rexroth
A Bosch Company

Instruction manual

Electronic control devices for foot pedal

2THE5R

4THE5NR

4TH5NR

Hybrid function

RE 29698-01-B/2021-06-22, EN

The data specified within only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

The cover shows an example application. The product delivered may differ from the image on the cover.

The original instruction manual was created in the English language.

Contents

1 About this documentation

1.1 Validity of the documentation

This documentation is valid for the following products:

- Electronic control devices for foot pedal operation
  - 2THE5R series 40 (CAN PLc, CAN PLd, PWM)
  - 4THE5R, 4THE5NR series 40 (CAN PLc, CAN PLd, PWM)
  - 4TH5NR series 40 hybrid function

This documentation is intended for machine/system manufacturers, assemblers and service engineers.
This documentation contains important information on the safe and proper transport, installation, commissioning, operation, maintenance, disassembly and simple troubleshooting of the product.

▶ Read this documentation completely, in particular chapter 2 "Safety instructions" on page 7 and chapter 3 "General instructions on property damage and product damage" on page 11 before you start working with the product.

1.2 Required and supplementary documentation

▶ Only commission the product if the documentation marked with the book symbol 🕮 is available to you and you have understood and observed it.

Table 1: Required and supplementary documentation

	Title	Document number	Document type
🕮	**Electronic control device for double foot pedal with dampening 4THE5NR** Contains the permissible technical data, ports, main dimensions and circuit diagrams of standard versions.	29898	Data sheet
🕮	**Electronic control device for single foot pedal 2THE5R** Contains the permissible technical data, ports, main dimensions and circuit diagrams of standard versions.	29698	Data sheet
🕮	**Hybrid pilot control device for double foot pedal with dampening 4TH5NR** Contains the permissible technical data, ports, main dimensions and circuit diagrams of standard versions.	64536	Data sheet

1.3 Representation of information

Uniform safety instructions, symbols, terms and abbreviations are used throughout this documentation to ensure safe and proper use of the product. For clarification, they are explained in the sections below.

1.3.1 Safety instructions

This documentation contains safety instructions in chapter 2.6 "Product-specific safety instructions" on page 10 and in chapter 3 "General instructions on property damage and product damage" on page 11, as well as before a sequence of actions or an instruction for action involving a risk of personal injury and property damage. Always follow the measures for danger prevention associated with the use of this product.

Safety instructions are set out as follows:

⚠ SIGNAL WORD

Type and source of danger!
Consequences of noncompliance
▶ Danger prevention measures

- **Warning sign:** draws attention to the danger
- **Signal word:** identifies the degree of the danger
- **Type and source of danger:** indicates the type and source of the danger
- **Consequences:** describes what occurs if safety instructions are disregarded
- **Precautions:** states how the danger can be avoided

Table 2: Hazard classes as defined in ANSI Z535.6

Warning sign, signal word	Meaning
⚠ DANGER	Identifies a dangerous situation that will result in death or serious injury if it is not avoided.
⚠ WARNING	Identifies a dangerous situation that may result in death or serious injury if it is not avoided.
⚠ CAUTION	Identifies a dangerous situation that may result in minor to moderate injury if it is not avoided.
NOTICE	Property damage: The product or surrounding area may be damaged.

1.3.2 Symbols

The following symbols indicate notices that are not safety-relevant but increase understanding of the documentation.

Table 3: Meaning of symbols

Symbol	Meaning
	If this information is disregarded, the product cannot be used and/or operated to its full extent.
▶	Single, independent action
1. **2.** **3.**	Numbered instruction: The numbers indicate that the actions must be completed in order.

1.3.3 Designations

This documentation uses the following designations:

Table 4: Designations

Designation	Meaning
2THE5R	Electronic control device for single foot pedal
4THE5NR	Electronic control device for double foot pedal with dampening option
4TH5NR	Hybrid pilot control device for double foot pedal with dampening

As a generic term for the "Electronic control devices for foot pedal 2THE5R, 4THE5NR, 4TH5NR", the designation "product" or "pedal" will be used in the following.

1.3.4 Abbreviations

This documentation uses the following abbreviations:

Table 5: Abbreviations

Abbreviation	Meaning
ANSI	**A**merican **N**ational **S**tandards **I**nstitute is an organization that coordinates the development of voluntary standards in the United States
CAN	**C**ontroller **A**rea **N**etwork
EMC	**E**lectro**m**agnetic **c**ompatibility
ESD	**E**lectro**s**tatic **d**ischarge
PWM	**P**ulse **W**idth **M**odulation

2 Safety instructions

2.1 About this chapter

The product has been manufactured in accordance with generally accepted engineering standards. There is still, however, a danger of personal injury or property damage if this chapter and the safety instructions in this documentation are not observed.

- Read this documentation completely and thoroughly before working with the product.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when passing the product on to third parties.

2.2 Intended use

The pedal is intended as a component for application in mobile working machines. It is used to detect actuations from the driver (proportional and On/Off actuations). The pedal may only be commissioned after it has been installed in the machine/system for which it is intended and the safety of the entire system has been established in accordance with the Machinery Directive.

- Generally, the pedal must be operated within the operating ranges specified and approved in the data sheet, particularly with regard to voltage, temperature, vibration, shock and other described environmental influences.
- Its use outside of these specified and approved boundary conditions may result in danger to life and/or cause damage to components which could result in sequential damage to the mobile working machine.
- Serious personal injury and/or damage to property may occur in case of non-compliance with the appropriate regulations.
- Observe the corresponding IP protection class.

The product is intended only for professional use and not for private use. Intended use includes having fully read and understood this documentation, especially chapter 2 "Safety instructions" on page 7.

2.3 Improper use

Any use other than that described as intended use is considered improper.
Bosch Rexroth AG is not liable for damages resulting from improper use. The user is solely responsible for any risks arising from improper use.
The following foreseeable forms of faulty usage are also considered improper (this list is not exhaustive):

- Use outside the operating parameters approved in the data sheet (unless customer-specific approval has been granted)
- Use of non-approved fluids, e.g. bleach or aggressive cleaning agents
- Use of the pedal under water
- Application of the pedal in explosive environments
- Use of the pedal in a corrosive atmosphere

2.4 Personnel qualifications

The activities described in this documentation require basic mechanical, electronical/electrical and hydraulic knowledge, as well as knowledge of the associated technical terms. In order to ensure safe use, these activities should only be performed by skilled personnel or an instructed person under the direction and supervision of skilled personnel.
Skilled personnel refers to persons who possess the professional training, knowledge and experience, as well as the understanding of the regulations relevant to the work to be done that are necessary to recognize possible dangers and take the appropriate safety measures. Skilled personnel must follow the rules relevant to their field and have the necessary expert knowledge of mechatronics, electronics and hydraulics, if applicable.
Expert knowledge means, for instance:

- Being able to read and fully understand electrical circuit diagrams and hydraulic diagrams, if applicable,
- in particular, fully understanding the relationships with regard to safety devices,
- as well as to carry out the wiring of electronic components correctly and
- to have knowledge of the function and interaction of electronic, mechanical and hydraulic components.

Only trained and experienced specialists who are adequately familiar with both the components used and the complete system should implement system developments or install and commission electronic systems for controlling hydraulic drives.

Bosch Rexroth offers you measures supporting training in specific areas. You can find an overview of the training contents on the Internet at: `www.boschrexroth.com/training`.

2.5 General safety instructions

- Observe country-specific accident prevention and environmental protection regulations.
- Observe the safety regulations of the country in which the product is used/ operated.
- Use Rexroth products only when they are in good working order.
- Do not install, operate, disassemble or maintain Rexroth products if under the influence of alcohol, drugs or medication that may affect your reaction time.
- Only use approved accessories and original spare parts from Rexroth in order to exclude hazards to persons due to unsuitable spare parts.
- Observe the technical data and ambient conditions specified in the product documentation.
- If unsuitable products are installed or used in applications that are of relevance to safety, unexpected operating conditions may occur in the application, which could result in personal injury or property damage. For this reason, only use the product in safety-relevant applications if this use is expressly indicated and approved in the product documentation, e.g. in safety-related parts of a control system (functional safety).
- Only commission the product if it has been determined that the end product (e.g. machinery/system) in which the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards for the application.
- Use tools appropriate for the work being performed and wear appropriate protective clothing to prevent punctures and cuts (e.g. when removing protective covers, disassembly).
- The proposed circuits do not imply any technical liability for the system on the part of Bosch Rexroth.
- Opening the pedal or carrying out modifications to or repairs on the pedal is prohibited. Modifications to or repairs on the wiring can lead to dangerous malfunctions.
- The pedal may only be installed/disassembled in a de-energized and depressurized state.
- Make sure that nobody is in the machine’s danger zone.
- Do not use defective components or components which are not in a proper working order. If the pedal fails or demonstrates a faulty operation, it must be replaced.
- Despite the greatest care being taken when compiling this document, it is not possible to consider all feasible applications. If notices for your specific application are missing, please contact Bosch Rexroth.

2.6 Product-specific safety instructions

The following safety instructions apply to chapters 6 to 14.

⚠ WARNING

System/machine under pressure!

Risk of death or serious injury when working on unsecured machines/systems! Property damage!

- Switch off the relevant machine/system part and secure it against reactivation according to the parameters by the machine/system manufacturer.
- Ensure that all relevant components of the hydraulic system are depressurized. For this purpose, observe the parameters indicated by the machine/system manufacturer.
- Please note that the hydraulic system might still be pressurized even after separation from the actual pressure supply.
- Do not diskonnect any line connections, ports and components as long as the hydraulic system is under pressure.

Electrical voltage!

Danger to life or risk of injury due to electric shock or property damage!

- Always disconnect the voltage supply to the relevant machine/system part before installing the product and/or connecting or disconnecting the connector.
- Protect the machine/system against being re-energized.

⚠ CAUTION

Improper cable and line routing!

Risk of stumbling and property damage! Improper routing of cables and lines can cause a risk of stumbling as well as damage to equipment and components, e.g. due to lines and connectors being torn off.

- Always install cables and lines in a way that nobody can fall over them, that they are not bend or twisted, do not chafe on edges and are not guided through ducts with sharp edges without sufficient protection.

Danger due to malfunctions!

Risk of injury and property damage as well as machine damage due to malfunctions of the pedal!

- Carry out a risk assessment of your machine and determine the possible safety-relevant functions.
- Take suitable measures to ensure safety in applications relevant to safety, e.g. pedal redundancy, plausibility check, emergency switch, etc.
- Product data that is required for the safety assessment of the machine is included in data sheet.

2.7 Personal protective equipment

The personal protective equipment is the responsibility of the user of the product. Observe the safety regulations in your country.
All pieces of personal protective equipment should be intact.

3 General instructions on property damage and product damage

The following notices apply to chapters 6 to 14.

NOTICE

Danger from improper handling!

Product can be damaged!

- Do not expose the product to any mechanical, hydraulic or electric loads under any circumstances.
- Never use the product as handle.
- Do not put/place any objects on the product.
- Do not use sensitive assembled parts (e.g. harness or connector) for transporting the pedal.
- Carefully place the pedal onto the contact surface to prevent it from being damaged and secure it against falling.
- Do not set/place the pedal onto the actuation elements.
- Do not hit sensitive assembled parts (e.g. actuation elements).
- Do not hit sealing surfaces (e.g. on the work ports).
- Leave the protective covers on the pedal until you connect the lines.
- Disconnect all electric connectors before any painting or soldering operations on the machine.
- Ensure that the electronic components (e.g. sensors) are not electro-statically charged (e.g. during painting operations).

Improper cleaning

Product can be damaged!

- Plug all openings with appropriate protective equipment to prevent cleaning agents from entering the pedal.
- Never use solvents or aggressive cleaning agents. Clean the pedal using only water and a plastic cleaning agent if necessary.
- Do not direct the high-pressure cleaner to sensitive components, e.g. pedal base, rubber parts (bellows), electric connections (solenoids, sensors) and actuation elements.
- Use fibre-free cleaning cloths for cleaning.

Environmental pollution due to incorrect disposal!

Careless disposal of the product and the packaging material could lead to environmental pollution!

- Dispose of the product and packaging in accordance with the national regulations in your country.

Electrical voltage!

Damage to property due to electrical voltage!

- Always disconnect the voltage supply to the relevant machine/system part before installing the product and/or connecting or disconnecting the connector. Protect the machine/system against being re-energized.
- Do not touch the connector pins with a tool or fingers for ESD reasons.

The warranty exclusively applies to the delivered configuration.
The warranty will be voided if the product is incorrectly installed, commissioned or operated, or if it is used or handled improperly.

4 Scope of delivery

Fig. 1: 2THE5R, 4THE5NR electronic pedal base, 4TH5NR hybrid pedal

The scope of delivery is defined by a single axis pedal base (2THE5R) (**1**), a dual axis pedal base (4THE5NR) (**2**), or a hybrid dual axis pedal base with or without pedal (4TH5NR) (**3**).

Multiple type of packaging exist according to the batch size ordered.

5 About this product

5.1 Product description

The pedal is made to be connected to a machine controller (ECU) which will be used as a power control and system logic. The pedal is suitable for the control of mobile machines. Thanks to its modularity, it answers to many configuration of controls, allowing to have an efficient and easy interface with the machine.

Sample applications

Thanks to its various type of output, the pedal is compatible with Bosch Rexroth controllers.

Output variants available

- **4THEC5NR, 2THEC5R**: CAN pedal for application in safety-related parts of control systems up to PLc, Vbat supply
- **4THED5NR, 2THED5R**: CAN pedal for application in safety-related parts of control systems up to PLd, Vbat supply
- **4THESW5NR, 2THESW5R:** Analog PWM 5 V pedal, PLd capable

5.2 Product identification

The product can be identified using the material number (**1**) on the label of the base.

Fig. 2: Material number on sticker on the base

6 Transport and storage

Check the pedal for transport damage. If there are obvious signs of damage, please inform the transport company and Bosch Rexroth immediately.
If the pedal is dropped, it is not permissible to use it any longer, as invisible damage could have a negative impact on reliability.

6.1 Storing the pedal

Requirement Storage time: 2 years at an average relative humidity of 60% and a temperature between −20 °C and +40 °C. Short-term for up to 100 hours a storage temperature of −40 °C and +85 °C shall be permissible.

7 Installation

Prior to installation, the following documents should be to hand:
- Data sheet of the product (contains the permissible technical data, main dimensions and installation drawing)

7.1 Unpacking

NOTICE! Danger due to electrostatic discharge!
When unpacking the pedal, there is a danger of damage to the electronic components of the pedal due to electrostatic discharge.
- ▶ During unpacking, the pedal is to be protected against electrostatic discharge.

- ▶ Remove the packaging from the pedal.
- ▶ Check the pedal for transport damage and completeness, see chapter 4 "Scope of delivery" on page 12.
- ▶ Dispose of the packaging in accordance with the regulations in your country.

7.2 Installation conditions

The installation position and position of the pedal essentially determine the procedures for installation and commissioning.
- ▶ Do not install the pedal close to parts that generate considerable heat (e.g. exhaust).
- ▶ Lines are to be routed with sufficient distance from hot or moving vehicle parts.
- ▶ A sufficient distance to radio systems must be maintained.
- ▶ Before electric welding and painting operations, the pedal must be disconnected from the power supply and the pedal connector must be removed.
- ▶ Cables/wires must be equipped with an individual seal to prevent water from entering the connector.

7.3 Installing the pedal

7.3.1 Preparation

1. Use the material number on the sticker of the packaging unit or directly on the product to check whether the correct pedal is available, see chapter 4 "Scope of delivery" on page 12.
2. Compare the material number with the details in the order confirmation.

If the material number of the pedal does not match the one in the order confirmation, contact your local contact person for clarification. You can find their contact information at
`www.boschrexroth.com/addresses`

7.3.2 General instructions

Please refer to data sheet 29898 or 29698.

7.3.3 Installation

NOTICE! The product should not be installed in a cavity. All the dust, water and mud must be evacuated and not remain in contact with the pedal. In case of damaged or disassembled boot, the product must be repaired.

1. Insert the pedal in the floor with care to prevent damage on the wiring or protection boot.
2. Fasten the pedal using the specified mounting bolt, required tightening torque written on installation drawing (maximum tightening torque 30 Nm).
3. Make sure the boot is in its correct position for an optimal protection. Note that this boot has no pannel IP relevance.
4. Connect the product with caution regarding the pin-out written on the installation drawing.

7.3.4 Notice on wiring and circuitry

- Lines from the pedal to the electronics must not be routed close to other power-conducting lines in the machine.
- The wiring harness should be mechanically secured in the area in which the pedal is installed.
- If possible, lines should be routed in the machine interior. If the lines are routed outside of the machine, their secure mounting is to be ensured.
- Lines must not be kinked or twisted, must not rub against edges and must not be routed through sharp-edged ducts without protection.

7.3.5 Electrically connecting the pedal

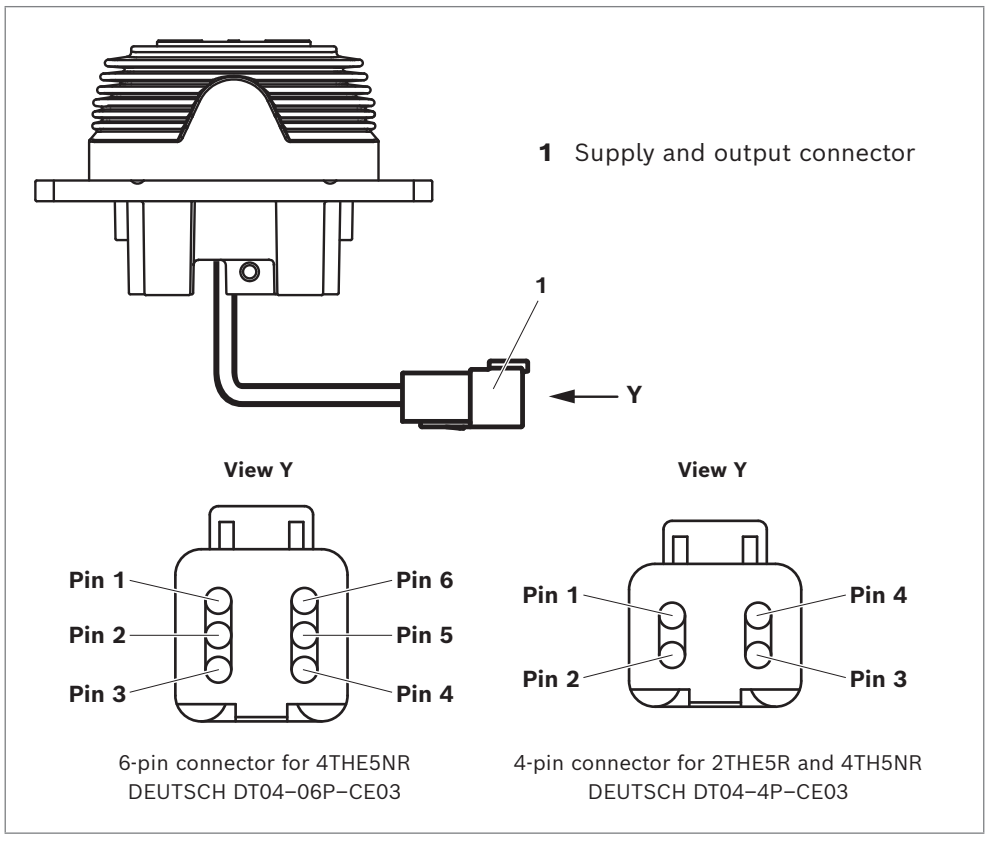


Fig. 3: Pin assignment

Table 6: Pin Assignment for 4THE5NR

Pin	CAN version	PWM version
1	V_{Bat}	5 V regulated
2	GND	GND
3	CAN_IN High	Axis 1 Principal
4	CAN_IN Low	Axis 1 Redundant
5	CAN_OUT High	Axis 2 Principal
6	CAN_OUT Low	Axis 2 Redundant

Table 7: Pin Assignment for 2THE5R

Pin	CAN version	PWM version
1	V_{Bat}	5 V regulated
2	GND	GND
3	CAN_High	Axis 1 Principal
4	CAN_Low	Axis 1 Redundant

Table 8: Pin Assignment for 4TH5NR

Pin	Pin out
1	V_{Bat}
2	GND
3	Output (on/off out of neutral, max. 1.5 A)
4	Plugged

1. Make sure that the DEUTSCH mating connector is in de-energized condition.
2. Connect the mating connector of the wiring harness to the pedal connector until it engages noticeably and observe the correct plug-in position.
3. The pedal is ready for operation within
   - 1500 ms (CAN version)
   - 5 ms (PWM version)

   after the voltage supply is applied.

8 Commissioning

During all work for commissioning the pedal, observe the general safety instructions and intended use detailed in chapter 2 "Safety instructions" from page 7 on.

- When commissioning the pedal, the machine may pose unforeseen dangers. Before commissioning the system, you must therefore ensure that the vehicle and the hydraulic system are in a safe condition.
- Commission the machine and check the correct functioning of the pedal (e.g. direction of movement and correct messages or output levels).

9 Operation

This product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Use the product only within the performance range specified in the technical data.

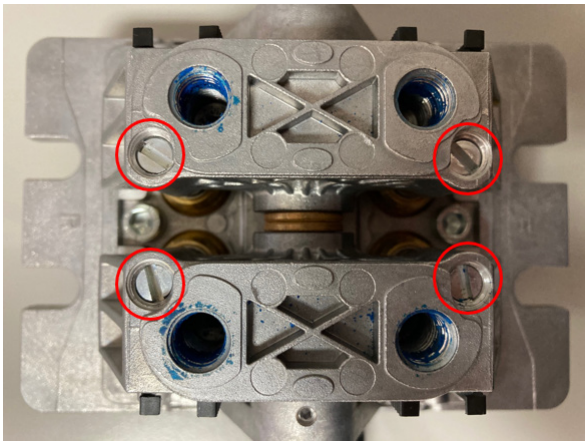
10 Maintenance and repair

⚠ DANGER

Dangerous malfunctions!

Opening the product could result in a loss of neutral point and unwanted movement!

- Do not touch the neutral setting screws.



- Do not open the spring package, this could damage the electronics.

10.1 Cleaning and care

NOTICE

Damage to bellows, connectors and electronics/electrics due to mechanical effects!

The water jet of a high-pressure cleaner may damage the bellows, connectors and electronics/electrics of the pedal!

- ▶ Do not point the high-pressure cleaner directly towards the pedal.

For cleaning and care of the pedal, observe the following:

- ▶ Check whether all the seals and fittings on the plug-in connections are securely seated to ensure that no moisture can penetrate into the pedal and the installation space during cleaning.
- ▶ Use only water and, if necessary, a mild cleaning agent to clean the pedal. Never use solvents or aggressive cleaning agents.

10.2 Inspection and maintenance

No special activities are necessary.

10.3 Repair

The pedal base and the bellow are available as spare parts. The pedal base itself cannot be repaired but only replaced.

- ▶ Only use original spare parts from Rexroth, otherwise the functional reliability cannot be guaranteed, and the warranty will be voided.
- ▶ Spare parts can be found online at `www.boschrexroth.com/eshop`

Address all questions regarding repair to your responsible Bosch Rexroth service.

11 Removal and replacement

- Only disassemble the pedal when de-energized and depressurized.

12 Disposal

⚠ CAUTION

Spring-loaded components!
Risk of injury due to ejected components during disassembly of the pedal.
- Do not open the product, this results in warranty loss.

Careless disposal of the pedal can lead to environmental pollution.
- Dispose of the pedal and the packaging material in accordance with the national regulations in your country.

13 Extension and conversion

Do not convert the pedal.

The warranty from Bosch Rexroth only applies to the configuration as delivered. Entitlement to warranty cover will be rendered void in case of conversion, extension or a software modification by customer.

14 Troubleshooting

The Table 9 is intended to support troubleshooting. This table is not exhaustive. Issues may occur in practice that are not listed here.

If the electronic CAN pedal is faulty, an error code is emitted. The message containing the error code depends on the protocol used (see data sheet). The description of the error codes is available on request.

14.1 Malfunction table

Table 9: Pedal malfunction table

Malfunction	Occurrence possible			Possible cause	Remedy
	Proto	0 km	Operation		
Pedal does not supply a signal	x	x		Mixing up the connection lines when connecting the pedal to the superior control system.	Check the wiring and/or the wiring harness both at the pedal connector and at the superior control.
	x	x	x	Pedal was mechanically damaged from the outside during operation.	Check the pedal for obvious damage. Replace the product if needed.
	x	x	x	Incorrect or faulty voltage supply: - Pedal supply voltage is missing. - Pedal supply voltage is too low.	Measure the supply voltage at the contacts of the pedal and make sure that all contacts in the mating connector are correctly fitted and latched. Make sure that the mating connector is connected to the pedal until latching.
	x	x	x	Short circuit of the output signals of the pedal by: - Damage to the insulation in the connected wiring harness.	Check the pedal and machine harness for obvious damage. Replace the product if needed.
Pedal supplies incorrect or no signal	(x)	x	x	Humidity has entered the wiring harness or the pedal.	The seals of the wiring harness connector are defective or the cable/pedal has been damaged.
	x			The input resistances RPU and/or RPD of the control unit are either too large (high resistance) or too small (low resistance).	Check whether the pedal is operated within its "operating limits" and make sure that the input resistances and the input capacitances of the connected control unit are within the limits specified in data sheet.
	x	x	x	The ground line of the pedal is not connected to the pedal ground of the control unit. There is a "potential shift" due to different grounds between pedal and higher-level control	Make sure that the ground of the pedal is connected to the respective ground of the control unit with a low resistance. Measure the connection.
			x	The pedal EMC environment exceed the values stated in the data sheet.	Stop the machine.

15 Technical data

The permissible technical data of the pedal can be found in the data sheet.

The data sheet can be found in the online product catalog at

www.boschrexroth.com/p-4THE5NR

www.boschrexroth.com/p-2THE5R

www.boschrexroth.com/p-TH5NR

16 Alphabetical index

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