

Vectorque™

V6-H-M0 SERIES INVERTER ADDITIVE MANUAL

(M0)

V&T

V6-H Series
ADDITIVE MANUAL

Change Scope

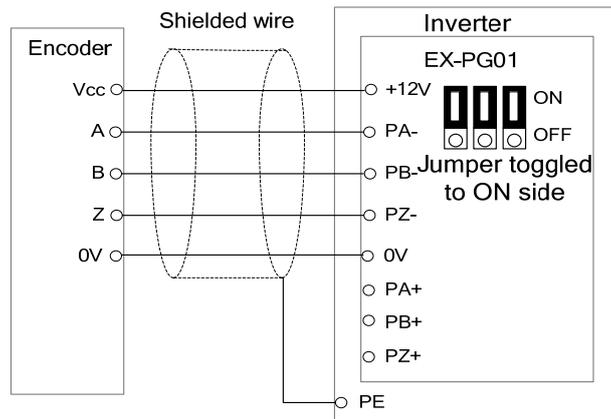
Increase control function of vector control 2 with encoder speed feedback to support machine tool spindle orientation and multi-segment simple positioning.

1. Vector control 2 with encoder speed feedback operational processes

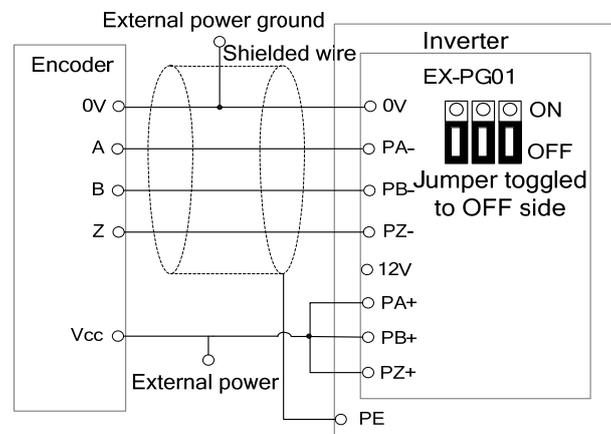
(1) Hardware prepare

For the open collector, voltage, push-pull (complementary) type speed feedback encoder whose power supply is +12V to +24V, please adopt the V&T PG feedback card EX-PG01. If the inverter needs to transmit the motor rotation speed to other equipment for calculation or speed measurement in addition to vector control 2 with encoder speed feedback, please adopt the V&T feedback card EX-PG03 with frequency division output.

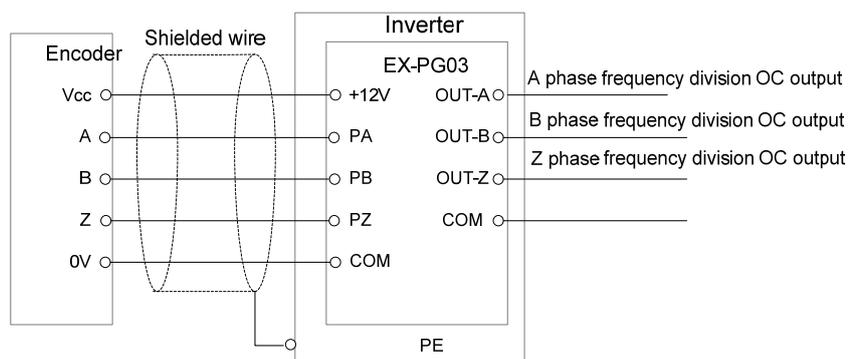
- ◆ Connection diagram for EX-PG01 card adopting internal power supply:



- ◆ Connection diagram for EX-PG01 card adopting external power supply

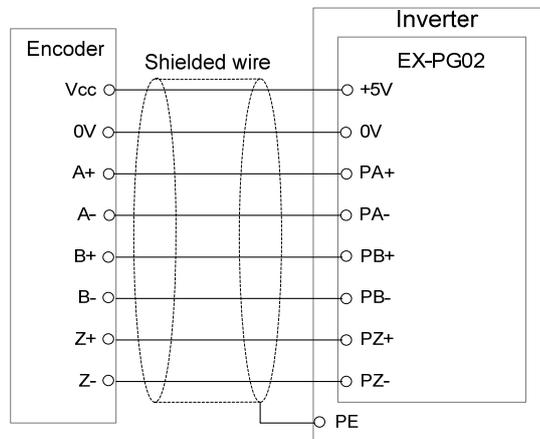


- ◆ Connection diagram of EX-PG03 card (Does not support external power supply)

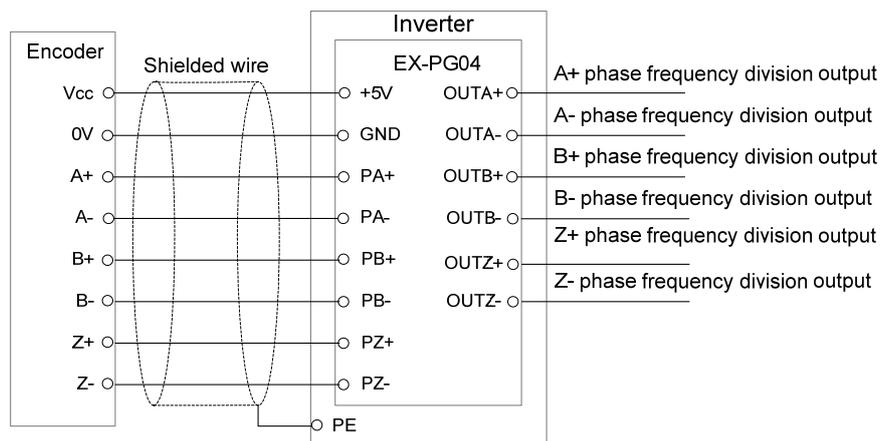


For the differential motor speed feedback encoder whose power supply is +5V, please adopt the V&T PG feedback card EX-PG02. If the inverter needs to transmit the motor rotation speed to other equipment for calculation or speed measurement in addition to vector control 2 with encoder speed feedback, please adopt the V&T feedback card EX-PG04 with frequency division output.

◆ Connection diagram for EX-PG02 card

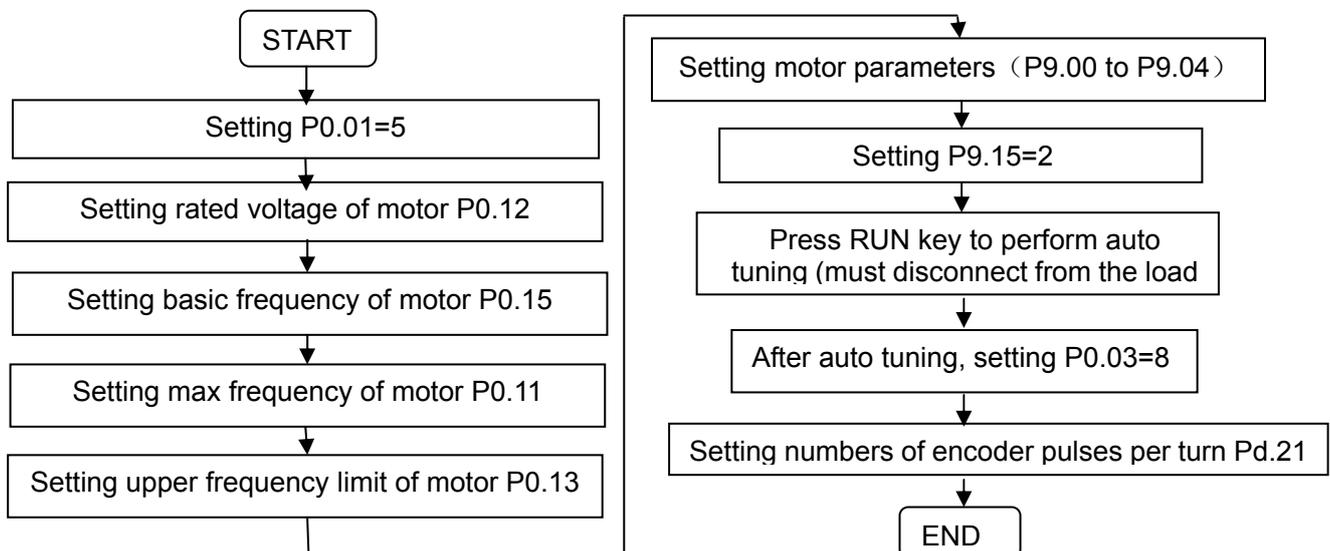


◆ Connection diagram for EX-PG04 card



In accordance with V6-H user manual to connect the inverter power input lines, the electrical output lines, and other related hardware. For details, refer to user manual of V6-H high performance vector/torque control inverter.

(2) Start to set function code about vector control 2 with encoder speed feedback:



After setting and test by the above steps, should JOG running first. If working order , the user can set other function according to V6-H user manual, for details, refer to user manual of V6-H high performance vector control/torque control inverter.

Note: If the inverter report over current (E.oC1) or over load (E.oL1) when JOG running, please change encoder direction Pd.22=1, or check if A phase and B phase of encoder correspond to PA and PB of PG feedback card.

If the inverter report over current (E.oC1) or over load (E.oL1) or encoder disconnection (E.dL1) when JOG running, please check the connect lines between PG feedback card and encoder whether exist virtual access or disconnect.

If the encoder is not directly installed on the motor shaft, there exists deceleration ratio between motor shaft and encoder, deceleration ratio Pd.24 should be set. For example, if motor turning 6 turns correspond to the encoder turning 5 turns, set this parameter to 1.2. If the encoder is directly installed on the motor shaft, set this parameter to 1.

2. Function codes table

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection
P0.03	Control operation mode	0	0~8	/	×	0:Vector control 1 without encoder speed feedback 4:Vector control 2 without encoder speed feedback 8:Vector control 2 with encoder speed feedback
P3.09	Anti-reverse selection	0	0~1	/	×	0:Disable(reverse enable) 1:Enable(reverse disable)
PA.09	Energy consumption braking selection	1	0~1	/	×	0:Disable 1:Enable
Pd.17	Vector control 2 slip compensation gain (electric)	100.0	10.0~300.0	%	○	10.0%~300.0%
Pd.18	Vector control 2 slip compensation gain (power generation)	100.0	10.0~300.0	%	○	10.0%~300.0%
Pd.19	ASR input filtering time	0.5	0.0~500.0	/	○	0.0~500.0mS
Pd.20	ASR output filtering time	0.5	0.0~500.0	/	○	0.0~500.0mS
Pd.21	Numbers of encoder pulses per turn	1024	0~9999	/	×	1~9999 pulses/turn
Pd.22	Encoder direction selection	0	0~1	/	×	0:Forward; 1:Reverse
Pd.23	Encoder disconnection detection time	2.0	0~8.0	/	×	0~8.0 sec
Pd.24	Deceleration ratio between motor and encoder	1.000	0.000~65.535	/	○	0.000~65.535
Pd.25	Enable zero servo	0	0~1	/	○	0: Disable; 1:Enable
Pd.26	Zero servo initial frequency	0.30	0~10.00	Hz	○	0~10.00Hz
Pd.27	Zero servo gain	1.000	1.000~9.999	/	○	1.000~9.999
Pd.28	Static friction compensation coefficient	0	0~100.0	%	○	0~100.0%
Pd.29	Sliding friction compensation coefficient	0	0~100.0	%	○	0~100.0%
Pd.30	Rotation inertia compensation coefficient	0	0~100.0	%	○	0~100.0%
Pd.31	Rotation inertia compensation frequency upper limit 1	0	0~300.00	Hz	○	0~300.00Hz
Pd.32	Rotation inertia compensation frequency upper limit 2	50.00	0~300.00	Hz	○	0~300.00Hz
Pd.33	Torque limiting compensation coefficient in constant power zone	40.0	0~40.0	%	○	0~40.0%
Pd.34 ~ Pd.36	Reserved					

H0.01	Angel of orientation 1	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.02	Orientation direction selection	0	0~2	/	○	0~2
H0.03	Orientation angle speed	15.00	0.00~300.00	Hz	○	0.00~300.00
H0.04	Orientation complete scope	5	0~65535	/	○	0~65535
H0.05	Orientation complete time	0.100	0.000~8.000	s	○	0.000~65535.5 s
H0.06	Position loop gain	2.000	0.000~65.535	/	○	0.000~65.535
H0.07	Angel of orientation 2	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.08	Angel of orientation 3	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.09	Angel of orientation 4	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.10	Determine time of terminal selection for orientation angle	0.001	0.000~4.000	s	○	0.000~4.000s
H0.11	Display pulses of orientation angle	0	0~(4*Pd.21-1)	/	×	0~(4*Pd.21-1)
H0.16	Angel of orientation 5	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.17	Angel of orientation 6	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.18	Angel of orientation 7	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
H0.19	Angel of orientation 8	0	0~(4*Pd.21-1)	/	○	0~(4*Pd.21-1)
Increase digital input terminal function: 40		Enable positioning control			Setting in P5.00~P5.06	
Increase digital input terminal function: 41~43		Orientation angle selection terminal			Setting in P5.00~P5.06	
Increase digital input terminal function: 66		Enable zero servo			Setting in P5.00~P5.06	
Increase digital input terminal function: 40		Output positioning complete signal 2			Setting in P5.00~P5.06	

3. Function Description

P0.03	Control operation mode	0	0~8
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0: Vector control 1 without encoder speed feedback

4: Vector control 2 without encoder speed feedback

8: Vector control 2 with encoder speed feedback

Other options refer to user manual of V6-H high performance vector control/torque control inverter.

Pd.17	Vector control 2 slip compensation gain (electric)	100.0	10.0%~300.0%
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When loads increase, motor slip will increase, but the rotating speed will decrease. The speed of motor can be controlled constantly by slip compensation. Please make adjustments according to below conditions:

When the motor speed is below the setting target value, increase vector control slip compensation gain.

When the motor speed is above the setting target value, decrease vector control slip compensation gain.

Note: When the temperature of motor increases, interior parameters of motor will change and the slip will increase. Adjusting the function code can help to compensate the effects from temperature rise of motor.

Pd.18	Vector control 2 slip compensation gain (electric) (power generation)	100.0	10.0%~300.0%
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When loads increase, motor's slip will increase, and the rotating speed will also increase. The speed of motor can be controlled constantly by slip compensation. Please make adjustments according to below conditions:

When the motor speed is below the setting target value, decrease vector control slip compensation gain.

When the motor speed is above the setting target value, increase vector control slip compensation gain.

Note: When the temperature of motor increases, interior parameters of motor will change and the slip will increase. Adjusting the function code can help to compensate the effects from temperature rise of motor.

Pd.19	ASR input filtering time	0.5	0.0~500.0ms
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This function defines the input filtering time of speed adjuster (ASR). In general, it needs no modification.

Pd.20	ASR output filtering time	0.5	0.0~500.0ms
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This function defines the input filtering time of speed adjuster (ASR). In general, it needs no modification.

Pd.21	Number of pulses per turn for encoder (vector control 2 with encoder)	1024	0~9999 pulses/turn
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It is used for vector control 2 with encoder speed feedback to set number of pulses per turn for encoder. This parameter shall be set properly according to the number of pulses per turn of the encoder.

Pd.22	Encoder direction selection	0	0~1
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0: Forward

1: Reverse

The factory setting value is 0. If the wiring sequence for connecting the encoder to inverter connection board does not match the wiring sequence for connecting inverter to motor, this parameter may be set to "1" to adjust the wiring sequence to avoid re-wiring.

Pd.23	Encoder disconnection detection time	2.0	0~8.0 s
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Pd.23 is used to define the disconnection detection time for encoder signal upon vector control 2 with encoder speed feedback. If the encoder disconnection detection time exceeds the time set in Pd.23, the inverter will report E.dL1 error.

Pd.24	Deceleration ratio between motor and encoder	1.000	0.000~65.535
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If the encoder is not directly mounted on the motor shaft, there exists deceleration ratio between motor shaft and encoder, deceleration ratio Pd.24 should be set. For example, if motor rotation 6 turn but the encoder rotation is 5 turn, set this parameter to 1.2; If the encoder is directly mounted on the motor shaft, set this parameter to 1.

Pd.25	Zero servo enable	0	0~1
Pd.26	Zero servo initial frequency	0.30	0~10.00Hz
Pd.27	Zero servo gain	1.000	1.000~9.999

Upon vector control 2 with encoder speed feedback, when the motor speed is less than the rotation speed corresponding to the zero servo initial frequency Pd.26, if the zero servo enable is valid, it enters zero servo locking status. At this time, the position of the motor in stop status will be maintained. The zero servo initial frequency is the condition for the inverter to enter zero servo status. If Pd.26 is too large, it may cause over-current failure. If adjustment is needed, you may increase/decrease the leave-factory value. Zero servo gain Pd.27 is the parameter to adjust the zero servo retentively. When this value is increased, the zero servo rapidity can be increased. However, if it is too large, it may cause vibration of the inverter.

Note: For the zero servo function enabled by function code Pd.25, you may exit from the zero servo mode by setting the frequency higher than the zero servo initial frequency. For the zero servo function enabled by function 66 of X terminal (zero servo enable terminal), when the terminal is invalid, it exits from the zero servo mode. It doesn't matter whether the setting frequency is higher than the zero servo initial frequency Pd.26 or not.

Pd.28	Static friction compensation coefficient	0	0~100.0%
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When the system is under torque control mode, to overcome the static friction force upon zero-speed operation or startup of the system, static friction compensation coefficient may be set

to provide preset torque increase for the system.

Pd.29	Sliding friction compensation coefficient	0	0~100.0%
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When the system is under torque control mode, the friction force existing during the system operation will reduce the inverter output torque. Sliding friction compensation coefficient may be set to reduce the influence of the friction on the inverter output torque.

Pd.30	Rotation inertia compensation coefficient	0	0~100.0%
Pd.31	Rotation inertia compensation frequency upper limit 1	0	0~300.00Hz
Pd.32	Rotation inertia compensation frequency upper limit 2	50.00	0~300.00Hz

When the system is under torque control mode, if the system load inertia is large, additional rotation inertia compensation shall be provided during the acceleration/deceleration of the system. The compensation determined by the rotation inertia compensation coefficient Pd.30 is valid only when it is less than Pd.31 which corresponds to the rotation inertia compensation frequency upper limit 1.

Note: It shall be ensured that the normal and stable running frequency of the inverter is above the rotation inertia compensation frequency upper limit 1. Pd.32, the rotation inertia compensation frequency upper limit 2, is generally set as the maximum frequency of the inverter.

Pd.33	Torque limiting compensation coefficient of constant power zone	40.0	0~40.0%
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This parameter compensates the torque limiting of the constant power zone. The acceleration/deceleration time and output torque of the inverter when running in constant power zone can be optimized by changing this parameter.

◆ **The following function is used for spindle orientation.**

First, through X terminal to enable orientation function (X terminal setting in P5.00 to P5.06):

40: Enable orientation function through X terminal

H0.01	Angle of orientation 1	0	0~(4*Pd.21-1)
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The angle of orientation is relative to encoder phase Z signal. It define the orientation angle of phase Z as 0°, Four times pulse number of encoder (Pd.21) corresponds to the angle of 360°. If pulse number of encoder is 1024, the H0.01 setting range is 0 to 4095 corresponds to the angle 0° to 360°. If want to orientation at the angle of 120°, setting $H0.01 = 120/360 \times (1024 \times 4) = 1365$.

While searching for the orientation angle, it can first orientation at an angle, and then adjust the function code to find the correct angle.

Note: Motor stops if any jitter while orientation, please reduced the speed loop proportional gain (Pd.03) or increase the speed loop integral time 2 (Pd.04) properly.

H0.02	Orientation direction selection	0	0~2
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- 0: From current running rotation direction
- 1: From forward running rotation direction
- 2: From reverse running rotation direction

0: From current running rotation direction:

If the motor in running state receive orientation command (X terminal is set to 40 and terminal is valid), the speed decelerate to orientation speed (H0.03) according to deceleration time, after reach orientation speed perform orientating action.

If the motor in stopping state receive orientation command, after receive forward running command, the motor accelerate to orientation speed of forward direction to perform orientating action. On the contrary, if the motor in stopping state then receive orientation command, after receive reverse running command, the motor accelerate to orientation speed of reverse direction, to perform orientating action.

If the motor in orientation state, if change angle of orientation (H0.01、H0.07、H0.08、H0.09) or through switch orientation angle selection terminal to find a new angle, the motor move to new direction for shortest distance.

1: From forward running rotation orientation:

If the motor in running state receive orientation command (X terminal is set to 40 and terminal is valid), the motor will run to orientation speed (H0.03) of forward direction to perform orientating action. If the motor in stopping state receive orientation command, in spite of forward running or reverse running command, the motor will accelerate to orientation speed of forward direction, after reach orientation speed, perform orientating action.

If the motor in orientation status, if change angle of orientation (H0.01、H0.07、H0.08、H0.09) or through switch orientation angle selection terminal to determine a new angle, the motor move to new angle from forward running direction.

2: From reverse running rotation orientation:

If the motor in running state receive orientation command (X terminal is set to 40 and terminal is valid), the motor will run to orientation speed (H0.03) of reverse direction, to perform orientating action; if the motor in stopping state receive orientation command, in spite of forward running or reverse running command, the motor will accelerate to orientation speed of reverse direction, after reach orientation speed, perform orientating action.

If the motor in orientation status, if change angle of orientation (H0.01、H0.07、H0.08、H0.09) or through switch orientation angle selection terminal to determine a new angle, the motor move to new angle from reverse running direction.

H0.03	Orientation speed	15.00	0.00~300.00Hz
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The motor will run to orientation speed if motor in running command and orientation command is valid, (X terminal is set to 40 and terminal is enable), after reach orientation speed then perform orientation. The higher orientation speed setting is the quicker orientation process is, but overshoot maybe occur if setting orientation speed too high.

H0.04	Orientation complete scope	5	0~65535
H0.05	Orientation complete time	0.100	0.000~8.000s

In orientating process, if detect the error between encoder direction and angle of orientation 1 (H0.01) less than orientation complete scope and duration excess orientation complete time(H0.05), output orientation complete signal through Y terminal (Y terminal is setting to 40). The output will disappear if stop the inverter.

H0.06	Position loop gain	2.000	0.000~65.535
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Position loop gain is for speed loop position gain coefficient upon orientation control. The larger value is, the quicker orientation speed is. Shock or overshoot maybe occur if the value setting too high, but orientation process will become slowly if the value setting too small.

H0.07	Angle of orientation 2	0	0~(4*Pd.21-1)
H0.08	Angle of orientation 3	0	0~(4*Pd.21-1)
H0.09	Angle of orientation 4	0	0~(4*Pd.21-1)
H0.16	Angle of orientation 5	0	0~(4*Pd.21-1)
H0.17	Angle of orientation 6	0	0~(4*Pd.21-1)
H0.18	Angle of orientation 4	0	0~(4*Pd.21-1)
H0.19	Angle of orientation 8	0	0~(4*Pd.21-1)

Different angle of orientation can be selected by switch X terminal status (X terminal is set to 41- 43). ON means the terminal is valid and OFF means the terminal is invalid. If no terminal is set as orientation angle selection terminal, the orientation angle is angle of orientation 1(H0.01).

Orientation angle selection terminal 2	Orientation angle selection terminal 2	Orientation angle selection terminal 1	Orientation angle
OFF	OFF	OFF	Angle of orientation 1 (H0.01)
OFF	OFF	ON	Angle of orientation 2 (H0.07)
OFF	ON	OFF	Angle of orientation 3 (H0.08)
OFF	ON	ON	Angle of orientation 4 (H0.09)
ON	OFF	OFF	Angle of orientation 1 (H0.16)
ON	OFF	ON	Angle of orientation 2 (H0.17)
ON	ON	OFF	Angle of orientation 3 (H0.18)
ON	ON	ON	Angle of orientation 4 (H0.19)

For orientation angle selection terminal X terminal function setting in P5.00~P5.06:

- 41: Orientation angle selection terminal 1
- 42: Orientation angle selection terminal 2
- 43: Orientation angle selection terminal 3

H0.10	Determine time of terminal selection for orientation angle	0.010	0.000~4.000s
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When through terminal switch orientation angle, the determinate time is set by H0.10. The terminal is considered valid if terminal status without change last determinate time to prevent from the two orientation angle selection terminal change asynchronous.

H0.11	Display pulses of orientation angle	/	0~(4*Pd.21-1)
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The function code can display current direction real time, the setting method and range as the same as orientation angle (H0.01、H0.07、H0.08、H0.09)

When spindle is in orientating stopping state, it cans micro-adjust the orientation angle to ensure the precision

H0.29	Digital reference positioning value 6 high bits	0	0~9999	ON	ON	OFF	Multi-segment frequency 6 (P4.27)
H0.30	Digital reference positioning value 6 low bits	0	0~9999				
H0.31	Digital reference positioning value 7 high bits	0	0~9999	ON	ON	ON	Multi-segment frequency 7 (P4.28)
H0.32	Digital reference positioning value 7 low bits	0	0~9999				

The value of the above table is pulse from receive the rising edge of forward or reverse positioning terminal. The motor running direction is determine by forward positioning or reverse positioning terminal.

H0.33	Display reference positioning value high bits	0	0~9999
H0.34	Display reference positioning value low bits	0	0~9999
H0.35	Display current positioning value high bits	0	0~9999
H0.36	Display current positioning value low bits	0	0~9999

The function code of H0.33 to H0.35 is display value of reference positioning value and current positioning value, the value is four times of encoder pulse per turn.

Note: This non-stand software cancel the following functions:

1. Cancel display running time of user (Pb.12~Pb.14)
2. Cancel display terminal state LED (P2.02,P2.03)
3. Cancel analog terminal use for digital terminal
4. Cancel delay time setting of digital output terminal Y1 and Y2
5. Cancel analog curve 2、3 and 4
6. Cancel delay time setting of X1 terminal and X2 terminal (P5.08,P5.09)
7. Cancel PID control
8. Cancel high speed pulses DI input function

Dear Users:

To further expand our products range of applications, V6-H inverter made to improve the local design, in order not to affect your use, please refer to this manual of change information and debug instructions before operation. This manual should be used with V6-H user manual.

Thank you for your cooperation!

Shenzhen V&T Technologies Co.,Ltd.

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