700/720 Model AC DRIVE

User Manual

Sensorless current/flux vector control

Version No. 2.20 (LS700)
Version No. 1.0 (LS720)

Suitable model : Single Phase 110V / 200V Class
Three Phase 200V / 400V Class

Summary differences between LS700/LS720

The ac drive has been set to LS700 model or LS720 model at ex-factory; please see the summary description of relevant difference below:

◎ LS700 with an external PID function (LS720 without this function)

Page No. for description of relevant parameters	Summary descriptions
P4-7	Multifunctional PID applied to set the flow process
P5-29、P5-30	Description of external PID parameters (F115~F123)

◎ LS720 with an second group of Speed PI control (LS700 without this function)

Page No. for description of relevant parameters	Summary descriptions
P4-8	2 groups of speed PI control applied to set the flow process
P5-31	Description of parameters for the second group of speed PI control (F115~F118)

◎ LS720 special machine setup (LS700 without this function)

Page No. for description of relevant parameters	Summary descriptions	
P5-32～P5-34	Parameters	F119:DC brake initiating frequency for shutdown
		F120:DC brake B.B. (Base Block) time for shutdown
		F121:Setting the time unit for acceleration & deceleration
		F122:Start frequency
		F123:Selecting the source for analog control of torque current

This manual is attached a summary difference of parameter setup relevant to LS720 while this model is designed for the special machine industry; when mentioned the 700 Series or LS700 Series in the manual; it means that LS720 series is included; a separate description for introduction will be provided in case they have different contents.

Preface

More and more applications of ac drive are commercially used nowadays as automated process operation becomes popular. Based on our professional commitments by focusing on “provision of modern technologies and promotion of industrial upgrades”, we attach this manual to our high performance ac drive. This manual contains detailed instructions on installation (including operation, maintenance, inspection, and repair), peripheral wirings, specifications, and parameter setup process, and gives you complete description of types and technical operation of the product.

This manual details the types of product and thereof technology & operation in full with the content gone from the easy to the difficult; meanwhile, to help you complete the installation setup in a systematic and efficient way, a summary process flowchart is given in the "Test run" section for you to skip over otherwise complicated setup procedures while saving your time in working out the proper installation.

Thank you for having our LS700 Series current flux vector ac drive (Sensorless), one that has been incorporated the advanced IGBT Module mute design with decades of our expertise accommodated for industrial application. We sincerely hope that our discreetly manufactured current flux vector ac drive can yield the optimal economic benefits for you when applied to your production facilities.

- Peruse this manual before installation, wiring, operation, maintenance, inspection, and repair, and follow the appropriate instructions. For any doubts, please consult with us, or local dealers.
- To prevent any personal injury or property loss due to unexpected accident, please strictly comply with the warning, caution, and danger marks and the prompts following those marks.
- Please put this manual at a place where handy access is allowed for the operators to refer to.


CAUTION

CAUTION To warn that any act of omission to the instructions following this mark may cause personal injury.


WARNING

WARNING To warn that any act of omission to the instructions following this mark may cause personal injury and property loss.


INHIBIT

INHIBIT To warn that any act of omission or violation against the instructions following this mark may cause personal injury and property loss.

- This product has been treated with strict QC and provided with reinforced packing materials prior to its ex-factory to ensure free of any unexpected impact or damage during the shipment.
- Operators referred in this manual include: qualified technicians of service and installation, those who are familiar with technologies involved, and well-disciplined operating employees.

- When both LS700 and LS720 are to take the built-in V/F and vector control, etc. control modes (P5-23) to control the current vector (F92=2), it is necessary to set up the rated capacity for ac drive and motor first, and then execute the inspection & testing for the electric auto parameters (F92=-1 or 0); after successfully setting the parameters, set F92 to 2 that enables an immediate current vector control; and when enabling the V/F or voltage vector control (F92=1 or 3) is desired, it is necessary to set up the rated capacity for ac drive and motor first; please refer to P4-6 for flow process of relevant parameters.

- Each unit of ac drive has been set the basic parametric values before its ex-factory, unless otherwise necessary; please do not change thereof internally set parameter values. Please confirm first the safe allowable range to the motor or the mechanical system before operation or in case that the output frequency must be set to exceed 60 Hz.
- Only qualified technician is allowed to operate this ac drive. The qualified technician to this purpose is referred to one who is familiar with the internal construction, installation procedure, operating method, and service steps of the ac drive; and who also knows how to practice safety measures to prevent any occurrence of hazard and/or accident.
- Before installing the ac drive, please check the environment of the installation site to see if it is suitable for the installation. If yes, firmly secure the ac drive onto a level cement or metal plate wall and properly shielded it from impact by foreign objects during its application that may damage the ac drive.
- When installing multiple ac drives in the same control panel is desired, additional mounting of cooling fans is a must to ensure that the incoming air temperature of these ac drives will not rise too high to affect thereof operation.
- Check if all the wires connected to each terminal block are firmly secured, and all grounding terminals on ac drive and motor are properly earthed.
- Before operating, always verify if the voltage of power supply complies with the rated voltage of the ac drive; and check for correct wiring to any brake controller or brake resistance, if provided.
- Since the VDC of the main circuit inside the ac drive is as high as up to 565 VDC (400V Class)/283 VDC (200V Class), therefore, never use your hands to direct touch any internal circuits of the ac drive to avoid electric shock. Also, do not remove the protection lid when the circuits are energized. Before performing any service or inspection job, make sure to disconnect the power supply first, wait until the “CHARGE” indicator goes off, and then use a multi-meter to verify there is no VDC between the ⊕ P and ⊖ N terminals.
- Terminals inside the ac drive may still carry dangerous voltage even the ac drive stops; so never use hands to touch the terminal block of the ac drive directly. To perform any wiring inspection and service routines, always wait for five minutes or longer after the power supply is turned off and after the “CHARGE” indicator goes off.
- If the use of ac drive is not desired for an extended period of time, be sure to disconnect the power supply to the ac drive, and well prepare the dustproof and moisture-proof measures to avoid unnecessary replacement of parts when using the ac drive is desired in future.
- When the ac drive is going to shut down for an extended period of time, please perform the charging/discharging work for the capacitor once every two months; that is, turn on the power supply for one minute, and then turn off the power supply and wait for the “CHARGE” indicating lamp to go out, re-turn on the power supply, repeatedly perform this cyclic action for more than 10 times in order to prolong the life of ac drive.

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I Installation

Receiving

First-time Use

Thank you for Purchasing our 700 Model AC DRIVE. To protect your right and interests, please confirm the following receiving inspection Prior to the installation and use of ac drive.

Are the descriptions and specifications of the received product the same as your order ?

Please check if the contents in the nameplate side-attached to the product are in line with the purchased specifications.

Any breakage ?

Check the appearance for any damage to the product, such as ingression of water, damaged package or dents on the machine during transportation.

Are there any loosened lids/screws?

Use a screwdriver to confirm their tightness if necessary.

WARNING

Upon receiving Series 700 ac drive, please check it for correct voltage, specifications, and capacity. Any mistake in the voltage class may lead to a burnt-out of the drive, and personal injury or fire hazard in serious case.

Precautions with regard to installation site

Installation Site

INHIBIT

Please keep the ac drive away from the places where the following substances or situations may be easily encountered:

- Inflammable materials, e.g., wood;
- Dust, metal powder, and oil stain;
- Radioactive substance, and EMI;
- Corrosive gases, liquids, water leakage, and high humidity;
- Vibration when installed on a machine vulnerable to vibration;
- Where exposed to direct sunshine, or at an ambient temperature lower than -10 °C or higher than 45 °C ; and
- High attitude of 1000m or higher above sea level.

WARNING

Avoid installing or placing the ac drive in any of the foregoing locations for such adverse circumstances may leave the ac drive open to failure, damage, deterioration, or even fire accident.

Temperature & Humidity

Installation type	Ambient temperature	Ambient Humidity
Closed Wall Mounting	-10 ~ +50°C	Below 95% RH (non-condensation)
In-Panel Mounting	-10 ~ +45°C	Below 95% RH (non-condensation)
Storage Temperate	-20 ~ +60°C	Below 95% RH (non-condensation)

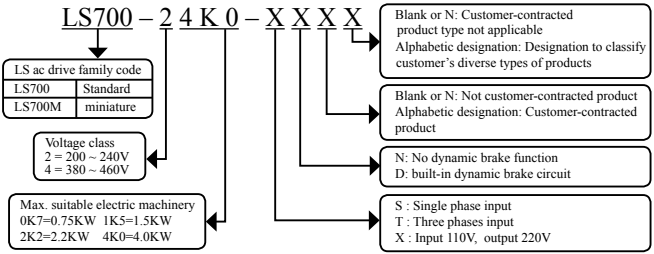
＊The above mentioned temperature and humidity are provided as reference only for your environmental assessment of installation.

Content of nameplate

Found on one side of the ac drive, the nameplate contains model, specification, protection class and other information as described below.

Model No. →	MODEL : LS700-24K0-XXXX (VER 2.20)
Input Spec. →	INPUT : AC 3Ph 200~240V 50/60Hz
Output Spec. →	OUTPUT : AC 3Ph 0 ~240V 6.6KVA
	16.0A cont 24.0A int
	4.0KW 5Hp
Frequency output →	Freq. Range : 0.00~300.00Hz
Protection Class →	PANEL. : IP20 NEMA 1
Manufacturing Series No. →	S/NO :

Description of Model on the Nameplate of the Drive: (MODEL)

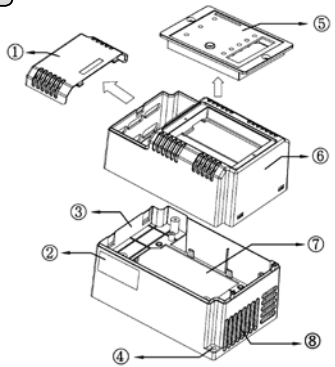


◆ **Model No., specifications and power of ac drive**

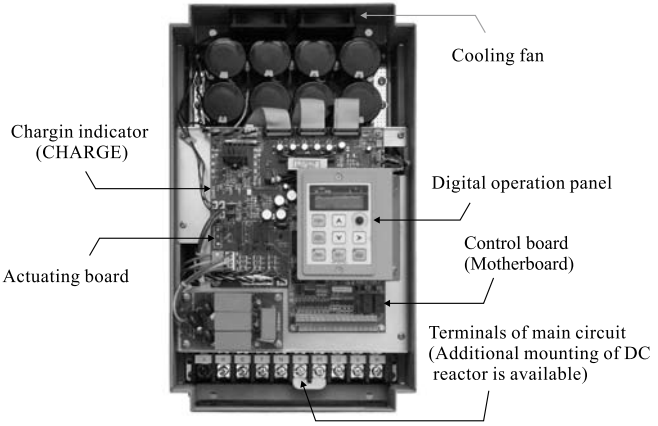
Model No. specifications	Power	HP	Model No. specifications	Power	HP	Model No. specifications	Power	HP
0K2	0.25KW	0.3HP	011	11KW	15HP	075	75KW	100HP
0K4	0.4KW	0.5HP	015	15KW	20HP	090	90KW	125HP
0K7	0.75KW	1HP	018	18.5KW	25HP	110	110KW	150HP
1K5	1.5KW	2HP	022	22KW	30HP	132	132KW	175HP
2K2	2.2KW	3HP	030	30KW	40HP	160	160KW	215HP
4K0	4.0KW	5HP	037	37KW	50HP	185	185KW	250HP
5K5	5.5KW	7.5HP	045	45KW	60HP	220	220KW	300HP
7K5	7.5KW	10HP	055	55KW	75HP			

Parts identification

① Terminal Block Lid
② Specification Nameplate
③ AC Drive Base
④ Setscrew Hole
⑤ Keyboard Panel
⑥ AC Drive Lid
⑦ Heat Sink Location
⑧ Heat Sink Vent



High horsepower control box layout



Removing the AC drive lid

0.5HP ~5.0HP

Step 1: Have one thumb slightly push the locking buckle.

Step 2: Push to lift the lid and remove the terminal lid.

Step 3: To remove the lid for service, have both thumbs press LH & RH locking buckles to unbuckle the lid.

Step 4: Hold and pull upward to remove the entire lid.

7.5HP～30HP

Step 1: Take and hold the PULL UP and push the panel up.

Step 2: Remove the panel.

40HP～300HP

Step 1: Unscrew to remove four screws first.

Step 2: Unscrew to remove four screws first.

Step 3: Finish the removal of panel.

Mounting direction and space

To maintain a good cooling air circulation, the ac drive must be secured in vertical position with sufficient clearance left to its surroundings, abutted components and baffles. Whereas cooling fans are mounted at the base of the ac drive, sufficient space shall be maintained to facilitate the air ventilation.

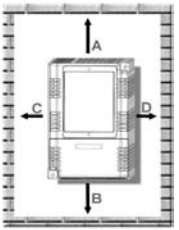
Cautionary points for installations:

(1) For application at an ambient temperature of 40°C or higher, install the ac drive at a well ventilated place or enhance the cooling device for external environment.

(2) Instant generation of high temperature may take place if an additional brake resistor is equipped to the ac drive; please select carefully the installation site for the brake resistor, or mount additional fans to help heat dissipation.

(3) Installation site should be well ventilated and kept far away from inflammables.

(4) Determine the minimum clearance between the body of the ac drive and the wall according to the model of the ac drive and the number of horsepower.



CAUTION

After turning off the power supply, wait five minutes or longer for the complete discharge of the internal capacitor before opening the lid.

Minimum In-panel Installation Clearance (Refer to Chart and Table)

Direction and safe distance / LS700 capacity	A	B	C	D
Below2.2kw	Above≧100 mm	Above≧100 mm	Above≧50 mm	Above≧50 mm
4.0kw ~ 11kw	Above≧120 mm	Above≧120 mm	Above≧50 mm	Above≧50 mm
15kw ~ 22kw	Above≧150 mm	Above≧150 mm	Above≧100 mm	Above≧100 mm
30kw ~ 37kw	Above≧200 mm	Above≧200 mm	Above≧150 mm	Above≧150 mm
45kw ~ 75kw	Above≧300 mm	Above≧300 mm	Above≧200 mm	Above≧200 mm
90kw ~ 220kw	Above≧400 mm	Above≧400 mm	Above≧250 mm	Above≧250 mm

Functions and maintenance of cooling fan

- There is a cooling fan mounted inside the ac drive and will be triggered its running when temperature of ac drive reaches up to 40^{o}C after operation. A temperature rise to reach 85^{o}C(±5^{o}C) due to a heavy & full load or a too-high environment temperature will trip an over temperature protection (Err17).

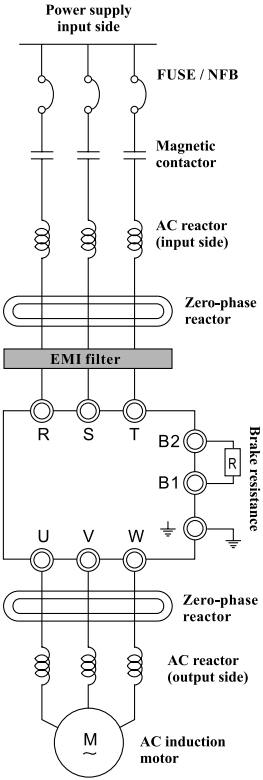
- Regular cleaning and maintenance is necessary to ensure the heat sink function of cooling fan when mounted at a place with worse environmental conditions, such as power, dust, oil sludge and cotton fibers, etc.

II Wiring

Schematic view of peripheral configuration

3-phase 200V/400V Series

System wiring diagram for model avobe 15HP (including)
(For peripheral machines, please select them according to the need)

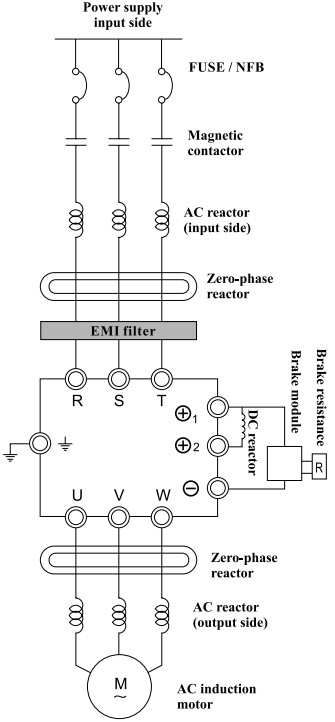


Power supply input side	Please follow the rated power supply specifications from the operation instruction manual to install the power supply (Please see Appendix A P9-1).
FUSE / NFB	There may be a higher input current when turning on the power supply. Please select an appropriate no-fuse breaker or fuse.
Magnetic contactor	When mounted a magnetic contactor (MC) at the power supply side, please do not use this MC to make a frequent ON and OFF operations to avoid failing the ac drive. The number of time to switch ON/OFF MC shall be one time in 30 minutes the utmost.
AC reactor (input side)	When connected to a power supply transformer with a higher capacity (above 600KVA) or switching over to phase capacitance may be desired, a current higher than the peak value will inrush into the input power supply circuit and damage the ac drive; therefore, additional mounting of AC reactor is recommended to improve the power while the wiring distance shall be within 10m.
Zero-phase reactor	Fitted to attenuate the low-frequency interference; especially for the locale with audio frequency device together with interference from the input & output sides reduced as well. The effective range is AM frequency channel 10MHz.
EMI filter	Can be applied to weaken the interference from electromagnetic waves.
Brake resistance	Mounted to shorten the deceleration time for motor. Please see the details in Chapter 8.
AC reactor (output side)	When wired from the output side to motor, the wiring length of motor will affect the magnitude of voltage back wave. An additional mounting of AC reactor is recommended when the wiring length of motor is longer than 20 meters (the closer the wiring length to the ac drive side, the better the effect will be).

3-phase 200V/400V Series

System wiring diagram for model above 20HP (including)

(For peripheral machines, please select them according to the need)



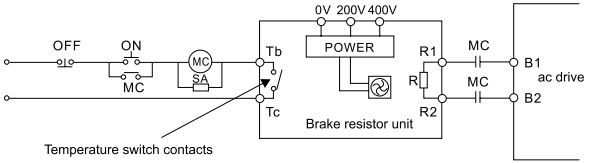
Power supply input side	Please follow the rated power supply specifications from the operation instruction manual to install the power supply (Please see Appendix A P9-1).
FUSE / NFB	There may be a higher input current when turning on the power supply. Please select an appropriate no-fuse breaker or fuse.
Magnetic contactor	When mounted a magnetic contactor (MC) at the power supply side, please do not use this MC to make a frequent ON and OFF operations to avoid failing the ac drive. The number of time to switch ON/OFF MC shall be one time in 30 minutes the utmost.
AC reactor (input side)	When connected to a power supply transformer with a higher capacity (above 600KVA) or switching over to phase capacitance may be desired, a current higher than the peak value will inrush into the input power supply circuit and damage the ac drive; therefore, additional mounting of AC reactor is recommended to improve the power while the wiring distance shall be within 10m.
Zero-phase reactor	Fitted to attenuate the low-frequency interference; especially for the locale with audio frequency device together with interference from the input & output sides reduced as well. The effective range is AM frequency channel 10MHz.
EMI filter	Can be applied to weaken the interference from electromagnetic waves.
Brake resistance And brake module	Mounted to shorten the deceleration time for motor. Please see the details in Chapter 8.
AC reactor (output side)	When wired from the output side to motor, the wiring length of motor will affect the magnitude of voltage back wave. An additional mounting of AC reactor is recommended when the wiring length of motor is longer than 20 meters (the closer the wiring length to the ac drive side, the better the effect will be).

Mounting the brake control circuits

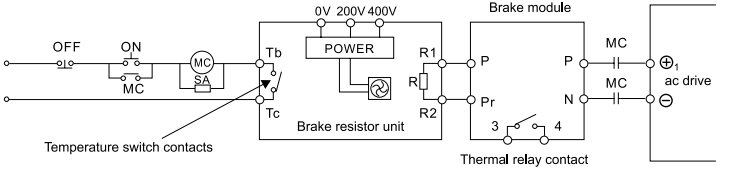
Mounting the brake resistor for overheating protection

To mount the brake resistor (Model No.: LSDR, please see P8-3) onto ac drive for overheating protection.

0.4KW~11KW Ac Drive(200V class/400V class)

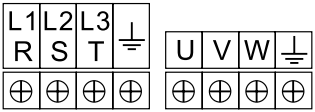


15KW~260KW Ac Drive (200V class/400V class)

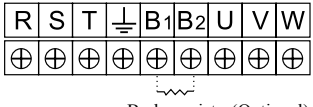


Main circuit terminal block

◆ 0.25KW~2KW (LS700M)

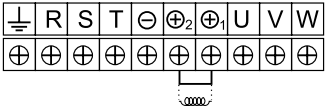


◆ 0.4KW~11KW(200V/400V Series)



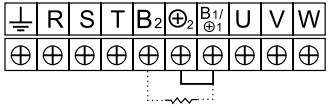
Brake resistor(Optional)

◆ 15KW~22KW (200V Series)
15KW~30KW (400V Series)



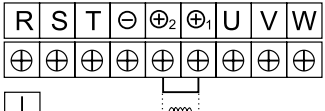
DC reactor(Optional)

◆ 15KW~22KW(200V Series with BRAKE)
15KW~30KW(400V Series with BRAKE)



Brake resistor(Optional)

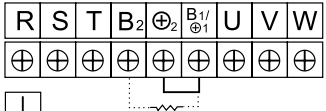
◆ 30KW~55KW(200V Series)
37KW~75KW(400V Series)



DC reactor(Optional)

Grounding terminal is located at exterior of cabinet

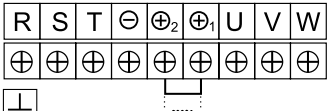
◆ 30KW~55KW(200V Series with BRAKE)
37KW~75KW(400V Series with BRAKE)



Brake resistor(Optional)

Grounding terminal is located at exterior of cabinet

◆ 75KW~110KW(200V Series)
90KW~220KW(400V Series)



DC reactor(Optional)

Grounding terminal is located at left lower corner of terminal block

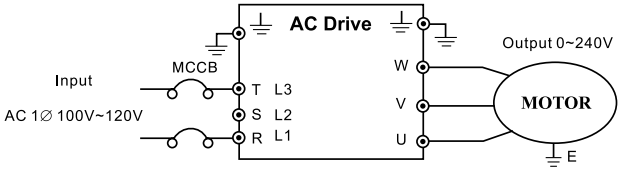
Synopsis of new-old notes on main-circuit terminal blocks

Old terminal note	New terminal note	Descriptions
R/L1, S/L2, T/L3	R/L1, S/L2, T/L3	Power supply input terminal (single/three phases)
U, V, W	U, V, W	AC motor actuator output, connecting the 3-phase induction motor
P, P1	⊕1, ⊕2	Power correction DC reactor connecting terminal; remove the short-circuit tab for installation.
P, B	B1/⊕1, B2	Brake resistance connecting terminal; please purchase the optional item according to the selection table.
P, N	⊕1, ⊖	Brake unit connecting terminal (LSBR Series)
⏚	⏚	Grounding terminal, please follow the 200 V series third-type grounding and 400V series particular grounding from Electrical Code to ground the terminal.

Wiring Method

Phase Main Circuit Wiring Diagram (100-120V)

Single-phase input voltage 115V — (LS700M-10K2-SX、LS700M-10K4-SX、LS700M-10K7-SX)



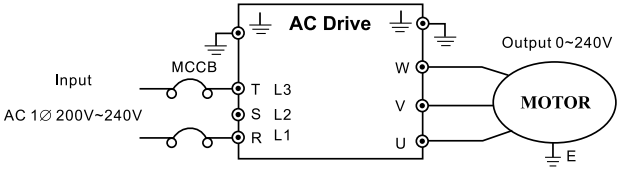
CAUTION

(1) Single-phase input voltage 115V, has not attached brakes the electric circuit.
(2) Every ac drive and motor casing must be well grounded to protect from being struck by lightning and electric-shocked to the human body.
(3) Please wire the 1-phase input voltage 115V to L1 and L3 positions, do not wire it to L2 position.

Type specifications LS700M-1□□□-SX		0K2	0K4	0K7
Output specifications	Applicable motor capacity(KW)	0.2	0.4	0.75
	Applicable max. motor horsepower (HP)	0.25	0.5	1
	Output capacity (KVA)	0.6	1.2	1.7
	Continuously rated current (A)	1.6	3.2	4.5
	Rated output frequency	0.01 ~ 300.00HZ		
	Overload capacity	rated current150%, one minute		
	MAX. Output voltage	2-fold single-phase input voltage		
Input specifications	Input voltage / frequency	Single-phase 100V~120Vac • 50/60HZ		
	Allowable voltage fluctuating rate	Voltage: ±10%		
	Allowable frequency fluctuating rate	Frequency: ±8%		
	Input current (A)	6	9	17

1-Phase Main Circuit Wiring Diagram (200-240V)

1-phase input voltage 230V — (LS700M-20K2-S、LS700M-20K4-S、LS700M-20K7-S、LS700M-21K5-S)



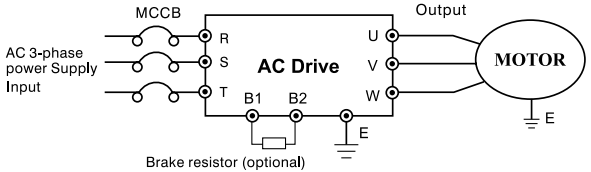
CAUTION

(1) Single-phase input voltage 230V, has not attached brakes the electric circuit.
(2) Each frequency ac drive and motor casing must be properly grounded to prevent lightning and electric shock.
(3) Please wire the 1-phase input voltage 115V to L1 and L2 positions, do not wire it to L3 position.

Type specifications LS700M-2□□□-S		0K2	0K4	0K7	1K5
Output specifications	Applicable motor capacity (KW)	0.2	0.4	0.75	1.5
	Applicable max. motor horsepower (HP)	0.25	0.5	1	2
	Output capacity (KVA)	0.6	1.2	1.7	2.7
	Continuously rated current (A)	1.6	3.2	4.5	7.0
	OutpRated output frequency	0.01 ~ 300.00HZ			
	Overload capability	rated current 150%, one minute			
	MAX. Output voltage	3-phase corresponding input voltage			
Input specifications	Input voltage/frequency	1-phase 200V~240Vac • 50/60HZ			
	Allowable voltage fluctuating rate	Voltage: ±10%			
	Allowable frequency fluctuating rate	Frequency: ±8%			
	Input current (A)	4.9	6.5	9.7	15.7

3-Phase Main Circuit Wiring Diagram -1

（LS700-20K4、LS700-20K7、LS700-21K5、LS700-22K2、
LS700-24K0、LS700-25K5、LS700-27K5、LS700-2011)
（LS700-40K7、LS700-41K5、LS700-42K2、LS700-44K0、
LS700-45K5、LS700-47K5、LS700-4011)

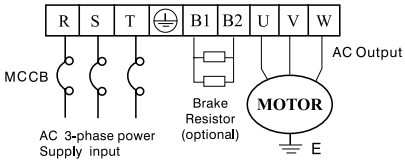


CAUTION

(1) Units in 3-phase 200V and 400V series with a horsepower up to 15HP are fitted a brake circuit. Please see P8-1 for selecting the correct resistance and the watt number.
(2) Every ac drive and motor casing must be well grounded to protect from being struck by lightning and electric-shocked to the human body.

3-phase power supply terminal block

(0.4KW/0.5HP~11KW/15HP)

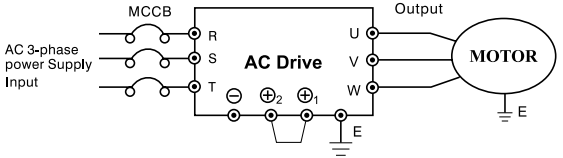


Symbols	Descriptions
R.S.T	Connected to 3-phase power supply input
B1.B2	Can be connected to brake resistor; circuit has been embedded, additional mounting of brake unit is unnecessary.
U.V.W	To be connected to 3-phase motor output terminals
⏚ or ⏚	Grounding terminal

3-Phase Main Circuit Wiring Diagram -2

(LS700-2015、LS700-2018、LS700-2022、LS700-2030、LS700-2037、LS700-2045、LS700-2055、LS700-2075、LS700-2090、LS700-2110)

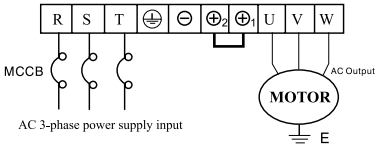
(LS700-4015、LS700-4018、LS700-4022、LS700-4030、LS700-4037、LS700-4045、LS700-4055、LS700-4075、LS700-4090、LS700-4110、LS700-4132、LS700-4160、LS700-4185、LS700-4220)

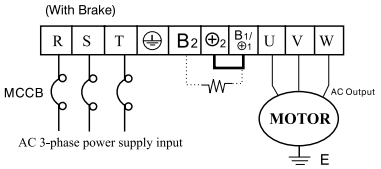


CAUTION

(1) No brake circuit is provided for 3-phase Series 200V and 400V of 20HP or greater. User shall refer to P. 8-1 for selecting correct resistance and wattage of brake unit.
(2) The brake circuit of 20HP～100HP can be customized and fabricated inside the ac drive.(option)
(3) Each ac drive must be properly grounded to prevent electric shock.

3-phase power supply terminal block (Please see P2-4 for detailed descriptions)





Symbols	Descriptions
R. S. T	Connecting the AC 3-phase power supply input.
⊕1 . ⊖	⊕1 , ⊖ terminals can be connected to external brake unit, but direct connection to brake resistor is not acceptable.
⊕1 . ⊕2	For connecting DC reactor
B2. B1	Can be connected to brake resistor, additional mounting of brake unit is not necessary for embedded circuit
⏚ or ⏚	Grounding terminal
U. V. W	Output to connect 3-phase motor terminals

Cautionary points

(1) Wiring of the main circuit

1. Make sure that the connections of power supply for input terminals R.S.T, and output terminals U.V. W (to be connected to the motor) are correct; any wrong connection will lead to a serious damage of the ac drive.
2. Never connect any power factor capacitor, or LC, RC noise filters to the output side of the ac drive.
3. Keep the wirings of main circuit to the ac drive far away from signal cable of the control systems (e.g., PLC, electronic signal system) to avoid interference.
4. Please firmly fasten the screws on main circuit terminals to avoid any production of sparkling due to vibration-loosened screws.
5. The specifications for the distance between the power supply input and output in ac drive are described in the table below.

	standard wiring length	Limit of wiring length
Distance from power supply system →to power supply side of ac drive	Within 2~30 meters	Within 30~300 meters
Output side of ac drive →Junction side of AC electric machinery	Within 2~25 meters	Within 25~200meters
Remedy action to a too-long wiring problem	Additional mounting of input & output reactors is recommended.	Additional mounting of input & output reactors is a must.

WARNING

If the power line is too long, a parasitic capacitance will be produced from the electric machinery and power lines to the ground (lower potential side) that lead to a generation of high-voltage surge to destroy the voltage-withstanding insulation of ac drive and motor.

(2) Ground wires

1. For the purpose of safety and reducing the noise, please apply the third grounding type ⏚ to 200V series and special grounding type ⏚ to 400V series. (grounding impedance below 10Ω) ◦
2. Avoid sharing the grounding electrodes and ground wires with other power facilities including the welding machine and dynamo-machines. Keep the ground wire away from the power cable of large capacity equipment as far as possible.

(3) Circuit breaker for wiring the main circuit – Electromagnetic contactor

To protect the circuit, a NFB, or an additional electromagnetic contactor must be mounted between the AC power supply of main circuit and the LS700 input terminals R.S.T. at the power supply side.

∗ Use of electric leakage circuit breaker :

1. When an exclusive leakage breaker switch for the ac drive is used, please select to set an induced current of 30mA or greater for each ac drive.
2. If a general leakage breaker switch is used, please select to set an induced current of 200mA or greater and a time duration of more than 0.1s for each ac drive.

(4) Surge absorber

Any windings for the peripheral devices of ac drive, e.g., electromagnetic contactor, relay, solenoid valve, etc., must be connected in parallel with the surge absorber to prevent the noise interference. Please refer to the table below for selecting the surge absorber:

Voltage	Where needed	Specifications of surge absorber
200V	Windings of large capacity other than relay	AC250V 0.5uf 200Ω
	Control relay	AC250V 0.1uf 100Ω
400V	Ditto	AC500V 0.5uf 220Ω

Wire gauge cross-reference table for main circuit and control circuit

CAUTION

◎ Before wiring, please confirm that the voltage of power supply conforms to the rated input voltage of the ac drive.
◎ Please follow the regulations set forth in Electric Codes to select the specifications of terminal screws and the size of wire diameter and firmly fasten them.
◎ Wiring the input terminals (1Ø for L1, L2, 3Ø for R.S.T) of power supply side will not cause any phase sequence problem, but wiring the u, v, w terminals at output side may encounter a phase sequence problem and affect the rotational direction of motor; just switch any two of the three wires to fix the problem.

WARNING

◎ The wiring operation for the ac drive must be done only after the power supply is cut off for operation safety.
◎ Please mount a no-fuse MCCB (Molded Case Breaker) at the power supply input side to turn on/off the power supply and protect the input end of the ac drive.
◎ Properly connect the ground wire to avoid possible electric shock or fire disaster.

The rated current of no-fuse MCCB switch shall be ranging 2~4 times of ac drive's rated current.

Table (I) 200V~240V

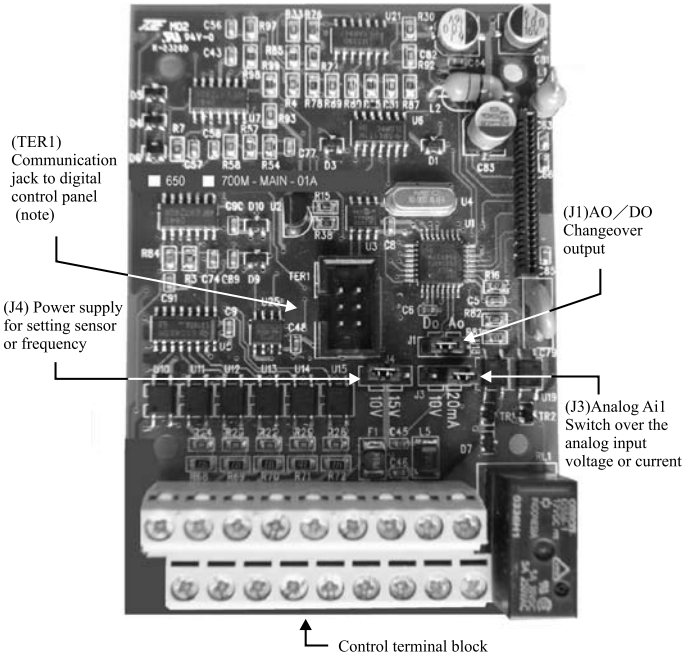
Specifications / Descriptions	20K2	20K4	20K7	21K5	22K2	24K0	25K5	27K5	2011	2015	2018	2022	2030	2037	2045	2055	2075	2090	2110
Capacity KW/HP	0.2 / 0.25	0.4 / 0.5	0.75 / 1	1.5 / 2	2.2 / 3	4.0 / 5	5.5 / 7.5	7.5 / 10	11 / 15	15 / 20	18.5 / 25	22 / 30	30 / 40	37 / 50	45 / 60	55 / 75	75 / 100	90 / 125	110 / 150
3-phase MCCB rated current(A)	10	10	15	20	30	40	50	60	100	125	150	200	225	250	300	400	450	600	700
Power line wire gauge (mm^2)	2.0					3.5	5.5	8.0	14	30			50	60	80	100		150	
Main circuit screws	M4							M5		M6	M8			M10		M12			
Wire gauge for control loop (mm^2)	0.5 mm^2 ~ 1.25 mm^2																		

Table (II) 380V~460V

Specifications / Descriptions	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220
Capacity KW/HP	0.75 / 1	1.5 / 2	2.2 / 3	4.0 / 5	5.5 / 7.5	7.5 / 10	11 / 15	15 / 20	18.5 / 25	22 / 30	30 / 40	37 / 50	45 / 60	55 / 75	75 / 100	90 / 125	110 / 150	132 / 175	160 / 200	185 / 250	220 / 300
3-phase MCCB rated current(A)	5	10	15	20	20	30	40	50	60	75	100	125	150	175	250	300	400	500	600	600	800
Power line wire gauge (mm^2)	2.0			3.5		5.5		8.0		14	22	38		50	60	100				120	
Main circuit screws	M4						M5		M6			M8			M10		M12				
Wire gauge for control loop (mm^2)	0.5 mm^2 ~ 1.25 mm^2																				

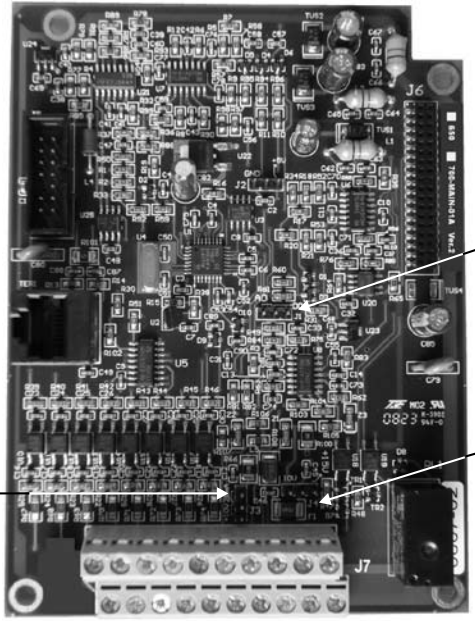
Location of control terminal block

LS700M Control board (Motherboard)



※ Please see P2-16 for the function description of the jumpers (J1, J3, J4), and P2-14 ~ P2-18 for the function description of the control terminal block.

LS700 Control panel (Motherboard)



※ Please see P2-16 for the function description of the jumpers (J1, J3, J4), and P2-14 ~ P2-18 for the function description of the control terminal block.

◆ LS700M Specification of communication connector to the digital operation panel.

1. LS700M exclusive communication connector as shown in the left picture.

◆ LS700 Specification of communication connector for digital operation panel

2. RJ45：A short connector as shown in the left photo shall be used instead of the general-purpose communication connector available in the market.

◆ Control terminal block

LS700M control terminals – Wiring addresses and sequence are shown follows :

Di1	Di3	Di5	DCM	Do	Ai1	Ao	E	Tc
Di2	Di4	Di6	COM	Ai2	+10V	AVG	Ta	Tb

LS700 control terminals – wiring addresses and sequence are shown follows :

Di1	Di3	Di5	Di7	DCM	Do	Ai1	Ao	E	Tc
Di2	Di4	Di6	Di8	COM	Ai2	+10V	AVG	Ta	Tb

※ Please use slender type "-" or "+"(#101 screwdriver) screwdriver to unscrew the terminal screws on the terminal block, then route the wire from the wiring opening below the terminal block to connect respective terminal and firmly fasten the terminal screws. (Please refer to P2-15 for cautionary points when wiring the terminal block is desired)

Wiring connection of control circuit terminals

Cautions for wiring the control circuit

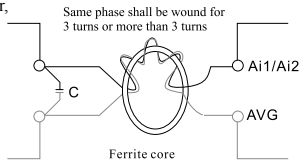
WARNING

Shielded & meshed wire shall be applied and grounded to connect the control circuit and terminal block. Improper wiring will cause serious interference, make operation abnormal and result in accident, personal injury and property loss.

- ☑ For safety concerns, select suitable specifications of wire gages for wiring connection in accordance with the Electric Code.
- ☑ For overseas customers, please follow the national regulations relevant to power wiring connection locally.
- ☑ Control circuit wiring: Wire to connect the control circuit wirings after separating the main circuit wiring from other power cable electricity wires; if interlacing the wiring connection is necessary, please make it in a cross connection of 90 degrees.
- ☑ Communication cables for all I/O control signals or remote digital operation editor must be separated from power cables of large current (power supply, motor, brake) as far as possible, and shall never be configured with these power cables in the same cable tray.
- ☑ As long as the indicating lamp of digital operation panel is on never attempt to connect or remove any cable.

Analog input terminals (Ai1, Ai2, AVG)

- ☑ Connecting to a weak analog signal is easily interfered by external noise, therefore, the wiring length for connection shall not be too long (less than 20m is recommended), and a shielding wire shall be used. Moreover, the peripheral meshed wires to the shield wires shall be well grounded; for a bigger induced noise, connection to AVG terminal can access a better effect.



- ☑ When connecting the external analog signal output is desired, an error action may taken place due to the interference produced from the analog signal output and the AC motor actuator; when encountered such a situation, connecting the external analog output side to a capacitor and a ferrite core can inhibit the noise. Such a connection is shown in the right figure:

Digital input terminals (Di1~Di8, COM)

- ☑ Multifunctional input terminals are characterized as dry contact that cannot be input any signal carrying voltage; when inputting signal to contacts for control, in order to prevent the occurrence of bad contact, contacts with high reliability in contacting the weak signal shall be used.

Do output (Do, DCM)

- ☑ When enabling the control relay is desired, a surge absorber or a flywheel diode shall be connected in parallel to both ends of exciting coil while attention shall be made to the correctness of polarity for connection.

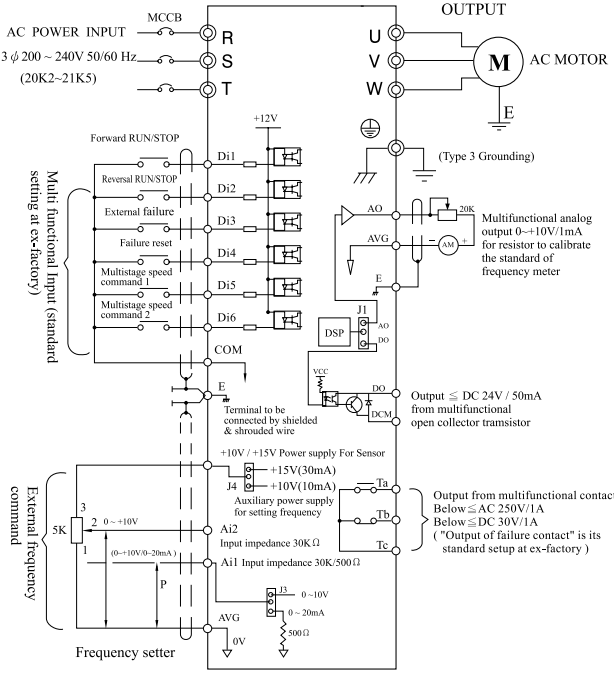
Functional description of control circuit terminals

* The following summary chart describes the standard setting at ex-factory for each control terminal.

Terminal mark		Designated function	Descriptions
Multifunctional input terminals	Di1	Forward rotation command	Di1-COM ON for forward rotation running, and OFF for stop
	Di2	Reverse rotation command	Di2-COM ON for reversal rotation running, and OFF for stop
	Di3	Input at external failure	External fault signal ON trips the ac drive to stop.
	Di4	Failure reset	Di4 ON releases the status imposed and maintained by the circuit protection action against failure.
	Di5	Multistage speed command 1	To take binary 2 Bit to execute 4-stage speed control when enabled.
	Di6	Multistage speed command 2	
	Di7	Inching operation	To execute the inching frequency operation when enabled ON. LS700M has no interfaces for Di7 and Di8.
	Di8	Free run stopping	When enabled (ON) a stop command, ac drive stops outputting voltage immediately that leaves the motor to a coast down running and stop.
	COM	Common terminal for digital input	Common terminal for multifunctional input terminals.
Analog frequency setup	+10V	+15V Sensor power supply	Power supply outputs DC+15V (maximum current 30mA) for sensor use.
		+10V power supply for setting up frequency	Power supply outputs DC+10V for frequency setup (maximum current 10mA)
	Note 1：To output the +10V of +15V to output voltage is determinedbyJ4;ex-factory setting is +10V output.		
	AVG	Common terminal for frequency setup	Common terminal of input signal (terminal Ai1, Ai2) for frequency setup.
	Ai1	Analog voltage or current signals command	Input impedance 30kΩ at input voltage DC 0~10V/or input impedance 500Ω at input current DC 0~20mA is determined by the J3 command selected from the voltage or current signal.
	Ai2	Analog voltage signal command	Input impedance 30kΩ at input voltage DC 0~10V.
Multifunctional output terminals	AO	Analog output	Multifunctional analog output monitoring (DC 0~10V); common terminal is AVG.
	DO	Frequency to reach	This contact will be enabled “ON’ status when output frequency of ac drive reaches the frequency setting (F70)
	Note 2：It can only have one choice, either AO or DO, as a synchronous setting output made by software and hardware J1. Software AO is to be established by parameters F56~F58 while software DO is to be set up by parameter F69.		
	DCM	DO Output common terminal	Common terminal for signals from multifunctional input/output terminals.
	Ta	Output at failure	Contacts 1a and 1b will be enabled when triggered by the protection function against ac drive failure.
	Tb		* Ta-Tc is closed (ON) at failure.
	Tc		* Tb-Tc circuit is opened (OFF) at failure.
	E	Terminal for grounding wire	Shrouded and shielded wire shall be exclusively used as grounding wire.

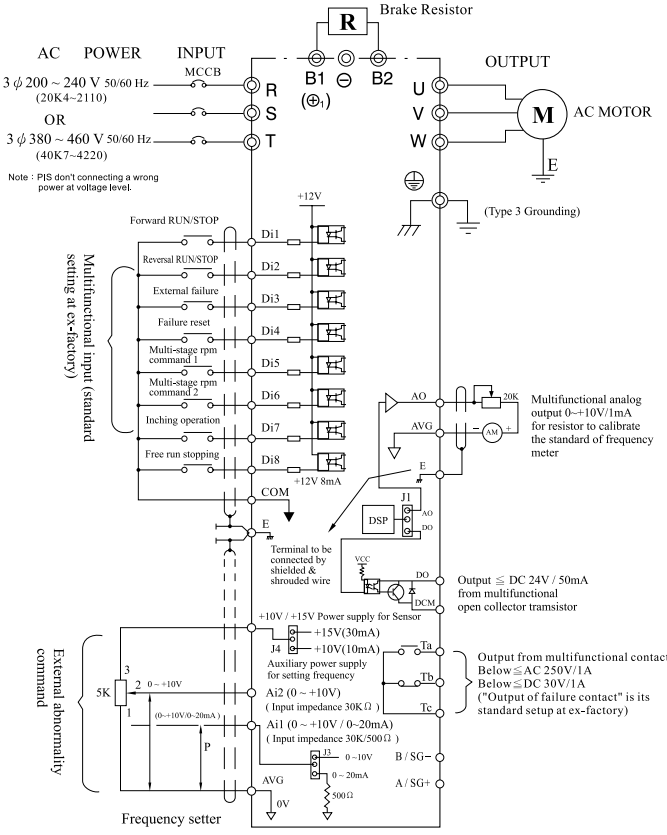
Wiring diagram of control circuit terminal

LS700M control circuit wiring diagram



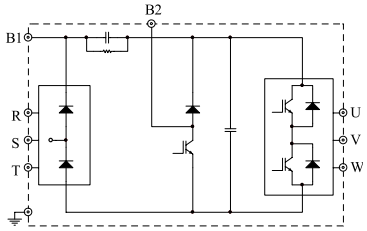
symbols	descriptions	
AVG	Signal grounding end	Grounding end 0V of signal DC+10V
COM		Grounding end 0V of signal DC+12V
⏚	Grounding pin of control box body is connected to E.	
E	Grounding pin of motor or shielded wire network wire.	
⏚ or ⏚	Grounding pin of control box body is connected to E and ⏚ for turn on.	

LS700 Control circuit wiring diagram

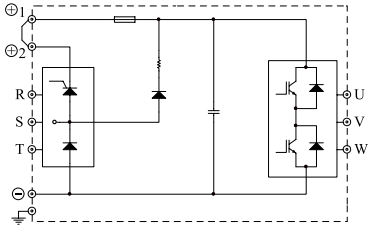


Main circuit constitution diagram

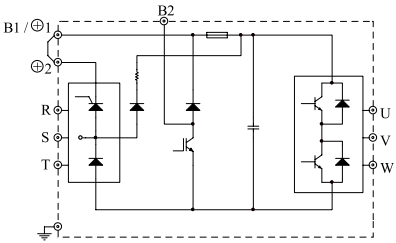
200V Series Models: (LS700-20K4~LS700-2011)	400V Series Models: (LS700-40K7~LS700-4011)



Models: LS700-2015~LS700-2110，LS700-4015~LS700-4220

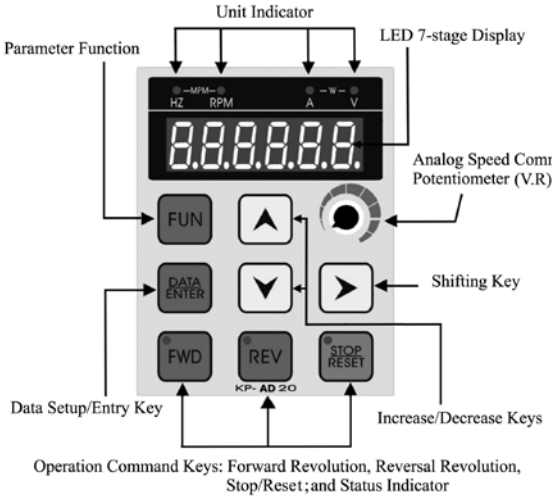


Models: LS700-2015~LS700-2055，LS700-4015~LS700-4075 (With Brake Chopper)



III Digital Operation panel

Panel details

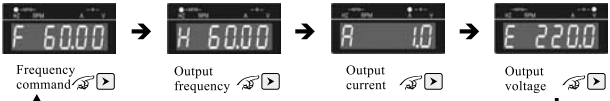


Functions of digital operation panel

The operation panel is able to perform the functions of running, shutdown, and frequency setup, monitoring the running status, parameter setup and failure display, etc.

Prompt & cyclic display functions during operation

A press of ➤ key from the digital operation panel during operation is able to display the functions in the following order: Frequency command → Output frequency → Output current → Output voltage.



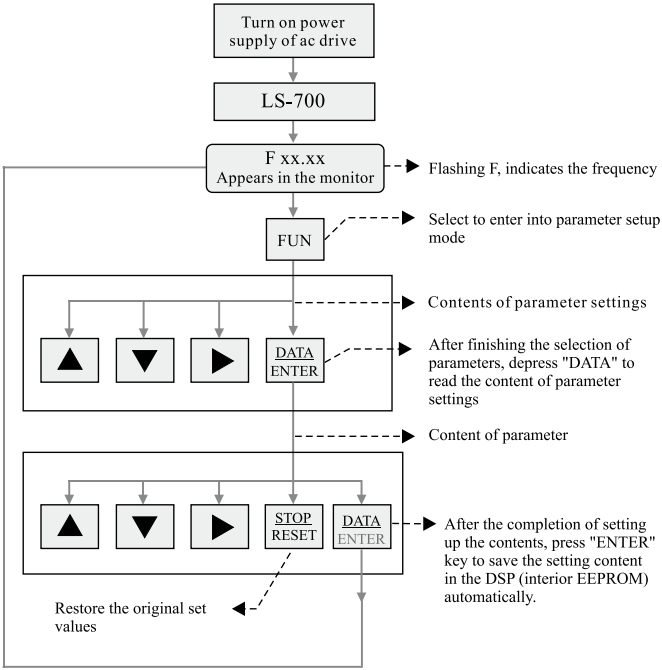
Function description of Keys

Classific -ation	Keys	Summary descriptions of functions
Parameter / Data keys	FUN	Depress to enter into Parameter Function Mode.
	DATA ENTER	To read and write parameter settings.
		To confirm and enter data, and save the data at DSP (interior of EEPROM) automatically.
Shift, increment, decrement keys	➤	To move the position of flashing cursor rightward to select the place for data entry.
		* **Each depress of right-shift key will enable a cyclic display during the operation.** F: Frequency command → H: Output frequency → A: Output current → E: Output voltage →
	▲	Depress to make an increment of numerical values for parametric encoding and setting values, etc.
		To perform the frequency setting under operation control mode by setting the F4: Frequency command source = 0 to the digital operation panel.
	▼	Depress to make an decrement of numerical values for parametric encoding and setting values, etc.
		To enter into F0 to monitor variety of displays under the operation control mode.
Operation command keys	FWD	To execute an operation command in forward revolution and illuminate the LED indicator.
		To serve as a function key to execute the stop running command when setting the revolving direction is not limited to the FWD command.
	REV	To execute an operation command in reversal revolution and illuminate the LED indicator.
		To serve as a function key to execute the stop running command when setting the revolving direction is not limited to the REV command.
	STOP RESET	To execute the STOP running command.
		To reset the failure when encountered a failure; depress of this key in parameter setup mode will restore the original setting values.
Speed command		Speed control for operation panel Ai (V.R) when F4 : Frequency command source = 1

Parameter setup mode

This mode is for changing the set values of internal parameters. Please use the Increment, decrement, and shift Keys to change the parameter settings, and press the ENTER/DATE key to save the changed data in DSP (interior EEPROM) automatically and exit the setup mode. For more details of parameters, please see the “Summary of parameter setting” in the Appendix C.

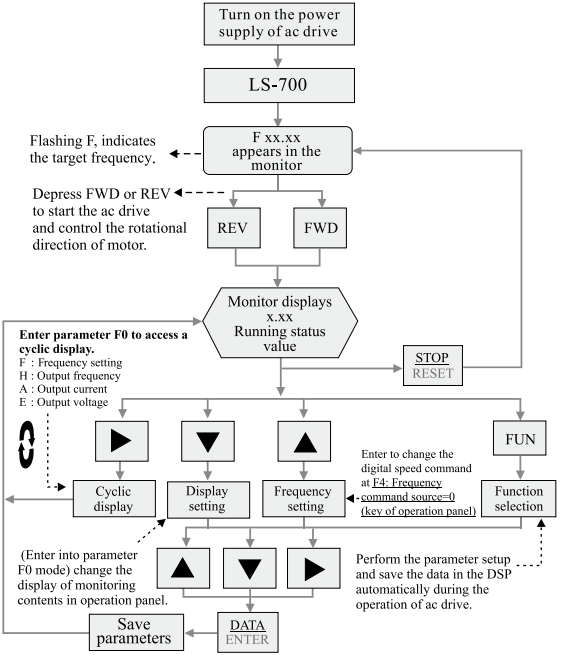
Flow process of parameter setup mode



Control mode

The flowchart of control mode for the digital operation panel is given below. This mode is to control the operation and display the frequency commands, output frequency, output current, output voltage, failure content, failure records, etc. For details of parameters, please see Appendix C. “Summary of Parameter Settings”.

Flowchart of control mode for digital operation panel



Note 1：If the speed signal source is not under F4 (Frequency command source)=0:digital operation panel mode, then the digital speed command will be ineffective.

Status check menus of digital input terminals

◆ **Accessible from F0=13 : Din (display the status of the input values of the digital terminal)**

◆ **To check the display of digital input status, it can only be available when the ac drive is running.**

Example No.	Digital total value	Di8	Di7	Di6	Di5	Di4	Di3	Di2	Di1	Digital terminals Digital bit value
		128	64	32	16	8	4	2	1	Indicating value When enabled
1	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Indicating value When enabled
		X	X	X	X	X	X	X	X	
2	42	OFF	OFF	ON	OFF	ON	OFF	ON	OFF	Indicating value When enabled
		X	X	32	X	8	X	2	X	
3	87	OFF	ON	OFF	ON	OFF	ON	ON	ON	Indicating value When enabled
		X	64	X	16	X	4	2	1	
4	176	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	Indicating value When enabled
		128	X	32	16	X	X	X	X	
5	199	ON	ON	OFF	OFF	OFF	ON	ON	ON	Indicating value When enabled
		128	64	X	X	X	4	2	1	
6	216	ON	ON	OFF	ON	ON	OFF	OFF	OFF	Indicating value When enabled
		128	64	X	16	8	X	X	X	
7	222	ON	ON	OFF	ON	ON	ON	ON	OFF	Indicating value When enabled
		128	64	X	16	8	4	2	X	
8	255	ON	ON	ON	ON	ON	ON	ON	ON	Indicating value When enabled
		128	64	32	16	8	4	2	1	

◆ **Digital total value is to check if Di1 ~ Di8 digital terminal blocks operate normally.**

Example 1 : Digital total value is 0, terminals Di1～Di8→ are all OFF。
Example 2 : Digital total value is 42, terminals Di2、Di4、Di6→are ON state。
Example 3 : Digital total value is 87, terminals Di1、Di2、Di3、Di5、Di7→are ON state。
Example 8 : Digital total value is 255, terminals Di1～Di8→are all ON。

*** Take Example 2 for the calculation: Digital bit value of Di2 is 2, digital bit value of Di4 is 8 and digital bit value of Di6 is 32, therefore, the indication of digital total value is 2+8+32=42.**

IV Test run

Test run operation

#Pre-start confirmation:

◎ After the completion of wirings and before supplying the power for test run, please go through the following checkups:

1. Check if wirings are correct.「input terminals R.S.T shall be wired to power supply while output terminals U.V.W shall be connected to 3-phase induction motor」. Phase reversal at input/output terminals is not allowed.
2. Look around the interior and all the wiring terminal blocks inside the ac drive to see if there are any wire chips of leads; make sure to remove them thoroughly.
3. Check if terminals and screws, etc. components are firmly and tightly fastened.
4. Check if there is short-circuit or grounding among the terminals.
5. Check if the voltage of the input power supply is the same as the rated voltage of the ac drive. 200V class : Single/3-phase AC200~240V 50/60HZ
   400V class : 3-phase AC380~480V 50/60HZ

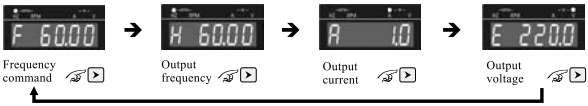
#Test run:

◎ F92 = 1, the V/F voltage control mode. was set to the ac drive at ex-factory; however, selecting a control mode according to F92 is available as well; please see P.5-20 for details. F3 = 0 is to enable the digital operation panel as the means for operation control while F4 = 1, the frequency command source, is to enable a control over the Variable Resistor (V. R.) from the operation panel. Before supplying power to perform the test run, please rotate the V. R. knob counterclockwise all the way to the bottom, and then turn on the power supply. Please perform the test run according to the following steps:

1. Turn on the power.
2. Verify the indicated status is "F ××.××".
3. Enter into the operation control mode (Depress FWD to enter into the operation control for forward rotation).
4. Input the speed command (rotate slowly the potentiometer knob in operation panel clockwise and perform the test run within 10Hz)
5. Depress STOP key to slow down and stop motor.

#Operation checklist :

◎ Check if motor runs in correct direction of rotation.(Interchange any two of the phase lines to change the motor's direction of rotation.)
◎ Check if motor runs smoothly.
◎ Check if motor vibrates abnormally.
◎ Check if acceleration and deceleration are smooth.
◎ Check if output load current is normal.(Press the ▼ key to access parameter F0=2 : output current, or right-shift cyclic key to monitor the output load currents.)



Auto tuning

#Prerequisites for Auto-tuning

◎ If F92=2: sensorless flux vector, or 3: sensorless voltage vector control is selected as the control mode, auto tuning must be performed prior to the drive operation.

◎ Before executing the auto tuning function of parameters, it is necessary to establish the following parameters in accordance with the capacity data specified in the nameplate of motor: F87 : rated frequency, F88 : rated voltage(rms), F89 : rated current(rms), F90 : horse power rating (HP), F91 : number of poles of motor, etc.

*** Note**: **Set up the parameters to go with actual motor capacity.**

◎ Please select F3 (operation control source) =0 : operation by digital operation panel when performing the auto tuning.

Caution: Dynamic parameter tuning: After executing the FWD command for motor to run at 40HZ for about one minute, then the detection of motor parameter at no-load or heavy-load is available

CAUTION

When performing the auto tuning, **the motor must be disengaged from the machine** and a confirmation that there will be no danger at all even the motor is running shall be made.

#Parameter auto-tuning

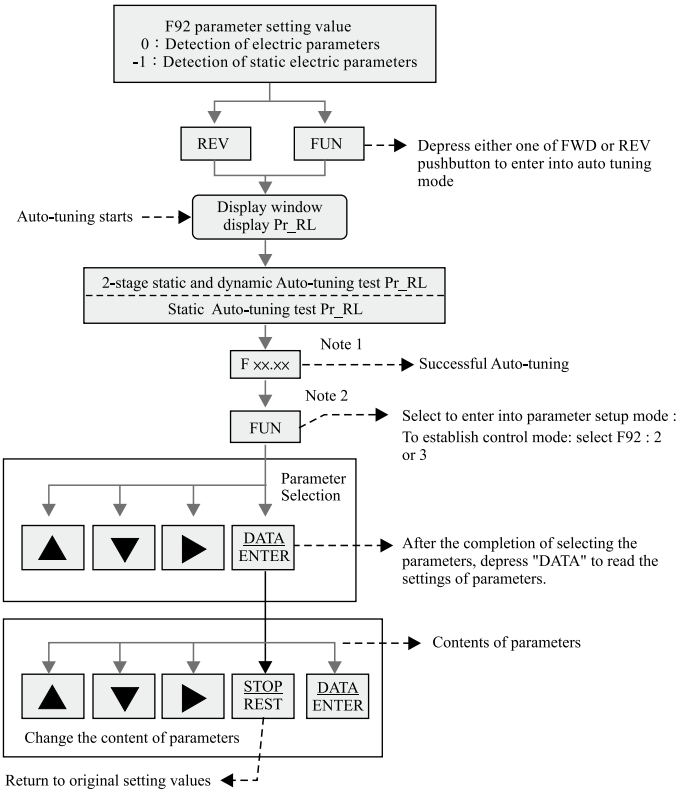
◆ **Parameter tuning** (F92) -1:Auto tuning of static electric parameters: This function is designed for those machinery equipments coupled with heavy duty that fails the detection of dynamic parameters; however, it shall be used in association with the setup of parameter F97 (motor's no-load current %) so that the motor's electric parameter group (F93~F96) can be detected in full while the accuracy in this regard is lower than the 0: Electric parameter Auto tuning.

◆ **Parameter tuning** (F92) -0: Electric parameter auto tuning: To execute an automatic tuning for static and dynamic parameters.

◆ **When performing the auto-tuning for electric parameters, the ac drive will continue to perform the functions of static parameters auto-tuning or static & dynamic parameters auto-tuning. Thus performing is able to automatically detect the electric characteristics of motor and set up the motor's electric parameter group, and then save the parameter settings in the software. Perform the auto-tuning according to the following steps:**

1. Depress "FWD" or "REV" pushbutton to pop up a display of Pr-RL indicating that ac drive starts outputting DC current to motor to perform the parameter tuning of static mode for the first stage and parameter tuning of dynamic mode in relation to the rotational operation of motor for the second stage.
2. If the auto-tuning has been successfully executed, the ac drive will automatically set up the electric characteristics of the motor to their corresponding parameters F93~F97.
3. Change the control mode (F92) to one of the two control modes: 2: Sensorless flux vector Control.

Auto-Tuning flow chart



Note 1：Detection of electric parameters is completed.
Note 2：Set up the relevant operation control mode from F92

Basic parameter setup

Parameter code	Descriptions	Setting range	Unit	Ex-factory setting	Page No
F3	Operation control source	0～1		0	P5-2
0: Digital operation panel 1: Digital input terminal					
F4	Frequency command source	0～8		1	P5-2
0: Digital operation panel (main speed) 3: Ai2 6: Ai1, Ai2 / MIN 1: Operation panel Ai (V.R) 4: Ai1+Ai2 7: PID (LS720 retention) 2: Ai1 5: Ai1, Ai2 / MAX 8: Digital terminals for acceleration & deceleration					
F5	Enabling the DC brake mode	0～2		0	P5-3
0: Started from zero speed 1: DC brake rerun 2: Resistance calibration + DC brake rerun					
F8	Stop mode	0～2		1	P5-4
0: Free run stopping 1: Dynamic stopping 2: Dynamic + DC brake					
F11	Restriction of rotational direction	0～3		1	P5-5
0: Forward and reversal rotation 2: Reversal rotation only 1: Forward rotation only 3: Backward rotation available for negative bias					
F12	Lower limit of frequency(※F12≦F13)	0.00～60.00	Hz	0.00	P5-5
F13	Upper limit of frequency(※F12≧F13)	0.00～300.00	Hz	60.0 (Note)	P5-5
F31	Main speed (inching) acceleration time	0.1～3000.0	Second	10.0	P5-7
F32	Main speed (inching) deceleration time	0.1～3000.0	Second	10.0	P5-7
F60	Di1、Di2 setup	0～2		0	P5-12
0：Di1(FWD/STOP)，Di2(REV/STOP) 2：3-wire shutdown:Di3(FWD/REV), Di2(Stop), Di1(Running), 1：Di1(RUN/STOP)，Di2(FWD/REV) disable F61 setup automatically at the same time					
F73	Stall-Protection setup	0～31		7	P5-16
bit4: AVR Voltage-regulating function bit3: Protection function F77 bit2:Protection function F76 bit1: Protection function F75 bit0: Protection function F74					
F74	Stall voltage setup for deceleration	1.00～1.25	1.414*F85	1.20	P5-17
F75	Stall current setup for acceleration	0.50～2.50	F89	170.0	P5-18
F76	Stall current setup for operation	0.50～2.50	F89	160.0	P5-18
F77	Current level for electronic thermal relay	1.01～2.50	F89	1.50	P5-18
F78	Acting time for electronic thermal relay	0.1～120.0	Second	60.0	P5-18
If $\int (I^2_{A(pu)}-1) dt \geq (I^*_{OL}{}^2-1) \times T_{OL}$ Will lead to an overload and overtime					
ac drive parameters	F84	PWM carry frequency	2000～16000	Hz	5000	P5-21
	F85	RST input voltage (rms)	150～480	V	N (Note)	P5-21
	※ Note: Make different F85 setup according to the actually input voltage.					
	F86	Vdc indicating value gain (read only)	50～300	folds	140	P5-21
motor nameplates	F87	Rated frequency (Hz)	40.00～150.00	Hz	N (Note 1)	P5-22
	F88	Rated voltage (rms)	150～480	V	N (Note 1)	P5-22
	F89	Rated current (rms)	0.5～600.0	A	N (Note 1)	P5-22
	F90	Horse power rated	0.20～300.00	Hp	N (Note 1)	P5-22
	F91	Number of poles	2～16	Poles	N (Note 1)	P5-22
	※ Note: Set up F87 ~ F91 according to the actual capacity of motor.					
F92	Control mode setup	-1～3		1	P5-23
-1: Auto-tuning of static electric parameters 1: V/F voltage control 3: Sensor-less voltage vector control 0: Auto-tuning of electric parameters(standard Mode) 2: Sensor-less flux/vector control					

Fast operation control mode

#Fast operation control mode

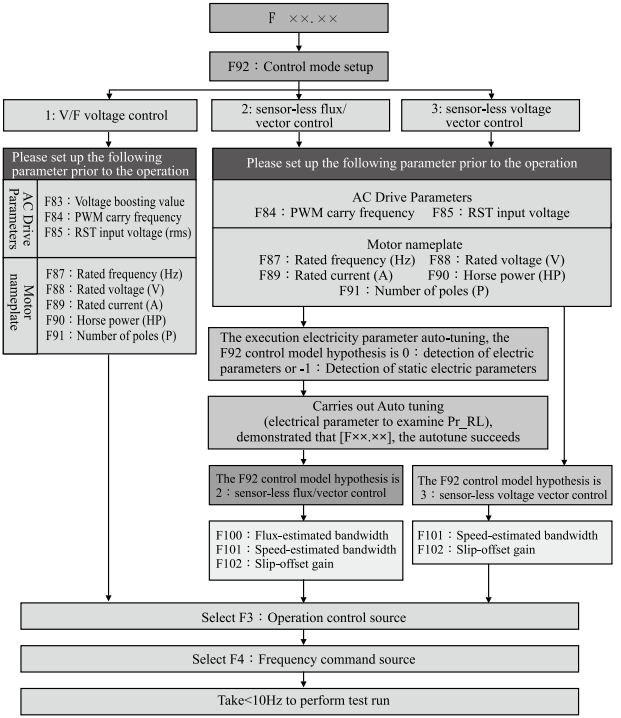
◎ There are several operation control methods applicable to the ac drive for the startup operation. You can use the following operation methods to simply and quickly start the ac drive.

◎ There are two primary operation control parameters to start the operation of ac drive: one is the F3: Operation Control Source and the other one is F4: Frequency command source. Please see the table below for description of operation.

Parameter function	Description of operation procedures	Ex-factory setting	Page No.
F3: Operation Control source			
0 : Digital operation panel	Depress [FWD] key after "F xx.xx" shown in the display window ↓ Enter into the forward-rotation operation mode	0	P5-2
	* Please pay attention to the motor's direction of rotation when performing the test run.*		P5-2
1 : Digital input terminal	Terminal Di1 /ON →FWD(indicator ON) Run → OFF/stop.		P5-2
F4 : Frequency command source			
0 : Digital operation panel	Depress the ▲ key under running state to enter into the frequency-changing mode.	1	P5-2 ~ P5-3
1 : Operation panel Ai input(V.R)	To perform the speed control from the potentiometer (V.R.) in operation panel.		
2 : Ai1 input (+10V/20mA)	To perform the speed control by inputting 0~+10V/0~20mA to analogy terminal Ai1.		
3 : Ai2 input (+10V)	To perform the speed control by inputting 0~+10V to analogy terminal Ai2.		
4 : Ai1+Ai2	To perform the speed control by making an addition operation of two analog signals from Ai1 and Ai2 analog terminals at the same time.		
5 : Ai1, Ai2/MAX	To take the maximum value from two sets of analog signals, Ai1 and Ai2, to perform operation control.		
6 : Ai1, Ai2/MIN	To take the minimum value from two sets of analog signals, Ai1 and Ai2, to perform operation control.		
7 : PID (LS720 retention)	To execute the external analog signals for PID feedback control.		
8 : Digital terminals for speed increase or decrease keys	To perform speed increase and decrease control by inputting signals to digital input terminals.		

#Three kind of control model choice hypothesis flow

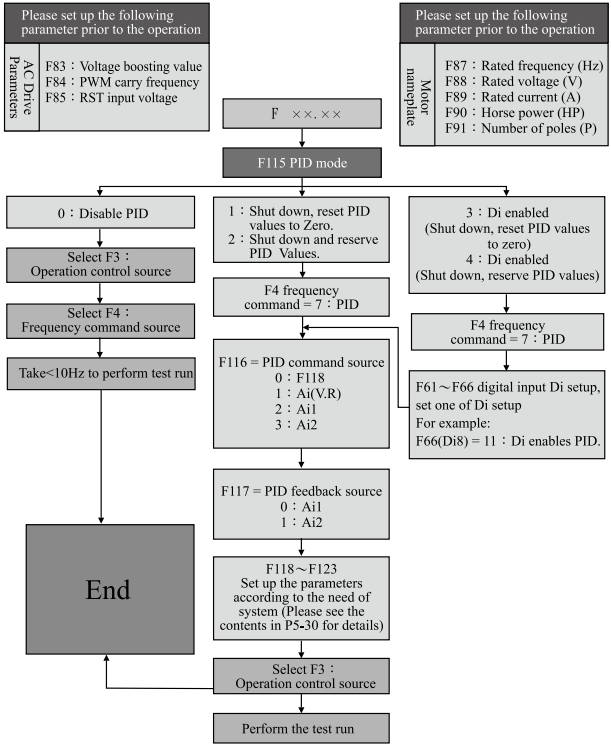
- LS700 provides three kind of control model F92=1:V/F voltage control, 2: sensor-less flux/vector control, 3: sensor-less voltage vector control. The user may act according to own application demand, uses several manipulators to make the control model choice hypothesis.
- When inverter in leaving the plant, has established is the V/F control model, before the test run, invites according to next table flow hypothesis control model and the motor related parameter.



#Multifunctional PID setup

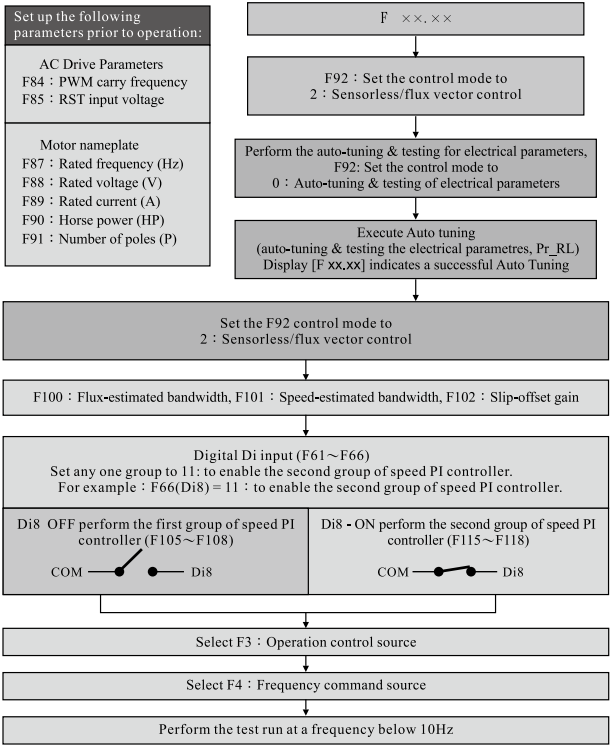
◆ A PID control technology to apply the advanced digital coding technology by combining, tuning and consisting of three aspects of P (Proportion), I (Integration) and D (differential).

◆ When PID control module is in use；generally, both acceleration & deceleration times of F31 and F32 are set less than 2.0 seconds.



#LS720 special application parameter hypothesis

◆ LS720 has 2 group of speed PI controller to provide control model F92 = 2: sensor-less flux/vector control operation. The user may act according to own application demand to make the hypothesis. (Di establishes 11: Sends can 2nd group of speed PI controller this population of parameters be LS720 special-purpose, LS700 does not have this function)



V Description of parameter functions

Display setup of operation panel

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F0	Select the variables to be displayed in operation panel	0～16		1

※ Operation panel has been equipped with 7-staged display window and LED lamps to monitor the running status data, 15 data in total, of ac drive during standby or operation.

Set value	Function	Description of function	Related parameters
0	Set up frequency (F)	Set up the frequency of display..	
1	Output frequency (H)	Display the output frequency.	
2	Output current (A)	Display the load of current output (U,V,W) to drive motor.	
3	Output voltage (E)	Display the output voltage (U,V,W) (rms)	
4	Normal voltage at D.C. side (Vdc)	Display the DC voltage of capacitor running on capacitor.	
5	Voltage before start at D.C. side (Vdc)	The DC voltage at DC bus of capacitor before startup.	
6	Compensation frequency of output power supply (HZ)	Monitor the compensated value of output frequency.	
7	Speed estimation (rpm)	Monitor the predicted speed under sensor-less flux/vector control.	F92=2
8	Digital operation panel Ai (%)	● Monitor the displayed percentage % of analog input voltage. ● Monitor the noise voltage generated from the wiring as well and use this voltage to set up the bias voltage to avoid unnecessary noise interference.	F4=1
9	Ai1 (%)		F4=2
10	Ai2 (%)		F4=3
11	Torque current command (A)	Data of torque current command in vector control mode	
12	PID(%) (LS720 Reserved)	Display the PID-controlled output value in %.	
13	Input status value at digital terminals	Able to monitor the control of digital input terminals and access a real-time numerical display of status during the standby and running modes (please see P3-5 for status monitoring)	F61~F66
14	Software version	To display the version number of software.	
15~16	Reserved	Reserved	

○	F1	Unit of speed display	0～1		0

◆ This parameter is to set up the display of output unit for running speed of ac drive in frequency (HZ)or revolutions per minutes (rpm) and show the display in the selected F0- function to select a status to be displayed in operation panel.

0 : Frequency (HZ)

1 : Revolutions per minute (rpm)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F2	Display of filter time	0～15		6

◆ This function is able to filter out the variation of the low-bit display values so as to read the data of displayed status.

◆ Please do not set a long time to this parameter for it will affect the response speed in displaying the data.

Operation control parameters

×	F3	Operation control source	0～1		0

※ Operation control command must be given first before starting the ac drive to initiate its operation. By then, you may select the operation control source from either digital operation panel or digital input terminals.

■ **0 : Digital operation panel**－**Digital operation panel shall control the ac drive's start of operation, forward rotation, reverse rotation and stop operation.**

■ **1 : Digital input terminals**－**Digital input terminals (F60) shall control the ac drive's start of operation, forward rotation, reverse rotation and stop operation.**

×	F4	Frequency command source	0～8		1

◆ This parameter is the Frequency command source for the drive motor of ac drive. The following nine options of speed command sources are available for selection in accordance with the configured requirements of control system.

◆ The sequence of priority for Frequency command source is : Inching ＞Di enables Ai1 ＞Speed of designated stage＞F4 Frequency command source.

■ **0 : Digital operation panel (master speed) – To be set and controlled by the increase and decrease keys in digital operation panel.**

■ **1 : Operation panel Ai input (V.R) － To be controlled by the DC 0~5V signal from potentiometer (V.R.) in operation panel.**

■ **2 : Ai1 input (+10V/20mA) － To be controlled by the input analog voltage signal DC 0~+10V (or DC 0~20mA) from analog input terminal Ai1.**

■ **3 : Ai2 input (+10V) － To be controlled by the input analog voltage signal DC 0~+10V from analog input terminal Ai2.**

■ **4 : Ai1+Ai2 － To be controlled by adding the two input signal values of input analog voltage and analog voltage (or current) from both analog input terminals Ai1 and Ai2. (Setting the function of F11:3 , the negative bias is able to make a reversal rotation, control by addition & subtraction is available.**

- **5 : Ai1 、Ai2/MAX － To take the maximum value for operation control from two sets of analog signal input at both Ai1 and Ai2.**
- **6 : Ai1 、Ai2/MIN － To take the minimum value for operation control from two sets of analog signal input at both Ai1 and Ai2.**
- **7 : PID(%) (LS720 Reserved)－ To execute the external analog feedback signal and input it into the PID feedback control module. (Please select the source terminal of PID desired value and PID feedback value from parameter setup, i.e., the PID parameter group F115 ~ F123). (When set to enable the function of F11=3: Reversal revolution is available at negative bias, performing the negative PID% control is available.) (LS720 does not have this function)**
- **8 : Digital terminal for increase/decrease － To input signal to digital input terminal for controlling the increase / decrease of master speed**

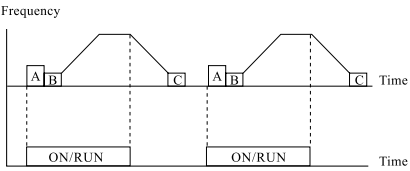
※ The operating range of the analog input frequency commands and the PID frequency commands shall be 100% corresponding to the set value of upper-limit frequency; When (F87 × 6) ≦F13 upper-limit frequency, the product of (F87 × 6) shall be taken as the maximum base point of analog operation; and when (F87 × 6) ≧F13 upper-limit frequency, the F13 upper-limit frequency shall be taken as the maximum base point of analog operation.

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F5	Enabling the DC brake mode	0～2		0

- **0 : Start from zero speed**－To start to run the ac drive from zero speed to the commanded speed value.
- **1 : DC-brake and start from zero speed** －When received a running command signal, the ac drive will perform a DC dynamic brake first to make sure the motor is stopped its idling; and then start its running from zero speed. Please see F6 and F7 for the parameter setup of DC brake before starting the running from zero speed.
- **2 : Resistance calibration + DC braking rerun**－50% of motor's rated current shall be exerted to perform a calibration inspection & testing for 1 second to calibrate the stator resistance and rotor resistance before enabling the DC brake.

※ This resistance-calibration function is to be used by the F92=2: Sensorless flux vector control mode as a torque compensation against the temperatue rise after motor's running ; and please set the F6 braking duration to 0 second when DC braking function is not desired.



ON/RUN : Operation command
A: DC calibrate B: Starting DC brake C: Stop DC brake

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F6	Braking duration before start	0.0~120.0	Second	5.0

◆ This parameter is to set up time duration of DC dynamic braking enabled when ac drive is started, ac drive will start its running only after the entered time duration elapsed. An entry of minimum value “0” to the duration will disable the braking function.

×	F7	Braking current before start	0.0~100.0	%	30.0

◆ This parameter is to set the percentage of the DC brake current output before the operation of the ac drive. A minimum set value, i.e., "0", will deny the output brake energy, and will be regarded as a control to trigger a delay for the start of operation. F6 setting shall govern the time span of delay. (DC brake current = F89 Rated Motor current × F7 Braking current before start)

×	F8	Stop mode	0~2		1

◆ To select an appropriate stop mode in accordance with the operational requirements of machine & equipment.

■ 0 : Free run stop－An input of stop signal will trigger the ac drive to turn off its drive signal immediately and enable an open-circuit state between the ac drive and the motor so that motor can coast down from idling to stop.

■ 1 : Dynamic stop－Decelerate and stop the motor according to speed rate of the deceleration time.

■ 2 : Dynamic+DC brake－Slow down the speed according to the speed rate of deceleration time; action of DC braking is enabled when the output frequency is reduced to zero speed; thus the occurrence of coasting operation can be avoided after stopping the motor.

×	F9	Stopping & brake current time	0.0~120.0	Second	5.0
×	F10	Stopping & brake current	0.0~100.0	%	30.0

※Do not enter a minimum value “0” to set up the stopping & braking time and the stopping & braking current; an entry of “0” will leave the time and braking energy inactive.

Speed limit

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F11	Restriction of rotating direction	0～3		1

◆ Please use this parameter to select and restrict the rotating direction of motor when motor is restricted its rotating direction to forward or reverse direction required for the concern relevant to the operation of mechanical system.

■ 0 : Forward / reverse rotation available ■ 1 : Forward rotation only

■ 2 : Reversal rotation only ■ 3 : Reversal rotation at negative bias available

◆ When the **3: Reversal rotation at negative bias available** is selected, there are six types of analog input signal status at parameter F4: frequency command source available to set up the negative bias frequency. When the analog input signal value is working on the bandwidth of negative bias frequency, the motor is rotating in reversal direction for operation; and the motor will rotate in forward direction when the signal value is working on the positive frequency bandwidth. 【For details of analog signal shifting setup, please see each shifting parameter group (F48, F50, F53) of analog signal】

◆ Select 3: Reversal revolution is available at negative bias, F4=4: Ai1 + Ai2 addition & subtraction for operational control is available, and F4=7: PID% is taken to perform negative PID% control.

WARNING

The direction of rotation set to ac drive is not necessarily the same as the motor's direction of rotation. Each motor has different polarity, so please pay attention to the danger resulted from the reverse rotation..

×	F12	Lower limit of frequency	0.00~60.00	Hz	0.00
×	F13	Upper limit of frequency	0.00~300.00	Hz	60.0

◆ An appropriate setting of upper and lower frequency limit is able to truly protect your valuable mechanical system from damage caused by speeding or idling operation when received a wrong entry of speed command from the operator.

◆ When enabled the F126 Retrieve Parameter, F13- upper limit of frequency will become the parametric value according to the set value of F87- Rated frequency.

※ The operating range of the analog input frequency commands and the PID frequency commands shall be 100% corresponding to the set value to (F13) upper limit of frequency.

※ The set values of frequency at upper limit and lower limit must satisfy the condition: F13 ≧ F12.

※ Prompt: The maximum values of F13 ~ F30 are restricted by (6 × F87) ≦ 300.00Hz.

Ex.1: (F87) 40Hz × 6= 240.00Hz, then the maximum operating range of F13 ~ F30 is within 240.00Hz.

Ex.2: (F87) 60Hz × 6= 360.00Hz, then the maximum operating range of F13 ~ F30 is within 300.00Hz.

Multi-stage speed frequency command setup

R : Parameter changeable during operation (○)

terminal /stage →			Inching command	Multi-stage command 3	Multi-stage command 2	Multi-stage command 1	Setting range	Unit	Ex-factory setting
○	F14	Master	OFF	OFF	OFF	OFF	0.00~300.00HZ	HZ	5.00
○	F15	Stage 1	OFF	OFF	OFF	ON	0.00~300.00HZ	HZ	10.00
○	F16	Stage 2	OFF	OFF	ON	OFF	0.00~300.00HZ	HZ	15.00
○	F17	Stage 3	OFF	OFF	ON	ON	0.00~300.00HZ	HZ	20.00
○	F18	Stage 4	OFF	ON	OFF	OFF	0.00~300.00HZ	HZ	30.00
○	F19	Stage 5	OFF	ON	OFF	ON	0.00~300.00HZ	HZ	40.00
○	F20	Stage 6	OFF	ON	ON	OFF	0.00~300.00HZ	HZ	50.00
○	F21	Stage 7	OFF	ON	ON	ON	0.00~300.00HZ	HZ	60.00
○	F22	Stage 8	ON	OFF	OFF	OFF	0.00~300.00HZ	HZ	0.00
○	F23	Stage 9	ON	OFF	OFF	ON	0.00~300.00HZ	HZ	0.00
○	F24	Stage 10	ON	OFF	ON	OFF	0.00~300.00HZ	HZ	0.00
○	F25	Stage 11	ON	OFF	ON	ON	0.00~300.00HZ	HZ	0.00
○	F26	Stage 12	ON	ON	OFF	OFF	0.00~300.00HZ	HZ	0.00
○	F27	Stage 13	ON	ON	OFF	ON	0.00~300.00HZ	HZ	0.00
○	F28	Stage 14	ON	ON	ON	OFF	0.00~300.00HZ	HZ	0.00
○	F29	Stage 15	ON	ON	ON	ON	0.00~300.00HZ	HZ	0.00

- ON and OFF shown in the table express the commands given to open or close the circuit at external terminals.
- Under the operation mode of multi-stage speed, compilation to select the stage and speed for operation (16 stages of speed the utmost) through the multi-functional input terminals (F61 ~ F66) is available while the compilation shall be made in a binary system of 4-bit (please see the table above).

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F30	Inching speed	0.00~300.00	HZ	6.00

WARNING

The inching operation has the top priority over any speed from the master through Stage 15 speed; it is unable to select any other speed for operation whenever the inching operation is being executed. The inching operation is a simplex command that has the preference to override any other frequency command sources for executing its operation.

Acceleration/deceleration time

R : Parameter changeable during operation (○)

◎ Can be set up to 3000.0 seconds for a resolution of 0.1 second and 30000 seconds for a resolution of 1 second. Please set the F121 parameter (P5-33) first for the relevant setup of resolution in second.

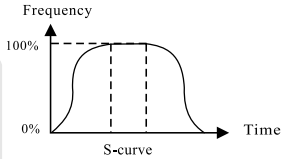
◎ Resolution function is exclusive for LS720, and LS700 does not have such function; the acceleration/deceleration time can be set from 0.1 second to 3000.0 seconds.

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F31	Acceleration time for master speed, inching, stage 8 speed setting	0.1～3000.0	Second	10.0
○	F32	Deceleration time for master speed, inching, stage 8 speed setting	0.1～3000.0	Second	10.0
○	F33	Acceleration time of stage 1,9	0.1～3000.0	Second	10.0
○	F34	Deceleration time of stage 1,9	0.1～3000.0	Second	10.0
○	F35	Acceleration time of stage 2,10	0.1～3000.0	Second	10.0
○	F36	Deceleration time of stage 2,10	0.1～3000.0	Second	10.0
○	F37	Acceleration time of stage 3,11	0.1～3000.0	Second	10.0
○	F38	Deceleration time of stage 3,11	0.1～3000.0	Second	10.0
○	F39	Acceleration time of stage 4,12	0.1～3000.0	Second	10.0
○	F40	Deceleration time of stage 4,12	0.1～3000.0	Second	10.0
○	F41	Acceleration time of stage 5,13	0.1～3000.0	Second	10.0
○	F42	Deceleration time of stage 5,13	0.1～3000.0	Second	10.0
○	F43	Acceleration time of stage 6,14	0.1～3000.0	Second	10.0
○	F44	Deceleration time of stage 6,14	0.1～3000.0	Second	10.0
○	F45	Acceleration time of stage 7,15	0.1～3000.0	Second	10.0
○	F46	Deceleration time of stage 7,15	0.1～3000.0	Second	10.0
○	F47	S curve	0.1～100.0	%	0.0

◆ The long or short time duration set to acceleration or deceleration determines the increasing or decreasing rate of output frequency. F87 : rated frequency is the reference frequency for the acceleration or deceleration time.

◆ Variation of setting in S-curve can effectively lessen the load and mitigate impact phenomenon received at start and stop of ac drive.

◆ Function of S-curve is only applicable to F4 = 0 : digital operation panel (master speed) and multi-stage speed commands.



CAUTION

A shorter acceleration/deceleration time may lead to a danger of momentary over-current or over-voltage while an improper time tuning will result in a threat of trip, damage against the drive or a burnt-out of electric machinery.

Analog input (Ai)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F48	Ai : 0V input bias %	-300.00～300.00	%	0.00
○	F49	Ai : 5V input gain %	-300.00～300.00	%	100.00

◆ Parameters F48 and F49 are to define the Ai (V.R) value of analog signal command for knob in the operation panel. The bias ratio corresponding to the Parameter F48/0V may be applied to set up a set of negative bias to avoid noise interference at 0V, or for the application by other control; Parameter F49/5V is a gain frequency with its maximum output value limited by the F13 upper-limited frequency. (Please see the following examples for six types of basic curve).

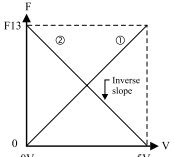


Figure 1

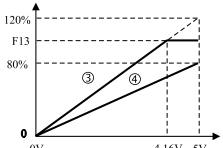


Figure 2

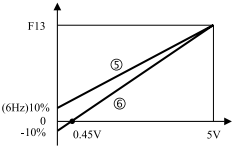


Figure 3

※ Please refer to Figure 1 ,2 ,3 and see the description of parameters in the table below：

	Curve ①	Curve ②	Curve ③	Curve ④	Curve ⑤	Curve ⑥
F4 frequency command source	1 : Ai/(V.R)	1 : Ai/(V.R)	1 : Ai/(V.R)	1 : Ai/(V.R)	1 : Ai/(V.R)	1 : Ai/(V.R)
F13 Upper limit of frequency	60HZ	60HZ	60HZ	60HZ	60HZ	60HZ
F48 operation panel Ai:0V bias ration	0.0%	100%	0.0%	0.0%	10%	-10%
F49 operation panel Ai:5V gain ratio	100%	0.0%	120%	80%	100%	100%

◆ Ai max. output frequency = (F13) Upper limit of frequency × (F49) gain ratio

◆ Frequency at positive bias = (F13) Upper limit of frequency × (F48) bias ration
For example: Curve ⑤ = 60Hz × 10% = 6Hz

◆ Negative bias voltage = [5V(Ai) ÷ (F48 bias ration + F49 gain ration)]× F48 Negative bias ratio
For example:Curve ⑥ = [5V ÷ (10% + 100%)] × 10% = 0.45V (positive and negative symbol shall be ignored for operation)

◆ Operating voltage(V) = $\frac{\text{The max. voltage} \times \text{The max. operating frequency}}{\text{Upper limit of frequency} \times \text{gain ratio}}$

◆ Gain ration = $\frac{\text{The max. voltage} \times \text{The max. operating frequency}}{\text{Upper limit of frequency} \times \text{operating voltage}}$

For example: Curve ③ = $\frac{5V \times 60Hz}{60Hz \times 120\%} = 4.16V$

For example: Curve ③ = $\frac{5V \times 60Hz}{60Hz \times 4.16V} = 120\%$

For example: Curve ④ = $\frac{5V \times 48Hz}{60Hz \times 80\%} = 5V$

For example: Curve ④ = $\frac{5V \times 48Hz}{60Hz \times 5V} = 80\%$

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F50	Ai1 : 0V input bias %	-300.00 ~ 300.00	%	0.00
○	F51	Ai1 : 10V input gain %	-300.00 ~ 300.00	%	100.00
○	F52	Ai1 : (Dead Band)	0.00 ~ 85.00	%	0.00
○	F53	Ai2 : 0V input bias %	-300.00 ~ 300.00	%	0.00
○	F54	Ai2 : 10V input gain %	-300.00 ~ 300.00	%	100.00
○	F55	Ai2 : (Dead Band)	0.00 ~ 85.00	%	0.00

- The functional commands of this parameter group are to define the frequency (gain frequency) corresponding to the maximum value (10V or 20mA) of analog signal while the output value of this gain frequency is restricted by the frequency of upper limit.
- Ai1 and Ai2 have the same mode of operation; however, 0~10V/0~20mA is selectable to Ai1 with operation selected by J3 while 0~10V is the only option for Ai2.
- F52 ~ F55 insensitive band voltage setup can effectively keep away the noise interference at 0V, but fail the actuator to stop operation correctly that leads to motor's swinging operation between forward and reversal rotations.

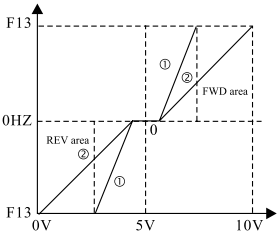


Figure 1

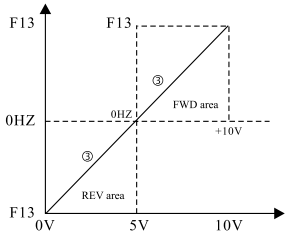


Figure 2

	Curve ① Figure 1	Curve ② Figure 1	Curve ③ Figure 2
F4 frequency command source	2 : Ai1/10V	2 : Ai1/10V	2 : Ai1/10V
F11 restriction of rotating direction	3 : REV available at bias	3 : REV available at bias	3 : REV available at bias
F13 frequency of upper limit	60HZ	60HZ	60HZ
F50 0V : bias ratio	-200%	-100%	-100%
F51 10V : gain ratio	200%	100%	100%
F52 Dead band setup	10%	10%	0%

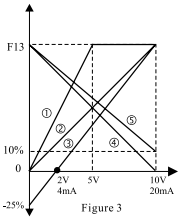


Figure 3

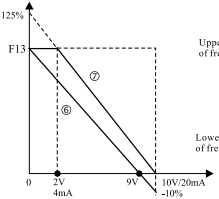


Figure 4

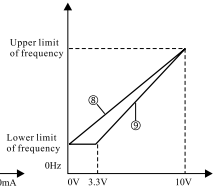


Figure 5

※ Please refer to Figure 3 and see the description of parameter along different curves in the table below :

	Curve ①	Curve ②	Curve ③	Curve ④	Curve ⑤
F4 Frequency command source	2:Ai1/10V	2:Ai1/10V	2:Ai1/10V	2:Ai1/10V	2:Ai1/10V
F13 Upper limit of frequency	60HZ	60HZ	60HZ	60HZ	60HZ
F50、F53, 0V(0mA) bias ratio	0.0%	0.0%	-25%	100%	100%
F51、F54, 10V(20mA) gain ratio	200%	100%	100%	0.0%	10%

※ Please refer to Figure 4, 5 and see the description of parameter along different curves in the table below：

	Curve ⑥	Curve ⑦	Curve ⑧	Curve ⑨
F4 Frequency command source	2:Ai1/10V	2:Ai1/10V	2:Ai1/10V	2:Ai1/10V
F12 Frequency of lower limit	0.0HZ	0.0HZ	20HZ	20HZ
F13 Upper limit of frequency	60HZ	60HZ	60HZ	60HZ
F50、F53, 0V(0mA) bias ratio	100%	125%	33.34%	-50%
F51、F54, 10V(20mA) gain ratio	-10%	0.0%	100%	100%

◎ Ai1, Ai2 max. output frequency = (F13) frequency of upper limit × (F51 or F54) gain ratio.

◎ Frequency at positive bias = (F13) frequency of upper limit × (F50 or F53) bias ratio

For example：Curve ⑥ = 60Hz × 100% = 60Hz

Curve ⑧ = 60Hz × 33.34% = 20.00Hz

◎ Negative bias voltage = [10V ÷ (bias ratio + gain ratio)] × bias ratio (positive and negative symbol shall be ignored for operation)

For example：Curve ③ = [10V ÷ (25% + 100%)] × 25% = 2.00V

Curve ⑨ = [10V ÷ (50% + 100%)] × 50% = 3.33V

◆ Operating voltage = $\frac{\text{the max. voltage} \times \text{the max. operating frequency}}{\text{The upper limit of frequency} \times \text{gain ratio}}$

Ex. : Curve ②、③ = $\frac{10V \times 60Hz}{60Hz \times 100\%} = 10V$

Ex. : Curve ① = $\frac{10V \times 60Hz}{60Hz \times 200\%} = 5V$

◆ Gain ration = $\frac{\text{the max. voltage} \times \text{the max. operating}}{\text{The upper limit of frequency} \times \text{operating voltage}}$

Ex. : Curve ③ = $\frac{10V \times 60Hz}{60Hz \times 10V} = 100\%$

Ex. : Curve ① = $\frac{10V \times 60Hz}{60Hz \times 5V} = 200\%$

Analog output (AO)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F56	A out function of analog variable	0 ~ 10		0
○	F57	A out : 0V corresponding value	-32767 ~ 32767		0
○	F58	A out : 10V corresponding value	-32767 ~ 32767		4096

◆ F56 : Both AO (Analog Output) and F69 : DO (Digital Output) are the output for a same I/O interface and only one function (AO or DO) of them is allowed to be output. When both functions are enabled at the same time, AO has preceding priority; however, hardware J1 functional selection must be established synchronously (please refer to P2-17 for the control circuit wiring diagram).

※ ◆ When enabled the F56:AO analog output, please disable the DO output: by setting F69=0 (both sets cannot be used at the same time).

◆ AO output F58 : the smaller the corresponding value, the higher the gain will be. Please refer to the standard ex-factory settings listed in the table below for the output functions, corresponding values and reference standard settings.

◆ The following 8 functions of analog output are able to monitor the analog input(Ai) signal and the status value of control output (rpm, current, voltage) from ac drive.

(F56) function of analog variable	(F58) 10V/ corresponding value	Reference standard point
0 : Disabled	⅄	⅄
1 : Output frequency (Figure 2)	4096	F87 parameter set value
2 : Predict rpm (Figure 2)	4096	F87 parameter set value
3 : Frequency of power supply (Figure 2)	4096	F87 parameter set value
4 : Output voltage (Figure 3)	2200 3800	220.0 V (F88 parameter set value) 380.0 V

(F56) function of analog variable	(F58) 10V/ corresponding value	Reference standard point
5 : Output current (Figure 4)	8192	F89 parameter set value
6 : Torque current command (Figure 4)	8192	F89 parameter set value
7 : Ai (Figure 1)	16384	Ai × (F48 and F49)
8 : Ai1 (Figure 1)	16384	Ai1 × (F50 and F51)
9 : Ai2 (Figure 1)	16384	Ai2 × (F53 and F54)
10 : PID (LS720 Reserved)	16384	100%

Example：

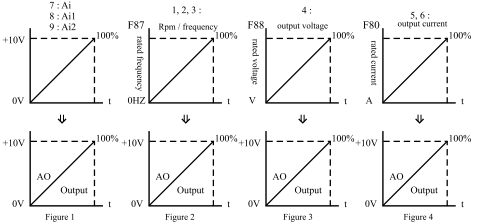


Figure 1 Figure 2 Figure 3 Figure 4

Description：

1. In Figure 1, F56 set value is 7 for the display of input analog signal, F58 set value is 16384, reference standard point is 100%, and the highest corresponding value of AO analog signal output is DC +10V.
2. In Figure 3, F56 set value is 4 for the display of output voltage, F58 set value is 2200, reference standard point is 220V, and the analog output signal AO is DC +10V.

Digital input (Di)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F59	Scan cycle of digital input	1.0 ~ 200.0	ms	1.0

◆ This function is able to filter out the interference from the noise to the multi-function input terminals or get rid of the CUP malfunction caused by the resilience of switch, noise interference or switching ejection.

×	F60	Di1, Di2 setup	0 ~ 2		0

◆ This function is to set up the Di1 and Di2 terminals only and correspond to two-way operation control only, the rest of multi-functions are out of the operation range of Di1 and Di2.

■ **0 : Di1(FWD/STOP), Di2(REV/STOP),** 2-way control

F3 (operation control source) = 1
(digital input terminal)
F11 (Restriction of rotating direction) = 0
(FWD/REV available)
F60 (Dil, Di2) = 0

Di1 open : STOP, close : FWD operation
Di2 open : STOP, close : REV operation
COM

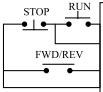
■ **1 : Di1(RUN/STOP), Di2(FWD/REV),** 2-way control

F3 (operation control source) = 1
(digital input terminal)
F11 (Restriction of rotating direction) = 0
(FWD/REV available)
F60 (Dil, Di2) = 1

Di1 open : STOP, close : RUN
Di2 open : FWD, close : REV
COM

■ **2 : 3-wire stop:Di3(FWD/REV), Di2(STOP), Di1(RUN), and F61 setup is disabled automatically at the same time.**

F3 (operation control source) = 1
(digital input terminal)
F11 (Restriction of rotating direction) = 0
(FWD/REV available)
F60 (Dil, Di2) = 2



Di1 Close : Running (push button one time)
Di2 Open : Stop (push button one time)
Di3 Open : FWD, close : REV
COM

×	F61	Di3 setup	◆ Multifunction input terminals can be planned to set up their particular use as desired. To apply such functions, please peruse the functional instruction for their priority control and relevant description of functions. ◆ No fixed sequence is specified to set up the function for these six terminals; however, the set value of function for each terminal shall not be repeated except the set value "0 : disabled".	0～13	1
×	F62	Di4 setup		0～13	2
×	F63	Di5 setup		0～13	6
×	F64	Di6 setup		0～13	7
×	F65	Di7 setup		0～13	10
×	F66	Di8 setup		0～13	3

■ **0 : Disabled** ─ This function is to disable the functional input terminal to avoid any malfunction caused by unknown reason.

■ **1 : Enabled at external failure** ─ An input of external failure will trip the ac drive and stop its output.

■ **2 : RESET** ─ When the ac drive tripped at failure, use this RESET command to release the failure-maintained state.

Never operate the RESET command in a constantly energized (ON) state.

■ **3 : Free-Run stop** ─ After inputting the functional terminal signal, the ac drive will switch off its output, and let the motor run at idling state and coast down to stop.

■ **4 : Master speed increase** ─ Input the signal of frequency increase for master speed from the multifunctional terminals; for a F31 set value ≥ 20 seconds, F31 set value will be taken to perform acceleration for master speed increase; and for a F31 set value <20 seconds, 20 seconds will be taken to perform the acceleration for master speed increase.

■ **5 : Master speed decrease** ─ Input the signal of frequency decrease for master speed from the multifunctional terminals; for a F32 set value ≥ 20 seconds, F32 set value will be taken to perform deceleration for master speed decrease; and for a F32 set value < 20 seconds, 20 seconds will be taken to perform the deceleration for master speed decrease.

◆ These two sets of function mainly focus on the frequency of master speed as the external control can be set up through functional terminals; however, the control power of F4 : Frequency command source must be set to 8 : digital terminal increases/decreases.

■ **6 : Multi-stage rpm command 1**	Multi-stage speed commands 1, 2, 3 and 4 are formatted by binary system in 4-bit manner to compile 16 stages of speed for operation control.
■ **7 : Multi-stage rpm command 2**	
■ **8 : Multi-stage rpm command 3**	
■ **9 : Multi-stage rpm command 4**	

■ **10 : Inching operation** ─ When enabled the inching command, its priority is just next to the enabling of auto operation command.

■ **11 : Di enables PID(LS700 special-purpose)** ─ Once selected to enable the Di, then PID function is controlled by Di external terminals. (LS720 does not have this function)

■ **11 : To enable the second group of speed PI controller (LS720 exclusive)** – When selected Di (ON), enable the second group speed PI controller so that the speed PI is to be set up by F115~F118. (LS700 does not have such function).

■ **12 : Di enables Ai1** – When selected to enable Di, the frequency command source is mandatory to be Ai1.

※ When using this function, Ai1 shall not be assigned to other functions for their application (For example: the Ai1 setup relevant to the F4, F116 and F117).

※ Priority sequence: Inching > Di enables Ai1 > Speed of designated stage > F4 frequency command source.

■ **13: Di-enabling vector control mode (LS720 exclusive)** – Before enabling the control mode from an externally enabling vector control, 2: Sensor-less Flux Vector Control can only be enabled provided that a successful execution of F92=0: Electric Parameter Detection (Pr_RL) is performed. (Please refer to P4-2).

※ This function can only be enabled to activate the vector control after the machine comes to stop; if setting to enable Di for vector control during operation, enabling this function is not available while the originally established control mode will be remained.

Multi-stage command terminals / 16-stage speed	Din multi-stage command 4 $2^3 = 8$	Din multi-stage command 3 $2^2 = 4$	Din multi-stage command 2 $2^1 = 2$	Din multi-stage command 1 $2^0 = 1$
Master speed	OFF	OFF	OFF	OFF
Stage 1 speed	OFF	OFF	OFF	ON
Stage 2 speed	OFF	OFF	ON	OFF
Stage 3 speed	OFF	OFF	ON	ON
Stage 4 speed	OFF	ON	OFF	OFF
Stage 5 speed	OFF	ON	OFF	ON
Stage 6 speed	OFF	ON	ON	OFF
Stage 7 speed	OFF	ON	ON	ON
Stage 8 speed	ON	OFF	OFF	OFF
Stage 9 speed	ON	OFF	OFF	ON
Stage 10 speed	ON	OFF	ON	OFF
Stage 11 speed	ON	OFF	ON	ON
Stage 12 speed	ON	ON	OFF	OFF
Stage 13 speed	ON	ON	OFF	ON
Stage 14 speed	ON	ON	ON	OFF
Stage 15 speed	ON	ON	ON	ON

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F67	Setup to activate terminal after starting or abnormal to restoring the power supply	0 ~ 1		0

■ **0 : Direct startup** ─when set F3 (Operation control source) = 1: Digital input terminal for control, the operation control terminal (Di1 or Di2) will be normal close (ON) while the ac drive will be activated to run after inputting the power supply or restoring the power supply.

■ **1 : Command terminal reset and then activate** ─When set F3 (operation control source)=1:digital input terminal for control, the operation control terminal (Di1 or Di2) will be normal close (ON), while the command terminal shall be re-activated (Off→ON), then the ac drive follow to run after inputting the power supply or restoring the power supply or when happen an abnormal after RESET action.

Digital output (Do)

R : Parameter changeable during operation (○)

R	Parameter	Description	Explanation	Range	Unit	Ex-factory setting
×	F68	Relay setup	◆ Multifunctional output terminal is programmable for setting control, no specific sequence is required. ◆ When enabled the F69: DO digital output, please disable the analog output AO by setting F56=0 (both sets cannot be used at the same time).	0～10		1
×	F69	DO setup ※ To set up control mode, please see F56 parameter for description.(P5-11)				10

■ **0 : Disabled** ─To disable the function of the output terminal.

■ **1 : Enabled at failure(NC)** ─DO outputs ON (close) signal when the ac drive detects an occurrence of failure condition.

■ **2 : In operation** ─DO outputs ON (close) signal when the ac drive enters into standby mode or is in operation.

■ **3 : In zero speed** ─DO outputs ON (close) signal when the ac drive stops or has an output frequency of 0.

■ **4 : FWD** ─DO outputs ON (close) signal when the ac drive is executing the FWD command and outputting a frequency > 0Hz.

■ **5 : REV** ─DO outputs ON (close) signal when the ac drive is executing the REV command and outputting a frequency > 0Hz.

■ **6 : Accelerating** ─DO outputs ON (close) signal when the ac drive is accelerating toward the target command.

■ **7 : Decelerating** ─DO outputs ON (close) signal when the ac drive is decelerating toward the target command.

■ **8 : Consistent frequency** ─DO outputs ON (close) signal when the ac drive outputs a frequency consistent with the frequency set by speed commands (master speed ~ speed at stage 15). (This function is rather unsuitable for being applied to speed command of analog signal).

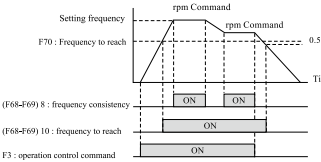
■ **9 : Overload pre-alarm** ─ Contact will be enabled an "ON (close)" state when the ac drive detects an overload output; ac drive is still continuous to run with the (F78) electronic thermal relay enabled for time counting (unloading can be processed at this moment)

※ Overload = F89(motor) rated current × (F77) current level of electronic thermal relay %

■ **10 : Frequency to reach** ─ DO outputs ON (close) signal when the ac drive outputs a frequency≧ frequency to reach (F70).

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F70	Frequency to reach	0.00～300.00	HZ	60.00

◆ The preset multifunctional output terminals will be maintained at ON state when output frequency ≧ set value of frequency to reach, and switched to OFF state if the output frequency goes down below the frequency to reach – 0.5HZ.



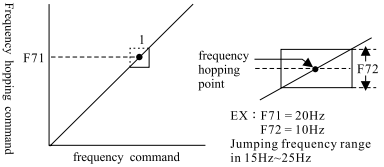
Jumping frequency

R : Parameter changeable during operation (○)

×	F71	Jumping frequency	0.00～300.00	HZ	0
×	F72	Jumping bandwidth	0.00～10.00	HZ	0

◆ Functions of frequency skip and skip bandwidth are applied to prevent the resonant vibration taken place to the mechanical or motor at some frequencies. It is bound to passing through this resonant area during acceleration or deceleration; however, the program will not allow the operation to stay at this area.

◆ An entry of 0HZ to set up the skip bandwidth will disable the function of frequency skip.



Motor Protection setup

×	F73	Stall-Protection setup	0～31		7

■ **bit0 : protection function F74** ─ To enable the function for stalling voltage protection during deceleration.

■ **bit1 : protection function F75** ─ To enable the function for stalling current protection during acceleration.

■ **bit2 : protection function F76** ─ To enable the function for stalling current protection during operation.

■ **bit3 : protection function F77** — To enable the function electronic thermal relay.

■ **bit4 : AVR voltage-regulating function** — To enable the AVR function for output voltage (U.V.W.).

※ Digital increment table

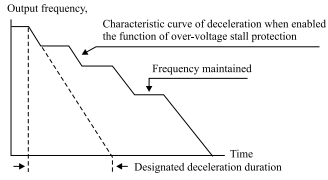
R : Parameter changeable during operation (○)

Set values	AVR 2^4=16	F77 2^3=8	F76 2^2=4	F75 2^1=2	F74 2^0=1	Set values	AVR 2^4=16	F77 2^3=8	F76 2^2=4	F75 2^1=2	F74 2^0=1
0	×	×	×	×	×	16	○	×	×	×	×
1	×	×	×	×	○	17	○	×	×	×	○
2	×	×	×	○	×	18	○	×	×	○	×
3	×	×	×	○	○	19	○	×	×	○	○
4	×	×	○	×	×	20	○	×	○	×	×
5	×	×	○	×	○	21	○	×	○	×	○
6	×	×	○	○	×	22	○	×	○	○	×
7	×	×	○	○	○	23	○	×	○	○	○
8	×	○	×	×	×	24	○	○	×	×	×
9	×	○	×	×	○	25	○	○	×	×	○
10	×	○	×	○	×	26	○	○	×	○	×
11	×	○	×	○	○	27	○	○	×	○	○
12	×	○	○	×	×	28	○	○	○	×	×
13	×	○	○	×	○	29	○	○	○	×	○
14	×	○	○	○	×	30	○	○	○	○	×
15	×	○	○	○	○	31	○	○	○	○	○

※ ○ : protection function enabled, × : protection function disabled, no protection function when F73 set value is 0.

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F74	Setup for stalling voltage during deceleration	1.00 ~ 1.25	F85 × 1.414	1.20 (Note)

◆ As a result from the inertia of motor load when the ac drive is executing the deceleration; the motor will regenerate energy into the interior of ac drive to heighten the voltage at DC bus. Therefore, the ac drive will stop decelerating (output frequency paused from decreasing) once a voltage at DC bus detected higher than the set value and resume its executing the deceleration provided that the voltage at DC bus falls below the set value.



※Note: Stall voltage level = F85 (220V) × 1.414 × 1.20 (ex-factory value) = 373 Vdc

R : Parameter changeable during operation (○)

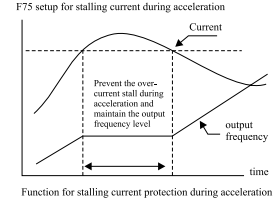
R	Parameter	Description	Range	Unit	Ex-factory setting
×	F75	Setup for stalling current during acceleration	0.50 ~ 2.50	F89	1.70
×	F76	Setup for stalling current during operation	0.50 ~ 2.50	F89	1.60

◆ When performing the acceleration or operation, the ac drive will stop accelerating (output frequency is paused from increasing) due to a too-fast acceleration or too-big motor load that leads to a quick rise of output current from ac drive to exceed the set value of stalling current level; ac drive will resume its acceleration provided that the current is lower than the set value.

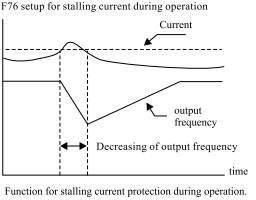
◆ Stalling current level during acceleration = (F89) motor rated current × (F75) stalling current percentage

◆ Stalling current level during operation = (F89) motor rated current × (F76) stalling current percentage

Example : stalling current level = 4A × 1.70 = 6.8A



Function for stalling current protection during acceleration



Function for stalling current protection during operation.

×	F77	Current level of electronic thermal relay	1.01 ~ 2.50	F89	1.50
×	F78	Acting duration of electronic thermal relay	0.1 ~ 120.0	Second	60.0

◆ When the rated capacity of ac drive is higher than motor's rated capacity, please input the motor's rated capacity into the parameters F87~F91 to avoid burning out the motor.

◆ This parameter provides a function of electronic thermal relay to protect the motor from overheating. This kind of protective characteristic has taken the protection against the low cooling ability encountered when motor is running at low speed into consideration.

◆ When the continuously loading current output from the ac drive exceeds the set value of (F89) motor rated current , the timer for acting duration of electronic thermal relay will be actuated.

※ $\int(I^2A(pu)-1)dt \geq (I^*_{OL}{}^2-1)\times T_{OL}$, overload is overtime.

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F79	Oscillation-inhibit gain	0.0 ~ 100.0	%	15.0

◆ When motor is running at a certain bandwidth that generates an oscillation of current,an adjustment of parametric set value at this moment may effectively correct this situation. The current-oscillating section of a bigger horsepower may appear in a bandwidth of lower frequency; a duly increase of set value will be helpful. A too-big setting may easily result in a generation of over-excited current, please make an appropriate adjustment.

◆ This parameter is an exclusive-use function for V/F control mode. (The control mode of F92=1, 3).

Magnetic flux setup

×	F80	Maximum output voltage (U.V.W)	0.50 ~ 1.00	F88	1.00

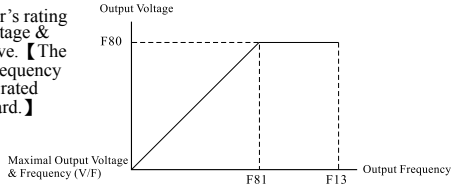
◆ The ac drive is able to receive an input voltage of AC 150V ~ 240V (or 380V ~ 480V) with its maximum output voltage set up by this parameter function to go with the motor's rated voltage.
Maximum output voltage = (F88) rated voltage × F80 (1.00 time) set value.

◆ When (F92) control mode is opted to 1: V/F voltage control, 3: sensorless voltage vector control, 1.0 is the most ideal value for setting the F80 maximum output voltage.

※Note－When (F92) control mode is set to 2: sensorless flux vector control, for a field within the high-speed domain [Approximately above 110% rated rpm of an electric machinery] where necessitated a speed precision, please set the F80 maximum output voltage to within 0.90 ~ 0.95.

×	F81	V/F maximum voltage & frequency	0.50 ~ 2.00	F87	1.00

◆ Please follow the motor's rating to set up the output voltage & frequency of the ac drive.【The maximum voltage & frequency (1.00) shall take F87：rated frequency as the standard.】



R : Parameter changeable during operation (○)

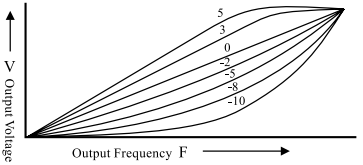
R	Parameter	Description	Range	Unit	Ex-factory setting
×	F82	V/F curve selection	-10 ~ 5		0

◆ The relation of variation in terms of square decreasing, linear or square increasing between the output voltage and the output frequency is defined and established (as shown in the figure below).

◆ A set value 0 is for linear V/F curve to be applied to a constant torque load.

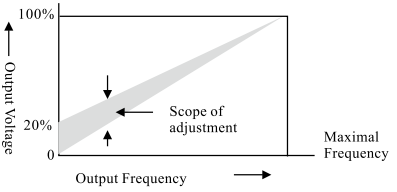
◆ A set value ranging -1 ~ -10 is for square decreasing V/F curve to be applied to fan and pump, etc.
(Not applicable to F92 = 2: Control Mode)

◆ A set value ranging 1 ~ 5 is for square increasing V/F curve.



○	F83	Voltage boosting value	0.000 ~ 0.200	Pu	0.010

◆ This function provides a technique to take the advantage of V/F linear curve theory to boost the output voltage corresponding to 0HZ in an appropriate amount so that the low torque performance of the motor at low-speed range can be improved.



◆ Excessive boosting may lead to motor's over-current and may be more likely to actuate the functions (F75~F78) to restrict the output current. Therefore, with the "F0=2: display of output current " enabled, please confirm the output current while performing the adjustment so as to tune to an optimal value.

◆ Generally, 3HZ should be able to start the operation of motor under the V/F control mode in principle.

Ac drive parameters

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F84	PWM carrier frequency	2000 ~ 16000	HZ	5000

◆ This parameter is able to set up the carrier frequency output from PWM.
◆ The carrier frequency range of PWM output from LS720 is 1000 ~ 16000Hz.
◆ The set value of carrier frequency will affect the electromagnetic noise of the motor, the switching loss of the IGBT and the heat dissipation due to switching loss as stated in the table given below:

Carrier frequency	Motor noise	Switching loss	Heat dissipation	Torque	Harmonic rate
2KHz	High	Low	Low	High	Low
↕	↕	↕	↕	↕	↕
16KHZ	Low	High	High	Low	High

×	F85	RST input voltage (rms)	150 ~ 480	V	220

◆ This parameter defines the standard input voltage from the mains power supply to the ac drive while the ac drive computes all working levels and protection levels relevant to voltage in accordance with this parameter.

Low voltage level (200Vac / 400Vac) = 190Vdc / 380Vdc (level is constant to the hardware)
Over voltage level (200Vac / 400Vac) = 410Vdc / 820Vdc (level is constant to the hardware)
Brake level = 360Vdc ± 3% for AC 200V series, 720Vdc ± 3% for AC 400V series,
Brake level is constant to the hardware.

×	F86	Vdc gain(read only)	50 ~ 300	Pu	140

◆ This parameter is to tune the gain of DC-BUS at both ends of capacitor while the result will be displayed (F0 = 4 : Vdc) and taken as one of the important parameters for internal control operation.

Motor nameplate

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F87	Rated frequency (Hz)	20.00 ~ 150.00	HZ	N(Note 1)
×	F88	Rated voltage (rms)	150 ~ 480	V	N(Note 1, Note 2)
×	F89	Rated current (rms)	0.5 ~ 600.0	A	N(Note 1)

◆ F87 ~ F91 are the parametric group for the rated values in motor's nameplate; that is, their set values must be entered according to the rated values in the motor's nameplate, and the ac drive will perform the functions of operational control, motor's overload protection, etc.
(Note 2 : F88 : motor's rated voltage must ≥ F85÷1.5)

◆ Motor parameters must be given for the application of vector control mode. Correct setting of parameters can obtain a better speed response curve and torque characteristic curve of motor.

◆ When applying an ac drive of high capacity to operate a motor of low capacity, the set value of F89 must satisfy the condition: F89>rated current of ac drive ÷ 6.

◆ The range of F89 from Minimum to Maximum is [Rated current of ac drive × (0.16~1.3)]

×	F90	Horse power	0.20 ~ 300.0	HP	N(Note 1)

◆ Motor's output rated power. Please set the motor's output rated power according to the number of horsepower.

Example : 1.5KW/0.75KW = 2.0HP

×	F91	Number of poles	2 ~ 16	Pole	N(Note 1)

◆ Enter the motor's number of pole as the set value.
◆ The motor's speed can be indicated correctly when performing the V/F control.
◆ When performing the vector control, the ac drive will take the set value of this parameter as the standard to undertake the calculation of speed vector control.

※ Note 1: The setup of F87 ~ F91 may vary with actual motor capacity.

Control mode

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F92	Control mode setup	-1 ~ 3		1

■ **-1 : Static electric parameter auto-tuning** ─ This function is to be used for some machinery equipment that has been coupled with a heavy-duty yet cannot be performed the dynamic parameter detection; however, the F97 value (motor's no-load current %) must be accurately set; thus the motor's electric parameter group (F93~F96) can be fully detected with an accuracy lower than the 0: Auto-tuning Electric parameter detection.

■ **0 : Electric parameter auto-tuning** ─ This function is to be enabled to perform the automatic tuning function for static and dynamic parameters that can measure the electric characteristics of motor automatically and enter the motor's parameters into the electric parameter group F93 ~ F97.

(Dynamic parameter tuning: When motor is performed a FWD revolution command to run at a frequency above 40HZ for one minute approximately, the inspection & testing of parameters at no-load or at a current below the motor's rated current for the coupled machine can be performed.)

※ **Note: Display Pr_RL(Detecting function)**

■ **1 : V/F voltage control** ─ The ac drive outputs SVPWM waveform to motor.

■ **2 : Sensor-less flux vector control** ─ It is a current-type sensor-less vector controller to use the current command and feedback current error for making a torque current compensation; the torque characteristic at low-speed area will be better than the voltage-type control and have a smaller rpm slip.

■ **3 : Sensor-less voltage vector control** ─ It is a voltage-type sensor-less controller to apply the voltage command and feedback current signal to predict the magnetic flux of stator and slip for frequency compensation.

※The parameters F87~F91 of motor's nameplate to execute F92 = 0: electric parameter Auto-tuning (Pr_RL) must be firstly set if the control mode is set to 2: sensor-less flux/vector control ; after its successful execution, follow to set the 2: sensor-less flux/vector control. (Please see P4-2).

Prompt : The application of 2 : sensor-less flux/vector control mode must fall within the high-speed |approximately 110% of the motor's rated rpm| domain where the speed precision is essential. After the completion of electric parameter detection, please set up the following parameter groups:

1.F80 = 0.90 ~ 0.95

2.F84 = 2K ~ 8K|carrier frequency|

3.F88 = Motor rated voltage × (110% ~ 120%)

Motor electric parameters

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F93	Stator resistance	500 ~ 32767	Pu:Q17	10000
×	F94	Rotor resistance	500 ~ 32767	Pu:Q17	8000
×	F95	Stator inductance	3250 ~ 32767	Pu:Q12	9000
×	F96	Mutual inductance	3250 ~ 32767	Pu:Q12	8750
×	F97	No-load current(%)	12.50 ~ 99.00	0.01%	40.00
×	F98	Voltage、resistance adjustment	0 ~ 32767		0
×	F99	Current、resistance adjustment	0 ~ 32767		0

※The motor's electric parameters in this parameter group can be detected by auto-tuning detection function set to F92 control mode— 0: auto-tuning detection functions for electric parameters.

If the auto-tuning fails, please manually enter the parameters F93, F94, F95, F96 and F97. Please obtain the set values of five parameters from the motor manufacturer – Rs: stator impedance, Rr: rotor impedance, Ls: stator inductance, Lm: mutual inductance, no-load current and then compute the parameters of F93, F94, F95, F96 and F97 according to the rated values of motor.

Example:

Motor manufacturer provides the data of parameters as follows:

Rs=0.3Ω Rr=0.303Ω

Ls=Lr=0.0477H Lm=0.0456H

Motor rated values: 220 V, 14 A, 60 Hz, no-load current : 4.2A

Computation is as right：

$$V_{base} = 220\sqrt{2}/\sqrt{3} = 179.63 \ \text{(volt)}$$
$$I_{base} = 14\sqrt{2} = 19.8 \ \text{(A)}$$
$$\omega_{base} = 2\pi\ 60 = 377 \ (rad/s)$$

$$R_{base} = V_{base}/I_{base} = 9.07(\Omega)$$
$$L_{base} = R_{base}/\omega_{base} = 0.02406\,(H)$$

$$\overline{R}_s = \frac{R_s}{R_{base}} * 2\text{^}17 = 0.033\,1 * 2\text{^}17 = 4338 \ldots\ldots (F93)$$

$$\overline{R}_r = \frac{R_r}{R_{base}} * 2\text{^}17 = 0.0334 * 2\text{^}17 = 4378 \ \ldots\ldots (F94)$$

$$\overline{L}_s = \overline{L}_r = \frac{L_s}{L_{base}} * 2\text{^}12 = 1.9825 * 2\text{^}12 = 8120 \ldots\ldots\ldots (F95)$$

$$\overline{L}_m = \frac{L_m}{L_{base}} * 2\text{^}12 = 1.8953 * 2\text{^}12 = 7763 \ldots\ldots\ldots (F96)$$

No-load current (%) = motor no-load current / motor rated current) × 100
= (4.2A / 14A) × 100 = 30(%) ..... (F97)

Note: 2^12 and 2^17 in the computing equations are constants in Q format, and shall not be changed.
(2^12 = 4096 , 2^17 = 131072)

Vector estimation

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F100	Bandwidth of magnetic flux prediction	0.50 ~ 20.00	HZ	3.0

◆ The setting value small, the low speed torque is big, the rate error is quite small, the speed easy to produce not stably.
When the setting value is big, the low speed torque is small, the rate error is quite big, the speed is quite stable.
※ Applicable to F92 = 2 : sensor-less flux vector control mode.

×	F101	Bandwidth of speed prediction	0.50 ~ 20.00	HZ	7.0

◆ The setting value small, the velocity response is slow, when stable state is steady. When the setting value is big, the velocity response is quick, when stable state is not steady.
※ Applicable to F92 = 2 : sensor-less flux vector control or 3 : sensor-less voltage vector control mode.

○	F102	Slip compensation gain	10 ~ 200	%	80

◆ When the motor load becomes too large, resulting in larger motor slip. Slip compensation gain of function that is to overcome the load changes, so that motor speed at rated current, more close to synchronous speed operation, can also control the motor to maintain a certain speed.
※ Applicable to F92 = 2 : sensor-less flux vector control or 3 : sensor-less voltage vector control mode.

◆ Motor Rated Slip to be from the motor nameplate value, calculated according to the following formula: Synchronous Motor Speed = 60Hz (4P) × 30 = 1800rpm
Motor rated speed = 1730rpm
Slip speed = 1800 - 1730 = 70rpm

※ LS700 Series unofficially rated slip frequency of 3Hz
Slip compensation = F102 × 3Hz
Example: slip compensation = 80% × 3Hz = 2.4Hz

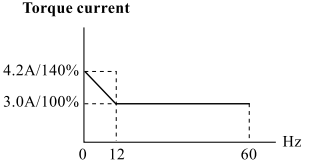
×	F103	Low-speed offset gain	100.0～180.0	%	140.0
×	F104	Torque offset cut-off frequency	0.00～0.60	Pu	0.20

◆ F103 and F104 are functions in sensorless flux vector control mode and suitable for the equipments with low rpm and high torque.

◆ Torque offset is to take motor's no-load current as the base point while offset cut-off frequency is to take motor's rated frequency as the base point.

Note: The no-load current is the detected value for detecting motor's electric parameters.

Ex : motor's no-load current = 3.0A
motor's rated frequency = 60Hz；
F103 = 140%、F104 = 0.20
calculation formula :
3.0 × 140% = 4.2A，
60Hz × 0.20 = 12Hz



Vector speed controller NO.1

R : Parameter changeable duringoperation (○)

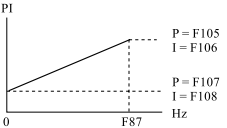
R	Parameter	Description	Range	Unit	Ex-factory setting
○	F105	High-speed control P gain(ASR)	0.20 ~ 200.00	%	30.00
○	F106	High-speed control I gain(ASR)	0.0 ~ 100.0	%	30.0
○	F107	Lower-speed control P gain(ASR)	0.20 ~ 200.00	%	15.00
○	F108	Lower-speed control I gain(ASR)	0.0 ~ 100.0	%	30.0

◆ PI control : PI control is the combination of (P) Proportional Control and (I) Integral Control to make a response against thereof controlled values in accordance with the magnitude of deviation and change of time.

※ Applicable to F92 = 2: Sensor-less flux vector control mode.

※ Caution: The foregoing adjustment of parameter is the PI adjustment parameter for speed; and it can affect the dynamic response speed and control precision of system directly; therefore, it is not necessary to alter the ex-factory value under general condition.

※ Please pay attention to the system reaction at the same time when tuning the parameters F105 and F108.



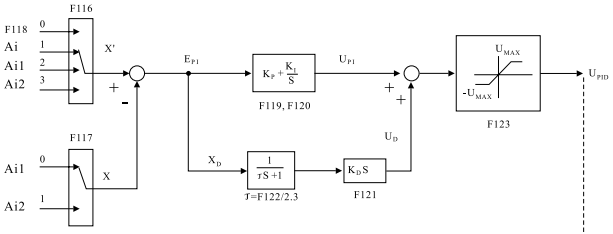
※ Prompts:

(1) When the motor is to be used at high efficiency, high torque or a lower substrate frequency, F105 and F17 shall be set a smaller P gain, on the other hand, a higher set value is required.

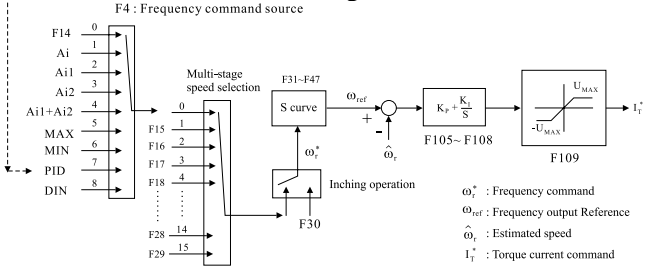
(2) If the system needs a shorter acceleration/deceleration time, please set the F73 : stall protection function to 0, and additional mount a brake unit or consider upgrading the capacity of ac drive for one more class.

(3) The speed control PI parameter is closely related to the motor's load inertia and acceleration/deceleration time; the user can perform the adjustment based on the ex-factory PI parameter mainly focusing on various need of loading characteristics in order to satisfy the need for various field applications.

PID control block diagram



Sensor-less vector speed PI control



R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F109	Torque current limit	0.050 ~ 1.250		1.000

◆ To set the torque current at the maximum load output from ac drive.
Torque current = Rated current of the ac drive (rms) × (F109) set value of torque current × 2

EX : 400V Series, 5HP, AC inverter rated current 9.0A
Torque current limit = 9.0 × 1.000 × 2 = 18.0A

◆ Torque current limit is provided only for the operation of F92= 2 : Sensor-less flux vector control.

※ **Caution : The ac drive must match with the motor capacity**

Failure record

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F110	Current failure record	0 ~ 20		0
×	F111	Failure record of last time	0 ~ 20		0
×	F112	Failure record of last two times	0 ~ 20		0
×	F113	Failure record of last three times	0 ~ 20		0
×	F114	Number of times to auto-reset the failure during operation	0 ~ 10		0

- ◆ F114 (set value 0 is to disable the auto-reset function) will reset to release the failure taken place to trip the ac drive during the operation.; in case there are safety concerns, please cancel the F114 auto reset function.
- ◆ The user can set up the number of times of auto-reset. When the number of times of failure is over the preset number of times, please use RESET pushbutton in the digital operation panel to clear it, or enable the digital input terminal 2: RESET to clear it; thus doing can zero the number of times of auto-reset.
- ◆ Default setting of duration is 6 seconds to auto-reset the failure. For an equipment with larger mechanical inertia, please refer to parameters F5 ~ F7 for functions to set a delay of time to start the operation.
- ◆ F114 auto-reset will not respond to the failure taken place during the standby (ready) state; please depress the RESET pushbutton to reset and clear it.
- ◆ If a failure taken place when operation control source is set to F3 = 0 : digital operation panel, F113 will reset it automatically and restart the operation. If there is a safety concern, please cancel the F114 auto-reset function.
- ◆ If a failure taken place when operation control source is set to F3 = 1 : digital input terminal, F114 will reset it automatically and operate the equipment under the current control mode.

※ Err 1~ Err 4 : hardware detection and protection

Error code	Description of failure
Err 0	Communication of digital operation panel failed
Err 1	Over-voltage (Err U1) or over-current (Err A1) in standby state
Err 2	Over-voltage (Err U2) or over-current (Err A2) during acceleration
Err 3	Over-voltage (Err U3) or over-current (Err A3) during deceleration
Err 4	Over-voltage (Err U4) or over-current (Err A4) during speed regulation
Err 5	External failure
Err 6	DC Bus voltage (O.V)
Err 7	DC Bus voltage (L.V)
Err 8	Electronic thermal relay activated

Error code	Description of failure
Err 9	Di setting repeated
Err 10	Electric parameter auto-tuning malfunctioned
Err 11	Current between motor and ac drive not matched
Err 12	Voltage between motor and ac drive not matched
Err 13	Circuit opened at output side of U phase or current detector malfunctioned
Err 14	Circuit opened at output side of W phase or current detector malfunctioned
Err 15	Parameters stored in DSP locked and unalterable.
Err 16	Parameter out of range (Default)
Err 17	Over temperature or PF or PUF failure
Err 18	F12 > F13
Err 19 ~ Err20 reserved.	

External PID (LS700 Special-Purpose)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F115	PID mode	0 ~ 4		0

■ **0 : PID disabled** ─ PID control disabled.

■ **1 : Stop and reset PID value to 0** ─ Operation values of PID control will not be reserved if a STOP command is input while executing the PID control.

■ **2 : Stop and reserve PID value** ─ Operation values of PID control will be reserved if a STOP command is input while executing the PID control. Those PID reserved values will be the initial values of PID operation when receiving a START command again.

■ **3 : Di enabled (Stop and reset PID value to zero)** ─ 11: Enable PID function can be set up from any one terminal of the external terminals Di (F61 ~ F66); and operation values of PID control will not be reserved if a STOP command is input while executing the PID control.

■ **4 : Di enabled (Stop and reserve PID values)** ─ 11: Enable PID function can be set up from any one terminal of the external terminals Di (F61 ~ F66); and operation values of PID control will be reserved if a STOP command is input while executing the PID control. Those PID reserved values will be the initial values of PID operation when receiving a START command again.

×	F116	PID command source	0 ~ 3		0

■ 0 : F118 Set value of PID command ■ 1 : Ai(V.R) ■ 2 : Ai1 ■ 3 : Ai2

×	F117	PID feedback point	0 ~ 1		0

◆ Select the input terminal to function as the detecting source of PID feedback point.

Set value	Function	Description
0	Ai1 input	● Input terminal of analog signal command for external feedback value. ● Parameter F50~F55 will undertake the adjustment and setup for the gain and shift of analog signal command.
1	Ai2 input	

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F118	Set value of PID command	0.00 ~ 100.00	%	50.00

◆ Enter a constant target value of command for this parameter to undertake the control.

○	F119	Kp	1.00 ~ 300.00	%	100.00
○	F120	Ki	0.00 ~ 300.00	%	25.00
○	F121	Kd	0.00 ~ 300.00	%	2.00
○	F122	Setup of input filter time D	0.05 ~ 10.00	second	0.20
○	F123	PID output limit	0.00 ~ 100.00	%	100.00

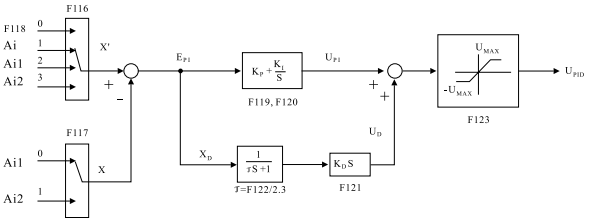
◆ Kp control : To output a proportional operating value according to the degree in response to the deviation. Entry of a big gain will obtain a fast response, but a too-big gain will cause oscillation; entry of a small gain will obtain a slow response.

◆ Ki control : A responding ability to output an operating gain of integral deviation so that the feedback value and the target value can be identical and effective. An entry of big integral gain will obtain a fast response speed, but a too-big gain will cause oscillation.

◆ Kd control : To output an operating gain of differential deviation so as to respond to the drastic variation as soon as possible. Entry of a big differential gain will attenuate the oscillation induced by the occurrence of deviation. However, an entry of too-big differential gain will cause oscillation instead.

◆ D input is connected to a low-pass filter in series to filter out the high-frequency noise, the time constant is τ = F122/2.3

PID Control block diagram :



Vector speed controller NO. 2 (LS720 special-purpose)

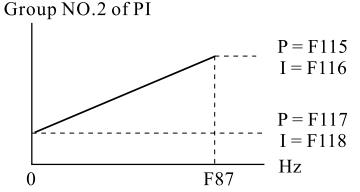
R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F115	High-speed control P 2 gain(ASR)	0.20 ~ 200.00	%	40.00
○	F116	High-speed control I 2 gain(ASR)	0.0 ~ 100.0	%	20.0
○	F117	Lower-speed control P 2 gain(ASR)	0.20 ~ 200.00	%	40.00
○	F118	Lower-speed control I 2 gain(ASR)	0.0 ~ 100.0	%	20.0

◆ LS720 has 2 groups of speed PI controller to provide a control mode F92=2: sensorless/flux vector control operation. The user can make the setup according to thereof own need. (Di setup 11: To enable the speed PI controller of the second Group; that is, Di-ON will enable the speed PI controller of the second Group while Di-OFF will enable the speed PI controller of the first Group (F105~ F108); this parametric group is exclusive for LS720, not available to LS700).
(Please refer to P4-8 for the setup-related flow process in detail)

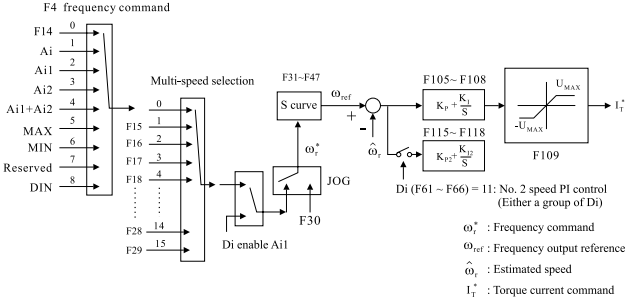
◆ PI speed control: PI control is a combination of proportional control (P) and integral control to feed back a response for speed control in accordance with the derivative variation of magnitude and time from speed deviation.

※ Prompts : (1) When used a motor that is high-efficiency, high-torque or a lower substrate frequency, a smaller set value should be set to the P gain of F115 and F117; on the other hand, a higher set value is required.
(2) If system requires a shorter acceleration/deceleration time (less than 0.8 second), the P gain that is about F117=10.0%, F115=8.0%; and I gain that is about F118=50.0%, F116=30.0% should be refered for setup.



※ Paleas pay attention to the reaction of system when modulating the parameters F115 ~ F118.

Sensor-less vector speed PI control

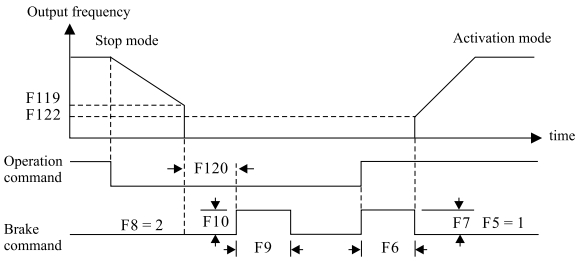


Special Machine Setup (LS720 special-purpose)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F119	Start frequency of DC brake when stopping machine	0.00 ~ 60.00	Hz	0.00

- This parameter is a function to set up the start frequency of dynamic DC brake when stopping machine; however, F8 machine-stopping mode= 2: dynamic + DC brake, F9: braking duration for stopping machine and F10: braking current for stopping machine must be set up first.
- This function is used by F92= 1:V/F voltage control or 3: sensorless voltage vector control.



R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
○	F120	B.B time of DC brake for stopping machine	0.10 ~ 2.00	second	0.20

◆ When enabled the start frequency of DC brake, a delay for an elapsing of a fixed B.B. (Base Block) time is required and then the DC brake function is performed accordingly.

×	F121	Time unit for acceleration & deceleration	0 ~ 1		0

■ **0 : 0.1 second** — F31 ~ F46 acceleration & deceleration time is 0.1 ~ 3000.0 seconds. (Ex-factory set value is 10 seconds).

■ **1 : 1 second** — F31 ~F46 acceleration & deceleration time is 1 ~ 30000 seconds. (Ex-factory set value is changed to 100 seconds).

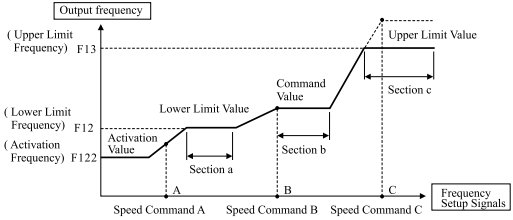
×	F122	Start frequency	0.00 ~ 30.00	Hz	0.00

◆ When the frequency of lower limit is less than the start frequency, the function to the frequency of lower limit will be disabled; that is, the frequency of low limit is inoperative.

◆ When rpm command value is higher than the set value of F122 start frequency, take and input the set value of start frequency into operation until the rpm command value is reached. If rpm command value is smaller than the start frequency, it leaves to an operation-standby state.

◆ When F12- frequency of lower limit is higher than the F122 start frequency and the rpm command value A is bigger than the F122 start frequency (The rpm command A shown in the figure), then take and input the set value of start frequency into operation until the lower limit of frequency is reached (the “a”bandwidth shown in the figure). If rpm command value is bigger than the start frequency of lower limit (The rpm command B shown in the figure), perform the operation until the rpm command value is reached (the “b” bandwidth shown in the figure).

◆ When the set value of rpm command is higher than the frequency of upper limit (the rpm command C shown in the figure), the output frequency will be limited to the frequency of upper limit for operation (the C bandwidth shown in the figure)



Special Machine Setup (LS720 only)

R : Parameter changeable during operation (○)

R	Parameter	Description	Range	Unit	Ex-factory setting
×	F123	Selecting the source of analog control for torque current	0 ~ 2	0	0

■ **0 : Disabled** ─ Disabled the limit of analog torque.

■ **1 : Ai1** ─ To enable a linear torque limit between the signal of input voltage (DC 0~10V) or input current (0~20mA) from the external terminals and thereof corresponding torque current values set to F109.

■ **2 : Ai2** ─ To enable a linear torque limit between the signal of input voltage (DC 0~10V) from the external terminals and thereof corresponding torque current values set to F109.

Retrieve parameters

×	F124	Reserved 1	-32767 ~ 32767		0
×	F125	Reserved 2	-32767 ~ 32767		0
×	F126	Retrieve parameter	0 ~ 2		0

■ **0 : Disabled**

■ **1 : Retrieve factory settings** ─ To retrieve the default ex-factory set values. **(Parameters F85 ~ F91 are excluded from this retrieval function).**

■ **2 : Clearance of failure records** ─ ◆ Any faulty phenomena taken place during the operation of ac drive will be recorded in the parameters F110 ~ F113.
◆ Enable the function of F126 : 2 clearance of failure records to clear the contents of failures saved in the memory.

×	F127	Lock the EEPROM parameter	0 ~ 1		0

■ **0 : Changeable** ─ All set values of parameters can be saved in the EEPROM memory

■ **1 : Functional parameters locked** ─ This function is able to lock most of the contents of parameters; the contents are unchangeable and for display only.

※ Parameters F0, F14 are exempted from this restriction of locking the functional parameters, they are changeable.

VI Protection and troubleshooting

Troubleshooting chart

◆ This chapter covers the displayed contents and the countermeasures relevant to the failure of ac drive, and the contents of problem and the solutions relevant to faulty conditions of motor.

<Table> Failure indication and remedy action

Displayed error code	Description	Possible causes	Remedy actions
Err 1	Over-voltage (Err U1) or over-current (Err A1) in standby state	● Input voltage of power supply (R.S.T.) was too high to cause the voltage at DC bus exceed the voltage detection level. ● Phase-phase short-circuits or grounding short-circuit taken place to output wire.	● Reduce the voltage to fall within the range of power supply specifications. ● Please verify the output wire to remove any short-circuit.
Err 2	Over-voltage (Err U2) or over-current (Err A2) during acceleration	● Started from motor's idling (easy to cause over-voltage or over-current). ● Acceleration time too short (easy to cause over-current) ● Any leakage due to poor insulation of the motor.	● Please set F5=1 : DC brake and start from the start frequency ● Extend the acceleration time appropriately.
Err 3	Over-voltage (Err U3) or over-current (Err A3) during deceleration	● Deceleration time too short (easy to cause over-voltage or over-current)	● Extend the deceleration time appropriately (setup shall comply with the deceleration time required by GD^2.)
Err 4	Over-voltage (Err U4) or over-current (Err A4)during speed regulation	● Motor was driven to start by an external force ● Drastic changing load	● Correct the system and remove the source of external force. ● Change the load smoothly.
Err 5	External failure	● External failure signal input from digital input terminals (Di3~Di8)	● Remove the cause of external failure.
Err 6	DC-Bus over voltage (O.V)	● Input voltage of power supply (R.S.T) too high to exceed the DC protection level. ● Deceleration time too short, motor's regenerative energy too big. Overvoltage protection (O.V): 200V : 410Vdc 400V : 820Vdc	● Lower the input voltage of power supply. ● Examine the set value of parameter F85. ● Extend the deceleration time, or connect the brake resistance (or brake controller).
Err 7	DC-Bus low voltage (L.V)	● Momentary power outage left the voltage lower than the DC protection level Low voltage protection (L.V) : 200V : 190Vdc 400V : 380Vdc ● Voltage of input power supply too low. ● Internal largest power-type fuse is blown.	● Please examine for the cause and improve the quality of power supply.
Err 8	Electronic thermal relay activated	● Motor's overload current exceeded the internal electronic set values (F77, F78 and F89).	● Please improve the motor load and check if parameters (F77, F78 and F89) are correct. ● Tune the F89 rated current of current a little be higher.

<Table> Failure indication and remedy action (Continued)

Displayed error code	Description	Possible causes	Remedy actions
Err 9	Di setting repeated	● Multifunctional input terminals Di3~Di8 were repeatedly set to an identical function (except the 0: disabled	● Please examine the set values of parameters F61~F66.
Err 10	Electric parameter auto-tunting malfunctioned	● Auto-tuning for motor's electric parameters failed.	● Please check if the set values of parameters F87~F91 are correct. ● Please make a manual calculation of motor data and enter them into motor electric parameter group (F93~F97).
Err 11	Current between motor and ac drive not matched	● F89 motor's rated current shall not be lower than six times of rated current of ac drive.	● Please change the motor capacity and examine the set value of parameter F89 (control and protection is not workable for a too-small motor capacity).
Err 12	Voltage between motor and ac drive not matched	● F88 motor's rated voltage shall not less than 1.5 times of (F85) input voltage of ac drive.	● Please change the class of motor voltage and examine the parameters F85 and F88.
Err 13	Circuit opened at output side of U phase or CT malfunctioned	● The phase lines of U.V.W phase at output side of ac drive and the wirings of motor were not firmly fastened, or thereof circuits were opened. ● Internal current transfomer (C.T.) failed.	● Please check the wiring loop and then perform the power resumption. ● Send it back to factory for repair.
Err 14	Circuit opened at output side of W phase or CT malfunctioned		
Err 15	Parameters stored in DSP locked and unalterable	● Storage of parameters has been restricted, and further storage of new data is unattainable.	● If storing new data is desired, please set up parameter F127 = 0 : Save.
Err 16	Parameter out of range (Default)	● EEPROM memory failed, no data, incomplete storage, set value of parameter out of range.	● Please use parameter F126 = 1 : retrieve the factory-set functions, and then proceed the setting for the parameter group of motor nameplate; or check the set values of parameters one by one for any value out of range. ● If the foregoing steps are still in vain, please send it back to factory for repair.
Err 17	Temperature of heat sink too high	● Faulty operation of cooling fan ● Ambient temperature too high	● Change the cooling fan. ● Increase the air change volume of environment.
	PF input power supply loss of phase or voltage too low	● Wiring obstructer or magnetic contactor defectively enabled. ● Loosened wiring terminals of input power supply. ● Fluctuation too big for voltage of input power supply	● Check the cause, take remedy actions and restore power. ● When the input is under phase and the output current is over the rated current of motor more than 50% time jumps Err17.
	PUF fuse blown	● An occurrence of short-circuit or grounding at output side of the ac drive may result in a damage to the IGBT module and further lead to a blown fuse that trips at Err17 or Err7.	● Check the causes, take remedy actions and replace or repair the ac drive.
Err 18	F12 > F13	● parameter setting error F12 > F13	● Please examine the conditions of standard values. F12 ≤ F13

Most frequently used troubleshooting

INHIBIT

(Any person other than the dedicated keeper or qualified technician of this machine are not allowed to troubleshoot the following failures; failure to obey this statement will void the liability for any incident occurred to this machine.).

Motor fails to rotate ?

Symptom : Motor fails to start its running.

§ Terminals of R.S.T. power supply energized?
→ Energize the power supply
→ Disconnect the power supply and re-energize it

§ Output of voltage from output terminals U.V.W confirmed ?
→ Confirm the power supply
→ Follow the operating procedure to operate it

§ Motor's rotating shaft jammed?
→ Lessen the motor load
→ Examine the mechanical structure
→ Replace motor with a new one

§ Wrong wiring?
→ Examine and repair the wiring loops

§ Protection functions enabled?
→ Verify the displayed content in monitor

§ Incorrect setting to the operation keyboard ?
→ Reconfirm the operating procedures once again

Ac drive trips when starting the motor ?

Symptom : An error code Err2 appears when starting or accelerating the motor (it may caused by the enabled protection function of over-current, or a momentary output current in excess of 200% of rated current, or a damaged IGBT module).

§ Short of torque when started at heavy load?
→ Change the parametric value for torque compensation

§ Acceleration time too short to match with the GD^2 of load?
→ Extend the acceleration time

§ Starting frequency too low ?
→ Increase the starting frequency

§ Protection function enabled?
→ Confirm the display in the monitor

§ Ac drive started when motor is idling ?
→ Set up the function: dc brake and start from zero frequency.

§ Incorrect setting to operation keyboard, electric leakage due to defective motor insulation?
→ Confirm it again

→ Replace it with a good motor, or remove the electric wire of output end and then re-supply the power to start it; if it still trips at Err2, then the ac does not trip at Err2, then the motor malfunctioned.

Ac drive trips when motor is decelerating?

Symptom：Err6 appears when decelerating the motor (Protective function of over-voltage enabled.)

§ The integral brake loop inside the ac drive failed to absorb the regenerative energy from motor during a sharp deceleration when the GD^2 of motor-driven load is too big?

＊Over-voltage protection function will be enabled immediately when regenerative energy exceeds 410V (200~240V series) or 820V (380~460V series).

→ Extend the deceleration time

→ Mount a dc brake resistance (optional) exclusive-use for external application below

→ Additional mounting of brake unit and resistance is necessary for application above 20HP

Trip during static operation ?

◆ Err7 appears during operation

§ Voltage of power supply Low?

→ Review the capacity of power supply equipment and find out the cause to the low voltage; such as, check if the contacts of no-fuse-breaker of magnetic switch are in good condition.

◆ Err6 appears during operation

§ Caused by load and motor or voltage of power supply?

§ Electric leakage due to bad motor insulation?

→ Additionally mount a dc brake resistance (optional) exclusive-use for external application.

→ Remove the output wires, re-supply the power and start it; if it still trips at Err6, then the ac drive malfunctioned, if it does not trip at Err6, then the motor is troubled with electric leakage and shall be replaced with new one. .

VII Maintenance, inspection & testing

Maintenance, inspection & testing

Cautions

- A maintenance professional shall confirm the current status of power supply switch in person. In order to ensure the safety of operation, strictly keep the power switch from the reach of irrelevant personnel with an identification label hung on the switch.
- Within a short period of time right after disconnecting the power supply, there will be DC high voltage remained at the electrolytic capacitor of large capacity in the internal rectification loop of the ac drive. For this reason, please make sure to see if the [CHARGE] light is off before performing the substrate inspection.

Highlights of regular maintenance:

● **External terminals, components and screws :** screws or connectors loosened ?	→ Redo mounting or fasten the screws.
● **Cooling fan :** noise or abnormal vibration ?	→ Replace or clean the cooling fan.
● **Capacitors and parts :** any discoloration, carbonization or strange odor ?	→ Send them back to factory for changing capacitorsor components of the ac drive.
● **Heat sink fins and circuit boards :** Deposited with dust or adhered with conductive iron chips or oil stain ?	→ Use a pressurized air gun to blow dry air to clean them. (Please do not use personal detergent for cleaning)

Daily inspection items :

- Motor follows the preset actions to run ? any faulty sound or vibration during its running ?
- Cooling fan mounted underneath the ac drive operates normally? Any abnormal heating condition ?
- The output current detected by the monitor exceeds the normal value ?
- The ambient temperature is normal ? the installation environment is normal ?

※ **Please truly follow the check items listed in this manual to conduct them item by itemto ensure this product is always maintained at a normal state for a long time.**

The ac drive is comprised of variety of components and takes the advantage of these parts & components to maintain and develop its expected functions. Because of it is an electronic part that will be worn somewhat by the working environment and operator's habit of using it, therefore, in order to obtain a normal operation for a long time, a regular check and replacement of parts & components is strongly recommended.

VIII Selection of brake resistance and brake unit

Selection of brake resistance and brake unit

WARNING

After the brake resistance's continuous discharging, a high ambient temperature will be formed to endanger the components around the brake resistance; therefore, please keep it away from the inflammables at a distance more than 2 meters and mount it at a well-ventilated place or mount an additional cooling fan for heat dissipation.

Ac drive						Specifications			
Voltage	Applicable motor capacity		Equivalent resistance specification W / Ω	Brake torque (10%ED) %	Equivalent Min resistance value (Ω)	Brake resistor (Module)	Brake resistor / SET	Specifications of externally mounted brake unit	Brake Unit / SET
	HP	KW							
200V	0.5	0.4	150W/150Ω	225	75Ω			Included	
	1	0.75	150W/150Ω	150	75Ω				
	2	1.5	300W/100Ω	125	39Ω				
	3	2.2	500W/60Ω	140	30Ω				
	5	3.7	800W/40Ω	125	27Ω				
	7.5	5.5	1200W/25Ω	135	18Ω	DR1K5W-24	1		
	10	7.5	1500W/20Ω	125	10Ω	DR1K5W-20	1		
	15	11	2200W/13.6Ω	125	10Ω	DR3K1W-12	1		
	20 △	15	3000W/10Ω	125	6.6Ω	DR3K1W-10	1	LSBR-2015B	1
	25 △	18.5	3700W/8Ω	125	6.6Ω	DR4K6W-8	1	LSBR-2022B	1
	30 △	22	4400W/6.8Ω	125	3.3Ω	DR4K6W-6.6	1	LSBR-2022B	1
	40 △	30	6000W/5Ω	125	3.3Ω	DR6K2W-5	1	LSBR-2015B	2
	50 △	37	7400W/4Ω	125	3.3Ω	DR4K6W-8	2	LSBR-2022B	2
	60 △	45	9000W/3.3Ω	125	2.5Ω	DR4K6W-6.6	2	LSBR-2022B	2
	75 △	55	11000W/2.7Ω	125	2.5Ω	DR6K2W-5	2	LSBR-2022B	3
	100	75	15000W/2Ω	125		DR6K2W-6	3	LSBR-2022B	4
	125	90	18000W/1.6Ω	125		DR6K2W-5	3	LSBR-2022B	4 or 5
	150	110	22000W/1.3Ω	125		DR6K2W-5	4	LSBR-2022B	5

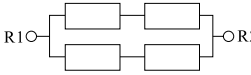
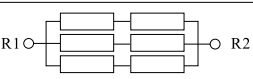
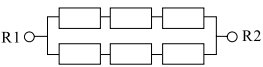
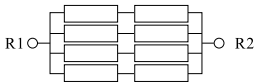
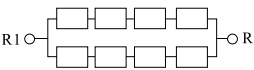
△ : An additional brake circuit can be fitted into the ac drive when placing the purchase order.

Ac drive						Specifications			
Voltage	Applicable motor capacity		Equivalent resistance specification W / Ω	Brake torque (10%ED) %	Equivalent Min resistance value (Ω)	Brake resistor (Module)	Brake resistor / SET	Specifications of externally mounted brake unit	Brake Unit / SET
	HP	KW							
400V	1	0.75	150W/300Ω	200	150Ω			Included	
	2	1.5	300W/300Ω	155	150Ω				
	3	2.2	500W/150Ω	175	72Ω				
	5	3.7	800W/100Ω	170	72Ω				
	7.5	5.5	1200W/80Ω	155	40Ω	DR1K5W-80	1		
	10	7.5	1500W/60Ω	155	40Ω	DR1K5W-60	1		
	15	11	2200W/50Ω	135	40Ω	DR3K1W-48	1		
	20 △	15	3000W/40Ω	125	20Ω	DR3K1W-40	1	LSBR-4015B	1
	25 △	18.5	3700W/32Ω	125	20Ω	DR4K6W-30	1	LSBR-4030B	1
	30 △	22	4400W/27.2Ω	125	20Ω	DR4K6W-30	1	LSBR-4030B	1
	40 △	30	6000W/20Ω	125	14.3Ω	DR6K2W-20	1	LSBR-4030B	1
	50 △	37	7400W/16Ω	125	14.3Ω	DR4K6W-30	2	LSBR-4030B	2
	60 △	45	9000W/13.3Ω	125	10Ω	DR4K6W-6.6	2	LSBR-4030B	2
	75 △	55	11000W/10Ω	125	6.6Ω	DR6K2W-20	2	LSBR-4030B	2
	100 △	75	15000W/8Ω	125	6.6Ω	DR6K2W-24	3	LSBR-4030B	3
	125	90	18000W/6.6Ω	125		DR6K2W-20	3	LSBR-4030B	3
	150	110	22000W/5.4Ω	125		DR6K2W-20	4	LSBR-4030B	4
	175	132	26400W/4.5Ω	125		DR6K2W-20	4	LSBR-4030B	5
	200	160	32000W/3.7Ω	125		DR6K2W-20	5	LSBR-4030B	6
	250	185	37000W/3.2Ω	125		DR6K2W-20	6	LSBR-4030B	7
	300	220	44000W/2.7Ω	125		DR6K2W-20	8	LSBR-4030B	8
	350	260	52000W/2.3Ω	125		DR6K2W-20	9	LSBR-4030B	9

△ : An additional brake circuit can be fitted into the ac drive when placing the purchase order.

Selection of brake resistance

◆ DR brake resistance specifications

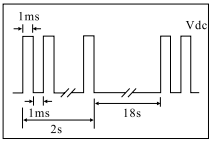
Model NO.		Model	Connection
DR1K5W-R			R1.R2 Line diameter above 3.5mm
R	16Ω	Figure A	
	20Ω		
	24Ω		
	40Ω		
DR3K1W-R			R1.R2 Line diameter above 5.5mm
R	8Ω	Figure B	
	10Ω		
	12Ω		
	20Ω		
	32Ω	Figure B	
	40Ω		
	48Ω		
	80Ω		
DR4K6W-R			R1.R2 Line diameter above 5.5mm
R	5.3Ω	Figure B	
	6.6Ω		
	8Ω		
	13.3Ω		
	12Ω	Figure B	
	15Ω		
	18Ω		
	30Ω		
DR6K2W-R			R1.R2 Line diameter above 8.0mm
R	4Ω	Figure C	
	5Ω		
	6Ω		
	10Ω		
	16Ω	Figure C	
	20Ω		
	24Ω		
	40Ω		

◆ Description of model number

DR 3K1W - 10

- Brake resistance module
- Rated power (W)
- Resistance (Ω) ±5%

Brake cyclic curve



Brake power condition

1. Duty/Cycle : 1ma/2ms
2. Brake time : 2s
3. Rest time : 18s

$ED\% = \frac{2s}{20s} \times 100\% = 10\%$

◆ Dimensions of Brake resistance

Figure A

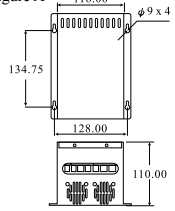


Figure B

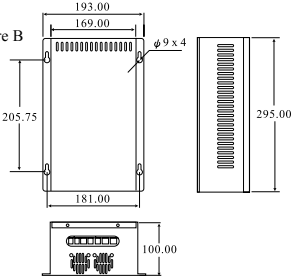


Figure C

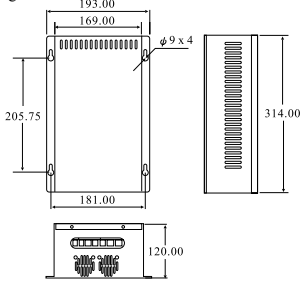
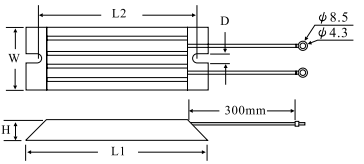


Figure D



Model No.	Dimensions (mm) ±3%					Resistance range (Ω)	Model No.	Dimensions (mm) ±3%					Resistance range (Ω)
	L1	L2	H	D	W			L1	L2	H	D	W	
SDR80W	140	125	20	5.2	40	0.1~10K	SDR300W	215	200	30	5.2	60	0.5~30K
SDR100W	165	150	20	5.2	40	0.1~10K	SDR400W	265	250	30	5.2	60	0.5~30K
SDR120W	190	175	20	5.2	40	0.15~15K	SDR500W	335	320	30	5.2	60	0.5~30K
SDR150W	215	200	20	5.2	40	0.15~15K	SDR600W	335	320	30	5.2	60	1~50K
SDR200W	165	150	30	5.2	60	0.3~20K	SDR800W	400	385	40	5.2	80	1~50K

★ NOTE:

1. Please select the resistance (ohms), watts and the frequency of application (ED%) specified by the Company.
2. A precaution toward the safety and inflammability around the peripheral environment shall be made when installing the brake resistance.
3. For an application with more than two sets of brake unit, please pay attention to the equivalent resistance after installing these brake units in parallel connection that shall not be lower than the equivalent minimum resistance of each ac drive. When using the brake unit is desired, please peruse the operation instruction of brake unit and connect the wirings accordingly.

IX Appendix

Appendix-A-Standard specifications-

200V series specifications

Model LS700-2 □□□		0K2	0K4	0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055	075	090	110
Applicable motor power (KW)		0.2	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
Applicable motor power (HP)		0.25	0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
Output	Rated output capacity (KVA)	0.6	1.4	1.9	2.8	4.7	6.6	9.5	12.9	19	25	31	38	49	62	72	87	114	133	173
	Continuous rated current (A)	1.6	3.7	5	7.5	12.5	17.5	25	34	50	68	82	100	130	165	190	230	300	350	455
	Max. output voltage (V)	3-phase corresponding input voltage																		
	Output frequency range (Hz)	0.00～300.00Hz																		
	Carrier frequency (Hz)	16KHZ						12KHZ			10KHZ			8KHZ			6KHZ		5KHZ	3KHZ
Power supply	Input voltage, frequency	3-phase power supply 200V～240V 50/60HZ																		
	Tolerance for voltage fluctuation of power supply	±10%(180V～264V)																		
	Tolerance for frequency fluctuation of power supply	±8%(46HZ～64.8HZ)																		
Cooling fan		Forced fan																		

400V series specifications

Model LS700-4 □□□		0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055	075	090	110	132	160	185	220
Applicable motor power (KW)		0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220
Applicable motor power (HP)		1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	200	250	300
Output	Rated output capacity (KVA)	2.8	3.8	5.7	7.6	10.6	13.3	19	28	32	38	51	62	76	99	125	152	175	209	228	266	346
	Continuous rated current (A)	3.7	5	7.5	10	14	17.5	25	38	43	50	68	82	100	130	165	200	230	275	300	350	455
	Max. output voltage (V)	3-phase corresponding input voltage																				
	Output frequency range (Hz)	0.00～300.00Hz																				
	Carrier frequency (Hz)	16KHZ				12KHZ			10KHZ			8KHZ			6KHZ		5KHZ		4KHZ		3KHZ	
Power supply	Input voltage, frequency	3-phase power supply 380V～480V 50/60HZ																				
	Tolerance for voltage fluctuation of power supply	±10%(342V～528V)																				
	Tolerance for frequency fluctuation of power supply	±8%(46HZ～64.8HZ)																				
Cooling fan		Forced fan																				

Common characteristics

Control	Control method	Sine wave SVPWM, 2-phase or 3-phase modulation, switching frequency 2K ~ 16KHZ, three control modes -V/F voltage vector control, sensorless flux voltage vector control, sensorless current vector control
	Max. output frequency	0.00 ~ 300.00Hz
	Frequency precision (temperature fluctuation)	Digital signal : ±0.1%(-10°C+40°C), analog signal : ±0.1%(25°C±10°C)
	Precision for frequency setup	Digital signal : 0.01Hz(0.01 ~ 300.00Hz), analog signal : 0.06/60.00Hz
	Precision for speed regulation	Voltage sensor-less vector : 10Hz± 1.0 %, V/F : ± 3.0% ~ 5.0%
	Acceleration / deceleration time	0.1 ~ 3000.0(seconds), 8-stage individual & independent setup of acceleration /deceleration time duration.
	Control functions	15 indication, 9 command sources of rotation speed, speed searching, torque limits, multi-function input and output terminal, 8 preset speeds control, skip frequency, AVR, Auto-Tuning motor parameters, S curve, Slip compensation, torque compensation, Max and frequency setting, DC brake in start/stop, PID function (LS700 only), Group 2-speed control PI control (LS720 only)
	Signal for frequency setup	DC 0 ~ 10V, 0 ~ 20mA
	Brake torque	20% approximately, 125% with brake controller mounted.
	Additional control functions	Digital operation panel, speed regulation, sensorless flux control, PID control, multi-stage speed control,…etc.
Control	Motor protection	Protected by an integral type electronic thermal-activated relay
	Over-current protection	Exceeding the rated current by 200% will trigger the over-current protection to stop motor automatically.
	Overload ability of ac drive	Exceeding the rated current by 150% for 60 seconds will trigger the over-current protection to stop motor automatically.
	Over-voltage protection	Over-voltage level : Vdc > 410V(200V~240Vclass) /Vdc > 820V(380V~480Vclas)
	Low-voltage protection	Low-voltage level : Vdc 190V(200V~240Vclas) / Vdc < 380V(380V~480Vclas)
	Power supply protection	Under phase protection for input power supply (equipped for ac drive with a power above 5.5KW), under phase protection for output (equipped for ac drive with a power above 0.4KW)
	Superheating heat radiation fins	Thermal coupler protection 85°C ± 5°C
	Stall protection	To protect the device from stall during acceleration/deceleration and operation.
	Grounding protection	To protect electronic circuits.
	Charging indication	Charging indicator will be turned “ON” when the DC voltage of main circuit is over 50V.
	Place used	Indoor places free of corrosion or dusts.
Environment conditions	Place used	Indoor places free of corrosion or dusts.
	Storage temperature (Note 1)	-20°C ~ +60°C
	Humidity	Below 95%RH (no condensation condition)
	Vibration	20HZ 1G, 20 ~ 50HZ, 0.2G

※Note 1：A too high storage temperature may damage the capacitor of main circuit.

Appendix-B-Ex-factory set values-

200V Series

Horsepower	KW	20K4	20K7	21K5	22K2	24K0	25K5	27K5	2011	2015
	HP	0.5	1	2	3	5	7.5	10	15	20
F83		0.040	0.040	0.030	0.030	0.025	0.025	0.020	0.020	0.015
F84		5000	5000	5000	5000	5000	5000	5000	5000	5000
F85		220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
Motor's rated parameters	F87	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ
	F88	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
	F89	2.0 A	3.5 A	6.0 A	8.2 A	15 A	20 A	27 A	38 A	50 A
	F90	0.5 HP	1.0 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP	15 HP	20 HP
	F91	4P	4P	4P	4P	4P	4P	4P	4P	4P

Horsepower	KW	2018	2022	2030	2037	2045	2055	2075	2090	2110
	HP	25	30	40	50	60	75	100	125	150
F83		0.015	0.010	0.010	0.008	0.008	0.006	0.006	0.003	0.003
F84		5000	5000	5000	5000	5000	3000	3000	3000	2000
F85		220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
Motor's rated parameters	F87	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ
	F88	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V	220 V
	F89	62 A	75 A	97 A	128 A	150 A	187 A	235 A	300 A	355 A
	F90	25 HP	30 HP	40 HP	50 HP	60 HP	75 HP	100 HP	125 HP	150 HP
	F91	4P	4P	4P	4P	4P	4P	4P	4P	4P

400V Series

Horsepower	KW	40K7	41K5	42K2	44K0	45K5	47K5	4011	4015	4018	4022	4030
	HP	1	2	3	5	7.5	10	15	20	25	30	40
F83		0.040	0.030	0.030	0.025	0.025	0.020	0.020	0.015	0.015	0.010	0.010
F84		5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
F85		380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V
Motor's rated parameters	F87	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ
	F88	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V
	F89	1.9 A	3.7 A	5.3 A	8.2 A	12 A	15 A	22 A	28 A	36 A	44 A	58 A
	F90	1.0 HP	2.0 HP	3.0 HP	5.0 HP	7.5 HP	10 HP	15 HP	20 HP	25 HP	30 HP	40 HP
	F91	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P

Horsepower	KW	4037	4045	4055	4075	4090	4110	4132	4160	4185	4220	Reserved
	HP	50	60	75	100	125	150	175	200	250	300	
F83		0.008	0.008	0.006	0.006	0.003	0.003	0.003	0.003	0.003	0.003	Reserved
F84		5000	5000	4000	4000	3000	3000	3000	3000	2000	2000	
F85		380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	
Motor's rated parameters	F87	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	60 HZ	
	F88	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	380 V	
	F89	72 A	84 A	108 A	135 A	165 A	210 A	260 A	290 A	340 A	385 A	
	F90	50 HP	60 HP	75 HP	100 HP	125 HP	150 HP	175 HP	200 HP	250 HP	300 HP	
	F91	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	

Appendix-C-Summary of parameter settings-

LS-700/720 Ver : NO.2.20 /NO.1.0 Summary of Parameter

R : Parameter changeable during operation (○)

1	R	Parameter code	Description	Range	Unit	Ex-factory setting	Page No
Display setup for operation panel	○	F0	Selection of displays in operation panel	0～16		1	P5-1
	0 : Frequency command (F) 1 : Output frequency (H) 2 : Output current (A) 3 : Output voltage (V) 4 : Normal voltage at DC side (Vdc) 5 : Voltage at DC side before startup (Vdc)		6 : Offset frequency to the output power supply (HZ) 7 : Estimated speed (HZ) 8 : Digital operation panel Ai(V.R)% 9 : Ai1(V/mA)%	10 : Ai2(V)% 11 : Torque current command (A) 12 : PID output (%) (LS720 Reserved) 13 : Input status at digital terminals 14 : Version of software 15~16 : Reserved			
	○	F1	Speed indicating unit	0～1		0	P5-1
	0 : Frequency (Hz) 1 : Revolving speed (rpm)						
	○	F2	Indicating the filtration time	0～15		6	P5-2
Operation control parameters	×	F3	Operation control source	0～1		0	P5-2
	0 : Digital operation panel 1 : Digital input terminals						
	×	F4	Frequency command source	0～8		1	P5-2
	0 : Digital operation panel (Master speed) 1 : Operation panel Ai(V.R) 2 : Ai1		3 : Ai2 4 : Ai1＋Ai2 5 : Ai1 , Ai2／MAX	6 : Ai1 , Ai2／MIN 7 : PID (LS720 Reserved) 8 : Digital terminals for increase decrease keys			
	×	F5	Enable the DC brake mode	0～2		0	P5-3
	0 : Start from zero speed 1 : DC brake and run 2 : Resistance calibration + DC brake and run						
	×	F6	Braking time before startup	0.0～120.0	Second	5.0	P5-4
	×	F7	Braking current before startup	0.0～100.0	%	30.0	
	×	F8	Shutdown mode	0～2		1	
	0 : Free run stopping 1 : Dynamic stop 2 : Dynamic + DC brake						
	×	F9	Stopping-braking time	0.0～120.0	Second	5.0	P5-4
	×	F10	Stopping-braking current	0.0～100.0	%	30.0	
Speed limit	×	F11	Rotating direction restriction	0～3		1	P5-5
	0 : FWD and REV 1 : FWD only 2 : REV only 3 : REV available at negative bias						
	×	F12	Lower limit of frequency	0.00～60.00	Hz	0.00	P5-5
	×	F13	Upper limit of frequency	0.00～300.00	Hz	60.00	
	○	F14	Master speed	0.00～300.00	Hz	5.00	P5-6
	○	F15	Speed at stage 1	0.00～300.00	Hz	10.00	
	○	F16	Speed at stage 2	0.00～300.00	Hz	15.00	
	○	F17	Speed at stage 3	0.00～300.00	Hz	20.00	
	○	F18	Speed at stage 4	0.00～300.00	Hz	30.00	
	○	F19	Speed at stage 5	0.00～300.00	Hz	40.00	

2	R	Parameter code	Description	Range	Unit	Ex-factory setting	Page No
Multi-stage speed-frequency command setup	○	F20	Speed at stage 6	0.00～300.00	Hz	50.00	P5-6
	○	F21	Speed at stage 7	0.00～300.00	Hz	60.00	
	○	F22	Speed at stage 8	0.00～300.00	Hz	0.00	
	○	F23	Speed at stage 9	0.00～300.00	Hz	0.00	
	○	F24	Speed at stage 10	0.00～300.00	Hz	0.00	
	○	F25	Speed at stage 11	0.00～300.00	Hz	0.00	
	○	F26	Speed at stage 12	0.00～300.00	Hz	0.00	
	○	F27	Speed at stage 13	0.00～300.00	Hz	0.00	
	○	F28	Speed at stage 14	0.00～300.00	Hz	0.00	
	○	F29	Speed at stage 15	0.00～300.00	Hz	0.00	
	○	F30	Inching speed	0.00～300.00	Hz	6.00	
Acceleration / Deceleration time	○	F31	Acceleration time for master speed, inching and speed at stage 8	0.1～3000.0	Second	10.0	P5-7
	○	F32	Deceleration time for master speed, inching and speed at stage 8	0.1～3000.0	Second	10.0	
	○	F33	Acceleration time for speed at stage 1 and stage 9	0.1～3000.0	Second	10.0	
	○	F34	Deceleration time for speed at stage 1 and stage 9	0.1～3000.0	Second	10.0	
	○	F35	Acceleration time for speed at stage 2 and stage 10	0.1～3000.0	Second	10.0	
	○	F36	Deceleration time for speed at stage 2 and stage 10	0.1～3000.0	Second	10.0	
	○	F37	Acceleration time for speed at stage 3 and stage 11	0.1～3000.0	Second	10.0	
	○	F38	Deceleration time for speed at stage 3 and stage 11	0.1～3000.0	Second	10.0	
	○	F39	Acceleration time for speed at stage 4 and stage 12	0.1～3000.0	Second	10.0	
	○	F40	Deceleration time for speed at stage 4 and stage 12	0.1～3000.0	Second	10.0	
	○	F41	Acceleration time for speed at stage 5 and stage 13	0.1～3000.0	Second	10.0	
	○	F42	Deceleration time for speed at stage 5 and stage 13	0.1～3000.0	Second	10.0	
	○	F43	Acceleration time for speed at stage 6 and stage 14	0.1～3000.0	Second	10.0	
	○	F44	Deceleration time for speed at stage 6 and stage 14	0.1～3000.0	Second	10.0	
	○	F45	Acceleration time for speed at stage 7 and stage 15	0.1～3000.0	Second	10.0	
	○	F46	Deceleration time for speed at stage 7 and stage 15	0.1～3000.0	Second	10.0	
	○	F47	S curve	0.0～100.0	%	0.0	

★Resolution of 0.1 seconds can be set to 3000.0 seconds; a resolution of 1 second can be set to 30000 seconds. Arelated parameter setting resolution in seconds, please set the parameters for F121.

★Resolution function is set to LS720-specific, LS700 there is no such function, acceleration and deceleration time of from 0.1 to 3000.0 seconds.

3	R	Parameter code	Description	Range	Unit	Ex-factory setting	Page No
Analog input (Ai)	○	F48	Ai:0V Input bias %	-300.00～300.00	%	0.00	P5-8
	○	F49	Ai:5V Input gain %	-300.00～300.00	%	100.00	
	○	F50	Ai1:0V Input bias %	-300.00～300.00	%	0.00	P5-9
	○	F51	Ai1:10V Input gain %	-300.00～300.00	%	100.00	
	○	F52	Ai1:Dead Band	0.00～85.00	%	0.00	
	○	F53	Ai2:0V Input bias %	-300.00～300.00	%	0.00	
	○	F54	Ai2:10V Input gain %	-300.00～300.00	%	100.00	
	○	F55	Ai2:Dead Band	0.00～85.00	%	0.00	
Analog Output(AO)	○	F56	A out function of analog variables	0～10		0	P5-11

F56 function of analog variable	F58 10V/ corresponding value	Reference standard point
0：Disabled	×	×
1：Output frequency	4096	F87 parameter set value
2：Predict rpm	4096	F87 parameter set value
3：Frequency of power supply	4096	F87 parameter set value
4：Output voltage	2200 3800	220.0 V F87 parameter set value 380.0 V

F56 function of analog variable	F58 10V/ corresponding value	Reference standard point
5：Output current	8192	F89 parameter set value
6：Torque current command	8192	F89 parameter set value
7：Ai	16384	Ai × (F48 and F49)
8：Ai1	16384	Ai1 × (F50 and F51)
9：Ai2	16384	Ai2 × (F53 and F54)
10：PID LS720 Re.	16384	100%

○	F57	A out : 0V output bias	-32767～32767		0	P5-11
○	F58	A out : 10V output gain	-32767～32767		4096	
×	F59	Scanning cycle of digital input	1.0～200.0	ms	1.0	P5-12
×	F60	Di1 , Di2 setup	0～2		0	

0 : Di1(FWD/STOP) ,Di2(REV/STOP) 1:Di1(RUN/STOP) , Di2(FWD/REV)
2 : 3-wire shutdown :Di3(FWD/REV),Di2(STOP),Di1(RUN), automatically disable F61 setting at the same time.

×	F61	Di3 setup	0～13		1	P5-12
×	F62	Di4 setup	0～13		2	
×	F63	Di5 setup	0～13		6	
×	F64	Di6 setup	0～13		7	
×	F65	Di7 setup	0～13		10	
×	F66	Di8 setup	0～13		3	

Digital input (Di)

0：Disabled
1：External failure input
2：RESET
3：Coastdown
4：Increasing the master speed
5：Decreasing the master speed
6：Multi-stage speed command 1
7：Multi-stage speed command 2
8：Multi-stage speed command 3
9：Multi-stage speed command 4
10：Inching operation
11：PID function enabled (LS700 Special-purpose)
11：Enable the 2nd group of speed PI controller (LS720 Special-purpose)
12：Frequency command reaches Ai1
13：Di-enabling vector control mode (LS720 exclusive)

×	F67	Setup to enable the terminal after restoring the power supply	0～1		0	P5-15

0：Directly enabling 1：Comand to reset terminal first and re-enable it.

4	R	Parameter code	Description	Range	Unit	Ex-factory setting	Page No
Digital output (Do)	×	F68	Relay setup	0～10		1	P5-15
	×	F69	DO setup	0～10		10	
	0 : Disabled 1 : Faulty output 2 : In operation 3 : At zero speed 4 : FWD revolution 5 : REV revolution 6 : In acceleration 7 : In deceleration 8 : Frequency consistency (At constant speed) 9 : Overload (prognostication) 10: Reaching frequency						
	×	F70	Reaching frequency	0.00～300.00	Hz	60.00	P5-16
Jumping frequency	×	F71	Jumping frequency	0.00～300.00	Hz	0.00	P5-16
	×	F72	Jumping bandwidth	0.00～10.00	Hz	0.00	
Motor protection setup	×	F73	Stall-protection setup	0～31		7	P5-16
	bit4：AVR voltage-regulating function bit3：Protection function F77 bit2：Protection function F76 bit1：Protection function F75 bit0：Protection function F74						
	×	F74	Setting the stalling voltage during deceleration	1.00～1.25	Vdc	1.20	P5-17
	×	F75	Setting the stalling current during acceleration	0.50～2.50	F89	1.70	P5-18
	×	F76	Setting the stalling current during operation	0.50～2.50	F89	1.60	
	×	F77	Current level of electronic thermal relay	1.01～2.50	F89	1.50	
	×	F78	Acting time of electronic thermal relay	0.1～120.0	Second	60.0	
	$\int (I^2 A(pu)-1)dt \geqq (I*_{OL}{}^2 -1) \times T_{OL}$ will lead to an overload and overtime.						
	○	F79	Oscillation-inhibit gain	0.0～100.0	%	15.0	P5-19
Magnetic flux setup	×	F80	Maximum output voltage (U.V.W)	0.50～1.00	F88	1.00	P5-19
	×	F81	V/F maximum voltage frequency	0.50～2.00	F87	1.00	
	×	F82	V/F curve selection	-10～5		0	P5-20
	○	F83	Voltage-boosting value	0.000～0.200	Pu	0.010	
Ac drive parameters	×	F84	PWM carrier frequency	2000～16000	Hz	5000	P5-21
	×	F85	RST input voltage (rms)	150～480	Vac	220	
	※ Note：F85 shall be set up according to actual input voltage.						
	×	F86	Vdc indicating value gain (Read only)	50～300	Fold	140	P5-21
	※ Note：200 Vac Series L.V = 190V, O.V = 410V; 400Vac Series L.V = 380V, O.V = 820V						
Motor nameplate	×	F87	Rated frequency (Hz)	20.00～150.00	Hz	60.00	P5-22
	×	F88	Rated voltage (rms)	150～480	Vac	220	
	×	F89	Rated current (rms)	0.5～600.0	A	3.4	
	×	F90	Horse power (HP)	0.20～300.00	Hp	1.00	
	×	F91	Number of pole (P)	2～16	Pole	4	
	※ Note：F87~F91 shall entered according to the actual capacity of motor.						

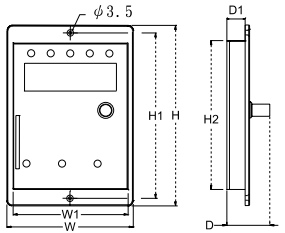
5	R	Parameter code	Description	Range	Unit	Ex-factory setting	Page No
Control mode	×	F92	Control mode setup	-1～3		1	P5-23
	-1 : Auto-tuning of static electric parameters 1 : V/F voltage control 3 : Sensor-less voltage vector control 0 : Auto-tuning of electric parameters 2 : Sensor-less flux/vector control						
Motor's electric parameters	×	F93	Stator's resistance	500～32767	Pu:Q17	10000	P5-24
	×	F94	Rotor's resistance	500～32767	Pu:Q17	8000	
	×	F95	Stator's self-induction	3250～32767	Pu:Q12	9000	
	×	F96	Mutual induction	3250～32767	Pu:Q12	8750	
	×	F97	No-load current(%)	12.50～99.00	0.01%	40.00	
	×	F98	Voltage calibration (Read only)	0～32767		0	
	×	F99	Current calibration (Read only)	0～32767		0	
Vector estimation	×	F100	Flux-estimated bandwidth	0.50～20.00	Hz	3.00	P5-25
	×	F101	Speed-estimated bandwidth	0.50～20.00	Hz	7.00	
	○	F102	Slip-offset gain	10～200	%	80	
	×	F103	Low-speed torque offset gain	100.0～180.0	%	140.0	
	×	F104	Torque-offset cut-off frequency	0.00～0.60	Pu	0.20	
Vector speed controller 1	○	F105	High-speed control P gain (ASR)	0.20～200.00	%	30.00	P5-26
	○	F106	High-speed control I gain (ASR)	0.0～100.0	%	30.0	
	○	F107	Lower-speed control P gain (ASR)	0.20～200.00	%	15.00	
	○	F108	Lower-speed control I gain (ASR)	0.0～100.0	%	30.0	
	×	F109	Torque current limit	0.050～1.250		1.000	P5-27
Failure records	×	F110	Current failure record	0～20		0	P5-28
	×	F111	Failure record of last time	0～20		0	
	×	F112	Failure record of last two times	0～20		0	
	×	F113	Failure record of last three times	0～20		0	
	0 : Communication failure of digital operation panel 1 : Over-voltage (Err U1) or over-current (Err A1) during standby state 2 : Over-voltage (Err U2) or over-current (Err A2) during acceleration 3 : Over-voltage (Err U3) or over-current (Err A3) during deceleration 4 : Over-voltage (Err U4) or over-current (Err A4) at constant speed 5 : External failure 6 : DC-Bus over voltage (O.V) 7 : Low DC Voltage during operation (L.V) 8 : Electronic thermal relay activated 9 : Di setup repeated 10 : Detection of electric parameters 11 : Unmatched currents between motor and ac drive 12 : Unmatched voltages between 13 : Open circuit at U-phase output 14 : Open circuit at W-phase output 15 : DSP-saved parameters locked that cannot be revised. 16 : Parameters exceeded the range(Default) 17 : Overtemperature or PF or PUF 18 : F12 > F13 19~20 : Reserved						
	×	F114	Number of times to auto`-reset the failure during operation	0～10		0	P5-28

6	R	Parameter code	Description	Range	Unit	Ex-factory setting	Page No
External PID			LS700 Special-purpose				
	×	F115	PID mode	0～4		0	P5-29
	0：Disable PID 1：Reset PID value to zero at shutdown 2：Reserve the PID value at shutdown			3：Di enables PID(Reset PID values to zero at shutdown) 4：Di enables PID(Reserve the PID value at shutdown)			
	×	F116	PID command source	0～3		0	P5-29
	0：F118	1：Ai	2：Ai1	3：Ai2			
	×	F117	PID feedback source	0～1		0	P5-29
	0：Ai1	1：Ai2					
	○	F118	PID commands setup	0.00～100.00	%	50.00	P5-30
	○	F119	Kp	1.00～300.00	%	100.00	
	○	F120	Ki	0.00～300.00	%	25.00	
	○	F121	Kd	0.00～300.00	%	2.00	
	○	F122	Set up the filtration time for Digital input	0.05～10.00	second	0.20	
	○	F123	PID output restriction	0.00～100.00	%	100.00	
Speed governor 2			LS720 Special-purpose				
	○	F115	High-speed control P 2 gain(ASR)	0.20～200.00	%	40.00	P5-31
	○	F116	High-speed control I 2 gain(ASR)	0.0～100.0	%	20.0	
	○	F117	Lower-speed control P 2 gain(ASR)	0.20～200.00	%	40.00	
	○	F118	Lower-speed control I 2 gain(ASR)	0.0～100.0	%	20.0	
	×	F119	Stop brake beginning frequency	0.00～60.00	Hz	0.00	P5-32
	○	F120	Stop DC brake B.B.time	0.10～2.00	second	0.20	P5-33
	×	F121	Acceleration and deceleration time units	0～1		0	
	0 : 0.1 Second (0.1 Sec ~ 3000.0 Sec)			1 : 1 Second (1 Sec ~ 30000 Sec)			
	×	F122	Activation frequency	0.00～30.00		0	P5-33
	×	F123	Torque Current Input Option	0～2		0	P5-34
	0 : Disabled	1 : Ai1		2 : Ai2			
Retrieve parameters	×	F124	Reserved 1	-32767～32767		0	P5-34
	×	F125	Reserved 2	-32767～32767		0	
	×	F126	Retrieve the parameters	0～2		0	
	0 : Disabled		1 : Retrieve the ex-factory setup		2: Clear the failure record		
	×	F127	Lock the parameters	0～1		0	P5-34
	0 : Revisable		1 : Lock the parameter				

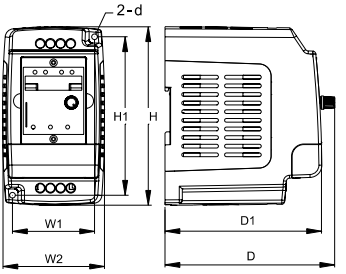
-Summary of Err codes and diagnostic descriptions-

Error code	Description of failure
Err 0	Communication of digital operation panel failed
Err 1	Over-voltage Err U1 or over-current Err A1 in standby state (hardware detection and protection)
Err 2	Over-voltage Err U2 or over-current Err A2 during acceleration (hardware detection andprotection)
Err 3	Over-voltage Err U3 or over-current Err A3 during deceleration (hardware detection and protection)
Err 4	Over-voltage Err U4 or over-current Err A4 during speed regulation (hardware detection and protection)
Err 5	External failure
Err 6	DC-Bus over voltage (O.V)
Err 7	DC-Bus low voltage (L.V)
Err 8	Motor overload longer than the allowable time
Err 9	DI setting repeated
Err 10	Electric parameter detection malfunctioned
Err 11	Current between motor and ac drive not matched
Err 12	Voltage between motor and ac drive not matched
Err 13	Circuit opened at output side of U phase or current detector malfunctioned
Err 14	Circuit opened at output side of W phase or current detector malfunctioned
Err 15	Parameters stored in DSP locked and unalterable.
Err 16	Parameter out of range (Default)
Err 17	Over temperature or PF or PUF failure
Err 18	F12 > F13
Err 19, Err 20 reserved	

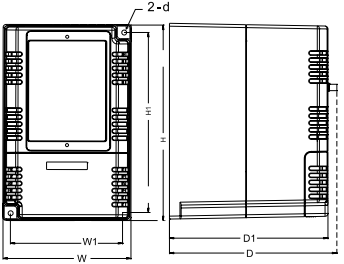
Digital operation panel (KP-AD20)



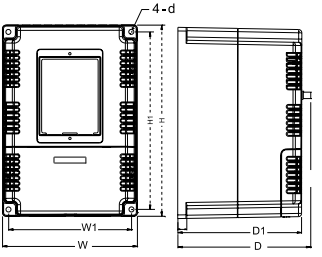
(Figure A)



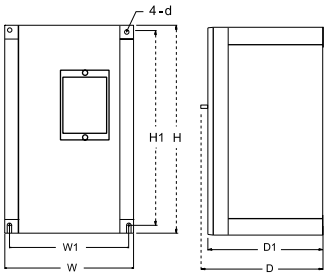
(Figure B)



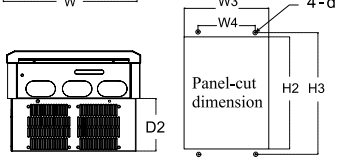
(Figure C)



(Figure D)



(Figure E)



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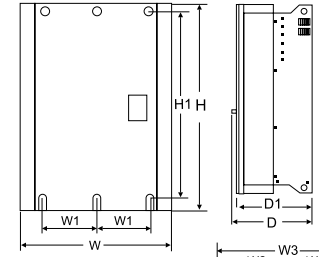

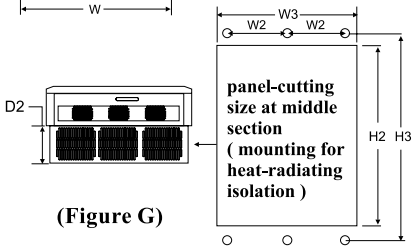

(Figure G)

※ Dimensions shown in the figures above are for reference only. Please refer to the newest catalogue for the updated dimensions. We reserve the right to change the dimensions without notice.

200V class series

Applicable motor capacity	Roughing-in dimensions (mm)			Constant dimension (mm)				ϕ	Holing, constant dimensions (mm)					Figure NO.
(HP)／(KW)	W	H	D	W1	W2	H1	D1	d	W3	W4	H2	H3	D2	
KP-AD 20	70.9	102	25.8	—	—	93	15.8	3.5	65.3	—	84.5	—	—	A
0.25 / 0.2	82.5	145	138	66.5	—	128.5	127.5	4.6	—	—	—	—	—	B
0.5 / 0.4														
1 / 0.75														
2 / 1.5														
0.5 / 0.4	114	172	146	101	—	159	136	5.3	—	—	—	—	—	C
1 / 0.75														
2 / 1.5														
3 / 2.2	152	214	146	137.5	—	200	136	5.3	—	—	—	—	—	D
5 / 3.7														
7.5 / 5.5	188	300	180	170	—	283	170	7	—	—	—	—	—	E
10 / 7.5														
15 / 11														
20 / 15	250	458	227	218	—	401	217	7	242	170	445	460	112	F
25 / 18.5														
30 / 22														
40 / 30	345	563	272	305	152.5	515	262	7	330	212	546	568	140	
50 / 37														
60 / 45														
75 / 55														
100 / 75	604	770	322	262.4	220	749.5	312	7	582	—	745	770	158	G
125 / 90														
150 / 110														

400V class series

Applicable motor capacity	Roughing-in dimensions (mm)			Constant dimension (mm)				ϕ	Holing, constant dimensions (mm)					Figure NO.
(HP)／(KW)	W	H	D	W1	W2	H1	D1	d	W3	W4	H2	H3	D2	
KP-AD 20	70.9	102	25.8	—	—	93	15.8	3.5	65.3	—	84.5	—	—	A
0.5 / 0.4	114	172	146	101	—	159	136	5.3	—	—	—	—	—	C
1 / 0.75														
2 / 1.5														
3 / 2.2	152	214	146	137.5	—	200	136	5.3	—	—	—	—	—	D
5 / 3.7														
7.5 / 5.5	188	300	180	170	—	283	170	7	—	—	—	—	—	E
10 / 7.5														
15 / 11														
20 / 15	250	458	227	218	—	401	217	7	242	170	445	460	112	F
25 / 18.5														
30 / 22														
40 / 30														
50 / 37	345	563	272	305	152.5	515	262	7	330	212	546	568	140	
60 / 45														
75 / 55														
100 / 75														
125 / 90	604	770	322	262.4	220	749.5	312	7	582	—	745	770	158	G
150 / 110														
175 / 132														
200 / 160														
250 / 185														
300 / 220														

* The company reserves the right to modify the models and specifications without notice.