LEVITRONIX®

Ultrapure Fluid Handling
Integrated Pump System Series

BPS-i600

3.1 bar	(45 psi)
75 liters/min	(20 gallons/min)

No Bearings. No Seals. No Contamination!

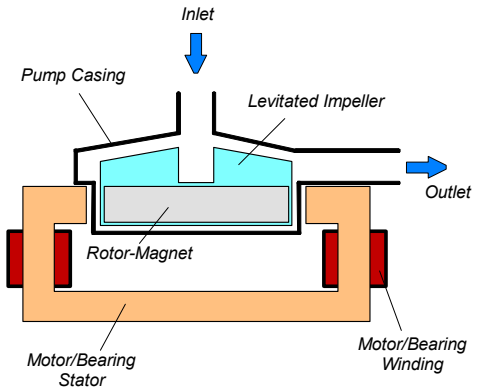


Figure 1: *Schematic of the MagLev centrifugal pump*

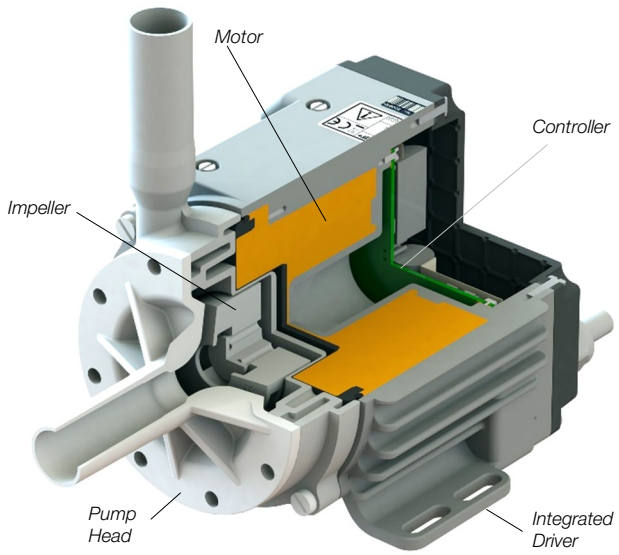


Figure 2: *Integrated MagLev pump driver with pump head*

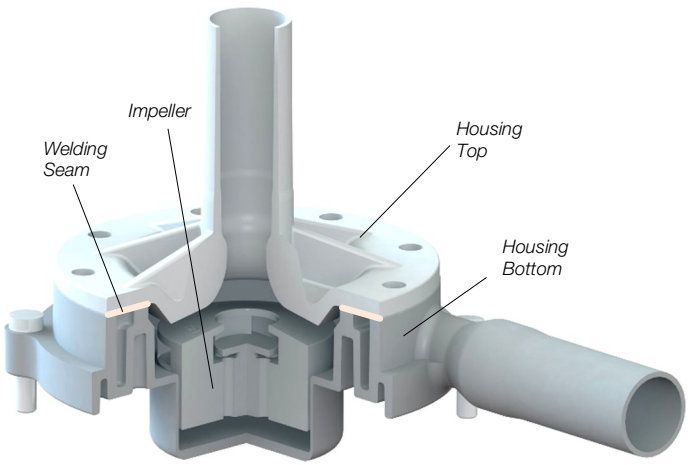


Figure 3: *Sealing-less pump head.*

INTRODUCTION

The *BPS-i600* pump system is a revolutionary centrifugal pump that has no bearings to wear out or seals to break down and fail. Based on the principles of magnetic levitation, the pump impeller is suspended, contact-free, inside a sealed casing and is driven by the magnetic field of the motor (*Figure 1*).

The impeller and casing are both fabricated from chemical-resistant high purity fluorocarbon resins. Together with the rotor magnet they make up the pump head. The pump housing is welded, hence reducing the risk of contamination and leakage caused by sealing O-rings.

The controller and the motor are integrated into the driver housing (see *Figure 2*). Thus, the cabling effort is reduced. Fluid flow rate and pressure are precisely controlled by electronically regulating the impeller speed without pulsation.

SYSTEM BENEFITS

- Extremely low particle generation due to the absence of mechanically contacting parts and filled sealing O-rings.
- Increased equipment uptime.
- Lower maintenance costs by eliminating valves, bearings, seals and costly rebuilds.
- Very low integration costs as no external controller is needed for speed or closed loop control.
- Reduced risk of contamination due to the self-contained design with magnetic bearings.
- Very gentle to sensitive fluids due to low-shear design.
- No narrow gaps and fissures where particles or microorganisms could be entrapped.
- Smooth, continuous flow without pressure pulsation.
- Electronic speed control.
- Compact design compared to pneumatic and mag-drive pumps.
- Proven technology in medical and semiconductor industry.

APPLICATIONS

- Semiconductor wet processing.
- Flip chip and advanced packaging.
- Solar cell production.
- Flat panel display manufacturing.
- Hard-disk fabrication.
- Printer ink handling.
- Pharmaceutical production.
- Plating.
- Circulation in flow batteries.

SYSTEM CONFIGURATION FOR SPEED CONTROL

Figure 7 illustrates the interfacing of the integrated pump systems. Various PLC signals allow for a simple setup where the pump speed can be precisely set via an analog input. Various digital inputs and outputs allow controlling and monitoring of the system.

An *RS485* interface allows communication with a PC in connection with the *Levitronix® Service Software*. Hence parameterization, firmware updates and diagnostics are possible. The *RS485* can also be used as a fieldbus to implement more sophisticated concepts of pump control.

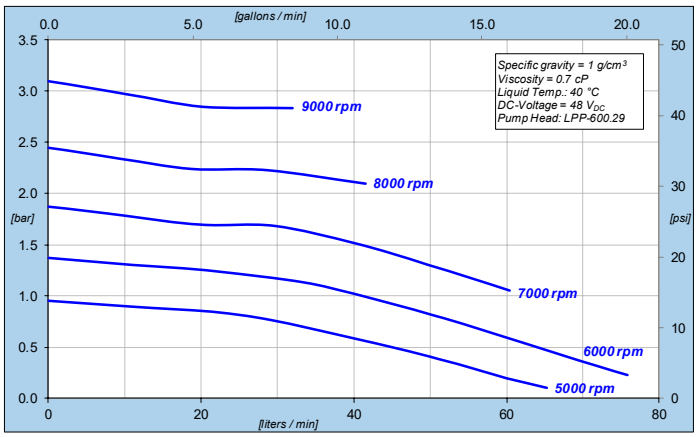


Figure 4: *Pressure/flow curves for aqueous liquids*
(Typical data measured with pump head LPP-600.29)

SYSTEM CONFIGURATION FOR PROCESS CONTROL

The *PLC* interface of the *BPS-i600* pump system enables the implementation of precise closed loop flow or pressure control in connection with either a flow or pressure sensor (see *Figure 8*).

Precise ultrapure flow control systems can be realized with the *BPS-i600* pump system in combination with *LEVIFLOW®* flowmeters. *Levitronix®* provides either turnkey solutions for closed loop flow control or helps to design your own flow control system. Experience has been gained with fluids such as CMP slurries, surface-conditioning chemicals, plating solutions, ultrapure water and solvents.

The versatility of *Levitronix®* flow control systems goes far beyond the capabilities of simple flow controllers. In addition to the flow control function, the *Levitronix®* control firmware comes with several condition monitoring features to monitor the integrity of the fluid circuit. *Levitronix®* flow control systems can generate alarms for preventive filter exchange, no-flow conditions or line clogging. Dynamic Condition Trending (DCT) enables failure prediction and scheduling of preventive maintenance (*Figure 5*).

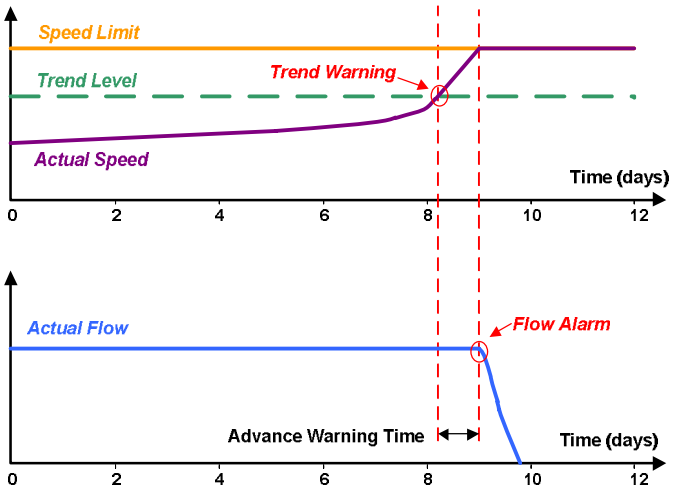


Figure 5: *Dynamic Condition Trending (DCT)*

MULTI-PUMP SYSTEM CONFIGURATION

The *RS485* fieldbus (Modbus RTU protocol) allows easy usage of multiple pump arrays (see *Figure 6*) addressing each pump with a unique address, which can be set via *Levitronix® Service Software*.

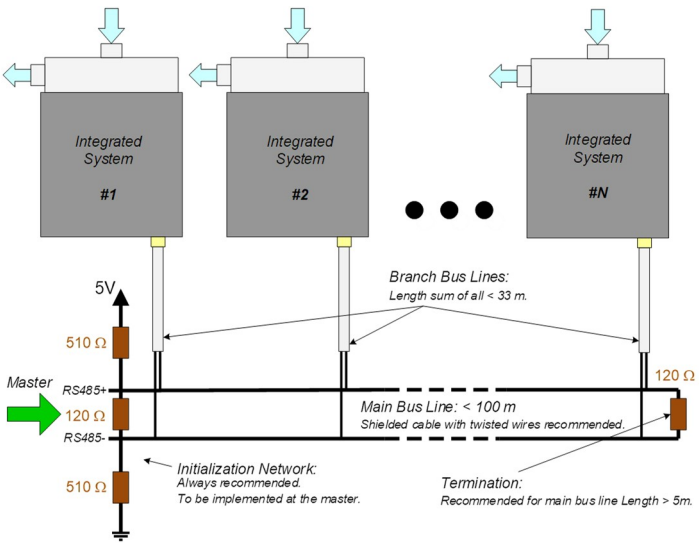
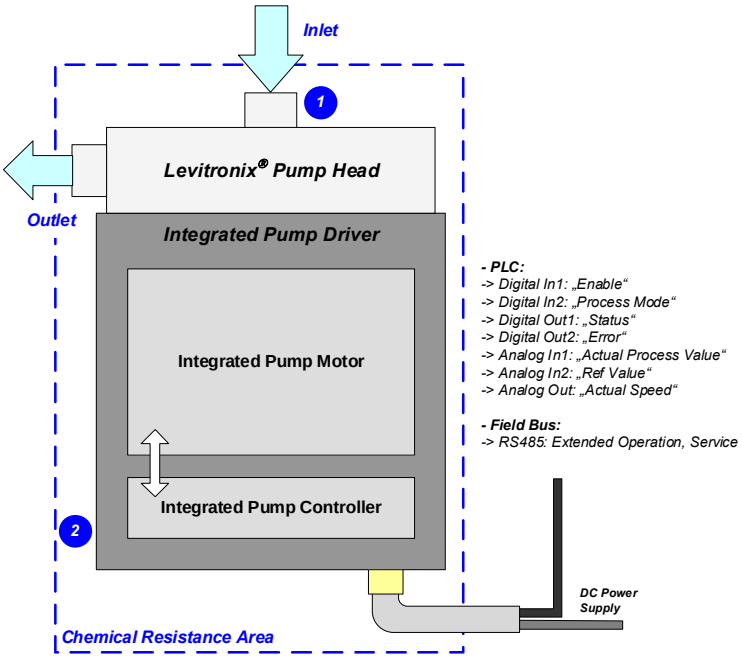


Figure 6: *Multi-pump array with fieldbus*



Wire Name	Description	Standard Designation	Hardware Specification
2x P+	+48 VDC	Supply	Voltage: 48 VDC
2x P-	Power Input Ground / Earth		P- to be connected to earth
Ain1	Analog Input 1 (Current Input)	Actual Process Value	Analog current input: 4 – 20 mA (450 Ω shunt input, no galvanic isolation)
Ain2	Analog Input 2 (Voltage Input)	Reference Value	Analog voltage input: 0 – 10 V (7.9 kΩ, no galvanic isolation) *Note: The Analog Input 2 can be changed to a current input, with the same specifications as Ain1, in the Levitronix Service Software.*
Ain_GND	Analog Input Ground	--	Reference for Ain1 and Ain2
Din1	Digital Input 1	Enable (Reset)	Galvanic separation with optocoupler
Din2	Digital Input 2	Process Mode	2.2 kΩ input resistance, 5 – 24 V for active input
Din_COM	Common Digital Input	--	Reference for Din1 and Din2
Aout1	Analog Output (Voltage Output)	Actual Speed	0 – 10 V (no galvanic isolation) AGND is reference. *Note: The analog output can be changed to a 4 – 20 mA current output in the Levitronix Service Software.*
Dout1	Digital Output 1	Status	Open drain, max. 24 V, 100 mA
Dout2	Digital Output 2	Error	Reference ground is AGND
AGND	Analog Ground	--	Reference for Aout1, Dout1 and Dout2
RS485+	RS485 +	Field Bus	Modbus protocol
RS485-	RS485 -		
NC	Do not connect	Do not connect	For internal usage
NC	Do not connect	Do not connect	For internal usage
Shield	Shielding	Shielding	To be connected to earth (see wire no. 2, P-)

Figure 7: Standard system configuration for speed control

Note 1: Power supply connectiona P+ and P- are 2 connected wires each with 1.5 mm² per wire (total of 3 mm²) and signal wires are 0.14 mm².
Note 2: For more detailed description of interface consult user manual.

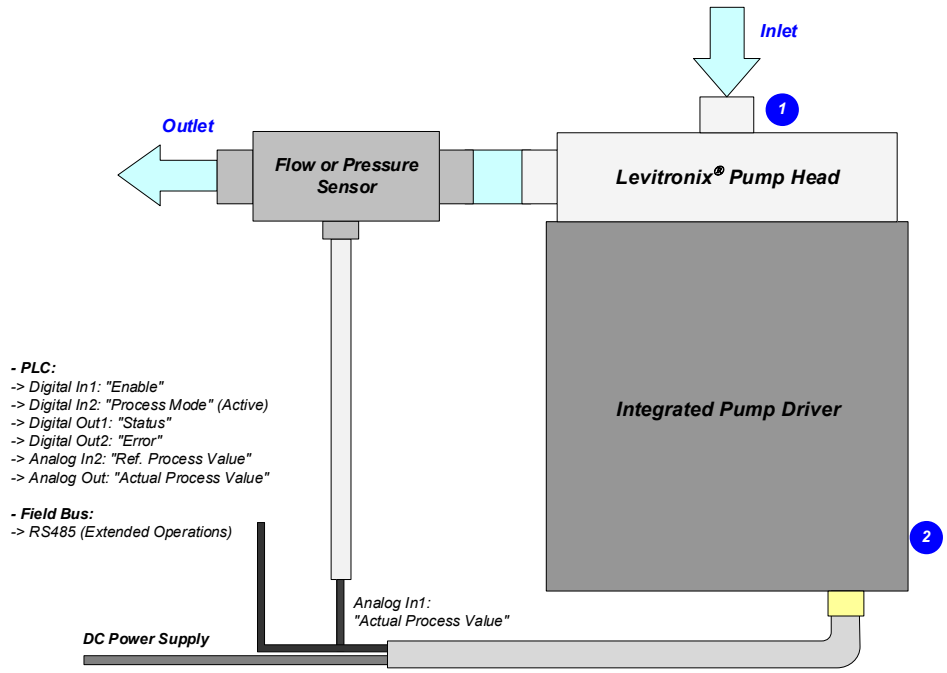
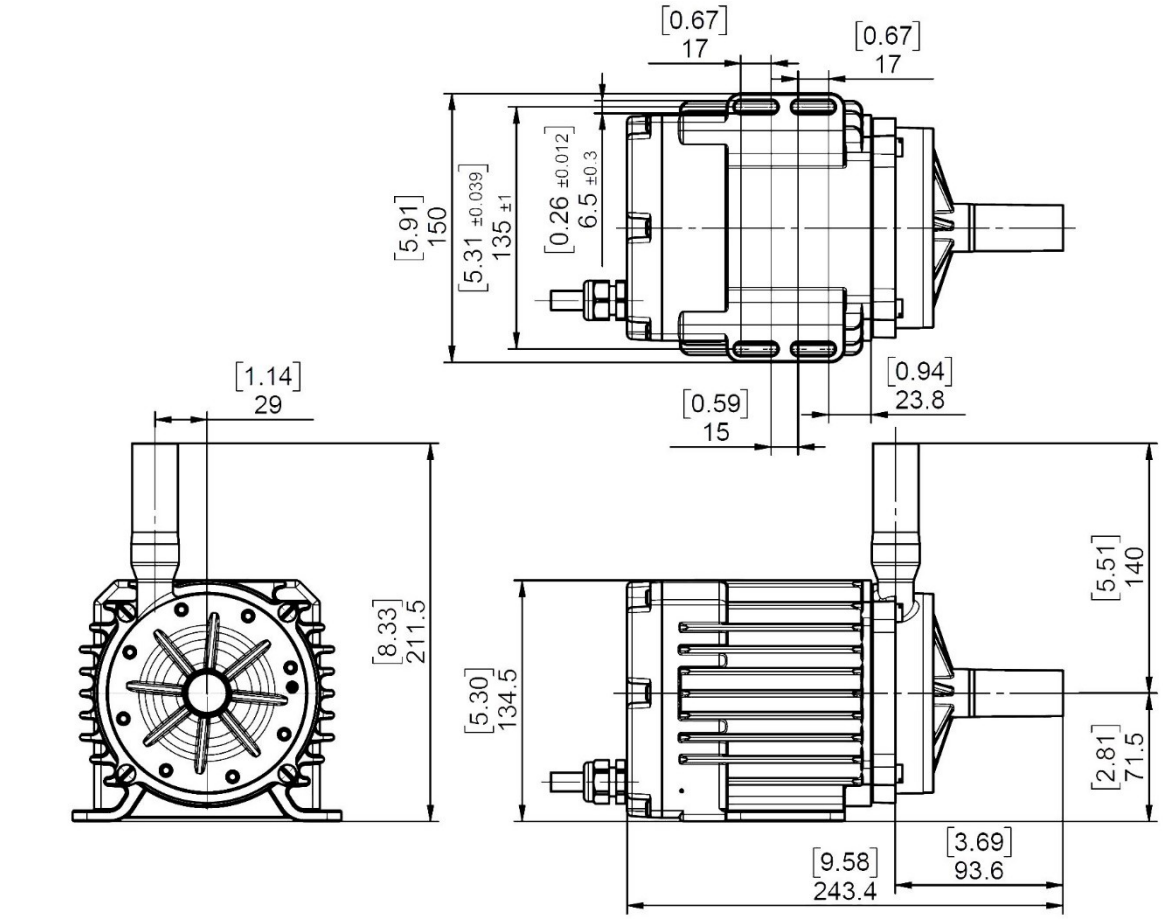


Figure 8: Standard system configuration for process control

Note: Parameters of closed loop control can be configured via Levitronix® Service Software over RS485.



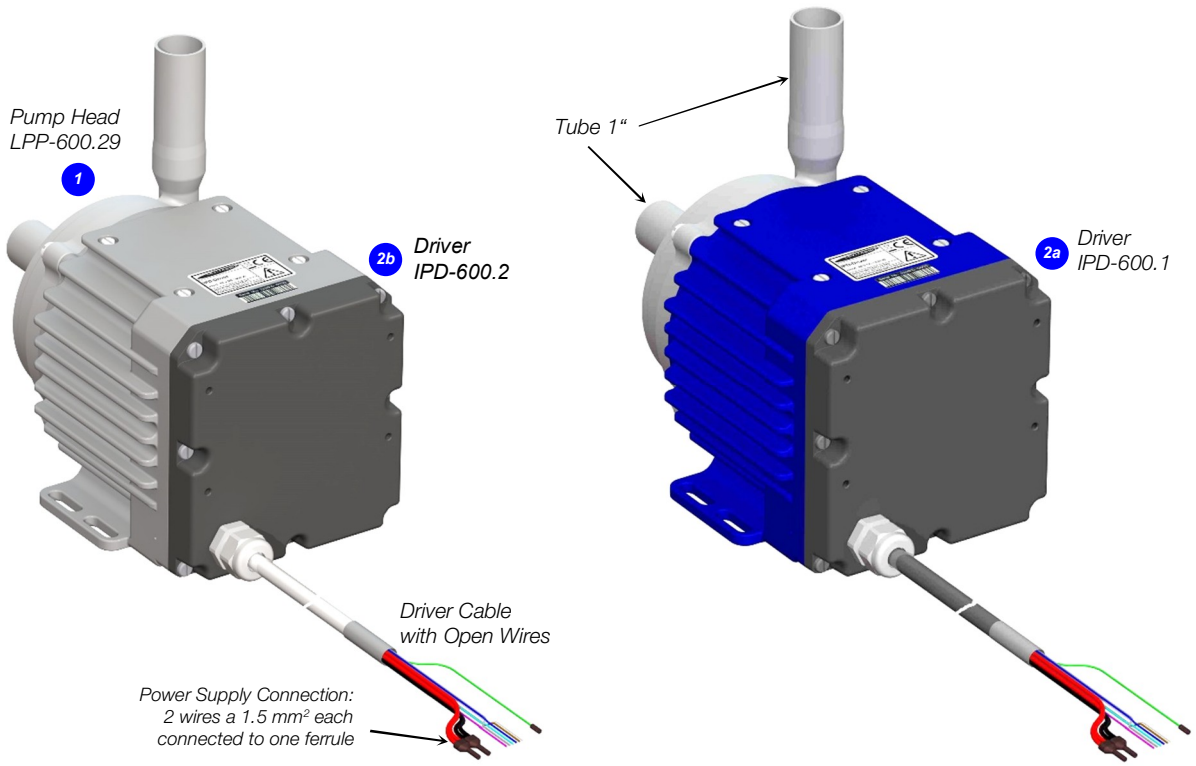


Figure 9: Dimensions of integrated driver with pump head (in mm and [inch])

Note 1: Non-tolerated dimensions are for reference only.

ORDER INFORMATION

System Name	Article #	Pump Head	Driver	Note
BPS-i600.1	100-91405	LPP-600.29	IPD-600.1-50-01	*PFA pump head, Epoxy coated motor, 5 m PVC cable with open wires*
BPS-i600.2	100-91406	LPP-600.29	IPD-600.2-50-01	*PFA pump head, ETFE coated motor, 5 m FEP cable with open wires*

Table 1: *Standard system configurations*

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
1	Pump Head	LPP-600.29	100-91403	Impeller / Pump Housing	*PFA / PFA*
				Housing Sealing	*No sealing ring used. Pump housing is welded.*
				Inlet / Outlet Fittings	*Tube 1"*
				Max. Flow	*75 liters/min / 20 gallons/min*
				Max. Diff.-Pressure	*3.1 bar / 45 psi*
				Max. Viscosity	*20 cP*
				Max. Liquid Temp.	*90 °C / 194 °F*
2a	Integrated Pump Driver	IPD-600.1-50-01	100-10179	Voltage, Power	*48 VDC ± 10%, 600 W*
				Housing	*Epoxy (corrosion resistant) coated aluminum, waterproof (IP65)* [1]
				Cable	*PVC jacket, open wires, cable length 5 m*
				Interfaces	*PLC with - 1 analog input 4 – 20 mA; - 1 analog input 0 – 10 V OR 4 – 20 mA; - 1 analog output 0 – 10 V OR 4 – 20 mA; - 2 digital inputs 0 – 24 V (optocoupler); - 2 digital outputs 0 – 24 V / 100 mA (open drain)* *RS485 interface (for service and extended field operation). Modbus protocol.*
				Standard Firmware	*I1.48*
2b	Integrated Pump Driver	IPD-600.2-50-01	100-10180	Housing	*ETFE (chemical resistant) coated aluminum, waterproof (IP65)* [1]
				Cable	*FEP jacket, open wires, cable length 5 m*

Table 2: *Specification of standard components*
1: Designed and tested for IP67.

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
4	AC/DC Power Supply	TSP 600-148-M (M = Modified Levitronix design from Traco)	100-40013	Voltage / Power Output	*48 VDC / 600 W*
				Voltage Input	*85 – 265 VAC (automatic detection)*
				Certification or Standards	*CB, UL, CSA, Semi F47*
5	USB to RS485 Adaptor TR Isolated	YN-485I-TR	100-30392	Structure / Design	*USB connector (A) with termination resistor and cable with connector pair (B and C) for external RS485 wire connection. Magnetically isolated. Cable length is 2 m. Included is a USB space saver cable (D).*
				Purpose	*Communication over fieldbus of driver with PC*
6	Water Cooling Module	WCM-i600.1	190-10465	Materials Motor Mounting Screws	*PTFE coated stainless steel for cooling plate (A) and screws (B).* *4 x M4x16, Inox A4 (PTFE coated)*
				Cooling Flow Pressure Drop Max Static Pressure	*Min. 0.5 l/min at ≤ 20 °C. In- and outlet are NPT 1/8" x 6.9mm.* *0.13 bar at 1 l/min (for water at 20 °C)* *4 bar*
				Purpose	*Driver cooling for higher liquid temperatures (see user manual).*

Table 3: *Specification of standard accessories*

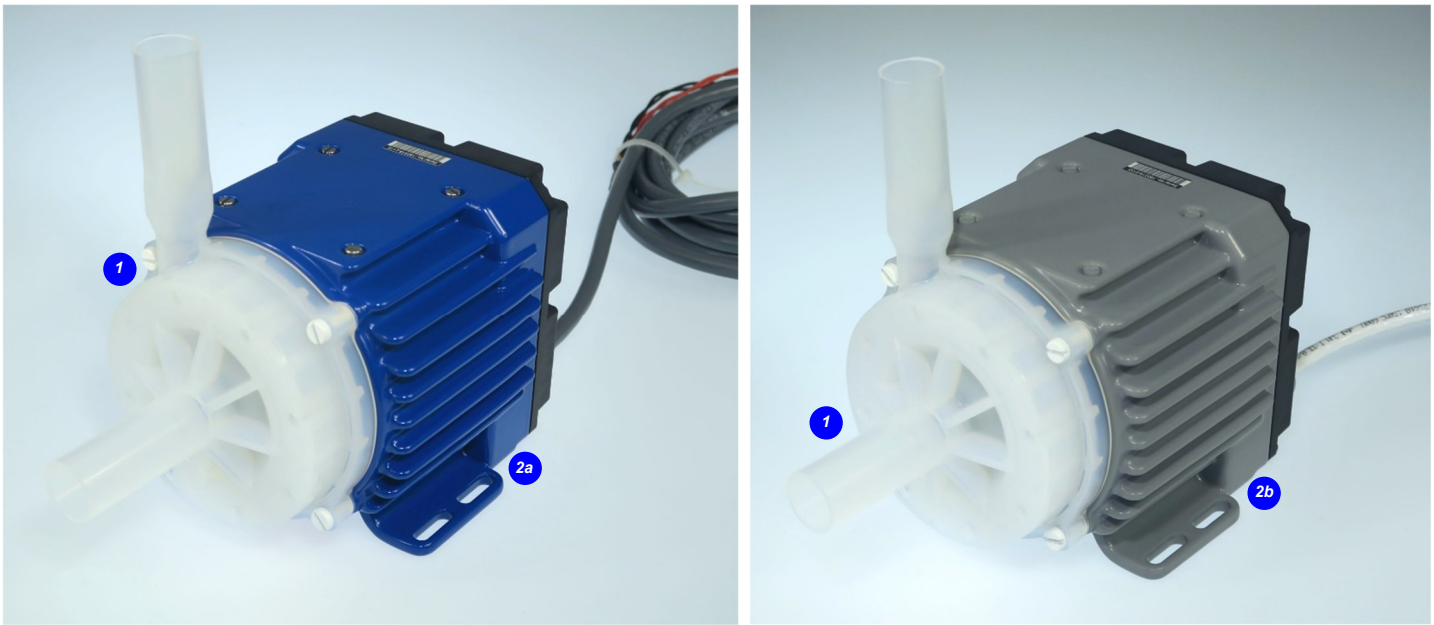
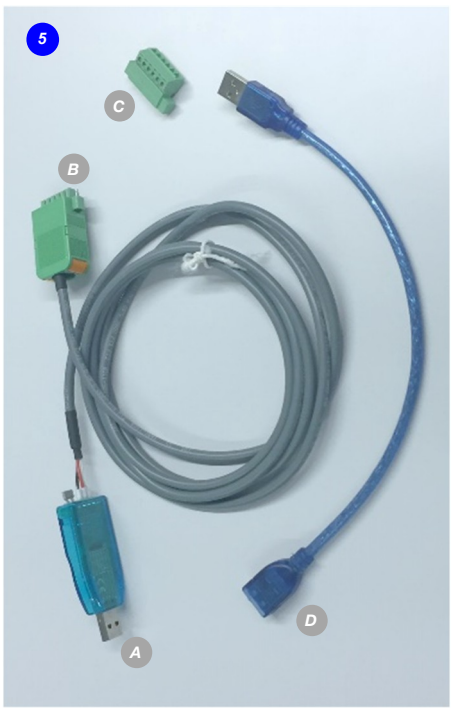


Figure 10: Pump system with standard components



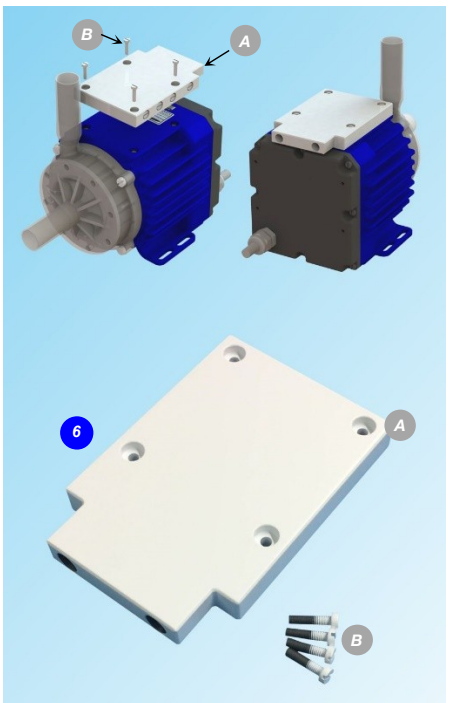


Figure 11: Standard accessories

Levitronix® is the world-wide leader in magnetically levitated bearingless motor technology. *Levitronix®* was the first company to introduce bearingless motor technology to the Semiconductor, Medical and Lifescience markets. The company is ISO 9001 certified. Production and quality control facilities are located in Switzerland. In addition, *Levitronix®* is committed to bring other highly innovative products like the *LEVIFLOW®* flowmeter series to the market.

Headquarter and European Contact

Levitronix GmbH
Technoparkstr. 1
CH-8005 Zurich
Switzerland

Phone: +41 44 974 4000
E-Mail: salesEurope@levitronix.com

US Contact

Levitronix Technologies LLC
10 Speen Street, Suite 102
Framingham, Massachusetts 01701
USA

Phone: +1 508 861 3800
E-Mail: salesUS@levitronix.com

Japan Contact

Levitronix Japan K.K.
Wing Eight 5floor, 4-16-4
Asakusabashi, Taito-ku
Tokyo, 111-0053 Japan

Phone: +81 3 5823 4193
E-Mail: salesJapan@levitronix.com

Taiwan Contact

Levitronix Taiwan
5F, No. 251, Dong Sec. 1, Guangming 6th Rd., Chu Pei City,
Hsin-Chu 302, Taiwan, R.O.C.

Phone: +886 3 657 6209
E-Mail: salesAsia@levitronix.com