SHS
ELECTRONICS

User Guide
STEPPING MOTOR DRIVE

Series

HT7

Models

ETHERNET/IP

ISO 9001
BUREAU VERITAS
Certification

ACCREDIA
L'ENTE DI ACCREDITAMENTO

HT7_ETHERNET/IP_rev6_eng

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⚠️ **Safety notes**

The SHS automation products should be handled, installed and maintained by qualified personnel trained on installation of automation components, and only for the purposes described in the user manual.
Installers must pay particular attention to the potential risks caused by mechanical and electrical equipment.

It is very important that applications and installations meet all applicable safety requirements.

Each installer has an obligation to take responsibility to verify their knowledge and understanding of all applicable safety standards.

Any use which does not meet the safety requirements can damage equipment and injure the user.
SHS s.r.l. does not consider itself responsible for, and assumes no liability for damage caused by handling products and / or improperly installed, or in cases where the customer has allowed, or executed, modifications and / or repairs not authorized by SHS s.r.l.

The SHS drives are devices for automation high performance capable of generating rapid movements and high forces.

Pay high attention, especially during installation and application development.

Only use equipment properly sized for the application..

The SHS devices are considered components for automation and are sold as finished products to be installed only by qualified personnel and in accordance with all local safety regulations.

The technicians must be able to recognize possible dangers that may result from programming, by changing parameter values and generally by the mechanical, electrical and electronic.

SHS s.r.l. recommends to always follow basic safety rules. Failure to heed them can result in injury to persons and / or property.

General precautions:

This manual is subject to change due to product improvement, specification changes or improvements of the manual

SHS s.r.l. is not responsible for damage to property and/or persons caused by faulty installation and / or unauthorized modifications of the product.

The damaged drive systems must not be installed or put into operation in order to avoid injury persons and damage to property. Changes or modifications made to the drive systems is prohibited and It involves the extinction of any right to warranty or of any obligation of responsibility.

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1. ETHERNET/IP

Use the device master file "**EDS-SHS-HT7-yyyymmdd.EDS**" to configure your communication software on the master.
To set the Drive IP address use the "Ipconfig" utility, downlodable from HMS website.

1.1 DATA COMMUNICATION

The data format used is Motorola ("Big Endian").

User data structure from MASTER (PLC) to SLAVE (HT7 drive):

PKW		PZD	REMAP AREA OUTPUT			
PKE	PWE	ZSW	SLOT1 OUT	SLOT2 OUT	SLOT3 OUT	SLOT4 OUT
U16	S32	U16	S32	S32	S32	S32

PKW: Parameter identifier value
PZD: Process data

PKE: Parameter idetifier
PWE: Parameter value

ZSW: Control word

U16:   Word unsigned, MSB first (H-L)
S32:   Double Word Signed, MSB first (HH-HL-LH-LL)

Parameter Identifier (PKE):

Bits 0 to 10 contain the number of the desired parameter (PNU). Refer to the parameter listing (Chapter 3.4)
Bits 12 to 15 contain the task or reply identifier (AK).

PKE		
Bit 15(H)…12	Bit11	Bit 10…0(L)
AK	Not used	PNU

AK: Task or reply identifier
PNU: Parameter number

AK VALUE	MEANING
0	No task
1	Request parameter value
2	Change parameter value

User data structure from SLAVE (HT7 drive) to MASTER (PLC):

PKW		PZD	REMAP AREA INPUT			
PKE	PWE	STW	SLOT1 IN	SLOT2 IN	SLOT3 IN	SLOT4 IN
U16	S32	U16	S32	S32	S32	S32

PKW: Parameter identifier value
PZD: Process data

PKE: Parameter idetifier
PWE: Parameter value

STW: Status word

U16:   Word unsigned, MSB first (H-L)
S32:   Double Word Signed, MSB first (HH-HL-LH-LL)

Parameter Identifier (PKE):

Bits 0 to 10 contain the number of the desired parameter (PNU). Refer to the parameter listing (Chapter 3.4)
Bits 12 to 15 contain the task or reply identifier (AK).

PKE		
Bit 15(H)…12	Bit11	Bit 10…0(L)
AK	Not used	PNU

AK: Task or reply identifier
PNU: Parameter number

AK VALUE	MEANING
0	No task
2	Transmit parameter value
7	Task not executable (with error number on word 4)

ERROR (WORD 4)	MEANING
0	No task
1	Parameter value cannot be changed

1.2 CONTROL BITS

BITS ZSW – MASTER ⇒ SLAVE

| BIT	VALUE	FUNCTION	REMARKS
0 (L)	1 - ON 0 - OFF	ON - Start RELATIVE positioning OFF - Stop RELATIVE positioning	This bit is ignored when absolute positioning or JOG function is active
1	1 - ON 0 - OFF	ON - Start ABSOLUTE positioning OFF - Stop ABSOLUTE positioning	This bit is ignored when relative positioning or JOG function is active
2			
3	1 - ON 0 - OFF	ON - Drive enable OFF - Dive disable (motor current=0)	To execute every postitioning command this bit must be set to 1
4	1 - ON 0 - OFF	ON - Reset Alarm	
5			
6			
7			
8	1 - ON 0 - OFF	ON - START Jog cw (infinite motion) OFF - Stop	This bit is ignored when relative/absolute positioning or JOG CCW function is active
9	1 - ON 0 - OFF	ON - START Jog ccw (infinite motion) OFF - Stop	This bit is ignored when relative/absolute positioning or JOG CW function is active
10			
11	1 - ON 0 - OFF	ON - Set OUT3 OFF - Reset OUT3	Set/reset OUT3 To use this function bit 12 must be set to 1
12	1 - ON 0 - OFF	ON - Enable outputs force OFF - Disable outputs set (Standard function on outputs)	This bit disable standard outputs functions and permit to force outputs through bits 13 and 14 of this word (ZSW)
13	1 - ON 0 - OFF	ON - Set OUT1 OFF - Reset OUT1	Set/reset OUT1 To use this function bit 12 must be set to 1
14	1 - ON 0 - OFF	ON - Set OUT2 OFF - Reset OUT2	Set/reset OUT2 To use this function bit 12 must be set to 1
15 (H)		Reserved for refresh Bit	

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BIT	VALUE	FUNCTION	REMARKS
0 (L)	1 - ON 0 - OFF	ON - Drive ready OFF - Drive fault or disable	
1	1 - ON 0 - OFF	ON - Motor running OFF - Motor stop	
2	1 - ON 0 - OFF	ON - Drive disable OFF - Drive enable	
3	1 - ON 0 - OFF	ON - Protection active OFF - Protection not active	
4	1 - ON 0 - OFF	ON - IN1 active OFF - IN1 not active	
5	1 - ON 0 - OFF	ON - IN2 active OFF - IN2 not active	
6	1 - ON 0 - OFF	ON - IN3 active OFF - IN3 not active	
7			
8			
9			
10	1 - ON 0 - OFF	ON - Max frequency reached OFF - Max frequency not reached	
11	1 - ON 0 - OFF	ON - Positioning completely executed OFF - Positioning not completely executed	
12	1 - ON 0 - OFF	ON - Axis zeroing executed OFF - Axis zeroing not executed	
13	1 - ON 0 - OFF	ON - EXTRA-SWITCH reached OFF - EXTRA-SWITCH notreached	
14	1 - ON 0 - OFF	ON - Error durig encoder positioning OFF - OK	
15 (H)	1 - ON 0 - OFF	Reserved for refresh Bit	

1.3 ZSW BITS POSITIONING

ZSW bit Profile Mode

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ZSW bit Jog Mode
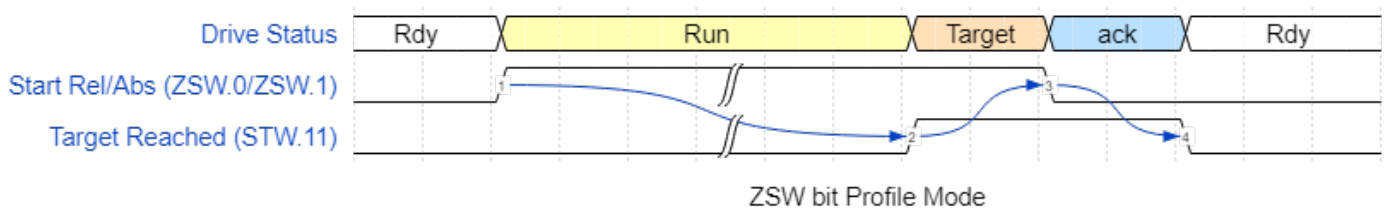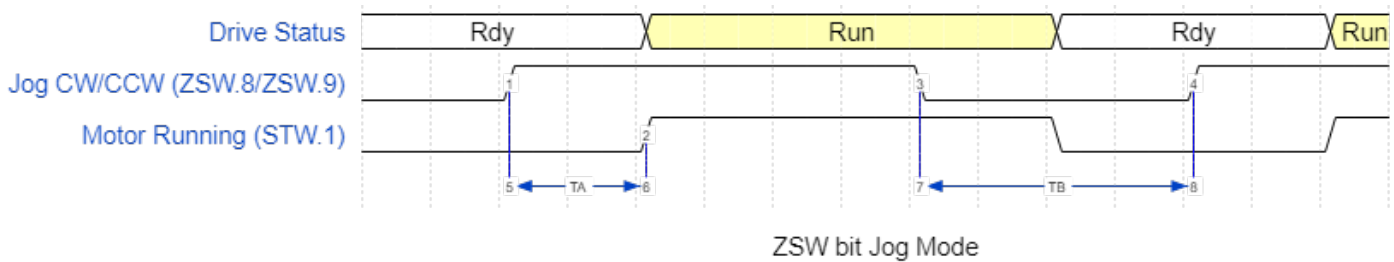
TA = time to START motor: **maximum 20 ms**
TB = time between falling edge and rising edge of start signal: **minimum 40 ms**

COMMAND SEQUENCE TO EXECUTE A POSITIONING:

RELATIVE POSITIONING:
- Enable driver (ZSW BIT 3)
- Set target quote (PNU 7)
- Set start relative positioning bit (ZSW BIT 0) to 1
- Wait Target Reached front 0-1 bit (STW BIT 11)
- Reset start relative positioning bit (ZSW BIT 0) to 0
- Wait Target Reached front 1-0 bit (STW BIT 11)

ABSOLUTE POSITIONING:
- Enable driver (ZSW BIT 3)
- Set target quote (PNU 7)
- Set start absolute positioning bit (ZSW BIT 1) to 1
- Wait Target Reached front 0-1 bit (STW BIT 11)
- Reset start absolute positioning bit (ZSW BIT 1) to 0
- Wait Target Reached front 1-0 bit (STW BIT 11)

JOG CW / JOG CCW:
- Enable driver (ZSW BIT 3)
- Set JOG CW (ZSW BIT 8) or JOG CCW (ZSW BIT 9) to 1 (start motor)
- Wait TA time to START motor (minimum 30ms) or front 0-1 of motor running bit (STW BIT 1)
- Set JOG CW (ZSW BIT 8) or JOG CCW (ZSW BIT 9) to 0 (stop motor)
- Wait zero level of motor running bit (STW BIT 1)
- Wait TB time (minimum 50ms) to start new JOG. If TB is not respected motor may be not start

HOMING:
- Connect switch or proximity sensor (NO or NC) to IN1
- Enable driver (ZSW BIT 3)
- Set maximum frequency - PNU 1 (in homing function it represents home search speed)
- Set minimum frequency - PNU 0 (in homing function it represents sensor disengage speed)
- Start homing (PNU 18) with a parameter 0x01 (HEX) for NC sensor or 0x11 (HEX) for NO sensor on IN1

Sensor not engaged:
When you write PNU 18 the motor starts immediately in CCW direction with maximum speed, then it stops on sensor and starts in CW direction with minimum speed to disengage sensor then stops and set position register (PNU 10) to 0.
It's very important that the motor stops with sensor engaged without get over it. To avoid this it is possible reduce maximum frequency or reduce ramp (PNU 2)

Sensor engaged:
When you write PNU 18 the motor starts immediately in CW direction with minimum speed to disengage the sensor then it stops and set position register (PNU 10) to 0.

NOTE: If motor starts in wrong direction during homing you must change motor phases connection (swap A1 with A2 clamps).

REMAP OUTPUT VARIABLE EXAMPLE:

Remap Target Position
- Set REMAP SLOT1 OUT (PNU 40) to 7 (Target Quote)
- Set SLOT1 OUT with new position
- Wait at least 10ms before change Control Word
- To switch OFF remap set 255 to REMAP SLOT

REMAP INPUT VARIABLE EXAMPLE:

Remap Actual Position
- Set REMAP SLOT1 IN (PNU 43) to 10 (Actual Position)
- Read in SLOT1 IN the drive position
- To switch OFF remap set 255 to REMAP SLOT

1.4 PARAMETERS

PNU	FUNCTION	PARAMETER	REMAP
0	**Setting of minimum frequency** Motor rotation start frequency	From 1 to 10000 Hz	RD/WR
1	**Setting of maximum frequency** Motor rotation working frequency	From 1 to 20000 Hz	RD/WR
2	**Setting of ramp inclination** If motor is running, this parameter will be acquired to the next motion command.	From 1 to 255 expressed in ms * 10	NO
3	**Setting of motor resolution** If motor is running, this parameter will be acquired to the next motion command.	If the sent = 128 → full step mode = 64 →1/2 step mode = 32 →1/4 step mode = 16 →1/8 step mode = 8 →1/16 step mode = 4 →1/32 step mode = 2 →1/64 step mode = 1 →1/128 step mode = 1040→1/2.5 step mode = 1020→1/5 step mode = 1010→1/10 step mode = 1005→1/20 step mode = 1002→1/50 step mode = 1001→1/100 step mode	NO
4	**Mode setting of electric current reduction** Set % or current reduction when motor is stopped	If the sent = 0 →current = 0 (max reduction) = 1 →no reduction = 2 →reduction to 25% = 3 →reduction to 50%	RD/WR
5	**Time setting of electric current reduction** Time after which current reduction (from 0 to 255) must occur on a time basis of 32 ms	From 0 to 255	RD/WR
6	**Current setting** Set motor current	From 0 to 10000 mA	NO
7	**Set target quote** Indicate the positioning with respect to the present position of the motor to be carried out at the next START (with control bit) or TRIGGER START expressed in 1/128 step	From -2147483647 to 2147483647	RD/WR

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PNU	FUNCTION	PARAMETER	REMAP
8	**Unused**	-	-
9	**Setting of home position** Drive associates the entered value to home position of the motor	From -2147483647 to 2147483647	RD/WR
10	**Present position** Position register, you can read or write this value. (expressed in 1/128 step)	From -2147483647 to 2147483647	RD/WR
11	**Present frequency** Motor rotation frequency	READ ONLY REGISTER	RD
12	**Final position** Motor destionation quote	READ ONLY REGISTER	RD
13	**Trigger start (logic AND)** It defines the Input or the inputs and the respective Levels, which must be enabled for carrying out the START by an external command.	Use only less significant byte: The 4 less significant bits indicate the input or the inputs, which must be enabled for START (1= enabled input). The next 4 bits indicate the level of these inputs (1=input active at high level)	RD/WR
14	**Trigger stop (logic AND)** It defines the Input or the inputs and the respective Levels, which must be enabled for carrying out the STOP by an external command. USE ONLY ONE TRIGGER STOP AT TIME (PNU 14 OR PNU 15)	Use only less significant byte: The 4 less significant bits indicate the input or the inputs, which must be enabled for STOP (1= enabled input). The next 4 bits indicate the level of these inputs (1=input active at high level)	RD/WR
15	**Trigger stop (logic OR)** It defines the Input or the inputs and the respective Levels, which must be enabled for carrying out the STOP by an external command. USE ONLY ONE TRIGGER STOP AT TIME (PNU 14 OR PNU 15)	Use only less significant byte: The 4 less significant bits indicate the input or the inputs, which must be enabled for STOP (1= enabled input). The next 4 bits indicate the level of these inputs (1=input active at high level)	RD/WR
16	**Trigger home (logic AND)** It defines the Input or the inputs and the respective Levels, which must be enabled for carrying out the HOME by an external command and stop motor.		RD/WR

PNU	FUNCTION	PARAMETER	REMAP
17	**Trigger zerofly (logic AND)** It defines the input or the inputs and the respective levels, which must be enabled for carrying out zeroing of the value in the present motor position, when this condition occurs, and the value to be done on occasion of this condition. You must be set also ZEROFLY QUOTE (parameter 21) and/or MASK ZEROFLY QUOTE (parameter 20)	Use only less significant byte: The 4 less significant bits indicate the input or the inputs, which must be enabled for ZERO AT FLIGHT (1= enabled input). The next 4 bits indicate the level of these inputs (1=input active at high level)	**RD/WR**
18	**Axis zeroing** It defines the input and relative level where zero switch will be connected and it carries out axis zeroing. The zeroing phase includes: CCW motor start; the search of zero switch with rotation at max speed; stop on zero switch; disengagement of zero switch at min. speed and zeroing of absolute position.	Use only less significant byte: The 4 less significant bits indicate the input or the inputs, which must be enabled for AXIS ZEROING (1= enabled input). The next 4 bits indicate the level of these inputs (1=input active at high level)	NO
19	**Limit switch** It defines the input and the relative level where the limit switch will be connected. When the switch will be intercepted, it will cause the immediate motor stop and it allow only the opposite wise motion. The command activates this function until its disengagement through a new command with no specified input (Parameter=0).	Use only less significant byte: The 4 less significant bits indicate the input or the inputs, which must be enabled for LIMIT SWITCH (1= enabled input). The next 4 bits indicate the level of these inputs (1=input active at high level)	RD/WR
20	**Mask zerofly quote** Indicate the mask positioning to be done in the same rotation direction to enable zerofly trigger	From 0 to 2147483647	RD/WR
21	**Zerofly quote** Indicate the positioning to be done in the same rotation direction since when the condition expressed on the trigger zerofly byte	From 0 to 2147483647	RD/WR

22	**Low noise mode**	If the sent
		  = 2 →enable
		  = 0 →disable
			RD/WR

PNU	FUNCTION	PARAMETER	REMAP

24	**Protection active**	If the sent
		    0x00 → drive ready
		    Bit0=1 → disable hardware
		    Bit1=1 → short circuit
		    Bit2=1 → thermal protection
		    Bit3=1 → power supply undervoltage
		    Bit4=1 → power supply overvoltage
		    Bit5=1 → open motor phaseA
		    Bit6=1 → open motor phaseB
		    Bit7=1 → encoder fault
			RD

25	**Software release**	READ ONLY REGISTER	RD
26	**Power supply voltage [Vdc]**	READ ONLY REGISTER	NO
27	**Drive temperature [°C]**	READ ONLY REGISTER	NO
40	**Remap SLOT1 OUT variable** Variable OUT PLC	PNU admitted	NO
41	**Remap SLOT2 OUT variable** Variable OUT PLC	PNU admitted	NO
42	**Remap SLOT3 OUT variable** Variable OUT PLC	PNU admitted	NO
43	**Remap SLOT4 OUT variable** Variable OUT PLC	PNU admitted	NO
44	**Remap SLOT1 IN variable** Variable IN PLC	PNU admitted	NO
45	**Remap SLOT2 IN variable** Variable IN PLC	PNU admitted	NO
46	**Remap SLOT3 IN variable** Variable IN PLC	PNU admitted	NO
47	**Remap SLOT3 IN variable** Variable IN PLC	PNU admitted	NO

PNU	FUNCTION	PARAMETER	REMAP
50	**Encoder position** Encoder position register, you can read or write this value. (expressed in encoder steps) This value counts all fronts of two encoder phases	From -2147483647 to 2147483647	**RD/WR**

51	**Encoder mode**
	
	Set encoder mode
		If Write 0 → no encoder feedback. You can read encoder but the drive don't use it to control position
		         1 → encoder enabled without error detection
		         2 → encoder enabled with error detection
			RD/WR

52	**Set encoder pulse/revolution**	From 0 to 2147483647	RD/WR
53	**Set encoder fault steps** Set encoder steps to detect positioning error.	From 0 to 2147483647	RD/WR
54	**Encoder Index search frequency** It defines the search index frequency	From 1 to 5000 Hz	RD/WR
55	**Encoder index search mode** Indicate 4 modes to search index	0x01= search CW 0x02= search CCW 0x11= search CW and set position to 0 0x12= search CCW and set position to 0	RD