SEIKO
QUARTZ TESTER
QT-99

INSTRUCTION MANUAL

SEIKO QUARTZ TESTER QT-99

The SEIKO Quartz Tester QT-99 is the high-performance digital daily rate counter using a full-scale micro computer. It can measure and immediately indicate digitally with high accuracy and reliability the daily rate of high-precision electronic timepieces such as quartz watches and tuning fork watches.

The computer undertakes the measurement, data processing, and display of results according to the various, complicated routines stored in a built-in memory, making it possible to measure special watches that have so far defied the measurement by the conventional quartz testers.

The crystal oscillator used provides a highly stabilized reference frequency with an extremely high accuracy of 10^{-8}.

Your QT-99 works with solid-state reliability and stability and is very easy to handle.

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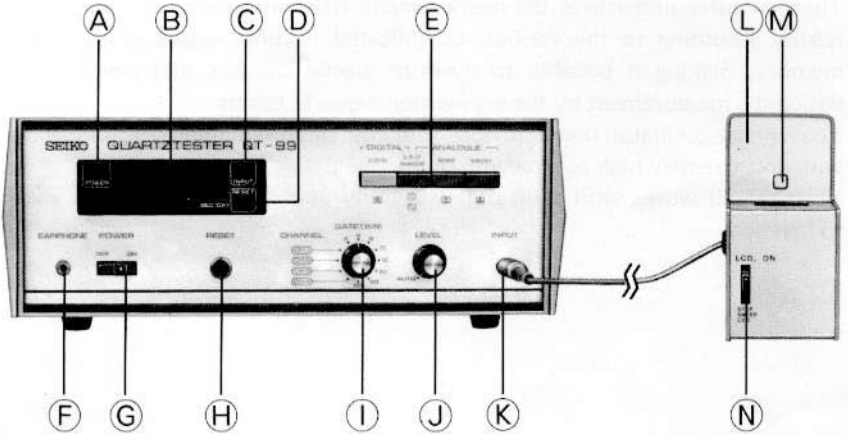
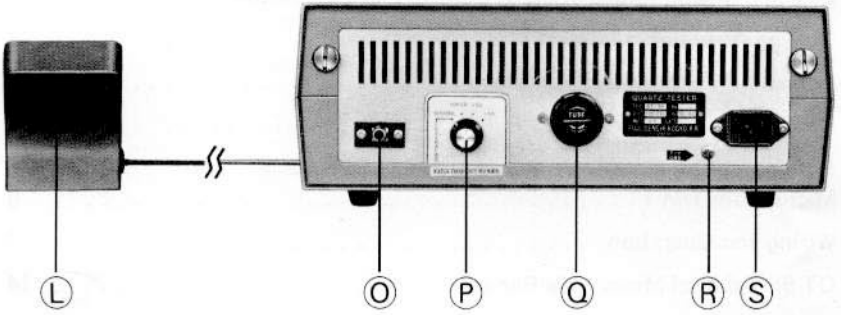
DESIGNATION AND EXPLANATION OF CONTROL PANEL FUNCTIONS

- Read the description of control panel functions while referring to the layout of functions shown below.





Japan Pat. No. 887228
903864
23 patents pending
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GETTING ACQUAINTED

- An Electro-magnetic/Electric-field detection microphone is used for QT-99, and it must be kept away from electric machines and appliances which emanate strong magnetic or static noises. Where a fluorescent lamp is located, for example, keep the microphone at least 30cm away from it. The quartz tester should not be exposed to direct sunlight, high humidity and high temperature. Do not leave QT-99 at a sunny or dank place or at a place close to a heat source like stove.
- Use QT-99 on the specified supply voltage. If it is connected to an outlet other power-consuming electric appliances are using, the supply voltage may decline or noises be generated, thus affecting the performance of QT-99.
- Plug the power cord into the outlet, and leave QT-99 to stand for some 20 min. so that the oscillator will attain an accuracy necessary for measurement. For a high stabilized measuring accuracy, it is recommended to keep QT-99 plugged into the outlet all the time. Once the power cord has been disconnected or a power failure has happened, it will take some 20 min. for QT-99 to be ready for measurement after the power cord is connected to the outlet again or power system is recovered.
- Handles the controls as instructed. Do not give undue forces on them or hold the switches at halfway position.
- For detection of the electric field signal, the microphone DM-1 requires two units of 1.5V silver oxide cell U.C.C. 301 for SEIKO watch use. The cells are furnished together with QT-99. Put them into the microphone from its bottom. The microphone consumes current as little as the ordinary quartz watch does, and the cells will stand more than two years of continuous duty. Replace the cells every two years or so.
- To clean the QT-99 enclosure, fittings and microphone, use a soft, dry cloth. Never use trichloroethylene, thinner, benzine, alcohol or any other solvent.

PRINCIPAL FUNCTIONS AND FEATURES

- Provided with a computer-aided watch measuring system, QT-99 assures you of easy operation and reliable results.
- The crystal oscillator that provides a reference signal for measurement is of an oven-controlled type, and ensures highly accurate, stabilized measurement.
- The daily rate can be automatically measured by placing the watch on the microphone with the automatic frequency selection device.
  Almost every watch can be measured in a single process; all that is needed for measurement is to load it on a microphone.
- The measured daily rate is displayed in four digits (max.) together with a (+) sign for gain and a (−) sign for loss.
- The measuring time can be set in eight steps—4, 6, 8, 10, 12, 30, 60 sec. and 120 sec.—from which to choose the best. In the case of channel setting, the optimum gate times can be selected out of the whole-numbered seconds within the range of 2 to 120 sec. to meet the setup of a given watch. Four channels are provided, and the memory data can be added or changed.
- The display unit is 0.01 sec./day or 0.1 sec./day (by rounding off the fractions to three or two decimal places. The measuring range is within ±19.99 sec./day or within ±199.9 sec./day.
- During measurement, the input indicator will flash in tune with the watch signal detected.
- The measurement starts automatically as soon as the watch is set on the microphone, and continuously until it is removed.
- You can monitor the watch signal detecting conditions by earphone to locate the watch at the best position on the microphone, making it feasible to measure a watch of feeble signal. In addition, the optimum volume at which the monitoring is made can be maintained as it is not affected by the change in the measuring level.
- QT-99 uses the special circuit which detects the watch signal most accurately. Read the value after measuring twice or three times, which indicate the accurate daily rate. So it is not necessary to take an average of values obtained by several measurements.
- When the watch signal is dead or when the daily rate is in excess of the measuring range, no display will be indicated, eliminating the deceptive readings as in the overflow lamp system.
- The 7-segment display is wide, bright and legible, and can be read even from a distance.
- The DM-1 microphone is both used as Electro-magnetic and Electric-field detection microphone because of its high performance, and it can be used for measuring the daily rate of both analogue and digital electronic watches.
- Various types of microphones for Timegrapher can also be used with QT-99.

DESCRIPTION OF CONTROL PANEL FUNCTIONS

(A) POWER indicator

Lights up when the power switch is turned ON for measurement.

(B) SEC./DAY (daily rate display)

Displays the measured time accuracy in the daily rate. Display is blanked out except for the decimal point in case of overflow or no entry of signal. The display also extinguishes when the measuring circuit is reset.

(C) INPUT indicator

This indicator blinks at the same frequency as the watch signal's. If the watch signal is high in frequency, the indicator will seem as if it stayed lit.

(D) RESET indicator

Lights up whenever the measuring circuit is reset. When the watch is on the microphone, the indicator will light up at the end of every cycle of measurement.

(E) Watch selection switch

The switch is selected according to the type of watch to be measured. For various types of watches and their measuring methods, refer to the "QT-99 Table of Measurable Ranges". When the channels are used for measurement, the watch selection switch is of no use.

(F) EARPHONE jack

Used for monitoring the watch signal.

(G) POWER switch

Power is supplied when the switch is moved to "ON" position. When this switch is turned on, the measuring circuit will be reset for measurement.

(H) RESET button

Used for the manual resetting of the measuring circuit. When it is required to read the initial data of a watch after placing it on a microphone or when it is required to measure watches one after another immediately, depress this button. When the button is depressed, the preceding data on the display will be cancelled immediately and the next measurement will be started. The RESET button facilitates the measurement, especially when the regulator is to be adjusted. When a watch is to be measured continuously under a fixed condition, it is not necessary to work this button. The measurement will not be started while the button is depressed.

(I) GATE TIME/CHANNEL setting switch

This switch is used for setting the gate time or the channel.

When the measurement is to be made with this switch set at GATE TIME, it is necessary to set the watch selection switch (E) and the watch signal divider selector switch (P) correctly. As soon as this switch is changed over, the measuring circuit will be reset.

When the switch is set at CHANNEL, all the work for measurement will be undertaken automatically by the computer so the watch selection switch (E) and the watch signal divider selector switch (P) are not used.

(J) LEVEL adjuster (with switch)

Used for adjusting the watch signal level.

For almost all watches, the AUTO position (Turn it counterclockwise until a click is heard.) will do for measurement. Except at the AUTO position, the knob will increase the signal level when it is turned clockwise. Turn the knob clockwise if a feeble signal is to be measured. If the signal is too strong as you will experience in the measurement of some specific clocks, turn the knob counterclockwise to moderate its level. The volume of the earphone is not affected by the adjustment of this knob.

(K) INPUT jack

Used for connecting the microphone.

(L) Electro-magnetic/Electric-field detection microphone DM-1

A microphone for exclusive use with electronic watches of both analogue and digital types.

(M) Mark for placing watch

A mark showing the best position for the detection of watch signal. Where a liquid crystal watch (LCD) is to be measured, place it on the microphone with its display side (glass) down on this mark.

(N) Electro-magnetic/Electric-field detection changeover switch and battery switch

This switch serves to change the detection mode from one to another and also to turn on and off the built-in battery circuit. For the measurement of liquid crystal watch (LCD), set the switch at LCD ON, and the battery circuit will be turned on to permit the measurement in the electric-field detection mode.

When measuring the analogue watch or light-emitting diode watch (LED) or when the microphone is not used, set the switch at STEP-SWEEP-LED, and the battery circuit will be turned off to conserve battery life.

(O) Crystal oscillator check terminal

A 4.32 MHz signal is generated at this terminal. Used to check the crystal oscillator of QT-99 for repair.

(P) Watch signal divider selector switch

This is used for measuring those watches whose output is of a special frequency. If the watch output frequency is of an odd number (e.g., 361 Hz) or of a mixed number (e.g., 170 2/3, 256 1/2, 361 1/3 Hz), set the switch to the corresponding position. The watches of these frequencies are of old-fashioned type, and will rarely be met with. Usually, therefore, the switch is to be kept at GENERAL (even numbered frequency position). If the switch is set at +N/3, the measurement will not be made unless the gate time is set at a multiple of 3 sec.

When the channel is used for measurement, this switch is not used.

(Q) FUSE holder

This fuse holder has a voltage setting switch. Be sure to use only a 1A fuse. As the voltage setting range is from 100V to 240V, it can cover any home outlet voltage abroad.

Before using QT-99, be sure to set the fuse holder at the outlet voltage available. If the power cord is plugged into the outlet with the power switch held on, the fuse may be blown. But this is not a malfunction. The voltage settings available are as follows.

100V, 110V, 120V, 200V, 220V, 240V

(R) Grounding terminal screw

For noise reduction and operator's safety, be sure to connect a grounding cable (furnished as one of standard accessories) to this screw. The QT-99 will be grounded. Note that the noise may be increased all the more if the cable is grounded improperly. Under any circumstances, do not connect the grounding cable to a gas pipe.

(S) Power cord connector

This is to insert the connector plug of the power cord.

FUNCTION OF ELECTRO-MAGNETIC/ELECTRIC-FIELD DETECTION MICROPHONE DM-1

SWITCH OPERATION

The switch (N) at the left of the microphone is for changeover to and from the electro-magnetic and the electric-field detection function.
When it is pushed to the LCD ON position, the battery will be activated, and the microphone will assume the electric-field detection function with which the daily rate of the LCD watch can be measured.
When it is pushed to the STEP-SWEEP-LED position, the battery will be turned off and the electro-magnetic function will start to measure the daily rate of the analogue and the LED watches.
When the microphone is not used, keep the switch at STEP-SWEEP-LED position to conserve battery life.

HOW TO OPERATE

- **Analogue electronic watch**
  Set the switch (N) at STEP-SWEEP-LED position (electro-magnetic field detection mode). Place the watch at or around the mark ⊡ (M) (appearing at the center of the microphone) with its dial facing you or upward.
  See Photos 1 and 2. (Select the photo 1 or 2 position whichever produces the higher sound level in the earphone.)

- **Liquid crystal watch (LCD)**
  Set the switch (N) at LCD ON position (electric-field detection mode). Place the watch on the microphone with its liquid crystal display to face the mark ⊡ (M) at the center of the microphone. (Namely, the case back will face you.)
  See Photo 3. The best way for measurement is to let the watch display the date digits which will stay unchanged during measurement.
  (Place the watch with its crown up or down whichever produces the higher sound level in the earphone.)

  Note: If the liquid crystal panel is smeared with sweat or oil, the microphone cannot pick up the watch signal. Do not put the watch in a vinyl bag when its daily rate is measured.

Photo 1

Photo 2

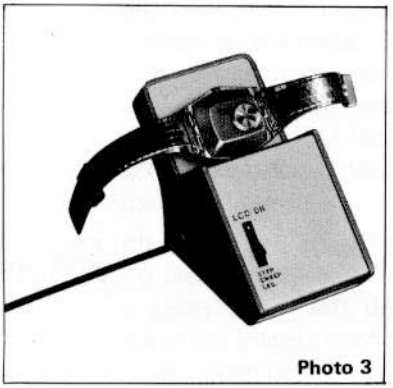

Photo 3

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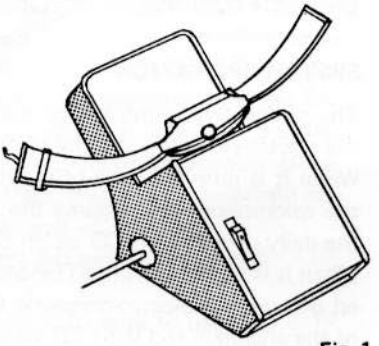


Fig. 1

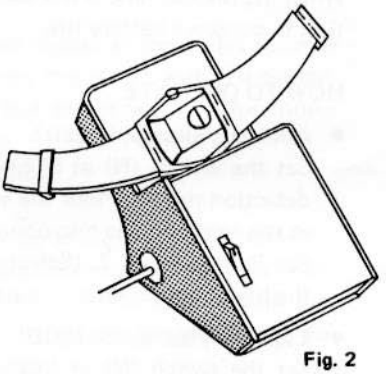


Fig. 2


Photo 4

- **Light-emitting diode (LED) watch**

  Set the switch (N) at STEP-SWEEP-LED position (electromagnetic field detection mode). Measure the watch by activating its display in some way or other. (Ex. Hold down the button with an adhesive tape.) The best way for measurement is to let the watch display the date digits which will stay unchanged during measurement.

  Place the watch at or around the mark ⊡ (M) appearing at the center of the microphone in a manner that its case back may be turned up or face you whichever makes the higher sound level in the earphone. See Figs. 1 and 2.

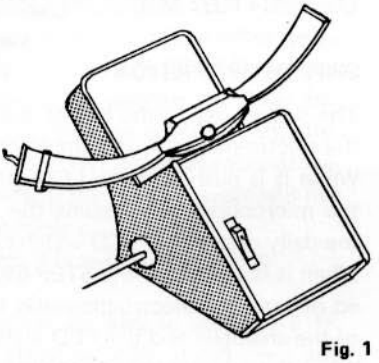


Fig. 1

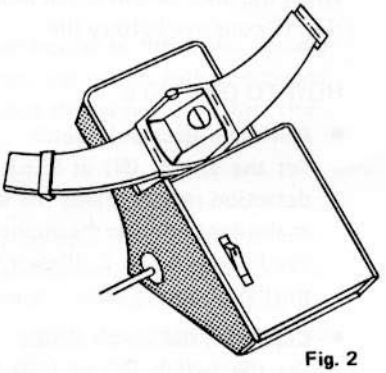


Fig. 2

- **Battery change**

  Remove the battery hatch from the bottom of the microphone by turning it counterclockwise with a coin or the like. Replace the two old cells with new ones, and close the battery hatch by turning it clockwise. Set two cells so that their negative faces may come on the far side in the battery holder. Use the battery U.C.C. 301 for SEIKO watch use. See Photo 4.

- **Cleaning**

  To clean the microphone, wipe it gently with a soft, dry cloth. Never use thinner, alcohol or any other solvent or chemical.

Photo 4

WIRING AND OPERATION

- Put the connector plug of the power cord into the power cord connector (S) in the back of QT-99.
- Put off the power switch (G), and connect the power cord plug into an outlet. QT-99 employs an oven-controlled crystal oscillator for highly accurate and stabilized measurement, and it takes some 20 min. for the oven to attain a stabilized temperature, that is, for the QT-99 to become ready for measurement at a required accuracy, after plugging the power cord to the outlet. Then, turn on the power switch (G), and the POWER indicator (A) will light up, showing the measurement is ready.
- For the measurement of ordinary watches, set the watch signal divider selector switch (P) at GENERAL.
- Put the plug of the Electro-magnetic/Electric-field detection microphone (L) into the INPUT jack (K).
- Set the GATE TIME/CHANNEL setting switch (I) in position.
  For the measurement of a watch for which a channel is specified, set the switch (I) at that channel.
  For other watches, use the GATE TIME.
  For those watches whose frequency is less than 1 Hz, select a measuring time in an integral multiple of the generation period of watch signal.
  For stabilized measurement, it is recommended to select an even-numbered multiple.

Ex.:

Frequency (period)	Measurement at a gate time of
0.25 Hz (4 sec.)	4, 8, 12, 60 or 120 sec.
0.1 Hz (10 sec.)	10, 30, 60 or 120 sec.
0.2 Hz (5 sec.)	10, 30, 60 or 120 sec.
1/3 Hz (3 sec.)	6, 12, 30, 60 or 120 sec.
1/30Hz (30 sec.)	30, 60 or 120 sec.
1/60Hz (1 min.)	60 or 120 sec.

Note: For example, SEIKO QUARTZ Cal. 4130A is rated at 0.2 Hz.

For almost every watch whose frequency is 1 Hz or up, any gate time will be available for measurement.
Note that the gate time available is limited for those watches whose frequency has a decimal fraction as shown below.

Ex.:

360 1/3 Hz (360.$\dot{3}$), 170 2/3 Hz (170.$\dot{6}$), 5 1/2 Hz (5.5) (Refer to (P).)

Where a number of gate times are available, it is recommended to use the longer rather than the shorter gate time, because it is recognized that the longer the measuring time, the higher the measuring accuracy. There are some special types of watches which defy measurement at an odd-numbered period. For such watches, use an even-numbered period. This is particularly the case with balance wheel type watches which may not be measured at an odd-numbered period under the influence of unbalanced swing.

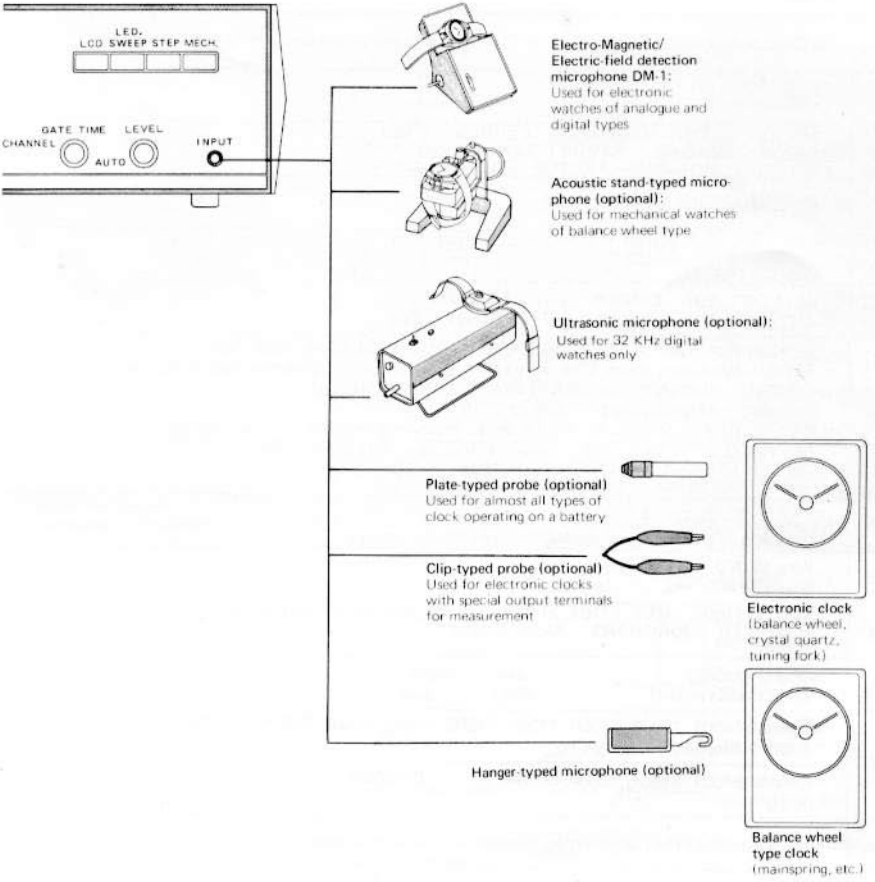
- For those watches for which a channel is not specified, the watch selection switch (E) must be set.
  Select and depress one of the push buttons to meet the type of a given watch, and the selection of frequency will be carried out automatically.
  Green button: For those leaping-hand watches, such as SEIKO analogue type quartz watches, whose frequency ranges from 1/120 Hz to 12 Hz, select the green button.
  White button: Use this button for SEIKO Digital type quartz watches, other liquid crystal watches or for electronic watches of 12 Hz to 64 Hz.
  Red button: Use this button for those quartz or tuning fork sweep-hand watches of more than 60 Hz or LED watches.
  Grey button: Use this button for the measurement of ordinary balance wheel type watches (incl. battery ones). If this button is depressed, the decimal point will be shifted to allow the daily rate measurement within ±199.9 sec./day. With the grey button, it is possible to measure leap-hand quartz watches of 1 Hz to 12 Hz, but the daily rate is shown in 0.1 sec./day.
  It is not necessary to operate these buttons when the channel is used for measurement. If any of the buttons but the grey one is depressed, the measurement will not be affected. In the case of channel measurement, the computer will handle all the processes according to the programmed data concerning type of watch and measuring method. (If the grey button is selected, the channel measurement will be impossible as the measuring unit is 0.1 sec./day.)
- Set the earphone plug into the EARPHONE jack (F).
- Set the LEVEL adjuster (J) at AUTO (turn it counterclockwise until a click is heard.)
- Set the switch (N) on the electro-magnetic/electric-field microphone (L) to meet the type of the watch to be measured. (For details, refer to "FUNCTION OF ELECTRO-MAGNETIC/ELECTRIC-FIELD DETECTION MICROPHONE DM-1" on page 8.)

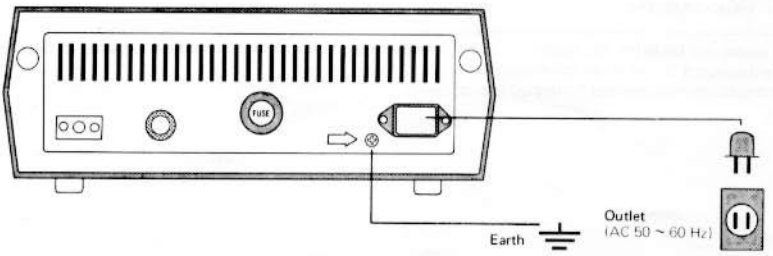
- Put on the earphone and place the watch in the center (marked position) of the microphone platform, and shift the watch or change its position until the watch signal is heard largest.
  (For an LED watch, the measurement should be made with its display on.)
  * For the use of other microphones, refer to relevant manuals.
- Measurement is started automatically by placing the watch on the platform of the microphone. If the measurement is started with the operator's finger on the watch or if the operator's finger touches the watch during measurement, the signal level may be changed to cause an error in the measurement. (A vibration of the operator's finger is communicated to the watch to change the relative position between the watch and microphone, developing a change in the signal level. The error is not due to the change in the timing of the watch itself.)
  In such a case, disregard the affected measurement, and read the next daily rate measured. If the reset button (H) is depressed immediately after the watch has been set on the microphone, the correct reading will be obtained from the beginning. The measurement is continued repeatedly until the watch is removed from the microphone.
- Almost every watch can be measured with the LEVEL adjuster (J) at AUTO. If the INPUT indicator (C) blinks precariously, turn the knob (J) clockwise.
  Note: The level adjustment has nothing to do with the volume of the earphone.

  For the measurement of balance wheel type watches with an acoustic microphone, turn the level adjuster from the AUTO position for better results. But be sure to keep the microphone away from acoustic noise and mechanical vibration. The INPUT indicator (C) turns on and off at the same frequency as that of the watch. If the watch has a high frequency, the indicator will seem as if it stayed lit. Whether the level adjustment is proper or not can be judged by the blinking state of this indicator.
- Immediately after the start of measurement, the display will be in the blank, during which the first measurement is going on. If the GATE TIME/CHANNEL setting switch is changed over while the data is displayed, the measuring circuit will be reset to blank out the display and start the measurement anew. This is also true of the case where the watch selection switch (E) is changed over.
  After the daily rate is measured, the display is automatically reset to extinguish when the watch is removed. The time to be required for the display to extinguish varies depending upon the gate time set.

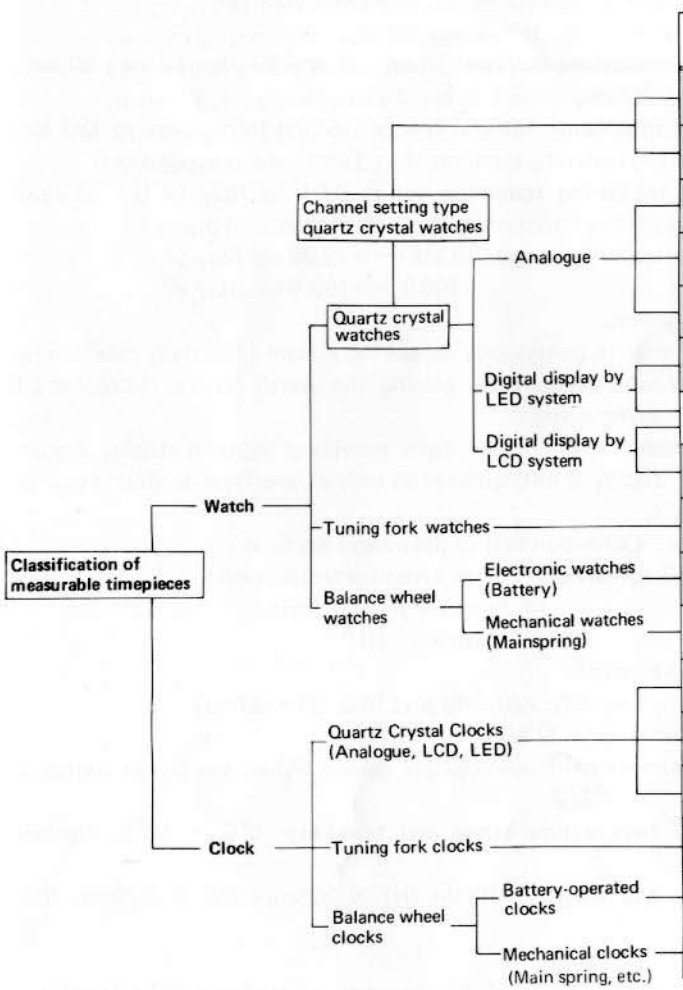
- If the RESET indicator blinks at a fast rate, it indicates that something is wrong with the switch setting.
  Check the switch setting by following the procedures below.
  1. The button of the watch selection switch is not depressed when the gate time is set.
  2. Two adjoining buttons of the watch selection switch are depressed when the gate time is set.
  3. When the watch signal divider selector switch is set at other than GENERAL, its setting does not agree with the gate time selected. (Ex.: The gate time is selected at 4 sec., 8 sec. or 10 sec. with +N/3. (For sweep-hand watch only))
  4. When an unoccupied channel is selected. (No measuring routine is programmed.)
  5. In the case of channel measurement, the grey button of the watch selection switch is depressed.
- In the following cases, measurement is impossible and the display will not function.
  A. When no input signal is supplied.
  (INPUT indicator (C) will not light up.)
  B. When the button of the watch selection switch (E) is not depressed properly for gate time measurement.
  C. When the daily rate of a watch exceeds the measuring range.
  D. When the Quartz Tester is affected by strong noise.
  For example, in case that the electro-magnetic microphone is used and if the earphone makes a scratching sound or a hum without placing the watch on it, don't measure the daily rate.
  (In this case, the INPUT indicator will blink even if no watch is set on the microphone. If the INPUT indicator goes out when the microphone plug is disconnected, you may consider that external noises are responsible for the trouble.)
- The measuring method varies depending upon the watch calibre. Some watch must be measured through the channel setting. When measuring any watch, be sure to refer to a relevant Watch Technical Guide.

WIRING DIAGRAM





QT-99 TABLE OF MEASURABLE RANGES



Type of Microphone	Button of watch selection switch	Measurable Hz	Available Watch & Clock
Electro-magnetic	/	Special	SEIKO Twin Quartz Cal. 99 → Set at CH-1. Pull out the crown completely.
Electric-field	/	Special	
Electro-magnetic	Green STEP	1/120 ~ 12 Hz	SEIKO OMEGA (Megaquartz) BENRUS Bifora RICOH Neo Sonic FAVRE-LEUBA JUNGHANS CITIZEN ROAMER ARCTOS TIMEX G-P
Electro-magnetic	White LCD.	12 ~ 64 Hz	CITIZEN (16 Hz)
Electro-magnetic	Red LED. SWEEP	60 ~ 1200 Hz	CERTINA (Ultraquartz) LONGINES (Ultraquartz) I.W.C. GHP RADO OMEGA (f8129)
Electro-magnetic	Red LED. SWEEP	60 ~ 1200 Hz	SEEMOS (LED) OMEGA (LED) URANUS (LED) CITIZEN (LED) RICOH (LED) ORIENT (LED)
Ultrasonic (32 KHz)	Green STEP	/	SEIKO (05LC, 05LCA, 06LC, 06LCA, 0114, 0124, 0634, 0644, 0654, 0664) SEIKO Digital Stop Watch (The daily rate is measured by using electric-field detection microphone.) CITIZEN ORIENT GRUEN BWC TIMEX NEPRO Microma SANYO Quartz WALCHRON CASIOTRON 01, 02, 03, 04 (For 04 Series, measuring time is 6 or 12 seconds.)
Electric-field	White LCD.	12 ~ 64 Hz	
Electro-magnetic	Red LED. SWEEP	60 ~ 1200 Hz	OMEGA f300 LONGINES Baume & Mercier BULOVA I.W.C. ETERNA CITIZEN (HI-SONIC) RADO CERTINA UNIVERSAL
Electro-magnetic	Grey MECH.	1/120 ~ 12 Hz	SEIKO (07EL, 33EL, 37EL) CITIZEN (COSMOTRON) etc. (The acoustic stand-typed microphone can also be used.)
Acoustic stand	Grey MECH.	1/120 ~ 12 Hz	King SEIKO Grand SEIKO, etc.
Plate-typed or clip-typed probe	Green STEP	1/120 ~ 12 Hz	SEIKO (71005, 71007, 71101, 71507) RADO (CHRONOMETER) SCHTIGAR JUNGHANS Aicron Quartz JECO
Plate-typed or clip-typed probe	White LCD.	12 ~ 64 Hz	SEIKO (71002) CITIZEN (Crystron)
Plate-typed or clip-typed probe	Red LED. SWEEP	60 ~ 1200 Hz	SEIKO (71003, 71006, 71009, 71201, 71202, 71502, 71503, 71504, 71505) JECO Rhythm Quartz (64 Hz)
Plate-typed or clip-typed probe	Red LED. SWEEP	60 ~ 1200 Hz	SEIKO (64001, 64501, 66004, 66504) CITIZEN (Elitron) JECO
Plate-typed probe	Grey MECH.	1/120 ~ 12 Hz	Various marks (The hanger-typed microphone can also be used.)
Hanger typed	Grey MECH.	1/120 ~ 12 Hz	Various marks

Notes: 1. When the daily rate of the LED display watch is measured by using the electro-magnetic/electric-field detection microphone, be sure to display all digits by pushing down the button with adhesive tape before the watch is placed on the microphone.
2. The coverage by the electro-magnetic/electric-field detection microphone furnished is shadowed.

QT-99 SPECIFICATIONS

1. **Measurable timepiece and Hertz:** Watches and clocks with quartz crystal, tuning fork and balance wheel (1/120 Hz ~ 1,200 Hz)
2. **Measuring time**
   Gate time measurement: 4 sec., 6 sec., 8 sec., 10 sec., 12 sec., 30 sec., 60 sec., 120 sec.
   Channel measurement: Integral number second from 2 sec. to 120 sec. (depending upon the contents stored in the memory element)
3. **Observable measuring minimum value:** 0.01 sec./day or 0.1 sec./day (Round off the franction to three or two decimal places.)
4. **Observable measuring range:** −19.99 ~ +19.99 sec./day or
   −199.9 ~ +199.9 sec./day
5. **Measuring system:**
   - Automatic start continuous measuring system (The daily rate can be measured automatically by placing the watch on the microphone.)
   - Micro-computer system
6. **Display system:** + or − four digits numerical segment display system (The digital display is extinguished in case of overflow or when signal is not supplied.)
7. **Display time:** Corresponding to the measuring time
8. **Crystal oscillator device:** Type: Oven-controlled device
   Frequency: 4.32 MHz
   Accuracy: 10^{-8}
9. **Power requirements:**
   AC 100, 110, 120, 200, 220, 240 V (±10%; 50 ~ 60 Hz)
   Power consumption: 22 W
   Power consumption of oven-control device (When the power switch is turned off): 3 ~ 4 W
10. **Operational temperature range and humidity:** 0°C ~ 50°C, Normal humidity
11. **Dimensions and weight:** 110mm (H) X 325mm (W) X 328mm (D); 7.2 kg.
12. **Accessories:**
    - Electro-magnetic/Electric-field detection microphone DM-1 (Used for analogue and digital electronic watches) (including 2 silver oxide batteries—U.C.C. 301) 1
    - Earphone for signal monitoring (can also be used with Timegrapher IC-70) 1
    - Power cord 1
    - Earth cable 1
    - Vinyl cover 1

13. Optional accessories

- Stand-typed microphone K-410 (Used for balance wheel watches; can also be used with the Timegrapher IC-70)
- Hanger-typed microphone (Used for balance wheel mechanical clocks; can also be used with the Timegrapher IC-70)
- Plate-typed probe K-401 and Clip-typed probe K-504 (Used for electronic clocks, can also be used with Timegrapher IC-70)
- Ultrasonic microphone US-32 (Used for digital watches with the crystal oscillator, 32 KHz)

TROUBLESHOOTING

The following are no trouble and can be remedied by yourself.

- **Even when the power switch is turned on, QT-99 will not work. (POWER indicator (A) will not light up.)**
  1. **Is the power cord plugged tight into the outlet?**
     — Connect the plug into the outlet thoroughly.
  2. **Is the fuse gone?**
     — Replace the fuse (1 A) with a new one. If the new is gone immediately, QT-99 is faulty.
- **The INPUT indicator (C) does not flash after the watch is placed on the microphone.**
  1. **Is the microphone plug connected to the input jack?**
     — Put the plug into the jack thoroughly.
  2. **Is the microphone switch (N) set properly according to the type of watch?**
     — Set the microphone switch (N) to meet the type of watch to be measured.
  3. **Is the LEVEL adjuster (J) set at a low level?**
     — Turn the LEVEL adjuster (J) clockwise or set it at AUTO.
  4. **Is the button of the watch selection switch (E) depressed for gate time measurement?**
     — Depress the button (E).
- **The INPUT indicator (C) will not flash only when a liquid crystal watch is measured.**
  1. **Is the microphone switch (N) set at LCD ON?**
     — Set the microphone switch (N) at LCD ON.
  2. **Is the battery (U.C.C. 301) in the microphone run down?**
     — Replace the batteries with new ones.
- **The earphone fails to detect the watch signal.**
  1. **Is the earphone plug connected in position?**
     — Set the earphone plug tight in position.
  2. **Is the earphone or earphone cord broken?**
     — Replace the earphone. (Crystal earphone)
- **Noises are heard on the earphone.**
  1. **Is there an electrical appliance radiating noises around?**
     — Turn off the noisy electrical appliance.
  2. **Are the measuring environments acceptable?**
     — Change the location of QT-99 to a proper place free of external noises and vibration.

- **Voices are heard on the earphone.**
  1. **Are there any wireless stations near around which interfere with the measuring system?**
     — Contact the wireless stations for measures against interference.
- **Daily rate is not displayed or it goes out soon after it is displayed.**
  1. **Is the correct microphone used to meet the type of watch?**
     — Select the microphone according to the type of watch. (Refer to "QT-99 Table of Measurable Ranges".)
  2. **Is the correct button of the watch selection switch (E) depressed?**
     — Work the correct button. (Refer to "QT-99 Table of Measurable Ranges".)
  3. **Is the daily rate of the watch beyond the measuring range?**
  4. **Is the watch placed in the right position on the microphone?**
     — Listen to the watch signal over the earphone, and place the right position.
  5. **Is the microphone strongly affected by nearby electrical noise sources?**
     — Turn off the electrical appliances that make noises to interfere with the measuring system.
  6. **Is the level adjustment proper?**
     — Adjust the level as required.
  7. **Is the ordinary method applied when the channel measurement must be followed?**
     — Set the QT-99 for channel measurement, and reset the watch as required.
- **Daily rate changes quickly over a wide range.**
  1. **Is the instantaneous daily rate of watch changing over a wide range?**
  2. **Is the microphone strongly affected by nearby electrical appliances?**
     — Turn off the noisy appliances.
  3. **Is the watch placed properly on the microphone?**
     — Listen to the watch signal over the earphone, and place the right position.
  4. **Is the level adjusted properly?**
     — Turn the LEVEL adjuster as required.
  5. **Is the ordinary method applied when the channel measurement must be followed?**
     — Set the QT-99 for channel measurement, and reset the watch as required.

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