

GSHD Series High Performance Servo Drive

Fully Interconnected Intelligent Manufacturing Core Technology Platform



GSHD series high performance servo drive adopts innovative design of the hardware and software, compact structure, easy to adjust and debug. It can implement high-precision control of all mainstream permanent magnet motors. Medium voltage drives support 200w to 7300w motors, and high voltage ones support up to 7.5kw motors. GSHD drives can operate in various control modes, such as position control mode, velocity control mode, and current (torque) control mode. Users can switch among current mode, velocity mode and position mode. GSHD drive supports analog command input, pulse command input and multiple network communication protocols, such as EtherCAT, gLink-II (Googoltech's Gigabit Ethernet communication protocol), etc. Users can implement drive parameter setting and test via the DriverStudio tuning software. Graphical software interface makes drive parameter setting easier. When equipped with Googoltech's motion controllers, tuning is more convenient, control accuracy is higher, and system performance is better.

GSHD series high performance servo drive has been widely used in high-precision laser processing, semiconductor, industrial robot, CNC machining center, automation production line, 3C equipment and many industrial automation fields.

Googol Technology (Overseas) Ltd.

01 Superb Technology & Abundant Functions

1. Drive multiple types of motors:

- Rotary servo motor
- Linear motor
- DC motor
- DD motor



Rotary servo motor



Linear motor



DC motor



DD motor

2. Support multiple input modes:

- Analog input
- Pulse input
- glink-II
- EtherCAT



Analog input



Pulse input



gLink-II



EtherCAT

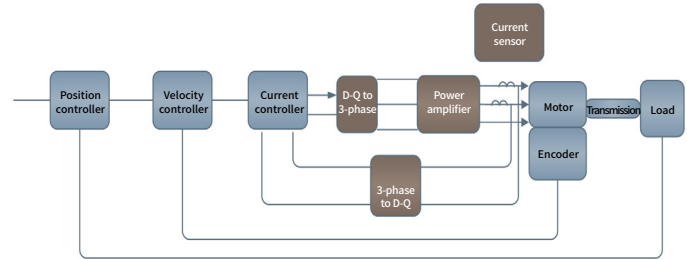
3. Supports various types of encoder convenient for users to freely choose third-party motors as needed

- Incremental encoder
- Absolute encoder
- Hall sensor
- Rotary transformer
- Sine-cosine encoder



4. Fully closed-loop control function

- Fully closed-loop second channel encoder supports sine-cosine, incremental encoders;
- Rotary or linear encoders can be selected for zero-return;
- Highly precise sampling in real time;
- Position accuracy up to ± 1 pulse, excellent dynamic characteristic.



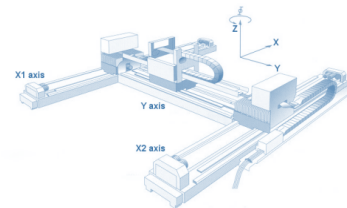
5. IO point-to-point control function

- The controller only needs to send the corresponding I/O instructions, and the drive can automatically perform motion planning and positioning, and realize the PLC logic function.

地址	名称	注释	数据类型	其他配置
Q0.0	启动按钮	启动按钮	Bool	
Q0.1	停止按钮	停止按钮	Bool	
Q0.2	限位按钮	限位按钮	Bool	
Q0.3	限位按钮	限位按钮	Bool	
Q0.4	限位按钮	限位按钮	Bool	
Q0.5	限位按钮	限位按钮	Bool	
Q0.6	限位按钮	限位按钮	Bool	
Q0.7	限位按钮	限位按钮	Bool	
Q1.0	限位按钮	限位按钮	Bool	
Q1.1	限位按钮	限位按钮	Bool	
Q1.2	限位按钮	限位按钮	Bool	
Q1.3	限位按钮	限位按钮	Bool	
Q1.4	限位按钮	限位按钮	Bool	
Q1.5	限位按钮	限位按钮	Bool	
Q1.6	限位按钮	限位按钮	Bool	
Q1.7	限位按钮	限位按钮	Bool	
Q2.0	限位按钮	限位按钮	Bool	
Q2.1	限位按钮	限位按钮	Bool	
Q2.2	限位按钮	限位按钮	Bool	
Q2.3	限位按钮	限位按钮	Bool	
Q2.4	限位按钮	限位按钮	Bool	
Q2.5	限位按钮	限位按钮	Bool	
Q2.6	限位按钮	限位按钮	Bool	
Q2.7	限位按钮	限位按钮	Bool	
Q3.0	限位按钮	限位按钮	Bool	
Q3.1	限位按钮	限位按钮	Bool	
Q3.2	限位按钮	限位按钮	Bool	
Q3.3	限位按钮	限位按钮	Bool	
Q3.4	限位按钮	限位按钮	Bool	
Q3.5	限位按钮	限位按钮	Bool	
Q3.6	限位按钮	限位按钮	Bool	
Q3.7	限位按钮	限位按钮	Bool	
Q4.0	限位按钮	限位按钮	Bool	
Q4.1	限位按钮	限位按钮	Bool	
Q4.2	限位按钮	限位按钮	Bool	
Q4.3	限位按钮	限位按钮	Bool	
Q4.4	限位按钮	限位按钮	Bool	
Q4.5	限位按钮	限位按钮	Bool	
Q4.6	限位按钮	限位按钮	Bool	
Q4.7	限位按钮	限位按钮	Bool	

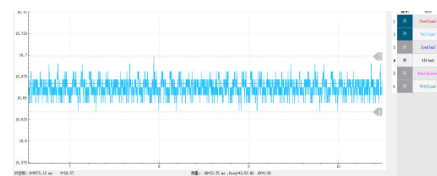
6. Gantry dual-drive function

- Dual-axis coupling control; one channel command input for slave axis follow, high precision & quick response;
- Simple tuning and quick configuration, only need to configure the communication between the main drive and the motion controller; Compensation for master and slave axis synchronization error;
- Advanced functions such as zero return, automatic alignment, protection, etc.



7. Sine-cosine subdivided function

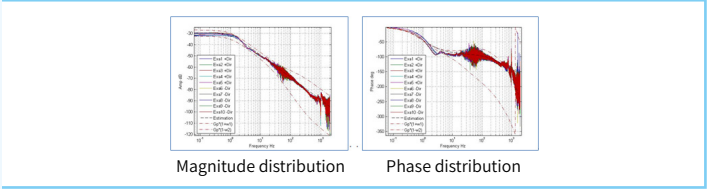
- Sine-cosine is subdivided into 4096 times, resolution can reach 32-bit;
- Rotating speed fluctuation 0.3%; maximum rotating speed can reach 60,000rpm.



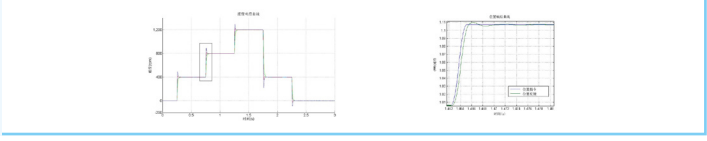
02 Advantages In Industry Applications

1. Model identification, parameters auto tuning, notch and vibration suppressing functions, no need parameters tuning

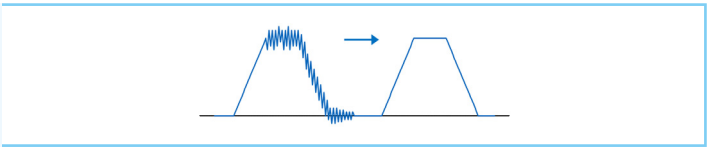
- By mean of the model identification, the transfer function or state space equation of the system can be obtained to guide the parameter design.



2. Parameters auto tuning based on loop shaping method. Less tuning time and less maintenance

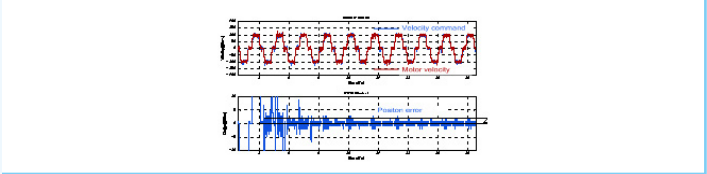


3. Automatic vibration suppression and notch filtering for complex on-site problems



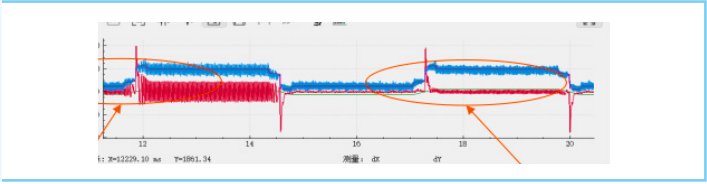
4. Precise repeated positioning accuracy

- Repeated positioning accuracy up to 1nm; System stability can be maintained under all operating conditions.



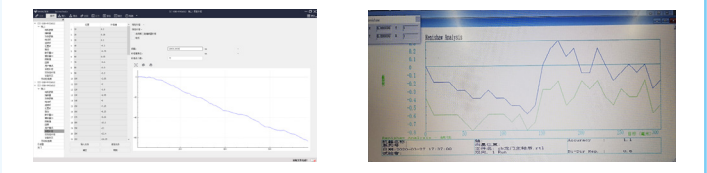
5. Cogging torque compensation

- Automatically compensates cogging torque with non-linear motor model testing.
- Reduces velocity and torque fluctuations and increases the system follow consistency.



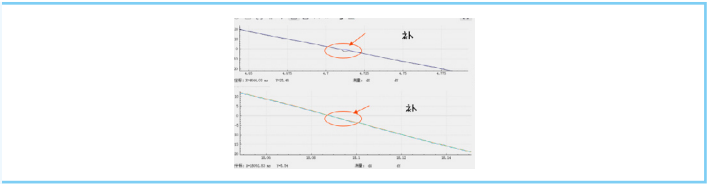
6. Grating scale, DD motor compensation

- The grating scale & precision compensation up to 1arcsec and 1um.
- One button operation for free-range compensation.
- Compensation result can be visually displayed.



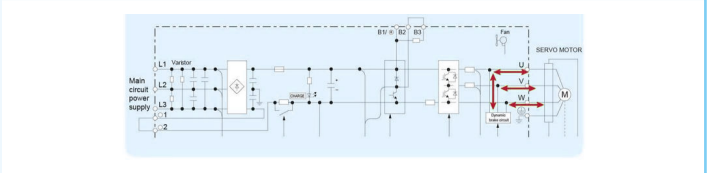
7. Friction / Gravity compensation

- Compensates for motor Coulomb and viscous friction, variable friction model, linked to velocity and acceleration.
- Compensate for gravity such as Z-axis, making drive tuning much smoother.



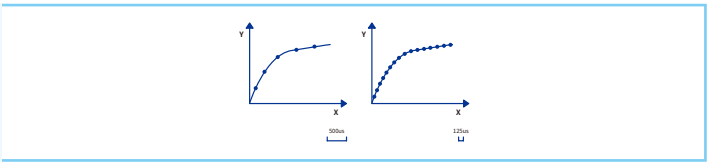
8. Full-time dynamic brake

- Active power failure damping and servo off damping functions, full-time dynamic brake for safer high speed linear motor.

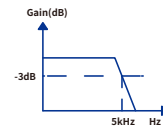


9. High speed communication

- Bus cycle supports minimum 125us.

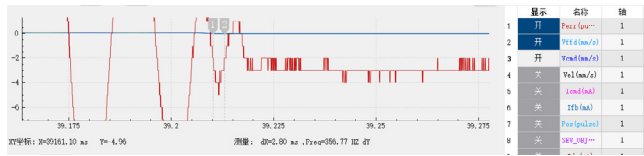


10. High actual operation bandwidth, current loop within 5kHz, 16-bit sampling resolution, operating cycle 31.25us, strong overload multiple



11. Advanced algorithms

- Advanced FFD and non-linear algorithms, short tuning time and stable static state, steady state fluctuation is small.



03 DriverStudio Tuning Software

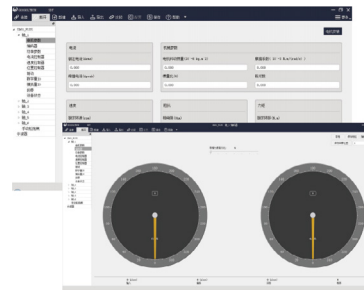
The interface of DriverStudio tuning software comes with circuit diagrams, including current loop, velocity loop and position loop. Users can conveniently and intuitively use the software to adjust and debug the three loops.

- Current fold back parameters can be set by users to raise the security rating of the drive and motor;
- Supports inertia auto tuning and variable controller;
- Compact edition software is only about 50M.



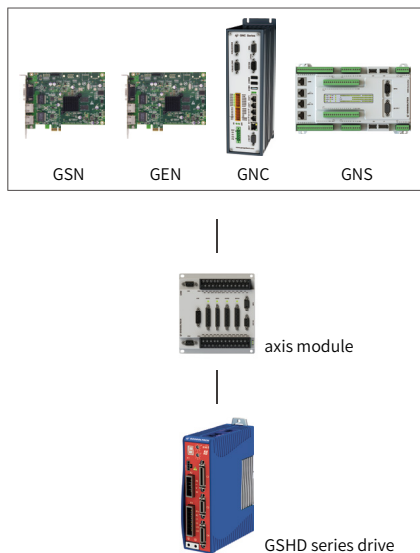
Runtime environment requirements

- CPU 2GHz
- RAM 2GB
- Hard disk 1GB
- Comes with network cable interface
- Supports Windows 7 and Windows 10 O/S
- 1Gbps Ethernet network
- Recommended screen resolution 1280x800
- Minimum resolution 1024x768

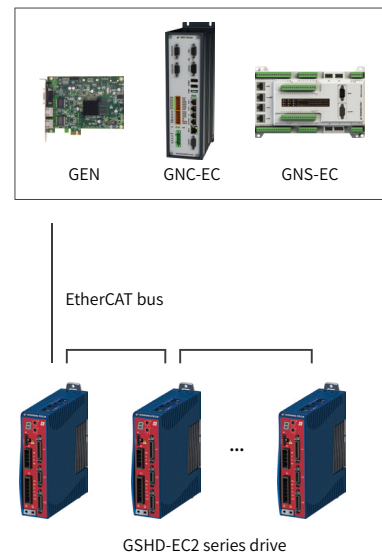


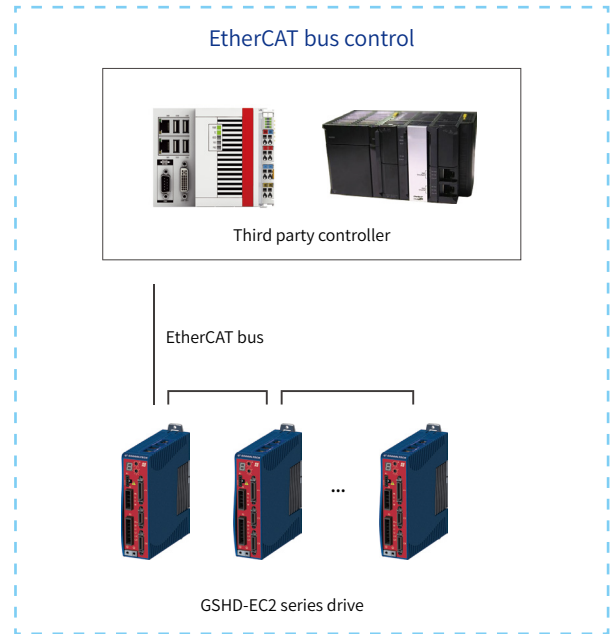
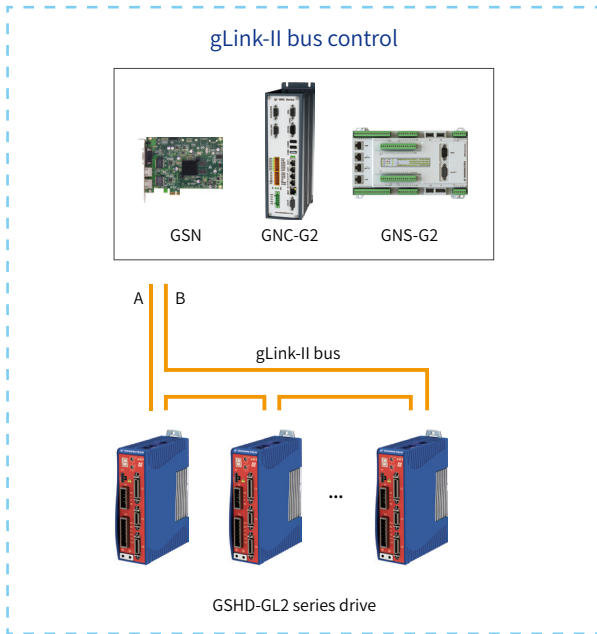
04 Architecture Diagram

Pulse analog control/IO control



EtherCAT bus control





05 Technical Specification

Control Specification		
Motor	AC rotary servo motor, AC linear servo motor, DC motor and DD motor	
Operating mode	Auto configuration	Auto configuration of motor phase and phase line setting
Current (torque) control	Selectable modes	Current (torque) control, velocity control, position control
	I/O command	Current command / 3-phase PWM command, 0-2kHz
	Performance	Refresh cycle 31.25us (32kHz), output sinusoidal waveform
	Step response time	Actual time of current arriving current command value is 2 cycles, 62.5us (up to 3kHz)
	Control method	DQ, PI and feed forward
	Reference command	Analog voltage ± 10 VDC, gLink-II, EtherCAT
Velocity control	Auto tuning	Auto tuning current loop parameters
	I/O command	Velocity / current command
	Performance	Refresh cycle 125us (8kHz)
	Selectable velocity control method	PI, IP
	Filter	First order low pass filter, second order low pass filter, notch, high pass filter, band pass filter or several types of filters cascading
Position control	Reference command	Analog voltage ± 10 VDC, gLink-II, EtherCAT
	I/O command	Position / velocity command
	Performance	Refresh cycle 125us (8kHz)
	Control method	PI and feed forward
Brake	Reference command	Pulse & direction with electronic gear, gLink-II, EtherCAT
	Method	Controlled stop; dynamic braking, dynamic forbidden
Status display	Format	7-segment LED (green), display drive status
Electronic gear	Method	User-defined gear ratio
	User interface	DriverStudio tuning software based on Windows
GUI	Function	Setting connection, drive information, power supply information, motor, feedback, I/O selection / configuration, motion setting / adjustment, fault history / status display, installation wizard, expert interface, etc.
	IO Specification	
Channel 1 analog input	Analog ± 10 VDC differential, 14-bit resolution	
Channel 2 analog input	Analog ± 10 VDC differential, 14-bit resolution	
Pulse & direction	Maximum input frequency 4MHz/8MHz*	
Equivalent encoder output	AB orthogonal signal / zero differential signal, maximum output frequency 8MHz	
Digital input (8 channels)	24V, optical isolation, low level input	
Quick digital input (3 channels)	24V, optical isolation, low level input	
Digital output (4 channels)	24V, open collector, with optical isolation, low level output, maximum current 40mA	
Quick digital output (2 channels)	24V, open collector, with optical isolation, low level output, maximum current 10mA	

Analog output	±10V, resolution 8-bit
Second encoder	AB orthogonal signal / zero differential signal, maximum input frequency 4MHz/8MHz*
Fault output relay	24V, maximum current 1A, can deploy dry contact
Communication	
Daisy chain	Up to 8 axes, use 2 rotary switches to set up the drive address, range 0-99, maximum wire length 10m
gLink-II	Used in drive and CiA 301 application layer and CiA 402 device sub-protocol of motion control, Gigabit Ethernet
EtherCAT	Used in drive and CiA 301 application layer and CiA 402 device sub-protocol of motion control
Motor Feedback Signal	
Drive	Main power supply: 5 VDC (7 VDC optional)
Incremental encoder	AB orthogonal signal with / without Hall sensor, RS422/485, maximum input frequency 8MHz
Hall sensor	Single-ended open collector (optional differential signal)
Rotary transformer	Sine/cosine differential signal, conversion ratio 0.45-1.6
Sine encoder	Sine/cosine differential signal with / without Hall sensor, 1Vpp@2.5V, EnDat®2.1, Hiperface®
SSI encoder	Support serial encoder of differential data and clock signal, EnDat®2.2, Nikon®, Tamagawa®, Yaskawa, Sankyo, Panasonic, HCFA, SSI, BiSS-C
Temperature sensor	Thermistor PTC or NTC, user-defined critical point
Protection Function & Environmental Requirement	
Protection function	Alarm content: under voltage and overvoltage, over current, over temperature of drive and motor, motor fold back, drive fold back, feedback missing, second encoder missing, STO signal not connected, not configured, circuit failure, motor phase loss, etc.
Standard	RoHS, REACH:ECRegulation1907/2006 Standard IEC61800-3 CE-EMC command 2004/108/EC, standard IEC61800-5-1 CE LVD 2006/95/EC
Environment	Ambient temperature: operating -20-55°C , storage -40-70°C ; humidity: 10-90%; vibration 1.0g Altitude: <2000m
Protection / pollution rating	Protection rating: IP20, pollution rating: 2 Do no use in the following areas: corrosive or inflammable gas, chemicals or oil-water, dust with iron and salt

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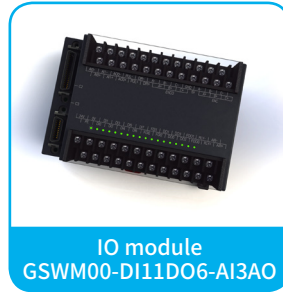
Selection Guide

Type	Voltage	Model	Description
Standard (STD)	Medium voltage	GSHD-1D5-2AAP1	1.5A, STD plus, Analog, P&D, RS485, 220V
		GSHD-003-2AAP1	3A, STD plus, Analog, P&D, RS485, 220V
		GSHD-4D5-2AAP1	4.5A, STD plus, Analog, P&D, RS485, 220V
		GSHD-006-2AAP1	6A, STD plus, Analog, P&D, RS485, 220V
		GSHD-008-2AAP1	8A, STD plus, Analog, P&D, RS485, 220V
		GSHD-010-2AAP1	10A, STD plus, Analog, P&D, RS485, 220V
		GSHD-013-2AAP1	13A, STD plus, Analog, P&D, RS485, 220V
		GSHD-020-2AAP1	20A, STD plus, Analog, P&D, RS485, 220V
		GSHD-024-2AAP1	24A, STD plus, Analog, P&D, RS485, 220V
		GSHD-003-2AAP1-LT	3A, STD plus, P&D, RS485, 220V, without SinCos
		GSHD-4D5-2AAP1-LT	4.5A, STD plus, P&D, RS485, 220V without SinCos
		GSHD-006-2AAP1-LT	6A, STD plus, P&D, RS485, 220V without SinCos
		GSHD-008-2AAP1-LT	8A, STD plus, P&D, RS485, 220V without SinCos
		GSHD-010-2AAP1-LT	10A, STD plus, P&D, RS485, 220V without SinCos
	GSHD-013-2AAP1-LT	13A, STD plus, P&D, RS485, 220V without SinCos	
	GSHD-020-2AAP1-LT	20A, STD plus, P&D, RS485, 220V without SinCos	
	GSHD-024-2AAP1-LT	24A, STD plus, P&D, RS485, 220V without SinCos	
	GSHD-4D5-2AAP1-DB	4.5A, P&D, RS485, 220V, Dynamic Brake	
	GSHD-006-2AAP1-DB	6A, P&D, RS485, 220V, Dynamic Brake	
	GSHD-006-2AAP1-DBLT	6A, P&D, RS485, 220V, Dynamic Brake, without SinCos	
High Voltage	GSHD-003-4DAP1	3A, STD plus, Analog, P&D, RS485, 380V	
	GSHD-006-4DAP1	6A, STD plus, Analog, P&D, RS485, 380V	
	GSHD-012-4DAP1	12A, STD plus, Analog, P&D, RS485, 380V	
	GSHD-020-4DAP1	20A, STD plus, Analog, P&D, RS485, 380V	
EtherCAT type	Medium Voltage	GSHD-1D5-2AEC2	1.5A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-003-2AEC2	3A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-4D5-2AEC2	4.5A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-006-2AEC2	6A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-008-2AEC2	8A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-010-2AEC2	10A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-013-2AEC2	13A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-020-2AEC2	20A, STD plus, Analog, P&D, EtherCAT, RS485, 220V
		GSHD-024-2AEC2	24A, STD plus, Analog, P&D, EtherCAT, RS485, 220V

EtherCAT type	Medium Voltage	GSHD-1D5-2AEC2-LT	1.5A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-003-2AEC2-LT	3A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-4D5-2AEC2-LT	4.5A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-006-2AEC2-LT	6A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-008-2AEC2-LT	8A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-010-2AEC2-LT	10A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-013-2AEC2-LT	13A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-020-2AEC2-LT	20A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-024-2AEC2-LT	24A, STD plus, P&D, EtherCAT, RS485, 220V, without SinCos	
		GSHD-1D5-2AEC2-LR	1.5A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry	
		GSHD-003-2AEC2-LR	3A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry	
		GSHD-4D5-2AEC2-LR	4.5A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry	
		GSHD-006-2AEC2-LR	6A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry	
		GSHD-008-2AEC2-LR	8A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry	
	GSHD-010-2AEC2-LR	10A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry		
	GSHD-013-2AEC2-LR	13A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry		
	GSHD-020-2AEC2-LR	20A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry		
	GSHD-024-2AEC2-LR	24A, STD plus, Analog, P&D, EtherCAT, RS485, 220V, Laser, Gantry		
	High voltage	GSHD-003-4DEC2	3A, STD plus, Analog, P&D, EtherCAT, RS485, 380V	
		GSHD-006-4DEC2	6A, STD plus, Analog, P&D, EtherCAT, RS485, 380V	
		GSHD-012-4DEC2	12A, STD plus, Analog, P&D, EtherCAT, RS485, 380V	
		GSHD-020-4DEC2	20A, STD plus, Analog, P&D, EtherCAT, RS485, 380V	
		GSHD-012-4DEC2-LR	12A, STD plus, Analog, P&D, EtherCAT, RS485, 380V, Laser, Gantry	
		GSHD-1D5-2AGL2	1.5A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
	gLink-II type	Medium Voltage	GSHD-003-2AGL2	3A, STD plus, Analog, P&D, gLink-II, RS485, 220V
			GSHD-4D5-2AGL2	4.5A, STD plus, Analog, P&D, gLink-II, RS485, 220V
GSHD-006-2AGL2			6A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
GSHD-008-2AGL2			8A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
GSHD-010-2AGL2			10A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
GSHD-013-2AGL2			13A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
GSHD-020-2AGL2			20A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
GSHD-024-2AGL2			24A, STD plus, Analog, P&D, gLink-II, RS485, 220V	
GSHD-003-2AGL2-LT			3A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-4D5-2AGL2-LT			4.5A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-006-2AGL2-LT			6A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-008-2AGL2-LT			8A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-010-2AGL2-LT			10A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-013-2AGL2-LT			13A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-020-2AGL2-LT			20A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
GSHD-024-2AGL2-LT			24A, STD plus, P&D, gLink-II, RS485, 220V, without SinCos	
High Voltage		GSHD-1D5-2AGL2-LR	1.5A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-003-2AGL2-LR	3A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-4D5-2AGL2-LR	4.5A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-006-2AGL2-LR	6A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-008-2AGL2-LR	8A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-010-2AGL2-LR	10A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-013-2AGL2-LR	13A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-020-2AGL2-LR	20A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-024-2AGL2-LR	24A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-003-4DGL2	3A, STD plus, Analog, P&D, gLink-II, RS485, 380V	
		GSHD-006-4DGL2	6A, STD plus, Analog, P&D, gLink-II, RS485, 380V	
		GSHD-012-4DGL2	12A, STD plus, Analog, P&D, gLink-II, RS485, 380V	
		GSHD-020-4DGL2	20A, STD plus, Analog, P&D, gLink-II, RS485, 380V	
		GSHD-003-4DGL2-LR	3A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-006-4DGL2-LR	6A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
		GSHD-012-4DGL2-LR	12A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry	
GSHD-020-4DGL2-LR	20A, STD plus, Analog, P&D, gLink-II, RS485, 220V, Laser, Gantry			
Modular Step Drive	GT422	40V 2.2A		
	GT556	50V 5.6A		
	GMDD-0422-PSX01	40V 2.2A, Dual Axis		
	GMSD-0556-ASX01	50V 5.6A, Analog		
IO module & cables	GSWM00	GSWM00-DI11DO6-AI3AO1		
	GSM-20L005	20-pin cable (0.5m) for GSWM00		
	GSM-36L005	36-pin cable (0.5m) for GSWM00		
Tuning Panel	GSPAD	Handheld Servo drive tuning panel		

Note: For linear & DD motor drive, add the suffix – LM after the original model number (e.g. GSHD-003-2AAP1 is changed to GSHD-003-2AAP1-LM), it means this specific model supports both rotary and linear motor.

07 Related Products and Accessories



Note: For details of the above-mentioned products and accessories, please refer to the corresponding product catalog.

08 Industry Application

