rexroth
A Bosch Company

Operating instructions

Hydraulic power unit

CytroBox

RE 51057-B, Edition: 2024-12, Replaces: 11.19

The data specified above only serve to describe the product. As our products are constantly being further developed, 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 configuration. The product supplied may therefore differ from the figure shown.

The original operating instructions were prepared in German.

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1 About this documentation

1.1 Validity of the documentation

This documentation applies to the following product:

- Hydraulic power unit CytroBox (for material numbers, refer to data sheet 51057)

These operating instructions apply only to the hydraulic power unit as such. If the basic device is operated with other attachments, e.g. hydraulic control or accumulator station, documentation is required for the entire scope of delivery.

This documentation is intended for assemblers, operators, service engineers and system end-users and machine and system manufacturers.

This documentation contains important information on the safe and proper transport, assembly, commissioning, operation, use, maintenance, disassembly and simple troubleshooting of the hydraulic power unit.

- ▶ Read this documentation carefully, in particular chapter 2 "Safety instructions" on page 11 and chapter 3 "General information on damage to property and damage to product" on page 18, before working with the hydraulic power unit.

1.2 Required and amending documentation

- ▶ Also observe the operating instructions and documentation of the overall machinery/system.
- ▶ The hydraulic power unit must not be commissioned until you have been provided with the documentation marked with the book symbol 🕮 and you have understood and observed it.

Table 1: Required and amending documentation

	Title	Document number	Document type
🕮	**Hydraulic power unit CytroBox** Includes technical data, operating conditions, performance limits and project planning information.	51057	Data sheet
🕮	**Pressure relief valve, direct operated; type DBD** Includes technical data, operating conditions and performance limits.	25402	Data sheet
🕮	**Pressure relief valve, direct operated (safety valve according to Pressure Equipment Directive 2014/68/EU); type DBD...1X/..E** Includes amending information on data sheet 25402.	25402-B	Operating instructions
	Hydraulic fluids based on mineral oils and related hydrocarbons Describes the requirements on hydraulic fluids on mineral oil basis and related hydrocarbons for operation with Rexroth hydraulic components and helps you to select a hydraulic fluid for your hydraulic system	90220	Data sheet

Title	Document number	Document type
Environmentally compatible hydraulic fluids Includes application notes and requirements for Rexroth hydraulic components.	90221	Data sheet
Sytronix, SvP 7020 IMC, variable speed pump drives Includes a description of how to commission SvP 7020 IMC.	62311-IB	Description of the commissioning
Sytronix, SvP 7020 IMC, variable speed pump drives Includes information on the electric drive system.	R911377187 (DE), R911377189 (EN)	Operating instructions
Axial piston units A10FZO, A10VZO and A10FZG, A10VZG; Series 10 for variable-speed drives Includes technical data, operating conditions, performance limits and project planning information.	91485	Data sheet
Axial piston units A10FZO, A10VZO and A10FZG, A10VZG; Series 10 for variable-speed drives Includes amending information on data sheet 91485.	91485-B	Operating instructions
MS2N synchronous servo motors Includes information for the operating, service and maintenance personnel and basic instructions on installation, operation and maintenance of the motors.	R911347580 (DE), R911347581 (EN)	Operating instructions
MS2N synchronous servo motors Explains the product properties, possible applications, application conditions and operating limits of the motors, includes the data of the available motors and gives information on product selection, handling and operation.	R911347582 (DE), R911347583 (EN)	Project planning instructions
Rexroth IndraDrive, drive controllers, power parts HCS03 Includes concise information on the installation and operation of the drive controllers of power parts HCS03.	R911327655 (DE), R911319656 (EN)	Instructions for use
Rexroth IndraDrive, drive controllers, power parts HCS03 Includes information on the installation and operation of the drive controllers of power parts HCS03.	R911339023 (DE), R911339024 (EN)	Operating instructions
Rexroth IndraDrive, control parts CSB02, CSE02, CSH02, CDB02 Includes information on the installation and operation of the control parts CSB02, CSE02, CSH02 and CDB02.	R911338961 (DE), R911338962 (EN)	Project planning description
IndraDrive, MPx-20, functions Describes all functional properties of variants MPB-20, MPM-20, MPC-20 and MPE-20.	R911345607 (DE), R911345608 (EN)	Application description
Rexroth IndraDrive – Integrated safety technology "Safe Torque Off" (from MPx-16) Includes information on the assembly and maintenance, on the correct and safe operation and on the decommissioning of the integrated safety technology "Safe Torque Off" of the IndraDrive drive technology.	R911332633 (DE), R911332634 (EN)	Application description
Rexroth IndraDrive, IndraDrive with PROFINET, example with Siemens SIMATIC S7 This documentation explains the commissioning of the drives: IndraDrive C, IndraDrive M and IndraDrive Cs with PROFINET communication. The connection to the drive for commissioning is established via a SIMATIC control system by Siemens.	R911341342 (DE), - (EN)	Commissioning instructions
Rexroth IndraDrive, IndraDrive with EtherCAT, example with Beckhoff TwinCAT This documentation explains the commissioning of drive controllers of the following drive families: IndraDrive C, IndraDrive M, IndraDrive Mi and IndraDrive Cs with EtherCAT communication in connection with the external control TwinCAT by Beckhoff.	R911341344 (DE), R911341345 (EN)	Commissioning instructions

1.3 Representation of information

Consistent safety instructions, symbols, terms and abbreviations are used in this documentation so that you can quickly and safely work with your hydraulic power unit. For a better understanding, they are explained in the following sections.

1.3.1 Safety instructions

In this documentation, safety instructions are contained in chapter 2.6 "Product- and technology-dependent safety instructions" on page 14 and in chapter 3 "General information on damage to property and damage to product" on page 18, and before any sequence of actions bearing the danger of personal injury or damage to property. The measures described for hazard avoidance must be observed.

Safety instructions are structured as follows:

⚠ SIGNAL WORD

Type and source of danger
Consequences in case of non-compliance
- ▶ Hazard avoidance measures
- ▶ <Enumeration>

- **Warning sign:** Draws attention to the danger
- **Signal word:** Identifies the degree of danger
- **Type and source of danger:** Specifies the type and source of danger
- **Consequences:** Describes the consequences of non-compliance
- **Precaution:** Specifies how the danger can be prevented

Table 2: Risk classes according to ANSI Z535.6-2006

Warning sign, signal word	Meaning
⚠ DANGER	Indicates a dangerous situation which will cause death or severe injury if not avoided.
⚠ WARNING	Indicates a dangerous situation which may cause death or severe injury if not avoided.
⚠ CAUTION	Indicates a dangerous situation which may cause minor to moderate (personal) injury if not avoided.
NOTICE	Damage to property: The product or the environment could be damaged.

1.3.2 Symbols

The following symbols indicate notes which are not safety-relevant but increase the comprehensibility of the documentation.

Table 3: Meaning of the symbols

Symbol	Meaning
	If this information is not observed, the product cannot be optimally used and/or operated.
▶	Individual, independent action
1. **2.** **3.**	Numbered instruction: The numbers indicate that the actions must be carried out consecutively.

1.3.3 Abbreviations

The following abbreviations are used in this documentation:

Table 4: Abbreviations

Abbreviation	Meaning
DBV	Pressure relief valve
EC	EtherCAT
EIP	EtherNetIP
HPU	Hydraulic Power Unit
IMC	Injection Molding Control
NC	Normally Closed
NO	Normally Open
OM	Operation mode
OZ	Ordinal number
PE	Protected Earth
PN	ProfiNet
PoE	Power over Ethernet
RE	Rexroth document in English language
REXXXXXX-B	Rexroth operating instructions in English
SC	Sercos
STO	Safe Torque Off

2 Safety instructions

2.1 About this chapter

The hydraulic power unit was designed and manufactured according to the generally accepted code of practice. However, there is still the danger of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

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

Due to the interaction between the hydraulic power unit and the complete machine, the installation of the hydraulic power unit into the overall machinery/system will result in additional potential hazards. This applies in particular to the influence of hydraulic and electric controls on hydraulic drives generating mechanical movements. It is therefore essential for the manufacturer of the overall machinery/system to have undertaken an independent risk assessment. Furthermore, the manufacturer must on this basis have prepared operating instructions for the overall machinery/system.

These operating instructions do not serve as replacement of the operating instructions of the overall machinery/system.

2.2 Intended use

The hydraulic power unit is a hydraulic system component.

You may use the hydraulic power unit as follows:
The hydraulic power unit constitutes partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC and is therefore not ready for use.
The hydraulic power unit is exclusively intended for integration into a machine or system or for assembly with other components to form a machine or a system.
The hydraulic power unit may be commissioned only if it has been integrated into the machine or system for which it is designed, and if the machine or system fully complies with the requirements of the EC Machinery Directive.
The hydraulic power unit serves for regulated generation of hydraulic flow and hydraulic pressure.

The hydraulic power unit is not considered to be a safety component in the sense of the EC Machinery Directive 2006/42/EC.
The hydraulic power unit must not exceed the operating conditions and performance limits specified in the technical data.

The hydraulic power unit is technical equipment exclusively intended for professional and not for private use.

Intended use includes having fully read and understood this documentation, especially chapter 2 "Safety instructions" on page 11 and chapter 3 "General information on damage to property and damage to product" on page 18.

2.3 Improper use

Any use deviating from the intended use is improper and thus not admissible.

Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

The hydraulic power unit is not suitable for operation in explosive environments.

Improper use of the hydraulic power unit includes
- non-compliance with the technical data, operating conditions, performance limits and environmental conditions specified in data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.
- if you operate the hydraulic power unit with a hydraulic fluid that does not correspond to the specifications in data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.
- use of spare parts that are not approved by the manufacturer.
- mechanical modification of the hydraulic power unit.
- welding or soldering works at the hydraulic power unit.

2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics and hydraulics as well as knowledge of the appropriate technical terms. For transporting and handling the hydraulic power unit, additional knowledge of how to handle lifting gear and the necessary attachment devices is required. In order to ensure safe use, these activities may only be carried out by a corresponding expert or an instructed person under the direction and supervision of an expert.

Experts are those who are able to recognize potential dangers and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant conditions pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary hydraulic and electrical expert knowledge.

Required experts are for example:
- Mechatronics engineer with additional hydraulic training
- Application engineer for parameterization of the drive parameters
- Automation engineer for parameterization of the field bus communication between hydraulic power unit and machine control

Bosch Rexroth offers measures supporting training in specific fields. Please find an overview of the training contents on the internet at: www.boschrexroth.com/de/de/academy

2.5 General safety instructions

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Only use Rexroth products in technically perfect condition.
- Observe all notes on the product.
- Persons who assemble, operate, disassemble or maintain Rexroth products must not be under the influence of alcohol, drugs or pharmaceuticals that may affect their ability to react.
- Only use accessories and spare parts approved by the manufacturer in order to exclude hazards to persons due to unsuitable spare parts.
- Comply with the technical data and environmental conditions specified in the product documentation.
- The installation or use of inappropriate products in safety-relevant applications could result in unintended operating conditions when being used which in turn could cause personal injuries and/or damage to property. Therefore, only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product, or if the safe suitability of the product in the application is confirmed by a separate conformity assessment procedure for the end product, for example, in explosion-protected areas or in safety-related parts of control systems (functional safety).
- Do not commission the product until you can be sure that the end product (for example a machine or system) where the Rexroth product is installed complies with the country-specific provisions, safety regulations and standards of the application.
- Only persons who have been authorized by the machine end-user may be granted access to the direct operating range of the machine/system. This also applies during any standstill of the machine/system.

2.6 Product- and technology-dependent safety instructions

⚠ WARNING

Pressurized hydraulic power unit, pressurized machine/system!
Danger to life! Risk of injury! Severe injury when working at machines/systems that have not been stopped! Damage to property!

- Ensure that all relevant components of the hydraulic system are depressurized and that the electrical control is de-energized and protected from restarting. To do so, observe the specifications of the machine/system manufacturer and/or end-user.
- Do not disconnect line connections, connections or components as long as the hydraulic system is pressurized.
- For commissioning or maintenance work during which safeguards such as fuses, pressure relief valves, etc. have to be deactivated, ensure that measures are taken to ensure that no dangerous situations can arise for persons or property.
- Make sure that all safeguards like fuses, pressure relief valves, etc. of the hydraulic power unit are in place, properly installed and fully functional on re-commissioning, and that the doors of the hydraulic power unit are closed.

High electrical voltage!
Danger to life, risk of injury caused by electric shock or of severe injury!

- Make sure the relevant system part is de-energized when working at the system.
- Secure the system against restarting.
- Operate the hydraulic power unit only with a permanently installed protective grounding conductor.

Leakage of (pressurized) hydraulic fluid and oil mist!
Danger to life! Risk of injury! Explosion hazard! Risk of fire! Environmental pollution! Damage to property!

- Switch the system off immediately (emergency off switch).
- Identify and remedy the leakage.
- Never try to stop or seal the leakage or the oil jet using a cloth.
- Avoid direct contact with the leaking hydraulic fluid.
- Carry out visual inspections for leak-tightness of the hydraulic power unit and the oil-containing components on a regular basis.
- Use your personal protective equipment.
- Keep open fire and ignition sources away from the hydraulic power unit.
- When dealing with hydraulic fluids, you must imperatively observe the manufacturer’s information.
- Make sure that the grounding (electric welding circuit) during welding works at the system is not led via the hydraulic power unit.

⚠ WARNING

Unexpected start-up due to malfunction/incorrect operation!

Danger to life! Risk of injury!

- Ensure that the hydraulic power unit is secured against unexpected start-up.
- Regularly check the hardware and software.
- Make sure that required measures for decommissioning (Safe Torque Off function) are implemented by the machine manufacturer as the hydraulic power unit is not equipped with direct measures (e.g. switches) for decommissioning of the product.

Direct contact with live components in case of faults, e.g. loose terminals, insulation defects, missing grounding, malfunction of fuses or damaged lines, components or terminals!

Danger to life! Risk of injury! Danger caused by electric shock or severe injury!

- Before any maintenance work, de-energize the relevant system part.
- Ensure continuous connection of the protective grounding conductor.
- Observe the operating conditions and performance limits specified in the technical data.
- Work at electric equipment may only be performed by specialized electricians.
- Comply with the recommended inspection and maintenance intervals.
- Close the doors of the hydraulic power unit.

Overheating of the hydraulic power unit!

Danger to life! Risk of injury! Explosion hazard!

- De-energize the relevant system part immediately.
- Correct the cause of overheating.
- Do not use the hydraulic power unit in potentially explosive areas.

Functional restrictions of the hydraulic power unit due to EMC irradiation!

Danger due to uncontrolled machine movements due to electro-magnetic radiation of unshielded connection lines.

- Observe the EMC limit values.
- Only use recommended electrical connection lines according to the EMC Directive and shield the electronics from the source of interference, if necessary.
- Keep the recommended distance to the source of interference.
- Provide for proper, safe PE connection.

Overheating of electric lines and components or short-circuit!

Danger to life! Risk of injury! Risk of fire!

- Observe the operating conditions and performance limits and safeguards specified in the technical data.

⚠ CAUTION

Hydraulic power unit has hot surfaces (motor, pump, block, valves, electronics components)!

Risk of injury! Risk of burning!

- Allow the hydraulic power unit to cool down sufficiently before touching it.
- Wear heat-resistant gloves or protective clothing. During or after the operation, temperatures may rise to values higher than 60 °C, depending on the operating conditions.
- Observe the protective measures of the machine/system manufacturer and/or operator.
- Make sure that all doors are closed during operation.

Leaked hydraulic fluid, oily surfaces!

Risk of injury! Slip hazard!

- If no separate hydraulic room is available, set up the hydraulic power unit in an external oil pan.
- Protect and mark the danger zone.
- Immediately remove hydraulic fluid that has leaked out.
- Use an oil binding agent in order to bind the leaked hydraulic fluid.
- Remove and dispose of the contaminated oil binding agent, see chapter 13 "Disposal" on page 112.
- Wear the personal protective equipment prescribed for your activity.
- Perform a leak test.

Contact with hydraulic fluid!

Health hazard/impairment of health, e.g. eye injuries, skin lesions, intoxication upon inhalation or due to swallowing, sensitization!

- Avoid contact with hydraulic fluids.
- When dealing with hydraulic fluids, you must imperatively observe the safety instructions of the hydraulic fluid manufacturer.
- Use your personal protective equipment (like e.g. safety goggles, protective gloves, suitable working clothes, safety shoes).
- If nevertheless hydraulic fluid comes into contact with the eyes or gets into the bloodstream or is swallowed, please consult a doctor immediately.

Electro-magnetic/magnetic fields!

Health hazard for persons with cardiac pacemakers, metal implants or hearing aids!

- Make sure that above specified personnel are prevented from accessing areas where drive components are installed and operated or only permit it after consultation with a doctor for approval.

⚠ CAUTION

Loud noise due to high sound pressure level (in case of malfunction)!
Danger of hearing damage (temporary/permanent), stress/loss of attention!
Fault in voice communication and acoustic signals!

- ▶ Wear your ear protection.
- ▶ Consult the machine manufacturer or Bosch Rexroth to identify any malfunction if applicable.
- ▶ Make sure that all doors are closed during operation.

2.7 Personal protective equipment

During operation and maintenance work as well as during installation and removal of the hydraulic power unit, always wear the following personal protective equipment:

- Heat- or cold-resistant protective gloves
- Ear protection
- Safety shoes
- Perfectly fitting safety goggles
- Protective helmet

2.8 Obligations of the machine end-user

In order to ensure safety when handling the hydraulic power unit and its components, the machine end-user of the system must:

- guarantee the intended use of the hydraulic power unit and its components as described in chapter 2.2 "Intended use" on page 11.
- instruct the operating personnel regularly in all items of the operating instructions and make sure that they are observed.
- ensure compliance with the instructions on occupational safety and with the operating instructions.
- ensure compliance with operating data (admissible operating temperature, maximum operating pressure).

The machine end-user of the Bosch Rexroth hydraulic power unit is obliged to provide personnel training on a regular basis regarding the following subjects:

- Observation and use of the operating instructions as well as the legal regulations.
- Intended operation of the Bosch Rexroth product.
- Observation of the instructions of factory security officers and of the operating instructions of the machine end-user.
- Behavior in case of emergency

3 General information on damage to property and damage to product

The warranty only applies to the delivered configuration. The claim to warranty expires if the product is assembled, commissioned and operated incorrectly, not used as intended and/or handled improperly.

NOTICE

Danger due to improper handling!
Damage to property!
- Only operate the hydraulic power unit according to chapter 2.2 "Intended use" on page 11.
- Do not expose the hydraulic power unit to any mechanical loads under any circumstances.
- Do not place/put any objects on top of the hydraulic power unit.
- Never use the hydraulic power unit and/or brackets mounted to the hydraulic power unit for electric or hydraulic lines as a handle or step.
- Do not apply any external loads to the hydraulic power unit.

Unauthorized changes to the drive parameters!
Damage to property!
- Only change the parameters specified in chapter 8.1.8 "Commissioning of the "electronics"" on page 81 according to your application and system requirements.
- Coordinate the changes to other parameters with the Bosch Rexroth customer service.

Operation with insufficient hydraulic fluid!
Damage to property!
- When commissioning or re-commissioning the machine/system, the oil tank as well as the suction and working lines of the hydraulic power unit and the components must be filled and remain filled with hydraulic fluid during operation according to manufacturer's specifications.
- Observe the machine/system manufacturer's specifications regarding the point "Control of the hydraulic fluid" and the prescribed remedial measures for the control result.

Leaking or spilled hydraulic fluid!
Environmental pollution and contamination of the ground water!
- Use an oil binding agent in order to bind the leaked hydraulic fluid.
- When filling or draining the hydraulic fluid, make sure that there are collecting containers with a sufficiently large volume.
- Observe the information in the safety data sheet of the hydraulic fluid and the machine/system manufacturer regulations.

NOTICE

Mixing hydraulic fluids!

Damage to property!

- Generally avoid any mixing of hydraulic fluids of different manufacturers and/or of different types of the same manufacturer.
- Check the compatibility of the various hydraulic fluids and their compatibility with the components and seals. Mixing of hydraulic fluids may occur, for example, due to hydraulic fluid residues in a component.

Contamination by fluids and foreign particles!

Early wear and malfunctions!

Take the following measures to protect the hydraulic power unit:

- During assembly, provide for cleanliness in order to prevent foreign particles e.g. welding beads or metal chips from getting into the hydraulic lines and causing wear or malfunctions in the hydraulic power unit.
- Make sure that all connections, hydraulic lines and attachment parts (e.g. measuring devices) are clean and free of chips.
- For removing lubricants or any other contamination, use industrial residue-free wipes.
- Only complete cleaning processes at the hydraulic power unit if the hydraulic connections are closed.
- Before commissioning, ensure that all hydraulic and mechanical connections are connected and that all seals and closures of the plug-in connections are correctly installed and undamaged.
- Ensure that no contamination is able to penetrate when sealing the measuring ports.

Improper cleaning!

Damage to property!

- Cover all openings with the appropriate protective threads in order to prevent cleaning agents from penetrating the system.
- Check that all seals and electric plug-in connections are firmly fitted to prevent the penetration of cleaning agents.
- Do not use aggressive and/or highly inflammable cleaning agents for cleaning. Clean the hydraulic power unit using a suitable cleaning liquid.
- Do not use a high-pressure washer.
- Do not use compressed air for the cleaning at functional interfaces.

Environmental pollution caused by incorrect disposal!

Environmental pollution! Damage to property!

- Dispose of the hydraulic power unit, the hydraulic fluid and the packaging in accordance with the applicable national regulations in your country.
- Dispose of the hydraulic fluid according to the applicable safety data sheet of the hydraulic fluid.

4 Scope of delivery

Included within the scope of delivery:
- Hydraulic power unit CytroBox
- Compressor cooler with cable set (optional)
- Operating instructions (this document) including EC declaration of incorporation
- or operating instructions for the hydraulic power unit including attached devices, e.g. hydraulic control, accumulator station
- Electric circuit diagram
- Line connector for port 20X1
- Mating connector for port 21X1
- Network cable for port 22X1
- Coupling socket for filling coupling
- 2 x adapter angle for water connection QR2-S-RVA-DA12-DA12

For required and amending documentation, refer to chapter 1.2 on page 7.
For further information on optionally available components and accessories, see data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

5 Product information

5.1 Performance description

Fields of application

The CytroBox is a drive system for hydraulic machines in a modular design, which was developed as a decentralized hydraulic supply unit for general mechanical engineering for the medium performance range from 7.5 to 30 kW.

Design

All built-in components of the CytroBox, such as the flow-optimized downsized oil tank or the compact MSN2 synchronous servo motor, are combined in one housing which can be integrated in existing production lines in a space-saving manner thanks to its small base area.
The powder-coated housing is sound-insulated and equipped with an integrated polymer concrete foundation with oil pan and drain function.
The aluminum mounting bracket used enables flexible connection of accessory components.
Optionally, the oil volume can be expanded via an additional oil tank connection or operation in the system network (master/slave).

Low noise level

The airborne sound is absorbed by the compact arrangement of all the components in one housing and by the built-in sound insulating mats. In order to reduce noise emissions from the area of structure-borne noise, the motor-pump assembly is rigidly affixed to a polymer-concrete foundation.

Cost-effective operation

The drive controller of the variable speed pump drive ensures dynamic adjustment of the power/speed and the flow to current requirements to reduce the operating costs. Consequently, the speed is reduced under partial or zero load to save energy and increased under full load with a highly dynamic response. This saves up to 80 percent of energy compared to constantly driven hydraulic power units.

Cooling

The electrical cabinet is air-cooled. The MSN2 synchronous servo motor is liquid-cooled.

The following options are available for cooling the MSN2 synchronous servo motor and the hydraulics or hydraulic fluid:

- Connection of an external cooling circuit via the "Water on" and "Water off" ports on the hydraulic cabinet
- Connection of an external cooling circuit via the "Water on" and "Water off" ports on the hydraulic cabinet and an additional water valve for the demand-dependent supply of the cooling water, which is installed ex works (by Bosch Rexroth) in the hydraulic cabinet
- Cooling of the hydraulic fluid and the MSN2 synchronous servo motor by a circulation circuit with a plate heat exchanger
- Cooling of the hydraulic fluid and the MSN2 synchronous servo motor by an internal cooling circuit with a compressor cooler (oil-air)

The hydraulic power unit requires a cooling water connection if it is powered without extension by a compressor cooler (optional).
The oil temperature can be set by means of parameters.

Decoupling of the cooling circuit between the CytroBox and a central cooling water supply is possible via an optional dirty water assembly (additional internal cooling circuit).

Sensor technology

Usually, the following sensors, on which the basic functions of the Cytrobox are based, are built into the system:
- Pressure sensor for pressure control
- Filling level sensor in the oil tank
- Temperature sensor in the oil tank
- Pressure sensors for the identification of filter contamination

Optionally the system can be extended by the following sensors and thus also by functions:
- Flow sensor in the drain line of the pump for leakage flow monitoring
- Temperature sensor in the drain line of the pump for leakage oil monitoring
- Sensor for detecting water content in the oil tank
- Sensor for the identification of the dissolved air proportion in the oil tank for the degassing function
- Particle sensor for the identification of contamination in the hydraulic fluid
- Leakage sensor in the oil pan

Current data and limit values can be read via the Multi-Ethernet interface, e.g. Sercos or PROFINET, and forwarded to the higher-level machine control. This ensures reading of all parameters required for condition monitoring / online diagnosis.

The operating condition of the hydraulic power unit is indicated on the integrated LED status display as well as on the display of the drive controller.
Possible status messages are:
- Ab = drive is ready
- AF = drive in closed-loop control
- AU = drive in operation under control

A description of the operating unit integrated in the control section of the drive controller and of possible operating states of the hydraulic power unit are provided in chapter 5.3.1 "Drive controller" on page 24.

Optionally available

Optionally, the following components are available:
- Hydraulic control, type IH20
- Accumulator station
- Customer-specific hydraulic control

5.2 Product description

The CytroBox is a hydraulic supply unit with servo technology on the motor side, axial piston pump and an intelligent drive controller.

The high degree of efficiency of the manifold block also contributes to efficient operation.

Thanks to the flow-optimized design of the oil tank, the required hydraulic fluid volume was reduced to 150 liters. The polymer concrete foundation used and rigidly connected to the drive unit, as well as the closed housing, significantly reduce the operating noise.

The oil pan integrated into the polymer concrete foundation collects minor internal leakages and prevents hydraulic fluid from flowing out into the environment.

Equipped with a sensor package and open interfaces, the CytroBox is predestined for use in connected environments. Integrated and wired sensors provide information on the current filter, oil or drive condition. The collected data is subsequently processed by the drive controller, and with the help of the multi-Ethernet interface, can then be conveniently further processed and integrated into modern machine design.

In addition, the CytroBox offers a connectivity option for machine end-users. With CytroConnect Solutions, you always have an eye on the state of your CytroBox. This intelligent condition monitoring solution permanently monitors the condition of your CytroBox and analyzes important parameters such as the filter, oil or drive condition. Thanks to integrated IoT connectivity and the secure 4G interface, data processing can be seamlessly integrated into modern machine designs.
Our user-friendly dashboard (app.cytroconnect.com) gives you access to live and historical data to make informed decisions and maximize the operating time of your machines. This allows maintenance work to be planned at an early stage and unplanned standstills to be avoided.
Bosch Rexroth provides the data acquisition hardware ex-works and the results of the rules-based analysis are available to you as warning messages in the dashboard and as emails. Additional services, such as innovative component analysis or digital maintenance documentation, can further reduce the risk of plant downtimes.
All services can be booked and combined flexibly by you.

For further information on the features and access to the CytroConnect service, visit our website:
www.CytroConnect.com

Additional information on the CytroConnect contract terms and conditions can be found in the General Terms and Conditions for DATA MANAGEMENT SERVICES of Bosch Rexroth AG under the following link:
www.boschrexroth.com/de/de/rechtliche-hinweise

The hydraulic power unit primarily serves for the regulated generation of hydraulic flow and hydraulic pressure.
Additional functions of the hydraulic power unit are:
- Oil cooling
- Oil degassing
- Provision of data for predictive maintenance
- Optional cooling systems
- Connection with CytroConnect

The system conditions are indicated by means of the integrated LED status display, see Fig. 5, item 3 on page 47 and on the display of the drive controller, see Fig. 1 on page 24 and Fig. 7 , item 16 on page 49.

5.3 Functional description

5.3.1 Drive controller

The drive controller is the central control unit. It controls, regulates and monitors the operation of the drive unit. When faulty states are detected, they are reported and reacted to as defined. This may result in the shutdown of the CytroBox. Access to the parameters is possible by the PC-based project planning tool IndraWorks DS. Depending on the type of control communication used, IndraWorks is connected either via the service interface of the control system or directly with the drive controller.

You will find further information on this later in this chapter and in chapter 8.1.8 "Commissioning of the "electronics"" on page 81.

Operating unit of the drive controller

The control part of the drive controller, see Fig. 7, item 14 on page 49, is equipped with an operating unit. On its 8-digit display, operating states, activated commands and error diagnoses and any active warnings and error messages are shown. The keys can be used to adjust settings, view information and execute certain commands.

Fig. 1: Operating unit with 8-digit display (standard display)

A detailed functional description of the operating unit is provided in the application description "IndraDrive, MPx-20, functions", see chapter 1.2 "Required and amending documentation" on page 7.

Table 5: Possible operating conditions on the display of the control part

Number of the drive in the control communication bus system	Message	Description
1	bb	Ready for operation
1	Ab	Drive is ready
1	AF	Drive enable
1	AH	Drive stop
1	AU	Drive in automatic mode
1	OM	Operation mode
1	PM	Parameter mode
1	STO	Safe Torque Off active

Further operating conditions and information on the operation of the display are provided in the help function of IndraWorks DS.

Press the enter key to jump to a subordinate menu:

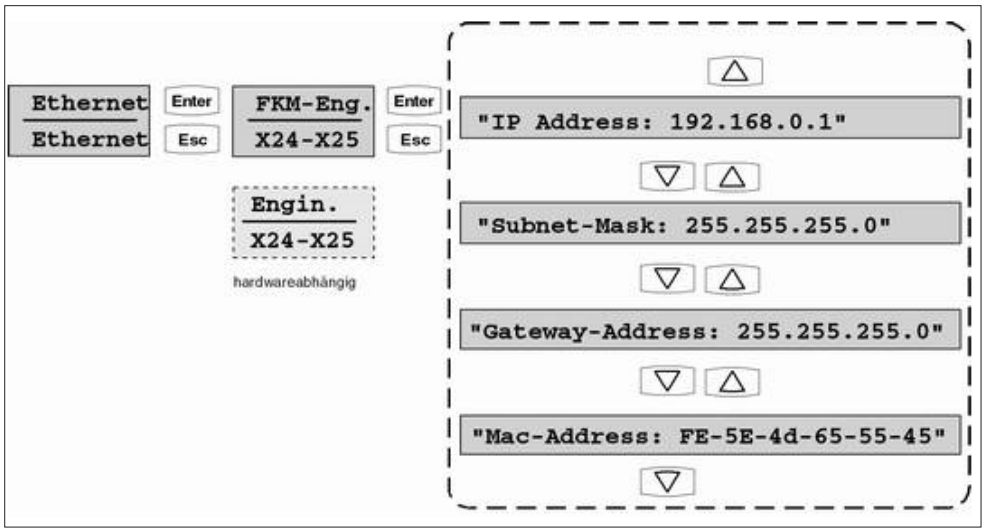


Fig. 2: Example: Display of IP addresses

Application software

The application software enhances the basic functionality of the firmware.
It includes the platform software IMC (Injection Molding Control) and an enhanced HPU (Hydraulic Power Unit).
The following figure shows the rough structure of the application software which is incorporated into the drive controller by means of the soft PLC function (MLD) of the drive controller firmware:

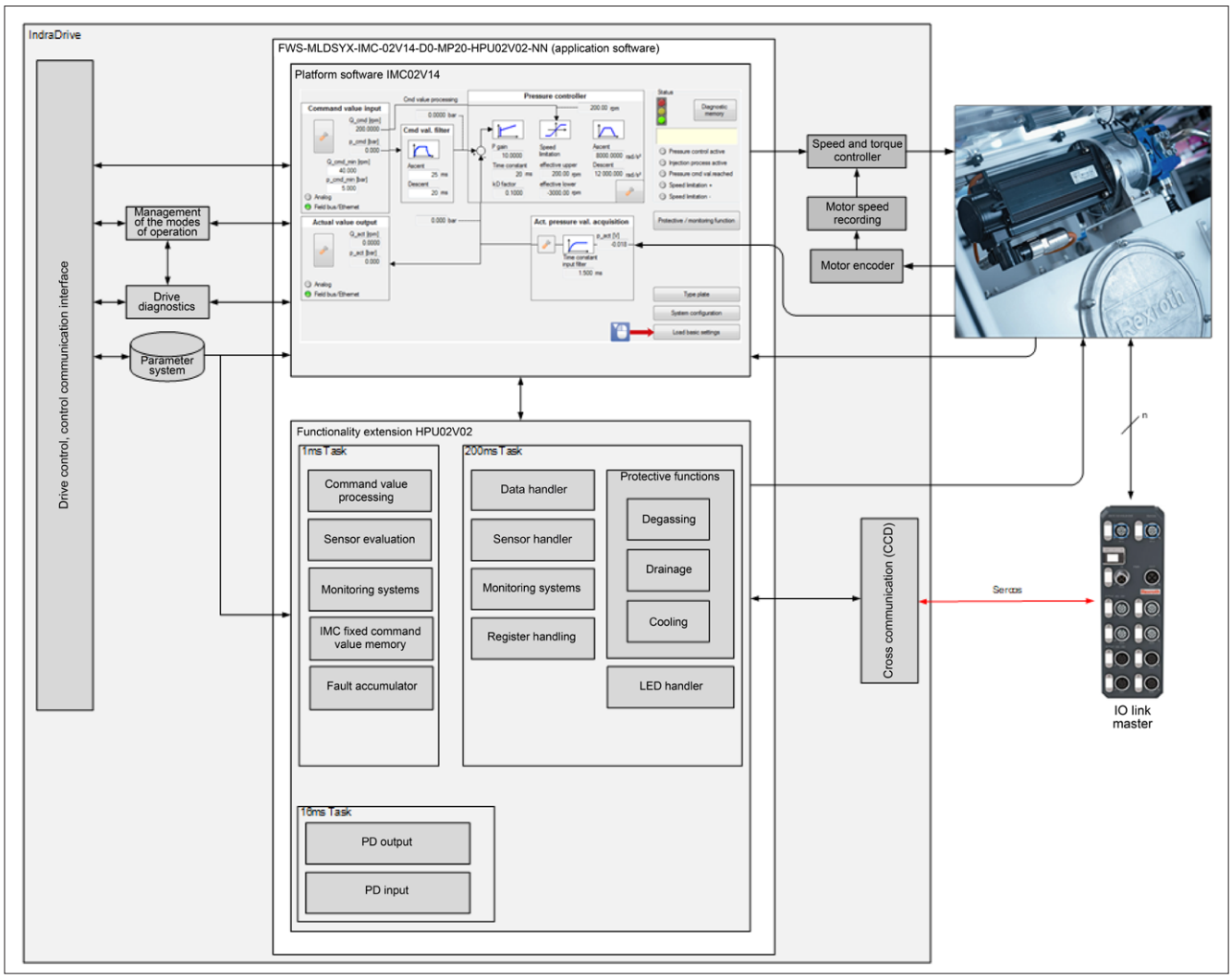


Fig. 3: Structure of the application software

In conjunction with the drive controller, the application software represents the central control unit. Its main task is the control and regulation of the CytroBox as well as its diagnosis.
Version of the application software used:
FWS-MLDSYX-IMC02VRS-D0-MP20-HPU02VRS-NN

Service interface

In connection with the PC-based IndraWorks DS service and commissioning tool, setting, process and diagnostic data can be imported or exported and software updates can be performed via the service interface X26 (in the electrical cabinet of the CytroBox, see Fig. 7, item 15 on page 49). The connection to the PC can be established by a standard RJ45 Ethernet cable.

5.3.2 Sensor evaluation

Sensors are fed via the IO-Link master, and the correct assignment is checked in the drive controller. If no optional sensors are connected, the default value -999 is output.

The sensor at port 1 is necessary for the function while the sensors at port 2 ... 6 are optional sensors. Retrofitting sensors is possible. After their first use, optional sensors are monitored for availability. Thus, the sensor technology can be easily extended in deviation from the condition as supplied.

Table 6: Overview of sensor technology

Sensors	Standard (included in the scope of delivery)	Optional
Pressure sensors (control pressure and pressure differential)	X	
Filling level sensor (oil tank)	X	
Temperature sensor (oil tank)	X	
Contamination sensor (pressure filter)	X	
Leakage flow sensor (pump drain line)		X
Leakage temperature sensor (pump drain line)		X
Water content sensor (oil tank)		X
Air inclusion sensor (oil tank)		X
Particle sensor (hydraulic component)		X
Leakage sensor (oil pan)		X

Oil level and oil temperature

Sensor ABZMS-41-1X/0500/LTD/DC-K24 at port 1 of the IO-Link gateway is used to measure the oil level and the oil temperature in the oil tank.

The measured value for the oil level is scaled linearly from % in liters. The scaling can be adjusted via the parameters P-0-1311[160] – P-0-1311[163]. The oil temperature is displayed in P-0-1279 and the oil level in P-0-1291.

Table 7: Parameters for oil level and oil temperature

Function		Parameter	Description	Unit	Bytes	Decimal points	Default
Oil temperature		P-0-1279	Actual value	°C	4	2	-
	Threshold value	P-0-1389[25]	Warning too low	°C	4	3	5
		P-0-1389[26]	Warning too high	°C	4	3	60
		P-0-1389[27]	Error too low	°C	4	3	0
		P-0-1389[28]	Error too high	°C	4	3	65
Oil level		P-0-1291	Actual value	Liters	4	2	-
	Standardization	P-0-1311[160]	Min.	Liters	4	4	100
		P-0-1311[161]	Max.	Liters	4	4	150
		P-0-1311[162]	Min.	%	4	4	0
		P-0-1311[163]	Max.	%	4	4	100
	Threshold value	P-0-1389[71]	Warning too low	Liters	4	3	90
		P-0-1389[72]	Warning too high.	Liters	4	3	140
		P-0-1389[73]	Error too low	Liters	4	3	85
		P-0-1389[74]	Error too high	Liters	4	3	145

Leakage flow and leakage temperature

The leakage volumetric flow rate and temperature are measured in the drain line of the pump via the SBG232 sensor (optional) on port 2 of the IO-Link gateway.
If the sensor is not present, the value -999 is output for both the leakage flow and the leakage temperature, and warning B323 is issued.
If leakage flow is below 0, the value -999 is output as well.
If leakage flow is below 0.5 l/min, the value 0 is output.
The leakage flow is indicated in P-0-1293 and the leakage temperature in P-0-1294.

Table 8: Parameters for leakage flow and leakage temperature

Function		Parameter	Description	Unit	Bytes	Decimal points	Default
Leakage flow		P-0-1293	Actual value	l/min	4	2	-
	Threshold value	P-0-1389[39]	Warning	l/min	4	3	5
		P-0-1389[40]	Error	l/min	4	3	6
Leakage temperature		P-0-1294	Actual value	°C	4	2	-
	Threshold value	P-0-1389[47]	Warning (75 °C)	°C	4	3	5
		P-0-1389[48]	Error (80 °C)	°C	4	3	6

Dissolved air inclusion

Detection of the dissolved air inclusion is carried out at the oil tank via the VISIPRO DO 120 sensor (optional). It is connected to port 3 of the IO-Link gateway via the analog IO-Link converter DP2200.
If the sensor is not present, the value -999 is output. If the sensor measures an invalid value, -999 is output as well and warning B324 is issued.
The measured value is linearly scaled from mA in mbar. The scaling can be adjusted via the parameters P-0-1311[165] – P-0-1311[168].
The dissolved air inclusion is output in P-0-1270.

The sensor must be conditioned for the respective oil. For this purpose, the measuring cap must be immersed in the respective fluid. This can be done in-service and can take up to two weeks. The measured values are only reliable after conditioning has been completed.

Table 9: Parameters for oil level and oil temperature

Function	Parameter		Description	Unit	Bytes	Decimal points	Default
Dissolved air inclusion		P-0-1270	Actual value	mbar	4	1	-
	Standardization	P-0-1311[165]	Min.	mbar	4	4	0.1
		P-0-1311[166]	Max.	mbar	4	4	600
		P-0-1311[167]	Signal min.	mbar	4	4	3.5
		P-0-1311[168]	Signal max.	mbar	4	4	22
	Threshold value	P-0-1389[7]	Warning	mbar	4	3	190
		P-0-1389[8]	Error	mbar	4	3	300

Particle concentration

The particle concentration is measured by bypass measurement via the OPM II-1X-M sensor (optional). It is connected to port 4 of the IO-Link gateway via the analog IO-Link converter DP2200.
If the sensor is not present, the value -999 is output. If the sensor measures an invalid value, -999 is output as well and warning B326 is issued.
The measured value is linearly scaled from mA in ordinal numbers (OZ). The value is defined by ISO 4406:99. The range is from 2^(x-1) to 2^(x) particles per 100 ml, whereas the value x is displayed in this parameter. The scaling can be adjusted via the parameters P-0-1311[170] – P-0-1311[173].
The measured values for the different particle sizes are transmitted serially on the basis of the analog value. For evaluation purposes, the start pulse is therefore detected if the signal for the start pulse duration (P-0-1311[177]) is above the start pulse threshold values (P-0-1311[176]). The first measured value is accepted after the initial waiting time (P-0-1311[178]), the other values are accepted after the cyclic waiting time (P-0-1311[179]).

Table 10: Parameters for particle concentration

Function	Parameter		Description	Unit	Bytes	Decimal points	Default
Particle concentration		P-0-1292	Average value	OZ	4	2	-
		P-0-1424	Actual value (S)	OZ	2	0	-
		P-0-1389[61]	Warning	OZ	4	3	16
		P-0-1389[65]	Error	OZ	4	3	18
		P-0-1425	Actual value (M)	OZ	2	0	-
		P-0-1389[62]	Warning	OZ	4	3	14
		P-0-1389[66]	Error	OZ	4	3	16
		P-0-1426	Actual value (L)	OZ	2	0	-
		P-0-1389[63]	Warning	OZ	4	3	12
		P-0-1389[67]	Error	OZ	4	3	14
		P-0-1427	Actual value (XL)	OZ	2	0	-
		P-0-1389[64]	Warning	OZ	4	3	10
		P-0-1389[68]	Error	OZ	4	3	12
	Standardization	P-0-1311[170]	Min.	OZ	4	4	0
		P-0-1311[171]	Max.	OZ	4	4	26
		P-0-1311[172]	Min.	mA	4	4	4
		P-0-1311[173]	Max.	mA	4	4	20
	Threshold value	P-0-1311[176]	Starting signal	mA	4	4	3.9
		P-0-1311[177]	Starting signal	ms	4	4	3400
		P-0-1311[178]	Delay	ms	4	4	3500
		P-0-1311[179]	Cycle	ms	4	4	4000

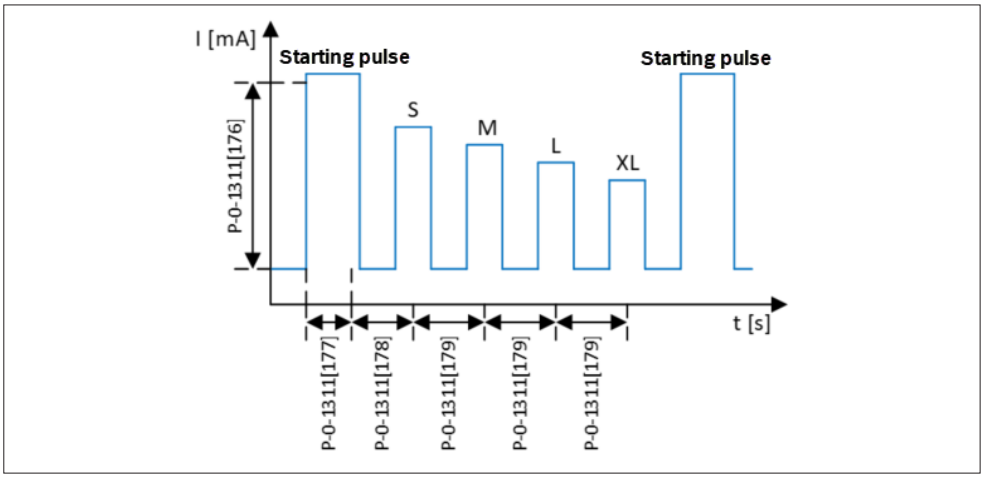


Fig. 4: Configuration of the evaluation of the serial signal of the particle sensor

The average particle content is output via P-0-1292. The individual values of the particle content are output via P-0-1424 (S), P-0-1425 (M), P-0-1426 (L) and P-0-1427 (XL).

Relative oil humidity

Sensor BCM (optional) on port 5 of the IO-Link gateway is used in the oil tank to measure the relative oil humidity.
If the sensor is not present, the value -999 is output. If the sensor measures an invalid value, -999 is output as well and warning B325 is issued.
Relative oil humidity is output in P-0-1272. The measured temperature value of the sensor is not used.

Table 11: Parameters for relative oil humidity

Function		Parameter	Description	Unit	Bytes	Decimal points	Default
Relative oil humidity		P-0-1272	Actual value	%	4	1	-
	Threshold value	P-0-1389[13]	Warning	%	4	3	100
		P-0-1389[14]	Error	%	4	3	130
		P-0-1389[15]	Debouncing time	ms	4	3	0

Fluid detection

Liquid detection is carried out in the oil pan via the sensor LMC110 (optional) on port 6 of the IO-Link gateway.
If the sensor is not present, the value -999 is output. If the sensor measures an invalid value, -999 is output as well and warning B328 is issued.
The value of the detected fluid is output in P-0-1274.

Table 12: Parameters for fluid detection

Function		Parameter	Description	Unit	Bytes	Decimal points	Default
Fluid detection		P-0-1274	Actual value	%	4	1	-
	Threshold value	P-0-1389[12]	Switch-on threshold	%	4	3	-
		P-0-1389[41]	Debouncing time	ms	4	3	-
		P-0-1389[42]	Warning Oil	%	4	3	8
		P-0-1389[43]	Warning Mixture	%	4	3	25
		P-0-1389[44]	Warning Water	%	4	3	70

5.3.3 Monitoring systems

The following monitoring functions are provided:

Oil filter (pressure filter) and return flow filter

The monitoring of the oil filter and of the optional return flow filter are active if the drive controller is enabled and the minimum oil temperature (P-0-1389[29]) for the debouncing time (P-0-1389[24]) has been reached.
This status is established with a cycle time of 200 ms.

For the oil filter, the pressure differential between the filter pressure (P-0-1273) and the system pressure (S-0-0813) is monitored. The monitoring is based on a cycle time of 1 ms.

Table 13: Oil filter monitoring

Message	Threshold value [bar]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning	P-0-1389[30]	P-0-1389[32]	B306	6
Error	P-0-1389[31]		D306	

In addition, the actual pressure value of the return flow filter (P-0-1283) is monitored. The monitoring is based on a cycle time of 1 ms.

Activation/deactivation of the monitoring for oil and return flow filter:
Oil filter: P-0-1380 Bit 20
Return flow filter: P-0-1380 Bit 21
FALSE = not activated; TRUE = activated

Table 14: Return flow filter monitoring

Message	Threshold value [bar]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning	P-0-1389[33]	P-0-1389[35]	B327	-
Error	P-0-1389[34]		D327	

Leakage flow

The monitoring of the leakage flow is active if a measured value via an I/O-Link sensor is present. The monitoring is based on a cycle time of 1 ms.

Table 15: Leakage flow monitoring

Message	Threshold value [l/min]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning	P-0-1389[39]	P-0-1389[38]	B318	11
Error	P-0-1389[40]		D318	

Oil level

The oil level monitoring is always active because the I/O-Link sensor is available as a standard. The monitoring is based on a cycle time of 200 ms.

Table 16: Oil level monitoring

Message	Threshold value [l]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning too low	P-0-1389[71]	P-0-1389[75]	B301	1
Error too low	P-0-1389[73]		D301	
Warning too high	P-0-1389[72]		B300	0
Error too high	P-0-1389[74]		D300	

Oil temperature

The oil temperature monitoring is always active because the I/O-Link sensor is available as a standard. The monitoring is based on a cycle time of 200 ms.

Table 17: Oil temperature monitoring

Message	Threshold value [°C]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning too low	P-0-1389[25]	P-0-1389[24]	B308	8
Error too low	P-0-1389[27]		D308	
Warning too high	P-0-1389[26]		B307	7
Error too high	P-0-1389[28]		D307	

Particle concentration

The monitoring of the particle concentration is active if a measured value via an IO-Link sensor is present. The sensor serially reads in the particle concentration for different particle sizes as an ordinal number. The monitoring interval is therefore specified by the sensor and is 21 s in the default configuration.

Table 18: Particle concentration monitoring

Message	Threshold value [OZ]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning S - 4 µm	P-0-1389[61]	-	B302	2
Error S - 4 µm	P-0-1389[65]		D302	
Warning M - 6 µm	P-0-1389[62]		B303	3
Error M - 6 µm	P-0-1389[66]		D303	
Warning L - 14 µm	P-0-1389[63]		B304	4
Error L - 14 µm	P-0-1389[67]		D304	
Warning XL - 21 µm	P-0-1389[64]		B305	5
Error XL - 21 µm	P-0-1389[68]		D305	

Dissolved air inclusion

The monitoring of the dissolved air inclusion is active if a measured value via an I/O link sensor is present. The monitoring is based on a cycle time of 200 ms.

Table 19: Dissolved air inclusion monitoring

Message	Threshold value [mbar]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning	P-0-1389[7]	P-0-1389[9]	B309	9
Error	P-0-1389[8]		D309	

Relative humidity

The monitoring of the relative humidity is active if a measured value via an I/O link sensor is present. The monitoring is based on a cycle time of 200 ms.

Table 20: Relative humidity monitoring

Message	Threshold value [%]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning	P-0-1389[13]	P-0-1389[15]	B310	10
Error	P-0-1389[14]		D310	

Leakage temperature

The monitoring of the leakage temperature is active if a measured value via an I/O link sensor is present. The monitoring is based on a cycle time of 200 ms.

Table 21: Leakage temperature monitoring

Message	Threshold value [°C]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning	P-0-1389[47]	P-0-1389[46]	B319	12
Error	P-0-1389[48]		D319	

Fluid detection

The fluid detection is active if a measured value via an I/O link sensor is present. A filling level sensor detects whether fluids are present in the oil pan and whether it is oil, water or a mixture. The monitoring is based on a cycle time of 200 ms.

Table 22: Fluid detection

Message	Threshold value [bar]	Debouncing time [ms]	Diagnostic number	Bit in status word (P-0-1412/P-0-1413)
Warning Oil	P-0-1389[42]	P-0-1389[41]	B329	-
Warning Mixture	P-0-1389[43]		B330	
Warning Water	P-0-1389[44]		B331	

Monitoring of digital feedback information

The feedback contacts of the circuit breaker for oil cooling, the circuit breaker for air cooling and the fuse for fan, LED and IPC are monitored.
On the basis of the configuration in parameter P-0-1380 Bit 3-Bit 5, it can be defined in which condition the monitoring is triggered. Monitoring is always triggered when the status of the signal bit in parameter P-0-1400 is identical to the status of the bit in parameter P-0-1380.
If one of the feedback contacts is triggered, a message is issued on the display of the drive controller, see Fig. 7, pos. 16 on 49, and troubleshooting is simplified.

Example: Circuit-breaker of the oil cooling:

Table 23: Example of the configuration of digital feedback information monitoring

Negation P-0-1380 bit 3	Signal P-0-1400 bit 0	Diagnostic number	Contact behavior
FALSE	FALSE	B320	NO
FALSE	TRUE	-	
TRUE	FALSE	-	NC
TRUE	TRUE	B320	

Monitoring is active in the operating mode (OM) and is based on a cycle time of 1 ms.

5.3.4 Fixed command value memory

With the fixed command value mode, it is possible to select an operating point for pressure p and speed n via the command value interface which is transferred to the IMC platform.
Alternatively, an alternative command value for pressure and speed can be cyclically commanded in service mode.

Activation of the service mode

The call-up of values and their transfer to IMC can be activated using service mode via parameter P-0-1401 (activation of service mode) bit 0. In this case the function for p and n command value presetting is activated equally.

Table 24: P-0-1401 service mode

P-0-1401 bit level	Function
0	Service mode selection FALSE = commanding p and n from cyclic customer interface for IMC TRUE = commanding p from P-0-1403 and n from P-0-1404

Activation of the fixed command value mode

Alternatively, p and n can be set separately for the command value presetting by means of configuration in P-0-1370 (configuration word process controller) bits 26 and 27.

Fixed command values can only be preset if the service mode is not active.

Table 25: P-0-1370 fixed command value mode

P-0-1370 Bit	Function
26	Selection Commanding pressure FALSE = commanding p from cyclic customer interface for IMC TRUE = commanding p from fixed command value memory
27	Selection Commanding speed FALSE = commanding n from cyclic customer interface for IMC TRUE = commanding n from fixed command value memory

Selection of the operating point in fixed command value mode

The selection of the operating point for p and n can be specified cyclically via the parameters. The function is selected in the 1-ms task. For pressure, the operating point can be selected using P-0-1394, while the operating point for speed can be selected using P-0-1395. The assignment to the operating point is provided in the following table:

Table 26: Selection of the operating point

Value for the selection of the operating point P-0-1394/P-0-1395	Operating point
0	0
1	1
2	2
3	3
ELSE	No new operating point is assigned. The last valid value in the command value presetting remains active.

The operating points for pressure p and speed n can be configured in the following parameters:

Table 27: Configuration of the operating points

Operating point index	Operating point	
	Pressure p	Speed n
0	P-0-1311[100]	P-0-1311[110]
1	P-0-1311[101]	P-0-1311[111]
2	P-0-1311[102]	P-0-1311[112]
3	P-0-1311[103]	P-0-1311[113]

5.3.5 Oil and water cooling

Activation

Oil and water cooling is provided. The function can be activated by means of configuration:

Table 28: Activation

P-0-1380 Bit 2	Description
FALSE	No oil and water cooling
TRUE	Activate oil and water cooling

Oil cooling

For oil cooling, an on/off valve is controlled by parameter P-0-1418 bit 2 depending on the oil temperature.
If the oil temperature (P-0-1279) is above the threshold temperature (P-0-1389 [19]) for a debouncing time (P-0-1389 [24]), cooling is started.
If the oil temperature (P-0-1279) for a debouncing time (P-0-1389 [24]) is lower than the switch-on threshold by the hysteresis (P-0-1389 [18]), cooling is stopped.

Table 29: Control of oil cooling valve

P-0-1418 Bit 2	Description
FALSE	Valve for oil cooling closed
TRUE	Valve for oil cooling open

Water cooling

For water cooling, an on/off valve is controlled by parameter P-0-1418 bit 6 depending on the motor winding temperature.
The valve for water cooling is controlled whenever the valve for oil cooling is controlled.
In addition, the water valve is controlled if the motor winding temperature (S-0-0383) is above the threshold temperature (P-0-1389[21]) for a debouncing time (P-0-1389[24]).
If the motor winding temperature (S-0-0383) for a debouncing time (P-0-1389 [24]) is lower than the switch-on threshold by the hysteresis (P-0-1389 [20]), cooling is stopped.

Table 30: P-0-1401 service mode

P-0-1418 Bit 6	Description
FALSE	Valve for water cooling open
TRUE	Activate oil and water cooling

5.3.6 RGB LED as status display

The LED is located in the upper door of the CytroBox. The color cyan means OK, yellow means warning and red means error. The LED is inactive in service mode.

Table 31: Color assignment

LED color	Description
Red	Drive error
Yellow	Drive warning
Cyan	Nothing amiss – Neither error nor warning

5.3.7 Description of parameters and diagnosis

The following chapter includes a list of all available parameters as well as all occurring errors and warnings.

Parameter description

Table 32: List of parameters

	Function		Parameter	Description	
Sensor evaluation	Oil temperature		P-0-1279	Actual value	Page 27
		Threshold value	P-0-1389[25]	Warning too low	
			P-0-1389[26]	Warning too high	
			P-0-1389[27]	Error too low	
			P-0-1389[28]	Error too high	
	Oil level		P-0-1291	Actual value	
		Standardization	P-0-1311[160]	Min.	
			P-0-1311[161]	Max.	
			P-0-1311[162]	Min.	
			P-0-1311[163]	Max.	
		Threshold value	P-0-1389[71]	Warning min.	
			P-0-1389[72]	Warning max.	
			P-0-1389[73]	Error min.	
			P-0-1389[74]	Error max.	
	Leakage flow		P-0-1293	Actual value	Page 28
	Leakage temperature		P-0-1294	Actual value	
		Threshold value	P-0-1389[39]	Warning	
			P-0-1389[40]	Error	
	Dissolved air inclusion		P-0-1270	Actual value	
		Standardization	P-0-1311[165]	Min.	
			P-0-1311[166]	Max.	
			P-0-1311[167]	Signal min.	
			P-0-1311[168]	Signal max.	
		Threshold value	P-0-1389[7]	Warning	
			P-0-1389[8]	Error	

	Function		Parameter	Description	
Sensor evaluation	Particle concentration		P-0-1292	Average value	Page 29
			P-0-1424	Actual value (S)	
			P-0-1389[61]	Warning	
			P-0-1389[65]	Error	
			P-0-1425	Actual value (M)	
			P-0-1389[62]	Warning	
			P-0-1389[66]	Error	
			P-0-1426	Actual value (L)	
			P-0-1389[63]	Warning	
			P-0-1389[67]	Error	
			P-0-1427	Actual value (XL)	
			P-0-1389[64]	Warning	
			P-0-1389[68]	Error	
		Standardization	P-0-1311[170]	Min.	
			P-0-1311[171]	Max.	
			P-0-1311[172]	Min.	
			P-0-1311[173]	Max.	
		Threshold value	P-0-1311[176]	Starting signal	
			P-0-1311[177]	Starting signal	
			P-0-1311[178]	Delay	
			P-0-1311[179]	Cycle	
	Relative oil humidity		P-0-1272	Actual value	Page 31
		Threshold value	P-0-1389[13]	Warning	
			P-0-1389[14]	Error	
			P-0-1389[15]	Debouncing time	
	Fluid detection		P-0-1274	Actual value	Page 31
		Threshold value	P-0-1389[41]	Debouncing time	
			P-0-1389[42]	Warning	
			P-0-1389[43]	Error	
			P-0-1389[44]	Error	

	Function		Parameter	Description	
Monitoring systems	Oil filter monitoring	Threshold value	P-0-1389[30]	Warning	Page 32
			P-0-1389[31]	Error	
			P-0-1389[32]	Debouncing time	
	Return flow filter monitoring	Threshold value	P-0-1389[33]	Warning	
			P-0-1389[34]	Error	
			P-0-1389[35]	Debouncing time	
	Leakage flow	Threshold value	P-0-1389[39]	Warning	
			P-0-1389[40]	Error	
			P-0-1389[38]	Debouncing time	
	Oil level monitoring	Threshold value	P-0-1389[71]	Warning	Page 33
			P-0-1389[73]	Error	
			P-0-1389[72]	Warning	
			P-0-1389[74]	Error	
			P-0-1389[75]	Debouncing time	
	Oil temperature monitoring	Threshold value	P-0-1389[25]	Warning too low	
			P-0-1389[27]	Error too low	
			P-0-1389[26]	Warning too high	
			P-0-1389[28]	Error too high	
			P-0-1389[24]	Debouncing time	
	Particle concentration	Threshold value	P-0-1389[61]	Warning S - 4 µm	
			P-0-1389[65]	Error S - 4 µm	
			P-0-1389[62]	Warning M - 6 µm	
			P-0-1389[66]	Error M - 6 µm	
			P-0-1389[63]	Warning L - 14 µm	
			P-0-1389[67]	Error L - 14 µm	
			P-0-1389[64]	Warning XL - 21 µm	
			P-0-1389[68]	Error XL - 21 µm	
	Dissolved air inclusion	Threshold value	P-0-1389[7]	Warning	Page 34
			P-0-1389[8]	Error	
			P-0-1389[9]	Debouncing time	
	Relative oil humidity	Threshold value	P-0-1389[12]	Activation of drainage	
			P-0-1389[13]	Warning	
			P-0-1389[14]	Error	
			P-0-1389[15]	Debouncing time	
	Leakage temperature	Threshold value	P-0-1389[47]	Warning	
			P-0-1389[48]	Error	
			P-0-1389[49]	Debouncing time	
	Fluid detection	Threshold value	P-0-1389[42]	Warning Oil	
			P-0-1389[43]	Warning Mixture	
			P-0-1389[44]	Warning Water	

	Function		Parameter	Description	
Fixed command value memory	Activation		P-0-1401 Bit 0	Service mode	Page 36
	Selection of the operating point		P-0-1370	Fixed command value mode	
			P-0-1394	Pressure operating point	
			P-0-1311[100]	Pressure configuration	
			P-0-1311[101]	Pressure configuration	
			P-0-1311[102]	Pressure configuration	
			P-0-1311[103]	Pressure configuration	
			P-0-1395	Speed operating point	
			P-0-1311[110]	Speed configuration	
			P-0-1311[111]	Speed configuration	
			P-0-1311[112]	Speed configuration	
			P-0-1311[113]	Speed configuration	
Activation	Oil and water cooling		P-0-1380 Bit 2	FALSE No oil and water cooling	Page 37
				TRUE Activate oil and water cooling	
	Oil cooling		P-0-1418 Bit 2	FALSE Valve for oil cooling closed	
				TRUE Valve for oil cooling open	
	Water cooling		P-0-1418 Bit 6	FALSE Valve for water cooling closed	
				TRUE Valve for water cooling open	

Description of diagnosis **Table 33: Warnings**

S-0-0390	P-0-1300	S-0-0095	Cause	Solution
E2013	B300	B300: oil level of tank very high	The monitoring of the oil level indicates a warning. P-0-1291 > P-0-1389[72]	▶ Check/reduce the oil volume in the oil tank. ▶ Check the limit value. ▶ Check the sensor output signal.
E2013	B301	B301: oil level of tank very low	The monitoring of the oil level indicates a warning. P-0-1291 < P-0-1389[71]	▶ Check/increase the oil volume in the oil tank. ▶ Check the limit value. ▶ Check the sensor output signal.
E2013	B302	B302: particle content S very high	The monitoring of the particle concentration indicates a warning. P-0-1424 > P-0-1389[61]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
E2013	B303	B303: particle content M very high	The monitoring of the particle concentration indicates a warning. P-0-1425 > P-0-1389[62]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
E2013	B304	B304: particle content L very high	The monitoring of the particle concentration indicates a warning. P-0-1426 > P-0-1389[63]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
E2013	B305	B305: particle content XL very high	The monitoring of the particle concentration indicates a warning. P-0-1427 > P-0-1389[64]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
E2013	B306	B306: filter clogging very high	The monitoring of the filter contamination indicates a warning. (P-0-1273 – S-0-0813) > P-0-1389[30]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Replace the filter element of the pressure filter.
E2013	B307	B307: oil temperature very high	The monitoring of the oil temperature indicates a warning. P-0-1280 > P-0-1389[26]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Reduce the current load. ▶ Check the drip pan pump. ▶ Check the water cooling unit.
E2013	B308	B308: oil temperature very low	The monitoring of the oil temperature indicates a warning. P-0-1280 < P-0-1389[25]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Heat the oil.
E2013	B309	B309: oxygen content very high	The monitoring of the air inclusion indicates a warning. P-0-1270 > P-0-1389[7]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the degassing function. ▶ Reduce the required flow.
E2013	B310	B310: relative humidity very high	The monitoring of the relative humidity indicates a warning. P-0-1272 > P-0-1389[13]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the drainage function. ▶ Reduce the required flow.
E2013	B314	B314: system pressure very low	The degassing function should run (P-0-1270 > P-0-1389[2]) but the system pressure is too low (S-0-0813 < P-0-1389[3]).	▶ Check the limit values. ▶ Perform a pressure control with a higher command value. ▶ Check the sensor output signal.
E2013	B315	B315: oil temperature very high	The degassing function should run (P-0-1270 > P-0-1389 [2]) but the oil temperature is too high (S-0-1280 < P-0-1389 [5]).	▶ Check the limit values. ▶ Reduce the load. ▶ Check the drip pan pump. ▶ Check the water cooling unit. ▶ Check the sensor output signal.

S-0-0390	P-0-1300	S-0-0095	Cause	Solution
E2013	B318	B318: leakage very high	The monitoring of the leakage flow indicates a warning. P-0-1293 > P-0-1389[39]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the pump and replace it, if necessary.
E2013	B319	B319: temperature of leakage very high	The monitoring of the leakage temperature indicates a warning. P-0-1294 > P-0-1389[47]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the drip pan pump. ▶ Check the water cooling unit. ▶ Check the pump and replace it, if necessary.
E2013	B320	B320: protective switch -23Q1 tripped	The monitoring of the digital feedback signal of the protective motor switch indicates a warning. P-0-1400.0 = P-0-1380.3	▶ Check the switch -23Q1. ▶ Check the configuration of the signal logic (NO / NC). ▶ Check the flashlight.
E2013	B321	B321: protective switch -23Q2 tripped	The monitoring of the digital feedback signal of the cooling unit switch indicates a warning. P-0-1400.1 = P-0-1380.4	▶ Check the switch -23Q2. ▶ Check the configuration of the signal logic (NO / NC). ▶ Check the flashlight.
E2013	B322	B322: service mode active	The service mode was activated. P-0-1401.0 = "1"	▶ Use the manual pressure command value (P-0-1403). ▶ Use the manual velocity command value (P-0-1404). ▶ Use the manual valve control word (P-0-1402). ▶ Finish the commissioning and maintenance work. ▶ Deactivate service mode (P-0-1401.0 = "0") for normal operation.
E2013	B323	B323: error leakage sensor on port 2	• The leakage flow and temperature sensor on IO link port 2 is no longer available. • An error has occurred at the sensor. • An incorrect sensor (vendor/device ID) is connected to IO link port 2.	▶ Check the connection and function of the leakage sensor (if the sensor is no longer needed, reset and restart the MLD program). ▶ Remove the faulty sensor. ▶ Check the connection of the leakage sensor on the basis of the electrical circuit diagram.
E2013	B324	B324: error oxygen sensor on port 3	• The air inclusion sensor on IO link port 3 is no longer available. • An error has occurred at the sensor. • An incorrect sensor (vendor/device ID) is connected to IO link port 3.	▶ Check the connection and function of the air inclusion sensor (if the sensor is no longer needed, reset and restart the MLD program). ▶ Remove the faulty sensor. ▶ Check the connection of the air inclusion sensor on the basis of the electrical circuit diagram.
E2013	B325	B325: error humidity sensor on port 5	• The water content sensor on IO link port 5 is no longer available. • An error has occurred at the sensor. • An incorrect sensor (vendor/device ID) is connected to IO link port 5.	▶ Check the connection and function of the water content sensor (if the sensor is no longer needed, reset and restart the MLD program). ▶ Remove the faulty sensor. ▶ Check the connection of the humidity sensor on the basis of the electrical circuit diagram.

S-0-0390	P-0-1300	S-0-0095	Cause	Solution
E2013	B326	B326: error particle sensor on port 4	• The particle sensor on IO-Link port 4 is no longer available. • An error has occurred at the sensor. • An incorrect sensor (vendor/device ID) is connected to IO-Link port 4.	▶ Check the connection and function of the particle sensor (if the sensor is no longer needed, reset and restart the MLD program). ▶ Remove the faulty sensor. ▶ Check the connection of the particle sensor on the basis of the electrical circuit diagram.
E2013	B327	B327: return flow filter clogging very high	The return flow filter monitoring indicates a warning. P-0-1283 > P-0-1389[33]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Replace the return flow filter.
E2013	B328	B328: error liquid sensor on port 6	• The oil pan leakage sensor on IO-Link port 6 is no longer available. • An error has occurred at the sensor. • An incorrect sensor (vendor/device ID) is connected to IO link port 6.	▶ Check the connection and function of the oil pan leakage sensor (if the sensor is no longer needed, reset and restart the MLD program). ▶ Remove the faulty sensor. ▶ Check the connection of the oil pan leakage sensor on the basis of the electrical circuit diagram.
E2013	B329	B329: oil detected in drip pan	The leakage monitor in the oil pan detects oil. P-0-1274 > P-0-1389[42]	▶ Check the oil pan. ▶ Check the oil pipe. ▶ Check the limit value. ▶ Check the sensor output signal.
E2013	B330	B330: oil water mix detected in drip pan	The leakage monitor in the oil pan detects an oil-water mix. P-0-1274 > P-0-1389[43]	▶ Check the oil pan. ▶ Check the oil and water pipes. ▶ Check the limit value. ▶ Check the sensor output signal.
E2013	B331	B331: water detected in drip pan	The leakage monitor in the oil pan detects water. P-0-1274 > P-0-1389[44]	▶ Check the oil pan. ▶ Check the water pipes. ▶ Check the limit value. ▶ Check the sensor output signal.
E2013	B332	B332: IO link config. error	• The configuration of the device description file used for the IO link gateway is wrong. • The device description file used for the IO link gateway is wrong.	▶ Check the configuration of the device description file used. ▶ Check the device description itself. ▶ Use the supplied device description file with the correct configuration.

Table 34: Error

S-0-0390	P-0-1300	S-0-0095	Cause	Solution
F2013	D300	D300: oil level of tank too high	The monitoring of the oil level indicates an alarm. P-0-1291 > P-0-1389[74]	▶ Check/reduce the oil volume in the oil tank. ▶ Check the limit value. ▶ Check the sensor output signal.
F2013	D301	D301: oil level of tank too low	The monitoring of the oil level indicates an alarm. P-0-1291 < P-0-1389[73]	▶ Check/increase the oil volume in the oil tank. ▶ Check the limit value. ▶ Check the sensor output signal.
F2013	D302	D302: particle content S too high	The monitoring of the particle concentration indicates an alarm. P-0-1424 > P-0-1389[65]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
F2013	D303	D303: particle content M too high	The monitoring of the particle concentration indicates an alarm. P-0-1425 > P-0-1389[66]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
F2013	D304	D304: particle content L too high	The monitoring of the particle concentration indicates an alarm. P-0-1426 > P-0-1389[67]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
F2013	D305	D305: particle content XL too high	The monitoring of the particle concentration indicates an alarm. P-0-1427 > P-0-1389[68]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Change the oil.
F2013	D306	D306: filter clogging too high	The monitoring of the filter contamination indicates an alarm. (P-0-1273 – S-0-0813) > P-0-1389[31]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Replace the filter element of the pressure filter.
F2013	D307	D307: oil temperature too high	The monitoring of the oil temperature indicates an alarm. P-0-1280 > P-0-1389[28]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Reduce the load. ▶ Check the drip pan pump. ▶ Check the water cooling unit.
F2013	D308	D308: oil temperature too low	The monitoring of the oil temperature indicates an alarm. P-0-1280 < P-0-1389[27]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Heat the oil.
F2013	D309	D309: oxygen content too high	The monitoring of the air inclusion indicates an alarm. P-0-1270 > P-0-1389[8]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the degassing function. ▶ Reduce the required flow.
F2013	D310	D310: relative humidity too high	The monitoring of the relative humidity indicates an alarm. P-0-1272 > P-0-1389[14]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the drainage function. ▶ Reduce the required flow.
F2013	D318	D318: leakage very high	The monitoring of the leakage flow indicates an alarm. P-0-1293 > P-0-1389[40]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the pump and replace it, if necessary.
F2013	D319	D319: temperature of leakage very high	The monitoring of the leakage temperature indicates an alarm. P-0-1294 > P-0-1389[48]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Check the drip pan pump. ▶ Check the water cooling unit. ▶ Check the pump and replace it, if necessary.

S-0-0390	P-0-1300	S-0-0095	Cause	Solution
F2013	D322	D322: fuse -11F4 tripped	The monitoring of the digital feedback signal of the sensor supply fuse indicates an alarm. P-0-1400.2 = P-0-1380.5	▶ Check fuse -11F4. ▶ Check the configuration of the signal logic (NO / NC). ▶ Check the flashlight.
F2013	D323	D323: error oil level sensor on port 1	• The oil level sensor on IO link port 1 is no longer available. • An error has occurred at the sensor. • An incorrect sensor (vendor/device ID) is connected to IO-Link port 1.	▶ Check the connection and function of the water content sensor (if the sensor is no longer needed, reset and restart the MLD program). ▶ Remove the faulty sensor. ▶ Check the connection of the oil level sensor on the basis of the electrical circuit diagram.
F2013	D327	D327: return flow filter contamination very high	The monitoring of the return flow filter indicates an alarm. P-0-1283 > P-0-1389[34]	▶ Check the limit value. ▶ Check the sensor output signal. ▶ Replace the return flow filter.
F2013	D700	D700: user config input err, P-0-1389 (...)	The configuration of the device data (e.g. threshold value) cannot be implemented.	▶ Check the editable inputs (for details see text). ▶ Reset the configuration to factory settings.

5.4 Component overview

The CytroBox hydraulic power unit basically consists of the following components:

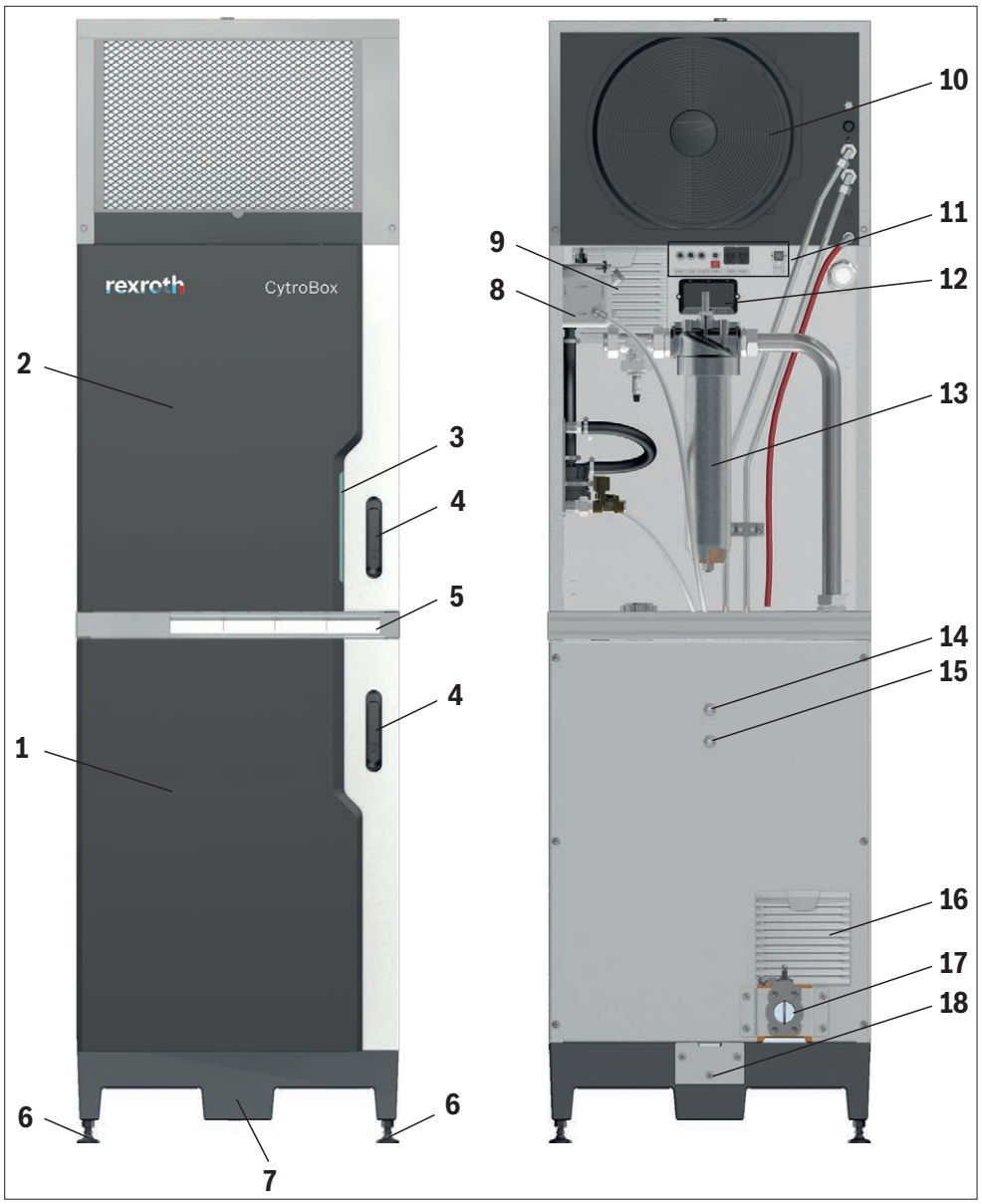
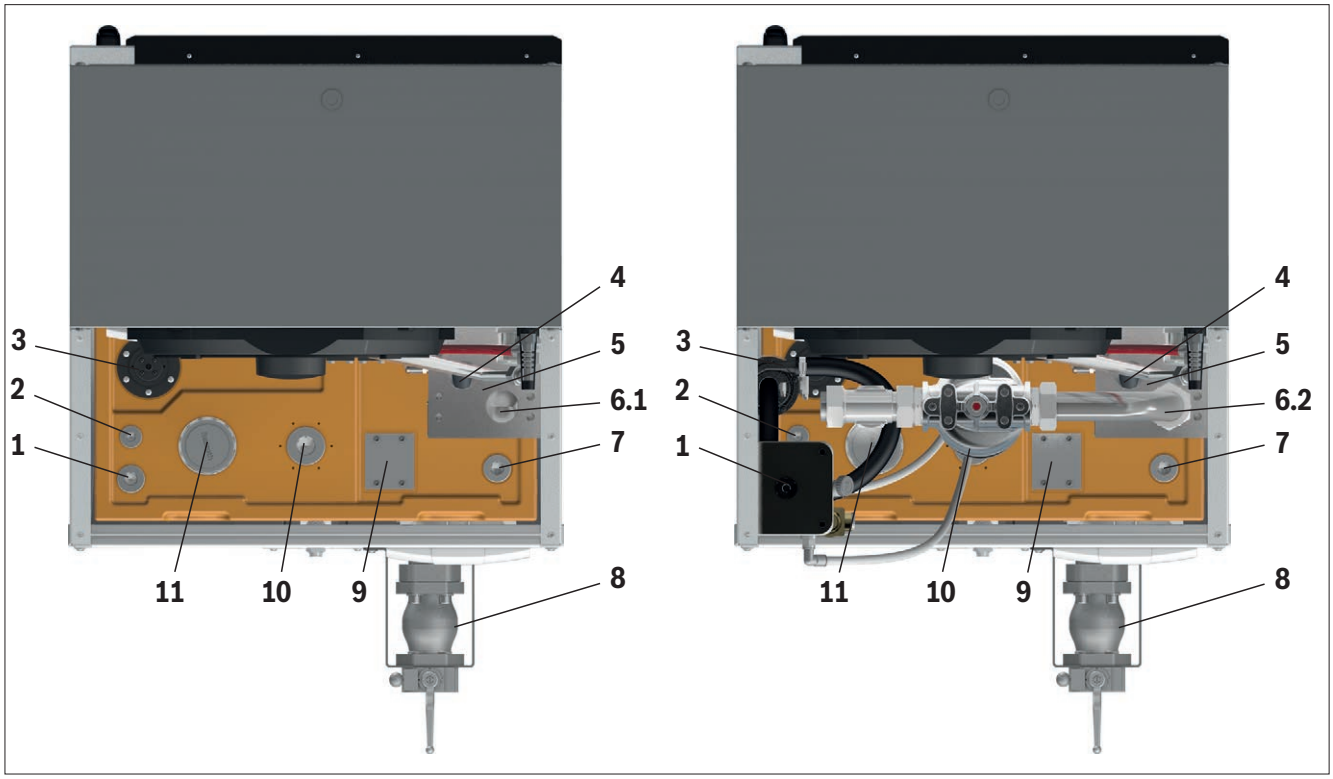


Fig. 5: View from front **View from rear**

1 Hydraulic cabinet
2 Electrical cabinet
3 LED status display
4 Door opener
5 Air inlet at the electrical cabinet
6 Adjustable machine feet
7 Foundation made of polymer concrete
8 Dirty water module option
9 Air outlet at the electrical cabinet
10 Compressor cooler option
11 Electrical interfaces
12 CytroConnect LTE router
13 Return flow filter unit option
14 Cooling water connection top, water in (push-in, d = 12 mm)
15 Cooling water connection bottom, water out (push-in, d =12 mm)
16 Air inlet at the hydraulic cabinet
17 Tank extension option SAE2 flange
18 Oil pan discharge plate



Standard version

Version with dirty water module and return flow filter

Fig. 6: View from top

1 Tank spare port (G1)
2 Tank spare port (G3/4)
3 Filling level and temperature sensor
4 Pressure port P (G1 1/4)
5 Connection block; optional adapter for modular plate systems IH20
6.1 Return flow port T (G1 1/2)
6.2 Return flow filter
7 Tank spare port (G1)
8 Tank extension option SAE2 flange
9 Connection for the degassing and drainage module (optional)
10 Tank spare port (G1 1/2)
11 Breathing filter

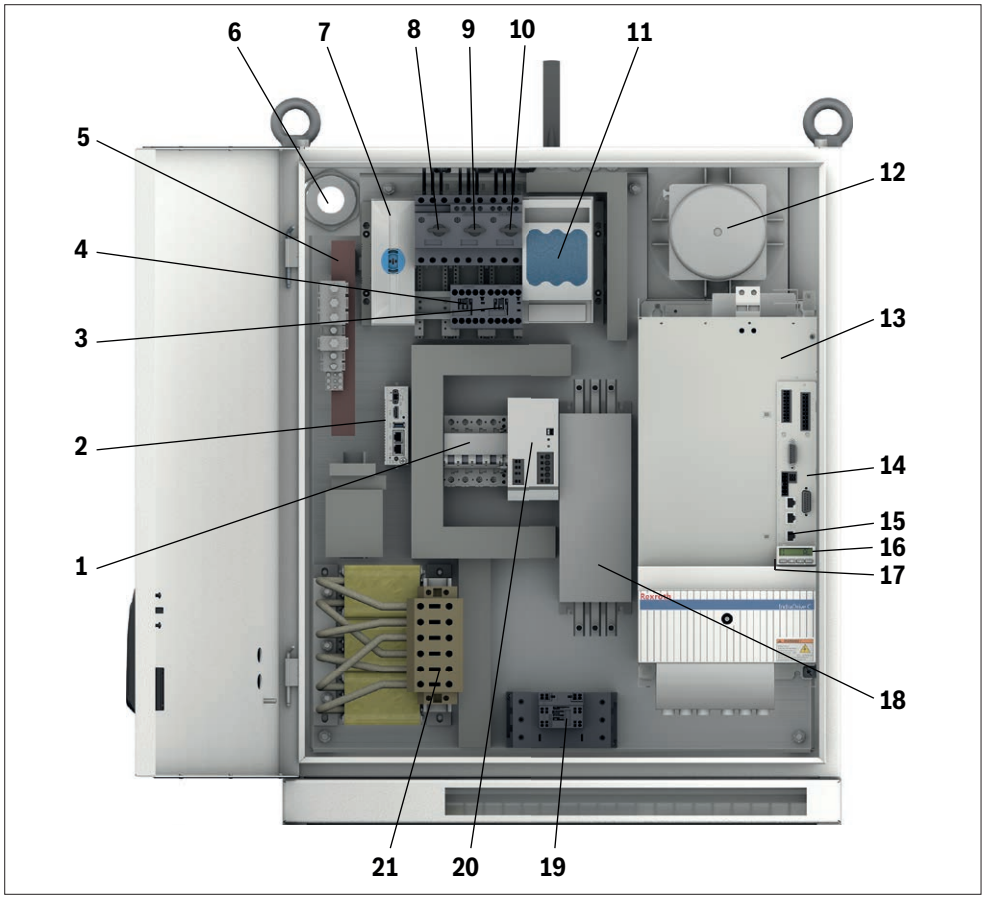


Fig. 7: Electrical cabinet

1 24-V-fuse protection
2 CytroConnect hardware
3 Contactor for air cooler
4 Contactor for circulating pump
5 Grounding terminal
6 Voltage supply/mains connection cable bushing
7 Connection terminal for feed-in
8 Fuse for 24-V-power supply unit
9 Protective motor switch for circulating pump
10 Protective motor switch for air cooler
11 Performance protection
12 Fan for electrical cabinet
13 Drive controller power part
14 Drive controller control part
15 X26: Engineering port
16 Drive controller operating unit
17 Micro SD card
18 Mains filter
19 Power contactor
20 24-V-power supply unit
21 Mains throttle

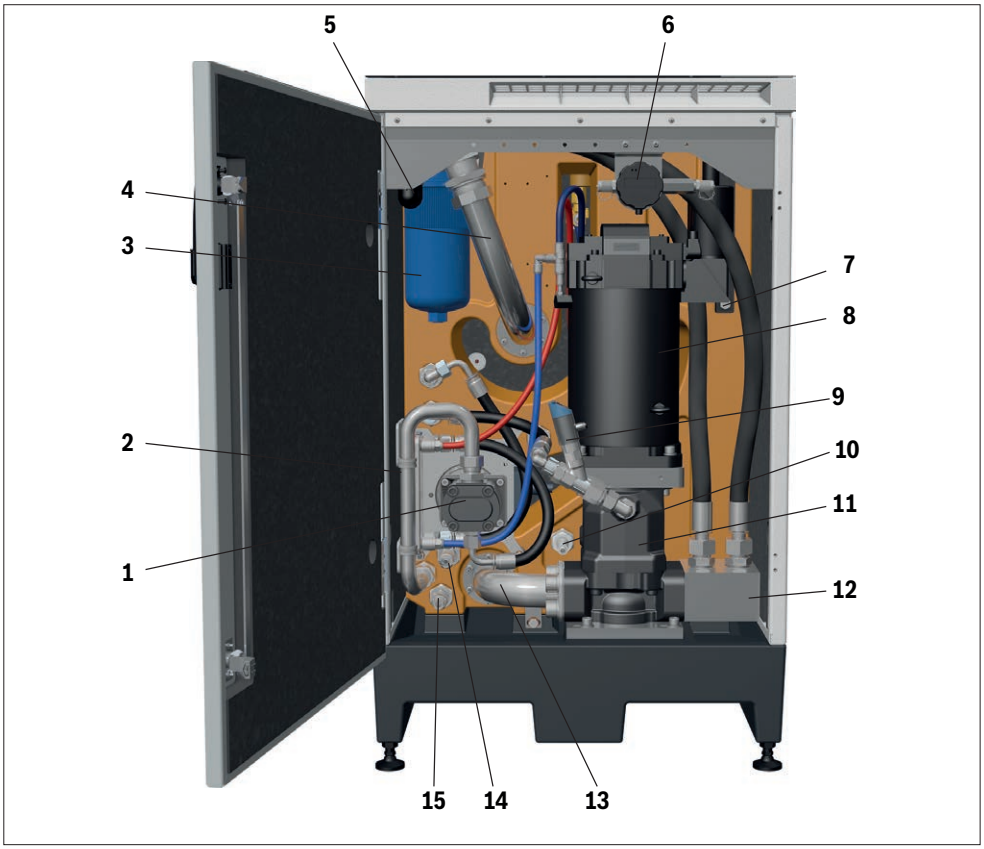


Fig. 8: Hydraulic cabinet

1 Circulating pump of the cooling circuit (optional)
2 Plate heat exchanger (optional)
3 Pressure filter
4 Return line
5 Pressure relief valve
6 Particle sensor (optional)
7 Optical oil level indicator
8 MS2N synchronous servo motor
9 Leakage flow rate/temperature sensor (optional)
10 Air inclusion sensor (optional)
11 Axial piston pump
12 Pressure line
13 Suction line
14 Water content sensor (optional)
15 Filling coupling

5.5 Circuit diagram, hydraulic

The hydraulic circuit diagram can be found in data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

5.6 Product identification

The hydraulic power unit can be identified by its name plate.
The following figure shows an exemplary representation:

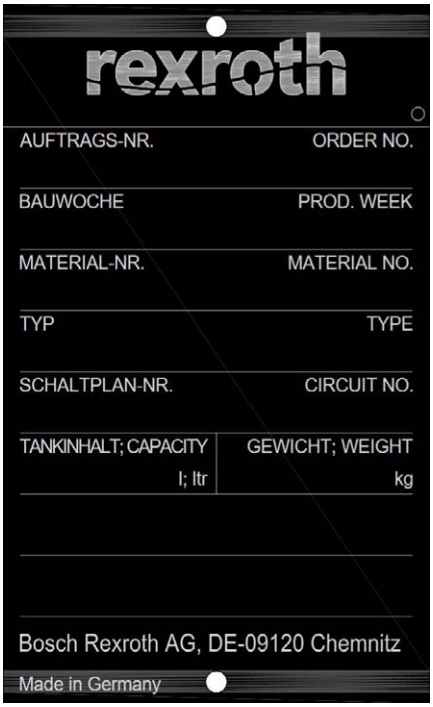


Fig. 9: Name plate

6 Transport and storage

- During storage and transport, the environmental conditions specified in data sheet 51057 must be observed, see chapter 1.2 "Required and amending documentation" on page 7.
- If the packaging has to be opened e.g. for inspection purposes, you should reseal the packaging according to the condition as supplied.

6.1 Transporting the hydraulic power unit

⚠ WARNING

Falling, tumbling or uncontrolled position change of the hydraulic power unit!
Danger to life! Risk of injury! Damage to property!

- Use the original packaging of the hydraulic power unit for transport.
- Check the weight of the hydraulic power unit.
- Make sure that the hydraulic power unit cannot fall due to its decentralized center of gravity.
- Transport the hydraulic power unit using a floor conveyor or suitable lifting gear.
- For fixation and lifting of the hydraulic power unit with lifting gear, only use the intended eyebolts.
- Transport the hydraulic power unit in an upright position using a floor conveyor.
- Observe the maximum load-bearing capacity of the attachment devices and floor conveyors.
- Never step or reach below suspended loads.
- Wear personal protective equipment, e.g. safety shoes.
- Ensure that no unauthorized persons are within the danger zone.
- Comply with the national laws and regulations regarding occupational health and safety and transport.

⚠ CAUTION

Heavy loads with a weight of more than 15 kg!
Risk of injury! Risk of health hazards! Damage to property!

- Use a forklift or suitable lifting gear e.g. lifting slings or lifting straps to transport the hydraulic power unit.
- During transport, secure the hydraulic power unit against falling.
- Carefully position the hydraulic power unit on the contact surface to prevent any damage.

To transport the hydraulic power unit, proceed as follows:

- If possible, transport the hydraulic power unit in the original packaging.
- Observe the transport instructions on the packaging.
- Ensure that it is only transported in an upright position.

6.1.1 Preparing for transport

Prior to transport, make the following preparations:

- Check the space required for installation of the hydraulic power unit at the place of use.
- Check the transport route.
- Depending on the type of transport, ensure additional space beside and above the hydraulic power unit.

Transport after previous operation

- For transportation after operation, drain the hydraulic fluid from the oil tank.

6.1.2 Transport using forklifts and similar floor conveyors

To transport the hydraulic power unit using a forklift, proceed as follows:

1. Move the fork of the forklift into the recesses provided for this purpose under the packaging of the hydraulic power unit or under the hydraulic power unit secured for transport.
2. Carefully lift the load to check the center of gravity position. Ensure a stable center of gravity position.
3. Make sure that the hydraulic power unit cannot move out of the intended position.
4. Secure the hydraulic power unit against the occurring acceleration forces and the related undesired motion of the hydraulic power unit.
5. During transport, only lift the hydraulic power unit as far off the floor as necessary for transport.

6.1.3 Transport using lifting gear

⚠ WARNING

Falling, uncontrolled change of position or damage to the hydraulic power unit during transportation at the eyebolts of the compressor cooler!

Danger to life! Risk of injury! Damage to property!

- Do not use the eyebolts on the cooler when transporting a CytroBox with a compressor cooler, as these eyebolts, as well as the connection between the hydraulic power unit and the compressor cooler, are not designed to support the total weight of the hydraulic power unit.

For transport, the hydraulic power unit can be connected to lifting gear.

Use the eyebolts on the hydraulic power unit, see Fig. 10, only for short-term transportation, e.g. to lift it into an external oil pan.
Avoid jerky acceleration and deceleration forces.
The total weight of the hydraulic power unit varies depending on the version and customer-specific extension. Lifting using eyebolts is admissible up to a maximum total weight of 800 kg.

For lifting and transport of the hydraulic power unit without a compressor cooler, proceed as follows:

1. Make sure that the lifting gear's lifting capacity is sufficient to safely bear the weight of the hydraulic power unit.
2. Use the pre-assembled eyebolts at the hydraulic power unit for transport, see Fig. 10.
3. Make sure that the eyebolts are securely tightened.

Fig. 10: CytroBox with eyebolts on the hydraulic power unit

1 Eyebolt

4. Make sure that all doors are closed during transport.
5. Attach a suitable lifting gear to the eyebolts.
6. Attach the lifting gear to a crane hook.

When attaching the lifting gear, make sure the angle is correct, see DIN 580 (ring bolts) and DIN 818-4 (chains).

7. Slowly and carefully lift the hydraulic power unit in order to avoid swinging.

6.2 Storing the hydraulic power unit

Storage conditions

- Store the hydraulic power unit in a dry location at constant temperature and in its original packaging if possible.
  Ideal storage temperature: +5 °C to +25 °C
- Provide for 100% UV protection.
- Store the hydraulic power unit protected against shocks.
- Store the hydraulic power unit in an upright position.
- Make sure that all doors are closed during storage.

Maximum storage time

The maximum storage time of the hydraulic power unit is 12 months.

If the storage time exceeds 12 months, check the functionality of the hydraulic power unit and flush it with suitable cleaning liquid prior to commissioning. Carry out the flushing procedure as described in chapter 8.1.6 "Flushing the hydraulic system" on page 79.

7 Assembly

7.1 Unpacking the hydraulic power unit

- Before opening the packaging and/or loosening the tension belts, make sure that the hydraulic power unit cannot fall over.
- Remove the packaging of the hydraulic power unit.
- Check the hydraulic power unit for obvious defects, for example, transport damage, leakage or other external damage and for completeness. See chapter 4 "Scope of delivery" on page 20.
- Use the hydraulic power unit only if in technically perfect condition.
- Dispose of the packaging material in accordance with the national regulations in your country and/or your company-internal specifications/procedures.

7.2 Installing the hydraulic power unit

⚠ WARNING

Falling, tumbling or uncontrolled position change of the hydraulic power unit!
Risk of injury! Damage to property!

- Make sure that the hydraulic power unit is only installed and assembled by qualified personnel. See chapter 2.4 "Qualification of personnel" on page 12.
- Observe the information on handling the product in chapter 6 "Transport and storage" on page 52.
- Position the hydraulic power unit on a suitable foundation.
- Observe the specifications on the total weight.

NOTICE

Damage to the surface/oil tank due to rough handling and incorrect positioning!
Damage to property!

- Make sure that the hydraulic power unit is correctly positioned.

Nearby vibrations!
Damage to property!

- Connect the hydraulic power unit to the machine via hydraulic hoses. Do not use rigid pipelines.

To install the hydraulic power unit, you should proceed as follows:

- Place the hydraulic power unit on a level surface.
- Ensure that a clearance area within one meter of the unit is maintained at the hydraulic power unit for unrestricted maintenance and servicing.
- Level the hydraulic power unit using the adjustable machine feet so that its longitudinal and transverse axes are horizontal.

7.2.1 Hydraulic power unit dimensions (in mm)

The dimensions of the hydraulic power unit can be found in data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

7.3 Assembling and connecting the compressor cooler

7.3.1 Preparing the compressor cooler

Prepare the compressor cooler for installation on the hydraulic power unit as follows:

1. Slide the filter element mat up, then remove the housing by loosening the 4 front and rear housing screws.

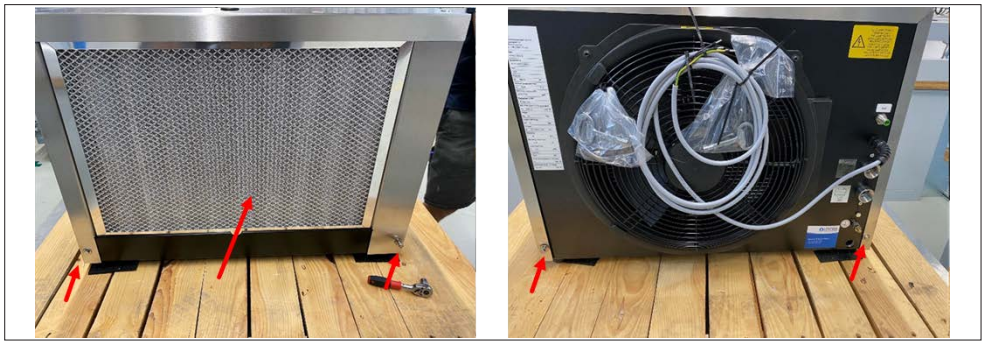


Fig. 11: Removing the filter element mat and housing

2. Remove the four rubber feet.

Fig. 12: Removing the rubber feet

3. Seal the two rear bores for the rubber feet.

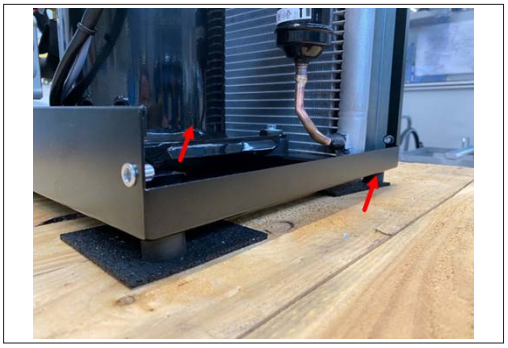


Fig. 13: Sealing bores

4. Reattach the housing if necessary.

7.3.2 Assembling the compressor cooler

To assemble the compressor cooler, perform the following steps:

1. Lift the compressor cooler to the desired position using the eyebolts on the mounted housing or with suitable lifting gear.

Fig. 14: Lifting the compressor cooler

2. Align the compressor cooler with the bores.

Fig. 15: Aligning the compressor cooler

3. Only secure the compressor cooler via the two front bores with 2 M10 screws and a washer (30 Nm).

Fig. 16: Attaching the compressor cooler

4. Reattach the compressor cooler filter element mat and housing with the housing screws.

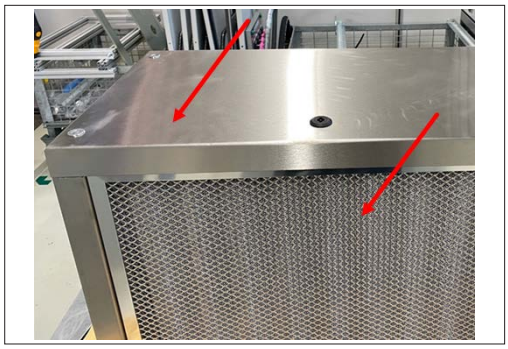


Fig. 17: Attaching the filter element mat and housing

7.3.3 Connecting the compressor cooler hydraulically

To hydraulically connect the compressor cooler, perform the following steps:

1. Connect the two hydraulic lines.

Fig. 18: Connecting the hydraulic lines

2. Connect the condensed water line (push-in).

Fig. 19: Connecting the condensed water line

7.3.4 Connecting the compressor cooler electrically

To set up the electrical connection, perform the following steps:

1. To set up the control of the compressor cooler, connect the -23x2 interface on the hydraulic power unit with the corresponding interface on the compressor cooler.
– To do this, use the cable provided in the scope of delivery.

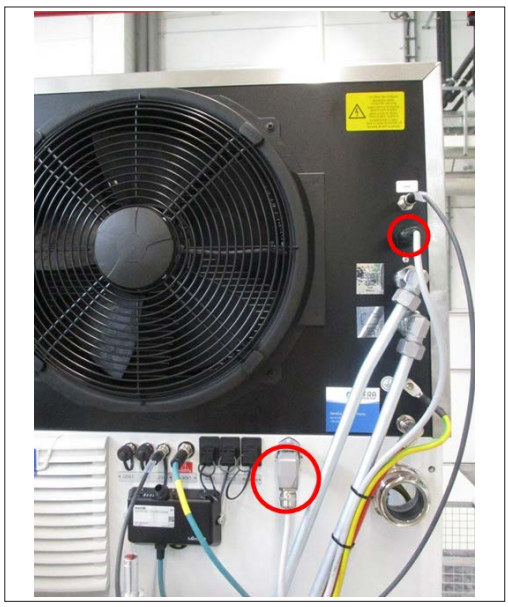


Fig. 20: Setting up control of the compressor cooler

2. To set up the control of the water valve, connect the -23X3 interface on the hydraulic power unit with the corresponding interface on the compressor cooler.
– To do this, use the M12 line connector included in the scope of delivery.

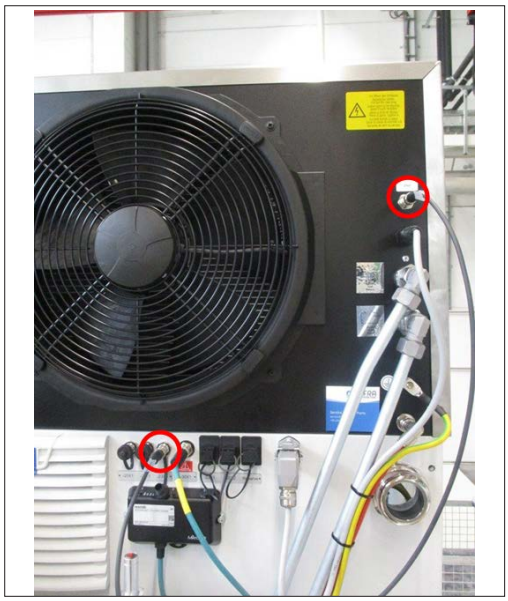


Fig. 21: Setting up control of the water valve

3. Connect the protective grounding conductor (-8W1) in the electrical cabinet to the compressor cooler using a yellow-green wire (16 mm^2).

Fig. 22: Connecting the protective grounding conductor

7.4 Connecting the hydraulic supply

⚠ WARNING

Pressurized system!
Danger to life, risk of injury, damage to property!
- Before assembling the hydraulic power unit, depressurize all relevant system components.

Exceeded nominal pressure of a component!
Danger to life, risk of injury, damage to property!
- Make sure that the maximum operating pressure of 315 bar is not exceeded.
- Dimension the hose lines according to the maximum operating pressure.
- If necessary, use hose safety catches.
- Only use components, e.g. fittings, that are approved for the required operating pressure.
- Make sure that only fittings with inch threads are used.

NOTICE

Damage to the hydraulic power unit!
Damage to property!
- Make sure that the connection between the hydraulic power unit and the machine is only realized via hose lines. Do not use rigid pipelines.
- Assemble the hose lines without any tension stress.

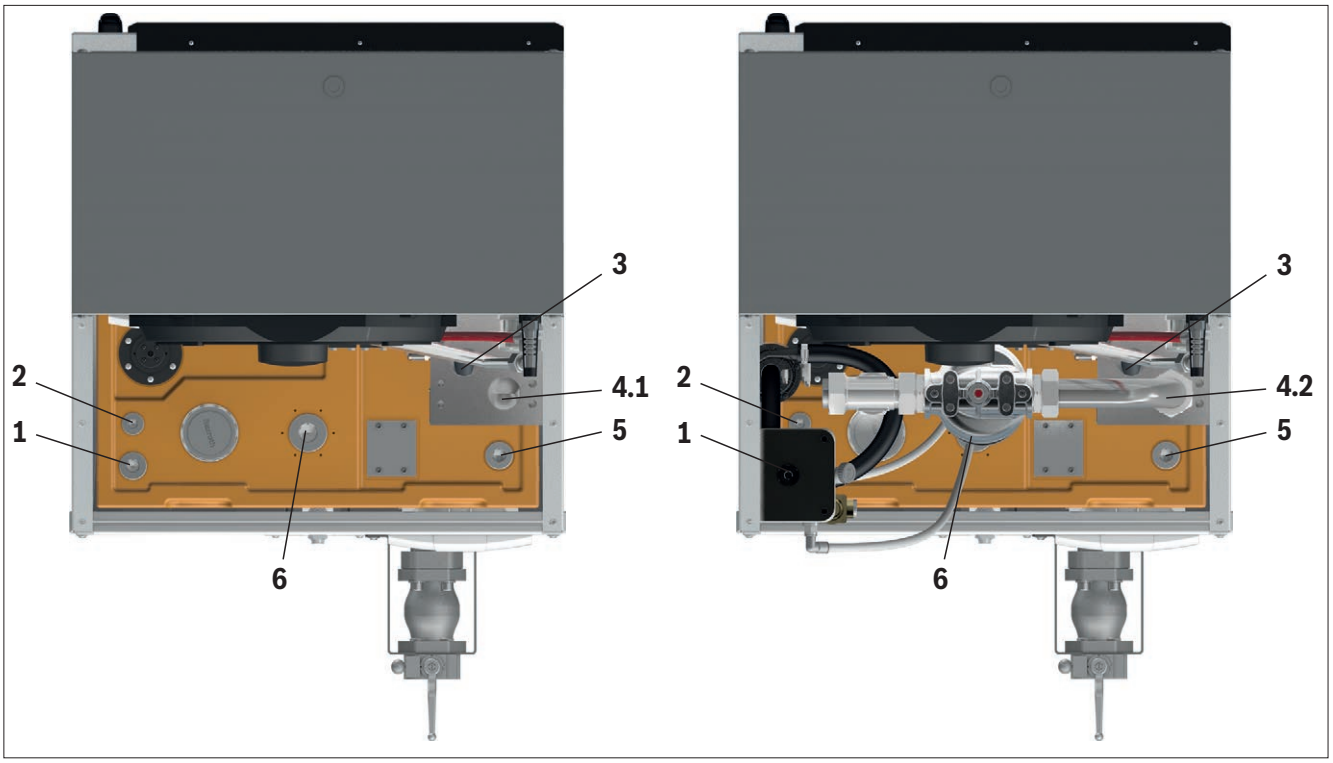
Preparation
- Remove the blanking plugs (colored plastic) and replace them by pressure-resistant fittings.
- Observe the installation information from the fitting manufacturers to prevent any external leakage. Bosch Rexroth recommends fittings with elastic seals.

Hose lines
- Install the hose lines in such a way that
  - buckling and tensile load of the hose is prevented during operation, and
  - the hose is not twisted.
  - the outer layer of the hose is not subject to abrasion or impacts.
  - and the weight of the hose line does not lead to inadmissible loads.

7.4.1 Hydraulic supply connection

Return line, pressure line

- If there is no subplate mounting, e.g. type IH20, connect the return line with a G1 1/2 fitting in the standard version via the return flow port T, G1 1/2, see Fig. 23, item 4.1, or with the return flow filter option to the connection 42L, see Fig. 23, item 4.2.
- Close unused ports with blanking plugs.
- Connect the pressure line with a G1 1/4 fitting via the pressure port G1 1/4, see Fig. 23, item 3.



Standard version

Version with dirty water module and return flow filter

Fig. 23: Oil tank ports, pressure port

1 Tank spare port (G1)
2 Tank spare port (G3/4)
3 Pressure port P (G1 1/4)
4.1 Return flow port T (G1 1/2)
4.2 Return flow filter (42L)
5 Tank spare port (G1)
6 Tank spare port (G1 1/2)

Pressure relief valve (DBV)

The pressure relief valve in the CytroBox is only used as a safeguard for the motor-pump-unit in the event of a malfunction. This valve does not perform a safety function for the connected hydraulic system.

The pressure relief valve is completely opened at the factory and must be set during commissioning. For further information on setting the pressure relief valve, please refer to chapter 8.1.5 "Commissioning of the "hydraulics"" on page 77.

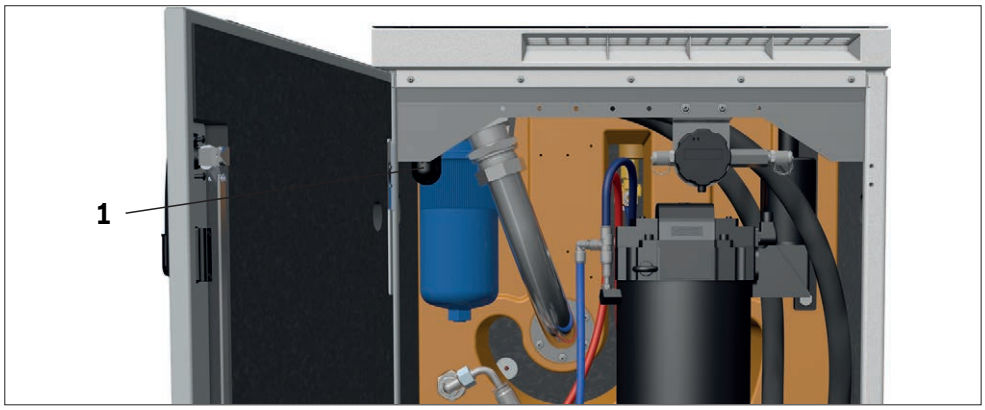


Fig. 24: Pressure relief valve

1 Pressure relief valve

Back pressure-protected oil tank ports

The back pressure-free oil tank ports G3/4 (see Fig. 23, item 2), G1 (see Fig. 23, item 1 and 5) and G1 1/2 (see Fig. 23, item 6), can be optionally connected, e.g. for a rotary transmission leadthrough. Close unused ports with blanking plugs.

If failure of a hose line may cause a whiplash hazard, installation of a hose safety catch is recommended.
If the hose lines are equipped with tear-proof fittings, a hose safety catch is not required.

Minimess connection MP3

The Minimess connection MP3 on the manifold block is used to determine the actual operating pressure or to bleed the system if no control system is installed.

- ▶ Close unused ports with blanking plugs.

7.4.2 Connection of the hydraulic supply in master/slave operation

Several hydraulic power units or additional tanks can be interconnected via the optionally available additional oil tank connection (SAE 2, see Fig. 6, item 8 on page 48). This port can be blocked using the built-in shut-off cock and is closed with a protective cap in the condition as supplied.

To connect multiple hydraulic power units in interconnected operation (master/slave operation), perform the following steps:

1. Make the return flow as symmetric as possible so that the oil flowing back can be distributed evenly over the hydraulic power units.
2. Connect the oil tanks via the additional oil tank connection to compensate for possible filling level discrepancies via the high pressure.

Connecting the return flow directly to the additional oil tank connector bypasses the oil tank degassing function and can cause premature damage to the hydraulic system.

Fig. 25: CytroBox connections

7.5 Connecting the water supply

To cool the motor, the hydraulic power unit requires water cooling.
Optionally, oil cooling is also incorporated.

Connecting push-in connectors (standard)

- Connect the cooling water supply to the two push-in connections (d = 12 mm) as supply and return flow, see Fig. 26, items 1 and 2.

  This will cool the electric motor and the hydraulic fluid, if any.

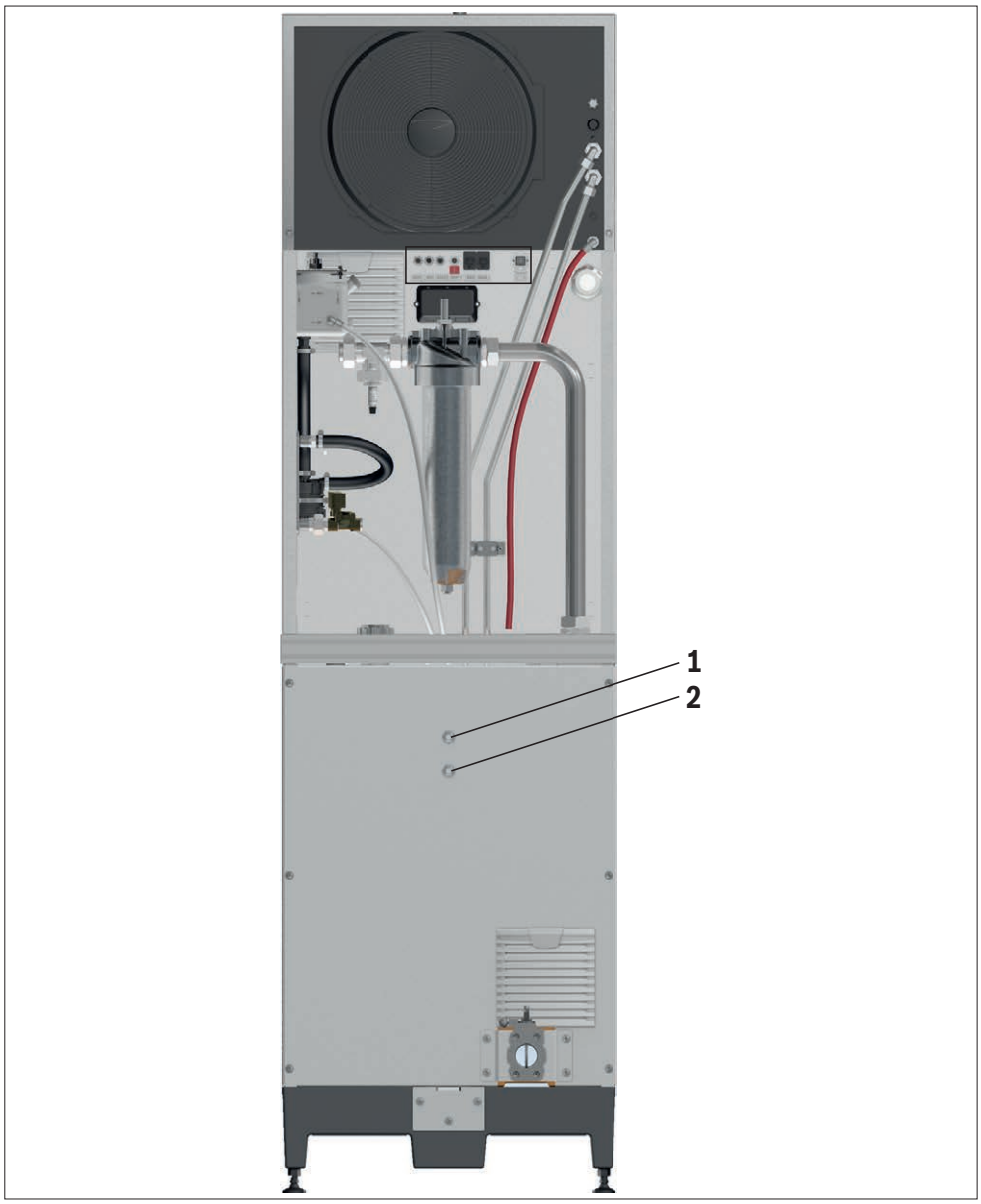


Fig. 26: Cooling water connections

1 Push-in cooling water connection (input)

2 Push-in cooling water connection (output)

The cooling water connections are not required for the operation of the CytroBox with compressor cooling.

Oil cooling (optional)

If the CytroBox is equipped with an additional oil cooling system, it is already completely assembled ex works.

- Ensure a maximum particle size of 100 µm for the purity of the cooling water.
- Make sure that the cooling water supply temperature does not fall below the dewpoint of the ambient air around the hydraulic power unit.
- Observe the following requirements:
  - Maximum cooling water input temperature: 15 ... 25 °C
  - Minimum cooling water flow: 20 l/min
  - Maximum glycol content: 30 %
  - Maximum cooling water pressure: < 6 bar

7.6 Overview of the electrical interfaces

⚠ WARNING

High electrical voltage!

Danger to life, risk of injury, damage to property!

- Make sure that any work at the electrical equipment is only carried out by a specialized electrician.
- For any work at the electric operating equipment, only use suitable insulated tools (German Social Accident Insurance DGUV regulation 3).
- Before assembling the hydraulic power unit, de-energize all relevant system components. Observe the five safety rules (according to DIN VDE 0105-100).
- Make sure that only suitable fuses are used.
- After establishing the feed-in connection and prior to switching on, check the protective grounding conductor connection to the hydraulic power unit (verification by means of test records according to DIN EN 60204-1 VDE 0113-1, End-to-end connection of the protective grounding conductor system, or DIN VDE 0701-0702, Protective grounding conductor inspection).

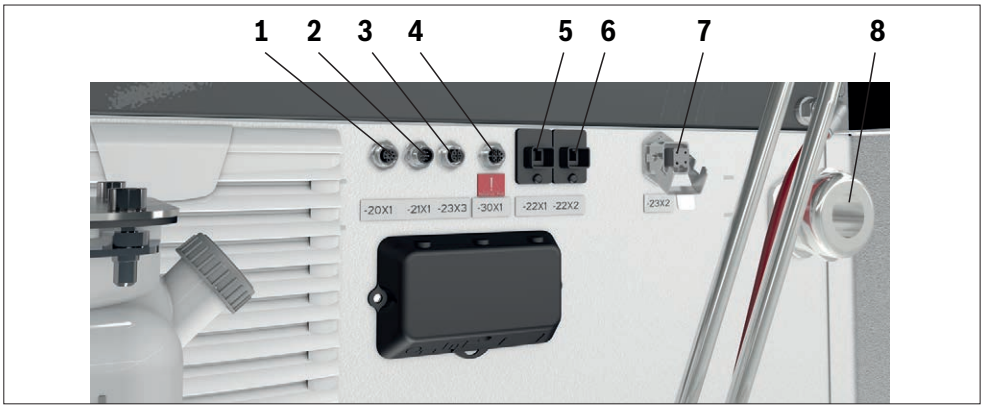


Fig. 27: Electrical connections

1 20X1: Digital input and output signals [1)]
2 21X1: Safe Torque Off (STO)
3 23X3: Control of water valve/compressor cooler or additional dirty water assembly (optional)
4 30X1: Power over Ethernet (PoE) CytroConnect [2)]
5 22X1: Multi-Ethernet control communication (network output)
6 22X2: Multi-Ethernet control communication (network input)
7 23X2: Voltage supply compressor cooler (optional) [3)]
8 Voltage supply/mains connection cable bushing

[1)] when control communication is not used

[2)] is wired by Bosch Rexroth

[3)] is wired by Bosch Rexroth when the option is selected

7.7 Description of the electrical interfaces

7.7.1 General information

- For electric installation of the interfaces, proceed according to applicable regulations for electrical engineering.
- You must ensure that the electric power supply is disconnected and also safeguarded against being switched on unintentionally.
- Unintended switching on should be prevented by means of an information sign indicating that work is carried out at the electrical system.

To operate the CytroBox, the following electrical connection must be implemented:

1. Voltage supply/mains connection 400 ... 500 VAC
2. 21X1: Safe Torque Off (STO)

One of the following options can be used to control the CytroBox:

3. 20X1: Digital input and output signals

or

4. 22X1: Multi-Ethernet control communication (network output)
5. 22X2: Multi-Ethernet control communication (network input)

Depending on the option used, the following interfaces must be connected/enabled:

6. 23X2: Voltage supply compressor cooler (optional)
7. 23X3: Control of water valve/compressor cooler or additional dirty water assembly (optional)
8. 30X1: PoE (Power over Ethernet), CytroConnect (activation at the conclusion of a service contract)

The following interface can be used for commissioning and service purposes:

9. X26: Engineering port

7.7.2 Voltage supply/mains connection

Table 35: Electric data

Electrical	
Voltage (according to IEC 60038)	400 ... 500 VAC (+10 % / -10 %)
Frequency	50/60 Hz
Fuse for the supply line, customer-side	Converter HCS03 - 0070: maximum 50 A Converter HCS03 - 0100: maximum 80 A Converter HCS03 - 0150: maximum 125 A

Table 36: Voltage supply/mains connection assignment

Position 6	Voltage supply (PG...)					
Mains connection voltage in VAC	Power rating	Maximum current in A	PIN	Terminal	Cable cross-section in mm2 1)	Cable gland
400 ... 500	70	63	L1 L2 L3	2 4 6	16-25	M48
			GNYE	PE	16	
	100	100	L1 L2 L3	2 4 6	35-50	M63
			GNYE	PE	25	
	150	125	L1 L2 L3	2 4 6	50-70	M63
			GNYE	PE	25	

1) Installation method B2 according to IEC 60364-5-52, for example, multi-wire line in cable channel, main electric circuits, outside of housings, fixed installation, multi-wire lines, ambient temperature ≤ 40°C

To connect the voltage supply/mains connection, perform the following steps:

- Feed the voltage supply cable through the PG fitting (cable bushing) on the back into the interior of the CytroBox.
- Attach the voltage supply/mains connection to the connection terminals of the feed-in, see Fig. 7, item 7 and 8 on page 49.
- To ensure correct function of the circulating pump and cooling system, the voltage supply must be connected in the clockwise rotating field.

Bosch Rexroth recommends measuring the rotating field using a rotating field measuring device.
Refer to your measuring device's specific manufacturer's instructions for the use and handling of the rotating field measuring device.

General procedure for checking the rotating field

1. Attach the test probe connector end to the appropriate measuring device to ensure that the device can measure the rotating field.
2. Connect the test probe end to the three mains phases that feed the CytroBox.

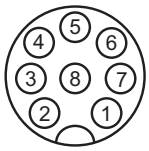
   The rotating field indicator lights up clockwise or counterclockwise to indicate the direction of the rotating field.
3. If the indicator is lit counterclockwise, switch 2 of the power phases and check that the indicator lights up clockwise.

7.7.3 Interface 20X1: Digital input and output signals

This interface can be used instead of the control communication as an interface to the parent machine control.

- Assign the line connector (optionally available as accessory) as the interface to higher-level machine control in accordance with the following description of the unit-side mating connector:

Table 37: Interface 20X1 assignment on the hydraulic power unit

	Pin	Function	Input DI/output DO
 (Mating connector) M12x1; 8-pole A-coded	1	Enable	DI
	2	Reset	DI
	3	GND . Ext	DI
	4	Filter alarm	DO
	5	Oil level alarm	DO
	6	Temperature alarm	DO
	7	Ready for operation, no error	DO
	8	In operation	DO

Inputs: 24 VDC (high ≥ 11 V; low ≤ 5 V)
Outputs: max. current 500 mA; total of all currents max. 2000 mA

For further information on the accessories, refer to data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

7.7.4 Interface 21X1: Safe Torque Off (STO)

- Assign the mating connector (optionally available as accessory) the as interface to higher-level machine control in accordance with the following description of the unit-side connector:

Table 38: Interface 20X1 assignment on the hydraulic power unit

	Pin	Function
 (Connector) M12x1; 8-pole A-coded	1	Input channel 2 (SI_Ch2)
	2	0 V voltage supply
	3	Input channel 1 (SI_Ch1)
	4	+24 V voltage supply ±20%/0.7 A
	5	Output channel 2 (Dyn_Ch2)
	6	Output channel 1 (Dyn_Ch1)
	7	Not used
	8	Not used

For further information on the accessories, refer to data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

The Safe Torque Off interface must be integrated into the safety concept of the machine. If STO is activated, the servodrive is torque disengaged. Further information on the connection possibilities is provided in the application description "Rexroth IndraDrive, integrated safety technology "Safe Torque Off" (from Mpx-16)", see chapter 1.2 "Required and amending documentation" on page 7.

Application examples

STO function

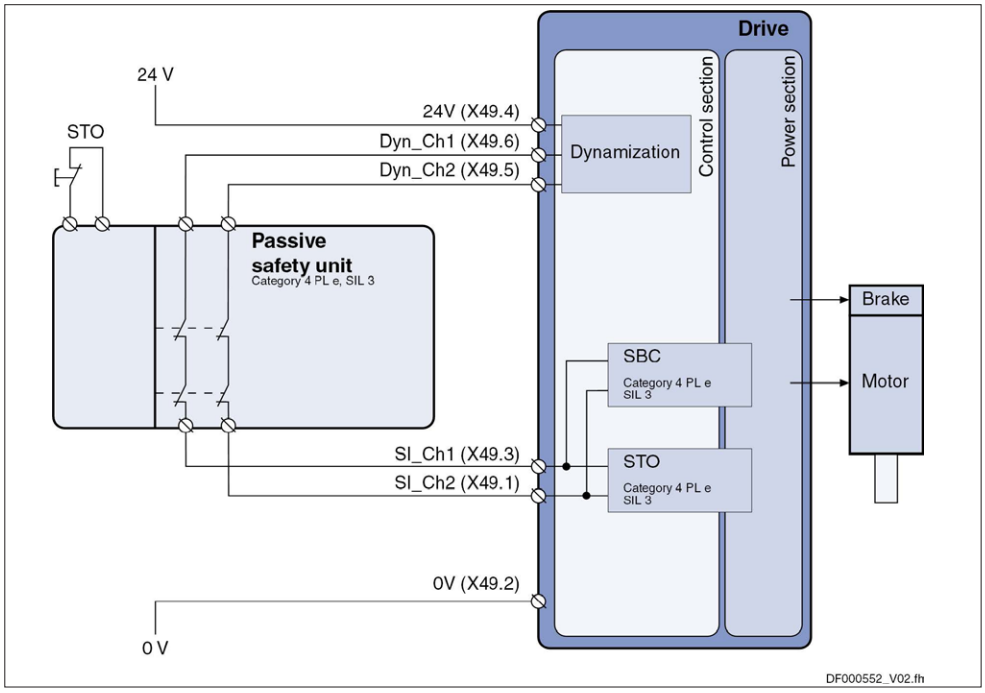


Fig. 28: With two-channel wiring and passive safety unit

The dynamization signals can be freely assigned.

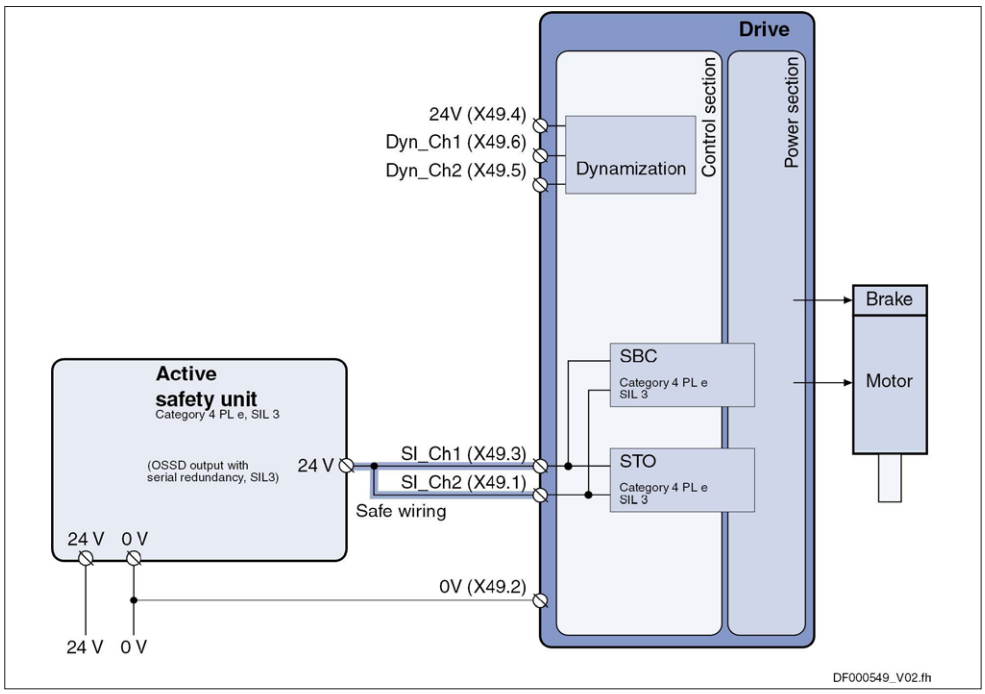


Fig. 29: With active safety unit (plus-plus switching outputs)

When selecting via a plus-plus switching safety unit, the following errors must be detected by the OSSD outputs:

- Short-circuit of selection signals with 24 V
- Short-circuit between both selection signals

7.7.5 Interfaces 22X1 and 22X2: Multi-Ethernet control communication

The CytroBox can be connected to the higher-level machine control via the multi-Ethernet interfaces 22X1 and 22X2.
With EtherNet/IP™ and PROFINET®, it does not matter which interface is used as a port. With EtherCAT®, port 22X2 must be used for command (network input).

For the connections 22X1 and 22X2, use only suitable RJ45 line connectors with push-pull functionality. The push-pull connectors are required to comply with protection class IP67.

For example, you can use the following line connectors:
- R901469479, CONNECTOR IE-PS-V04P-RJ45-FH
- R901471844, NETWORK CABLE RJ45/IP67-RJ45 5M

The network cable is included in the scope of delivery.

Table 39: Allocation of interfaces 22X1 and 22X2

RJ45 (IP67)	Position	Port	Function
	Fig. 27, item 5 (p. 68)	22X1 (network output)	Multi-Ethernet control communication
	Fig. 27, item 6 (p. 68)	22X2 (network input)	

▶ Seal the respective connection when not in use to maintain the degree of protection.

7.7.6 Interface 23X2: Voltage supply compressor cooler (optional)

When the option is selected, the interface is wired by Bosch Rexroth.
This port is a cartridge bush, MIN BUS assembly 3A.

The cable required for connection to the hydraulic power unit is contained in the scope of delivery of the compressor cooler.

7.7.7 Interface 23X3: Control of water valve/compressor cooler or additional dirty water assembly (optional)

When the option is selected, the interface is wired by Bosch Rexroth.
This port is an M12 5-pole bush.

Compressor cooler option:
- The M12 power connector required for connection to the hydraulic power unit is contained in the compressor cooler scope of delivery.

Dirty water module option:
- The connector on the filling level sensor in the compensation tank must be connected.
- The cable required for connection to the hydraulic power unit is contained in the scope of delivery of the dirty water assembly.

7.7.8 Interface 30X1: PoE (Power over Ethernet) CytroConnect

This interface is wired by Bosch Rexroth. This port is an X-coded 8-pole M12 bush that can be attached to a POE-enabled cable.

The CytroConnect LTE router is connected as standard.

The cable needed for connection to the hydraulic power unit is included in the scope of delivery of the LTE router.

If the hydraulic power unit is located in an area without mobile phone reception, a network connection via LAN can be established with the CytroConnect connection 30X1.

If you wish to use the CytroConnect service via this connection type, please contact us at the following email address: Consult-and-Connect@boschrexroth.de

7.7.9 Interface X26

Reading or configuration of parameters or reading of errors can be realized via the engineering port X26, see image Fig. 7, item15 on page 49, and by means of the "IndraWorks DS" and "Commissioning Assistant" software.

The "IndraWorks Ds" and "Commissioning assistant" software is available free of charge on our website www.boschrexroth.com under the search term "IndraWorks Ds" or "Cytrobox commissioning assistant".

▶ Use an appropriate standard RJ45 connector for the X26 port, see also chapter 7.7.5 on page 73.

The engineering port X26 is only required for commissioning and service cases.

8 Commissioning

⚠ WARNING

Leakage of hydraulic fluid under high pressure due to faulty assembly of the hydraulic power unit!

Risk of injury, damage to property!

- Ensure that the hydraulic power unit has been mounted by an expert, see chapter 2.4 "Qualification of personnel" on page 12, completely and without any tension stress before commissioning of the hydraulic power unit.

According to EC Machinery Directive 2006/42/EC, commissioning must not be undertaken until it has been determined that the machine to be equipped with the hydraulic power unit complies with the provisions of all relevant directives. Combination of components may lead to additional/other types of hazards. For commissioning of the hydraulic power unit, always observe the operating instructions of the overall machinery/system. This particularly applies to "Mechanical hazards" due to mechanical motions of the machine initiated by the hydraulic power units and drives (cylinder, motor).

8.1 First commissioning

The "Commissioning assistant" software is available free of charge on our website www.boschrexroth.com under the search term "Cytrobox commissioning assistant". Alternatively, it is also available on the SD card supplied in the converter. The SD card must be unplugged or plugged in only when the converter is turned off.

8.1.1 Before commissioning

- Check the safe condition of electric and hydraulic lines.
- Make sure that the cooling water system is in operation.

The system is parameterized and tested and thus ready for operation. All necessary protective functions are active.

8.1.2 Filling of the hydraulic power unit

- Use HLP mineral oil according to DIN51524 to fill the hydraulic power unit.

The optimal tank volume of the CytroBox is 100 to 130 liters and can be checked via the oil level display, see Fig. 30, item 1,.

- Make sure that the maximum filling pressure does not exceed 2 bar.

To fill the hydraulic power unit you should proceed as follows:

- Open the front door at the bottom and connect a filling unit to the quick-release coupling type CEJN567-G1/2-020-105676200, see Fig. 30, item 2.

Information on the required coupling connector can be found in data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

- Note the required oscillating volume and the maximum filling level.

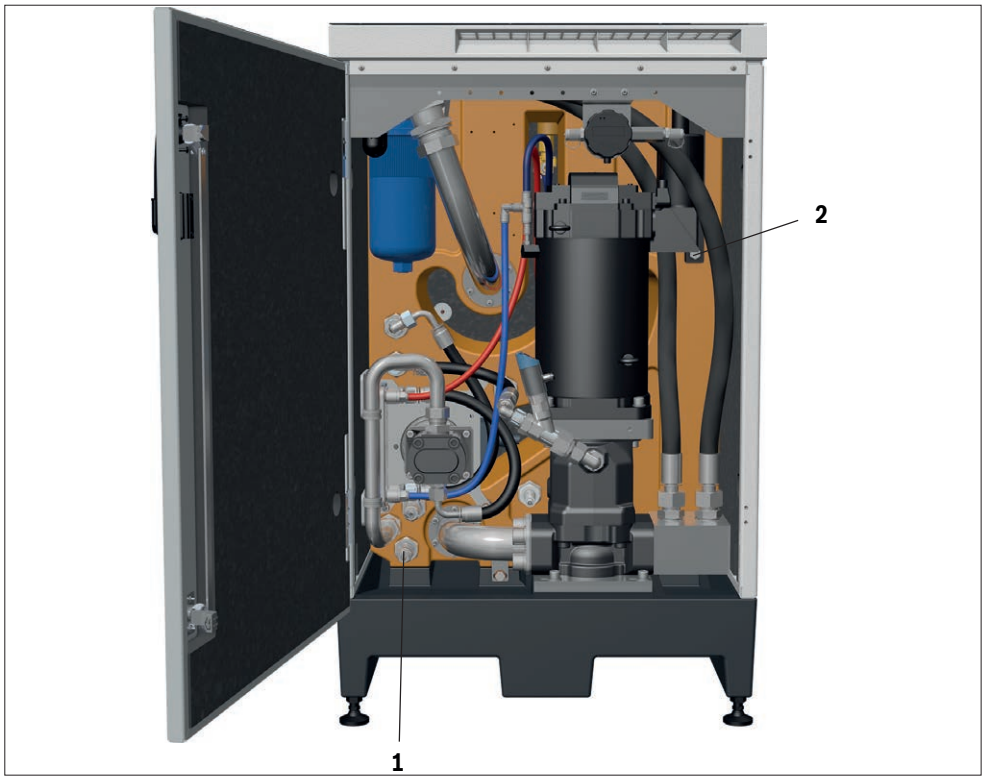


Fig. 30: Filling options

1 Oil level display

2 Filling coupling

Recommendation: Experience has shown that the cleanliness class required for the operation of the machine/system is already exceeded with new hydraulic fluids in the original packing drum.
If you want to ensure the cleanliness class, carry out the filling of the hydraulic power unit using a special filling unit, if necessary, or use a filter station with a 10 µm fine filter.

8.1.3 Switching on the power supply

All protective elements (protective motor switches and 24 VDC fuses) are switched off in the delivered condition.

- ▶ Switch on the voltage supply with an appropriate mains isolating device.

For further information, refer to chapter 7.6 "Overview of the electrical interfaces", on page 68, 7.7 "Description of the electrical interfaces" on page 69 and to the operating instructions of the machine/system manufacturer.

8.1.4 Bleeding the entire hydraulic system of the machine

- ▶ Bleed the hydraulic system at the highest point of the hydraulic components.

The MP3 Minimess connection on the manifold block is suitable for this purpose if no other hydraulic control is installed.
For further information, refer to the operating instructions of the machine/system manufacturer.

8.1.5 Commissioning of the "hydraulics"

⚠ DANGER

Activation of machine functions by means of commissioning!
Danger to life, risk of injury!

- ▶ Before commissioning of the hydraulic power unit, make sure that all electrical, mechanical and hydraulic connections are properly installed and connected as described in the superior instructions of the machine/system manufacturer.
- ▶ Make sure that the safeguards are activated.

Proceed as follows unless higher-level commissioning instructions must be observed at the machine level.

For commissioning of the hydraulic power unit, proceed as follows:

- ▶ Flush the hydraulic system as described in chapter 8.1.6 on page 81.
- ▶ Operate the directional valves and extend and retract the actuators several times.
- ▶ Repeat the bleeding process.

Bleeding is ensured if no foaming of hydraulic fluid in the oil tank, no jerky motions at the actuator and no irregular noise occur.

- ▶ Observe the fluid level in the oil tank and top up if necessary.

- ▶ Monitor the operating temperature development if the machine is fully in operation for several hours.
- ▶ Check the hydraulic power unit for external leakage and correct as necessary.
- ▶ Check the connection points for leakage after several operating hours.

Adjustment of the maximum pressure at the pressure relief valve

- ▶ After switching on the main feed pump, determine the existing system pressure.

The system pressure can be determined at the following points:
• Measuring points MP2 and MP3
• Pressure sensor (control pressure)

The hydraulic circuit diagram can be found in data sheet 51057, see chapter 1.2 Required and amending documentation on page 7.

Proceed as follows to set the maximum pressure protection:

1. Remove the protective cap at the pressure relief valve.
2. Loosen the lock nut (SW19).
3. Turn the grub screw with an internal hexagon of 6 mm clockwise further into the valve.

   The maximum pressure will increase.

   – Check the pressure at the above-mentioned points.

   – Unscrew the grub screw counterclockwise.

   The pressure will decrease.

   – Set the required maximum pressure in this way.
4. Tighten the lock nut applying a tightening torque of 10^{+5} Nm.
5. Put the protective cap back on the pressure relief valve.

When adjusting the pressure relief valve, the seat valve must be in the closed position.
The hydraulic circuit diagram can be found in data sheet 51057, see chapter 1.2 Required and amending documentation on page 7.
Further information on pressure relief valves according to DBDS can be found in the operating instructions 25402-B, see chapter 1.2 Required and amending documentation on page 7.

Problems during commissioning

To support a systematic search for and reduction of errors, refer to the matrix, see Table 47 "Impact of defects" in chapter 15 "Troubleshooting" on page 115.

8.1.6 Flushing the hydraulic system

- Flush the hydraulic system to achieve a defined cleanliness of the hydraulic fluid. This prevents faults and simultaneously increases the life cycle of the components.
- Ensure that the minimum requirements of the cleanliness class for the components are fulfilled after installation of the hydraulic power unit into the machine, as well as after integration into the hydraulic system.

Hydraulic systems in general industrial applications require a cleanliness class of 20/18/15 according to ISO 4406; hydraulic systems with servo valves or sophisticated high-response valves have higher requirements with regard to the cleanliness class, e.g. 19/16/13.

Observe the cleanliness requirement of the components according to the manufacturer data sheets for definition of the targeted condition after flushing.

Preparations:

Required material

- Provision of replacement or flushing filter elements
- If required: Provision of additional pipeline and hose material for flushing and short-circuit links
- Provision of flushing plates, alternative directional valves
- As applicable: Provision of flushing fluid (see information below)

Information on flushing fluid

The same medium can be used as in later operation of the hydraulic system. If a different hydraulic fluid is used, it must be compatible with the operating medium intended for the hydraulic system and with the materials used in the hydraulic system, and in particular the seals. A maximum admissible residual amount (e.g. 0.5 percent by volume) of flushing fluid in the operating medium can be defined (see manufacturer's specifications); in this case, it must be ensured by thorough draining of the flushing fluid prior to filling with operating medium.

In case of comprehensive hydraulic systems with ring and branch lines, detailed planning of the flushing procedure and thorough processing is required.

The following instructions refer to flushing with the hydraulic power unit described in these operating instructions.
For use of a separate flushing unit, the respective operating instructions must be observed!

Flushing temperature

For flushing, the hydraulic power unit is to be set to operating temperature and operated at reduced pressure. Please note that any pressure control circuits must be deactivated during the flushing phase, or prepared for low flushing pressures.

Flushing time No general statement can be made on the duration of the flushing process.
Bosch Rexroth recommends that, regular hydraulic fluid samples should be taken during flushing and analyzed for cleanliness. A suitable sampling point is the return line upstream of the return flow filter.
Depending on the result, it can be decided whether flushing can be stopped (target cleanliness reached) or must be continued.

After flushing After completion of the flushing process, the operating conditions of the hydraulic power unit must be restored, flushing connections removed and connections closed in pressure-tight manner.

8.1.7 Common errors during commissioning

- The oil tank is not checked.
- Hydraulic fluid is filled without filtering.
- The hydraulic system is not bled properly.
- Pressure relief valves set with insufficient distance from the operating pressure (closing pressure difference not observed).
- The switching hysteresis of pressure switches is not observed for setting.
- Parameter changes to the condition of the hydraulic power unit as supplied, e.g. operating pressure, are not documented.

8.1.8 Commissioning of the "electronics"

1. Connection establishment to the CytroBox (IndraDrive)

General information

The IndraWorks software is used for commissioning and diagnosis of IndraDrive drives.
Alternatively, the assistant already mentioned in chapter 8.1 on page 75 can be used for commissioning. The assistant also describes the steps required for commissioning.

Requirements

The following components and prerequisites are required for Ethernet communication with the drive controller:
- Standard Ethernet cable
- Free Ethernet connection on PC or notebook
- IndraWorks Ds

The software "IndraWorks Ds" can be found free of charge on our website www.boschrexroth.com under the search term "IndraWorks Ds".

Establishing a connection

To configure the drive in IndraWorks, a connection to the drive controller must first be established. It can be established via an Ethernet connection using a free Ethernet interface on the drive.
The engineering port X26 on the control section with IP address 192.168.1.10 is provided for this purpose (see Fig. 7, pos. 15 on page 49).

The connection can be established directly when IndraWorks DS is started, or via the menu Extras ▶ Connection ▶ Connection selection.

The IP address can be changed via the operating unit of the drive controller or via IndraWorks DS.

If the control system is connected to the company network, follow the instructions of your network administrator.

Ethernet connection

After starting IndraWorks, the connection selection dialog opens. Select the network search tab to find all devices which are in the same network, regardless of their IP and computer configuration. You will also find devices with IP configurations beyond the sub-network used.
However, this requires a fixed IP address set on the PC or notebook (no DHCP).

A search across network boundaries (router) is not possible.

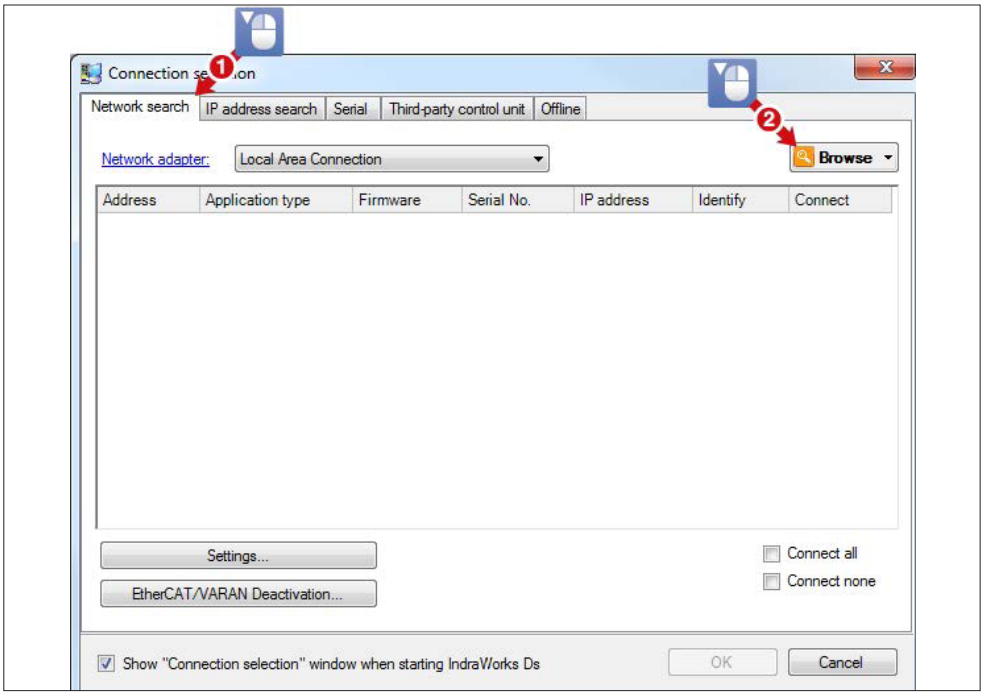


Fig. 31: Network search

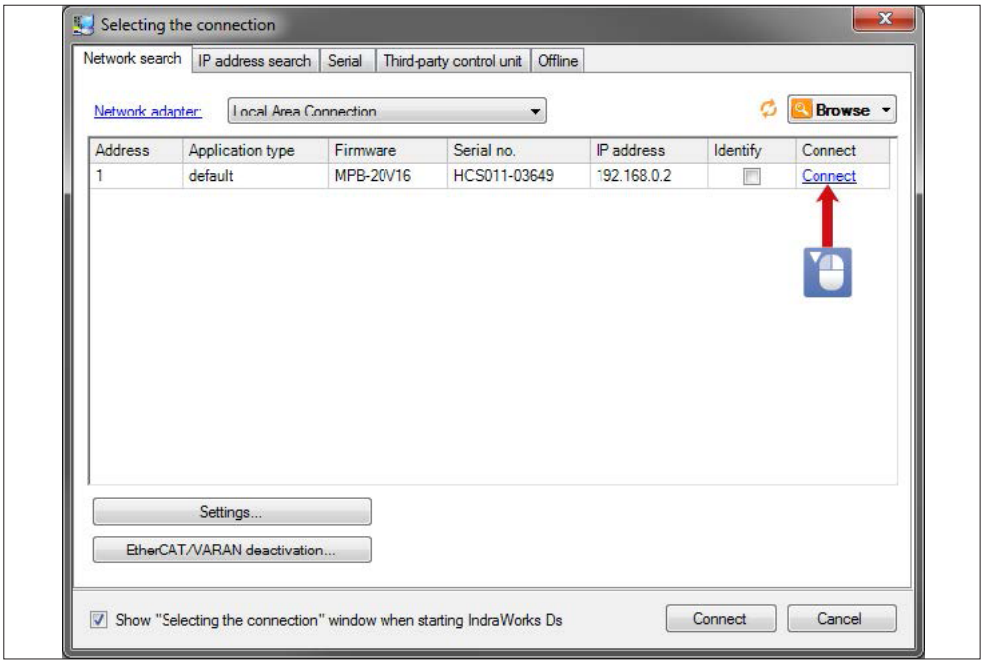


Fig. 32: Establishing a connection in the network search

When "Check" is set in the "Identify" column, hash tags flash on the display of the drive controller, see Fig. 7, pos. 16 on page 49 of the indicated drive.

If the network search was successful but the IP address does not match, communication is not possible. IndraWorks then displays the device in red.

▶ In this case, click on “Connect” to add the computer IP address.

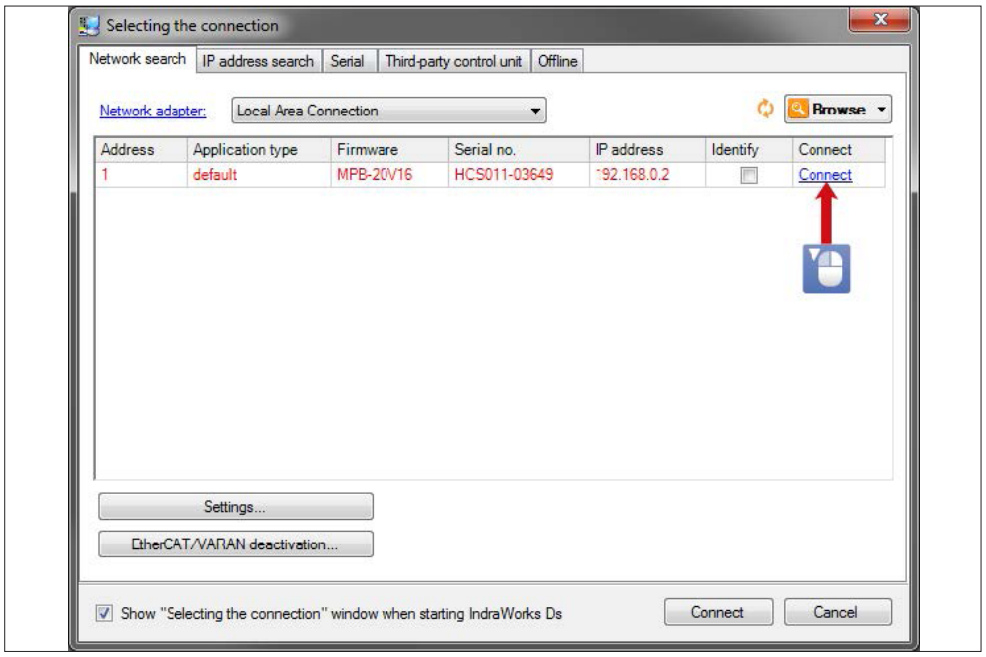


Fig. 33: IP address does not match

IndraWorks automatically adds an appropriate IP address in the computer to enable communication with the devices. The address is automatically deleted if the checkbox for "Restore old settings on exit" is selected and IndraWorks is closed, or after a system restart.

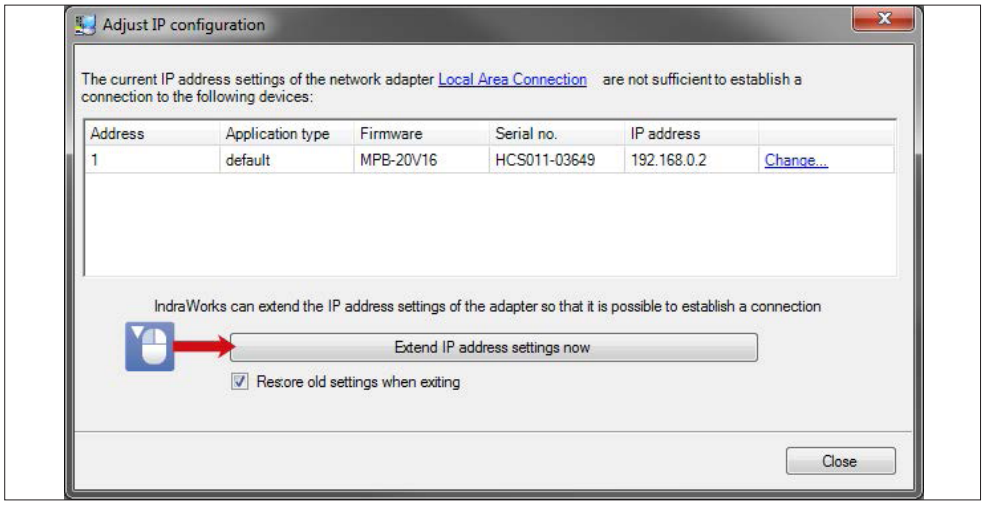


Fig. 34: Adding IP address settings

Another way to establish a TCP/IP connection is to specify the address range to be searched in the connection selection dialog in the IP address search tab.

This method also works across network boundaries (router).

To this end, enter the address or the range in the following screen "Connection selection":

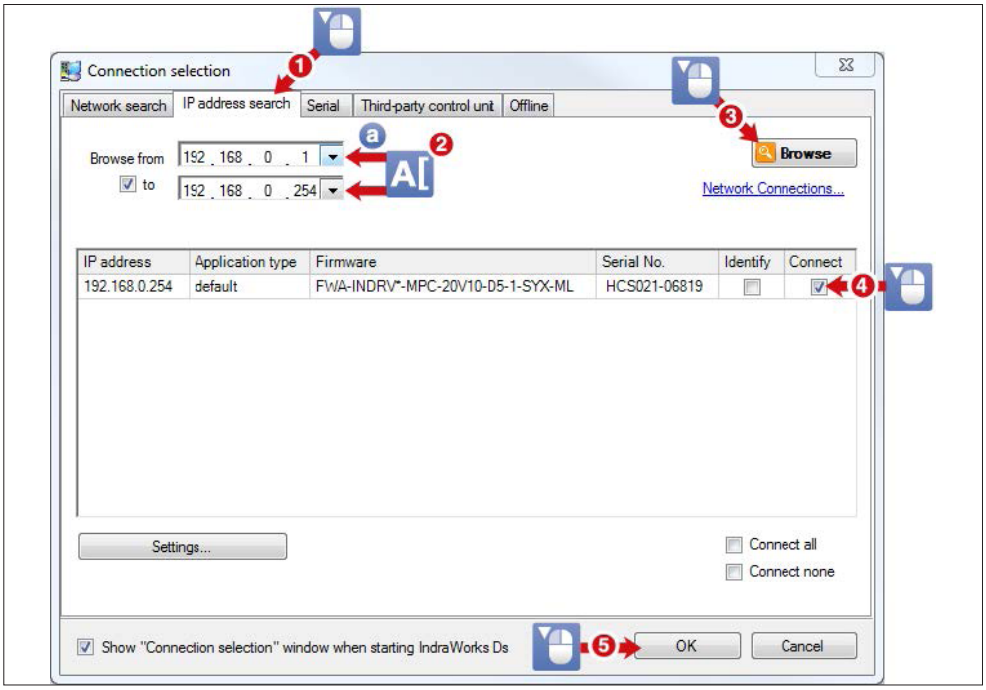


Fig. 35: Establishing a TCP/IP connection to the drive via an Ethernet interface

IP address range

The current IP settings of the drive can be read out from the operating unit.
For local networks, IP addresses in the following address range can be assigned:

- 10.0.0.0 to 10.255.255.255,
- 172.16.0.0 to 172.31.255.255 and
- 192.168.0.0 to 192.168.255.255

CytroBox default settings:

IP address:	192.168.0.10
Network mask:	255.255.255.0
Standard gateway:	0.0.0.0

Parameterization of the desired IP address, network mask and standard gateway is only possible in parameterization mode.
The possibly necessary switching into parameterization mode via the operating unit is described below.

Setting the IP address using the operating unit

To set the IP address using the operating unit (see Fig. 1 on page 24), proceed as follows:

- Switch on the control voltage of the drive controller.
- Press the "Enter" key on the operating unit.
- Using the ▲/▼ keys, select “Ethernet“ and confirm your selection with the “Enter” key.
- Now use the ▲/▼ keys to select the connected interface which you would like to configure (e.g. X22).
- Now select the address which you would like to configure and/or check:
  - IP address
  - MAC address
  - Gateway address
  - Network mask (subnet mask)

The individual octets are accepted by pressing the "Enter" key. You can always get back by using the "ESC" key.

2. Configuration of communication to IndraDrive

Service mode

First activate service mode as described in chapter 5.3.4 "Fixed command value memory" on page 35. It is also indicated on the display of the drive controller, see Fig. 7, item 16 on page 49. The command values for pressure and speed can then be specified via the appropriate parameters. Then the CytroBox can be activated via the easy startup mode. This mode is very well suited for initial commissioning in order to put the system under pressure independently of the set field bus communication. Moreover, the system can be bled in this mode.

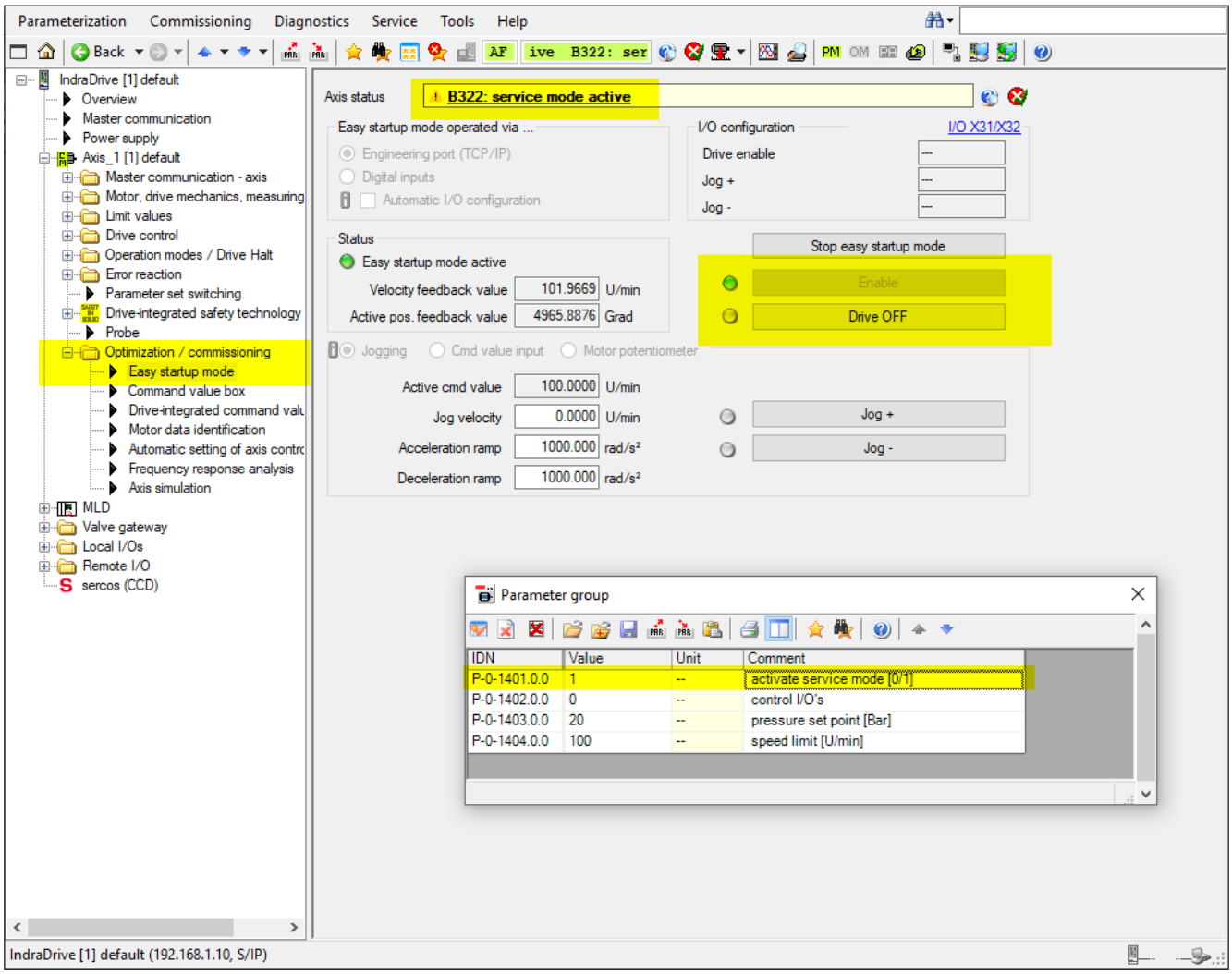


Fig. 36: Easy Start

In service mode, the optional oil cooling and water valve are not started automatically. These functions can be controlled manually via the bits in parameter P-0-1402, see Table 40.

Table 40: Parameter P-0-1402

Parameter P-0-1402		
Bit	**Description**	**Note**
0	Reserved	
1	Reserved	
2	Switch for oil cooling pump 0: not enabled 1: enabled	Effective when P-0-1401 bit 0 = "1"
3	LED green 0: not enabled 1: enabled	Effective when P-0-1401 bit 0 = "1"
4	LED red 0: not enabled 1: enabled	Effective when P-0-1401 bit 0 = "1"
5	LED blue 0: not enabled 1: enabled	Effective when P-0-1401 bit 0 = "1"
6	Switch/valve for water cooling 0: not enabled 1: enabled	Effective when P-0-1401 bit 0 = "1"
7 ... 15	Reserved	

Control communication

Connection to the control system

Connection to the control system can be established via the communication interfaces provided in the drive. In this connection, the following interface types are distinguished:

- Digital I/Os from interface
- Multi-Ethernet (EtherNet/IP™, Sercos®, PROFINET®, EtherCAT®)

All fieldbuses available to the IndraDrive are supported:

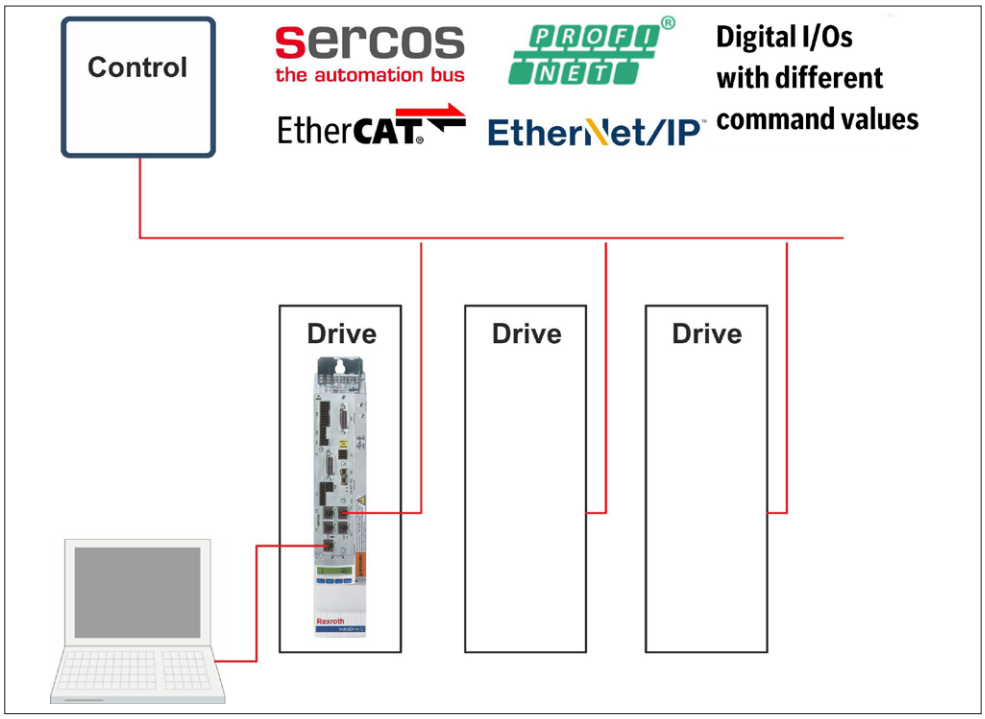


Fig. 37: Connection to the control system

Bosch Rexroth recommends activating the control communication only after the remaining configuration of the IndraDrive and the technology function. Repeated phase switching of the drive state machine, which is necessary for commissioning, leads to delays in machine commissioning under an active fieldbus.

The basic configurations are made for the selected interface by loading basic settings.

The device file for all fieldbuses can be found on our website www.boschrexroth.com under the search term "DeviceDataSheet". Alternatively, the files can be obtained from the IndraWorks Ds installation directory, e.g. C:\Program Files (x86)\Rexroth\IndraWorks Ds\DeviceDataSheets\IndraDrive.

PROFINET®

The commissioning instructions "IndraDrive with PROFINET® - example with Siemens SIMATIC S7" (R911341342), see chapter 1.2 "Required and amending documentation" on page 7, describe the detailed configuration of the control system and the IndraDrive. The major steps to be taken from the IndraDrive side are described below.

1. Activating the fieldbus (P-0-4089.0.1 = 4)

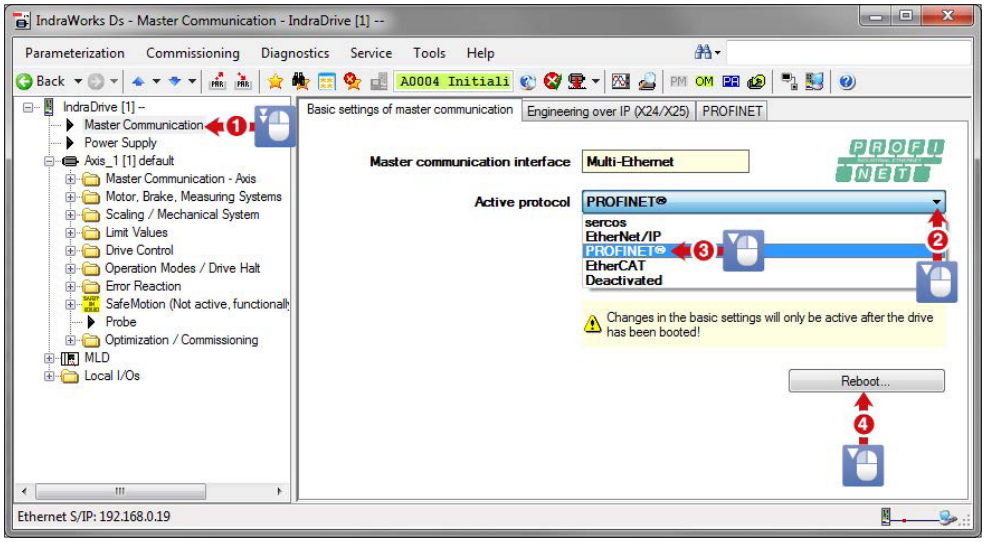


Fig. 38: Fieldbus start dialog

Restart (C6400) required!

2. The slave address (P-0-4025) can be set optionally; the communication is IP-based and is configured via the device name on the higher-level control.

3. Activating the profile type "freely configurable mode" (P-0-4084 = 0xFFFE)

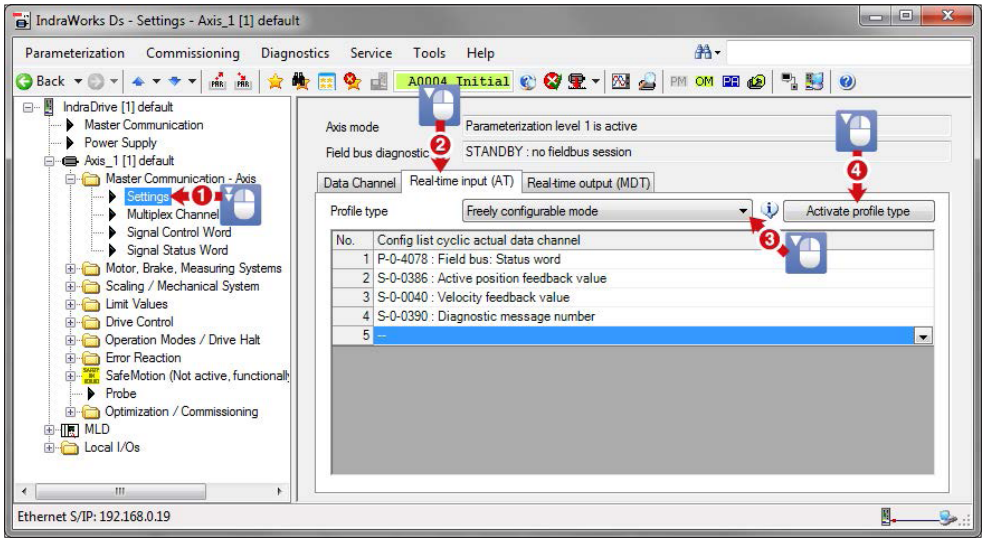


Fig. 39: Activating the freely configurable mode

4. Configuring cyclic actual values (AT) and command values (MDT)

▶ Configure cyclic actual values (AT) and command values (MDT) as required from Table 41 on page 95.

EtherNet/IP™ Below, the major configuration steps for the IndraDrive are described.

1. Activating the fieldbus (P-0-4089.0.1 = 3)

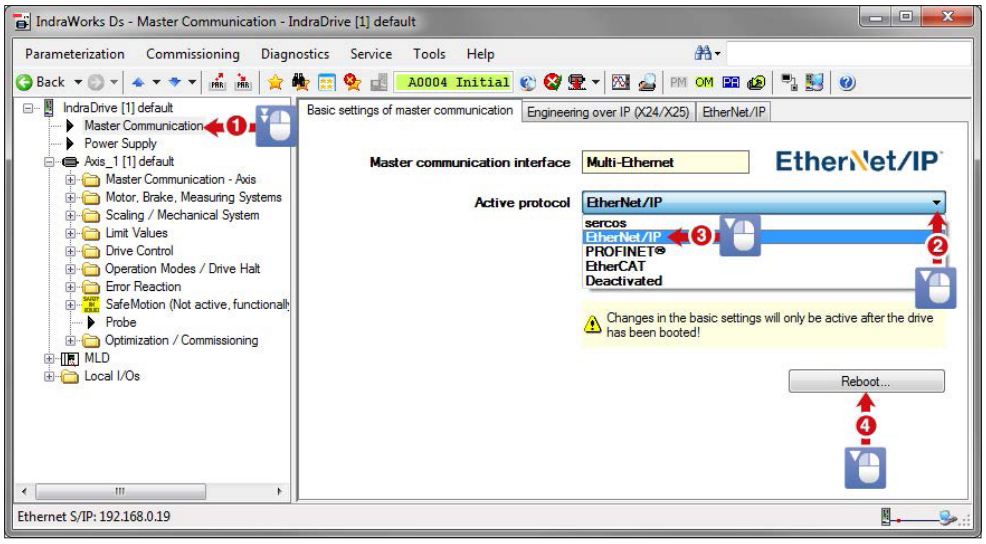


Fig. 40: Activating EtherNet/IP™

Restart (C6400) required!

2. The slave address (P-0-4025) can be set optionally; the communication is IP-based and is configured on the higher-level control.

3. Activating the profile type "freely configurable mode" (P-0-4084 = 0xFFFE)

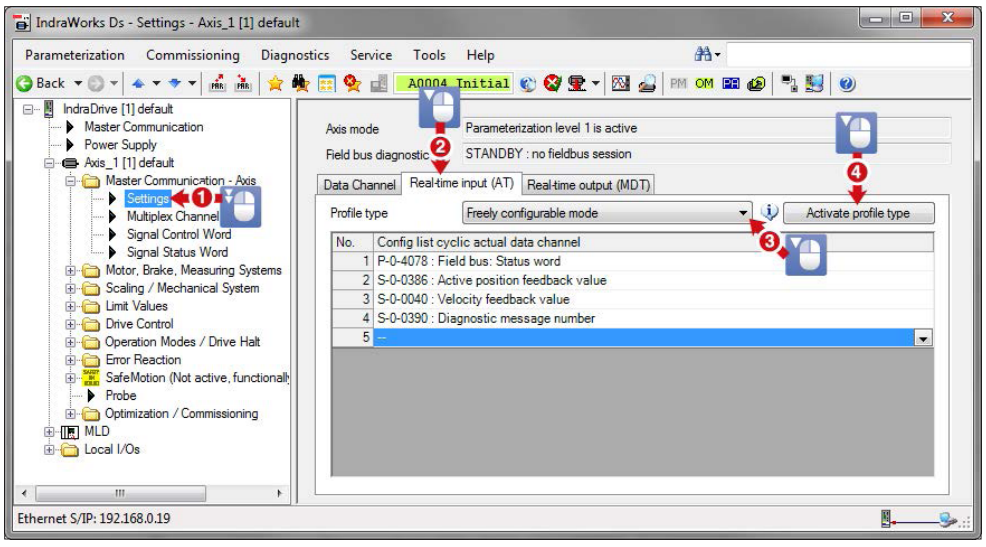


Fig. 41: Activating the freely configurable mode

4. Configuring cyclic actual values (AT) and command values (MDT)

▶ Configure cyclic actual values (AT) and command values (MDT) as required by Table Table 41 on page 95.

EtherCAT® (SoE)

The commissioning instructions "IndraDrive with EtherCAT® - example with Beckhoff TwinCAT®" (R911341344), see chapter 1.2"Required and amending documentation" on page 7, describe the detailed configuration of the control system and the IndraDrive. Since the configuration is carried out almost exclusively on the control system side, only the control communication must be activated on the IndraDrive.

1. Activating the fieldbus (P-0-4089.0.1 = 5)

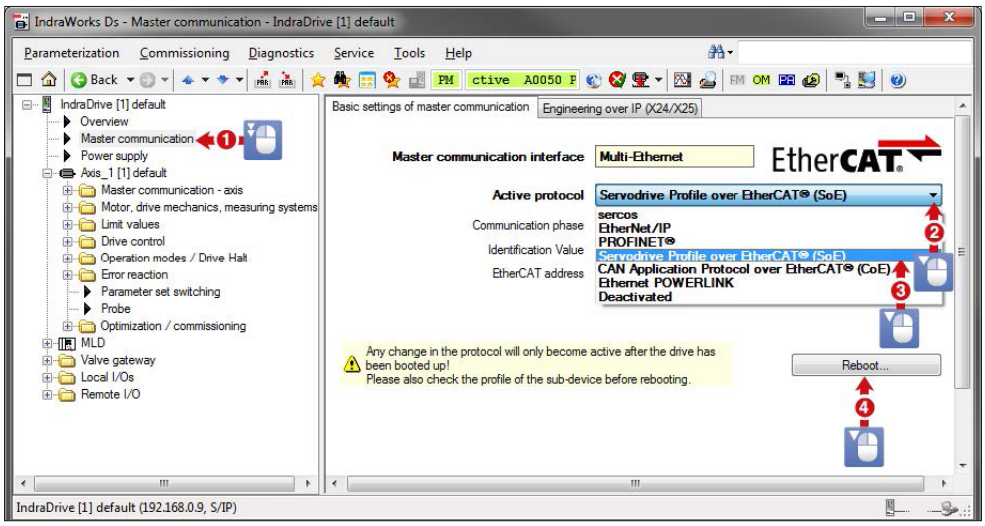


Fig. 42: Activating EtherCAT® (SoE)

Restart (C6400) required!

2. Profile type "Servodrive Profile" (P-0-4084 = 0x0002)

3. Configuring cyclic actual values (AT) and command values (MDT)

▶ Configure cyclic actual values (AT) and command values (MDT) as required from Table 41 on page 95.

EtherCAT® (CoE)

1. Activating the fieldbus (P-0-4089.0.1 = 8)

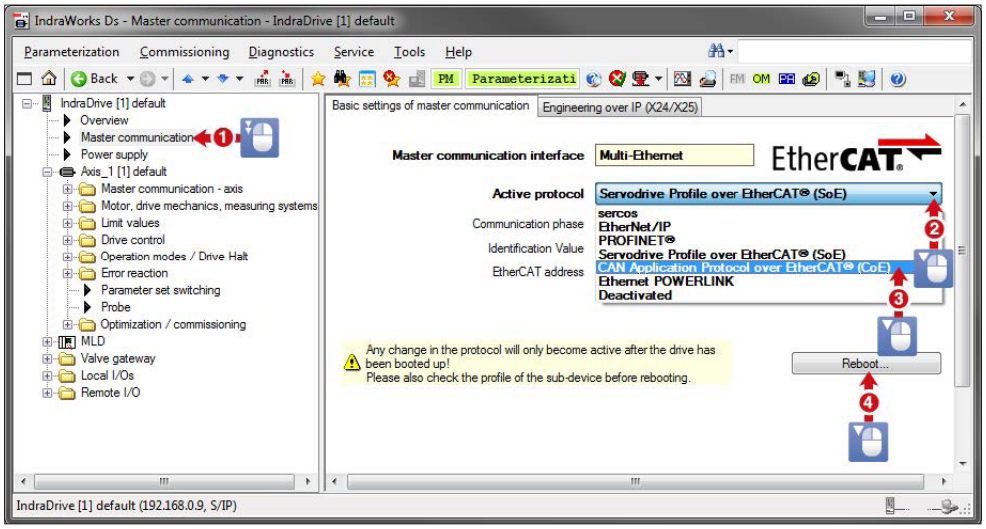


Fig. 43: Activating EtherCAT® (SoE)

Restart (C6400) required!

2. Profile type "Servodrive Profile" (P-0-4084 = 0x0402)

3. Configuring cyclic actual values (AT) and command values (MDT)

▶ Configure cyclic actual values (AT) and command values (MDT) as required from Table 41 on page 95.

Sercos® Since the configuration is carried out almost exclusively on the control system side, only the control communication must be activated on the IndraDrive slave.

1. Activating the fieldbus (P-0-4089.0.1 = 6)

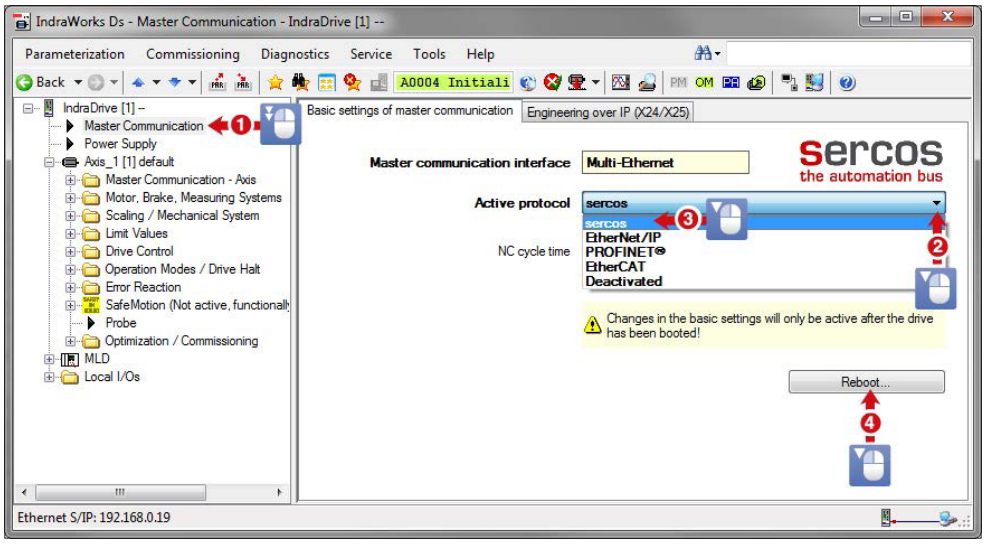


Fig. 44: Activating Sercos®

Restart (C6400) required!

2. Profile type "FSP drive (Sercos® profile)" (P-0-4084 = 0x0102)

On the control side, the CytroBox is not to be set up as an IndraDrive but as a Sercos I/O device.

3. Configuring cyclic actual values (AT) and command values (MDT)

▶ Configure cyclic actual values (AT) and command values (MDT) as required from Table 41 on page 95.

CytroBox field bus interface

Table 41: Field bus interface

Parameter	Description	Length [byte]	Length [word]	Resolution	Unit	Fieldbus	Note
Control system -> CytroBox							
S-0-0134	Master control word	2	1	0	-	SC/EC	CytroBox on. Pressure control active! (Activate bit 13,14,15.) Remove at PN/EIP.
S-0-0145	Signal control word	2	1	0	-	SC/EC	Delete error. (Activate bit 0.) Remove at PN/EIP.
P-0-4077	Fieldbus control word	2	1	0	-	PN/EIP	CytroBox on. Pressure control active! (Activate bit 13,14,15, delete bit 5 error.) Remove at SC/EC.
S-0-0800	Pressure command value	4	2	0.001	bar	SC/EC/PN/EIP	Pressure command value presetting
P-0-1377	Speed limitation	4	2	0.0001	rpm	SC/EC/PN	Speed limitation
CytroBox -> control							
S-0-0135	Drive status word	2	1	0	-	SC/EC	Drive status Remove at PN/EIP.
P-0-4078	Fieldbus status word	2	1	0	-	PN/EIP	Drive status Remove at SC/EC.
S-0-0813	Actual value of system pressure	4	2	0.001	bar	SC/EC/PN/EIP	-
S-0-0040	Actual value of speed	4	2	0.0001	rpm	SC/EC/PN/EIP	-
P-0-1301	Actual value of flow	4	2	0.0001	l/min	SC/EC/PN/EIP	-
P-0-1300	Diagnostic number	4	2	0	-	SC/EC/PN/EIP	Diagnostic number
P-0-1411	Diagnostic function	2	1	0	-	SC/EC/PN/EIP	-
P-0-1412	Diagnostic warning	2	1	0	-	SC/EC/PN/EIP	-
P-0-1413	Diagnostic fault	2	1	0	-	SC/EC/PN/EIP	-
P-0-1279	Oil temperature	4	2	0.01	°C	SC/EC/PN/EIP	-
P-0-1291	Oil level	4	2	0.01	l	SC/EC/PN/EIP	-
S-0-0383	Servo motor temperature	2	1	0.1	°C	SC/EC/PN/EIP	-
P-0-0141	Thermal utilization converter	2	1	0.1	%	SC/EC/PN/EIP	Optional
P-0-0446	Thermal utilization servo motor	2	1	0.1	%	SC/EC/PN/EIP	Optional
P-0-1293	Leakage flow	4	2	0.01	bar	SC/EC/PN/EIP	Optional
P-0-1294	Leakage temperature	4	2	0.01	°C	SC/EC/PN/EIP	Optional
P-0-1270	Air inclusion	4	2	0.1	mbar	SC/EC/PN/EIP	Optional
P-0-1272	Water content	4	2	0.1	ppm	SC/EC/PN/EIP	Optional
P-0-1273	Actual pressure value of filter	4	2	0.01	bar	SC/EC/PN/EIP	Optional
P-0-1292	Particle content	4	2	0.01	OZ	SC/EC/PN/EIP	Optional
P-0-1424	Particle content S	2	1	0	OZ	SC/EC/PN/EIP	Optional
P-0-1425	Particle content M	2	1	0	OZ	SC/EC/PN/EIP	Optional
P-0-1426	Particle content L	2	1	0	OZ	SC/EC/PN/EIP	Optional
P-0-1427	Particle content XL	2	1	0	OZ	SC/EC/PN/EIP	Optional

PN = ProfiNet, EC = EtherCat, SC = Sercos, EIP = EtherNetIP

The ProfiNet communication of the CytroBox allows a maximum of 48 byte / 24 word. Bosch Rexroth counts the bits starting from 0 to 15 for a word. Further communication via parameter channel or multiplexer.

Digital I/Os

With the fixed command value mode, it is possible to select an operating point for pressure p and speed n via the command value interface which is transferred to the IMC platform.
Alternatively, an alternative command value for pressure and speed can be cyclically commanded in service mode.

Activation of the service mode

The call-up of values and their transfer to IMC can be activated using service mode via parameter P-0-1401 (activation of service mode) bit 0. In this case the function for p and n command value presetting is activated equally.

In service mode, the optional oil cooling and water valve are not started automatically. These functions can be controlled manually via the bits in parameter P-0-1402, see Table 40.

Table 42: P-0-1401 service mode

P-0-1401 bit level	Function
0	Service mode selection FALSE = commanding p and n from cyclic customer interface for IMC TRUE = commanding p from P-0-1403 and n from P-0-1404

Activation of the fixed command value mode

Alternatively, p and n can be set separately for the command value presetting by means of configuration in P-0-1370 (configuration word process controller) bits 26 and 27.

Fixed command values can only be preset if the service mode is not active.

Table 43: P-0-1370 fixed command value mode

P-0-1370 bit	Function
26	Selection Commanding pressure FALSE = commanding p from cyclic customer interface for IMC TRUE = commanding p from fixed command value memory
27	Selection Commanding speed FALSE = commanding n from cyclic customer interface for IMC TRUE = commanding n from fixed command value memory

Selection of the operating point in fixed command value mode

The selection of the operating point for p and n can be specified cyclically via the parameters. The function is selected in the 1-ms task. For pressure, the operating point can be selected using P-0-1394, while the operating point for speed can be selected using P-0-1395. The assignment to the operating point is provided in the following table:

Table 44: Selection of the operating point

Value for the selection of the operating point P-0-1394/P-0-1395	Operating point
0	0
1	1
2	2
3	3
ELSE	No new operating point is assigned. The last valid value in the command value presetting remains active.

The operating points for pressure p and speed n can be configured in the following parameters:

Table 45: Configuration of the operating points

Operating point index	Operating point	
	Pressure p	Speed n
0	P-0-1311[100]	P-0-1311[110]
1	P-0-1311[101]	P-0-1311[111]
2	P-0-1311[102]	P-0-1311[112]
3	P-0-1311[103]	P-0-1311[113]

3. Configuration of the hydraulic power unit (HPU)

The configuration of the HPU is pre-set at the factory, and usually does not need to be adjusted. Any changes that are necessary nonetheless can be made via parameter P-0-1380. Moreover, the threshold values can be adjusted if necessary.

Only carry out changes if they are absolutely necessary and you have agreed them with Bosch Rexroth.

4. IMC configuration

The CytroBox pressure control is optimized for most of the applications. If necessary, the parameters of the control setting can be optimized.

For further information, refer to the commissioning description of the SvP 7020 IMC, see chapter 1.2"Required and amending documentation" on page 7.

- Check whether the optimization of the pressure control is necessary for your application.
- To this end, analyze the behavior of the pressure control by means of the oscilloscope function.

IMC optimization

For easier commissioning, dialogues are provided which have been specially developed for the technology function.

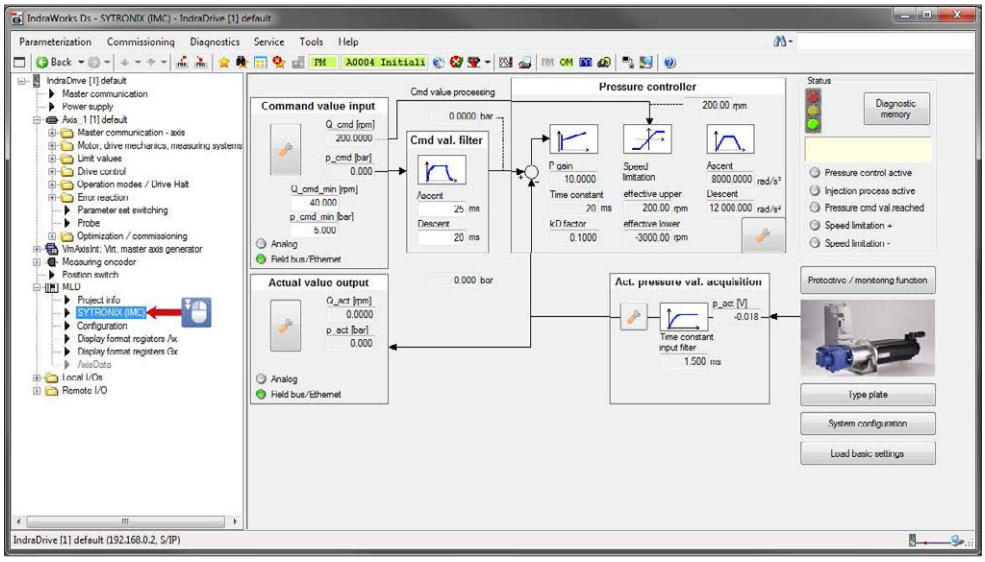


Fig. 45: Start dialog of the IMC software / parameter file

The optimized parameters are imported during manufacturing and can be maintained for most applications. These instructions can be used for any necessary optimization/adaptation of the pressure values.

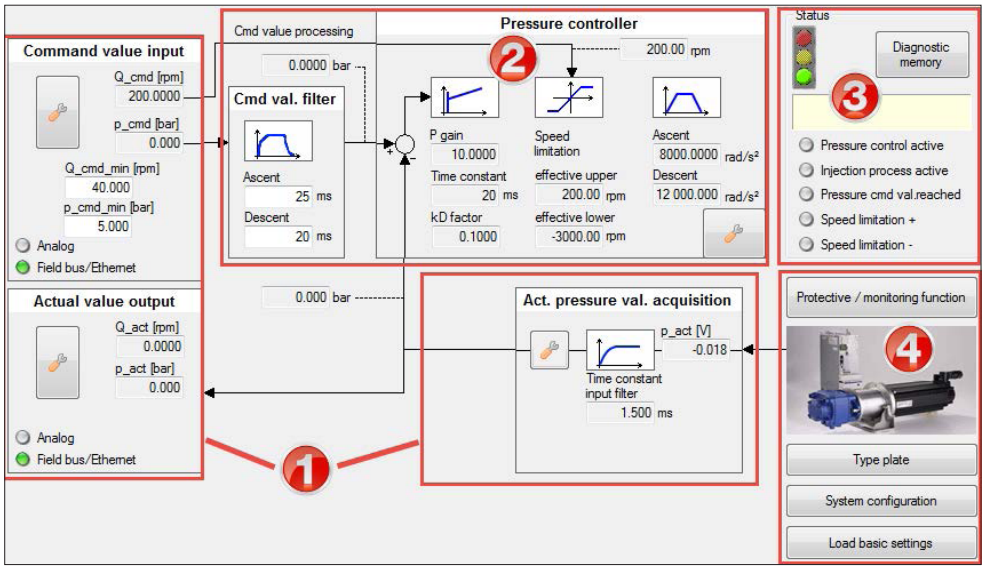


Fig. 46: Operating range of the start dialog

The dialog consists of four operating ranges which are explained below:

1. I/O configuration:

Configuration of the input and output signals for the IndraDrive

2. IMC controller:

Configuration of the IMC controller

3. Diagnosis:

Status display and issue of warnings and errors

4. Configuration:

Information on the settings of the overall system (hardware and software)

These four functions can be displayed with IndraWorks.

5. Loading the HPU project (in case of service or update)

Software/parameter file (*.par)

To work with the HPU dialog, the software/parameter file must be loaded on the micro SD card, see Fig. 7, item 17 on page 49.
In the condition as supplied, the software/parameter file FWS-MLDSYX-IMC-02Vxx-D0-MP20-HPU02Vxx-NN is already installed.

No PLC programming knowledge is required since the CytroBox function is fully operable via the dialogues and functions in IndraWorks.

To this end, the following steps must be carried out:

1. To display the active MLD program and its status, click "Project info" under the MLD node in IndraWorks.
2. Here, the loaded software/parameter file can be verified, and it can be ensured that the program is running (“RUN” status).
3. If necessary, a new program can be loaded (as software/parameter file) via "Load project...".
4. When the project name (FWS-MLDSYX-IMC-02Vxx-D0-MP20-HPU02Vxx-NN) is displayed, the "SYTRONIX 7020 (IMC02)" dialog appears in the project tree.

Loading the basic parameters results in loss of HPU functionality and should not be performed.
To restore the condition as supplied in case of error, the HPU project (FWS-MLDSYX-IMC-02Vxx-D0-MP20-HPU02Vxx-NN) and the corresponding standard parameters must be reloaded.
This is only necessary in case of service or for updates.

8.2 Re-commissioning after longer standstill

For re-commissioning after a lengthy standstill, proceed as follows:

- Check:
  - the hydraulic fluid level
  - hydraulic components and line systems for tightness
- Switch on components with increased caution.
- Bleed the hydraulic system.
- Observe the information in the operating instructions of the machine/system manufacturer.

9 Operation

The hydraulic power unit is intended as partly completed machinery for installation into a machine/system.
The hydraulic power unit has no direct function (e.g. switch) to put the product out of operation. Make sure that required measures for decommissioning are implemented by the machine/system manufacturer.
Information on operating the hydraulic power unit can only be provided in connection with the machine/system. For this information, please refer to the operating instructions of the machine/system manufacturer.

10 Maintenance and repair

Maintenance tasks (inspection, maintenance, repair) must be defined according to system-specific requirements, operating conditions (pressures, temperatures, environmental conditions) and the operating life (duty cycle, cycle times, shift operation).
The declarations made in this chapter are based on climate conditions in Central Europe and common environments in the metal-processing industry.
A negative trend of test parameters such as hydraulic fluid temperature, short replacement intervals of filter elements, or noise, indicate changes. If necessary, the troubleshooting matrix, see chapter 15, Table 47 on page 115, provides support for the identification of any issues that occur.
Slow increase in temperature and/or shorter filter replacement intervals indicate potential wear at the pump, seals as well as aging of hydraulic fluid and should initiate inspection of all relevant components.
Immediate strong increases in temperature are a warning sign and require immediate inspection of the machine/system.

For further information on the scope and time intervals for maintenance and repair of the overall machinery/system, please refer to the operating instructions of the machine/system manufacturer.

10.1 Cleaning and care

For cleaning and care of the hydraulic power unit, observe the following:

- Make sure that all seals and electric plug-in connections are firmly fitted to prevent the penetration of cleaning agents and/or humidity into the hydraulic power unit.
- Do not use aggressive cleaning agents for cleaning. Clean the hydraulic power unit using a suitable cleaning liquid.
- Do not use a high-pressure washer.
- Do not use compressed air for the cleaning at functional interfaces.
- Remove external coarse dirt and keep sensitive and important parts like electrical connections clean.
- For cleaning, use a damp, non-linting cloth or residue-free industrial wipes.

10.2 Inspection

Bosch Rexroth recommends documenting the inspection results

- so that considering functionality and economy, the inspection and maintenance intervals can be adjusted to the actual operating conditions,
- by comparing the documented values, you can identify faults at an early point in time.

▶ Before any inspection work, clean the hydraulic power unit as necessary.
▶ Carry out the following visual inspections for clearly apparent defects:
  – Illegible notices or warning signs
  – Leakage
  – Loose and/or missing parts
  – Indications of external force effects

10.3 Warning devices

The hydraulic power unit is equipped with an LED strip for status display:

- Normal operation: LED strip illuminated in cyan
- Warning: LED strip illuminated in yellow
- Error: LED strip illuminated in red

Precise reading of error messages is possible via the X26 interface (engineering port) of the control part and the IndraWorks DS software.
The errors are also indicated on the display of the drive controller, see Fig. 7, item 16 on page 49.

10.4 Maintenance schedule

Note the status display on the display of the drive controller, see Fig. 7, item 16 on page 49.

Table 46: Maintenance schedule

Activity/maintenance interval	1/2 year	1 year	2nd/6th year	10 years	Alternatively: Hours of operation
Visual inspection External leakage, cracking, force effect, corrosion (oil tank, hose lines, fittings)	X				
Checking Electric components/installation		X			
Checking Pressure values	X				
Checking (oil sample) Quality control of the hydraulic fluid		X [1)]			
Replacement Pressure filter element Return flow filter element		X [1)]			Depending on the clogging indicator
Visual inspection/replacement/cleaning Supply and exhaust air in electrical cabinet Hydraulic cabinet supply air Breathing filter oil tank		X [1)]			
Change Hydraulic fluid					20,000 [2)]
Replacement Pressure transducer					60.000
Replacement Hydraulic hose lines Water pipes			6 years after production or 2 years in case of higher requirements [3)]		
Bearing replacement MS2N motor Axial piston pump					30,000 [2)]
Replacement/product overhaul IndraDrive control and power part				X	
Replacement Memory cards				X	
Replacement UPS				X	
Replacement Motor and pump bearings Shaft seal rings				X	
Relubrication Molybdenum lubricating paste				X	
Replacement/product overhaul Sensors				X	
Replacement Additional components				X	

[1)] These components/substances or materials are subject to natural wear. It is therefore very important to permanently check the components' condition. If necessary, these components are to be replaced outside the maintenance intervals.
[2)] Depending on the operating temperature and oil sample analysis.
[3)] Increased requirements are, for example, extended times of use, powerful external and internal influences or pressure pulsation.

By using the CytroConnect Predict online service, see chapter 5.2 on page 23, the required activities from Table 46 can be carried out depending on the actual condition.

10.5 Maintenance

10.5.1 Checking the electric components/installation

- Have the entire electric installation regularly checked by a specialized electrician.
- In addition, carry out regular machine and system inspections in accordance with DIN EN 60204-1 (VDE 0113 Part 1) or DIN VDE 0701-0702.
- Check the power unit housings, cables as well as the plug-in connections and connector contacts for damage.

Inadmissible damage includes breaks, cracks, abrasion, deformation or discoloration.
The hydraulic power unit may only be operated if the electric components are not damaged.

10.5.2 Monitoring the filling level

Measures in case of exceeding maximum filling level:

1. Expansion due to temperature increase
   (Rough determination: delta V = thermal expansion coefficient x delta T)
   – Correct the filling level
2. Exceeding of the maximum filling level due to presumed water ingress
   – Close water valves (locking of the cooling water supply)
   – Take an oil sample from the bottom of the oil tank and check it for water content
   – If water ingress is confirmed, finish the working cycle of the machine and put it out of operation under safe conditions
   – Carry out additional control measures and take the following measures depending on the results:
   – Correct the cause of the water ingress
   – Clean or drain and change hydraulic fluid
   – If necessary, flush the system
   – Check the hydraulic fluid for admissible water content

Measures in case of falling below the minimum filling level:

– Identify and correct the cause of the leakage
– Afterwards, fill hydraulic fluid to the correct filling level
– Note the oscillating volume

10.5.3 Monitoring the oil temperature

Possible causes for temperature increase:

Possible causes for temperature increase include:
- Heat exchanger malfunction
- Change in cooling water conditions
- Circulating pump for oil cooling defective
- Malfunction or incorrect setting of pressure valves (e.g. maximum pressure limit, pump control, pressure reducing valve)
- Error at the pump (wear, increased leakage)
- Changed environmental conditions (e.g. increased ambient temperature)
- Changed load conditions at drives

In case of inadmissible temperature increases, the causes must be determined and corrected.

Cold start behavior monitoring

The cold start behavior is safeguarded via the oil temperature. The switching threshold is analyzed and monitored using parameters P-0-1389[25] with warning and P-0-1389[27] with error. Furthermore, the monitoring of the filter is suppressed until the temperature threshold P-0-1389[29] is exceeded.

Diagnostic numbers:	B308 warning	Parameter P-0-1389[25]
	D308 error	Parameter P-0-1389[27]

For further information, refer to data sheet 91485, see chapter 1.2 Required and amending documentation on page 7.

10.5.4 Monitoring the filter element contamination (pressure filter)

Be skeptical if the filter contamination sensor technology (pressure sensor) does not indicate a required change over several inspection intervals. Of course, this may always be an indicator that the hydraulic fluid is clean. However, it may also have the following causes:

– The filter element is defective.

Measure:

Plan and carry out replacement of the filter element at the end of the shift. Shorten the intervals between the required replacement of filter elements, identify the cause of the deposition of dirt and correct it.

Changing the filter element of the pressure filter:

Proceed as follows:

1. Before starting to work, provide receptacles for the hydraulic fluid and the filter element.
2. Depressurize the hydraulic power unit and secure it against unintentional start-up.
3. Make sure that the pressure accumulators are completely empty and the system is depressurized.
4. Loosen the plug screw of the pressure filter, see Fig. 8, item 3, on page 50, using a hexagon wrench.
5. Loosen the filter bowl using an open-end wrench.
6. Pull the filter bowl down about 10 cm by hand.
7. Then pull the filter element downwards out of the manifold block so that it lies in the filter bowl.
8. Remove the filter bowl together with the filter element from the hydraulic cabinet.
9. Replace the filter element and re-install the filter bowl in the hydraulic power unit in reverse order.
10. Turn the filter bowl hand-tight to the bottom with the open-end wrench and then turn it back half a turn.
11. Bleed the manifold block, e.g. using a Minimess hose, at measuring point MP3 and start the drive in service mode (via the Wizard or IndraWorks Ds).
12. Check the oil level and refill with appropriate hydraulic fluid, if necessary.
13. Dispose of the filter element in accordance with national or company-specific regulations.

10.5.5 Visual inspection of the air filter

▶ Carry out an annual visual inspection and replace the air filters as necessary (see Fig. 5, item 5, 9 and 16 on page 47, Fig. 6, item 11 on page 48).

10.5.6 Checking the pressure values

The pressure values need to be checked in case of any changes in drive behavior (e.g. increased cycle time, end product quality, etc.). Otherwise, Bosch Rexroth recommends an inspection at least every six months.

In addition, Bosch Rexroth recommends documenting the pressure values in the maintenance documentation.

10.5.7 Hydraulic fluid care

The hydraulic fluid should be analyzed at least annually. For analyzing the hydraulic fluid, a thorough hydraulic fluid sample must be taken. The hydraulic fluid sample must be checked in a qualified laboratory according to the applicable manufacturer's specifications for the hydraulic fluid.

Measures: Depending on the result, additional measures need to be taken, e.g.:
- Additional filtering measures
- Dehydration
- Replacement

The use of treated and recycled hydraulic fluid (secondary raffinate hydraulic fluid) is to be avoided.

For hydraulic fluid change, proceed as follows:
- ▶ Fully drain the hydraulic fluid, see also chapter 11.1 "Preparing for decommissioning" on page 110.
- ▶ In this connection, ensure complete draining of the lines and actuators.
- ▶ If necessary, carry out bleeding measures.
- ▶ Fill the system as for initial filling with subsequent bleeding of the hydraulic system, see chapter 8.1.2 "Filling of the hydraulic power unit" on page 76.

10.5.8 Visual inspection for leakage, cracking, force effects and corrosion

External inspection is visual inspection and needs to be carried out at least semi-annually (or more often depending on operating conditions and use).
Clean the system before visual inspection as necessary.
Visual inspection is carried out for:
- Leakage
- Cracking
- Corrosion
- Dents due to external force effects

Leakage In case of leakage at screwed in components, these must be tightened with the appropriate torque and documented. If leakage still occurs at this position, the contact must be thoroughly checked for the cause of leakage. Depending on the result, seals and/or the component must be replaced.

Cracking and resulting leakage In case of cracking and resulting leakage, the cause must be identified and corrected. Afterwards, affected components must be replaced or thoroughly repaired.

External force effects In case of indications of external force effects, the cause must be identified and corrected. Afterwards, the component and nearby components must be checked for damage and assessed for further reliable use.
As required, these components are to be replaced or thoroughly repaired.

Corrosion In case of indications of corrosion, the component must be checked for damage and assessed for further reliable use. As required, this component is to be replaced or thoroughly repaired. In any case, corrosion protection must be ensured.

10.6 Spare and wear parts

- Please send any spare part orders to the nearest Bosch Rexroth service center or directly contact the headquarters.
  For the addresses, please refer to chapter 17.1 "List of addresses" on page 118.

Spare parts order

- Order spare parts in writing. In urgent cases, you can also place an order by phone, but you are kindly requested to confirm your order in writing, e.g. by fax.
- Please provide the following information when ordering spare parts:
  - material number and order number of the hydraulic power unit (name plate)
  - material number of the respective component
  - required quantity
  - the desired type of dispatch (e.g. as parcel, freight, air freight, by courier service, etc.)

Further information on available spare parts can be found at the following link: www.boschrexroth.com/spc

QR code

11 Decommissioning

11.1 Preparing for decommissioning

- Provide collecting containers large enough to accommodate the total volume of the hydraulic fluid.

The total volume of the hydraulic system comprises the volumes of the oil tank, the line system, the drives, etc.

- Always observe applicable instructions for the overall machinery/system.
- Unless these operating instructions provide different information, proceed as follows:
  - Prevent any hazards due to machinery in the vicinity.
  - Unauthorized personnel must not be allowed access to the working area.
  - Lower loads or support them safely.

11.2 Decommissioning the system

- Switch off the power supply and secure the system against restarting.
- Switch off the hydraulic pressure supply and secure it.
- Make sure that all relevant system parts are depressurized and de-energized.
- Empty the oil tank with a filling unit via the filling coupling (connector plug) type CEJN567-G1/2-020-105676200, see Fig. 8, item 15 on page 50.
  - In this connection, ensure complete draining of the lines and actuators.
  - If necessary, carry out bleeding measures.

Overall machinery/ system

- Decommission the overall machinery/system as described in the overall machinery/system operating instructions.

12 Disassembly and replacement

Only disassemble device parts if this is required to carry out the necessary work. In general, all disassembled parts should be reassembled properly at the intended position.

12.1 Preparing for disassembly

- Ensure sufficient stability of the hydraulic power unit.
- Observe the weight and the position of the center of gravity of the hydraulic power unit.
- Do not loosen the fastening of the hydraulic power unit before the stability of the machine is ensured.
- Prior to disassembly, drain the hydraulic fluid from the hydraulic power unit as described in chapter 11 "Decommissioning" on page 110.
- Check the tight fitting of the eyebolts, see Fig. 10 on page 54, if you need them to lift the hydraulic unit out of the external oil pan, if present.

Safety measures:

- Always observe applicable instructions for the overall machinery/system.
- Unless these instructions provide different information, proceed as follows:
  - Carry out decommissioning as described in chapter 11 on page 110 of these operating instructions.
  - Unauthorized personnel must not be allowed access to the working area.

12.2 Disassembly process

- For disassembly, carry out the work steps described in chapter 7 "Assembly" on page 56 in reverse order.
- Hydraulic fluid runs out of the hydraulic line system of the hydraulic power unit or hydraulic system even after draining. For this reason, close all outlets of lines with suitable blanking plugs.

After disassembly, observe the information on safe transport of the product in chapter 6 "Transport and storage" on page 52.

13 Disposal

When disposing of the hydraulic power unit, please note the following points:

- Fully drain the hydraulic power unit prior to disposal.
- Disassemble the hydraulic power unit into its individual components in order to recycle them.
- Separate, for example:
  - Cast iron
  - Steel
  - Non-ferrous metal
  - Plastic
  - Seals

13.1 Environmental protection

Careless disposal of the hydraulic power unit, its components, the hydraulic fluid and the packaging material can lead to environmental pollution.

Please therefore observe the following points:

- Fully drain the hydraulic power unit prior to disposal.
- Dispose of the hydraulic power unit and the packaging material in accordance with the applicable national regulations in your country.
- Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country. Please also note the valid safety data sheets.

14 Extension and modification

You will be considered responsible for any extensions or modifications to the product.

Any declarations shall become invalid

If you undertake any extensions to or modifications of the product marketed by Bosch Rexroth, this means you are changing the condition as supplied. Any statements made by Bosch Rexroth regarding this product will then become invalid.

For hydraulic power units, this has the following consequence:
Hydraulic power units are partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC. For this product, a declaration of incorporation was received with the product-specific documentation. In case of extension or modification of the hydraulic power unit, this declaration will become invalid.
Please send any queries you may have to your nearest Bosch Rexroth service center or directly to the headquarters.
For the addresses, please refer to chapter 17.1 "List of addresses" on page 118.

14.1 Accessories

For further information on optionally available components and accessories, see data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

15 Troubleshooting

⚠ WARNING

Deactivated safeguards!
Danger to life! Risk of injury!
- ▶ Make sure that all safeguards, e.g. fuses, protective grounding conductor, pressure relief valves are active.
- ▶ Proceed with extreme caution if safeguards need to be deactivated for troubleshooting.
- ▶ If possible, operate the machine/system with reduced performance data in set-up mode for identification of errors.

Successful troubleshooting within the hydraulic power unit requires precise knowledge on the set-up and the mode of operation of individual components. The combination of hydraulics with electrics and electronics makes troubleshooting very complex.
Circuit diagrams (hydraulic and electric), parts lists, functional diagrams as applicable and other documentation must be available for effective troubleshooting.

15.1 How to proceed when troubleshooting

- ▶ Always work systematically and purposefully, even when under time pressure. Random, thoughtless disassembly and changing of settings might in the worst case result in the inability to restore the original cause of error.
- ▶ First, get a general idea of the function of the hydraulic power unit in combination with the overall machinery/system.
- ▶ Try to find out whether the hydraulic power unit has worked properly in combination with the overall machinery/system before the error occurred first.
- ▶ Try to determine any changes of the overall machinery/system, in which the hydraulic power unit is integrated:
- ▶ Were there any changes to the application conditions or area of application of the hydraulic power unit?

Control questions

- Have modifications (e.g. refittings) or repair works been carried out on the overall system (machine/system, electrical system, control) or on the hydraulic power unit?
- If yes: What were they?
- Was the hydraulic power unit or the machine/system used as intended?
- How did the fault become apparent?
- Try to get a clear idea of the cause of the fault.

- ▶ If necessary, ask the actual (machine) operator.

15.2 Overview of the impact of defects

Table 47: Impact of defects

Error	Possible cause	Remedy
Excessive noise level	The hydraulic power unit is not standing with all four machine feet on a level and non-vibrating surface.	▶ Using the height-adjustable machine feet, ensure that all four machine feet are standing evenly on a level and non-vibrating surface and align the hydraulic power unit vertically.
	The hydraulic power unit is connected to the machine via pipelines.	▶ Route out the hydraulic connections between the hydraulic power unit and the machine with hose lines.
Pressure fluctuations in the pressure line	Vibration of the control system, e.g. pressure controller	▶ Check the settings of the controller, see chapter "Optimizing IMC" on page 98.
Incorrect operating pressure	Incorrect pressure command value presetting	▶ Check the pressure command value with parameter S-0-0800 and the fixed command value memory for the command pressure with parameter P-0-1311[100...103]. – Fixed command value memory correctly parameterized – Command value correctly preset via the field bus interface – Service mode active
	Excessive pressure loss due to incorrect dimensioning of hose lines	▶ Replace the hose lines against larger nominal widths.
Pressure command value is not reached or insufficient flow.	Speed limit too low	▶ Check the following values: – Speed limitation with parameter P-0-1377 – Speed limitation of fixed command value memory with parameter P-0-1311[110...113] ▶ Observe the maximum admissible speed of the application. – If necessary, contact the Bosch Rexroth customer service.
Overload of the drive controller during operation	Drive insufficiently dimensioned	▶ Indicator in display "Torque overload drive" – Check parameter S-0-0082, torque/force limit value bipolar. – Check parameter P-0-0141, thermal load converter, and P-0-0446, thermal load servo motor. – Observe the maximum ambient temperature, see also the performance curves in the drive data sheet provided in chapter 1.2 "Required and amending documentation" on page 7.
	Control cabinet air filter contaminated	▶ Replace the air filter of the control cabinet.
Overload of the drive controller when disconnecting hydraulic actuators	Pressure relief valve set too high	▶ Make sure that the pressure relief valve is set 10 bar over the operating pressure.
Drive overtemperature	Insufficient cooling water flow, cooling water temperature too high, insufficient cooling water in the system, inlet pressure too low or deposits in the heat exchanger	▶ Make sure that the coolant complies with the requirements of the technical specifications.
	Cooling water valve does not switch.	▶ Check the cooling water valve for its function. – Make sure that the lamp on the valve connector is illuminated. – Dismantle the rear side of the hydraulic cabinet to this end.

Error	Possible cause	Remedy
Hydraulic fluid temperature too high	Insufficient cooling power of hydraulic fluid.	▶ Calculate the heat input in the hydraulic system, e.g. by calculation of the hydraulic power loss of valves, rotary transmission leadthrough, etc. ▶ Compare the results with the selected oil cooling power of the hydraulic power unit. ▶ Reduce the cooling water temperature, increase the cooling water flow or contact the Bosch Rexroth customer service to install an external oil cooling, if necessary. ▶ Check if the cooling circuit is starting up. The parameter P-0-1411, Status word of special functions Bit 9, indicates whether the oil cooling is active (see also chapter 5.3.5 on page 37).
	Faulty and usually too low pressure valve setting. A part of the pump delivery volume is returned back to the oil tank via the pressure relief valve.	▶ Make sure that the pressure relief valve is set 10 bar over the operating pressure.
	External heat input into the hydraulic fluid	▶ Check whether external heat sources are positioned too close to the hydraulic system. ▶ If necessary, separate the heat sources from the hydraulic system.
	Insufficient cooling water flow, cooling water temperature too high, insufficient cooling water in the system, inlet pressure too low or deposits in the heat exchanger	▶ Make sure that the coolant complies with the requirements of the technical specifications.
	Increased efficiency losses due to changed conditions including wear.	▶ Carry out maintenance work and replace affected components as necessary.
	Cooling water valve is not opened.	▶ Make sure that the cooling water valve is opened (lamp on the valve connector is illuminated).
	Switching threshold of the oil temperature is set too high.	▶ For information, refer to chapter 5.3.5 on page 37.
	Protective motor switch of the recirculation motor has been triggered.	▶ Switch off the protective motor switch for the recirculation motor.
Increased filter contamination	Deposition of dirt due to insufficient cleaning of components during installation.	▶ Flush the system and replace the filter element.
	Deposition of dirt during filling of hydraulic fluids.	▶ Fill the hydraulic power unit via a filling unit with integrated filter.
	Abrasion at components	▶ Make sure that all components are operated according to their specifications.
Air filter contaminated	Contaminated ambient air	▶ Clean or replace the air filters for the oil tank, electrical cabinet and hydraulic cabinet, see chapter 10.6 "Spare and wear parts" on page 109.
Filling level not in the specified range	Leakage	▶ Check and correct the causes for the loss of hydraulic fluid. ▶ If necessary, refill hydraulic fluid.
	Oscillating volume too high	▶ Make sure that the sum of the required oscillating volume of the plunger or differential cylinder complies with the specifications of the hydraulic power unit.
	Water ingress	▶ Check the functionality of the installed plate heat exchanger.
Hydraulic fluid viscosity too high	Insufficient hydraulic fluid temperature or viscosity class too high	▶ Increase the temperature of the hydraulic power unit before starting the machine function. ▶ If necessary, use hydraulic fluid with a lower viscosity class.

16 Technical data

You can find the technical data in data sheet 51057, see chapter 1.2 "Required and amending documentation" on page 7.

17 Appendix

17.1 List of addresses

Contacts for service and spare parts:

Bosch Rexroth AG
Industrial Hydraulics Service
Bürgermeister-Dr.-Nebel-Straße 8
97816 Lohr am Main
Germany

Phone: +49 (0) 9352/40 50 60
Email: service@boschrexroth.com

For service representatives in your area outside of Germany, please refer to www.boschrexroth.com.

Headquarters:

Bosch Rexroth AG
Zum Eisengießer 1
97816 Lohr am Main
Germany

Phone: +49 (0) 9352/18 0

For questions about the product:

Bosch Rexroth AG
Online Customer Support

Phone: +49 (0) 9352/40 30 20
Email: my.support@boschrexroth.com

The addresses of our sales and service network and sales organizations can be found at www.boschrexroth.com/adressen.

17.2 Declaration of incorporation

rexroth
A Bosch Company

Declaration of Incorporation (Translation of the original) **Doc.-No.:** **RE51057-EE**
As defined by the EC Machinery Directive 2006/42/EC, Appendix II B **Date:** **06.11.2019**

The manufacturer

Bosch Rexroth AG
Beckerstr. 31
09120 Chemnitz
GERMANY

Here by declares that the partly completed machinery

Name:	CytroBox - Standardized Hydraulic Power Unit
Function:	Drive unit for hydraulic work machine
Material- / Serial no:	According to R_51057
Type code:	CYTROBOX-N/...

Satisfies the following essential requirements of Machinery Directive 2006/42/EC in accordance with the chapter numbers in Appendix I:

The requirements are fulfilled provided that the data in the product documentation (fitting instructions, operating instructions, project management and configuration documents) are implemented by the product user. The requirements of Appendix I to Machinery Directive 2006/42/EC not mentioned here are not applied and have no relevance for the product.

The special technical documentation for this partly completed machinery was issued according to annex VII part B and is communicated electronically on justified request of individual national bodies.

The partly completed machinery is applied to the following further EC-Directives and harmonised standards:

EN ISO 12100:2010
EN ISO 4413:2010

The partly completed machinery may only be put into operation when it has been established that the machine into which the partly completed machinery is incorporated conforms to the provisions of EC Machinery Directive 2006/42/EC, where relevant according to this directive.

The following person is authorized to compile the relevant technical documentation:

Name:	Andreas Günder
Address:	Bosch Rexroth AG, Zum Eisengießer 1, 97816 Lohr, GERMANY

Place	Date	Martin Laube (Director Product Development)	Guilherme Capudi (Director Manufacturing)
_____ ,	07.11.2019	_____	_____

Place/date/signature as indicated in the original declaration.

The contents of the Declaration of Incorporation are subject to change without notice. Currently valid edition on request.

rexroth
A Bosch Company

Appendix to Declaration of Incorporation

Essential health and safety requirements in accordance with Machinery Directive 2006/42/EC, Appendix I

Notes:

- "Applied" means that the requirement is used and relevant to the product ("X" identifier appears under "applied").
- Requirements with identifier "-" under "applied" are not used and are not relevant to product.
- The following identifiers under "fulfilled" mean: "X" = "yes, fulfilled" and "-" = "not fulfilled"

No.	Requirement	applied	fulfilled
	General principles		
1.	Risk assessment and risk reduction	x	—
1.	Essential health and safety requirements		
1.1	GENERAL REMARKS		
1.1.1	Definitions		
1.1.2	Principles of safety integration	x	x
1.1.3	Materials and products	x	x
1.1.4	Lighting	—	—
1.1.5	Design of machinery to facilitate its handling	x	x
1.1.6	Ergonomics	—	—
1.1.7	Operating positions	—	—
1.1.8	Seating	—	—
1.2	CONTROL SYSTEMS		
1.2.1	Safety and reliability of control systems	x	—
1.2.2	Control devices	—	—
1.2.3	Starting	—	—
1.2.4	Stopping		
1.2.4.1	Normal stop	—	—
1.2.4.2	Operational stop	—	—
1.2.4.3	Emergency stop	—	—
1.2.4.4	Assembly of machinery	—	—
1.2.5	Selection of control or operating modes	—	—
1.2.6	Failure of the power supply	—	—
1.3	PROTECTION AGAINST MECHANICAL HAZARDS		
1.3.1	Risk of loss of stability	x	x
1.3.2	Risk of break-up during operation	x	x
1.3.3	Risks due to falling or ejected objects	x	x
1.3.4	Risks due to surfaces, edges or angles	x	x
1.3.5	Risks related to combined machinery	—	—
1.3.6	Risks related to variations in operating conditions	x	x
1.3.7	Risks related to moving parts	x	x
1.3.8	Choice of protection against risks arising from moving parts	x	x
1.3.8.1	Moving transmission parts	x	x
1.3.8.2	Moving parts involved in the process	—	—
1.3.9	Risks of uncontrolled movements	—	—
1.4	REQUIRED CHARACTERISTICS OF GUARDS AND PROTECTIVE DEVICES		
1.4.1	General requirements	x	x
1.4.2	Special requirements for guards		
1.4.2.1	Fixed guards	x	x
1.4.2.2	Interlocking movable guards	—	—
1.4.2.3	Adjustable guards restricting access	—	—
1.4.3	Special requirements for protective devices	—	—
1.5	RISKS DUE TO OTHER HAZARDS		
1.5.1	Electricity supply	x	—
1.5.2	Static electricity	x	x
1.5.3	Energy supply other than electricity	—	—
1.5.4	Errors of fitting	x	x
1.5.5	Extreme temperatures	x	—
1.5.6	Fire	x	—
1.5.7	Explosion	x	—
1.5.8	Noise	x	—
1.5.9	Vibrations	x	—
1.5.10	Radiation	x	—
1.5.11	External radiation	x	—
1.5.12	Laser radiation	—	—
1.5.13	Emissions of hazardous materials and substances	x	x
1.5.14	Risk of being trapped inside a machine	x	x
1.5.15	Risk of slipping, tripping or falling	x	—
1.5.16	Lightning	—	—
1.6	MAINTENANCE		
1.6.1	Machinery maintenance	x	—
1.6.2	Access to operating positions and servicing points	x	—
1.6.3	Isolation of energy sources	x	—
1.6.4	Operator intervention	—	—
1.6.5	Cleaning of internal parts	x	x
1.7	INFORMATION		
1.7.1	Information and warnings on the machine	x	x
1.7.1.1	Information and information devices	—	—
1.7.1.2	Warning devices	—	—
1.7.2	Warning of residual risks	x	x
1.7.3	Marking of machinery	—	—
1.7.4	Instructions	x	—
1.7.4.1	General principles for the drafting of instructions	x	x
1.7.4.2	Contents of the instructions	x	—
1.7.4.3	Sales literature	x	x

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