WAVECREST **Corporation**

Calibration Procedure for the DTS-2075 Time Measurement System

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CALIBRATION PROCEDURE FOR DTS-2075 TIME MEASUREMENT SYSTEM

Equipment Required:

1	Frequency counter with high stability time base (9½ digit resolution)
1	Digital voltmeter (6½ digit resolution)
1	Variable output power supply (Ø-6 VDC)
3	50 ohm SMA connectorized cables of equal length (approximately 1 meter)
1	5/64" Hex wrench
1	Straight blade screwdriver, medium
1	Small, non-conductive straight blade screwdriver tool for adjusting oscillator
1	DTS-2075 User's Guide
4	SMA shorting caps provided with the system
A/R	Connector adapters as required to interface listed equipment with SMA cables
1	Oscilloscope with 1 GHz minimum bandwidth
1	Calibrated delay line with SMA interconnects
1	Function generator with outputs to 100 KHz and a variable duty cycle adjustment (pulse width).
1	Computer with GPIB interface and cable
1	"Virtual Instruments" -or- calibration software

Notes:
1) **Use only electronic test equipment with calibrations traceable to NIST standards.**
2) **Refer to the DTS-2075 User's Guide for general operating instructions.**
3) **For all measurements using the DTS-2075, the system's cover should be installed and the system should be allowed to warm-up at least 15 minutes.**
4) **All calibration operations should be made at a grounded workstation while wearing a grounded strap.**

1.0 Removal of the System Top and Bottom Covers

(1-1) Place the system on a sturdy horizontal surface such as a workbench. The system should be resting on all four feet. Verify the AC power cord is not connected at this time.

(1-2) Using the Hex wrench, remove (3) screws from the left and (3) screws from the right side panels. Then remove (15) screws from the top side.

(1-3) While slightly spreading the side panels from the bottom, lift the cover straight up until clear of the system. Store cover and screws in a safe place.

(1-4) Turn DTS system over, so the top is resting on the workbench, and the bottom cover is facing up.

(1-5) Using the hex wrench, remove the screws from the bottom. Store cover and screws in a safe place.

(1-6) Turn DTS system over, so that the front panel is right side up. Then connect the AC power cord to the rear of the DTS. Ensure that the main DTS power switch and front panel standby switch are both off.

CAUTION: With the cover removed for servicing, there are areas of exposed AC voltage at the power supply terminal blocks and in the area of the fans. To avoid exposure to these hazardous voltages, use extreme caution making adjustments to the power supplies with the power on.

Note: The DTS-2075 system is most accurate when the system temperature has reached a stable condition. The system should be allowed to warm up with the power "ON" for at least 1 hour prior to beginning the calibration procedure. The power should be left "ON" as often as possible throughout the calibration.

2.0 Power Supply Checks

(2-1) Verify the AC power cord is connected to an appropriate power source (110V/60 Hz) or (230V/50 Hz). Turn on the main power switch at the rear of the system. Then turn on the standby switch on the front panel. Verify the display illuminates, both fans are blowing air OUT of the system, and the system initiates its self test routine.

Make the following measurements referenced to chassis ground and adjust the power supply outputs if necessary.

Record the following voltage readings on the test data record (before and after adjustment).

(2-2) Using the voltmeter, measure the (+OUT) output of the ±15VDC power supply **(orange wire)** at connector J2, shown in Figure 1A. Verify the voltage is +15VDC ±0.15V. If necessary, adjust +15VDC at VOUT on the ±15V module.

(2-3) Using the voltmeter, measure the (-OUT) output of the ±15VDC power supply **(blue wire)** at connector J2, shown in Figure 1A. Verify the voltage is -15VDC ±0.15V. If necessary, adjust -15VDC at OVP on the ±15V module.

(2-4) Using the voltmeter, measure the (+OUT) output of the +24VDC power supply **(yellow wire)** at connector J2, shown in Figure 1A. Verify the voltage is +24VDC +0.24V. If necessary, adjust the +24VDC supply.

(2-5) Using the voltmeter, measure the (+OUT) output of the +5VDC power supply **(red wire)** at TP5 on the backplane referenced to ground. Verify the voltage is +5VDC +0.05V. If necessary, adjust the main supply adjustment.

(2-6) Using the voltmeter, measure -5VDC on Pin 3 of the power connector (P2) on the MSU board (large board on bottom of DTS) as shown in Figure 1B. Verify the voltage is -5VDC ±0.05V. If adjustment is required, both -5VDC modules must be alternately adjusted at VOUT. The two -5VDC modules provide load sharing, and must be balanced to provide optimum performance.

Reference Voltage Check

(2-7) Using the digital voltmeter, probe the red and black pin jacks located on the back panel of the DTS, verify the DC voltage reads within ±1.1m VDC of the value recorded on the previous calibration label. Record this value in the test data record.

Figure 1A

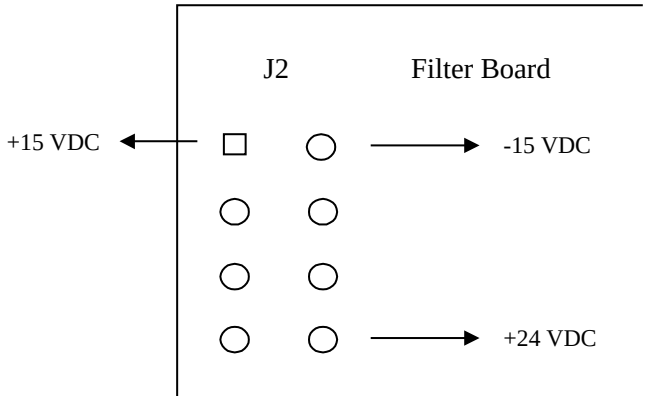
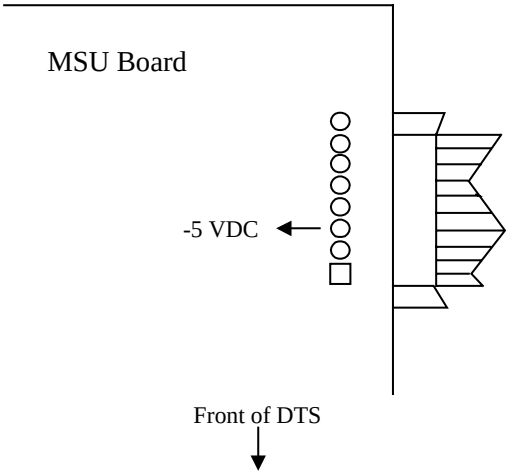


Figure 1B



3.0 100 MHz Oscillator Check

(3-1) Connect one SMA cable to the l00 MHz reference clock output at the back of the unit. Connect the SMA cable to the frequency counter (50 ohm input) and verify the oscillator output is 100.0 MHz ±0.9 Hz.

If necessary, remove the screw on the top surface of the oscillator located in the front half of the system, and use the non-conductive adjustment tool to change the oscillator frequency. (Clockwise adjusts the frequency down.) Allow frequency to settle for one to two minutes before readjustment.

(3-2) When adjusted properly, install screw into oscillator. Re-install top and bottom covers, but **do not put screws in the top cover at this time**. Allow system to run for one hour before proceeding.

(3-3) Repeat the oscillator check and verify the oscillator output is 100 MHz ±0.9 Hz before proceeding. When ready to proceed, **install the screws in the top cover.**

4.0 Self Calibration

Note: The (4) shorting caps and (2) 36" SMA cables provided with the system will be used in the following steps.

(4-1) Initiate an internal calibration sequence by pushing the INT CAL button on the front panel. The display will indicate the time remaining to accomplish the internal calibration, counting down on the display. When the countdown reaches 0 seconds, the display will change to: **CALIBRATED.** The previous mode and display then returns.

(4-2) Press the EXT CAL button on the front panel. The display will direct the user from the front panel. Both the DC and AC calibrations should be done at this time. Follow the instruction prompts on the front panel display. DO NOT use shorting caps on the CAL1 or CAL2 output connectors. Use only on CH1, CH2, ARM1 and ARM2 connectors. When the instrument completes its calibration sequence, the DTS will display **CALIBRATED.** The previous mode and display then returns.

(4-3) With the DTS connected to a computer, use the "Virtual Instruments" software or calibration software to first perform the DTS connect sequence over the GPIB interface, then perform the STROBE CAL operation. Follow the instructions on the computer display. When the strobe calibration has completed successfully, exit the program and disconnect the GPIB interface.

This completes the calibration portion of this procedure. The remaining steps are performance verification steps to ensure the system is operating properly.

5.0 Reference Voltage Operational Check

(5-1) Using the voltmeter, set the power supply for each value shown in Table 1. Then remove the voltmeter and connect the power supply to the DTS CH1. Press the "FUNC" key to perform a pulse find operation. The displayed voltages at Menu #15 for CH1 should be between the values shown in Table 1.

Table 1. Input Voltage Correlation

Selected Voltage	Min Reading	Max Reading
-1.000V	-1.0025V	-0.9975V
-0.250V	-0.2522V	-0.2478V
-0.025V	-0.0271V	-0.0229V
+0.025V	+0.0229V	+0.0271V
+0.250V	+0.2478V	+0.2522V
+1.000V	+0.9975V	+1.0025V

(5-2) Repeat for CH2.

Note: Depending on the power supply drive capability, the 50 ohm input impedance of the DTS may result in slightly lower readings on the DTS display. It may be necessary to measure and set the DC voltage at the DTS input connectors using a "T" adapter.

6.0 Calibration Signal Outputs

(6-1) Using the frequency counter and the oscilloscope and BNC-SMA adapter, if required, measure the outputs of both the CAL1 and CAL2 connectors. Verify the outputs are:

2.0Vpp ± 0.2V
200 MHz ± 200 Hz

Note: It is necessary to terminate both CAL outputs to 50 ohms when measuring outputs. This can be done by measuring one channel while externally triggering from the other output channel.

(6-2) Connect the CAL1 to the CH1 channel, and the CAL2 to the CH2 channel using the SMA coax cables.

(6-3) Go to Menu #9 (see Figure 2-6 in the User's Guide) and change MEASURE to ON. Then press the BURST button on the front panel. The display will read: **Subsequent cables will use this cable arrangement as a reference.** To verify this, press BURST again. The value displayed should be less than two picoseconds.

(6-4) Place the delay line between the CH1 input and the SMA cable connected to CAL1. Verify that CAL2 is connected to the CH2 input.

(6-5) Press the BURST button on the front panel. Verify the "electrical length" of the cable delay line being measured (in picoseconds) is within ±10 psec of the calibrated length.

(6-6) Set MEASUREMENT to OFF and remove the delay line.

7.0 AC Performance Checks

This step turns on the 200 MHz calibration signal following the cable measurement step.

(7-1) Verify that CAL1 is connected to CH1 and CAL2 is connected to CH2. Press the EXT CAL button on the front panel. The display will direct the user from the front panel. Perform only the AC external calibration at this time. (Do not press "GO" for DC Cal.) When the instrument completes its calibration sequence, the DTS will display **CALIBRATED.** The previous mode and display then returns.

(7-2) Go to Menu #11 (see Figure 2-6 in the User's Guide) and place the cursor on the CLEAR field. Then press FUNC. This sets up the DTS in a known defaults state.

(7-3) Go to Menu #14 and set the Number of Readings (sample size) to l0,000, SETS to l, and press CONT. Then go to Menu #1.

(7-4) With the TRIG field set to 50%-50%, scroll through the various measurement options shown belowand record the measurements. Verify JITTER (JTrms) measures <6ps (>2KHz for frequency). Then connect CAL1 to CH2 and CAL2 to CH1. Scroll through the various measurement options shown below and record the measurements. Average te two sets of measurements recorded for each measurement option. The average should be within the limits shown below.

*Both Channels

TPD++	0.000 psec ± 10 psec
TPD--	0.000 psec ± 10 psec
TPD+-	2500.000 psec ± 10 psec
TPD-+	2500.000 psec ± 10 psec
PW+*	2500.000 psec ± 10 psec
PW-*	2500.000 psec ± 10 psec
PERIOD*	5000.000 psec ± 10 psec
FREQ*	200.0 MHz ± 1 KHz

(7-5) Scroll to TT+ and press FUNC. The TT+ and TT- measurements for both input channels are now set for 10%-90% trigger levels and should read between 1400 psec and 1500 psec.

Note: When selecting Channel 2 in step (7-5), it will be necessary to press FUNC to perform a pulse find measurement on Channel 2 to get the proper results.

8.0 Arming and Gating Checks

(8-1) Connect CAL2 to the ARM1 input channel. Connect CAL1 to the delay line and the delay line to the CH1 input channel.

(8-2) At Menu #1, select PERIOD, CH1, TRIG = 50%-50%. Select AUTO ARM and CONTINUOUS mode on the front panel, and press FUNC. Verify the displayed measurement is 5000 psec ±10 psec with JITTER <6 psec.

(8-3) Set the function generator to output a square wave with a 5 nsec wide duty cycle, and a $1V_{pk\text{-}pk}$ signal at 1 KHz.

(8-4) Select EXTERNAL ARMING on ARM2 mode. Verify sample size = 10,000.

(8-5) Connect the CAL1 to the CH1 input channel and CAL2 to the CH2 input channel. Connect the output of the function generator to the ARM2 input. Go to Menu #3 and set GATE = "ON H". Then press CONTINUOUS.

(8-6) Determine the approximate amount of time it takes the DTS to obtain l0,000 samples. This can be done by watching Menu #16. Then change the gating duty cycle on the function generator from 5 nsec to 2 nsec. The time to obtain the 10,000 samples should now be more than twice as long.

(8-7) Remove all test equipment and cabling from the DTS.

9.0 Shut Down the DTS System

(9-1) Go to Menu #11 and select CLEAR. Then press FUNC to return the system to the default state.

(9-2) Power off the standby switch on the front panel and the main power switch on the rear of the instrument. Remove all cables and unplug the AC power cord from the power source and package the accessories that accompanied the system for return to the customer.

9.1 End of Calibration Procedure

If any display function does not appear to provide reasonable results, notify the *WAVECREST* Corporation factory for support at 1-800-733-7128.

REQUEST FOR
NOTIFICATION OF FUTURE PROCEDURE UPDATES

NOTICE TO RECIPIENT:

If you would like to be included in the distribution of new versions of this calibration procedure in the future, please indicate this to us by mailing this form back to Wavecrest Corp. at the address shown below, or fax it to the Director of Quality at **(612) 831 - 4474**.

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