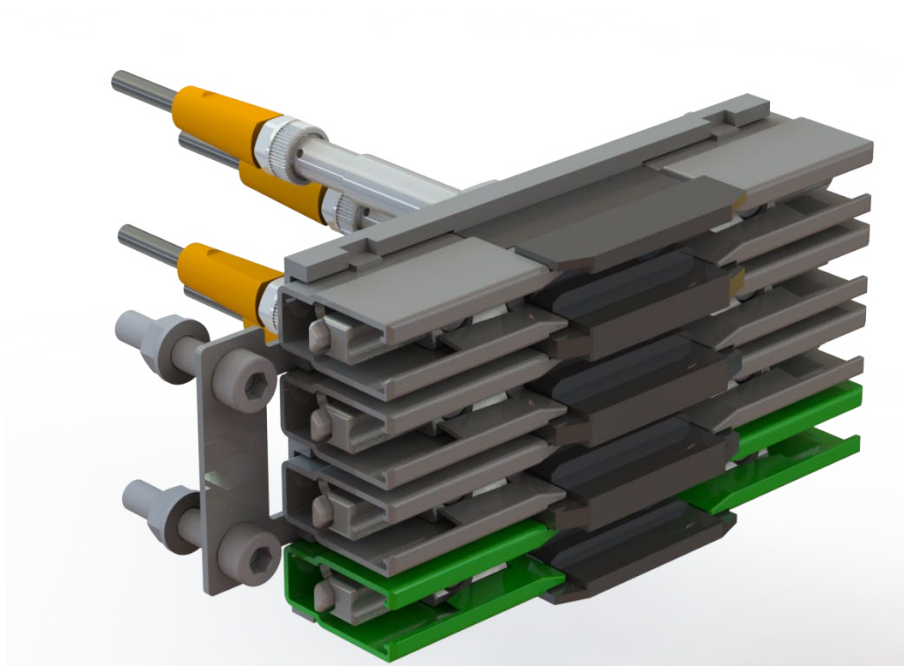


Collector Brush Sensor Unit
Program 0815

08-P102-0xxx



Contents

1	General notes	4
1.1	Information about these installation and operating instructions.....	4
1.2	Limitation of liability	4
1.3	Copyright	5
1.4	Spare parts	5
1.5	Material defects	5
1.6	Technical Support.....	5
2	Safety instructions.....	6
2.1	Explication of symbols	6
2.2	Requirements to the personnel	7
2.2.1	Qualification	7
2.2.2	Unauthorized personnel	7
2.2.3	Instruction	8
2.3	Personal protective equipment.....	8
2.4	Intended use.....	9
2.5	Protective measures to be taken by the / user	10
2.6	5 safety rules for work on electrical installations	10
2.7	Specific hazards	11
2.7.1	Electrical hazards and sources of danger	11
2.7.2	Mechanical hazards and sources of danger.....	12
2.7.3	Hazard due to dust and vapors	12
2.8	Actions in the event of accidents and faults	13
3	Technical specifications	13
3.1	General information	13
3.2	Interfaces.....	13
3.3	Operating conditions.....	14
4	Product description and function.....	14
4.1	Short description.....	14
4.2	Construction and operating mode of inductive sensors.....	15
4.3	Function of the collector brush sensor unit.....	15
4.4	The output signal	16

Collector Brush Sensor Unit

Program 0815

4.5	Prerequisite for reliable application	16
4.6	Possibilities of an impulse extension	18
4.7	Evaluation logic	18
5	Transport, packaging and storage	18
5.1	Transport	18
5.1.1	Transport inspection	18
5.2	Packaging	19
5.3	Storage of the packages	19
6	Mounting and commissioning	20
6.1	Safety	20
6.2	Preparations	22
6.3	Installation	23
6.3.1	Installation of the collector brush sensor unit	24
6.3.2	Electrical connection	27
6.4	Testing and initial commissioning	27
6.4.1	Test list for initial commissioning	28
6.4.2	Perform initial commissioning	28
7	Operation	29
7.1	Safety	29
8	Maintenance and Servicing	29
8.1	Safety	29
8.2	Maintenance schedule	30
9	Fault diagnosis	31
10	Disassembly and disposal	33
10.1	Safety	33
10.2	Disassembly	34
10.2.1	Dismounting of the assembly	34
10.3	Disposal	34
11	Additional Documents	35
11.1	Other applicable documents	35
12	Index	36
13	Appendix Program example (contact plan)	37

1 General notes

1.1 Information about these installation and operating instructions

These mounting and operating instructions allow the safe and efficient handling of the product.

These mounting and operating instructions are a component of the product and must be kept in the immediate vicinity of the product and accessible to the personnel at all times. Prior to starting any work, the personnel must have carefully read through and understood these mounting and operating instructions. It is a basic requirement for safe working that all safety and handling instructions listed in these mounting and operating instructions are complied with.

Add these mounting and operating instructions to your system documentation and maintenance documents.

Local accident protection regulations and general safety guidelines for the application field of the device also apply. Illustrations in this documentation are for basic comprehension and may deviate from the existing product.

1.2 Limitation of liability

All information and advice in these mounting and operating instructions have been compiled with due regard to the standards and regulations in force, best engineering practice, and the findings and experiences we have accumulated over many years.

The manufacturer is in no way liable for damage resulting from:

- Nonobservance of these mounting and operating instructions
- Improper use
- Use by untrained personnel
- Unauthorized reconstructions
- Technical changes
- Use of unauthorized replacement parts and accessories

The actual scope of delivery may differ from the explanations and illustrations described here for special variants, if additional order options are utilized, or due to the latest technical changes.

The obligations agreed upon in the delivery agreement and our General Terms of Business apply, as do the delivery conditions of the manufacturer and all regulations applicable at the time the contract was concluded.

All products are subject to technical modifications in the context of improvement of usage properties and further development.

Collector Brush Sensor Unit

Program 0815

1.3 Copyright

These mounting and operating instructions are subject to copyright and exclusively intended for internal use.

Provision of the document to third parties, duplications in any form – even in part – as well as the reuse and/or disclosure of their content are not permitted without the written approval of the manufacturer, except for internal use by the customer.

Violations will be subject to damages. This will not exclude additional claims.

1.4 Spare parts



WARNING!

Safety risk due to wrong spare parts!

Wrong or faulty spare parts can impair safety and result in damage, malfunction or complete failure.

→ Use only original spare parts of the manufacturer!

Order replacement parts from your contracted dealer or directly from the manufacturer.

Contact information for spare part orders: See last page of these operating instructions.

1.5 Material defects

The regulations about material defects are listed in the general terms and conditions of business.

1.6 Technical Support

Our customer service is available for technical questions.

Contact data: See last page of these operating instructions.

For technical support please contact our staff from the Customer Support Department.

2 Safety instructions

2.1 Explication of symbols

Safety and hazard information is identified in these mounting and operating instructions by symbols. Signal words are used to indicate the degree of hazard. Always observe safety instructions and work carefully to avoid accidents, personnel injury or property damage!



DANGER!

... indicates an immediately hazardous situation, which if not avoided, may result in death or serious injury.



DANGER!

... indicates an immediately hazardous situation due to electricity, which if not avoided, may result in death or serious injury.



WARNING!

... indicates a possibly hazardous situation, which if not avoided, may result in death or serious injury.



WARNING!

... indicates a possibly hazardous situation due to electricity, which if not avoided, may result in death or serious injury.



CAUTION!

... indicates a possibly dangerous situation, which, if not avoided, may result in moderate or minor injury or property damage.



Advice and recommendations:

... refers to useful advice and recommendations as well as information for an efficient and trouble-free operation.

Collector Brush Sensor Unit

Program 0815

2.2 Requirements to the personnel

2.2.1 Qualification



WARNING!

Risk of injury due to insufficient qualification!

Improper use can result in serious personal injury or property damage.

→ All operations have to be carried out only by personnel who are qualified for the specific work!

The following qualifications have been mentioned in these operating instructions for different fields of operation:

- **Trained personnel/operators**

have been instructed by the operator about the tasks assigned to him/her and the possible hazards resulting from improper behavior.

- **Qualified specialists**

due to their specialized training, knowledge, and experience, as well as knowledge of applicable regulations, are capable of carrying out works assigned to them, while independently recognizing and avoiding possible risks.

Personnel are considered as qualified, if they have successfully concluded training, for example, as master electricians, assistant electricians, electrical engineers, or electrical technicians. Personnel are also as considered qualified who have been employed correspondingly for several years, have been educated in theory and practice during that time, and whose electrical knowledge and skills have been tested by qualified specialists.

The operator of the electrical facility must document that the corresponding certification or other documentation of qualification are present or have been demonstrated.

- Only those persons are authorized as personnel who can be expected to perform their work reliably. People whose capacity for reaction is influenced e.g. by drugs, alcohol, or medications are not authorized.
- When selecting personnel, follow all age- and job-related guidelines applicable at the place of operation.

2.2.2 Unauthorized personnel



WARNING!

Danger due to unauthorized personnel!

Unauthorized personnel who do not meet the requirements described here do not understand the danger in the working area.

- Keep unauthorized personnel away from the working area
- In case of doubt, address the persons and direct them away from the working area
- Stop work as long as unauthorized personnel are in the working area

Collector Brush Sensor Unit

Program 0815

2.2.3 Instruction

Before commissioning, the personnel must be instructed by the operator. Record the instruction according to the following pattern in order to make the instruction traceable:

Date	Name	Type of instruction	Instruction given by	Signature
05.11.2009	Heinz Mustermann	First safety instruction for the personnel	Horst Müller	

2.3 Personal protective equipment

Always wear

For all work, always wear



Work safety clothing

Serves primarily as protection against being seized by moving machine parts. Work safety clothing must fit tightly with low resistance to tearing, close-fitting sleeves and no protruding parts.



Protective footwear

Used to protect from falling heavy parts and slipping on slippery floors.

For special tasks, wear

When carrying out particular tasks, special safety gear is required. The individual sections specify this gear in detail.



Protective gloves

To protect hands from friction, scrapes, stabbing, or deep wounds, as well as from contact with hot surfaces.



Protective helmet

For protection against falling and flying parts and materials.



Safety goggles

For eye protection against harmful effects from strong light, chemicals, dust, splinters or weather.



respirator mask(FFP-3 – according to county-specific guidelines)

for protection against substances, particles or organisms Here: protection against dust arising from abrasion of collector brush and the PVC-insulation of the conductor rail.

Collector Brush Sensor Unit

Program 0815

2.4 Intended use

The equipment is exclusively designed and built for the intended use described here.

Intended use

- Carbon brush sensor units are used in electrical monorail systems (EMS-systems) for monitoring the collector brushes. For this purpose a collector brush sensor unit is installed into the conductor rail that is mounted in the track profile of the EMS.
- With the help of the sensor in the collector brush sensor unit and the respective program adaptations to be carried out by the operator, the control of the EMS-system can be enabled to recognize missing or excessively worn out collector brushes and give an appropriate error message.
- Software or supplements to the program code of the EMS-system control are not included in the scope of delivery!



WARNING!

Danger due to improper use!

Any application that deviates from and/or goes beyond the intended use of the devices can result in a hazardous situation.

- Strictly comply with all specifications in these mounting and operating instructions
- Refrain from use that is not intended!
- Pay attention to advice regarding non-intended use

Non-intended use in particular includes the following:

- Using the device with unapproved accessories not authorized by the manufacturer.
- Operation of the device by uninstructed personnel
- Operation of the device outdoors
- Operation of the device when installed on an improper foundation

Claims of any kind due to damage from non-intended use are excluded.

The operator is liable for all damage resulting from non-intended use.

For the installation it is imperative to follow these technical conditions

- Installation position in the rail according to the drawing in the project documentation
- Installation height on same level as the conductor rail
- Suitable place of installation at reduced speed

Electrotechnical operating conditions

- The electrical installation must be properly protected according to the regulations in force on site

Collector Brush Sensor Unit

Program 0815

2.5 Protective measures to be taken by the / user

The equipment is used in an industrial setting (electrical monorail systems). The operator of the device is thus subject to legal obligations for operational safety. In addition to the safety guidelines in these mounting and operating instructions, the safety, accident protection, and environmental protection regulations applicable at the place of operation of the device must be followed. This particularly includes:

- Work on electrical components of the system may **only be carried out when disconnected from the power**.
- The operator must be informed of applicable workplace safety guidelines and identify any additional hazards that result from the special working conditions at the site of operation of the device. These must be implemented in the form of operating instructions for the use of the device.
- The operator must verify during the entire operating time of the device, if the operating instructions provided still correspond to the current state of regulations, and adapt these instructions if necessary.
- The operator must clearly regulate and determine responsibilities for installation, operation, troubleshooting, and maintenance.
- The operator must ensure that all employees involved with the unit have read and understood these mounting and operating instructions. He must furthermore train personnel at regular intervals and inform them of hazards.
- The operator must provide the personnel with all required safety gear.

The operator is furthermore responsible for ensuring that the device is always in a technically trouble-free condition. The following thus applies:

- The operator must ensure that the maintenance schedule described in these mounting and operating instructions is followed.
- The operator must have all safety systems regularly inspected for proper functioning and completeness.
- If the device or system has been modified, the safety systems must be inspected again and adapted to the changed conditions in such a way that the device or system is safe again.

2.6 5 safety rules for work on electrical installations

- Carry out work on electrical installations only when disconnected from power. Follow these **5 safety rules** (see DIN VDE 0150-100:2009-10 / EN 50110-1:2004-11) before starting work:
 1. Disconnect system from power using the main switch
 2. Secure the main switch against reactivation
 3. Confirm absence of power by measuring
 4. Ground and short-circuit parts of the installation that need to be worked on
 5. Cover or block off neighboring parts still carrying voltage
- Only persons skilled for electrical work or persons instructed for electrotechnical work are allowed to disconnect from power or to approve power reactivation after work has been done on an installation disconnected from power.



Collector Brush Sensor Unit

Program 0815

2.7 Specific hazards

The following section lists residual risks determined on the basis of a risk assessment.

- Follow the safety instructions listed here and the warnings in other sections of these mounting and operating instructions in order to reduce health hazards and avoid dangerous situations.

2.7.1 Electrical hazards and sources of danger

Danger of life due to electric shock!

Touching electrically live parts may result in death or serious injury due to electric shock. Furthermore, there's a risk of injury due to shock reactions, falling or being cast-off triggered by electric shock.

Risk of injury due to falling or being cast-off after electric shock

- Parts carrying electrical current: Conductor rail, feed, current collector, devices and connections at the collector brush sensor unit and within control cabinets, etc.

Before working on the parts listed above:

- **Disconnect the conductor rail system from power** following the 5 safety rules **and secure against reactivation**. 5 safety rules see Chapter 2.6



While working:

- Use insulated tools
- Observe stipulations for work on live components and systems

Before switching on power:

- Prior to each start of the device or system, test the insulation resistance according to locally applicable technical standards, directives, and laws
- Carry out mandatory electrical tests specified in the country where the device is installed

Sustain electrical safety:

- Inspect and maintain electrical equipment regularly
- If you observe hazardous defects, immediately take measures to remedy the defects
- Always replace blown fuses by fuses of equivalent rating

Collector Brush Sensor Unit

Program 0815

2.7.2 Mechanical hazards and sources of danger

Risk of injury due to crushing

There's crush hazard for skin and limbs due to:

- Moving parts, e.g. mobile units within the monorail system
- Current collector (spring force) at assembly, disassembly and servicing



Risk of injury due to impact

- Keep a distance to moving or rolling units, block the working area, if necessary
- Installation must be carried out by instructed, skilled personnel only
- While working on the conductor rail system, use protective footwear, protective gloves and a protective helmet
- Place the ladder in such a way that it will not be hit by mobile units (risk of falling)



2.7.3 Hazard due to dust and vapors

Risk of sensitization, mucous membrane irritation and respiratory disease due to dust!

Abrasion of collector brushes is accumulated in the conductor rails and the track profile. This dust is very fine and is categorized as a health risk. Frequent exposition can lead to sensitization. Persons that frequently stay within a highly frequented system for a longer time without protective equipment must expect the following **consequences**:

- Mucous membrane irritation
- Respiratory diseases
- Cancer



Handling dust accumulations carelessly (e.g. blowing out dust by means of compressed air) may also lead to these consequences.

- Wear protective equipment during all works at the conductor rail system where dust is whirled up. In particular, wear protective equipment during cleaning works
 - Safety goggles
 - Dust mask class FFP3
 - Protective gloves
 - Disposable overall
- Before starting work, clean the conductor rail as prescribed. There are special instructions for this, see Chapter 11.1
- Protect the environment during cleaning work, e.g. by covering or removing stock goods and blocking of areas, where dust might fall down on persons
- Do **not blow off** dust **with compressed air**, suck it off with a vacuum cleaner instead. The vacuum cleaner should be equipped with a fine filter class H
- Do not eat, drink or smoke during these works!



Collector Brush Sensor Unit

Program 0815

2.8 Actions in the event of accidents and faults

Measures in case of accidents:

- Take first aid measures
- Rescue personnel by taking them out of the danger zone
- Inform the responsible person at the place of operation
- Alarm the rescue service
- Make access ready for rescue vehicles

3 Technical specifications

3.1 General information

Order number of the collector brush sensor unit	Poles	Dimensions H x B x T [mm]	Weight (kg)
08-P102-0110	4	132 x 58 x 29	0,190
08-P102-0111	6	132 x 86 x 29	0,280
08-P102-0112	8	132 x 114 x 29	0,370

3.2 Interfaces

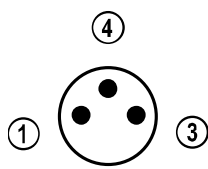
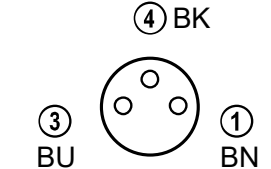
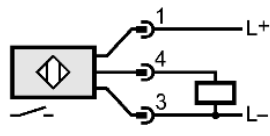
Electrical: data of the inductive sensors

Manufacturer, type	IFM, IE5391		
Electrical			
	Variant		
	Operating voltage sensors U _B	[V]	10 ... 30, DC
	Current consumption	[mA]	< 20
Outputs			
	Output function	Normally open	
	Voltage drop	[V]	< 2,5
	Current rating	[mA]	200
	Switching frequency	[Hz]	1000
Range			
	Sensing range	[mm]	4
	Real sensing range	[mm]	4 ±10%
Environment			
	Temperature range	[°C]	-25 ...+70
	Protection class	IP67	
Connector			
	Wiring	3-wire system	

Collector Brush Sensor Unit

Program 0815

Cables and plugs

Code	Core color	Function, standard at 3-wire system	Plug / cable socket	Pin assignment plug and socket connection	
				Plug	Cable socket
BN	Brown	L+	Pin 1		
BU	Blue	L-	Pin 3		
BK	Black	Output	Pin 4		
					

3.3 Operating conditions

Environment:

Designation	Value	Notes
Temperature range	0 to 40 °C	
Relative humidity, maximum	65%	Application only indoors

4 Product description and function

4.1 Short description

For the energy supply of EMS-systems Conductix-Wampfler has developed the conductor rail system 0815. An option for this system is a collector brush sensor unit, which can monitor the condition of the collector brushes closely. The collector brush sensor unit is integrated into the conductor rail and allows to test the condition of the collector brushes separately for each conductor rail pole.

On each passage of the current collectors the collector brush sensor unit gives signals to the control of the EMS-system.

If the control of the EMS-system is equipped accordingly, it can generate the following messages from the signals of the sensor unit:

- Carbon brush exists
- Carbon brush ok
- Wear limit exceeded
- Carbon brush / current collector not recognized or missing

Collector Brush Sensor Unit

Program 0815

4.2 Construction and operating mode of inductive sensors

Inductive sensors (proximity switches) contain a coil and a capacitor that form an LC oscillating circuit. A magnetic alternating field can be created with the oscillating circuit with little energy input. If you bring a conductive object into the magnetic alternating field, an eddy current will be generated within this conductive object. The eddy current will withdraw energy from the LC oscillating circuit and the oscillation will be more or less damped (damping). Both states of the oscillating circuit "oscillates" or "does not oscillate" will be used by an additional circuit, in order to generate a binary output signal (current flows = 1 = high / current does not flow = 0 = low).

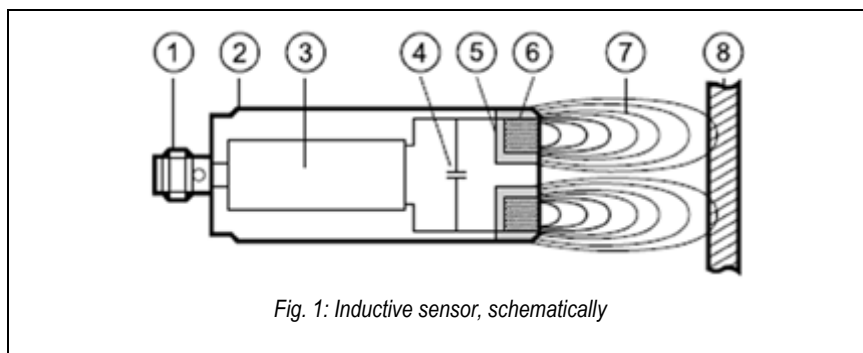


Fig. 1: Inductive sensor, schematically

1) Connection ring	(5) Pot core
(2) Housing	(6) Coil
(3) Subsequent electronics	(7) Electromagnetic alternating field
(4) Capacitor	(8) Switching plate (target) = electrically conductive material

4.3 Function of the collector brush sensor unit

The current collectors are checked by means for inductive proximity switches (sensors). One sensor is integrated in the collector brush sensor unit per conductor rail pole, which recognizes the collector brush, when it passes a sensing range. At the switching output the sensor will provide the signal as a voltage level, so that it can be processed by the control (PLC) of the EMS-system. So each pole will be surveyed.

The inductive sensors are supplied with an operating voltage U_B of 10 to 24 V DC. This voltage is applied at the switching output (collector brush ok = 1 = high = U_B), when a functional collector brush passes the sensing range of the sensor. Without damping (see Chapter 4.2) the switching output remains on 0 V.

The operating voltage U_B for the inductive sensors must be provided by the electric installation on site.

Collector Brush Sensor Unit

Program 0815

Operational case	Switching output	Comment
No current collector in the sensing range	Low / 0	
Carbon brush in the sensing range, Status: ok	High / 1	Current collector existing and ok
Carbon brush in the sensing range, Status: worn out	Low / 0	Current collector existing, however not functional (collector brush worn out)
Carbon brush missing	Low / 0	Current collector broken

Note: "Sensing range" in the existing table means "Sensing range of the sensor unit" (= distance, over which the status of the collector brush is checked), not "Sensing range of the sensor", see table in Chapter 3.2.

For the time, when the collector brush passes the sensor, the switching output of the inductive sensor will be set on "1". On double current collectors this will generate 2 impulses, the status of the double current collector can thus be checked.

Via the evaluation that a double impulse is pending, the evaluation for the status of the double current collector can be carried out.

For the test of the PE-follower the evaluation can be analogous. In faultless condition there are 2 double impulses available for the evaluation, separated by a defined intermission.

The intermission between the 2 collector brushes of the PE current collector and the first collector brush of the follower depends on the distance between the two current collectors and their speed over the collector brush sensor unit.

4.4 The output signal

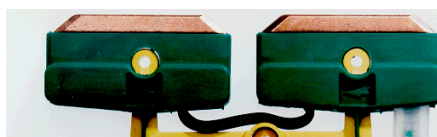
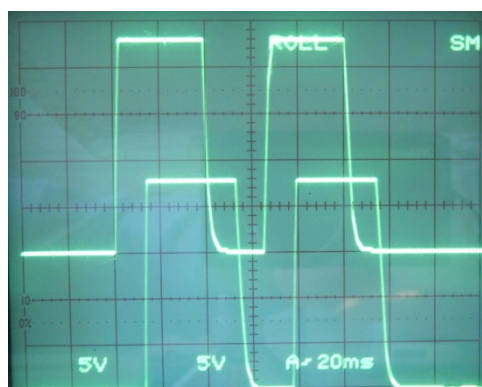


Fig. 2: Output signal of the sensor for pole 1 and pole 2 (double impulse = double current collector)

Note: The time offset between pole 1 and pole 2 results from the offset arrangement of the sensors.

4.5 Prerequisite for reliable application

To be able to generate reproducible evaluation results, the collector brushes must drive through the sensor unit with a uniform, not too high speed.

Collector Brush Sensor Unit Program 0815

We therefore recommend integrating the collector brush sensor unit in a track section, where the mobile units are driving through the sensor unit with low and uniform speed.

The speed is limited, since the control (PLC) of the EMS system queries the status of the sensors time-discrete (= individual points in time, not continuously) and in cycles. The maximum speed depends from the time interval between the status queries, the cycle time. If the collector brushes drive through the sensor unit with a too high speed, it cannot be guaranteed, that the collector brushes are correctly recognized.

We recommend that the persons who plan the EMS-system, coordinate themselves in due time with those whole are programming the control. Together they can establish the speed of the mobile units and a useful cycle time of the control.


Example:

With a recommended speed of 20 m/min at the measurement point (sensor unit) and with a distance of 10 mm between the two carbons of a double current collector and a minimum scanning rate of 2, this produces a value of 5 mm, which must be securely recognized.

$$20 \text{ m/min} = 333 \text{ mm/s} \quad \Rightarrow \quad 0,003 \text{ s/mm} \quad \Rightarrow \quad \text{cycle time } T_z = 0,015 \text{ s}$$

With a minimum scanning rate of $n = 2$ scans for the distance between the collector brushes of 10 mm this results in a maximum cycle time of 0,06 s for the PLC of the EMS-system.

Generally applies: The higher the speed at the measurement point, the shorter must be the cycle time of the PLC.

Speed at the measurement point	Track to be recognized with $n = 2$	Maximum cycle time of the control
40 m/min = 666 mm/s	$10 \text{ mm} \div 2 = 5 \text{ mm}$ 	0,0075 s
20 m/min = 333 mm/s		0,015 s
10 m/min = 166 mm/s		0,030 s
5 m/min = 83 mm/s		0,060 s
2 m/min = 42 mm/s		0,120 s

Practical value

As a practical value you will get a speed at the measurement point of 5 (m/min or lower, so that the collector brushes are reliably recognized and standard PLC assembly groups can be installed. Cycle times of less than 0,06 s (60 ms) are not possible with many PLC-systems, since longer cycle times will be the result, if an PLC is optimally utilized.

Collector Brush Sensor Unit

Program 0815

4.6 Possibilities of an impulse extension

If it is not possible to reduce the speed at a given cycle time, the impulse duration can instead be artificially extended by means of external assembly groups. If required please consult Conductix-Wampller.

In practice you can abstain from this, if the test track is generated in an area, where the mobile units are driving process-related at a low speed. Suitable areas are e.g. in front of lifters or at the entrance or exit of a buffer track.

4.7 Evaluation logic

The logic evaluation of the signals generated by the sensor unit is the task of the software of the system control. Besides the information about the status of the collector brush sensor unit, further information will be incorporated into the algorithm depending on the system concept, such as

- Vehicle- or mobile-unit-ID,
- current speed,
- position.

An example of a program for a possible evaluation is documented in the enclosure.

5 Transport, packaging and storage

5.1 Transport

5.1.1 Transport inspection

Check the shipment for completeness and transport damage immediately upon receipt.

If transport damage is externally visible, proceed as follows:

- Do not accept the shipment, or accept it only with reservations.
- Note the scope of damage on the transport documents or on the transporter's delivery note.
- Initiate a complaint.



Claim every defect as soon as it has been detected. Damage compensation claims may only be made within the applicable claim periods.

Collector Brush Sensor Unit

Program 0815

5.2 Packaging

The individual packages must be packed according to the transport conditions to be expected. Only environmentally friendly materials have been used for packaging.

The packaging must protect the individual components from transport damage, corrosion and other damage until the installation will be made. Thus do not destroy the packaging and remove it only immediately before the installation.

Handling of packaging materials:

Dispose of packaging material according to the valid legal regulations and local guidelines.



Environmental damage due to improper disposal!

Packaging material is a valuable resource and can be reused, processed or recycled in many cases.

- Dispose of packaging materials in an environmentally appropriate manner.
- Comply with locally applicable disposal guidelines; if necessary, engage a specialist for disposal.

5.3 Storage of the packages

Store packages under the following conditions:

- Do not store outdoors.
- Store in a dry, dust-free place.
- Do not expose to aggressive media.
- Protect from direct sunlight.
- Avoid mechanical vibrations.
- Storage temperature: 15 to 35°C.
- Relative humidity: max. 60%.
- When storing for more than 3 months, check the general condition of all parts and the packaging at regular intervals. If necessary, add or replace the preservative.



Under some circumstances, there may be instructions for storage on the packages which go beyond the requirements listed here. Follow them appropriately.

6 Mounting and commissioning

6.1 Safety

Personnel:

- Installation and initial commissioning may only be carried out by experienced, skilled technicians.

Wear the following protective gear during all work of installation and initial commissioning:



Work safety clothing



Protective helmet



Protective footwear



Protective gloves



DANGER!

Danger of life due to electric shock!

Touching electrically live parts may result in death or serious injury due to electric shock. Furthermore, there's a risk of injury due to shock reactions, falling or being cast-off triggered by electric shock.

- Parts carrying electrical current: Conductor rail, feed, current collector, devices and connections at the collector brush sensor unit and within control cabinets, etc.

Before working on the parts listed above:

- **Disconnect the conductor rail system from power** following the 5 safety rules and **secure against reactivation**. 5 safety rules see Chapter 2.6

During works:

- Use insulated tools
- Observe stipulations for works on live components and systems

Before switching on power:

- Prior to each start of the device or system, test the insulation resistance according to locally applicable technical standards, directives, and laws
- Carry out mandatory electrical tests specified in the country where the device is installed

Sustain electrical safety:

- Inspect and maintain electrical equipment regularly
- If you observe hazardous defects, inform the system operator immediately
- Always replace blown fuses by fuses of equivalent rating



Collector Brush Sensor Unit

Program 0815



WARNING!

Danger to life due to suspended loads!

Falling loads can lead to severe injuries or death.

- Never step under suspended loads
- Move loads only under supervision
- Set down loads before leaving the work area



WARNING!

Risk of sensitization, mucous membrane irritation and respiratory disease due to dust!

Abrasion of collector brushes is accumulated in the conductor rails and the track profile. This dust is very fine and is categorized as a health risk. Frequent exposition can lead to sensitization. Persons that frequently stay within a highly frequented system for a longer time without protective equipment must expect the following **consequences**:

- mucous membrane irritation
- respiratory diseases
- cancer

Handling dust accumulations carelessly (e.g. blowing out dust by means of compressed air) may also lead to these consequences.

- At work places with permanent exposition and highly frequented equipment, protect the personal from dust by effective measures
- Wear protective equipment during all works at the conductor rail system where dust is whirled up. In particular, wear protective equipment during cleaning works
 - Safety goggles
 - Dust mask class FFP3
 - Protective gloves
 - Disposable overall
- Before starting work, clean the conductor rail as prescribed. There are special instructions for this, see Chapter 11.1
- Protect the environment during cleaning work, e.g. by covering or removing stock goods and blocking of areas, where dust might fall down on persons
- Do **not blow off** dust with **compressed air**, suck it off with a vacuum cleaner instead. The vacuum cleaner should be equipped with a fine filter class H
- Do not eat, drink or smoke during these works!



Collector Brush Sensor Unit

Program 0815



WARNING!

Risk of injury due to improper installation and initial commissioning!

Improper installation and initial commissioning can result in serious injury to person and property.

- Before starting work, ensure sufficient space for assembly
- Handle open, sharp-edges components carefully
- Maintain order and cleanliness in the assembly area! Loosely stacked or scattered components and tools are sources of danger
- Mount components properly. Comply with specified screw tightening torques
- Secure components so that they cannot fall or tip over

6.2 Preparations

Required preparatory works

The **section and the fixing holes** must be made according to a drawing that will be provided in the context of the project as **project documentation**.

- Disconnect the conductor rail from the power supply, observe safety instructions and warnings!
- Provide an appropriate section at the track profile
- Drill fixing holes

Required tools:

- Flat wrench SW 10
- Allen wrench 3 mm
- Torque wrench 1-3 Nm
- Hacksaw
- Key file
- Tape measure
- Pencil / Scriber / Felt pen

Collector Brush Sensor Unit

Program 0815

Screw tightening torques:

- Flat wrench SW 10: 8 Nm
- Feed terminal with end cap: 2 Nm

6.3 Installation



WARNING!

Risk of crash due to uneven or slippery ground!

Crashing from a ladder bears a risk of serious, life-threatening injuries.

- Use portable and stable ladders
- Ensure that the ladder has a safe position. Clean the ground, if required, or use an appropriate underlay
- Remove any EMS-vehicles from the working area, block the working area
- Place the ladder in such a way that it will not be hit by mobile units (risk of falling)



WARNING!

Danger of crushing!

There's crush hazard for skin and limbs due to:

- Moving parts, e.g. mobile units within the monorail system
 - Current collector (spring force) at assembly, disassembly and servicing
-
- Keep a distance to moving or rolling units, block the working area, if necessary
 - Installation must be carried out by instructed personnel only
 - While working on the conductor rail system, use protective footwear, protective gloves and a protective helmet

Personnel:

- Execution only by experienced qualified technicians

Collector Brush Sensor Unit

Program 0815

6.3.1 Installation of the collector brush sensor unit

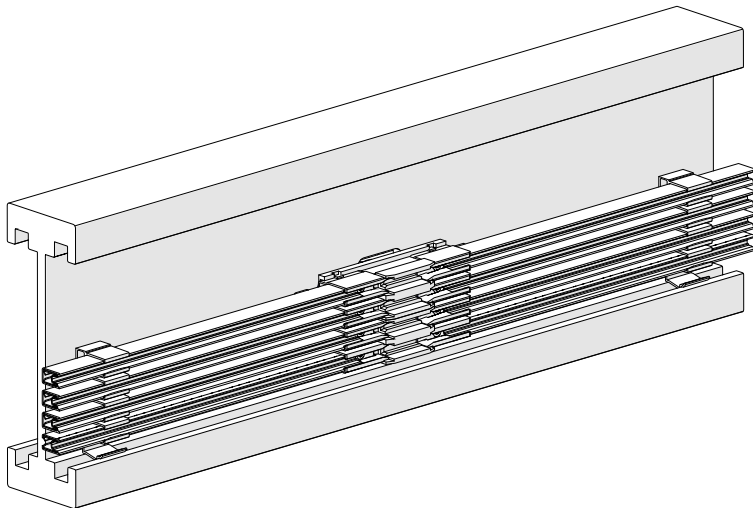


Fig. 3: Conductor rail section with collector brush sensor unit program 0815

- The collector brush sensor unit is installed in the medium web of the track profile.
- Make **section and the fixing holes** according to a project-specific (if available). The **dimensions** given in the illustrations in these operating instructions are only **examples and may vary!**
- The size of the section depends on the quantity of poles (number of poles) of the collector brush sensor unit.
- Form and length of the sensor unit is designed in such a way that the height of the running surface of the sensor unit is on the same level as the remaining conductor rail system.
- The collector brush sensor unit is mounted on that side, where the conductor rail is installed and is fixed directly onto the medium web of the track profile. Therefore shimming is not necessary on different web widths.

Collector Brush Sensor Unit
Program 0815

Example

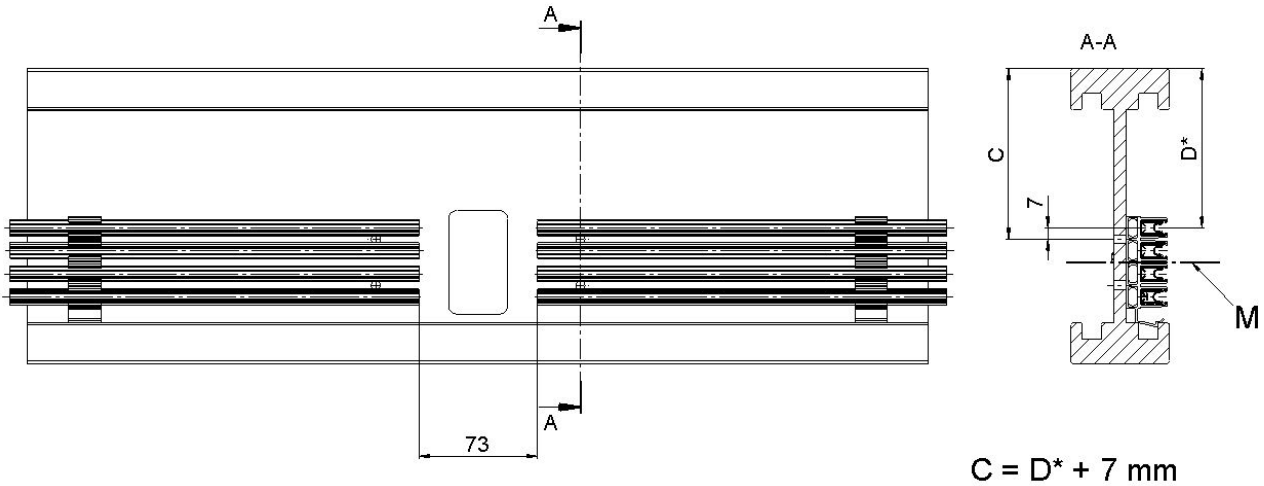


Fig. 4: Example: Installation drawing shown in front view (section for 4-pole collector brush sensor unit)

*Distance from the upper edge of the EMS profile to the center of the conductor rail pole 1 (position of the conductor rail (pole 1 – dimension D) is an individual system dimension and must be determined on site).

M = Middle of the conductor rail

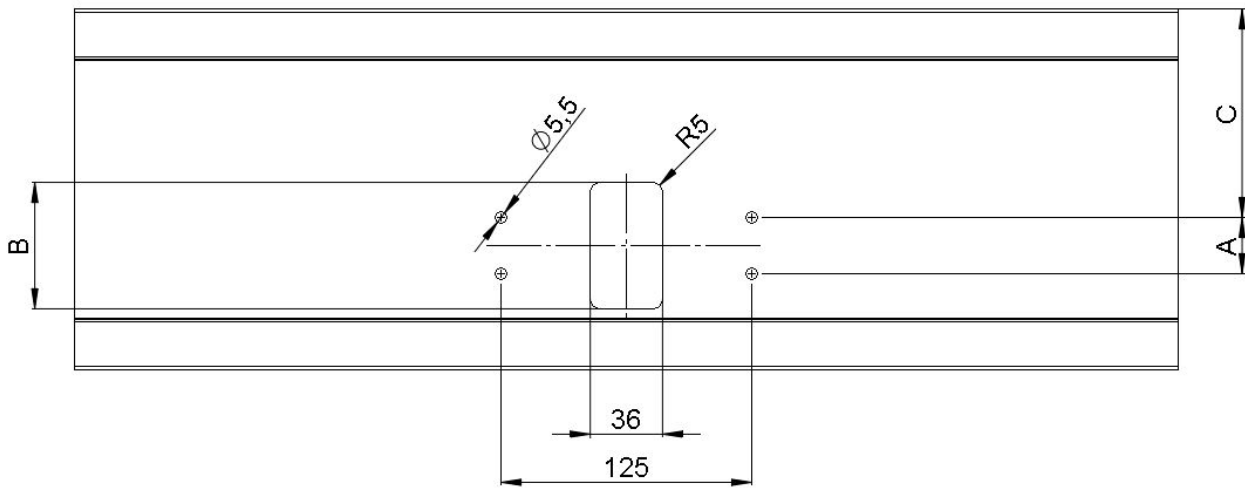


Fig. 5: Example: Installation drawing shown in rear view (section and hole pattern for 4-pole collector brush sensor unit)

Collector brush sensor unit	Dimension A
4-pole	28mm
6-pole	56 mm
8-pole	84 mm

Collector Brush Sensor Unit

Program 0815

Remark

The position of the section and the holes depends on the center of all conductor rails (Example: With 4 poles, the conductor rails center M lies between the 2nd and the 3rd pole, see Fig. 4). In this example, the 4 poles in the lower area of the EMS profile have been used to leave space for e.g. a code tape.

Assembly steps (mechanical integration)

- Check section hole pattern (prescription according to project documentation)
- It is imperative to install hanger clamps on the left and right of the collector brush sensor unit at a distance of approx. 100 mm
- Align sensor unit with grounding conductor (PE) according to the specifications (see advice: Grounding conductor position in the EMS-system), place it into the track profile and fix with the included screws

Advice: Grounding conductor position in the EMS-system

As grounding conductor (PE) in EMS-systems use the fourth pole (counted from upper edge track profile) according to national and international standards. Current collector, funnel, sensor unit and other assembly groups are designed for this arrangement.

- Cut conductor rails to measure, if required (see Fig. 5), deburr cutting edges. More details see mounting instructions for rail material / conductor rail 0185
- Mount end caps at the end of the rails, push power terminal onto the copper rail, put on end caps and then tighten clamping screw with Allen screw (2 Nm). Pay attention to color coding: Install green end caps on PE grounding conductor pole. Install black end caps on phases and data poles
- Press end caps into the sensor unit until they snap in

The sensors are adjusted to the used collector brush type ex works and must therefore not be readjusted on site.

Test mechanical integration

- Drive the collector brushes through the sensor unit manually by means of a loose current collector

The installation is faultless, if the current collector will not get stuck and can be driven through the sensor unit with uniform pressure and without any resistance.

Collector Brush Sensor Unit Program 0815

6.3.2 Electrical connection

Cables and plugs

The sensors are supplied with 3-pole cables provided with plugs. For information about the pin assignment of the plugs see Chapter 3.2, cables and plugs.

Wire sensors individually in a 3-wire system

The inductive sensors must be wired individually with the control unit in a 3-wire-system. Do not switch the sensors in series or in a 2-wire-system, since faults due to transient effects might occur.

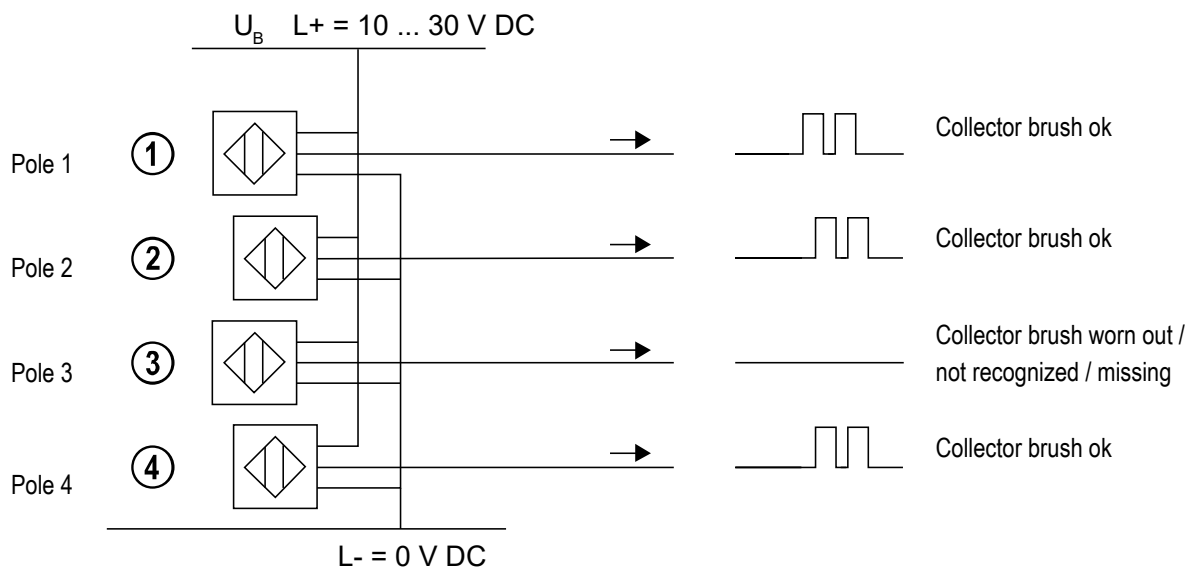


Fig. 6: Wiring example for 4-pole sensor unit for individual evaluation

6.4 Testing and initial commissioning



WARNING!

Danger of injury due to improper commissioning!

Improperly performed commissioning can lead to dangerous situations for the personnel.

→ Prior to commissioning, carry out the tests in the test list of the manufacturer

Collector Brush Sensor Unit

Program 0815

6.4.1 Test list for initial commissioning

Activity	Checked
Check function of the sensors	
Check function of the evaluation	
All screws tightened according to torque	
Operating personnel trained	

.....
Date

.....
Signature

6.4.2 Perform initial commissioning

To carry out initial commissioning: (disconnect the conductor rail from the power supply! Observe safety instructions in Chapter 2.7 !)

1. Connect unit with the control of the EMS-system / evaluation
2. Start software operation
3. Pass through each pole of the sensor unit once with a faultless current collector with new collector brush (good sample) and once with a current collector with worn out collector brush (bad sample). Check if the control gives a correct result
4. Test mobile units with faultless collector brushes and current collectors in test operation and push them over the unit by hand => an error must not be displayed
5. Test error display: Move the current collector and the mobile unit manually over the sensor unit => Error must be recognized
6. Repeat process in 5 steps for missing PE-follower => missing of the PE-follower must be recognized

Collector Brush Sensor Unit

Program 0815

7 Operation

When the sensor unit is mounted and their operation has been started properly, further operating steps will not be necessary at the sensor unit to fulfill the intended use.

→ Note the maintenance notes in Chapter 8, in order to keep the operation undisturbed as far as possible

7.1 Safety



WARNING!

Danger for unauthorized personnel!

Unauthorized personnel who do not meet the requirements described in Chapter 2.2, do not know the dangers that might arise in the working area.

- Keep unauthorized personnel away from the working area
- In case of doubt, address the persons and direct them away from the working area
- Stop work as long as unauthorized personnel is in the working area



DANGER!

Danger of life due to electric shock!

Parts carrying electrical current: Conductor rail, feed, current collector, devices and connections at the collector brush sensor unit and within control cabinets, etc.

Before working on the parts listed above:

- **Disconnect the conductor rail system from power** following the 5 safety rules and **secure against reactivation**. 5 safety rules see Chapter 2.6



8 Maintenance and Servicing

8.1 Safety



WARNING!

Danger of injury due to improperly executed maintenance tasks!

Improper maintenance can result in serious injury and property damage.

- Before starting work, ensure sufficient space for assembly
- Maintain order and cleanliness in the assembly area! Loosely stacked or scattered components and tools are sources of danger
- If components have been removed, be careful to reinstall them properly, replace all fastening elements, and comply with screw tightening torques

Collector Brush Sensor Unit

Program 0815



DANGER!

Danger of life due to electric shock!

Parts carrying electrical current: Conductor rail, feed, current collector, devices and connections at the collector brush sensor unit and within control cabinets, etc.

Before working on the parts listed above:

- **Disconnect the conductor rail system from power** following the 5 safety rules and **secure against reactivation**. 5 safety rules see Chapter 2.6



WARNING!

Risk of sensitization, mucous membrane irritation and respiratory disease due to dust!

Abrasion of carbon brushes (dust) is accumulated in the conductor rails and the track profile. For further information see Chapter 2.7.3. Possible **consequences**

- Mucous membrane irritation
 - Respiratory diseases
 - Cancer
- Do **not blow off** dust with **compressed air**, suck it off with a vacuum cleaner instead. The vacuum cleaner should be equipped with a fine filter class H
- Wear protective equipment during all works at the conductor rail system where dust is whirled up. In particular, wear protective equipment during cleaning works
- Safety goggles
 - Dust mask class FFP3
 - Protective gloves
 - Disposable overall
- Before starting work, clean the conductor rail as prescribed. There are special instructions for this, see Chapter 11.1
- Protect the environment during cleaning work, e.g. by covering or removing stock goods and blocking of areas, where dust might fall down on persons
- Do not eat, drink or smoke during these works!



8.2 Maintenance schedule

The next sections describe the maintenance tasks required for optimum, trouble-free operation. The tasks carried out according to the maintenance schedule must be recorded.

If regular inspections reveal increased wear, the corresponding maintenance intervals should be shortened in accordance with the actual signs of wear.


In case of any questions regarding maintenance tasks and intervals, contact the manufacturer; see the service address on the last page.

Collector Brush Sensor Unit

Program 0815

Interval	Maintenance work	To be carried out by
4 weeks after commissioning	Visual and functional inspection	skilled electrician
Every 6 months	Visual and functional inspection <ul style="list-style-type: none"> ■ Functional inspection with good and bad sampling ■ Visual inspection at regular intervals for signs of wear or damage 	skilled electrician
	Check of screw connections <ul style="list-style-type: none"> ■ Check for firm seating of the screws ■ If required tighten with torque (see Chapter 6 „Assembly and commissioning“) 	skilled electrician


9 Fault diagnosis



WARNING!

Danger of injury due to improper fault elimination!
 Improper fault elimination can result in serious injury and property damage

- Contact the manufacturer in case of malfunction
- Allow troubleshooting to be carried out only by personnel from or authorized by the manufacturer




DANGER!

Danger of life due to electric shock!
 Parts carrying electrical current: Conductor rail, feed, current collector, devices and connections at the collector brush sensor unit and within control cabinets, etc.


Before working on the parts listed above:

- **Disconnect the conductor rail system from power** following the 5 safety rules and **secure against reactivation**. 5 safety rules see Chapter 2.6



Collector Brush Sensor Unit

Program 0815



WARNING!

Risk of sensitization, mucous membrane irritation and respiratory disease due to dust!

Abrasion of carbon brushes (dust) is accumulated in the conductor rails and the track profile. For further information see Chapter 2.7.3. Possible **consequences**

- Mucous membrane irritation
- Respiratory diseases
- Cancer

→ Do **not blow off** dust with **compressed air**, suck it off with a vacuum cleaner instead. The vacuum cleaner should be equipped with a fine filter class H





→ Wear protective equipment during all works at the conductor rail system where dust is whirled up. In particular, wear protective equipment during cleaning works

- Safety goggles
- Dust mask class FFP3
- Protective gloves
- Disposable overall

→ Before starting work, clean the conductor rail as prescribed. There are special instructions for this, see Chapter 11.1

→ Protect the environment during cleaning work, e.g. by covering or removing stock goods and blocking of areas, where dust might fall down on persons

→ Do not eat, drink or smoke during these works!

Observation	Possible cause	Remedy
Sensor unit contaminated with coal dust	Not cleaned	Cleaning. Observe instructions for the cleaning of conductor rails, see Chapter 11.1!
Worn out collector brushes receive a good signal	Sensor unit worn out	Replace sensor unit
Output of the signal not reliable	Loose connection in the sensor / cable	Replace sensor / cable
No signal with good collector brush	Sensor defective / cable defective	Replace sensor / cable
No output / no effect of the signal	Control / evaluation faulty	Check control / evaluation

Collector Brush Sensor Unit

Program 0815

10 Disassembly and disposal

10.1 Safety



WARNING!

Danger of injury due to improper disassembly!

Stored residual energy, edged components, points, and edges on and in the device or the tools needed can cause injury.

- Before starting work, ensure sufficient space
- Handle open, sharp-edged components carefully
- Maintain order and cleanliness in the work area! Loosely stacked or scattered components and tools are sources of danger
- Secure components so that they cannot fall or tip over
- Involve the manufacturer in case of any unclear points



WARNING!

Risk of sensitization, mucous membrane irritation and respiratory disease due to dust!

Abrasion of collector brushes (dust) is accumulated in the conductor rails and the track profile that is harmful to health. For further information see Chapter 2.7.3. Possible **consequences:**

- Mucous membrane irritation
- Respiratory diseases
- Cancer

→ Do **not blow off** dust with **compressed air**, suck it off with a vacuum cleaner instead. The vacuum cleaner should be equipped with a fine filter class H

→ Wear protective equipment during all works at the conductor rail system where dust is whirled up. In particular, wear protective equipment during cleaning works

- Safety goggles
- Dust mask class FFP3
- Protective gloves
- Disposable overall

→ Before starting work, clean the conductor rail as prescribed. There are special instructions for this, see Chapter 11.1

→ Protect the environment during cleaning work, e.g. by covering or removing stock goods and blocking of areas, where dust might fall down on persons

→ Do not eat, drink or smoke during these works!



Collector Brush Sensor Unit

Program 0815



DANGER!

Danger of life due to electric shock!

Parts carrying electrical current: Conductor rail, feed, current collector, devices and connections at the collector brush sensor unit and withing control cabinets, etc.

Before working on the components listed above:

→ **Disconnect the conductor rail system from power** following the 5 safety rules and **secure against reactivation**. 5 safety rules see Chapter 2.6



10.2 Disassembly

After the system is no longer in use, the device must be disassembled and disposed of in an environmentally appropriate manner.

10.2.1 Dismounting of the assembly

Personnel:

- Execution only by experienced qualified technicians

Required tool:

- see Chapter 6.2
- Securing tool

10.3 Disposal

Properly disassembled components are to be recycled if no return or disposal agreement has been made.

- Scrap metals.
- Take plastic elements to recycling.
- The other components are to be disposed off according to their material composition.



CAUTION!

Environmental damage due to improper disposal!

Electrical waste, electronic components, lubricants and other auxiliary materials are subject to hazardous waste disposal regulations and may only be disposed of by authorized specialists.

Local community officials or special disposal companies can provide information about environmentally appropriate disposal.

11 Additional Documents

11.1 Other applicable documents

Consecutive No.	Document No.	Name of document
01	WV0800-0001	Cleaning of conductor rails

12 Index

Accident.....	13	Maintenance schedule	30
Copyright.....	5	Mounting and commissioning.....	20
Customer service	5	Operating conditions	14
Disassembly.....	34	Operator	10
Disposal.....	34	Packaging	19
Explication of symbols.....	6	Personnel	7
Fault diagnosis	31	Product description	14
Faults.....	13	Protective measures	10
Function.....	14	Safety.....	20, 29, 33
Hazards	11	Spare parts.....	5
Initial commissioning	27	Storage.....	19
Instruction	8	Technical specifications	13
Intended use.....	9	Transport.....	18
Limitation of liability	4	Unauthorized personnel.....	7
Maintenance and Servicing	29	Warranty and guarantee	5

Operating Instructions



Collector Brush Sensor Unit

Program 0815

13 Appendix Program example (contact plan)

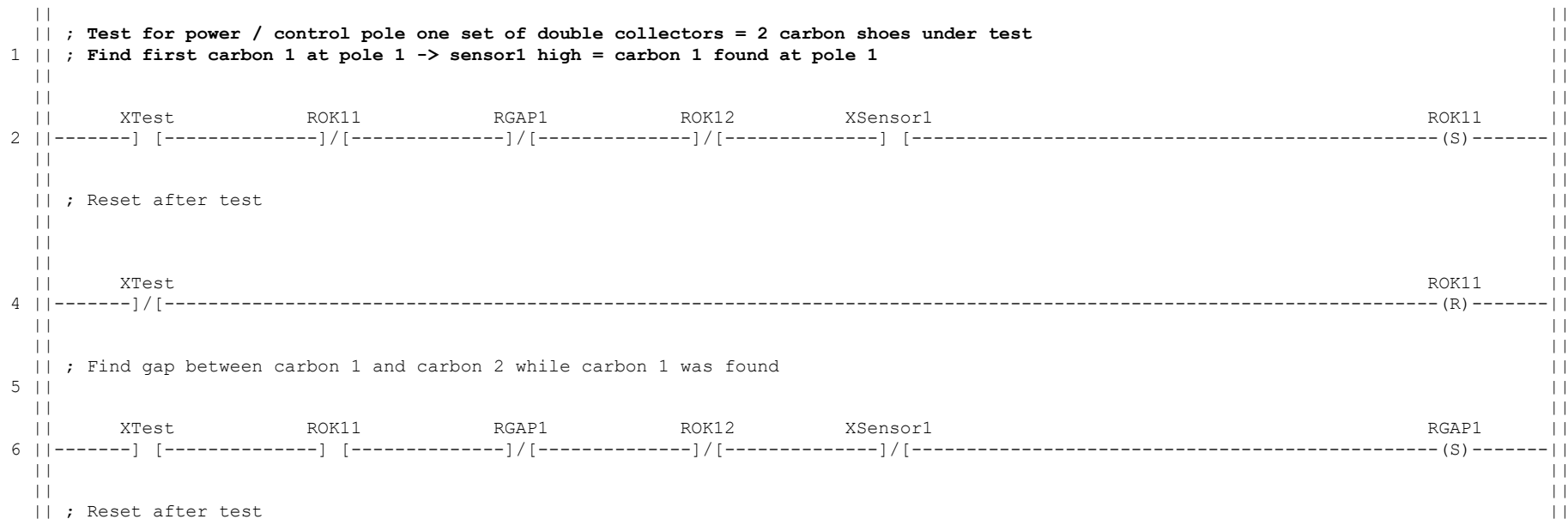
Section 1 to 16: Evaluation of a collector brush at a phase pole (double current collector with 2 collectors)

This section must be extended for each pole for further phase poles. For reasons of clarity only one phase-pole is listed here.

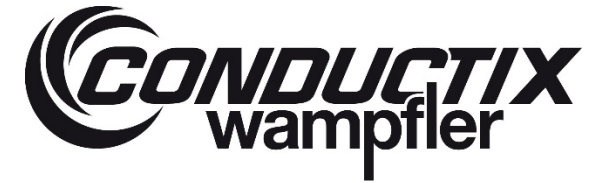
Section 17 to 35: Evaluation of a collector brush at protective earth conductor pole PE with follower

starting from section 35 I/O and merker listing

LADDER DIAGRAM:



Operating Instructions

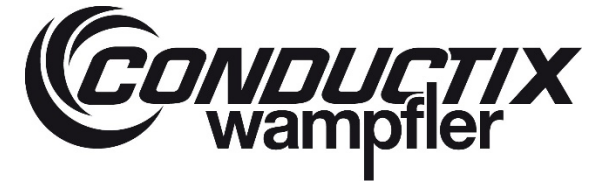


Collector Brush Sensor Unit

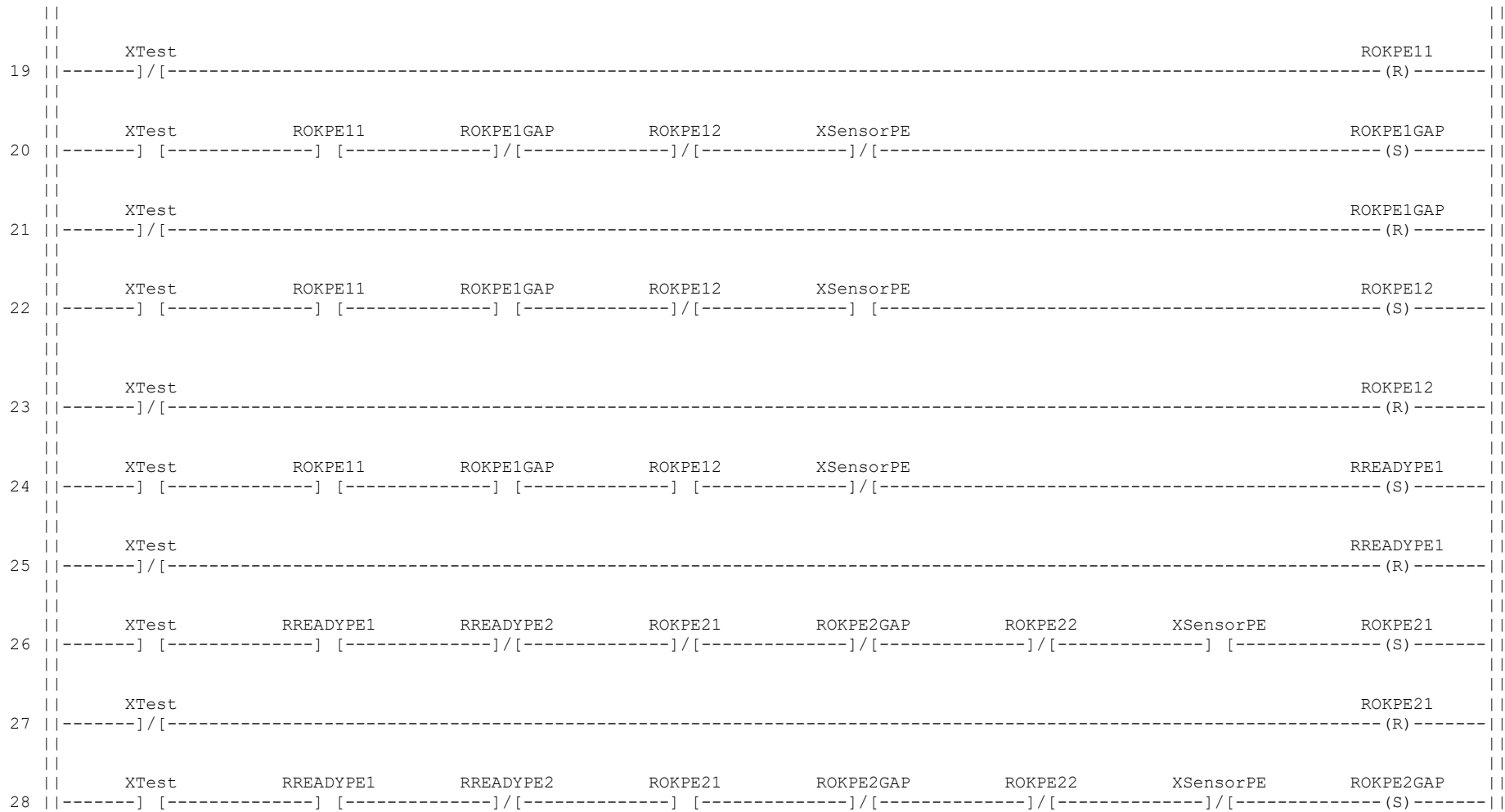
Program 0815

```
7 ||
8 ||           XTest                               RGAP1
9 || -----]/[----- (R) -----
10 || ; Find second carbon 2 at pole 1 -> sensor1 high = carbon 2 found at pole 1
11 || ; Carbon 1 and gap were found before
12 ||           XTest           ROK11           RGAP1           ROK12           XSensor1           ROK12
13 || -----] [-----] [-----] [-----]/[-----] [-----] (S) -----
14 || ; Reset after test
15 ||           XTest                               ROK12
16 || -----]/[----- (R) -----
17 || ; Both carbons and gap found - current collector at pole 1 ok
18 ||           XTest           ROK11           RGAP1           ROK12           XSensor1           RREADY1
19 || -----] [-----] [-----] [-----] [-----]/[-----] (S) -----
20 || ; Reset after test
21 ||           XTest                               RREADY1
22 || -----]/[----- (R) -----
23 || ; Test for PE pole with two sets of double collectors = 4 carbon heads under test
24 ||           XTest           ROKPE11           ROKPE1GAP           ROKPE12           XSensorPE           ROKPE11
25 || -----] [-----]/[-----]/[-----]/[-----] [-----] (S) -----
```

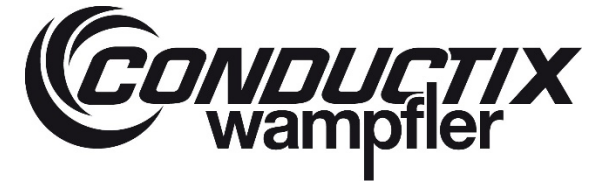
Operating Instructions



Collector Brush Sensor Unit Program 0815



Operating Instructions



Collector Brush Sensor Unit Program 0815

I/O ASSIGNMENT:

Name	Type	Pin
XSensor1	digital in	
XSensorPE	digital in	
XTest	digital in	
YTESTPASSED	digital out	
RGAP1	int. relay	
ROK11	int. relay	
ROK12	int. relay	
ROKPE11	int. relay	
ROKPE12	int. relay	
ROKPE1GAP	int. relay	
ROKPE21	int. relay	
ROKPE22	int. relay	
ROKPE2GAP	int. relay	
RREADY1	int. relay	
RREADYPE1	int. relay	
RREADYPE2	int. relay	

Operating instructions



Collector Brush Sensor Unit
Program 0815

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