Performance Verification

INTRODUCTION

This procedure can be used to verify the warranted characteristics of the DA1855A Differential Amplifier.

The recommended calibration interval for this Differential Amplifiers is one year. The complete performance verification procedure should be performed as the first step of annual calibration. Test results can be recorded on a photocopy of the Test Record provided in Appendix B.

Performance verification can be completed without removing the instrument covers or exposing the user to hazardous voltages. Adjustment should only be attempted if a parameter measured in the Performance Verification Procedure is outside of the specification limits.

Adjustment should only be performed by qualified personnel. Removing the covers from the instrument may alter critical compensation adjustments, requiring the instrument to be re-calibrated. Re-establishing these adjustments requires the use of special calibration fixtures. Therefore, the covers should never be removed by the user. The Adjustment Procedure is contained in the Service Manual.

TEST EQUIPMENT REQUIRED

The following lists the test equipment and accessories, or their equivalents, which are required for performance verification of the DA1855A.

This procedure has been developed to minimize the number of parameters required to be calibrated in the test instrumentation.

Only the parameters listed in **boldface** in the Minimum Requirements column must be calibrated to the accuracy indicated.

Because the input and output connector types may vary on different brands and models of test instruments, additional adapters or cables may be required.

Table 9-1. List of required Equipment

Description	Minimum Requirements	Test Equipment Examples
Wide Band Oscilloscope	500 MHz bandwidth 2 mV - 200mv scale factors 1 ns - 10 µs sweep speed 2% vertical accuracy 50 Ω termination	LeCroy LT374 series oscillo-scope
Digital Multimeter	**DC: 0.01% accuracy** **AC: 0.2% accuracy** to measure 200 mV and 2 V rms @ 1 kHz 6½ digit resolution	HP 34401A, or Fluke 8842A-09, or Keithley 2001
Oscillator/Function Generator	Sine Wave output 20 Vp-p at 70 Hz	Stanford Research Model DS340,or Hewlett Packard 33120A, or Leader LAG-120B
Leveled Sine Wave Generator	**Relative output level accurate to 0.5 dB flatness from 1 – 100 MHz and 50 kHz.** Output adjustable to 2 Vp-p	Tegam SG503 with TM series mainframe and 012-0482-00 output cable
Terminator, in-line, BNC	50 Ω ± 2% coaxial termination	ITT Pomona 4119-50, or AIM 27-9008
Terminator, precision, BNC	50 Ω ± 0.05%	LeCroy TERM-CF01
Attenuator, BNC	50 Ω ± 2%, ÷10 (20 dB)	ITT Pomona 4108-20dB, or AIM 279300-20
BNC coaxial cable, (3 ea)	Male-male BNC, 50 Ω, 36”	ITT Pomona 5697-36
BNC coaxial cable, (2 ea)	Male-male BNC, 50Ω, 4"-6"	Pasternack Enterprises PE3067-5
BNC ’Y’ connector	Male to dual female, BNC	AIM 27-9294
BNC Tee connector	Male to dual female, BNC	AIM 27-8140 ITT Pomona 3285
BNC adapter	Female to female	AIM 25-7430, or ITT Pomona 3283
Banana Plug adapter	BNC female to dual banana plug	ITT Pomona 1269

PRELIMINARY PROCEDURE

1. Connect the DA1855A Differential Amplifier to an AC power source within the range listed in the Nominal Characteristics in the Specification section.
2. Allow at least 20 minutes warm-up time for the DA1855A and test equipment before performing the Verification Procedure.
3. Turn on the other test equipment and allow these to warm up for the time recommended by the manufacturer.
4. While the instruments are reaching operating temperature, make a photocopy of the Performance Verification test record (located at the end of this section), and fill in the necessary data.

The warranted characteristics of the DA1855A Differential Amplifiers are valid at any temperature within the Environmental Characteristics listed in Specifications. However, some of the other test equipment used to verify the performance may have environmental limitations required to meet the accuracy requirements needed for the procedure. Be sure that the ambient conditions meet the requirements of all the test instruments used in the procedure.

Note:

When the oscilloscope input is connected to the DA1855A ***AMPLIFIER OUTPUT,*** *the oscilloscope input impedance must be set to DC 50W unless otherwise stated. Use a 50W inline termination when using an oscilloscope without an internal 50W termination.*

Position the oscilloscope display to center screen. Unless otherwise noted, the oscilloscope position and offset must remain at zero for the duration of the verification procedure.

This procedure is written assuming local control of the DA1855A Differential Amplifier. When using a LeCroy oscilloscope, do not use the ProBus cable.

Prior to performing the verification, set the DA1855A as follows:

GAIN	**X1**
ATTENUATOR	**÷1**
INPUT RESISTANCE	**1M**
+INPUT	**OFF**
–INPUT	**OFF**
V_{COMP}	**OFF**
V_{DIFF}	**OFF**
BANDWIDTH LIMIT	**FULL**
PVG	**ZERO**
OFFSET	**ZERO**

FUNCTIONAL CHECK

The functional check will verify the basic operation of the Differential Amplifier functions.

It is recommended that the Functional Check be performed prior to the Performance Verification Procedure to assure that all other non-warranted functions perform as specified.

To perform the functional check:

Select channel 1 of the oscilloscope and set the input coupling to DC 50 Ω, vertical scale to 100 mV/div, timebase to 10 µsec/div and adjust the trace to screen center.

Connect the output of the function generator with a BNC cable to channel 1 of the oscilloscope and set the output to square wave and the amplitude to 300 mV (3 div on screen).

Remove the function generator output cable from the oscilloscope.

FUNCTIONAL CHECK PROCEDURE

1. ProBus operation.

a. Connect the ProBus and the BNC cables to the output of the DA1855A and to channel 1 of the oscilloscope.

b. Verify that channel 1 is selected and that the DA1855 is being recognized by showing DA1855A on the screen's menu.

2. Coupling.

a. Connect the 300 mV output voltage of the square wave generator to the **+INPUT** of the DA1855A.

b. Verify that the trace is a single line centered on the screen.

c. Press the **DC** button on the **+INPUT** of the DA1855A. and verify that the trace has moved either up or down depending on the polarity of the signal and that DC is highlighted on the screen's menu.

d. Press the **AC** button on the **+INPUT** and verify that the input signal is centered on screen and AC is highlighted on the screen's menu.

e. Disconnect the function generator's output signal from the **+INPUT** and connect it to the **–INPUT**.

f. Verify the performance of steps 2-b through 2-d for the – input.

3. Bandwidth Limiting.

a. Press the **10 MHz** BW Limit button on the front panel of the DA1855A and verify that the slope of the trace's leading and trailing edge has decreased.

b. Press the resp. **1 MHz** and **100 kHz** BW Limit buttons and verify that in each case that the slope of the leading and trailing edges decreases.

c. Return to maximum bandwidth by pressing the **FULL** BW Limit button.

4. X10 Gain and ¸10 Attenuator

a. Press the **¸10** attenuator button and verify that the signal on screen has reduced by about a factor of 10.

b. Press the X10 Gain button and verify that the signal on screen is again about 3 division.

c. Remove all cables, accessories and return all setting of the DA1855A as shown in the table in the Preliminary Procedure.

VERIFICATION PROCEDURE

1. Check X1 Gain Accuracy

a. Set the DA1855A **+INPUT** to **DC**.

b. Connect the Sine Wave Generator output via a 50 Ω BNC coaxial cable and a standard 50 Ω termination to a female BNC to banana plug adapter.

c. Set the DMM to measure AC Volts.

d. Connect the banana plug adapter to the DMM.

e. Set the sine wave generator to 70 Hz and the output amplitude to read 200 mVrms ± 5 mV on the DMM.

f. Record the DMM reading to 100 µV resolution in the Test Report as 'Sine Wave Generator Output Voltage'.

g. Disconnect the sine wave generator output cable with the 50 Ω termination from the BNC to banana plug adapter on the DMM.

h. Connect this cable with the standard 50 Ω termination to the **+INPUT** of the DA1855A.

i. Remove the banana plug adapter from the DMM and connect the DA1855A **AMPLIFIER OUTPUT** connector via another coaxial cable and the precision 50 Ω termination to the DMM. See Figure 8-1.

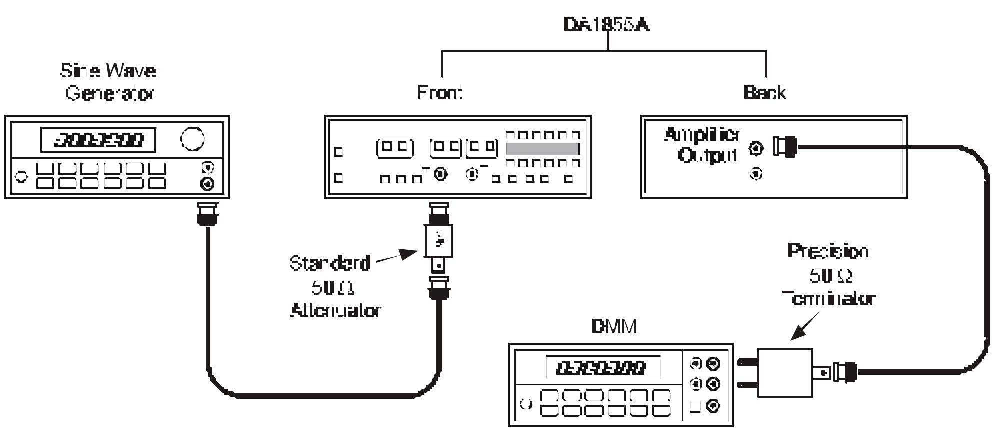

Figure 9-1. X1 gain Accuracy.

j. Press the **X1 GAIN** button to remove any residual DC offset from the input. (A DC component may interfere with the RMS computation in some DMMs.)

k. After the DMM has stabilized, record the reading to 100 µV resolution as ‘Amplifier Output Voltage’ in the Test Record.

l. Divide the measured amplifier output voltage from step 1-k by the sine wave generator output voltage (amplifier input voltage) in step 1-f. Subtract the ratio from 1.0 and multiply the result by 100% to get the error in percent.

$$Error = \left(1 - \frac{Amplifier\ Output\ Voltage}{Amplifier\ Input\ Voltage}\right) x\ 100\%$$

m. Record the result to two decimal places (± 0.xx %) as ‘X1 Gain Error’ in the Test Record.

n. Check that the calculated **X1** Gain error is less than ± 1.0%.

2. Check X10 Gain Accuracy

NOTE

Because most DMMs do not provide the required accuracy on lower AC voltage ranges, the check for X10 Gain Accuracy uses a ratio technique with an external ¸10 attenuator. The actual attenuation of the attenuator is determined using higher amplitude signals.

a. Disconnect the DA1855A amplifier output cable and the precision 50 Ω termination from the DMM.

b. Disconnect the sine wave generator output cable from the **+INPUT** and remove the 50 Ω termination from the coaxial cable.

c. Connect one female end of a BNC Tee to the sine wave generator cable.

d. Connect a 50 Ω ÷10 attenuator to the male end of the BNC Tee followed by a standard 50 Ω termination.

e. Reconnect the banana plug adapter to the DMM and connect another coaxial cable from the banana plug adapter to the other female end of the BNC Tee. See figure 8-2.

f. Set the sine wave generator output amplitude to read 2.00 Vrms ± 50 mV on the DMM.

g. Record the reading to 1 mV resolution as the 'Sine Wave Generator Output Voltage' in the Test Record.

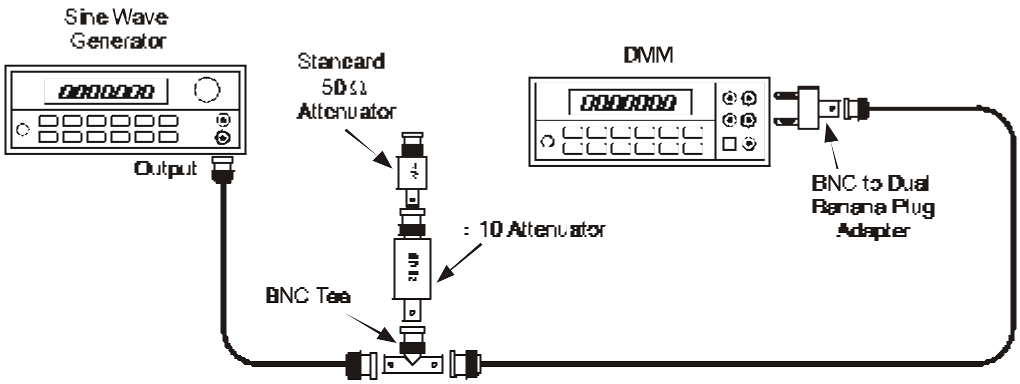

Figure 9-2. X10 Gain Accuracy setup.

h. Remove the DMM cable from the BNC Tee and from the banana plug adapter on the DMM.

i. Connect the 50 Ω termination end of the termination/attenuator/BNC Tee combination on the sine wave generator cable to the Banana Plug adapter on the DMM. See figure 8-3.

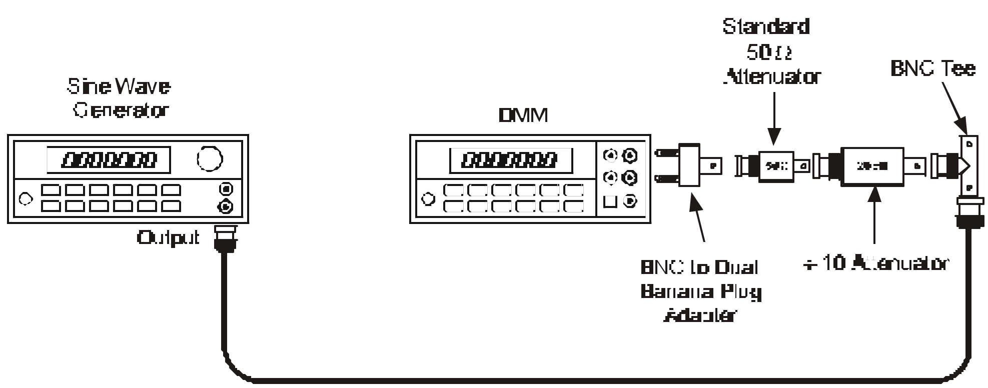

Figure 9-3. X10 Gain Accuracy setup.

j. Record the DMM reading to 100 µV resolution as 'Attenuator Output Voltage' in the Test Record.

(Note: This reading should be approximately 200 mV. If it is not, verify that the in-line attenuator and termination are installed in the correct order. The 50 Ω termination should be closest to the DMM.)

k. Divide the DMM reading in step 2-j into the output amplitude measured in step 2-g. This is the exact attenuation of the attenuator-termination combination.

l. Record the result as 'Exact Attenuation' to four digit resolution in the Test Record.

m. Disconnect the termination/attenuator/BNC Tee combination from the Banana Plug adapter on the DMM.

n. Connect the terminated end of the termination/attenuator/ BNC Tee combination to the DA1855A **+INPUT**.

o. Connect the DMM to the free female end of the BNC Tee connector using the previously removed cable. Figure 8-4.

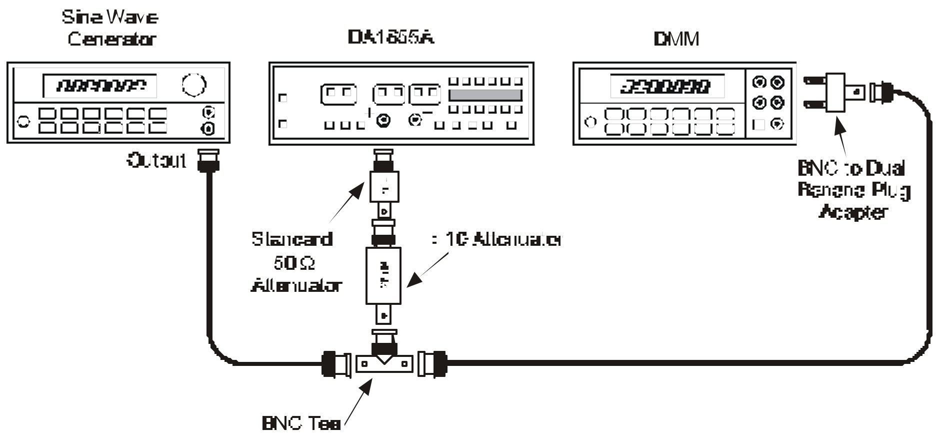

Figure 9-4. X10 Gain Accuracy setup.

p. Adjust the sine wave generator output amplitude to read 200 mVrms ± 50 mV on the DMM.

q. Record the DMM reading to 100 µV resolution as 'Sine Wave Generator Output Voltage' in the Test Record.

r. Disconnect the DMM cable from the BNC Tee and remove the BNC to banana plug adapter from the cable and DMM.

s. Connect the DMM cable to the DA1855A **AMPLIFIER OUTPUT** connector.

t. Insert the precision 50 Ω termination between the other end of this cable and the input of the DMM. See fig. 8-5.

u. Set the DA1855A **GAIN** to **X10**.

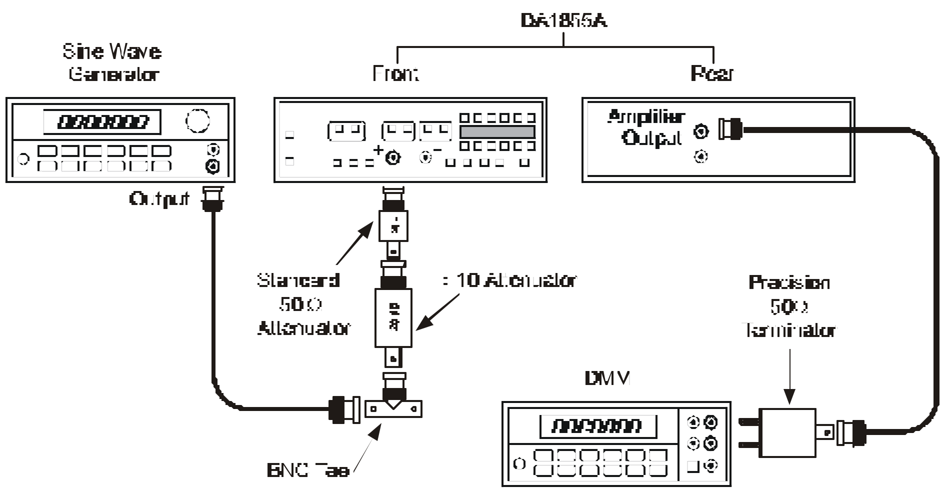

Figure 9-5. X10 Gain Accuracy setup.

v. Divide the sine wave generator output voltage recorded in step 2-q by the exact attenuation factor recorded in step 2-l. This represents the actual voltage on the input of the amplifier. Record the result as ‘Amplifier Input Voltage’ in the Test Record.

w. Multiply the amplifier input voltage as recorded in step 2-v by 10.0 to obtain the expected output voltage. Record the result to four digit resolution as ‘Expected Amplifier Output Voltage’ in the Test Record.

x. After the DMM reading has stabilized, record the measured voltage to 100 µV resolution as ‘Measured Amplifier Output Voltage’ in the Test Record.

y. Calculate the error by dividing the expected output voltage recorded in step 2-w by the measured output voltage recorded in step 2-x. Subtract this ratio from 1 and multiply by 100% to get the error in percent.

$$Error\ =\ \left(1 - \frac{Expected\ Output\ Voltage}{Measured\ Output\ Voltage}\right)x\ 100\%$$

z. Record the calculated error to two decimal places (±0.xx%) in the Test Record as 'X10 Gain Error'.

aa. Check that the calculated error is less than ± 1%

3. Check ¸10 Attenuator Accuracy

a. Remove the DA1855A output cable/precision termination from the DMM.

b. Remove the sine wave generator output cable/BNC Tee/ attenuator/termination combination from the **+INPUT** of the DA1855A.

c. Remove the BNC Tee and attenuator from the cable but leave the standard 50 Ω termination connected.

d. Connect the terminated output cable from the sine wave generator to the DMM using the BNC to Banana Plug adapter. Refer to fig. 8-6.

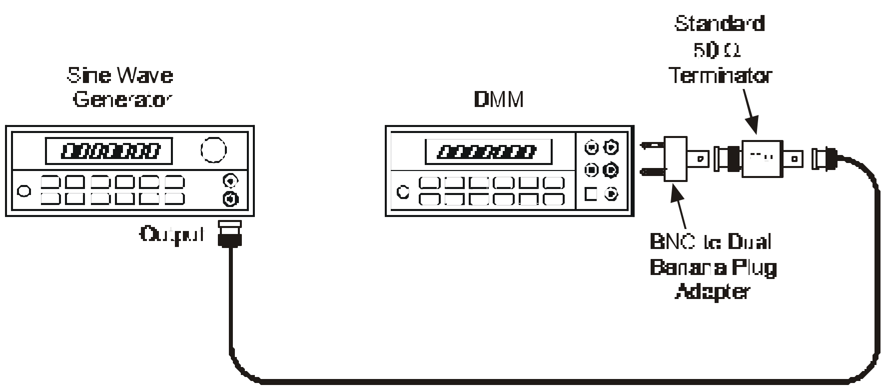

Figure 9-6. ¸10 Attenuator Accuracy.

e. Set the sine wave generator to read 2.00 Vrms ± 50 mV on the DMM.

f. Record the reading as ‘Sine Wave Generator Output Voltage’ to four digit resolution in the Test Record.

g. Divide the reading recorded in step 3-f by 10.00 and record the result as ‘Expected Output Voltage’ to four digit resolution in the space provided in the Test Record.

h. Set the DA1855A **GAIN** to **X1** and the **ATTENUATOR** to **¸10**.

i. Disconnect the sine wave generator output cable and standard 50 Ω termination from the DMM and reconnect to the **+INPUT**.

j. Remove the BNC to banana plug adapter from the DMM.

k. Connect the DA1855A **AMPLIFIER OUTPUT** cable/precision termination to the DMM. Refer to fig. 8-7.

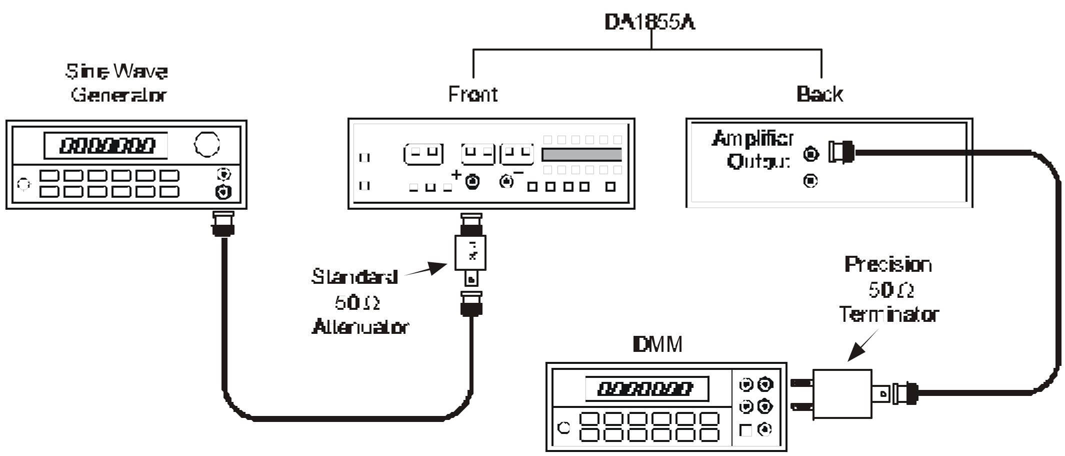

Figure 9-7. ¸10 Attenuator Accuracy setup.

l. Press the **X1 GAIN** button to autozero the amplifier.

m. After the DMM reading has stabilized, record the reading as ‘Measured Amplifier Output Voltage’ to 100 μV resolution in the Test Record.

n. Calculate the error by dividing the expected output voltage recorded in step 3-g by the measured amplifier output voltage recorded in step 3-m. Subtract this ratio from 1 and multiply by 100% to get the error in percent.

$$Error = \left(1 - \frac{Expected\ Output\ Voltage}{Measured\ Output\ Voltage}\right) x\ 100\%$$

o. Record the calculated error to two decimal places (± 0.xx%) as '÷10 Attenuation Error' in the Test Record.

p. Check that the calculated error is less than ± 1%.

q. Disconnect the DMM, sine wave generator, cables and terminations, but leave the amplifier output cable (without termination) connected to the DA1855A **AMPLIFIER OUTPUT**.

4. Check X1 Bandwidth and Calculate Rise Time

a. Connect the DA1855A **AMPLIFIER OUTPUT** to channel 1 of the oscilloscope.

b. Set the channel 1 input coupling to 50 Ω.

NOTE

If the oscilloscope does not have an internal 50 W input termination, insert the standard inline 50 W termination between the cable and the oscilloscope input.

Use the standard wide bandwidth 50 W termination. The precision termination is not accurate at frequencies higher than 100 kHz.

c. Verify that the DA1855A **GAIN** is set to **X1** and the **ATTENUATOR** to **¸10**.

d. Connect a BNC cable to the output of the leveled sine wave generator.

NOTE

Many leveled sine wave generators, including the SG503, are calibrated only when a special BNC cable is used on its output. Be sure to use a cable which is specified for the generator.

e. Insert a standard 50 Ω termination on the free end of the cable and connect the termination to the **+INPUT** of the DA1855A. Refer to fig. 8-8.

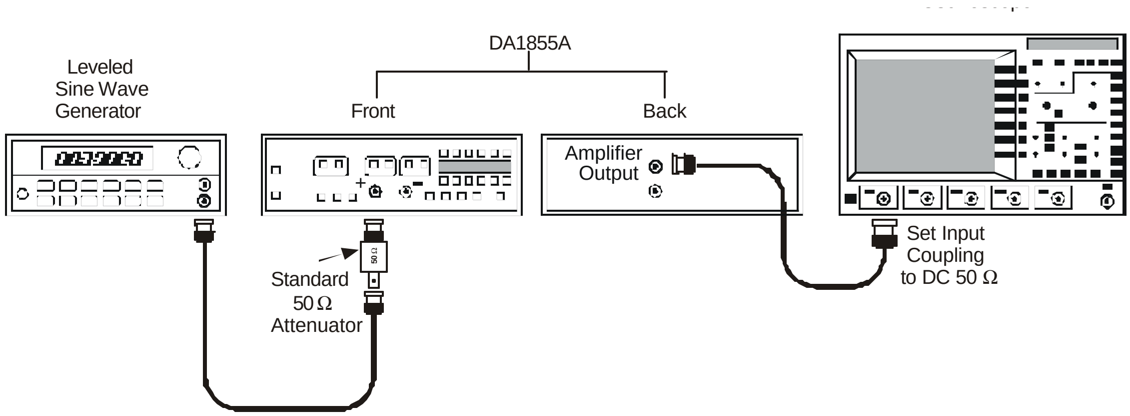

Figure 9-8. X1 Bandwidth Check setup.

f. Set the leveled sine wave generator output frequency to 50 kHz, and the amplitude to approximately 3 Vp-p.

g. Set the oscilloscope Volt/div to 50 mV/div and the time/div to 20 µsec/div. Oscilloscope bandwidth to FULL. Triggering to Channel 1. Adjust the trigger level for a stable display.

h. Adjust the leveled sine wave generator output for an amplitude of exactly 6 divisions on the oscilloscope.

i. Set the sine wave generator output frequency to 50 MHz. Be careful not to alter the output amplitude.

NOTE

The displayed waveform will be compressed in time to form a solid rectangle. It is not necessary to alter the time/div setting as long as the peak amplitude can be measured.

j. Slowly increase the output frequency of the leveled sine wave generator until the displayed amplitude decreases to exactly 4.2 divisions. This is a 3 dB reduction in amplitude.

k. Record in the Test Record the frequency where the –3 dB amplitude is obtained as 'Measured –3 dB Frequency at X1 Gain'.

l. Check that the frequency is > 100 MHz.

m. Divide 0.35 by the –3 dB frequency (in Hz) recorded in step 4-k. The result is the calculated rise time. Record the result as ‘Calculated Rise Time at X1 Gain’ in the Test Record.

5. Check High Frequency CMRR

NOTE

Common Mode Rejection Ratio, CMRR, is defined as the Differential Mode Gain divided by the Common Mode Gain (normalized inverse of the Common Mode Feedthrough). At higher frequencies (>10 MHz) where the bandwidth of the amplifier begins to attenuate the differential mode signal, both the differential mode gain and common mode gain feedthrough must be measured to derive the CMRR.

a. Make the set-up the same as used for the bandwidth test. (Steps 4 a-e). See figure 8-9.

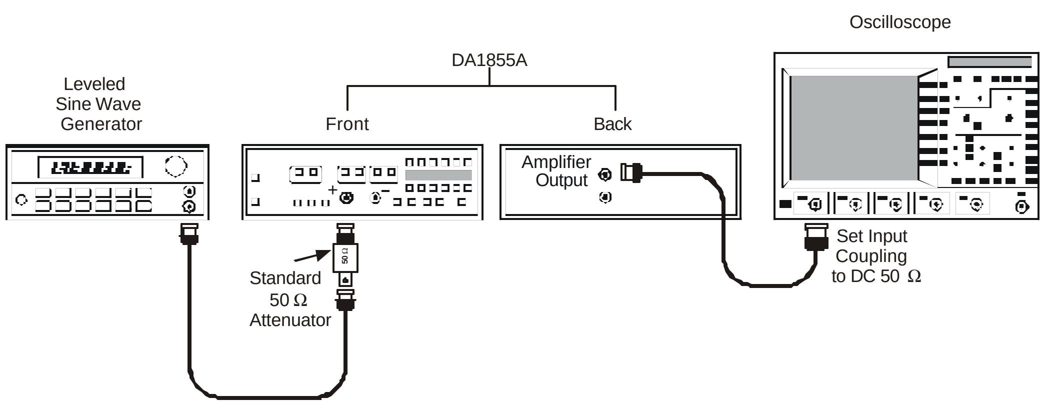

Figure 9-9. X1 and X10 HF CMRR Check setup.

b. Set the DA1855A **GAIN** to **X1**, **ATTENUATOR** to **÷1**.

c. Set the leveled sine wave generator output frequency to 50 kHz. If necessary adjust the output amplitude for a display of exactly 6 divisions (300 mV) peak to peak.

d. Change the output frequency to 10 MHz, taking care not to change the output amplitude.

e. Measure the peak to peak output amplitude of the DA1855A. Record the reading to two digit resolution (xx0 mV) as 'Amplifier Output Voltage at 10 MHz' in the Test Record.

f. Divide the measured output amplitude by 300 mV. Record the answer to two digit resolution (0.xx) in the Test record. This is the 'Differential Mode Gain at 10 MHz'.

g. Remove the leveled sine wave generator from the **+INPUT** of the DA1855A.

h. Connect a BNC cable from the Frequency Reference Signal Output of the sine wave generator to the External Trigger Input of the oscilloscope. (If the sine wave generator does not have a Frequency Reference Signal Output, insert a BNC Tee adapter into the Output connector and attach the External Trigger BNC cable to the BNC Tee.)

i. Disconnect the **AMPLIFIER OUTPUT** cable from the oscilloscope's channel 1 and connect the terminated end of the sine wave generator output cable to the channel 1 input of the oscilloscope. Refer to figure 8-10.

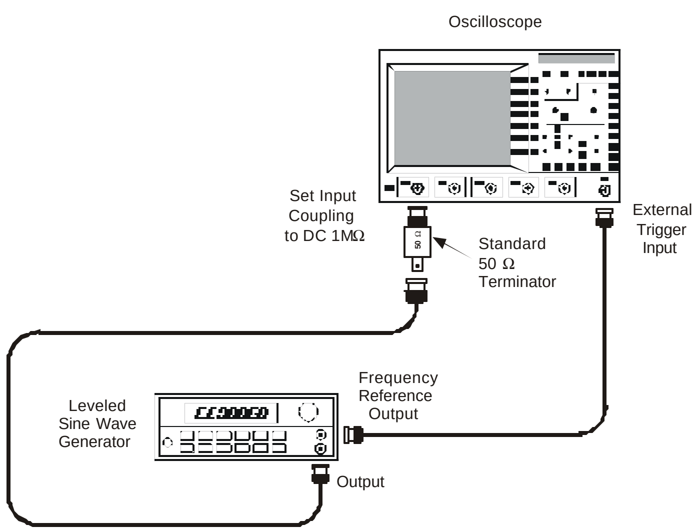

Figure 9-10. HF CMRR Check setup.

j. Verify that the channel 1 input coupling is set to DC and 1MΩ.

k. Set the oscilloscope to display channel 1, the vertical sensitivity to 1 Volt/div, timebase to 50 ns/div and trigger source to external ÷10. If necessary, adjust the trigger level for a stable display.

l. Set the leveled sine wave generator frequency to 10 MHz.

m. Set the leveled sine wave generator output amplitude to exactly 5 Vp-p. (5 divisions on the oscilloscope).

n. Remove the leveled sine wave generator output cable and termination from the oscilloscope.

o. Attach to the 50 Ω termination a female to female BNC adapter, a BNC 'Y' and a 6" BNC cable to each end of the BNC 'Y'.

p. Set both the DA1855A **+INPUT** and **–INPUT** to **DC**.

q. Connect the two free ends of the 6" BNC cables to the DA1855A **+INPUT** and –**INPUT**.

r. Reconnect the **AMPLIFIER OUTPUT** cable to channel 1 of the oscilloscope. Refer to figure 8-11.

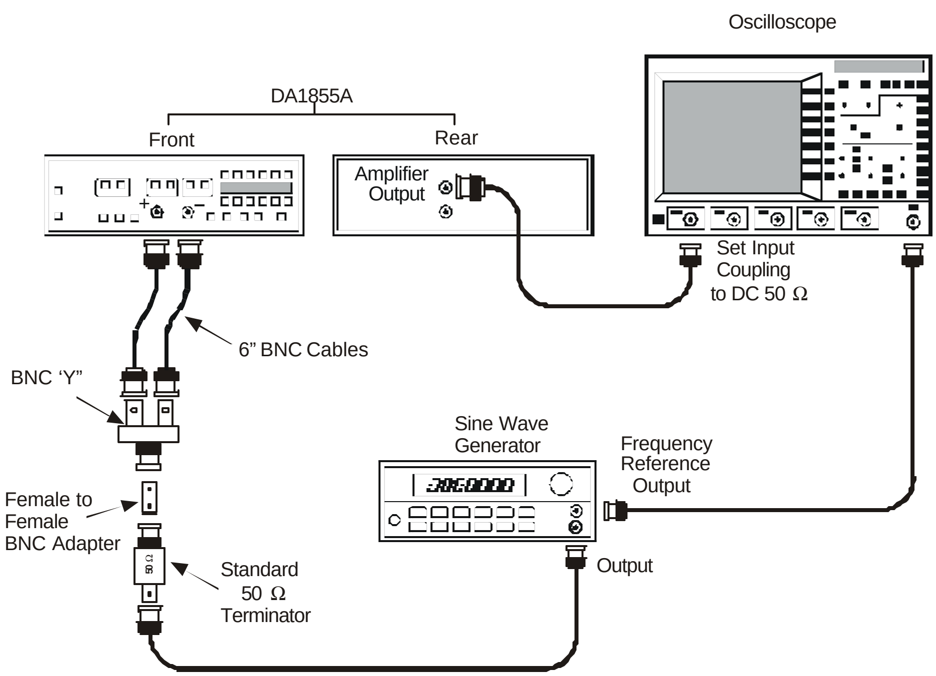

Figure 9-11. HF CMRR Check setup.

s. Verify that the oscilloscope is set to display channel 1 and the input coupling to **DC** and **50W**.

t. Increase the channel 1 vertical sensitivity to maximum.

u. Verify that the oscilloscope is triggered on the Frequency Reference Signal Output of the sine wave generator.

v. Measure the peak to peak amplitude. The displayed signal is the Common Mode Feedthrough. (Use the oscilloscope **ZOOM** function and averaging if needed to increase the size of the displayed waveform and to reduce noise.

NOTE

The amplitude of the Common Mode Feedthrough should be very small. If the output waveform appears to be 1 Volt square wave, check that both of the DA1855A inputs are set to DC.

w. Record the Common Mode Feedthrough amplitude to two digit resolution in the Test Record as ‘Common Mode Feedthrough at 10 MHz’.

x. Calculate the Common Mode Gain by dividing the Common Mode Feedthrough (in mV) by 5,000 mV.

y. Record the result to two significant places as ‘Common Mode Gain at 10 MHz’ in the Test Record. (Keep all of the leading zero’s or use scientific notation.)

z. Calculate the Common Mode Rejection Ratio (CMRR) at 10 MHz by dividing the Differential Mode Gain at 10 MHz as recorded in step 5-f by the Common Mode Gain recorded in step 5-y.

aa. Record the result to two significant places as ‘Common Mode Rejection Ratio at 10 MHz’ in the Test Record. (Keep all of the trailing zero’s).

ab. Check that the CMRR at 10 MHz is greater than 316:1 (50 dB)

ac. Disassemble setup by removing all cable, adapters, etc. from the instruments.

6. Check Low Frequency CMRR.

NOTE

The attenuation of the DA1855A at 70 Hz and 100 kHz is so insignificant that the Differential Mode Gain can be assumed to be unity (1.0). However, the high value of the CMRR specification requires the zoom and averaging function to boost the level of the common mode feedthrough to an amplitude where it can be measured.

a. Connect a BNC cable from the output of the high amplitude sine wave generator to the channel 1 input of the oscilloscope. Do not terminate the cable into 50 Ω, and verify that channel 1 coupling is set to DC and 1MΩ.

b. Connect a BNC cable from the Frequency Reference Signal Output of the leveled sine wave generator to the External Trigger Input of the oscilloscope. (If the sine wave generator does not have a Frequency Reference Signal Output, insert a BNC Tee adapter into the Output connector and attach the External Trigger BNC cable to the BNC Tee.)

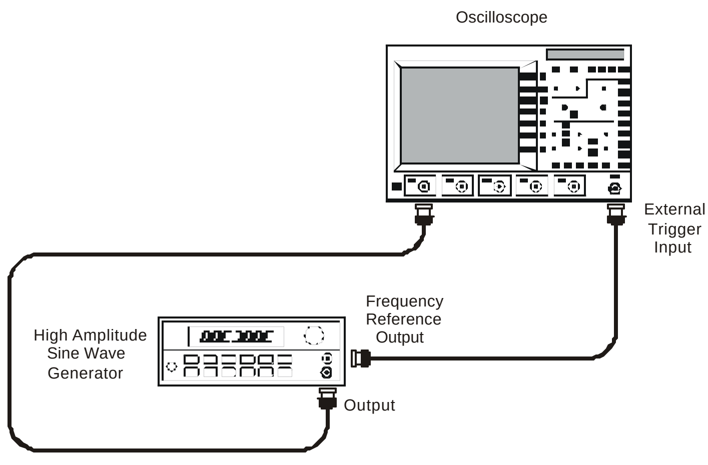

Figure 9-12. LF CMRR Check setup.

c. Set the oscilloscope to display channel 1, vertical scale to 5 V/div and timebase to 10 ms/div.

d. Set the sine wave generator frequency to 70 Hz.

e. Set the high amplitude output of the sine wave generator to exactly 20 Vp-p (4 divisions). Adjust the oscilloscope trigger level as necessary for a stable display. Take care not to alter the sine wave generator settings during the following steps.

f. Remove the sine wave generator output cable from the oscilloscope input.

g. Connect the open end of this cable to the female to female BNC adapter, a BNC ‘Y” and a 6” BNC cable to each end of the BNC ‘Y”.

h. Connect the two free ends of the 6” BNC cables to the **+INPUT** and **–INPUT** of the DA1855A. Refer to figure 8-13.

i. Verify that both the **+INPUT** and **–INPUT** of the DA1855A are set to **DC**.

j. Connect another BNC cable from the **AMPLIFIER OUTPUT** on the DA1855A under test to channel 1 of the oscilloscope.

k. Set the oscilloscope to display channel 1, coupling to DC and impedance to 50 Ω and the vertical sensitivity as necessary to measure the amplitude of the displayed waveform. Refer to figure 8-13.

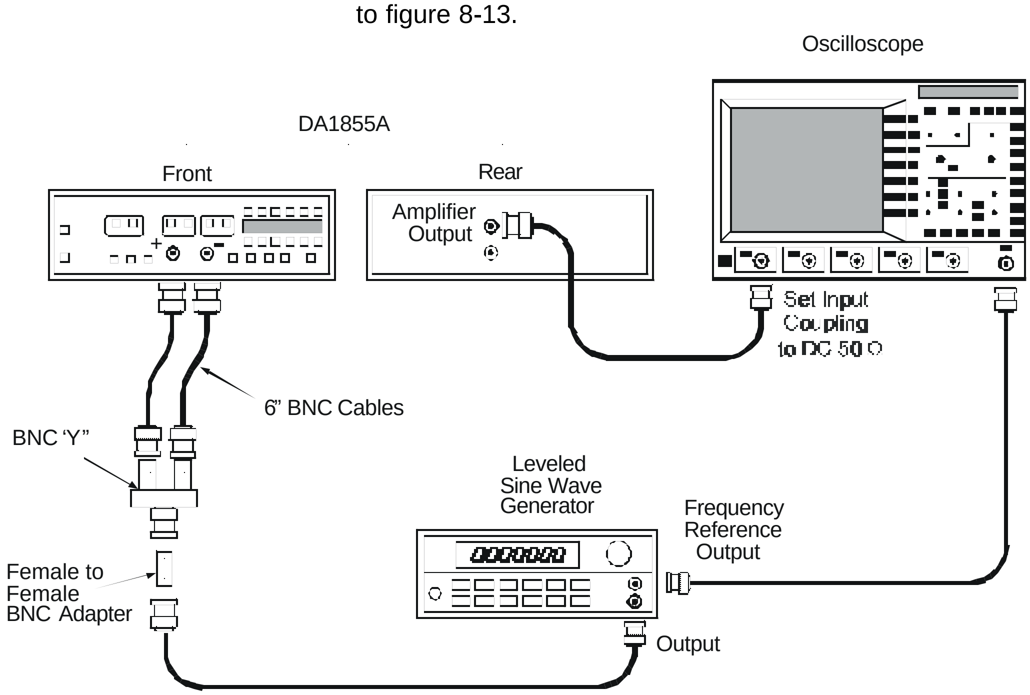

Figure 9-13. LF CMRR Check setup.

l. The displayed signal is the Common Mode Feedthrough. (Use the oscilloscope **ZOOM** function and averaging if needed to increase the size of the displayed waveform and to reduce noise.)

NOTE

This measurement needs to be made very carefully. The signal is only several hundred µV in amplitude and measuring the peak to peak amplitude of this signal, using oscilloscope measurement functions, may cause erroneous reading. Measure only the amplitude of the common mode feedthrough, not the total value of the signal plus noise.

m. Record the displayed ‘Common Mode Feedthrough at 70 Hz’ to two digit resolution in the Test Record.

n. Calculate the Common Mode Gain by dividing the Common Mode Feedthrough (in µV) by 20,000,000 µV. Record the result to two significant places as’Common Mode Gain at 70 Hz’ in the Test Record. (Keep all of the leading zeros or use scientific notation.)

o. Calculate the Common Mode Rejection ratio (CMRR) at 70 Hz by dividing the Differential Mode Gain at 70 Hz (1.0) by the Common Mode Gain (recorded in step 6-p). Record the result as ‘Common Mode Rejection Ratio at 70 Hz’ to two significant places in the Test Record. (Keep all of the trailing zeros.)

p. Check that the CMRR at 70 Hz is greater than 50,000:1 (94 dB).

q. Remove the sine wave generator output cable from the DA1855A’s + input. Reconnect the cable to the channel 1 input of the oscilloscope.

r. Set the oscilloscope to display channel 1, The coupling to DC and 1 MΩ, the vertical scale to 5 V/div and the horizontal scale to 5 µs/div. If necessary, adjust the trigger level for a stable display.

s. Set sine wave generator to 100 kHz.

t. Adjust the output amplitude of the sine wave generator to 20 Vp-p (4 divisions). Readjust the oscilloscope trigger level of necessary to maintain a stable display.

u. Remove the sine wave generator output cable and reconnect it to the female to female BNC adapter and cables attached to the DA1855A inputs. Refer to figure 8-13.

v. Connect the DA1855A output to channel 1 of the oscilloscope

w. Set the oscilloscope to display channel 1, input coupling to DC and 50Ω and the vertical scale as necessary to measure the amplitude of the displayed signal. The displayed signal is the Common Mode Feedthrough.(Use the oscilloscope **ZOOM** function and averaging if needed to increase the size of the displayed waveform and to reduce noise.)

NOTE

This measurement needs to be made very carefully. The signal is only several hundred µV in amplitude and measuring the peak to peak amplitude of this signal, using oscilloscope measurement functions, may cause erroneous reading. Measure only the amplitude of the common mode feedthrough, not the total value of the signal plus noise.

x. Record the displayed amplitude as ‘Common Mode Feedthrough at 100 kHz’ to two digits resolution in the Test Record.

y. Calculate the Common Mode Gain by dividing the Common Mode Feedthrough (in µV) by 20,000,000 µV. Record the result as ‘Common Mode Gain at 100 kHz’ to two significant places in the Test Record. (Keep all of the leading zeros or use scientific notation.)

z. Calculate the Common Mode Rejection Ratio (CMRR) at 100 kHz by dividing the Differential Mode gain at 70 Hz (1.0) by the Common Mode Gain recorded in step 6-bb. Record the result as ‘Common Mode Rejection Ratio at 100 kHz’ to two significant places in the Test Record. (Keep all of the trailing zeros.)

aa. Check that the CMRR at 100 kHz is greater than 50,000:1 (94 dB).

ab. Remove all cables, terminations and adapters from the instruments.

7. Check the Precision Voltage Generator Accuracy

a. Connect a BNC cable from the DA1855A **OFFSET VOLTAGE** output connector on the rear panel of the DA1855A to the DMM input. Do **not** use a 50 Ω termination.

b. Push the **PVG ZERO** button, located at the lower left side of the Precision Voltage Generator display.

c. Set the DMM to DC Volts on the most sensitive range. After the display has stabilized record the reading as ‘PVG Zero Output Voltage’ in the Test Record.

d. Check that the measured 0.0000 V output is within ± 0.5 mV.

e. Set the DMM range to read 15.5 V.

f. Press and hold MSB increment button (button to right of ± button) until the display reads +15.500V. (If necessary, press the ± button once to invert the polarity.)

g. After the DMM display has stabilized record the reading as ‘PVG Output Voltage at 15.5 V’ in the Test Record with 100 µV resolution.

h. CHECK — That the measured output is within15.4917 to 15.5082 V.

i. Press the **±** button to change the output voltage to –15.5000 V.

j. After the DMM display has stabilized record the reading as ‘PVG Output Voltage at –15.5 V’ in the Test Record with 100 µV resolution.

k. Check that the measured output is within –15.4917 to –15.5082 V.

l. Disconnect DMM and all cables from amplifier.

This completes the Performance Verification Procedure. File the test results as required to support your internal calibration procedures.

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