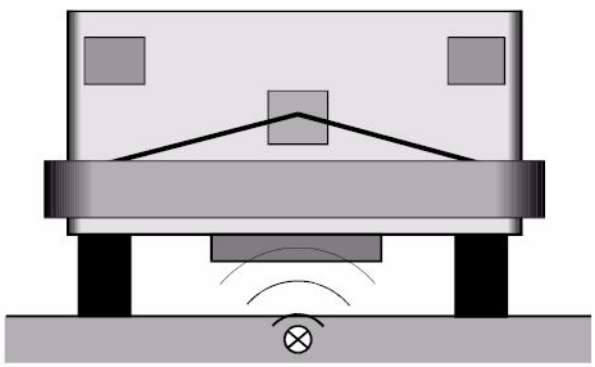


Inductive Modem

G_75100-A

English, Revision 01	Dev. by: A.K.
Date: 06.05.2004	Author(s): RAD / A.F.
Götting KG, Celler Str. 5, D-31275 Lehrte - Röddensen (Germany), Tel.: +49 (0) 51 36 / 80 96 -0, Fax: +49 (0) 51 36 / 80 96 -80, eMail: techdoc@goetting.de, Internet: www.goetting.de	

Contents

1 General System Description

1.1 Inductive Data Transmission Systems of Götting KG

Inductive data transmission systems are applied for radio data connection between automated guided vehicles and a central guidance computer. The vehicle's equipment consists of a transmitter / receiver as well as an antenna. Except for the transmitter / receiver an induction loop as an antenna is required on the system side. This induction loop may be laid in or next to the roadway. Generally the operations involved are carried out by the customer or the vehicle supplier.

The assembly G_75100-A is composed of a transmitter and a receiver, each of them operating on different frequencies. Thus two channels for simultaneous operation in both transmitting and receiving direction are available (full duplex).

1.2 Special System Featuress

The inductive data transmission system of Götting KG is a modular construction. It is possible to realize customized versions with little development effort and moderate production expenses.

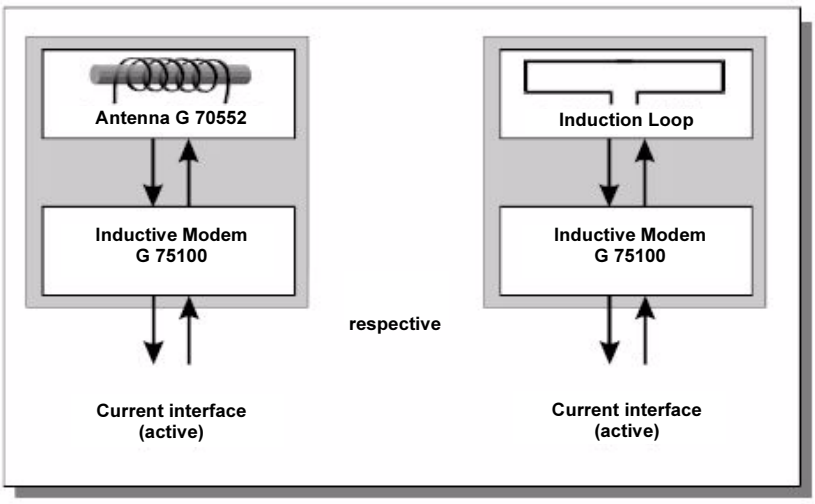
1.3 Application Example for Automation

Operation of the inductive modem is run in the following field of applications:

- Driverless transport vehicles in production lines
- Automated Warehousing (High rise racks)
- Crane Controlling
- Tracked Vehicles
- Van Carrier

1.4 Configuration of the Inductive Data Transmission System

Figure 1 Configuration of the System



The system consists of the following components

- Inductive Modem G_75100-A
- Transmit / Receive Antenna G 70522
- Induction Loop (not part of the scope of supply)

1.5 Function Description

The data which have to be transmitted are sent via input control into the modem G_75100-A. According to the configuration fixed in the output controls, the HF - signal is generated, data are modulated and then output from the final HF stage. The transmission system is tested to ensure the funcitonality (test for loop fractures). The result of this test is indicated on the front panel.

The reception antenna transfers the HF- signal into the range of the vehicle. Here a signal processing with a following data recovery will be realized. If the receptor's control logic recognizes a sufficient level of reception this is indicated on the front panel and the data is communicated from the serial output of the modem to the vehicle's computer.

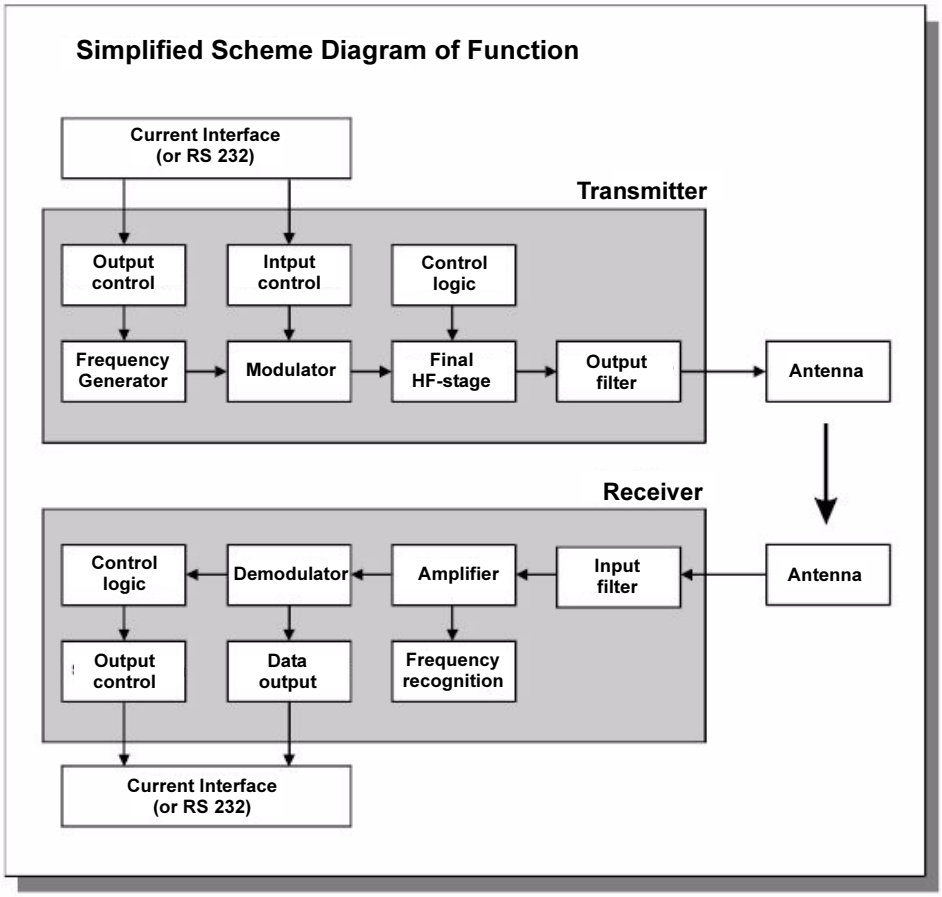


Figure 2 Simplified Scheme Diagram of Function

2 The Inductive Data Transmission System

2.1 The Inductive Modem G_75100-A

2.1.1 Configuration of the Modem

The Inductive Modem HG 751 is composed of

Transmitter:

- Input and output control
- Frequency generator
- Modulator
- Final HF- Stage
- Output filter
- Control logic

Receiver:

- Input filter
- Amplifier
- Digital frequency recognition
- Demodulator
- Control logic
- Data and control output

2.1.2 The HF Signal

The transmitter works with modulation type F1, i.e. it is keyed between two corner frequencies fo and fu, which are generated from the crystal frequency fq. These corner frequencies are located in identical distances df (frequency shift) above rsp. below a centre frequency.

Frequency	95 kHz Transmitter	55 kHz Trasnmitter
fq:	7,5522 MHz	7,5617 MHz
fm:	95 kHz	55 kHz
df:	600 Hz	600 Hz
fo:	95,6 kHz	55,6 kHz
fu:	94,4 kHz	54,4 kHz

Table 1 Corner Frequencies

The modulation of the signal results from a keyed line current. According to CCITT- reference the signal is demodulated in the same way and is output by keying of a line current.

Signal Low (no current) : upper limit frequency

Signal High (current) : lower limit frequency

2.1.3 Data Transmitter

The HF- signal is generated in the data transmitter, is data modulated and is then feeded into the induction loop or the antenna after amplification via a filter.

Frequency Generator:

The frequencies 7,5616 MHz (55 kHz-transmitter) and 7,5522 MHz (95 kHz-transmitter) are produced by a quartz oscillator. In the divider which can be programmed subsequently both frequency pairs (54,4 kHz / 55,6 kHz and 94,4 kHz / 95,6 kHz) will be generated for frequency modulation.

HF- Output Stage:

If the transmitter is gated, the rectangular HF-signal will be switched to the output stage.

Transmitter Filter:

Due to the rectangular triggering of the output stage interferences arise. These are suppressed in the two-circuit output filter. As the filter is provided with a transformer, the galvanical isolation of the output is effected.

Control logic:

For function control of the transmitter the HF-current flowing through the transmitter antenna is measured and compared with a valid set value. Sufficient antenna current is valued as a correct operation of the transmitter and is signalized by a green LED at the front panel. During a power break in the antenna circuit the display will expire. Furthermore the transmitter modulation is indicated by the red LED at the front panel.

2.1.4 Power and Transmission

The transmitter of the modem has a power output of 1 Watt (+30 dBm) to 60 Ohm. If the transceiver antenna G 70522 is connected the transmitter is perfectly adapted. A low-inductive induction loop has to be adjusted by multiplier resistors (integrated on the modem card), so that the HF- loop current is limited to 130 mA.

2.1.5 Data Receiver

Input Filter and Amplifier:

The HF-input consists of two three- section filters. An amplifier for decoupling is placed between these filters. By a transformer in the first filter stage a galvanical seperation of the input is realized. The second filter is following a further amplifier stage.

After this amplifier the signal branches. On the one hand the signal is supplied to the limiter amplifier and is then converted to a square- wave reversal with an TTL level, on the other hand a level monitoring of the received signal is carried out.

Frequency Detection:

The frequency detection works merely digitally. The HF-signal with a TTL level is applied to an evaluation control counting the receive frequency by means of a crystal reference.

Data Output:

Data Output is carried out potentially separated as an active current interface.

Control Logic:

By output of a line current the level monitoring indicates a sufficient HF- reception level. Furthermore the modem's reception status is displayed by two LEDs at the front panel („HF" = sufficient reception level and „Daten" = status of data output).

3 General Technical Data

3.1 Inductive Modem

Inductive Modem G_75100-A		
Dimensions		Euro - Card, 5 TE
Material	Circuit Board	Epoxyd
	Front Panel	Aluminium, anodized
Weight		approx. 250 g
Operating Temperature Range		0^{o} C - 55^{o} C
Storage Temperature Range		-20^{o} C - 70^{o} C
Relative Humidity at 25^{o} C without condensation		95%
Protection Class		IP00
Operating Voltage		22 to 26 V
Current Consumption		typ. 100 mA (Standby)
Connection Plug		VG-strip DIN 41612 32-pin ac
Transmitter	Output Power	1 Watt on 60 Ohm
	Output Resistance	60 Ohm
Receiver	Input Voltage	at least 7 mV
	Input Resistance	60 Ohm
Logic Level	HIGH	Line Current 20 mA
	LOW	No Current

Table 2 General Technical Data Inductive Modem G_75100-A

Allocation of the VG-Connector Strip	
Supply Power	
2ac	Operation Voltage
12 ac	Bridge to 2ac (Card inserted Control)
32 ac	Operation Ground
Receiver	

Table 3 General Technical Data: Allocation of the VG-Connector Strip (part 1 of 2)

Allocation of the VG-Connector Strip	
24 ac	Antenna Input, potential free (50-60 Ohm)
30 ac	
26 ac	Antenna Input, potential free (22 Ohm, multiplier)
30 ac	
28 ac	Antenna Input, potential free (33 Ohm, multiplier
24 ac	
28 ac	Antenna Input, potential free (55 Ohm, multiplier)
26 ac	
14 a	Reception Signal - Control, potential free
14 c	
16 a	Data Output, potential free
16 c	
22 ac	Preamplifier-Signal Output
Transmitter:	
4 ac	Antenna- Output, potential free (50 - 60 Ohm)
10 ac	
6 ac	Antenna- Output, potential free (22 Ohm multiplier)
10 ac	
8 ac	Antenna - Output, potential free (33 Ohm multiplier)
4 ac	
8 ac	Antenna- Output, potential free (55 Ohm multiplier)
6 ac	
18 a	Transmitter keying, potential free
18 c	
20 a	Modulation, potentialfree
20 c	

Table 3 General Technical Data: Allocation of the VG-Connector Strip (part 2 of 2)

3.2 Antenna

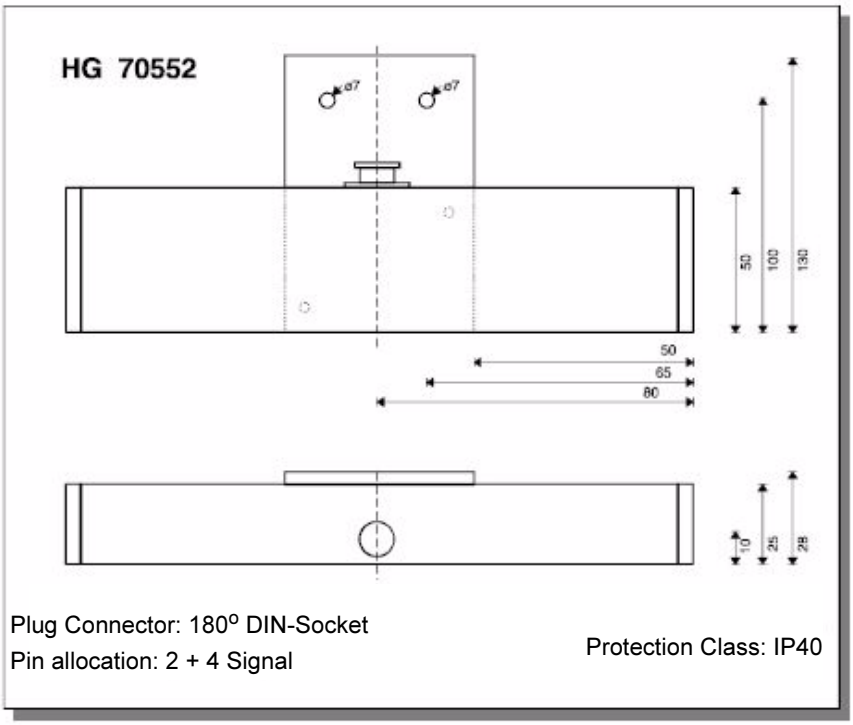
Transmitting- / Receiving Antenna G 70552	
Dimensions	See drawings
Weight	approx. 240 g
Operating temperature range	0^{o} C - 55^{o} C
Storage temperature range	-10^{o} C - 70^{o} C
Relative humidity at 25 C without condensation	95 %
Protection Class	See drawings
Cable (Modem - Antenna)	2 core with shielding
Max. Cable Length	10 m with shielded cable
Connecting Plug	See drawings
System Frequency	55 kHz / 95 kHz

Table 4 General Technical Data: Transmitting- / Receiving Antenna G 70552

Hints:

- Antenna form: see following drawings
- Different Casing Types: available on request

3.2.1 Casing Dimensions Antenna Type I

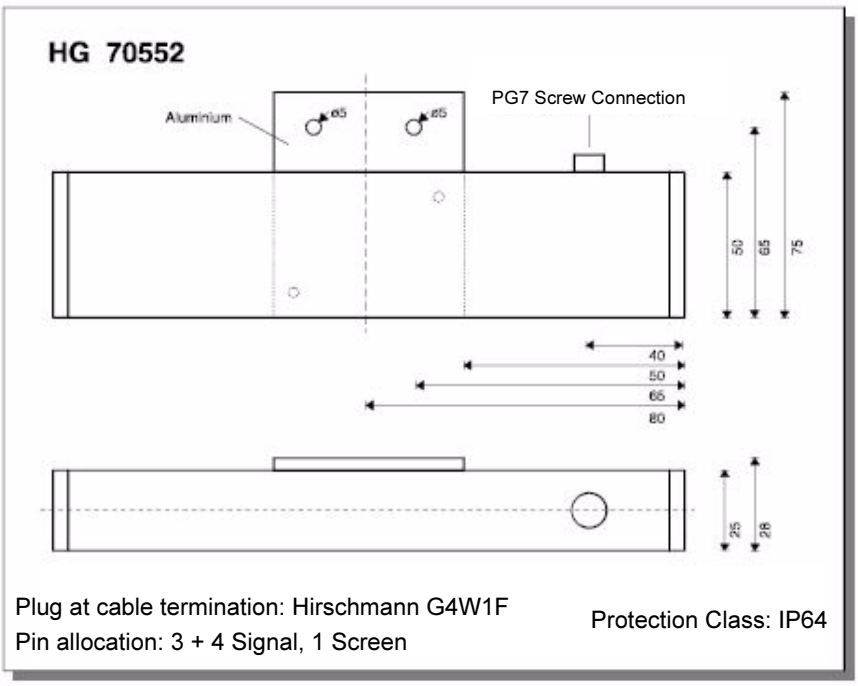


Plug Connector: 180° DIN-Socket
Pin allocation: 2 + 4 Signal

Protection Class: IP40

Bild 3 Casing Dimensions Antenna Type I

3.2.2 Casing Dimensions Antenna Type II



Plug at cable termination: Hirschmann G4W1F
Pin allocation: 3 + 4 Signal, 1 Screen

Protection Class: IP64

Bild 4 Casing Dimensions Antenna Type II

3.2.3 Casing Dimensions Antenna Type III

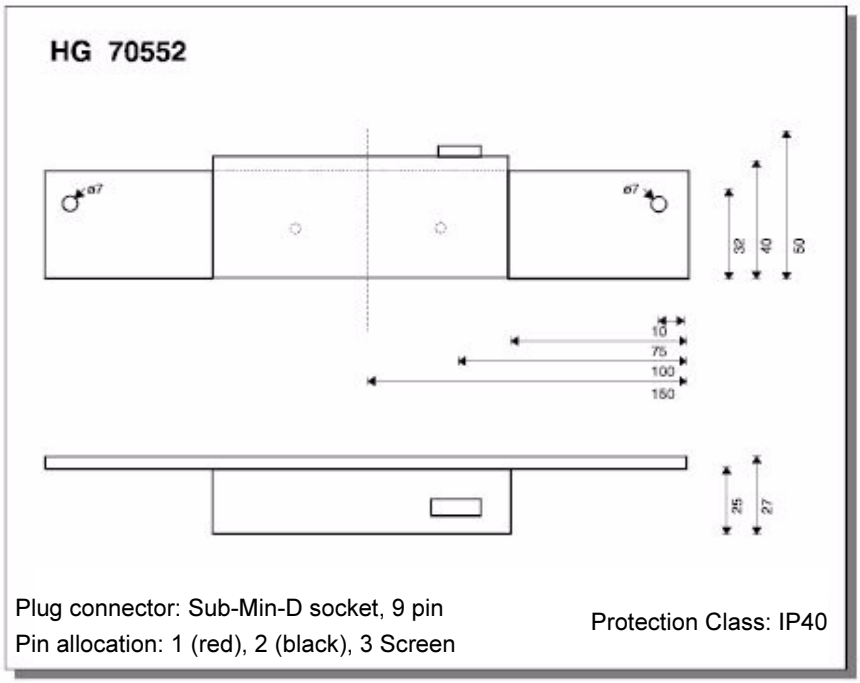


Bild 5 Casing Dimensions Antenna Type III

4 Mounting and Operation Instructions

4.1 Connection of Loop and Antenna

The antennas' inputs and outputs of the transmitter / receiver are each decoupled for the other frequency, this allows simultanoeus operation and a parallel connection.

4.2 Connection of Antennas

The HF- Interfaces of transmitter and receiver are dimensioned for a 60 Ohm connector. Therefore it is possible to connect them with the 2-frequency Antenna HG 70552

4.3 Classification of the Inductive Loops

Length: 1 m - 20 m

Concerning the connection of the loop you have to make sure that the transmitter output and / or receiver input are terminated with approx. 60 Ohm. Should the ohmic resistance of the loop and the connecting cable be insufficient, the corresponding multipliers have to be inserted. In order to minimize the wiring effort, transmitting outputs with multipliers are already realized on the modem card G_75100-A so that just an output corresponding to the required multiplier has to be selected.

Length: 20 m - 100 m

Loops of this length can be connected directly to the inductive modem. With an increasing loop length a compensation of the loop inductance / inductivity with a capacitor is recommendable.

Length: > 100 m

The loops can be so high-impedant that the HF-transmission current drops and the receiving power decreases accordingly. Furthermore it is possible that a powerful LF-transmitter leads to an interference of the wanted signal.

4.4 Electromagnetic Interference

In order to keep the radiation of the induced magnetic field within the required working area it is necessary to cross the loop segments so that the signal is inverted an therefore as far as possible compensated.

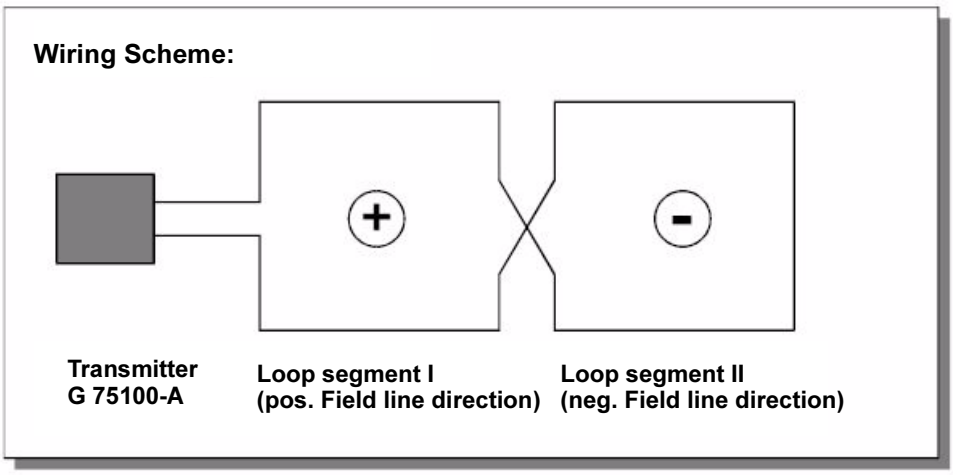


Figure 6 Wiring Scheme

4.5 Grounding

According to corresponding guidelines induction loops have to be operated isolated from earth. Therefore a connection of the loop with parts of the building construction or with water pipes is not allowed.

5 Options

For an optimal application of the inductive data transmission system G_75100-A the following options are available:

Inductive- Modem:

- Operating Voltage 12 V or 24 V
- RS 232 level for data input and output
- VG- strip DIN 41612 type C or F

Transmitting - / Receiving Antenna:

- Selection between three Casingtypes

6 Overview of Ordering Numbers

Description	55 / 95 kHz	95 / 55 kHz
Ind.-Modem, 24 V, 20 mA, Connector Strip Type C	HG 75120	HG 75130
Ind.-Modem, 24 V, 20 mA, Connector Strip Type F	HG 75121	HG 75131
Ind.-Modem, 12 V, 20 mA, Connector Strip Type C	HG 75122	HG 75132
Ind.-Modem, 12 V, 20 mA, Connector Strip Type F	HG 75123	HG 75133
Ind.-Modem, 24 V, RS 232, Connector Strip Type C	HG 75124	HG 75134
Ind.-Modem, 24 V, RS 232, Connector Strip Type F	HG 75125	HG 75135
Ind.-Modem, 12 V, RS 232, Connector Strip Type C	HG 75126	HG 75136
Antenna Casing Type I	HG 70552 Type 1	
Antenna Casing Type II	HG 70552 Type 2	
Antenna Casing Type III	HG 70552 Type 3	

Table 5 Ordering Numbers

Preformed cable according to customer requirement

Example:

10 Inductive Modems, 95 / 55 kHz, 24 v, RS 232, connector strip, type F

10 Antennas Type II

10 units HG 75135

10 units HG 70552 type 2,5 m cable

Subject to technical changes, errors excepted

7 Appendix

A Checking of Data Transmitter

Devices required:

- DC mains power supply for UB = 24 V (12 V)
- Oscilloscope
- Digital frequency counter
- 2 switches

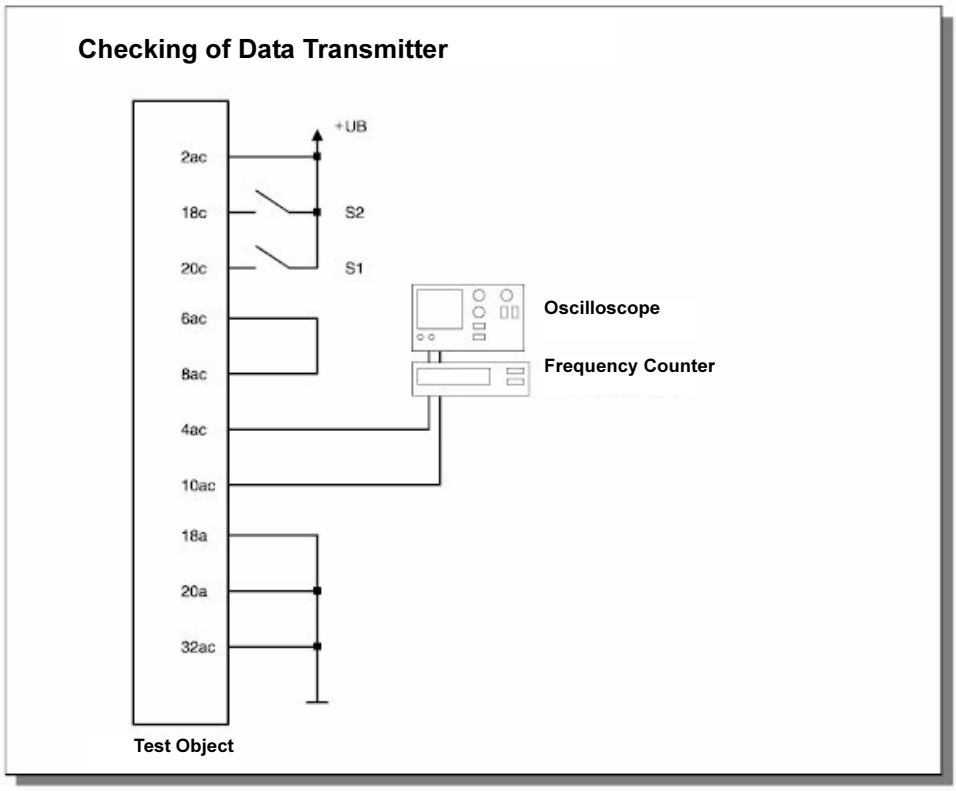


Figure 7 Checking of Data Transmitter

The test circuit is configured according to the drawing on page 16. The following measuring instruments are applied: A digital frequency counter for frequency measurement and an oscilloscope for determination of the voltage. As the transmitter is terminated with 50 Ohm during this test programm, the transmitting voltage is a result of the transmitting current divided by 50 Ohm.

The test of the transmitting functions is implemented by means of both switches S1 and S2, whereas the following allocation is applied accordingly:

S1	S2	Frequency	Characteristics
L	L	–	L = 0 mA H = 20 mA Ua = 7 V_{eff} = 20 V Ia = 127 mA_{eff} = 360 mA_{SS}
H	L	fo	
H	H	fu	
L	H	–	

Table 6 Switch allocation S1 and S2

B Checking of Data Receiver

Devices required:

- DC mains power supply for UB = 24 V (12 V)
- 2 multimeters
- 2 switches
- Resistors 15 kOhm and 60 Ohm

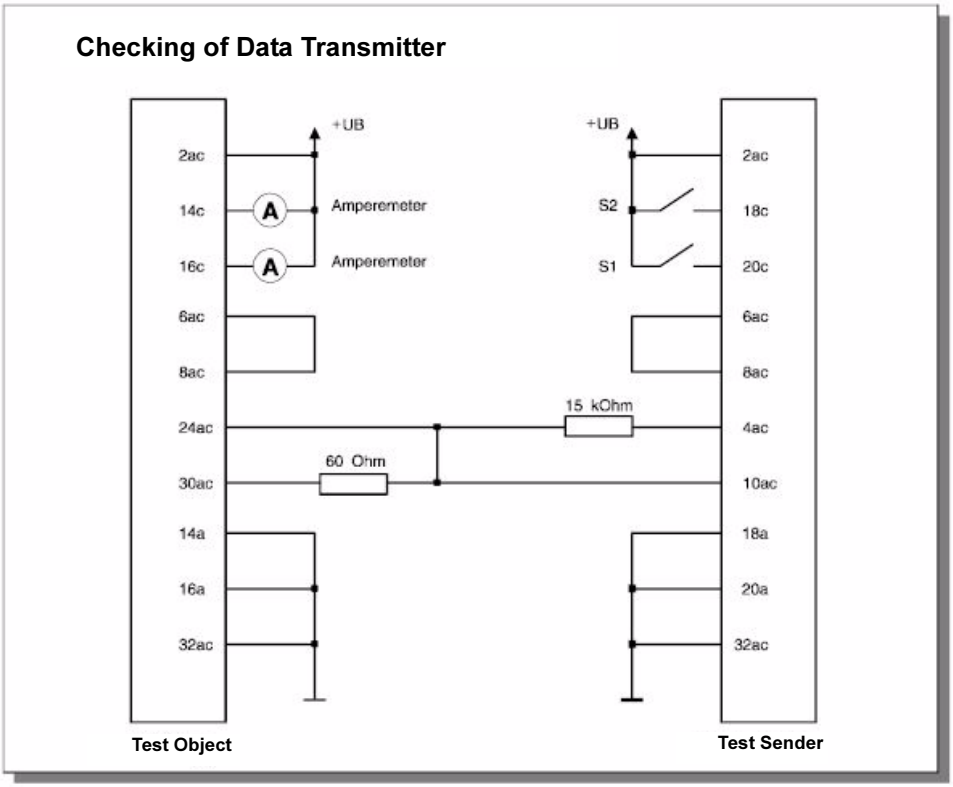


Figure 8 Checking of Data Receiver

The test circuit is configured according to the drawing on page 18. Controlling of the outputs „level“ and „data“ is realized by the multimeters, they measure the loop current. The operability of the reception circuit is tested by means of both switches S1 and S2, whereas the following allocation is applied accordingly:

S1	S2	Frequency	Data	Level	Characteristics
L	L	–	H	L	L = 0 mA H = 20 mA Ue = 15 mV_{eff}
H	L	fo	L	H	
H	H	fu	H	H	
L	H	–	H	L	

Table 7 Switch allocation S1 and S2

8 List of Pictures

9 List of Tables

10 Copyright and Terms of Liability

10.1 Copyright

This manual is protected by copyright. All rights reserved. Violations are subject to penal legislation of the Copyright.

10.2 Exclusion of Liability

Any information given is to be understood as system description only, but is not to be taken as guaranteed features. Any values are reference values. The product characteristics are only valid if the systems are used according to the description.

This instruction manual has been drawn up to the best of our knowledge. Installation, setup and operation of the device will be on the customer's own risk. Liability for consequential defects is excluded. We reserve the right for changes encouraging technical improvements. We also reserve the right to change the contents of this manual without having to give notice to any third party.