

NIHON KOHDEN
CORPORATION

OPERATOR'S MANUAL

IMPEDANCE PLETHYSMOGRAPH ✓

20472

Model . AI-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 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 prepaid.

In the USA and Canada other warranty policies may apply.

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Internal Switch Setting
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Introduction

The Impedance Plethysmograph AI-601G is a plug-in unit for the Polygraph system RM-6000 series.

This unit utilizes electrodes applied to the human body to measure electrical impedance and impedance change caused by respiration and blood flow. The

Cardiac output is an especially important parameter as an index of the dynamic function of the heart, and the demand for a non-invasive method of continuous cardiac output measurement over a long period is increasing. Therefore impedance measurement based on Kubicek' theory for easy cardiac output determination is becoming prevalent.

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

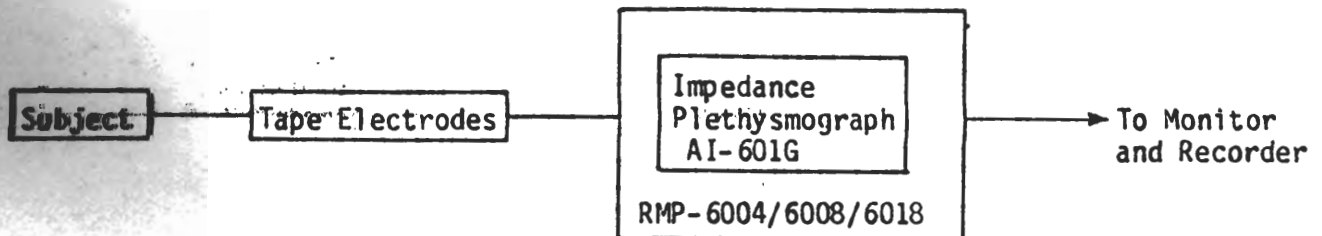
Composition

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

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

COMPOSITION EXAMPLES

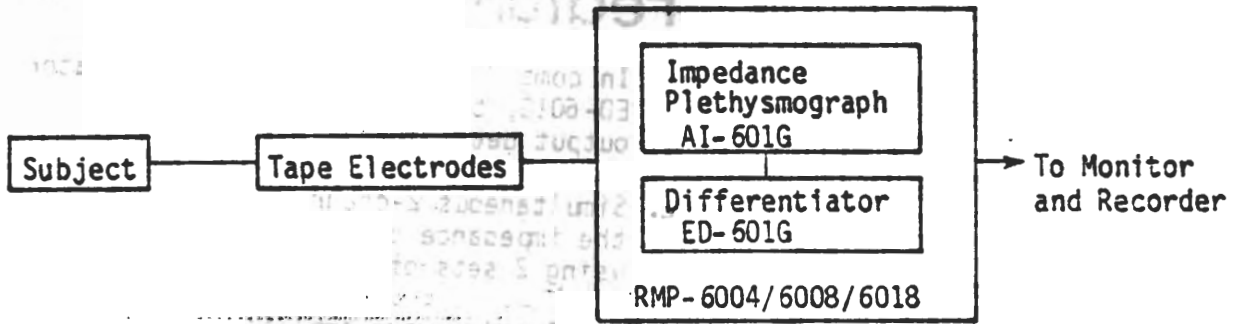
Impedance Plethysmograph Measurement



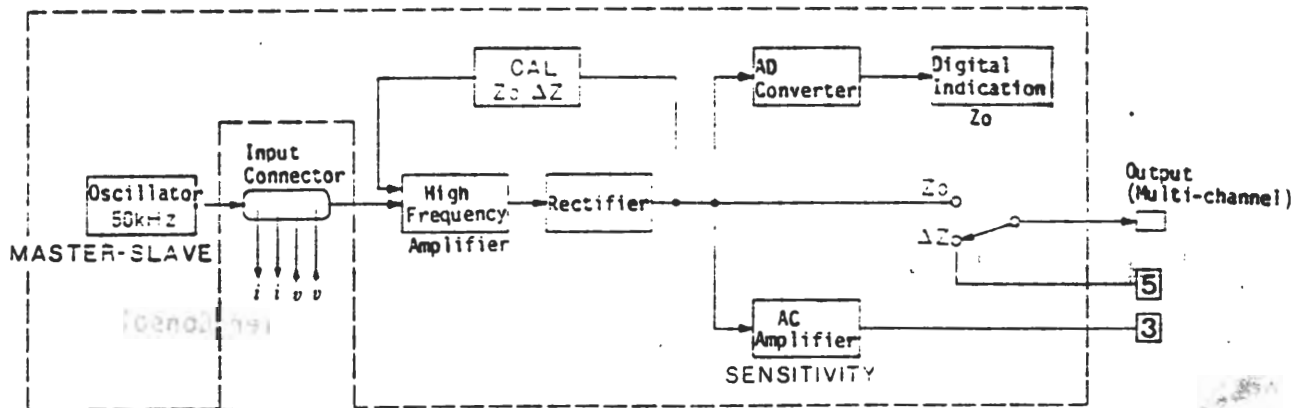
Features

1. In combination with the Differentiator ED-601G, the AI-601G provides cardiac output data.
2. Simultaneous 2-channel measurement of the impedance of the four limbs using 2 sets of the AI-601G.
3. Respiration wave amplification
4. The mean body impedance Z_0 is displayed in the digital display.

Impedance Waveform Differentiation (Cardiac output measurement)



BLOCK DIAGRAM



Controls and Switches

Refer to figure on page 21.

(1) Input Connector

Connects the transducer.

The red tip of the input cord is for excitation current electrodes and the black one is for voltage detecting electrodes.

(2) MEAS-OFF-CAL

Selects input signal.

MEAS : Amplifies input signals.

OFF : Turns amplifier off.

CAL : Applies calibration signal of 30Ω to the amplifier.

When the CAL switch on the console is pressed, Z_0 calibration signal of 30Ω is displayed on the indicator and ΔZ calibration signal of 0.1Ω is recorded on the recorder.

(3) MASTER or SLAVE

When two units of the impedance plethysmograph are used simultaneously for one subject, this terminal is used to equalize the current of each unit.

(Refer to MASTER-SLAVE selector(9).)

(4) Z_0 GAIN

Adjusts the value of the Z_0 indicator(5) to 30Ω when the the CAL switch of the MEAS-OFF-CAL(2) is selected.

(5) Z_0 Indicator

Indicates the value of Z_0 in three digits down to one decimal place.

(6) ΔZ SENSITIVITY Step Control

Selects the sensitivity in 6 steps.

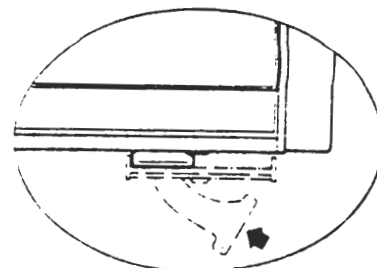
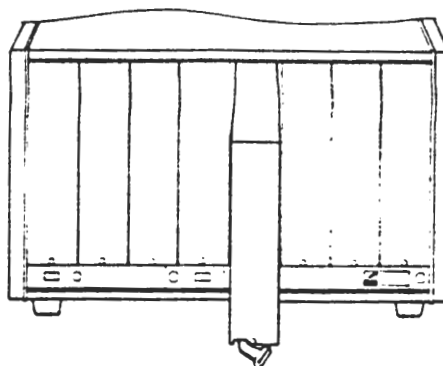
(7) ΔZ SENSITIVITY Fine Control

Controls the fine sensitivity.

(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) MASTER-SLAVE

Used when two units of the AI-601G are used simultaneously. Set this selector on one unit to MASTER, while setting on the other unit to SLAVE, connecting the two units with the provided connection cord.

(10) Zo-AZ

Selects output signal for a monitor and a recorder.

(11) RESP-OFF

Selects the filter to be used.

RESP : When measuring respiration.

OFF : When measuring blood flow.

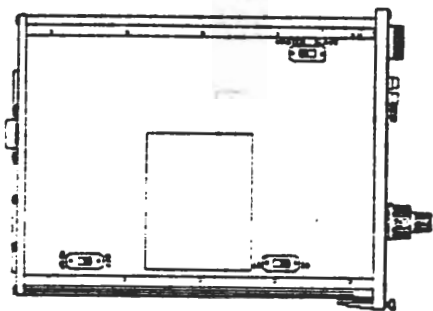
Measurement

(CARDIAC OUTPUT)

INTERNAL SWITCH SETTING

Pull the unit lock lever and draw out the AI-601G from the Polygraph Amplifier Console. Remove the side shield plate from the amplifier and check to see that the following switches are properly set as follows.

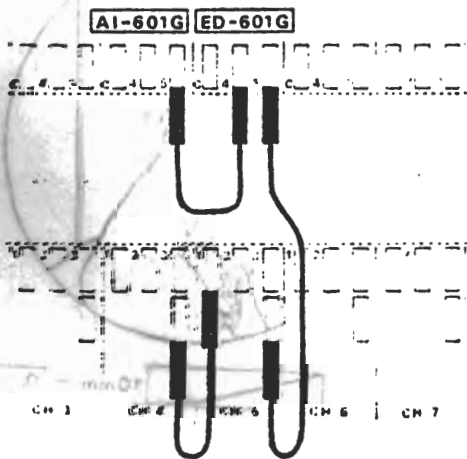
- MASTER-SLAVE selector(9) .. MASTER
- Zo-ΔZ selector(10) ΔZ
- RESP-OFF selector(11) OFF



After setting the internal switches, be sure to re-attach the side shield plate to the pull-in unit and restore to the Polygraph Console.

CONNECTION BOARD WIRING

Draw out the connection board from the Polygraph Amplifier Console. Connect the terminals as follows. After connection, restore the connection board to the console.



AI601G(A)

Socket No.3 and 5

Outputs signal to a monitor and a recorder.

Socket No.3 and 1

Inputs an impedance signal (ΔZ) to differentiator.

Socket No.5 and 4

For simultaneous calibration of the impedance plethysmograph and the differentiator.

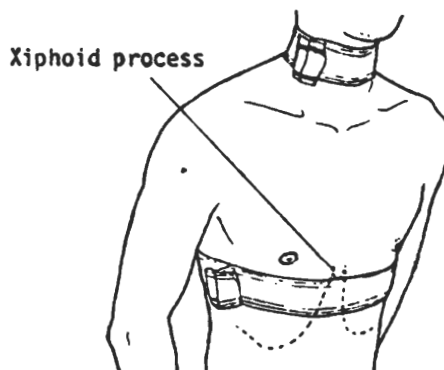
When the MEAS-OFF-CAL switch is set to MEAS or OFF, impedance waveform is outputted, while set to CAL, triangular waveform is outputted.

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.

ELECTRODE PLACEMENT

1. Wind the tape electrodes around the patient's chest and neck with firm skin contact as follows.



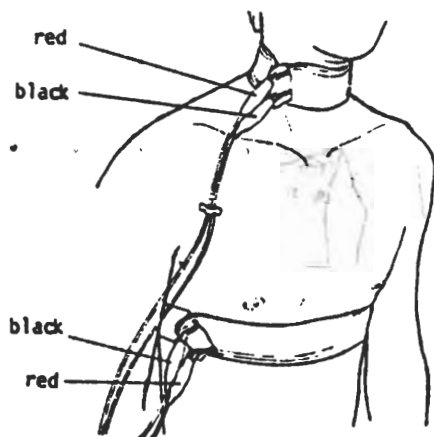
2. Fold both ends of the tape electrode and meet them on the electrode side firmly so they do not slip off the patient.



3. Connect the input cord to the current electrodes by clipping the aluminum stripe with the red alligator clips.
4. Similarly connect the input cord to the voltage electrodes (between the current electrodes) by clipping the aluminum stripes with black alligator clips. Fix the input cords near the alligator clips to the patient's skin with surgical tape to secure stable measurement.

NOTE

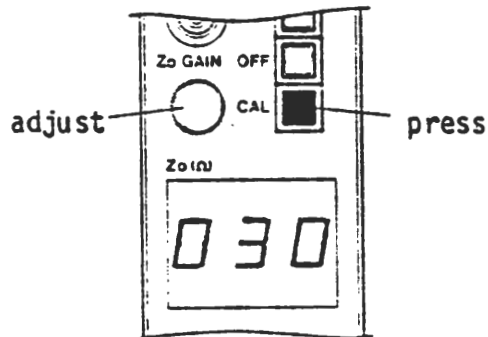
- a. Be sure to set the electrodes so that the current electrodes are on the outer and the voltage electrodes on the inner side.
- b. When measuring the impedance simultaneously at arms and legs, be sure that electrodes do not come in contact with each other, and set the MASTER-SLAVE selector to MASTER on one unit and SLAVE on the other unit.



SENSITIVITY CALIBRATION

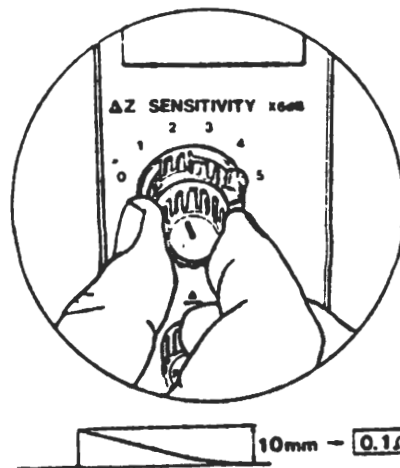
Zo Calibration

1. Set the MEAS-OFF-CAL switch(2) to CAL.
2. Adjust the Zo on the indicator to 30Ω with the Zo GAIN knob(4). (In CAL position $30\Omega \pm 1\%$ resistor is connected to the input.)



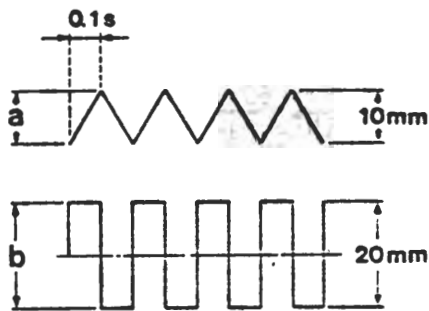
ΔZ Adjustment

1. Set the MEAS-OFF-CAL switch(2) to the CAL.
2. Run the recorder at slow speed.
3. Set the SENSITIVITY selector(6) to "5". Press the CAL switch on the Polygraph Amplifier Console. Adjust the amplitude of the calibration signal to 10mm (corresponding to 10Ω) with the SENSITIVITY fine control(5).



ΔZ and dz/dt Calibration

- Set the control settings of the differentiator ED-601G.
 Front panel switch
 TIME CONST 5ms
 HI CUT 75Hz
 Internal switch
 /sec-/0.1sec ... /0.1sec
 IND-INT INT
- Set the MEAS-OFF-CAL switch to CAL.
- Run the recorder and following waveform will be recorded.



- Adjust "a" to 10mm with the CAL knob of the differentiator.
 The slope of this waveform is $0.1\Omega/0.1\text{sec}$.
- Adjust "b" to 20mm with the SENSITIVITY step and fine control of the differentiator.

After the above settings, both units are calibrated as follows.

AI-601G : $0.1\Omega/\text{cm}$
 ED-601G : $1\Omega/\text{sec}/\text{cm}$

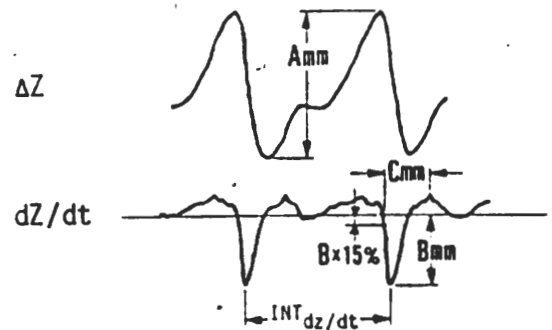
MEASUREMENT

Zo Measurement

Set the MEAS-OFF-CAL switch(2) of the AI-601G to MEAS and that of the ED-601G to OFF. The Zo indicator shows the Zo of the patient.
 If an artifact is caused by respiration of the patient (if the indicator fluctuates largely due to patient's respiration), measure the Zo at the moment when the patient has fully expired all of the air in his lungs.

ΔZ , dZ/dt Measurement

- Run the recorder at paper speed of 50mm/sec to record calibration waveforms of ΔZ and dZ/dt .
- Push the MEAS switches of both AI-601G and ED-601G, and following waveform will be recorded.
 Since ΔZ waveform is affected by patient's respiration, measure while having the patient stop breathing in inspiration to record stable waveform.



Paper speed 50mm/sec

The value of ΔZ and dZ/dt are calculated from the recorded waveform using the following equations.

$$\Delta Z = 0.1(\Omega) \times A(\text{mm})/10(\text{mm}) \\ = 0.1 \times A/10 (\Omega)$$

$$dZ/dt[\text{min}] = 1.0 \times B/10 (\Omega/\text{sec})$$

The ventricle ejection period (T) can be obtained as follows.

$$T = C(\text{mm})/50(\text{mm}/\text{sec}) \\ = C/50 (\text{sec})$$

Where, C is a distance between the point whose amplitude is 15% of the negative peak value (Bmm) of the dZ/dt waveform and the peak of the positive going spike.

CARDIAC OUTPUT CALCULATION

By Equation

a) Stroke Volume

The stroke volume can be calculated from the following equation.

$$\Delta V = \rho \left(\frac{L}{Z_0} \right)^2 \cdot \frac{dZ}{dt} [\text{min}] \cdot T$$

Where, Z_0 : Total impedance between voltage electrodes
 $dZ/dt[\text{min}]$

: First derivation of ΔZ (Ω/sec)

T : Ventricular ejection period

L : Distance between voltage electrodes

ρ : Relative resistance of blood

Substitute the following values for the above equation:

Example) $Z_0 = 25\Omega$
 $dZ/dt[\text{min}] = 2.0\Omega/\text{sec}$
 $T = 0.3\text{sec}$
 $L = 25\text{cm}$
 $\rho = 135\Omega \cdot \text{cm}$

$$\Delta V = 135 \times \left(\frac{25}{25} \right)^2 \times 2.0 \times 0.3 \\ = 81 (\text{mL})$$

NOTE

If the distance between voltage electrodes (L) on the chest is different from those on the back, the average value should be L.

b) Cardiac Output

Cardiac output can be calculated by the following equation.

$$\text{C.O.} = \Delta V \times \frac{60}{\text{INT}_{dZ/dt}(\text{S})} \times \frac{1}{1000}$$

Where, $\text{INT}_{dZ/dt}(\text{S})$: Distance between the $dZ/dt(\text{min})$ signal and the adjacent $dZ/dt(\text{min})$ signal.

Example) $\text{INT}_{dZ/dt} = 1\text{sec}$
 $\Delta V = 81\text{mL}$

$$\text{C.O.} = 81 \times \frac{60}{1} \times \frac{1}{1000} \\ = 4.86 (\text{L}/\text{min})$$

NOTE

If an unstable differentiated impedance plethysmograph makes it impossible to measure the ventricular ejection period, substitute the interval between the first sound and the second sound of the phonocardiograph for the ventricular ejection period.

By Nomogram

The Nomogram is attached on page 19 and 20.

Similarly measure the Z_0 , L , T , $dz/dt(\text{min})$, ρ , heart rate.

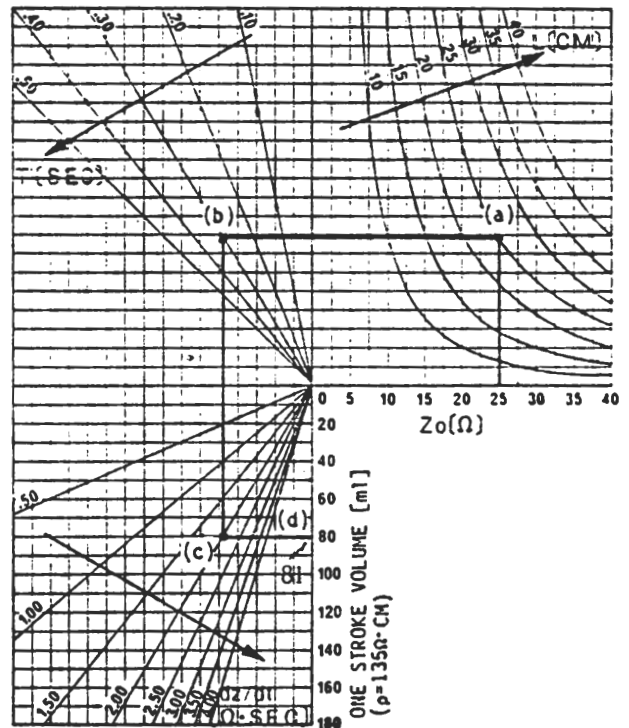
Assuming that the following values are obtained in the above measurement.

- $Z_0 = 25\Omega$
- $dz/dt[\text{min}] = 2.0\Omega/\text{sec}$
- $T = 0.3\text{sec}$
- $L = 25\text{cm}$
- $\rho = 135\Omega \cdot \text{cm}$
- Heart rate = 60bpm

Cardiac output can be obtained in the following procedures using Graph I and II.

Graph I

1. Draw a vertical line from the 25Ω point on the Z axis and mark point (a) where the vertical line crosses the $L(25\text{cm})$ curve in the figure.
 2. Draw a horizontal line from point (a) and mark point (b) where the horizontal line crosses the $T(0.3\text{sec})$ line.
 3. Draw a vertical line from point (b) and mark point (c) where the vertical line crosses the $dz/dt(2.0\Omega/\text{s})$ line.
 4. Draw a horizontal line from point (c) and mark point (d) where the horizontal line crosses the vertical line.
- Point (d) indicates that the stroke volume is 81mL.

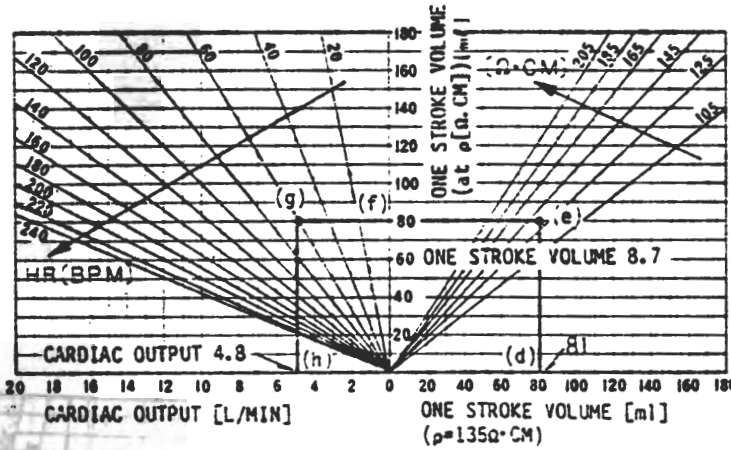


Graph I

Graph II

In the above graph I, ρ is assumed to be $135\Omega\cdot\text{cm}$. If ρ , however, is apparently different from $135\Omega\cdot\text{cm}$, compensate the stroke volume using by right side of the graph II.

Graph II



5. Mark point (d) where the stroke volume is 81ml on the horizontal line.
6. Draw a vertical line from point (d) and mark point (e) where the vertical line crosses the $\rho(135)$ line.
7. Draw a horizontal line from point (e) and mark point (f) where the horizontal line crosses the vertical axis.
Point (f) indicates that the stroke volume is 81ml. In this case, the stroke volume is 81ml since the Δ is assumed to be 135.
8. Draw a horizontal line from point (f) and mark point (g) where the HR(60) line crosses the horizontal line.
9. Draw a vertical line from point (g) and mark point (h) where the vertical line crosses the horizontal line.
Point (h) indicates that the cardiac output is 4.8L/min.

Other Measurement

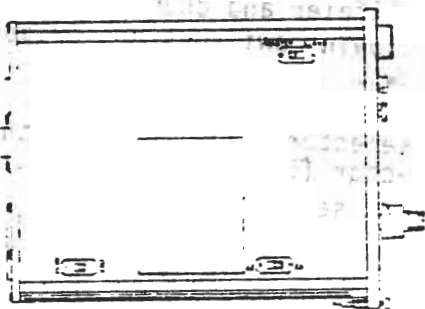
(THE IMPEDANCE CHANGE ΔZ CAUSED BY BLOOD FLOW)

1. WHEN USING TWO UNITS (AI-601G)

INTERNAL SWITCH SETTING

Pull the unit lock lever and draw out the AI-601G from the Polygraph Amplifier Console. Remove the side shield plate from the amplifier and check to see that the following switches are properly set as follows.

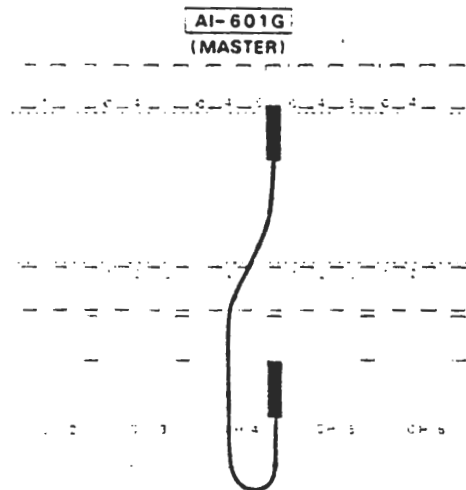
RESP-OFF selector (11) OFF
Zo- ΔZ selector (10) ΔZ



After setting the internal switches, be sure to re-attach the side shield plate to the pulg-in unit and restore the unit.

CONNECTION BOARD WIRING

Draw out the connection board from the Polygraph Amplifier Console. Connect sockets 3 and 5 of the corresponding channel with the connection lead. After connection, restore the connection board to the console.



TAPE ELECTRODE PLACEMENT

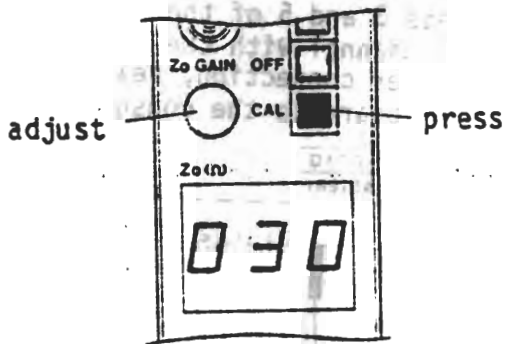
Place electrodes in the same way as described in CARDIAC OUTPUT MEASUREMENT on page 2.

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.

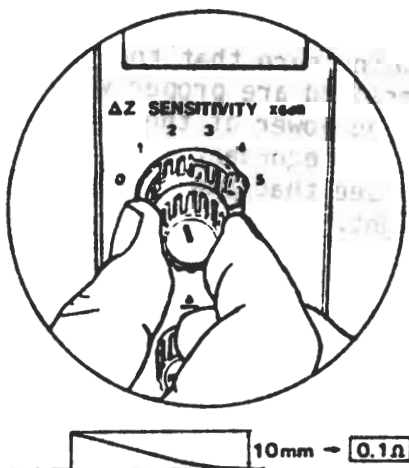
Zo CALIBRATION

1. Set the MEAS-OFF-CAL switch(2) to CAL.
2. Adjust the Zo on the indicator to 30Ω with the Zo GAIN knob(4).
(In CAL position 30Ω±1% resistor is connected to the input.)



ΔZ ADJUSTMENT

1. Set the MEAS-OFF-CAL switch(2) to CAL.
When used with ED-601G, set the MEAS-OFF-CAL switch of ED-601G to MEAS.
2. Run the recorder at slow speed.
3. Set the SENSITIVITY selector(6) to "5".
Press the CAL switch on the Polygraph Amplifier Console.
Adjust the amplitude of the calibration signal to 10mm (correspond to 10\$) with the SENSITIVITY fine control(5).



MEASUREMENT

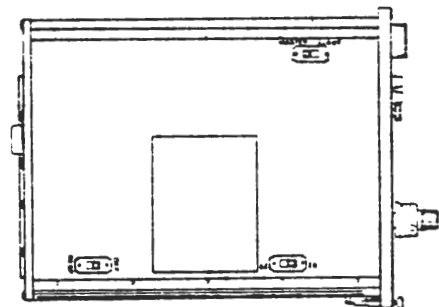
Set the MEAS-OFF-CAL switch(2) to MEAS, and run the recorder.
Impedance waveform will be recorded.

2. WHEN MEASURING IMPEDANCE AT TWO LOCATIONS SIMULTANEOUSLY USING TWO UNITS

INTERNAL SWITCH SETTING

Pull the unit lock lever and draw out the AI-601G from the Polygraph Amplifier Console. Remove the side shield plate from the amplifier and check to see that the following switches are properly set as follows.

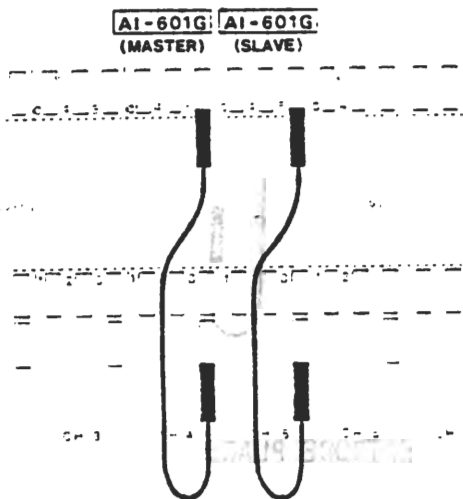
RESP-OFF selector (11) .. OFF (both)
Zo-ΔZ selector (10) ΔZ (both)
MASTER-SLAVE selector (9)
 MASTER (one unit)
 SLAVE (another unit)



After setting the internal switches, be sure to re-attach the side shield plate to the pulg-in unit and restore to the console.

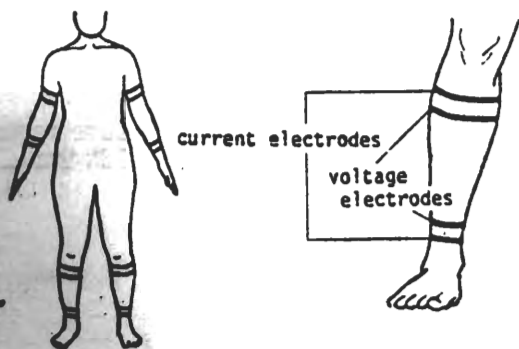
CONNECTION BOARD WIRING

Draw out the connection board from the Polygraph Amplifier Console. Connect terminals 3 and 5 of the corresponding channel with the connection lead. After connection, restore the connection board to the console.



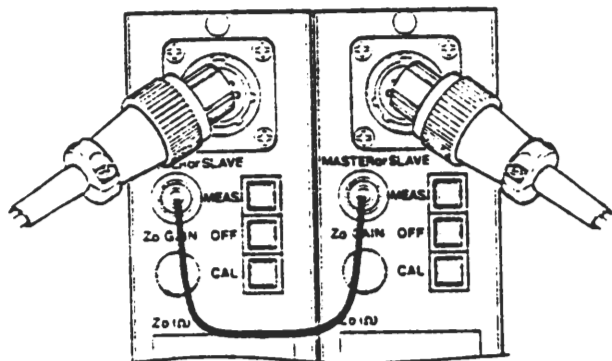
TAPE ELECTRODE PLACEMENT

Place electrodes on arms and legs as shown in the figure. Both arms and both legs should be separated from each other so that electrodes do not come in contact with each other.



SENSITIVITY CALIBRATION

Connect both MASTER or SLAVE terminals with the provided connection cable.



Calibrate the units in the same way as described in Zo CALIBRATION and ΔZ ADJUSTMENT on page 12.

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.

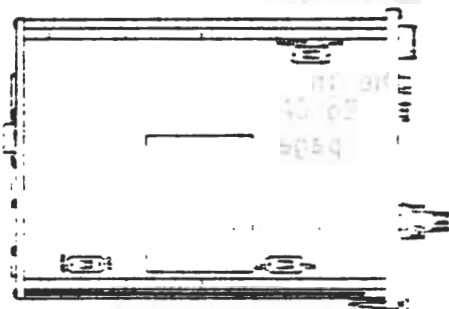
Measurement

(IMPEDANCE CHANGE CAUSED BY RESPIRATION)

INTERNAL SWITCH SETTING

Pull the unit lock lever and draw out the AI-601G from the Polygraph Amplifier Console. Remove the side shield plate from the amplifier and check to see that the following switches are properly set as follows.

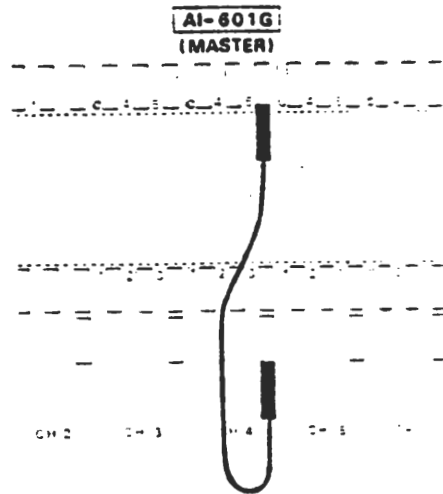
RESP-OFF selector(11) RESP
 Zo-ΔZ selector(10) ΔZ



After setting the internal switches, be sure to re-attach the side shield plate to the plug-in unit and restore the unit to the console.

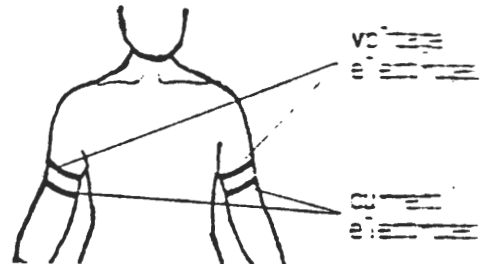
CONNECTION BOARD WIRING

Draw out the connection board from the Polygraph Amplifier Console. Connect terminals 3 and 5 of the corresponding channel with the connection lead. After connection, restore the connection board to the console.



TAPE ELECTRODE PLACEMENT

Place electrodes as follows.



SENSITIVITY CALIBRATION

Calibrates the unit in the same manner as described in Zo CALIBRATION CALIBRATION.

MEASUREMENT

Set the MEAS-OFF-CAL switch(2) and run the recorder. Impedance waveform will be recorded.

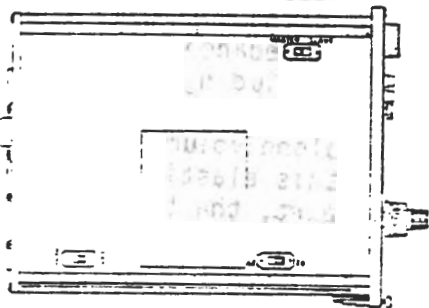
Measurement

(Z_o CAUSED BY BIOPHYSIOLOGICAL FLUID : EFFECT OF DIURETIC DRUG)

INTERNAL SWITCH SETTING

Pull the unit lock lever and draw out the AI-601G from the Polygraph Amplifier Console. Remove the side shield plate from the amplifier and check to see that the following switches are properly set as follows.

- RESP-OFF selector(11) OFF
- Z_o-ΔZ selector(10) Z_o
- MASTER-SLAVE selector(9) .. MASTER

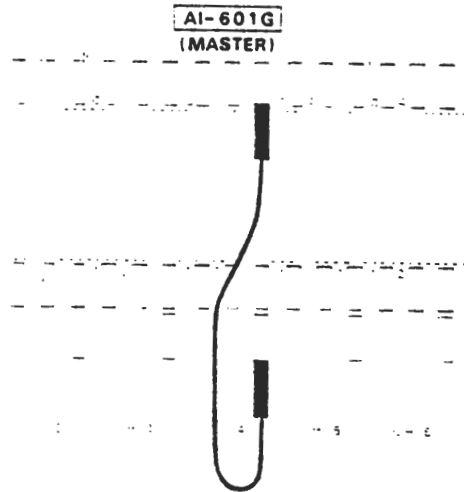


After setting the internal switches, be sure to re-attach the side shield plate to the pulg-in unit and restore the unit to the console.

CONNECTION BOARD WIRING

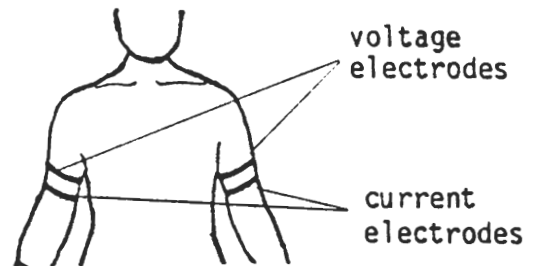
Draw out the connection board from the Polygraph Amplifier Console. Connect terminals 3 and 5 of the corresponding channel with the connection lead. After connection, restore the connection board to the console.

AI601G(A)



TAPE ELECTRODE PLACEMENT

Place electrodes as follows.



SENSITIVITY CALIBRATION

Calibrates the unit in the same manner described in Z_o CALIBRATION on page 12.

MEASUREMENT

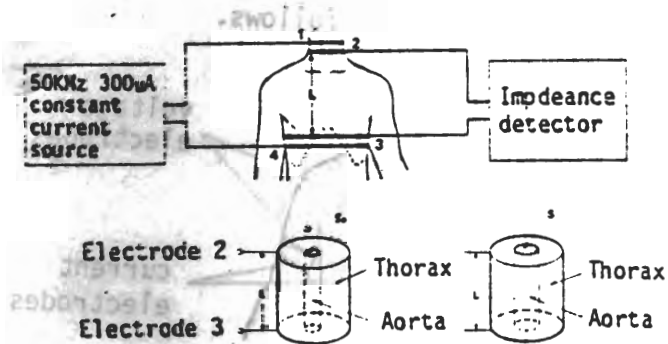
Set the MEAS-OFF-CAL switch(2) to MEAS, and run the recorder at slow speed. Impedance waveform will be recorded.

Principle

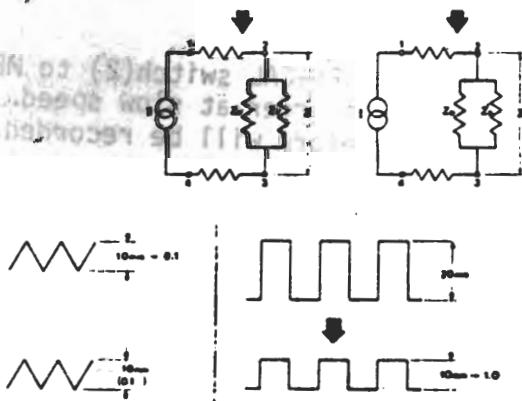
The AI-601G is designed to measure cardiac output according to the following principle.

A pair of tape electrodes are wound around the neck and thorax. By applying a small amount of high frequency current between current electrodes 1 and 4, a signal whose voltage is proportional to the impedance of the intra-thoratic tissues is obtained through electrodes 2 and 3.

The impedance between the electrodes 2 and 3 varies as the cardiac output varies. Since the cardiac output is proportional to the impedance change, the cardiac output can be obtained by measuring the impedance change.



S_0, S : Sectional area of aorta
 L : Distance between electrodes 2 and 3



Assuming that the construction of the human body is a round elastic tube, in the center of which the aorta is located as shown in the above figure, then the total impedance of the tube is ;

$$Z = \frac{Z_0 Z_s}{Z_0 + Z_s}$$

Where, $Z_s = \rho \frac{L}{S_0}$

ρ : Relative reistance of the blood ($\Omega \cdot \text{cm}$)

Z_0 : Impedance of the tube excluding aorta

If the pulse blood volume ΔV flows into the aorta of this elastic tube with each beat of the heart, the total impedance is ;

$$Z' = \frac{Z_0 Z_s'}{Z_0 + Z_s'}$$

Where, $Z_s' = \rho \frac{L}{S}$

Accordingly, the impedance change is obtained as follows.

$$\begin{aligned} \Delta Z &= \frac{Z_0 Z_s}{Z_0 + Z_s} - \frac{Z_0 Z_s'}{Z_0 + Z_s'} \\ &= \frac{Z_0^2 (Z_s - Z_s')}{(Z_0 + Z_s)(Z_0 + Z_s')} \end{aligned}$$

Since $Z_0 \ll Z_s, Z_s'$ and $V_0 = S_0 \cdot L$

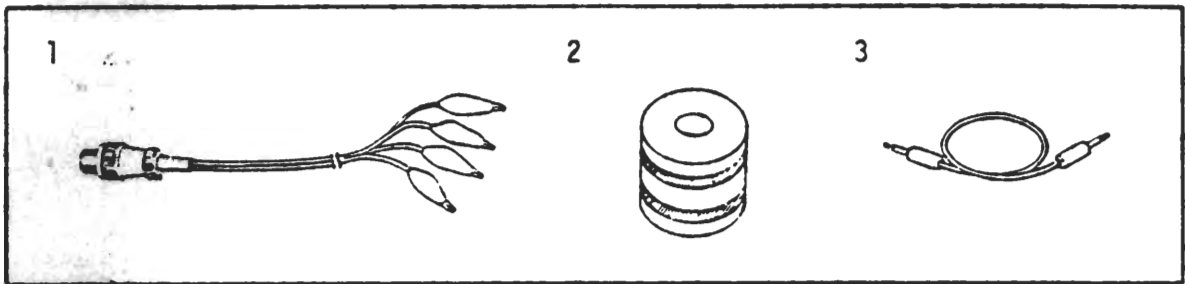
$$\begin{aligned} \Delta Z &= Z_0^2 \left(\frac{1}{Z_s'} - \frac{1}{Z_s} \right) \\ &= Z_0^2 \left(\frac{S}{\rho L} - \frac{S_0}{\rho L} \right) \\ &= \frac{Z_0^2}{\rho L^2} (V - V_0) \\ &= \frac{Z_0^2}{\rho L^2} \Delta V \end{aligned}$$

Specifications

Z₀	Measuring Range	5 to 200 Ω
	Display	3 digit digital meter
	Output	1.5V/30 Ω
	Linearity	$\leq \pm 3\%$ (10 to 200 Ω)
	Calibration	30 $\Omega \pm 1\%$
ΔZ	Measuring Range	0 to 2 Ω
	Output	$> 2V/0.1\Omega$
	Frequency Response	60Hz $\pm 20\%$
	Noise Level	$< 100mVp-p$
	Sensitivity	
	Step control	6dB x 5, accuracy $< \pm 3\%$
	Fine control	7 ± 1 dB, continuously variable
	Current Source	
	Frequency	50kHz $\pm 10\%$
	Current	350 $\mu A_{rms} \pm 5\%$
	Output impedance	$> 40K\Omega$
	Calibration	0.1 $\Omega \pm 5\%$
	Input	Floating input
	Impedance	$> 40k\Omega$
	Electrodes	Tape electrodes (two lines of aluminum electrodes)
	Output Selector	$\Delta Z - Z_0$
	Output Impedance	$< 50\Omega$
	Dimensions	50(W) x 200(H) x 280(D)mm
	Net Weight	Approx. 1.2kg

Standard Accessories

Description	Q'ty	Code No.
Input cord	1	5512027
Tape electrode	1	5030672
Connection Cable	1	5511982

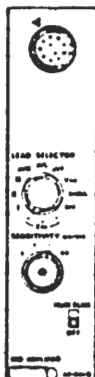


Related Instruments

DIFFERENTIATOR
ED-601G



ECG AMPLIFIER
AC-601G

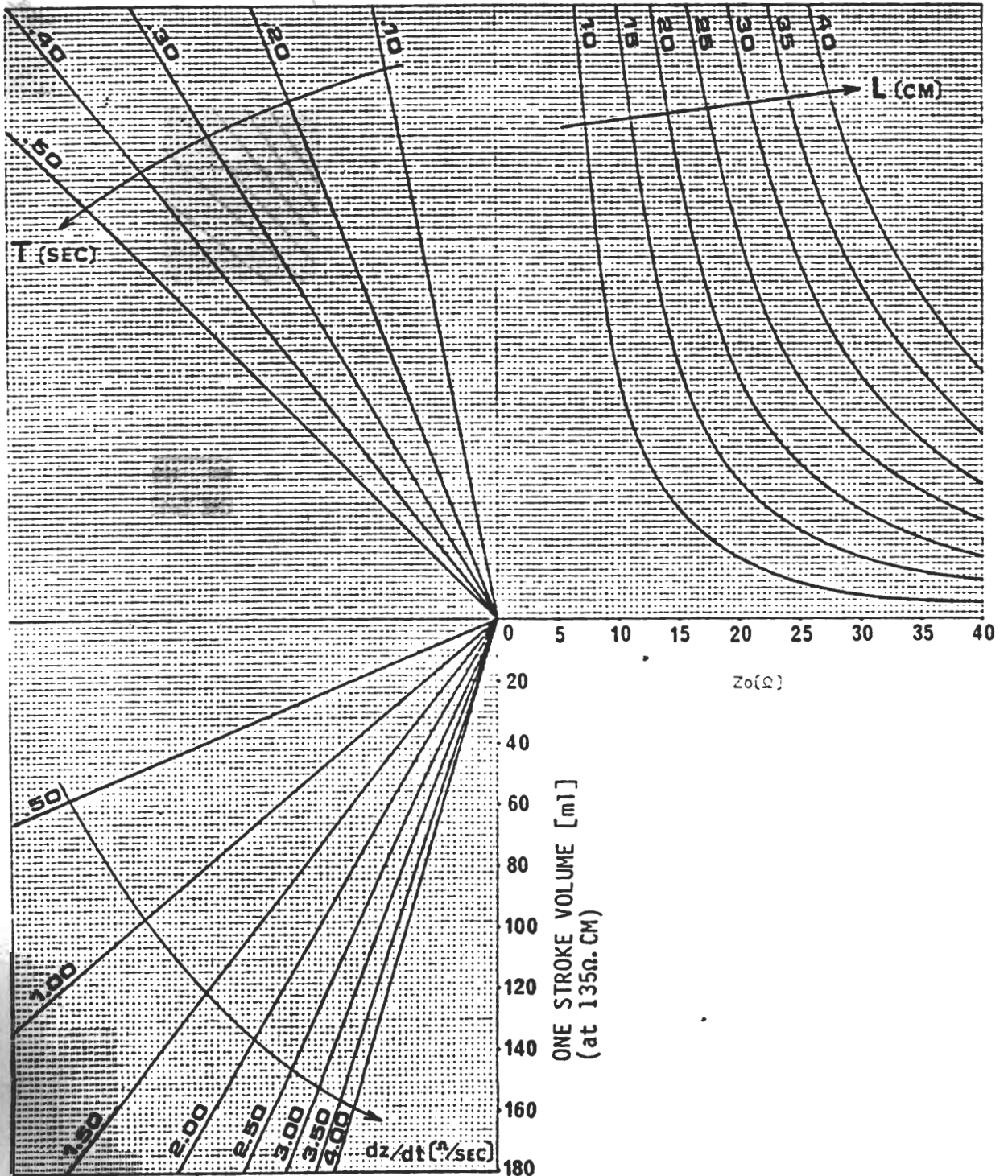


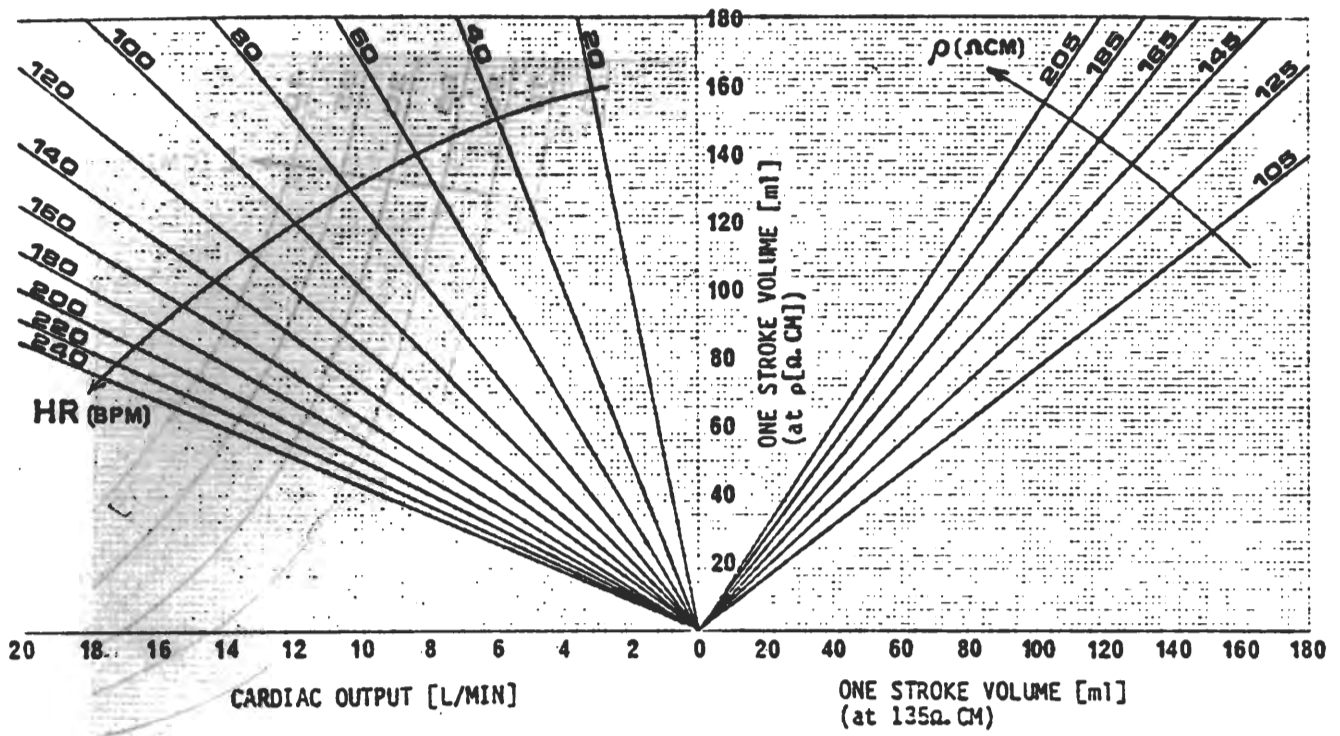
PCG COUPLER
AS-650H



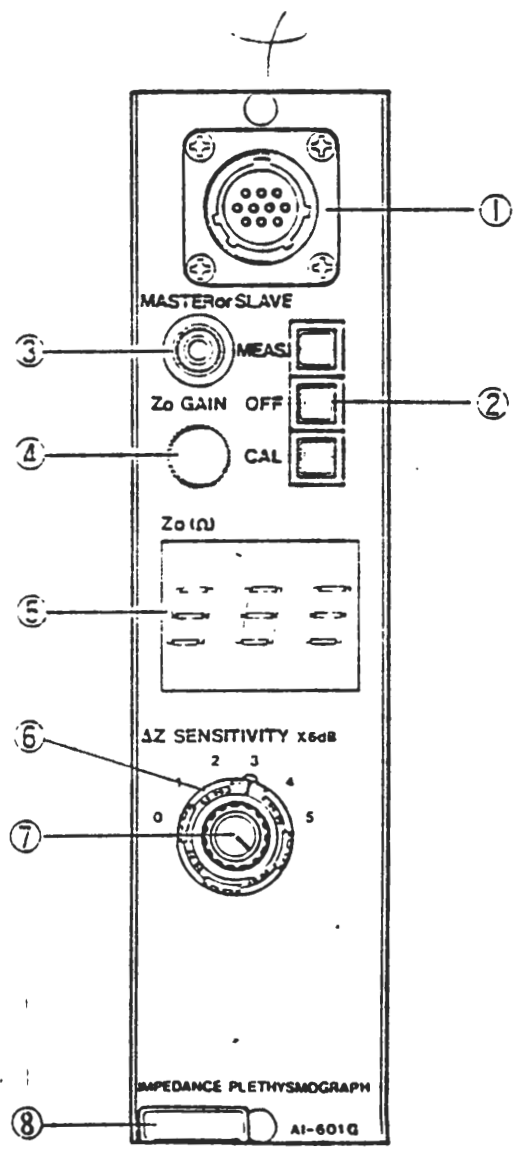
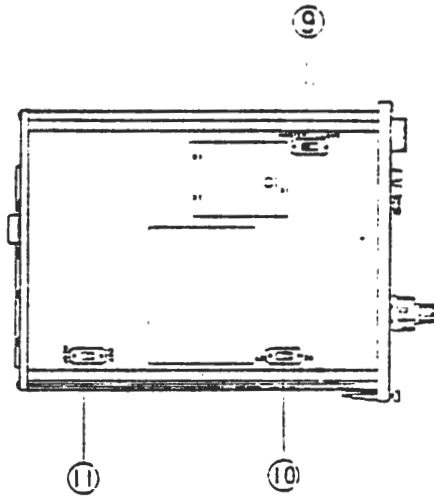
PCG AMPLIFIER
AS-601H

Appendix





Panel Illustration



S-20472