PumpExpert

Pump Diagnostic System

Applications

- Industry / Process engineering:
  Process cycles, industrial water supply, cooling systems and other industrial processes
- Water / Waste water:
  Water extraction, water treatment, water supply, waste water disposal.
- Building services:
  Cooling, air-conditioning
- Energy:
  Cogeneration plants, heat transfer stations, district heating

Monitored pump series

- CPK
- Magnochem
- Secochem
- Secochem Ex
- Etanorm
- Etanorm R
- Etamagno
- Etaseco
- RPH
- RPK
- KWP
- Multitec
- Omega
- RDLO
- Sewatec
- Amarex KRT
- Amacan

Integration of other pump series in preparation.

Performance data

Number of pumps: 1
Each pump is equipped with one PumpExpert. This also applies to multiple pump systems.

Supply voltage: 230 Volt AC or 24 Volt DC

Function

PumpExpert is an intelligent centrifugal pump diagnostic system. The diagnostic system provides clear and concise information on the pump, system and process status. The values measured by the sensors are evaluated by the PumpExpert software, and the results are output locally via the display and “traffic light” signals.

PumpExpert provides plain-text information on:

- Trouble-free operation
- Equipment malfunctions. PumpExpert issues alerts and warnings, as well as appropriate recommendations for action.

The alerts and warnings can be directly acknowledged on site.

An internal data logger records the operating data (number of starts, operating hours and load profile), the measured values, alerts and warnings over a prolonged period of time.

The data obtained by one or several PumpExpert systems can be downloaded to a handheld PDA using an infrared interface. The data can then be transferred to a PC for detailed evaluation, visualization and archiving.

A field bus interface for data transmission to a plant process control system is available on option.

PumpExpert helps to:

- Maintain and improve process and system reliability
- Optimize the process and the system’s energy efficiency
- Increase system availability by condition-based maintenance

The PumpExpert sales configurator in KSB Offert helps users select the appropriate sensors and instrumentation for the pump series to be monitored.

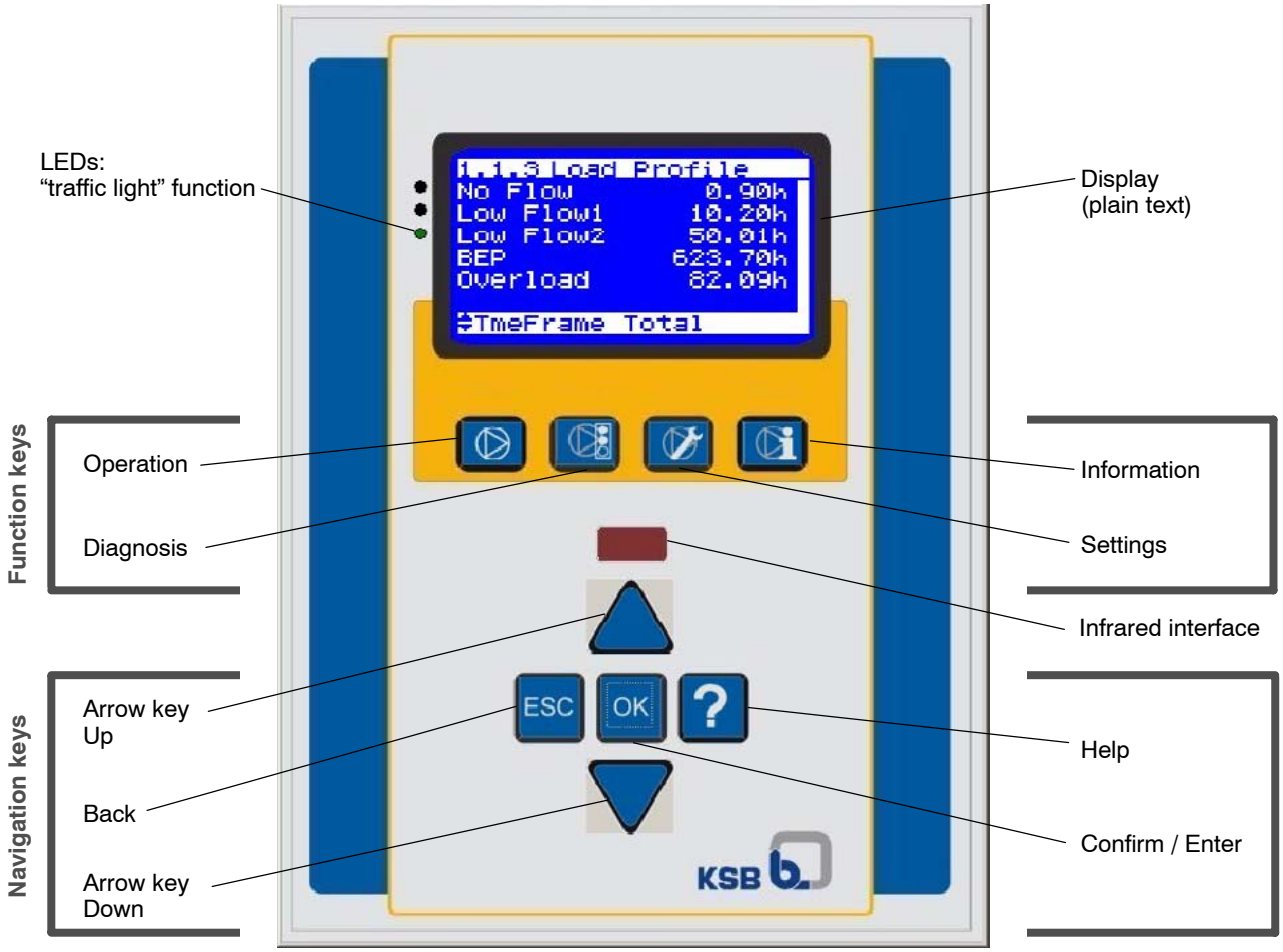
Depending on the sensors installed, the following variables can be measured:

- Fill level
- Temperature
- Vibrations
- Power
- Flow rate
- Pressure
- Speed of rotation

KSB

PumpExpert control panel

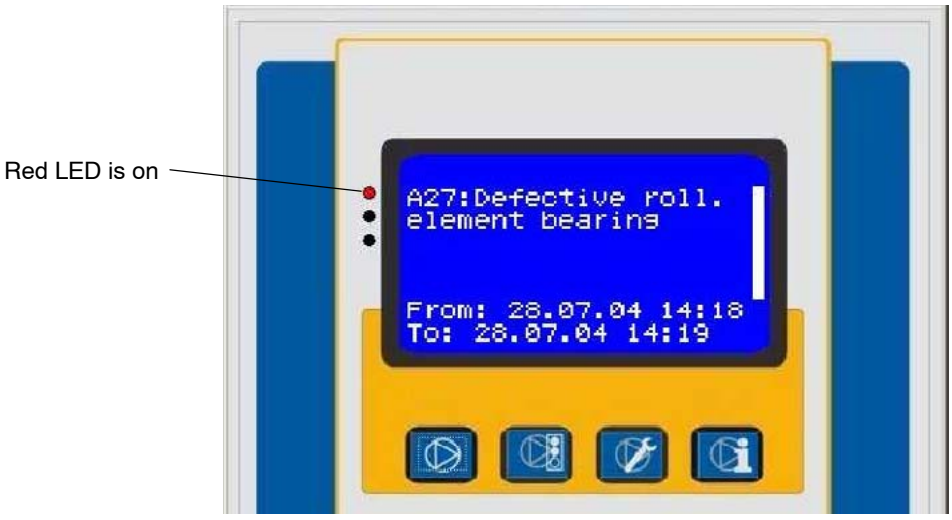
The PumpExpert control panel is designed to provide fast and straightforward on-site access to all the required information and to simplify parameter setting.
The control panel comprises a display, four function keys, five navigation keys and an infrared (IrDA) interface.



LED display

The “traffic light” signals inform the user about the status of pump and / or system.

LEDs:	Red:	One or several alerts are active
	Yellow:	One or several warnings are active
	Green:	Signals trouble-free operation



Example: Display shows alert

Function keys

The function keys provide direct access to the individual menu levels: Operation, Diagnosis, Settings and Information.

Operation menu level
Operating data (number of starts, operating hours, load profile in graphical and numerical format)
Measured values (current readings supplied by the connected sensors)
Time plots (development of a measured value within a user-defined time frame)

Diagnosis menu level
Active messages (display, acknowledge, display recommendation for action)
Message history (display alert, display recommendation for action)
Recommended action (display)

Settings menu level
Language (select)
Measured variables (show current sensor settings, for example the measuring range)
Commissioning (set characteristic values and operating points)
General settings (adjust date, time, contrast)

Information menu level
PumpExpert (product name, product number)
Pump (works number, flow rate, discharge head, speed, pump type, number of vanes)
Motor (type of motor, power rating, power supply, cos phi, frequency, speed, size)

Infrared interface

The infrared interface serves to transfer operating data and measured values to a handheld PDA and then to a PC for visualization, evaluation and archiving.

PumpExpert provides valuable information on pump operation at all times.

Operation menu level
At the Operation menu level, key operating data can be accessed. PumpExpert's permanent operating data logger enables users to retrieve information and evaluation results at any time.
Specific time frames can be defined to select the range of data to be shown:
- the last 24 hours, hour by hour
- the last 31 days, day by day
- the last 12 months, month by month
- the last 10 years, year by year

In other words, data are available for comparable time frames. This helps identify any changes that might have occurred in the process.

Number of starts

The number of starts for a specific, user-defined time frame is shown.

Operating hours

The number of operating hours for a specific, user-defined time frame is shown.

Load profile, numerical

The actual distribution of pump operation at BEP, No Flow, Low Flow 1, Low Flow 2 and Overload is shown numerically for a user-defined time frame.

Load profile, graphical

The actual distribution of pump operation at BEP, No Flow, Low Flow 1, Low Flow 2 and Overload is shown graphically for a user-defined time frame. The start date, start time and time frame can be specified by the user.

Scope of performance

The scope of the diagnostic functions provided by PumpExpert is described by alerts, warnings and information.
PumpExpert is configured to order so that it is matched precisely to the pump series it is used for and the available measuring points.
A PumpExpert sales configurator has been integrated in the KSB Offert pump selection software to facilitate selection of the optimum configuration.

Pump type series	CPK	RPH	RPK	KWP	Etanorm	Eta R	Magnochem	Etamagno	Secochem	Etaseco	Multitec	Omega	RDLO	Sewatec	Amacan	KRT
Alert																
Unacceptably low flow	x	x	x	x	x	x	x	x	x	x	x	x	x	(x)**	(x)**	(x)**
Overload	x	x	x	x	x	x	x	x	x	x	x	x	x	(x)**	(x)**	(x)**
Flow cut-off	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dry running	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Partial clogging of impeller	x	x	x	x	x	x	x	x	x	x				(x)**	(x)**	(x)**
Inadequate mechanical seal lubrication	x	x	x	x	x	x	–	–	–	–	x	–	–	–	–	–
Quench fluid level too low*	x	x	x	x	x	x	–	–	–	–	x	–	–	–	–	–
Barrier fluid level too high*	x	x	x	x	x	x	–	–	–	–	x	–	–	–	–	–
Mechanical seal leakage	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	(x)**
Defective rolling element bearing	x	x	x	x	x	x	x	x	–	–	–	–	–	–	–	–
Defective rolling element bearing, drive end	–	–	–	–	–	–	–	–	–	–	x	x	x	x	x	(x)**
Defective rolling element bearing, non-drive end	–	–	–	–	–	–	–	–	–	–	x	x	x	x	x	(x)**
Defective fan-side motor bearing									–	–		x	x		–	–
Defective shaft-side motor bearing									–	–		x	x		–	–
Defective plain bearing	–	–	–	–	–	–	x	x	x	x	–	–	–	–	–	–
Excessive vibrations	x	x	x	x	x	x	x		x	x	x	x	x	x	x	(x)**
Extreme external vibrations	x	x	x	x	x	x	x		x	x	x	x	x	x	x	(x)**
Magnetic coupling decoupled (start-up)	–	–	–	–	–	–	x		–	–	–	–	–	–	–	–
Magnetic coupling decoupled (operation)	–	–	–	–	–	–	x		–	–	–	–	–	–	–	–
Defective motor	x	x	x	x	x	x	x	x			x	x	x			
Moisture in motor	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	x
Motor overheated (operation)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Motor overheated at standstill	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Motor overheated under low flow conditions	–	–	–	–	–	–	–	–	x	x	–	–	–	–	–	–
Motor overloaded	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bimetal switch triggered; pump not stopped	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	(x)**
Moisture switch triggered; pump not stopped	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	(x)**
Pumped fluid temperature too high	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Unacceptable containment shell temperature	–	–	–	–	–	–	x	x	–	–	–	–	–	–	–	–
Unacceptable rotor space temperature	–	–	–	–	–	–	–	–	x	x	–	–	–	–	–	–
Unacceptable rotor space / winding temperature	–	–	–	–	–	–	–	–	x	x	–	–	–	–	–	–
Viscosity too high	–	–	–	–	–	–	x	x	x	x	–	–	–	–	–	–
Warning																
System not primed	x	x	x	x	x	x	x	x	x	x	x	x	x			
Extreme cavitation	x	x	x	x	x	x	x		x	x	x	x	x			
Discharge head too low	x	x	x	x	x	x	x		x	x	x	x	x			
Increased vibrations	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
External vibrations	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Motor anomaly	x	x	x	x	x	x	x	x			x	x	x			
Starting power too high	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Containment shell temperature too high	–	–	–	–	–	–	x	x	–	–	–	–	–	–	–	–
Information																
Operating hours and operating period based on flow rate, motor power, speed or discharge head	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Start-stop cycles based on flow rate, motor power, speed or discharge head	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Load profile based on flow rate	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Load profile based on power	x	x	x	x	x	x	x	x	x	x	x	(x)**	(x)**			
Load profile based on discharge head														(x)**	(x)**	(x)**
Pump not submerged (bimetal switch)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x

x Function available
– Function not feasible physically

* Mechanical seal monitoring only for barrier fluid or quench systems
** Not available for all types of hydraulic system; see PumpExpert sales configurator

Technical data

Ambient temperature:	0 °C to +40 °C
Storage temperature:	–10 °C to +60 °C
Supply voltage:	230 V AC 1A Wide range input 93 – 264 Volt AC, 50/60 Hz or optionally (without power supply unit) 24 Volt DC 1.25 A plus power requirement of external devices
Max. voltage fluctuations:	+/– 10%
Vibration fatigue limit:	IEC 60068-2-6
Shock resistance:	IEC 60068-2-27
Generic immunity standard:	EN 50082-2
Generic emission standard:	EN 50081-2
Enclosure:	
Housing:	IP54
Assembly installed in control cabinet:	IP20
Explosion protection:	Model for potentially explosive atmospheres in zone IIc Ex II 2GD EExd IIC IP66

Design

Housing:

Standard model

- IP54 enclosure to be mounted on the wall or on a stand placed on the pump baseplate or the floor
  Material: steel, colour RAL 7035
  Dimensions: 380 x 300 x 210 mm
  Right-hinged door
  Incl. wall hanging brackets
  Stand for mounting on pump baseplate or floor (accessory)

- Modules assembled on IP20 mounting plate, ready-wired, for installation into a control cabinet
  Material: galvanized steel
  Dimensions: 335 x 275 x 180 mm (WxHxD)

Explosion-proof model

- EExd-IIc enclosure
  Flameproof enclosure, incl. terminal box for installation in potentially explosive atmospheres
  Material: die-cast aluminium, colour RAL 9002
  Dimensions: 276 x 276 x 200 mm (not incl. brackets) (WxHxD)
  Right-hinged door
  Glass screw cap
  Terminal box
  Material: die-cast aluminium, colour RAL 9002
  Dimensions: 310 x 235 x 100 mm (WxHxD)
  No brackets required for wall mounting
  Stand for mounting on pump baseplate or floor (accessory)

Communication

Local communication via infrared (IrDA) interface

Data transmission and parameterization via handheld PDA (accessory).

Field bus*

- Profibus
- Other field bus types on request

Remote data transmission*

- Modem

* The hard- and software can be retrofitted.

Accessories

- Handheld PDA (recommended accessory)
  Mobile device for data transmission and parameterization
  Model: Palm m515
  in standard or explosion-protected design

- Stand for mounting the PumpExpert housing on the floor or on the pump baseplate

- Traffic light signalling module
  optical signal (steady burning light),
  to be mounted on PumpExpert housing or on the wall
- Sensor cable for frequency inverter

Scope of supply

The scope of supply varies depending on the PumpExpert configuration.

- Fully functional, modular diagnostic system incl. pump- and application-specific software.
  Enclosures:
  IP54 or EExd-IIc housing or assembled on a IP20 mounting plate to be installed in a control cabinet
- Software for handheld PDA
- Data analysis and evaluation software for a PC
- PumpExpert operating instructions

Commissioning is not included in KSB's scope of supply. Upon request, installation and commissioning can be carried out by KSB.

For easier commissioning, we recommend using a handheld PDA.

Planning information

PumpExpert usage

Each pump is equipped with its own PumpExpert. This also applies to multiple pump systems.
The PumpExpert software is configured to suit the pump it is used for.

New pumps plus PumpExpert

The pump and PumpExpert are connected on site (by the user). PumpExpert is supplied ready for connection.

Upgrading a pump with PumpExpert

Retrofitting of a PumpExpert may involve mechanical rework on the pump unit.
The scope and type of rework required depends on the pump type and design.
For details see the PumpExpert sales configurator in KSB Offert.

Adding PumpExpert modules

Modules for additional functions can be retrofitted. The retrofit kit includes the appropriate software updates.

Use in potentially explosive atmospheres

If PumpExpert is used in potentially explosive atmospheres and the sensors are already installed in the plant, make sure that the sensors are compatible with the electrical data of the PumpExpert barriers used.
For electrical data refer to the PumpExpert operating instructions.

Sensors

Sensors available on site can be used, provided that the sensor signals are properly isolated, for ex. by means of a buffer amplifier. The buffer amplifiers must be provided by the customer. Refer to the PumpExpert sales configurator in KSB Offert for a potential range of suitable sensors.

Mounting options for PumpExpert

- Wall hanging brackets (IP54 and EExd-IIc) (standard)
- Stand for mounting on the floor or pump baseplate (IP54 and EExd-IIc) (accessory)
- Modules assembled on a galvanized mounting plate for installation in a control cabinet

Power supply

The PumpExpert supply voltage is 230 V AC or, if a power supply unit is used, 24 V DC.

Recommended layout of cable from sensor to PumpExpert

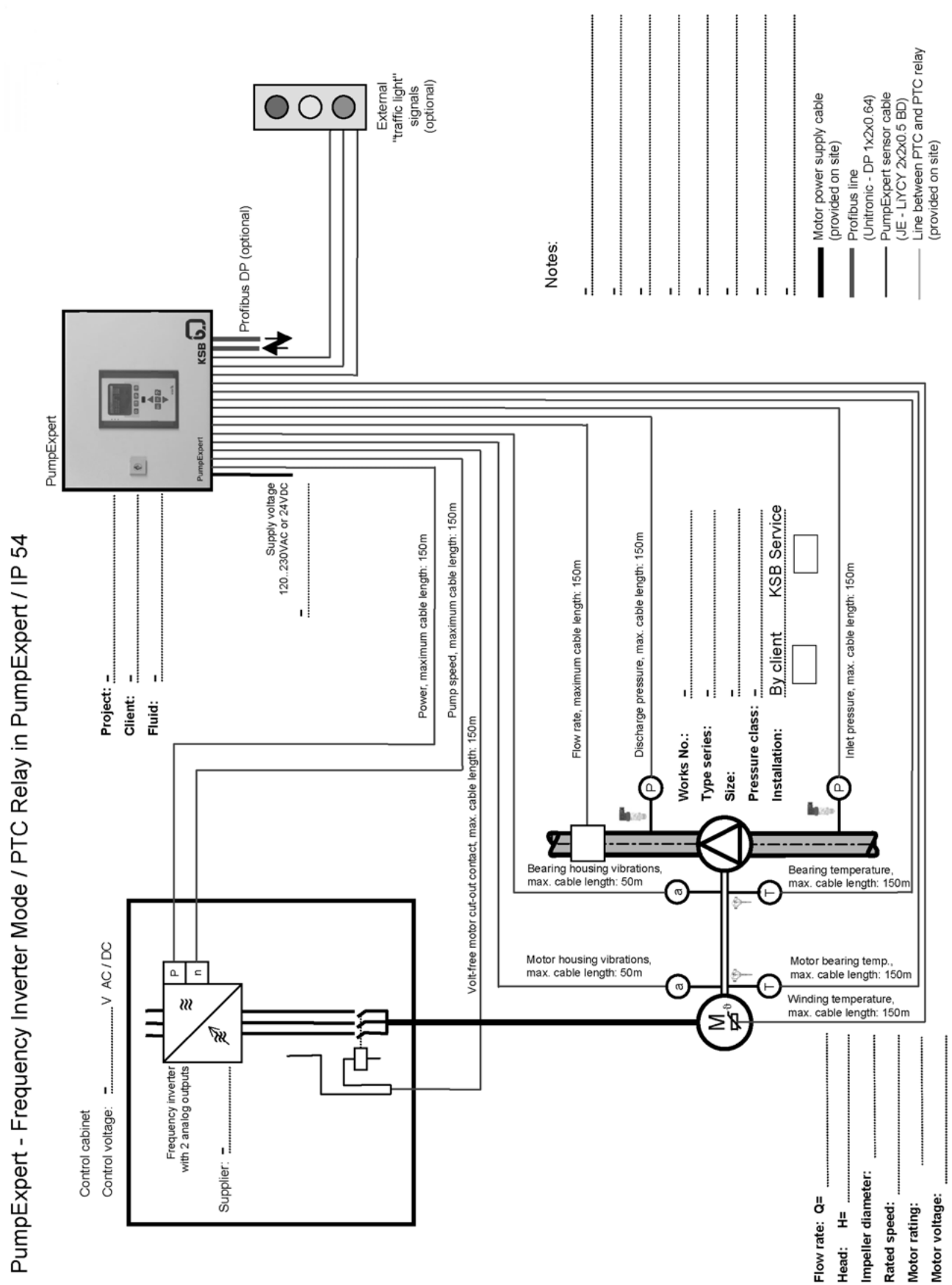
Cabling from the sensors to PumpExpert must not be laid along power lines.
Sensor cables must be shielded, twisted pair cables.

Installation and commissioning

PumpExpert is installed locally in close proximity to the pump. It can be installed and commissioned by the customer.
Installation and commissioning are not included in KSB's scope of supply.
Upon request, installation and commissioning can be carried out by KSB.

PumpExpert integration into the system

Schematics for other configurations are also available.



Communication via Profibus DP

PumpExpert can be integrated into a Profibus DP (Class V.1) master system for the transmission of messages and measurement readings of the connected sensors or for the receipt of data or measured values from the plant.

Caution Profibus DP (Class V.2), Profibus FMS and Profibus PA are not supported.

Communication principle

In each cycle, PumpExpert and DP master exchange 5 double words of user data.
This means: In each cycle, the master writes 5 double words (QD) into the output process image of the master.

QD0	QD1	QD2	QD3	QD4

PumpExpert then writes 5 double words (ID) into the input process image of the master.

ID0	ID1	ID2	ID3	ID4

Process image of outputs from the master's point of view

Double word	Word	Byte	Description
QD0	QW0	QB0	Control word: Bit 0=Fault acknowledgement; Bit 1 + Bit 2 = Load profile + Delete pump starts; Bit 3 = Reset PTC evaluation relay
		QB1	
	QW1	QB2	Register address; Bit 31 = Write bit
		QB3	
QD1	QW2	QB4	Register contents; written only if Bit 31 has been activated in the register address!
		QB5	
	QW3	QB6	
		QB7	
QD2	QW4	QB8	Measured value 1 via field bus
		QB9	
	QW5	QB10	
		QB11	
QD3	QW6	QB12	Measured value 2 via field bus
		QB13	
	QW7	QB14	
		QB15	
QD4	QW8	QB16	Measured value 3 via field bus
		QB17	
	QW9	QB18	
		QB19	

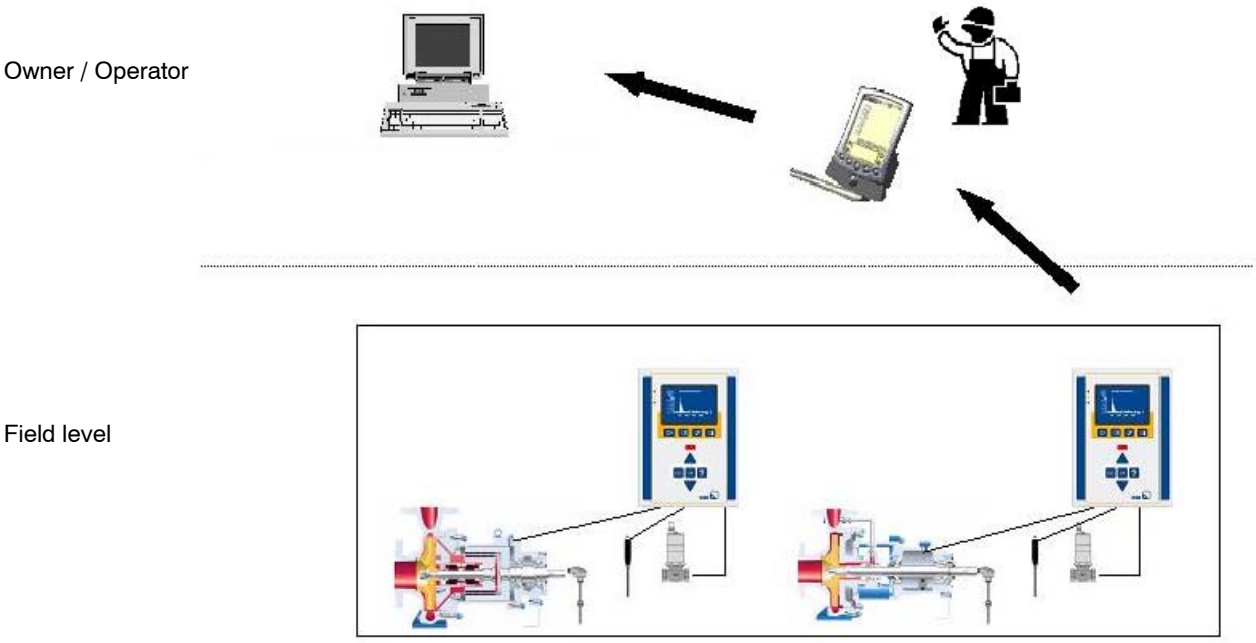
Process image of inputs from the master's point of view

Double word	Word	Byte	Description
ID0	IW0	IB0	Status word
		IB1	
	IW1	IB2	Register address acknowledgement
		IB3	
ID1	IW2	IB4	Register contents
		IB5	
	IW3	IB6	
		IB7	
ID2	IW4	IB8	Status bits 0..31: Alerts
		IB9	
	IW5	IB10	
		IB11	
ID3	IW6	IB12	Status bits 32..63: Warnings
		IB13	
	IW7	IB14	
		IB15	
ID4	IW8	IB16	Status bits 64..95: Fault, measurement equipment
		IB17	
	IW9	IB18	
		IB19	

Typical applications

Mobile data transmission to PC
Using a handheld PDA, the data are downloaded from PumpExpert via the infrared interface and then transferred to a PC.

- All the information (operating data, alert history, measured values and settings) is available in the system and can be transferred to a PC for visualization, evaluation and archiving.
- Very little installation work required
- Access to saved data as required



Data transmission to plant process control system
Integration in a plant process control system enables data access from the control station at any time.

- All the information (operating data, alert history, measured values and settings)) is simultaneously available in the control station.
- Very little wiring and installation work thanks to local field bus nodes
- Permanent data logging