rexroth
A Bosch Company

Hydraulic power unit CytroBox

Operating instructions
RE 51057-B/11.19

Replaces: –.–
English

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. Please note 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.

Contents

CytroBox, RE 51057-B/11.19, **Bosch Rexroth AG**

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1 About this documentation

1.1 Validity of the documentation

This documentation applies to the following product:

- Hydraulic power unit type 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, 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 product.

- ▶ You should read this documentation thoroughly, and in particular chapter 2 "Safety instructions" and chapter 3 "General information on damage to property and damage to product", before handling 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
🕮	**CytroBox hydraulic power unit** 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
	Filter elements type 1.; 2.; 4.; 6.; 7. and 20. Filter elements Includes technical data, operating conditions and performance limits.	51420	Data sheet
	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
	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 how to commission SvP 7020 IMC.	R911376148	Description of the commissioning

Table 1: Required and amending documentation

	Title	Document number	Document type
	Sytronix, SvP 7020 IMC, variable-speed pump drives Includes information on the electric drive system.	R911377187	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
	General operating instructions for axial piston units Includes amending information on data sheet 91485.	90300-B	Operating instructions
	IndraDyn S, synchronous motors MS2N Includes information for the operating, service and maintenance personnel and basic instructions on installation, operation and maintenance of the motors.	R911347580	Operating instructions
	Rexroth IndraDrive, drive controllers, power sections HCS03 Includes information on the installation and operation of the drive controllers, power sections HCS03 in short.	R911327655	Instructions for use
	Rexroth IndraDrive, drive controllers, power sections HCS03 Includes information on the installation and operation of the drive controllers, power sections HCS03.	R911339023	Operating instructions
	Rexroth IndraDrive, control sections CSB02, CSE02, CSH02, CDB02 Includes information on the installation and operation of the control sections CSB02, CSE02, CSH02 and CDB02.	R911338961	Project planning description
	IndraDrive, MPx-20, functions Describes all functional properties of variants MPB-20, MPM-20, MPC-20 and MPE-20.	R911345607	Application description
	Rexroth IndraDrive, integrated safety technology "Safe Torque Off" (as of 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	Application description
	MS2N synchronous servo motors Explains the product properties, application possibilities, application conditions and operating limits of the motors, includes the data of the available motors and gives advice on product selection, handling and operation.	R911347582	Project planning instructions
	Rexroth IndraDrive, IndraDrive with PROFINET, example with Siemens SIMATIC S7 This documentation explains the commissioning of the following 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	Commissioning instruction
	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	Commissioning instruction

Bosch Rexroth AG, CytroBox, RE 51057-B/11.19

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 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-specific safety instructions" and in chapter 3 "General information on damage to property and damage to product" and wherever a sequence of actions or instructions are explained which bear the danger of personal injury or damage to property. The hazard avoidance measures described 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
- Precautions: 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 or medium (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 notices 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 one after the other.

1.3.3 Abbreviations

The following abbreviations are used in this documentation:

Table 4: Abbreviations

Abbreviation	Meaning
AB	Power unit construction
BR	Bosch Rexroth
DBV	Pressure relief valve
EC	EtherCAT
HPU	Hydraulic Power Unit
IMC	Injection Molding Control
OM	Operation Mode
OZ	Ordinal number
PE	Protected Earth
PN	ProfiNet
RE	Rexroth document in English language
REXXXXXX-B	Rexroth operating instructions in English
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
RoHS	Restriction of (the use of certain) Hazardous Substances in electrical and electronic equipment
SC	SERCOS
STO	Safe Torque Off
SVHC	Substances of Very High Concern
WEEE	Waste of Electrical and Electronic Equipment

2 Safety instructions

2.1 General information on 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 complete machinery.

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 product as follows:
The hydraulic power unit constitutes partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC and is respectively not usable.
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 product 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 read and understood this documentation, especially chapter 2 "Safety instructions" and chapter 3 "General information on damage to property and damage to product".

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 chapter 16.
- Operation of the hydraulic power unit with hydraulic fluid not complying with the specifications in chapter 16.
- 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 the training in specific fields.
Please find an overview of the training contents on the internet at:
http://www.boschrexroth.de/training

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.
- Exclusively use Rexroth products in technically perfect condition.
- Observe all notices on the product.
- Persons who assemble, operate, disassemble or maintain Rexroth products must not consume any 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, e.g. 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-specific safety instructions

⚠ WARNING

Pressurized hydraulic power unit, pressurized machine/system!
Danger to life, risk of injury, severe injury when working at running machines/systems, burning, environmental pollution, damage to property!

- Ensure that all relevant components of the hydraulic system are depressurized and that the electrical control is de-energized. For doing 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.
- Make sure that appropriate safety measures are implemented to prevent any dangerous situations for personnel and real assets if commissioning or maintenance work requires decommissioning of safeguard like fuses, pressure relief valves, etc.
- 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 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.

(Pressurized) hydraulic fluid and oil mist leaking!
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 notices of the manufacturer.
- Make sure that the grounding (electric welding circuit) during welding works at the system is not lead via the hydraulic power unit.

⚠ WARNING

Unexpected start-up due to malfunctions/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 fault, 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 atmospheres.

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, electronic 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 during operation, all doors are closed.

Leaked hydraulic fluid, oily surfaces!
Risk of injury! Slip hazard!
- If no separate hydraulic room is available, put the hydraulic power unit into a drip 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".
- 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 arrange consultation with a doctor for approval.

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 during operation, all doors are closed.

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 according to chapter 2.2 "Intended use".
- 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!
- You may only use the hydraulic power unit according to chapter 2.2 "Intended use".
- 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 on 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"" according to your application and system requirements.
- Coordinate the any changes of other parameters with the Bosch Rexroth customer service.

Operation with lack of 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 and draining the hydraulic fluid, always put a drip pan under the hydraulic power unit.
- Observe the information in the safety data sheet of the hydraulic fluid and the machine/system manufacturer's 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.

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 have been made.
- Ensure that no pollutants are 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 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:
- CytroBox hydraulic power unit
- Operating instructions (this document) including EC declaration of incorporation
- 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
- Connector plug for filling coupling

For required and amending documentation, refer to chapter 1.2.
For further information on optional components, refer to chapter 17.4 "Accessories".

5 Product information

5.1 Performance description

Fields of application

The CytroBox is a drive system for hydraulic machines in modular design, which was developed as a decentralized hydraulic supply unit for general machine construction 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 tank or the compact synchronous motor, are combined in one housing which can be integrated in existing production lines in a space-saving manner thanks to its small footprint.
The powder-coated housing is sound-insulated and equipped with an integrated polymer concrete foundation with drip pan and drain function.
The aluminum mounting bracket used enables flexible connection of accessory components.

Low noise level

The airborne sound is absorbed by the compact arrangement of all the components in one housing and the built-in sound insulating mats. In order to reduce noise emissions stemming from structure-borne noise, the motor-pump assembly is rigidly affixed to a polymer-concrete foundation. Consequently, the noise emission of the CytroBox is less than 75 dB(A) – even at full load!

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 control cabinet is air-cooled and the synchronous motor is water-cooled. Optionally, the hydraulic fluid is cooled by a circulation circuit with a plate heat exchanger.

The hydraulic power unit requires a cooling water connection.
The oil temperature can be set by means of parameters.

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 tank
- Oil temperature sensor in the 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 the identification of the water content in the tank for the drainage function
- Sensor for the identification of the dissolved air inclusion in the tank for the degassing function
- Particle sensor for the identification of the contamination in the hydraulic fluid
- Leakage sensor in the drip pan

Current data and limit values can be read via the Multi-Ethernet interface, e.g. Sercos or PROFINET, and forwarded to the superior 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".

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 pumps 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 operating noise is significantly reduced due to the coupled polymer concrete foundation and the closed housing.

The integrated drip pan 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 are then processed by the drive controller. With the help of the Ethernet interfaces, they can then be conveniently further processed and integrated into modern machine design. The CytroBox also provides machine end-users with a connectivity option, enabling them to easily unlock the full potential of IoT technologies as a pay-per-use service without any risk. All information regarding the CytroBox – from the component and operating state or forthcoming maintenance work to predictive maintenance analyses is available via Rexroth's Online Diagnostics Network (ODiN). As a result, the information is always close to hand.

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
- Oil de-watering
- Monitoring of the system conditions
- Optional cooling systems
- Connection with CytroConnect

The system conditions are indicated by means of the integrated LED status display, see Fig. 5, pos. 3 on page 48 and on the display of the drive controller, see Fig. 1 on page 24 and Fig. 7 , pos. 16 on page 50.

5.3 Functional description

5.3.1 Drive controller

The drive controller represents 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"".

Operating unit of the drive controller

The control section of the drive controller, see Fig. 7, pos. 14 on page 50 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. Using the keys, settings can be adjusted, information can be viewed, and some commands can be executed.

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".

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

Number of the drive in the bus system of the control communication	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.

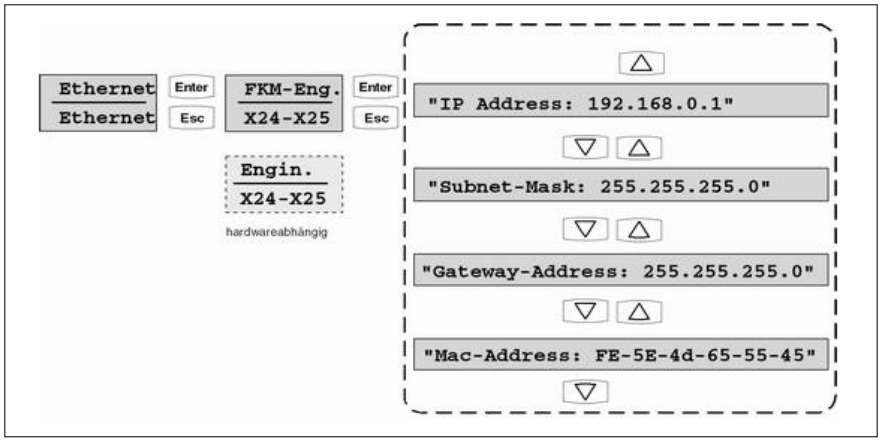

Fig. 2: Example: Display of IP addresses

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.

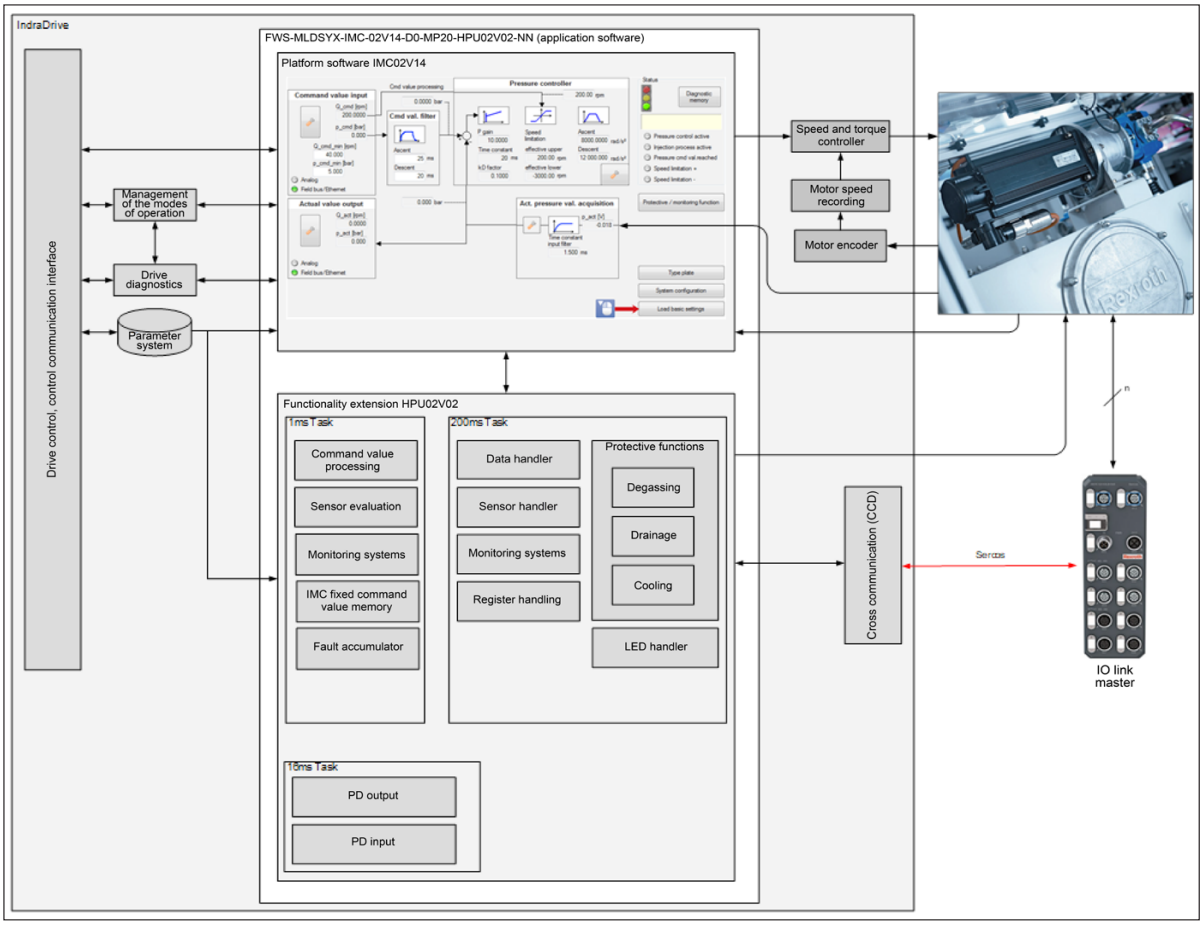

Fig. 3: Structure of the application software

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 and 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 fed or read out and software updates can be performed via the service interface X26 (in the electrical cabinet of the CytroBox). 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.

Oil level and oil temperature

Sensor ABZMS-41-1X/0500/LTD/DC-K24 (6.120) at port 1 of the IO link gateway is used to measure the oil level and the oil temperature.
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 6: 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	10
		P-0-1389[26]	Warning too high	°C	4	3	55
		P-0-1389[27]	Error too low	°C	4	3	5
		P-0-1389[28]	Error too low	°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]	Min.	liters	4	3	105
		P-0-1389[72]	Max.	liters	4	3	145
		P-0-1389[73]	Min.	liters	4	3	100
		P-0-1389[74]	Max.	liters	4	3	150

Leakage flow and leakage temperature

Sensor 6.210 at port 2 of the IO link gateway is used to measure the leakage flow and the leakage temperature.
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 7: 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	-
Leakage temperature		P-0-1294	Actual value	°C	4	2	-
	Threshold value	P-0-1389[39]	Warning	l/min	4	3	5
		P-0-1389[40]	Error	l/min	4	3	6

Dissolved air inclusion

The dissolved air inclusion is measured by the sensor 6.310.
It is connected to port 3 of the IO link gateway via the analog IO link converter 6.330.
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.

Table 8: Parameters for dissolved air inclusion

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	170
		P-0-1389[8]	Error	mbar	4	3	180

Particle concentration

The particle concentration is measured by the sensor 6.420, OPM II-1X-M. It is connected to port 4 of the IO link gateway via the analog IO link converter 6.460.
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 9: 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
	Thresholdvalue	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

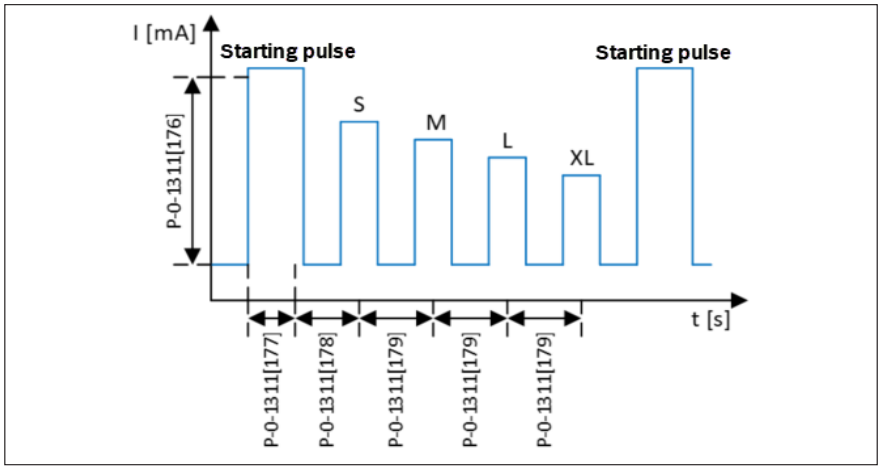

Fig. 4: Configuration of the evaluation of the serial signal of the particle sensor

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 6.510 at port 5 of the IO link gateway is used 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 10: 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	85
		P-0-1389[14]	Error	%	4	3	95
		P-0-1389[15]	Debouncing time	ms	4	3	0

Fluid detection

Sensor 6.620 at port 6 of the IO link gateway is used to detect the fluid.
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 11: 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

Table 12: Sensors

Sensors	Standard (included in the scope of delivery)	Optional
Pressure sensor	X	
Filling level sensor	X	
Temperature sensor	X	
Pressure filter contamination sensor	X	
Leakage flow sensor		X
Leakage temperature sensor		X
Water content sensor		X
Air inclusion sensor		X
Dirt particle sensor		X
Drip pan leakage sensor		X

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 I/O link sensor is present. The sensor serially reads in the particle concentration for different particle sizes as 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 drip 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 [%]	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 at 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 triggers, a message is issued on the display of the drive controller, see Fig. 7, pos. 16 on page 50, 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	

The monitoring is in the active 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 retrieval of values and their transfer to IMC can be activated using the 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 input 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: Control of water cooling valve

P-0-1418 Bit 6	Description
FALSE	Valve for water cooling closed
TRUE	Valve for water cooling open

5.3.6 Degassing and drainage

The degassing and drainage function is deactivated on delivery. Due to complex interactions with the complete hydraulic system, these functions can only be activated and parameterized in cooperation with Bosch Rexroth.

Activation/deactivation of the function

Degassing and drainage of oil is provided. For this purpose, the air and water concentration in the oil is evaluated and, if threshold values are exceeded, a degassing valve and a drain valve are controlled. The functions can be activated as follows:

Table 31: Activation/deactivation of the function

Parameter/Bit	State	Description
P-0-1380 Bit 0	FALSE	Degassing deactivated
	TRUE	Degassing activated
P-0-1380 Bit 1	FALSE	Drainage deactivated
	TRUE	Drainage activated

Degassing

If the measured value of the air concentration (P-0-1270) is above the threshold value (P-0-1389[2]) for a debouncing time (P-0-1389[9]), the degassing valve (P-0-1418 bit 0) is controlled until the degassing time (P-0-1389[11]) has expired. After successful degassing, a restart lockout occurs for a pause time (P-0-1389 [10]).

Table 32: Overview of "Degassing" parameters

Parameter	Description	Unit	Default
P-0-1270	Actual value	mbar	-
P-0-1389[9]	Debouncing time	ms	0
P-0-1389[2]	Threshold value	mbar	160
P-0-1389[11]	Degassing time	sec	30
P-0-1389[10]	Pause time	sec	300

Drainage

Drainage is only active when degassing is not requested.

If the measured value of the relative oil humidity (P-0-1272) is above the threshold value (P-0-1389[12]) for a debouncing time (P-0-1389[15]), the degassing valve (P-0-1418 bit 0) and the drain valve (P-0-1418 bit 1) are controlled until the drain time (P-0-1389[17]) has expired.
After drainage, degassing is automatically carried out. The degassing valve (P-0-1418 bit 0) is still controlled until the "degassing time after drainage" (P-0-1389[22]) has expired.
After successful degassing, a restart lockout occurs for a pause time (P-0-1389 [16]).

Table 33: Overview of "Drainage" parameters

Parameter	Description	Unit	Default
P-0-1272	Actual value	%	-
P-0-1389[15]	Debouncing time	ms	0
P-0-1389[12]	Threshold value	%	180
P-0-1389[17]	Drainage time	sec	15
P-0-1389[22]	Degassing time	sec	30
P-0-1389[16]	Pause time	sec	600

Table 34: Parameter P-0-1418

P-0-1418			Description
Degassing valve	P-0-1418 Bit 0	Disabled	Valve for degassing closed
		Enabled	Valve for degassing open
Drain valve	P-0-1418 Bit 1	Not activated	Valve for drainage closed
		Activated	Valve for drainage open

Monitoring of system pressure and oil temperature

The monitoring of the system pressure becomes active when the pressure falls below the threshold value for a debouncing time.
The monitoring of the oil temperature becomes active when the pressure exceeds the threshold value for a debouncing time.
In both cases, a warning is issued.

5.3.7 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 35: Color assignment

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

5.3.8 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 36: 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]	Min.	
			P-0-1389[72]	Max.	
			P-0-1389[73]	Min.	
			P-0-1389[74]	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	
	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	

	Function		Parameter	Description	
Sensor evaluation	Relative oil humidity		P-0-1272	Actual value	Page 30
		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	
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	

	Function		Parameter	Description	
Monitoring systems	Leakage temperature	Threshold value	P-0-1389[47]	Warning	Page 34
			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	
Fixed command value memory	Activation		P-0-1401 Bit 0	Service mode	Page 35/36
	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	
	Degassing and drainage		P-0-1380 Bit 0	FALSE Degassing deactivated	Page 38
				TRUE Degassing activated	
			P-0-1380 Bit 1	FALSE Drainage deactivated	
				TRUE Drainage activated	
	Degassing		P-0-1418 Bit 0	Disabled Valve for degassing closed	
				Enabled Valve for degassing open	
	Drainage		P-0-1418 Bit 1	Not activated Valve for drainage closed	
				Activated Valve for drainage open	

Description of diagnosis

Table 37: Warnings

S-0-0390	P-0-1300	S-0-0095	Cause	Remedy
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 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 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 oil cooling 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 oil 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.

S-0-0390	P-0-1300	S-0-0095	Cause	Remedy
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 oil cooling pump. ▶ Check the water cooling unit. ▶ Check the sensor output signal.
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 oil cooling 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 the 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 oxygen sensor on the basis of the electrical circuit diagram.

S-0-0390	P-0-1300	S-0-0095	Cause	Remedy
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.
E2013	B326	B326: error particle sensor on port 4	• The dirt 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 dirt 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 drip 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 drip 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 drip pan leakage sensor on the basis of the electrical circuit diagram.
E2013	B329	B329: oil detected in drip pan	The leakage monitor in the drip pan detects oil. P-0-1274 > P-0-1389[42]	▶ Check the drip 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 drip pan detects an oil-water mix. P-0-1274 > P-0-1389[43]	▶ Check the drip 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 drip pan detects water. P-0-1274 > P-0-1389[44]	▶ Check the drip 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 38: Error

S-0-0390	P-0-1300	S-0-0095	Cause	Remedy
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 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 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 oil cooling 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.

S-0-0390	P-0-1300	S-0-0095	Cause	Remedy
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 oil cooling pump. ▶ Check the water cooling unit. ▶ Check the pump and replace it, if necessary.
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 oil level 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:

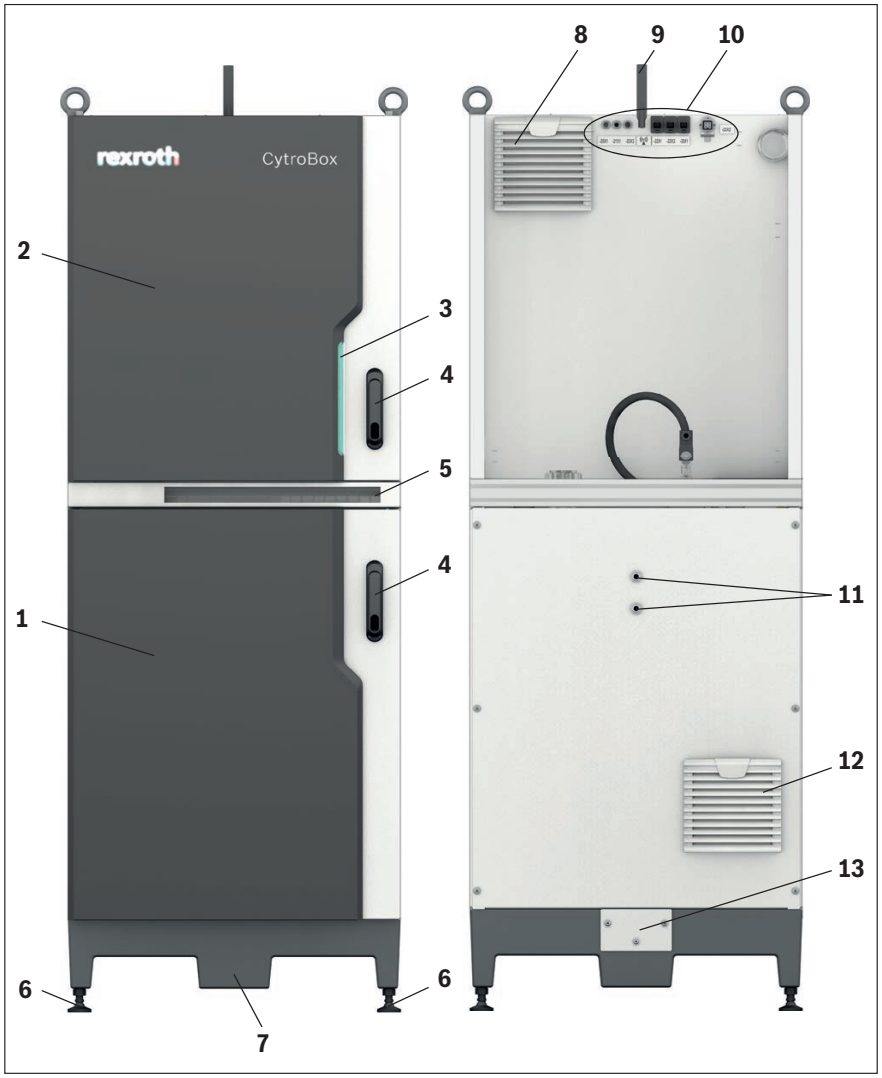

Fig. 5: View from front **View from rear**

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 Air outlet at the electrical cabinet
9 Mobile communications antenna
10 Electrical interfaces
11 Cooling water connections (push-in, d =12 mm)
12 Air inlet at the hydraulic cabinet
13 Drip pan discharge plate

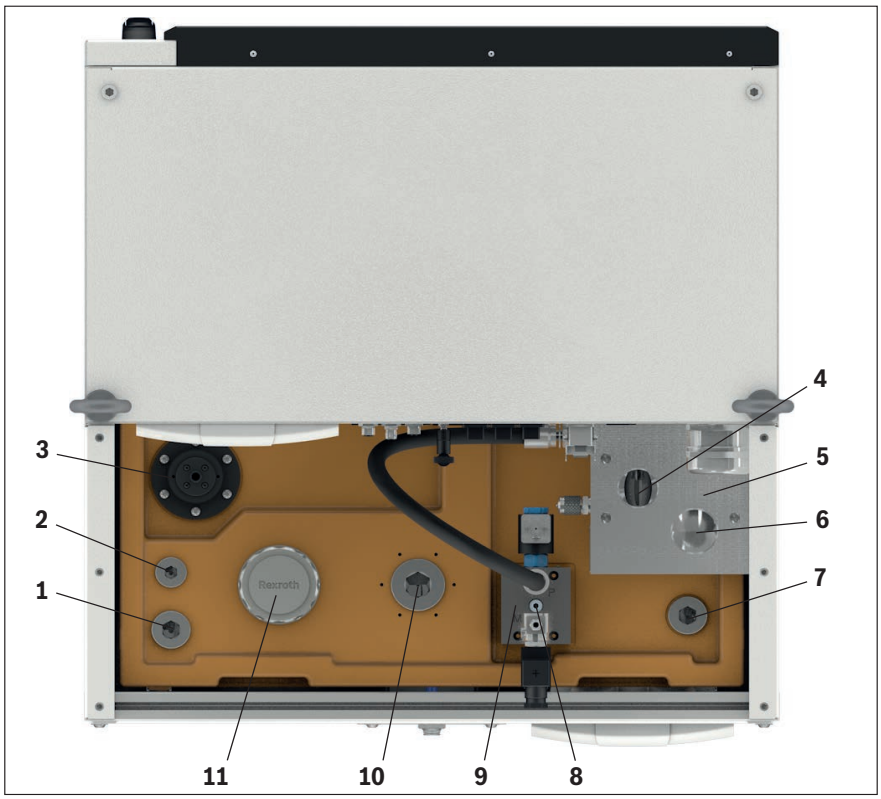

Fig. 6: View from top

1 Oil tank port G1 (backup)
2 Oil tank port G3/4 (backup)
3 Filling level and temperature sensor
4 Pressure port P, G1 1/4
5 Manifold block
6 Return flow port T, G1 1/2
7 Oil tank port G1 (backup)
8 Pneumatic connection for drainage
9 Degassing and drainage module
10 Oil tank port G1 1/2 (backup)
11 Breathing filter

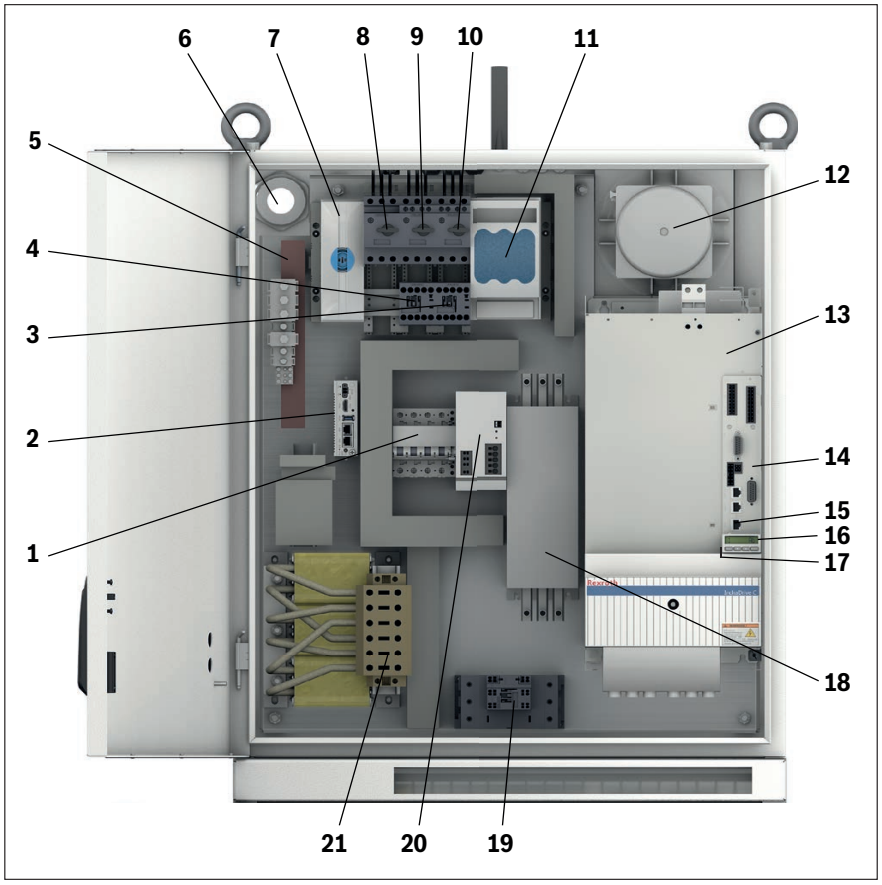

Fig. 7: Electrical cabinet

1 24-V-fuse protection
2 CytroConnect hardware
3 Contactor for air cooler
4 Contactor for circulating pump
5 Grounding terminal
6 Cable bushing for power supply
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 section
14 Drive controller control section
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

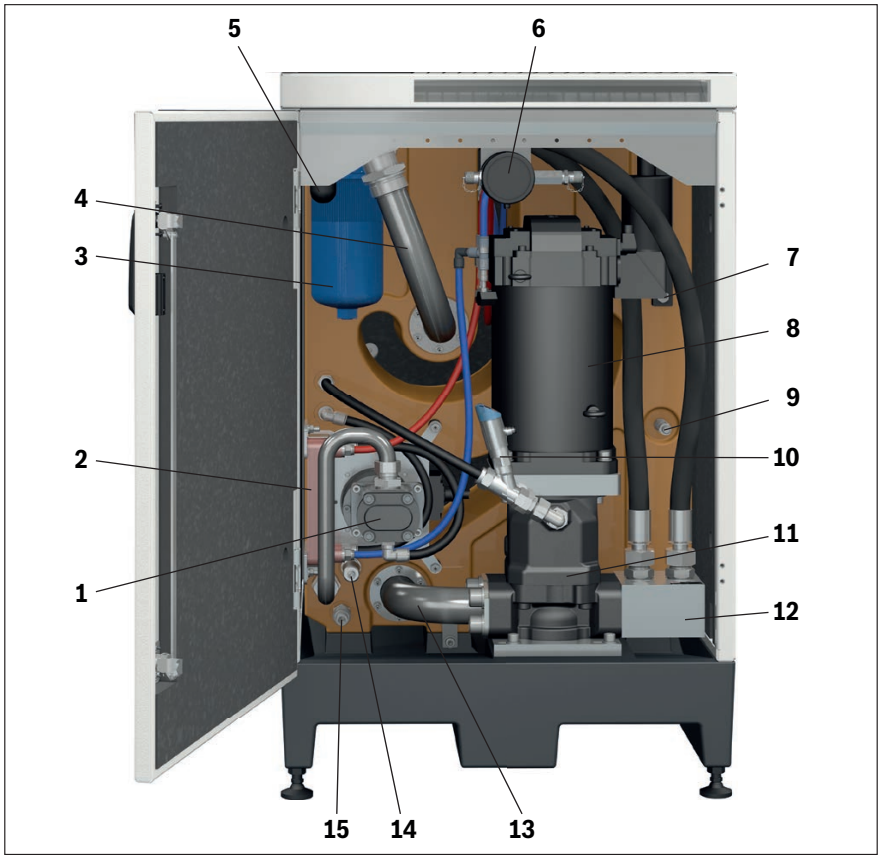

Fig. 8: Hydraulic cabinet

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

5.5 Circuit diagram, hydraulic

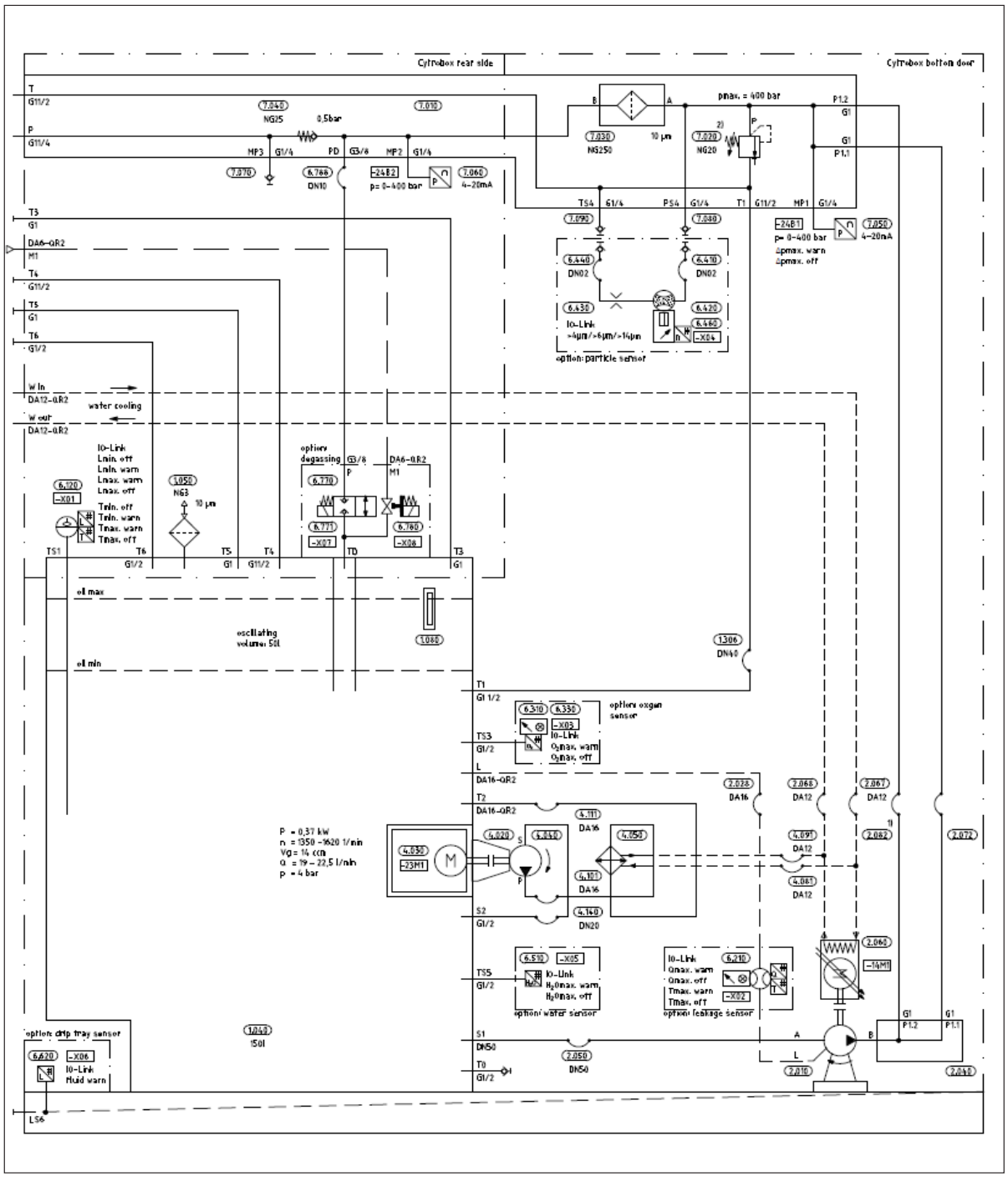

Fig. 9: Circuit diagram, hydraulic

Pos.	Denomination
1.040	CytroBox oil tank
1.050	Air filter ELF P 3 F 10 W 1.X
1.080	Oil level indicator AB31-21/254
1.306	Corrugated hose return line
2.010	Axial piston pump A10FZO
2.028	Drain line pipe
2.040	Manifold block AGEV2
2.050	Corrugated hose suction line
2.060	Servo motor MS2N
2.067	Cooling water line pipe
2.068	Cooling water line pipe
2.072	Pressure line hose line
2.082	Pressure line hose line
4.020	Motor pump assembly kit ABZPZ
4.030	Circulation circuit three-phase current
4.040	Circulation circuit gear pump AZPF
4.050	Circulation circuit plate heat exchanger
4.081	Circulation circuit cooling water line pipe
4.091	Circulation circuit cooling water line pipe
4.101	Circulation circuit pressure line pipe
4.111	Circulation circuit return line pipe
4.140	Circulation circuit corrugated hose suction line
6.120	Level and temperature sensor ABZMS-41
6.210	Flow sensor SBG232
6.310	Gas sensor VISIPRO DO 120
6.330	Gas sensor evaluation system DP2200
6.410	Particle sensor measuring hose DN2
6.420	Particle sensor OPM II-1X-M
6.430	Flow sensor 2103-A0-02.00
6.440	Flow sensor measuring hose DN2
6.460	Particle sensor evaluation system DP2200
6.510	Water content sensor BCM
6.620	Drip pan leakage sensor LMC110
6.770	Degassing module solenoid valve OD15
6.771	Degassing module solenoid coil OD02
6.780	Degassing module solenoid valve VZWD
6.788	Degassing module pressure line hose line
7.010	Manifold block AGEV2 main port block
7.020	Pressure relief valve DBDS 20 K1X/315
7.030	Pressure filter 550PMFAN0250-PWR10B00-M
7.040	Check valve M-SR 25 KE05-1X/
7.050	Pressure sensor HM 20-2X/400-C-K35-N
7.060	Pressure sensor HM 20-2X/400-C-K35-N
7.070	MeasuringcouplingMCS20-SDS-E-G1/4-ST3N00Z-M
7.080	MeasuringcouplingMCS20-SDS-E-G1/4-ST3N00Z-M
7.090	MeasuringcouplingMCS20-SDS-E-G1/4-ST3N00Z-M

5.6 Product identification

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

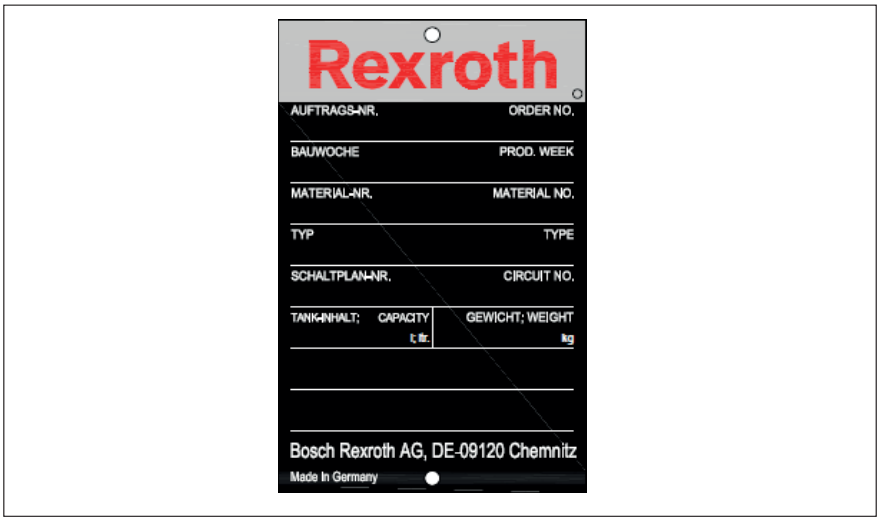

Fig. 10: Example: name plate

6 Transport and storage

- Observe the transport instructions on the packaging.
- During storage and transport, the environmental conditions specified in chapter 16 "Technical data" must be observed.
- If the packaging has to be opened e.g. for inspection purposes, you should reseal the packaging to the condition in which it was supplied.
- Ensure that the hydraulic power unit is only transported in an upright position.

6.1 Transporting the hydraulic power unit

⚠ WARNING

Falling, tumbling or uncontrolled position change of the hydraulic power unit!
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.

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 besides 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.

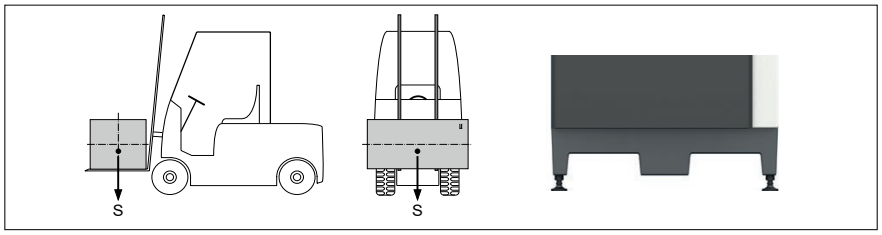

Fig. 11: Transport using a forklift

6.1.3 Transport using lifting gear

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

Use the eyebolts only for short-term transport of the hydraulic power unit, e.g. to lift it into a drip 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, proceed as follows:

1. Make sure that the lifting gear's lifting capacity is sufficiently dimensioned in order 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. 12.
3. Make sure that the eyebolts are securely tightened.
4. Make sure that during transport, all doors are closed.
5. Attach a suitable lifting gear to the eyebolts.
6. Attach the lifting gear to a crane hook.
7. Slowly and carefully lift the hydraulic power unit in order to avoid swinging.

Fig. 12: Eyebolts

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

6.2 Storage of 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 during storage, all doors are closed.

Maximum storage time

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

If the storage time exceeds 12 months, check the function 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".

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".
- Use the hydraulic power unit only 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".
- Observe the information on handling the product in chapter 6 "Transport and storage".
- 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.

Vibrations in the environment!
Damage to property!

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

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

- Put the hydraulic power unit on a level ground.
- Level the hydraulic power unit using the adjustable machine feet so that its longitudinal and transverse axis are horizontal.

7.2.1 Dimensions of the hydraulic power unit (dimensions in mm)

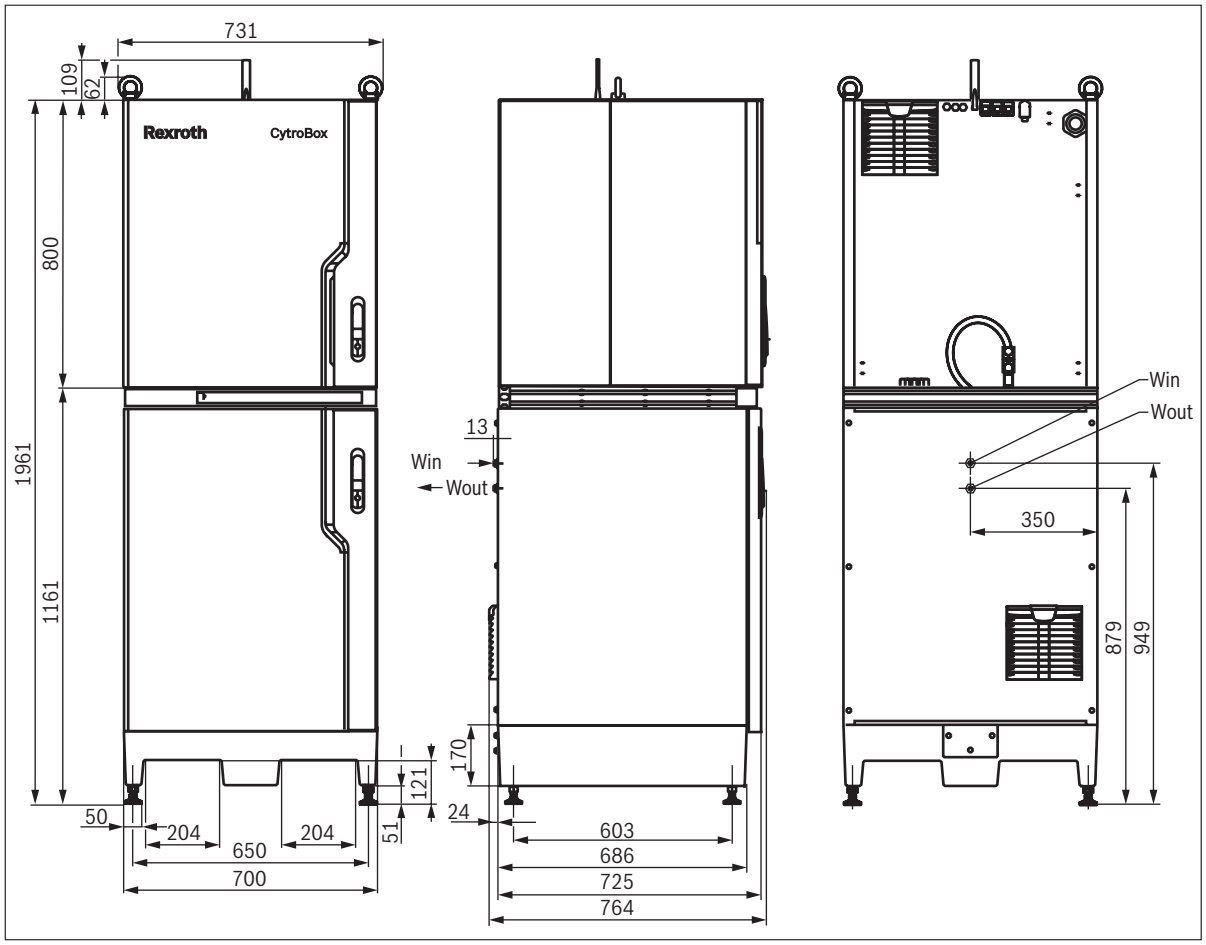

Fig. 13: Dimensions of the hydraulic power unit

7.3 Hydraulic supply connection

⚠ 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 threads measured in inches 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 any 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 of 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
- kinking and tensile load at the hose is prevented during operation.
- the hose is not twisted.
- the outer layer of the hose is not subject to abrasion or impacts.
- the weight of the hose line does not lead to inadmissible loads.

Return line, pressure line

- If there is no subplate mounting, e.g. type IH20, connect the return line with a G1 1/2 fitting via the return flow port T, G1 1/2, see Fig. 14, pos. 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. 14, pos. 1.

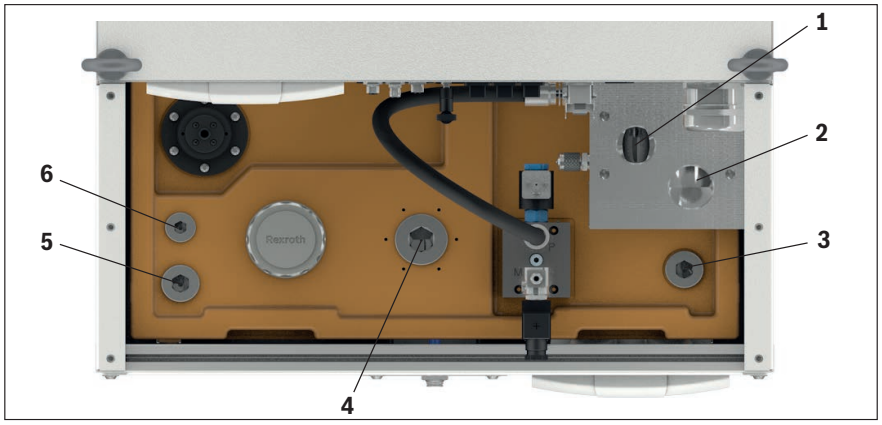

Fig. 14: Oil tank ports, pressure port

1 Pressure port P, G1 1/4
2 Return flow port T, G1 1/2
3 Oil tank port G1 (backup)
4 Oil tank port G1 1/2 (backup)
5 Oil tank port G1 (backup)
6 Oil tank port G3/4 (backup)

Pressure relief valve

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The pressure relief valve is completely opened on delivery 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 73.

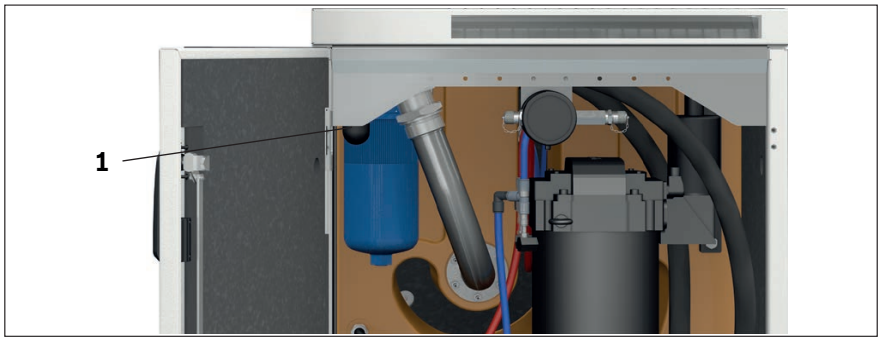

Fig. 15: Pressure relief valve

1 Pressure relief valve

Back pressure-protected oil tank ports

- The back pressure-protected oil tank ports G3/4 (see Fig. 14, pos. 6), G1 (see Fig. 14, pos. 3 and 5) and G1 1/2 (see Fig. 14, pos. 4), can be optionally connected for rotary transmission leadthrough. Close unused ports with blanking plugs.

If failure of a hose line may cause hazards caused by whipping, 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.

Connection for the degassing and drainage module (optional)

If the degassing module is included in the scope of delivery, it is assembled at the factory.

- Connect a pneumatic hose (d = 6 mm), see Fig. 16, pos. 1.

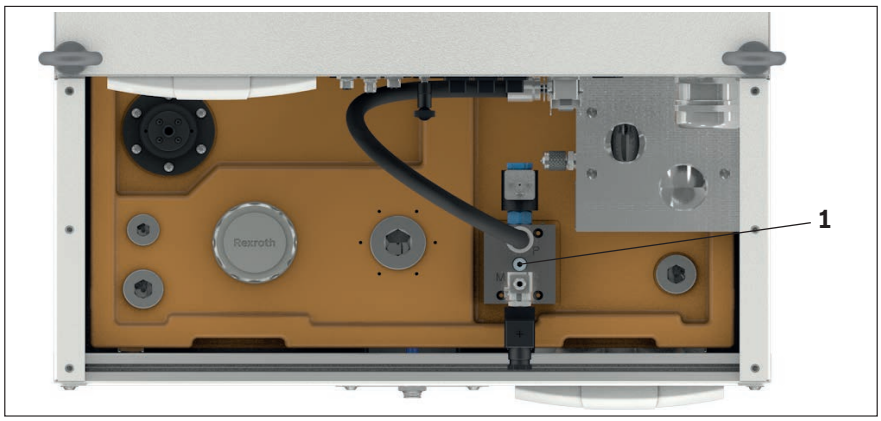

Fig. 16: Pneumatic connection

1 Pneumatic connection

Minimess connection MP3

The Minimess connection MP3 (see Fig. 9, pos. 7.070 on page 52) is used to determine the actual operating pressure or to bleed the system if there is no control system.

- Close unused ports with blanking plugs.

7.4 Water supply connection

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. 17, pos 1 and 2.

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

Fig. 17: Cooling water connections

1 Push-in cooling water connection (input)

2 Push-in cooling water connection (output)

Oil cooling (optional)

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

- Ensure that the purity of the cooling water has a maximum particle size of 100 µm.
- 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: < 10 bar

7.5 Electrical interface assignment

- 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.

For operation of the hydraulic power unit, at least the following electrical connections are required:

1. Supply voltage feed-in 400 ... 500 VAC
2. 20X1: Digital input and output signals
3. 21X1: Safe Torque OFF (STO)
4. 22X1: Multi-Ethernet control communication (network output)
5. 22X2: Multi-Ethernet control communication (network input)
6. 23X2: Cooling unit connection (optional)
7. 23X3: Water valve connection (optional)
8. 30X1: CytroConnect (optional)
9. X26: Engineering port

7.5.1 Voltage supply feed-in assignment

Table 39: Electric data

Electrical	
Voltage (according to IEC 60038)	400 ... 500 VAC (+10 % / -15 %)
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

- Feed the voltage supply cable through the PG fitting on the back into the interior of the CytroBox.

The voltage supply is connected to the feed-in, see Fig. 7, pos. 7 and 8 on page 50. To ensure correct function of the circulating pump and cooling system, the voltage supply must be connected in the clockwise rotating field.

Table 40: Voltage supply feed-in assignment

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

[1] Start of installation 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

7.5.2 Interface 20X1 assignment: Digital input and output signals

- Assign the line connector (optionally available, see chapter 17.4 "Accessories") as interface to the superior machine control in accordance with the following description of the unit-side mating connector:

Table 41: Interface 20X1 assignment on the hydraulic power unit

	Pin	Function	*
 (Mating connector) M 12x1; 8-pole A - coded	1	Release	**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**

*) Input DI/output DO

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

7.5.3 Interface 21X1 assignment: Safe Torque OFF (STO)

▶ Assign the mating connector (optionally available, see chapter 17.4 "Accessories") as interface to the superior machine control in accordance with the following description of the unit-side connector:

Table 42: Interface 21X1 assignment on the hydraulic power unit

	Pin	Function
 (Connector) M 12x1; 8-pole A - coded	1	Input channel 2
	2	0 V power supply (SI_Ch2)
	3	Input channel 1
	4	+24 V power supply ±20 %/0.7 A (SI_Ch1)
	5	Output channel 2 (Dyn_Ch2)
	6	Output channel 1 (Dyn_Ch1)
	7	Not used
	8	Not used

The Safe Torque Off interface must be integrated into the safety concept of the machine. If STO is activated, the torque of the servodrive is disengaged and the CytroBox is thus depressurized.
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".

Application examples

STO function

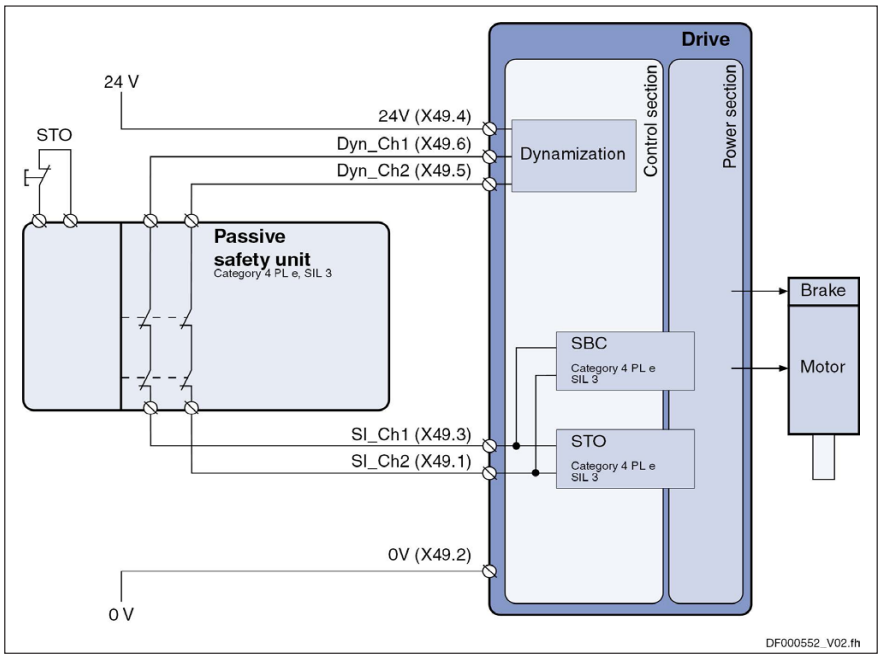

Fig. 18: With two-channel wiring and passive safety unit

The dynamization signals can be freely assigned.

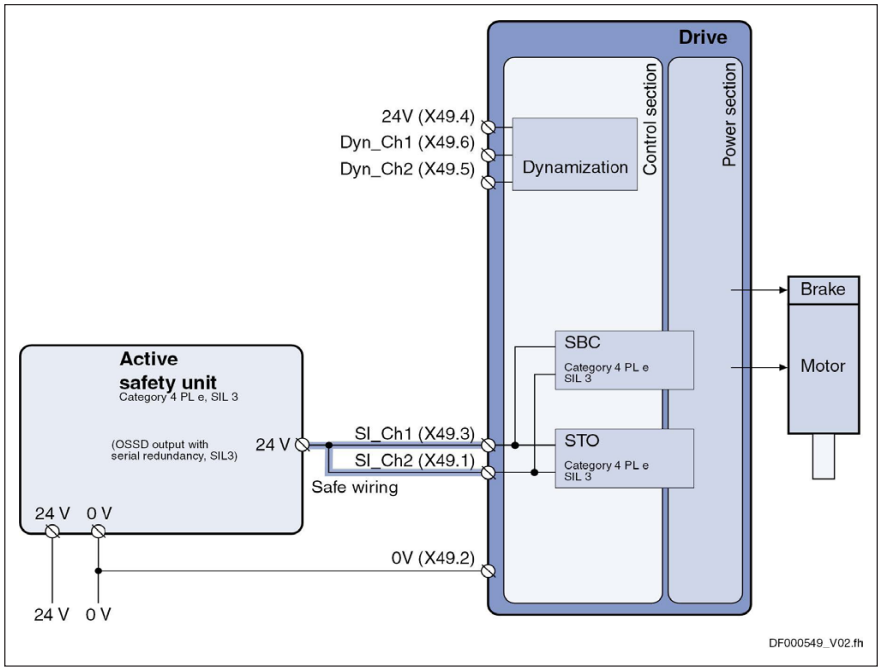

Fig. 19: With active safety unit (plus-plus switching outputs)

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

7.5.4 Interfaces 22X1 and 22X2: Multi-Ethernet control communication as well as 30X1: CytroConnect

The CytroBox can be connected with the superior machine control via the multi-Ethernet interfaces 22X1 and 22X2. Interface 22X1 (network output) is always connected. Interface 22X2 (network input) is used for connecting further devices.

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 e-mail address: Consult-and-Connect@boschrexroth.de

▶ Connect the CytroConnect connection 30X1 to the company network using a corresponding RJ45 line connector.

For the connections 22X1 and 22X2 and 30X1 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

Table 43: Assignment of interfaces 22X1, 22X2 and 30X1

RJ45 (IP67)	Position	Port	Function
	Fig. 20, Pos. 5 (page 70)	22X1 (network output)	Multi-Ethernet control communication
	Fig. 20, Pos. 6 (page 70)	22X2 (network input)	
	Fig. 20, Pos. 7 (page 70)	30X1	CytroConnect

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

7.5.5 Interface 23X2 assignment: Connection of cooling unit and 23X3: Water valve connection (optional)

In preparation.

7.5.6 Interface X26 assignment

Reading or configuration of parameters or reading of errors can be realized via the engineering port X26, see Fig. 7, pos. 15 on page 50, and by means of the software IndraWorks DS.

▶ Use an appropriate standard RJ45 connector for the X26 port.

7.6 Electrical interface connection

⚠ 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).

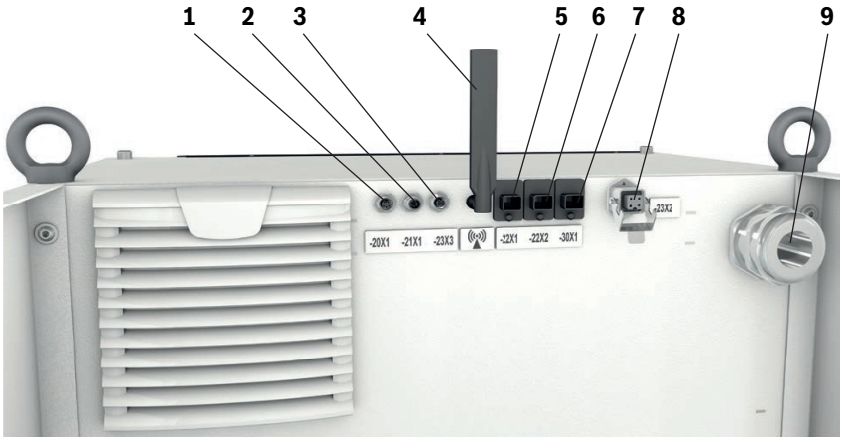

Fig. 20: Electrical connections

1 20X1: Digital input and output signals
2 21X1: Safe Torque OFF (STO)
3 23X3: Water valve control (optional)
4 Mobile communications antenna
5 22X1: Multi-Ethernet control communication (network output)
6 22X2: Multi-Ethernet control communication (network input)
7 30X1: CytroConnect
8 23X2: Cooling unit control (optional)
9 Cable bushing for power supply

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", 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

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 for filling the hydraulic power unit.

The optional tank volume of the CytroBox is 100 to 130 liters and can be checked via the oil level indicator, see Fig. 21, pos. 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. 21, pos. 2.

For further information on the connector plug, please refer to chapter 17.4 "Accessories".

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

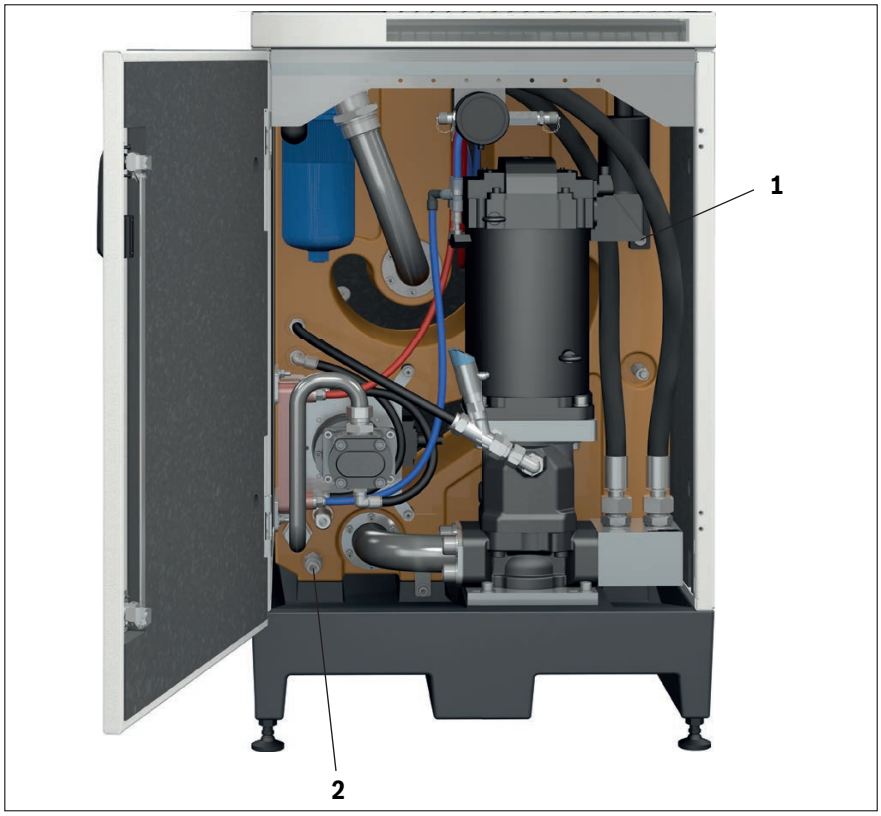

Fig. 21: Filling options

1 Oil level indicator

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

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

For further information, refer to chapter 7.5 "Electrical interface assignment", 7.6 "Electrical interface connection" 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 superior commissioning instructions must be observed on machine level.

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

- Flush the hydraulic system as described in chapter 8.1.6.
- 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 having switched on the main feed pump (pos. 4.020), determine the system pressure.

  The system pressure can be determined at the following points:
  – measuring point (pos. 7.070, pos. 7.080 or pos. 7.090)
  – pressure sensor (pos. 7.050 or pos. 7.060)

The specified positions can be found in the hydraulic circuit diagram, see Fig. 9 on page 52.

Proceed as follows to set the maximum pressure limitation:

1. Remove the protective cap at the pressure relief valve (pos. 7.020).
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 (pos. 7.020), the seat valve (pos. 6.770) must be in the "Closed" position.
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".

Problems during commissioning

To support systematic inspection for and reduction of errors, refer to the matrix, see Table 51 "Impact of defects" in chapter 15 "Troubleshooting".

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.
- ▶ Make sure that the minimum requirements of the cleanliness class for the components are fulfilled after installation of the hydraulic power unit into the machine and 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 valve or sophisticated high-response valves have even stricter requirements regarding 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.

Required material

Preparations:

- 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 materials and particularly the seals used in the hydraulic system. 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.
As per Bosch Rexroth recommendation, 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.
Based on the result, it is to 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 pressure-tight.

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 valve set with insufficient difference to the operating pressure (closing pressure difference not observed).
- The switching hysteresis of pressure switches is not observed for setting.
- Parameter changes from the condition as supplied of the hydraulic power unit, e.g. operating pressure, are not documented.

8.1.8 Commissioning of the "electronics"

1. Connection establishment to the CytroBox (IndraDrive)

General information

For commissioning and diagnosis of IndraDrive drives, IndraWorks software is being used.

Prerequisites

- The following components and prerequisites are required for an Ethernet communication with the drive controller:

- Standard Ethernet cable
- Free Ethernet connection on PC or notebook
- IndraWorks DS

IndraWorks DS software can be downloaded for free at https://www.boschrexroth.com/indraworks - Download .

Establish the 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 50).

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.

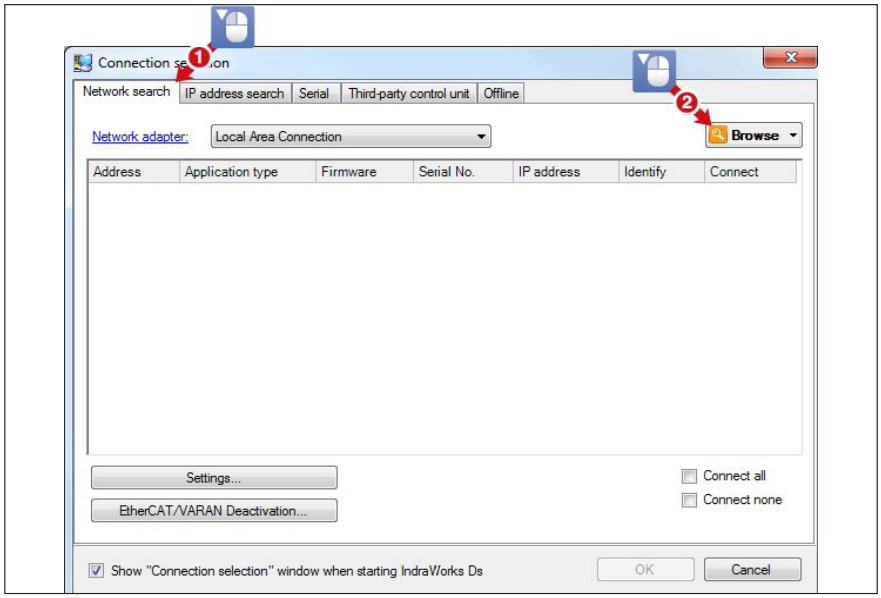

Fig. 22: Network search

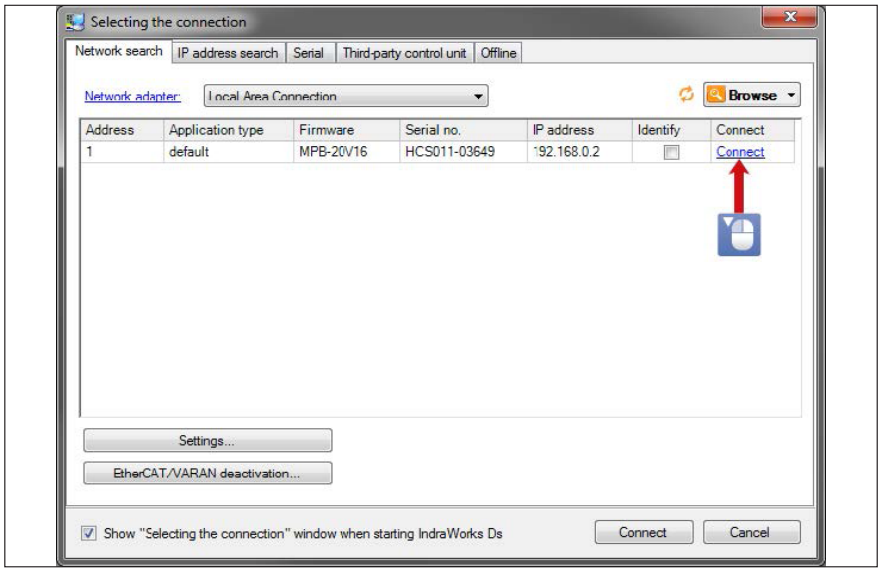

Fig. 23: Establishing a connection in the network search

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 50 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.

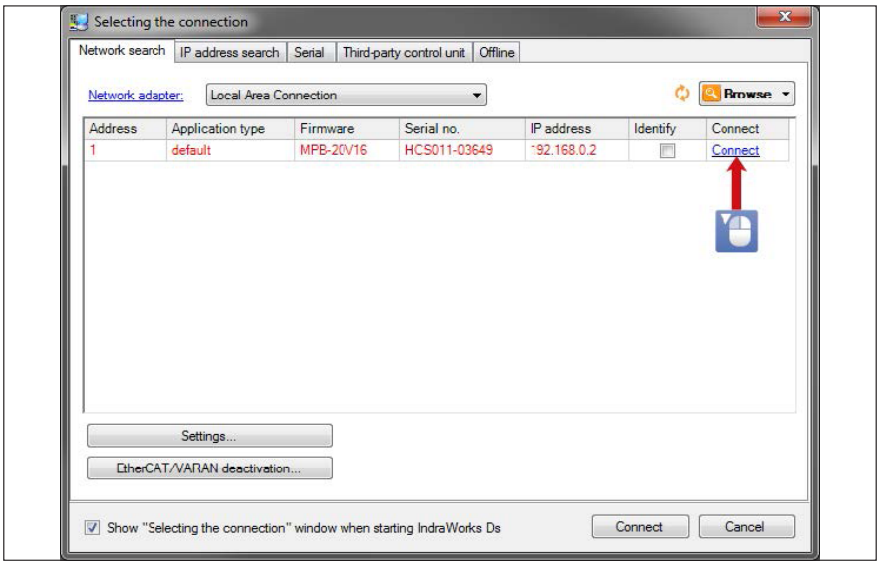

Fig. 24: IP address does not match

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.

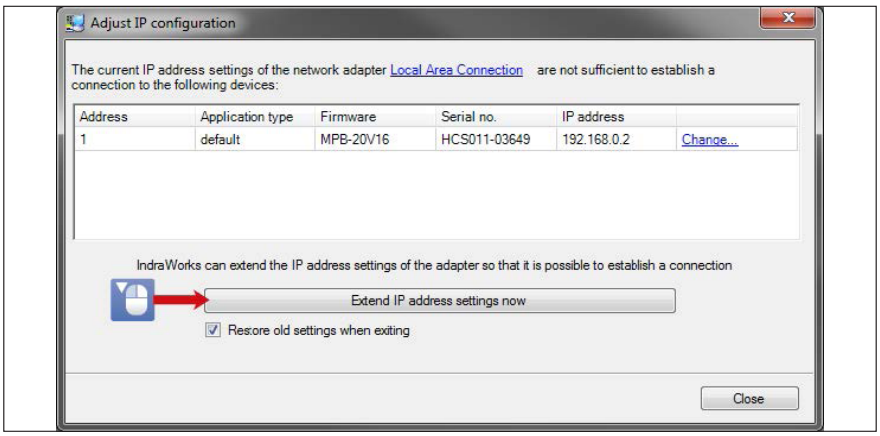

Fig. 25: Adding IP address settings

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":

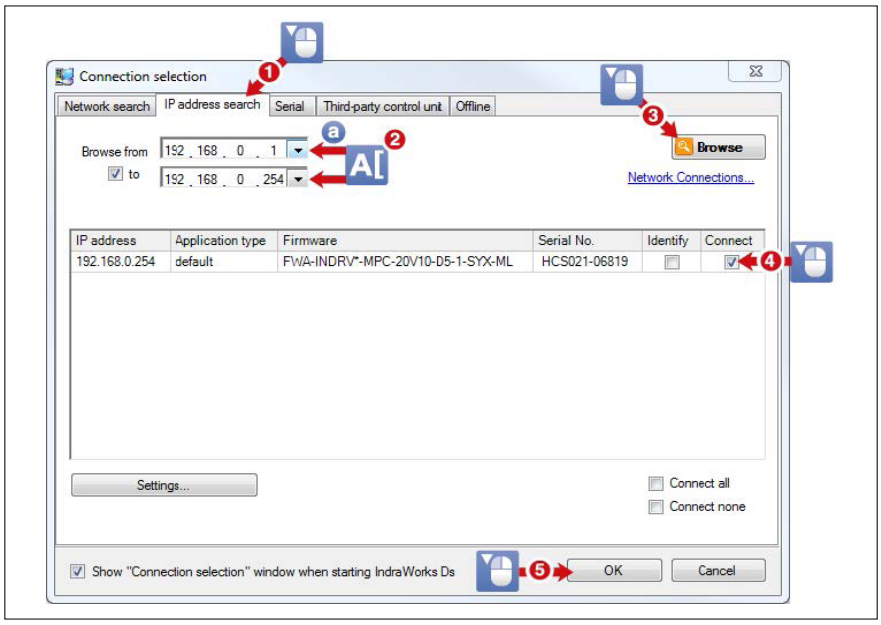

Fig. 26: Establishing a TCP/IP connection to the drive via an Ethernet interface

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 interface which is connected and 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 with the "ESC" key.

2. Configuration of the communication to IndraDrive

Service mode

To this end, you must at first activate the service mode as described in chapter 5.3.4 "Fixed command value memory". It is also indicated on the display of the drive controller, see Fig. 7, pos. 16 on page 50. 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.

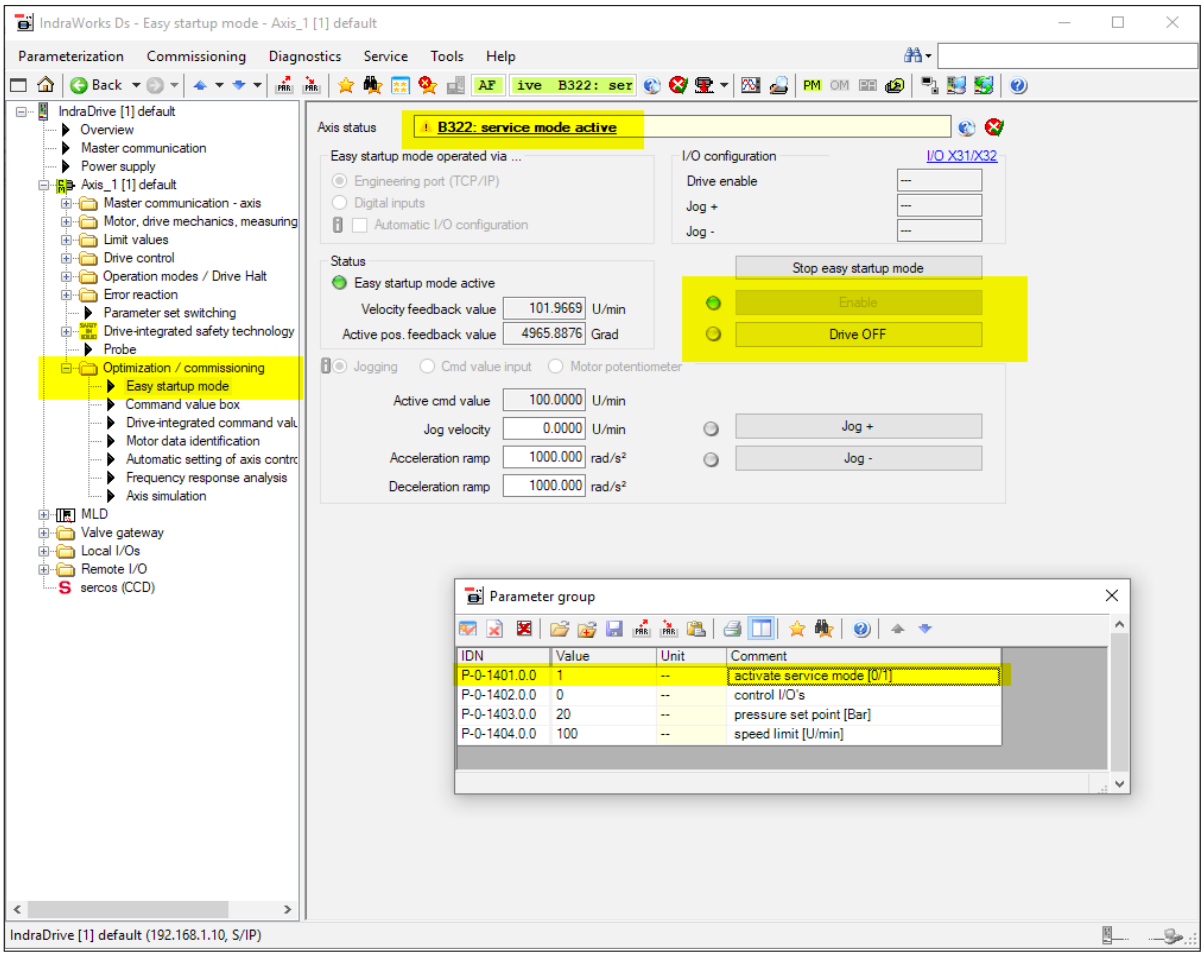

Fig. 27: Easy startup mode

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/IPTM, Sercos®, PROFINET®, EtherCAT®)

All field buses available to the IndraDrive are supported:

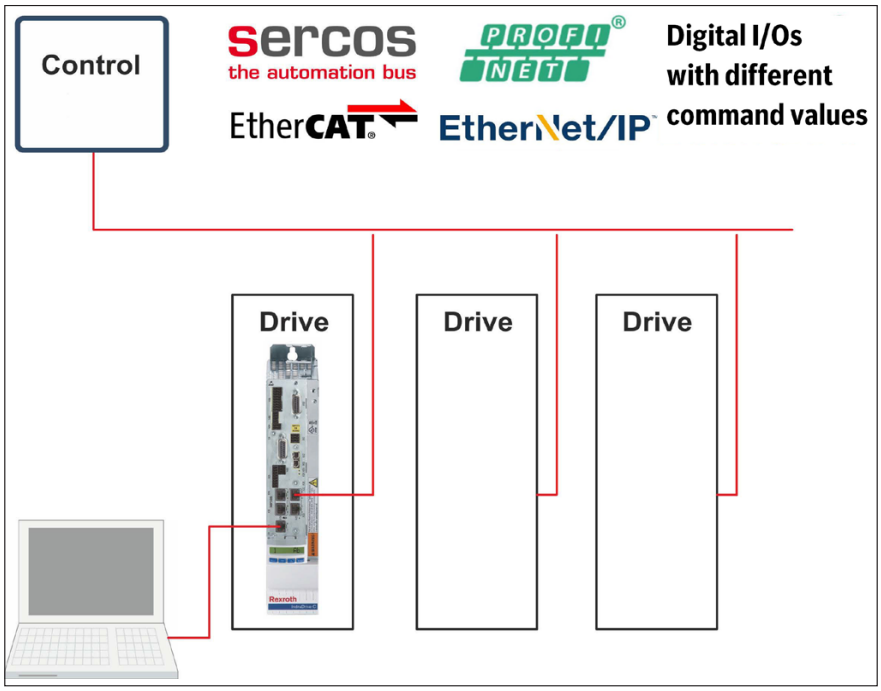

Fig. 28: Connection to the control system

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 field bus.

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

The device file for all field buses can be downloaded at the following link https://www.boschrexroth.com/de/de/produkte/produktgruppen/elektrische-antriebe-und-steuerungen/servoantriebe/steuerteile/csh02-advanced-einzelachs-steuerteil.

PROFINET® The commissioning instructions "IndraDrive with PROFINET® - example with Siemens SIMATIC S7" (R911341342), see chapter 1.2 "Required and amending documentation" describe the detailed configuration of the control system and the IndraDrive. Below, the major steps for the IndraDrive are described.

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

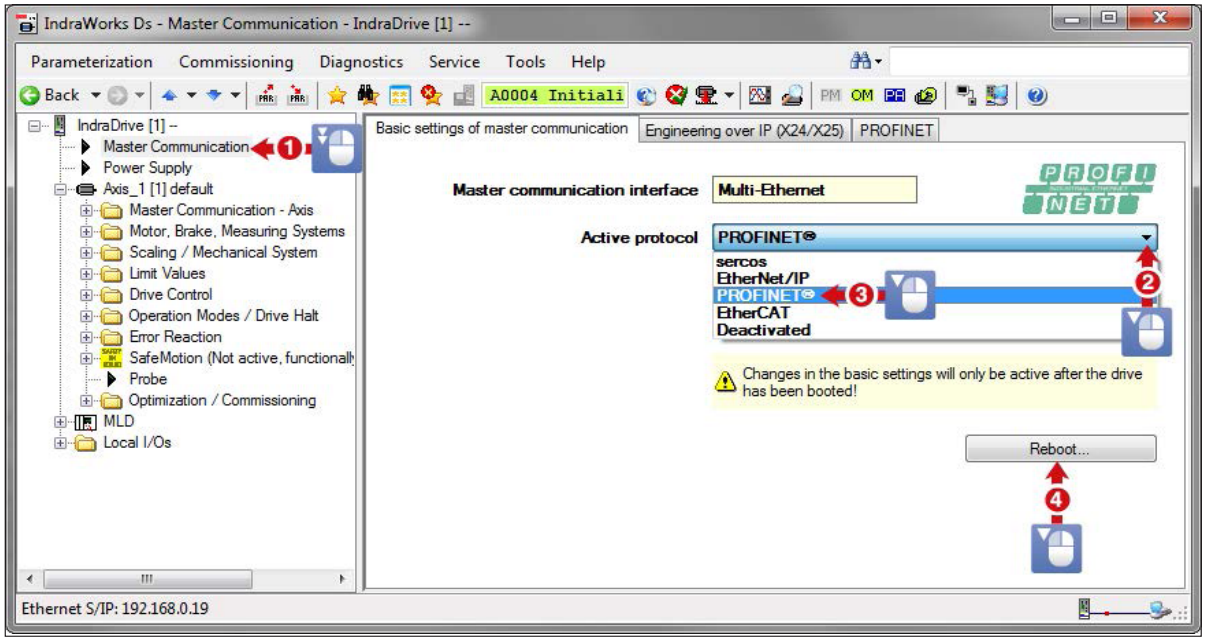

Fig. 29: Field bus start dialog

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 superior controller.

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

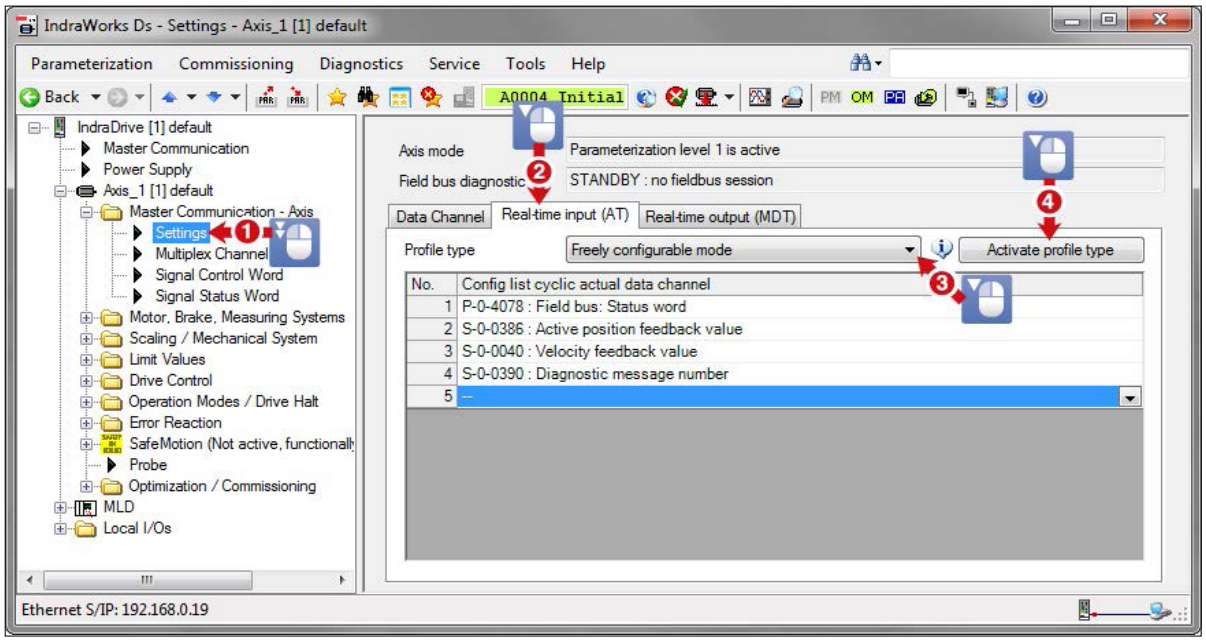

Fig. 30: Activating the freely configurable mode

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

▶ Configure cyclic actual values (AT) and command values (MDT) as required from Table 44 on page 91.

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

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

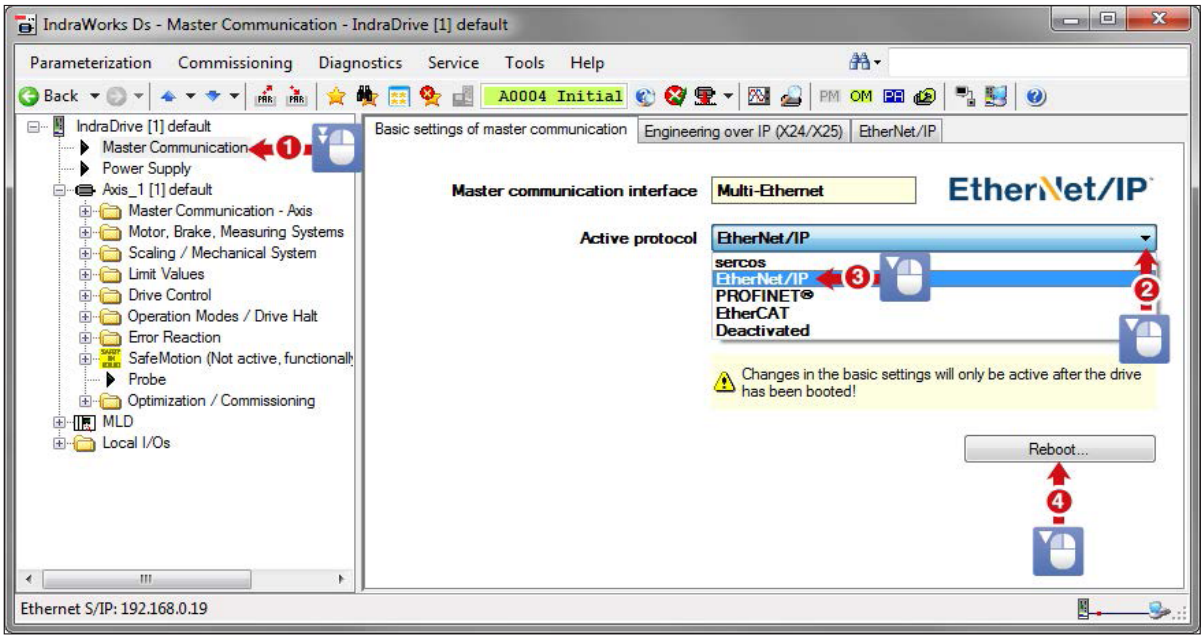

Fig. 31: Activating the EtherNet/IP™

Restart (C6400) required!

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

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

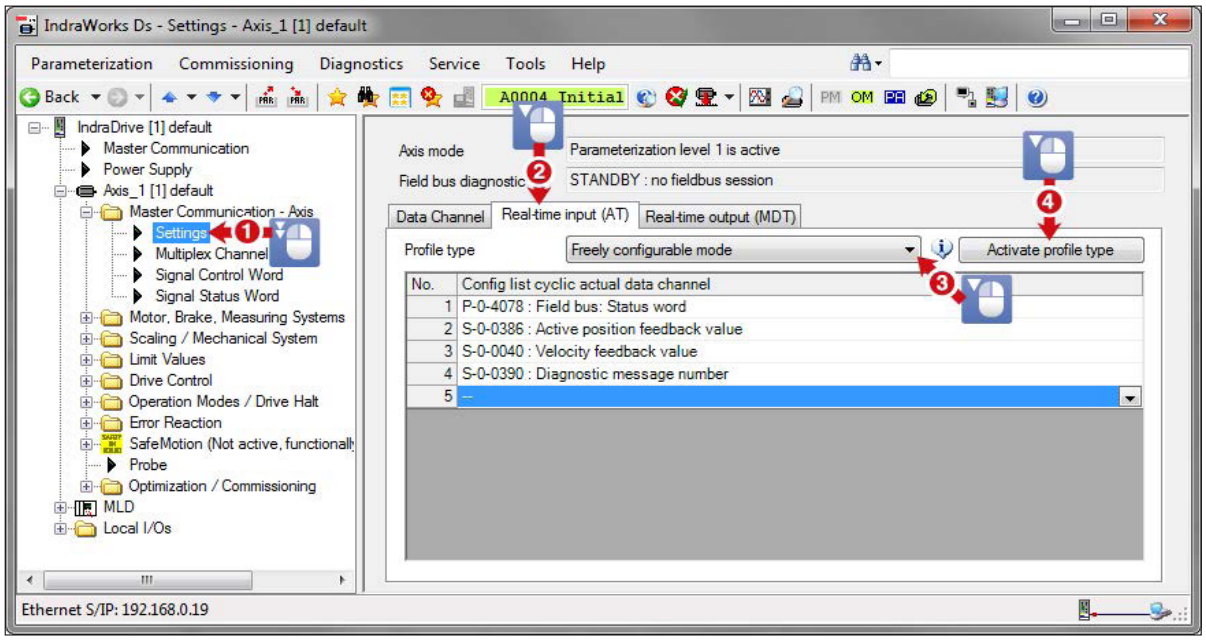

Fig. 32: Activating the freely configurable mode

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

▶ Configure cyclic actual values (AT) and command values (MDT) as required from Table 44 on page 91.

EtherCAT® (SoE)

The commissioning instructions "IndraDrive with EtherCAT® - example with Beckhoff TwinCAT®" (R911341344), see chapter 1.2 "Required and amending documentation" 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 field bus (P-0-4089.0.1 = 5)

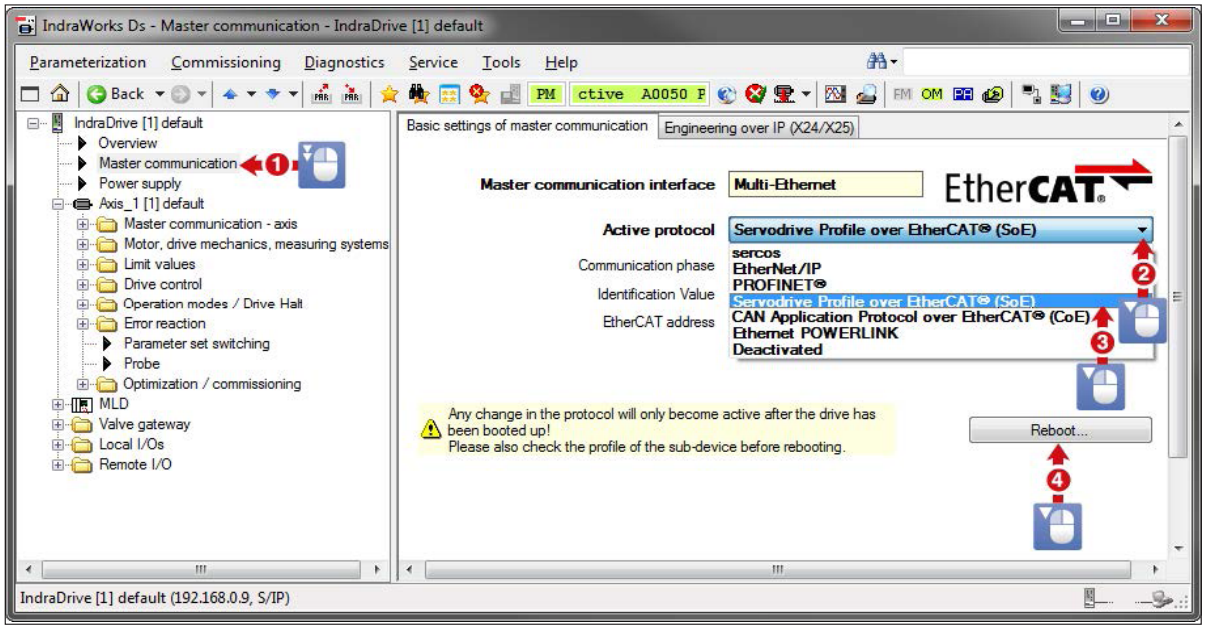

Fig. 33: Activating EtherCAT® (SoE)

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 44 on page 91.

EtherCAT® (CoE) 1. Activating the field bus (P-0-4089.0.1 = 8)

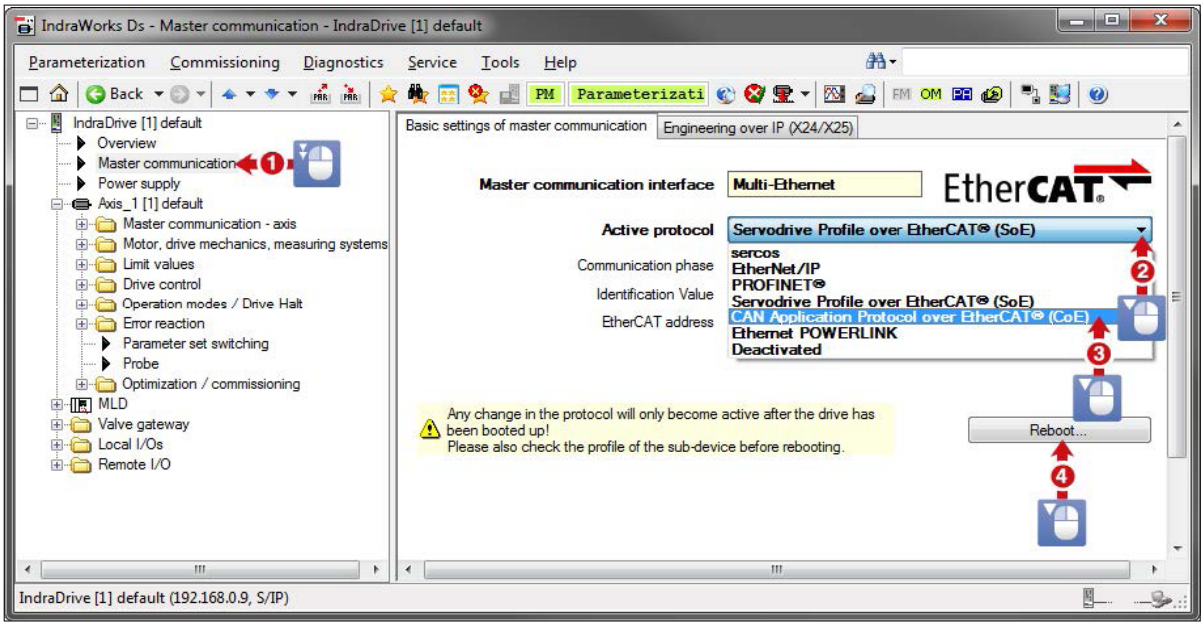

Fig. 34: Activating EtherCAT® (CoE)

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 44 on page 91.

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 field bus (P-0-4089.0.1 = 6)

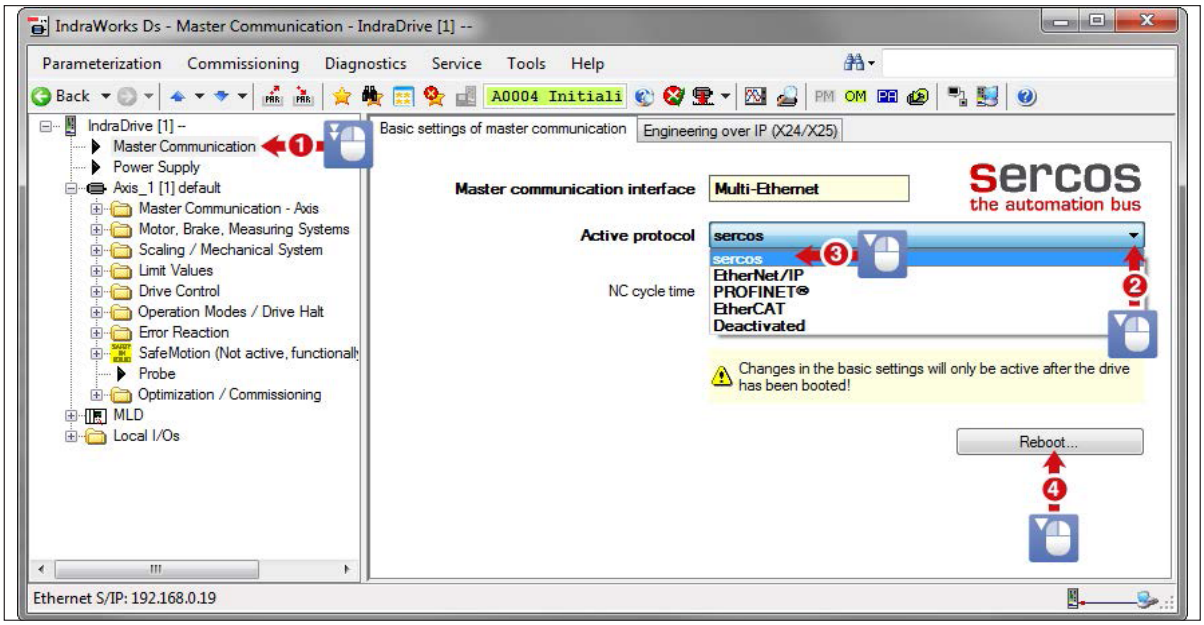

Fig. 35: Activating Sercos®

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 44 on page 91.

Communication interface of the CytroBox

Table 44: Communication interface

Parameter	Description	Length [Byte]	Length [Word]	Resolution	Unit	Field bus	Comment
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	Field bus 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	Field bus 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-0-1293	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 = EtherNet
SC = Sercos
EIP = EtherNetIP

The ProfiNet communication of the CytroBox allows a maximum of 48 byte / 24 words. 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 retrieval of values and their transfer to IMC can be activated using the 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 45: 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 input 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 46: 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 47: 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 48: 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".

- 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, dialogs are provided which have been specially developed for the technology function.

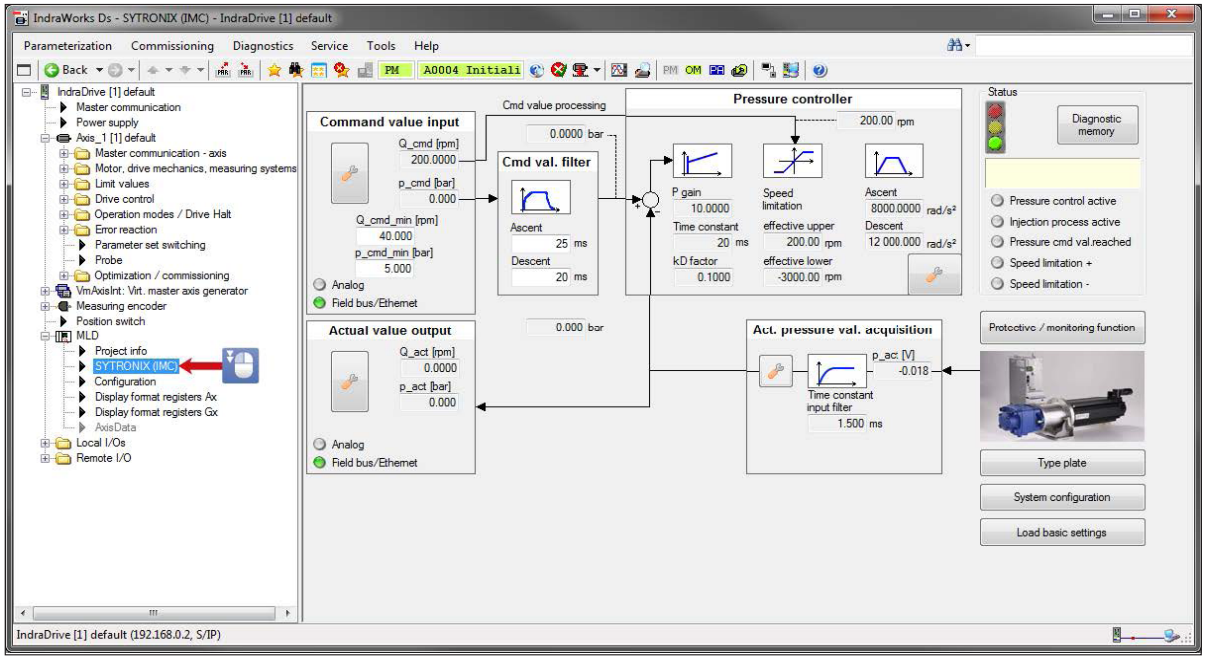

Fig. 36: Start dialog of the IMC software / parameter file

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

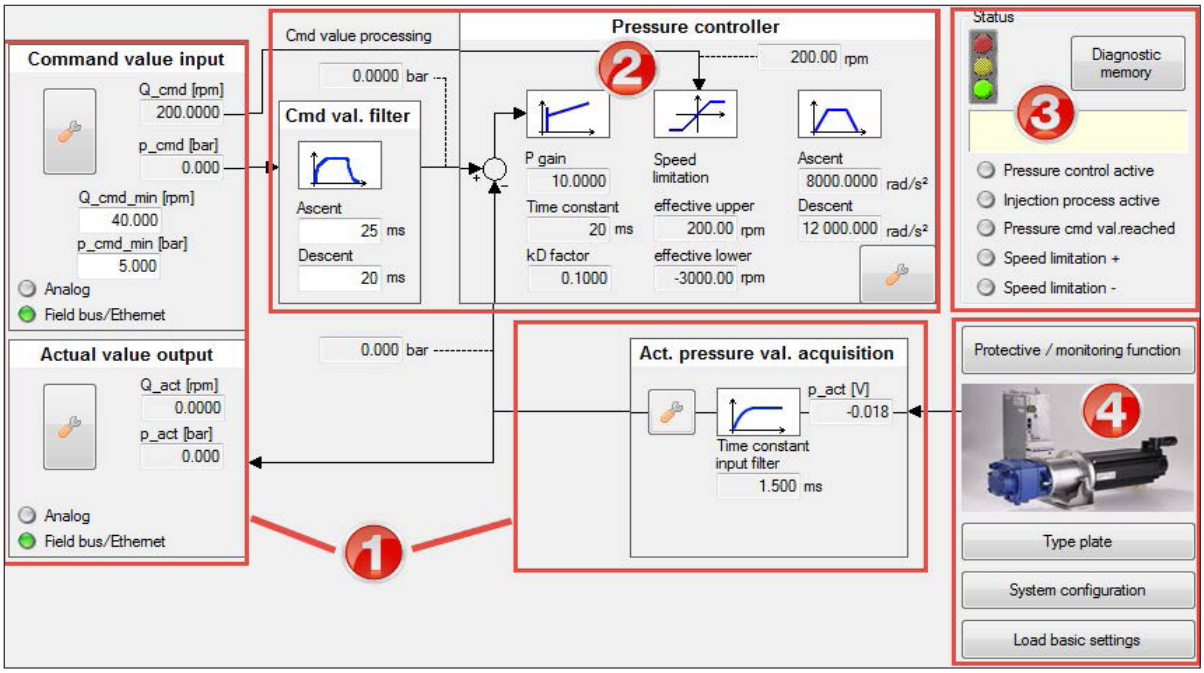

Fig. 37: Operating range of the start dialog

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 the 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, pos. 17 on page 50.
On delivery, the software/parameter file FWS-MLDSYX-IMC-02Vxx-D0-MP20-HPU02Vxx-NN is already loaded.

No PLC programming knowledge is required since the CytroBox function is fully operable via the dialogs 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 longer 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 like hydraulic fluid temperature, short replacement intervals of filter elements or noise indicate changes. If necessary, the troubleshooting matrix, see chapter 15, Table 51, 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 alarming 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 the 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 section and the IndraWorks DS software. The errors are also indicated on the display of the drive controller, see Fig. 7, pos. 16 on page 50.

10.4 Maintenance schedule

Note the status display on the display of the drive controller, see Fig. 7, pos. 16 on page 50.

Table 49: Maintenance schedule

Activity/maintenance interval	1/2 y.	1 y.	Alternative: Operating hours
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 Return flow filter element		X [1)]	
Visual inspection/replacement Electrical cabinet supply and exhaust air Hydraulic cabinet supply air Tank breathing filter		X [1)]	
Change Hydraulic fluid			20.000 [2)]

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.

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 and 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 if the maximum filling level is exceeded:

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 its admissible water content

Measures if the minimum filling level is fallen below:

– Identify and correct the cause of the leakage
– Afterwards, fill in 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.

10.5.4 Monitoring the filter element contamination (pressure filter)

Be critical if the filter contamination sensors do not indicate any change over multiple 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, pos. 3, on page 51, 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 with the open-end wrench hand-tight to the bottom and then turn it back half a turn.
11. Bleed the manifold block e.g. via a Minimess hose at measuring point 7.080, see Fig. 9 on page 52, and start the drive in service mode (via the wizard or IndraWorks DS).
12. Check the oil level and refill 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, pos. 5, 8 and 12 on page 48, Fig. 6, pos. 11 on page 49) .

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, semi-annual inspections are recommended.

Bosch Rexroth recommends documentation of 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".
- 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".

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 enclosing 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.

Bosch Rexroth AG, CytroBox, RE 51057-B/11.19

10.6 Spare and wear parts

- For a list of spare and wear parts for the hydraulic power unit, refer to Fig. 38 and Table 50:

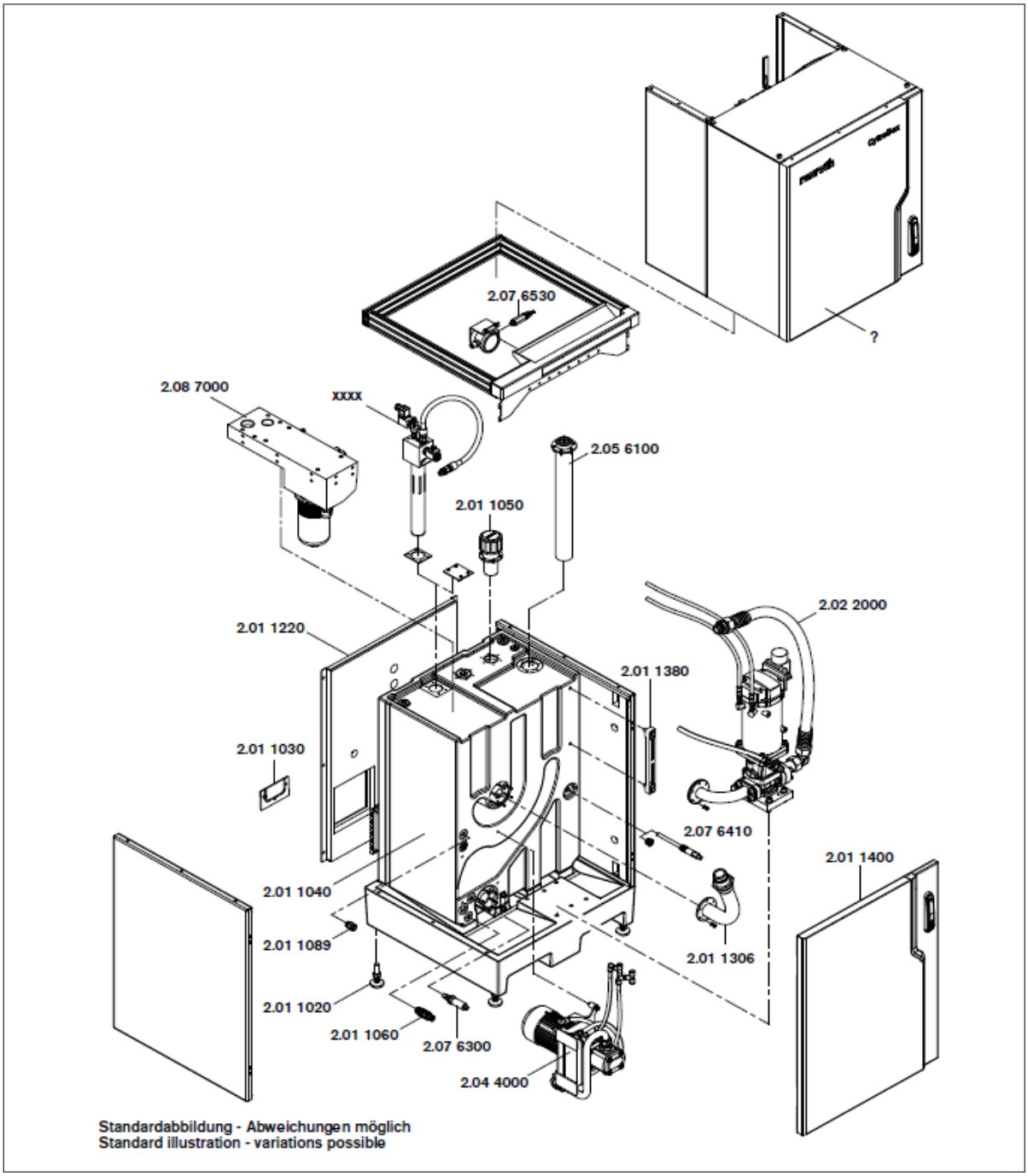

Fig. 38: Spare and wear parts

Table 50: Spare and wear parts

Material number	Denomination	SAP short designation	Assembly
R928006872	FILTER ELEMENT	2.0250 PWR10-B00-0-M	
R913071884	LEVELING FOOT	GN343.2-50-M16-63-OS	1020
R901500461	COVER	CYTROBOX DISCHARGE	1030
R901511842	OIL TANK	CYTROBOX-150B/PP-1004	1040
R900011023	AIR FILTER	ELF P 3 F 10 W 1.X	1050
R901500464	CONNECTOR PLUG	CEJN567-G1/2-020-105676200	1060
R900023618	OIL LEVEL INDICATOR	AB31-21/254	1080
R412007956	ELBOW UNION	QR2-S-RVT-G012-DA16	1089
R901500548	BACKPLANE MODULE	CB-V1-7035	1220
1823391641	BULKHEAD UNION	QR2-S-RSM-DA12-DA12	1223
R901521087	CORRUGATED HOSE	CB DN40 620MM/G2-TK80	1306
R901500559	MACHINE DOOR	CB-BOTTOM-V1-BLACK	1400
R901521082	FILTER MAT	CB-SUPPLY CONTROL CABINET-V1	1440
R901522194	FAN	SK3239.124 INCL- CONNECTION CABLE	1480
R902564300	AXIAL PISTON PUMP	A10FZO063/10R-VWC02K04	2010
R412007956	ELBOW UNION	QR2-S-RVT-G012-DA16	2027
R412004794	PUR TUBING	TU1-X-PUR-016-2500-BK-0025-WH	2028
R900023829	R-RING	54,5X3,53X3,53NBR90	2041
R901519249	CORRUGATED HOSE	CB DN50 250MM/G2-TK80	2050
R911389668	SERVOMOTOR	MS2N10-F0BHL-BSBB0-NCNNN-NN	2060
1823373062	THREADED FASTENER	QR2-S-RAS-G018-DA08	2064
1823391624	MALE CONNECTOR	QR2-S-RED-DA12-DA08	2065
1823386082	PLUG CONNECTOR	QR2-S-RSK-DA12-DA12	2066
R412009992	PUR TUBING	TU1-S-PUR-012-0150-BU-0050	2067
1820712024	PUR TUBING	TU1-S-PUR-012-0150-RD-0025	2068
R901515721	HOSE ASSEMBLY	3SP-19/P00-25P00-25/1000-1ST3N00Z0Z000Z	2072
R901515722	HOSE ASSEMBLY	3SP-19/P00-25P00-25/960-1ST3N00Z0Z000Z	2082
R901515106	INDUSTRIAL COMPUTER	CYTROCONNECT HARDWARE	3020
R911375012	CONTROL UNIT	CSH02.1B-CC-EC-ET-L3-DA-NN-FW	3030
R911306667	ACCESSORIES	HAS01.1-225-NNN-CN	3060
R911174437	INTERFACE MODULE	S67E-S3-IOL8-DI4-M12-6P	3130
R412009992	PUR TUBING	TU1-S-PUR-012-0150-BU-0050	4081
1823391944	THREADED FASTENER	QR2-S-RVA-DA12-DA12	4082
1823381048	TEE UNION	QR2-S-RTK-DA12-DA12	4083
1820712024	PUR TUBING	TU1-S-PUR-012-0150-RD-0025	4091
1823391944	THREADED FASTENER	QR2-S-RVA-DA12-DA12	4092
1823381048	TEE UNION	QR2-S-RTK-DA12-DA12	4093
R412004794	PUR TUBING	TU1-X-PUR-016-2500-BK-0025-WH	4101
R412007956	ELBOW UNION	QR2-S-RVT-G012-DA16	4102
R412004794	PUR TUBING	TU1-X-PUR-016-2500-BK-0025-WH	4111
R412007956	ELBOW UNION	QR2-S-RVT-G012-DA16	4112
R901521022	CORRUGATED HOSE	CB DN20 550MM/G1-G1	4140
R911286923	POWER-LINE FILT.	NFD03.1-480-130	6070
R901503635	FLOAT SWITCH	ABZMS-41-1X/0500/LTD/DC-K24	6120

Material number	Denomination	Comment	Assembly
R901432063	FLOW SENSOR	SBG232	6210
R900218276	MEASURING HOSE	DN2-630/MCS20-MCSH20/300ST3Z00Z-Z	6410
R928052298	TEST APPLIANCE	OPM II-1X-M	6420
R928052661	FLOW LIMITER	2103-A0-02.00	6430
R900981026	MEASURING HOSE	DN2-630/MCS20-MCSH20/630ST3Z00Z-P	6440
R911392372	A/D CONVERTER	DP2200	6460
R901519382	MEASUREMENT TRANSDUCER	BCM-WS120-1D-1	6510
R901520331	MOUNTING PLATE	CYTROBOX-EMPTY	8010

- Please send any spare part orders to the nearest Bosch Rexroth service center or directly contact the headquarters.
  For the addresses, please refer to www.boschrexroth.com.

Spare parts order

- Order spare parts in writing. In urgent cases you can also 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

11 Decommissioning

11.1 Preparing for decommissioning

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

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 and securely support all loads.

11.2 Decommissioning process

- 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 tank with a filling unit via the filling coupling (connector plug) type CEJN567-G1/2-020-105676200, see Fig. 8, pos. 15 on page 51.
  - 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 assemble device parts if it is required to carry out the necessary work. In general, all disassembled parts should be reassembled properly at the intended position.

12.1 Preparing 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 fixation 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".
- Check the tight fitting of the eyebolts, see Fig. 12 on page 57, if you need them to lift the hydraulic unit out of the drip 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 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" in reverse order.
- Hydraulic fluid will run 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".

13 Disposal

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. Also observe the applicable safety data sheets.

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14 Extension and modification

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

Declarations 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 machines 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 www.boschrexroth.com.

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 an electrical system 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 for troubleshooting

- Always work systematically and purposefully, even when under time pressure. Random and imprudent disassembly and readjustment of settings can, in the worst-case scenario, result in the inability to determine 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 error.

- Ask the direct (machine) operator, if necessary.

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15.1.1 Overview of the impact of defects

Table 51: Impact of defects

Error	Possible cause	Remedy
Excessive noise level	Hydraulic power unit does not stand with all four machine feet on a level and non-vibrating surface.	▶ Using the height-adjustable machine feet, ensure that all four machine feet evenly stand 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 "IMC optimization" on page 94.
Incorrect operating pressure	Incorrect pressure command value presetting	▶ Check the pressure command value, parameter P-0-1271. – Fixed command value memory correctly parameterized – Command value correctly preset via the field bus interface – Service mode active ▶ If only one pressure rating is intended, make sure that F1.03 and F1.04 are set to 0. – For further information, refer to chapter "IMC configuration" on page 94.
	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	▶ As applicable, change the following parameters: – P-0-1285 Effective flow command value – P-0-1289 Effective maximum velocity limitation ▶ Check the following values in IndraWorks DS: – Speed limitation via field bus presetting – Fixed command value memory speed limitation ▶ 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 "drive overload torque" – Check parameter S-0-0092 Torque/force limit value bipolar. – Check parameter P-0-0141 Thermal controller utilization. – Observe the maximum ambient temperature, see also the performance curves in the Drive data sheet provided in chapter 1.2 "Required and amending documentation".
	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.

Error	Possible cause	Remedy
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.
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 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.
Breathing filter contaminated	Contaminated ambient air	▶ Clean or replace the breathing filters for the tank, control cabinet and hydraulic cabinet, see Table 50 "Spare and wear parts".

Error	Possible cause	Remedy
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 function of the installed 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.

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16 Technical data

General			
Installation position			Vertical
Line connections	▶ Pressure port		G1 1/4
	▶ Return flow		G1 1/2
Place of installation			Industrial building; stationary application
Ambient temperature range (during operation)		°C	+10 ... +40
Weight (depending on configuration level) without oil		kg	500 ... 550 depending on the equipment
Material	▶ Tank		Plastic (PP)
	▶ Steel components		Galvanized, painted, powder-coated
	▶ Base		Polymer concrete

Hydraulic			
Maximum operating pressure		bar	315, see characteristic curves on page 12 in the data sheet 51057
Maximum flow		l/min	160, see characteristic curves on page 12 in the data sheet 51057
Maximum oscillating volume		l	50
Maximum tank capacity		l	150
Maximum temperature range of the hydraulic fluid		°C	+5 ... +70
Hydraulic fluids			Mineral oil HLP according to DIN 51524
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Pressure filter [2]	▶ Filter rating	µm	10
Filling level monitoring	▶ Early warning	l	Adjustable by means of parameters, see page 33.
	▶ Shut-off	l	
Temperature monitoring (hydraulic fluid)	▶ Early warning	°C	Adjustable by means of parameters, see page 33.
	▶ Shut-off	°C	
Pump	▶ Minimum flow	l/min	0
	▶ Hydraulic fluid viscosity range (see data sheet 91485)	mm^2/s	≦ 1000 in case of cold start 1000 ... 400 warm-up phase 400 ... 16 continuous operation

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components. For selecting the filters, see www.boschrexroth.com/filter.

[2] Directly mounted at the block.

For further information and data on the use of other hydraulic fluids, please contact us.

Electrical			
Voltage (according to IEC 60038)		V	400 ... 500 AC (+10%/-15%)
Frequency		HZ	50/60
Protection class according to DIN EN 60529			IP 54
Fuse for the supply line, customer-side	▶ HCS03-0070	A	50
	▶ HCS03-0100	A	80
	▶ HCS03-0150	A	125

Cooling water supply [1]		
Flow	l/min	20
Inlet temperature	°C	15 ... 25
Connections		Quick-release coupling push-in Ø 12 mm
Maximum glycol content	%	30
Maximum cooling water pressure	bar	< 10

[1] In addition, the R911347582 project planning instructions must be observed, see chapter 1.2 "Required and amending documentation".

For the operation of the CytroBox, a cooling water supply must always be connected.

Plate heat exchanger		
Thermal output (for hydraulic fluid and motor)	kW	4 or 8
Inlet temperature of hydraulic fluid	°C	50
Outlet temperature of hydraulic fluid	°C	43
Inlet water temperature	°C	20
Outlet water temperature	°C	25

The power unit requires a cooling water connection; the oil temperature can be set by means of parameters.
The control cabinet is air-cooled and the electric motor is water-cooled.
The hydraulic fluid is cooled by a circulation circuit with a plate heat exchanger.

17 Appendix

17.1 List of addresses

For the addresses of our sales and service network, please refer to www.boschrexroth.com.

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.

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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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17.3 Prohibited substances - REACH, RoHS, WEEE

Our AB products such as power units, control blocks, AB assemblies and AB accessories are free of prohibited substances according to the current status and thus meet all EU requirements with regard to the above-mentioned directives.
If, in exceptional cases, prohibited substances are used above the admissible concentration, we will endeavor to replace these substances or notify our customers of their use (REACH information on the use of lead alloys >0.1 % on our homepage).
Our products do not formally fall under the relevant substance prohibition directives (REACH, RoHS, WEEE), as they are intended as partly completed machinery, assemblies or components to be installed in machines by specialists.
Our AB products do not provide a stand-alone function for end users. Therefore, they do not receive a CE mark due to the mentioned directives.
As far as necessary in individual cases, we issue the required declarations of conformity, supplier's declarations for our products/product families for each order or make the LINK available for download.
We regularly check our products for the use of hazardous substances (SVHC), buy our components exclusively from qualified suppliers and ensure with the compliance of the Bosch standard N2580 that our AB products do not pose any danger to people and the environment.

17.4 Accessories

Table 52: Accessories

	Material number	Denomination	Comment
Electric	R913002119	LINE CONNECTOR 8P 7000-17081-2910500 (included in the scope of delivery)	**CytroBox connection: 20X1 (digital inputs and outputs)** Connector, straight, shielded, 8-pole M12, with free PUR line end, length: 5 m (8 x 0.25 mm² /d = 7.0 mm) 24 VAC/DC, max. 1.5 A Protection class: IP67
	R913002641	LINE CONNECTOR 8P 7000-17081-2911000	**CytroBox connection: 20X1 (digital inputs and outputs)** Connector, straight, shielded, 8-pole M12, with free PUR line end, length: 10 m (8 x 0.25 mm² / d = 7.0 mm) 24 VAC/DC, max. 1.5 A Protection class: IP67
	R913002121	MATING CONNECTOR 8P 7000-17121-2910500 (included in the scope of delivery)	**CytroBox connection: 21X1 (Safe Torque OFF)** Socket, straight, shielded, 8-pole M12, with free PUR line end, length: 5 m (8 x 0.25 mm² /d = 7.0 mm) 24 VAC/DC, max. 1.5 A Protection class: IP67
	R901467712	MATING CONNECTOR 7000-17041-3771000	**CytroBox connection: 21X1 (Safe Torque OFF)** Socket, straight with cable support sleeve, 8-pole M12, with free PUR line end, length: 10 m (8 x 0.34 mm² / d = 6.2 mm) 30 VAC/DC, max. 2.0 A Protection class: IP65 and IP67 in plugged and screwed condition
	R901469479	CONNECTOR IE-PS-V04P-RJ45-FH	**CytroBox connection: 22X1/22X2/30X1 (Multi-Ethernet RJ45)** Connector without cable
	R901471844	NETWORK CABLE RJ45/IP67-RJ45 5M (included in the scope of delivery)	**CytroBox connection: 22X1/22X2/30X1 (Multi-Ethernet RJ45)** length: 5 m Certificate: CAT 6A / RoHS
	R901471845	NETWORK CABLE RJ45/IP67-RJ45 5M RJ45/ IP67-RJ45 10M	**CytroBox connection: 22X1/22X2/30X1 (Multi-Ethernet RJ45)** length: 10 m Certificate: CAT 6A / RoHS
	R901492613	NETWORK CABLE RJ45/IP67-RJ45 10M RJ45/ IP67-RJ45 20M	**CytroBox connection: 22X1/22X2/30X1 (Multi-Ethernet RJ45)** length: 20 m Certificate: CAT 6A / RoHS
Hydraulic	R901500464	CONNECTOR PLUG CEJN567-G172-020-15676200 (included in the scope of delivery)	

The accessories listed in table Table 52 can be ordered separately under the specified material numbers.

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