ARMSTRONG

AGE4 variable speed circulator

AGE4(D)

Installation and operating instructions

AGE4(D)

EN   Installation and operating manual

EN: Compliance of the product with EU standards:
- Machinery directive (2006/42/EC).
  Standard used: EN 809;
- Low Voltage (2014/35/EU).
  Standard used: EN 60335-1; EN 60335-2-51;
- Electromagnetic compatibility (2014/30/EU)
  Standard used: EN 55014-1; EN 55014-2; EN 61000-3-2; EN 61000-3-3;
- Ecodesign Directive (2009/125/EC)
  Standard used: EN 16297-1:2012;
- Circulators: Commission Regulation No. 641/2009.
  For EEI see nameplate.
  Standard used: EN 16297-1:2012; EN 16297-2:2012;

English (EN) Installation and operating manual

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Pump curves are on the end of the manual.

Subject to alterations!

Symbols used in this manual:

Warning:

Safety precautions which, if ignored could cause personal injury or machinery damage

Notes:
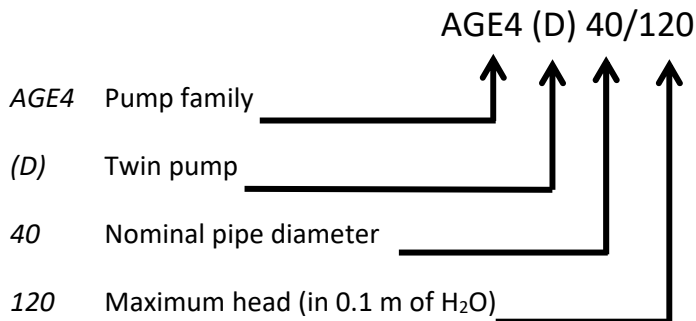
Tips that could ease pump handling.

1 GENERAL INFORMATION

1.1 USES

The AGE4 circulating pumps are used for the transfer of liquid medium within systems for hot-water heating, air-conditioning and ventilation. They are designed as single or twin variable-speed pumping aggregates where the speed is regulated by electronic device. The pump constantly measures pressure and flow and adjusts the speed according to the set pump mode.

The main purpose of the twin pump is uninterrupted operation if one of the pumps fails. Common hydraulic housing is equipped with a change-over flap and two pump heads, separately connected to the electrical grid.

1.2 PUMP LABELING

<div align="center">AGE4 (D) 40/120</div>

AGE4	Pump family
(D)	Twin pump
40	Nominal pipe diameter
120	Maximum head (in 0.1 m of H_2O)

1.3 PUMP MAINTENANCE, SPARE PARTS AND DECOMMISSIONING

Pumps are designed to operate without maintenance for several years. Spare parts will be available for at least 3 years from the warranty period expiration. This product and its components must be disposed of in an environmentally friendly manner. Use waste collection services, if this is not possible, contact the nearest ARMSTRONG Pumps Service or authorized repairers.

2 SAFETY

These instructions should be studied carefully before installing or operating the pump. They are meant to help you with installation, use and maintenance and to increase your safety. Installation should only be performed with regards to local standards and directives. Only qualified personnel should maintain and service these products.

Failure in following these instructions can cause damage to the user or product and can void warranty. Safety functions are only guaranteed if the pump is installed, used and maintained as described in this manual.

3   TEHNICAL SPECIFICATIONS

3.1   STANDARDS AND PROTECTIONS

Pumps are made in according to the following standards and protections:

Protection class:	Insulation class:	Motor protection:
IP44	F	Thermal - built in

Installation specification		
Pump type	Nominal pressure	Fitting length [mm]
AGE4 25-60		180
AGE4 25-100		180
AGE4 25-120		180
AGE4 30-60		180
AGE4 30-100	Common hydraulics PN6 and PN10	180
AGE4 30-120		180
AGE4 25-60Z		180
AGE4 25-100Z	Common hydraulics PN6 and PN10	180
AGE4 25-120Z		180
AGE4 30-60Z		180
AGE4 30-100Z		180
AGE4 30-120Z		180
AGE4D 30-60		180
AGE4D 30-100		180

3.2   PUMP MEDIUM

Pump medium can be pure water or a mixture of pure water and glycol, which is appropriate for central heating system. Water must meet water quality standard VDI 2035. The medium must be free from aggressive or explosive additives, free from mixtures of mineral oils and solid or fibrous particles. The pump should not be used for pumping flammable, explosive media and in an explosive atmosphere.

AGE4 is designed exclusively for pumping sanitary water.

Permanent magnet rotor inside the pump is prone to accumulating magnetic particles (magnetite) on its surface, which can lead to abrasion of bearings and rotor can or even blocking the rotor. Although the pump is built in a way that the effect of magnetic particles is minimal, failures of bearings, rotor cans and blocked rotors are not a subject of claims.

To improve pump resistance to magnetite we recommend the use of magnetite filter.

3.3 TEMPERATURES AND AMBIENT HUMIDITY

Permitted ambient and media temperature:			
Ambient temperature [°C]	Medium temperature [°C]		Relative ambient humidity
	min.	max.	
Up to 25	2	110	
30	2	100	
35	2	90	< 95 %
40	2	80	

- Medium temperature should be higher or the same as ambient temperature, so that the condensate does not gather on pump surface.

- Operation outside recommended conditions may shorten pump lifetime and void the warranty.
- For AGE4 , the maximum ambient temperature is 40°C, and the temperature range of the medium is from +2°C to +65°C.

3.4 ELECTRICAL SPECIFICATION

3.4.1 POWER SUPPLY

Electrical properties				
Pump	Rated voltage	Rated power [W]	Rated current (I_{max}) [A]	Startup
AGE4 xx/60	230 VAC ± 15 %, 47-63 Hz Pumps can operate at reduced voltage with limited power ($P = I_{max} \cdot U$)	90	0,75	Build-in startup circuit
AGE4 xx/100		180	1,5	
AGE4 xx/120		180	1,55	

3.4.2 ELECTRICAL SPECIFICATIONS OF INPUTS, OUTPUTS AND COMMUNICATION

To see inputs, outputs and communication functions see chapter 5 Setup and operation. Not all functions are available in all versions!

3.4.2.1 DIGITAL INPUT (RUN, 0V)

Electrical properties	
Max. resistance of the closed loop	100 Ω

- Only potential-free contact can be connected to this input.

3.4.2.2 ANALOG INPUTS AND OUTPUTS (SET1, SET2, SET3)

Connections can be used either as inputs or outputs, depending on how we set it. Pump has 3 connectors: SET1, SET2 and SET3.

Electrical properties		
Input voltage	−1 - 32 VDC	When used as input.
Output voltage	0 – 12 VDC	When used as an output. Max. 5 mA load on individual output.
Input impedance	Module U: ~ 50 kΩ	Open circuit detection – max source output impedance < 50 kΩ
	Module C: ~ 100 kΩ	0.5 mA additional load for most configurations.
Input sink current	0 – 33 mA	Common sink on COM, if used as output.
Galvanic isolation		Voltage 4 kV up to 1 s, 275 V permanent.

3.4.2.3 RELAY OUTPUT

Electrical properties	
Rated current	3 A
Maximum voltage	250 VAC, 30 VDC
Maximum power	300 VA

3.4.2.4 ETHERNET

Electrical properties		
Connector	RJ-45, 10BASE-T, 10 Mbit/s.	
Services	-Web server (port 80) -Software update through web interface. - Modbusa RTU through TCP/IP	
Default IP address	192.168.0.245 (192.168.0.246 for right pump)	
Ethernet visual diagnostics	LED1	Slowly blinking if module is on. Lights up when the connection is established.
	LED2	

3.4.2.5 MODBUS

Modbus specification		
Data protocol	Modbus RTU	
Modbus connector	Screwless terminals	2+1 pins.
Modbus connection type	RS-485	
Modbus wire configuration	Two-wire + common	Conductors: A, B and COM (Common).
Communication transceiver	Integrated, 1/8 of standard load	Connect either via passive taps or daisy chain.
Maximum cable length	1200 m	
Slave address	1-247	Default is 245, settable over Modbus.
Line termination	Not present	Line termination is not integrated. For low speed/short distance, termination can be omitted. Otherwise, terminate the line externally on both ends.
Supported transmission speeds	1200, 2400, 4800, 9600, 19200, 38400 baud	Settable over Modbus register [default=19200].
Start bit	1	Fixed.
Data bits	8	Fixed.
Stop bits	1 or 2	1 stop bit minimum, up to 2 when parity not enabled [default=1]
Parity bit	Even/odd/none	[default=Even]
Modbus visual diagnostics	LED2	Flashing yellow when data reception detected. Combined (OR) with Ethernet ACT function.
Maximum number of Modbus devices	247	Limited by possible Modbus addresses to 247. 1/8 nominal load enables 256 devices.
Maximum Modbus packet size	256 bytes	Including address (1) and CRC (2) bytes.
Isolation	Common ground (COM) with SET1, SET2 and SET3.	Modbus shares common ground with other signals.

4   PUMP INSTALLATION

4.1   INSTALLATION INTO PIPE LINES

The pump must be installed into pipe lines with its electromotor axis in horizontal position (figure 1) and in one of the allowed positions (figure 2). Direction arrow on hydraulic housing shows direction of water flow. For pump to operate with minimal vibrations and noise, it is recommended to install pump in part of the pipe line without curves for at least 5 D (D = rated pipe diameter) from both side of hydraulic housing.

Pump with suffix F is designed to be built with connecting flanges, using all screws. The connecting flanges are designed so the pump can be installed in PN6 or PN10 nominal pressure pipelines. Because of the combined flange design, washers must be used on the pump side, when installing the pump.

Desired head orientation can be achieved by rotating the pump head according to the hydraulic housing (**Picture 3**). If the pump is already in the system with medium, it is necessary to first close valves before and after the pump, to rotate the head. Unscrewing four screws which hold the head attached to the hydraulic housing makes rotating possible. Before fixing head back on, pay special attention to the position of seal between hydraulic housing and head of the pump.

Ambient around the pump should be dry and illuminated as appropriate and the pump should not be in direct contact with any objects. Pump seals prevents dust and particles from entering as prescribed by IP class. Make sure that the distribution box cover is mounted and that the cable glands are tightened and are sealing.
Pump will provide the longest lifetime with ambient at room temperature and moderate medium temperature. Prolonged operation at elevated temperatures could increase wear. Aging is accelerated by high power and high temperatures.

Before first run of the pump, the system must be filed with medium and evacuated. Pump must have pressure on the suction side to operate properly. On the first run it is possible for the pump to make noise until it is automatically evacuated.

- Misconnection or overload could cause pump shutdown or even permanent damage.

- Pumps might be heavy. Provide yourself help if needed.
- Pump must not be used in the safety pipelines.
- Pump should not be used as a holder during welding!
- When reassembling, care should be taken to ensure seal fit. Failing that, water could cause damage to pumps internal parts.
- Drains between pump motor housing and hydraulic housing must be left free (should not be thermally insulated), as it could interfere with cooling and condense drainage (figure 1).
- Hot medium can cause burns! The motor can also reach temperatures that could cause injury.

4.2   ELECTRICAL INSTALLATION

Electrical connection is done with connector supplied with the pump.

Markings	Descriptions
L	230 VAC, electric power supply
N	
PE	Safety ground

The pump has a built-in over current fuse and protection, temperature protection and basic overvoltage protection. It doesn't need an additional thermal protection switch. Connection leads should be capable of carrying rated power and should be properly fused. Ground lead connection is essential for safety. It should be connected first. Grounding is only meant for pump safety. Pipes should be grounded separately.

- Connection of the pump must be carried out by qualified personnel,
- Connection of the connecting cable must be done in a manner that ensures it is never in contact with the casing of the device, due to the high temperatures of the casing,

4.3   CONNECTION INSTRUCTION

4.3.1   DIGITAL/ANALOG INPUTS/OUTPUTS, RELAY OUTPUT, MODBUS (RS-485)

Electrical properties	
Cross section	0,33 – 2,08 mm^2 (14 – 22 AWG)
Strip length	7,5 – 8,5 mm

More on figure 4.

4.3.2   ETHERNET, MODBUS

5 SETUP AND OPERATION

5.1 CONTROL AND FUNCTIONS

All pumps feature:
- Display panel - it controls and overviews pump modes, parameters and on/off status.

Variant **AGE4(D)** features:
- Digital input RUN – to start/stop the pump.
- Relay output - signalizes pumps status.

Variant **AGE4(D)** features:
- Digital inputs: RUN – to start/stop the pump, MAX to run pump at maximum head or maximum speed (Input MAX works only in combination with input RUN – look at priorities!), MIN to run pump at minimum head or minimum speed.
- 0-10 V analog input for changing reference point.
- Two relay outputs - signalizes pumps status.

Variant **AGE4(D)** features:
- 10-step switch - it allows us to change relay output, analog inputs/outputs and resetting the pumps communication configuration.
- Analog inputs - gives us control over the pump (start, stop, MAX II. curve, min. curve, 0 – 10 V, 4 – 20 mA,…).
- Analog outputs - are used for getting analog information about the pump's performance (errors, speed, mode, flow, height).
- Relay output - signalizes pumps status.
- Ethernet connection - offers control over all pump functions and settings (pumps variables, digital inputs, error overview).
- Modbus connection - gives us the overview of all parameters and settings (pumps variables, analog inputs/outputs, error overview).

Several signals will influence the pump operation. For this reason, settings have different priorities as shown in the table below. If two or more functions are active at the same time, the one with highest priority will take precedence.

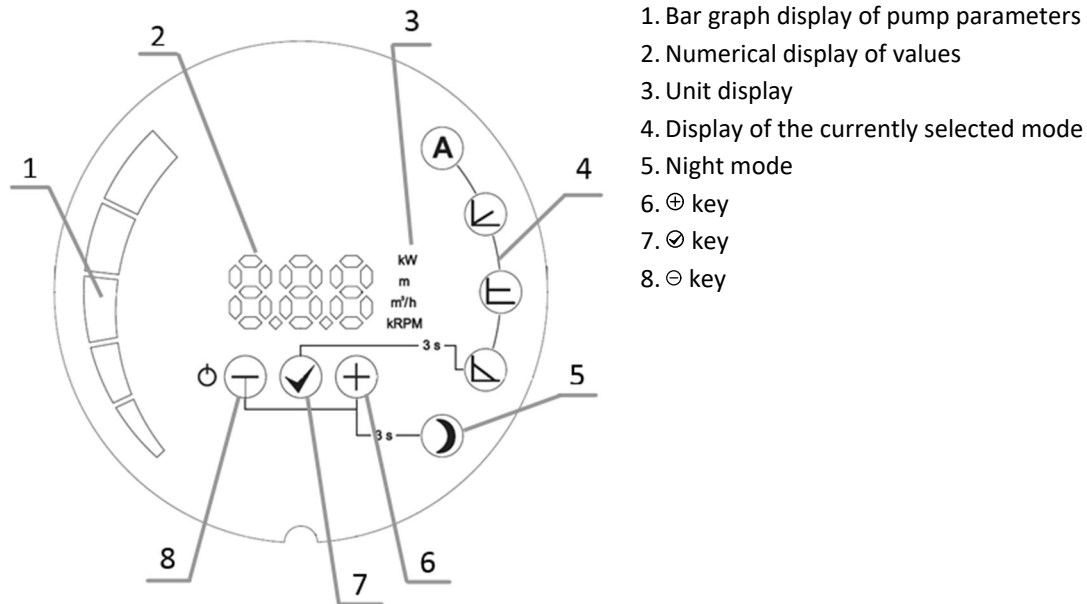| Priority	Pump control panel and Ethernet settings	External signals[1]	Modbus control
1	Stop (OFF)		
2	Active night mode[2]		
3	Max. speed (Hi)		
4		Minimal curve	
5		Stop (RUN not active)	
6		Max. speed (Hi)[3]	Stop
7			Reference point
8		Reference point	
9	Reference point		

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[1] All inputs are not available in every mode of operation.
[2] In night mode the external signals and Modbus stop signal become active. Due to the possibility of confusion we do not recommend using the night mode while using external signals.
[3] Not available if using Modbus communication.

5.1.1   DISPLAY PANEL

With the use of the display panel, you can control and overview pump modes, on/off control, pump parameters and errors. To see how pump modes work, see chapter 5.2 Operation.

1. Bar graph display of pump parameters
2. Numerical display of values
3. Unit display
4. Display of the currently selected mode
5. Night mode
6. ⊕ key
7. ⊘ key
8. ⊖ key

5.1.1.1   KEY FUNCTIONS

⊖ Key

Short press:
- Scrolling through parameters downwards when not changing parameter values,
- scrolling through modes downwards when mode selection is selected,
- changing parameters downwards when setting parameter values.

Long press:
- 3 seconds together with ⊕ turns on night mode,
- 3 seconds together with ⊘ locks pumps current operation,
- 5 seconds to turn off pump,
- 5 seconds together with ⊘ and ⊕ keys to restore pump to factory settings.

⊘ Key

Short press:
- To confirm currently selected values of both mode and parameter.

Long press:
- 3 seconds to trigger mode selection,
- 3 seconds together with ⊖ locks pumps current operation,
- 5 seconds together with long press on ⊖ and ⊕ keys to restore pump to factory settings.

$\oplus$ Key

Short press:

- Scrolling through parameters upwards when not changing parameter values,
- scrolling through modes upwards when mode selection is selected,
- changing parameters upwards when setting parameter values.

Long press:

- 3 seconds together with $\ominus$ puts us in night mode,
- 5 seconds together with $\ominus$ and $\oslash$ keys to restore pump to factory settings.

5.1.1.2 TURNING ON AND OFF

On first start up the pump will operate with factory settings in automatic mode.

With subsequent start-ups, the pump will operate with the last settings that were set prior to its shut-down.

To switch the pump off, press and hold the $\ominus$ key for 5 seconds, until OFF is shown on the display. When the pump is switched off, the numerical display shows OFF.

To turn the pump on, press the $\ominus$ key briefly.

5.1.1.3 PUMP MODES AND PARAMETERS

For transition between modes, we hold the $\oslash$ key for 3 seconds and then select the mode in which we wish the pump to operate with $\oplus$ or $\ominus$ keys. We confirm the selection with the $\oslash$ key.
After confirming the mode, the parameter, which can be set, will automatically be displayed and blink (except for auto mode). If necessary, we set the parameter value with $\oplus$ and $\ominus$ keys, then confirm the setting with the $\oslash$ key or just press the $\oslash$ key to accept the given parameter.
We can scroll through the parameters within a mode with $\oplus$ and $\ominus$ keys. We select the parameter that can be adjusted (see individual mode) in the mode with the $\oslash$ key and set the desired value with $\oplus$ and $\ominus$ keys. We confirm the selected value with the $\oslash$ key.
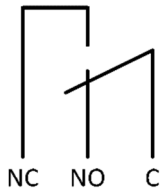
5.1.1.4 PUMP OPERATION LOCK

For locking and unlocking pump current pump mode and parameters, hold $\ominus$ and $\oslash$ keys for 3 seconds. When the pump is locked, it is possible to turn the pump on and off, view parameters and reset the pump to factory settings that also unlocks the pump.

5.1.2   RELAY OUTPUT

Relay output configuration is only possible in variant AGE4(D).

Configuration	S module	U module	C module	Function description
Fault (error)		Default for Relay 2	Default for Relay 2	The relay is in active position only when the pump is powered up and an error is present.
Ready	Default	Default for Relay 1	Default for Relay 1	The relay is in active position when the pump is powered up and no error is present. If an error occurs, relay will deactivate.
Run				The relay is in active position when the pump is powered up and running. If the pump is stopped or an error occurs, relay will deactivate.
No function				Relay is always in deactivated position.
Always on				Relay in active position

Active relay position	Deactivated relay position

NC   NO   C   NC   NO   C

5.1.3   DIGITAL INPUT

Inputs	Function description
RUN	Connecting input RUN to COM/0V – pump starts.
MAX	Connecting input MAX to COM/0V - pump runs on maximum head or maximum speed.
MIN	Connecting input MIN to COM/0V runs - pump runs on minimum head or minimum speed.

- Input MAX is enabled only when RUN is connected– check priorities.
- Inputs MAX and MIN are disabled in duplex mode.

5.1.4   ANALOG INPUT/OUTPUT (SET1, SET2, SET3)

Only available in variants AGE4(D).
U variant pumps have one analog input 0-10V input:

Input/Output	Function description
+	Contacts for analog input – characteristic:
-	0V-1V=OFF 1V-2V=Hysteresis 2V-3V=minimum height or minimum speed 3V-10V=linear to maximum head or maximum speed - Maximum output resistance of analog power supply < 5kΩ

Input/Output	Function	Function description
SET1	Run **[Default - Mode 1]**	Turning the pump on/off. By default activating with connection to SET3.
SET2	MAX II/Min **[Default - Mode 1]**	Set the pump to MAX II. settings when SET1 is active and to min. settings when SET1 is inactive.
SET3	FB **[Default - Mode 1]**	10 V voltage output used for activating SET 1 and SET2 by connecting them to SET3.

5.1.5   10-STEP SWITCH

There is a mode selection rotary switch in the terminal box. It can be rotated by gently inserting a screwdriver into the arrow mark on top and rotating the switch to desired value.

Switch setting is used when the pump turns on! More details about different modes can be found in communications manual.

Mode switch position	Function	Description
0	Free configuration	Terminal functions are configured over Ethernet interface.
1	Mode 1	SET1 = RUN input SET2 = MAX input SET3 = FB (10.5 V) output, used to supply RUN and MAX inputs. External voltage source can also be used. RS-485 = Modbus interface.
2	Mode 2	SET1 = RUN input SET2 = SPEED input SET3 = FB (10.5 V) output, used to supply RUN and MAX inputs. External 5-24 V voltage source can also be used. RS-485 = Modbus interface
3..5	Reserved	Reserved for future or customer specific use.
6	Show relay configuration	LED1 and LED2 will show relay configuration.
7	Change relay configuration	Relay configuration will be increased (0->1, 1->2, 2->0) when electricity is turned on. LED1 and LED2 will show current relay configuration.
8	Twin reset to factory	Same as Mode 9, with exception of: module IP address is set to 192.168.0.246 Twin IP address is set to 192.168.0.245
9	Reset to factory	This mode will set communication interface to default values. Main purpose is to restore default settings. **NOTE:** • Disconnect any SET1, SET2 and SET3 connections when using this mode to prevent possible harm to controller. SET1, SET2, SET3 will output test voltages of 10 V, 7 V and 5 V respectively. RS-485 port is actively driven. Relay will cycle. This is used for testing purposes. • It is recommended that all module wires are disconnected to prevent possible harm to external controllers.

5.1.6 ETHERNET

The pump has a built-in web server which allows you to access your pump directly via an existing Ethernet connection. The default address for access to the pump is "AGE4pump /" or 192.168.0.245/

The web server uses HTML pages to set/view:
- Regulation mode settings,
- regulation parameters (power, RPM, head, flow),
- relay settings,
- external control inputs settings,
- current and previews error,
- pump statistics (power consumption, run time and other).

5.1.7 MODBUS

Pump has built in Modbus client, through which we can access pump information using the RS 485 standard or ETHERNET (TCP/IP).

Modbus allows us to set and view:
- Regulation mode settings,
- regulation parameters (power, RPM, head, flow),
- relay settings,
- external control inputs settings,
- current and previews error,
- pump statistics (power consumption, run time and other).

5.1.8 RESETTING PUMP TO FACTORY SETTINGS

For resetting the pump to factory settings all three buttons must be held for 5 seconds. This way the pump will set itself to automatic mode, delete previous height and power settings and unlock setting pump operation (if locked).

Resetting of communications module needs following steps:
1. Disconnecting power from pump,
2. set the 10-step switch to number 9[4] (or 8 for left twin pump),
3. turning the pump on and off again,
4. setting the 10-step switch to number 1,
5. turning the pump on.

Communications module should now be set to factory settings.

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[4] This also sets up the right twin pump.

The pump can operate in 5 different modes. We can set the pump in the most appropriate mode, depending on the system where the pump operates.
The pump modes:

- Automatic mode (factory default),
- proportional pressure,
- constant pressure,
- constant speed,
- combined mode (all mode indicators are off).

Ⓐ Automatic mode
In automatic mode the pump automatically sets the operating pressure, depending on the hydraulic system. By doing so, the pump finds the optimal operating position.
This mode is recommended in most systems.
The parameters cannot be set; they can only be scrolled through.

Proportional pressure
The pump maintains the pressure with relation to the current flow. The pressure is equal to the set pressure (Hset on the drawing) at maximum power; at 0 flow it is equal to HQ % (default 50%, HQ % can be set on the pump webpage) of the set pressure. In between, the pressure changes linearly, relative to the flow.
In regulated mode we can only set the pump pressure (Hset on the drawing). We can only scroll through the other parameters.
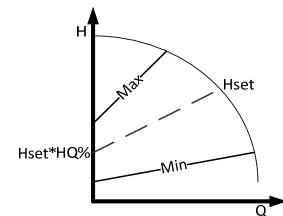
Constant pressure
The pump maintains the currently set pressure (Hset on the drawing), from 0 flow to maximum power, where the pressure begins to drop.
At constant pressure, we can only set the pressure (Hset on the drawing) which the pump will maintain. We can only scroll through the other parameters.
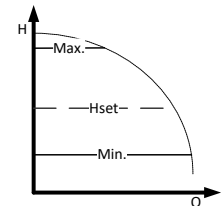
Constant speed
The pump operates with the currently set speed (RPMset on the drawing).
In the unregulated mode, we can only set the speed at which the pump will operate. We can only scroll through the other parameters.
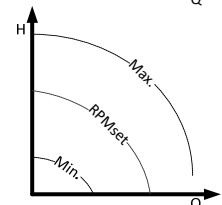
Combined mode

Multiple limits can be set only over the web interface. None of the other modes are on.

☾ Night mode
When the pump is operating in night mode, it automatically switches between the current mode and night mode. Switch occurs based on the temperature of the medium. While in night mode its icon is turned on and the pump operates in chosen mode. If the pump senses drop in temperature of the medium for 15 -20 °C (in time frame of 2 hours), icon starts to blink and the pump switches to night mode. When the temperature of the medium rises, blinking stops and the pump goes back to previously chosen operation mode.

Night mode can only work in compliment to other modes and is not a mode that can run by itself.

5.2.1 TWIN PUMP OPERATION

Twin pumps have double hydraulic housing with integrated check valve, which automatically turns based on flow, and two separated motors.

AGE4(D) pumps do not have a control logic that ensures the continuous operation of at least one pump - the control logic must be carried out by the customer / user himself. It is recommended that the control logic exchanges pumps for operation with time interval of ≤ 24 h.

AGE4(D) pumps communicate with each other and have the following features:
- Alternating operation: One pump is operating while the other one is on standby. Pumps switch their role every 24 hours or when an error occurs on one pump.
- Duplex communication connection: Screened cable with line cross section 2x0.25mm^2, 90°C resistant and not longer than 1m must be used for duplex connection. One line of a cable is connected to COM/0V on both pumps. The other line of a cable is: -on one pump (primary pump) it is connected to MAX/DPLX1 and on the other pump (secondary pump) line is connected to MIN/DPLX2. Our duplex pumps with U module are already equipped with suitable cable which is correctly connected! When duplex communication is used, digital inputs MAX and MIN are disabled.

AGE4(D) pumps communicate with each other and have the following features:
- Alternating operation **[default setting]** – One pump is operating while the other one is on standby. Pumps switch their role every 24 hours or when an error occurs on one pump.
- Backup operation – One pump operates constantly and the other one is on standby. If an error occurs on the operating pump the one on standby will automatically start working. This mode can be set up by turning off the pump that we wish to be on standby. That is done by holding the ⊖ button for 5 seconds.
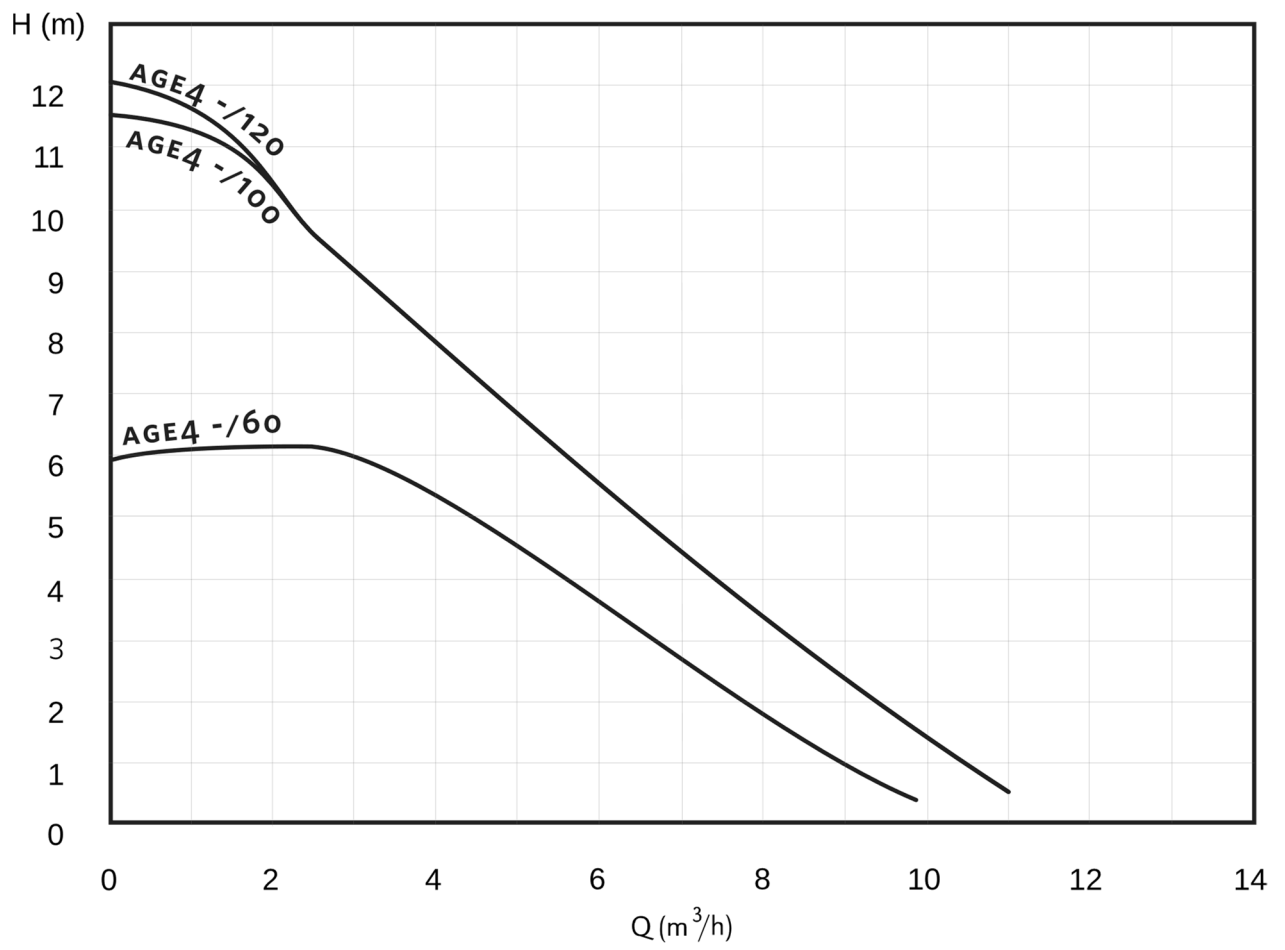
Parallel operation – Both pumps work at the same time with the same settings of constant pressure. This mode is used when greater flow than one single pump can output is needed. When the first pump hits its flow limit the second one turns on and compliments the first to reach desired flow. This mode is activated when we set both pumps to constant pressure mode. Night mode is not recommended in this mode of operation.
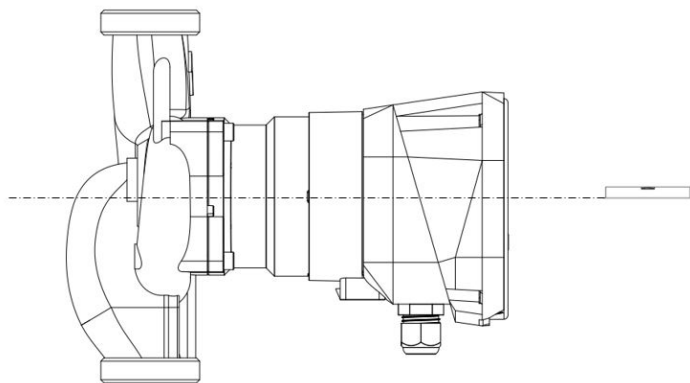
6 ERROR AND TROUBLESHOOTING

If pump failure occurs, the error code will appear on the display.

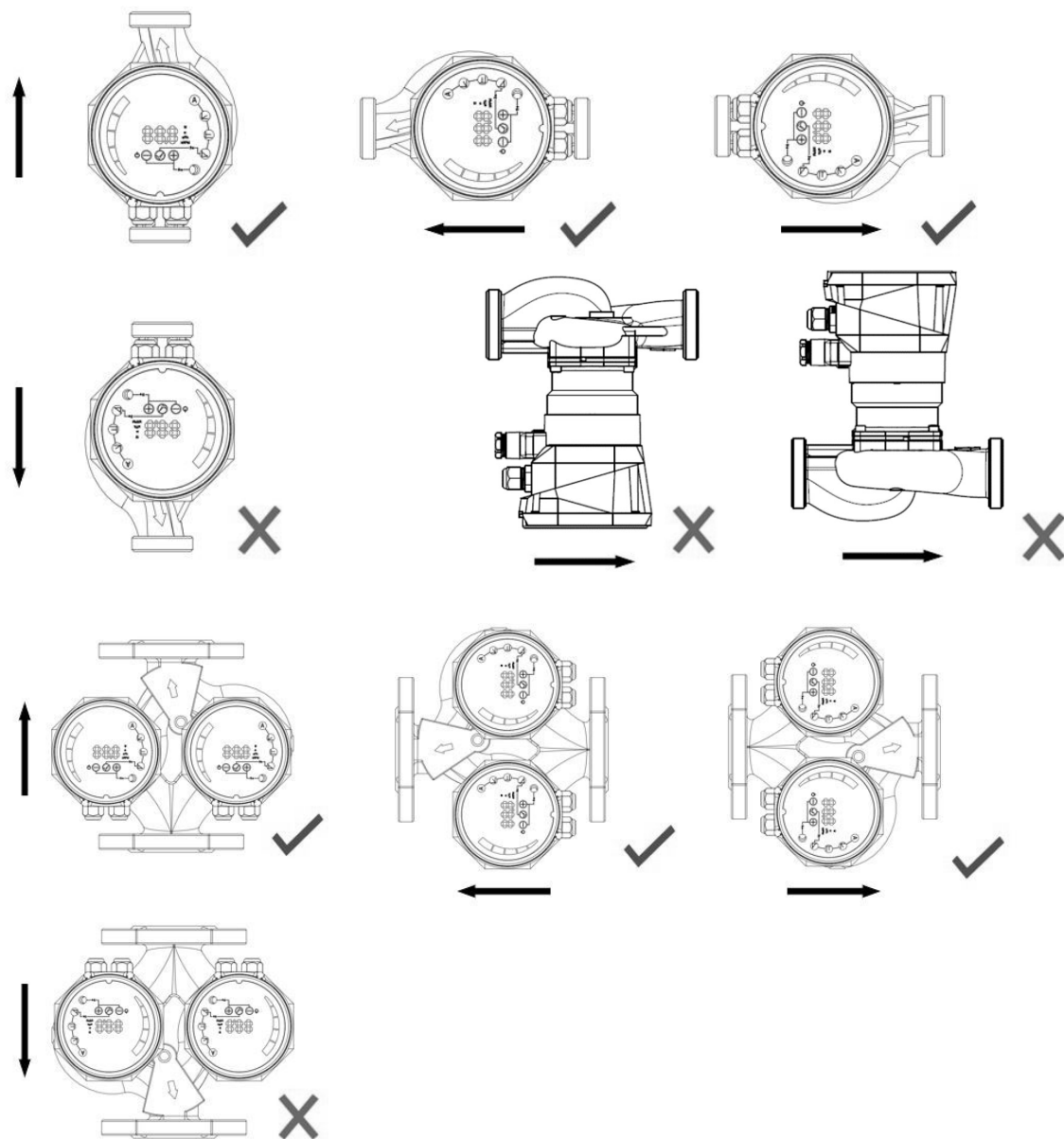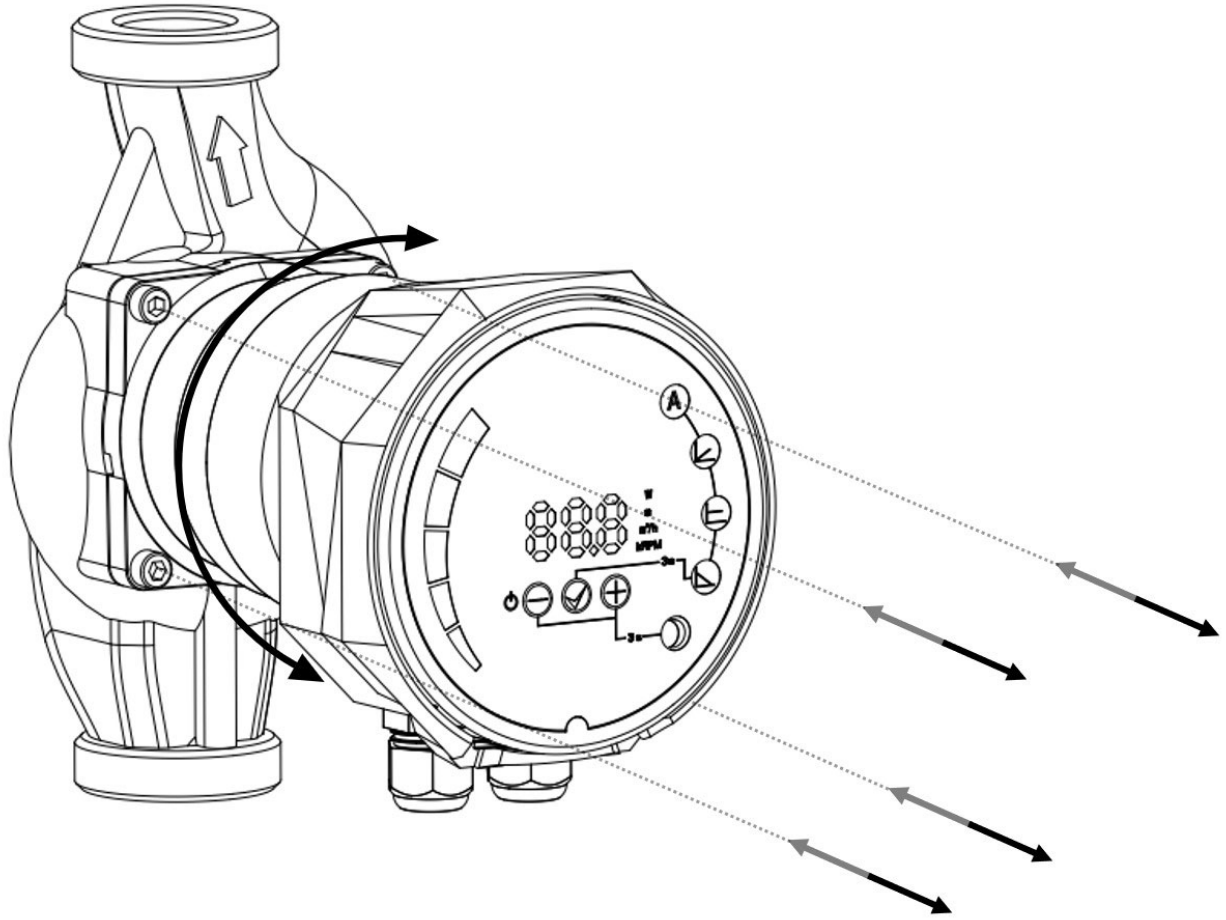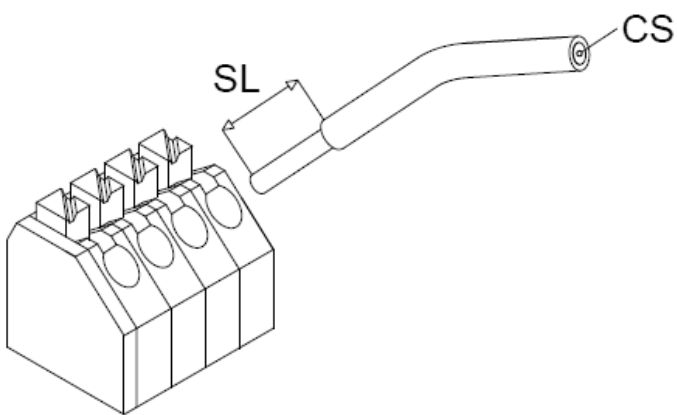| Error code	Description	Probable cause
E1x	*Load errors*	
E10 (dry)	Low motor load	Low load detected. Pump is running dry.
E11	High motor load	Motor might be faulty or viscous medium is present.
E2x	**Protection active**	
E22 (hot)	Converter temperature limit	Circuit is too hot and power was reduced to less than 2/3 of rated power.
E23	Converter temperature protection	Circuit is too hot to run, pump stopped
E24	Converter overcurrent	Hardware overcurrent protection triggered.
E25	Overvoltage	Line voltage is too high
E26	Undervoltage	Line voltage is too low for proper operation.
E27	PFC Overcurrent	Power correction circuit current cannot be controlled
E3x	*Pump errors*	
E31	Software motor protection active.	Average motor current was too high, pump load is much higher than expected
E4x	*Device specific error codes*	
E40	General frequency converter error	Electrical circuitry did not pass self-test.
E42 (LED)	LED faulty	One of the display segment diodes is faulty (open/short)
E43 (con)	Communications failed	Display board does not detect proper connection to main board, but power supply is present
E44	DC link current offset	Voltage on DC link shunt (R34) not in expected range
E45	Motor temperature outside limits	During MFG. TEST, this is 10 kΩ, 1 % resistor for 10 °C..30 °C During operation, expected values are -55 °C..150 °C
E46	Circuit temperature outside limits	During MFG. TEST, this is 0 °C..50 °C. During operation, expected values are -55 °C..150 °C
E47	Voltage reference outside limits.	Comparison between internal references does not match
E48	15 V outside limits	15 V power supply is not 15 V.
E49	Test SW	SW has to be reprogramed.
E5x	Motor error codes	
E51	Motor parameters out of range	Motor does not behave as expected
E52	Thermal protection active	Motor temperature is too hot to operate.
E53	Invalid model selected	Pump model not valid or out of reach.
	Pump is non-responsive	Turn power on and off.
	Pump doesn't work	Check electrical installation and fuse.

Picture 1

Picture 2

Picture 3

Picture 4

Guarantee

Retailer	Retail company:	
	Date sold:	
Guarantee	Product name:	
	Serial number:	
	Guarantee period	24 months

Manufacturer

Declaration on guarantee and terms of guarantee

Manufacturer declares:

- That the product conforms to the prescribed/declared quality.
- That the product will operate faultlessly within the terms of guarantee if the technical instructions provided are observed by user.
- That he will repair faults and shortcomings at his own expense caused by eventually differences between the actual and prescribed/declared quality or those due to which the product does not operate faultlessly or the manufacturer will replace the product.
- Cost from the previous paragraph for repairing or replacing the product are valid for material, spare parts, work and shipping.
- Shipping cost for restitution of the product are only recognized if the product was delivered to the nearest authorized service or retailer and comprise rail or postal charges.
- That within the term of guarantee work to maintain or repair the product will be completed within 45 days from submission of a request.
- The guarantee will apply within the country that it was sold via an authorized dealer.
- That he will keep the spare parts in the stock for three years after the expiration of guarantee period.
- That the term of guarantee will be extended for the time the product was being repaired.
- That he is bound to fulfill the guarantee obligations under the following conditions:
  - That the product was used in accordance with technical instructions.
  - That the product is not mechanically damaged.
  - That a confirmed guarantee certificate or invoice is enclosed with the product.
  - That an unauthorized person has not made interventions into the product or non-original parts were incorporated into it

This guarantee does not exclude consumer rights resulting from the seller's liability for defects in the goods.
Repairs under guarantee are made only by an authorized service. The guarantee is only valid with an invoice

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