



# Operating Instructions MA 790

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## **WARRANTY**

This warranty is extended to the original purchaser of the MA 790 Audiometer by Maico, through the authorized distributor from whom it was purchased, and covers defects in material and workmanship for a period of one year from date of delivery of the audiometer to the original purchaser.

If the MA 790 audiometer contains a defect in material or workmanship Maico, at its option, will repair or replace the instrument at no charge except for transportation to and from the point of service. It is the purchaser's responsibility to return the audiometer to the Maico Special Instrument Distributor from whom it was purchased or directly to Maico after receiving authorization to return.

This warranty does not cover accessory cords and breakage or failure occasioned by tampering, misuse, carelessness, accident or modification. The warranty is void if the MA 790 audiometer is repaired by other than an authorized Maico Special Instrument service center.

## **NOTE:**

Specifications in this manual were in effect at the time of printing. Maico, whose policy is one of continuing progress, reserves the right to discontinue or change specifications or design at any time without notice or incurring obligation.

## **WARNING:**

The Maico MA 790 is designed to be used with a hospital grade outlet. Injury to personnel or damage to equipment can result when a three-prong to two-prong adapter is connected between the power plug and an AC outlet or extension cord.



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## 1.0 SPECIFICATIONS

### AUDIOMETRIC

Test frequencies:	500, 1000, 2000 3000, 4000, 6000, 8000 Hz $\pm$ 2%
Attenuator range:	0-95 dB <sub>HL</sub> $\pm$ 3 dB, 5 dB steps
Attenuator linearity:	$\pm$ .5 dB/step
Stimulus:	Pulsed, 2.5 pulses/second or continuous
Rise/Fall time:	35 msec. typical
Distortion:	.5% typical, 3% maximum
Right/left crosstalk:	-100 dB minimum
Stimulus on/off ratio:	100 dB or -10 <sub>HL</sub> , whichever is lower

### PRINTER

Print time:	Approximately 25 seconds
Chart dimensions:	2.5" (6.35 cm) wide by 5.7" (14.5 cm) or longer, thermal sensitive paper.

3M type 1900 or equivalent, 3.0" (7.62 cm) maximum diameter roll. Printout, Labeled space for: subject, job no., noise exposure, hearing protectors, birth date and examiner. Printed data for I.D. number, date, test code comments, audiogram results, model and serial number, calibration date, and calibration specifications.

### CONTROLS

Front panel:	+5 dB, Stimulus, -10 dB, Left, Right, Save, Enter, Menu, Start, Stop, Print and Data Entry/Frequency keys
Rear panel:	Power switch

### MECHANICAL

Dimensions:	14.5" (37.5 cm) wide by 4" (10.2 cm) high by 13" (33 cm) deep.
Weight:	10 pounds (4.5 kg) with standard accessories
Case:	Durable ABS housing

### ELECTRICAL

Voltage:	117 or 234 VAC $\pm$ 10%, 50-60 Hz externally selectable
Power Consumption:	30 watts
Operating temperature:	60°-100°F (15° to 38° C)
Storage temperature:	0°-120°F (-18° to 49° C)
Test headset:	TDH-39 earphones



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## 2.0 INTRODUCTION

Your Maico MA 790 Automatic Audiometer provides the latest in hearing evaluation technology. It is easy to use, reliable and provides accurate testing in a fast, cost-effective manner. It is flexible, so that it can be programmed to fit the needs of your particular testing program.

A microprocessor in the MA 790 automatically presents a pure tone stimulus in discrete 5 dB steps, at random intervals of 2 to 4 seconds. The stimulus consists of three tone pulses, or beeps, when the stimulus button is pressed. The hearing level ranges from 0-95 dB, and the frequency ranges from 500 Hz to 8000 Hz. The subject responds by pushing a hand-held switch each time the stimulus is heard. The program used is the familiar "down 10, up 5" sequence normally employed in manual pure tone audiometry.

Test repeatability is established by the MA 790 at the beginning of each test to minimize unproductive test time. If the subject responds inappropriately before repeatability has been established by the instrument, the test will be terminated, a signal will sound and "Invalid Retest" will appear in the display. If, after repeatability has been established, the subject fails to establish a threshold at a given level, the audiometer will skip that frequency, and retest it one more time after completion of the normal test procedure. When the automatic test procedure has been completed a signal will sound to alert the operator that the test is finished, and the test results will be printed.

The MA 790 will detect the following inappropriate responses:

**MR - Multiple Responses** to a pure tone stimulus presentation

**NR - No Response**, failure to respond at 95 dB<sub>HL</sub>

**SE - Subject Error**, failure to establish a threshold within 17 stimulus presentations

The MA 790 also has the capacity to complete a variety of hearing loss calculations, including AAO-1979. Important subject information, such as noise exposure level and type of ear protector used can become a part of each subject's audiogram.



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## 3.0 INSPECTION AND SET-UP

### 3.1 External Inspection

Your MA 790 was carefully inspected and packaged for shipping, however, it is a good practice to thoroughly inspect the outside of the shipping container for signs of damage. If any damage is noted after unpacking, notify your carrier immediately.

### 3.2 Unpacking

Once the MA 790 and accessories have been carefully removed from the carton, inspect the case for damage. Notify the carrier immediately if any mechanical damage is noted. This will assure that a proper claim can be made. Save all packing material so the claim adjuster can inspect it as well. Notify your Special Instrument Distributor where this instrument was purchased as soon as the adjuster has completed the inspection.

**SAVE ALL THE ORIGINAL PACKING MATERIAL AND THE SHIPPING CONTAINER SO THE INSTRUMENT CAN BE WELL-PACKAGED IF IT NEEDS TO BE RETURNED FOR SERVICE OR CALIBRATION.**

### 3.3 Standard Accessories

Please check to verify that all standard accessories listed below are received in good condition. If any accessories are missing or damaged, immediately notify your Maico Special Instrument Distributor or Maico.

<u>Standard Accessories</u>	<u>Part Number</u>
Chart Paper	5496
Dust Cover	5516
Operating Instructions	1162-9402
Patch Cords (2 wire)	1025-352
Subject Response Switch	2169
Subject Dual Headset	4687

The earphones are color-coded to eliminate the possibility of incorrect positioning.

**NOTE:** One headset cord has a RED PLUG to identify the RIGHT EARPHONE CORD that attaches to the RIGHT PHONE JACK. The BLUE PLUG attaches to the LEFT PHONE JACK. The SUBJECT RESPONSE CORD attaches to the SUBJECT RESPONSE JACK. See figure 2.



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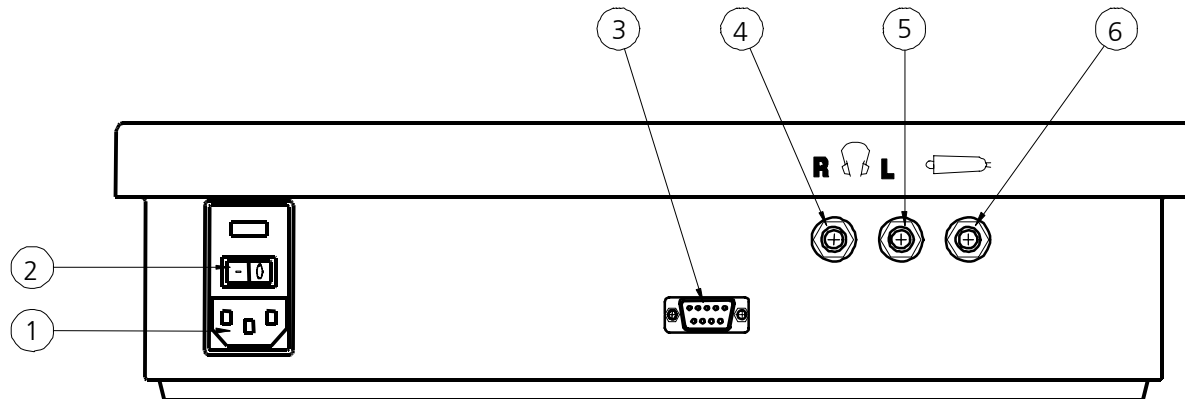


FIGURE 2

## MA 790 Rear Panel Description

- |                        |                     |
|------------------------|---------------------|
| 1. AC Power Connection | 5. Left Phone       |
| 2. On/Off Power Switch | 6. Subject Response |
| 3. RS 232 Connector    |                     |
| 4. Right Phone         |                     |

### 3.4 Optional Accessories

<u>Optional Accessories</u>	<u>Part Number</u>
Carrying Case	1035-3002
Audiocup Headset	4695

### 3.5 Sound Room Installation

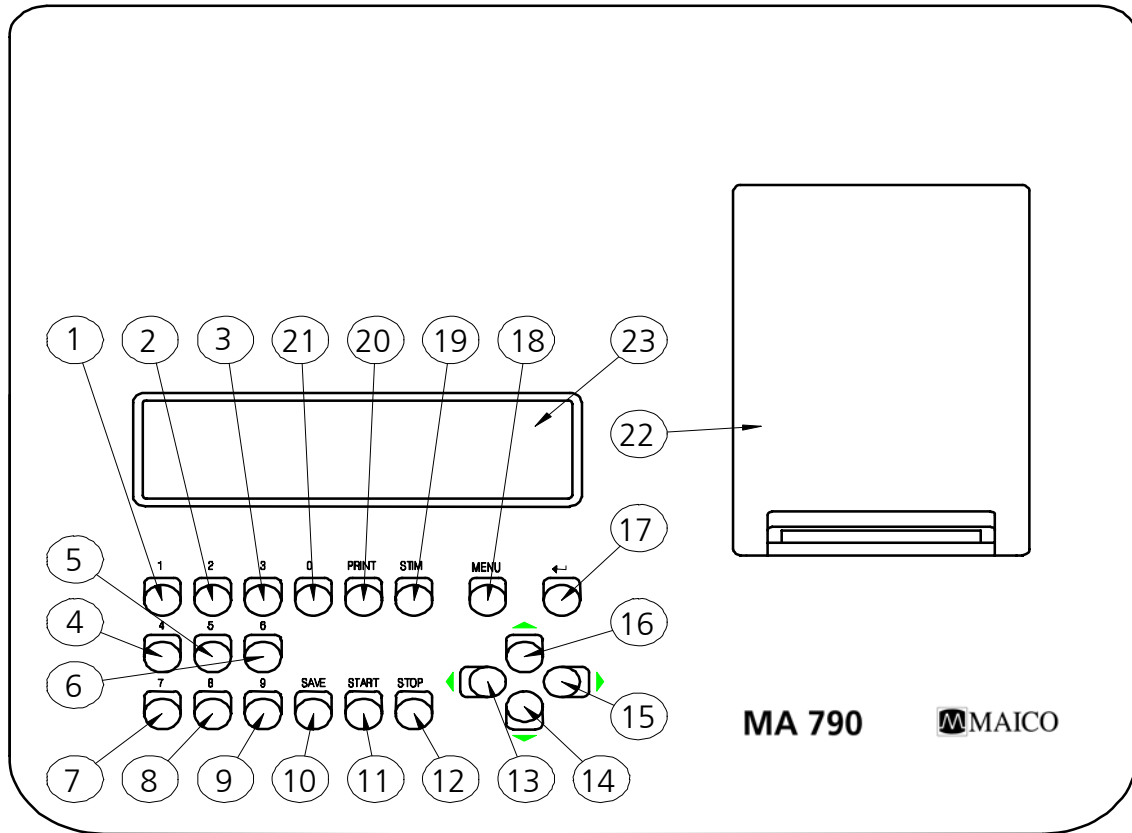
If the MA 790 is used in conjunction with a sound room, three patch cords are needed; two cords are needed for the headset, and one is needed for the subject response switch. Two-wire patch cords must be used for the headset and the subject response switch. These patch cords are supplied with the MA 790.

If you have any questions while installing your MA 790, contact your authorized Maico Special Instrument Distributor.



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## 4.0 KEYPAD FUNCTION GUIDE



**FIGURE 3**

Many of the MA 790 keys have dual functions. The upper characters are used to enter data and create the set-up the MA 790. The lower characters are used to operate the MA 790 audiometer. Instructions and key functions appear on the LCD screen (23).

### DATA ENTRY

<u>KEY</u>	<u>FUNCTION</u>	<u>AUDIOMETER FUNCTION</u>	
1.	1	Enters 1	Manual selection of 1000 Hz stimulus.
2.	2	Enters 2	Manual selection of 2000 Hz stimulus.
3.	3	Enters 3	Manual selection of 3000 Hz stimulus.
4.	4	Enters 4	Manual selection of 4000 Hz stimulus.
5.	5	Enters 5	Manual selection of 500 Hz stimulus
6.	6	Enters 6	Manual selection of 6000 Hz stimulus.
7.	7	Enters 7	
8.	8	Enters 8	Manual selection of 8000 Hz stimulus.
9.	9	Enters 9	



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## DATA ENTRY

<b>KEY</b>	<b>FUNCTION</b>	<b>AUDIOMETER FUNCTION</b>
10.	SAVE	Saves data from manual testing and entered baselines.
11.	START	Starts the automatic test.
12.	STOP	Stops testing.
13.	◀	Selects <b>LEFT</b> ear for automatic or manual testing.. Changes setting of highlighted items on the LCD screen
14.	▼	Lowers intensity of stimulus in 10 dB steps. Moves the highlighted box on the LCD screen.
15.	▶	Selects <b>RIGHT</b> ear for automatic or manual testing. Changes setting of highlighted items on the LCD screen.
16.	▲	Raises intensity of stimulus in 5 dB steps. Moves the highlighted box on the LCD screen
17.	↵	ENTER Enters completed data, selects item or moves to next screen
18.	MENU	Exits the current screen.
19.	STIM	Enters a space. Manually presents the stimulus
20.	PRINT	Initiates audiogram printout.
21.	0	Enters 0
22.	Print cover	Access to the printer to add or change paper.
23.	LCD Display	Displays menu screen and test screen with patient information.

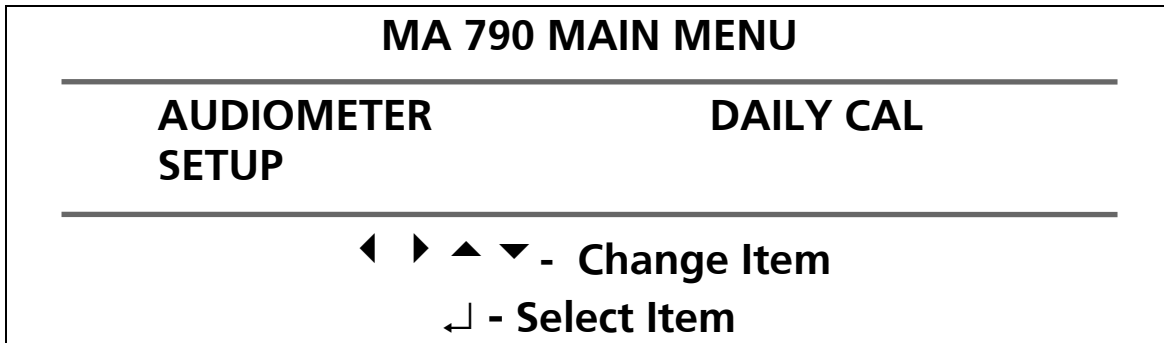


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## 5.0 OPERATION AND SETUP OF THE MA 790

The MA 790 can be customized to your particular testing requirements. There are many options you can select to create the type of test and printout that suits your testing needs.

### 5.1 Main Menu



Highlight the desired item and press ENTER to enter that mode:

AUDIOMETER - begins subject information entry and actual testing (see Section 5.2 below).

SETUP - allows customization of all aspects of the audiometer (see Section 5.3).

DAILY CAL. - runs a fast daily calibration test to check the calibration of the MA 790 (see Section 5.4).

### 5.2 Audiometer

To begin audiometric testing highlight AUDIOMETER in the MA 790 MAIN MENU screen. Press the ENTER key.

#### 5.2.1 Audiometer Subject Information Data Entry

You may wish to have identifying data become a part of each subject's audiogram.

Data may include:

Subject ID number for Social Security number, up to 9 digits

Technician ID number, up to 9 digits\*

Job number, up to 6 digits

Department, up to 6 digits

Location, up to 6 digits\*

Exposure, up to 3 digits

Protector, up to 6 digits

Birth date

Sex, M or F; change using ◀ or ▶ keys

\*Data may be entered once, and until changed, is stored in memory permanently until changed.



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Employee data is stored in the MA 790 temporary memory and appears at the top of the audiogram printout. Press the desired upper case characters on the data entry keyboard. When you have completed entering the employee data, press the ENTER key, and the next screen will appear. If the particular subject information field has not been turned on from the SETUP, PRINTOUT menu, that field will not be displayed.

<b>SUBJECT ID</b>	<b>11111111</b>	<b>JOB NUMBER</b>	<b>333333</b>
<b>BIRTH DATE</b>	<b>01/07/60</b>	<b>DEPARTMENT</b>	<b>444444</b>
<b>SEX</b>	<b>F</b>	<b>LOCATION</b>	<b>555555</b>
<b>PROTECTOR</b>	<b>888888</b>	<b>EXPOSURE</b>	<b>777</b>
<b>TECH. ID</b>	<b>123456789</b>		

▲ ▼ - Change Field

↵ - Next Screen MENU - Main Menu

## 5.2.2 Audiometer Test Screen

<b>1000 Hz</b>	<b>RESPONSE</b>	<b>STIMULUS</b>	<b>40 dB HL</b>
<b>FREQ (Hz)</b>	<b>500</b>	<b>1K</b>	<b>2K 3K 4K 6K 8K</b>
<b>LEFT (dB)</b>	<b>00</b>	<b>00</b>	<b>00 00 00 00 00</b>
<b>RIGHT (dB)</b>	<b>00</b>	<b>00</b>	<b>00 00 00 00 00</b>

**START - Start Test    STOP - Stop Test**  
**MENU - Next Subject**

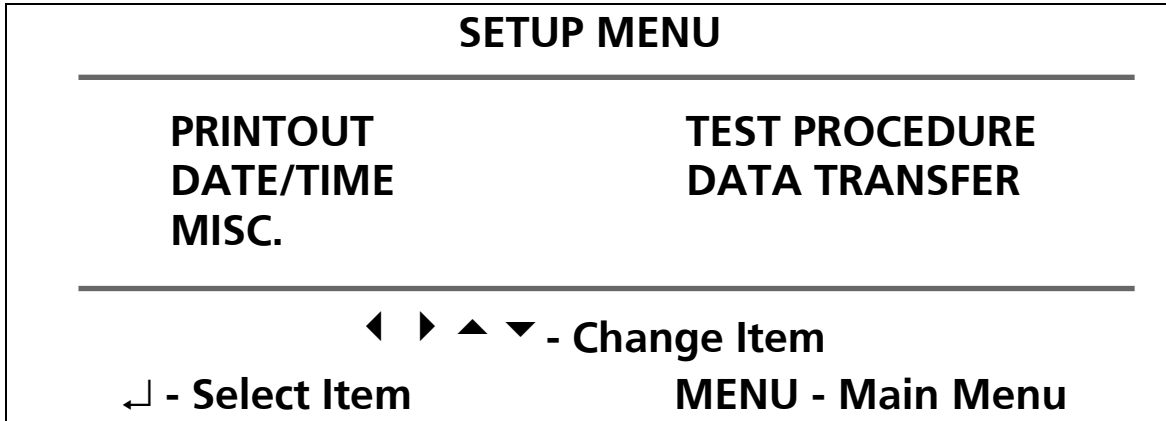
All keys now operate in the audiometric modes. A manual test can be performed at this time or an automatic test can be started by pressing the START key. The starting ear for the automatic test can be selected as right or left in the manual mode, then press START to start the test.



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## 5.3 Setup Menu

To access the screens which lists all of the setup options, move the highlight to SETUP in the MA 790 MAIN MENU screen and press the ENTER key. The following will appear:



Highlight the setup option that you want to change or look at and press the ENTER key.

PRINTOUT allows selecting what information is on the printout.

DATE/TIME allows changing the date and time.

MISC. allows changing the display contrast, the beep volume or setting up a password so that no changes can be made to the setup.

TEST PROCEDURE allows changes to the type of test, or setting up of a custom test (User Defined).

DATA TRANSFER allows changes to the RS 232 protocol or data information.

The following pages show the various screens that list the options.



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## 5.3.1 Printout Menus

Printout allows customization of test results and subject information allowed on the printout. Its subscreens follow. Selecting items ON will allow them to be printed on the printout.

SUB. DATA is the selection of subjective data, which represents the actual responses from the subject to every presentation of the stimulus.

<b>BIRTHDATE</b>	<b>ON</b>	<b>LOCATION</b>	<b>ON</b>
<b>SEX</b>	<b>ON</b>	<b>EXPOSURE</b>	<b>ON</b>
<b>ECH. ID</b>	<b>ON</b>	<b>PROTECTOR</b>	<b>ON</b>
<b>JOB NUMBER</b>	<b>ON</b>		
<b>DEPARTMENT</b>	<b>ON</b>	<b>SUB. DATA</b>	<b>ON</b>

---

◀ ▶ - Change Setting      ▲ ▼ - Change Field  
↵ - Next Screen      MENU - Prev Screen

CAL. DATE selected ON prints the calibration date. CAL. DUE DATE selected ON prints the calibration due date (usually one year from calibration date). AUDIOGRAM selected ON prints the X and O audiogram of the test results (Note: Only thresholds of 0-85dB appear on the audiogram).

<b>CAL. DATE</b>	<b>ON</b>	<b>AAO-1979</b>	<b>ON</b>
<b>CAL. DUE DATE</b>	<b>ON</b>	<b>AAO-1965</b>	<b>ON</b>
<b>AUDIOGRAM</b>	<b>ON</b>	<b>AMA-1947</b>	<b>ON</b>
<b>NY STATE</b>	<b>ON</b>		
<b>CHABA</b>	<b>ON</b>		

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◀ ▶ - Change Setting      ▲ ▼ - Change Field  
↵ - Next Screen      MENU - Prev Screen



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NY STATE selected ON prints the hearing impairment calculation for New York state, which is: The average of 1K, 2K, 3K minus 25dB, multiplied by 1.5 for each ear, and the better ear weighted 5 to 1. CHABA selected ON prints the hearing impairment calculation for the Committee on Hearing and Bioacoustics, which is: the average of 1K, 2K, 3K minus 35dB, multiplied by 1.75 for each ear, with the better ear weighted 5 to 1. AAO-1979 selected ON prints the hearing impairment calculation established by the American Academy of Ophthalmology and Otolaryngology, which is: The average of .5K, 1K, 2K, 3k minus 25 dB, multiplied by 1.5 for each ear, and the better ear weighted 5 to 1. AAO- 1967 selected ON prints the hearing impairment calculation established by the American

Academy of Ophthalmology and Otolaryngology in 1967 which is: The average of .5K, 1K, 2K minus 25dB multiplied by 1.5 for each ear, and the better ear weighted 5 to 1. AMA-1947 selected ON prints the hearing impairment calculation established by the American Medical Association in 1947 which is: the average of .5K, 1K, 2K, 3K, 4K minus 25dB, multiplied by 1.5 (monaural impairment).

<b>.5-1-2K AVG.</b>	<b>ON</b>	<b>.5-1-2-3K AVG.</b>	<b>ON</b>
<b>1-2-3K AVG.</b>	<b>ON</b>	<b>WISCONSIN</b>	<b>ON</b>
<b>2-3-4K AVG.</b>	<b>ON</b>	<b>PRINT AFTER TEST</b>	<b>ON</b>
<b>3-4-6K AVG.</b>	<b>ON</b>	<b>PRINT ON COMMAND</b>	<b>ON</b>
<b>4-6-8K AVG.</b>	<b>ON</b>	<b>PRINT NAME</b>	<b>ON</b>
<hr/>			
<b>◀ ▶ - Change Setting</b>		<b>▲ ▼ - Change Field</b>	
<b>↩ - Next Screen</b>		<b>MENU - Prev Screen</b>	

Selecting any of the AVERAGES ON will print the average of those frequencies for each ear. WISCONSIN selected ON prints the hearing impairment calculation for the state of Wisconsin which is: the average of .5K, 1K, 2K, 3K, minus 30dB, multiplied by 1.6 for each ear, and the better ear weighted 5 to 1.



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PRINT AFTER TEST selected on prints the entire test results at the end of the test. PRINT ON COMMAND selected ON will only print the test results when the PRINT key is pressed. If both of these are off the test will print the subjective data as the test is in progress and complete the printout at the end of the test. PRINT NAME selected ON will print the company name doing the testing (if so entered) or any other desired name. The name can be entered from the screen below and be up to 60 characters long (three lines of 20 characters each).

<b>NAME</b>	<b>Maico</b>
<hr/> <hr/>	
<b>◀ ▶ - Change Setting</b>	<b>▲ ▼ - Change Field</b>
<b>↵ - Next Screen</b>	<b>MENU - Prev. Screen</b>

## 5.3.2 Date/Time Menu

<b>YEAR</b>	<b>98</b>	<b>HOUR</b>	<b>7</b>
<b>MONTH</b>	<b>8</b>	<b>MINUTE</b>	<b>30</b>
<b>DAY</b>	<b>25</b>	<b>AM/PM</b>	<b>PM</b>
<hr/>			
<b>◀ ▶ - Change Setting</b>	<b>▲ ▼ - Change Field</b>		
<b>↵ - Setup Menu</b>	<b>MENU - Setup Menu</b>		

This screen enters a new date or time. To change the information, highlight the field and use the change setting keys to enter the new data.



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## 5.3.3 Misc. Menu

<b>DISPLAY CONTRAST</b>	<b>3</b>
<b>BEEP VOLUME</b>	<b>3</b>
<b>SETUP PASSWORD</b>	<b>OFF</b>
<hr/>	
<b>◀ ▶ - Change Setting</b>	<b>▲ ▼ - Change Field</b>
<b>↵ - Setup Menu</b>	<b>MENU - Setup Menu</b>

DISPLAY CONTRAST changes the contrast and brightness of the display (0 min. 15 max.).

BEEP VOLUME changes the volume level of the keypad beep every time a key is pressed (0= off, 3= loudest). It also enables the "end of the test" or "test rejected alarm".

SETUP PASSWORD selected ON requires the user to enter a password to make changes in the setup screens. If SETUP PASSWORD is ON, changes to the MA 790 setup can only be achieved by entering the password, thereby entering setup mode. The password is 123.

## 5.3.4 Test Procedure Menus

Test procedure allows you to customize the test to your specific needs and has several sub screens which follow.

<b>CONTINUOUS TONE</b>	<b>ON</b>
<b>MANUAL TEST</b>	<b>ON</b>
<b>SETUP TYPE</b>	<b>STANDARD</b>
<hr/>	
<b>◀ ▶ - Change Setting</b>	<b>▲ ▼ - Change Field</b>
<b>↵ - Setup Menu</b>	<b>MENU - Setup Menu</b>

CONTINUOUS TONE selects pulsed when OFF, or continuous tone stimulus when ON. Select MANUAL TEST ON to allow individual frequencies to be manually retested after a completed automatic test. SETUP TYPE selects the type of test to be used in the automatic testing mode. There are four types of tests that have been stored for use: STANDARD, NO 8K, 10 dB LOW, FAST; plus two user definable tests. The STANDARD test allows testing of all frequencies and 1 retest frequency at 1kHz in the left ear.



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Note that if the ear is changed to start in the right ear the retest frequency also changes ears. The lower test limit is 00 dB<sub>HL</sub> and the upper limit is 95 dB<sub>HL</sub>. All start levels are set at VSL (variable start level, see following for an explanation) except for the first frequency in each ear which is set at 40 dB<sub>HL</sub>. NO 8K is the same type test except 8KHz is not tested. 10 dB LOW is the same type test as the standard test except that the lower test limit is set at 10 dB. The FAST test only tests 1,2,4 and 6KHz in each ear with the lower test limit at 10 dB and the upper limit at 95 dB. The user defined tests can be selected by changing the test type to USER1 or USER2 and pressing the ENTER key.

Create your own test procedure using the following screens.

FIRST EAR SETUP								
	1	2	3	4	5	6	7	8
FREQ	1K	500	1K	2K	3K	4K	6K	8K
START	40	VSL	VSL	VSL	VSL	VSL	VSL	VSL
LOWER	00	00	00	00	00	00	00	00

◀ ▶ - Change Setting      ▲ ▼ - Change Field  
↵ - Setup Menu              MENU - Setup Menu

SECOND EAR SETUP								
	1	2	3	4	5	6	7	8
FREQ	500	1K	2K	3K	4K	6K	8K	
START	40	VSL	VSL	VSL	VSL	VSL	VSL	
LOWER	00	00	00	00	00	00	00	

◀ ▶ - Change Setting      ▲ ▼ - Change Field  
↵ - Setup Menu              MENU - Setup Menu



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<b>FIRST EAR: UPPER LIMIT</b>	<b>LEFT 95</b>
<hr/>	
◀ ▶ - Change Setting ↵ - Setup Menu	▲ ▼ - Change Field MENU - Setup Menu

Up to 15 frequencies may be entered. If all frequencies are used this allows one retest frequency to establish repeatability. If fewer frequencies are used, more retest frequencies can be used, one for each ear. The START LEVEL determines the level at which that frequency will start. If VSL (Variable Start Level) is selected the test will start at 10dB above the previous threshold (Note: VSL may not be used for the first frequency).

LOWER sets the lower limit for the test. This is the lowest possible dB level that the automatic test will reach if all responses are positive. It can be useful for screening tests to speed up test time. FIRST EAR is the starting ear selected at the beginning of each test. This can be changed at the beginning of each test by changing ears, and it also changes the retest ear. The UPPER LIMIT is the maximum level that the test will increase to; by setting this level low for screening tests, test time will be reduced.

### 5.3.5 Data Transfer

<b>BAUD RATE</b>	<b>1200</b>	<b>HARDWARE HAND.</b>	<b>OFF</b>
<b>PARITY</b>	<b>EVEN</b>	<b>MANUAL TRANS.</b>	<b>OFF</b>
<b>STOP BITS</b>	<b>2</b>		
<b>XON/XOFF</b>	<b>OFF</b>		
<hr/>			
◀ ▶ - Change Setting ↵ - Setup Menu	▲ ▼ - Change Field MENU - Setup Menu		

The computer interface connector is used to connect the MA 790 through a cable to any RS-232C serial data port on a computer. The data sent is asynchronous ASCII with selectable baud rates from 110 to 9600. Parity can be selected as even, odd, or none. Stop bits can be selected as 1 or 2. XON/XOFF selected ON inserts an XON character (DC2) and XOFF character (DC4) at the beginning of each test (see section 12 for more information). Hardware handshaking ON or OFF activates or deactivates use of the CTS/RTS communication lines. MANUAL TRANSMIT selected ON allows the test results to be sent over the interface when the ENTER key is pressed at the end of the test.



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## 5.4 Daily Calibration Menu

To do a daily calibration check highlight DAILY CAL. from the MA 790 MAIN MENU and press the ENTER key. Make sure the artificial patient (ME 500 Bioacoustic Calibrator) is connected properly or that the person to be tested is ready. Press the START key to begin the test. If a NR (no response) occurs on the first frequency being tested, the test will abort and instruct you to double check the cable connections plugged into the back of the MA 790.

<b>1000 Hz</b>	<b>RESPONSE</b>	<b>STYMULUS</b>	<b>40 dB HL</b>				
<b>FREQ (Hz)</b>	<b>500</b>	<b>1K</b>	<b>2K</b>	<b>3K</b>	<b>4K</b>	<b>6K</b>	<b>8K</b>
<b>LEFT (dB)</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>
<b>RIGHT (dB)</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>00</b>
<b>- DAILY CALIBRATION -</b>							
<b>START - Start Test</b>				<b>EXIT - Main Menu</b>			



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## 6.0 TEST PROCEDURES

### 6.1 Environment

Proper test environment is essential for obtaining valid and reliable hearing thresholds. Ensure that your testing area is quiet and free from audible and visual distractions.

### 6.2 Pre-test Preparation

- A. Seat your subject comfortably in a chair near the MA 790. To ensure that responses are based on tone stimuli and not visual clues, face the subject away from the audiometer.
- B. Instruct your subject that a short series of three pulsing tones will be heard, i.e. "beep-beep-beep", or one long beep if using continuous tone. Each time the "beeps" are heard, the subject should press and then release the button on top of the patient response switch. Manual operation of the instrument may be used to familiarize the subject with the sound of the tone.

**IMPORTANT: STRESS THAT YOU ARE TRYING TO ASCERTAIN THE LEAST AUDIBLE SOUND THE SUBJECT CAN HEAR. IF THE SUBJECT THINKS A TONE IS HEARD, BUT IS NOT CERTAIN, A RESPONSE SHOULD BE MADE BY PRESSING AND RELEASING THE SWITCH RATHER THAN WAITING FOR THE TONE TO BECOME LOUDER.**

- C. If the subject is wearing glasses or hearing aids, remove them. Put on and adjust the earphones and headband carefully, making certain that the openings on the earphones are in line with the subject's ear canals. Be certain to put the **red** earphone on the **right** ear and the **blue** earphone on the **left** ear.
- D. To conduct an automatic test, see Section 7. To conduct a manual test, turn to Section 8.



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## 7.0 AUTOMATIC TESTING

### 7.1 Test Procedure

When all informational data has been entered into the MA 790 and pretest instructions have been given, press the START key. The test will begin at the starting test frequency, at the starting level in the selected ear.

**To activate the talkover microphone, press the RIGHT and LEFT keys simultaneously. Press the STOP key when completed.**

The test will proceed as programmed and will continue unless the retest frequencies are not within 5 dB<sub>HL</sub> of each other. If they are, the better threshold will be recorded, and the test will continue. If they are not within 5 dB of each other, the audiometer will sound the alarm, and an invalid retest message will be displayed on the screen. Press any key to turn off the alarm.

Clarification of instructions should be given to the subject, and the test can then be continued or stopped.

The following is an example of an audiogram printout that was rejected because the 1000 Hz threshold was not repeatable.

L	1K	40+30+20+10-15-20+10-15-20+	Thresholds at 1000 Hz are not within 5 dB of each other
L	.5K	30+20+10+00+00+	
L	1K	10+00-05+00+00+	
KHz	L	R	
.5	NT	00	Better of two 1 KHz thresholds is put on the printout
1	NT	00	

Message "Invalid Retest" is displayed on the LCD with "Start to Continue" and "Stop to Quit".

The MA 790 audiometer considers a threshold to have been established when the following steps have been accomplished in the order listed.

1. A positive response (subject response switch pressed within 2 seconds of the onset of the stimulus).
2. A negative response (subject response switch not pressed within 2 seconds of the onset of the stimulus).
3. At least two positive responses at one level. OHL requires two positive responses, all others require three.

(Because of the "down 10, up 5" nature of the test program, this test method requires several crossings of the threshold except at OHL).



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Once the programmed retest frequencies have been matched within 5 dB of each other, the best level will be recorded and the test will continue. The remaining programmed frequencies will be tested in the programmed order. Problems encountered during any of these threshold tests (see automatic test result codes, section 7.4) will cause the audiometer to test the next frequency at the completion of the test. Only problems that are encountered twice will be reported in the final audiogram.

In all tests, if the subject does not respond to the first stimulus by pressing the subject response switch, the stimulus will increase by 20 dB until the subject responds or 95 dBHL is reached. Following that response, all stimulus increases are in 5 dB steps, decreases in 10 dB steps. At the completion of each threshold determination, the printer is activated, and prints a record of each stimulus presentation and the subject's response to that presentation. If Print After Test or Print on Command was selected in setup, then it stores all information until the end of the test. This important information provides a permanent record of the actual test procedure for medical or legal purposes.

The STOP key can be used at any time during the test. Should an unexpected interruption occur, simply depress STOP and the test will stop until you press START to resume testing. A paused test is indicated by the message "Automatic test paused" displayed on the display. To abort the test press the STOP key twice.

Upon completion of the automatic test an alarm is sounded, unless the alarm is turned off using SETUP options. Press any key to turn off the alarm. Test results will automatically be printed unless Print On Command was selected during setup. In that case, the PRINT key must be pressed. For additional printouts, press the PRINT key. If you have a MA 790 RS, press the ENTER key to transmit the test results over the serial interface.

## 7.2 Simplified Automatic Test Summary

- A. Turn rear panel power switch ON.
- B. Highlight AUDIOMETER, press ENTER.
- C. Enter subject identification data by pressing the desired upper case characters.
- D. Press the up/down arrow keys to scroll through the selections in the subject identification data screen.
- E. Press ENTER again and the audiometer will show the TEST screen. Conduct a manual test at this time, if desired.
- F. Press START to start the automatic test.  
If interruptions occur during testing, press STOP to pause the test. Press START to resume, or STOP again to abort the test.
- G. At the end of a test, press any key to turn the alarm off. The alarm is a selectable item.



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## 7.3 Test Result Codes

Below are examples of codes that may appear on an audiogram printout.

CODE	CAUSE	EXAMPLE
NT (Not Tested)	Frequency has not been tested	TEST RESULTS KHZ L R .5NT NT NT
MR (Multiple Response)	Patient Response Switch was pushed more than once between the onset of two adjacent stimulus become an error.	L 1K 40+30+ 20-25 25 KHZ L R .5 NT NT
NR (No Response)	Failure to respond at 95 dB <sub>HL</sub> , or failure to release the response switch.	L 1K 40-60-80-95-95 KHZ L R .5NT NT NT 1 NR NT
SE (Subject Error)	Failure to establish threshold at a given frequency within 16 tone presentations	L 1K 40+30+20+10+00+ 00-05-10-15-20-25- 30-30-40-45-50+45+ KHZ L R .5 NT NT 1 SE NT

Any test result code (except "NT") which occurs prior to matching the retest frequency thresholds will sound the signal alarm, and terminate the test. After matching the retest frequency thresholds, the codes "MR", "SE" or "NR" will appear only if the subject responds incorrectly during the test and the retest. The retest helps to ensure that the incomplete test was a true error, rather than an unintentional mistake by the subject.



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## 8.0 MANUAL TESTING

### 8.1 Test Procedure

Occasionally you will encounter a difficult-to-test subject. It may be necessary to establish one or more thresholds or perform the entire test in the manual mode.

The test should be performed using the standard "Ascending /Descending" method. After all the informational data has been entered into the MA 790, and pretest instructions have been given, proceed with the following steps to do manual testing.

**To activate the talkover microphone, press the RIGHT and LEFT keys simultaneously. Press the STOP key when completed.**

1000 Hz	RESPONSE	STYMULUS	40 dB HL
FREQ (Hz)	500	1K	2K 3K 4K 6K 8K
LEFT (dB)	00	00	00 00 00 00 00
RIGHT (dB)	00	00	00 00 00 00 00
<b>START - Start Test      STOP - Stop Test</b> <b>MENU - Next Subject</b>			

- A. Press **ENTER** from the Subject Information screen to enter the AUDIOMETER test screen.
- B. Press desired **FREQUENCY** key. Note actual frequency on the LCD screen.
- C. Select desired intensity level. Increasing the intensity level is accomplished by pressing the **▲** key. The intensity will increase in 5 dB steps. To decrease the intensity level press the **▼** key. The level will decrease in 10 dB steps.
- D. To present the test stimulus, momentarily press and release the **STIM** stimulus key. The tones will be presented to the subject.
- E. Watch the **RESPONSE** light to see if the subject has responded to the stimulus.

**IMPORTANT! DO NOT GIVE YOUR SUBJECT VISUAL CLUES WHEN TESTING OR PRESENTING THE STIMULUS BY MOVING YOUR HEAD, EYES, OR HANDS.**

- F. When the subject has met the threshold criteria, select the next desired intensity level and frequency. Continue testing both ears as required.
- G. When the test is completed, save desired threshold levels with the SAVE key. This stores the test in the audiometer's memory for later recall if Automatic Test Store is selected. Press the PRINT button and the results will be printed out. The printout will not contain the subjective data that appears in "Automatic" testing. Press the ENTER key to transmit the test results over the serial interface.



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## 8.2 Simplified Manual Test Summary

- A. Turn rear panel power switch on.
- B. Press ENTER at the highlighted AUDIOMETER.
- C. Enter the subject identification data by pressing the desired characters. Press ENTER.
- D. Press ENTER to enter Test Screen.
- E. Manual testing can now be started by selecting the desired phone, frequency and intensity.
- F. Present the stimuli by pressing the STIM switch and store the thresholds for each frequency by pressing the SAVE key when finished.
- G. Press PRINT for copy of test results.
- H. Press the ENTER key to transmit the test results over the serial interface.



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## 8.3 Test Printout Example

ID# :

SUBJECT:

X\_\_\_\_\_

DATE: 1/ 6/ 0  
TIME: 5:48 AM  
BIRTH DATE: / /  
SEX:  
TECH. ID: 222222222  
JOB NUMBER:  
DEPARTMENT:  
LOCATION: 555555  
EXPOSURE:  
PROTECTOR:

L .5 40+30 30  
L 2K 40 40  
L 3K 40 40  
L 4K 40 40  
L 6K 40 40-60-80-95-  
95-  
L 8K 40-60+50-55-60+  
50+40+30+20+10+  
0+ 0- 5-10-15-  
20-  
R .5 40-60-

TEST RESULTS

TEST

KHZ L R

.5 MR NT  
1 40.NT  
2 MR NT  
3 MR NT  
4 MR NT  
6 NR NT  
8 SE NT

. - MANUAL TEST  
NT - NOT TESTED  
SE - SUBJECT ERROR  
MR - MULT. RESPONSE  
NR - NO RESPONSE

### AUDIOGRAM

00 20 40 60 80  
I I I I I

8K

6K

4K

3K

2K

1K

.5

I I I I I  
00 20 40 60 80

LEFT-X RIGHT-0

MAICO MA790 SN 54321  
CALIBRATED 1-13-98  
CAL. DUE 1-13-99  
ANSI S3.6-1989

!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!

EXAMINER

X\_\_\_\_\_



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## 9.0 PRINTER

### 9.1 Operation

The MA 790's quiet thermal printer provides a convenient means of retaining a record of your test results. To obtain manual test results, depress PRINT when the test is completed. Results from automatic testing can be selected to print automatically at the conclusion of a completed test. Additional copies may be obtained by pressing the print key.

### 9.2 Paper Installation

Remove the printer cover by pressing on the rear of the printer compartment door. The door will pop up when the latch is released, allowing access to the printer. Remove the spindle and place the paper onto the spindle. Replace the spindle so that the paper unrolls from the **bottom** of the roller. Insert the free end of the paper under the black rubber roller and press the PRINT key until the paper thread through. If additional paper centering on the roller is required, re-cut the paper and try again. Feed the end of the paper through the slot in the printer cover. Replace the printer cover and push down on the rear of the cover to lock it into position.

### 9.3 Paper Specification

The paper used in the MA 790 is thermal sensitive. For best results use 3M type 1900 thermal paper or equivalent. The roll should be 2.5" wide, with a maximum diameter 3.0". These rolls are available through your Maico Special Instrument Distributor and can be ordered using Maico part number 5496. The readability of this paper will remain stable well in excess of ten years under normal storage conditions of 70° F and 50% relative humidity.



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## 10.0 CARE AND MAINTENANCE

The MA 790 was designed and constructed to provide years of accurate audiometric testing. To ensure accurate performance, proper care must be given.

- A. Handle the headset carefully. If the receivers are snapped together or dropped, calibration may be affected.
- B. Remove cords by holding the base of the jacks. DO NOT DISCONNECT THEM BY PULLING ON THE CORDS.
- C. Have your MA 790 re-calibrated once a year by an authorized Maico Special Instrument Distributor. This is necessary to keep your warranty valid. More importantly, it protects your company, and it's employees through accurate testing.



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## 11.0 MA 790 RS-232 COMPUTER INTERFACE INFORMATION

### 11.1 RS-232 Configuration and Operation

The computer interface connector is used to connect the MA 790 to any RS-232C standard data communication equipment. The data is sent serial, 7-bit ASCII, with user selectable baud rates from 300 to 9600, even, odd or no parity and 1 or 2 stop bits, all controlled from a setup menu. Handshaking is also user selectable between X-on and X-off handshaking, or hardware handshaking (RTS, CTS). The audiometric data consists of all of the test data and some of the associated data. See MA 790 Data Output, Section 11.3 below.

### 11.2 Interface Configuration

The MA 790 is configured at the factory as a DCE operating at 1200 baud, even parity, 7 data bits and 2 stop bits. The hardware signals used are listed below:

RS 232	
<u>PIN NO.</u>	<u>SIGNAL</u>
5	Chassis Ground (CG)
2	Transmit Data (TD)
3	Receive Data (RD)
8	Request to Send (RTS)
7	Clear To Send (CTS)
6	+12V (DSR)



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## 11.3 MA 790 Data Output

The results of each automatic test can be transmitted by the MA 790 to an external device. If MANUAL TRANSMIT is selected ON in the setup mode (data transfer, section 5.4.5), pressing the ENTER key will transmit the test results over the serial interface in the same format as the remote control "D" command (see below). Otherwise the MA 790 must be operated under remote (computer) control.

The remote control commands are listed below:

1. The "D" command is used to get the test results from the MA 790 to the computer under control. This command works in the manual mode or at the end of a completed automatic test. If used at the end of 2 rejected tests the MA 790 will send out the subjective data (same format as on printout) so it can be determined from the keyboard why the tests were rejected. The following data stream is the data sent when prompted to do so, from the manual or test complete mode.

ABCCCCDDDDDEEEEEEEEGGHHJJKLLMMNPPQRRSSTTUUVWXYZ

The 23 fields are defined as follows:

A:	Control R (ASCII DC2)
B:	Space
C:	Serial Number
D:	Date
E:	Employee Social Security Number
F:	Calibration Date
GG:	Threshold, Left Ear 500 Hz
HH:	Threshold, Right Ear 500 Hz
JJ:	Threshold, Left Ear 1KHz
KK:	Threshold, Right Ear 1KHz
LL:	Threshold, Left Ear 2KHz
MM:	Threshold, Right Ear 2KHz
NN:	Threshold, Left Ear 3KHz
PP:	Threshold, Right Ear 3KHz
QQ:	Threshold, Left Ear 4KHz
RR:	Threshold, Right Ear 4KHz
SS:	Threshold, Left Ear 6KHz
TT:	Threshold, Right Ear 6KHz
UU:	Threshold, Left Ear 8KHz
VV:	Threshold, Right Ear 8KHz
W:	Control T (ASCII DC4)
X:	Line Feed
Y:	Carriage Return



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## 2. "O" - On Line

The "O" command is used to put the MA 790RS under remote control. The instrument will respond by transmitting its serial number back to the computer.

## 3. "E" - Enter

The "E" command has exactly the same function as the ENTER key on the keyboard. It can be used to move from entering the date, ID number, start an automatic test, pause the test or restarts a rejected test.

## 4. "S" - Stop

The "S" command has the same function as the stop key on the keyboard. It can be used to stop a test in progress, go to manual retest mode if manual retest option is selected or go to ID mode. It can also be used to clear ID# in ID mode.

## 5. "P" - Print

The "P" command is used to generate a printout of the test results on the MA 790RS printer. This command may be used in the manual mode, after a rejected or completed test.

## 6. "Q" - Status

The "Q" command causes the instrument to respond with a character which identifies the current machine status.. The external computer can therefore use this command to monitor audiometer operation. The various responses to the "Q" command are as follows:

- a. "D" - ready for date and time entry, 10 characters
- b. "I" - ready for ID entry, 9 characters
- c. "M" - manual test mode
- d. "SE" - subject error in manual test mode
- e. "PR" - patient responded in manual mode
- f. "A" - automatic test in progress
- g. "H" - automatic test is paused
- h. "R" - rejected automatic test
- i. "C" - completed automatic test

## 7. "X" - Sign Off

The "X" command will abort any function in progress (except printing) and return the MA 790 to the date entry mode. The audiometer can then be used under remote control by issuing serial commands or local control by using the keyboard.



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8. "V" - Stimulus

The "V" command has the same functions as the stimulus key on the keyboard. It can be used to present the stimulus in the manual mode or to continue a rejected test.

9. "U" - +5 dB

The "U" command raises the HL level 5 dB in the manual mode when entered.

10. "Y" - -10 dB

The "Y" command lowers the HL level 10 dB in the manual mode when entered.

11. "T" - Manual Mode Status

The "T" command is a request for status of the MA 790 in the manual mode. It sends to the computer the HL, ear and frequency.

12. "1" - 1KHz

When in the manual mode the "1" command changes the frequency to 1KHz. In the date or ID entry mode it is a numerical value.

13. "2" - 2 KHz

When in the manual mode the "2" command changes the frequency to 2 KHz. In the date or ID entry mode it is a numerical value.

14. "3" - 3 KHz

When in the manual mode the "3" command changes the frequency to 3 KHz. In the date or ID entry mode it is a numerical value.

15. "4" - 4 KHz

When in the manual mode the "4" command changes the frequency to 4 KHz. In the date or ID entry mode it is a numerical value.

16. "5" - 500 Hz

When in the manual mode the "5" command changes the frequency to 500 Hz. In the date or ID entry mode it is a numerical value.

17. "6" - 6 KHz

When in the manual mode the "6" command changes the frequency to 6 KHz. In the date or ID entry mode it is a numerical value.



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18. "7" - R/L

When in the manual mode the "7" command has the same function as the it does on the keyboard — it changes right or left phones. In the date or ID entry mode it is a numerical value.

19. "8" - 8 KHz

When in the manual mode the "8" command changes the frequency to 8 KHz. In the date or ID entry mode it is a numerical value.

20. "9" - Store

When in the manual mode the "9" command has the same function as the STORE key on the keyboard. In the date or ID entry mode it is a numerical value.

