

# **DUTYPOINT** **SETTING THE BAR**

## **VG2 and VG3 (-LSM) Cold Water Booster Sets**



## **Operation and Maintenance Manual**

DOC-VGOM1901



## About us.

Applied knowledge.  
Shared know-how.  
Fearless innovation.

Together, we are Dutypoint. Since 1976, we've been building up industry-defining expertise in fluid technology.

This knowledge means we solve complex challenges with straightforward solutions that are built around meeting and exceeding our clients' needs. We approach everything with the same philosophy: how will we go above and beyond?

Our commitment to collaboration and sharing knowledge galvanises and cements robust relationships. Relationships that are built to last, because our clients are our partners.

Our focus for the future? Innovation. We want to be the future of our industry, globally. Where we benchmark thought leadership, expertise and customer care.

We set the bar.

## Contact details.

**T:** +44(0)1452 300592

**E:** [info@dutypoint.com](mailto:info@dutypoint.com)

**Registered Office:**

Dutypoint Limited  
Shepherd Road  
Gloucester  
GL2 5EL  
United Kingdom

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# 1. Important Safety Information

## 1.1 Health & Safety at Work Act 1974

Section 6(a) of this Act requires manufacturers to advise their customers on the safety and the handling precautions to be observed when installing, operating, maintaining and servicing their products. The user's attention is therefore drawn to the following:

- The appropriate sections of this manual must be read before working on the equipment.
- Installation, operating and maintenance must only be carried out by suitably trained/qualified personnel.
- Normal safety precautions must be taken and appropriate procedures observed to avoid accidents.

Refer to Dutypoint for any technical advice or product information. It is the responsibility of the customer and/or the contractor:

- To ensure that anyone working on the equipment is wearing all necessary protective gear/clothing;
- Is aware of appropriate health & safety warnings and to read the information in this manual.

## 1.2 Safety Messages and Hazard Statement

**Table 1.1:** Hazard Notice Definitions

Message Level	Definition
DANGER	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION	A hazardous situation which, if not avoided, could result in minor injury or moderate injury
ELECTRICAL HAZARD	Risks associated with electricity will cause hazards if not properly avoided
Note	A situation which may arise resulting in undesirable conditions and/or will not cause direct hazards to persons

## 1.3 Qualified Personnel

### WARNING

**This product is intended for operation by qualified personnel only**

- Only qualified personnel are allowed to install or operate this equipment
- Qualified personnel are defined as trained staff, who are authorised to install, commission and maintain equipment, systems and circuits in accordance with relevant laws and regulations. Personnel must be familiar with the instructions and safety procedures described in this document.
- This product should not be used by anyone with mental disabilities, or anyone without the relevant experience and knowledge, unless they have received instructions on using the equipment and on the associated risks, or are supervised by a responsible person.
- Children must be supervised to ensure they do not play on or around the equipment.

## 1.4 Environmental Protection

All local regulations and codes regarding emissions and waste disposal must be followed. This may include:

- Reporting of emissions to appropriate authorities

- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills
- Separate disposal of electrical components from domestic waste

## 1.5 Mechanical Device Servicing

- Familiarise yourself with the relevant contents of this manual
- Installation, maintenance and repair work must only be carried out by trained, skilled and suitably qualified personnel.
- Disconnect or lock-out the power source to ensure that the item(s) will remain inoperative. Locking out the equipment by switching off the release mechanism or set value WILL NOT prevent accidental starting.
- Allow the item(s) to cool if over-heated.
- CLOSE the isolating valves on the suction and discharge connections of the affected item(s).
- If working on pump, VENT slowly and cautiously – Refer to the relevant section of this manual.
- DRAIN the pump(s).

## 1.6 Pump Hand Control Mode (Where Fitted)

In the 'HAND' position the pump(s) controlled by the switch will normally run at full speed and completely independently of any control devices, and can result in pump(s) running against a closed valve head if there is no draw. This can cause the system to be maintained at the maximum pressure produced by the pump plus any incoming pressure and additional pressure caused by water surge and can potentially damage the pump and other parts of the system.

The 'HAND' option should only be used with a competent operator in attendance, or when there is a continued demand sufficient to provide constant flow through the pumps to maintain the running pressure of the system to an acceptable level.

## 1.7 Personal Protective Equipment

Use personal safety equipment according to the site conditions and employer regulations. This may include, but may not be limited to:

- Hard hat
- Safety goggles with side shields
- Protective footwear
- Protective gloves
- Respirator
- Ear protection
- First aid kit
- Safety devices

## 1.8 Precautions Before Commencing Work

Ensure that the following safety precautions are complied with before commencing work:

- Provide a suitable barrier around the work area
- Ensure all safety guards are in place and secure
- Ensure you have a clear path of exit
- Ensure that the product cannot roll or fall over and cause damage to persons or property
- Ensure all lifting equipment is in good condition and rated for the intended task
- Use a lifting harness, safety line and respirator as required
- Allow hot components to cool before handling them
- Ensure that product has been thoroughly cleaned
- Disconnect and lock out power supply, ensuring that it cannot be accidentally re-connected

- Check for any risk of explosion before using hand tools

## 1.9 Precautions During Work

- Never work alone
- Always wear protective clothing and hand protection
- Stay clear of suspended loads
- Always use appropriate lifting devices
- Beware of risks of sudden starts of any automated equipment such as level control
- Beware of starting jerks of electric motors - these can be powerful
- Do not exceed the stated operating limits of equipment
- Do not remove vent plugs from a pressurised system - ensure pressurised components are relieved of pressure before disassembly
- Ensure guards are in place during operation

## 1.10 Hazardous Fluids and Chemicals

If hazardous chemicals come into contact with skin or eyes, use the following procedures:

Condition	Action
Chemicals or hazardous fluids in eyes	1) Hold your eyelids apart forcibly with your fingers 2) Rinse the eyes with eyewash or running water for at least 15 minutes 3) Seek medical attention
Chemicals or hazardous fluids on skin	1) Remove contaminated clothing 2) Wash the skin with soap and water for at least 1 minute 3) Seek medical attention

## 1.11 Electrical Safety - High Voltages

This information is especially applicable when Variable Speed Controllers (Inverters) are fitted to pumps.

When the inverter variable speed drive head is connected to the power supply the components of the power unit as well as certain components of the master control unit – are also connected to the power supply.

### **DANGER!**

**Touching these components can seriously endanger life!**

- Before removing the frequency inverter cover, the system must be disconnected from the power supply
- After switching off the power supply wait at least 5 minutes before starting work on or in the inverter drive head - the capacitors in the intermediate circuit must be given time to discharge completely via the discharge resistors.

### **ELECTRICAL HAZARD**

**Up to 800V can be present - if there are faults this can be higher**

- All work carried out when the frequency inverter is open must be performed only by suitably qualified and properly authorised personnel.

## ELECTRICAL HAZARD

**THE SYSTEM MUST ONLY BE OPERATED WHEN IT HAS BEEN CORRECTLY EARTHED AND PIPES BONDED TO EARTH IN ACCORDANCE WITH IEE REGULATIONS**

- When connecting external control wires care must be taken not to short circuit adjacent components. Bare cable ends which are not in use must be insulated.
- 

## 1.12 Electronic Safety Devices

- Inverter drives contain electronic safety devices which switch off the control element in the event of a fault developing.
  - A motor can also be stopped by 'mechanical blocking'
  - If it is switched off electronically, the motor is disconnected from the mains voltage supply via the electronics in the inverter drive.
  - Voltage fluctuation and power failures (temporary outages) can cause the motor to switch itself off.
- 

### WARNING

**A motor will have zero current but will remain energised as it stops**

- Take necessary precautions - the motor is not voltage-free in the circuit itself
- 

### WARNING

**Repair of faults can cause items to start up again unexpectedly**

- Ensure the motor is isolated before commencing any work
- 

### WARNING

**High voltage tests of inverters may damage the electrical components.**

- Bridge before the incoming/outgoing terminals L-L2-L3 and U-V-W.
  - To avoid incorrect metering by capacitors incorporated in the electronic circuits, isolate the motor from the inverter drive head.
- 

## 1.13 Spare Parts

### WARNING

**Use of non-genuine spare parts may cause damage to equipment, damage to property and voiding of warranty**

- Use genuine, Dutypoint-approved spare parts only
  - If in doubt, contact Dutypoint Service on 01452 300590.
-

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## 1.14 Transportation and Lifting

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### WARNING: LIFTING HAZARDS

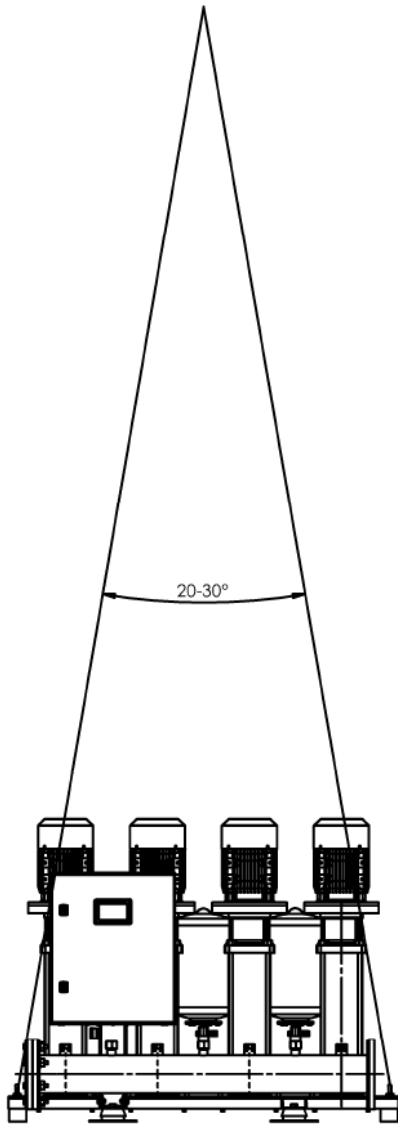
- Stay clear of suspended loads
  - Observe accident prevention regulations in force
  - Do not damage the cables during transports; so not squeeze, bend or dray the cable
  - Always keeps the cable ends dry
  - Secure the unit against tipping over and slipping until it is mounted and fixed in its final location
  - Lift and handle the product carefully, using suitable lifting equipment (stacker, crane, crane mounting device, lifting blocks, sling ropes, etc.)
  - Always lift the unit by its lifting handle
  - This equipment has not been designed to lift people, and should not be used in this way.
- 

### WARNING: ASSEMBLED SYSTEMS ARE HEAVY

- This equipment has been designed to be lifted by crane
  - Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage,
  - Lift equipment only at the specifically identified lifting points.
  - Lifting devices such as eye bolts, slings and spreaders must be rated, selected and used for the entire load being lifted
  - Select the appropriate lifting points
  - Slings should be sized in accordance with the gross weight of the product that is being lifted.
  - To minimise tension in legs a sling angle of 20-30° is recommended & appropriate lifting shackles should be used. See [Figure 1.1: Lifting best practice](#) (p. 9).
- 

- 1) Inspect the package
    - a) Inspect the package for damage or missing items upon delivery
    - b) Note any damaged or missing items on the shipping paperwork and contact Dutypoint immediately
    - c) File a claim with the shipping company if anything is out of order
    - d) If the product has been picked up at a distributor, file a claim with the distributor
  - 2) Inspect the unit
    - a) Remove packing materials from the product
    - b) Dispose of all packing materials in accordance with local regulations
    - c) Inspect the product to determine if any parts have been damaged or are missing
    - d) If applicable, unfasten the product by removing any screw, bolts or straps. For your personal safety, be careful when you handle nails and straps.
    - e) Contact Dutypoint if you have any issues.
  - 3) Attach appropriate lifting equipment
-



**Figure 1.1:** Lifting best practice

## 1.15 Storage

The product must be stored in a covered and dry location free from heat, dirt and vibrations.

**NOTE:** Protect the product against humidity, heat sources and mechanical damage

**NOTE:** Do not place heavy weights on the packed product

## 1.16 Disposal

At the end of its working life, this product should not be disposed of with standard household waste, but rather dropped off at a collection point for the disposal of Waste Electrical and Electronic Equipment (WEEE) for recycling.

**Figure 1.2:** Waste Symbol

This is confirmed by the [Waste Symbol](#) found on the product, user manual or packaging.

Depending on their characteristics the materials may be recycled. Through recycling and other forms of processing Waste Electrical and Electronic Equipment, you can make a significant contribution towards helping to protect the environment.

Please contact your local authorities for information on the collection point nearest you.

## 1.17 Potable Water Safety

According to HSE guidance, all water systems should be cleaned, flushed and disinfected as specified in BS EN 806 and BS 8558.

A risk assessment should be performed before commissioning to identify and take into account the potential for stagnation as this may lead to microbial growth where buildings are not to be fully occupied immediately.

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### **WARNING**

**The temperature of stored water must be kept below 23° to prevent bacteria growth.**

- Storage cisterns should be regularly checked for signs of stagnation or microbial growth
  - See HSE guidance for more details: [www.hse.gov.uk/legionnaires](http://www.hse.gov.uk/legionnaires)
-



## 2. System Overview

The Dutypoint VG booster set consists of 2 or 3 variable speed electrical pumps connected in parallel. The pumps are mounted on a common base plate with suction and discharge manifolds, isolation valves, non-return valves, a pressure gauge, pressure transducers, and control panel. The system must be equipped with pressure vessels (supplied). The product can be used to pump clean, cold water only. The product cannot be used in closed loop systems. Suitable applications are as follows:

- Default: pressure regulation (open loop systems)
- Level and flow regulation (open loop systems)
- Irrigation applications with single or multiple pumps

Figure 2.3: Model Codes

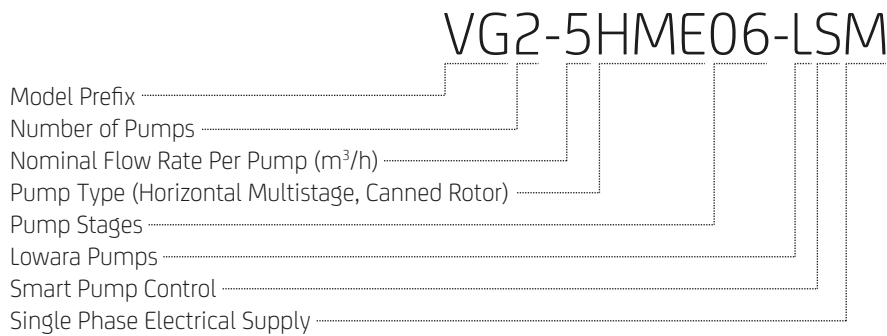


Figure 2.4: System Components

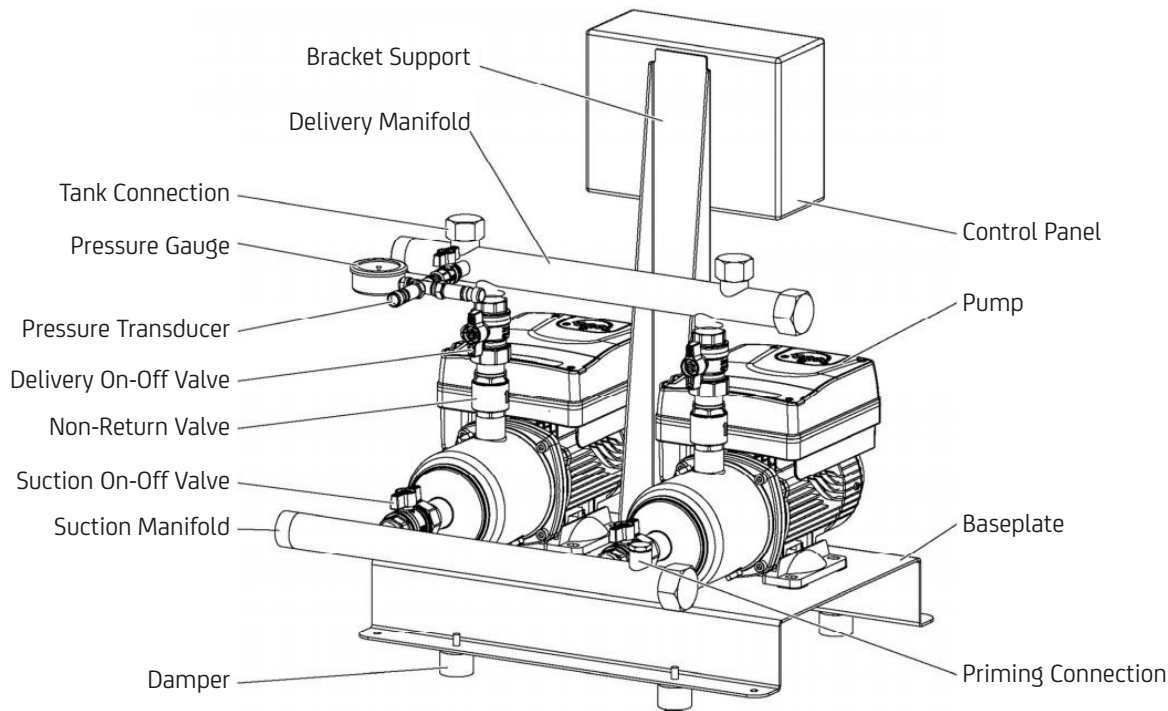


Table 2.2: Technical Data

Input Voltage	230V ±10%
Supply Frequency	50/60Hz ±2
Max Input Current	See rating plate
Enclosure Protection	IP55
Storage Relative Humidity	5%-95%

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Ambient Temperature	-20°C - +50°C
Max Altitude	1000m above sea level
Sound Pressure LpA	<62 dB @ 3000 rpm
Maximum Operating Pressure	See rating plate
Liquid Temperature	0 - 60°C

## 3. Storage and Transportation

### 3.1 Inspect the Package

- 1) Inspect the package for damage or missing items upon delivery
- 2) Note any damaged or missing items on the shipping paperwork and contact Dutypoint immediately
- 3) File a claim with the shipping company if anything is out of order
- 4) If the product has been picked up at a distributor, file a claim with the distributor

### 3.2 Storage Guidelines

The product must be stored in a covered and dry location free from heat, dirt and vibrations.

**NOTE:** Protect the product against humidity, heat sources and mechanical damage

**NOTE:** Do not place heavy weights on the packed product

**NOTE:** See section on storage limits

### 3.3 Inspect the Unit

- 1) Remove packing materials from the product
- 2) Dispose of all packing materials in accordance with local regulations
- 3) Inspect the product to determine if any parts have been damaged or are missing
- 4) If applicable, unfasten the product by removing any screw, bolts or straps. For your personal safety, be careful when you handle nails and straps.
- 5) Contact Dutypoint if you have any issues.

### 3.4 Transportation Guidelines

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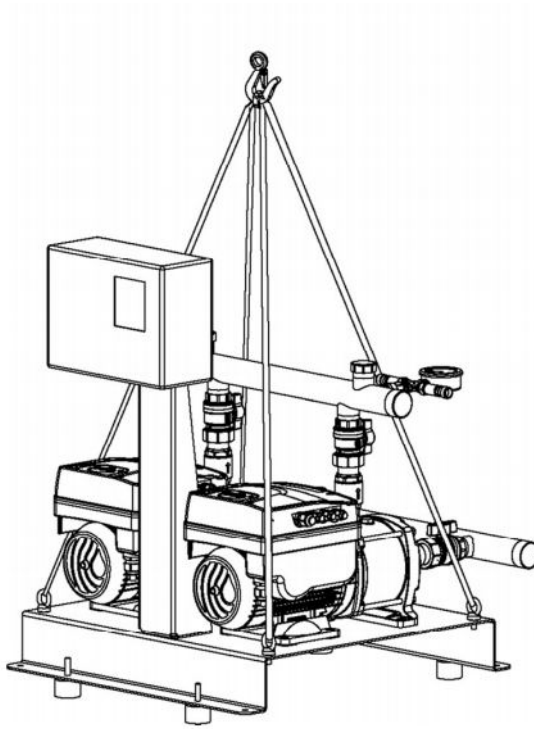
#### **WARNING: LIFTING HAZARDS**

- Stay clear of suspended loads
  - Observe accident prevention regulations in force
  - Do not damage the cables during transports; so not squeeze, bend or dray the cable
  - Always keeps the cable ends dry
  - Secure the unit against tipping over and slipping until it is mounted and fixed in its final location
  - Lift and handle the product carefully, using suitable lifting equipment (stacker, crane, crane mounting device, lifting blocks, sling ropes, etc.)
  - Always lift the unit by its lifting handle
- 

---

#### **WARNING: ASSEMBLED PUMP SYSTEMS ARE HEAVY**

- Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage,
  - Lift equipment only at the specifically identified lifting points.
  - Lifting devices such as eye bolts, slings and spreaders must be rated, selected and used for the entire load being lifted
  - Select the appropriate lifting points see [Figure 3.5: Lifting](#)
-

**Figure 3.5:** Lifting

## 4. Mechanical Installation

### 4.1 Site Checklist

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#### **DANGER:**

- Never install the unit in an explosive or flammable environment
- 

#### **WARNING:**

- Always refer to local regulations, legislation and codes in force regarding the selection of installation site, and water and power connections.
  - Keep the documentation, drawings and diagrams accessible for detailed installation and operation instructions. It is important that the manual is available for equipment operators.
  - Ensure that the ingress protection rating of the unit (IP55) is suitable for the installation environment.
- 

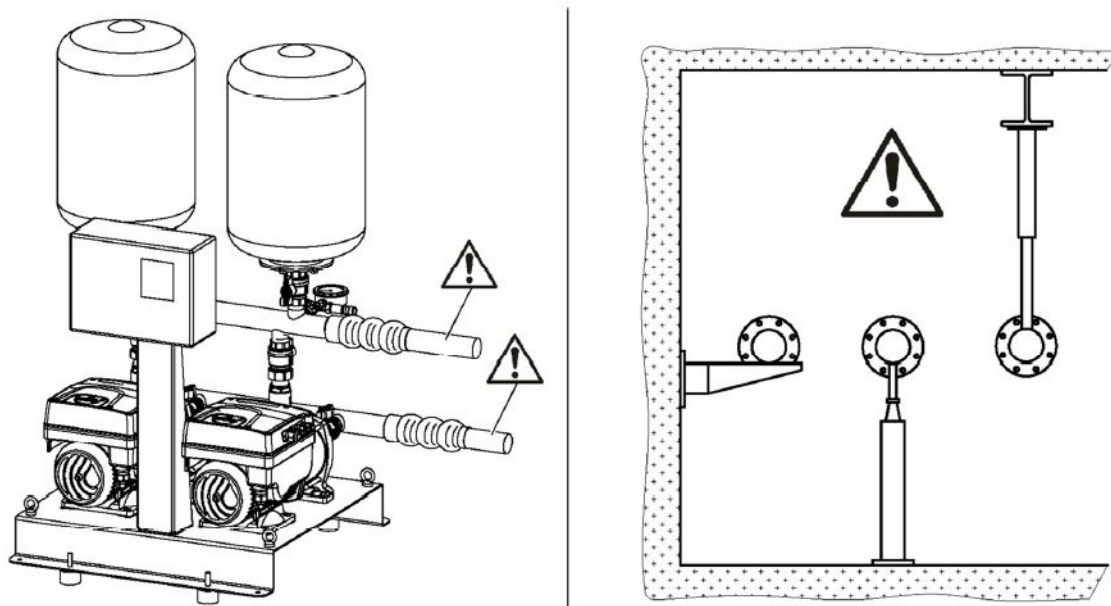
#### **CAUTION:**

- Ingress protection (IP55) can only be guaranteed if the unit is properly closed
  - Make sure that there is no liquid on the unit before opening the control panel and plastic cover of the frequency inverter unit
  - Ensure all cable glands and unused holes for glands are properly sealed
  - Make sure that the panel and plastic cover of the frequency inverter is correctly closed
  - Device damage through contamination: do not leave the unit without the terminal box cover
  - Remove straps, dirty and solid parts from inside the control panel and frequency inverter unit
- 

### 4.2 Unit Installation

- Install the unit according to the system's liquid flow
- Usually arrows on the pump housing show flow and rotating direction
- The standard rotating direction for the unit is clockwise (seen from the fan cover). For more information contact Dutypoint.
- The unit must be installed according to [Figure 4.6: Installation Diagram](#).
- Always install a back flow-prevention device on the suction side
- Install the unit in a well-ventilated room, allowing sufficient clearance (0.5m) on all sides and front for maintenance. Guarantee 0.5m height above the highest part
- It is recommended to install an isolation valve immediately after the unit
- It is recommended to install a drain valve for testing if no tap has been provided near the unit



**Figure 4.6:** Installation Diagram

### 4.3 Piping

- The pipes that are connected to the set must be adequately sized (if possible, according to manifold diameter). You can use either end of the manifold, but do not forget to plug the unused end
- Suction pipe and foot valve must be of sufficient size to prevent excessive flow resistance and the consequent cavitation

**NOTE:** To prevent undue stress, expansion joints and suitable pipe supports should be provided. The weight of the pipes and tanks increases when they are filled with water. Before starting the pump set, make sure you have closed and tightened all the unused couplings.

### 4.4 Protection Against Dry Running

The standard control panel is ready for connection of a common float switch applicable for open tanks or a minimum pressure switch on the suction side (recommended value 0.2-0.4 bar). When the minimum pressure conditions are restored, the pumps start up automatically. If protection against dry running is considered superfluous, do not remove the jumper on the terminal in the panel. The correct terminal numbers are specified in the wiring diagram found inside the panel.

**NOTE:**

- Factory setting: the pump drive has factory-enabled software protection
- No dry running control: the booster set comes from the factory with the jumper already installed, which disables the control

### 4.5 Outside Installation

When the unit is installed outdoors, a suitable cover must be provided. The cover must be sized to ensure that the pump set is not exposed to snow, rain or direct sunlight.

## 5. Electrical Installation

### 5.1 Precautions

---

#### WARNING: EQUIPMENT HAZARD

- Rotating shafts and electrical equipment can be hazardous. All electrical work must conform to national and local electrical codes. Installation, start-up and maintenance must be performed by trained and qualified personnel. Failure to follow these guidelines could result in death or serious injury.
- 

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#### WARNING: ELECTRICAL HAZARD

- All electrical wiring must be carried out by an authorised electrician, in accordance with the local regulations in force.
- 

**NOTE:** For electrical connections, see the wiring diagram inside the control panel.

### 5.2 Electrical Requirements

The local regulations in force overrule specified requirements below.

Check that the following requirements are met:

- The electrical leads are protected from high temperature, vibrations and collisions
- The current type and voltage of the mains connection must correspond to the specifications on the data plate on the control panel
- Make sure that the supply cable can handle the rated current of the booster unit and connect it to the corresponding terminals in the control panel. The wiring diagram and the labels on the panel provide the necessary information for connection and the required power supply values.
- Connect the power supply cable to the L - N terminals, PE to grounding terminal
- Cables, when visible, must be suitably protected
- The power supply line is provided with a high sensitivity differential switch (30mA) [RCD] suitable for earth fault currents with DC or pulsating DC content (a type B RCD is suggested)
- A mains isolator switch with a contact gap of at least 3mm.

**NOTE:** In its standard configuration, the pump set is shipped with a control panel. When the unit is sold without a control panel, one must be installed to match the ratings of the pump(s). Incorrect combinations will lead to failure to guarantee protection of the unit.

Check that the following requirements are met:

- The control must protect the pump against short circuit. A time lag fuse or a circuit breaker (type C model is suggested) can be used to protect the pump.
- The pump has built-in overload and thermal protection, no additional overload protection is required.

---

#### ELECTRICAL HAZARD

- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energised.
-

---

## ELECTRICAL HAZARD

- Always connect the external protection conductor to ground (earth) terminal before making other electrical connections.
  - All electrical equipment must be ground (earth) connected. This applies to the pump unit and related equipment.
  - Verify the pump ground terminal is earthed
- 

- Keep the ground wire connections as short as possible
- Use high-strand wire to reduce electrical noise (recommended)

## 5.3 Wire Type and Ratings

In its standard configuration, the booster set comes with motor power cables and control cables. If the motor power cable or control cable, or both, must be replaced or added, see the Installation, Operation and Maintenance Manual for Lowara Smart Drive Pumps.

## 5.4 Power Supply Connection

---

### WARNING

- Do not make any connection in the pump control box unless the power supply has been switched off for at least 4 minutes
  - In its standard version, the booster set comes with motor power cables. If the power cable of the motor must be replaced or added, fit a new one of a cross-section that is suited to the maximum current consumption of the motor
- 

For control panel connection, see the wiring diagram inside the control panel.

For frequency inverter unit connection, see the Installation, Operation and Maintenance manual for Lowara Smart Drive pumps.

## 6. Operating the Pump Set

In case of co-existence of two or more of the following conditions:

- High ambient temperature
- High liquid temperature
- Duty points insisting on unit maximum power
- Persisting under-voltage of mains,

Lift expectancy of the pump set may be affected and/or de-rating may occur. Contact Dutypoint for more information.

### 6.1 Discharge Time

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#### WARNING

- Disconnect and lock out electrical power and wait for 4 minutes.
  - Failure to wait the specified time after power has been removed before performing service or repair could result in death or serious injury.
- 

---

#### ELECTRICAL HAZARD

**frequency inverters contain DC-link capacitors that can remain charged even when the unit is not powered**

- Disconnect the AC mains
  - Disconnect any permanent magnet type motors
  - Disconnect any remote DC-link power supplies, including battery backups and DC-link connections to other frequency converters.
  - Wait for the capacitors to discharge completely before performing any service or repair work
- 

### 6.2 Start or Stop the Unit

The starting and stopping of the pump are determined based on the unit to be controlled (pressure, level) settings of the controller. Each inverter is connected to a sensor. The inverters share all the information and provide for cyclic duty changeover.

---

#### ELECTRICAL HAZARD

- Disconnect the power supply before making any adjustments.
- 

**NOTE:** For settings, refer to the Lowara Smart Drive manual.

- The pressure vessels supply water upon demand from an end user
- When the pressure drops below the PS value, the first pump is started; the speed is adjusted to maintain a constant pressure as the demand increases
- When the demand decreases the speed is decreased until minimum speed is reached; at this point one of the pumps is deactivated
- If the demand keeps increasing and the pump reached maximum speed, the second pumps is started and the speed is adjusted to maintain a constant pressure
- If the demand decreases further, the pump slows down, fills the pressure vessels and then stops when the PS value is reached.

If adjustments are required, consult the Lowara Smart Drive manual.

See [8. Pressure Vessel](#) for details of pressure vessel adjustment.

## 6.3 Startup

To start the pump set, proceed as follows:

- 1) Connect the water supply
- 2) Connect the power supply
- 3) Check the pressure vessel pre-charge value (see [8. Pressure Vessel](#))
- 4) Close the pump delivery valves
- 5) Prime the pump set and suction manifold
- 6) To supply power and set the inverter to manual mode operation, use the appropriate switch on the control panel
- 7) Start the first pump
- 8) Slowly open the pump delivery valve and bleed the air
- 9) Repeat the preceding operations for the other pumps
- 10) Set the inverters to automatic mode operation

To modify settings, after the set has been started, proceed as follows to modify the settings within the maximum pressure limits of the pumps or system, or both:

- 1) Determine the required pressure value
- 2) Set the new value on the control panel of one of the inverters; the setting is modified automatically on the other inverter also

# 7. Commissioning

## 7.1 Installation and Commissioning Overview

Before shipment, all Dutypoint pump sets are pre-commissioned. Whilst important procedures such as venting and rotational direction checks need to be carried out on site, initial parameters including pressure settings and delay timers will be adjusted to suit the site conditions previously advised to Dutypoint.

In practice, a system can almost invariably be made to perform more efficiently if further re-commissioning is carried out on site.

Please note that engineer visits by Dutypoint are priced at one visit to commission one pump set. If there are multiple units on a site, special terms can be negotiated. To arrange a commissioning visit, please call the Technical Service Help line 01452 300590.

The following checks should be carried out at the initial installation before any run tests are performed.

---

### WARNING

- Ensure that you have read and understood Section [1. Important Safety Information](#) (p. 4).
- 

## 7.2 Pipework and mechanical components

- 1) Ensure that the mounting area and any associated groundwork provides adequate support for the pump set.
- 2) Ensure all supports/brackets are in place and secure.
- 3) Verify all pipe joints are sealed and tight.

## 7.3 Electrical

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### WARNING

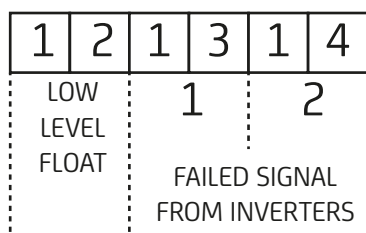
- These checks MUST be carried out by a competent electrician.
  - Ensure that the power source is sufficient to allow the running of all pumps together where there are multiple pumps in the system. This also applies to 'standby' pumps.
- 

- 1) Check the motor voltage and frequency information on all the motor nameplates and on controllers etc. correspond with that of the source power supply.
- 2) Check that all electrical connections are correctly made and secure. Pay particular attention to earth and bonding connections.
- 3) Carry out specific checks for earth bonding.
- 4) Carry out NICEIC certification checks as required for the installation, e.g Earth Loop Impedance, Insulation Tests, etc.
- 5) Carry out any other pre-start checks recommended by the pump manufacturer. Refer to the pump manual in the Appendix of this manual. DO NOT POWER UP AT THIS STAGE.

## 7.4 Low Level Float Switch Wiring (Hydrovar or VASCO Systems only)

Terminal 1 and 3 require a normally closed contact in order to allow the pump set to operate. To facilitate this the unit will be supplied with a wire loop between 1 and 2. To install a low level float switch this loop has to be removed and the float switch wired to operate as an open on fail scenario.

If 2 or more float switches are required (due to twin compartment or multiple tanks) all float switches are wired into terminals 1 and 2 in parallel.

**Figure 7.7: Terminal Wiring**

If installing a Dutypoint FS-series float switch, the following terminals should be used:

BROWN: Terminal 1

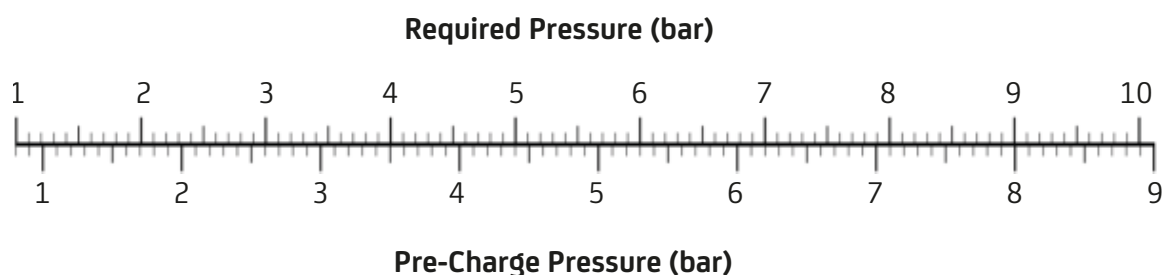
BLACK: Terminal 2

BLUE: Not used - terminate safely

## 7.5 Final Checks Before Commissioning

- 1) Re-check all equipment for any accidental damage caused during installation.
- 2) Carry out the pre-charging and venting procedures described next.

## 7.6 Pressure Vessel Pre-Charging (If fitted)

**Figure 7.8: Pressure Vessel Pre-charge**

Before commissioning starts the pre-charge of the pressure vessels should be checked.

On variable speed systems the pre-charge air pressure for vessels should be 90% of the maximum pressure generated by the pump in the pipework system

e.g: If the maximum pressure generated by the pump in a system is 6 bar, this will require a pre-charge pressure of  $6 \times 90\% = 5.4$  bar.

To verify the pre-charge pressure:

- 1) First check that the expansion or pressure vessel(s) are totally drained of water, and that the system is switched off and no electrical parts are live.
- 2) Locate the charging valve on each vessel, accessed by removing the plastic cover on the top of the vessel
- 3) Connect a portable pressure gauge with a measuring range compatible with the expected pressures in your application, which has a flexible hose and Schrader-type connector to the charging valve.
- 4) Check the pre-charge pressure above the diaphragm in each pressure vessel correspond to criteria given in the text above.
- 5) If necessary, release or add additional air to correct.

## 7.7 Venting Pumps

It is important to bleed all air from the pump body before initial start-up.

## 7.8 Procedure for flooded suction

Flooded Suction is defined as the condition where there is positive pressure on the suction (inlet) side of the pump(s) as is the case where the storage tank water level is at the same or higher level than the pump bleed point.

This procedure should be carried out individually for each pump in the pump set.

- 1) Open all valves on the suction (inlet) side of the pump.
- 2) Using the vent screw at the top of the pump (refer to Appendix to locate), allow any air in the pump body and suction pipework to vent to atmosphere.
- 3) When water (under pressure from the storage tank feeding the pump on the suction side) escapes through the vent screw hole - and no more air bubbles can be seen - close the vent screw.
- 4) Switch on the electrical supply to the pump motor and start the pump in AUTO mode. As each motor starts verify that the direction of rotation correctly corresponds with the direction of the arrow shown on the body of the pump. If rotation is backward STOP, switch off the pump and investigate.
- 5) Slowly open the valve on the discharge manifold outlet to the system allowing water to be pumped into the system.
- 6) Switch off, re-close the discharge valve and repeat steps 3 to 6 several times to ensure that all air is released from the pump body and local pipework.

The above procedure should be carried out individually for each pump in the pump set.

It may be necessary to add the suction head of the break tank to the maximum head parameter for greater accuracy and to enable smoother running.

## 7.9 Procedure for Lift Suction

Lift Suction is defined where the water storage tank is at a lower level than the pump set. In this case a negative pressure condition may exist at the pump suction.

**NOTE:** The "Lift Suction" mode of operation requires specific venting procedures. Please call Dutypoint Systems Technical Support on +44 (0)1452 300590 for advice before attempting to vent the pump(s).

The advised procedure should then be carried out individually for each pump in the pump set.

## 7.10 Programming the Controller

Dutypoint Systems fit a design of Inverter/Controller that is most suitable for the design duty of the pump set.

Manufacturer's information for them is detailed in the Appendices to this manual.

Carefully follow the appropriate step-by-step setting-up procedures contained in the manual, ensuring that any data required to be entered by the end user is accurately inserted where requested.

If in doubt please call Dutypoint Systems Technical Support on 01452 300590 for advice.

## 7.11 Operation and Performance Tests

Having checked that the pump set is installed, pre-charged, vented in accordance with the procedures set out earlier, carry out the following running tests before handing over the pump set for operational use.

- 1) Run each pump by selecting HAND (Manual) control.
- 2) Re-select to AUTO mode.
- 3) Create the conditions for a normal start and run and allow the selected 'Duty' pump to run. Whilst running observe the pressure values. Verify the pump motor speeds up / slows down in accordance with the desired control philosophy.

## 7.12 Duty/Standby Twin Pump Sets

- 1) On Duty/Standby sets, wait for a normal stop to take place (or create the conditions where this would happen) and check that the 'Duty' pump stops. Whilst stopped simulate a fault by inhibiting the 'Duty' pump and then recreate the conditions for a normal start to take place. Check that the 'Standby' Pump now starts and runs in place of the inhibited 'Duty' pump and observe the pressure values. Verify that the pump motor speeds up / slows down in accordance with the desired control philosophy.
- 2) Wait for a normal stop to take place (or create the conditions where this would happen) and check the 'Standby' pump stops. Whilst stopped undo the inhibit to the 'Duty' pump which should now return to normal.



## 7.13 Duty/Assist Twin Pump Sets

- 1) For 'Duty/Assist' applications, run the system up to pressure using the 'Duty' Pump only, then deliberately create the condition(s) which will require the 'Assist' Pump to operate as well. (e.g: open taps to reduce the pressure in the system to a point where one pump only cannot maintain the required output. Verify that the 'Assist' Pump starts and runs together with the 'Duty' Pump and that the desired pressure is duly restored and maintained.
- 2) Close the taps again (thereby reducing the demand) and check the 'Assist' Pump slows down and stops, allowing the 'Duty' Pump to continue on its own.

## 7.14 Commissioning/Handover Check

- 1) Record any indicated voltage / amperage / pressure data / controller passwords for future reference.
- 2) Re-check all isolating valves are fully open and replace any cover(s).
- 3) With all the isolators ON and the switches and/or control programs set to AUTO, the pump set is now fully operational in automatic control mode.

**NOTE:** No manual operation or attendance is required other than for routine servicing and maintenance checks. Other than for maintenance purposes, the supply to the Controller(s) and the Pump motor(s) should never be switched off.

## 8. Pressure Vessel

The pressure vessel supplied as part of your Dutypoint product is used to absorb and conserve the potential energy of pressurised liquid. Stored energy from liquid under pressure is transferred to the water system when required.

### 8.1 Installation Safety Notes

These notes are taken from the pressure vessel installation manual:

- This product is designed to hold water up to +110°C
- Never exceed the maximum working pressure and temperature of the expansion tank; ensure appropriate controls are installed for this purpose.
- During installation prepare adequate systems for drainage to limit damage caused by leakage from the tank, draining and venting.
- During installation the installer should account for external stress such as traffic, wind and earthquakes.
- Always install the appliance in conformity to current legislation.
- This product must be installed and regularly inspected by qualified personnel only.
- The manufacturer shall not be held liable for any personal or material damage caused by the product if installed and/or used improperly or in way anyhow diversely from manufacturer's specifications.
- Exceeding temperature and pressure limits specified by the manufacturer will give cause to cancel any guarantee covering the product as well as any manufacturer's liability.
- For fluids other than water, check compatibility before installing.
- The appliance must be installed in a safe place with access for authorized personnel only.
- The appliance must be protected by an appropriate earthing systems or isolated from the system by a dielectric joint.

### 8.2 Periodic Maintenance

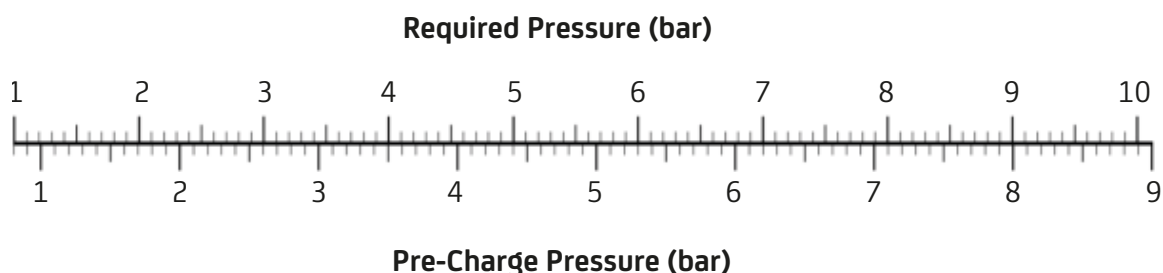
Periodic maintenance is recommended at least twice a year and should be carried out by authorised specialised personnel only.

- 1) First check that the pressure vessel is totally drained of water, and that the system is switched off and no electrical parts are live.
- 2) Check and, if necessary reset the pre-charge pressure, using the instructions below. Ensure that the pressure does not exceed the value specified in the procedure.

### 8.3 Checking and Adjusting Pressure Vessel Pre-Charge

Before commissioning starts and during every routine service, the pre-charge of the pressure vessels should be checked according to the following chart and instructions.

**Figure 8.9:** Pressure Vessel Pre-charge



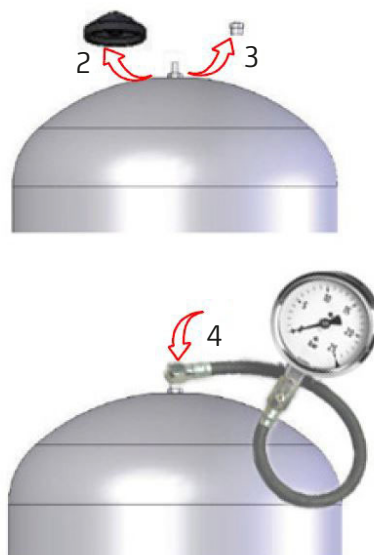
On variable speed systems the pre-charge air pressure for vessels should be 90% of the maximum pressure generated by the pump in the pipework system

e.g: If the maximum pressure generated by the pump in a system is 6 bar, this will require a pre-charge pressure of  $6 \times 90\% = 5.4$  bar.

To verify the pre-charge pressure:

- 1) First check that the expansion or pressure tank is totally drained of water and isolated.
- 2) Refer to [Figure 8.10: Pre-Charging a Pressure Vessel](#) (p. 27). Remove the air vent cover.
- 3) Unscrew the air valve cap.
- 4) Connect a pressure gauge. Verify that the pre-charge pressure is correct. If it is low then the vessel pre-charge must be corrected by additional inflation of the diaphragm.
- 5) When the pre-charge pressure is correct replace the air valve cap and vent cover.

**Figure 8.10:** Pre-Charging a Pressure Vessel



## 8.4 General Maintenance and Repair

Disconnect all electrical equipment before starting on any maintenance jobs or checking the installation pressure and temperature. The pre-charge pressure should be checked and if necessary corrected during any maintenance work.

## 8.5 Diaphragm Replacement

To replace a diaphragm:

- 1) Empty the expansion tank
- 2) Remove the pre-charging by releasing the air vent.
- 3) Loosen the M8 screws fastening the flange
- 4) Remove the flange
- 5) Extract the diaphragm and replace it

## 8.6 Installing a Replacement Vessel

Read these instructions carefully before installing the product:

- 1) Make sure the product is in good condition. If the product is damaged do not start on installation but take it back to the seller for immediate replacement.
- 2) The product must be installed in the position (vertical or horizontal) specified in the technical specifications.
- 3) While the system is cold, measure the static pressure with a gauge, at the point where the tank has to be installed.

- 4) Set the pre-charge pressure, using the procedure earlier in this section. Ensure that the pressure does not exceed the value specified in the procedure.
- 5) The appliance must be supplied with efficient and sufficient safety and control facilities, in particular the safety valve must be connected to the appliance and be free from interference and must be gauged to the quantity of fluid to be discharged. The safety valve should also be designed to ensure that the pressure does not permanently exceed the maximum tolerated pressure (a temporary pressure peak, limited to 10% of the maximum tolerated pressure, is allowed).
- 6) Make sure the cap of the valve is fitted tightly after pre-loading and that there is no leakage.



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# 9. Maintenance

## 9.1 General

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### ELECTRICAL HAZARD

- Before any service or maintenance work, disconnect the system from the power supply and wait at least 4 minutes before starting work on the unit (the capacitors in the intermediate circuit are discharged by the internal discharge resistors)
- 

The pump set does not require any special maintenance, but some periodic checks are essential.

Check list:

- 1) Make sure that the cooling fan and vents are free from dust
- 2) Make sure that the ambient temperature is correct according to the limits of the pump set
- 3) Make sure that qualified personnel perform all modifications to the pump set
- 4) Make sure that the unit is disconnected from the power supply before any work is carried out. Always consider the pump and motor instruction.
- 5) The electric panels and frequency converters do not require any maintenance
- 6) Pressure vessels: see separate instructions and ensure the pre-charge is checked at least once a year.

## 9.2 Check the Functions and Parameters

If the hydraulic system is changed then follow this procedure:

- 1) Make sure that all functions and parameters are correct
- 2) Adjust the functions and parameters if necessary.



# 10. Troubleshooting

## WARNING

- The maintenance and repair operations must be performed by qualified personnel
- Before servicing the pump set, disconnect the power supply and make sure there is no pressure in the hydraulic components
- Wait at least 4 minutes before starting work on or in the unit. The capacitors in the intermediate circuit are discharged by the internal discharge resistors.

The frequency inverter records the previous alarms triggered. Refer to the inverter operating instructions for the types of malfunctions and directions on how to check the previous alarms triggered.

**Table 10.3:** Troubleshooting Checklists

Symptom	Cause	Solution
Pump set is off	Power supply disconnected	Connect power supply
	Switch is in OFF position	Set switch to ON
Motor does not start	Power supply disconnected	Connect power supply
	Triggering of motor thermal protection	Eliminate malfunction and reset the switch
	Defective motor	Repair or replace the motor
Frequent start up and stops	Defective pressure vessel	Repair or replace the pressure vessel
	Incorrect pressure vessel pre-charge	Set the new pre-charge according to the set point of the pump set
	Pre-charge pressure in vessel is zero	The vessels must be pre-charged
The pump speed increases and decreases without stop, and with no water consumption	Water leaking through the non-return valve	Check the hydraulic system and check the valve
	Pressure vessel damaged	Check, repair and replace
The motor runs but no water is delivered	No water on suction side or inside pump	Fill (prime) the pump and suction pipework. Open the on-off valves.
	Air in suction pipework or pump	Bleed the pump, check the suction connections.
	Loss of pressure on the suction side	Check the NPSH and, if necessary, modify the system
	Check valve blocked	Check the valve
	Clogged pipe	Clean the pipe
Water leaking from pump	Defective mechanical seal	Replace the mechanical seal
	Undue mechanical stress on pump	Support the pipes
Too noisy	Water return when pump stops	Check the non-return valve
	Cavitation	Check suction line
	Pump rotation hindered	Check for undue mechanical stress on pump



Symptom	Cause	Solution
The unit does not generate the desired pressure	Pumps rotating in wrong direction	Check the correction connection to the motor by exchanging 2 leads
	On-off valves closed	Open the valves
	Air in the suction pipe	1) Eliminate the air 2) Prime the pumps
	Excessive suction lift	Reduce the suction lift
	Excessive flow resistance on suction side	Increase the diameter of the pipes
	Foot valve damaged	Replace the foot valve
	Excessive flow resistance in delivery pipes, or valve, or both	Reduce water leaks
Triggering of general system protection (fuses)	Short circuit	1) Check the connection cable 2) Check the motor
Triggering of differential protection	Motor is damaged	Replace the motor
	The power cable of the motor is faulty or worn	Replace the cable
	The RCD breaker is not compliant to specifications	Replace the RCD
	Residual current too high	Electrical installation should be modified by qualified personnel
Pump runs at maximum speed without stopping	Pressure set point not suitable for the system (the value is higher than the pump is able to deliver)	Set new set point according to pump performance
	Sensor is not connected or damaged	Check the hydraulic and electrical connection of the sensor
Only one pump operating	Pumps have different settings	Check the inverter settings
There is demand for water, but pump does not start	Set point is set to zero	1) Check frequency inverter settings 2) Adjust the set point



Figure 11.12: Sheet 2 of 8

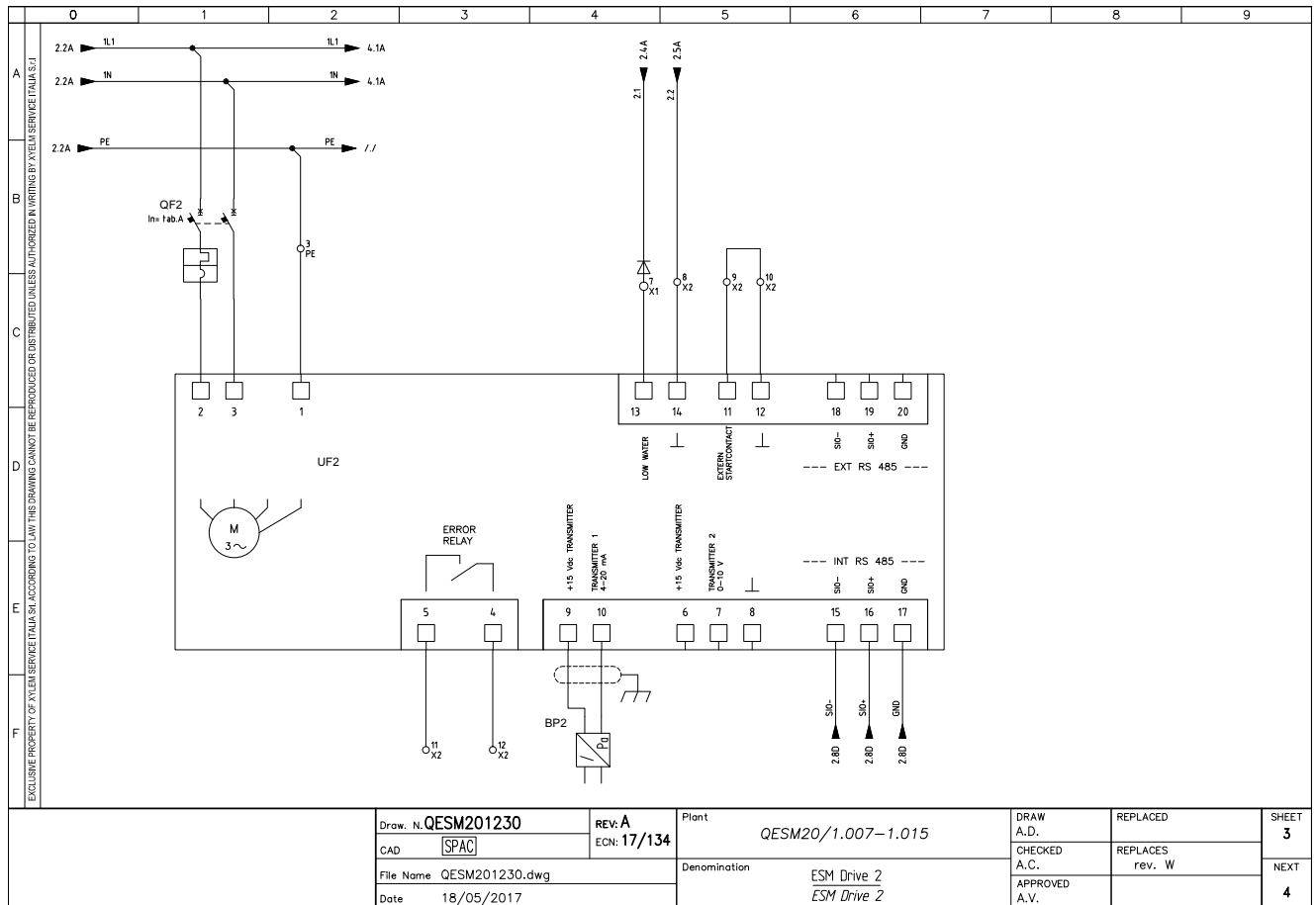


Figure 11.13: Sheet 3 of 8

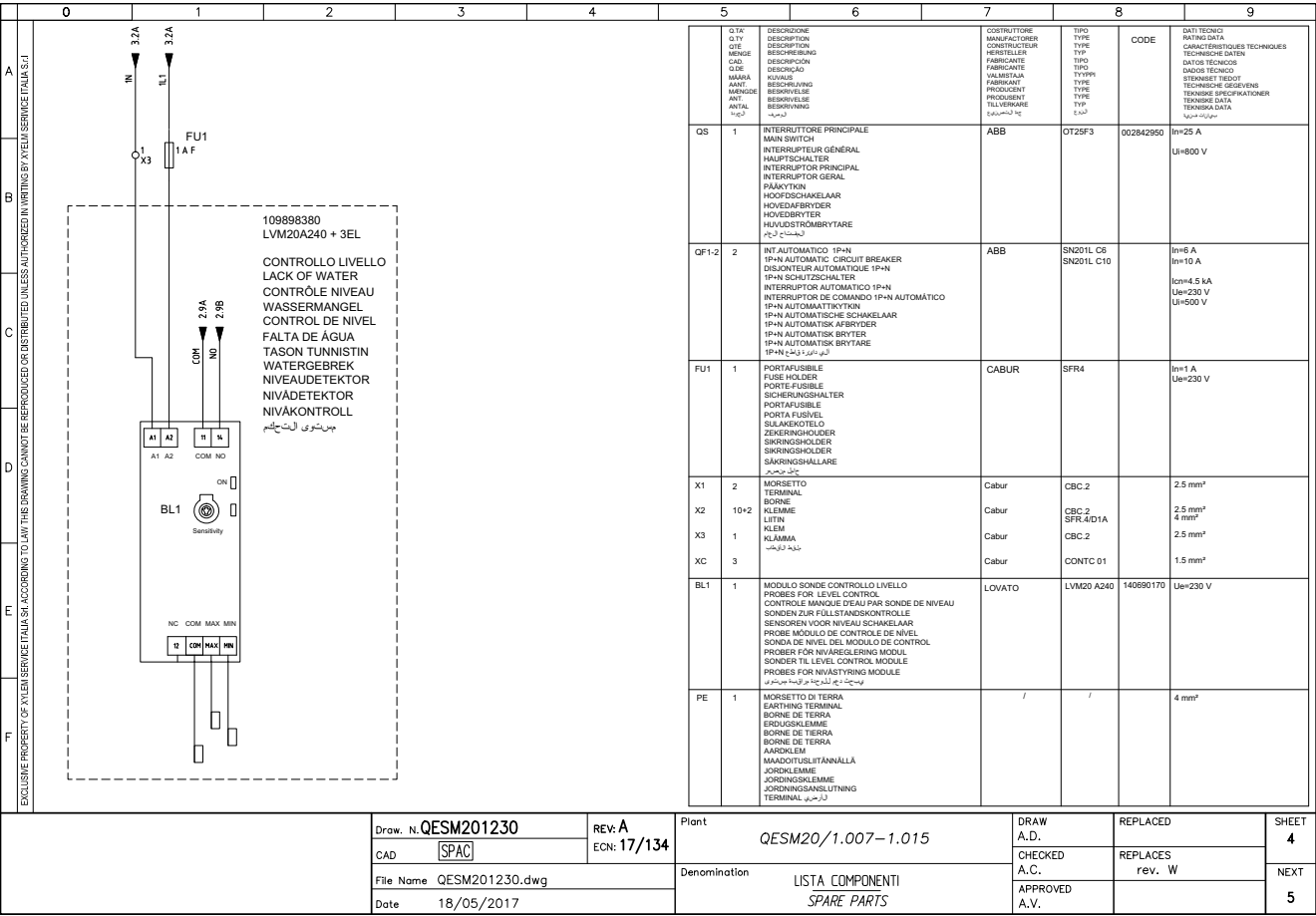


Figure 11.14: Sheet 4 of 8

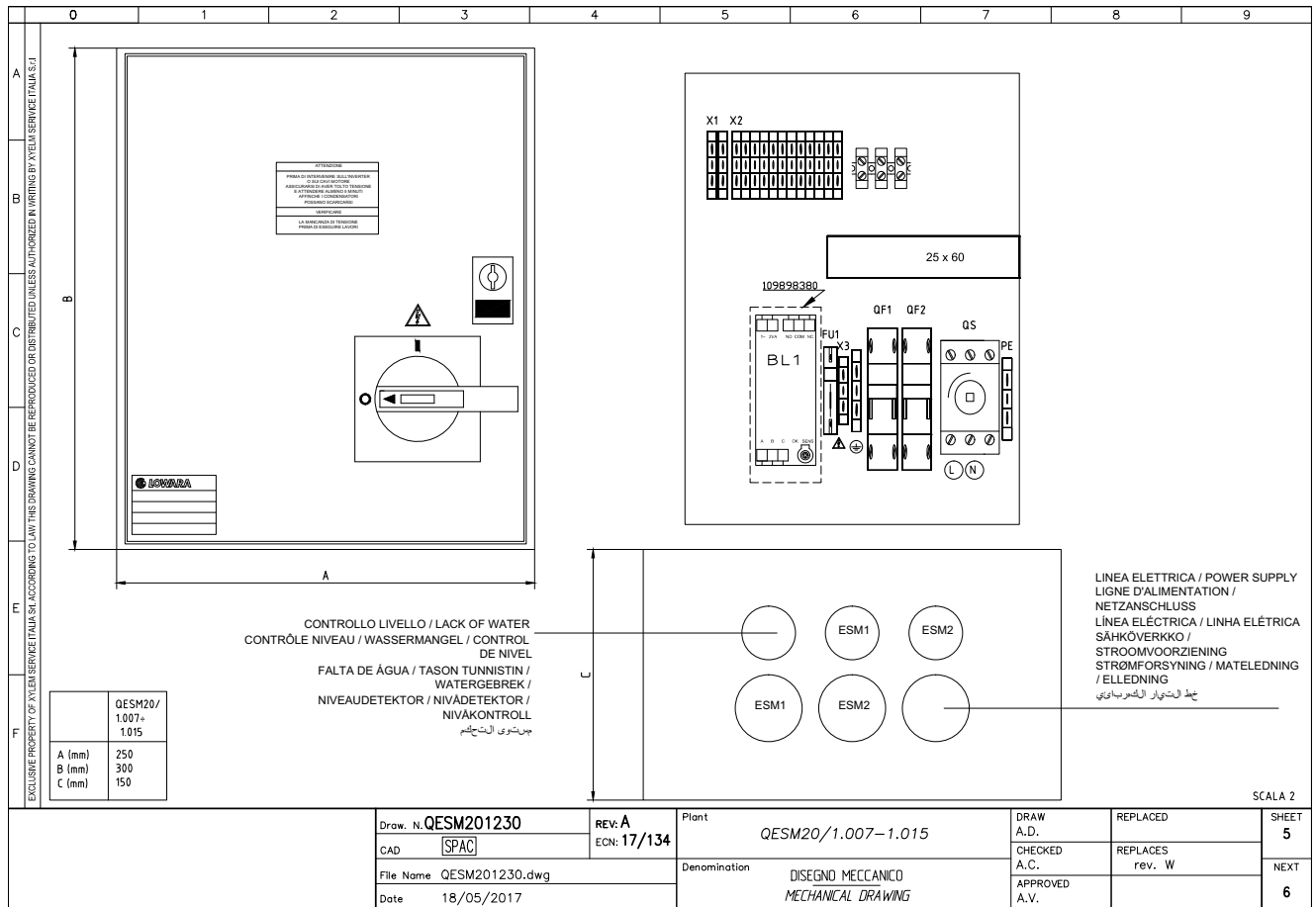


Figure 11.15: Sheet 5 of 8

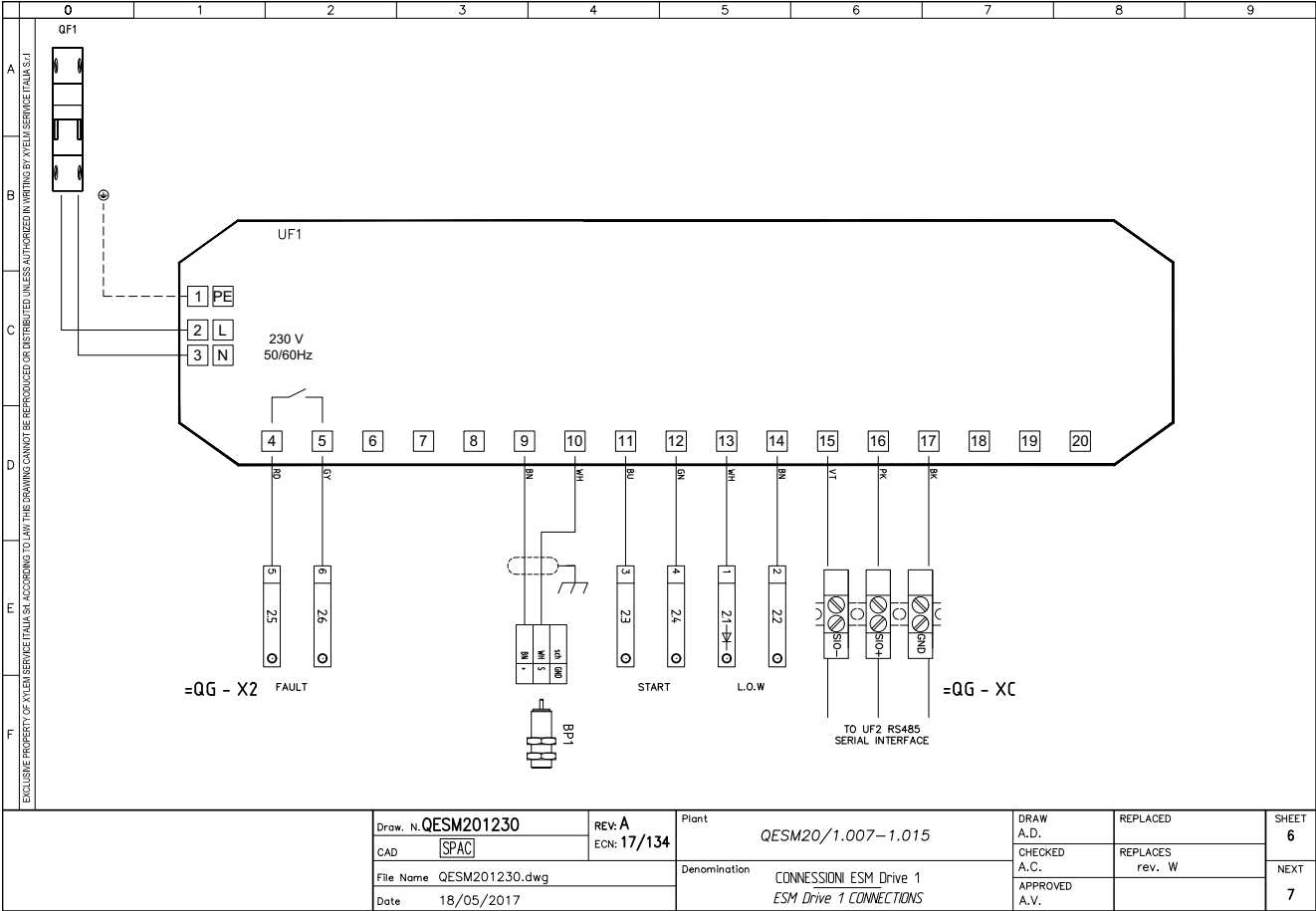


Figure 11.16: Sheet 6 of 8

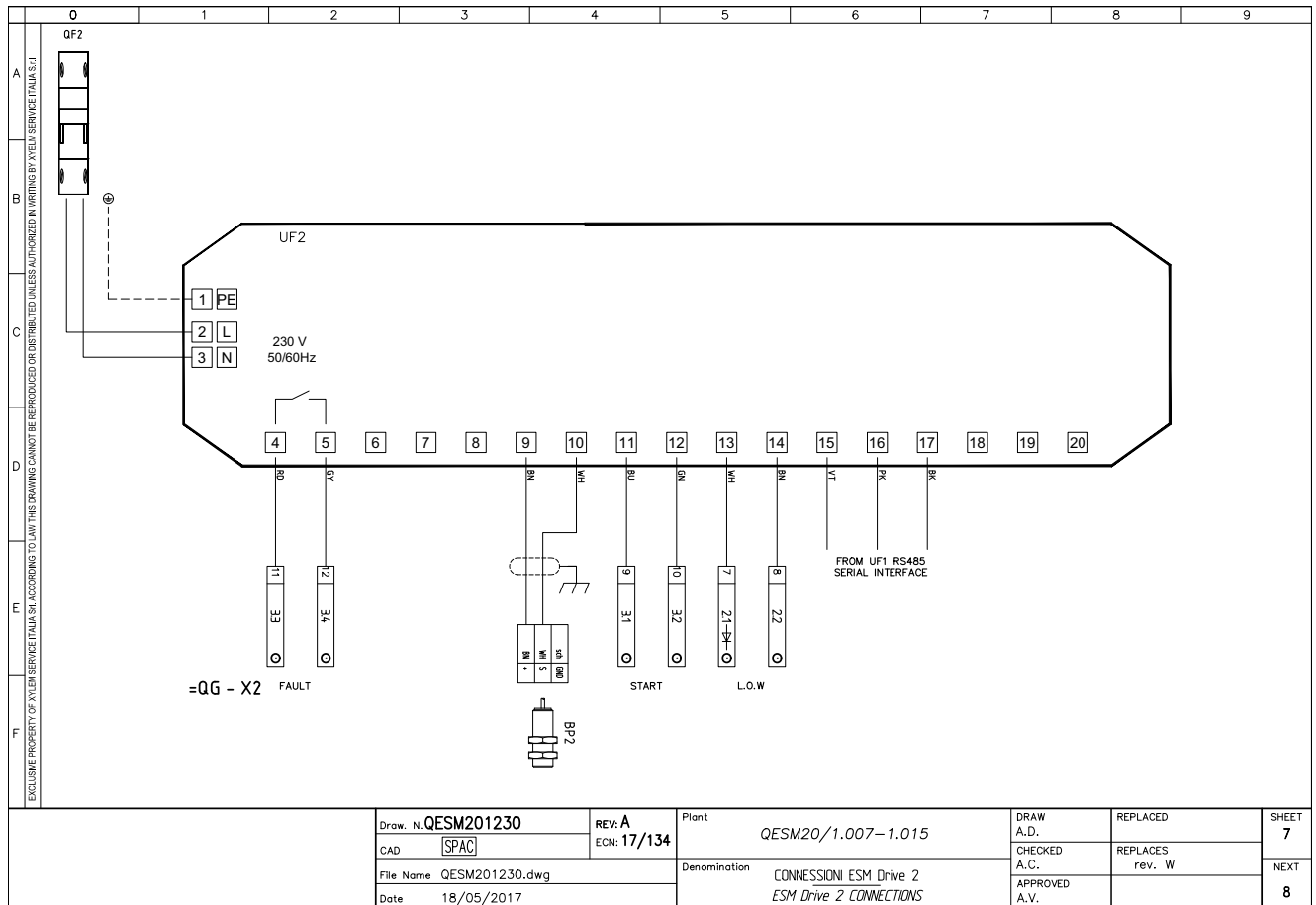


Figure 11.17: Sheet 7 of 8

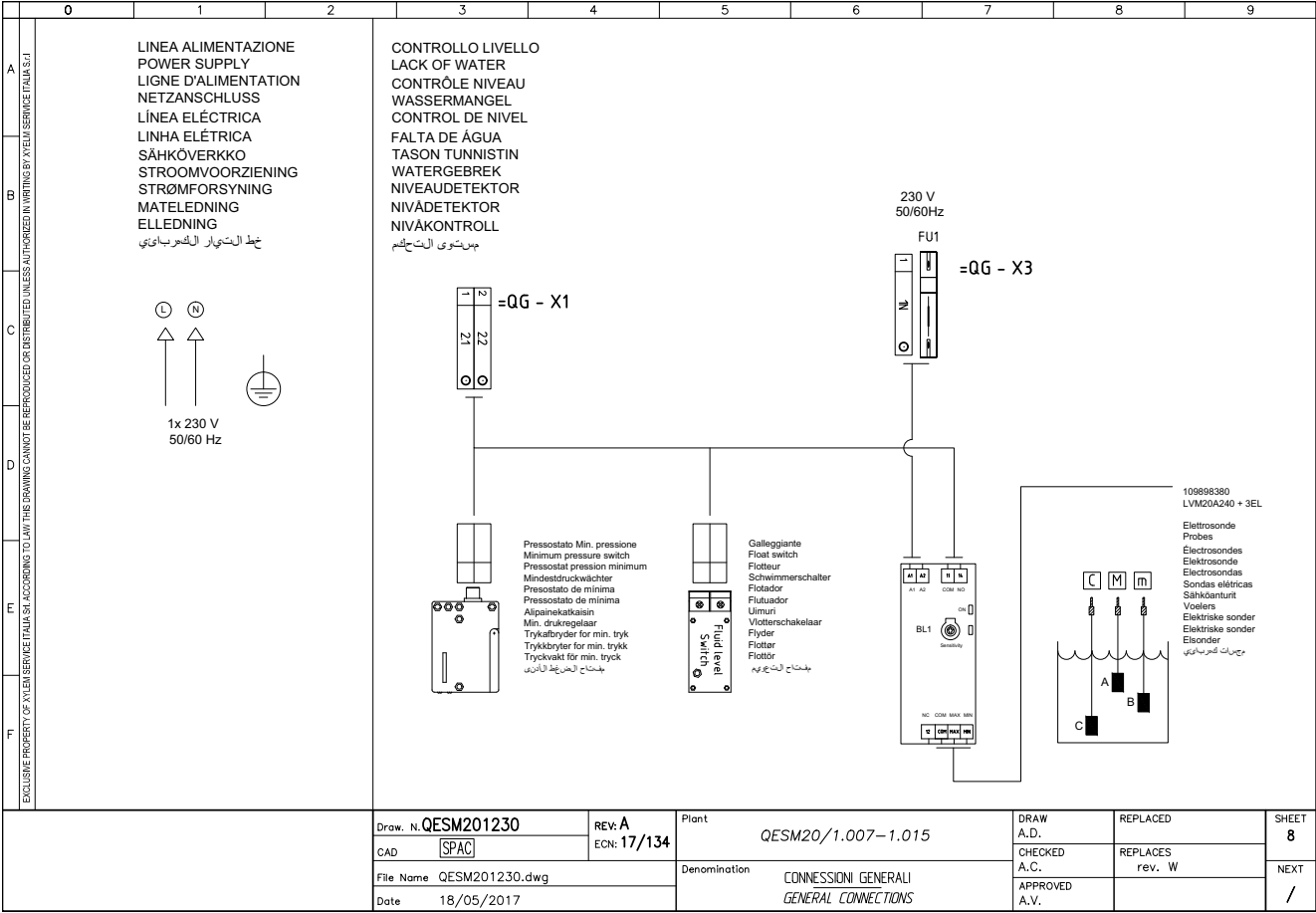




Figure 11.18: Sheet 8 of 8

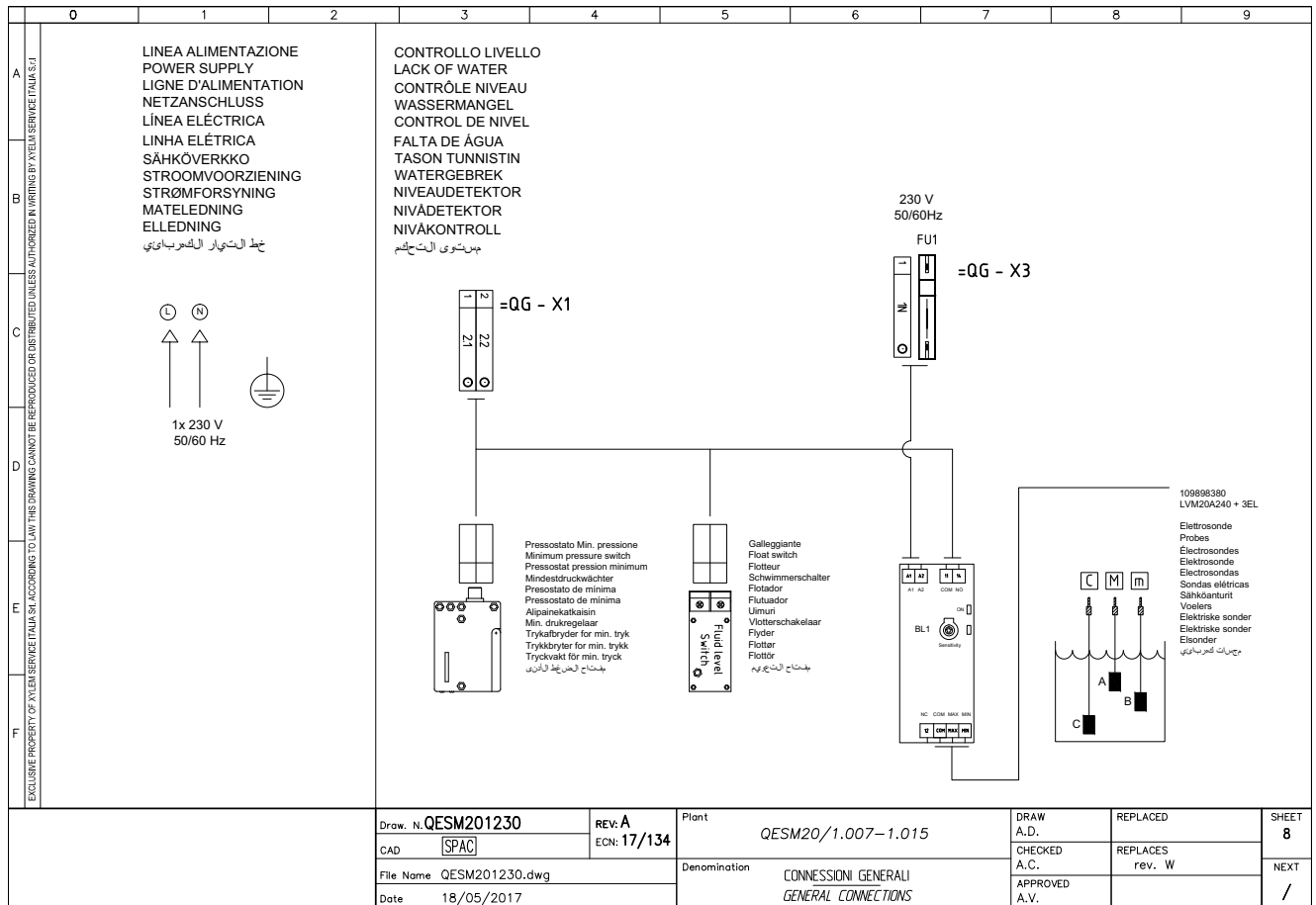






Figure 12.21: Sheet 3 of 10

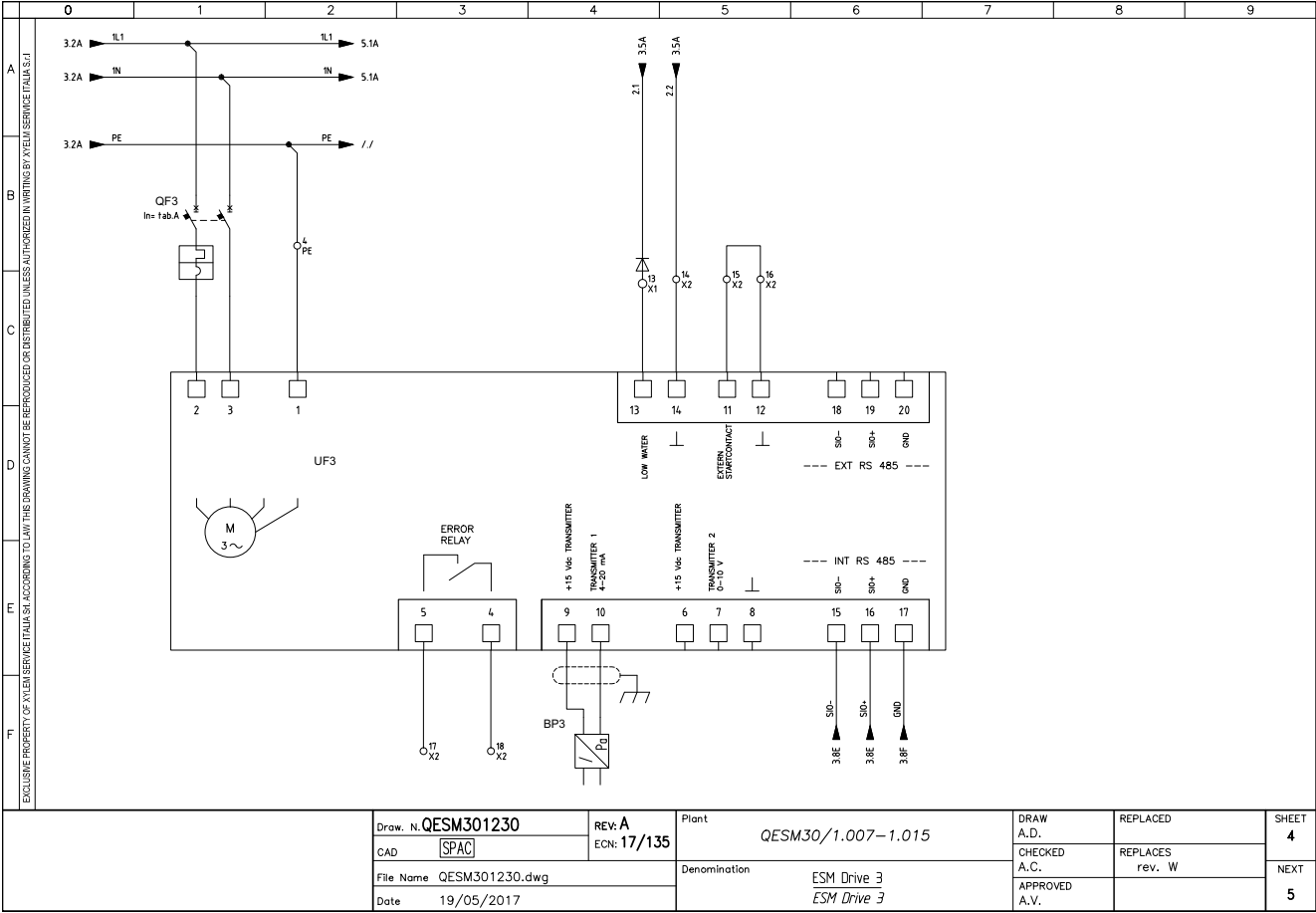




Figure 12.23: Sheet 5 of 10

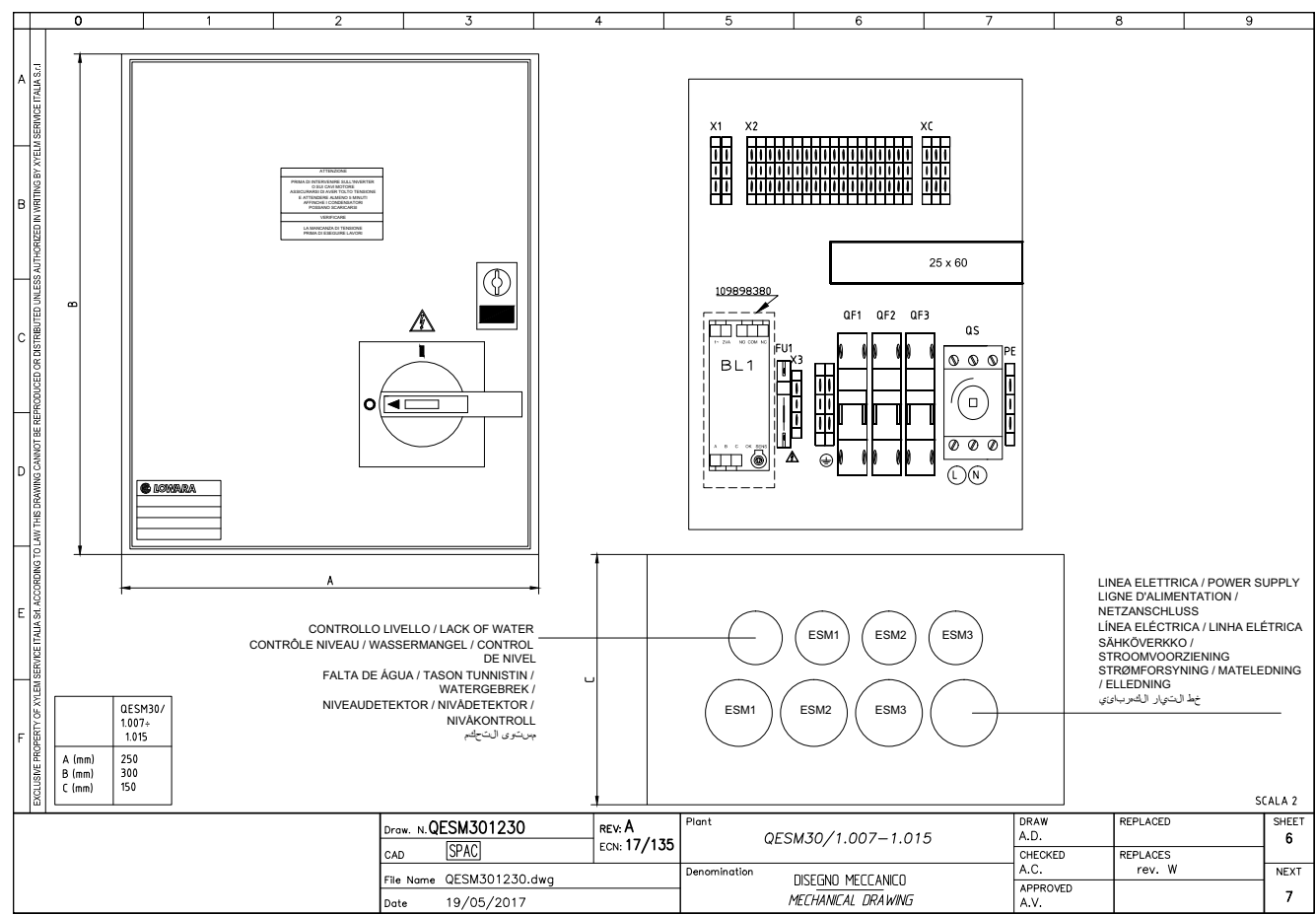


Figure 12.24: Sheet 6 of 10

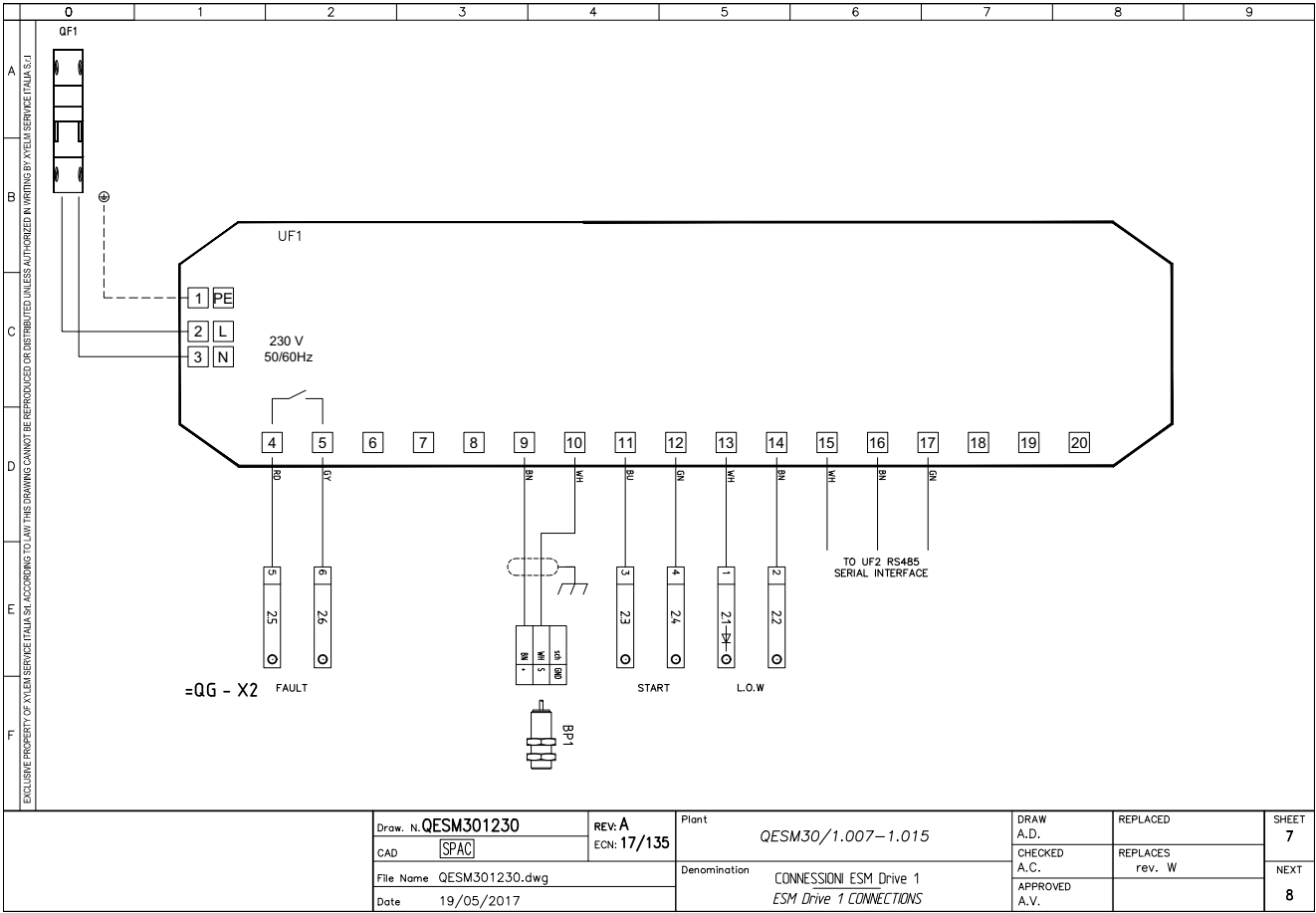


Figure 12.25: Sheet 7 of 10

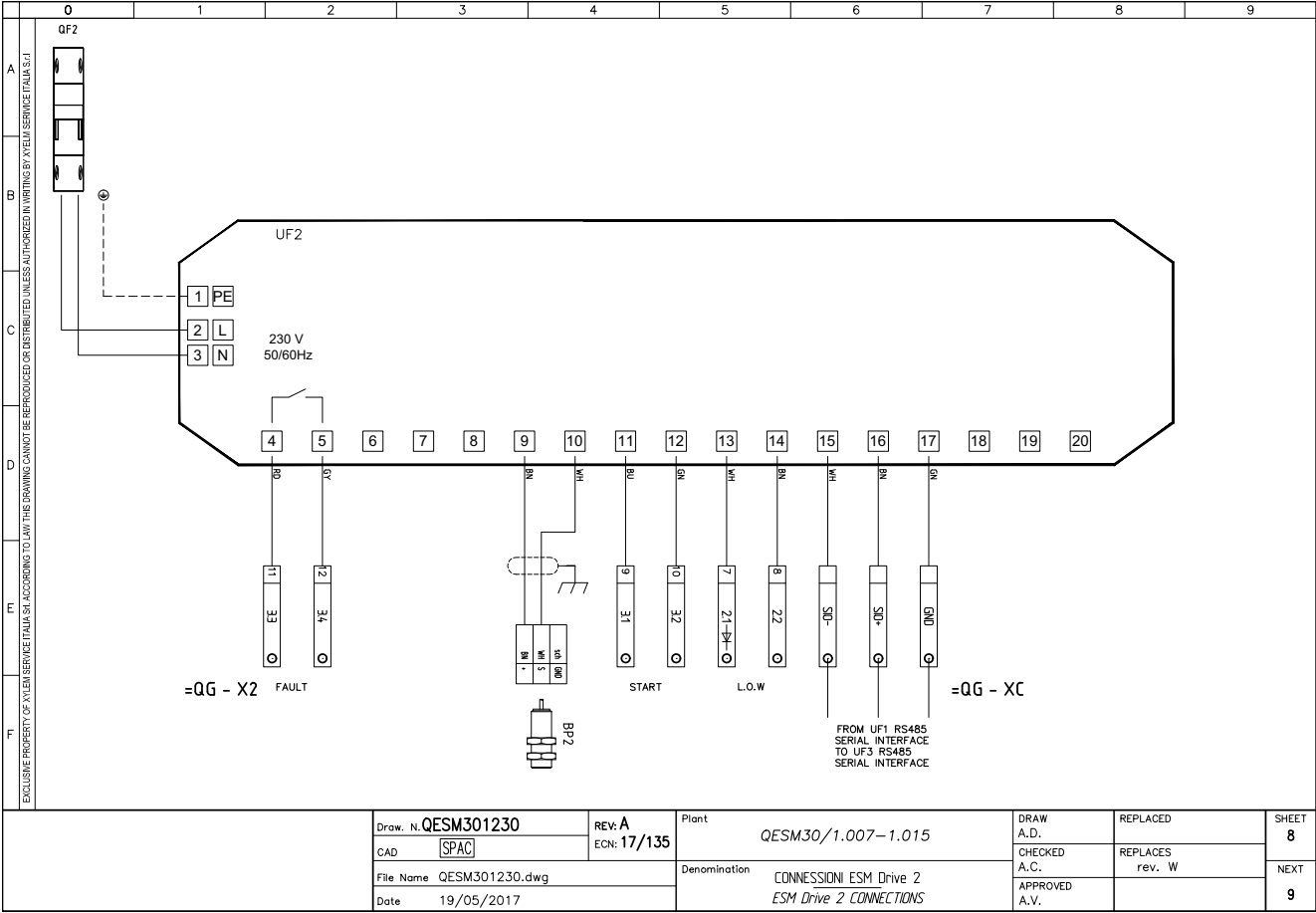




Figure 12.26: Sheet 8 of 10

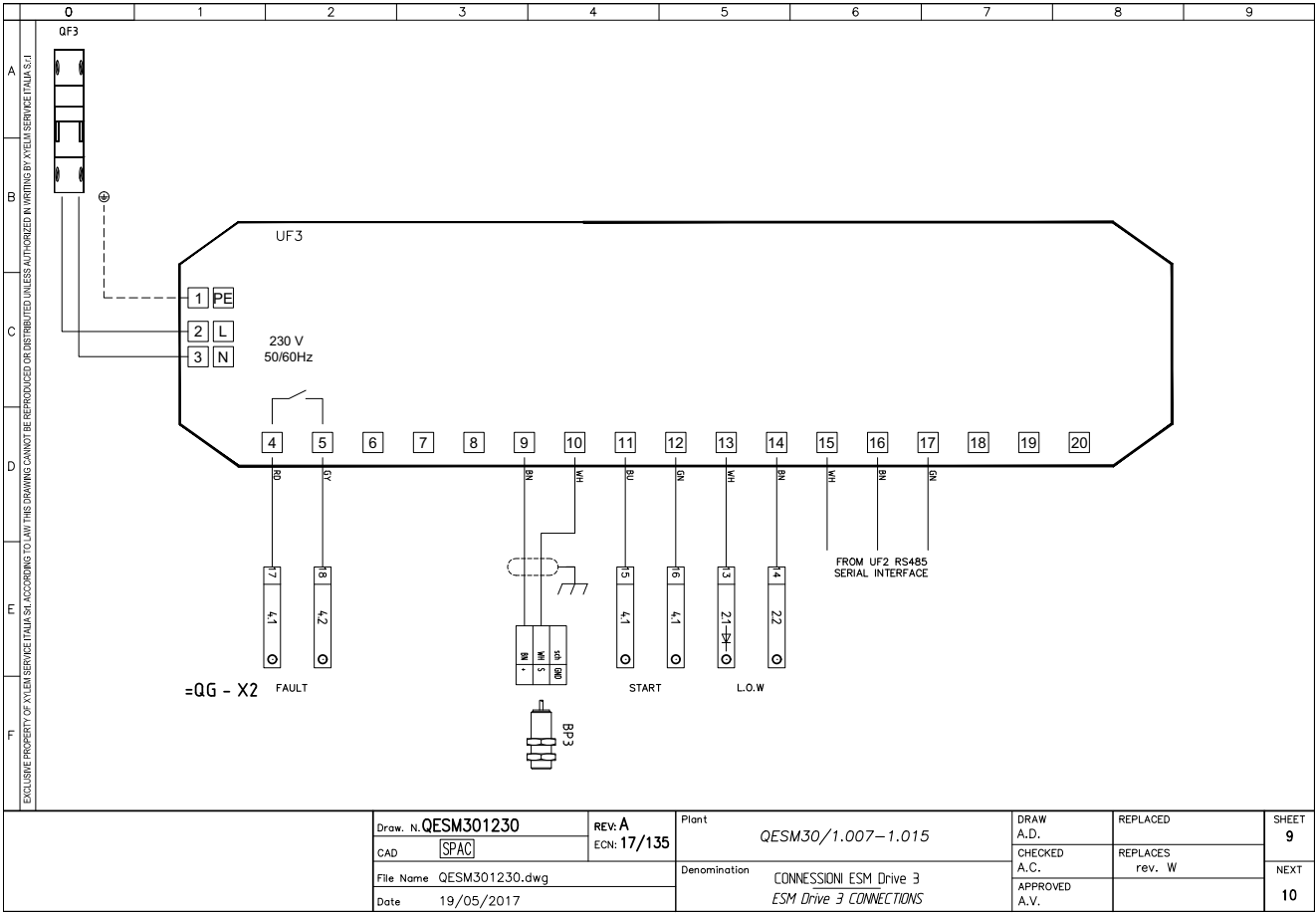


Figure 12.27: Sheet 9 of 10

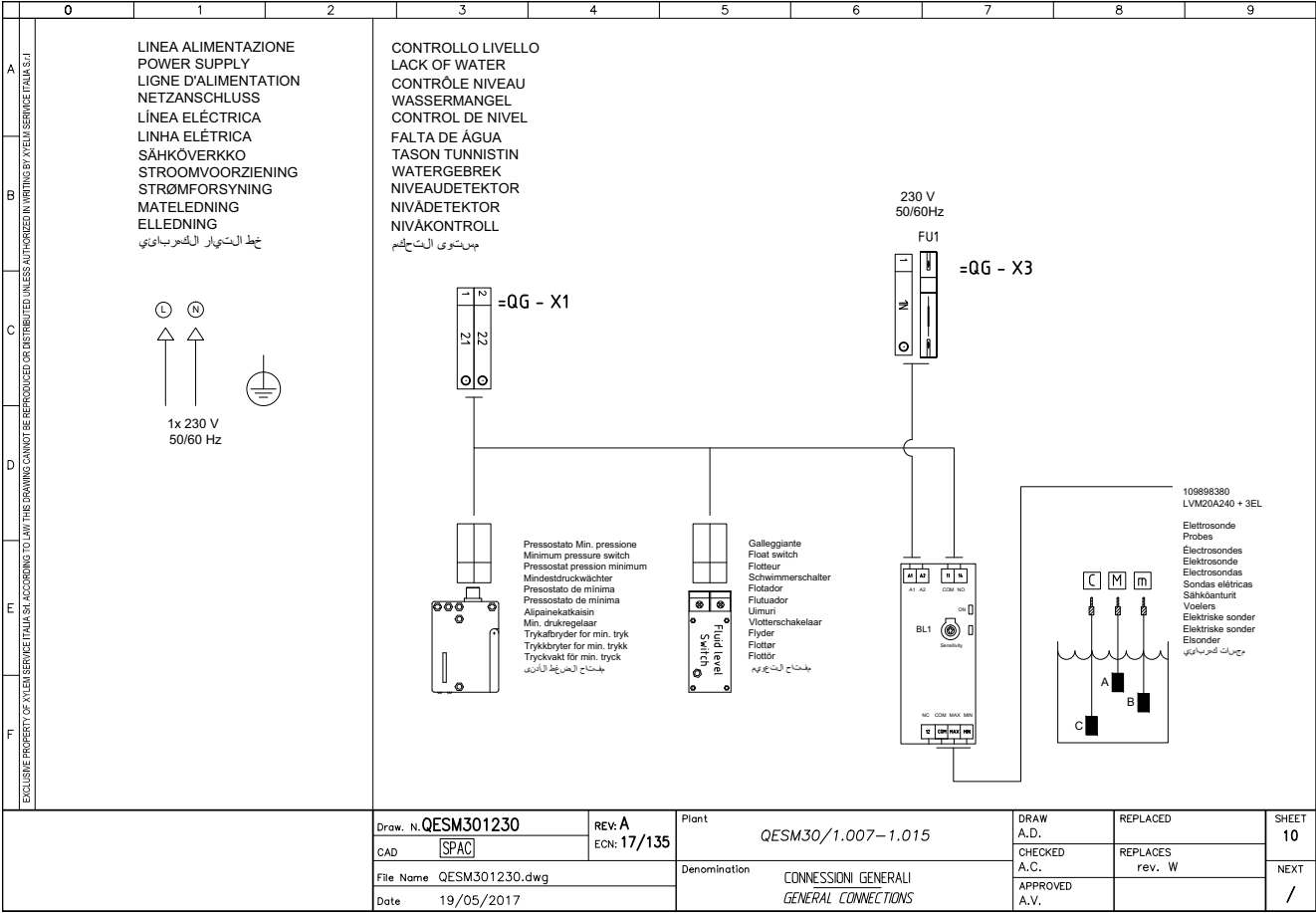
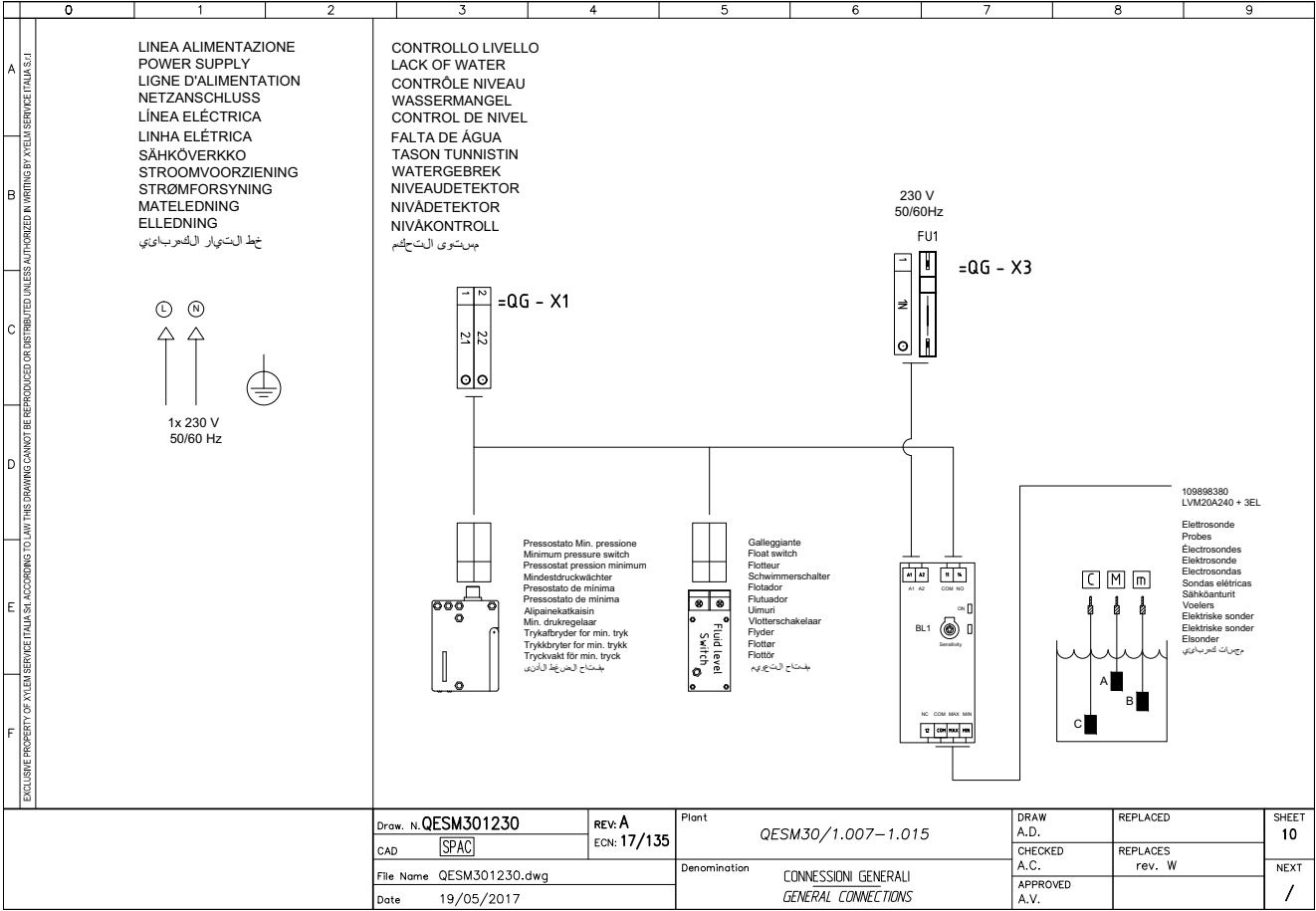


Figure 12.28: Sheet 10 of 10



# 13. Lowara eSM Pump Drives

## 13.1 Specifications

**Table 13.4:** Motor Specification Table

	e-SM Drive Model										
	103	105	107	111	115	303	305	307	311	315	322
Input											
Input Frequency	50/60Hz ±2										
Mains Supply	LN					L1 L2 L3					
Nominal Input Voltage	208-240V ±10%					208-240V / 380-460V ±10%					380-460V ±10%
Max Input Current Continuous (A)	2.3	3.3	4.4	6.3	8.6	-	-	-	-	-	-
PDS Efficiency Class	IES2										
Output											
Min-Max Speed (rpm)	800-3600 rpm										
Leakage Current	< 3.5mA										
I/O auxilliary + 15VDC power supply (mA)	Imax < 40										
Fault signal relay	1 × NO Vmax < 250 [VAC]. Imax < 2A					2 × NO Vmax < 250 [VAC]. Imax < 2A					
Electromagnetic compatibility	Installations must comply with EMC Good Practice Guidelines										
Sound pressure LpA [dB(A)]	< 62 @ 3000rpm < 66 @ 300rpm										
Insulation class	Class 155 F										
Enclosure rate	IP55 Enclosure Type 1 Protect product from direct sunlight and rainfall										
Relative humidity (storage and operating)	5% - 95% RH										
Storage temperature	-25 - 65°C										
Operating temperature	-20 - 50°C										
Air pollution	Pollution Degree 2										
Altitude	Max 1000m ASL. For installation over 1000m, de-rating may occur										

## 13.2 Terminal Connections

Figure 13.29: Terminal Connections Diagram

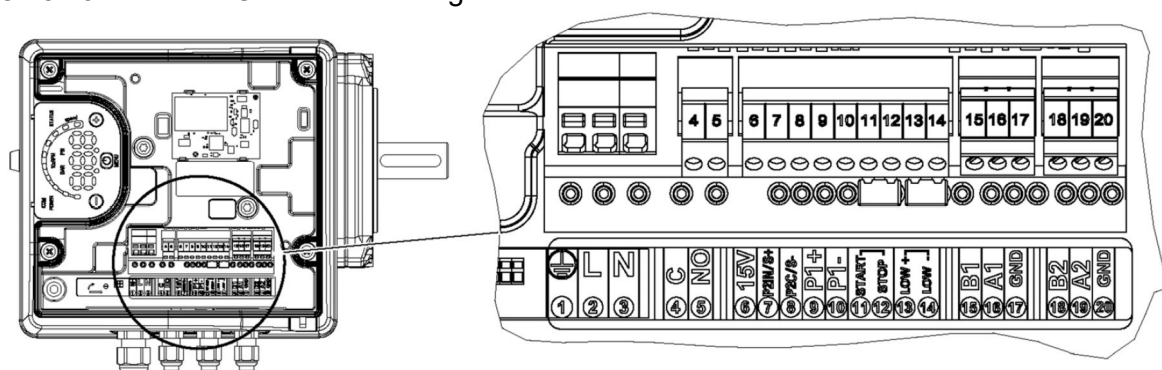


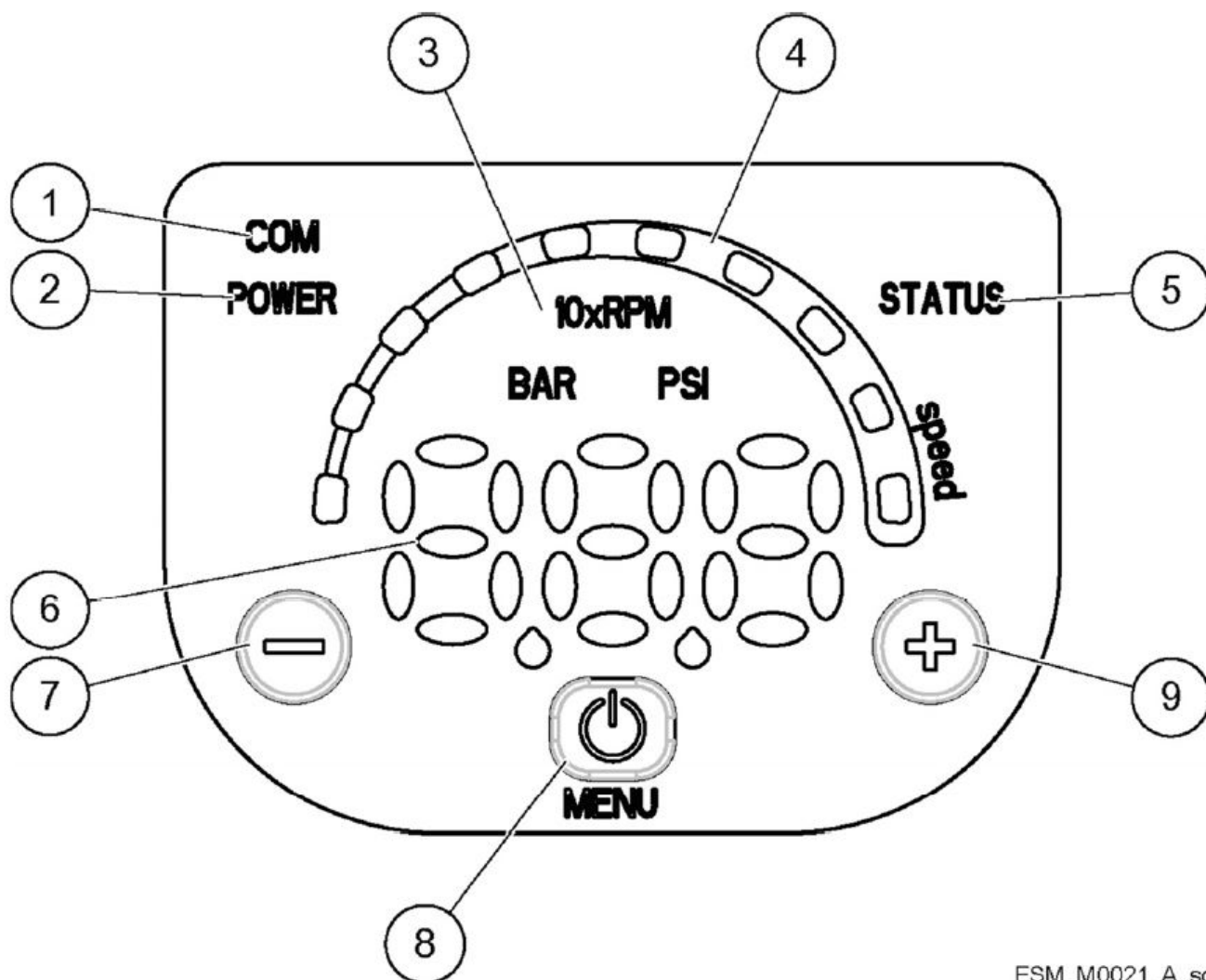
Table 13.5: I/O Terminals

Item	Terminals	Number	Description	Comments
Fault Signal	C	4		In case of power wires: use M20 cable gland
	No	5		
Auxiliary Voltage Supply	15V	6	Voltage supply	15VDC, 100mA
Analogue 0-10V	P2IN/S+	7	Actual value voltage	0-10 VDC
	P2C/S-	8	Ground for external sensor or external speed control	GND, electronic ground (for S+)
External Pressure Sensor	P1+	9	Voltage supply	15VDC 100mA
	P1-	10	Actual value current	4-20mA
External Start/Stop	START	11	External ON/OFF input	Default short circuited. Pump is enabled to RUN.
	STOP	12	Ground for external ON/OFF input	
External Lack of Water	LOW+	13	External lack of water	Default short circuited. Lack of water detection enabled.
	LOW-	14	Ground for external lack of water	
Communication Bus	B1	15	RS485 port 1: RS485 -1N	ACT, HCS control mode: RS485 port 1 for external communication. MSE, MSY control mode: RS 485 port 1 for multi-pump systems
	A1	16	RS485 port 1: RS485 -1P	
	GND	17	GND, electronic ground	
Communication Bus	B2	18	RS485 port 2: RS485 -2N	RS 485 power 2 for external communication
	A2	19	RS485 port 2: RS485 -2P	
	GND	20	GND, electronic ground	

## 13.3 Programming the Controller

**NOTE:** Read and follow the instructions carefully before your start programming. This is to prevent incorrect settings which cause malfunction. All modifications must be done by qualified technicians.

**Figure 13.30:** eSM Drive Control Panel



ESM\_M0021\_A\_sc

N o.	Description	Function
1	Communication LED	Green when selected control protocol is activated and functioning.
2	Power LED	When green LED is lit, the pump is supplied with power and the electronic devices are operative.
3	Unit of measure LEDs	Switch between Speed and Head display
4	Speed LED bar	Composed of 10 LEDs, each representing a 10% step from 10% to 100% of the interval between absolute minimum and maximum speed parameter values. LEDs are lit if the motor is running and its speed reaches the specific % step represented. If the motor is running and its speed is lower than the absolute minimum, the first LED blinks. The the motor is stopped, all arc LEDs are off.

N o.	Description	Function
5	Status LED	Not lit: pump stopped or disabled Green: pump running Orange/Green Alternating: non-blocking alarm is detected while the pump is running Orange: non-blocking alarm detected while the pump is stopped RED: a blocking error is detected and the pump is stopped (pump motor not running)
6	Numeric display	OFF: Contacts 11,12 not short circuited STP: [STOP mode] pump is manually stopped ON: on for a few seconds, pump is not in STOP Mode and contacts 11, 12 are short-circuited. This indicates pump is on and motor will start depending on control mode
7	-	Decrease the selected value
8	Start/Stop	Start/Stop Pump. Long press = switch to Parameter Selection and back
9	+	Increase the selected value

## 13.4 Display

Display	Mode	Description
OFF	OFF	Contacts 11 and 12 are not short-circuited. Note: lower display priority than STOP mode.
STP	STOP	Pump stopped manually. If the pump is switched on after setting P04 = OFF it is stopped so that the motor is not in operation, and STP flashes (STP -> STP). To manually stop the pump <ul style="list-style-type: none"> <li>Example A: HCS, MES, MSY control modes with initial required value (head) of 4.20 bar and minimum value 0.5 bar. 4.20 BAR -&gt; on/off press -&gt; STP once</li> <li>Example B: ACT control mode with initial required value (speed) of 200 10×RPM and minimum value 80 10×RPM 200 10×RPM -&gt; on/off press -&gt; STP once</li> </ul>
ON	ON	Pump on; the motor starts following the selected control mode. It appears for a few seconds when contacts 11 and 12 are short circuited and the pump is not in STOP mode. To manually set the pump to ON mode: <ul style="list-style-type: none"> <li>Example A: HCS, MES, MSY control modes that reach a required value (head) of 4.20 bar, starting with a minimum value of 0.5 bar after manual stop <i>Display reads: STP -&gt; ON/OFF press -&gt; Display reads: ON -&gt; once, and after a few seconds... -&gt; Display reads: 4.20 BAR</i></li> <li>Example B: ACT control mode that reaches a requested value (speed) of 200 10×RPM, starting with a minimum value of 80 10×RPM after manual stop: <i>Display reads: STP -&gt; ON/OFF press -&gt; Display reads: ON -&gt; once, and after a few seconds...Display reads: 200 10 x RPM</i></li> </ul>

## 13.5 Parameters

**Table 13.6:** Status Parameters

N o.	Parameter	Type	Unit	Description
P01	Required value	Ready only	bar/psi/ rpm×10	<p>This parameter shows the SOURCE and the VALUE of the active required value. Visualization cycles between SOURCE and VALUE occur every 3 seconds.</p> <p>SOURCES:P02</p> <ul style="list-style-type: none"> <li>SP (SP): internal required value set point related to the control mode selected.</li> <li>VL (UL): external required value speed set point related to 0-10V input.</li> </ul> <p>VALUE can represent a Speed or a Head, depending on the selected control mode: in case of Head, the unit of measure is defined by parameter P41.</p>
P02	Effective required value	Ready only	bar	<p>Active required value calculated based on parameters P58 and P59.</p> <p>This parameter is effective only in control modes MSE or MSY.</p>
P03	Regulation restart value [0-100]	Global	%	<p>It defines the start value after the stop of the pump, as a percentage of the P01 value. If the required value is met and there is no further consumption, then the pump stops. The pump starts again when the pressure drops below P03. P03 is valid when:</p> <ul style="list-style-type: none"> <li>Different from 100% (100%=off)</li> <li>The control mode is HCS, MSE or MSY.</li> </ul> <p>Default: 100%.</p>
P04	Auto-start [OFF-ON]	Global		<p>If P04 = ON, then the pump starts automatically following a power supply disconnection.</p> <p>If the pump is switched on after setting P04 = OFF, it is stopped so that the motor is not in operation, and STP flashes (STP -&gt; STP).</p> <p>Default: ON.</p>
P05	Operating time months	Ready only		This parameter shows the total operating time months, to be added to P06.
P06	Operating time hours	Ready only	hours	This parameter shows the total operating time hours, to be added to P05.
P07	Motor time months	Ready only		This parameter shows the total operating time months, to be added to P08.
P08	Motor time hours	Ready only	hours	This parameter shows the total operating time hours, to be added to P07.



N o.	Parameter	Type	Unit	Description
P09	1st error	Ready only		This parameter stores the last error occurred in chronological order. The information displayed switches through the values: <ul style="list-style-type: none"> <li>(Exx): xx indicates the error code</li> <li>(Hyy): yy is the value of hours referred to P05-P06 when the error Exx happened</li> <li>(Dww): ww is the value of days referred to P05-P06 when the error Exx happened</li> <li>(Uzz): zz is the value of weeks referred to P05-P06 when the error Exx happened</li> </ul> Example of visualisation: E04 -> K10 -> d03 -> U15
P10	2nd error	Ready only		Saves the penultimate error in chronological occurred. Other characteristics: like P09
P11	3rd error	Ready only		Saves the third from the last error in chronological occurred. Other characteristics: like P09.
P12	4th error	Ready only		Saves the fourth from the last error in chronological occurred. Other characteristics: like P09
P13	Power module temperature	Ready only	°C	Temperature of the power module.
P14	Inverter current	Ready only	A	This parameter shows the actual current supplied by the frequency converter.
P15	Inverter voltage	Ready only	V	This parameter shows the actual estimated input voltage of the frequency converter.
P16	Motor speed	Ready only	rpm×10	This parameter shows the actual motor rotational speed.
P17	Software version	Ready only		This parameter shows the Control Board software version.

**Table 13.7:** Settings Parameters

N o.	Parameter	Description
P20	Password [0-999]	The user can enter here the system password, which gives access to all system parameters: this value is compared with the one stored in P22. When a correct password is entered, the system remains unlocked for 10 minutes.
P21	Jog mode [MIN-MAX]	It deactivates the internal controller of the unit and forces the actual Control Mode (ACT): the motor starts and the value of P21 becomes the temporary ACT set point. It can be changed by just entering a new value on P21 without confirming it; otherwise, it causes immediate exit from temporary control.
P22	System password [1-999]	This is the system password, and must be the same as the password entered in P20. Default: 66.
P23	Lock function [OFF, ON]	By using this function, the user can lock or unlock parameter setting in the main menu. When ON, enter the P20 password to change the parameters. Default: ON.

**Table 13.8:** Drive Configuration Parameters

N o.	Parameter	Type	Unit	Description
P2 5	Control mode [ACT, HCS, MSE, MSY]			<p>This parameter sets the Control Mode (default value: HCS). Options as follows</p> <ul style="list-style-type: none"> <li>• ACT: Actuator mode</li> <li>• HCS: Hydrovar® Controller mode for Single pump.</li> <li>• ACT: Actuator mode</li> <li>• MSE: Hydrovar Controller mode for multiple pumps in Serial Cascade.</li> <li>• MSY: Hydrovar® Controller mode for Multiple pumps in Synchronous Cascade.</li> </ul> <p>For more information, see</p>
P2 6	Max RPM set [ACT set-Max Depending on the type of pump used]	Global	10 × rpm	Maximum pump speed setup.
P2 7	Min RPM set [Min÷ACT set]	Global	10 × rpm	Minimum pump speed setup.
P2 8	Ramp 1 [1-250]	Global	s	This parameter adjusts the fast acceleration time. It affects the control of the pump for HCS, MSE and MSY control modes. Default: 3 s.
P2 9	Ramp 2 [1-250]	Global	s	This parameter adjusts the fast deceleration time. It affects the control of the pump for HCS, MSE and MSY control modes. Default: 3 s.
P3 0	Ramp 3 [1-999]	Global	s	<p>This parameter adjusts the slow acceleration. It determines:</p> <ul style="list-style-type: none"> <li>• The Hydrovar adjustment speed, in case of small flow rate variations</li> <li>• The constant outgoing pressure</li> </ul> <p>The ramp depends on the system being controlled, and affects the control of the pump in HCS, MSE and MSY modes. Default: 35 s</p>
P3 1	Ramp 4 [1-999]	Global	s	<p>This parameter adjusts the slow deceleration time.</p> <p>Other characteristics: as for Ramp 3.</p>
P3 2	Ramp Speed Min Acceleration [2.0-25.0]	Global	s	<p>This parameter sets the fast acceleration time.</p> <p>It represents the acceleration ramp used by the Hydrovar controller until the minimum speed of the pump is reached (P27).</p> <p>It affects the control of the pump for HCS, MSE and MSY control modes.</p> <p>Default: 2.0 s.</p>
P3 3	Ramp Speed Min Deceleration [2.0-25.0]	Global	s	<p>This parameter sets the fast deceleration time.</p> <p>It represents the deceleration ramp used by the controller for stopping the pump once the minimum speed of the pump is reached (P27).</p> <p>It affects the control of the pump for HCS, MSE and MSY control modes. Default: 2.0s</p>

N o.	Parameter	Type	Unit	Description
P3 4	Speed Min Configuration [STP, SMI]	Global		<p>This parameter defines the operation of the Hydrovar controller once the minimum speed of the pump is reached (P27):</p> <ul style="list-style-type: none"> <li>(STP): once the required pressure is reached and no further request is made, the pump speed decreases to the selected P27 value: Hydrovar then keeps running for the selected time interval (P35), and then stops automatically.</li> <li>(SMI): once the required pressure is reached and no further request is made, the pump speed decreases to the selected P27 value: Hydrovar continues running at the same speed. This parameter affects the control of the pump for HCS, MSE and MSY control modes.</li> </ul>
P3 5	Smin time [0-100]	Global	s	<p>This parameter sets the time delay before a shut-off below P27 occurs. It is only used by the Hydrovar controller if P34 = STP. It affects the control of the pump for HCS, MSE and MSY control modes. Default: 0 s.</p>
P3 6	Window [0-100]	Global	%	<p>This parameter sets the ramp control interval, as a percentage of the pressure set point. It is used to define the range of pressures, around the set point, in which the Hydrovar® controller uses slow acceleration and deceleration ramps instead of fast ones. It affects the control of the pump for HCS, MSE and MSY control modes. Default: 10%.</p>
P3 7	Hysteresis [0-100]	Global	%	<p>This parameter sets the slow ramp hysteresis, as a percentage of P36. It helps define the pressure range, around the setpoint, in which Hydrovar® goes from slow acceleration ramp (P28) to slow deceleration ramp (P29). This parameter affects the control of the pump for HCS, MSE and MSY control modes. Default: 80%.</p>
P3 8	Speed Lift [0-MAX]	Global	10 × rpm	<p>This parameter sets the speed limit after which the linear increase of the actual required value starts (P02), until the total increase (P39) at maximum speed (P26). Default: P27.</p>
P3 9	Lift Amount [0-200]	Global	%	<p>This parameter sets the increase value of the actual required value (P02) at the maximum speed (P26), measured as a percentage of the required value (P01). It determines the increase of the required pressure set, useful to compensate for flow resistances at high flow rates. Default: 0.</p>

**Table 13.9: Sensor Configuration Parameters**

N o.	Parameter	Unit	Type	Description
P4 1	Pressure Sensor Unit Of Measure [BAR, PSI]	bar/psi	Global	<p>This parameter sets the unit of measure (BAR, PSI) or the pressure sensor. It affects the head view LED parameter. Default: bar.</p>

N o.	Parameter	Unit	Type	Description
P4 2	Pressure Sensor Full Scale - 4-20mA [0.0-25.0 bar] / 0.0-363 psi]	bar/psi	Global	This parameter sets the Full Scale value of the 4-20mA pressure sensor connected to analogue input 9 and 10. Default: depending on the type of pump.
P4 4	Zero Pressure Auto-Calibration	bar/psi		<p>This parameter lets the user perform the initial auto-calibration of the pressure sensor. It is used to compensate for the offset signal of the sensor at zero pressure caused by the tolerance of the sensor itself. Procedure:</p> <ol style="list-style-type: none"> <li>1) Access P44 when the hydraulic system is at 0 pressure (no water inside), or with the pressure sensor disconnected from the piping: the actual value of 0 pressure is displayed</li> <li>2) Start the auto-calibration by pressing + or -</li> <li>3) At the end of the auto-calibration, the 0 (zero) pressure is displayed, or the "---" (---) message, if the sensor signal is out of the permitted tolerance</li> </ol>
P4 5	Pressure Minimum Threshold [0-42]	bar/psi	Global	Setting the minimum pressure threshold. If the system pressure falls below this threshold for the time set in P46, a low pressure error E14 is generated. Default: 0 bar.
P4 6	Pressure Minimum Threshold - Delay Time [1-100]		Global	Time delay setup. This parameter sets the time delay during which the unit remains idle with a system pressure below P45, before generating the low pressure error E14. Default: 2 s.
P4 7	Pressure Minimum Threshold - Automatic Error Reset [OFF,ON]		Global	Enabling/disabling of automatic unit attempts in case of low pressure error. Default: ON.
P4 8	Lack of Water Switch Input [DIS, ALR, ERR]		N/A	<p>This parameter enables/disables the management of the lack of input water</p> <p>It defines the behaviour of the unit when the lack of water input is enabled and the switch is open:</p> <ul style="list-style-type: none"> <li>• (DIS): the unit doesn't manage the information coming from the "lack of water" input</li> <li>• (ALr): the unit reads the "lack of water" Input (enabled) and reacts, at the opening of the switch, by displaying the corresponding alarm A06 on the display, and keeping the motor running</li> <li>• (Err): Err, the unit reads the Lack Of Water Input (enabled) and reacts, at the opening of the switch, by stopping the motor and generating the corresponding error E11. The error condition is removed when the switch closes again and the motor is started.</li> </ul> <p>Default: ERR</p>
P5 0	Communication protocol [MOD, BAC]			<p>This parameter selects the specific protocol on the communication port:</p> <ul style="list-style-type: none"> <li>• NOD (MOD): Modbus RTU</li> <li>• BAC (BAC): BACnet MS/TP Default: MOD</li> </ul>

N o.	Parameter	Unit	Type	Description
P5 1	Communication protocol - Address [1÷247]/[0÷127]			This parameter sets the desired address for the unit, when connected to an external device, depending on the protocol selected in P50: <ul style="list-style-type: none"> <li>MOD: any value in the 1÷247 range</li> <li>BAC: any value in the 0÷127 range</li> </ul>
P5 2	Comm Protocol – BAUDRATE [4.8, 9.6, 14.4, 19.2, 38.4, 56.0, 57.6 KBPS]	kbps		This parameter sets the desired baud rate for the communication port. Default: 9.6 kbps.
P5 3	BACnet Device ID Offset [0÷999]			This parameter sets the hundreds, tens and units of the BACnet Device ID. Default: 002. Device ID default: 84002
P5 4	Comm Protocol – Configuration [8N1, 8N2, 8E1, 801]			This parameter sets the length of the data bits, the parity and the length of the STOP bits.

## 13.6 Multi-pump configuration parameters

All these parameters affect MSE and MSY control modes.

N o.	Parameter	Unit	Description
P5 5	Multipump – Address [1-3]		This parameter sets the address of each pump based on the following criteria: <ul style="list-style-type: none"> <li>Each pump needs an individual pump address (1-3)</li> <li>Each address may only be used once</li> </ul> Default: 1
P5 6	Multipump – Max Units [1-3] [G]		This parameter sets the maximum number of pumps operating at the same time. Default: 3
P5 7	Multipump – Switch Interval [0-250] [G]	h	This parameter sets the automatic switch interval for automatic change-over of the MASTER pump and the assist pumps. As soon as the set time is reached, the next pump becomes the MASTER pump and the meter restarts, ensuring a balanced distribution of the operating hours amongst all pumps. Default: 24 h.
P5 8	Multipump – Actual Value Increase [0.0-25.0 BAR] / [0.0-363PSI] [G]	bar/psi	This parameter affects the calculation of P02, to improve the Multipump control. Default: 0.35 bar
P5 9	Multipump – Actual Value Decrease [0.0-25.0 BAR] / [0.0-363PSI] [G]	bar/psi	This parameter affects the calculation of P02, to improve the multi-pump control. Default: 0.15 bar
P6 0	Multipump – Enable Speed [P27-P26] [G]	rpm×10	This parameter sets the speed that a pump must reach before starting the next assist pump, after a system pressure drop below the difference between P02 and P59. Default: depending on the type of pump

N o.	Parameter	Unit	Description
P6 1	Multipump Synchronous – Speed Limit [P27-P26] [G]	rpm×10	This parameter sets the speed limit below which the first assist pump stops.Default: depending on the type of pump
P6 2	Multipump Synchronous – Window [0-100] [G]	rpm×10	This parameter sets the speed limit for the stop of the next assist pump.Default: 150 rpm×10
P6 3	Multipump – Priority		<p>This parameter shows the pump priority value within the multi-pump set</p> <p>This parameter displays the following information: (Pr1) .. (Pr3) or (Pr0) where</p> <ul style="list-style-type: none"> <li>Pr1 .. PR3, indicate that the pump is communicating with others pumps and its priority order, is equal to the visualized number</li> <li>Pr0 indicates that the pump does not detect the communication with other pumps and is considered alone in the multi-pump bus</li> </ul>
P6 4	Multipump – Revision		This parameter shows the multi-pump protocol revision value used

## 13.7 Test Run Configuration Parameters

Test Run is a function that starts the pump after the last stop, in order to prevent it from blocking.

No.	Parameter	Unit of measure	Description
P65	Test Run – Time Start [0÷100] [G]	h	This parameter sets the time after which, once the pump has stopped for the last time, the Test Run will start.Default: 100 h
P66	Test Run – Speed [Min÷Max] [G]	rpm×10	This parameter sets the pump rotational speed for the Test Run.The Min and Max speeds depend on the pump type.Default: 200 rpm×10
P67	Test Run – Time Duration [0÷180] [G]	s	This parameter sets the duration of the Test Run.Default: 10 s

## 13.8 Special Parameters

No.	Parameters	Unit of measure	Description
P68	Default Values Reload [NO,rES]		If set to RES, after confirmation this parameter performs a factory reset that reloads the default parameter values

No.	Parameters	Unit of measure	Description
P69	Avoid Frequent Parameters Saving [NO, YES]		This parameter limits the frequency with which the unit stores the required value P02 in the EEPROM memory, in order to extend its life. This could be particularly useful in applications with BMS control devices that require continuous variation of the value for fine tuning purposes. Default: NO

## 13.9 Control Modes

**Table 13.10:** Drive Control Modes

Code	Name	Description
ACT	Actuator Mode	A single pump maintains a fixed speed at any flow rate. ACT will always try to minimize the difference between the speed set point and the actual rotational speed of the motor If a 0-10V signal is supplied to terminals 7 and 8, the pump automatically switches to ACT mode, following the external signal. If the external signal is missing, the pump remains in ACT mode, using the value set as set point using the display
HCS	Hydrovar Controller mode for Single pump.	The pump maintains a constant pressure at any flow rate: the Hydrovar algorithm, based on the set of parameters from P26 to P37, is implemented. HCS mode must be set in conjunction with the use of an absolute reading pressure sensor installed in the hydraulic circuit, which supplies to the unit the pressure feedback signal: HCS will always try to minimize the difference between the pressure set point and the pressure feedback signal.
MSE	Hydrovar Controller mode for multiple pumps in Serial Cascade.	Pumps are managed in series: only the last activated pump modulates the speed to maintain the set pressure, while all the others in operation rotate at the maximum speed. The set of pumps, connected to each other through the multi-pump protocol, maintains a constant pressure at any flow rate: the Hydrovar algorithm, based on the set of parameters from P26 to P37, is implemented. MSE mode must be set in conjunction with the use of absolute reading pressure sensors, one for each pump, which supply to the set the pressure feedback signal: MSE will always try to minimize the difference between the pressure set point and the pressure feedback signal. Using the multi-pump protocol, it is possible to connect up to 3 pumps, all of the same type and with the same power
MSY	MSY: Hydrovar Controller mode for Multiple pumps in Synchronous Cascade	The pumps are synchronised: they all keep the set pressure and operate at the same speed. Other characteristics: as for MSE mode.





## 13.11 Example: Ramp Settings

Figure 13.32: Ramp settings

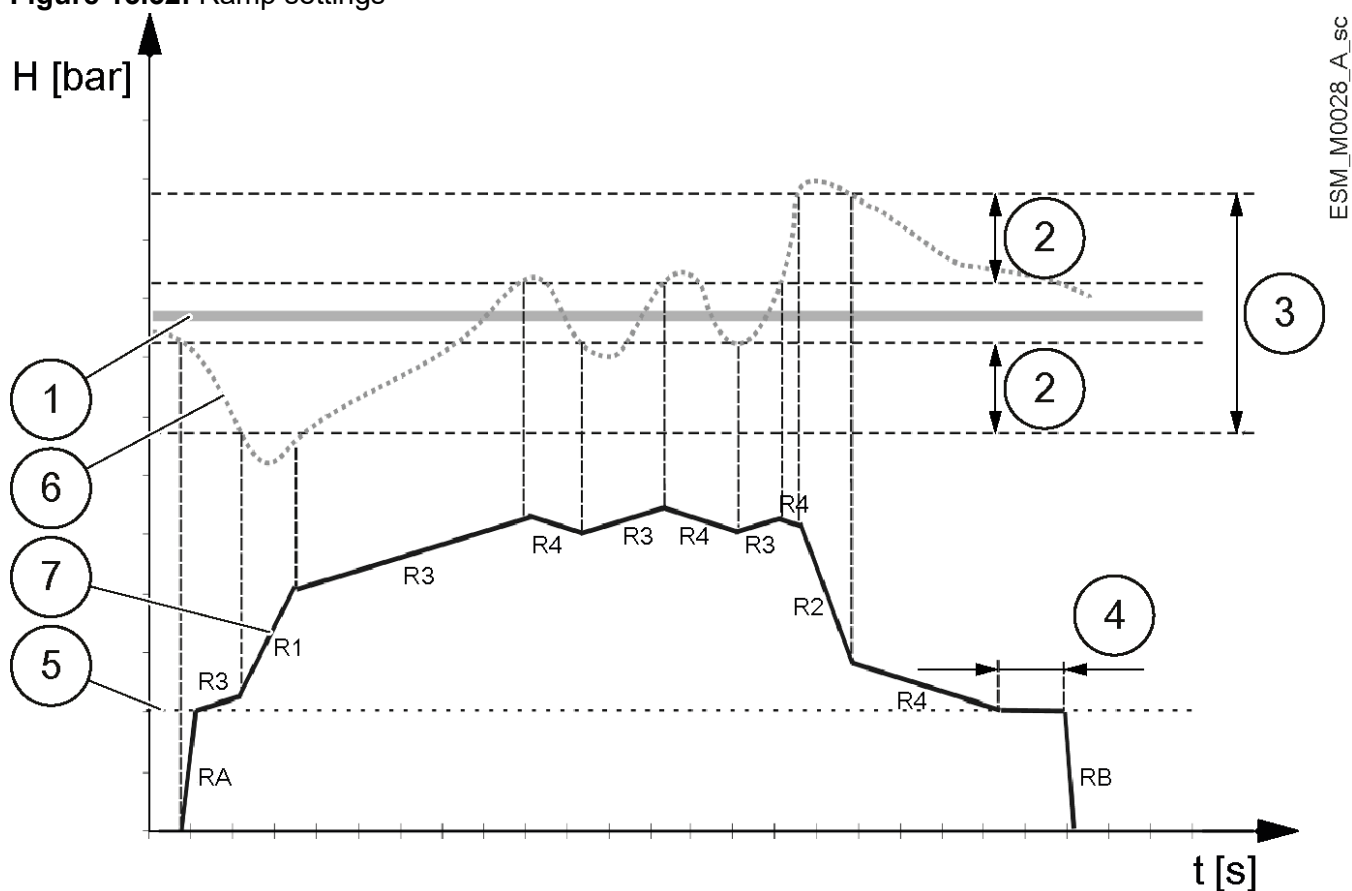


Table 13.12: Descriptions

1	P01 (Required Value)
2	P37 (Adjustment hysteresis) as a % of P36 (Adjustment window)
3	P36 (Adjustment window) as a % of P01 (Required Value)
4	P35 (Minimum speed - Duration)
5	P27 (Minimum speed)
6	Actual Head
7	Actual Speed
RA	P32 (Acceleration ramp at start up)
RB	P32 (Deceleration ramp at shut down)
R1	P28 (Ramp 1) - Fast ramp speed increase
R2	P29 (Ramp 2) - Fast ramp speed decrease
R3	P30 (Ramp 3) - Slow ramp speed increase
R4	P31 (Ramp 4) - Slow ramp speed decrease

## 13.12 Example: Effective Required Value

Pumps activation in cascade modes:

- 1) Lead pump reaches its P60 (Enable Speed).
- 2) Actual value falls to the cut in-value of the 1st assist pump. The 1st assist pump switches on automatically. (Cut-in value = P01 (Required Value) - P59 (Actual Value Decrease))
- 3) A new required value, P02 (Effective Required Value) is calculated after the start up.

Calculation of Effective Required Value in Cascade Serial (MSE):

- $K$  = number of active pumps
- $Pr$  = pump priority
- $P02$  (Actual Required Value) =  $P01$  (Required Value) +  $(K - 1) * P58$  (Actual Value Increase) –  $(Pr - 1) * P59$  (Actual Value Decrease)

Calculation of Effective Required Value in Cascade Synchronous (MSY):

- $K$  = number of active pumps ( $K \geq Pr$ )
- $P02$  (Actual Required Value) =  $P01$  (Required Value) +  $(K - 1) * (P58 - P59)$

Behaviour of P58 (Actual Value Increase) and P59 (Actual Value Decrease):

- if  $P58$  (Actual Value Increase) =  $P59$  (Actual Value Decrease) → Pressure constant, independent of how many pumps are in operation.
- if  $P58$  (Actual Value Increase) >  $P59$  (Actual Value Decrease) → Pressure rises when assist pump switches on.
- if  $P58$  (Actual Value Increase) <  $P59$  (Actual Value Decrease) → Pressure decreases when assist pump switches on.

## 13.13 Troubleshooting

**Table 13.13:** Alarm Codes

Code	Description	Cause
A03	Derating	Temperature too high
A05	Data memory alarm	Data memory corrupted
A06	LOW alarm	Lack of water detection (if P48 = ALR)
A15	EEPROM write failure	Data memory damaged
A20	Internal alarm	
A30	Multi-pump connection alarm	Corrupted multi-pump connection
A31	Loss of multi-pump connection	Loss of multi-pump connection

**Table 13.14:** Error Codes

Code	Description	Cause
E01	Internal communication error	Internal communication lost
E02	Motor overload error	High motor current
E03	DC-bus overvoltage error	DC-bus over-voltage
E04	Trip control error	Motor stall
E05	EEPROM Data memory error	EEPROM Data memory corrupted
E06	Grid voltage error	Voltage supply out of operating range

Code	Description	Cause
E07	Motor winding temperature error	Motor thermal protection trip
E08	Power module temperature error	Frequency converter thermal protection trip
E09	Generic Hardware error	Hardware error
E10	Dry-run error	Dry run detection
E11	LOW error	Lack of water detection (if P48= ERR)
E12	Pressure sensor error	Missing pressure sensor (not present in ACT)
E14	Low pressure error	Pressure below minimum threshold (not present in ACT)
E30	Multi-pump protocol error	Incompatible multi-pump protocol

# DUTYPOINT

SETTING  
THE BAR

Dutypoint Limited  
Shepherd Road  
Gloucester  
GL2 5EL  
United Kingdom

**T:** +44(0)1452 300592  
**W:** [www.dutypoint.com](http://www.dutypoint.com)