

## X-JET (Counter current system)

### **GB** Instruction Manual

Translation of the original



27131 - B

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## **1 General**

### **1.1 Warranty instructions**

If the instructions described in this manual are not followed, warranty will be void.

### **1.2 General**

All parts in contact with the media are designed for water quality to DIN 19643

This counter current swimming system (X-Jet) is state-of-the-art technology. It has been manufactured with great care and is subject to constant quality checks.

This operator's manual contains important instructions on how to use the counter current system safely, properly and economically. The instructions must be strictly adhered to in order to avoid danger and to ensure that the counter current system has a long lifespan

This manual does not take into account local regulations, the observance of which is the responsibility of the operator that includes the installation personnel that may be involved.

The data plate specifies the serial number, the model number and the most important operating data. Please indicate these data (especially the serial number) when more information is required or when ordering spare parts or additional systems.

### **1.3 Usage instructions**

This counter current system is designed for use in private pools. Consequently it must not be installed in public pools. Neither the complete system nor parts of it should be installed in other systems. We therefore strongly advise to use it as intended.

This counter system must not be operated beyond the parameters indicated in the technical data (3.1). In case of doubt, please contact your dealer or the manufacturer.

## **2 Safety instructions**

### **2.1 General**

- Please ensure that the users have read and understood the manual before operating the system. Not the users, but the owners (operators) are responsible for the safety.
- Please ensure that the regulations valid in the operating company and/or in the country where the counter current system is installed are complied with.
- All parts that come into contact with the medium are resistant to an absolute salt content of up to 4500 mg/l Cl<sup>-</sup>. If the salt concentrations are higher, please contact the manufacturer.
- Use the counter current system only when it is in perfect technical condition, in accordance with the regulations, observing safety requirements and danger conditions and strictly adhering to all the instructions given in this manual.
- Immediately eliminate faults that could affect the safety.
- Prior to carrying out repairs, the system must be disconnected from the power supply and protected from possible unintentional switching on!
- Regardless of what nature they may be, repairs must only be carried out by qualified personnel and the counter current system must be emptied first.

- The operator must ensure that:
  - The instruction manual is always readily available to the users.
  - The instructions in the manual are followed.
  - The system is immediately stopped should abnormal voltages, temperatures, noises, vibrations, leakages or other faults occur.

## 2.2 Symboles

The following symbols are used in this manual to draw your attention to dangers.



**Warning! Risk of injury! / Warning! Risk of damage!**

**This symbol warns you of dangers through mechanical effects and also warns for handling that could damage the product.**



**Warning! Lethal danger!**

**This sign warns of danger caused by electrical current.**

Instructions attached to the counter current system, such as the direction of rotation arrow, must be observed and kept in a readable condition.

## 2.3 Safety instructions for the operator

Electrical equipment must be installed and serviced only by qualified personnel. The applicable safety and installation regulations at the installation site must be complied with. The definition of qualified personnel is described in VDE 0105 and IEC 364. Information for unqualified personnel is not included in this manual. We bring to your attention that the EC regulations prohibit unqualified personnel to work on electrical systems.



**Lethal danger caused by electrical current!**

Electrical connections should only be performed by a qualified electrician in accordance with VDE Directive 0100. Please observe the regulations of the local electricity company and the standards and safety regulations for electrical installations in swimming pools.

**Observe DIN EN 13451!**

### 3 Unit description / Technical data

The counter-current system complies with the VDE regulations

The motor and the pump are electrically separated

The motor has IP55 protection

The complete counter current system is built to protection class I

#### 3.1 Technical data pump kits

System type:	X-Jet 80	X-Jet 160	X-Jet 240
Pump type	WP 6513/2-5,5	NB 12525/4-11	NB 12525/4-15
Power	5,5 kW	11 kW	15 kW
Voltage	690 Y / 400 D	690 Y / 400 D	690 Y / 400 D
Frequency	CF [ 52 Hz ]	CF [ 50 Hz ]	CF [ 50 Hz ]
Current			
Speed	2 900 min <sup>-1</sup>	1 450 min <sup>-1</sup>	1 450 min <sup>-1</sup>
Impeller	130 mm	230 mm	255 mm
Flow	80 m <sup>3</sup> /h	160 m <sup>3</sup> /h	240 m <sup>3</sup> /h
Discharge pressure	15 m	15 m	15 m
Nozzle pressure	10 m	10 m	10 m
Max. water temperature	50° C	50° C	50° C

#### 3.2 Pipe sizing

##### 3.2.1 Flow velocities

To avoid collisions (water hammer) due to acceleration or deceleration the flow velocity in all pipes should be kept the same. In the literature, the following values are mentioned.

Water		Source	X - Jet		
			Simple [80]	Double [160]	Triple [240]
Suction of centrifugal pumps	1,0 - 1,5 m/s	Dubbel	DN 150	DN 200	DN 250
Discharge of centrifugal pumps	2,5 - 3,0 m/s	Dubbel	DN 125	DN 150	DN 250

The economic flow velocity determines the pipe sizing. It results from the optimum of the sum of the capital cost of the pipeline, the investment cost of the mechanical equipment (pumps, compressors) and the energy and maintenance costs over the entire operating time.

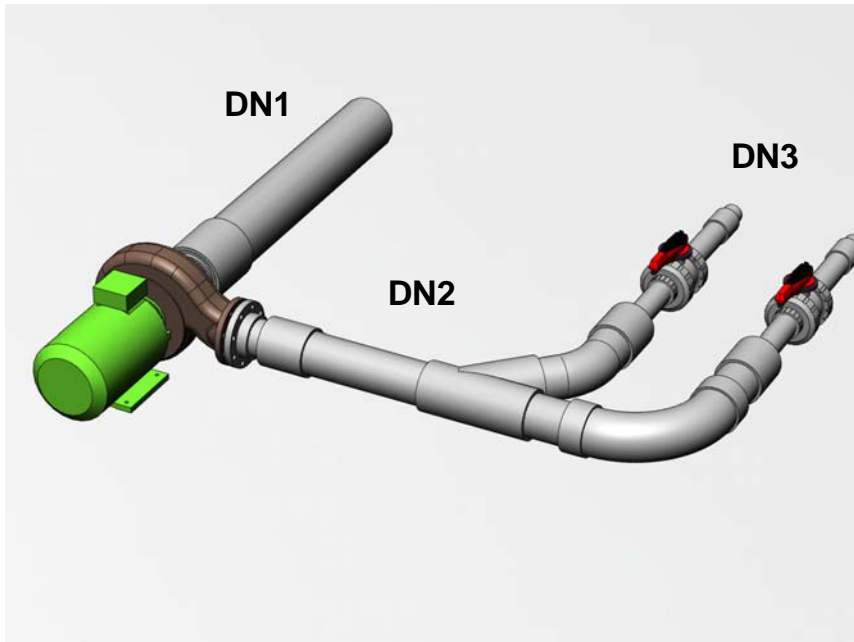


Note!

Pipes longer than >6m the diameter should be enlarged, e.g. suction side from DN150 to DN200 and discharge side from DN 125 to DN150.

To obtain the lowest possible friction losses, always use bends and not elbows and 45 ° instead of 90 ° t-pieces.

### 3.2.2 Piping example



DN1 = Suction side  
DN2 = Discharge side  
DN3 = Installation kit  
X-Jet [DN50]

Pipe line example X-Jet 160 [double]

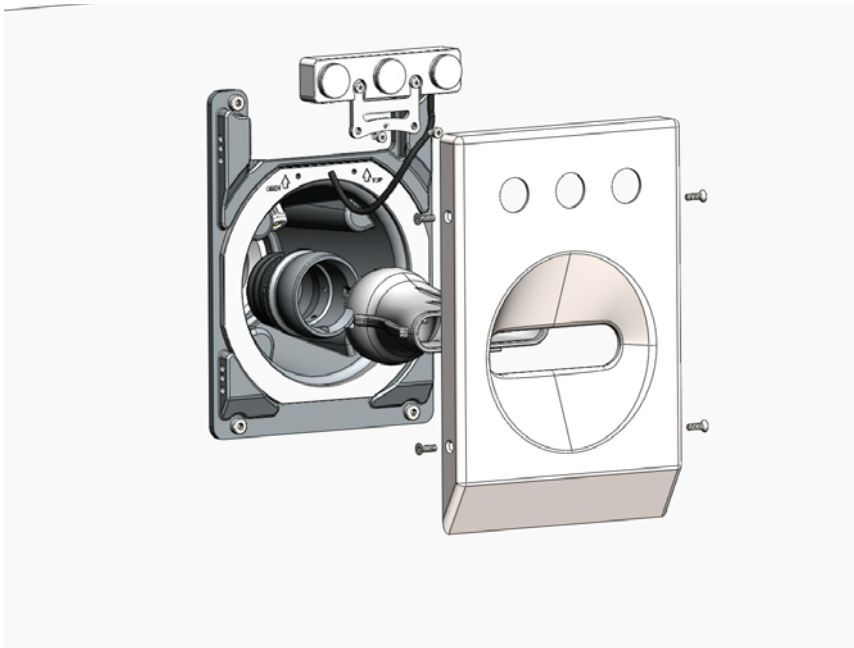


Note!

When sizing the suction please observe DIN EN 13451.

### 3.3 System components

The counters current system consist of 3 main components:



1. Installation kit
2. Assembly kit
3. Pump kit

The installation kit as well as the assembly kit is different for each pool type:

### 3.4 Shortcut

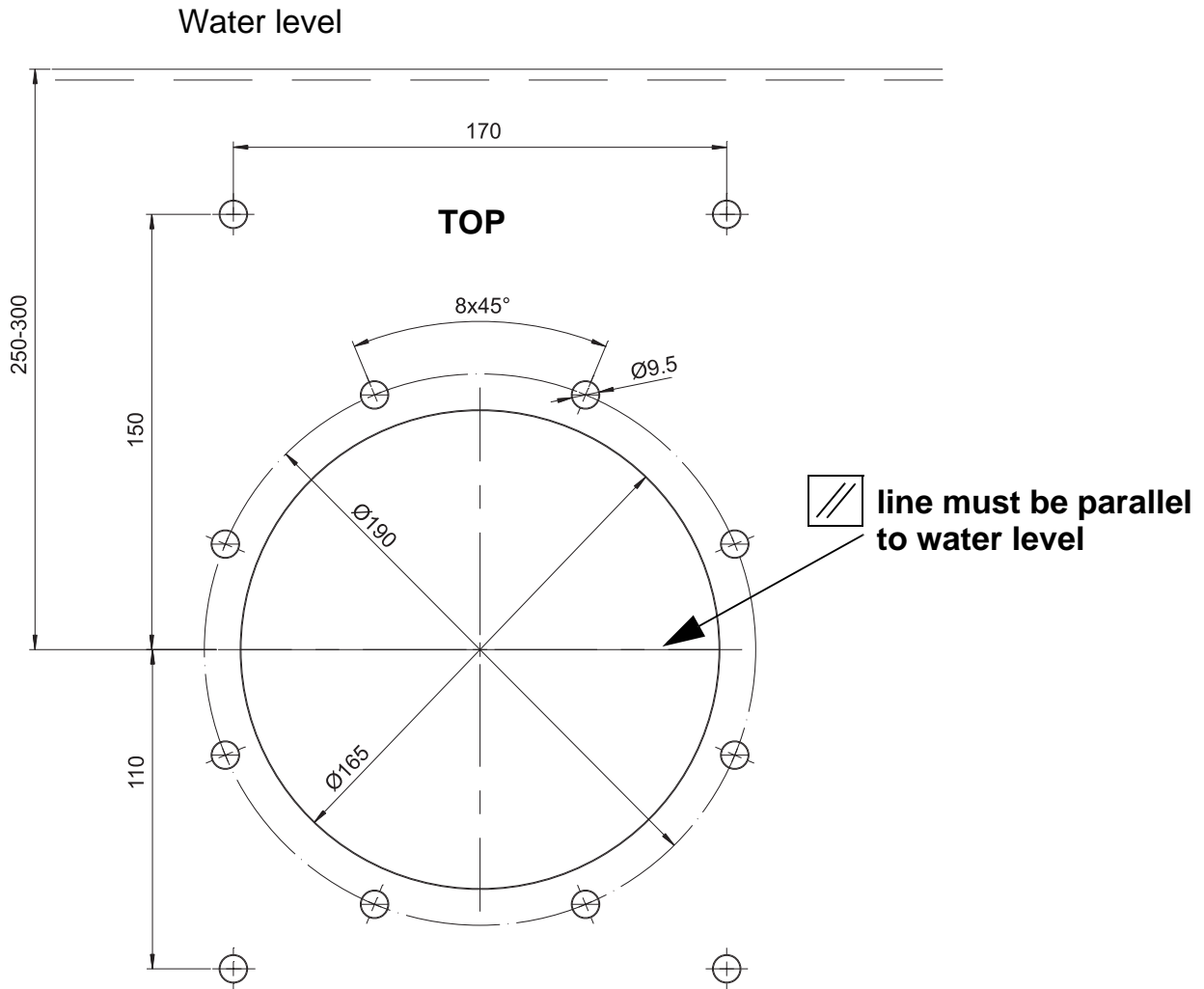
- A Prefabricated (Steel, GFK, a.o.)
- B Concrete and tiles
- H Concrete and liner
- S Concrete and tiles, with or without brushed applied sealant

## 4 Installation kit instructions

### 4.1 Installation preparation

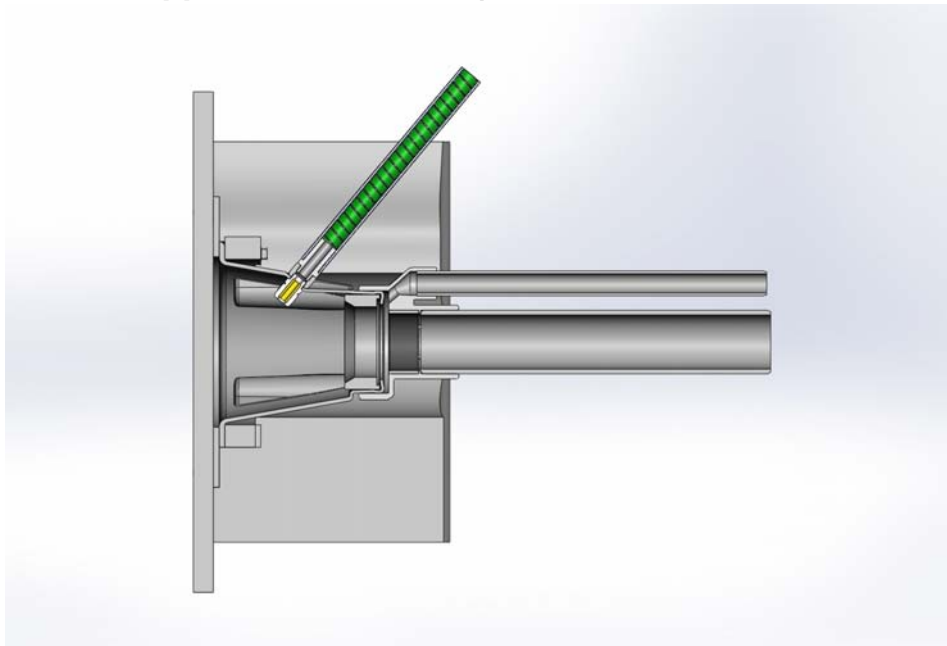
In systems with multiple nozzles it is important to ensure a minimum distance between the centre lines of the installation kits of 320 mm.

### 4.2 Installation preparation prefabricated pools

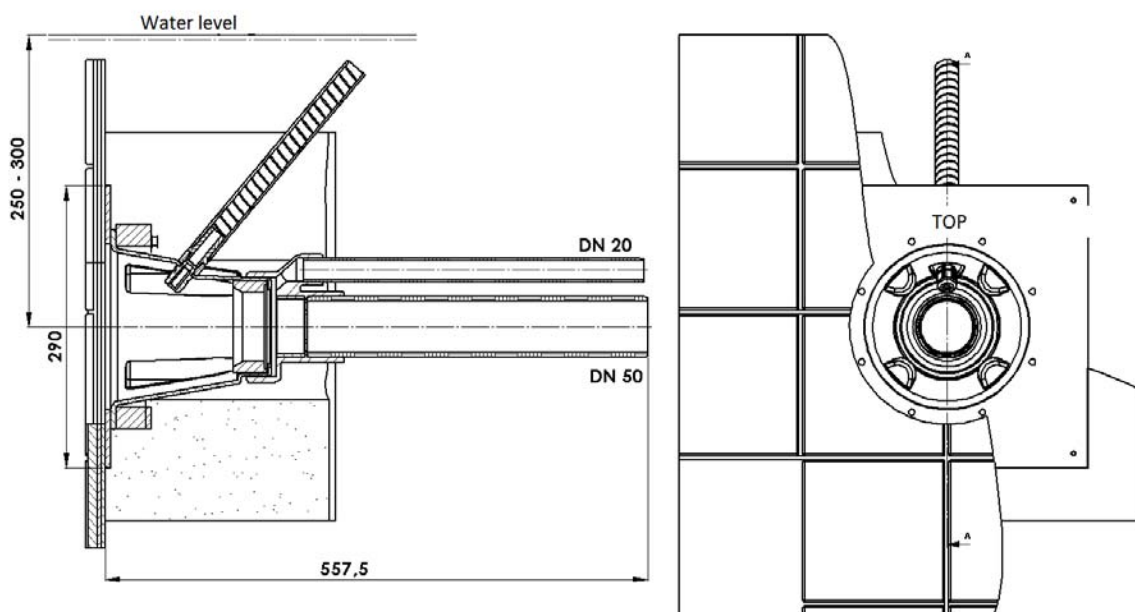


The cut-out must be Ø 165 mm and the drilling for the mounting holes must be Ø 9,5 mm.

### 4.3 Mounting the installation kit in concrete pools (tiled - with or without brushed applied sealant, liner)

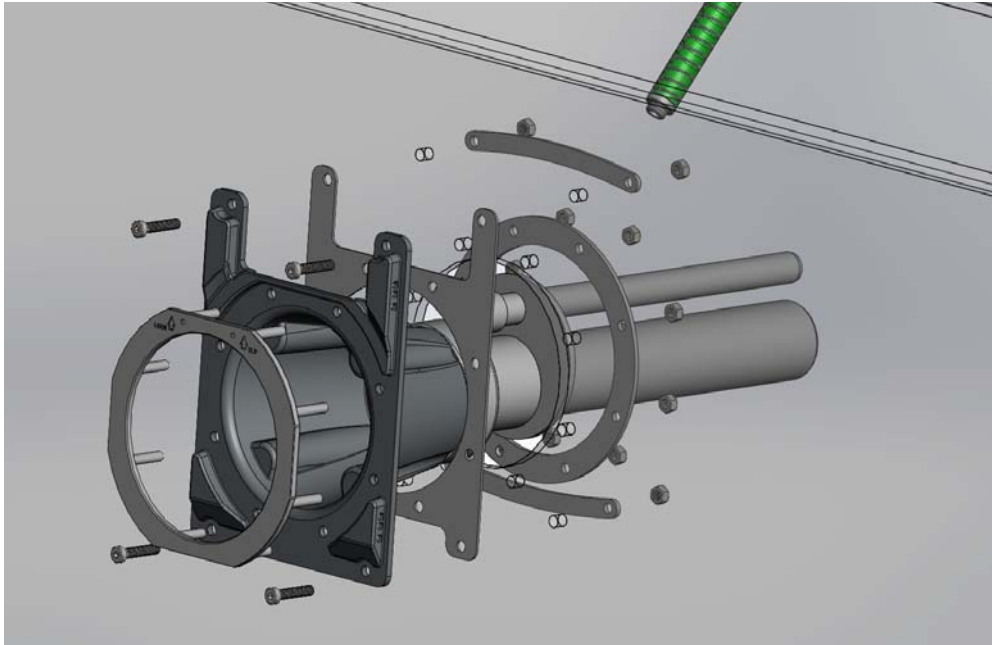


Fix the installation kit in the desired position with 4 studs on the formwork board. It is important that before pouring the concrete, that the installation kit is horizontally level, accurately and securely mounted between the formwork boards because it cannot be adjusted afterwards.

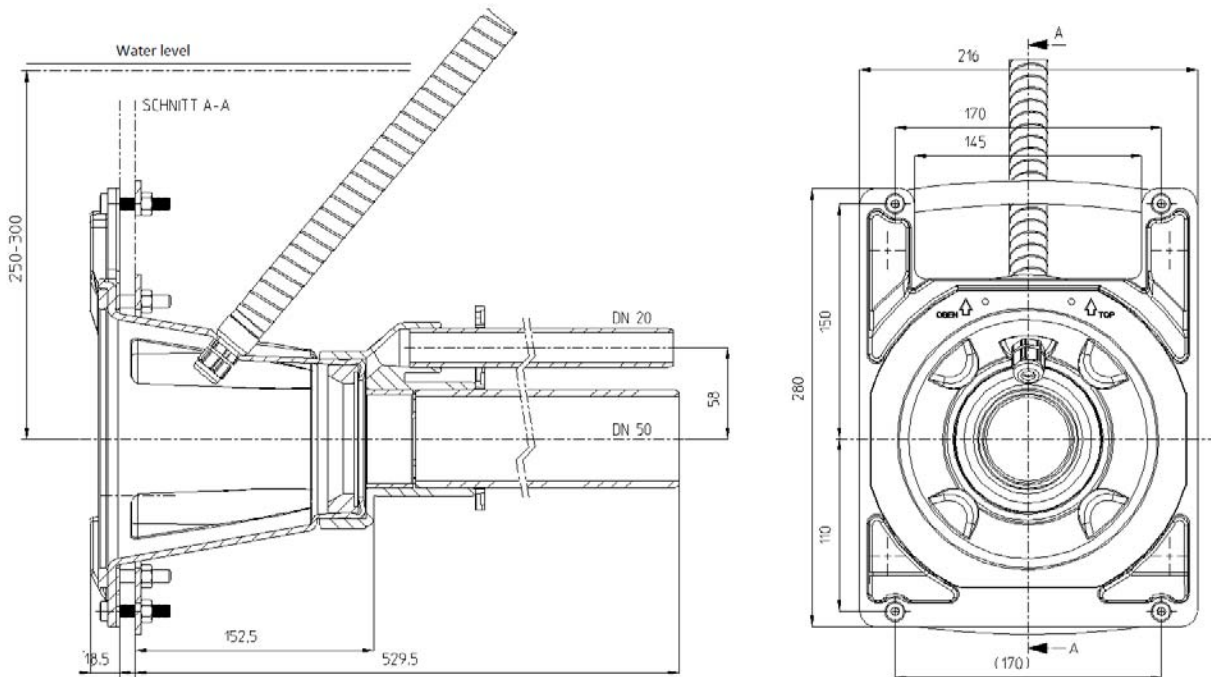


**The arrangement of the air valve should always be above the pool water level. Keep the air pipe as short as possible.  
When installing multiple units every unit must have its own air supply**

#### 4.4 Mounting the installation kit in prefabricated pools



Mount the clamping ring with the housing, gasket and retaining ring with the included screws onto the pool wall. The sealing surfaces must be clean and smooth.



**i** The arrangement of the air valve should always be above the pool water level. Keep the air pipe as short as possible.  
When installing multiple units every unit must have its own air supply.

## 5 Installation instructions assembly kit



Assembly :

Nozzle  
Control unit  
Faceplate

### 5.1 Mounting the control unit (general)



Lead the cable from the control unit through the cable entry and the cable protection hose to a suitable junction box or directly to the variable speed drive. Then tighten the cable entry firmly.

When a counter current is used without the control unit the supplied blanking plug must be fitted into the gland to ensure that this passage is properly sealed.

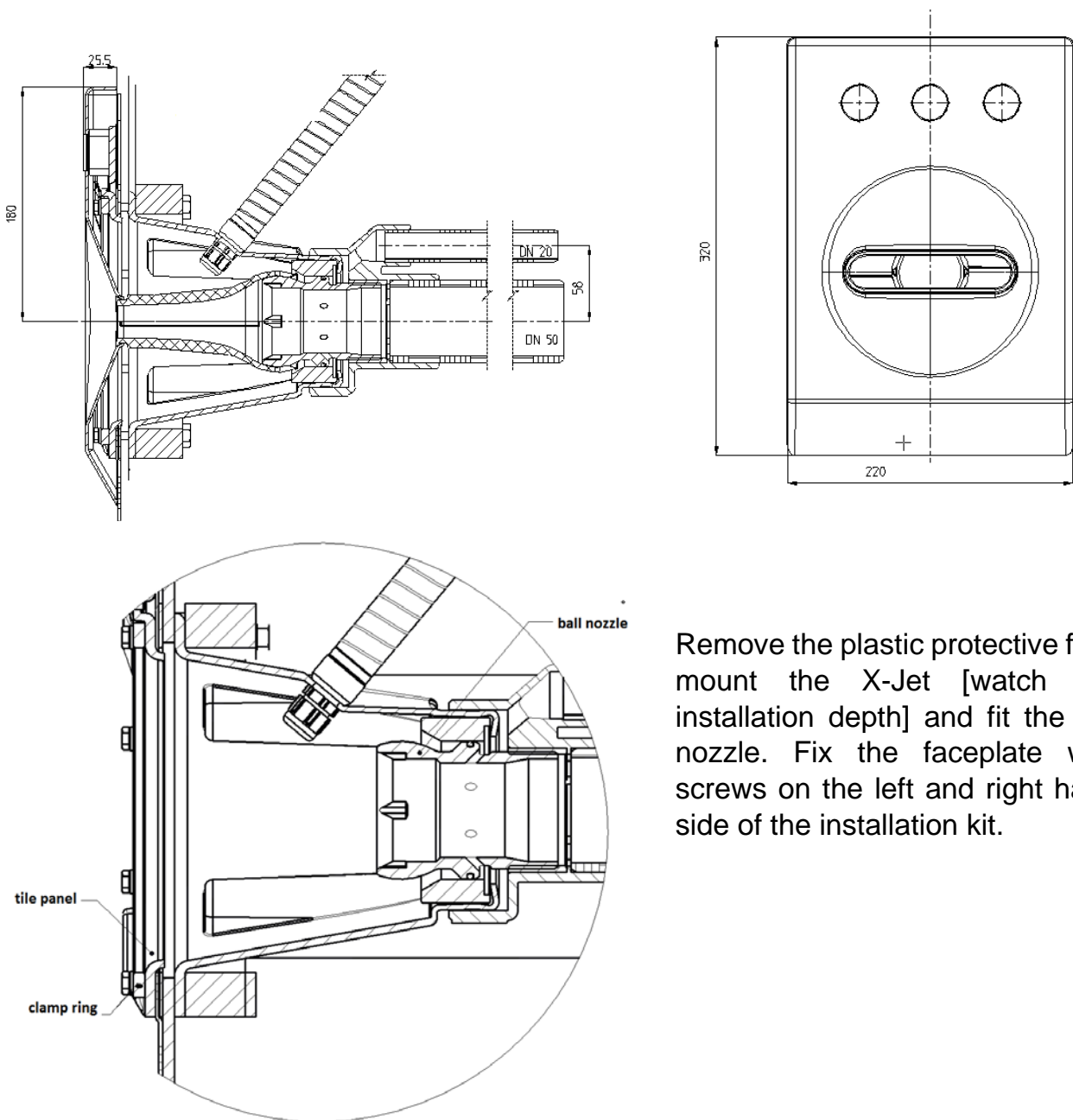
The control unit is to be fitted with the supplied brackets in such a way that it matches with the expected angle of the nozzle.

The control unit must be connected to the VFD according to the instruction in chapter 6.

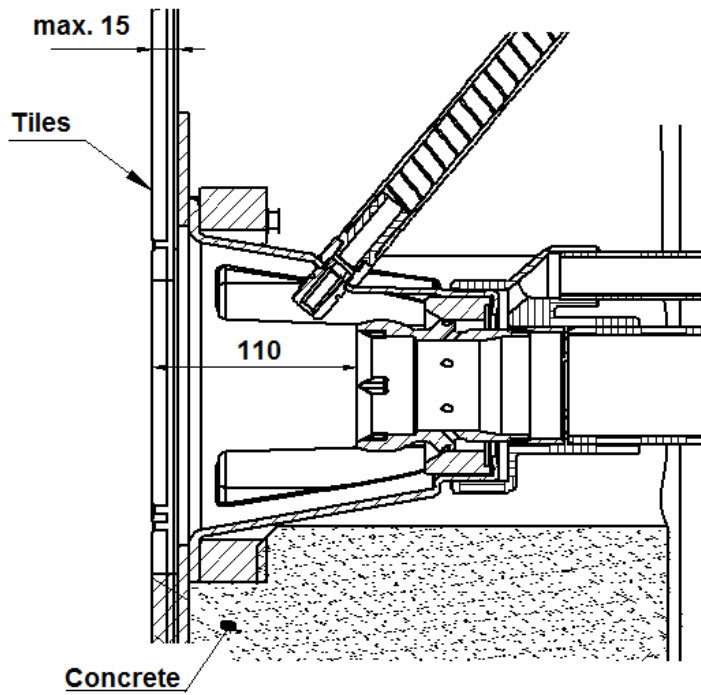


**In addition to the X-jet's control unit an emergency stop or a second on-off switch is recommended.**

## 5.2 Mounting in concrete pools (tiled - with or without brushed applied sealant)



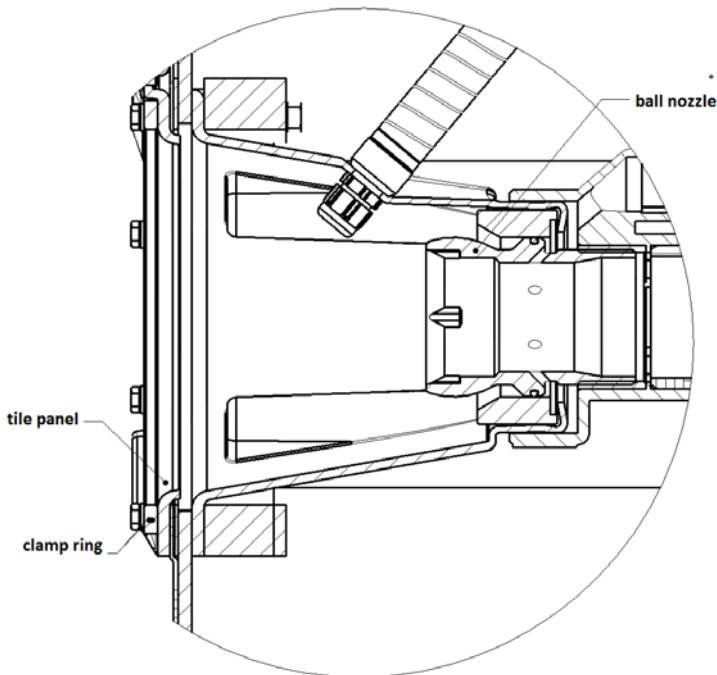
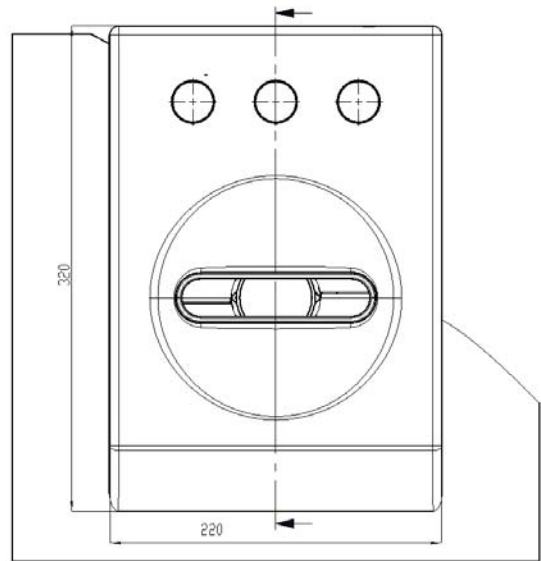
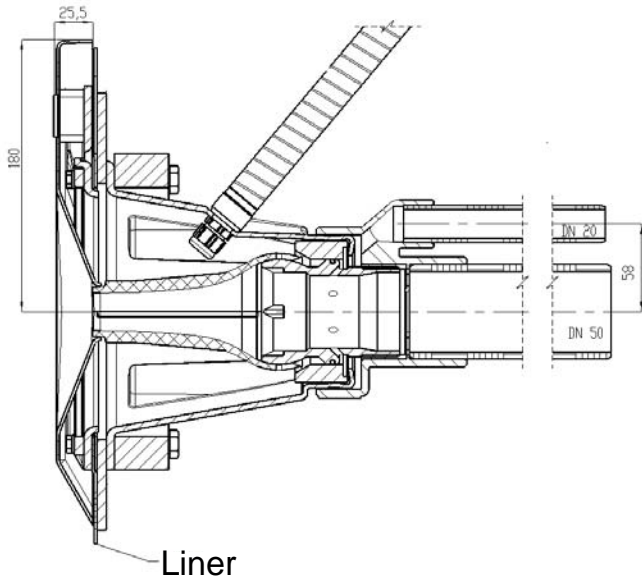
Remove the plastic protective film; mount the X-Jet [watch the installation depth] and fit the fan nozzle. Fix the faceplate with screws on the left and right hand side of the installation kit.



**Note:**

For tiles thicker than 15 mm  
apply extended nozzle.

### 5.3 Mounting in concrete pools (liner)

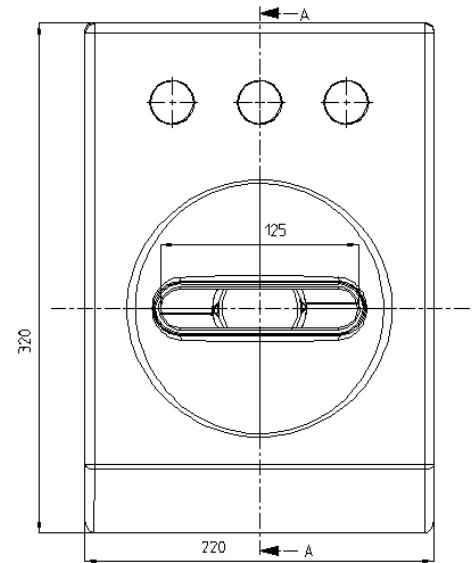
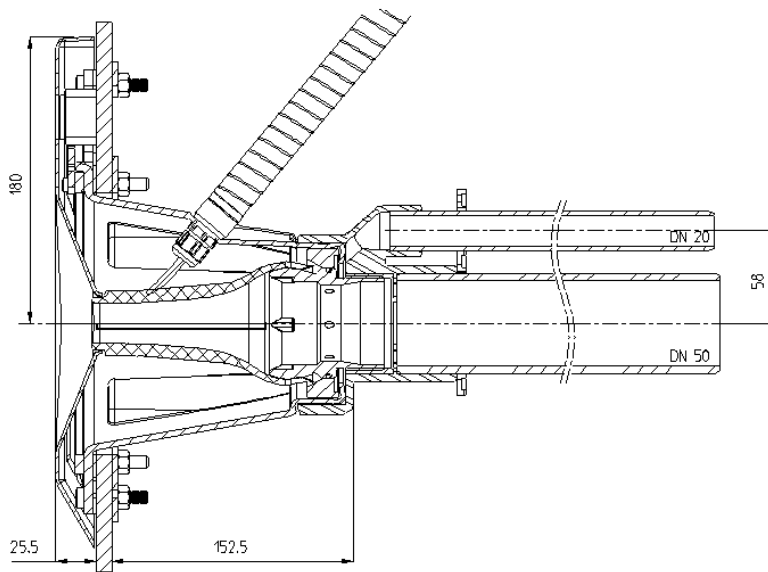


Remove the plastic protective film. Place the gasket between the housing and liner and mount the clamping ring with the screws onto the housing. The sealing must be clean and smooth.

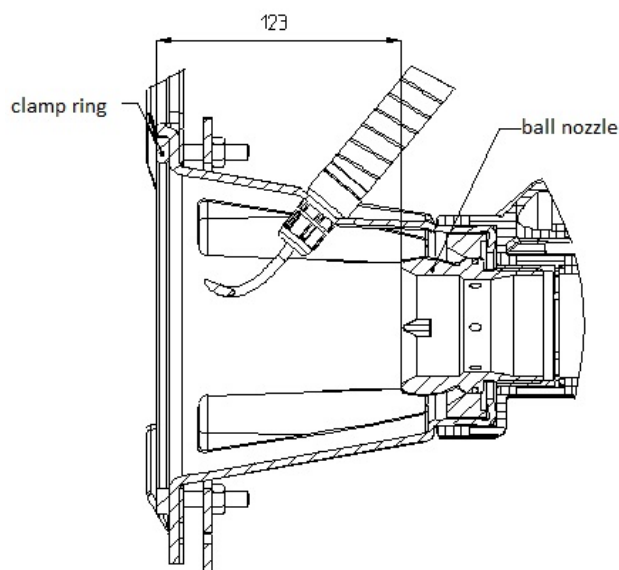
Now cut the liner.

Then X-Jet nozzle screw, [note depth] and attach fan nozzle. Screen the side panel at the mounting housing.

## 5.4 Mounting in prefabricated pools



installation dimension ball nozzle



X-Jet nozzle screw, [note depth] and attach fan nozzle. Screen the side panel at the mounting housing.

## 6 Connection frequency inverter (FU) with control unit



### 6.1 Control unit



Activation via  
3 x sensor button

#### Sensor button connection cable

- 5-wire special cable
- Standard cable length 2m
- Colour coded DIN 47100
- External diameter 6.3 mm
- Wire cross-section 0.5 mm<sup>2</sup>

#### Sensor button - connection assignment

Wire colour	Functions
Grey	LED1
White	Switching contact S1
Brown	24V
-	LED2
Yellow	Switching contact S2
-	24V
-	LED3
Green	Switching contact S3
-	24V

Note: Arrangement corresponds to the order of terminals in the converter box

#### Sensor button - technical information

Effect of switching:	Pulse activated one time
Electrical function:	normally open / N/O contact
Electrical data:	$I_{\max} = 200\text{mA}$ / $U_B = 24\text{V DC}$



**Note:**

When laying cables, safe isolation between different types of currents within an installation system must be ensured **without exception**. Comply with the requirements of DIN EN 50174 and DIN VDE 0100-520 for communication wiring when laying the cables.

**Safety isolation**

For reasons of electrical safety, the sensor button must without exception be operated via "safety isolation" such as a control box item no. 61405. The defined maximum line lengths must also be observed (see capitel 6.8).

**6.2 Converter box**



**The converter box 3.0 also serves as a safety isolating element and for evaluating button pulses of the sensor button.**

The signal output for the *X-Jet* is via an analog output (AOUT).

The main task of the converter box is to ensure a safe isolation between the sensor buttons (buttons 1-3) on one side and the analog and Vcc connections on the other side of the frequency inverter. The purpose of the converter box is to ensure safe and reliable operation of the sensor buttons in the swimming pool.



**The converter box must always be positioned above the water level of the pool!**

**Operator's Manual 27251 "Converter Box 3.0" applies**

- Device overview
- Operating mode – mode 1 "THREE-button control with analog signal"
- Installation instructions and cable length
- Housing dimensions

### 6.3 Pump with frequency inverter



#### Operator's Manual 27216 "Centrifugal Pump NB,FB,WP,SM,F" applies

- General information with data sheet for pump
- Safety Instructions
- Transport and storage
- Electrical connection of the pump
- Operating the Centrifugal Pump

The abbreviation FU stands for the frequency inverter (German Frequenzumrichter) and the drive controller



**Operator's Manual "INVEOR drive controller" applies**  
<http://www.kostal-industrie-elektrik.com/de-DE/Download/Antriebstechnik>

- General information
- Safety Instructions
- Installation
- Start-up
- Detecting and eliminating errors
- Technical data



If three-phase frequency inverters are used, conventional FI circuit breakers type A, also called RCD (residual current-operated protective device) are **not** approved for protection against direct or indirect contact!  
In accordance with DIN VDE 0160 and EN 50178, the FI circuit breaker must be a FI circuit breaker RCD type B (sensitive to all currents)!

### 6.4 FU programming - X-Jet specific delivery state Information to supplement the INVEOR Operator's Manual

The centrifugal pump is generally delivered with the FU attached. The power data is coordinated between the FU and the motor.

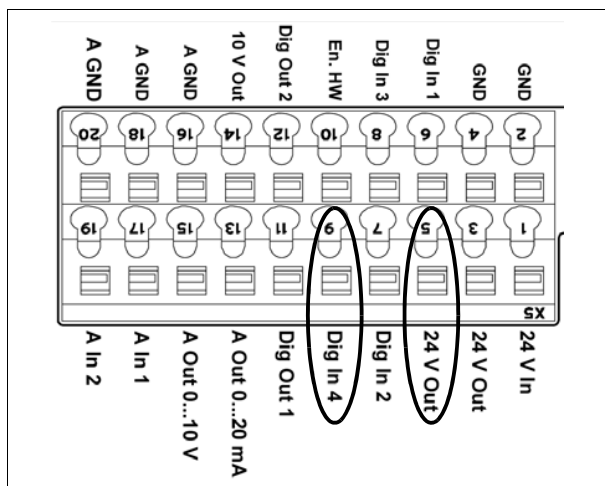
The FU has an active motor overcurrent protection function. The mains power connection for the FU must be designed according to the information in the INVEOR Operator's Manual (KOSTAL).

### 6.4.1 Operating modes:

The FU is delivered with two operating modes.

At the time of delivery operating mode 2 is activated via a wire jumper.

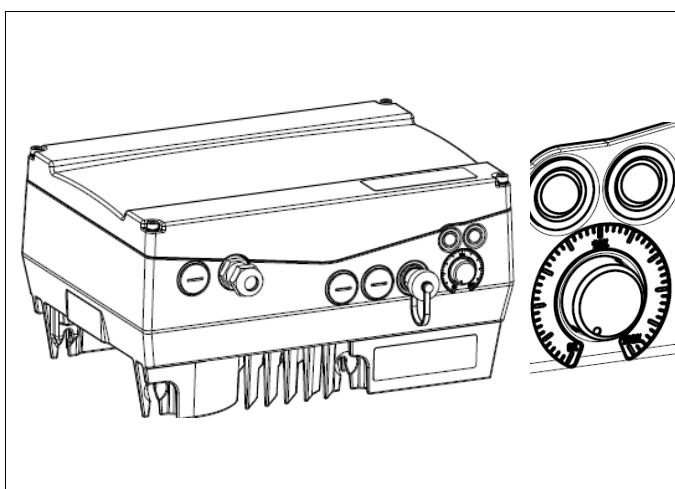
You can change between the two operating modes with DigIn4.



#### Operating mode 1:

##### Internal potentiometer

Commissioning function

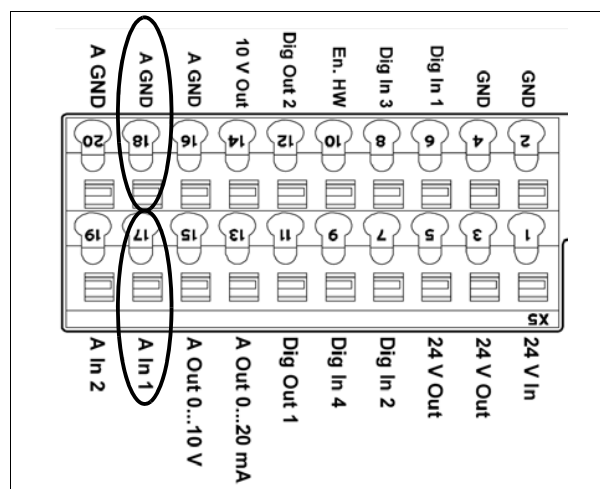


- Manual speed setting via rotary potentiometer directly on the FU
- Control range between saved MIN / MAX speed
- Active when DigIn4 is unassigned

#### Operating mode 2:

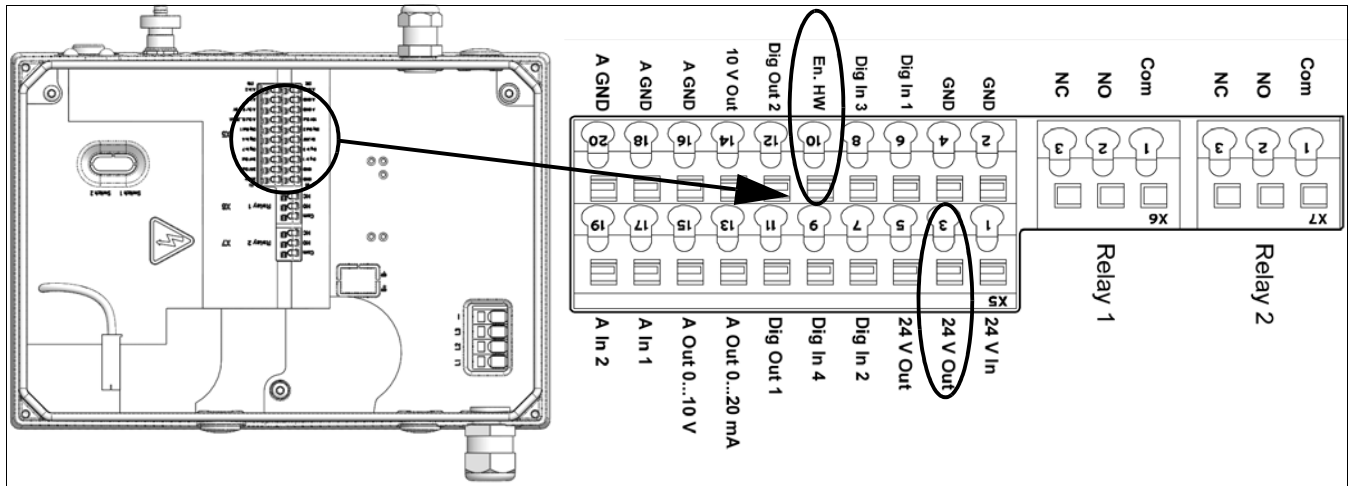
##### Analog control

X-Jet



- Speed setting via analog signal 0-10V on control terminal A In1
- Control range between saved MIN / MAX speed
- Active with jumper between DigIn4 and 24VOut

### 6.4.2 "Internal potentiometer" operating mode



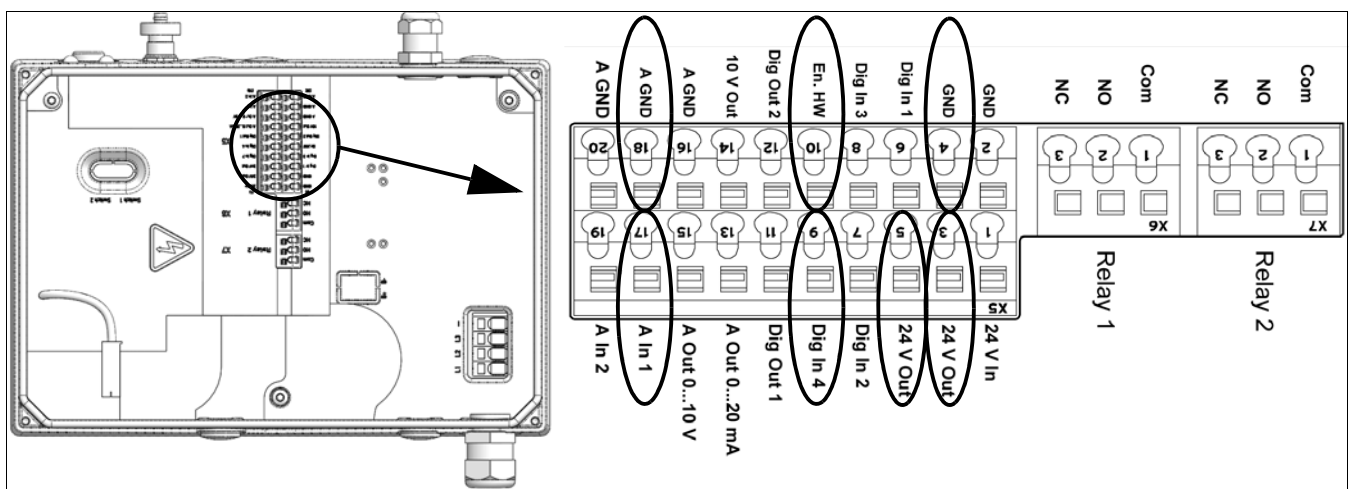
The FU does not start up until the hardware enable (En.HW) is set.

At the time of delivery the hardware enable **(En.HW) is not set**.

The FU is ready for operation when the green signal LED is flashing. Mains voltage is applied then with the hardware enable not set. If the hardware enable is set now, the green signal LED is lit continuously, the motor can start up and manual speed control between MIN and MAX speed is now possible using the potentiometer on the FU.

### 6.4.3 "Analog control" operating mode

As terminals for X-Jet function



The FU does not start up until the hardware enable (En.HW) is set.

At the time of delivery the hardware enable (En.HW) is not set.

The FU is ready for operation when the green signal LED is flashing. Mains voltage is applied then with the hardware enable not set. If the hardware enable is set now, the green signal LED is lit continuously.

The hardware enable is set via Dout4 when the converter box is connected according to the connection diagrams, sensor-controlled design (see capital 6.5). This Dout4 is switched together with Aout when the Start button is pressed.

This ensures that the FU is disabled in Stop status.

The analog signal 0-10V which is present is used to control the speed between the MIN and MAX speed value.

## 6.4.4 Additional feedback contact

### Switches with "Malfunction"





Relay 1 (potential-free change) + DigiOUT1





### Switches with "Operation"

Relay 2 (potential-free change) + DigiOUT2

For additional terminal assignments, please see the INVEOR Operator's Manual Section 3.3.4 Control connections table, 4 Terminal assignment

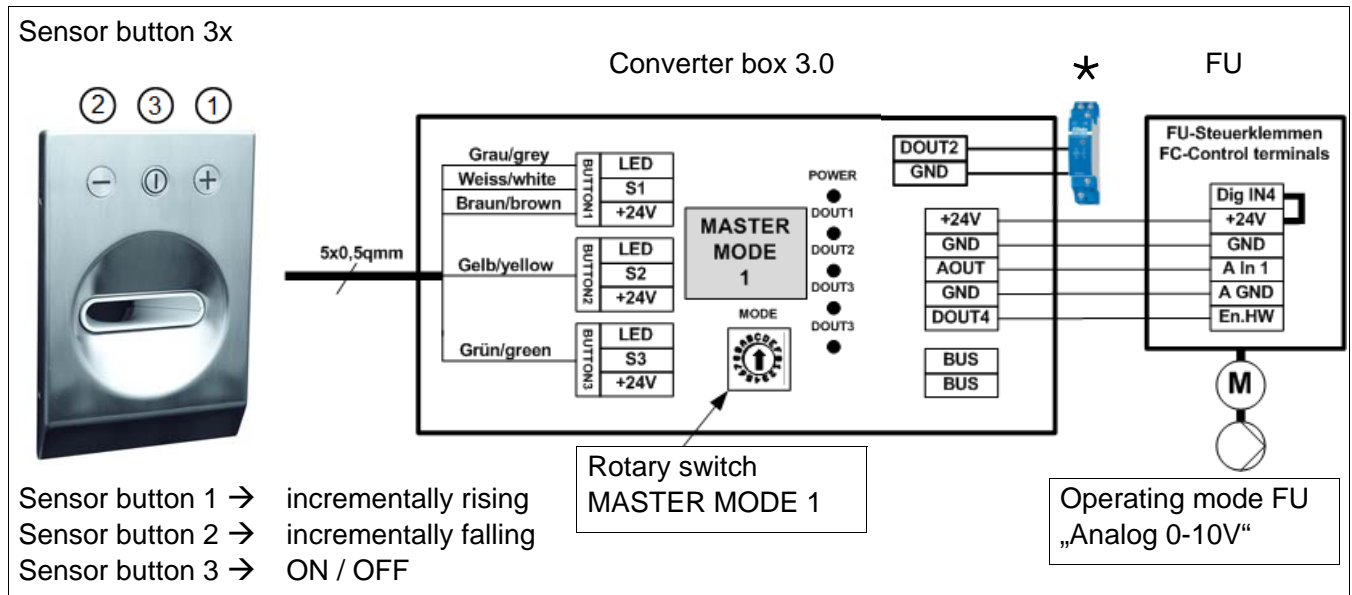
#### 6.4.4.1 Error message on FU

Red LED	Green LED	Status
		Warning
		Error

Key			
	LED off		LED on
	LED flashing		LED flashing quickly

## 6.5 Connection diagram

Connection diagram of the switching unit with 3 sensor buttons and a 5-pin connection cable



**The button pulses (buttons 1-3) cause an incremental change to analog output AOUT.**

AOUT: Starting voltage 4V control range 4 / 5 / 6 / 7 / 8 / 9 / 10V

Dout4: ON when AOUT is active / ON when AOUT 0V and non-active (enable)

### ★Air valve control:

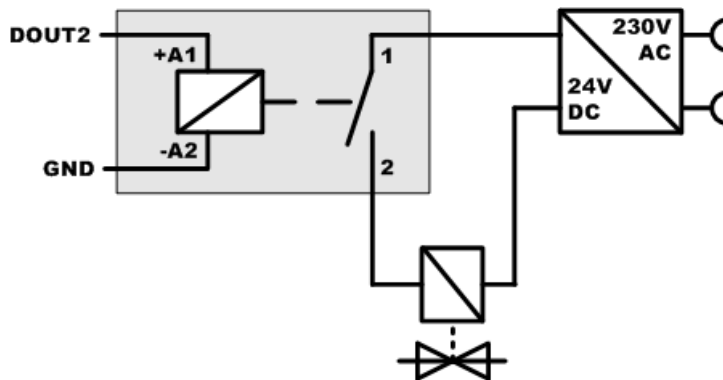
If AOUT is active, a pulse combination to S2 (2 pulses within 0.5sec) causes digital output DOUT2 to be activated.

DOUT2 can be set to inactive again with

- S3 - System OFF
- Pulse combination to S2 (2 pulses within 0.5sec)

Switching output of Dout2: 24V DC  $I_{max} = 20\text{mA DC}$


To be able to switch an air valve with a higher electrical output, a multi-function relay item no. 55323 can be connected to DOUT2.



## 6.6 Testing the wiring

Sensor button with converter box.

1. The button pulse of the connected sensor buttons is received by the connected box when the lit ON/OFF button indicates this visually by flashing.

2. MODE1 active via rotary switch .

Measurable signals

OFF → Aout = 0V / Dout4 = 0V

ON → Start status AOUT = 4 / 5 / 6 / 7 / 8 / 9 / 10V / Dout4 = 24V

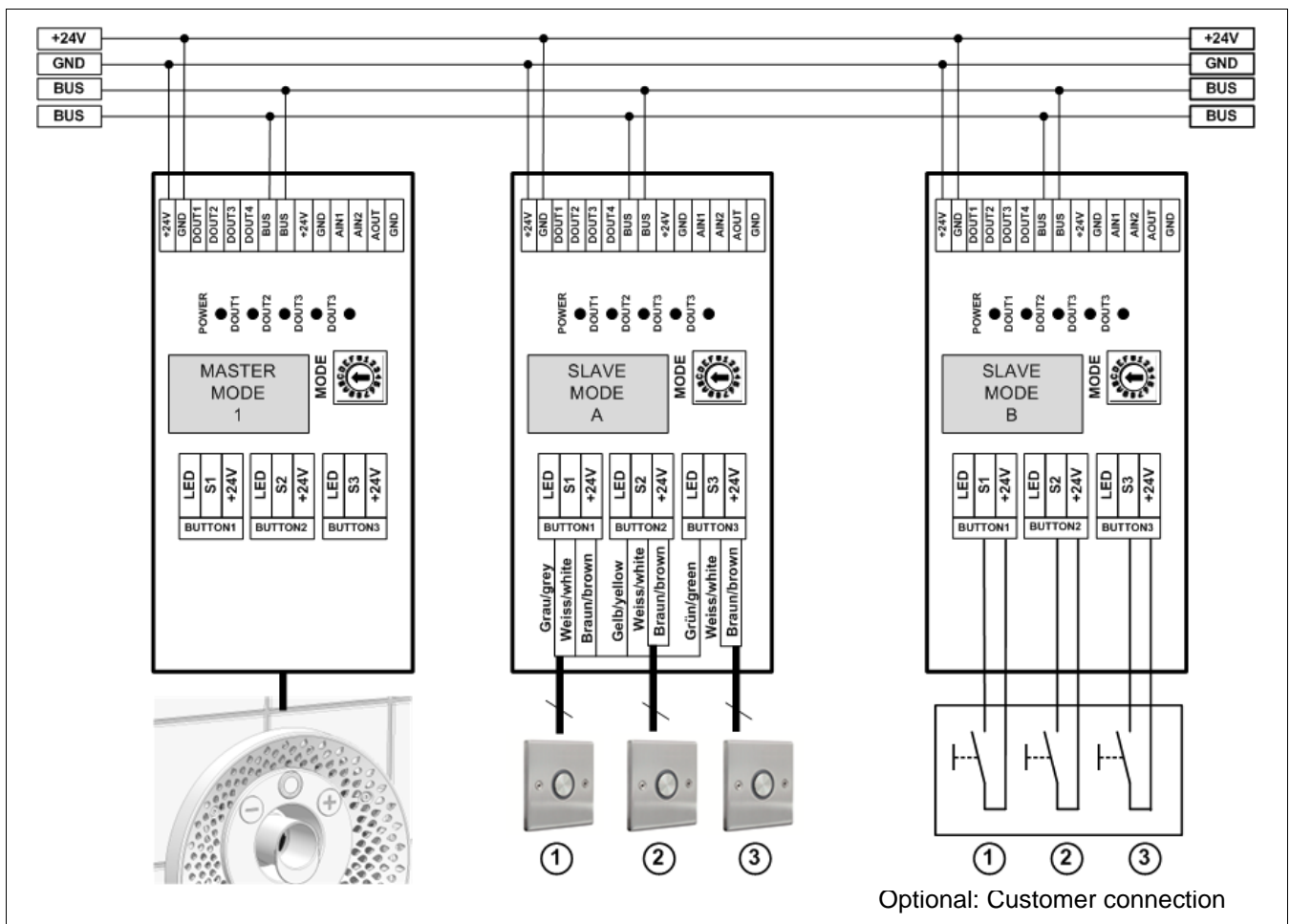
Pressing the +/- key causes AOUT to change +/- 1V

Lower limit: AOUT = 4V

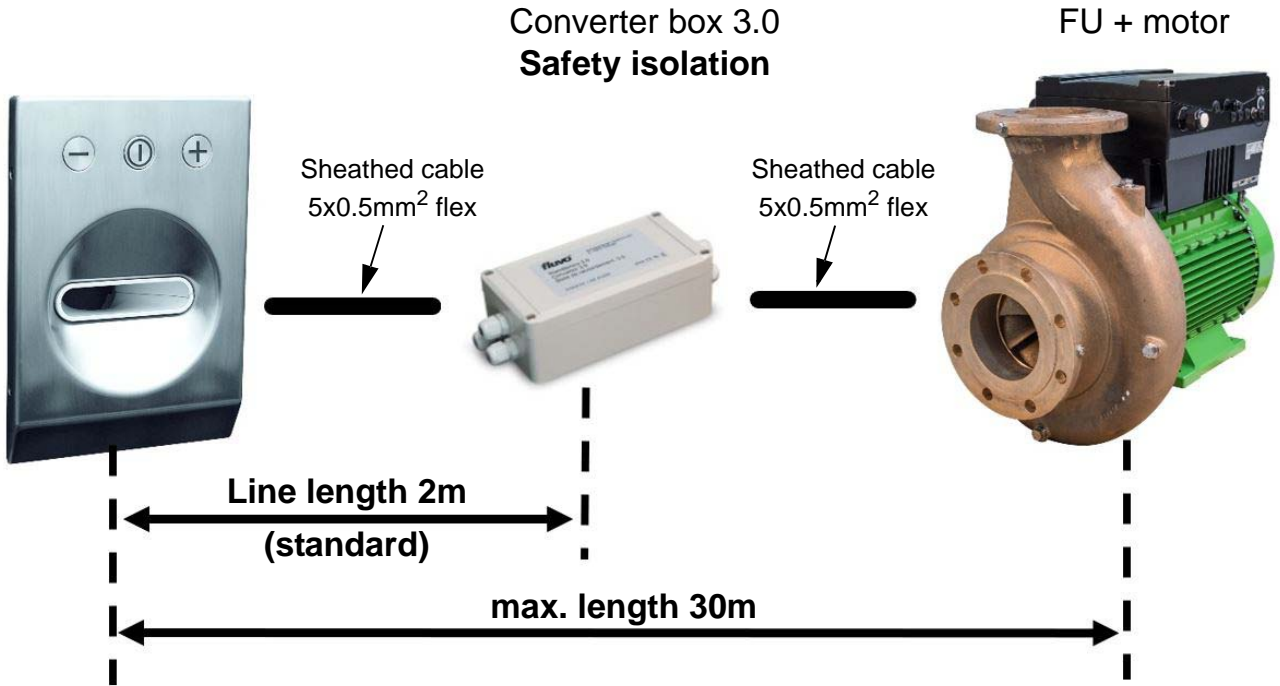
Upper limit: AOUT = 10V

Reaching the lower and upper limit is indicated by the button flashing several times.

## 6.7 Connection for external operation



### 6.8 Installation instructions for sensor button and control unit



## 7 Operation

The X-Jet is equipped with an electronic control unit for the operation and the direct control of the VFD.



### 7.1 On-/ Off switching

By pressing the middle button of the control unit, the system is switched to the lowest speed level. Re-pressing the button shuts off the system.

Regardless of the intensity previously set, after the system is shut off it is reset to the lowest speed level.

### 7.2 Regulation of intensity

By pressing one of the two outer buttons, the intensity is regulated. Right increases the speed and with the left button the speed can be decreased again.

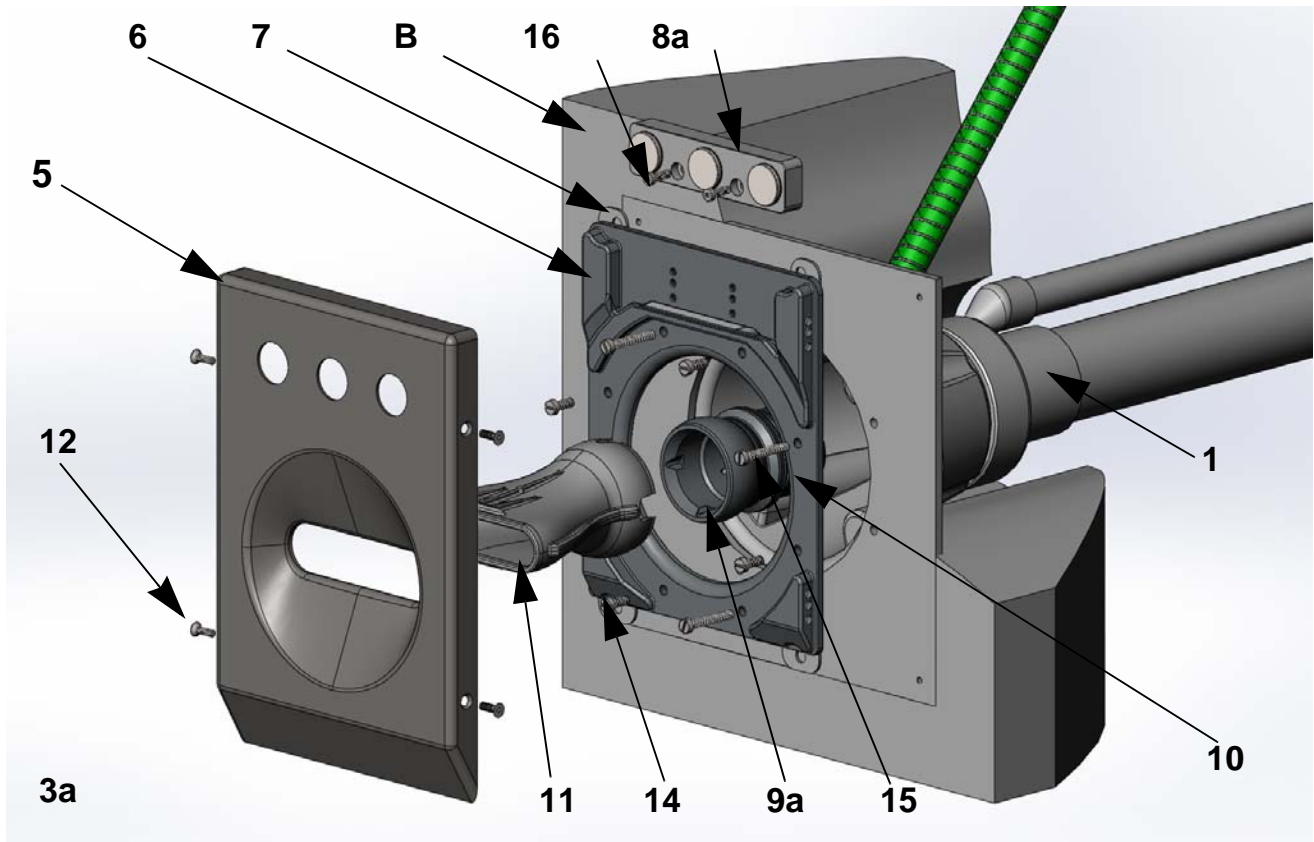
### 7.3 Adding air

Air is added with a min. flow rate of  $\sim 30\text{m}^3 / \text{h}$  automatically.

A regulation is not provided here.

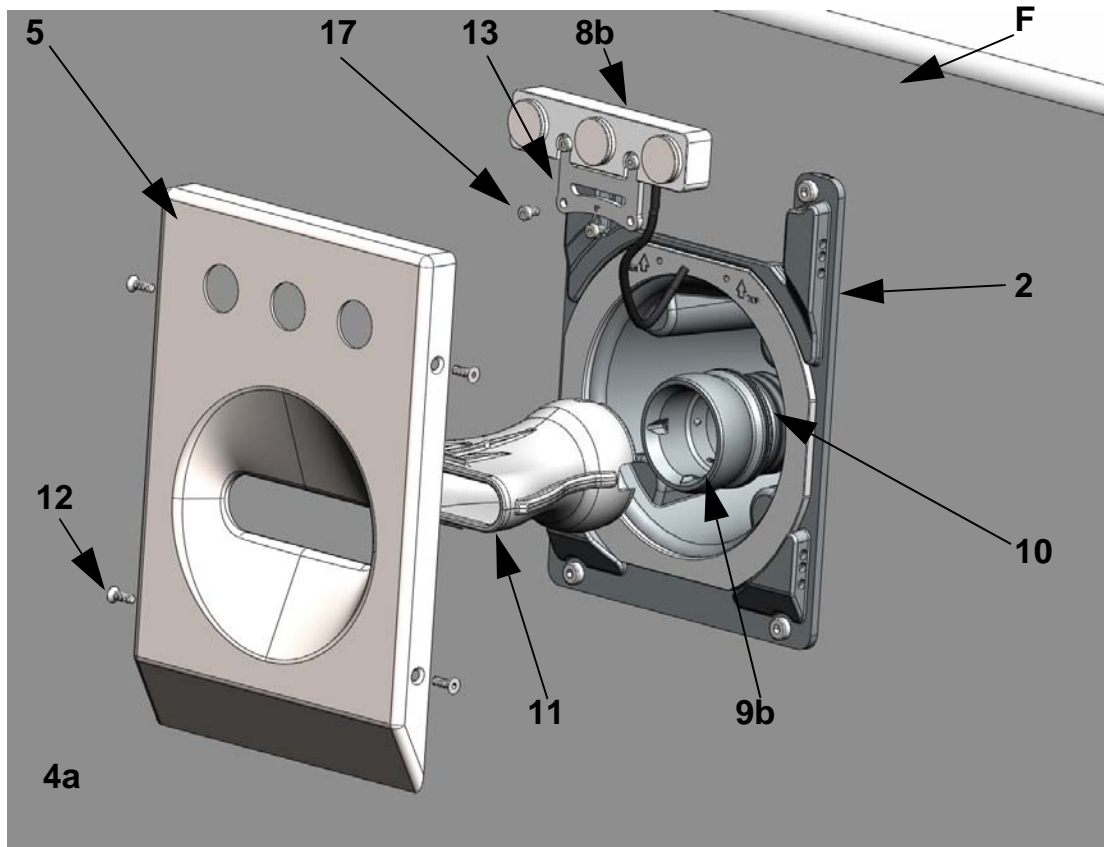
## 8 Spare parts list

### 8.1 Concrete pool (tiled -with or without brushed applied sealant)



Pos.	Order No.	Description	Remark	Qty.
B		Concrsete		
1	98450	Installation	-BHS	
3a	98470	Assembly kit	-BS including control unit	
3b	98471	Assembly kit	-BS excluding control unit	
5	51126	Screen		1
6	51176	Tile screen		1
7	23062	Tile seal		1
8a	61397	Switching unit		1
9a	51128 51129 51130	Motive nozzle	Compensation 0 -15 mm Compensation 15 - 30mm Compensation 30 - 40 mm	1
10	24111	O-Ring		1
11	64120	Nozzle		1
12	11016	Countersunk screw	M5 x 16	4
14	10473	Cylinder screw	M6 x 16	4
15	10468	Cylinder screw	M6 x 40	4
16	11031	Cylinder screw	M5 x 16	2

## 8.2 Prefabricated pool



Pos.	Order No	Description	Remark	Qty
F		Pre fabricated pool wall	(Max. 25mm)	
2	98451	Installation kit	-A including clamping ring and gasket	
4a	98474	Assembly kit	-A including control unit	
4b	98475	Assembly	-A excluding control unit	
5	51126	Nozzle		1
8b	61399	Switching unit	-A	1
9b	5118	Nozzle	-A	1
10	24111	O-Ring		1
11	64120	Nozzle		1
12	11016	Countersunk screw	M5 x 16	5
13	51448 51449 51447	Bride de fixation	+3° 0° -5°	1
17	11034	Cylinder screw	M5 x 8	4









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