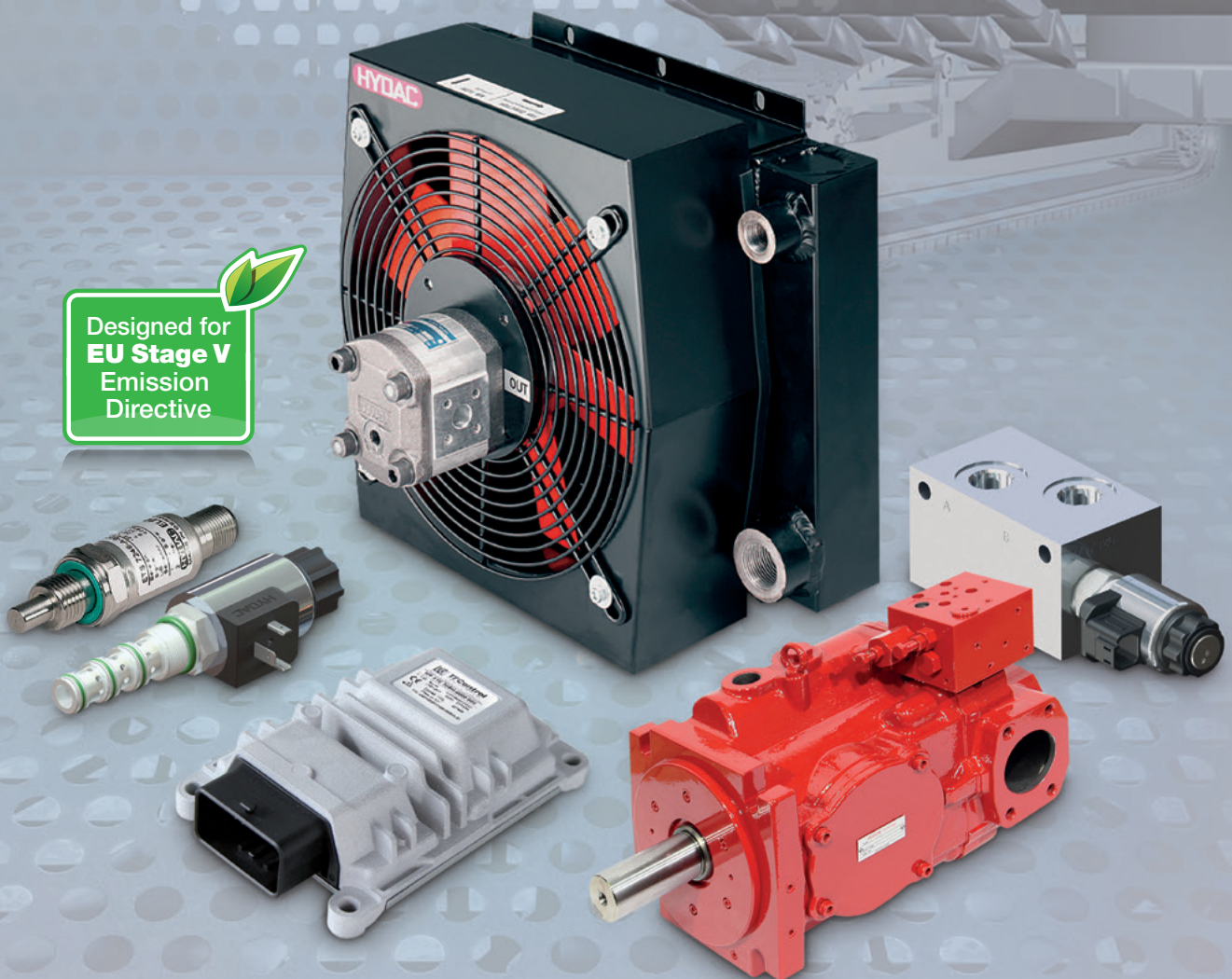


# HYDAC

# INTERNATIONAL

## A Breath of Fresh Air in Electro-Hydraulic Cooling Control

Designed for  
**EU Stage V**  
Emission  
Directive



## Your partner for expertise in electro-hydraulic needs-based cooling control

### Optimal operating temperatures for low fuel consumption and a clean environment

Selecting the right cooler and the relevant fan control is one of the most important stages in machine development. Approximately 5 - 10% of the nominal power of the drive motor is allotted to the fan drive alone.

Generally speaking, fan drives are divided into three different drive concepts:

- 1 **Direct fan drive**
- 2 **Electric fan drive**
- 3 **Hydrostatic fan drive**

HYDAC offers electric and hydrostatic fan drives. The choice of fan drive is based primarily on the machine design, the cooling requirement and of course the installation space available.

Hydraulic components already installed in the machine simplify the choice of fan drive (see matrix on page 3).

In the current combustion engine generation, the legally required reduction in emissions is achieved by optimal combustion temperatures, amongst other things. The appropriate needs-based cooling capacity is provided by controlled fan drives built onto the cooling module.

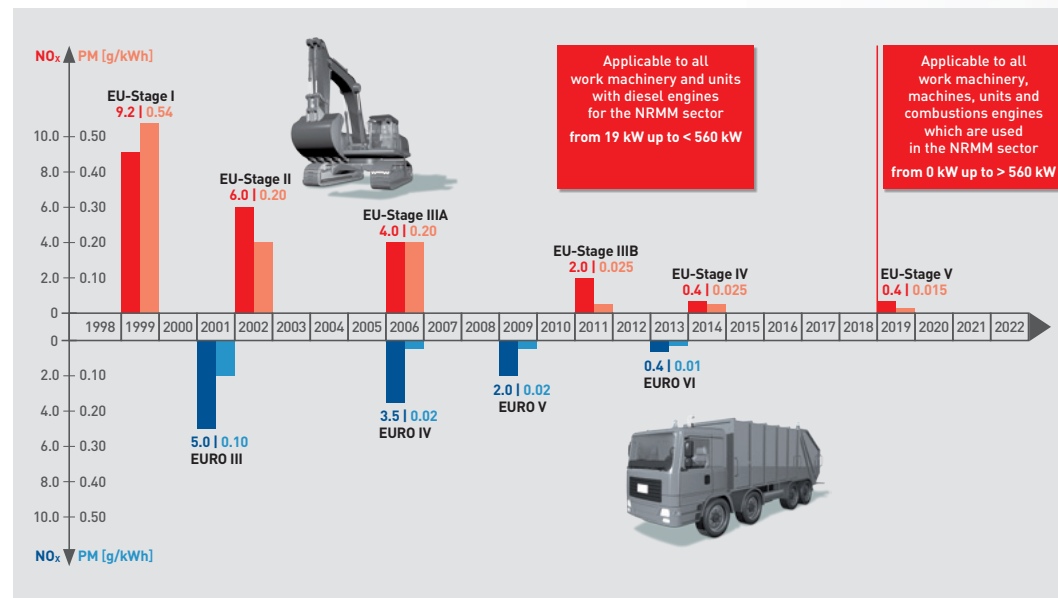
Other advantages are a reduction in noise level and fuel consumption.

#### Note

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

#### HYDAC components are designed for TIER 5 and EU stage V emission directive

As a result of the increased requirements concerning energy efficiency and noise development in mobile machines, cooling systems for these vehicles have to be designed to the limits of physical possibility. Special design features lay the foundation for optimal cooling systems.



### Our technology

- Fan controls in various nominal sizes with / without reversing function
- Fail-safe mode in event of power failure
- Optional reversal of direction of rotation (reversing function)
- Soft start and speed control
- Fan control with optimized consumption (10 % reduction in speed reduces the energy requirement by approx. 27 %)
- Fan speed can be controlled proportionally
- Constructive characteristics in design process
- Needs-based cooling
- Quickly reaches operating temperature
- 3 dB(A) reduction in noise can be achieved by just 13 % reduction in speed
- Vibration resistant design

### Your advantages

#### Flexibility

- Specifically adapted to customer requirements

#### Safety

- Maximum protection for motor / cooler
- Cooler cleaning
- Prevents pressure peaks in the hydraulic system

#### Energy efficiency and life cycle cost

- Reduction in fuel requirement
- Precise temperature regulation according to cooling requirement and increased service life of the machine
- Low hydraulic energy losses

#### Energy saving

- Reduced friction protects the material

#### Noise reduction

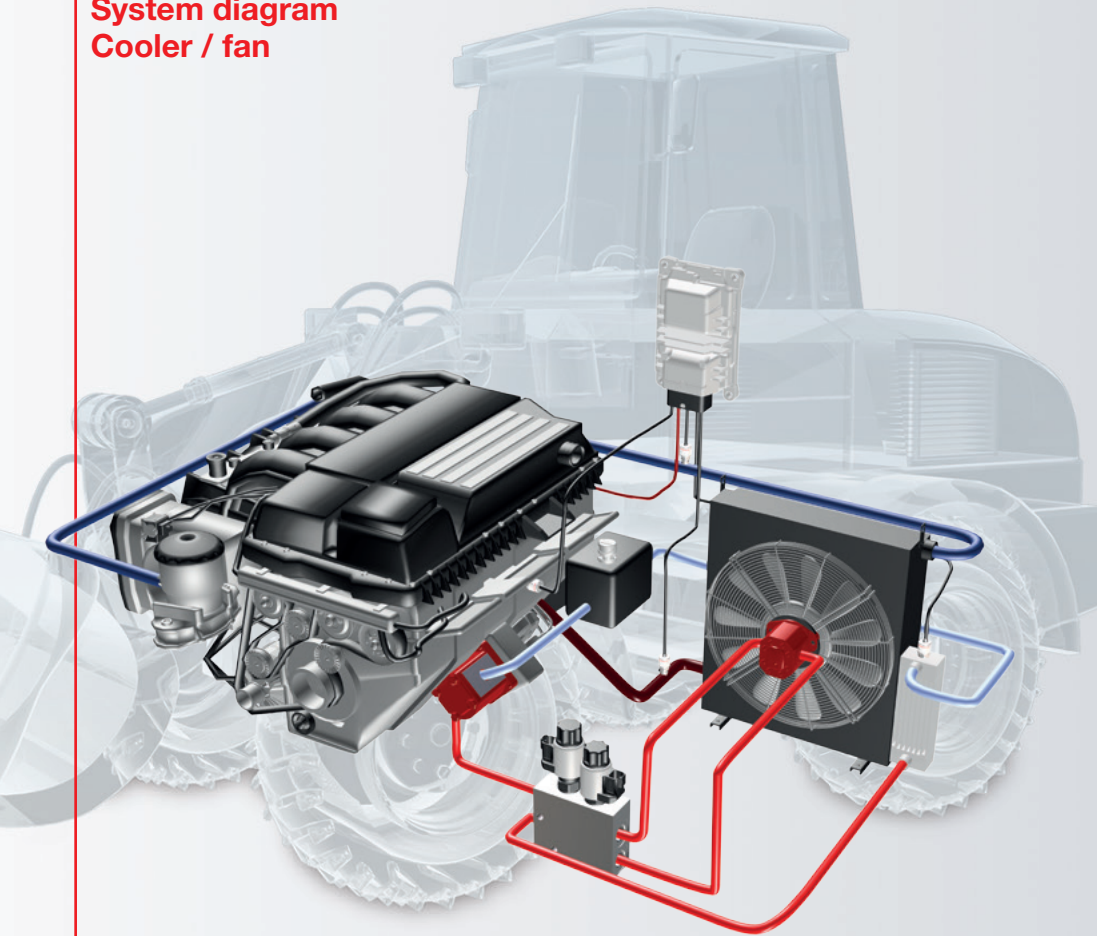
- Lower noise level (lower statutory noise emission value – 70 % of nominal) for continuously controlled fans than for fans operated in ON/OFF mode

#### Comfort


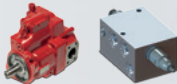


- No vibrations in the machine



# System diagram Cooler / fan



## Matrix for system selection

Fan power	Ambient conditions (simplified)	
	Clean	Contaminated
> approx. 25 kW	 <p>Variable displacement pump <b>without</b> reversing function</p>	 <p>Variable displacement pump <b>with</b> reversing function</p>
< approx. 25 kW	 <p>Fixed displacement pump <b>with</b> fan control <b>without</b> reversing function</p>	 <p>Fixed displacement pump <b>with</b> fan control <b>with</b> reversing function</p>
< approx. 18 kW	Electric drive	Electric drive with electrical reversing function

# Electro-hydraulic control for needs-based cooling

As a single-source supplier of products for hydraulic systems, HYDAC also offers controls for needs-based cooling in mobile machines. Starting with coolers, gear motors, pumps, hydraulic fan controls and sensors, through to electronic controls, HYDAC provides all components both individually and as complete systems.

## Hydraulic fan controls

Hydraulic fan controls from HYDAC are at the hydraulic heart of the system. They control the speed of the fan depending on the temperature of the medium. They are supplied by a variable or fixed displacement pump and can be installed directly on the fan motor, on the cooler or other location. As an option, these controls can also be supplied with a reversing function, to “purge” the cooler of external dirt (e.g. dust, sand...)

Right from the design stage, these fan controls in mobile machines are always designed to be fuel efficient thus helping to reduce emissions and also to meet future environmental regulations efficiently (e.g. Stage 5 Emission directive 2019).

## Reversing manifold and variable displacement pump

In the case of a variable displacement pump which is controlled directly by sensors according to need, the fan control is no longer required and a reversing manifold is used instead to reverse the direction of rotation of the fan motor.

The technological basis for these controls is the reliable valve technology from HYDAC. Systematic R&D work and completely new valves provide a high degree of security against system failure and long service life. These valves have been specifically developed for this type of control and are protective against cavitation erosion.

This valve technology can either be installed directly in external gear motors or connected in the separate manifold. This produces a compact unit for customized solutions.

### Gear pump fixed displacement PGE

Constant supply of hydraulic energy to the fan control system.

### Axial piston pump variable displacement PPV

Variable supply of hydraulic energy to the fan control system.

### **Mobile Controller HY-TTC 30**

Electronic control of the whole system:  
Integration of the sensors,  
control of the proportional  
valves in the fan manifold  
and possibly the variable  
displacement pump.

**Electronic temperature  
transmitters ETS 7200  
and HTT 8000,  
pressure transmitters  
HDA 8000,  
electro-mechanical  
flow switches  
HFS 2000 and  
speed sensors HSS**

Comprehensive range  
of sensors covering all  
aspects of hydraulics  
for direct evaluation in  
the electronic control.

### **Hydraulic Fan Control B-BM**

Proportional control  
of the speed of the fan  
motor.

Available with reversing  
option to reverse the  
direction of rotation.

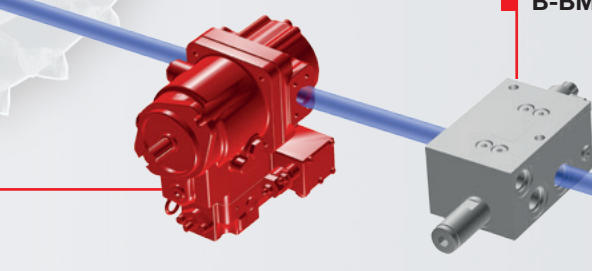
### **Gear motor MGE**

Constant  
supply  
of hydraulic  
energy to  
the fan.

### **Mobile cooler OK-ELH**

Maximum cooling  
capacity is ensured  
by the combination  
of high performance  
cooling elements  
and hydraulic drive  
motors for long-term  
and trouble-free  
operation.

### **Hydraulic reversing of fan motor B-BM Rev.**





# Electrical control for needs-based

Electric drive fans are used primarily for cooling capacities of < 18 kW approx.. Since the available electrical power provided by standard alternators is limited, this application is often just restricted to the oil cooling.

In some mobile applications (diesel-electric vehicles, hybrid vehicles, amongst others), however, increasingly frequently the demand is for an integrated solution: cooling with a combined cooler using several DC fans (multi-fan array). For these applications, powerful alternators are of course also available.

**Generally speaking, there are two versions of electric fan control.**

## Brush fans OK-ELD

The electric brush fan is used to control the speed of the fan wheel smoothly according to the temperature of the medium.

It is controlled by the control electronics ESC (Electronic Speed Control) which is installed externally on the cooler.

This is a cost-effective way of controlling the fan speed smoothly via the on/off signal of a temperature sensor.

Soft start and reversing functions are also available as options. These make it possible to gently reverse the rotation direction of the fan to blow away dust and particles.

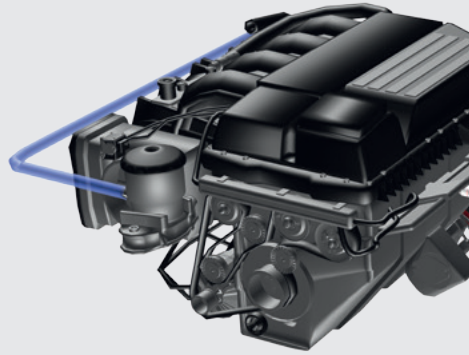
## Brushless fans CMS

The electric brushless fan is also used to control the speed of the fan smoothly according to the temperature of the medium.

The electronics is completely encapsulated in the fan housing and is activated via the PWM or analogue signal provided by the machine.

This design is notable for excellent reliability, long service life and compact construction.

Soft start and reversing functions are also available on this brushless version.



## Brush fans OK-ELD

- Cooling capacity up to approx. 34 kW
- Integrated temperature pressure bypass (IBT)
- ESC: electronic, temperature-dependent speed control for up to 2 fans
- Protection class IP 68

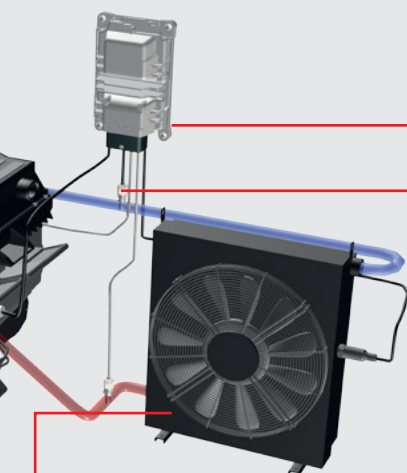
See brochure no. E 5.805 (OK-ELD)

## Brushless fans CMS

- Cooling capacity up to approx. 34 kW
- Individually controllable cooling circuits to achieve reduction in noise and fuel
- Diagnostic output available
- Excellent efficiency, low noise level
- Long service life 10,000 – 30,000 hours
- Protection class IP6K9K

See brochure no. 5.812 (CMS)

# sed cooling



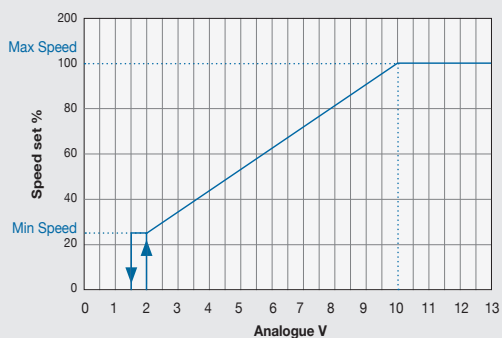
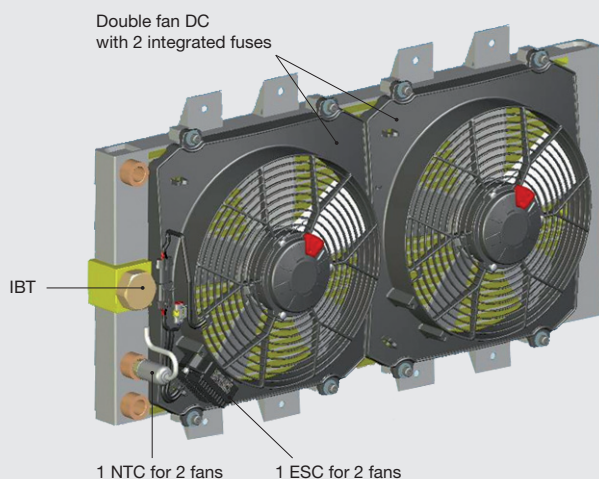
Oil/air cooler  
with DC motor

## Mobile Controller HY-TTC 30

Electronic control of the whole system:  
Integration of the sensors, control of the  
proportional valves in the fan control manifold  
and possibly the variable displacement pump.

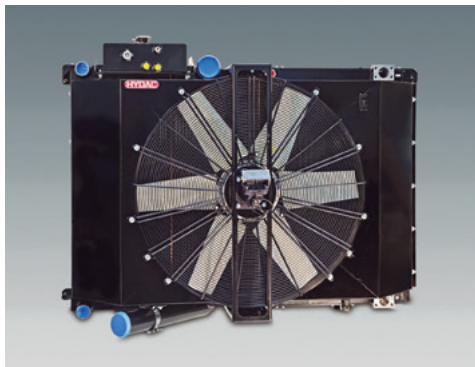
**Electronic temperature transmitters  
ETS 7200 and HTT 8000,  
pressure transmitters HDA 8000,  
electro-mechanical flow switches  
HFS 2000 and speed sensors HSS**

Comprehensive range of sensors  
covering all aspects of the hydraulics  
for direct evaluation in the electronic  
control.



# At a glance – all the HYDAC compo

## Mobile coolers for charge air, water, hydraulic oil, gear oil OK-ELH / AC-LNH or CMS



### Oil/air coolers – with hydraulic drive motor

These coolers have been specially developed for mobile applications and as such must guarantee high capacities and efficiency. In addition, the coolers must be highly compact and simple to install in the limited space available.

#### Typical applications are:

- Construction machinery
- Agricultural machinery
- Forestry machinery
- Cranes

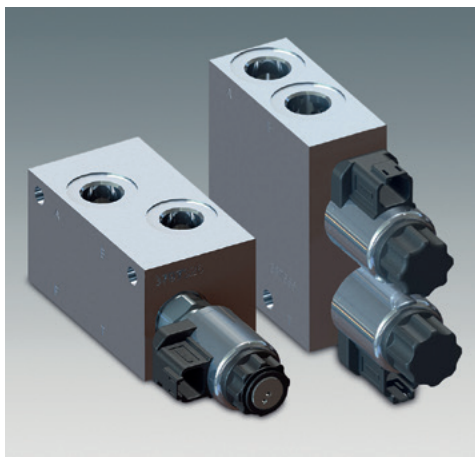
These coolers use a combination of high-capacity cooling elements and hydraulic drive motors to ensure long and trouble-free operation of the hydraulic system in the mobile sector.

#### Technical data:

- Cooling capacity range: 2 – 140 kW
- Hydraulic motors from 6.3 to 22 cm<sup>3</sup>/rev
- Speed of up to 2,500 rpm
- Easy disassembly of components

See brochure 5.805 (Oil/air coolers)

## Hydraulic fan controls B-BM



### Manifolds for the electro- proportional control of the fan motor – with or without reversing function

With integrated, inversely proportional pressure relief valve PDB10PZ for continuous control of the fan speed according to the temperature.\*

4/2 Directional Control Valve WK10Y to reverse the direction of fan rotation. Anti-cavitation valve to protect against cavitation.

#### Technical data:

- Operating pressure: max. 210 bar
- Flow rate: max. 40 / 60 / 70 l/min
- Supply: 12 / 24 V

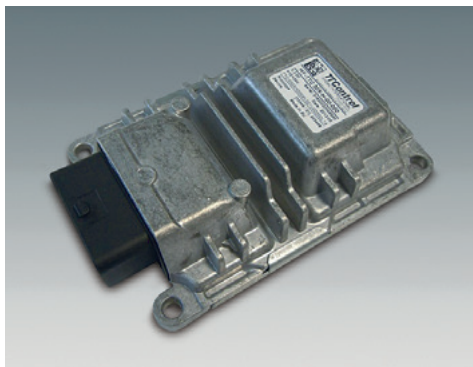
See brochure no. 10.148  
(Hydraulic fan controls)

\* In the event of system failure, maximum speed to protect the motor



# Components to control needs-based cooling

## Mobile Controller HY-TTC 30



HYDAC provides a 16-bit mobile controller to control the hydraulic functions, namely the proportional valves integrated in the manifold, the sensors and possibly the variable pump.

It is an intelligent controller with 2 – 6 PWM high side outputs with current control (to control the proportional solenoids); 2 HS digital outputs (to control the switching solenoids). The controller is protected by a very robust aluminium compact enclosure.

See brochure no. 18.500 (HY-TTC 30)

## Sensors



**Electronic temperature transmitters ETS 7200 and HTT 8000, pressure transmitters HDA 8000, electro-mechanical flow switches HFS 2000 and speed sensors HSS**

To monitor relevant operational data from the “needs-based cooling” control system, HYDAC has various electronic switches and transmitters to offer.

## Gear pump (fixed) or axial piston pump (variable) PGE / PPV / Gear motor MGE



### Axial piston pumps – PPV series

- Nominal pressure / Max. pressure: 320/350 bar
- Specific displacement: 16 – 200 cm<sup>3</sup>/rev
- Comprehensive range of controllers available
- Through-drive capability for multiple pump combinations.
- Also suitable for use with fire-resistant fluids (depending on specification)

### External gear pump – PGE series

- Nominal pressure / Max. pressure: 250/300 bar (size-dependent)
- Specific displacement: 0.25 – 60 cm<sup>3</sup>/rev
- Compatible with multiple pump combinations up to 25 kW

### External gear motor MGE

- Nominal pressure / Max. pressure: 200 / 220 bar
- Specific displacement: 1.6 – 60 cm<sup>3</sup>/rev

See brochure no. 2.902 (MGE, PGE or PPV100S)

# Mobile coolers for charge air, water

## Air cooler with speed control AC-LN MI



The AC-LN MI air cooler series can be used in all sectors where either oil or water-glycol is to be cooled with air.

The integrated frequency inverter controls the fan speed according to the temperature of the medium in the cooling element. Consistent outlet temperature of the medium is achieved with lower energy consumption and lower noise levels.

### Technical data:

- Cooling capacity range: 20 – 40 kW
- Constant fluid temperature
- Energy efficient
- Lower noise level

See brochure no. 5.814 (AC-LN MI)

## Air cooler with DC motor OK-ELD



The OK-ELD series with DC motor has been specially developed for mobile hydraulic applications where the requirement is for high capacity, as well as for a highly compact design which is simple to install.

With the electronic speed control ESC it is possible to control the fan speed smoothly, according to the oil temperature. This ensures that the fan speed is precisely coordinated to the required cooling capacity and the oil temperature remains constant.

### Technical data:

- Cooling capacity up to 34 kW
- DC motor with 12 V or 24 V
- Constant oil temperature

See brochure no. 5.805 (OK-ELD)

# er, hydraulic oil, gear oil, fuel ...

## Oil/air cooler with hydraulic motor OK-ELH



The use of high-capacity cooling elements and hydraulic drive motors in the OK-ELH / AC-LNH series ensures long and trouble-free operation of the hydraulic system in the mobile sector.

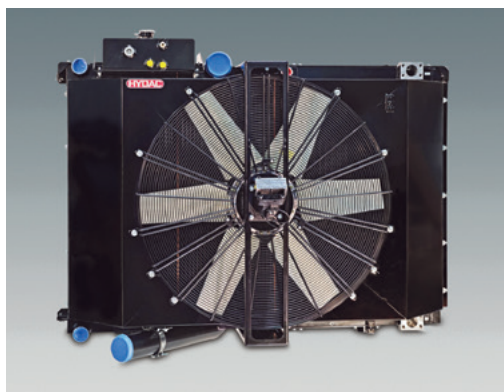
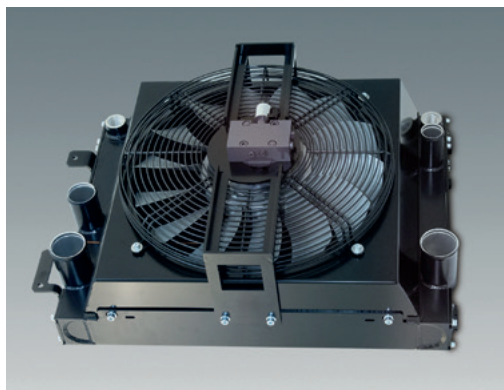
Typical applications for these coolers with hydraulic motor are primarily mobile cranes, concrete mixers and concrete pump trucks, pavers, in the transmission cooling ...

### Technical data:

- Cooling capacity range: 2 – 140 kW
- Hydraulic motors from 6.3 to 22 cm<sup>3</sup>/rev
- Speed of up to 2,500 rpm

See brochure no. 5.808 (OK-ELH)

## Combined cooler series CMS



### Component combinations, for example:

- Air/air coolers
- Oil/air coolers
- Water-glycol/air coolers

The implementation of the emissions standard requires progressive reduction of pollutant emissions from mobile machines. This has resulted in a sometimes drastic increase in the amount of heat to be dissipated and the appropriate adjustment of the cooler size. The limited space available in a mobile machine must therefore be utilized efficiently and intelligently.

The following cooling circuits can be combined together in various ways in a CMS mobile cooler:

- Charge air cooling (CAC) for diesel turbo engines
- Coolant cooling (RAD)
- Oil circuits
  - Transmission
  - Hydraulics
  - Fan drive
- Fuel cooling

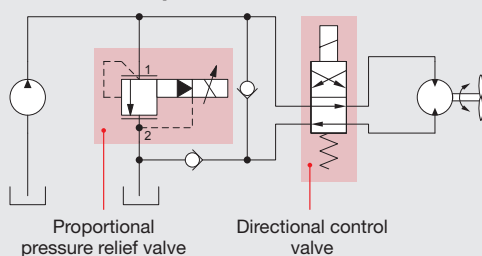
If required, a condenser for the air conditioning unit can also be integrated into the cooling system. With the aid of our cooling calculation software (KULI), and on the basis of available data, it is simple to adjust for pressure losses and heating of the cooling air which will also occur as a result of installing a condenser.

See brochure no. 5.812 (CMS)



# Compact Hydraulics – Components

## Application example

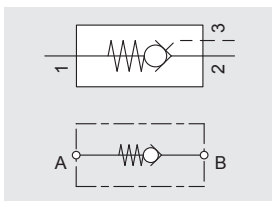


## Cartridge valves

- Check / anti-cavitation valves
- Directional control valves
- Manually adjustable pressure relief valves
- Inversely proportional pressure relief valves
- Bypass valves

See Catalogue 53.000 (Compact Hydraulics)

## Check / anti-cavitation valves RV



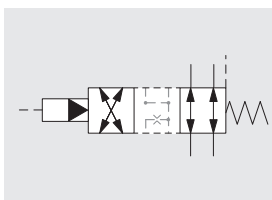
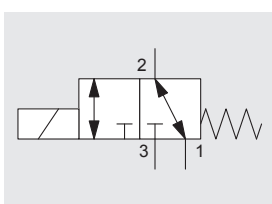
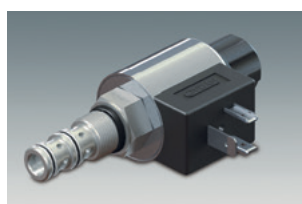
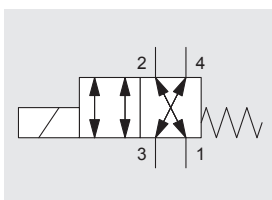
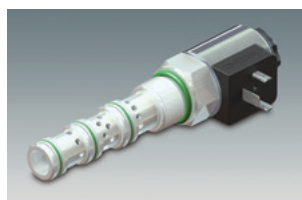
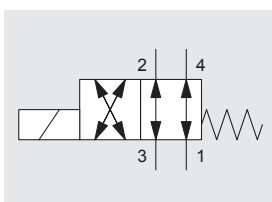
(Series RV08-10A-51, RV10-16A-01, RVM06020/10120-51)

HYDAC check valves, cone poppet type, are leak-free, prevent pressure shocks and are designed for long service life. They supply the proportional valves and ensure cavitation-free suction in this system.

- Durable and robust
- $P_{\max} = 350 \text{ bar}$ ;  $Q_{\max} = 80 \text{ l/min}$

See brochure nos. 5.912, 5.953, 5.952, 5.951

## Directional control valves WK10Y / WK12X / WK06C



### 4/2 solenoid directional valves

**WK10Y-40 / WK121X-40 specially designed for reversing the direction of rotation of the fan**

- In main flow direction, lower pressure losses than NG6 spool valve
- More compact solution than Cetop spool valve
- Performance adapted to the application
- Robust spool design for extreme environmental conditions in the engine compartment: heat, dust, water

- Deutsch plug with IP6K9K protection

See brochure nos. 5.971.1, 5.961.1

### 3/2 mini solenoid directional valves WK06C-01

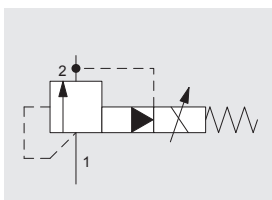
- Reduction in installation spaces and weight
- Excellent performance for safe switching

See brochure no. 5.149.0

**4/3 directional spool valve manifold specially designed for reversing the rotation direction of the fan**

- Hydraulically controlled
- Very low pressure loss
- Patent-pending manifold
- Gentle switching
- Requires only a small pilot valve (WK06)
- $P_{\max} = 350 \text{ bar}$ ;  $Q_{\max} = 120 \text{ l/min}$

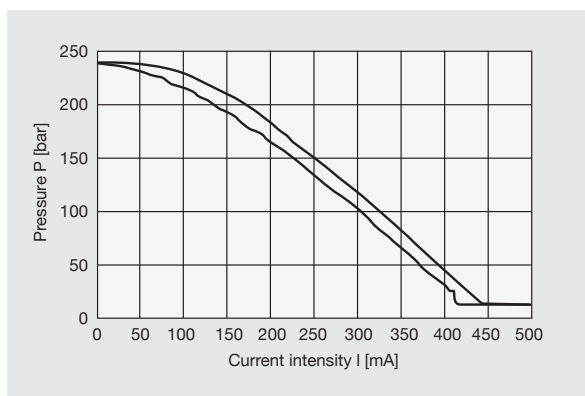
## Proportional pressure relief valve PDB08PZ-30 to PDB16PZ-30



HYDAC offers a full range of proportional pressure relief valves from size 08 to size 16.

They have a common design feature which is significant in protecting against cavitation. This phenomenon occurs more frequently with fan controls in particular, due to the high speed of the fan, causing the housing to fail very quickly.

# for fan controls



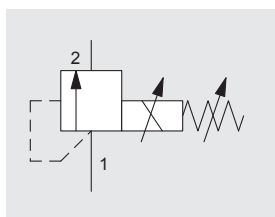
Valves in this series each have an inverse curve, i.e. maximum pressure at lowest electrical current – this means that in the event of electrical failure, the fan speed automatically operates at maximum to protect the engine from overheating.

In each case the valve is connected in the bypass to the hydraulic motor and restricts the pressure to the motor. The speed of the fan motor is no longer dependent on the speed of the diesel engine. The cooling requirement is controlled by temperature sensors.

- Optimal operating temperature of the combustion engine achieved by electronic control of the hydrostatic fan drive
- Complies with emission directive (TIER 5, Stage V)
- Fail-safe design: inverse control in the case of electrical failure – maximum fan speed to protect against overheating
- Adjustable and can be vented
- Hydrodynamic damping for sizes 08 and 10
- Anti-cavitation protection – reduces cavitation erosion
- Module sizes 08, 10, 12, 16 – available with short standard delivery times
- $P_{\max} = 350 \text{ bar}$ ;  $Q_{\max} = 300 \text{ l/min}$

See brochure nos. 5.991.22, 5.991.23, 5.991.24, 5.991.25

## Fail-safe valves PDBM06020Z-01

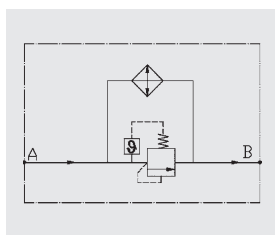
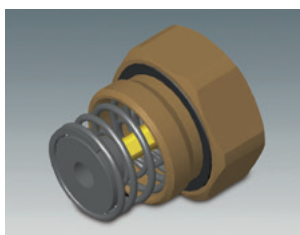


The most energy-efficient way of driving a fan is to directly control a variable pump. This means, that only the power is created which momentarily provides the required cooling capacity.

With the inversely proportional pressure relief valves in the series PDBM06020Z this is possible. They can be installed directly on the pump.

- Designed for pilot control of variable pumps for large fans
- Energy efficient pump flow control in variable pumps
- $P_{\max} = 350 \text{ bar}$ ;  $Q_{\max} = 3 \text{ l/min}$

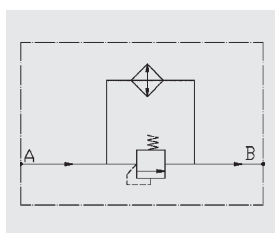
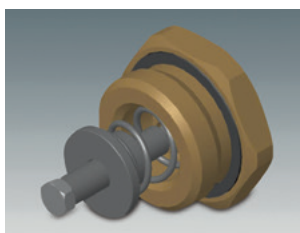
See brochure no. 5.978



## IBT – Integrated Thermal Bypass IBT45-2

The valve only opens the line through the cooling element at a certain temperature.

- Precise temperature control
- Low pressure drop
- Protects against excessive back-pressures
- Installation position optional
- Max. differential pressure: 16 bar
- Maintenance-free



## IBP – Integrated Pressure Bypass IBP2

If a particular pressure is exceeded, the IBP opens the bypass line, thereby protecting the cooling element from excessive back-pressure.

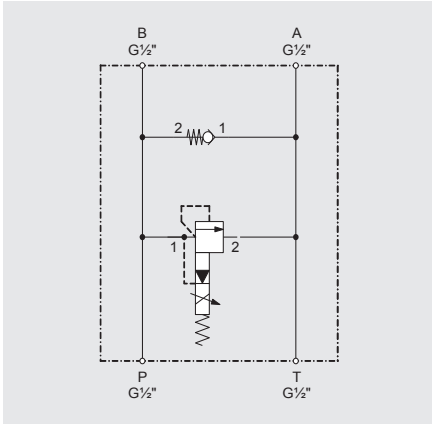
- Low pressure drop
- Installation position optional
- Maintenance-free

Warning: these valves require a special cooling element with integrated bypass line and they cannot be retrofitted.

See brochure "Accessories for Oil/air coolers"

# Systems for fan controls

## Fan controls without reversing function



### Hydraulic fan control without reversing function

**B-BM-LST-40-140...**

**B-BM-LST-60-140...**

With integrated, inversely proportional pressure relief valve for continuous control of the fan speed. In the event of system breakdown, the PDB10PZ switches to maximum pressure and therefore maximum fan speed to protect the motor.

Standardized fixing holes (2 different hole patterns) means that the fan control can be replaced by one with reversing function. Integrated anti-cavitation check valve RV to protect against cavitation.

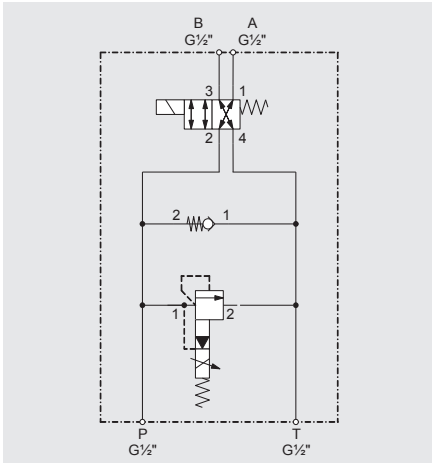
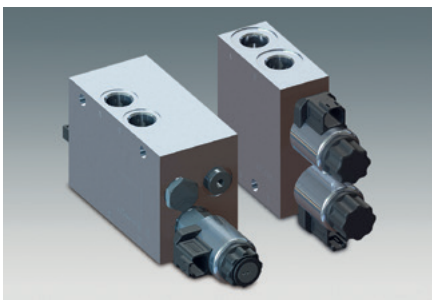
For applications in combination with a fixed displacement pump.

- Operating pressure: max. 210 bar
- Flow rate: max. 40 / 60 l/min

The reversing function is an important additional function for mobile machines which operate in a very dirty environment, to allow reversal of the rotation of the fan wheel. The coolers, particularly on wheel loaders, excavators and combine harvesters, draw in not only air, but dust

and dirt which can accumulate in the cooler blades. This reduces the cooling capacity and increases the energy consumption of the fan drive. To avoid this, a reversing function together with the fan control valve is built into a highly compact manifold in order to meet the restricted installation space requirements in the engine compartment.

## Fan controls with reversing function



### Hydraulic fan control with reversing function

**B-BM-LSTR-40-140...**

**B-BM-LSTR-60-140...**

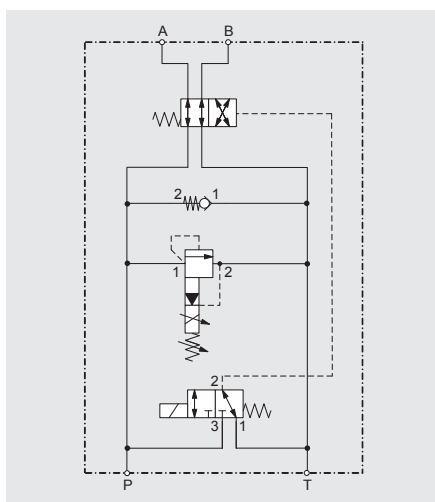
With integrated, inversely proportional pressure relief valve PDB10PZ for continuous control of the fan speed according to the temperature. In the event of system breakdown, the PDB10PZ switches to maximum pressure and therefore maximum fan speed to protect the motor.

#### B-BM-LSTR-40 specifically:

Additional 4/2 directional valve WK10Y is included to reverse the fan rotation direction of up to 40 l/min.

- Operating pressure: max. 210 bar
- Flow rate: max. 40 l/min





### B-BM-LSTR-60 specifically:

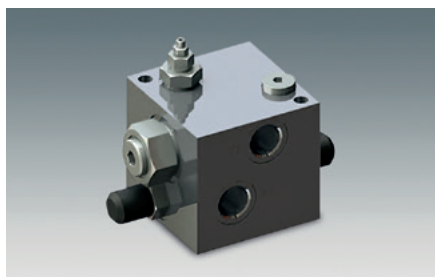
A hydraulically operated 4/2 directional valve WK10Z which is switched by the 3/2 directional mini valve, reverses the direction of rotation of the fan. This configuration produces a higher flow rate of up to 60 l/min.

Standardized fixing holes (2 different hole patterns) means that the fan control can be replaced by one with reversing function. Integrated anti-cavitation check valve RV to protect against cavitation.

For applications in combination with a fixed displacement pump.

- Operating pressure: max. 250 bar
- Flow rate: max. 60 l/min

See brochure no. 10.148  
(Hydraulic fan controls)



### Hydraulic fan control, temperature based B-BM-LSTB-44-220

#### Function:

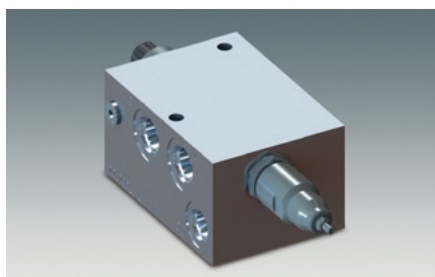
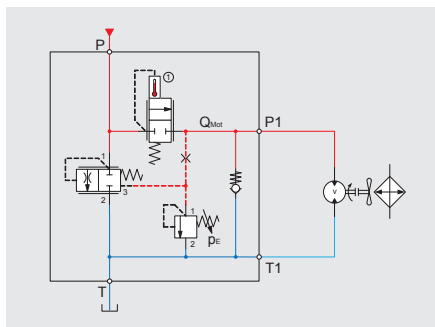
The new developed Thermo valve regulates the rpm of a hydraulically driven fan motor in dependence of the incoming flow. It is build as a priority-style flow regulator in housing.

Used in oil-air coolers with hydro-motor, e.g. of HYDAC series OK-ELH and AC-LNH.

#### Advantages:

- Significantly higher life cycle times as competitor wax elements by innovative shape memory technology
- Significantly better regulation performance than wax elements

- Operating pressure: max. 250 bar
- Flow rate: max. 44 l/min
- Temperature range: T50 [40 – 55 °C]  
T60 [55 – 72 °C]



### Hydraulic fan – Reversing function B-BM-LREV-70

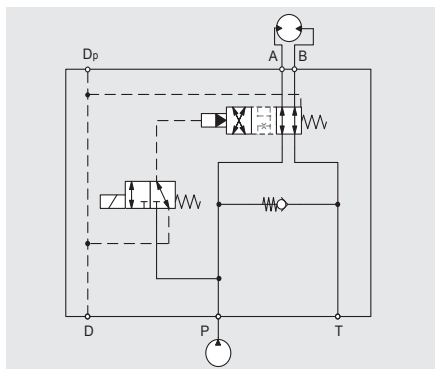
Hydraulic fan reversing function to “purge” the cooler when it is dirty. For fan controls with variable displacement pump.

The hydraulically operated 4/2 directional spool valve WK12 integrated into the manifold can change the switch position sequentially so that the direction of rotation of the fan can be reversed gently and with minimal damage to the material. This has been realized by a motion profile, which is stored in the electronic control for valves and pump.

#### Vorteile:

- Very low delta p
- Patented kit
- Only small pilot valve necessary (WK06)

- Operating pressure: max. 260 bar
- Flow rate: max. 70 l/min



# Electronic and software solutions

## Software functionalities

### Control of fan speed

- Proportional valve
- Variable displacement pump
- Viscosity clutch
- Interface for up to five independent electric fans

### Reversing function

- Using 4/2 or 4/3 directional control valve
- Manual push-button
- Automatic over adjustable time period

### Fluid level detection

- Up to two fluid level sensors, e.g. cooling water and / or hydraulic oil

### Filter clogging detection

- Via pressure switch

### Control of the fan speed

- Up to two external speed sensors
- PID controller in the closed loop control circuit

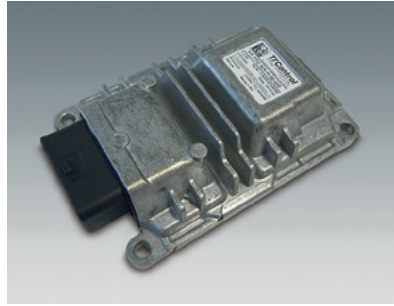
### Temperature measurement

- Up to five hard-wired sensors
- Available interfaces:
  - PT100 or PT1000
  - 4 ... 20 mA
  - 0 ... 5 V
- Up to five temperature values via J1939 CAN messages, e.g. motor cooling circuit, hydraulic oil, intake air, gear oil and air conditioning units

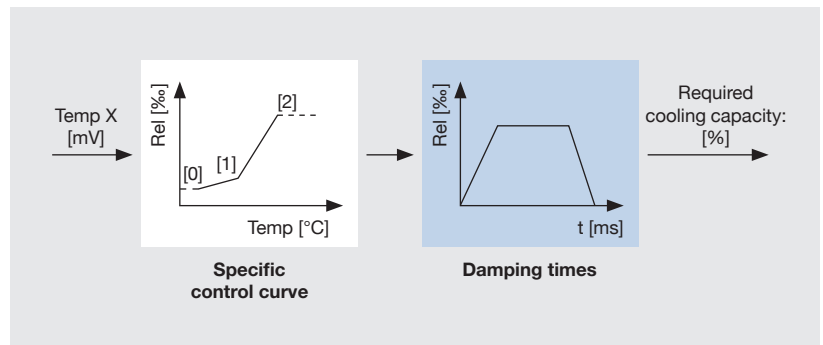
### Diagnostic warning signals

- Red and / or yellow light
- Inverted or non-inverted signal output

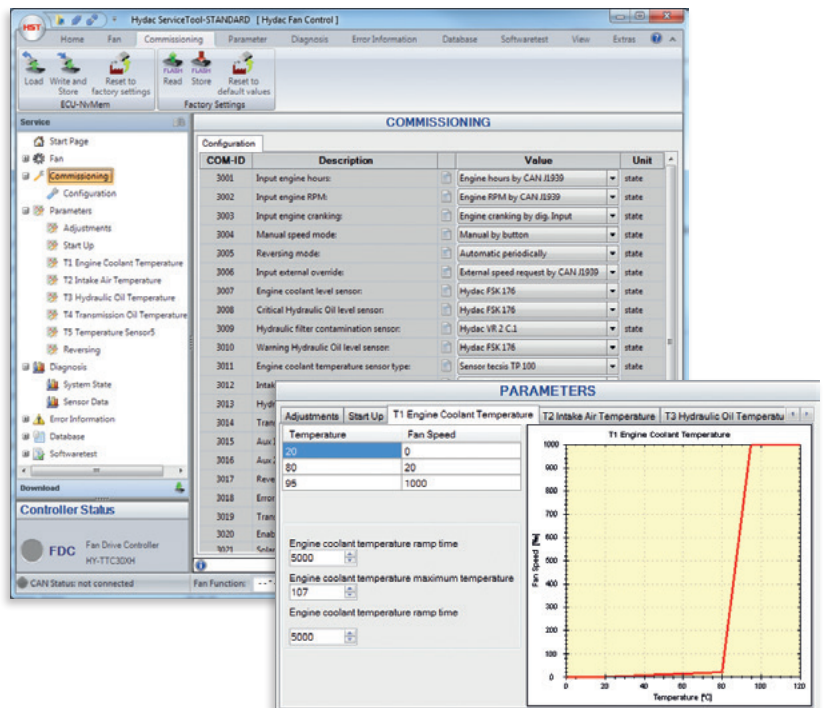
## Mobile Controller HYDAC HY-TTC 30



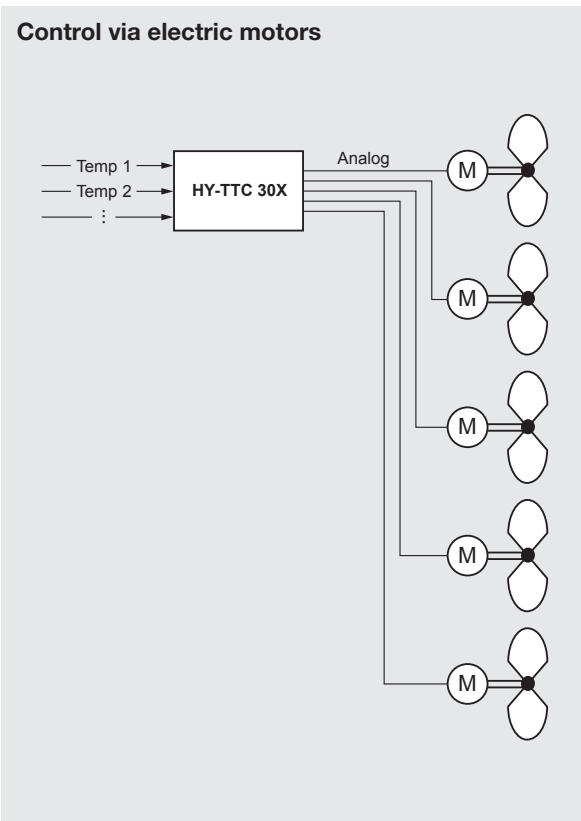
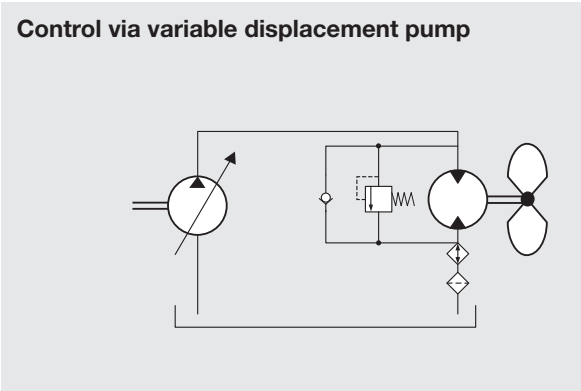
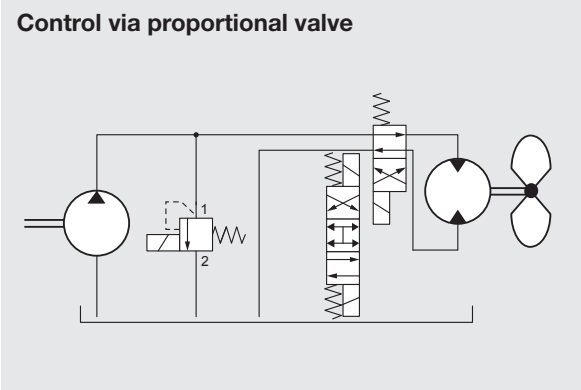
## Signal conditioning of a temperature channel



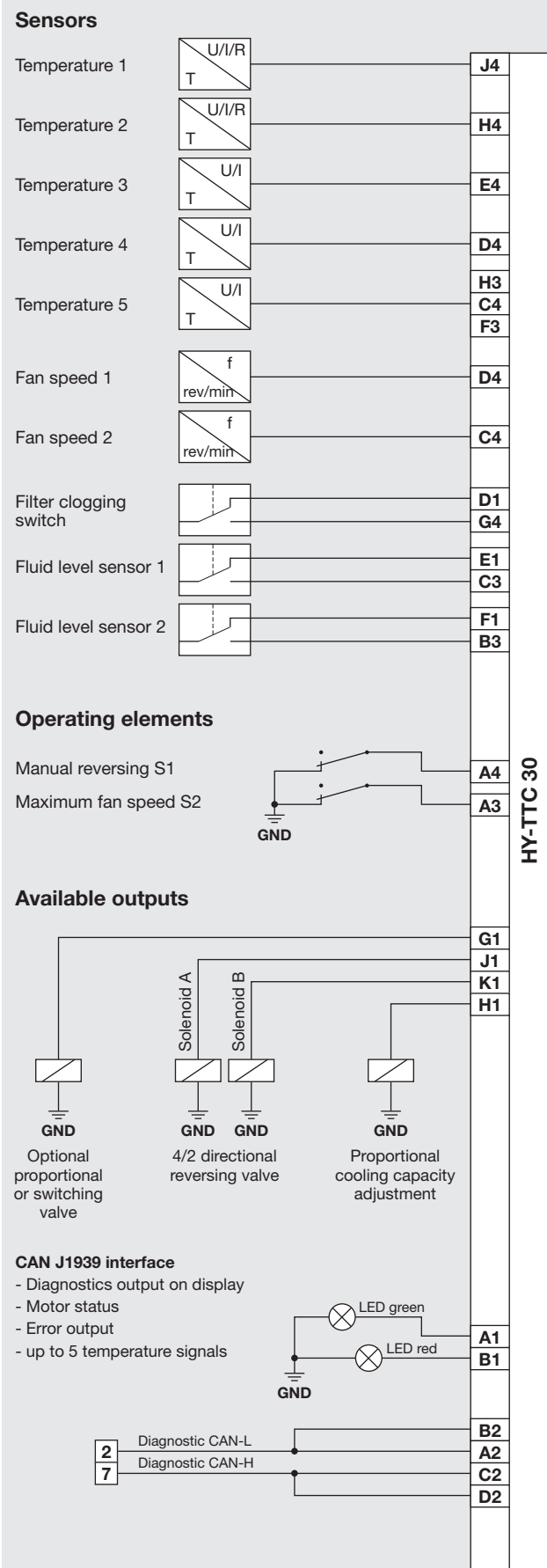
## PC tool for parameterization and configuration



System architectures



Connection options





# Sensors: recording and evaluating measurement

## Electronic temperature transmitter ETS 7200



The ETS 7200 is an electronic temperature transmitter which, because of its compact design, is particularly suited to measuring temperature in hydraulic applications in the mobile sector.

Based on a silicon semiconductor device and corresponding evaluation electronics, the temperature transmitter is designed to measure temperatures in the range  $-25^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$  (for hydraulic oil).

Various analogue output signals, e.g.  $4 \dots 20 \text{ mA}$  or  $0 \dots 10 \text{ V}$  are available on the standard version for integration into modern controls. These can be output to the periphery via an M12x1 connector.

With a pressure resistance of up to 600 bar and excellent EMC properties, the ETS 7200 is ideal for use in harsh environments.

### Benefits:

- Accuracy  $\leq \pm 1 \%$  FS typ.
- Ideal for OEM applications
- Very compact design
- Excellent EMC characteristics
- Long-term stability
- Standard protection class IP 67

See brochure no. 18.315 (ETS 7200)

## Electronic temperature transmitter HTT 8000



The temperature transmitter series HTT 8000 has been specifically developed for the OEM market in mobile applications. It is based on a silicon semiconductor device with corresponding evaluation electronics.

The temperature sensor is designed for a measuring range of  $-25^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  and as such is ideally suited for temperature monitoring of gear oil, coolant and charge air.

All parts in contact with the medium are in stainless steel, and are welded together.

The usual analogue output signals (current or voltage) are available for integration in modern control systems.

For the electrical connection, various built-in connections are available.

Pressure resistance up to 600 bar and excellent EMC characteristics make the HTT 8000 ideal for use in harsh conditions.

### Benefits:

- Accuracy  $\leq \pm 1 \%$  FS type
- Small, compact design
- Excellent EMC properties
- Long-term stability

See brochure no. 18.389 (HTT 8000)

# ed values accurately

## Pressure transmitters HDA 8000



The pressure transmitter series HDA 8000 have been specially developed for use in OEM applications, e.g. in the mobile sector. Like most of our pressure transmitter series, the HDA 8000 is based on a robust, durable, thin-film sensor. All parts (sensor and pressure connection) which are in contact with the fluid are made of stainless steel and are welded together. This means that there are no sealing points in the interior of the sensor. The possibility of leakage is excluded.

The pressure transmitters are available in various pressure ranges from 0 .. 40 bar to 0 .. 600 bar. For integration into modern controls, standard analogue output signals (current or voltage) are available. For the electrical connection, various integrated connections are available.

### Benefits:

- Accuracy  $\leq \pm 0.25$  % FS typ. or  $\leq \pm 0.5$  % FS typ.
- Outstanding characteristics in terms of temperature effect and EMC
- Small, compact design
- ECE type approval

See brochure nos. 18.348 (HDA 8400) / 18.347 (HDA 8700)

## Electro-mechanical flow switch HFS 2000



The HYDAC flow switches in the HFS 2100 and 2500 series are based on a variable area float principle and are position-independent. They are available with various accuracies of threshold value. Typical applications include monitoring flow rates of fluid media, amongst others, in lubrication oil system sectors and particularly stationary cooling, hydraulic systems, pumps and many others

### Benefits:

- Accuracy  $\leq \pm 5$  % and  $\leq \pm 10$  % FS
- Installation position optional
- High level of functional safety
- High level of switching accuracy
- Smooth switch point setting by user
- High pressure resistance
- Threaded connection
- ATEX version also available for potentially explosive atmospheres

See brochure nos. 18.384 (HFS 2500) and 18.379 (HFS 2100)

## Speed sensors HSS



The contact-free speed sensors in the HSS 100 and 200 series detect the movement of ferromagnetic structures, such as gear wheels, gear rims or perforated discs, using the changes in magnetic flux. For integration into standard controls, standard output signals are available. Due to their extremely compact design, the robust housing and protection class IP 6K9K, the devices can be used in almost any application and any mounting position. The main fields of application are detection of speed and rotation direction on gear wheels with a small module and high resolution.

### Benefits:

- 1 or 2 channel Hall differential sensor
- Different signal outputs available
- Extremely compact design
- Wide frequency range
- Alignment required when installing
- Large air gap

See brochure nos. 18.606, 18.607, 18.608, 18.609, 18.610 (HSS Series)

# Pumps and motors

## Gear pump PGE



### Description

Size:	0, 1, 2, 3
Flow rate:	0.25 – 60 cm <sup>3</sup>
Nominal pressure:	130 – 250 bar*
Peak pressure:	150 – 300 bar*
Speed range:	650 – 4,000 rev/min*
Direction of rotation:	clockwise, anti-clockwise, reversible*
Reversible with drain port	
Seals:	FPM, NBR
* size-dependent	

Flanges range from 2-hole mounting to special flange

Shaft tapered, splined and cylindrical

Suction and pressure ports available as threaded and flange connections

### Advantages

- Simple and robust design
- High pressures from small dimensions and low weight
- Wide range of speeds
- Multiple pumps possible
- Cost-effective

See brochure no. 2.910 (PGE)

## Gear motor MGE



### Description

Size:	0, 1, 2, 3
Flow rate:	1.6 – 60 cm <sup>3</sup>
Nominal pressure:	200 bar*
Peak pressure:	220 bar*
Speed range:	650 – 4,000 rev/min*
Direction of rotation:	reversible*
Reversible with drain port	
Also available with clockwise and anticlockwise rotation as an option (without drain port)	
* size-dependent	

Flanges range from 2-hole mounting to special flange

Shaft tapered, splined and cylindrical

Suction and pressure ports available as threaded and flange connections

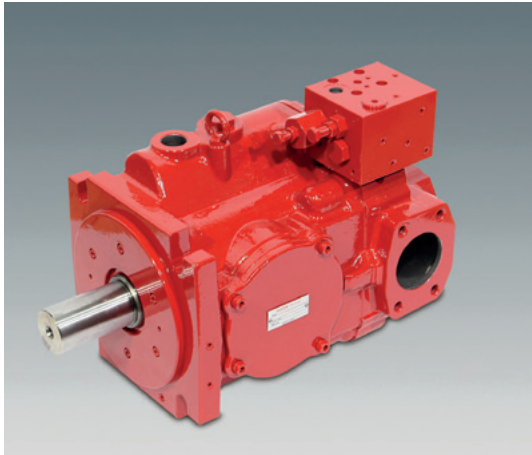
### Advantages

- High degree of efficiency
- High pressures from small dimensions and low weight
- Wide range of speeds
- Reversible motors for 2 and 4 quadrant operation
- Cost-effective

See brochure nos. 2.902 (Pump Overview MGE), 2.910 (PGE)



## Axial piston pump PPV100S (for open circuit)



In combination with constant pump optionally available.

### Description

Flow rate:	16 – 180 cm <sup>3</sup>
Nominal pressure:	315 bar*
Peak pressure:	350 bar*
Speed range:	600 – 3,600 rev/min*
Flange:	2 and 4 hole flange to ISO 3019 and SAE J744
Cylindrical and splined shaft to DIN 6885 and ANSI B92.1	
* flow-rate dependent	

### Control type

Pressure reducing valve
Remote pressure reducing valve
Load sensing

### Advantages

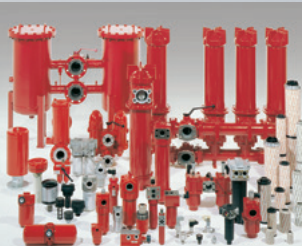
- Mounting flange SAE J744 and ISO 3019
- Wide range of speeds
- Finely graduated flow rate range
- Long service life
- High level of efficiency for industrial and mobile applications with complete through-drive capability

See brochure no. 2.907 (PPV100S)

Pump size			16	37	56	71	100	145	180
Geometric displacement		cm <sup>3</sup> /rev	16.3	37.1	56.3	70.7	100.5	145.2	180.7
Pressure	Rated	bar	315						
	Peak		350						
Drive speed	Min.	rpm	600						
	Max. (at -0.2 bar inlet pressure)		3,600	2,700	2,500	2,300	2,100	1,800	1,800
	Max. (at 0 bar inlet pressure)		3,800	2,700	2,700	2,400	2,200	2,000	1,800
Power (at 1,500 rpm, 315 bar)		kW	14	32	48	60	86	126	156
Filling volume		cm <sup>3</sup>	400	700	900	1,300	1,700	2,400	3,200
Approx. weight (with pressure compensator 01)			14.5	19.5	25.7	35	44.6	60	70.4
Approx. weight (with remote pressure compensator 07)		kg	16.2	21.2	27.4	37.2	46.9	62.2	72.6
Approx. weight (with load sensing control 14)			17.5	22.5	28.7	38	47.6	63	73.8
Moment of inertia		kgm <sup>2</sup>	0.0009	0.0034	0.0069	0.0092	0.0163	0.0277	0.0362



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Justus-von-Liebig-Straße  
66280 Sulzbach/Saar  
Germany

Tel.: +49 6897 509-01  
Fax: +49 6897 509-577

E-mail: [flutec@hydac.com](mailto:flutec@hydac.com)  
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