CAPTURING DATA FROM SYMMETRICOM PHASE NOISE AND ALLAN DEVIATION TEST SETS FOR ANALYSIS BY STABLE32

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ABSTRACT

This document describes the methods by which phase data can be captured (read and stored to a file) from one of the Symmetricom (formerly Timing Solutions) 5110A, 5115A, or 5120A phase noise and Allan deviation test sets. While these instruments include built-in provisions for analyzing and displaying the results of time and frequency domain frequency stability measurements, they can also be used as measuring devices to provide data for off-line batch processing. By capturing these data, the full capabilities of the Stable32 analysis functions can be employed for more detailed manual analysis and presentation.

INTRODUCTION

The Symmetricom (formerly Timing Solutions) 5110A, 5115A, and 5120A phase noise and Allan deviation test sets provide state-of-the art capabilities for measuring the stability of precision clocks and oscillators. While these instruments are capable of analyzing and displaying the results of their time and frequency domain frequency measurements, they can also serve as excellent measuring devices to provide data for off-line batch processing. By capturing these data and reading them into the Stable32 program for frequency stability analysis, the full capabilities of that program can be employed to perform a more detailed manual analysis, and those results prepared for publication-quality presentation.

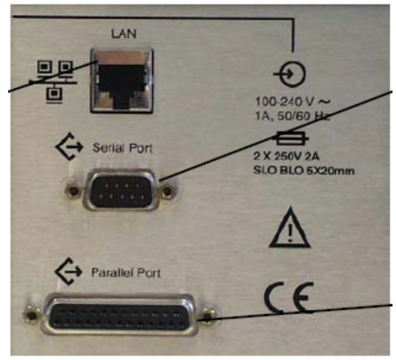
The general process for capturing data from one of these Symmetricom instruments is quite straightforward. While the instrument is collecting data, those data are output from a serial communications (RS-232) or Ethernet LAN data port. By making a suitable connection to a personal computer (PC), and running an appropriate terminal program, the data stream can be read and stored to a disk file. At the conclusion of the measurement, the data file can then be read directly into the Stable32 program for analysis. These data are in the form of a single column of ASCII characters representing floating point numbers, one number to a line. They represent the phase, in cycles, of the instrument's A channel input, which must be scaled to phase in seconds (x) by multiplying them by the nominal period of the signal (e.g., 100 nsec or 1e-7 for a 10 MHz signal). That scaling can be accomplished within the Stable32 program, either automatically by setting the Multiplier value in the Inputs dialog, or manually with the Multiplier value of the Scale function. The appropriate measurement interval (tau) must also be entered.

Stable32 includes a utility program called 5110Comm to capture data from the serial communications (RS-232) port of the 5110A Time Interval Analyzer. Any Telnet client program that can store data to a disk file (e.g. Windows HyperTerminal) can be used to capture data from a 5110A, 5115A, or 5120A Ethernet port.

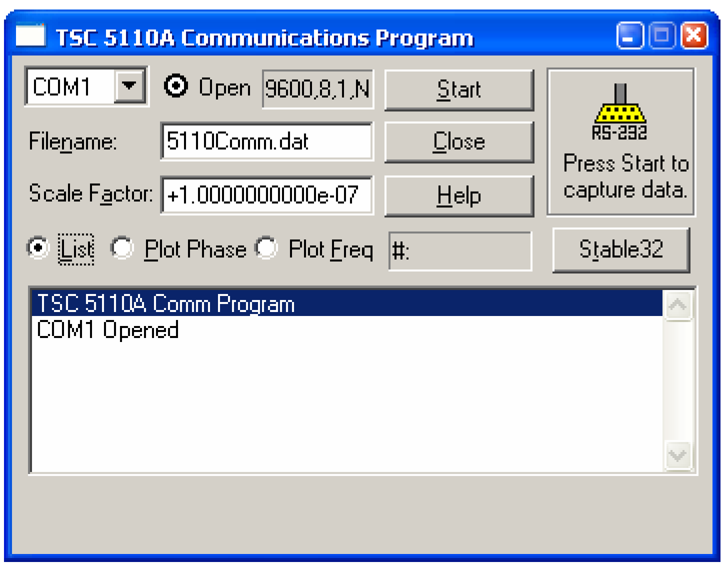
More details about capturing data from these instruments are given below.

5110A TIME INTERVAL ANALYZER

This instrument has a serial communications (RS-232) port that outputs a stream of phase data at a rate of 1 measurement per second, and an optional Ethernet LAN data port that outputs a stream of phase data at a rate of 100 measurements per second, when it is collecting data.



Stable32 comes with a small utility program called 5110Comm that supports serial data capture from a 5110A. It is more convenient than using a general-purpose terminal program because it includes provisions for scaling the phase data, listing the data stream, counting the number of data points, plotting the phase or frequency data, and launching Stable32 on-the-fly. A screen shot of the 5110Comm program is shown below. See its Help file for more information about its setup and operation [4].



To capture data from the 5110A Ethernet port, first configure the network connection as described in Section 5.1 Configuring Network Connection of the 5110A Operations and Maintenance Manual [1]. Then connect to the 5110A via the network connection from a remote computer using a Telnet client to read and capture the stream of phase data from the instrument. See the following excerpt from the 5110A manual, and the instructions for using a Telnet client in the 5115A/5120A section of this document below.

5.2 Accessing the 5110A Remotely and Exiting the Remote Session

Once you set up the network connection and connect the 5110A to your network, you can access the instrument remotely from any computer on your network. You need to know the IP address and the Command port number. You use a network connection program, such as Telnet, to send commands over the network to access the instrument. You can have only one active connection to the Command port to start, stop, and print data.

You can also use Telnet to connect to the Data port. From the Data port, you can view phase difference data and the Allan deviation table.

To access the 5110A remotely:

1. From a command prompt or your Telnet software, enter:

   telnet <IP address> <Command port>

   telnet <IP address> <Data port>

   - This opens two Telnet sessions and connects you to both ports so you can control the instrument and view phase difference data.
   - If someone has started data collection, the phase difference displays on the Data port. If you need to start collecting data, see "5.3 Starting and Stopping Data Collection (Remotely)" on page 31.
2. When you are finished with your remote session, enter the following:

   quit

5.3 Starting and Stopping Data Collection (Remotely)

Using the Ethernet port and a Telnet-capable program, you can start and stop data collection remotely over a TCP socket.

To start and stop data collection remotely:

1. Access the Command port.
   - For more information, see "5.2 Accessing the 5110A Remotely and Exiting the Remote Session" on page 30.
2. From the Command port Telnet session, enter:

   set control remote

   start

   - Data collection starts. After a few seconds, phase difference data starts to display in the Data port Telnet session.
   - You can use the following command to set the control to permit either local or remote use: **set control none**.
3. When you want to stop data collection, enter:

   stop

5.4 Viewing Data (Remotely)

You can view phase difference data remotely and store it in a file. The phase differences are in cycles of the input reference signal. The Data port outputs floating point numbers one number per line, 10 each second on the serial port and up to 100 each second on the Ethernet connection. See theory of operations section on page 48 for details on sampling rates.

You can also view the Allan deviation table or print from the Command port.

To view phase difference data remotely:

1. Access the Data port.
   - For more information, see "5.2 Accessing the 5110A Remotely and Exiting the Remote Session" on page 30.
2. If you want to store the data in a file, tell your Telnet software to capture the data.
3. Access the Command port.
   - For more information, see "5.2 Accessing the 5110A Remotely and Exiting the Remote Session" on page 30.

4. From the Command port Telnet session, enter:

   set control remote

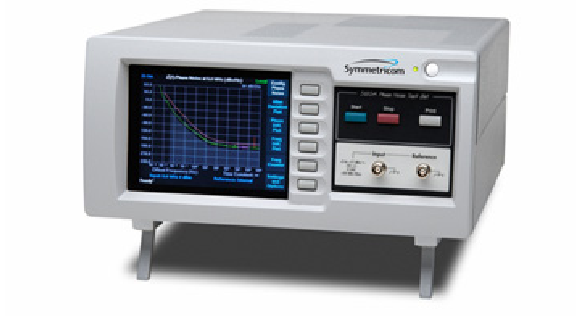
   start

   - Data collection starts. After a few seconds, phase difference data is continuously written to the Data port.
5. When you want to stop data collection, enter the following in the Command port Telnet session:

   stop

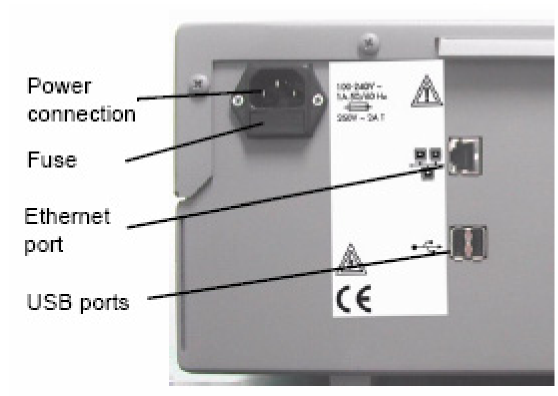
5115A PHASE NOISE AND ALLAN DEVIATION TEST SET
5120A HIGH PERFORMANCE PHASE NOISE AND ALLAN DEVIATION TEST SET

5115A



5120A

These instruments have a Ethernet data port that outputs a stream of phase data at a rate of 1000 measurements per second when they are collecting data.



The following is an excerpt from the 5120A/5120A Operations and Maintenance Manual [2]:

7.3 The Network Data Port

The network data port outputs phase difference data while the test set is in the *Collecting* state. The phase differences are in units of cycles of the Input signal. Phase differences are output as floating point numbers, one number per line, 1000 each second.

The data port accepts no input, all input to data port connections is discarded by the TSC 5120A or 5115A.

Phase difference measurements are published while the test set is in the *Collecting* state. See "3.2.1 Collecting State" on page 13. When data collection is stopped or the test set is in the *Initializing* state, no data is published. Once collection is restarted, phase differences are output again. This means that a data port connection can be kept open while collection is stopped, input or reference signal sources are changed, and collection is restarted.

To retrieve phase difference data remotely:

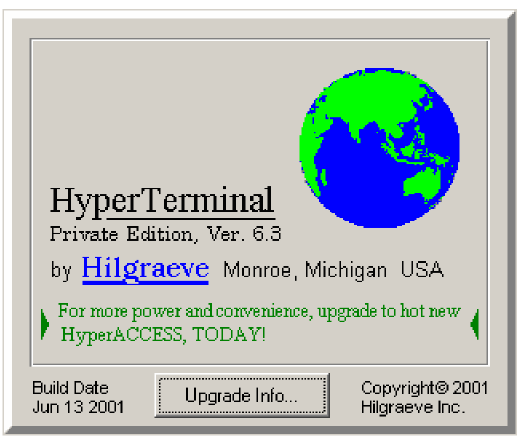
1. Access the Data port.
   - For more information, see "7.1 Accessing the 5120A or 5115A Remotely and Exiting the Remote Session" on page 56.

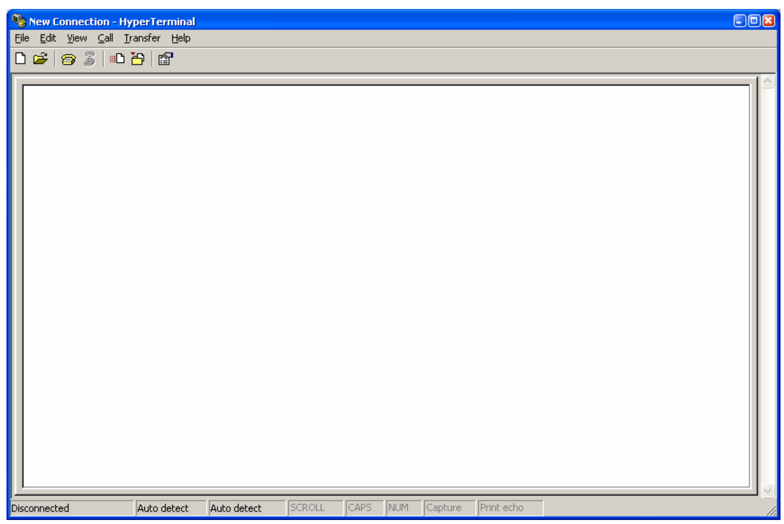
5120A/5115A Operations and Maintenance Manual 65

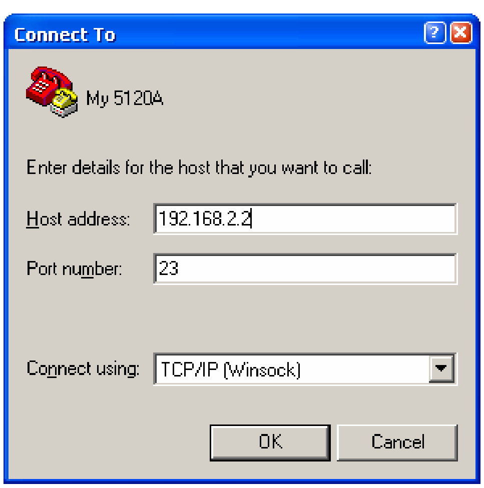
- If you want to store the data in a file, tell your Telnet software to capture the data.
- If no phase difference data is published on the command port, the test set is not in the *Collecting* state - connect to the command port and start data collection. See “7.2.2 Starting and Stopping Data Collection” on page 57 for details.

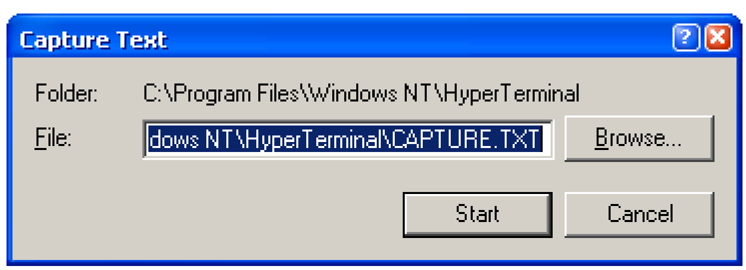
To capture these data, it is first necessary to make a network connection between the instrument and a personal computer (PC) through a local area network (LAN). See Section 4.1.2 Network Configuration on page 23 of the 5120A/5115A Operations and Maintenance Manual for information about configuring the network connection. The details of establishing this connection will vary depending on the local circumstances. The instrument’s IP address will be needed to establish the connection from the PC. Also consult the manual for information about setting up the measurement, and starting and stopping data collection.

Next, launch a suitable Telnet client program on the PC. Many such programs are available (some free) on the Internet, or the HyperTerminal that is included with most versions of the Microsoft Windows® operating system can be used. The essential requirement is that data can be stored to a disk file. One such program is HyperTerminal Private Edition from Hilgraeve Inc.









Generally, one enters an arbitrary name for the connection (e.g., My 5120A), the connection type (TCP/IP), and the IP address (e.g. 192.168.2.2). There will be a menu option like "Capture Text" to support data capture that will ask for a filename where the data is to be stored. Data capture can then be started, and stopped at the end of the run.

STABLE32

Entering the captured data into Stable32 from a disk file is straightforward, and is accomplished by the File/Open function [3]. Enter the filename, select Phase as the data type, and press Open. The data will be read and displayed. Because there are no associated timetags, and no file header, the measurement interval (tau) must be entered manually (e.g., 1e-3, corresponding to 1 msec or 1000 measurements per second). Press OK again. Finally, the phase data must be scaled from cycles to seconds with the Edit/Scale function. Enter the period of the input signal (in seconds) as the Multiplier (e.g. 1e-7 for 10 MHz) and press OK. The data is now ready for analysis.

For repetitive data entry, it is easier to enter the scale multiplier value into the Multiplier box of the Inputs dialog (either from the Data File Opened dialog or the Utility/Inputs menu) and check the Scale data checkbox in the Data File Opened dialog so that the phase data will be scaled automatically as it is read. For repetitive analysis, use one of the Auto functions.

REFERENCES

1. *5110A Operations and Maintenance Manual*, DOC05110A, Symmetricom, Inc., 34 Tozer Road, Beverly, MA 01915 USA.

2. *5120A/5120A Operations and Maintenance Manual*, DOC05120A, Symmetricom, Inc., 34 Tozer Road, Beverly, MA 01915 USA.

3. *Stable32 User Manual*, Hamilton Technical Services, 650 Distant Island Drive, Beaufort, SC 29907 USA.

4. 5110Comm.chm, Microsoft Windows HTML Help File for the 5110Comm TSC Model 5110A Communications Program, Hamilton Technical Services, 650 Distant Island Drive, Beaufort, SC 29907 USA.

File: Capturing Data from Symmetricom Instruments.doc

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