LEVITRONIX®

PuraLev®
Life Science Integrated Pump Series

PuraLev® i30SU (Single-Use)

1.0 bar	(14.5 psi)
7.7 liters/min	(2.0 gallons/min)

Low Shear Design - High Cell Viability

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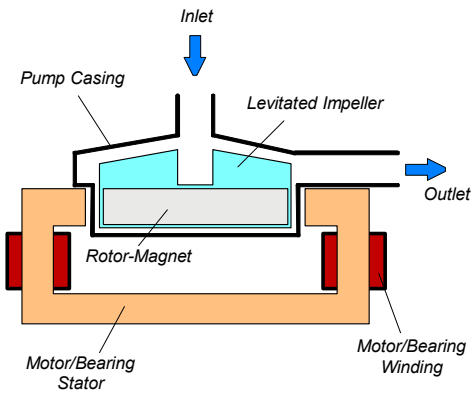

Figure 1: *Schematic of the main elements of the MagLev centrifugal pump*

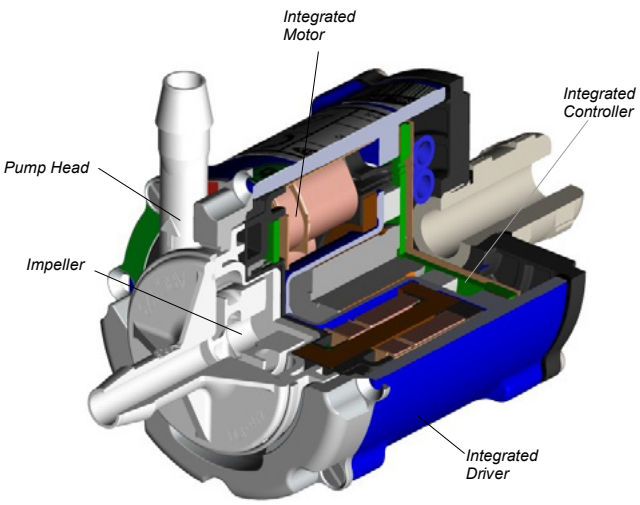

Figure 2: *Integrated MagLev pump driver with pump head*

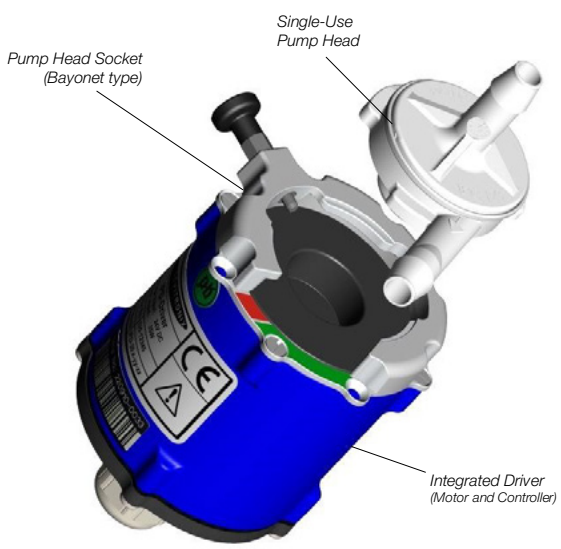

Figure 3: *Single-use pump head concept*

INTRODUCTION

Levitronix® has developed a revolutionary pump that has no bearings to wear out or seals to break. Based on the principles of magnetic levitation, the pump's 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 biocompatible (FDA, USP-VI, BSE/TSE and Animal free) gamma sterilizable polypropylene (PP) and together they make up the disposable pump head. A simple and intuitive exchange of the single use pump head is achieved with a bayonet socket type mounting procedure (see *Figure 6*). Flow rate or pressure is precisely controlled by electronically regulating the rotor speed, which eliminates any pulsation. With the lack of mechanical bearings plus the self-contained pump head design, the risk of contamination is drastically reduced. The absence of narrow gaps between the impeller and pump casing, plus the low-shear pump design allows the gentle pumping of sensitive liquids. The pump head can be easily inserted and removed with an intuitive bayonet socket. The controller and the motor are integrated into the driver housing (see *Figure 2*), hence cabling effort is reduced.

SYSTEM BENEFITS

- Low shear-forces.
- Reduced risk of contamination due to the self-contained design with magnetic bearings.
- No particle generation.
- No over-pressure situations (compared to roller pumps).
- No narrow gaps between the impeller and pump casing where bacteria could be entrapped.
- Pump head is gamma sterilizable.
- Biocompatibility of wet materials: FDA, USP-VI, Animal/BSE/TSE free.
- Bayonet socket design for easy and intuitive exchange of disposable pump head (see *Figure 6*).
- Small size.
- Dry running capability.
- Proven technology in the medical (disposable blood pumps) and semiconductor (high-purity pumps) industries.
- High flow capability with compact design.
- Pulsation free.

APPLICATIONS

- Pumping of shear-sensitive liquids and cells.
- Bioprocessing (for example perfusion).
- Recirculation and transfer applications in bioreactors.
- Filtration.

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SYSTEM CONFIGURATION – "STAND-ALONE"

Figure 7 and *Figure 11* illustrate a "Plug and Play" stand-alone system with integrated user panel and buttons to set the speed manually.

The driver also contains a PLC interface for remote speed control by analog and digital signals.

Various accessories are available like a desktop power supply with relevant power cable and signal cables to connect to the PLC.

SYSTEM CONFIGURATION – "EASYCONNECT"

The "EasyConnect" models (see *Figure 8* and *Figure 13*) with according cable accessories are designed to realize various interface configurations with minimal setup effort.

Two Fieldbus connectors (IN and OUT) allow to setup arrays of multiple pumps. Therefore, serial pumping configurations as shown in *Figure 9* can be realized.

The PLC interface allows not only remote control by analog/digital signals but also connections of external sensors hence enabling for example a precise flow or pressure control (see notes below).

The Fieldbus interface allows remote control over a PC, a User Panel or other devices with Modbus protocol.

SYSTEM CONFIGURATION – "OEM"

The "OEM" models are designed for a compact integration with one integrated driver cable containing all available interface signals (see *Figure 10* and *Figure 15*). Basically all configurations of the "EasyConnect" models are possible allowing the users with integration capabilities to adapt the cable to their needs.

PROCESS CONTROL WITH FEEDBACK SENSORS

Together with an external sensor, process parameters like flow or pressure can be controlled or monitored as shown in *Figure 10*.

Precise ultrapure flow control systems can be realized with the 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 a wide range of applications.

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.

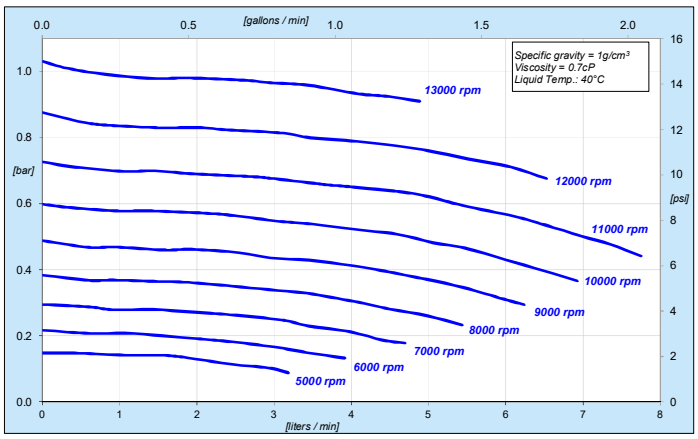

Figure 4: *Pressure/flow curves for aqueous liquids (similar to water)*

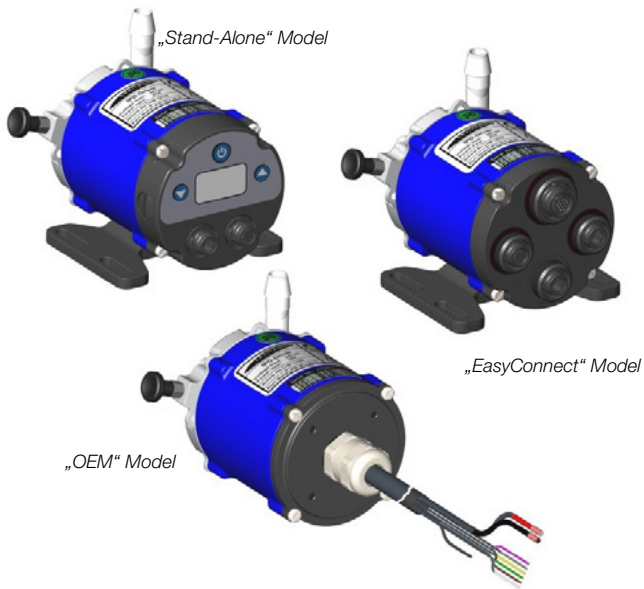

Figure 5: *Pump system models*

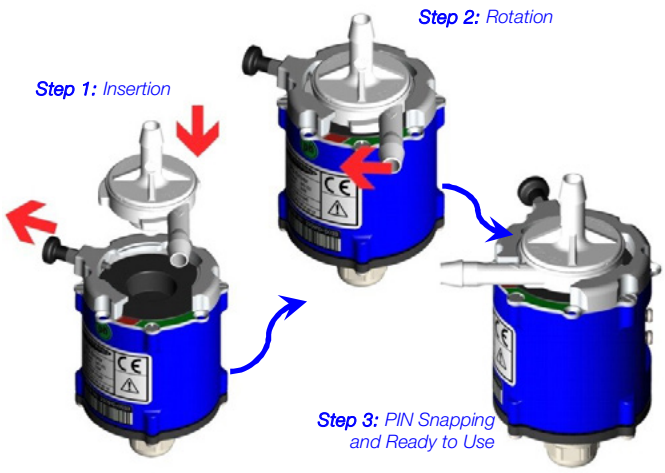

Figure 6: *Intuitive 3-step pump head mounting procedure with bayonet type socket (PHS-i30.1)*

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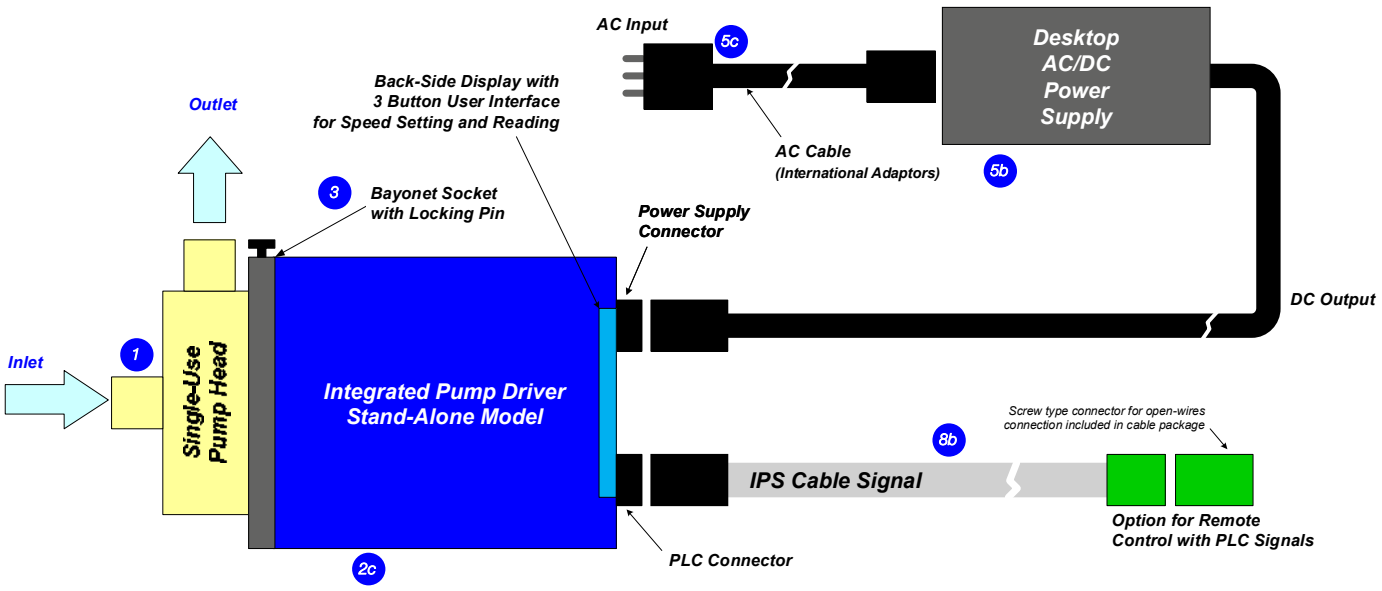

Figure 7: Standard "Stand-Alone" system configuration with main accessories
(See section "Order Information" for details to numbered components and other options)

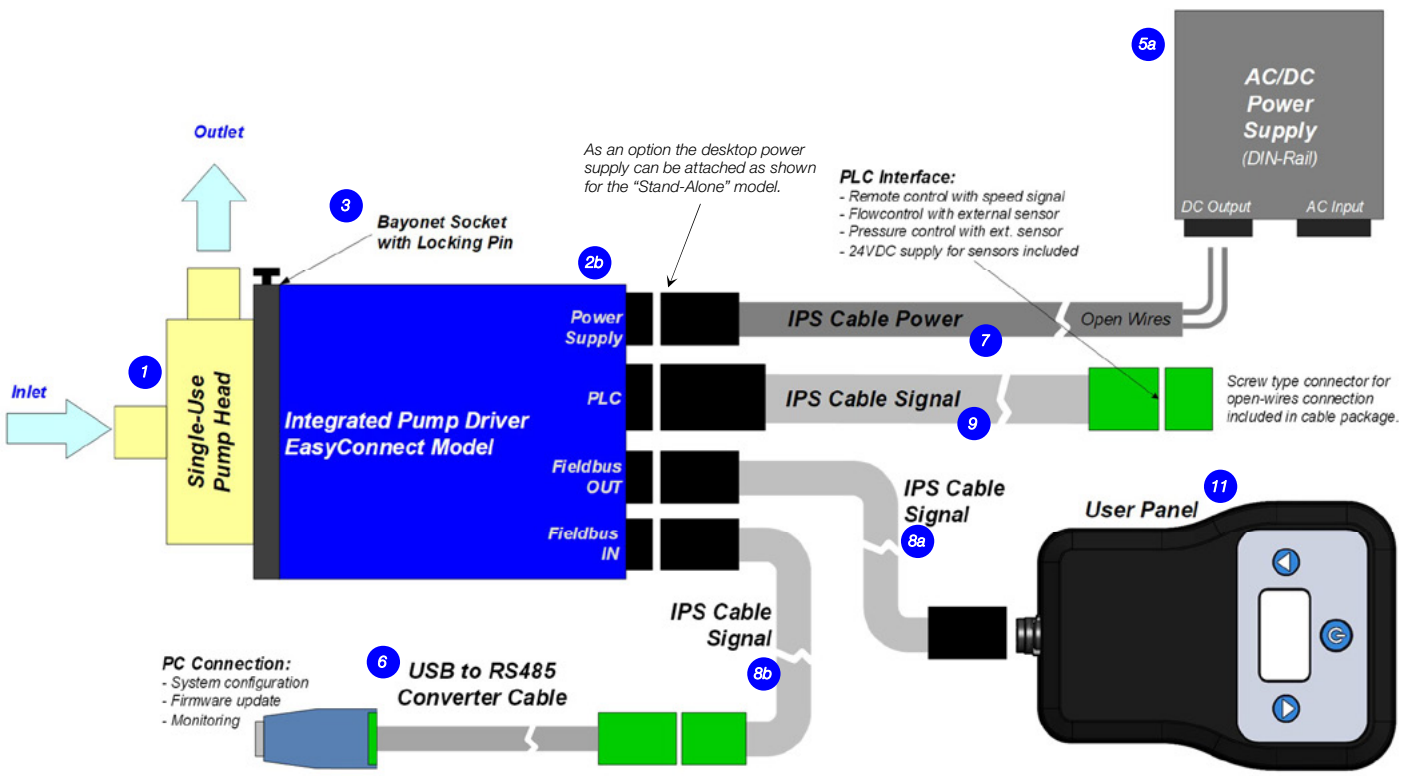

Figure 8: Standard "EasyConnect" system configuration with main accessories
(See section "Order Information" for details to numbered components and other options)

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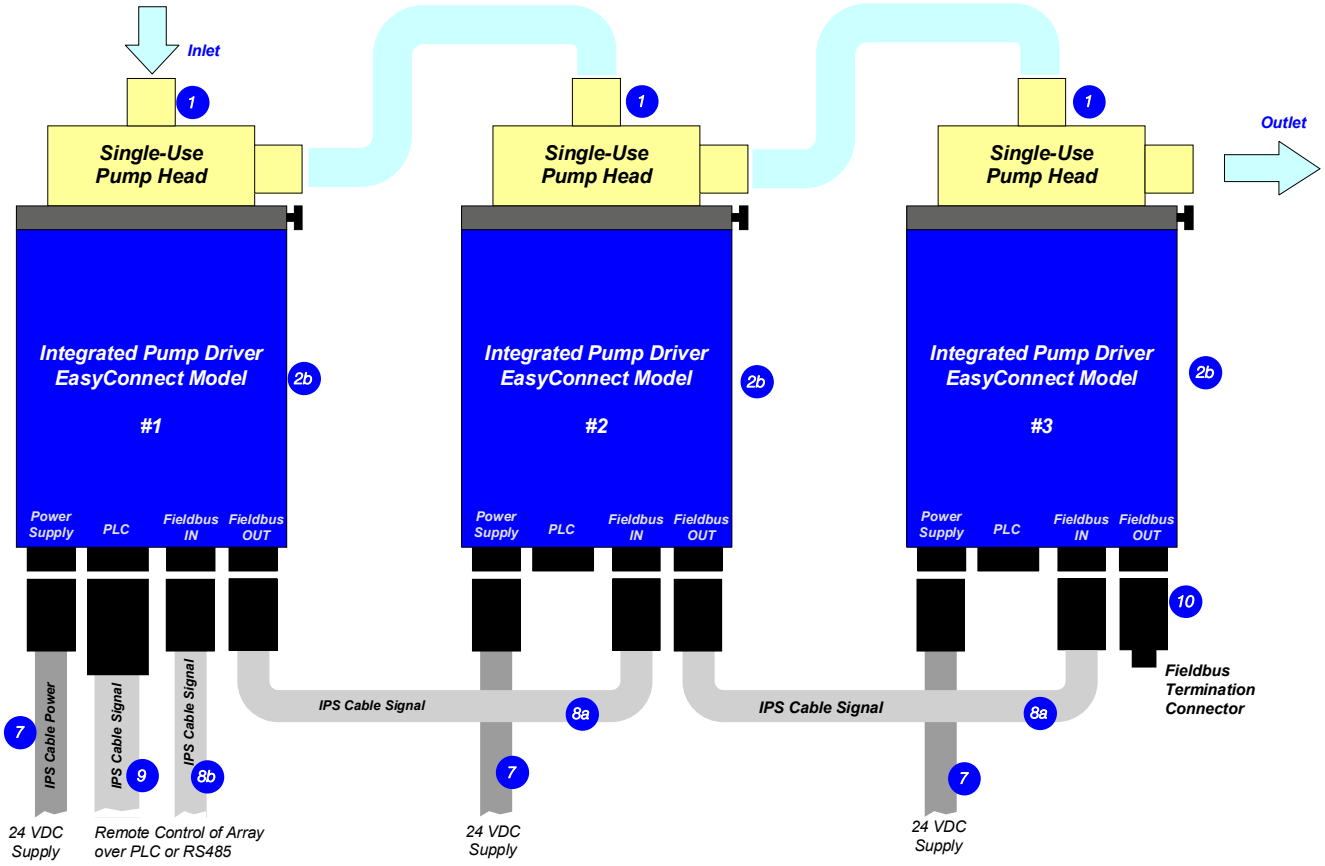

Figure 9: Serial pumping configuration with "EasyConnect" models
(See section "Order Information" for details to numbered components and other options)

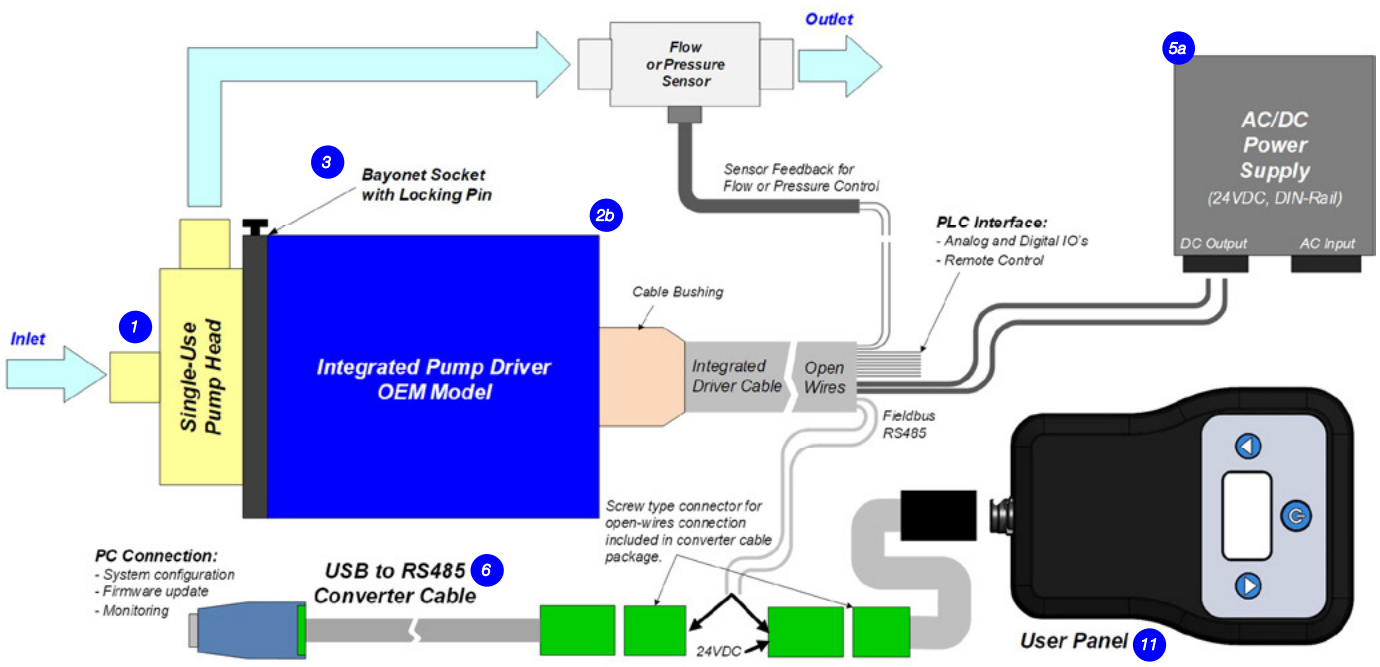

Figure 10: Standard "OEM" system configuration
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Interface	PIN Name	Description	Standard Designation	Hardware Specification
Power Supply	P+	+ 24 VDC	Supply	Voltage: 24 VDC Power: 35 W
	P-	Power Input Ground / Earth		
	NC	Not connected.	--	--
PLC 6	Ain	Analog Input (Current Input)	Remote Speed	Analog current input: 4 – 20 mA (450 Ohm shunt input, no galvanic isolation)
	Ain_GND	Analog In. GND	--	Reference for Ain
	Dout	Digital Output 1	Status	Open drain, max. 24V, 100mA Reference ground is GND
	GND	Analog Ground	--	Reference for Dout
	Din1	Digital Input 1	Enable (Reset)	Galvanic separation with optocoupler 2.2 kΩ input resistance, 5-24V for active input
	Din_COM	Com. Digi. Input	--	Reference for digital input.
Display and Buttons	--	Display	Speed and Status Display	
	--	Up/Down	Setting speed	--
	--	On/Off	Enable/Disable	--

Figure 11: *Interface specifications of standard "Stand-Alone" model*

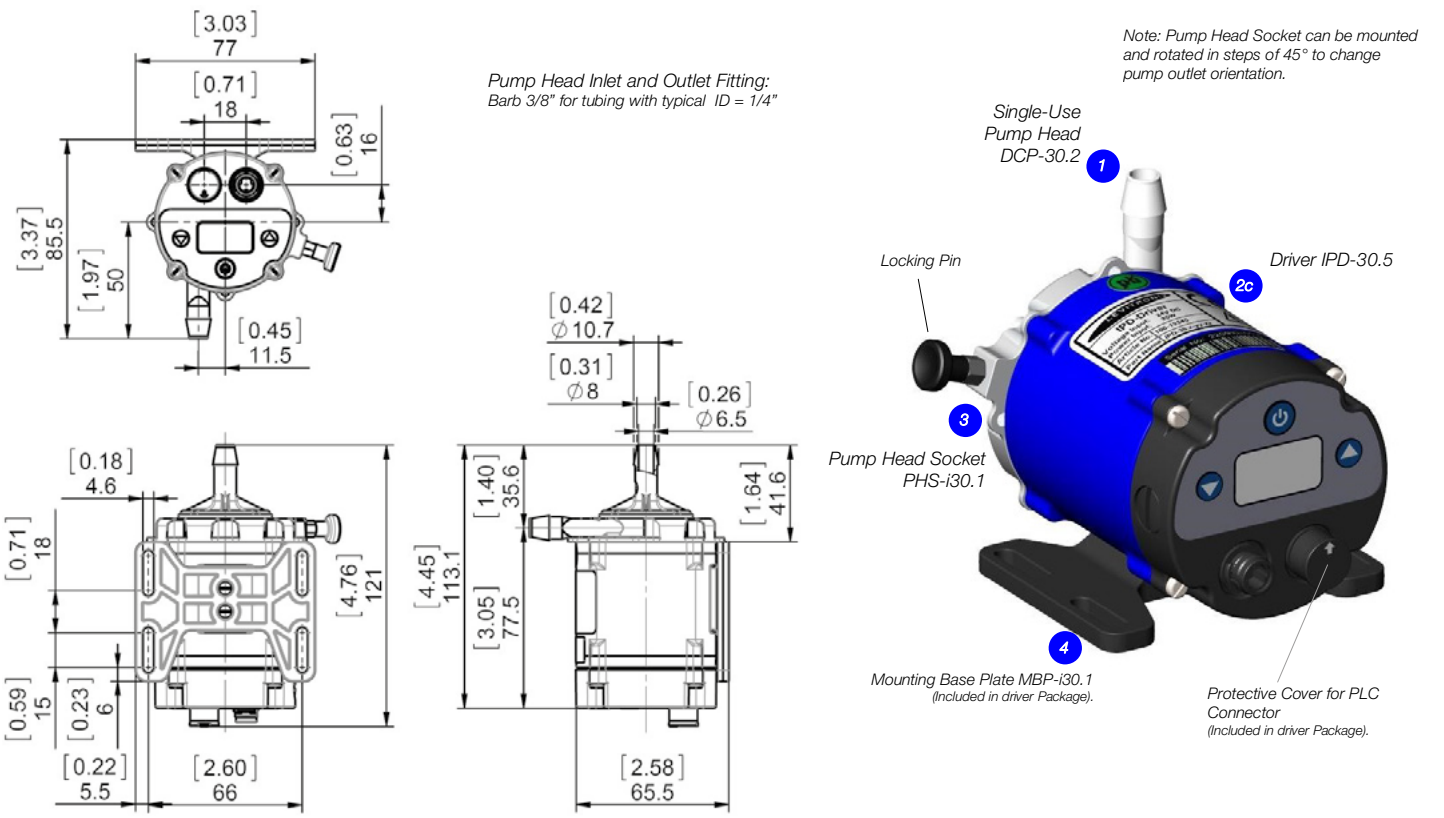

Figure 12: *Basic dimensions and description of standard "Stand-Alone" model*

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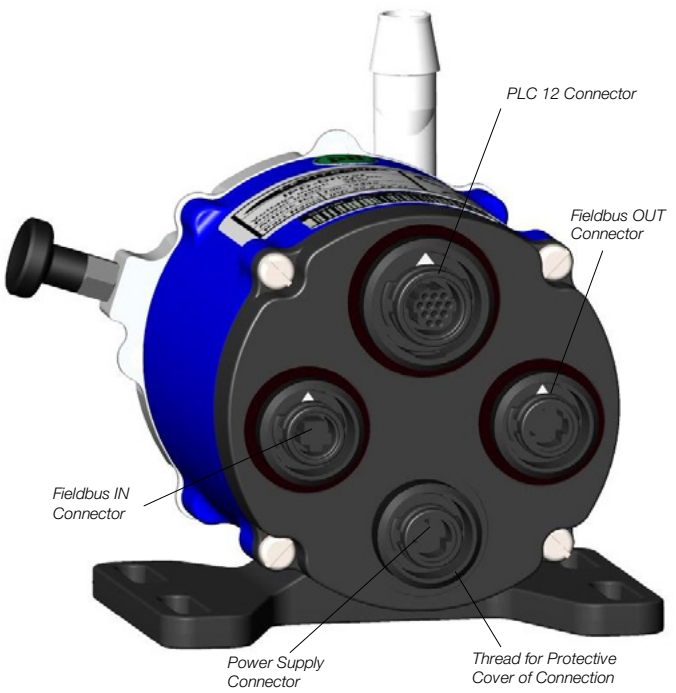

Connector	PIN Name	Description	Standard Designation	Hardware Specification
Power Supply	P+	+ 24 VDC	Supply	Voltage: 24 VDC Power: 35 W
	P-	Ground / Earth		
	NC	Not connected.	--	--
PLC 12	Dout1	Digital Output 1	Status	Open drain, max. 24V, 100mA Reference ground is GND
	Dout2	Digital Output 2	Error	
	Din1	Digital Input 1	Enable (Reset)	Galvanic separation with optocoupler 2.2 kΩ input resistance, 5-24V for active input
	Din2	Digital Input 2	Process Mode	
	Din_COM	Com. Digi. Input	--	Reference for digital input.
	Ain1	Analog Input 1 (Current Input)	Actual Process Value	Analog current input: 4 – 20 mA (450 Ohm shunt input, no galvanic isolation)
	Ain2	Analog Input 2 (Voltage Input)	Reference Value	Analog voltage input: 0 – 10V (7.9 kOhm, no galvanic isolation)
	Ain_GND	Analog In. GND	--	Reference for Ain1 and Ain2
	Aout1	Analog Output (Voltage Output)	Actual Speed	0 – 10V (no galvanic isolation) GND is reference
	GND	Analog Ground	--	Reference for Aout1, Dout1, Dout2 and Pout
	Pout	Output +24VDC	Supply Output	For supply of external devices (e.g. sensors). (Current 200mA together with Pout o Fieldbus OUT)
	NC	Not connected.	--	--
Fieldbus OUT	GND	Ground	--	Reference for Pout.
	Pout	Output +24VDC	Supply Output	For supply of external devices (user panels) (Current 200mA together with Pout of PLC 12)
	RS485+	RS485 +	Field Bus	Modbus protocol
	RS485-	RS485 -		
	Internal	Internal Bus	Do not connect	Internal bus needed to connect pumps for serial pumping.
	Internal	Internal Bus	Do not connect	
Fieldbus IN	GND	Ground	--	Connected to PLC12 GND and reference for supply
	NC	Not connected.	--	--
	RS485+	RS485 +	Field Bus	Modbus protocol
	RS485-	RS485 -		
	Internal	Internal Bus	Do not connect	Internal bus needed to connect pumps for serial pumping.
	Internal	Internal Bus	Do not connect	

Figure 13: *Interface specifications of standard "EasyConnect" model*

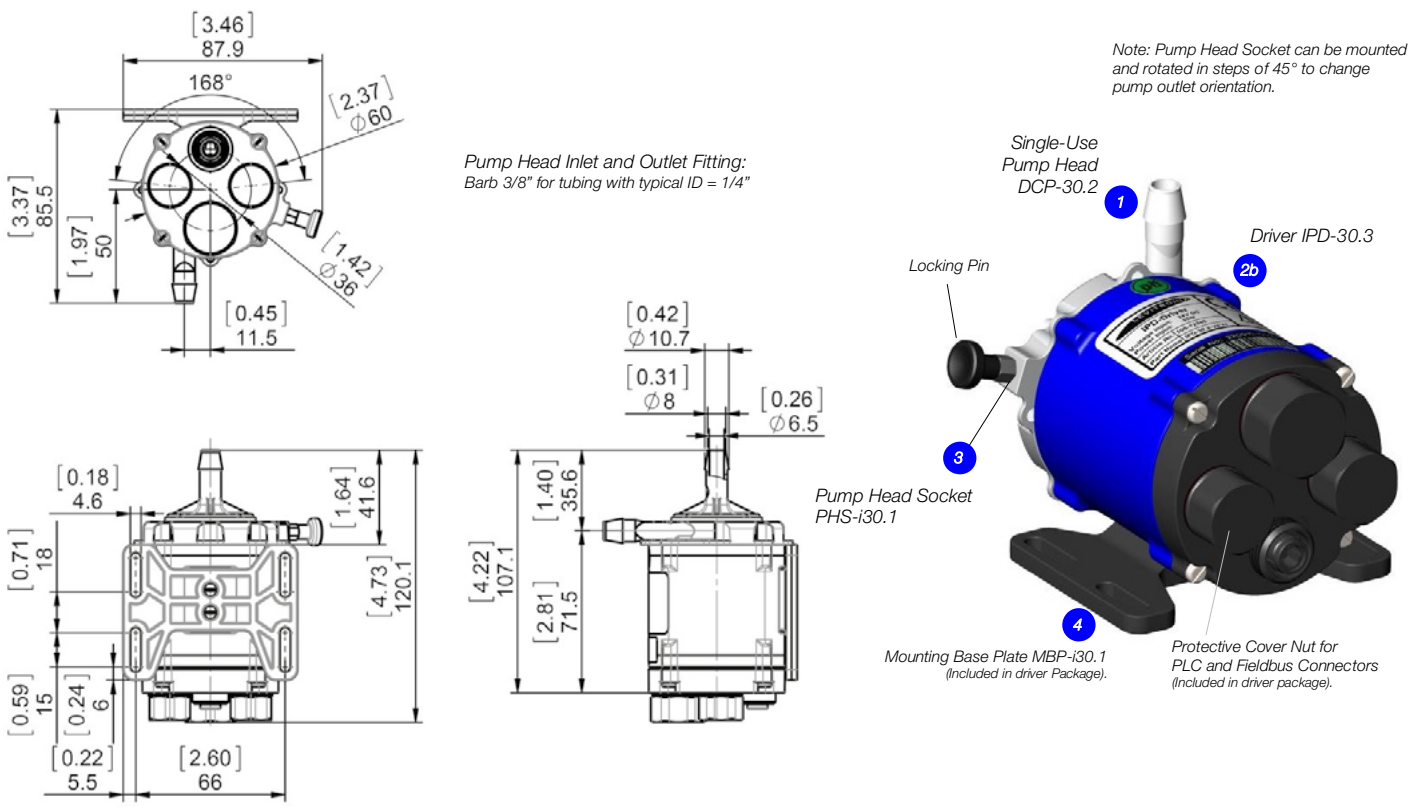

Figure 14: *Basic dimensions and description of standard "EasyConnect" model*

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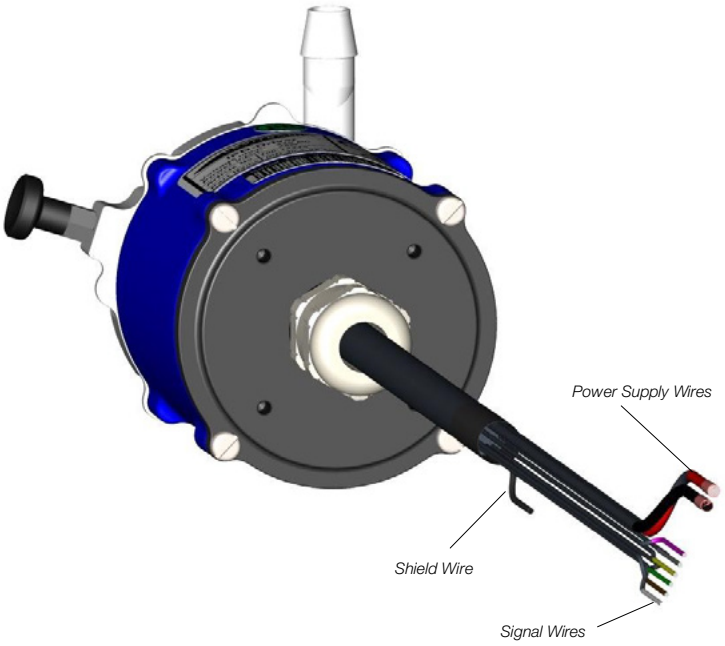

Wire Name	Description	Standard Designation	Hardware Specification
P+	+ 24 VDC	Supply	Voltage: 24 VDC P- to be connected to earth
P-	Power Input Ground / Earth		
Ain1	Analog Input 1 (Current Input)	Actual Process Value	Analog current input: 4 – 20 mA (450 Ohm shunt input, no galvanic isolation)
Ain2	Analog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

Figure 15: *Interface specifications of standard "OEM" model*

Note 1: Power supply wire cross-section is 1.5 mm² and for signal wires 0.14 mm² *Note 2: For more detailed description of interfaces consult user manual*

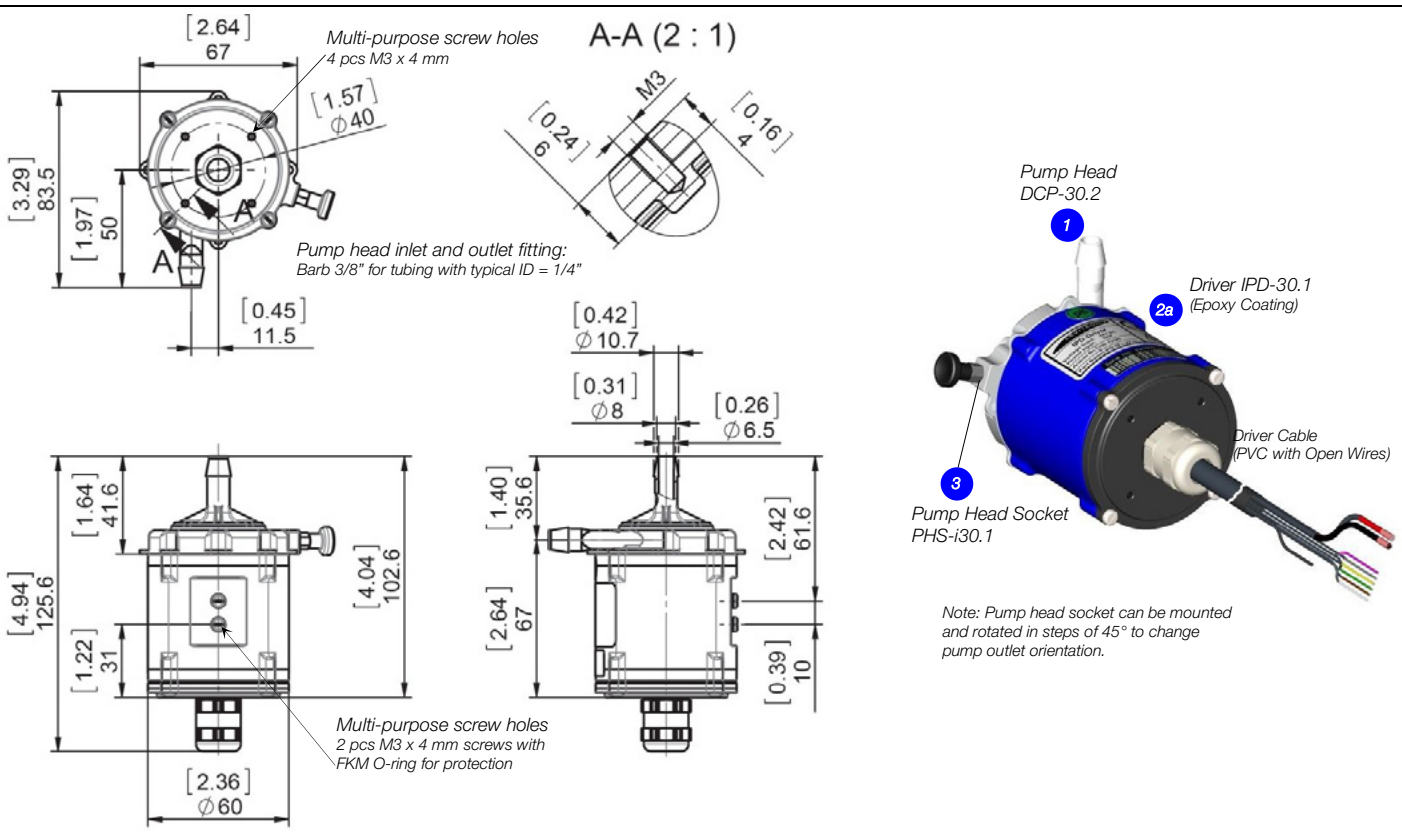

Figure 16: *Basic dimensions and description of standard "OEM" model*

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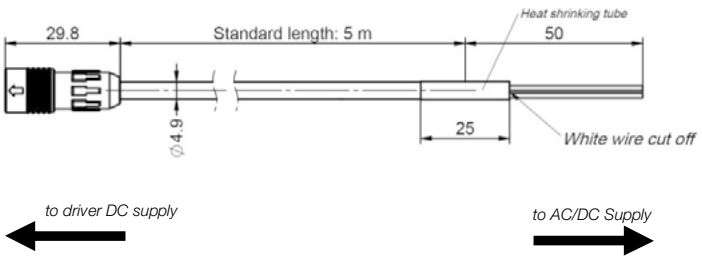
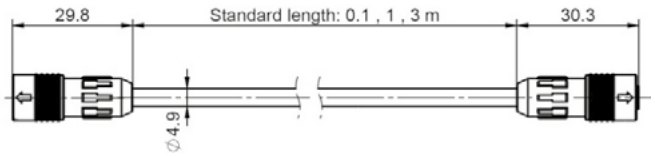
7 *IPS Cable Power ICP-1.1 (for EasyConnect and Stand-Alone drivers)*



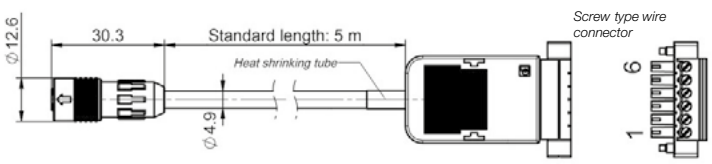
to driver DC supply — *to AC/DC Supply*

8a *IPS Cable Signal ICS-1.1 (for EasyConnect drivers)*



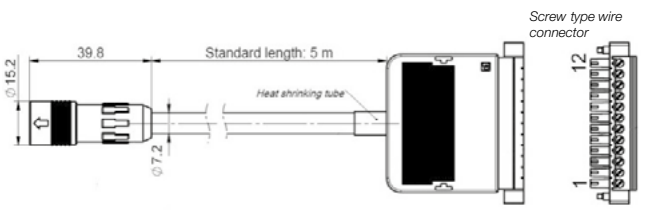
to driver fieldbus OUT — *to driver fieldbus IN*

8b *IPS Cable Signal ICS-1.2 (for EasyConnect and Stand-Alone drivers)*



EasyConnect driver: to field bus
Stand-Alone driver: to PLC — *to external interface*

9 *IPS Cable Signal ICS-2.1 (for EasyConnect drivers)*



to driver PLC — *to external PLC*

Figure 17: Basic dimensions and specifications of standard cables

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ORDER INFORMATION

System Name	Article #	Pump Head Socket	Driver	Note
PLD-i30SU.1	100-90955	PHS-i30.1	IPD-30.1-50-02	*OEM - Driver, 5 m PVC cable with open wires, pump head socket*
PLD-i30SU.2	100-91025	PHS-i30.1	IPD-30.3-02 (MBP-i30.1 included)	*EasyConnect - Driver with interface connectors, pump head socket.*
PLD-i30SU.3	100-91026	PHS-i30.1	IPD-30.5-02 (MBP-i30.1 included)	*Stand-Alone - Driver with integrated user panel, pump head socket.*

Table 1: *Standard driver system configurations*

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
1a 1b	Single-Use (SU) Pump Head	DCP-30.2 (Barb) DCP-30.1 (Triclamp)	100-90968 100-90959	Material Impeller and Pump Housing Housing Sealing In-/Outlet Fittings Max. Flow Max. Diff.-Pressure Max. Viscosity Max. Liquid Temp. Wet Pump Volume/Surface Sterilization Methods	*Polypropylene (FDA, USP Class VI, BSE/TSE/Animal free)* *Infrared welding* *Barb 3/8" or Triclamp 3/8" for tubing with typical ID = 1/4"* *7.7 liters/min / 2.0 gallons/min* *1.0 bar / 14.5 psi* *40 cP* *60 °C / 140 °F* *7.7 ml / 55.9 cm^2* *Gamma radiation up to 40kGy*
1c 1d	Irradiated SU Pump Head	DCP-30.2-G25 (Barb) DCP-30.1-G25 (Triclamp)	100-91071 100-91170	Applied Gamma Dosage	≥ 25 kGy
1e	Irradiated SU Pump Head with Sterile Fittings	DCP-30.2-SF1-G25	100-91234	Pump Type (A) / Tubing (C) Sterile Fittings (B) Fitting Compatibility Applied Gamma Dosage	*DCP-30.2 (Barb) / Silicone* *AseptiQuik® S from CPC® with part # AQS17006 [3]* *Various sizes and types including autoclavable versions available at CPC®* *≥ 25 kGy*
2a	Integrated Pump Driver ("OEM Model")	IPD-30.1-50-02	100-10088	Voltage, Power Housing Cable Interfaces Standard Firmware	*24 VDC ±10%, 35 W* *Epoxy coated Aluminum, PP for bottom lid, IP65 [1]* *PVC jacket, open wires, cable length 5 m* *PLC and RS485 with Modbus protocol (see Figure 15 for details)* *H2.48*
2b	Integrated Pump Driver ("EasyConnect" Model)	IPD-30.3-02 (MBP-i30.1 included)	100-10097	Housing Interfaces Standard Firmware	*Epoxy coated Aluminum, PP for bottom lid, IP65* *2x Fieldbus RS485 with Modbus protocol, PLC and power supply* *H2.48 [2]*
2c	Integrated Pump Driver ("Stand-Alone" Model)	IPD-30.5-02 (MBP-i30.1 included)	100-10098	Housing Interfaces Standard Firmware	*Epoxy coated Aluminum, PP for bottom lid, IP65* *User panel with 3 user buttons, PLC and power supply* *H2.25*
3	Pump Head Socket	PHS-i30.1	100-90947	Mounting Type Material Assembly Screws	*Bayonet type with locking pin* *Anodized Aluminum* *4 pcs M3 x 6 mm (Stainless Steel, INOX A4)*

Table 2: *Specification of standard components*

Note 1: Designed and tested for IP67. Note 2: Special firmware for serial pumping (see Figure 9) as one unit available on request. Note 3: CPC® and AseptiQuik® are registered marks of the Colder Product Company.

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
4	Mounting Base Plate	MBP-i30.1	190-10313	Material / Mounting Screws	*PP + 30% GF / 2 pieces, stainless steel FEP coated, M3 x 10 mm*
5a	AC/DC Power Supply	TPC 055-124 (Traco)	100-40014	Voltage Output / Input Basic Dimensions Certification or Standards	*24 VDC with 55 W / 85 – 264 VAC, 47-63 Hz* *45 x 90 x 96.5 mm (mountable on DIN rail 35 mm)* *UL, CSA, CB, Semi F47*
5b	Desktop AC/DC Power Supply	AC/DC Power Supply VEC50US24 HR30	100-40015	Voltage Output / Input Basic Dimensions Safety Approvals Note	*24VDC, 50W / 90 – 264 VAC, 47-63 Hz* *116 x 52 x 31 mm* *IEC60950-1, EN60950-1, UL/cUL60950-1* *Connector for direct connection to power supply of driver with cable length 1.2m.*
5c	AC Mains Cables (for Desktop power supply 5b)	AMC-1.1 (2m) AMC-1.2 (2.5m) AMC-1.3 (2.5m) AMC-1.4 (2.5m) AMC-1.5 (2.5m)	190-10331 190-10332 190-10333 190-10334 190-10335	Approvals and Country Approvals and Country Approvals and Country Approvals and Country Approvals and Country Cable Specifications	*UL, cUL, US, Canada* *CB, Germany, Denmark, Norway, Finland, Belgium, Netherland, Sweden, Austria* *PSE, Japan* *Switzerland* *CE, United Kingdom* *Black color, ROHS*
6	USB to RS485 Adaptor-TR Isolated	YN-485I-TR	100-30392	Structure/Design Purpose	*USB connector (A) with termination resistor and cable (2m) with connector pair (B and C) for external RS485 wire connection. Magnetically isolated. Cable length is 2m. Included is a USB space saver cable (D).* *Communication over fieldbus of driver with PC*
7	IPS Cable Power 3 Wires	ICP-1.1-50 (5 m)	190-10342	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 3x 0.5 mm^2 (only 2 wires used, 1 is cut)* *Open wires / Circular Hirose type to driver* *Connection of power supply to "Stand-Alone" and "EasyConnect" drivers*
8a	IPS Cable Signal 6 Wires	ICS-1.1-01 (0.1 m) ICS-1.1-10 (1 m) ICS-1.1-30 (3 m)	190-10343 190-10344 190-10345	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 6x 0.08 mm^2 and shielding* *Circular Hirose type / Circular Hirose type* *Fieldbus connection between "EasyConnect" drivers (e.g. multi-pump arrays)*
8b	IPS Cable Signal 6 Wires	ICS-1.2-50 (5 m)	190-10346	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 6x 0.08 mm^2 and shielding* *Connector with screw type plug for open wire connection / Circular Hirose type* *Fieldbus connection to "EasyConnect" drivers and to PLC of "Stand-Alone" drivers.*
9	IPS Cable Signal 12 Wires	ICS-2.1-50 (5 m)	190-10347	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 12x 0.14 mm^2 and shielding* *Connector with screw type plug for open wire connection / Circular Hirose type* *General connection to PLC of "EasyConnect" drivers.*
10	Fieldbus Termination Connector	FTC-1.1	190-10348	Materials Main Purpose	*PPS for connector housing and FPM for sealing.* *Termination of fieldbus.*
11	User Panel	LUI-B.1-01	100-30448	Interface / Housing Rating Standard Firmware	*RS485 / IP65* *A3.00*

Table 3: *Specification of accessories*

Note 1: Designed and tested for IP67.

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Figure 18: Pump systems with standard components

Figure 19: General standard accessories

Figure 20: Standard cables

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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 Life Science 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.

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