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SIGNAL GENERATOR MONITOR

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1 Introduction

This document describes the application developed for controling and monitoring the signal generator SML via RS232 using remote control commands. The application is written in C language and runs on the server machine. The server machine is connected with the signal generator via serial port, whereas the user log in remotely from the personal computer (using putty) to server machine as they are connected togather via ethernet network. This is shown in Figure 1.

2 System Overview

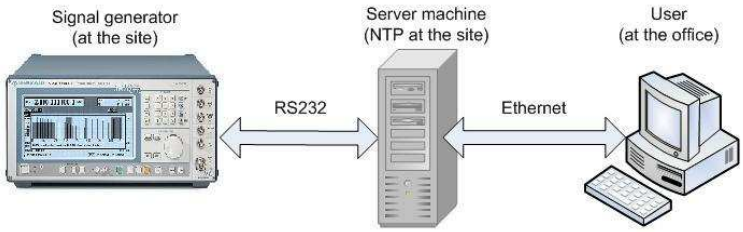

Figure 1: System Overview

The application is running on a server machine and toolbox was used for testing, but it is desired to run on an Network Time Protocol (NTP). The RS232 transmission parameters of the signal generator and the server machine must be the same. The signal generator is defined to accept certain settings and they are defined in the next section, hence the server machine need to be set according to them.

3 Transmission Parameters

The following are the RS232 settings defined for signal generator [1] (chapter 5).

- **Transmission rate (Baud rate)** 8 different baud rates can be set on the instrument: 1200, 2400, 4800, 19200, 38400, 57600, 115200.
- **Data bits** Data transmission is in 8-bit ASCII code. LSB (Least significant bit) is transmitted as the first bit.
- **Start bit** The transmission of the data byte is initiated with a start bit. The falling edge of the start bit indicates the beginning of the data byte.
- **Parity bit** No parity bit is used.
- **Stop bit** The transmission of a data byte is terminated by a stop bit (1 bit is used).

The transmission rate used during the testing of the application is 9600, and the application uses this baud rate as a default. The baud rate can be change using export BAUD_RATE=19200 (suppose user choses 19200), this can be done directly on a terminal window because the BAUD_RATE is defined as an environment viriables. The DEVICE is also defined as an environment variable, and this is where the RS232 transmission parameters are defined for the server machine. The default DEVICE name is /dev/ttyMI1.

It should be noted that every command sent to the signal generator should be appended with a carriage return and line feed, (0X0D0A - hex format). This is defined as interface function for the remote control commands via serial port. For commands that are sent as a sinlge entity, then this should be done once to the last command, i.e. *RST;CLS<CR><LF>. The semicolon separates commands if they are concatenated and sent as a single string. The application caters for the carriage return and line feed, the user does not have to add it as an argmunent or append to the command, but should be aware especially when interacting with the signal generator directly via a terminal window.

4 Application

The develop application is sg_monitor.c and the compiled (using make file with gcc compiler) file name is sg_monitor. The user is expected to run the application as follows: ./sg_monitor arguments. The arguments are optional, but they are necessary to interact with the signal generator. If the arguments are not specified, then the application request the identification of the signal generator (*IDN? - remote common command), and also state that the user must use -h as an argument to get started.

The application defines the short cut commands as the one that start with hyphen (-), such as -f, -p. The full commands are the one that can be sent as they are, meaning they are compatible with signal generator, i.e. FREQ?, FREQUENCY?.

The Figure 2 shows the sample taken while running the application on the toolbox machine through Putty application. For more details the user should type -h as an arguments and it will display information about how to use this application. The manual page has been created for this application and it saved under directory man1. The user is advised to copy the directory and paste it in the working directory, then when the user type *man sg_monitor*, the manual page will be printed on the window.

- **./sg_monitor** - the application send *IDN? command to the signal generator, and then wait for the response - if the timeout is reached while there is no response, this implies that the communication between the server and signal generator is not sucessful/established. Therefore the user need to confirm the transmission setting of the signal generator and the sever if they are the same.
- **./sg_monitor -f 100MHz or FREQ 100MHz or FREQUENCY 100MHz** - showing different commands for setting the RF signal, and this will not generate any response. The user is recommended to enter the control command and then follows with a query command, i.e. ./sg_monitor -f 100MHz -f or FREQ 100MHz FREQ? or “FREQ 100MHz” FREQ?.
- **./sg_monitor -s** - this is not shown in the Figure 2 but it is defined in the help manual. This request the RF value, Power, RF output status, Status register and if the error is detected then the error message is requested.

To check if the command was executed correctly or if there is any error then use either -e or *ESR? as an argument to request the status report. The -e is recommended because if the response is greater than 0 then the error message is requested, otherwise the user is advised to request the error message report using *SYST:ERR?.

The status register also records if the signal generator has been changed from remote control to manual - this happens if the user has directly press the LOCAL button on the signal generator(switches to manual mode). It also indicates if the signal generator is switched ON only if it was switched OFF and then ON. This flags are necessary to konw if something have changed then it may be result of that the user has changed it manually or the power has went down and then the signal generatoer was switched ON again. Therefore this is not considered as an error, even though it recorded in the status register.

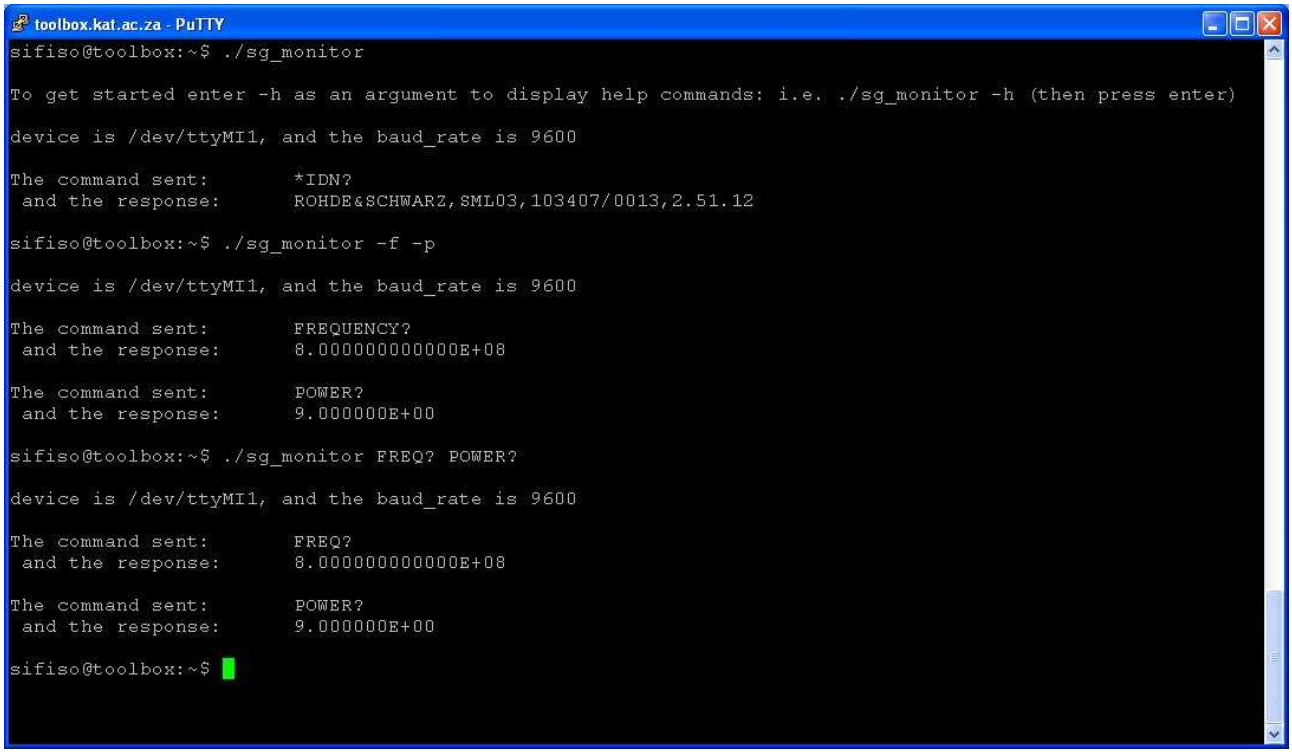

Figure 2: Running Application on a toolbox machine

The application does handle commands where a user enters the short cuts and full commands simultaneously, i.e. ./sg_monitor -f POWER?. Therefore the user must either use the short cuts or full commands when enters more than one arguments, i.e. ./sg_monitor -f -p -o or ./sg_monitor FREQ? POWER? OUTPUT?. The application can handle up to the maximum of 20 commands during its run time, but this can be changed if necessary.

The application is define to accept the command with either 0 (./sg_monitor FREQ?) or 1 (./sg_monitor FREQ 100MHz) arguments. If the command is composed of more than 2 arguments, then the user must use inverted commas, i.e. ./sg_monitor “FREQ 100 MHz” - and the application interpretes this as a command with no arguments as they are recorded as a single entity.

5 Remote Control Commands

Refer to referrence [1] for remote control commands. The user can run the application using the argument -h for basic commands. Enter *man sg_monitor* to request manual page if the man1 directory with sg_monitor.1 is copied to the working directory.

References

[1] Signal Generator Operating Manual {R&S SML01, R&S SML02, R&S SML03, R&S SMV03}, chapter 5 and 6, *https://katfs.kat.ac.za/svnROACH/sw/signal_generator_monitor_RS232*, ROHDE&SCHWARZ, Test and Measurement Divison.