INSTRUCTIONS

OJ DVULH

OJ Drives®
A DRIVES PROGRAMME DEDICATED TO VENTILATION SOLUTIONS

OJ ELECTRONICS

Contents

Notice!
The language used in the original documentation is English. Other language versions are a
translation of the original documentation. The manufacturer cannot be held liable for any errors in
the documentation. The manufacturer reserves the right to make alterations without prior notice.
Content may vary due to alternative software and/or configurations.

1.   Product presentation

For areas with sensitive electrical equipment, such as hospitals, data centers and airports, the OJ DV Ultra Low Harmonic is your ideal choice. The OJ DV Ultra Low Harmonic drive lets you reduce harmonic distortion with an easy-to-install, compact solution. The 3-phase active frontend incorporated into the drive housing eliminates the need for additional filters and cables, enabling you to create fully finished, factory-tested units that offer minimal harmonic distortion, complying with the strictest regulations and recommendations and with all the features of the original OJ-DV.

Product series:
- **OJ-DVULH-3055-XXXX (5.5kW)**
- **OJ-DVULH-3075-XXXX (7.5kW)**

2.   Introduction

- Read this manual thoroughly and follow the instructions it contains before taking the OJ DVULH into use.
- This manual contains important information and should be used when installing, connecting and commissioning the OJ DVULH as well as during maintenance, service and troubleshooting.
- If the instructions contained in this manual are not observed, the liability of the supplier and the warranty shall be voided *(see also Section 6. Prohibition on use).*
- Technical descriptions, drawings and figures must not be wholly or partly copied or disclosed to third parties without the permission of the manufacturer.
- All rights are reserved if the product is included in patent rights or other form of registration.

3.   Key to symbols

Particular attention should be paid to the sections in these instructions which are marked with symbols and warnings.

⚠ Warning

3.1.   This symbol is used where there is a risk of severe or fatal personal injury.

❗ Caution

3.2.   This symbol is used where potentially dangerous situations may result in minor or moderate personal injury. The symbol is also used to warn against unsafe and hazardous conditions.

📄 Note

3.3.   This symbol is used to indicate important information and in situations which may result in serious damage to equipment and property.

⚠ Warning

4.   Ensuring safety before installation

4.1.   The OJ DVULH must only be installed by qualified personnel or people who have received appropriate training and have thus become qualified to install the product.

4.2.   Qualified personnel have knowledge of the installation practices used and can perform installation in accordance with relevant local and international requirements, laws and regulations.

4.3.   Qualified personnel are familiar with the instructions and safety precautions described in this manual.

4.4.   The OJ DVULH contains dangerous high voltage when connected to the mains.

4.5.   Mains voltage must always be disconnected before any installation, service or maintenance tasks are performed on the product.

4.6. When the OJ DVULH is connected to the mains, there is a risk that the motor could start unintentionally, causing a risk of dangerous situations and personal injuries.

4.7. Unintentional start during programming, service or maintenance may result in serious injury or damage to equipment and property.

4.8. The motor/fan can be started via an external input signal, RS-485 interface or a connected control panel.

4.9. Before connecting mains voltage to an OJ DVULH, all of the OJ DVULH, motor and fan components must be properly fitted.

4.10. Before connecting mains voltage to the OJ DVULH, all openings, covers and cable glands must be properly fitted and closed. Unused cable glands must be replaced with blank glands.

4.11. The OJ DVULH contains capacitors which become charged during operation. These capacitors can remain charged even after the power supply has been cut off. There is a risk of severe personal injury if the connection terminals or wire ends are touched before these capacitors have been completely discharged. The discharge time is about 3 minutes under normal conditions.

5. Product use

5.1. The OJ DVULH is especially used in ventilation applications (fans).

5.2. The OJ DVULH can also be used in other applications. If the OJ DVULH is used in applications where it cannot be positioned directly in a flow of air, impaired OJ DVULH cooling must be taken into account. This can be countered by creating additional ventilation around the product or by reducing performance requirements. See Section 25. Technical specifications.

5.3. The OJ DVULH is an electronic motor controller used to regulate fan speed. The OJ DVULH can be used to control PM motors.

5.4. Depending on what is needed, the OJ DVULH is suitable for stand-alone applications or as part of larger systems/machines.

5.5. The product can be used under various environmental conditions. See Section 25. Technical specifications.

5.6. The OJ DVULH can be fitted directly to the frame of the fan motor, thus saving space.

5.7. Motor operation can be regulated by commands from an external controller.

5.8. The OJ DVULH has built-in motor protection.

5.9. The OJ DVULH can be used in domestic and industrial environments and has a built-in EMC filter.

5.10. The OJ DVULH is developed for use in industry and defined as professional equipment and it is not intended for sales to the general public.

 Warning

6. Prohibition on use

- The OJ DVULH must not be taken into use until the machine or product into which it is incorporated has in its entirety been declared to be in conformity with all relevant national and international regulations.
- The product must not be energised until the entire installation complies with ALL relevant EU directives.
- The product carries a manufacturer's warranty if installed in accordance with these instructions and applicable installation regulations.
- If the product has been damaged in any way, e.g. during transport, it must be inspected and repaired by authorised personnel before being connected to the power supply.
- If the OJ DVULH is built into machinery with rotating parts, e.g. a ventilation system, transport system, etc., the entire system must comply with the Machinery Directive.

7. Approvals and certifications

7.1. CE marking

- OJ Electronics A/S hereby declares under sole responsibility that the product complies with the following European Parliament directives:
  - LVD – Low voltage 2014/35/EU
  - EMC – Electromagnetic Compatibility 2014/35/EU
  - RoHS – Restriction of the use of certain hazardous substances 2011/65/EU + amending annex II: EU/2015/863
  - ECO – Ecodesign energy-related products: 2009/125/EC (implement of motor and variable speed drives: 2019/1781/EU)

7.2. UL 61800-5-1

The OJ DVULH product series is cULus Recognised.

Additional evaluation is required before the combined drive and motor can be operated. The system in which the product is installed must also be UL listed by the appropriate party. The drive complies with UL 61800-5-1 thermal memory retention requirements.

The OJ DVULH complies to the US National Electric Code NFPA 70 and the Canadian Electric Code CSA C22.1.

7.3. UK marking

- OJ electronics Ltd hereby declares under sole responsibility that the product complies with the following UK legislations:
  - LVD – The Electrical Equipment (Safty) Regulations 2016
  - EMC – The Electromagnetic Compatibility Regulations 2016
  - Ecodesign – The Ecodesign for Energy-Related products and Energy Information Regulations 2010 as retained in UK law and amended.
  - RoHS – The Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Table 7.2					
Certification		**-4**	**-5**	**-6**	**-7**
EC Declaration of Conformity	CE	-	√	√	√
UL Recognised	c UL us	√	-	-	√
UK Conformity Assessment	UKCA	-	√	√	√

7.4. Product standard

- In accordance with EN/BS 61800-2 – Adjustable speed electrical power drive systems. Part 2. General requirements.

7.5. Safety

- In accordance with EN/BS 61800-5-1 – Adjustable speed electrical power drive systems. Part 5. Safety requirements – Electrical, thermal and energy.

7.6. **EMC - Electromagnetic compatibility**
- The OJ DVULH has built-in EMC filter.

Table 7.6				
OJ DVULH size	Motor cable length	Intended use	Immunity PDS in Second enviroment of EN/BS 61800-3	Emission PDS in category EN/BS 61800-3
5.5 kW & 7.5kW	> 5.0 m	First enviroment	Industrial level as per EN/BS 61000-6-2	Residential level as per EN/BS 61000-6-3

- In accordance with EN/BS 61000-6-3 – Adjustable speed electrical power drive systems. Part 3. EMC requirements and specific test methods. See table 8.1
- The OJ DVULH product line fulfils the "residential level" for emissions as per EN/BS 61000-6-3 and the "industrial level" for immunity as per EN/BS 61000-6-2 with up to 5 metre shielded motor cables.
- Longer motor cables can be used. Industrial level for both immunity and emissions can be fulfilled, depending on the cable capacity as well as the motor capacity.
- By reducing the motor cable length, it is possible to install up to 6 OJ DVULHs in the same unit with EN/BS 61800-3 C1 & C2 still being fulfilled.

7.7. **Harmonic distortion**
The OJ DV ULH is a Ultra Low Harmonic drive that comply with IEC 61000-3-2 Class A, IEEE 519 Special applications, which is the strictest standard for harmonic distortion.
The OJ ULH drive not only has an ultra low harmonic content at full load. The harmonic distortion is below 3% down to 10% max. load.

7.8. **RoHS compatible**
- Contains no hazardous substances according to the RoHS Directive.

8. **Product programme**
- The product programme contains two power sizes, 5.5kW and 7.5kW, see table 8.
- Enclosures are designated H4x.
- The enclosure is primarily made of die-cast aluminium.

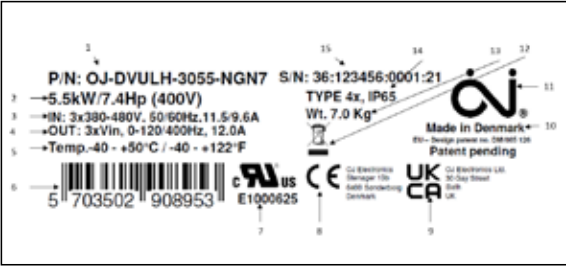| Table 8				
Product name	Enclosure	Power	Supply voltage	Dimensions (w, h, d)
OJ-DVULH-3055	H4x	5.5 kW / 7.4 hp	3 x 380-480 V	220 x 374 x 107 mm
OJ-DVULH-3077	H4x	7.5 kW / 10.5 hp	3 x 380-480 V	220 x 374 x 107 mm

Caution

Operating and motor parameters are set for connection to a supply voltage of 3x380-480V.
Motor parameters can be changed by the installer via the hand terminal (OJ-DV-HMI-35T), OJ-Drives-Tool or OJ-DV-PC-Tool. Configuration parameters can only be changed by the manufacturer.

9. Rating plate

9.1. The OJ DVULH is equipped with a silver-coloured rating plate.
See the example in fig. 9.1 and explanation in table 9.2.
Check that the information specified on the rating plate is as expected.

Figure 9.1

9.2. Rating plate, information and explanation

9.3. Explanation of product code
Each and every OJ DVULH is given its own product code during manufacture.
The product code (see table 9.3) gives precise information on the specific OJ DVULH.
The product code contains the following information:

Table 9.3			
Week number	Batch	Serial no.	Year
W W	B B B B B	S S S S S	Y Y
Week of production	Manufacturer's order number	Unit number	Year of manufacture

9.4. The product ID consists of a combination of 14 numbers and letters, each of which provides information about the specific product, see fig. 9.4 and table 9.4.

Table 9.2	
1	Product ID: see table 9.4
2	Shaft power at nominal voltage
3	Max. Input voltage voltage, Hz/A
4	Max. Output voltage, Hz/A
5	Temperature range, operating
6	Bar code
7	UL recognised, logo
8	CE approved, logo & European address
9	UKCA approved, logo & UK address
10	Country of manufacture
11	Manufacturer's logo
12	Disposal, logo
13	Weight
14	Enclosure rating
15	Product code: see table 9.3

Table 9.4	
1	Manufacturer's initials
2	
3	
4	Product type
5	
6	
7	Electrical connection
8	Controller power/size
9	
10	
11	
12	Optional module type
13	Cable entry
14	Integrated cooling fan
15	Classification
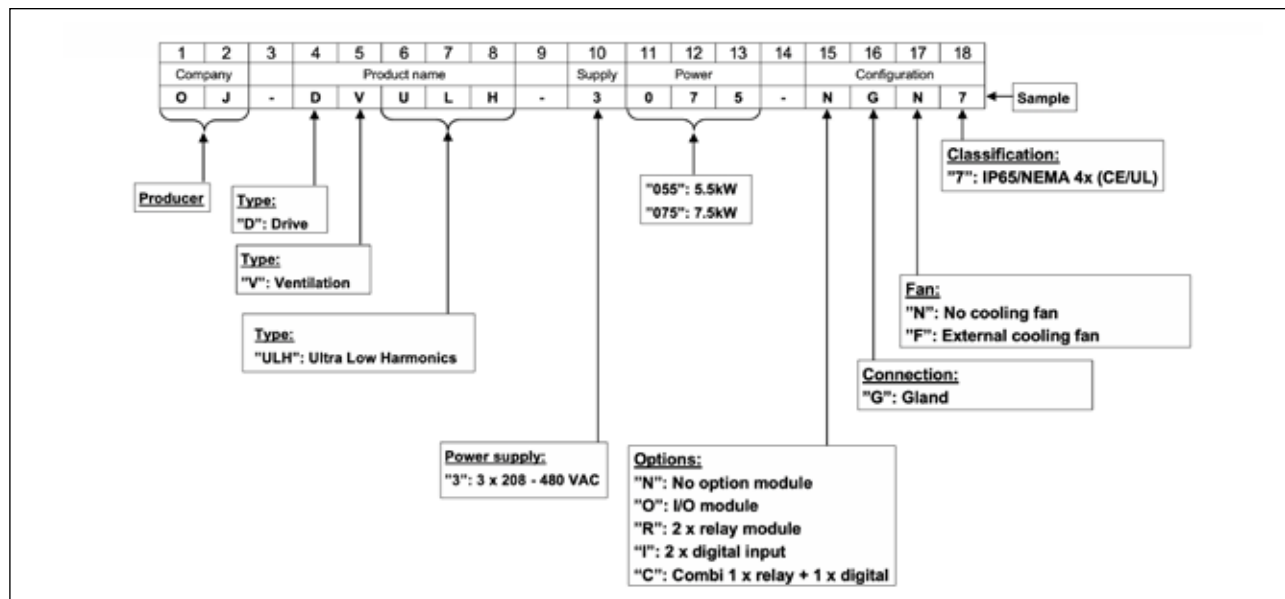
Figure 9.4

10. Exploded and dimensioned drawings

Figure 10.1

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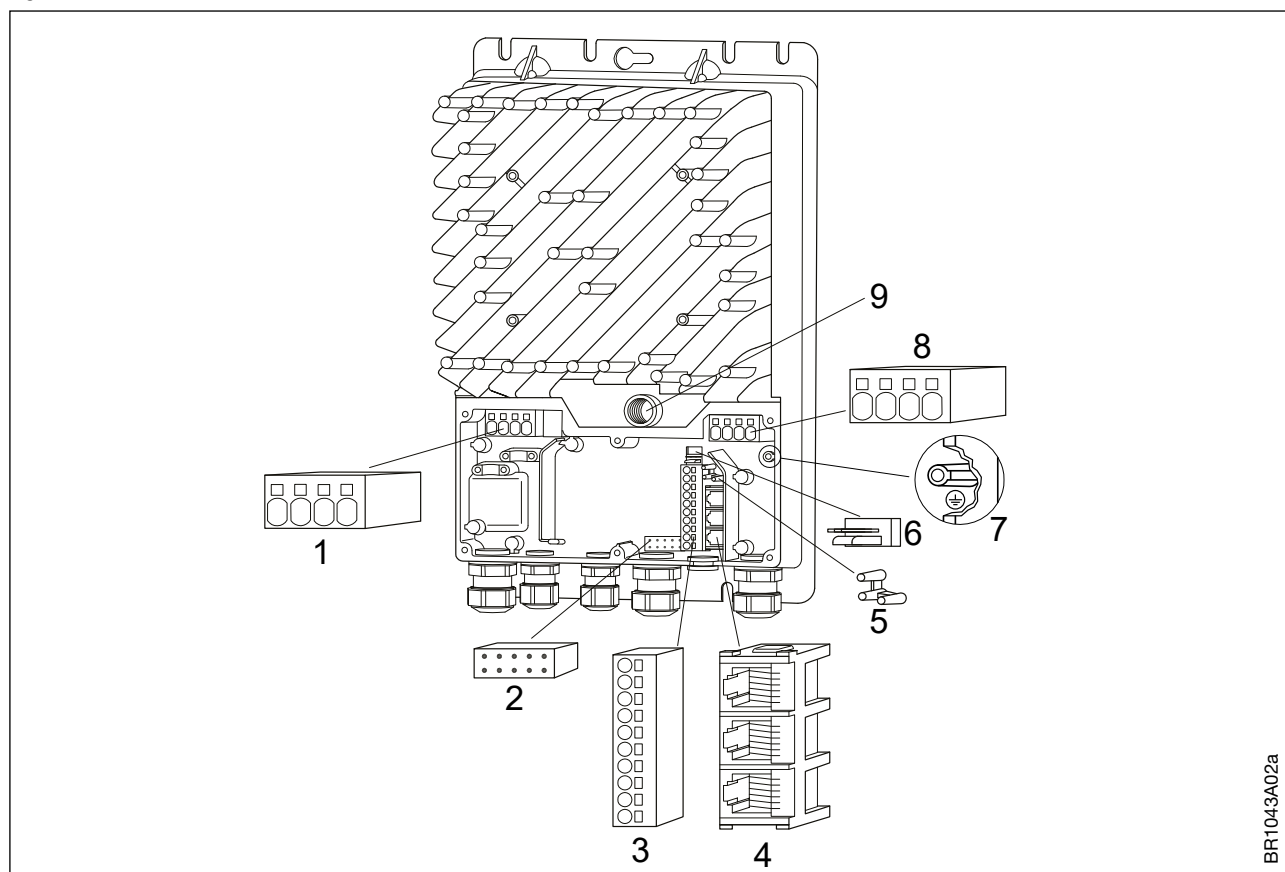
No.	Description	No.	Description
Table 10.1			
1	Motor connection terminals	6	External cooling fan connection
2	Connector for optional modules	7	Connector for the earth (PE) protective conductor
3	Terminal strip for RS-485 interface and A/D control signals	8	Power terminals (L1, L2, L3, ⏚)
4	RJ12 RS-485 (2 x Slave & 1 X Master)	9	Blanked M16 gland hole for the external fan cable
5	3-point stain relief for Modbus connector cable (ribbon cable)		

Dimensioned drawings

Figure 10.2
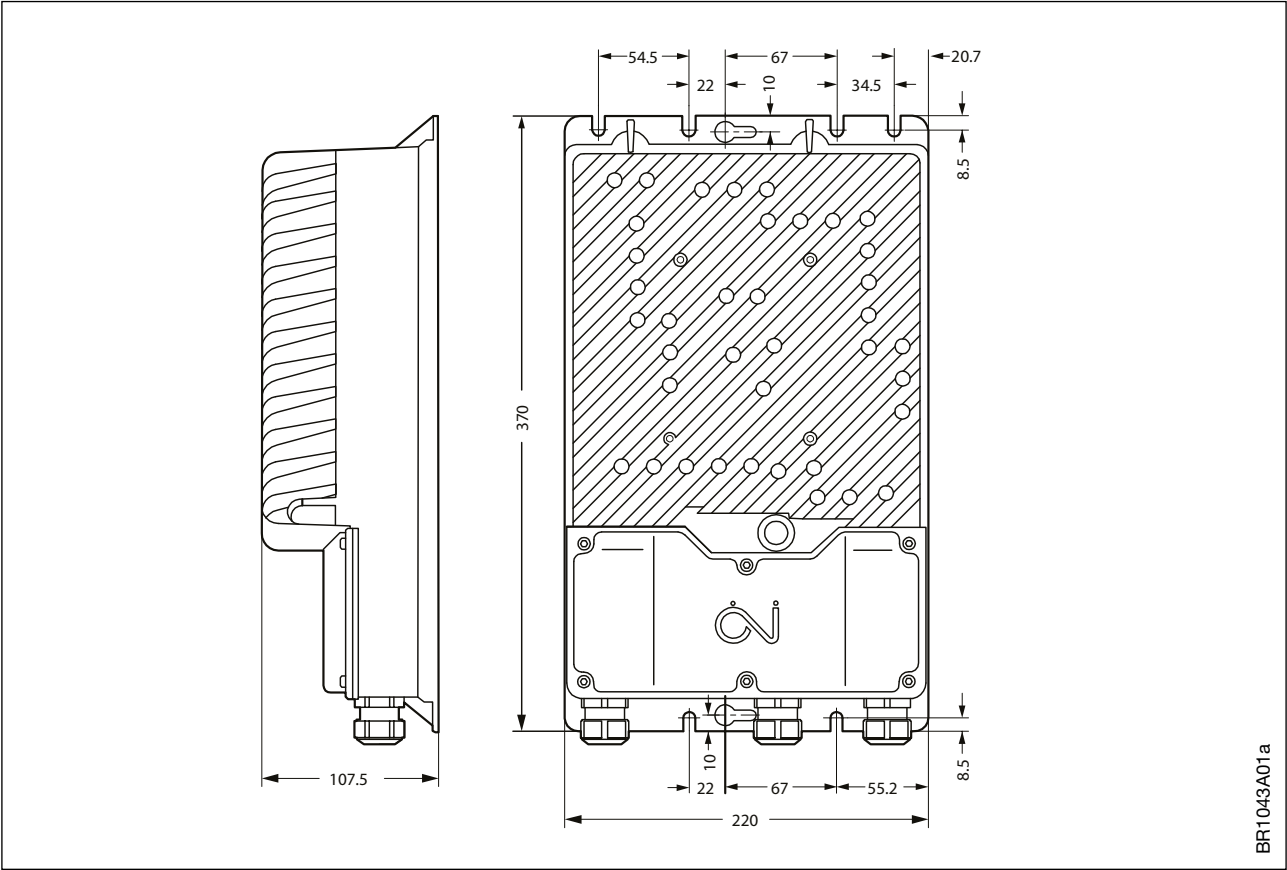
11. Mechanical installation

⚠️ **Warning** Incorrect mechanical installation may cause overheating and impaired performance.

- The OJ DVULH must only be installed by trained/experienced personnel.
- To ensure proper cooling of the OJ DVULH, it must be positioned in such a way that the passing air flow (> 3 m/s turbulent air speed) can cool the OJ DVULH cooling fins. (3 m/s turbulent air speed is equivalent to 6.5 m/s laminar air speed). If the OJ DVULH is installed in a reduced air flow (< 3 m/s turbulent air speed) or mounted outside a direct airstream, the output power (kW) will be reduced. External on-board cooling fan can be added.
- To facilitate future service and maintenance tasks, ensure that there is sufficient space around the unit after it has been installed.
- To achieve the specified enclosure rating, the cable glands must not point upwards (see fig. 11.1).
- To prevent water from entering the OJ DVULH via cables and cable glands, ensure that connection is performed in such a way that water is prevented from accumulating around the cable in the gland. See fig. 11.2.
- Check that the surface to which the OJ DVULH is attached is capable of supporting the entire weight of the unit.
- The OJ DVULH can be mounted vertically, horizontally or at an incline. See fig. 11.1).
- The OJ DVULH must be installed on a flat solid surface.
- To avoid unnecessarily long motor cables (max. 5 m), the OJ DVULH should be installed as close to the motor as possible.
- Use only the pre-cut installation holes/screw holes to secure the OJ DVULH in place.
- Dimensioned drawings, see figs 10.2 to 10.6.
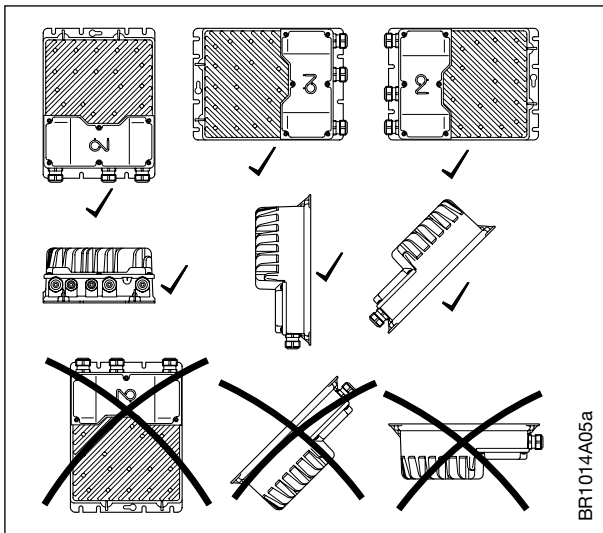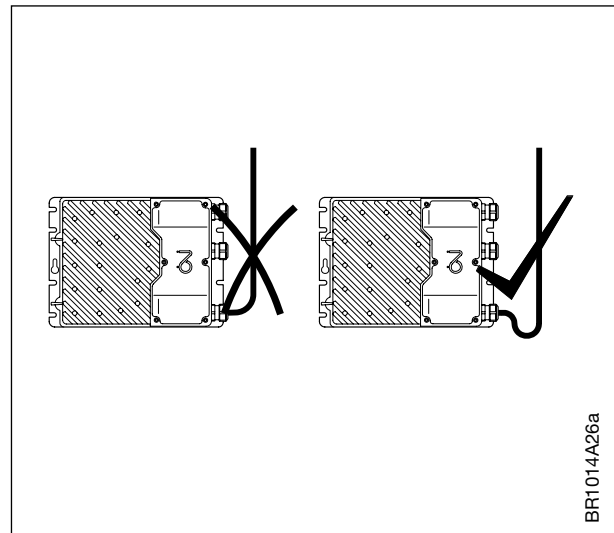- The OJ DVULH is not intended to be installed in direct sunlight.

Figure 11.1

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Figure 11.2

BR1014A26a

12. Electrical installation

⚠ **Warning**

- The OJ DVULH must only be installed and commissioned by trained/qualified personnel.
- Check that the data specified on the rating plate of the motor matches the data specified on the OJ DVULH rating plate.
- Incorrect electrical installation may cause a risk of severe or fatal personal injury.

⚠ **Advarsel**

12.1 Dangerous induced voltage (Windmilling)
- If natural drafts through the duct system cause the fan to rotate even when it has not received an operating signal (called windmilling), there is a risk that the motor will induce voltage on the OJ DVULH motor terminals, making them dangerous to touch.

ⓘ **Caution**

12.2 EMC-compliant installation
- Always use shielded cables as motor cables.
- Shielded cable is not necessary for I/O signal cables and RS-485 interface cables.
- Cable shields must always be electrically connected to the earthed product enclosure.
- Use the internal, factory-fitted cable clamps to ensure proper shield connection.
- Never convey mains voltage, motor connections and control signals in the same cable.
- The +24 VDC from the OJ DVULH is not intended to be used as power supply for third party products. If the +24 is used for power supply to third party products, the product might not fulfill the EMC regulations.

▤ **Note**

12.3 Short-circuit protection – Power supply
- Short-circuit protection for the supply side of the OJ DVULH is not provided together with the product.
- Correct short-circuit protection at the power supply input side on the OJ DVULH must always be used in accordance with local and international regulations.
- Short-circuit protection equipment must as a minimum have a tripping curve "C" conforming to IEC 60898-1.
- Short-circuit protection is supplied by the installer.

⚠ **Warning**

12.4 Personal protection - use of RCDs (TT-system), direct current (AC/DC) risk
This product can cause a DC current in the ground protective conductor in the event of a ground fault.
If the 3 phases to the OJ DVULH are not switched in at exactly the same time, then there will be a generated current in the earthing/ground conductor during the switching time until all 3 phases are connected.
Take notice of the following precautions:
- If a residual current device (RCD) is used for extra personal protection, use only an RCD of Type B on the supply side of this product (B type, for alternating and/or pulsating current with DC components and continuous fault current).
- RCDs of type B must comply with all provisions of IEC 61008/9
- Protective earthing of the OJ DVULH in combination with the use of RCDs must always be performed in accordance with the relevant local and international requirements, laws and regulations
- Failure to follow these precautions can lead to severe or fatal injuries to persons and animals.

⚠️ **Warning**

12.5 Potential equalisation

- There is a risk of electrical interference if the ground potential between the OJ DVULH and the air handling unit or duct differ from each other.
- An equalisation conductor must always be fitted to prevent potential differences between system components.
- Recommended cable cross section: 10 mm^2.
- Lugs should be used, and the equalisation conductor should be attached to the OJ DVULH enclosure via one of the screws used to mechanically install the unit.

⚠️ **Warning**

12.6 Grounding hazard (PE) leakage current hazard

Follow national and local regulations regarding protective earthing of equipment with a leakage current exceeding 3.5 mA.

The OJ DVULH technology causes switching at high frequency. This will generate a leakage current in the earth/grounding connection, ⏚ .

This ground leakage current is dependant on the different configurations, including RFI filtering, shielded motor cables and the motor type.

EN/BS/IEC 61800-5-1 (Power Drive System Product Standard) requires special emphasis because the leakage current in the OJ DVULH possibly exceeds 3.5 mA. See EN/BS 60364-5-54 paragraph 543.7 (Reinforced protective conductors for protective conductor currents exceeding 10 mA) for further information.

Earth/grounding connection must be made in one of the following 3 ways:

- When connecting only one (1) PE conductor, the minimum cross-section should be at least 10 mm^2, or
- When connecting 2 separate ground conductors, both should comply with the dimensioning rules.
- If 2 conductors are used, they must be connected to individual earth/grounding connectors in the OJ DVULH controller.
- External grounding connection. If the machine housing is approved as a grounding connector, then the OJ DVULH can be grounded to the machine.
- Grounding connectors must always be made in accordance with applicable local and international standards and directives.
- Follow all local and national electrical regulations for earth/grounding the OJ DVULH properly.
- Establish well-executed protective grounding for this OJ DVULH that has a leakage current exceeding 3.5 mA.
- A dedicated ground conductor is required for input power, motor power and control wiring.
- Use the clamps and connectors on the OJ DVULH for proper ground connections.
- Do not "daisy chain" the ground connection between 2 or more OJ DVULH controllers.
- Keep the ground conductor connections as short as possible.
- Always use shielded cables between the OJ DVULH and motor, to reduce electrical noise.
- Follow motor manufacturer wiring requirements.

📋 **Note**

12.7 Cable requirements

- All cables and conductors used in connection with the OJ DVULH must comply with local and national rules and regulations.
- The OJ DVULH product line fulfils the "residential level" for emissions as per EN/BS 61000-6-3 and "industrial level" for immunity as per EN/BS 61000-6-2 with up to 5 metre shielded motor cables. (15 kW is limited to up to 4 metre motor cables). Longer motor cables can be used but it is the installer's responsibility to ensure the standards in EN/BS 61000-6-2 are complied with. Industrial level for both immunity and emissions can be fulfilled, depending on the cable capacity as well as the motor capacity.

- A 6-core, unshielded, 30 AWG/0.066 mm^2 telecommunications cable can be used as a RS-485 interface cable.
- Generally, cable types with copper conductors are recommended.
- For recommended cable dimensions, see table 12.7.

Table 12.7					
Power cable *1					
	Cable gland	Cable diameter	Cable size, min.	Cable size, max.	Core sleeve/stripped min.
H4x	M20	6-12 mm	4x1.5 mm^2	4x4 mm^2	10-15 mm
Motor cable *1					
	Cable gland	Cable diameter	Cable size, min.	Cable size, max.	Core sleeve/stripped min.
H4x	M20	6-12 mm	4x1.5 mm^2	4x4 mm^2	10-15 mm
A/D control cable					
	Cable gland	Cable diameter	Cable size, min.	Cable size, max.	Core sleeve/stripped min.
H4x	M20	6-12 mm	2x2x0.7 mm^2	10x2x0.7 mm^2	10 mm
RS-485 interface round cable					
	Cable gland	Cable diameter	Cable size, min.	Cable size, max.	Core sleeve/stripped min.
H4x	M16	4-8 mm	3x2x0.7 mm^2	10x2x0.7 mm^2	10 mm
RS-485 interface ribbon cable					
H4x: Telecommunication cable/ribbon cable, 6-core, unshielded, 30 AWG/0.066 mm^2					

Note 1: Power and motor cables for OGF variants must be 90°C rated
Note 2: All cable dimensions are based on copper wires

12.8 Opening the OJ DVULH
- Check that the voltage supply to the OJ DVULH has been disconnected before opening the cover.
- Wait approx. 3 minutes after disconnecting mains voltage before removing the cover.
- The OJ DVULH is opened by loosening the six Torx 20 screws holding the plastic cover in place.
- Carefully remove the loosened cover.

12.9 Cable entries – cable glands – strain relief
- The factory-fitted cable glands should be used when inserting power, motor and control cables into the OJ DVULH.
- Remember to re-tighten the cable glands to ensure ingress protection and strain relief.
- The RS-485 interface cable entry features 3-point strain relief, which must be used.

12.10 Spring terminals
- If multi-core cables/leads are used, core sleeves/ end sleeves must always be used.
- The connection terminals are spring loaded and the stripped wire can be easily inserted into the terminal by carefully pushing the wire into the terminal without using tools. Alternatively, the terminal spring can be loosened by pressing it lightly with a screwdriver or similar implement. See fig. 12.10.
- Solid and multi-core cables/leads can be used.
- Stripped wire ends or end sleeves must be between 8 and 15 mm.
- Wires can be removed by carefully loosening the terminal spring by pressing lightly with a screwdriver or similar implement. See fig. 12.10.

Figure 12.10

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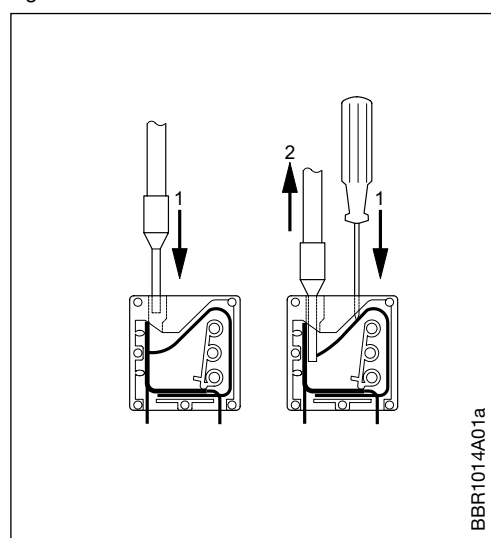
12.11 Terminal and connector overview

Figure 12.11
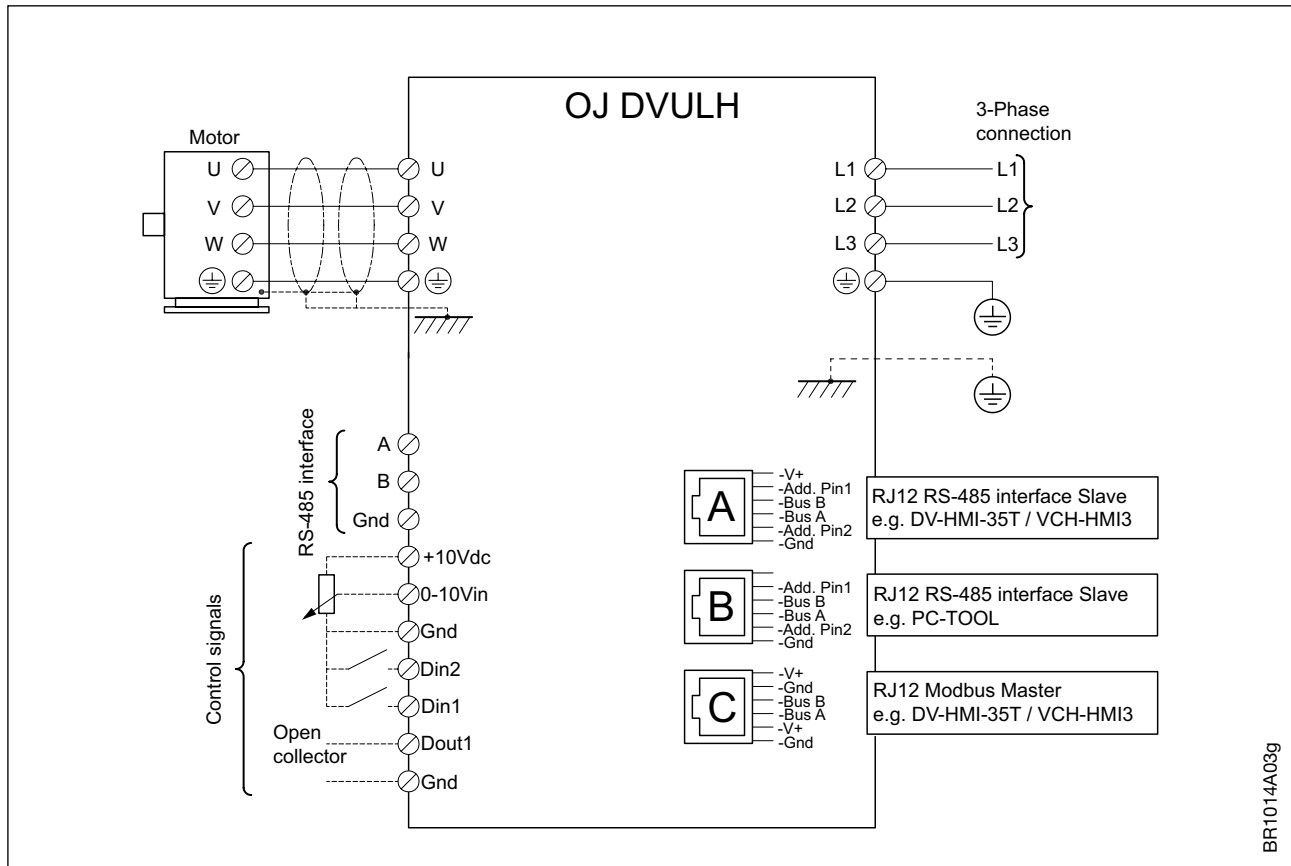
12.12 Motor connection

- The motor cable must be connected to the terminals marked "U", "V" and "W".
- When the stripped wire is properly inserted into the terminal (see section 12.10), the terminal tensions automatically with the correct torque.
- IMPORTANT! The motor cable must always be a shielded cable and the shield must be ended in the clamp intended for that purpose. See fig. 12.12.
- Remember to re-tighten the cable glands to ensure ingress protection and strain relief.

Figure 12.12
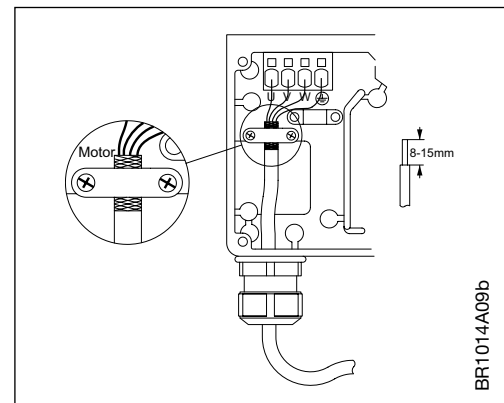
12.13 **Mains voltage connection**
- Connect the power cable to the terminals marked "L1", "L2", "L3" and "⏚". See fig. 12.13.1.
- Pay special attention to section 13.6 in these instructions, in particular:
  - Earth/grounding connection must be made in one of the following 3 ways:
    - When connecting only one (1) PE conductor, the minimum cross-section should be at least 10 mm2, or
    - When connecting 2 separate ground conductors, both should comply with the dimensioning rules.
    - If 2 conductors are used, they must be connected to individual earth/grounding connectors in the OJ DVULH controller.
   - External grounding connection. If the machine housing is approved as a grounding connector, then the OJ DVULH can be grounded to the machine.
    - Grounding connectors must always be made in accordance with applicable local and international standards and directives.
- It is recommended that the PE wire is 20 mm longer than the other wires in the cable. If the cable is accidentally pulled out of the OJ DVULH while there is voltage on the cable and terminals, the PE wire will then be the last to be disconnected. OJ DVULH is thus prevented from causing electric shock.
- When the stripped wire is properly inserted into the terminal (see section 12.10), the terminal tensions automatically with the correct torque.
- Remember to re-tighten the cable glands to ensure ingress protection and strain relief.

Figure 12.13.1
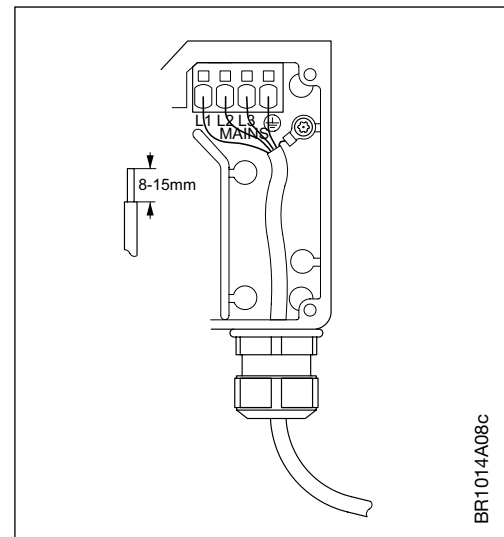
12.14 **RS-485 interface connection**
- The OJ DVULH uses two types of RS-485 interface controls: Modbus and BACnet MS/TP. See Modbus and BACnet MS/TP (BACnet MS/TP has a limited number of registers, compared to Modbus) Protocols for more information.
- The OJ DVULH is equipped with four RS-485 connections. Three RJ-12 connectors and designated spring terminals.
- On the spring terminals for control signals (A/D I/O), the terminals for connecting RS-485 interface are marked "Bus A", "Bus B" and "GND". See fig. 12.14.1.
  Note: "GND" must be used to ensure a proper signal.
- The RS-485 interface spring terminals are internally connected in parallel to the RS-485 interface pins in the RJ12 connectors marked "A" and "B".
- The three 3 RJ12 connectors are marked "A", "B" and "C".
- "A": RS-485 interface connection, slave, +24 V voltage in connector.
  - "B": RS-485 interface connection, slave,, no +24 V voltage in connector.
  - "C": RS-485 interface connection, master, external equipment, e.g. OJ-DV-HMI-35T / OJ-VCH-HMI3 in passive mode. See fig. 12.11.
  - A 6-core, unshielded, 30 AWG/0.066 mm^2 telecommunications cable or similar type of ribbon cable can also be used for RS-485 interface communication.

Figure 12.14.1
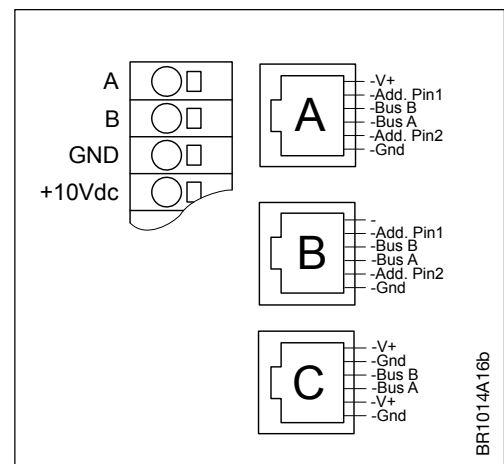
- Attach RJ12 connectors to both ends using a special-purpose tool.
- The OJ DVULH is ready to be installed in to either a daisy chain or star Modbus networks. Every OJ DVULH has a preinstalled RS-485 interface termination resistor of size 1 kΩ, which in most applications would be sufficient.
- Extra Modbus termination resistors are not to be used, except in installations where the RS-485 interface exceeds >100 m in a daisy chain RS-485 interface connection.
- If the Modbus exceeds 100 m, it might be necessary to install an extra Modbus termination resistor of size 180 Ω. This resistor is only to be installed in the last OJ DVULH in the chain.
- In Modbus star connection installations, a Modbus termination resistor is generally not to be used.
- BACnet MS/TP can only be installed in a daisy chain connection.

Note

IMPORTANT! RJ12 connectors must be fitted to the ends in such a way that both connectors have the same colour sequence as the cable. See fig. 12.14.2.

Figure 12.14.2

12.15 **A/D control signal connections**
- Connect A/D control signals to the terminal strip, see fig. 12.15.1
- For further information on using the spring terminals, see section 12.10.
- The function/programming of A/D inputs and outputs can be changed via Modbus.
  For further information on the Modbus protocols, see the OJ DV website at ojelectronics.com

- **+10Vdc** = Constant + 10 VDC for control signal and NOT intended as power supply for other purposes.
- Short-circuit proof also short-circuit between +24 VDC and +10 VDC
- Tolerance ± 3%

- **0-10V In** = Analogue 0-10V control input for speed
  - Potentiometer, electrical connection, see fig. 12.15.2.
  - Potentiometer: min. 500 Ω, recommended 4.7 kΩ
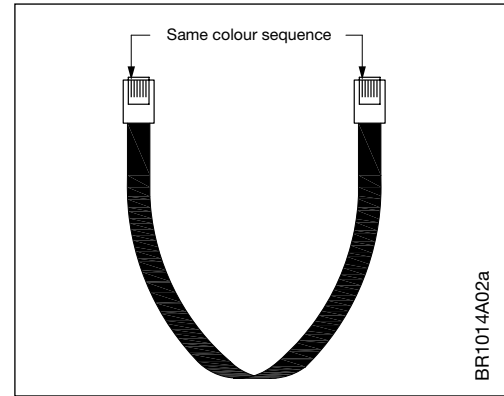 - Internal input impedance: 60 kΩ
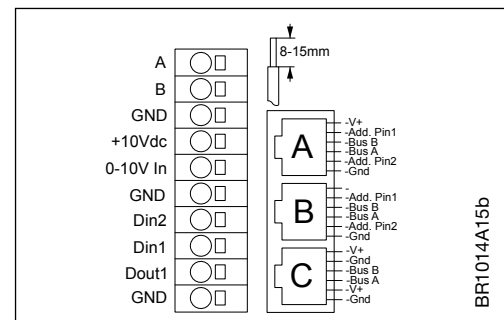 - External controller, electrical connection, see fig. 12.15.3
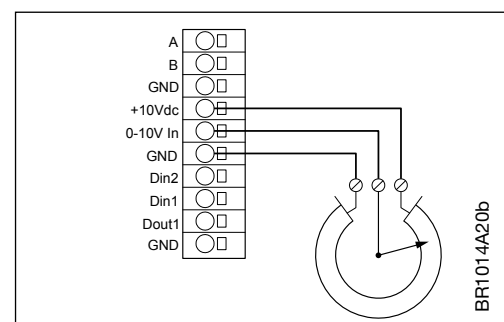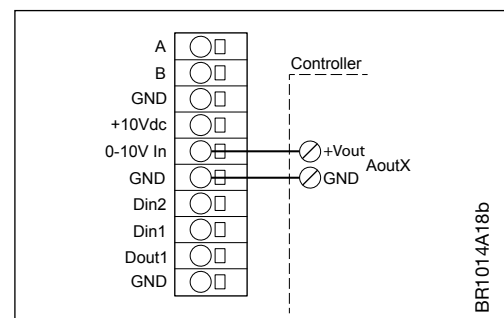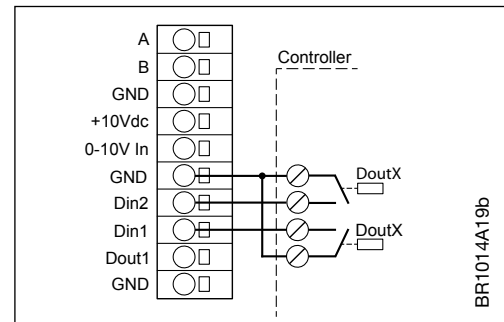
Figure 12.15.1

Figure 12.15.2

Figure 12.15.3

- **GND** = Ground (-)

- **Din2** = Alarm reset *(factory setting)*
  - Digital input
  - Internal input impedance: 60 kΩ
  - Electrical connection, see fig. 12.15.4

- **Din1** = Start/Stop *(factory setting)*
  - Digital input
  - Internal input impedance: 60 kΩ
  - Electrical connection, see fig. 12.15.4

- **Dout1** = Tacho Out; Open Collector *(factory setting)*
  - Digital output
  - Pull-up resistance range 1.5-22 kΩ
  - Pull-up voltage range 0-24 V DC
  - Pull-up current range 1-20 mA
  - Logical low for high stability after 1 ms
  - If EMC sensitive equipment is to be connected, then an external RC filter must be mounted with a time constant of 1 μs.
  - Electrical connection, see fig. 12.15.5

- **GND** = Ground (-).

Figure 12.15.4

Figure 12.15.5
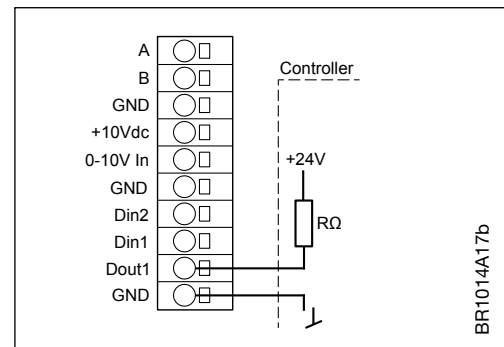
12.16 Closing of the OJ DVULH
- When all electrical connections have been correctly mounted, OJ DVULH can be closed again
- Be careful not to trap the wires when replacing the plastic cover.
- Fasten the plastic cover with the associated 6 TX20 screws.
- Tightening torque on the screws in the blue cover is 2 Nm. To ensure that the product constantly maintains the IP enclosure rating specified for the product, it must be ensured that the 6 TX20 screws are sufficiently tightened to the tightening torque. At the same time, it must be ensured that the tightening torque is not so high that the blue plastic cover is deformed.

13. Checklist – mechanical and electrical installation
- Before the OJ DVULH is energized for the first time, installation and connection must be checked.
- Use the table below as a checklist.

Item to be checked	Description of check	√
Completion	Check that the entire installation is ready to be commissioned, both electrically and mechanically, before energizing the installation.	
	Check that no people or animals are present in the vicinity of moving parts.	
Product conformity	Check that the mains voltage on the supply terminals corresponds to the rated input voltage of the OJ DVULH.	
	Check the rating plates of the motor and OJ DVULH to ensure that the units have been sized correctly.	
Mechanical installation	Check that the OJ DVULH is correctly and securely attached to a flat surface. See Section 12 in this manual.	
	Check that there is a free, unobstructed passage of air to the cooling fins. See Section 12 in this manual.	
	Check that the blue plastic cover on the OJ DVULH is correctly mounted and that all screws are sufficiently tightened before switching the power on to the product. Tightening torque on the screws is 2 Nm.	
	Check that all unused cable glands and other unused openings are appropriately blanked off in accordance with the applicable enclosure rating.	

Item to be checked	Description of check	√
Ambient conditions	Check that requirements on the surrounding environment have been met. Check that temperature and other environment specifications are observed. *See technical specifications, Section 25 in this manual.*	
Cabling	Check that all cabling has been fitted correctly and that motor and control cables are kept apart in separate cable conduits.	
	Check that the motor cable is a shielded cable and that its length is no longer than 5 metres.	
	Check that all cables are securely attached and relieved of tension and torsion.	
Electrical installation	Check that cables have been correctly inserted into the OJ DVULH and that the cable glands have been correctly tightened.	
	Check that the OJ DVULH voltage supply terminals have been connected to the correct mains voltage level.	
	Check that all cables are correctly ended and securely attached.	
	Check that all cables are free of visible damage throughout their length.	
	Check whether there are any loose connections, which may cause overheating and serious damage to the product and property.	
Mains voltage	Check that the mains voltage wires have been correctly fitted to the supply terminals: one-phase on terminals "L", "N" and "⏚" and three-phase on terminals "L1", "L2", "L3" and "⏚".	
	Check by means of voltage measurement that there is the correct voltage on the terminals.	
	Check short-circuit protection and supplementary protection.	
Motor connection	Check that motor cables are correctly connected to "U", "V", "W" and "⏚" – and check that tightening torque is correct on the spring terminals of the motor.	
Control and signal wires	Check that control cables are ended correctly and securely attached.	
	Check that both ends of the RS-485 interface cable have been attached to the correct connectors.	
Shield	Check that the motor cable shield is ended correctly and use continuity measurement to check that the shield is connected to an active earth connection at both ends.	
Fuses and circuit breakers	Check that active short-circuit protection has been correctly fitted and sized.	
	Check that all safety equipment is operative and set correctly.	
Earthing	Check that all earth connections in the motor and the OJ DVULH are correctly connected and free of oxidation.	
	Check by means of continuity measurement that the earth connection is active and that the contact resistance complies with applicable local and international directives and regulations.	

14. OJ-DV-HMI-35T: connection and functions

- The OJ DVULH range can be connected to an HMI-35T hand terminal via RS-485 interface RJ12 connector "A" and "C". See fig. 14.1.
- If an HMI-35T is connected to terminal "A", it will act as a master to the OJ DVULH.
- Only one master at a time can be connected to the RJ12 connectors marked "A" and "B". It is thus not possible to connect both a hand terminal to connector "A" and an active Modbus communication cable to connector "B" at the same time.
- When connected to terminal "C" the OJ-DV-HMI-35T will be passive to the OJ DVULH acting as a screen for the DVULH. If the Modbus communication is lost between the BMS controller and OJ DVULH or manually set to "Manual override", the OJ-DV-HMI-35T will be able to take over control of the OJ DVULH.

Figure 14.1

BR1014A11c
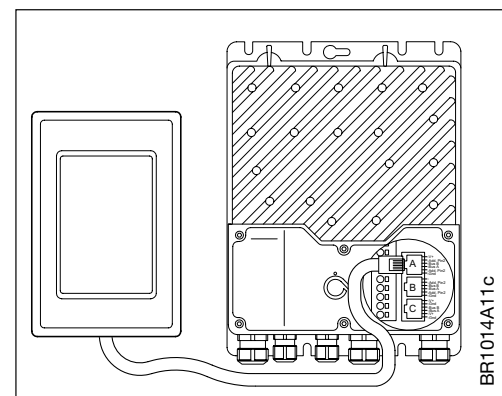
  Note

For further information, please refer to separate OJ-DV-HMI-35T instructions or contact OJ Electronics A/S.

15. OJ-DV-PC-Tool – connection and functions

- The OJ DVULH range can be configured using OJ-DV-PC-Tool, which must be connected to RS-485 interface RJ12 connector "B" or the spring terminals A, B and GND.
- OJ-DV-PC-Tool allows motor and controller parameters to be viewed and set, including:
  - Status: Control and operating parameters for connected OJ DVULH
  - Setup: Setting application parameters
  - Alarm: Read-out of alarm log for connected OJ DVULH
  - Modbus: Changing Modbus settings for and initiating BACnet SM/TP control for the OJ DVULH
  - About: Read-out of software version no. and type for connected OJ DVULH
  - Config: Configuration of motor, input and output settings
  - Log data: Read-out of log files
  - Firmware: Updating firmware and motor/fan/user configuration
  - Motor: Configuring motor parameters
  - Fan: Configuring fan parameters
  - Hardware: Configuring OJ DVULH hardware

OJ-DV-PC-Tool is used solely by fan and system manufacturers.
For further information on OJ-DV-PC-Tool operation and menus, please refer to separate OJ-DV-PC-Tool instructions or contact OJ Electronics A/S.

16. Optional modules – connection and function

- Various optional modules can be connected to OJ DVULH, providing extra versatility where the unit is to be built into systems and applications that require additional inputs and outputs.

For further information on the possibilities offered by optional modules, contact OJ Electronics A/S.

17. Functions

17.1 Analogue/digital control

- The OJ DVULH can be controlled via analogue/digital (A/D) inputs or via Modbus or BACnet protocol.
- The factory setting is analogue/digital (A/D) control.
- Connect A/D control signals to the terminal strip, see section 12.15.1.

0-10V In
- Is used to control motor speed in relation to a 0-10V signal.

4-20mA
- Is used to control motor speed in relation to a 4-20mA signal. Note: an OJ-DV-IO-Module is required for this function

Note

- With A/D control, functions such as alarm read-out and acknowledgement are still possible via RS-485 interface even though "Protocol control" is not activated.
- The relationship between the 0-10V control signal and motor speed depends on the settings for min./max. speed and ramp up/ramp down times. See figs 17.1 and 17.2.
- The "+10Vdc", "0-10V In" and "GND" terminals can be connected to a potentiometer, see electrical connection in fig.12.15.2.

The function of the digital inputs and outputs has been defined by OJ Electronics A/S as follows:
- Din1 = Start/Stop (1 = Start)
- Din2 = Alarm reset (1 = Alarm reset)
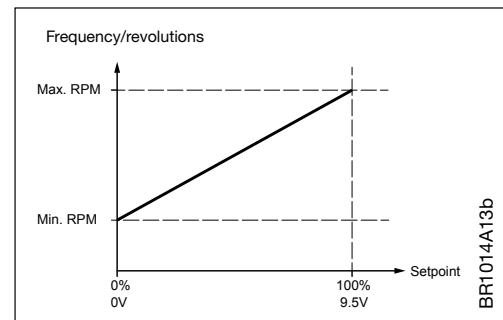- Dout1 = Tacho Out (1 pulse per motor revolution)

Note

The digital inputs and outputs can be given alternative functions via Modbus protocol.

Relationship between control signal (0-10V In) and speed – see fig. 17.1.

The control signal regulates motor speed between the set minimum and maximum speeds and the set ramp times – see fig.17.2.

Figure 17.1

17.2 **RS-485 interface control**
- The OJ DV can be controlled via Modbus or BACnet MS/TP commands according to the RS-485 interface protocols. (Note: BACnet MS/TP does not have the full range of commands as Modbus).
- BACnet MS/TP needs to be selected via Modbus or OJ-DV-PC-Tool.
- Control of motor speed via RS-485 interface communication is factory disabled.
- If the OJ DVULH is to be controlled via RS-485 interface, Coil Stat Bit register 8 must be set to "0" = "Protocol control".
- Other functions, such as alarm read-out and

  acknowledgement, are still possible via RS-485 interface even though "Protocol control" is not activated.
- *NOTE! See OJ Electronics OJ DV web page for the RS-485 Protocols*

Figure 17.2

17.3 **Switching frequency**
Switching frequency is crucial in determining the amount of audible acoustic noise emitted by the OJ DVULH.
The higher the switching frequency, the less audible noise will be emitted by the OJ DVULH. At the same time, however, internal losses will be increased, reducing efficiency.
The OJ DVULH can be set to operate constantly with a switching frequency of either 4 kHz or 8 kHz, or it can be set to change switching frequency automatically depending on motor speed (AUTO setting). Switching frequency (switching mode) is set via Modbus:
- Setting "4kHz" = Constant 4kHz switching frequency
- Setting "8kHz" = Constant 8kHz switching frequency
- Setting "AUTO" = Switching frequency is changed automatically:
  - At motor speeds higher than 60% of rated speed, switching frequency is changed to 4 kHz
  - At motor speeds lower than 50% of rated speed, switching frequency is changed to 8 kHz
  - The higher set point can be changed using OJ-DV-PC-Tool. The lower set point is automatically set to 10% less.

17.4 **Braking power**
- The electronics within the OJ DVULH can as a starting point supply braking power corresponding to its own consumption. It is expected that an air flow capable of maintaining typically up to 30% of nominal fan speed can be braked by this function.

17.5 **Fire mode**
Fire mode designates a function in which the OJ DVULH is kept in operation by an emergency program which disables the alarm monitor.
Among other things, the function can be used in connection with smoke extraction from a burning property. When fire mode is activated, an extraction fan will continue to remove smoke from the property for as long as possible. The fire mode function can be activated via RS-485 interface or digital input.
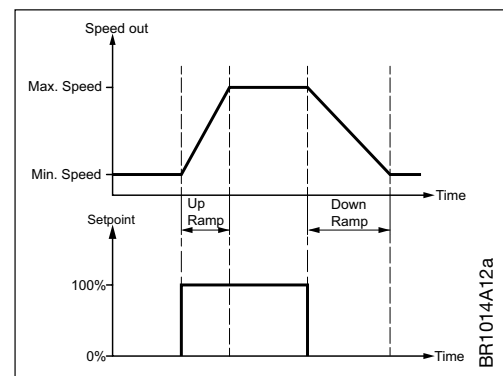
In fire mode, the OJ DVULH is able to maintain operation for at least an hour, even when the OJ DVULH and the fan motor are overheated (max. 70°C).

There are three different fire mode to choose from; normal-, max-, and analog fire mode.

Normal fire mode

All warnings and alarms in the OJ DVULH will be ignored and the OJ DVULH output to the motor remains the same value as it was just before the fire mode condition was activated. If the OJ DVULH is controlled via RS-485 interface and there is a communication failure when in normal fire mode, the output signal to the motor will have the same value as just before the RS-485 interface communication was disconnected. The DV continues to deliver voltage & current to the motor as long as possible until the OJ DVULH is powered off and the digital input go back to the normal position.

If the motor is not operating when normal fire mode is activated, the motor will remain stopped.

Max fire mode

All warnings and alarms in the OJ DVULH will be ignored and the OJ DVULH will go to the max. RPM.

The motor will continue to work this way for as long as possible or until the OJ DVULH is powered off or the digital input returns to the normal position. Even if the motor is not operating when fire mode is activated, the output to the motor goes to the maximum rotation speed defined.

Analog fire mode

If the 0-10V analog input detects 9V or higher, fire mode is activated even if the analog input is reduced below 9V again. All warnings and alarms in the OJ DV will be ignored and the motor will run at max. speed as long as possible or until the OJ DV is powered off and the analog input is below 9V again.

17.6 **Electronically commutated mode (EC mode) – for PM**

The OJ DVUHL factory-set to frequency converter mode for standard asynchronous induction motors (AC-IM) and the control mode is 0-10 VDC input.

This can be changed using the OJ-DV-PC-Tool or OJ-DV-HMI-35T (Hand terminal).

The difference between an AC-IM motor and a PM-SM is basically the rotor.

In the PM-SM motor, the windings in the rotor are replaced with permanent magnets, but the control system has to be and is very different, using generated configuration files, which are specific to the motor and fan (MCF and FCF). These files are generated in the OJ-DV-PC-Tool with Engineering Access Level. Due to the permanent magnets in the rotor, they will induce voltage in the stator windings as they rotate and as a result also voltage back to the controller. This is what is called back EMF (EMF = electromotive force) and describes an important and special characteristic of the motor. The controller has to be able to handle this back EMF and that is why you cannot control a PM-SM motor with an OJ DVUHL controller in frequency converter mode.

Before operation, select and load the correct fan and motor parameter files using the OJ-DV-HMI-35T or OJ-DV-PC-Tool. It is the installer's responsibility to enter the correct control and motor parameters.

Pay special attention to the following parameters:

Minimum rpm	Even if the control signal is e.g. 0% or 0.0V and the OJ DVUHL has an activated start signal, the motor will not run slower than the value in this parameter.
Maximum rpm	Even if the control signal is e.g. 100% or 10.0V and the OJ DVUHL has an activated start signal, the motor will not run faster than the value in this parameter.
Ramp-up time	Ramp-up time is the time (in seconds) given for the motor revolutions to increase from minimum to maximum.

Pay special attention to the following parameters:

Ramp-down time	Ramp-down time is the time (in seconds) given for the motor revolutions to decrease from maximum to minimum.
Switch frequency	Switch frequency is a parameter that has an influence on the efficiency and the audible noise from the connected motor and/or the OJ DVUHL controller. In the OJ DVUHL it is possible to select "Auto", "4 kHz" and "8 kHz". The higher the switch frequency, the lower the audible noise from the OJ DVUHL controller system, but the consequence of lower audible noise is decreasing efficiency of the OJ DVUHL controller system. In "Auto" the OJ DVUHL will automatically switch between "4 kHz" and "8 kHz". During start-up from 0 - 60% speed, the switch frequency will be "8kHz" and this will make for less audible noise from the connected motor and/or the OJ DVUHL controller. When the speed has increased and passes 60%, the switch frequency will then switch to "4 kHz". The noise from the fan and airflow will now drown out the audible noise from the OJ DVUHL controller system. In the speed-down sequence, the OJ DVUHL will switch to "8 kHz" when the speed of the motor passes 50% downwards. It is also possible to select a fixed switch frequency of "4 kHz" or "8 kHz". In the speed-down sequence, the OJ DVUHL will switch to "8/10 kHz" when the speed of the motor passes 50% downwards. It is also possible to select a fixed switch frequency of "4 kHz" or "8/10 kHz".

For further information about parameters in the OJ DVUHL, see OJ DVUHL RS-485 interface protocols.

17.7   Jumping frequency

In an application with resonance problems, it is possible to avoid the frequencies that trigger the resonance.
By programming the OJ DVUHL, it is possible to avoid three different frequency bands.
1. Low1 rpm/Hz – High1 rpm/Hz: the rpm/Hz between Low1 and High1 will be avoided.
2. Low2 rpm/Hz – High2 rpm/Hz: the rpm/Hz between Low2 and High2 will be avoided.
3. Low3 rpm/Hz – High3 rpm/Hz: the rpm/Hz between Low3 and High3 will be avoided.

These three low and high rpm/Hz frequency bands must be configured via PC Tool, UDF or RS-485 interface.

Example: There is resonance in the application at 250 rpm. Program Low1 = 245 rpm & High1 = 255 rpm, and the OJ DVUHL will not let the motor run at a rpm between 245 and 255 rpm in other words; the OJ DVUHL jumps over the troublemaking 250 rpm.

Tip: If there are problems with resonance at a specific rpm, there may also be problems at double the rpm. If so, use the second frequency band to avoid that too.

17.8   Dual speed digital input

If only two speeds are needed, dual speed can be controlled by using digital input. When the chosen digital input is open the low speed is selected and the high speed when closed. High and low speeds must be configured via Modbus or OJ-DV-PC-Tool.

18.   Built-in protection

- If the temperature inside the OJ DVULH exceeds 95°C, the OJ DVULH will attempt to reduce its internal heat generation by reducing motor speed (rpm).
- The OJ DVULH has built-in current limitation for the protection of motor and cables and cannot therefore supply more current than it is set to.
- In the event of lacking phase on the supply input, the OJ DVULH will reduce speed and activate a non-critical alarm.
- The OJ DVULH motor output terminals are short-circuit protected against phase-to-phase short

circuiting.

19.   Alarms

The OJ DVULH has a built-in warning and alarm monitor, which monitors optimal fault-free operation and triggers a warning or alarm if operating or performance problems are observed.

Warnings are "non-critical" alarms that reduce motor performance, whereas alarms are "critical" and will stop the OJ DVULH. Once the alarm situation passes, the alarm will automatically reset and the OJ DVULH will restart.

If the maximum number of restarts (factory setting: 5 times/60 min.) is exceeded, the alarm must be reset manually. The alarm can be reset by means of a RS-485 interface command, via an OJ-DV-HMI-35T or it will automatically reset if the power is disconnected for longer than 60 seconds.

Warnings and alarms can be read via the OJ-DV-HMI-35T or RS-485 interface.

Alarm overview, see table 19.1.

Table 19.1

| Alarm overview	Trigger	Alarm priority	Motor operation/ response
Supply voltage too low	✓ Supply voltage to the OJ DVULH is too low. ✓ The OJ DVULH is mistakenly connected to mains voltage 3 x 230VAC.	**Alarm**	"RP"
Supply voltage too high	✓Supply voltage to OJ DVULH is too high.	**Alarm**	"SA5"
The motor's power use is too high	✓ Short circuit in motor cable. ✓ Short circuit in one or more motor windings.	**Alarm**	"SA5"
Internal temperature in the OJ DV too high (>95 °C)	✓ Cooling of the OJ DVULH enclosure too low. ✓ Insufficient air circulation around the OJ DVULH. ✓ Air temperature around the OJ DVULH is too high.	**Warning**	"RP"
Phase error; one phase disconnected (L1, L2, L3)	✓ Missing phase in supply voltage to the OJ DVULH ✓ Large imbalance in supply voltage.	**Warning**	"RP"
Blocked rotor	✓ The rotor is unable to rotate due to a mechanical blockage of the rotor or fan.	**Alarm**	"SA5"
Motor power has reached it's limit	✓ The OJ DVULH has reached the limit for maximum output power. ✓ The connected motor is larger than allowed for the chosen OJ DVULH. ✓ The load is too big for the connected motor.	**Warning**	"RP"
Running in the wrong direction	✓ Windmilling in the opposite direction during the start up process.	**Alarm**	"SA5"
Fault in internal EEPROM circuit	✓ Incorrectly chosen configuration file - tried to download a configuration file which is not contained in the OJ DVULH. ✓ The OJ DVULH is defective.	**Warning**	"RP"
Phase error in motor supply (U, V, W)	✓ One or more motor phases / motor cables is disconnected. ✓ One or more motor windings is disconnected.	**Alarm**	"SA5"
Internal communication fault	✓ During the process of updating the MOC configuration file, communication was inadvertently disconnected. ✓ If the alarm goes off during normal operation, it usually indicates a defective OJ DVULH.	**Alarm**	"SA5"
Ripple voltage too high	✓ Imbalance on voltage supply.	**Warning**	"RP"
External 24VDC supply overloaded.	✓ Overloading or short circuit on +24V voltage supply.	**Warning**	"RP"

Abbreviations:
"RP"=Reduced performance
"SA5"=Motor stops after 5 restarts caused by same fault within 60 min

20. LED indications

- The OJ DVULH is equipped with a two-colour LED which indicates operating status.
- The LED is located on the underside of the OJ DVULH beside the entry for the mains cable.
  See fig. 20.1.
  - Lights constantly green when mains voltage is connected
  - Flashes green when RS-485 interface communication is active
  - Lights constantly red when at least one critical alarm is active
  - The LED can be set (Show alarm on LED) by Modbus or OJ-DV-PC-Tool to flash in a sequence to indicate where the Error has arisen.
    1 Flash = Supply issue
    3 Flashes = Internal DV issue
    5 Flashes = Motor issue
  - Flashes red when at least one non-critical alarm is active

Figure 20.1
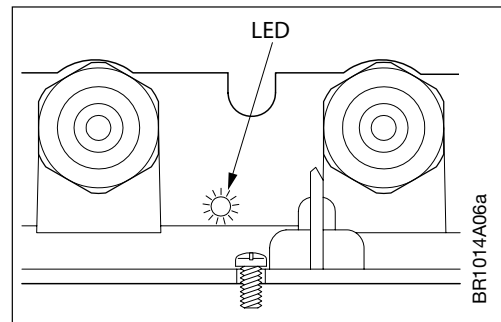
21. Modbus addressing of the OJ DVULH

Modbus addressing of the OJ DVULH can be accomplished in two different ways.
- Via the addressing pins of the "A" or "B" connectors – see fig. 12.14.1 and table 21.1.

Table 21.1

Add. Pin. no.	0X36 (54 dec)	0X37 (55 dec)	0X38 (56 dec)	0X39 (57 dec)
Add.Pin1	⏚̸	⏚	⏚̸	⏚
Add.Pin2	⏚̸	⏚̸	⏚	⏚

⏚̸ = No connection between "GND" and Add.Pin1/ Add.Pin2

⏚ = Connection between "GND" and Add.Pin1/ Add.Pin2

- Via OJ-DV-PC-Tool, where the OJ DVULH can be set to other Modbus addresses – *see instructions for OJ-DV-PC-Tool.*

- Modbus protocol for the OJ DVULH can be found on OJ DVULH web page.

Modbus communication

- OJ DVULH is supplied with the factory setting (see table 21.2):

Table 21.2

	Setting range	Unit	Factory settings
Address	1-247	n/a	**54 dec**
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2	kbs	**38.4 kbs**
Parity	None, Odd, Even	n/a	**None**

Table 21.2			
Stop bit(s)	One, Two	n/a	ONE
Communication timeout	0-240	Sec.	10

- OJ DVULH supports the following commands (see table 21.3):

Table 21.3	
Function code	Description
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Force Single Coil
6	Preset Single Registers
8	Diagnostics. Sub-function 00 Only – Return Query Data (loop back)
15	Force Multiple Coils
16	Preset Multiple Registers

- Values that are written to the OJ DVULH via Modbus are rounded off to the nearest valid value.

Detection of active Modbus
- The OJ DVULH automatically detects valid Modbus communication on the Modbus inputs (RJ12 connector or "A" & "B" terminals on the terminal strip).
- The OJ DVULH will first detect on the communication parameters: ID 54, 38.4 ,None, One
- Alternative communications parameters can be set using the Modbus register.
- After 10 seconds without receiving a valid Modbus request with the default parameters, the DVULH will try to detect a Modbus request with the alternative parameters.

22. BACnet MS/TP

BACnet MS/TP can only be used for the operation of the OJ DVULH. When the application specific configurations (Digital Inputs etc.) needs to be set in the OJ DVULH, only the Modbus interface or OJ-DV-PC-Tool can be used.

BACnet communication parameters
BACnet communications parameters can be set using OJ-DV-PC-Tool or Modbus

Table 22			
	Setting range	Unit	Factory settings
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2	kbs	115.2 kbs
BACnet MAC	0-127	1	0
BACnet MaxMaster	1 - 127	1	1
Device Object ID	0 - 4194302	1	0

The OJ DVULH can be configured to automatically detect valid BACnet MS/TP communication on the RS-485 interface RJ12 connectors "A" & "B" or sprint terminals 1(A), 2(B) and 3(GND)."
- After 10 seconds without detecting an active BACnet MS/TP network, the OJ DVULH will try to detect a different communication protocol.

23. Maintenance

23.1. The OJ DVULH is maintenance free under normal operating conditions and load profiles.
23.2. The cooling fins must be kept free of dust, dirt and other foreign matter so that air can pass freely over them. Deposits of dust, dirt or other foreign matter on and between the cooling fins will prevent cooling of the OJ DVULH and thus impair performance.

Caution

23.3. The cooling fins may become very hot. (Max. 95°C under normal operating conditions.)

Warning

23.4. The OJ DVULH cannot be repaired on site. Never attempt to repair a defective unit. Contact your supplier to obtain a replacement.

23.5. Additional technical data are available on request from OJ Electronics A/S.

24. Troubleshooting

Warning

24.1. Before opening the OJ DVULH, the mains voltage must be disconnected for at least 3 minutes to ensure there is no risk of dangerous residual currents in electronic circuits or capacitors.

24.2. If natural drafts through the duct system cause the fan to rotate even though it has received no operating signal, there is a risk that the motor will induce voltage on the OJ DVULH motor terminals, making them dangerous to touch.

24.3. Troubleshooting when the OJ DVULH is controlled via A/D signals:

Symptom	Cause	Action
Motor inoperative	Lacking supply voltage	Check the voltage supply to the OJ DVULH terminals "L" and "N" on 230V models (H1) or terminals "L1", "L2" and "L3" on 3x400V and 3x230V models (H3…H5). (Nominal supply voltage is stated on the rating plate.)
		Check whether short-circuit protection has been activated.
		Check that the voltage supply to the OJ DVULH has not been cut off by other components.
	Poor electrical connections	Check electrical connections.
	Wrong motor for the OJ DVULH setup	Check that the correct motor settings have been read into and stored in the OJ DVULH setup.
	Lacking operating signal	A/D control: Check that the OJ DVULH can receive an operating signal. With A/D control, the OJ DVULH must have a signal connected to the "Start/Stop" input – digital input Din1 or Din2 depending on the setup.
	Lacking 0-10VDC control signal	Check that an operating signal is connected to "0-10V In".
		Potentiometer control: Check that the potentiometer is correctly connected to terminals "+10Vdc", "0-10V In" and "GND" on the terminal strip.
	Active alarm	Read out active alarms and remedy their cause.
	The motor has been stopped 5 times by the built-in motor protector because of overloading or other alarm	Reset the alarm by short-circuiting the "Alarm reset" input – digital input Din1 or Din2 depending on the setup. The alarm can also be reset by disconnecting the power supply to the OJ DVULH and reconnecting it after approx. 60 seconds.
	Defective OJ DVULH controller	Replace the OJ DVULH. Never attempt to repair a defective OJ DVULH controller. Contact your supplier for replacement/repair.
	Defective motor	Replace motor.
Motor running in wrong direction	Wrong phase sequence in motor cable	Interchange two phase wires on the motor or the OJ DVULH terminal strip.

Symptom	Cause	Action
The OJ DVULH noisier than acceptable	Switching frequency too low	Increase switching frequency. 0 = Auto 1 = Low = 4 kHz 2 = High = 8 kHz Increasing switching frequency increases losses within the OJ DVULH, thus reducing efficiency. The OJ DVULH switching frequency can be changed via OJ-DV-HMI-35T, Modbus or OJ-DV-PC-Tool.
The OJ DVULH cuts out due to an alarm	At least one alarm active	Use OJ-DV-HMI-35T to view the alarm and determine which alarm has stopped the controller/motor.
		Reset the alarm by short-circuiting the "Alarm reset" input – digital input Din1 or Din2 depending on the setup. The alarm can also be reset by disconnecting the power supply to the OJ DVULH and reconnecting it after approx. 60 seconds.
	The alarm is re-activated after reset	Use OJ-DV-PC-Tool to view the alarm and determine which alarm has stopped the controller/motor.
		Remedy the cause of repeated alarm activation.

24.4. Troubleshooting when the OJ DVULH is controlled via RS-485 interface :

Symptom	Cause	Action
Motor inoperative	Lacking supply voltage	Check the voltage supply to the OJ DVULH terminals "L1", "L2" and "L3" on 3x400V and 3x230V models. (Nominal supply voltage is stated on the rating plate.)
		Check whether short-circuit protection has been activated.
		Check that the voltage supply to the OJ DVULH has not been cut off by other components.
	Poor electrical connections	Check electrical connections.
	Wrong motor for the OJ DVULH setup	Check that the correct motor settings have been read into and stored in the OJ DVULH setup.
	Lacking operating signal	Check that OJ-DV can receive an operating signal. Coil Stat Bits Register 0X0001: Motor start/stop (1=On).
	Speed set point has not been set.	Check the RS-485 interface control signal at Modbus address: Holding registers; Register 3X0001 or BACnet Integer Value, IV:0: PrcSet 0-10000 (0-100%).
	The motor has been stopped 5 times by the built-in motor protector because of overloading	Reset alarm: Coil Stat Bits Register 0X0002: Reset (1 pulse = Reset). The alarm can also be reset by disconnecting the power supply to the OJ DVULH and reconnecting it after approx. 60 seconds.
	Defective OJ DVULH controller	Replace the OJ DVULH. Never attempt to repair a defective OJ DVULH controller. Contact your supplier for replacement/repair.
	Defective motor	Replace motor.
Motor running in wrong direction	Wrong phase sequence in motor cable	Interchange two phase wires on the motor or the OJ DVULH terminal strip.
The OJ DVULH noisier than acceptable	Switching frequency too low	Increase switching frequency. 0 = Auto 1 = Low = 4 kHz 2 = High = 8 kHz Increasing switching frequency increases losses within the OJ DVULH, thus reducing efficiency. The OJ DVULH switching frequency can be changed via OJ-DV-HMI-35T, Modbus or OJ-DV-PC-Tool.

Symptom	Cause	Action
The OJ DVULH cuts out due to an alarm	At least one alarm active	Use OJ-DV-HMI-35T to view the alarm and determine which alarm has stopped the controller/motor.
		Reset the alarm by short-circuiting the "Alarm reset" input – digital input Din1 or Din2 depending on the setup. The alarm can also be reset by disconnecting the power supply to the OJ DVULH and reconnecting it after approx. 60 seconds.
	The alarm is re-activated after reset	Read out the alarm via RS-485 interface registers and determine which alarm has stopped the controller/motor.
		Remedy the cause of repeated alarm activation.

25.   Storage

The OJ DVULH should be stored indoors, if possible in the original packing. Recommended: a dry room with temperatures between -40°C and +50°C and a relative humidity below 70%. When the OJ DVULH is stored as recommended, the drive can be stored for years from the date of manufacture.

26.   Disposal

- The OJ DVULH contains electronic components and must not be disposed of together with household waste.
- The OJ DVULH must be disposed of in accordance with applicable local rules and regul
- The OJ DVULH meets the requirements on marking of electronic waste contained in the European WEEE Directive 2012/19/EU.

27.   Fuse and Circuit Breaker Specifications

27.1   Overcurrent protection
Provide overload protection to avoid overheating of the cables in the installation. Overcurrent protection must always be carried out according to local and national regulations. Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480volt maximum. Circuit breakers must be designed for protection in a circuit capable of supplying a maximum of 10,000 Arms (symmetrical), 480 V maximum; or the value rated on the individual circuit breaker.

27.2   UL / Not UL Compliance
Use the breakers or fuses listed below in table 25.1 to ensure compliance with UL or IEC 61800-5-1. Circuit breakers must be designed for protection in a circuit capable of supplying a maximum of 10,000 Arms (symmetrical), 480 V maximum. In the event of malfunction, failure to follow the protection recommendation may result in damage to the drive / frequency converter. Circuit breaker must comply with UL 489.

27.3   Circuit breaker and fuse rating

Enclosure	Nominal power rating	Circuit breaker		Fuses	
		Rec. UL	Max. UL	Rec. UL	Max. non-UL
				Type	
				RK5, RK1,J, T,CC	gG
H4x	5.5	15	50	20	16
	7.5	20	70	25	16

28. Technical specifications

Type		DVULH-3055	DVULH-3075
Enclosure		H4x	
Power size	kW	5.5	7.5
Horsepower	Hp	7.4	10.0
Efficiency	%	> 96.5%	
Power supply			
Voltage		3 x 380 - 480 Vac 50/60 Hz +/-10%	
Supply current at max. load at nominel supply voltage (400V/480V)	A	11.5 / 9.6	15.7 / 13.1
Power factor (cos-phi) at max. load		> 0.99	
Motor output			
Nominal motor power (on shaft) *2	kW	5.5	7.5
Frequency	Hz	PM motor: 0-400	
Max. output voltage	Vrms	3 x 0 - Vin	
Max. output current	Arms	12.0	16.0
Protection			
Max. fuse	A	16	
Short circuit capacity	A	3500	5000
FLA	A	12.0	16.4
Motor output		Short-circuit protected between phases	
Motor		Protected by current limit	
Impulse protection		Protected against transient voltages	
Over-voltage protection		Yes, 565 V	
Overload protection		Current and temperature overload protection	
Environment			
Operating temperatures	°C / °F	-40°C to +50°C / -40°F to +122°F	
Starting temperatures	°C / °F	-40°C to +50°C / -40°F to +122°F	
Storage temperatures	°C / °F	-40°C to +70°C / -40°F to +158°F	
Dimensions	mm	220 x 374 x 107	
Protection rating		IP 55/65	
Enclosure material		Aluminium	
Front cover		Plastic	
Weight	kg	7.0	
Humidity	% rh	10-95% rh, non-condensing	
Surface		Corrosion resistant to EN/ISO 12944-2:1998 Category C4	
Airflow / cooling		Turbulent air speed of min. 3m/s to achieve max. output power at max. ambient temperature. Turbulent air speed below 3m/s and higher ambient temperature might lead to reduced output power. (3m/s turbulent air speed is equivalent to 6,5m/s laminar air speed)	
Interfaces			
Modbus RTU		RS485 (baud rate: 9.6, 19.2, 38.4, 57,6 115.2 Kbaud)	
BACnet MS/TP		Baud rate: 9600, 19200, 38400, 57600, 115200 kbs MAC: 0 - 127, MAX Master: 1 -127, Device object ID: 0 - 4194302	
Digital communication	Slave	2 x RJ12 & 3 x spring terminal	
Digital communication	Master	1 x RJ12 connection	
Analogue In 1		0-10 VDC, 100% @ 9.5 VDC +/-2%	
Analogue Out 1		+10 VDC	
Digital In 1		Start/stop with internal pull-up	
Digital In 2		Alarm reset	
Digital Out 1		Tacho: 1 pulse/revolution	Alarm/running signal	
Green LED		Lit: Power connected	Flashing: Active communication	
Red LED		Flashing: Alarm but still running	Constantly lit: Critical alarm - stop motor	
Features			
Technology		Sinusoidal back-EMF signal controlled via FOC (Field Oriented Control)	
Flying start		Yes, < 30% of max. speed	
Ramp-up time	sec.	15 – 300	
Ramp-down time	sec.	15 – 300	
Alarm		Yes	
Alarm reset		Via digital input, RS-485 interface or powering down for more than 60 seconds	
Fan stop		The braking system stops the fan as quickly as possible. Braking time will depend on the inertia of the fan.	
Service data log		Operating hours, alarms, loads, software version, max. temp., max. motor voltage, max. motor current, max. ripple voltage, max. ripple current	
Software updating		Yes, via serial interface	
Motor parameters		Preprogrammed by OJ or on-site configuration	
Fire mode		Nominal power for 1 hour at 70°C ambient temperature	
Field weakening		Yes	
Short-circuit protection		Yes	
Integrated EMC filters		Yes	
Harmonic distortion	THD(i)	Full load: < .5% / 10-100% load: < 3%	
Approvals			
EMC		EN/BS 61800-3 (C1 & C2)	
LVD		EN/BS 61800-5-1 / UL 61800-5-1	
Product standard		EN/BS 61800 Part 2	
North America		UL -61800-5-2 / CS22.2.174	
RoHS Directive		Yes	
Product approvals		CE / c**UL**us / UK CA	

Note: Data are valid at: nominal supply voltage, +25°C and sufficient air flow. * 1: At 3 x 230V supply the output power is reduced to 58%. * 2: Motor Power Factor = 0.8 and efficiency = 90%