WiRobot™
The Heart of Robot

MSA3502 Two-channel General-purpose Signal Amplifier Module User Manual

DrRobot®

Version: 1.0.1

July 2004

Table of Contents

Dr.Robot®
www.DrRobot.com
25 Valleywood Dr., Unit 20, Markham, ON, L3R 5L9 Canada Tel: (905) 943-9572 Fax: (905) 943-9197

I. Introduction

The MSA3502 Two-channel General-purpose Signal Amplifier Module offers two independent channels for weak signal amplifying targeting sensor interfacing applications. For each channel, there are two potentiometers for input center-point adjusting and gain adjustment, and an active low pass filter for signal conditioning. The MSA3502 is suitable for low voltage, low power, and low frequency applications.

Features

- Single power supply
- Two single-ended uni-polar signal inputs: 0 to power supply voltage
- Rail-to-rail input/output
- Gain adjustment: from 0.5 to 50, continuously
- Input signal center-point adjustment: from 0 to power supply voltage, continuously
- Low-pass filter cut-off frequency: 30 Hz
- Accuracy: ±2%

Applications

- Sensor signal conditioning
- Weak signal amplifying

II. Operations

The MSA3502 Module is designed to run as part of the WiRobot system. It can be used for interfacing to custom sensor expansions. With proper power supply, the output signals from the MSA3502 can be directly connected to the custom A/D expansion connector on the PMS5005 Robot Sensing and Motion Controller board.

II.1. Amplifying Equation

The amplifying equation of the MSA3502 is as following

$$VOUT = VCP + AG * (VCP - VIN)$$

Where

VOUT = Output voltage

VIN = Input voltage

VCP = Center point voltage of input signal

AG = Gain

II.2. Gain Selection

The adjustable gain is selected and applied to an input signal as a multiplication factor as shown in Section II.1. You should adjust the gain so that the amplified signal in the range which can be measured and processed accurately and easily by a standard analog to digital converter (ADC) such as the one on the PMS5005 controller board.

For example, if the ADC handles signals in 0 to 3V range and the signal to be measured is in the range of 0 to 300 mV (VCP ± 150mV), you would use a gain of 10 to amplify the signal to the ADC input range. Similarly, if the measured signal is in the range of ADC input, a gain of 1 could be selected and the signal will not be amplified while only the low pass filter on the MSA3502 is used for the signal conditioning.

Dr.Robot® www.DrRobot.com
25 Valleywood Dr., Unit 20, Markham, ON, L3R 5L9 Canada Tel: (905) 943-9572 Fax: (905) 943-9197

II.3. Calibration

The MSA3502 board is initially calibrated at the factory, with VCP = 1.5V and AG = 10. However, this may not be suitable for your applications and you should calibrate the MSA3502 board before connecting it into your system. Moreover, you are advised to check the calibration every six months and to calibrate again when necessary.

II.3.1. Equipment Required

The equipment requirements for calibrating a MSA3502 board are as follows:

- A digital voltmeter accurate to a minimum of 4 1/2 digits
- An adjustable 0 to 3 V voltage signal source
- A fix 3 V DC power supply

The procedure is described as follows (taking the calibration for channel #1 at VCP = 1.5V and AG = 10, under 3 volts):

Step #1: Power the MSA3502 though the Signal Output connector with the 3V DC power supply.

Step #2: Adjust the Gain Pot so that it is closed to yield maximum gain.

Step #3: Apply VIN = VCP = 1.5V to the signal input of Channel #1.

Step #4: Adjust the Zero Pot so that the output signal of Channel #1 VOUT = VCP.

Step #5: Apply VIN = 1.5V + 75 mV = 1.575 V to the signal input of Channel #1.

Step #6: Adjust the Gain Pot so that the output-signal of Channel #1

VOUT = 1.5 V - 750 mV = 0.75 V.

Step #7: Check VIN = 1.5 V, 1.5 V – 50 mV, 1.5 V – 100 mV, 1.5 V – 150mV, 1.5 V + 50 mV,

1.5 V + 100 mV, and 1.5 V + 150 mV to make sure everything is okay.

III. Connections

III.1. Board Structure

Figure III.1 illustrates the structure of the board and the potentiometers and signal input/output connectors.

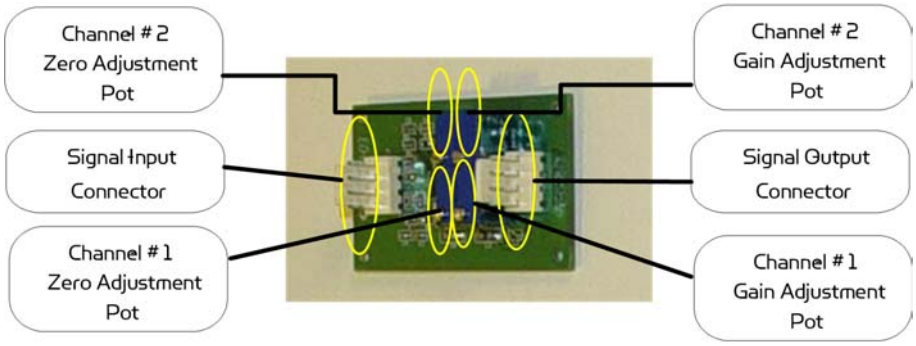

Figure III.1 MSA3502 Structure

III.2. Connector Description

Both of the signal input and signal output connectors on the MSA3502 are 4-pin 2.54 mm-pitch single row connectors. The signal connections are listed in the Table III.1 and III.2.

Dr.Robot®
www.DrRobot.com
25 Valleywood Dr., Unit 20, Markham, ON, L3R 5L9 Canada Tel: (905) 943-9572 Fax: (905) 943-9197

Table III.1 Signal Output Connector TO_AD

Pin	Name	Function
1	V_{CCA}	Positive power source
2	SOUT1	Channel #1 analog signal output
3	SOUT2	Channel #2 analog signal output
4	GND	Signal ground

Table III.2 Signal Input Connector SENSOR

Pin	Name	Function
1	V_{CCS}	Positive power supply output for sensors
2	SIN1	Channel #1 small analog signal input
3	SIN2	Channel #2 small analog signal input
4	GND	Signal ground

III.3. Signal Connections

When you wire signals to the analog input channels, you are advised to wire the unused channel to GND. This action prevents the signal amplifiers from saturating, and ensures the accuracy of the sensor data. Please avoid any ground loop in the connections of the sensors, the MSA3502 board and the WiRobot system.

Data acquisition systems provide access to inputs of the system. In any case, do not mix your sensor inputs with the high voltage AC or DC lines, or you risk damaging the system. An inadvertent short between sensor signal line and power lines can cause extensive and costly damage to your system. The manufacturer can accept no liability for this type of accident. To prevent this happen, use the following precautions:

- Avoid direct connections to the high voltage lines.
- Make sure all connections are tight so that signal wires are not likely to come loose and short to high voltages.
- Where necessary, use isolation amplifiers and transformers.

IV. Specifications

Table IV.1 MSA3502 Specification

Parameter	Conditions	MIN	TYP	MAX	Unit
Power Supply Voltage (V_{CCA})		1.8	3	5.0	V
Current Consumption	Excluding power output from V_{CCS}			2	mA
Power Output Voltage	V_{CCS}	1.8		V_{CCA}	V
Power Output Current	V_{CCS}			50	mA
Gain Range		0.5		50	
Input signal center-point adjustment		0		V_{CCA}	V
Low-pass filter cut-off frequency			30		Hz
Accuracy			±2		%
Board Size			30 x 48		mm x mm

Dr.Robot® www.DrRobot.com
25 Valleywood Dr., Unit 20, Markham, ON, L3R 5L9 Canada Tel: (905) 943-9572 Fax: (905) 943-9197