



**ETYMÖTIC  
RESEARCH, INC.**

CALIBRATION MANUAL

**ER36 XP Color Calibration Manual**

Effective Date: **2014-02-06**

Doc. No. **036-CAL-02**

Rev. **1.00**

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# 036 Series Hearing Test Instrument Calibration Manual




**036-CAL-02 XP Color Cal Manual Revision 1.00**

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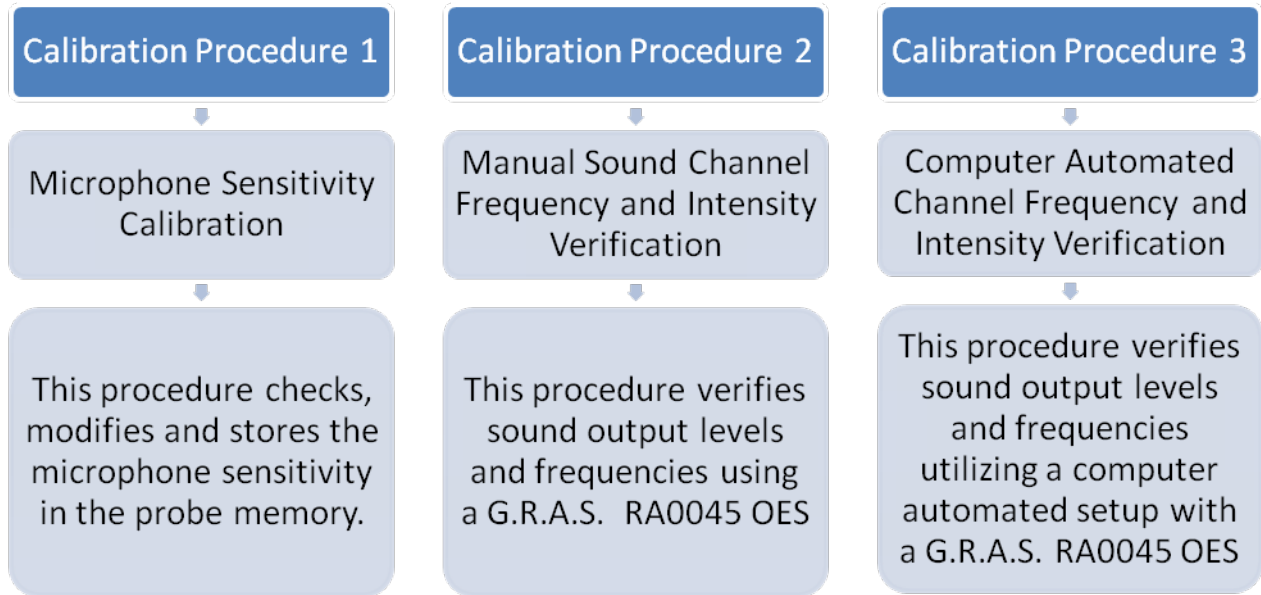
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## 2. Revision History

Date	Revision	Comments / ECN	Preparer
2/6/2014	1.00	Original	DAD



### 3. Procedures Summary



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## 4. CALIBRATION of the ERO-SCAN XP Color Instrument

Field Service and/or Calibration must be performed by an authorized service provider. Service may only be performed by an authorized service provider. The warranty will be voided if the handheld instrument, external probe, cradle, or printer is opened by non-qualified personnel. Use of unauthorized replacement parts will void the warranty and may result in erroneous operation. In order to maintain the quality operation of the instrument the procedures used for testing must be performed exactly as described in this manual.

Please verify that the calibration manual being used is the most current revision available. If problems are encountered that are not described in this manual the device must be returned to an authorized service provider for repair.

**NOTE: Always use a clean (no obstructions) probe tube when performing any of the calibration procedures. Also, make sure that the Probe Tube Adapter is clean and free of any foreign material that could cause an acoustic occlusion or leak.**



Figure 1 – Probe, DP0774, 4231



Figure 2 – G.R.A.S. RA0045 & ER036355R

## CALIBRATION PROCEDURES

The following test procedures explain how to test for normal operation of the OAE screener. These procedures must be completed after any servicing of the instrument. It is recommended to perform these measurements in a quiet environment (less than 60 dBA) due to the low levels involved. The test procedures must be performed exactly as outlined and with the exact same (or equivalent) equipment, which is listed below. If there is any question on the validity of the function of any instrument, document the service procedures performed and return the instrument to an authorized service provider for repair.

## 5. Equipment Required

- 1 Bruel & Kjaer Sound Level Calibrator Type 4231 (4231 calibrator)
- 1 Bruel & Kjaer DP0774 1/8" Microphone Adapter Insert (DP0774 adapter)
- 1 G.R.A.S. RA-0045 60318-4 (formerly IEC-60711) type Occluded Ear Simulator (OES or RA-0045 coupler)
- 1 True RMS Digital Multi-Meter (alternate: Sound Level Meter [SLM] with 1/2" mic connector and/or Direct input)  
**NOTE: It may be helpful to use a (1/3<sup>rd</sup> octave) band pass filter, set to pass the signal of interest.**
- 1 ER036355R Stainless Steel Probe Tube Adapter (PTA) for use with RA0045 OES


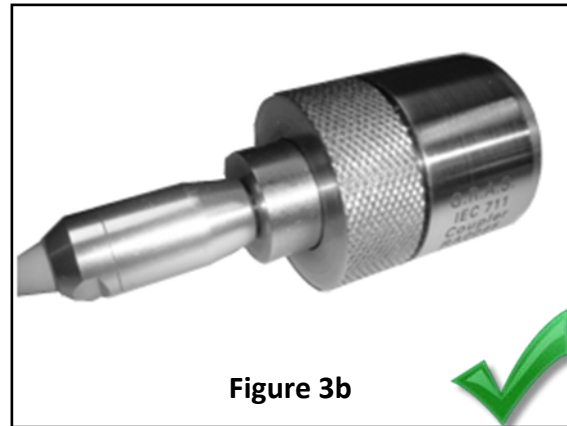
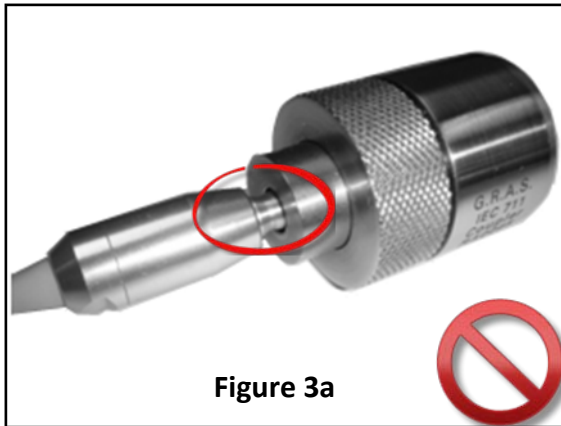
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Figure 1 shows a correctly inserted probe with probe tip and DP0774 adapter in a 4231 calibrator. Figure 2 shows a G.R.A.S. RA0045 IEC-60711 type Occluded Ear Simulator acoustic coupler and substitution of a ER036355R Probe Tube Adapter (PTA) in place of the canal extension provided from G.R.A.S. See Figure 3b for the correct insertion of probe tubes into a RA0045 coupler PTA. Figure 3a shows incorrect insertion. The probe will snap into the coupler adaptor when fully seated.




**Figure 3 - Proper Probe Insertion into Coupler Adapter**

## 6. Equipment Setup

Connect the RA0045 coupler microphone to the preamplifier cable and power supply, measuring amplifier or SLM. Connect the ac output to the DMM (or read directly from the SLM). Use the individual calibration sensitivity for the ½" pressure microphone (40AG) in the RA0045 to adjust the measurement chain calibration sensitivity to read in dB SPL. e.g. If the 40AG sensitivity is 15.9 mV/Pa, a measurement of 5.0 mV RMS would indicate 84 dB SPL.

NOTE: All calibration limit values are expressed in dB SPL unless otherwise noted.

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## 7. Calibration Procedure 1 - Microphone Sensitivity Calibration

*This procedure is used to calibrate the microphone sensitivity at 94 dB SPL produced by the B&K 4231 calibrator.*

The external probe retains an offset value in EEPROM. This allows external probes to be shared or exchanged at will between host handheld instruments with no re-calibration required.



- Step 1)** Always attach the probe before turning the instrument on. Place the ERO-SCAN in diagnostic mode by following the instructions given in [Appendix A: ERO-SCAN Navigation to Diagnostic Mode](#). Once you see the diagnostics menu press the right arrow until the "Adjust Mic Gain" screen appears (see figures above).
- Step 2)** Press the down arrow to enter the calibration mode. Turn on the sound level calibrator and allow it time to settle per the manufacturer instruction. Insert the probe tip into the 1/8" insert of the sound level calibrator until it stops and hold it there during the calibration process. (see figure above) The display on the ERO-SCAN instrument will indicate three different readings. The RAW reading is the actual un-calibrated reading that the ERO-SCAN is measuring. The CAL reading is what the ERO-SCAN should display after the calibration factor is applied, hence this value should always be 94 dB in a calibrated 94 dB SPL sound level calibrator. The ERR reading is the calibration factor that the ERO-SCAN uses to obtain the correct reading (this is the offset value stored in EEPROM in the probe).
- Step 3)** Hold the unit stable for a moment and press the down arrow key to set the sensitivity. The next screen will display the old and the new calibration factors.
- Step 4)** Press either the left or right arrow keys to save the calibration factor. If the next screen displays "Mic Gain Saved", then press the down arrow to get back into the diagnostic programs menu. The ERR reading must be in the range of +/- 3dB, if the reading is out of this range, then the screen will display "Mic Failed". If this occurs repeat steps 1 through 4. If the ERR reading is still out of range, then the probe may need servicing. Document the condition and contact an authorized service provider for recommendations.
- Step 5)** Repeat steps 1 through 4 to check the calibration setting. If the displayed level is within a fraction of a dB of the calibrator output, press the down arrow key to exit the test. If the instrument does not display a stable reading, repeat steps 1 through 5 with a different calibrator. If the problem persists, the instrument needs to be serviced.

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## 8. Calibration Procedure 2: Manual Sound Channel Frequency and Intensity Verification with a G.R.A.S. RA0045 OES

*This procedure is used to determine whether the frequency response is within the specifications stated in the tables below.*

- Step 1)** Insert probe tip into the stainless steel probe tube adapter until it stops (See *Figure 3 above*). Setup the equipment as shown in the *figure* below.
- Step 2)** Place the ERO-SCAN in diagnostic mode by following the instructions given in [Appendix A: ERO-SCAN Navigation to Diagnostic Mode](#). Once you see the diagnostics menu press the right arrow until the "Calibrate Mode" screen appears.
- Step 3)** Press "Enter" by using the down arrow to enter the calibration mode. Use the up and down arrow keys to increment and decrement the frequency. Record the frequency and magnitude measurements from the DMM, Measuring Amplifier or SLM at each frequency.
- Step 4)** Compare the obtained frequency and magnitude results to the ranges in the table below. If the results are out of range then change the probe tube and repeat steps 1 through 3. If the readings are still out of range the instrument needs to be serviced.



**Probe Calibration Setup**

**Frequency and Intensity with G.R.A.S. RA0045 OES**

Output Frequency (Hz)	Minimum Frequency (Hz)	Maximum Frequency (Hz)	Minimum Magnitude (dB SPL)	Maximum Magnitude (dB SPL)
732.4	727	737	<b>83</b>	<b>93</b>
1037.6	1033	1043	<b>85</b>	<b>95</b>
1464.8	1460	1470	<b>88</b>	<b>98</b>
2075.2	2070	2080	<b>92</b>	<b>102</b>
2929.7	2925	2935	<b>92</b>	<b>102</b>
4150.4	4145	4155	<b>85</b>	<b>95</b>
5859.4	5855	5865	<b>76</b>	<b>86</b>

## 9. Calibration Procedure 3: Computer Automated Channel Frequency and Intensity Verification with a G.R.A.S. RA0045 OES

*An alternative to Calibration Procedure 2, this procedure is used to determine whether the frequency response is within the specifications using a computer automated method.*

Instructions for use of the Field Service Software are available in the “Erotest Test Suite User Manual” (#036-USE-04).

When executed correctly, the DPOAE and TEOAE based software programs will take control of the connected handheld instrument, perform multiple tests and return a result page with pass/fail flags for each of four test types. All four test types must result in a “PASS” in order for the Device Under Test to be considered to have passed this stage of testing.


## 10. Calibration Procedure 4 – Set Calibration Date

*This procedure is used to set the calibration due-date for the remote probe.*

After calibrating the remote probe a calibration due-date can be specified and saved to the probe using the SET CAL DATE function.



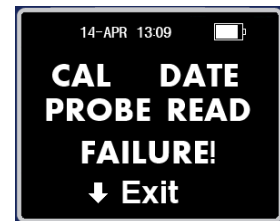
**Step 1)** Attach the probe before turning the instrument on. Place the instrument in diagnostic mode by following the instructions given in [Appendix A: ERO-SCAN Navigation to Diagnostic Mode](#). Once you see the “REMOTE PROGRAM” screen press the right arrow until the “SET CAL DATE” screen appears (see figures above).

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**Step 2)** Press the down arrow to enter the “CAL DATE” mode. The left and right arrows will scroll through the 4 ranges: 6 months, 1 year, 18 months and 2 years. When a choice is made press the down arrow to SET the date. The “CAL DATE SAVED” screen will appear and the down arrow can again be selected to Exit this mode.

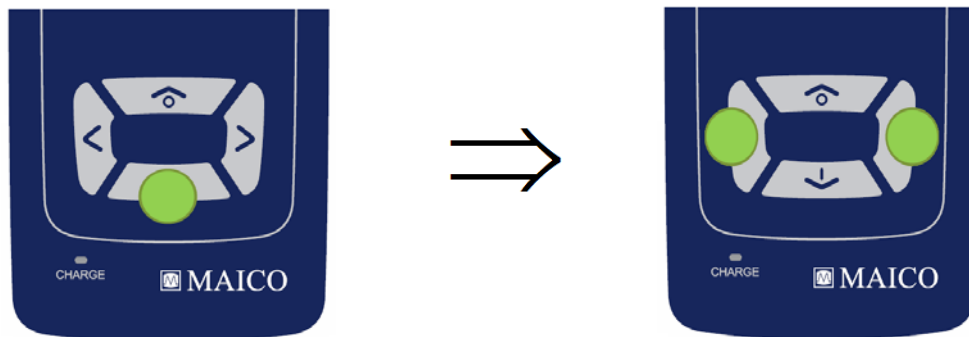
**NOTE:**

- 1.) The choice “OFF” can be selected to disable the calibration due-date checking function.
- 2.) The instrument will display a “DUE FOR SERVICE” screen daily after the due-date until the calibration date is reset.
- 3.) A “PROBE READ FAILURE” screen will appear when setting the calibration date if there is a problem accessing the probe. Check the probe connection to the instrument and repeat the process at Step 1. If the problem persists, the instrument needs to be serviced.

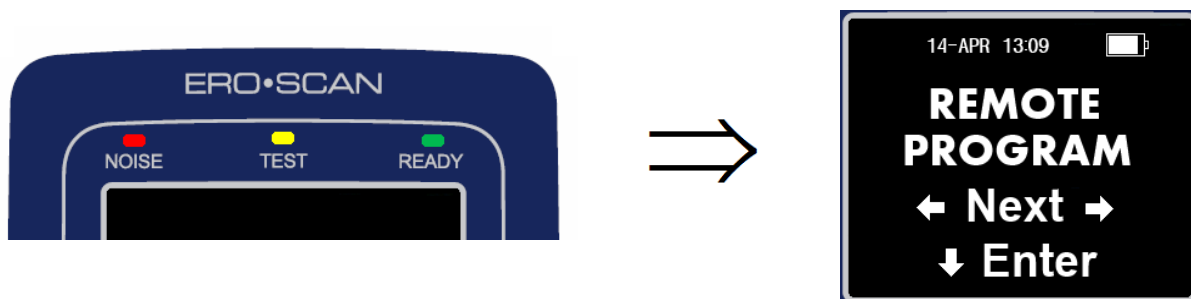


## 11. Appendix A – ERO·SCAN Navigation to Diagnostic Mode

**Step 1)** Always attach the probe before turning the instrument on. Place the ERO·SCAN in diagnostic mode by pressing the down arrow key, and then immediately press and hold the left and right arrow keys.



**Step 2)** If the key sequence was performed correctly the “NOISE”, “TEST” and “READY” LED’s will simultaneously illuminate. After releasing the keys, the LCD screen should display the “Diagnostic Test Programs” for a brief moment and then “REMOTE PROGRAM”.



**Step 3)** If this message does not appear, turn the unit off by pressing the up arrow and repeat the key sequence



## 12. Appendix B – Reference Data

### NOMINAL SOUND CHANNEL SOURCE MAGNITUDES

As measured using RA-0045 = G.R.A.S. IEC 60711 type Occluded Ear Simulator

**Table 4: Probe Nominal Sound Channel Magnitudes in dB SPL**

FREQUENCY	IEC 60711 RA-0045
<b>732.4</b>	88.0
<b>1037.6</b>	90.0
<b>1464.8</b>	93.5
<b>2075.2</b>	97.8
<b>2929.7</b>	97.8
<b>4150.4</b>	90.6
<b>5859.4</b>	81.9

## 13. Appendix C – Real Ear Testing

At any time instrument operation is suspect, testing of real ears with known pathology, or lack thereof, should be used to verify system operational integrity. We strongly suggest maintaining a Device History Record file of all tests performed on an instrument. These may be referenced and comparisons made against future records.