TELECO
SHM SYSTEMS

TGA102

CONFIGURATION AND USER'S MANUAL

TELECO Spa
Via E.Majorana, 49
48022 LUGO (RA) Italy
Tel. 0545 25037 Fax 0545 32064
www.telecoshmsystems.com

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I. INTRODUCTION

The TGA102 analog data acquisition unit is a flexible unit that can be inserted on the bus of a Teleco SHM602 system to acquire and store measures obtained from a wide range of analog transducers like strain gauges, load cells, thermocouples, temperature, pressure and position transducers, piezoelectric accelerometers, gyros etc.

The high configurability level of the TGA102 relies on choices that are taken into account at a fabrication level and must, consequently, be selected at the ordering stage, and on choices that can be modified at will by the user when desired. This document describes the choices to be performed when a TGA102 unit is ordered and the tailoring that can be performed by the user.

II. GENERAL DESCRIPTION AND ORDER OPTIONS

The TGA102 is a two-channel analog data acquisition unit whose bus is compatible with the SHM602 standard; these units can thus be mixed with accelerometric units TSM02 in a SHM system or be used for realizing data acquisition and storage systems (data loggers) for a wide range of applications. In both cases the control and storage unit is the Teleco TSD10.

The input of every channel relies on a state-of-the-art instrumentation amplifier whose differential input, in many applications, is generated by a bridge where the sensing element is inserted. It is also possible, of course, to configure the input for acquiring unbalanced signals. The TGA102 generates internally the regulated voltage for powering the measure bridges.

The unit is offered in two versions that differ only for what concerns the overall gain. The TGA102A has a channel gain of 10 or 100 (selectable by the users, by means of internal jumpers); the channels can be set, if desired, at different gain values (e.g. G=10 for the first channel and G=100 for the second or vice-versa). Also the TGA102B allows the users to select the channel gains by means of internal jumpers; in this case the gain can be selected at 1 or at one of the following values (to be selected at the order): 2, 10, 100, 200. On special order it is also possible to deliver TGA102A/B units whose first channel can be set at G=10 or G=100 while the second can be set at one of the following couples of gains: G=1, G=2; G=1, G=10; G=1, G=100; G=1, G=200.

The second choice that must be performed at the ordering level concerns the voltage generated by the unit to power the input bridges (if present). The available values are: 2V, 5V and 10V. A single power supply is present (both bridges, if present, are fed by the same voltage) and the total maximal allowed current is 100mA.

The third choice concerns the value of the resistances in the arms of the bridges; the selectable values are 120Ω (0.1%) or 350Ω (0.1%). Different values require external components to be properly connected by the user.

The following tables can be used to configure the TGA102A , TGA102B and the single channels of the TGA102A/B.

TGA102A configuration table			
Bridge voltage	2V	5V	10V
Bridge 1 configuration	Full bridge	Half bridge	No bridge
Bridge 1 resistance	120Ω	350Ω	
Bridge 2 configuration	Full bridge	Half bridge	No bridge
Bridge 2 resistance	120Ω	350Ω	

TGA102B configuration table				
Bridge voltage	2V	5V	10V	
Channel gains	1/2	1/10	1/100	1/200
Bridge 1 configuration	Full bridge	Half bridge	No bridge	
Bridge 1 resistance	120Ω	350Ω		
Bridge 2 configuration	Full bridge	Half bridge	No bridge	
Bridge 2 resistance	120Ω	350Ω		

TGA102A/B configuration table				
Bridge voltage	2V	5V	10V	
Channel gains	1/2	1/10	1/100	1/200
Bridge 1 configuration	Full bridge	Half bridge	No bridge	
Bridge 1 resistance	120Ω	350Ω		
Bridge 2 configuration	Full bridge	Half bridge	No bridge	
Bridge 2 resistance	120Ω	350Ω		

III. CONNECTIONS AND USER SETTINGS

A picture of the TGA102 unit is reported in Figure 1. The four-pins connectors denoted as Bus Input and Bus Output are standard SHM602 bus connectors.

Figure 1 – The TGA102 analog data acquisition unit

These connectors are symmetrical and their pins correspond to the following connections:

Pin 1	A+ (bus 485)
Pin 2	B– (bus 485)
Pin 3	+12V
Pin 4	GND

Table I – TGA102 bus connections

The 6-pins connectors denoted as Analog Input 1 and Analog Input 2 allow the access to the inputs of the instrumentation amplifiers of channels 1 and 2 and to the bridge power supply. Their pins correspond to the following connections:

Pin 1	Instr. ampl. non inverting input
Pin 2	Instr. ampl. inverting input

Pin 3	GND
Pin 4	Bridge power supply (+)
Pin 5	Not connected
Pin 6	Not connected

Table II – TGA102 input connections

The printed circuit of the TGA102 is shown in Figure 3 where the arrows indicate the jumpers J6, J8, J9, J11, J12 and J13 that can be configured by the user as described in the following.

GAIN CONFIGURATION

TGA102A: Leave J12 (channel 1) open for G=10, close for G=100. Leave J13 (channel 2) open for G=10, close for G=100.

TGA102B: Leave J12 (channel 1) open for G=1, close for G equal to the value set in the production stage (2, 10, 100 or 200). Leave J13 (channel 2) open for G=1, close for G equal to the value set in the production stage (2, 10, 100 or 200).

TGA102A/B: Leave J12 (channel 1) open for G=10, close for G=100. Leave J13 (channel 2) open for G=1, close for G equal to the value set in the production stage (2, 10, 100 or 200).

Before describing the possible setting of J6, J8, J9 and J11 it can be useful to consider some examples concerning the possible connections of the TGA102.

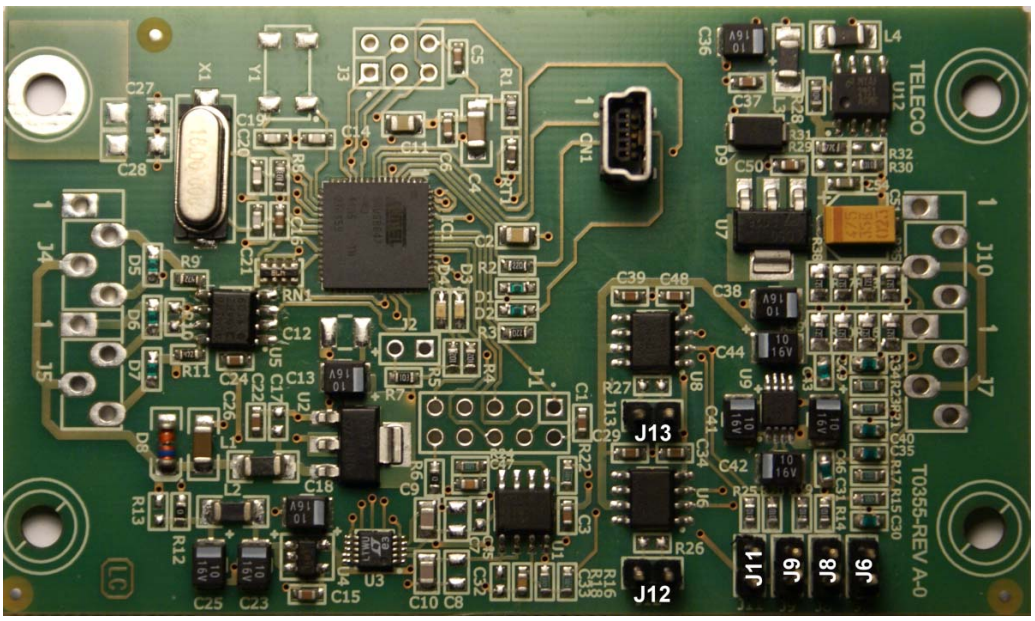

Figure 3 – Printed circuit board of the TGA102

EXAMPLE 1

This example concerns one of the most common configurations in which an external resistive sensor is inserted in a bridge configuration. The circuit relies on a standard internal bridge (350Ω in this case) and on an external load cell TC4 with a nominal resistance of 350 Ω. The connections are the following.

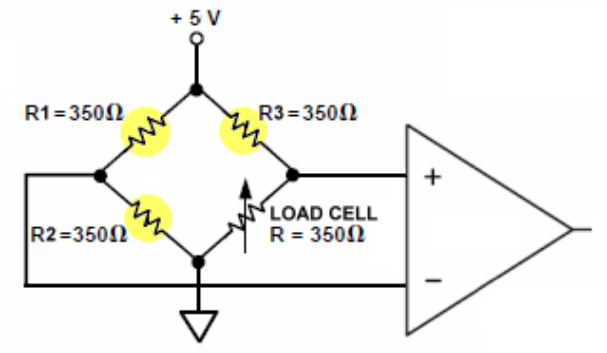

Figure 4 – Connection of a resistive sensor in bridge configuration (internal bridge, 350Ω)

In this case the required bridge resistances have standard values and can be mounted internally during the production stage so that all that is necessary is the connection of the load cell to pins 1 and 2 of the connector. The resistances R1, R2 and R3 are allocated inside the TGA102. Ordering option: Full bridge, 350Ω.

EXAMPLE 2

This example is quite similar to the previous one since it concerns a resistive strain gauge still connected in a full bridge configuration. The nominal value of the strain gauge is, however, 1200Ω and the TGA102 is not available with pre-mounted bridge resistances having this value. It will thus be necessary to configure the bridge externally and perform a connection by using all four pins. Ordering option: No bridge.

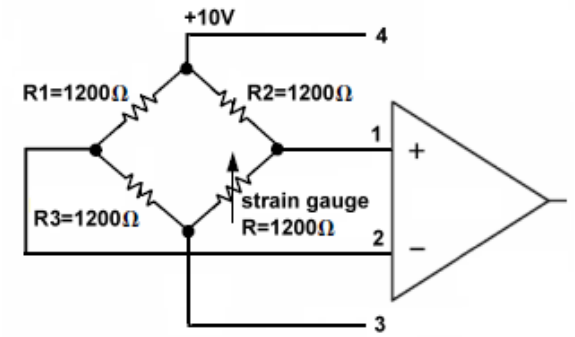

Figure 5 – Connection of a resistive sensor in bridge configuration (external bridge)

EXAMPLE 3

Also this example concerns a bridge connection. In this case we have four resistive strain gauges connected in a bridge configuration. The connection is the same as in Example 2 and also in this case no bridge components are mounted inside the TGA102. Ordering option: No bridge.

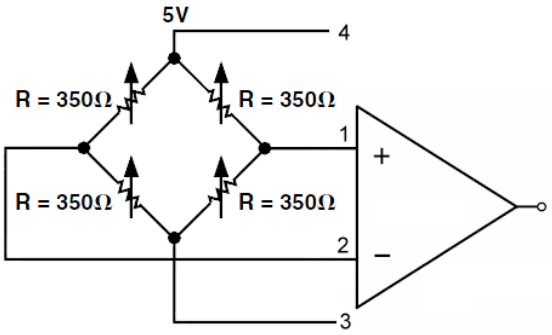

Figure 6 – External bridge of resistive sensors (strain gauges)

EXAMPLE 4

In this case we have two external strain gauges connected in a bridge configuration. Only two resistances (R1 and R2) will be mounted inside the TGA102. If the resistance of the sensors differs from 120Ω or 350Ω, also these resistances must be mounted outside the TGA102.

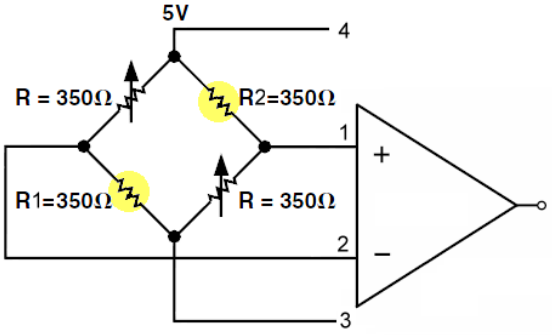

Figure 7 – Connection of two strain gauges in full bridge configuration

The resistances R1 and R2 are mounted inside the TGA102. Ordering option: Half bridge, 350Ω.

EXAMPLE 5

This example concerns the connection to the TGA102 of a pressure transducer MPX4115AP that requires a 5V power supply and is not endowed with a differential output. The inverting input of the TGA102 (pin 2) has thus been connected to ground (pin 3) in a single-ended configuration. Ordering option: No bridge.

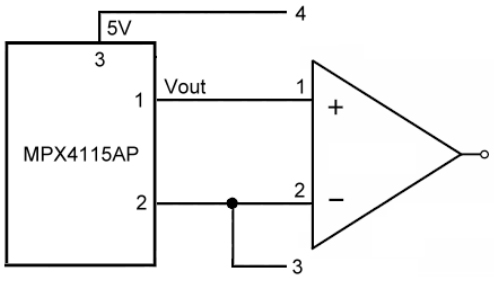

Figure 8 – Single-ended connection of a pressure transducer

EXAMPLE 6

This example refers to the connection to the TGA102 of a thermocouple. This transducer can be simply connected to the differential inputs (pins 1 and 2). Such a floating connection would not leave, however, any ground return path for the bias currents of the inputs; this is obtained by connecting to ground one of the inputs. The low resistance of the thermocouple provides a path also for the non inverting input. Ordering option: No bridge.

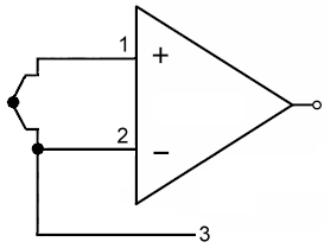

Figure 9 – Connection of a thermocouple to a TGA102

EXAMPLE 9

This example is similar to the previous one in that it refers to a source of input signals, a piezoelectric transducer, that can be connected directly to the differential inputs but that does not offer any ground return path for the input bias currents. The necessary paths are obtained by means of the 100KΩ resistances. Note that, because of the high impedance of the transducer, it is necessary to implement, differently from Example 6, two separate paths. The 100 KΩ resistances are mounted inside the TGA102. Ordering option: No bridge.

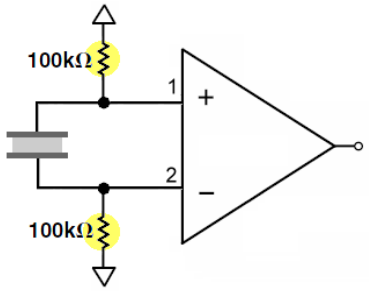

Figure 10 – Connection of a piezoelectric transducer to a TGA102

CONFIGURATION OF THE INPUT BIAS CURRENTS GROUND PATHS

When necessary (see Example 9) the ground paths for the input bias currents can be configured by means of the jumpers J6, J8, J9 and J11, according with the following table.

Input bias currents return paths settings		
J6	Channel 1, inverting	100 KΩ
J8	Channel 1, non inverting	100 KΩ
J9	Channel 2, inverting	100 KΩ
J11	Channel 2, non inverting	100 KΩ

TGA02 SPECIFICATIONS

Gain: 10 / 100 (user selectable, TGA102A); 1 / 2, 10, 100, 200 (user selectable, TGA102B)
Output range: ±4000 mV
Output resolution: 16 bit @ 20Hz acquisition rate
Max. gain error: 0.15%
Operating temperature: -20°C +80°C
Max. error over temperature at G=100 (intrinsic)[1]: 0.004% of output range /°C
Max. error over temperature at G=100 (bridge)[2]: 0.006% of output range /°C
Input resistance (dc): 10 GΩ
Input range[3]: ±4.0V (G=1), ±400mV (G=10), ±40mV (G=100), ±20mV (G=200)
Input offset[3]: ±8.0V
Max. admissible input voltage: ±20V
Max. admissible differential input voltage: ±20V

[1] Shorted inputs
[2] Using internal bridge and power supply
[3] The maximal voltage on the input pins (input + offset) must not exceed 8V or be lower than -8V. This condition should be checked when G=1.