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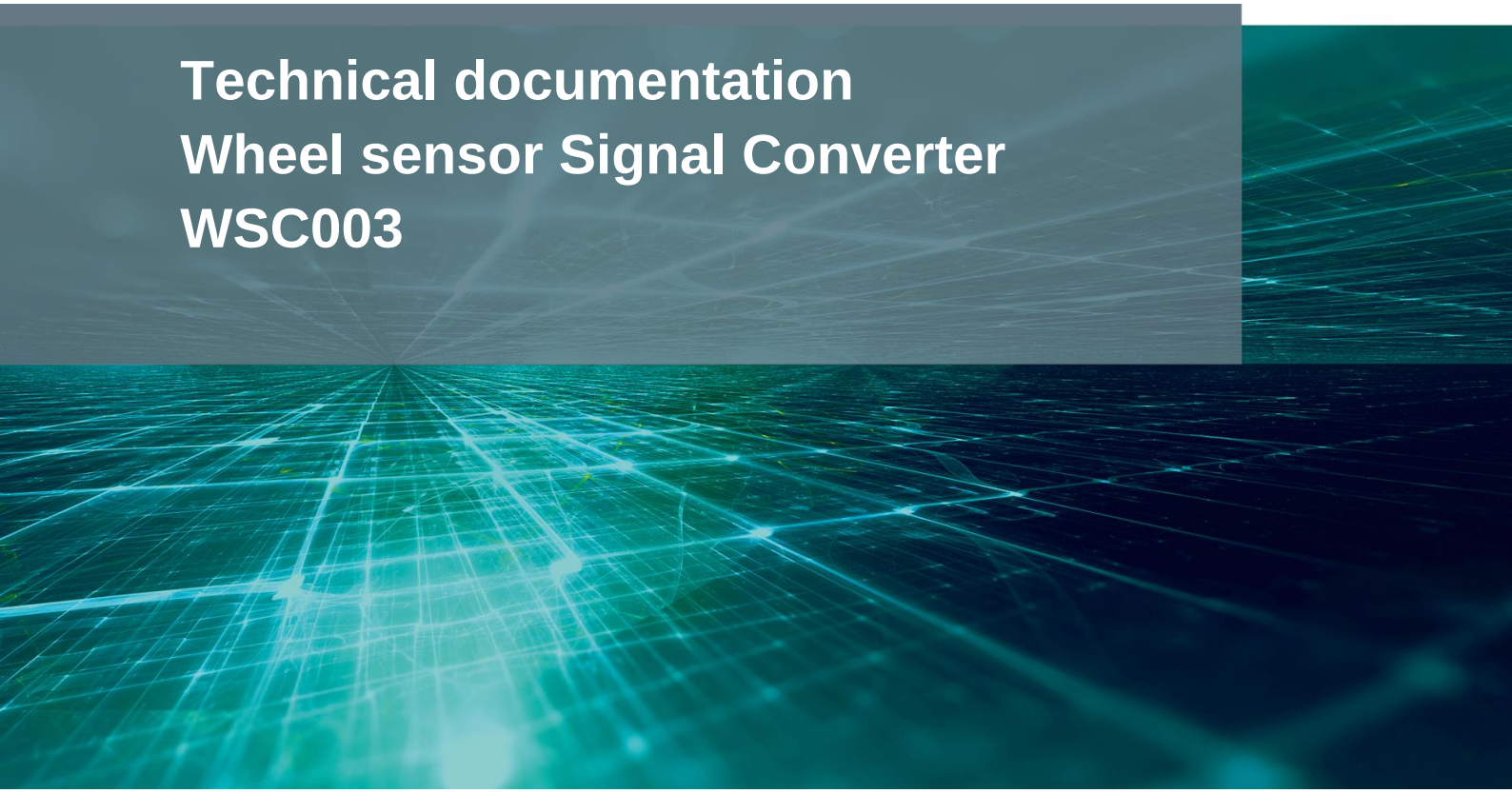
Track more with less.

Technical documentation
Wheel sensor Signal Converter
WSC003



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Thank you for your feedback.

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Review list

Version	Date	Prepared by	Modified sections	Modifications
1	2019-07-10	Anita Ecker	All	Initial version
2	2020-09-22	David Scherrer	Bibliography	D6758 added
			Chapter 1.4	“4-edges direction pulse” revised
			Chapter 3.1	Added
			Chapter 3.5.1	Reference to D6758 added
			Chapter 5.2.1.1	OFF-OFF-ON: Status sensor system changed to “1” Footnote added
			Chapter 8.2.1	Figures 8.1, 8.2, 8.4 modified, figure 8.3 added
			Chapter 8.2	WSC-specific button added

Bibliography

D-Number	Title	Version[1]
D2860	Brief instruction testing plate PB200 GS03	4
D4231	Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting with rail claw)	2
D4232	Application guideline Wheel sensor RSR110	2
D6758	Diagnostic interface and protocol specification – Wheel sensor Signal Converter WSC003	1
D21004	Brief description Advanced Service Display ASD101	4

1 The specified version or a later 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 60947-5-6	Low-voltage switchgear and controlgear – Part 5-6: Control circuit devices and switching elements – DC interface for proximity sensors and switching amplifiers (NAMUR)	2000
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 60529	Degrees of protection provided by enclosures (IP Code)	2014
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	1997
EN 60721-3-3	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations	1995

1 About this document

This document provides information about the product features, the configuration and the installation of the Wheel sensor Signal Converter WSC003.
In the following, the Wheel sensor Signal Converter WSC003 is referred to as WSC for simplification.

1.1 Conventions on presentation of information

The following conventions are used in this document:

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

Content (descriptions, figures, tables, etc.) in this document is generally described from left to right and from top to bottom.

Numbers

- Numbers with 4 or more digits are arranged from right to left with thousands separators in groups of 3 to make them easier to read (e.g. 1 234).
- Depending on the language of the document, decimal numbers are represented by different decimal separators, either by a decimal comma (e.g. 3,25) or by a decimal point (e.g. 3.25).

1.2 Units of measurement

The following units of measurement are used in this document:

bit	Bit
°C	Degrees Celsius (degrees Fahrenheit °F = °C * 1.8 + 32)
m	Meter (yard = m * 1.09361)
mA	Milliampere
mm	Millimeter (inch = mm * 0.0393701)
ms	Millisecond
µs	Microsecond
Ω	Ohm
s	Second
V	Volt

1.3 Abbreviations

The following abbreviations are used in this document:

0b	Prefix of a binary number
0x	Prefix of a hexadecimal number
A	Measurement A, vertical mounting position of the wheel sensor
AEI	Automatic Equipment Identification
AMB	Adjustment and Maintenance Box
ASD	Advanced Service Display
DC	Direct Current
DIN	German Institute for Standardization
DIP	Dual In-line Package (DIP-switch)
EMC	Electromagnetic compatibility
EN	European standard
GND	Ground
GS	Equipment version
IEC	International Electrotechnical Commission
IPxx	International Protection (degree of protection, e.g. IP65)
LED	Light-Emitting Diode
MTBF	Mean Time Between Failures
NAMUR	User Association of Automation Technology in Process Industries
PB	Testing plate
PLC	Programmable Logic Controller
PWR	Power supply
Ri	Direction pulse of a traversing
Ri1	Direction pulse, direction 1
Ri2	Direction pulse, direction 2

RJ45	Registered Jack (standardized connectors/sockets for data transmission in networks)
RSR	Wheel sensor
RSR110	Wheel sensor, type RSR110
RSR110-001	Wheel sensor, type RSR110-001
RSR110-002	Wheel sensor, type RSR110-002
Sys	System pulse
Sys1	System pulse of sensor system 1
Sys2	System pulse of sensor system 2
SYS1	Sensor system 1
SYS2	Sensor system 2
USB	Universal Serial Bus
WSC	Wheel sensor Signal Converter
WSC003	Wheel sensor Signal Converter, type 003

1.4 Terms and definitions

The following terms and definitions are used in this document:

4-edges direction pulse	The direction pulse is output at the end of a correct traversing for the configurable duration of the pulse length.
Center pulse duration	The center pulse duration is the configurable time for which the center pulse is output.
Commissioning	Test on an item carried out on site to prove that it is correctly installed and can operate correctly.
Damped	One or two sensor systems of a wheel sensor indicate an occupancy (generally in case of traversing by a train wheel or when damped by a testing plate).
Digital filtering time	The digital filtering time is the time for which the sensor current must fall below the trigger level or exceed the tripping level, before the sensor system is considered to be “damped” or “not damped”.
Direction pulse duration	The direction pulse duration is the time for which the direction pulse applies at the output. The direction pulse duration is retriggerable.
Interference voltage	Voltage that may occur at the ends of outdoor equipment cables as a result of inductive or capacitive influences to ground.
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. Synonym: repair

Maintenance, preventive	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. Synonym: servicing
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. Synonym: preventive maintenance
Normal operating sensor current level	The normal operating sensor current level corresponds to the sensor current at the time of a successfully carried out adjustment and is to be equated with 100 % (adjustment value).
Normal operating sensor current (RSR110)	The sensor current is referred to as “normal operating sensor current” if the wheel sensor is correctly mounted on the rail, successfully adjusted and not damped.
Overcurrent level	If the sensor current exceeds the overcurrent level for a time > overcurrent suppression time, then the evaluation board identifies the behavior as “overcurrent”.
Overcurrent suppression time	The overcurrent suppression time is the minimum time for which the sensor current must exceed the overcurrent level, so that the evaluation board identifies the behavior as “overcurrent”. The sensor system is then considered to be “faulty”.
Overlap	“Overlap” means that both sensor systems are damped.
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. Synonym: corrective maintenance
System output delay time	The system output delay time is the time that passes after the digital filtering time until the switching operation at the system output, when the sensor current falls below the trigger level.

System output extension time	The system output extension time is the time that passes after the digital filtering time until the switching operation at the system output, when the sensor current exceeds the tripping level. The system output extension time is retriggerable.
Top-hat rail	Rail with hat-shaped cross-section according to DIN EN 60715, type TH 35-7.5, perforated
Trigger level	If the sensor current falls below the trigger level for a time > digital filtering time, then the sensor system is considered to be “damped”.
Tripping level	If the sensor current exceeds the tripping level for a time > digital filtering time, then the sensor system is considered to be “not damped”.
Wire break level	If the sensor current falls below the wire break level for a time > wire break suppression time, then the evaluation board identifies the behavior as “wire break”.
Wire break suppression time	The wire break suppression time is the minimum time for which the sensor current must fall below the wire break level, so that the evaluation board identifies the behavior as “wire break”. The sensor system is then considered to be “faulty”.
Wire short-circuit level	If the sensor current exceeds the wire short-circuit level for a time > overcurrent suppression time, then the evaluation board identifies the behavior as “wire short-circuit”.

1.5 Block diagram symbols

In this document, the following symbols are used for block diagrams:

Wheel sensor Signal Converter


Wheel sensor (with 2 sensor systems)


Wheel sensor (with 1 sensor system)

1.6 Target group

This document is intended for project engineers and technicians with subject-specific knowledge who are responsible for configuration, installation, commissioning, operation and maintenance of Frauscher components.

2 Safety

This document contains important warning and safety information that must be observed by the user to ensure correct operation.

2.1 General protective provisions

Frauscher components 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, unauthorized modifications of the components are not permitted.
If, nevertheless, modifications of a component are required, then Frauscher must be consulted in any case and in advance.

	The component described in this document must only be used for non-safety-relevant applications.

	All operational protective provisions of the railway operator must be complied with.

	The railway operator must ensure that only authorized personnel or people in the company of authorized personnel have access to Frauscher components.

	Prior to and during work on the track, safety measures must be implemented in accordance with the applicable railway regulations.

2.2 Qualified personnel

	Any work on Frauscher components (configuration, installation, commissioning, maintenance, etc.) must be carried out by trained, skilled personnel.

2.3 Safety-conscious working

- The railway operator is responsible for occupational safety.
- Frauscher components may only be operated in proper condition.
- All actions carried out on Frauscher components must not impair the safety of people or the function of the system.
- Unauthorized alterations and modifications must not be carried out on Frauscher components.

2.4 Intended use

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

3 Structure and function

In combination with a wheel sensor RSR110 or in combination with a NAMUR sensor, the WSC provides outputs triggered by a passing wheel of a rail vehicle.

Examples of possible trigger applications:

- AEI card reader
- Lubrication system
- Hot box detection system
- Vision monitoring system
- Warning system
- Flat wheel detection system

3.1 Dimensions of the WSC003

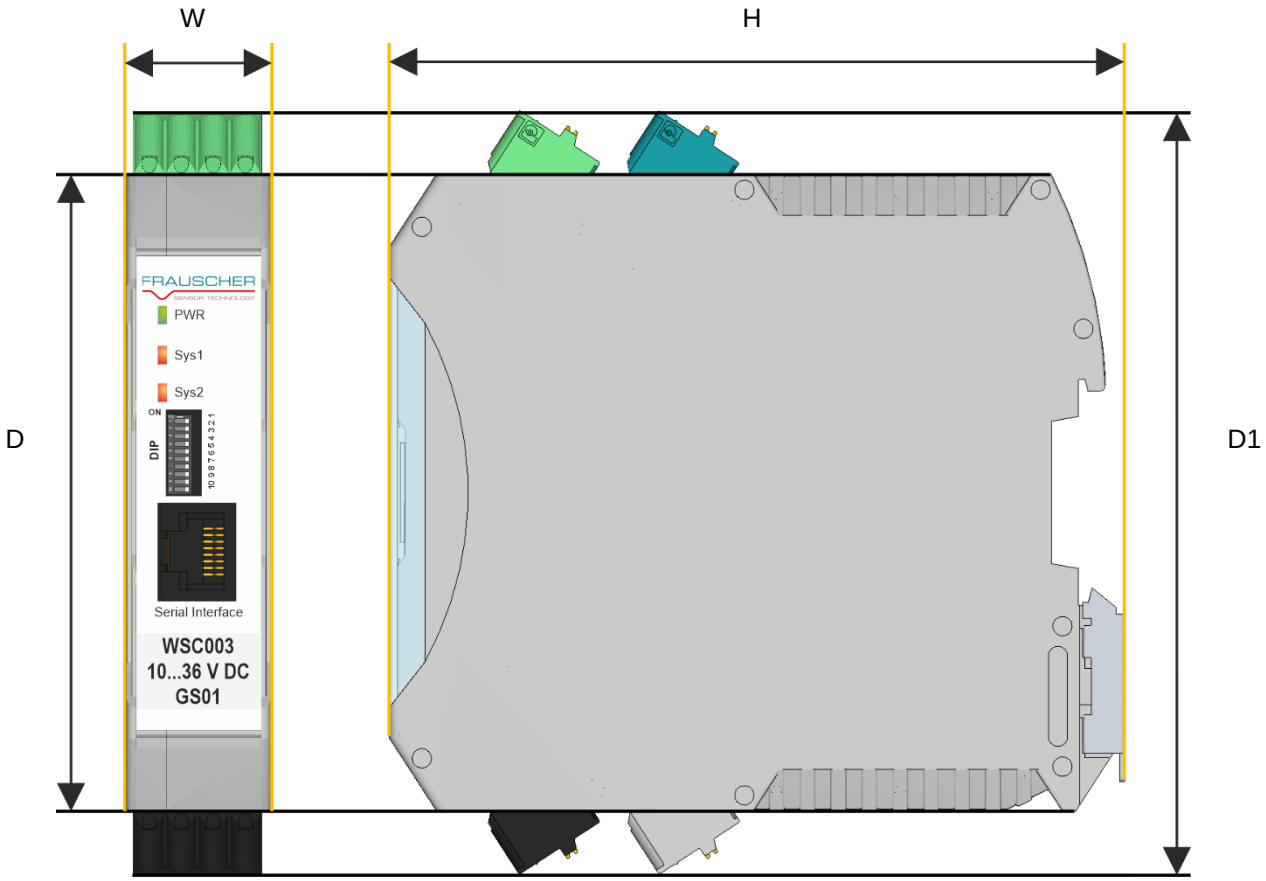


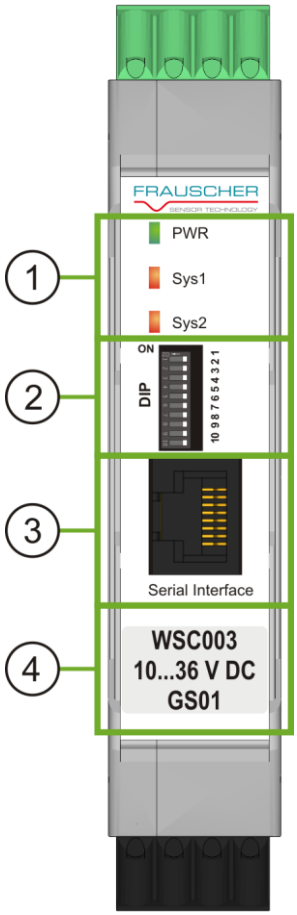
Figure 3.1: Dimensions of the WSC003

	Value	Tolerance
W	22.6 mm	+0.35/-0.3 mm
H	114 mm	±0.4 mm
D	99 mm	±0.4 mm
D1	118.85 mm	±0.4 mm

Table 3.1: Dimensions of the WSC003

3.2 Front panel elements

The front panel of the WSC is designed as follows:



1 **LEDs:**
- PWR (status of power supply)
- Sys1 (status of sensor system 1)
- Sys2 (status of sensor system 2)

2 **DIP-switches:**
- Configuration of the WSC
- Configuration of the wheel sensor type
- Adjustment of the wheel sensor RSR110

A NAMUR sensor cannot be adjusted by the WSC

3 **Serial Interface (RJ45 socket):**
Connection socket for diagnostic interface

4 **Type key:**
- WSC003 (board identification)
- 10…36 V DC (permissible supply voltage)
- GS01 (equipment version)

Figure 3.1: Front panel of the WSC

3.3 Function

The WSC supplies a wheel sensor with voltage and converts the analog signals of a wheel sensor into digital signals. The digital signals are transmitted as digital switching signals to a higher-ranking system via optocoupler outputs.

The sensor current is evaluated level-related by the WSC depending on the occupancy of the wheel sensor. Based on the normal operating sensor current of the sensor system, the WSC detects a current change. This current change can cause a higher or lower value than the normal operating sensor current and results in a switching operation at the interfaces “Optocoupler output 1 and 2” and “Optocoupler output 3 and 4” (see chapter “Signal diagrams”).

If errors occur, there are 3 possibilities for troubleshooting:

- LEDs “Sys1” and/or “Sys2” on the front panel of the WSC (see chapter “LED indications on the WSC”)
- Diagnostic interface “Serial Interface” (see chapter “Diagnostic interface ‘Serial Interface’”)
- Error output (if configured)

The required information and prerequisites for the application of a wheel sensor RSR110 can be found in D4232 “Application guideline Wheel sensor RSR110”[2].

3.4 Possible combinations with wheel sensors and output of information

The WSC can process and output wheel sensor information. The following combinations are possible with 1 WSC:

- RSR110
  - 1 RSR110-001 with 2 sensor systems
  - 1 or 2 RSR110-002 with 1 sensor system each
- NAMUR
  - 1 wheel sensor with 2 sensor systems
  - 1 or 2 wheel sensors with 1 sensor system each

2 If a NAMUR wheel sensor is used, the required information and prerequisites of the respective manufacturer must be observed and complied with.

The output of information depends on the wheel sensor type (number of sensor systems):

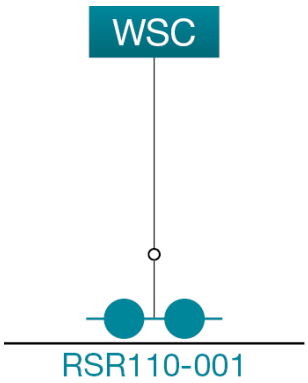
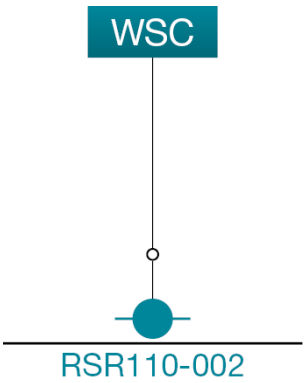
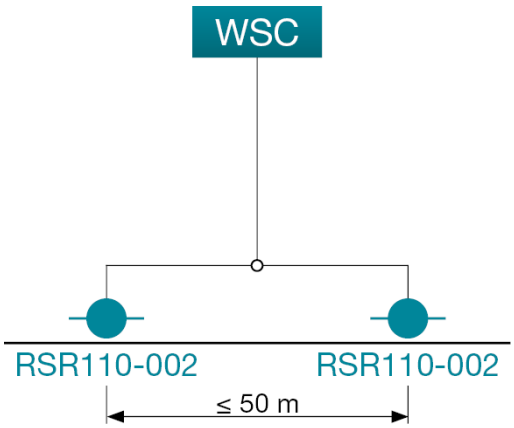
▪ Status of sensor systems* ▪ Travel direction ▪ Center pulse ▪ Gate pulse ▪ Error output	▪ Status of sensor system* ▪ Error output	▪ Status of sensor system* ▪ Error output
Higher-ranking system 	Higher-ranking system 	Higher-ranking system 
WSC combined with 1 RSR110-001	WSC combined with 1 RSR110-002	WSC combined with 2 RSR110-002
* Possible statuses: damped, not damped, faulty		

Figure 3.2: Block diagrams with possible combinations of the WSC with RSR110-001 or RSR110-002

In order to limit the interference voltage, the following must be complied with:

- The distance between the WSC and the higher-ranking system must not exceed 30 m.
- The distance between 2 wheel sensors with 1 sensor system each that are connected to the same WSC must not exceed 50 m.

3.5 Interfaces

The WSC provides 5 interfaces in total. 4 interfaces are designed as cage clamp terminals (see the following table). The 5th interface is the diagnostic interface “Serial Interface” designed as an RJ45 socket (see chapter “Front panel elements”, figure “Front panel of the WSC”).

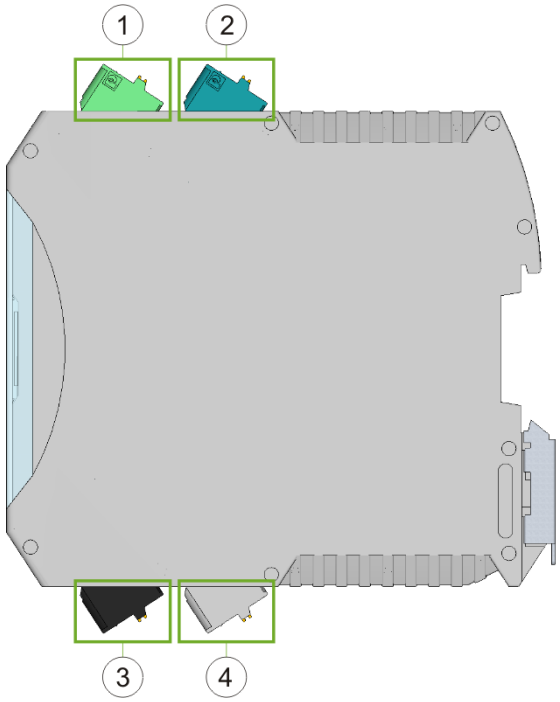
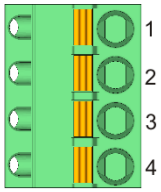
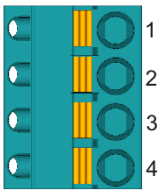
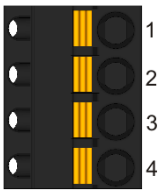
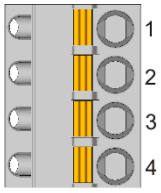
Side view of the WSC	Interfaces	Cage clamp terminals	Color
	① “Wheel sensor”		Green
	② “Power supply”		Blue
	③ “Optocoupler output 1 and 2”		Black
	④ “Optocoupler output 3 and 4”		Gray

Table 3.1: Overview of the interfaces designed as cage clamp terminals

3.5.1 Diagnostic interface “Serial Interface”

The diagnostic interface “Serial Interface” is designed as an RJ45 socket on the front panel of the WSC. Via this interface, diagnostic data and error information can be read out and saved in a text file by means of the diagnostic tool Advanced Service Display ASD.

Further information regarding the data request of the WSC can be found in chapter “Data request with Advanced Service Display ASD”.

For further information regarding the diagnostic interface “Serial Interface”, see D6758 “Diagnostic interface and protocol specification – Wheel sensor Signal Converter WSC003”.

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

	If any other diagnostic system than the ASD is connected to the diagnostic interface “Serial Interface”, galvanic separation must be ensured. For further information (e.g. interface description), contact Frauscher.

3.5.2 Interface “Wheel sensor”

A wheel sensor is supplied and evaluated via the interface “Wheel sensor”.

Wheel sensor	Supply voltage	Loop resistance wheel sensor cable
RSR110-001, RSR110-002	+24 V DC	≤ 500 Ω
NAMUR	+8.2 V DC	≤ 50 Ω

Table 3.2: Values for the interface “Wheel sensor”

- The WSC can supply and evaluate
  - 1 wheel sensor with 2 sensor systems or
  - up to 2 wheel sensors with 1 sensor system each.
- The interface “Wheel sensor” is short-circuit-proof.

A wheel sensor can be simulated with a resistor (see the following figures).

Simulation of an RSR110

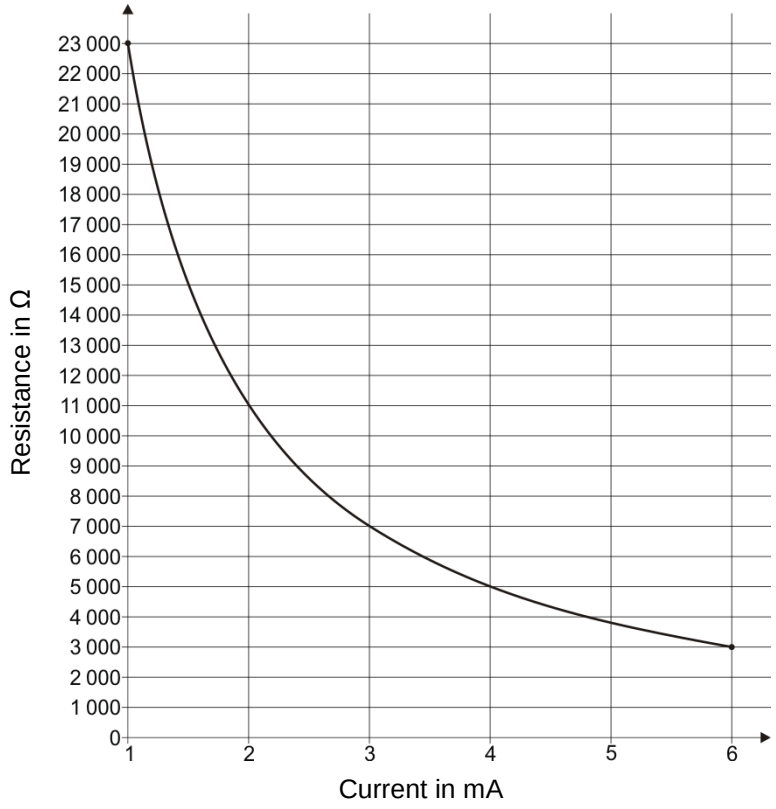


Figure 3.3: Resistance values to simulate an RSR110

Simulation of a NAMUR sensor

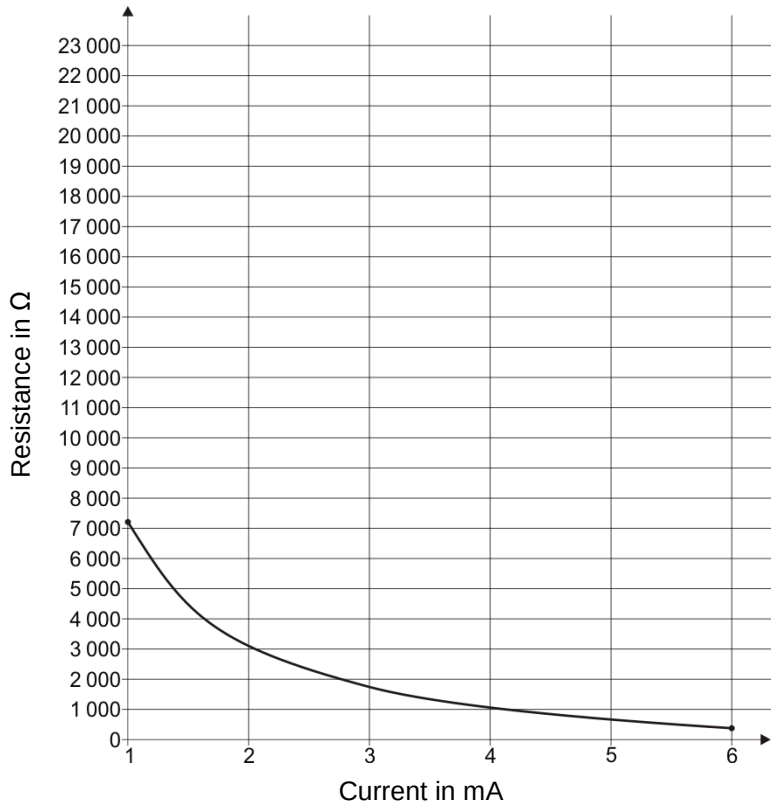


Figure 3.4: Resistance values to simulate a NAMUR sensor

3.5.2.1 Wire assignment of the wheel sensors

In general, the following connection diagram applies to wheel sensors RSR110 and sensors with NAMUR interface.
When using a sensor with NAMUR interface, it is possible that the number of wires and/or the colors of the individual wires vary depending on the wheel sensor cable used.

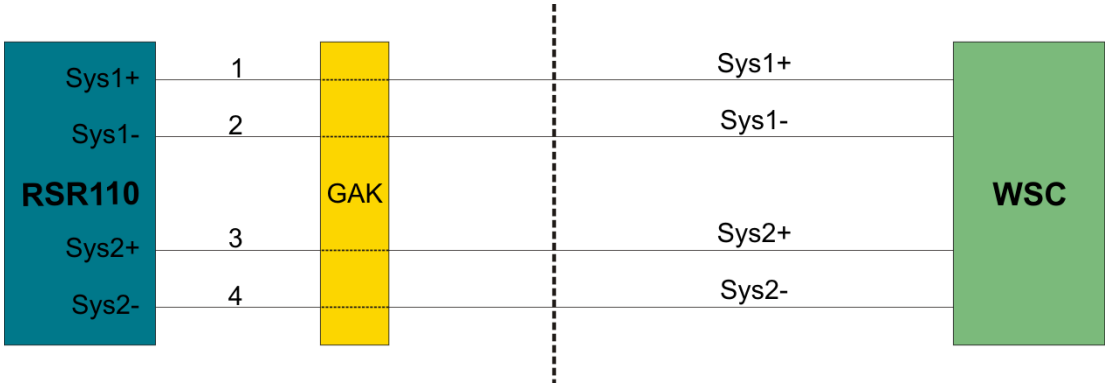


Figure 3.5: Connection diagram for RSR110 and NAMUR sensors

The wire assignment of a wheel sensor with 2 sensor systems differs from the wire assignment of a wheel sensor with 1 sensor system:

- In the case of **2 sensor systems**, **all 4 wires** of the wheel sensor cable must be connected (see table “Wire assignment for RSR110-001”).
- In the case of **1 sensor system**, **only wires 1 and 2** of the wheel sensor cable must be connected (see table “Wire assignment for RSR110-002”).

Wire assignment for RSR110-001

No.	Color of wire	Wire assignment	
1	 (brown)	Sensor system 1	Sys1+
2	 (yellow)		Sys1-
3	 (green)	Sensor system 2	Sys2+
4	 (white)		Sys2-

Table 3.3: Wire assignment for RSR110-001

Wire assignment for RSR110-002

No.	Color of wire	Wire assignment	
1	 (brown)	Sensor system 1	Sys1+
2	 (yellow)		Sys1-
3	 (green)	**Do not connect**	
4	 (white)		

Table 3.4: Wire assignment for RSR110-002

It is recommended to lay the wires 3 and 4 in the trackside connection box. There is no need for any further termination.

3.5.3 Interface “Power supply”

The WSC is supplied with voltage via the interface “Power supply”, which is galvanically separated from all other interfaces. It is recommended to use an uninterruptible power supply.

Parameter	Value
Permissible supply voltage	10 to 36 V DC
Insulation voltage	+1 000 V DC
Insulation distance (according to EN 50124-1)	2 mm

Table 3.5: Values for the interface “Power supply”

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

3.5.3.1 Power-up current and current consumption of the WSC

The maximum power-up current and the current consumption of the WSC depend on the connected wheel sensor:

- If the WSC is connected to 1 wheel sensor with 2 sensor systems or 2 wheel sensors with 1 sensor system each, the maximum power-up current is **260 mA**.
- If the WSC is connected to 1 wheel sensor with 1 sensor system, the maximum power-up current is **240 mA**.

The maximum power-up current must only be provided for a few µs, so that a conventional power supply unit is sufficient.

Current consumption of RSR110

The depicted values of current consumption apply if all outputs are closed and the sensor current is 5 mA.

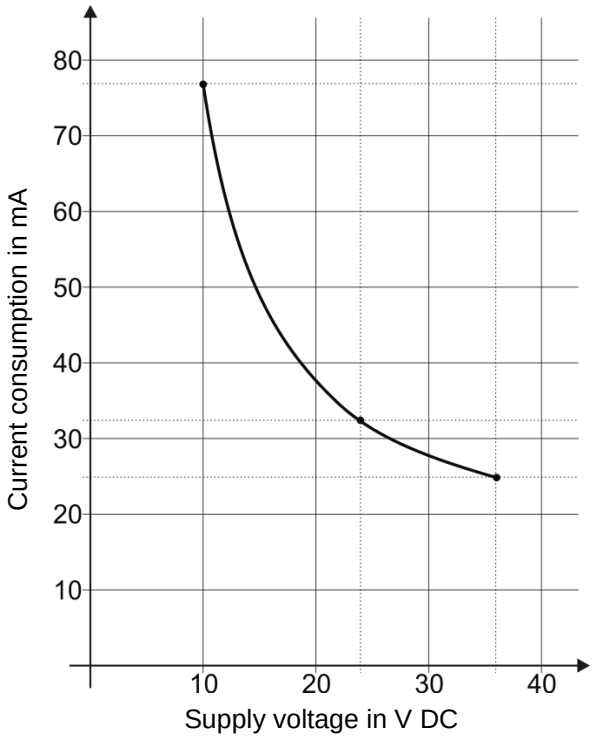


Figure 3.6: WSC current consumption with 1 RSR110-001 or 2 RSR110-002

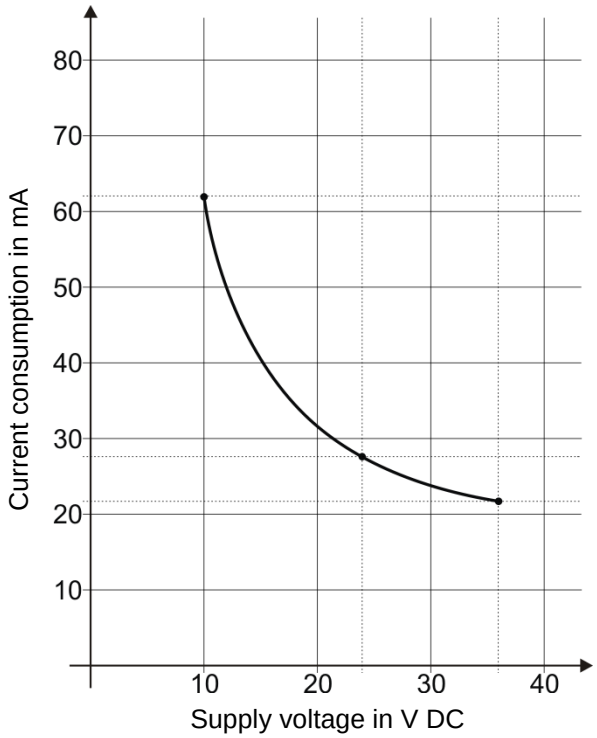


Figure 3.7: WSC current consumption with 1 RSR110-002

Values of the WSC current consumption in case an RSR110 is connected:

1 RSR110-001 or 2 RSR110-002		1 RSR110-002	
Supply voltage	**Current consumption[3]**	**Supply voltage**	**Current consumption[4]**
10 V DC	77 mA	10 V DC	62 mA
24 V DC	32 mA	24 V DC	28 mA
36 V DC	25 mA	36 V DC	22 mA

Table 3.2: Values of the WSC current consumption in case an RSR110 is used

3 The values are taken from the figure “WSC current consumption with 1 RSR110-001 or 2 RSR110-002”.

4 The values are taken from the figure “WSC current consumption with 1 RSR110-002”.

Current consumption of NAMUR sensor

The depicted values of current consumption apply if all outputs are closed and the sensor current is 2.95 mA.

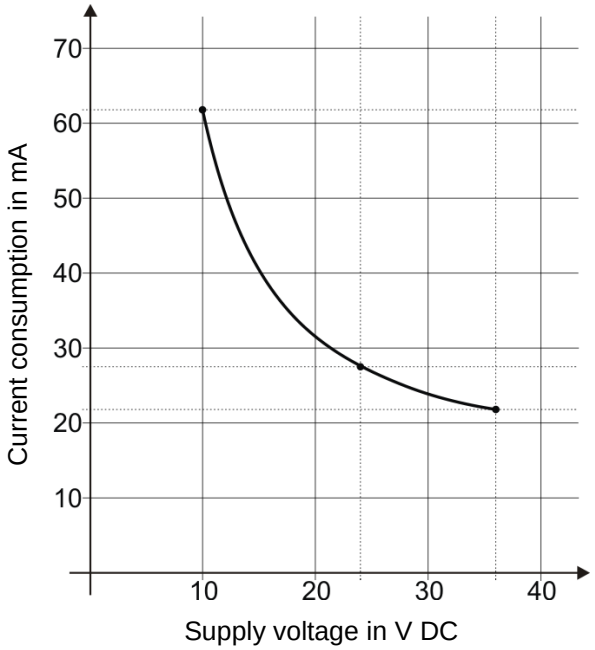


Figure 3.8: WSC current consumption with 1 NAMUR sensor with 2 sensor systems or with 2 NAMUR sensors with 1 sensor system each

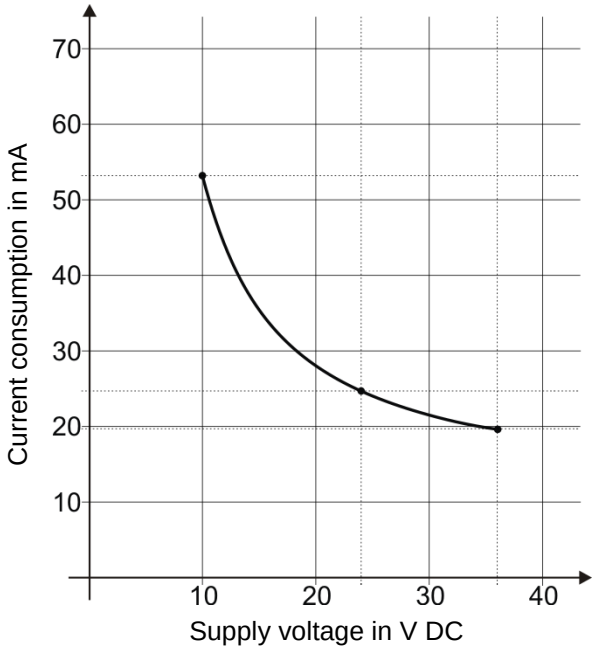


Figure 3.9: WSC current consumption with 1 NAMUR sensor with 1 sensor system

Values of the WSC current consumption in case a NAMUR sensor is used:

1 NAMUR sensor with 2 sensor systems or 2 NAMUR sensors with 1 sensor system each		**1 NAMUR sensor with 1 sensor system**	
Supply voltage	**Current consumption[5]**	**Supply voltage**	**Current consumption[6]**
10 V DC	62 mA	10 V DC	53 mA
24 V DC	28 mA	24 V DC	25 mA
36 V DC	22 mA	36 V DC	20 mA

Table 3.3: Values of the WSC current consumption in case a NAMUR sensor is used

5 The values are taken from the figure “WSC current consumption with 1 NAMUR sensor with 2 sensor systems or with 2 NAMUR sensors with 1 sensor system each”.

6 The values are taken from the figure “WSC current consumption with 1 NAMUR sensor with 1 sensor system”.

3.5.4 Interfaces “Optocoupler outputs”

The interfaces “Optocoupler outputs” consist of the interfaces “Optocoupler output 1 and 2” and “Optocoupler output 3 and 4”. The interfaces are open-collector outputs and galvanically separated.

Parameter	Value
Switching current	1 to 100 mA
Switching voltage	+3.3 to +72 V DC
Maximum insulation voltage	+3 000 V DC

Table 3.6: Values for the interfaces “Optocoupler outputs”

Information output at interface “Optocoupler output 1 and 2”:
- System occupancy
- Travel direction

Information output at interface “Optocoupler output 3 and 4”:
- Center pulse
- Gate pulse
- Error
- Travel direction

Example configuration:

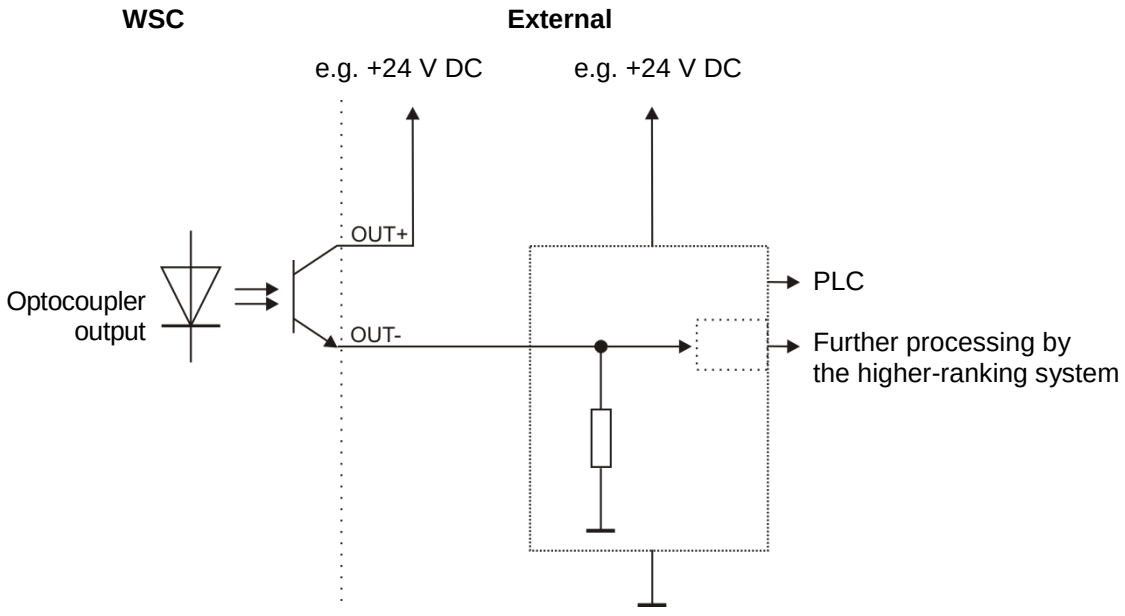


Figure 3.10: Example configuration

4 Conditions for the installation

4.1 Environmental conditions

The WSC is intended for the installation in a cubicle or in an outdoor cabinet according to the specifications in EN 60721-3-3.

The following operating conditions[7] apply for the WSC:

Parameter	Value	Standard
Temperature	-40 to +70 °C	EN 50125-3: “In cubicle”, climatic class T2
Humidity	5 to 100 % without condensation	
Maximum height	1 400 m above sea level	EN 50125-3: class A1
Degree of protection	IP20*	EN 60529
* The WSC is protected against access by a finger to hazardous parts and against the ingress of solid foreign objects ≥ 12.5 mm. The WSC is not protected against dust and the harmful ingress of water.		

Table 4.1: Operating conditions for the WSC

If these conditions cannot be complied with, consult Frauscher.

4.2 Electromagnetic compatibility

An EMC type test has been carried out successfully in accordance with EN 50121-4.

7 The same environmental conditions that apply for operation also apply for transportation (according to EN 60721-3-2) and storage (according to EN 60721-3-1).

5 Configuration

The configuration of the WSC is carried out by means of the DIP-switches on the front panel of the WSC.

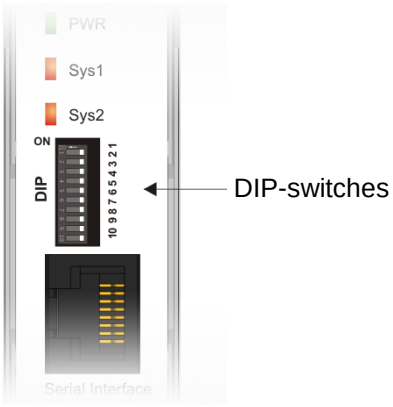


Figure 5.1: DIP-switches on the front panel of the WSC

5.1 General setting of the DIP-switches

There are 2 possible DIP-switch positions:

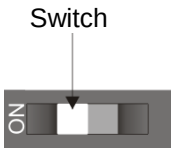


Figure 5.2: DIP-switch position “ON”

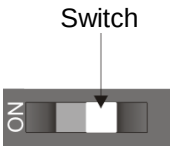


Figure 5.3: DIP-switch position “OFF”

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

5.2 DIP-switches of the WSC

There are 10 DIP-switches on the front panel of the WSC. The DIP-switches are used for the configuration of the WSC (see following table). The configuration of the WSC must be carried out **before** power-up.

DIP-no.	DIP-switches	Possible settings	Function
1		ON/OFF	Configuration of ▪ System outputs ▪ Direction outputs ▪ Center pulse output ▪ Gate pulse output ▪ Error output
2		ON/OFF	
3		ON/OFF	
4		ON/OFF	Configuration of the normal status of all optocoupler outputs (except error output) It is not possible to configure the normal status of the error output.
5		ON/OFF	Configuration of the system output extension time
6		ON/OFF	
7		ON/OFF	Configuration of ▪ Direction pulse duration ▪ Center pulse duration
8		ON/OFF	
9		ON/OFF	
10		ON/OFF	▪ Adjustment* ▪ Switching between RSR110 and NAMUR sensors

* Information about adjustment with the DIP-switch (DIP-no. 10) can be found in chapter “Adjustment”.
If a NAMUR sensor is used, an adjustment via WSC is not possible. In this case, the manufacturer’s documentation must be complied with.

Table 5.1: DIP-switches of the WSC

By means of the DIP-switch with DIP-no. 10, it is possible to switch between RSR110 and NAMUR sensors. This setting must be carried out **before** the power-up.

- If an RSR110 is used, the DIP-switch with DIP-no. 10 must be set to “OFF” (right).
- If a NAMUR sensor is used, the DIP-switch with DIP-no. 10 must be set to “ON” (left).

The signals that are actually output depend on the configuration of the WSC.
The signal diagrams in chapter “Signal diagrams” show all signals that can be output.

	In order for the WSC to accept a new configuration (due to a change of the DIP-switches), the WSC must be restarted by interrupting the power supply.

5.2.1 Configurable functions

In the following, there is a description of the configurable functions. Further information about the switching behavior of the WSC can be found in chapter “Signal diagrams”.

System output

The system output is used to get information about the status of the sensor system (damped, not damped, or faulty).

4-edges direction output

The 4-edges direction output is output after the wheel has fully traversed the wheel sensor. The travel direction can only be determined if a wheel sensor with 2 sensor systems is used.

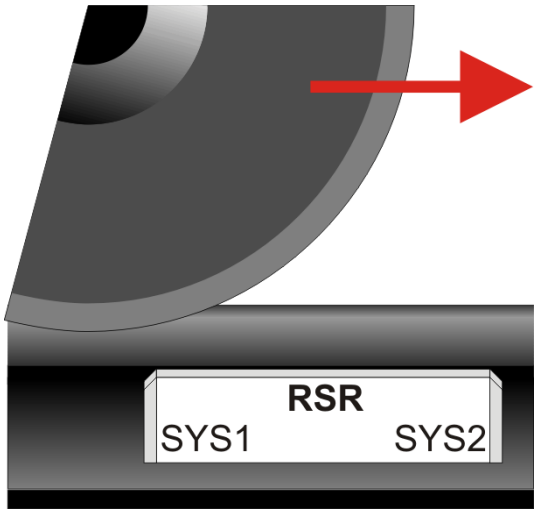


Figure 5.4: Direction 1

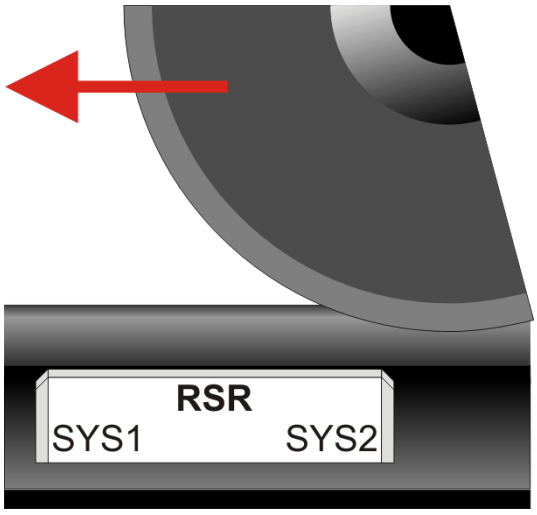


Figure 5.5: Direction 2

In general, the travel direction of a wheel is defined with “direction 1” and “direction 2”, depending on which sensor system of the wheel sensor is damped first:

- Direction 1: first, sensor system 1 is damped, then, sensor system 2 is damped
- Direction 2: first, sensor system 2 is damped, then, sensor system 1 is damped

Center pulse output

The center pulse is output at the moment in which the wheel is above the center of the wheel sensor. A delay of 300 µs can occur due to the processing time of the WSC (in the worst case). The center pulse output can be used for triggering various functions (e.g. hot box detection system).

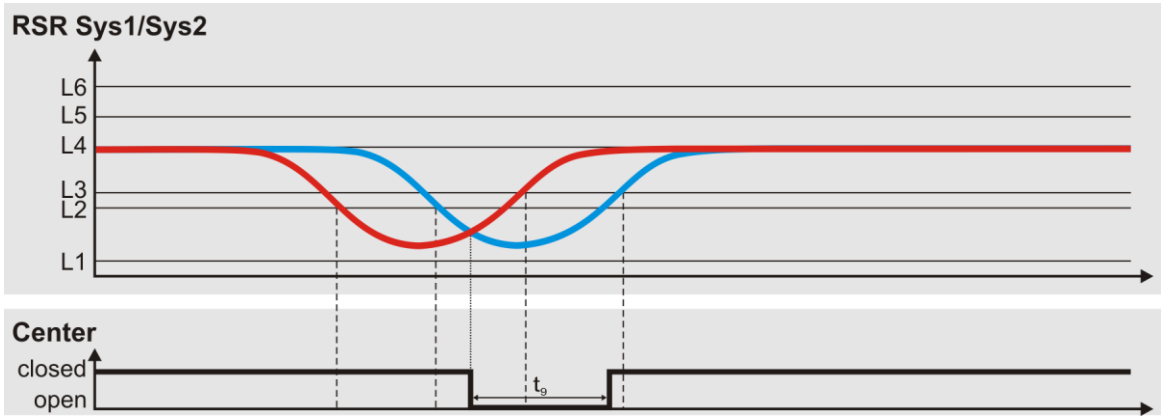


Figure 5.1: Center pulse output

Gate pulse output

The gate pulse is output for the period of time between the trigger level of sensor system 1 and the tripping level of sensor system 2. The gate pulse output can be used for triggering various functions (e.g. lubrication system).

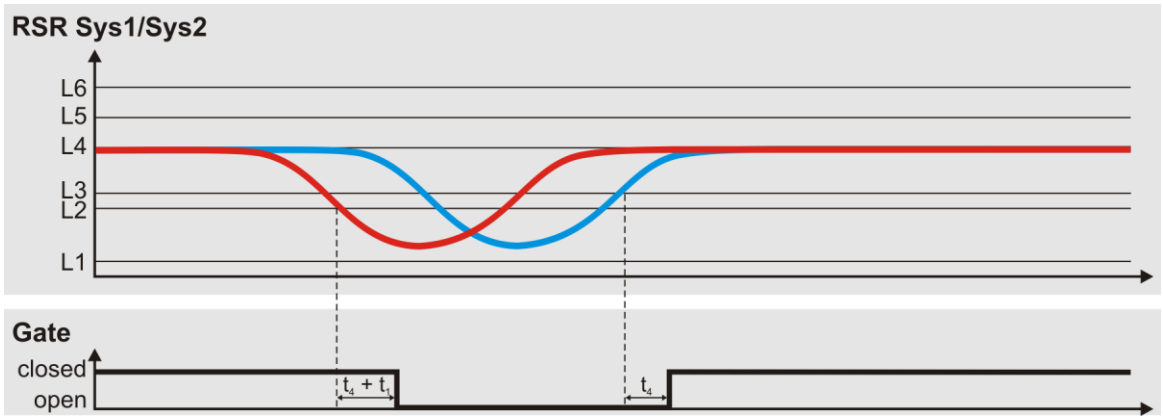
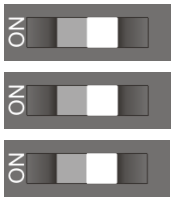
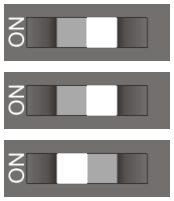
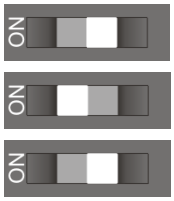
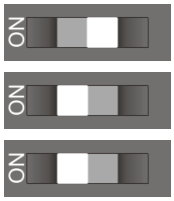
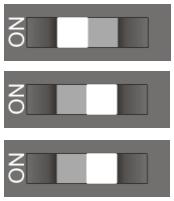
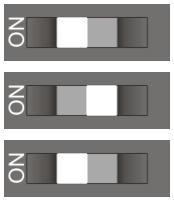


Figure 5.2: Gate pulse output

Error output

The error output can be used to forward error information to the higher-ranking system.

5.2.1.1 Configuration of the optocoupler outputs

DIP-no.	DIP-switches	Setting	Outputs
1		OFF	Standard configuration:
2		OFF	**2 system outputs** ▪ Status sensor system 1 ▪ Status sensor system 2
3		OFF	**2 direction outputs** ▪ Direction 1 ▪ Direction 2
1		OFF	**2 system outputs** ▪ Status sensor system 1
2		OFF	▪ Status sensor system 1[8]
3		ON	**2 error outputs**
1		OFF	**2 system outputs** ▪ Status sensor system 1
2		ON	▪ Status sensor system 2
3		OFF	**1 center pulse output** **1 error output**
1		OFF	**2 system outputs** ▪ Status sensor system 1
2		ON	▪ Status sensor system 2
3		ON	**1 center pulse output** **1 gate pulse output**
1		ON	**2 direction outputs** ▪ Direction 1
2		OFF	▪ Direction 2
3		OFF	**1 center pulse output** **1 error output**
1		ON	**2 direction outputs** ▪ Direction 1
2		OFF	▪ Direction 2
3		ON	**1 center pulse output** **1 gate pulse output**

8 As this setting is used for the configuration of an RSR with 1 system, only 1 sensor system is analysed. Therefore, the switching outputs are assigned twice with equal values for system outputs and error outputs each.

DIP-no.	DIP-switches	Setting	Outputs
1		ON	This setting is not allowed.
2		ON	
3		OFF	
1		ON	This setting is not allowed.
2		ON	
3		ON	

Table 5.1: Configuration of the optocoupler outputs

The following table shows which interfaces are used for the output of the standard configuration (DIP-no. 1, DIP-no. 2 and DIP-no. 3 are all set to “OFF”):

Interface	Spring connection	Output
“Optocoupler output 1 and 2”	4 (OUT1+) and 3 (OUT1-)	Status of sensor system 1
	2 (OUT2+) and 1 (OUT2-)	Status of sensor system 2
“Optocoupler output 3 and 4”	4 (OUT3+) and 3 (OUT3-)	Direction 1
	2 (OUT4+) and 1 (OUT4-)	Direction 2

Table 5.2: Interfaces for the output of standard configuration

The following table shows which interfaces are used for the output of the other configuration possibilities:

Interface	Spring connection	Output
“Optocoupler output 1 and 2”	4 (OUT1+) and 3 (OUT1-)	Status of sensor system 1
	2 (OUT2+) and 1 (OUT2-)	Status of sensor system 2
	4 (OUT1+) and 3 (OUT1-)	Direction 1
	2 (OUT2+) and 1 (OUT2-)	Direction 2
“Optocoupler output 3 and 4”	4 (OUT3+) and 3 (OUT3-)	Error
	2 (OUT4+) and 1 (OUT4-)	
	4 (OUT3+) and 3 (OUT3-)	Center pulse
	2 (OUT4+) and 1 (OUT4-)	Gate pulse

Table 5.3: Interfaces for the output of the other configuration possibilities

Further information regarding the interfaces and the wire assignment can be found in chapter “Wiring of the Wheel sensor Signal Converter WSC”.

5.2.2 Configuration of the normal status of optocoupler outputs

The normal status of the optocoupler outputs applies under the following conditions:

- Wheel sensor mounted correctly
- Wheel sensor adjusted correctly
- Wheel sensor not damped
- No error

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

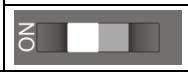
DIP-no.	DIP-switches	Setting	Configuration
4		OFF	Closed in normal status (recommended setting)
		ON	Open in normal status

Table 5.2: Configuration of the normal status of optocoupler outputs

- The configured normal status applies to all optocoupler outputs and is independent of the output functionality.
- It is recommended to configure “closed in normal status” to correctly output occupancies, faults, and/or errors of a sensor system.
- If an error, fault, or voltage interruption occurs, all outputs are open as long as the error, fault, or voltage interruption persists.
- The normal status of the error output is closed and cannot be configured.
- If the optocoupler outputs are configured with “Open in normal status”, the
  - system pulse,
  - direction pulse,
  - center pulse, and
  - gate pulse

are not output if faults, and/or errors occur (e.g. wire break, overcurrent).

	If the recommended configuration “closed in normal status” is used in combination with a configuration that includes 2 direction outputs, the 2 direction outputs output a 4-edges direction pulse in case of an error.

5.2.3 Configuration of the system output extension time

The system output extension time can be configured as follows:

DIP-no.	DIP-switches	Setting	Configuration
5		OFF	**0 ms**
6		OFF	
5		OFF	**5 ms** ±0.2 ms
6		ON	
5		ON	**500 ms** ±0.2 ms
6		OFF	
5		ON	**5000 ms** ±0.2 ms
6		ON	

Table 5.4: Configuration of the system output extension time

If an error, fault, or voltage interruption occurs, all outputs are open as long as the error, fault, or voltage interruption persists.

If a configuration without system outputs is used, the DIP-switches with the DIP-no. 5 and 6 must be set to “OFF”.

5.2.4 Configuration of the direction pulse duration and the center pulse duration

The direction pulse duration and the center pulse duration can be configured as follows:

DIP-no.	DIP-switches	Setting	Configuration
7		OFF	
8		OFF	**5 ms** ±0.2 ms
9		OFF	
7		OFF	
8		OFF	**10 ms** ±0.2 ms
9		ON	
7		OFF	
8		ON	**25 ms** ±0.2 ms
9		OFF	
7		OFF	
8		ON	**50 ms** ±0.2 ms
9		ON	
7		ON	
8		OFF	**100 ms** ±0.2 ms
9		OFF	
7		ON	
8		OFF	**500 ms** ±0.2 ms
9		ON	
7		ON	
8		ON	**1 000 ms** ±0.2 ms
9		OFF	

DIP-no.	DIP-switches	Setting	Configuration
7		ON	**10 000 ms** ±0.2 ms
8		ON	
9		ON	

Table 5.3: Configuration of the direction pulse duration and the center pulse duration

If an error, fault, or voltage interruption occurs, all outputs are open as long as the error, fault, or voltage interruption persists.

6 Signal diagrams

The following signal diagrams depict all signals that can be output. Only signals whose output has been configured must be taken into account.

Although the analog signal courses for NAMUR sensors differ from the signal courses of the RSR110 wheel sensors, the output behavior is identical. Therefore, the signal diagrams are not shown separately for NAMUR sensors.

Information regarding the output signals of the used configuration can be found in chapter “Configuration”.

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

If the optocoupler outputs are configured with “**open in normal status**”, then, in case of a traversing, the signals “Sys” and “Ri” are inverted to the respective signals in the following diagrams.
In case of a wire break, or overcurrent or error, the system outputs and direction outputs remain in the open status.

It is not possible to configure the normal status of the error output. Therefore, the normal status of the error output is normally closed.

6.1 Switching times and switching levels

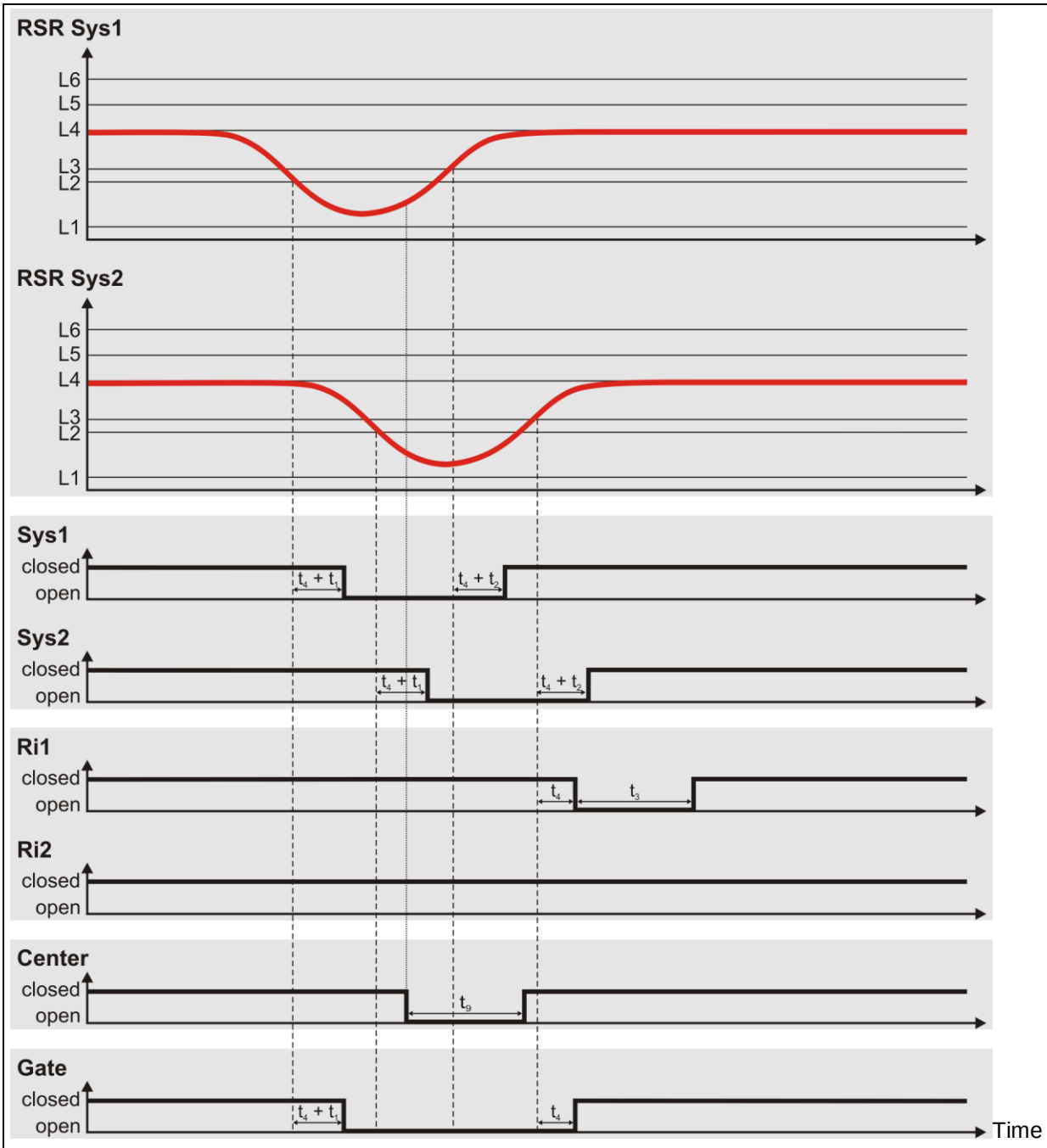
The following switching times and switching levels apply for the WSC:

Switching times	**Abbreviation**	**RSR110 and NAMUR**	
System output delay time	t_1	0 ms	
System output extension time	t_2	Configurable	
Direction pulse duration	t_3	Configurable	
Digital filtering time	t_4	1.5 ms	
Overcurrent suppression time	t_5	200 ms	
Wire break suppression time	t_7	200 ms	
Center pulse duration	t_9	Configurable	
Switching levels	**Abbreviation**	**RSR110**	**NAMUR**
Wire break level	L1	0.2 mA	0.2 mA
Trigger level	L2	3.75 mA	1.65 mA
Tripping level	L3	4.3 mA	2.45 mA
Normal operating sensor current level	L4	5 mA	2.95 mA
Overcurrent level	L5	6 mA	7 mA
Wire short-circuit level	L6	-	-
"-" means that the respective parameter is not relevant for the WSC.			

Table 6.1: Switching times and switching levels of the WSC

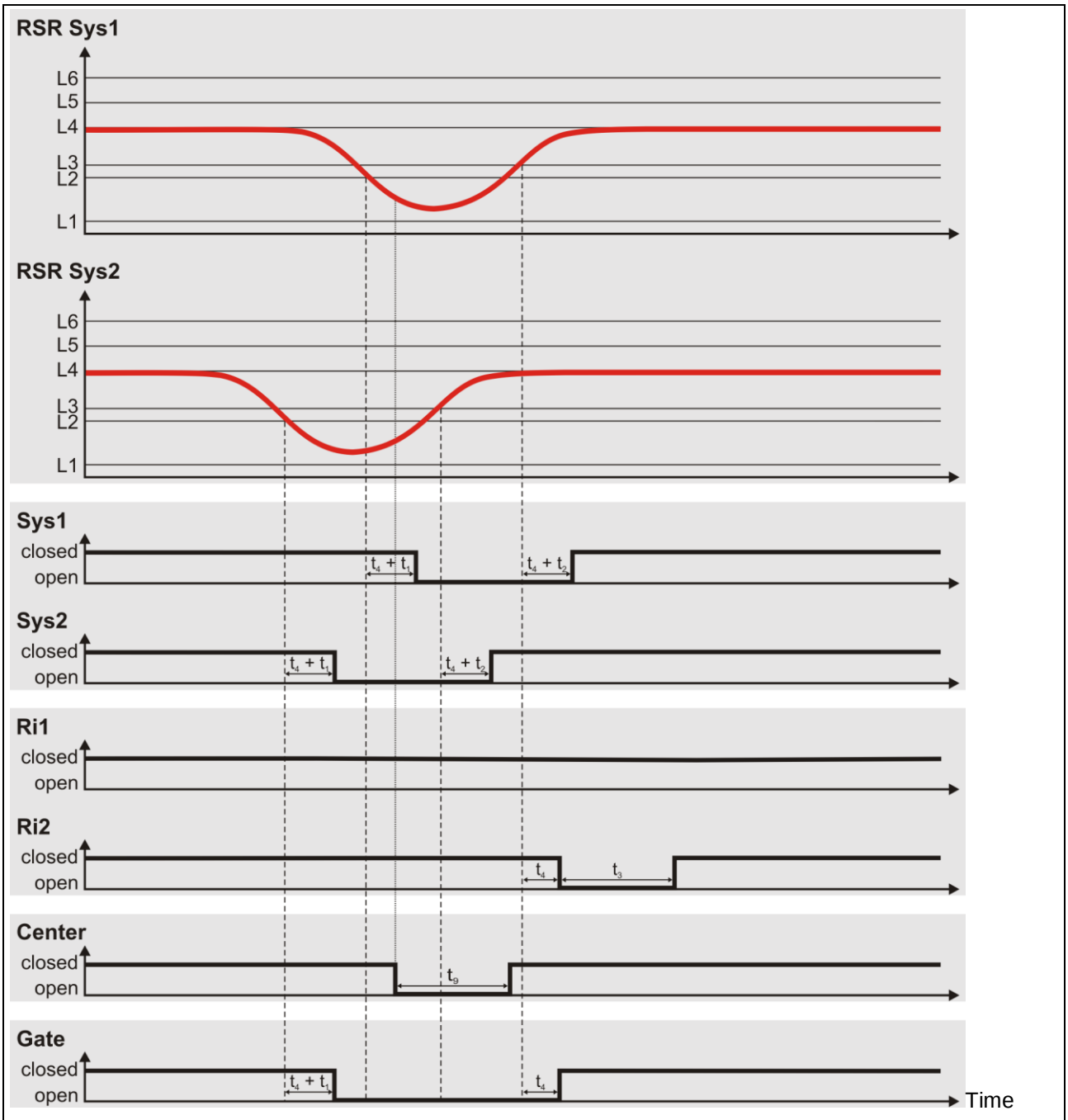
6.2 Traversings

6.2.1 Correct traversing of one wheel



L1: Wire break level	L2: Trigger level	L3: Tripping level
L4: Normal operating sensor current level	L5: Overcurrent level	L6: Wire short-circuit level
t_1: System output delay time	t_2: System output extension time	t_3: Direction pulse duration
t_4: Digital filtering time	t_9: Center pulse duration	

Figure 6.1: Correct traversing of one wheel in direction 1

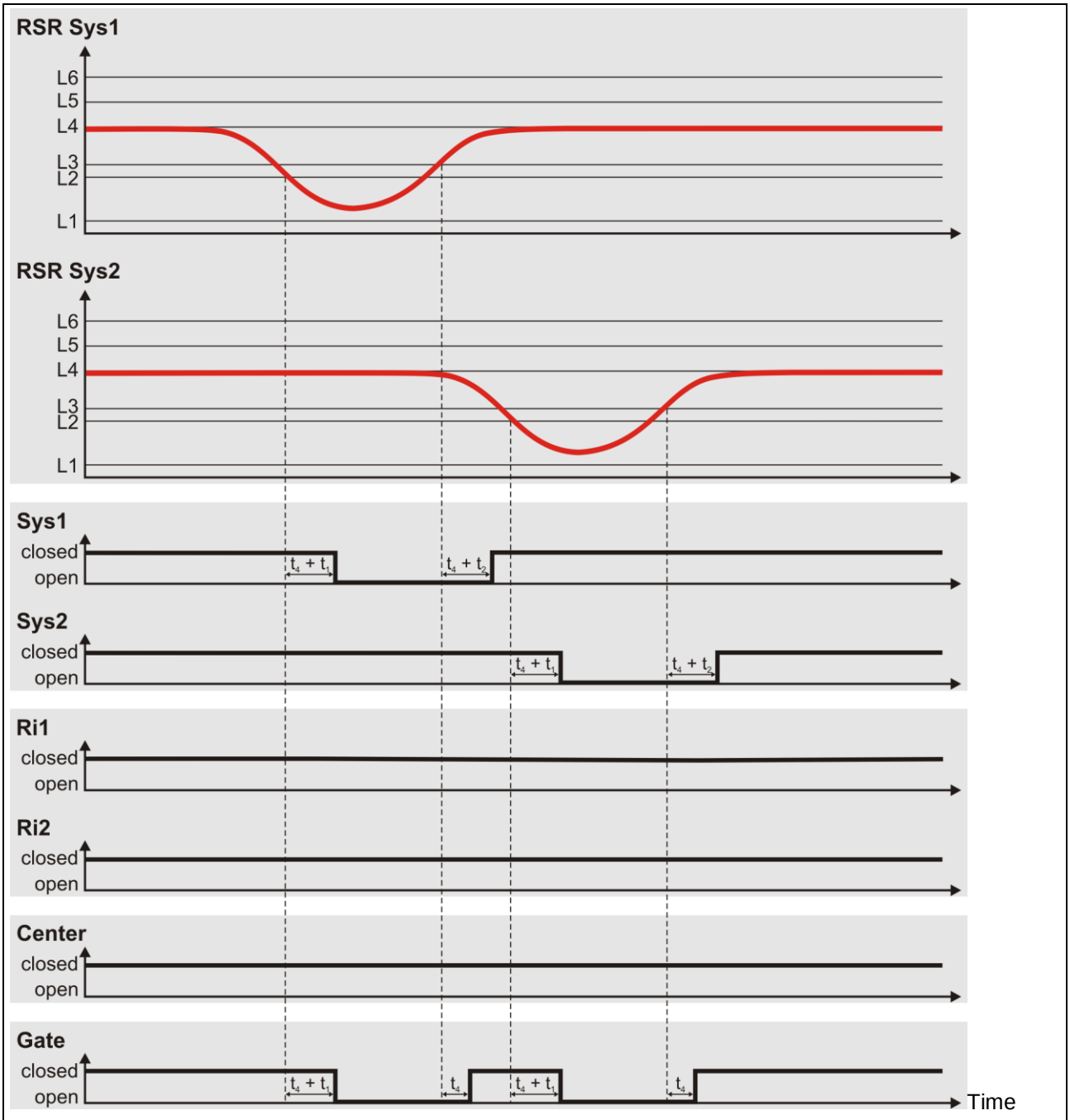


L1: Wire break level	L2: Trigger level	L3: Tripping level
L4: Normal operating sensor current level	L5: Overcurrent level	L6: Wire short-circuit level
t_1: System output delay time	t_2: System output extension time	t_3: Direction pulse duration
t_4: Digital filtering time	t_9: Center pulse duration	

Figure 6.2: Correct traversing of one wheel in direction 2

The point of intersection of the 2 curves (RSR Sys1 and RSR Sys2) results in the center pulse. The duration of the center pulse output (t_9) is configurable (see chapter “Configuration of the center pulse duration”).

6.2.2 Traversing of one wheel without overlap



L1: Wire break level	L2: Trigger level	L3: Tripping level
L4: Normal operating sensor current level	L5: Overcurrent level	L6: Wire short-circuit level
t_1: System output delay time	t_2: System output extension time	t_4: Digital filtering time

Figure 6.3: Traversing of one wheel in direction 1, without overlap

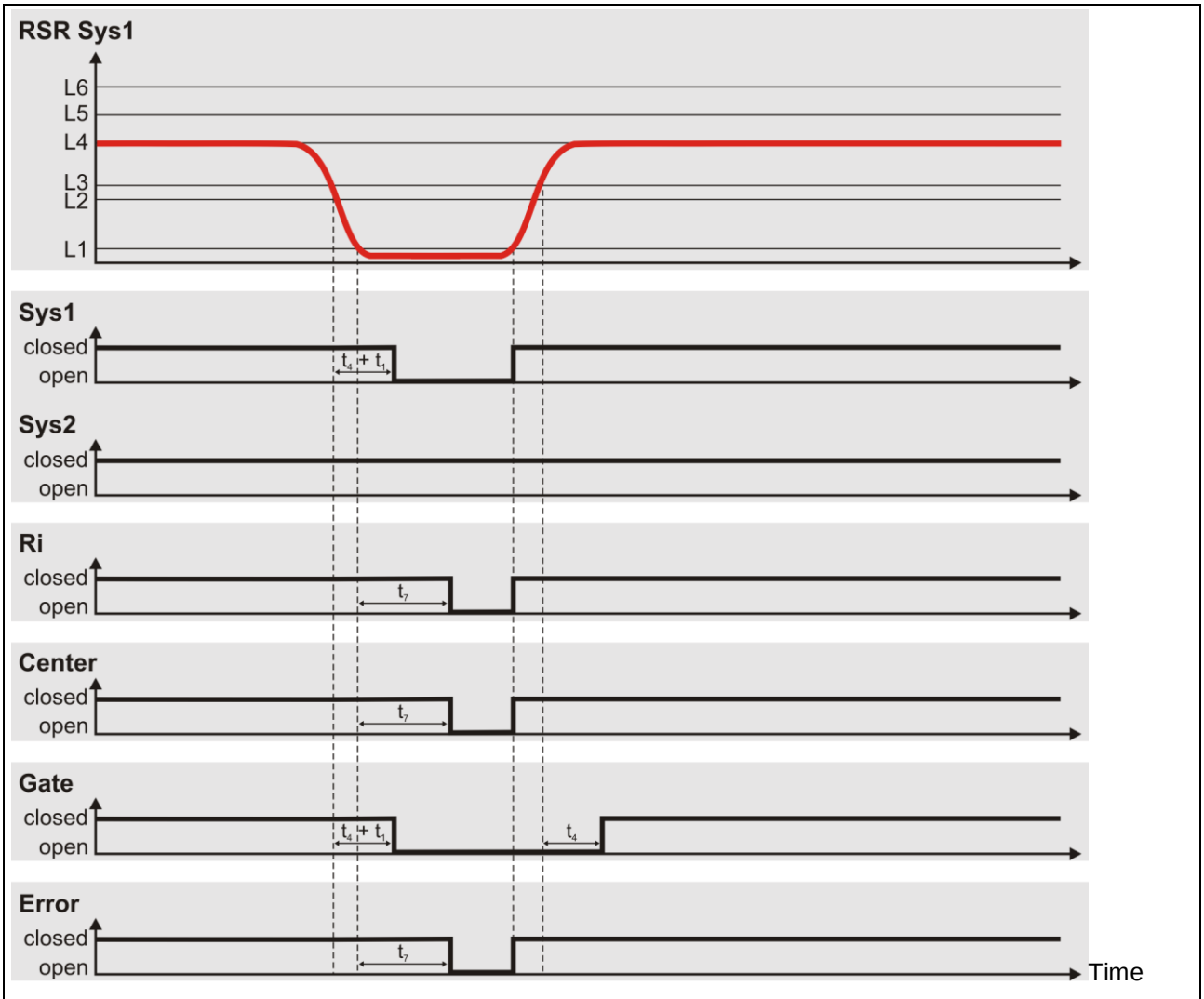
Reasons for a missing overlap:

- Wheel geometry (wheel diameter too small)
- Usage of 2 wheel sensors with 1 sensor system each on the same rail

6.2.3 Behavior in the case of wire break

The depicted signal course is valid for system 1 and system 2 as well as for Ri1 and Ri2.

If a wire break occurs at sensor system 1, the outputs Sys1, Ri1, Ri2, center pulse, and gate pulse are open with normal status closed. The output Sys2 is closed.
If a wire break occurs at sensor system 2, the outputs Sys2, Ri1, Ri2, center pulse, and gate pulse are open with normal status closed. The output Sys1 is closed.



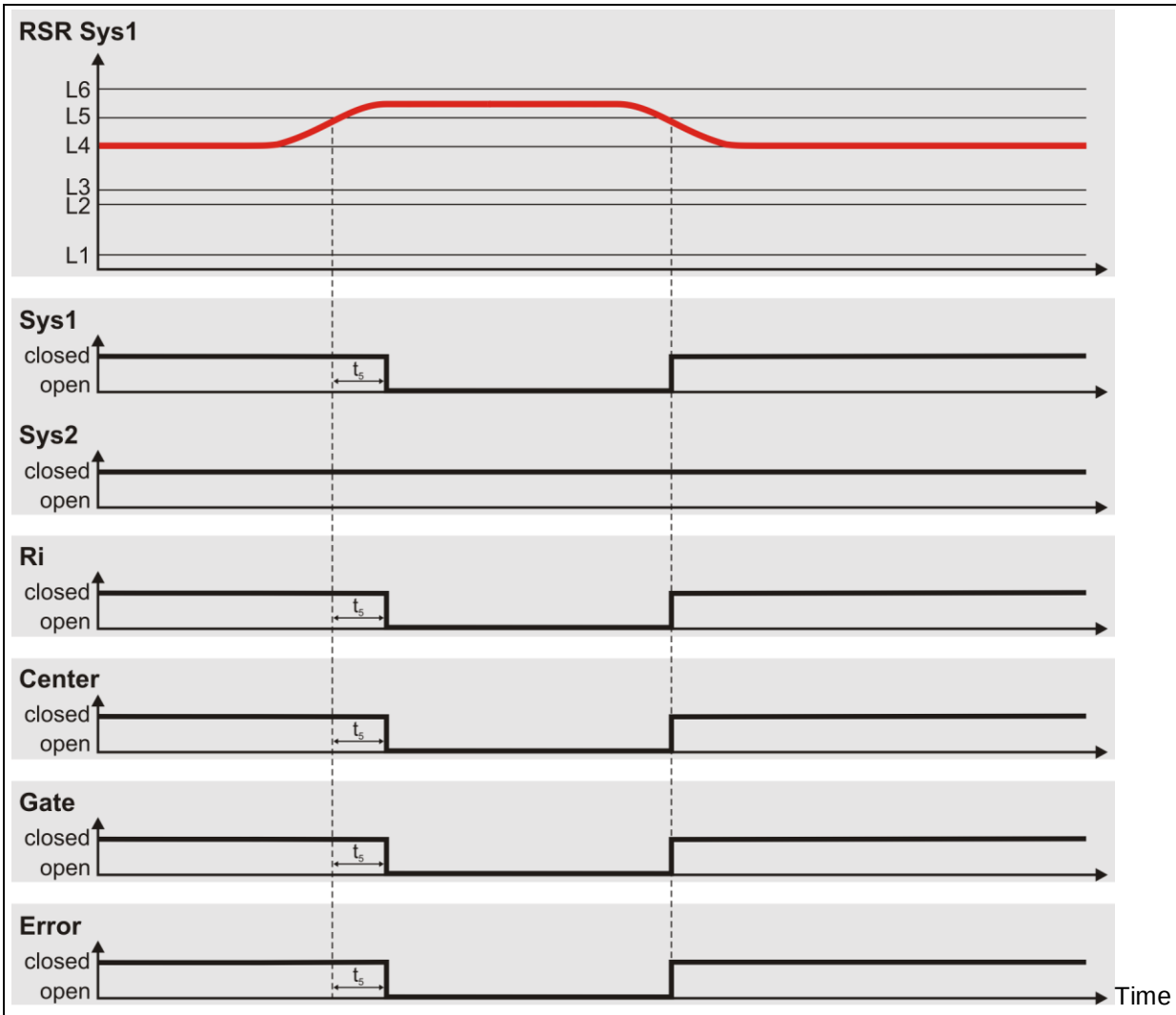
L1: Wire break level	L2: Trigger level	L3: Tripping level
L4: Normal operating sensor current level	L5: Overcurrent level	L6: Wire short-circuit level
t_1: System output delay time	t_4: Digital filtering time	t_7: Wire break suppression time

Figure 6.4: Behavior in the case of wire break

6.2.4 Behavior in the case of overcurrent

The depicted signal course is valid for system 1 and system 2 as well as for Ri1 and Ri2.

If overcurrent occurs at sensor system 1, the outputs Sys1, Ri1, Ri2, center pulse, and gate pulse are open with normal status closed. The output Sys2 is closed.
If overcurrent occurs at sensor system 2, the outputs Sys2, Ri1, Ri2, center pulse, and gate pulse are open with normal status closed. The output Sys1 is closed.



L1: Wire break level	L2: Trigger level	L3: Tripping level
L4: Normal operating sensor current level	L5: Overcurrent level	L6: Wire short-circuit level
t_5: Overcurrent suppression time		

Figure 6.5: Behavior in the case of overcurrent

7 Installation

	When handling the WSC, safety precautions (e.g. insulated tools) against dangerous contact voltages must be taken.

7.1 Wiring of the Wheel sensor Signal Converter WSC

To carry out the wiring of the WSC, the cage clamp terminals can be levered out by using a flat-blade screwdriver. The cage clamp terminal can simply be pushed back in.

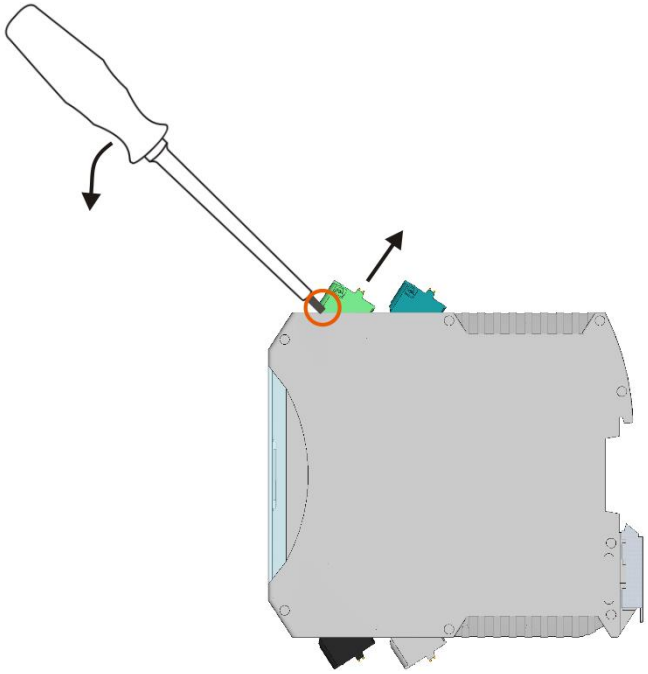


Figure 7.1: Levering out a cage clamp terminal

To insert and/or to remove the wires into/from the cage clamp terminal, the orange push-in spring connection must be pushed down with the help of a flat-blade screwdriver.

The wiring of the WSC must be carried out according to the wire assignment as described in the following tables.

Interface “Wheel sensor”

In general, the wire assignments shown in the following tables also apply to sensors with NAMUR interface (see the connection diagram in chapter “Wire assignment of the wheel sensor”). When using a NAMUR sensor, it is possible that the number of wires and/or the colors of the individual wires vary depending on the wheel sensor cable used.

Wire assignment for RSR110-001:

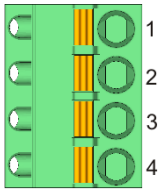
Green cage clamp terminal	Spring connection	Color of wire	Wire assignment	
	1	1 (brown)	Sensor system 1	Sys1+
	2	2 (yellow)		Sys1-
	3	3 (green)	Sensor system 2	Sys2+
	4	4 (white)		Sys2-

Table 7.1: Wire assignment interface “Wheel sensor” (input) for RSR110-001

Wire assignment for RSR110-002:

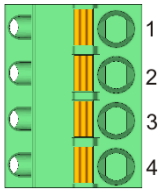
Green cage clamp terminal	Spring connection	Color of wire	Wire assignment	
	1	1 (brown)	Sensor system 1	Sys1+
	2	2 (yellow)		Sys1-
	3	3 (green)	**Do not connect**	
	4	4 (white)		

Table 7.2: Wire assignment interface “Wheel sensor” (input) for wheel sensors with 1 sensor system

It is recommended to lay the wires 3 and 4 in the trackside connection box. There is no need for any further termination.

Wire assignment for 2 wheel sensors RSR110-002:

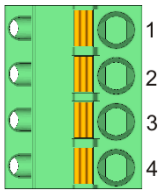
Green cage clamp terminal	Spring connection	Color of wire	Wire assignment	
	1	1 (brown)	Sensor system 1	Sys1+
	2	2 (yellow)		Sys1-
	3	1 (brown)	Sensor system 1	Sys1+
	4	2 (yellow)		Sys1-
	-	3 (green)	**Do not connect**	
	-	4 (white)		

Table 7.3: Wire assignment interface “Wheel sensor” (input) for 2 wheel sensors with 1 sensor system each

It is recommended to lay the wires 3 and 4 in the trackside connection box. There is no need for any further termination.

Interfaces “Power supply”, “Optocoupler output 1 and 2” and “Optocoupler output 3 and 4”

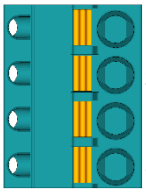
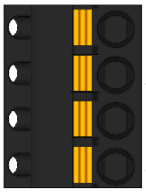
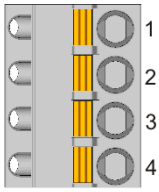
Interface	Cage clamp terminal	Spring connection	Wire assignment
„Power supply“ (input)		1	V+
		2	V+
		3	GND
		4	GND
“Optocoupler output 1 and 2” (output)		1	OUT2-
		2	OUT2+
		3	OUT1-
		4	OUT1+
“Optocoupler output 3 and 4” (output)		1	OUT4-
		2	OUT4+
		3	OUT3-
		4	OUT3+

Table 7.4: Wire assignment of the interfaces “Power supply”, “Optocoupler output 1 and 2” and “Optocoupler output 3 and 4”

7.2 Mounting and dismounting of the WSC

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

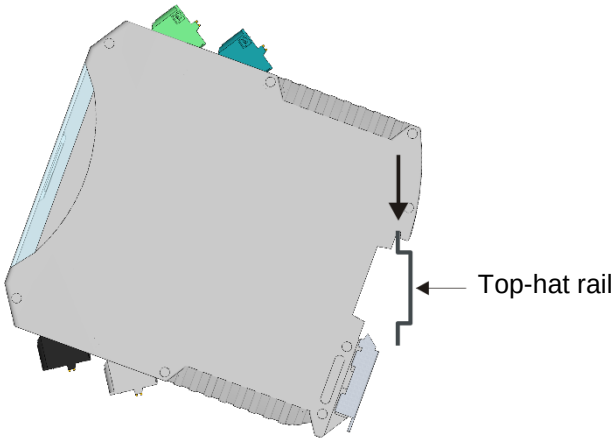


Figure 7.1: Mounting of the WSC, step 1

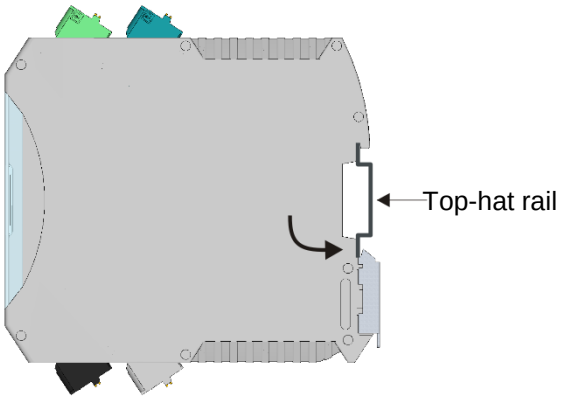


Figure 7.2: Mounting of the WSC, step 2

The WSC is dismounted by pushing down the metal foot catch of the WSC with a flat-blade screwdriver and lifting the WSC from the top-hat rail.

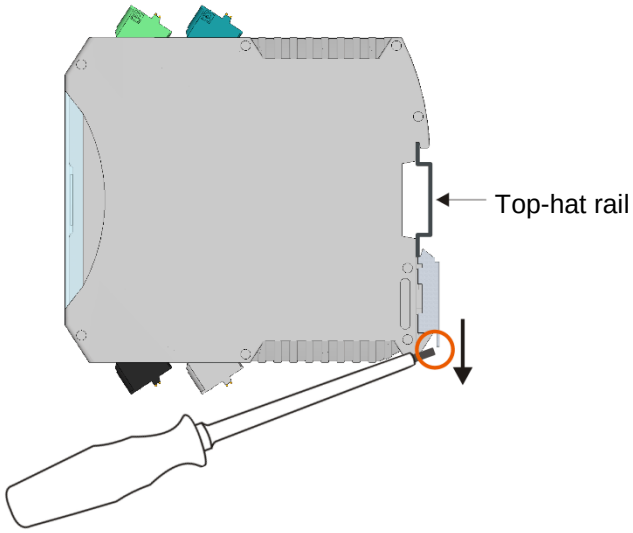


Figure 7.3: Dismounting of the WSC, step 1

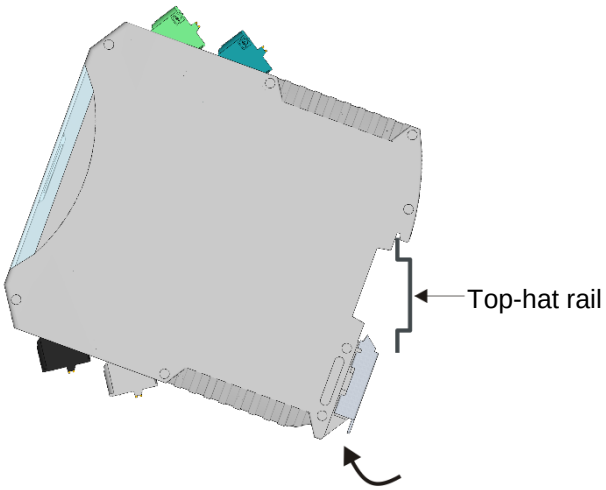


Figure 7.4: Dismounting of the WSC, step 2

8 Commissioning

The WSC may only be operated in a proper and checked condition. During commissioning, wheel sensors must not be damped or traversed.

Before the WSC is put into operation, an adjustment of the connected wheel sensor must be carried out.

8.1 Adjustment of the wheel sensor

Before carrying out the adjustment, the correct mounting of the wheel sensor RSR110 must be checked. The adjustment may only be carried out if the wheel sensor RSR110 is mounted correctly and is not damped.

There are 3 possibilities to carry out an adjustment:

- DIP-switch with the DIP-no. 10 on the front panel of the WSC
- Diagnostic interface “Serial Interface” (e.g. Advanced Service Display ASD)
- Adjustment and Maintenance Box AMB001

The outputs of the WSC do not switch during the adjustment process.

If a NAMUR sensor is used, the manufacturer’s documentation must be observed and complied with.

8.1.1 Adjustment by means of the DIP-switch with DIP-no. 10

The adjustment of the RSR110 can also be carried out by means of the DIP-switch with DIP-no. 10 on the front panel of the WSC.

To request the adjustment process, the following actuation sequence must be carried out:

1. When delivered, the DIP-switch with DIP-no. 10 is set to “OFF”.
2. Set DIP-switch to position “ON”.
   Keep DIP-switch in this position for more than 2 s and less than 6 s.
3. Set DIP-switch back to position “OFF”.

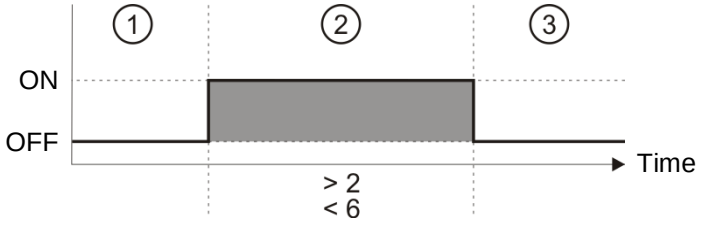


Figure 8.1: Actuation sequence for the adjustment process, time in s

After the actuation sequence, an initialization sequence of 40 s follows.

During the adjustment process, the LEDs “Sys1” and “Sys2” are illuminated. When the adjustment process is completed, the LEDs “Sys1” and “Sys2” go out.

If 2 wheel sensors RSR110-002 are used, both wheel sensors are adjusted at the same time.

If the actuation sequence is not carried out correctly or if the DIP-switch is accidentally set to “ON” and remains in this position for more than 6 s, the LEDs “Sys1” and “Sys2” flash until the DIP-switch is set back to “OFF”.

8.1.2 Adjustment via Serial Interface

It is possible to carry out a remote adjustment via the Serial Interface. If this function is required, contact Frauscher for further information (e.g. interface description).

8.1.3 Adjustment by using the AMB

The adjustment of the RSR110 by using the AMB is described in D4231 “Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting with rail claw)”[9] and must be carried out accordingly.

8.2 Data request with Advanced Service Display ASD

The Advanced Service Display ASD is used to read out diagnostic data and error information. For data request, the diagnostic interface “Serial Interface” on the front panel of the WSC must be connected to an appropriate USB port of the computer using the Service Display Cable.

Information regarding the hardware requirements, the installation of the ASD, and the program interface of the ASD can be found in D21004 “Brief description Advanced Service Display ASD101”.

WSC-specific buttons

The following buttons are available when a WSC003 is requested by the ASD.

Traversing direction 1	Simulates a traversing in direction 1
Traversing direction 2	Simulates a traversing in direction 2
Adjust	Performs an adjustment of the connected wheel sensor Only available if DIP10 is set to “OFF”

Table 8.1: WSC-specific buttons

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

	If any other diagnostic system than the ASD is connected to the diagnostic interface “Serial Interface”, galvanic separation must be ensured. For further information (e.g. interface description), contact Frauscher.

9 If it is not possible to mount the wheel sensor with a rail claw, then the wheel sensor can be mounted on the rail web. In this case, D5525 “Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting on rail web)” applies.

8.2.1 Data request at the WSC

Three different tabs are displayed in the upper area of the program interface:

- “INFO” tab
- “STATUS” tab
- “STATISTICS” tab

8.2.1.1 “INFO” tab

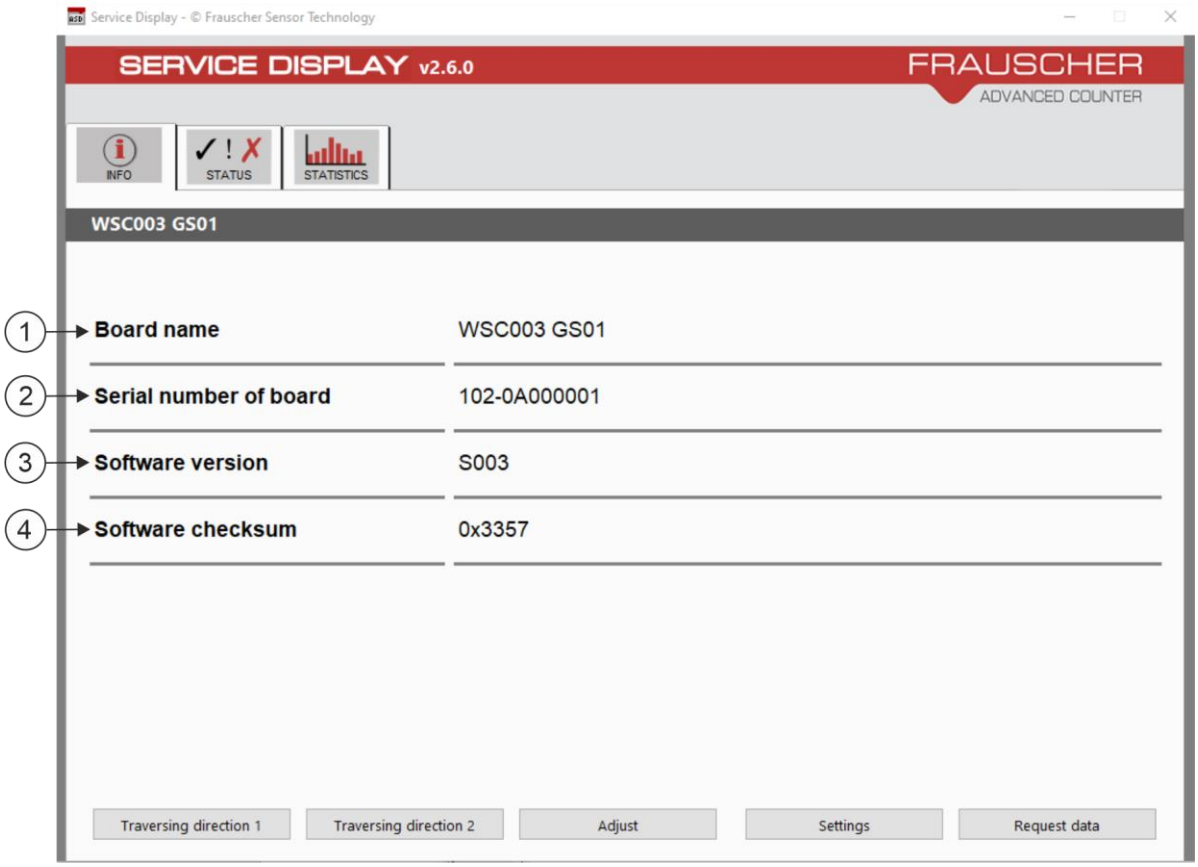


Figure 8.1: “INFO” tab

(1)	Board name, type and equipment version of this WSC
(2)	Serial number of this WSC
(3)	Software version of this WSC
(4)	Checksum of the software version of this WSC

8.2.1.2 “STATUS” tab

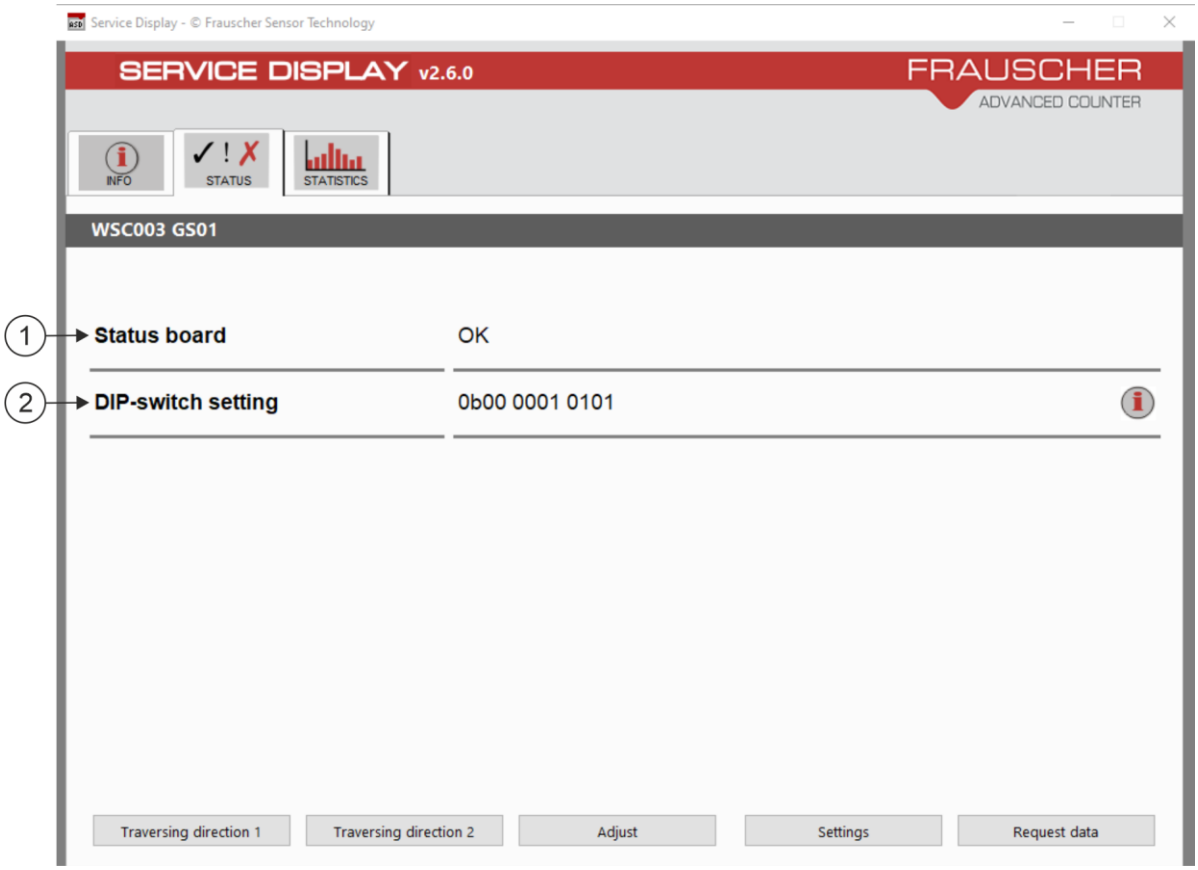


Figure 8.2: “STATUS” tab

1	Status information of this WSC: ▪ “OK” ▪ “Internal error” ▪ “Overcurrent Sys1” ▪ “Overcurrent Sys2” ▪ “Wire break Sys1” ▪ “Wire break Sys2” ▪ “Wrong position DIP-no. 10”
2	Position of the DIP-switches of this WSC[10] (see following table)

10 For reasons of better readability, the 10-digit number is displayed in groups of 4 binary digits.

Bits	DIP-no.	Function
0 1 2	1 2 3	▪ System outputs ▪ Direction outputs ▪ Center pulse output ▪ Gate pulse output ▪ Error output
3	4	Normal status of optocoupler outputs
4 5	5 6	System output extension time
6 7 8	7 8 9	Direction pulse duration and center pulse duration
9	10	▪ Adjustment via WSC (only with RSR110) ▪ Switching between RSR110 and NAMUR sensors

Table 8.1: Function of the DIP-switches

The DIP-switch position “ON” (left) corresponds to the binary value of ‘1’.
The DIP-switch position “OFF” (right) corresponds to the binary value of ‘0’.

DIP-Info

By clicking the „i“-icon the DIP-Info window opens.
This window shows the assignments of the DIP-switches.

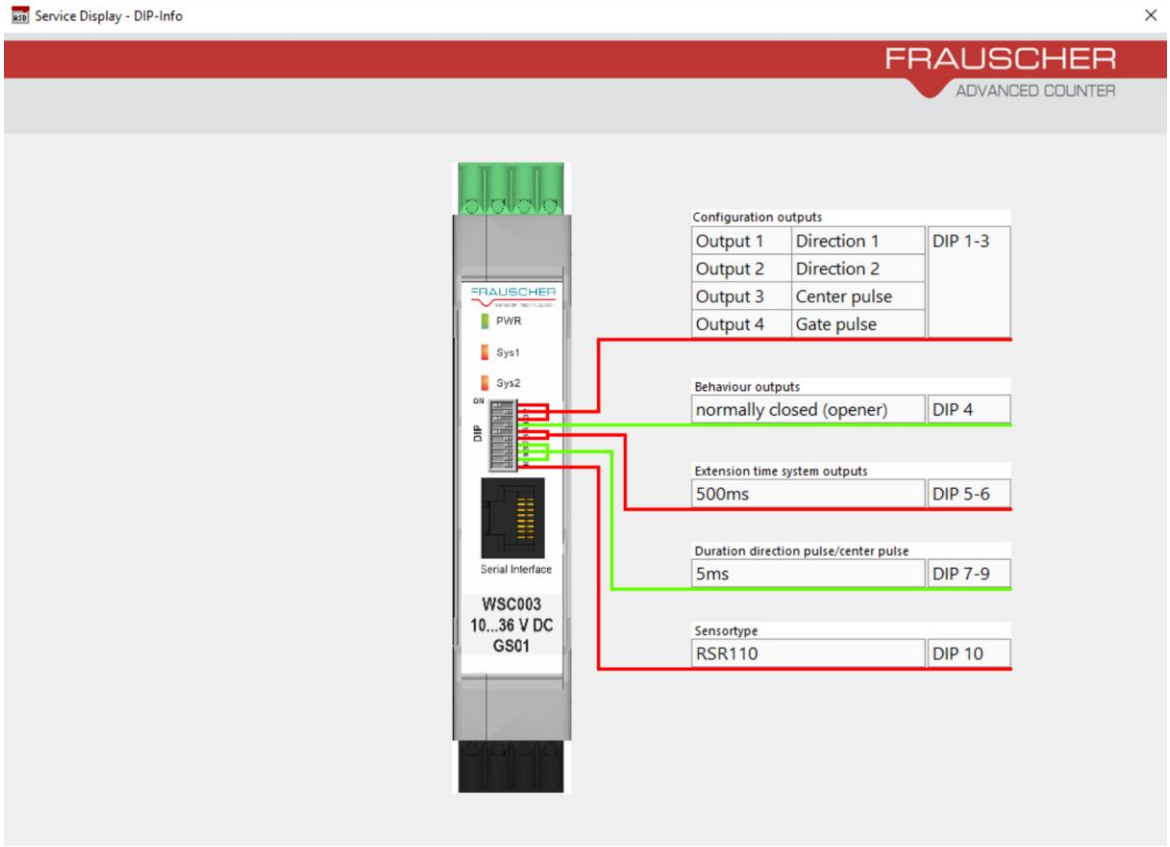


Figure 8.3: DIP-Info

8.2.1.3 “STATISTICS” tab

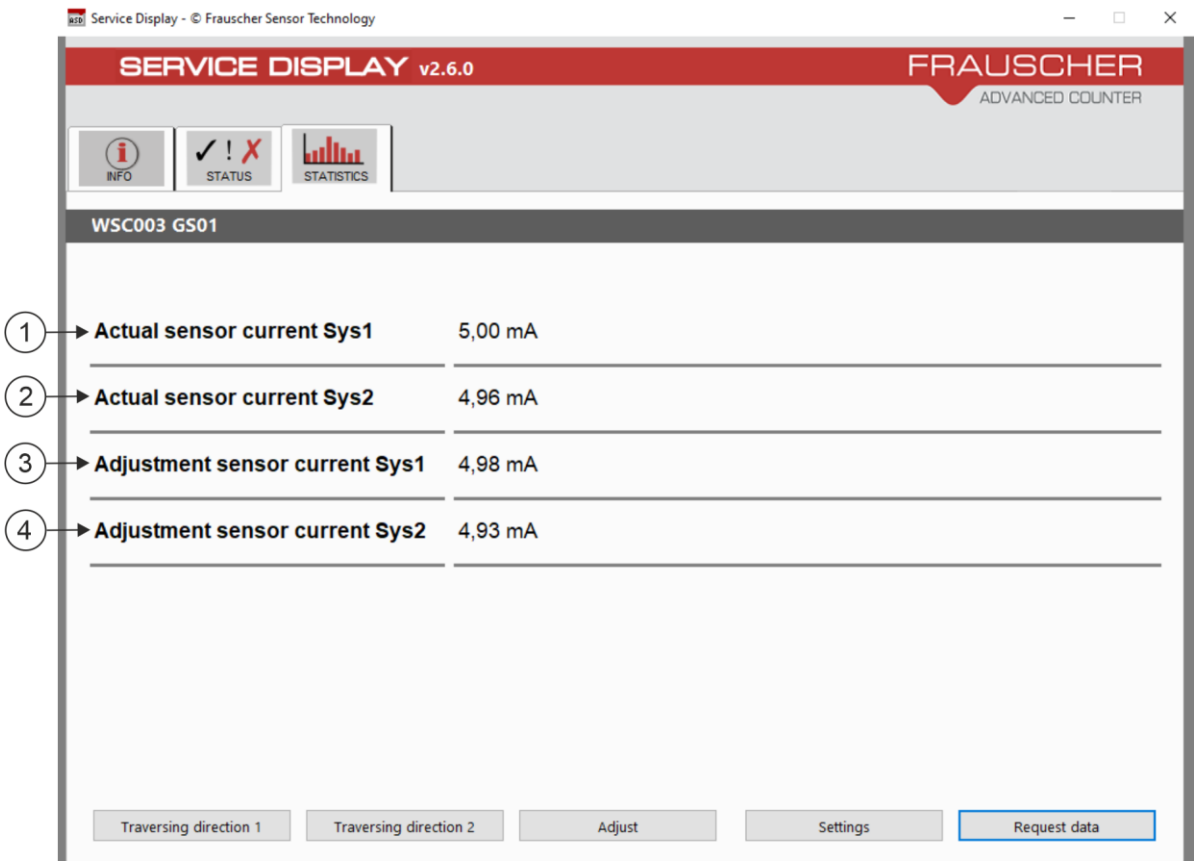


Figure 8.4: “STATISTICS” tab

(1) Measured sensor current at the time of data request, system 1	
(2) Measured sensor current at the time of data request, system 2	
(3) Adjustment sensor current, system 1 (stored reference value of the initial adjustment carried out during production; cannot be influenced by the user)	For the WSC GS01, the displayed value deviates from the actual value. Required value: ▪ RSR110: 5 mA (±3 %) ▪ NAMUR sensor: 2.95 mA
(4) Adjustment sensor current, system 2 (stored reference value of the initial adjustment carried out during production; cannot be influenced by the user)	

9 Maintenance

The WSC is maintenance-free. The MTBF value for the WSC is 60 years.

In order to maintain the availability and reliability of the wheel sensors RSR110, it is recommended to carry out the checks described in D4231 “Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting with rail claw)”[11] at least every 24 months.

During maintenance, only the actions described in D4231 “Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting with rail claw)” may be carried out. If there are still other actions that must be carried out (e.g. replacement of the WSC because of a defect or faults and errors with unclear causes), the respective repair measures must be carried out immediately (see chapter “Repair”).

If NAMUR sensors are used, the manufacturer’s documentation must be observed and complied with.

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

9.1 Required measuring equipment and tools

To carry out maintenance, the following measuring equipment and tools are required:

- Measuring tape
- Testing plate PB200
- Advanced Service Display ASD (software incl. Service Display Cable)
- Windows computer

9.2 Visual inspection and mechanical check of the wheel sensor

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

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

The visual inspection and the mechanical check of the wheel sensor RSR110 are described in D4231 “Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting with rail claw)” and must be carried out accordingly.

11 If it is not possible to mount the wheel sensor with a rail claw, then the wheel sensor can be mounted on the rail web. In this case, D5525 “Mounting, commissioning and maintenance Wheel sensor RSR110 (Mounting on rail web)” applies.

	The following inspections must be carried out at least every 2 years and must be adapted to the track conditions: ▪ Check for heavy soiling and remove any loose dirt when dry ▪ Check for mechanical damages ▪ Check that the fixing elements of the wheel sensor are secure ▪ Check the protection tube for mechanical damage ▪ Check that the terminals of the wheel sensor cable are secure ▪ Check whether measurement A is still within the permitted range

9.3 Check of the sensor currents of the wheel sensor

The sensor current of each sensor system can be read out via the diagnostic interface “Serial Interface” on the front panel of the WSC using the ASD.
Reading out the sensor current using the ASD is described in chapter “Diagnostic interface ‘Serial Interface’” and must be carried out accordingly.

The **normal operating sensor current** of an RSR110 must be between **4.75 and 5.25 mA**.
The **normal operating sensor current** of a NAMUR sensor must be **2.95 mA**.

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

9.4 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

- If a wheel sensor **with 2 sensor systems** is used, sensor system 1 and sensor system 2 must be traversed error-free by a rail vehicle.
- If a wheel sensor **with 1 sensor system** is used, sensor system 1 must be traversed error-free by a rail vehicle.

In both cases, the traversing must cause the associated outputs of the WSC to switch correctly.

Check with the testing plate PB200

- If a wheel sensor **with 2 sensor systems** is used, at least 1 traversing over sensor system 1 and sensor system 2 must be carried out correctly using the testing plate PB200.
- If a wheel sensor **with 1 sensor system** is used, at least 1 traversing over sensor system 1 must be carried out correctly using the testing plate PB200.

In both cases, the traversing with the testing plate (see D2860 “Brief instruction testing plate PB200 GS03”) must cause the associated outputs of the WSC to switch correctly.

10 Repair

	Defective components must not be repaired by unauthorized persons but can either be returned to Frauscher for repair or can be replaced by Frauscher components of the same type.

After repair or replacement of the WSC, the setting of the DIP-switches must be checked for compliance with the actual configuration.

10.1 Troubleshooting on the WSC

Troubleshooting on the WSC can be carried out as follows:

- With the LED indications on the front panel of the WSC
- By means of the Advanced Service Display ASD via the diagnostic interface “Serial Interface” on the front panel of the WSC

10.1.1 LED indications on the WSC

LED “PWR”

If the LED “PWR” is off, then this indicates an error status:

Figure 10.1: LED “PWR” off

Meaning	Possible measure(s)
No power supply	Apply power supply
Wrong polarity	Reverse polarity
Fuse broken	Replace WSC

Table 10.1: LED “PWR” off

If the LED “PWR” is illuminated, then this indicates an operating status:

Figure 10.2: LED “PWR” illuminated

Meaning	Possible measure(s)
Power supply applies	-

Table 10.2: LED “PWR” illuminated

LED “Sys1” and “Sys2”

If the LED “Sys1” and/or “Sys2” is off, then this indicates an operating status:

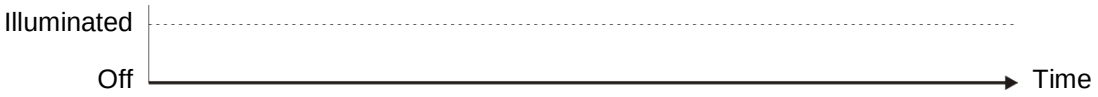


Figure 10.3: LED “Sys1” and/or “Sys2” off

Meaning	Possible measure(s)
Wheel sensor not damped	-
No error at the wheel sensor	-
No power supply	Apply power supply

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

If the LED “Sys1” and/or “Sys2” is illuminated, then 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 10.4: LED “Sys1” and/or “Sys2” illuminated

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

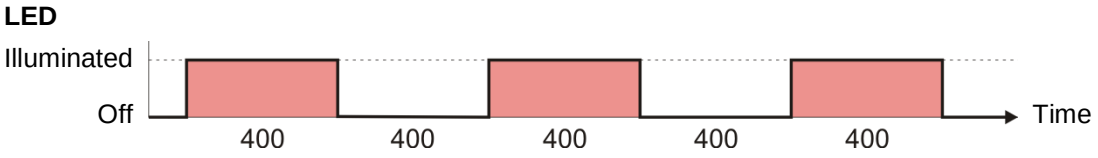


Figure 10.5: LED “Sys1” and/or “Sys2” flashes slowly, time in ms

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 ▪ Defective wheel sensor	 Check cable connection between outdoor equipment and indoor equipment Replace wheel sensor
Overcurrent, e.g. due to: ▪ Wire short-circuit in the wheel sensor cable ▪ Wheel sensor adjusted incorrectly ▪ Defective wheel sensor	 Rectify short-circuit Adjust wheel sensor correctly Replace wheel sensor

Table 10.5: LED “Sys1” and/or “Sys2” flashes slowly

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

If a configuration with 1 system output is used, then the LED “Sys2” is not used and therefore is always out.

10.1.2 Measurements on the WSC with connected wheel sensor

The sensor currents of a wheel sensor can be read out with the ASD. Further information regarding data request at the WSC can be found in chapter “Data request with Advanced Service Display ASD”.

Value RSR110	Value NAMUR	Meaning	Possible measure(s)
< 0.2 mA	< 0.2 mA	Wire break in the wheel sensor cable	Check cabling and connections
		Interrupted cable connection between outdoor equipment and indoor equipment	Check cable connection between outdoor equipment and indoor equipment
		Wheel sensor has dropped off the rail	Check mounting of wheel sensor and correct it if necessary, carry out adjustment again
		Defective wheel sensor	Replace wheel sensor
		No wheel sensor connected	Connect wheel sensor
≥ 0.2 mA < 4.75 mA	≥ 0.2 mA < 1.65 mA	Wheel sensor not adjusted	Adjust wheel sensor
		Wheel sensor damped (traversed)	-
≥ 4.75 mA ≤ 5.25 mA	2.95 mA	Normal operating sensor current[12]	-
> 5.25 mA < 6 mA	> 2.95 mA < 4.13 mA	Wheel sensor not adjusted	Adjust wheel sensor
≥ 6 mA	≥ 7 mA	Overcurrent, e.g. due to:	
		▪ Wire short-circuit in the wheel sensor cable	Rectify short-circuit
		▪ Wheel sensor adjusted incorrectly	Adjust wheel sensor correctly
		▪ Wheel sensor connected incorrectly	Connect wheel sensor correctly
		▪ Defective wheel sensor	Replace wheel sensor
		▪ Wheel sensor has dropped off the rail	Check mounting of wheel sensor and correct it if necessary, carry out adjustment again

Table 10.6: Measurements on the WSC with connected wheel sensor

12 Nominal value for RSR110: 5 mA

11 Removal from service

Defective components that are not returned to Frauscher according to chapter “Repair” must be disposed of in accordance with country-specific regulations. The disposal of components and parts of components is the responsibility of the respective railway authority.