SGA2

Strain Gauge Amplifier

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Thank you!

Thank you for purchasing Elsys Strain Gauge
Measurement Equipment.
For more information, please visit
www.elsys-instruments.com

Notice

The information in this document is subject to
change without notice.

Safety Information

This instrument is intended for indoor use and
should be operated in a clean, dry environ-
ment. Do not block any ventilation openings.

Make sure this product's operating environ-
ment is kept within the parameters as specified
in the chapter Operating Condition!

The design of the instrument has been verified
to conform to the EN 61010-1 safety standard
per the following limits:

- Installation (Over voltage)
- Category II (Main Supply Connector) and
  Category I (Measuring Terminals)
- Pollution Degree 2
- Protection Class I

Warning (Rack Unit only)

Lethal voltages exist inside the instrument.
Only qualified technicians of supplier staff are
authorized to open the case of the Base Unit.
Otherwise warranty will be lost!

Always ensure that power cord is removed
before opening the case.

Content

1. Introduction

1.1 Overview

The Strain Gauge Amplifier SGA-2 MK2 is designed as a differential front-end amplifier to connect full, half or ¼ bridge strain gauges with internal bridge completion.

The amplifier is available as a 2-channel boxed version or as a multi-channel rack system.

Typical Applications:
- Deformation testing for material characterization
- High speed dynamic material deformation
- Load Cell measurements

1.2 Key Capabilities

- Internal ½- and ¼ bridge completion
- Two independent channels per module
- Gain x1, x10, x100
- 4-wire and 6-wire technique
- 1.5 MHz bandwidth at gain x1, x10
- Low offset voltage drift
- Low output noise
- Auto-Offset compensation
- USB or RS485 interface for configuring all settings and read back of the actual output signal.
- Different input connector variant available (6-Pin, 7-Pin and 16-Pin)

2-Channel Boxed Variant
- 2-Channel modules SGA-Box/6, SGA-Box/7 or SGA-Box/16

- USB interface (emulated COM port)

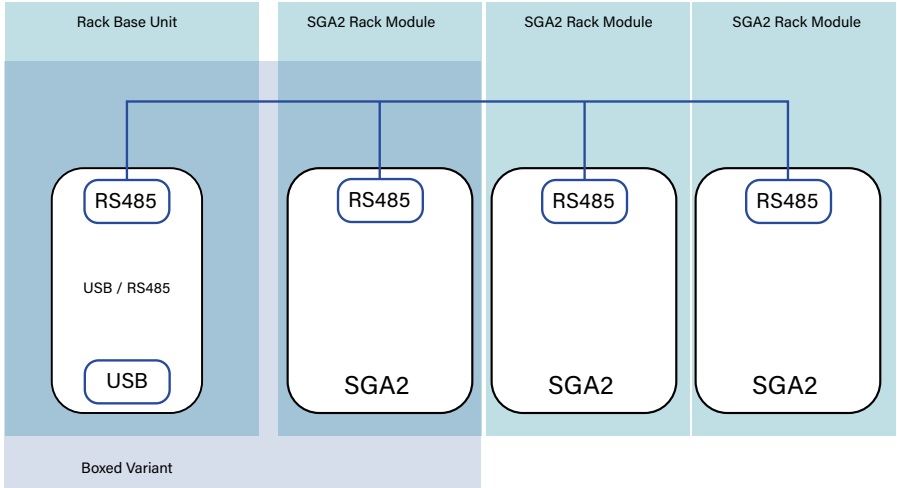- External power supply

Multi-Channel Rack Version
- 2-Channel Rack-Modules SGA-Box/6, SGA-P/7 or SGA-P/16
- Amp-BU-10

(for up to 5 modules / 10 channels)
- Amp-BU-24
  (for up to 12 modules / 24 channels)
- USB interface (emulated COM port) for accessing all installed amplifier (Internally over RS485)

2. Communication

All SGA modules have a RS485 interface. For the boxed version, each box comes with an USB to RS485 converter module. RS485 interface is used as a unidirectional interface.

| Rack Base Unit | SGA2 Rack Module | SGA2 Rack Module | SGA2 Rack Module |

RS485   RS485   RS485   RS485

USB / RS485

USB   SGA2   SGA2   SGA2

Boxed Variant

The Rack version uses a so called Base Unit with a built in USB to RS485 converter module. The USB module uses a standard FTDI chip and its FTDI drivers. After installation of the drivers the module will be listed in the windows device manager as a USB Serial Port.

The number of the Serial Port, in this example COM9 depends on the configuration and already used ports on the final system. There is no need to do change any settings in the device manager, this should be done with software or configuration tool itself.

USB Serial Port (COM9)

2.1 Serial Port Settings

Use the following settings to communicate with the modules:

Settings	Value
Baud	19'200
Data Bits	8
Stop Bits	1
Parity	None

2.2 Driver Download

Download the drivers for the USB to RS485 converter chip directly from the FTDI web-site: www.ftdichip.com/Drivers/VCP.html

3. Recommended Tools

Main tool for using the SGA mk2 modules is the Elsys SGA 2.0 Application. It allows to configure the SGA modules directly. It can be downloaded from the website
www.elsys-instruments.com
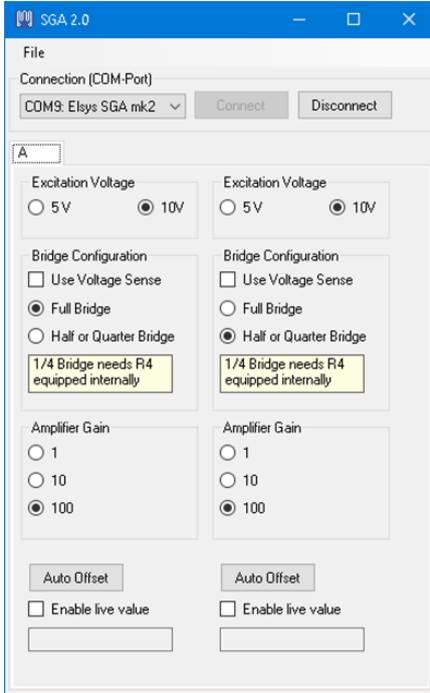
3.1 Serial Terminal
A very useful tool for testing is HTerm, this can be downloaded here:
https://www.der-hammer.info/terminal/

4. Serial Protocol

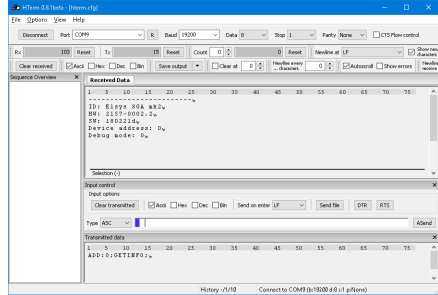The used protocol is based on simple string commands and parameters, which makes it easy to understand and to use. The syntax is always: **COMMAND:VALUE;**

4.1 Addressing
The ADD:n; and CHN:n; parameters can be used to select a specific device or channel.

Some Parameters are broadcast messages, which can be used for either all available channel or one specific channel.

4.2 Info
Some functions and commands are meant to get information from the device.

- ADD:0;GETINFO; returns multiple lines with information about hard and software.

- GETADD; is a Broadcast command and returns the Address of all connected SGA boards. A delay form approx. 100ms. will be between each reply.

- ADD:0;SETDEBUG:1; enables the debug output which will give much more detailed feedback regarding settings etc..

  It's not recommended to use SETDEBUG:1; in combination with the SGA 2.0 tool.

4.3 System
System functions are meant for configuration and calibration. CALIB; can be used to activate the zero-offset compensation. It can also be used for the factory calibration, means parameters stored with the command CALIB:666; will be restored in combination with the command RESTORE;.
The command RESET; is used to return from the software configuration back to the hardware configuration.

4.4 Write Settings
Commands like SETGAIN, SETEX, SETHBEXT and SETWI will be used for the software configuration. These settings can also be done with the Dip-Switches on each board.
SETADC will be used for the calibration of its internal ADCs. The scaling of the return value of GETADC can be changed with this function.

4.5 Example ADC calibration

The function SETADC is used to parametrize the return value of the GETADC command. The return value of GETADC is calculated according:

$$PhysVal = ADCval * m + Offset$$

In this standard linear calculation, m is defined as slope, Offset as the adjusted zero offset compensated value. In the Standard and factory setting, the return value for GETADC is calibrated to voltages, the value as the output signal of the SGA mk2. These settings can be changed or recalibrated, in case of scaling to another physical unit, e.g. re-turn value should be a Force instead of Voltages. Recalibration has to be done according the following procedure:

1.) Zero offset compensation

Make sure the input signal is 0, enter command for calibration, this will define value for Offset.

ADD:0;CHN:1;CALIB;

2.) Positive value

Feed a positive signal to the input of the SGA mk2, enter its value in Volt or any other physical unit, e.g. 4.9V

ADD:0;CHN:1;SETADC:4.9;

3.) Negative value

Feed a negative signal to the input of the SGA mk2, enter its value in Volt or any other physical unit, e.g. -4.9V

ADD:0;CHN:1;SETADC:-4.9;

It is necessary to perform all three of these steps, calibration hast to be done first. Parameter m will be calculated from the difference of the two defined values (positive and negative). After the three steps, ADD:0;CHN:1;GETADC; returns the measured voltage as the defined physical unit.

To get more information regarding the status of each step, enter ADD:0;SETDEBUG:1; into the terminal console.

4.6 Read Settings

Commands like GETGAIN, GETEX, GETH-BEXT and GETWI will be used to get the actual used configuration. GETMODE returns information if hardware or software settings are active.

GETADC returns an actual output signal of the SGA.

Please note this command is meant to get an overview and is not for high precision measurement. Accuracy will be approx. 2%.

GETOFFSET returns the used range for offset compensation. Values will be between -50% up to +50%. This function is also meant to get information about an abnormal calibrated bridge, or damaged sensors.

5. Commands

Parameter (String)	Value	Return	Broad-cast	All Chn	Description
Addressing					
ADD	0 — 15	-	-	-	Address of the device
CHN	1, 2, n	-	-	-	Channel 1, 2 or both
Info					
GETINFO	-	multiple lines	no	-	returs ID, HW SW, ADD
GETID	-	Elsys SGA 2.0	no	-	Description
GETHW	-	2157-2002.2	no	-	HW Revision
GETSW	-	yymmddRev	no	-	SW Revision, e.g: 180105a
GETADD	-	0 — 15	yes	-	Address, Rotary switch position
GETMODE	-	0, 1	no	no	0=HW settings, 1=SW
ECHO	-	0 — 15	no	-	Returns Address, if alive
SETDEBUG	-	0	no	-	1 more detailed output, any other value than 1 will be equal to SETDEBUG:0;
System					
CALIB	none, 666	0, -1 + ErrorCode	yes	yes	CALIB; offset compensation, CALIB:666; does the same, but saves the values as factory settings, this can be reloaded with RESTORE Return value will be 0/1 for the command, afterwards 0 per channel for a successfully calibration. A fail will be return with a minus for its gain, e.g. -110 means fail for Gain 10 and Gain 100
RESTORE	-	0	yes	yes	Restore to Main Calibration Settings, saved with CALIB
RESET	-	0	yes	yes	Reset to HW settings
WIPE	666	0, -1	no	-	Wipe Eeprom Settings (CALIB and ADC)
Write Settings					
SETGAIN	1, 10, 100	0, -1	yes	yes	Set SW gain 1, 10, 100
SETADC	[Voltage]	0, -1	no	no	Set ADC Value, scaling to
SETEX	5, 10	0, -1	yes	yes	Excitation voltage
SETHBEXT	0, 1	0, -1	yes	yes	Half Bridge Extern 0=intern=LED on
SETWI	4, 6	0, -1	yes	yes	4/6 Wire
SETRE	0, 1	0, -1	yes	yes	Reserve
Read Settings					
GETADC		[Voltage]	no	no	Read ADC value
GETOFFSET		[Offset%]	no	no	Read DAC Offset, -50% —+50%
GETGAIN		1, 10 , 100	no	no	Read current Gain settings
GETEX		5, 10	no	no	Excitation voltage
GETHBEXT		0, 1	no	no	Half bridge Extern 0=intern
GETWI		4, 6	no	no	4/6 Wire
GETRE		0, 1	no	no	Reserve

6. Examples

Some examples on how to use the commands
to control an SGA-2mk2 device:

Command	Description
CALIB;	Broadcast, all channels starts a Zero Offset compensation
ADD:0;CALIB;	First device, both channels starts a Zero Offset compensation
ADD:0;CHN:1;CALIB;	First, device, first channels starts a Zero Offset compensation
SETGAIN:1;	Broadcast, all channels set gain to 1
ADD:0;CHN:2;SETGAIN:10;	First, device, second channels set gain to 10
GETADD;	Every connected SGA module replies its Board Address, with a delay according to its number. If there are any boards missing or unexpected characters, there could be two or more boards with the same address
ADD:0;CHN:1;GETADC;	Read the ADC value of the first device, first channel. Factory settings is set to voltages according the output signal. Please note that the built in ADC works slow, it's meant for read out the current position of a sensor and not for high speed acquisition.

File Revision:

Date	Description
09.11.2023	Manual Update