ISMC servo drive
Modbus Application Manual

ISMC Servo drive Modbus Application Manual

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Preface

First of all, thank you for using the servo drive with the built-in Modbus fieldbus function of ISMC!

ISMC servo supports two kinds of communication methods: CANopen and EtherCAT, only servo drive with CANopen communication supports Modbus communication on the same time.This manual only describes the functional applications related to Modbus for servo drives with Modbus communication. For other general functions, please refer to the Servo drive User Manual. After reading the manual, if you still have any questions about using Modbus, please consult our company's technical personnel for assistance.

Our company reserves the right to continuously improve our products without prior notice.

When opening the box, please carefully confirm:

Confirm project	illustrate
Does the ordered model match the arrival?	Please determine the drive model based on the drive nameplate.
Are the product accessories complete?	Please check the entire machine and confirm if the drive terminals and connectors are complete (it is recommended to purchase cables recommended by the manufacturer).
Is there any damage of the product?	Please confirm if the product has been damaged during transportation.
If there are any issues with any of the above, please contact your supplier or our company for solution.	

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⚠️ Product Electrical Safety Usage Specification:

Dear user, hello! Before assembling and debugging the ISMC servo drive product, please carefully read the following safety usage specifications for servo drive products. Improper use of this product may cause personal injury or equipment damage. Be sure to strictly follow the relevant instructions and requirements.

1.Before powering on the equipment, please ensure that all system components of the equipment are grounded and ensure electrical safety through low impedance grounding (according to EN/IEC 618005-1 standard, protection level 1). At the same time, the motor should be connected to the protective ground through an independent grounding conductor, and the specification of the grounding conductor should not be lower than that of the motor power cable.

2. Only qualified technical personnel can carry out the installation, operation, maintenance, and repair procedures of this product. These qualified personnel must have received sufficient technical training and possess sufficient knowledge to predict and identify potential hazards that may arise when using products, modifying settings, and operating the mechanical, electrical, and electronic components of the entire machine system. Emergency stop switches must be installed to ensure unpredictable operations that may cause personal injury or property damage.

3.This product contains components that are sensitive to static electricity. Improper placement can damage these components. Please avoid contact with high insulation materials (such as artificial fibers, plastic films, etc.) and place them on conductive surfaces. Before operation, operators must use an electrostatic wristband to release any potential static electricity.

4.To avoid serious personal injury or product damage during operation, please add a protective cover during product debugging and close all cabinet doors during equipment debugging.

5. This manual uses the following identification terms to further explain the precautions to be followed in preventing personal injury and equipment damage. Distinguish the harm and degree of damage caused by misoperation by identifying terminology. The content is all important content related to safety, please be sure to comply with:

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	Danger signs ● Before powering on, please carefully read the product manual to ensure that the maximum power supply voltage does not exceed the voltage range specified in the product specifications. The actual maximum current used should not exceed the maximum peak current specified in the product. ● **Before powering on, check the wiring to avoid any short circuits or abnormal connections between U\V\W\PE\DC+\DC-, otherwise the drive may be burned or even sparks may occur, causing personal injury or death.** ● **It is necessary to avoid reverse connection of DC+\DC-, otherwise the drive may be burned or even sparks may occur, causing personal injury or death.** ● **To avoid the harm of electric arcs and other hazards to personnel and electrical contacts, it is prohibited to plug and unplug all servo connector cables while the servo is powered on.** ● Before wiring, inspection, maintenance and other operations, please make sure to cut off all power supply, confirm that the servo indicator light is off, and that the DC side voltage input is 0 volts, otherwise it may cause damage to the drive or the risk of electric shock to personnel.
	Warning signs ● In order to dissipate heat, a certain distance should be maintained between the drives as required, and the operating environment should comply with the product environmental standards. In addition, secondary heat dissipation plates should be added according to the actual situation. ● **USB does not support hot swapping, otherwise there may be a voltage difference between the drive and the PC, which can cause damage to the drive or the PC, and it must be powered off before plugging and unplugging.** ● **Please avoid using external power supply for encoder 5V unless necessary. In case of special circumstances, external 5V power supply should be used. It is necessary to ensure that the 5V reference ground is shared with the ground (i.e. to avoid voltage difference), otherwise there is a risk of damaging the drive.** ● **When controlling the power supply of the switch to power on or off the drive, it is necessary to do so on the AC input side of the switch power supply to avoid the instantaneous peak voltage generated during switch operation, which may cause overvoltage damage to the drive.** ● Products with STO function, please ensure that the safety torque cut-off function is effective before powering on and running. ● Ensure the drive working altitude does not exceed 1000m. ● To prevent the motor from being in an energy feeding state, which may cause overvoltage on the bus and damage the drive hardware,

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	a braking module should be added according to the actual working conditions. ● Before powering on and debugging, please ensure that all safety measures have followed the installation steps in this manual.
	Anti static Peugeot ● This product is only suitable for standard ESD operating environments. Please ensure that there are no abnormal static power sources in the operating environment; ● **When operating with bare hands, operators must use an electrostatic wristband to release potential static electricity, wear anti-static gloves, and then come into contact with servo drive products for installation operations, avoiding contact with board components.** ● Please avoid contact with high insulation materials (such as artificial fibers, plastic films, etc.) and place them on the surface of conductive materials during installation.
	Grounding sign ● The heat dissipation plate, shell, and other system shielding ground of the product must be reliably connected to the ground, otherwise it may cause equipment abnormalities, damage, or other unpredictable dangers.

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Version change record

Date	Revised version	Changes
20200801	V1.0	Release 1st version
20200814	V1.1	Add speed setting function by setting 60FF and modify some high and low bit address
20200922	V1.2	Add the required parameters for Customer: Gang Cun
20201102	V1.3	Add parameters required for soft landing function
20221110	V1.4	Add function generator parameters and position, speed feedback address

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1 Modbus communication technology

1.1 Modbus communication configuration

1.1.1 First, confirm the port and baud rate settings of Modbus through ISMC PC tuning software.
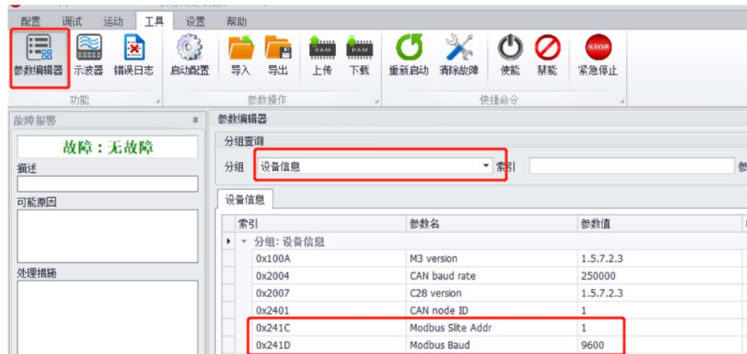
1.1.2 Communication terminal port:
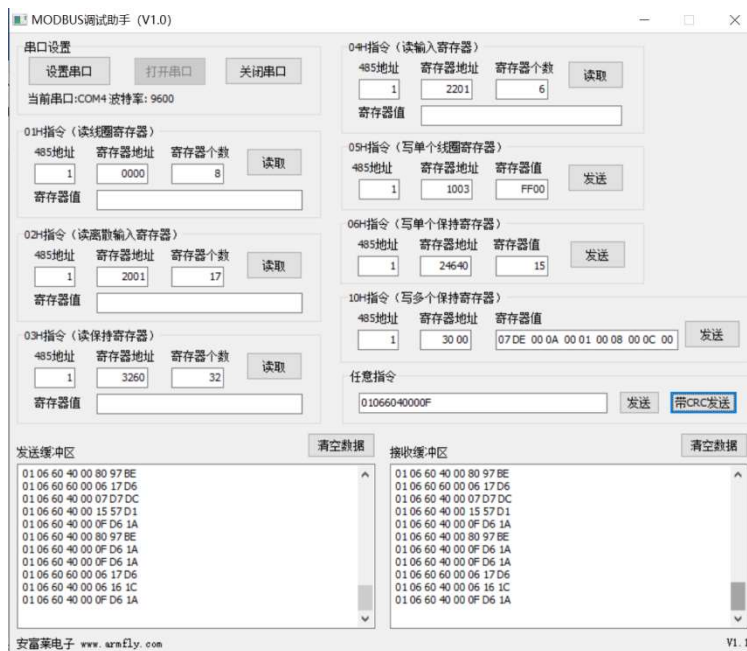
1.1.3 Communication Terminal por Instruction Description

1，The value of a register can be read through the 03H instruction (read holding register) window (the window is displayed in decimal).

2，It is possible to write the numerical value of a single register through the 06H instruction (write a single coil register) window (the window is displayed in decimal)

3，It is possible to write the values of multiple registers through the 10H instruction (write multiple holding registers) window (the window is displayed in decimal)

4，Instructions can be written through any instruction window (displayed in hexadecimal)

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The instruction format is

0106 6040 000F (enable command)

01 is the RS485 address

06 is a write instruction

6040 is the register address

000F is a register value (assigning each bit of a register value separately is meaningless and must be combined with other bits to form a control instruction)

1.2 Modbus Address Summary

The register addresses of Modbus are divided into high bits (high 16 bits) and low bits (low 16 bits). Please refer to the appendix at the end of the document for specific addresses. When writing parameters, write the low bit first and then the high bit. When reading values, it is recommended to read the low bit first and then the high bit, because the low bit value changes quickly, and there may be significant numerical deviation during the delay of reading.

The parameters related to Modbus communication control are as follows.

1. The following are the high and low address operations for 32-bit address variables

Variable	High 16 bits address	Low 16 bits address	data type	read-write permission
Position setting	0x607A	0x6101	Int32	Write only
PP mode speed setting	0x6081	0x6102	Uint32	Write only
PV mode speed setting	0x60FF	0x6108	Int32	Write only
Digital IO output	0x60FE	0x6103	Uint32	Write only
Digital IO output shielding bit	0x6100	0x6104	Uint32	Write only
PP mode acceleration	0x6083	0x6105	Uint32	Write only
PP mode deceleration	0x6084	0x6106	Uint32	Write only
Position feedback	0x6201 0x5001(1.6.5-1.4 and above versions)	0x6064 0x5000 (1.6.5-1.4 and above versions)	Int32	read only

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Speed feedback	0x6202 0x5003(1.6.5-1.4 and above versions)	0x606C 0x5002(1.6.5-1.4 and above versions)	Int32	read only
Digital IO input status	0x6203	0x60FD	Uint32	read only
Quick stop deceleration	0x6085	0x6107	Uint32	Write only
Homing high-speed	0x6099	0x6111	Uint32	Write only
Homing low speed	0x6113	0x6112	Uint32	Write only
Homing acceleration	0x609A	0x610C	Uint32	Write only
Homing offset	0x607C	0x610D	Uint32	Write only
Maximum profile velocity	0x607F	0x610A	Uint32	Write only
Position following error	0x6065	0x610B	Uint32	Write only
Minimum software limit value	0x607D	0x610E	Int32	Write only
Maximum software limit value	0x6110	0x610F	Int32	Write only
MOS temperature	0x2315	0x2314	Int32	read only
Current	0x230B	0x230A	Int32	read only
Bus voltage	0x230D	0x230C	Int32	read only
1、 Automatic Homing grating position initial value setting 2、 DI start function position setting	0x2706	0x2705	Int32	Read and write
DO status display	0x2802	0x2801	Uint32	read only
Soft landing operation on:1-on, 0- off	No	0x2126	Uint16	Read and write

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Soft landing function module on and off: 1-on, 2-off	No	0x2128	Uint16	Read and write
Perform actions after soft landing at the landing point: 1-hold torque 2-hold position 3-switch off 4-nothing to do	No	0x2129	Int16	Read and write
Soft landing return command 1-return, 0-no action	No	0x212B	Uint16	read only
Application scenario 1: Soft landing return add PV segment. 1-valid 0-invalid	No	0x2139	Uint16	Read and write
Soft landing speed	0x2127	0x6114	Int32	Write only
Soft landing position error threshold	0x212A	0x6115	Int32	Write only
Soft landing position	0x212C	0x6116	Int32	Write only
Positive torque limit value	No	0x60E0	Uint16	Read and write
Negative torque limit value	No	0x60E1	Uint16	Read and write
Soft landing completion Speed threshold determination (cnt/s)	No	0x2001	Int16	Read and write
1.Soft landing 2nd segment speed (cnt/s) 2.DI - Start function speed setting	0x2708	0x2707	Uint32	Read and write
Torque setting	No	0x6071	Int16	Read
Torque feedback	No	0x6077	Int16	Write
Debugging type: 1-position 2-speed, 3-current,	No	0x3000	Uint16	Read and write

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Function types: 1-square wave, 2-sine waves	No	0x3001	Uint16	Read and write
Amplitude	0x3003	0x3002	Int32	Read and write
Signal frequency	0x3005	0x3004	Int32	Read and write
Number of signals	0x3007	0x3006	Uint32	Read and write
Duration time	0x3009	0x3008	Uint32	Read and write
Function generator startup	0x300B	0x300A	Int32	Read and write

Note: V1.6.5-1.4 versions change the location and speed feedback address. Location and speed continuous address reading are only supported in this version and above

1.3 Detailed Case Study of Modbus Communication Usage

Enter command information in the following window.

The diamond drive uses a serial port RS485 for communication, and the serial port sends code data in the following format:

Set the node number of the drive to 1.

1.3.1 Modbus communication control servo operation in PV and PP mode

Operation method for profile velocity mode:

1. Set [6060h: Mode of operations] to 3 (Profile velocity mode);

2. Set [6083h: Profile acceleration] to modify the acceleration curve (unit: cnt/s ^ 2);

3. Set [6084h: Profile cancellation] to modify the deceleration curve (unit: cnt/s ^ 2);

4. Set [6040h: Control word] to enable the servo drive and start the motor to run;

5. Set [60FFh: Target speed] to set the target speed (unit: cnt/s);

6. Query [6041h: Status word] to obtain the status feedback of the servo drive(Speed zero, Max slippage error, Target reached);

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Operation method for profile position mode:

1. Set [6060h: Mode of operations] to 1 (Profile position mode);
2. Set [6081h: Profile velocity] as the planned speed (unit: cnt/s);
3. Set [6083h: Profile acceleration] as the planned acceleration (unit: cnt/s ^ 2);
4. Set [6084h: Profile deceleration] as the planned deceleration (unit: cnt/s ^ 2);
5. Set [607Ah: Target position] as the target position (unit: cnt);
6. Set [6040h: Control word] to enable the servo drive and trigger the target position to take effect (set to 0x0F is enableplease refer to Section 4.3 for more information on 6040h;
7. Query [6064h: Position actual value] to obtain feedback on the actual position of the motor;
8. Query [6041h: Status word] to obtain the status feedback of the servo drive (following error, set point acknowledge, target reached).

Profile velocity mode	Object Name	object	Set values	Hex	Serial port sending data code (Hex)
Operation mode	Operation mode	0x6060-00	3	0x00000003	01 06 60 60 00 03
Parameter settings	Maximum profile velocity	0x607F-00	25000	0x000061A8	01 06 61 0A 61 A8 (low 16 bits) 01 06 60 7F 00 00 (high 16 bits)
	Acceleration	0x6083-00	10000	0x00002710	01 06 61 05 27 10 (low 16 bits) 01 06 60 83 00 00 (high 16 bits)
	Deceleration	0x6084-00	10000	0x00002710	01 06 61 06 27 10 (low 16 bits) 01 06 60 84 00 00 (high 16 bits)
	Emergency stop deceleration	0x6085-00	10000	0x00002710	01 06 61 07 27 10 (low 16 bits) 01 06 60 85 00 00 (high 16 bits)
	Motion profile type	0x6086-00	0	0x0000000	01 06 60 86 00 00
Enabling devices	Control word (Off)	0x6040-00	0x06	0x00000006	01 06 60 40 00 06
	Control Word (On)	0x6040-00	0x0f	0x000000F	01 06 60 40 00 0F
Setting speed	Target speed	0x60FF-00	1000	0x000003E8	01 06 61 08 03 E8 (low 16 bits) 01 06 60 FF 00 00 (high 16 bits)
Start moving	Control word	0x6040-00	0x00F	0x000000F	01 06 60 40 000F
Stop moving	Control word (Halt)	0x6040-00	0x10F	0x0000010F	01 06 60 40 01 0F
	Control word (emergency stop)	0x6040-00	0x00B	0x00000000B	01 06 60 40 00 0B

Profile position mode	Object Name	Object	Set values	Hex	Serial port sending data code (Hex)
MODE	Operation mode	0x6060-00	1	0x00000001	01 06 60 60 00 01
Parameter settings	Maximum following error	0x6065-00	2000	0x000007D0	01 06 61 0B 07 D0 (low 16 bits) 01 06 60 65 00 00(high 16 bits)
	Max limit of position	0x607D-01	-2147483648	0x800000000	01 06 61 0E 00 00 (low 16 bits) 01 06 60 7D 80 00 (high 16 bits)
	Min limit of position	0x607D-02	2147483647	0x7FFFFFFF	01 06 61 0FFF FF (low 16 bits) 01 06 61 10 7FFF (high 16 bits)
	Maximum profile velocity	0x607F-00	25000	0x000061A8	01 06 61 0A 61 A8 (low 16 bits) 01 06 60 7F 00 00 (high 16 bits)
	Profile velocity	0x6081-00	1000	0x000003E8	01 06 61 02 03 E8 (low 16 bits) 01 06 60 81 00 00 (high 16 bits)
	Acceleration	0x6083-00	10000	0x00002710	01 06 61 05 27 10 (low 16 bits) 01 06 60 83 00 00 (high 16 bits)
	Deceleration	0x6084-00	10000	0x00002710	01 06 61 06 27 10 (low 16 bits) 01 06 60 84 00 00 (high 16 bits)
	Emergency stop deceleration	0x6085-00	10000	0x00002710	01 06 61 07 27 10 (low 16 bits) 01 06 60 85 00 00 (high 16 bits)
	Motion profile type	0x6086-00	0	0x0000000	01 06 60 86 00 00
Enabling devices	Control word (Off)	0x6040-00	0x06	0x00000006	01 06 60 40 00 06
	Control Word (On)	0x6040-00	0x0f	0x000000F	01 06 60 40 00 0F
Set target	Target Position	0x607A-00	2000	0x000007D0	01 06 61 01 07 D0 (low 16 bits) 01 06 60 7A 00 00 (high 16 bits)
Start moving	Control word (absolute)	0x6040-00	0x1F	0x0000001F	01 06 60 40 00 1F
	Control word (absolute immediate)	0x6040-00	0x3F	0x0000003F	01 06 60 40 00 3F
	Control word (relative)	0x6040-00	0x7F	0x0000007F	01 06 60 40 00 7F
	Control word (relative immediate)	0x6040-00	0x5F	0x0000005F	01 06 60 40 00 5F
Stop moving	Control word (stop position)	0x6040-00	0x010F	0x0000010F	01 06 60 40 01 0F
	Control word (emergency stop)	0x6040-00	0x00B	0x0000000B	01 06 60 40 00 0B

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1.3.2 Modbus communication control servo operation Homing mode

Homing mode operation method:

1. Set [6060h: Mode of operations] to 6 (homing mode);

2. Set the [6098h: Homing method] to a range of 1-35 (detailed details can be found in the DS402 standard);

3. Set [607Ch: Homing offset] to set the origin offset;

4. Set [6099h Sub-01: Homing speeds] to modify the speed of searching for limit switches during the Homing process (unit: cnt/s);

5. Set [6099h Sub-02: Homing speeds] to modify the speed (unit: cnt/s) for looking for zero position during the Homing process;

6. Set [609Ah: Homing acceleration], set the Homing acceleration speed (unit: cnt/s $^$ 2);

7. Set [6040h: Control word] to enable the servo drive, the Homing operation start (Bit4) starts from a change of 0->1, and the Homing operation start interrupts the Homing process from a change of 1->0;

8. Motor search for limit switch and home switch, complete the homing action;

9. Query [6041h:Status word] to obtain status feedback of the servo drive(Homing error, Homing attached, Target reached).

Homing mode	Object Name	object	setting value	Hex	Serial port sending data code (Hex)
Operation mode	Operation mode	0x6060-00	6	0x00000006	01 06 60 60 00 06
Parameter settings	Maximum following error	0x6065-00	2000	0x000007D0	01 06 61 0B 07 D0 (low 16 bits) 01 06 60 65 00 00(high 16 bits)
	Homing offset	0x607C-00	0	0x0000000	01 06 61 0D 00 00 (low 16 bits) 01 06 60 7C 00 00(high 16 bits)
	Maximum profile velocity	0x607F-00	25000	0x000061A8	01 06 61 0A 61 A8 (low 16 bits) 01 06 60 7F 00 00 (high 16 bits)
	Emergency stop deceleration	0x6085-00	10000	0x00002710	01 06 61 07 27 10 (low 16 bits) 01 06 60 85 00 00 (high 16 bits)
	Switch searching speed	0x6099-01	100	0x00000064	01 06 61 11 00 64 (low 16 bits) 01 06 60 99 00 00 (high 16 bits)
	Zero searching speed	0x6099-02	10	0x0000000A	01 06 61 12 00 0A (low 16 bits) 01 06 61 13 00 00 (high 16 bits)
	Homing acceleration	0x609A-00	1000	0x000003E8	01 06 61 0C 03 E8 (low 16 bits) 01 06 60 9A 00 00 00 (high 16 bits)
Set Homing Mode	Homing mode	0x6098-00	27	0x001b	01 06 60 98 00 1B

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Enabling devices	Control word (Off)	0x6040-00	0x06	0x00000006	01 06 60 40 00 06
	Control Word (On)	0x6040-00	0x0F	0x000000F	01 06 60 40 00 0F
Starting Homing	Control Word (On)	0x6040-00	0x1F	0x0000001F	01 06 60 40 00 1F
	Control word (Halt Homing)	0x6040-00	0x11F	0x0000011F	01 06 60 40 01 1F
	Control word (emergency stop)	0x6040-00	0x00B	0x00000000B	01 06 60 40 00 0B

1.4 Modbus communication instruction demonstration and precautions

If the drive reports an error, clear the error command:
01 06 60 40 00 80

Command to read the actual position value of the motor: (Obtain the current position of the motor by returning data through the serial port)
Low 16 bit read: 01 03 60 64 00 01
High 16bit read: 01 03 62 01 00 01

V1.6.5-1.4 and above:
Can read high bits and low bits simultaneously.

Command to read the actual speed of the motor: (Obtain the current speed of the motor by returning data through the serial port)
Low 16 bit read: 01 03 60 6C 00 01
High 16bit read: 01 03 62 02 00 01
V1.6.5-1.4 and above:
Can read high bits and low bits simultaneously: 01 03 50 02 00 02

Command to read internal status information of the drive: (Return data through serial port to obtain the current status of the drive 0x6041-00)
01 03 60 41 00 01

Set the Node number of the drive to 1.

1. Taking position mode as an example:
1.Set operation mode
    01 06 60 60 00 01
2. Enabling process:
    1) 01 06 60 40 00 06
    2) 01 06 60 40 00 0F
3. Set the target position to 2000cnt
    Low 16 bit write value: 01 06 61 01 07 D0
    High 16 bit write value: 01 06 60 7A 00 00
4. Set the profile speed to 2000cnt/s
    Low 16 bit write value: 01 06 61 02 07 D0
    High 16 bit write value: 01 06 60 81 00 00
5. Starting operation (taking absolute position as an example)
    01 06 60 40 00 1F
    Start operation (taking relative position as an example)
    01 06 60 40 00 4F
    01 06 60 40 00 5F

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6. Stopping operation
    1) 01 06 60 40 01 0F Pause
    2) 01 06 60 40 00 0B Emergency stop

2. Taking the Homing mode as an example (the homing method and speed can be saved directly):
    1. Set the operating mode to 6:
        01 06 60 60 00 06
    2. Enable:
        1) 01 06 60 40 00 06
        2) 01 06 60 40 00 0F
    3. Start homing:
        01 06 60 40 00 1F
4、Stop homing:
        01 06 60 40 01 0F

3. Taking speed mode as an example:
1. Set operation mode
    01 6 60 60 00 03
2. Set target speed: Taking 2000cnt/s as an example
    Low 16 bit write value: 01 06 61 08 07 D0
    High 16 bit write value: 01 06 60 FF 00 00
3. Enable:
        1) 01 06 60 40 00 06
        2) 01 06 60 40 00 0F enable

    For each mode switching, parameter changing or execution of the next action, an activation status command needs to be issued first than the next action can be executed.

4. Function Generator Function Instructions:
First you need to configure the function generator related parameters.
0x20030004 Debugging type: 3 current, 2 speed, 1 position- Modbus address: 3000
0x20030005 Function type: 1 square wave, 2 sine wave- Modbus address: 3001
0x20030002 amplitude- Modbus address: 3003 high bit, 3002 low bit
0x20030001 signal frequency- Modbus address: 3005 high bit, 3004 low bit
0x20030006 Number of signals- Modbus address: 3007 high bit, 3006 low bit
0x20030007 duration time- Modbus address: 3009 high bit, 3008 low bit
Configure the above parameters first and start
Start timing:
0x60600000: 11;
0x6040000:6;

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0x6040000:7;

0x6040000:15;

0x20030003:1- Modbus address: 300B high bit, 300A low bit;

Stop timing:

0x20030003:0- Modbus address: 300B high bit, 300A low bit;

Notes: 1. Write the low bit first before writing the high bit to prevent data errors when writing to the high bit;

  2. This feature is currently only compatible on customized versions.

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