MIPS

DMS
Operation Manual Addendum
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WARNING
TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOSITURE.

WARNING
Avoid spilling liquids onto/into the unit.
Do not expose to excessive heat or moisture.
Do not open – there are no user serviceable parts inside.
Do not block the chassis vent slots or the fan inlet.

Only qualified electrical workers are able to install and test this system. Please follow these recommendations:

1.) Never operate the system with the covers removed.
2.) Make sure to cover all your connections to protect them from accidental contact.
3.) Place the MIPS power supply in a position that will provide clearance for its intake fans and air exit openings.
4.) Do not operate this MIPS power supply until you have read the operating instructions and tuning instructions.
5.) There are no user serviceable parts inside the MIPS power supply so do not remove the covers.
6.) Only replace fuses with the specifications defined on the rear panel of the MIPS system.
7.) Never operate this system in a combustible gas environment.

Grounding! Your MIPS system has a ground lug on the rear panel. This connection must be bonded to earth ground before using your system.

Introduction

This document describes the operation of the DMS MIPS system. MIPS is the platform we use to configure a number of different types of systems. MIPS provides a unified interface for all of our systems. The specific function of a MIPS system is defined by the modules that are integrated into the system. This DMS system has a single FAIMSfb module installed and configured. The following discussion defines the capability of the FAIMSfb module. The term FAIMS will be used in the following discussion and this is equivalent to DMS.

The FAIMSfb module develops the FAIMS waveform using a fly back transformer technique. This module also generates the CV voltage and supports scanning.

The module has two outputs that attached to the plates of your FAIMS or DMS device. The system generates a positive and negative symmetrical set of outputs that are presented on the positive and negative outputs. When you set the FAIMS RF voltage (Vrf) to 1000 volts you will see a +500 volt signal on the positive output and a -500V output on the negative output. Likewise the CV voltage has a +1/2CV output and a -1/2CV output.

Note: We build a single ended output version of the DMS system. In this case the Vrf+ output contains the RF and CV signals. In this case if you set the RF voltage to 1000V you will see a 1000Vp-p RF signal on VRF+. The Vrf- output is not connected in the single ended version. The CV voltage is also single ended and will match the value you enter on the Vrf+ output. Single ended versions are labeled on the rear panel.

Use caution when measuring the output voltages due to loading from your scope. Try to keep all cabling as short as possible and minimize the system capacitance. As the capacitance increases the power requirements increase and the waveform pulse width will widen.

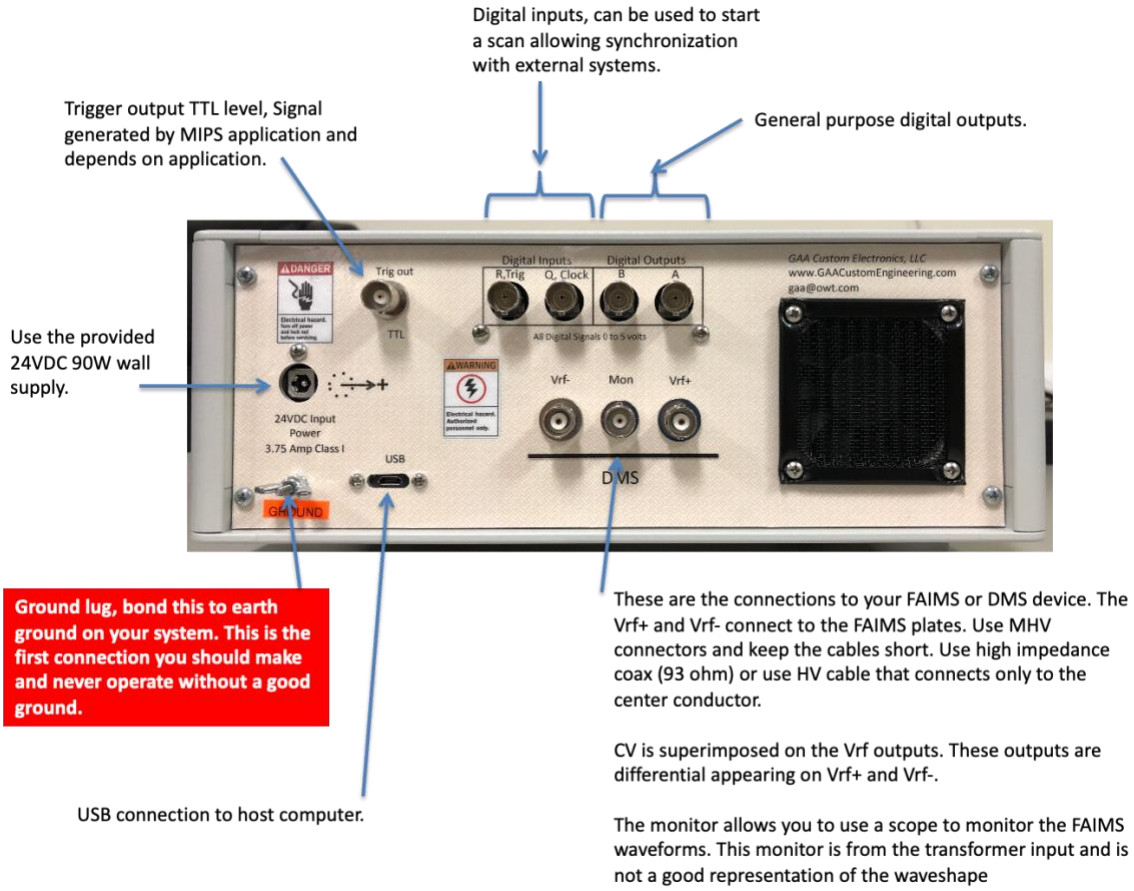
Charging the primary of a transformer and then interrupting the primary current generates the FAIMS waveform. This primary current interruption causes the magnetic field in the transformer to rapidly collapse and induce a large voltage in the secondary of the transformer. This is the fly back transformer technique. The FAIMSfb module allows you to control the frequency of the signal charging the transformer primary and its duty cycle (the percentage of on time in a cycle). With these two parameters you can tune the system to your devices specific characteristics. This tuning allows you to define the FAIMS waveform duty cycle. You will need a scope to monitor the waveforms when tuning. Remember that the power will increase linearly with frequency and capacitance but at a much higher rate with voltage.

You can install up to two FAIMSfb modules in one MIPS system and an optional dual electrometer is available and integrated into the system to support data collection during a CV scan.

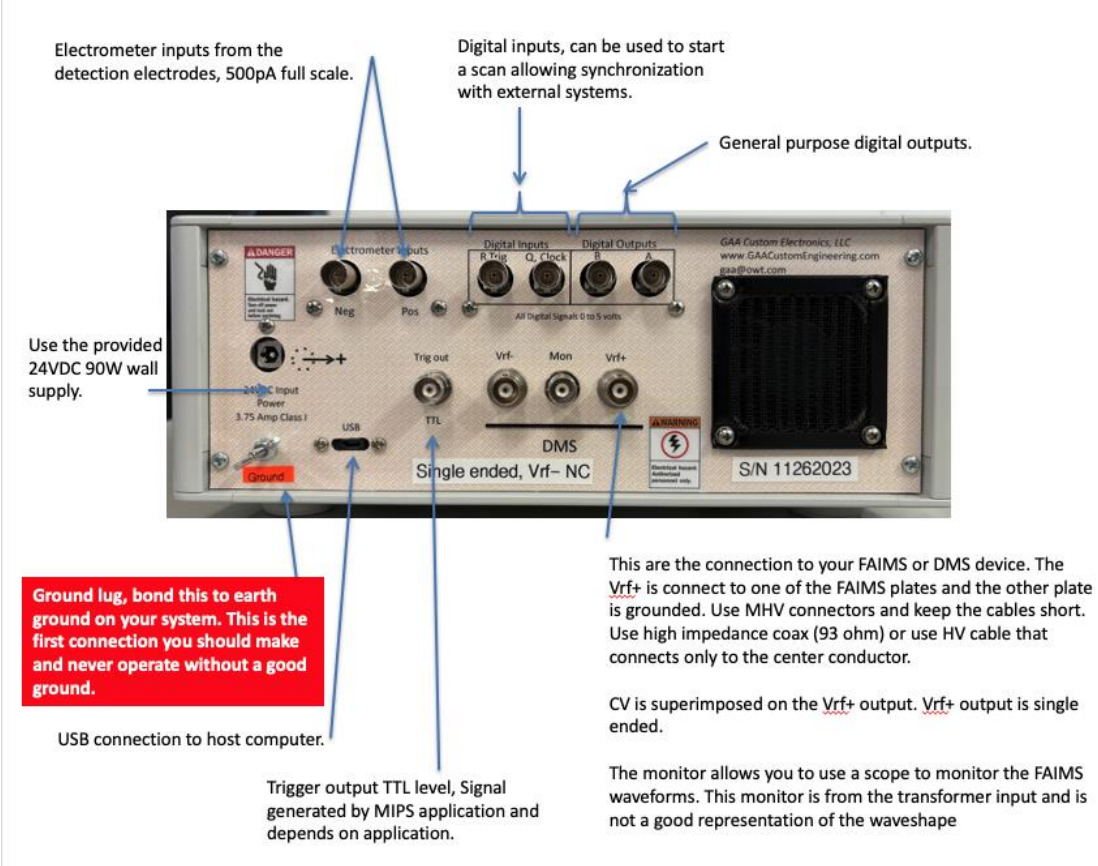
The FAIMSfb module has a number of host commands to allow control from a USB connected computer. These are the commands use by our MIPS host app. These commands are defined later in this document.

The FAIMSfb module supports scanning both the CV voltage and/or the Vrf voltage level. This is a step based scanning system where the user defines the number of steps and the step duration in mS. The total scan time is the number of steps times the step duration. The user defines the starting and ending values for CV and Vrf. If the start and end values are equal then the parameter will not be scan and its value will remain at its current setting.

The figure below shows the rear panel connections and shows a single FAIMSfb system without an electrometer.



The figure below shows the rear panel for a FAIMSfb system with an electrometer and configured for single ended operation:



The FAIMSfb module has a series of menu options that allow you to operate and control the system from the MIPS front panel. These menu options are documented below. Additionally you can control the FAIMfb system using the MIPS host app from a PC or MAC. This interface is described later in this document. The MIPS host app interface is a much more user friendly and an optimal way to operate the system.

Main menu

Module

This option allows you to select the module number you with to interact with, 1 or 2.

Enable

This option will enable the module if set to true. The module will not generate RF or DC voltages unless it has been enabled.

Mode

There are two mode of operation for the FAIMSfb module. If this option is true then the user defines the desired RF peak voltage (Vrf) and the module will adjust the drive automatically to achieve this

voltage and continuously monitor and control the drive level to hold this voltage fixed. If this option is false then the user sets the drive level in percentage.

Drive

This parameter allows you to control the drive level to the FAIMSfb transformers. This parameters range is 0 to 100 percent. This parameter directly controls the Vrf output peak voltage level. Use caution as you increase this parameter and monitor the power level. It is very possible to overdrive the system. When you are in the automatic Vrf level control mode (Mode=true) this value will be adjusted by the system and you will see it change as the system makes adjustments. You can also see this parameter change is you exceed a maximum power limit and the system makes automatic adjustments.

Vrf

Vrf is the peak FAIMS waveform RF voltage. This parameter has two readouts, the setpoint you can adjust, and the actual output RF voltage that is read by monitoring electronics and is a display only parameter. If you are in the automatic Vrf level control mode (Mode=true) then entering a value will cause the FAIMS module to adjust the drive level as needed to reach this voltage. If you are in manual mode (Mode=false) then adjusting this value will have no effect.

CV

This is the CV dc voltage. This parameter has two readouts, the setpoint you can adjust, and the actual output CV voltage that is read by monitoring electronics and is a display only parameter. The valid range for this parameter is -48 to 48 volts.

Settings

This selection will advance you to the settings menu that will allow you to adjust additional system parameters.

Electrometer

This option is only displayed if your system has an electrometer installed. Selecting this option will display the electrometer menu that allows you to control offset, zero the readings, and display the currents.

Return to main menu

Selecting this option will exit the FAIMSfb module menu and return you to the MIPS system menu.

Settings

Scan

Selecting this option will advance you to the Scan menu that allows you to select the CV and or Vrf scan settings.

Frequency

The parameter allows you to set the frequency of the FAMIS Vrf waveform. The range is 250000 to 2000000 Hz. This value is set at 1500000 in the factory. The capacitance of your device and the

desired duty factor will impact this setting. You will need to monitor the outputs with a scope to properly tune the device.

Duty cycle

This is the duty factor for the drive to the primary of the fly back transformer. The units are in percent. Typically this value is set at 50%. The ripple on the baseline of the FAIMS waveform will be impacted by the percentage. You will need to monitor the outputs with a scope to properly tune the device.

Max drive

This parameter sets the maximum drive level for the FAIMS module. If the user tries to set a higher level this system will limit the value to Max drive. Additionally if the closed loop control of Vrf tries to exceed this level the system will limit the drive.

Max power

This parameter sets the maximum power that the FAIMS module that is allowed to dissipate. If the power exceeds this value the system will automatically reduce the drive level as needed.

*Save setting*s

Selecting this option will save the entire FAIMSfb module configuration data to a non-volatile memory chip on the FAIMSfb module. You will see a popup menu indicating the status of this save operation. You need to use this option to record any changes you have made to the parameters or they will be lost when power is cycled or the system is rebooted.

Restore Settings

This option will reload FAIMSfb module configuration settings that were saved to non-volatile memory. This function is automatically called when the MIPS system powers up.

Return

Select this option to return to the main FAIMSfb menu.

Scan

Start CV

End CV

These options define the starting and ending CV values for a scan. If these values are set to the same value then the scanning will not change the CV values or make any changes to the current settings.

Start Vrf

End Vrf

These options define the starting and ending Vrf values for a scan. If these values are set to the same value then the scanning will not change the Vrf values or make any changes to the current settings.

Num steps

This parameter defines the number of steps in a scan.

Step duration

This parameter defines the step duration in mS. This is how long the system will hold at each step value.

Start scan

This option will manually start a scan.

Abort scan

This option will stop a scan that is in process.

Return

Select this option to return to the main FAIMSfb Settings menu.

Electrometer

Pos current, pA

This is a display only value that shows the electrometer current in pA on the positive channel.

Neg current, pA

This is a display only value that shows the electrometer current in pA on the negative channel.

Pos offset

This parameter allows you to set an offset voltage or bias voltage on the positive electrometer input. The range is 0 to 5 volts. Setting this value to 5 volts will apply a DC bias of 5 volts on the electrometer's positive input.

Neg offset

This parameter allows you to set an offset voltage or bias voltage on the negative electrometer input. The range is 0 to 5 volts. Setting this value to 5 volts will apply a DC bias of -5 volts on the electrometer's negative input.

Zero

Selecting this option will zero the electrometers output current values. You can use this option to remove the effects of leakage current and to zero the outputs after a bias setting is changed.

Return

Select this option to return to the main FAIMSfb menu.

Host commands

The host interface allows you to control the MIPS FAIMSfb system from your own application or use the MIPS app to control the system. The commands are documented here for completeness but if you use the MIPS app and custom control panels you will not need to use these command. If you look at the custom control panel configuration file you will see how these commands are used to create the control panel for at DMS/DMS system.

General FAIMSfb module commands.

SFBENA,<Module>,<TRUE or FALSE>

This command will enable or disable the FAIMSfb module you select. Module is 1 or 2 depending on how many modules are present in your system. The module will not generate any voltages unless this value is set to TRUE.

GFBENA,<Module>

Returns the enable status of the FAIMSfb module, TRUE or FALSE for the FAIMSfb module you select.

SFBMODE,<Module>,<TRUE or FALSE>

This command will define the Vrf control mode. If this parameter is set to TRUE then the FAIMSfb system will automatically maintain the Vrf value you define and adjust the drive level as needed to maintain the voltage. If set to FALSE then the drive level will define the Vrf level.

GFBMODE,<Module>

This command returns the mode (TRUE or FALSE) for the module number (1 or 2) you select.

SFBFREQ,<Module>,<Value>

This command sets the frequency of the Vrf output for the module you select. The frequency range is 250000 to 2000000 Hz.

GFBFREQ,<Module>

This command returns the current Vrf frequency for the selected module.

SFBDUTY,<Module>,<Value>

This command sets the duty cycle for the Vrf generation drive signal to the fly back transformer. The value is in percent and the valid range is 0 to 90 percent.

GFBDUTY,<Module>

This command will return the current duty cycle percentage for the selected FAIMSfb module. This duty cycle is the percentage of the fly back transformer's primary drive transistor's on time.

SFBDRV,<Module>,<Value>

This command sets the Drive level percentage for the fly back transformer. This setting will define the Vrf signal level. The valid range is 0 to 100 percent.

GFBDRV,<Module>

This command will return the current drive level for the selected FAIMSfb module.

GDRVV,<Module>

This command will return the fly back transformer drive voltage level for the selected module. This value is in volts with a range of 0 to 24 volts.

GDRVI,<Module>

This command will return the flay back transformer drive current in mA.

SVRF,<Module>,<Value>

This command sets the Vrf output peak voltage for the selected module. This value is in volts with range of 0 to 2000. This is the desired Vrf value or setpoint. Note, this command will set the setpoint value and if the Mode value is true then the system will adjust the drive level to achieve the setpoint.

SVRFN,<Module>,<Value>

This command sets the Vrf output peak voltage for the selected module. This value is in volts with range of 0 to 2000. This is the desired Vrf value or setpoint. Note, this command will set the setpoint and adjust the drive level as needed to achieve the Setpoint.

SVRFT,<Module>,<Value>

This command sets the Vrf output peak voltage for the selected module. This value is in volts with range of 0 to 2000. This is the desired Vrf value or setpoint. Note, this command will set the setpoint and adjust the drive level using a lookup table to achieve the desired voltage. The lookup table has to be generated using the GENVRFTBL command. Using the table allows this command to set the drive level with the minimum about of processing.

GENVRFTBL,<Module>

The command will generate a lookup table to use for setting the Vrf drive level. Before you issue this command you should have your system connected and the FAIMSfb channel and enabled. The system will scan the drive level from 0 to the maximum drive level you have set and create the lookup table.

GVRF,<Module>

This command returns the Vrf setpoint value entered with the SVRF command.

GVRFV,<Module>

This command returns the actual Vrf output voltage that the selected FAIMS module is producting.

GPWR,<Module>

This parameter returns the power in watts that is being used by the fly back transformer to generate the Vrf output voltage.

The following settings allow you to set limits on the drive level and power levels as well as define the CV and Bias voltages.

SFBMAXDRV,<Module>,<Value>

This parameter allows you to set the maximum drive level percentage that you will allow the FAIMSfb module to use when setting and adjusting the Vrf level.

GFBMAXDRV,<Module>

This command will return the current maximum drive level in percentage for the selected module.

SFBMAXPWR,<Module>,<Value>

This command allows you to define the maximum power limit, in watts, for the selected modules fly back transformer waveform generator. This value's range is 0 to 50 watts.

GFBMAXPWR,<Module>

This command returns the current maximum power level in watts that is set for the selected FAIMSfb module.

SCV,<Module>,<Value>

This command will set the desired CV voltage that you wish to generate. This value is in volts and the range is -48 volts to 48 volts.

GCV,<Module>

This command returns the CV voltage setpoint entered with the SCV command.

GCVV,<Module>

This command returns the actual CV voltage output value that the FAIMSfb module is generating.

SBIAS,<Module>,<Value>

This command will set the desired Bias voltage that you wish to generate. This value is in volts and the range is -48 volts to 48 volts.

GBIAS,<Module>

This command returns the Bias voltage setpoint entered with the SBIAS command.

GBIASV,<Module>

This command returns the actual Bias voltage output value that the FAIMSfb module is generating.

The following scans support the FIAMSfb module scan functions. You can scan both CV and Vrf. If you do not want to scan a parameter just set the start and stop values the same. If they are the same they will not be changed from the active values.

SFBCVSTRT,<Module>,<Value>

This parameter sets the scan function's starting value for CV. This value is in volts with a valid range of -48 to 48.

GFBCVSTRT,<Module>

This parameter returns the current setting for the scan function's starting value for CV.

SFBCVEND,<Module>,<Value>

This parameter sets the scan function's ending value for CV. This value is in volts with a valid range of -48 to 48.

GFBCVEND,<Module>

This parameter returns the current setting for the scan function's ending value for CV.

SFBVRFSTRT,<Module>,<Value>

This parameter sets the scan function's starting value for Vrf. This value is in volts with a valid range of 0 to 2000.

GFBVRFSTRT,<Module>

This parameter returns the current setting for the scan function's starting value for Vrf.

SFBVRFEND,<Module>,<Value>

This parameter sets the scan function's ending value for Vrf. This value is in volts with a valid range of 0 to 2000.

GFBVRFEND,<Module>

This parameter returns the current setting for the scan function's ending value for Vrf.

SFBSTEPDUR,<Module>,<Value>

This command allows you to set the duration, in mS, for each step in a scan. The valid range for this parameter is 1 to 2000mS.

GFBSTEPDUR,<Module>

This command returns the current setting for the duration, in mS, for each step in a scan.

SFBNUMSTP,<Module>,<Value>

This command allows you to set the number of steps in a scan. The valid range for the number of steps is 10 to 2000.

GFBNUMSTP,<Module>

This command returns the current setting for the number of steps per scan.

FBSCNSTRT,<Module>

This command will start a scan on the selected FAIMSfb module. If 3 is entered for the module number then the scan will be started on both module 1 and 2.

FBSCNSTP,<Module>

This command will stop a active scan on the selected FAIMS fb module. If 3 is entered for the module number then the scan will be stopped on both module 1 and 2.

The following commands support the optional dual channel electrometer.

SELTMTRENA",<TRUE or FALSE>

This command us a factory setup command used to inform the system that an electrometer is present in the system. Setting this value to TRUE will enable the electrometer. The user should not change this setting.

GELTMTRENA

This command will return TRUE if an electrometer is installed in the system.

GELTMTRPOS

This command will return the electrometer current on the positive channel. The valid range for this value is 0 to 500 pA.

GELTMTRNEG

This command will return the electrometer current on the negative channel. The valid range for this value is 0 to 500 pA.

SELTMTRPOSOFF,<Value>

This command allows you to set a DC bias level on the electrometer's positive input. The valid range for this value is 0 to 5 volts.

GELTMTRPOSOFF

This command returns the current value of the DC bias level on the electrometer's positive input.

SELTMTRNEGOFF,<Value>

This command allows you to set a DC bias level on the electrometer's negative input. The valid range for this value is 0 to 5 volts. Note that the actual DC bias level will be negative, for example if you enter 5 volts the actual bias value will be -5 volts.

GELTMTRNEGOFF

This command returns the current value of the DC bias level on the electrometer's negative input. Note that the actual DC bias level will be negative, for example if this command returns 3 volts the actual bias value will be -3 volts.

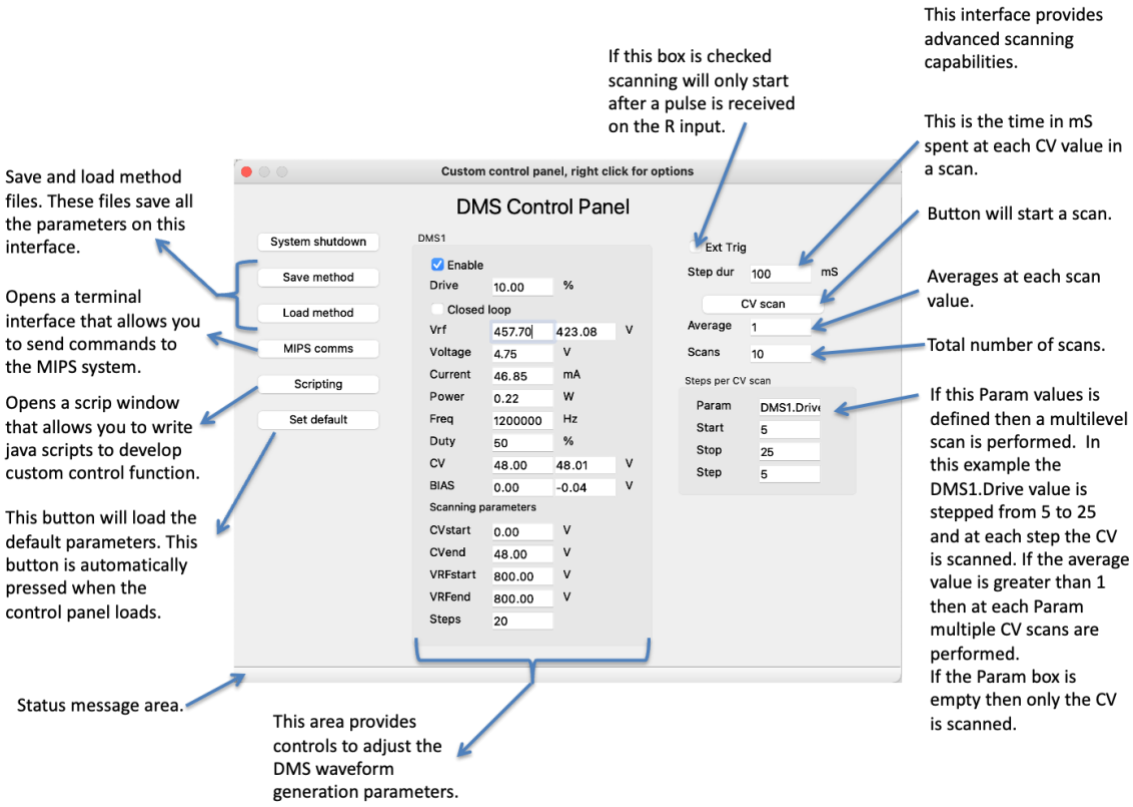
ELTMTRZERO

This command will zero the electrometer's reading. This is useful for subtracting background leakage current or reestablishing zero after the DC bias offset values are changed.

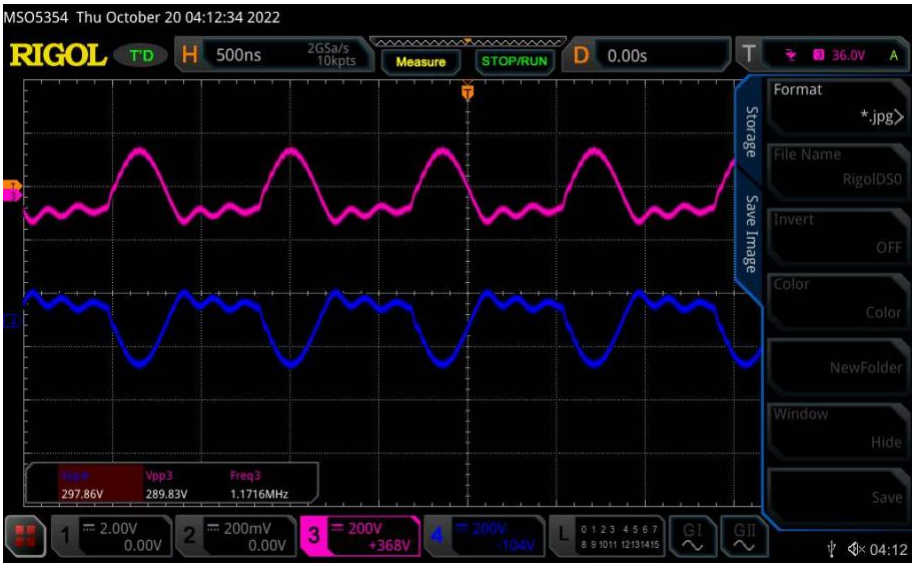
Grounding! Your MIPS system has a ground lug on the rear panel. This connection must be bonded to earth ground before using your system.

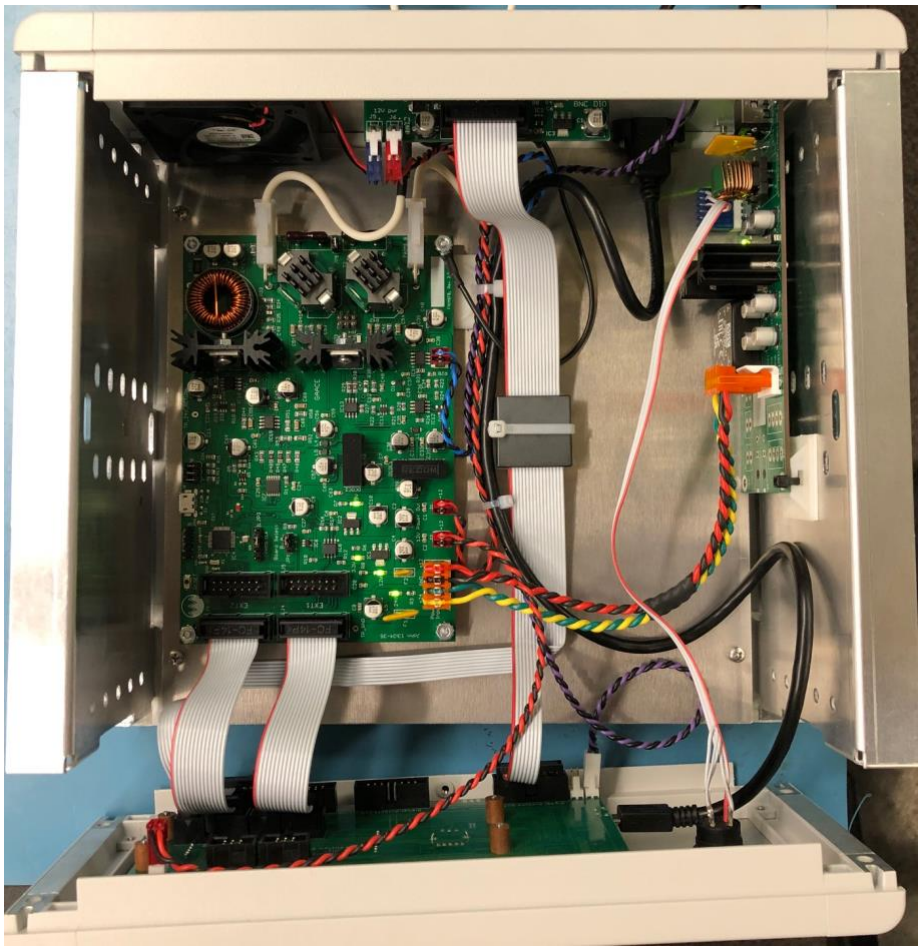
The user friendliest way to interact with the system is to use the MIPS host application on your PC or MAC connected to the MIPS FAIMSfb box via a USB interface. This will allow you use a graphical user interface to interact with your system.

You will find a thumb drive in the package with your system that contains all the documentation files and the host application as well as a control panel file we developed for testing your system. To install the host application just copy the MIPS folder and all its contents to the C drive on your PC, open the MIPS folder and double click on the MIPS application. Make sure the MIPS system is powered up and attach the USB cables to your PC, you can then press the "Find MIPS and connect" button, the application will then connect to your systems. You can load the control panel using the tools->Select… menu option and select the DMSne.cfg file in your MIPS folder. You can automate this loading process using the properties dialog under the Help menu option. We can help setup the software and show you how to use its capability, just call or email and setup a time.

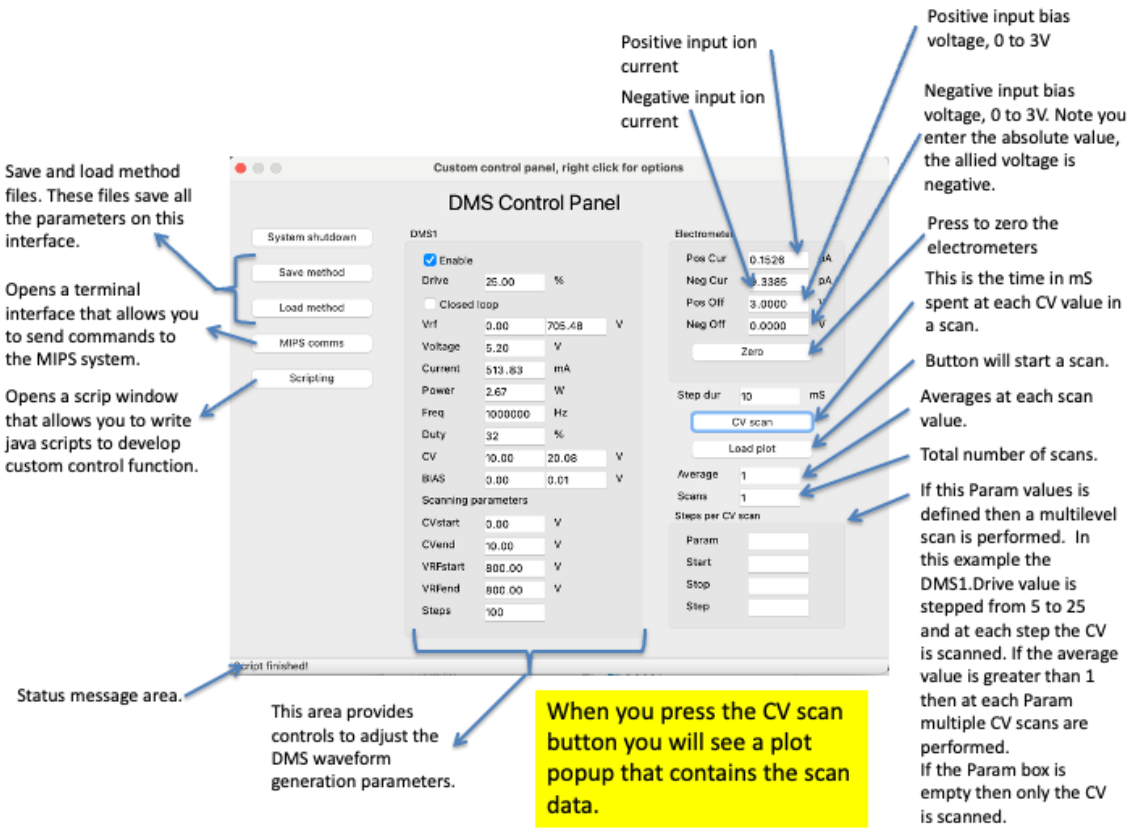


The image below shows the typical waveforms you should expect to see using the FAIMSfb system. The ripple you see on the base line is due to leakage inductance in the flyback transformer and the waveform shape will change based on your load capacitance and operating frequency.





DMS system with dual electrometer installed. For this interface the control panel file included with your system is named DMS.cfg.



Warrantee

GAA Custom Electronics, LLC warrantees the MIPS system to be free from defects in materials and workmanship and will repair or replace the unit for a period of one year. This warrantee assumes the system is operated in compliance with the procedures and recommendation outlines in this document. GAA Custom Electronics, LLC will also provide free phone support and firmware bug fixes for up to one year. The addition of new features is not covered in this warrantee.

Liability

The liability of GAA Custom Electronics, LLC hereunder or otherwise is solely and exclusively limited to replacement, repair or credit at the purchase price, as GAA Custom Electronics, LLC may elect, for any product which is returned by Buyer during the applicable warranty period, or services for which timely notice of defect has been given by Buyer, and which are found by GAA Custom Electronics, LLC to be subject to adjustment under this warranty. IN NO EVENT SHALL GAA Custom Electronics, LLC BE LIABLE FOR SPECIAL, INDIRECT,

INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSS OF ANTICIPATED PROFIT OR OTHER ECONOMIC LOSS OR FOR ANY DAMAGES ARISING IN TORT WHETHER BY REASON OF STRICT LIABILITY, NEGLIGENCE OR OTHERWISE.