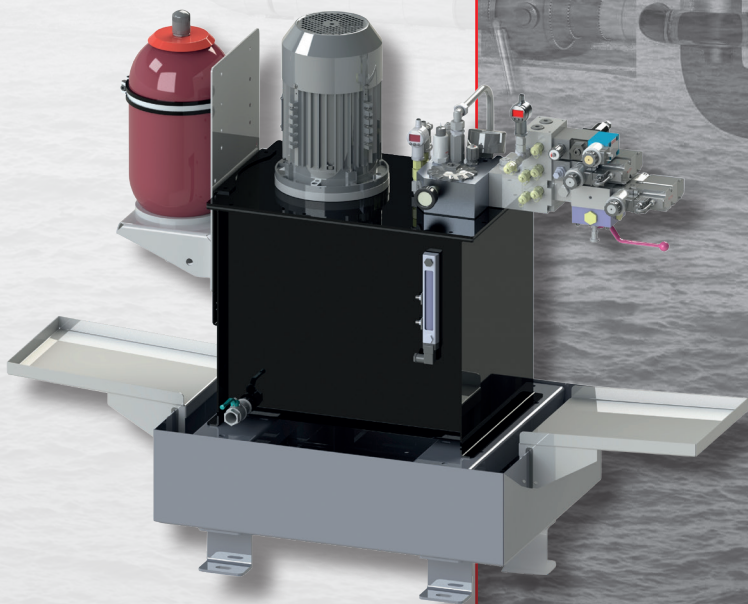


HYDAC HYDROBOX

Modular, Hydraulic Controller
for Hydropower Plants



1.	CONTROL APPLICATIONS IN HYDROPOWER PLANTS	2
2.	HYDROBOX FOR CONTROL APPLICATIONS IN THE HYDROPOWER INDUSTRY	3
3.	CONFIGURATION OPTIONS	4
4.	QUICK SELECTION OF THE MAIN COMPONENTS	4
5.	GENERAL FUNCTIONALITY AND DESCRIPTION OF COMPONENTS	6
6.	VALVES	7
7.	SAFETY	8
8.	ELECTRICAL INTERFACE	9

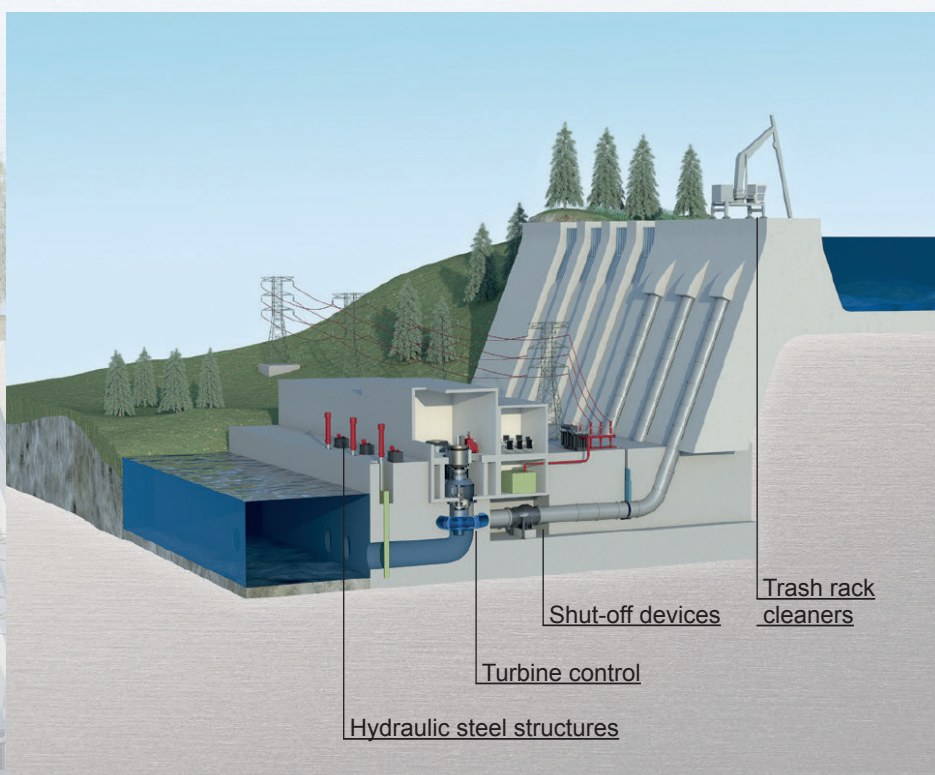
Your professional partner

With over 9500 employees worldwide, HYDAC is one of the leading suppliers of fluid power, hydraulic and electronic equipment.

More than 50 subsidiaries and over 500 sales and service partners guarantee competent on-site service – wherever you need our support.

Our wide range of products, combined with our expertise in development, manufacturing, sales and service, allows HYDAC to provide comprehensive fluid conditioning concepts - from individual filter components to the complete system.

1. CONTROL APPLICATIONS IN HYDROPOWER PLANTS



Examples

Hydraulics for hydraulic steel structures

- Weirs
- Weir shutters
- Sluice gates

Hydraulics for turbine control

- Runners
- Guide vanes
- Brakes
- Pelton nozzles
- Deflectors

Hydraulics for shut-off devices

- Ball valve control
- Butterfly valves
- Safety-related control

Hydraulics for trash rack cleaners

- Rakes
- Lifting cylinders
- Pressing cylinders

HYDROBOX

The HYDROBOX is a modular, hydraulic controller for the hydropower industry which is based on the tried-and-tested HYBOX basic system. The HYBOX basic system is a modular unit concept consisting of high-quality components from HYDAC.

For system manufacturers, this modular system boasts a unique valve block concept consisting of a multi flexible manifold. This manifold makes it possible to attach additional functional blocks, including HYDAC's valve stacking system block (ML series) and the multi station manifold for size 6 (Cetop 03) valves.

The aluminium/steel blocks are designed for a max. of 60 l/min at 250/350 bar.

In its entirety, the HYBOX concept aims to modularise all system components: from tanks, motor-pump groups including electric motors, valve manifolds with pressure valves, emergency closing valves and proportional valves, filters, accumulators, sensors, coolers and seals to all components which make it possible to build a hydraulic unit, or "HYDROBOX", for the hydropower industry.

2. HYDROBOX FOR CONTROL APPLICATIONS IN THE HYDROPOWER INDUSTRY (general overview)

HYDAC's modular, hydraulic controller offers a range of solutions for both simple and complex control systems in hydropower plants. Some examples of the possible applications for this control are listed below:

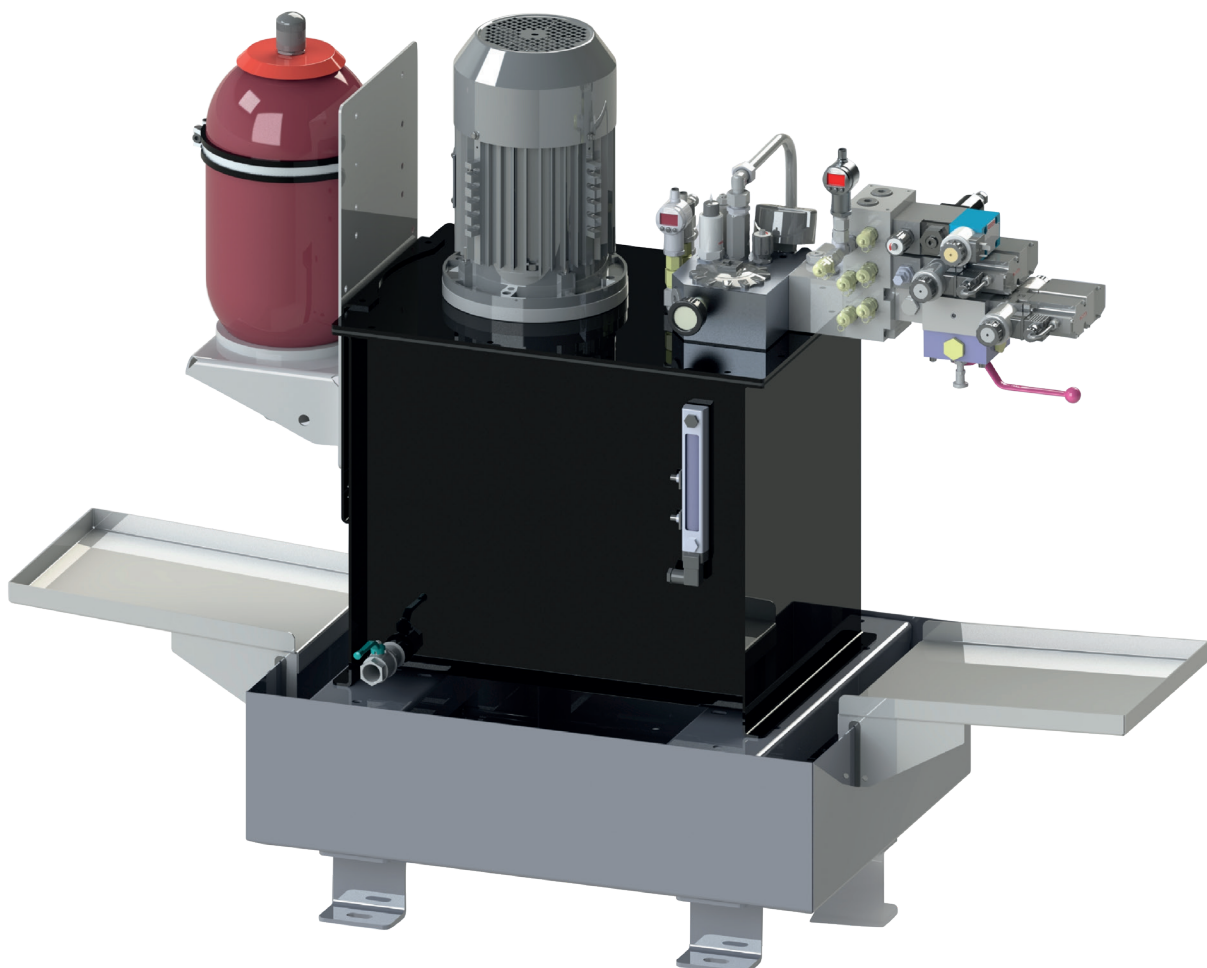
- Kaplan runners and guide vanes
- Pelton nozzles
- Pelton deflectors
- Brakes
- Butterfly valve controls
- Inlet valves
- Main shut-off devices
- Trash rack cleaners

2.1 OUR SOLUTIONS

- Our modular, standard unit enables you to configure your hydraulic controller according to the particular hydropower application
- Tried-and-tested technology and use of standard components
- User-friendly unit configuration
- Development and assembly carried out by our experienced and fully trained technicians

2.2 YOUR BENEFITS

- Standard unit in a modular design
- Compact, proven technology
- Continuous product development
- Tried-and-tested and high-quality hydraulic controller
- Time can be saved in the dimensioning, ordering, processing and commissioning phases due to the standardised technical design
- Fast delivery times
- Stock of spare parts



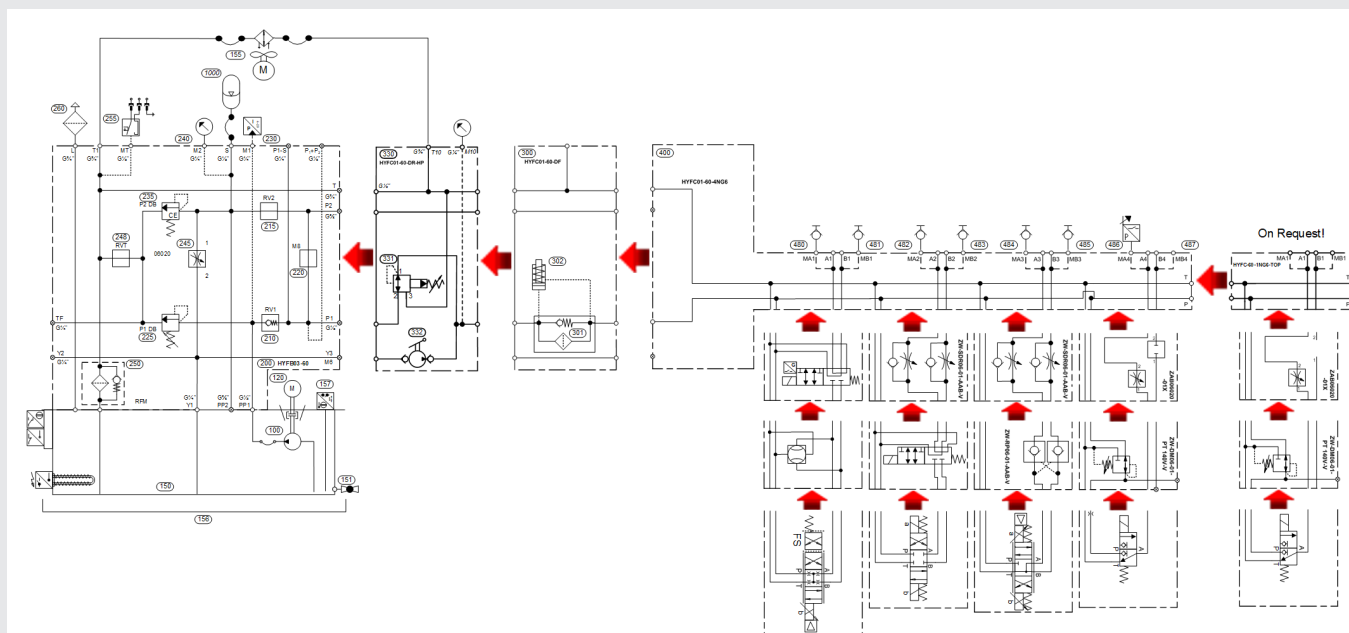
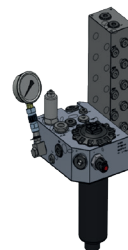
3. CONFIGURATION OPTIONS

3.1 MODULAR DESIGN

Configuring the different turbine controls is quick and easy thanks to the HYDROBOX system's modular design.

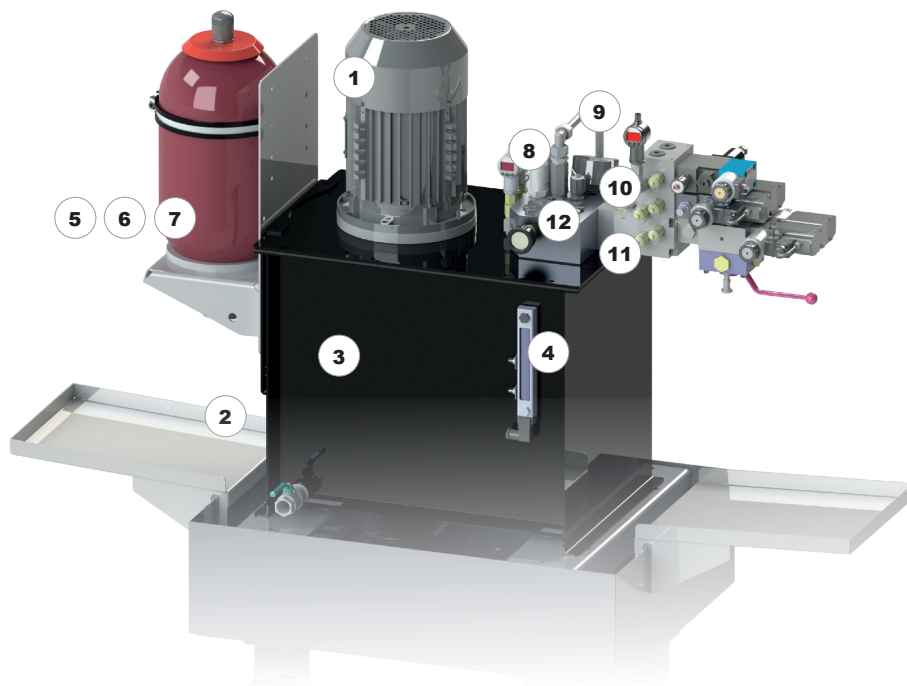
The different functional parts and blocks in the HYDROBOX range can be combined in many ways to create a system that fulfills the functional requirements of the hydropower industry.

Example of a base block with a built-on functional block



4. QUICK SELECTION OF THE MAIN COMPONENTS

4.1 RANGE OF COMPONENTS AVAILABLE



1 Electric motor

- 0.55 to 22 kW

2 Cooler and/or heater

**3 Steel tank
(+ collecting pan)**

- 25 l
- 50 l
- 100 l
- 150/300 l
- 200/400 l

4 Fluid level gauge

- FSA 176
- FSK 176
- TS60
- FT200
- PT100

5 Diaphragm accumulator

- 0.75 l, 1.4 l, 2 l, 3.5 l

6 Bladder accumulator

- 10 l, 20 l, 32 l

7 Piston accumulator (on request)

- 10 l, 20 l, 32 l, 50 l

8 Temperature sensor

9 Filter

- Pressure filters in 3 and 10 µm
- Return line filters in 3, 10 and 20 µm

10 Size 6 / Cetop 03 valves

- 1 – 6 valves

11 Valve manifolds

- 60 l/min @ 250/350 bar

12 Sensors

- Pressure gauges
- Pressure switches
- Pressure sensors
- Level sensors
- Clogging indicators
- AquaSensors

4.2 MODEL CODE (also order example)

HYDROBOX-P-50-2.2-PGE-10.8-80-2NG6-SB330 /-xxxxx

Application

Tank size [l]

Motor [kW]

Pump type

Flow rate [l/min]

Operating pressure [bar]

Manifold block

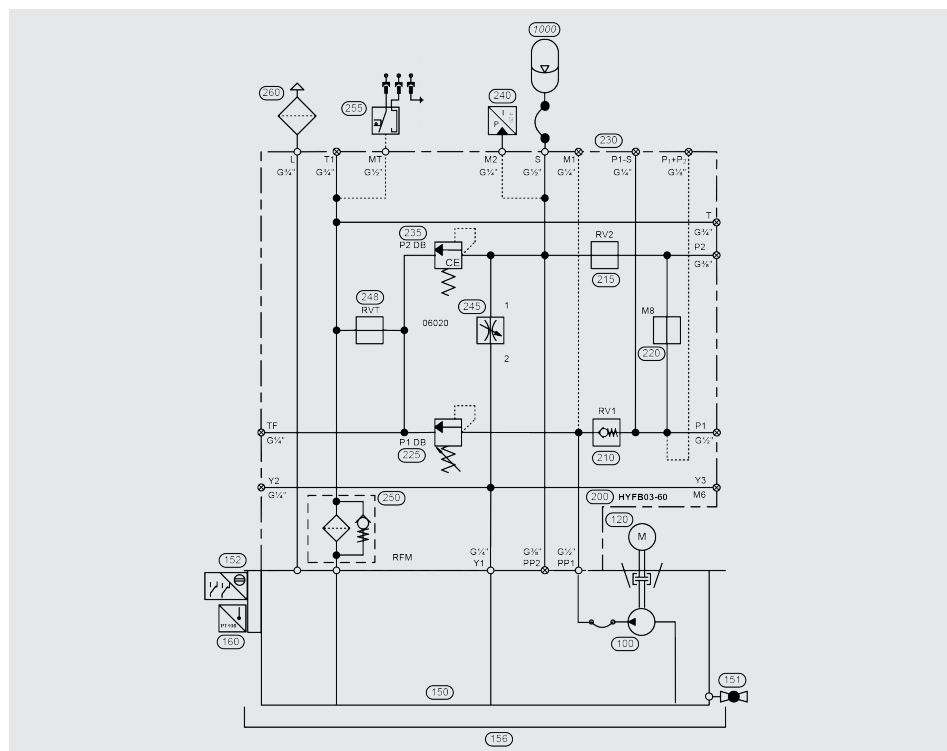
Accumulator (and size)

Supplementary details

4.3 TECHNICAL DETAILS

General data	Models
Design	Modular design
Operating temperature range	min. 20 °C to max. 40 °C
Ambient temperature range	min. -20 °C to 70 °C
Protection class	IP 55
Paint colour	All components come in the manufacturer's standard paint colour

5. GENERAL FUNCTIONALITY AND DESCRIPTION OF COMPONENTS

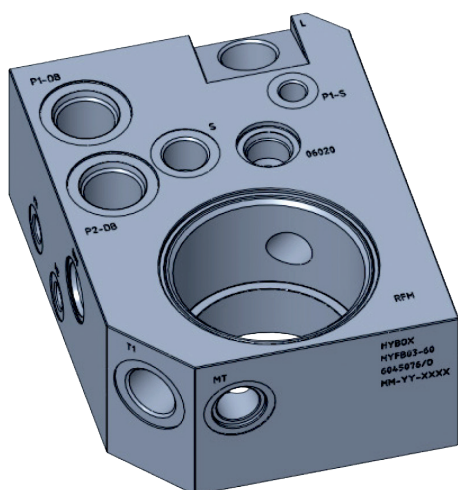


5.1 BASE BLOCK

The range of functions can be configured according to the system requirements.

The HYDROBOX base block forms the basis. Pumps, valves, sensors, accumulators, function blocks etc. can then be connected to this.

The schematic shows a typical HYDROBOX compact unit without functional valves.



5.2 TANKS

Oil tanks are available in steel in the following sizes: 25, 50, 100, 150, 200, 300, 400 l. Tanks can be equipped with a fluid level gauge, a level switch, a temperature gauge, a PT100 resistance thermometer, a temperature switch and a combined fluid level/temperature sensor with analogue and/or switch output.

5.3 OIL COLLECTING PAN

An oil collecting pan which is able to contain the full tank volume can be selected.

5.4 ACCUMULATORS

Bladder accumulators up to 20 l are stock items. A 32 l accumulator can, however, also be selected. If necessary, 10, 20, 32 or 50 l piston accumulators can also be supplied in the following type: SK210-XX/3218U. Accumulators under 10 l are mounted directly onto the unit. Accumulators over 10 l are installed on a separate stand.

5.5 MOTORS

4-pin electric motors are available with the following characteristics: 3x400 V and 50 or 60 Hz in the range of 0.55 to 22 kW. The IE3 efficiency class motors are designed for S1 duty cycles.

5.6 PUMPS

Pumps are available as external or internal gear pumps. They are available in 0.94 to 42 ccm/rev. The pumps are mounted in a B5 configuration as standard so that the pump is immersed in oil. This reduces any noise and improves the suction conditions. A system with a redundant motor-pump group can also be designed if desired.

5.7 HAND PUMP AND/OR PRESSURE REDUCTION

An extra manifold can be added between the main manifold and the row manifold so that a hand pump and/or a pressure reducing valve can be incorporated. The hand pump from HYDAC (MP10-01) is designed for a pressure of 207 bar.

5.8 FILTRATION

For hydraulic systems in hydropower plants, maintaining a good oil condition is the most effective way of ensuring high system availability and a long service life.

This is why all HYDROBOX units are equipped with Optimicron® filter elements which offer absolute filtration.

● Return line filters

The HYDROBOX is always equipped with a type RFM HYDAC return line filter which is available with a filtration rating of 3, 10 or 20 µm.

● Pressure filters

The HYDROBOX can also be equipped with a 3 or 10 µm type DF pressure filter if desired.

5.9 CETOP 03 VALVES

A range of more than 50 different Cetop 03 directional valves and functional sandwich plates are available (including proportional valves). Up to 6 rows of valve configurations are possible. Proportional valves and emergency closing valves are available (up to 10 rows).

5.10 SENSORS

In addition to sensors in the tank (temperature sensors and level sensors), pressure gauges, pressure switches, pressure sensors, Minimes connectors and filter clogging indicators can also be integrated. A type AS3008-5-000 HYDAC AquaSensor can be added onto the base manifold. Minimes connectors can be provided for the temporary installation of sensors.

5.11 COOLING AND HEATING

The HYDROBOX can be equipped with both oil cooling and oil heating. For cooling, both oil-air type coolers with fans and oil-water type heat exchangers are possible. For heating, a 1 kW immersion heater is possible either with or without a thermostat.

6. VALVES

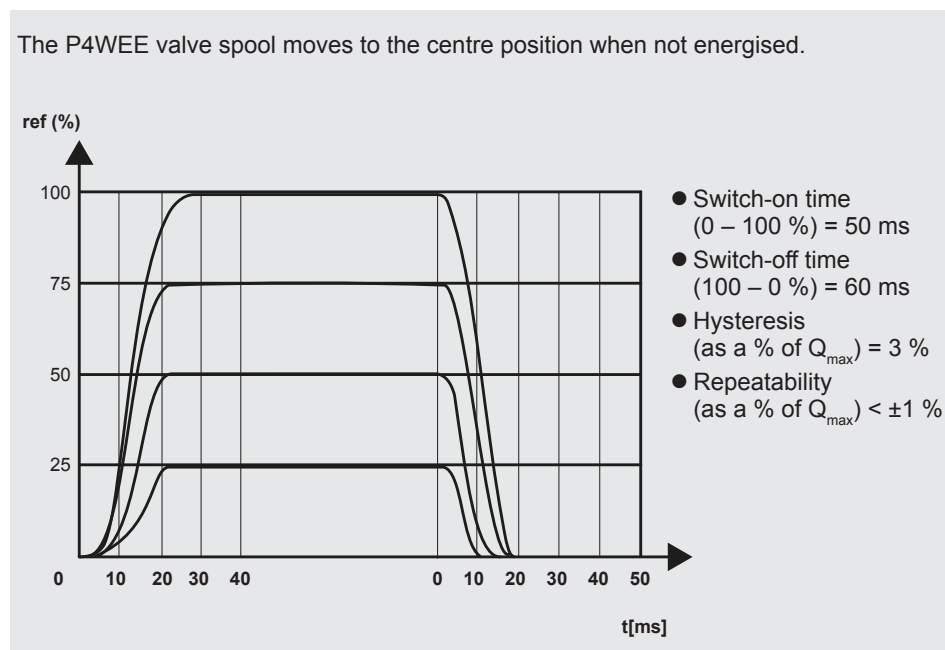
6.1 SWITCH VALVES

Switch valves are well-suited to simple control applications. These types of valves can be combined with a needle valve. In this case, the control can be performed with a switch valve which is combined with a needle valve.

This is possible with the HYDAC 4WE6 valve which is available for all standard directional valve types.

6.2 PROPORTIONAL VALVES

If proportional control is required, a P4WEE 06 valve can be used. This is a positive overlap proportional valve without spool position feedback and without a spool fail safe position. The electronics are integrated into the valve.



6.3 CONTROL VALVES

If very precise control of the actuator is required, a valve with a better performance level can be chosen. An example of this type of valve is the HYDAC C4WERE servo proportional valve.

This type of control valve is a proportional valve with improved dynamics, reduced overlap and spool position feedback for precise control. This valve has a predefined fail safe position.

See diagram on page 8

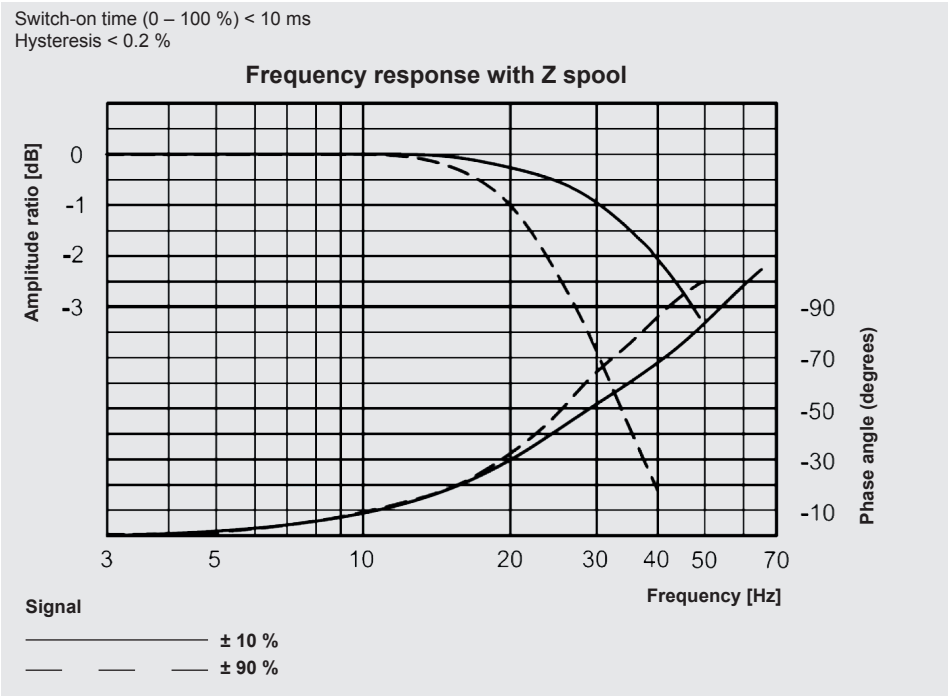
6.4. SANDWICH PLATE

The 6/2 sandwich plate enables the turbine's emergency shutdown safety function to be performed.

6.5 DATA SHEETS

Dimensional drawings for the various valves can be provided on request. To request a dimensional drawing, please contact the relevant technical department or your local sales representative.

Figure relating to section 6.3



7. SAFETY

There are different ways of making the hydraulic control function in hydropower plants safer.

One option is to add one or more fail safe functions.

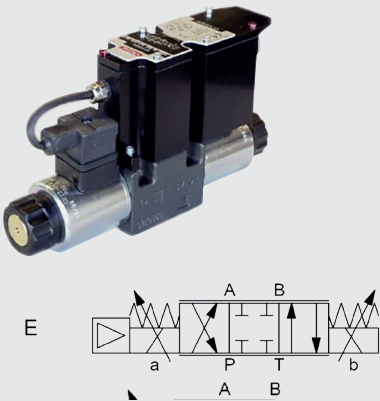
The schematic on page 8 shows some of the typical components for safety related functions in hydraulic hydropower systems.

Systematic emergency shutdown in hydropower plants

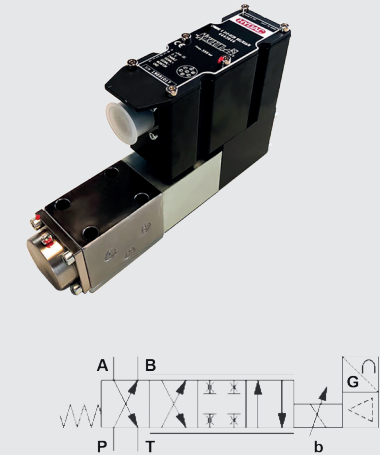
HYDAC product	Control valve with fail safe position	Control valve with fail safe position & position-monitored sandwich plate	Control valve without fail safe position	Control valve without fail safe position and with position-monitored sandwich plate
P4WEE06			X	X
C4WERE 06	X	X		
ZW-4WH(E) R0 6		X		X
Safety	Single	Redundant	None	Single

HYDAC products for systematic emergency shutdown in hydropower plants

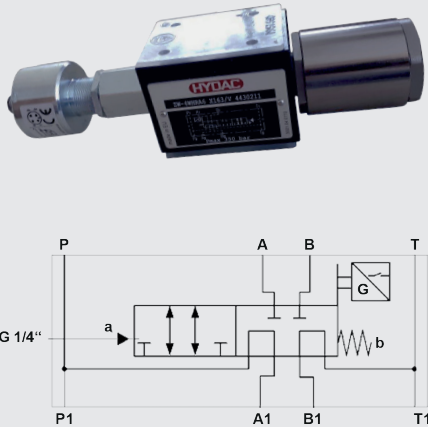
P4WEE06



C4WERE 06



ZW-4WH(E) R0 6



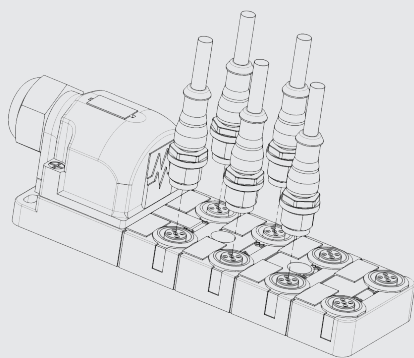
8. ELECTRICAL INTERFACE

The HYDROBOX can be supplied with one or more I/O modules. This serves as an interface which all sensors and valves with ready-to-use cables can be wired to. This reduces the amount of cabling work needed for the HYDROBOX.

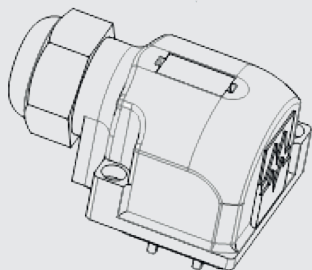
- Reliable connection
- Plastic housing with a good resistance against chemicals and oils
- Short delivery times for spare parts
- A cost effective solution due to the simple mounting process and use of standard components
- Protection class IP67

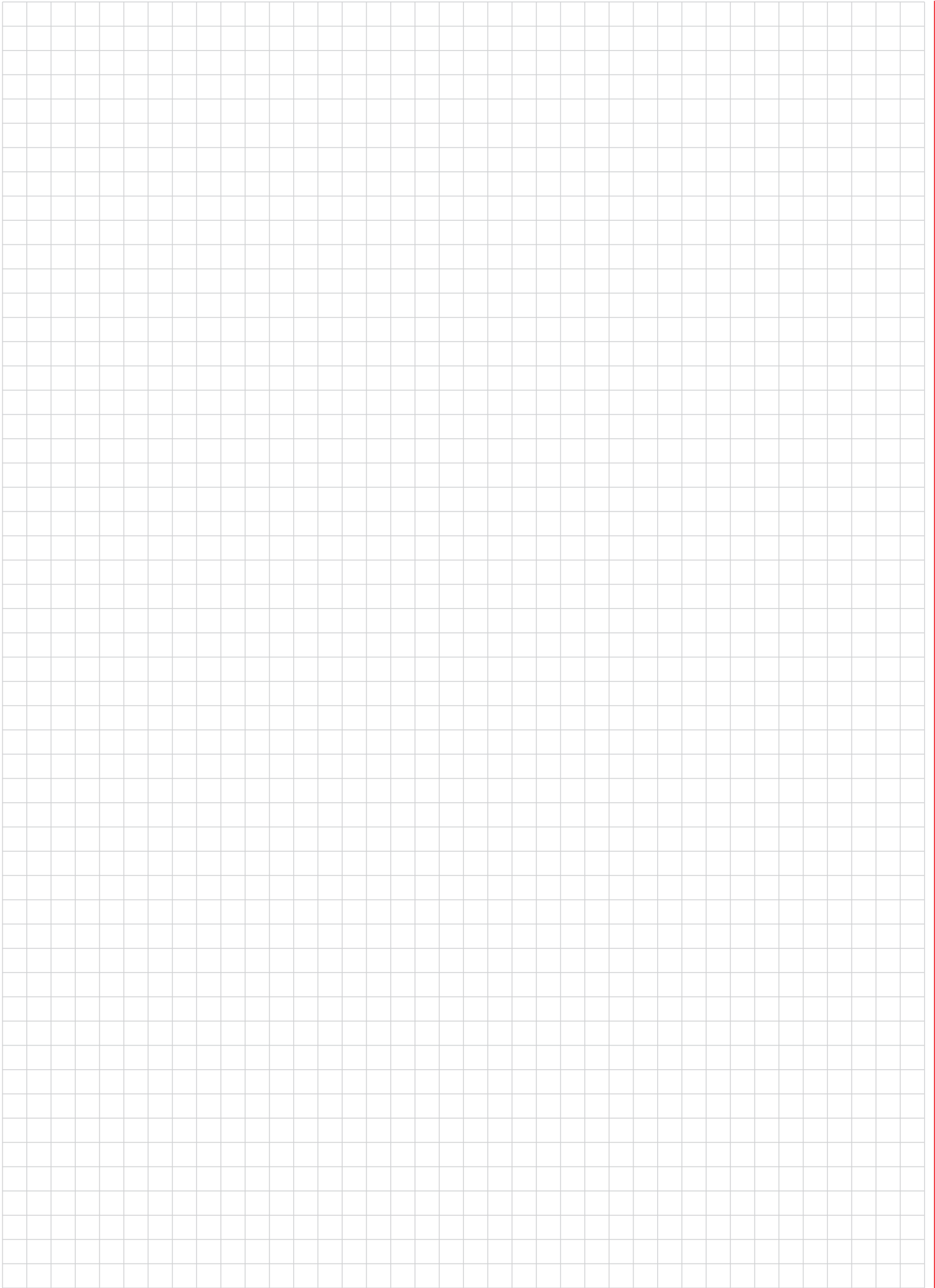
Example of an electrical interface

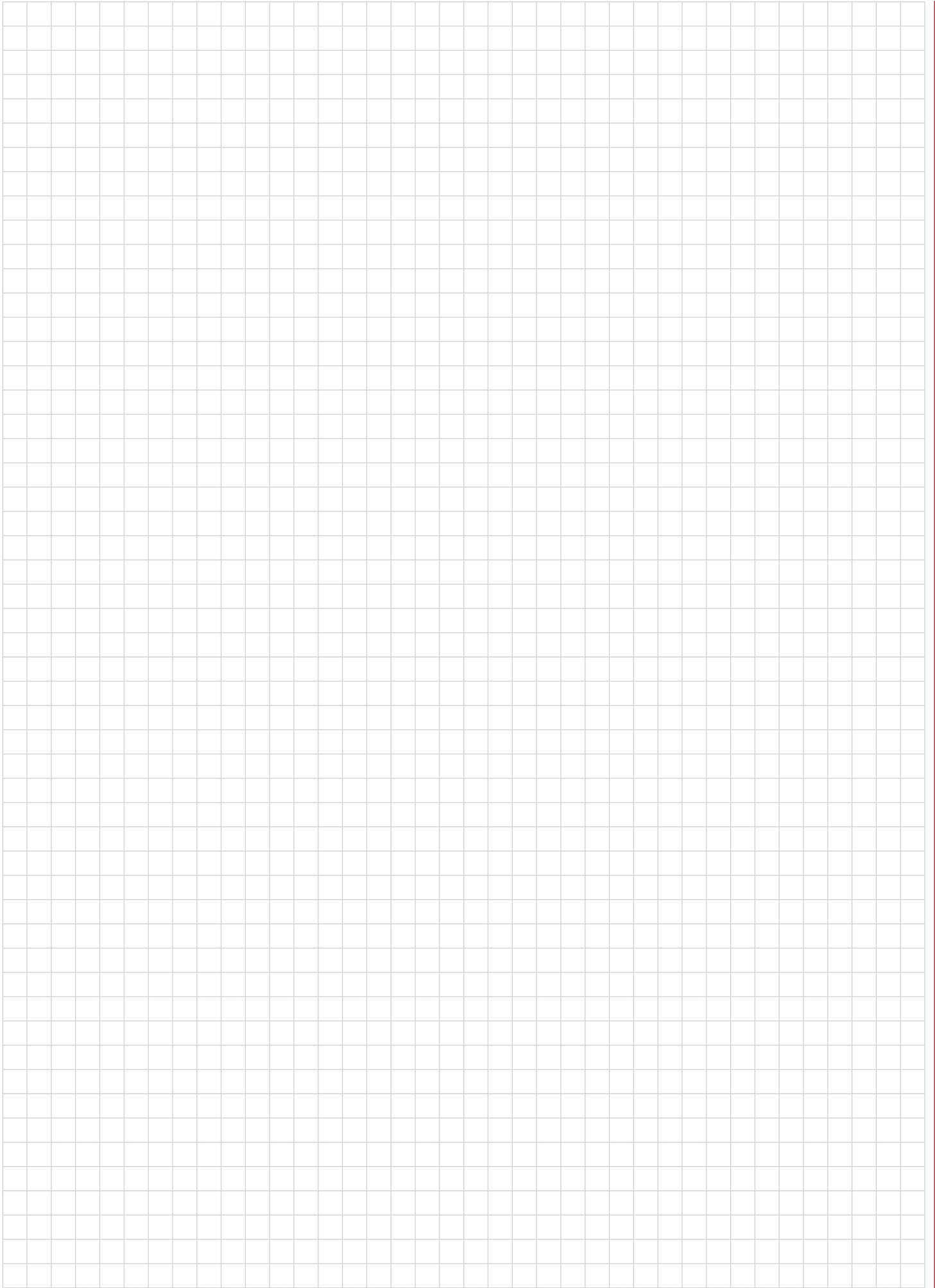
All valves, sensors etc. are connected to the distribution box with M12x1 connectors.



The switch cabinet is connected to the manifolds via male connectors which are delivered along with the manifolds. The male connectors are equipped with spring clips for easy installation.

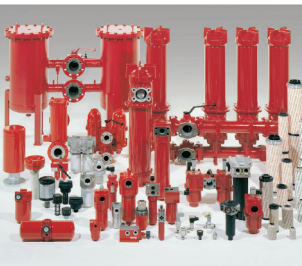








Accumulators 30.000



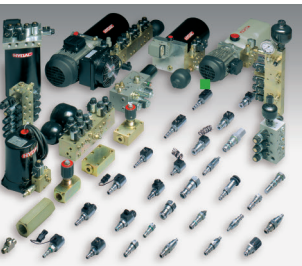
Fluid Filters 70.000



Process Technology 77.000



Filter Systems 79.000



Compact Hydraulics 53.000



Accessories 61.000

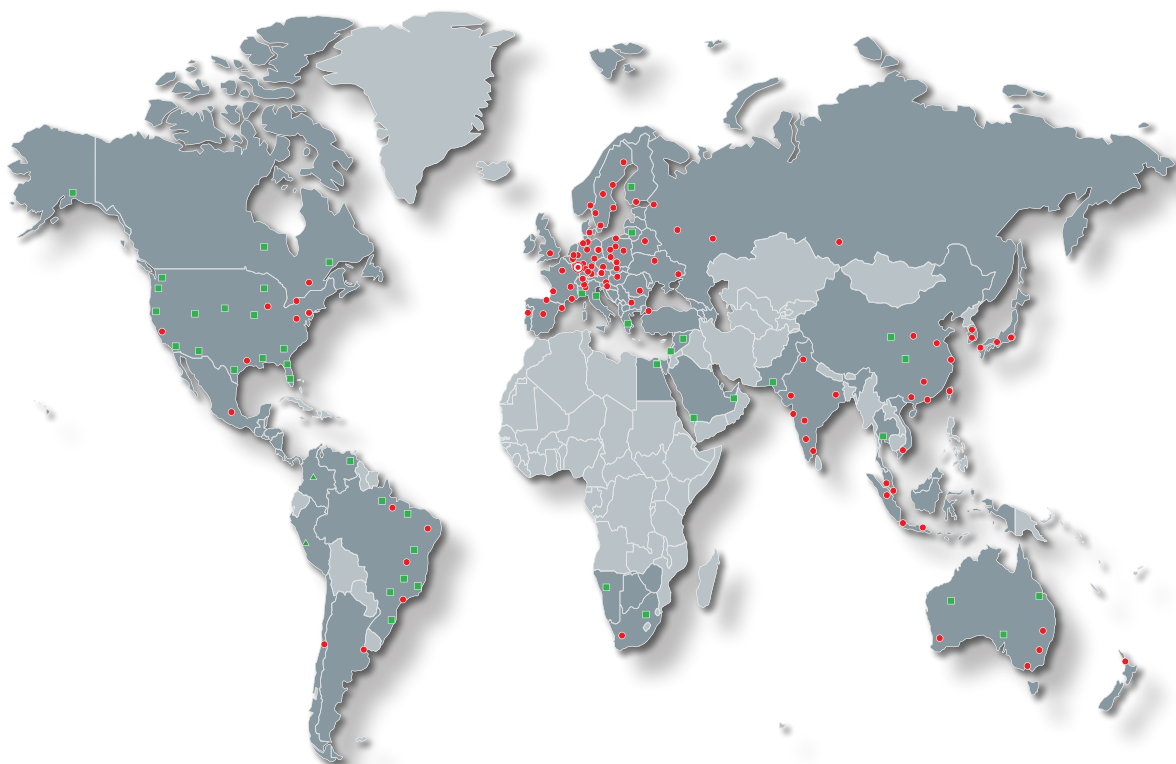


Electronics 180.000



Cooling Systems 57.000

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HYDAC INTERNATIONAL

HYDAC INTERNATIONAL
GMBH

Industriegebiet
66280 Sulzbach/Saar
Deutschland

Telefon
+49 6897 509-01

Fax:
+49 6897 509-577

info@hydac.com
www.hydac.com

Note

The information in this brochure relates to the operating conditions and applications described. For applications and / or operating conditions not described, please contact the relevant technical department.

Subject to technical modifications.