INSTRUCTIONS

OJ DRHX 14Nm

OJ DRHX 14Nm
A DRIVES PROGRAMME DEDICATED TO ROTARY HEAT EXCHANGERS

OJ ELECTRONICS

Contents

1. Product presentation

The OJ DRHX is the new generation of drives for the control of rotary heat exchangers – based on new technology. The OJ DRHX covers motors rated from 2 Nm to 14 Nm with both RS-485 interface and analogue controllers.

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.

The 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-1690-MAN5**
  - **OJ-DRHX-1790-MAN5**
  - **OJ-DRHX-1055-MNN5**
  - **OJ-DRHX-1055-MAD5** *– specified in a separate document*
  - **OJ-DRHX-1220-MNN5**
  - **OJ-DRHX-1220-MAN5**

- Read these instructions thoroughly and follow the directions they contain before taking the 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.

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

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.

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**

The 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.

The 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 the 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 an external input signal or the RS-485 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 the 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.

The 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**

The OJ DRHX is used to regulate the speed of a rotary heat exchanger in air handling units.

The OJ DRHX can only be used to control OJ MRHX stepper motors supplied by OJ Electronics A/S. Never try to connect or control other types of stepper motor.

Depending on usage, the 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 23. Technical specifications.

The drive and stepper motor is a slave unit that is controlled by signals or commands from an external control unit.

The OJ DRHX has built-in stepper motor protection.

The 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 the OJ DRHX is built into machinery with rotating parts, e.g. in an air handling unit or the like, the entire system must comply with the Machinery Directive.

7. EMC – Electromagnetic compatibility

- The OJ DRHX has a 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 3 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-1690-MAN5 – described in these instructions
  √ OJ-DRHX-1790-MAN5 – described in these instructions
  √ OJ-DRHX-1055-MNN5 – *see separate instructions*
  √ OJ-DRHX-1055-MAD5 – *see separate instructions*
  √ OJ-DRHX-1220-MNN5 – *see separate instructions*
  √ OJ-DRHX-1220-MAD5 – *see separate instructions*

Table 9.1*	DRHX-1055 -MNN5	DRHX-1055 -MAD5	DRHX-1220 -MNN5	DRHX-1220 -MAD5	DRHX-1690 -MAN5	DRHX-1790 -MAN5
RS-485 interface	Yes	Yes	Yes	Yes	Yes	Yes
Modbus	Yes	Yes	Yes	Yes	Yes	Yes
BACnet	No	Yes	No	Yes	Yes	Yes
0-10 V	No	Yes	No	Yes	Yes	Yes
Display	No	Yes	No	Yes	No	No
Smart rotor guard	Standard	Standard	Standard	Standard	Standard	Standard
External rotor guard	no	Accessories	no	Accessories	Accessories	Accessories
Aut. purg. function	no	Yes	no	Yes	Yes	Yes
Deformation safeguard	Yes	Yes	Yes	Yes	Yes	Yes
Power (max.)	55 W	55 W	110/220 W	110/220 W	690W	790 W
Supply voltage	1x230 V AC	1x230 V AC	1x230 V AC	1x230 V AC	1x230 V AC	1x230 V AC
Nominal torque	2 Nm	2 Nm	4/8 Nm	4/8 Nm	14 Nm	14 Nm
Max. rpm	400 rpm	400 rpm	400 rpm	400 rpm	400 rpm	400 rpm
Motor voltage	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC	3x0-200 V AC
Dimensions (w,h,d) (mm)	183.0x142.7 x55.0	183.0x142.7 x55.0	183.0x142.7 x55.0	183.0x142.7 x55.0	185.0x230.5 x90.0	184.5x265.5 x125.0
Enclosure rating (IP)	IP54	IP54	IP54	IP54	IP54	IP54

* See also the technical specifications in section 23.

9.2 Stepper motor programme

The associated stepper motor programme is comprised of 3 different torque ratings: (See table 9.2)
√ OJ-MRHX-3P02N-03C5
√ OJ-MRHX-3P04N-03C5
√ OJ-MRHX-3P08N-03C5
√ OJ-MRHX-3P14N-03C5

Table 9.2	OJ-MRHX-3P02N-03C5	OJ-MRHX-3P04N-03C5	OJ-MRHX-3P08N-03C5	OJ-MRHX-3P14N-03C5
Motor torque	2 Nm	4 Nm	8 Nm	14 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	400rpm
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)	85 mm, 85 mm, 67 mm	85 mm, 85 mm, 97 mm	85 mm, 85 mm, 156 mm	134 mm, 134 mm, 170 mm
Shaft diameter	Ø12 mm	Ø12 mm	Ø12 mm	Ø19 mm
Enclosure rating (IP)	IP54	IP54	IP54	IP54

⚠ **Warning**

Only the original stepper motors from OJ Electronics A/S must be connected to the DRHX drive.

9.3 Extension cable programme

The drive is supplied with no cable, which therefore needs to be ordered as a separate item. The extension cables are also supplied with a pre-fitted 4-pole connector (Tyco MATE-N-LOK) at one end.
The other end of extension cable wires is 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
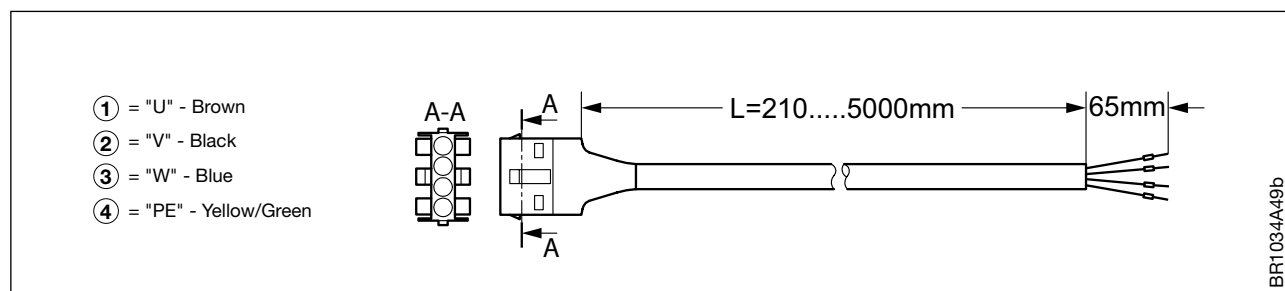
Extension cable programme:
- Product code. 97301 (L=500 mm)
- Product code. 97302 (L=2000 mm)
- Product code. 97303 (L=3000 mm)
- Product code. 97304 (L=5000 mm)
- Product code. 97306 (L=310mm)
- Product code. 97307 (L=210mm)
- Product code. 97308 (L=700mm)

10. Product label

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

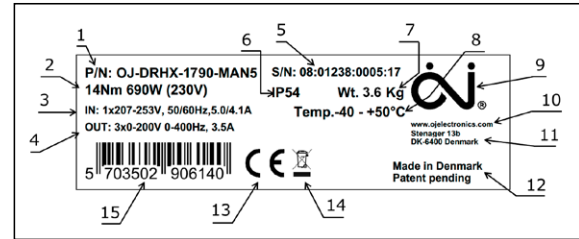### 10.2 The OJ DRHX Drive: Rating plate, information and explanation
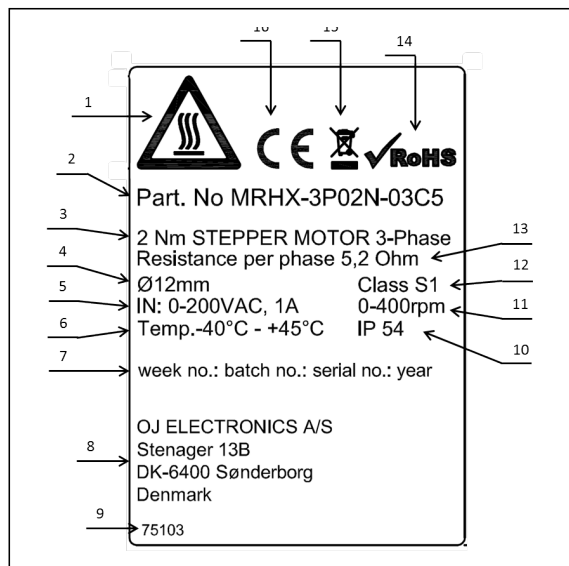
10.3 The OJ MRHX stepper motor is fitted with a rating plate.

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 OJ MRHX Stepper motor: Rating plate, information and explanation

Figure 10.3

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

Figure 10.1

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

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

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

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 fig. 10.6.1 (Drive) & fig. 10.6.2 (Stepper motor)

Figure 10.6.1 - Drive; Product ID
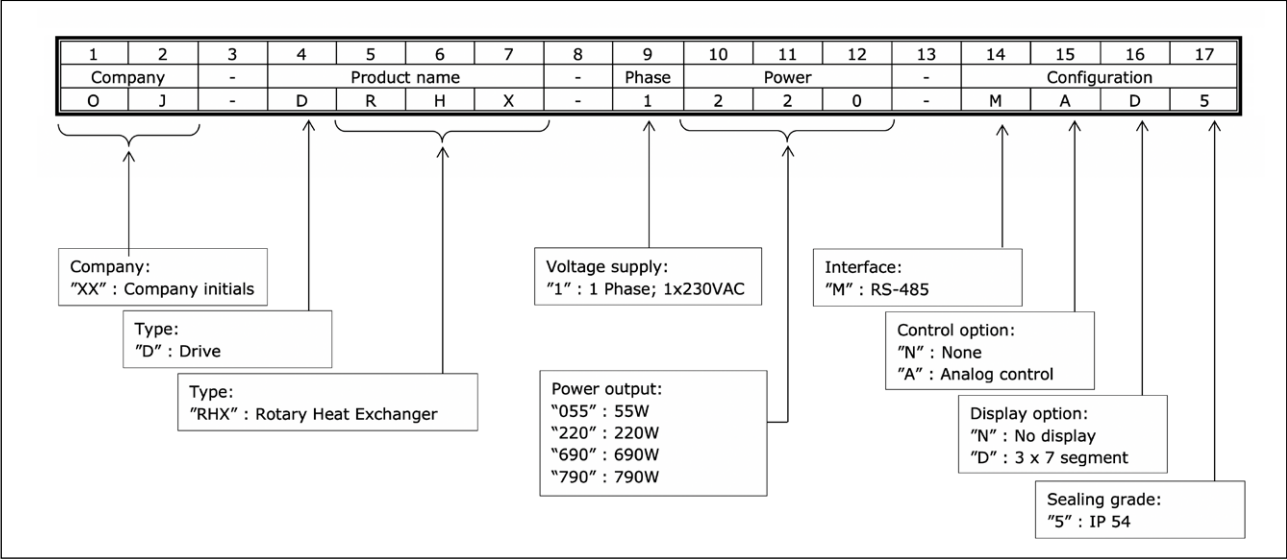
Figure 10.6.2 - Stepper motor; Product ID
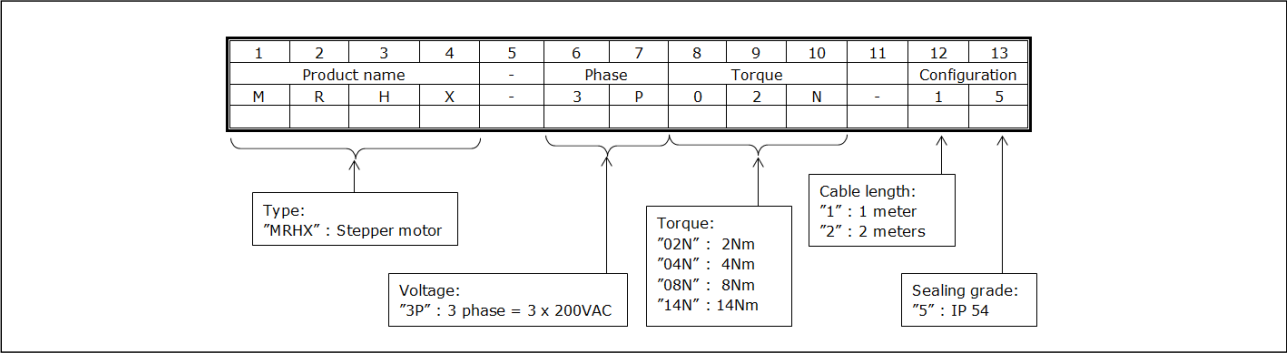
11.   Exploded and dimensioned drawings

Figure 11
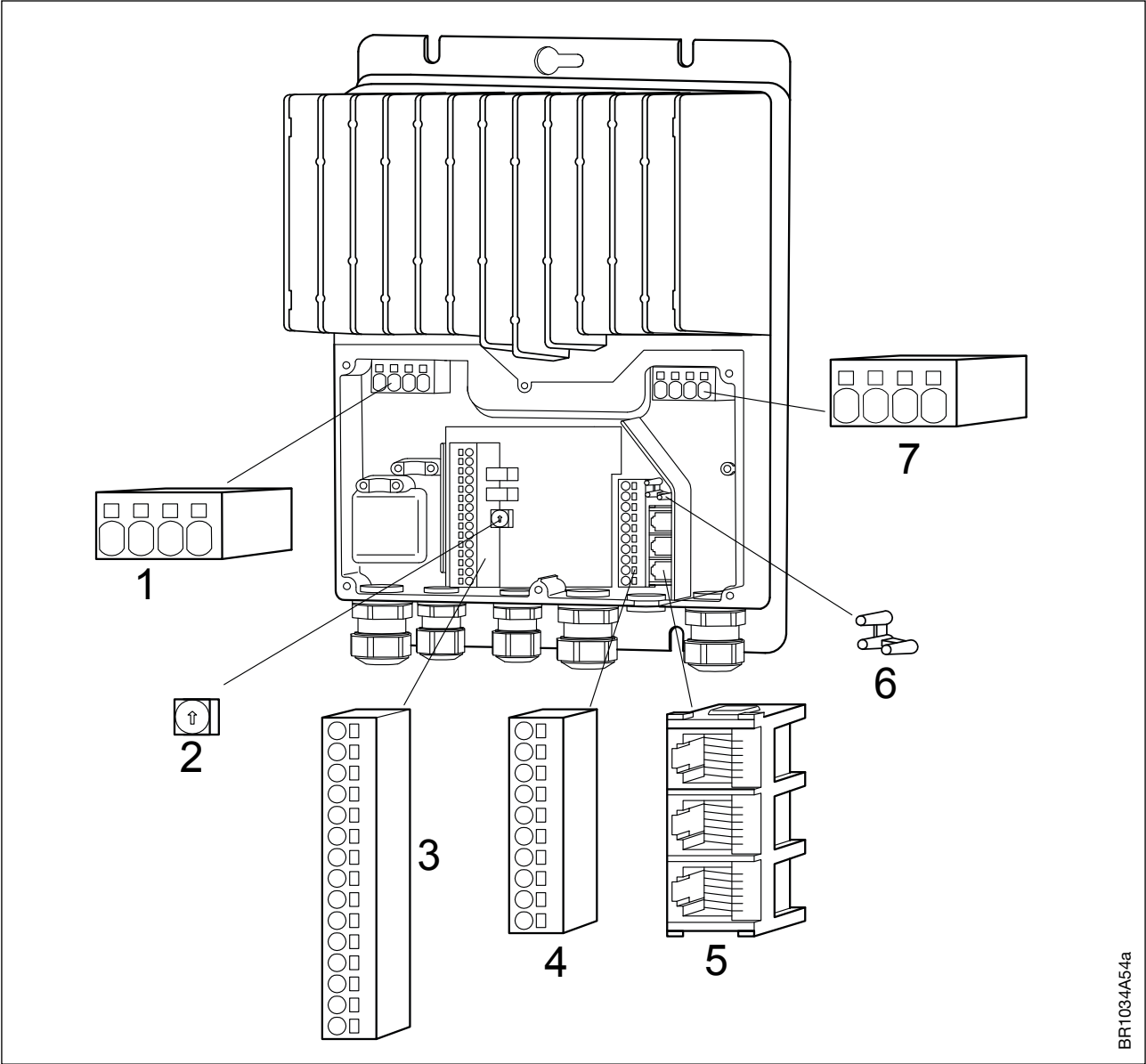
BR1034A54a

Table 11			
No.	Description	No.	Description
1	Stepper motor connections (U, V, W, PE)	5	RJ12 RS-485 interface connectors
2	Rotary switch for speed settings	6	3-point strain relief for ribbon cable
3	Terminal Strip for A/D control signals	7	Supply terminals (L, N, PE)
4	Terminal strip for Modbus and A/D control signals		

11.1 Drive – dimensioned drawing

Figure 11.1.1 - OJ-DRHX-1690-MAN5

Figure 11.1.2 - OJ-DRHX-1790-MAN5

11.2 Stepper motor – dimensioned drawing

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.

12.1   Drive

- The 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.
- Max./min. ambient temperature: See section 23, 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. 12.1.1).
- 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°. The cooling fins should thus always be able to be cooled by the natural thermic upflow past the cooling fins.
- The OJ DRHX must be installed on a flat solid surface.
- To avoid unnecessarily long stepper motor cable, the 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
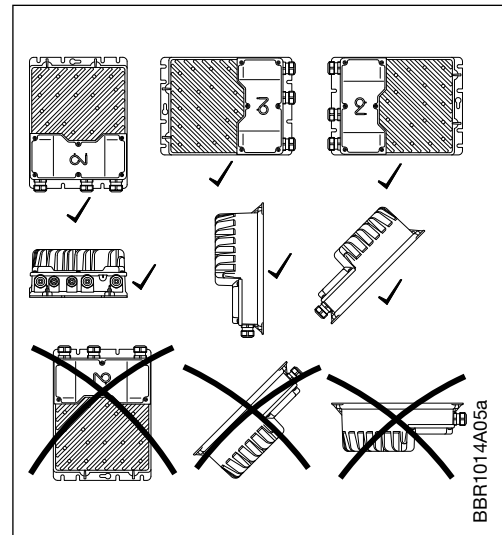
Figure 12.1.2
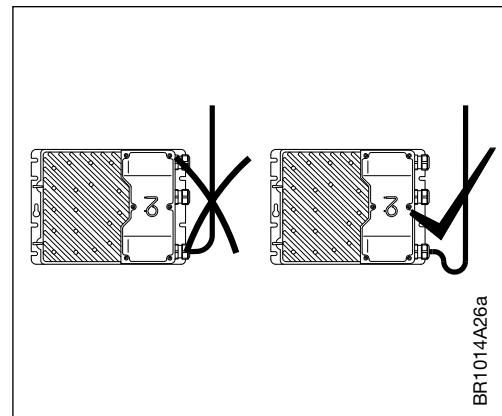
12.2   Stepper motor

⚠️ **Warning**

Incorrect mechanical installation of the stepper motor can cause electrical shock, audible noise in air handling units, channels, other construction elements, 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.

- The stepper motor is equipped with four holes to facilitate attachment to a mounting plate. (see example fig. 12.2.1; marked *1).
- 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).

Note

Alternatively, the stepper motor can be fixed with vibration dampers.

Note

The manufacturer has no specific requirements that vibration dampers should be used.

- In order to counteract noisy resonance in the unit and channel system, the mounting plate must be solid and mounted on vibration dampers (see fig.12.2.2; marked *2)
- As the stepper motor is isolated from the air handling unit by the vibration dampers, if damage to the stepper motor is to be avoided, an equalisation conductor must be installed between the frame of the stepper motor and the chassis of the air handling unit (see fig.12.2.2; marked *3).

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.
- 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.
- 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. (see table 12.3)

Figure 12.2.1

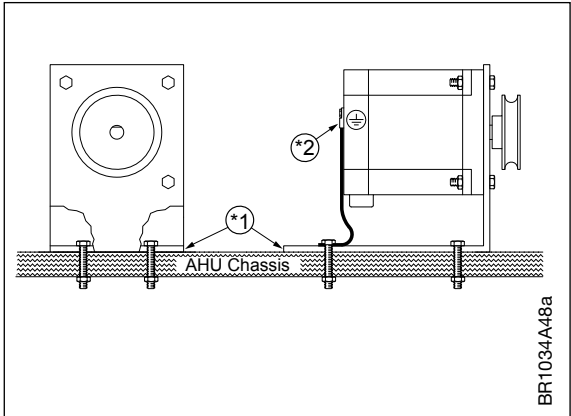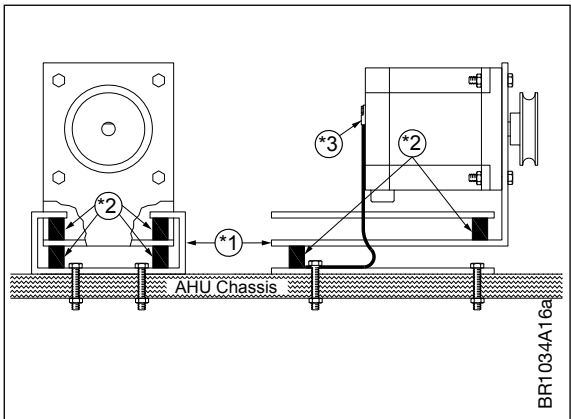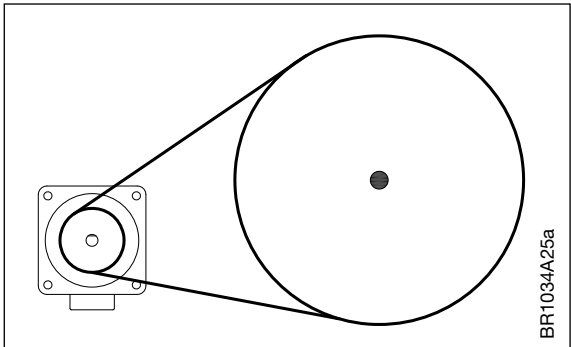*Figure 12.2.2*

Figure 12.3

Table 12.3		
14 Nm Pulley Size		
Stepper motor size	**Min. Pulley size**	**Max. Pulley size / weight**
14 Nm	50 mm	150 mm / 5 kg 200mm / 2.8 kg 250mm / 1.8 kg

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**

- The 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.

❗ **Caution**

13.2 **EMC-compliant installation**
- There is no requirement for shielded cables to the I/O and RS-485 interface 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 the 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 grounding 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 rotor chassis or the air handling unit differ from each other. In the event of potential differences between system components, an equalisation conductor must always be fitted.
Recommended cable cross section: 10 mm^2.
Lugs should be used, and the equalisation conductor should be attached to the OJ DRHX enclosure via one of the screws used to mechanically install the OJ DRHX drive.

⚠️ **Warning**

13.6 Leakage current risk when (PE)

Follow national and local regulations for the protective earthing of devices with leakage current rated over 3.5 mA.
The OJ DRHX technology produces engagement/disengagement at high frequencies. This can generate a leakage current in the earth connection, PE (PE=Protective Earth).
EN/IEC61800-5-1 (the product standard for Adjustable Speed Electrical Power Drive Systems) requires special attention, because the leakage current in the OJ DRHX may exceed 3.5 mA.
See further information in EN60364-5-54 § 543.7 Reinforced protective conductors for current in protective conductor exceeding 10 mA.
The earth connection must be implemented in one of the following 3 ways:

- If only one (1) PE-conductor is connected, the min. cable cross-section must be at least 10 mm^2, or
- If two separate earth conductors are connected, they must both comply with the regulations for dimensioning.
- If two conductors are used, each must be connected to its own earth connection in the OJ DRHX.
- External earth connection: If the rotor is approved as earth connection, OJ DRHX can be earthed to the rotor.
- Use the terminals and connectors of the OJ DRHX to achieve proper earthing.
- Avoid serial (daisy chain) connection of 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 the OJ DRHX must comply with local and national rules and regulations.
- Generally, cable types with copper wires are recommended.
- Recommended cable dimensions for M20 connectors are 6-13 mm.
- 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. 13.12) 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 RS-485 interface 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 the OJ DRHX has been disconnected before opening the cover.
- Wait approx. 3 minutes after disconnecting mains voltage before removing the cover.
- The OJ DRHX is opened by loosening the six Torx 20 screws holding the plastic cover in place.
- Carefully remove the loosened cover.

13.9 Cable entries – cable glands – strain relief
- The factory-fitted M20 cable glands should be used when inserting power, motor and control cables into the OJ DRHX.
- Remember to re-tighten the cable glands to ensure the ingress protection level and to provide cable strain relief.

13.10 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. 13.10.
- 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. 13.10.

Figure 13.10
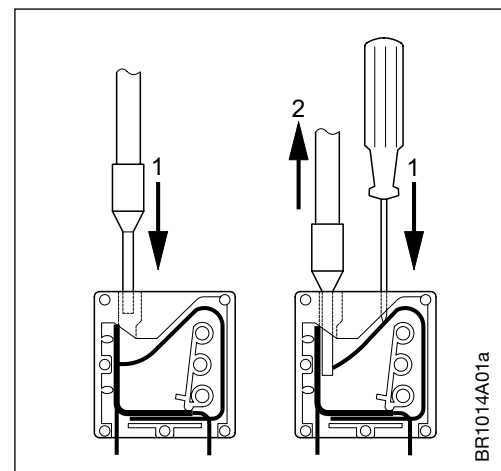
13.11 **Terminal and connector overview**
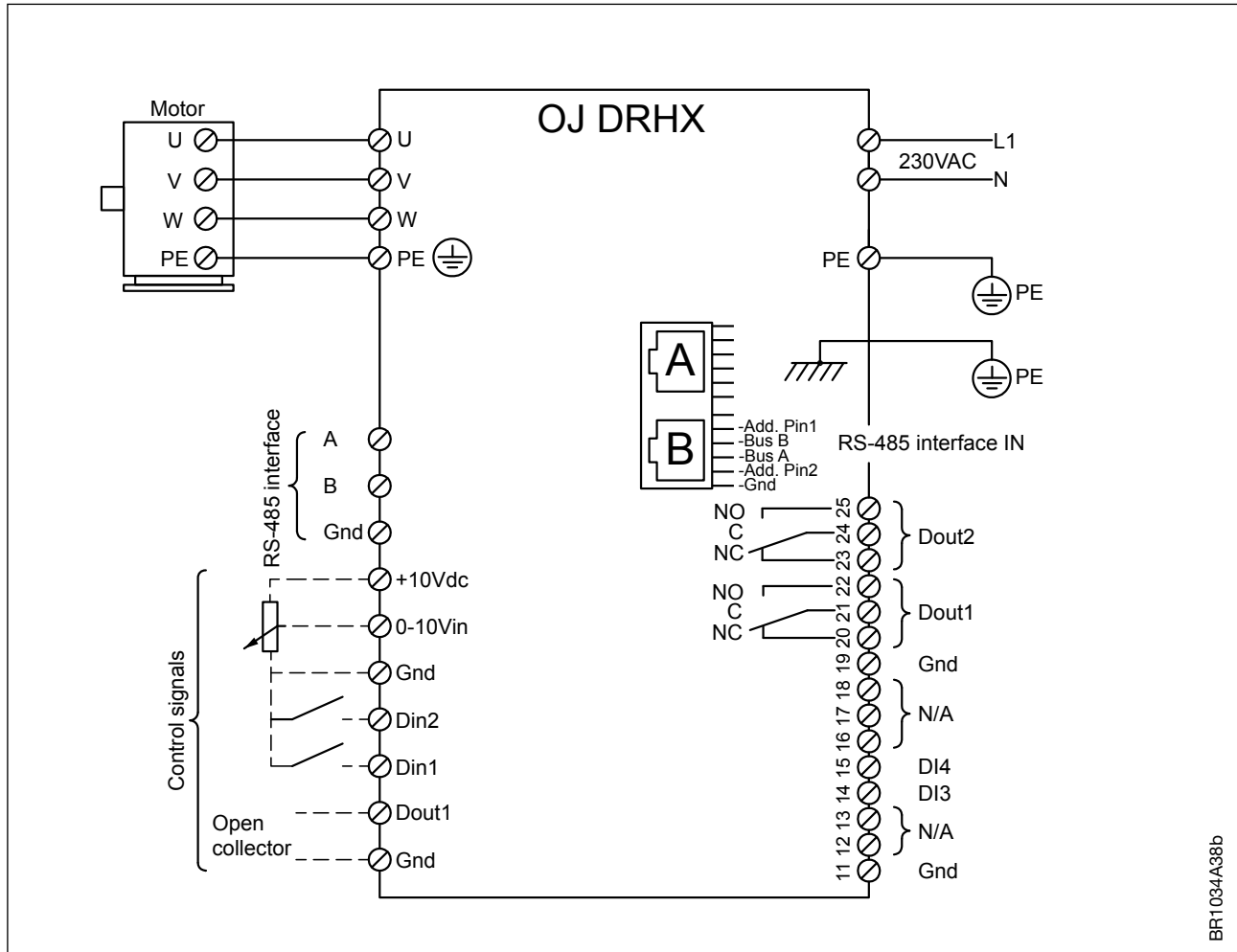
13.12 **Mains voltage connection**

- The supply voltage must be 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. 13.12). 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. The 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 and to provide cable strain relief.

Figure 13.12
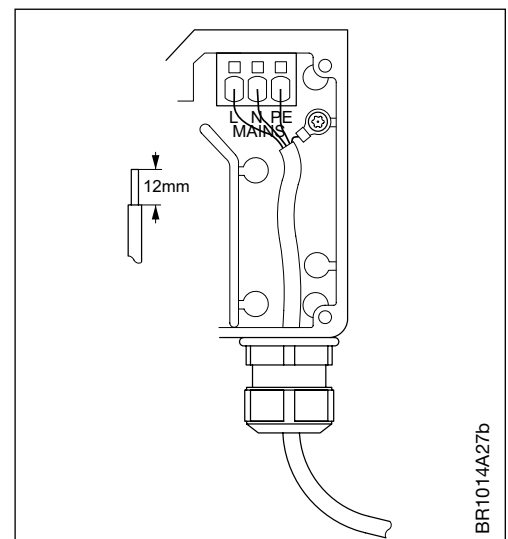
13.13 **Stepper motor**
- The stepper motor cable consists of the fixed cable on the stepper motor and an extension cable.
- The stepper motor cable (see fig. 13.13 marked "C") is equipped with a 4-pole connector and extension cable (see fig. 13.13 marked "A") and is provided with the corresponding 4-pin 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.
- The extension cable should be connected to the terminals marked:
  "U" - Brown
  "V" - Black
  "W" - Blue
  "PE" - Yellow/Green
- When the extension cable wires are properly inserted into the terminals "U", "V", "W" & "PE" of the DRHX drive (see section 13.10), the terminal tensions automatically with the correct torque.
- Because the stepper motor cable from factory is directly connected into the motor windings, it may not be replaced nor shortened.
- Remember to re-tighten the cable glands in the DRHX drive to ensure ingress protection and relief.

Figure 13.13
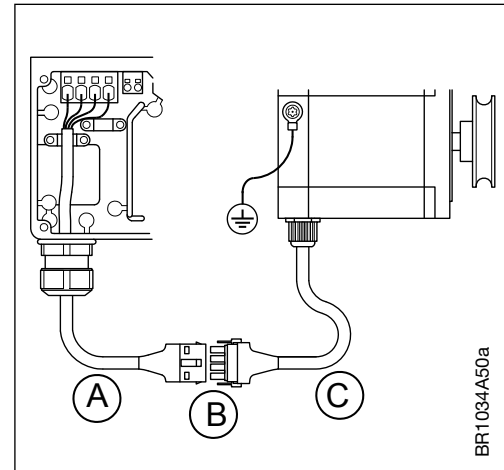
13.14 **RS-485 interface**
- RS-485 interface can be connected to the OJ DRHX via RJ12 connectors marked "B" or via spring terminals in the terminal strip.

⚠ **Warning**

- RJ 12 Plug connector marked with "A" supplies 24V to some pins, only use compatible products.
- RJ 12 Plug connector marked with "C" cannot not be used. (see fig. 13.14.1).

Figure 13.14.1
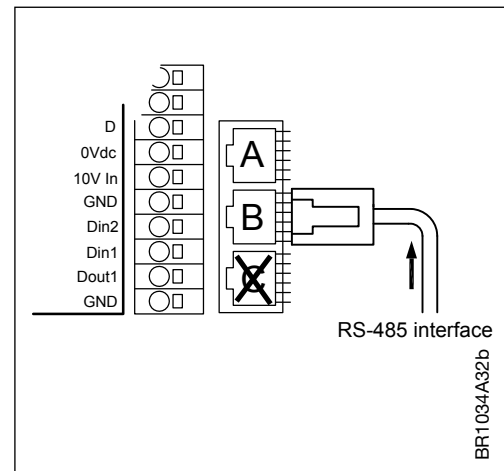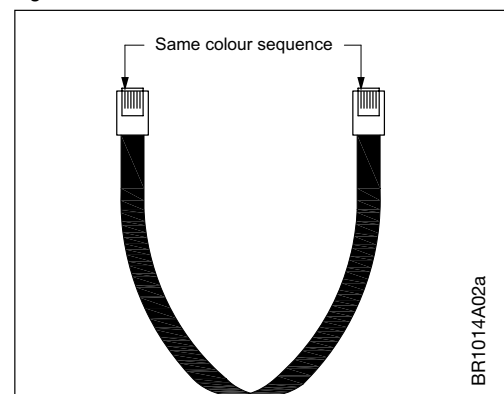
- If RJ12 connectors are used, we recommend the use of telecom cable, 6-wire, unshielded, 30 AWG/0.066 mm² (flat/telecom cable).
- When installing the RJ12 connectors, note that the connectors must be aligned so that the colour sequence in the connectors is the same at both ends (see fig. 13.14.2).

Figure 13.14.2

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

Figure 13.14.3

⚠ **Warning**

• "Add. Pin1" and "Add. Pin2" are not used and
must not be connected to any active electrical
signal.
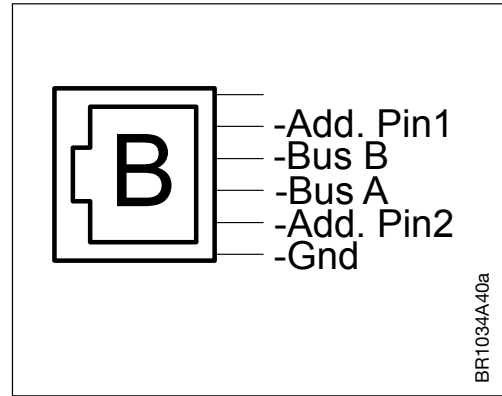
• RS-485 interface can also be connected via spring
terminals in the terminal strip
(see fig. 13.14.4)

Figure 13.14.4
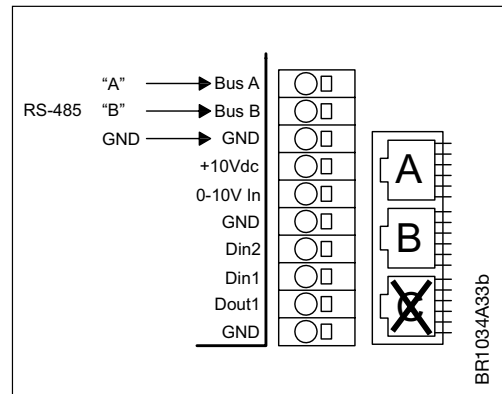
13.15 Analogue/digital signal connections
• Connect A/D control signals to the terminal strip,
(see fig. 13.15).
• Max. wire dimension is 0.75 mm² for control
terminals.
• For further information on using the spring
terminals, see section 13.10.

Figure 13.15
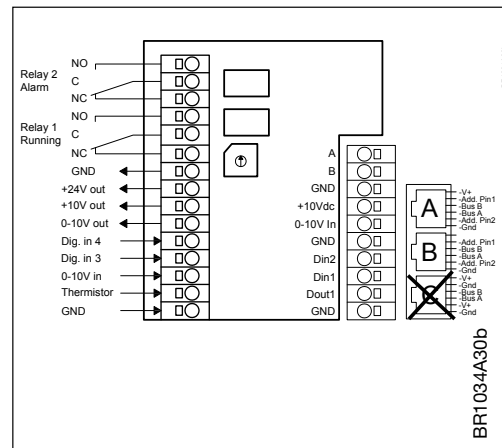
13.16 0-10 V in
• Analogue 0-10 V control input for speed control
via external 0-10 V control signal – (see fig. 13.16).

Figure 13.16
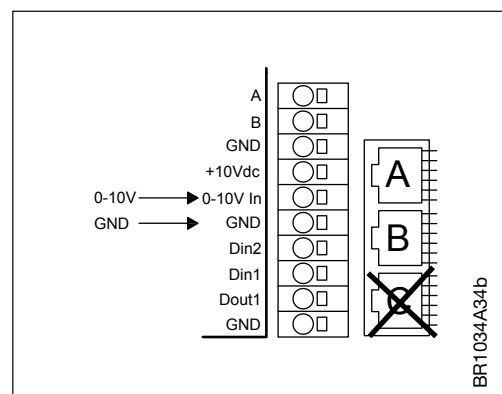
13.17 **Digital relay outputs**
- The OJ DRHX is equipped with 2 digital relay outputs, which can e.g. be used for alarm signal (see fig. 13.17).
- The relay outputs are potential-free relays with changeover switch.
- Max. load is 2 A/30 V DC/24 V AC
- The function of the relays can be defined using Modbus commands – see Modbus, section 18.

- The factory settings are:
  - Relay1: Operation relay
    Use spring contacts 20 (C) and 21 (NO)
  - Relay2: Alarm relay
    Use spring contacts 24 (C) and 23 (NC)
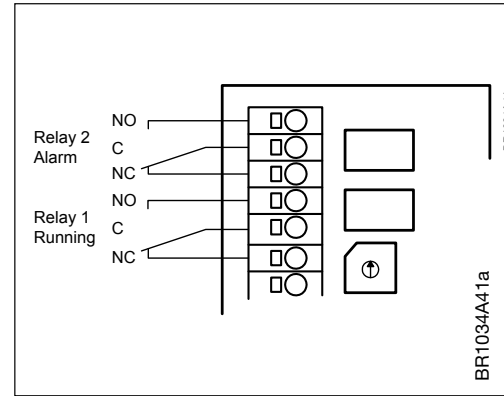
13.18 **Digital inputs**
- The OJ DRHX is equipped with 4 digital inputs, which can e.g. be configured and used for alarm reset, external rotor guard and operating test (see figs. 13.18.1 & 13.18.2).

- The function of the digital inputs can be defined using OJ-DRHX-PC-Tool or Modbus commands – see Modbus protocol.

- The factory settings are:
  - DI1: Alarm reset
  - DI2: Activate external rotor guard
  - DI3: Signal from external rotor guard
  - DI4: Testing

Figure 13.17
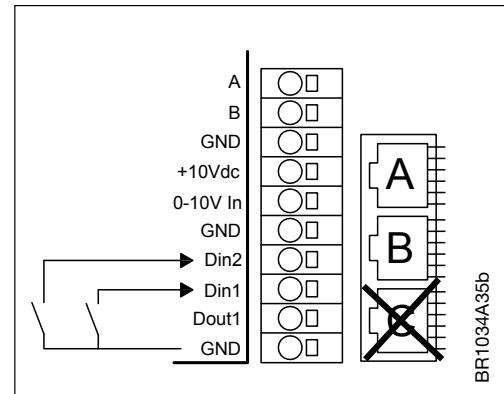
Figure 13.18.1

Figure 13.18.2
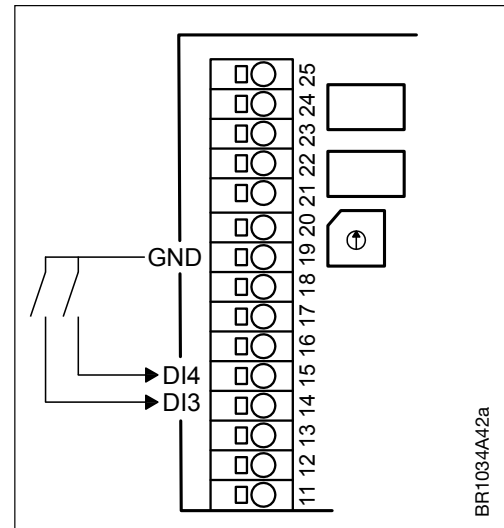
13.19 **Closing of the OJ DRHX**
- When all electrical connections are made, the test has been completed and the checklist (see checklist, section 14) has been filled in, the OJ DRHX must be closed again.
- Fasten the blue plastic cover with the associated 6 TX20 screws.
- Tightening torque on the screws 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.

14. Checklist – mechanical and electrical installation

Before the OJ DRHX is energized for the first time, installation and connection must be checked. Use the table below as a checklist.

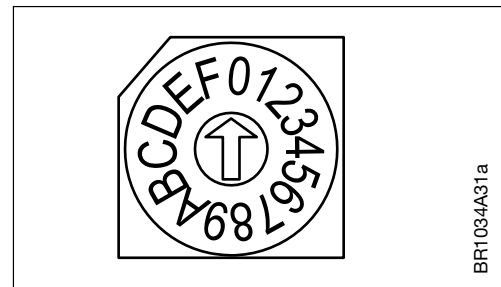| Item to be checked	Description of item to be checked	√
Completion	Check that the entire installation is ready to be commissioned, both electrically and mechanically, before energizing the installation.	
	Check that no people or animals are present in the vicinity of moving parts.	
Product conformity	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 the 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 the OJ DRHX. See section 12.1 in these instructions.	
	Check that the blue plastic cover on the OJ DRHX 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.	
	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 the 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 "L", "N" 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 RS-485 interface cable have been attached to the correct connectors. *(RS-485 interface 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.	

15.   Settings and functions

15.1   Rotary switch

The OJ DRHX 14Nm series is fitted with a rotary switch for setting min./max. stepper motor speed. Pos.1, Pos. 2 and Pos. 3 can be set in the user defined file (udf) in the OJ-DRHX-PC-Tool – see fig. 15.1. see table 15.1.

Figure 15.1

15.2   Testing

- The DRHX 14Nm is fitted with a test function.
- Activation of digital input DI4 will override the signal to the stepper motor to max. speed corresponding to +10 V DC on the "0-10 V" input (see fig. 13.16).
- As long as the digital input DI4 is activated, the stepper motor will be overridden to max. speed.
- The test button also works when RS-485 interface control is activated.

Note

- The test function is factory set to be active on digital input DI4 – see fig. 15.2.
- The function on the digital input DI4 can be changed using Modbus command and OJ-DRHX-PC-Tool. The function on DI4 can thus be changed compared to the factory settings.
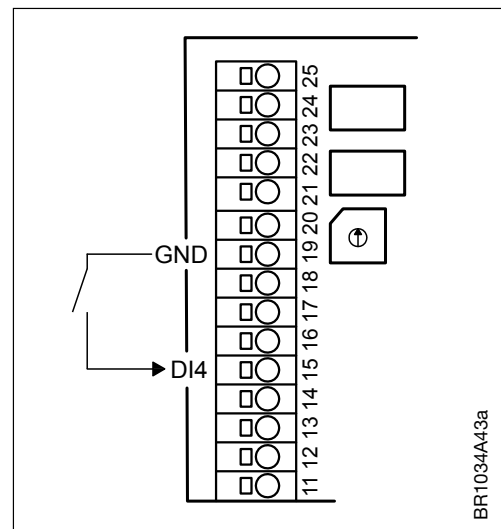
15.3   LED indicator

- The OJ DRHX 14Nm is fitted with an LED indicator.
- The LED is located on the underside of the OJ DRHX beside the entry for the mains cable – see fig. 15.3

The LED can be set (Show alarm on LED) by Modbus or OJ-DRHX-PC-Tool to flash in a sequence to indicate where the Error has arisen.
1 Flash = Supply issue
3 Flashes = Internal DRHX issue
5 Flashes = Motor issue

Table 15.1	
Rotary switch	Max RPM
Pos. 0	*Note 1*
Pos. 1	UDF 1 speed
Pos. 2	UDF 2 speed
Pos. 3	UDF 3 speed
Pos. 4	250 rpm
Pos. 5	300 rpm
Pos. 6	350 rpm
Pos. 7	400 rpm

NOTE 1: Use values set via Modbus registers – see section Modbus protocol

Figure 15.2

Figure 15.3
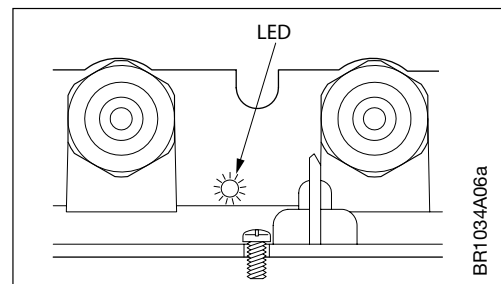
15.4 **0-10 V control**

- The 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 protocol).
- The motor starts when there is a control signal over 1.1 V (see fig. 15.4).
- The motor stops when control signal is less than 0.6 V (see fig. 15.4).
- The motor runs at maximum speed when there is a control signal over 9.5 V (see fig. 15.4). Max. motor speed can be set to either 179, 236, 279 or 321 RPM by means of the rotary 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. 15.4).
- K-factor is configured via Modbus register or via OJ-DRHX-PC-Tool.
- Default K-factor is configured by the manufacturer to 100.

Figure 15.4
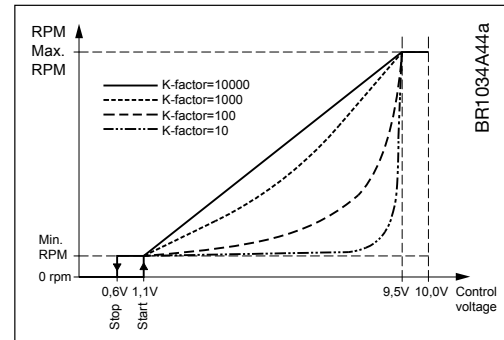
15.5 **RS-485 interface control**

- The OJ DRHX can be controlled via RS-485 interface, by use of Modbus and BACnet protocols (see Modbus and BACnet MS/TP protocols).
- If a signal is received via RS-485 interface at the start register and/or speed register, the drive will temporarily change from 0-10 V control to protocol control until the next restart.
- If the OJ DRHX is to be controlled permanently via protocol, Coil Stat Bit register 8 must be set to "0" = "protocol" (see Modbus protocol).
- Alarms and operating status can still be monitored via RS-485 interface, even if "protocol control" is not activated.

15.6 **Rotation monitoring**

- Because the stepper motor and rotor are mechanically connected via one or other form of belt drive, it will be necessary to monitor whether the stepper motor, via this belt drive, is rotating the rotor.
- If the stepper motor is no longer rotating the rotor due to lack of tension or a defective belt, the drive will trigger a "Defective drive belt" alarm.
- Monitoring of correct rotor rotation can be set to external or internal rotor guard.
- Factory setting is "Internal rotor guard".
- The function "External rotor guard" can be activated via digital input DI2 (factory setting) via OJ-DRHX-PC-Tool or via Modbus command – see Modbus protocol.
- Internal rotor guard:
  - Internal rotor guard involves monitoring of the stepper motor's current, voltage and back-EMF conditions.
  - The alarm is triggered if there is a mismatch between the expected current, voltage and back-EMF conditions and the actual conditions.
- External rotor guard:
  - If an external rotor guard is to be used, an external rotor guard in the form of e.g. an inductive sensor must be installed. Can be supplied by OJ Electronics A/S as an accessory. (See section 17: Accessories).

If external rotor guard is selected, "Internal rotor guard" will be automatically deactivated.

15.7 **Start function**

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

15.8 **Purging function**
- When the OJ DRHX is controlled via 0-10 V signal, the purging function starts automatically when the stepper motor has been stopped for 10 minutes.
- When the OJ DRHX drive is set to "Protocol" control, the automatic purging function will be deactivated and the purging function must be controlled from the air handling unit's control system.
- The purging function will start the stepper motor for 10 seconds at 10% of max. 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.

15.9 **Brake/retention function**
- To prevent the rotor from rotating due to air flow, the 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 retention torque is factory configured to 10% of configured max. torque.
- Setting of retention torque level can be altered via the OJ DRHX-PC-Tool or via Modbus command.
- The function can be deactivated by setting the value to 0%.

15.10 **Built-in protection**
- If the temperature inside the OJ DRHX exceeds 95°C, the OJ DRHX will attempt to reduce its internal heat generation by reducing the amount of current that is sent to the stepper motor.
- The 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.
- The OJ DRHX is short-circuit protected against phase-phase short-circuits on the OJ DRHX connector terminals for the stepper motor (U, V, W).
- The OJ DRHX outputs are protected against short-circuits.

15.11 **Display of actual speed**
- Rotor speed can be read out via the Protocol registers – (see Modbus and BACnet MS/TP protocols).
- If the size of the pulley and rotor are entered via Modbus Holding Register (see Modbus protocol) or OJ-DRHX-PC-Tool, the Modbus register will show the current speed (rpm) for the rotor – see Modbus protocol.
- If no values are specified for the actual size of the pulley and rotor, the Modbus register will show the current speed (rpm) of the stepper motor – see Modbus protocol.
- Pulley size (ø mm) is indicated in the Holding Register (see Modbus protocol) or via OJ-DRHX-PC-Tool – entered in mm and measured on the pulley's contact face.
- Rotor size (ø mm) is indicated in the Holding Register (see Modbus protocol) or via OJ-DRHX-PC-Tool – entered in mm.

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

The OJ DRHX series can be configured using OJ-DRHX-PC-Tool, 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 the connected OJ DRHX
- Setup: Application parameter settings
- Alarm: Read-out of alarm log for the connected OJ DRHX
- Modbus: Changing RS-485 interface settings for the OJ DRHX
- About: Read-out of software version and type for the 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.

Figure 16.1
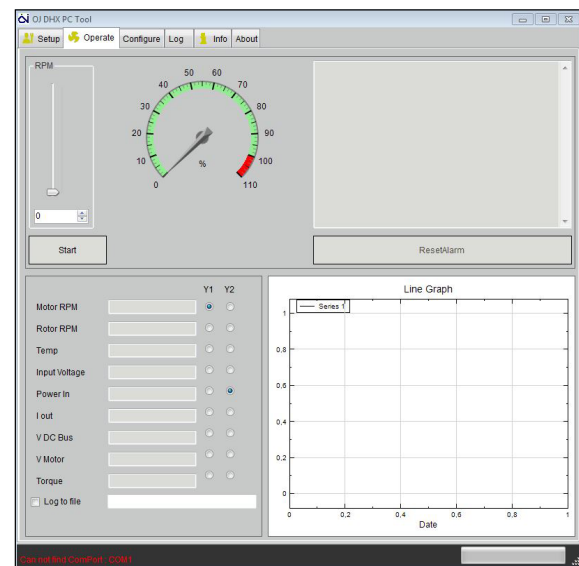
17. Accessories

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

External rotor guard

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 OJ-DRHX-PC-Tool or in the Modbus register – see Modbus protocol.
- 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
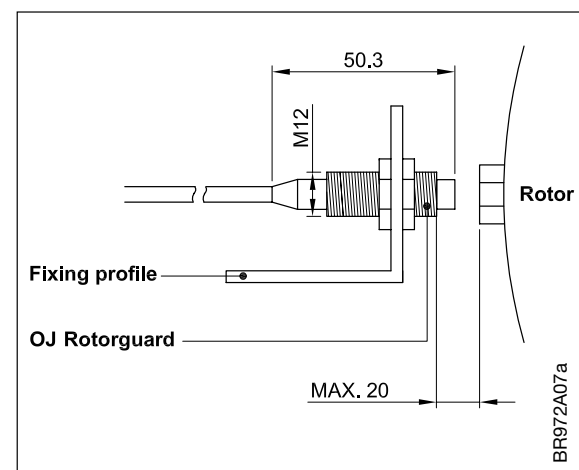
Electrical connection
- If the rotor is to be monitored via an external rotor guard, this should be connected to terminal: "Ø19/GND", "Ø18/+24V" and "Ø14/DI3" (see fig. 17.2).
- The rotor guard is a triple-conductor inductive sensor and is supplied by OJ Electronics A/S as an accessory.

Figure 17.2
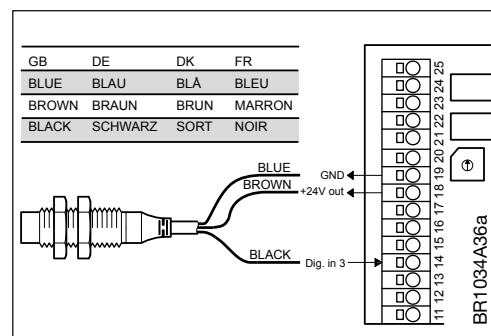
18. Modbus

18.1 Introduction
- The OJ DRHX can be controlled via Modbus RTU, according to the Modbus protocol.
- The OJ DRHX is factory-set for "0-10 V" control.
- When the OJ DRHX detects a start signal or speed setpoint via Modbus, the OJ DRHX will automatically shift to control via Modbus RTU. The "0-10 V" signal is ignored. The function is automatically reset when the OJ DRHX is restarted.
- The 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

- The OJ DRHX is supplied with the factory setting (see table 16.2.1):

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

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

18.3 **Detection of active RS-485 interface**
- The OJ DRHX automatically detects valid Modbus communication on the Modbus inputs (RJ12 connector or "A" & "B" terminals on the terminal strip).
- First connection with the DRHX will be on the default Modbus parameters: ID 79, 38.4 – 8 – N – 2
- Alternative communications parameters and BACnet MS/TP can be set using the Modbus register.
- If no valid active Modbus communication is found, the OJ DRHX will automatically set the drive to "0-10 V" control.

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

19. BACnet MS/TP

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

19.1 **BACnet communication parameters**
BACnet communications parameters can be set using OJ-DRHX-PC-Tool or Modbus.

Table 19			
	Setting range	Unit	Factory setting
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	127
Device Object ID	0 - 4194302	1	0

The OJ DRHX automatically detects 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 DRHX will try to detect a different communication protocol.

The current BACnet MS/TP protocol is available for download at www.ojelectronics.com

20. Alarms and fault codes

The OJ-DRHX-14Nm 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 the 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 RS-485 interface command or via a digital input set to "alarm reset".
The alarm is automatically reset if the power is disconnected for longer than 60 seconds.
Alarms can be read using Modbus and BACnet MS/TP registers or the OJ-DRHX-PC-Tool.
Motor issue.
Alarm/fault code overview, see table 20

	Alarm overview	Alarm priority	Activity
	Alarm from rotor guard	”C”	”SA5”
	Excessive supply voltage	”C”	”SA5”
	Insufficient supply voltage	”C”	”S”
	Power to the motor increased at a critical level, e.g. short-circuiting cable, connector or motor	”C”	”SA5”
	Excessive temperature inside OJ DRHX (> 95°C)	”NC”	”RP”
	Blocked motor	”C”	”SA5”
	No valid RS-485 interface communication >10 sec.	”C”	”S”
	Phase fault on stepper motor power supply (U, V, W)	”C”	”SA5”
	Internal hardware error	”C”	”S”

Table 20

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

21. Maintenance

The 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**

The 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.

22. Troubleshooting

⚠️ **Warning**

Before opening the 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 the 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. The stepper motor can become very hot >60°C.

Troubleshooting when the OJ DRHX is controlled via A/D signals:

Symptom	Cause	Action
Stepper motor is not running	Lacking supply voltage	Check the voltage supply (230 V AC) to the 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 the OJ DRHX has not been cut off by other components.
	Poor electrical connections	Check electrical connections.
	Wrong stepper motor for the 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 OJ-DRHX-PC-Tool or 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 the OJ DRHX receives an operating signal >1.1 V on "0-10 V In".
	Active alarm	Read active alarms via RS-485 registers 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 supply voltage to the OJ DRHX and reconnecting it after approx. 60 seconds.
	Defective OJ DRHX controller	Replace the 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 stepper motor or on the OJ DRHX stepper motor terminals.
	Motor rotation is incorrectly configured	Motor rotation can be checked and changed using the Modbus registers or OJ-DRHX-PC-Tool. (CW=Right/CCW=Left)
The OJ DRHX cuts out due to an alarm	At least one alarm active	View the alarm via RS-485 interface or OJ-DRHX-PC-Tool to determine which alarm has stopped the control/stepper 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 supply voltage to the 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.

Troubleshooting when the OJ DRHX is controlled via RS-485 interface:

Symptom	Cause	Action
Stepper motor is not running	Lacking supply voltage	Check the voltage supply to the OJ DRHX terminals "L" and "N" (230 V AC)
		Check whether short-circuit protection has been activated.
		Check that the voltage supply to the OJ DRHX has not been cut off by other components.
	Poor electrical connections	Check electrical connections.
	Wrong stepper motor for the OJ DRHX setup	Check that the correct motor settings have been read into and stored in the OJ DRHX setup.
	Lacking operating signal	Check that the OJ DRHX can receive an operating signal. Coil Stat Bits Register 0X0001: Stepper motor start/stop (1=On)
	Speed set point has not been set	Check the protocol control signal at Modbus address: Holding registers; Register 4X0001 or BACnet Integer Value, IV:0: 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: Modbus Coil Stat Bits Register 0X0002 or BACnet Binary Values, BV:1: Reset (1 pulse = Reset) The alarm can also be reset by disconnecting the supply voltage to the OJ DRHX and reconnecting it after approx. 60 seconds.
	Defective OJ DRHX controller	Replace the 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 stepper motor or on the OJ DRHX stepper motor terminals.
	Motor rotation is incorrectly configured	Motor rotation can be checked and changed using the Modbus register or OJ-DRHX-PC-Tool. (CW=Right/CCW=Left)
The OJ DRHX cuts out due to an alarm	At least one alarm active	Use Protocols or OJ-DRHX-PC-Tool to view the alarm and determine which alarm has stopped the controller/stepper 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 supply voltage to the OJ DRHX and reconnecting it after approx. 60 seconds.
	The alarm is re-activated after reset	Read out the alarm via Protocol registers and determine which alarm has stopped the controller/stepper motor. Remove what is causing the alarm.
		Remedy the cause of repeated alarm activation.

23. Disposal

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

24. Technical specifications

	Type	DRHX-1055-MNN5	DRHX-1220-MNN5	DRHX-1220-MAD5	DRHX-1690-MAN5	DRHX-1790-MAN5
Torque	Nm	2.0	4.0 / 8.0	4.0 / 8.0	14.0	
Power size	W	55	220		690	790
Efficiency	%	> 90%			> 94%	
Power supply						
Voltage	VAC	1 x 230 V AC 50/60 Hz -10%/+10%				
Supply current at max. load	A	0.6	1.2 / 2.4		4.4	
Power factor (cos-phi) at max. load		0.65			> 99 (Active PFC)	
Motor output						
Nominal motor power (on shaft) *1	kW	55	110 / 220	110 / 220	790	
Motor speed	rpm	0-250			0-400	
Nominel motor Torque	Nm	2.0	4.0 / 8.0		14.0	
Boost motor torque	Nm	2.5	5.0 / 10.0		17.5	
Frequency	Hz	0-120				
Max. output voltage	Vrms	3 x 0 - 150V AC			3 x 0 – 230V AC	
Max. output current	Arms	2.5	3.5	3.5	4.5	4.5
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			Yes, 400V (PTC)	
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			185 x 230,5 x 90	185 x 265 x 125
Protection rating	IP	54				
Enclosure material		Plastic			Aluminium	
Front cover		Plastic				
Weight	kg	0.9			2.0	3.6
Humidity	% rh	10-95% rh, non-condensing				
Cooling		Self-cooling				
Interfaces						
RS-485 interface protocol		RS-485 interface (Baud rate: 9.6, 19.2, 38.4, 57.6, 115.2 Kbaud) Default: 38.4k baud, 1 stop bit, none parity				
RS-485 interface connection		2 x RJ12 & 3 x spring terminals				
RS-485 interface cable		Max. 100 m				
7-segment display		No	No	3	No	No
Analogue In1		No	No	0 - 10 VDC, 100% @ 9.5 V DC +/-2%		
Analogue Out1		No	No	+10VDC		
Digital In1 (internal Pull up)		No	No	Start / Stop (Configurable)		
Digital In2 (internal Pull up)		No	No	Alarm reset (Configurable)		
Digital In3 (internal Pull up)		No	No	External rotor guard (Configurable)		
Digital Out1		No	No	No	Alarm signal	Alarm signal
Alarm relay		No	No	SPDT relay 1A 30VDC/24VAC		
Green LED		On: Power connected | Flashing: Active RS-485 interface communication				
Red LED		Flashing: Alarm but keep running | Constant on: Serious alarm - stop motor				
DIP switch		4	4	4	No	No
Rotary switch		No	No	No	Yes	Yes
Option module		No	No	No	Yes *1	Yes *1
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		Yes				
Alarm reset		Via digital input, RS-485 interface or powering down for more than 60 seconds				
Purging	sec.	Yes				
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

MRHX-3P02N-03C5	Type	
Torque	Nm	2.0
Weight	kg	≈ 2.4 kg
Sealing grade	IP	54
Operating temperature	°C	-40°C to +40°C
Storage temperature	°C	-40°C to +70°C
Dimensions	mm	85 x 85 x 67
Shaft diameter	mm	12
Cable length (with connector)	m	0.3
Max. radial force (20 mm from the flange)	Nm	250
Max. axial force	Nm	60
MRHX-3P04N-03C5	Type	
Torque	Nm	4.0
Weight	Kg	≈ 3.5Kg
Sealing grade	IP	54
Operating temperature	°C	-40°C to +40°C
Storage temperature	°C	-40°C to +70°C
Dimensions	mm	85 x 85 x 97
Shaft diameter	mm	12
Cable length (with connector)	m	0.3
Max. radial force (20 mm from the flange)	Nm	250
Max. axial force	Nm	60
MRHX-3P14N-03C5	Type	
Torque	Nm	8.0
Weight	Kg	≈ 5 Kg
Sealing grade	IP	54
Operating temperature	°C	-40°C to +40°C
Storage temperature	°C	-40°C to +70°C
Dimensions	mm	85 x 85 x 156
Shaft diameter	mm	12
Cable length (with connector)	m	0.3
Max. radial force (20 mm from the flange)	Nm	250
Max. axial force	Nm	60
MRHX-3P14N-03C5	Type	
Torque	Nm	14.0
Weight	Kg	≈ 13.2
Sealing grade	IP	54
Operating temperature	°C	-40°C to +40°C
Storage temperature	°C	-40°C to +70°C
Dimensions	mm	134 x 134 x 170
Shaft diameter	mm	19
Cable length (with connector)	m	0.3
Max. radial force (20 mm from the flange)	Nm	250
Max. axial force	Nm	60