RailPilot – optical anti-collision sensors

System manual FR 85-2 ILLG-S1L5

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1 RailPilot FR 85 anti-collision sensor

The sensor's task is to prevent the collision of vehicles on rail-mounted tracks, primarily suspension tracks; RailPilot is the reliable solution for this task. Breaking distances and distances between vehicles differ according to the type of goods being carried and the speed of travel. This requires a flexible adjustment of switching distances. Constantly changing objects around the vehicles and the presence of other sensors do not impair RailPilot's reliable anti-collision function.

In order to maintain the reliable anti-collision function and ensure accurate switching points regardless of the surroundings and conditions of the vehicles themselves, a reflector is fitted to the rear of every vehicle present in the installation. RailPilot is fitted to the front of each vehicle and thus always points at the reflector on the vehicle ahead. Should the vehicle come closer than the currently selected breaking distance, the breaking system is activated and the vehicle slows down. Should the vehicle come closer than the stopping distance, it comes to a complete standstill. Once the vehicle in front moves further away, the signals are enabled one after the other and the vehicle travels forward again.

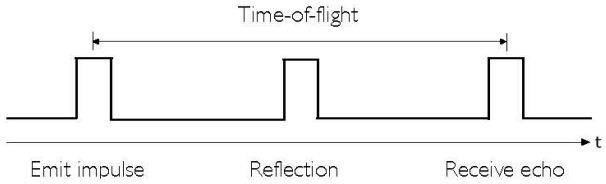
When using vehicles of variable length, e.g. due to overhanging loads, the distances maintained in the installation can be varied. This RailPilot function enables optimum use of congested areas.

1.1 RailPilot FR 85 sensor technology

Railpilot FR 85 works on the principle of optical time-of-flight measurement.
Distance measurement uses the physical principle that light always spreads at a constant speed of c=299,792 kilometres per second.
In other words, light travels a distance of 1 m in 3.335 ns (0.000,000,003,35 s).

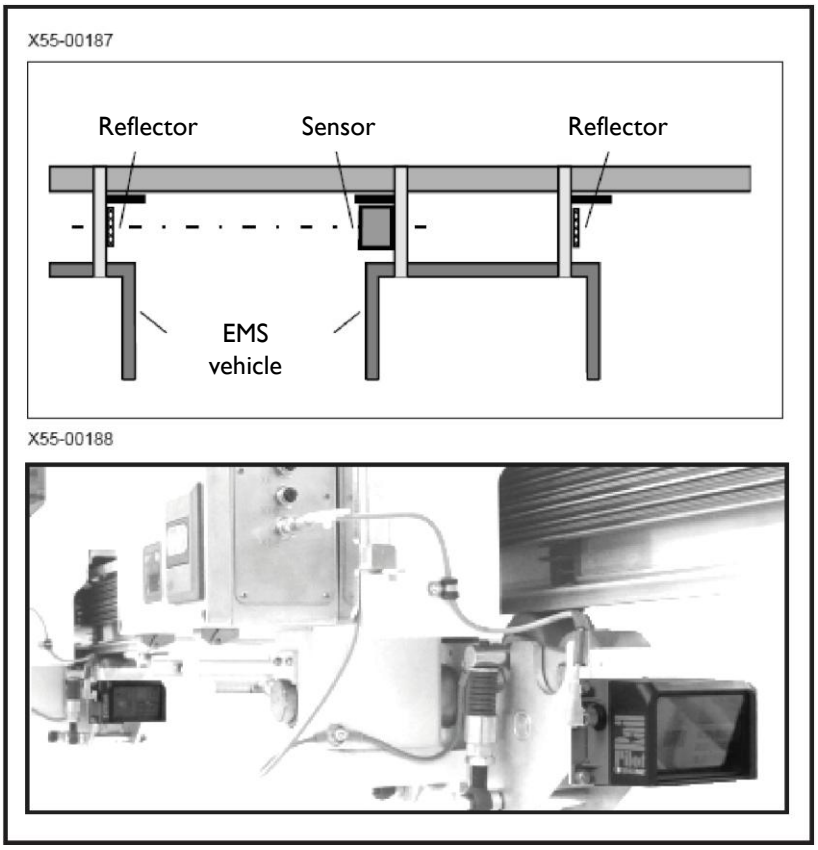
RailPilot uses the principle of pulsed time-of-flight measurement:

With pulsed time-of flight-measurement, a very short light impulse is emitted, reflected and registered by the receiver; measured time is stopped at that very same moment.
The emitted impulse triggers a clock which is stopped by the received impulse. The time elapsed (time of flight) is always proportional to the optical path length.



Use of this physical principle makes RailPilot ideal for optical anti-collision distance measurement.

1.1.1 Aligning RailPilot in a conveyor system (EMS)



1.2 RailPilot versions

RailPilot is available in two versions:

FR 85-2 ILLG-S1L5	RS485, 57.6 kB
FR 85-2 ILLG-S1L5	RS485, 62.5 kB

Their sensor technology is virtually identical, as each version **only** detects **reflectors** within its detection range. Machines or rail components which may also be in the field of vision do not affect the RailPilot.
Close-up at distances of **less than 0.3 m**, the RailPilot detects **every object**. This function is used for detecting obstacles directly in front of the sensor.
The sensor versions differ in signal function and detection range.

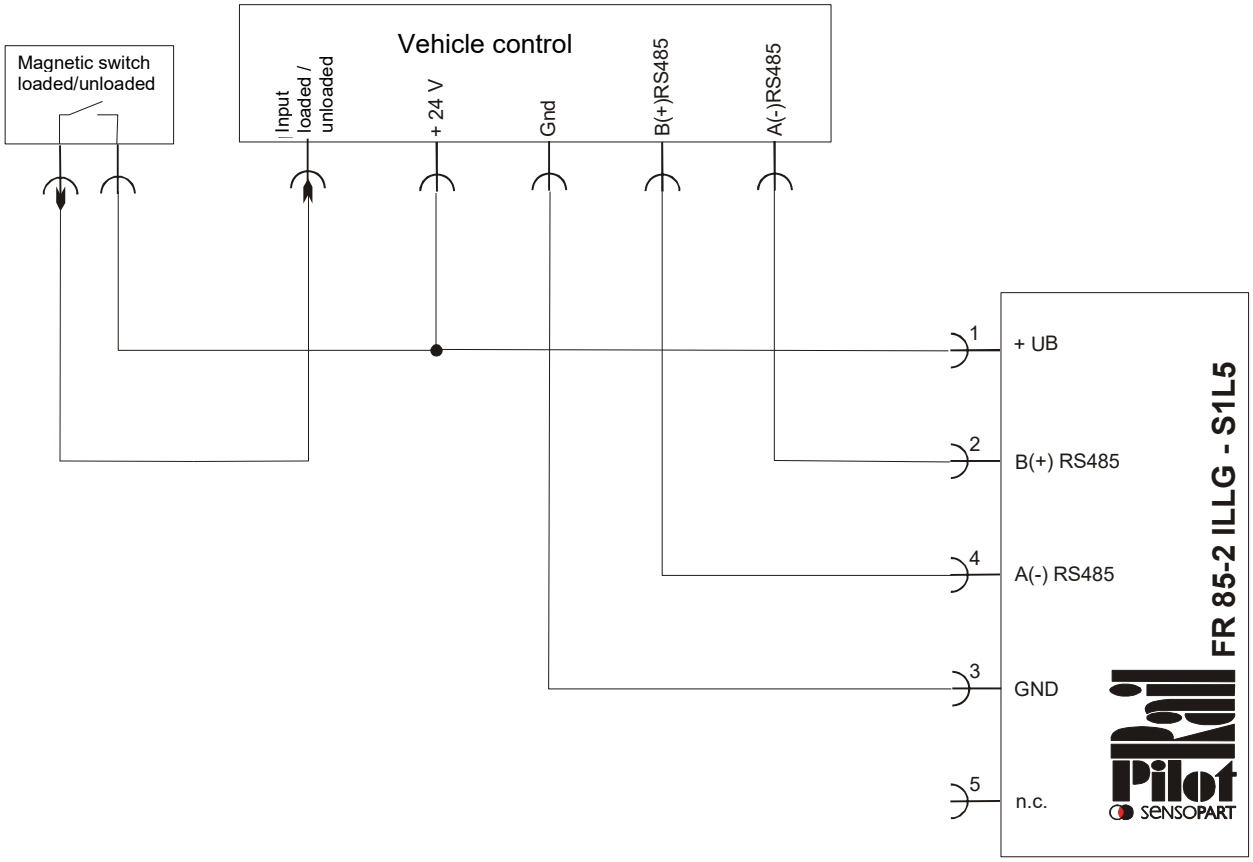
FR 85-2 ILLG-S1L5

- Detection range 0 … 6 m
- Aperture angle horizontal ± 7.5 degrees; vertical ± 3.5 degrees
- RS485 serial interface

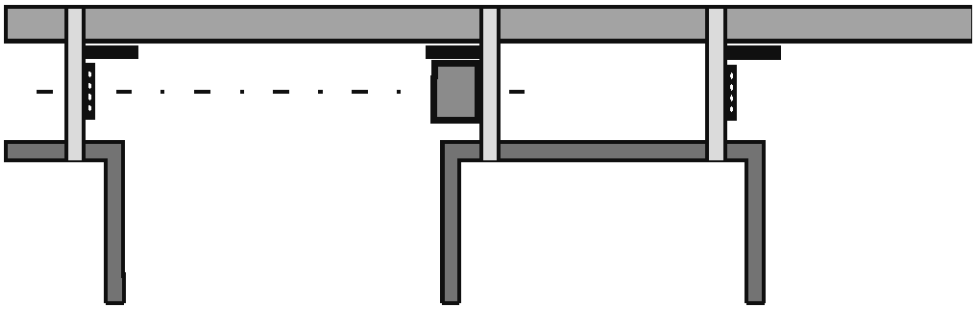
The FR 85-2 ILLG-S1L5 only communicates with the vehicle control system via the RS485 interface.
For this purpose, the vehicle control software must have implemented the protocol of the
FR 85-2 ILLG-S1L5.
(Control systems with this function are currently available from Lenze DETO, LJU and SEW).
In this application, RailPilot acts as an actual value indicator for the distance to the vehicle in front. The control system continuously interrogates the sensor for the distance to the reflector in front. If the reflector is within detection range, RailPilot sends the distance value to the control system, otherwise the signal sent indicates "no reflector detected". Based on this information, the vehicle control system can position the vehicle as.

Advantages:
parameter settings are carried out via the control system. Should it be necessary to replace the RailPilot, no sensor adjustments are required.

Connection example:



1.3 Installation / Mounting suggestion



The illustrated frame protection prevents damage occurring to sensors and reflectors when the EMS vehicles are pushed up close together during service interventions.

1.4 Serial communication FR 85-2 ILLG-S1L5

FR 85-2 ILLG-S1L5 only communicates with the vehicle control system via the RS485 interface.
When installing with a suitable vehicle control system, it is merely necessary to set the correct baudrate.

The factory setting is 57.6 kBaud.

This setting makes the FR 85-2 ILLG-S1L5 sensor suitable for immediate use with the Lenze DETO and the SEW control system.

When used with the **LJU control system**, the baudrate must be set to **62.5 kBaud** (see transmission protocol data sheet and description of test software).

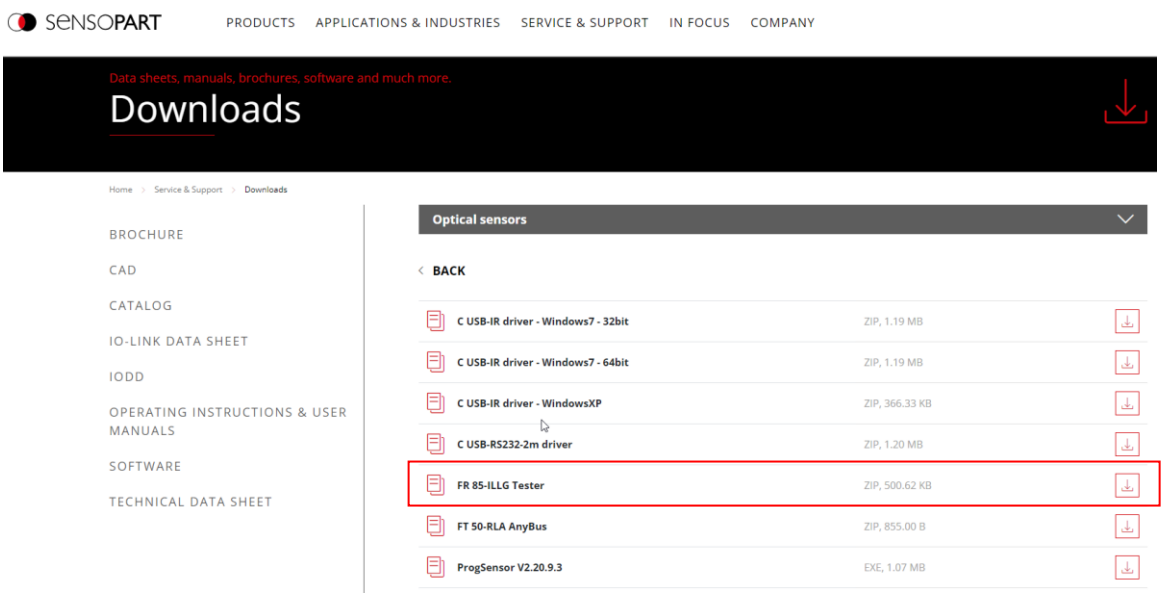
The sensor is also available with preset baudrate:

Type / order reference	Switching output interface	Baudrate	Suitable for control system	Part no.
FR 85-2 ILLG-S1L5	RS485	57.6 kB	Lenze DETO, SEW	529-11008
FR 85-2 ILLG-S1L5-62,5kB	RS485	62.5 kB	LJU	529-11014

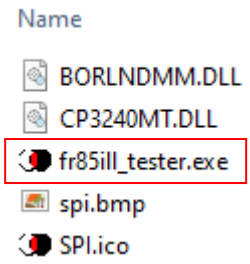
1.5 Instruction FR 85 Offset-Feature (from V6.2)

1.5.1 Installation FR 85-ILLG Tester software

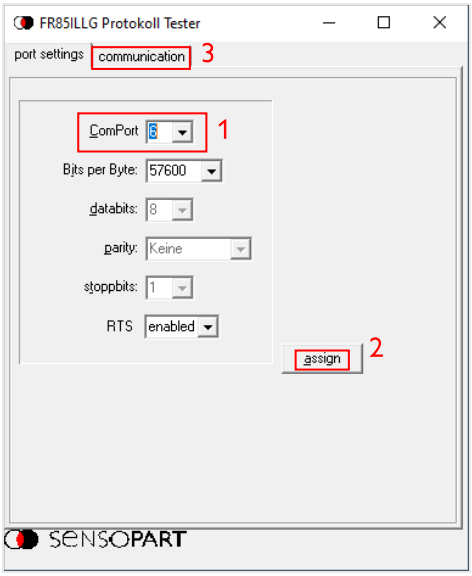
1. Download the FR 85-ILLG Tester software.
   Use the following link: FR 85.ILLG Tester



2. Extract the .zip file
3. Open the .exe file: fr85ill_tester.exe

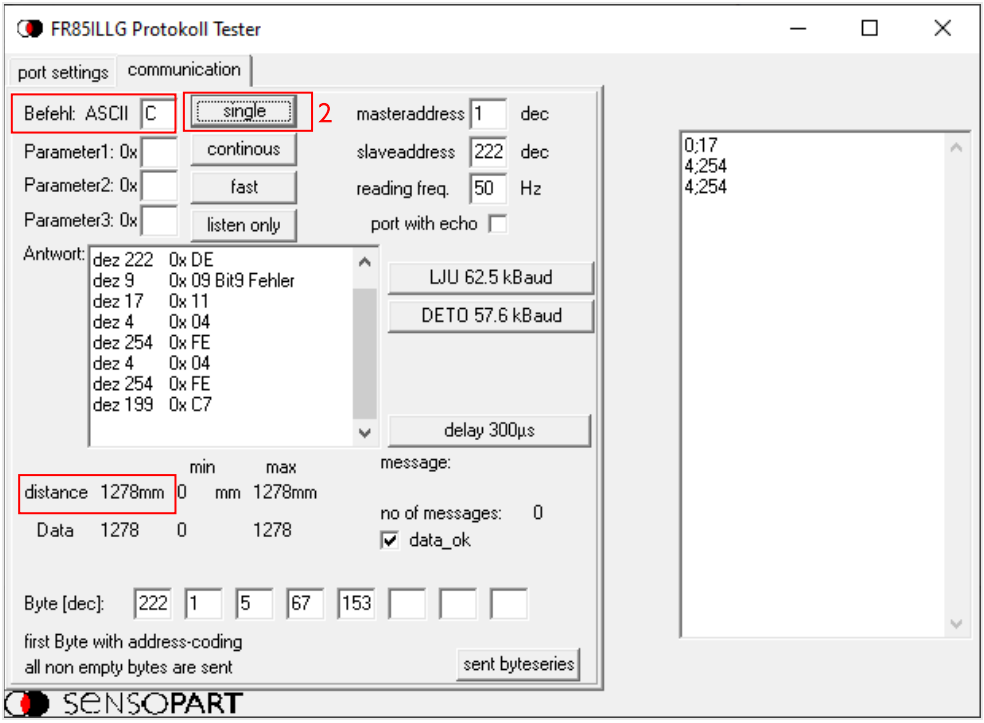


1.5.2 Start FR 85-ILLG Tester software



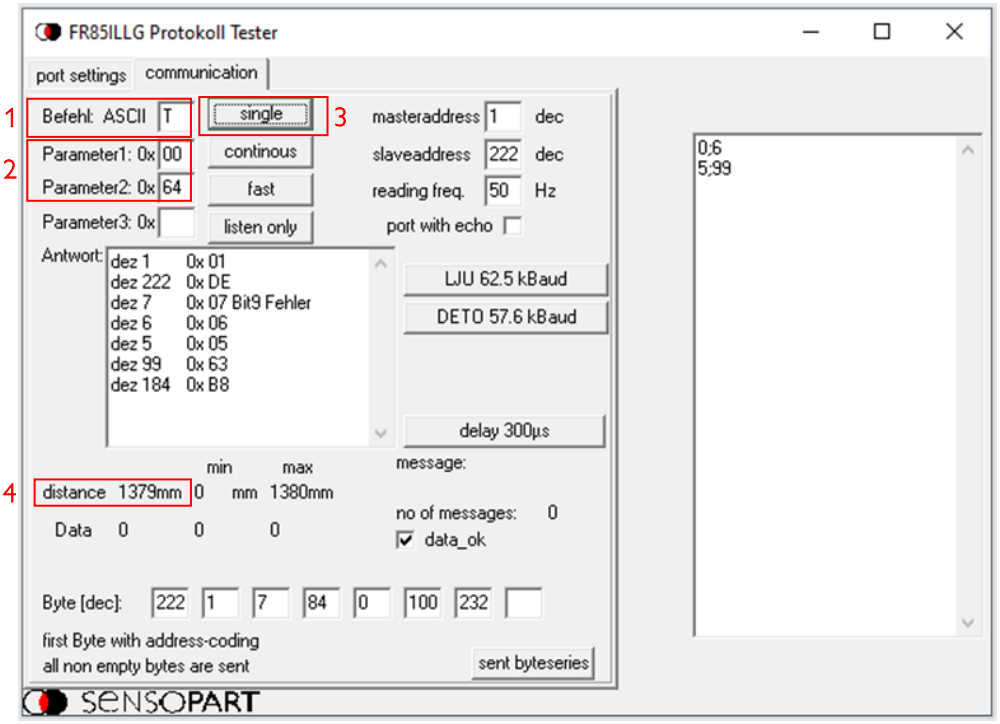
1. Select the COM port via which the sensor is connected to the PC.
   Please ensure that a COM port from 1-9 is used.
2. Click assign.
3. Switch the tab to communication.

1.5.3 Read distance



1. **Command C** is used to read the current measurement value.
2. Click single to get the current measurement value.
3. Read the current measurement value.

1.5.4 Set offset – “current measurement value + offset”



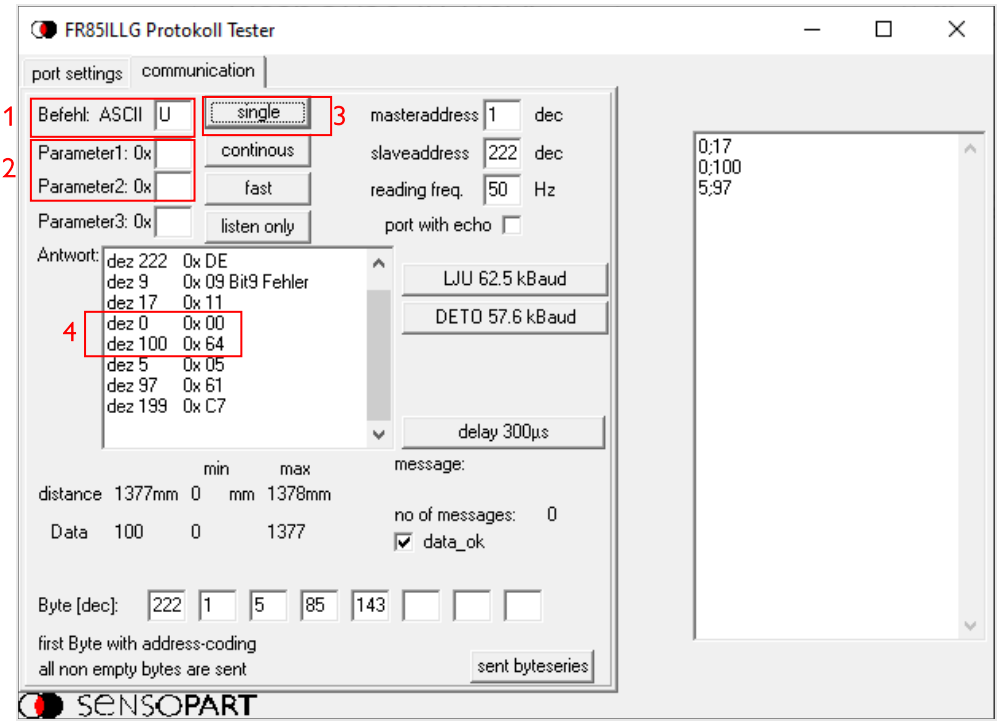
1. Command T is used to set an offset.
2. Use parameter 1 and parameter 2 to set an offset.

   Example 1:
   - Distance offset: 100 mm
   - Corresponds hex: 64
   - Parameter 1: 00
   - Parameter 2: 64

   Example 2:
   - Distance offset: -100 mm
   - Corresponds hex: FF9C
   - Parameter 1: FF
   - Parameter 2: 9C

3. Click single to apply the offset.
4. Read the distance value.
   (current measurement value + offset)

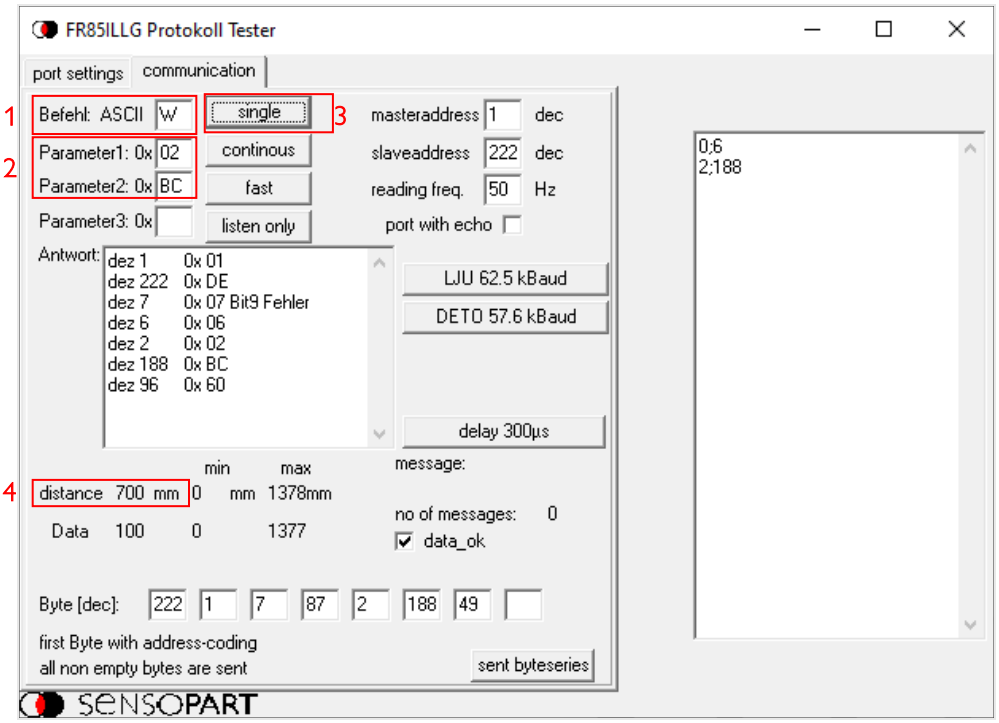
1.5.5 Read offset



1. Command U is used to read the offset.
2. No parameters!
3. Click single to read the offset.
4. Response offset in hex

Example:
- 0x0064
- Corresponds: 100 mm

1.5.6 Teach offset – “distance value = x”

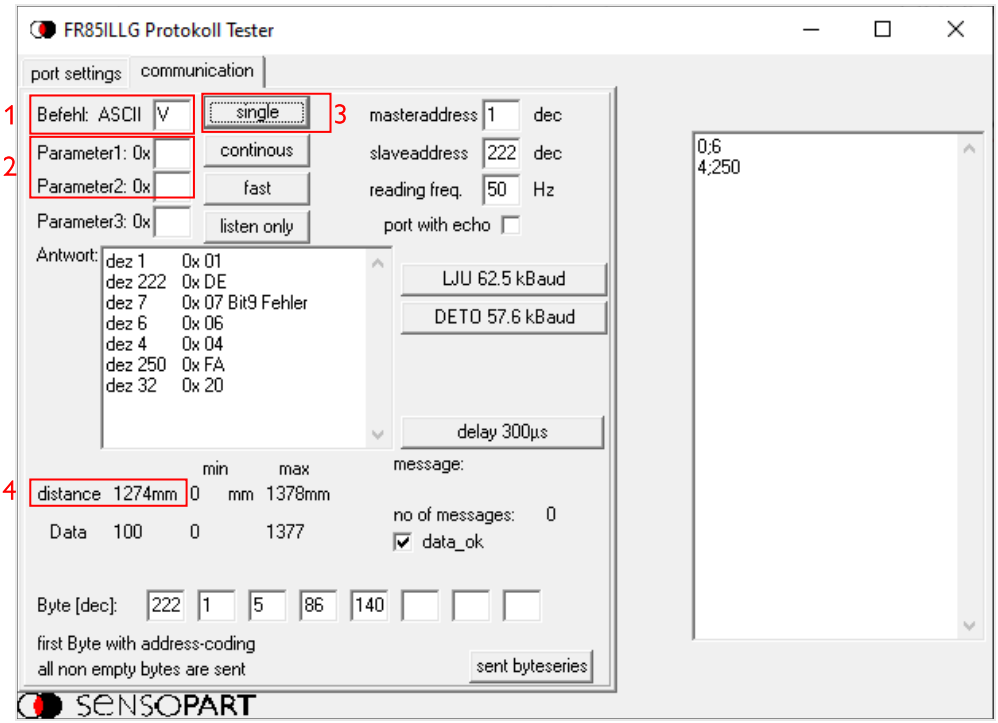


1. Command W is used to teach an offset.
2. Use parameter 1 and parameter 2 to set an offset.

   Example:
   - Teach offset: 700 mm
   - Corresponds hex: 2BC
   - Parameter 1: 02
   - Parameter 2: BC

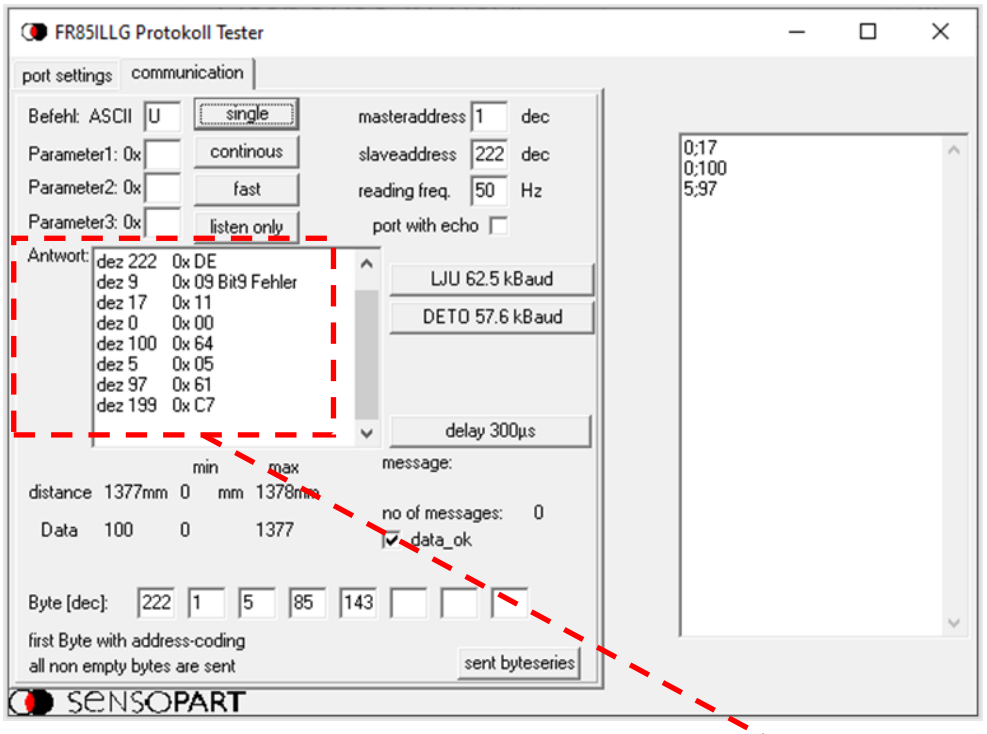
3. Click single to apply the offset.
4. Read the distance value.

1.5.7 Reset offset



1. Command V is used to reset the offset.
2. No parameters!
3. Click single to reset the offset.
4. Read the current measurement value without offset.

1.5.8 Breakdown of bytes



Slave address..... dez 222 0x DE
Length of the response: 9 bits - variable depending on the command..... dez 9 0x 09 Bit9 Fehler
Command response (0x11 = parameter set; 0x15 = NAK; 0x06 = ACK)..... dez 17 0x 11
Parameter byte 1 (MSB)..... dez 0 0x 00
Parameter byte 2 (LSB)..... dez 100 0x 64
Distance byte 1 (MSB)..... dez 5 0x 05
Distance byte 2 (LSB)..... dez 97 0x 61
Checksum..... dez 199 0x C7

NAK = Not acknowledge
AK = Acknowledge

Answer (from FR 85)

master-Id	own-Id	lenght	command	parameter(s)	Checksum (answer from slave)

This means:

- xxx_id = address or sender (1 byte)
- Length = number of characters sent, incl. frame (1 byte)
- Command = control command (1 byte)
- Parameter = 0 to n, according to command (0 to n byte), nmax = 48
- Checksum = checksum of all characters sent by "Exclusive-OR" (1 byte) without address selection bit

1.6 Accessories

Type / order reference	Description	Part-No.
L5-2m-G-PUR	2 m, straight, a-coded, PUR, IP 65 / IP 67 / IP 68	902-51652
R10/2	(2 x R10) reflector in housing 100 x 100 x 9 mm	904-51636

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