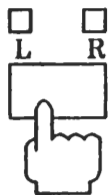
MLR	17 Oct '88 13:41	
AMP	Sens 2ch	20 $\mu$ V/div
	Lo-cut	20 Hz
	Hi-cut	1K Hz
ACQ	Anal. Time	50 ms
	Delay	0 div
	Monitor Time	200 ms
	Preset Count	500
	Paper Speed	25 mm/s
STIM	Trigger Mode	RECUR
	Stim Rate	5 Hz
	Duration	0.1 ms
	Intensity	90 dB
	Mask Level	-40 dB
	Side	BOTH
	Phase	ALT

\* When "Phase" is set at ALT on the condition screen, the phase of stimulating sound is reversed each time and the artifacts from the stimulating headphone can be suppressed.

- Select a channel to be used by pressing the CHANNEL key.  
In the MLR mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- Select a side to be stimulated by pressing the L/R key.  
Each time the L/R key is pressed, the following selection will be repeated.



- Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.



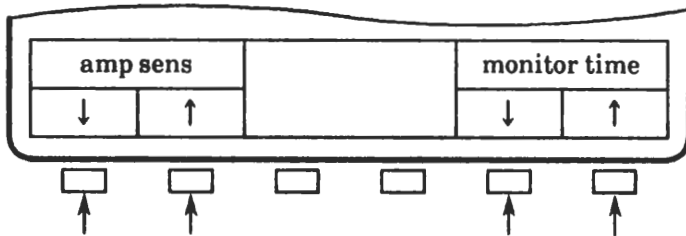
[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.



◆ **Monitor Screen**

Function keys

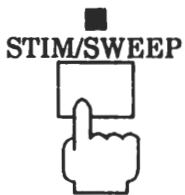


Switches the input sensitivity. Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

6.

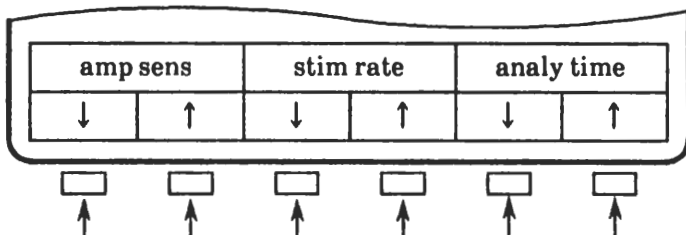


Start stimulation by pressing the **STIM/SWEEP** key.

A sweep screen is displayed. Adjust the stimulation sound intensity value with the Stimulation Value Set knob.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity. Adjusts the stimulation repeating frequency. Switches the screen display time.

Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

**MONITOR:** Displays the monitor waveform during stimulation.  
(The status is recovered to the sweep status by pressing the **STIM/SWEEP** key.)



: LTNCY and AMPTD measurement

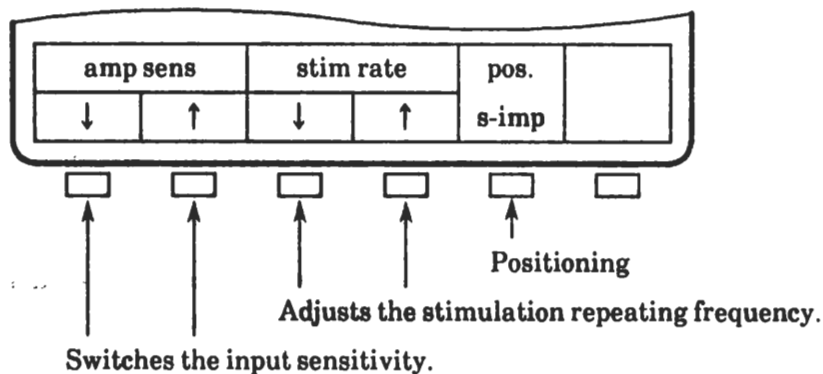
(Cursor movement dial)

7.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

#### ◆ Analysis Screen Function keys



#### Panel keys

POSITION ↓ ↑:

Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑:

Switches the waveform display amplitude.

MONITOR:

Displays a monitor waveform while repeating stimulation and averaging.

(When the ANALYSIS key is pressed, the status is recovered.)

STIM/SWEEP:

Displays a sweep waveform during averaging.

(When the ANALYSIS key is pressed, the status is recovered.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

\* **Stopping averaging**

- When the **STOP** key has been pressed and averaging stopped, the averaging count is not returned to 0. When the **ANALYSIS** key is pressed again, averaging is resumed from the current count.
- While averaging is stopped, the input waveform can be checked with the **MONITOR** key.

\* **Reattempting averaging**

- If the **ERASE** key is pressed after the **STOP** key is pressed, the waveform is erased and the averaging count is returned to 0.

8.



**STORES** the averaging waveform.

When the **STORE** key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

\* **Erasing the stored waveform**

**STAGE SELECT**



Select a stage.



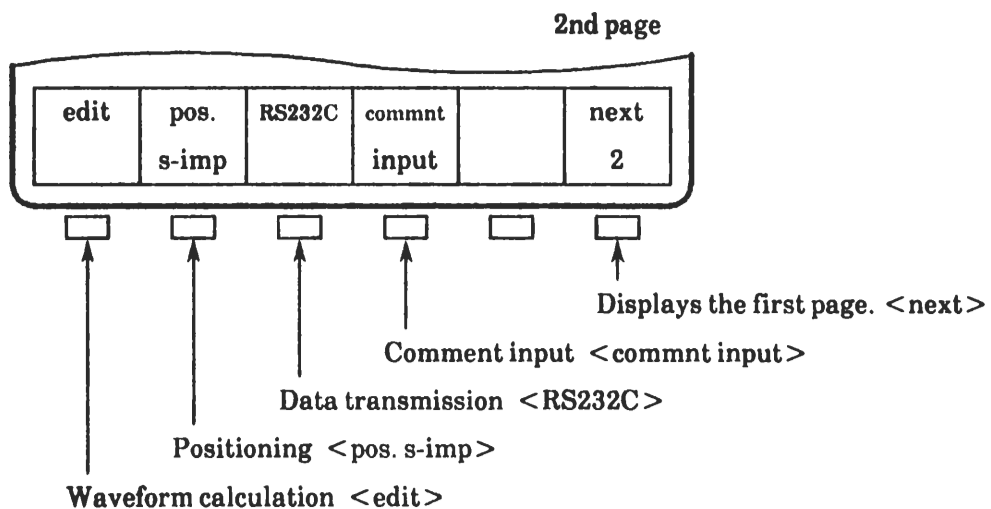
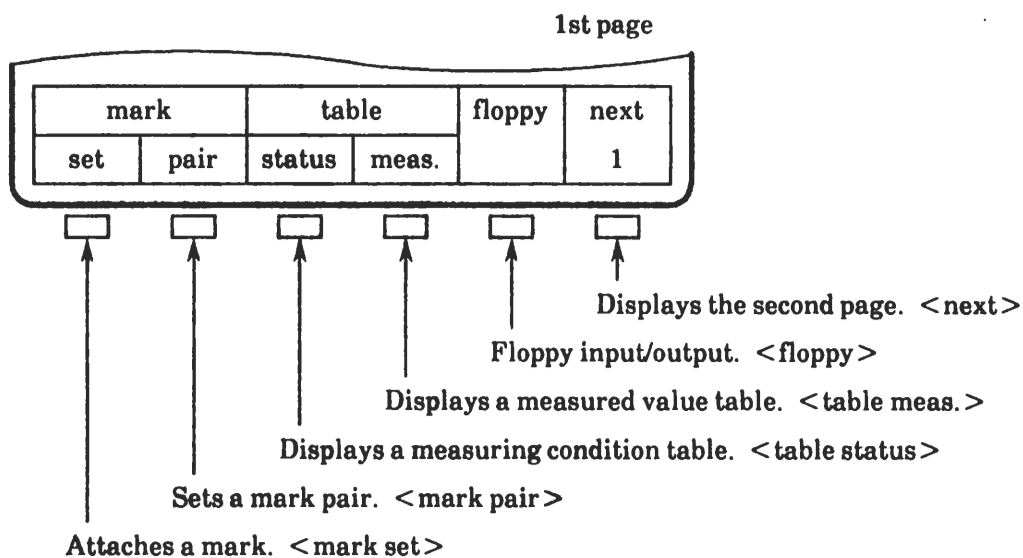
**ERASE**



Erase the waveform.

9. **Make another measurement to confirm the reproducibility of the waveform.**

◆ Stop Screen  
Function keys



Panel keys

POSITION ↓ ↑ : Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑ : Switches the waveform display amplitude.



: LTNCY and AMPTD measurement

(Cursor movement dial)

10.

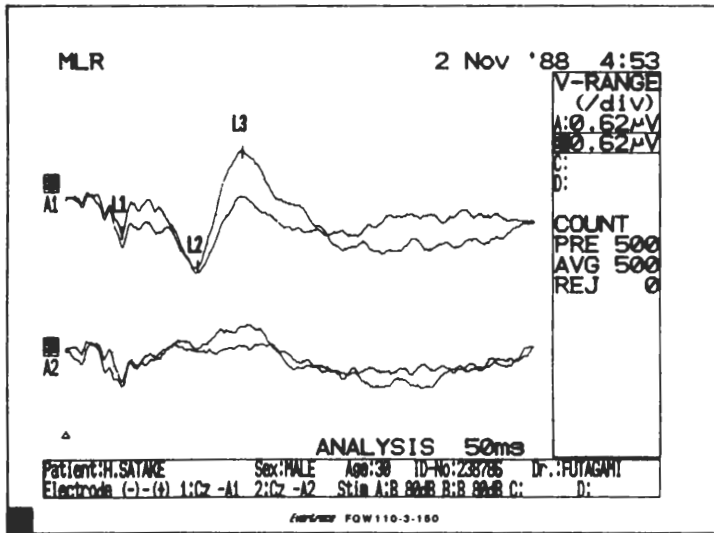


Press the RECORD key to start recording.

11. Termination of Examination

When Auditory menu is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

MLR							2 Nov '88 4:53
	L1	L2	L3	L4	L5		AREA
A1	5.90	13.9	18.7			ms	
A2							
B1							
B2							

INTERVAL				AMPLITUDE			
A1				A1			
A2				A2			
B1				B1			
B2				B2			

Patient: H. SATAKE Sex: MALE Age: 38 ID-No: 238765 Dr.: FUYAGAMI  
Electrode (-)-(+) 1: Cz -A1 2: Cz -A2 Stim A: R 80dB B: R 80dB C: D:

NEURON RECORDING

## 15 SVR (Slow Vertex Response)

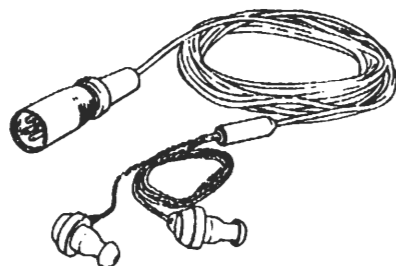
### ◆ Description of Examination

Slow vertex response (SVR) is one of a series of auditory evoked responses (AEP) derived from the scalp with auditory stimulation, and appears 50 msec or more after ABR and MLR. This origin is not well understood; however, this response is considered as nonspecific response on the cerebral level.

The SVR is used to judge aphasia or auditory dysesthesia.

### ◆ Related Equipment

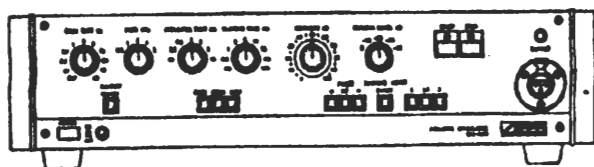
- Earphone stimulator YE-102J (optional)  
(for intraoperative and postoperative monitoring)



- Headphone

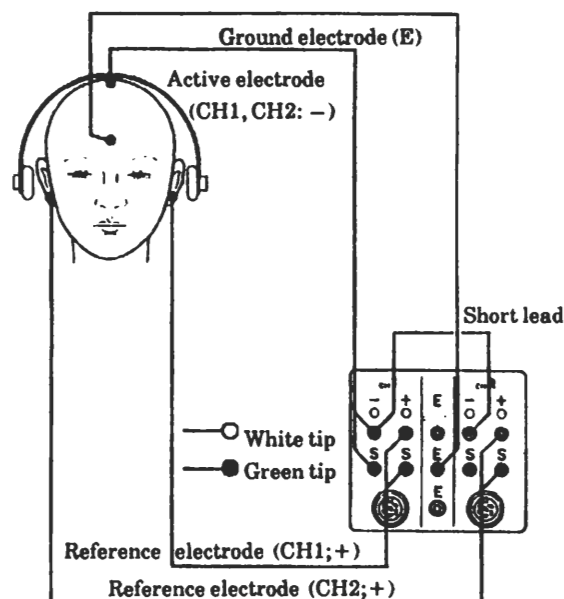


- Auditory stimulator SSS-3200 (optional)  
Used to give stimulation with tone pip.



### ◆ Electrode Placement

- (1) For connection to the electrode junction box, use the short lead provided with the electrode set.
- (2) The green tip from the ground electrode (Fpz) is not connected.
- (3) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.



Active electrode (-): Vertex (Cz)

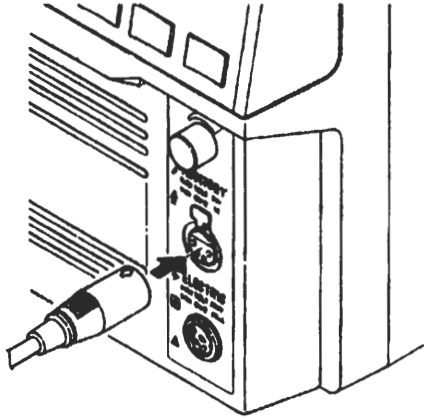
Reference electrode (+): Earlobe on the stimulation side (A1 or A2), or mastoid process

Ground electrode: Forehead (Fpz)

- \* When the electrodes are placed as shown above, a measurement result becomes negative up.

- \* Set the headphone so that its speaker may be applied correctly to the porus acusticus externus.

Right ear: red; Left ear: blue

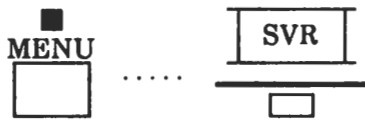


Connect the headphone to the Auditory Stimulation Output connector of the main unit.


◆ **Preparing the patient**

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary. Keep the lead wires of the headphone a sufficient distance from the recording electrode and the electrode junction box.
- Have the patient lie on a reclining chair or bed quietly. Fix his head to prevent neck EMGs from appearing. Instruct him to keep the mouth slightly open to prevent chin EMGs from appearing.
- The measurement waveform varies with the conscious condition of the patient. Have the patient awake during measurement.
- If the patient closes his eyes,  $\alpha$ -waves appear. Therefore, instruct him to keep his eyes open and to stare at one point without blinking.

◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the SVR mode according to the procedure of menu selection.

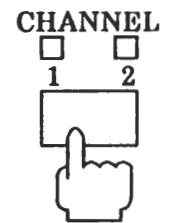
- 

Check the condition by pressing the CONDITION key.

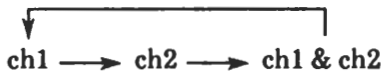
Condition Screen

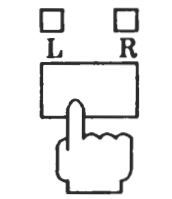
SVR	17 Oct '88 13:41	
AMP	SENSITION	PARAM.
	Sens 2ch	20 $\mu$ V/div
	Lo-cut	1 Hz
	Hi-cut	50 Hz
ACQ	Anal. Time	500 ms
	Delay	0 div
	Monitor Time	500 ms
	Preset Count	100
	Paper Speed	25 mm/s
STIM	Trigger Mode	RANDOM
	Stim Rate	0.5 Hz
	Duration	0.1 ms
	Intensity	90 dB
	Mask Level	-40 dB
	Side	BOTH
	Phase	ALT

\* When "Phase" is set at ALT on the condition screen, the phase of stimulating sound is reversed each time and the artifacts from the stimulating headphone can be suppressed.

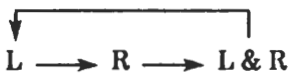
- 

Select a channel to be used by pressing the CHANNEL key.  
In the SVR mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

Select a side to be stimulated by pressing the L/R key.  
Each time the L/R key is pressed, the following selection will be repeated.



- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.

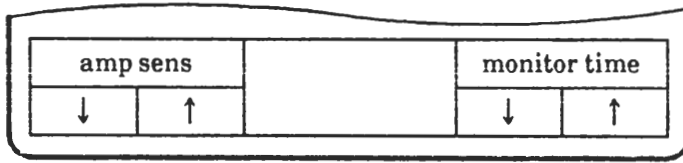
[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.



◆ **Monitor Screen**

Function keys

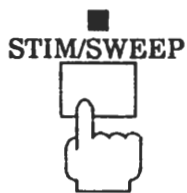


Switches the input sensitivity. Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

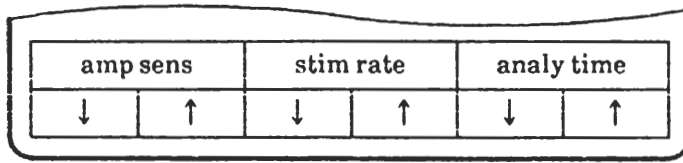
6.



Start stimulation by pressing the **STIM/SWEEP** key. A sweep screen is displayed. Adjust the stimulation sound intensity value with the Stimulation Value Set knob.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity. Adjusts the stimulation repeating frequency. Switches the screen display time.

Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

MONITOR: Displays the monitor waveform during stimulation. (The status is recovered to the sweep status by pressing the STIM/SWEEP key.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

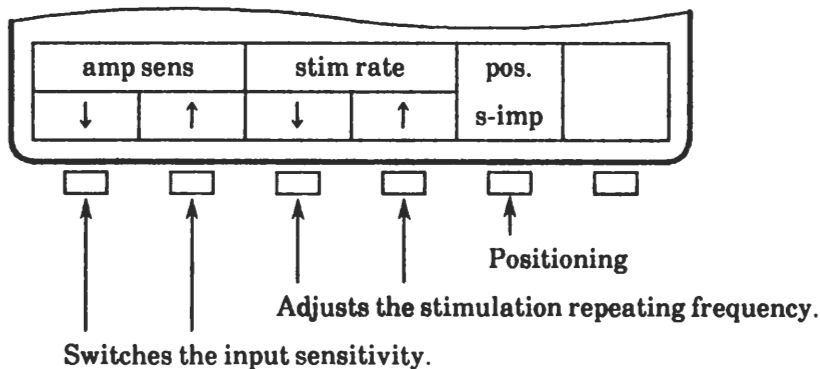
7.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

#### ◆ Analysis Screen

Function keys



#### Panel keys

**POSITION** ↓ ↑: Moves the displayed waveform up and down.

**VERTICAL GAIN** ↓ ↑: Switches the waveform display amplitude.

**MONITOR:** Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)

**STIM/SWEEP:** Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

- \* **Stopping averaging**
  - When the **STOP** key has been pressed and averaging stopped, the averaging count is not returned to 0. When the **ANALYSIS** key is pressed again, averaging is resumed from the current count.
  - While averaging is stopped, the input waveform can be checked with the **MONITOR** key.
- \* **Retrying averaging**
  - If the **ERASE** key is pressed after the **STOP** key is pressed, the waveform is erased and the averaging count is returned to 0.

8.

**STORE**

Stores the averaging waveform.

When the **STORE** key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

- \* **Erasing the stored waveform**

**STAGE SELECT**

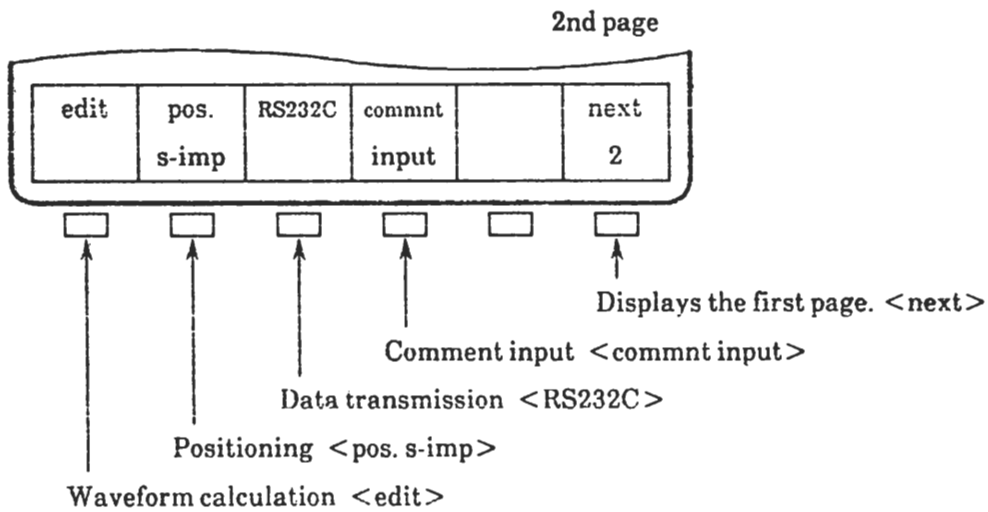
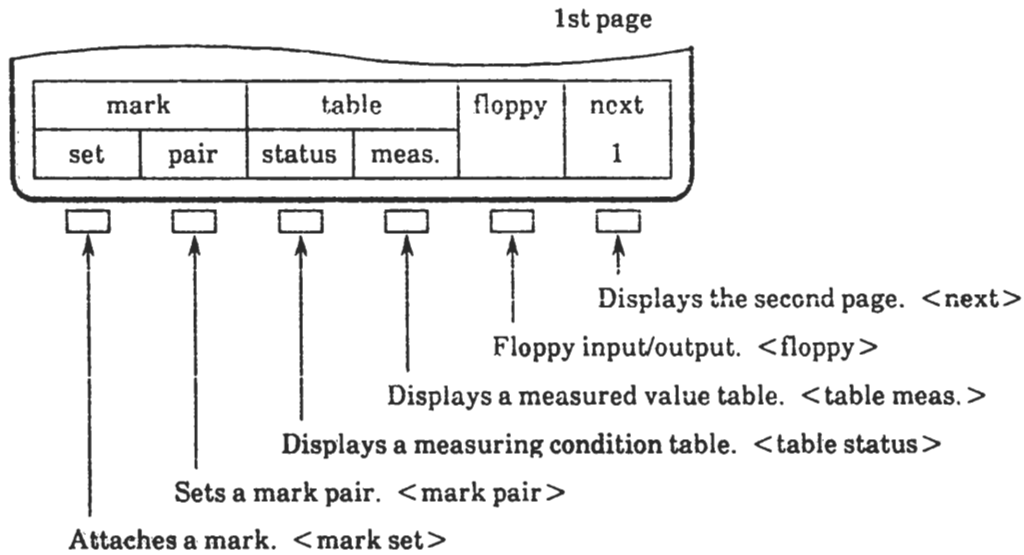
Select a stage.

**ERASE**

Erase the waveform.

9. **Make another measurement to confirm the reproducibility of the waveform.**

◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

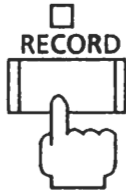
VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



(Cursor movement dial)

: LTNCY and AMPTD measurement

10.

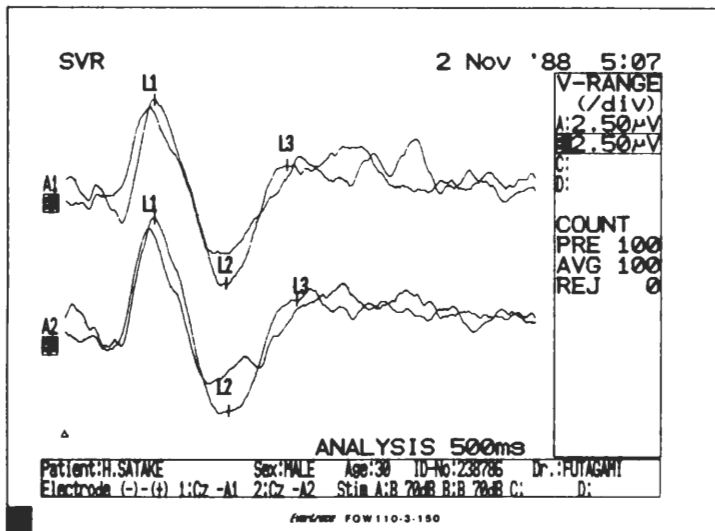


Press the RECORD key to start recording.

11. Termination of Examination

When Auditory menu is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waves are erased.

Recording sample



Recording sample: Hard copy of the measure table

SVR		2 Nov '88 5:07					AREA
	L1	L2	L3	L4	L5		
A1	93.0	169	233			ms	
A2	93.0	173	244			ms	
B1							
B2							

INTERVAL				AMPLITUDE			
	L1-L2	L2-L3			L1-L2	L2-L3	
A1	76.0	64.0	ms	A1	12.8	8.25	mV
A2	80.0	71.0	ms	A2	13.4	7.75	mV
B1				B1			
B2				B2			

Patient: H.SATAKE Sex: MALE Age: 30 ID-No: 238786 Dr.: FUTAGAMI  
Electrode (-)-(+) 1: Cz -A1 2: Cz -A2 Stim A: B 70dB B: B 70dB C: D:

NIHON KODEN

# 16 Ecoch G (Electrocochleogram)

◆ **Description of Examination**

This mode is used to measure the whole nerve action potential (AP) with auditory stimulus.

◆ **Related Equipment**

- Headphone



◆ **Required Electrode**

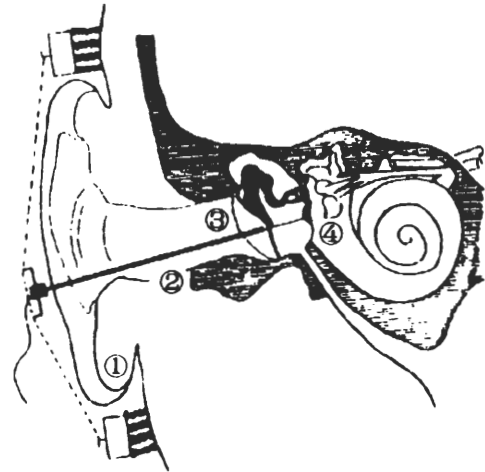
Ecoch G electrode (5090339)  
Intra-tympanic needle electrode

◆ **Electrode Placement**

- (1) The green tip from the ground electrode is not connected.
- (2) When using the Ecoch G electrode, make an impedance check and adjust the contact resistance of the electrode to 5 kΩ or less.

**CAUTION**  
When using the needle electrode, do not make any impedance check.

The following figure shows intra-tympanic derivation.



\*Intra-tympanic derivation

(Use the intra-tympanic needle electrode)

Reference electrode (surface electrode)  
(CH1, 2: +):

Earlobe on the stimulation side ① or mastoid process

Active electrode (needle electrode)

(CH1, 2: -): Tympanic promontory ④

Ground electrode (surface electrode) (E):  
Forehead (Fpz) or nose tip

\*Extra-tympanic derivation

(Use the Ecoch G electrode.)

Reference electrode (surface electrode)  
(CH1, 2: +):

Earlobe on the stimulation side ① or mastoid process

Active electrode (Ecoch G electrode)

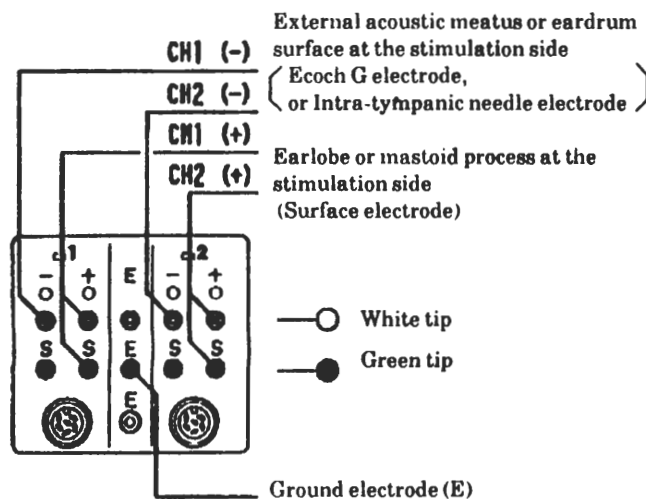
(CH1, 2: -):

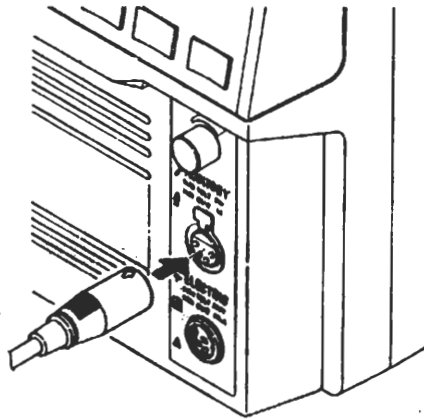
External acoustic meatus skin ② or Eardrum surface ③

Ground electrode (surface electrode) (E):  
Forehead (Fpz) or nose tip

- \* Set the headphone so that its speaker may be applied correctly to the porus acusticus externus.

Right ear: red; Left ear: blue





Connect the headphone to the Auditory Stimulation Output connector of the main unit.

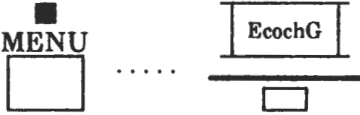
#### ◆ Preparing the patient

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Have the patient lie on a reclining chair or bed quietly, and support his head with a pillow so it will not shift.
- For intra-tympanic derivation, disinfect the external acoustic meatus and eardrum with a solution of 0.05% Hibitane and then apply local anesthesia with 8% lidocaine hydrochloride. After that, insert the needle electrode.
- For external tympanic derivation, apply surface anesthesia to the external acoustic meatus and wipe it with alcohol, and then slowly fix the Ecoch G electrode with paste.
- For external acoustic meatus derivation, apply surface anesthesia to the external acoustic meatus and wipe it in alcohol, and then fix the Ecoch G electrode with paste.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary.
- Keep the headphone, electrode lead and electrode junction box away from one another.
- Make the patient to be relax and avoid the appearance of EMGs during examination. Instruct him to open his mouth slightly to prevent the chin EMG from appearing.

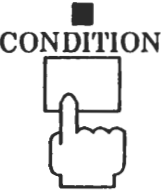
#### **CAUTION**

Place the electrodes following a physician's instructions. Use ECG paste or ultrasonic jelly as paste.

◆ Measurement

- 

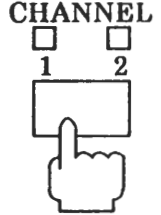
Press the MENU key to display the menu screen.  
Select the EcochG mode according to the procedure of menu selection.

- 

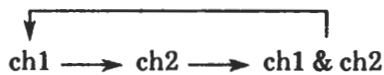
Check the condition by pressing the CONDITION key.

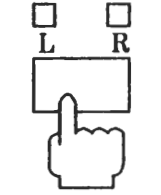
Condition Screen

EcochG		17 Oct '88 13:42
AMP	Sens 2ch	10 $\mu$ V/div
	Lo-cut	200 Hz
	Hi-cut	3K Hz
ACQ	Anal. Time	10 ms
	Delay	0 div
	Monitor Time	200 ms
	Preset Count	1000
	Paper Speed	25 mm/s
STIM	Trigger Mode	RECUR
	Stim Rate	10 Hz
	Duration	0.1 ms
	Intensity	90 dB
	Mask Level	-40 dB
	Side	BOTH
	Phase	ALT

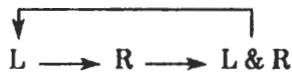
- 

Select a channel to be used by pressing the CHANNEL key.  
In the EcochG mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

Select a side to be stimulated by pressing the L/R key.  
Each time the L/R key is pressed, the following selection will be repeated.



- 

Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.

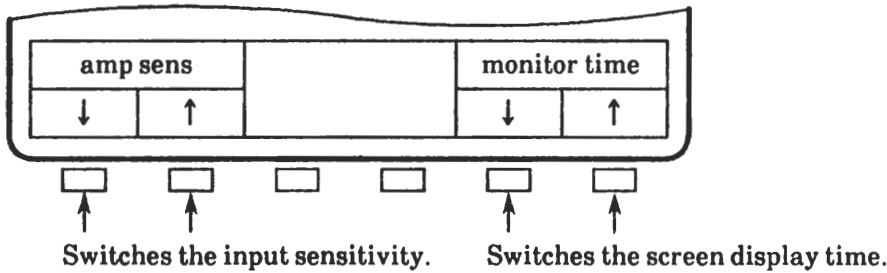
[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.



◆ **Monitor Screen**

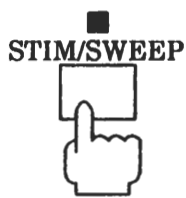
Function keys



Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

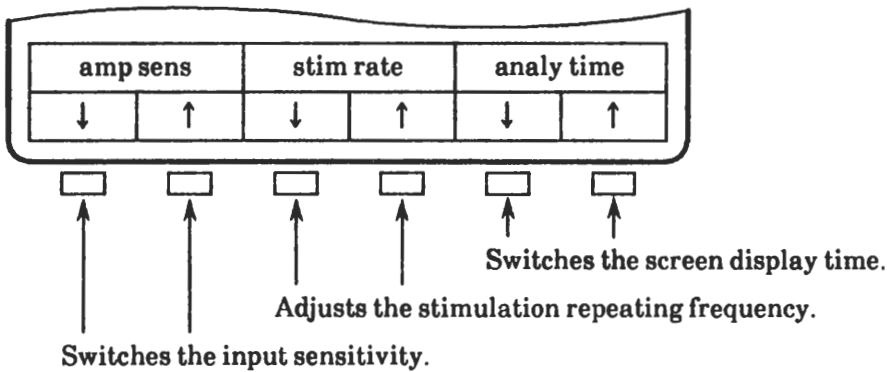
6.



Start stimulation by pressing the **STIM/SWEEP** key. A sweep screen is displayed. Adjust the stimulation sound intensity value with the Stimulation Value Set knob.

◆ **Sweep Screen**

Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

**MONITOR:** Displays the monitor waveform during stimulation. (The status is recovered to the sweep status by pressing the **STIM/SWEEP** key.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

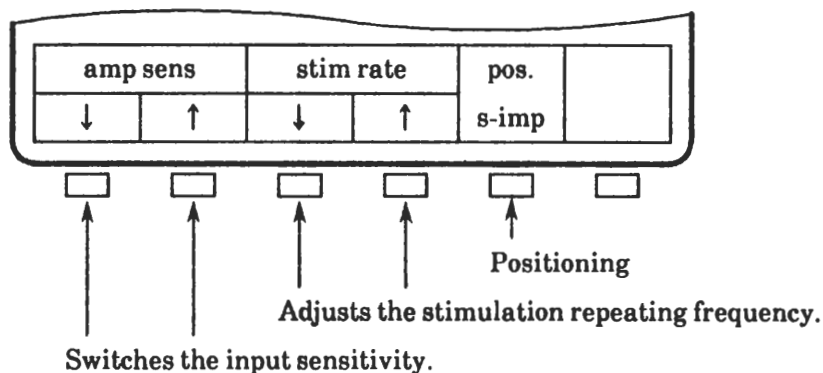
7.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

#### ◆ Analysis Screen

Function keys



#### Panel keys

**POSITION** ↓ ↑: Moves the displayed waveform up and down.

**VERTICAL GAIN** ↓ ↑: Switches the waveform display amplitude.

**MONITOR:** Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)

**STIM/SWEEP:** Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)




: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

- \* **Stopping averaging**
  - When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
  - While averaging is stopped, the input waveform can be checked with the MONITOR key.
- \* **Reattempting averaging**
  - If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

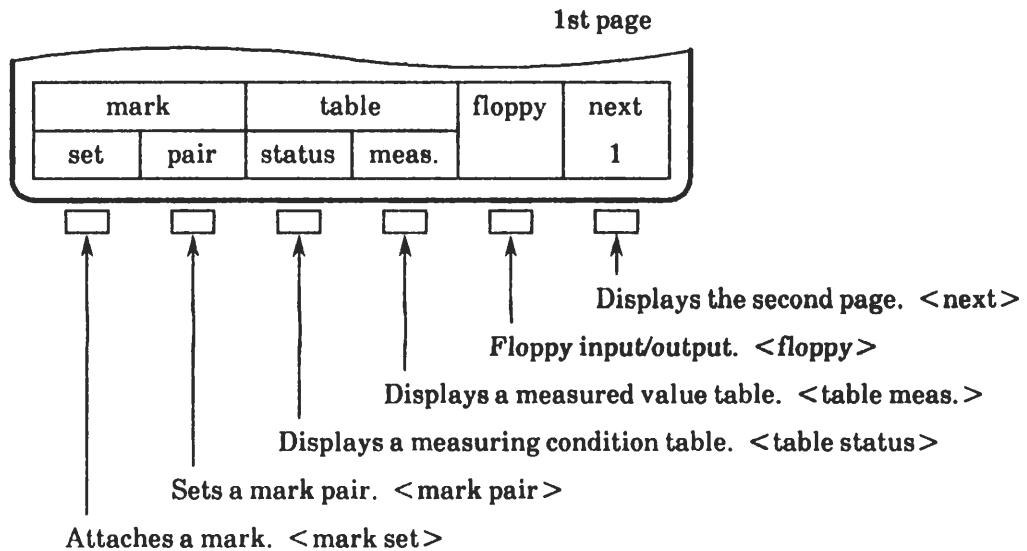
8. **STORE**  Stores the averaging waveform.  
 When the STORE key is pressed, the latest averaging waveform is stored into the stage (memory).
- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

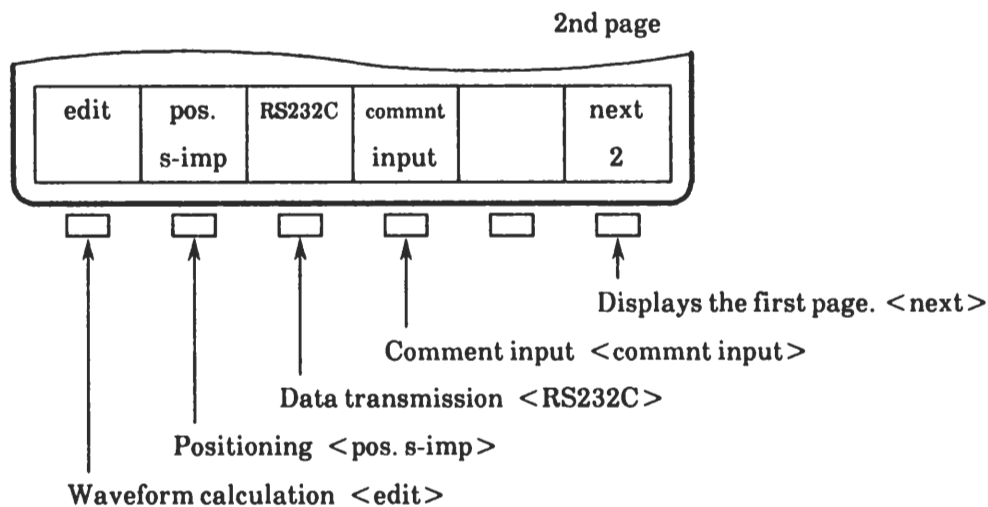
\* **Erasing the stored waveform**



9. Make another measurement to confirm the reproducibility of the waveform.

◆ **Stop Screen**  
 Function keys





#### Panel keys

POSITION ↓ ↑ : Moves the displayed waveform up and down.

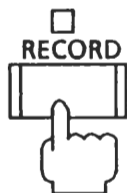
VERTICAL GAIN ↓ ↑ : Switches the waveform display amplitude.



: LTNCY and AMPTD measurement

(Cursor movement dial)

10.



Press the RECORD key to start recording.

#### 11. Termination of Examination

When Auditory menu is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waveforms are erased.



# Visual

**17 PR-VEP** (Pattern Reversal-Visual Evoked Potential : 視覚誘発電位)

**18 F-VEP** (Flash-Visual Evoked Potential : 視覚誘発電位)

**19 ERG** (Electroretinogram : 網膜電位図)

**20 EOG** (Electrooculogram : 眼球電位図)

## 17 PR-VEP (Pattern Reversal-Visual Evoked Potential)

### ◆ Description of Examination

Visual evoked potential (VEP) is a reaction caused in the cerebral cortex when photic stimulation is given to the retinal receptor and a reaction waveform is recognized within 250 msec.

The VEP is classified into flash VEPs and pattern VEPs by the stimulation method. The source of the waveform has not been made clear.

The waveform is greatly affected by the active electrode location and derivation method. A large, positive valley-shaped waveform with a latency of 100 msec, called P<sub>100</sub>, is the ideal waveform.

The PR-VEP is used as an auxiliary means for diagnosis of visual nerve tract disorders and hemianopsia examination.

This menu permits VEP measurement by means of pattern reversal stimulation.

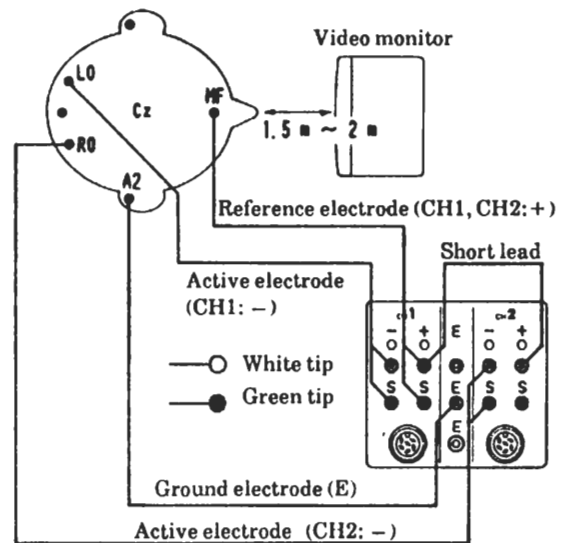
### ◆ Related Equipment

Pattern display TV monitor:

Video monitor VD-401A (optional)

### ◆ Electrode Placement

- (1) For connection to the electrode junction box, use the short lead provided with the electrode set.
- (2) The green tip from the ground electrode (A2) is not connected.
- (3) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 kΩ or less.



Active electrode (-):

5 cm above from the inion and 5 cm left and right (LO, RO)

Reference electrode (+):

12 cm above the nasion (MF)

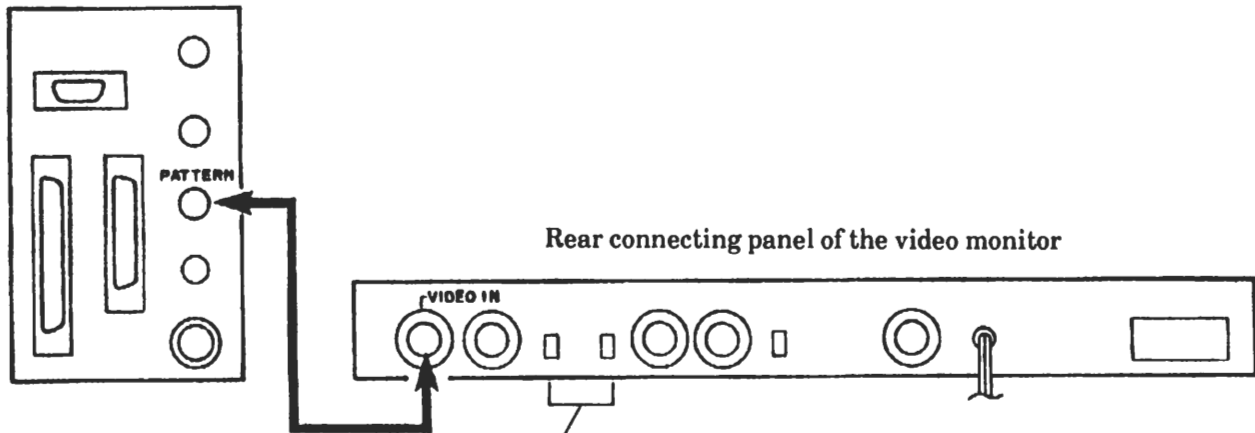
Ground electrode: Earlobe (or vertex (Cz))

- \* When the electrodes are placed as shown above, a measurement result becomes negative up.

◆ **Connection and Setting of Video Monitor (VD-401A)**

1. Darken the room as much as possible for measurement.
2. Adjust the center of the screen to the height of the patient's eyes.
3. Adjust the distance from the nasion to the monitor to set the visual angle. Refer to P.17.3.

Rear panel of the main unit



- \* Switch setting on the rear panel (video monitor)



Set the video input switch to the "ON" side.

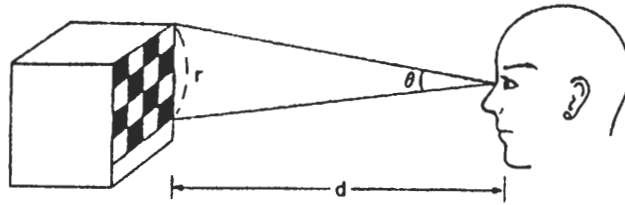
Set the SYNC select switch to the "INT" side.

◆ **Preparing the Patient**

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape.
- Have the patient sit quietly in a chair and lean back so that the head is fixed. Have him relax the neck and chin. Fix the head with a headrest or pillow.
- Adjust the center of the screen to the height of the patient's eyes and adjust the distance from the nasion to the monitor to set the visual angle.
- Select an eye to be examined and mask the other eye with an eye patch.
- A spot is displayed in the center of the screen. Instruct the patient to watch the spot and to avoid blinking his eyes as much as possible.

◆ **Visual Angle of Pattern Reversal Stimulation**

The angle of pattern reversal stimulation can be calculated as follows.



Assume that the length of one side of the screen is  $r$  and the distance between the screen and eyes is  $d$ . Then, the visual angle  $\theta$  to the screen can be approximated by the following expression:

$$\frac{\theta}{360} \approx \frac{r}{2\pi d}$$

Accordingly:

$$\theta = \frac{360}{2\pi} \times \frac{r}{d} = 57.3 \times \frac{r}{d}$$

The screen size of the VD-401A is  $350 \times 275$  mm.

When the length of one side is 300 mm, the distance and visual angle are as follows.

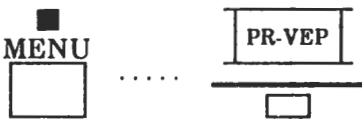
Distance $d$ between Screen and Eyes (m)	Visual Angle to Screen $\theta$
1	17.2°
2	8.6°
3	5.7°

On the other hand, the visual angle to the size of the black-and-white pattern depends on the check size.

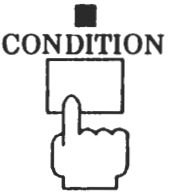
In the case of check size 2, it becomes 1/2 of the visual angle to the screen. In the case of check size 4, it becomes 1/4.



◆ Measurement

- 

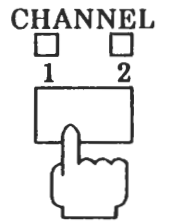
Press the MENU key to display the menu screen.  
Select the PR-VEP mode according to the procedure of menu selection.

- 

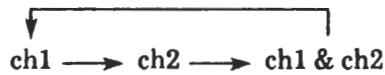
Check the condition by pressing the CONDITION key.

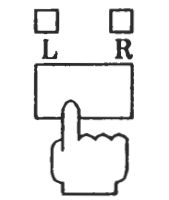
Condition Screen

PR-VEP	17 Oct '88 13:39	
AMP	SENS 2ch	20 $\mu$ V/div
	Lo-cut	1 Hz
	HI-cut	100 Hz
ACQ	Analys. Time	300 ms
	Delay	0 div
	Monitor Time	300 ms
	Preset Count	200
	Paper Speed	25 mm/s
STIM	Trigger Mode	RECUR
	Stim Rate	1 Hz
	Checker Size	16
	Location	BOTH
	PARAM.	5 $\mu$ V
		10
		50
		100
		200
		500
		1 mV
		10
		DC

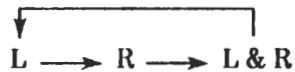
- 

Select a channel to be used by pressing the CHANNEL key.  
In the PR-VEP mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- 

Select a side to be stimulated by pressing the L/R key.  
Each time the L/R key is pressed, the following selection will be repeated.



- 

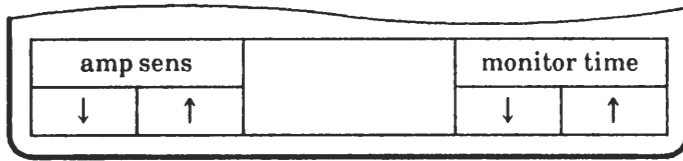
Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.

◆ **Monitor Screen**

Function keys

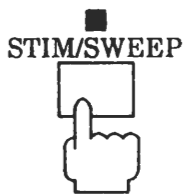


Switches the input sensitivity.      Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

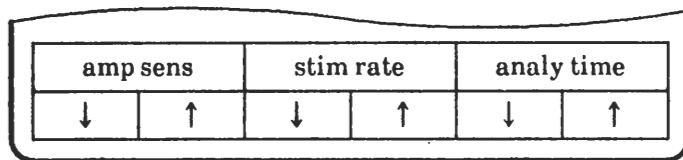
6.



Start stimulation by pressing the *STIM/SWEEP* key. A sweep screen is displayed. Instruct the patient to watch the center of the video monitor screen.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity.      Adjusts the stimulation repeating frequency.      Switches the screen display time.

**Panel keys**



: Switches the check size

(Stimulation value set knob)

POSITION ↓ ↑: Moves the displayed waveform up and down.

MONITOR: Displays the monitor waveform during stimulation.  
(Pressing the STIM/SWEEP key restores sweep status.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

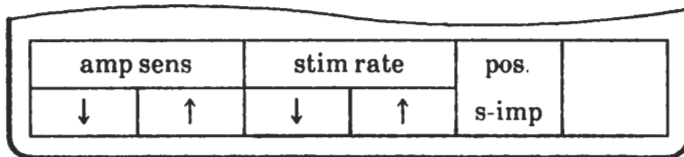
7.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

◆ **Analysis Screen**

**Function keys**



Adjusts the stimulation repeating frequency.

Positioning

Switches the input sensitivity.

## Panel keys

- POSITION ↓ ↑: Moves the displayed waveform up and down.
- VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.
- MONITOR: Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)
- STIM/SWEEP: Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, the status is recovered.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

- \* **Stopping averaging**
  - When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
  - While averaging is stopped, the input waveform can be checked with the MONITOR key.
- \* **Reattempting averaging**
  - If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

8.



Stores the averaging waveform.

When the STORE key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A – D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

( 1ch measurement:  $4 \times 1\text{ch} = 4$  waveforms )  
( 2ch measurement:  $4 \times 2\text{ch} = 8$  waveforms )

- \* **Erasing the stored waveform**

STAGE SELECT



Select a stage.



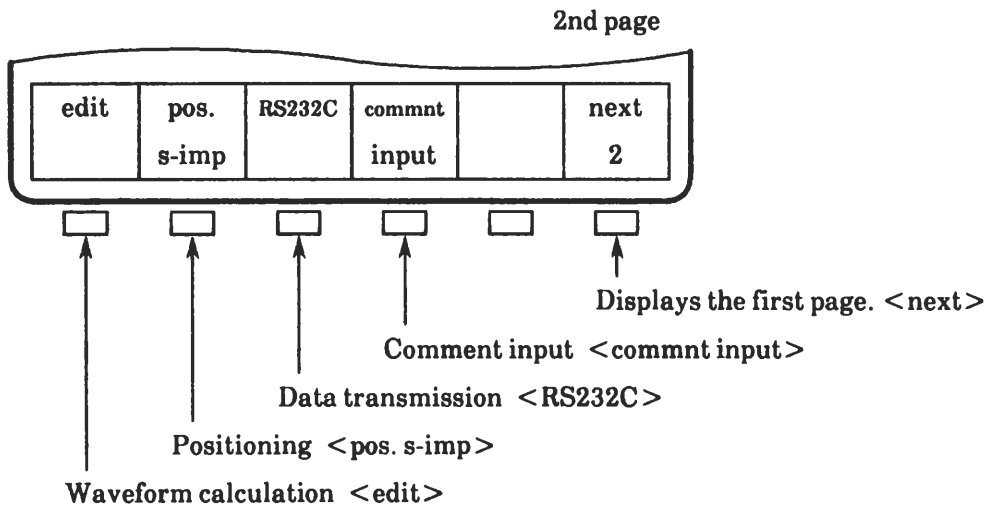
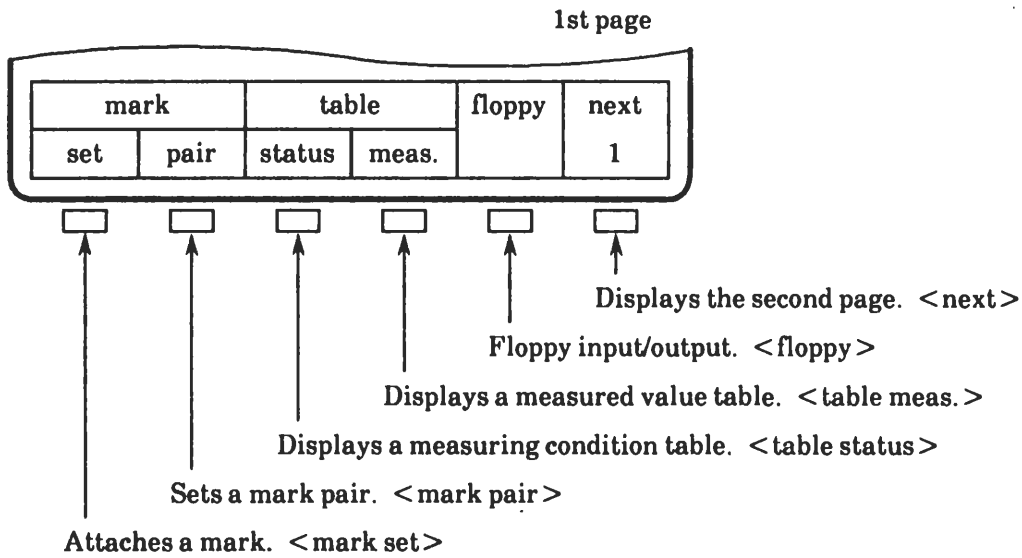
ERASE



Erase the waveform.

9. Make another measurement to confirm the reproducibility of the waveform.


◆ **Stop Screen**  
Function keys



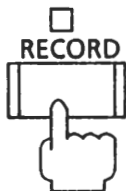
**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

 : LTNCY and AMPT'D measurement  
(Cursor movement dial)

10.

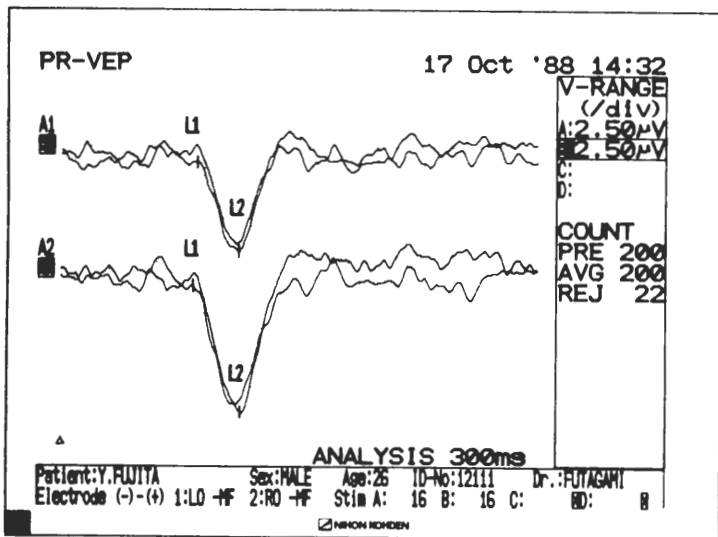


Press the RECORD key to start recording.

11. Termination of Examination

When PR-VEP or TR-VEP is selected as the next examination menu, all waveforms are saved.  
When any menu other than the above is selected, all the waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

PR-VEP 17 Oct '88 14:26

	L1	L2	L3	L4	L5	AREA
A1	85.2	111				ms
A2	82.8	112				ms
B1						
B2						

INTERVAL				AMPLITUDE			
				L-1	L-2		
A1				-0.94	6.14		$\mu$ V
A2				-1.14	8.65		$\mu$ V
B1							
B2							

Patient: Y. FUJITA Sex: MALE Age: 26 ID-No: 12112 Dr.: FUJAGAMI  
Electrode (-)-(+) 1: LO +F 2: RO +F Stim A: 16 B: 16 C: ED: H

NIHON KOKEN

## 18 F-VEP (Flash-Visual Evoked Potential)

### ◆ Description of Examination

This menu is used to measure VEP with flash stimulation.

Flash stimulation, which does not require the patient's cooperation, is useful for children's diseases, comatose patients, hysteria, depression, and other disorders to which pattern reversal stimulation is hard to apply. Similarly, when the patient cannot stare at patterns because of high paropsis or other visual disorders, flash stimulation is more effective.

However, flash stimulation provides large variations in standard values. This makes abnormality judgment for individual patients unclear. Furthermore, pattern reversal stimulation is clinically useful because of small variations in standard values and a high abnormality detecting percentage.

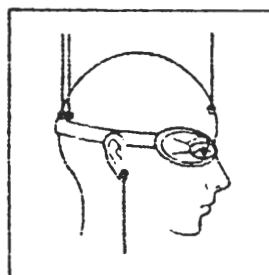
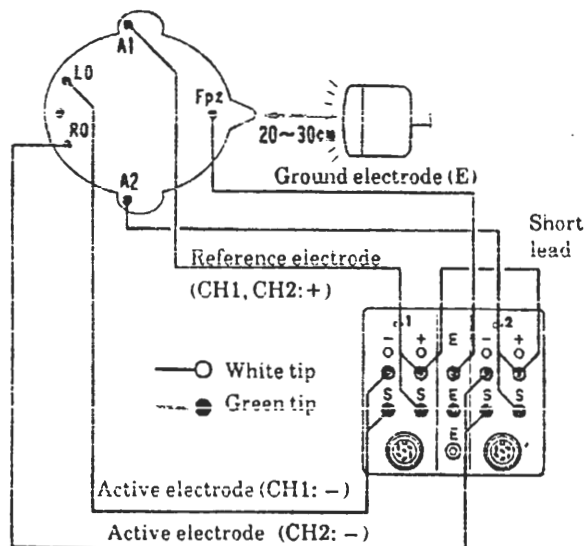
For VEP measurement of the patient in bed, use of goggle stimulation (with a light-emitting diode inlaid in the part equivalent to a lens) is convenient.

### ◆ Related Equipment

Flash stimulator SLS-3100 (optional)  
(NIHON KOHDEN), or  
LED visual stimulator SLS-3500 (optional)  
(NIHON KOHDEN)

### ◆ Electrode Placement

- (1) For connection to the electrode junction box, use the short lead provided with the electrode set.
- (2) The green tip from the ground electrode (A1) is not connected.
- (3) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (4) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.



When the LS-101J is used

Active electrode (-):

- CH1: 5 cm left from MO (LO)
- CH2: 5 cm right from MO (RO)
- (MO: 5 cm up from theinion)

Reference electrode (+):

Both earlobes (A1 + A2)

Ground electrode: Forehead (Fpz)

- \* When the electrodes are placed as shown above, the measurement result becomes negative up.

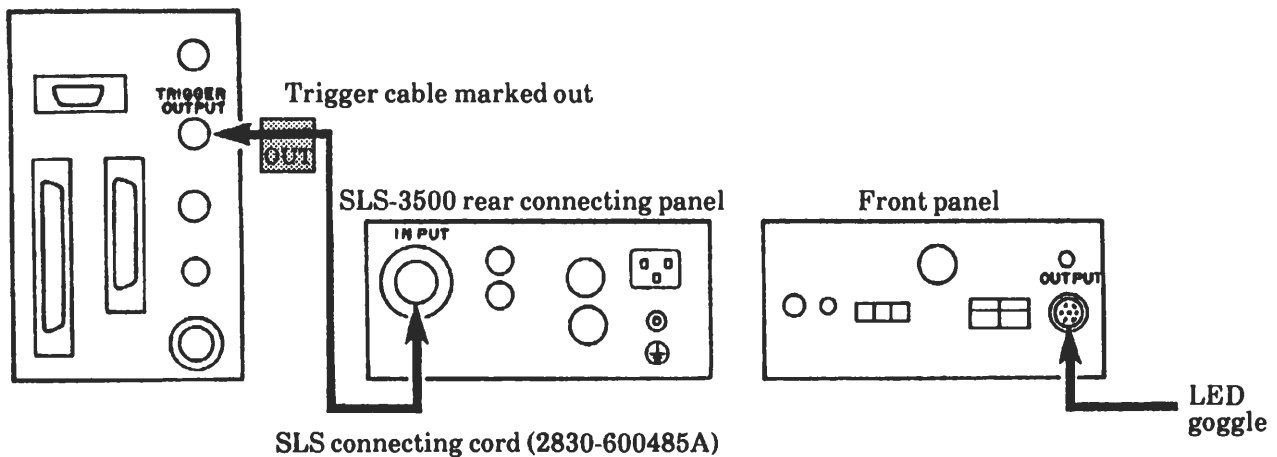
◆ **Connection and Setting of the Flash Stimulator (SLS-3100)**

1. Darken the room as much as possible for measurement.
2. Connect the photic stimulator in the same way as ERG.
3. Set the luminous amount to 0.6 J on the SLS-3100 side.

◆ **Connection and Setting of the LED Visual Stimulator (SLS-3500)**

Darken the room as much as possible for measurement. Refer to the operator's manual for SLS-3500.

Rear panel of the main unit

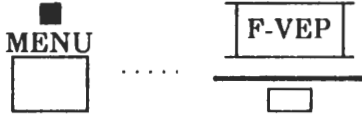


◆ **Preparing the Patient**

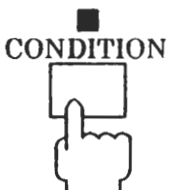
- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fix them with tape.
- Have the patient sit quietly in a chair and lean back so that the head is fixed. Have him relax the neck and chin. Fix the head with a headrest or pillow.
- Instruct the patient to watch the spot and to avoid blinking the eyes as much as possible.



◆ Measurement

- 

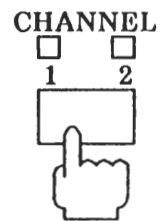
Press the MENU key to display the menu screen.  
Select the F-VEP mode according to the procedure of menu selection.

- 

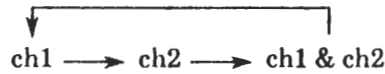
Check the condition by pressing the CONDITION key.

Condition Screen

F-VEP	17 Oct '88 13:39	
AMP	SENS 2ch	20 $\mu$ V/div
	Lo-cut	1 Hz
	Hi-cut	100 Hz
ACQ	Analy. Time	300 ms
	Delay	0 div
	Monitor Time	300 ms
	Preset Count	200
	Paper Speed	25 mm/s
STIM	Trigger Mode	RECUR
	Stim Rate	1 Hz
	PARA.M.	5 $\mu$ V
		10
		50
		100
		200
		500
		1 mV
		2
		10
		DC

- 

Select a channel to be used by pressing the CHANNEL key.  
In the F-VEP mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- Set the luminous amount to 0.6 J on the connected photic stimulator side.

- 

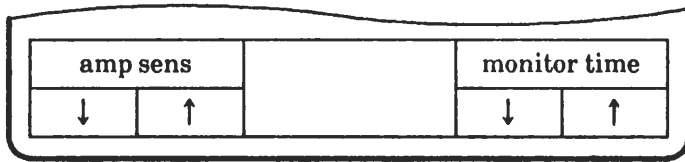
Monitor the input waveform by pressing the MONITOR key to check that no artifact appears.

[NOTES]

- If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.
- Waveforms that jump off the screen are excluded from averaging.

◆ **Monitor Screen**

Function keys



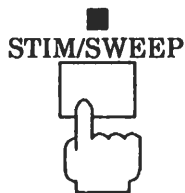
Switches the input sensitivity.

Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

6.

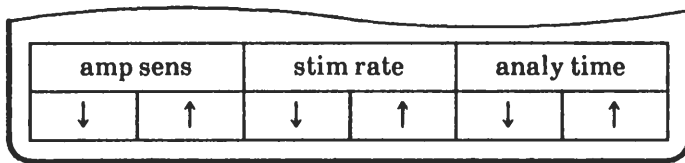


Start stimulation by pressing the **STIM/SWEEP** key.

A sweep screen is displayed. Instruct the patient to watch the stimulation lamp.

◆ **Sweep Screen**

Function keys



Switches the input sensitivity.

Adjusts the stimulation repeating frequency.

Switches the screen display time.

Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

MONITOR:

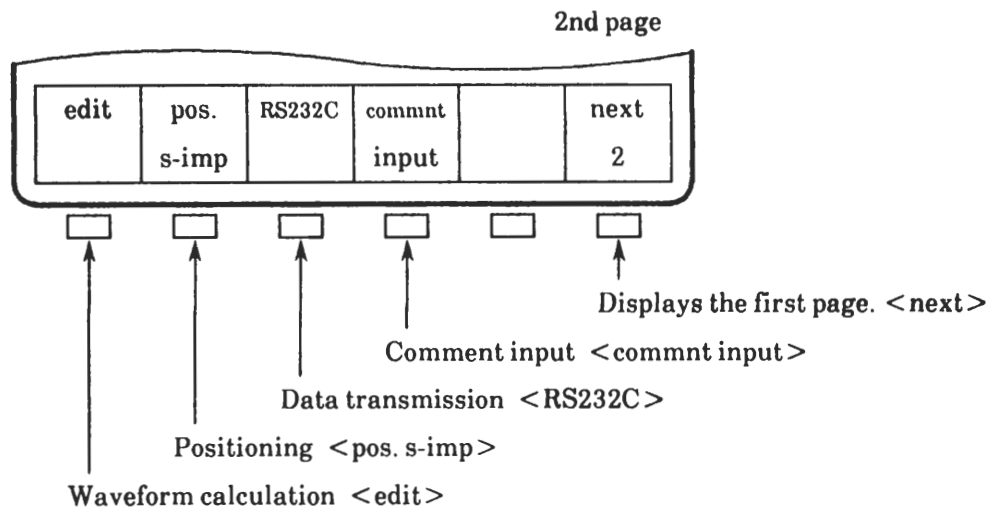
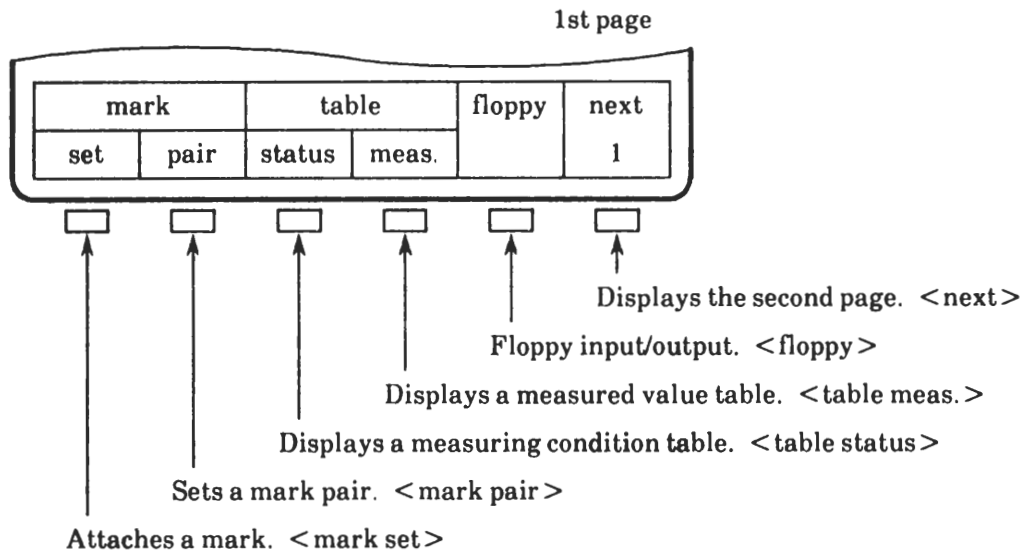
Displays the monitor waveform during stimulation.  
(Pressing the **STIM/SWEEP** key restores sweep status.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



: LTNCY and AMPTD measurement

(Cursor movement dial)

10.

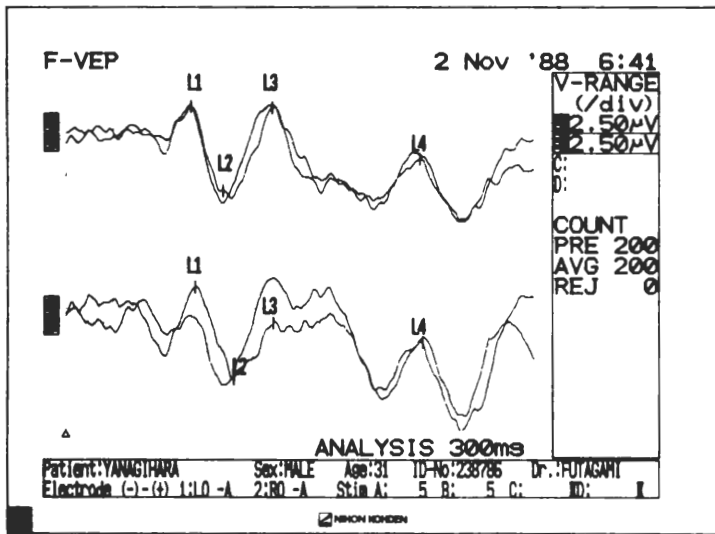


Press the RECORD key to start recording.

11. Termination of Examination

When F-VEP or ERG is selected as the next examination menu, all waveforms are saved. When any menu other than the above is selected, all the waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

F-VEP 2 Nov '88 6:42

	L1	L2	L3	L4	L5	AREA
A1	79.2	99.6	130	226		
A2	82.2	106	132	228		
B1						
B2						

	INTERVAL			AMPLITUDE		
	L1-L2	L2-L3	L3-L4	L1-L2	L2-L3	L3-L4
A1	147	126	95.4 ms	5.97	5.85	-1.14 $\mu$ V
A2	145	121	96.0 ms	6.39	3.90	-1.64 $\mu$ V
B1						
B2						

Patient: YANAGIHARA Sex: MALE Age: 31 ID-No: 238786 Dr.: FUJAGAMI  
 Electrode (-)-(+) 1:LO -A 2:RO -A Stim A: 5 B: 5 C: ID:

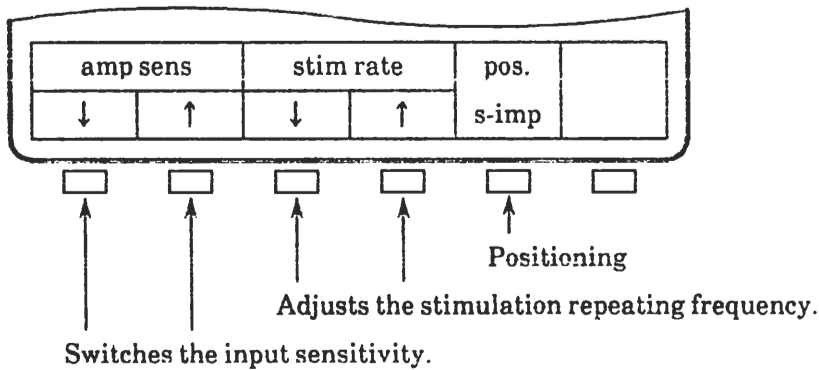
FORMER FOW110-3-100

7.



Start averaging by pressing the ANALYSIS key.  
An averaging waveform is displayed.

◆ **Analysis Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.

MONITOR: Displays a monitor waveform while repeating stimulation and averaging.  
(When the ANALYSIS key is pressed, status is restored.)

STIM/SWEEP: Displays a sweep waveform during averaging.  
(When the ANALYSIS key is pressed, status is restored.)



: LTNCY and AMPTD measurement

(Cursor movement dial)

When the averaging count reaches the preset count on the condition screen, the apparatus terminates averaging automatically and a stop screen is displayed.

\* Stopping averaging

- When the STOP key has been pressed and averaging stopped, the averaging count is not returned to 0. When the ANALYSIS key is pressed again, averaging is resumed from the current count.
- While averaging is stopped, the input waveform can be checked with the MONITOR key.

\* Retrying averaging

- If the ERASE key is pressed after the STOP key is pressed, the waveform is erased and the averaging count is returned to 0.

8.



Stores the averaging waveform.

When the STORE key is pressed, the latest averaging waveform is stored into the stage (memory).

- Four stages A - D are available. One stage is used when a waveform is stored once. Up to four sets of waveforms can be stored.

( 1ch measurement:  $4 \times 1\text{ch} = 4$  waveforms )  
 ( 2ch measurement:  $4 \times 2\text{ch} = 8$  waveforms )

\* Erasing the stored waveform

STAGE SELECT



Select a stage.



ERASE



Erase the waveform.

9. Make another measurement to confirm the reproducibility of the waveform.

## 19. ERG (Electroretinogram)

### ◆ Description of Examination

A change in retinal potential caused by lighting the xenon lamp is measured with the contact lens electrode.

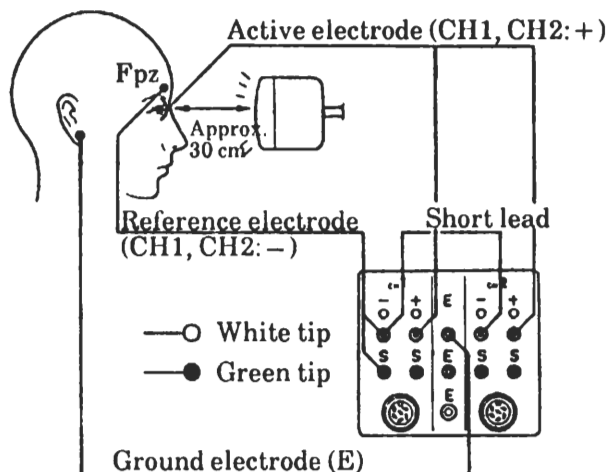
Response waveforms are used to diagnose retinal function for retinal pigment degeneracy, diabetic retinopathy, etc.

### ◆ Related Equipment

- Flash stimulator SLS-3100 (NIHON KOHDEN) (optional)
- Contact lens electrode KE-L (for adult) or KE-S (for infant) (optional)

### ◆ Electrode Placement

- (1) Place the electrodes on the earlobe (A1) and forehead (Fpz), then leave the patient in the dark for 25 minutes or more to adapt<sup>1</sup>.
- (2) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (3) Put the contact lens electrode in place after dark adaptation in order to avoid oxygen deficit of the cornea due to long-time placement of contact lens electrode.
- (4) For connection to the electrode junction box, use the short lead provided with the electrode set.
- (5) The green tip from the ground electrode (A1) is not connected.



Active electrode (+):

Contact lens electrode for ERG (left and right eyes)

Ground electrode: Earlobe (A1)

Reference electrode (-):

Forehead (Fpz). Cover the reference electrode with black tape to prevent artifacts caused by flash.

- \* When the electrodes are placed as shown above, the measurement result becomes positive up.

### 1 Dark adaptation

- Sufficient dark adaptation for the patient is required to obtain good measurement results.  
Normally, measurement is possible after 25 – 30 minutes of dark adaptation.
- Leave the patient in a dark room or with an eye patch with a complete light shield function for 25 minutes or more.

### ◆ Placement of Contact Electrode

- Place the contact lens electrode under dark red light and do not expose the patient's eyes to other light.
- Put the contact lens electrode in place after applying a topical anesthetic such as Benoxil.
- Apply a drop of Scopolol on the concave side of the contact lens; first pull down the lower eyelid and insert the lower edge of the lens, then pull up the upper eyelid and fully insert the lens.

### CAUTIONS

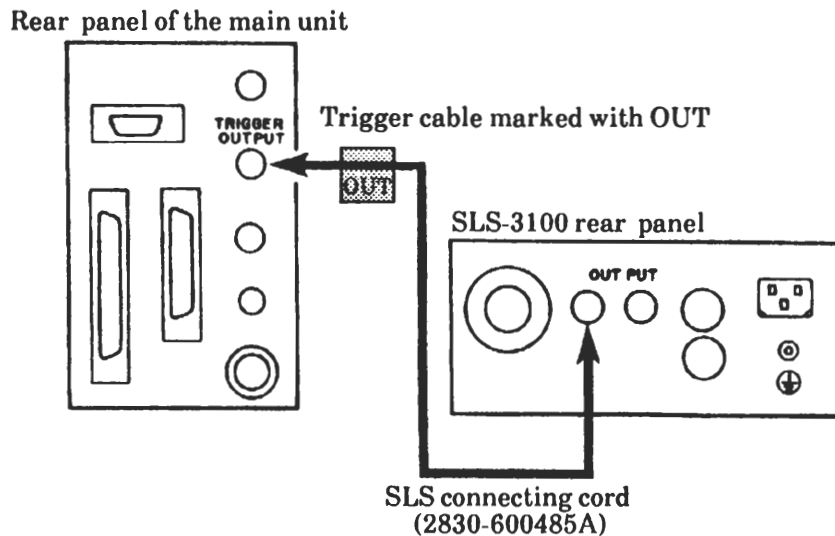
- Be sure to place the contact electrode under a physician's supervision.
- When placing the contact lens electrode, do not make any impedance check.
- Long-time placement of the contact lens electrode is undesirable because it causes an oxygen deficit in the cornea.

The maximum continuous placement time should be 45 minutes. If longer placement is necessary, take out the electrode once and place it in again in about 10 minutes.

### ◆ Connection of the Flash Stimulator SLS-3100

1. Darken the room as much as possible for measurement.
2. Set the luminous amount to 20 J or 40 J on the SLS-3100.

Refer to the operator's manual for the SLS-3100.

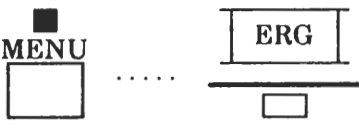


### ◆ Preparing the Patient


- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Have the patient lie on a chair or bed quietly and fix the head with a headrest or pillow. Relax the neck and chin to avoid the appearance of EMG during examination.
- Adjust the height of the flash lamp to the height of the patient eyes.
- Instruct the patient to stare at the red LED on the flash lamp.
- Instruct the patient to avoid blinking the eyes for a while just before stimulation.



◆ Measurement

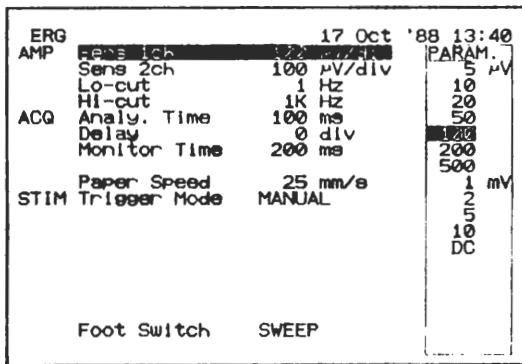
- 

Press the MENU key to display the menu screen.  
Select the ERG mode according to the procedure of menu selection.

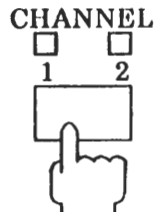
- 

Check the condition by pressing the CONDITION key.

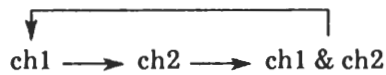
Condition Screen




\* Foot switch operation  
In the ERG mode, when the foot switch is stepped on, single-shot stimulation is performed. The reaction waveform is displayed and the stimulation stops.

- 

Select a channel to be used by pressing the CHANNEL key.  
In the ERG mode, each time the CHANNEL key is pressed, the following selection will be repeated.



- Set the luminous amount to 20 J or 40 J on the connected flash stimulator side.

- 

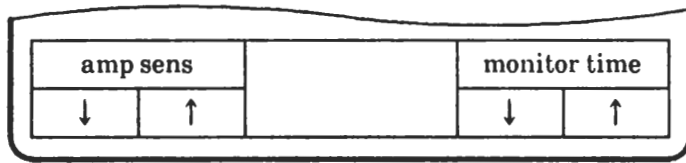
Monitor the input waveform by pressing the MONITOR key to check that no artifact is mixed.  
Instruct the patient to stare at the lamp for stimulation.

[NOTE]

If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.

◆ **Monitor Screen**


Function keys




Switches the input sensitivity.      Switches the screen display time.

Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

6.  **STIM/SWEEP**
- When the monitor waveform becomes flat, press the **STIM/SWEEP** key (or engage the foot switch) to start single-shot stimulation. A reaction waveform is stored and stops automatically.
- \* To obtain a good waveform, it is important to give unexpected stimulation to the patient.

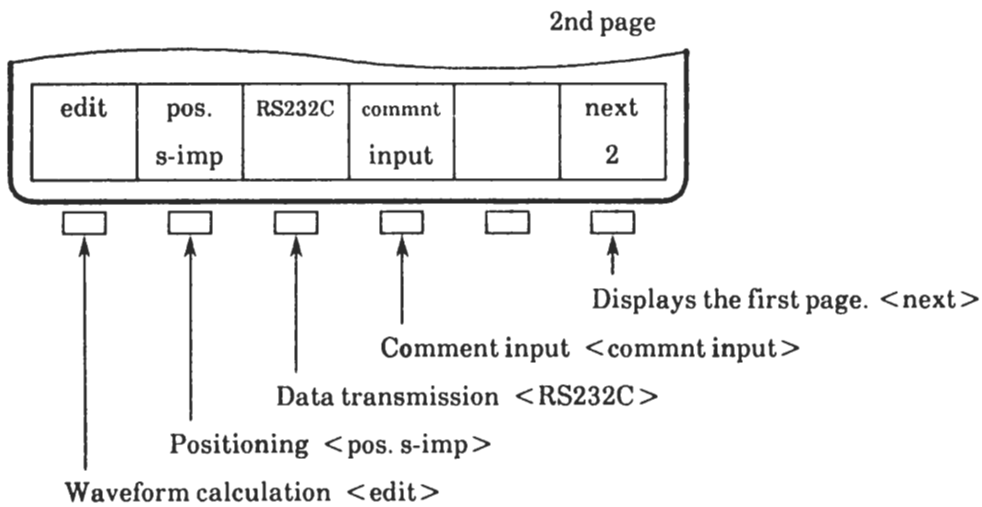
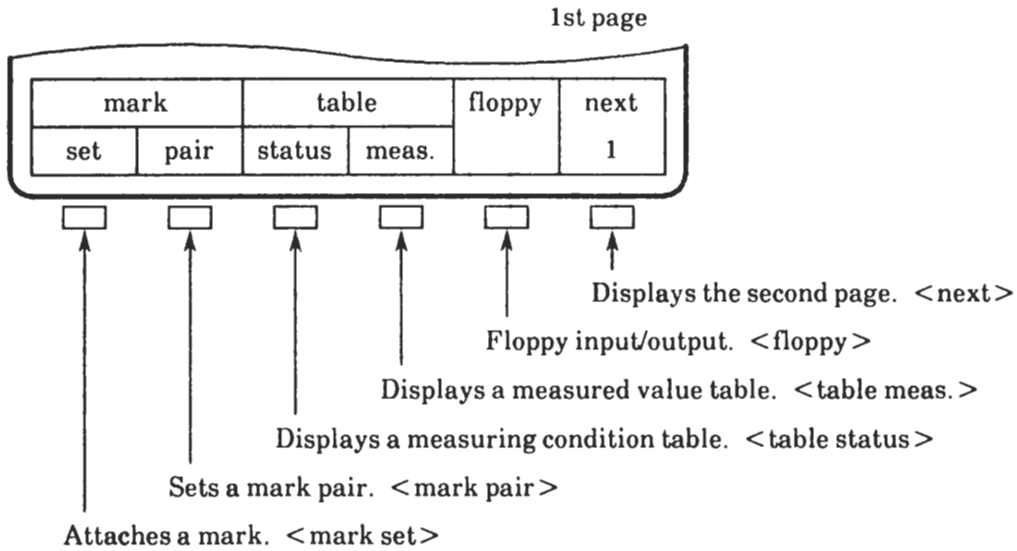
7.  **STORE**
- Stores the displayed waveform. When the **STORE** key is pressed, the displayed waveform is stored in the stage (memory).
- Four stages A – D are available. One stage is used for each stored waveform. Up to four sets of waveforms can be stored.
  - \* If the next measurement is made without the **STORE** function, the displayed waveform is erased.

\* Erasing the stored waveform



8. Make another measurement to confirm the reproducibility of the waveform.

◆ Stop Screen  
Function keys



Panel keys

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



: LTNCY and AMPTD measurement

(Cursor movement dial)

9. RECORD Press the RECORD key to start recording.

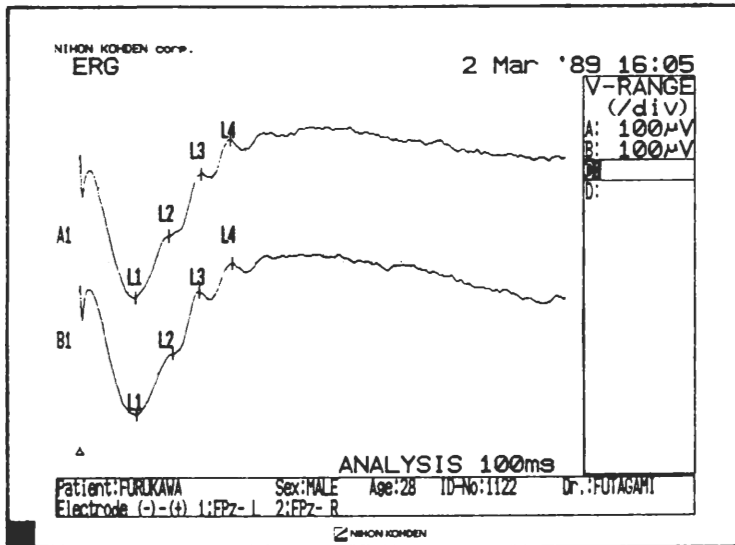


10. Termination of Examination

When ERG or F-VEP menu is selected as the next examination menu, all waveforms are saved.

When any menu other than the above is selected, all the waveforms are erased.

Recording sample



Recording sample: Hard copy of the measure table

NIHON KOHDEN corp. ERG 2 Mar '89 16:05

	L1	L2	L3	L4	L5	AREA
A1	11.4	18.2	24.8	30.8		
B1	11.6	19.0	24.4	31.2		

INTERVAL				AMPLITUDE		
	L1-2	L1-3	L1-4	L1-2	L1-3	L1-4
A1	6.80	13.4	19.4	167	333	427 $\mu$ V
B1	7.40	12.8	19.6	167	333	410 $\mu$ V

Patient: FURUKAWA Sex: MALE Age: 28 ID-No: 1122 Dr.: FOTAGAMI  
Electrode (-)-(+) 1: FPz- L 2: FPz- R

For type FOW110 1A-150



**Trend**

**21 TREND MODE (SEP, ABR, VEP)**

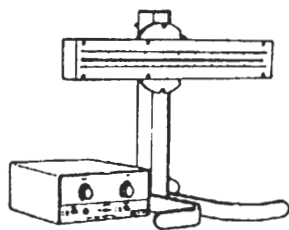
## 20. EOG (Electrooculogram)

### ◆ Description of Examination

A change of potential caused by movement of the eyeballs is recorded. An ophthalmic nerve abnormality is reflected on the nystagmus. Objective and quantitative nystagmus measurement provides necessary data for determination of the disordered part.

### ◆ Related Equipment

Visual target: ENG stimulator SLE-5100  
(NIHON KOHDEN) (optional),  
EOG stimulator

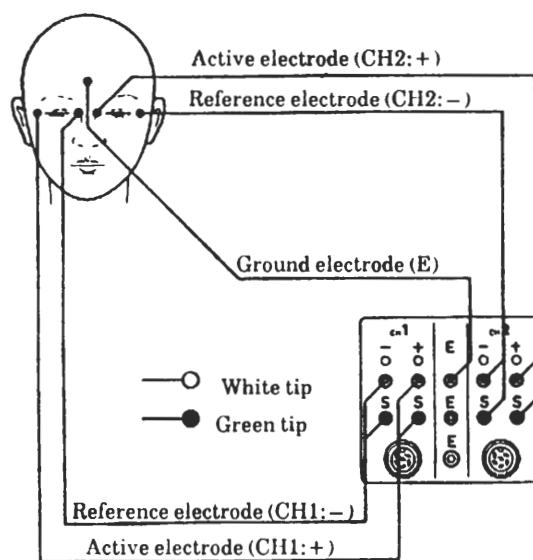


### ◆ Preparing the Patient

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Have the patient sit quietly in a chair, and adjust the height of the patient's eyes to the visual target of the ENG stimulator.
- Bundle the lead wires of the electrode and fix them with tape. Fix the electrode with tape if necessary.
- Have the patient relax to prevent neck, chin and face EMGs from appearing. Instruct the patient to avoid blinking the eyes as much as possible.

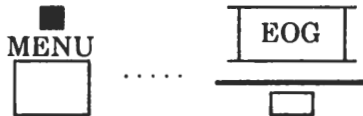
### ◆ Electrode Placement

- (1) Use the disk electrode as the ground electrode. The green tip from the ground electrode is not connected.
- (2) Use the EEG disk electrodes and fix them with paste. Use Skinpure to decrease the contact resistance of the electrode.
- (3) Make an impedance check and adjust the contact resistance of the electrode to 5 k $\Omega$  or less.

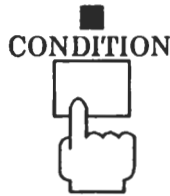


Active electrode: Outside corner of the eye  
Left and right nasions  
Ground electrode: Forehead

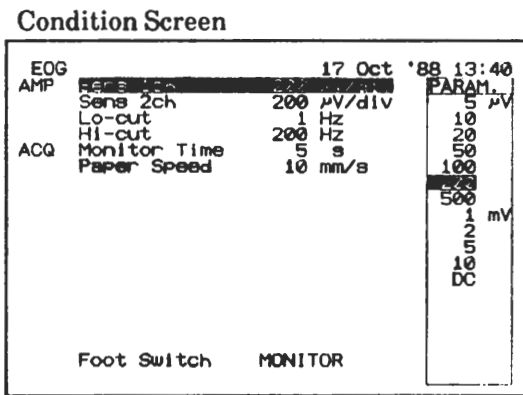
◆ Measurement

- 

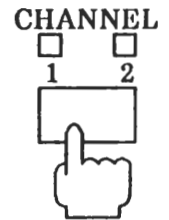
Press the MENU key to display the menu screen.  
Select the EOG mode according to the procedure of menu selection.

- 

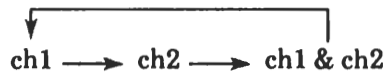
Check the condition by pressing the CONDITION key.




- \* Foot switch operation
  - Press the foot switch for MONITOR screen.
  - Release the foot switch for STOP screen.

- 

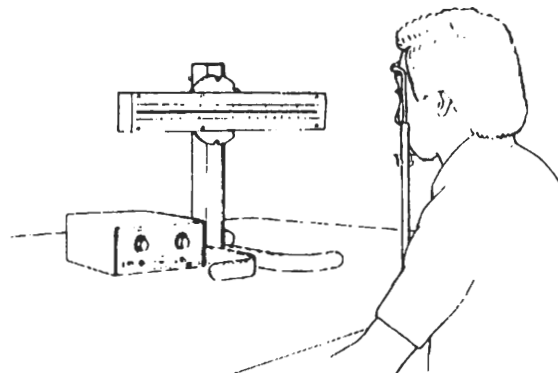
Select a channel to be used by pressing the CHANNEL key.  
In the EOG mode, each time the CHANNEL key is pressed, the following selection will be repeated.



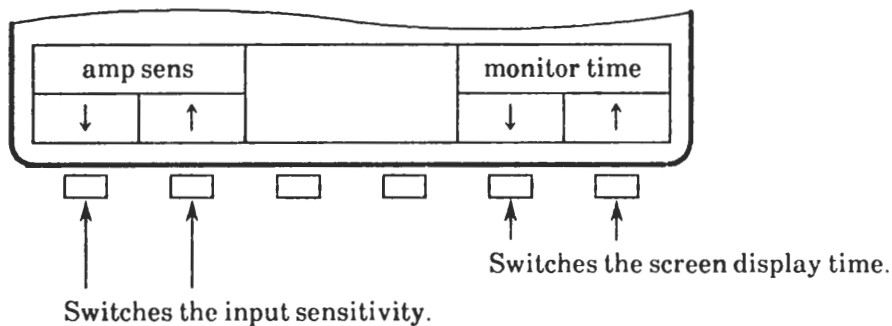
- 

Monitor the input waveform by pressing the MONITOR key (by engaging the foot switch).

- Operate the ENG stimulator (SLE-5100 : optional) and let the patient follow the visual target.



◆ **Monitor Screen**  
Function keys



Panel key

POSITION ↓ ↑: Moves the displayed waveform up and down.

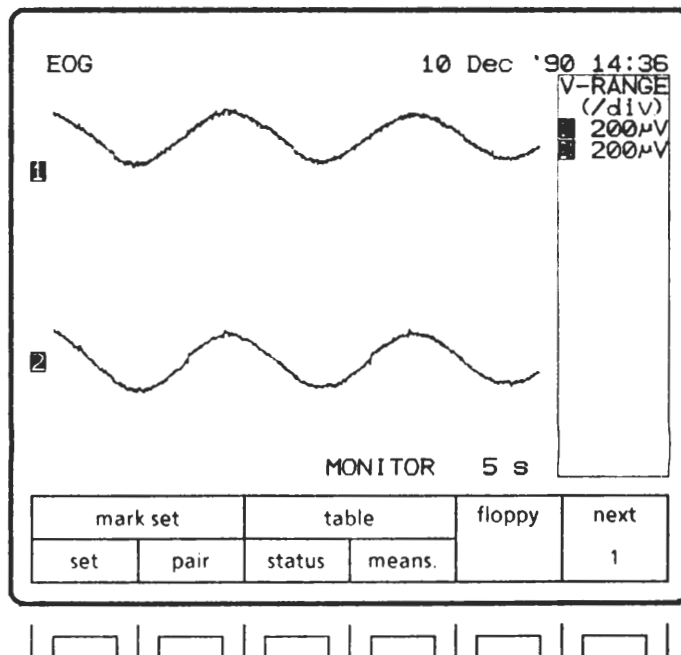
6. **RECORD**

When an appropriate waveform appears, record it.

- Direct recording: Continuously records the monitor waveform.

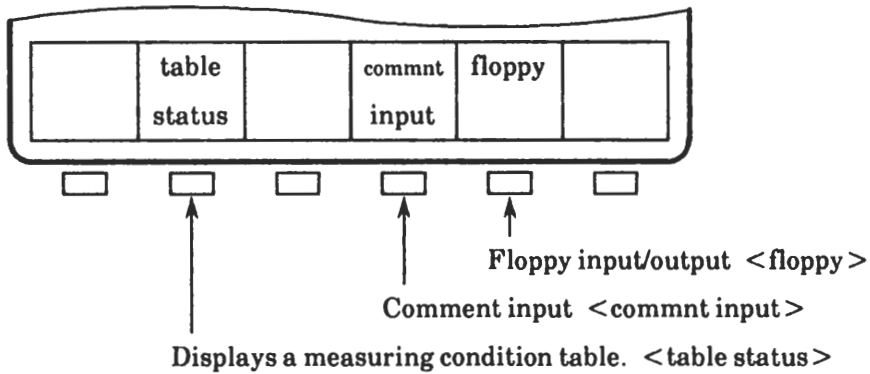
7. **STOP**

Press the STOP key if necessary. (Foot switch operation: Release the foot switch for STOP screen.)





◆ **Stop Screen**  
Function keys



**Panel keys**

POSITION ↓ ↑: Moves the displayed waveform up and down.

VERTICAL GAIN ↓ ↑: Switches the waveform display amplitude.



: LTNCY and AMPTD measurement

(Cursor movement dial)

\* **Copying the display screen**

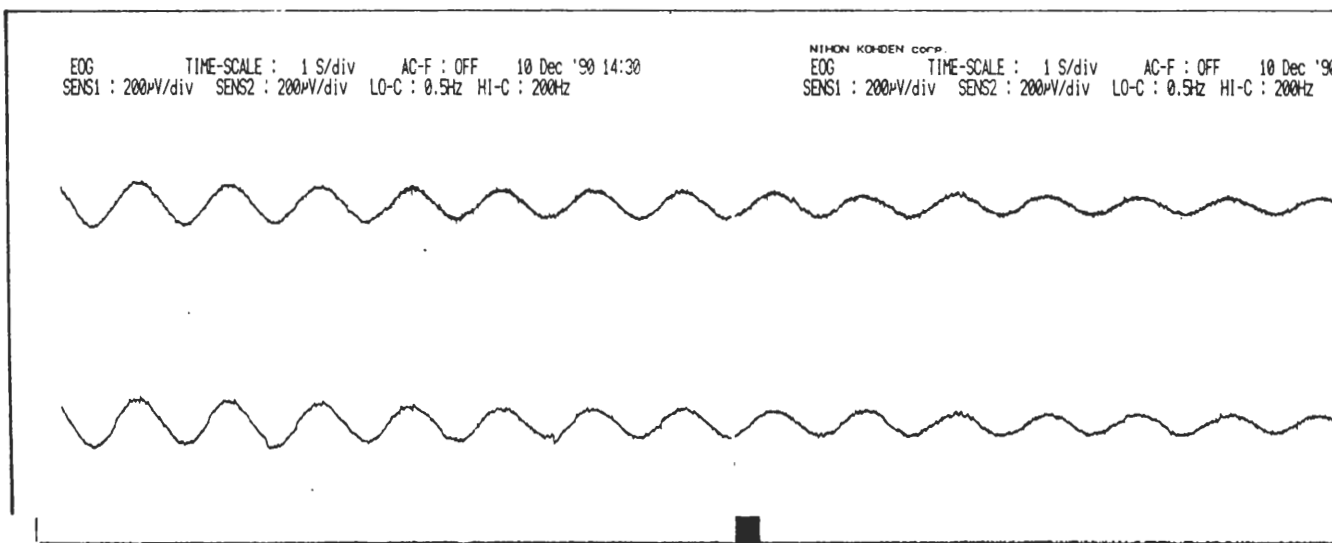
When the RECORD key is pressed, a hard copy of the screen is made.

8. **Termination of Examination**

When INTERF, SURFAC or EOG is selected as the next examination menu, all waveforms are saved.

If any menu other than INTERF, SURFAC and EOG is selected, all the waveforms are erased.

Recording sample: Direct recording



## 21. TREND MODE (SEP, ABR, VEP)

### ◆ Description of Examination

In evoked response examinations such as SEP, ABR and VEP, this mode is used to record evoked response waveforms continuously for a long period, repeating stimulation and averaging at a certain interval of time.

### ◆ Related Equipment

- TR-SEP: Surface stimulation electrode
- TR-ABR: Headphone or earphone stimulator (for intraoperative monitoring) (optional)
- TR-VEP: Stimulation video monitor (VD-401A), Photic stimulator (SLS-3100), LED photic stimulator (SLS-3500) (optional)

Refer to the sections describing SEP, ABR and VEP examinations.

### ◆ Electrode Placement

Refer to the sections describing SEP, ABR and VEP examinations.

### ◆ Connection to the Electrode Junction Box and Preparing the Patient

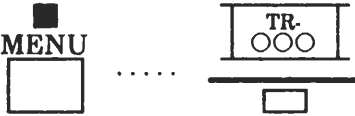
Refer to the sections describing SEP, ABR and VEP examinations.

### CAUTION

If a stimulation current is continuously given to the same location on the skin, a thermal burn may occur when the felt tip becomes dry. Care should be taken to avoid this in long-time measurement.

## 21. TREND MODE

### ◆ Measurement

- 

Press the MENU key to display the menu screen.  
Select the TREND MODE according to the procedure of menu selection.

- 

Check the condition by pressing the CONDITION key.

#### Condition Screen

TR-ABR		17 Oct '88 13:42	
AMP	Sens 2ch	10 $\mu$ V/div	5 $\mu$ V
	Lo-cut	50 Hz	20
	Hi-cut	3K Hz	20
ACQ	Analy. Time	10 ms	50
	Delay	0 div	100
	Monitor Time	200 ms	200
	Preset Count	2000	500
STIM	Trigger Mode	RECUR	1 mV
	Stim Rate	10 Hz	2
	Duration	0.1 ms	5
	Intensity	80 dB	10
	Mask Level	-40 dB	DC
	Side	BOTH	
	Phase	ALT	
	Trend Interval	5 min	
	Disp Wave	8	
	Trend Record	ON	
	Trend Floppy	OFF	

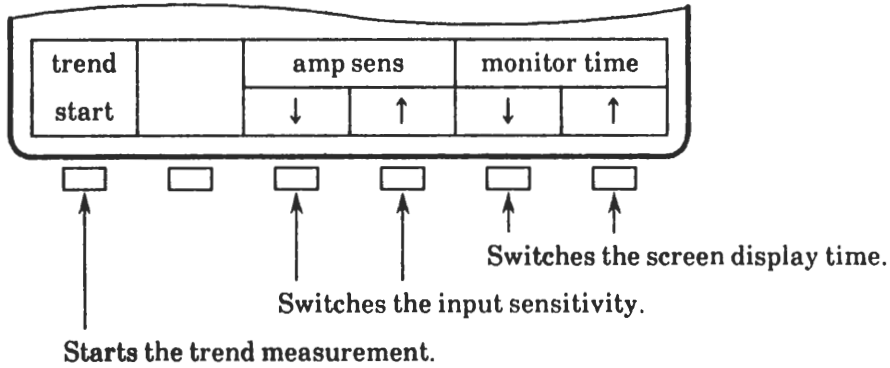
TR-SEP		17 Oct '88 13:42	
AMP	Sens 2ch	10 $\mu$ V/div	5 $\mu$ V
	Lo-cut	20 Hz	20
	Hi-cut	3K Hz	20
ACQ	Analy. Time	50 ms	50
	Delay	0 div	100
	Monitor Time	200 ms	200
	Preset Count	200	500
STIM	Trigger Mode	RECUR	1 mV
	Stim Rate	3 Hz	2
	Duration	0.2 ms	5
	Trend Interval	2 min	10
	Disp Wave	8	DC
	Trend Record	ON	
	Trend Floppy	OFF	

TR-VEP		17 Oct '88 13:43	
AMP	Sens 2ch	10 $\mu$ V/div	5 $\mu$ V
	Lo-cut	1 Hz	10
	Hi-cut	100 Hz	20
ACQ	Analy. Time	300 ms	50
	Delay	0 div	100
	Monitor Time	300 ms	200
	Preset Count	200	500
STIM	Trigger Mode	RECUR	1 mV
	Stim Rate	1 Hz	2
	Checker Size	16	5
	Location	BOTH	10
	Trend Interval	5 min	DC
	Disp Wave	8	
	Trend Record	ON	
	Trend Floppy	OFF	

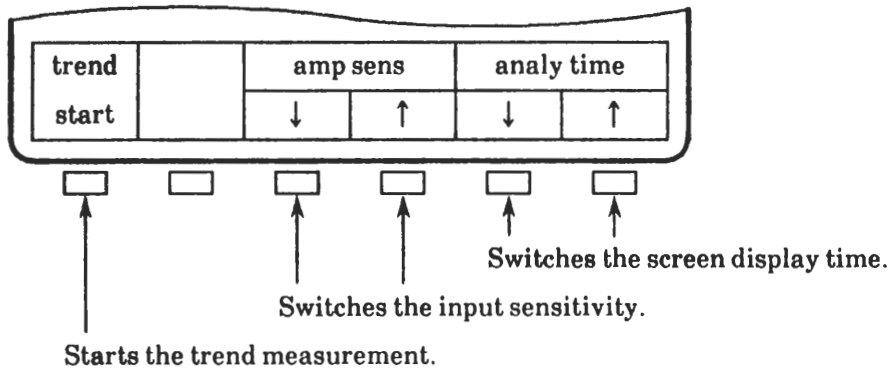
- Check that an evoked potential can be derived with the normal evoked potential examination procedure. Refer to the measuring procedure for each menu.

\* Part of the function key indications are different from those for the normal evoked menu.

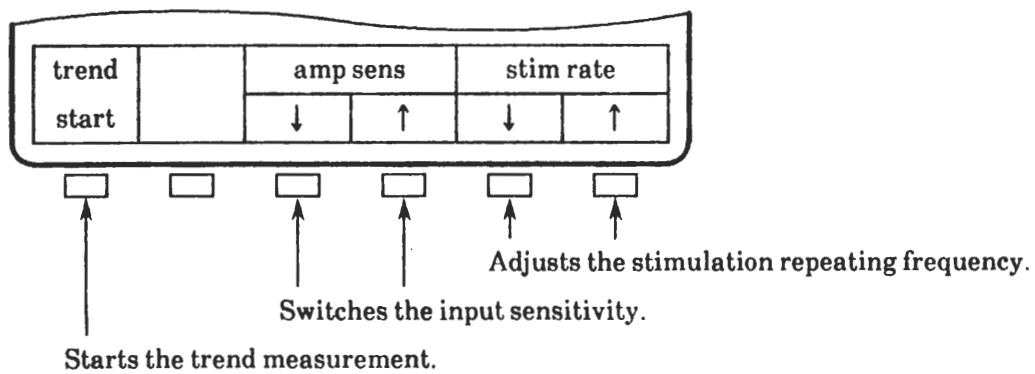
◆ Monitor Screen



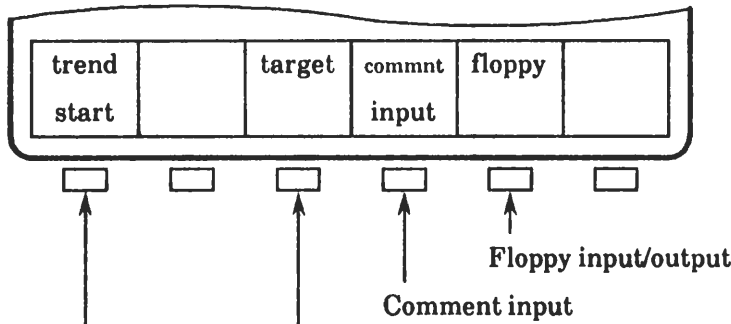
◆ Sweep Screen



◆ Analysis Screen



◆ Stop Screen



\* Registers the latest averaging waveforms as target waveforms .

Starts the trend measurement.

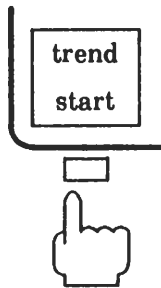
\* <target> Registration of the target waveform.

To compare the current averaging waveform with the averaging waveform in the progress of trend measurement, the averaging waveforms (1, 2) can be registered as target waveforms (T1, T2).

The registered target waveforms are displayed on the top of the screen.

If the trend waveform is updated with the progress of trend measurement, the target waveforms are held. When the <target> key is pressed during trend measurement, the latest averaging waveforms are replaced with the target waveforms currently being registered.

4.

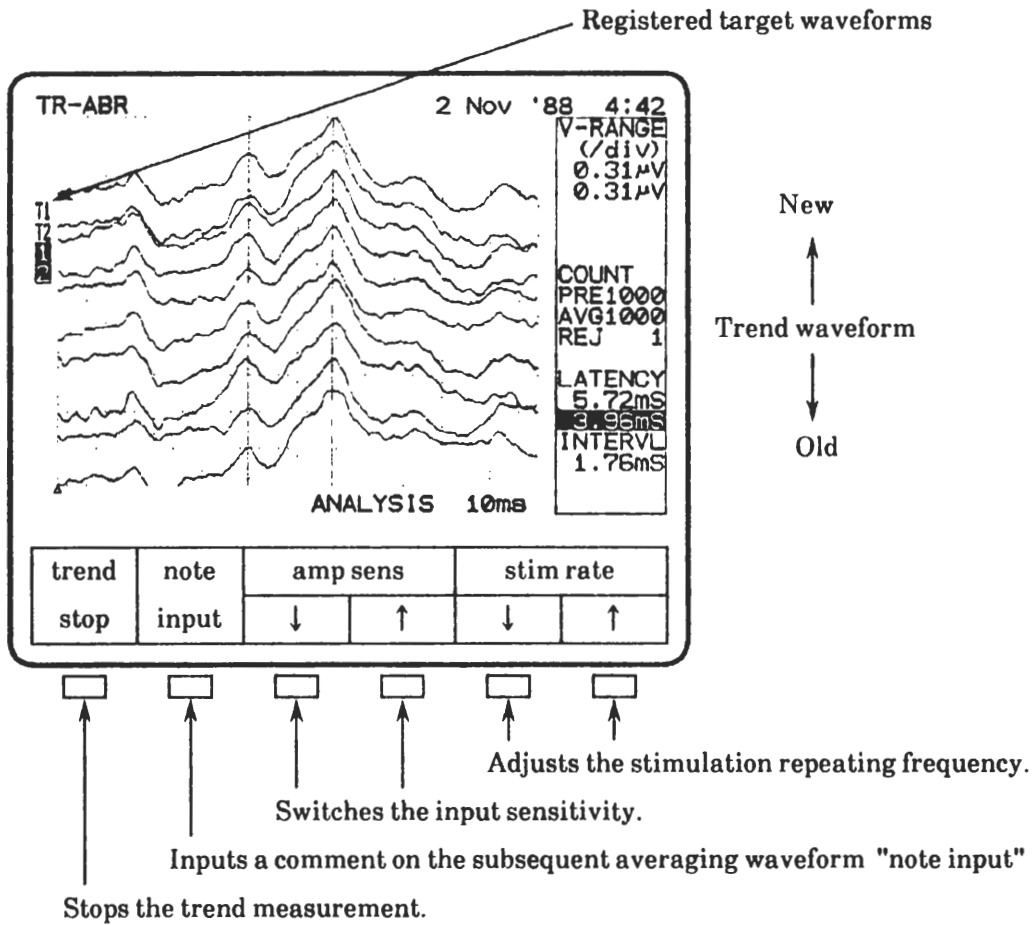


Start a trend measurement.

When the <trend start> key is pressed, stimulation and averaging are started. When reaching the preset count, they stop automatically.

Evoked potential examinations are repeatedly made in the "trend interval" (fixed interval) set on the condition screen. The number of waveforms set in "display wave" are displayed sequentially on the screen.

◆ Analysis Screen



Panel keys

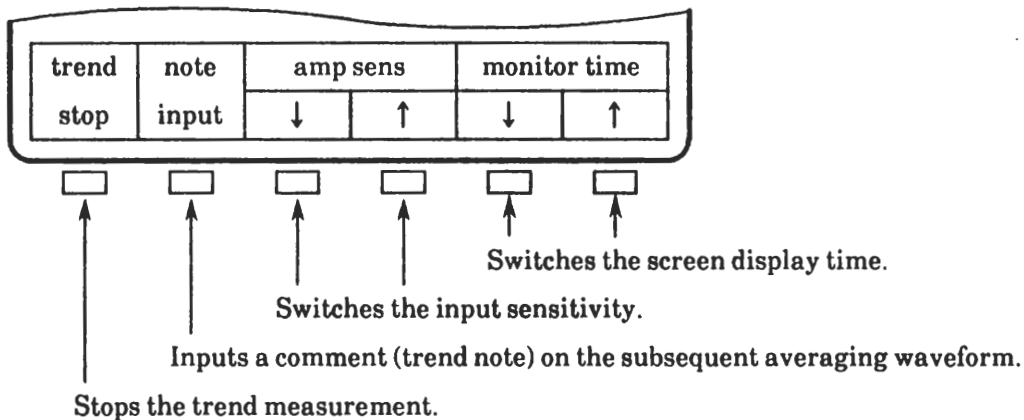
- POSITION ↓ ↑:** Moves the displayed waveform up and down.
- VERTICAL GAIN ↓ ↑:** Switches the waveform display amplitude.
- MONITOR:** Displays a monitor waveform during averaging. (When the ANALYSIS key is pressed, analysis status is restored.)
- STIM/SWEEP:** Displays a sweep waveform during averaging. (When the ANALYSIS key is pressed, analysis status is restored.)



(Cursor movement dial)

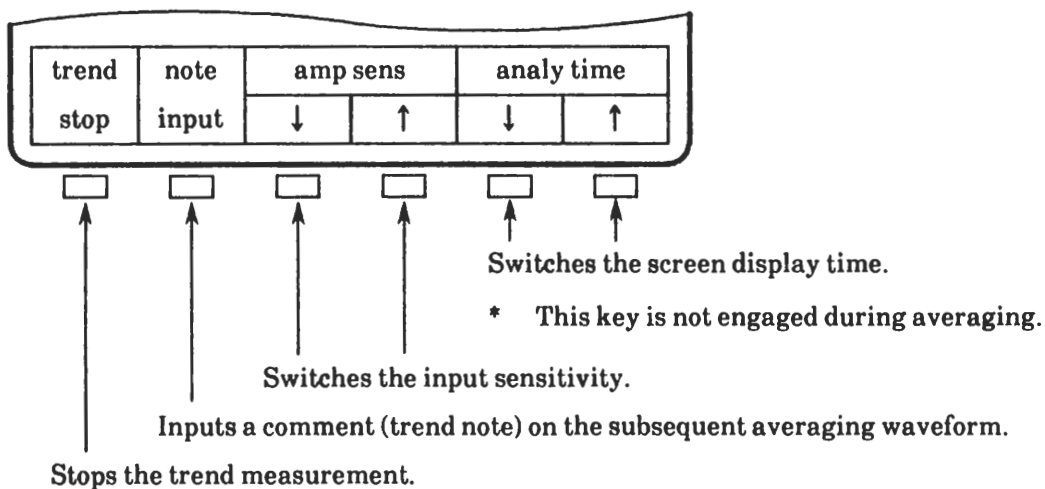
: LTNCY and AMPTD measurement

◆ Monitor Screen (During trend measurement)



\* Panel key operations conform to those on the analysis screen.

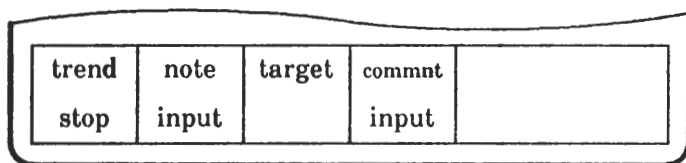
◆ Sweep Screen (During trend measurement)



\* Panel key operations conform to those on the analysis screen.



◆ Stop Screen (During trend measurement)

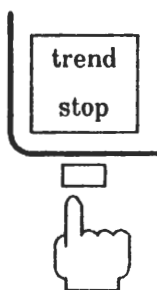


- Inputs a comment.
- Registers the latest averaging waveform as a target waveform.
- Inputs a comment (trend note) on the subsequent averaging waveform.
- Stops the trend measurement.

[NOTES]

- When the ERASE key is pressed on the stop screen, the latest averaging waveform is erased and canceled from the record.
- When the ANALYSIS key is pressed in the middle of trend interval, averaging is started.

5.



Press the <trend stop> key to terminate the examination.

◆ Trend Recording

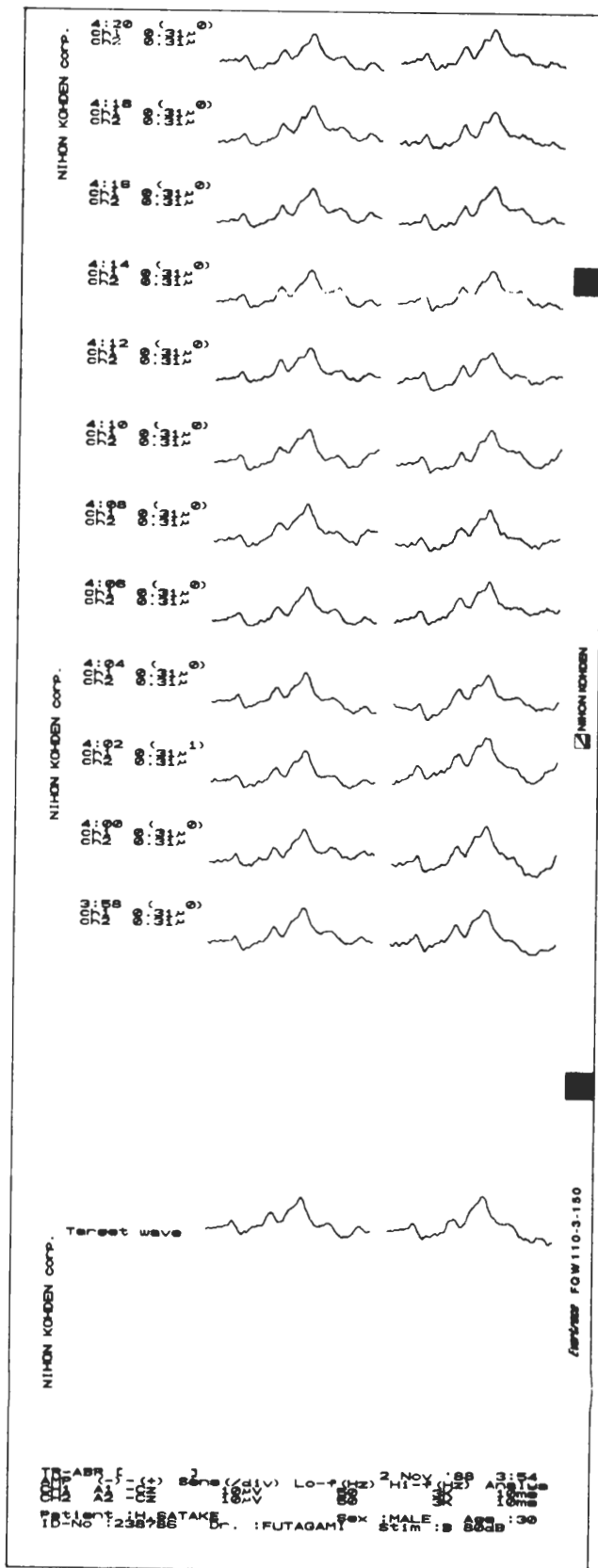
When "Trend Record" is set to ON on the condition screen, recording is performed each time the trend measurement count reaches the number of displayed waveforms plus 1.

\* During trend recording, direct recording and hard copy of the screen are not available.

◆ Trend Floppy Function

When "Trend Floppy" is set to ON on the condition screen, the data on waveforms, comments and status are stored into a floppy disk after the measured waveforms reach the number of displayed waveforms.

◆ Recording sample





# Others

**22 EXT (外部刺激装置用検査メニュー)**

**23 ジャークロックアベレージ(Jerk-locked averaging)**

## 22 EXT (Examination Menu for External Stimulator)

### ◆ Description of Examination

When an examination requires an external stimulator, select this menu. Though the built-in stimulator does not work in the menu, the other functions are same as the functions in each evoked potential menu.

When the instrument sends the trigger signal to an external stimulator for the synchronization, connect the TRIGGER OUTPUT terminal and the stimulator with the trigger cord.

When the instrument receives the trigger signal from an external stimulator for the synchronization, connect the TRIGGER INPUT terminal and the stimulator with the trigger cord after the Trigger Mode is changed to EXT (External Trigger IN) on the CONDITION screen.

### ● Initial CONDITION screen

NIHON KOKDEN CORP.		20 Dec '90 16:03	
EXT			
AMP	Sens 1ch	100 $\mu$ V/div	PARAM.
	Sens 2ch	100 $\mu$ V/div	5 $\mu$ V
	Lo-cut	1 Hz	10
	Hi-cut	1K Hz	20
ACQ	Analy. Time	100 ms	50
	Delay	0 div	100
	Monitor Time	200 ms	200
	Preset Count	200	500
	Paper Speed	25 mm/s	1 mV
STIM	Trigger Mode	RECUR	2
	Stim Rate	1 Hz	5
			10
			DC
	Foot Switch	SWEEP	

### ● CONDITION screen after trigger mode is changed to EXT

NIHON KOKDEN CORP.		20 Dec '90 16:03	
EXT			
AMP	Sens 1ch	100 $\mu$ V/div	PARAM.
	Sens 2ch	100 $\mu$ V/div	RECUR
	Lo-cut	1 Hz	RANDOM
	Hi-cut	1K Hz	MANUAL
ACQ	Analy. Time	100 ms	EXT
	Delay	0 div	
	Monitor Time	200 ms	
	Preset Count	200	
	Paper Speed	25 mm/s	
STIM	Trigger Mode	EXT *	
	Foot Switch	TRIGGER	

## 23 Jerk-locked Averaging

### ◆ Description of Examination

When an electromyogram caused by spontaneous myoclonus is used as the trigger for electroencephalogram EEG averaging, the spike prior to the myoclonus appears on the averaged EEG.

In the MUAP menu, this jerk-locked averaging examination can be performed with the averaging function.

### ◆ Electrode Placement

1. Use the evoked EEG disk electrodes for the examination.
2. Before fastening each electrode with the EEG paste Elefix, decrease the electrode-skin contact impedance with the skin preparation gel Skinpure so that the impedance can be  $5k\Omega$  or less in the impedance check.

#### <Channel 1>

Place the two active electrodes at 3 or 4 cm interval on the skin over the central belly of the muscle which has jerks clearly.

#### <Channel 2>

Active electrode (–): On the scalp of somato-motor area corresponding to the muscle for trigger (channel 1)

Reference electrode (+): On the earlobe at the same lateral of the active electrode  
A1/A2 or both  
earlobes A1 + A2

Ground electrode: Forehead Fpz

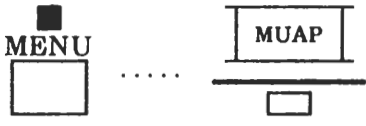
#### [NOTE]

The obtained waveform has negative up according to the above polarity.

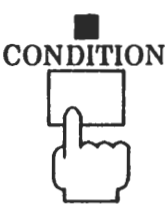
### ◆ Notes to Patient

- Keep the patient and the electrode junction box 1 m or more away from the main unit.
- Bundle the lead wires of the electrode and fasten them with tape. Fasten the electrode with tape if necessary.
- Have the patient lie on a reclining chair or bed quietly.
- Keep the patient at rest with the neck and chin in a comfortable, relaxed position, and the eyes closed for examination.
- Hold the patient's head to prevent neck EMGs from appearing. Instruct the patient to keep the mouth slightly open to prevent chin EMGs from appearing.

◆ Measurement

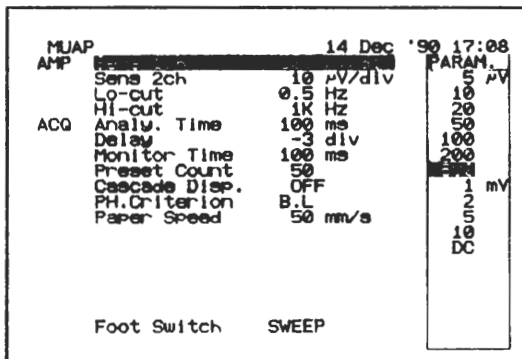
- 

Press the MENU key to display the menu screen.  
Select the MUAP mode according to the procedure of menu selection.

- 

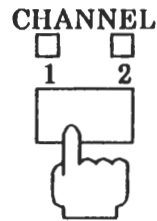
Press the CONDITION key for the set condition check.

Condition Screen




\* Foot switch operation

- Press the foot switch for SWEEP screen.
- Release the foot switch for STOP screen.

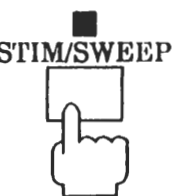
- 

Select both the channel 1 and 2 with the CHANNEL key.  
Then, both the LEDs for channel 1 and 2 are lit.

- 

Press the MONITOR key to monitor the two input waveforms. Confirm they have no artifact.

**[NOTE]**  
If the patient is stressed, the EMG of the neck or chin may be mixed in the waveform.

- 

Press the STIM/SWEEP key to display the SWEEP screen.

6. Set the level cursor just below the peak of the monitored EMG in the monitor window with the cursor movement dial. When the monitored EMG exceeds the level cursor, the swept EMG and EEG are displayed by the trigger function.

On the front panel

**VERTICAL GAIN** ↓ ↑ : Changes the monitor window display amplitude.



: Moves the level cursor up and down.

(Cursor movement dial)

7.



Press the **ANALYSIS** key for averaging. The averaged EMG and EEG are displayed at every averaging. If a swept waveform includes artifact during averaging, the swept waveform is excluded from averaging.

8.



After the averaging is completed, press the **STORE** key to store the averaged EMG and EEG if required.

The stored EMG and EEG can be confirmed with the <stored wave> function key.