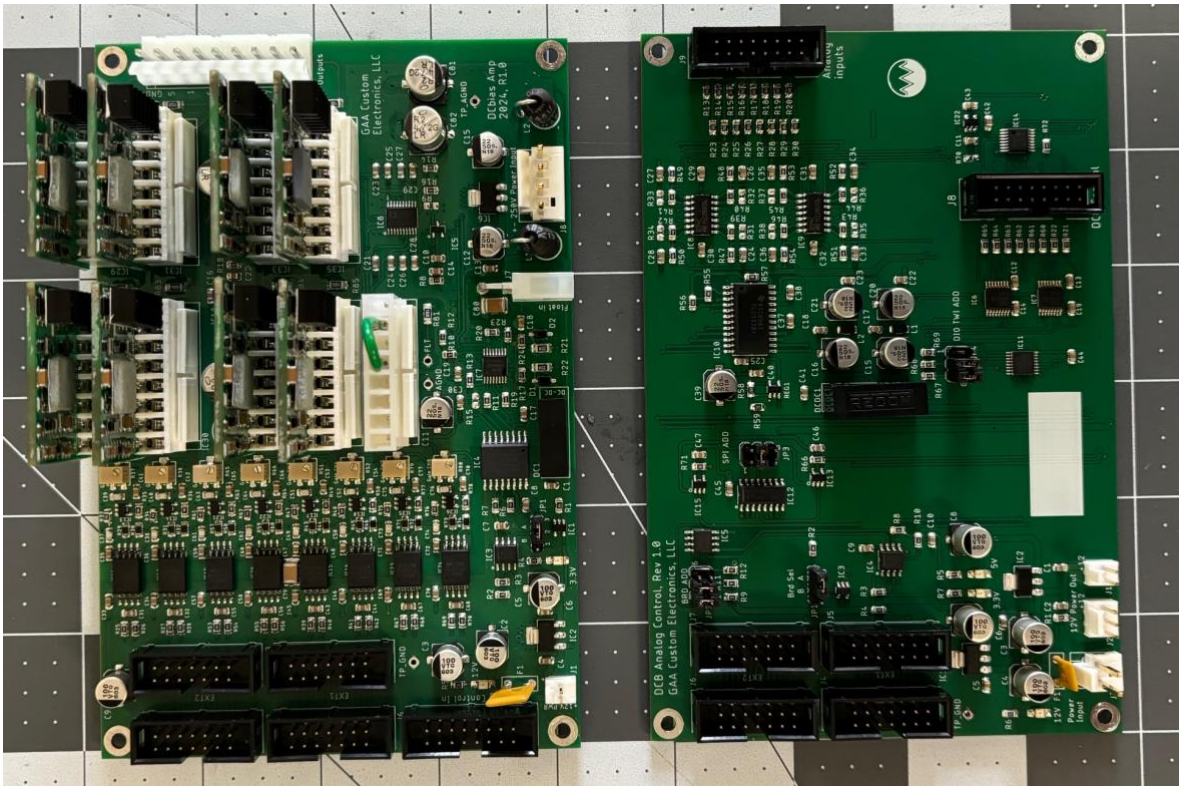
DCBias Analog Control System
August 25, 2024



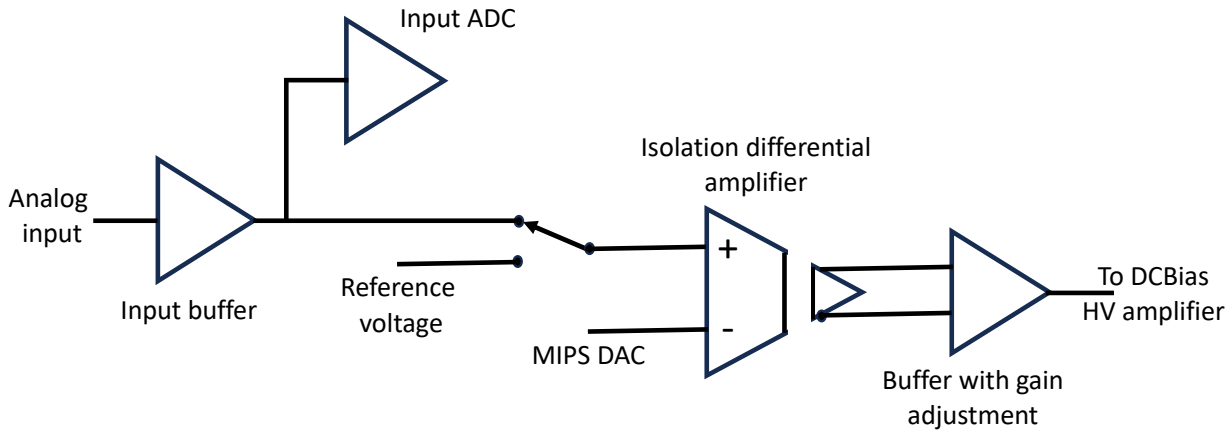
The DCBias analog control system is a two-board set that provides all the features of the DCBias module with added capability to allow an external analog input voltage to control the DCBias output voltage. The standard configuration accepts +/-10V analog inputs and generates +/- 250V outputs. This system also has an 8 channel 14-bit ADC to allow monitoring the input analog control voltage. The user can select, channel-by-channel, output control via MIPS or the external analog input. This configuration can be changed via a control command at any time. The DCBias output channels are ground isolated and a float input allows the user to apply a float voltage, +/- 250V, that is common to all outputs on the module.

A total of four of these two board sets can be installed in one MIPS system. The default DCBias control firmware manages all the common features while an additionally firmware modules detect the presents of this system and loads the additional drivers and host commands.

The added features provided by this system can only be controlled using the host interface and the add commands defined later in this document.

The configuration settings and calibration parameters for this analog control system are saved on the corresponding DCBias module's EEPROM. This EEPROM is located on the control board and uses the standard addressing for a DCBias module. The additional parameters are saved after the DCBias parameter in the same EEPROM. This allows the user to save the configuration desired and on powerup the saved settings are applied.

The block diagram below shows the analog control system's low voltage signal path. This illustrates the signal path for one channel, each module has eight sets of this signal path. The switch allows selecting between ADC control or MIPS control of the output voltage. This switch is controlled by MIPS and can be changed at any time. The buffer amplifier after the isolation amplifier has a gain adjustment resistor, this is use to set the gain for each channel when in the ADC mode. The MIPS DAC serves two purposes; when in the ADC mode this DAC provides offset control, in the MIPS mode this DAC controls the output voltage.



Low voltage signal path

The following commands are automatically enabled when an analog control system is detected.

DCBCLOAD,ch

This command will load the saved parameters for the analog control system defined by channel number (ch). Note that all the parameters are loaded for all the channels on the module defined by the channel number.

DCBCSAVE,ch

This command will save the parameters for the analog control system defined by channel number (ch). Note that all the parameters are saved for all the channels on the module defined by the channel number.

DCBCFORMAT,ch

This command will format the data storage for the analog control system defined by channel number (ch). Formatting will erase all the parameters and set to default values; this will result in the loss of all calibration data. This command is used for initial system setup. Note that all the parameters are saved for all the channels on the module defined by the channel number.

SDCBCMD,ch,MIPS|ADC

This command will define the channel mode for the channel number (ch) defined. Valid modes are MIPS and ADC, MIPS indicates the MIPS controller will control the output channels voltage, ADC indicate the output voltage is controlled by the corresponding analog input channel.

GDCBCMD,ch

This command will report the mode for the channel number (ch) defined. The mode is either MIPS or ADC.

SDCBCOF,ch,cnt

This command will set the output DC voltage offset when a channel is in ADC mode for the channel number (ch) defined. The parameter cnt is the DAC raw counts in range of 0 to 65535. This number is defined in the factory when the system is initial calibrated, this value is typically in range of 200 to 400. The user should not use this command. It is possible to apply a negative offset for a channel using this command, the output DC offset is approximately equal to -0.00776 * cnt.

GDCBCOF,ch

This command will return the offset cnt value for the channel number (ch) defined.

GDCBCADCch

This command returns the analog voltage read from the ADC channel (ch) defined. The returned value is in volts and typically calibrated in the +/-10V range.

CALDCBCCH,ch

This command is used to calibrate the ADC channel number (ch) defined. The system will ask the user to enter voltages and will then calculate calibration parameters. This is a factory setup command and should not be used in the field.

System calibration

This system calibration requires a number of steps performed the order listed in the outline below. This procedure defines how calibration is performed in the factory and is not intended for end users to perform this procedure.

1.) The first step is to define the input buffers gain or attenuation needed to generate +/-2.5 volts on its output. The standard configuration of +/-10V operation is done using a input resistive divider of 75K and 25K, this also provides a 100K input impedance.
2.) With the system in MIPS control mode calibrate the DCBias module offset channel using the CDCBOFF command.
3.) Set the mode to ADC for the channel you are calibrating.
4.) Apply a 100Hz sin wave signal to the analog input channel you are calibrating, set the Vpp to span a range of about 125Vpp out of the amplifier.
5.) Adjust the gain resistor on the channel you are calibrating to reach the proper voltage.
6.) Remove the input AC signal and monitor the output with a volt meter. Use the SDCBCOF command to set the offset voltage to zero.
7.) Set the channels mode to MIPS and use the CDCBCH command to calibrate the DCBias channel.
8.) When all channels are complete use the SAVEM,DCB, and DCBCSAVE,ch commands to save the calibration data.