

MAINTENANCE GUIDE

STARVERT - iG5A



- This guide contains safety information and basic troubleshooting and maintenance guidance. For more detailed information, refer to the user manual included with the product or contact your supplier.
- For your safety, carefully read the Maintenance Guide before you install and use the product.



■ Safety information

- ▶ Read and follow all safety instructions in this guide to understand the safe operating conditions for the equipment and to avoid property damage and personal injury.
- ▶ For your safety, Warning and Caution information is provided below.

 **Warning** Indicates an imminently hazardous situation which, if not avoided, may result in severe injury or death.

 **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in injury or damage to property.

Warning

- ▶ **Do not open the inverter covers while it is energized or operating.**
Doing so may cause the inverter to malfunction or result in electric shock.
- ▶ **Do not allow objects, such as metal filings or other debris inside the inverter.**
Doing so may cause the inverter to malfunction or result in a fire.

Caution

- ▶ **Ensure that cables are correctly specified for the inverter's rated voltage, cable entry, and terminal arrangement. Ensure that all wiring connections are installed correctly.**
Incorrect cable specifications and connections may cause the inverter to malfunction or result in a fire.
- ▶ **Apply the correctly rated torque when tightening terminal screws.**
Loose screws or over tightened screws may result in an electric shock or a fire.
- ▶ **Do not install the inverter near flammable objects.**
Doing so may cause a fire.
- ▶ **Ensure that the inverter location or installation method is not affected by vibration.**
Vibration may affect the inverter's operation and result in an electric shock or fire.
- ▶ **Ensure that the inverter is not serviced or repaired by unauthorized persons.**
Unauthorized work may result in an electric shock or a fire and void the warranty.
- ▶ **Ensure the inverter load does not exceed the product's rated load and that the inverter is installed in accordance with the environmental conditions specified in the User's Manual.**
Exceeding the rated load or incorrectly installing the inverter may cause the inverter to malfunction, overheat, or result in an electric shock or a fire.

Selecting inverter capacity

- **Selecting the correct inverter capacity**
 - 1) Check that the required output for the load is within the inverter's rated output [KVA].
 - 2) Check that the motor rating is within the inverter's rated output [KVA].
 - 3) Check that the current for the actual load is within the inverter's rated current [A].
- **When operating multiple motors with one inverter**
 - 1) Ensure the inverter's rated output is greater than or equal to the combined rating of the motors.
 - 2) Electronic Over-Current Relay (EOCR) protection is recommended. (Note: Over-current protection for all motors supplied by the inverter cannot be provided.)
 - 3) Not recommended for motors with large differences in ratings.

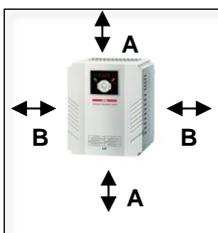
⚠ Caution

- ▶ If an inverter's capacity is incorrect it may cause trip faults and also cause the inverter and connected motors to malfunction.

Safety information - Inverter installation

- **Installation conditions**
 - 1) The inverter must not vibrate and be installed on a wall that can support the inverter's weight.
 - 2) Since the inverter may overheat during operation, it must be installed on a fire-resistant or flame-retardant surface and have adequate clearance around it.
 - 3) The ambient temperature of the inverter's operational environment must be within $-10 - 50^{\circ}\text{C}$.

Clearances around the inverter



A : >10cm
B : >5cm

Area for measuring temperature



Safety information – Inverter wiring

- **Things to check before wiring**
 - 1) Ensure the inverter is turned off before wiring.
 - 2) After the inverter is turned off, ensure that the inverter's charging circuit is fully discharged. (Wait at least 10 minutes after the inverter is turned off.)
- **Safety information for wiring**
 - 1) Do not allow objects, such as metal filings or cable off-cuts inside the inverter. Doing so may damage the inverter or cause inverter malfunction.
 - 2) Apply the correctly rated torque when tightening screws. If screws are loose or over tightened, the inverter may malfunction or cause a short circuit.
 - 3) If the forward command (Fx) is on, the motor should rotate counterclockwise when viewed from the load side of the motor. If the motor rotates in the reverse direction, switch the position of the U and V connections at the inverter.

Distance between inverter and motor	< 50 m	< 100 m	> 100 m
Allowed carrier frequency	< 15 kHz	< 5 kHz	< 2.5 kHz

⚠ Caution

- ▶ When installing phase advance condensers, surge killer, or electronic noise filters on the output side of the inverter, the inverter protection function may perform or the surge killer may be damaged.

⚠ Warning

- ▶ Ensure the input terminals (R,S,T) and output terminals (U,V,W) are connected correctly. Transposing the input and output connections may damage the inverter.
- ▶ Do not short-circuit the B1 and B2 terminals. This may damage the inverter.

- ※ Ensure the total cable length does not exceed 200 m.
- ※ Use Shielded Twisted Pair (STP) cables for signal circuits used with remotely located motors that are connected to the inverter. Do not use 3 core cables.
- ※ When using long cable lengths, decrease the carrier frequency and install a micro surge filter or sine wave filter.

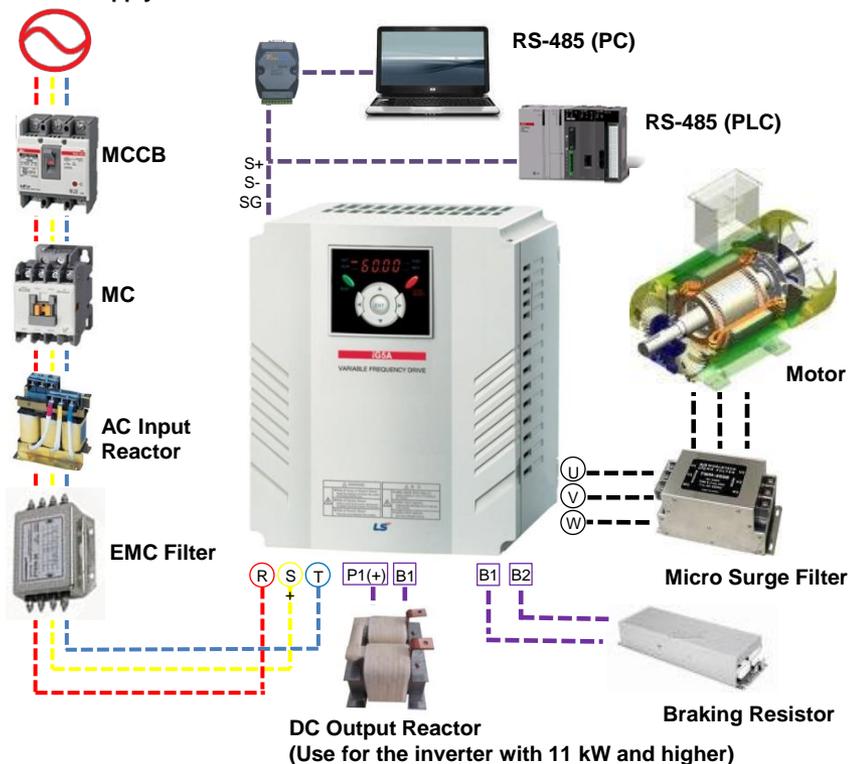
Inverter operating conditions

▪ Ideal operating conditions

Item	Description
Ambient temperature Ambient humidity Environmental factors	-10 °C ~ 50 °C (ice free conditions) < 90 % rH (condensation free conditions) No exposure to corrosives, flammable gases, oil residue, or dust.
Altitude Vibration	< 1,000 m above sea level < 0.6 G, 5.9 m/s ²

Peripherals and optional device configuration

AC Power Supply



Cautions for peripherals and optional device configuration

Name	Description
 AC Power (Power source)	- Connect the inverter to the specified input power supply. (Phase to phase voltage: within 15 % below - 10 % over, nominal supply voltage.)
 MCCB (Circuit breaker /Current leakage breaker)	- Protects the power system from a short-circuit faults. - High levels of in-rush current occur when the power is on, so select correctly rated MCCBs. (Contact the manufacturer for further information.)
 M/C (Magnetic contactor)	- Avoid starting and stopping the inverter unnecessarily. It may impact the lifespan and reliability of the product and cause switching noise. - Select correctly rated M/Cs. (Contact the manufacturer for further information.)
 Reactor (AC and DC reactors)	- Protects the inverter when a high load is connected, suppresses high frequency and improves power factor. - Use a maximum cable length of 10 m. - Select correctly rated reactors. (Contact the manufacturer for further information.) - Use an inverter rated at 11 kW or higher.
 EMC Filter	- Reduces electro-magnetic interference. - Use a maximum cable length of 10 m. - Select correctly rated filters. (Contact the manufacturer for further information.)
 Braking Resistor	- Used when the inverter requires electrical braking for vertical loads, or to shorten the deceleration time. It absorbs the regenerative energy at braking by turning it into heat. - Ensure that B1 and B2 are not short-circuited when wiring. - The rated capacity must be based on the amount of regenerated energy. - Select correctly rated resistors. (Contact the manufacturer for further information.)
 Micro Surge Filter	- Reduces noise occurring at the input and output sides of cables and components that can affect inverter operation. - Use a maximum cable length of 10 m. - Select correctly rated filters. (Contact the manufacturer for further information.)

※ Ensure optional devices are correctly connected to the inverter and correctly configured for the system. Incorrect connections and configurations may affect the product's lifespan and reliability and cause serious damage to the product.

Protective functions

Type	Trip Name	Function	Description
Current	OCT	Over Current	Inverter output current exceeds 200 % of the rated current.
	OC2	Over current	Inverter detects a IGBT Arm short circuit or an output short circuit.
	OLT	Over load	The current value exceeds the motor's rated current. (Default value = 180 % of the motor's rated current)
	GFT	Ground trip	The sum of 3 phases current(Normal 0V) is higher than the level which is set and flowing through inverter output for the setting time.
	IOLT	Inverter over load	The inverter is operating at 150 % of the rated current for more than 60 sec or at 200 % of the rated current for 10 sec (this feature has inverse time characteristics).
	ETH	Electronic thermal	Stops the inverter operation to protect the motor when a current exceeding the motor rated current is supplied for a specific period of time (Default value = 150 % of the motor's rated current detected for 60 sec. This feature has inverse time characteristics). The inverter output current exceeds the motor's rated current
Voltage	OVT	Over voltage	The internal DC circuit voltage exceeds the specified value. 200 V: 400 Vdc 400 V: 820 Vdc
	LVT	Low voltage	The internal DC circuit voltage is less than the specified value. 200 V: 180 Vdc (Reset level: 230 Vdc) 400 V: 360 Vdc (Reset level: 460 Vdc)
	-	Braking operation	IGBT braking is turned on as DC voltage has combined with regenerated voltage and exceeds the specified voltage. Turn On: 200 Vdc-390 Vdc , 400 Vdc-780 Vdc Turn Off: 200 Vdc-380 Vdc , 400 Vdc-760 Vdc

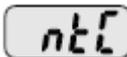
Fault trip troubleshooting

Display	Cause	Remedy
 Over current	<ul style="list-style-type: none"> Deceleration time is too short. The inverter output current exceeds the rated capacity. The motor's mechanical brake is operating improperly. Over current occurs when the inverter power is turned on. The actual current value is different from the value displayed. 	<ul style="list-style-type: none"> Set the Acc/Dec time. Decrease the load or replace the inverter with a higher-rated model. Check the mechanical brake. Adjust the torque boost. Contact the supplier.
 Over current2 (Arm short)	<ul style="list-style-type: none"> IGBT phase to phase fault. There is a short circuit in the wiring on the output side. Motor output cables are too long. Surge voltages occur at the output terminals. 	<ul style="list-style-type: none"> Check for a phase to phase short circuit at the IGBT. Check the output cables. Use the correct length for motor cables. Reduce the carrier frequency. Resolve the surging voltage condition.
 Ground trip	<ul style="list-style-type: none"> A ground fault has occurred in the output side of the inverter. Phase to phase difference of output voltage has occurred. The motor's insulation is damaged. 	<ul style="list-style-type: none"> Check the output cables. Check the voltages between the phases are balanced. Check the motor's insulation resistance.
 Over heat  Fan trip	<ul style="list-style-type: none"> Cooling system fault. Cooling fan fault. The ambient temperature around the panel is too high. The carrier frequency is too high. 	<ul style="list-style-type: none"> Check that foreign objects are obstructing the vent. Replace the cooling fan. Reduce the ambient temperature to below 50 °C. Reduce the carrier frequency.
Note	Cooling fan faults can be inspected by sound and the exterior condition. If the fan is malfunctioning, it may damage the inverter.	

Fault trip troubleshooting

Keypad display	Cause	Remedy
 Inverter over load	<ul style="list-style-type: none"> The load is higher than the inverter rating. 	<ul style="list-style-type: none"> Ensure the motor and the inverter are correctly rated.
 Over load trip	<p>Note</p> <p>The difference between OLT and IOLT is the reference current (OLT-motor's rated current, IOLT-inverter's rated current).</p>	
 Output phase open	<ul style="list-style-type: none"> The magnetic contactor on the output side has a connection fault. Output side wiring is faulty, or the 3-phase inverter output has one or more phases in an open circuit condition. IGBT is faulty. 	<ul style="list-style-type: none"> Check the magnetic contactor. Check the output cables. Contact the supplier.
	<p>Note</p> <p>The output phase open trip mode can be set by adjusting the parameter.</p>	
 Input phase open	<ul style="list-style-type: none"> The magnetic contactor on the input side has a connection fault. The input side wiring has one or more phases in an open circuit condition. The capacitor inside the inverter is broken due to long-term use. 	<ul style="list-style-type: none"> Check the magnetic contactor. Check the input cables. Replace the capacitor.
	<p>Note</p> <p>The input phase open trip mode can be set by adjusting the parameter.</p>	

Fault trip troubleshooting

Keypad display	Cause	Remedy
 Over voltage	<ul style="list-style-type: none"> Deceleration time is too short for load inertia (GD2). Regenerative load is at the inverter output. Input voltage is too high. 	<ul style="list-style-type: none"> Increase the acceleration time. Use the braking unit. Ensure the input voltage is at the specified value.
 Low voltage	<ul style="list-style-type: none"> Input voltage too low. A load greater than the power capacity is connected to the inverter. (e.g., a welder, direct motor connection, etc.). The magnetic contactor on the input side has a connection fault. 	<ul style="list-style-type: none"> Ensure the input voltage is at the specified value Increase the power capacity. Replace the magnetic contactor.
 	<ul style="list-style-type: none"> Parameter saving fault. 	<ul style="list-style-type: none"> Reconnect the loader cables.
 	<ul style="list-style-type: none"> Loader fault. 	<ul style="list-style-type: none"> If the fault occurs continuously, contact the supplier.
 	<ul style="list-style-type: none"> Communication error between the loader and inverter. 	<ul style="list-style-type: none"> Contact the supplier.
 	<ul style="list-style-type: none"> Hardware fault. 	
 	<ul style="list-style-type: none"> Insulated Gate Bipolar Transistor (IGBT) temperature sensor fault. 	

Troubleshooting other faults

Type	Cause	Remedy
The inverter is not responding when power is supplied	<ul style="list-style-type: none"> ▪ There is an input power fault. ▪ The inverter does not have short circuit connectors at P and B1 (11- 22 kW models). ▪ Loader fault and a loader and inverter contact fault. ▪ Switched-mode power supply (SMPS) fault. 	<ul style="list-style-type: none"> ▪ Ensure the input voltage is correct. Check the circuit breaker and magnetic contactor (before the input terminal). ▪ Install short circuit connectors. ▪ Replace the loader. ▪ Contact the supplier.
The motor does not rotate	<ul style="list-style-type: none"> ▪ Current is not supplied at the inverter output(U, V, W). ▪ Motor cable fault or peripheral device connection fault. 	<ul style="list-style-type: none"> ▪ Check the operation and frequency commands. ▪ If the inverter is not operating, even if the Run Lamp is on and the frequency command is correct, contact the supplier. ▪ Check the wiring and peripheral devices.
The motor does not accelerate or decelerate	<ul style="list-style-type: none"> ▪ Operation and frequency command values are incorrect. ▪ The load is too high and an over-current control condition exists. ▪ The maximum frequency or frequency limit is set. 	<ul style="list-style-type: none"> ▪ Check the operation and frequency commands. ▪ Reduce the load or increase the inverter rating. ▪ Adjust the parameter.
The inverter is overheating	<ul style="list-style-type: none"> ▪ The charging resistor is damaged. 	<ul style="list-style-type: none"> ▪ Check the input and output cables, braking resistor, and connections (ground etc.).

Troubleshooting other faults

Type	Cause	Remedy
The motor vibrates severely, does not rotate normally, and stalls.	<ul style="list-style-type: none"> ▪ There are large load fluctuations. ▪ The input voltage is not stable. ▪ The torque boost value is too high. 	<ul style="list-style-type: none"> ▪ Adjust the load to the rated value. ▪ Ensure the input voltage is correct ▪ Adjust the torque boost value.
The motor is overheating.	<ul style="list-style-type: none"> ▪ The motor has been operating continuously at low speed. ▪ The base frequency is set incorrectly. 	<ul style="list-style-type: none"> ▪ Adjust the operation speed setting or install an extra cooling system for the motor. ▪ Ensure the motor rating is correct and set the base frequency correctly.

Maintenance

▪ Consumable parts

Name	Replacement indications	Recommended replacement cycle
Cooling fan	Check for fan noise and cooling efficiency.	3 years
DC link capacitor	The top of the capacitor swells.	4 years
Relay	Check the relay operation sound when power is supplied to the inverter. LV trips occur when the motor runs.	After inspection

Maintenance

- The replacement cycle for parts varies depending on the operating environment, including ambient temperature and ventilation efficiency. It also depends on the use rate, load, and time operating under load.
- Conditions that reduce the lifespan and affect reliability of the product and its components are as follows:
 - 1) The inverter is located in a space that is exposed to high and significant changes in temperature and humidity.
 - 2) The motors run and stop frequently.
 - 3) The inverter is exposed to significant changes in power supply and load, including changes in voltage, frequency, and waveform distortion.
 - 4) The inverter is exposed to regular vibration.
 - 5) The inverter is exposed to corrosive or flammable substances, oil residue, or dust.
 - 6) The inverter has been in storage for a long time or has been stored incorrectly.
 - 7) The power capacity exceeds the inverter rating. (10 times greater)

▪ Indications for part replacement after long term use)

Part	Description
Main capacitor	<ul style="list-style-type: none"> ▪ Increased motor noise. ▪ Fault trips occur (OCT, OC2,GFT etc.,). ▪ Inverter malfunction due to SMPS damage and long term use of SMPS.
Cooling fan	<ul style="list-style-type: none"> ▪ Decreased fan speed and increased fan noise. ▪ Fan over current condition occurs due to fan malfunctions. ▪ Reduced fan efficiency and fan speed cause an OHT trip and result in deterioration of internal parts due to the high temperature conditions inside the inverter. ▪ Over current at the fan causes SMPS damage.

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