INTERBUS

Conformance Test

Basic Test

Optical Fibers

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1. General

The steps of the INTERBUS optical fiber conformance test are based on the INTERBUS basic conformance test and are carried out as described below. This does not apply if the procedures described are impossible or irrelevant.
This document only lists the differences compared to the INTERBUS basic conformance test.

1.1. Exclusion

Due to the ongoing development of INTERBUS technology encouraged by the INTERBUS Club, optical fiber devices without optical control/diagnostics are usually no longer certified, because they no longer correspond to the current state of technology.

2. Basic Test

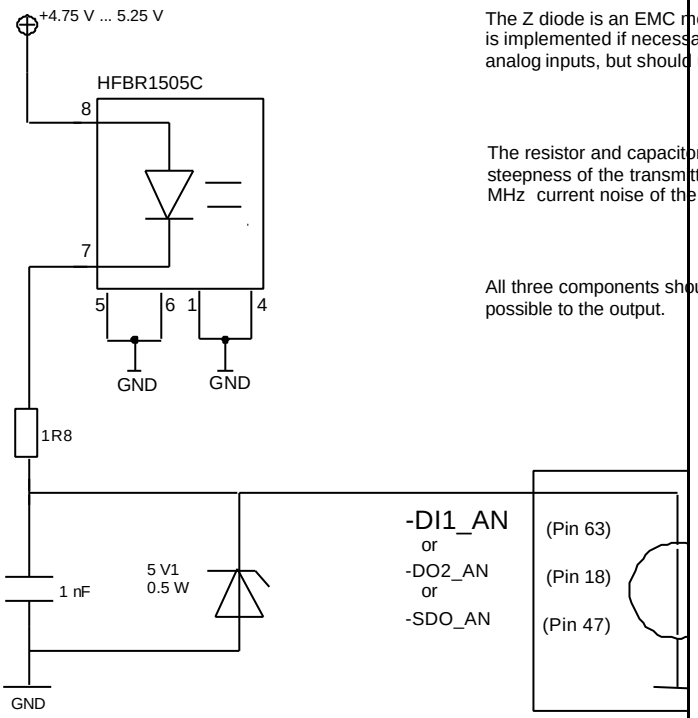
The reference circuit diagrams are the circuit diagrams in the corresponding up-to-date user manuals for the protocol chips.
All "**HE**" test steps are implemented in the manufacturer declaration.
The test laboratory carries out "**TL**" test steps.
Where several options are available, a specific option must be selected.

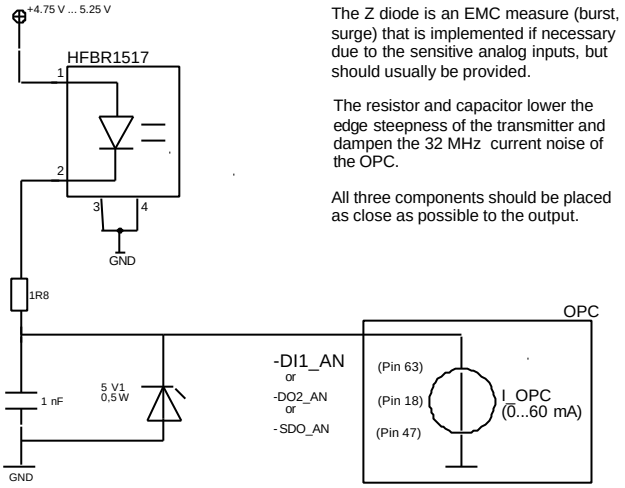
2.1. Physical Interface

2.1.1. INTERBUS/Optical Fiber Interface

2.1.1.1. Optical Fiber Interface - Transmitter

2.1.1.1.1. Wiring

No.	Test Steps	OK
1. **HE** 1.	**Optical fiber interface - HFBR 1505C (FSMA) transmitter** - Has the optical fiber interface with the HFBR 1505C optical fiber (FSMA) transmitter, Z diode, capacitor, and resistor been implemented as shown in the diagram? OPC Optical Fiber Control: Basic Wiring of the HFBR1505C Optical Fiber Transmitter  The Z diode is an EMC measure (burst, surge) that is implemented if necessary due to the sensitive analog inputs, but should usually be provided. The resistor and capacitor lower the edge steepness of the transmitter and dampen the 32 MHz current noise of the OPC. All three components should be placed as close as possible to the output. Date: 01/18/00 - All resistors have a tolerance of +/- 10%.	

2. **HE** 2.	**Optical fiber interface - HFBR 1517 transmitter (rugged connector)** - Has the optical fiber interface with the HFBR 1517 optical fiber transmitter (rugged connector), Z diode, capacitor, and resistor been implemented as shown in the diagram? OPC Optical Fiber Control: Basic Wiring of the HFBR1517 Optical Fiber Transmitter  Date: 01/18/00 - All resistors have a tolerance of +/- 10%.	

2.1.1.1.2. Transmission Power Control for the Optical Fiber LEDs

An ambient temperature of 15°C to 25°C (59°F to 77°F) must be maintained for all tests.

When using **Type 4: HFBR 1505C** optical fiber LEDs (FSMA connector) from Hewlett Packard, the optical power must be balanced.

Setpoint range for optical power: **- 4.5 dBm > Popt > - 6.8 dBm**

The test objects must be balanced. The equipment for balancing and the manufacturing process of the manufacturer are verified by checking the transmission power. If the transmission power is not in the tolerance range, this is noted in the log.

The power values are determined using a specially measured 1 m (3.28 ft.) reference fiber. The component to be tested is only connected to the voltage supply. **No** connection is established between the data line and other components. Measurements are only recorded when the voltage supply has been connected and after a waiting time of approximately 10 seconds.

When using **Type 5: HFBR 1517** optical fiber LEDs (rugged connector) from Hewlett Packard, the optical power does **not** have to be balanced.

Setpoint range for optical power: **- 3.5 dBm > Popt > - 8.8 dBm**

The test objects do not have to be balanced. The manufacturing process of the manufacturer is verified by checking the transmission power. If the transmission power is not in the tolerance range, this is noted in the log.

The power values are determined using a specially measured 1 m (3.28 ft.) Rugged Line reference fiber. The component to be tested is only connected to the voltage supply. **No** connection is established between the data line and other components. Measurements are only recorded when the voltage supply has been connected and after a waiting time of approximately 10 seconds.

No.	Test Steps	OK
1. TL 1.	Measure the transmission power of the optical fiber LED for the incoming bus segment: **Popta =_____ dBm** Transmission power is in the tolerance range	
1. TL 2.	Measure the transmission power of the optical fiber LED for the outgoing bus segment: **Poptw =_____ dBm** Transmission power is in the tolerance range	
1. TL 3.	Measure the transmission power of the optical fiber LED branch bus segment: **PoptS =_____ dBm** Transmission power is in the tolerance range	

2.1.1.1.3. Testing Peak Wavelengths for the Transmitter LEDs

When testing the peak wavelength of **Type 4: HFBR 1505C** (FSMA) optical fiber transmitter LEDs the filter effect (wavelength-selective attenuation) of a specially selected 100 m (328.08 ft.) reference fiber is used. The minimum transmission power of the transmitter binary "0" is tested after running through this 100 m (328.08 ft.) fiber.

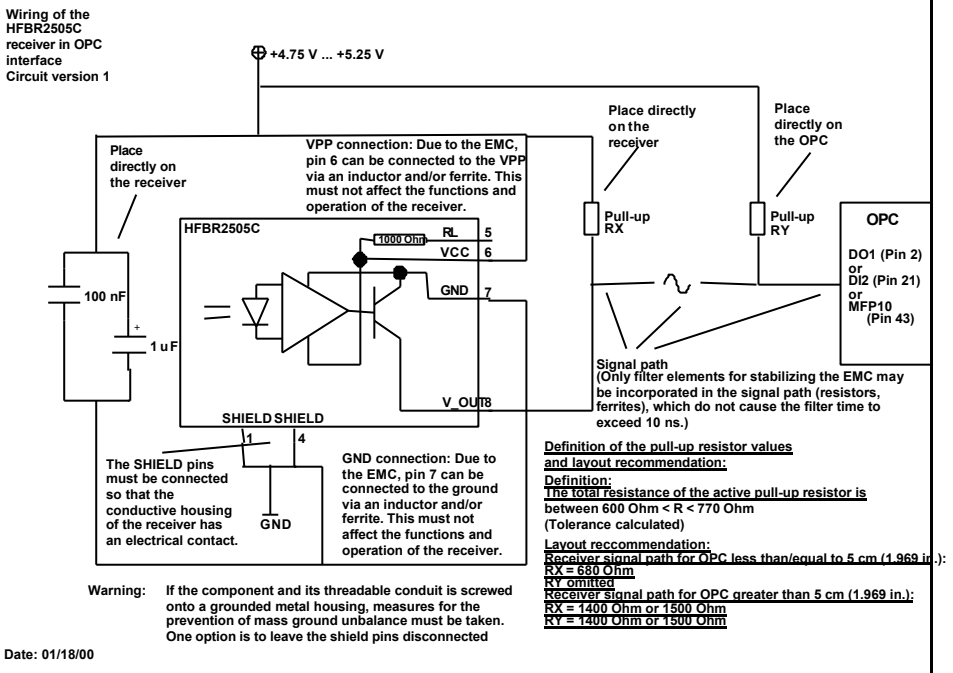
When testing the peak wavelength of **Type 5: HFBR 1517** optical fiber transmitter LEDs (rugged connector) the filter effect (wavelength-selective attenuation) of a specially selected 100 m (328.08 ft.) reference fiber is used. The minimum transmission power of the transmitter binary "0" is tested after running through this 100 m (328.08 ft.) fiber. The Rugged Line reference fiber is connected to the FSMA reference fiber via a coupling and the Popta value (1 m [3.28 ft.]) is recorded at the end of the FSMA reference fiber. In addition, the Rugged Line reference fiber is connected to the 100 m (328.08 ft.) reference fiber via a coupling and the Popta (100 m [328.08 ft.]) measured value is recorded.

Values for the Incoming Bus Segment					
LED Type	λ_{WC} [nm]	$\alpha_k(\lambda_{WC})$ [dB]	P_{opta}(1 m [3.28 ft.]) [dBm]	P_{opt}(1 m [3.28 ft.]) - $\alpha_k(\lambda_{WC})$ [dB]	P_{opta}(100 m [328.08 ft]) [dBm]
Type 4	660				
Type 5	660				
Values for the Outgoing Bus Segment					
LED Type	λ_{WC} [nm]	$\alpha_k(\lambda_{WC})$ [dB]	P_{opta}(1 m [3.28 ft.]) [dBm]	P_{opt}(1 m [3.28 ft.]) - $\alpha_k(\lambda_{WC})$ [dB]	P_{opta}(100 m [328.08 ft]) [dBm]
Type 4	660				
Type 5	660				
Values for the Branch Bus Segment					
LED Type	λ_{WC} [nm]	$\alpha_k(\lambda_{WC})$ [dB]	P_{opta}(1 m [3.28 ft.]) [dBm]	P_{opt}(1 m [3.28 ft.]) - $\alpha_k(\lambda_{WC})$ [dB]	P_{opta}(100 m [328.08 ft]) [dBm]
Type 4	660				
Type 5	660				

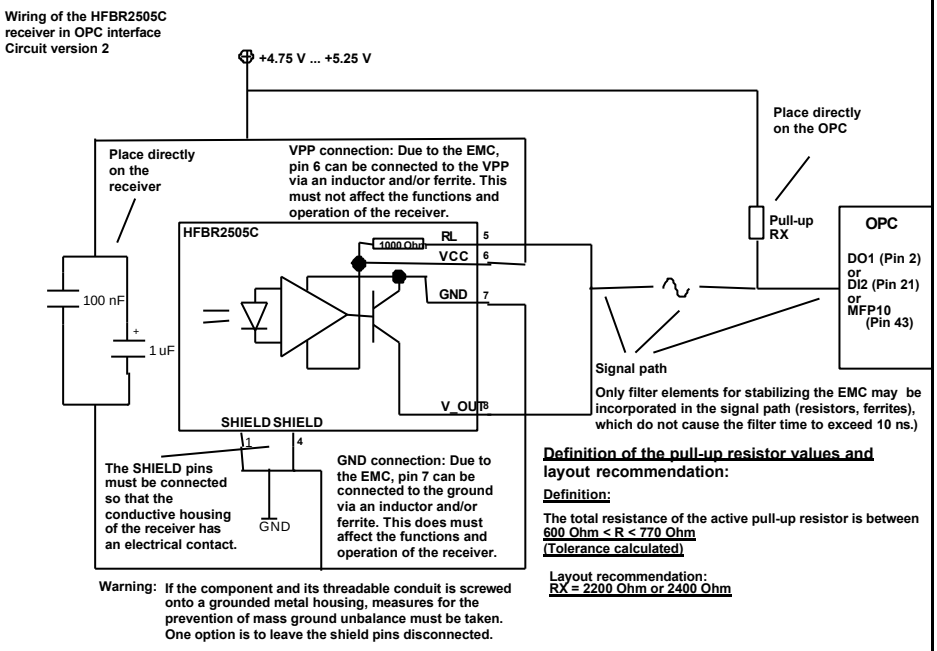
No.	Test Steps	OK
1. TL 4.	Minimum transmission power binary "0" for the incoming bus segment $Popt_a$ (100 m [328.08 ft.]) ≥ $Popt_a$ (1 m [3.28 ft.]) - a k(l WC)	
1. TL 5.	Minimum transmission power binary "0" for the outgoing bus segment $Popt_W$ (100 m [328.08 ft.]) ≥ $Popt_W$ (1 m [3.28 ft.]) - a k(l WC)	
1. TL 6.	Minimum transmission power binary "0" for the branch bus segment $Popt_W$ (100 m [328.08 ft.]) ≥ $Popt_W$ (1 m [3.28 ft.]) - a k(l WC)	

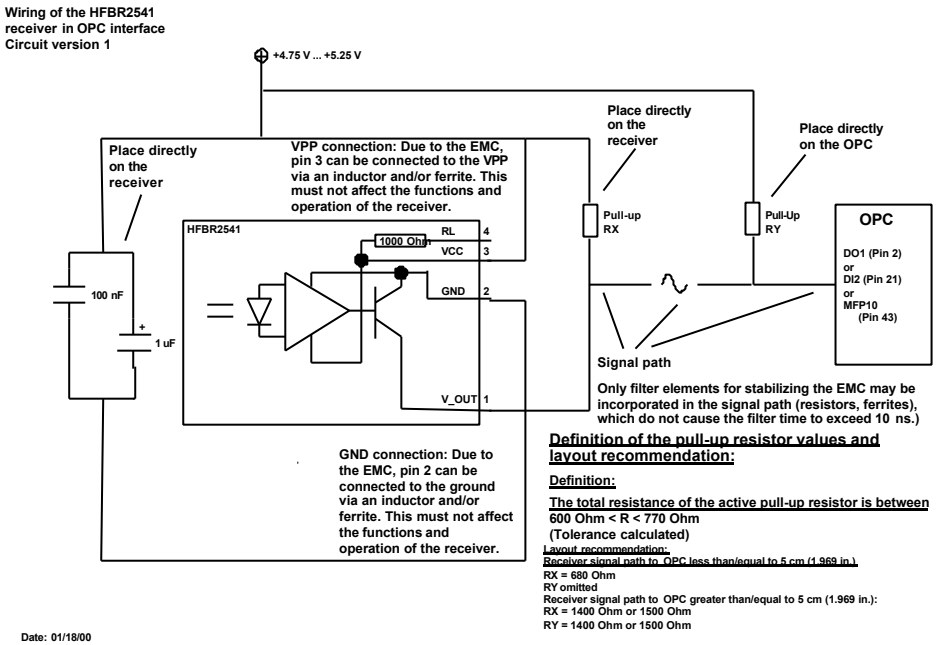
2.1.1.2. Optical Fiber Interface - Receiver

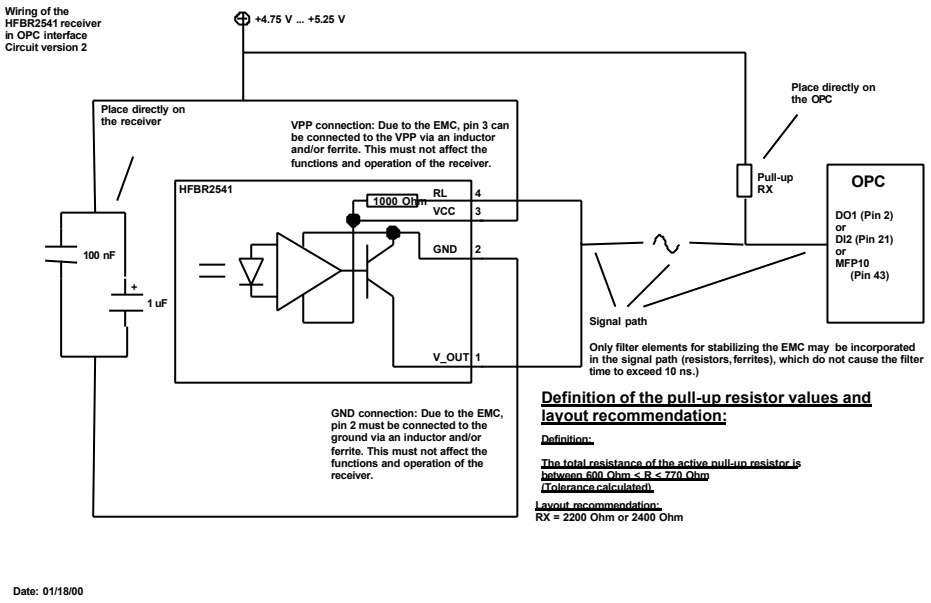
No.	Test Steps	OK
1.1. **HE** 3.	**Optical fiber interface - HFBR 2505C (FSMA) receiver** - Is the optical fiber interface implemented as one of the two alternatives provided with the HFBR 2505C optical fiber (FSMA) receiver, capacitors, and resistors as shown in the diagram?	



- All resistors have a tolerance of +/- 1%.

No.	Test Steps	OK
1.2. **HE** 4.	**Optical fiber interface – HFBR 2505C (FSMA) receiver** - Is the optical fiber interface implemented as one of the two alternatives provided with the HFBR 2505C optical fiber (FSMA) receiver, capacitors, and resistors as shown in the diagram?  - All resistors have a tolerance of +/- 1%.	

No.	Test Steps	OK
1.3. **HE** 5.	**Optical fiber interface - HFBR 2541 receiver (rugged connector)** - Is the optical fiber interface implemented as one of the two alternatives provided with the HFBR 2541 optical fiber receiver (rugged connector), capacitors, and resistors as shown in the diagram?  - All resistors have a tolerance of +/- 1%.	

No.	Test Steps	OK
1.4. **HE** 6.	**Optical fiber interface - HFBR 2541 receiver (rugged connector)** - Is the optical fiber interface implemented as one of the two alternatives provided with the HFBR 2541 optical fiber receiver (rugged connector), capacitors, and resistors as shown in the diagram?  - All resistors have a tolerance of +/- 1%.	

No.	Test Steps	OK
1. TL 7.	**Receiver Sensitivity** The test object interface is connected to a device from the test equipment via a 60 m (196.85 ft.) optical fiber test cable. In idle state (INTERBUS master is not connected with the test setup) the transmitter optical power of the test equipment device is adjusted after POWER-UP to **-17.0 dBm +/-0.25 dB** at the other end (test object) of the 60 m (196.85 ft.) optical fiber test cable. All connections are then re-established. (This procedure must be repeated on all the interfaces of the device.)	
2. TL 8.	Outgoing interface The bus is started in a **controlled** way using the ACTIVE, READY, and **RUN** state. The control level of the data return path (receiver test object) should not exceed 14. The FO LEDs for this interface should not be lit.	
3. TL 9.	Outgoing interface Function test with OPC reference device with set transmission power via a specially measured 60 m (196.85 ft.) polymer fiber for at least 1 minute. (Error-free transmission at minimum receiving power binary "0": -17.0 dBm +/-0.25 dB)	
4. TL 10.	Branch interface The bus is started in a **controlled** way using the ACTIVE, READY, and **RUN** state. The control level of the data return path (receiver test object) should not exceed 14. The FO LEDs for this interface should not be lit.	
5. TL 11.	Branch interface Function test with OPC reference device with set transmission power via a specially measured 60 m (196.85 ft.) polymer fiber for at least 1 minute. (Error-free transmission at minimum receiving power binary "0": -17.0 dBm +/-0.25 dB)	
6. TL 12.	Incoming interface The bus is started in a **controlled** way using the ACTIVE, READY, and **RUN** state. The control level of the data forward path (receiver test object) should not exceed 14. The FO LEDs for this interface should not be lit.	

7. TL 13.	Incoming interface Function test with OPC reference device with set transmission power via a specially measured 60 m (196.85 ft.) polymer fiber for at least 1 minute. (Error-free transmission at minimum receiving power binary "0": -17.0 dBm +/-0.25 dB)	
8. **HE** 7.	**Additional wiring test for INTERBUS data lines** - Have **any other** active and passive components (e.g., Transsorb or suppressor diodes, filters, etc.) been used on/in the INTERBUS data path in addition to those currently used and specified in the circuit versions?	

No.	Test Steps	OK
1. TL 14.	**Optical fiber warning** The attenuation of the optical fiber path should be carefully increased mechanically with INTERBUS running until the corresponding MAU warning is detected for the master. (This test must be repeated on all of the available optical fiber interfaces for the device.)	
2. TL 15.	Is the corresponding FO1 LED lit (incoming interface)?	
3. TL 16.	Is the bus still operational?	
4. TL 17.	Is the corresponding FO2 LED lit (outgoing interface)?	
5. TL 18.	Is the bus still operational?	
6. TL 19.	Is the corresponding FO3 LED lit (branch interface)?	
7. TL 20.	Is the bus still operational?	

2.1.2. Medium Access, Mechanics

No.	Test Steps	OK
HE 8.	**Connector pin assignment** - Has an approved connector type been used? *) - Which? (please enter here)	

*) Approved connector types:
Alternatively, other connection methods can be selected. However, appropriate adapters must also be supplied as standard.

- FSMA (HFBR1505C, HFBR 2505C)
- Rugged Line optical fiber connector (HFBR1517, HFBR 2541)

Explanations: see below.

2.1.2.1. Optical Fiber Rugged Connector

See Basic Test "Copper Rugged Connector"

2.2. Protocol Chip/Configuration/Wiring

No.	Test Steps	OK
1. **HE** 9.	- Has an approved type of protocol chip or an approved alternative been used? *)	
2. **HE** 10.	- Is optical control enabled? (RF1=RF2=0 for SUPI3 OPC)	
3. ff	- see Basic Test	

*) See table for approved components

Item No.	Designation		Manufacturer
1.	IC SUPI 3 OPC, QFP64	SM	ST
2.	IC SUPI 3 BT, QFP64	SM	ST

See Basic Test

2.3. Voltage Supply

See Basic Test

2.4. Reset Wiring

See Basic Test

2.5. Clockline

See Basic Test

2.6. Register Expansion (Optional)

See Basic Test

2.7. Diagnostics

See Basic Test

2.8. Product Entry in the Supplier Index

TL 1. See Basic Test

2.9. Configuration

TL 2. See Basic Test

2.10. The Last Device

TL 3. See Basic Test

2.11. Testing the Behavior of an Optional Power Unit

TL 4. See Basic Test

2.12. Master <--> Test Object Data Transfer

TL 5. See Basic Test

2.13. Basic Test for PCP

TL 6. See Basic Test

3. Options

TL 7. See Basic Test