AQ-347

TECHNICAL MANUAL

INSTRUMENT CALIBRATION PROCEDURE

DIGITAL MULTIMETER

WAVETEK
1271
WITH OR WITHOUT
OPT12 OR 20

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LIST OF EFFECTIVE PAGES

The purpose of this list is to identify the pages in this document affected by any technical content changes made since the previous release of the document.

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SECTION 1

INTRODUCTION AND DESCRIPTION

1.1 This procedure describes the calibration of the Wavetek 1271 Digital Multimeter with or without OPT12 or 20. The instrument being calibrated is referred to herein as the TI (Test Instrument).

1.2 All comments concerning this procedure should be directed to the Measurement Science Department, Corona Division, Naval Surface Warfare Center, P.O. Box 5000, Corona, CA 92878-5000.

1.3 This procedure includes tests of essential performance parameters only. Any malfunction noticed during calibration, whether specifically tested for or not, should be corrected.

1.4 The TI is not calibrated to 1 MHz above 10 V and not calibrated over 500 V. It is calibrated using the manufacturer's 12 month specifications. This is an NSWC Measurement Science Department (MSD) assigned tolerance.

1.5 It should be noted that the specifications cited below, in Table 1, are for the Fluke 8505/8506 series digital multimeters (unless noted otherwise). Since the Fluke specifications were the "procurement specifications" for the Wavetek 1271 (TI), a SPECIAL CALIBRATION tag shall be affixed to the TI, upon completion of calibration, indicating that the TI was calibrated to the (12 month) Fluke 8505/8506 specifications. This is an NSWC/MSD assigned specification.

Table 1. Calibration Description

TI Characteristics	Performance Specifications	Test Method
Direct voltage	Ranges: 100 mV, 1, 10, 100 and 1000 V dc Tolerances: 100 mV: ±(0.00403% iv + 90 counts) 1 V: ±(0.0024% iv + 9 counts) 10 V: ±(0.0019% iv + 9 counts) 100, 100 V: ±(0.00297% iv + 9 counts)	Tested with a voltage measurement system containing a voltage divider, reference divider, and DC voltage standard.
Resistance	Ranges: 10, 100 Ω, 1, 10, 100 kΩ, 1, 10, 100 MΩ Tolerances: 10 Ω: ±(100 ppm + 20 counts) 100 Ω: ±(60 ppm + 1.4 counts) 1, 10, 100 kΩ, 1 MΩ: ±(60 ppm + 0.8 counts) 10 MΩ: ±(398 ppm + 0.8 counts) 100 MΩ: ±(1004 ppm + 1 count)	Compared with a known resistance.
AC RMS Voltage	Tolerances: 100 mV range: 10 to 40 Hz: ±0.152% iv 40 to 20 kHz: ±(0.035% iv + 5 μV) 20 to 50 kHz: ±0.0825% iv 50 to 100 kHz: ±0.308% iv 10 V range: 10 to 40 Hz: ±0.152% iv 40 to 20 kHz: ±0.025% iv 20 to 50 kHz: ±0.0825% iv 50 to 100 kHz: ±0.308% iv 100 to 200 kHz: ±0.689% iv 200 to 500 kHz: ±2.04% iv 500 kHz to 1 MHz: ±4.49% iv	Compared with known direct voltages by thermal voltage conversion.

TI Characteristics	Performance Specifications	Test Method
AC RMS Voltage (continued)	100 V range: 10 to 40 Hz: ±0.152% iv 40 to 20 kHz: ±0.025% iv 20 to 50 kHz: ±0.0825% iv 50 to 100 kHz: ±0.308% iv 1000 V range: 10 to 40 Hz: $\pm\left[(0.152 + 0.02)\ x\left(\frac{V_{in}}{600}\right)^2\right]$% iv 40 Hz to 20 kHz: $\pm\left[(0.025 + 0.02)\ x\left(\frac{V_{in}}{600}\right)^2\right]$% iv 20 to 50 kHz: $\pm\left[(0.0825 + 0.02)\ x\left(\frac{V_{in}}{600}\right)^2\right]$% iv 50 to 100 kHz: $\pm\left[(0.308 + 0.02)\ x\left(\frac{V_{in}}{600}\right)^2\right]$% iv	

NOTES

1. Volt-Hertz product must be $<10^7$ for the Wavetek 1271.
2. The 500 V range voltage coefficient error is $\left(\frac{V_{in}}{600}\right)^2$ x 200 ppm
3. Slow filter must be used for AC RMS voltage tests below 100 Hz.

SECTION 2

EQUIPMENT REQUIREMENTS

NOTES

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the using laboratory. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

The instruments utilized in this procedure were selected from those known to be available at Navy calibration facilities and the listing by make or model number carries no implication of preference, recommendation, or approval for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in this procedure.

Table 2. Equipment Requirements

Item	Minimum Use Specifications	Calibration Equipment
2.1 Direct voltage measurement system	Range: 10 mV to 1000 V Uncertainties: 100 mV: ±0.003% iv 1 V: ±0.000825% iv (at 1 V) 10 V: ±6 ppm (at 19 V) 100 V: ±0.001% iv (at 100 V) 1000 V: ±0.001% iv (at 1000 V)	Fluke 7105A
Required Components:		
2.1.1 DV source		Fluke 332B or 335A
2.1.2 Voltage divider		Fluke 720A
2.1.3 Reference divider		Fluke 750A
2.1.4 Null detector	Note: Not required if item 2.1.1 is a Fluke 335A (p/o Fluke 7105)	Fluke 845AB
2.1.5 DC transfer standard (ERS)		Fluke 732AAN, 731B
2.2 Alternating voltage source (AV)	Voltage range: 0 to 1000 V ac Uncertainty: based upon a comparison of the output voltage by the TTS (item 2.10) with the direct voltage measurement system (item 2.1) Frequency range: 10 Hz to 1 MHz Uncertainty: based upon a comparison of the output voltage by the TTS (item 2.10) with the direct voltage measurement system (item 2.1)	Fluke 5200A and 5205A
2.3 Resistor, standard	Resistance: 10 Ω, ±0.007%	Leeds and Northrup 4025B
2.4 Resistor, standard	Resistance: 100 Ω Uncertainty: NA (actual value is measured)	Leeds and Northrup 4030B
2.5 Resistor, standard	Resistance: 1 kΩ Uncertainty: NA (actual value is measured)	Leeds and Northrup 4035B
2.6 Resistor, standard	Resistance: 10 kΩ Uncertainty: NA (actual value is measured)	Leeds and Northrup 4040B

Item	Minimum Use Specifications	Calibration Equipment
2.7 Resistor, standard	Resistance: 100 kΩ Uncertainty: NA (actual value is measured)	Electro-Scientific Industries SR1-100K
2.8 Resistor, standard	Resistance: 1 MΩ Uncertainty: NA (actual value is measured)	Electro-Scientific Industries SR1-1M
2.9 Resistor, standard	Resistance: 100 MΩ in 10 MΩ steps Tolerance: ±0.01% iv	Electro-Scientific Industries SR1-1050-10M STEP
2.10 Thermal transfer standard (TTS)	Certified with a Report of Calibration from NPSL	Fluke 540B
2.11 Resistor, standard	Resistance: 1 Ω ±0.003%	Leeds and Northrup 4020B

SECTION 3

PRELIMINARY OPERATIONS

3.1 Ensure that all power switches are set to off, and set all auxiliary equipment controls as necessary to avoid damage to the equipment and so that dangerous voltages will not be present on output terminals when the power switches are turned on.

3.2 Ensure that the following equipment controls are set as follows:

Reference Divider (item 2.1.3)

STD CELL CIRCUIT switch to	OPEN
INPUT VOLTAGE switch to	100 V
OUTPUT VOLTAGE switch to	100 V

ERS (item 2.1.5)

Voltage-Output controls to	V_{ref} (its 10 V Assigned-Reference-Output voltage)

Voltage Divider (item 2.1.2)

Voltage Dials set to	one-twentieth of proceeding V_{ref} : $\frac{V_{ref}}{20}$

Null Detector (item 2.1.4

OPR-ZERO switch to	ZERO
RANGE switch	300 μV (to be changed as required later)

DV Source (item 2.1.1)

POWER switch to	STDBY/RESET
VOLTAGE RANGE switch to	100
OUTPUT DIALS for	22 V
VOLTAGE TRIP vernier to	fully CW
METER switch to	VOLTAGE
CURRENT LIMIT control to	approximately ¼ of fully CW position (about 15 mA)

3.3 Connect the applicable equipment as shown in Figure 1, the reference setup for low voltage tests. Turn the power switches on and allow the setup to warm-up for 1 hour. (During warm-up time, proceed with steps 3.4 through 3.10.)

3.4 Turn the TI power switch to ON.

3.5 Allow the TI to warm-up for 4 hours. Ensure that the TI CAL switch (TI rear panel) is set to DISABLE.

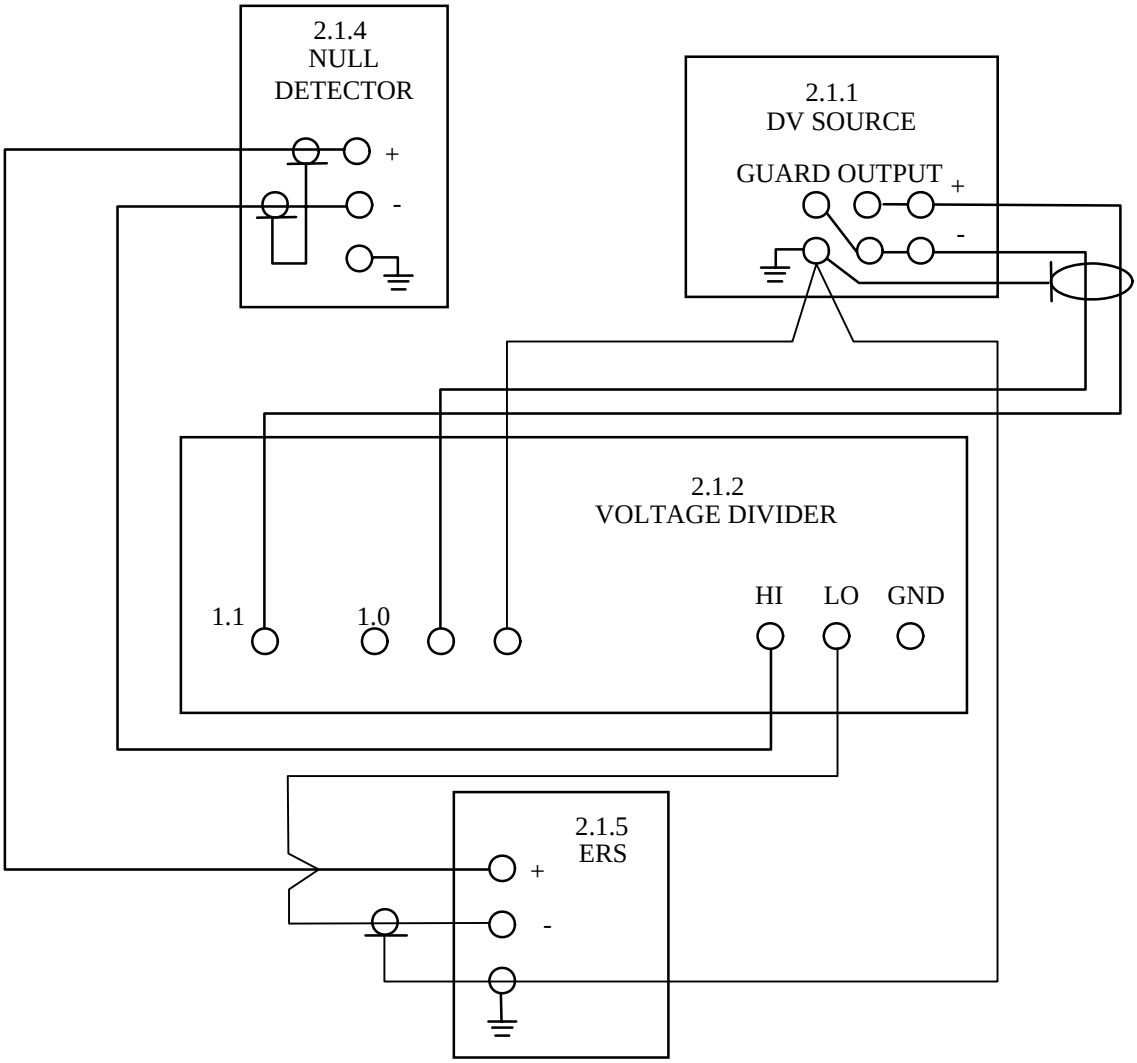

Figure 1. DC Volts Reference Setup (20 V or less)

3.6 Make a copy of the following table. Using the Report of Calibration for the TTS (item 2.10), fill in the values of the ±% AC-DC difference (column 2) that are applicable to the voltage ranges and frequency values listed. For frequencies below 1 kHz, use the 1 kHz AC-DC difference value.

Frequency	TTS Range (1)	±% AC-DC Difference (2)	Correction Factors CF= 0.01X(Column 1)X(Column 2) (3)
10 Hz	1 V		
50 Hz	1 V		
1 kHz	1 V		
20 kHz	1 V		
50 kHz	1 V		
100 kHz	1 V		
1 MHz	1 V		
10 Hz	10 V		
50 Hz	10 V		
1 kHz	10 V		
20 kHz	10 V		
50 kHz	10 V		
100 kHz	10 V		
1 MHz	10 V		
10 Hz	100 V		
50 Hz	100 V		
1 kHz	100 V		
20 kHz	100 V		
50 kHz	100 V		
100 kHz	100 V		
10 Hz	1000 V		
50 Hz	1000 V		
1 kHz	1000 V		
20 kHz	1000 V		
50 kHz	1000 V		
100 kHz	1000 V		

3.7 To complete the chart, fill in the CF (Correction Factor) values by multiplying the following three items: the TTS voltage range, the ±% AC-DC difference, and the value 0.01 (to convert % to decimal). Fill in CF values to 1 μV resolution. For example, if at a TTS Range of 100 V and at a frequency of 20 kHz, a +0.001% AC-DC difference is listed, the CF value is (100)(+0.001)(0.01) = +0.001000 V; if the % AC-DC difference is a -0.001%; the CF value would be (100)(-0.001)(0.01) = -0.001000 V.

3.8 Set all other calibration equipment controls, as necessary, to avoid damage to the equipment and so that dangerous voltages will not be present on output terminals when the power switches are turned on. Connect the equipment to their appropriate power sources, turn all power switches on, and allow a sufficient warm-up time for the equipment.

3.9 Set the null detector (item 2.1.4) OPR-ZERO switch to ZERO. Perform the mechanical or electrical zero adjustments for the null detectors, as required. Electrically zero adjust the null detectors up to their 3 μV ranges; then set null range selectors, as necessary, to avoid damage.

3.10 Measure items 2.4 (100 Ω) through 2.8 (1 MΩ) as described in NAVAIR 17-20AR-29 to establish the nominal values of the standard resistors. Record the measured values as the reference values in step 4.3.6.

SECTION 4

CALIBRATION PROCESS

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 DIRECT VOLTAGE TESTS

4.1.1 Zero Tests

4.1.1.1 Connect a low thermal short to the TI HI and LO terminals. Depress the TI ZERO pushbutton. Wait until the TI BUSY light is extinguished. Depress the TI DCV pushbutton, and depress the RANGE pushbutton to select from the TI RANGE listed in the following table, one range at a time.

4.1.1.2 Verify that the TI indication is within the tolerance limits listed in the following table.

TI RANGE	Nominal (V)	Tolerance Limits (V)
100 mV	0.0000^{-3}	-0.0090^{-3} to $+0.0090^{-3}$
1 V	0.000000	-0.000009 to +0.000009
10 V	0.00000	-0.00009 to +0.00009
100 V	0.0000	-0.0009 to +0.0009
1 kV	0.000	-0.009 to +0.009

4.1.1.3 Disconnect the low thermal short from the TI INPUT HI and LO terminals.

4.1.2 Establish Reference Voltage. Referring to Figure 1, set the DV source power switch to OPR. Adjust the controls of the DV source and the null detector, as necessary, to obtain a reference null on the null detector. The DV source output indication at null should be approximately 22 V.

4.1.3 Taking precautions, disconnect the ERS (item 2.1.5) and the null detector from the reference setup. Connect the TI as shown in Figure 2.

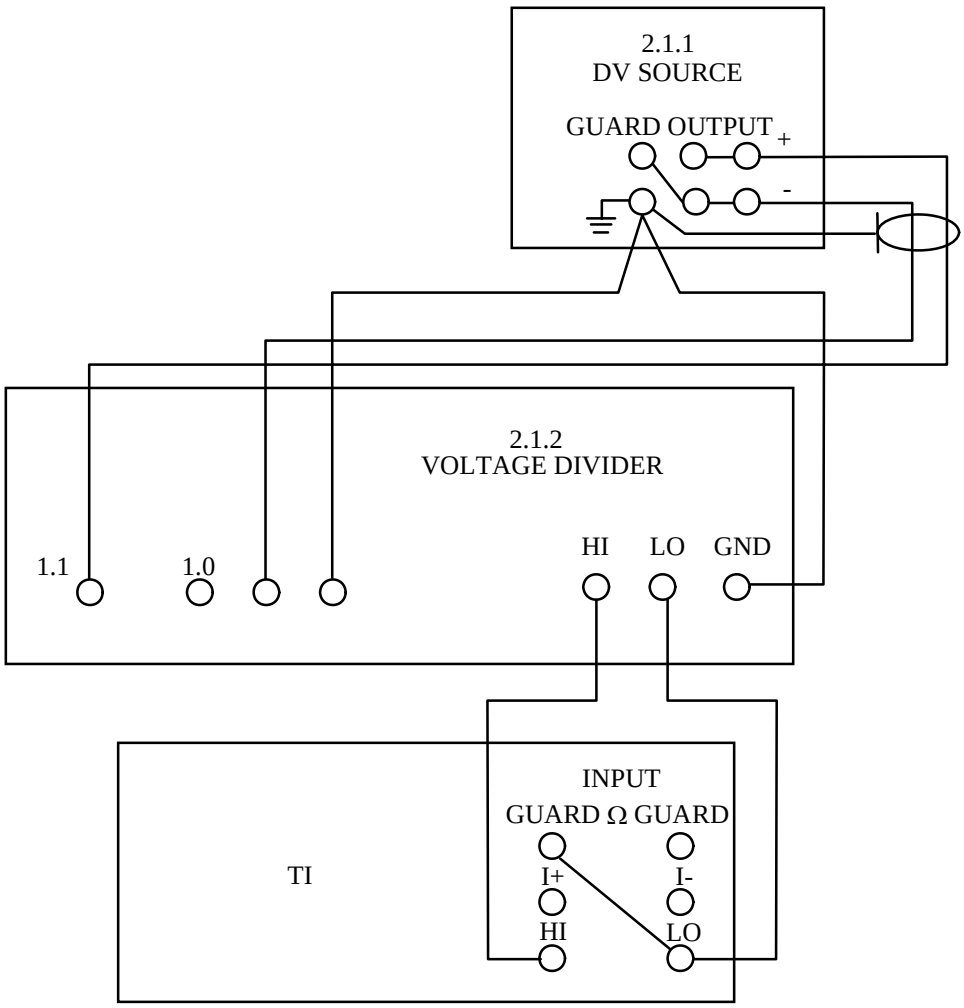

Figure 2. DC Voltage Tests (20 V or less)

4.1.4 Depress the TI RANGE controls to select the following TI RANGE. Set the applicable equipment controls for the settings indicated, and verify that the TI indications are within the tolerance limits listed in the following table.

TI RANGE	Divider Setting	Nominal (V)	Tolerance Limits (V)
100 mV	0.0005000	10.0000^{-3}	9.9906^{-3} to 10.0094^{-3}
100 mV	0.0050000	100.0000^{-3}	99.9869^{-3} to 100.0131^{-3}
1 V	0.0050000	0.100000	0.099989 to 0.100011
1 V	0.0500000	1.000000	0.999967 to 1.000033
10 V	0.0250000	0.50000	0.49990 to 0.50010
10 V	0.0375000	0.75000	0.74990 to 0.75010
10 V	0.0700000	1.40000	1.39988 to 1.40012
10 V	0.1300000	2.60000	2.59986 to 2.60014
10 V	0.2550000	5.10000	5.09981 to 5.10019

TI RANGE	Divider Setting	Nominal (V)	Tolerance Limits (V)
10 V	0.4000000	8.00000	7.99976 to 8.00024
10 V	0.5000000	10.00000	9.99972 to 10.00028
10 V	0.7000000	14.00000	13.99964 to 14.00036
10 V	0.9500000	19.00000	18.99955 to 19.00045
Reverse output polarity of DV source.			
10 V	0.9500000	-19.00000	-18.99955 to -19.00045

4.1.5 Set the controls of the DV source for minimum output. Disconnect the test setup.

4.1.6 Connect the equipment as shown in Figure 3.

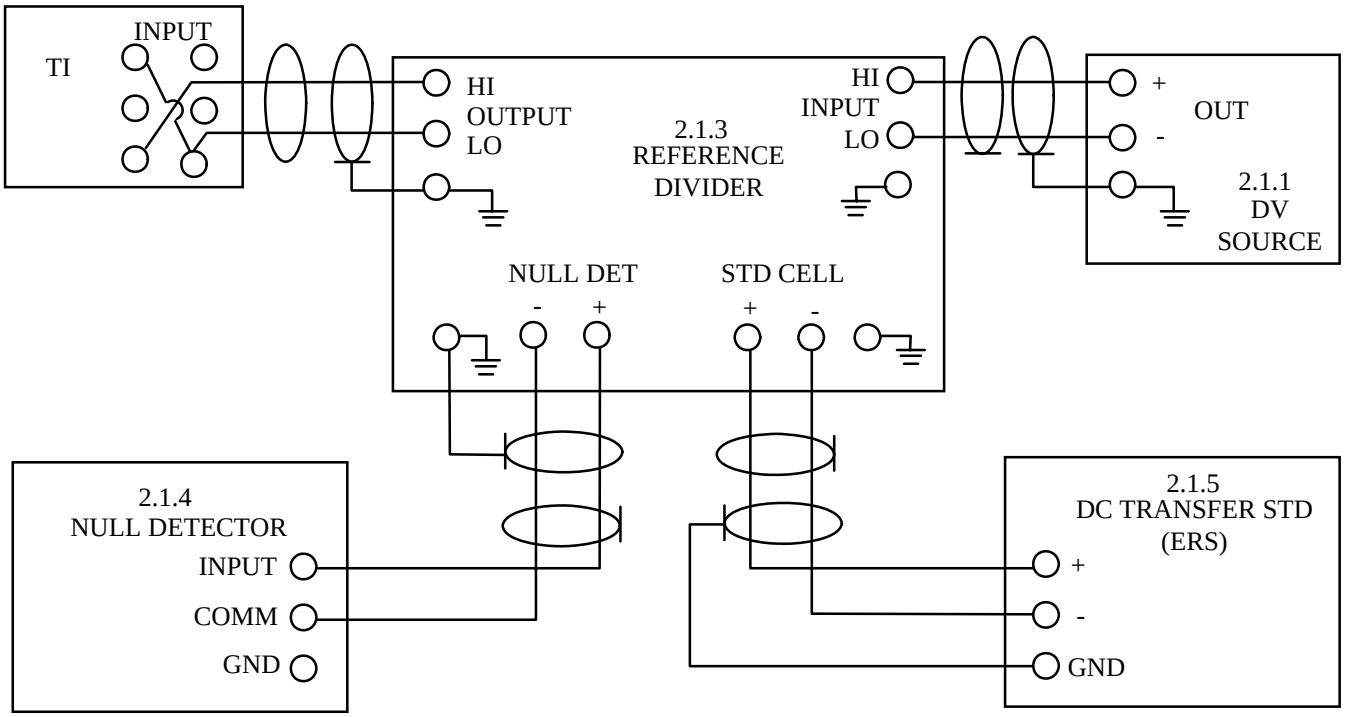

Figure 3. DC Voltage Setup (100 V or More)

4.1.7 Set the ERS output controls for its certified 1 volt reference output voltage and set the reference divider standard cell dials for the value of the 1 volt reference.

4.1.8 Zero the null detector on its 10 μV range; then, set its OPR-ZERO switch to OPR. Set the DV source power switch to OPR and the ERS (item 2.1.5) power switch to ON.

4.1.9 Set the reference divider STD-CELL switch to MOMENTARY long enough to establish a reference null indication within ±5 μV on the null detector, by adjusting the DV source voltage output controls and the reference divider coarse and fine controls, as required. Increase the null range sensitivity of the null detector, as necessary, during the adjustment for the reference null. The DV source output indication at null should be approximately 100 V.

4.1.10 Set the reference divider STD-CELL switch to LOCKED. Adjust the DV source voltage-output controls and the reference divider input adjust controls, as required, to maintain the reference null on the null detector.

4.1.11 Perform the measurements tabulated below as follows:

4.1.11.1 Set the null detector OPR-ZERO switch to ZERO and set the equipment controls, as required, to obtain the settings listed in the following table for the TI RANGE, the reference divider Input-Output switches, and the DV source. Depress the TI RANGE pushbutton to select the TI 100 V or 1000 V RANGE, as required.

4.1.11.2 Set the null detector OPR-ZERO switch to OPR. Adjust the DV source voltage output controls and the reference divider coarse and fine adjust controls to maintain a null on the null detector 10 μV range, taking precautions as required to avoid meter pegging.

TI RANGE (V)	Input (V)	Output (V)	DV Source (V)	Nominal (V)	Tolerance Limits (V)
100	100	100	100.000	100.000	99.9961 to 100.0039
1000	1000	1000	1000.00	1000.00	999.961 to 1000.039

4.1.11.3 Verify that the TI indication is within the tolerance limits listed.

4.1.12 Set the DV source power switch to STDBY/RESET, and disconnect the test setup.

4.2 AC RMS VOLTAGE TESTS

4.2.1 Connect the equipment as outlined in Figure 5 (line power input from a common source).

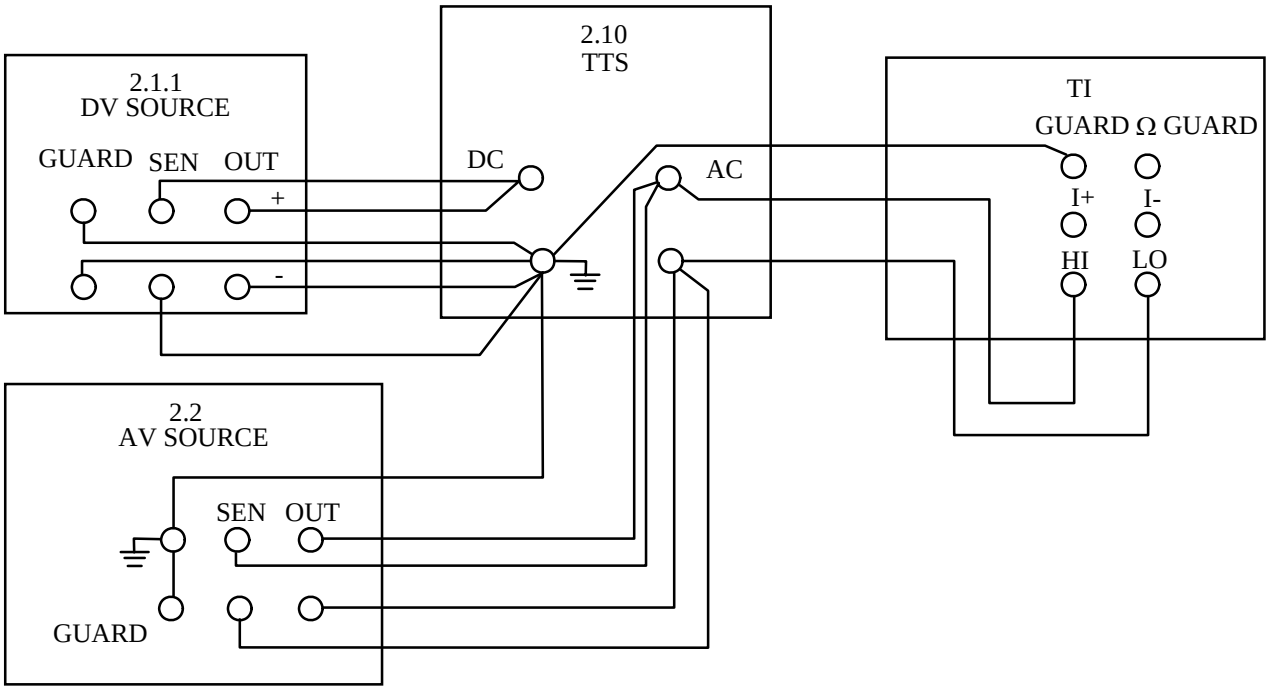

Figure 4. True RMS Voltages: 1 V and Higher

4.2.2 Set the following equipment controls:

4.2.2.1 TI controls:

FUNCTION ACV

RANGE	1 V
FILTER	10 Hz
REMOTE GUARD	REM Ω (light on)
MEASUREMENT RESOLUTION	5 digit

NOTES

To select ACV filter:

Depress TI CONFIG pushbutton
Select Filt function
Select 10 Hz filter
Depress TI ACV pushbutton

To select REMOTE GUARD:

Depress the TI INPUT pushbutton
Select REM Ω function
Depress TI ACV pushbutton

4.2.2.2 AV source (item 2.2) controls:

Voltage Range to	1 V
Voltage output setting	1 V
Frequency controls to	50 Hz
Vernier Voltage Error to	0%
Voltage Error % SW	X.1
Sense switch to	EXT
Mode switch to	OPER
Phase Lock (5200)	OFF

4.2.3 Perform the DC to AC Transfer measurements tabulated below as follows:

4.2.3.1 Set the DV source output controls for a voltage value equal to the difference between 1 volt and the CF value (correction factor) that is applicable to the frequency of the measurement listed in the following table. For example, if the measurement frequency is 20 kHz and the CF at 20 kHz (from step 3.6) is -0.000030, set the DV source output controls for 1.000030 V (because: 1-(-0.000030) = 1.000030); if CF is +0.000020, set DV source for 0.999980 V.

4.2.3.2 Set the TTS mode switch to the DC Transfer position, selecting the correct range so that the percent input meter will indicate in the green area. Establish a galvanometer null at its most sensitive range while maintaining an onscale meter indication by adjusting the applicable reference adjust control when switching to a more sensitive range.

NOTE

Allow for stabilization time. The Fluke 540B may initially take as long as 10 minutes; however, it is considered stabilized when the galvanometer indication drifts <2 small divisions per minute in its most sensitive position. Re-adjust the reference adjust controls to re-establish the galvanometer null.

DV Source Output	AV Source		Tolerance Limits (V)
	Frequency	% Error Indication	
1-CF 10 Hz*	10 Hz		0.99848 to 1.00152
1-CF 50 Hz*	50 Hz		0.99975 to 1.00025
1-CF 1 kHz	1 kHz		0.99975 to 1.00025
1-CF 20 kHz	20 kHz		0.99975 to 1.00025
1-CF 50 kHz	50 kHz		0.99918 to 1.00082
1-CF 100 kHz	100 kHz		0.99692 to 1.00308
1-CF 1 MHz	1 MHz		0.95510 to 1.04490

*Select 10 Hz ACV filter.

4.2.3.3 Set the TTS GALV switch to open and the sensitivity switch to low.

4.2.3.4 Set the TTS mode switch to AC search, selecting the correct range switch setting so that the percent input meter indicates in the green area; then switch the mode switch to the AC transfer position.

4.2.3.5 Vary the % error mode controls of the AV source, as required, to re-establish the galvanometer null indication. Do not adjust the TTS reference controls while in the AC MOD.

4.2.3.6 Obtain a null indication successively in the “medium” and “high” positions of the TTS sensitivity switch by adjusting the % error controls of the AV source. Make note of the AV source % error indication.

4.2.3.7 Set the TTS GALV switch to open, sensitivity switch to low and polarity switch to the opposite setting as in step 4.2.3.3.

NOTE

If the TTS polarity switch has been disconnected, skip to step 4.2.3.12.

4.2.3.8 Repeat steps 4.2.3.2 through 4.2.3.6.

4.2.3.9 Set the TTS GALV switch to open and the sensitivity switch to low.

4.2.3.10 Set the AV source % error control to midway of the two settings noted in steps 4.2.3.6 and 4.2.3.8.

4.2.3.11 Verify that the TI indication is within the tolerance limits listed in the following table.

4.2.3.12 Record the AV source ±% error indications on a separate piece of paper or fill in the values on a duplicate copy of the tabulated measurements. These values will be referred to during the calibration of the TI 100 mV range in step 4.2.11.1.

4.2.4 Set the AV source error controls for 0% error indication and initially, set the equipment controls, as necessary, for the DC to AC transfer measurement values listed in the following table. Perform step 4.2.3.2 to establish a DC reference null.

TTS and TI RANGE (V)	DV and AV Source Output		Characterized V ac Equivalent (V)	Tolerance Limits (V)
	(V)	(Freq)		
10	10.0000	10 Hz*		9.9848 to 10.0152
10	10.0000	50 Hz*		9.9975 to 10.0025
10	10.0000	1 kHz		9.9975 to 10.0025
10	10.0000	20 kHz		9.9975 to 10.0025
10	10.0000	50 kHz		9.9918 to 10.0082

TTS and TI RANGE (V)	DV and AV Source Output (V)	(Freq)	Characterized V ac Equivalent (V)	Tolerance Limits (V)
10	10.0000	100 kHz		9.9692 to 10.0308
10	10.0000	1 MHz		9.5510 to 10.4490
100	100.000	10 Hz*		99.848 to 100.152
100	100.000	50 Hz*		99.975 to 100.025
100	100.000	1 kHz		99.975 to 100.025
100	100.000	20 kHz		99.975 to 100.025
100	100.000	50 kHz		99.918 to 100.082
100	100.000	100 kHz		99.692 to 100.308
	NOTE Set the AV source controls for minimum output; disconnect the low voltage output connections of the AV source from the TTS AC input terminals and connect the AV source power output (high voltage) terminals to where the low voltage (100 V and less) were previously connected.			
1000**	500.000	10 Hz*		499.240 to 500.760
1000**	500.000	50 Hz*		499.875 to 500.125
1000**	500.000	1 kHz		499.875 to 500.125
1000**	500.000	20 kHz		499.875 to 500.125
1000**	200.000	50 kHz		199.835 to 200.165
1000**	100.000	100 kHz		99.692 to 100.308

***** Select 10 Hz ACV filter.
****** 6 digit resolution required.

4.2.5 Set the TTS GALV switch to open, and the sensitivity switch to low.

4.2.6 Set the TTS mode switch to AC search, select the correct range so that the percent input meter indicates in the green area and then switch the mode switch to the AC transfer position.

4.2.7 Adjust the AV source output voltage controls (not the % error controls) to re-establish the galvanometer null indication. Do not adjust the TTS reference control while in the AC Mode.

4.2.8 For each transfer measurement, perform the following:

4.2.8.1 Verify that the difference between the TI indication and the applicable CF (correction factors to compensate for the TTS % AC-DC difference) is within the tolerance limits listed in the following table.

4.2.8.2 If more than one TI is to be calibrated, record the AV source final output voltage indication on a separate piece of paper (or on a duplicate copy of the preceding tabulated measurements). These characterized voltage values may be used (re-dialed) to calibrate other TIs when connected directly to the AV source within 24 hours.

4.2.9 Set equipment output controls for minimum output and disconnect the test setup.

4.2.10 Connect the equipment as outlined in Figure 6. Both pieces of equipment should be connected to the same power source.

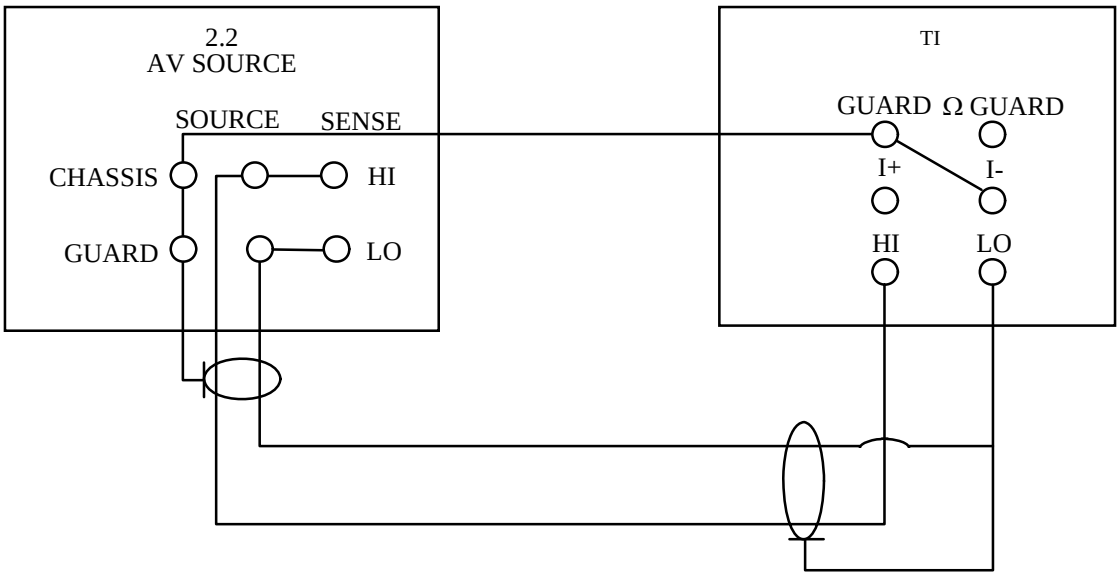

Figure 5. Measurement for 100 mV Range

4.2.11 Select the AV source 1 V range and perform the following measurement.

4.2.11.1 Depress the TI controls to select the 100 mV RANGE. Set the AV source controls to the indicated voltage value, to the indicated frequency, and to the ±% error setting applicable to the frequency of measurement as obtained in step 4.2.3.8.

4.2.11.2 Verify that the TI indication is within the tolerance limits listed in the following table.

TI RANGE (mV)	AV Source		Tolerance Limits
	Output Volts	Frequency	
100	0.100000	10 Hz*	99.848^{-3} to 100.152^{-3}
100	0.100000	50 Hz*	99.960^{-3} to 100.040^{-3}
100	0.100000	1 kHz	99.960^{-3} to 100.040^{-3}
100	0.100000	20 kHz	99.960^{-3} to 100.040^{-3}
100	0.100000	50 kHz	99.918^{-3} to 100.082^{-3}
100	0.100000	100 kHz	99.692^{-3} to 100.308^{-3}

*Select 10 Hz ACV filter.

4.2.12 Set the equipment controls for minimum output and disconnect the test setup.

4.3 RESISTANCE TESTS (OPTION 20 ONLY)

4.3.1 Connect the 10 Ω standard resistor (item 2.3) to the TI as shown in Figure 7.

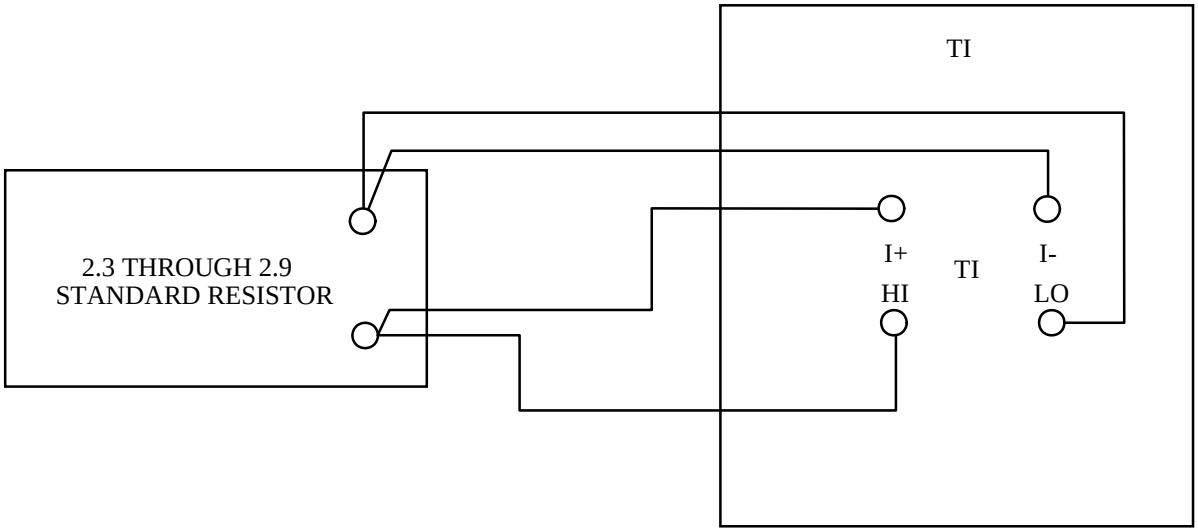

Figure 6. Ohm Test

4.3.2 To measure the 10 Ω standard resistor, perform these steps:

Depress the TI OHMS pushbutton

Depress the TI CONFIG pushbutton

Select the CHG function

Select the Tru Ω function

Select the 10 Ω range

Depress the TI CONFIG pushbutton

Select the Resl function

Select 5 digit resolution

Depress the TI OHMS pushbutton

4.3.3 Connect a short across the 10 Ω standard resistor.

4.3.4 Depress the TI ZERO pushbutton. Wait until the TI BUSY light is extinguished.

4.3.5 Remove the short from across the 10 Ω standard resistor.

4.3.6 Using Figure 7 for the test setup, connect each of the standard resistors required for the measurements tabulated in the following table. Set the TI ohms range manually (using the correct pushbuttons) to the range indicated. For each measurement, verify that the TI indication is within the tolerance limits listed.

NOTES

The nominal values applicable for the 100 Ω through 1 MΩ measurements in the following table are the reference values that were measured in step 3.10 as described in NAVAIR 17-20AR-29.

To select the 100 MΩ range, perform these steps:

Depress TI CONFIG pushbutton

Select the CHG function

Select the HI Ω function

Select the 100 MΩ range

Depress the TI OHMS pushbutton

Test Resistance Nominal Value	TI RANGE	TI Tolerance Limits
10 Ω	10 Ω	9.9970 to 10.0030 Ω
100 Ω	100 Ω	Ref ±0.0074%
1 kΩ	1 kΩ	Ref ±0.0068%
10 kΩ	10 kΩ	Ref ±0.0068%
100 kΩ	100 kΩ	Ref ±0.0068%
1 MΩ	1 MΩ	Ref ±0.0068%
10 MΩ	10 MΩ	9.9959 to 10.0041 MΩ
100 MΩ	100 MΩ	99.899 to 100.101 MΩ

4.3.7 Disconnect the TI from the 100 MΩ standard resistor.

4.4 CALIBRATION FACTORS

4.4.1 If all ranges and quantities are within tolerance, skip to step 4.5.1. Otherwise, enter the TI calibration factors as follows. Perform only those steps required for the quantities that tested out-of-tolerance.

4.4.2 To begin setting the calibration factors engage the CAL switch on the rear panel of the TI.

4.4.3 Perform an INTERNAL CHARACTERIZATION. This is accomplished by performing the following (in the order shown): press CAL, select EXT, QUIT, and then TRIG.

4.4.4 Upon completion of the internal characterization, perform the FAST TEST. This is accomplished by selecting TEST and then selecting FAST.

4.4.5 If the FAST TEST was satisfactorily completed, then perform the FULL TEST. The FULL TEST is accomplished by selecting TEST and then selecting FULL. If the FAST TEST was unsatisfactory, then consult the manufacturer's manual to troubleshoot the specific problem.

4.4.6 Upon satisfactory completion of the full test, proceed to enter the CALIBRATION DATE. This is accomplished by performing the following (in the order shown): press CAL, select EXT, QUIT, QUIT, enter the date, and then select ENTER. If the FULL TEST was unsatisfactory, then consult the manufacturer's manual to troubleshoot the specific problem.

4.4.7 Once the calibration date has been entered, then disengage the CAL switch on the rear of the TI.

4.4.8 Repeat the sections of the TI calibration that had previously failed. If these sections are completed satisfactorily, then proceed to Section 4.5. Otherwise, consult the manufacturer's manual to troubleshoot the problems encountered.

4.5 SECURING THE TI

4.5.1 Any steps that produced an out-of-tolerance reading must be repeated at this point. Use the TI SECOND RUN checklist column to repeat the necessary steps and verify that these steps are now within the given tolerance limits.

4.5.2 Affix a SPECIAL CALIBRATION label to the TI indicating the following: "TI calibrated to Fluke 8505/8506 12 months specs (MSD assigned tolerance)." The date of calibration may by added to the TI memory, if desired, by following the instructions in the manufacturer's manual.

4.5.3 Unless other measurements are to be performed, set all power controls to off or standby, and disconnect the TI from the setup.

CALIBRATION CHECKLIST

TEST INST (S) Wavetek 1271 Digital Multimeter with or without OPT12 or 20

PROC. NO. NA 17-20AQ-347		MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.1	Direct Voltage Tests					
4.1.1	Zero Tests					
4.1.1.2	TI Range (Zero Input)	(V)				(V)
”	100 mV	0.0000^{-3}				-0.0090^{-3} to $+0.0090^{-3}$
”	1 V	0.000000				-0.000009 to +0.000009
”	10 V	0.00000				-0.00009 to +0.00009
”	100 V	0.0000				-0.0009 to +0.0009
”	1 kV	0.000				-0.009 to +0.009
4.1.4	Range Divider	(V)				(V)
”	100 mV 0.0005000	10.0000^{-3}				9.9906^{-3} to 10.0094^{-3}
”	” 0.0050000	100.0000^{-3}				99.9869^{-3} to 100.0131^{-3}
”	1 V 0.0050000	0.100000				0.099989 to 0.100011
”	” 0.0500000	1.000000				0.999967 to 1.000033
”	10 V 0.0250000	0.50000				0.49990 to 0.50010
”	” 0.0375000	0.75000				0.74990 to 0.75010
”	” 0.0700000	1.40000				1.39988 to 1.40012
”	” 0.1300000	2.60000				2.59986 to 2.60014
”	” 0.2550000	5.10000				5.09981 to 5.10019
”	” 0.4000000	8.00000				7.99976 to 8.00024
”	” 0.5000000	10.00000				9.99972 to 10.00028
”	” 0.7000000	14.00000				13.99964 to 14.00036
”	” 0.9500000	19.00000				18.99955 to 19.00045
”	” 0.9500000	-19.00000				-18.99955 to -19.00045
4.1.11.3	100 V	100.000				99.9961 to 100.0039
”	1000 V	1000.00				999.961 to 1000.039

*Select 10 Hz ACV filter.

CALIBRATION CHECKLIST

TEST INST (S) Wavetek 1271 Digital Multimeter with or without OPT12 or 20

PROC. NO. NA 17-20AQ-347			MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)		NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.2	AC RMS Voltage Tests						
	TI Range	Freq	(V)				(V)
4.2.3.2	1 V	10 Hz*	1.00000				0.99848 to 1.00152
”	”	50 Hz*	1.00000				0.99975 to 1.00025
”	”	1 kHz	1.00000				0.99975 to 1.00025
”	”	20 kHz	1.00000				0.99975 to 1.00025
”	”	50 kHz	1.00000				0.99918 to 1.00082
”	”	100 kHz	1.00000				0.99692 to 1.00308
”	”	1 MHz	1.00000				0.95510 to 1.04490
4.2.4	10 V	10 Hz*	10.0000				9.9848 to 10.0152
”	”	50 Hz*	10.0000				9.9975 to 10.0025
”	”	1 kHz	10.0000				9.9975 to 10.0025
”	”	20 kHz	10.0000				9.9975 to 10.0025
”	”	50 kHz	10.0000				9.9918 to 10.0082
”	”	100 kHz	10.0000				9.9692 to 10.0308
”	”	1 MHz	10.0000				9.5510 to 10.4490
”	100 V	10 Hz*	100.000				99.848 to 100.152
”	”	50 Hz*	100.000				99.975 to 100.025
”	”	1 kHz	100.000				99.975 to 100.025
”	”	20 kHz	100.000				99.975 to 100.025
”	”	50 kHz	100.000				99.918 to 100.082
”	”	100 kHz	100.000				99.692 to 100.308
”	1000 V	10 Hz*	500.000				499.240 to 500.760
”	”	50 Hz*	500.000				499.875 to 500.125
”	”	1 kHz	500.000				499.875 to 500.125
”	”	20 kHz	500.000				499.875 to 500.125
”	”	50 kHz	200.000				199.835 to 200.165
”	”	100 kHz	100.000				99.692 to 100.308

*Select 10 Hz ACV filter.

CALIBRATION CHECKLIST

TEST INST (S) Wavetek 1271 Digital Multimeter with or without OPT12 or 20

PROC. NO. NA 17-20AQ-347		MFR	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.2.11.2	100 mV 10 Hz*	100.000^{-3}				99.848^{-3} to 100.152^{-3}
”	” 50 Hz*	100.000^{-3}				99.960^{-3} to 100.040^{-3}
”	” 1 kHz	100.000^{-3}				99.960^{-3} to 100.040^{-3}
”	” 20 kHz	100.000^{-3}				99.960^{-3} to 100.040^{-3}
”	” 50 kHz	100.000^{-3}				99.918^{-3} to 100.082^{-3}
”	” 100 kHz	100.000^{-3}				99.692^{-3} to 100.308^{-3}
4.3	Resistance Tests (Option 20 only)	(Ω)				(Ω)
4.3.6	10 Ω range ref =	10.0000				9.9970 to 10.0030
”	100 Ω range ref =					Ref ±0.0074%
		(kΩ)				(kΩ)
”	1 kΩ range ref =					Ref ±0.0068%
”	10 kΩ range ref =					Ref ±0.0068%
”	100 kΩ range ref =					Ref ±0.0068%
		(MΩ)				(MΩ)
”	1 MΩ range ref =					Ref ±0.0068%
”	10 MΩ range	10.0000				9.9959 to 10.0041
”	100 MΩ range	100.000				99.899 to 100.101
4.5	Securing The TI					
4.5.2	SPECIAL CALIBRATION	--	ck ( )			Affix sticker stating
						“TI calibrated to
						Fluke 8505/8506 12
						Month specifications”
”						
”						
”						

*Select 10 Hz ACV filter.