INSTRUCTIONS

MODEL AVX-DD-A2-PS-TC-HR

DUAL CHANNEL
DIGITAL DELAY GENERATOR

SERIAL NUMBER: _____

WARRANTY

Avtech Electrosystems Ltd. warrants products of its manufacture to be free from defects in material and workmanship under conditions of normal use. If, within one year after delivery to the original owner, and after prepaid return by the original owner, this Avtech product is found to be defective, Avtech shall at its option repair or replace said defective item. This warranty does not apply to units which have been dissembled, modified or subjected to conditions exceeding the applicable specifications or ratings. This warranty is the extent of the obligation assumed by Avtech with respect to this product and no other warranty or guarantee is either expressed or implied.

TECHNICAL SUPPORT

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Manual Reference: /fileserver1/officefiles/instructword/avx-dd/AVX-DD-A2-PS-TC-HR.doc, created August 30, 1999

INTRODUCTION

The AVX-DD-A2-PS-TC-HR is a dual channel digital delay generator. The delay of each channel can be set between 0 and 9.9999999999 seconds, in 100 ps increments. The insertion delay is less than 35 ns.

The instrument is triggered by TTL-level pulses. Two outputs are supplied, both of which generate TTL levels, and which can operate into loads as low as 50Ω. The output pulse widths of the two channels are independently variable between 100 ns and 1 μs.

SPECIFICATIONS

Model:	AVX-DD-A2-PS-TC-HR
No. of output channels:	Two
Delay control:	Thumbwheel
Variable delay range:	0 to 9.9999999999 s[1]
Delay resolution:	0.1 ns
Jitter (RMS):	$\pm$ 40 ps $\pm$ 0.0005% of delay.
Insertion delay:	$\leq$ 35 ns
Rise time, fall time:	$\leq$ 10 ns
Output amplitude:	+3V (TTL) will drive 50 Ohm loads
Trigger required:	+ 5 Volt, PW > 50 ns
OUT pulse width:	100 ns to 1 μs, one-turn control
Max duty cycle:	80%
Pulse repetition frequency:	0 to 1 MHz
Connectors:	BNC
Power requirement:	110/220 Volts (switchable) 50 - 60 Hz
Dimensions: (H x W x D)	100 mm x 430 mm x 375 mm (3.9” x 17” x 14.8”)

[1] Improved since publication of original datasheet

INSTALLATION

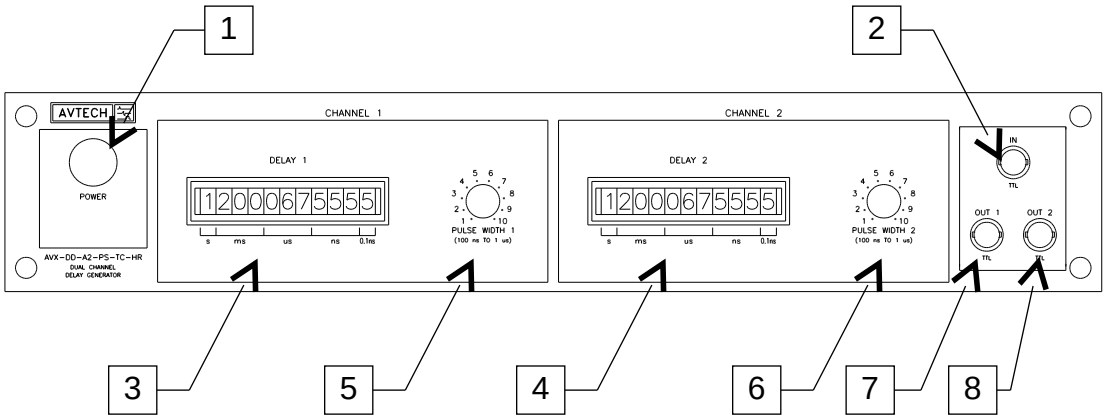
VISUAL CHECK

After unpacking the instrument, examine to ensure that it has not been damaged in shipment. Visually inspect all connectors, knobs, and the handles. Confirm that a power cord and this manual are with the instrument. If the instrument has been damaged, file a claim immediately with the company that transported the instrument.

PLUGGING IN THE INSTRUMENT

Examine the rear of the instrument. There will be a male power receptacle, a fuse holder and the edge of the power selector card visible. Confirm that the power selector is in the correct orientation - it should be marked either 120 or 240, indicating whether it expects 120V AC or 240V AC. If it is not set for the proper voltage, remove the fuse and then grasp the card with a pair of pliers and remove it. Rotate horizontally through 180 degrees. Reinstall the card and the correct fuse. In the 120V setting, a 1/2A slow blow fuse is required. In the 240V setting, a 1/4 slow blow fuse is required.

FRONT PANEL CONTROLS



1. POWER Switch. The POWER push button switch applies AC prime power to the primaries of the transformer, turning the instrument on. The push button lamp (#382 type) is connected to the internal +15V DC supply.

2. IN Connector. The TTL-level (i.e., 0 and 3-5V) input trigger is applied to this connector. The input impedance is greater than 500 Ω.

3. DELAY 1 Thumbwheel Switch. This thumbwheel switch controls the delay between the IN signal and the output on the OUT 1 connector.

4. DELAY 2 Thumbwheel Switch. This thumbwheel switch controls the delay between the IN signal and the output on the OUT 2 connector.

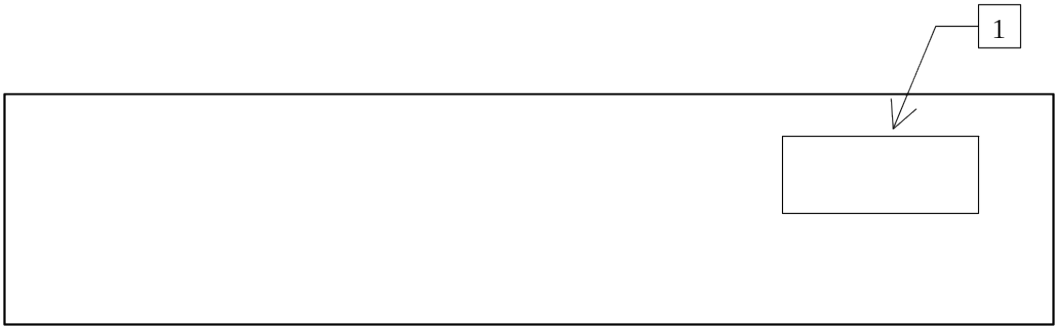
5. PULSE WIDTH 1. This dial controls the pulse width of the signal on the OUT 1 connector.

6. PULSE WIDTH 2. This dial controls the pulse width of the signal on the OUT 2 connector.

7. OUT 1 Connector. This TTL-level output is delayed relative to the signal on the IN connector. The delay time is determined by the “DELAY 1” thumbwheel switch. The pulse width is controlled by the “PULSE WIDTH 1” dial. This output will drive loads as low as 50 Ω.

8. OUT 1 Connector. This TTL-level output is delayed relative to the signal on the IN connector. The delay time is determined by the “DELAY 2” thumbwheel switch. The pulse width is controlled by the “PULSE WIDTH 2” dial. This output will drive loads as low as 50 Ω.

REAR PANEL CONTROLS

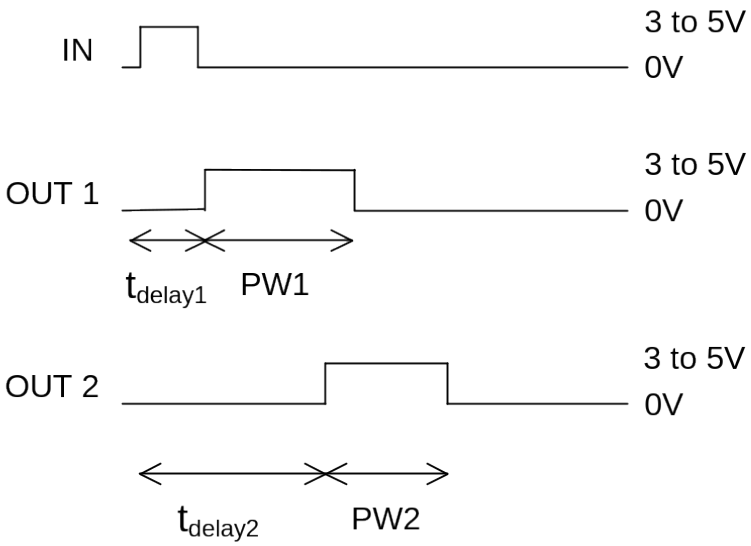


1. AC POWER INPUT. A three-pronged recessed male connector is provided on the back panel for AC power connection to the instrument. Also contained in this assembly is a slow blow fuse (1/4A for 120V operation, 1/8A for 240V operation) and a removable card that can be repositioned to switch between 120V AC in and 240V AC in.

GENERAL INFORMATION

BASIC OPERATION

The two output channels are delayed relative to the input channel, as shown below. The delay is the sum of the insertion delay (< 35 ns) and the programmed delay, set on the front panel thumbwheel switches.



The outputs will drive loads as low as 50Ω.

WARM-UP TIME

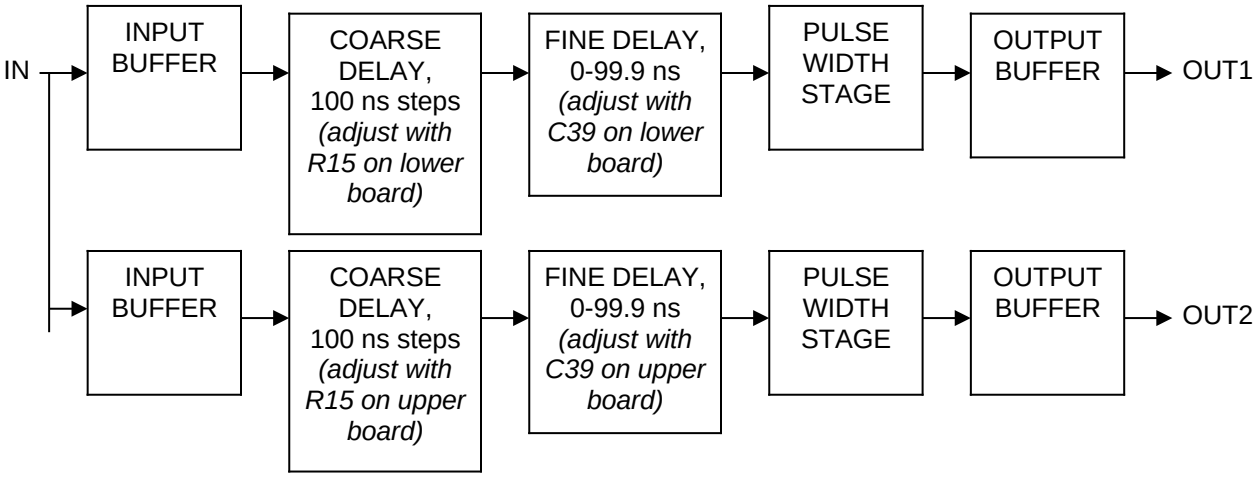
The AVX-DD-A2-PS-TC-HR will benefit from a warm-up time. If possible, the instrument should be allowed to warm up for one hour, to obtain the lowest possible jitter. Output jitter is reduced if the instrument is allowed several minutes to come to thermal equilibrium after changing settings.

ELECTROMAGNETIC INTERFERENCE

To prevent electromagnetic interference with other equipment, all used outputs should be connected to shielded 50Ω loads using shielded 50Ω coaxial cables. Unused outputs should be terminated with shielded 50Ω BNC terminators or with shielded BNC dust caps, to prevent unintentional electromagnetic radiation. All cords and cables should ideally be less than 3m in length.

CALIBRATION

THEORY OF OPERATION



The two delay channels are completely independent, aside from the common input. Internally, the two channels are implemented on two almost-identical stacked circuit boards. Channel 1 is the lower circuit board, and Channel 2 is the upper board.

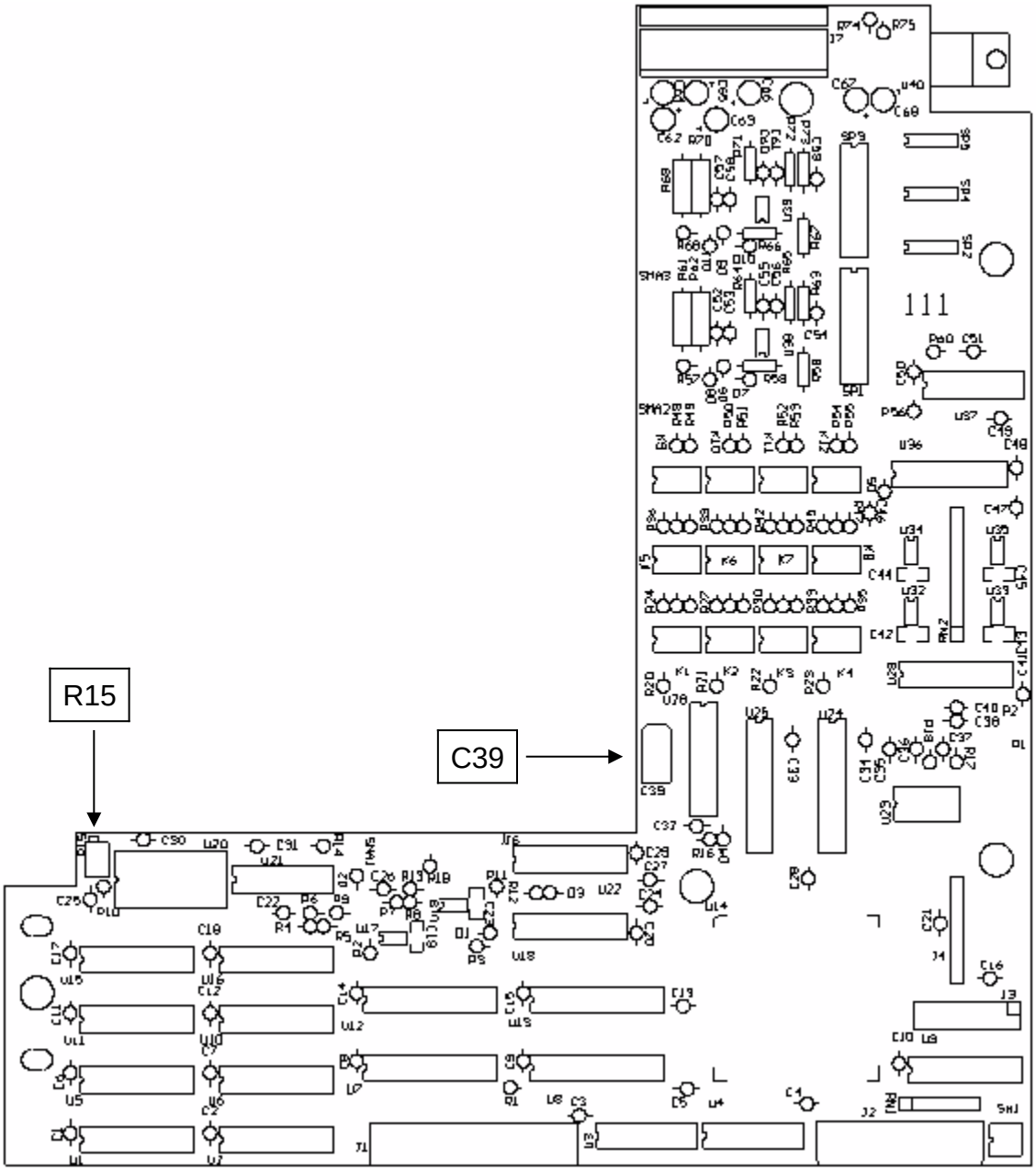
Each channel consists of two delay circuits: the “coarse delay” circuit delays the pulse in increments of 100 ns (i.e., the first 8 digits of the thumbwheel switch control this section.) The “fine delay” circuit handles the remaining delay, in the range of 0 to 99.9 ns. (The last 3 digits of the thumbwheel switch control this section.)

Both the coarse and fine circuits are adjustable within a narrow range, to allow calibration and synchronization.

To calibrate the coarse section, measure the different delays obtained when you switch between settings of 100.0 ns and 200.0 ns. The difference between the two measurements should be exactly 100.0 ns. If it is not, remove the top cover and locate the trimming potentiometer (or “trimpot”) R15 on the appropriate circuit board (see the diagram below). Using a small slot screwdriver, rotate the twelve-turn brass screw on the trimpot until a delay increment of 100.0 ns is obtained.

To calibrate the fine section, observe the different delays when you switch between settings of 99.9 ns and 100.0 ns. The difference between the two measurements should be exactly 0.1 ns. If it is not, remove the top cover and locate the variable capacitor C39 on the appropriate circuit board (see the diagram below). Using a small slot screwdriver, rotate the brass screw on the capacitor until a delay increment of 0.1 ns is obtained.

TRIMPOT AND VARIABLE CAPACITOR LOCATIONS



JITTER PERFORMANCE

The jitter of the delayed output is affected somewhat by the setting of calibration trimpot R15. After calibrating the instrument for accuracy, the jitter should be checked as well, if this parameter is important for your application. If jitter stability is of paramount importance, R15 can be adjusted to obtain minimum jitter at the expense of absolute accuracy.

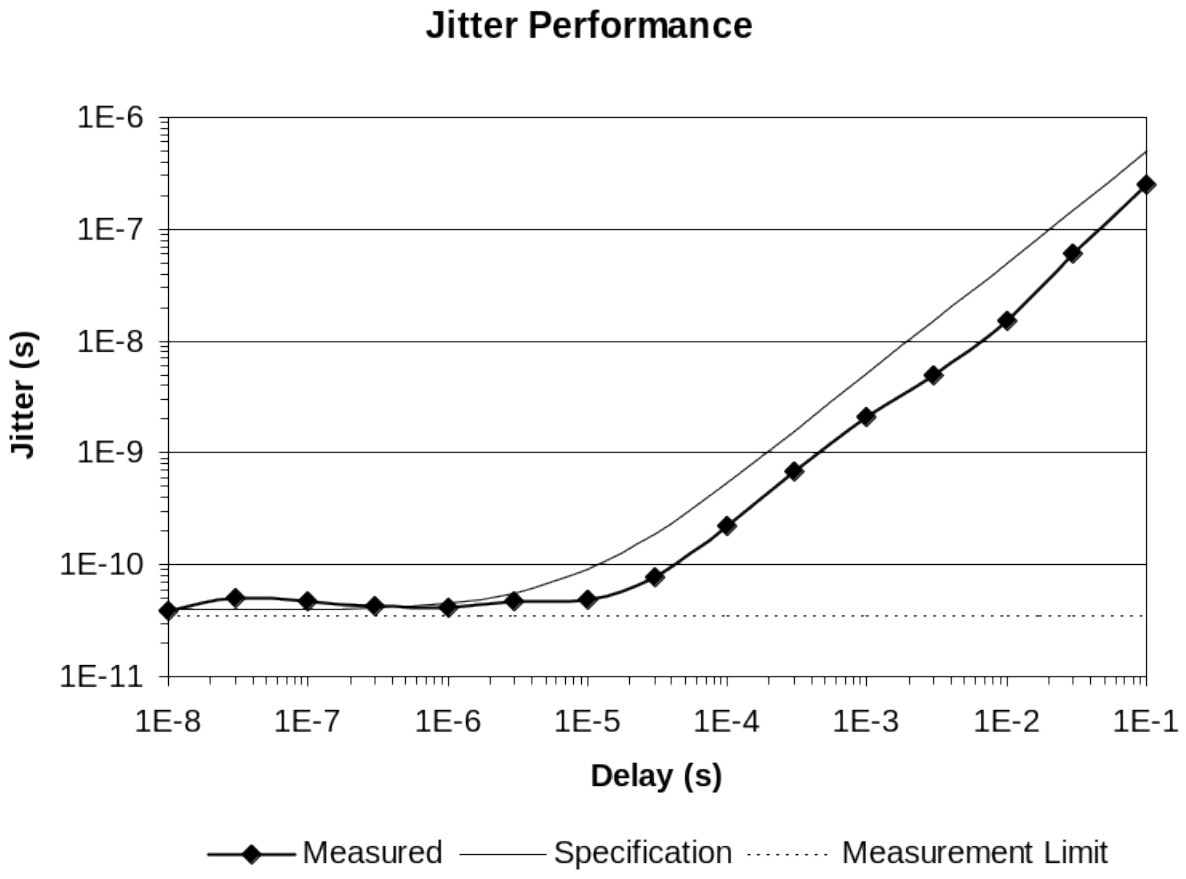
TOP COVER REMOVAL

The interior of the instrument may be accessed by removing the four Phillips screws on the top panel. With the four screws removed, the top cover may be slid back (and off).

TYPICAL PERFORMANCE RESULTS

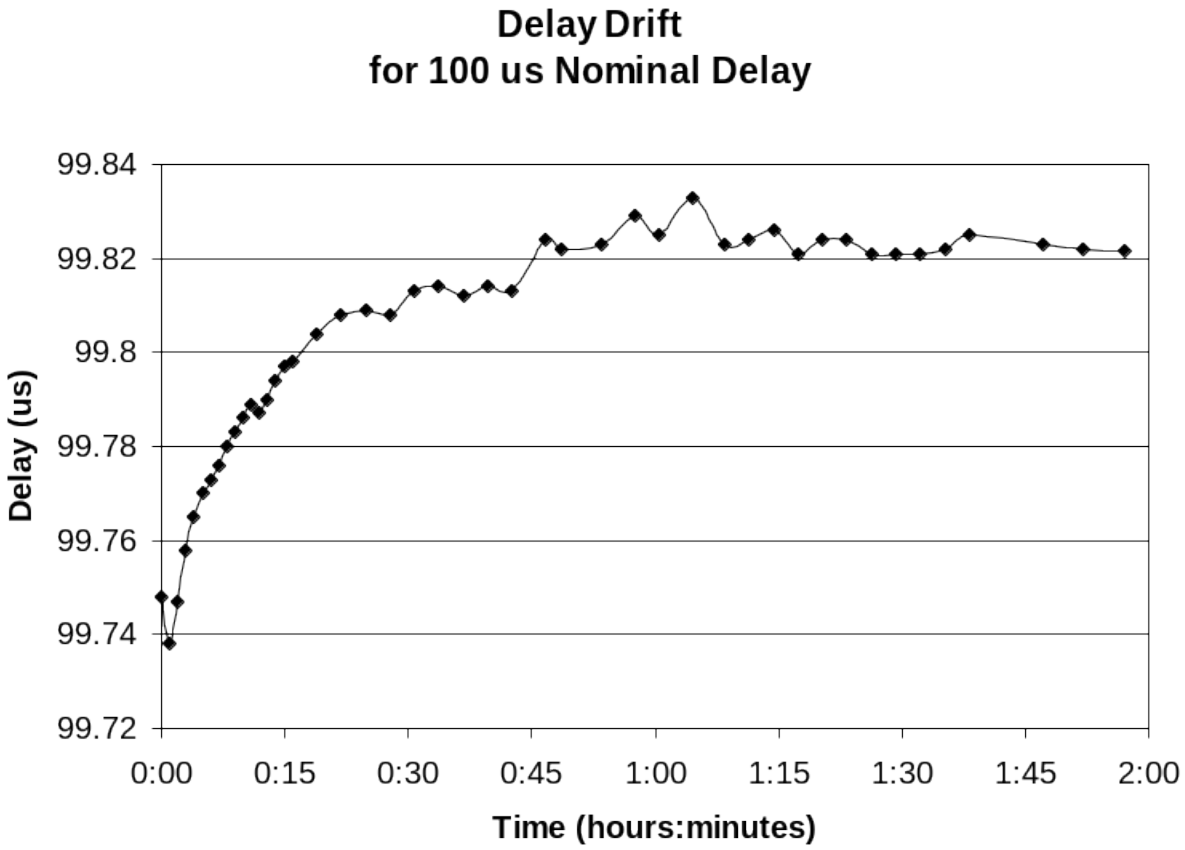
DELAY JITTER

Jitter is the short-term (over periods of less than one second) variation of the delay. The chart below shows the typical jitter as a function of the delay. These measurements have been made using a Hewlett-Packard HP5370A Time Interval Counter, after the delay generator has warmed up. The HP5370A introduces approximately 35 ps of its own jitter; this measurement limit is indicated on the graph as a dashed line. The measured jitter is the sum of the HP5370A jitter and the delay generator jitter.



DELAY DRIFT AND WARM-UP

As noted previously, the instrument will benefit from a warm-up period. The graph below shows the measured output delay as a function of time, for a nominal delay setting of 100 μs:



PERFORMANCE CHECKSHEET