EMCtools

Microbox FlexRay

Fiber optic FlexRay transceiver

EMCtools
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1. Introduction

Functional tests e.g. in automotive test-labs often require insulated FlexRay installations to control the device under test. For this purpose special FlexRay transceivers are available. They allow bidirectional data transmission of bus signals via fiber optic cables and can be used during susceptibility tests at high field strength levels.
Quite often these transceivers are built into relatively big metal housings and use enhanced filtering at the electrical FlexRay bus connectors. These filters may affect signal integrity and may have major effect on emission tests.
Our EMCtools Microbox has been designed for emission and susceptibility tests. Using multilayer technology and sophisticated circuit design full FlexRay compatibility and the ability to perform tests at electromagnetic field levels of 270 V/m 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 FlexRay bus via SUB-D female connectors.
In combination with a second Microbox a complete optical FlexRay bus setup can easily be arranged.
EMCtools Microbox has been tested for compatibility and works perfectly in combination with MK Messtechnik optoFlex (see technical data).

2. *EMCtools* Microbox

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.

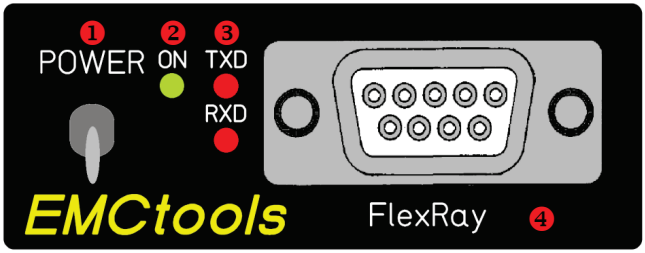


Fig. 1: Front Panel

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 and RXD bus activity
4	9-pin Sub-D connector for bus-connection

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

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

Two red LEDs (Fig.1 – No.3) indicate the status of data transmission.
„TXD“(= transmit-data) indicates transmission of fiber optic data and „RXD“(= receive-data) reception of fiber optic data.

The 9-pin Sub-D connector (Fig.1 – No.4) is used to connect the Microbox to the electrical FlexRay-bus. See chapter 5 for details.

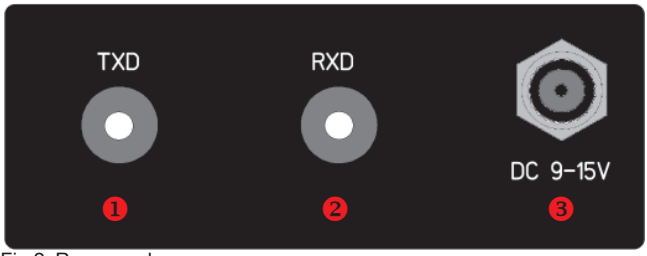


Fig.2: Rear panel

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

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

3. Setup of *EMCtools* Microbox

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

1. Connect two transceivers with crossed fiber optic cables:
   - connect Microbox No.1 „TXD“ with Microbox No.2 „RXD“
   - connect Microbox No.1 „RXD“ with Microbox No.2 „TXD“
2. Connect the electrical FlexRay-bus cables with attached cable ferrites acc. Photo 1 to the Sub-D connectors of both Microboxes (see chapter 5 for Sub-D pinning)
   It is sufficient to connect only BM and BP – GND is not needed.
3. Set the bus impedance and FleyRay speed (see chapter 3)
4. Plug in the power cables with attached cable ferrites acc. Photo 1 and connect power
5. Switch on both Microboxes

For unidirectional operation („listen only“) only one fiber optic cable (simplex) is needed.

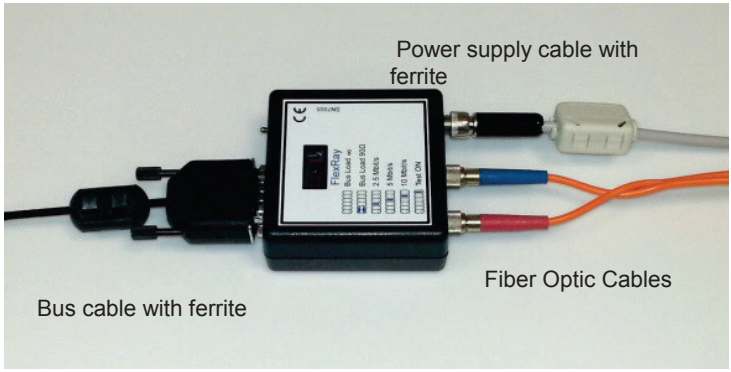
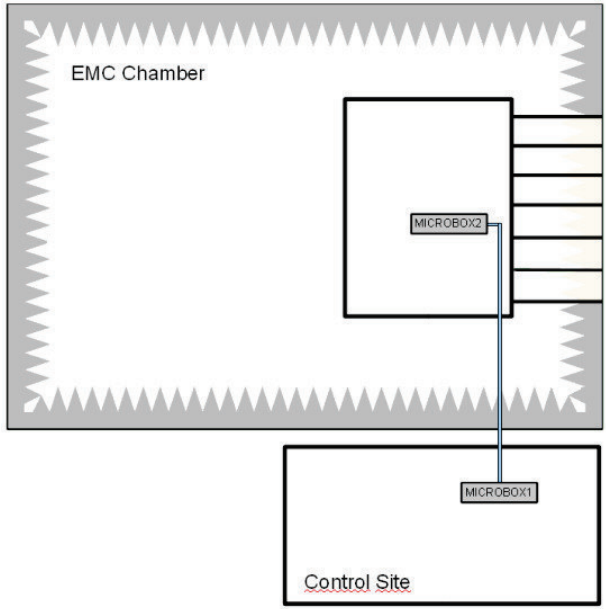


Photo 1: Cable connection and application of cable ferrites



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

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

Fig.3: Microbox setup in test environment

4. Setting the bus-options of the *EMCtools* Microbox

Bus impedance and FlexRay speed are set using jumpers. These jumpers can easily be accessed through a hole in the Microbox housing top.

Photo 2: Microbox with Jumpers

To check the fiber optic connection without 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 second Microbox should be permanently on. Remove the „Test“-jumper for proper bus operation. A printed label on the Microbox housing shows the most important jumper setting options.

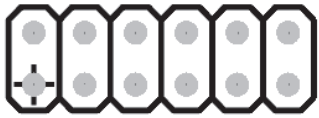
4.1 Jumper options of Microbox FlexRay:

FlexRay physical layer is described in FlexRay Consortium - FlexRay Communications System Electrical Physical Layer Specification V3.0.1 or in ISO/DIS 17458-4

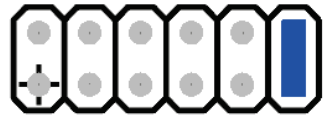
FlexRay bus impedance is usually 80Ω - 110Ω. Usually 90 Ω termination resistors are put at both ends of the FlexRay bus cable. Set the Microbox FlexRay Jumpers so, that a total DC bus resistance of 40Ω - 55Ω is achieved.

The “Test”-Jumper may be set at any time independent of the other jumper setting. Remove the jumper for real FlexRay operation.

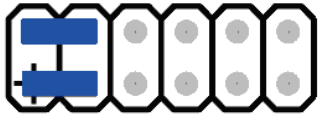
A printed label on the Microbox housing shows the most important jumper setting options.



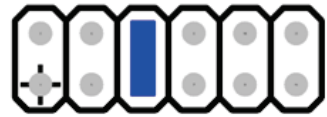
No Bus termination, Test off



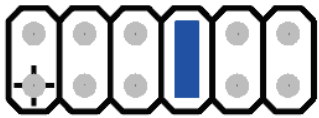
No Bus termination, Test on



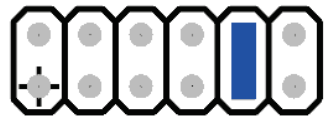
Bus termination 90Ω, Test off



Bus speed 2.5Mbit/s



Bus speed 5Mbit/s



Bus speed 10Mbit/s

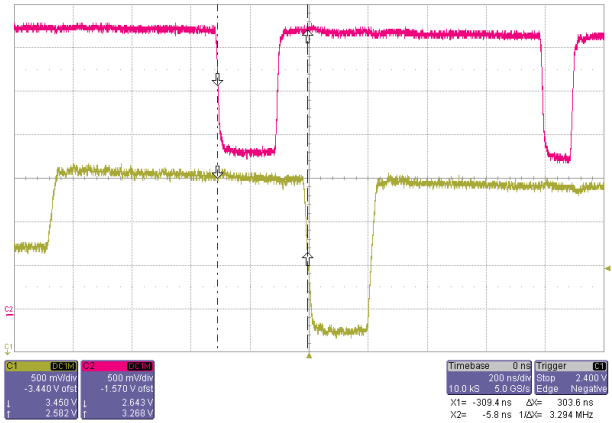


Fig. 5: FlexRay Signal delay time measurement: approx. 300ns - 20m fiber, 2x Microbox FR

5. Bus front end circuit of *EMCtools* Microbox

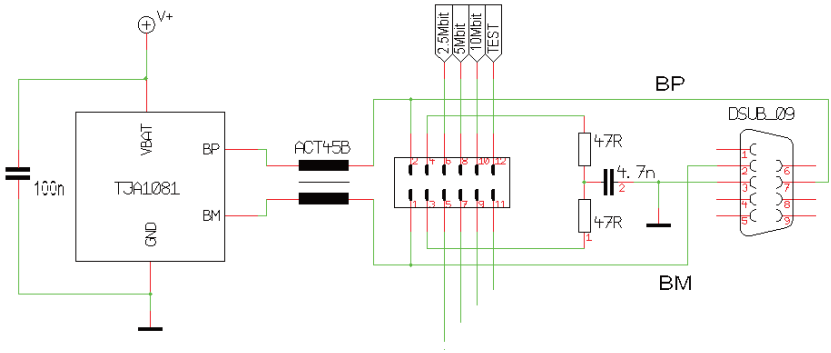


Fig.6: *EMCtools* Microbox FlexRay

6. ESD Protection:

Microbox FlexRay is protected against electrostatic discharge to the bus line for standard lab use.

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

7. Delivered devices of the system and accessories:

Microbox:

1 pcs EMCtools Microbox FlexRay
1 pcs printed manual
1 pcs power supply cable (1m) with cable ferrite (DC-plug: Switchcraft S761K)
1 pcs cable ferrite for the bus-line (Ferrite: Würth Part-No: 72471142)

Microbox-Set:

2 pcs EMCtools Microbox FlexRay
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: 72471142)

8. Available accessories:

a) Battery Box for EMCtools Microbox (Mod. 150)
- uses 9V block battery PP3 size
- 1 battery alkaline PP3 size included
- **only necessary for conducted emission tests**

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

9. Technical data *EMCtools* Microbox:

Bitrate:	**FlexRay:**	10 MBit/s, 5 MBit/s, 2.5MBit/s	
Signal delay time:	**FlexRay:**	approx. 300ns - 20m fiber, 2x Microbox FlexRay	
	FO cable:	5ns/m	
Power-Supply:	9 – 15V DC (7V min), 50mA, DC Power Jack 2.1mm, center pin positive		
Fiber optic:	F-SMA, duplex 62,5/125µm or 50/125µm		
BUS-connector:	9-pin Sub-D		
Available bus options (by jumper setting):			
FlexRay:	infinite, 90Ω		
Temperature range:	operating:	-40 – 85ºC	(-40 – 185º F)
	storage:	-40 – 85ºC	(-40 – 185º F)
Compatibility:	*EMCtools* Microbox FlexRay:		
	- *EMCtools* Microbox FlexRay		
	- MK Messtechnik optoFlex		
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:	FlexRay
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 FlexRay bus, locally supplied by battery.

Ostrach, Oktober 31st 2012

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