EIT Test Adapter ETA

Test and demonstration device for use with Swisstom EIT devices.

Intended Use

The EIT Test Adapter is not a medical device. Therefore, the hardware and software components of the EIT Test Adapter are intended for testing only and should never be used in diagnostics, treatment or any other capacity where it would come in contact with patient.
Set-up and use of the EIT Test Adapter is the sole responsibility of the user.

Specifications

The ETA contains complete SensorBelt hardware which is connected to a resistor phantom simulating the human thorax. The impedance distribution in the phantom can be changed manually, automatically or by external signals. ETA is powered by the SensorBeltConnector.

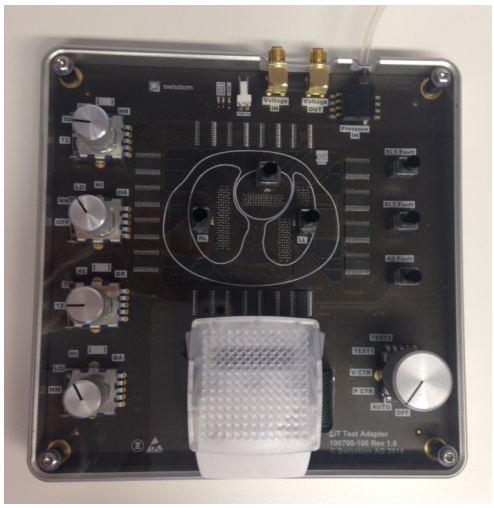

Figure 1: EIT Test Adapter ETA
The ETA device with control buttons and mode selectors.

Abbreviations:

ETA: EIT Test Adapter

SBC: SensorBeltConnector

SB: SensorBelt

HR: Heart Rate

HA: Heart Amplitude

[ ]: reserved

NM: Normal Amplitude

HI: High Amplitude

LO: Low Amplitude

BR: Breath Rate

BA: Breath Amplitude

RL: Right Lung

LL: Left Lung

El 1 Fault: Electrode 1 disconnected

EL 7 Fault: Electrode 7 disconnected

All Fault: All electrodes disconnected

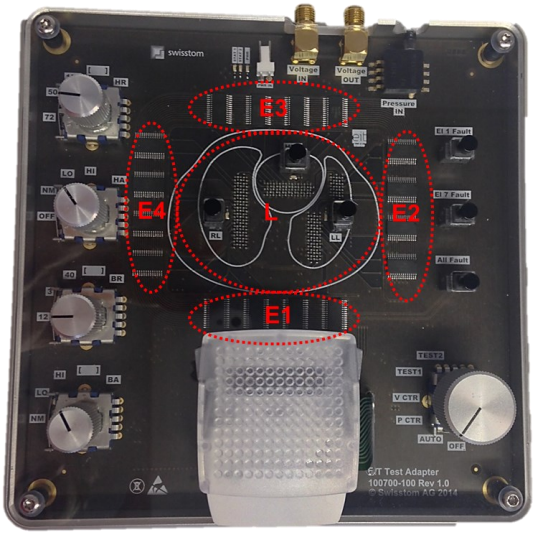

Figure 2: Essential ETA components: **L** is a complete resistor phantom of the human thorax designed accoring to Gagnon et.al.. **E1**, **E2**, **E3**, **E4** are banks of 8 active electrodes feeding the resistor phantom.

The resistor mesh phantom was designed by Hervé Gagnon and consists of 160 resistors. Details can be found in the literature (see references below).

Component	Specifications	Description
Resistor phantom L	Resistor network	160 resistors
Active electrodes E1-E4	32 electrodes	Identical to SensorBelt
Manual control M1-M3	3 push buttons	Change impedance in lung and heart region
Electrode failure M4-M6	3 push buttons	Disconnect electrodes 1, 7, and/or all
Program switch C1	6 positions	See below
Docking station A1	To connect SBC	SBC: SensorBeltConnector
Parameter selectors	4 selectors	Control

References

A. Adler and R. Guardo: "Electrical Impedance Tomography: Regularized Imaging and Contrast Detection", IEEE Transactions on Medical Imaging, vol. 15, no. 2, April 1996.

H. Gagnon, M. Cousineau, A. Adler and A. E. Hartinger, "A Resistive Phantom for the Assessing the Performance of EIT Systems," Biomedical Engineering, IEEE Volume: 57 Issue: 9, 2010.

The impedance distribution of the resistor phantom is controllable by a number of means:

◊ Manually by pressing M1-M6

◊ Automatically by means of C1-C5

◊ Externally through signals A3 and A4

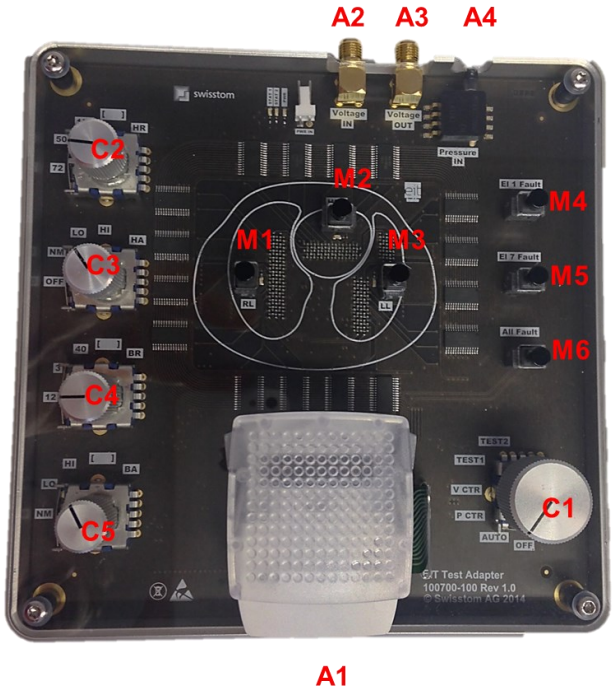

Figure 3: Control elements of ETA. Details see table below.

	Modes (C1)
OFF	Manual
AUTO	Automatic
P CTR	Controlled by port A4
V CTR	Controlled by port A3
Test1	Reserved

Manual	Settings
M1	Right Lung
M2	Heart
M3	Left Lung
M4	Electrode 1 disconnect
M5	Electrode 7 disconnect
M6	All electrodes disc.

AUTO	Controls
C2	Heart rate HR
C3	Heart amplitude HA
C4	Breath rate BR
C5	Breath amplitude BA

External	Connectors
A1	SensorBeltConnector
A2	SMA female, reserved
A3	SMA female, 0-5V
A4	1/8“ tube ID, 0-50mbar

Dimensions
Size: 15.3 cm x 4 cm x 15 cm
Weight: 470 gr

Use case „Manual“

Connect ETA to an SBC.

Set C1 to OFF

Press M1 and you should see ventilation in the right lung

Press M2 and you should see ventilation in the left lung

Press M3 and you should see ventilation in the heart region

Press M4 and you should see electrode 1 disconnected

Press M5 and you should see electrode 7 disconnected

Press M6 and you should see all electrodes disconnected

Use case „stand alone demonstration, breathing“

Connect ETA to an SBC.

Set C1 to AUTO

Set C2 to any setting

Set C3 to OFF

Set C4 to 12 (12 breaths per second)

Set C5 to NML (arbitraty normal amplitude)

You should now see the two lungs breathing at 12 breaths per minute.

Use case „stand alone demo, breathing & heart action“

Connect ETA to an SBC.

Set C1 to AUTO

Set C2 to 72 (heart rate of 72 beats per minute)

Set C3 to NML (arbitrary normal amplitude)

Set C4 to 12 (12 breaths per second)

Set C5 to NML (arbitraty normal amplitude)

You should now see the two lungs breathing at 12 breaths per minute plus a pulsating heart

Use case „demo with ventilator & heart action“

Connect ETA to an SBC. Connect Input A4 to a pressure port at the Y-piece of the ventilator.

Set C1 to P CTR

Set C2 to 72 (heart rate of 72 beats per minute)

Set C3 to NML (arbitrary normal amplitude)

Set C5 to LO

You should now see the two lungs breathing at the rate and amplitude as set on the ventilator plus a pulsating heart.

Swisstom AG

Swisstom AG develops innovative medical devices for the monitoring of lung and heart function in ICU patients and patients undergoing general anesthesia.

The vision of Swisstom AG is to become a globally active and leading provider of life saving, non-invasive medical technology for patient monitoring – to the benefit of patients, physicians, caregivers and society.

Unlike traditional tomographic methods, Swisstom´s imaging does not use x-rays.

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