



Perform Calibration Certification on Your Own Eddy Current Instrument without Costly Shipments and Down Time !



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Reference Standards, Applications,
Research & Development*



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Are you sure the inspection results you obtain from your Eddy Current Instrument are accurate?

Is your instrument actually performing at the frequency you have selected?

Is the screen display showing you a true representation of the defect?

Now, you can *Measure* and *Verify* your Eddy Current Instrument Calibration.

The VMGTB-100 Gain Test Box system will Verify:



- ✓ Internal Oscillator Frequency
- ✓ Internal Oscillator Amplitude
- ✓ Receiver Amplification Gain
 - ✓ Receiver Linearity
 - ✓ Receiver Stability
 - ✓ Alarms





The military does not presently require periodic certification of eddy current instrument calibration. Instruments not working properly could possibly be used for critical inspections.

This is not the case in the commercial aviation sector. The FAA does require periodic certification of instrument calibration.





This presents the problem of taking the instrument out of service for the period of time it takes to send it in for calibration. This also creates another expense for the operator.

This procedure together with the normal calibration using a certified reference standard before performing an inspection, will ensure the integrity of the instrument for the job.





This Calibration Verification procedure can be divided into two parts.

Part # 1 Internal Oscillator Output

The internal oscillator provides the signal to the probe and has to meet frequency and amplitude requirements.

Part # 2 Receiver (Detection and Amplification)

The probe signals are processed by electronic circuits such as detectors and amplifiers, before they are sent to the display. The Gain and Linearity of this part of the instrument needs to be tested.





This verification method follows the guidelines set forth in Section 5.2.2 Instrument Calibration/Certification of:

**Boeing Specification Support Standard - BSS 7048,
Eddy Current Inspection, Discontinuities.**

This method for eddy current instrument certification has been in satisfactory operation at the Boeing Metrology Laboratory for over 7 years and has been acceptable to the FAA.





This presentation will feature the Nortec 2000D Eddy Current Instrument as an example.

Required Equipment will include:

- **Standard Oscilloscope with a minimum of 20 MHz bandwidth & 10 mVolt sensitivity**
- **Frequency Counter with a minimum range of 100Hz - 2MHz**
- **Gain Test Box – VMGTB-100**
- **Adapter Cable – VM99L16-102F Lemo 16-pin to Fischer Triaxial adapter**
- **VM99BB2 BNC to BNC Cable, 2 Ft. long**

We have selected the Fluke 123 Scopemeter because it incorporates the Oscilloscope and Frequency Counter in one small package.





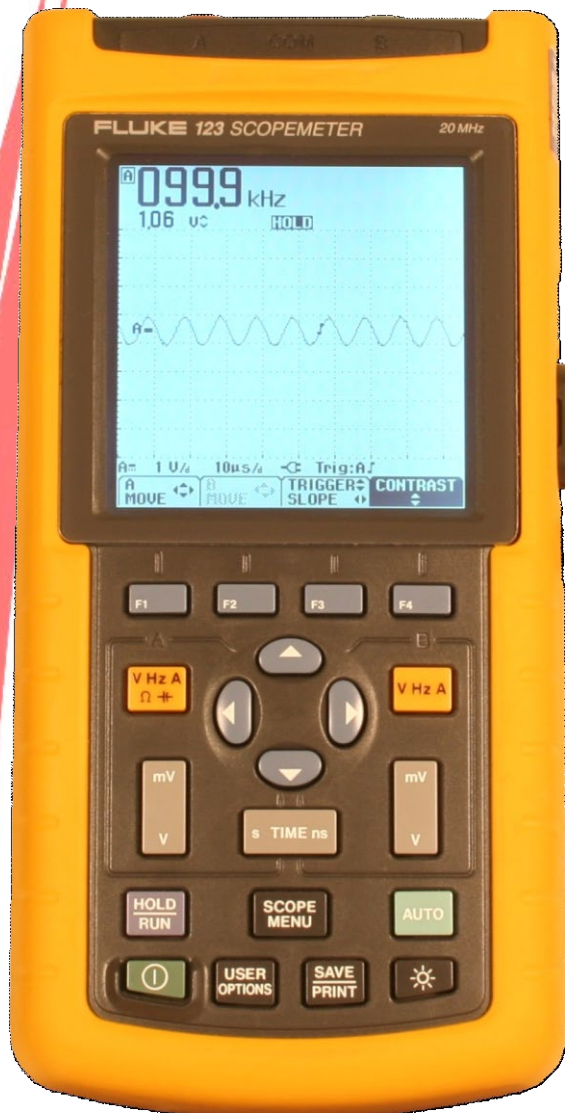
Test Set-Up

- **Attach the VM99L16-102F Adapter Cable to the Nortec 2000D and the VMGTB-100 Gain Test Box.**
- **Attach the counter/oscilloscope to the Coil A connector on the test box using the BNC-BNC cable.**





Preliminary Set Up for the Fluke 123 Scopemeter



- Turn Instrument ON
- Press SCOPE MENU – Select DC & NORMAL under INPUT A, Select DC & OFF under INPUT B. Press the ENTER key.
- Press SCOPE MENU – Press the F1 key under SCOPE OPTIONS... Select NORMAL for SCOPE MODE and SMOOTH under WAVEFORM MODE. Press the ENTER key.
- Press SCOPE MENU – Press the F2 key under PROBES... Select PROBE on A. Press the ENTER key.
- Select 1:1 LEADS under INPUT A. Press the ENTER key.
- Press SCOPE MENU– Press the F3 key under TRIGGER... Select A under INPUT...Select FREE RUN under SCREEN UPDATE... Select 15Hz under AUTO RANGE. Press the ENTER key.
- Press the V Hz A key under A. Select Hz and press the ENTER key.
- Press the V Hz A key. under B. Select OFF and PEAK. Press the ENTER key.
- Press the mV/V key under A until 1V/d appears in the lower left of the screen.
- Press the TIME key until 10 μ S/d appears in the lower left of the screen, next to V/d.



General Set-Up for the Nortec 2000D Eddy Current Instrument



- Set the **FREQ** to 100 kHz
- Set the **ANGLE** to 92°
- Set the **H-GAIN** & **V-GAIN** to 82.0 dB
- Set the **LP FILTER** to 100
- Set the **HP FILTER** to OFF
- Set the **CONT NULL** to OFF
- Set the **DISPLAY** to SWEEP OFF
- Set both the **V-POS** & **H-POS** to 50.0%
- Set all **ERASE** to OFF
- Set **DOT/BOX** to DOT
- Set **GRATICULE** to ON
- On **SETUP MENU** select **PROBE DRIVE LOW**
- On **SETUP MENU** select **FREQ SINGLE**





Internal Oscillator Frequency Verification

BSS 7048 section 5.2.2.2.a. “Internal Oscillator Output” requires that instrument frequency be within $\pm 20\%$ of the indicated value and shall not drift more than $\pm 10\%$ in a 15 minute period.

Set the Nortec 2000D to the frequencies listed in the first column of the following table. Adjust the Scopemeter sweep display up or down using the “TIME” button to maintain enough cycles to trigger the readings. Observe the frequency displayed on the Scopemeter display.

FREQUENCY $\pm 20\%$	MINIMUM	MAXIMUM	STABILITY
100 Hz	80 Hz	120 Hz	Check (at a frequency of 100 kHz only) that any frequency drift is below 10% during 15 minutes. <div>Pass Fail</div>
500 Hz	400 Hz	600 Hz	
1 kHz	800 Hz	1.2 kHz	
5 kHz	4 kHz	6 kHz	
10 kHz	8 kHz	12 kHz	
50 kHz	40 kHz	60 kHz	
100 kHz	80 kHz	120 kHz	
500 kHz	400 kHz	600 kHz	
1 MHz	800 kHz	1.2 MHz	
5 MHz	4 MHz	6 MHz	
10 MHz	8 MHz	12 MHz	
12 MHz	9.6 MHz	14.4 MHz	



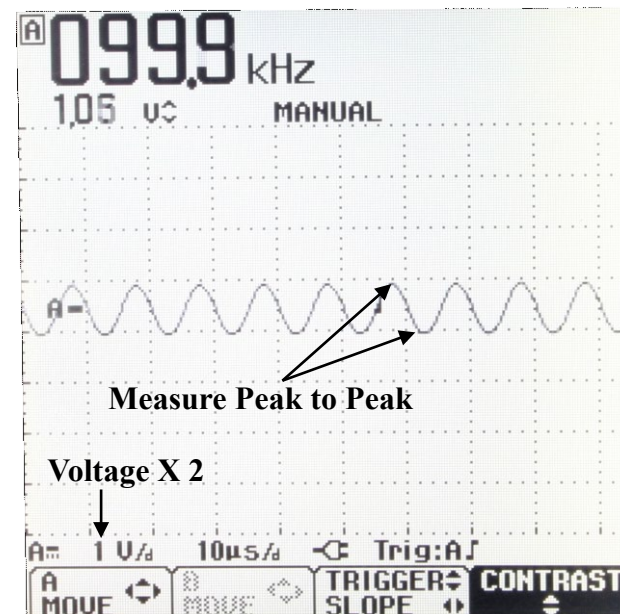


Internal Oscillator Amplitude Verification

BSS 7048 section 5.2.2.2.a. "Internal Oscillator Output" requires that signal amplitude shall not vary more than $\pm 10\%$ in a 15 minute period or more than $\pm 20\%$ over the calibration period.

With frequency set at 100 kHz, measure and record the following peak to peak amplitudes using the oscilloscope (measure the base waveform, disregarding the spikes. These are outside of the frequency band and do not affect the eddy current test).

Oscillator Output (PROBE DRIVE)	MINIMUM	MAXIMUM	STABILITY
(HIGH) Nominal = 12 Volts	12 Volts – 20% = 9.6 Volts	12 Volts + 20% = 14.4 Volts	Check (at a frequency of 100 kHz only) that the amplitude has a variation of less than 10% during 15 minutes. Pass / Fail
(MID) Nominal = 6 Volts	6 Volts – 20% = 4.8 Volts	6 Volts + 20% = 7.2 Volts	
(LOW) Nominal = 2 Volts	2 Volts – 20% = 1.6 Volts	2 Volts + 20% = 2.4 Volts	



* The voltage on the Scopemeter will read $\frac{1}{2}$ the actual value on the Nortec 2000D.

Double this reading for actual voltage.

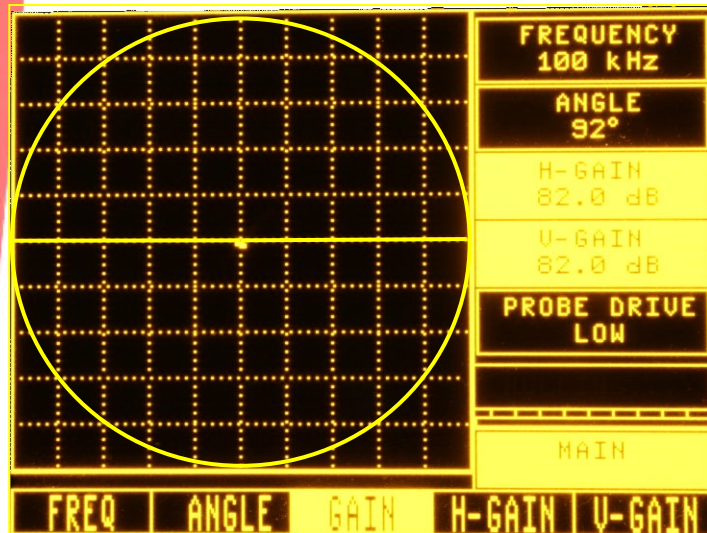




Receiver Verification

BSS 7048 section 5.2.2.2.b. “Receiver” requires that the instrument produce deflection of 80% of full scale given a calibrated input. The signal response must not vary more than $\pm 10\%$ in a 15 minute period or more than $\pm 20\%$ over the calibration period.

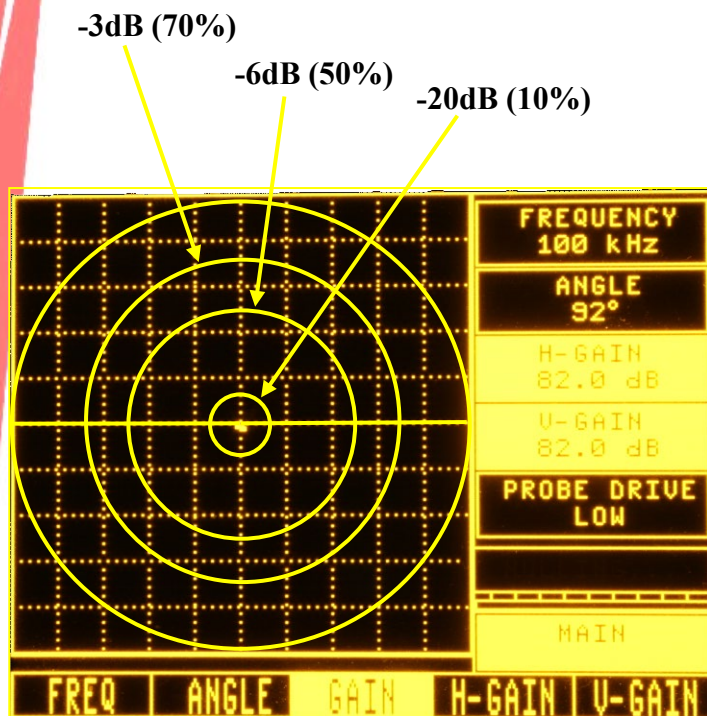
Gain must be within ± 2 dB for any combination of gain setting changes. Vertical and horizontal displays must be within 5% of the full scale calibrated height and width. The alarm shall activate when the signal is within $\pm 10\%$ of the indicated alarm value.



- Null the instrument
- Depress the button on the gain test box toward coil “A”. Adjust the phase so that the resultant indication moves horizontally to the left and that depressing the button towards “B” moves the indication to the right.
- Adjust Gain to verify that the signal moves at least 80% of full screen. Record Pass or Fail.
- Adjust Gain so that depressing the button on the gain test box yields an indication of 5 divisions on the instrument screen (approximately 84 dB setting).
- While holding the button depressed toward Coil “A”, use the phase control to rotate the dot around the screen and verify that a circle with a radius of 5 divisions $\pm \frac{1}{2}$ division is drawn on the screen. Record Pass or Fail.



Receiver Verification (Continued)



- Repeat while holding the button depressed toward Coil “B”. Record Pass or Fail.
- Reduce Gain by 3 dB and verify that the circle is reduced to a radius of 3.5 divisions (70%) ± 0.35 divisions for both Coil “A” and “B”. Record Pass or Fail.
- Reduce Gain by 6 dB from the initial Gain setting and verify that the circle is reduced to a radius of 2.5 divisions (50%) $\pm \frac{1}{4}$ division for both Coil “A” and Coil “B”. Record Pass or Fail.
- Reduce Gain by 20 dB from the initial Gain setting and verify that the circle is reduced to a radius of .5 divisions (10%) with no visible ovality for both Coil “A” and Coil “B”. Record Pass or Fail.
- Return Gain to the initial setting and verify that the circle does not change more than $\frac{1}{2}$ division over a 15 minute period for both Coil “A” and Coil “B”. Record Pass or Fail.



CERTIFICATE OF CALIBRATION

Nortec 2000D Eddy Current Test Instrument

Serial Number: _____

Test Date: _____

Date Due: _____

Technician: _____

Counter: _____

Ser #: _____

Cal Due Date: _____

Oscilloscope: _____

Ser #: _____

Cal Due Date: _____

Gain Test Box: _____

Ser #: _____

Cal Due Date: _____

Frequency (+/-20%):

100 Hz _____

500 Hz _____

1 kHz _____

5 kHz _____

10 kHz _____

50 kHz _____

100 kHz _____

500 kHz _____

1 MHz _____

5 MHz _____

10 MHz _____

12 MHz _____

Frequency Drift (+/-10% over 15 min.):

Pass _____

Fail _____

Oscillator Amplitude (+/-20%):

High (4.5 Vp-p) _____

Mid (3 Vp-p) _____

Low (1 Vp-p) _____

Oscillator Amplitude Drift (+/-10% over 15 min.):

Pass _____

Fail _____

Receiver Gain (80% full screen deflection):

Pass _____

Fail _____





Receiver Linearity (+/-5% full scale height & width):

Frequency 1:

Gain	Display	Coil A Amplitude		Coil B Amplitude	
	Reduction	Amplitude			
Ref	100%	Pass _____	Fail _____	Pass _____	Fail _____
-3dB	70%	Pass _____	Fail _____	Pass _____	Fail _____
-6dB	50%	Pass _____	Fail _____	Pass _____	Fail _____
-20dB	10%	Pass _____	Fail _____	Pass _____	Fail _____

Receiver Linearity Drift (+/-10% over 15 min.):

Pass _____ Fail _____

Alarm:

Pass _____ Fail _____

Alarm Level (+/- 10% of indicated value):

Pass _____ Fail _____

Oscillator Amplitude Drift (+/-20% over test period):

Pass _____ Fail _____

Receiver Linearity Drift (+/-10% over test period):

Pass _____ Fail _____

