



NIHON KOHDEN
CORPORATION

OPERATOR'S MANUAL

INTEGRATOR

Model EI-601G

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 electro-surgical 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.

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Introduction

The Integrator EI-601G is a plug-in unit for the Polygraph system RM-6000 series.

This unit is usually used in integration of the EMG, respiratory flow, and blood flow to obtain muscle work, ventilatory flow volume, and blood flow volume.

Please read this manual thoroughly prior to operation. Also refer to the operator's manual of the main unit and the other plug-in units.

Features

1. Simple integration balance adjustment.
2. Built-in calibration circuit provides easy sensitivity calibration.
3. Four types of rectifier for conditioning signals for integration.
4. Four reset modes; Manual, internal signal, external signal and built-in timer.
5. Mean integration provides an envelope waveform.

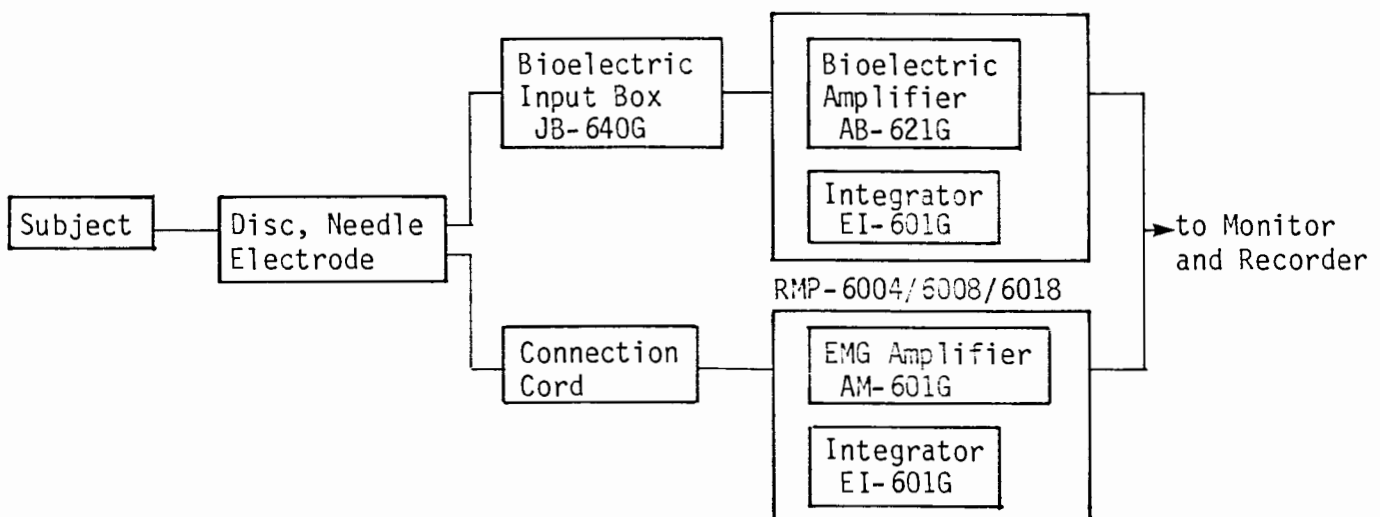
Composition

The integrator is plugged in the Polygraph Amplifier Console RMP-6004/6008/6018.

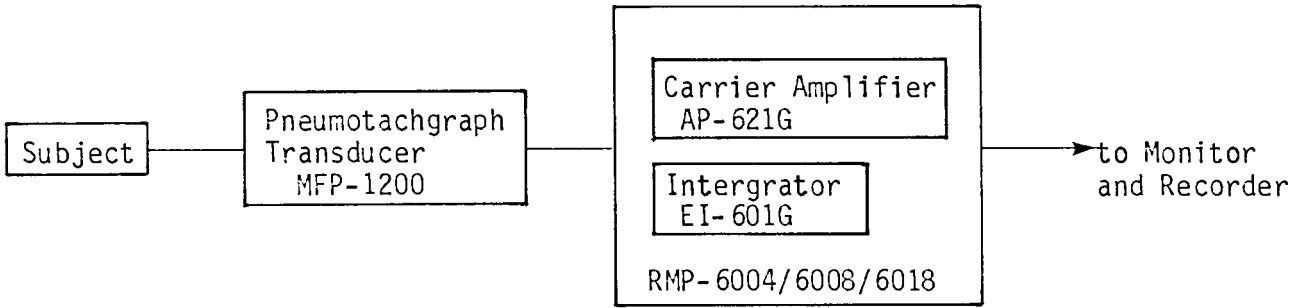
Examples of the system composition and a block diagram of the integrator are shown in the following figures:

COMPOSITION EXAMPLES

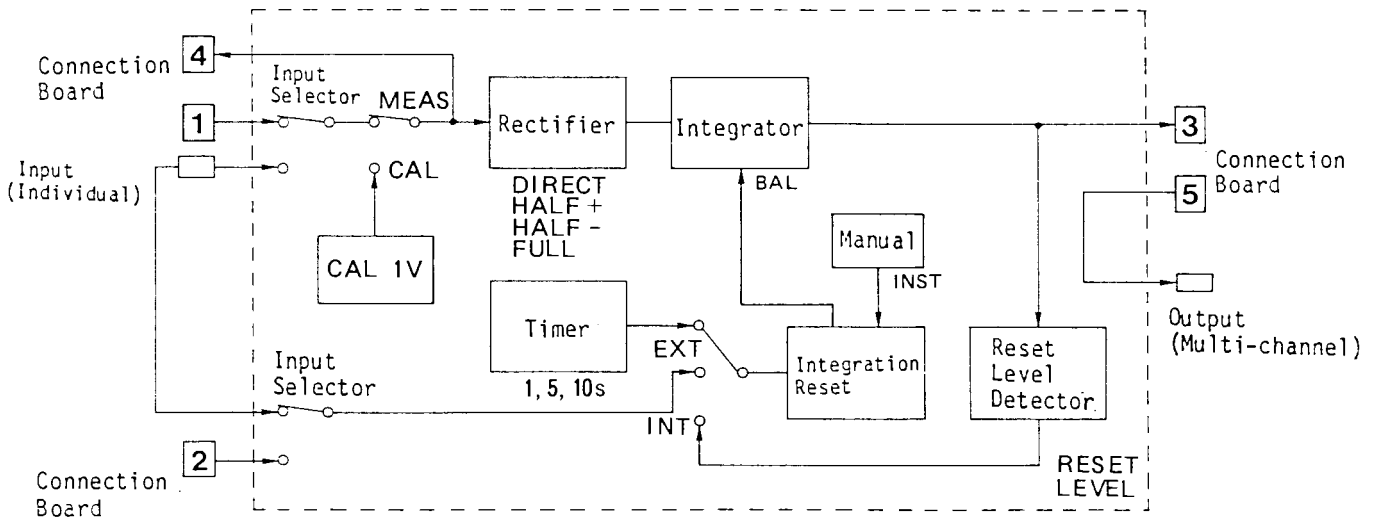
EMG Envelope Measurement (Muscle work)



Respiratory Flow Volume



BLOCK DIAGRAM



Controls and Switches

Refer to Panel Illustration on page 11.

(1) MEAS-OFF-BAL-CAL Input Selector

Selects input.

MEAS : Integrates the waveform in this position.

OFF : Stops integration.

BAL : Adjusts DC balance of the integrator with the BAL knob(6).

CAL : Applies the calibration signal to the differentiator.

(2) MEAN-INTEG RESET

Selects the time constants of the mean and the reset mode of the integrator.

MEAN : 0.1, 0.3, 1sec

INTEG RESET :

INT Intergration is reset to zero when the output of the integrator reaches the value set by the RESET LEVEL(7).

EXT Intergration is reset to zero when the external reset signal is applied to the integrator and the trigger level reaches the value set by the RESET LEVEL(7).

The reset signal selected by the signal selector(9) is supplied via the connection board or independent input.

TIMER 1, 5, 10sec
Intergration is reset to zero in above interval.

(3) CLIP Clipper

Selects the rectification mode of the input signal to be applied to the integrator.

DIRECT : Input signal is directly applied without recitification.

HALF + : Only positive components of the input signal are applied.

HALF - : Only negative components of the input signal are applied.

FULL : Full wave rectified signal is applied.

(4) SENSITIVITY Step control

Selects the rough amplitude of the signal.

INTEG : Output signal represents the area of the amplitude x time. The unit is V(volt)xS(sec)/DIV.

MEAN : Output signal represents the envelope of the input signal. This value has no unit.

(5) SENSITIVITY
Fine control

Adjusts the fine amplitude of the signal.

(6) BAL

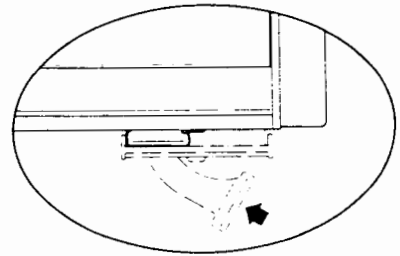
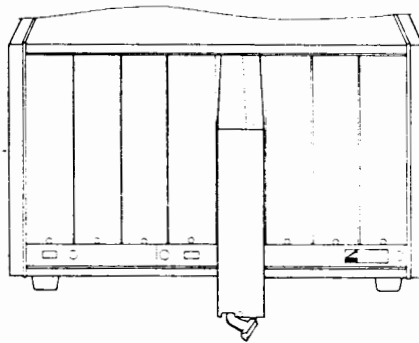
Adjusts the DC balance of the integrator.

(7) RESET LEVEL

Adjusts the reset level of the output voltage in a range between 0.5 and 5V.

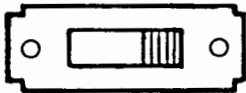
(8) Module Lock Lever

Pull this lever to draw out the unit from the Polygraph Amplifier Console.
After setting the internal switch, be sure to attach the side shield plate to the plug-in unit and restore the unit.



(9) Input and Reset
Signal Selector

INPUT-CB.1 IND CB.1
RESET-IND CB.2 CB.2



Selects the input and reset signal simultaneously.

CB1/IND : The input signal is supplied from terminal No.1 of the other channel on the connection board.

The reset signal is supplied from the independent input on the rear of the Polygraph Amplifier Console.

IND/CB2 : The input signal is supplied from the independent input on the rear of the Polygraph Amplifier Console.

The reset signal is supplied from terminal No.2 of the other channel on the connection board.

CB1/CB2 : The input signal is supplied from terminal No.1 of the other channel on the connection board.

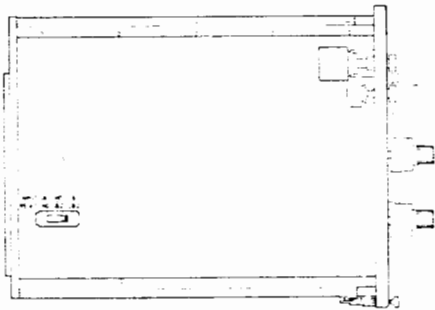
The reset signal is supplied from terminal No.2 of the other channel on the connection board.

Measurement

(EMG ENVELOPE AND MUSCLE WORK)

INTERNAL SWITCH SETTING

Pull the unit lock lever and draw out the EI-601G from the Polygraph Amplifier Console. Remove the side shield plate from the amplifier and set the input and reset signal selector on the right side (CB1/CB2). The input signal is supplied from terminal No.1 of the connection board. The reset signal is supplied from terminal No.2 of the connection board.

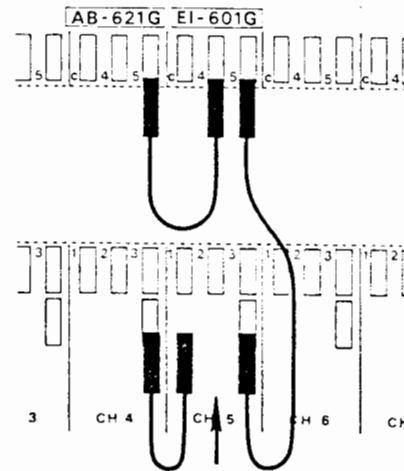


After setting switches, be sure to restore the unit to the console and lock the lever.

CONNECTION BOARD WIRING

Draw out the connection board from the Polygraph Amplifier Console. Connect as follows.

When used with the Bioelectric Amplifier AB-621G



Pin No.3 and 5:

Outputs the signal to a monitor and recorder.

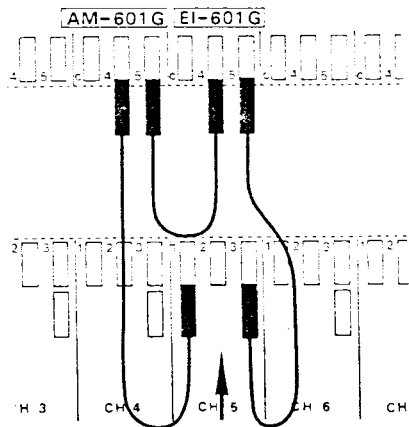
Pin No.3 and 1:

Inputs the signal to the integrator from the bioelectric amplifier.

Pin No.4 and 5:

For simultaneous calibration of the integrator and bioelectric amplifier. When the MEAS-OFF-BAL-CAL switch is set to the MEAS or OFF, bioelectric signal is outputted. DC signal of +1V is outputted when set to CAL.

When used with the EMG Amplifier AM-601G



Pin No.3 and 5

Outputs the signal to a monitor and recorder.

Pin No.4 and 1

Inputs the signal to the integrator from the EMG amplifier.

Pin No.4 and 5

For simultaneous calibration of the integrator and EMG amplifier.

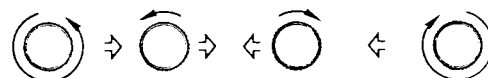
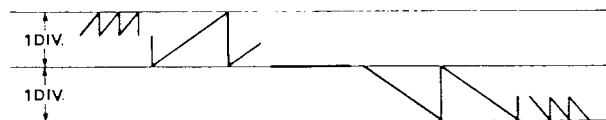
POWER ON

After making sure that the ground lead and power cord are properly connected, turn on the power of the rack, console, monitor and recorder. Check to see that the power indication lamps light.

BALANCE ADJUSTMENT

1. Set the MEAS-OFF-BAL-CAL switch (1) to the OFF.
2. Adjust the baseline of a recorder and monitor as desired.
3. Set the CLIP selector (3) to the DIRECT.
4. Set the SENSITIVITY selector (4) to 5.

5. Set the MEAS-OFF-BAL-CAL switch (1) to the BAL.
6. If the DC balance of the integrator is not properly adjusted, the sawtooth waveform of the integrated output appear on the positive side or negative side. In this case, adjust the amplitude of the sawtooth waveform to zero with the BAL knob (6).



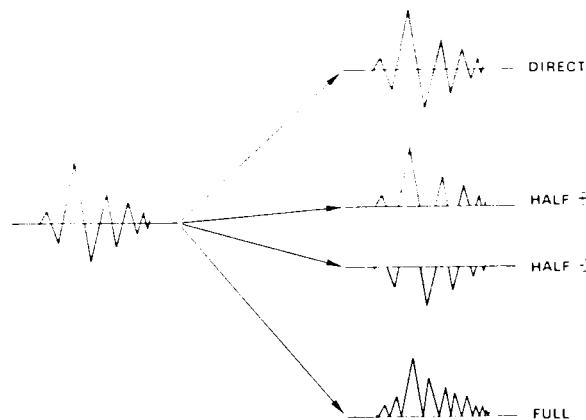
7. Turn the SENSITIVITY selector (4) from 5, 2,... to 0.2 to increase the sensitivity and adjust the DC balance in the same way mentioned above.

NOTE

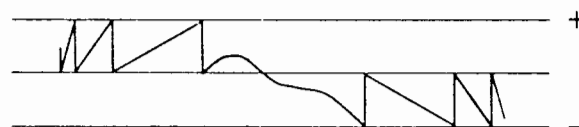
Be sure to adjust the DC balance prior to measurement. However, if the input signal includes DC offset, readjust the the integrator in the MEAS position.

CLIPPER

Input signal of the integrator is rectified to followings.

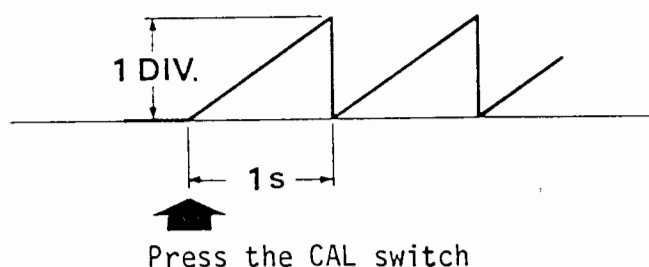


Though positive and negative amplitude of the EMG measured by a surface electrode are the same, those measured by a needle electrode are different. Therefore, select the FULL rectification when using the needle electrode.



SENSITIVITY CALIBRATION

1. Set the MEAS-OFF-BAL-CAL switch (1) to the CAL and a sawtooth waveform will be recorded.
2. Set the SENSITIVITY selector(4) to 1 V.S/DIV. Adjust the calibration signal amplitude to 1 DIV (10mm) with the SENSITIVITY fine control (5).



RESET

Select the proper reset mode according to the purpose among four reset modes.

Manual Reset

The integration is reset when the INST switch is pressed on the Polygraph Amplifier Console with no relation to the MEAN-INTEG RESET selector(2) setting.

Internal Reset

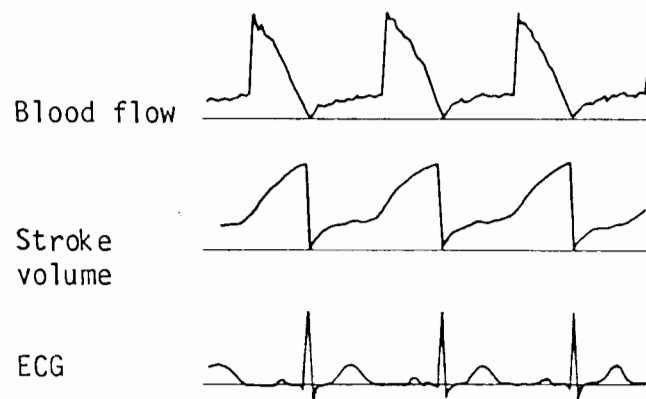
The integration is reset when the output reaches the level set by the RESET LEVEL knob(7). Counting the number of resets in a certain time period provides the frequency measurement.

Reset level is set on both positive and negative sides simultaneously with the same amplitude.

External Reset

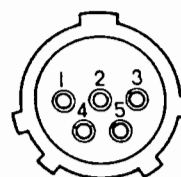
The integration is reset when the external signal is applied to the independent connector or the pin of the connection board.

For example, in blood flow measurement, one stroke volume is obtained from the differentiated blood flow waveform and the ECG as an external reset signal. The reset level is adjusted with the RESET LEVEL knob(7).



The reset signal is applied to the independent connector on the rear of the console directly or through the Input Panel PI-680G by the connection cable provided with the console.

Pin assignment of the connector is as follows.

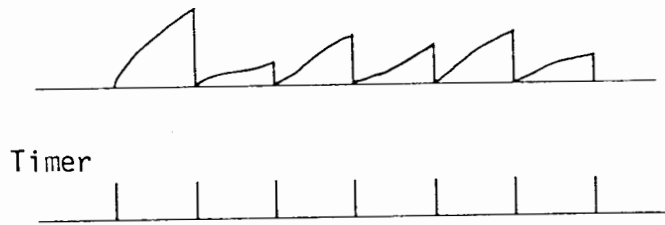


1. Not connected
2. (+) Input signal
3. Not connected
4. Ground
5. (-) Input signal

Connector type SRC06A13-5P
Code No. 5310067

Timer Reset

The integration is reset at each interval set by the internal timer. The amplitude of the integrated waveform shows integration value at a certain time.



MEASUREMENT

Place the electrodes referring to the operator's manual of the AB-621G and AM-601G.

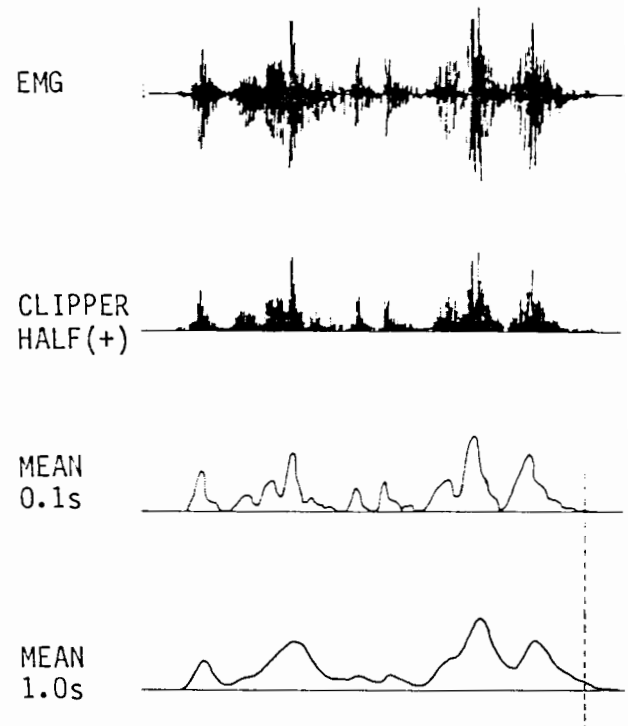
Mean Integration (Envelope waveform)

Mean integration is used to observe the envelope of the EMG waveform.

1. Set the control switches of the EI-601G as follows.

MEAS-OFF-BAL-CAL switch(1) : MEAS
MEAN-INTEG RESET selector(2) : 0.1
CLIP : + HALF

2. Set the MEAS-OFF-CAL switch to the MEAS of the AM-601G and the envelope will be recorded.
The smaller T.C. produces a waveform more similar to the envelope's actual characteristics.
Set the time constant to the proper value according to the measuring purpose.

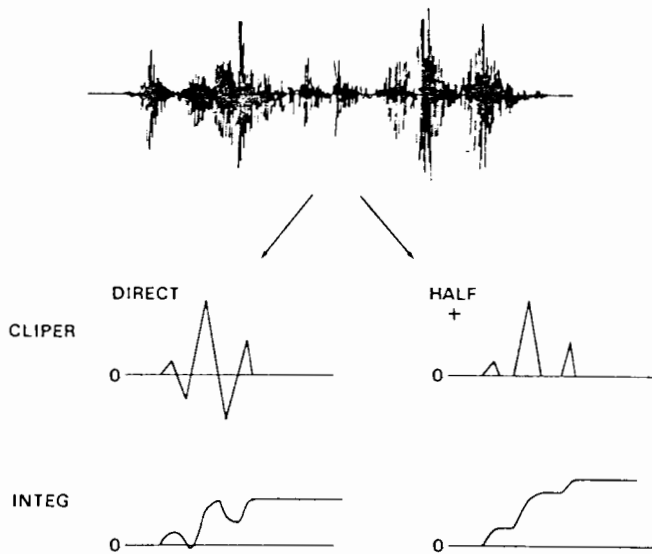


Integration (Muscle work measurement)

1. Set the controls of the EI-601G as follows.

MEAS-OFF-BAL-CAL switch(1) ... MEAS
MEAN-INTEG RESET selector(2) .. INT
CLIP selector(3) as desired

2. Set the MEAS-OFF switch to MEAS to measure EMG.
3. Set the integration reset level with RESET LEVEL knob(7).



When the CLIP(3) is set to the DIRECT, the integrator integrates both positive and negative signals. Therefore when the input signal is positive, the integrated waveform increases, while when the input signal is negative, the integrated waveform decreases.

When the CLIP(3) is set to the HALF + mark, only the positive component of the input signal is integrated.

The reset level should be set to the maximum recording limit of the recorder. (Refer to RESET for reset setting.)

Specifications

Input Circuit	Single-ended
Input Impedance	100k Ω
Sensitivity	
Step control	0.2-0.5-1-2-5 V.S/DIV (INTEG), accuracy $\leq \pm 3\%$
Fine control	10 ± 2 dB, continuously variable
Time Constant	0.1-0.3-1 sec, accuracy $\leq \pm 20\%$
Integration Reset	
Manual reset	Actuated by the INST switch on the console.
Internal reset	Actuated by the output signal of ± 0.5 V to 5V.
External reset	Actuated by an external signal of ± 0.5 V to 5V and of more than 10msec width.
Timer reset	Interval of 1, 5 and 10sec, accuracy $\leq \pm 2\%$
Integration Linearity	$\leq 2\%$, in continuous period of 100sec.
Input Selector	DIRECT, HALF(+), HALF(-), FULL, accuracy $\leq \pm 2\%$
Calibration	+1V DC, reset every second
Maximum Output Voltage	> 5.0 V
Output Impedance	$\leq 50\Omega$
Dimensions and Net Weight	50(D) x 200(H) x 280(W)mm Approx. 1.2Kg

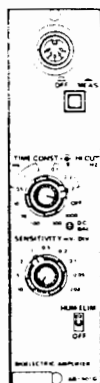
Related Instruments

BIOELECTRIC AMPLIFIER

AB-621 G

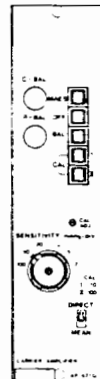


AB-601 G



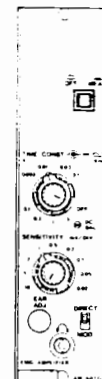
CARRIER AMPLIFIER

AP-621 G



EMG AMPLIFIER

AM-601 G



Panel Illustration

