

N2102A Option H10 8.5 Gb/s Pulse Pattern Generator

User's Guide

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Introduction

The N2102A Pulse Pattern Generator is a differential NRZ data pattern generator that requires a clock input. It is a single-wide 3U PXI module. The range of operation covers most rates up to 10 Gb/s. The ideal clock input can be supplied by the N2099A Synthesizer. The N2102A provides the following features:

- Differential NRZ data generation
- External clock input (SMA)
- User selectable data patterns
- 2048-bit user pattern memory
- Differential data generation
- Variable modulation voltage
- Wide range of supported data rates and patterns

The accompanying software includes a Windows application described in [“Using the Control Panel” on page 10](#) and an ActiveX control wrapper for the DLL providing the same functions. For programming information, refer to [“Programming” on page 14](#).

NOTE

Please note that this former PXIT product PX2000-337 is now part of Agilent Technologies. Although most references have been changed to Agilent Technologies, this manual may contain some references to PXIT Inc.

CAUTION

The N2102A is shipped in materials which prevent damage from static. The module should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken.

WARNING

This product is NOT tested for use in medical or clinical applications.

WARNING

No operator serviceable parts inside. Refer servicing to qualified service personnel.

Data Bit Rates

- 1.0 to 2.5 Gb/s
- 2.5 to 3.3 Gb/s (this range requires a clock at double the desired output bit rate)
- 4.0 to 6.6 Gb/s
- 7.4 to 10.3125 Gb/s

Output Voltage

The actual output range is from 250 mV to 1.6V. Setting the output signal amplitude to a value below the range's minimum result in the output signal being set to 250 mV. Setting the output signal amplitude to a value above the maximum value results in the output amplitude being set to 1.6V.

Clock Input

For most ranges the clock input is simply the equivalent frequency number as the rate. For example, a 1 Gb/s clock input would need to be 1 GHz. However between the range 2.5 and 3.3 Gb/s, a double frequency is required. For example, a 3.0 Gb/s requirement would be a clock input of 6 GHz.

Clock and Pattern Outputs

The module has a clock output, a divided clock output (by 128, 256, 512, for example), and a pattern output. You can select from up to 9 different internal pattern types as well as being able to define your own pattern. The pattern length can be a PRBS at 2^n-1 , where n is equal to 7, 9, 10, 11, 15, 23, or 31. Pattern lengths of K28.5, K28.7, CRPAT are also available.

The pattern trigger can be configured so that the trigger pulse changes state at each repetition of the transmit pattern or at a specified multiple of 128 bits of the transmit signal.

Installing

The PXI chassis can be controlled using either embedded PXI controller or an external PC using a PCI - cPCI/PXI remote bridge (such as the NI MXI-4 product). If an external PC is used, the PC must meet the following specification:

- Windows 2000 or XP operating system
- 128 MB RAM
- Pentium, 133 MHz or greater

NOTE

When using an external PC, if the sequence of the following installation steps is not followed, the PC BIOS will not be able to locate the instruments in the PXI chassis.

Step 1. Inspect the Shipment

- 1 Inspect the shipping container and kit for damage. Keep the shipping container and cushioning material until you have inspected the contents of the shipment for completeness and have checked the kit mechanically and electrically.
- 2 Locate the shipping list. Verify that you have received all of the items listed.

To contact Agilent Technologies for technical assistance, contact your local Agilent Call Center. In the Americas, call 1 (800) 829-4444. In other regions, visit <http://www.agilent.com/find/assist>. Before returning an instrument for service, you must first call the Call Center at 1 (800) 829-4444.

- 3 Do not install the N2102A in the PXI chassis at this time.

WARNING

Ensure that the PXI chassis is connected to the specified power source using the correct power cord (noting country of use).

WARNING

Ensure that the PXI chassis containing the N2102A provides adequate earth grounding.

WARNING

Ensure that the air supply to the chassis is working correctly. The N2102A requires an optimal air flow within the chassis. It is recommended to regularly change filters on PXI Chassis.

Step 2. Install the Instrument Driver Software

- 1 If using an external PC and remote bridge, turn the PXI chassis power off. If using an embedded controller, remove all N2102A modules from the chassis.

NOTE

This step ensures that the PC BIOS will be able to locate the instruments in the PXI chassis.

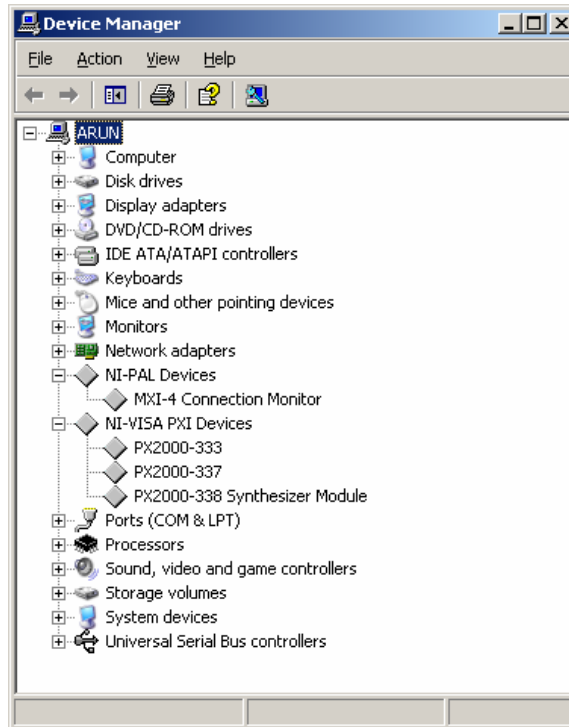
- 2 Log onto the PC with administrator privileges, so that you can install the software.
- 3 Go to the Agilent website: www.agilent.com/find/pxit

- 4 Click on the Technical Support link and then the Drivers link.
- 5 Download the latest version of the following driver:
Agilent N2102A (PX2000-337) PPG Driver
- 6 Once the download has completed, run the file, N2102AInstall.exe. During the installation, you will enter the user name and organization. Select the all users option to ensure the software is available to all users of the PC. Click **Next**.
- 7 When install is finished click **Finish**. The N2102A control software is now installed.

Step 3. Install the N2102A

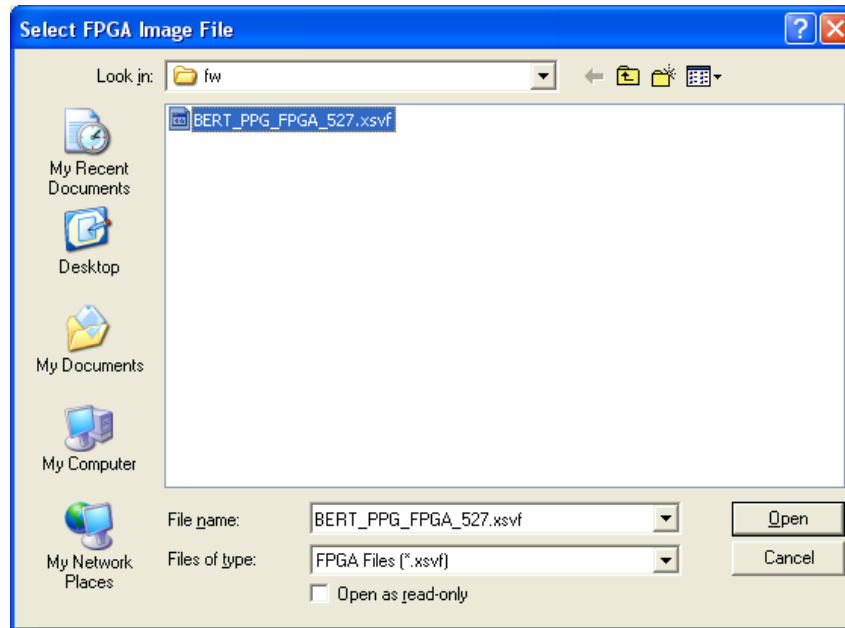
- 1 With the PC and chassis powered off, install the N2102A module in an available slot in a PXI chassis.
- 2 Power on the PXI chassis and wait for the power up sequence to complete.
- 3 Turn on the PC.

If needed, you can use Windows Device Manager to determine if the instruments have been correctly identified by the BIOS. There should be an NI-VISA PXI Devices entry with your N2102A/PX2000 series instrument as shown in the following figure.

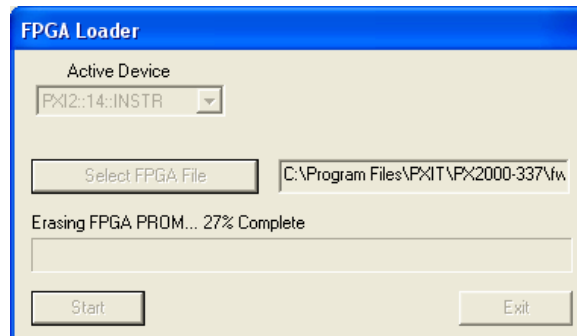


User's Guide

- a Select the FPGA file- in the this example the file is BERT_PPG_FPGA_527.xsvf

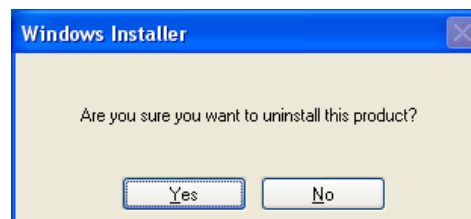


- 4 Hit the <Start> button. The software will then start to remove the old FPGA image. Then the software will load the new FPGA image. Please be patient the time to upload is approximately 5 minutes. Once complete the above screen shot will appear. The FPGA has now been successfully updated. The system must then be rebooted before the N2102A can be controlled.

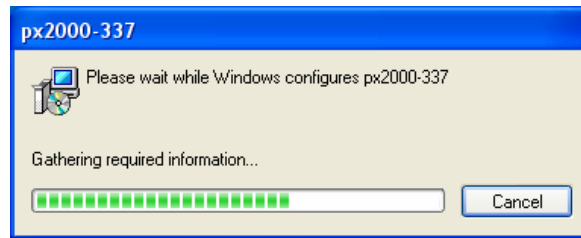


Removing the Software Install

Also available within the /ALL Programs/PXIT/PX2000-337/ is the uninstall option. Select this to remove the software. The following screen will appear:

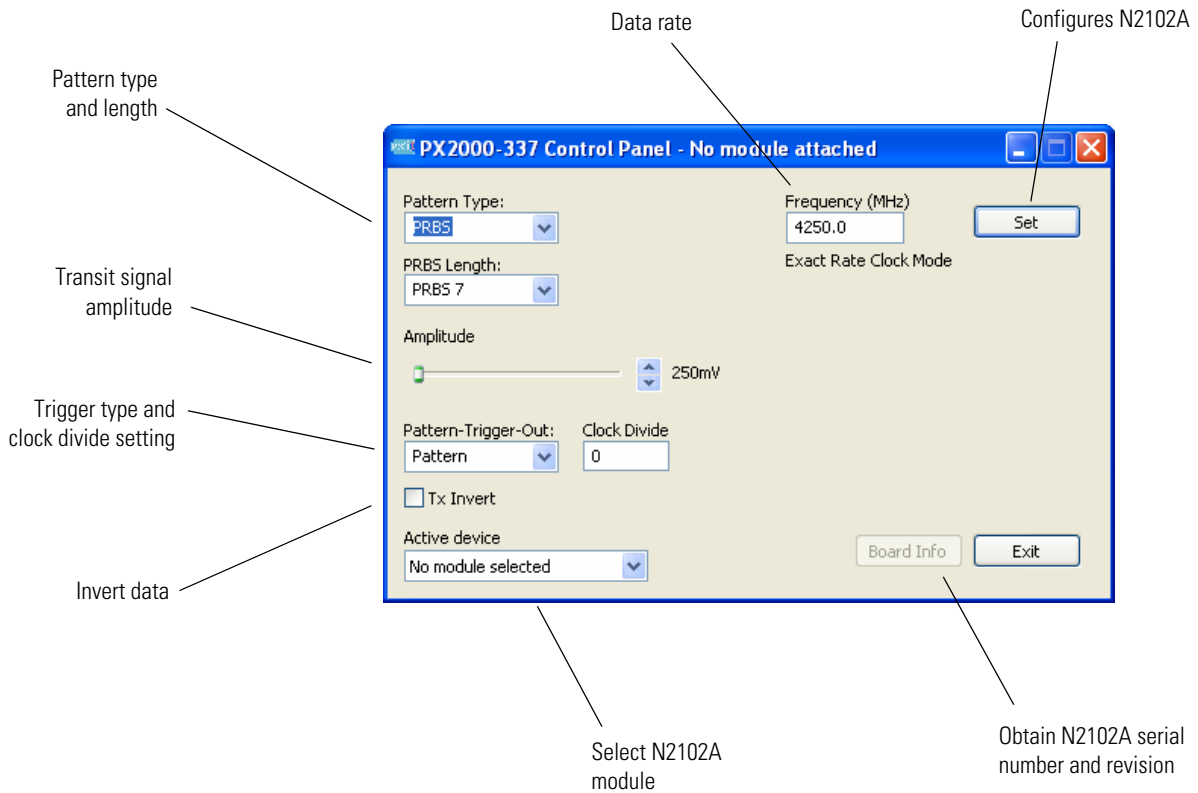


Select the Yes option to continue with the uninstall. This will complete the removal of the software.



Using the Control Panel

The N2102A Control Panel is Windows application that you can use to control the N2102A. If only the N2102A is installed in the system, the N2102A is automatically selected.



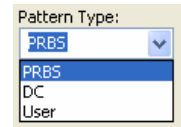
Control Panel Features

To start the control panel

- 1 Click the Window's Start menu.
- 2 Click **All Programs**, **PXIT**, and then **PX2000-337**.
- 3 Click **PX2000-337 Control Panel**.

Pattern Type

Click on this drop down box to choose the appropriate pattern type. If PRBS is selected as the pattern, you must select which length of PRBS is required. If a DC pattern is selected, you must choose between: K28.5, K28.7, or CRPAT. If the User Pattern option is selected, you must click the browse button to select the appropriate file. A user pattern requires a file with the following format:



- Text (txt) file.
- The first line must contain the length of the pattern in HEX.
- The next line contains the pattern in a 16-bit HEX format or multiples of.
- If the pattern is less than the 16 bits, then it gets padded to the right with 0's.
- User comments can be entered on any line once the line begins with //.

The following is an example of a user pattern file:

```
// This creates a K28.7 signal - 5 1's and 5 0's.
A
// The A is the length in Hex.
// So we are saying its length here is 10 bits.
F800
    // The above is the pattern in a 16Bit Hex value
    // To get this you start with 1111100000 and
    // then pad 000000 to the right giving 1111100000000000 and then
    // convert to HEX
```

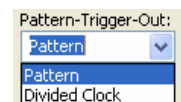
The N2102A has the capability of storing a pattern that is 2^{17} or 131,072 bits in length. However, there are a number of requirements needed in order to achieve this maximum pattern length. The pattern is stored within a 64 x 2048 array. The FPGA processes the data 64 bits at a time. All patterns less than or equal to 2048 in length are valid. For an odd length pattern the maximum valid length is 2047 bits. If a pattern length is divisible by 64 and is less than or equal to 131,072 in length then it is valid. If a pattern length is not divisible by 64 but its remainder (for example, $\text{Pattern Length} \% 64$) is a factor of 64 then it is valid if the $64/\text{Remainder} \times \text{Pattern length} \leq 2^{17}$.

Amplitude

The amplitude can be set by moving the slider as shown above to the left or to the right. The increment or decrement buttons can also be used.

**Pattern Trigger Out**

The **Pattern -Trigger Out** SMA connector on the front panel of the N2102A can be set to either of two options: Pattern or Divided Clock. When Pattern is selected the output will switch from a low state to a high state at the beginning of each new pattern output. Divided Clock allows the user to use this output as a clock divided down signal. If this is selected then the user must also enter a value into the clock divide option.

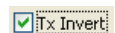


The clock divide == $\text{Data rate Out} \times (n+1) \times 128$ for $n=0,1,2\dots64,000$

Entering a zero will give a clock divide out signal of 128.

TX Invert

By checking this option the output can be inverted. i.e where a bit was expected to be a 1 it will now be a zero.

**Active Device**

This drop down box allows the user to select between various N2102A Pattern Generators within the system.

Board Info

Selecting this button will return the serial number of the pattern generator. It will also display the software revision numbers.

User's Guide**Set Frequency**

The user must enter the frequency in MHz of the required rate within this input box.

By hitting the Set button the N2102A sets its appropriate internal configuration for this rate. Between 2.5 and 3.3

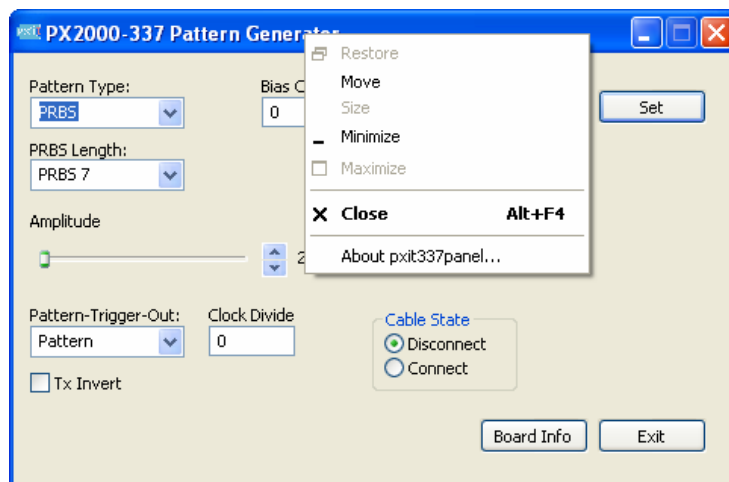
Gb/s a message appears stating that the input clock rate must be doubled. For example, if the required rate is 2.7 Gb/s, you must supply a clock rate at twice this (5.4 Gbps). The clock output in this condition is still the actual rate out divided by 128 (for an input of zero in the clock divide option). For this example, the clock out will be 2.7 GHz/ 128.

Exit

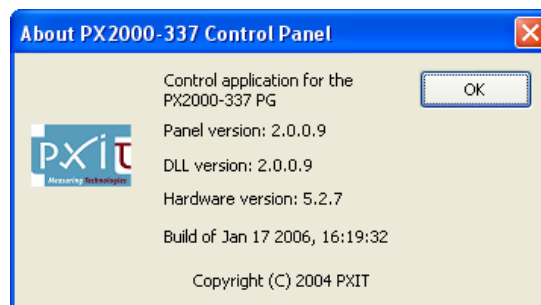
The exit button allows the user to close the Control Panel window.

About N2102A Panel

To obtain further information about the Pattern Generator, right click on the top of the Control Panel window's title bar.



Then select **About pxit337panel....** A panel displays showing the Panel Version number, DLL version number, Hardware (FPGA) version number.



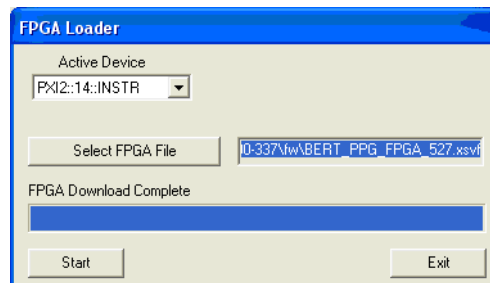
Upgrading the Instrument's Firmware

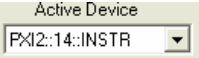
Your new N2102A is compatible with the current version of the control panel software. If your PXI chassis includes older N2102A (PX2000-337) instruments, you may need to upgrade the firmware in those older instruments as described in this section. Connecting to a module with an incompatible version results in an error message similar to the following.



To update the firmware and execute the FPGA Loader program, perform the following steps:

- 1 Close any open Control Panels.
- 2 On the Windows Start menu, click All Programs, PXIT, PX2000-337, FPGA Loader.



- 3 Select the Active Device.
 - a Click on the drop down box **Active Device**.
- 
- b Select the appropriate instrument (if there is only one N2102A in the system then there will only be one item in the list).
- 4 Select FPGA File.
 - a Click **FPGA File**.
 - b Browse to c:\Program Files\PXIT\PX2000-337\fw\

Programming

The N2102A and its accompanying software comply with PXI specifications and provide a Windows application that allows the user to control the N2102A without any software development. A Dynamic Link Library (DLL) provides an API for developing custom applications. An ActiveX Control wrapper for the DLL is also provided which extends programmability to any ActiveX container application or COM compliant programming environment. This includes Visual C++, Visual Basic, C#, LabView and many other environments.

Software features include:

- A DLL providing the functions of the API.
- An ActiveX Control wrapper for the DLL providing the same functions.
- A Windows Control Panel Application.
- FPGA Upgrade Panel.

Steps Needed to Program the N2102A

1 Obtain the N2102A VISA handle.

All calls to the N2102A API take a VISA handle that identifies the module to be accessed by the function call. This handle can be obtained by directly using the VISA API or by calling the function `PXIT337GetInstHandle` as shown in the following example. The first parameter to this function call is a pointer to the location where the VISA handle will be stored. The second parameter is used to enumerate the N2102A modules present in the system. For example, a second parameter of 0 returns the VISA handle of the first N2102A detected. Incrementing this parameter in subsequent calls returns the VISA handle of other detected N2102A modules.

```
#include <stdlib.h>
#include <windows.h>
#include <pxit337.h>

main ()
{
    ViSession instHandle; VISA handle for the PATTERN GENERATOR.
    PXIT337GetInstHandle(&instHandle, 0);
    if (instHandle != NULL)
    {
        PXIT337Reset(instHandle);Reset the N2102A
    }
}
```

2 Open the device using the following API call.

```
BOOL PXIT337OpenDevice (char *pszDevice,ViSession *inst,int *pDevID);
```

3 Set the modulation voltage in 5 mV increments from 250 mV up to 1.6V using the following API call.

```
int PXIT337SetTxAmplitude(ViSession inst, unsigned long amplitude);
```

- 4 Set the bit rate. You must also provide a clock input into the N2102A at the required bit rate. Use the following API call.

```
int PXIT337SetFrequency (ViSession inst, float fFrequency);
```

- 5 Configure the two trigger outputs. The clock trigger output cannot be reconfigured but the pattern trigger output can be programmed to toggle at the start of the transmit pattern. Alternatively, it can be programmed to toggle at a specified multiple of 128 bits of the transmit output. Use the following API calls:

```
int PXIT337SetPatternTrigger(ViSession inst, PGPatternTrigger patternTriggerCfg);  
void PXIT337SetClockDivide (int viSession,ULONG ClockDivide);
```

DLL API Reference

This section documents the functions that are included in the DLL. [Table 1](#) specifies bits 16 to 31 of the methods return values. You should mask off the lowest 16 bits of the return values before to compare it to one of the major error codes described in this table. Bits 16-31 of the errors codes may contain info about the cause of the error.

Table 1. Function Return Codes

| Mnemonic | Value | Description |
|---------------------------|------------|---|
| SUCCESS | 0x00000000 | Operation completed successfully. |
| UNEXPECTED_ERROR | 0x00010000 | Unexpected error. Contact support with a description of how this error occurred. |
| MEASURE_IN_PROGRESS_ERROR | 0x00020000 | The requested operation cannot be completed because there is a measurement currently running. Try calling the StopCurrentMeasure() method before retrying. |
| UNKNOWN_DEVICE | 0x00030000 | The instrument handle used is not recognised as a valid handle. Make sure there is at least one PATTERN GENERATOR present in the system, that the PXI chassis is powered up and that the PC has been rebooted after the chassis was powered up. |
| INVALID_PARAMETER | 0x00040000 | One of the parameters passed to the method is invalid or is not supported by the revision of hardware present in the system. |
| BOARD_REGISTER_ERROR | 0x00050000 | Cannot access the N2102A board registers. Power cycle the system. Contact support if problem persists. |
| BOARD_DEVICE_ERROR | 0x00060000 | Cannot access one of the devices present on the board. Usually happens when one of the I2C devices present on the board is not responding. Bits 0-7 contain the bus address and bits 8-15 contain the bus number of the device causing the error. |

PXIT337GetInstHandle

Obtains a VISA handle identifying a N2102A detected in the system. This handle is stored in the location passed as parameter. The content of this location is set to NULL if no N2102A was detected for the specified index.

Function Prototype int PXIT337GetInstHandle(ViSession *instHandle, int index);

***instHandle** Pointer to the location where the VISA handle of the first N2102A detected in the system will be stored.

index Index of N2102A for which a VISA handle is requested. This index starts at 0 and can be incremented after each call to PXIT337GetInstHandle to enumerate all the N2102A present in the system.

PXIT337Reset

Resets the N2102A hardware. The traffic generator is configured to A known"sensible" state that can be retrieved by calls to PXIT337GetTxConfig.

Function Prototype int PXIT337Reset(ViSession inst);

inst VISA handle of the N2102A to be reset.

PXIT337GetHardwareVersion

Reads the PATTERN GENERATOR hardware version number.

Function Prototype int PXIT337GetHardwareVersion(ViSession inst, Pattern GeneratorVersion *versionNb);

Inst VISA handle of the N2102A from which to read the hardware version.

***versionNb** Pointer to a Pattern GeneratorVersion variable into which the function will write the hardware version number.

PXIT337GetSoftwareVersion

Reads the PATTERN GENERATOR software version number.

Function Prototype void PXIT337GetSoftwareVersion(PGVersion *versionNb);

***versionNb** Pointer to a PGVersion variable into which the function will write the software version number.

PXIT337GetTxConfig

Retrieves the current configuration of the transmit part of the PATTERN GENERATOR.

Function Prototype int PXIT337GetTxConfig(ViSession inst, PGTxConfig *txConfig);

Inst VISA handle of the N2102A from which to read the configuration.

***txConfig** Pointer to an instance of PGTxConfig. Points to the location where the transmit configuration will be stored.

PXIT337ConfigureTx

Configures the PATTERN GENERATOR's transmit block.

Function Prototype int PXIT337ConfigureTx(ViSession inst, PGTxConfig *TxConfig);

Inst VISA handle of the N2102A to configure.

***txConfig** Pointer to an instance of PGTxConfig. Points to the location containing the new transmit configuration to be applied.

PXIT337SetTxAmplitude

Specifies the amplitude of the pattern generator output. The amplitude is specified in milli-Volts.

Function Prototype int PXIT337SetTxAmplitude(ViSession inst, unsigned long amplitude);

Inst VISA handle of the N2102A to configure.

amplitude Output signal amplitude specified in mV

PXIT337SetPatternTrigger

Selects the configuration of the Pattern Trigger output. The Pattern Trigger output can be configured to toggle at a programmable multiple of 64 bits (for example, every 64, 128, 172, 256, bits, up to every 2261 bits) of the transmit signal. Alternatively, the Pattern Trigger can be programmed to toggle at the start of a bit pattern but not at the start of every bit pattern. In this configuration the trigger output is toggled every time a PRBS or user pattern starts repeating itself.

Function Prototype int PXIT337SetPatternTrigger(ViSession inst,unsigned long pattern);

inst VISA handle of the N2102A to configure.

pattern Specifies the trigger pattern to configure the Trigger Output with. Setting this parameter to 0 indicates that the Pattern Trigger output must toggle at the beginning of each repetition of the transmit pattern. The Pattern Trigger toggling rate is then dependant on the length of the PRBS or user pattern generated on the transmit output. Setting this parameter to a non zero value indicates how many 64 bits blocks should be generated on the transmit output in between each toggling of the Pattern Trigger output. Valid values range from 1 up to 256.

PXIT337GetPatternTrigger

Retrieves the current configuration of the pattern trigger output.

Function Prototype int PXIT337GetPatternTrigger(ViSession inst, PGPatternTrigger *patternTriggerCfg);

inst VISA handle of the N2102A to configure.

***patternTriggerCfg** Pointer to a Pattern GeneratorPatternTrigger instance where the configuration of the pattern trigger output will be stored when this function returns.

Data Types and Structures

PGPattern

This data structure is used to individually describe transmit patterns. All parameters to define transmit and receive patterns are included in this structure. This structure is typically used to specify the traffic generator and receiver's configuration.

```
typedef struct
{
    PGPatternType    Type;
    Union
    {
        PGPrbsLength    PrbsLength;
        PGDcPattern     DcPattern;
        PGUserPattern   UserPattern;
    };
} PGPattern;
```

PGPatternType

This enumeration defines the three possible pattern types supported by the N2102A.

```
typedef enum
{
    PRBS,
    DC,
    User
} PGPatternType;
```

PGPrbsLength

This enumeration defines the PRBS pattern lengths supported by the N2102A.

```
typedef enum
```

```

{
    PRBS_7,
    PRBS_9,
    PRBS_11,
    PRBS_15,
    PRBS_23,
    PRBS_31
} PGPrbsLength;

```

PGDcPattern

This enumeration defines the DC patterns supported by the N2102A.

```

typedef enum
{
    K28dot5 = 0,
    K28dot7,
    CRPAT,
    GBETESTPAT
} PGDcPattern;

```

PGUserPattern

This structure is used to define a user pattern. It is used to specify the buffer in which the user pattern is stored and the bit length of that pattern.

```

typedef struct
{
    unsigned long * BitPattern;
    int BitSize;
} PGUserPattern;

```

PGTxConfig

This data structure is used to fully describe the traffic generator's configuration. This structure is typically used as a parameter to a PXIT337ConfigureTx function call to configure the traffic generator.

```

typedef struct
{
    PGBitRate          BitRate;
    PGPattern          Pattern;
    unsigned long      Amplitude;
    PGClockSource      ClockSource;
    bool               DataInvert;
} PGTxConfig;

```

Specifications

The distinction between specifications and characteristics is described as follows:

- Specifications describe warranted performance over the temperature range 0° C to +40° C and relative humidity <95% (unless otherwise noted). All specifications apply after the temperature of the probe and the probe adapter has been stabilized after 30 minutes of continuous operation.
- *Characteristics* provide useful information by giving functional, but nonwarranted, performance parameters. *Characteristics are printed in italics.*

This product complies with the Electrostatic Discharge immunity requirement in IEC/EN 61326 using performance criterion B. Degradation of some product specifications can occur during the instance of an electrostatic discharge. The product self-recovers and operates as specified after the discharge.

Table 2. Transmit (Tx) Specifications

| | |
|-------------------------------------|---|
| Output Jitter | 2 ps rms |
| Rise/Fall Time (20-80%) | 30 ps minimum <i>35 ps (characteristic)</i> |
| Maximum Frequency Modulation | 20 MHz |
| Output Range | 250 mV to 1.6V |
| Amplitude Accuracy | ±5% |
| Amplitude Resolution | 5 mV |
| Operation Range | 1.0 Gb/s to 2.5 Gb/s 2.5 Gb/s to 3.3 Gb/s ^a 4.0 Gb/s to 6.6 Gb/s 7.4 Gb/s to 10.3125 Gb/s |

a. The clock input needs to be doubled for this range.

Table 3. Trigger Output Specifications

| | |
|------------------------------------|---|
| Pattern Trigger | User defined to be triggering on pattern start, clock divided by 2 ⁿ , or Burst Enable Output / Input. |
| Output Amplitude DC Coupled | 500 mV |

Table 4. Environmental Specifications

| | |
|-------------------|---------------------|
| Use | indoor |
| Dimensions | Two-slot PXI module |

Electrostatic Discharge Information

CAUTION

Electrical channel input circuits and the trigger input circuit can be damaged by electrostatic discharge (ESD). Therefore, avoid applying static discharges to the front-panel input connectors. Prior to connecting any coaxial cable to the connectors, momentarily short the center and outer conductors of the cable together. Avoid touching the front-panel input connectors without first touching the frame of the instrument. Be sure that the instrument is properly earth-grounded to prevent buildup of static charge. Wear a wrist-strap or heel-strap.

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. The following figure shows an example of a static-safe work station using two types of ESD protection:

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.

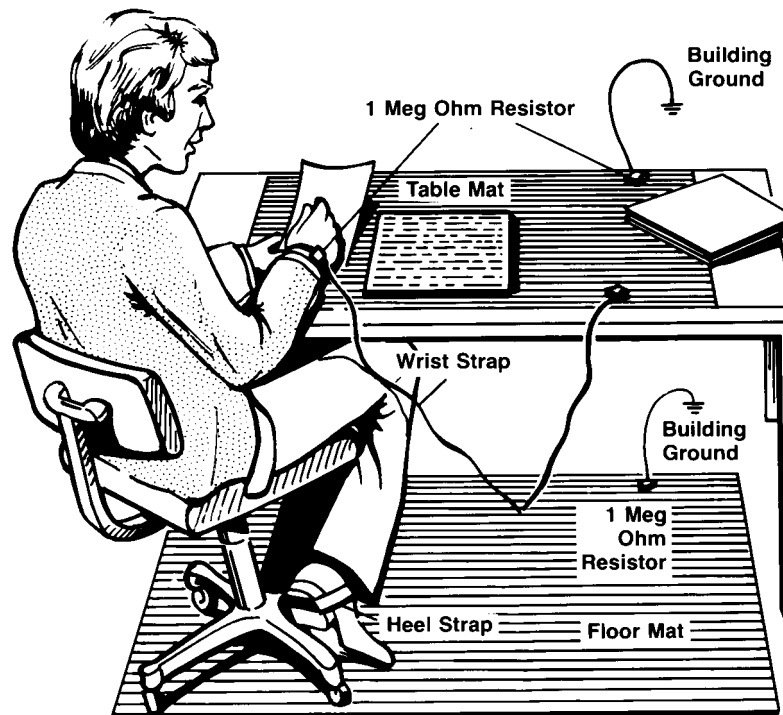


Figure 1. Static-safe Work Station

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least $1\text{ M}\Omega$ of isolation from ground. Refer to [Table 5](#) for information on ordering static-safe accessories.

WARNING

These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.

Table 5. Static-Safe Accessories

| Agilent Part Number | Description |
|----------------------------|---|
| 9300-0797 | Static control mat, 0.6 m x 1.2 m (2 ft x 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.) |
| 9300-0980 | Wrist-strap cord 1.5 m (5 ft). |
| 9300-1367 | Wrist-strap, adjustable, without cord. |
| 9300-1126 | ESD heel-strap |

Connector Care

Advances in measurement capabilities make connectors and connection techniques more important than ever. Observing simple precautions can ensure accurate and reliable measurements.

Handling and storage

- Keep connectors clean
- Extend sleeve or connector nut
- Use plastic endcaps during storage
- Do not touch mating plane surfaces
- Do not set connectors contact-end down

Visual inspection

- Inspect all connectors carefully before every connection
- Look for metal particles, scratches, and dents
- Do not use damaged connectors

Cleaning

- Clean with compressed air first
- Clean the connector threads
- Do not use abrasives
- Do not get liquid onto the plastic support beads

Making connections

- Use a connector saver
- Align connectors carefully
- Make preliminary connection lightly
- To tighten, turn connector nut only
- Do not apply bending force to connection
- Do not over tighten preliminary connection
- Do not twist or screw in connectors
- Use a torque wrench, and do not tighten past the "break" point of the torque wrench

3.5 mm and SMA Connectors

Precision 3.5 mm microwave connectors are compatible with an SMA connector within its specification. Due to the variable quality of the SMA connector, mating with an SMA can sometimes cause severe damage to the 3.5 mm connector. You can use SMA connectors if special care is taken when mating the connectors, and all connectors are undamaged and clean. Before each use, check the mechanical dimensions of all connectors with a connector gauge to make sure that the center conductors are positioned correctly.

CAUTION

A male SMA connector pin that is too long can smash or break the delicate fingers on the precision 3.5 mm female connector.

CAUTION

Some precision 3.5 mm female connector fingers are very tight and can pull the center pin of their mates out past specifications when the connectors are disconnected. If such a male pin is inserted into a female connector, it can cause considerable damage by pushing the female center conductor back too far. Be aware of this possibility and check all connectors before mating them again.

Contacting Agilent Technologies

The instructions in this section show you how to properly package the instrument for return to an Agilent Technologies service office. If the instrument is still under warranty or is covered by an Agilent maintenance contract, it will be repaired under the terms of the warranty or contract. If the instrument is no longer under warranty or is not covered by an Agilent maintenance plan, Agilent will notify you of the cost of the repair after examining the unit.

When an instrument is returned to an Agilent service office for servicing, it must be adequately packaged and have a complete description of the failure symptoms attached.

When describing the failure, please be as specific as possible about the nature of the problem. Include copies of any instrument failure settings, data related to instrument failure, and error messages along with the instrument being returned.

Please notify the service office before returning your instrument for service. Any special arrangements for the instrument can be discussed at this time. This will help the Agilent service office repair and return your instrument as quickly as possible.

Call Center

For technical assistance, contact your local Agilent Call Center. In the Americas, call 1 (800) 829-4444. In other regions, visit <http://www.agilent.com/find/assist>. Before returning an instrument for service, you must first call the Call Center at 1 (800) 829-4444.

Preparing the product for shipping

- 1** Write a complete reason for returning the product and attach it to the instrument. Include any specific performance details related to the problem.
- 2** Pack the product. Use original packaging or comparable. Original materials are available through any Agilent office. Or, follow these recommendations:
 - Use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength. The carton must allow approximately 7 cm (3 inches) on all sides of the kit for packing material and be strong enough to accommodate the weight of the kit.
 - Surround the kit with approximately 7 cm (3 inches) of packing material, to protect the kit and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D-240 Air Cap™ from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with air bubbles. Use the pink (antistatic) Air Cap™ to reduce static electricity. Wrapping the kit several times in this material will protect the kit and prevent it from moving in the carton.
- 3** Seal the carton with strong nylon adhesive tape.
- 4** Mark the carton "FRAGILE, HANDLE WITH CARE".
- 5** Retain copies of all shipping papers.