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EXHAUSTO

APPLICATION NOTE

OJ-DRHX Modbus protocol

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OJ DRHX

A DRIVES PROGRAMME DEDICATED TO ROTARY HEAT EXCHANGERS

OJ ELECTRONICS

Introduction

This protocol contains the Modbus addresses and registers which are available in OJ-DRHX. Modbus can access single addresses or several addresses simultaneously, either reading or writing 1-bit or 16-bit values. A Modbus address contains either a 1-bit value or a 16-bit integer

This protocol applies to the following product variants:

- **OJ-DRHX-1055-MNN5**
- **OJ-DRHX-1055-MAD5**
- **OJ-DRHX-1220-MNN5**
- **OJ-DRHX-1220-MAD5**
- **OJ-DRHX-1690-MAN5**

Modbus connection

OJ-DRHX is provided with connections for Modbus communication.

The product variants:

- **OJ-DRHX-1055-MNN5**
- **OJ-DRHX-1055-MAD5**
- **OJ-DRHX-1220-MNN5**
- **OJ-DRHX-1220-MAD5**

- Do have 2 pcs. Modbus EIA-485 RJ12-plug connectors marked ”A” & ”B” (see fig. 1)

AND

- 1 set of spring terminals marked ”A” & ”B” + “GND” (see fig. 2)
- All “MNN5”-variants only support terminal 3, 4 & 5

The Modbus terminals (terminal no. 3/**Bus A** & terminal no. 4/**Bus B**) on the strip of spring terminals are internally connected in parallel to the Modbus pins in the RJ12 connectors marked ”A” and ”B” (pin no. 3/**Bus A** & pin no. 4/**Bus B**).

Product variants:

- **OJ-DRHX-1690-MAN5**

- Do have 1 pcs. of RJ12-plug marked with ”B” (see fig. 4)

Note

Plug marked with ”A” & ”C” cannot and may NOT be used.

AND

- 1 set of spring terminals (see fig. 4)

The Modbus terminals (terminal **Bus A** & terminal **Bus B**) on the strip of spring terminals are internally connected in parallel to the Modbus pins in the RJ12 connectors marked ”A” and ”B” (pin no. 3/**Bus A** & pin no. 4/**Bus B**).

Figure 1

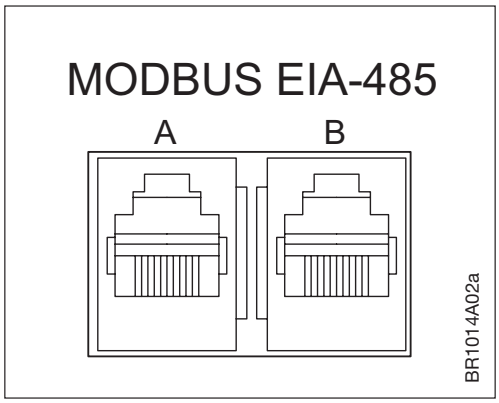


Figure 2

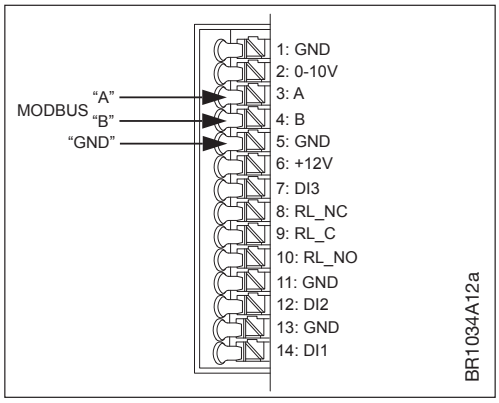


Figure 3

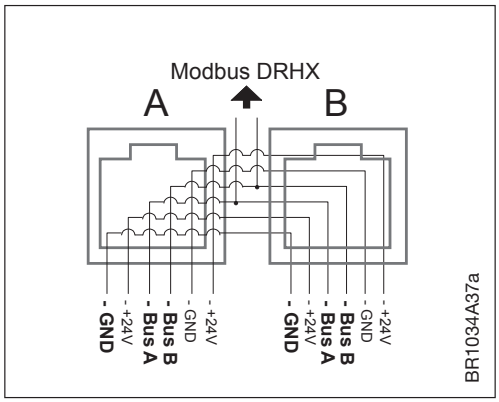
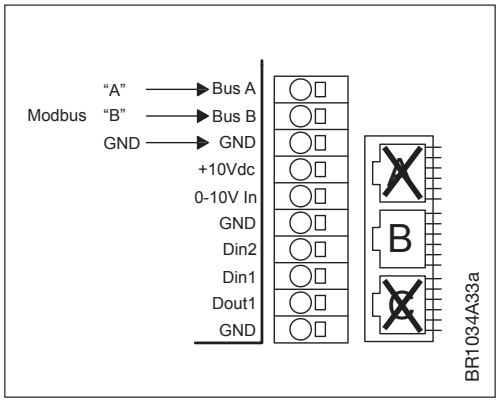


Figure 4



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Modbus cable

Types of Modbus cables which can be used:

- Round communications cable (like twisted pair cables) can be used and connected in the spring terminals marked ”A” & ”B” + “GND”.
- Flat cable/tele cable, 6-wire, not shielded, 30 AWG, 0,066 mm^2 or equal types of flat cable.

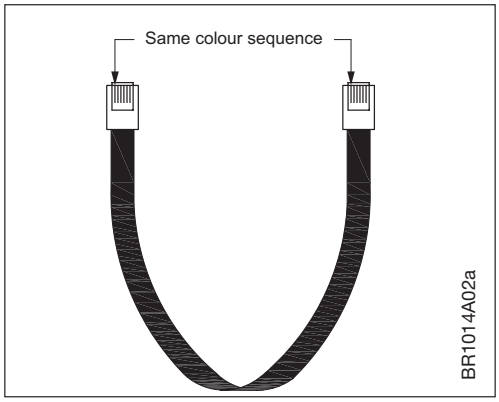
Note

If flat cable/tele cable is used, RJ12 connectors must be attached to both ends of the cable, using a special crimp tool.

Note

IMPORTANT! If flat cable/tele cable is used, the RJ12 connectors in both ends must be attached in such a way that the two connectors follow the same sequence of wire colours. (See fig. 5)

Figure 5



Modbus register types:

Modbus Type	Description	Reference
Coil Status (R/W)	Discrete Output	0x
Input Status (R)	Discrete Input	1x
Input Register (R)	16-bit Input Register	3x
Holding Register (R/W)	16-bit Output Register	4x

R=Read only
R/W = Read / Write

Supported Modbus commands

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

Modbus address

From factory the Modbus ID is pre-set to: 79
Modbus ID can be changed using a Modbus tool (e.g. Modbus Poll) or from the OJ-DRHX-PC-Tool.
OJ-DRHX-PC-Tool can be downloaded from www.ojelectronics.com

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Communication parameters

Communication parameters (see table 1) can be change using a Modbus tool (e.g. Modbus Poll) or from the OJ-DRHX-PC-Tool.

Table 1				
	Range	**Unit**	**Default setting**	**Alternative setting**
Address	1-247	n/a	79	3
Baud rate	9.600, 19.200, 38.400, 57.600, 115.200	bps	38.400	115.200
Parity	None, even, odd	n/a	None	Even
Stop bit(s)	0, 1, 2	n/a	1	2

n/a=not applicable

Modbus register list

Coil Stat Bits – Available Coil Stat Bits: According to the table below (see table 2)

Standard-MODBUS (RTU)

Coil Stat Bits: 11 (R/W)
0x01: Read
0x05: Write Single Coil (NOTE: ON => output value = 0xFF00)
0x0F: Write Multiple Coils

Table 2					
Register	**Address**	**Function**	**Range**	**Active state**	**Factory**
0x0001	0	Motor ON/OFF	0 - 1	1 = ON	0
0x0002	1	Reset Alarms	0 - 1	1 = Reset	0
0x0004	3	Rotation direction	0 - 1	1 = CounterClockWise	0
0x0008	7	Control mode [1]	0 - 1	0 = Modbus, 1 = 0-10V	1
0x0009	8	Use altern. comm. settings	0 - 1	1 = Alternative	0
0x0010	9	Autodetect communication [2]	0 - 1	1 = Enable	1
0x0011	10	Analog start signal [1]	0 - 1	1 = Enable	1
0x0012	11	Autodetect control mode [1]	0 - 1	1 = Enable	1
0x0013	12	Disable internal rotor guard	0 - 1	1 = Disabled	0
0x0014	13	Enable external rotor guard [1]	0 - 1	1 = Enabled	0
0x0015	14	High speed resolution	0 - 1	0 = Resolution = 0.1 RPM 1 = Resolution = 0.01 RPM	1
0x0016	15	K-factor for Modbus	0 - 1	1 = K-factor not used for Modbus	1
0xx17	17	Enable auto saving of UDF	0 - 1	1 = UDF stored automatically	1

[1]: Not supported on “Modbus only” variant (DRHX-1xxx-xNNx)

Note

[2]: Factory setting (0x0010: Autodetect communication) is “1”=Enabled.
This means that even if the communication parameters of the DRHX have changed to the alternative

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settings (4x0014 – 4x0017), it will always be possible to communicate on the default communication settings (Modbus ID 79, baudrate 38.400, no parity, 1 stop bit).

If Autodetect communication is “0”=Disabled and the communication parameters of the DRHX have changed to the alternative settings, it will only be possible to communicate on these alternative settings.
Input Stat Bits – Available Input Stat Bits: According to the table below (see table 3)
Input Stat Bits: 23 (R)
0x02: Read

Table 3				
Register	**Address**	**Function**	**Range**	**Active state**
1x0001	0	Rotorguard Alarm	0 - 1	1 = Alarm
1x0002	1	V LO Alarm	0 - 1	1 = Alarm
1x0003	2	V HI Alarm	0 - 1	1 = Alarm
1x0004	3	I HI Alarm (Motor out short)	0 - 1	1 = Alarm
1x0005	4	Temperature High	0 - 1	1 = Warning
1x0009	8	Rotorguard Signal	0 - 1	1 = Pulse
1x0010	9	Overload / I_Limit	0 - 1	1 = Warning
1x0011	10	Internal Stop	0 - 1	1 = Alarm (Stop)
1x0012	11	Rotor Blocked	0 - 1	1 = Alarm
1x0013	12	EEPROM error	0 - 1	1 = Warning
1x0014	13	Communication error MOC [1]	0 - 1	1 = Alarm
1x0015	14	Motor Phase Error	0 - 1	1 = Alarm
1x0016	15	Ripple	0 - 1	1 = Warning
1x0017	16	Digital Input 1 [1]	0 - 1	1 = HI
1x0018	17	Digital Input 2 [1]	0 - 1	1 = HI
1x0019	18	Ext. 24V supply overload [2]	0 - 1	1 = Overload
1x0020	19	MOC in bootloader [1]	0 - 1	1 = Alarm
1x0021	20	Digital Input 3 [1]	0 - 1	1 = HI
1x0022	21	Digital Input 4 [2]	0 - 1	1 = HI
1x0023	22	Communication error IOM [2]	0 - 1	1 = Warning
1x0024	23	Rotation OK	0 - 1	1 = OK
1x0025	24	Test function active	0 - 1	1 = Active
1x0026	25	Purging active	0 - 1	1 = Active
1x0027	26	IO Config mismatch [1]	0 - 1	1 = Warning

[1]: Not supported on “Modbus only” variant (DRHX-1xxx-xNNx)
[2]: Only supported on DRHX-1690-MAD5

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Input Registers – Available Input Registers: According to the table below (see table 4)
Input Registers: 31 (R)
0x04: Read

Table 4					
Register	**Address**	**Function**	**Range**	**Resolution**	**Unit**
3x0001	0x0000	DHX Type	0 - 14	1	-
3x0002	0x0001	AOC SW version [1]	0 - ?	0.01	-
3x0003	0x0002	PrcOut	0 - 10000	0.01	%
3x0004	0x0003	Intern Temp	-5000 - 15000	0.01	ºC
3x0005	0x0004	Motor Speed Out	0 - 40000	0.01	RPM
3x0006	0x0005	V In	0 - 300	1	V
3x0007	0x0006	I Out (RMS)	0 - 10000	1	mA
3x0008	0x0007	Power In	0 - 1000	1	W
3x0009	0x0008	ExternSet [2]	0 - 10000	1	mV
3x0010	0x0009	Operation Day	0 - 9999	1	Day
3x0011	0x000A	Operation Minutes	0 - 1439	1	Min.
3x0012	0x000B	I Ripple [4]	0 - 10000	1	mA
3x0013	0x000C	V Ripple	0 - 100	1	V
3x0014	0x000D	Config file variant	AA - ZZ	2 ASCII characters	
3x0015	0x000E	Config file version	100 - 32000	0.01	-
3x0016	0x000F	MOC SW version	0 - ?	0.01	-
3x0017	0x0010	Rotor Speed Out	0 - 40000	0.01	RPM
3x0018	0x0011	Torque	0 - 1500	0.01	Nm
3x0018	0x0012	SW variant [3]	-	-	-
3x0019	0x0013	AOC Boot SW [1]	0 - ?	0.01	-
3x0020	0x0014	MOC Boot SW	0 - ?	0.01	-
3x0021	0x0015	Motor Cfg. Var.	0 - 65535	1	-
3x0022	0x0016	Motor Cfg. Ver.	0 - 65535	0.01	-
3x0023	0x0017	Rotor Cfg. Var.	0 - 65535	1	-
3x0024	0x0018	Rotor Cfg. Ver.	0 - 65535	0.01	-
3x0025	0x0019	User Data Var.	0 - 65535	1	-
3x0026	0x001A	User Data Ver.	0 - 65535	0.01	-
3x0027	0x001B	IOM SW version [4]	0 - ?	0.01	-
3x0028	0x001C	V DC Bus (Peak)	0 – 400	1	V
3x0029	0x001D	V Motor (Peak)	0 – 400	1	V
3x0030	0x001E	ExternSet2 (IOM) [4]	0 - 10000	1	mV

[1]: MOC SW versions shown in “Modbus only” variant (DRHX-1xxx-xNNx)
[2]: Not supported on “Modbus only” variant (DRHX-1xxx-xNNx)
[3]: “100” on “analog” variant (DRHX-1xxx-xADx), “200” on “Modbus only” variant (DRHX-1xxx-xNNx), “300” on DRHX-1690-MAN5
[4]: Only supported on DRHX-1690-MAN5

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Holding Registers – Available Holding Registers: According to the table below (see table 5)
Holding Registers: 32 (R/W)
0x03: Read
0x06: Write Single
0x10: Write Multiple

Table 5						
Register	**Address**	**Function**	**Range**	**Resolution**	**Unit**	**Factory**
4x0001	0x0000	Setpoint / PrcSet	0 - 10000	0.01	%	-
4x0002	0x0001	Min. Motor Speed	100 - Max.	0.01	RPM	100
4x0003	0x0002	Max. Motor Speed	Min. - 40000	0.01	RPM	25000
4x0004	0x0003	Start I Out (Boost)	0 - ?	1	mA (RMS)	I_{max} + 50%
4x0005	0x0004	Start Time (Boost)	0 - ?	1	Sec.	10
4x0009	0x0008	Prc Holding Torque	0 - 1000	0.1	% of max	0
4x0010	0x0009	UpRampTime	15 - 300	1	Sec.	60
4x0011	0x000A	DownRampTime	15 - 300	1	Sec.	60
4x0012	0x000B	SwitchMode	0	(Auto)		
			1	8	kHz	
			2	10	kHz	X
4x0013	0x000C	DHX Type	0 - ?	1	-	0 [3]
4x0014	0x000D	Alternative Modbus ID	1 - 247	1	-	3
4x0015	0x000E	Alternative BaudRate	0	9600	bps	
			1	19200	bps	
			2	38400	bps	
			3	57600	bps	
			4	115200	bps	X
4x0016	0x000F	Alternative Parity	0	None	-	
			1	Odd	-	
			2	Even	-	X
4x0017	0x0010	Alternative Stop Bits	0	INVALID	-	
			1	1	-	
			2	2	-	X
4x0018	0x0011	Number of retries	-1 - 100	1	-	5
4x0019	0x0012	Modbus Timeout	0 - 240	1	Sec.	0
4x0020	0x0013	Pulley size (diameter)	0 - 1000	1	mm.	0
4x0021	0x0014	Rotor size (diameter)	0 - 10000	1	mm.	0
4x0022	0x0015	Pulses per rotation	0 - 10	1	-	1
4x0023	0x0016	K factor	0-10000	-	-	100
4x0024	0x0017	DigIn1 config [2]	0	Disabled	-	
			1	Start/stop	-	
			2	AlarmReset	-	X
			3	Rotation direction	-	
			4	Test function	-	
			5	Ext. rotor guard signal	-	
			6	Enable ext. rotor guard	-	
4x0025	0x0018	DigIn2 config [2]	0	Disabled	-	
			1	Start/stop	-	
			2	AlarmReset	-	
			3	Rotation direction	-	
			4	Test function	-	
			5	Ext. rotor guard signal	-	
			6	Enable ext. rotor guard	-	X
4x0025	0x0019	DigOut config [1]	0	Disabled	-	

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Table 5						
Register	**Address**	**Function**	**Range**	**Resolution**	**Unit**	**Factory**
			1	TachoOut	-	X
			2	RunningStart	-	
			3	AlarmOut	-	
			4	RunningSpin	-	
4x0026	0x001A	MotorConfigVar	0 - 65535	1	-	0 [3]
4x0027	0x001B	RotorConfigVar	0 - 65535	1	-	0 [3]
4x0028	0x001C	DigIn3 config [2]	0	Disabled	-	
			1	Start/stop	-	
			2	AlarmReset	-	
			3	Rotation direc-tion	-	
			4	Test function	-	
			5	Ext. rotor guard signal	-	X
			6	Enable ext. rotor guard	-	
4x0029	0x001D	DigIn4 config [1]	0	Disabled	-	X
			1	Start/stop	-	
			2	AlarmReset	-	
			3	Rotation direc-tion	-	
			4	Test function	-	
			5	Ext. rotor guard signal	-	
			6	Enable ext. rotor guard	-	
4x0030	0x001E	Relay1 config [2]	0	Disabled	-	
			1	N/A	-	
			2	RunningStart	-	
			3	AlarmOut	-	X
			4	RunningSpin	-	
4x0031	0x001F	Relay2 config [1]	0	Disabled	-	X
			1	N/A	-	
			2	RunningStart	-	
			3	AlarmOut	-	
			4	RunningSpin	-	
4x0032	0x0020	AnalogOut1 config [1]	0	Disabled	-	X
			1	ActSpeed	-	
4x0034	0x0022	AnalogIn2 config [1]	0	Disabled	-	X
			1	Enable ext. rotor guard	-	
4x0035	0x0023	Modbus Response Wait Time	0 - 200	1	ms	1
4x0037	0x0025	Max speed step	0 - 10.000	0.01	RPM	0
4x0038	0x0026	Purging inteval	0 - 30.000	1	Sec.	600
4x0039	0x0027	Purging rotation	0 - 5.000	1	Rotation	10

[1]: Only supported on DRHX-1690-MAN5

[2]: Not supported on “Modbus only” variant (DRHX-1xxx-xNNx)

[3]: Set by DIP1 & 2 on DRHX-1xxx-xNNx and DRHX-1xxx-xADx

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