Advanced Simulation Technology inc.
441-A Carlisle Drive
Herndon, Virginia 20170 U.S.A.
Tel. (703)471-2104 • Fax. (703)471-2108
www.asti-usa.com

ASTi
8-Channel Waveform Synthesizer
User Guide

Document: DOC-01-8AFA-UG-1

Advanced Simulation Technology inc. 441-A Carlisle Drive, Herndon, Virginia, 20170 USA
Revision A (August 2003)

ASTi ASTi 8-Channel Waveform Synthesizer User Guide

ASTi

441-A Carlisle Drive

Herndon, VA 20170

Table of Contents

General Description

The 8-channel Waveform Synthesizer is one of two types of DSP-based digital audio cards that can be installed in ASTi's Digital Audio Communications System (DACS) equipment. While current application solutions primarily utilize ASTi's TDM/RIU technology, ASTi has continued to support this card since its inception in 1993.

The card itself supports 8 audio inputs and 8 audio outputs. Balanced, high quality audio amplification stages and superior codec technology provide high-end audio with maximum noise rejection. User-configurable preamplification capabilities and high-current output drives provide flexibility for interfacing with a variety of military and commercial headphones and other audio equipment.

In an effort to support ongoing production programs and applications where the 8-channel Waveform Synthesizer configurations may still be preferred, ASTi has recently updated the 8-channel Waveform Synthesizer card. Consequently, the interface specifications, device capabilities, configuration, and other features have been upgraded or modified to improve audio quality and flexibility.

The user should be aware that, while these changes provide additional capability, some features and interfacing techniques associated with earlier configuration of 8-channel Waveform Synthesizers might also have changed. Explanations of these differences are provided in the following sections of this guide.

For clarity, the use of the term "second generation" is used for the latest, updated versions of the card (part numbers C208-B-2 and/or C208-B-3), and "first generation" is used to identify previous card versions (C208-B-1).

Identifying 8-channel Waveform Synthesizer Versions

It is important to identify the 8-channel Waveform Synthesizer card version to determine the features available, and to avoid incorrect interfacing and possible damage to the card. The card version can be identified in a number of different ways:

Using the Component Part Number

The card part number for the Waveform Synthesizer in the DACS is identified in the system drawing provided at the time of delivery. Consult the "Drawings" section of the documentation shipped with the DACS. Second generation cards have part number **C208-B-2** or **C208-B-3**. First generation cards have part number **C208-B-1**.

Using the System Part Number

The system part number on the back of the DACS provides distinction of the Waveform Synthesizer card type. An example of a system part number is: **ND–2U–T1–HA1–F2–FD**. C208-B-**2** cards are indicated by a **–HA#–** in the system part number. C208-B-**3** cards are indicated by a **–HB#–** in the system part number. First generation cards are indicated by a **–H#–** in the system part number. In all these cases, the "#" represents the number of 8-channel Waveform Synthesizer cards present in the system.

Using Model Builder's Software Environment

1. Start the DACS and permit it to boot normally.
2. From the Model Builder environment main menu, select "Waveform DSPs", then choose the "Times" submenu.
3. Use the page up/down keys to move to page 2.
4. Examine the "DSP Version" section. Second generation cards display a value of "**v8.00**" under the "DSP Board" heading. First generation cards display a value of "**v4.88**" on this page.
5. Examine the value displayed under the "Mem" column. First generation cards have a memory size of **512**. Second generation cards have a memory size of **2048**.
6. Examine the column to the right of "Mem". First generation cards display "8ch". C208-B-2 cards display "8CHn". C208-B-3 cards display "8Chn".

Through Physical Inspection

Card versions can also be identified by physical inspection. First generation cards use primarily **through-hole** construction. Second generation cards use almost entirely **surface-mount** components, and have gain jumpers in the vicinity of the DB-37 connector.

Note: It may violate your warranty to open your system. Contact ASTi prior to opening the chassis for permission and additional instructions.

Interface Specifications

First generation Waveform Synthesizer card

Audio Inputs:

- Can accept signal levels up to a maximum of +/– 1.5 Vpeak
- Balanced/Differential input
- Nominal input impedance is > 5 kΩ
- Input preamp gain configurable via Model Builder software environment (See configuration file command section in the Model Builder Reference manual for more information.)

Audio Outputs:

- Maximum output levels are +/– 2.5 Vpeak into 600 Ω or larger loads
- Unbalanced/Single-ended output
- Output impedance is < 100 Ω

Second generation Waveform Synthesizer card

Audio Inputs:

- Can accept signal levels up to a maximum of +/– 2.5 Vpeak (with 0 dB gain jumper setting)
- Balanced/Differential input
- Nominal input impedance is > 5 kΩ
- Input preamp gain configurable via jumper settings on card, additional preamp gain control via the Model Builder software environment (See configuration file command section in the Model Builder Reference manual for more information.)

Audio Outputs:

- Outputs may be configured to operate in single-ended or differential mode
- Maximum output levels into 8 Ω load or greater are:
  - Differential mode: +/– 2.25 Vpeak
  - Single ended mode: +2.25 Vpeak
- Output impedance is typically 0.1 Ω into an 8 Ω bridge-connected load

Waveform Synthesizer Pin Information

First and second generation Waveform synthesizer cards have identical pin-out information as indicated below.

NOTE: While the pinouts are identical between the board versions, the electrical interface is not. See "Interfacing to the Waveform Synthesizer card" section below.

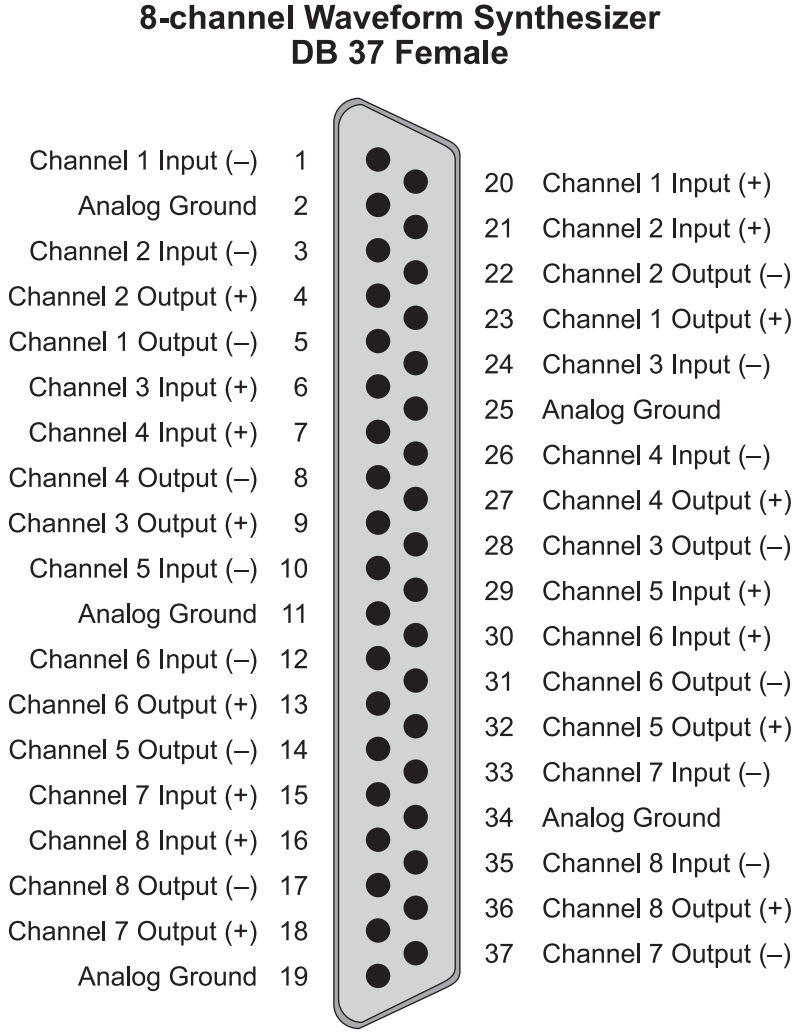

Figure 1: Waveform Synthesizer connector pin assignments

Model Builder Version Required

The first generation Waveform Synthesizer cards will work with **MB 3.05** or higher, including the latest version of Model Builder.

C208-B-2 second generation Waveform Synthesizer cards require **MB 4.08** or higher.

C208-B-3 second generation Waveform Synthesizer cards require **MB 4.09g** or higher.

Sample Rates Supported

First generation Waveform Synthesizer cards support 8.0, 9.6, 11.025, 12.0, 14.7, 16.0, 17.64, 19.2, 22.0, 24.0, 29.4, 32.0, 44.1, and 48.0 kHz sampling rates.

C208-B-2 second generation Waveform Synthesizer cards support 8.0, 16.0, 24.0, 32.0 and 48.0 kHz sampling rates.

C208-B-3 second generation Waveform Synthesizer cards support a 22.0 kHz sampling rate.

Warning: It is important to note the sample rate of your model when ordering spares and follow-on equipment. The C208-B-2 and C208-B-3 second generation cards are not interchangeable with respect to the sample rates they support.

Configuring Waveform Synthesizer Cards

Both 8-channel Waveform Synthesizer and TDM cards require proper jumper and switch settings to configure the address and interrupt used by each card. Additionally, one card in each DACS unit must be configured as the master, while all other cards must be configured as slaves.

Switch/jumper settings and location are slightly different between first and second generation cards. Consult the card configuration drawing provided with your documentation set (see the “Drawings” section of your system documentation) for switch/jumper setting information.

Second generation Waveform Synthesizer cards also provide jumper settings for individual input channel gain (additional gain can also be set in the Model Builder environment), and differential vs. singled output operation. Consult your card configuration drawing for details. Also consult the section below for information about properly interfacing to a second generation Waveform Synthesizer card.

Interfacing to the Waveform Synthesizer

Differences exist between the two versions of Waveform Synthesizer cards that may require different connection and interface approaches, depending on the type of audio peripheral or equipment connected. The following sections provide guidance for connecting these items.

Microphone Interface

First Generation Cards

Audio inputs are balanced, high-impedance, and allow connection of a wide variety of dynamic microphones, ranging from 5 Ω to 1 kΩ. For optimum performance, however, choose a microphone in the 100-300 Ω range with good sensitivity. The larger the microphone signal output, the less susceptible the input signal is to noise pick-up and cross-coupling.

All dynamic mics will require some additional preamp gain to boost mic signal levels to a reasonable level before sampling by the input stage. Preamp gains can be set using commands in the start-up file of Model Builder on an input channel-by-channel basis for first generation version cards. Settings depend on the microphone type and sensitivity, but range typically from 30-40 dB for most commercial types to as much as 60 dB for low-output military microphones.

Gains should be set such that signal levels register between 0.1 to 0.3 in a VOX object signal level detector in the Model Builder environment. These levels are for normal speech levels with the mic positioned properly. Avoid gains which produce signal levels near or over 1.0, as this indicates clipping of the input signal.

Gains are set either temporarily from screens in the Model Builder environment, or permanently via configuration commands in the start-up file. See the Model Builder Reference manual configuration file section for more information.

If electret or amplified dynamic microphones are used, external equipment will be required to support the phantom power requirements of these microphones. If this is an issue, the user should consider using ASTi's newer TDM/RIU technology, which supports phantom power without the need for external equipment.

Connections should be made to the In (+) and In (–) for each channel. Shields should be drained to an appropriate shield tie point. ASTi does not recommend connecting shields to the analog ground pins.

Second Generation Cards

Audio inputs are balanced, high-impedance, and allow connection of a wide variety of dynamic microphones ranging from 5 Ω to 1 kΩ. For optimum performance, however, choose a microphone in the 100-300 Ω range with good sensitivity. The larger the mic signal output, the less susceptible the input signal is to noise pick-up and cross-coupling.

All dynamic microphones will require some additional preamp gain to boost microphone signal levels to a reasonable level before sampling by the input stage. Preamp gains can be set on an input channel-by-channel basis on the card itself using gain jumpers. Available settings include 0, 20, 30, 40, and 60dB. Your card configuration drawing included with your system documentation provides jumper location and configuration information. Additional gain can be added either temporarily from screens in the Model Builder environment, or permanently via configuration com-

mands in the start-up file. See the Model Builder Reference manual configuration file section for more information.

Again, settings depend on the microphone type and sensitivity, but range typically from 30-40 dB for most commercial types to as much as 60 dB for low output military microphones. Gains should be set such that signal levels register between 0.1 to 0.3 in a VOX object signal level detector in the Model Builder environment. These levels are for normal speech levels with the microphone positioned properly. Avoid gains which produce signal levels near or over 1.0 as this indicates clipping of the input signal.

If electret or amplified dynamic microphones are used, the phantom power available on the Waveform Synthesizer may be sufficient to support the microphone. Insert resistor packs into sockets J6, J7, J8 and J9 to send phantom power to the microphone. J6 supplies phantom power to channels 1 and 2; J7 provides phantom power to channels 3 and 4; J8 provides phantom power to channels 5 and 6; J9 provides phantom power to channels 7 and 8. ASTi recommends using 2 kΩ to 10 kΩ resistor packs. If the on-board phantom power is not sufficient, then external equipment will be required to support the phantom power requirements of these microphones.

Connections should be made to the In (+) and In (–) for each channel. Shields should be drained to an appropriate shield tie point. ASTi does not recommend connecting shields to the analog ground pins.

Headset Interface

First Generation Cards

Audio outputs are unbalanced, low-impedance, and drive loads as low as 100 Ω satisfactorily. Loads lower than 100 Ω will likely require additional external amplification to avoid fold-over of the output stage. This is typical of military headsets where earcup loads are often in the 15-50 Ω range. Alternatives to external amplification under these conditions include use of second generation Waveform Synthesizer card or ASTi's TDM/RIU components.

Optimum load impedances are in the range of 150-300 Ω for maximum dynamic range. However, larger loads can also be driven.

For most headsets, earcup connections should be made to the Out(+) and Out(–) for each channel. Shields should be drained to an appropriate shield tie point. ASTi does not recommend connecting shields to the analog ground pins. Note that there are exceptions such as headsets where the earcup and microphone signal low side are shared. These types of headsets may require connection of the earcup to Out(–) and the low side to audio ground. Contact ASTi for further assistance.

NOTE: When connecting to unbalanced inputs on audio peripherals or equipment instead of an isolated load such as a headset, an isolation transformer may be required for optimum noise reduction and ground loop hum avoidance.

Second Generation Cards

The output stage of second generation waveform synthesizer cards are balanced, low-impedance, and drive loads as low as 8 Ω satisfactorily. This often eliminates the need for additional external amplification for low impedance headsets (military) and provides increased dynamic range.

Optimum load impedances are in the range of 150-300 Ω, however, smaller and larger loads can also be driven.

For headsets, earcup connections should be made to the Out(+) and Out(–) for each channel. Shields should be drained to an appropriate shield tie point. ASTi does not recommend connecting shields to the analog ground pins. Contact ASTi for further assistance.

WARNING: Proper connection and care must be taken when connecting loads or other audio equipment to the outputs to prevent damage to the card. Please follow the guidance presented on the following page.

When driving bridge connected loads (differential, with no ground connection):
Use both the Audio Out + and – connections.

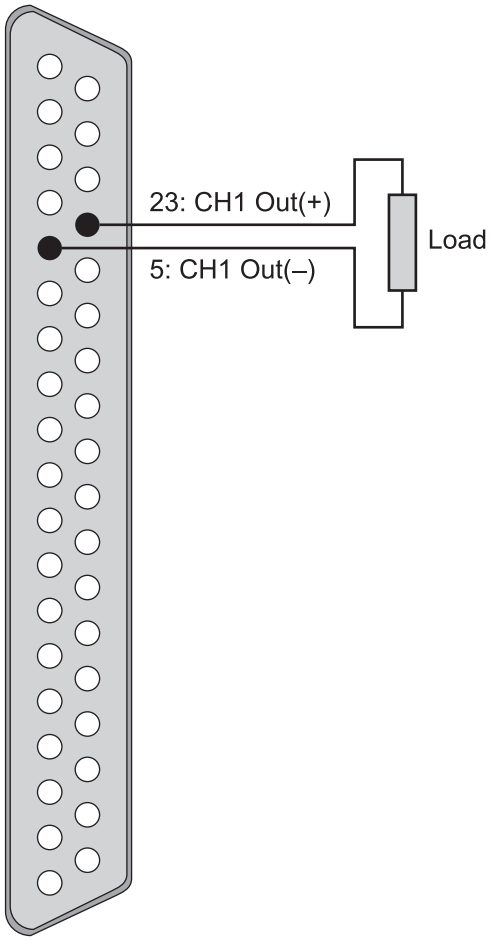

Figure 2: Differential load connected to channel 1

WARNING: Do not connect the audio output + or – pins to ground directly or through a low impedance load. This will damage or destroy the output stages.

When driving unbalanced/single ended loads: Remove the jumper for the appropriate channel.

- Channel 1 = J11
- Channel 2 = J12
- Channel 3 = J13
- Channel 4 = J14
- Channel 5 = J15
- Channel 6 = J16
- Channel 7 = J17
- Channel 8 = J18

NOTE: Once this jumper has been removed, it is permissible to connect low-impedance loads to the Audio Out + pin(s) only.

Connect the Audio Out + side to the load. Connect the return (ground) side of the load to either pin 2, 25, 11 or 34.

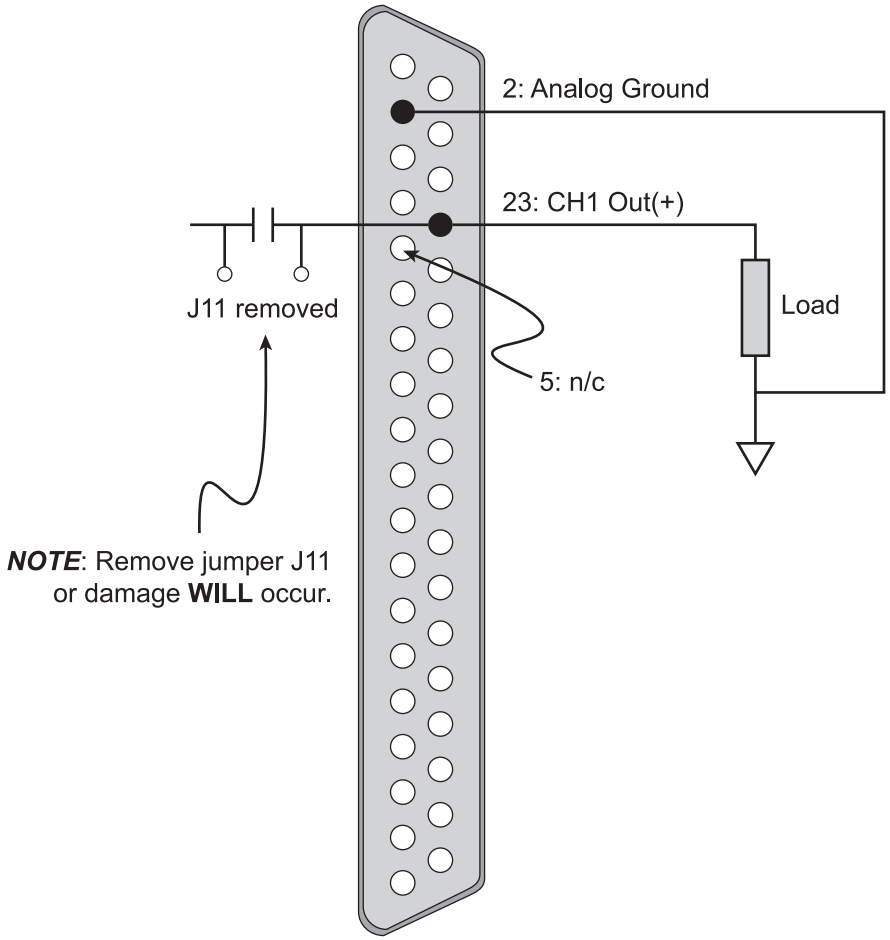

Figure 3: Unbalanced/single-ended load connected to channel 1

Replacing First Generation Waveform Synthesizers with Second Generation Cards

WARNING: If you are upgrading existing systems or ordering follow-on systems for Waveform Synthesizer-based DACS systems, inspect the cabling and equipment connections to ensure that the audio output + or – pins are not grounded or connected to unbalanced loads.

1. Note the sampling rate of the model for the DSP being replaced. If the sampling rate is 8 or 16 kHz, no model changes are required.
2. If the sample rate of the model for the DSP being replaced does not match a sample rate supported by the new card, then several items must be considered and changed.
    a. The sample rate of any soundfiles used in the model will need to be adjusted to the sample rate of the new card(s). For example, 22 kHz soundfiles must be up-sampled to 24 kHz using Cool Edit or an equivalent program.
    b. The DSP loading must be taken into account. If possible, check the DSP loading of the original card/model. If the “Spare %”column on page 1 of the “Waveform DSPs >>Times” page is less than 10-15%, the new DSP will most likely overrun when the model is loaded.
    c. For multiple DSP systems, it may be possible to alleviate the overrun condition by shifting some of the modeling load from one DSP to the other.
    d. For single DSP systems, it may be necessary to restructure the model or add a second DSP, and spread some of the load to the second card.
3. If multiple Waveform Synthesizer cards are currently linked in order to support global channel connections, all cards must be second generation. ***First generation and second generation cards may not be linked.***

Additional Information

For more information about the 8-channel Waveform Synthesizer or other ASTi technology, consult the “Support” section of ASTi’s website at: **http://www.asti-usa.com/support**, which features various application notes and frequently asked questions.

Alternately, send email to **support@asti-usa.com** with any questions.

