GAFFORD

User's Manual
GD10 series inverter

Chapter 1 Summary

1.1 Safety Precautions

In order to ensure the safe and reasonable use of this product, please fully understand the safety precautions described in this manual before using this product.

Warning signs and meanings

The following marks are used in this manual to indicate that they are important for safety. Failure to follow these precautions could result in personal injury or death, and damage to the product and associated systems.

	**DANGER: Failure may result in death or serious safety accident.**
	Caution: Misoperation may cause minor injuries.

Operation qualification

This product must be operated by trained professionals. In addition, operators must be trained in professional skills, familiar with the installation, wiring, operation and maintenance of the equipment, and properly respond to various emergencies in use.

Safety guidance

Warning signs are proposed for your safety and are measures taken to prevent injury to operators and damage to the product and associated systems; please read this manual carefully before use, and strictly follow the safety rules and warnings in this manual Flag to operate.

- Correct transportation, storage, installation, and careful operation and maintenance are vital to the safe operation of the inverter. During transportation and storage, ensure that the inverter is not subject to shock and vibration. It must also be stored in a dry, non-corrosive gas, non-conductive dust, and place where the ambient temperature is less than 60 ° C.
- This product has dangerous voltage, and it controls the motion mechanism with potential danger. If you do not follow the regulations or operate in accordance with the requirements of this manual, it may cause personal injury and death, and damage to the product and related systems.
- Do not perform wiring work when the power is on, otherwise there is a danger of death due to electric shock; during wiring, inspection, maintenance, etc., please cut off the power of all related equipment, and confirm that the DC voltage of the main circuit has dropped to Safety level, wait 5 minutes before performing related operations.
- The power cables, motor cables, and control cables must be tightly connected. The ground terminal must be reliably grounded and the ground resistance must be less than 10Ω.
- The static electricity of the human body will seriously damage the internal sensitive devices. Before performing related operations, please observe the measures and methods prescribed by the electrostatic discharge prevention measures (ESD), otherwise the inverter may be damaged.
- Because the output voltage of the inverter is a pulse waveform, if a capacitor to improve power factor or a varistor for lightning protection is installed on the output side, be sure to remove or modify it on the input side of the inverter.
- Do not add switching devices such as circuit breakers and contactors

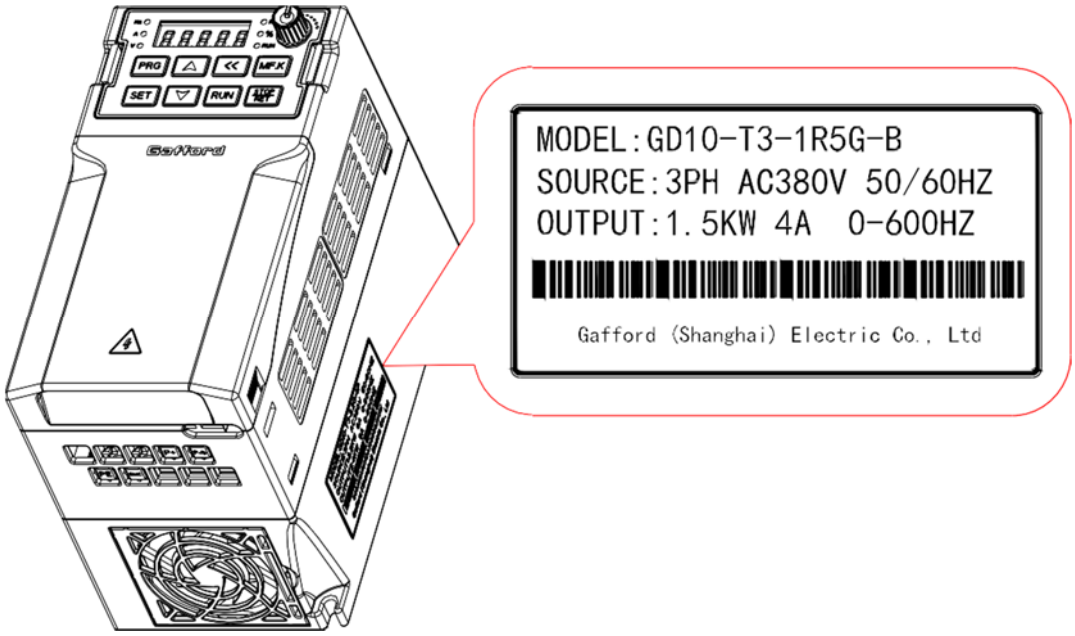
on the output side of the inverter (if you must connect switching devices on the output side, you must ensure that the output current of the inverter is zero during the switching operation).

- No matter where the fault occurs in the control equipment, it may cause shutdown and major accidents. Therefore, please take necessary external protective measures or backup devices.
- This product can only be used for the purpose specified by the manufacturer. It must not be used in emergency, rescue, marine, medical, aviation, nuclear facilities and other special fields without permission.
- The maintenance of this product can only be performed by the company or professionals authorized by the company. Unauthorized modification and use of accessories not approved by the company may cause product failure. During maintenance, any defective device must be replaced in time.

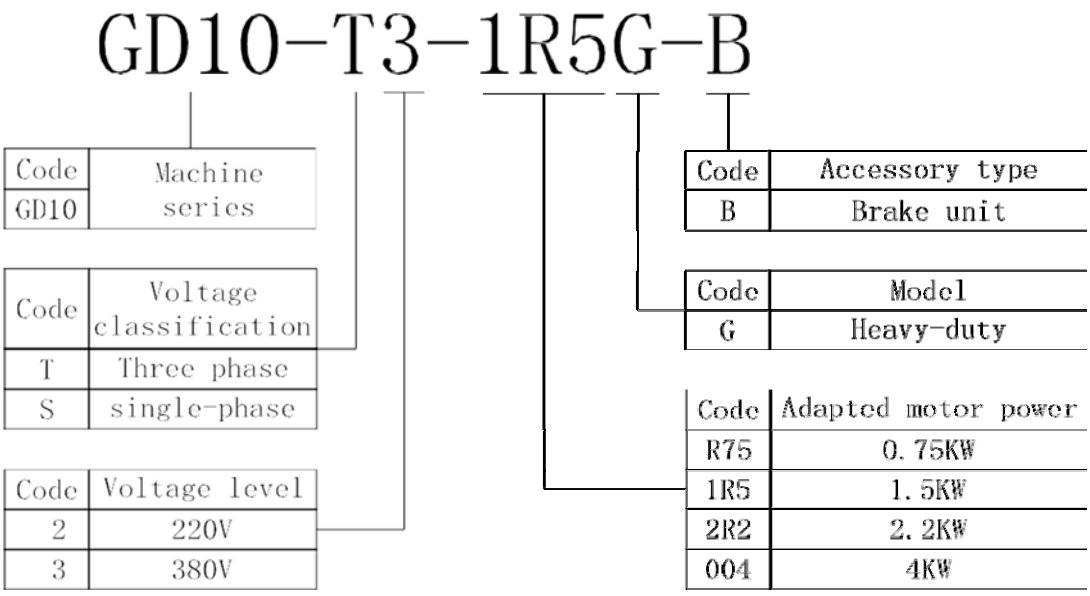
1.2 Before use

After receiving the product you ordered, please check the outer package if have damage or not, open the outer package after confirming the integrity, and confirm whether the inverter is damaged, scratched or dirt (the damage caused by the transportation is not included in the "Three Guarantees" of the company range). If the product you received has been damaged during shipping, please contact us or the shipping company immediately. After confirming that the received product is intact, please confirm whether the received inverter model is the same as the product you ordered.

Position and content of nameplate



Nameplate model description and rated parameters



Voltage	220V	380V
Power (KW)	Rated output current (A)	
0.75	4	3
1.5	7	4
2.2	10	5
4		9.5

1.3 Technical specifications

Item		Specification
Power input	Voltage, Frequency	Single-phase 220V 50/60Hz ; Three-phase 380V 50/60Hz ;
	Allow fluctuations	Voltage imbalance rate:<3%; Frequency:±5%; Distortion rate meets IEC61800-2 requirements
	closing striking current	Less than rated current
	Power factor	≥0.94(with DC reactor)
	Inverter efficiency	≥96%
Output	Output voltage	Output under rated conditions: 3 phases, 0 ～ input voltage, error less than 5%
	Output frequency range	0～600Hz
	Output frequency accuracy	± 0.5% of the maximum frequency value
	Overload capacity	T3 model: 150% rated current 1 minute, 180% rated current 5 seconds, 200% rated current 0.5 seconds S2 model: 150% rated current 20 seconds, 180% rated current 0.5 seconds
Main control performance	Motor control mode	PG-free V / F control, PG-free vector control (T3 series)
	Modulation	Optimized space vector PWM modulation
	Carrier frequency	0.7～16.0kHz
	Speed control range	Vector control without PG, rated load 1;100;

Item		Specification
	Steady speed accuracy	Vector control without PG: ≤2% rated synchronous speed;
	Starting torque	Vector control without PG: 150% of rated torque at 0.5Hz;
	Torque response	Vector control without PG: <20ms;
	Frequency accuracy	Digital setting: maximum frequency × ± 0.01%; Analog setting: maximum frequency × ± 0.2%
	Frequency resolution	Digital setting: 0.01Hz; Analog setting: maximum frequency × 0.05%
Product basic functions	Torque control	Torque setting calculation, torque mode speed limitation
	DC braking capacity	Starting frequency: 0.00 ～ 50.00Hz; Braking time: 0.0 ～ 60.0s; Braking current: 0.0 ～ 150.0% of rated current
	Torque boost	Automatic torque boost 0.0% ～ 100.0%; manual torque boost 0.0% ～ 30.0%
	V / F curve	Four modes: linear torque characteristic curve, self-set V / F curve, reduced torque characteristic curve (1.1 ~ 2.0 power), square V / F curve

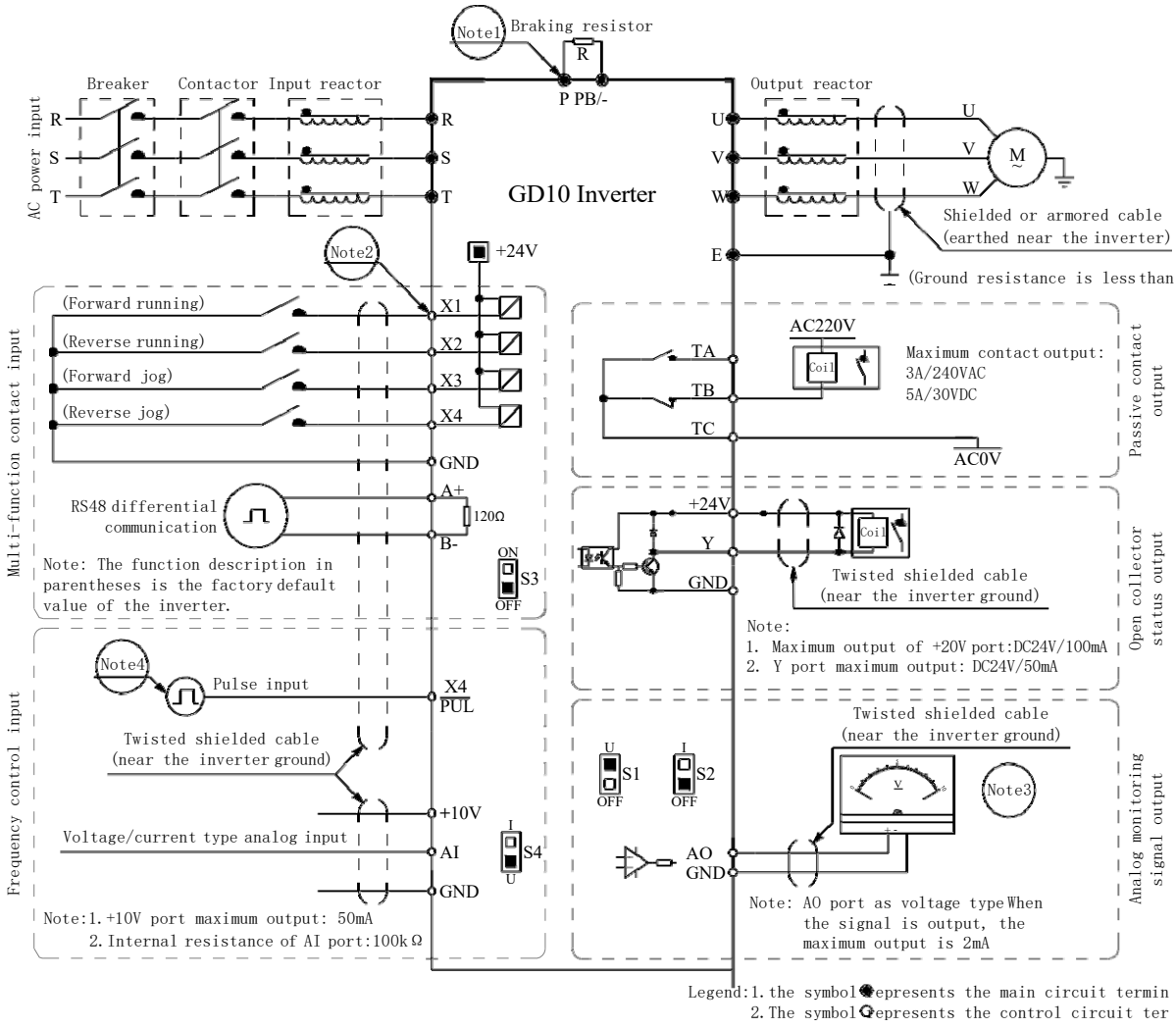
Item		Specification
	Acceleration / deceleration curve	Two ways: linear acceleration and deceleration, S curve acceleration and deceleration Four sets of acceleration and deceleration time, time unit 0.01s, maximum 650.00s
	Rated output voltage	Using the power supply voltage compensation function, the rated voltage of the motor is 100%, which can be set within the range of 50 to 100% (the output cannot exceed the input voltage)
	Automatic voltage adjustment	When the grid voltage fluctuates, it can automatically keep the output voltage constant
	Automatic energy-saving operation	Under V / F control mode, the output voltage is automatically optimized according to the load to achieve energy-saving operation
	Automatic current limit	Automatic current limit during operation to prevent frequent overcurrent fault trips
	Instant power off processing	Uninterrupted operation through bus voltage control during momentary power failure

Item		Specification
	Standard function	PID control, speed tracking and restart after power failure, skip frequency, frequency upper and lower limit control, program operation, multi-stage speed, RS485, analog output, frequency pulse output, parameter access level setting, common parameter setting, monitoring parameter comparator output , Counting and timing function, wobble frequency function
	Frequency setting channel	Keyboard digital setting, keyboard potentiometer, analog voltage / current terminal AI, communication reference and multi-channel terminal selection, combination of main and auxiliary channels, can be switched in various ways
	Feedback input channel	Keyboard potentiometer, voltage / current terminal AI, communication reference, pulse input PUL, PUL pulse input multiplex X4 terminal
	Command running channel	Operation panel setting, external terminal setting, communication setting
	Command input signal	Start, stop, forward and reverse, jog, multi-speed, free stop, reset, acceleration / deceleration time selection, frequency setting channel selection, external fault alarm
	External output signal	1 relay output, 1 collector Y terminal output, 1 AO output, selectable as 0 ～ 10V or 0 ～ 20mA or 4 ～ 20mA output

Item		Specification	
Protective function		Over-voltage, under-voltage, current limit, over-current, overload, electronic thermal relay, over-temperature, over-voltage stall, data protection, rapid protection, input and output phase loss protection	
Keyboard display	LED display	Pluggable keyboard: single-line 5-digit digital tube display	Can monitor 1 inverter status
	Condition monitoring	All parameters of the monitoring parameter group such as output frequency, given frequency, output current, input voltage, output voltage, motor speed, PID feedback, PID given value, module temperature, given torque, output torque, etc.	
	Error alarm	Overvoltage, undervoltage, overcurrent, short circuit, phase loss, overload, overheating, overvoltage stall, current limit, data protection is damaged, current fault operating conditions, historical fault	
Environment	Installation site	Altitude is less than 1000 meters, derating for use above 1000 meters, derating 1% for every 100 meters; no condensation, icing, rain, snow, hail, etc., solar radiation is less than 700W / m2, air pressure is 70 ～ 106kPa	
	Temperature, humidity	-10 ～ + 50 ℃, derating above 40 ℃, maximum temperature 60 ℃ (no-load operation) 5% to 95% RH (non-condensing)	

Item		Specification
	Vibration	When 9～200Hz, 5.9m/s2(0.6g)
	Storage temperature	-30 ～ +60℃
	Installation method	Wall-mounted
	Protection grade	IP20
	Cooling method	Forced air cooling

1.4 Standard connection diagram



Note:

1. Select the braking resistor resistance. For details, please refer to the braking resistor specifications recommended by GD10 series inverters.

2. Multi-function input terminals (X1 ～ X4 / PUL), compatible design of NPN, PNP transistor signal input, factory default is NPN transistor signal type input;

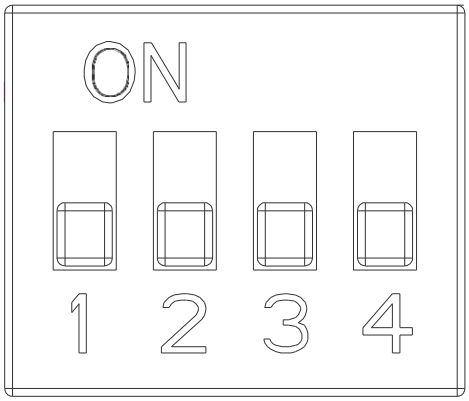
3. The analog monitoring output is a dedicated output for indicator meters such as ammeters and voltmeters, and cannot be used for control operations such as feedback control;

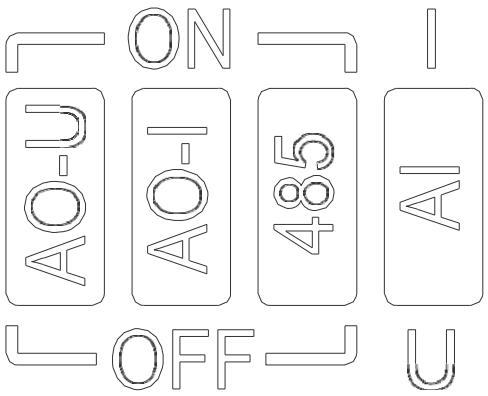
4. Due to the existence of multiple pulse types in actual use, please refer to the detailed description for the specific wiring method. The maximum pulse input specification: 50KHz / 24V.

1.5 Auxiliary terminal output capability

Terminal	Function definition	Maximum output
+10V	10V auxiliary power output, reference potential is GND	50mA
AO	Analog monitoring output, reference potential is GND	Maximum output 2mA when used as voltage type signal
+24V	24V auxiliary power output, reference potential is GND	100mA
Y	Open collector output, programmable action object	DC24V/50mA
TA/TB/TC	Passive contact output, programmable action object	3A/240VAC 5A/30VDC

1.6 Function diagram and description of transfer switch





Tag number	Digit coding	Choose location	Function Description
S9	1	ON	Enable AO-U voltage output, output range: 0 ～ 10V (Factory default)
		OFF	Turn off AO-U voltage output

	2	ON	Enable AO-I current output, output range: 0 ～ 20mA or 4 ～20mA
		OFF	Turn off AO-I current output
	3	ON	RS485 communication terminal resistance
		OFF	Disconnect RS485 communication terminal resistance (Factory default)
	4	I	AI adaptive current type analog input, 0 ～ 20mA or 4 ～ 20mA
		U	AI adaptive voltage type analog input, 0 ～ 10V (Factory default)

1.7 Recommended braking resistor specifications and instructions for the inverter

Three-phase 380V voltage level			
Motor Power（KW）	**Resistance（Ω）**	**Resistance power（W or KW）**	**Braking torque（%）**
0.75 KW	750Ω	150W	100%
1.5 KW	400Ω	300W	100%
2.2 KW	250Ω	400W	100%
4.0 KW	150Ω	500W	100%
5.5KW	100Ω	600W	100%
7.5 KW	75Ω	780W	100%
Single-phase 220V voltage level			
Motor Power（KW）	**Resistance（Ω）**	**Resistance power（W or KW）**	**Braking torque（%）**
0.4 KW	400Ω	100W	100%
0.75 KW	200Ω	120W	100%
1.5 KW	100Ω	300W	100%

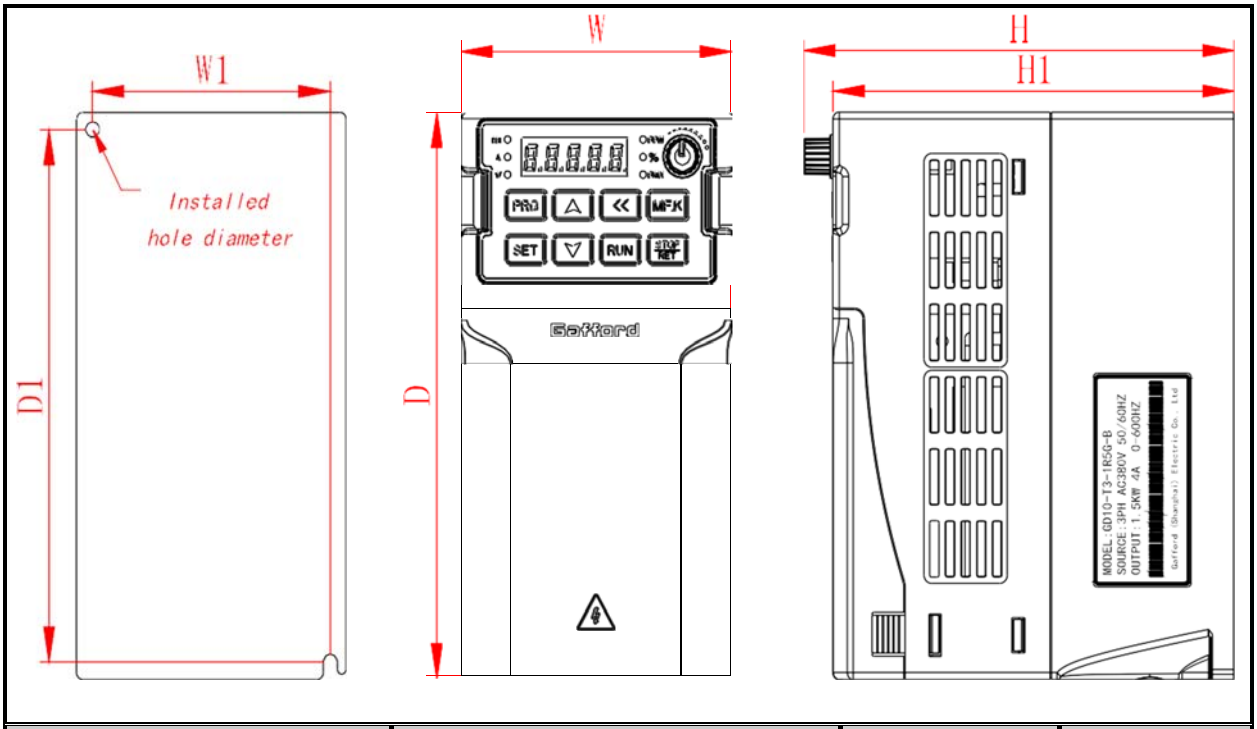
2.2 KW	75Ω	300W	100%
4.0 KW	50Ω	500W	100%

The braking resistor resistance and resistance power described in the above table are determined in accordance with ordinary inertia loads and intermittent braking methods. If it needs to be used in the occasion of large inertia and frequent braking for a long time, please adjust the braking resistor resistance and resistance power according to the specifications of the selected inverter and the rated parameters of the braking unit. If in doubt, please consult the Customer Service Department of Gafford (Shanghai) Electric Co., Ltd

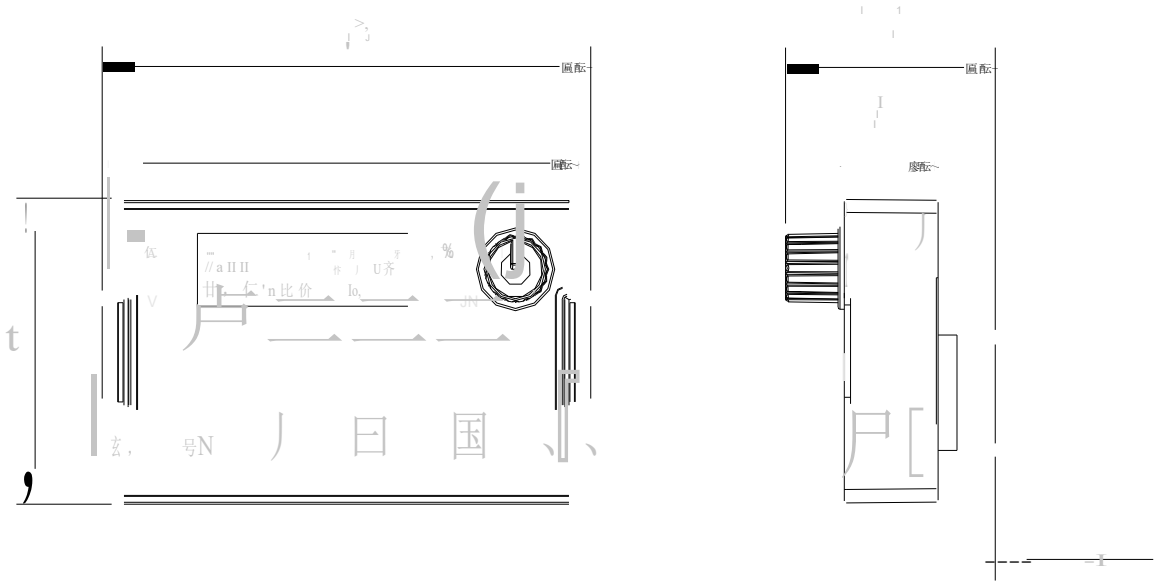
Chapter 2 Installation

In order to ensure the safe use of the product by the user, maximize the performance of the inverter, and ensure the reliable operation of the inverter, please use this product strictly in accordance with the environmental, wiring, and ventilation requirements described in this chapter.

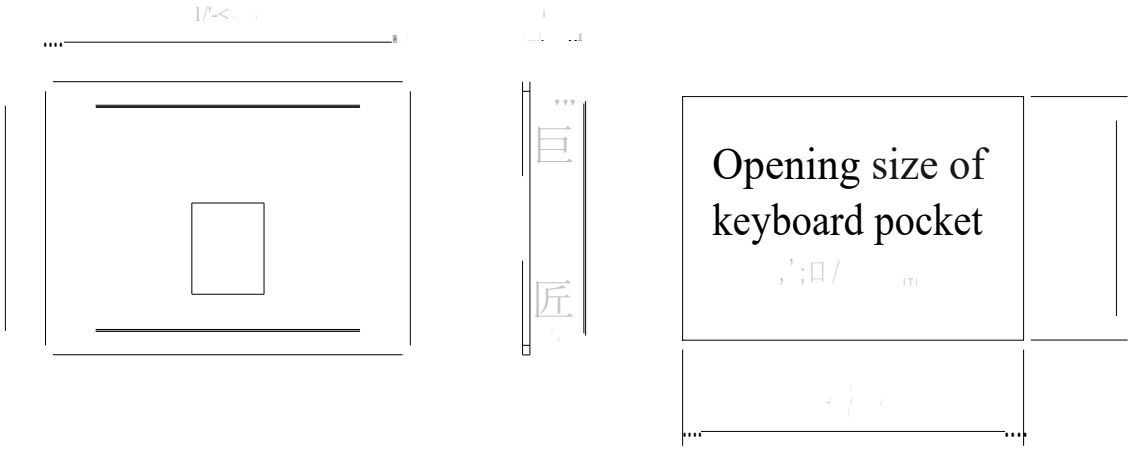
Inverter and keyboard dimensions



Inverter model	Dimensions (mm)				Installation size (mm)		Installation Aperture
	W	D	H1	H	W1	D1	Φ
GD10-S2-R75G-B	86	162	128	137	76	152	4.5
GD10-S2-1R5G-B	91	175	128	137	81	164	4.5
GD10-S2-2R2G-B							
GD10-T3-R75G-B	86	162	128	137	76	152	4.5
GD10-T3-1R5G-B							
GD10-T3-2R2G-B							
GD10-T3-004G-B	91	175	128	137	81	164	4.5



External keyboard dimensions of GD10 series



Outline and opening size of GD10 series external keyboard pocket

Chapter 3 Keyboard Layout and Operation Instructions

3.1 Keyboard operator appearance

3.2 Key functions

Key symbol	Function definition	Function description
PRG	Menu	First level menu entry or exit
SET	Set / shift key	Enter the menu screen step by step and confirm the setting parameters
▲ ▼	Up and down keys	Data or function code increment and decrement
RUN	Run key	In keyboard operation mode, used for running operation
STOP RET	Stop / Reset button	When running, press this key to stop the running operation; if fault alarm, it is used to reset the operation. The characteristics of this key are restricted by the F4-01 parameter

	Shift key	In the display interface, select the display parameters cyclically; when changing the parameters, it is used to change the bit.
	Multi-function key	Select function switching according to F4-00 parameters, which can be defined as jog or running

3.3 Light meaning

Name		Status	Meaning
Unit indicator	Hz	Flashing / On	Frequency unit
	A	On	Current unit o
	V	On	Voltage unit
	RPM	On	Speed unit
	%	Flashing / On	Percentage unit
Status Indicator	RUN	On	Inverter forward running
	RUN	Flashing / On	Inverter reverse running
	RUN	Off	Inverter shutdown

Chapter 4 Function Table

This chapter only provides the function summary. For detailed function description, please refer to the GD10 technical manual or consult our company.

4.1 Safety Precautions

Danger
Please pay attention to all the information about safety in this book.
Failure to follow the warnings may result in death or serious injury. The company will not be held liable for injuries and equipment damage caused by your company or your customers' failure to comply with the contents of this book.

4.2 How to read the parameter list

◆ **Icons and terminology for control mode**

Icons	Content
S2	Effective parameters of single-phase (S2) inverter
T3	Effective parameters of three-phase (T3) inverter

◆ **Icons and terminology for control mode**

Icons	Content
○	Parameters that cannot be modified during operation
●	Parameters that can be modified during operation
×	This parameter can only be read and cannot be modified
※	This parameter is related to the inverter model

4.3 Functional group

F0 Basic parameter group

Function code (address)	Function code name	Factory default	Setting value range and definition	Attributes	Note
F0-00 (0x000)	Control operation mode	0	0： VF control 1: PG-free vector control	○	S2 only supports VF control

F0-01 (0x001)	Kepp			○	
F0-02 (0x002)	Run instruction selection	0	0: keyboard 1: terminal 2: RS485 communication	○	
F0-03 (0x003)	Main frequency given source	0	0: keyboard frequency given frequency 1: keyboard potentiometer given 2: Analog AI given 3: Terminal pulse HDI given 4: RS485 communication given 5: Terminal UP / DW control 6: PID control given 7: Program control (PLC) given 8: Multi-speed setting	●	
F0-04 (0x004)	Auxiliary frequency given source	1		●	
F0-05 (0x005)	Auxiliary frequency reference	0	0: Use the maximum output frequency as the reference source 1: Use the main frequency as the reference source	●	
F0-06 (0x006)	Frequency command overlay selection	0	0: main frequency 1: auxiliary frequency 2: primary + secondary 3: primary-secondary 4: Maximum of the two 5: Minimum of the two	●	
F0-07 (0x007)	Run command bundle	0000	**Units: keyboard command bundle** **Tens place: terminal command binding** **Hundreds: communication command bundle** 0: No bundling 1: keyboard number given 2: Potentiometer given 3: AI given 4: HDI given 5: RS485 given 6: Terminal UP / DW 7: PID given 8: PLC given	●	

			9: Multi-speed setting		
F0-08 (0x008)	Keyboard number setting frequency	50.00Hz	0.00～Upper frequency	●	
F0-09 (0x009)	Maximum frequency	50.00Hz	Upper frequency～600.00Hz	○	
F0-10 (0x00A)	Upper frequency source selection	0	0: Digital setting of upper limit frequency 1: keyboard potentiometer given 2: Analog AI given 3: Terminal pulse HDI reference 4: RS485 communication given	●	
F0-11 (0x00B)	Digital setting of upper frequency	50.00Hz	Lower limit frequency～ maximum frequency	●	
F0-12 (0x00C)	Lower limit frequency	0.00Hz	0.00～Upper frequency	●	
F0-13 (0x00D)	Lower limit frequency operation mode	1	0: stop output 1: Run at the lower limit frequency	○	
F0-14 (0x00E)	Acceleration time 0	Model settings	0.01～650.00s	※	
F0-15 (0x00F)	Deceleration time 0	Model settings		※	
F0-16 (0x010)	Selection of running direction	0000	One's place: reverse the running direction 0: The direction is unchanged 1: reverse direction Tens place: running direction prohibited 0: Invalid 1: Reverse prohibited 2: Forward is prohibited Hundreds place: Frequency	○	

			control direction command 0: Invalid 1: valid		
F0-17 (0x011)	PWMCarrier frequency	Model settings	0.7～16.0kHz	※	
F0-18 (0x012)	PWM Control mode	1111	**Ones place: Carrier is related to temperature** 0: Not relevant 1: about **Tens place: Carrier is related to output frequency** 0: Not relevant 1: about **Hundreds place: random PWM enable** 0: Forbidden 1: enable **Thousands: PWM modulation** 0: three-phase modulation 1: automatic switching	●	
F0-19 (0x013)	Parameter initialization	0	0: No operation 1: Restore factory value (do not restore motor parameters) 2: Restore factory value (restore motor parameters) 3: Clear fault records	○	0x013

F1 Start-stop control parameter group

Function code number	Function code name	Factory default	Setting value range and definition	Attributes	Note
F1-00 (0x0100)	Start way	0	0: Start directly 1: Start after DC injection 2: Start after speed tracking	○	
F1-01 (0x0101)	Start pre-excitation time	0.00s	0.00～60.00s	○	
F1-02 (0x0102)	Starting frequency	0.50Hz	0.00～60.00Hz	○	
F1-03 (0x0103)	Start frequency hold time	0.0s	0.0～50.0s	○	

F1-04 (0x0104)	DC injection current	60.0%	0.0～150.0%	○	
F1-05 (0x0105)	DC injection time	0.0s	0.0～60.0s	○	
F1-06 (0x0106)	Speed tracking speed	0.50s	0.00～60.00s	○	
F1-07 (0x0107)	Speed tracking shutdown delay	1.00s	0.00～60.00s	○	
F1-08～F1-09		Keep			
F1-10 (0x010A)	Stop mode	0	0: deceleration stop 1: Free stop	●	
F1-11 (0x010B)	Starting frequency of DC braking at stop	1.00Hz	0.00～50.00Hz	○	
F1-12 (0x010C)	DC braking current at stop	60.0%	0.0～150.0%	○	
F1-13 (0x010D)	DC brake holding time at stop	0.0s	0.0～60.0s	○	
F1-14 (0x010E)	Minimum output frequency at shutdown	0.50Hz	0.00～50.00Hz	●	
F1-15 (0x010F)	Keep				
F1-16 (0x0110)	Acceleration and deceleration	0010	**Units: time base selection** 0: maximum frequency 1: fixed frequency 50Hz 2: set frequency **Tens place: S acceleration and deceleration selection** 0: linear acceleration / deceleration 1: S curve acceleration and deceleration **Hundreds and thousands: reserved**	○	
F1-17 (0x0111)	Acceleration start S curve	0.10s	0.00～10.00	○	

	time				
F1-18 (0x0112)	Acceleration end S curve time	0.10s	0.00～10.00	○	
F1-19 (0x0113)	Deceleration start S curve time	0.10s	0.00～10.00	○	
F1-20 (0x0114)	S curve time at the end of deceleration	0.10s	0.00～10.00	○	
F1-21 (0x0115)	Acceleration time 1	10.00s	0.01～650.00s	●	
F1-22 (0x0116)	Deceleration time 1	10.00s	0.01～650.00s	●	
F1-23 (0x0117)	Acceleration time 2	10.00s	0.01～650.00s	●	
F1-24 (0x0118)	Deceleration time 2	10.00s	0.01～650.00s	●	
F1-25 (0x0119)	Acceleration time 3	10.00s	0.01～650.00s	●	
F1-26 (0x011A)	Deceleration time 3	10.00s	0.01～650.00s	●	
F1-27 (0x011B)	Emergency stop deceleration time	1.00s	0.01～650.00s	●	
F1-28 (0x011C)	Forward and reverse dead time	0.0s	0.0～120.0s	○	
F1-29 (0x011D)	Zero speed torque frequency threshold	0.50Hz	0.00～10.00Hz	●	
F1-30 (0x011E)	Zero speed torque holding coefficient	60.0%	0.0～150.0%	●	
F1-31 (0x011F)	Zero speed torque holding time	0	0.0～6000.0s When set to 6000.0s, keep	●	

F1-32～F1-34		Keep			
F1-35 (0x0123)	Restart action selection after power failure	0	0: Invalid 1: valid	○	
F1-36 (0x0124)	Waiting time for restart after power failure	0.50s	0.00～60.00s	○	
F1-37 (0x0125)	Keep				
F1-38 (0x0126)	Jog running frequency setting	5.00Hz	0.00～Maximum frequency	●	
F1-39 (0x0127)	Jog acceleration time	10.00s	0.01～650.00s	●	
F1-40 (0x0128)	Jog deceleration time	10.00s	0.01～650.00s	●	

F2 Multi-function terminal parameter group

Function code number	Function code name	Factory default	Setting value range and definition	Attributes	Note
F2-00 (0x200)	X1 terminal input function selection	1	Refer to attached list 4.21	○	
F2-01 (0x201)	X2 terminal input function	2	Refer to attached list 4.21	○	
F2-02 (0x202)	X3 terminal input function	4	Refer to attached list 4.21	○	
F2-03 (0x203)	X4 terminal input function	5	Refer to attached list 4.21	○	
F2-04 (0x204)	X1 ～ X4 terminal characteristics selection	0000	0: closed effective 1: open effective Ones place: X1 Tens place: X2 Hundreds: X3 Thousands: X4	●	
F2-05 (0x20A)	X1 effective detection delay	0.010	0.000～6.000s	●	