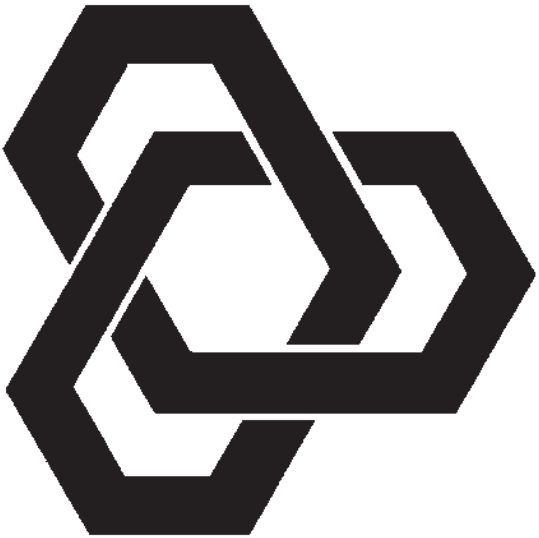
TAMS
Test & Measurement Systems Inc.

TAMS 1701A
Frequency Synthesizer



Installation & Operation

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Introduction

The TAMS 1701A Frequency Synthesizer provides an easy to use, compact mechanism to generate frequencies in the 0-200 Mhz range. It is particularly suited to controlling system clocks for products under development, but also has uses in factory-floor testing.

It also generates pseudo-random bit sequences over the same frequency range, which can be useful in testing communication channels. If used with a laptop computer, a highly portable solution is available for use in the field.

To use the product, I/O libraries from either Agilent or National Instruments must be installed to allow communication over USB, using the USBTMC (Universal Synchronous Bus, Test and Measurement Class) device type. The frequency can be controlled either manually with a supplied GUI, or programmatically using SPCI (Standard Commands for Programmable Instruments) commands with SICL or VISA calls. The default frequency generated at power-up can be easily changed in the device. If a single frequency is required, it can be set as the default, and the device automatically generates that frequency when power is applied. The GUI maintains a list of commonly used frequencies in a drop-down box, so that they can be recalled easily. The outputs can be gated using either a hardware input to the device, or programmatically.

The device is USB 2.0 compliant, and operates either in full-speed (12 Mbits/sec) or high-speed (480 Mbits/sec) mode. It is a bus-powered device, eliminating the need for an external power supply.

Software Installation

Windows

Consult the I/O Library vendor's documentation before starting install. It is recommended that USB devices be disconnected during software installation, and that any previously installed libraries be uninstalled before installing new one. Reboot the computer after old libraries are uninstalled, and again after new ones are installed. Then the USB devices may be re-attached.

The 1701A product can be used with Microsoft Windows 2000 or XP Professional. An I/O library must be installed before proceeding with installing the GUI. Suitable libraries include:

* NI-Visa Software for Windows, ver 3.2 or later, runtime or full version.

* Agilent Suite 14.1 with Patch 2. There are minor usability issues, but nothing critical.

USBTMC support is a relatively recent addition to these I/O Libraries, so do not try to use earlier versions than specified. These libraries are not included with the 1701A product, and must be purchased separately. If compiled programs are to be used to drive the 1701A, install the full version of the NI libraries.

After the libraries are properly installed, install the GUI if desired by inserting the supplied CD into the drive, and following the on-screen instructions.

Linux

The 1701A product can also be used on RedHat Linux systems by installing TAMS I/O Libraries for Linux, 82091. Supported RedHat releases include RH 9, EL WS3, and EL WS4.

Hardware Installation

It is important to install the I/O Libraries before connecting the 1701A to a USB port in a Windows environment, since an improper driver may be attached to the device if this is not done. See the troubleshooting appendix for directions to correct a problem of that nature.

With the libraries installed, the unit may be connected to a USB port with the supplied cable. The Power LED will flash very briefly red as the hardware initializes, then turn solid green when the unit powers up. The Activity light will flash green when the device uses the USB bus. A solid red on the Activity light indicates an error condition inside the unit, generally caused by a USB protocol violation or a user syntax error in a command. This can be cleared by querying the unit for errors with software. If both red and green are on, an orange color is created.

The first time a unit is connected to a Windows computer, the Plug and Play manager will search for a suitable driver for the device. This should be niusbtmc (with NI libraries installed), or ausbtmc (with Agilent libraries). If an attempt is made to switch between the libraries, an incorrect driver may remain attached to the device. To check, open the Device Manager for Windows, and look under USB Test and Measurement Device. A yellow mark indicates the problem. Click on Properties/Driver/Update Driver and allow a search for the proper driver.

If the Power LED does not stay on, but only flashes green periodically, the unit is having trouble powering up. Try inserting a powered hub between the computer and 1701A, or try a shorter USB cable. Given the voltage drops possible with some long cables, it is recommended to use 2 meters or less.

There are three outputs available, putting out 1.8, 2.5, and 3.3 volts open circuit, with a 50 ohm source impedance. They all put out the same frequency square wave, in phase. The Enable Input is high-active, and passively pulled high, so the device has active outputs with nothing connected to that input. A TTL or LVTTL signal can be used to control the outputs. The PRBS output has the same electrical characteristics as the three square-wave outputs, with a 3.3 volt open-circuit voltage. That output may change state at the rising edge of the square wave outputs, with a 50% probability. If the Enable input is driven low, the PRBS generator is reset such that the bit sequence starts consistently in the same pattern after Enable is set high.

Normally, a 50 ohm impedance cable is used to connect the 1701A to external circuitry. If the end of the cable is terminated in 50 ohms, then the amplitude of the signal at that point will be half of the open-circuit value. If the end of the cable is high-impedance (open circuit), then the amplitude will be the same as the open-circuit value, due to the reflected-wave configuration. The amplitude is chosen by selecting the appropriate output jack along with the termination impedance. It cannot be changed under software control, to prevent programming mistakes from causing damage to external circuitry.

To minimize RFI emissions, it is recommended to use a premium, double-shielded coaxial cable to transmit the output signals. One such RG 223/U cable is the Pomona 2249-Y-36. The fast edges and high-frequency capability of the unit make adequate shielding important for minimizing emissions.

High quality terminators are also important for minimizing emissions. Amphenol 46650-51 or equivalent are suitable.

Setting Frequency with a Soft Front Panel

TAMS GUI for Windows

If the GUI is installed, it may be used to manually control the output frequency. Either the NI or Agilent libraries are required to use this GUI. Click the icon on the desktop to open the GUI. If one or more 1701A devices are connected to the computer, then they can be identified by their unique serial number. If high-speed USB communication is established, the words “High Speed” will also appear in the title of the window(s). The first time a 1701A is added to a system, the proper driver must be associated with the device. See the troubleshooting appendix in case the GUI cannot find attached devices.

Frequency may be set by dragging the dimples in the control knobs to new positions. Finer control is possible by clicking up or down with the buttons. The frequency is not constantly updated when the knobs are moved, it is changed approximately a half-second after the setting stops changing. This reduces USB bus traffic, but adds a slight delay to the process.

In order to change the default power-up frequency, just set the desired frequency for the device. Then click on the “Save as Power On Default” button, and the frequency is stored in the device.

These are in a pull-down box labeled “Frequently Used Frequencies”. It is populated with a few commonly used values initially, but others can be added with the “Add” button. Unwanted values can be deleted by selecting the frequency to be deleted, and hitting the “Delete” button. The changes made to the list during a GUI session are lost when the GUI is exited.

The frequency can also be changed by using the “Nudge” buttons, which just increase or decrease the frequency by the indicated percentage.

You may notice the indicated frequency jumping to a slightly different value after it is set. This is due to the software rounding the requested frequency to the nearest frequency the unit can synthesize.

If using the Agilent Suite 14.1 libraries, the system will not automatically detect the 1701A being plugged or unplugged from USB. You must hit View/Refresh after one of these events in order for the screen to represent the current connection. If you unplug and replug a device, the GUI will be displayed, but inoperative, until you hit View/ Refresh. This is not a problem when using NI libraries.

Linux

There currently is no GUI provided for use under Linux. See the section on setting frequencies programmatically.

National Instruments LabVIEW

To use the 1701A with LabVIEW, it is possible to create a graphical program that sends Direct I/O commands sent to the device without a customized driver. A sample program is included on the 1701A support disk that demonstrates this. See the Direct I/O appendix for a full list of commands that may be sent. Using LabVIEW for this requires that the NI libraries (NI-Visa Software for Windows) be installed.

Agilent VEE

Agilent VEE also has the capability of controlling the unit easily from a graphical interface. The Agilent I/O Libraries for Windows must be installed (Suite 14.1, Patch 2). Do not try to use with earlier versions of the Libraries.

Early versions of VEE do not support USBTMC devices, so it is required to use 7.X versions or later.

Setting Frequency Programmatically

Windows

It is possible to write compiled programs with VISA calls that send the appropriate Direct I/O commands to the device. See the Direct I/O appendix for a list of available commands. The same programs should be useable with either the Agilent I/O libraries or the NI libraries. Sample programs are on the support CD, under \1701A_examples\C_language\VISA.

If the Agilent libraries are installed, there are command-line utilities supplied that allow scripts to be used. The error checking with these utilities is very minimal, and performance is worse than with a compiled program, so their use is not recommended.

User programs can also be compiled using the SICL library. Functionality is similar to that provided with VISA. VISA is generally preferred, due to portability of the programs across I/O library vendors.

Linux

The TAMS I/O libraries currently support SICL calls (not VISA) to allow Direct I/O commands to be sent to the device. Sample C language programs are included on the CD, under /1701A_examples/C_language/SICL. In order to compile the programs, it is only necessary to include the sicl library. For example:

cc –o idn idn.c -lsicl

Then, run the programs with a valid SICL alias for the device, as configured by the iosetup command:

 # ./idn device5
Opening session with device5
TAMS INC,TAMS 1701A,SN1701-00005,1.0

Closing session with device5

Syntax

The TAMS 1701A Frequency Synthesizer is controlled via SCPI (Standard Commands for Programmable Instruments) and IEEE 488.2 commands.

Detailed information on SCPI is available at www.scpiconsortium.org.

Conventions

In the Direct I/O appendix, you'll see a command string like

STATus

This means that the short form of the command is STAT. The long form of the command is STATUS. The string STATU is not allowed – the commands must be the short form or the complete long form, not something in between. The device is not case sensitive: you can send "status" and get the same result as sending "StaTus".

Optional parts

Optional parts of the command are in square brackets:

[SOURce:]FREQuency <number> [MHZ | KHZ | HZ]

This means that you can send any of the following commands. They are all equivalent. They all set the frequency to 120KHz.

```
FREQ 120KHz
SOUR:FREQ 120KHZ
SOURCE:FREQ 120KHZ
SOURCE:FREQUENCY 120KHZ
SOUR:FREQ 120000
SOUR:FREQ 120000HZ
sour:freq .12MHZ
```

Entering numbers

The TAMS 1701A accepts floating point numbers with or without scientific notation. See the specific commands for the range of numbers allowed.

[SOURce:]FREQuency <number> [MHZ | KHZ | HZ]
[SOURce:]FREQuency ?

Set and query the output frequency. Some short examples:

```
FREQ 120KHz
Freq .12MHz
freq 120000
FREQ ?
```

In the last example, the device would return the current frequency (in this case, 120000) followed by a linefeed character. EOI would be set on the linefeed.

Some long examples:

```
SOURCE:FREQUENCY 120KHz
SOURCE:FREQUENCY 0.12MHz
SOURCE:FREQUENCY 120000
SOURCE:FREQUENCY ?
```

The minimum advertised frequency is .050 Hz, the maximum is 200 Mhz. The unit actually can generate frequencies from .047 Hz to 204 MHz. Attempting to program frequencies outside of this range creates a "data out of range" error.

Waiting Until Commands are Complete

By default, commands return as soon as they start, not when they are complete. For example, a command to set the frequency, followed by a command to read that frequency with a counter will probably require synchronization. The command to set the frequency will return before the TAMS 1701A Frequency Synthesizer has settled to the given frequency.

If you really need to wait until the frequency is settled, code this:

```
FREQ 12MHZ;*OPC?
```

The *OPC? command causes the device to wait until the current command is completed, and then return a "1" to the host. Here we must read the device and verify the "1" is returned. Then we can trigger the frequency counter to read the correct frequency.

If we did not need synchronization with another instrument, but in fact just needed to ensure that the command was completed, we could use the *OPC or *WAI command. These commands wait until the current command is complete. So for example, you could send this long string for rapid frequency stepping:

```
FREQ 12MHZ; *WAI; FREQ 13MHz; *WAI; FREQ 14MHZ
```

This command will cause the device to output 12MHz, wait until the device has settled at 12MHz, then output 13MHz, wait until that is settled, and so on. Use of the *OPC or *WAI commands is optional. The frequency will generally be stabilized before the next command is sent, due to the very rapid frequency change characteristics of the device.

SCPI Status Commands

The SCPI Status Commands can be used to query the status of the device. Like all sources, the TAMS 1701A has no real status to query.

488 Status

The 488 Status commands can be used to detect the following events:

has device power been interrupted?
has a device error occurred?
has the device operation completed?
is there a message available for the host?

The bit definitions for these events are as follows:

Event	Register.bit	Mask	Bit Weight
Device power on	ESR.7	ESE.7	128
Device Command error	ESR.5	ESE.5	32
Device Execution error	ESR.4	ESE.4	16
Device Query error	ESR.2	ESE.2	4
Operation Complete	ESR.0	ESE.0	1
Message available	STB.4	SRE.4	16

For example, to query if there has been an error,

*ESR?

will cause the device to return the value of the ESR register, which your program would then examine to determine the nature of the error. Of course, your program could always just issue an error query such as

SYST:ERR?

and get the exact error.

To determine if the device has a message to send back to the host,

*STB?

will return the Status Byte STB register, and the test program can then examine bit 4.

To get an SRQ on these events in register ESR, the appropriate mask bits must be set. The mask bit register for ESR is ESE. In addition, bit 5 of SRE must be set as well. For example to get an SRQ on Operation Complete, send the following commands.

*ESE 1 — set bit 1 of the Standard Event Enable register

*SRE 32— set bit 5 of the Status Register Enable register

To get an SRQ on error, send the following commands.

*ESE 52— set bits 2,4, and 5
*SRE 32— set bit 5

Termination

When the 1701A sends information on the USB, it always terminates the transmission with a <LF> tagged with EOI.

When it receives data, the recommended termination is the same <LF> tagged with EOI. However, <LF> with no EOI, or EOI with the last character are both acceptable. A <CR> may be sent before a <LF> if desired. A semicolon is also an acceptable terminator for a command, commonly used to separate multiple commands in a string.

Appendix A: Installation Reference

Installed Files (on Windows)

```
C:\Program Files
     TAMS
         USB Front Panel
              KnobControl.dll
              TAMS 1701A Installation and Operation.pdf
              tams.ico
              TAMS18xx.exe
              TAMSnotify.dll
              Examples
                   TAMS1701A
                        Agilent VEE
                            AG_DEMO.VEE
                        C language
                            SICL
                               formatio.c
                               idn.c
                               nonfmt.c
                            VISA
                               formatio.c
                               idn.c
                               nonfmt.c
                        NI LabVIEW
                            NI_DEMO.VI
```

CD Contents

```
autorun.inf
config.ini
dotnetfx.exe
settings.ini
setup.exe
setup.msi
doc
       TAMS1701A
              TAMS 1701A Installation and Operation.pdf
Examples
       TAMS1701A
              Agilent VEE
                     AG_DEMO.VEE
              C language
                     SICL
                            formatio.c
                            idn.c
                            nonfmt.c
                     VISA
                            formatio.c
                            idn.c
                            nonfmt.c
              NI LabVIEW
                     NI_DEMO.VI
```

Appendix B: Specifications

Electrical:

Frequency range:	.050 Hz to 200 MHz
Resolution:	5 ppm or better
Accuracy:	35 ppm (0 to 40 degrees C)
	15 ppm (20 degrees C)
Outputs:	LVCMOS 1.8, 2.5, and 3.3 volt square waves, 50 ohm impedance
	LVCMOS 3.3 volt PRBG, 50 ohm impedance
Input:	Enable Input, 0 to 3.3 volts, 5 volts max
Power:	5 volts, 350 ma max, USB bus-powered

Environmental:

Operating temperature:	0 to 40 degrees C
Storage temperature:	-20 to 55 degrees C
Operating humidity:	10 to 90% RH

Size, weight:

2.8 x 4.8 x 1.1 inches
11 oz.

Viewed from the front of the instrument (looking at the BNC's), the Frequency Synthesizer connectors are, left to right:

Enable Input
2.5 Volt Out
3.3 Volt Out
1.8 Volt Out
PRBS Out (3.3 volt)

These are labeled on the bottom side of the unit.

Appendix C: Direct I/O Commands

[SOURce:]FREQuency <number> [MHZ | KHZ | HZ]
[SOURce:]FREQuency ?

Set or query the output frequency. Some short examples:

```
FREQ 120KHz
FREQ .12MHz
FREQ 120000
FREQ ?
```

In the last example, the device would return the current frequency (in this case, 120000) followed by a linefeed character. EOI would be set on the linefeed.

STATus:OPERation:ENABle <mask>
STATus:OPERation:ENABle ?

Set and query the Status Operation Enable mask. See SCPI Status Commands.

Valid mask values are from 0 – 255.

STATus:OPERation [:EVENt] ?

Query the Status Operation Event register. See SCPI Status Commands. This register is cleared on read.

STATus:PRESet

Clear the Status Enable register to 0. See SCPI Status Commands

SYSTem:ERRor?

Return the last error message from the device. This also clears the error message. Example messages:

```
+0,"No error"
+1,"No scan list"
```

For a table of common errors and remedies, see the Error appendix.

SYSTem:VERSion?

Return the version of the SCPI standard to which this device adheres.

***CLS**

This clears the Standard Event Register (ESR), the Status Byte (STB), any output message to be sent to the controller, and the error number.

***ESE <value>**
***ESE?**

These commands set and query the ESE register. The value of this register is from 0-255. The ESE register serves as a "mask" between the ESR register and bit 5 of the STB register. See 488 Status.

***ESR?**

This command queries the value of the ESR register. The value will be between 0 and 255. The ESR register will then be cleared after the read. See 488 Status.

***IDN?**

This command returns a string that identifies the manufacturer, model, serial number, and firmware revision of the device. For example,

```
*IDN?
```

causes the device to return

```
TAMS INC,1701A,SN00001,1.0
```

***OPC**

This command (Output Complete) can be used to synchronize the device with the host program. This command will cause the device to wait until all pending commands have completed. Then it will set bit 0 of register ESR to the value "1". See 488 Status. See Waiting Until Commands are Complete.

***OPC?**

This command (Output Complete) can be used to synchronize the device with the host program. This command will cause the device to wait until all pending commands have completed. Then it will set bit 0 of register ESR to the value "1". Then it will cause the device to return a "1". See 488 Status. See Waiting Until Commands are Complete.

***RCL 0**

This command (Recall state) can be used to recall the default power on frequency. See the *SAV command. For example,

```
FREQ 33MHz
*SAV 0
```

will cause the device to output 33MHz when power is applied. The command

```
*RCL 0
```

will cause the device to output 33MHz as well.

***SAV 0**

This command (Save state) can be used to save the current frequency as the default power on frequency. For example,

```
FREQ 33MHz
*SAV 0
```

will cause the device to output 33MHz when power is applied.

***RST**

This command (Reset) resets the device. The following actions occur:

All status registers are cleared
The output frequency is set to 1.00 MHz.

***SRE <value>**
***SRE?**

These commands set and query the SRE register. The value must be between 0 and 255. The SRE register serves as a mask between the STB register and the SRQ logic. In order to get an SRQ, the appropriate bit of SRE must set. See 488 Status.

***STB?**

This command queries the STB or Status Byte register. The value will be between 0 and 255. See 488 Status.

***TST?**

This command performs a quick self-test and returns the result.

***WAI**

This command can be used to synchronize the device with the host program. This command will cause the device to wait until all pending commands have completed. See Waiting Until Commands are Complete.

Appendix D: Error Numbers

The list of possible error numbers returned from the device, along with their meaning:

-101, Invalid char
An invalid character was sent during a command

-102, Syntax error
Incorrect syntax for a command was detected

-120, Numeric data error
Bad number syntax

-222, Data out of range
Frequency is out of range

-240, Hardware error
Internal hardware error detected

-400, Query error
Two queries were received in a row

Appendix E: Software License Agreement

Please carefully read this License Agreement before installing the software. Rights in the software are offered only on the condition that the Customer agrees to all terms and conditions of the License Agreement. If you do not agree to the terms of the License Agreement, you may return the unopened software package and the hardware for a full refund. In return for the payment of fee TAMS grants the Customer a license to use the software, until terminated subject to the following:

Customer may use the software on any one computer.
Customer may not reverse assemble or decompile the software.
Customer may make copies for archival purposes.
Customer has no other rights to copy.

All copies of the software must bear the copyright notice(s) contained on the original.
OWNERSHIP: Customer agrees that they do not have any title or ownership of the software, other than ownership of the physical media. Customer acknowledges and agrees that the software is copyrighted and protected under the copyright laws.
Customer Acknowledges and agrees that the software may have been developed by a third party software supplier named in the copyright notice(s) included with the software, who shall be authorized to hold Customer responsible for any copyright infringement or violation of this License Agreement.
TRANSFER OF RIGHTS IN SOFTWARE: Customer may transfer rights in the software to a third party only as part of the transfer of all their rights and only if Customer obtains the prior agreement of the third party to be bound buy the terms of this License Agreement.
Upon such transfer, Customer agrees that their rights in the software are terminated and that they will either destroy their copies and adaptations or they will deliver them to the third party.
Transfer to a US government department or agency or to a prime or lower tier contractor in connection with a US government contract shall be made only upon their prior written agreement to terms required by TAMS.
SUBLICENSING AND DISTRIBUTION: Customer may not subliscence the software or distribute copies or adaptations of the software to the public in physical media or by telecommunications without the prior written consent of TAMS
TERMINATION: TAMS May terminate this software license for failure to comply with any of these terms provided TAMS has requested Customer to cure the failure and Customer has failed to do so within thirty (30) days of such notice.
UPDATES AND UPGRADES: Customer agrees that the software does not include updates and upgrades which may be available from TAMS under a separate support agreement.
EXPORT CLAUSE: Customer agrees not to export or re-export the software or any copy or adaptation in violation of the US Export Administration regulations or other applicable regulations.

LIMITED WARRANTY

TAMS warrants for a period of 90 days from the date of purchase that the software product will execute it's programming instructions when properly installed on the computer or workstation with a supported version of the Operating System. TAMS does not warrant that the operation of the software will be uninterrupted or error free. In the event that this software product fails to execute it's programming instructions during this warranty period , Customer's remedy shall be to return the CD media to TAMS for replacement. Should TAMS be unable to replace the media within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the entire product and all copies.

TAMS warrants the media upon which the product is recorded top be free from defects in materials and workmanship under normal use for a period of 90 days from the date of purchase. In the event any media prove to be defective during the warranty period, Customer's remedy shall be to return the media to TAMS for replacement. Should Tams be unable to replace the media within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the entire product and all copies.

NOTICE OF WARRANTY CLAIMS Customer must notify TAMS in writing of any warranty claim within the warranty period.

LIMITATION OF WARRANTY: TAMS makes no other express warranty, whether written or oral , with respect to this product. Any implied warranty of merchantability or fitness is limited to the 90-day duration of this written warranty. Some sates or provinces do not allow limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you.

This warranty gives specific legal rights, and you may also have other rights which vary from state to state, province to province or country to country.

EXCLUSIVE REMEDIES : The remedies provided above are Customer's sole and exclusive remedies. In no event shall TAMS be liable for any direct, indirect special, incidental, or consequential damages (including lost profit) whether based on warranty, contract, tort or any other legal theory. Some states provinces or countries do not allow the exclusion or limitation of incidental or consequential damages, so the limitation or exclusion may not apply to you.

WARRANTY SERVICE: Warranty service may be obtained directly from TAMS or from any of it's Distributors.

Appendix F: Warranty Information

ONE YEAR LIMITED WARRANTY

Test & Measurement Systems, Inc. warrants to the purchaser that the Freequency Synthesizer card will be free of all defects in material and/or workmanship for one year from the date of shipment to the customer.

In the event of malfunction or failure attributable directly to faulty material and/or workmanship, TAMS will at it's option, repair or replace the defective product or components, to whatever extent it shall deem necessary to restore the product or component, to proper operating condition. TAMS may at its option repair or replace, a defective unit with a new or refurbished unit.

The customer shall be solely responsible for the failure of any TAMS product, resulting from accident abuse, or misapplication of the product, and TAMS assumes no liability as a consequence of such events under the terms of this warranty.

While TAMS has made every effort to provide clear and accurate technical information about the application of this product, TAMS assumes no liability for any events arising out of the use of this technical information.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state, and from country to country.

This Warranty is in Lieu of all other express warranties which now or hereafter might otherwise arise with respect to this product. ANY AND ALL IMPLIED WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR PARTICULAR USE, SHALL HAVE NO GREATER DURATION THAN THE PERIOD FOR THE EXPRESS WRITTEN WARRANTY APPLICABLE TO THIS PRODUCT AS SHOWN ABOVE, AND SHALL TERMINATE AUTOMATICALLY AT THE EXPIRATION OF SUCH PERIOD.

(Some states and countries do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you) No action shall be brought for breach of any implied or express warranty after one year subsequent to the expiration of the period of the express written warranty.

Incidental and consequential damages caused by malfunction, defect, or otherwise and with respect to breach of any express or implied warranty, are not the responsibility of TAMS, and to the extent permitted by law, are hereby excluded both for property and to the extent not unconscionable, for personal injury damage. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.)

Appendix G: PRBS details

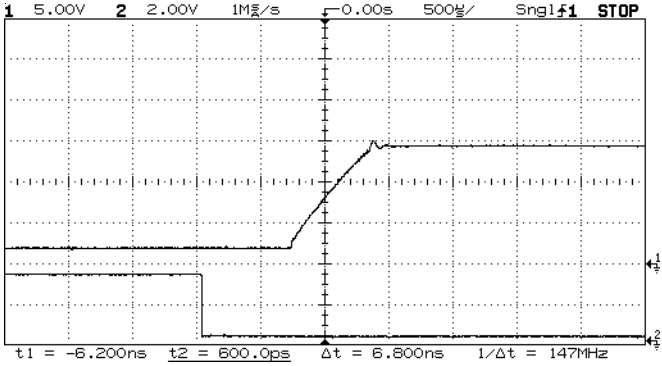
The PRBS output is generated by a maximal-length 32-bit Linear Feedback Shift Register. The bit changes occur immediately following a rising edge of the square-wave outputs. For the greatest timing margin, use the falling edge of a square-wave output as a clock.

The generator is reset to a known state by either asserting the Enable Input low, or programming 0 Hz. This creates a deterministic output sequence when the output is restarted.

Appendix H: Frequency Change Characteristics

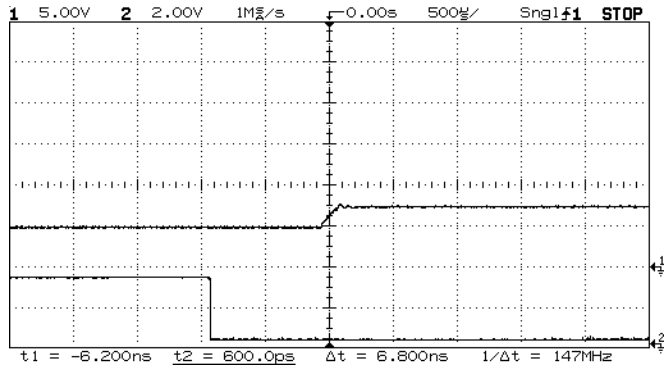
When a frequency change is commanded, the outputs stabilize at the new frequency in less than 2 ms. The output is phase-continuous for many frequency changes. If the old and new frequencies are both in the range 100-200 MHz, 50-100 MHz, 25-50 MHz, etc, then the outputs will be phase-continuous.

Examples of the frequency change timing are shown here, by capturing the internal input signal driving the VCO. First, for a (worst-case) 100 to 200 MHz change:



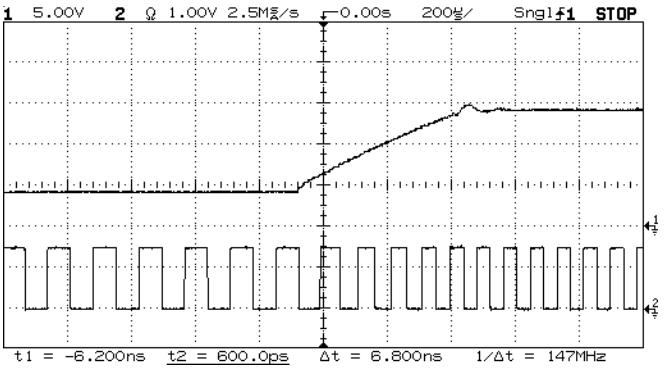
The lower trace going low indicates a command received by the 1701A. The upper trace is the internal VCO control frequency. The screen shot shows less than 800 uS to interpret the command, and 700 uS to accomplish the frequency change. The time for the workstation to format and send the command is additional.

Next, 60 to 70 Mhz:



This shows a quicker frequency shift, due to a lesser percentage change being required.

The frequency shifts smoothly, with minimal overshoot. The time to slew frequencies is proportional to the change commanded, plus a fixed overhead for the device to interpret the command. The next scope screenshot shows a phase-continuous transition from 7 to 12 Khz, with the period monotonically decreasing during the transition.



Appendix I: Troubleshooting

If communication problems are experienced, there are several potential sources of trouble that should be examined.

1) Communication with device interrupted. From the GUI, hit View/Refresh to restore communications. This will need to be done if the device is physically disconnected and reconnected with the GUI open, while using the Agilent I/O Libraries. Symptoms of the problem are frequency changes commanded by the GUI, with no corresponding flash of the Activity light.

2) Driver hung. Try rebooting the host to see if that resolves a driver issue. Note that a hanging I/O from another program could block the GUI or Explorer from communicating with the device.

3) No appropriate I/O Library installed. Verify that correct versions are installed. Use the Explorer or Connection Expert utility to see if the device is correctly recognized.

4) Improper usbtmc driver attached to device. Under Windows, use Start/Settings/ Control Panel/System/Hardware/Device Manager to see the USB Test and Measurement Devices. Under that should be an entry also labeled USB Test and Measure Device. Right click, select Properties/ Driver/Driver Details. For Agilent libraries, the Driver File should be ausbtmc.sys. For NI, it should be niusbtmc.sys. Use the Update Driver function to correct an incorrect driver.

Appendix J: Safety

This symbol indicates a caution. See the manual for a complete explanation, and only continue when all conditions are fully understood and met.

This symbol indicates that the product complies with the requirements of the Low Voltage Directive and the EMC Directive, and carries the CE Mark accordingly.

Ordinary protection: This unit is for indoor use only. It is not protected against a harmful ingress of moisture.

This product uses components that may be damaged by electrostatic discharge. Although all such components are protected, take precautions to avoid electrostatic discharge into the connectors.

Do not use this product in a manner not specified by TAMS.

Only qualified, TAMS-trained personnel may service this product.

Appendix K: Declaration of Conformity

The Declaration of Conformity is on file at TAMS Inc.

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Tams 1701A Frequency Synthesizer
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