CONTENTS

MULTIFUNCTION TIMEGRAPHER

I. Performances and Technical Specifications

The timegraphers of model MTG–4000A is used to test the perfor-mances of mechanical watches. On the large size colored LCD screen ,the diagram of watch beats is displayed. At the same time ,the numerical val-ues of rate, amplitude and beat error are automatically calculated and displayed. If a heat sensitive printer is equipped, all displayed diagrams and the numerical values could be printed.

The instrument has 2 testing modes, normal testing mode and pro-grammed one, and 2 diagram display modes, pushing mode and extending mode .

The functions of multi–rate display, diagram shift, time and calendar display, acoustic stimulation of beat noise and function of testing pause are all served by MTG–4000A.

Technical Specifications :

Beat number:

18000 b/h, 19800 b/h, 21600 b/h, 25200 b/h, 28800 b/h and 36000 b/h, can be selected automatically or manually.

Ranges of displayed numerical results and their accuracy:

Rate: –300 s/d ~ 300 s/d	Accuracy:	± 1 s/d
Amplitude: 100° ~345°	Accuracy:	± 3°
Beat error: 0 ~ 4.0 ms	Accuracy:	± 0.1 ms

Length of diagram displayed:

480 dots, corresponding to 80s(60s)*

Data stored:

720 beats, corresponding to 120s(90s)*

Position tested:

1 ~ 6 positions

Lift angle:

30° ~ 60°, default value: 52°

Power supply:

single phase, AC 90 V ~ 250 V, two wires, power consumption about 10 W.

Weight :

2.5 Kg

Dimension :

245 × 160 × 110 mm

Operating environment:

Temperature: 0°~50° C

Humidity: 0 ~ 85 % RH

Notice *:The values outside the parentheses are that correspond to watch's beat number of 21600 b/h, and the values in the parentheses are to beat number 28800 b/h. This notice is suitable for the instructions below.

MULTIFUNCTION TIMEGRAPHER

II. Components

MTG–4000A consists of three components: mainframe, microphone and DC power adapter. The heat–sensitive printer and/or the automatic microphone as options are available.

III. Preparations

1. Connection:

Insert the plugs of power adapter, microphone and also of the printer, if it is equipped, into the corresponding sockets through the back panel of the main frame. If the automatic microphone is equipped, its two plugs should be connected to the sockets marked with "MICROPHONE" and "CONTROL" correspondingly.

2. Power on:

Press the switch on the power adapter, then the instrument starts to work. If the printer and automatic microphone are equipped, please switch on the main frame first and then switch on the others, to switch off these devices should be in the opposite order. Another way is using a pin-board with multi sockets to switch on/off them simultaneously. After power on, the main menu ,calendar and time, beat number (or word "AUTO") and value of lift angle are displayed on the screen.

3. Settings:

Before the starting of test, it may be necessary to set the beat number, lift angle, calendar and time display, display colors and mode of diagram display. The following setting are carried out after power on and the starting window is opened.

(1)Setting of the beat number:

Press the "BEAT NUMBER" key to open the window of beat number selection, it may be done according to the prompt on the screen .The watches with beat number 18000,19800,21600,25200 28800 and 36000 can be test ,it may be selected automatically or may be set to one of above mentioned 6 beat numbers. Generally, beat number automatic selection should be used. Only when a special watch is tested, which beat number is determined difficultly by automatic selection or you doubt its selection, then you may set a beat number to attempt.

MULTIFUNCTION TIMEGRAPHER

(2)Setting of the lift angle

Press the "↑", "↓" keys to open the window of lift angle setting. And then press the "↑" key or "↓" key to increase or decrease the lift angle . After the setting of the lift angle, press the "PAUSE"key to confirm .The value range of the lift angle is 30° to 60° . Press "↑" key or "↓"key once the lift angle will be increased or decreased at step 0.1° , and if you press them continuously it will be changed at step 1° . Lift angle is a very important parameter of watch movement. The value of the lift angle must be known in advance to calculate the amplitude of the balance. If you do not know the value of the lift angle you may set it 52° , because most of the watches are with a lift angle of 52 ± 5° . So, for most of the watches, the error is limited to ± 10 %. But there are exceptions, and for some watches the lift angle varies largely. We must pay attention to this.

(3)Press "SETTING" key and then press "↓", "←" and "→" key respectively you can select the colors of display, set the calendar and time display, select the mode of diagram display.

① According to the prompt on the screen one of five modes of display colors may be selected .

② According to the prompt on the screen to open the window of calendar and time setting,you can set up the time and calendar by press the corresponding keys prompted. The time is given according to the 24-hours clock. If there are some irregular codes or there are some values very different from normal values you may press "SETTING" key to set them to middle values for easy adjustment.

③ According to the prompt on the screen you can select the display mode of watch beat diagram , pushing mode or extending mode. For push-

ing mode, the diagram scroll from left to right and the new dot of diagram always appears on utmost left end of diagram along with the progress of test. This mode is similar to that in the paper tape recording timegrapher. For extending mode, the diagram is simply extended when testing is in progress. The new dot always appears on the utmost front end of the diagram. We recommend you to select pushing mode, because you can observe the diagram more conveniently.

All the above mentioned setting operations can be carried out not only at the preparation stage but also when the normal testing is going on. For beat number and lift angle setting you can do it more simply, i.e. you press the " ↑ " or " ↓ " key, the lift angle will be increased or decreased, and press "BEAT NUMBER" key you can select the beat number, the test won't be interrupted.

The above setting values will be stored automatically and when the timegrapher is turned on once and again, the stored values will be remained. For the programmed testing, the setting can not be executed while the testing is going on. The setting method of the programmed testing is explained in part Ⅴ.

MULTIFUNCTION TIMEGRAPHER

Ⅳ. Normal Testing of Watches

In the start window ,press the key " ▶" the normal testing will start. The normal testing of watches refers to test the watches as the traditional instrument does. You just put the watch on the microphone, the timegrapher will continuously test the watches with the seting parameters and display the diagram and numerical values of the rate, amplitude and beat error with the LED flickering on the front panel and making a sound.

The diagram on the LCD screen is similar to that in the paper tape recording timegrapher ,the slope of the lines of diagram represents the rate deviation of tested watch and the distance between two lines represents the beat error. The value of rate is positive when the lines go upward and it is negative when the lines go downward. A horizontal diagram represents that the rate of the watch is thoroughly accurate. The above mentioned slope and distance of lines are related to the beat number. They may be different for two watches with the same rate and beat error but with different beat number. So attention should be paid to the numerical display.

The numerical value of the rate is the average of 48 beats while the values for the beat error and amplitude are the averages of 8 beats and 16 beats respectively. So they appear on the screen one after another at the beginning, then they will be updated every 12 beats. If the results are out of the limits, or the diagram is disorder, it is impossible to get the average values and there will become a blank area in the displayed places.

In addition to the display of the current value of the rate, at the same time, the rate for a certain section of the diagram is displayed in small digits, which is called "multi-rate display". With the diagram pushing or extending to the right, the rate display is also changed It is easy to observe the change of the rate.

MTG-4000A is equipped with signal processing module "TYPAS" and it has powerful Gain Automatic Control function, so the gain adjustment of watch signal is unnecessary.

When testing, the keys of "BEAT NUMBER", "LIFT ANGLE" can be used to set the beat number or lift angle directly. The "SETTING" key also can be used to set the colors, calendar and time, diagram display mode. Other keys are used to execute different functions as follows:

1.Shift:

The diagram data of 720 beats and the corresponding values for the rate both can be stored. If you would like to see the previously resultant diagram and the rate values which have already removed out of the screen, please press the keys of "←" and "→" to start shift operation. Then press key "←", the diagram will move to the left and the previous displayed diagram, as well as the corresponding rate value, will appear on the screen again. Press key "→", the diagram will move to the right until the latest section. In this way, we can see the diagram and the rate value for 120 seconds (90 seconds). Press the "PAUSE" key the testing will be resumed. If the whole screen is not full with the diagram, or the diagram display is of the extending mode , this function does not work.

2. Sound control

During the testing, the acoustic stimulation of beat noise can be heard. Press the trigger key "SOUND" to turn on/off the sound while the sound is off/on. The final state is remained until the next testing starts.

3. Pause

During testing ,you can press "PAUSE" key to pause the testing and press it again to continue.

4. Printing

During testing, press the "PRINT" key to open the printing selection window and then press corresponding key to choose printing mode, printing diagram along with numerical results of rate and amplitude every 96 beats or printing the diagram alone. The diagram will be printed from the latest displayed section to the previous one. Press the "PAUSE" key, the printing operation will be interrupted and resume to test. When the entire diagram is printed, the tester will return to testing automatically. The maximum length printed once can not exceed the volume of data storage i.e. 720 dots.

During testing, press the "RESET" key the testing will be interrupted and the starting window will appear again..

MULTIFUNCTION TIMEGRAPHER

Ⅴ. Programmed Testing of watches

Programmed testing is referred that before testing, the positions to be tested and the testing period of each position are programmed. The testing of every position will be executed according to the program step by step. The integrated results will be displayed on the screen at the end of testing.

In the starting window press key "|▶" the programmed testing will start. The operations are as follows:

1.Selection of the testing positions

After starting the programmed testing, the symbols of 6 positions will be displayed on the screen. The position symbol marked with "▲" implicates that it is selected. In order to select/cancel a testing position, move the high light band first to this position by "→" key and then to select/cancel it by "↑"、"↓" keys. When the selection is done press "PAUSE" key to confirm it.

2.Setting of the testing period of each position

The testing period of each position can be selected (excluding the time needed for rotation and stabilization). According the prompt on the screen to select it. The maximum testing period for each position is 30 seconds, while the minimum is 10 seconds. Generally, the testing period for each position should be 15 ~ 20 seconds (12~16 seconds).

3.Setting of the lift angle

The method of setting of the lift angle has been stated in Part III. "Preparations"

4.Testing

Having finished the above-mentioned three steps for the programming ,then the testing can be started. In each position, the testing is the same as that in normal testing mode, but there is no multi-rate display.

During the testing, only the key for sound control can be used, and other keys are not available. The mode of diagram display is set to "pushing" automatically. When the testing for one position is finished, the values for the rate, amplitude and beat error related to that position would be displayed. Then the symbol of next position is displayed. If your instrument is equipped with the automatic microphone, it will turn to the next position automatically. Otherwise, it is necessary to turn it to the next position by hand. When testing for all positions are finished, the rate, amplitude and beat error for each position will be displayed. At the same time, the maximum difference of rate and amplitude among all positions are calculated and displayed.

5.Printing

After all the tests are finished, the printing can be started if press the "PRINT" key. You can choose to print the numerical results or print the diagram. When printing the diagram, only the diagram itself is printed without additional numerical information. On the case of multi positions and related long testing period have been chosen, it may be impossible to print all the diagrams . If you choose to print the numerical results, all the displayed numerical results will be printed. In addition, the name of the customer and some compliment terms can also be printed. But this function must be required when place the order.

When the testing of a watch is finished, press the "←" key, the programmed testing will be started again , press the "RESET" key the testing will be interrupted and the starting window will appear again..

MULTIFUNCTION TIMEGRAPHER

VI. Frequency Calibration

The reference frequency of this timegrpher is 36.000000 MHz and this frequency should be calibrated periodically. For calibrating the frequency, please plug the probe unit of the frequency meter into the corresponding socket on the back panel through a larger hole marked with "Frequency Calibration".After the tester starts and comes to stable state, the frequency is measured. The allowable error of the frequency is ± 100 Hz. If the frequency is out of the limits, it should be calibrated by turning a built-in potentiometer using a small screwdriver through a smaller hole, which is located over the larger hole as mentioned above. The frequency should be within the limits and as close to the reference frequency as possible.

VII. Troubleshooting

1.After the tester is turned on, the screen is not bright, or it is bright, but no display. Press the "RESET" key for reset, but there is also no response.

Probably the plug of the power is not insert into the socket well. Please plug it again. There is another possibility that the power supply adapter is out of order. If this is the case, please have it repaired.

2.There is display of words only , but no display of the diagram, or the display of the diagram is in disorder. After the watch is wound and put it in its place again the testing still cannot be carried out properly.

Probably the plug of the microphone is not well inserted into the socket. Please plug it again. If it still does not work properly, the tester or the microphone has some trouble, but most possibly is some thing wrong with the microphone. If you have several testers, please exchange the microphones to see which one is wrong. The one with malfunction has to be repaired.

3.During the testing, there is sudden display of improper words or digits, or display of disorder diagram.

Generally speaking, this is the result of strong interference and the microprocessor does not work properly. Please press the "RESET" key and this will put everything in order.

4.The display of signal and sound is normal, but the diagram is in disorder, or the gradient of slope is abnormal.

Probably, the beat number is incorrect. Please check it and correct it.

MULTIFUNCTION TIMEGRAPHER

VIII. Options

1. Automatic Microphone

The tester can be equipped with automatic microphone. The microphone of this type has two plugs, insert the 4-pins plug into the socket marked with "Microphone" and another plug insert into a socket marked with "Control". After power is turned on, if the microphone is not in CH position (i.e. face -up), please press the "RESET" key, it will rotate to face-up position. The microphone can be controlled by the tester according to the program or controlled by buttons, and it can also be rotated to any position by hand.

2. Heat-sensitive Printer

On the printer, there are two small keys, marked with "SEL" and "LF" respectively. When the printer is working, the signal light on the "SEL" should be turned on. If not, please press the key "SEL". When you would feed the paper, the key "SEL" should be pressed first and the signal light will be turned off. Then press the key "LF" and the paper starts advancing, press the key again, the paper advancing will be stopped. Press the key "SEL"; the printer will restore its stand-by state.