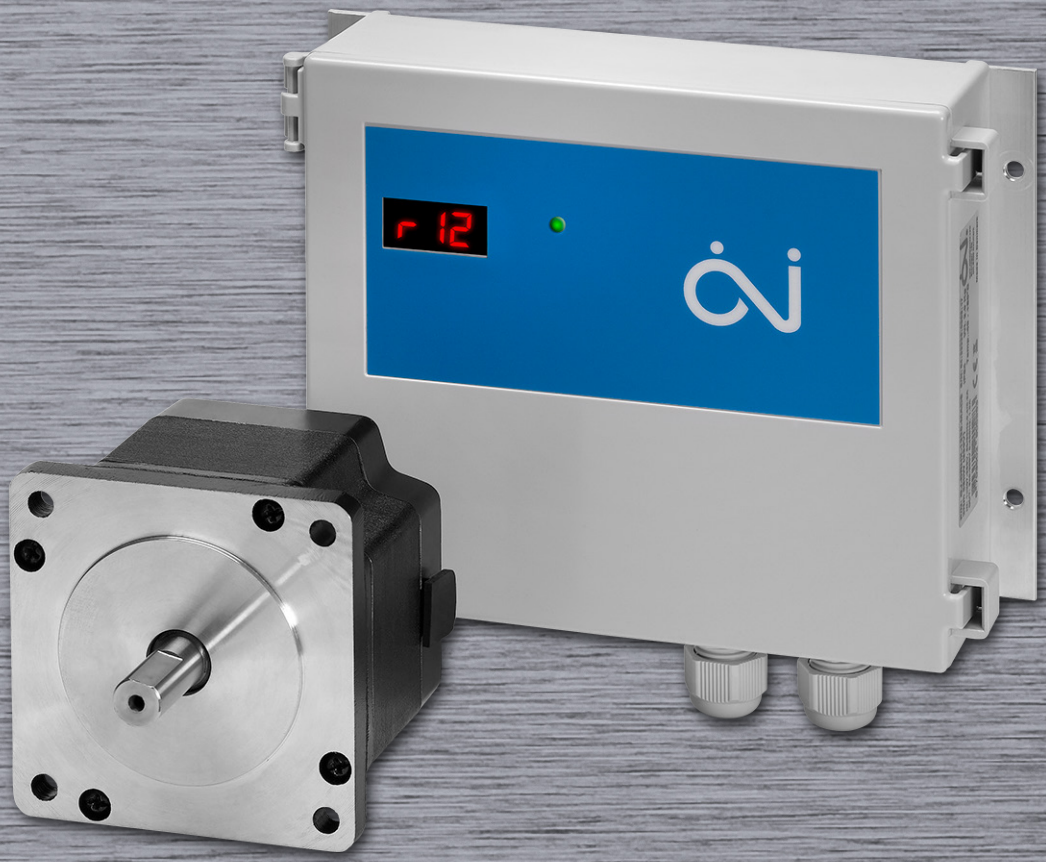
INSTRUCTIONS

OJ-DRHX



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OJ-DRHX 1-8Nm

A DRIVES PROGRAMME DEDICATED TO ROTARY HEAT EXCHANGERS

OJ ELECTRONICS

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Notice!
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1. Product presentation

OJ-DRHX is the new generation of drives for the control of rotary heat exchangers – based on new technology. OJ-DRHX covers motors rated from 1 Nm to 14 Nm with both Modbus and analogue controllers and a constant speed version. OJ-DRHX is also available in a variant with a 3x7 segment display.
By contrast with traditional geared motors which lose torque at low and high speeds, the stepper motor maintains the same high rotational torque for the entire rated speed.
The linear torque curve of the stepper motor allows highly precise rotor speed control over a much larger range. This results in energy-efficient heat recycling and more precise temperature control.
OJ-DRHX is equipped with advanced software to monitor rotor rotation, which means that no physical or optical rotor guard is required. Not only does this mean fewer components, but also makes it easier for you to install.
The combination of the high torque of the stepper motor with FOC (Field Oriented Controls) technology results in a uniquely innovative solution and increased efficiency. The drive uses the feedback signal from the motor to ensure that the motor receives exactly the required amount of current to achieve the required speed and torque.

2. Introduction

- These instructions describe the following product programme:
  - **OJ-DRHX-1055-MNN5**
  - **OJ-DRHX-1055-MAD5**
  - **OJ-DRHX-1220-MNN5**
  - **OJ-DRHX-1220-MAD5**
  - **OJ-DRHX-1690-MAN5** – *specified in a separate document*
  - **OJ-DRHX-1055-NCN5** – *specified in a separate document*
  - **OJ-DRHX-1220-NCN5** – *specified in a separate document*

- Read these instructions thoroughly and follow the directions they contain before taking OJ-DRHX into use.
- These instructions contain important information and should be used when installing, connecting and commissioning the OJ-DRHX as well as during maintenance, service and troubleshooting.
- If the instructions 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 OJ Electronics A/S.
- All rights are reserved by OJ Electronics A/S if the product is included in patent rights or other form of registration.
- OJ Electronics A/S reserves the right to amend the content of these instructions without notice.

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.

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Warning

4. Ensuring safety before installation

OJ-DRHX must only be installed by qualified personnel or people who have received appropriate training and have thus become qualified to install the product.
Qualified personnel have knowledge of the installation practices used and can perform installation in accordance with relevant local and international requirements, laws and regulations.
Qualified personnel are familiar with the instructions and safety precautions described in these instructions.
OJ-DRHX contains dangerous high voltage when connected to the mains.
Mains voltage must always be disconnected before any installation, service or maintenance tasks are performed on the product. The test button can be operated while mains voltage is connected.
When OJ-DRHX is connected to the mains, there is a risk that the stepper motor could start unintentionally, causing a risk of dangerous situations, personal injuries or material damage to equipment and property.
The stepper motor/rotor can be started up using the test button, the 0–10 V input signal or via the Modbus interface.
Before connecting mains voltage to the OJ-DRHX, all components, i.e. stepper motor, belt, pulley and rotor, must be installed correctly.
Before connecting mains voltage to OJ-DRHX, all openings, covers and cable glands must be properly fitted and closed. To maintain the specified enclosure rating, unused cable glands should be replaced with blank glands.
OJ-DRHX 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

OJ-DRHX is used to regulate the speed of a rotary heat exchanger in air handling units.
OJ-DRHX can only be used to control stepper motors supplied by OJ Electronics A/S. Never try to connect or control other types of stepper motor.
Depending on usage, OJ-DRHX is suitable for stand-alone applications or as part of larger systems/machines.
The product can be used in defined environmental and temperature scenarios.
See section 24. Technical specifications
The drive and stepper motor is controlled by signals or commands from an external control unit.
OJ-DRHX has built-in stepper motor protection.
OJ-DRHX can be used in domestic and industrial environments and has a built-in EMC filter.

Warning

6. Prohibition on use

The OJ-DRHX 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 (e.g. during transportation), it must be checked and (if necessary) repaired by OJ Electronics A/S before the product is installed, connected to mains voltage and energized.
If OJ-DRHX is built into machinery with rotating parts, e.g. in an air handling unit, transport system, etc., the entire system must comply with the Machinery Directive.

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7. EMC – Electromagnetic compatibility

- OJ-DRHX has built-in EMC filter.

8. Approvals and certifications

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: 2014/30/EU
  - RoHS - Restriction of the use of certain hazardous substances in electrical and electronic equipment: 2011/65/EU

Product standard

- In accordance with EN 61800-2 – Adjustable speed stepper motor drive, general requirements.

Safety

- In accordance with EN 61800-5-1 – Adjustable speed stepper motor drive: Safety requirements – Electrical, thermal and energy.

EMC – Electromagnetic compatibility

- In accordance with EN 61800-3 (C1 and C2) – Adjustable speed stepper motor drive. Part 3. EMC requirements and specific test methods.

RoHS compatible

- Contains no hazardous substances according to the RoHS Directive.

9. Product programme

9.1 Drive programme

- The OJ-DRHX stepper motor drive series is available in different power ratings and enclosures, the size and functionality of which varies according to the specific OJ-DRHX variant, see table 9.1
  - √ OJ-DRHX-1055-MNN5 – described in these instructions
  - √ OJ-DRHX-1055-MAD5 – described in these instructions
  - √ OJ-DRHX-1220-MNN5 – described in these instructions
  - √ OJ-DRHX-1220-MAD5 – described in these instructions
  - √ OJ-DRHX-1690-MAN5 – see separate instructions
  - √ OJ-DRHX-1055-NCN5 – specified in a separate document
  - √ OJ-DRHX-1220-NCN5 – specified in a separate document

Table 9.1*	DRHX-1055-MNN5	DRHX-1055-MAD5	DRHX-1220-MNN5	DRHX-1220-MAD5
Modbus	Yes	Yes	Yes	Yes
0-10 V	No	Yes	No	Yes
Display	No	Yes	No	Yes
Internal rotor guard	Standard	Standard	Standard	Standard
External rotor guard	No	Accessories	No	Accessories
Automatic purging function	No	Yes	No	Yes
Deformation safeguard	Yes	Yes	Yes	Yes
Power (max.)	27.5/55 W	27.5/55 W	110/220 W	110/220 W
Supply voltage	1x230 V AC	1x230 V AC	1x230 V AC	1x230 V AC
Nominal torque	1 Nm/2 Nm	1 Nm/2 Nm	1/2/4/8 Nm	1/2/4/8 Nm
Max. rpm	250 rpm	250 rpm	400 rpm **	400 rpm **
Motor voltage	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC
Dimensions (w, h, d) (mm)	183.0x142.7x55.0	183.0x142.7x55.0	183.0x142.7x55.0	183.0x142.7x55.0
Enclosure rating (IP)	IP54	IP54	IP54	IP54

* See also the technical specifications in section 24.

** 8 Nm torque at max. 250 rpm – but only max. 5 Nm torque at max. 400 rpm

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9.2 Stepper motor programme

The associated stepper motor programme is comprised of 3 different torque ratings: (See table 9.2)

√ OJ-MRHX-3P01N-03C5
√ OJ-MRHX-3P02N-03C5
√ OJ-MRHX-3P04N-03C5
√ OJ-MRHX-3P08N-03C5
√ OJ-MRHX-3P14N-03C5

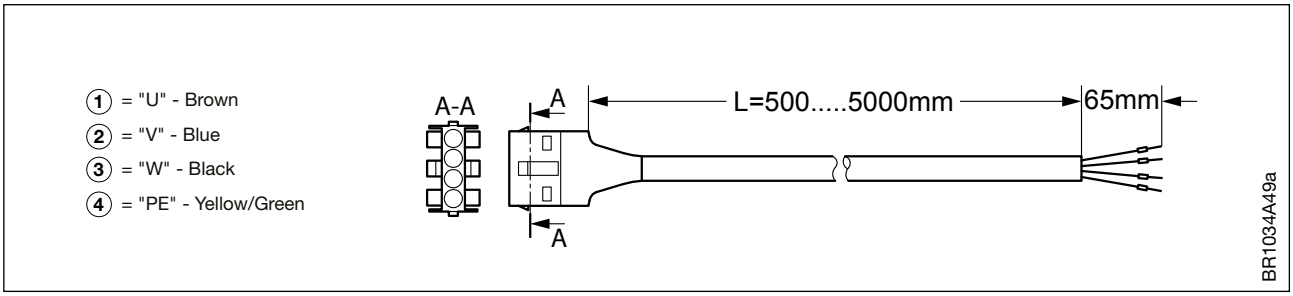
Table 9.2	OJ-MRHX-3P01N-03C5	OJ-MRHX-3P02N-03C5	OJ-MRHX-3P04N-03C5	OJ-MRHX-3P08N-03C5
Power (W)	27.5	55 W	110 W	220 W
Motor torque	1 Nm	2 Nm	4 Nm	8 Nm
Stepper motor voltage	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC
Min. rpm	1 rpm	1 rpm	1 rpm	1 rpm
Max. rpm	400 rpm *	400 rpm *	400 rpm*	400 rpm **
Cable length	300 mm	300 mm	300 mm	300 mm
Electrical connection	4-pole Tyco MATE-N-LOK	4-pole Tyco MATE-N-LOK	4-pole Tyco MATE-N-LOK	4-pole Tyco MATE-N-LOK
Stepper motor dimensions (w, h, d)	56 mm, 56 mm, 97 mm	85 mm, 85 mm, 67 mm	85 mm, 85 mm, 97 mm	85 mm, 85 mm, 156 mm
Shaft diameter	Ø12 mm	Ø12 mm	Ø12 mm	Ø12 mm
Enclosure rating (IP)	IP54	IP54	IP54	IP54

* Max. 250 rpm on DRHX-1055-MXX5 drive and up to max. 400 rpm on DRHX-1220-MXX5 drive
** 8 Nm torque at max. 250 rpm – but only max. 5 Nm torque at max. 400 rpm

9.3 Extension cable programme

The drive is supplied with no cable, which therefore needs to be ordered as a separate item. Extension cables are also supplied with a pre-fitted 4-pole connector at one end. The other end of extension cable wires are fitted with wire sleeves and should be connected to the drive's motor terminals (U, V, W, PE). Extension cables are supplied in 4 different lengths.

Figure 9.3



Extension cable programme:

- Product code. 97301 (L=500 mm)
- Product code. 97302 (L=2000 mm)
- Product code. 97303 (L=3000 mm)
- Product code. 97304 (L=5000 mm)

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10. Product label

10.1 The OJ-DRHX drive is fitted with a silver rating plate.

See the example in fig. 10.1 and table 10.2.

NOTE! Check that the information specified on the rating plate is as expected.

Figure 10.1a

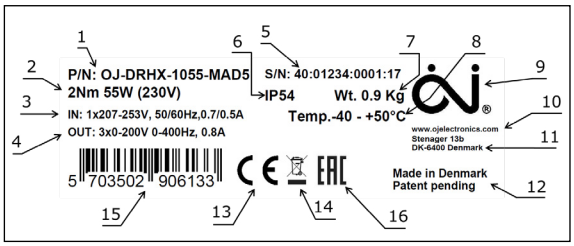

Table 10.2	
1	Product ID, see table 10.6
2	Shaft power at nominal voltage
3	Nominal power (V, Hz, A)
4	Nominal output (V, Hz, A)
5	Product code, see table 10.5.
6	Enclosure rating
7	Weight (kg)
8	Temperature range, operating (°C)
9	Manufacturer's logo
10	Manufacturer's website
11	Manufacturer's postal address
12	Country of manufacture
13	CE approved, logo
14	Disposal, logo
15	Bar code
16	EAC approved, logo

10.2 Rating plate, information and explanation

10.3 The OJ-MRHX stepper motor is fitted with a rating plate.

See the example in fig. 10.3 and table 10.4.

NOTE! Check that the information specified on the rating plate is as expected.

10.4 Rating plate, information and explanation

Figure 10.3

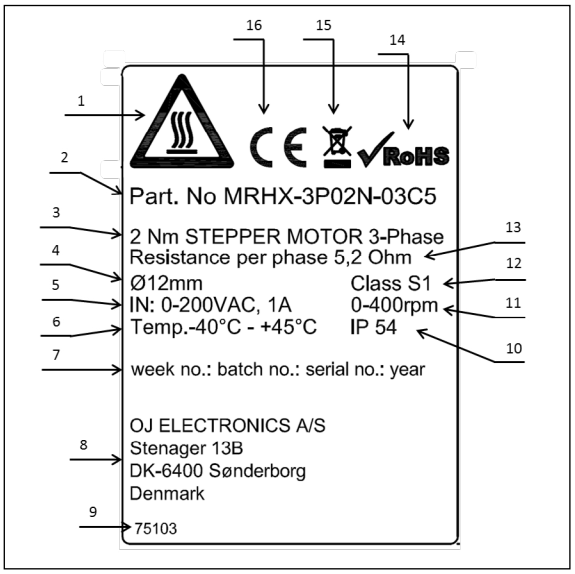

Table 10.4	
1	Warning: The motor can become very hot >60°C
2	Product ID
3	Product type and model
4	Shaft diameter
5	Nominal input voltage, current V/A
6	Ambient temperature, min/max
7	Production code
8	Manufacturer's name and address
9	Manufacturer's stock number
10	Enclosure rating (IP class)
11	RPM min/max
12	Operating classification (S1=Continuous operation)
13	Resistance per phase (Ω)
14	RoHS compatible
15	Disposal, logo
16	CE approved, logo

10.5 Production code

Each and every OJ-DRHX drive is given its own product code during manufacture.
The product code (see table 10.5) is composed of 14 numerals and provides information about the specific OJ-DRHX drive.
The product code contains the following information:

- Week of production
- Order number
- Sequential number
- Year of manufacture
- See table 10.5

Table 10.5			
Week number	Order number	Sequential number	Year
W W	**O O O O O**	**S S S S S**	**Y Y**
Week of production	Order number	Unit number	Year of production

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10.6 Product ID

The product ID consists of a combination of numbers and letters, each of which provides information about the specific product,
See explanation in table 10.6.1 (Drive) & fig. 10.6.2 (Stepper motor).

Figure 10.6.1 - Drive; Product ID

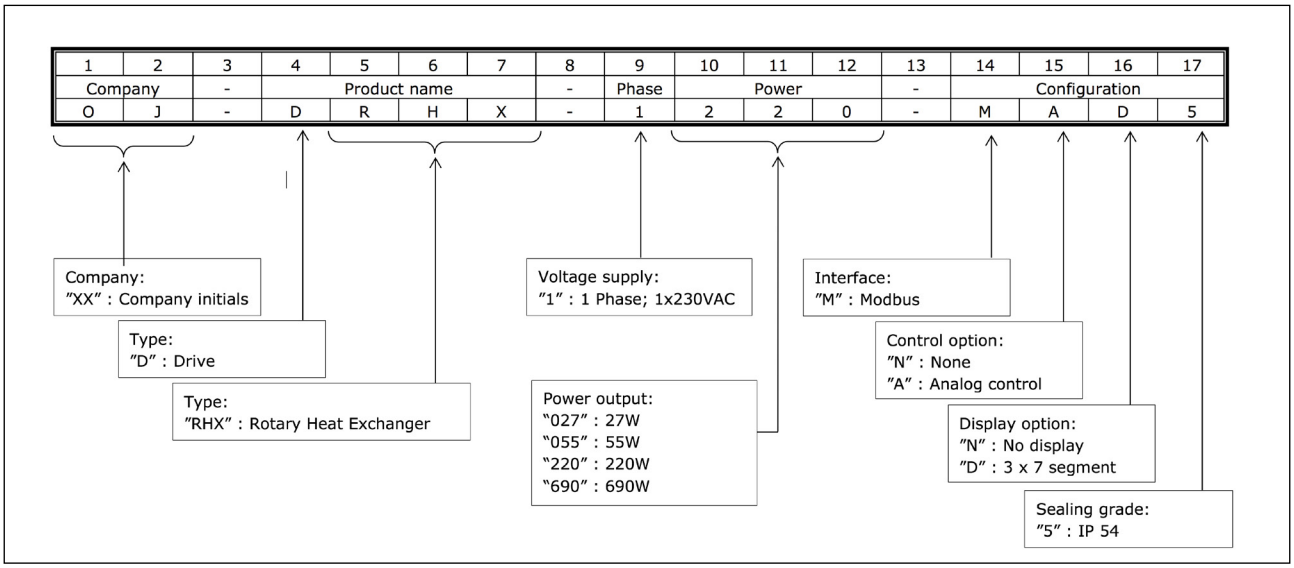
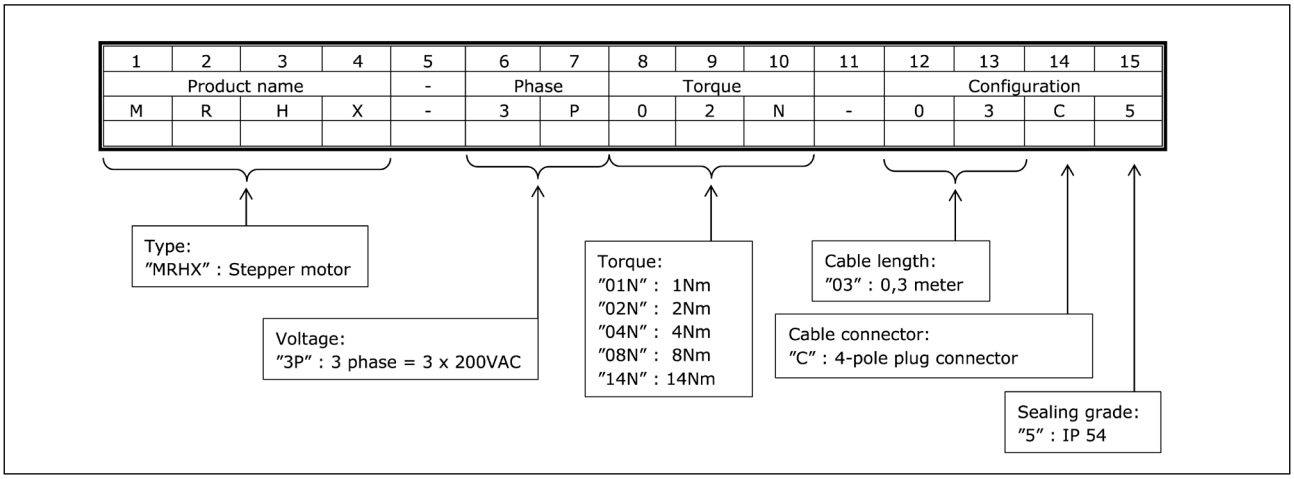


Figure 10.6.2 - Stepper motor; product ID



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11. Exploded and dimensioned drawings

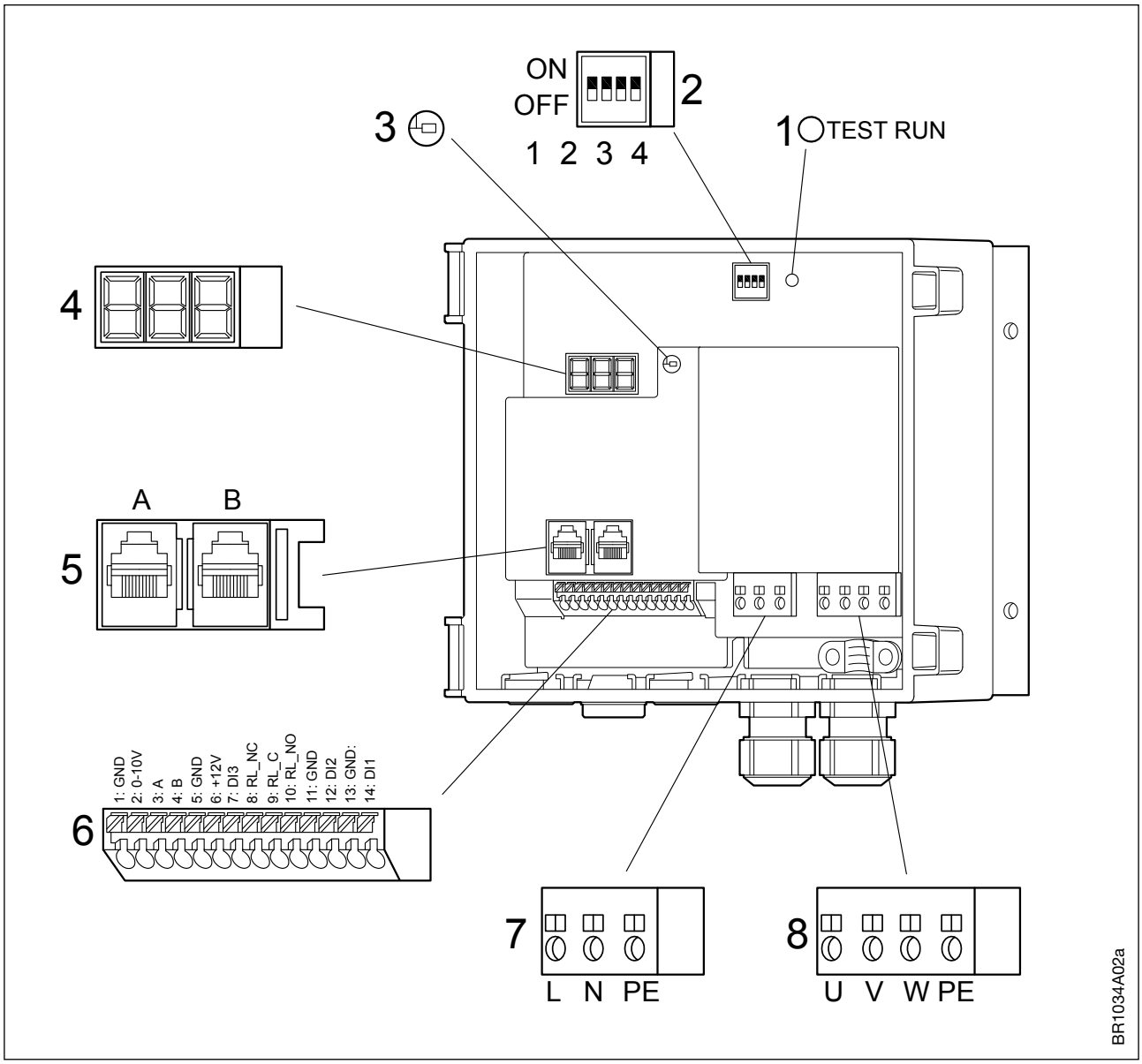

Table 11			
No.	**Description**	**No.**	**Description**
1	Test button	5	RJ12 Modbus connector (2 x RJ12)
2	4-pole DIP switch	6	A/D control and signal terminals, depending on variant
3	LED	7	Supply terminals (L, N, PE)
4	3 x 7-segment display - depending on variant	8	Connection terminals for stepper motor (U, V, W, PE)

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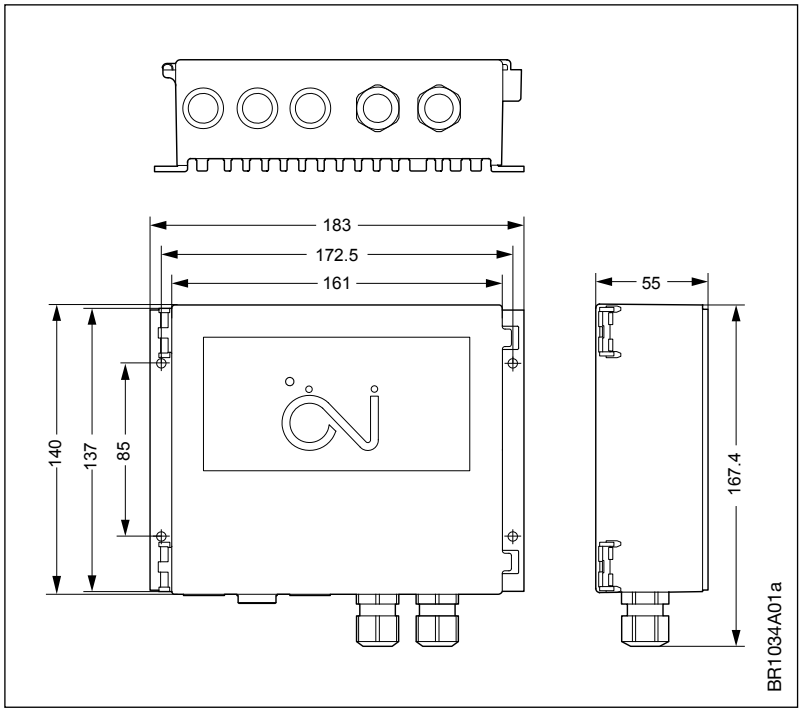
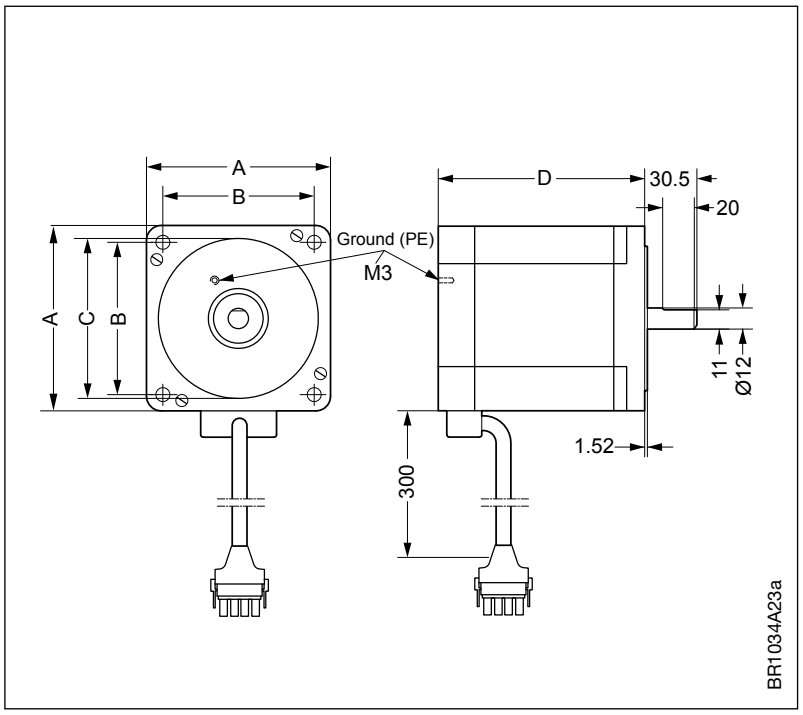
11.1 Drive – dimensioned drawing



11.2 Stepper motor – dimensioned drawing



Dimensions table 11.2				
	OJ-MRHX-3P01-03C5	OJ-MRHX-3P02-03C5	OJ-MRHX-3P04-03C5	OJ-MRHX-3P08-03C5
A	56 mm	85 mm	85 mm	85 mm
B	47 mm	69.6 mm	69.6 mm	69.6 mm
C	52 mm	73 mm	73 mm	73 mm
D	97 mm	67 mm	97 mm	156 mm

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12. Mechanical installation

Warning

- Incorrect mechanical installation may cause overheating and impaired performance.
- If the enclosure is fractured or otherwise shows signs of having been exposed to mechanical overload, there will be a risk of moisture ingress and electric shock. The drive should therefore be scrapped.

Note

- The drive and stepper motor must be installed within the enclosure/chassis of the air handling unit.

Note

- The stepper motor must be mechanically fixed to the chassis.

12.1 Drive

- OJ-DRHX must only be installed by trained/ experienced personnel.
- To achieve correct cooling of the OJ-DRHX, it must always be positioned so that there is free airflow around the cooling fins of the OJ-DRHX drive (see fig. 12.1.1).
- Max./min. ambient temperature: See section 24, Technical specifications.
- To facilitate future service and maintenance tasks, ensure that there is sufficient space around the drive after it has been installed.
- To achieve the specified enclosure rating, the cable glands must not point upwards (see fig. 12.1.2).
- To prevent water from entering OJ-DRHX 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.
- For optimal cooling of the OJ-DRHX, it must be installed vertically and on a slope, with a max. gradient of 45° (see fig. 12.1.1). The cooling fins on the reverse of the product should thus always be able to be cooled by the natural thermic upflow past the cooling fins.
- OJ-DRHX must be installed on a flat solid surface.
- To avoid unnecessarily long stepper motor cable, OJ-DRHX should be installed as close to the stepper motor as possible.
- The product should be attached using at least 3 of the screw holes in the aluminium cooler profile.
- The fourth screw can also be used to fit an electrical equalisation conductor, see section 13.5.
- The drive may not be installed in direct sunlight.
- Dimensioned drawing, see fig. 11.1

Figure 12.1.1

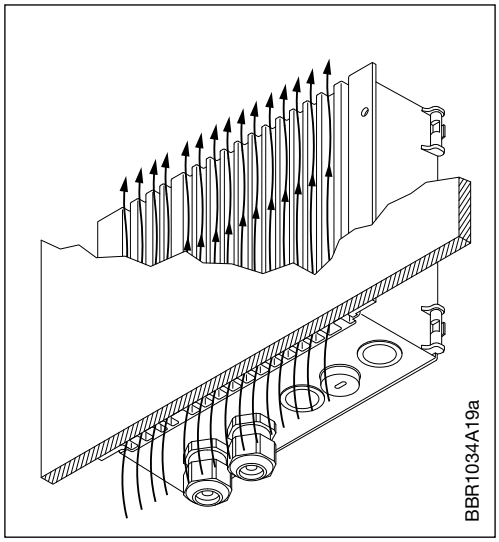
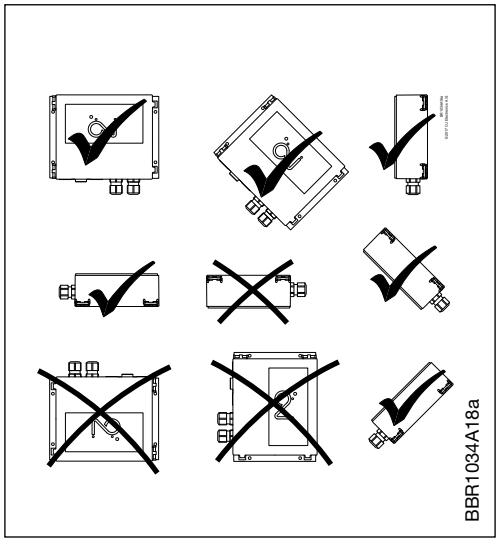


Figure 12.1.2



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Warning

Incorrect mechanical installation of the stepper motor can cause electrical shock, overheating, reduced performance and error alarms.

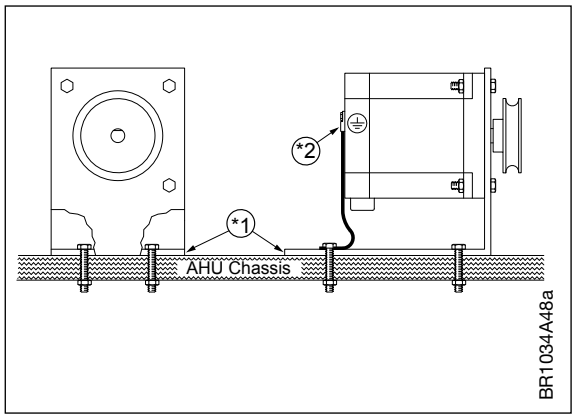
Warning

The MRHX stepper motor has been specially designed and precisely adapted to the DRHX drive. Never attempt to connect other motor types than the one that is supplied together with the product. If the stepper motor is defective, it should be exchanged with an equivalent model. Contact your supplier for delivery of the correct model and type.

12.2 Stepper motor

- To ensure you get the most out of the advanced integrated rotor guard in the DRHX controller, and to avoid false alarms and errors, it is important to follow the instructions for proper stepper motor mounting.
  The stepper motor comes with four holes for attachment to a solid mounting plate.
  The mounting plate must be firmly attached to the chassis of the rotary heat exchanger or AHU.
  Do not use vibration dampers or springs.
- The mounting plate must be firmly attached to the chassis of the unit
  (see example fig. 12.2.1; marked *1).
- The stepper motor must be earthed in accordance with local and national regulations (see fig.12.2.1; marked *2)
- Do not use or connect to any types of stepper motors other than the ones supplied by OJ Electronics and make sure that the dip switches are set for the correct stepper motor size

Figure 12.2.1

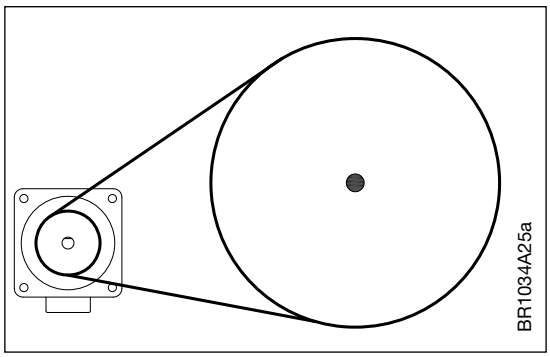


12.3 Stepper motor pulley

- The pulley must be attached using a set screw, which should grip the flat side of the stepper motor shaft.
- To select the correct DRHX, MRHX and to calculate the optimal pulley size for your rotor, consider the following aspects:
  - Rotor diameter
  - Rotor width
  - Wave heights
  - Rotor weight
  - Sealing lists
  - Added torque due to air flow

  This means that it is not possible to calculate the selection of the DRHX, MRHX and pulley size alone from a given rotor diameter. Contact OJ Electronics A/S for calculation tool.
- Greatest rotor torque can be achieved using a small pulley on the stepper motor, as stepper motor torque is transferred between rotor and stepper motor pulley by the transmission ratio (N) (see fig 12.3).
- The pulley must however be sufficiently large to achieve the desired rotor speed at maximum speed, while still transferring power to the belt.
- The belt must be tightened so that the stepper motor can drive the rotor, without friction on the pulley or rotor.

Figure 12.3



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- The belt must not be tightened more than specified in the maximum radial load for the stepper motor. See section 24, Technical specifications.

To ensure proper operation of the internal rotor guard function there are some restrictions on the inertia of the pulley which means the size (diameter) and weight of the pulley should be in the following range.

Stepper motor size	Min. pulley size	Max. pulley size / weight
1 Nm	50 mm	250 mm / 0.1 kg 140 mm / 0.3 kg 110 mm / 0.5 kg
2 Nm	50 mm	160 mm / 0.5 kg 140 mm / 0.75 kg 120 mm / 1 kg
4 Nm	50 mm	160 mm / 1 kg 140 mm / 1.3 kg 120 mm / 1.8 kg
8 Nm	50 mm	200 mm / 1 kg 160 mm / 1.5 kg 120 mm / 2.8 kg

It is possible to use a pulley that differs from the above but to ensure proper operation of the internal rotor guard, it is necessary to make a calibration (see 15.15).

12.4 Rotor friction

- A check should be made that the rotor is able to rotate with minimal and uniform friction throughout the entire rotation.
- If the rotor is not tensioned correctly with uniform friction all the way around, this can lead to the rotor being unable to be driven by the selected stepper motor and drive. This will lead to increased energy consumption, increased heat, reduced service life and error alarms.

13. Electrical installation

Warning

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

Warning

13.1 Dangerous induced voltage

- If natural drafts through the air handling unit cause the rotor to rotate even when it has not received an operating signal, there is a risk that the stepper motor will induce voltage on the OJ-DRHX stepper motor terminals, making them dangerous to touch.

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Caution

13.2 **EMC-compliant installation**

- There is no requirement for shielded cables to the I/O and Modbus communication, just as there is no requirement for shielded motor cables.
- Never convey mains voltage, stepper motor connections and control signals in the same cable.
- The drive and stepper motor must be installed within the enclosure/chassis of the air handling unit.
- The cable between the stepper motor and the OJ-DRHX drive must be fixed to the enclosure/ chassis of the air handling unit for its entire length. The cable consists of the stepper motor cable, connector and extension cable.

Note

13.3 **Short-circuit protection**

- Correct short-circuit protection must always be used ahead of OJ-DRHX in accordance with local and international regulations.
- The short-circuit protection of OJ-DRHX is not included with the product, but is delivered and installed by the fitter, the unit or rotor manufacturer.

Warning

13.4 **Residual Current Device (TT-system)**

This product can draw a direct current in the earth wire in the event of an earth fault.
Please note the following precautions:

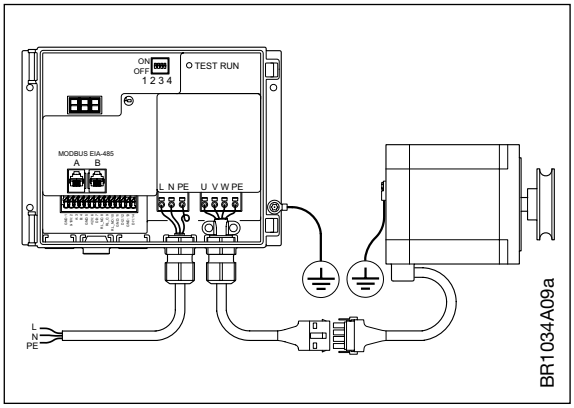
- If using a residual current device (RCD), a type B RCD must be used on the product's supply side (B type for AC power and/or pulsating power with DC components and fixed fault current).
- Type B residual current devices must comply with all IEC 61008/9 provisions.
- Protective earthing of the OJ-DRHX in combination with the use of residual current devices must always be executed in accordance with relevant local and international requirements, laws and regulations.
- Non-compliance with these measures may result in serious injury to people and animals.

Warning

13.5 **Potential equalisation**

- There is a risk of electrical interference if the ground potential between the OJ-DRHX and the air handling unit differ from each other.
- Lugs should be used, and the equalisation conductor should be attached to the OJ-DRHX alu-profile via one of the screws used to mechanically install the OJ-DRHX (see fig. 13.5).
- Recommended cable cross section: 10 mm^2.
- To prevent potential differences between system components, an equalisation conductor must always be fitted.
- A potential equalisation connection must always be installed between the stepper motor and the chassis of the air handling unit (see section 12.2).

Figure 13.5



Warning

13.6 **Leakage current risk when earthed (PE)**

OJ-DRHX technology produces engagement disengagement at high frequencies. This can generate a leakage current below 3.5 mA in the PE (Protective Earth) connection.
Follow national and local regulations for the protective earthing of devices with leakage current rated below 3.5 mA.

- Use the terminals and connectors of the OJ-DRHX to achieve proper earthing.
- Avoid serial (daisy chain) connection off the earth connection between two or more OJ-DRHX units.
- Keep earth connection wires as short as possible.
- Earth connections must always be carried out in accordance with applicable local and international standards and directives.

Note

13.7 **Cable requirements**

- All cables and leads used in connection with OJ-DRHX must comply with local and national rules and regulations.
- Generally, cable types with copper wires are recommended.
- Recommended cable dimensions for PG9 connectors are 3-8mm.
- Control wires installed in the terminal strip for control signals (see fig. 13.15) must comply with min./ max. dimensions in accordance with table 13.7.1
- Power leads installed in the terminal strip marked “L”, ”N” & “PE” (see fig. 13.10.1) must comply with min./ max. dimensions in accordance with table 13.7.2
- The factory-installed cable on the stepper motor, including the pre-fitted 4-pole connector, must be used and must not be replaced.
- The Modbus cable that is routed through the special rubber seal can be a telecom cable, 6-wire, unshielded, 30 AWG/0,066 mm^2 or equivalent.
- There are no requirements concerning the use of shielded cables.

Control wires and cables			
Table 13.7.1	**Conductor dimension. Min.**	**Conductor dimension. Max.**	**Cable dimension**
Solid wires	0.08 mm^2	1.5 mm^2	3-8 mm
Multi-core wires*	0.14 mm^2	1.0 mm^2	3-8 mm

* With or without core sleeves/end sleeves

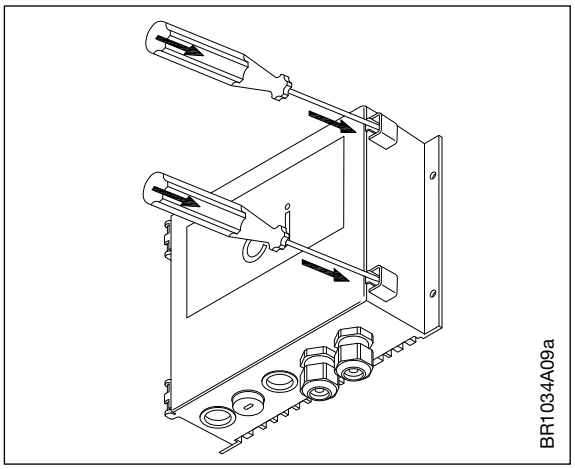
Power leads and cables			
Table 13.7.2	**Conductor dimension. Min**	**Conductor dimension. Max.**	**Cable dimension**
Solid wires	0.2 mm^2	4.0 mm^2	3-8 mm
Multi-core wires*	0.2 mm^2	2.5 mm^2	3-8 mm

* With or without core sleeves/end sleeves

13.8 **Opening the drive**

- Check that the voltage supply to OJ-DRHX has been disconnected before opening the cover.
- Wait approx. 3 minutes after disconnecting mains voltage before removing the cover.
- The drive can be opened using a screwdriver or similar (see fig.13.8.1)

Figure 13.8.1



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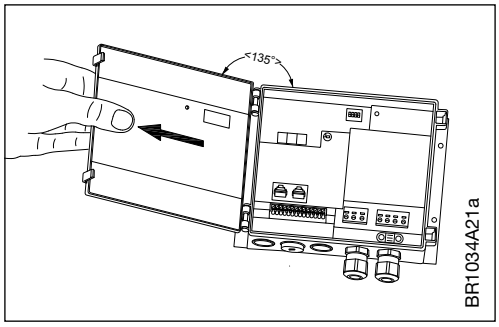
The cover can be removed from the enclosure

- To free up space for installation and service work, the cover can be removed completely from the OJ-DRHX enclosure.
- The cover can be opened approx. 135°.
- The specially-designed hinged brackets allow the cover to be removed with a light pull (see fig. 13.8.2)

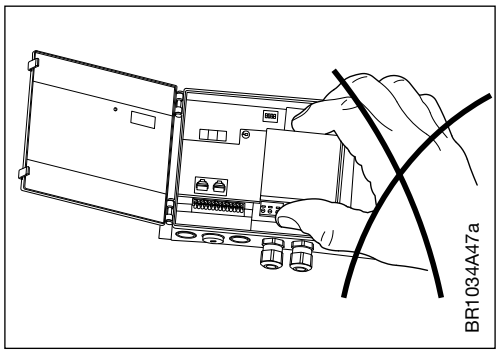
Figure 13.8.2



Warning

- The plastic cover (see fig. 13.8.3), which covers and protects against unnecessary touching of the OJ-DRHX's electronic circuit (PCB), must under no circumstances be removed or attempted to be removed.
- The cover must only be removed by OJ Electronics A/S, as all repairs to defective DRHX units must be carried out at the OJ Electronics A/S repair department.
- Never attempt to perform repairs on a defective product.
- Manufacturer liability and warranty obligation shall lapse if the cover has been removed or an attempt has been made to remove it.

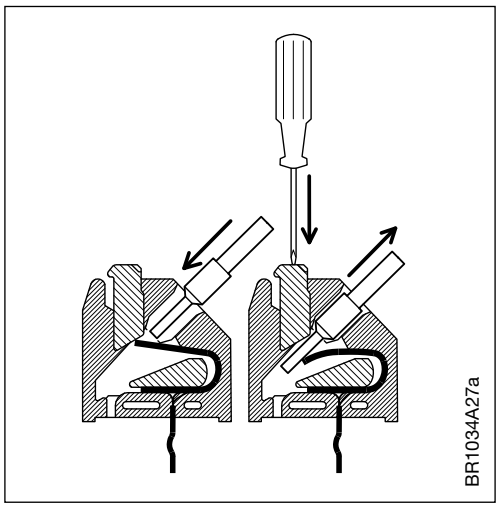
Figure 13.8.3



13.9 Spring terminals

- Solid and multi-core cables/leads can be used.
- If multi-core cables/leads are used, core sleeves/ end sleeves must always be used.
- Max./Min wire dimensions for control terminals (see table 13.7.1)
- Max./Min wire dimensions for supply terminals (see table 13.7.2)
- 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. 13.9.
- Stripped wire ends or end sleeves must be between 8 and 10 mm.
- Wires can be removed by carefully loosening the terminal spring by pressing lightly with a screwdriver or similar implement. See fig. 13.9.

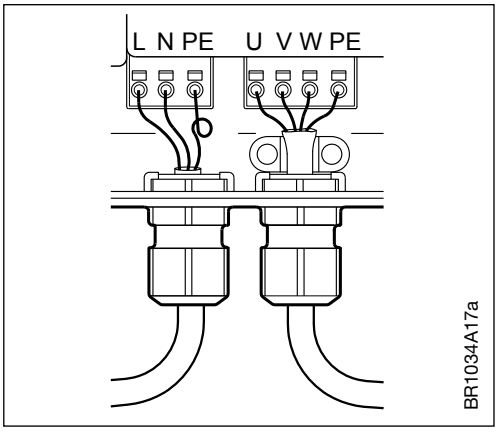
Figure 13.9



13.10 Cable entries – cable glands

- OJ-DRHX is supplied with 2 x factory-fitted PG9 connectors and one rubber grommet.
- The factory-fitted PG9 cable glands should be used when inserting power and stepper motor cables into OJ-DRHX (see fig. 13.10.1).
- Remember to re-tighten the cable glands to ensure ingress protection.
- Cables must be secured against pulling and twisting.

Figure 13.10.1



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Modbus cable

- If Modbus communication is based on a 6-core, unshielded, 30 AWG/0.066 mm^2 telecom cable, the cable must be inserted through the factory-fitted rubber seal (see fig. 13.10.2).
- The rubber seal has a cut insertion slit and ensures the product's enclosure rating if properly fitted (see fig. 13.10.2 MNN version only)

Additional Modbus cable entries

- If additional cable entries, cable glands and rubber grommets are required, knockouts can be removed.
- Use a screwdriver or similar to remove the plastic filling over the moulded entry point.
- In the hole (Ø15 mm), place a PG9 connector (see fig. 13.10.3) that fits the cable to be inserted into the OJ-DRHX drive.

Figure 13.10.2

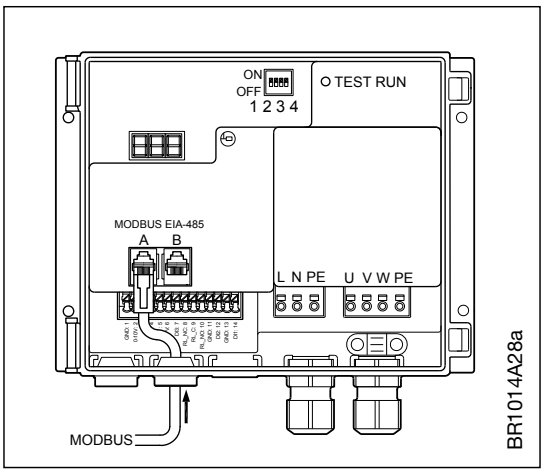
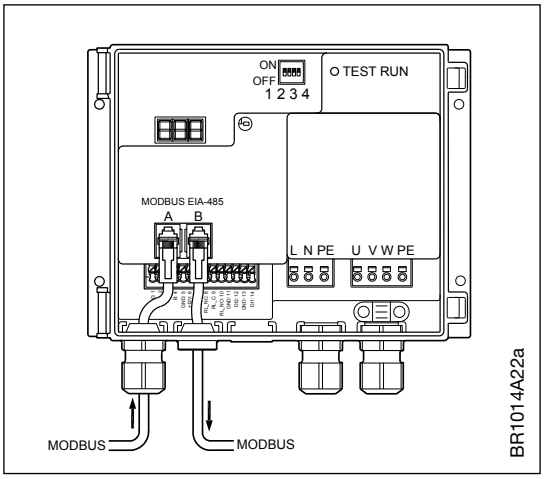
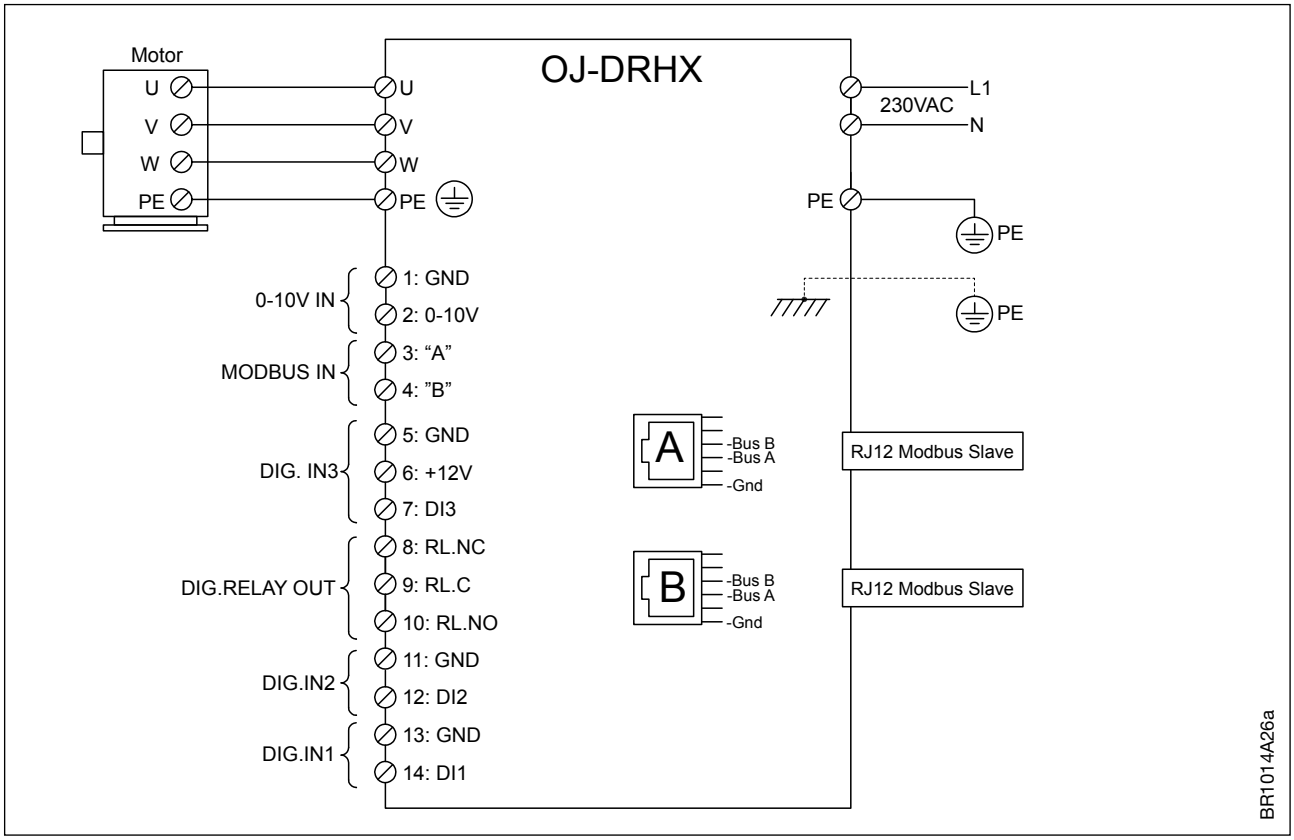


Figure 13.10.3



13.11 Terminal and connector overview

Figure 13.11



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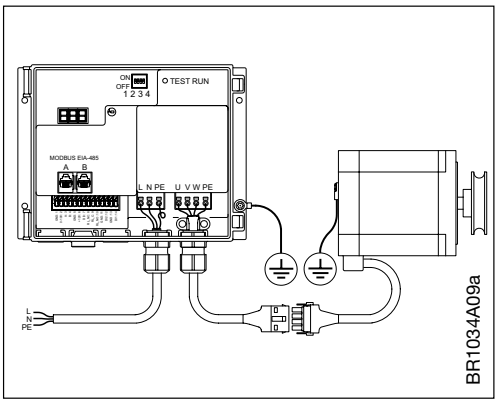
13.12 Mains voltage connection

- The power supply is 230 V AC; +/-10%.
- The power cable is connected to the OJ-DRHX drive on the terminals marked ”L”, ”N” and ”PE”. See fig. 13.12.
- It is recommended that the PE wire is 20 mm longer than the other wires in the cable (see fig. 13.2). If the cable is accidentally pulled out of the OJ-DRHX while there is voltage on the cable and terminals, the PE wire will then be the last to be disconnected. OJ-DRHX is thus prevented from causing electric shock.
- When the stripped wire is properly inserted into the terminal (see section 13.10), the terminal tensions automatically with the correct torque.
- Remember to re-tighten the cable glands to ensure the ingress protection level of the OJ-DRHX and to provide cable strain relief.

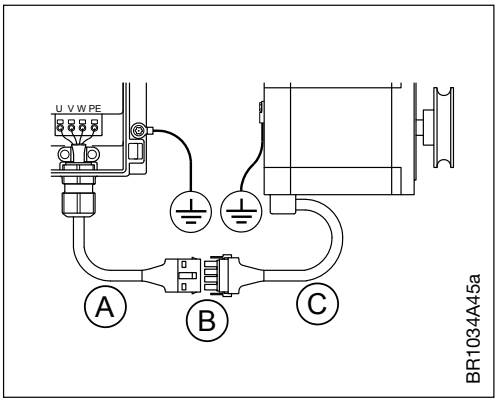
Figure 13.12



13.13 Stepper motor

- The stepper motor cable consists of the fixed cable on the stepper motor and an extension cable.
- The stepper motor cable (see fig. 13.13 marked "C") is equipped with a 4-pole connector and extension cable (see fig. 13.13 marked "A") and is provided with the corresponding 4-pin connector.
- The 2 connectors (see fig. 13.13 marked "B") should be carefully connected.
- The connector is properly assembled when the locking pawl on both sides of the connector on the motor cable is in firm connection with the connector on the extension cable.
- The connector can be separated again by releasing the locking pawl on both sides of the connector on the motor cable and pulling the 2 connectors apart.

Figure 13.13

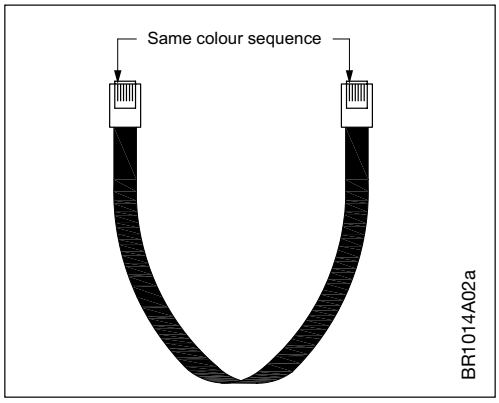


- The extension cable should be connected to the terminals marked:
  "U" - Brown
  ”V” - Blue
  ”W” - Black
  "PE" - Yellow/Green
- When the extension cable wires are properly inserted into the terminals (see section 13.10), the terminal tensions automatically with the correct torque.
- The factory-installed stepper motor cable must not be shortened.
- Because the stepper motor cable is directly connected into the motor windings, it may not be replaced.
- Remember to re-tighten the cable glands to ensure ingress protection and relief.

13.14 Modbus

- Modbus can be connected to OJ-DRHX via the 2 RJ12 connectors or via spring terminals in the terminal strip.
- If RJ12 connectors are used, we recommend the use of telecom cable, 6-wire, unshielded, 30 AWG/0.066 mm^2 (flat/telecom cable).
- When installing the RJ12 connectors, note that the connectors must be aligned so that the colour sequence in the connectors is the same at both ends (see fig. 13.14.1).

Figure 13.14.1



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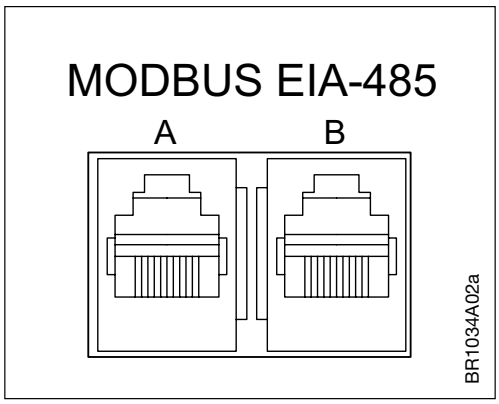
- OJ-DRHX RJ12 connectors are marked MODBUS EIA-485 "A" and "B" (see fig. 13.14.2).
- Connectors "A" and "B" are internally parallel connected and it is therefore optional which connector is used.

Figure 13.14.2

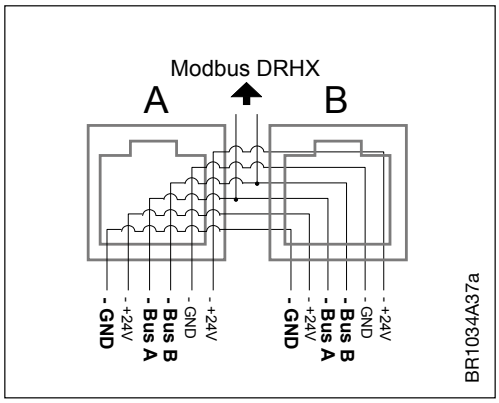


- Connection overview of RJ12 connector – (see fig. 13.14.3).

Note

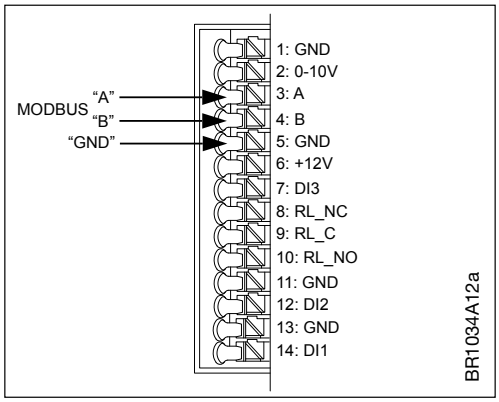
- Note that only "Bus A", " Bus B" on pins 3 and 4 of the RJ12 connector are connected internally with the DRHX drive. The other connections in the "MODBUS EIA-485" RJ12 connectors "A" and "B" are passed on directly between loop-through RJ12 connectors – (see fig. 13.14.3).

Figure 13.14.3



- In OJ-DRHX, Modbus can also be connected via spring terminals in the terminal strip (see fig. 13.14.4).

Figure 13.14.4



13.15 Analogue/digital signal connections

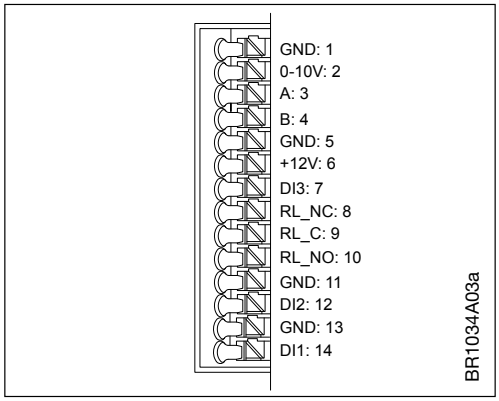
- Connect A/D control signals to the terminal strip, see fig. 13.15)
- Max. wire dimension is 0.75 mm^2 for control terminals.
- For further information on using the spring terminals, see section 13.10.

Note

NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

Figure 13.15



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13.16 **0-10V in**

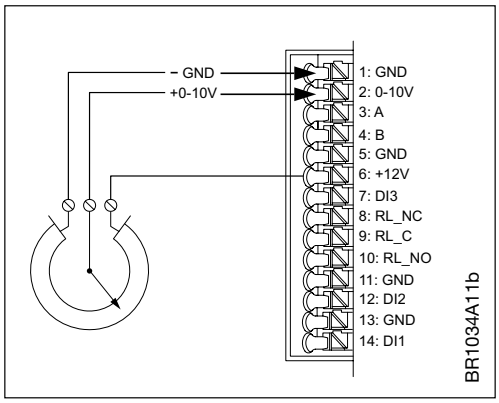
- Analogue 0-10 V control input for speed control via external 0-10 V control signal (see fig. 13.16).
- Use +12V DC output on pin 6 for 0-10V input on pin 2

Note

NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

Figure 13.16



13.17 **Digital relay outputs**

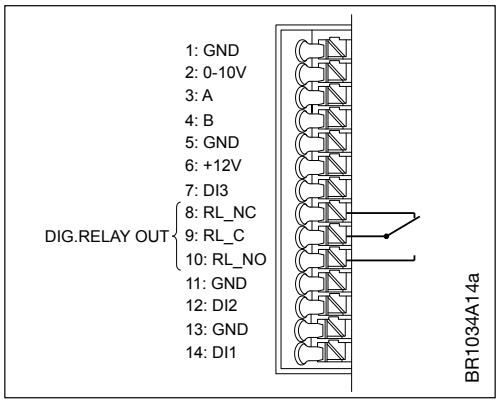
- OJ-DRHX is equipped with a digital relay output, which can, for example, be used for alarm signals (see fig. 13.17).
- The relay output is a potential-free relay with changeover switch.
- The factory-configured function is an alarm relay.
- Max. load is 2A/30 V DC/24 V AC.

Note

NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

Figure 13.17



13.18 **Digital inputs**

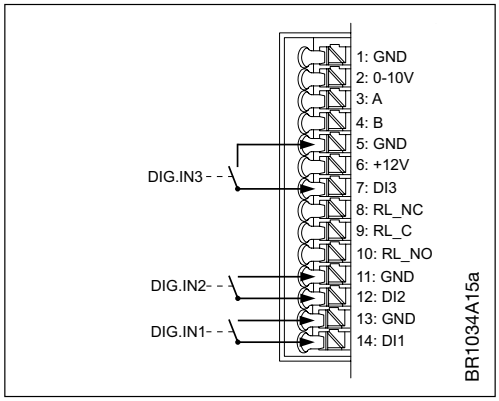
- OJ-DRHX is equipped with 3 digital inputs, which can e.g. be used for alarm reset (see fig. 13.18).

Note

NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

Figure 13.18



Factory-set functions are:

- DI1 = Alarm reset
- DI2 = Engage external rotor guard *
- DI3 = Signal from external rotor guard * - see section 17

*=Factory setting

Note

Digital input functions can be reconfigured using Modbus commands.

13.19 **Closing of OJ-DRHX**

- When all electrical connections are made, the operational test has been completed and the checklist (see checklist, section 14) has been filled in, the OJ-DRHX must be closed again.
- Position the cover in the same way as when it was removed, by placing it at a 135° angle and gently push it into the specially-designed hinge bracket (see fig. 13.8.2)
- Close the cover by pushing with moderate pressure until the specially-designed snap locks have engaged correctly.
- The cover is not properly closed until it cannot be opened without the use of tools.

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14. Checklist – mechanical and electrical installation

Before OJ-DRHX 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 indication of the nominal voltage on the OJ-DRHX rating plate is in compliance with the nominal mains voltage to which the OJ-DRHX will be connected.	
	Check that the selected stepper motor size meets the required torque in order to be able to run the specific rotor.	
Mechanical installation	Check that OJ-DRHX is correctly and securely attached to a flat surface. See section 12.1 in these instructions.	
	Check that there is a free, unobstructed passage of air to the cooling fins of OJ-DRHX. See section 12.1 in these instructions.	
	Check that the OJ-DRHX cover has been correctly fitted and that both snap locks have engaged correctly before energizing the product.	
	Check that all unused cable glands and other unused openings are appropriately blanked off in accordance with the applicable enclosure rating.	
	Check that the drive belt is tensioned correctly and that the rotor can rotate easily and unhindered, with a torque that is less than the rated torque for the stepper motor.	
	Make sure that the belt is not tensioned beyond the maximum permissible vertical tension on the stepper motor shaft.	
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 23 in these instructions.*	
Cabling	Check that all cabling has been fitted correctly and that stepper motor and control cables are kept apart in separate cable conduits. The motor cable must be fixed to the chassis of the rotor for its entire length	
	Check that all cables are securely attached and relieved of tension and torsion.	
	Check that all cables are free of visible damage throughout their length.	
Electrical installation	Check that cables have been correctly inserted into OJ-DRHX and that the cable glands have been correctly tightened.	
	Check whether there are any bad electrical connections, as they may cause overheating and serious damage to the product and to property.	
Mains voltage	Check that the mains voltage wires have been correctly fitted to the supply terminals: one-phase on terminals ”L”, ”N” and ”PE” and three-phase on terminals ”L1”, ”L2”, ”L3” and ”PE”.	
	Check by means of voltage measurement that there is the correct voltage on the terminals.	
Stepper motor connection	Check that the extension cable is properly connected to the OJ-DRHX terminals: ”U”, ”V”, ”W” and ”PE”	
Connector terminals, stepper motor and extension cable	Check that the connector terminals between the stepper motor cable and the extension cable are properly assembled and correctly engaged. The connector is properly assembled when the locking pawl on both sides of the connector on the motor cable is in firm connection with the connector on the extension cable.	
Control and signal wires	Check that control cables are correctly terminated in the spring terminals and that the control cables are securely attached. *(A/D control)*	
	Check that both ends of the Modbus cable have been attached to the correct connectors. *(Modbus control)*	
Fuses and circuit breakers	Check that the active short-circuit protection is correctly inserted and dimensioned and complies with applicable local and international directives and regulations	
	Check that all safety equipment, including supplementary protection, is operative and set correctly.	
Earthing	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.	

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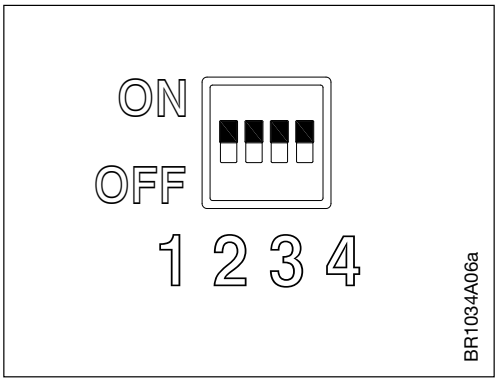
15. Functions and settings

15.1 DIP switch – settings and functions

The OJ-DRHX series is equipped with 4 DIP switches for setting e.g. the stepper motor size (see table 15.1.1) and maximum motor speed (see table 15.1.2).

Table 15.1.1	DIP1	DIP2
Stepper motor = 1Nm	ON	ON
Stepper motor = 2Nm	OFF	OFF
Stepper motor = 4Nm	ON	OFF
Stepper motor = 8Nm	OFF	ON

Table 15.1.2	DIP3	DIP4
Max RPM = 250 (Modbus*)	OFF	OFF
Max RPM = 200	ON	OFF
Max RPM = 170	OFF	ON
Max RPM = 150	ON	ON



Note

*With DIP3 & DIP4 in "OFF" position, max. speed could be overwritten/decreased via Modbus command or via the OJ-DRHX-PC-Tool. In case of other settings/combinations on DIP3 & DIP4, it is the DIP setting, which limits max. speed and max. speed cannot be overwritten/decreased using Modbus command or OJ-DRHX-PC-Tool.

Warning

Incorrect DIP switch setting to select stepper motor and max. motor speed can result in reduced performance or overload of the stepper motor, with a risk of overheating and lasting damage to the stepper motor and drive.

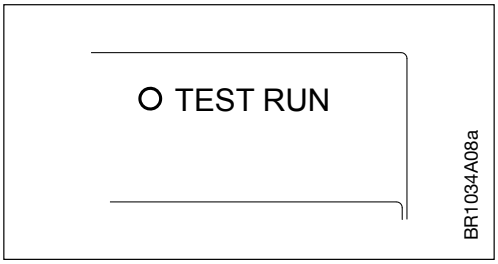
15.2 Testing

OJ-DRHX series is provided with a test function in the form of a built-in test push-button.
The test button is located inside the drive in the upper right corner and must be operated with the drive open.
The test button has different functions, depending on how long the button is pressed in:

1. Short press < 1sec.: The drive will enter test mode and stay in test mode until the button is pressed again. The rotor will start rotating in a sequence from 0–100 rpm according to the selected ramp-up time and remain at 100 rpm. Pressing the button a second time will cause the drive to leave test mode and stop the rotor according to the selected ramp-down time.
2. Pressing and holding the button will cause the drive to enter test mode where it will remain until the button is released. The signal to the rotor will override to 100 rpm according to the selected ramp-up time.
   Please note, that when pressing the testbutton for more than 20 sec. the calibration function off the internal rotorguard may be triggered, (see chapter 15.15)

The test button also works when Modbus control is activated.

Figure 15.2



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15.3 LED indicator

OJ-DRHX series is fitted with an LED indicator - see fig. 15.3.
LED can be viewed both with open and closed cover.
LED indicator codes (see table 15.3)

Figure 15.3

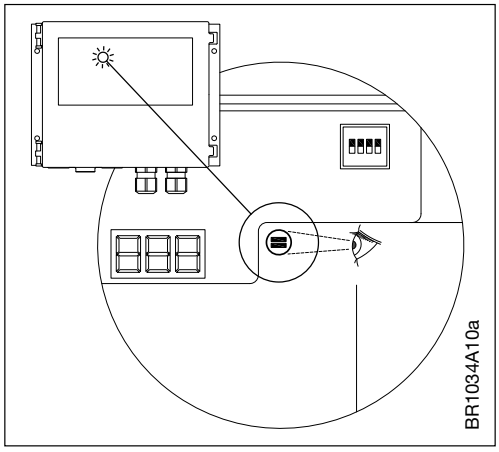


Table 15.3	
LED	**State**
OFF	No voltage
Green ON	Voltage is present
Flashing green	Valid Modbus communication
Red ON	Rotor stopped due to critical alarm
Flashing red	Operating with Reduced power
Orange ON	Test function activated
Flashing orange	Purging function activated

NOTE: Flashing means that the LED is off for 100 ms and on for min. 100 ms (ms=milliseconds)

15.4 Display

Note

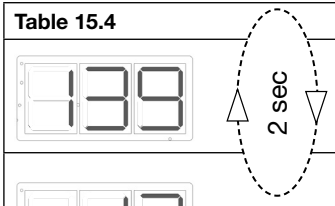
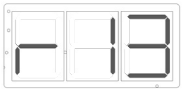
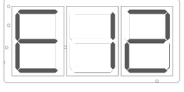
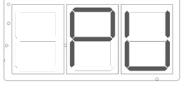
NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

Display is visible with open and closed cover.

The display shows current status for drive, stepper motor and rotor. See table 15.4.

Views:

Table 15.4	
	Current stepper motor speed is displayed when the stepper motor is running and no rotor or pulley diameter has been entered via OJ-DRHX-PC-Tool or the respective corresponding Modbus registers.
	Current rotor speed is displayed when the stepper motor is running and rotor and pulley diameter have been entered via OJ-DRHX-PC-Tool or the respective corresponding Modbus registers. *Display toggles between torque and speed with 2 sec toggle intervals.*
	Current torque (Nm) *Display toggles between torque and speed with 2 sec toggle intervals.*
	Fault codes*; see the importance of the individual fault codes under the section “Alarms and fault codes” – See table 19.
	Reduced performance operation due to current overload, overheating or other failure or overload. Read out the current fault/alarm via Modbus.
	Purging function activated

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	Test function is activated and stepper motor is receiving control signal for max. rpm rotations.
	Hold function is activated (Holding).
	Stepper motor is in “STOP” mode

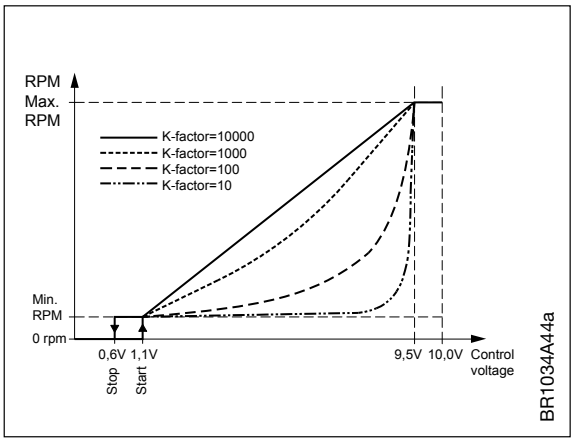
15.5 0-10 V control

Note

NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

Figure 15.5



- OJ-DRHX is factory-configured for 0-10 V control.
- This can be changed to constant Modbus control via the corresponding Modbus Register (see Modbus, section 15.6).
- The motor starts when there is a control signal over 1.1 V (see fig. 15.5).
- The motor stops when control signal is less than 0.6 V (see fig. 15.5).
- The motor runs at maximum speed when there is a control signal over 9.5 V (see fig. 15.5). Max. motor speed can be set to either 150, 170, 200 or 250 RPM by means of a DIP switch (see section 15.1).
- Compensation for non-linear heat transfer on the rotor can be achieved by configuring a K-factor. It is thus possible to achieve a far more optimal heat transfer and better adjustment (see fig. 15.5.).
- K-factor is configured via Modbus register or via OJ-DRHX-PC-Tool.
- Default K-factor is configured by the manufacturer to 100.

15.6 Modbus control

- OJ-DRHX can be controlled via Modbus commands according to the Modbus protocol (see separate documentation)
- If a request is received via Modbus for the start register and/or speed register, the drive will temporarily change from 0-10 V control to Modbus control until the next restart.
- If OJ-DRHX is to be controlled via Modbus, Coil Stat Bit register 8 must be set to ”0” = ”Modbus control" (see Modbus protocol)
- Alarms and operating status can still be monitored via Modbus, even if “Modbus control” is not activated.

15.7 Rotation monitoring in general

- As the stepper motor and rotor are mechanically connected through a belt drive, it is necessary to monitor whether the rotor is rotating.
- The DRHX is equipped with two types of rotor monitoring systems. A traditional external optical sensor can be used and it can be connected to the digital input ports, or a newly developed internal software rotor monitor can be used.
- If the motor is no longer rotating the rotor due to a lack of tension or a defective belt, the DRHX drive will trigger a “rotor guard” alarm.
- The factory setting is “Internal rotor guard”.
- The external rotor guard can be activated via digital input DI2 (factory setting) or via a Modbus command (see Modbus protocol).

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- For external rotation monitoring, an external rotor guard must be installed (see section 17: Accessories).
- The internal rotor monitor can be deselected by use of the PC tool

15.8 **Internal rotor guard**

The internal rotor guard monitors the correct rotation of the rotor by measuring the motor current and motor speed.
Every 10 seconds, the software rotation check observes the change of the motor speed after a short change of the motor current. Six consecutive failed detections will trigger one restart. The default DRHX setting is five restart attempts. After 5 minutes, a rotor guard alarm is emitted.
The internal rotor monitor works automatically with a motor speed above 25 rpm. For motor speeds below 25 rpm. the connected control unit (AHU controller) will typically help. If the rotor does not deliver the desired heat recovery, the connected controller will request a higher speed to enable a higher heat recovery.

15.9 **Boost function**

- The OJ-DRHX series has a built-in “Start function” which automatically allows higher current for the motor during start-up.
- OJ-DRHX can deliver up to 150% of rated current (stated in mA) to the stepper motor during start-up (max. 100 sec.)
- OJ-DRHX stops the start function when the “Start time” set in the timer runs out or when the stepper motor has reached 50% of the maximum set speed.

15.10 **Purging function**

- When the OJ-DRHX drive is set to "Modbus" control, the purge function is controlled from the air handling unit’s control system.
- When OJ-DRHX is controlled via 0-10 V signal, the purging function starts automatically when the stepper motor has been stopped for 10 minutes.
- The stepper motor will run for a number of turns (default number 10) at low speed, after which the stepper motor will stop again.
- The function is repeated every 10 minutes when the stepper motor is stopped.
- The function thus prevents mechanical breakdown and deformation of the rotor.
- The number of turns and repetition rate can be changed by use of the PC tool.

15.11 **Holding torque**

- To prevent the rotor from rotating due to air flow, OJ-DRHX has a brake function which retains the rotor in a fixed position.
- This brake function is automatically activated when the motor has no operating signal.
- The holding torque value is default set to 0% and can be changed by use of the PC tool.
- Setting of retention torque level can be altered via Modbus command, see section 18.4.
- The holding torque can be set in % up to 100% torque but should only be increased until the rotor stops moving.

15.12 **Display of actual speed**

Note

NOTE! Only applies to:

- OJ-DRHX-1055-MAD5
- OJ-DRHX-1220-MAD5

- During normal operation, the drive display will show the speed of the stepper motor or rotor.
- If no values are specified for the actual size of the pulley and rotor, the drive display will show the current speed (rpm) of the stepper motor (see section 15.4).
- If the size of the pulley and rotor are entered via Modbus Holding Register (see Modbus protocol) or OJ-DRHX-PC-Tool, the drive display will show the current speed (rpm) for the rotor.

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- Pulley size (ø mm) is indicated in the Holding Register (see Modbus protocol) or via OJ-DRHX-PC-Tool – entered in mm.
- Rotor size (ø mm) is indicated in the Holding Register (see Modbus protocol) or via OJ-DRHX-PC-Tool – entered in mm.
- Other read-outs – see section 15.4.
- Rotor speed can also be read out via the Modbus register – (see Modbus protocol).

15.13 Built-in protection

- If the temperature inside OJ-DRHX exceeds 95°C, OJ-DRHX will attempt to reduce its internal heat generation by reducing the amount of current that is sent to the stepper motor.
- OJ-DRHX has built-in current limitation for the protection of stepper motor and cables and cannot therefore supply more current than it is set to.
- OJ-DRHX is short-circuit protected against phase-phase short-circuits on the OJ-DRHX connector terminals for the stepper motor (U, V, W).
- OJ-DRHX control inputs are protected against short-circuits.

15.14 Rotor blocked detection

If the load of the rotor is above the rated maximum torque of the DRHX and motor, the DRHX will trigger a rotor blocked alarm.
This detection depends on the tension of the belt and the friction between belt and pulley.

- Significantly lower tension will be perceived as a broken belt and trigger the internal rotor guard alarm, causing the DRHX to stop the motor.
- A lower belt tension may reduce the friction between belt and pulley and can cause a lower rotor speed than desired if the belt is slipping in the pulley.
- Depending on the motor speed and the friction between belt and pulley, the DRHX will detect this malfunction by observing the speed ripple of the motor and the vibrations of the system.
- Higher ripple and vibrations will typically be detected at higher motor speeds.

15.15 Test and calibration for internal rotor guard

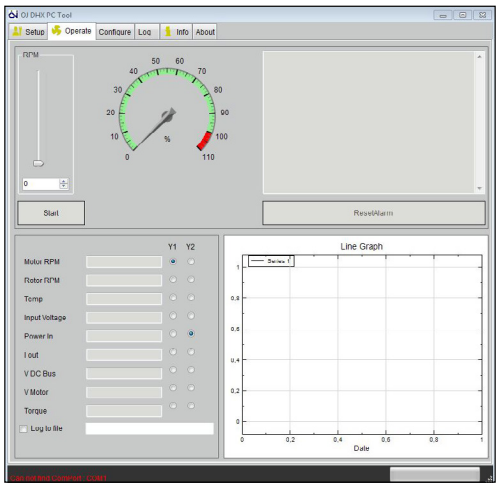
1. Turn off the DRHX and remove the belt from the pulley.
2. Turn on the DRHX and briefly press the test button > 1 second (right for the dip switches) to start test mode.
3. The LED will shine orange.
4. Wait for the stepper motor to reach maximum speed (limited to 100 RPM).
5. After the stepper motor has reached the maximum speed, the system will start performing the internal rotor guard function. The stepper motor will accelerate at short intervals every 10 seconds (that should be possible to hear).
6. If the stepper motor stops and restarts after one minute the internal rotor guard is correctly calibrated. Press the test button for 2 seconds to end test mode.
7. If the stepper motor continues to run for more than one minute, a calibration needs to be run.
8. To recalibrate: Press and keep pressing the test button (10–20 sec.) until LED flashes orange.
9. After recalibration you can turn off the DRHX and reapply the belt.

16. OJ-DRHX-PC-Tool – connection and functions

The OJ-DRHX series can be configured using OJ-DRHX PCTool, which must be connected to Modbus RJ12 connector.
OJ-DRHX-PC-Tool is a service program which is installed on a standard PC, allowing you to read out and configure stepper motor and drive parameters, including:

- Status: Control and operating parameters for connected OJ-DRHX
- Setup: Application parameter settings

Figure 16.1



- Alarm: Read-out of alarm log for connected OJ-DRHX
- Modbus: Changing Modbus settings for OJ-DRHX
- About: Read-out of software version and type for connected OJ-DRHX
- Log data: Read-out of log files

OJ-DRHX PC-Tool is used solely by rotor and system manufacturers.

Further information about the OJ-DRHX-PC-Tool: see separate manual.

17. Accessories

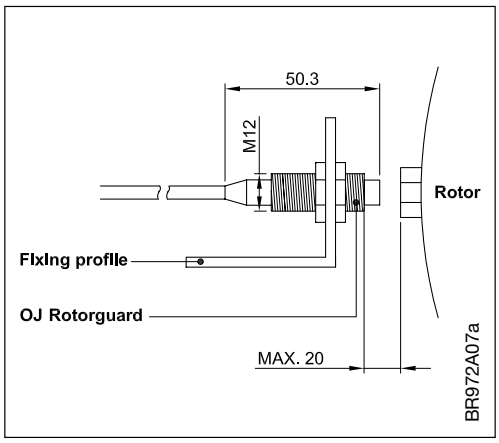
External rotor guard

- An external rotor guard can be connected to the OJ-DRHX, as an additional accessory.

Mechanical installation

- The “OJ Rotor guard” is an inductive sensor.
- A sensor plate must be fitted to the rotary heat exchanger. The sensor plate must be of metallic material, e.g. the head of a bolt, a screw or similar. See fig. 17.1.
- Max. sensor range is 20 mm.
- One or more sensor plates can be installed on the rotor. If more than one sensor plate is installed, the drive will receive a corresponding number of signals per revolution.
- If you want to use more than one sensor plate, the number of sensor plates should be entered to the drive using OJ-DRHX-PC-Tool or correspondingly in the Modbus register - see Modbus protocol.
- The value in this register will be used in the calculation of the rotor’s actual speed, as shown in the display.
- If the actual number of pulse signals from the rotor guard varies from the calculated number of pulse signals, a rotation error alarm will be triggered.
- This is how to monitor for untensioned or broken belts.

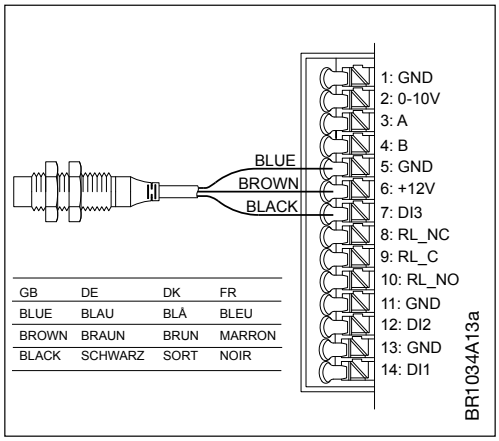
Figure 17.1



Electrical connection

- If the rotor is to be monitored via an external rotor guard, this should be connected to terminal: "GND", "+12V" and "DI3" (see fig. 17.2).
- The rotor guard is a triple-conductor induction sensor and is supplied by OJ Electronics A/S as an accessory.

Figure 17.2



GB	DE	DK	FR
BLUE	BLAU	BLÅ	BLEU
BROWN	BRAUN	BRUN	MARRON
BLACK	SCHWARZ	SORT	NOIR

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18. Modbus

18.1 Introduction

- OJ-DHRX can be controlled via Modbus RTU, according to the Modbus protocol.
- OJ-DRHX is factory-set for 0-10 V control.
- When OJ-DRHX detects a start signal or speed setpoint via Modbus, OJ-DRHX will automatically shift temporarily to control via Modbus RTU. The ”0-10 V” signal is ignored. The function is automatically reset when the OJ-DRHX is restarted.
- OJ-DRHX can be locked via the Modbus register to always be controlled via Modbus. The 0-10 V signal will thus be ignored also when no active Modbus communication is detected.
- To change and read out Modbus registers, use OJ-DRHX-PC-Tool or via e.g. the OJ-Air2WEB user interface.

Warning

Any changes to values are at your own responsibility:
It is your own responsibility to ensure that values and settings are configured so that no overload or damage is caused to the stepper motor or rotor.

18.2 Modbus communication

- OJ-DRHX is supplied with the factory setting (see table 18.2.1):

Table 18.2.1

	Setting range	Unit	Factory setting
Address	1-247	n/a	79 dec.
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2 kBaud		38.4
Parity	None, even, odd	n/a	None
Stop bit(s)	0, 1, 2	n/a	2
Communication timeout	0-240	Sec.	10

- OJ-DRHX supports the following commands (see table 18.2.2):

Table 18.2.2

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 OJ-DRHX via Modbus are rounded off to the nearest valid value.

18.3 Detection of active Modbus

- OJ-DRHX automatically detects valid Modbus communication on the Modbus inputs (RJ12 connector or "A" & "B" terminals on the terminal strip).
- OJ-DRHX will first detect on the communication parameters: ID 79, 38.4 – 8 – N – 2
- Alternative communications parameters can be set using the Modbus register.
- After 10 seconds without receiving a valid Modbus request with the default parameters, the DRHX will try to detect a Modbus request with the alternative parameters.

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18.4 Modbus protocol

The current Modbus protocol is availablle for download at www.ojelectronics.com

19. Alarms and fault codes

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

Alarms are either *"Critical"* alarms or "Non-critical" alarms.
"Critical" alarms stop the stepper motor.
"Non-critical" alarms reduce stepper motor performance.

The built-in alarm monitor stops the OJ-DRHX.
If the alarm situation passes, the alarm is automatically reset and OJ-DRHX restarted.
If the maximum number of restarts (5 times/60 min) is exceeded, the alarm must be reset.
The alarm can be reset by means of a Modbus command.
The alarm is automatically reset if the power is disconnected for longer than 60 seconds.
Alarm/fault code is shown on the display (only OJ-DRHX-1XXX-MAD5)
Alarms can be read via Modbus, see *Modbus protocol*
Alarm/fault code overview, see table 19.

Table 19

Fault code	Alarm overview	Alarm priority	Activity
E01	Alarm from rotor guard	**"C"**	**"SA5"**
E02	Excessive supply voltage	**"C"**	**"SA5"**
E03	Insufficient supply voltage	**"C"**	**"S"**
E04	Power to the motor increased at a critical level, e.g. short-circuiting cable, connector or motor	**"C"**	**"SA5"**
E05	Excessive temperature inside OJ-DRHX (> 95°C)	**"NC"**	**"RP"**
E06	Blocked motor	**"C"**	**"SA5"**
E07	No valid Modbus communication >10 sec.	**"C"**	**"S"**
E08	Phase fault on stepper motor power supply (U, V, W)	**"C"**	**"SA5"**
E09	Internal hardware error	**"C"**	**"S"**

Exx: Alarm codes can be read on the display – see section 15.4

Remarks: **"C"**=critical alarm **"NC"**=Non-critical
"RP"=Reducing performance
"SA5"=Stepper motor stops after 5 restarts caused by same fault within 60 min
"S"=Stepper motor stops immediately

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20. Maintenance

OJ-DRHX is maintenance free under normal operating conditions and load profiles.

Caution

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

Warning

OJ-DRHX cannot be repaired on site.
Never attempt to repair a defective OJ-DRHX drive or MRHX motor.
Contact your supplier to obtain a replacement.
Additional technical data is available on request from your supplier or OJ Electronics A/S.

21. Liability

This instruction must be observed, otherwise the liability of the manufacturer will be void.
This product must only be installed by qualified personnel or people who have received appropriate training.

Appropriate service and maintenance of the rotary heat exchanger system is needed to ensure proper operation of the product in general. It must be specifically ensured at all times that the belt is tight to ensure proper function of the software rotor monitor.

Any changes or modifications of this product will void the liability of the manufacturer.

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22. Troubleshooting

Warning

Before opening OJ-DRHX, the mains voltage must be disconnected for at least 3 minutes to ensure that there is no risk of dangerous residual currents in electronic circuits or capacitors.
If OJ-DRHX has no operating signal, but natural drafts through the air handling unit cause the rotor and thus the stepper motor to rotate, there is a risk that the stepper motor will induce voltage on the OJ-DRHX stepper motor terminals, making them dangerous to touch.
When servicing or troubleshooting the stepper motor: The stepper motor can become very hot >60°C.

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Troubleshooting when OJ-DRHX is controlled via A/D signals (0-10 V):

Symptom	Cause	Action
Stepper motor is not running	Lacking supply voltage	Check the voltage supply (230 V AC) to OJ-DRHX terminals ”L” and ”N” (Nominal supply voltage is stated on the rating plate). LED displays constant green light – see section 15.3 for additional LED indications.
		Check whether short-circuit protection has been activated.
		Check that the voltage supply to OJ-DRHX has not been cut off by other components.
	Poor electrical connections	Check electrical connections.
	Wrong stepper motor for OJ-DRHX setup	Check that the DIP switch is correctly set for the selected stepper motor size and speed.
	Lacking operating signal	A/D control: DRHX can be configured via the Modbus register to receive a start signal via an optional digital input. If this function is selected, check that the OJ-DRHX has a signal connected to the "Start/Stop” input - digital input Din 1, 2 or 3, depending on the configuration.
	Lacking 0-10 V DC control signal	Check that OJ-DRHX receives an operating signal >1.1 V on ”0-10 V In”.
	Active alarm	Read active alarms via the display, Modbus register or with OJ-DRHX-PC-Tool and remove what is causing the alarm.
	The stepper motor has been stopped 5 times by the built-in stepper 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 OJ-DRHX and reconnecting it after approx. 60 seconds.
	Defective OJ-DRHX controller	Replace OJ-DRHX. Never attempt to repair a defective OJ-DRHX controller. Contact your supplier for replacement/repair.
	Stepper motor is defective	Replace stepper motor
Stepper motor is running in wrong direction	Wrong phase sequence in stepper motor cable	Swap 2 phase wires on OJ-DRHX stepper motor terminals.
	Modbus register is incorrectly configured	Rotation direction can also be inverted via Modbus command or using the OJ-DRHX-PC-Tool.
OJ-DRHX cuts out due to an alarm	At least one alarm active	Alarm is viewed via display*, Modbus or using OJ-DRHX-PC-Tool to determine which alarm has stopped the stepper motor. *:Only applies to model with display (-MAD5)
		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 OJ-DRHX and reconnecting it after approx. 60 seconds.
	The alarm is re-activated after reset	Use OJ-DRHX-PC-Tool to view the alarm and determine which alarm has stopped the stepper motor.
		Remedy the cause of repeated alarm activation.
The rotor stops unintentionally (Fault code: E01, display version)	Internal rotor guard detects a loose or defective belt	Tighten or replace belt
	The internal rotor guard is incorrectly calibrated (see 15.8 for more information)	Make a recalibration (see 15.15)

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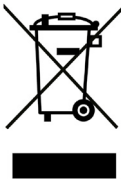
Troubleshooting when OJ-DRHX is controlled via Modbus:

Symptom	Cause	Action
Stepper motor is not running.	Lacking supply voltage	Check the voltage supply to OJ-DRHX terminals ”L” and ”N” (230 V AC)
		Check whether short-circuit protection has been activated.
		Check that the voltage supply to OJ-DRHX has not been cut off by other components.
	Poor electrical connections	Check electrical connections.
	Wrong stepper motor for OJ-DRHX setup	Check that the DIP switch is correctly set for the selected stepper motor size and speed.
	Lacking operating signal	Check that OJ-DRHX can receive an operating signal. Coil Stat Bits Register 0X0001: Stepper motor start/stop (1=On)
	No % control signal from Modbus drive	Check the Modbus control signal at Modbus address: Holding registers; Register 3X0001: PrcSet 0-10000 (0-100%)
	The stepper motor has been stopped 5 times by the built-in stepper 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 OJ-DRHX and reconnecting it after approx. 60 seconds.
	Defective OJ-DRHX controller	Replace OJ-DRHX Never attempt to repair a defective OJ-DRHX controller. Contact your supplier for replacement/repair.
	Stepper motor is defective	Replace stepper motor
Stepper motor is running in wrong direction	Wrong phase sequence in Steppermotor cable	Swap 2 phase wires on OJ-DRHX stepper motor terminals.
	Modbus register is incorrectly configured	Rotation direction can also be inverted via Modbus command or using the OJ-DRHX-PC-Tool.
OJ-DRHX cuts out due to an alarm	At least one alarm active	Alarm is viewed via display*, Modbus or using OJ-DRHX-PC-Tool to determine which alarm has stopped the stepper motor. *:Only applies to model with display (-MAD5)
		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 OJ-DRHX and reconnecting it after approx. 60 seconds.
	The alarm is re-activated after reset	Use OJ-DRHX-PC-Tool to view the alarm and determine which alarm has stopped the stepper motor.
		Remedy the cause of repeated alarm activation.
The rotor stops unintentionally (Fault code: E01, display version)	Internal rotor guard detects a loose or defective belt	Tighten or replace belt
	The internal rotor guard is incorrectly calibrated (see 15.8 for more information)	Make a recalibration (see 15.15)

23. Disposal

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



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24. Technical specifications

	Type	DRHX-1055-MNN5	DRHX-1055-MAD5	DRHX-1220-MNN5	DRHX-1220-MAD5
Torque	Nm	1.0 / 2.0	1.0 / 2.0	4.0 / 8.0	4.0 / 8.0
Power size	W	27.5 / 55		220	
Efficiency	%	> 90%			
Power supply					
Voltage	VAC	1 x 230 V AC 50/60 Hz -10%/+10%			
Supply current at max. load	A	0.6		1.0 / 2.0 / 4.0 / 8.0	
Power factor (cos-phi) at max. load		0.65			
Motor output					
Nominal motor power (on shaft) *1	kW	27.7 / 55	27.7 / 55	110 / 220	110 / 220
Motor speed	rpm	0-250			
Nominal motor Torque	Nm	1.0 / 2.0		4.0 / 8.0	
Boost motor torque	Nm	2.5		5.0 / 10.0	
Frequency	Hz	0-120			
Max. output voltage	Vrms	3 x 0 - 150V AC			
Max. output current	Arms	2.5	2.5	3.5	3.5
Protection					
Max. fuse	A	10			
Motor output		Short-circuit protected between phases			
Motor		Protected by current limit			
Impulse protection		Transient protected by VDR			
Overvoltage protection		No			
Overload protection		Current and temperature overload protection			
Environment					
Operating temperature	°C	-40°C to +40°C			
Starting temperature	°C	-40°C to +40°C			
Storage temperature	°C	-40°C to +70°C			
Dimensions	mm	183 x 143 x 55			
Protection rating	IP	54			
Enclosure material		Plastic			
Front cover		Plastic			
Weight	kg	0.9			
Humidity	% rh	10-95% rh, non-condensing			
Cooling		Self-cooling			
Interfaces					
Modbus protocol		MODBUS RTU RS485 (Baud rate: 9.6, 19.2, 38.4, 57.6, 115.2 Kbaud) Default: 38.4k baud, 1 stop bit, non-parity			
Modbus connection		2 x RJ12 & 3 x spring terminals			
Modbus cable		Max. 100 m			
7-segment display		No	3	No	3
Analogue In1		No	0–10 VDC, 100% @ 9.5 V DC +/-2%	No	0 - 10 VDC, 100% @ 9.5 V DC +/-2%
Analogue Out1		No	+10 V DC	No	+10 V DC
Digital In1 (internal Pull up)		No	Start / Stop (configurable)	No	Start / Stop (Configurable)
Digital In2 (internal Pull up)		No	Alarm reset (configurable)	No	Alarm reset (Configurable)
Digital In3 (internal Pull up)		No	External rotor guard (configurable)	No	External rotor guard (Configurable)
Digital Out1		No	No	No	No
Alarm relay		No	SPDT relay 1A 30VDC/24VAC	No	SPDT relay 1A 30VDC/24VAC
Green LED		On: Power connected | Flashing: Active Modbus communication			
Red LED		Flashing: Alarm but keep running | Constant on: Serious alarm - stop motor			
DIP switches		4	4	4	4
Rotary switch		No	No	No	No
Option module		No	No	No	No
Functions					
Technology		Sinusoidal back-EMF signal controlled via FOC (Field Oriented Control)			
Ramp-up time	sec.	15-300			
Ramp-down time	sec.	15-300			
Alarm		Ja			
Alarm reset		Via digital input, MODBUS or powering down for more than 60 seconds			
Purging	sec.	Ja			
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			
Short-circuit protection		Yes			
EMC filter		Integrated			
Approvals					
EMC		EN 61800-3 (C1 & C2)			
LVD		EN 61800-5-1			
Product standard		EN 61800 Part 2			
RoHS Directive		Yes			
Product approvals		CE			

Note: Data are valid at: nominal supply voltage and at +25°C ambient temperature
*1: IO option module is mounted as standard

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	Type	MRHX-3P01N-03C5	MRHX-3P02N-03C5	MRHX-3P04N-03C5	MRHX-3P14N-03C5
Torque	Nm	1.0	2.0	4.0	8.0
Power size	W	27.5	55	110	220
Weight	kg	≈ 1.4 kg	≈ 2.4 kg	≈ 3.5Kg	≈ 5 Kg
Sealing grade	IP	54	54	54	54
Operating temperature	°C	-40˚C to +40˚C	-40˚C to +45˚C	-40˚C to +45˚C	-40˚C to +45˚C
Storage temperature	°C	-40˚C to +70˚C	-40˚C to +70˚C	-40˚C to +70˚C	-40˚C to +70˚C
Dimensions	mm	56 x 56 x 97	85 x 85 x 67	85 x 85 x 97	85 x 85 x 156
Shaft diameter	mm	12	12	12	12
Cable length (with connector)	m	0.3	0.3	0.3	0.3
Max. radial force (20 mm from the flange)	Nm	75	250	250	250
Max. axial force	Nm	15	60	60	60

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