D4586-0.2

Technical documentation

Wheel sensor Signal Converter

WSC001

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	Name	Signature	Date	**Technical documentation Wheel sensor Signal Converter WSC001**	Classified	
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Masthead

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Review list

Version	Date	Prepared by	Sections modified	Modifications
0.1	2015-12-17	Susanna Schachinger	all	initial version (DRAFT)
0.2	2016-xx-xx	Susanna Schachinger	xxx	xxx

Bibliography

D-Number	Title	Version[1]
D2860	Brief instruction testing plate PB200 GS03	4
D4231	Mounting, commissioning and maintenance manual wheel sensor RSR110	1
D4232	Application guide wheel sensor RSR110	1

1 The stated or a higher version is valid.

List of standards

Number	Title	Issue/ version
DIN EN 60715	Dimensions of low-voltage switchgear and controlgear Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations	2001
EN 50121-4	Railway applications – Electromagnetic compatibility – Part 4: Emission and immunity of the signalling and telecommunications apparatus	2016
EN 50124-1	Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment	2006
EN 50125-3	Railway applications – Environmental conditions for equipment – Part 3: Equipment for signalling and telecommunications	2003
EN 50126-1	Railway applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)	1999
EN 50128	Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems	2011
EN 50129	Railway applications – Communications, signalling and processing systems – Safety related electronic systems for signalling	2003
EN 60529	Degrees of protection provided by enclosures (IP Code)	1991
EN 60721-3-1	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage	1997
EN 60721-3-2	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation	1998

EN 60721-3-3	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weather-protected locations	1995
EN 60721-3-4	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weather-protected locations	1997

1 About this documentation

This documentation provides information of the product features and the required information for the configuration and installation of the Wheel sensor Signal Converter WSC001.

1.1 Typographical conventions

The following typographical conventions are applied in this documentation:

1.1.1 Pictograms

Important notes

Important notes contain information and instructions regarding the availability and the safe operation of the system.

Important information and notes are shown as follows:

 Description

1.1.2 Styles of writing and other formal principles

Orders

- Contents (descriptions, figures, tables etc.) are generally described in this documentation “from left to right” and “from top to bottom”.

Numbers

- Decimal places of decimal numbers are separated by a comma (,) (e.g.: 123,45).
- For reasons of better readability, digits of four- or multi-figure decimal numbers are arranged from right to left with thousands separators in groups of three digits (e.g. 1 234).

1.2 Units of measurement

In this documentation the following units of measurement are used:

bit	bit
°C	degree in Celsius
km	kilometre
m	metre
mA	milliampere
mm	millimetre
ms	millisecond
Ω	ohm
s	second
V	volt

1.3 Abbreviations

In this documentation the following abbreviations are used:

A	measurement A, vertical mounting position of the wheel sensor
ABP	wire break level
AEI	Automatic Equipment Identification
AKP	wire short-circuit level
AMB	Adjustment and Maintenance Box
ASD	Advanced Service Display
ASP	tripping level
DC	direct current
DIN	German institute for standardization
DIP	Dual In-line Package (DIP-switch)
EMC	electromagnetic compatibility
EN	European standard
ESD	electrostatic discharge
ESP	trigger level
GND	ground
GS	equipment version
IEC	International Electrotechnical Commission
IPxx	International Protection (protection type, e.g. IP65)
LED	light-emitting diode
PB	testing plate
Ri	direction pulse of a traversing
Ri1	direction pulse of a traversing from sensor system 1 to sensor system 2 (direction 1)

Ri2	direction pulse of a traversing from sensor system 2 to sensor system 1 (direction 2)
RJ45	Registered Jack (standardised socket) for connectors of the type 45
RSR	wheel sensor
RSR110	wheel sensor, type RSR110
RSR110-001	wheel sensor, type RSR110-001
RSR110-002	wheel sensor, type RSR110-002
SIL	Safety Integrity Level
SPS	Programmable Logic Controller (PLC)
Sys	system of a wheel sensor
Sys1	system pulse of sensor system 1
Sys2	system pulse of sensor system 2
ÜSP	overcurrent level
WSC	Wheel sensor Signal Converter

1.4 Terms and definitions

commissioning	Test on an item carried out on site, to prove that it is correctly installed and can operate correctly (IEC 60050-151-16-24).
damped	One or two sensor system(s) of a wheel sensor indicate(s) an occupancy (generally in the case of traversing by a train wheel and/or when damped by a testing plate).
digital filtering time	Period of time by which the wheel sensor signal is required to fall below the trigger level or rise above the tripping level before the sensor system is deemed to be “damped” or “clear”.
direction pulse length	The direction pulse length (t_3) is the time for which the direction pulse applies at the output.
interference voltage	Voltage that may occur at the ends of outdoor equipment cables as a result of inductive or capacitive influences to earth.
maintenance, corrective	The maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function (IEC 60050-191-07-08). Synonym: repair
maintenance, servicing	The maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item (IEC 60050-191-07-07). Synonym: preventive maintenance
normal operating sensor current	Sensor current, when wheel sensor is correctly mounted at rail and not damped. Stated in milliampere (mA) and to be equated with 100 %.
output extension time	The output extension time (t_2) is the time which elapses, from rising of the sensor system signal above tripping level ASP until the switching operation at the output.

overcurrent level	Rated above normal operating sensor current of the wheel sensor and indicated as percentage of the same.
overcurrent suppression time	The overcurrent suppression time (t_5) is the time, by which the sensor system signal must exceed the overcurrent level ÜSP before the sensor system is considered to be faulty.
repair	The maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function (IEC 60050-191-07-08). Synonym: corrective maintenance
top-hat rail	DIN rail with hat-shaped cross-section, type TS 35 x 7,5, perforated
trigger level	If the sensor current of a sensor system falls below the trigger level ESP, then the sensor system is considered as damped.
tripping level	If the sensor current of a sensor system rises above the tripping level ASP, then the sensor system is considered as not damped. The tripping level ASP must always be considered in context with the trigger level ESP. The tripping level ASP is above the trigger level ESP and is indicated as percentage related to the normal operating sensor current.
wire break level	Rated below the trigger level and stated in milliampere (mA).
wire break suppression time	The wire break suppression time (t_7) is the time in which the sensor system signal must fall below the wire break level ABP before the sensor system is considered to be faulty.

1.5 Target group

This documentation is intended for the personnel who are responsible for commissioning, operation and maintenance of the system components.

2 Safety

This documentation contains important warning and safety information, which must be observed by the user. Only by compliance with these prerequisites and safety measures, a proper operation can be ensured.

2.1 General protective provisions

Components of Frauscher must be used in the original condition (= characteristics and functions as described in the respective documentation).
Only the settings described in the respective documentation may be carried out. Apart from that, arbitrary changes of the components are not permitted.
However, if changes of a component should be required, then Frauscher must be consulted in any case and in advance.

All operational protective provisions of the rail operator must be observed.

The operator must ensure that only authorised personnel or people in the company of authorised personnel have access to the system.

Prior to and during the works on the track, safety measures must be carried out according to the applicable railway regulations.

2.2 Qualified personnel

Working on components of Frauscher (installation, commissioning and maintenance) must only be carried out by trained skilled personnel.

2.3 Safety-conscious working

The operator is responsible for the occupational safety.

Components of Frauscher may only be operated in undamaged condition.

The component described in this documentation may only be used for non-safety-relevant applications.

All actions carried out on components of Frauscher may not impact the safety of persons or the function of the system.

2.4 Intended use

The product is intended for a specific operation purpose described in the documentation. If applied outside the intended use described, in the case of non-compliance of the documentation or in the case of non-compliance with compulsory requirements and safety measures, no warranty and/or liability shall apply.

Examples of possible applications for the WSC:

- activation of AEI card reader
- activation of lubricator
- hot box detection
- vision monitoring
- warning system
- wheel flat detection

3 Structure and function

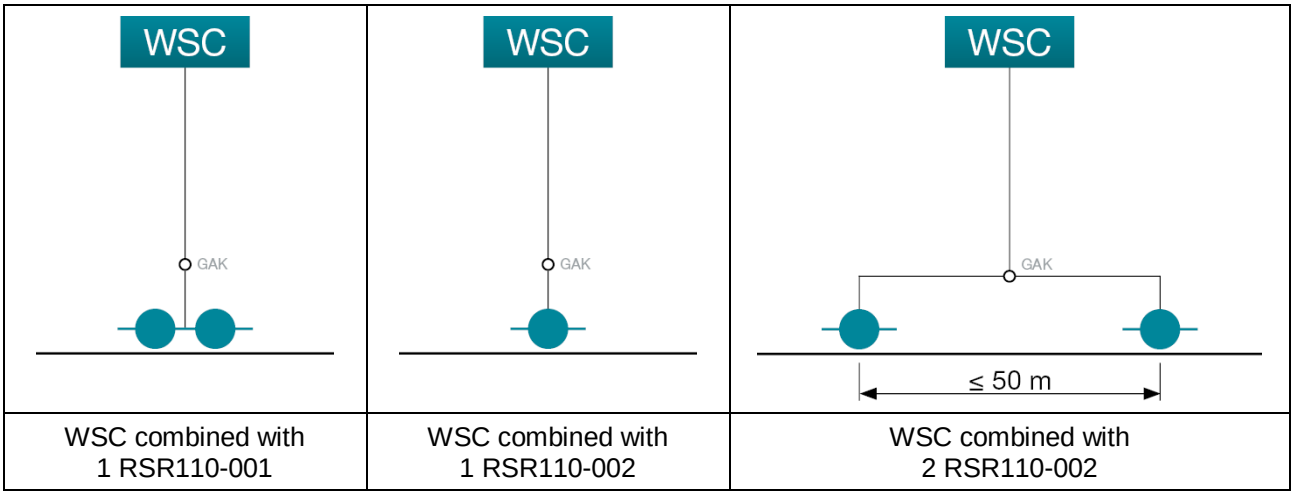
The Wheel sensor Signal Converter WSC processes the wheel sensor information of the wheel sensor RSR110-001 and the wheel sensor RSR110-002.

The wheel sensor **RSR110-001** is equipped with **2 sensor systems** and can output information regarding the status of the sensor systems (damped, not damped or faulty) and information regarding the direction of a traversing.

The wheel sensor **RSR110-002** is equipped with **1 sensor system** and can output information regarding the status of the sensor system (damped, not damped or faulty).

The WSC can be combined with:

- 1 wheel sensor RSR110-001
- 1 wheel sensor RSR110-002
- 2 wheel sensors RSR110-002



WSC combined with 1 RSR110-001	WSC combined with 1 RSR110-002	WSC combined with 2 RSR110-002

Figure 3.1: Track layouts with possible combinations of the WSC with RSR110-001 or RSR110-002

The distance between the WSC and the wheel sensor(s) must not be more than 10 km.

Wheel sensors are mounted on the inside face of rail. The displayed line in the track layout marks the centre line of the track. The wheel sensors are mounted on the side of track with the smallest lateral wear of rail head.

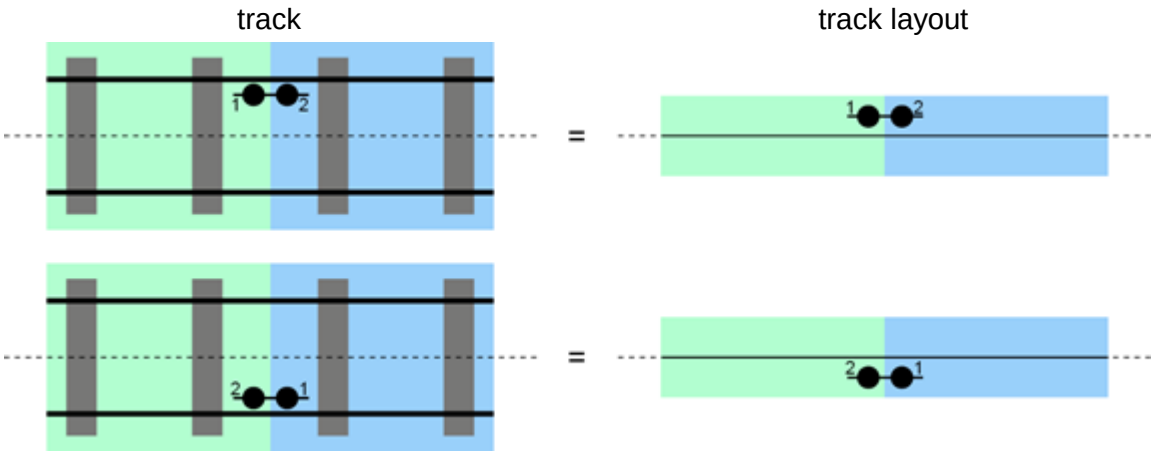
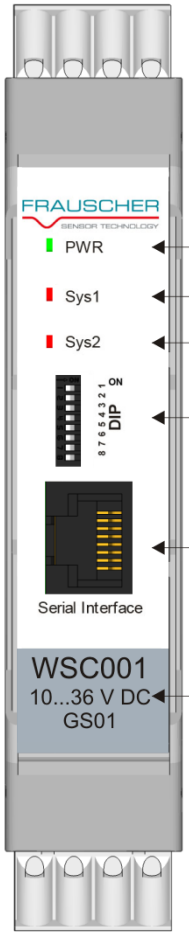


Figure 3.2: Side of track the wheel sensor is mounted

The WSC supplies the wheel sensor(s) with voltage and converts the analogue signal of the wheel sensor(s) into digital signals. The digital signals are transmitted as digital switching signals to a higher-ranking system via optocoupler. At the outputs, a traversing and/or the direction of the traversing is output.
The sensor current depending on the occupancy of the wheel sensor is evaluated level-related by the WSC. Based on the normal operating sensor current of the sensor system, a current change can be detected downwards or upwards and results in a respective switching operation at the interface.
Errors are indicated via the LEDs “Sys1” and/or “Sys2” on the front panel of the WSC.

The WSC complies with the requirements of SIL 0.

The required information and prerequisites for the application of the wheel sensor RSR110-001 are described in the documentation D4232 “Application guide wheel sensor RSR110”.



Element	Description
PWR (LED)	status indicator of power supply
Sys1 (LED)	status indicator of system 1
Sys2 (LED)	status indicator of system 2
DIP-switches	configuration and adjustment of the wheel sensor via WSC
Serial Interface (RJ45-socket)	connection socket for diagnostic interface (ASD)
Type key	
WSC001	board identification
10…36 V DC	permissible supply voltage
GS01	equipment version (beginning with 01)

Figure 3.3: Front panel of the WSC

3.1 Interfaces

The interfaces are arranged on pluggable cage clamp terminals as shown in the following figure:

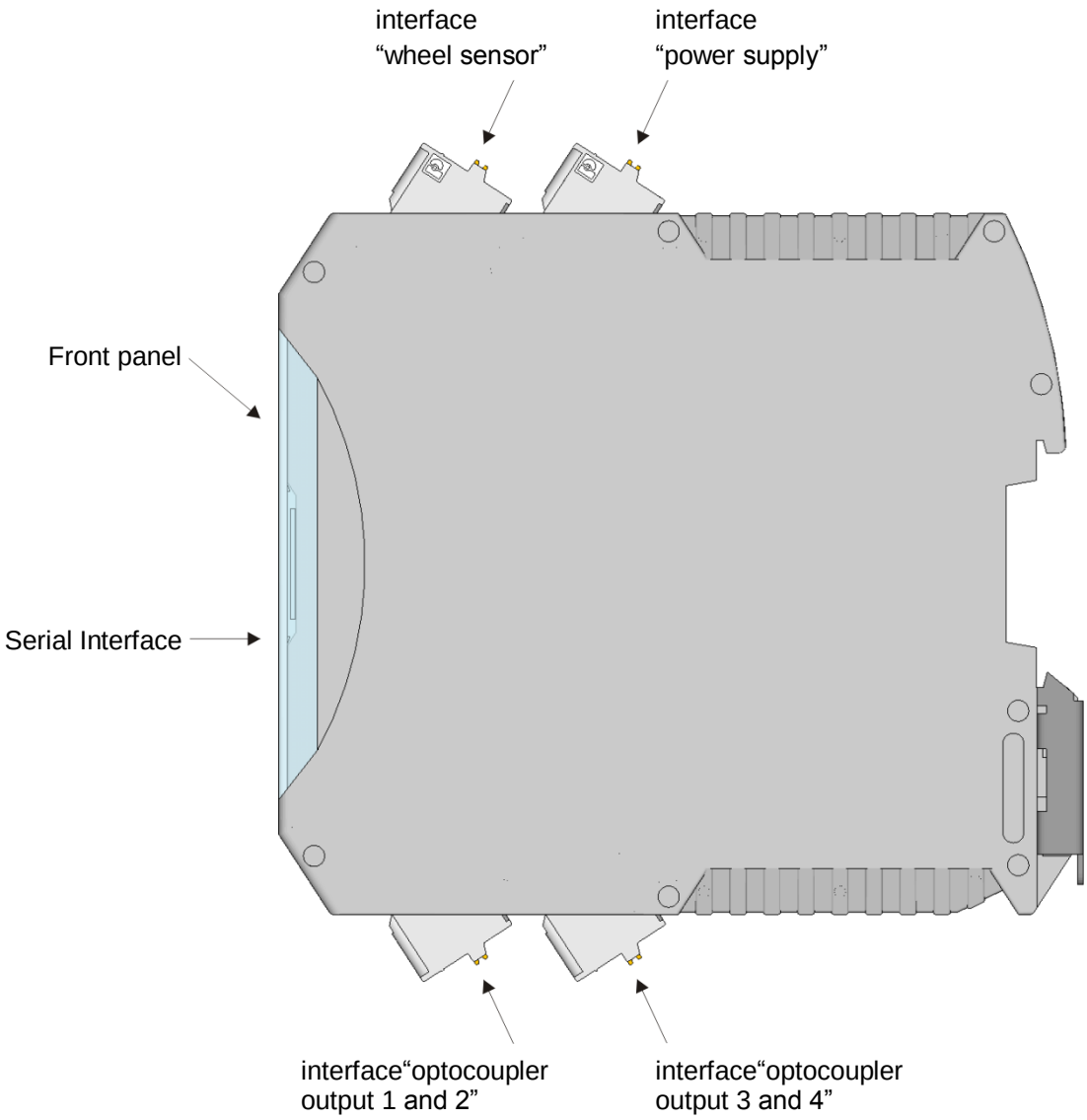


Figure 3.4: Interfaces of the WSC

3.1.1 Diagnostic interface “Serial Interface”

Error diagnostics can be carried out by means of the Advanced Service Display (ASD).

When handling the diagnostic interface “Serial Interface”, safety precautions against dangerous contact voltages must be taken. (At the diagnostic interface “Serial Interface” an interference voltage against earth can be present.)

Only the Frauscher Advanced Service Display ASD with the associated Service Display Cable may be connected to the diagnostic interface “Serial Interface”.

3.1.2 Interface “wheel sensor”

Via this interface the wheel sensor(s) is/are supplied and evaluated.
The WSC provides 24 V DC supply voltage for the wheel sensor(s).
The loop resistance at the interface “wheel sensor” must not exceed 500 Ω.
The interface “wheel sensor” is short-circuit-proof.

In case the WSC is used with the wheel sensor **RSR110-001**, 1 wheel sensor can be supplied and evaluated by the WSC.

In case the WSC is used with the wheel sensor **RSR110-002**, up to 2 wheel sensors can be supplied and evaluated by the WSC. In case the WSC is used with 2 wheel sensors, the maximum distance between the wheel sensors must not exceed 50 m.

3.1.3 Interface “power supply”

Via this interface the WSC is supplied with voltage.
The permissible supply voltage is 10 to 36 V DC.

The current consumption of the WSC varies depending on the connected wheel sensor(s).

The current consumption of the WSC can be taken from the following table. The following values apply when all outputs are closed and the sensor current is 5 mA.

Supply voltage	Combination of WSC and RSR	Current consumption of the WSC
10 V DC	WSC with 1 connected wheel sensor RSR110-001	74 mA DC
10 V DC	WSC with 1 connected wheel sensor RSR110-002	68,6 mA DC
10 V DC	WSC with 2 connected wheel sensors RSR110-002	74 mA DC
24 V DC	WSC with 1 connected wheel sensor RSR110-001	31,4 mA DC
24 V DC	WSC with 1 connected wheel sensor RSR110-002	28,8 mA DC
24 V DC	WSC with 2 connected wheel sensors RSR110-002	31,4 mA DC
36 V DC	WSC with 1 connected wheel sensor RSR110-001	24 mA DC
36 V DC	WSC with 1 connected wheel sensor RSR110-002	22,4 mA DC
36 V DC	WSC with 2 connected wheel sensors RSR110-002	24 mA DC

Table 3.1: Current consumption of the WSC

When handling the interface “power supply”, safety precautions against dangerous contact voltages must be taken. (At the interface “power supply” an interference voltage against earth can be present.)

3.1.4 Interfaces “optocoupler outputs”

The interfaces “optocoupler outputs” support switching currents of up to 100 mA DC and withstand a maximum switching voltage of 72 V DC.

The interfaces “optocoupler outputs” consist of the interface “optocoupler output 1 and 2” and the interface “optocoupler output 3 and 4”.

Sample configuration

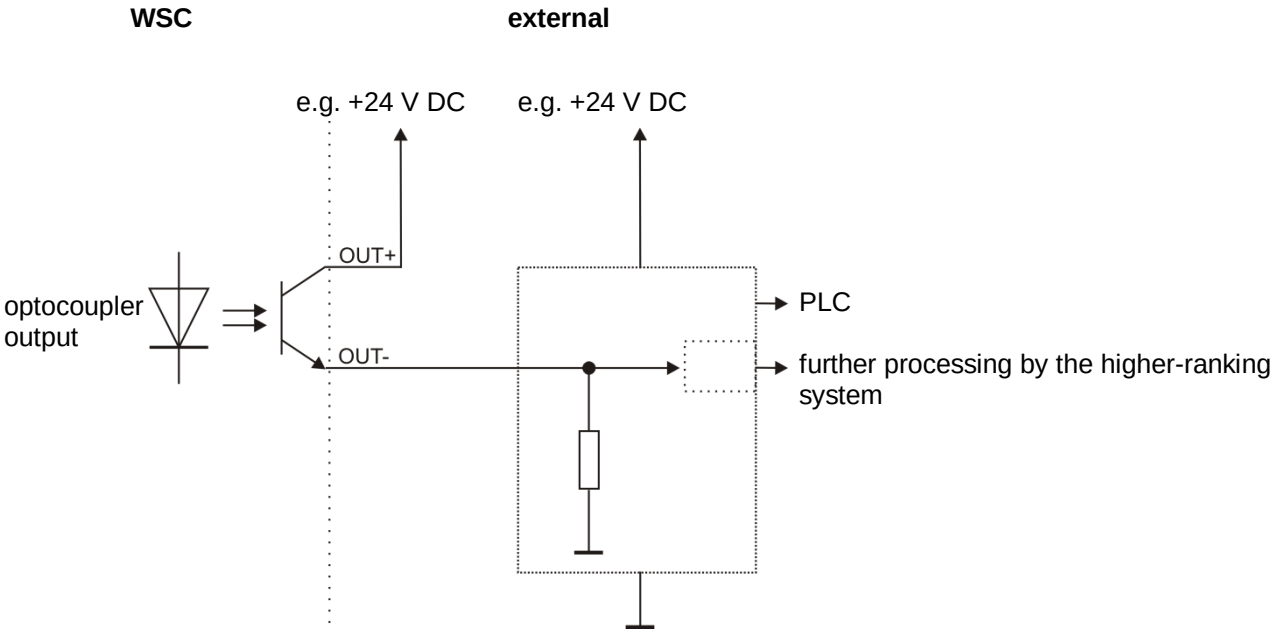


Figure 3.5: Sample configuration

3.1.4.1 Interface “optocoupler output 1 and 2”

The interface “optocoupler output 1 and 2” is an optocoupler output with galvanic separation and open-collector output.
Digital signals of 2 bits, which provide information regarding system occupancy and/or direction, are output at this interface.

3.1.4.2 Interface “optocoupler output 3 and 4”

The interface “optocoupler output 3 and 4” is an optocoupler output with galvanic separation and open-collector output.
Digital signals of 2 bits, which provide information regarding direction and/or error, are output at this interface.

4 Basic conditions for the installation

4.1 Environmental conditions

- The Wheel sensor Signal Converter WSC is intended for the installation into a cubicle or a trackside connection box.
- The WSC corresponds to IP20 and is protected against access to hazardous parts with a finger and the ingress of solid foreign objects ≥ 12,5 mm. The WSC is not protected against harmful ingress of water.
- The WSC may be operated in the temperature range of -40 to +70 °C (corresponds to the classification of environment “In the cubicle” T2 of EN 50125-3).
- The WSC may be operated up to a maximum height of 3 000 m.
- The WSC must be stored and transported in respective ESD packaging.
- For the storage the same environmental conditions apply as for the operation.
- For the transportation the same environmental conditions apply as for the operation.

In case of deviating environmental conditions, consult Frauscher.

4.2 Electromagnetic compatibility

An EMC type testing in compliance with EN 50121-4 was carried out successfully.

5 Configuration

The configuration of the Wheel sensor Signal Converter WSC is carried out by means of the DIP-switches on the front panel of the WSC. In order to set the DIP-switches, the transparent cover of the front panel of the WSC must be opened. The cover can be opened at the bottom by hand or with the help of a flat-blade screwdriver.

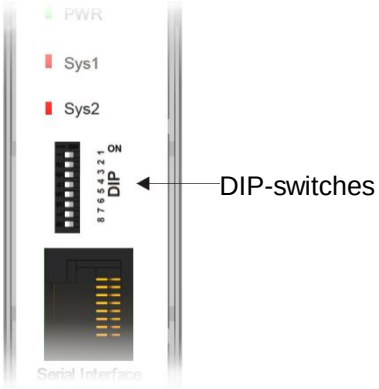


Figure 5.1: DIP-switches on the front panel of the WSC

5.1 Setting of DIP-switches

When setting the DIP-switches, the following applies:

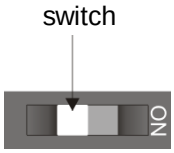


Figure 5.2: DIP-switch position “OFF”

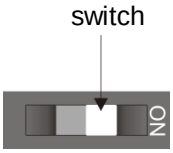


Figure 5.3: DIP-switch position “ON”

For DIP-switches applies:

- The DIP-switch position “OFF” corresponds to the binary value of ‘0’.
- The DIP-switch position “ON” corresponds to the binary value of ‘1’.
- In order to change the position of the switch, a suitable object is required, e.g. a flat-blade screwdriver with a blade thickness of ≤ 1 mm or another small tool with a fine tip.
- When delivered the DIP-switches are set to “OFF”.

5.1.1 DIP-switches of the WSC

DIP-no.	DIP-switches	Possible settings	Function
1		OFF/ON	configuration of system outputs and/or direction outputs
2		OFF/ON	“optocoupler output 1 and 2” and “optocoupler output 3 and 4”
3		OFF/ON	configuration of the normal status of all optocoupler outputs
4		OFF/ON	configuration of the output extension time
5		OFF/ON	
6		OFF/ON	configuration of the direction pulse length “optocoupler output 1 and 2” and “optocoupler output 3 and 4”
7		OFF/ON	
8		OFF/ON	adjustment

Table 5.1: DIP-switches of the WSC

5.2 Configuration of system outputs and/or direction outputs

System outputs
Via the configuration of the optocoupler outputs as system outputs, information regarding the status of the sensor system(s) (damped, not damped or faulty) can be output.

Direction outputs
Additionally, via the configuration of the optocoupler outputs as direction outputs, information regarding the direction of a traversing can be output, in case a wheel sensor RSR110-001 is used. Because of the 2 sensor systems of the wheel sensor RSR110-001, the direction of a traversing can be determined.

The output of direction is carried out in form of a 4-edges direction pulse.
An output of the 4-edges direction pulse with direction 1 takes place at the end of a correct traversing, where sensor system 1 is traversed first, and then sensor system 2 is traversed.
An output of the 4-edges direction pulse with direction 2 takes place at the end of a correct traversing, where sensor system 2 is traversed first, and then sensor system 1 is traversed.
If the normal status is configured with “open”, the 4-edges direction pulse is not output in case failures and/or errors occur (e.g. wire break, overcurrent).

The system outputs and/or direction outputs can be configured as follows:

DIP-no.	DIP-switches	Setting	Configuration
1 2		OFF OFF	output: • 2 system outputs • 2 direction outputs This configuration is possible in combination with 1 wheel sensor RSR110-001. In order to correctly output occupancies, failures and/or errors of a sensor system, the system outputs must be closed in normal status. If the normal status is configured with “open”, the 4-edges direction pulse is not output in case failures and/or errors occur (e.g. wire break, overcurrent).
1 2		ON OFF	output: • 2 direction outputs • 1 error output, which is output twice (normal status = closed) This configuration is possible in combination with 1 wheel sensor RSR110-001.
1 2		OFF ON	output: • 2 system outputs • 1 error output, which is output twice (normal status = closed) This configuration is possible in combination with 1 wheel sensor RSR110-001 or 2 wheel sensors RSR110-002.
1 2		ON ON	output: • 1 system output, which is output twice • 1 error output, which is output twice (normal status = closed) This configuration is possible in combination with 1 wheel sensor RSR110-001 or 1 wheel sensors RSR110-002. It is recommended to use this configuration with 1 wheel sensors RSR110-002.

Table 5.2: Configuration of system outputs and/or direction outputs

5.3 Configuration of the normal status of all optocoupler outputs

The normal status of the optocoupler outputs is present under following conditions:

- wheel sensor mounted correctly
- wheel sensor adjusted correctly
- no occupancy of the wheel sensor
- no error

The normal status of the optocoupler outputs can be configured as follows:

DIP-no.	DIP-switches	Setting	Configuration
3		OFF	closed in normal status (recommended setting)
3		ON	open in normal status

Table 5.3: Configuration of the normal status of the optocoupler outputs

It is recommended to configure “closed in normal status”.

In case of an error, failure or voltage interruption, all outputs are open.

It is not possible to configure the normal status of the error output. The normal status of the error output is closed.

5.4 Configuration of the output extension time

The output extension time (t_2) is the time which elapses, from rising of the sensor system signal above tripping level ASP until the switching operation at the output.

The output extension time can be configured as follows:

DIP-no.	DIP-switches	Setting	Configuration
4		OFF	output extension time = 0 ms
5		OFF	
4		OFF	output extension time = 5 ms
5		ON	
4		ON	output extension time = 500 ms
5		OFF	
4		ON	output extension time = 5 s
5		ON	

Table 5.4: Configuration of the output extension time

In case of an error, failure or voltage interruption, all outputs are open.

In case of an error the system output(s) and the error output are output until the error is rectified.

In case a configuration without system outputs is chosen, the DIP-switches with the DIP-no. 4 and 5 must be set to “OFF”.

5.5 Configuration of the direction pulse length

The direction pulse length (t_3) is the time for which the direction pulse applies at the output.

The direction pulse length can be configured as follows:

DIP-no.	DIP-switches	Setting	Configuration
6		OFF	direction pulse length = 10 ms
7		OFF	
6		OFF	direction pulse length = 100 ms
7		ON	
6		ON	direction pulse length = 1 s
7		OFF	
6		ON	direction pulse length = 10 s
7		ON	

Table 5.5: Configuration of the direction pulse length

In case of an error, failure or voltage interruption, all outputs are open.

In case of an error the direction outputs and the error output is output until the error is rectified

In case a configuration without direction outputs is chosen, the DIP-switches with the DIP-no. 6 and 7 must be set to “OFF”.

Information regarding the DIP-switch with the DIP-no. 8 can be found in chapter “Adjustment”.

In order that the WSC accepts the new configuration, the WSC must be restarted by interrupting and reapplying the power supply of the WSC.

6 Signal diagrams

The structure of the signal diagrams depends on the selected configuration.

For the following signal diagrams, the normal status of the optocoupler outputs is displayed with the recommended configuration “closed in normal status”.

6.1 Configuration of 2 system outputs and 2 direction outputs

This configuration is possible in combination with 1 wheel sensor RSR110-001.

6.1.1 Traversing in direction 1

If the configuration “open in normal status” is selected, then in case of a traversing in direction 1 the signals “Sys” and “Ri” are inverted to the respective signals in the following diagram.

Figure 6.1: Traversing in direction 1

6.1.2 Traversing in direction 2

If the configuration “open in normal status” is selected, then in case of a traversing in direction 2 the signals “Sys” and “Ri” are inverted to the respective signals in the following diagram.

Figure 6.2: Traversing in direction 2

6.1.3 Behaviour in case of wire break

If the configuration “open in normal status” is selected, then in case of wire break, the system and/or direction outputs remain in the open status.

Figure 6.3: Behaviour in case of wire break

6.1.4 Behaviour in case of overcurrent

If the configuration “open in normal status” is selected, then in case of overcurrent, the system and/or direction outputs remain in the open status.

Figure 6.4: Behaviour in case of overcurrent

6.2 Configuration of 2 direction outputs and 1 error output

This configuration is possible in combination with 1 wheel sensor RSR110-001. The error output is output twice.

6.2.1 Traversing in direction 1

If the configuration “open in normal status” is selected, then in case of a traversing in direction 1 the signal “Ri” is inverted to the respective signal in the following diagram.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.5: Traversing in direction 1

6.2.2 Traversing in direction 2

If the configuration “open in normal status” is selected, then in case of a traversing in direction 2 the signal “Ri” is inverted to the respective signal in the following diagram.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.6: Traversing in direction 2

6.2.3 Behaviour in case of wire break

If the configuration “open in normal status” is selected, then in case of wire break, the direction outputs remain in the open status.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.7: Behaviour in case of wire break

6.2.4 Behaviour in case of overcurrent

If the configuration “open in normal status” is selected, then in case of overcurrent, the direction outputs remain in the open status.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.8: Behaviour in case of overcurrent

6.3 Configuration of 2 system outputs and 1 error output

This configuration is possible in combination with 1 wheel sensor RSR110-001 or 2 wheel sensors RSR110-002. The error output is output twice.

6.3.1 Traversing in direction 1

If the configuration “open in normal status” is selected, then in case of a traversing in direction 1 the signal “Sys” is inverted to the respective signal in the following diagram.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.9: Traversing in direction 1

6.3.2 Traversing in direction 2

If the configuration “open in normal status” is selected, then in case of a traversing in direction 2 the signal “Sys” is inverted to the respective signal in the following diagram.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.10: Traversing in direction 2

6.3.3 Behaviour in case of wire break

If the configuration “open in normal status” is selected, then in case of wire break, the system outputs remain in the open status.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.11: Behaviour in case of wire break

6.3.4 Behaviour in case of overcurrent

If the configuration “open in normal status” is selected, then in case of overcurrent, the system outputs remain in the open status.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.12: Behaviour in case of overcurrent

6.4 Configuration of 1 system output and 1 error output

This configuration is possible in combination with 1 wheel sensor RSR110-001 or 1 wheel sensors RSR110-002. The system output and the error output are output twice.

6.4.1 Traversing in direction 1

If the configuration “open in normal status” is selected, then in case of a traversing in direction 1 the signal “Sys” is inverted to the respective signal in the following diagram.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.13: Traversing in direction 1

6.4.2 Traversing in direction 2

If the configuration “open in normal status” is selected, then in case of a traversing in direction 2 the signal “Sys” is inverted to the respective signal in the following diagram.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.14: Traversing in direction 2

6.4.3 Behaviour in case of wire break

If the configuration “open in normal status” is selected, then in case of wire break, the system output remains in the open status.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.15: Behaviour in case of wire break

6.4.4 Behaviour in case of overcurrent

If the configuration “open in normal status” is selected, then in case of overcurrent, the system output remains in the open status.
It is not possible to configure the normal status of the error output, therefor the signal for the error output is identical to the displayed signal at the error output.

Figure 6.16: Behaviour in case of overcurrent

7 Installation

7.1 Handling of boards

When handling the boards, the following must be observed:

- Before touching a board, always charge balancing must be carried out by touching a bare metal surface of the frame, rack or cubicle. This charge balancing prevents the discharge from passing through the electronic circuit components.
- Boards that are not installed must always be stored in an ESD packaging.
- Always transport boards in an ESD packaging.
- If boards without packaging are handed from one person to another, hands of the participants must be touched to balance potential before handover.

7.2 Wiring of the WSC

To carry out the wiring of the Wheel sensor Signal Converter WSC, the cage clamp terminals must be removed.

To remove a cage clamp terminal, position a flat-blade screwdriver on the cage clamp terminal at the slit and push out the cage clamp terminal. The cage clamp terminal can simply be plugged back in.

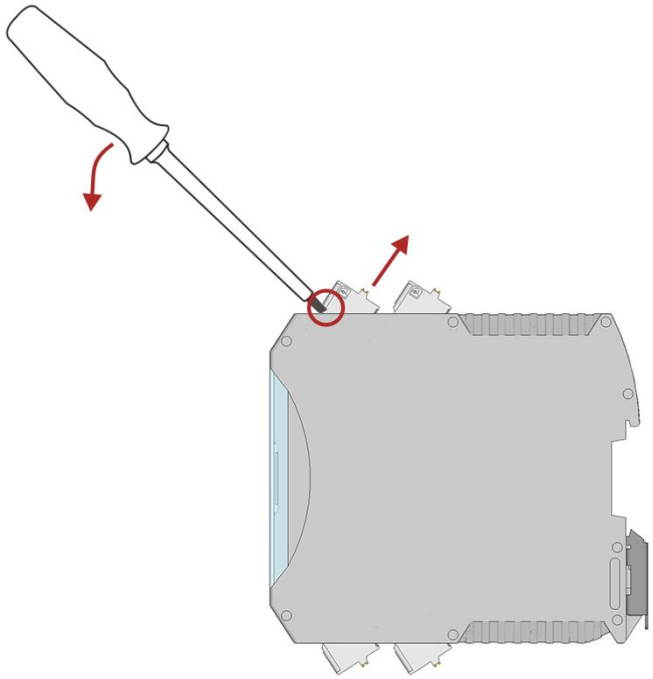


Figure 7.1: Removing of a cage clamp terminal

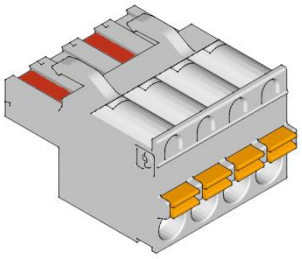


Figure 7.2: Cage clamp terminal

The cage clamp terminals of the WSC must not be pushed out or plugged in while the WSC is applied to voltage, because during the handling of the cage clamp terminals there is the danger of an electric shock and/or a short-circuit.

In order to avoid an accidentally mixing up of the cage clamp terminals, the cage clamp terminals are coded and cannot be plugged into a wrong interface.

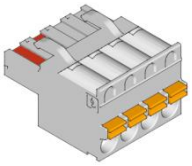
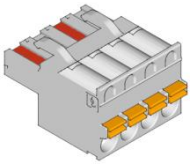
	Cage clamp terminal	Interface
WSC top		“wheel sensor”
		“power supply”

Table 7.3: Coding of the cage clamp terminals located on the WSC top

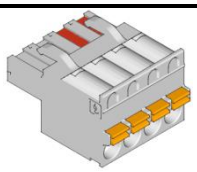
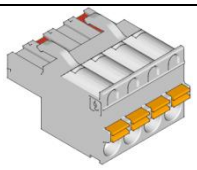
	Cage clamp terminal	Interface
WSC bottom		“optocoupler output 1 and 2”
		“optocoupler output 3 and 4”

Table 7.4: Coding of the cage clamp terminals located on the WSC bottom

In order to insert the cable wires into the cage clamp terminal, the orange push-in spring connection must be pushed down with the help of a flat-blade screwdriver.
In order to remove the cable wires from the cage clamp terminal, the orange push-in spring connection must be pushed down again with the help of a flat-blade screwdriver.

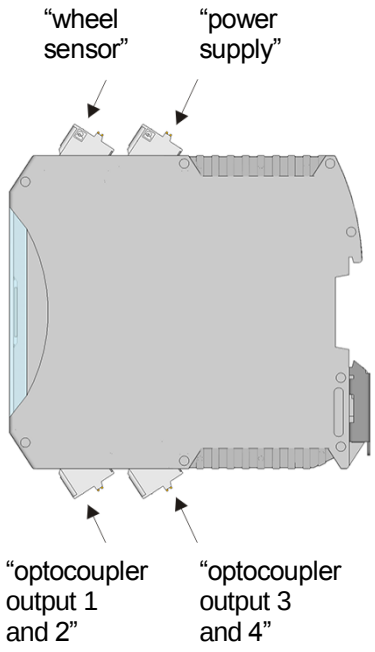


Figure 7.5: Interfaces of the WSC for the wiring

Figure 7.6: Wires of the wheel sensor cable

The wiring of the WSC must be carried out according to the pin assignment in the following table.

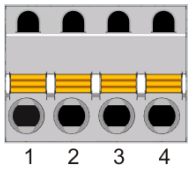
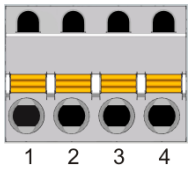
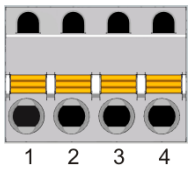
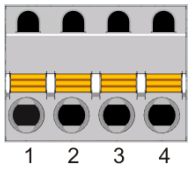
	Interface	Socket	Pin	Pin assignment
Inputs	"wheel sensor"		1	Sys2-
			2	Sys2+
			3	Sys1-
			4	Sys1+
	"power supply"		1	GND
			2	GND
			3	V+
			4	V+
Outputs	"optocoupler output 1 and 2"		1	OUT1+
			2	OUT1-
			3	OUT2+
			4	OUT2-
	"optocoupler output 3 and 4"		1	OUT3+
			2	OUT3-
			3	OUT4+
			4	OUT4-

Table 7.1: Pin assignment of the WSC

7.3 Mounting and dismounting of the WSC

The WSC is mounted by clicking the WSC into place on the TH 35 top-hat rail (DIN EN 60715). When a “click” is heard, then the WSC is mounted correctly on the top-hat rail.

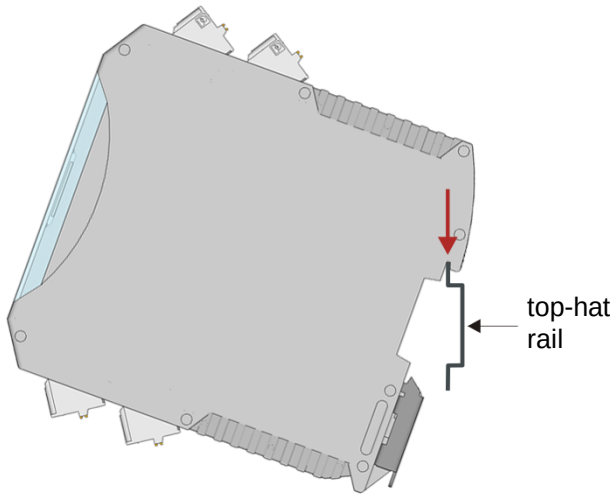


Figure 7.7: Mounting of the WSC on the top-hat rail, step 1

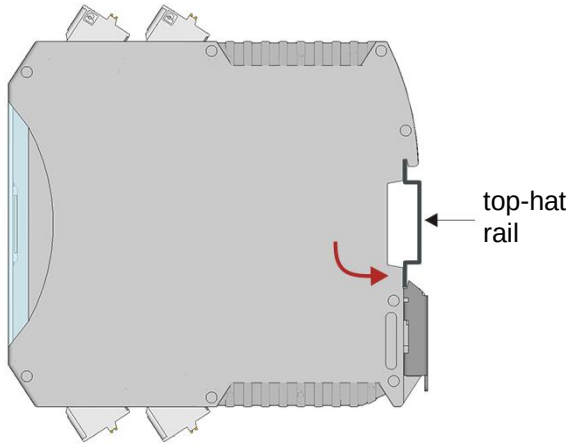


Figure 7.8: Mounting of the WSC on the top-hat rail, step 2

The WSC is dismounted by pushing down the top-hat rail adapter of the WSC at the opening with a flat-blade screwdriver and taking the WSC down from the top-hat rail.

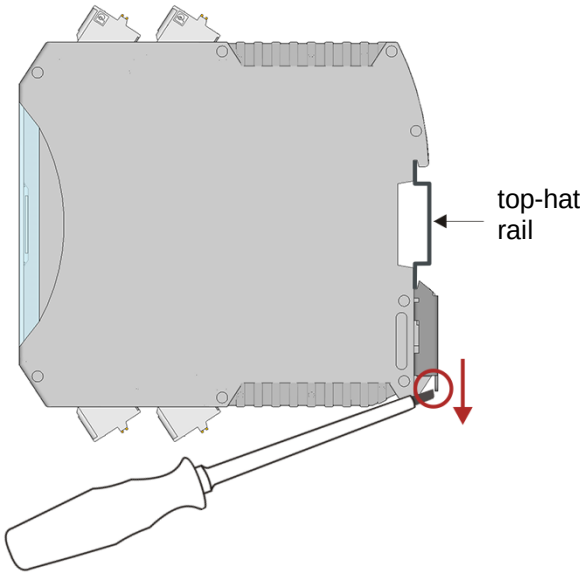


Figure 7.9: Dismounting of the WSC, step 1

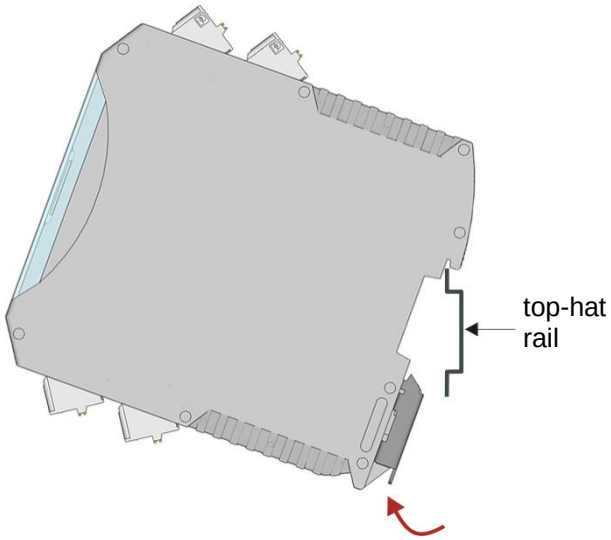


Figure 7.10: Dismounting of the WSC, step 2

8 Commissioning

The Wheel sensor Signal Converter WSC may only be put into operation in proper and checked condition. During commissioning no wheel sensor may be damped or traversed.

8.1 Adjustment

Before the WSC can be put into operation, an adjustment of the connected wheel sensor(s) must be carried out.

The adjustment process is carried out by means of the DIP-switch with DIP-no. 8 on the front panel of the WSC. In order to set the DIP-switch, the transparent cover of the front panel of the WSC must be opened. The cover can be opened at the bottom by hand or with the help of a flat-blade screwdriver.

The delivery status of the DIP-switch with DIP-no. 8 is “OFF”.
To request the adjustment process, the following actuation sequence must be complied with:

1. Push the DIP-switch with DIP-no. 8 to the right to “ON”.
2. Keep the DIP-switch with DIP-no. 8 in this position for a minimum of 2 s but for a maximum of 4 s.
3. Push the DIP-switch with DIP-no. 8 to the left to “OFF”.

After the actuation sequence, an initial sequence of 40 s follows during which all outputs are open.

In case a configuration with 2 system outputs and/or 2 direction outputs is used, the LEDs “Sys1” and “Sys2” are illuminated. When the adjustment process is completed, the LEDs “Sys1” and “Sys2” go off.

In case a configuration with 1 system output is used, the LED “Sys1” is illuminated. When the adjustment process is completed, the LED “Sys1” goes off.

In case 2 wheel sensors RSR110-002 are used, the 2 wheel sensors RSR110-002 are adjusted at once.

Additionally it is possible to carry out the adjustment by means of the adjustment and maintenance box AMB001. When combined with a conventional voltmeter, the AMB serves to provide automatic adjustment of the wheel sensor RSR110-001 and the wheel sensor RSR110-002.

The adjustment by means of the AMB is described in the documentation D4231 “Mounting, commissioning and maintenance manual wheel sensor RSR110” and must be carried out accordingly.

9 Maintenance

The Wheel sensor Signal Converter WSC itself is maintenance-free, but in order to maintain the availability and reliability of the wheel sensor RSR110-001 and RSR110-002, it is recommended to carry out the checks described in this chapter at at least every 24 months.

9.1 Check operations during the maintenance

In order to ensure an error-free operation, maintenance and all actions in the course of maintenance must be coordinated operationally.

During maintenance, only the actions described in the following chapters should be carried out.

9.1.1 Required tools and measuring equipment

For the checks during maintenance, the following tools and measuring equipment are required:

- measuring tape
- testing plate PB200
- Advanced Service Display ASD inclusive Service Display Cable
- multimeter
- test leads with test prods

9.1.2 Visual inspection and mechanical check of the wheel sensor

The cycle of visual inspection and mechanical check of the wheel sensor for dirt, wear etc. depends on the operator's maintenance strategy.

At the wheel sensors RSR110-001 and RSR110-002 the following maintenance work must be carried out, adapted to the conditions of the track (but at least every 24 months):

- a visual and mechanical check
  - check wheel sensor for heavy dirt, remove loose dirt dryly
  - check wheel sensor for external mechanical damages
  - check fixing elements of the wheel sensor for correct fitting
  - check protection tube for mechanical damage
  - check cable connecting terminals for correct fitting

- a check of measurement A

In this context, particularly the spacing between the wheel sensor top and the top of the rail (measurement A) must be checked and corrected if necessary.

The visual inspection and mechanical check of the wheel sensors RSR110-001 is described in the documentation D4231 “Mounting, commissioning and maintenance manual wheel sensor RSR110” and must be carried out accordingly.

9.1.3 Check of the sensor current of the wheel sensor

The sensor current of each sensor system can be read out via the diagnostic interface using the ASD.

Additionally the sensor current of the wheel sensor can be measured using a multimeter.
The used multimeter must be equipped with a jack for mA DC metering.

In order to measure the sensor current of Sys1, disconnect the cable wire of the cage clamp terminal for the interface “wheel sensor” Sys1- (Pin 3) by pushing down the orange push-in spring connection with the help of a flat-blade screwdriver. Connect the cable wire of Sys1- with the test prod of the red test lead and then insert the other side of the red test lead into the jack for the mA DC metering of the multimeter.
Insert the test prod of the black (or blue) test lead into the measuring point of Sys1- on the front side of the cage clamp terminal of the interface “wheel sensor” (see following figures) and then insert the other side of the black (or blue) test lead into the jack “COM” of the multimeter.

In order to measure the sensor current of Sys2, disconnect the cable wire of the cage clamp terminal for the interface “wheel sensor” Sys2- (Pin 1) by pushing down the orange push-in spring connection with the help of a flat-blade screwdriver. Connect the cable wire of Sys2- with the test prod of the red test lead and then insert the other side of the red test lead into the jack for the mA DC metering of the multimeter.
Insert the test prod of the black (or blue) test lead into the measuring point of Sys2- on the front side of the cage clamp terminal of the interface “wheel sensor” (see following figures) and then insert the other side of the black (or blue) test lead into the jack “COM” of the multimeter.

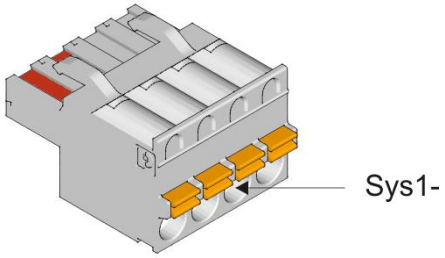


Figure 9.1: Measuring point of Sys1- at the cage clamp terminal of the interface “wheel sensor”

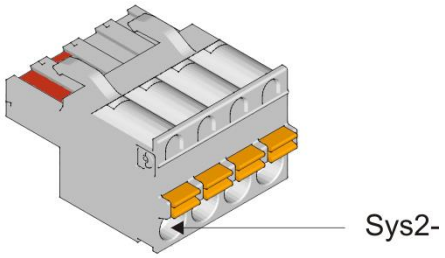


Figure 9.2: Measuring point of Sys2- at the cage clamp terminal of the interface “wheel sensor”

Wheel sensor	Sensor system(s)	Normal operating sensor current
RSR110-001	system 1 and system 2	5 mA DC ±5 %
RSR110-002	system 1	5 mA DC ±5 %

Table 9.1: Normal operating sensor current

If the measured values do not match the required values, this error must be rectified before commissioning (check the mounting of the wheel sensor, carry out an adjustment or replace the wheel sensor if necessary).

When handling the diagnostic interface “Serial Interface”, safety precautions against dangerous contact voltages must be taken. (At the diagnostic interface “Serial Interface” an interference voltage against earth can be present.)

9.1.4 Check of the occupancy detection capability

The check of the occupancy detection capability can be carried out in 2 ways:

- **Check with a rail vehicle:**
  - The wheel sensor must be traversed error-freely with a rail vehicle (traversing system 1 and system 2, in case RSR110-001 is used; or traversing system 1, in case RSR110-002 is used).
  - For this the associated outputs of the WSC must switch correctly.

- **Check with the testing plate PB200:**
  - If using the WSC with the wheel sensor RSR110-001, at least 1 counting procedure must be carried out correctly over system 1 and system 2 with the help of the testing plate PB200 (see documentation D2860 “Brief instruction testing plate PB200 GS03”).
  - If using the WSC with the wheel sensor RSR110-002 at least 1 counting procedure must be carried out correctly over system 1 with the help of the testing plate PB200 (see documentation D2860 “Brief instruction testing plate PB200 GS03”).
  - For this the associated outputs of the WSC must switch correctly.

10 Repair

Defective components must not be repaired, but must be replaced by components of the same type, which were checked by Frauscher.

Defective components may only be repaired by Frauscher.

A defective WSC must be returned to Frauscher.

10.1 Diagnostics

10.1.1 Troubleshooting on the WSC

The troubleshooting on the WSC can be carried out as follows:

- with the LED indications on the front panel of the WSC (see chapter “LED indications on the WSC”)
- by means of the ASD (via diagnostic interface “Serial Interface” on the front panel of the WSC)

10.1.1.1 Measurements on the WSC with connected wheel sensor

The normal operating sensor current(s) of the wheel sensor RSR110-001 and the wheel sensor RSR110-002 are read out with the ASD.

The normal operating sensor current of the wheel sensor depends on:

- the mounting position
- the type of mounting (rail claw mounting, rail web mounting, etc.)
- the rail profile (large e.g. UIC60, small e.g. VST36)

Value read out via ASD	Meaning	Possible measure(s)
< 0,3 mA	wire break in the wheel sensor cable e.g. due to: interrupted cable connection between outdoor and indoor equipment defective wheel sensor wire short-circuit in the wheel sensor cable	 check cable connection between outdoor and indoor equipment replace wheel sensor rectify short-circuit
≥ 4,75 mA ≤ 5,25 mA	normal operating sensor current	-
≥ 6 mA	overcurrent e.g. due to: cable short-circuit wheel sensor adjusted incorrectly defective wheel sensor	 rectify short-circuit adjust wheel sensor correctly replace wheel sensor

Table 10.1: Measurements on the WSC with connected wheel sensor

10.1.1.2 LED indications on the WSC

LED “PWR”

In case the LED “PWR” is off, this indicates an error status:

Figure 10.1: LED “PWR” off

Meaning	Possible measure(s)
no power supply	apply power supply
fuse broken	replace WSC

Table 10.2: LED “PWR” off

In case the LED “PWR” is illuminated, this indicates an operating status:

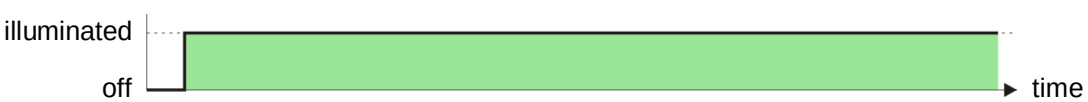


Figure 10.2: LED “PWR” illuminated

Meaning	Possible measure(s)
power supply applies	-

Table 10.3: LED “PWR” illuminated

LED “Sys1” and “Sys2”

In case the LED “Sys1” and/or “Sys2” are off, this indicates an operating status:

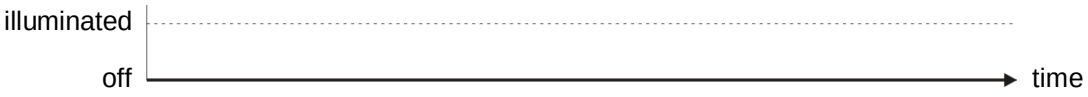


Figure 10.3: LED “Sys1” and/or “Sys2” off

Meaning	Possible measure(s)
wheel sensor not damped	-
no error at the wheel sensor	-

Table 10.4: LED “Sys1”and/or “Sys2” off

In case the LED “Sys1” and/or “Sys2” is illuminated, this indicates an operating status:

Figure 10.4: LED “Sys1” and/or “Sys2” illuminated

Meaning	Possible measure(s)
wheel sensor damped	-
wheel sensor adjustment not yet completed	wait for the adjustment process to be completed

Table 10.5: LED “Sys1” and/or “Sys2” illuminated

In case the LED “Sys1” and/or “Sys2” flashes slowly, this indicates an error status:

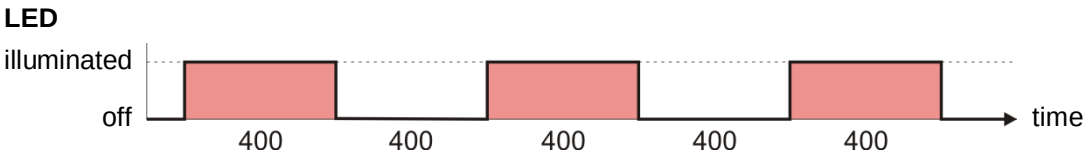


Figure 10.5: LED “Sys1” and/or “Sys2” flashes slowly, time data in ms

Meaning	Possible measure(s)
wheel sensor not adjusted	adjust wheel sensor
incorrect actuation sequence for adjustment	carry out correct actuation sequence
wire break in the wheel sensor cable e.g. due to:	
interrupted cable connection between outdoor and indoor equipment	check cable connection between outdoor and indoor equipment
wire short-circuit in the wheel sensor cable	rectify short-circuit
defective wheel sensor	replace wheel sensor
overcurrent e.g. due to:	
cable short-circuit	rectify short-circuit
wheel sensor adjusted incorrectly	adjust wheel sensor correctly
defective wheel sensor	replace wheel sensor

Table 10.6: LED “Sys1”and/or “Sys2” flashes slowly

As soon as the error is rectified the LED “Sys1” and/or “Sys2” will go off.

In case a configuration with 1 system output is used, the LED “Sys2” is not used and therefore always off.

11 Removal from service

Decommissioning and disposal

Defective components, which are not returned to Frauscher according to chapter “Repair”, are to be disposed in correspondence to the national regulations. Planning and performance of a de-commissioning as well as the disposal of components and parts fall under the responsibility of each railway operator.