

Manual OJ Electronics Stepper motor system MRHX-14Nm & DRHX-1790

HO*-DRHX-1790MAN5

Hoval

This manual is specific for the setup of the Hoval drive system in RHE

Hoval factory setting is for analogue use (0-10V)

DI1: Alarm reset

DI2: Enable external rotor guard

DI3: Signal from external rotor guard

DI4: Test function

MHRX = motor DRHX = control unit

*The DRHX control unit is programmed with Hoval custom made UDF file



For complete instructions, information, warnings (caution/ protection) see OJ's original manual.

Also valid for Modbus or OJ-DRHX-PC-Tool:

Introduction



MRHX/DRHX cannot be repaired on site. Never attempt to repair defective DRHX control unit or MHRX motor. Contact Hoval for support.

Ensuring safety before installation

Product MRHX/ DRHX **must only be installed by qualified personnel or people who have received appropriate training and have thus become qualified to install the product.**

Controller 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 controller 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 Modbus.

Before connecting mains voltage to the DRHX controller

- all components, i.e. stepper motor, belt, pulley and rotor, must be installed correctly.
- 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.

Controller 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.

Product use

Controller DRHX is used to regulate the speed of a rotary heat exchanger in air handling units. DRHX can only be used to control MRHX stepper motors, supplied by OJ Electronics A/S. Never try to connect or control other types of stepper motor. The drive and stepper motor is a slave unit that is controlled by signals or commands from an external control unit.

Technical specifications

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

Controller DRHX has built-in stepper motor protection and has a built-in EMC filter.

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

No 4220728 Ver2 2021-09-30/ SESTCH

Contact
Headquarters
Hoval Aktiengesellschaft
Austrasse 70
9490 Vaduz
Liechtenstein
Tel. +423 399 24 00
Fax +423 399 27 31
info.klimatechnik@hoval.com
www.hoval-energyrecovery.com

Sweden
Hoval AB
Hedenstorpavägen 4
555 93 Jönköping
Sweden
Tel. +46 36 375660
Fax +46 36 375668
info.se@hoval.com
www.hoval-energyrecovery.com

United Kingdom
Hoval Ltd.
Northgate, Newark
Nottinghamshire
NG24 1JN
United Kingdom
Tel. +44 1636 672 711
Fax +44 1636 673 532
heatrecovery@hoval.co.uk
www.hoval-energyrecovery.com

Technical data

Motor		MRHX-14*
Control unit		DRHX-1790 MAN5
Max Torque	Nm	14
Input Signal	V	0-10
Output Rpm 50Hz		350 and 400 rpm
Voltage Input 50/60Hz	V	1x230
Motor voltage	V	3x0-200 V AC
Motor power	kW	0,790
Rated current	A	4,4
Class of protection		IP54
Weight motor	kg	13,2
Weight controller	kg	3,6
Shaft Ø (motor)	mm	19

*Full name: MRHX-3PO14N-03C5

11. Exploded and dimensioned drawings

Figure 11

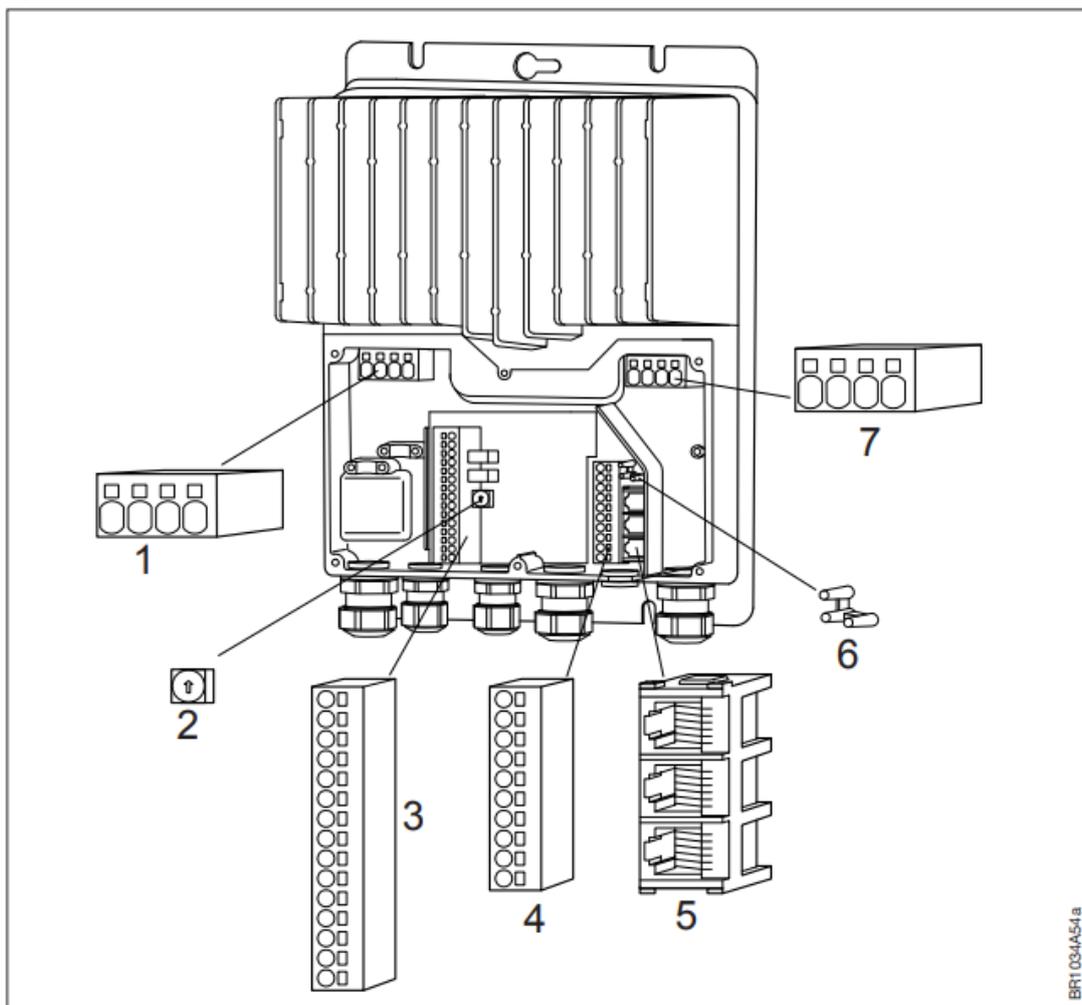


Table 11

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		

MECHANICAL INSTALLATION

Control unit

- To achieve correct cooling of the DRHX, it must always be positioned so that there is free airflow around the cooling fins of the DRHX (see fig. 12.1.1).
- To achieve the specified enclosure rating, the cable glands must not point upwards (see fig. 12.1.1).
- To facilitate future service and maintenance tasks, ensure that there is sufficient space around the DRHX after it has been installed.
- To prevent water from entering 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 (see fig. 12.1.2).
- For optimal cooling of the DRHX, it must be installed vertically and on a slope, with a max. gradient of 45° (see fig. 12.1.1). The cooling fins should thus always be able to be cooled by the natural thermic flow past the cooling fins.
- DRHX must be installed on a flat solid surface.
- The product should be attached using at least 3 of the screw holes in the aluminium cooler profile.
- The DRHX should not be installed in direct sunlight.

Motor

- To ensure integrated rotor guard in the DRHX, and to avoid false alarms and errors, it is important to install it proper. 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 (see figure 12.2.1, marked 1)

**Do not use vibration dampers or springs!
Must be mounted on a fixed motor bracket.**

ELECTRICAL INSTALLATION

Potential equalization

There is a risk of electrical interference if the ground potential between the DRHX and the air handling unit differ from each other. It's important to fix the control unit and the motor with metallic screws into the casing.

Above is fulfilled if delivered to be fixed inside casing by Hoval (using Hoval console for controller).

If not following need to be insured of:

- Lugs should be used, and the equalization conductor should be attached to the DRHX alu-profile via one of the screws used to mechanically install the DRHX (see fig.13.5).
- Recommended cable cross section: 10 mm².
- To prevent potential differences between system components, an equalization conductor must always be fitted.
- A potential equalization connection must always be installed between the stepper motor and the chassis of the air handling unit (see section 12.2).

Figure 12.1.1

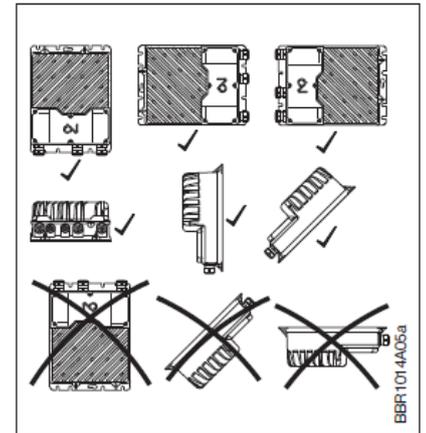


Figure 12.1.2

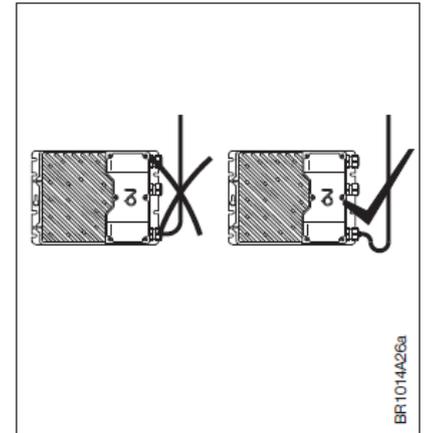
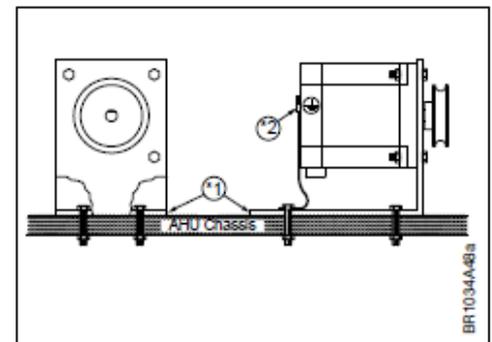


Figure 12.2.1



Opening the control unit

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



Cable entries – cable glands – strain relief

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

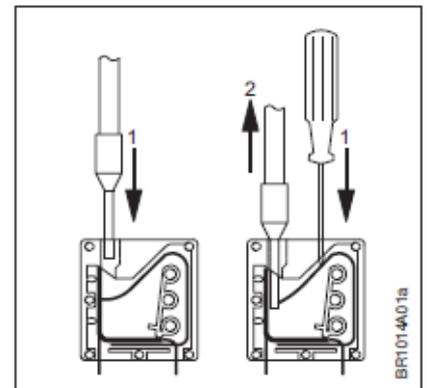
Spring terminals

- The connection terminals are spring-loaded and the stripped wire can be easily inserted into the terminal/ or removed by carefully pushing the wire into the terminal without using tools.

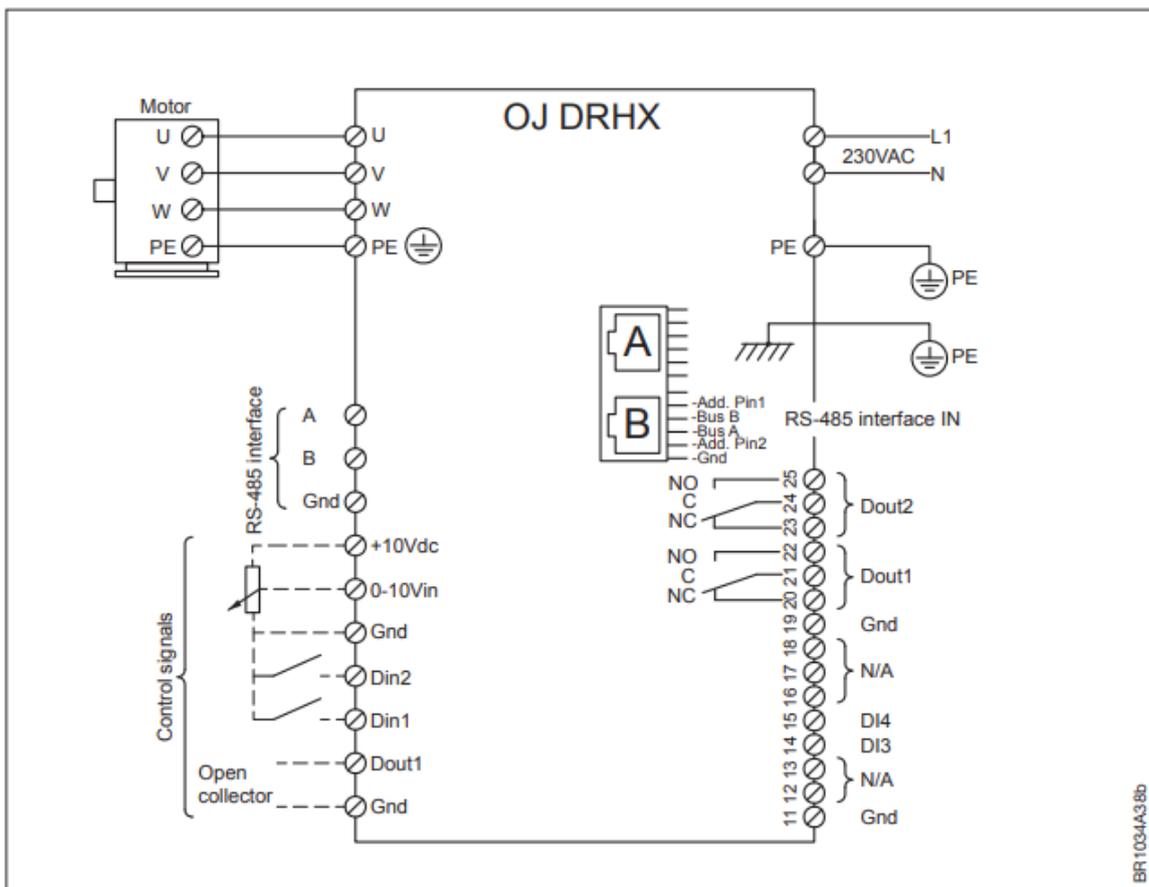
Alternatively, the terminal spring can be loosened by pressing it lightly with a screwdriver or similar implement. See fig. 13.10.

- Stripped wire ends or end sleeves must be between 8 and 15 mm.

Figure 13.10



13.11 Terminal and connector overview



Mains voltage connection

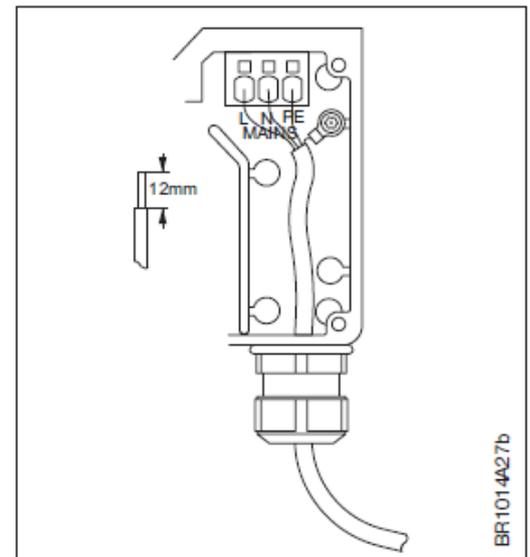
- The power cable is connected to the DRHX controller on the terminals marked "L", "N" and "PE". See fig. 13.12.
- It is recommended that the PE wire is 20 mm longer than the other wires in the cable (see fig. 13.12).

If the cable is accidentally pulled out of the DRHX while there is voltage on the cable and terminals, the PE wire will then be the last to be disconnected.

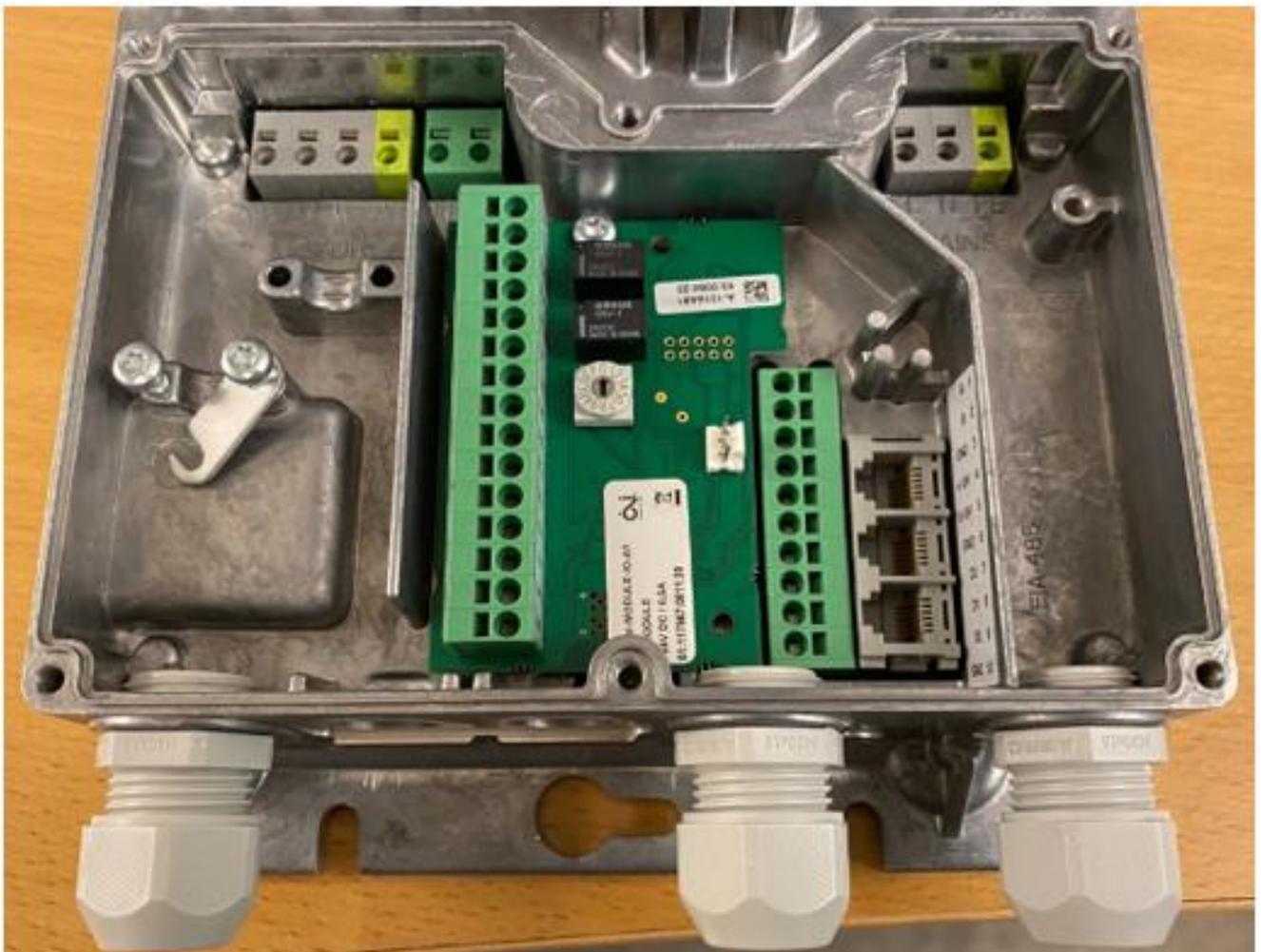
DRHX is thus prevented from causing electric shock.

- When the stripped wire is properly inserted into the terminal (see page 4, figure 13.10), the terminal tensions automatically.
- Remember to **re-tighten the cable glands** to ensure the ingress protection level of the DRHX and to provide cable strain relief.

Figure 13.12



Inside DRHX-1790, with cover removed:

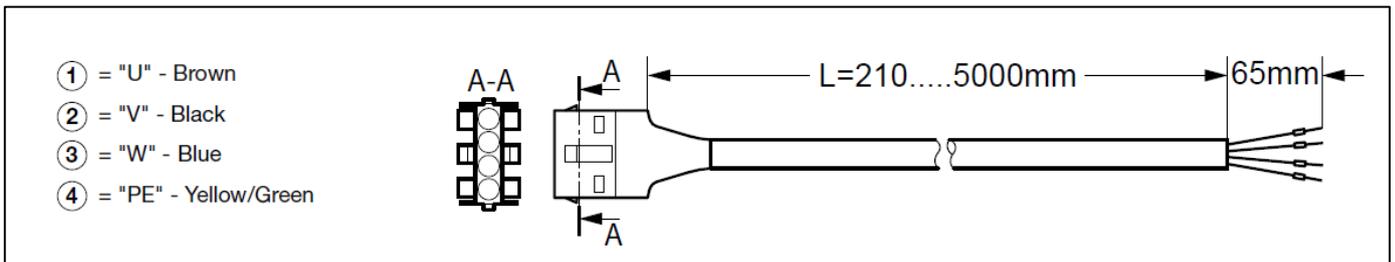
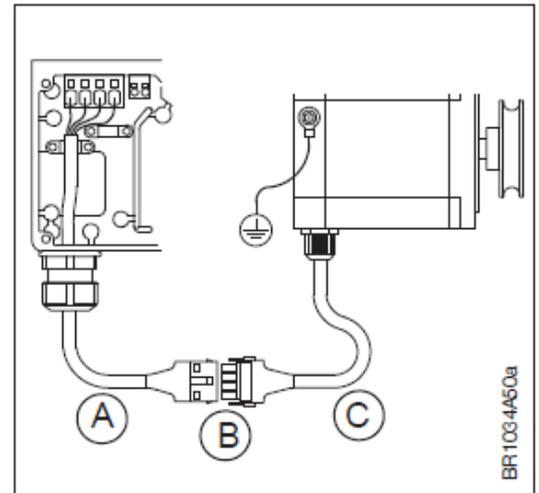


Cable

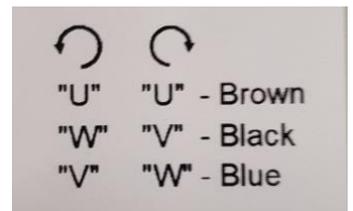
- The stepper motor cable is connected directly into the motor windings from factory, **it is not allowed to be replaced or shortened.**
- The motor cable is correctly assembled when the locking pawl on both sides of the connector is locked in place with the connector from the cable from the DRHX (extension 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

Figure 13.13



- **If rotation of rotor is wrong: switch the "V" (black) and "W" (blue) cable to change motor direction.**



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 fig. 13.10

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 13.15

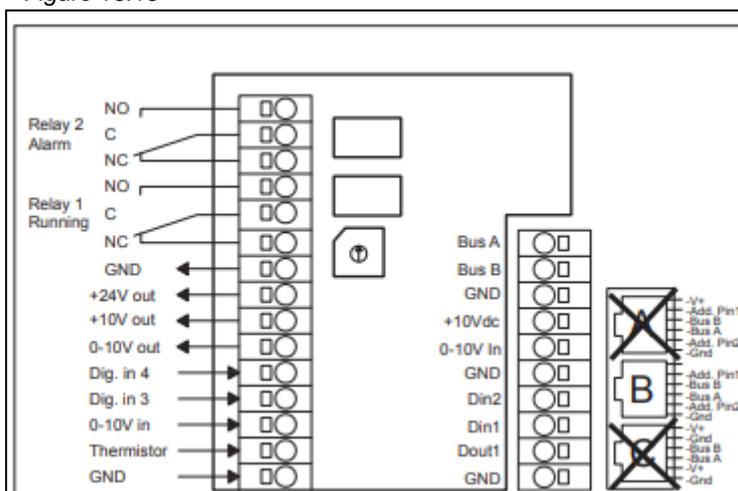
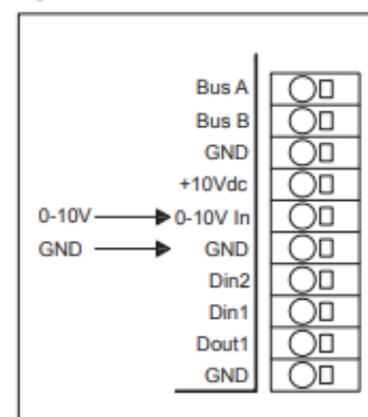


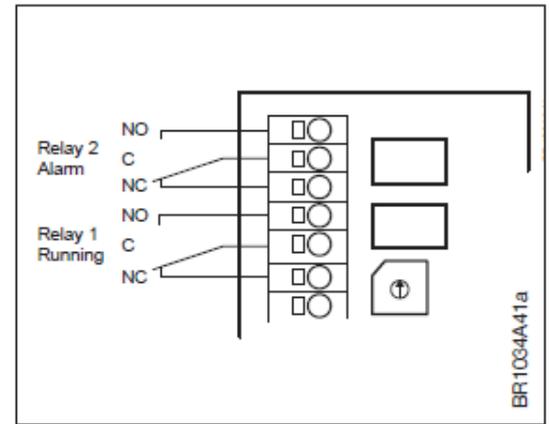
Figure 13.16



Digital relay outputs

- DRHX is equipped with 2 digital relay outputs (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 factory settings are:
 - Relay1: Operation relay (terminal 21+22)
 - Relay2: Alarm relay (terminal 24+23)

Figure 13.17



Digital inputs

- DRHX is equipped with 4 digital inputs (see fig. 13.18.1 and 13.18.2).
- The factory settings are:
 - DI1: Alarm reset
 - DI2: Enable external rotor guard (see page 10)
 - DI3: Signal from external rotor guard (see page 10)
 - DI4: Testing (see page 8)

Figure 13.18.1

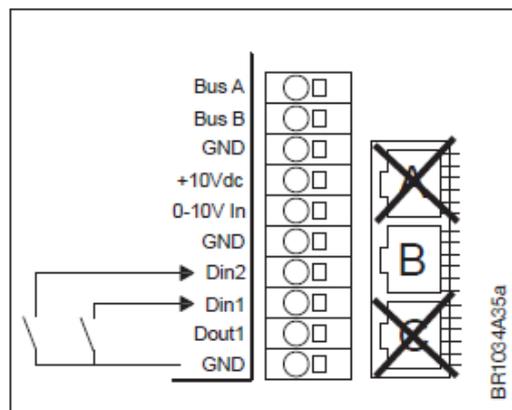
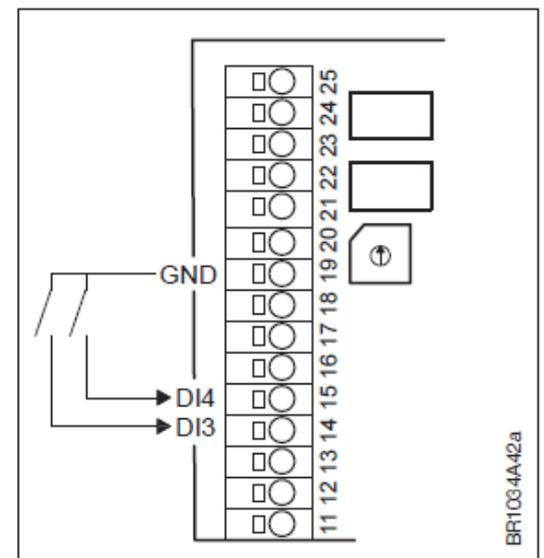


Figure 13.18.2



Closing of controller DRHX

- When all electrical connections are made, the test has been completed, the DRHX must be closed again.
- Fasten the black plastic cover with the associated 6 TX20 screws.
- Tightening torque on the screws in the black 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 black plastic cover is deformed.



FUNCTIONS

Settings and functions

Rotary switch **Are pre-set if delivered with a rotary heat exchanger from Hoval**

DRHX series is fitted with a rotary switch for setting min./max. stepper motor speed – see fig. 15.1.

Required motor rpm is calculated by Hoval.

Depends on rotor Ø, pulley Ø, rotor and motor torque, and given rotor rpm. See table 15.1.1

Figure 15.1

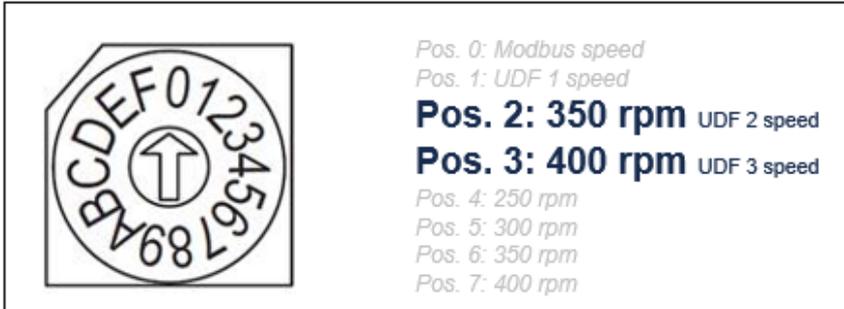


Figure 15.1.1

Rotor 12 RPM Rotor type ST1, SE3, SC1, ST2				Rotor 20 RPM Rotor type ST3				Rotor 20 RPM Rotor type HM1, SH1			
Rotor Ø _{exact}	Drive type	Pulley	Motor rpm	Rotor Ø _{exact}	Drive type	Pulley	Motor rpm	Rotor Ø _{exact}	Drive type	Pulley	Motor rpm
3400-3619	MRHX 14N	1610-125A	350	2650-2899	MRHX14N	1610-140A	400	2650-2779	MRHX 14N	1610-140A	400
3620-3819	DRHX 1790	1610-132A	350	2900-2969	1790 MAN	1610-150A	400	2780-2969	DRHX 1790	1610-150A	400
3820-4049	"	1610-140A	350	2970-3159	"	1610-160A	400	2970-3159	"	1610-160A	400
4050-4200	"	1610-150A	350	3160-3359	"	1610-170A	400	3160-3359	"	1610-170A	400
				3360-3549	"	1610-180A	400	3360-3549	"	1610-180A	400
				3550-3599	"	2012-212A	350	3550-3600	"	2012-212A	350
				3600-3749	"	2012-212A	350				
				3750-3899	"	2012-212A	400				
				3900-4049	"	2012-212A	400				
				4050-4200	"	2012-212A	400				



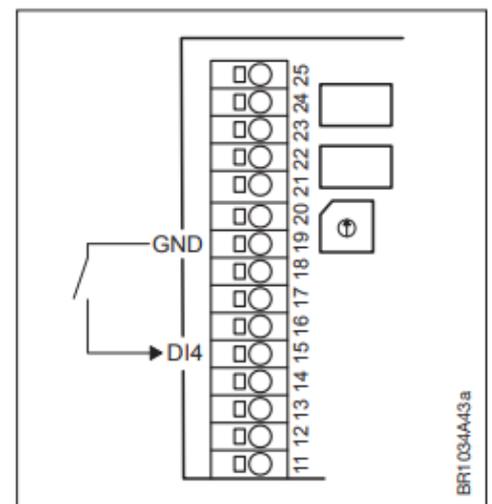
Incorrect setting of max. stepper motor speed can result in reduced performance or overload of the stepper motor, with a risk of overheating and lasting damage to the stepper motor and drive.

Test function

DRHX series is fitted with test function.

- The test function is factory set to be active on digital input DI4. Activate DI4 (15) and GND (19), see fig. 15.2.
- Activation of digital input DI4 will override the analogue signal and raise the stepper motor to max. set motor rpm. The LED will change to orange.
- De-activation of DI4 will stop the test. The LED will change to green
- The test function also works when Modbus control is activated.

Figure 15.2

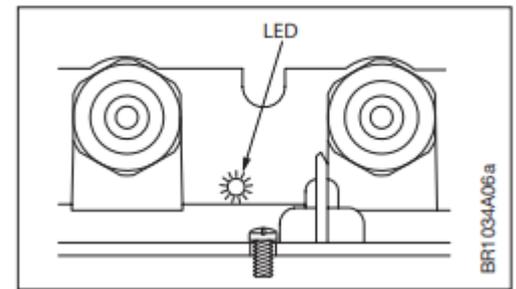


BR1 03/4/13a

LED indicator

- DRHX series is fitted with an LED indicator.
- The LED is located on the bottom next to the gland of DRHX controller, beside the entry for the mains cable – see fig. 15.3
- LED indicator code see table 15.3:

Figure 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)

Also see Alarm and fault codes page 11

0-10 V control

- Controller DRHX is factory-configured for 0-10V control.
This can be changed to constant Modbus control via the corresponding Modbus Register (see Modbus protocol, see OJ's homepage, link/ QR-code on first page in this manual).
- The motor starts when there is a control signal over 1.1 V.
- The motor stops when control signal is less than 0.6 V.
- The motor runs at maximum speed when there is a control signal over 9.5 V.
Max. motor speed is 350 or 400 depending on rotor type (see table 15.1.1, page 8)

Rotation monitoring

Due to the stepper motor and rotor are mechanically connected through a belt, it is necessary to monitor whether the rotor is rotating.

- If the motor is no longer turning the rotor due to a lack of tension or a broken/ damage belt, the DRHX controller will trigger a “rotor guard” alarm (E01).
- The DRHX has two possibilities of rotor monitoring systems: internal and external
- The factory setting is “Internal rotor guard”, external is an option (Hoval option RG3):

Internal rotor guard:

The internal rotor guard monitors the rotation of the rotor by measuring the electrical signal returning from the motor, will take place every 10 seconds.

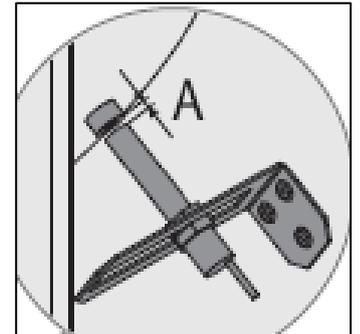
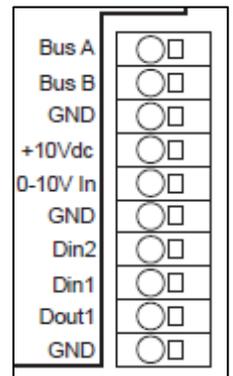
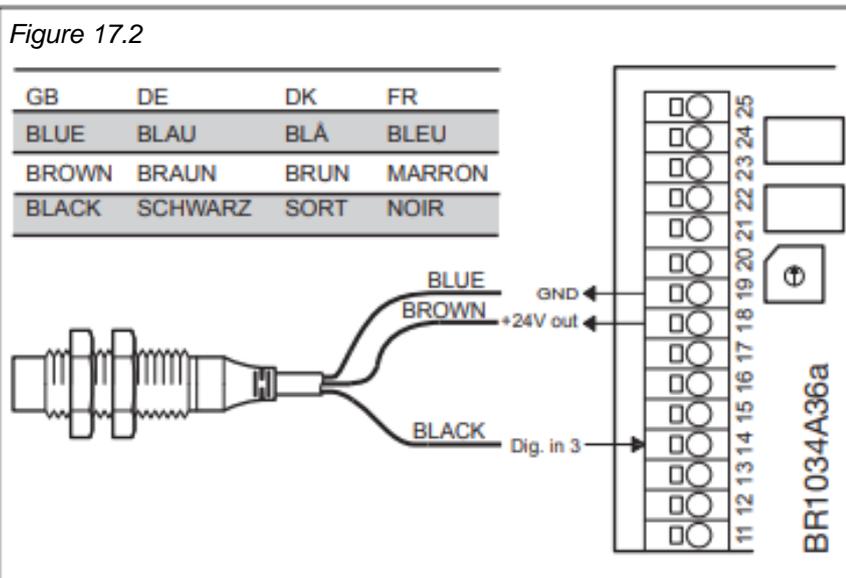
- After five consecutive failed detections within 1 hour the alarm E01 is given (see page 11).
- The internal rotor monitor works automatically with a motor speed above 25 rpm.

External rotation guard:

If external rotor guard is selected, “Internal rotor guard” will be automatically deactivated. An external sensor (3 wired) can be connected to the digital input ports (Hoval production code/ option RG3).

Mounting instruction for rotation guard, 3 wire (mtrl no 2045980):

- Connect the sensor to 19 (GND), 18 (+24V) and 14 (DI3)
- Connect a jumper between 6 (GND) and 7 (DI2) to activate external sensor, is there to stay.
- **Distance between magnet and sensor: A= 3-5 mm**



Boost function

- The DRHX series has a built-in "Start function" which automatically allows higher current for the motor during start-up (set to 10 seconds at 150% of rated current).

Purging function, cleaning

- When DRHX is controlled via 0-10 V signal (analogue), the purging/ cleaning function starts automatically when the stepper motor has been stopped for 10 minutes.
- The stepper motor shaft will rotate 10 times at a low speed, after which the stepper motor will stop again.

Holding torque

- To prevent the rotor from rotating due to air flow going through or start rotating by itself (can happen larger rotor diameters, but it is very rare) the 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.

Built-in protection

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

Rotor blocked, do not run/ turn

If the load of the rotor is higher than the rated maximum torque of the DRHX system, the controller will trigger a motor blocked alarm.

- This detection depends on the tension of the belt and friction between belt and pulley.
- Depending on the motor speed and the friction between belt and pulley, the DRHX controller 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, rpm.

Alarms, LED and fault codes

Alarm LED indicator overview

DRHX-1790 controller **LED will flash Red** in a sequence, see table below

Table 16

LED red	Error type	Possible reason
1 flash	Input error	Too low/ high supply voltage (in signal)
3 flashes	External error (MRHX)	Rotor blocked (do not run/ turn), rotation guard error (internal-/ external guard/ belt), motor phase error
5 flashes	Internal error (DRHX)	Overheating, hardware failure

To analyse the error more thoroughly you need to use the OJ-DRHX-PC-Tool or Modbus
Also see bottom of this page (see link/ QR-code on the first page in this document)

Alarm

DRHX has a built-in alarm monitor, which monitors optimal fault-free operation and triggers an alarm if operating or performance problems are observed. There is LED indicator showing operational status.

Alarms are either "Critical" or "Non-critical" alarms:

- "Critical" alarms stop the stepper motor.
- "Non-critical" alarms reduce stepper motor performance.

The built-in alarm monitor stops the DRHX.

- If the alarm situation passes, the alarm is automatically reset and DRHX will be restarted.
- If the maximum number of restarts (5 times/60 min) is exceeded, the **alarm must be reset**
- Alarm reset: **The alarm is automatically reset if the power is disconnected for longer than 60 seconds.**

Modbus Codes

There is alarm fault codes in DRHX1790, but only been visible via OJ-DRHX-PC-Tool or Modbus.
When analogue controlled LED is valid, see table 16, at top of this page.

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"

"C" = Critical alarm, stop the motor. / "NC" = Non-critical , reduce the motor performance

"RP" = Reducing performance.

"SA5" = Stepper motor stops after 5 restarts caused by same fault within 60 min

"S" = Stepper motor stops immediately



Before opening 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 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 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.

Troubleshooting - also see page 11, table 19 Fault and alarm codes

Troubleshooting when 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 DRHX terminals "L" and "N" (Nominal supply voltage is stated on the rating plate). LED displays constant green light – see page 9 for additional LED indications. Check whether short-circuit protection has been activated, external controller in the AHU.
	Poor electrical connections	Check electrical connections. Make sure there are no loose threads when connecting to the terminals, use cable shoes (multi core).
	Wrong DRHX setup	Check the rotary switch so it is correctly set for the valid speed, see page 8.
	<i>Lacking operating signal</i>	<i>A/D control: DRHX can be configured via the RS-485 interface register to receive a start signal via an optional digital input. If this function is selected, check that the DRHX has a signal connected to the "Start/Stop" input - digital input Din 1, 2 or 3, depending on the configuration.</i>
	Lacking 0-10 V DC control signal	Check that DRHX receives an operating signal >1.1 V on "0-10 V In".
	Active alarm	See Alarm LED overview on page 11 and remove what is causing the alarm. View the alarm via OJ-DRHX-PC-Tool or Modbus to determine which alarm has stopped the drive equipment.
	The motor has been stopped 5 times by the built-in stepper motor protector because of overloading or other alarm	Reset the alarm by disconnecting the power supply to DRHX controller and reconnecting it after approx. 60 seconds.
	Defective DRHX controller	Replace the DRHX controller. Never attempt to repair a defective DRHX controller. Contact Hoval for support/ replacement/ repair.
Stepper motor is defective	Replace stepper motor. Contact Hoval for support/ replacement/ repair.	
Rotor is running in wrong direction	Wrong phase sequence in stepper motor cable	Swap two phase wires in the controller DRHX. Switch the "V" (black) and "W" (blue) cable to change motor direction (see page 6)
DRHX cuts out due to an alarm	Active alarm	See Alarm LED overview on page 11 and fix what is causing the alarm. (you can also view the alarm via OJ-DRHX-PC-Tool or Modbus). Is external rotation guard activated even if its run by internal? Remove the jumper from DI2 see page 10. If using external rotor guard: is the magnet in front of the sensor? Is the distance correct? Is the holder fixed? See page 10 External rotation guard is activated even if it's not in use: remove jumper from DI2 (see page10)
		Reset the alarm by disconnecting the power supply to 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 Repair the cause of repeated alarm activation.