





DTR-VS-ver.5.0 (09.2017)



The drive unit complies with the Polish Standard: IEC/EN 60439-1 +AC Low voltage switchgears and controllers

VTS reserves the right to implement changes without prior notice



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1. INTRODUCTION

This documentation describes information regarding the data, transport, storage and service of the Rotary Heat Exchangers.

• Before taking any action you should absolutely read this document.



2. TECHNICAL DATA

2.1. Base Data of the Drive Unit

2.1.1. Construction

The drive unit is an integral part of each rotary heat exchanger delivered by VTS.

Basic elements:

- Frequency converter / EC motor controller (depending on version and region)
- Exchanger rotor
- Rotor drive belt transmission
- Motoreducer engine coupled with reduction gearing

2.1.2. Device Operation

Drive unit is responsible for the start-up and smooth control of rotary exchanger speed in the range of 3 to 10 rpm (for TOTAL exchanger up to 20 rpm).

Utilizing a wide range of regulator functions, it is also possible to monitor the performance of the drive unit in detail.

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2.2. Technical Specification

2.2.1. Co	nstruction										
Inverter-ty	pe drive unit	with asyno	chrono	us moto	oreduce	er and belt tra	ansmiss	ion. Individu	al elements a	are lo	cated
inside the	rotary exchar	nger's casi	ng in a	ppropri	ately a	dapted space	S				
2.2.2. Op	peration par	ameters									
System											
U ₃ rated p	ower supply v	oltage							1x(200-230))V ±10	9%
Rated free	quency								50-60 Hz ±	5%	
Protection	n class after in	stalling in	the VT	S AHU					IP54		
Acceptabl	Acceptable operating temperature 50°C										
EMC envi	EMC environment 1										
2.2.3. Ra	ted data of	the unit	comp	onents	5						
AH	IU data		engine	data				inverter dat	a	-	
AHU size	diameter of exchanger rotor	type	Pn	Un	In	type	Un	ا (primary side)	ا (secondary side)	f min	f max
	[mm]		[kW]	[V]	[A]		[V]	[A]	[A]	[Hz]	[Hz]
21	750	AC 5IK60GU	0.06		0.45	0.400 //05				16	55
30	785	AC 5IK60GU	0.06	3x230	0.45	SV004iC5- 1F LG	1x230	5,5	2,5	17	58
40	995	AC 5IK60GU	0.06		0.45						52
55	1165	EC NS 65-30- 037.23	0.37		1.05			-	-		
75	1305	EC NS 65-30- 037.23	0.37		1.05						
100	1485	EC NS 65-30- 037.23	0.37		1.05						
120	1680	EC NS 65-30- 037.23	0.37		1.05					-	
150	1870	EC NS 65-30- 037.23	0.37	1x230	1.05		-				-
180	1870	EC NS 65-30- 037.23	0.37		1.05						
230	2240	EC NS 65-30- 037.23	0.37		2,1						
300	2335	EC NS 65-30- 037.23	0.37		2,1						
400	2750	AC M7 1B4 TERM	0.37		2,1					17	56
500	3250	AC M7 1B4 TERM	0.37	3x230	2,1	SV004iC5- 1F LG	1x230	5,5	2,5	16	53
650	3365	AC M7 1B4 TERM	0.37		2,1					16	55



2.3. Installation and Configuration of the Drive Unit



- Connect the converter in non-voltage state
- Protect the circuit against an unintended switch-on. Apply the grounding circuit.
- All operations: assembly, start-up and maintenance should be performed by properly trained, responsible and professional staff.
- Ensure allowing for static discharge before touching the device.
- The control leads should be installed so as to eliminate influence of distracted or capacitive inductive fields onto the automation functions.
- Fluctuations and aberrations of the rated supply voltage must meet requirements mentioned in the technical parameters. In other cases some functional interferences or hazardous states may appear.
- After switching off the frequency converter, some hazardous voltage from loaded capacitors may appear at conductive elements and power supply. Please use warning plates.

2.4. Drive Unit installation and Configuration with Frequency Converter and VTS Automation

2.4.1. Circuit diagram of the exchanger drive circuit





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To meet the electromagnetic compatibility requirements, motor lead's shield must be grounded at two sides - at the motor's as well as frequency converter's side.



VTS production controllers are designed for direct connection of the exchanger drive unit. These controls normally have the appropriate protection and clamps for supply and control of the rotary exchanger.

If an HMI Advanced user interface is connected to the controller, the drive parameters can be configured automatically using the programming option in the Advanced tab.

How to connect the power supply to the VTS control unit is on the electrical diagram of the control unit.

The method of connecting the communication line to control the rotary heat exchanger is in the diagram of the automation application provided with the control.

2.4.2. Installation and Configuration of the Drive Unit

No.	Parameter	Parameter code	Parameter Code			
1	Acceleration Time	ACC		30		
2	Deacceleration Time	dEC		30		
3	Converter control method	Drv		3		
4	Frequency Converter method	Frq		8		
5	Base frequency (motor rater frequency)	F22		50		
6	V/G pattern	F30		0		
7	Thermal motor protection	F50	1			
	AHU Size		021-040	055-180	230-650	
8	Number of motor speeds	H31	4	4	4	
9	Rater motor slip	H32	5	4	4,33	
10	Rater motor current	H33	0,4	1	2,1	
11	Idle run current	H34	0,3	0,8	1,5	
12	Torque control mode	H40		0		
13	Funcion of binary input P4	123		19		
14	4 Modbus address I60 4					
15	Reaction on communication decay	162	2			
16	Communication latency time	163	20			
17	Automatic parameters tunning	H41		1		



After entering all the configuration data, perform the automatic tuning procedure.



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2.4.3. Motor Protection

Motor overload protection is realized on two manners Frequency converter is furnished with numeric algorithm, which calculates time and value of the motor current overflow (i²t integral). If the converter detects an overload, it turns off the motor and generates an alarm signal.



The alarm needs to be deleted by turning off and restarting the supply voltage to the converter.

It is imperative to wait 20 minutes before restarting the exchanger drive after each such event. This is the time needed to cool down the engine. Immediate startup can damage the engine!

2.5. Drive Unit installation and Configuration in any Automation System

2.5.1. Circuit diagram of the exchanger drive circuit



To meet the electromagnetic compatibility requirements, motor lead's shield must be grounded at two sides - at the motor's as well as frequency converter's side.



Recommended protection of a supply circuit of the frequency converter:

- B6-type installation switch
- Gg6-type fuse-element

2.5.2. Control of the exchanger drive unit

The wide range of the frequency converter's functions enables to adapt the exchanger's drive unit to various needs of an user.

The iC5 converter features:

- 5 2-state control inputs, e.g.: start / stop / operating speed select (1 of 7)
- continuous current or voltage input for setting operation frequency
- two configurable 2-state outputs relay and transistor's one
- RS485 communication interface with Modbus protocol enabling full control of exchanger

2.5.3. Example of a Converter Configuration

Functioning:

- Frequency setting via an analogue voltage input
- Start/Stop command via 2-state input
- Alarm signaling via universal relay output

Converter's control strip connections diagram





Converter's parameter listing for a sample configuration



Converter's parameter listing for a sample configuration

Parameter	Parameter code		Value												
Acceleration time	ACC		30												
Deceleration time	dEC								30						
Cinventer control method	Drv								1						
Frequency setting method	Frq								3						
Base frequency	F22								50						
V/F pattern	F30								0						
Thermal motor protection	F50								1						
AHU size			21-	40			5	55-18	0			2	30-65	50	
Number of motor speeds	H31		4	1				4			4				
Rated motor slip	H32		Ę	5				4			4,33				
Rated motor current	H33		0	,4				1			2,1				
Idle run current	H34		0	,3				0,8					1,5		
Torque control mode	H40								0						
Function of binary input P4	123								19						
V1 volatage input filter	16								1						
V1 input scaling - min	17								1						
AHU size		21	30	40	55	75	100	120	150	180	230	300	400	500	650
Frequency scaling - min	18	16	17	16	15	15	16	16	15	15	15	16	17	16	16
V1 input scaling - max	19	9													
AHU size		21 30 40 55 75 100 120 150 180 230 300 400 500 6				650									
Frequency scaling - max	l10	55	58	52	51	51	54	52	51	51	51	53	56	53	55
Automatic parameters tuning	H41		1												

After triggering the parameters auto tuning function wait till the converter's display changes from TUn into H41. Converter's auto tuning duration is 1 minute.

2.5.4. Motor Protection

Motor overload protection is realized on two manners Frequency converter is furnished with numeric algorithm, which calculates time and value of the motor current overflow (i2t integral). If the converter detects an overload, it turns off the motor and generates an alarm signal.



The alarm needs to be deleted by turning off and restarting the supply voltage to the converter.

It is imperative to wait 20 minutes before restarting the exchanger drive after each such event. This is the time needed to cool down the engine. Immediate startup can damage the engine!



Clamp number			Description				
AN1			Analog input; Setpoint 0-10 V; $R \ge 1 \ k\Omega$				
GND 2, 5 A 3 B 4		2, 5	Reference point				
		3	Serial Bus RS485 - A (+) / MODBUS RTU				
		4	Serial Bus RS485 - B (-) / MODBUS RTU				
A PE 6		6	Grounding wire PE				
er Sul	L	7					
Powe	N	8	- Supply wire, 1x230vac				

2.6. Instalation and Configuration of the Drive Unit in System with EC Regulator



VTS production controllers are designed for direct connection of the exchanger drive unit. These controls normally have the appropriate protection and clamps for supply and control of the rotary exchanger.

If an HMI Advanced user interface is connected to the controller, the drive parameters can be configured automatically using the programming option in the Advanced tab.

How to connect the power supply to the VTS control unit is on the electrical diagram of the control unit.

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2.6.1. ModBus RTU/RS485 Parameters for the EC Regulator

Coils							
Address	Function	Range	Description				
0	Motor ON/OFF	0-1	Indication, 1=ON, 0=OFF				
1	Reset Controller	0-1	1=Reset controller				

Discrete status bits (inputs)								
Address	Function	Range	Description					
0	Under Voltage	0-1	1=Voltage too low to run					
1	Over Voltage	0-1	1=Voltage too high to run					
2	IGBT Overcurrent	0-1	1=Overcurrent protection tripped					
3	Hot	0-1	1=Temperature protection active, power reduced					
4	Phase Loss	0-1	1=Phase or motor sync loss					
5	RESERVED							
6	Parameters CRC	0-1	1=Parameter checksum failed (TBD)					
7	Circuit Fault	0-1	1=There was an error detected during circuit internal check					
8	Motor Fault	0-1	1=Motor does not behave as expected					
9	Too Hot	0-1	1=Converter too hot to operate					
10	I2R IGBT Fault	0-1	1=Software IGBT protection triggered					
11 - 13	RESERVED							
14	Restart Fault	0-1	1=Fault condition repeated several times in a short time. Converter power should be power cycled or reset.					
15	RESERVED							
16 - 17	RESERVED							
18	Waiting To Stop	0-1	1=Motor should be stopped, but is still spinning					
19 – 23	RESERVED							
24	RpmReg	0-1	Speed regulator active					
25	PowerReg	0-1	Power limit regulator active					
26	RESERVED							
27	OvermodReg	0-1	Over modulation reached. Converter can no longer supply the voltage required by motor.					
28	RegenReg	0-1	Motor is in regeneration. Speed increased to prevent DC link over voltage					
29	IphaseReg	0-1	RMS motor phase current limit reached					
30	SyncReg	0-1	Motor is still in Synchronous mode					

Access levels:

- 0 read only
- 1 basic settings / password: 1
- 2 service setting



Holding Registers								
Address	Function	Range	Resolution	Description	LEVEL			
0	Set point	010000	0,01%	Performance set point for speed depends on operation mode.	1			
6	Operation Mode			0: AN1 Speed (default) 2: MODBUS Speed	1			

Input Registers									
Address	Function	Range	Resolution	Description					
0	HW Version		1	Hardware version					
1	FW Version		1	Firmware version					
23	RESERVED	SERVED							
4	Speed	032767	1	RPM					
5	Controller temperature	-50150	0.01	℃					
6	UDC		0.1	DC Bus voltage in V					
7	Stator IRMS		0.001	RMS Stator current in A					
8	Power		0.1	W					
9	Analogue1	-3002000	0.01V	Analogue input 1 voltage					
10 - 18	RESERVED	<u>^</u>		^					
19	Error Code	07, -1	Red LED error codes (priority in the order below): 7 = motor failed to start repeatedly 6 = under or overvoltage 5 = motor misconnected/faulty 4 = internal frequency converter fault 3 = temperature protection active 2 = active overcurrent protection 1 = slow blink = standby -1 = fast blink (fire activated) 0 = always on (operating normally)						
20 - 21	RESERVED		-	· · ·					
23	Op Minutes		Minutes of operation						
24	Op Days			Days of operation (RPM>0, no error)					

2.6.2. Rotating Speed Control from MODBUS Level

To switch from a 0-10Vdc control signal to a ModBus RTU:

- Set "Operation Mode" parameter value to 2
- In parameter "Set Point" save the desired value of the control at the percentage of maximum speed

Example:

Set_Point < 1000 (10,00 %) ... Engine stopped

Set_Point = 1000 (10,00 %) ... Motor running at minimum speed

1000 (10,00 %) < Set_Point <= 10000 (100,00 %) ... Motor running with desired speed.

The engine speed is converted according to the formula:

$$Speed[RPM] = RPM_Min + \frac{RPM_Max - RPM_Min}{9000} * Set_Point[\%]$$



2.7. Recommendations For Installation

	Recomended conductors									
Size, application	Description	Parameters	Pictorial diagram							
3x1,5mm² exchanger's feeding conductor	Multi-conductor cables, single - or multi - wire copper conductors, PCV insulated.	Rated volatage: 450/750V Operating temperature: from -40 to 70°C								
1x1mm ² or 2x1mm ² control circuits	Control cables with copper conductors, shielded with copper wires, PCV insulated.	Rated volatage: 300/500 V Operating temperature: from -40 do 70°C								
UTP or STP cable, 2x2x24 AWG (2 pairs) serial communication	Multi-conductor cables, single - or multiwire copper conductors, PCV or PE insulated, wired in two to minimize interference, except for the UTP - type, they are equipped with an additional shield.	Operating temperature: from -20 do 60°C	UTP							
	The wire cross-sections have been selecte three load conductors. Due to the protection currents, revise feede	d for long-term current capacit seletivity, lenght, cable placer ers' cross-sections in the table	y acording to the Picture, for nent method and short-circuit below.							

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3. STORAGE AND TRANSPORT



- Rotary Heat Exchanger can be unloaded and transported only by employees with proper experience possessing appropriate qualifications to operate transporting equipment.
- It is permissible to transport the rotary exchanger only in the vertical position.



For transport purpose heat exchanger, substrate and frame corners are secured with cardboard and stretched. Whole rotary heat exchanger stands on wooden bars with dimension 100 [mm] x 100 [mm]. Before assembly wooden bars and cardboard have to be removed.

4. START-UP

Before starting up the exchanger, check the following:

- after removing the wedge-shaped belt if the motor's rotor rotates freely,
- tension of the drive belt,
- distance between the rotor and casing,
- electric connections,
- if the cleaning air-lock is installed on the side of the supply-air duct,
- once the drive belt is assembled and the exchanger is turned on, make sure that direction of rotor's rotations led from exhaust-air ducts, through the cleaning air-lock and to the supply-air ducts



5. MAINTENANCE



Switch off the power of the equipment before starting any maintenance works. Device should be protected against accidental or unauthorized activation during the maintenance.

5.1. Rotary Heat exchanger and Drive Belt



Check the exchanger no less than three months and inspect its technical condition as well as contamination level of the rotor. During maintenance activities of the rotary exchanger check if:

- rotor rotates freely. Sensible resistance can be caused by too excessive hold down of sealing brushes and touching the rotor's edges. In such a situation adjust the brushes properly. Worn out brushes sealing should be replaced. If previously removed brush sealing is to be installed again, it should be installed so that its direction should be in line with the rotor's rotation direction. After replacement or adjustment of sealing brushes, the exchanger should operate 30 minutes so that the brushes could adapt to the rotor's surface. After this time check the motor's current and compare it with the rated current in order to find out if the motor is not overloaded.
- drive belt is not damaged and if it is clean as well as if it does not slip on the cylindrical part of the rotor. If
 despite maximal tension by the strain system the clearance still exists, the belt should be replaced or
 shortened,
- air inlet holes are not covered with dust or contaminated in any other way. In order to clean the rotor apply
 one of the methods designed for other exchangers.

Rolling bearings of rotor and drive motor are greased in continuous manner during operation. Amount of grease in bearings during the exchanger assembly is enough for long-lasting operation and there is no need to lubricate the bearings during operation. It is recommended to clean the motor and gear from dust so as an insulation layer was not formed on the motor's surface which may lead to increase of drive operating temperate.



Cleaning

Necessary cleaning should be carried out using:

- vacuum cleaning with soft suction nozzle,
- blowing through the ducts with air stream in a direction opposite to the normal air flow direction,
- washing the air ducts at their whole length with water with cleaning agents which do not cause aluminum corrosion,
- in case of very contaminated exchangers you can use stream of compressed water to clean them.

While cleaning the exchanger using mechanical cleaning agents pay utmost attention not to damage or deform the exchanger's panels. During exchanger operation in below zero temperature, the exchanger must be thoroughly dried before next start-up.

5.2. Rotary seal

In the event of damage to the seal and the need to replace the sealing, Please cut off the sealing on the outline of the exchanger and install the sealing brush.



- $\underline{\mathbb{N}}$
- Please keep in mind that whole rubber seal have to be cut off around rotary heat exchanger edge in order to mount new sealing. It is forbidden to partially cut off damaged part and replace sealing.