NOVATECH INSTRUMENTS, INC.
MODEL 2910A DIRECT DIGITAL SYNTHESIZER
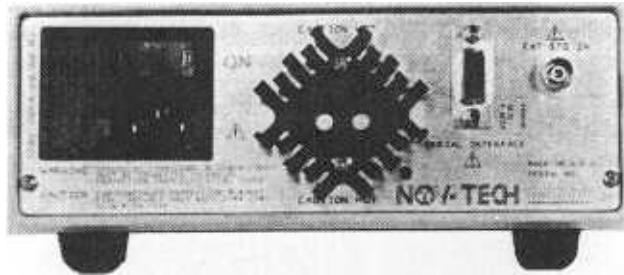
INSTRUCTION   MANUAL

2910A

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2910A Rear View

SECTION 1 - INTRODUCTION AND SPECIFICATIONS

1.0 The **Model 2910A** Direct Digital Synthesizer is packaged in a bench-top enclosure and has an adjustable output sinewave frequency from 1 μHz to 12 MHz and an adjustable output clock frequency from 1 μHz to 48 MHz. The display shows output frequency and amplitude simultaneously.

The 2910A has two front panel BNC connectors. One provides a sinewave output and the other provides a clock output that is menu selectable for either CMOS/TTL or ECL. There is a rear panel BNC that accepts an external standard input of 1 or 2 MHz.

1.1 Two **pushbuttons** and one **rotary knob** provide manual control of the instrument. The rotary knob changes either frequency or amplitude depending on the position of the underline cursor. The Menu pushbutton cycles the display through seven menus and then back to the Frequency and Amplitude Display. The Select pushbutton moves the underline cursor one digit each time it is depressed. If it is depressed and held, then the cursor can be moved with the rotary knob. When a menu is present the select button steps through the choices in each menu.

1.2 The back lit **Liquid Crystal Display (LCD)** shows both frequency in MHz and amplitude in Volts. The frequency display has eleven digits and a step size of 1 mHz. The voltage display has three digits and a step size of 0.01V up to 1V and 0.1V above 1V. After the menu button is depressed, the display shows the menu name and the current selection.

1.3 Specifications

Output
SINE: 0.001 Hz to 12 MHz.
11 Digits when set from front panel, smallest step 0.001 Hz.
14 Digits when set via EIA232, smallest step 0.000001 Hz.

TTL/CMOS/ECL: 0.001 Hz to 48 MHz.
11 Digits when set from front panel, smallest step 0.001 Hz.
14 Digits when set via EIA232, smallest step 0.000001 Hz.

Output Amplitude
SINE: 0.01 to 10 Vpp into open circuit (half this into 50 ohms),
Resolution is 0.01 V below 1 V, 0.1 V above 1 V, ± 1 mV max
DC offset, Accuracy is ± 1dB.

TTL/CMOS/ECL: Fixed amplitude, 50% ± 10% Duty Cycle.
Meets appropriate level specification into open circuit. ECL
requires external termination to ECL levels.

Frequency Stability
10ppm, 1 year, 20-30 C.
If an external frequency standard is connected to the 2910A
external input then stability is equal to that of the external
standard.

Frequency Accuracy
± 5ppm of displayed value, 20-30 C, 24 hours.
Accuracy of 0.001 ppm is achievable using an external
frequency standard.

Power
100, 120 or 230VAC ± 10%, 50/60Hz, 28VA

Physical
2.6"H, 7.3"W. 9.5"L, excluding bail and feet
5.2 lbs

Phase Noise
<-110 dBc, 100 Hz Offset, 10 Hz to 12 MHz
<- 95 dBc, 10 Hz Offset, 10 Hz to 12 MHz

Sinewave Purity

Frequency	Harmonics	Spurious
.01-100kHz	<-65dBc	<-75dBc
.1-1MHz	<-65dBc	<-70dBc
1-5MHz	<-45dBc	<-60dBc
5-10MHz	<-35dBc	<-55dBc
>10MHz	<-30dBc	<-35dBc

Measured in a frequency range extending to 10x test frequency.
Purity degrades below 1 Hz.

CMOS/ECL Output
CMOS output will drive CMOS/TTL levels into loads >300
ohms. ECL output, when terminated, is ECL 10K compatible.
CMOS or ECL mode selected from display menu or computer
interface.

Rise/Fall Time: <10ns.
Jitter: <0.2% of period or 200 ps whichever is greater
(<12MHz).
Jitter: <5% of period or 2ns whichever is greater (>12MHz).

Amplitude aberrations: < 20%.
Symmetry: 50% ± 10%.

Settling Time
Frequency: <0.001% in 100 μs (setup delay excluded).
Amplitude: <1% in 100 ms.

Output Impedance
50 Ohms ± 2%, female BNC both Signal and CMOS/ECL.
Open Emitter ECL output requires termination to ECL levels.
BNC shell is chassis common.

Display
Two line by sixteen character backlit liquid crystal display.
Frequency and amplitude of sine output displayed
simultaneously. Provides menu for instrument setup and
control.

External Standard
Rear panel BNC input accepts either 1 or 2 MHz ± 2ppm from
an external standard. Voltages from 200mV to 4 Vrms will
lock and pull internal reference to external standard.

Non-Volatile Memory
Last power-up state retained in memory for 24 hours.

EIA232 Computer Interface
Rear panel nine pin female D-connector serial input allows
setting all functions. Baud Rate is programmable from 300 to
9600 baud from front panel menu. Once remote operation is
selected, front panel display and control are disabled.

OVEN OSCILLATOR
NOVATECH INSTRUMENTS INC. Model 2950A Series.
Quartz Frequency Standard is Available. Consult Factory.

SECTION 2 - OPERATING INSTRUCTIONS

2.0 **Introduction.** This section of the manual contains information about connecting and operating the 2910A and should be read completely before using the instrument.

WARNING

This product is grounded through the grounding conductor of the power source. Before connecting anything to the instrument, be sure to plug the power cord into a properly wired power receptical that is connected to a high quality earth ground. It is necessary to ground the instrument in this way in order to avoid electrical shock and assure safe operation.

NOTE

The BNC output shield is grounded.

2.1 **Input Power.** The 2910A is factory wired to operate from 100, 120 or 230 ± 10% Volts AC, 60 Hz. Verify that the correct power is available before plugging in the instrument.

2.2 **Fuse Replacement.** The 2910A is protected by two ac line input fuses that are located on the left portion of the power receptical. Use a small screwdriver to apply pressure at the side of the fuseholder and the fuseholder will snap out.

WARNING

The 2910A must be disconnected from line power before attempting to replace the fuses.

CAUTION

For fire protection, replace the fuses only with slow fuse rated for 250 V and 0.25 amperes.

NOTE

Either 5 x 20mm or 1/4" x 1 1/4 " fuses may be used. 5 x 20mm are recommended.

2.3 **Local (Front Panel) Operation.** The following procedure should be used to operate the 2910A Direct Digital Synthesizer from the front panel.

a) Connect the 2910A to AC line power.

b) Connect the appropriate coaxial cables to the BNC output connectors on the 2910A front panel.

NOTE

The output amplitude can vary from the output setting when using long cable lengths unless the cable is terminated with a 50 ohm load. NOVATECH recommends using a 50 Ohm Terminator. When using a terminator the display shows twice the amplitude delivered to the load.

c) Turn on the 2910A by depressing the power switch located on the rear panel just above the power cord input plug and wait approximately 7 seconds while the 2910A performs a self test. The display will read (c) 1993 NOVATECH, 2910A Rev x.xx during self test.

NOTE

The first time the 2910A is used it will be setup with its default settings of 1.000 MHz and 1.00 Vpp OC after the self test is completed. The default menu settings are shown in Table 1. The 2910A setup can be changed using the menu and select push buttons. Menu selections 4, 5, and 6 affect the operation of the instrument and should be set appropriately prior to operating the 2910A under local control.

TABLE 1
2910A MENU SETTINGS

MENU	CHOICES	DEFAULT
Baud Rate	Serial Baud Rate of 9600, 4800, 2400, 1200, 600 or 300	9600
Echo	Remote Echo On or Off	On
User I/F	Local Control or Remote Computer Control	Local Control
Squarewave	CMOS/TTL or ECL Levels	CMOS/TTL
Power Up	Default Settings or Save Last Settings	Default
External Standard	Disabled, 1 MHz, 2 MHz	Disabled
High Frequency	High Frequency Disabled or Enabled (Sine output is 25% of displayed value above 12 MHz when High Frequency is enabled)	Disabled

d) Push the menu button four times to recall the Square Wave Levels menu. The first three menu selections do not affect manual operation. Push the select button to recall "ECL" if you plan to connect the square wave output to an ECL circuit. Leave the selection on "CMOS/TTL" if you are not planning to connect to an ECL circuit.

CAUTION

The ECL output is an open emitter output and must be terminated to ECL levels, normally 50 ohms to -2 V or 510 ohms to -5.2. Selecting ECL output mode while connected to a TTL or CMOS circuit may damage the user's circuit, the 2910A or both.

e) Push the menu button again to recall the Power Up Mode Menu. Push the select button to display the "Save Settings" selection if you want the 2910A to save all current display and menu settings after the power is turned off and then back on. Leave the selection on "Use Defaults" if you prefer the default settings shown in Table 1 to be set after the power is turned off and then back on.

f) Push the menu button again to recall the External Standards Menu. Push the select button to display either 1 MHz or 2 MHz if you plan to lock the 2910A to an external 1 MHz or 2 MHz frequency standard. Leave the selection on Disabled if you do not plan to lock the 2910A to an external standard.

g) Push the menu button again to display the High Frequency menu. Push the select button and toggle to display to either enabled and disabled. When enabled is selected the CMOS/ECL output can go to 48 MHz. However when in the enabled mode and displaying over 12 MHz the sinewave output frequency is 25% of the displayed value.

NOTE

For optimum sinewave purity disable the High Frequency mode when not needed.

h) Push the menu button again to recall the frequency and amplitude setting to the display. Set the desired frequency and amplitude using the rotary knob and the select button. The select button advances the underline cursor and the knob changes the value. Pushing and holding the select button enables the knob to move the cursor in both directions.

NOTE

It is possible to adjust the contrast on the 2910A display with a small insulated adjustment tool. An access hole is located on the rear panel just above the NOVATECH logo.

2.4 **Remote (External Computer or Terminal) Operation** The following procedure should be used to operate the 2910A Direct Digital Synthesizer from a remote computer or terminal.

a) Connect a cable between the 2910A and the serial port of a computer or terminal. On most PCs COM1: is the serial port.

NOTE

The serial cable should be a straight through 9 pin cable with a male common type connector on the end that plugs into the 2910A. Only Rx, Tx and GND are used.

b) Setup the computer or terminal so it uses 8 data bits, 1 stop bit and no parity. Set the Baud rate on the computer or terminal at any desired rate between 300 Baud and 9600 Baud.

c) Perform the setup operations for Local Operation as described in paragraphs 2.3 a) through g).

TABLE 2
2910A EIA232 ASCII COMMAND SET

COMMAND	DESCRIPTION
F XX.XXXXXXXXXXX	Sets Frequency in MegaHertz
A X.XX	Sets Amplitude in Volts
RESET	Has the same effect as cycling power and clearing all settings to their default settings.
E D	Disables Remote Echo
E E	Enables Remote Echo
H D	Disables High Frequency Mode
H E	Enables High Frequency Mode
X D	Disables External Standard
X 1	Enables External Standard for 1 MHz
X 2	Enables External Standard for 2 MHz
P D	Use Default Setting on Power Up
P S	Use Saved Settings on Power Up
S E	Set Square Wave Output to ECL
S T	Set Square Wave Output to CMOS/TTL

The 2910A returns "XX<CR> <LF>" after receiving a command. The characters XX are either "OK" or "?N" where N is an error code. The N error codes are "0" for unrecognized command, "1" for bad frequency, "2" for bad amplitude and "3" for input line too long.

There must be a space after the first letter of all commands except the RESET command. The commands are not case sensitive.

d) Push the menu button until you have recalled the Echo Menu. Push the select button to toggle between Echo ON and Echo OFF as desired. Echo ON is normally desirable when using a dumb terminal, but is not commonly used with PCs.

e) Push the menu button again to recall the Baud Rate menu. Push the select button to select the desired Baud rate to match the computer setup.

f) Push the menu button again to recall the User Interface menu. Push the select button to select Remote. The 2910A is now ready to receive remote commands.

NOTE

The 2910A Display and front panel controls are disabled when in remote. The SELECT button remains active. Remote can be selected or unselected only from the front panel.

h) Transmit a command to the 2910A from a computer or terminal to set the output frequency of the 2910A. The command should consist of the ASCII characters "F <SP>XX.XXXXXXXXXXXX <CR>" where the X's represent the frequency in MegaHertz, <SP> is a space and <CR> is a carriage return.

After receiving this command, the 2910A will respond by transmitting two characters followed by a <CR> <LF>. If the received command was successfully interpreted and executed by the 2910A then the two characters returned will be "OK". If the received command was not successfully received and executed then the characters "?N" will be returned. The "N" represents an error code number. See Table 2 for an interpretation of the error codes.

i) Transmit a command to the 2910A from a computer or terminal to set the output amplitude of the 2910A. The command should consist of the ASCII characters "A<SP>X.XX<CR>" where the X's represent the desired numeric value of the Amplitude in Volts.

j) After receiving this command the 2910A will respond as described in paragraph 2.4 h) above.

k) The 2910A setup can be changed using the ASCII commands shown in Table 2. Send these commands, one at a time, as desired.

l) The QBASIC™ program listing in Table 7 is an example program that can be used to send commands from a PC to the 2910A. It uses COM1: and 1200 Baud, which may be changed by the user. It asks the user to enter a 2910A command. After the user enters the command and hits the Enter/Return key, the PC will transmit the command, display the 2910A response and again ask the user to enter a 2910A command.

SECTION 3 - PERFORMANCE TEST AND MAINTENANCE

WARNING

To avoid personal injury do not remove the panels or covers and do not operate the 2910A unless the panels and covers are properly installed.

3.0 **Introduction.** The 2910A Frequency Synthesizer requires no periodic calibration or maintenance. It is recommended that the

TABLE 3
RECOMMENDED TEST EQUIPMENT

Test Instrument	Minimum Specifications	Example Instrument
Digital Multimeter	AC RMS, dB, 10MOhm imput impedance 4 1/2 digits, true RMS	HP 34401A
RF Probe	100 kHz to 12 MHz, with known or calibrated response	HP34301A, Fluke 85RF, Tektronix P6420
Oscilloscope	100 MHz	Tektronix TAS 465
Terminator	50 Ohm ±1%	Tektronix 011-0049-01
Frequency Standard	1 or 2 MHz, 0.2 V RMS to 4.0 V RMS	Novatech Instruments 2950A
Frequency Counter	± 1 ppm, 9 digits	Tektronix CMC251A, HP5314A-001
Frequency Synthesizer	Able to be set to 1 or 2 MHz ± 5 ppm Lockable to external standard	Novatech Instruments 2910A
Computer	PC Compatible with QBASIC™ and terminal emulation software	
ECL Bias and Load	50 Ohm to -2.0V or 510 Ohm to -5.2V	
Stop Watch		

performance test in paragraph 3.1 be performed periodically to verify that the instrument is functioning properly. If the instrument does not pass the performance test then it should be returned to NOVATECH INSTRUMENTS, INC. for repair or replacement.

3.1 Performance Test. Refer to Table 3 for a listing of the recommended test equipment. If the recommended test instrument is not available then a substitute that meets the minimum specifications should be used. The ambient temperature must be between 20 and 30 degrees C.

3.1.1 Front panel verification (Frequency)

a) Connect the 2910A Signal Out to a Frequency Counter, turn on power and let the instrument warm up for 30 minutes.

b) Set the display to 1.00 MHz, 1.00 Vpp. The Counter should read 1.000000 MHz ± 5 Hz plus or minus Counter accuracy. Repeat for the frequencies in Table 4.

<div align="center">NOTE</div>

Frequency counter error adds to this test. Be sure to account for it.

c) Reset the 2910A to 1 MHz. Set the cursor to the 10 Hz position (5 digits from the right). Adjust up one count and down one count. Verify that the counter registers ± 10 Hz shift. Verify that the 2910A display shows the correct frequency. Repeat for each value in Table 2.

<div align="center">NOTE</div>

Unless external termination is supplied for the ECL output use the CMOS/TTL output mode for the next test.

d) Repeat b) and c) for the CMOS/ECL output

e) Select High Frequency Enabled and CMOS/TTL output.

f) Adjust output to frequencies shown in Table 5. Verify limits shown.

<div align="center">*NOTE*</div>

In high frequency enabled mode the CMOS/ECL output frequency is four times the SIGNAL OUTPUT frequency for frequency settings above 12 MHz.

3.1.2 Front Panel Verification (Amplitude)

a) Set the output frequency to 0.010 MHz and output amplitude to 10.0 Vpp OC.

b) Using a short BNC-BNC cable and BNC-to-Banana adaptor, connect the Signal Out on the 2910A to the DMM input. Select AC volts, autorange on the DMM.

c) Verify that the RMS reading on the DMM is between 3.104 V RMS and 3.967 V RMS with a nominal value of 3.536 V RMS

d) Select the SHIFT dB function on the DMM. The display should read 0 dB.

TABLE 4

FREQUENCY VERIFICATION

2910A SETTING	COUNTER READING		ACTUAL
MHz	LOW	HIGH	
0.100	99999.5	100000.5	_____
0.200	199999.0	200001.0	_____
0.500	499997.5	500002.5	_____
1.000	999995.0	1,000,005.0	_____
2.000	1,999,990.0	2,000,010.0	_____
5.000	4,999,975.0	5,000,025.0	_____
10.000	9,999,950.0	10,000,050.0	_____
12.000	11,999,940.0	12,000,060.0	_____

CMOS/ECL ONLY ABOVE 12 MHZ

15.000	14,999,925.0	15,000,075.0	_____
20.000	19,999,900.0	20,000,100.0	_____
25.000	24,999,875.0	25,000,125.0	_____
30.000	29,999,850.0	30,000,150.0	_____
35.000	34,999,825.0	35,000,175.0	_____
40.000	39,999,800.0	40,000,200.0	_____
48.000	47,999,760.0	48,000,240.0	_____

e) Select the amplitude values in Table 6. Verify that the DMM readings are within the error limits shown. This verifies the attenuator.

f) Disconnect the cable from the DMM. Connect the RF probe to the 2910A Signal Out using a probe tip to BNC adapter. Connect the RF probe to the DMM. Select DC volts, autorange.

g) Set the 2910A to 1.00 MHz, 10 Vpp OC output. Wait for a settled DMM reading, then select SHIFT dB mode. The display should read 0 dB.

h) Adjust the frequency in 1 MHz steps to 12 MHz. Verify that the DMM displays between -1dB and +1dB for all settings.

NOTE

The frequency response error of the probe adds to this test. Be sure to account for it.

i) Reset the 2910A frequency to 1 MHz. Change the amplitude to 0.79 Vpp OC. Reselect SHIFT dB to rezero the DMM. Repeat h) for this setting.

j) Disconnect the DMM and the probe from the 2910A.

k) Select CMOS/TTL mode in the menu. Verify, using the oscilloscope with a x10 probe that the CMOS/ECL out signal swings from 0.4 low to 4.8 V high with less than 1 volt overshoot, undershoot or ringing. Verify symmetry of 40/60% to 60/40%. Set the 2910A to the frequencies of h) for this test.

NOTE

The ECL verification test requires an external load and power supply. If you do not use ECL it can be ignored.

l) Select the ECL mode in the menu. Connect the load as shown in Table 5.

TABLE 5		
	-VTERM	**LOAD R**
CMOS/ECL OUTPUT	-2 VDC	50 Ohms
	-5.2 VDC	510 Ohms
Note: BNC shell is common		

m) Verify ECL output levels (nominally -0.8 high, -1.6 low).

n) Repeat steps k) through m) after selecting High Frequency enabled in the menu. Highest test frequency is now 48 MHz.

o) Disconnect all cables. Reset instrument to CMOS/TTL, High Frequency disabled, 1.00 MHz, 10.0 Vpp.

p) Connect output to oscilloscope through a Tee BNC. Observe amplitude. Connect 50 Ohm terminator. Amplitude should decrease to 1/2 previous.

TABLE 6
AMPLITUDE VERIFICATION

| 2910A SETTING | ------------------ DMM READING (dB) ---------------------- | | |
Vpp OC	LOW	HIGH	ACTUAL
10.0	-0.01	+0.01	_____
7.9	-3.047	-1.047	_____
6.3	-5.013	-3.013	_____
5.0	-7.021	-5.021	_____
2.5	-13.041	-11.041	_____
1.6	-16.918	-14.918	_____
0.63	-25.013	-23.013	_____
0.25	-33.041	-31.041	_____
0.10	-41.000	-39.000	_____
0.05	-47.021	-45.021	_____
0.02	-54.979	-52.979	_____
0.01	-61.000	-59.000	_____

q) Disconnect oscilloscope and connect a DMM to Signal Out. Select DC volts, autorange. Verify a DC value between -1 mV and +1 mV.

NOTE

Some DMMs do not have adequate high frequency filtering for Low Level DC measurements in the presence of high frequency sinewaves. If you are not using the recommended meter you will need to check your DMM.

3.1.3 External Standard Verification

a) Connect either a 1 MHz or 2 MHz frequency standard to the EXT STD IN on the rear of the 2910A, through a BNC tee connector. Select External Standard Menu for 1 MHz or 2 MHz to match your input.

b) Set the output of the 2910A to 10 MHz, 1 Vpp OC.

c) Connect the 2910A signal output to one channel of the oscilloscope. Connect the External Standard

from the tee to the other channel of the oscilloscope. Set up the oscilloscope to trigger on the external standard with approximately one cycle of the 2910A signal on the screen.

d) Verify using the stop watch that the 2910A output signal takes greater than 100 seconds to drift one complete cycle.

NOTE:

This is a go/no-go test. The drift should be imperceptible.

e) Adjust the 2910A frequency to 10.0000001 MHz and 9.9999999 MHz. The drift should now take 10 seconds in each case. (First left; then right).

f) If the amplitude of your standard is adjustable, repeat d) for amplitudes of 200 mV RMS (565 mVpp) to 4.0 V RMS (11.3 Vpp)

3.1.4 External Standard Verification (Alternate method)

a) This method allows testing of the lock range, but requires a known good synthesizer locked to an external standard. This description assumes the use of another 2910A.

b) Connect the external standard to a known good 2910A and select the appropriate External Standard Mode (1 or 2 MHz). Adjust this 2910A for 1.00 MHz and 5 VppOC.

c) Connect the Signal Output of the locked 2910A to the 2910A under test (UUT) EXT STD input connector. Select the 1 MHz external standard mode on the UUT.

d) Connect the output of the first 2910A and the UUT to an oscilloscope as described in 3.1.3 paragraphs a) and c). Trigger from the first 2910A Signal out. Adjust the UUT for 1.00 MHz output and 10 VppOC.

e) Adjust the 1 Hz position of the first 2910A while observing the oscilloscope. The signals should remain locked with no drift between 0.999998 MHz and 1.000002 MHz minimum (typically twice this range).

f) Repeat c) through e) with the first 2910A and the UUT set to 2.0 MHz. The lock range should now be 1.999996 to 2.000004 minimum.

g) Adjust the amplitude of the first 2910A from 1 VppOC to 10 VppOC. The UUT should stay locked with imperceptible drift. Ignore phase shift and momentary phase jumps.

3.1.5 Battery Backup Verification

NOTE

The charge state of the internal battery is uncontrolled during storage and shipment. This test must be performed after the instrument has been powered for at least 120 hours.

a) Select Save Settings mode in the menu.

b) Set the frequency and amplitude to something other than the default values of 1 MHz and 1 V. Record your settings. Turn off power.

c) After 24 hours restore power. The display values should be the same as those recorded in b). Verify that the outputs match the displayed values.

d) Verify that all menu settings selected before power down have maintained their settings.

3.1.6 Front Panel Menu Verification.

a) Verify that all the menu items shown in the operating instructions section are selectable.

b) Depress the SELECT pushbutton and hold down. Verify that the rotary knob moves the cursor right for CW and left for CCW rotations.

3.1.7 Computer Interface Verification

a) The most complete method to verify the computer interface is to repeat the verification tests of 3.1.1

through 3.1.4 using a terminal or a terminal emulation program on a computer. Refer to the operating instructions for the command and connection instructions.

NOTE

The example QBASIC™ program in Table 7 is written for this purpose. You may also use a terminal emulation program such as PROCOMM™.

b) The following QBASIC™ program enables you to communicate with the NOVATECH 2910A Synthesizer. Prior to running the program make sure that the 2910A User Interface Menu has Echo set to Off, the Baud Rate set to 1200 and Remote set to On. It is also assumed that you are connected to COM1:. Hold down the Control key and hit the Break key to exit the program and return to QBASIC™.

TABLE 7

QBASIC™ EXAMPLE PROGRAM

```
CLS<CR>

    OPEN "COM1:1200,N,8,1,CD0,CS0,DS0,OP0,RS" FOR RANDOM AS #1<CR>

    PRINT #1,""<CR>

    LINE INPUT #1,a$<CR>

        DO WHILE 1=1<CR>

            INPUT "ENTER COMMAND TO SEND TO 2910A: ", CMND$<CR>

            PRINT #1,CMND$<CR>

            LINE INPUT #1,RESP$<CR>

            PRINT RESP$<CR>

        LOOP<CR>

    END<CR>
```

WARRANTY

NOVATECH INSTRUMENTS, INC. warrants that all instruments it manufactures are free from defects in material and workmanship and agrees to replace or repair any instrument found defective during a period of one year from date of shipment to original purchaser.

This warranty is limited to replacing or repairing defective instruments that have been returned by owner, at owner's expense, to NOVATECH INSTRUMENTS, INC. and that have not been subjected to misuse, neglect, improper installation, repair alteration or accident. NOVATECH INSTRUMENTS, INC. shall have the sole right to final determination regarding the existence and cause of a defect.

This warranty is in lieu of any other warranty, either expressed or implied, including but not limited to any warranty of merchantability or fitness for a particular purpose. In no event shall seller be liable for collateral or consequential damages. Some states do not allow limitations or exclusion of consequential damages so this limitation may not apply to you.

All instruments manufactured by NOVATECH INSTRUMENTS, INC. should be inspected as soon as they are received by the purchaser. If an instrument is damaged in shipment the purchaser should immediately file a claim with the transportation company. Any instrument returned to NOVATECH INSTRUMENTS, INC. should be shipped in it's original shipping container or other rigid container and supported with adequate shock absorbing material.

This warranty constitutes the full understanding between NOVATECH INSTRUMENTS, INC. and the purchaser and no agreement extending or modifying it will be binding on NOVATECH INSTRUMENTS, INC. unless made in writing and signed by an authorized official of NOVATECH INSTRUMENTS, INC.

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2910A/02 DIRECT DIGITAL SYNTHESIZER
ADDENDUM TO MANUAL

The Model 2910A/02 is a modified version of the Model 2910A. The Model 2910A manual applies to the 2910A/02 with the following changes:

SECTION 1: INTRODUCTION AND SPECIFICATIONS

The Model 2910A/02 outputs have been modified to provide dual differential clock outputs from 10Hz to 24MHz. The 2910A/02 has two front panel Triax connectors (Trompeter BJ-76 or equivalent) both providing different clock outputs from RS422 drivers. All features relating to amplitude and output mode selection have been eliminated. A provision to disable the front panel control has been added.

Delete references to amplitude, sinewave and CMOS/TTL or ECL. Change frequency range to 10Hz to 24.0MHz. Change output description to read: Dual, differential clock outputs using DS8921AN RS422 Transceivers. Outputs are offset positive from ground. Delete reference to 50 ohm output impedance. Change Output connector references to read TRIAX connector, Trompeter BJ-76 or equivalent. Change external standards to 5MHz or 10MHz.

SECTION 2: OPERATING INSTRUCTIONS

CAUTION

The Triax output shield is grounded, while the two inner conductors are offset from the ground. Shorting either or both of the inner conductors continuously to ground or together can result in damage to the drivers or the 2910A/02.

Ignore all references to Amplitude and to CMOS/TTL or ECL. The Square Wave and High Frequency choices have been deleted from the menus and from the computer I/F command. The external Standard menu now selects 5MHz or 10MHz. The Serial I/F connector on the rear panel has been modified to accept a switch or contact closure to disable control of the instrument. Pin 8 is contact common (connected to instrument ground) and Pin 9 is pulled-up to +5V through 10k ohms. A switch closure (< 500 ohms) will disable the control of the instrument and will be indicated on the second line of the display showing "Control Disabled."

SECTION 3: PERFORMANCE TEST

Ignore all references to amplitude, CMOS/TTL, ECL and High Frequence. Table 4 can be used for frequencies below 24MHz. The same accuracies apply. External standard verification is performed as outlined except 5MHz and 10MHz standards are substituted for 1MHz and 2MHz. To verfy the differential output perform the following.

a) **Verify single-ended performance.** Connect a 10x scope probe to the test oscilloscope. Verify that both inner conductors of both Triax outputs swing from a minimum of 0.8 Volts to 2.4 Volts. Use the frequencies of Table 4 below 24MHz for this test.

b) **Verify differential performance.**

Connect the 2910A/02 output to an oscilloscope set for differential measurements. Verify that the output swings a minimum of ± 1.6 Volts over the frequencies of a) above, when terminated with 100 ohms. Verify that the DC offset is less than 0.4 Volts.