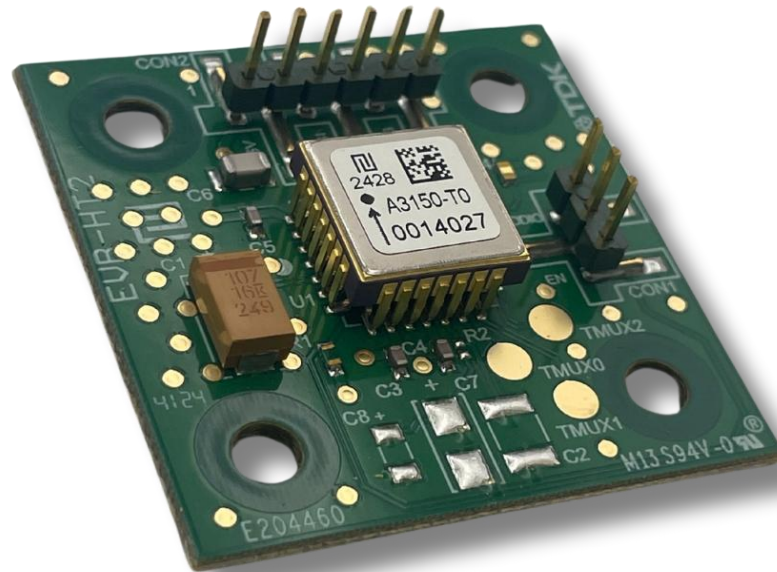


## AXO315T Evaluation Board User Manual



### 1. Key Features of Tronics EVB-HT2

- Printed Circuit Board for evaluation of High Temperature AXO315T MEMS accelerometer
- Includes 1 inertial sensor and external passive components
- 5V single power supply
- 5V, 3.3V and 1.8V compatibility communication interface
- High Temperature Polyimide PCB material
- High Temperature components and solder paste

### 2. Introduction

Tronics-EVB HT2 evaluation board is intended to perform characterizations of AXO<sup>®</sup>315T High Temperature Series easily and achieving best performances. Tronics-EVB HT2 was specially designed to be used for wide temperature range [-30°C to +175°C].

The 1.8V, 3.3V and 5V compatibility for SPI communication also enables connecting the Tronics-EVB HT2 with most of the acquisition systems and microcontrollers in the market.

This document describes the mechanical and electrical features of the Tronics-EVB HT2 board as well as the SPI protocol used for the digital communication.

For more information about performances of each product, please refer to the dedicated datasheet.



## 4. EVB HT2 Connectors

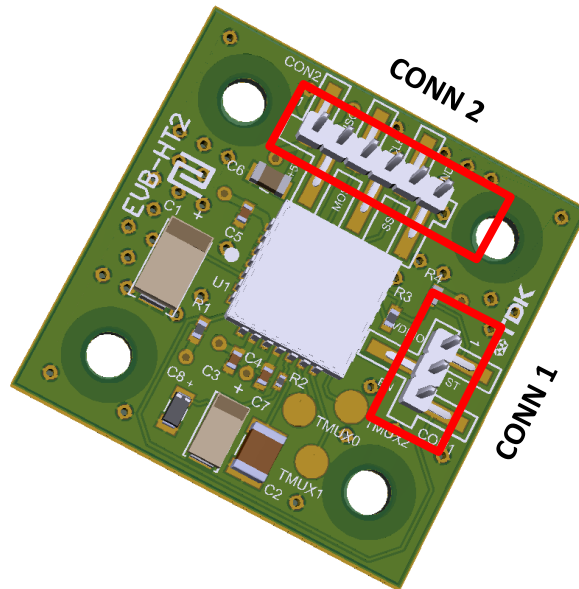


Figure 2 : EVB HT2 Connectors position

EVB HT2 connectors are described below.

Pin #	Name	Type	Function
#1	5V	Power	5V Power Supply
#2	MISO	Output	SPI data output
#3	MOSI	Input	SPI data input
#4	SCLK	Input	SPI Clock
#5	SSB	Input	Slave selection
#6	GND	Power	Ground

Table 1 : CONN2 connector

Pin #	Name	Type	Function
#1	VDDIO	Input	Reference voltage for digital signal
#2	ST	Output	Analog Self-Test
#3	Enable	Input	Enable Pin

Table 2 : CONN1 connector

## 5. Electrical circuit

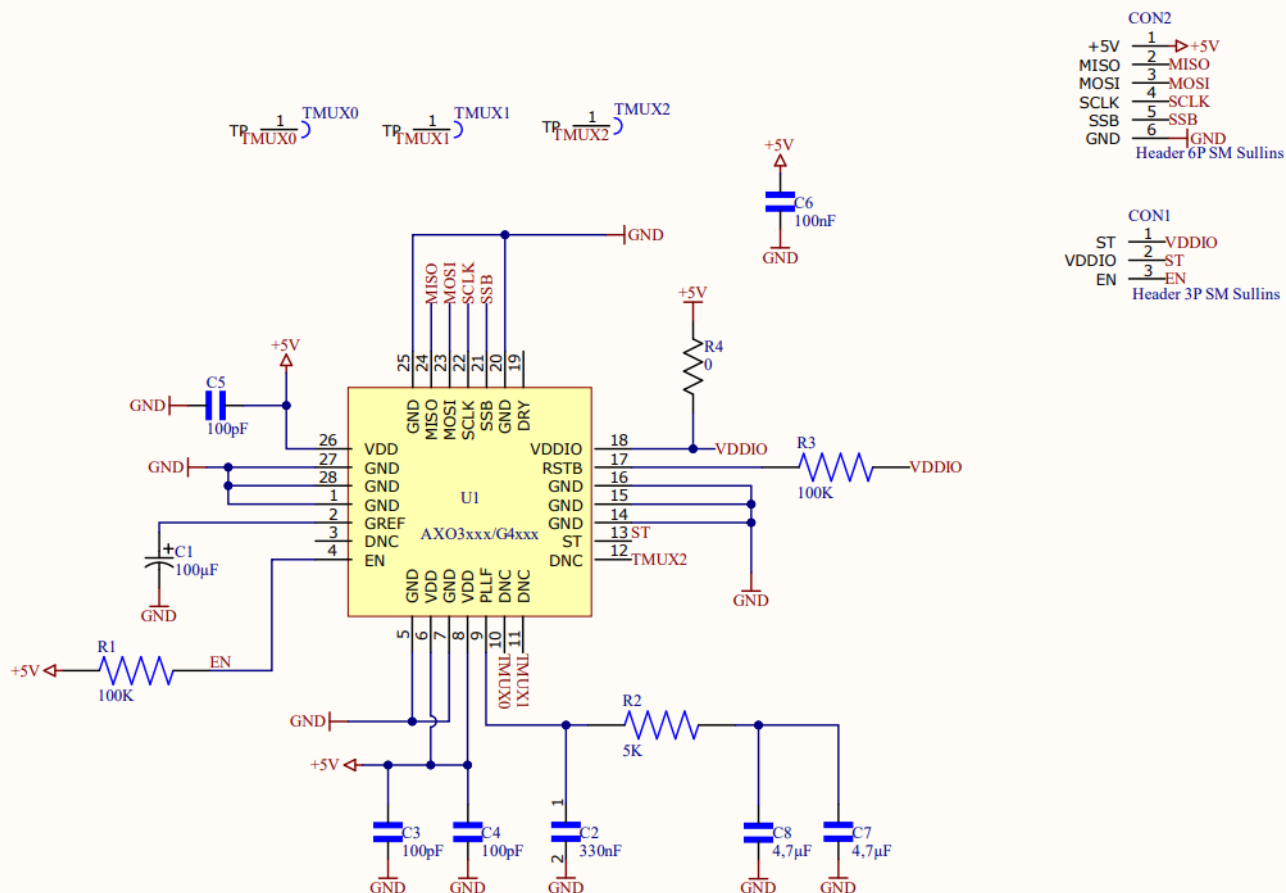


Figure 3 : EVB HT2 Schematic

**Note:** TMUX0, TMUX1 and TMUX2 are reserved for manufacturing purpose and must not be used.

## 6. Electrical Characteristics

Parameter	Min	Typical	Max	Units
5V Power Supply (VDD)	4.75	5	5.25	V
Digital IO Voltage (VDDIO)	1.8	-	5	V
VDD Current consumption <sup>1)</sup>		25		mA

<sup>1)</sup> The specified value represents the typical current consumption of AXO® products.

Table 3: Electrical characteristics

Passive components	Value	Characteristics
C1	100μF	Tantalum 16V ; -55°C/+175°C ; 10%
C2 (Not used)	330nF	X7R ; 25V ; -55°C/+255°C ; 10%
C3, C4, C5	100pF	COG/NPO ; 50V ; -55°C/+200°C ; 5%
C6	100nF	COG/NPO ; 25V ; -55°C/+200°C ; 5%
C7; C8 ( Not used )	4,7μF	Tantalum 25V ; -55°C/+230°C ; 10%
R1;R3	100kΩ	1% -55°C / +250°C
R2 ( Not used )	5kΩ	1% -55°C / +250°C
R4	0Ω	1% -55°C / +215°C

Table 4: typical value of passive components (resistors & capacitances)

Environmental specifications for AXO®EVB HT2 are the following:

Parameter	Condition	Min	Typ	Max	Units
Operating temperature range		-30		+175	°C
Humidity	At 45°C			98	%

Table 5: Environmental specifications

For more information about advanced use AXO®315T product, please refer to the dedicated datasheet.

### Caution!



The product may be damaged by ESD, which can cause performance degradation or device failure! We recommend handling the device only on a static safe workstation. Precaution for the storage should also be taken.

The sensor **MUST** be powered-on *before* any SPI operation. Having the SPI pads at a high level while VDD is at 0V could damage the sensor, due to ESD protection diodes and buffer

## 7. Connecting EVB HT2 to an external control unit (MCU/CPU)

Connecting EVB to an external MCU requires the minimal connection of 6 signals. (VDDIO, Enable and Self-Test pins are optional)

These signals are situated on CONN2 connector.

Some others signal can also be connected if needed but this is not mandatory for good device behavior.

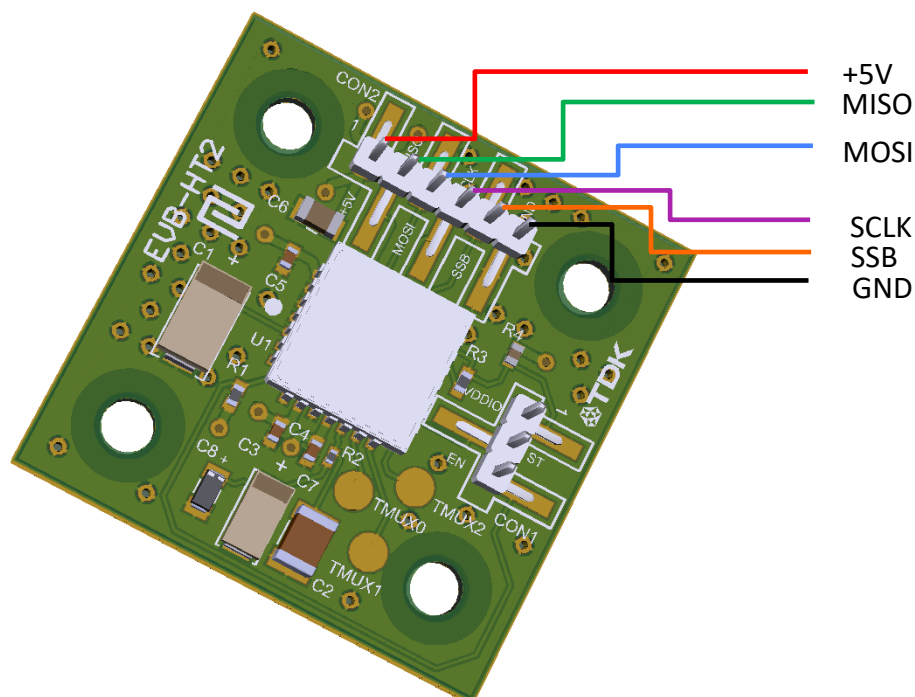


Figure 4 : EVB HT2 signals positions and names

All lines drawn on the figure above are mandatory.

CONN1 connector gives access to optional signals:

- Enable pin can be connected to reset the device (by setting this pin low)
- ST is an output, needed in case an analog monitoring of the device health status is needed. This signal is also available digitally in the SPI frame.
- VDDIO is optional, except if lower voltage than 5V VDDIO is needed. (see next chapter).

## 8. VDDIO selection

By default, the EVB HT2 board is ready for 5V VDDIO communication.

If a 3.3V or lower communication voltage level is needed, it is possible to use VDDIO pin to supply a lower voltage.

**Caution:** It is necessary to remove R4 (0-ohm resistor) in order to allow other VDDIO supply by external CONN1 connector.

## 9. Cable selection

To proceed to vibrations, shocks, or temperature tests with Tronics Evaluation Boards, it could be necessary to create a wired connection to an Arduino board or to an external control unit located outside the test equipment.

For this operation, we recommend using shielded twisted pair cable. We recommend also connecting the shield at the CPU GND side, but not on the EVB GND side to ensure better EMC behavior, and to facilitate vibration test setup.

In case the DRY (Data Ready) and Analog Self-Test pins are not used, 8 wires are needed, so 4 twisted pairs are sufficient. Using an S/FTP ethernet cable can be a good option.

It is recommended to mix DC signal with AC signal by twisted pair. As such, MOSI, MISO, SCLK and SSB should be on separated twisted pair.

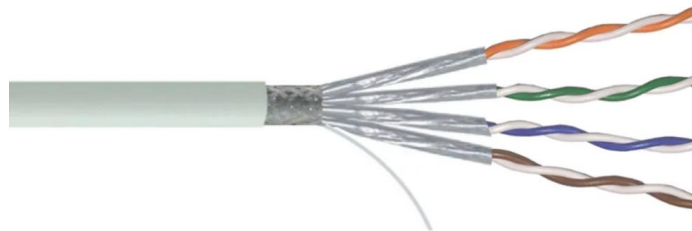


Figure 5 : S/FTP or F/FTP cable is recommended

In case the Enable pin or Analog Self-test are necessary, five twisted pairs are required. Since single cables with this configuration might be difficult to purchase, we suggest using two S/FTP Ethernet cables, which are known to be more commonly available.

For high temperature application we can recommend this parts:

- Glenair 963-033-26
- Gore RCN9047-26
- SAB CATLine Industrial Ethernet cable

The typical reached length, at 1Mbps SPI bus speed, is expected to be at least 1 meter. To accommodate longer lengths, it is possible to reduce the SPI speed from 1 Mbps to 250 kbps for example.

## 10. Mating connector

Mating connector can be:

- FMC03SLFN 3 pins Through Hole -40°C; +200°C connector
- FMC06SLFN 6 pins Through Hole -40°C; +200°C connector

This connector can eventually be used to design a PCB board for external cable.

## 11. Mechanical fastening

The EVB HT2 board has been specially developed to allow for direct mounting on the test setup support. The bottom layer is completely isolated from the electronic circuit.

Four M4 mounting holes are available. We recommend a torque value of 2.9 N·m.

## 12. Reading AXO sensor output

The AXO<sup>®</sup> output (24-bit word) is available within the 4 read-only registers at addresses 0x0 to 0x3. The temperature sensor's output (14-bit word) is available within the 2 read-only registers at addresses 0x4 and 0x5.

**Caution:** Internal temperature sensor functionality is limited to 115°C. To reach the targeted specification, user must perform a system calibration using an external temperature sensor.

SPI bus of AXO<sup>®</sup> device is described below:

- SPI mode: Mode 0
- Data sampled on rising edge and shifted out on the falling edge
- Bit Order: MSB first
- Word Length: 8 Bits

### 12.1. Reading command description

Reading command is described in the table below:

	SPI Command	SPI Address	Argument
<b>Sensor output reading command</b>	0x5	0x0	0x00 00 00 00
<b>Temperature reading command (Temperature sensor is valid up to 115 °C)</b>	0x5	0x4	0x00 00

Table 6 : SPI reading command description

Number of bytes of argument (0x00) sent on MOSI correspond to the size of data to be read. See example on Figure 6.

Table 7 bellow shows the SPI register description (address 0x0 to address 0x5).

SPI Address	B7 (MSB)	B6	B5	B4	B3	B2	B1	B0 (LSB)
0x0	DRY	snzor_out [23]	snzor_out [22]	snzor_out [21]	snzor_out [20]	snzor_out [19]	snzor_out [18]	snzor_out [17]
0x1	snzor_out [16]	snzor_out [15]	snzor_out [14]	snzor_out [13]	snzor_out [12]	snzor_out [11]	snzor_out [10]	snzor_out [9]
0x2	snzor_out [8]	snzor_out [7]	snzor_out [6]	snzor_out [5]	snzor_out [4]	snzor_out [3]	snzor_out [2]	snzor_out [1]
0x3	snzor_out [0]	Resereved	Resereved	Resereved	Resereved	Resereved	Resereved	ST
0x4	0	0	temp_out [13]	temp_out [12]	temp_out [11]	temp_out [10]	temp_out [9]	temp_out [8]
0x5	temp_out [7]	temp_out [6]	temp_out [5]	temp_out [4]	temp_out [3]	temp_out [2]	temp_out [1]	temp_out [0]

Table 7 : SPI register description

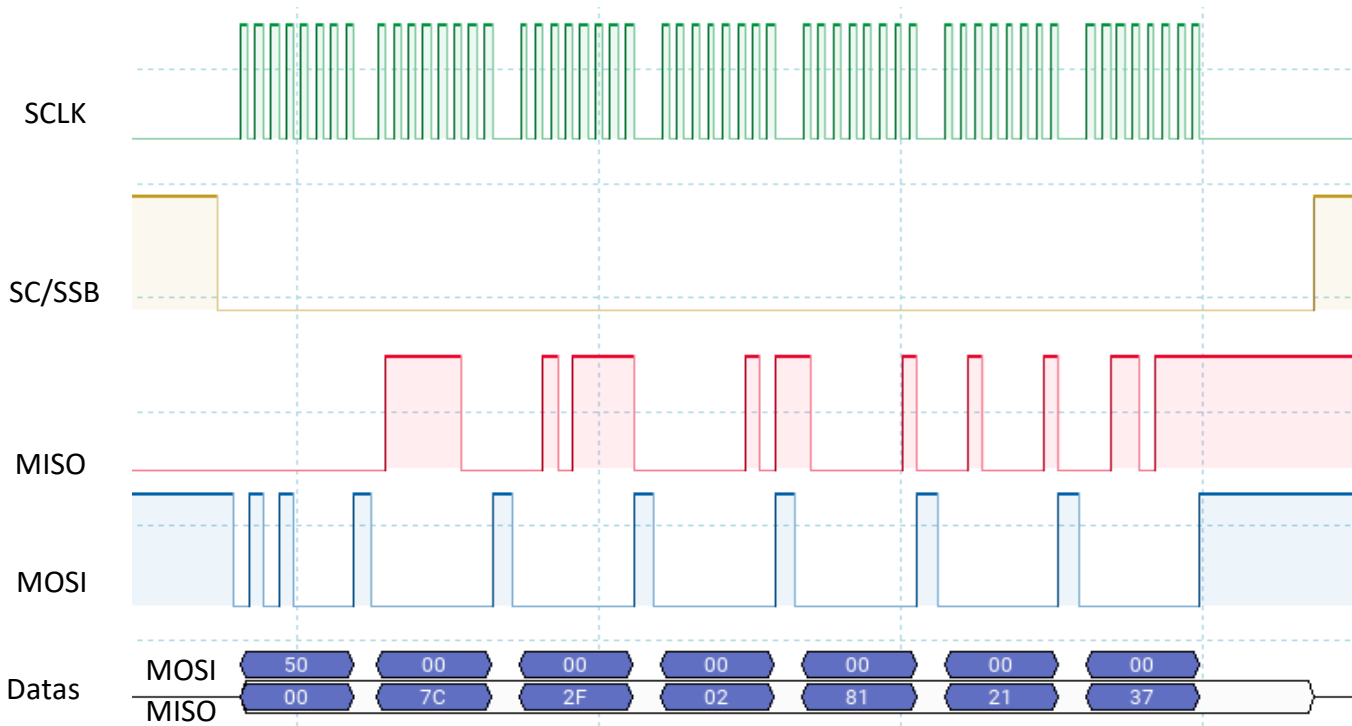


Figure 6 : sensor output and temperature reading on SPI bus.

On this example, a 0x50 command is sent (read from address 0x0) and 6 bytes argument are sent to receive a 6 bytes data message.

**0x7C 0x2F 0x02 0x81** is the sensor value output (DRY =0 in this case because the valid value has already been sent previously)