rexroth
A Bosch Company

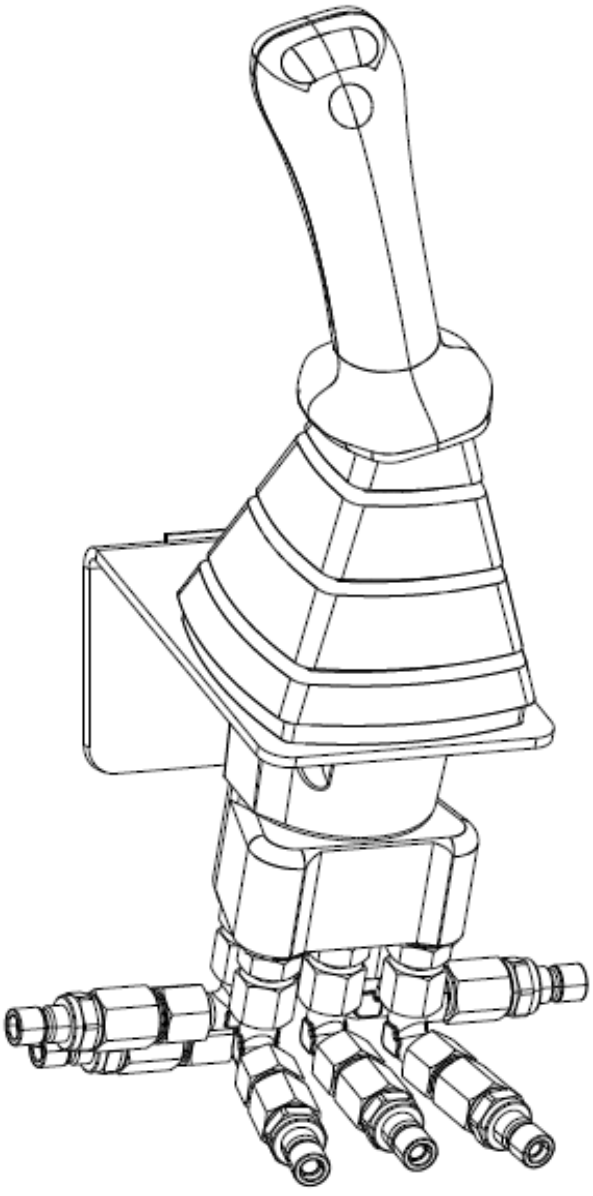
Training components for the DS4 training system - Mobile hydraulics

Pilot control unit TS- -MH2X/4TH6-97

RE 09982-MON/09.2023

Replaces: RE 09982-12.11
English

Assembly instructions



The data specified above only serve 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 page shows an example configuration. The product supplied may therefore differ from the photo shown.

The original assembly instructions were prepared in German.

Contents

1 About these assembly instructions

This document describes the TS –MH2X/4TH6-97 training component on the basis of the industrial serial product 4TH6 pilot control unit.
Further down in the description, the term "Pilot control unit TS-…/4TH6" will be used for the training component.

These assembly instructions contain important information on the safe and appropriate transport, assembly, maintenance, disassembly and simple troubleshooting of the pilot control unit TS-…/4TH6.

The original assembly instructions were prepared in German.

Please note that the operating instructions for the DS4 hydraulic training system are an indispensable part for compliance with occupational health and safety regulations for the entire handling of the DS4 hydraulic training system.

1.1 Related documents

Please also observe the following documents:

- Data sheet RE 64555 "Hydraulic pilot control units for arm rest installation".
- Operating instructions RE 00225-B "DS4 hydraulic training system"
- Data sheet RE 64020 "Hydraulic valves for mobile applications"

Please also observe the generally applicable, legal or otherwise binding regulations of the European or national legislation and the regulations on accident prevention and environmental protection applicable in your country.

If you need more help, please contact your local foreign subsidiary which you can find at:
www.boschrexroth.com

1.2 Abbreviations used

Abbreviations used

Abbreviation	Meaning
RE	Rexroth document number
MON	Assembly instructions
DCA	Drive & Control Academy
MNR	Material number
TS	Training system
DS4	Didactics system 4 (hydraulic training system)
TH	Télécomande Hydraulique
T	Tank port
P	Pump port

2 General safety instructions

The TS-…/4TH6 pilot control unit was designed and manufactured according to the generally accepted state-of-the-art. There is, however, still a risk of personal injury and damage to property if the general safety instructions and warnings contained in these assembly instructions are not observed.

Please observe the following information:

- Read these assembly instructions completely and thoroughly before working with the pilot control unit.
- Read the operating instructions for the DS4 hydraulic training system before working with the DS4 training system and the TS-…/4TH6 pilot control unit. Please observe particularly chapter 2 "Safety instructions".
- Keep the assembly instructions in a location where they are accessible to all users at all times.
- Always include the assembly instructions when you pass the TS-…/4TH6 pilot control unit on to third parties.

2.1 Intended use

The TS-…/4TH6 pilot control unit may generally only be used as component for setting up hydraulic exercises at the DS4 training system.

It is technical equipment for hydraulic experts or for persons under the supervision of such qualified persons.

The pilot control unit is intended for the set-up of exercises and simulations according to the Bosch Rexroth project manuals available for that purpose or comparable exercise arrangements in order to impart knowledge and skills in the area of hydraulics in the industrial and technical training and further development.

The TS-…/4TH6 pilot control unit is not intended for private use.

The intended use also includes that you have completely read and understood this information and direction for use, in particular chapter "2 General safety instructions".

Deviating from the general rule, use as component for setting up exercises at other training systems is possible provided that:

- There are the same brackets for the mechanical system,
- Identical quick release couplings are used,
- The identical performance limits as specified in the technical data are complied with,
- Equal superior safety equipment is available and effective.

2.2 Improper use

Any use of the TS-…/4TH6 pilot control unit other than described in chapter “Intended use” is considered as improper.

The operation of hydraulic hoses outside their life cycle is prohibited.

Any non-professional use of the product is prohibited during the practical exercises and outside the training sessions.

2.3 Safety instructions in these assembly instructions

In these assembly instructions, there are safety instructions before the steps whenever there is a risk of personal injury or damage to the equipment. The measures described for the prevention of dangers must be observed.

Meaning of signal words

Signal word	Application
WARNING! 	Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or even death.

2.4 Adhere to the following instructions

For safety in general

- Observe the regulations on accident prevention and environmental protection for the country where the product is used and at the workplace.
- Check the product for visible defects, for example cracks in the housing or missing lead seals, screws, covers or seals.
- Exclusively use Rexroth products in technically perfect condition.
- Exchange defective quick release couplings immediately.
- Make sure that all hydraulic connections are either used or covered. Commission the product only if it is installed completely.
- Never assemble and disassemble components under pressure! There is a risk of injury from components flying around (missiles) or from leaking oil (oil jet).
- Please observe the information on the pressure relief in the project manual.

For your personal safety

- Persons who assemble, operate, disassemble or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to react.
- Working shoes and safety goggles must be worn as personal protective equipment during transport, assembly and disassembly.

To maintain the functionality

- Never relieve the pressure by opening the hydraulic system (fittings).
- When assembling, provide for absolute cleanness in order to prevent contamination from getting into the hydraulic piping and causing product wear or malfunctions.
- Let the product acclimate itself for several hours before commissioning, as otherwise water may condense in the housing.
- Before commissioning, make sure that all the seals and caps of the quick release couplings are installed correctly and undamaged to ensure that fluids and contamination parts are prevented from penetrating the product.
- Close unused Minimess connections using protective caps. Contamination will lead to leakage in the Minimess connection.
- Never try to connect the quick release couplings using force. Set the levers of the pilot control unit into neutral position and ensure pressure relief according to the exercise set-up.

Warranty

- The warranty expires if the product is incorrectly assembled, not used as intended and/or handled improperly.
- Do not change or modify the TS-…/4TH6 pilot control unit.
- Only use the product within the performance limits specified in the technical data.

3 Scope of delivery

Scope of delivery

Quantity	Designation	Mat. no.
1	Training component for the mobile hydraulics, TS-MH2X/4TH6-97 pilot control unit	R961005968
1	Assembly instructions RE 09982-MON in English	R961005945

4 Product description

4.1 Performance description

The pilot control unit allows for the proportional-hydraulic control of directional valves. Two axes are controllable simultaneously by means of a control lever. In this connection the product shows the following features:

- Sensitive actuation
- Low actuating force at the control lever.
- Ergonomic handle

Suitability for teaching and learning contents

Within the scope of industrial training and further development, the TS-…/4TH6 pilot control unit can be used to impart the following contents:

- The mode of operation when controlling mobile hydraulic control blocks, depending on the equipment.
- The influence of the control curves (characteristic curves) of pilot control units on the control behavior.
- The influence of loads; the different load types and their effects on the pilot control.
- The system comparison in individual operation (1 axis) of throttle control, load sensing, LUDV (load-independent flow distribution).
- The different behavior of the 3 control systems, e.g. their load sensitivity, response behavior to the lever movement, velocity control.
- The system comparison in parallel operation (2 axes), the degree of mutual influencing of the axes in the relevant control system, the interaction of the pilot control of 2 axes with the 4 directions.

Use in exercise manuals

The TS-…/4TH6 pilot control unit can be used to set up exercises at the "DS4" hydraulic training stand, which - at the time of printing - are described in the following project manuals:

- "Mobile hydraulics throttle control" project manual:
  Trainer manual RE 00886; trainee manual RE 00887.
- "Load sensing" project manual:
  Trainer manual RE 09970; trainee manual RE 09971.
- "Load-independent flow distribution" project manual:
  trainer manual RE 09972; trainee manual RE 09973.

4.2 Unit description

The TS-…/4TH6-97 pilot control unit consists of:

- 1 block into which 4 pressure reducing valves are integrated,
- 1 ergonomically formed hand lever for the 4 control directions,
- 6 quick release couplings for hydraulic connections,
- Retaining sheet with suspension lug.

Inlet pressure The inlet pressure is supplied via port "P".

Pressure reducing valves The pressure reducing valves consist of a control spool, a control spring, a return spring and a plunger. They change the pilot pressure for the control of the directional valves.

Control lever The control lever is used to activate and/or deactivate the pressure reducing valves.

Pilot ports In the de-energized condition, the control lever is held in zero position by four return springs. In the zero position of the hand lever, the pilot ports are unloaded via the tank port "T". Upon deflection of the hand lever, the plunger presses against the return spring and the control spring. The control spring pushes the control spool downwards and thus closes the relief line to port "T" and in this way controls the specified pressure at the pilot ports.

Quick release couplings Every quick release coupling contains a check valve which opens upon insertion of the counterpart and automatically closes upon its removal.

Control curve The pilot control units are generally available with different control curves. The control curve with characteristic "97" has been integrated into this product. One feature of this control curve is the high degree of utilization of the actuation angle at the hand lever as proportional actuating range. From 0° to (2-3)° of the actuation angle, a step has been integrated into the control curve for positive overlap in the 10 % flow range. This prevents unwanted movements of the axes caused by vibrations at the hand lever.

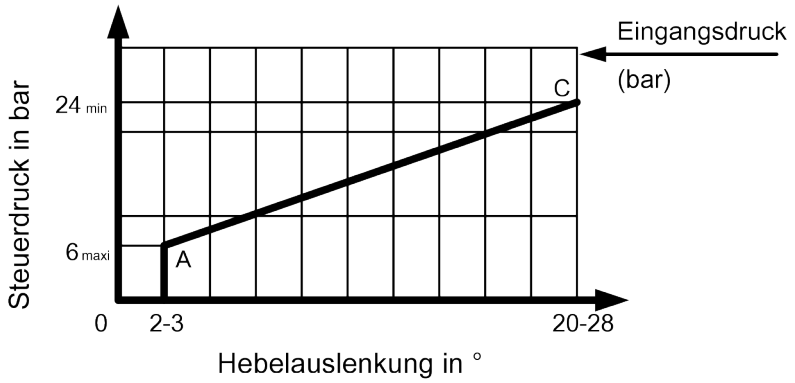


Fig. 1: Control curve according to characteristic 97

Control curve according to characteristic 97

Number of operated actuators		1	2
Actuating torque in Nm	A	0.72	1.44
	C	2.45*	4.91*

*p = 35 bar

The specified actuating torques are theoretical values, the resistance of the bellows has not been considered.

Functional principle in detail

For a more detailed description of the hydraulic functional principle please refer to the data sheet: RE 64555 "Hydraulic pilot control units for arm rest installation".

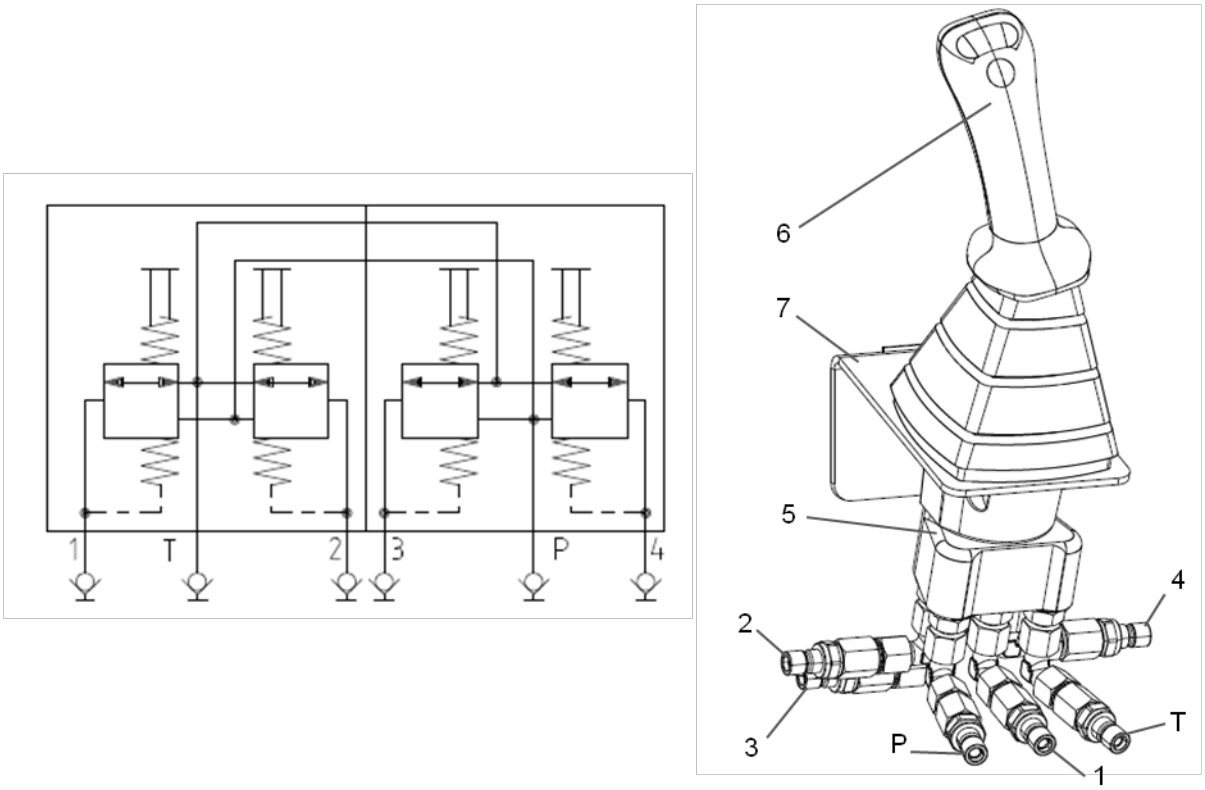


Fig. 2: Pilot control unit type 4TH6

1 Pilot port "1"
2 Pilot port "2"
3 Pilot port "3"
4 Pilot port "4"
5 Housing with pressure reducing valves
6 Control lever
7 Retaining sheet
P Port for pressure line
T Port for relief line

4.3 Product identification

The training component is identified by means of the attached name plate.

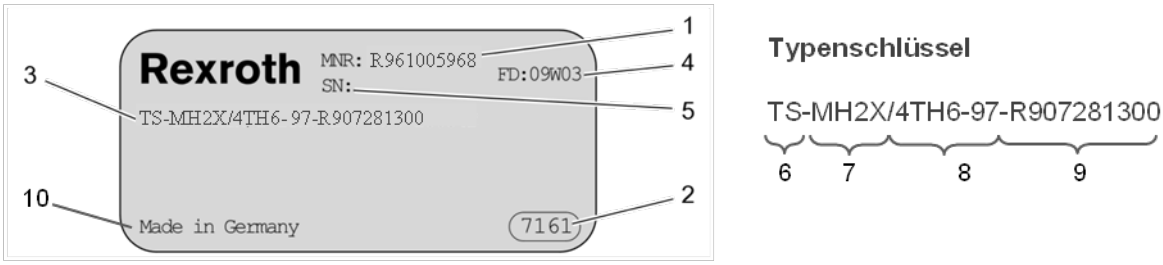


Fig. 3: Name plate and type key

1 Material number of the training component

2 Internal code for area / works number

3 Type designation of the training component

4 Date of manufacture

5 Serial number (placeholder)

6 TS training system assignment

7 MH - mobile hydraulics, 2X - assignment

8 4TH6-97 – functional code, industrial serial product

9 R907281300 – material number, industrial serial product

10 Designation of origin

5 Transport and storage

- When storing and transporting the product, always observe the ambient conditions specified in chapter 10 "Technical data".

Short-term storage

For safekeeping between exercises, the pilot control unit should be fastened at the component rack.

- Fasten the pilot control unit at the component rack as described in chapter 6.1.
- Make sure that the hydraulic lines can hang freely.
- Make sure that all hydraulic connections are covered.
- Make sure that there is an oil tray under the pilot control unit for collecting the leaking residual oil.

Permanent storage

- In case of permanent storage, provide for straight laying of the hoses. The minimum bending radius must always be observed.

6 Assembly

6.1 Assembling the pilot control unit

Preparation for assembly

- Remove the component from its packaging.
- Dispose of the packaging in accordance with the national regulations.
- Carry out a visual inspection of the component.
- Make sure that the hydraulic lines are not damaged and that their life cycle has not been exceeded.

Mounting the pilot control unit

The bracket at the component is prepared for a 50 x 50 mm grid as it is available at the DS4 training system and the component rack.

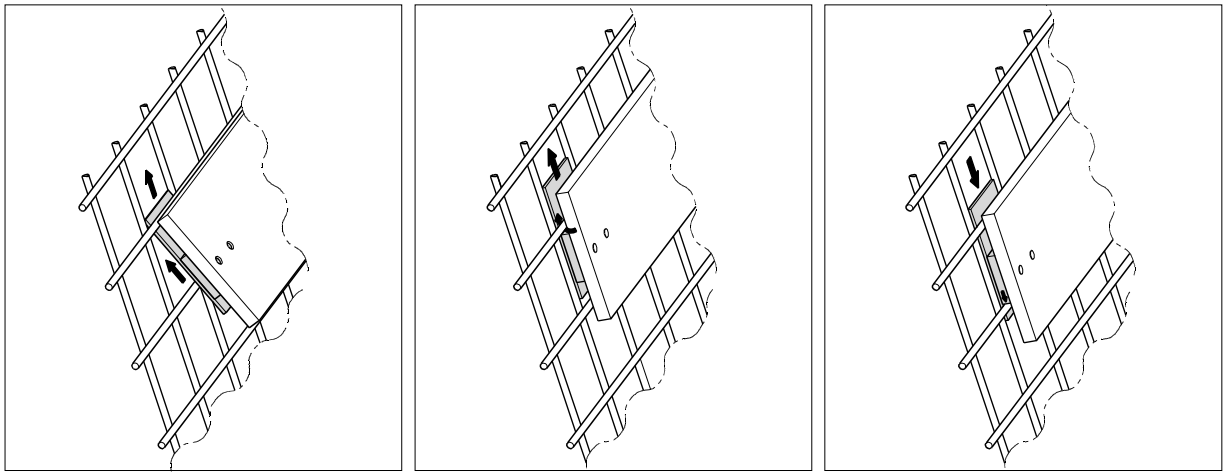


Fig. 4: Attaching, lifting and lowering the component

- Grab the pilot control unit safely with both hands.
- Attach the retaining sheets of the pilot control unit between two longitudinal wires at the grid.
- Lift the pilot control unit to the upper stop and in this lifted position, tilt it downwards to the grid.
- Lower the pilot control unit to the lower stop of the spacer sheet.
- Check the safe support of the components:
  Now, the entire surface of the pilot control unit must rest against the grating. The retaining sheets at the top and at the bottom must be fully engaged with the cross bars of the grid.

  The component is now safely attached to the DS4 mounting grid.

6.2 Hydraulically connecting the pilot control unit

The component is hydraulically connected according to the specifications on the exercise set-up regarding the quick release couplings at the training component.

7 Disassembly and exchange

Considering the exercise set-up before the disassembly, the TS-.../4TH6 pilot control unit is to be brought into a hydraulically depressurized condition.

Disassembly

- Cause a depressurized condition according to the exercise set-up.

WARNING!

Risk of intoxication and injury!

Hydraulic oil spurting out under high pressure may cause most severe injuries!

- Never disassemble the pressure lines using force.
- Before opening, depressurize the system.
- Be very careful when opening the system despite completed pressure relief.
- Works at the hydraulic system may only be performed by a hydraulic expert.

- Interrupt the connection to other components by loosening the quick release couplings.
- Grab the pilot control unit with both hands and push it to the upper stop.
- In the lifted position, tilt the pilot control unit away from the grid.
- Now loosen the pilot control unit from the grid by pulling it diagonally downwards.

The pilot control unit is now disassembled.

8 Disposal

Careless disposal of the pilot control unit and the hydraulic fluid could lead to environmental pollution.

Please observe the following:

- Thus, dispose of the TS-.../4TH6 pilot control unit and the hydraulic fluid in accordance with the currently applicable national regulations in your country.
- Dispose of hydraulic fluid residues according to the safety data sheet for this hydraulic fluid.

The pilot control unit consists of the following materials:

- Rubber
- Steel
- Oil residues
- Aluminum
- Plastic

9 Troubleshooting

In case of malfunctions, re-check the exercise set-up first. Failures are almost always attributable to non-compliance with the specifications in the exercises.

Malfunction list TS-.../4TH6 pilot control unit

Fault	Cause	Remedy
Couplings cannot be inserted or only with difficulties	Pressure was not discharged	Depressurize the system - Bring the pilot control unit into the neutral position Consider the exercise set-up
The hand lever at the pilot control unit is stiff	The relief line at "T" is not connected	Connect the relief line at "T"
Leakage at the quick release couplings	Mechanical damage at the quick release couplings	Exchange of the quick release coupling

10 Technical data

General data

General data TS-MH2X/4TH6-97 pilot control unit

Denomination	Unit	Value
Dimensions (length x width x depth)	mm	213 x 405 x 184
Weight	kg	5.0
Type of mounting	Can be hooked into grid 50 x 50 mm	

Hydraulic data

Hydraulic data TS-MH2X/4TH6-97 pilot control unit

Denomination	Unit	Value
Max. adm. inlet pressure	bar	50
Max. control pressure	bar	35
Control curve	Characteristic 97 (see chapter 4.2)	
Max. adm. pilot flow	l/min	16
Operating temperature	°C	20 - 60
Hydraulic fluid	See operating instructions of the DS4 training system	
Hydraulic fluid temperature	See operating instructions of the DS4 training system	
Hydraulic connections	Quick release coupling with connector, type W	

Storage and application conditions

Storage and application conditions TS-MH2X/4TH6-97 pilot control unit

Denomination	Unit	Value
Ambient temperature	°C	15 – 30
Maximum humidity	%	90 (at 20 °C)
Maximum altitude of the location	m	1000 above sea level

Technical data

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Printed by Bosch Rexroth
R961005945/2011-12