

OPERATOR'S MANUAL

HEART RATE COUNTER

AT-601G

GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel. Use only Nihon Kohden approved products with this device. Use of non approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens and extension cables and cords for electrodes, input boxes and AC power.

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

- 1. To safely 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) Place the instrument on an even, level floor. Avoid vibration and mechanical shock 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 must correspond in frequency and voltage to specifications, and have sufficient 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.
 - 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.**
- (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.

8. Maintenance and Inspection:

- (1) The instrument and parts must 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.
- (3) Technical information such as circuit diagrams, parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden distributor.

9. When the instrument is used with an electrosurgical instrument, pay careful attention 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.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

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Introduction

The AT-601G Heart Rate Counter, a plug-in unit for the Polygraph Amplifier System RM-6000, is designed to count heart rate per minute, to display it on the digital meter, and to record the analog output.

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

Features

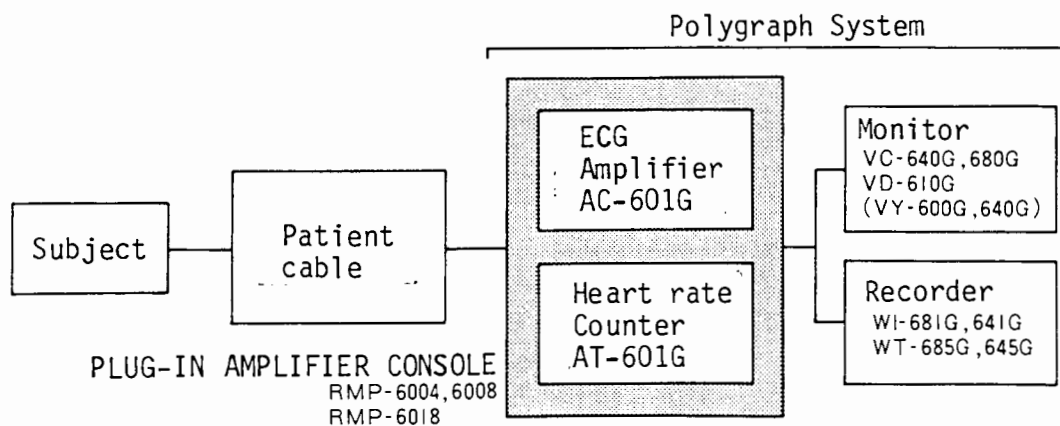
1. Microcomputer and digital circuit provides an accurate and stable indication.
2. Alarm facility is provided to monitor bradycardia and tachycardia.
3. Trigger pulse discriminator enables stable heart rate counting.
4. Highly resolute D/A converter provides monitoring and recording of small changes in heart rate in Analog output.

Composition

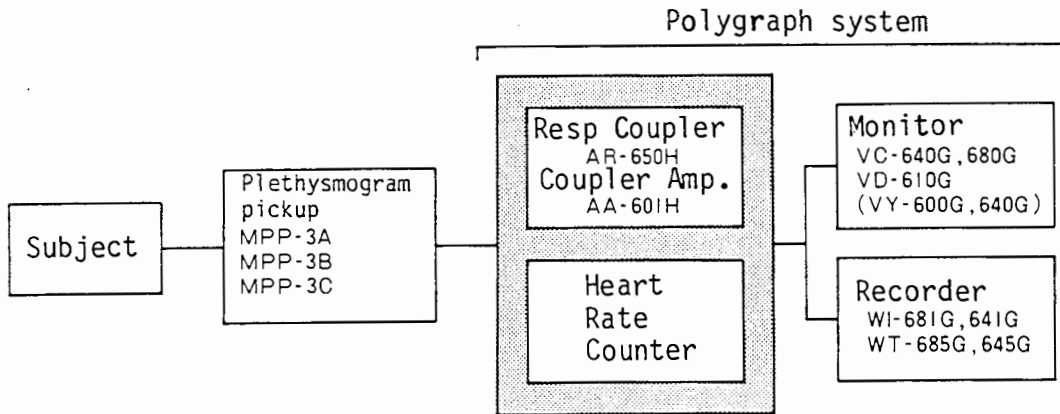
The AT-601G is plugged into the Polygraph Amplifier Console in combination with an ECG amplifier, Coupler Amplifier or Carrier Amplifier. The following figures show composition examples.

COMPOSITION EXAMPLES

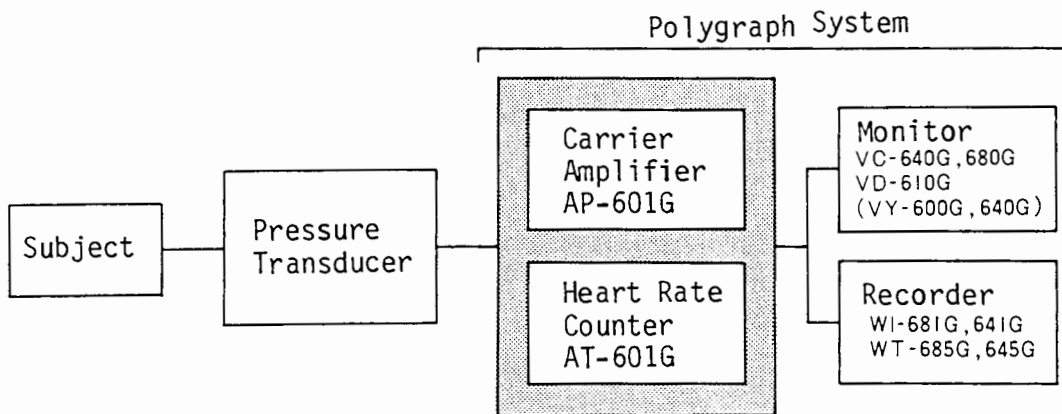
Count by ECG signal



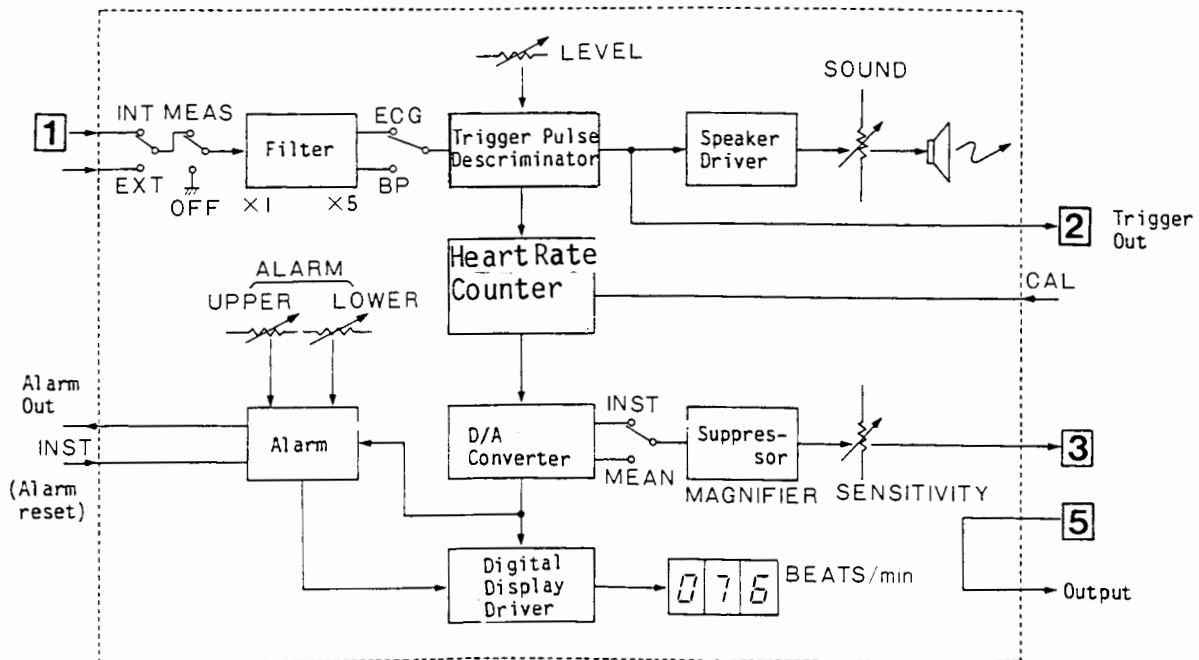
Count by plethysmogram signal



Count by bloodpressure waveform



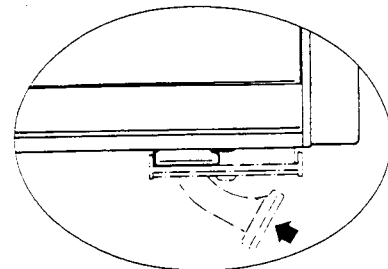
Blockdiagram




Controls and Switches


Refer to Panel illustration on the last page.

- | | |
|---------------------------------|---|
| (1) BEATS/min | Displays heart rate per minute in digital form. |
| (2) QRS Synchronous Lamp | Blinks in synchronization with the QRS. |
| (3) MEAS-OFF | MEAS : Counts heart rate.
OFF : Turns off the counter.
Calibration switch on the Polygraph Amplifier Console provides signal of 100 BEATS/min for a monitor and recorder. |
| (4) ALM SET | Press either of the following switches when setting heart rate limit for alarm with knob (5) or (6).
UP : For upper heart rate limit
LO : For lower heart rate limit |
| (5) LEVEL | Adjusts the trigger level of the rate counter so that the counter is triggered securely by the input signal.
One must be careful that the LEVEL is adjusted so that the rate counter is triggered once and not twice by one heart beat.
Confirm by the QRS Synchronous lamp that the rate counter is triggered once by each beat. |
| (6) UPPER | Sets upper heart rate limit. (See ALARM SETTING on page 8) |
| (7) LOWER | Sets lower heart rate limit. (See ALARM SETTING on page 8) |
| (8) SENSITIVITY
Step control | Selects the sensitivity of the analog output rate. |
| (9) SENSITIVITY
Fine control | Adjusts fine sensitivity of the SENSITIVITY(8) control. |
| (10) SOUND | Adjusts beep sound loudness of QRS synchronous pulse.
Turning it clockwise increases loudness while turning it counterclockwise decreases loudness. |
| (11) Module Lock
Lever | Pull the lever to remove the unit from the console.
When storing the unit in the console, be sure to attach the side shield plate to the unit. |



- (12) EXT-INT
Input Selector
- Selects terminal through which an input signal is supplied.
EXT : Input signal is supplied from the individual input on the rear of the Polygraph Amplifier Console(RMP-6004, 6008, 6018) or Input Panel PI-680G.
INT : Input signal is supplied from another plug-in unit through terminal-1 of the connection board.
- (13) BP-ECG
Filter Selector
- Selects the filter characteristic according to measuring parameter.
ECG : For spiky waveform such as ECG
BP : For slowly changing waveform such as blood pressure, plethysmogram, etc.
- (14) x1 - x5
Filter
Sensitivity
Selector
- Used to count the heart rate of small animals using a blood pressure waveform. When small change of the blood pressure waveform is obtained, set this selector to x5 to increase trigger sensitivity. Be sure to use x5 sensitivity in the case of high heart rate (more than 200 beats).
- (15) INST-MEAN
- Selects the output mode of the analog signal.
INST : Provides instantaneous heart rate.
MEAN : Provides averaged heart rate.
- 

Instantaneous heart rate



Averaged heart rate
- (16) SUPPRESS
- Used to magnify small changes of the analog output.
OFF : No suppression.
100 : Suppresses approx. 100 beats of the analog output.
200 : Suppresses approx. 200 beats of the analog output.

Measurement

INTERNAL SWITCH SETTING

Pull the unit lock lever (11) and draw out the plug-in unit from the Polygraph Amplifier Console. Remove the side shield plate and check to see that internal switches are properly set as follows.

EXT-INT Input Selector : INT

ECG-BP Filter Selector

- ECG : When ECG signal is applied.
- BP : When blood pressure or plethysmogram waveform is applied.

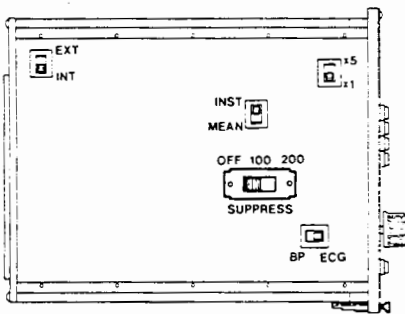
x1-x5

x5 : Applies for the blood pressure waveform of small animals.

x1 : Applies for other cases.

INST-MEAN : INST

SUPPRESS: OFF

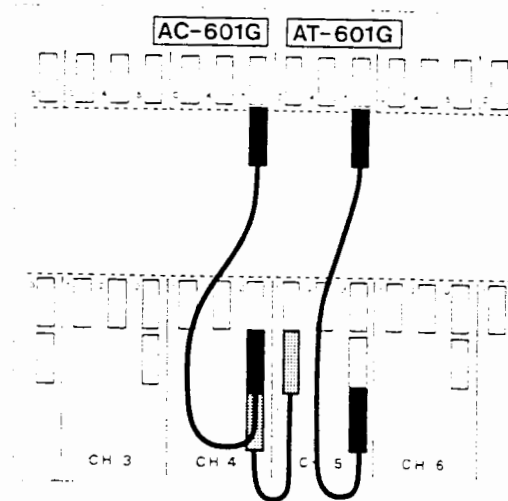


After setting switches, be sure the MEAS-OFF switch is pressed, attach the side shield plate to the unit, restore it into the console and secure the module lock lever.

CONNECTION BOARD WIRING

Draw out the connection board from the Polygraph Amplifier Console and connect sockets with connection leads as follows.

Ex. In combination with an ECG Amplifier



Socket No.3 and 1
For ECG signal input

Socket No.3 and 5
For signal output to a monitor
oscilloscope and recorder.

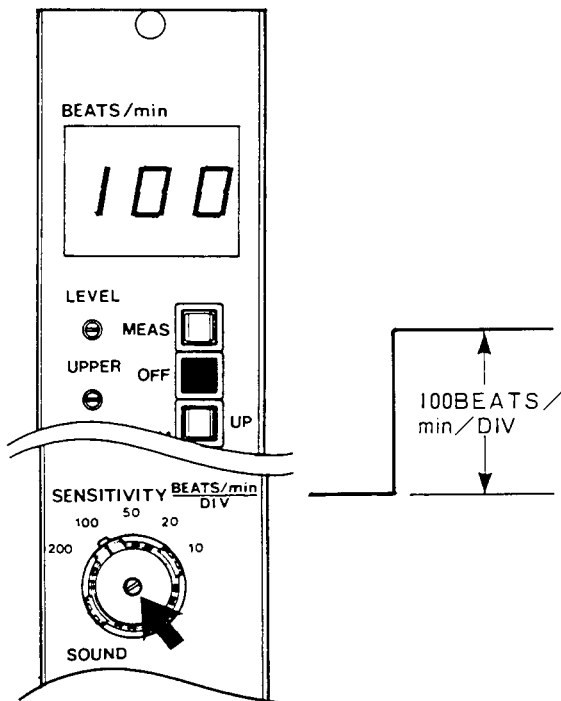
Connection to a Carrier Amplifier
AP-601G and Coupler Amplifier AA-601H
are the same as above.

POWER ON

Turn on the power switch of the console after making sure that the ground lead is properly connected. Check to see that the power indication lamp lights.

ANALOG OUT CALIBRATION

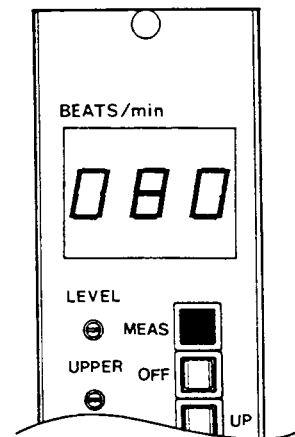
1. Press the CAL switch of the Polygraph Amplifier Console in MEAS or OFF mode.
2. Amplitude of output waveform will be 1 DIV when sensitivity selector(8) is set to 100 BEATS, 2 DIV when it is set to 50 BEATS. BEATS/min(1) indicates 100 at that time. If amplitude and indication is not as above, adjust SENSITIVITY Fine control using a screwdriver.



MEASUREMENT

Mount ECG electrodes (when using ECG Amplifier AC-601G), plethysmogram pickup (when using Coupler Amplifier AA-601H) or a pressure transducer (when using Carrier Amplifier AP-601G/621G) to the subject according to the operator's manual of each pulg-in amplifier.

1. After making sure that the signal is securely obtained, set MEAS-OFF switch (3) to MEAS.
2. Monitor synchronous pip sound or blinking dot on the indicator. If the counter is triggered twice by one beat or is not triggered at all, adjust LEVEL(5) adjustment for secure triggering.
3. Heart rate is shown on the indicator.

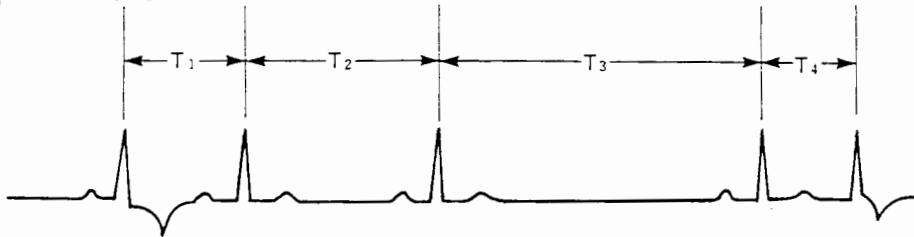


Perform the same procedure as above in counting the heart rate by blood pressure waveform and plethysmogram.

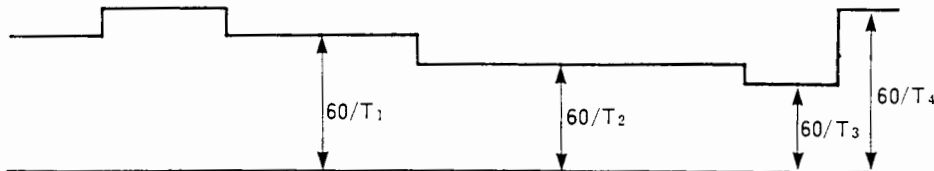
Analog Output Recording

Set internal INST-MEAN Selector according to output waveform.
 (See INTERNAL SWITCH SETTING on page 5.)

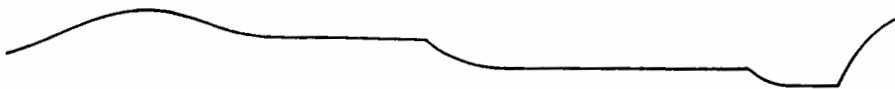
Input waveform



INST (瞬時心拍数) の場合の出力波形



Output waveform of MEAN

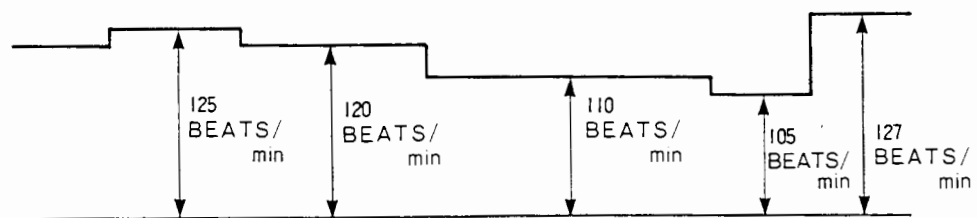


0 Lev

When detail change of output is required, remove unnecessary DC level by setting SUPPRESS switch(16) to 100 or 200. Examples are given below.

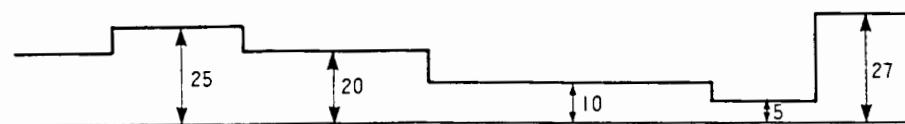
SENSITIVITY.....50BEATS/min/DIV

Original waveform



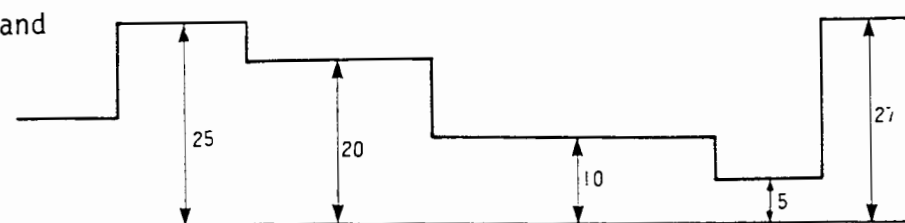
SUPPRESS.....100BEATS

Suppressed waveform



SENSITIVITY.....10BEATS/min/DIV

Suppressed and magnified waveform

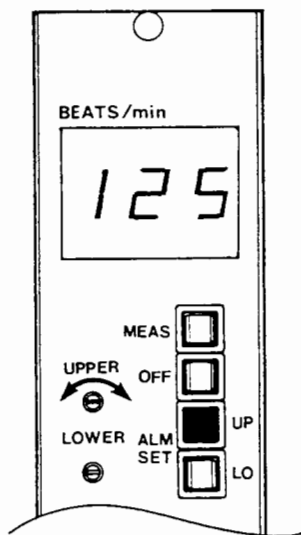


Alarm

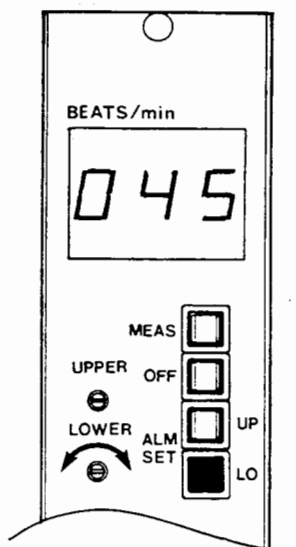
Alarm gives warning when heart rate exceeds preset range.

ALARM SETTING

1. Push the UP of ALM SET switch (4). The upper limit of heart rate is displayed. Adjust the limit with the UPPER adjustment (6) to between 0 to 999 beats/min.



2. Push the LO of ALM SET switch (4). The lower limit of heart rate is displayed. Adjust the limit with the LOWER adjustment (7) to between 0 to 999 beats/min.



When alarm is not required, turn the UPPER adjustment fully clockwise and the LOWER adjustment fully counter-clockwise.

ALARM INDICATION

Push the MEAS of MEAS-OFF switch (3) to operate alarm function. When alarm status arises, numerals on the display blink and the Polygraph Amplifier Console (RMP-6018M only) emits alarm sound.

ALARM RESET

Once heart rate exceeds the limit, alarm status is maintained even after heart rate returns to within limits. To reset alarm, push the OFF of the MEAS-OFF switch (3) or the INST switch on the Polygraph Amplifier Console.

Alphanumeric Annotation

The AT-601G in the Polygraph Amplifier Console provides the following control signals for print on the recorder with annotation facility and display on the color monitor.

Measuring unit	: BPM
Plug-in unit status:	MEAS, OFF
Sensitivity	: 10, 20, 50, 100, 200
Digital out	: Start pulse Pulse train Busy pulse

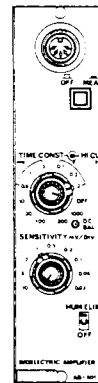
Specifications

Input	
Filter	ECG, PULSE
Trigger level	ECG: 0.5 to 4.0V BP: 1.0 to 5.0V (x1) 0.2 to 5.0V (x5)
Input impedance	>100k Ω
Measuring Range	12 to 999 BEATS/min < $\pm 2\%$ ± 1 beat
Heart Rate Indication	
Measuring method	Instantaneous type
Display method	Digital, 3-digits (Mean type)
Display interval	Approx.0.3sec
Output	
Output voltage	0 to 5.0V
Sensitivity selector	10, 20, 50, 100, 200 BEATS/min/DIV
Suppression	OFF, 100, 200 BEATS/min
Output Impedance	<50 Ω
Digital out	Start pulse Pulse train Busy pulse
Alarm	
Setting method	Set by UPPER and LOWER knob.
Setting Range	0 to 999 BEATS/min
Trigger	Monitored by LED dot blinking and pip sound
Calibration	100 BEATS/min

Optional Units

Bioelectric Amplifier

AB-601G

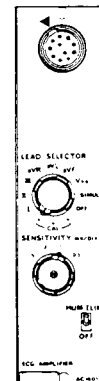


AB-621G



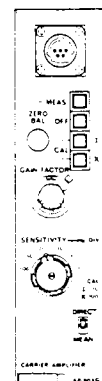
ECG Ampifier

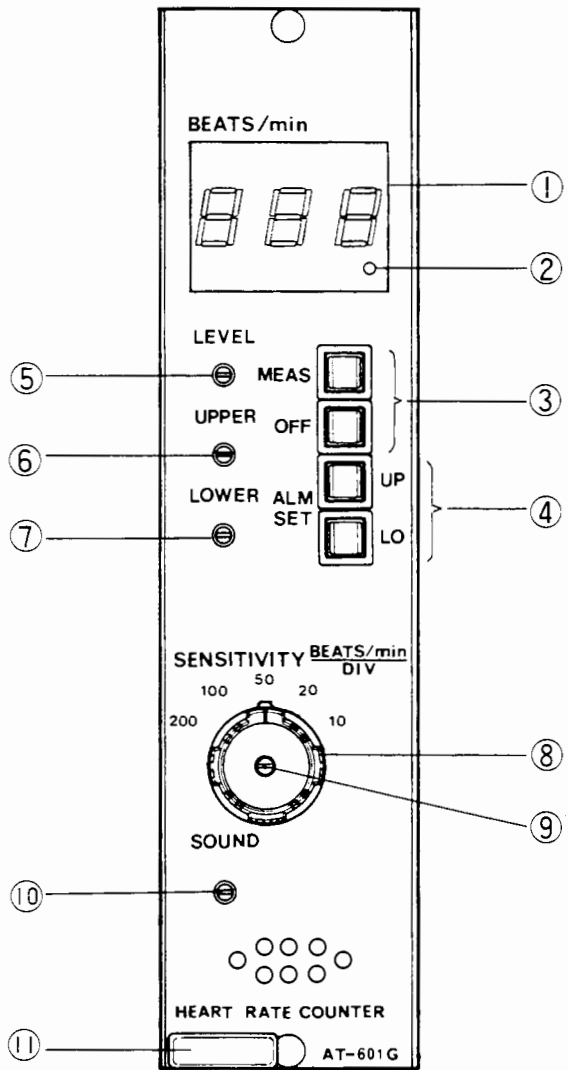
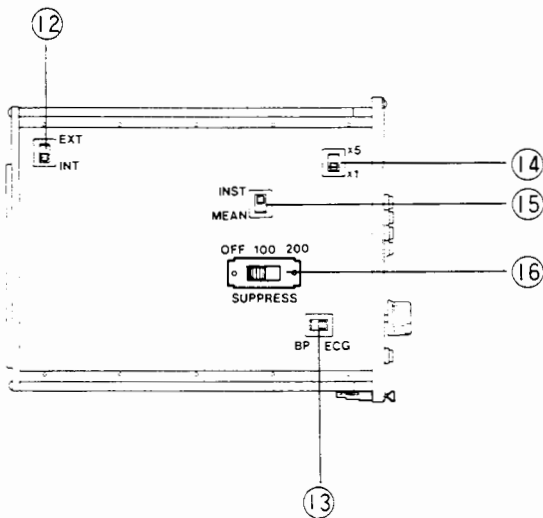
AC-601G



Carrier Amplifier

AP-601G





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The model and serial number of your instrument are identified on the rear or bottom of the unit. Write the model and serial number in the spaces provided below. Whenever you call your distributor concerning this instrument, these two pieces of information should be mentioned for quick and accurate service.

Model _____

Serial number _____

YOUR DISTRIBUTOR