Parametrization instead of programming: HACD-2X Standard Motion Control for electrohydraulic axes
Technology optimized for hydraulics – experience from thousands of applications

Hydraulics features a unique power density and robustness for numerous applications. With a wide range of Motion Control systems Rexroth opens up modern automation to hydraulic drives. What counts here is the experience gained in many thousands of applications, for this know-how significantly simplifies engineering and brings about fast, flexible and reliable solutions.

**Easy to use**
Easy realization of Motion Control, the operator units and the drives decisively accelerates commissioning.

Rexroth exploits the entire productivity potential of electric, hydraulic and hybrid drives for both, decentralized and central architectures. With industry- and application-specific function libraries you achieve production results more easily and faster. In addition, the Motion Control software takes account of the specific requirements of hydraulics and separates the drive physics from the automation level. As a result of this, all drives behave identically from the control’s and from the operator’s point of view.

Rexroth offers optimal control performance for nearly all industrial sectors in steelworks, forming and rolling mill technology, material handling and testing technology as well as in plastics processing, woodworking and paper-making or special machines.
Scalable in hardware and software

Ranging from single-axis controls integrated in the drive through multi-axis controls installed in the control cabinet to complete machine control with integrated PLC, Rexroth always perfectly meets the requirements of any type of hydraulic application. The proven Bundled I/O strategy covers a wide variety of interfaces to offer you the optimum solution for your specific application.

This fine scalability of hardware and software from Rexroth standardizes automation across all drive technologies.

Flexible parameterization, simple commissioning and transparent diagnostics of all drives via the control shortens commissioning times and cuts total cost of ownership for the user.

- **standard**
  - IAC-R valves with p/Q and axis control

- **programmable**
  - HACD-2X standard axis control for control cabinet installation, 3 control loops
  - HNC100-3X scalable, programmable NC axis control for 1 – 4 axes

- **advanced**
  - MAC-8 Modular motion control for 2 – 32 axes

Open to any solution

Also with regard to control solutions for hydraulic drives Rexroth consequently counts on open interfaces and programming standards. Motion controls support all common field buses and Ethernet protocols and fit seamlessly into a wide variety of automation environments.

The perfect solution for your application:

Motion controls for electrohydraulic drives
HACD-2X: Flexible standard hydraulic control

Rexroth expands the proven HACD-2X family by Ethernet-capable variants. With this parameterizable standard performance class you get a matched, easy-to-operate solution for the optimum control of your hydraulic system, which is supported all over the world. According to our motto ‘Just Enough’ the most important basic controller functions are adapted to your application – without the need to compromise on flexibility and variety of interfaces.
Modern automation increasingly relies on bus and Ethernet systems for standardized network communication of automation solutions. The HACD-2X supports a wide variety of communication interfaces and allows the easy and fast integration into existing control architectures.

- **Openness**
  - In communication: Support of all common field buses and Ethernet protocols
  - In control technology: Open access to control parameters and controller structure
  - In function sequences: free configuration of motion sequences using parameterization

- Control and instrumentation system, HMI, engineering: Ethernet-based communication between controls, HMI and higher-level systems
- Controls: Higher-level machine control for Logic Control
- Drive controller: Decentralized hydraulic drive controllers HACD-2X for Motion Control
- Hydraulic axes
Flexible interfaces: As many as necessary, as few as possible!

According to the motto ‘Just Enough’, with the HACD product family, Rexroth consequently pursues and improves its proven Bundled I/O strategy, which provides you with the optimum variety of interfaces that you require for your specific application. This will offer you even more flexibility in the selection of a suitable control concept for your application.

The HACD-2X conforms with CE according to EMC Directive 2009/108/EG and EMVG (German EMC law). In view of its resistance to vibration, shock and climate according to EN 60068-2/IEC 68-2/DIN 40046 it is perfectly suited for operation in harsh industrial environments.

The HACD-2X offers Bundled I/O that are tailored to the relevant application, with suitable analog and digital interfaces for reading in and out common industrial signals as well as SSI and incremental sensor information.

- 2 × SSI encoder or 1 × incremental encoder
- 8 × digital inputs
- 7 × digital outputs (freely configurable)
- 6 × analog inputs (12 bit)
- 3 × analog outputs (14 bit)

Field bus: PROFIBUS DP

Voltage supply 24 V

COM (RS232 for PC)

Adress for PROFIBUS DP

EtherNet: PROFINET RT EtherNet/IP
Parameterizable controllers, function sequences and more

The HACD-2X is more than just a drive controller. Parameterizable control loop structures offer common control functions, a time-based generation of ramps as well as PIDT control. Moreover, it features special signal functions that are required for optimizing hydraulic closed-loop control applications. These functions allow you to employ closed-loop control of position, velocity, pressure, and force independently of one another or together with bumpless transitions in the drive control.

**Controller functions**

- **Position Control**
  - Velocity control
  - Characteristic curve correction
  - Linear gain curve
  - Fine positioning

- **Force Control**
  - PIDT1-controller
  - Differential pressure evaluation

- **Pressure Control**
  - PIDT1-controller
  - Pressure limitation

- **State Control/Active Damping**
  - Position
  - Acceleration
  - Pressure

- **Alternating Control**
  - Positioning with automatic transition to force control and back

**Function sequences**

- **Parameterizing**
  - Simple parameterizing instead of programming of motion sequences

**Monitoring**

- **Diagnosis – WinView**
  - Multi-channel oscilloscope and data logger

- **Monitoring**
  - Cable break
  - Following error
  - Traversing range limits
Efficient hydraulic drives – easily and quickly realized!

The HACD-2X is convincing by its ease of handling – from its installation through to commissioning:

- Top hat rail mounting
- Plug-in terminal connections
- Non-interchangeable connection blocks
- BODAC – Bosch Rexroth Operator Interface for Digital Axis Controller
- Free operator software
- Programming without programming knowledge
- Future-proofness with downward compatibility

Realize your application in four steps:

1. Configure
   Assign inputs and outputs to the loops

2. Calibrate
   Select measuring ranges, sensors, scaling and offset

3. Operate
   Real-time oscilloscope WinView for analyzing the control performance

4. Optimize
   Improve the control performance with the easy-to-operate parameter window
BODAC operator software: Parameterizing instead of programming

Simple programming
The example of an "overriding position/pressure (force) control" shows, how you can create the desired function in BODAC with only a few, simple parameter sets: A hydraulic axes traverses at a given command velocity to the target position. When the command pressure or command force is reached during the traversing process (example: press), an automatic changeover to pressure or force control will take place. The changeover process is based on the minimum value principle ("overriding") of the controller outputs. The traversing movement can, however, be stopped at any time.

Structure Editor
The Structure Editor is provided for configuring and linking variables. First of all, the required variables for position (SSI1-S = SSI encoder) and pressure (IN1 – analog input) have to be selected with the help of pull-down menus. Setting of the trigger (T1) starts the motion sequence. In the blocks Loop 1 and 2 the selected command values are compared with the measured actual values and corrected. The command values can either be provided internally or transmitted over common bus systems from the PLC. The "overriding control" is implemented according to the minimum value principle of the controller outputs. Here, the smallest value of the position and force controller is automatically issued as output signal (LO1). The movement can be stopped at any time.
## Technical data

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<td>123,5 mm (D); 120,0 mm (H)</td>
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HACD-2X
Form follows function

Depending on the requirements and intended use, the HACD-2X is provided with different functionalities. The “type code” helps you make the right choice:

VT-HACD3-2X/□-I-00/000

Control loops
- 3 control loops 3

Bus interfacing
- Without option 0
- PROFIBUS DP V0 P
- Ethernet E
- PROFINET N

Measuring system
- Incremental/SSI 1

Additional functions
- None 00

Software options
- None 000

HACD-2X documentation:
- Product data sheet RE 30543
- Declaration on environmental compatibility RE 30543-U
- Installation and operating instructions RE 30543-B
- Commissioning and software description RE 30543-01-B
- Commissioning instructions PROFIBUS DP RE 30543-01-Z
- Commissioning instructions Ethernet RE 30543-04-Z
- Commissioning instructions PROFINET RT RE 30543-05-Z

The HACD software BODAC and documentation relating to the HACD-2X can be downloaded on the Internet: www.boschrexroth.com/hacd
Rexroth won’t leave you alone

All around the HACD-2X Rexroth offers direct support in three categories: Tailored training, application-related parameterization and commissioning on site. Your digital control can always be kept up to date over the Internet. Users also get direct support via e-mail.

Training courses that are tailored to the individual needs of users take two to three days. The objective: Imparting the know-how required for the application at hand so that the user can create the application and carry out commissioning on his own. In case that Rexroth is to create the application, this will be carried out in close cooperation with the customer on the basis of a jointly worked out specification. And for commissioning, Rexroth will provide additional service support.

Internet support: www.boschrexroth.com/hacd
The comprehensive download area on the Rexroth websites offer current software updates and information on tools and configurations. Apart from comprehensive documentation, it also comprises detailed answers to all questions in conjunction with this digital control electronics.

Whether you wish to update the BODAC software, require information on Rexroth firmware, learn more about latest tools and configurations or generally want to deepen your HACD-2X knowledge – utilize the comprehensive download area of the Rexroth websites!

Individual support
Contact our specialists by e-mail: support.hacd@boschrexroth.de
Success confirms it, Motion Logic systems from Rexroth in the field of hydraulics are unique. Rexroth products are developed with the support of a global network of product, application and service specialists and used around the world. All around the HACD-2X Rexroth offers tailored training courses, application-related programming and commissioning on site. Follow the road to success with this unique application know-how and support!

HACD-2X for hydraulic drives – at home throughout the world in a wide variety of applications

Be it in presses, steelworks and rolling mill technology, material handling or special machinery – Rexroth offers the optimum motion logic systems.

Special machines
- Packaging machines
- Bending machines
- Transfer
- Shears
- Lifting equipment
- Assembly machines

Steelworks and rolling mill technology
- Rolling mill machines
- Revolving furnace controls
- Transport equipmens

Pressen
- Press brakes and cutting presses
- Tube bending machines
- Assembly presses
- Tile presses

Machine tools
- Grinding and milling machines
- Drilling machines
- Bending machines

Woodworking machines
and many more
The data specified above only serve to describe the product. As our products are constantly being further developed, no statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.