Synthesized Signal Generator, 10 MHz to 20 GHz

HMC-T2100

125790 Rev00.0409

Analog & Mixed-Signal ICs, Modules, Subsystems & Instrumentation

User Manual
Installation, Operation & Maintenance Guide

20000.00MHz   INT
 +23.0dBm   ON

HMC-T2100
10 MHz - 20 GHz Signal Generator

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POWER

HMC-T2100

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1. Introduction

This User's Manual describes the HMC-T2100 10MHz to 20GHz Synthesized Signal Generator unit (SG). Most of the pertinent information can be quickly located through the table of contents and highlighted sections.

The following conventions and indicators are used in this user's guide:

This indicator calls attention to critical or important information, concerning an operation or maintenance procedure or practice, which if not strictly followed and observed, could potentially result in serious injury to operating personnel. An example is the proximity of high AC line voltage.

This indicator draws attention to a situation relating to the equipment set-up, operating or maintaining the equipment, which if not observed, could result in permanent damage to sensitive microwave devices or other electronic components.

This indicator highlights a required equipment preparation, fundamental procedure, practice, condition or statement. Other indicators in bold **Blue** capital lettering emphasize important points of information, input or output connections and signal generator specification headings.

The following nomenclature is affixed to the signal generator front and back panels:

HITTITE MODEL NUMBER: HMC-T2100 four-digit alphanumeric, front panel.

This user's guide should be thoroughly read in depth and reviewed again completely before attempting to unpack, install or operate the SG unit.

2. Package Contents

The SG unit and packaging material weigh approximately 8 lbs. Before unpacking, check for any physical damage to the shipping container. If any noticeable damage is observed, immediately contact Hittite Microwave Corporation. Carefully open the shipping container and inspect the SG unit for any visible signs of damage. Save the shipping container to repackage the SG unit, or for submitting necessary damage claims to the transporter. Remove the documentation packet and any other separately supplied components before attempting to remove the SG unit from the shipping container. It is highly recommended as a preventative measure, to exercise antistatic safeguards when handling the SG unit.

Verify that all of the following components are included with the shipment:

Item	Quantity
HMC-T2100 Signal Generator	1
AC Wall Power Supply	1
AC Power Cord	1
CD ROM (Contains User manuals and software)	1
Calibration Certificate	1
HMC-T2100 Quick Start Guide	1

Table 1: Packing List

3. General Overview of Instrument Capabilities

The HMC-T2100 is a single channel frequency synthesizer. The block diagram for this unit is shown in figure 1. This unit provides one RF output channel with programmable output frequency and output power. The output frequency range is programmable from **10 MHz to 20 GHz** in 10 KHz increments. The synthesizer provides an internal 10 MHz reference source which can be overridden by an external source. An AC wall type power supply is provided to generate the required DC power for the unit. The detailed performance specifications for the synthesizer are listed in the datasheet on the Hittite website.

The user may control the frequency, power, and RF Standby functions from either the **Front Panel** or the peripheral interfaces which include a **USB, Ethernet[1], and GPIB interface** [1]. The RF Standby function will apply the maximum attenuation to the RF output.
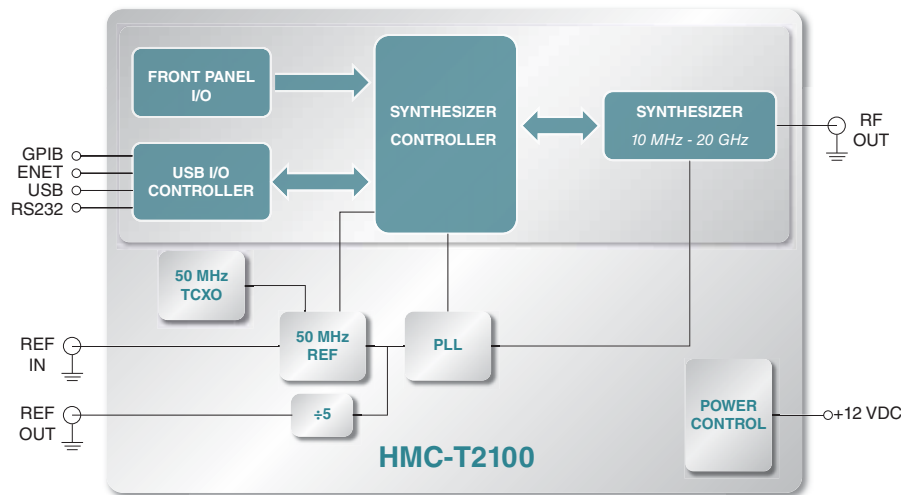

Figure 1: HMC-T2100 Block Diagram

4. Installation of Equipment and Safety

The guidelines shown below must be followed for proper installation of the SG equipment:

- The SG equipment was designed for **LABORATORY USE ONLY** and is not protected against moisture.

- Utilize appropriate ESD handling procedures and precautionary measures when installing this equipment.

- The SG unit is intended for placement on a laboratory workbench.

- During install make certain there are no obstructions that would impede air flow to the venting of the unit on the sides of the enclosure, or the fans located on the rear panel.

- Ensure that all external components and RF/microwave coaxial cables are in proper condition.

- A grounded, three pin AC power receptacle should be used to connect power to the AC wall power supply. It is recommended that the ON/OFF power switch on the front panel be used to interrupt power to the unit. Interrupting power by pulling out the AC cord may result in injury or unit damage.

[1] Ethernet & GPIB Interface are not operational until June 2009.

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- The detachable AC power cord, and the power switch on the front panel must be easily accessible to facilitate removal of power from the unit.

- Verify the facility AC line voltage is within specifications before applying power to the unit, or the applied DC power source is within the specifications of the unit. See paragraph. 5.2.6 to determine the acceptable input AC voltage, and frequency range.

- The DC power connector has GND pins which connect to the chassis. Both of these must be connected to GND for safe operation of the unit.

5. Operation and Setup

The SG unit control features and setup are detailed in this section.

5.1 Equipment Setup and Operation

Before the SG unit can be operated, external coaxial cables, equipment and instrumentation are required to be set-up. The instruction steps listed below must first be completed:

1. Use appropriate ESD precautions when connecting cabling, and external equipment to the HMC-T2100 Signal Generator.

2. Verify that the front panel power switch is switched to the "OFF" (Button not depressed) position.

3. Connect DC power cable to rear panel (DIN style DC power connector).

4. Ensure that the ON/OFF switch on the AC power adapter is in the OFF position.

5. Connect the AC power cable to an appropriate 3 prong AC receptacle.

6. Place the ON/OFF switch on the AC power adapter in the ON position. The LED indicator located on the adapter should be illuminated green in this condition.

7. Connect the RF output to the peripheral equipment using an SMA compatible connector.

8. If desired, connect the USB, GPIB, or Ethernet connectors to the Host PC or equivalent.

9. If desired, connect the appropriate BNC connectors to external equipment to provide an external 10 MHz reference.

10. If desired, connect the 10 MHz reference input to external equipment.

11. Press the front panel power switch to the "ON" (labeled 1) position.

12. It is recommended that the user allows a minimum of 30 minutes warm-up time before using the instrument.

13. Verify the unit is powered on by monitoring the front panel LCD display.

14. Using either the Front Panel Controls or the peripheral interfaces, control the operation of the SG.

5.2 Hardware Interfaces

The front panel of the unit contains a multi-function rotary knob, an RF Standby switch, power On/Off

switch, LCD display, and the connector for the RF output. See figure 2 for a view of the front panel. The rear panel of the unit contains the connectors for the External Reference Input, Reference Output, DC power, GPIB, Ethernet, and USB interface. See figure 3 for a view of the rear panel.

Figure 2: Front Panel view of the HMC-T2100

Figure 3: Rear Panel view of the HMC-T2100

5.2.1 RF Output Standby

The RF output is delivered via an SMA connector located on the front panel. The RF output may be commanded to the Standby State by either the RF Standby switch on the front panel, or by commanding the unit via one of the peripheral interfaces. When in the Standby State, the output power attenuators are set for maximum attenuation. The RF output specifications are located in the data sheet on the Hittite website. Please note that while the SG unit is in the Stand-by state, there is still a minimal level of RF power at the signal generator RF output.

5.2.2 Front Panel Rotary Control Knob

The large rotary knob on the front panel is used to control the synthesizer's frequency and power output. When the knob is depressed it will cycle through its functions. The functions consist of the following:

1. Increment/Decrement frequency with 10 KHz steps

2. Increment/Decrement frequency with 100 KHz steps

3. Increment/Decrement frequency with 1 MHz steps

4. Increment/Decrement frequency with 10 MHz steps

5. Increment/Decrement frequency with 100 MHz steps

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6. Increment/Decrement frequency with 1 GHz steps

7. Increment/Decrement Output Power with 0.1 dB steps

8. Increment/Decrement Output Power with 1.0 dB steps

Rotation of the knob will increment or decrement the synthesizer's selected function.

Note: When the front panel controls have been locked out due to computer commands via one of the peripheral interfaces, the rotary knob may be depressed for ~1.5 seconds to re-enable front panel controls, and disable computer controls.

5.2.2.1 Setting Synthesizer GPIB Address

If unit is in the Remote mode, press and hold front panel rotary knob for ~1.5 seconds to exit the Remote mode. Then, press and hold front panel rotary knob for ~1.5 seconds to go to the GPIB address menu. Rotate the knob to select a GPIB address between 0 and 15. Press and hold the rotary knob for ~1.5 seconds. This will store the selected GPIB address, and then the LCD display will change to display the unit's Serial Number, along with Software and Hardware revision information. Press and hold the rotary knob for ~1.5 seconds to switch to normal operation, and display power and frequency.

5.2.3 Front Panel LCD Display

At power turn-on the LCD will display the units Serial Number, Model Number, as well as the firmware revision. Sometime thereafter the LCD will change to display its operational state. The operational state provides the information listed in the Table below.

Function	Units	Comments
Frequency	MHz	Output Frequency
RF Output Power	dBm	Commanded Output Power
RF Status	N/A	Output ON or OFF
Unit Status	N/A	F – Fan failure, RF output disabled L – PLL loss of lock R – Remotely controlled via one of the peripheral interfaces.
Reference Source	N/A	INT (Internal) EXT (External)
Selected Function Indicator	N/A	Underlined character indicates whether rotary knob controls frequency or power, and determines the resolution step size.
RF Power Status	N/A	Blank – Output Power Leveled UNLVLD – Output Power Un-Leveled

Table 2: Front Panel Display

5.2.3.1 Front Panel Power Level Status

The HMC-T2100 includes a power level indicator on the Front Panel display which can be monitored by the user to determine if the output power specified by the user is within the instruments calibrated output range (See the data sheet). When the instrument is commanded to a Frequency and Power combination which is beyond the units specified calibration range, the "UNLVLED" indicator will appear on the display.

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Figure 4: Un-calibrated output power indicator

5.2.4 Computer Peripheral Interfaces

The synthesizer's status and programmable functions are identified in the Programmer's guide document.

5.2.4.1 USB Interface

The USB connector is located on the rear panel. The USB interface is compliant with USB 1.1, and USB 2.0. The mating connector for this unit is a USB Series B plug style connector.

5.2.4.2 Ethernet Interface

The Ethernet connector is located on the rear panel. The mating connector is a standard RJ-45 plug style connector. The Ethernet interface is a 10/100 Base T interface.

5.2.4.3 GPIB Interface

The GPIB connector is located on the real panel. The mating connector is a standard 24 pin male connector. The GPIB interface is compliant with IEEE 488.2.

5.2.5 External Reference/Internal Reference

5.2.5.1 Internal Reference Out

The HMC-T2100 includes a single precision 10 MHz reference. The internal 10 MHz reference connects to one of the BNC connectors on the rear panel. The performance of this reference output is specified in the datasheet on the Hittite website. The internal reference out feeds through the external reference in.

5.2.5.2 External Reference In

The internal reference can be overridden by connecting an external reference to the BNC connector located on the rear panel. The unit automatically detects and uses the external reference if present.

5.2.6 Power Input

The unit is powered using the supplied AC wall supply.

5.2.6.1 AC Power adapter

The unit will operate from a single phase AC source of 100 to 240 VAC, with a frequency of 47/63 Hz supplying current of between 1.25 and 0.5A. The internal AC to DC power supply automatically adjusts to the connected power source. A 110 VAC, USA standard wall type power supply and cable is provided with this unit. The AC power adapter contains a power switch, and a power on indicator LED.

5.2.6.2 Power On/Off

Power is turned On/Off with the switch located on the front panel of the enclosure.

5.3 Environmental Requirements

The unit is designed to be operated in an environment meeting the following requirements:

Environment Condition	Value
General Usage	Indoors
Temperature	0 to 35 degrees C
Humidity	15% to 95% non-condensing
Altitude	Less than 3000 meters

Table 3: Environmental Operating Conditions

5.4 Fan Air Inlets

The unit utilizes fans, mounted on the rear panel for cooling. Please ensure that the fans, and vent openings are not obstructed or the unit may overheat and damage may result.

5.5 GUI Instrument control

The instrument may be controlled from a computer using the Hittite Supplied GUI application. The features of the GUI are described in this section. A picture of the GUI is shown in figure 5.
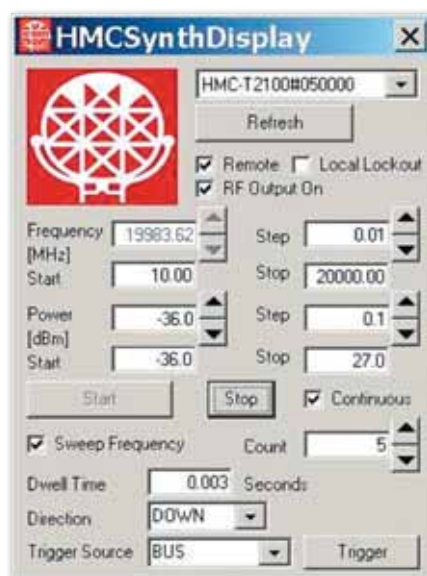
Figure 5: GUI application

5.5.1 Hardware Selection and Control

The application software supports multiple HMC-T2100 synthesizers being connected to the computer at one time. With the supplied software GUI, only one HMC-T2100 synthesizer can be selected and controlled from the GUI application at one time. Multiple HMC-T2100's can be programmed by the user to be controlled simultaneously. Please refer to section 7.0 herein. The Control Menu may be accessed by pointing to the GUI and performing a Right Click with the mouse. The functions available from this menu

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are ReMap Hardware, Open, Close, Refresh, and Disable Power Checks. The top right pull-down menu will provide a list of connected T2100 synthesizers after the application has been opened. Some of the features below may be accessed through the button below the hardware pull-down menu. The function of this button changes depending on the state of the software.

5.5.2 ReMap Hardware

If synthesizer's are added to the computer after the application has been opened, the ReMap Hardware function may be used to force the computer to go and check for any new synthesizer units.

5.5.2.1 Open

The Open function is used to establish a connection to a specified synthesizer. A synthesizer is selected with the upper right hand pull-down menu.

5.5.2.2 Close

The Close function is used to disconnect the currently selected synthesizer. A new synthesizer may then be selected with the upper right hand pull-down menu, and the Open function.

5.5.2.3 Refresh

Once a synthesizer has been selected with the Open command, the Refresh function may be used to read the current status of the synthesizer. If the GUI checkbox for Remote and Local Lockout has not been checked, the Refresh function will read the current status of the unit as commanded via the synthesizer's front panel.

5.5.2.4 Disable Power Checks

Within the menu this function may be selected to disable software power level checking.

5.5.3 Synthesizer Selection Menu

This is a pull-down menu at the top right hand side of the GUI. All synthesizers which have been detected by the software are displayed in this menu. If synthesizers are added to the computer after the application has been started, use the ReMap Hardware function to force the software to check for other synthesizers.

5.5.4 Remote and Local Lockout

The Remote and Local Lockout feature is enabled by a checkbox available within the GUI. When the checkbox is selected, computer controlled operation via the USB is enabled. Front panel control of the unit is disabled. If this checkbox is not selected, the software application will not change any settings in the synthesizer. However in this state, if the Refresh button is depressed, the current Frequency and Power fields will be updated with the current settings within the synthesizer.

5.5.5 Frequency Field

When the Remote and Local Lockout checkbox is selected, the Frequency of the synthesizer may be controlled with the text-box. The desired frequency can be either typed into the provided text-box, or either the up and down arrows on the keyboard, or the GUI field may be used to increment or decrement the frequency by the amount indicated in the Step box. After a new frequency has been entered, the application attempts to set the synthesizer to the commanded frequency. If for any reason (Example: outside the calibration range) the unit does not go to the commanded frequency, the field will be highlighted in yellow.

5.5.6 Power field

When the Remote and Local Lockout checkbox is selected, the Power of the synthesizer may be controlled with the text-box. The desired power can be either typed into the provided text-box, or either the up and down arrows on the keyboard, or the GUI field may be used to increment or decrement the frequency by the dBm indicated in the Step box. After a new power level has been entered, the application attempts to set the synthesizer to the commanded frequency. If for any reason (Example: outside the calibration range) the unit does not go to the commanded power, the field will be highlighted in yellow.

5.5.7 RF Output On

When the Remote and Local Lockout checkbox is selected, the RF Output On checkbox is used to enable and disable the RF output of the Signal Generator.

5.5.8 Synthesizer Frequency Sweeping Controls

The GUI provides a number of controls to allow the user to perform sweeps of either frequency or power, or both. The sweep rate, frequency, and power commands are generated by the software application. The Remote and Local Lockout checkbox must be selected in order for any of the sweep functions to be enabled.

5.5.8.1 Single Sweep / Start Continuous Sweep

When the start button is pressed, a single sweep is performed with the selected parameters. If "Continuous" is selected, sweeping runs continuously for the parameters selected. Depressing the "Stop" button will stop the current sweep. At the normal completion of any sweeps, the unit will remain at the last programmed (STOP condition) power and frequency.

5.5.8.2 Sweep Frequency for each Power OR Sweep Power for each Frequency

Depending on which function is selected with the radio button, the software will either sweep the frequency from the START value to the STOP value set in the GUI for each output power level, or will sweep the power from the START value to the STOP value for each output frequency.

5.5.8.3 Sweep Frequency / Sweep Power

The user can select to sweep Power, Frequency, or both using the checkboxes on the GUI.

5.5.8.4 Start Frequency / Stop Frequency / Step Size

For sweep operations, the user can select the start frequency, the stop frequency, and the step size between frequencies.

#### 5.5.8.5 Start Power / Stop Power / Step Size

For sweep operations, the user can select the start power level, the stop power level, and the step size between power levels. Power levels which are selected outside of the calibrated region of operation will be highlighted in yellow.
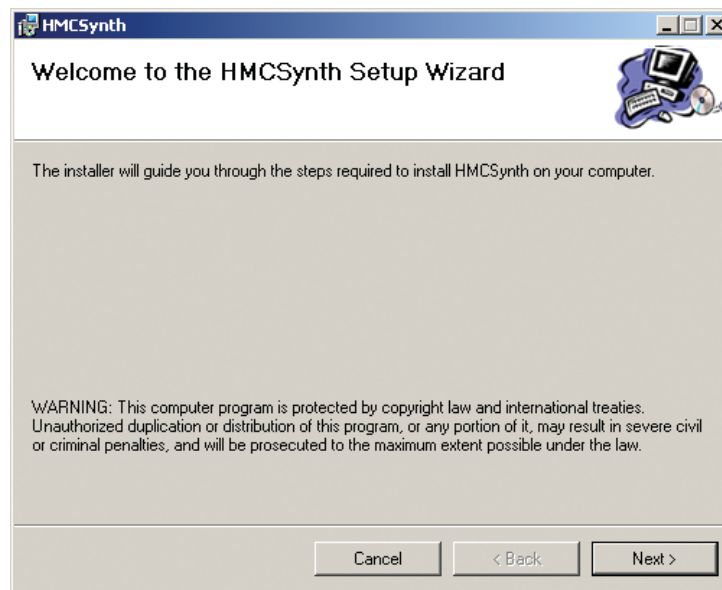
5.5.8.6 Dwell Time

A text box is provided to enter the value of the "Dwell Time" for each step in the sweep. Valid values for this field are 0.001 secs to 3600 secs. The value may be entered by typing the desired value or using the up and down arrows to increment or decrement the time duration.

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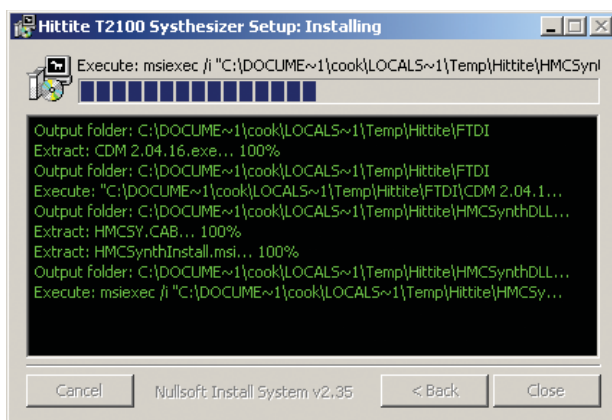### 5.5.9 Software Installation

When installing the software from the CD follow the directions provided by the installation program. See below for general installation process.
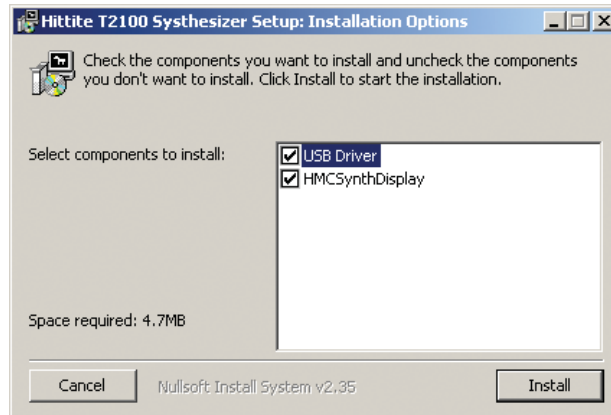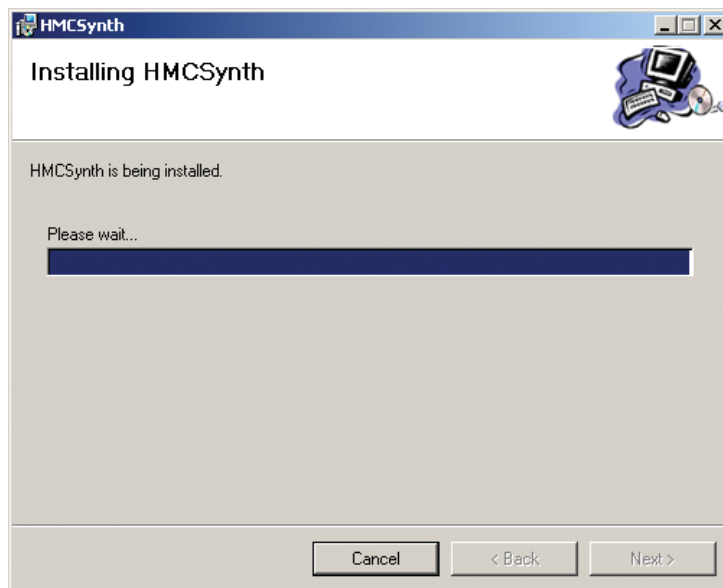

Select the desired components with the checkboxes, and select the install button. The default installation recommended.
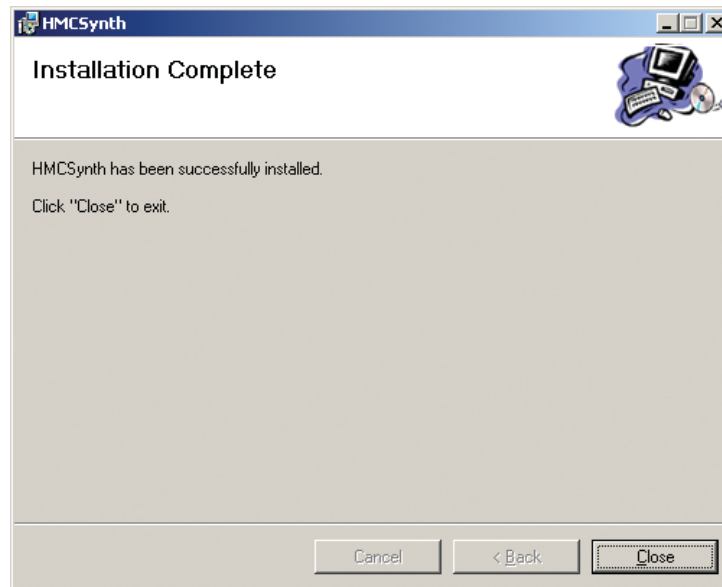

Select Next.

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This window will be displayed during the install process. This window shows status of the install.

The software is being installed.

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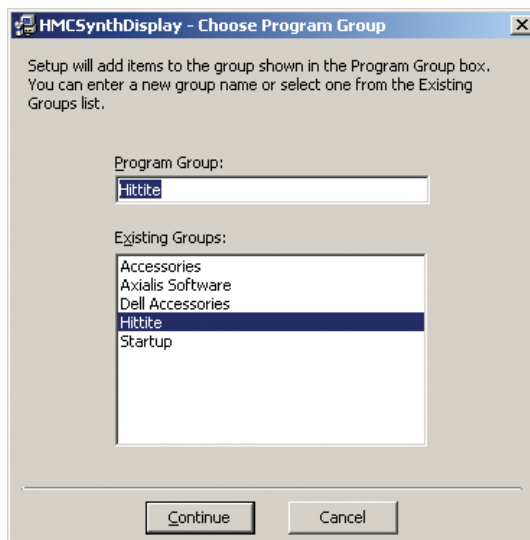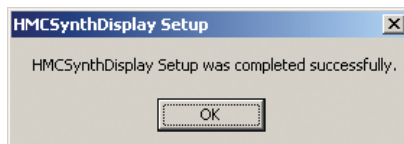
Select Close.
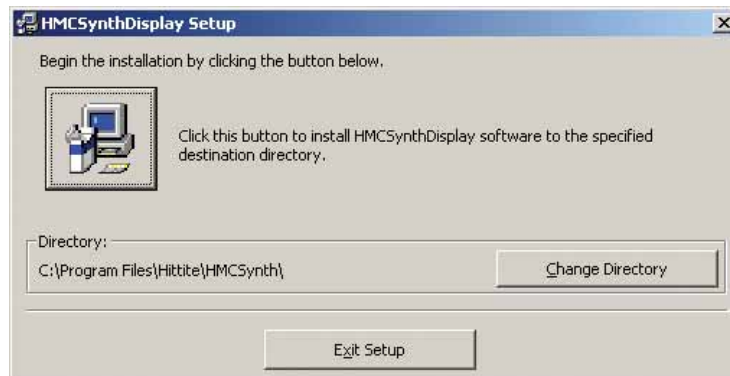
*Change the install directory if desired, and then select the large button on the top left.
It is recommended that the installation is to the default directory.*

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Select the desired folder name and location, and select whether you want anyone who uses this computer to be able to run the application. The default folder location is recommended.
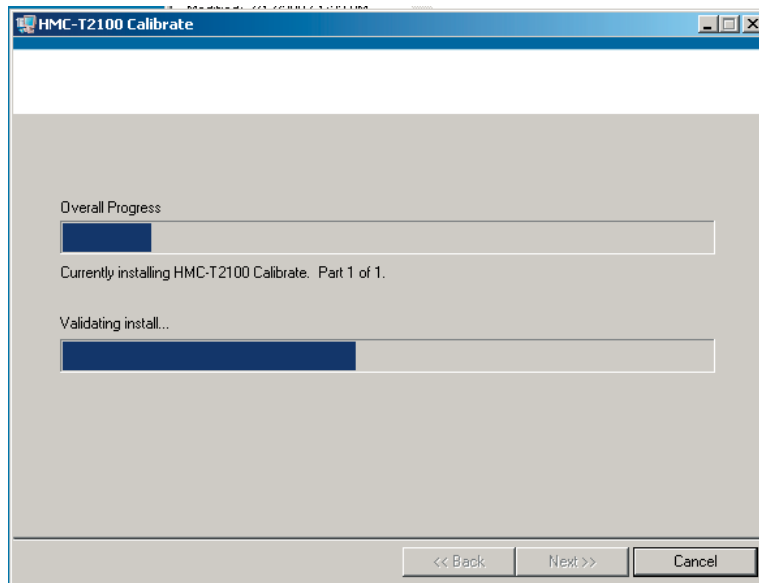

Select the Program Group for installation. Hittite is the recommended group.
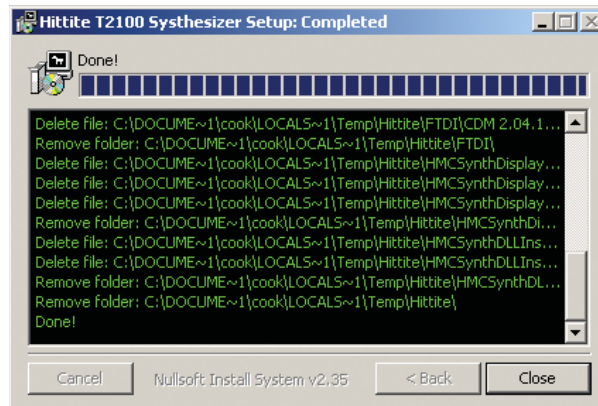

Select OK.

This window displays software installation progress.

Select Close. The installation of all software components is done.

6. Maintenance

The unit should be calibrated every 12 months. The unit is provided with calibration software so that the user can perform periodic calibrations. The RF output connector should be cleaned as needed.

6.1 External Cleaning

Disconnect the power cable to the unit. Do not use any spray or liquid detergents to clean the HMC-T2100 unit. These cleaning products typically employ chemicals or degreasers that could enter the enclosure and damage electronic components. Only use a soft cloth that is slightly dampened with a mild cleansing agent diluted in water, to clean the main SG enclosure, as well as the front and back panels.

6.2 Instrument Calibration

The instrument is supplied with a Hittite software application to support the calibration of the unit's output power. A picture of the GUI is shown in figure 8. The software will provide information related to the required equipment, and setup for the calibration. It is assumed that the user will perform the synthesizer calibration with calibrated test equipment. Insure that the synthesizer has been powered on for at least 30 minute prior to performing the calibration.

6.2.1 Calibration GUI Operation

1. Start the HMC-T2100 calibration software by opening the file: C:\Program Files\LCS\LCS.exe.
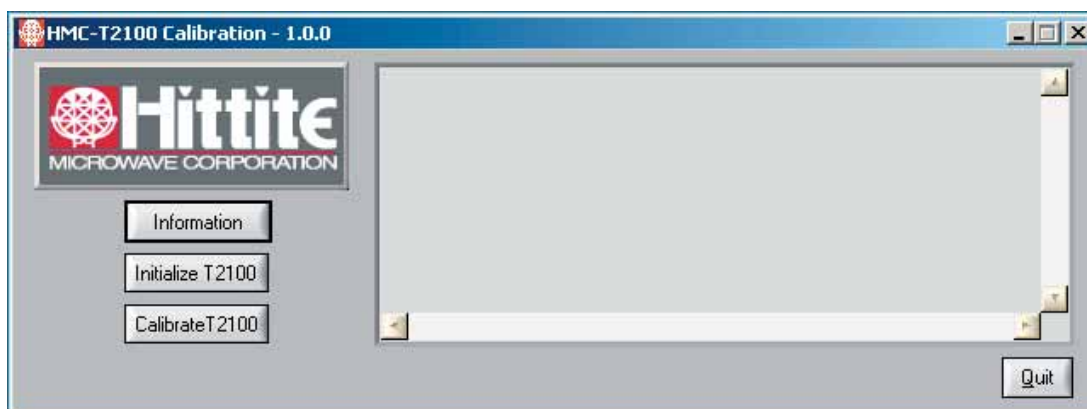
2. The following window should appear.

Figure 6: Calibration GUI

3. Select the "Information" button to show calibration system setup, see figure 9 herein.
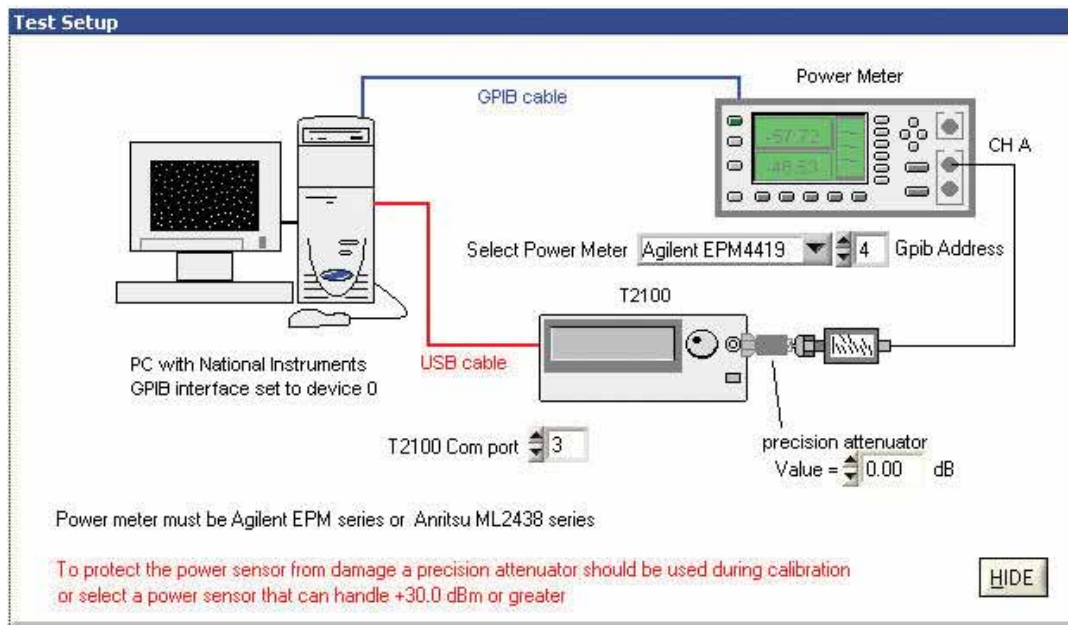
Figure 7: Calibration Setup

4. From the Select Power Meter pull down windows, select the model and GPIB address of the Power Meter.

5. From the Optional precision attenuator pull down menu, select the amount of attenuation between at the output of the HMC-T2100 and the Power Meter.

6. Verify power is ON to the HMC-T2100 and select "Initialize T2100" and verify the following window appears:
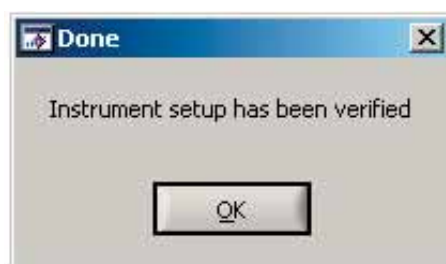

Select OK

7. Select Calibrate.

8. The following error and warning messages may appear if the power meter has a channel with no power sensor connected. Select OK until the Done window appears indicating that Instrument setup has been verified.
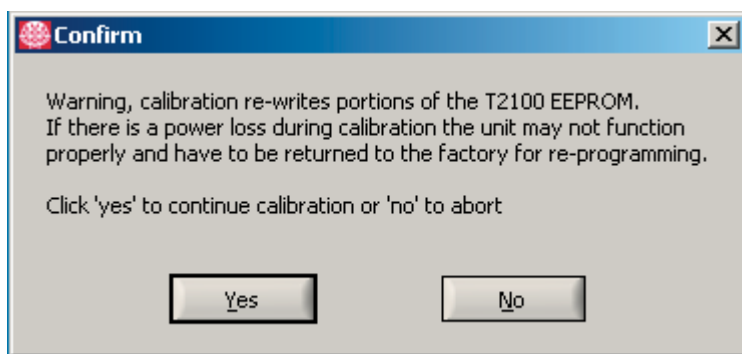
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Select OK

Select OK

Select OK

9. Select Yes to begin calibration

7. Programming

The enclosed CDROM contains the necessary control software and drivers to support a smooth installation with a Windows XP® operating system. Also included is a Programmer's Reference Guide which provides the primary software commands, GUI source codes and C language support that permits customized control compatible with Labview® or LabWindows® routines.

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8. Technical Support

Please contact apps@hittite.com or call 978-250-3343 and request the HMC-T2100 technical support department. Hittite Microwave provides local direct support in many areas around the world. Please see the "Contact Us" page at www.hittite.com.

9. Warranty

Seller warrants to Buyer that Seller's standard product instrumentation goods delivered hereunder will conform to the applicable specifications and certifications and be free of defects in material and workmanship for a period of one (1) year from the date of shipment to the Buyer. The warranties stated herein are in lieu of all other warranties, expressed, implied, or statutory and of all other obligations or liabilities on the part of Seller. Buyer expressly waives any right, claim, or cause of action that might otherwise arise out of the purchase and use of seller's products or service. Seller shall not be liable for special or consequential damages of any nature with respect to any merchandise or service sold, delivered, or rendered No product is warranted to be fit for any particular use or application, and no warranty is made that any set of standards will be met other than what is marked on the product. Seller warrants all parts of merchandise of its manufacture to be free from defects caused by faulty material or poor workmanship. Liability is limited to the obligation to repair, or, to replace without charge Ex-Works Chelmsford, MA any part found to be defective under normal use and service within the warranty period provided: (1) Seller is promptly notified within the warranty period in writing upon discovery or such defects; (2) the original product is returned to Seller with Seller's prior authorization, transportation charges prepaid; and (3) Seller's examination shall disclose to its satisfaction that such defects have not been caused by abuse after delivery. Seller reserves the right to impose a reasonable charge on Buyer for evaluation and repair of returned goods under certain conditions. The full text of the instrumentation warranty and returns warranty can be found in the on-line Hittite Microwave Terms and Conditions of Sale http://www.hittite.com/content/documents/terms.pdf

10. Appendix

Please see the HMC-T2100 specification sheet for further information.

www.DataSheet4U.com

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