

How to set up and use your digitizer system with M1 Waveform Tools™

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If you are installing M1™

If you are installing M1 for use with your digitizers, you will make the most efficient use of your time if you read this entire Application Note first. If you are installing M1 for use with an oscilloscope, you should refer to ASA 09-03, "Connecting M1 to your Scope: You Have Choices", instead.

The purpose of this document is to describe the steps a user needs to take in order to set up M1 Waveform Tools and his digitizer system for use. It will also overview new capabilities that have been added to M1 specifically to assist digitizer users. Finally, M1's licensing policy for digitizers will be reviewed.

M1 Waveform Tools and digitizers

M1 is a mature and very stable suite of tools intended to accelerate your waveform-oriented workflow from concept all the way through production testing and field deployment. It provides a vast range of capabilities, many of which were ground-breaking industry firsts, and many of which are still only available in M1. These include analysis, debug tools, automation of analysis flow, collaboration, waveform archiving and reuse, compliance testing, a third-party Apps program, and many more. M1 works with waveforms from a wide range of sources, including real-time oscilloscopes, EDA tools, and digitizers, regardless of brand. After the waveform has been acquired, it no longer matters what the original source was. However, as these sources are very different from each other, the correct setup procedure for the type of source you are using must be followed. It should also be recognized that M1 may provide certain additional capabilities in dealing with one type of waveform source versus another that the operator will want to know about. For example, M1 provides control and display capabilities that effectively turn your digitizer system into a full-functioned, high channel-count, higher resolution interactive oscilloscope with more analysis options than are even in the native software provided for oscilloscopes. The purpose of this note is to acquaint the digitizer user with the proper setup and usage procedures.

Setting up the digitizer hardware

You should set up and test your digitizer hardware and software in accordance with the manufacturer's instructions, preferably before installing M1. If you have more than one digitizer module, the modules will appear in M1 in the same order that they appear in the manufacturer's viewer utility, with the first module listed being considered the **primary module**. In an external card cage, the primary module will generally be the module farthest to the left or top. For internal PC cards, the primary module will generally be either the module closest to the end of the motherboard or the module closest to the power supply.

Important Note

ASA only officially supports digitizer systems in which **all hardware and software are from a single manufacturer**. The reason for this is because, in our experience, it is very difficult (and sometimes outright impossible) to get systems consisting of hardware and software from multiple vendors to work together reliably and correctly.

Triggering

It is important to know which module will be the **primary module** because all modules except the primary must ultimately be externally-triggered by the **Trigger Out** signal from the primary module. The primary module can be triggered either on a channel or by an external trigger (but not an external trigger that is connected to the Trigger Out of another module). This setup is required to ensure that all digitizers are acquiring at the same time, working from a common trigger event, and with a consistent skew between each module's first sample point and the first sample point of the primary module.

Note that not all modules need to be *directly* triggered off of the primary module's Trigger Out. As shown in Fig. 1 below, in a three-module system (with module A being primary), module B could be triggered by module A's Trigger Out and module C could then be triggered by module B's Trigger Out. This arrangement simply increases the delay between the primary module's trigger event and module C's trigger event versus the situation where module C is also directly connected to the primary module's Trigger Out. This skew is not critical as M1 provides the means to deskew the modules for proper display and analysis.

For some boards, only one Trigger connection is available and is configured internally as input or output. In this case, the triggering arrangement shown in the left side of the diagram below must be used, as the middle style requires distinct Trigger In and Trigger Out connections on module B.

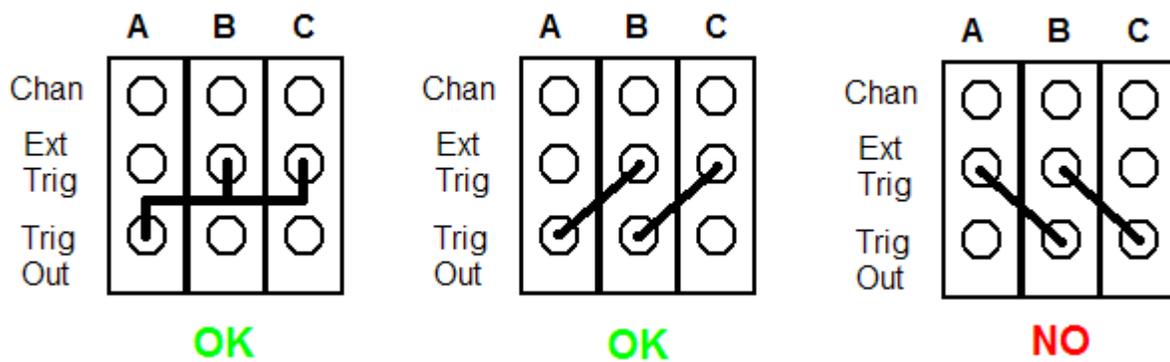


Figure 1. Multiple Module Triggering.

Combining Channels

For multi-channel modules in which you intend to combine channels to increase sample rate, M1 will use the first channel of the digitizer as the combined channel, or the first two channels in the case of a 4-channel digitizer where you combine pairs of channels rather than all four. In general, if you will not have signals attached to all channels of a particular module, you should attach the signals to the lowest numbered channel(s) of the module if you want to maximize the sample rate. Please note that not all multi-channel digitizer modules support channel combination. If a module does not support channel combination, the channel combination option will be disabled for that module in M1's **Digitizer Setup** dialog.

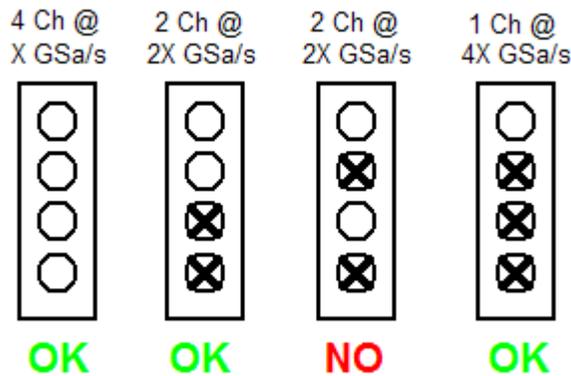


Figure 2. Channel Combination.

Manufacturer-Specific Notes

In this section, specific comments and suggestions unique to a particular manufacturer's products are discussed. You should read the subsection for the manufacturer of your digitizers, but may safely skip the other subsections in this section. Manufacturers are listed in alphabetical order. If your digitizer's manufacturer is not listed, no specific comments or suggestions are required at this time.

GaGe

The Trigger Out signal is not enabled by default on GaGe digitizers, and it is not possible for M1 to turn this on programmatically. Therefore if you have more than one module, you must enable the Trigger Out signal on the Primary module (as well as any other modules that you may be using the Trigger Out signal from in your setup) before using these modules with M1. To do this, run the **GaGe CompuScope Manager** utility (Start/Programs/ GaGe/CompuScopeManager by default) and follow these steps for each module.

1. Right-click on the module in the **Resource Manager** tab and select "**Aux I/O Configuration**"
2. On the **Aux I/O Configuration** dialog, click on **Trigger Out As Output** and select "**Trigger Out**" from the associated drop box
3. Check the "**Save Configuration**" box
4. Click **OK** to save your changes and then **Exit** to exit the CompuScope Manager utility

If you have multiple digitizer boards configured in a Master/Slave arrangement, they will appear as a single instrument in the GaGeScope software and CompuScope Manager utility. On M1's Digitizer Setup dialog, however, each board will be represented as a separate module. This is done to allow the user to better visualize the relationship between the physical boards and their channel arrangement in M1. M1 does understand the Master/Slave relationship, and acts accordingly. For example, many M1 module settings are disabled for Slave modules, with a comment noting that the selected module is a Slave module and providing the location of the associated Master module for reference.

In a Master/Slave arrangement, providing external trigger signals (as described above) to Slave modules is not necessary. Slave modules are internally triggered from the Master module.



National Instruments

All hardware data acquisition systems have ‘personalities’ that may require certain special handling. In many cases, ASA is able to deal with these quirks internally to M1 so that the user never needs to know about them. However, in the case of National Instruments digitizer systems that contain more than one module, there is a special calibration procedure that ASA highly recommends performing if you intend to make any measurements (e.g. Delay measurements) that involve channels on different modules. If your system includes multiple NI digitizers, you should read **ASA Application Note 11-02**, “Calibrating a National Instruments Digitizer System for use with M1 Waveform Tools” for more detailed information on this matter.

Spectrum

If your system contains a mix of M2i and M3i boards, all of the M2i boards will be detected before any of the M3i boards, regardless of the physical arrangement of the boards. This is a characteristic of the Spectrum driver that cannot be controlled by ASA. To maximize the similarity between the physical order of the boards and the order M1 presents the boards in the Digitizer Setup Dialog, all M2i boards should be inserted into the lowest-numbered slots and then all M3i boards after them. Note that this means that the M1 primary module will always be an M2i board.

If you have multiple digitizer boards configured using StarHub, they will still appear on M1’s Digitizer Setup dialog as separate modules. This is done to allow the user to better visualize the relationship between the physical boards and their channel arrangement in M1. M1 does understand the Master/Slave relationship, and acts accordingly. For example, many M1 module settings are disabled for Slave modules, with a comment noting that the selected module is a Slave module and providing the location of the associated Master module for reference.

In a Master/Slave arrangement, providing external trigger signals to Slave modules is not necessary. Slave modules are internally triggered from the Master module. The Master module will always be the lowest-slot card that is attached to the StarHub; note that this is not necessarily the card that physically has the StarHub hardware on it.

The Delay settings for Spectrum modules can only be changed in increments of 4 sample points, e.g. if you are sampling at 100 MSa/s (10 ns), the Delay can only be changed in increments of 40 ns. This is not enforced in the Digitizer Setup dialog, but the value in the dialog will be updated to reflect the actual allowed Delay value that was closest to the entered value. Note that if you are combining channels to achieve a higher sample rate, the minimum Delay increment then increases to 8 pts, i.e. 80 ns in the previous example. This is a characteristic of the Spectrum driver; ASA is investigating ways to improve the resolution via other means.

Setting up M1

M1 normally requires a software layer called VISA to communicate with oscilloscopes or digitizers; however VISA is not required by Agilent/Acqiris, GaGe, or Spectrum digitizers¹. If you do not have VISA installed on your system for other reasons, you may see a standard warning when installing M1 about VISA not being present. You may ignore this warning if your digitizers are from Agilent/Acqiris, GaGe, or Spectrum. National Instruments (and newer Agilent) digitizers should install VISA as part of their normal installation process.

You do not need to make any special settings in M1 for use with your digitizer system. M1 will automatically detect the presence of your digitizers just as it would detect any supported oscilloscope. Since M1, in effect,

¹ Note that this exclusion applies only to the older Agilent digitizers that were inherited with their purchase of Acqiris. Newer Agilent digitizers, such as the M9xxx series, do require VISA.

treats every scope as simply a digitizer, M1 is able to treat a digitizer in exactly the same way that it treats a scope without any special action on the part of the user.

Configuring the digitizer

Since digitizers do not have a display and front panel to allow the user to change settings directly like an oscilloscope does, M1 provides a special **Digitizer Setup** dialog to allow the user to make these settings. This dialog comes up automatically during startup when M1 detects a digitizer system so that the user can make the initial setup, and is also available at any time under the More button so that settings may be changed in the middle of a measurement session if required.

Full documentation on the Digitizer Setup dialog is available in the M1 Help file, but here is a brief overview:

At the top right of the dialog, you can set the acquisition window length and turn segmented memory on or off.

Each digitizer module in your system is represented by one column of controls (e.g. in the example to the right, the system has 4 modules), allowing you to

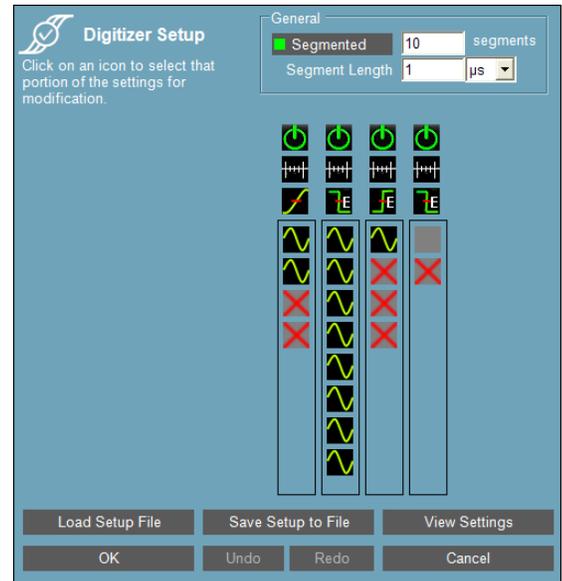
- Turn the entire module on or off
- Set **Timebase and Sample Rate** parameters
- Set **Triggering** parameters (with the control visually indicating important aspects of the current settings)

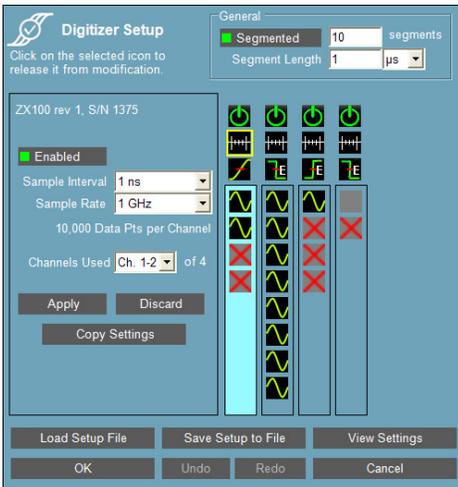
Below this are controls for each channel in the module, which visually indicate whether that channel is

- Available and currently in use by M1
- Available but not currently in use by M1
- Unavailable due to channel combination being used to increase the maximum sampling rate on the remaining channels in a module

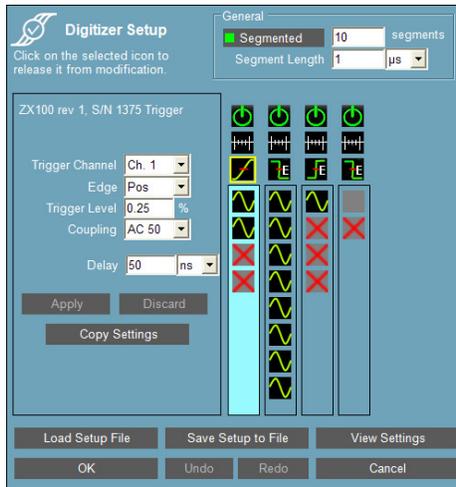
When any of these controls is clicked, the area to the left of the digitizer module columns will be populated with specific information relevant to the module and control that was clicked. Examples of the parameters available for the **Timebase**, **Triggering**, and **Channel** controls are shown below. The module's model number and serial number are always shown so that you can ensure you're looking at the settings for the correct module. Provision is also made for copying the settings from one channel or module to other channels or modules, as well as saving and reloading settings files for common instrument setups you use.

Important: During M1 startup, there must be a live signal available that will be triggered by your Triggering settings in the **Digitizer Setup** dialog. M1's AutoMeasure feature will trigger the digitizers several times during startup as it detects and sets up your signals.

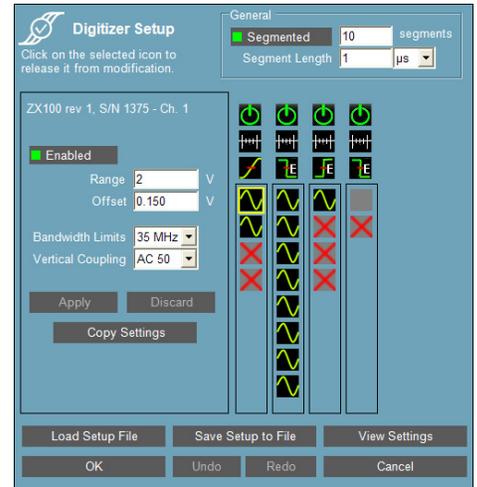




Timebase Settings



Triggering Settings



Channel Settings

Licensing

ASA M1 licensing for digitizers is based on the specifications of the digitizers and the total number of digitizer channels (not modules) in the system. The base system level is set by the most-capable individual digitizer module in the system and includes support for up to 8 acquisition channels across all modules. If support for more than 8 acquisition channels is required, a license upgrade can be purchased directly from ASA. A maximum of 128 acquisition channels can exist on a single M1 license. Note that all channels on all modules are counted towards this limit whether they are currently in use or not.

An M1 Waveform Tools license is tied to a particular set of unique serial-numbered digitizer modules. You may remove digitizers from the system and M1 will continue to function with the remaining licensed instruments. If you add digitizers to the system, M1 will only recognize the licensed digitizers and you will continue to be able to fully use those. The new/unlicensed digitizers will be ignored by M1.

If you wish to change the set of digitizers that your M1 license is allowed to acquire data from, please contact ASA. License transfers can be made for a nominal fee.

If you have any questions regarding licensing, please contact ASA Sales at sales@amherst-systems.com.

Summary

This document has described various notes and procedures specific to the setup and operation of digitizers with M1 Waveform Tools. ASA also has a substantial list of Best Practices for making measurements with oscilloscopes that we have gathered over the past two decades of work in this area. We recommend that you review those Best Practices, since most of them apply to digitizer users as well. These Best Practices can be found in the M1 Help file under Getting Started.