EMCtools

Fiber optic SENT transceiver
Microbox

EMCtools
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1. Introduction

Functional tests e.g. in test-labs often require insulated SENT-bus (Single Ended Nible Transmission) installations to control and monitor the device under test. For this purpose special Fiber Optic SENT transceivers are available. They allow data transmission of SENT signals via fiber optic cables and can be used during susceptibility tests at high field strength levels.
Our EMCtools Microbox has been designed for emission and susceptibility tests. Using multilayer technology and sophisticated circuit design full SENT compatibility and the ability to perform tests at electromagnetic field levels of 270 V/m and above could be achieved. The handy plastic housing allows tests with limited test space and a minimum of impact on the field.
The EMCtools Microbox uses standard multimode fiber optic cables and allows direct connection to the electric bus via SUB-D female connectors.
Combining a Microbox SENT TX (transmitter) and a Microbox SENT RX (receiver) an fiber optic SENT connection can easily be arranged.

2. *EMCtools* Microbox SENT

The Microbox is built into a handy, rugged plastic housing (65x66x27mm).
Power is supplied externally e.g. by using an external battery or power-supply.

SENT TX (Transmitter):

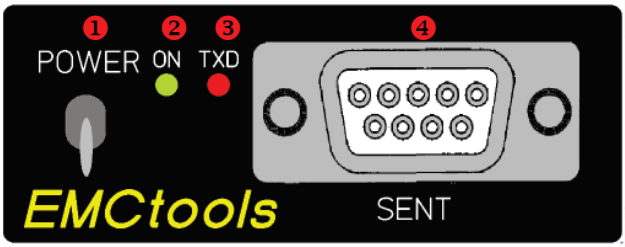


Fig. 1: Front Panel Microbox SENT TX

No. in Fig. 1:	Description
1	Power on/off toggle switch
2	Control-LED for Power on/off status and supply voltage: LED off when supply voltage less than 7V
3	Control-LED TXD
4	9-pin Sub-D connector for bus-connection

An illuminated green LED (Fig.1 – No.2) indicates the operating status of the Microbox.

A red LEDs (Fig.1 – No.3) indicates the status of data transmission.
„TXD“ (= transmit-data) indicates transmission of fiber optic data.

The 9-pin Sub-D connector (Fig.1 – No.4) is used to connect the Microbox to the electrical SENT-bus. See chapter 4 for pinning details.

The Microbox is put into and is taken out of operation by using the toggle switch (Fig.1 – No.1).

Fig.2: Rear panel Microbox SENT TX

No. in Fig.2:	Description
1	Fiber optic connector TXD (Transmitter)
2	Power supply (DC Power Jack 5.5/2.1mm)

On the rear panel you can find the F-SMA connector „TXD“ for the fiber optic data transmission (Fig.2 – No.1) . Here the fiber optic cable is connected.
The „TXD“ (= transmit-data) labeled connector is the transmitter of the fiber optic data transmission.

SENT RX (Receiver):

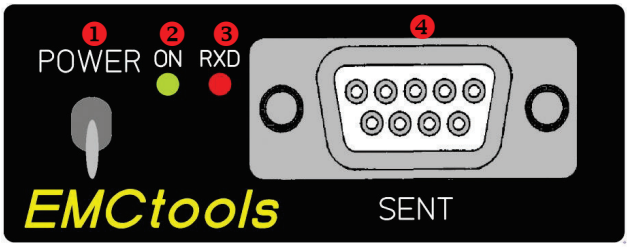


Fig. 3: Front Panel Microbox SENT RX

No. in Fig. 3:	Description
1	Power on/off toggle switch
2	Control-LED for Power on/off status and supply voltage: LED off when supply voltage less than 7V
3	Control-LED TXD
4	9-pin Sub-D connector for bus-connection

An illuminated green LED (Fig.3 – No.2) indicates the operating status of the Microbox.

A red LEDs (Fig.3 – No.3) indicates the status of data transmission.
„RXD“ (= receive-data) indicates reception of fiber optic data.

The 9-pin Sub-D connector (Fig.3 – No.4) is used to connect the Microbox to the electrical SENT-bus. See chapter 4 for pinning details.

The Microbox is put into and is taken out of operation by using the toggle switch (Fig.3 – No.1).

Fig.4: Rear panel Microbox SENT RX

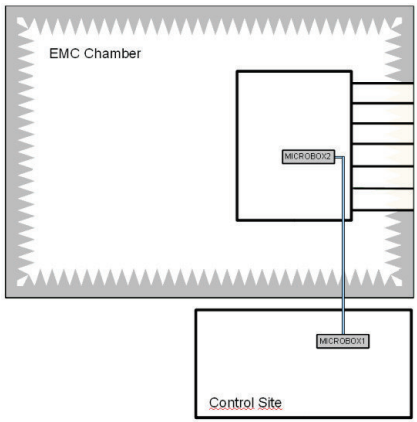
No. in Fig.2:	Description
1	Fiber optic connector RXD (Receiver)
2	Power supply (DC Power Jack 5.5/2.1mm)

On the rear panel you can find the F-SMA connector „RXD“ for the fiber optic data transmission (Fig.4 – No.1) . Here the fiber optic cable is connected.
The „RXD“ (= receive-data) labeled connector is the receiver of the fiber optic data transmission.

3. Setup of *EMCtools* Microbox SENT

The setup for operating a fiber optic data transmission for SENT using the Microbox is easy:

1. Connect two transceivers with a simplex fiber optic cable:
   - connect Microbox SENT TX „TXD“ with Microbox SENT RX „RXD“
2. Connect the electrical SENT-bus cables with attached cable ferrites to the Sub-D connectors of both Microboxes (see chapter 4 for Sub-D pinning)
3. Set the Mcicrobox SENT TX Input Threshold Voltage (see chapter 5)
4. Plug in the power cables with attached cable ferrites acc. Photo 1 and connect power
5. Switch on both Microboxes



One *EMCtools* Microbox SENT is put into the test environment.

It is connected to a second Microbox SENT at the control site using a simplex fiber optic cable

Fig.5: Microbox SENT setup in test environment

4. Pinning of 9-pin Sub-D connector

Microbox SENT TX:

Sub-D Pin #	Description
1	n.c.
2	n.c.
3	GND
4	n.c.
5	n.c.
6	n.c.
7	SENT bus
8	n.c.
9	5V DC out

Microbox SENT RX:

Sub-D Pin #	Description
1	n.c.
2	n.c.
3	GND
4	n.c.
5	n.c.
6	n.c.
7	SENT bus
8	n.c.
9	5V DC in

Remark: Microbox SENT RX can also be supplied by connecting 5V DC to Sub-D Pin9.

5. Setting the Jumper options of the *EMCtools* Microbox SENT

Five different Input Threshold Voltages for the Microbox SENT can be set using jumpers. These jumpers can easily be accessed through a hole in the Microbox SENT TX housing top.

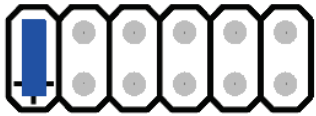
Photo 2: Microbox with Jumpers

To check the fiber optic connection without a bus signal the „Test“-jumper may be used. The TXD-LED then transmits permanently and the RXD-Signal on the other end of the optical cable can be checked. During this test the control-LED RXD (Fig.1 – No.3) of the Microbox SENT RX should be permanently on. Remove the „Test“-jumper for proper bus operation.

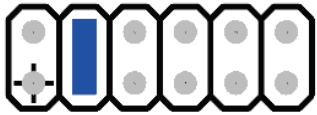
SENT bus physical layer is described in SAE J2716.

A printed label on the Microbox housing shows jumper setting options.

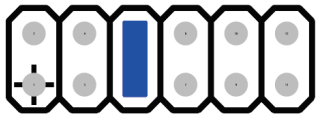
The “Test”-Jumper may be set at any time independent of the other jumper setting.



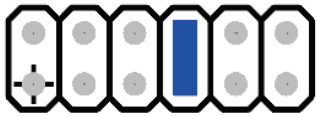
Input Threshold Voltage V_{IH} 2.0 Volt



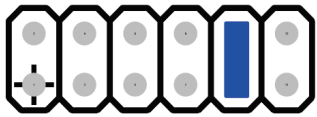
Input Threshold Voltage V_{IH} 2.5 Volt



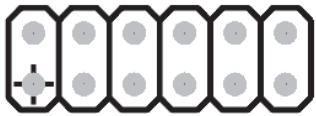
Input Threshold Voltage V_{IH} 2.9 Volt (Standard Setting)



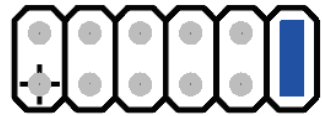
Input Threshold Voltage V_{IH} 3.4 Volt



Input Threshold Voltage V_{IH} 3.7 Volt



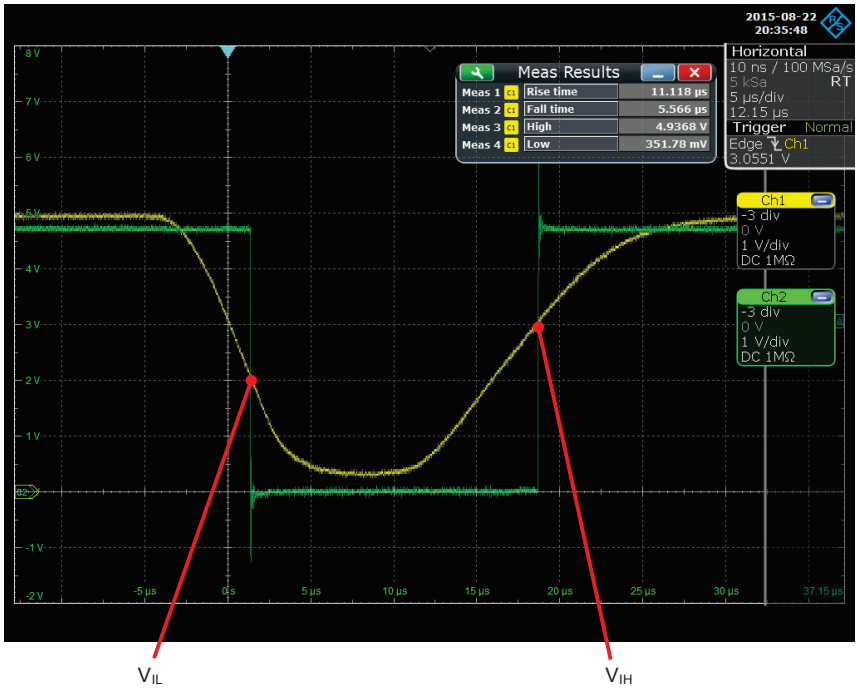
Test off



Test on

6. Microbox SENT TX Bus Threshold setting

Jumper setting defines the V_{IH} Threshold voltage. The V_{IL} voltage is 0.6V lower.
Example: V_{IH} = 2.9V
$V_{IL} = V_{IH} - 0.6V = 2.3V$



7. Bus front end circuit of *EMCtools* Microbox SENT

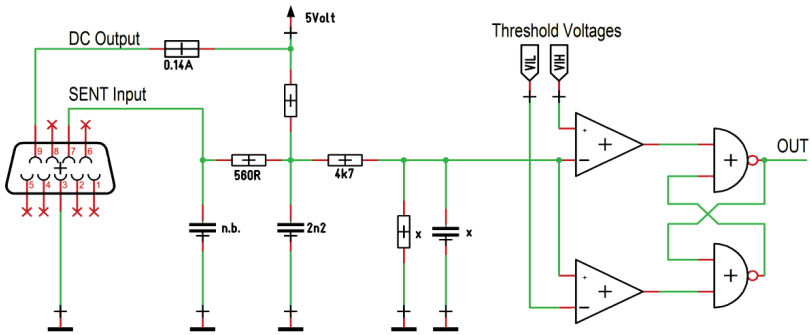


Fig.4: *EMCtools* Microbox SENT TX Input

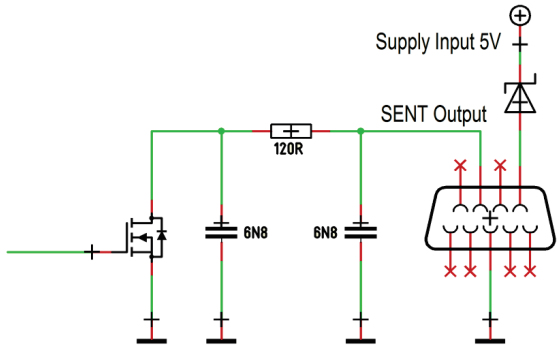


Fig.5: *EMCtools* Microbox SENT RX Output

8. ESD Protection:

Microbox SENT TX/RX is protected against electrostatic discharge in lab use.

This built in protection is not sufficient if you intend to perform ESD tests.
Here an additional ESD protection is needed.
We suggest to use our *EMCtools* EMC Protector

9. Delivered devices of the system and accessories:

Microbox SENT-Set:

1 pcs EMCtools Microbox SENT TX
1 pcs EMCtools Microbox SENT RX
1 pcs printed manual
2 pcs power supply cable (1m) with cable ferrite (DC-plug: Switchcraft S761K)
2 pcs cable ferrite for the bus-line (Ferrite: Würth Part-No: 74271142)

10. Available accessories:

a) rechargeable Battery Box for EMCtools Microbox (Mod. 350)
- to be used inside the EMC chamber
- to be used for ESD-Tests in combination with *EMCtools* ESD-Protector

b) Plug-In wall supply for EMCtools Microbox (Mod. 165 or Mod.167)
- to be used outside the EMC chamber

11. Technical data *EMCtools* Microbox SENT:

Microbox SENT TX:

Bitrate SENT:	30 kBit/s acc. SAE J2716
DC Output:	5V (+/- 2%) max. 100mA, auto resettable fused (Pin 9 - D-SUB)
Power-Supply:	9 – 15V DC (7V min)
	max. 150mA (depending on DC output current)
	DC Power Jack 2.1mm, center pin positive
Fiber optic:	F-SMA, duplex 50/125µm or 62.5/125µm
BUS-connector:	9-pin Sub-D (female)
Input Hysteresis:	$V_{IH} – V_{OL}$ = 0.6V typ.
Available Input Voltage Threshold V_{IH}:	
	3.7V, 3.4V, 2.9V, 2.5V, 2.0V (+/- 5%)
Temperature range:	operating: -40 – 85°C (-40 – 185° F)
	storage: -40 – 85°C (-40 – 185° F)
Housing Size:	66 x 65 x 27 mm (66 x 85 x 27 mm incl. connector jack / switch)
Weight:	85 g

Microbox SENT RX:

Bitrate SENT:	30 kBit/s acc. SAE J2716
Power-Supply:	9 – 15V DC (7V min), max. 50mA
	DC Power Jack 2.1mm, center pin positive

or:

DC Input:	5V max. 50mA (Pin 9 - D-SUB)
Fiber optic:	F-SMA, duplex 50/125µm or 62.5/125µm
BUS-connector:	9-pin Sub-D (female)
Temperature range:	operating: -40 – 85°C (-40 – 185° F)
	storage: -40 – 85°C (-40 – 185° F)
Housing Size:	66 x 65 x 27 mm (66 x 85 x 27 mm incl. connector jack / switch)
Weight:	85 g

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CE

Declaration of Conformity

Hereby we declare, that our product is compliant with the CE directives and standards listed below.

Product:	***EMCtools* Microbox**
Model:	SENT Bus
Directives:	2004/108/EG (EMC)
Standards:	DIN EN 61326-1 (2006) DIN EN 61000-4-3 (2008) DIN EN 61000-4-2 (2009) DIN EN 55022 (2008)
Tested Setup:	Typical setup for fiber optic conversion of bus, locally supplied by battery.

Ostrach, July 27nd 2015

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