Self-cooling Motor-independent Frequency Inverter

PumpDrive 2

Application Guide

Application Guide PumpDrive 2

The use cases in the application guide are only typical examples for training purposes. The examples are not customer specific solutions. The examples are not binding and can be incomplete. The examples do not cover all possible eventualities. The examples do not cover all design details and variants, nor do they cover all scenarios and situations that may arise during installation, operation or maintenance. The application guide is not replacing the operating manual. In any case of divergence the operating manual has higher priority. The operator must take care about the appropriate operation referring to the operating manual. The examples do not excuse from the save utilization, installation and service. Changes of this application guide will be done without announcement.

1. Pre-Conditions

- The motor data are set according to the operating manual.
- The motor control is correct selected and suits to the motor.
- The pump curves are stored in the drive.

Pre-settings from production
Pumps with PumpDrive are delivered with the following pre-settings:

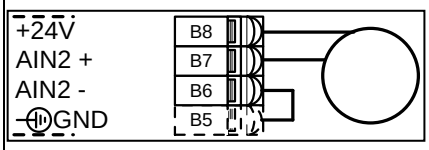
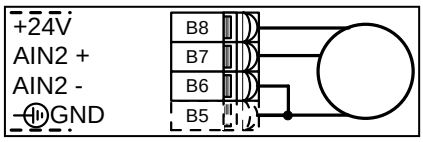
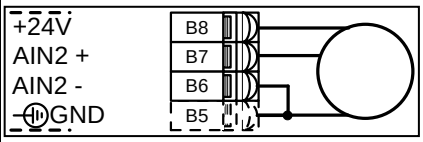
- Motor data
- Motion control according to motor type
- Pre-setting of PumpMeter including sensors
- Pump curves

Type series	**Etaline / Etaline Z**	**Etanorm, Etabloc, Etachrom Multitec, Movitec, Sewatec**	**Retrofit Drive**	**PumpDrive spare part**
selection	**EasySelect**	**EasySelect**	**EasySelect**	**Material number**
Motor data	preset	preset	preset	-
Asynchronous motor	Vector ASM	Vector ASM	V/f characteristic	-
SuPremE	Vector SuPremE	Vector SuPremE	Vector SuPremE	Vector SuPremE
with PumpMeter	Closed loop control: Differen-tial pressure and sensors pre-set	Closed loop control: pressure p constant and sensors preset	-	-
without PumpMeter	Open-loop Control	Open-loop Control	Open-loop Control	Open-loop Control
Pump curve	preset	preset	-	-
Setpoint	with PumpMeter: preset	with PumpMeter: preset	-	-

Retrofit PumpDrives, which will be selected in EasySelect, will be delivered only with motor data (work is in progress). The pump curves must be parameterized on site, can be uploaded from PumpMeter, can be set from ServiceTool or display.

PumpDrives (spare parts), which are ordered by material numbers are not parameterized in the production.

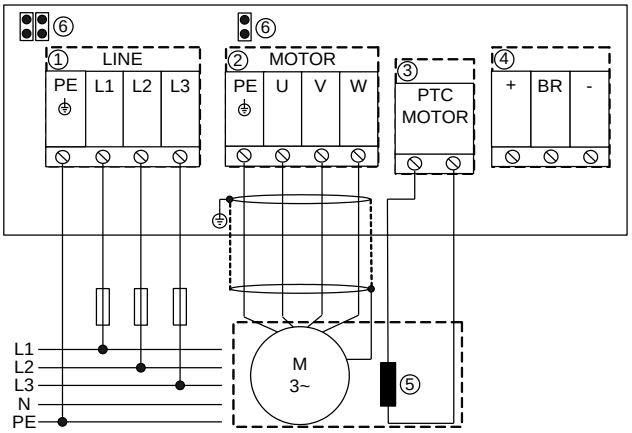
Sensors connected on the differential analog input:

Output signal: 0/4…20mA 2 wires	**Output signal: 0/4…20mA 3 wires**	**Output signal: 0/2…10V 3 wires**
		

Using a 0/4…20mA or 0/2…10V Sensor for control a PumpMeter can be used as internal sensor in parallel. PumpMeter used as internal sensor improves the flow estimation.

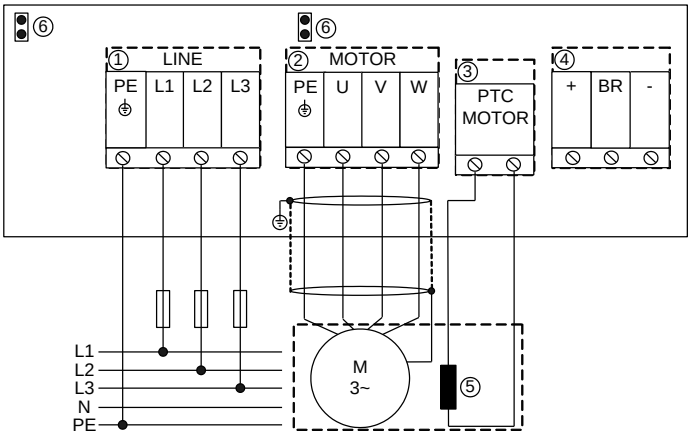
Connecting mains and motor

Size A (0,37 kW – 1,5 kW)



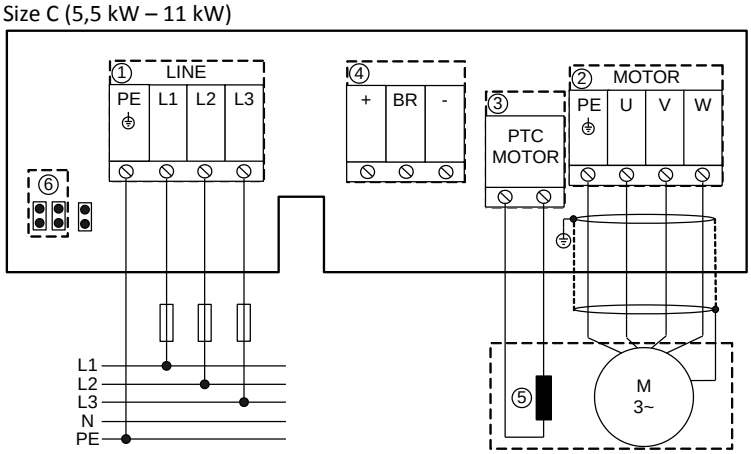
Nr.	Function
1	Mains connection
2	Motor connection
3	PTC connection
4	Brake
5	Motor PTC
6	Jumper for IT mains

Size B (2,2 kW – 4 kW)



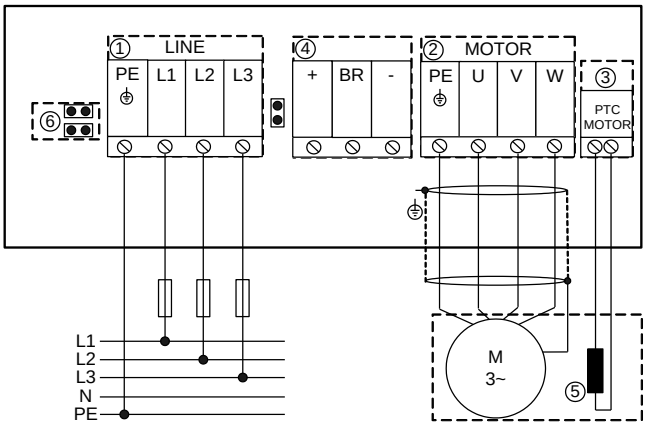
Nr.	Function
1	Mains connection
2	Motor connection
3	PTC connection
4	Brake
5	Motor PTC
6	Jumper for IT mains

Size C (5,5 kW – 11 kW)



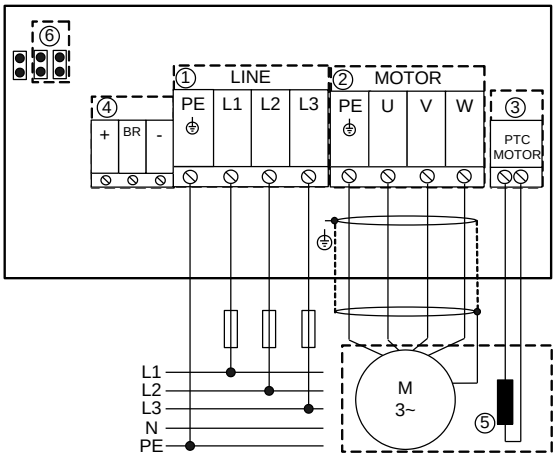
Nr.	Function
1	Mains connection
2	Motor connection
3	PTC connection
4	Brake
5	Motor PTC
6	Jumper for IT mains

Size D (15 – 30 kW)



Nr.	Function
1	Mains connection
2	Motor connection
3	PTC connection
4	Brake
5	Motor PTC
6	Jumper for IT mains

Size E (37 – 55 kW)



Nr.	Function
1	Mains connection
2	Motor connection
3	PTC connection
4	Brake
5	Motor PTC
6	Jumper for IT mains

Graphic Display

For the parameterization of the following applications the user must be logged in Customer Level.

With the menu keys  the user selects the first menu level.

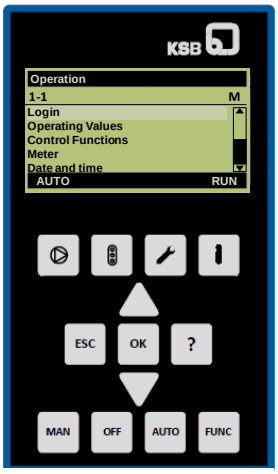
By pressing the first menu key operation  the user opens the menu operation **1**-x-x-x.

Customer Login:

1.)

Main Screen

2.)

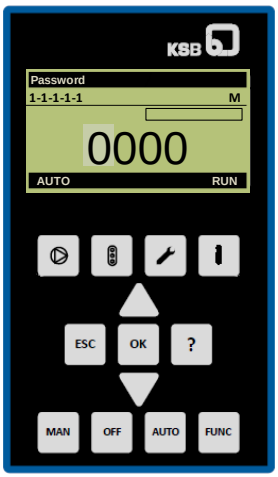


Menu 1
Operation

3.)

Parameter 1-1-1
Customer Login

4.)



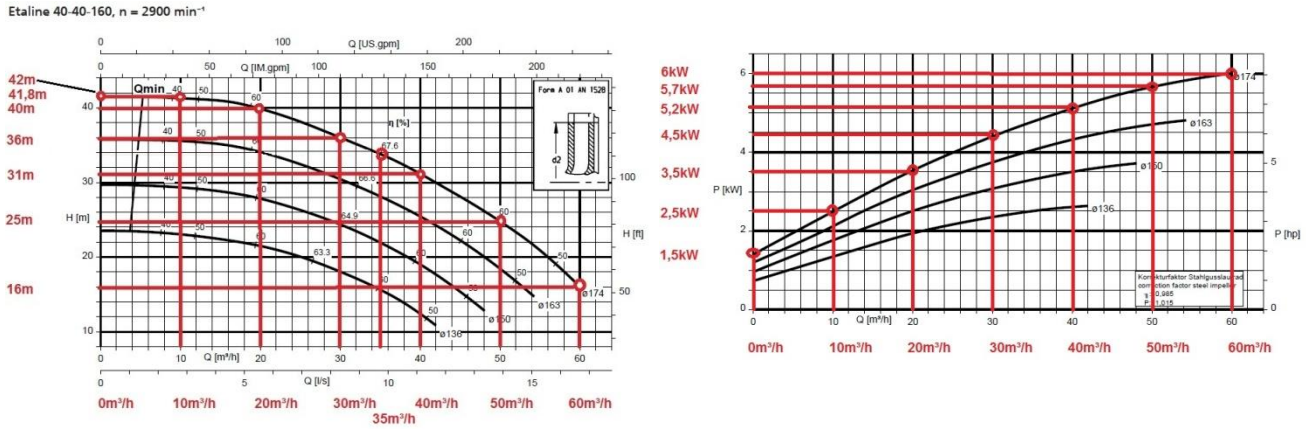
Type in PIN: 0000

5.)

In the head line the character C is displayed after successful login

1.1.1 *Pump characteristic curve*

The pump characteristic curve for an Etaline 040-040-160 with full impeller diameter 174 has to been set manually. The values for the pump characteristic curves are readout of the type series booklet at nominal speed of the pump with impeller diameter 174.



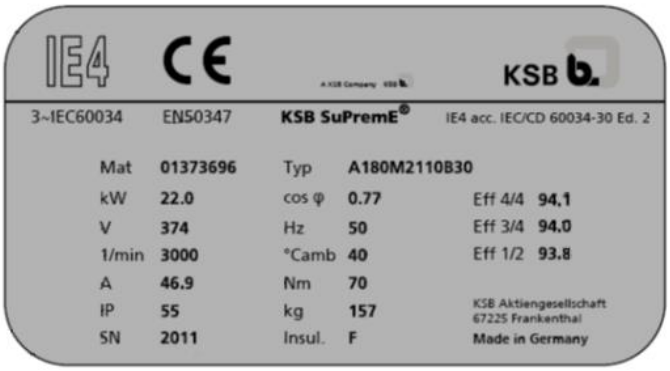
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-4-3-1	Flow Rate Q_0	0.0 [m³/h]	**Preset: 0,0 m3/h**
3-4-3-2	Flow Rate Q_1	10.0 [m³/h]	**Preset: 10,1 m3/h**
3-4-3-3	Flow Rate Q_2	20.0 [m³/h]	**Preset: 20,3 m3/h**
3-4-3-4	Flow Rate Q_3	30.0 [m³/h]	**Preset: 30,5 m3/h**
3-4-3-5	Flow Rate Q_4	40.0 [m³/h]	**Preset: 40,6 m3/h**
3-4-3-6	Flow Rate Q_5	50.0 [m³/h]	**Preset: 50,8 m3/h**
3-4-3-7	Flow Rate Q_6	60.0 [m³/h]	**Preset: 60,9 m3/h**
3-4-3-8	Flow Rate Q_opt	35.0 [m³/h]	**Preset: 35,0 m3/h**
3-4-3-9	Pump Input Power P_0	1.50 [kW]	**Preset: 1,52 kW**
3-4-3-10	Pump Input Power P_1	2.50 [kW]	**Preset: 2,62 kW**
3-4-3-11	Pump Input Power P_2	3.50 [kW]	**Preset: 3,73 kW**
3-4-3-12	Pump Input Power P_3	4.50 [kW]	**Preset: 4,64 kW**
3-4-3-13	Pump Input Power P_4	5.20 [kW]	**Preset: 5,39 kW**
3-4-3-14	Pump Input Power P_5	5.70 [kW]	**Preset: 5,97 kW**
3-4-3-15	Pump Input Power P_6	6.00 [kW]	**Preset: 6,34 kW**
3-4-3-16	Head H_0	42.00 [m]	**Preset: 43,06 m**
3-4-3-17	Head H_1	41,80 [m]	**Preset: 42,89 m**
3-4-3-18	Head H_2	40.00 [m]	**Preset: 41,41 m**
3-4-3-19	Head H_3	36.00 [m]	**Preset: 37,48 m**
3-4-3-20	Head H_4	31.00 [m]	**Preset: 32,45 m**
3-4-3-21	Head H_5	25.00 [m]	**Preset: 25,88 m**
3-4-3-22	Head H_6	16.00 [m]	**Preset: 16,88 m**
3-4-3-30	Low Flow Limit Flow Rate in % Qopt	30 [%]	**Preset**

2) Pre-settings for completely assembled pump, motor, drive

1.1.2 *Parameterization of Motor data*

A PumpDrive 2 is parameterized for a 2 pole SuPremE Motor. The pump rotation is clockwise.

Name plate of motors:



Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-2-1-1	Nominal Motor Power	22.00 [kW]	**Preset: 22.00 [kW]**
3-2-1-2	Nominal Motor Voltage	374 [V]	**Preset: 400 [V]**
3-2-1-3	Nominal Motor Frequency	50.0 [Hz]	**Preset: 50.0 [Hz]**
3-2-1-4	Nominal Motor Current	46.90 [A]	**Preset: 46.90 [A]**
3-2-1-5	Nominal Motor Speed	3000 [1/min]	**Preset: 3000 [1/min]**
3-2-1-6	Nominal Cos Phi Value	0.77	**Preset: 0.77**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset: 500 [1/min]**
3-2-2-2	Maximum Motor Speed	3000 [1/min]	**Preset: 3000 [1/min]**
3-2-3-1	PTC Data Analysis	ON	**Preset: ON**
3-2-3-2	Thermal Motor Protection Behaviour	Non-self-acknowledging	**Preset: Non-self-acknowledging**
3-2-4-1	Motor Direction of Rotation	Clockwise [4)]	**Preset: Clockwise**
3-3-1	Motor Control Method	SuPremE Vector Control	**Preset: SuPremE Vector Control**
3-3-4-1	Update Motor Parameters	Run	**Preset**

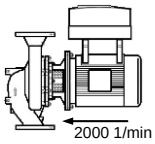
2) Pre-settings for completely assembled pump, motor, drive
4) Pump dependent

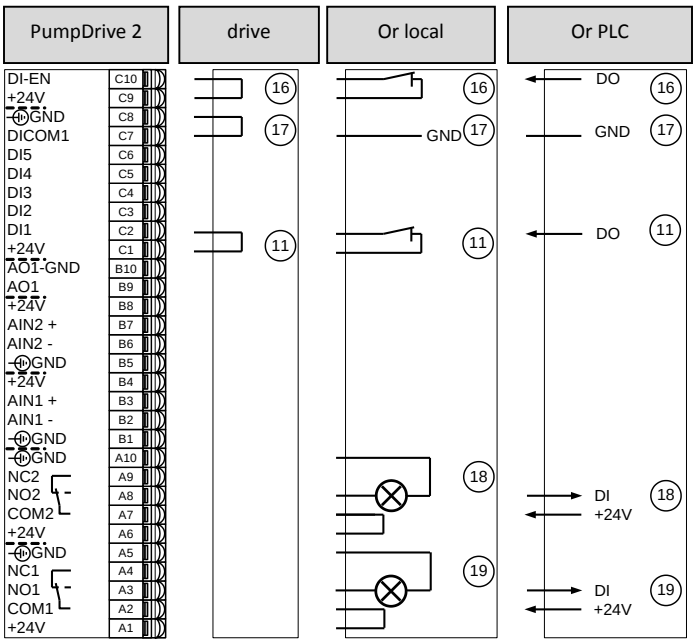
2. Single pump

2.1 Single pump – Open loop control

2.1.1 *Open loop control: control value at display*

A fixed speed of 2000 1/min should be set on the display. The nominal speed of the 2 pole motor is 2950 1/min.





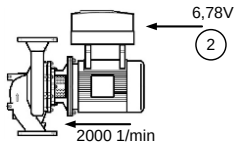
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm

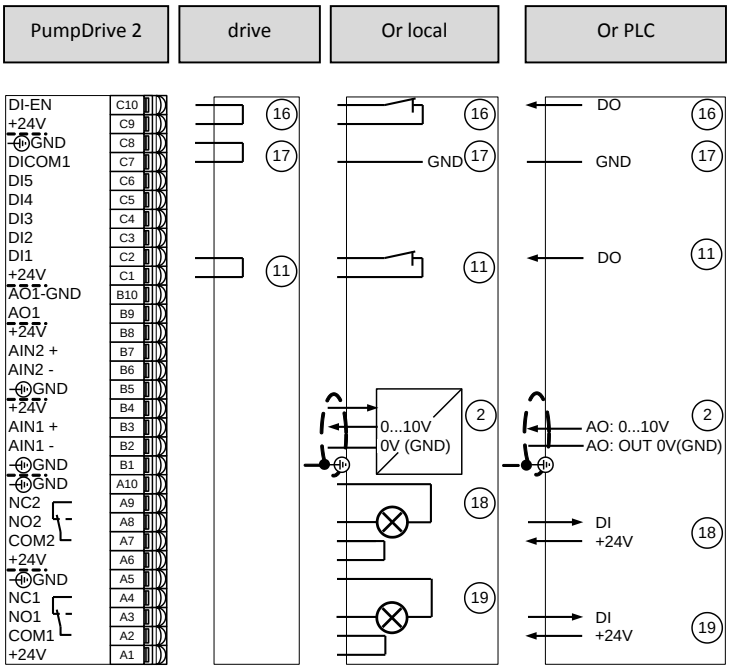
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**preset**
1-3-3	Control Value (Open-loop Control)	2000 [1/min]	motor specific
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

2.1.2 *Open loop control: control value by external signal 0…10V*

A fixed speed of 2000 1/min should be given by an external signal 0…10V at analog input 1.
2000 1/min is equal to 6,78 V when using a 2-pole motor with a nominal speed of 2950 1/min.
Information: the set point can't be lower than the minimum speed.





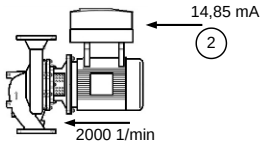
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
2	Set point (open loop): external signal0...10V
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm

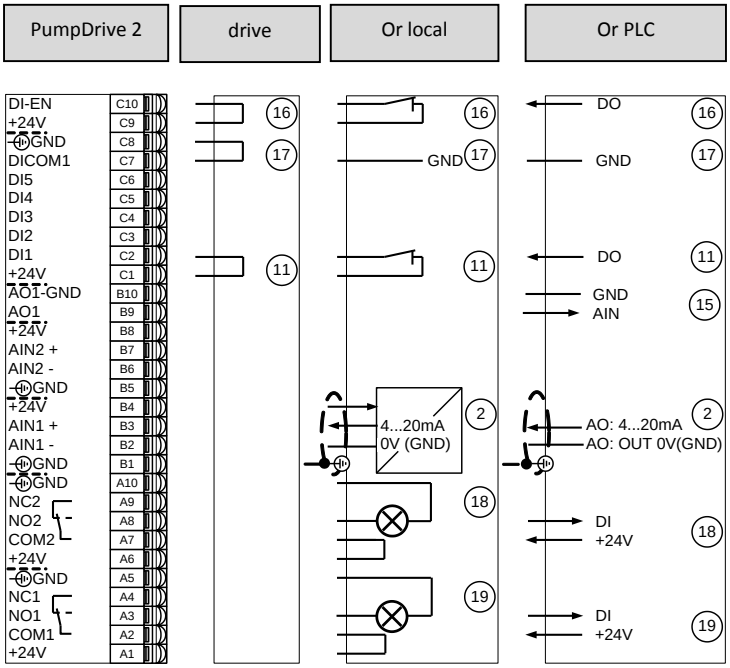
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**preset**
3-8-1-1	Analog Input 1 Signal	0…10V	OFF
3-8-1-2	Analog Input 1 Function	Setpoint/Control value (Auto)	No Function
3-8-1-3	Analog Input 1 Lower Limit	0 [1/min]	-
3-8-1-4	Analog Input 1 Upper Limit	2950 [1/min]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

2.1.3 *Open loop control: control value by external signal 4…20mA*

A fixed speed of 2000 1/min should be given by an external signal 4…20mA at analog input 1.
The feedback of the speed should be send by analog output to a PLC.
2000 1/min is equal to 14,85 mA when using a 2-pole motor with a nominal speed of 2950 1/min (16mA / 2950 rpm * 2000 rpm + 4 mA = 14,85 mA). Information: the set point can't be lower than the minimum speed.





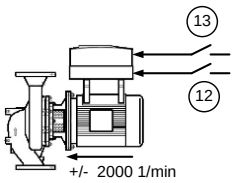
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
2	Set point (open loop): external signal 4...20mA
11	System start with DI1[1)]
15	Analog output: speed
18	Operating mode RUN
19	Alarm

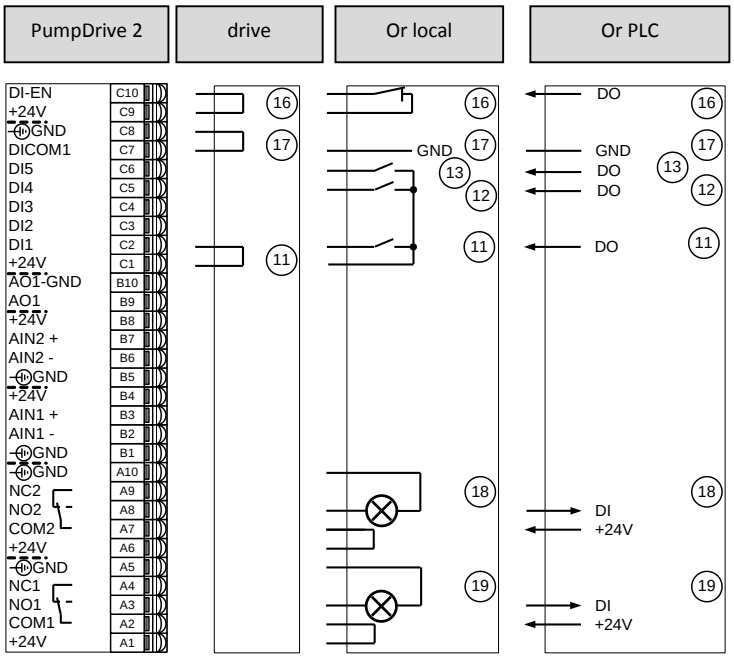
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	preset
3-2-2-1	Minimum Motor Speed	500 [1/min]	preset
3-2-2-2	Maximum Motor Speed	2950 [1/min]	preset
3-8-1-1	Analog Input 1 Signal	4…20mA	OFF
3-8-1-2	Analog Input 1 Function	Setpoint/Control value (Auto)	No Function
3-8-1-3	Analog Input 1 Lower Limit	0 [1/min]	-
3-8-1-4	Analog Input 1 Upper Limit	2950 [1/min]	-
3-8-7-1	Assignment 1 Analog Output 1	Motor Speed	preset
3-8-6-1	Digital Input 1 Function	System Start[1)]	preset

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

2.1.4 *Open loop control: digital motor potentiometer*

A fixed speed of 2000 1/min should be changeable by the digital inputs with an increment of 10 [1/min] in AUTO operation.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
13	DI5: Increase speed
12	DI4: Decrease speed
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**preset**
1-3-3	Control Value (Open-loop Control)	2000 [1/min]	motor specific
3-8-6-4	Digital Input 4 Function	Potentiometer Auto -	No Function
3-8-6-5	Digital Input 5 Function	Potentiometer Auto +	No Function
3-6-6-2	Speed Change Increment	10 [1/min]	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

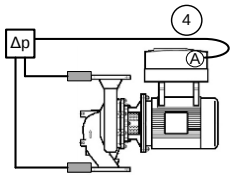
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

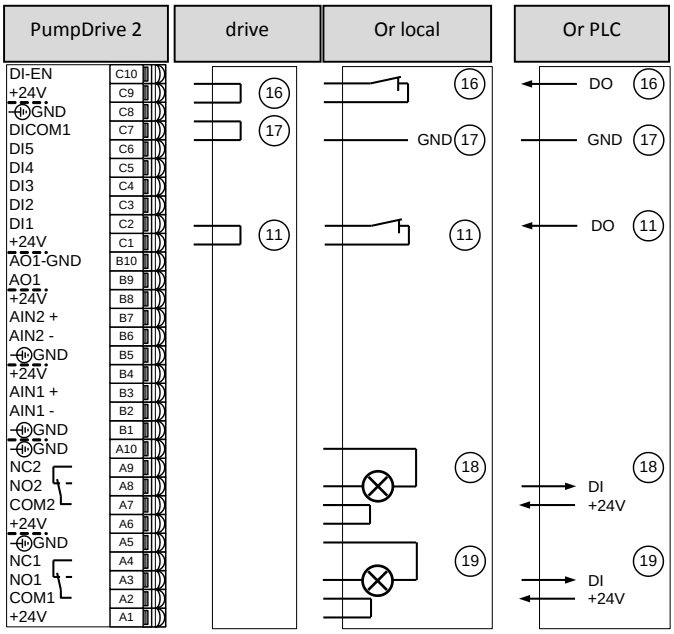
2) Pre-settings for completely assembled pump, motor, drive

2.2 Single pump – closed loop control

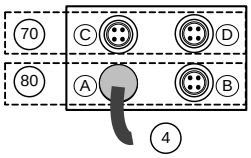
2.2.1 *Closed loop control: Differential pressure with PumpMeter (Modbus)*

A constant differential pressure of 4 bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of Pump-Meter to the M12 Module (color: black, female: straight, male: angled)



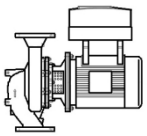
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

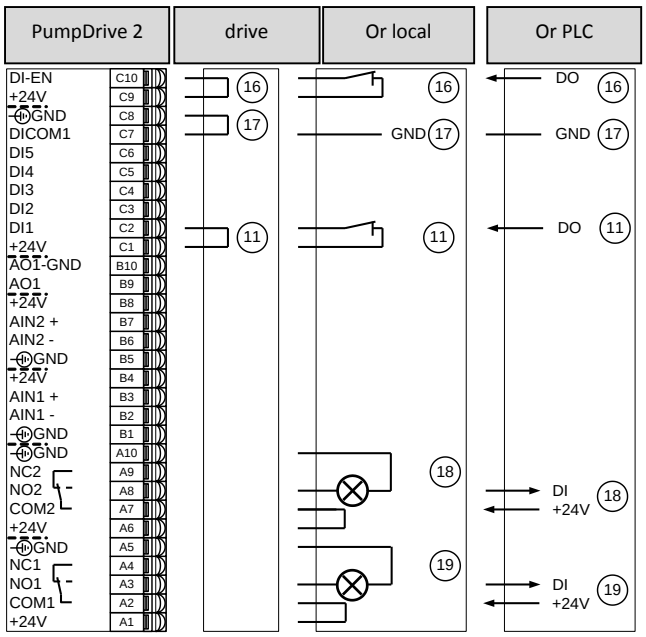
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential Pressure	**preset referring to chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**
3-9-1	Broken Wire Detection		
3-9-1-1	Response to Failure	Fixed Speed	All Pumps OFF
3-9-1-2	Time Delay	0,5 s	**preset**
3-9-1-3	Speed During Failure	500 - 4200	Parameter 3-2-2-1 Minimum Motor Speed

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter
3) In all applications with feedback signals it is possible to realize an emergency control with a fixed speed by activating the broken wire detection. For this define a speed under parameter 3-9-1-3 with which your system can run. The PumpDrive will announce the following in case the sensor fails: broken wire, failure actual value, no main pump.

2.2.2 *Closed loop control: Sensorless differential pressure control*

A constant differential pressure of 0.8 bar is needed without using a sensor (example for Etaline 40-40-160). The set point is given by the display. The procedure is based on the characteristic curves of the pump. Steep power curves are conducive to high process accuracy. The process is suitable to a limited extent if sections of the power curve are constant over the flow rate. To facilitate sensorless differential pressure control, all parameters of the pump characteristic curves (3-4-1, 3-4-3-1 to 3-4-3-22) and the pipe diameters (3-5-2-1 und 3-5-2-2) must be entered. All needed parameters for the flow rate estimation like inner pipe diameter suction side (example: 40mm), inner pipe diameter discharge side (example: 40mm) and height difference of pressure measuring points (example: h1 + h2 = 340mm) are preset in the pump production when ordering a completely assembled pump, motor and drive.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm

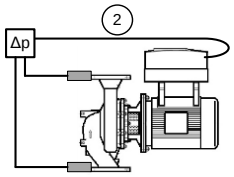
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	-1.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	3.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	0.80 [bar]	0,00 [bar]
3-9-8-1	Flow Rate Estimation	On	**preset**
3-5-2-1	Pipe Diameter_Suction Pressure Measuring Point	40 mm	**preset**
3-5-2-2	Pipe Diameter_Discharge Pressure Measuring Point	40 mm	**preset**
3-5-2-3	Height Difference_Pressure Measuring Points	0,34 m	**preset**
3-5-2-4	Pressure Measuring Point Positions	Close to Pump	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

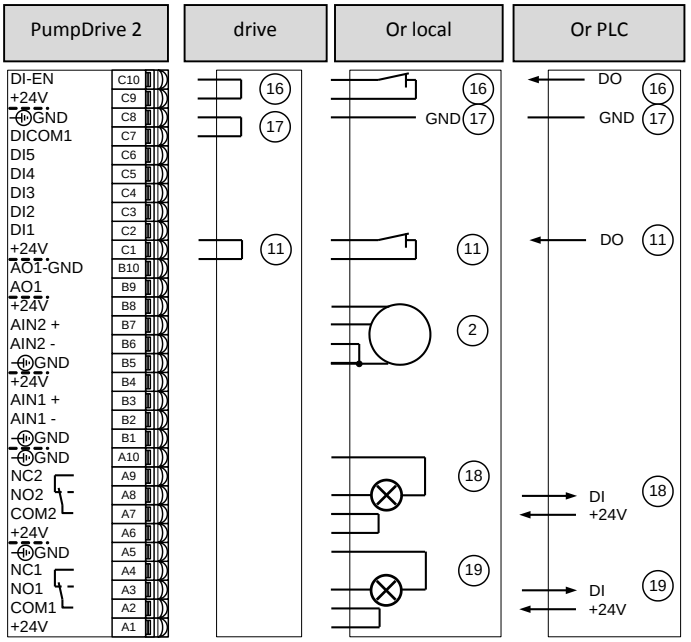
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

2.2.3 *Closed loop control: differential pressure with sensor 4…20mA*

A constant differential pressure of 4 bar is needed. The 4…20mA differential pressure sensor with a measurement range of 0-6 bar is connected to analog input 2. The set point is given by the display.





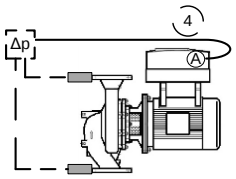
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value: differential pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm

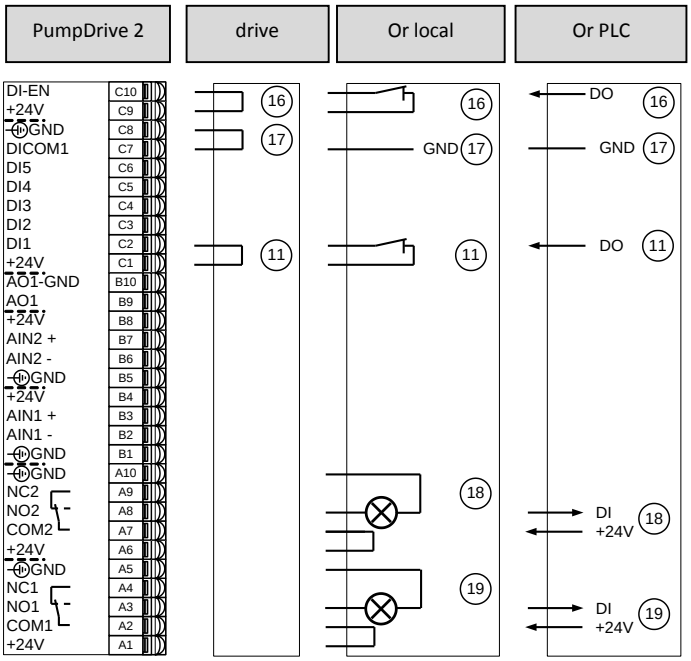
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	-1.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Differential pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	-1.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**
3-9-1	Broken Wire Detection		
3-9-1-1	Response to Failure	Fixed Speed	All Pumps OFF
3-9-1-2	Time Delay	0,5 s	**preset**
3-9-1-3	Speed During Failure	500 - 4200	Parameter 3-2-2-1 Minimum Motor Speed

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

2.2.4 *Closed loop control: differential pressure via M12 module*

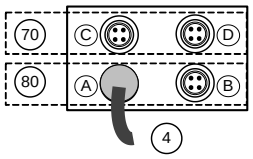
A constant differential pressure of 4 bar is needed. The 4…20mA differential pressure sensor with a measurement range of -1-10 bar is connected with M12 plug to the M12 module. The set point is given by the display.

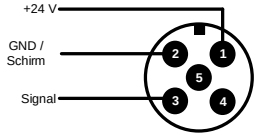




Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Sensor cable

Assignment M12 plug





Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection for differential pressure sensor
B	-
C	-
D	-

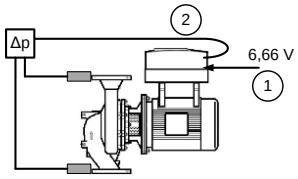
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**Preset – see chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**Preset depending Q,H design**
3-8-4-1	Function M12 Module Input A	Differential pressure	**preset**
3-8-4-2	Lower Limit M12 Module Input A	-1.00 [bar]	-
3-8-4-3	Upper Limit M12 Module Input A	10.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

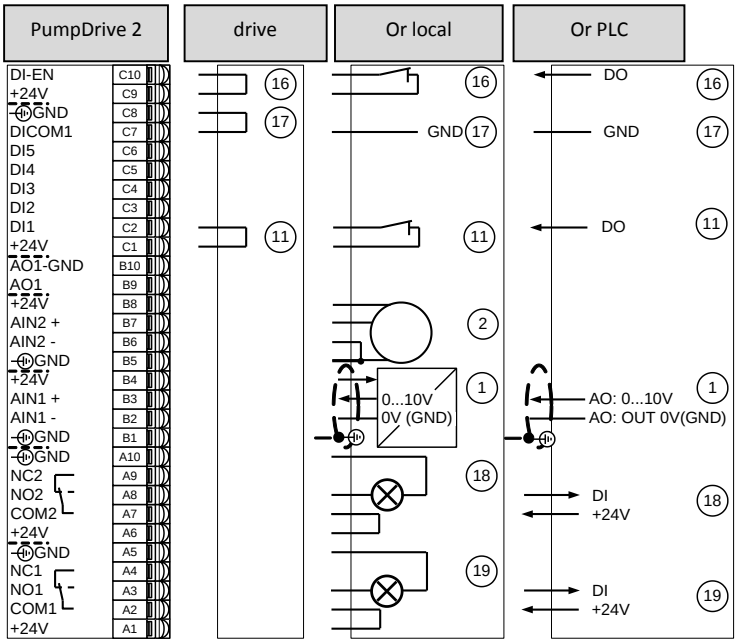
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive
3) Customer differential pressure sensor

2.2.5 *Closed loop control: differential pressure with sensor 4…20mA set point via analog input*

A constant differential pressure of 4 bar is needed. The 4…20mA differential pressure sensor with a measurement range of 0-6 bar is connected to analog input 2. The set point is given via analog input 1 by a voltage 0…10V signal. The set point is 4 bar is equivalent to 6,66V (10V/6bar*4bar).

Info: the set point via analog input has a higher priority than the set point via display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value: differential pressure sensor 4…20mA
1	Set point 0…10V
18	Operating mode RUN
19	Alarm

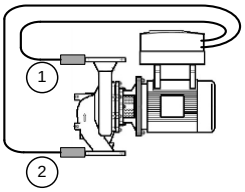
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	Bar	**preset**
3-8-1-1	Analog Input 1 Signal	0…10V	OFF
3-8-1-2	Analog Input 1 Function	Setpoint/Control value (Auto)	No Function
3-8-1-3	Analog Input 1 Lower Limit	0.00 [bar]	-
3-8-1-4	Analog Input 1 Upper Limit	6.00 [bar]	-
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Differential pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

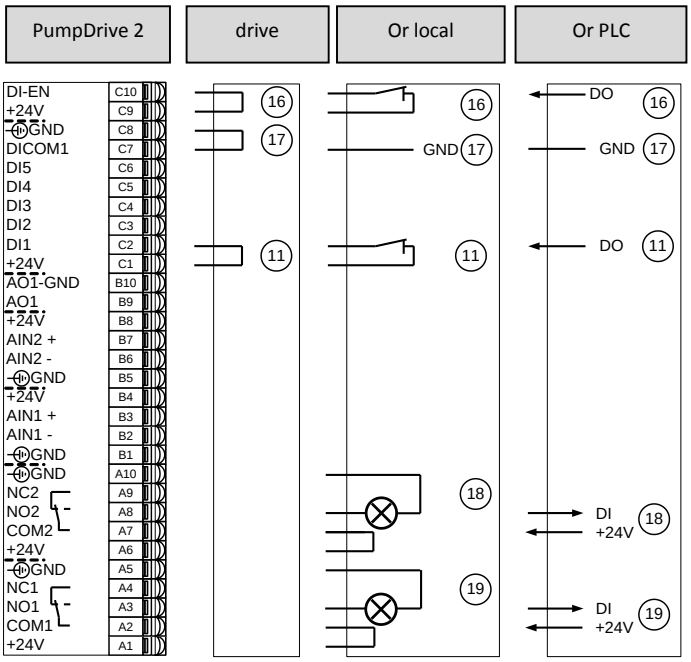
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

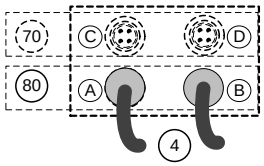
2.2.6 *Closed loop control: differential pressure via 2 pressure sensors connected to the M12 module*

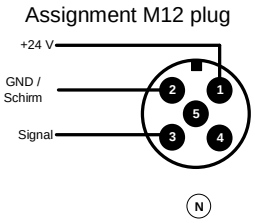
A constant differential pressure of 4 bar is needed. A 4…20mA pressure sensor with a measurement range of 0-2 bar is connected with M12 plug to the connection A of the M12 module. A 4…20mA pressure sensor with a measurement range of 0-6 bar is connected with M12 plug to the connection B of the M12 module. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Sensor cable





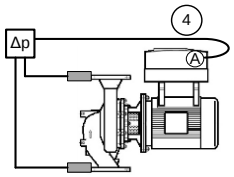
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection for suction pressure sensor
B	M12 Module female B: connection for discharge pressure sensor
C	-
D	-

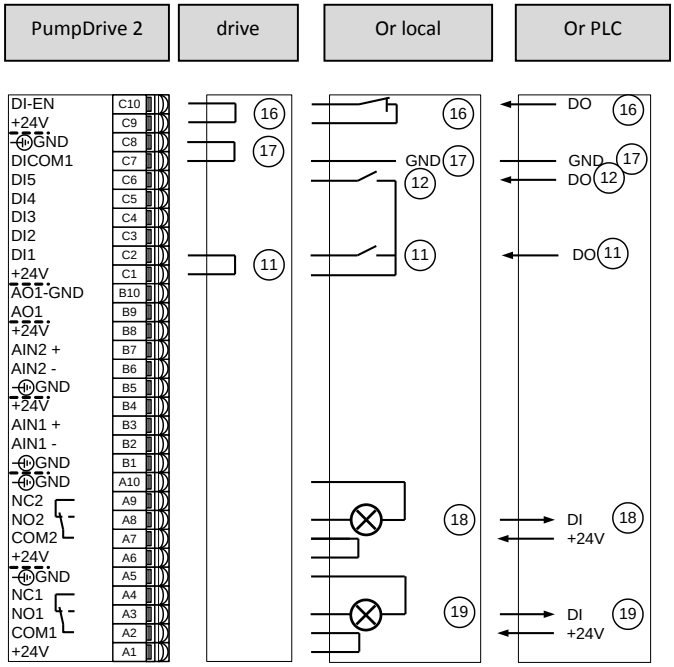
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**Preset – see chapter 1**
3-11-2-1	Minimum Pressure	0.00 [bar]	-1.00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
3-8-4-1	Function M12 Module Input A	Suction Pressure	OFF
3-8-4-2	Lower Limit M12 Module Input A	0.00 [bar]	-
3-8-4-3	Upper Limit M12 Module Input A	2.00 [bar]	-
3-8-5-1	Function M12 Module Input B	Discharge Pressure	OFF
3-8-5-2	Lower Limit M12 Module Input B	0.00 [bar]	-
3-8-5-3	Upper Limit M12 Module Input B	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive
3) The M12 module can process Modbus or 4-20mA signals.

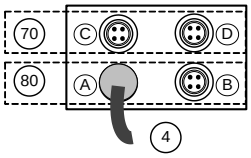
2.2.7 *Closed loop control differential pressure: Alternative setpoint switched by Digital Input*

A constant differential pressure of 1.2bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 3bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. With the Digital Input 5 the setpoint will be reduced to 0,8bar.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	Optional: system start with DI[1)]
12	Switch to alternative setpoint at DI5
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



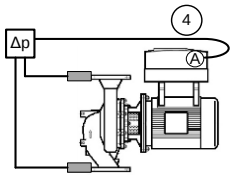
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

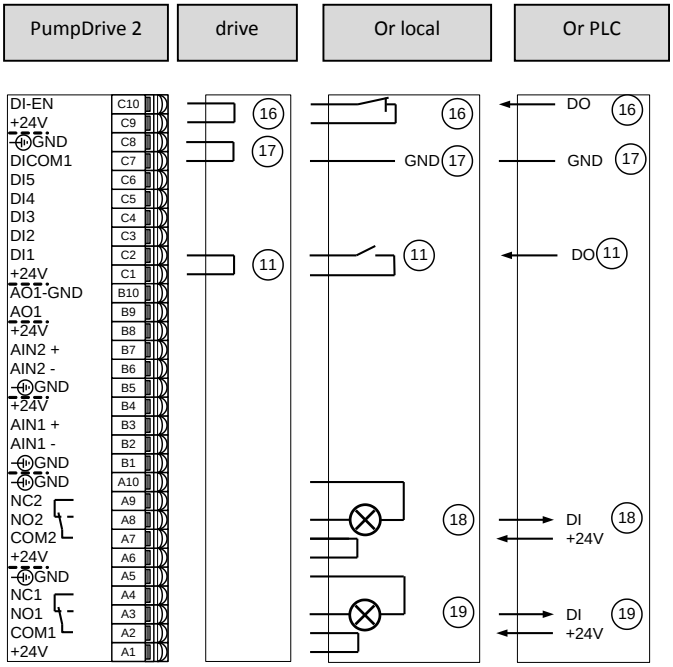
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential Pressure	**preset – see chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	3.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	1.20 [bar]	**Preset according to Q,H**
1-3-9-1	Alternative Setpoint (Closed-loop Control)	0.80 [bar]	0.00 [bar]
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**
3-8-6-1	Digital Input 5 Function	Alternative Setpoint/Control Value Active	No Function

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

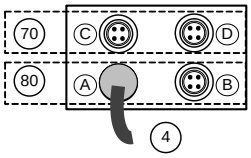
2.2.8 *Closed loop control differential pressure: Alternative setpoint switched by clock*

A constant differential pressure of 1.2bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 3bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. At night during 10pm to 6am the setpoint is changed to 0.8bar.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	Optional: system start with DI[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of Pump-Meter to the M12 Module (color: black, female: straight, male: angled)



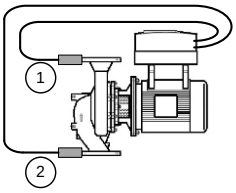
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

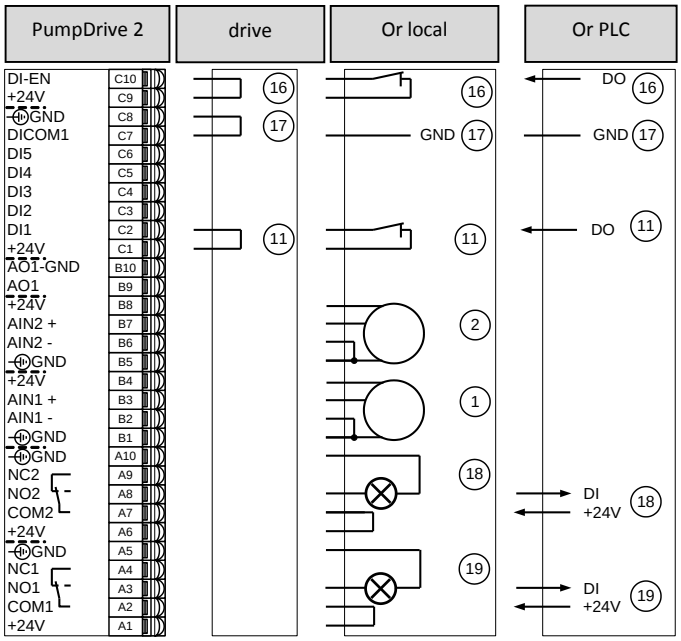
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**preset – see chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	3.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	1.20 [bar]	**Preset according to Q,H**
1-3-9-1	Alternative Setpoint (Closed-loop Control)	0.80 [bar]	0.00 [bar]
1-3-9-3	Start of Alternative Setpoint/Control Value	22.00 [h]	00.00 [h]
1-3-9-4	End of Alternative Setpoint/Control Value	06.00 [h]	00.00 [h]
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

2.2.9 *Closed loop control: differential pressure with 2 pressure sensors 4...20 mA*

A constant differential pressure of 4 bar is needed. A 4…20mA pressure sensor on the high pressure side with a measurement range of 0-6 bar is connected to analog input 1. A 4…20mA pressure sensor on the low pressure side with a measurement range of 0-2 bar is connected to analog input 2. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
1	Actual value high pressure side: Pressure sensor 4...20mA
2	Actual value low pressure side: Pressure sensor 4...20mA
18	Operating mode RUN
19	Alarm

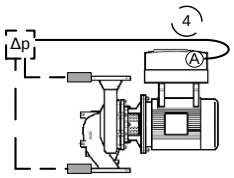
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
3-8-1-1	Analog Input 1 Signal	4…20mA	OFF
3-8-1-2	Analog Input 1 Function	Discharge Pressure	No Function
3-8-1-3	Analog Input 1 Lower Limit	0.00 [bar]	-
3-8-1-4	Analog Input 1 Upper Limit	6.00 [bar]	-
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Suction Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	2.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

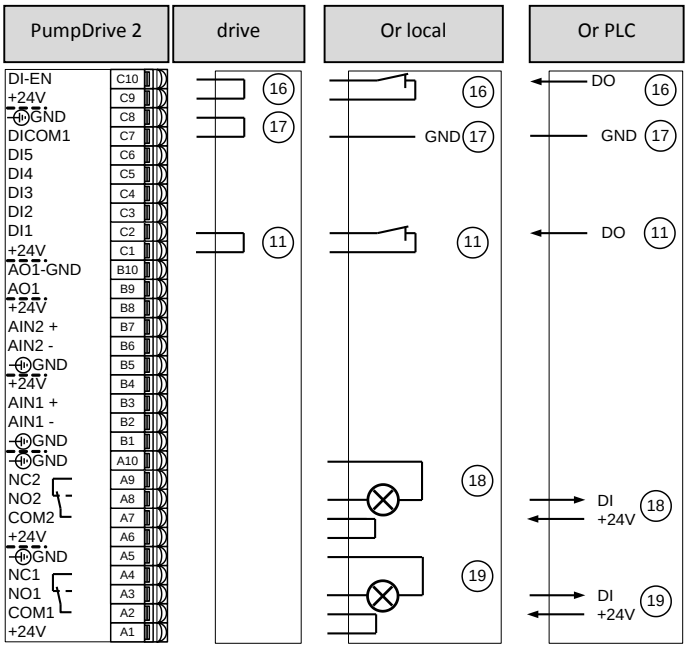
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

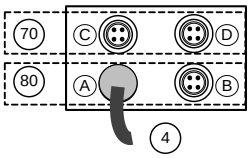
2.2.10 *Closed loop control: Pressure with PumpMeter (Modbus)*

A constant pressure of 4 bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

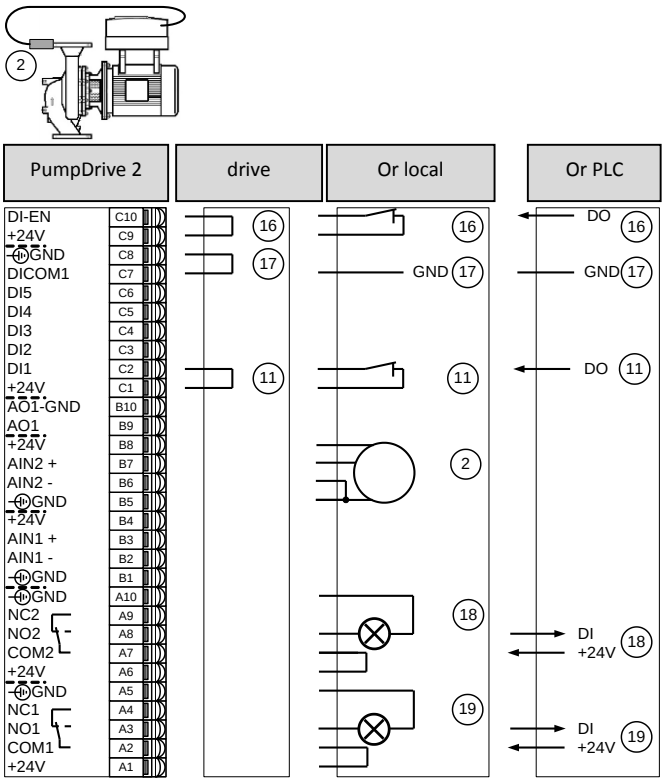
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	**preset referring to chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

2.2.11 *Closed loop control: pressure with pressure sensor 4...20 mA*

A constant pressure of 4 bar is needed. The 4…20mA pressure sensor on the high pressure side with a measurement range of 0-6 bar is connected to analog input 2. The set point is given by the display.



Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value Pressure: Pressure sensor 4...20mA
18	Operating mode RUN
19	Alarm

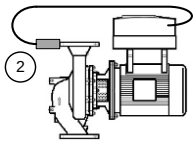
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Discharge Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

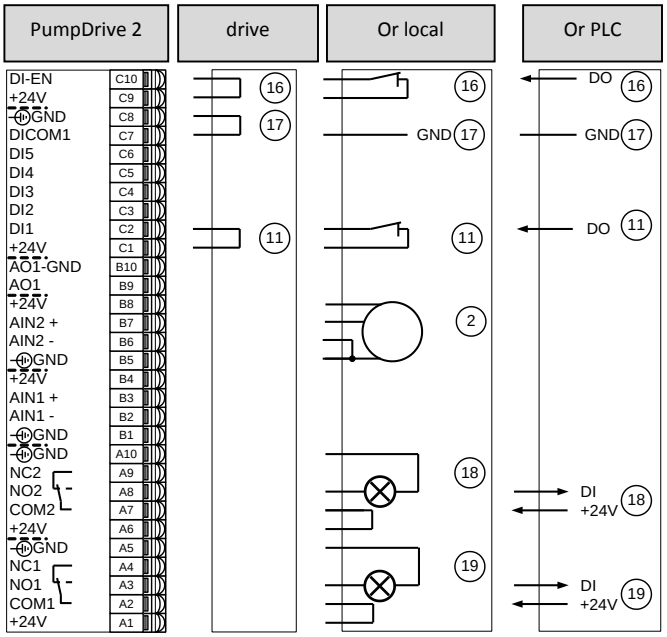
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

2.2.12 *Closed loop control: Pressure with Pressure sensor 0...10 V*

A constant pressure of 4 bar is needed. The 0…10V pressure sensor on the high pressure side with a measurement range of 0-6 bar is connected to analog input 2. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value Pressure: Pressure sensor 0...10V
18	Operating mode RUN
19	Alarm

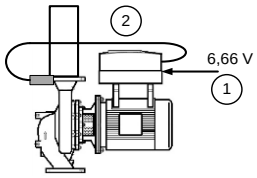
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	0…10V	OFF
3-8-2-2	Analog Input 2 Function	Discharge Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

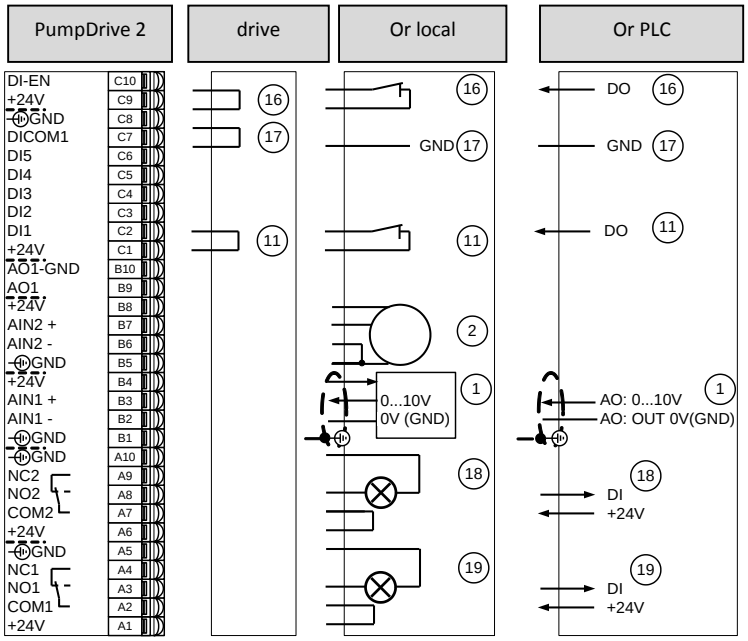
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

2.2.13 *Closed loop control: Pressure, Set point (closed loop) at analog input 0…10V*

A constant pressure of 4 bar is needed. A 4…20mA pressure sensor on the high pressure side with a measurement range of 0-6 bar is connected to analog input 2. The set point is given by an external voltage signal connected to analog input 1. A set point with 4 bar is equal to 6,66V (10V/6bar*4bar).

Info: The set point given by an analog input has a higher priority than the set point typed in at display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	Optional: system start with DI[1)]
2	Actual value: Pressure sensor 4…20mA
1	Set point (closed loop): 0…10V
18	Operating mode RUN
19	Alarm

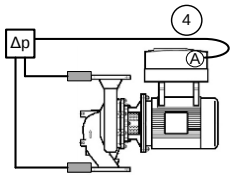
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1.00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999.99 [bar]
3-11-2-3	Pressure Unit	bar	bar
3-8-1-1	Analog Input 1 Signal	0…10V	OFF
3-8-1-2	Analog Input 1 Function	Setpoint/Control value (Auto)	No Function
3-8-1-3	Analog Input 1 Lower Limit	0.00 [bar]	-
3-8-1-4	Analog Input 1 Upper Limit	6.00 [bar]	-
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

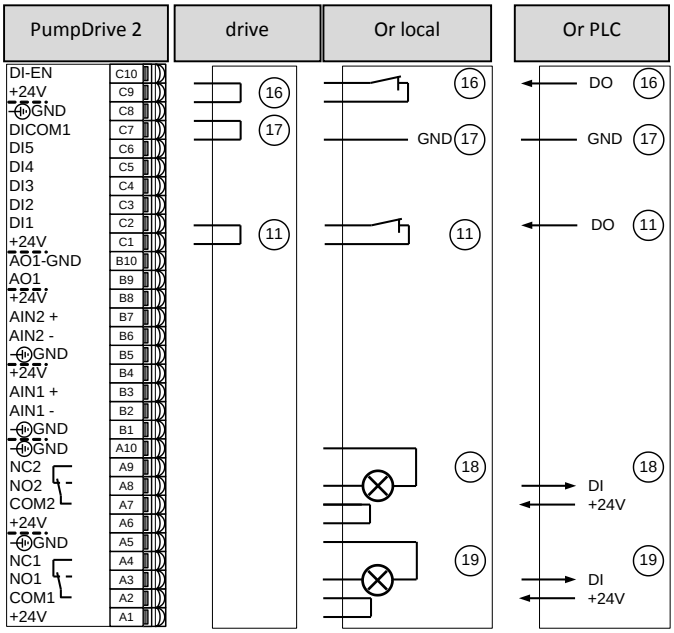
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

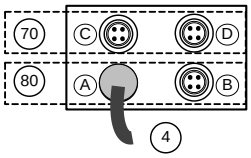
2.2.14 *Closed loop control: flow control with PumpMeter (Modbus)*

A constant flow rate of 30 m³/h is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. A warning indicates that the flow is below 5m³/h.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

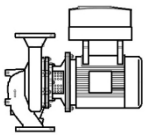
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Flow Rate (Sensorless)	Differential Pressure
3-11-3-1	Minimum Flow Rate	5.0 [m³/h]	0.0 [m³/h]
3-11-3-2	Maximum Flow Rate	60.0 [m³/h]	999.9 [m³/h]
3-11-3-3	Flow Rate Unit	m³/h	**preset**
1-3-2	Setpoint (Closed-loop Control)	30.0 [m³/h]	0.0 [m³/h]
3-9-8-1	Flow Rate Estimation	ON	**preset**
3-9-8-2	Time Constant for Attenuation of Estimated Flow Rate Values	5.0 s	**preset**
3-5-2-1	Pipe Diameter Suction Pressure Measuring Point	40 mm	**preset**
3-5-2-2	Pipe Diameter Discharge Pressure Measuring Point	40 mm	**preset**
3-5-2-3	Height Difference Pressure Measuring Points	0.34 m	**preset**
3-5-2-4	Pressure Measuring Point Positions	Close to Pump	**preset**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

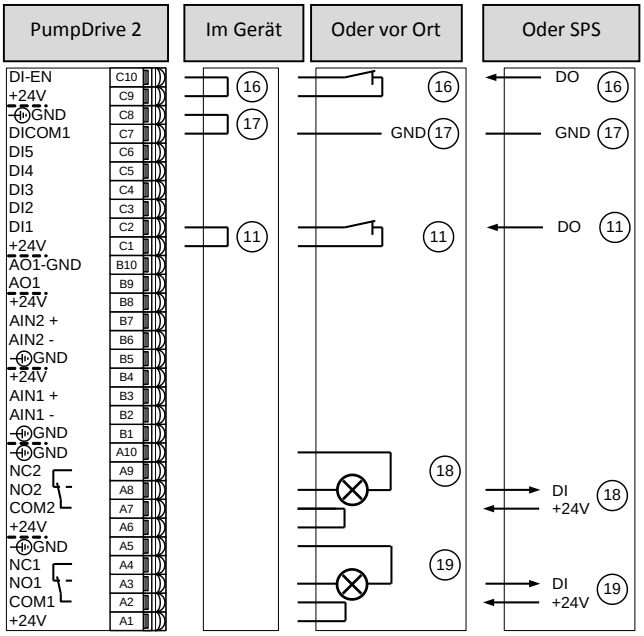
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

2.2.15 *Closed loop control: sensorless flow control*

A constant flow rate of 30m³/h with no use of a sensor is needed (Example for Etaline 40-40-160). The set point is given by the display. The procedure is based on the characteristic curves of the pump. Steep power curves are conducive to high process accuracy.
For power curves with sections of the curve being constant over the flow rate (flat characteristic curve), signals must be made available for the suction pressure and discharge pressure of the pump. To facilitate sensorless flow rate control, all parameters of the pump characteristic curves (3-4-1, 3-4-3-1 to 3-4-3-22) and the inside pipe diameters at the pressure measuring points (3-5-2-1 and 3-5-2-2) must have been entered. All needed parameters for the flow estimation like Pipe Diameter Suction Pressure Measuring Point (e.g. 40mm), Pipe Diameter Discharge Pressure Measuring Point (e.g. 40mm) and Height Difference Pressure Measuring Points (e.g. h1 + h2 = 340mm) are preset individually for each pump when ordering a fully assembled pump.





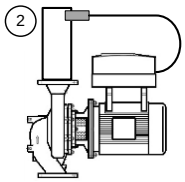
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm

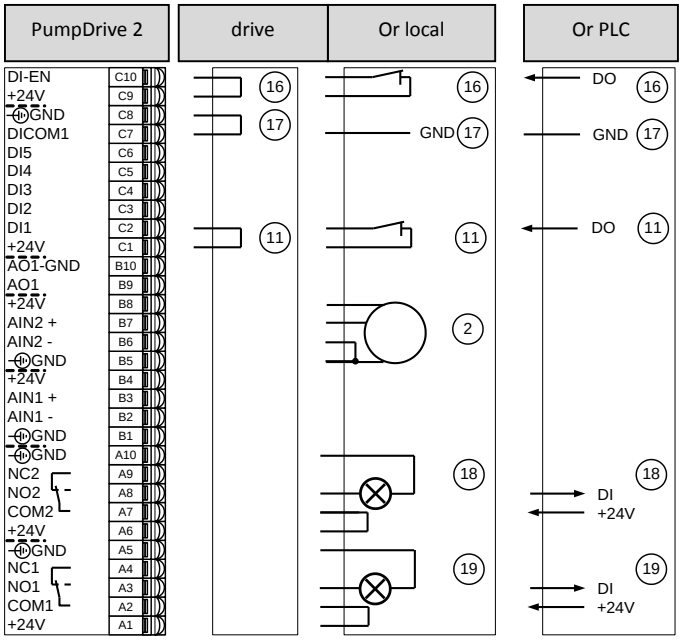
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Flow Rate (Sensorless)	OFF (Open-loop Control)
3-11-3-1	Minimum Flow Rate	0.0 [m³/h]	**preset**
3-11-3-1	Maximum Flow Rate	60.0 [m³/h]	999.9 [m³/h]
3-11-2-3	Flow Rate Unit	m³/h	**preset**
1-3-2	Setpoint (Closed-loop Control)	30.0 [m³/h]	0.0 [m³/h]
3-9-8-1	Flow Rate Estimation	ON	**preset**
3-9-8-2	Time Constant for Attenuation of Estimated Flow Rate Values	5 s	**preset**
3-5-2-1	Pipe Diameter Suction Pressure Measuring Point	40 mm	**preset**
3-5-2-2	Pipe Diameter Discharge Pressure Measuring Point	40 mm	**preset**
3-5-2-3	Height Difference Pressure Measuring Points	0.34 m	**preset**
3-5-2-4	Pressure Measuring Point Positions	Close to Pump	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor and drive

2.2.16 *Closed loop control: Flow rate with flow rate sensor 4…20mA*

A constant flow rate of 100 l/min is needed. The 4…20mA flow rate sensor on the high pressure side with a measurement range of 0...200 l/min is connected to analog input 2. The set point is given by the display.





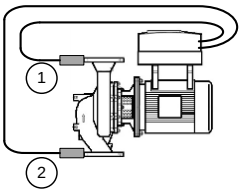
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value: Flow rate sensor 4…20mA
18	Operating mode RUN
19	Alarm

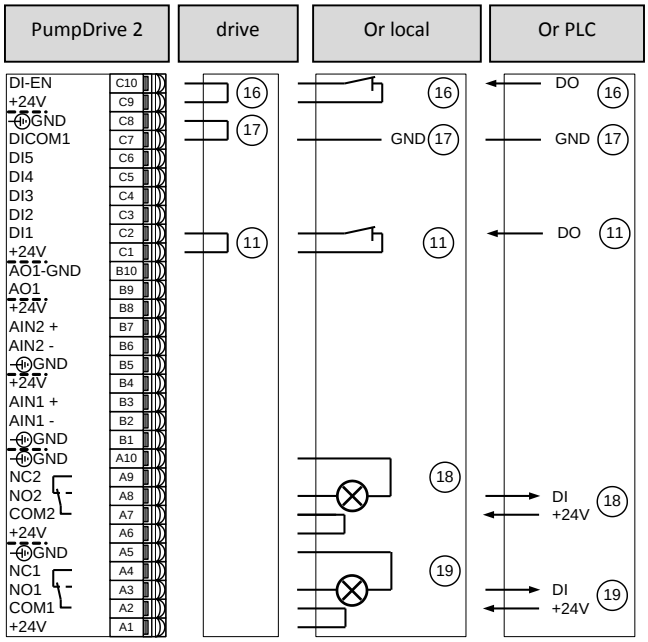
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Flow rate	OFF (Open-loop Control)
3-11-3-1	Minimum Flow Rate	0.00 [l/min]	0.00 [m³/h]
3-11-3-2	Maximum Flow Rate	200.00 [l/min]	9999.99 [m³/h]
3-11-3-3	Flow Rate Unit	l/min	m³/h
1-3-2	Setpoint (Closed-loop Control)	100.00 [l/min]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Flow rate	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [l/min]	-
3-8-2-4	Analog Input 2 Upper Limit	200.00 [l/min]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

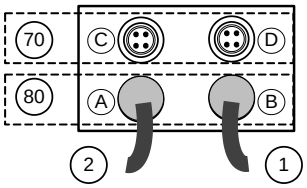
2.2.17 *Closed loop control: Flow rate with 2 pressure sensors 4…20mA from PumpMeter (PumpMeter inside)*

A constant flow rate of 40m³/h is needed. The pressure sensors of PumpMeter are used as 4…20mA analog sensors, which are connected to the M12 module. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
1	Internal value: sensor 4…20mA discharge side
2	Internal value: sensor 4…20mA suction side
18	Operating mode RUN
19	Alarm



Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection sensor suction side
B	M12 Module female B: connection sensor discharge side
C	-
D	-

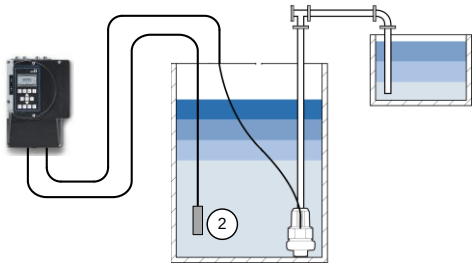
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	type of Control	Flow Rate (Sensorless)	OFF (Open-loop Control)
3-11-3-1	Minimum Flow Rate	0.00 [m³/h]	0.00 [m³/h]
3-11-3-2	Maximum Flow Rate	65.00 [m³/h]	9999.99 [m³/h]
3-11-3-3	Flow Rate Unit	m³/h	m³/h
1-3-2	Setpoint (Closed-loop Control)	40.00 [m³/h]	0.00 [bar]
3-8-4-1	Function M12 Module Input A	Suction Pressure_Internal	OFF
3-8-4-2	Lower Limit M12 Module Input A	-1.00 [bar]	OFF
3-8-4-3	Upper Limit M12 Module Input A	3.00 [bar]	OFF
3-8-5-1	Function M12 Module Input B	Discharge Pressure_Internal	OFF
3-8-5-2	Lower Limit M12 Module Input B	-1.00 [bar]	OFF
3-8-5-3	Upper Limit M12 Module Input B	10.00 [bar]	OFF
3-9-8-1	Flow Rate Estimation	ON	**Preset**
3-9-8-2	Time Const. for Attenuation of Est. Flow Rate Values	5 s	**Preset**
3-5-2-1	Pipe Diameter Suction Pressure Measuring Point	40 mm	0
3-5-2-2	Pipe Diameter Discharge Pressure Measuring Point	40 mm	0
3-5-2-3	Height Difference Pressure Measuring Points	0,34 m	0
3-5-2-4	Pressure Measuring Point Positions	Close to pump	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

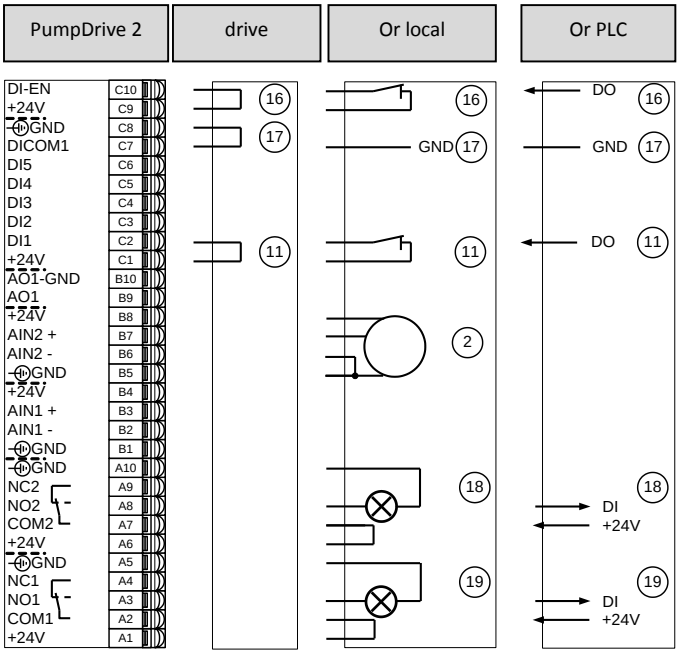
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

2.2.18 *Closed loop control: constant level at low pressure side with submersible sensor 4…20mA*

A constant level of 2 m is needed in a tank on the suction side. The 4…20mA level sensor with a measurement range of 0-1 bar is connected to analog input 2. 1 bar is equal to 10,197 meter water column. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value low pressure side: submersible sensor 4…20mA
18	Operating mode RUN
19	Alarm

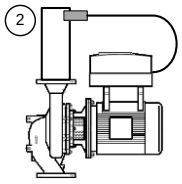
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Suction-side Level	OFF (Open-loop Control)
3-11-5-1	Minimum Level	0.00 [m]	**preset**
3-11-5-2	Maximum Level	10.20 [m]	100,00 [m]
3-11-5-3	Level Unit	m	**preset**
1-3-2	Setpoint (Closed-loop Control)	2.00 [m]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Level	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [m]	-
3-8-2-4	Analog Input 2 Upper Limit	10.20 [m]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

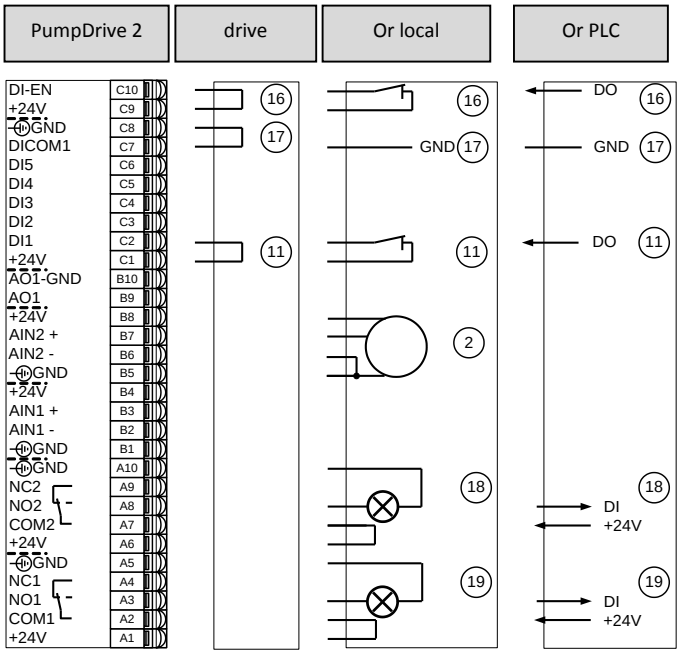
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive

2.2.19 *Closed loop control: temperature with thermometer 4…20mA*

A constant cooling temperature of 50°C is needed. The 4…20mA thermometer on the high pressure side with a measurement range of 0-150°C is connected to analog input 2. The set point is given by the display.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value: thermometer 4…20mA
18	Operating mode RUN
19	Alarm

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Temperature (Cooling)	OFF (Open-loop Control)
3-11-4-1	Minimum Temperature	0.00 [°C]	-200.00 [°C]
3-11-4-2	Maximum Temperature	150.00 [°C]	350.00 [°C]
3-11-4-3	Temperature Unit	°C	**preset**
1-3-2	Setpoint (Closed-loop Control)	50.00 [°C]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Temperature	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [°C]	-
3-8-2-4	Analog Input 2 Upper Limit	150.00 [°C]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

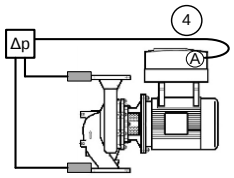
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

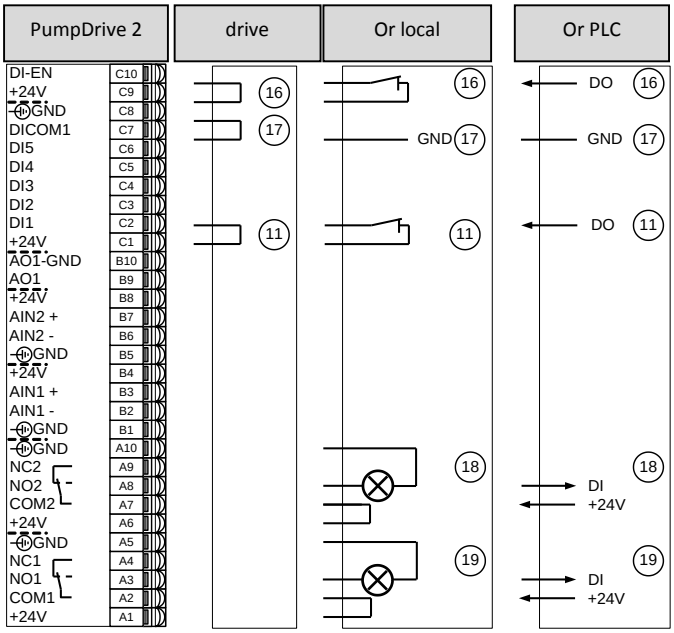
2) Pre-settings for completely assembled pump, motor, drive

2.3 Single pump – Options

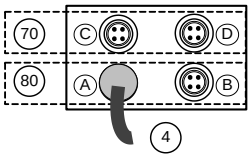
2.3.1 *Optional IO Card*

A constant differential pressure of 4 bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. With the optional IO Card additional messages by relays are signalized and the actual value by analog output is parameterized.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)

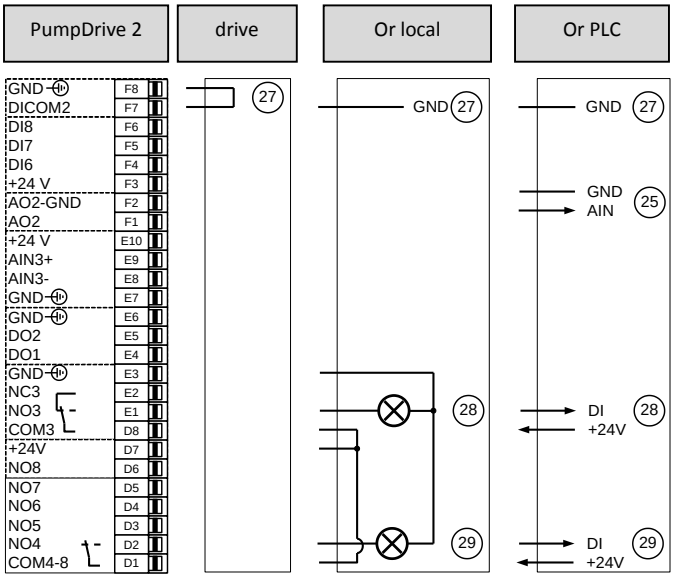


Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential Pressure	**preset referring to chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

Optional IO Card:

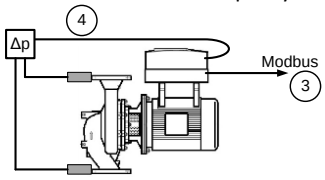


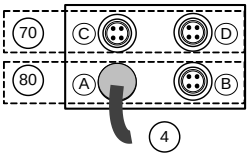
Nr.	Function
27	Ground for digital inputs
25	Analog output: Actual value
28	Message: current too high
29	Message: frequency too high

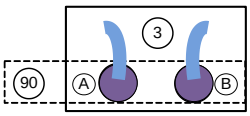
Nr.	Parameter	Change value to	Pre-settings by factory
3-8-8-1	Assignment 1 Analog Output 2	Actual Value	Motor Speed
3-8-11-1	Relay 3 Function	Current Too High	No Function
3-8-12-1	Relay 4 Function	Frequency Too High	No Function

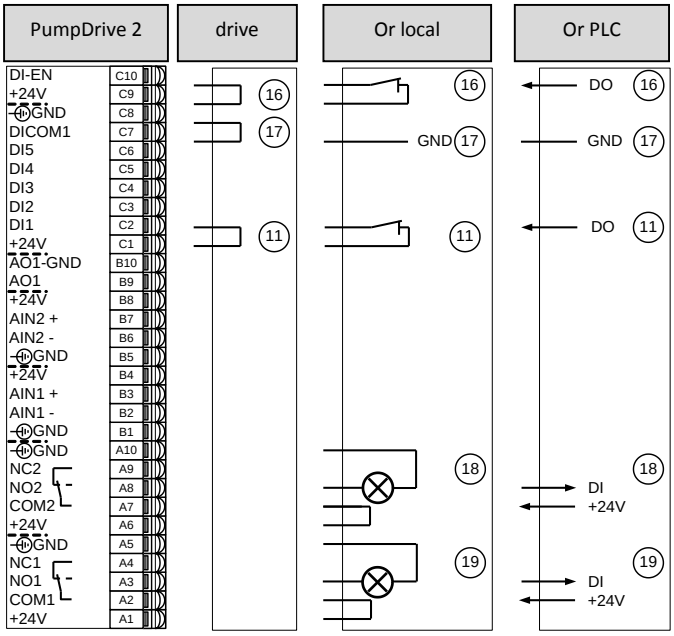
2.3.2 *Monitoring / control Fieldbus Module Modbus*

A constant pressure of 4 bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. By the optional fieldbus module Modbus only values are send (read-only): The Control Point is therefore set to local. The fieldbus module Modbus has the address 61. The baud rate is set to 19200. The parity is even.









Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
3	Fieldbus Module Modbus
4	Actual value: tailor-made bus cable for the connection of Pump-Meter to the M12 Module (color: black, female: straight, male: an-gled)
	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

	Function
90	Fieldbus Module Modbus
A	Modbus Module: plug male M12 B-coded
B	Modbus Module: plug female M12 B-coded

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential Pressure	**preset referring to chapter 1**
3-6-2	Control point	Local	**preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**
3-12-2-1	Modbus Slave Address	61	1
3-12-2-2	Baud Rate	19200	**preset**
3-12-2-3	Parity	even	**preset**
	Control via fieldbus		
3-6-2	Control point	Fieldbus	local
3-6-3	Actual Value Source	Fieldbus / Local	Local, or via analog input
3-8-6-1	Digital Input 1 Function	No function	System Start[1)]
3-12-2-3	Parity	Even	**preset**

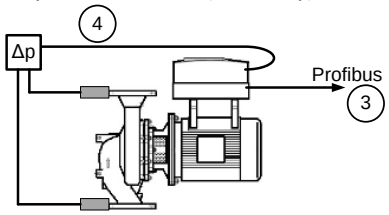
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

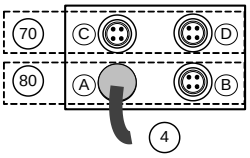
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

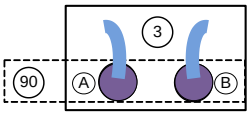
In the multi pump operation all drive can be control by one Modbus module.
It is possible to use a second module as redundant.
In this case the data must be written in both modules but only the Master will evaluate them.

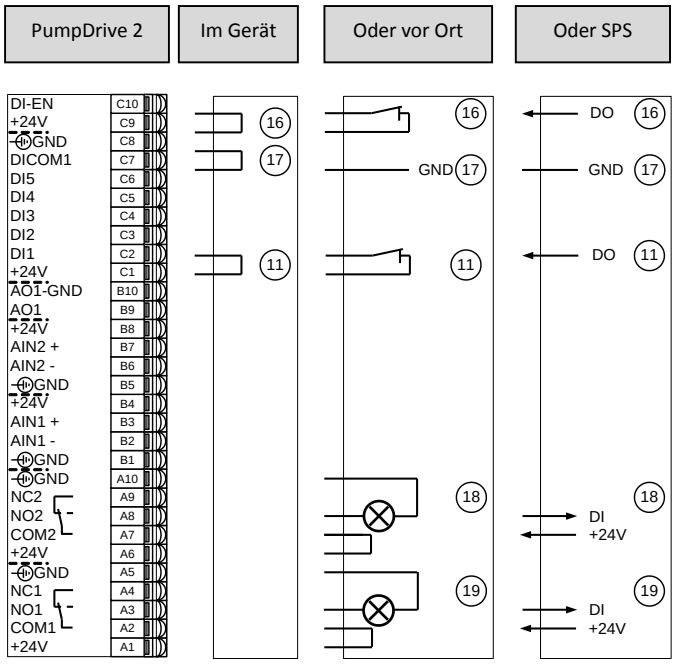
2.3.3 *Monitoring / control Fieldbus Module Profibus*

A constant pressure of 4bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. By the optional fieldbus module Profibus only values are send (read-only): The Control Point is therefore set to local. The fieldbus module Profibus has the address 61.









Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
3	Fieldbus Module Modbus
4	Actual value: tailor-made bus cable for the connection of Pump-Meter to the M12 Module (color: black, female: straight, male: angled)

	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

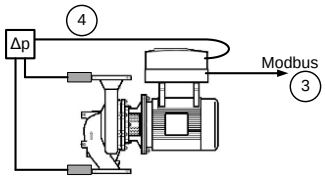
	Function
90	Fieldbus Module Profibus
A	Profibus Module: plug male M12 B-coded
B	Profibus Module: plug female M12 B-coded

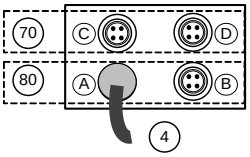
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential Pressure	**preset referring to chapter 1**
3-6-2	Control point	Local	**preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**
3-12-1-1	Profibus Slave Address	61	126
3-12-1-2	Pump number	1	**preset**
	Control via fieldbus		
3-6-2	Control point	Fieldbus	local
3-6-3	Actual Value Source	Fieldbus / Local	Local, or via analog input
3-8-6-1	Digital Input 1 Function	No function	System Start[1)]

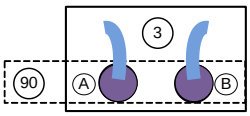
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

2.3.4 *Control via Fieldbus Module Modbus with control via digital inputs if communication with field bus is lost.*

A constant pressure of 4 bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point and system start is given by the field bus Modbus. The Control Point is therefore set to field bus. The fieldbus module Modbus has the address 61. The baud rate is set to 19200. The parity is even.





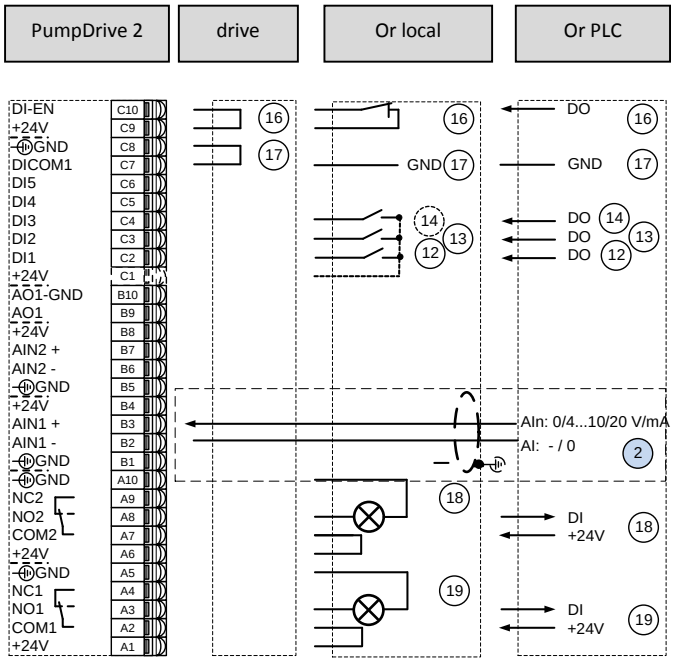


	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

	Function
90	Fieldbus Module Modbus
A	Modbus Module: plug male M12 B-coded
B	Modbus Module: plug female M12 B-coded

3 other fixed speeds Auto, Hand and OFF to be selected for the emergency operation via digital switches.
Alternatively, a variable speed as 0/4 - 10/20 V / mA can be preset via analogue input 1.
Attention: The drive must now always be switched via the digital inputs with Auto zero or Man.
Info: by selecting fixed speed the PumpDrive goes to manual mode. The AUTO key on the display has no function (see control point concept).

		DI 1: Control digital (Bit 0)	DI 2: Control digital (Bit 1)	DI 3: Control digital (Bit 2)
All DI on 0	**Off**	**0**	**0**	**0**
Only Automatic DI 1 on 1	**Automatic**	**1**	**0**	**0**
Hand variable speed DI 2 on 1	**Hand (variable speed)**	**0**	**1**	**0**
Fix speed 1: 2950 1/min	**Hand (Fix speed 1)**	**1**	**1**	**0**
Fix speed 2: 2213 1/min	**Hand (Fix speed 2)**	**1**	**0**	**1**
Fix speed 3: 1475 1/min	**Hand (Fix speed 3)**	**1**	**1**	**1**



Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
14	Digital control (Bit 2)
13	Digital control (Bit 1) Hand variable speed
12	Digital control (Bit 0) Automatic
18	Operating mode RUN
19	Alarm
2	Analog hand setting signal (voltage or current)
3	Fieldbus Module Modbus
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential Pressure	**preset referring to chapter 1**
3-6-2	Control point	Fieldbus	local
3-6-3	Actual Value Source	Fieldbus	local
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	Written via fieldbus	**preset according to spec. Q,H**
3-6-5-1	Fixed speed 1	2950 [1/min]	500 [1/min]
3-6-5-2	Fixed speed 2	2250 [1/min]	500 [1/min]
3-6-5-3	Fixed speed 3	1500 [1/min]	500 [1/min]
3-8-1-1	Analog Input 1 Signal	0/2 – 10 V; 0/4-20 mA	OFF
3-8-1-2	Analog Input 1 Function	Control Value (Manual)	Alternative variable speed
3-8-1-3	Analog Input 1 Lower Limit	0 [1/min]	-
3-8-1-4	Analog Input 1 Upper Limit	2950 [1/min]	-
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**preset**
3-8-6-1	Digital Input 1 Function	Control Digital Bit 0	System Start[1)]
3-8-6-2	Digital Input 2 Function	Control Digital Bit 1	No function
3-8-6-3	Digital Input 3 Function	Control Digital Bit 2	No function
3-12-2-1	Modbus Slave Address	61	1
3-12-2-2	Baud Rate	19200	**preset**
3-12-2-3	Parity	even	**preset**

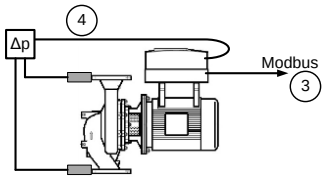
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter
3) This application is also applicable for all other fieldbus modules. Please see the supplementary operating manual of the respective field bus.

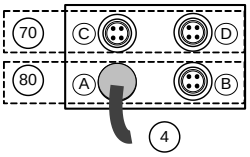
From firmware version 1.3.1 the Cycle Time, Setpoint/Control Value and Actual Value were monitored on the field bus.
If no value is written in the PumpDrive during this time it reports failure actual value, no main pump.
With the alarm no main pump the broken wire detection take effect.

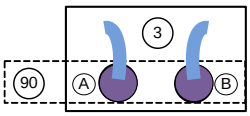
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-12-2-5	Cycle Time, Setpoint/ Control Value	1 s	5 s *0 disables the monitoring
3-12-2-6	Cycle Time, Actual Value	1 s	**preset** *0 disables the monitoring
3-9-1	Broken Wire Detection		
3-9-1-1	Response to Failure	Fixed Speed	All Pumps OFF
3-9-1-2	Time Delay	0,5 s	0,5 s
3-9-1-3	Speed During Failure	500 - 4200	Parameter 3-2-2-1 Minimum Motor Speed

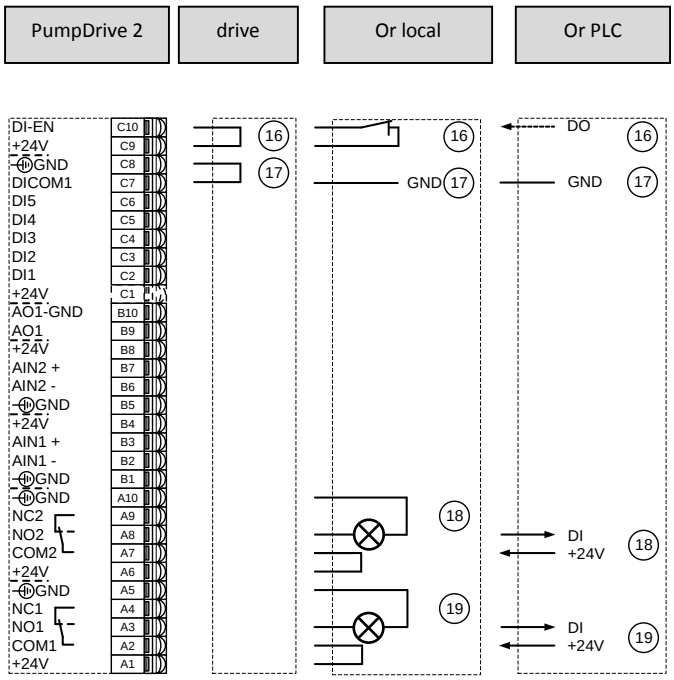
2.3.5 *Monitoring Fieldbus Module Modbus with monitoring of the cycle time*

A constant pressure of 4 bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point and system start is given by the field bus Modbus. The control point is therefore set to field bus. The fieldbus module Modbus has the address 61. The baud rate is set to 19200. The parity is even.









	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

	Function
90	Fieldbus Module Modbus
A	Modbus Module: plug male M12 B-coded
B	Modbus Module: plug female M12 B-coded

Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
18	Operating mode RUN
19	Alarm
3	Fieldbus Module Modbus
4	Actual value: tailor-made bus cable for the connection of Pump-Meter to the M12 Module (color: black, female: straight, male: angled)

Nr.	Parameter	Change value to	Pre-settings by factory [2]
3-6-1	Type of Control	Differential Pressure	**preset referring to chapter 1**
3-6-2	Control point	Field bus	local
3-6-3	Actual Value Source	Field bus or PumpMeter	local
3-11-2-1	Minimum Pressure	-1.00 [bar]	**preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**preset**
3-11-2-3	Pressure Unit	bar	**preset**
1-3-2	Setpoint (Closed-loop Control)	Written via fieldbus	**preset according to spec. Q,H**
3-8-6-1	Digital Input 1 Function	No function	System Start[1]
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure or intern PMtr Suction/Discharge Pressure	**preset**
3-12-2-1	Modbus Slave Address	61	1
3-12-2-2	Baud Rate	19200	**preset**
3-12-2-3	Parity	even	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter
3) This application is also applicable for all other fieldbus modules. Please see the supplementary operating manual of the respective field bus.

From firmware version 1.3.1 the Cycle Time, Setpoint/Control Value and Actual Value were monitored on the field bus.
If no value is written in the PumpDrive during this time it reports failure actual value, no main pump.
With the alarm no main pump the broken wire detection take effect.

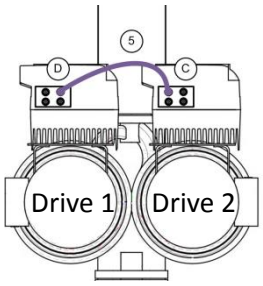
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-12-2-5	Cycle Time, Setpoint/ Control Value	1 s	5 s *0 disables the monitoring
3-12-2-6	Cycle Time, Actual Value	1 s	**preset** *0 disables the monitoring
3-9-1	Broken Wire Detection		
3-9-1-1	Response to Failure	Fixed Speed	All Pumps off
3-9-1-2	Time Delay	0,5 s	**preset**
3-9-1-3	Speed During Failure	500 - 4200	Parameter 3-2-2-1 Minimum Motor Speed

3. Double pump

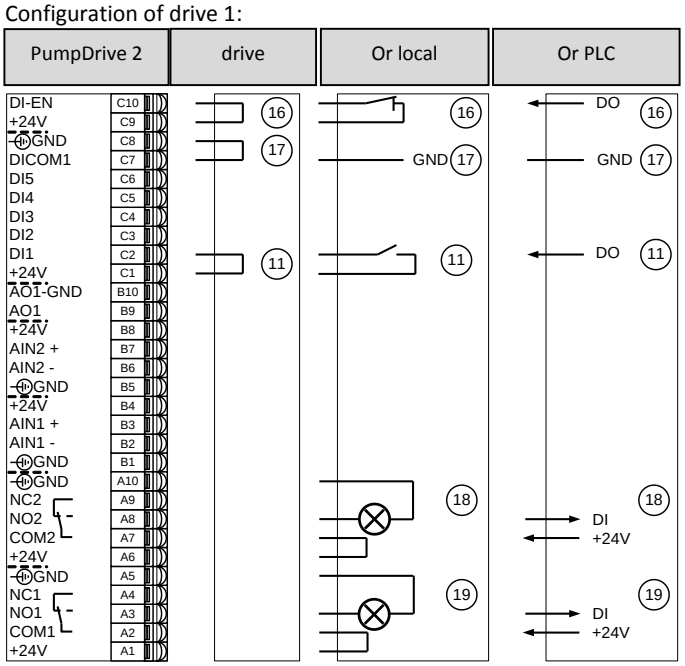
3.1 Double pump – Open loop control

3.1.1 *Open loop control: control value at display*

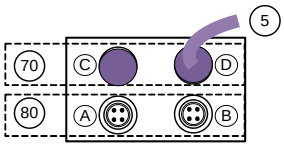
Etaline Z double pump (2x100%): A fixed speed of 2000 1/min should be set on the display. The nominal speed of the 2 pole motor is 2950 1/min. Pump changeover will take place regularly after 24 hours of operation.



Configuration of drive 1:



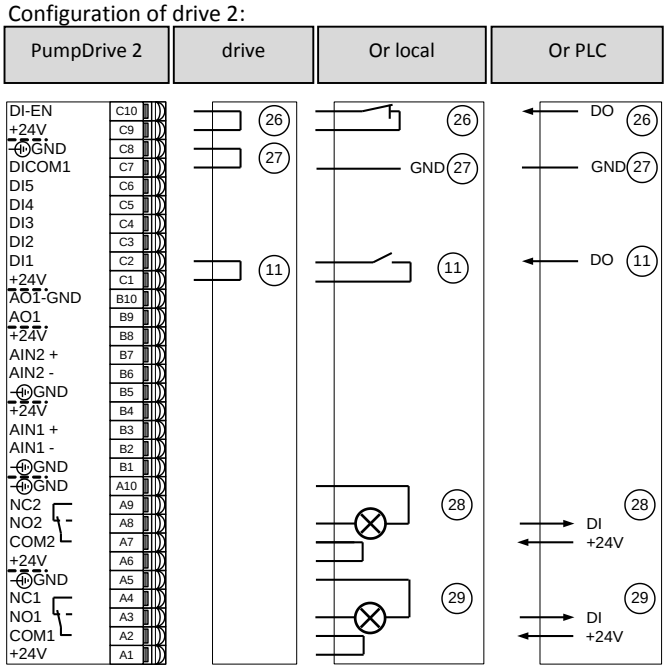
	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
18	Operating mode RUN
19	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



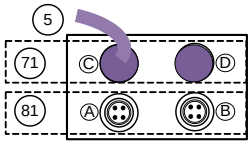
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	preset
3-2-2-1	Minimum Motor Speed	500 [1/min]	preset
3-2-2-2	Maximum Motor Speed	2950 [1/min]	preset
1-3-3	Control Value (Open-loop Control)	2000 [1/min]	motor specific
3-7-1	Role in Multiple Pump System	Master control	preset
3-7-2	Maximum Number of Pumps Running	1	preset
3-7-4-1	Automatic Pump Changeover	Runtime	preset
3-7-4-2	Runtime Prior to Pump Changeover	24 [h]	preset
3-8-6-1	Digital Input 1 Function	System Start[1)]	preset

Configuration of drive 2:



	Function
26	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



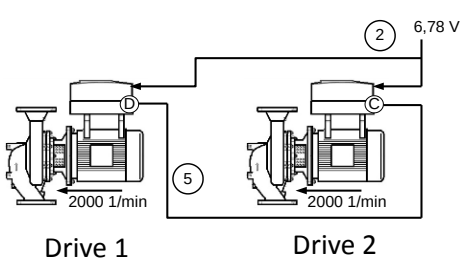
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

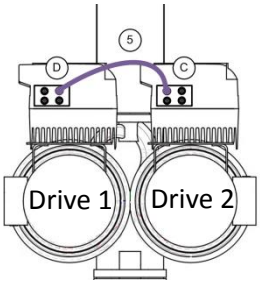
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	preset

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

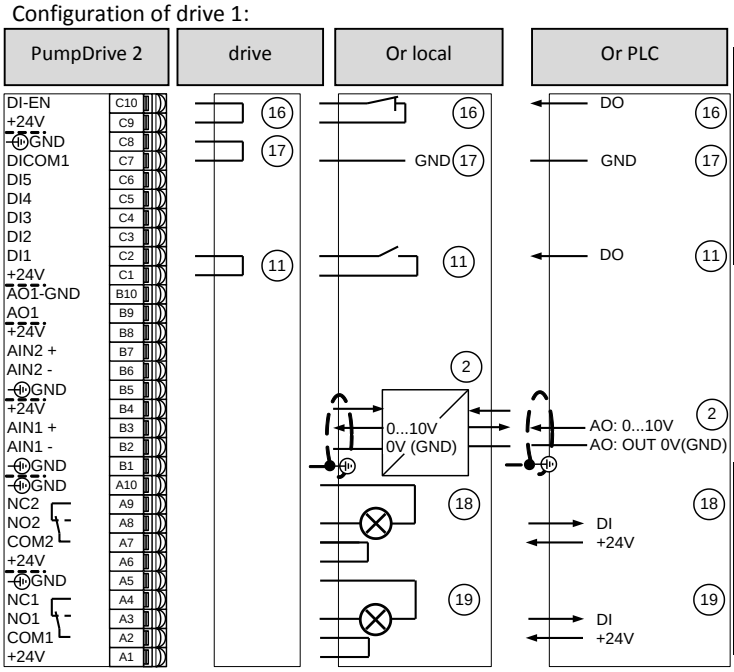
3.1.2 *Open loop control: control value with external signal*

Etaline Z double pump (2x50%): A fixed speed of 2000 1/min is given by an external signal 0…10V at analog input 1.
2000 1/min is equal to 6.78 V when using a 2-pole motor with a nominal speed of 2950 1/min.
Information: the set point can't be lower than the minimum speed.

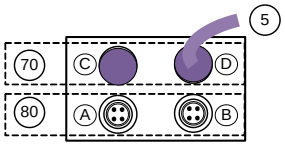




Configuration of drive 1:



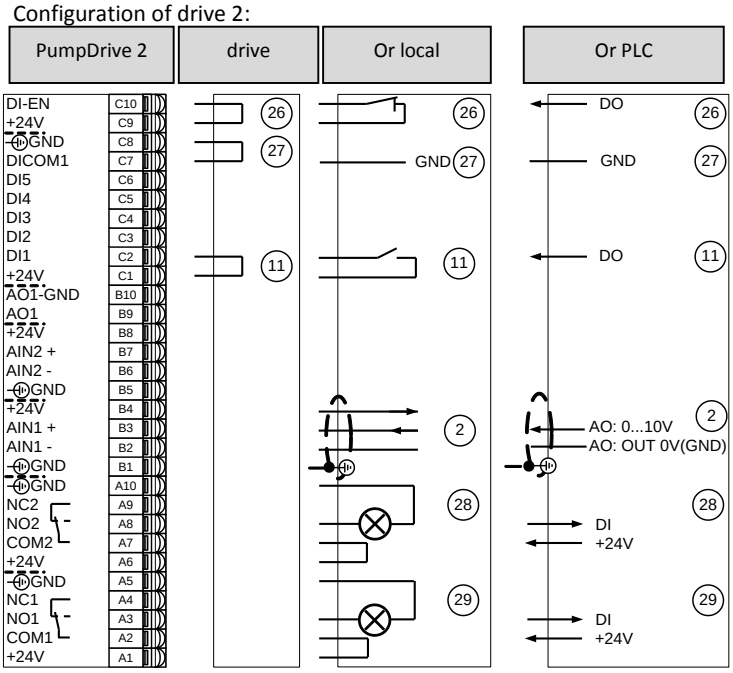
	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
2	Set point (open loop): 0…10V
18	Operating mode RUN
19	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



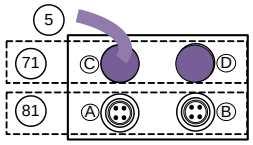
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	preset
3-2-2-1	Minimum Motor Speed	500 [1/min]	preset
3-2-2-2	Maximum Motor Speed	2950 [1/min]	preset
3-8-1-1	Analog Input 1 Signal	0…10V	OFF
3-8-1-2	Analog Input 1 Function	Setpoint/Control value (Auto)	No Function
3-8-1-3	Analog Input 1 Lower Limit	0 [1/min]	-
3-8-1-4	Analog Input 1 Upper Limit	2950 [1/min]	-
3-7-1	Role in Multiple Pump System	Master control	preset
3-7-2	Maximum Number of Pumps Running	2	1
3-8-6-1	Digital Input 1 Function	System Start[1)]	preset

Configuration of drive 2:



	Function
26	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
2	Set point (open loop): 0...10V
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

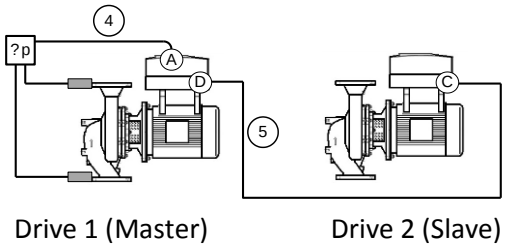
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	preset

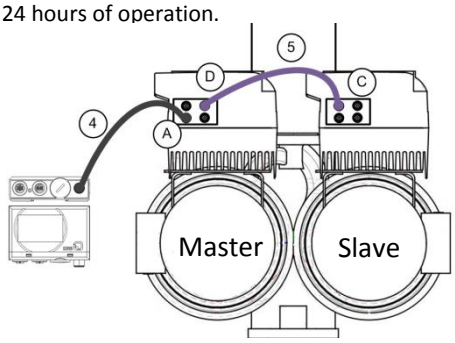
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

3.2 Double pump – closed loop control

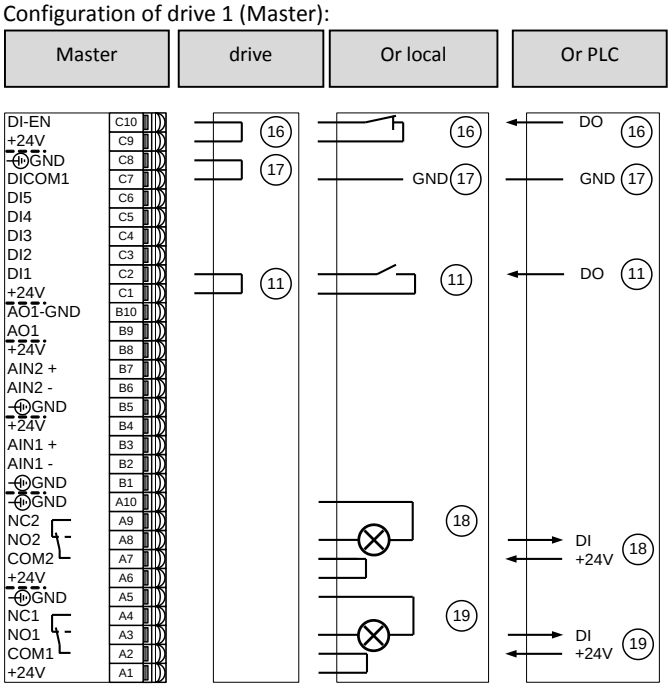
3.2.1 *Closed loop control non redundant: differential pressure with PumpMeter (Modbus)*

Etaline Z double pump (2x100%): A constant differential pressure of 4 bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. Pump changeover will take place regularly after 24 hours of operation.

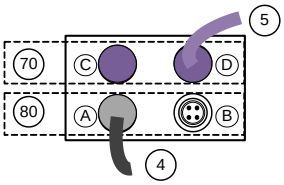




Configuration of drive 1 (Master):



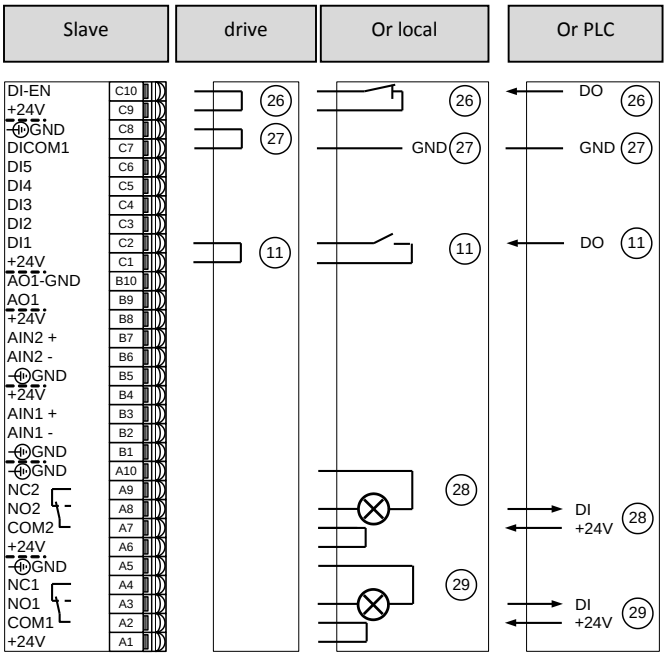
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



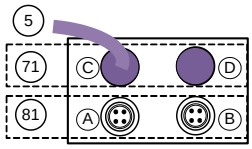
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	preset
3-11-2-1	Minimum Pressure	-1.00 [bar]	preset
3-11-2-2	Maximum Pressure	10.00 [bar]	preset
3-11-2-3	Pressure Unit	bar	preset
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	preset according to spec. Q,H
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	preset
3-7-1	Role in Multiple Pump System	Master control	preset
3-7-2	Maximum Number of Pumps Running	1	preset
3-7-4-1	Automatic Pump Changeover	Runtime	preset
3-7-4-2	Runtime Prior to Pump Changeover	24	preset
3-8-6-1	Digital Input 1 Function	System Start[1)]	preset

Configuration of drive 2 (Slave):



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



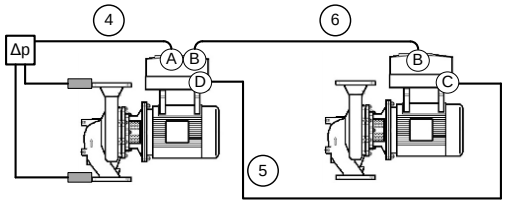
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Auxiliary Control	**preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

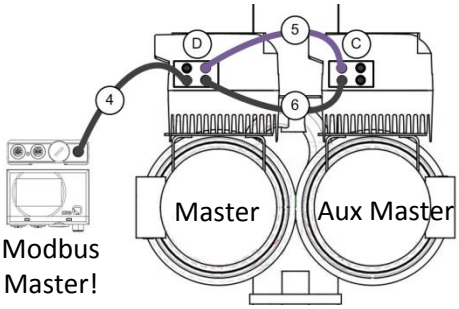
3.2.2 *Closed loop control redundant: differential pressure with PumpMeter (Modbus)*

Etaline Z double pump (2x100%): A constant differential pressure of 4 bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The sensor signal of PumpMeter is linked by a cross link cable (see accessories) from drive to drive. The AuxMaster can take over control if the Master fails. The set point is given by the display. Pump changeover will take place regularly after 24 hours of operation.
This also works in systems with more than 2 pumps.

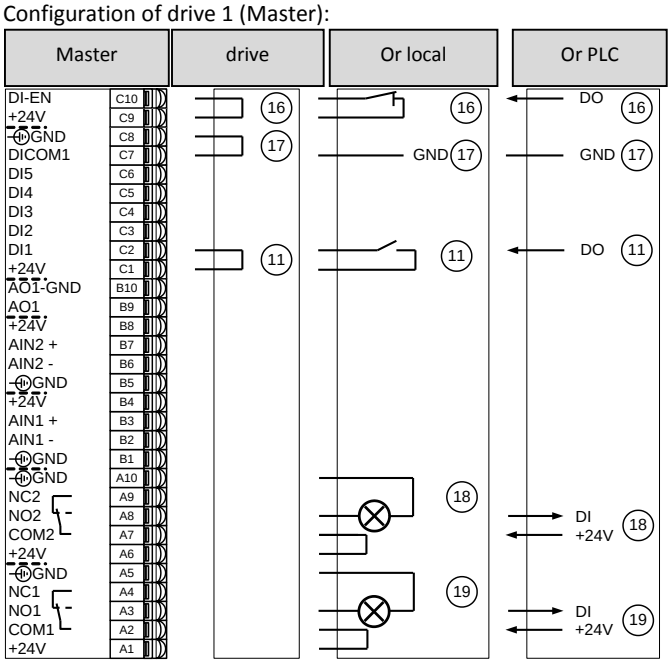


Drive 1 (Master) Drive 2 (Aux Master)

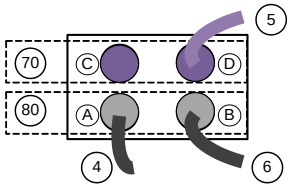
Special Firmware Modbus Master in PumpMeter is needed. In case of Etaline Z the special firmware is programmed in factory (DTM see also KSB Homepage)



Configuration of drive 1 (Master):



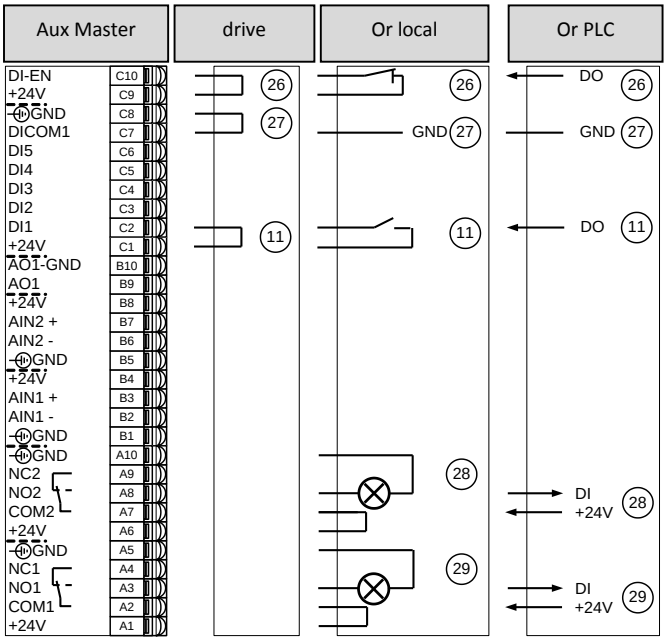
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)
6	Actual value: tailor-made cross link bus cable for the redundant connection of PumpMeter (color: black, female: angled, male: angled)



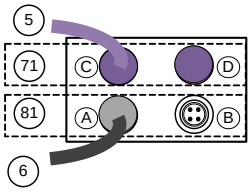
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	M12 Module female B: cross link bus cable PumpMeter (Modbus)
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**According to spec. Q,H preset**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-13-5	PumpMeter Master/Slave	Master	**Preset at Etaline Z**
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	1	**Preset**
3-7-4-1	Automatic Pump Changeover	Runtime	**Preset**
3-7-4-2	Runtime Prior to Pump Changeover	24	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 2 (AuxMaster):



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)
6	Actual value: tailor-made cross link bus cable for the redundant connection of PumpMeter (color: black, female: angled, male: angled)



Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	M12 Module female A: cross link bus cable PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

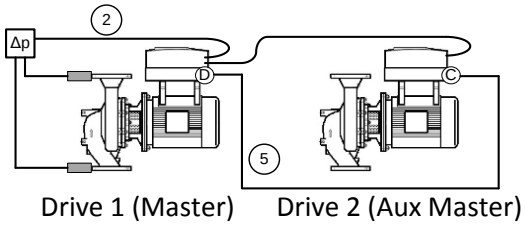
In the Etaline Z the second drive will be delivered as Slave. In the case of connection of a crosslink cable the second drive must be parameterized as Master control.

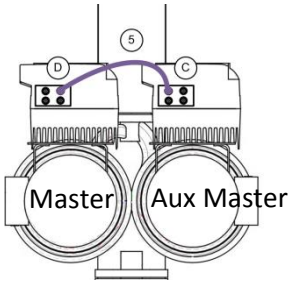
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-13-5	PumpMeter Master/Slave	Master	**Preset at Etaline Z**
3-7-1	Role in Multiple Pump System	Master control	Auxiliary Control

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

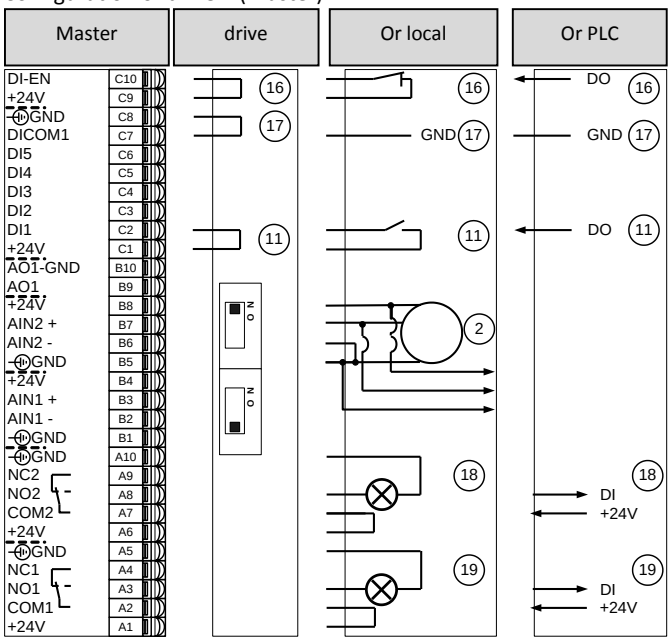
3.2.3 *Closed loop control redundant: differential pressure with sensor 4…20mA*

Etaline Z double pump (2x100%): A constant differential pressure of 4 bar is needed. The 4…20mA differential pressure sensor with a measurement range of 0-6 bar is connected in parallel to each analog input 2 of Master and AuxMaster. The AuxMaster can take over control if the Master fails. When connecting a 4…20mA sensor in parallel to both drives the 4…20mA current signal must be converted to a 2…10V voltage signal: therefore the DIP switch of the analog input 2 of the Master must be set to "ON" [3)]. The set point is given by the display. Pump changeover will take place regularly after 24 hours of operation.

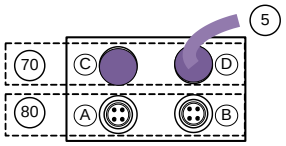




Configuration of drive 1 (Master):



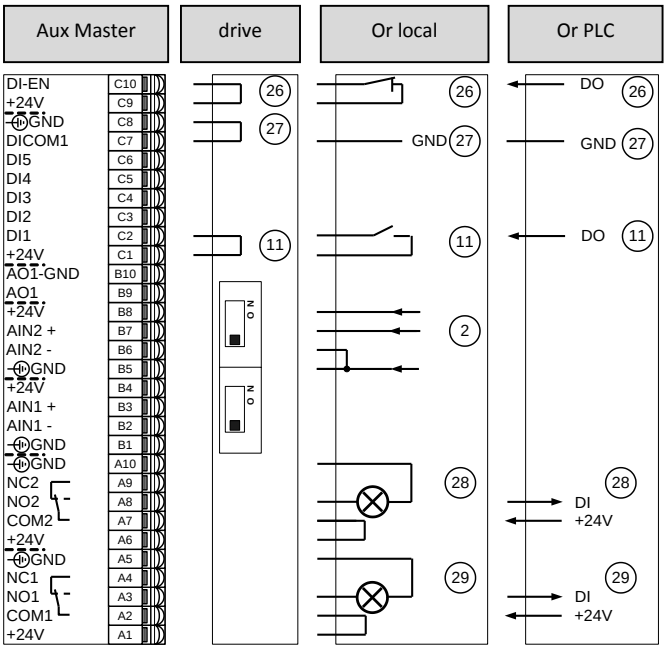
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: differential pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



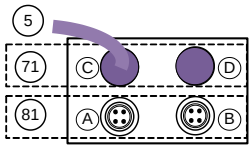
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	**Preset**
3-11.2.2	Maximum Pressure	6.00 [bar]	999.99 [bar]
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0.00 [bar]
3-8-2-1	Analog Input 2 Signal	2…10V[3)]	OFF
3-8-2-2	Analog Input 2 Function	Differential pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	1	**Preset**
3-7-4-1	Automatic Pump Changeover	Runtime	**Preset**
3-7-4-2	Runtime Prior to Pump Changeover	24	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 2 (AuxMaster):



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: differential pressure sensor 4…20mA
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



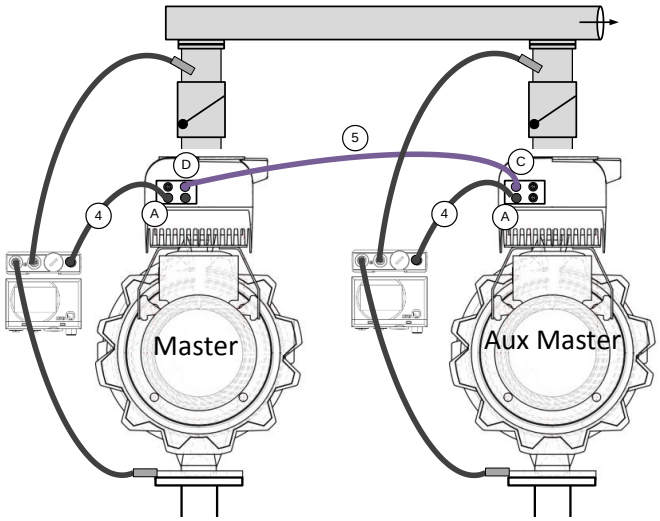
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

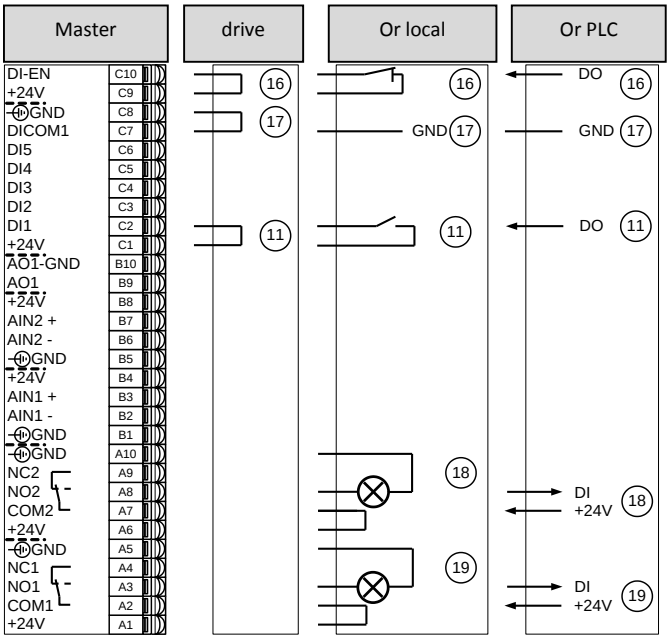
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	**Preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive
3) On all drives will be the 4…20mA signal converted to 2…10V signal, if the DIP switch in the Master is set to „ON“

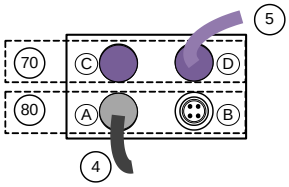
3.2.4 *Closed loop control redundant: differential pressure with two PumpMeter*

Etaline / Etabloc (2x100%): A constant differential pressure of 0.8 bar is needed. Two PumpMeter are used as a differential pressure sensor in the measurement range of -1 … 3 bar. Each PumpMeter is connected by Modbus to the M12 Module of his drive. Der discharge pressure is mounted after the non-return valve. Due to the changed mounting position of the sensor the height of measuring points is changed from 0.34m to 1m. The setpoint is given by the display. Pump changeover will take place regularly after 24 hours of operation.





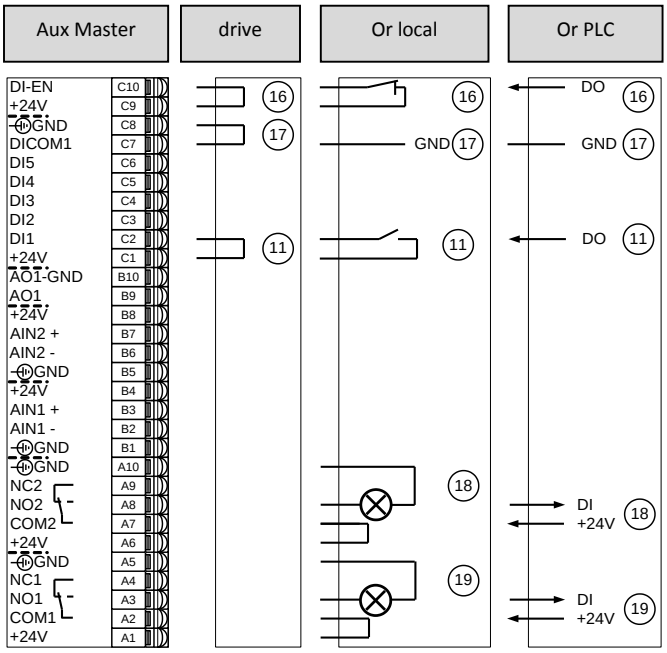
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



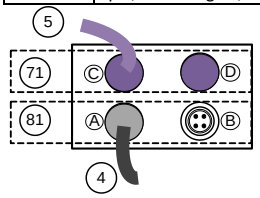
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Etaline: Differential pressure Etabloc: Discharge pressure	**Preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	3.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-9-8-1	Flow Rate Estimation	On	**Preset**
3-5-2-1	Pipe Diameter_Suction Pressure Measuring Point	40 [mm]	**Preset**
3-5-2-2	Pipe Diameter_Discharge Pressure Measuring Point	40 [mm]	**Preset**
3-5-2-3	Height Difference_Pressure Measuring Points	1.00 [m]	0.34 [m]
3-5-2-4	Pressure Measuring Point Positions	Distant from pump	Close to pump
3-8-4-1	Function M12-Modul Input A	PMtr Suction/Discharge Pressure	**Preset**
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	1	**Preset**
3-7-4-1	Automatic Pump Changeover	Runtime	**Preset**
3-7-4-2	Runtime Prior to Pump Changeover	24	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 2 (AuxMaster):



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



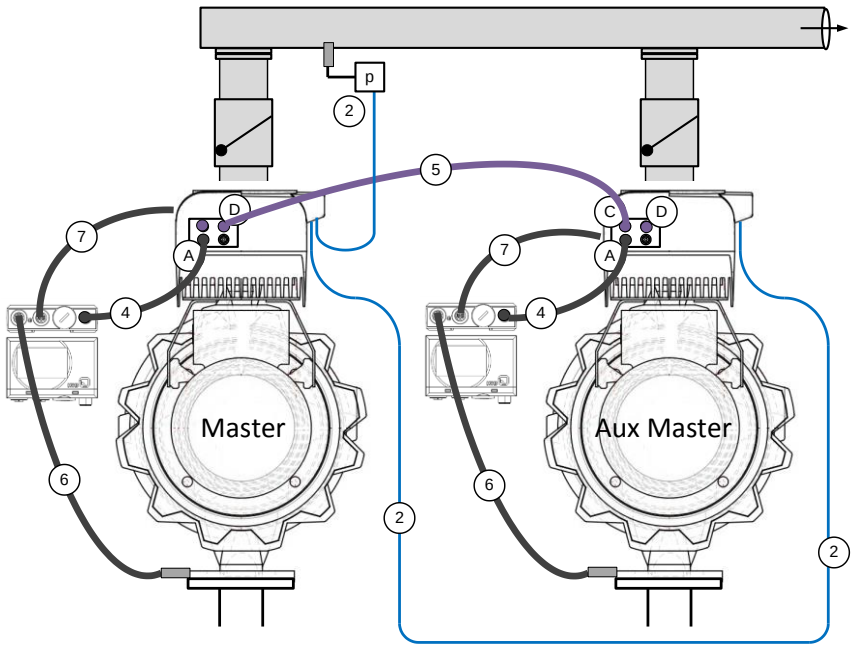
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-5-2-4	Pressure Measuring Point Positions	Distant from pump	Close to pump
3-8-4-1	Function M12-Modul Input A	PMtr Suction/Discharge Pressure	**Preset**
3-7-1	Role in Multiple Pump System	Master control	**Preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

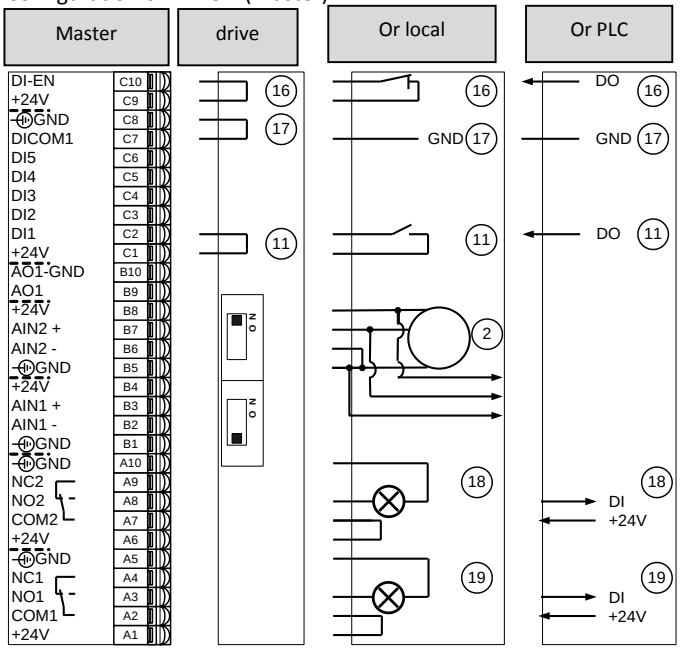
3.2.5 *Closed loop control redundant: Discharge pressure with pressure sensor 4…20mA and PumpMeter each pump*

Etaline / Etabloc (2x100%): In a multi pump system with three pumps a constant pressure of 4bar is needed. The 4…20mA pressure sensor with a measurement range of 0-6 bar placed in the manifold is connected in parallel to each analog input 2 of Master and AuxMaster1. The AuxMaster can take over control if the Master fails. When connecting a 4…20mA sensor in parallel to all drives the 4…20mA current signal must be converted to 2…10V voltage signal: therefore the DIP switch of the analog input 2 of the Master must be set to "ON" [3]. Each pump uses PumpMeter as an internal sensor -1 to 6bar, which is not used for the control. The set point is given by the display.

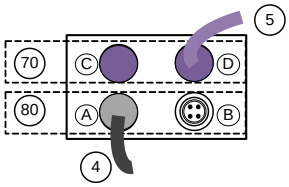


Nr.	Function
2	Actual value: pressure sensor 4…20mA redundant
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)
6	Sensor PumpMeter suction side
7	Sensor PumpMeter pressure side
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus) or Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus) or Bus resistor

Configuration of Drive 1 (Master):



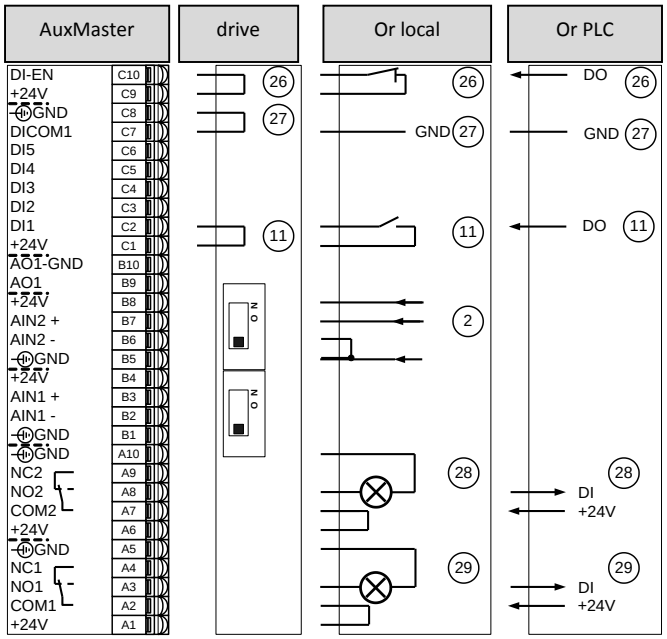
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



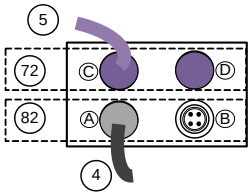
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	Differential pressure
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	6.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	4,00 [bar]
3-8-2-1	Analog Input 2 Signal	2…10V[3)]	OFF
3-8-2-2	Analog Input 2 Function	Discharge Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-8-4-1	Function M12 Module Input A	PMtr Internal Suction/Discharge Pressure[4)]	PMtr Suction/Discharge Pressure
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	1	1
3-7-4-1	Automatic Pump Changeover	Runtime	OFF
3-7-4-2	Runtime Prior to Pump Changeover	24	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of Drive 2 (AuxMaster 1):



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: pressure sensor 4…20mA
28	Operating mode RUN
29	Alarm
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



Nr.	Function
72	M12 Module: Double and multi pump operation
82	M12 Module: PumpMeter
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	**Preset**

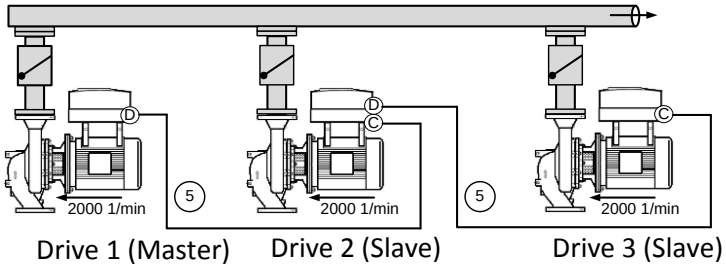
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive
3) On all drives will be the 4…20mA signal converted to 2…10V signal, if the DIP switch in the Master is set to „ON“
4) If PumpMeter is only used as an internal measured variable at input A of the M12 module (via Modbus) and not for control, the Function M12 Module Input A parameter (3-8-4-1) must be set to PMtr Internal Suction/Discharge Pressure.

4. Multi pump operation

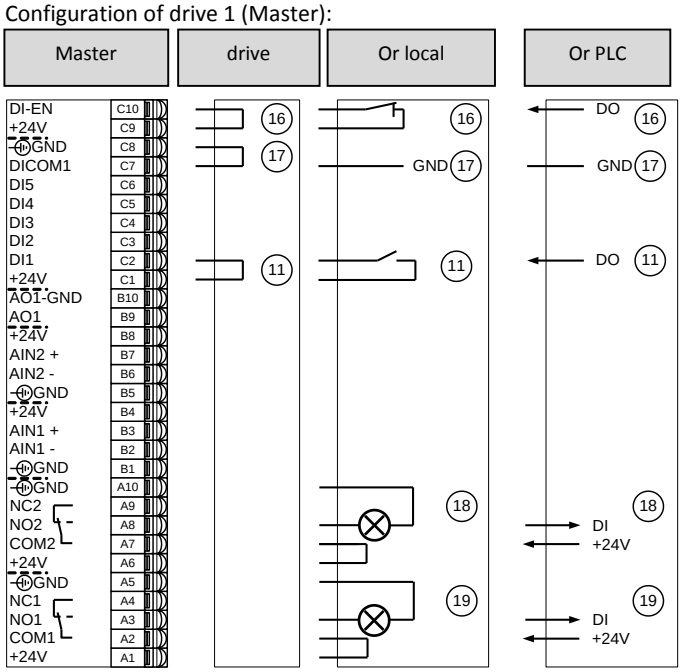
4.1 Multi pump operation – Open loop control

4.1.1 *Open loop control: control value at display*

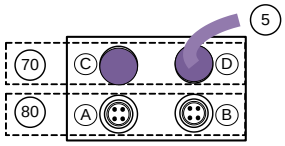
Three Maximum Number of Pumps Running in parallel with a fixed speed of 2000 1/min. The nominal speed of the 2 pole motor is 2950 1/min. The set point is given by the display.



Configuration of drive 1 (Master):



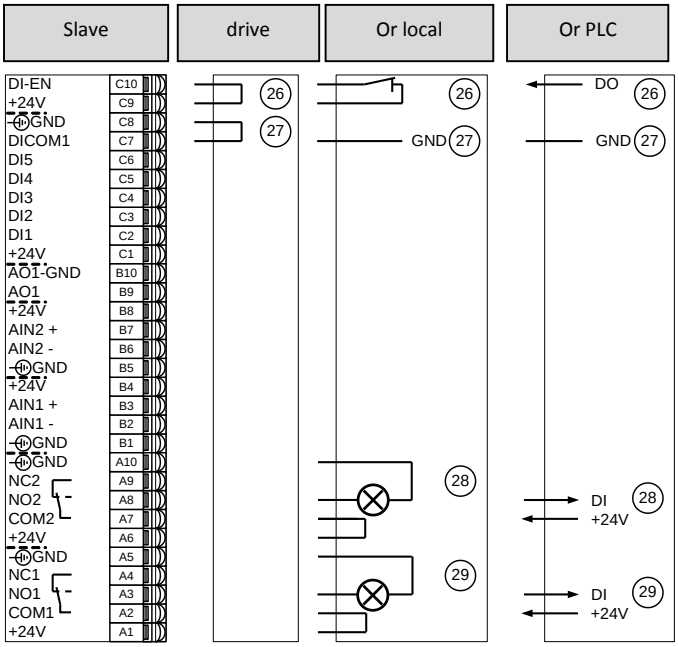
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: differential pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



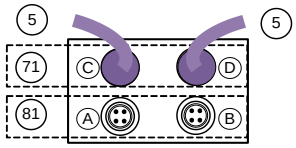
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**Preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
1-3-3	Control Value (Open-loop Control)	2000 [1/min]	motor specific
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 2 (Slave):



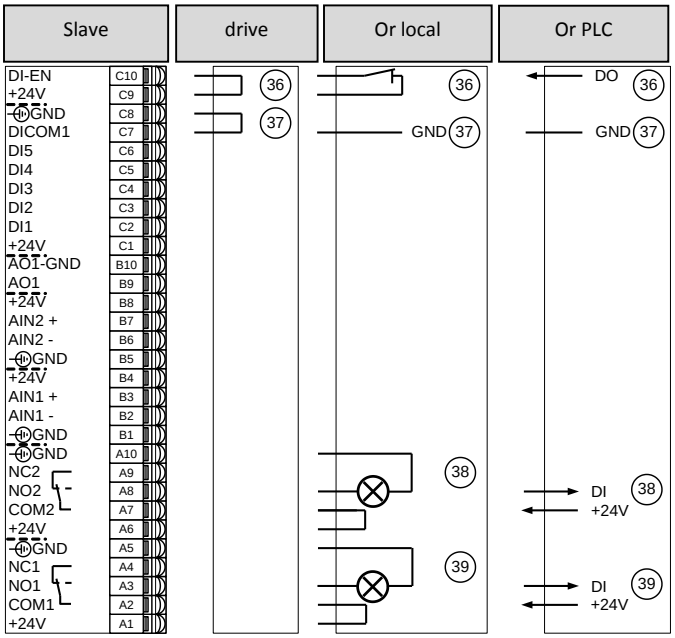
Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



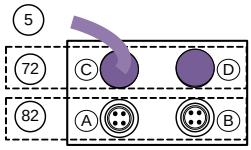
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**Preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
3-7-1	Role in Multiple Pump System	Auxiliary Control	Master control
3-7-2	Maximum Number of Pumps Running	3	1

Configuration of drive 3 (Slave):



Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
38	Operating mode RUN
39	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



Nr.	Function
72	M12 Module: Double and multi pump operation
82	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**Preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
3-7-1	Role in Multiple Pump System	Auxiliary Control	Master control
3-7-2	Maximum Number of Pumps Running	3	1

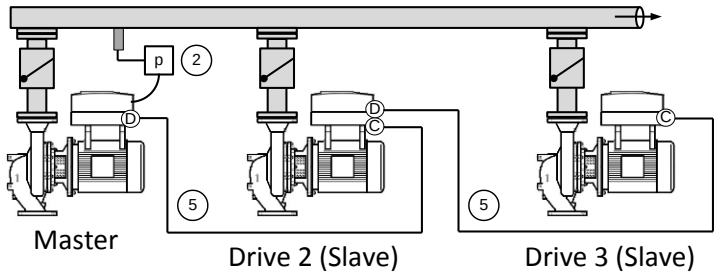
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

4.2 Multi pump operation – closed loop control

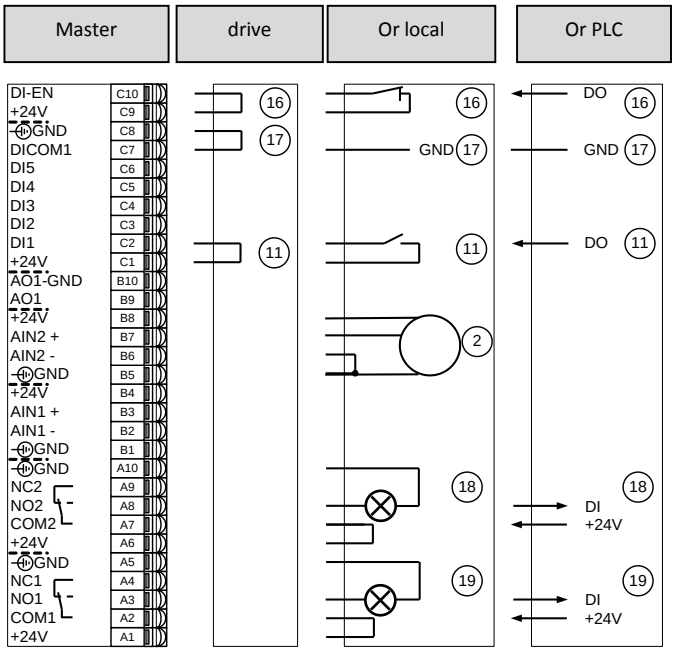
All the examples shown here can be extended up to 6 PumpDrives.
All pumps can be master, by connecting to them the signal of a sensor and a system start.
For a redundant operation, we recommend the application starting on chapter 4.2.3 .

4.2.1 *Closed loop control: pressure with pressure sensor 4...20 mA*

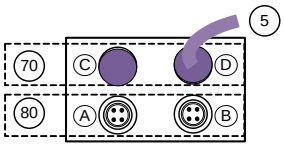
In a multi pump operation with three pumps a constant pressure of 4 bar is needed. The 4…20mA differential pressure sensor with a measurement range of 0-6 bar placed in the manifold is connected to analog input 2 of the Master. The set point is given by the display.



Configuration of drive 1 (Master):



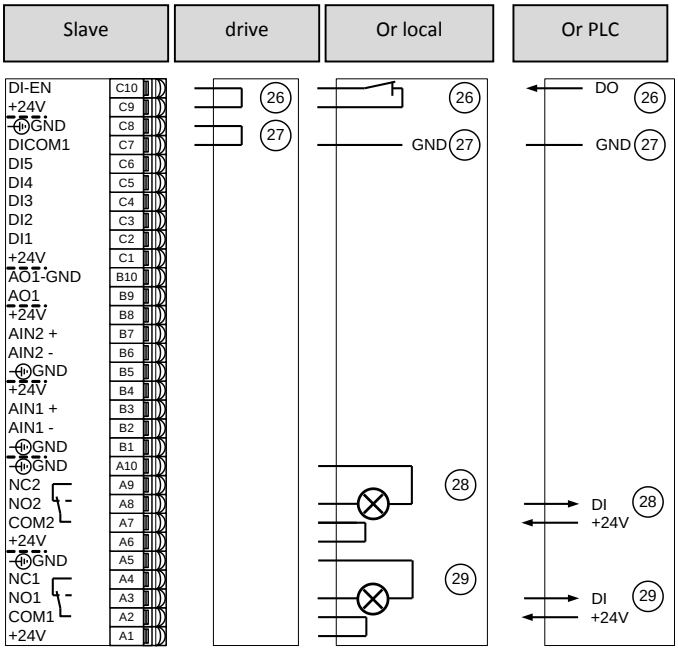
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: differential pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



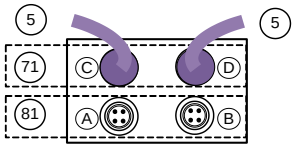
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Discharge Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 2 and 3 (Slave):



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)

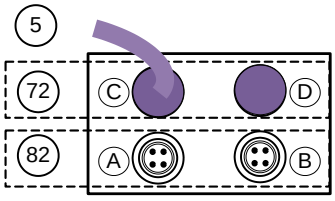


Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Auxiliary Control	Master control
3-7-2	Maximum Number of Pumps Running	3	1

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive.

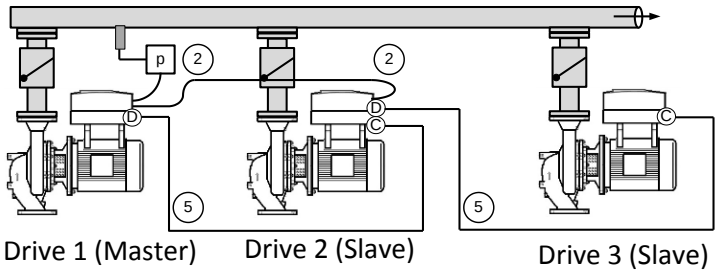
M12 Module Drive 3:



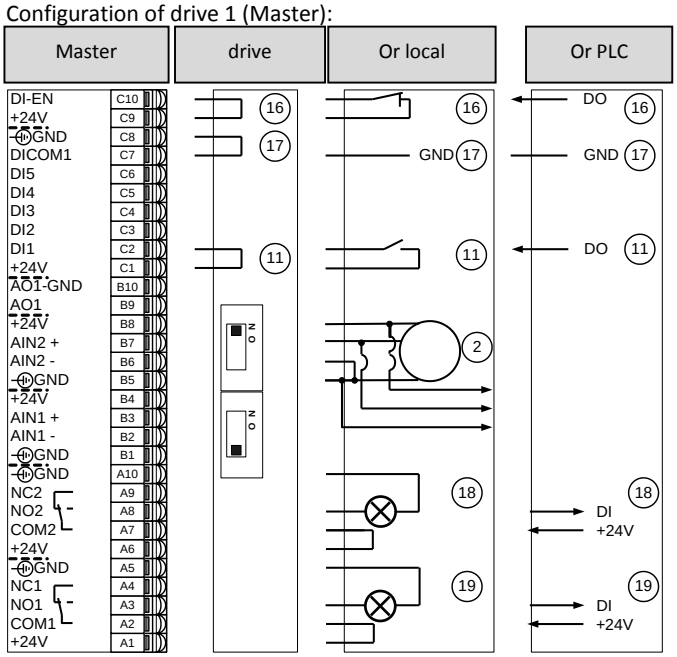
Nr.	Function
72	M12 Module: Double and multi pump operation
82	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

4.2.2 *Closed loop control redundant: pressure with pressure sensor 4...20 mA*

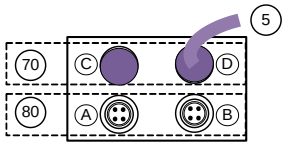
In a multi pump operation with three pumps a constant pressure of 4 bar is needed. The 4…20mA pressure sensor with a measurement range of 0-6 bar placed in the manifold is connected in parallel to each analog input 2 of Master and AuxMaster. The AuxMaster can take over control if the Master fails. When connecting a 4…20mA sensor in parallel to both drives the 4…20mA current signal must be converted to 2…10V voltage signal: therefore the DIP switch of the analog input 2 of the Master must be set to "ON" [3]. The set point is given by the display.



Configuration of drive 1 (Master):



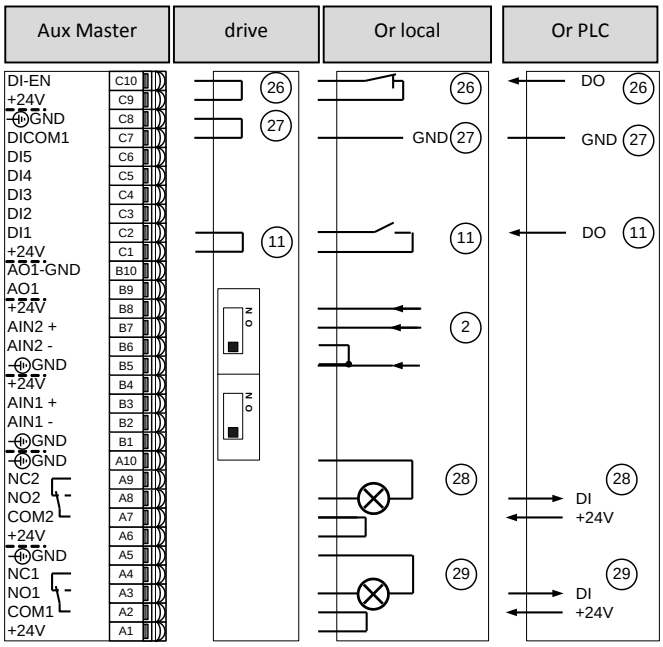
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1]
2	Actual value: pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



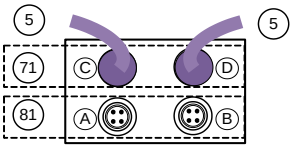
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	2…10V[3]	OFF
3-8-2-2	Analog Input 2 Function	Discharge Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1
3-8-6-1	Digital Input 1 Function	System Start[1]	**Preset**

Configuration of drive 2 (AuxMaster):



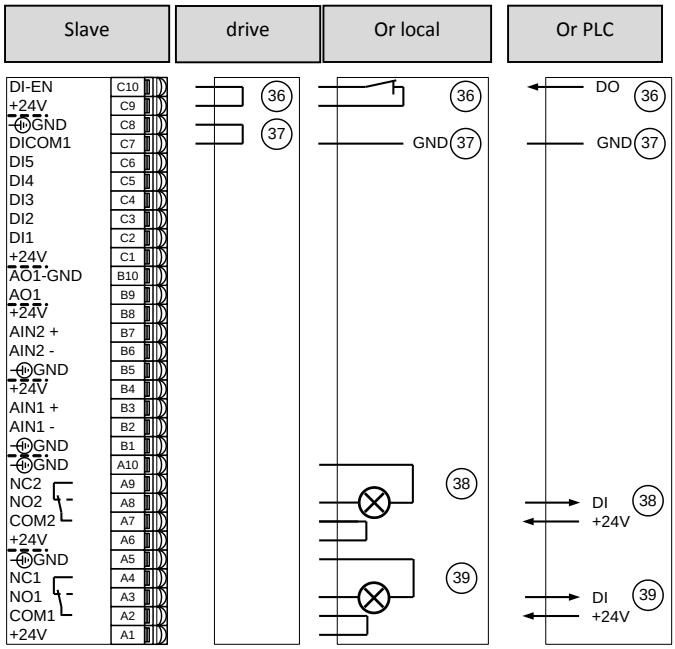
Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1)]
2	Actual value: pressure sensor 4…20mA
28	Operating mode RUN
29	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



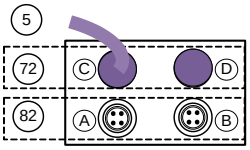
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	2…10V[3)]	OFF
3-8-2-2	Analog Input 2 Function	Discharge Pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	6.00 [bar]	-
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 3 (Slave):



Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
38	Operating mode RUN
39	Alarm
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



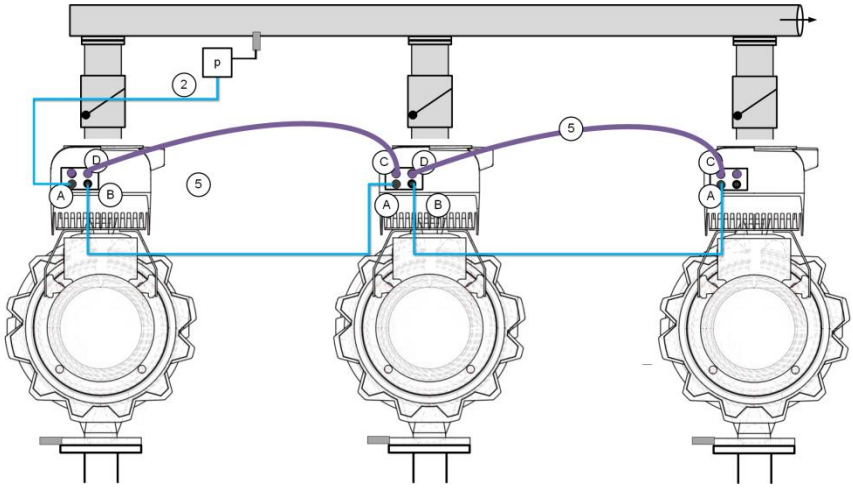
Nr.	Function
72	M12 Module: Double and multi pump operation
82	M12 Module: PumpMeter
A	-
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Auxiliary Control	Master control
3-7-2	Maximum Number of Pumps Running	3	1

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive
3) On all drives will be the 4…20mA signal converted to 2…10V signal, if the DIP switch in the Master is set to „ON“

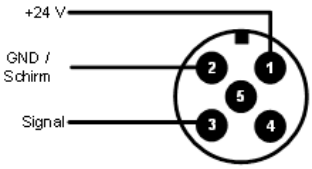
4.2.3 *Closed loop control redundant: pressure with pressure sensor 4...20 mA via M12 module*

In a multi pump operation with three pumps a constant pressure of 4 bar is needed. A 4…20mA pressure sensor with a measurement range of 0-6 bar placed in the manifold is connected to the M12 module by an A-coded male plug. The signal is sent to both AuxMasters with the crosslink cables. Therefore the CURR-IN DIP switch of the M12 module must be set to “OFF”. If the master failed, the signal will be sent to the other drives through the crosslink cable. The role of master will be taken from an AuxMaster.
The set point is given by the display.



Drive 1 (Master) Drive 2 (AuxMaster 1) Drive 3 (AuxMaster 2)

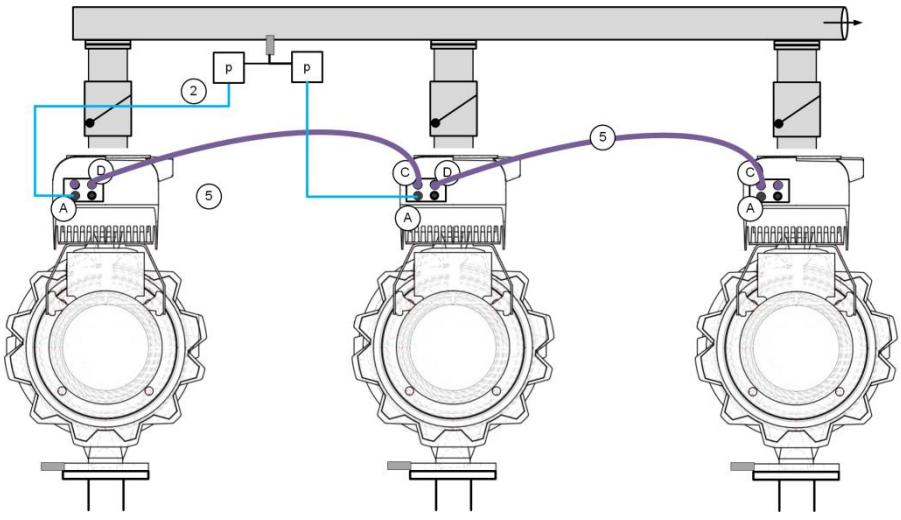
Assignment M 12 male plug of the sensor



II

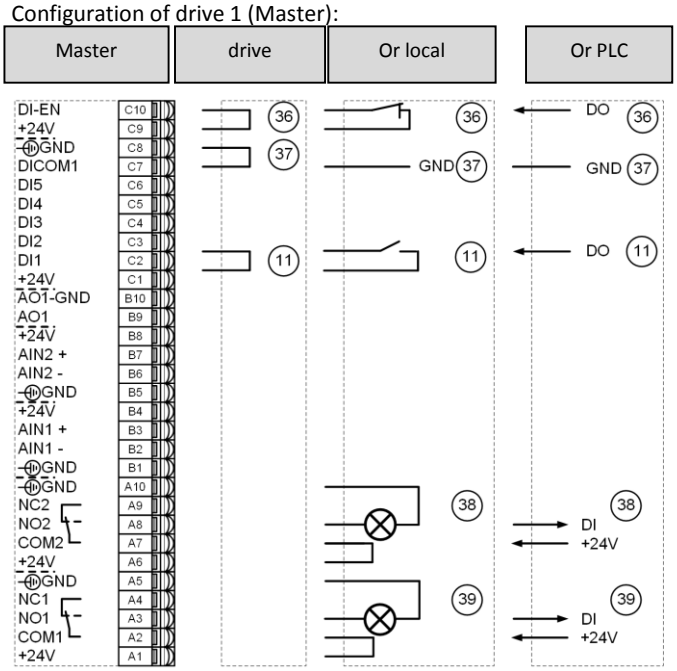
Nr.	Function
2	Actual value: pressure sensor 4...20mA redundant
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)
A	M12 Module female A: connection for the pressure sensor
B	M12 Module female B: connection crosslink cable
C	M12 Module female C: for Double and multi pump operation (KSB-device bus) or Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus) or Bus resistor

Variant 2: Multi pump operation with redundant sensor 2 Master, 1 slave
For this variant there is no need of changing the DIP switches of the M12 modules, there is no crosslink cable.

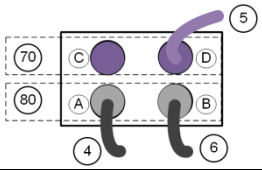


Drive 1 (Master) Drive 2 (AuxMaster 1) Drive 3 (Slave)

Configuration of drive 1 (Master):



Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
38	Operating mode RUN
39	Alarm
4	Sensor with M12 plug
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)
6	tailor-made crosslink bus cable (color: black, female: angled, male: angled)

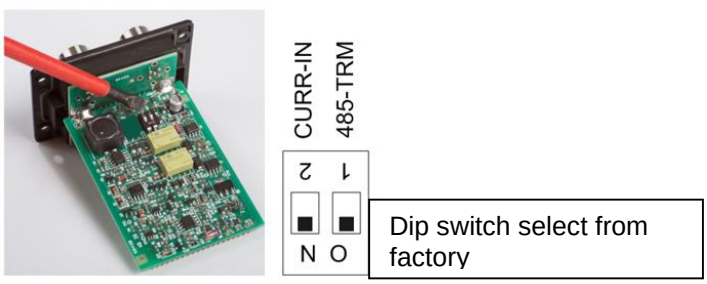


Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection for the pressure sensor with M12 plug
B	M12 Module female B: connection crosslink cable
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

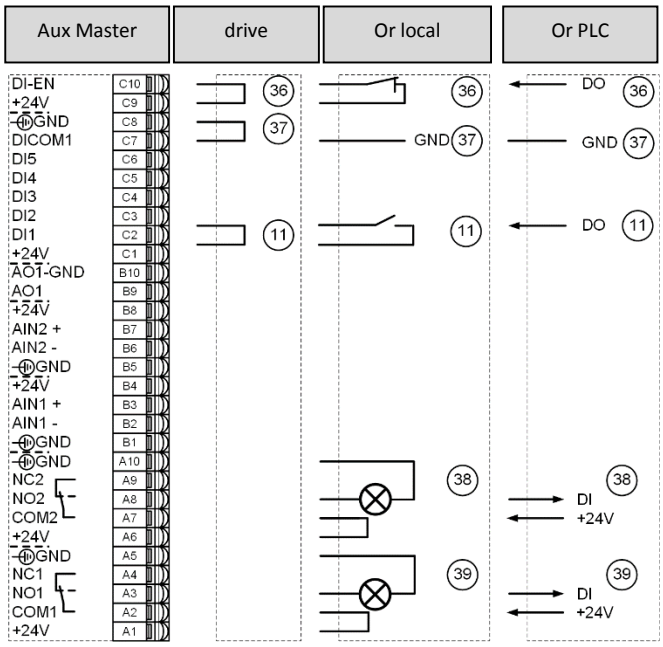
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	Differential pressure
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	6.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	0,00 [bar]
3-8-4-1	Function M12 Module Input A	Discharge Pressure	**Preset**
3-8-4-2	Lower Limit M12 Module Input A	0.00 [bar]	-
3-8-4-3	Upper Limit M12 Module Input A	6.00 [bar]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**
3-9-1	Broken Wire Detection		
3-9-1-1	Response to Failure	Fixed Speed	All Pumps OFF
3-9-1-2	Time Delay	0,5 s	**preset**
3-9-1-3	Speed During Failure	500 - 4200	Parameter 3-2-2-1 Minimum Motor Speed

With the activation of the broken wire detection an emergency control can be realized with a fixed speed. For this define a speed under parameter 3-9-1-3 with which your system can run. The PumpDrive will announce the following in case the sensor fails: broken wire, failure actual value, no main pump

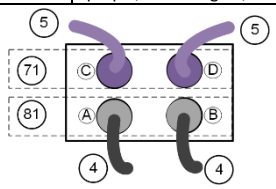
DIP Switch M 12 Module Drive 1



Configuration of drive 2 (AuxMaster):



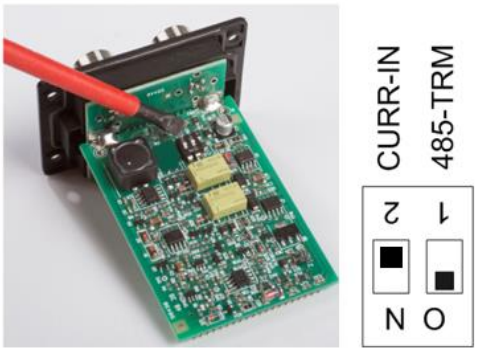
Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
28	Operating mode RUN
29	Alarm
4	Sensor with M12 plug
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



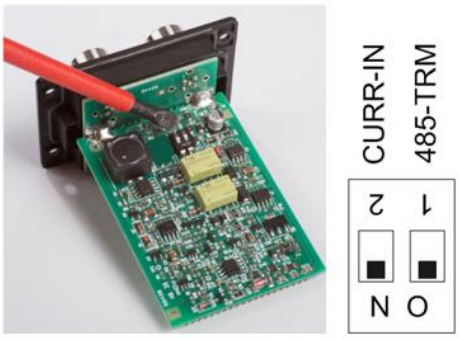
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	M12 Module female A: connection crosslink cable
B	M12 Module female B: connection crosslink cable
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1

DIP Switch M 12 Module Drive 2



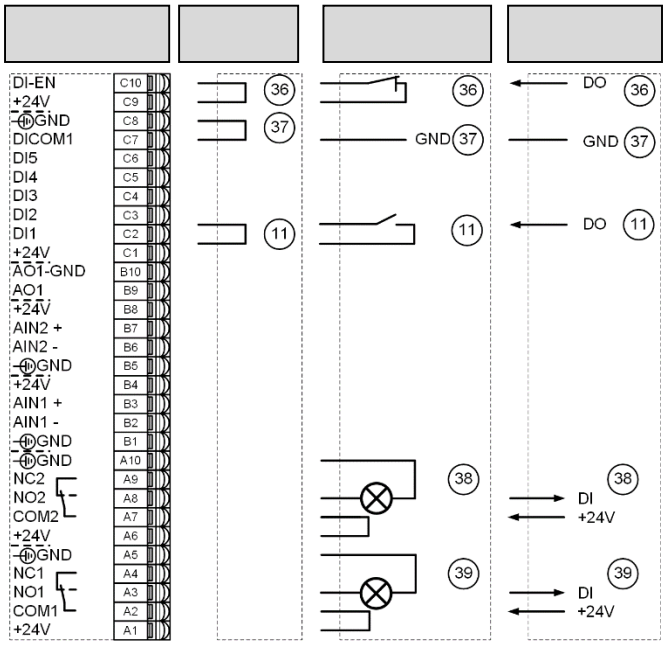
Variant 2: redundant sensor



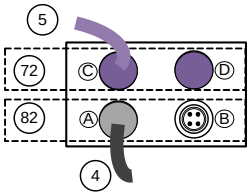
The application parameters will be transferred from the master to all other connected PumpDrives. For this purpose turn all PumpDrive on and connect first the bus cables and terminators.
Option 2: parameterize the Master and leave all other PumpDrive without power supply, then connect bus cable and terminators, and finally turn the PumpDrives on.

In the case that the parameters haven´t been transferred, the bus cable may be improperly assembled or one of the M 12 plugs is broken.
You can remove the bus cable from the PumpDrive while the PumpDrives are switched on. When you connect the cable again all PumpDrives should do a reboot. If this is not the case the M 12 modules must be checked.

Configuration of drive 3 (AuxMaster 2):



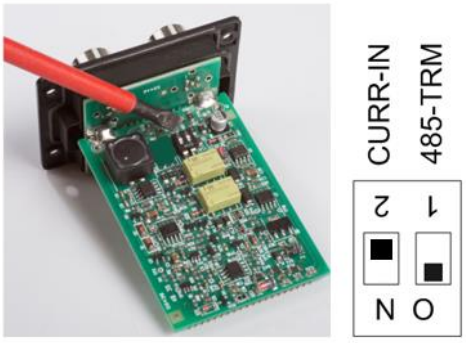
Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1]
38	Operating mode RUN
39	Alarm
4	
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



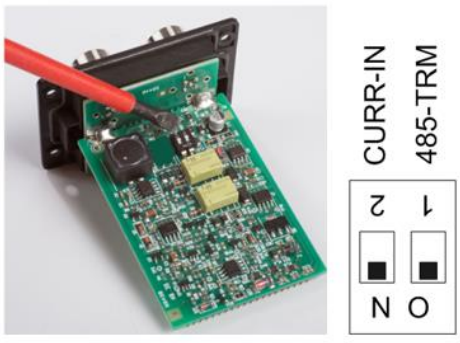
Nr.	Function
72	M12 Module: Double and multi pump operation
82	M12 Module: PumpMeter
A	M12 Module female A: connection crosslink cable
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2]
3-7-1	Role in Multiple Pump System	Master control	**Preset**
	Variant 2		
3-7-1	Role in Multiple Pump System	Auxiliary Control	
3-7-2	Maximum Number of Pumps Running	3	1

DIP Switch M 12 Module Drive 3



Variant 2 redundant Sensor

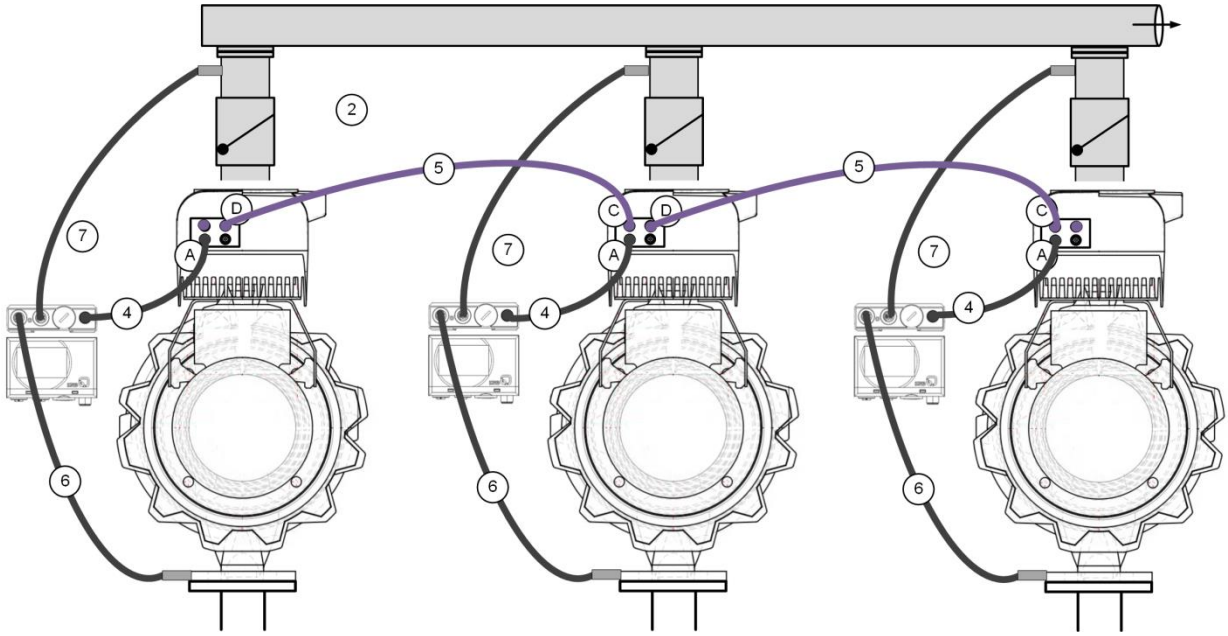


1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive
3) On all drives will be the 4…20mA signal converted to 2…10V signal, if the DIP switch in the Master is set to „ON“
4) If there is a crosslink cable (the sensor signal goes also to the second and third drive) only one DIP Switch CURR IN should be at ON. With it the 4-20mA signal is converted to 2-10V signal.
5) By the use of a redundant sensor the DIP remains at ON,

In the variant 2 all parameters are set identically.
The auxiliary control will not consider and evaluate the values that are coming from the M12 module.
Start system digital input 1 (11) will be omitted.

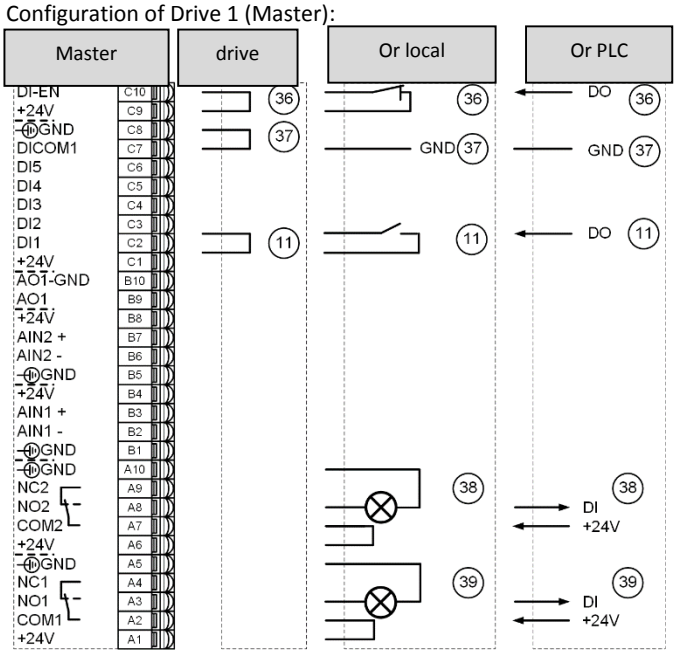
4.2.4 *Closed loop control redundant: PumpMeter each pump*

In a multi pump system with three pumps a constant pressure of 4 bar is needed. The AuxMaster 1 or 2 can take over control if the Master fails. The discharge pressure sensors must be placed above the non-return valve. The set point is given by the display.

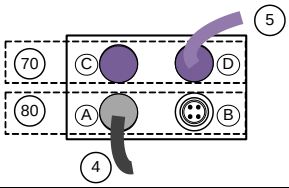


Nr.	Function
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)
6	Sensor PumpMeter suction side
7	Sensor PumpMeter pressure side
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus) or Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus) or Bus resistor

Configuration of Drive 1 (Master):



Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
38	Operating mode RUN
39	Alarm
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



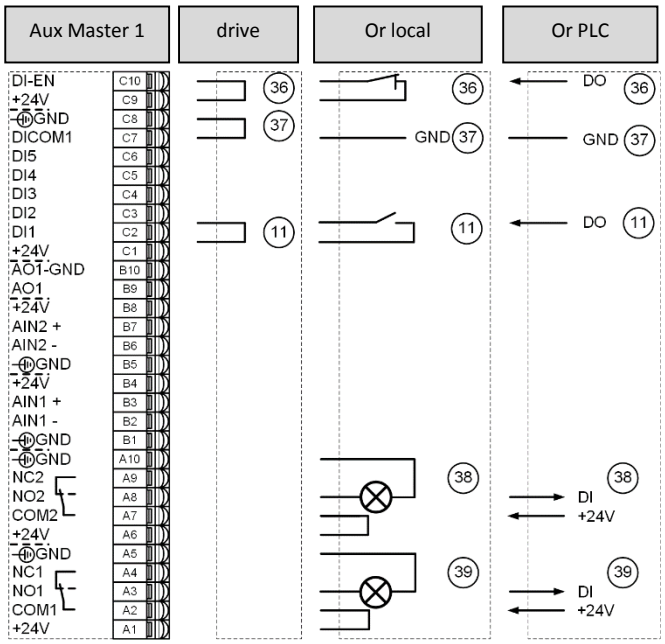
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge Pressure	Differential pressure
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	4,00 [bar]
3-8-4-1	Function M12 Module Input A	PMtr Suction/ Discharge Pressure[4)]	**Preset**
3-8-4-2	Lower Limit M12 Module Input A	-1.00 [bar]	
3-8-4-3	Upper Limit M12 Module Input A	10.00 [bar]	**Preset**
3-5-2-1	Pipe Diameter Suction Pressure Measuring Point	40 mm	**Preset**
3-5-2-2	Pipe Diameter Discharge Pressure Measuring Point	40 mm	**Preset**
3-5-2-3	Height Difference_Pressure Measuring Points	1,00 m	0,34 m
3-5-2-4	Pressure Measuring Point Positions	Distant from Pump	Close to Pump

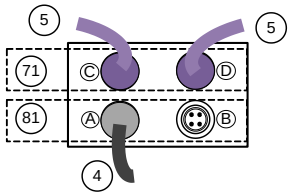
The application parameters will be transferred from the master to all other connected PumpDrives. For this purpose turn all PumpDrive on and connect first the bus cables and terminators.
Option 2: parameterize the Master and leave all other PumpDrive without power supply, then connect bus cable and terminators, and finally turn the PumpDrives on.

In the case that the parameters haven´t been transferred, the bus cable may be improperly assembled or one of the M 12 plugs is broken.
You can remove the bus cable from the PumpDrive while the PumpDrives are switched on. When you connect the cable again all PumpDrives should do a reboot. If this is not the case the M 12 modules must be checked.

Configuration of Drive 2 (AuxMaster 1):



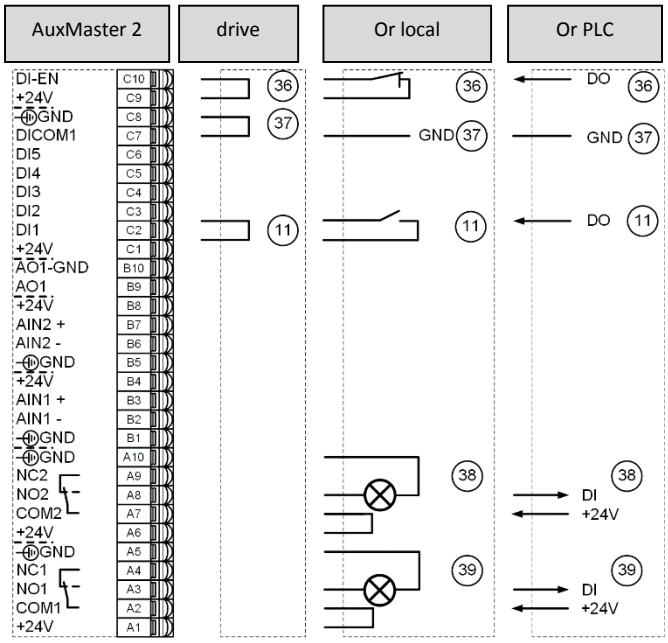
Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
38	Operating mode RUN
39	Alarm
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



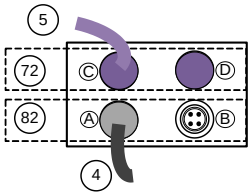
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1

Configuration of Drive 3 (AuxMaster 2):



Nr.	Function
36	Enable power electronic
37	Ground for digital inputs
11	System start with DI[1)]
38	Actual value: pressure sensor 4…20mA
39	Operating mode RUN
4	Tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



Nr.	Function
72	M12 Module: Double and multi pump operation
82	M12 Module: PumpMeter
A	M12 12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	3	1

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

4.2.5 *Switching on and off of pumps in multiple pump operation*

The switching on and off in multiple pump operation works based on the speed limit as well as the overload and partial load detection. For this reason, it is important to set the correct parameters related to the flow rate estimation and limit values.
With the learning function it is possible to do an optimization of the flow rate estimation that is important when parameter 3.5.2.4 is set to “distant from pump” and when having a flat characteristic curve.

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-4-3-30	Low Flow Limit Flow Rate in % Qopt	30%	**Preset** (Switching off the pumps)
3-4-3-31	Overload Limit Flow Rate in % Q6 (Qmax)	98%	**Preset** (Switching on the pumps)
3-5-2-1	Pipe Diameter Suction Pressure Measuring Point	40 [mm]	**Preset**
3-5-2-2	Pipe Diameter Discharge Pressure Measuring Point	40 [mm]	**Preset**
3-5-2-3	Height Difference_Pressure Measuring Points	1,00 [m]	0,34 [m]
3-5-2-4	Pressure Measuring Point Positions	Distant from Pump	Close to Pump
3-7-3-1	Min. Time Start	10 s	**Preset**
3-7-3-2	Min. Time Stop	20 s	**Preset**
3-7-3-3	Start Speed	90-95%	100%
3-7-3-4	Stop Speed	50%	May vary according to local conditions.
3-7-3-5	Start Flow Rate	95 %	**Preset**
3-9-8-1	Flow Rate Estimation	ON	**Preset**
	Optimization of flow rate estimation	**Close discharge-side valves**	**Remove System start, set Drive in automatic mode**
3-9-6-3	Start Learning Function	The frequency inverter activates 5 speed points and saves the associated mechanical power values.	If the parameter in Pactware is not visible read again parameters of the drive.
3-9-6-1	Hydraulic Blockage Limit	0 (Deactivate)	110
3-9-6-2	Dry Run Time Limit	0 (Deactivate)	85

The start speed should not be 100%, so that the Drive can control until the next pump switches on.
With the parameters 3-7-3-1 and 3-7-3-2 may be delayed the switching on and off of the pumps, in case the pumps are always switching on and off when the load changes.

5. Pump functionality

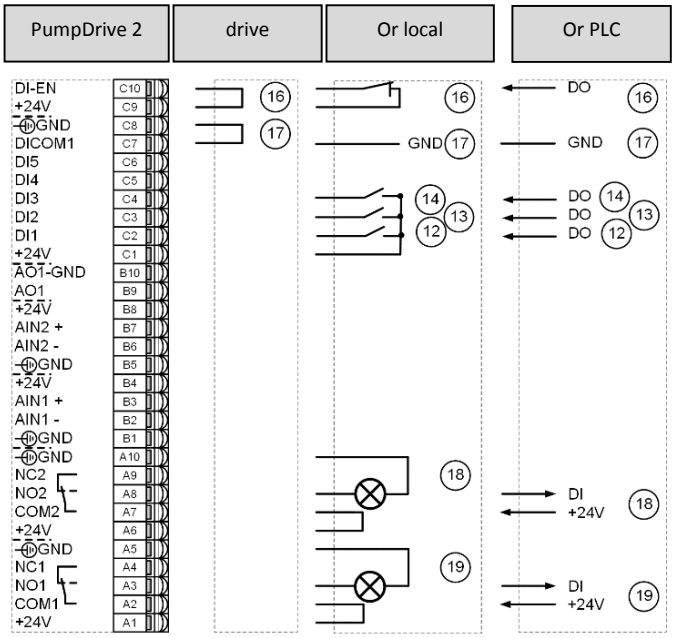
5.1 Open loop Control

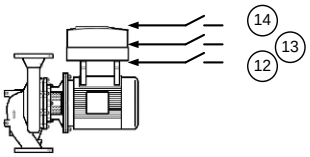
5.1.1 *Open loop control: 3 fix speed selected by digital switches*

A fixed speed of 2000 1/min should be set on the display. The nominal speed of the 2 pole motor is 2950 1/min.
3 additional fixed speeds and OFF should be selectable by local digital switches:

		DI 1: Automatic start system	DI 2: Control digital (Bit 0)	DI 3: Control digital (Bit 1)	DI 4: Control digital (Bit 2)
Off all inputs 0	**Off**	**0**	**0**	**0**	**0**
Automatic only DigIn 1 in 1	**Automatic**	**0**	**1**	**0**	**0**
Fix speed 1: 2950 1/min	**Hand (Fix speed 1)**	**0**	**1**	**1**	**0**
Fix speed 2: 2213 1/min	**Hand (Fix speed 2)**	**0**	**1**	**0**	**1**
Fix speed 3: 1475 1/min	**Hand (Fix speed 3)**	**0**	**1**	**1**	**1**

Info: by selecting a fixed speed the drive changes to manual operation. The Auto button at the display is then out of function (see also control point concept)





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
14	Digital control(Bit 0)
13	Digital control(Bit 1)
12	Digital control(Bit 2)
11	System start with DI[1)]
18	Operating mode RUN
19	Alarm

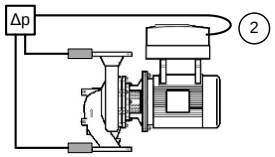
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	OFF (Open-loop Control)	**Preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
1-3-3	Control Value (Open-loop Control)	2000 [1/min]	500 [1/min]
3-6-5-1	Fixed speed 1	2950 [1/min]	500 [1/min]
3-6-5-2	Fixed speed 2	2213 [1/min]	500 [1/min]
3-6-5-3	Fixed speed 3	1475 [1/min]	500 [1/min]
3-8-6-3	Digital Input 3 Function	Control Digital Bit 2	No Function
3-8-6-4	Digital Input 4 Function	Control Digital Bit 1	No Function
3-8-6-5	Digital Input 5 Function	Control Digital Bit 0	No Function
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

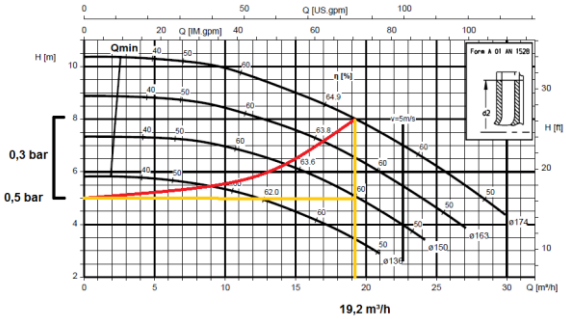
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

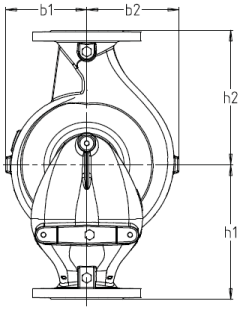
5.2 Closed loop control

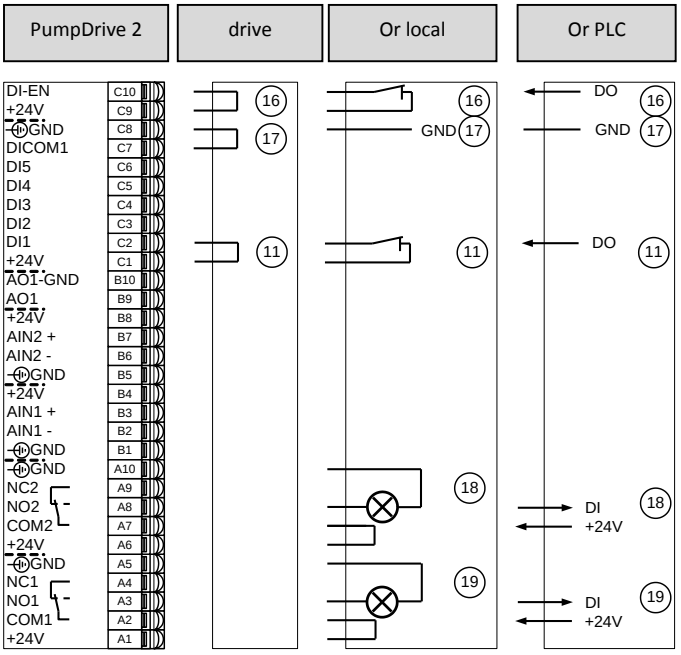
5.2.1 *Closed loop control: dynamic differential pressure set point compensation based on flow rate estimation*

A constant differential pressure of 0.5bar is needed (example for Etaline 40-40-160). PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 3 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. For the optimal energy saving the “dynamic differential pressure set point compensation based on flow rate estimation” is activated. The nominal flow is 19,2 m3/h. The pipe friction losses are roundabout 0.3bar (0.5bar + 0.3 bar friction losses = 0.8 bar at the pump). All needed parameters for the flow rate estimation like inner pipe diameter suction side (example: 40mm), inner pipe diameter discharge side (example: 40mm) and height difference of pressure measuring points (example: h1 + h2 = 340mm) are preset in the pump production when ordering a completely assembled pump, motor and drive.

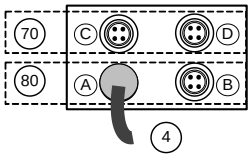








Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



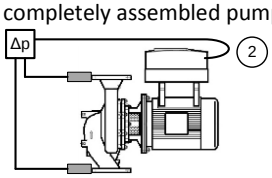
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

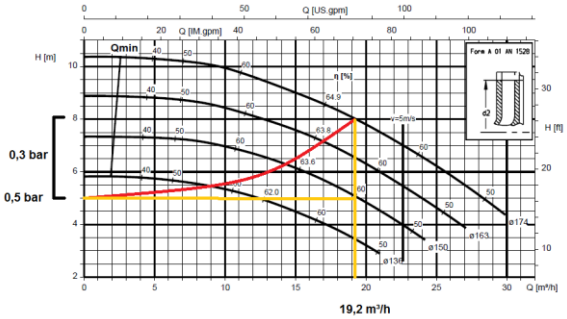
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**preset referring to chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	3.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
3-11-3-1	Minimum Flow Rate	5,45 [m³/h]	**Preset**
3-11-3-2	Maximum Flow Rate	60,69 [m³/h]	9999.99 [m³/h]
3-11-3-3	Flow Rate Unit	m³/h	**Preset**
1-3-2	Setpoint (Closed-loop Control)	0.50 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-9-8-1	Flow Rate Estimation	ON	**Preset**
3-5-2-1	Pipe Diameter Suction Pressure Measuring Point	40 mm	**Preset**
3-5-2-2	Pipe Diameter Discharge Pressure Measuring Point	40 mm	**Preset**
3-5-2-3	Height Difference_Pressure Measuring Points	0,34 m	**Preset**
3-5-2-4	Pressure Measuring Point Positions	Close to Pump	**Preset**
3-9-3-1	Dynamic Pressure Setpoint Compensation Method	Flow rate	OFF
3-9-3-2	Dyn Press Setpoint Comp Q Data Point	19,2 [m³/h]	0.00 [m³/h]
3-9-3-4	Setpoint Compensation	0.30 [bar]	0.00 [bar]
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

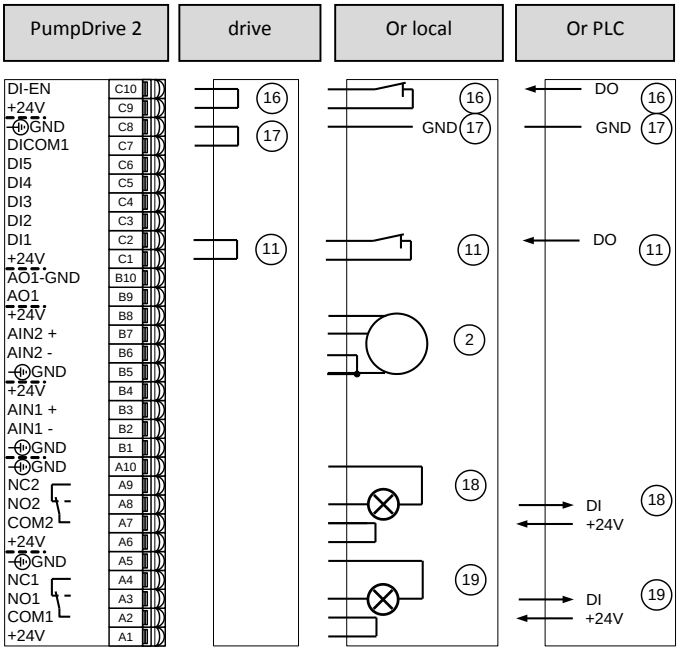
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive

5.2.2 *Closed loop control: dynamic differential pressure set point compensation based on speed*

A constant differential pressure of 0.5bar is needed (example for Etaline 40-40-160). The 4…20mA differential pressure sensor with a measurement range of 0-3 bar is connected to analog input 2. The set point is given by the display. If neither the measured nor estimated flow rate is available, dynamic pressure setpoint compensation can be realized based on speed. This is only possible for closed hydraulic circuits, however. The pipe friction losses are roundabout 0.3bar (0.5bar + 0.3bar friction losses = 0.8bar at the pump). All parameters needed for the flow estimation like pipe diameters are preset individually for each pump size by the pump production when ordering a completely assembled pump, motor, drive.







Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
2	Actual value: differential pressure sensor 4…20mA
18	Operating mode RUN
19	Alarm

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	OFF (Open-loop Control)
3-11-2-1	Minimum Pressure	0.00 [bar]	-1,00 [bar]
3-11-2-2	Maximum Pressure	3.00 [bar]	999,99 [bar]
3-11-2-3	Pressure Unit	bar	**Preset**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
1-3-2	Setpoint (Closed-loop Control)	0.50 [bar]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	4…20mA	OFF
3-8-2-2	Analog Input 2 Function	Differential pressure	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [bar]	-
3-8-2-4	Analog Input 2 Upper Limit	3.00 [bar]	-
3-9-3-1	Dynamic Pressure Setpoint Compensation Method	Speed	OFF
3-9-3-3	Dyn Press Setpoint Comp n Data Point	100 [%]	0 [%]
3-9-3-4	Setpoint Compensation	0.30 [bar]	0.00 [bar]
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

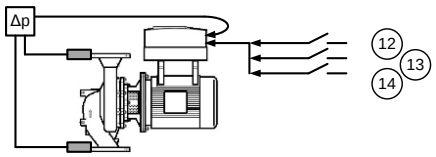
2) Pre-settings for completely assembled pump, motor, drive

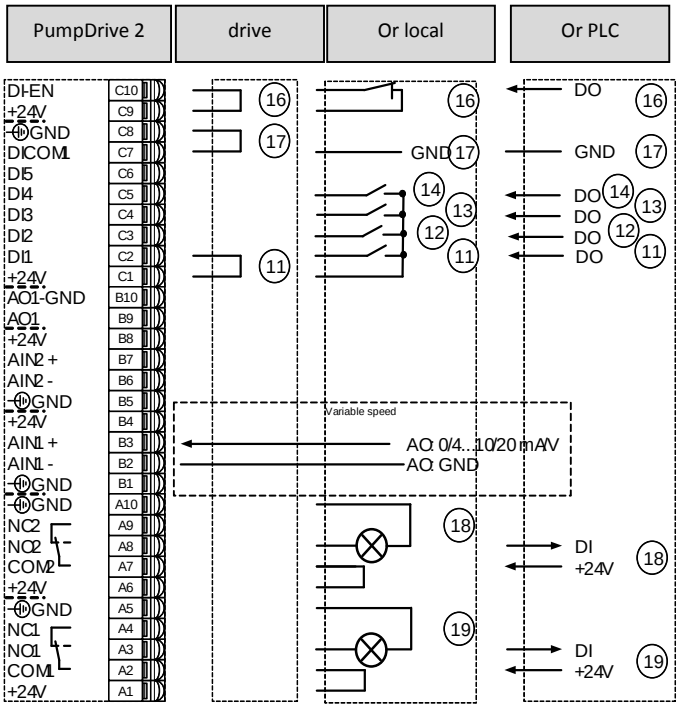
5.2.3 *Closed loop control: 3 fix speed selected by digital switches or 1 speed can be selected*

A constant differential pressure of 4 bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. The nominal speed of the 2 pole motor is 2950 1/min. 3 additional fixed speeds and OFF should be selectable by local digital switches.
Alternatively can be preset a variable speed as a 0/4 – 10/20 V/mA via analogue input 1.
Attention: the drive must be turned on now via the digital inputs in Auto zero or MAN.

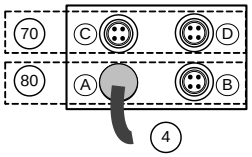
		DI 1: Automatic start system	DI 2: Control digital (Bit 0)	DI 3: Control digital (Bit 1)	DI 4: Control digital (Bit 2)
Off all inputs 0	**Off**	**0**	**0**	**0**	**0**
Automatic only DigIn 1 in 1	**Automatic**	**0**	**1**	**0**	**0**
Automatic mode	**Start system**	**1**	**1**	**0**	**0**
Manual mode variable speed DigIn3 in 1	**Hand (variable speed)**	**0**	**0**	**1**	**0**
Fix speed 1: 2950 1/min	**Hand (Fix speed 1)**	**0**	**1**	**1**	**0**
Fix speed 2: 2213 1/min	**Hand (Fix speed 2)**	**0**	**1**	**0**	**1**
Fix speed 3: 1475 1/min	**Hand (Fix speed 3)**	**0**	**1**	**1**	**1**

Info: by selecting a fixed speed the drive changes to manual operation. The Auto button at the display is then out of function (see also control point concept





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
14	Digital control(Bit 0)
13	Digital control(Bit 1)
12	Digital control(Bit 2)
11	System start with DI[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



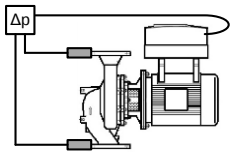
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

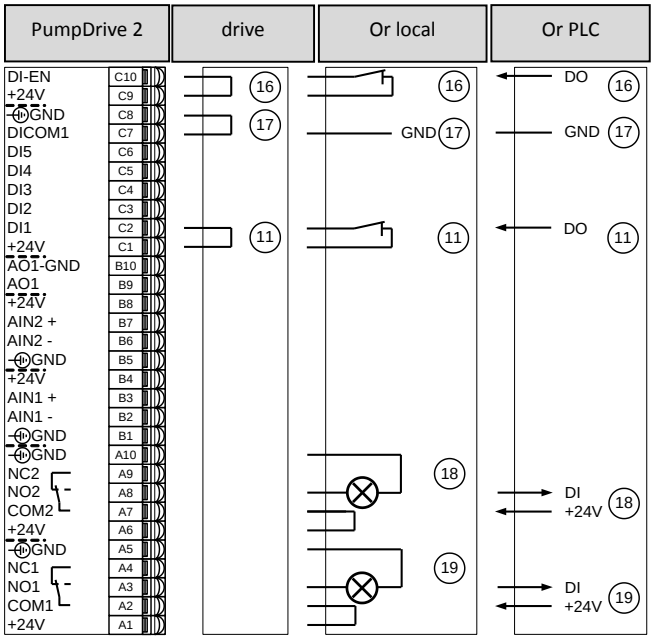
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**preset referring to chapter 1**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-6-5-1	Fixed speed 1	2950 [1/min]	500 [1/min]
3-6-5-2	Fixed speed 2	2250 [1/min]	500 [1/min]
3-6-5-3	Fixed speed 3	1500 [1/min]	500 [1/min]
3-8-1-1	Analog Input 1 Signal	0/2 – 10 V; 0/4-20 mA	-
3-8-1-2	Analog Input 1 Function	Control Value (Manual)	Alternative variable speed
3-8-1-3	Analog Input 1 Lower Limit	0 [1/min]	-
3-8-1-4	Analog Input 1 Upper Limit	2950 [1/min]	-
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**
3-8-6-3	Digital Input 3 Function	Control Digital Bit 0	No Function
3-8-6-4	Digital Input 4 Function	Control Digital Bit 1	No Function
3-8-6-5	Digital Input 5 Function	Control Digital Bit 2	No Function

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

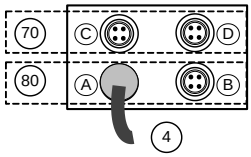
5.2.4 *Closed loop control: sleep Mode*

A constant discharge pressure of 4 bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. The frequency inverter stops the pump without setpoint increase in the case of low flow rates, i.e. when the low flow limit or stop speed is reached: Sleep mode without setpoint increase. Sleep mode is only active in the automatic operation.
Info: The sensor must be mounted after the check valve because of the detection of the stabile pressure.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



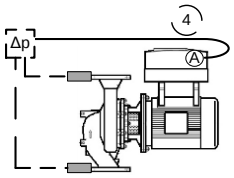
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

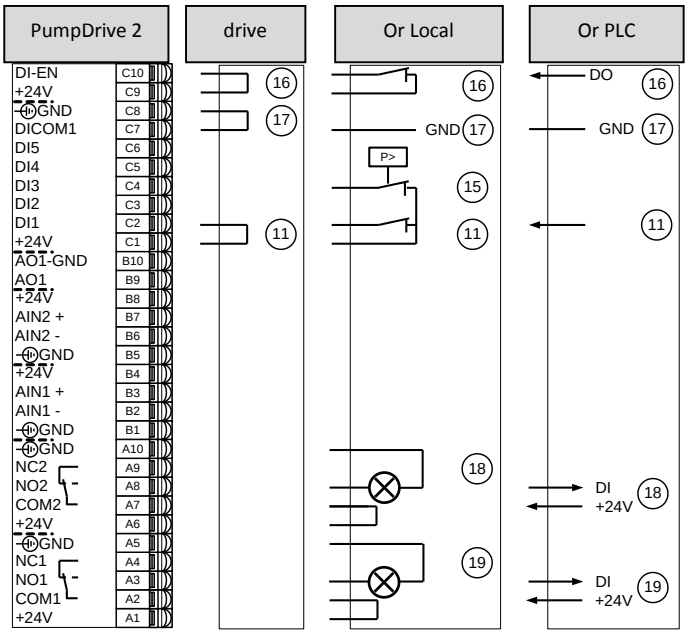
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge pressure	**preset referring to chapter 1**
3-2-2-1	Minimum Motor Speed	500 [1/min]	**Preset**
3-2-2-2	Maximum Motor Speed	2950 [1/min]	**Preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-9-4-1	Sleep Mode	ON	OFF
3-9-4-2	Setpoint Increase	0.00 [bar]	**Preset**
3-9-4-3	Monitoring Period	30.0 [s]	**Preset**
3-9-4-4	Duration of Setpoint Increase	100.0 [s]	**Preset**
3-9-4-5	Permissible Deviation	1.00 [bar]	**Preset**
3-9-4-6	Minimum Runtime	60.0 [s]	**Preset**
3-9-4-7	Ramp-up Time for Setpoint Increase	30.0 [s]	**Preset**
3-9-4-8	Stop Speed	1500 [1/min]	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

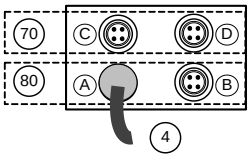
5.2.5 *Dry run protection external*

A constant discharge pressure of 4 bar is needed. PumpMeter is used as a pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The set point is given by the display. For the dry run protection a pressure switch is connected to Digital Input 3 (an alternative solution is the sensorless dry run protection). When dry run (Pmin) is indicated by the pressure switch, then the pressure switch must signalize 0V to the drive. The Digital Input 3 is parameterized for dry run with the behavior self acknowledged. If dry run happens, then the drive is locked and the alarm A14 Dry Run (External) is displayed. When the pressure is above the threshold, the drive is ready for operation (self quitting)





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI1[1)]
15	Dry run external: pressure switch
18	Operating mode RUN
19	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Discharge pressure	**preset referring to chapter 1**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**
3-6-6-3	Digital Input 3 Function	Dry Running Protection	No Function
3-9-7-1	External Dry Running Detection Behaviour	Self-acknowledging	Non-self-acknowledging

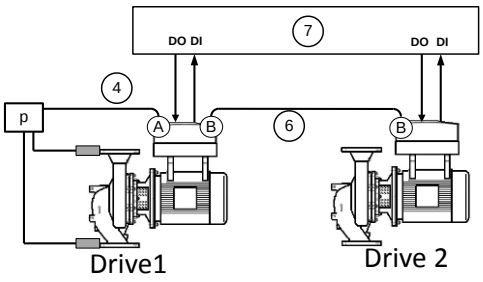
1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

6. Country specific applications

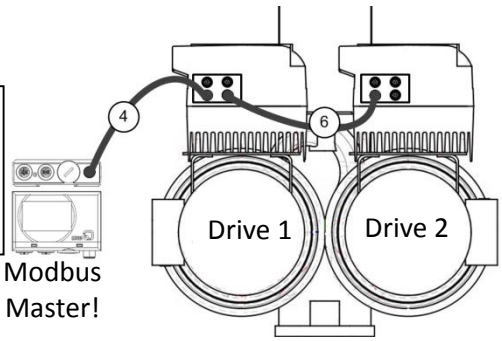
6.1 France

6.1.1 *Closed loop control redundant: differential pressure with PumpMeter (Modbus)*

Etaline Z double pump (2x100%): A constant differential pressure of 4 bar is needed. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive. The sensor signal of PumpMeter is linked by a cross link cable (see accessories) from drive to drive. The AuxMaster can take over control if the Master fails. The set point is given by the display. Pump changeover will be done by PLC.

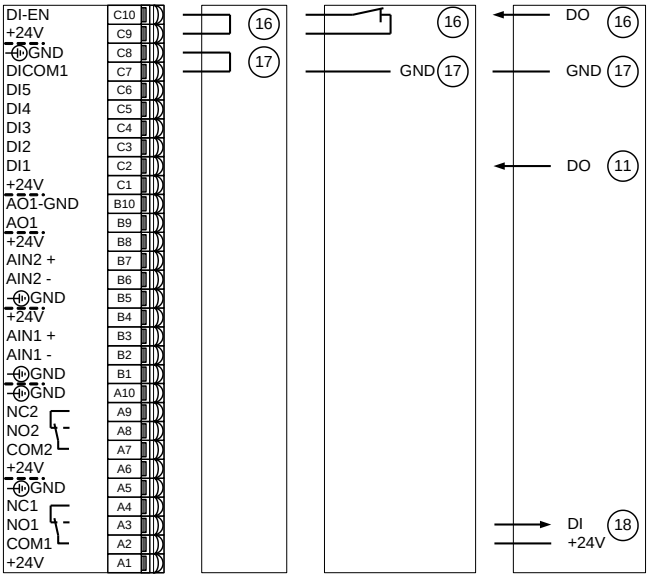


Special Firmware Modbus Master in PumpMeter is needed. In case of Etaline Z the special firmware is programmed in factory

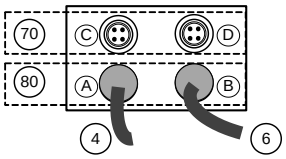


Configuration of drive 1:

PumpDrive 2	drive	Or local	Or PLC



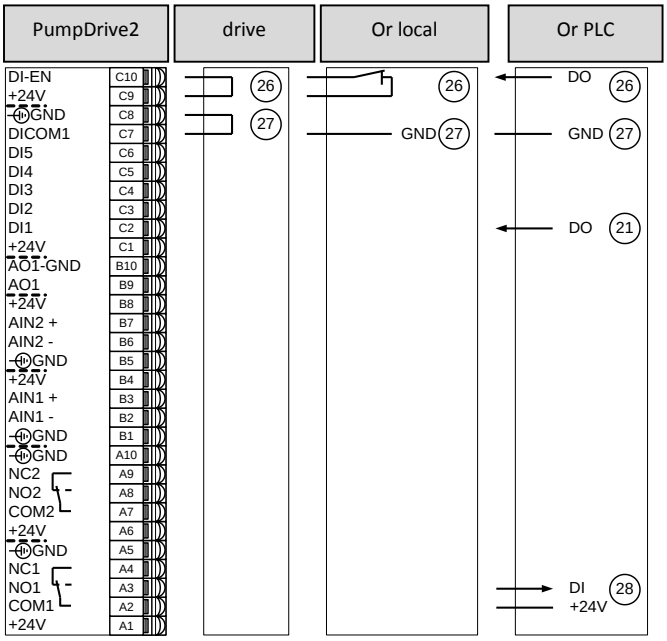
Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
18	Alarm
4	Actual value: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
6	Actual value: tailor-made cross link bus cable for the redundant connection of PumpMeter (color: black, female: angled, male: angled)
7	PLC - Pump changeover



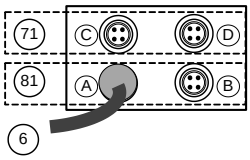
Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	M12 Module female B: cross link bus cable PumpMeter (Modbus)
C	-
D	-

Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**According to spec. Q,H preset**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-13-5	PumpMeter Master/Slave	Master	**Preset for Etaline Z**
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	1	**Preset**
3-7-4-1	Automatic Pump Changeover	off	Runtime
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

Configuration of drive 2:



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
21	System start with DI[1)]
28	Alarm
6	Actual value: tailor-made cross link bus cable for the redundant connection of PumpMeter (color: black, female: angled, male: angled)



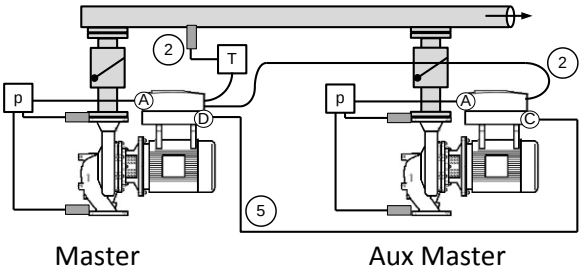
Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

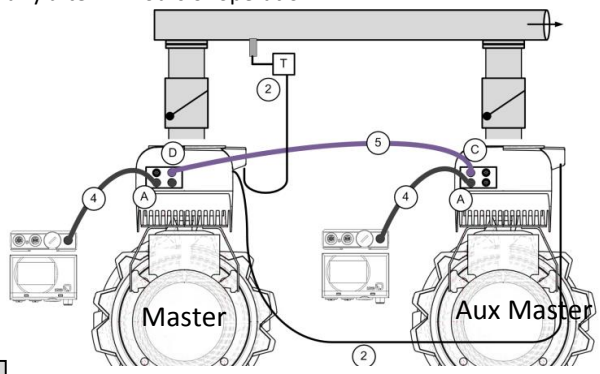
Nr.	Parameter	Change value to	Pre-settings by factory [2)]
3-6-1	Type of Control	Differential pressure	**Preset**
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
1-3-2	Setpoint (Closed-loop Control)	4.00 [bar]	**preset according to spec. Q,H**
3-8-4-1	Function M12 Module Input A	PMtr Suction/Discharge Pressure	**Preset**
3-13-5	PumpMeter Master/Slave	Master	**Preset for Etaline Z**
3-7-1	Role in Multiple Pump System	Master control [3)]	Auxiliary Control
3-7-2	Maximum Number of Pumps Running	1	**Preset**
3-7-4-1	Automatic Pump Changeover	Off	Runtime
3-8-6-1	Digital Input 1 Function	System Start[1)]	**Preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter
3) Preset by factory of second drive as Slave. When using Crosslink cable with second drive as AuxMaster the role must be changed to Master

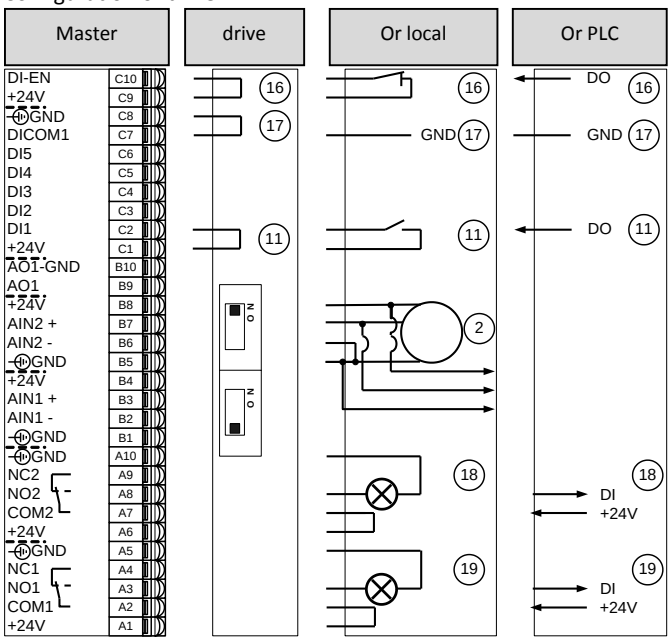
6.1.2 *Closed loop control redundant: Temperature control with additional PumpMeter*

Etaline / Etabloc (2x100%): A constant heating temperature of 50°C is needed. The 4…20mA thermometer on the high pressure side with a measurement range of 0-150°C is connected to analog input 2 of Master and AuxMaster.
The AuxMaster can take over control if the Master fails. When connecting a 4…20mA sensor in parallel to both drives the 4…20mA current signal must be converted to a 2…10V voltage signal: therefore the DIP switch of the analog input 2 of the Master must be set to "ON"[3]. The set point is given by the display. PumpMeter with the measurement range of -1 – 10 Bar is only used as an internal sensor, which is not used for control. Pump changeover will take place regularly after 24 hours of operation.

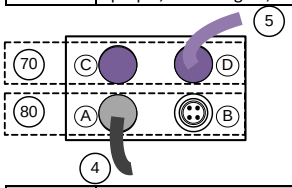




Configuration of drive 1:



Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1]
2	Actual value: Temperature sensor 4…20mA
18	Operating mode RUN
19	Alarm
4	tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus))
B	-
C	M12 Module female C: Bus resistor
D	M12 Module female D: for Double and multi pump operation (KSB-device bus)

The application parameters will be transferred from the master to all other connected PumpDrives. For this purpose turn all PumpDrive on and connect first the bus cables and terminators.
Option 2: parameterize the Master and leave all other PumpDrive without power supply, then connect bus cable and terminators, and finally turn the PumpDrives on.

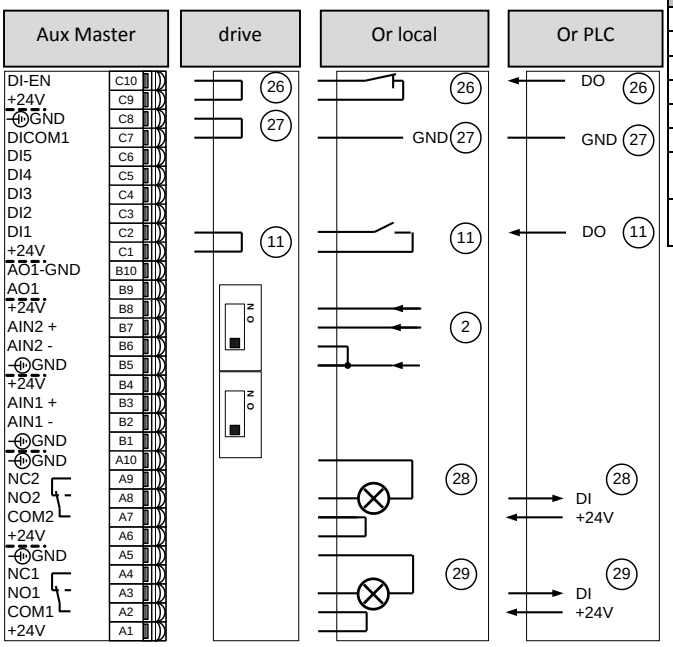
In the case that the parameters haven´t been transferred, the bus cable may be improperly assembled or one of the M 12 plugs is broken.
You can remove the bus cable from the PumpDrive while the PumpDrives are switched on. When you connect the cable again all PumpDrives should do a reboot. If this is not the case the M 12 modules must be checked.

Parameter 3.7.1. must be set individually for each drive.

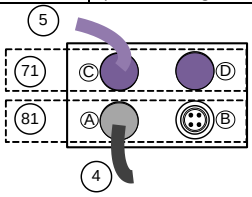
Nr.	Parameter	Change value to	Pre-settings by factory [2]
3-6-1	Type of Control	Temperature (Heating)	Discharge Pressure
3-11-2-1	Minimum Pressure	-1.00 [bar]	**Preset**
3-11-2-2	Maximum Pressure	10.00 [bar]	**Preset**
3-11-2-3	Pressure Unit	bar	**Preset**
3-11-4-1	Minimum Temperature	0.00 [°C]	**Preset**
3-11-4-2	Maximum Temperature	150.00 [°C]	999,99 [°C]
3-11-4-3	Temperature Unit	°C	**Preset**
1-3-2	Setpoint (Closed-loop Control)	50.00 [°C]	0,00 [bar]
3-8-2-1	Analog Input 2 Signal	2…10V[3]	Off
3-8-2-2	Analog Input 2 Function	Temperature	No Function
3-8-2-3	Analog Input 2 Lower Limit	0.00 [°C]	-
3-8-2-4	Analog Input 2 Upper Limit	150.00 [°C]	-
3-8-4-1	Function M12 Module Input A	PMtr Internal Suction/Discharge Pressure[4]	PMtr Suction/Discharge Pressure
3-7-1	Role in Multiple Pump System	Master control	**Preset**
3-7-2	Maximum Number of Pumps Running	1	**Preset**
3-7-4-1	Automatic Pump Changeover	Runtime	**Preset**
3-7-4-2	Runtime Prior to Pump Changeover	24	**Preset**
3-8-6-1	Digital Input 1 Function	System Start[1]	**Preset**

All shown settings are examples and the values must be adapted to the data of the sensors on site!

Configuration of drive 2:



Nr.	Function
26	Enable power electronic
27	Ground for digital inputs
11	System start with DI[1]
2	Actual value: Temperature sensor 4…20mA
28	Operating mode RUN
29	Alarm
4	tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)



Nr.	Function
71	M12 Module: Double and multi pump operation
81	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	M12 Module female C: for Double and multi pump operation (KSB-device bus)
D	M12 Module female D: Bus resistor

Nr.	Parameter	Change value to	Pre-settings by factory [2]
3-7-1	Role in Multiple Pump System	Master control	**Preset**

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)

2) Pre-settings for completely assembled pump, motor, drive and PumpMeter

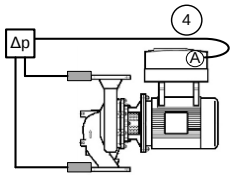
3) On all drives will be the 4…20mA signal converted to 2…10V signal, if the DIP switch in the Master is set to „ON“

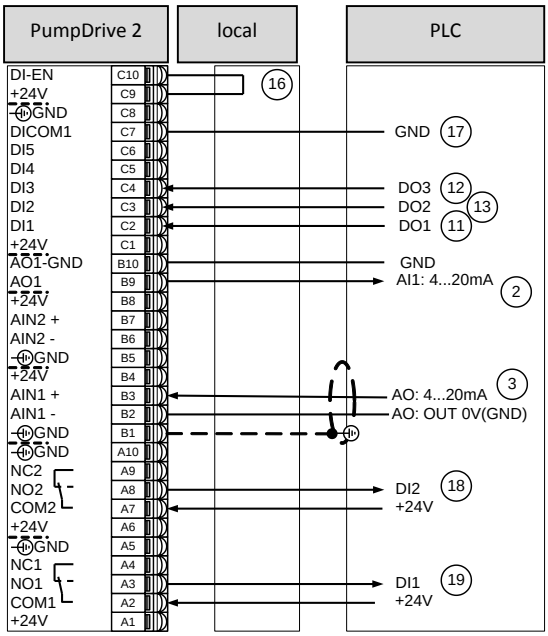
4) If PumpMeter is only used as an internal measured variable at input A of the M12 module (via Modbus) and not for control, the Function M12 Module Input A parameter (3-8-4-1) must be set to PMtr Internal Suction/Discharge Pressure.

6.2 Germany

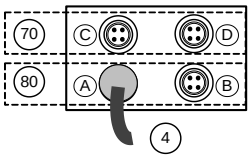
6.2.1 *Open loop control: fix speed from PLC, 4 values send via analog output, additional PumpMeter*

A PLC sends a fixed speed of 2000 1/min to the analog input 1 of the drive in Automatic mode. Speed, flow, suction pressure and discharge pressure are send by the analog output of the drive to the PLC. The switching between these values is done by the PLC using the digital inputsDI2 and DI3 of the drive. PumpMeter sends suction pressure and discharge pressure to the drive. The drive calculates the flow. PumpMeter is used as a differential pressure sensor in the measurement range of -1 … 10 bar. PumpMeter is connected by Modbus to the M12 Module of the drive.





Nr.	Function
16	Enable power electronic
17	Ground for digital inputs
11	System start with DI[1)]
12	Switching of process values of analog output by DI3
13	Switching of process values of analog output by DI2
2	Output of process values at analog output
3	Setpoint (open loop): external signal 4...20mA from PLC
18	Operating mode RUN
19	Alarm
4	Suction pressure and discharge pressure: tailor-made bus cable for the connection of PumpMeter to the M12 Module (color: black, female: straight, male: angled)



Nr.	Function
70	M12 Module: Double and multi pump operation
80	M12 Module: PumpMeter
A	M12 Module female A: connection PumpMeter (Modbus)
B	-
C	-
D	-

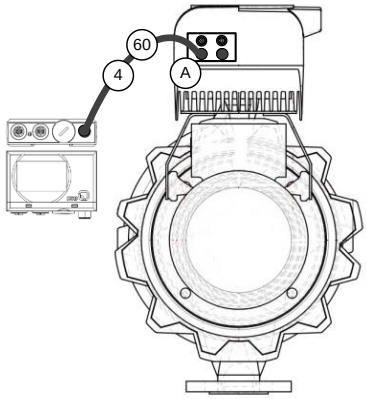
Nr.	Parameter	Change value to	Pre-settings by factory [2)]	Operating manual V. 4
3-6-1	Type of Control	OFF (Open-loop Control)	Differential Pressure	7.7.1.1.1 – Page 69
3-11-1-1	Minimum Speed	500 1/min[9)]	**preset**	7.10.4 – Page 122
3-11-1-2	Maximum Speed	2950 1/min[9)]	**preset**	7.10.4 – Page 122
3-8-1-1	Analog Input 1 Signal	4…20mA	Off	7.10.2 – Page 118
3-8-1-2	Analog Input 1 Function	Setpoint/Control Value (Auto)	No function	7.10.2 – Page 118
3-8-1-3	Analog Input 1 Lower Limit	0 [1/min]	-	7.10.2 – Page 118
3-8-1-4	Analog Input 1 Upper Limit	2950 [1/min]	-	7.10.2 – Page 118
3-8-4-1	Function M12 Module Input A	PMtr Suction/discharge internal[4)]	PMtr Suction/discharge	7.11 – Page 128
3-8-6-1	Digital Input 1 Function	System Start[1)]	**preset**	7.10.1 – Page 114
3-8-6-2	Digital Input 2 Function	Control AOUT Bit 0[3)]	No function	7.10.1 – Page 114
3-8-6-3	Digital Input 3 Function	Control AOUT Bit 1[3)]	No function	7.10.1 – Page 114
3-8-7-1	Assignment 1 Analog Output 1	Motor Speed[5)]	**preset**	7.10.4 – Page 121
3-8-7-2	Assignment 2 Analog Output 1	flow[6)]	No function	7.10.4 – Page 121
3-8-7-3	Assignment 3 Analog Output 1	Discharge pressure[7)]	No function	7.10.4 – Page 121
3-8-7-4	Assignment 4 Analog Output 1	Suction pressure[8)]	No function	7.10.4 – Page 121
3-11-2-1	Minimum Pressure	-1.00 [bar] [9)]	**preset**	7.10.4 – Page 122
3-11-2-2	Maximum Pressure	10.00 [bar] [9)]	**preset**	7.10.4 – Page 122

3-11-3-1	Minimum Flow Rate	0.00 m³/h[9)]	**preset**	7.10.4 – Page 122
3-11-3-2	Maximum Flow Rate	60.00 m³/h[9)]	**preset**	7.10.4 – Page 122

1) Digital Input 1 is set as at the factory as system start. If a digital input is set as system start, the parameter 1-3-1 System start is automatically without function (see control point concept in operating manual)
2) Pre-settings for completely assembled pump, motor, drive and PumpMeter
3) Switching between process values speed, flow, suction pressure and discharge pressure at analog output by digital inputs DI2 and DI3 from PLC.
4) If PumpMeter is connected on input A of the M12 Module by Modbus and PumpMeter is not used for control, then Parameter Function M12 Module Input A (3-8-4-1) must be set to PMtr Suction/discharge internal[4)].
5) Speed is send to PLC by analog output, when both digital inputs are connected to 0V (DI2=0, DI3=0).
6) Flow is send to PLC by analog output, when the PLC connects digital input 2 to 24V and Digital Input 3 to 0V (DI2=1, DI3=0).
7) Discharge pressure is send to PLC by analog output, when the PLC connects digital input 2 to 0V and Digital Input 3 to 24V (DI2=0, DI3=1).
8) Suction pressure is send to PLC by analog output, when the PLC connects digital input 2 to 24V and Digital Input 3 to 24V (DI2=1, DI3=1).
9) The scaling of analog output is referenced to the value range defined in menu 3-11 “Value Ranges and Units".

7. M12 Cable

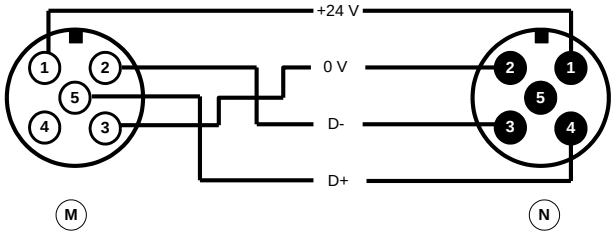
7.1 Bus cable for connecting PumpMeter to the M12-Module

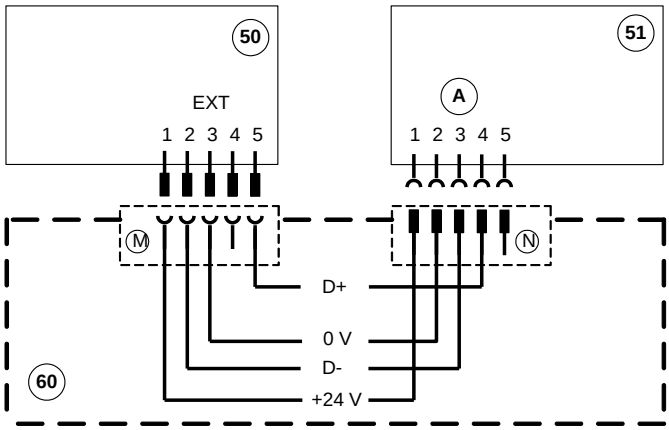


Tailor-made cable

Nr.	function	length	Mat.-Nr.
4	tailor-made bus cable for the connection of PumpMeter to the M12 Module color: black female: straight male: angled	1 m	01533775
		2 m	01533776
		3 m	01533777
		5 m	01533778
		10 m	01670718
		20 m	01670719

Self-made bus cable for the connection of PumpMeter to the M12 Module, Modbus screened:

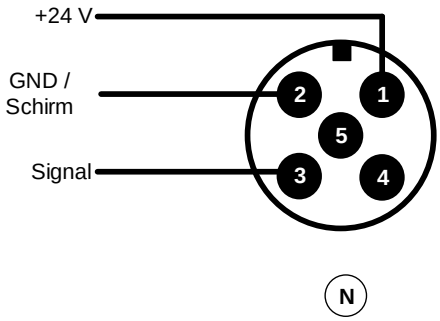




Nr.	Function	length	Mat.-Nr.
50	PumpMeter Connector EXT		
51	PumpDrive 2 M12 Module – Connector A		
60	CAN-Bus Cable, also for Modbus, cut to length, screened, twisted pair, cable 2 x 2 x 0,22 mm²	1 m	01111184
		5 m	01304511
		10 m	01304512
		20 m	01304513
M	M12 female, A-coded, 5 poles (Binder Connector Type: 99 1436 814 05)		-
N	M12 male, A-coded, 5 poles		01523004

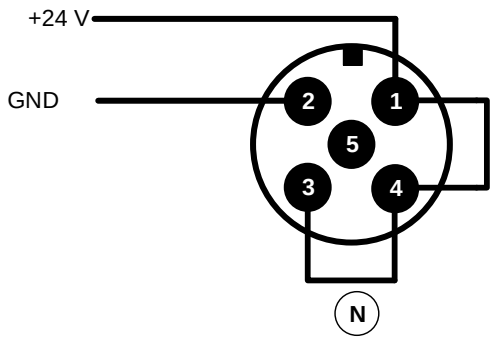
7.2 Connection of a sensors to a M12 plug

Self-made plug for the connection of a two/three wires sensor to a M12 plug
The assignment of this connector is not according to DIN standard but it is derived from our PumpMeter sensors.

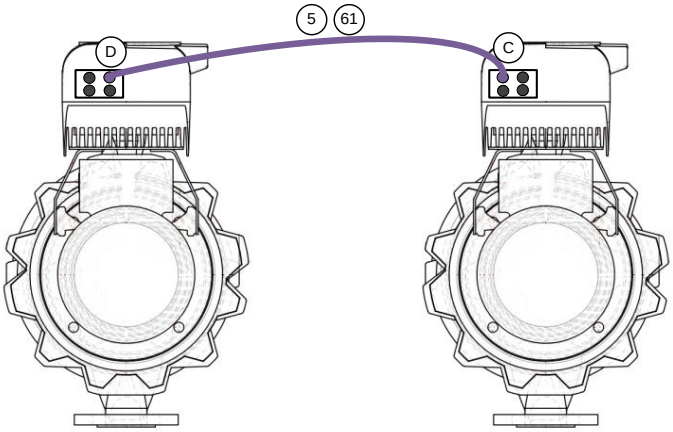


7.3 Power supply of PumpDrive via 24V power supply

It is possible to supply the PumpDrive with power with a D-coded M12 male plug and a 24V power supply, to e.g. do a parameterization.



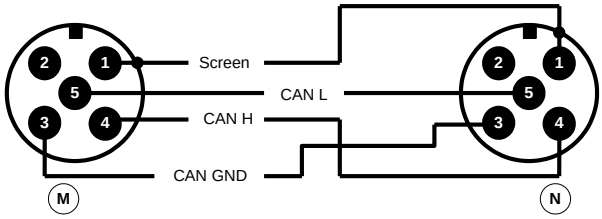
7.4 Bus cable for Double- and Multi Pump Operation

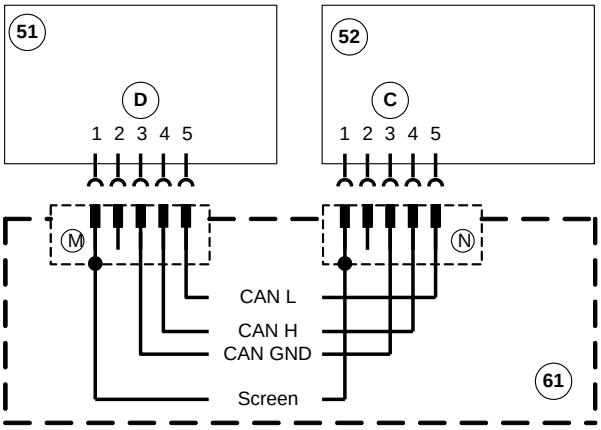


Tailor-made cable

Nr.	function	length	Mat.-Nr.
5	Tailor-made bus cable for double and multi pump operation (color: purple, male: angled, male: angled)	1 m	01533747
		2 m	01533748
		3 m	01533749
		5 m	01651182
		10 m	01651183
		20 m	01651184

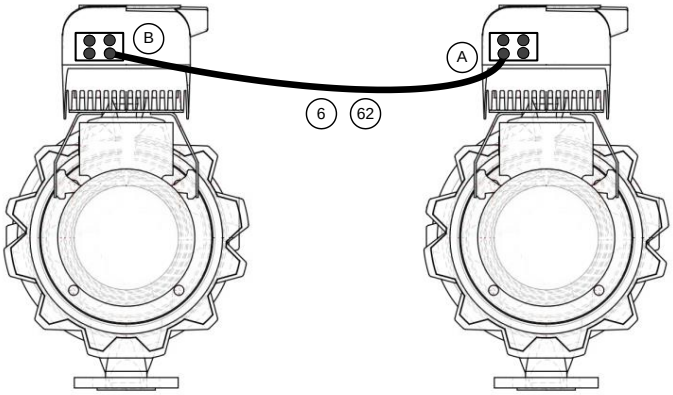
Self-made bus cable for the connection for double and multi pump operation:





Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with M12 Module – Connector D		
52	PumpDrive 2 (Drive 2) with M12 Module – Connector C		
61	CAN-Bus cable cut to length, screened, twisted pair, cable 2 x 2 x 0,22 mm²	1 m	01111184
		5 m	01304511
		10 m	01304512
		20 m	01304513
M, N	M12 male, A-coded, 5 poles		01523004

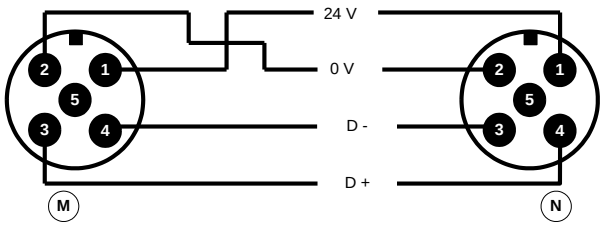
7.5 Crosslink cable

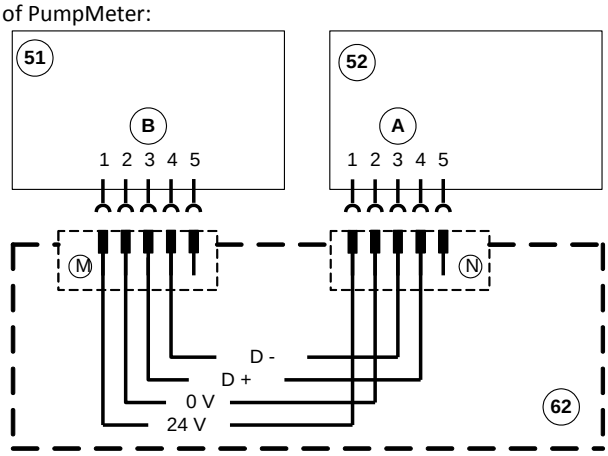


Tailor-made cable:

Nr.	function	length	Mat.-Nr.
6	tailor-made cross link bus cable for the redundant connection of PumpMeter (color: black, female: angled, male: angled)	1 m	01533769
		2 m	01533770
		3 m	01533771
		5 m	01533772
		10 m	01533773
		20 m	01533774

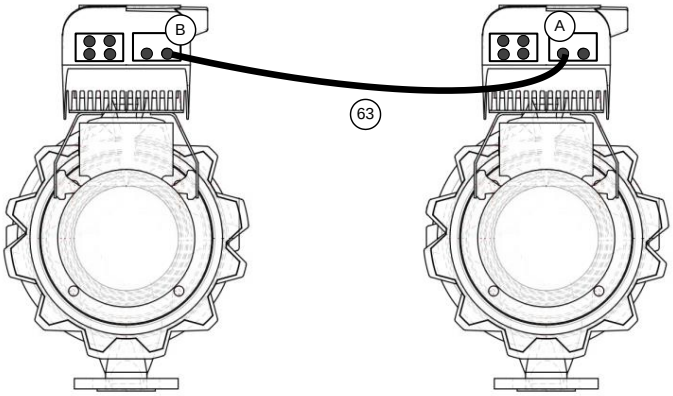
Self-made bus cable for the connection for the redundant connection of PumpMeter:





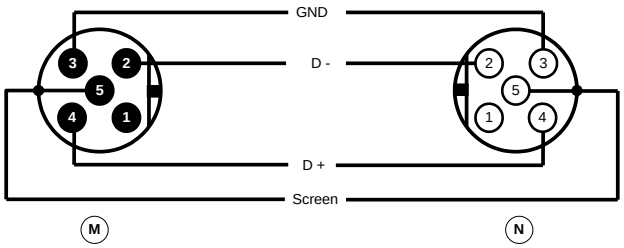
Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with M12 Module – Connector B		
52	PumpDrive 2 (Drive 2) with M12 Module – Connector A		
62	CAN-Bus cable cut to length, screened, twisted pair, cable 2 x 2 x 0,22 mm²	1 m	01111184
		5 m	01304511
		10 m	01304512
		20 m	01304513
M, N	M12 male, A-coded, 5 poles		01523004

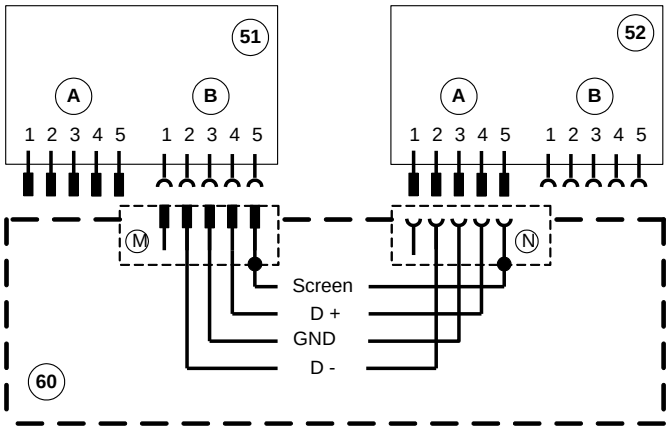
7.6 M12 Cable for fieldbus module Modbus RTU



Tailor-made cables are not available due to individual length.

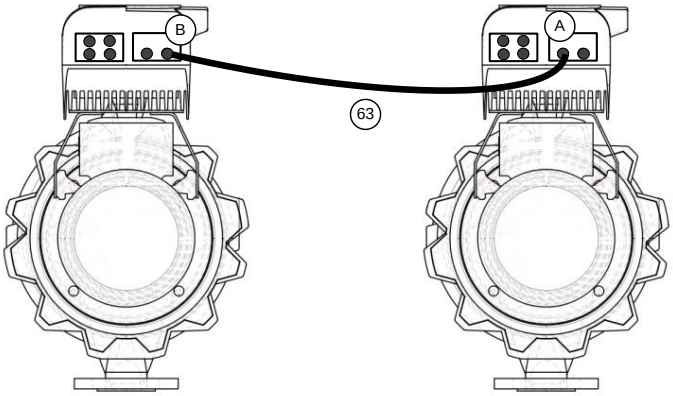
Self-made bus cable for fieldbus module Modbus:





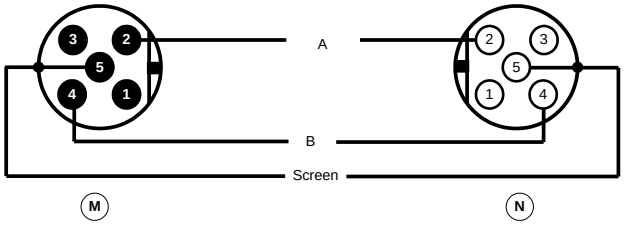
Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with Modbus Module – connector B		
52	PumpDrive 2 (Drive 2) with Modbus Module – connector A		
63	CAN-Bus cable cut to length, screened, twisted pair, cable 2 x 2 x 0,22 mm²	1 m	01111184
		5 m	01304511
		10 m	01304512
		20 m	01304513
M	M12 male, B-coded, 5 poles (Binder Connector Type: 99 1437 920 05)		01651298
N	M12 female, B-coded, 5 poles (Binder Connector Type: 99 1436 820 05)		01651264
-	M12 end resistor male for Profibus, Modbus and BACnet Alternative: Phoenix Contact male: SAC-5P-M12MS PB TR - 1507803		01125102

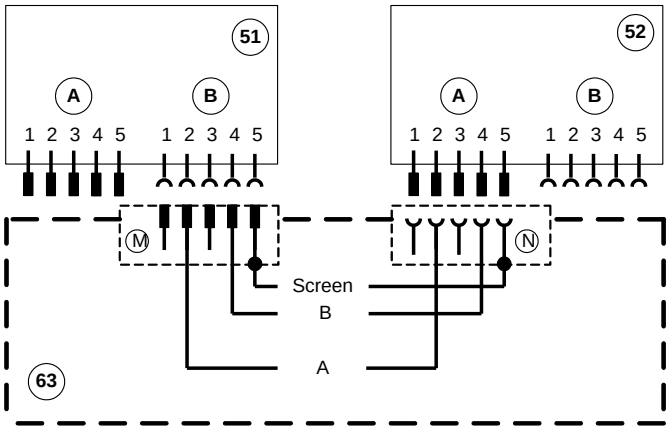
7.7 M12 Cable for fieldbus module Profibus



Tailor-made cables are not available due to individual length.

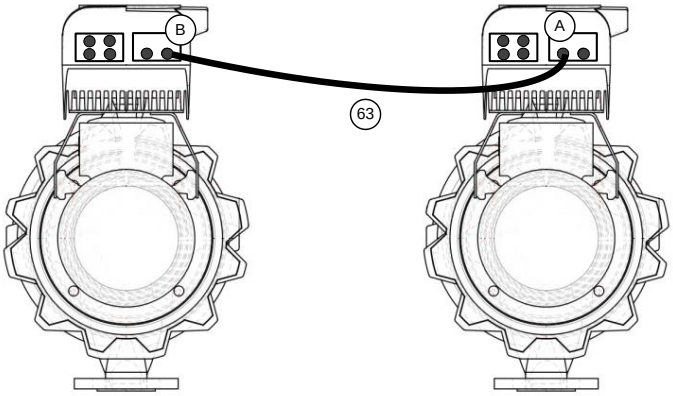
Self-made bus cable for fieldbus module Profibus:





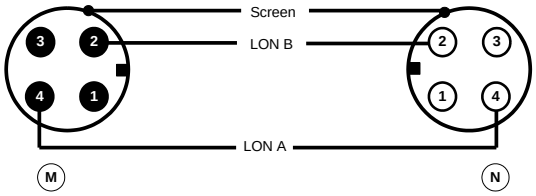
Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with Profibus module – connector B		
52	PumpDrive 2 (Drive 2) with Profibus Module – connector A		
63	Profibus-Bus cable		-
M	M12 male, B-coded, 5 poles (Binder Connector Type: 99 1437 920 05)		01651264
N	M12 female, B-coded, 5 poles (Binder Connector Type: 99 1436 820 05)		01651298
-	M12 end resistor male for Profibus, Modbus and BACnet Alternative: Phoenix Contact male: SAC-5P-M12MS PB TR - 1507803		01125102

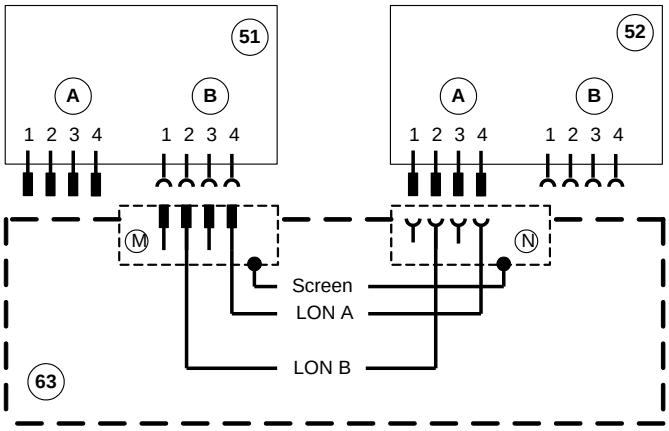
7.8 M12 Cable for fieldbus module LON



Tailor-made cables are not available due to individual length.

Self-made bus cable for fieldbus module LON:

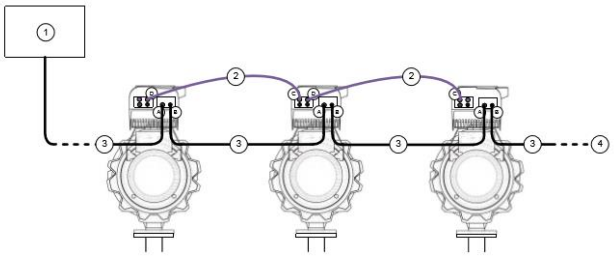




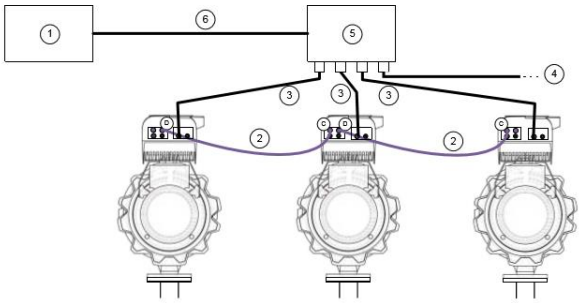
Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with LON module – connector B		
52	PumpDrive 2 (Drive 2) with LON module – connector A		
63	Bus cable		-
M	M12 male, A-coded, 4 poles (Binder Connector Type: 99 1429 824 04)		-
N	M12 female, A-coded, 4 poles (Binder Connector Type: 99 1430 824 04)		-

7.9 M12 Cable for fieldbus module Profinet

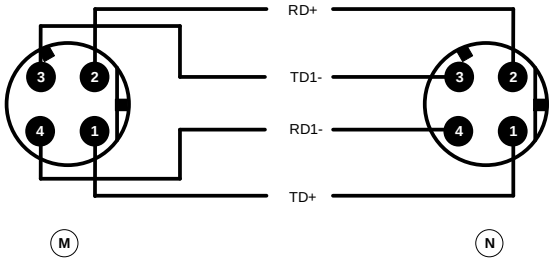
Connect fieldbus in the network topology
Attention: the Profinet module hasn´t a T connector.
In case a drive has a failure all other drives will fail.

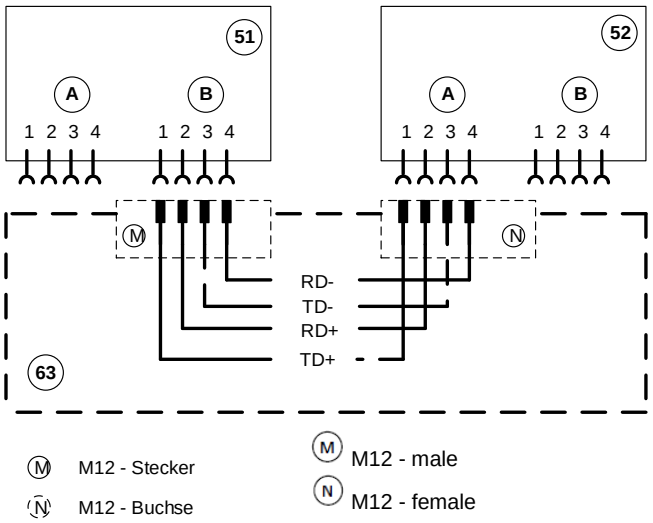


Profinet module in star topology (usual connection)



Self-made bus cable
Attention: The self-made bus cables for Profinet must be certified.





Pin assignment:

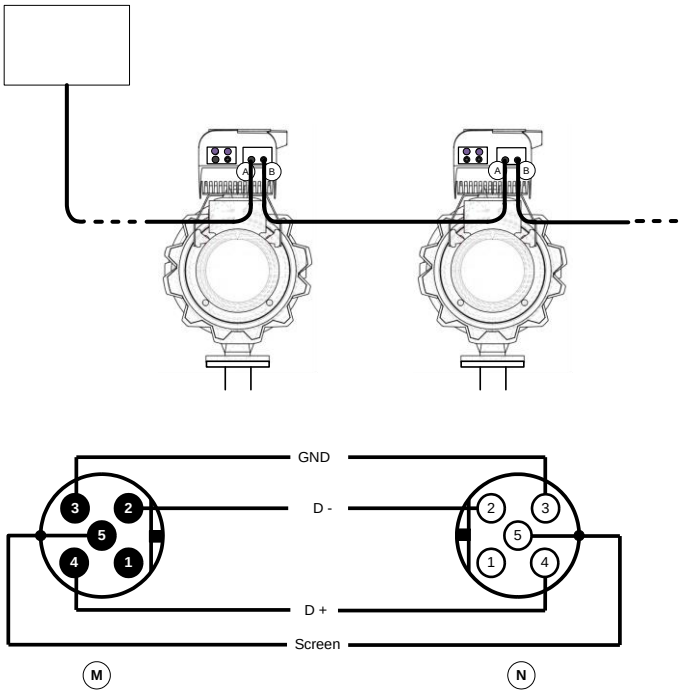
Pin	Core color code of Ethernet cable (category 5, IEC 11801)	M12 connector/M12 socket assignment (B coding)
1	Yellow	TD+/RD+
2	White	RD+/TD+
3	Orange	TD-/RD-
4	Blue	RD-/ TD-
Thread	Shielding	Shielding

Consisting of:

Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with Profinet Module – connector B		
52	PumpDrive 2 (Drive 2) with Profinet Module – connector A		
63	Bus cable		-

7.10 M12 Cable for fieldbus module Bacnet

Connect Bacnet MS/TP in the network topology



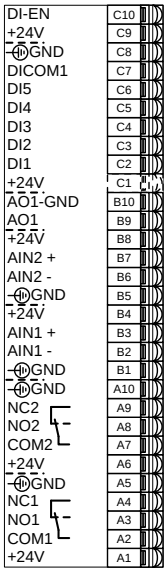
Self-made bus cable for fieldbus module BACnet:

Nr.	function	length	Mat.-Nr.
51	PumpDrive 2 (Drive 1) with BACnet Module – connector B		
52	PumpDrive 2 (Drive 2) with BACnet Module – connector A		
63	CAN-Bus cable cut to length, screened, twisted pair, cable 2 x 2 x 0,22 mm²	1 m	01111184
		5 m	01304511
		10 m	01304512
		20 m	01304513
M	M12 male, B-coded, 5 poles (Binder Connector Type: 99 1437 920 05)		01651264
N	M12 female, B-coded, 5 poles (Binder Connector Type: 99 1436 820 05)		01651298
-	M12 end resistor male for Profibus, Modbus and BACnet Alternative: Phoenix Contact male: SAC-5P-M12MS PB TR – 1507803		01125102

8. Project

Description:

PumpDrive 2	drive	Or local	Or PLC



Nr.	Function

Nr.	Parameter	Change value to

9. Other documents

PumpDrive 2 - PumpDrive 2 Eco Type Series Booklet 4074.5
https://shop.ksb.com/document/ES000911/4074.5_EN

Pump Drive 2 – Application Guide 4074.51
https://shop.ksb.com/document/ES000911/4074.51_EN

Pump Drive 2 Eco – Application Guide 4074.52
https://shop.ksb.com/document/ES000911/4074.52_EN

Pump Drive 2 – Operating manual 4074.81
https://shop.ksb.com/document/ES000911/4074.81_EN

Pump Drive 2 Eco – Operating manual 4074.82
https://shop.ksb.com/document/ES000911/4074.82_EN

PumpMeter - Type Series Booklet 4072.5
https://shop.ksb.com/document/ES000807/4072.5_EN

PumpMeter - Operating manual 4072.8
https://shop.ksb.com/document/ES000807/4072.8_EN

Pump Drive 2 – LON supplementary operating manual 4074.802
https://shop.ksb.com/document/ES000911/4074.802_EN

Pump Drive 2 – Profibus supplementary operating manual 4074.801
https://shop.ksb.com/document/ES000911/4074.801_EN

Pump Drive 2 - Modbus supplementary operating manual 4074.803
https://shop.ksb.com/document/ES000911/4074.803_EN

Pump Drive 2 - Profinet supplementary operating manual 4074.806 (only German)
https://shop.ksb.com/document/ES000911/4074.806_DE

26.04.2017

4074.51/04-EN

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