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APPLICATION BULLETIN

IMPROVING 4895 PROGRAM PERFORMANCE AND RESPONSE TIMES

INTRODUCTION

This application note describes the Model 4895's response times for controlling GPIB instruments with the new Revision 18 firmware. This note also describes the five new short form commands that have been added to the 4895's firmware to reduce the serial transmission times.

BACKGROUND

The Model 4895 is a Serial-to-GPIB Bus Controller that is used to control GPIB instruments over serial links. The serial link can be a connection to a PC COM port, a long cable with RS-485 signals or a dial-up telephone line with a modem at the 4895 end. In all cases, the 4895 commands are received as serial messages and the response data is sent back as serial messages.

In some applications, the systems's response time becomes important, either because it represents a large part of the total program execution time or the system requirements dictate some minimum system response times. When measuring the system's response time, the user must take into account the time it takes to send a command to the 4895, the 4895's internal command execution time, GPIB bus transmission time, instrument response time, and the time it takes to get the data into the 4895 and transmitted back to the host computer. Of these times, the Model 4895 only has direct control of the command parsing time and partial control of the GPIB bus transfer times. Figures 1 and 2 show the serial data transmission and its relationship with the GPIB Bus signals.

The goal of this application note is to give the 4895 user some guidance for estimating system response time and some techniques for improving system performance.

SYSTEM TIMING

Figure 1 shows the timing diagram for a typical enter command that querys a device and reads back its response. Figure 2 shows a typical output command that sends data to a device.
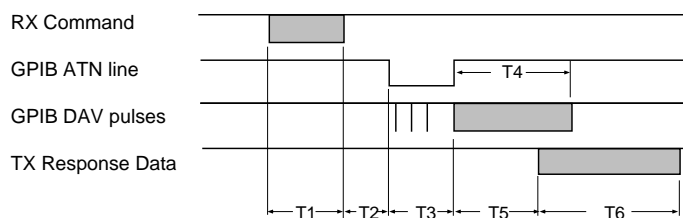

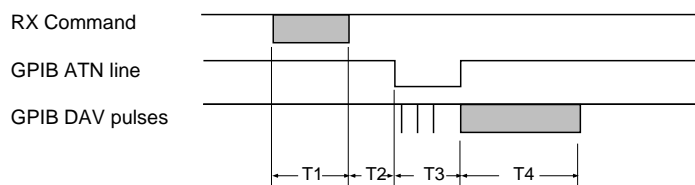**Figure 1   Enter Command Timing Diagram**

Figure 2   Output Command Timing Diagram

The serial transmission time, T1, is a function of the command length and the data rate of the serial data path. Typical 4895 commands like OUTPUT or OUTPUTB use 6 or 7 characters for the command name plus the included data characters and five overhead characters for each command. (Number of characters = command name + space + address + ';' + data string + terminator). T1 is a function of the baud rate and the total the total command character count. When connected to a DOS PC, the data rate normally is limited to 19.2 Kbaud. Although some computers have faster data rates, they often have some dead time between the output characters. Use an oscilloscope to check your computer's serial output when running your test program to be sure that it does not insert any unwanted delays between the output characters.

T2 is the 4895's internal processing time. This value varies for each command as the work that the parser performs varies with each command. T2 also varies by how the command is ranked in the parser. The more frequently used commands are ranked higher to reduce their processing times. Conversely, the less frequently used commands are ranked lower as they will have little affect on the average user's program. Table 1 lists the T2 times for the five most common commands. Figure 2 is misleading if the output commands have long data strings as the 4895 starts parsing output commands when it receives the semicolon after the address characters. For long data strings it is possible for the 4895 to output DAV pulses before it receives all of the serial data.

T3 is the time it takes to send the GPIB address characters to the device. Not much can be done to change the T3 time.

For a query, T4 is the GPIB device's response and 4895 input time. For an output command, T4 is the data transfer time from the 4895 to the device. These times are a function of the 4895, the GPIB device being used and the length of the command and data strings. The times for T3 and T4 in Table 1 were recorded using an ICS 4811 Bus Analyzer in the device mode to handshake in the data characters. The output and response messages held 10 data characters. The T3 and T4 times will vary with different GPIB bus devices. To obtain correct values, the user should measure these times on the actual device.

T5 is the 4895's internal delay between inputting the first response character and starting the serial transmission to the host computer. This is a fixed value.

T6 is the serial transmission time. It is a function of the number of characters in the response message and the baud rate.

Table 1   Command Response Times in ms

Command	T1	T2	T3	T4	T5	T6
OP	8.4	0.4	1.0	12	n/a	n/a
OUTPUT	10.5	2.8	1.0	12	n/a	n/a
OPB	8.9	0.3	1.0	12	n/a	n/a
OUTPUTB	11.0	2.3	1.0	12	n/a	n/a
IP	2.6	5.0	1.1	0.8	0.6	6.3
ENTER	4.2	8.2	1.1	0.8	0.6	6.3
IPB	3.1	5.2	1.1	0.7	0.6	12.0
ENTERB	4.7	7.9	1.1	0.7	0.6	12.0
TRG	3.1	5.0	0.3	n/a	n/a	n/a
TRIGGER	5.2	6.1	0.3	n/a	n/a	n/a

Notes: Commands used:
　　　OP/OUTPUT 2;1234567890 cr lf.
　　　IP/ENTER 2 cr lf with response = 1234567890.
　　　TRG/TRIGGER 2 cr lf.
　　　ENTERB and IPB send data and data length replies during T6.
　　　Baud rate = 19,200

IMPROVING SYSTEM PERFORMANCE

The first step is to improving system performance is to put the system together and measure its times. Connect an oscilloscope to the 4895's serial input line and trigger it on a rising edge (the start bit in the first RS-232 character). Connect another lead to the GPIB DAV line and one to the 4895's serial transmit line. If the oscilloscope only has two traces, the measurements will have to be taken in two steps. Record the DAV pulse timing first and the serial transmission line second as it is not needed for some commands. Compare the results against Figures 1 and 2 and the times in Table 1.

If the times need to be shortened, check the following possibilities:
1. Increase the baud rate to reduce the serial transmission time. Be careful of some computers and operating systems that actually insert dead time between characters when the baud rate increases.
2. For 4895s with revision 18 or later firmware, change the enter, output and trigger commands to their short form. Use IP instead of Enter, IPB for EnterB, OP for Output, OPB for OutputB and TRG for Trigger.
3. For older 4895s, contact ICS and upgrade to the latest firmware to reduce the 4895's internal operation times and to be able to use the short form commands.
4. Use GPIB addresses 1 through 9 for the remote devices and don't send the leading 0. This will remove one character time.
5. Verify that the PC is not outputting two terminators when one will do. Can save a character time.
　　　i.e. a carriage return and a line feed.
6. Check the command sequence to see if rearranging commands can reduce the device performance time or make multiple devices parallel their operations. i.e. trigger DVMs before taking readings.
7. Check the GPIB device for shorter response formats. i.e. binary vs long ASCII strings.
8. Make use of the 4895's ability to store command sequences in its program buffers. Repeated command sequences can be executed with a simple RUN command.
　　　i.e. TRIGGER 4;TRIGGER 5;TRIGGER 6 <lf>
　　　can be replaced with: RUN 1 <lf>.

SUMMARY

This application note has described the different factors that affect the systems's responses when using a Model 4895 and steps the user can take to improve system performance. Data is included on the new 4895 revision 18 PROM performance and five new short form commands that can be used tin place of standard 4895 commands.