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3164 VXI ARB Waveform Generator (VX405C-S-2272) User Manual

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FOR YOUR SAFETY

Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNINGS** and **CAUTION** notices.



This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.



If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.



Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.



Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuit points.

Before operating this instrument:

1. Ensure the proper fuse is in place for the power source to operate.
2. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

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DOCUMENT CHANGE HISTORY

Revision	Date	Description of Change
A	10/23/12	Document Control release

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Chapter 1
GETTING STARTED

Introduction

The 3164-2 and 3164-4 are single-slot VXI module variants of four and two channel 14-bit Arbitrary Waveform Generators (AWG), respectively. For clarity in the following sections we shall refer to the 3164-2 and 3164-4 as the 3164 when referring to both models. An IVI-COM driver and Soft Front Panel (SFP) are supplied on installation media for use with the 3164.

Note: *Some of the screens and menus in the included software may display the model number "S2272" instead of "3164." There is no issue with this as the software functions the same for the 3164 except you may see the S2272 number.*

The 3164's maximum sample rate is 125 MS/s. All waveforms are output from data either previously loaded into waveform memory or loaded during operation. All outputs can operate independently or in locked mode. See **Figure 1-1** for a view of the 3164 front panel.

Standard waveforms such as Sine, Square, Triangle, Ramp and Pulse are calculated and loaded into waveform memory automatically based on their specified parameters. Pseudo-random Noise (white, quasi-Gaussian or pink) or a DC level can be generated for a defined or pseudo-random period using only one waveform memory word. AM modulation input is available via the front panel. Also, Sinc(Sin(x)/x) Gaussian Pulse and Exponential Pulse waveforms are available.

A large 2-page waveform memory (512K samples/page) is provided so that multiple waveforms can be loaded into memory for fast test execution. One page can be output while the second page is being re-loaded with fresh data allowing for real-time operation.

Powerful sequencing allows waveform segments to be looped and output in any order. There are provisions for jumping to different sequences based on a trigger input (with or without return). A sync bit can be placed anywhere in the waveform. Similarly, at any point during the output of a waveform, an alternate waveform can be inserted or used to replace the waveform being output for a defined number of samples.

The modular design of the 3164 utilizes powerful amplifier modules for the AWG output, making available both high frequency and high power capability.

The 3164 contains both MA1710 Amplifier/Attenuator and MA1801AS066 ARB modules. The MA1710 Amplifier/Attenuator output stage has eight fixed software-controlled voltage ranges. The outputs of the MA1801AS066 are connected to the inputs of the MA1710 with its output available as the MAIN OUT A or B (OA or OB), through software-controlled connect/disconnect relays. The desired output of the 3164 is controlled by the driver software that automatically programs the MA1801AS066, selects the appropriate Amplifier/Attenuator range/offset and applies a calibration correction factor to get the desired output signal.

The calibration correction factor is derived through a built-in software calibration procedure. The calibration correction factor is stored in non-volatile EEPROM that is part of the MA1710. Following the calibration procedure, the computed calibration correction factors are stored in this EEPROM and are retrieved and utilized on every subsequent programmed 3164 operation.

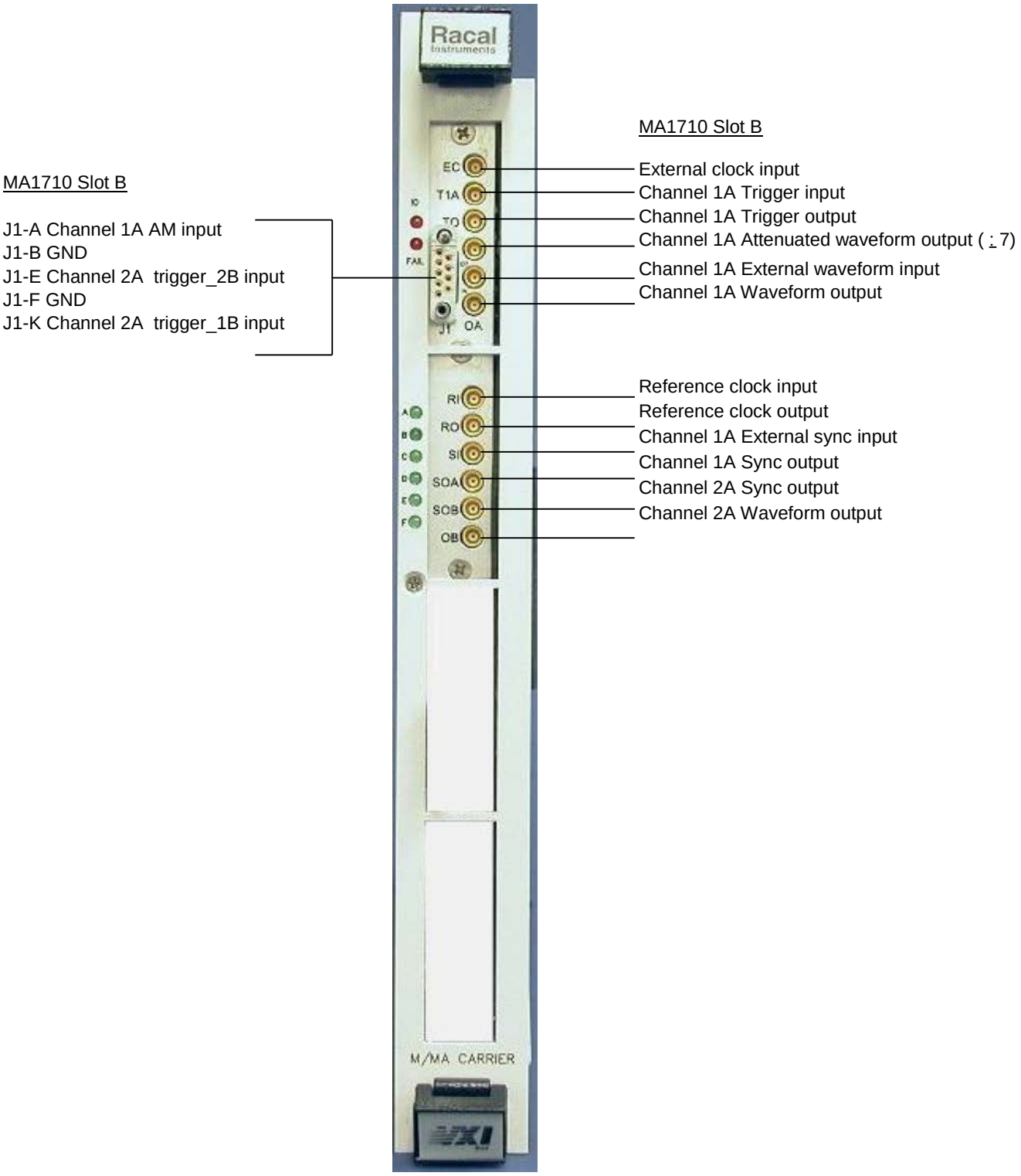


Figure 1-1, 3164-2 ARB Waveform Generator Front Panel

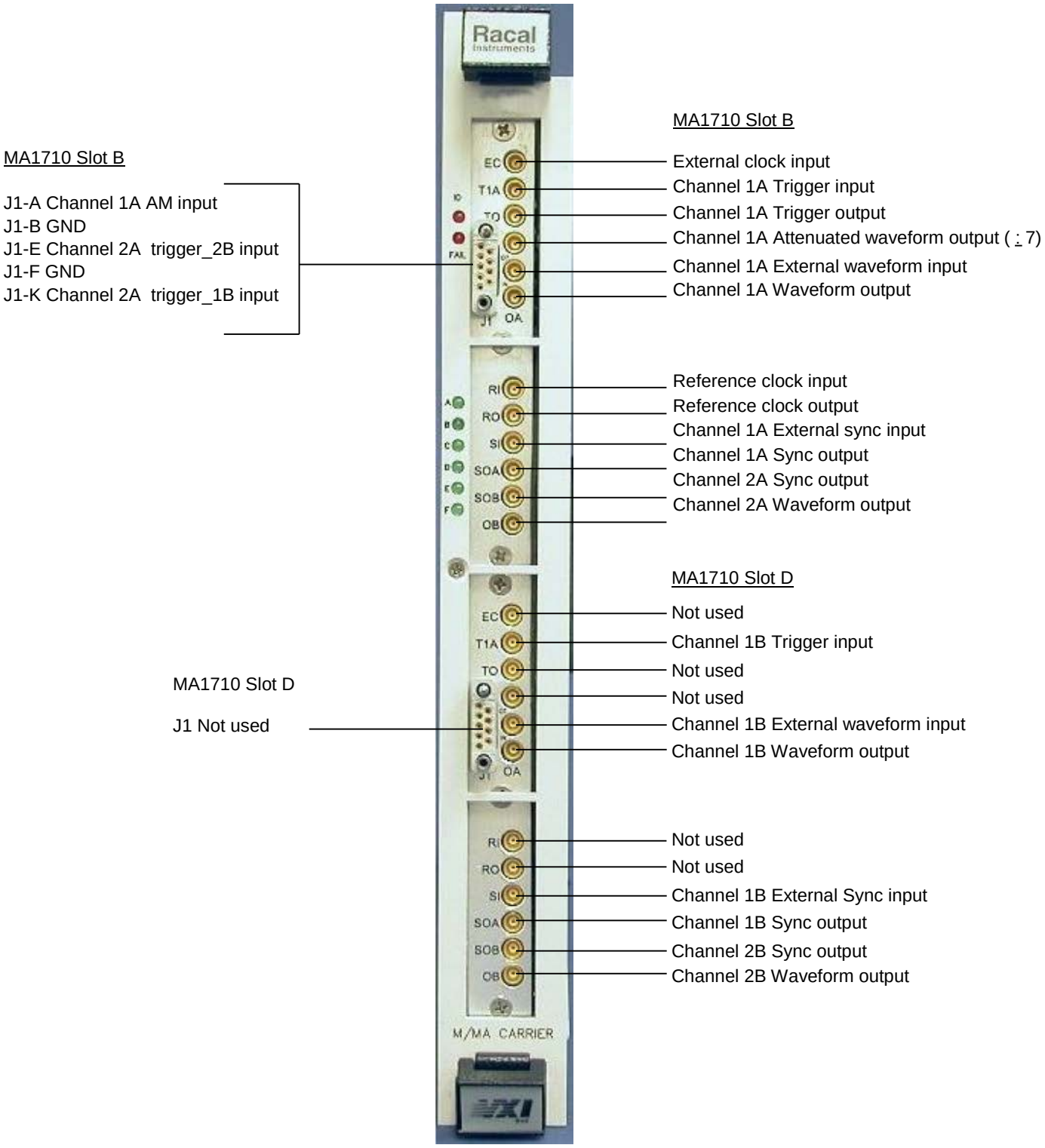


Figure 1-2, 3164-4 ARB Waveform Generator Front Panel

3164 Input and Outputs

The 3164 has the following inputs and outputs

Coaxial Connectors (Front Panel MCX)

The 3164 front panel coax connectors provide various input and output signals. Refer to **Figures 1-1**, **1-2**, **1-4**, and **1-5** for details.

EC: External clock input
T1A: Channel A trigger_1 input
TO: Channel A trigger output
O7: Attenuated Channel A waveform output (divided by 7)
IN: Channel A external waveform input
OA: Channel A waveform output

RI: Reference clock input
RO: Reference clock output
SI: External sync input
SOA: Sync output A
SOB: Sync output B
OB: Channel B waveform output

J1 Connector I/O (Front Panel 9-Pin Connector)

J1

Pin	Description
A:	AM Input
B:	GND
E:	Channel B trigger_2 input
F:	GND
K:	Channel B trigger_1 input
J:	GND

LED's

The front panel the following status LEDs.

FAIL:
This front panel LED indicates the PASS/FAIL (SYSFAIL) status. The LED illuminates during reset, initialization, or if there is a failure on the VX405C carrier itself.

MID:
This front panel LED illuminates whenever the host processor applies the MODID signal to the slot the module is occupying.

ACCESS LED	Description
A:	Not Used
B:	MA1710 Module B accessed
C:	Not Used
D:	MA1710 Module D accessed (3164-4 only)
E:	MA1801AS066 Module E accessed
F:	MA1801AS066 Module F accessed (3164-4 only)

3164 MA-Module Arrangement

The modular design of the 3164 utilizes MA1801AS066 ARB and MA1710 Amplifier MA-Modules installed into the VX405C Carrier. The figure below details how the MA-Modules arranged in the VX405C Carrier.

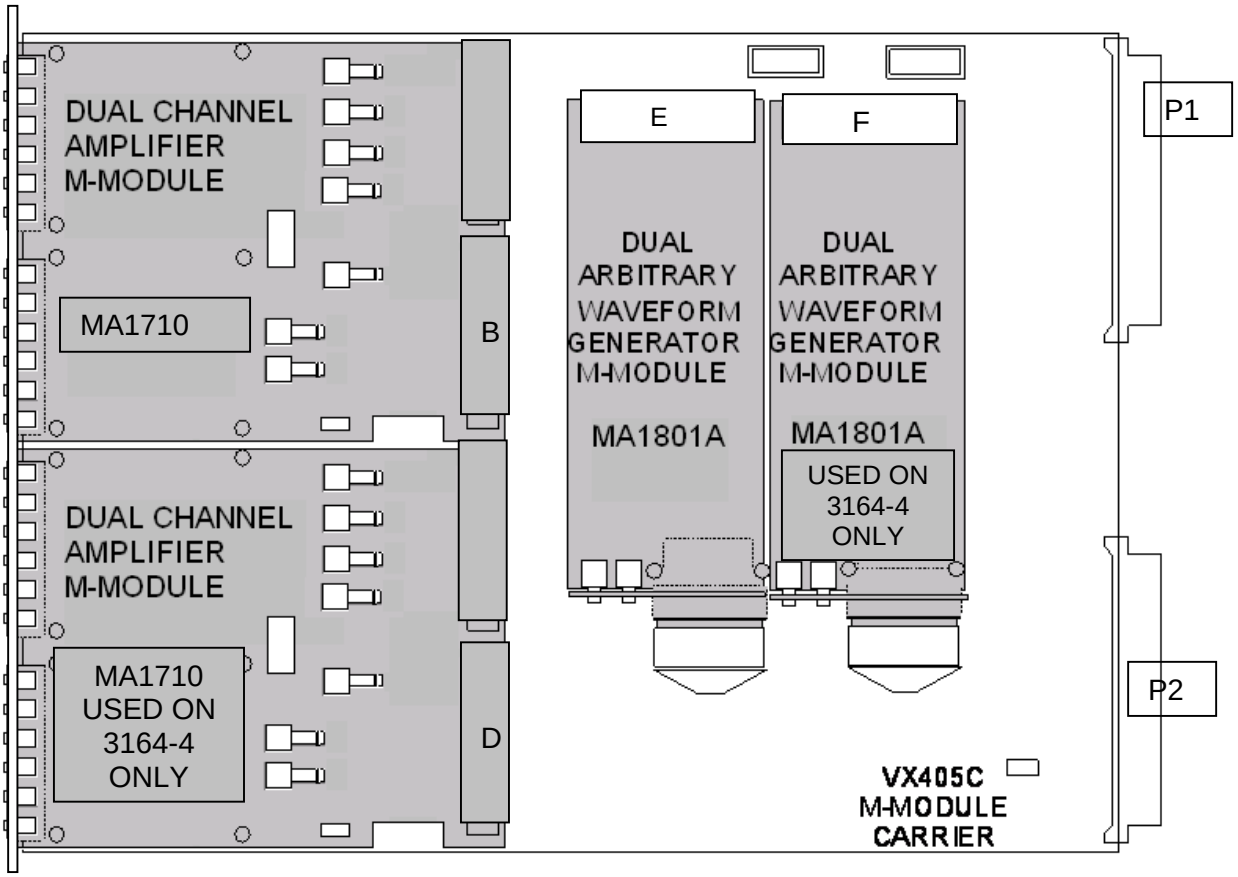


Figure 1-3, 3164 MA-Module Arrangement

3164-2 Block Diagram

Refer to the block diagram (**Figure 1-4**) detailing both the 3164-2 internal wiring/configuration and the external connections to the user CTI Interface. The block depicting the "GUI Channel" is included to indicate the Soft Front Panel (SFP) channel references (1A or 2A) from the pop-down menu found on the SFP.

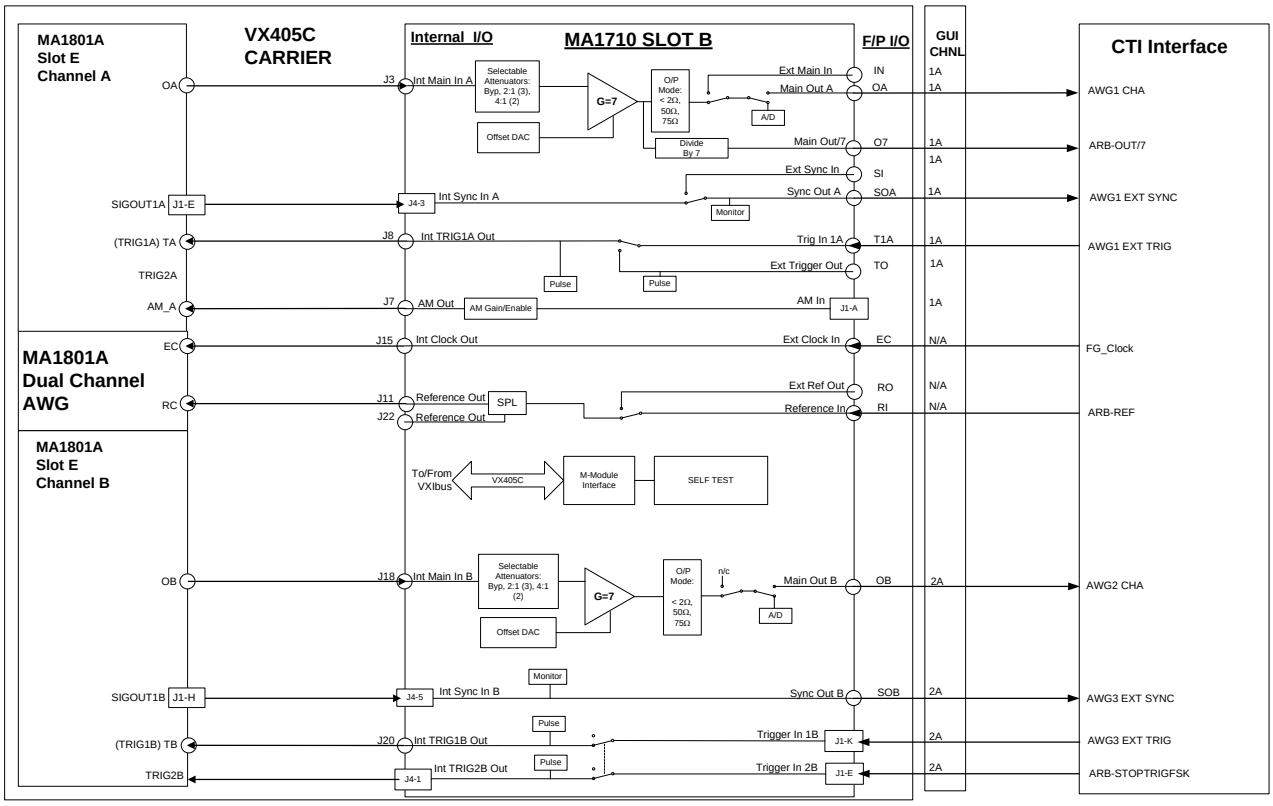


Figure 1-4, 3164-2 Block Diagram

3164-4 Block Diagram

Refer to the block diagram (**Figure 1-5**) detailing both the 3164-4 internal wiring/configuration and the external connections to the CTI Interface. The block depicting the "GUI Channel" is included to indicate the Soft Front Panel (SFP) channel references (1A, 2A, 1B or 2B) from the pop-down menu found on the SFP.

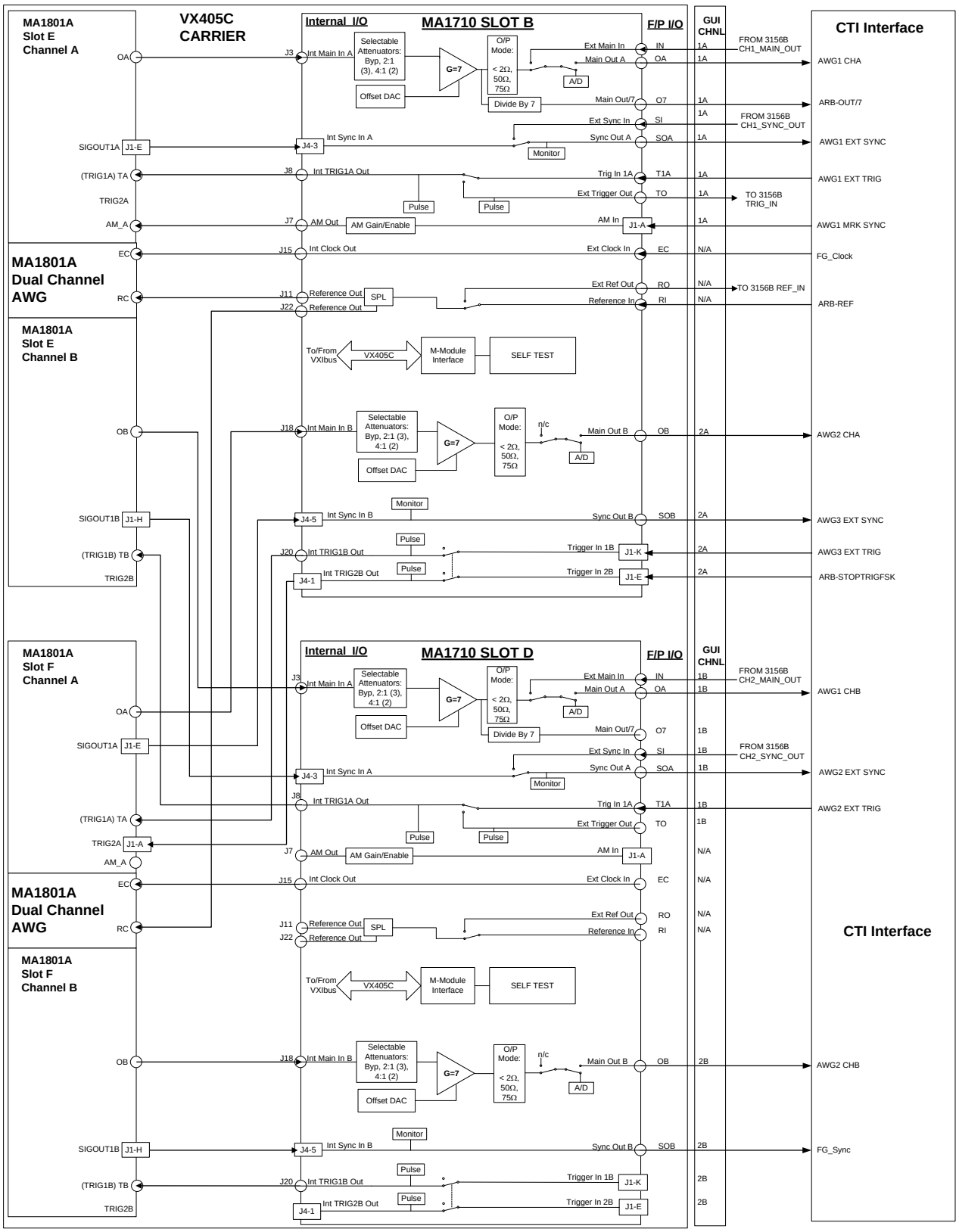


Figure 1-5, 3164-4 Block Diagram

3164-2 to CTI Interface Connections

The connectivity between the 3164-2 and the user CTI Interface is detailed below. The Soft Front Panel channel selection that controls to the signal path is provided in **Table 1-1**.

Table 1-1, 3164-2 Signal Interface

3164-2 Front Panel Signal	SFP Channel	CTI Interface Signal Connection
OA	1A	AWG1 CHA
O7	1A	ARB-OUT/7
SOA	1A	AWG1 EXT SYNC
T1A	1A	AWG1 EXT TRIG
AM_IN	N/A	AWG1 MARK SYNC
EC	N/A	FG_CLOCK
RC	N/A	ARB-REF
OB	2A	AWG2 CHA
SOB	2A	AWG3 EXT SYNC
TRIG_IN_1B	2A	AWG3 EXT TRIG
TRIG_IN_2B	2A	ARB-STOPTRIGSFK

3164-4 to CTI Interface and 3156B Connections

The connectivity between the 3164-4 and the user CTI and 3156B user interfaces are detailed below. The Soft Front Panel channel selection that controls to the signal path is provided in **Table 1-2**.

Table 1-2, 3164-4 Signal Interface

3164-4 Front Panel Signal	SFP Channel	CTI Interface Signal Connection	3156B Connection
IN	1A	---	CH1_MAIN_OUT
OA	1A	AWG1 CHA	---
O7	1A	ARB-OUT/7	---
SOA	1A	AWG1 EXT SYNC	---
SI	1A	---	CH1_SYNC_OUT
TO	1A	---	TRIG_IN
T1A	1A	AWG1 EXT TRIG	---
AM_IN	N/A	AWG1 MARK SYNC	---
EC	N/A	FG_CLOCK	---
RO	N/A	---	REF_IN
RC	N/A	ARB-REF	---
OB	2A	AWG2 CHA	---
SOB	2A	AWG3 EXT SYNC	---
TRIG_IN_1B	2A	AWG3 EXT TRIG	---
TRIG_IN_2B	2A	ARB-STOPTRIGSFK	---
IN	1B	---	CH2_MAIN_OUT
OA	1B	AWG1 CHB	---
O7	1B	---	---
SOA	1B	AWG2 EXT SYNC	---
SI	1B	---	CH2_SYNC_OUT
TO	1B	---	---
T1A	1B	AWG2 EXT TRIG	---
OB	2B	AWG2 CHB	---
SOB	2B	FG_SYNC	---

Chapter 2
INSTALLATION INSTRUCTIONS

Installation Instructions

Unpacking and Inspection



1. Remove the 3164 module and inspect it for damage. If any damage is apparent, inform the carrier immediately. Retain shipping carton and packing material for the carrier's inspection.
2. Verify that the pieces in the package you received contain the correct module option and the Users Manual. Notify our Customer Service department. if the module appears damaged in any way. Do not attempt to install a damaged module into a VXI chassis.
3. The 3164 module is shipped in an anti-static bag to prevent electrostatic damage to the module. Do not remove the module from the anti-static bag unless it is in a static-controlled area.

Reshipment Instructions

1. Use the original packing material when returning the module to Astronics Test Systems for servicing. The original shipping carton and the instrument's plastic foam will provide the necessary support for safe reshipment.
2. If the original packing material is unavailable, wrap the unit in an ESD Shielding bag and use plastic spray foam to surround and protect the instrument.
3. Reship in either the original or a new shipping carton.

Hardware Installation

This instrument will be installed in a VXIbus mainframe in any slot except slot 0 (zero). Prior to installation into the mainframe, the unit's logical address and addressing mode will be set at the factory as described in Chapter 3 - Logical Address Selection and Chapter 3 - MA/M Module Enable. Apply power.

Software Installation

This section explains the operation and features of the MA1710 M-Module Amplifier/Attenuator that is a component of the 3164. The provided software operates on any VXI-based platform with either Windows 2000 Professional SP4 or Windows XP Professional SP2 (or greater 32-bit Windows™ operating system) installed.

Note: *Some of the screens and menus in the included software may display the model number "S2272" instead of "3164." There is no issue with this as the software functions the same for the 3164 except you may see the S2272 number.*

Installation Prerequisite

This software utilizes library functions from VXI, VISA and MA1801AS066 VPP driver. As an installation prerequisite, the following software must be installed and verified operable prior to installing the driver software:

- VXI-VISA drivers for the appropriate VXI controller
- IVI Shared Components (version 2.0 or later) – available from the ivifoundation.org website, if needed

For example, software support for a MXI-2 installation requires the following prerequisite software installed:

- NI-VXI 3.3.1 (or greater)
- NI-VISA 2.6.1 (or greater)
- NI-Measurement and Automation Explorer (MAX) 2.2.0.3010 (or greater)

Install Driver

After the prerequisite software is installed and verified operable, install the provided 3164 Driver (922140-007). Reboot the system per the installation instructions to complete the installation.

After rebooting, run NI-Measurement and Automation Explorer and request MAX to search for new devices. This only has to be performed once following the initial installation of the 3164 software. The purpose is to register the software driver as a VISA-compliant virtual device. This step is not required on subsequent system start up.

Installation Quick Verify

To quickly verify the operation of the newly installed software, perform the following:

- Run VXI Resource Manager RESMAN to initialize VXI-VISA software.
- Run the FP S-2272.Net.exe Soft Front Panel. This is located in >Programs>Racal S-2272 ARB folder.

On FPS-2272.Net.exe start up, a panel will appear with available selectable modules appearing in the list box in the S2272 Select panel. Select the 3164 you wish to use.

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Chapter 3
OPERATION

Introduction

This section provides the Operator information needed to operate the 3164 in a VXI system. The unit resides in a VXI chassis and is subject to restrictions and benefits of that environment.

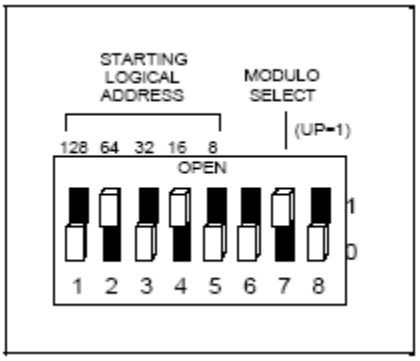
Hardware Configuration

CAUTION

All hardware configurations must be done only while the power to the module is OFF.

Logical Address Selection

There are two 8 position switches located inside the module cover. Switch number one is for the Logic Address Selection. It is set for the module by selecting the starting logical address and the desired sequencing (sequential or multiple of 8) of addressing using the toggle switches provided on the carrier. The following is an example of the two eight position switches used:



For Logical Address Selection, the following switch settings would already be set at the factory for switch number one and do not require the user to set:

Position	Setting
1	DOWN
2	UP
3	UP
4	UP
5	DOWN
6	DOWN
7	UP
8	UP

MA/M Module Enable

The second 8-position switch is for the MA/M Module Enable and is also located inside the cover of the module. This switch is provided to enable the individual MA/M locations. Again, this switch is already set from the factory as follows and would not require the user to set:

Position	Setting
1	UP
2	DOWN
3	UP
4	DOWN
5	DOWN
6	DOWN
7	DOWN
8	DOWN

The User Interface

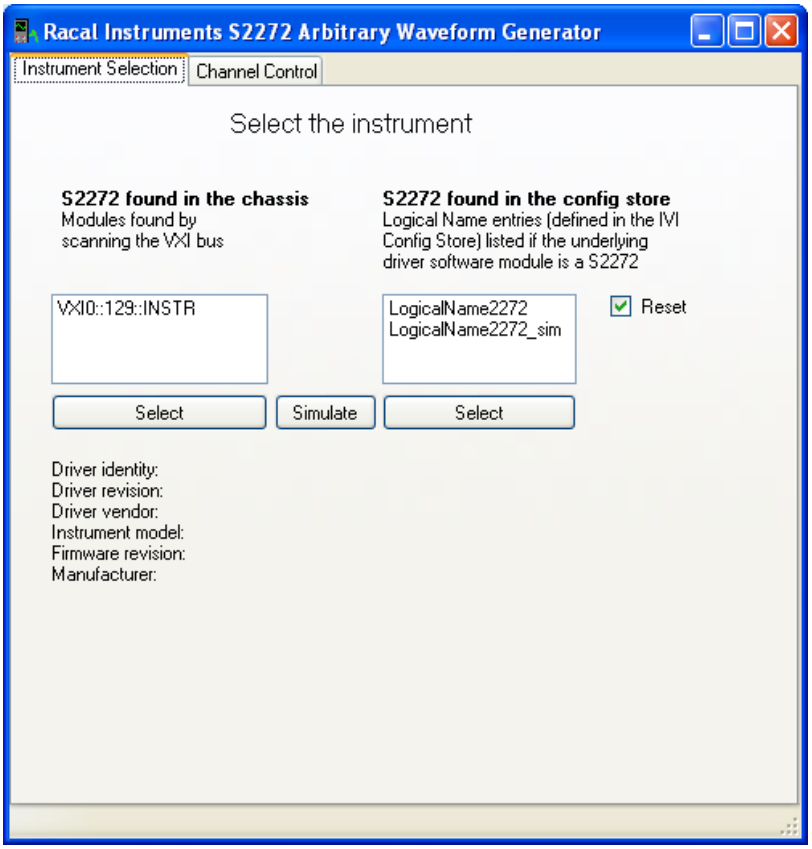
The user interface is called FPS-2272.Net.exe. It is a .NET application based on the version 2.0.NET framework, and so this must be installed on the PC in order for the software to run.

All of the interactions with the hardware are performed via the supplied IVI-COM driver. If the driver is not installed then the user interface will not be able to operate. Even in simulation mode the underlying driver is required.

Start Up

Upon startup of the FPS-2272.Net.exe software, the following screen is displayed:

Note: *Some of the screens and menus in the included software may display the model number "S2272" instead of "3164." There is no issue with this as the software functions the same for the 3164 except you may see the S2272 number.*



Note that if the underlying 3164 IVI-COM driver has not been installed then an error will result.

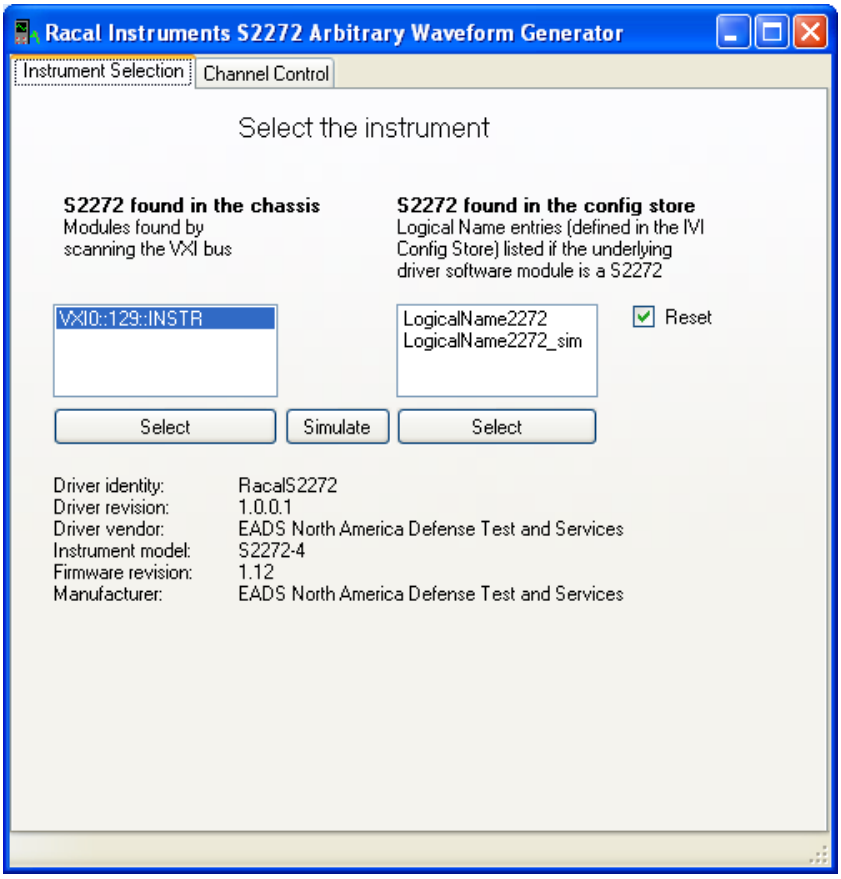
In this example the software has identified that there is one 3164 physically present in the VXI chassis, and two Logical Name entries in the IVI configuration store – one of which is a simulation.

By choosing a 3164 and then pressing the Select button the software will attempt to establish communication with the instrument and initiate a session.

The Simulate button is there for the case where the user wants to run a simulation without going to the trouble of setting up an instrument entry in the IVI Configuration store.

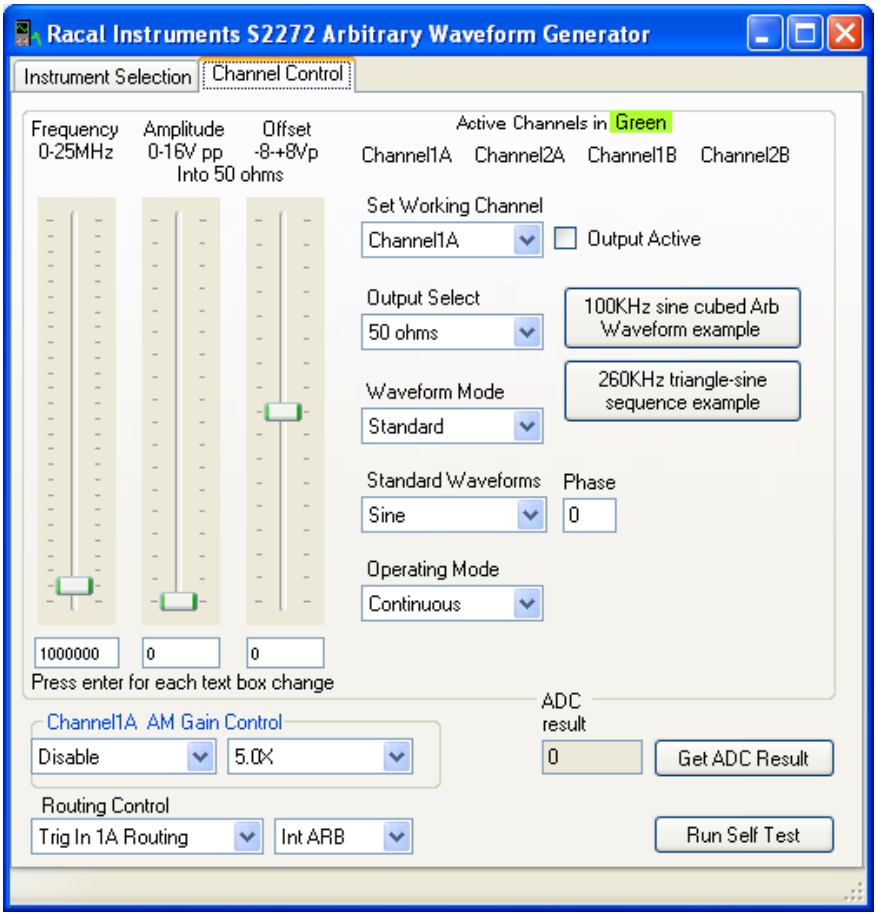
Initializing the Instrument

On selection of a valid instrument, the software will interrogate it for some standard information:



Channel Control

After initialization, the software automatically selects the Channel Control tab.



Using the Instrument

Slider controls can be used to adjust frequency, amplitude, and offset. These can also be altered by entering a decimal value into the text box below each one which will be applied when ENTER is pressed. In fact whenever there is a text box which accepts text from the user, ENTER must be pressed in order to send that value to the driver.

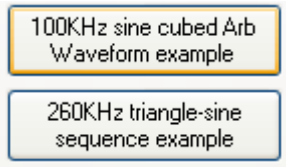
The other areas of operation are performed by typical Windows' controls, mostly by drop down list boxes.

The Working Channel is the channel on which subsequent operations are to be performed. To enable the output of a particular channel, the check box 'Output Active' must be checked. As a visual reminder to the user, active channel names will appear in green.

Arbitrary Waveform and Sequence Example

An example of the generation of an arbitrary waveform is provided as well as a sequence. These do everything needed to set up the example on the selected channel, updating the user interface to show the settings made.

Please refer to the IVI Specification (available at ivifoundation.org) or the online driver help for details of how to create a sequence or arbitrary waveform. It may also be necessary to refer to the MA1801 documentation also.



Here is example code for the Arbitrary Waveform.

```
private void btnArbWvfrmExample2_Clk(object sender, EventArgs e)
{
	try
	{
		Ivi.Fgen.Interop.IIviFgen fgen = (Ivi.Fgen.Interop.IIviFgen)m_drvI2272;

		// put into arb mode
		lstWaveformMode.SelectedIndex = 1;
		if (m_arbWfrm2Handle == 0) // just need to create the arb waveform once
		{
			double[] dArray = new double[360];
			double dData = 0;
			for (int n = 0; n < 360; n++)
			{
				dData = Math.Sin(n * Math.PI / 180);
				dArray[n] = dData * dData * dData;
			}
			m_arbWfrm2Handle = fgen.Arbitrary.Waveform.Create(ref dArray);
			double dAmplitude = 2;
			double dOffset = 0;

			fgen.Arbitrary.Waveform.Configure(lstChannels.Text,
				m_arbWfrm2Handle, dAmplitude, dOffset);

		}

		// for arbitrary waveform the frequency = Sample clock freq / Nos. waveform points
		// the set_Frequency function calculates the necessary Sampling Frequency based on
		// the number of points
		// Note the max sampling frequency is 125MHz, so any calculated frequency above
		// this will result in an error.
		double dFreq = 100000;
		fgen.Arbitrary.Waveform.set_Frequency(lstChannels.Text, dFreq);
	}
	catch (COMException ex)
	{
		MessageBox.Show(ex.Message);
	}
}
```

Here is the code for the Arbitrary Sequence from the front panel:

```
private void btnArbSeqExample_Clk(object sender, EventArgs e)
{
	try
	{
		// put into seq mode
		lstWaveformMode.SelectedIndex = 2;
		Ivi.Fgen.Interop.IIviFgen fgen = (Ivi.Fgen.Interop.IIviFgen)m_drvI2272;

		// generate the sine wave
		double[] dSine = new double[720];
		double dData = 0;
		double count = 0;
		for (int n = 0; count < 360; n++, count+=0.5)
		{
			dData = Math.Sin(count * Math.PI/180);
			dSine[n] = dData;
		}

		int[] WfmHandle = new int[2];

		WfmHandle[0] = fgen.Arbitrary.Waveform.Create(ref dSine);

		double[] dTriangle = new double[362];
		// generate the triangle
		for (int n = 0; n <= 90; n++)
		{
			dData = n / 90.0;
			dTriangle[n] = dData;
		}

		for (int n = 91; n <= 270; n++)
		{
			dData = (180.0 - n) / 90.0;
			dTriangle[n] = dData;
		}

		for (int n = 271; n <= 360; n++)
		{
			dData = (n - 360.0) / 90.0;
			dTriangle[n] = dData;
		}

		WfmHandle[1] = fgen.Arbitrary.Waveform.Create(ref dTriangle);

		int[] loopCount = new int[2];
		loopCount[0] = 1;  // 2048 orig
		loopCount[1] = 1;  // 5000 orig

		int hSeq = fgen.Arbitrary.Sequence.Create(ref WfmHandle, ref loopCount);

		double dAmplitude = 2;
		double dOffset = 0;
		fgen.Arbitrary.Sequence.Configure(lstChannels.Text, hSeq, dAmplitude, dOffset);

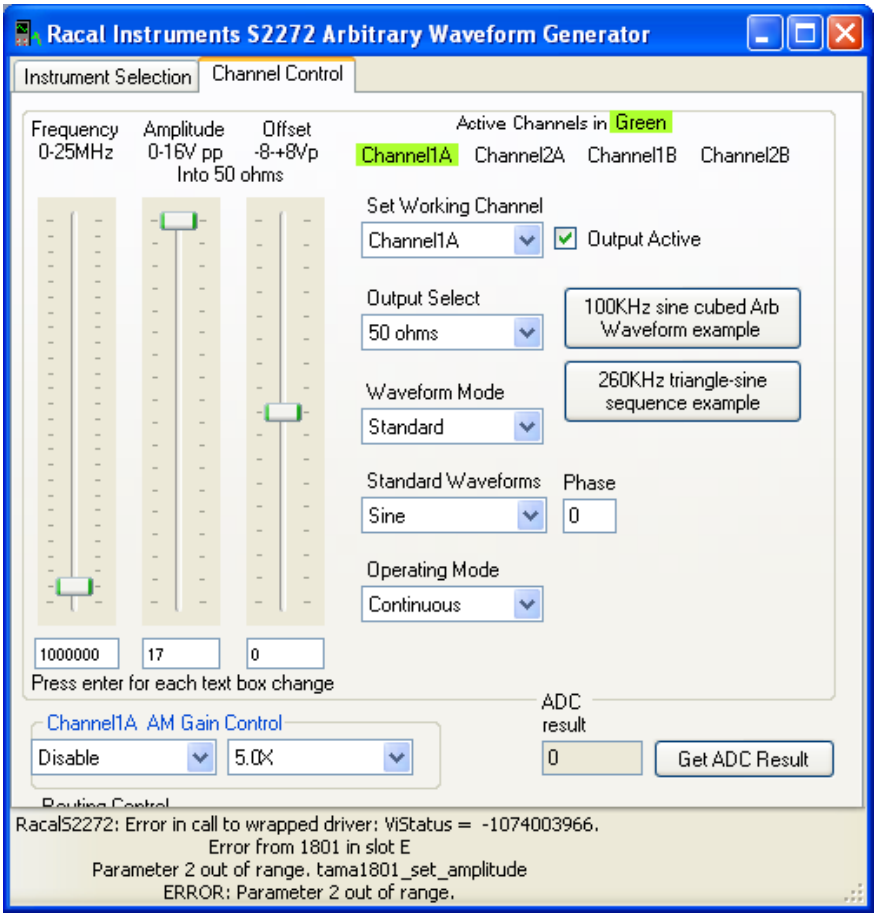
		// for an arbitrary waveform the freq = Sample clock freq / Nos. waveform points
		// Note the max sampling frequency is 125MHz, so any claculated frequency above
		// this will result in an error.
		fgen.Arbitrary.SampleRate = 125e6; // to give us a freq. of approx 230kHz.

	}
	catch (COMException ex)
	{
		MessageBox.Show(ex.Message);
	}
}
```

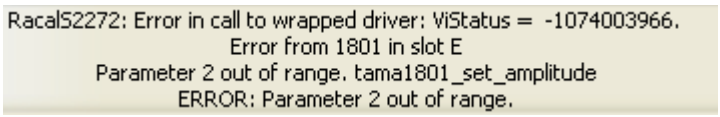
Errors

Occasionally an error may be generated. If the error is from the instrument driver it will appear in the status bar at the bottom of the form. In fact the bar's height will be extended to include the error contents.

Here an error has been generated because the user interface is requesting the driver for an amplitude of 17 V when the maximum is 16 V. A subsequent error free driver command will remove the error message.



The Error Message



A careful look at the error message will reveal the following:

1. The ViStatus error number -1074003966.
2. The origin of the error (in this case from the 1801 arb in Slot E)
3. The decode of the error (in this case 'Parameter 2 out of range')
4. The driver function which reported the error

In this case it is a **wrapped** driver error. This will be the most common error because the IVI-COM driver provides a wrapped interface to a lower level driver. In other words the IVI-COM driver itself calls a lower level driver to communicate with certain hardware.

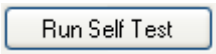
Get ADC Result

Pressing this button results in the output being disconnected and routed instead to the internal analog to digital converter. A measurement is made with this device and the signal then re-routed to the output. It is primarily used by the Self Test capability of the instrument.



Run Self Test

The self test exercises the major functions of the instrument. During this time, the user interface will be disabled until the self test is complete. If the self test fails, it will return with a reason for the failure, otherwise it will simply return "Pass".



Chapter 4
SPECIFICATIONS

Amplitude Characteristics

50 Ω mode into 50 Ω load, unless stated otherwise.

Amplitude	3 mV - 16 Vpk-pk into 50 Ω 6 mV - 32 Vpk-pk into 1 MΩ
Resolution	3.5 digits
AC Accuracy [1] **(at 1 kHz and specified output)**	1% of setting + 1% of Range
Amplitude Ranges **(50Ω Vpk-pk)**	R1: 3 mV – 125 mV R2: >125 mV – 250 mV R3: >250 mV – 500 mV R4: >500 mV - 1.00 V R5: >1.00 V - 2.00 V R6: >2.00 V - 4.00 V R7: >4.00 V - 8.00 V R8: >8.00 V - 16.00 V
DC Offset Range **(50Ω mode, 50Ω load)**	0 to ± 8 V
DC Offset Accuracy	1% of setting ± 16 mV
Low-Pass Filter	50 MHz, 7-pole, elliptic
Standby (Output disconnected)	Output On or Off
Output Protection	Short circuit

Standard Waveform

(Sine, Triangle, Square, Pulse, Ramp, Noise, DC)

Frequency Resolution	4 digits
Accuracy	50 ppm (internal crystal)
Jitter	< 30 ps rms
Sine Function **Frequency Range**	1 mHz to 25 MHz
Total Harmonic Distortion (THD) (1 to 15 Vpk-pk)	20 Hz to 100 kHz: < 0.25%
Harmonics	< 5 MHz: > 45 dBc < 10 MHz: > 40 dBc < 25 MHz: > 40 dBc (filter on)
Flatness	<100 kHz: < 0.1 dB <1 MHz: < 0.2 dB <10 MHz: < 1 dB <20 MHz: < 2.5 dB <25 MHz: < 3.5 dB
SFDR (SCLK = 100 MHz)	< 1 MHz: > 50 dBc
Crosstalk (fc = 10 MHz)	-70 dB, typical
Phase Range [3]	0 to 360º
Triangle/Ramp Function **Frequency Range**	1 mHz to 10 MHz
Phase Range [3]	0 - 360º
Square Wave/Pulse Function **Frequency Range**	1 mHz to 25 MHz

Duty Cycle Range [2 & 3]	1% - 99.9%
Rise/Fall Time	<10 ns (20% to 80%) <15 ns (10% to 90%)

Noise and DC Function

Types	White, quasi-gaussian or pink noise or DC
Generation	Real-time, pseudo-random
Period	Pre-defined (min and max samples specifiable) or pseudo-random

Arbitrary Waveform

Waveform Memory	1 Meg per channel
Memory Operation	One page can be outputting data while the other page is being re-loaded with new data.
Vertical Resolution	14 bits
Minimum Segment Size	2 points
Segments/Channel	1 to 512

Notes

1. *Measured with AC RMS Voltmeter*
2. *Subject to minimum pulse width*
3. *Subject to Sampling Clock Frequency*

Sequenced Waveforms

Sequencer Step Limits	1 to 512
Segment Loops	1 to 64 k or continuous

Sweep Waveforms (Preliminary)

Sweep Range	Sine: 1 mHz to 25 MHz Square: 1 mHz to 20 MHz Triangle: 1 mHz to 10 MHz
Waveforms	Sine, square, triangle
Spacing	Linear, Logrithmic
Direction	Up or down
Sweep Duration	200 µs to 335 s

Sampling Clock Input

Frequency Resolution	4 digits
Accuracy	50 ppm (internal crystal)
Jitter	<30 ps rms
Internal Source Range	1 Hz to 125 MHz
External Source Range	Up to 100 MHz
External Source Characteristics	• Connector: Front Panel MCX Range: 50 mVpk-pk to ±5 V • Threshold: ±4.75 V, programmable • Impedance: 50 Ω

Reference Clock

Internal Reference	10 MHz ±50 ppm
External Reference	Impedance: 50 Ω to 10 kΩ Range: 50 mVpk-pk to ±10 V Threshold: ±4.75 V, programmable

Triggering Characteristics

Sources	External: 50 mVpk-pk to ±10 V Input Impedance: 50 Ω or 10 kΩ Level (Programmable): ±9.75 V Resolution: 5 mV Accuracy: 100 mV VXI Backplane: TTLTRG0-7
Maximum Trigger Frequency	DC to 20 MHz
Minimum External Trigger Pulse Width	20 ns
Trigger Slope	Positive or negative
Trigger Delay	0 to 128k points (multiple of 2)
System Delay (trig/gate input to waveform output)	20 ns + 7 Sample Clock
Sync/Marker Output	Front Panel: TTL VXI Backplane: TTLTRG0-7 Sync Width: 1 to 4097 points, programmable individual memory words within a segment.

Front Panel I/O

(accessed with MCX and Positronics connectors)

Inputs (3164-2: 1 set, 3164-4: 2 sets)

- Trig In 1 A (T1A): MCX, Z_{IN} = 10 kΩ, ±9.75 V
- Ext Clk In (EC): MCX, Z_{IN} = 50 Ω, ±5 V
- Ext Waveform In (IN): MCX
- Ext Sync In (SI): MCX
- Ref Clk In (RI): MCX, Z_{IN} = 50 Ω, 50 mV to 20 Vpk-pk
- AM In: Positronic 9-pin, 1 kΩ, 2 Vpk-pk for 90% depth
- Trig In 1B, 2B (T1A, T1B): Positronic 9-pin, Z_{IN} = 10 kΩ, ±9.75 V

Outputs (MCX connectors) (3164-2: 1 set, 3164-4: 2 sets)

- Waveform (OA, OB): MCX, Z_{OUT} = <5 Ω, 50 Ω, or 75 Ω
- Waveform/7 (O7): MCX, Z_{OUT} = 650 Ω
- Sync (SOA, SOB): MCX, LVTTL
- Trig Out (TO): MCX
- Ref Clk Out (RO): MCX, Z_{OUT} = 50 Ω

VXIbus Interface Data

Single slot, Register Based, VXIbus 1.4 Compliant

Drivers

IVI-COM, IVI-C, LabVIEW™, VXI*plug&play* support for frameworks based on Microsoft Win32® application programming interface

Cooling (10°C Rise)

4.3 l/s @ 0.45mm H_2O

Peak Current & Power Consumption

	+24	+12	+5	-12	-24
IPm(A)	0.75	0.32	2.1	0.45	0.75

Total Peak Power: 55 Watts

Environmental

Temperature

Operating: 0°C to 50°C
Storage: -40°C to 70°C

Humidity (non-condensing)

5 to 95%

Weight

3164-2 2.5 lb. (1.2 kg)
3164-4 3.2 lb. (1.5 kg)

MTBF (ground benign)

3164-2 18,999 hours
3164-4 11,197 hours

EMC (Council Directive 89/336/EEC)

Emission: EN61326-1: 1997+ A1:1998, Class A
Immunity: EN61326-1:1997+ A1:1998, Table 1

Safety (Low Voltage Directive 73/23/EEC)

BS EN61010-1:1993/A2 1995

Chapter 5
PERFORMANCE VERIFICATION

Introduction

The 3164 has eight independent ranges (Range1 – Range8). Each channel and range has been calibrated independently. Calibration factors are stored in the EEPROM for each channel and include four calibration gain factors:

1. The AC Gain
2. The 0V DC Offset
3. The DC Gain for positive voltages
4. The DC Gain for negative voltages

Procedure

The following procedure verifies the 3164 has been properly calibrated and meets specifications. If the unit fails any of the following tests, it should be returned to the factory for repair.

1. AC Gain

The AC Gain is verified by measuring a sine wave in each range of the 3164 using the following parameters:

Waveform	Sine
Frequency	1 kHz
Amplitude	60% point in the range (see following table)
Output	On

The peak AC output voltage is verified on a DMM.

For each channel of the AWG, program the 3164 AWG to the values in the following table. Measure the AC peak output voltage with a DMM and verify the measured value is within the specified limits.

Range	Programmed Value	Low Limit	High Limit
R1: 3 mV-125 mV	76.2 mV	74.188 mV	78.212 mV
R2: >125 mV-250 mV	200 mV	195.5 mV	204.5 mV
R3: >250 mV-500 mV	400 mV	391 mV	409 mV
R4: >500 mV-1.00 V	0.8 V	0.782 V	0.818 V
R5: >1.00 V-2.00 V	1.6 V	1.564 V	1.636 V
R6: >2.00 V-4.00 V	3.2 V	3.128 V	3.272 V
R7: >4.00 V-8.00 V	6.4 V	6.256 V	6.544 V
R8: >8.00 V-16.00 V	12.8 V	12.512 V	13.088 V

2. 0 V DC Offset

The 0 V DC Offset is verified by programming each channel to a sine wave with zero amplitude and zero offset. The DC offset is verified using a DMM. The following setup is programmed for each channel:

Waveform	Sine
Frequency	1 MHz
Amplitude	0 V
Offset	0 V
Output	On

Set each channel of the 3164 to a 1 MHz sine wave with zero volt amplitude. Set the DC offset to 0 V. Measure the DC 0V offset and verify it is within $\pm$ 16 mV.

Programmed Amplitude	Programmed DC Offset	Offset Low Limit	Offset High Limit
0 V	0 V	-16 mV	16 mV

3. DC Gain (+)

The DC Gain (+) is verified by setting each channel to a sine wave with a zero volt amplitude and specified offset. The DC offset is verified with a DMM. The following setup is programmed for each channel:

Waveform	Sine
Frequency	1 MHz
Amplitude	0 V
Offset	per following table
Output	On

Measure the DC output with a DMM to verify offset is within the limits specified in the following table.

Programmed Amplitude	Programmed DC Offset	Offset Low Limit	Offset High Limit
0 V	1.0 V	0.974 V	1.026 V
0 V	2.0 V	1.964 V	2.036 V
0 V	3.0 V	2.954 V	3.046 V
0 V	4.0 V	3.944 V	4.056 V
0 V	5.0 V	4.934 V	5.066 V
0 V	6.0 V	5.924 V	6.076 V
0 V	7.0 V	6.914 V	7.086 V
0 V	8.0 V	7.904 V	8.096 V

4. DC Gain (-)

The DC Gain (-) is verified by setting each channel to a sine wave with a zero volt amplitude and specified offset. The DC offset is verified with a DMM. The following setup is programmed for each range in turn:

Waveform	Sine
Frequency	1 MHz
Amplitude	0 V
Offset	per following table
Output	On

Measure the DC output with a DMM to verify the offset is within the limits specified in the following table.

Programmed Amplitude	Programmed DC Offset	Offset Low Limit	Offset High Limit
0 V	-8.0 V	-8.096 V	-7.904 V
0 V	-7.0 V	-7.086 V	-6.914 V
0 V	-6.0 V	-6.076 V	-5.924 V
0 V	-5.0 V	-5.066 V	-4.934 V
0 V	-4.0 V	-4.056 V	-3.944 V
0 V	-3.0 V	-3.046 V	-2.954 V
0 V	-2.0 V	-2.036 V	-1.964 V
0 V	-1.0 V	-1.026 V	-0.974 V

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