ART ENERGY

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# Variable Frequency Drive iC5

0.4~2.2kW (0.5~3HP) 1 Phase 200-230Volts

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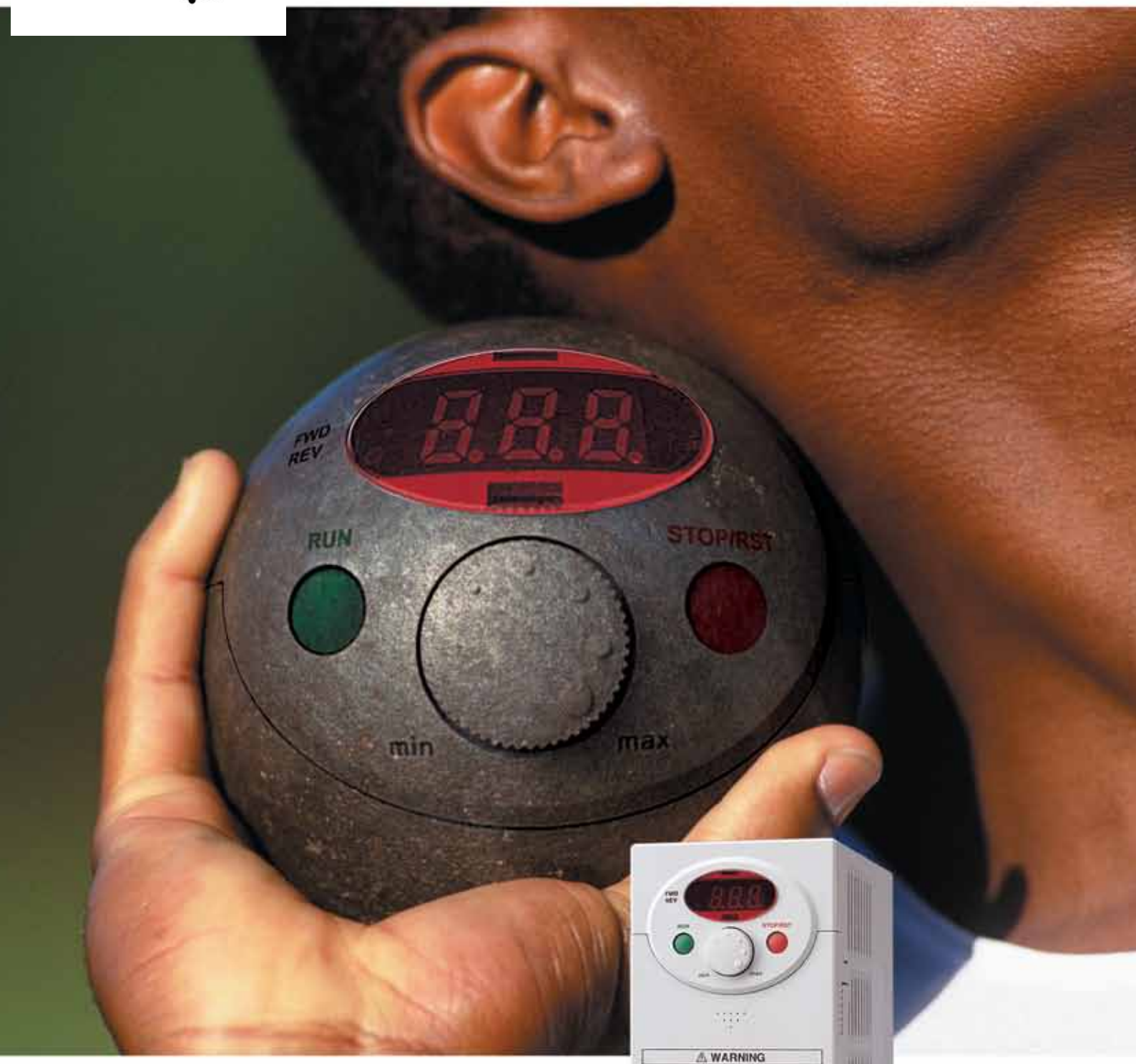
تهران، کیلومتر۲۱ بزرگراه لشگری (جاده مخصوص کرج)
روبروی پالایشگاه نفت پارس، پلاک ۱۲

FAMCO
هایپرصنعت





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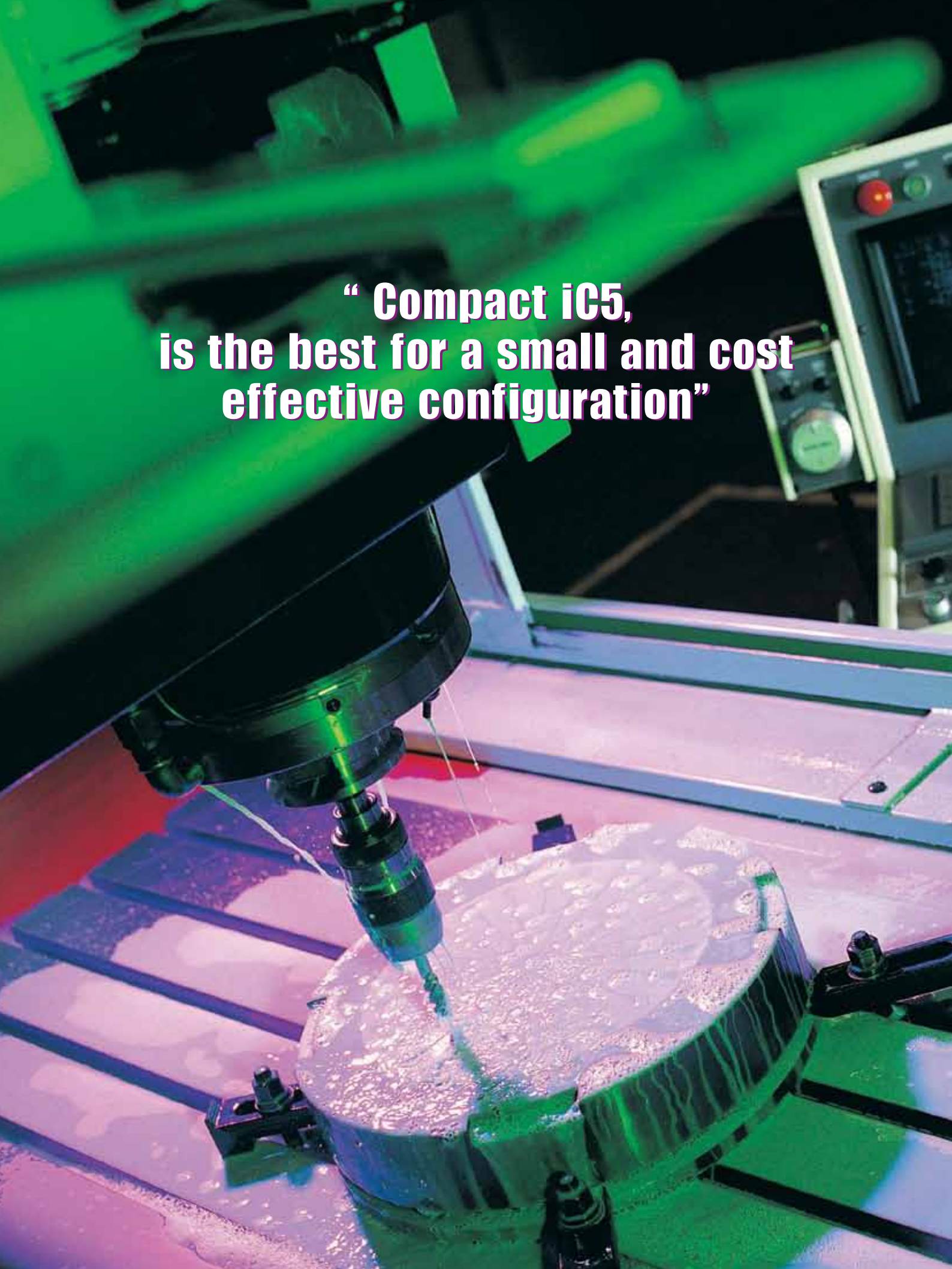
Starvert iC5


# " Global standard iC5, serves a wide variety of applications to meet the majority of user needs. "

- Modbus communication (Option)
- PID control
- Sensorless vector control
- Motor parameter auto tuning

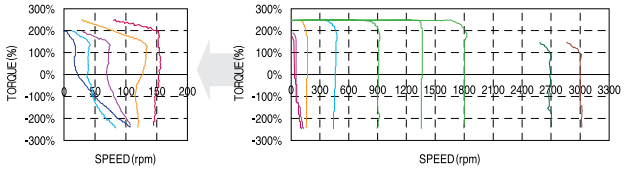
CE c UL us ISO9001 ISO14000


“ Compact iC5,
is the best for a small and cost
effective configuration”

## LS Drive iC5 Series

### Sensorless vector control

The iC5 adopts sensorless vector control algorithm, and it improves not only the torque control characteristics, but the speed controlability in an uncertain condition caused by the load variation as well.




### Auto tuning

The auto tuning algorithm in the iC5 sets the motor factors automatically that brings the traditional commissioning difficulties mainly in low speed by the load variation and the low torque generation to a settlement.

• Difficulty of measuring the motor constant • Input errors by an user
• Low torque in low speed • Low speed by the load variation • Setup by an expert

characteristic

• Setup by an user • Improving torque in low speed
• Auto tuning of the motor characteristics • Optimized motor control

### PNP and NPN switchable dual signals

The iC5 provides PNP and NPN signals for outside controllers.
It works with 24Vdc regardless of the type of PLC or control signals.

### Communication interface, ModBus-RTU

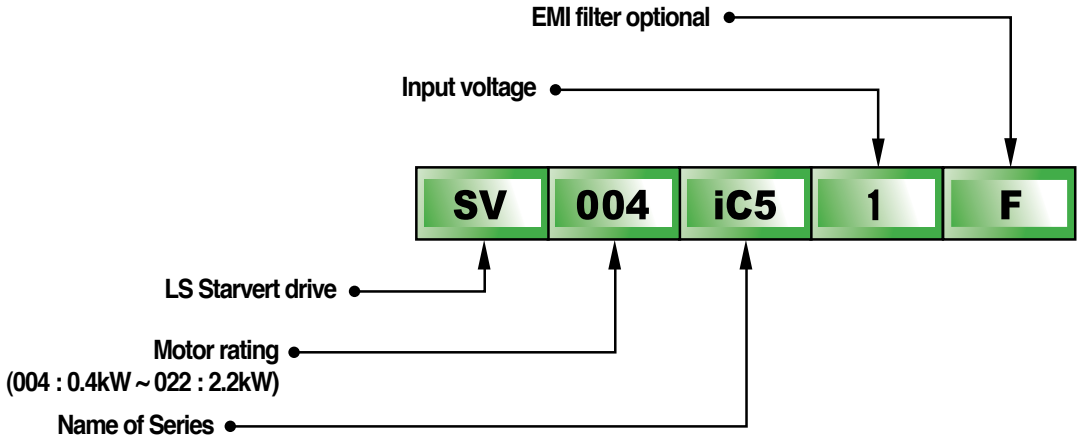
The iC5 provides the most popular communication interface, ModBus-RTU for remote control by PLC or other devices.

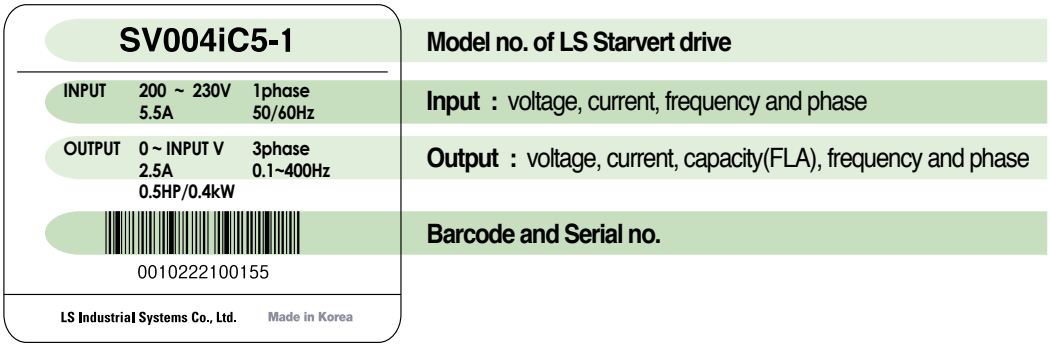
### Programmable PID process control

PID process control is used in iC5 to make speed corrections quickly with a minimal amount of overshoot and oscillation for the control of flow, temperature, pressure and etc.

# Models

| Applicable motor | 220V, single phase |
|---|---|
| 0.4kW (0.5HP) | SV004iC5-1 |
| 0.75kW (1HP) | SV008iC5-1 |
| 1.5kW (2HP) | SV015iC5-1 |
| 2.2kW (3HP) | SV022iC5-1 |



# Specifications

## Specifications (200-230V class)

| Model | | SV004iC5-1 | SV008iC5-1 | SV015iC5-1 | SV022iC5-1 |
|---|---|---|---|---|---|
| Motor rating | [HP] | 0.5 | 1 | 2 | 3 |
| | [kW] | 0.4 | 0.75 | 1.5 | 2.2 |
| Output ratings | Capacity[kVA] | 0.95 | 1.9 | 3 | 4.5 |
| | FLA[A] | 2.5 | 5 | 8 | 12 |
| | Voltage | Three phase, 200 to 230V | | | |
| | Frequency | 0 to 400Hz | | | |
| Input ratings | Voltage | Single phase, 200 to 230V ( ±10% ) | | | |
| | Frequency | 50 to 60Hz ( ±5% ) | | | |
| | Current | 5.5 | 9.2 | 16 | 21.6 |

## Control

| | |
|---|---|
| Control method | V/F control, Sensorless vector control |
| Frequency setting resolution | • Digital reference : 0.01Hz • Analog reference : 0.06Hz/60Hz |
| Frequency setting accuracy | • Digital : 0.01% of Maximum output frequency • Analog : 0.1% of Maximum output frequency |
| V/F ratio | Linear, Squar pattern, User V/F |
| Overload capacity | 1min. at 150%, 30sec. at 200% ( with inverse characteristic ) |
| Torque boost | Manual( 0 to 15% adjustable ), Auto |

## Operation

| | | |
|---|---|---|
| Input signal | Operator control | Keypad / Terminal / Communications |
| | Frequency setting | • Analog : 0~10V/0~20mA • Digital : Keypad • Communication : RS485 |
| | Start signal | Forward / Reverse |
| | Multi-step | Setting up to 8 speeds ( use multi-function terminal ) |
| | Multi-step accel /decel time | 0.1~6000 sec. Max. 8 types available by multi-function terminal<br>Selectable accel/decel patterns : Linear, U and S |
| | Emergency stop | Interrupting the output of the drive |
| | Jog | Jog operation |
| | Fault reset | Reset the fault when protective function is active |
| Output signal | Operation status & | Frequency detection, Overload alarm, Stalling, Overvoltage, Undervoltage, |
| | Fault output | Drive overheating, Run, Stop, Constant speed, Speed searching,<br>Fault output ( Relay and Open collector output ) |
| | Indicator | Choose one from output frequency, current, voltage and DC voltage.(Output voltage : 0~10V ) |
| Operation function | | DC braking, Frequency limit, Frequency jump, Second function,<br>Slip compensation, Reversing prevention, Auto restart, PID control |

## Protection functions

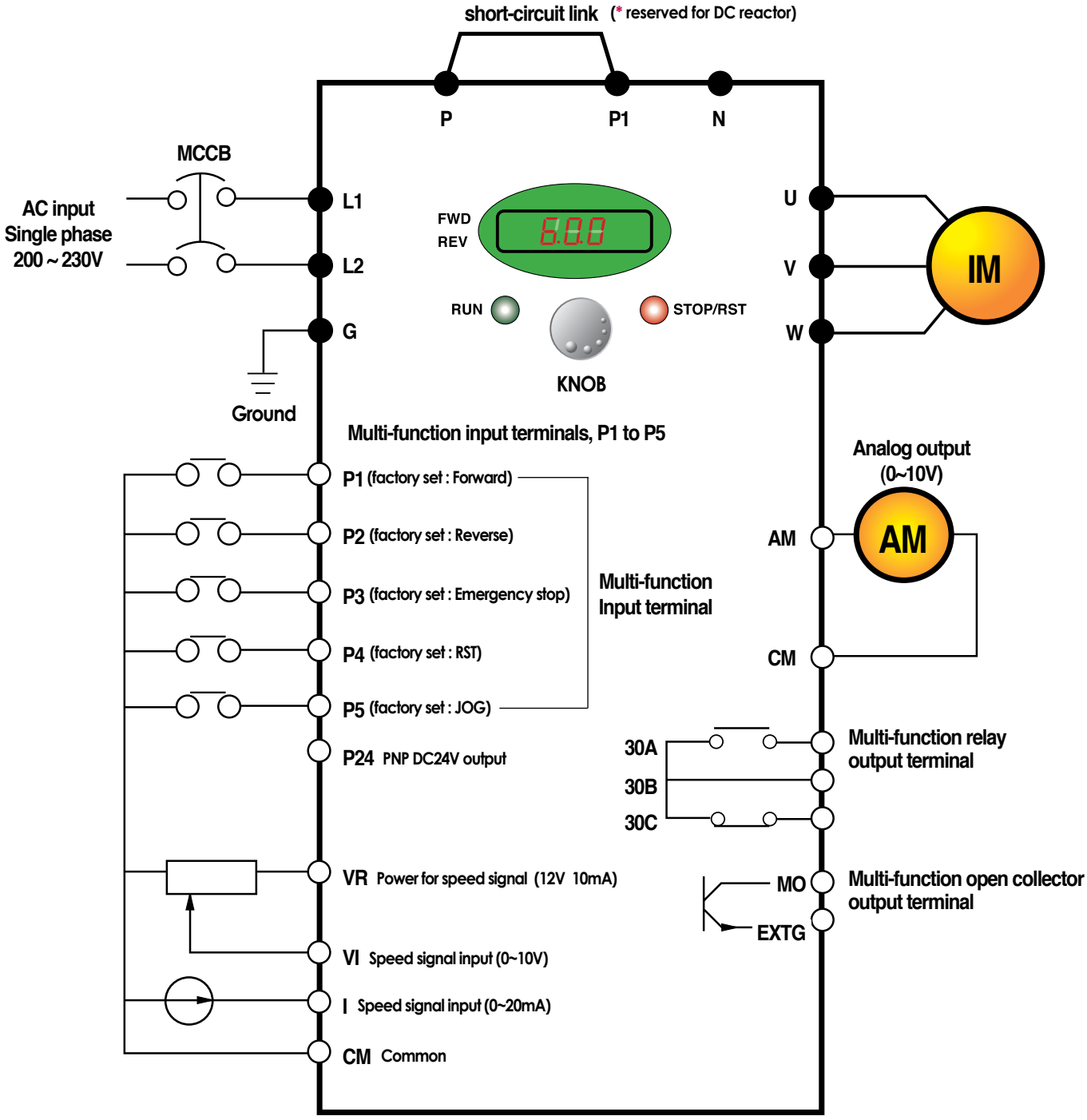
| | |
|---|---|
| Drive trip | Overvoltage, Undervoltage, Overcurrent, Drive overtemperature, Motor overtemperature, I/O phase loss, I/O mis-wiring,<br>Overload , External device fault 1.2, Loss of speed command, Hardware fault, Communication error, CPU error |
| Drive alarm | Stall prevention, Overload alarm |
| Momentary power less | • Less than 15 msec : keeping operation<br>• More than 15 msec : auto restart available |

## Display keypad

| | |
|---|---|
| Operation information | Output frequency, current and voltage, Set frequency value, Operation speed, DC voltage |
| Trip information | Display the trip cause when the protection function activates. Recent 5 faults records stored |

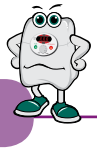
## Environment

| | |
|---|---|
| Cooling method | Forced air cooling |
| Degree of protection | Open, Pollution degree 2 |
| Ambient temperature | -10℃ ~ +50℃ |
| Storage temperature | -20℃ ~ +65℃ |
| Relative humidity | Less than 90% (no condensation) |
| Altitude, Vibration | 1,000m above sea level, Max. 5.9m/sec$^2$ (0.6G) |
| Application site | Protected from corrosive gas, combustible gas, oil mist or dust |




Note : 1. ● = Main circuit terminal ○ = Control circuit terminal
2. Analog output voltage is adjustable upto 12V.
3. Speed command can be set by Voltage, Current, Voltage+Current, Keypad, Keypad knob+Voltage , and Keypad knob+current.

# Terminal configuration



| L1 | L2 | P | P1 | N | U | V | W | G |
|---|---|---|---|---|---|---|---|---|

| Terminal | Signal | Description |
|---|---|---|
| L1, L2 | AC line input | Single phase AC line input |
| U, V, W | Drive output | 3 phase output terminals to motor |
| P, P1 | DC reactor | Connecting DC reactor |
| G | Ground | Chassis ground |

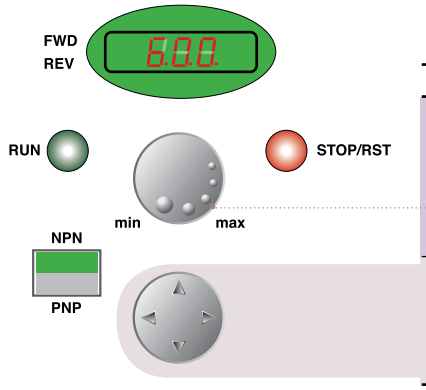
| | SV004iC5-1 | SV008iC5-1 | SV015iC5-1 | SV022iC5-1 |
|---|---|---|---|---|
| Input wire size | 2mm² | 2mm² | 3.5mm² | 3.5mm² |
| Output wire | 2mm² | 2mm² | 3.5mm² | 3.5mm² |
| Ground wire | 2mm² | 2mm² | 3.5mm² | 3.5mm² |
| Terminal Lug | 2mm² / 3.5ø | 2mm² / 3.5ø | 3.5mm² / 3.5ø | 3.5mm² / 3.5ø |
| Tightening Torque | 9 lb-in | 9 lb-in | 15 lb-in | 15 lb-in |

| P4 | P5 | VR | V1 | CM | I | AM |
|---|---|---|---|---|---|---|

| 30A | 30B | 30C | MO | EXTG | P24 | P1 | P2 | CM | P3 |
|---|---|---|---|---|---|---|---|---|---|

| Terminal | Terminal Description | Wire size | Torque(Nm) | Note |
|---|---|---|---|---|
| P1/P2/P3/P4/P5 | Multi-function input T/M P1-P5 | 22 AWG, 0.3mm² | 0.4 | |
| CM | Common Terminal for P1-P5, AM, P24 | 22 AWG, 0.3mm² | 0.4 | |
| VR | 12V power supply for external potentiometer | 22 AWG, 0.3mm² | 0.4 | |
| V1 | 0-10V Analog Voltage input | 22 AWG, 0.3mm² | 0.4 | |
| I | 0-20mA Analog Current input | 22 AWG, 0.3mm² | 0.4 | |
| AM | Multi-function Analog output | 22 AWG, 0.3mm² | 0.4 | |
| MO | Multi-function open collector output T/M | 20 AWG, 0.5mm² | 0.4 | |
| EXTG | Ground T/M for MO | 20 AWG, 0.5mm² | 0.4 | |
| P24 | 24V Power supply for P1-P5 | 20 AWG, 0.5mm² | 0.4 | |
| 30A | Multi-function relay A/B contact output | 20 AWG, 0.5mm² | 0.4 | |
| 30B | Multi-function relay A/B contact output | 20 AWG, 0.5mm² | 0.4 | |
| 30C | 30A, B Common | 20 AWG, 0.5mm² | 0.4 | |

# Keypad



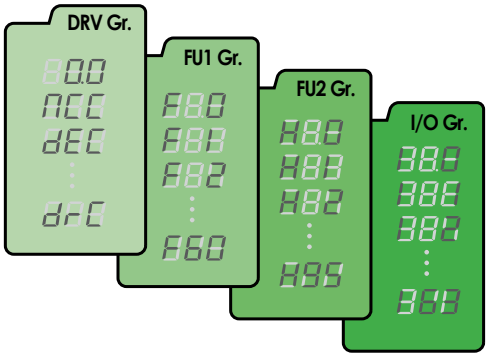

| Key | Function | Description |
|---|---|---|
| RUN | Run key | To operate the drive |
| STOP/RESET | Stop/Reset key | To stop operating or reset in case of fault |
| ● | Program/Enter | To change parameters and save them |
| KNOB(Volume) | Frequency | To change the frequency |
| NPN/PNP | Selection | Mode selection between NPN and PNP |
| ▲ | Up | To increase the parameter values |
| ▼ | Down | To decrease the parameter values |
| ◀ | Left | To move the cursor left |
| ▶ | Right | To move the cursor right |

## Parameter group

There are 4 parameter groups to set parameters properly for the operation.

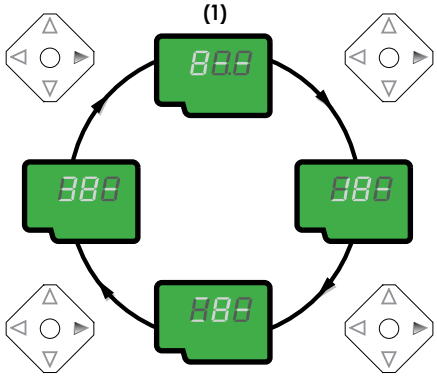
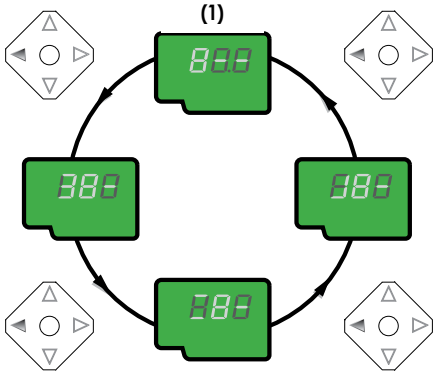
| Group | Description |
|---|---|
| Drive group | Basic parameters such as Command frequency, Accel/Decel time, etc. |
| Function 1 group | Basic functional parameters such as Max. frequency, Torque boost, etc. |
| Function 2 group | Application parameters such as Frequency jump, Max./Min. of limit of frequency, etc. |
| Input/Output group | Parameters to construct the sequence such as Multi-function terminal setting, Auto operation, etc. |

## Parameter group navigation




| | |
|---|---|
| Drive group | Basic operation parameters such as Command frequency, Accel/Decel time, etc. |
| Function 1 group | Basic functional parameters for adjusting Output frequency, Voltage, etc. |
| Function 2 group | Application parameters of PID operation, The 2nd motor setting, etc. |
| Input/Output group | Parameters to construct the sequence such as Multi-function terminal setting, etc |

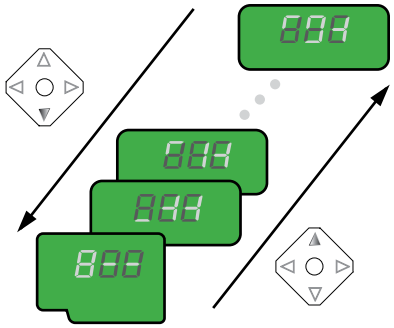
● Shifting between groups is possible only in the first code of each group.

| Shift by using Right shift key (▶) | Shift by using Left shift key (◀) |
|---|---|
|  |  |



(1) The value of the Command frequency will be displayed in the first code of the Drive group.
It will show the value set by the operator. The factory set value is 0.0.

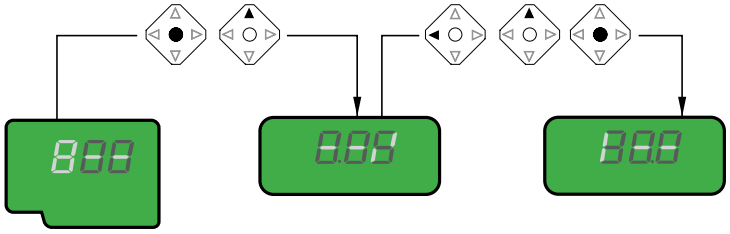
## Parameter navigation in Drive group



| | | |
|---|---|---|
| 1 | 0.0 | • The first code “0.0” displayed.<br>• Press up(▲) key once to move to next code. |
| 2 | 0 | • The second code “ACC” appears.<br>• Press up(▲) key once to move to next code. |
| 3 | 0.00 | • The third code “dEC” is shown.<br>• Press up(▲) key to move to next code. |
| 4 | 0.05 | • To move to the last code press up(▲) key until “drC” appears.<br>• Press up(▲) key once more to return to the first code. |
| 5 | 0.0 | • To move in reverse order use down(▼) key. |

## Procedure to set command frequency in Drive group

To input new command frequency 30.05[Hz] from 0.0 set in the factory



| | | |
|---|---|---|
| 1 | 0.0 | • The first code “0.0” displayed.<br>• Press pro/ent(●) key. |
| 2 | 0.0 | • The digit of the first decimal place can be changed.<br>• Press right (▶) key. |
| 3 | 0.00 | • The digit of the second decimal place can be changed.<br>• Press up(▲) key until the digit becomes 5. |
| 4 | 0.05 | • Press left(◀) key. |
| 5 | 0.05 | • The left digit can be set.<br>• Press left(◀) key. |
| 6 | 005 | • Press left(◀) key. |
| 7 | 000 | • Though 00.0 is displayed, the actual value remains at 0.05.<br>• Make 3 by pressing up(▲) key. |
| 8 | 30.0 | • Press pro/ent(●) key.<br>• 30.0 is flickering.<br>• Press pro/ent(●) key to stop the flickering. |
| 9 | 30.0 | • Command frequency 30.0 is stored. |

Note : (1) The LCD on the keypad of Drive iC5 displays only 3 digits.
Use the shift keys (◀ ▶) to monitor and set the parameters.
(2) To cancel the parameter setting press the shift keys
(◀ or ▶) while 30.0 is flickering in the procedure no. 8 .

# Program parameters descriptions

| Drive group | Keypad display | Description | Setting range | Factory default | Adjustable during run |
|---|---|---|---|---|---|
| | **0.00** | Output frequency : during run<br>Reference frequency : during stop | 0 to Max. frequency[Hz] | 0.00 | Yes |
| | **ACC** | Acceleration time | 0 to 6000 [sec] | 5 | Yes |
| | **DEC** | Deceleration time | 0 to 6000 [sec] | 10 | Yes |
| | **Drv** | Drive mode | 0(Keypad)<br>1(Fx/Rx-1)<br>2(Fx/Rx-2)<br>3(ModBus) | 1 | No |
| | **Frq** | Frequency mode | 0(Keypad-1)<br>1(Keypad-2)<br>2(Volume)<br>3(V1)<br>4(I)<br>5(Volume+1)<br>6(V1+I)<br>7(Volume+V1)<br>8(ModBus) | 0 | No |
| | **St1** | Step frequency 1 | 0 to Max. frequency[Hz] | 10.00 | Yes |
| | **St2** | Step frequency 2 | 0 to Max. frequency[Hz] | 20.00 | Yes |
| | **St3** | Step frequency 3 | 0 to Max. frequency[Hz] | 30.00 | Yes |
| | **Cur** | Output current | *[A] | * | * |
| | **RPM** | Motor speed | *[rpm] | * | * |
| | **DCL** | DC voltage | *[V] | * | * |
| | **v0L/P0r/t0r** | User display selection | * | * | * |
| | **n0n** | Fault display | * | * | * |
| | **drC** | Motor direction set | F(Forward)<br>R(Reverse) | F | Yes |
| **FU1 group** | **FU1** | Function Group 1 selection | | * | Yes |
| | **FU2** | Function Group 2 selection | | * | Yes |
| | **I/O** | I/O Group selection | | * | Yes |
| | **F0** | Jump to desired code # | 1 to 60 | 1 | Yes |
| | **F3** | Run prevention | 0(None)<br>1(Forward disable)<br>2(Reverse disable) | 0 | No |
| | **F5** | Acceleration pattern | 0(Linear)<br>1(S-curve) | 0 | No |
| | **F6** | Deceleration pattern | 0(Linear)<br>1(S-curve) | 0 | No |
| | **F7** | Stop mode | 0(Decel)<br>1(Dc-brake)<br>2(Free-run) | 0 | No |
| | **F8** | DC injection braking frequency | F23 to 60[Hz] | 5 | No |
| | **F9** | DC injection braking ON-delay | 0 to 60 [sec] | 0.1 | No |
| | **F10** | DC injection braking voltage | 0 to 200[%] | 50 | No |
| | **F11** | DC injection braking time | 0 to 60 [sec] | 1 | No |
| | **F12** | Starting DC injection braking voltage | 0 to 200[%] | 50 | No |
| | **F13** | Starting DC injection braking time | 0 to 60 [sec] | 0 | No |
| | **F14** | Motor exciting time | 0 to 60 [sec] | 1 | No |
| | **F20** | Jog frequency | 0 to 400 [Hz] | 10 | No |
| | **F21** | Maximum frequency | 40 to 400 [Hz] | 60 | No |
| | **F22** | Base frequency | 30 to Max. frequency[Hz] | 60 | No |
| | **F23** | Starting frequency | 0 to 10 [Hz] | 0.5 | No |
| | **F24** | Frequency limit selection | 0(No), 1(Yes) | 0 | No |
| | **F25** | Frequency limit - high | 0 to High limit [Hz] | 60 | No |
| | **F26** | Frequency limit - low | Low limit to Max. frequency[Hz] | 0.5 | No |
| | **F27** | Manual/Auto torque boost selection | 0(Manual), 1(Auto) | 0 | No |
| | **F28** | Torque boost in forward direction | 0.0 to 15.0[%] | 5 | No |
| | **F29** | Torque boost in reverse direction | 0.0 to 15.0[%] | 5 | No |
| | **F30** | Volts/Hz pattern | 0(Linear)<br>1(Square)<br>2(User V/F) | 0 | No |

# Program parameters descriptions

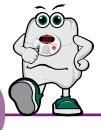
| FU1 group | Keypad display | Description | Setting range | Factory default | Adjustable during run |
|---|---|---|---|---|---|
| | **F31** | User V/F - frequency 1 | 0 to F33[Hz] | 15 | No |
| | **F32** | User V/F - voltage 1 | 0 to 100[%] | 25 | No |
| | **F33** | User V/F - frequency 2 | F31 to F35[Hz] | 30 | No |
| | **F34** | User V/F - voltage 2 | 0 to 100[%] | 50 | No |
| | **F35** | User V/F - frequency 3 | F33 to F37[Hz] | 45 | No |
| | **F36** | User V/F - voltage 3 | 0 to 100[%] | 75 | No |
| | **F37** | User V/F - frequency 4 | F35 to Maximum frequency[Hz] | 60 | No |
| | **F38** | User V/F - voltage 4 | 0 to 100[%] | 100 | No |
| | **F39** | Output voltage adjustment | 40.0 to 110.0[%] | 100 | No |
| | **F40** | Energy save | 0 to 30[%] | 0 | Yes |
| | **F50** | Electronic thermal selection | 0(No), 1(Yes) | 0 | Yes |
| | **F51** | Electronic thermal level -1 min. | F52 to 200[%] | 150 | Yes |
| | **F52** | Electronic thermal level -continuous | 50 to F51[%] | 100 | Yes |
| | **F53** | Motor cooling system | 0(self cool)<br>1(forced cool) | 0 | Yes |
| | **F54** | Overload alarm level | 30 to 150[%] | 150 | Yes |
| | **F55** | Overload alarm hold time | 0 to 30[sec] | 10 | Yes |
| | **F56** | Overload trip selection | 0(No), 1(Yes) | 1 | Yes |
| | **F57** | Overload trip level | 30 to 200[%] | 180 | Yes |
| | **F58** | Overload trip delay time | 0 to 60[sec] | 60 | Yes |
| | **F59** | Stall prevention mode selection | 000 to 111(bit set)<br>Bit 0 : During accel.<br>Bit 1 : During steady speed<br>Bit 2 : During decel. | 000 | No |
| | **F60** | Stall prevention level | 30 to 150[%] | 150 | No |
| **FU2 group** | **H0** | Jump to desired code # | 1 to 95 | 1 | Yes |
| | **H1** | Previous fault history 1 | | nOn | * |
| | **H2** | Previous fault history 2 | | nOn | * |
| | **H3** | Previous fault history 3 | | nOn | * |
| | **H4** | Previous fault history 4 | | nOn | * |
| | **H5** | Previous fault history 5 | | nOn | * |
| | **H6** | Delete fault history | 0(No), 1(Yes) | 0 | Yes |
| | **H7** | Dwell frequency | 0 to Max. frequency[Hz] | 5 | No |
| | **H8** | Dwell time | 0 to 10[sec] | 0 | No |
| | **H10** | Selection of jump frequency | 0(No), 1(Yes) | 0 | No |
| | **H11** | Jump frequency 1, low | 0 to H12[Hz] | 10 | No |
| | **H12** | Jump frequency 1, high | H11 to Maximum frequency[Hz] | 15 | No |
| | **H13** | Jump frequency 2, low | 0 to H14[Hz] | 20 | No |
| | **H14** | Jump frequency 2, high | H13 to Maximum frequency[Hz] | 25 | No |
| | **H15** | Jump frequency 3, low | 0 to H16[Hz] | 30 | No |
| | **H16** | Jump frequency 3, high | H15 to Maximum frequency[Hz] | 35 | No |
| | **H17** | Inclination at the beginning of S curve | 1 to 100[%] | 40 | No |
| | **H18** | Inclination at the end of S curve | 1 to 100[%] | 40 | No |
| | **H19** | Output phase loss protection | 0(No), 1(Yes) | 0 | Yes |
| | **H20** | Power ON start selection | 0(No), 1(Yes) | 0 | Yes |
| | **H21** | Restart after fault reset | 0(No), 1(Yes) | 0 | Yes |
| | **H22** | Speed search selection | 0000 to 1111(bit set)<br>Bit 0 : During accel.<br>Bit 1 : After fault reset<br>Bit 2 : Restarted after instant power failure<br>Bit 3 : When H20 is set to 1(Yes) | 0 | No |
| | **H23** | Speed search current limitation level | 8 to 200[%] | 100 | Yes |
| | **H24** | Speed search P gain | 0 to 9999 | 100 | Yes |
| | **H25** | Speed search I gain | 0 to 9999 | 1000 | Yes |
| | **H26** | Number of auto restart attempt | 0 to 10 | 0 | Yes |
| | **H27** | Delay time before auto restart | 0 to 60[sec] | 1 | Yes |
| | **H30** | Motor power rating selection | 0.2, 0.75, 1.5, 2.2[kW] | * | No |
| | **H31** | Number of motor poles | 2 to 12 | 4 | No |
| | **H32** | Rated motor slip | 0 to 10[Hz] | * | No |
| | **H33** | Rated motor current in RMS | 0 to 20[A] | * | No |
| | **H34** | No load motor current in RMS | 0.1 to 20[A] | * | No |
| | **H36** | Motor efficiency | 70 to 100[%] | * | No |

| FU2 group | Keypad display | Description | Setting range | Factory default | Adjustable during run |
|---|---|---|---|---|---|
| | **H37** | Load inertia | 0 to 2 | 0 | No |
| | **H39** | Carrier frequency | 1 to 15[kHz] | 3.0 | Yes |
| | **H40** | Control mode selection | 0(V/F)<br>1(Slip compen)<br>2(PID)<br>3(Sensorless vector control) | 0 | No |
| | **H41** | Auto tuning | 0 to 1 | 0 | Yes |
| | **H42** | Stator reristance | 0 to 5 [BŸ] | 0 | Yes |
| | **H44** | Leakage inductance | 0 to 300[mH] | 0 | Yes |
| | **H45** | Sensorless P gain | 0 to 32767 | 1000 | Yes |
| | **H46** | Sensorless I gain | 0 to 32767 | 100 | Yes |
| | **H50** | PID feedback signal selection | 0(I)<br>1(V1) | 0 | No |
| | **H51** | P gain for PID control | 0 to 999.9[%] | 300 | Yes |
| | **H52** | I gain for PID control | 0.1 to 32.0[sec] | 1 | Yes |
| | **H53** | D gain for PID control | 0.1 to 30.0[sec] | 0 | Yes |
| | **H54** | F gain for PID control | 0 to 999.9[%] | 0 | Yes |
| | **H55** | Limit frequency for PID control | 0 to Max. frequency[Hz] | 60 | Yes |
| | **H70** | Reference frequency for Accel/Decel | 0(Max. freq.)<br>1(Delta freq.) | 0 | Yes |
| | **H71** | Accel/Decel time scale | 0(0.001sec)<br>1(0.01sec)<br>2(1sec) | 1 | No |
| | **H72** | Power On display | 0(Command frequency)<br>1(Accel. Time)<br>2(Decel. Time)<br>3(Drive mode)<br>4(Frequency mode)<br>5(Step frequency 1)<br>6(Step frequency 2)<br>7(Step frequency 3)<br>8(Current)<br>9(Speed)<br>10(DC link voltage)<br>11(User display)<br>12(Fault display)<br>13(Motor direction) | 0 | Yes |
| | **H73** | User display selection | 0(Voltage)<br>1(Watt)<br>2(Torque) | 0 | Yes |
| | **H74** | Gain for motor speed display | 1 to 1000[%] | 100 | Yes |
| | **H79** | Software version | x.xx | x.xx | * |
| | **H81** | 2nd acceleration time | 0 to 6000 [sec] | 5 | Yes |
| | **H82** | 2nd deceleration time | 0 to 6000 [sec] | 10 | Yes |
| | **H83** | 2nd acceleration time | 30 to Max. frequency[Hz] | 60 | No |
| | **H84** | 2nd V/F pattern | 0(Linear)<br>1(Square)<br>2(User V/F) | 0 | No |
| | **H85** | 2nd forward torque boost | 0.0 to 15.0[%] | 5 | No |
| | **H86** | 2nd reverse torque boost | 0.0 to 15.0[%] | 5 | No |
| | **H87** | 2nd stall prevention level | 30 to 150[%] | 150 | No |
| | **H88** | 2nd electronic thermal level -1 min. | H89 to 200[%] | 150 | Yes |
| | **H89** | 2nd electronic thermal level -continuous | 50 to H88[%] | 100 | Yes |
| | **H90** | 2nd motor rated current | 0.1 to 20[A] | * | No |
| | **H93** | Parameter initializing | 0(No)<br>1(All groups)<br>2(Drive)<br>3(Function 1)<br>4(Function 2)<br>5(I/O) | 0 | No |
| | **H94** | Parameter writing protection | 0 to FFF | 0 | Yes |
| | **H95** | Parameter change protection | 0 to FFF | 0 | Yes |

| I/O group | Keypad display | Description | Setting range | Factory default | Adjustable during run |
|---|---|---|---|---|---|
| | I0 | Jump to desired code # | 0 to 63 | 1 | Yes |
| | I1 | Filtering time constant for V0 signal input | 0 to 9,999[msec] | 10 | Yes |
| | I2 | V0 input minimum voltage | 0 to 10V | 0 | Yes |
| | I3 | Frequency corresponding to I2 | 0 to 400 [Hz] | 0.0 | Yes |
| | I4 | V0 input maximum voltage | 0 to 10V | 10 | Yes |
| | I5 | Frequency corresponding to I4 | 0 to 400 [Hz] | 60.0 | Yes |
| | I6 | Filtering time constant for V1 signal input | 0 to 9,999[msec] | 10 | Yes |
| | I7 | V1 input minimum voltage | 0 to 10V | 0 | Yes |
| | I8 | Frequency corresponding to I7 | 0 to Max. frequency[Hz] | 0.0 | Yes |
| | I9 | V1 input maximum voltage | 0 to 10V | 10 | Yes |
| | I10 | Frequency corresponding to I9 | 0 to Max. frequency[Hz] | 60 | Yes |
| | I11 | Filtering time constant for I signal input | 0 to 9,999[msec] | 10 | Yes |
| | I12 | I input minimum current | 0 to 20[mA] | 4 | Yes |
| | I13 | Frequency corresponding to I12 | 0 to Max. frequency[Hz] | 0 | Yes |
| | I14 | I input maximum current | I12 to 20[mA] | 20 | Yes |
| | I15 | Frequency corresponding to I14 | 0 to Max. frequency[Hz] | 60.0 | Yes |
| | I16 | Criteria for analog speed signal loss | 0(None)<br>1(Half of x1)<br>2(Below x1) | 0 | Yes |
| | I20 | Definition of multifunction input terminal<br>P18, 9, 15, 20, 21, 22, 23, 24, 25, 26<br>( - reserved - ) | 0(FX)<br>1(RX)<br>2(BX)<br>3(RST)<br>4(JOG)<br>5(Speed-L)<br>6(Speed-M)<br>7(Speed-H)<br>8(XCEL-L)<br>9(XCEL-M)<br>10(XCEL-H)<br>11(DC-Brake)<br>12(2nd function)<br>15(Up)<br>16(Down)<br>17(3 wire)<br>18(EXT-A)<br>19(EXT-B)<br>21(Open-loop)<br>22(Main drive)<br>23(Analog hold)<br>24(XCEL-stop) | 0(FX) | Yes |
| | I21 | Definition of multifunction input terminal P2 | Same as above I20 | 1(RX) | Yes |
| | I22 | Definition of multifunction input terminal P3 | Same as above I20 | 2(EST) | Yes |
| | I23 | Definition of multifunction input terminal P4 | Same as above I20 | 3(RST) | Yes |
| | I24 | Definition of multifunction input terminal P5 | Same as above I20 | 4(JOG) | Yes |
| | I25 | Terminal input status | 00000-11111[bit] | * | * |
| | I26 | Terminal output status | 00-11[bit] | * | * |
| | I27 | Filtering time constant for multifunction input terminal | 0 to Max. frequency[Hz] | 15 | Yes |
| | I30 | Step frequency 4 | 0 to Max. frequency[Hz] | 30 | Yes |
| | I31 | Step frequency 5 | 0 to Max. frequency[Hz] | 25 | Yes |
| | I32 | Step frequency 6 | 0 to Max. frequency[Hz] | 20 | Yes |
| | I33 | Step frequency 7 | 0 to Max. frequency[Hz] | 15 | Yes |
| | I34 | Acceleration time 1 | 0 to 600 [sec] | 3 | Yes |
| | I35 | Deceleration time 1 | 0 to 600 [sec] | 3 | Yes |
| | I36 | Acceleration time 2 | 0 to 600 [sec] | 4 | Yes |
| | I37 | Deceleration time 2 | 0 to 600 [sec] | 4 | Yes |
| | I38 | Acceleration time 3 | 0 to 600 [sec] | 5 | Yes |
| | I39 | Deceleration time 3 | 0 to 600 [sec] | 5 | Yes |
| | I40 | Acceleration time 4 | 0 to 600 [sec] | 6 | Yes |
| | I41 | Deceleration time 4 | 0 to 600 [sec] | 6 | Yes |
| | I42 | Acceleration time 5 | 0 to 600 [sec] | 7 | Yes |

# Program parameters descriptions

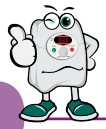
| I/O group | Keypad display | Description | Setting range | Factory default | Adjustable during run |
|---|---|---|---|---|---|
| | I43 | Deceleration time 5 | 0 to 600 [sec] | 7 | Yes |
| | I44 | Acceleration time 6 | 0 to 600 [sec] | 8 | Yes |
| | I45 | Deceleration time 6 | 0 to 600 [sec] | 8 | Yes |
| | I46 | Acceleration time 7 | 0 to 600 [sec] | 9 | Yes |
| | I47 | Deceleration time 7 | 0 to 600 [sec] | 9 | Yes |
| | I50 | AM output | 0(Frequency)<br>1(Current)<br>2(Voltage)<br>3(DC link voltage) | 0 | Yes |
| | I51 | AM output adjustment | 100 to 200[%] | 100 | Yes |
| | I52 | Frequency detection level | 0 to Max. frequency[Hz] | 30 | Yes |
| | I53 | Frequency detection bandwidth | 0 to Max. frequency[Hz] | 10 | Yes |
| | I54 | Definition of multifunction output terminal MO | 0(FDT-1)<br>1(FDT-2)<br>2(FDT-3)<br>3(FDT-4)<br>4(FDT-5)<br>5(OL)<br>6(IOL)<br>7(Stall)<br>8(OV)<br>9(LV)<br>10(OH)<br>11(Lost command)<br>12(Run)<br>13(Stop)<br>14(Steady)<br>15(Search)<br>16(Ready)<br>17(Fault select) | 12 | Yes |
| | I55 | Definition of relay functions | Same as above I54 | 17 | Yes |
| | I56 | Fault relay setting (30A, 30B, 30C) | 000 to 111(bit set)<br>Bit 0 : Low voltage<br>Bit 1 : Trip<br>Bit 2 : Number of auto retry | 010 | Yes |
| | I60 | Drive number | 1 to 32 | 1 | Yes |
| | I61 | Baud rate | 0(1200bps)<br>1(2400bps)<br>2(4800bps)<br>3(9600bps)<br>4(19200bps) | 3 | Yes |
| | I62 | Operating selection at loss of freq. reference | 0(None)<br>1(Free run)<br>2(Stop) | 0 | Yes |
| | I63 | Waiting time after loss of freq. reference | 0.1 to 12[sec] | 1.0 | Yes |



# Peripheral Device

## MCCB (Molded Case Circuit Breaker) and MC (Magnetic Contactor)

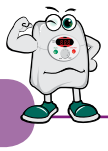
| Voltage | Capacity [kW] | Circuit Breaker (MCCB) | | | | Leakage Breaker (ELCB) | | Magnetic Contactor (MC) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Model | Rated Current[A] | Model | Rated Current[A] | Model | Rated Current[A] | Model | Rated Current[A] |
| 1-Phase 200V | 0.4 | ABS33c | 0.4 | UTE100 | 5 | EBS33c | 5 | MC-6a | 9 |
| | 0.75 | | 0.75 | | 10 | | 10 | MC-9a, MC-9b | 11 |
| | 1.5 | | 1.5 | | 15 | | 15 | MC-18a, MC-18b | 18 |
| | 2.2 | | 2.2 | | 20 | | 20 | MC-22b | 22 |
| 3-Phase 200V | 0.4 | ABS33c | 0.4 | UTE100 | 15 | EBS33c | 15 | MC-6a | 9 |
| | 0.75 | | 0.75 | | 15 | | 15 | MC-9a, MC-9b | 11 |



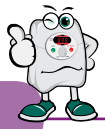
## Warning :

**If protection function activates due to error/fault in the drive, corresponding alarm is displayed on the keypad as shown below.**
**Correct the error/fault before restarting or it may decrease the drive's life expectancy.**

| Display | Fault/Error | Description |
|---|---|---|
| OCt | Overcurrent | Output current has been greater than 200% of the rated current. The drive output is interrupted. |
| GFt | Ground fault | Ground fault has been occurred at the load side of the drive. The drive output is interrupted. |
| tOL | Drive overload | Output current greater than 150% of the rated current has been flowed over 1 min.<br>The drive output is interrupted. |
| OLt | Overload trip | Output current has been greater than the set value (F57) of the rated current.<br>The drive output is interrupted. |
| OHt | Coolingpin overheat | Cooling pin has been overheated due to high ambient temperature.<br>The drive output is interrupted. |
| COL | DC link condenser overload | If the DC condenser of Drive is in need of replacement the drive output is interrupted. |
| POt | Output phase loss | One or more of output line U, V and W lost.<br>The drive output is interrupted. |
| Ovt | Overvoltage | The drive main voltage has been risen above the permissible limit 400V.<br>Check if deceleration time has been set too short or line input voltage is too high. |
| LVt | Undervoltage | The drive output is interrupted. |
| EtH | Electronic thermal | The drive output is interrupted according to the set time-inverse curve to prevent the overtemperature of the motor due to overloads. |
| EEP | Parameter store error | Error has been occurred on the storing of the changed parameters.<br>It is displayed when power is on. |
| HWt | Hardware error | It is displayed in case of software error.<br>It is not possible to reset by STOP/RST key on the keypad or reset terminals.<br>Open the drive power and make sure the keypad power is off and close the power again. |
| Err | Communication error | Communication error between controller and keypad.<br>It is not possible to reset by STOP/RST key on the keypad or reset terminals.<br>Open the drive power and make sure the keypad power is off and close the power again. |
| FAn | Coolingfan error | Error has been occurred on the coolingfan. |
| EST | Output instant interrupting | The drive output is interrupted in the case that BX terminal is ON.<br>**Warning** : To restart the drive make BX terminal OFF during the FX /RX is ON. |
| nEA | A contact fault signal input | If I20/21/22/23/24 set to 18 is ON, the drive output is interrupted. |
| nEb | B contact fault signal input | If I20/21/22/23/24 set to 19 is ON, the drive output is interrupted. |
| LOC | Frequency command loss | If signal input is failed for the driving by using analog input or option(RS485), try to drive according to the setting at I62. |



| Fault/Error | Possibsle cause | Solution |
|---|---|---|
| OCt<br>Overcurrent | ⚠<br>● Accel/Decel time is not enough for the load inertia ($GD^2$) Increase the Accel/Decel time<br>● The load is greater than the rating of the drive.<br>● Drive output is assigned during the free run of the motor.<br>● The motor brake operates too fast. | ▶ Replace the drive with a higher rating<br>▶ Operate after the motor stops or use speed search(H22) in FU2 in the output terminals.<br>▶ Verify the output wiring<br>▶ Verify the mechanical brake. |
| GFt<br>Ground fault | ● Ground fault at the load side of the drive.<br>● Insulation of the motor is broken. | ▶ Check to see if there is something wrong with output wiring.<br>▶ Replace a motor. |
| FOt<br>Drive overload<br>OLt<br>Overload trip | ● The load is greater than the rating of the drive.<br>● Power rating is set to the lower value than the load<br>● Torque boost is too great. | ▶ Increase the ratings of a motor and an drive.<br>▶ Check to see if the setting is correct.<br>▶ Reduce the torque boost. |
| OHt<br>Cooling fan overheat | ● Fault in the cooling system.<br>● The cooling fan is used beyond the life expectancy.<br>● High ambient temperature | ▶ Check to see if there is any alien substance in the ventilation system.<br>▶ Replace the cooling fan.<br>▶ Keep the ambient temperature below 40°…. |
| POt<br>Output phase loss | ● Fault in the load side contactor<br>● Wiring problem | ▶ Replace the contactor.<br>▶ Verify the output wirin |
| FAn<br>Coolingfan error | ● Alien substances are in the ventilator.<br>● The cooling fan is used beyond the expectancy. | ▶ Check to see if there is any alien substance in the ventilation system.<br>▶ Replace the cooling fan. |
| Ovt<br>Overvoltage | ● Decel time is not enough for the load inertia($GD^2$)<br>● There is a survived load in the load side.<br>● Higher voltage than rating is supplied. | ▶ Increase the Decel time<br>▶ Uase DB unit.<br>▶ Verify the power voltage. |
| Lvt<br>Undervoltage | ● Lower voltage than rating is supplied.<br>● Power capacity is not enough for the additional loads like welders and direct-on-line starting motors.<br>● Fault in the line side contactor | ▶ Verify the power voltage.<br>▶ Increase the power capacity.<br>▶ Replace the contactor. |
| EtH<br>Electronic thermal | ● Overtemperature of the motor<br>● The load is greater than the rating of the drive.<br>● Electronic thermal level is set lower than rating.<br>● Drive power rating is set to the lower value than the load<br>● Long operation at low speed. | ▶ Reduce the load or operation times.<br>▶ Increase the ratings of the drive.<br>▶ Adjust the electronic thermal properly.<br>▶ Adjust the drive rating properly.<br>▶ Replace the motor with the separated power cable for the cooling fan. |
| nSA<br>A contact fault signal input<br>nSb<br>B contact fault signal input | ● The terminal I20/21/22/23/24 set to18/19 is ON | ▶ Verify the circuits connected to the external fault terminals. |
| bAt<br>Frequency command loss | ● Frequency command loss at terminals V1 and I | ▶ Verify the wiring connected to V1 and I terminals. |
| Eep<br>Parameter store error<br>HWt<br>Output instant interrupting<br>Erp<br>Communication error | ● Refer to LS or distributors | |



## Warning :

**Carefully read the instruction for installation and wiring of drives and relevant devices. Normal operation is impossible in case of the improper system design and wiring. These can shorten the life of the drive and damage it at the worst.**

### INDUCTORS FOR VARIABLE SPEED DRIVES

The inductors manufactured with special magneticcores are advisable for location: BETWEEN MAINS AND VARIABLE SPEED DRIVE, in order to protect the equipment from overvoltages, voltage surges and also to limit the line current and the harmonics generated by VSD. BETWEEN VARIBLE SPEED DRIVE AND MOTOR, to absorb the voltage peaks in the motor terminals, when the connection cables are long or there are more than one motor in parallel, for having a better efficiency and to eliminate the humming noise of the motor.

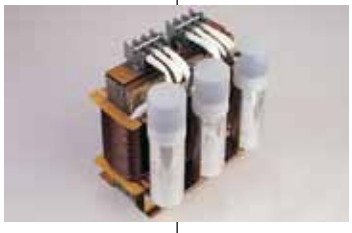
### POWER LINE FILTERS

The family of filters manufactured by LIFASA has been specially developed and approved for its application with variable speed drives, to assure the compliance of the EMC (Electro Magnetic Compatibility) and the LV safety European Directives, in both industrial and domestic environments.

### VARIABLE SPEED DRIVES

- Powers from 0.37 to 375 kW
- Single/three phase voltages 220/230 Vac
- Three phase voltages 380/460 Vac
- Sensorless vector control, V/F closed loop
- Removable console with copy function
- RS485 communication facilities as standard
- Autotuning
- Special parameters for special applications

### OUTPUT LC FILTERS



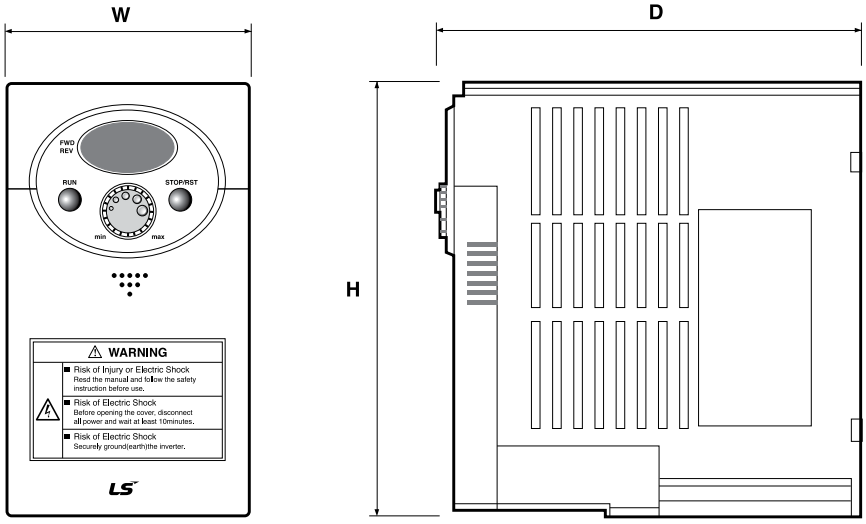
The commutation of the IGBT's at high frequency (PWM) provokes an output voltage with peaks up to 1300 V The LC filter - low pass - reduce the dV/dt converting the voltage in a sinus waveform, eliminating all the isolation problems in the motor and the emission of interference from the cables.

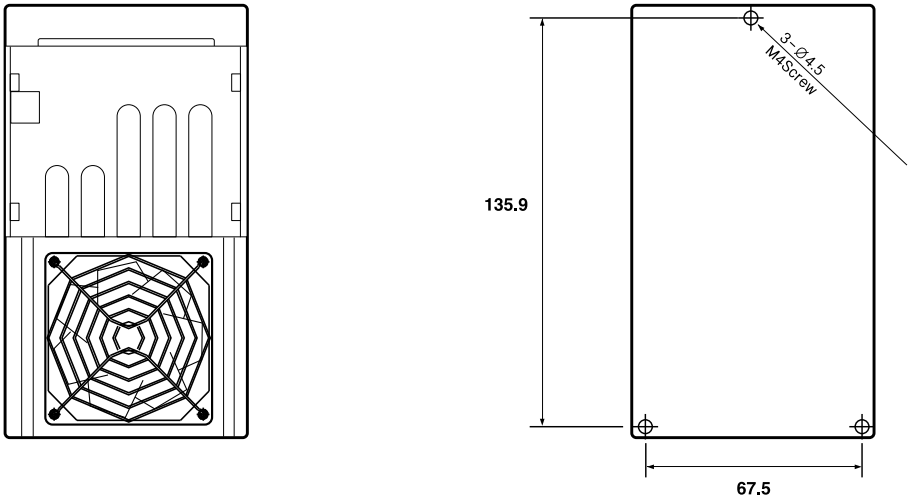
※ **Filter for use of LS Drives :**

Vector Motor Control Ib'erica (VMC)
C/Mar del Carib, 10 - Pol. Ind. La Torre del Rector 08130 - Santa Perp`etua de Mogoda (Barcelona) - SPAIN
Tel: (+34) 935 748 206 - Fax: (+34) 935 748 248 e-mail: info@vmc.es - www.vmc.es

# Dimensions

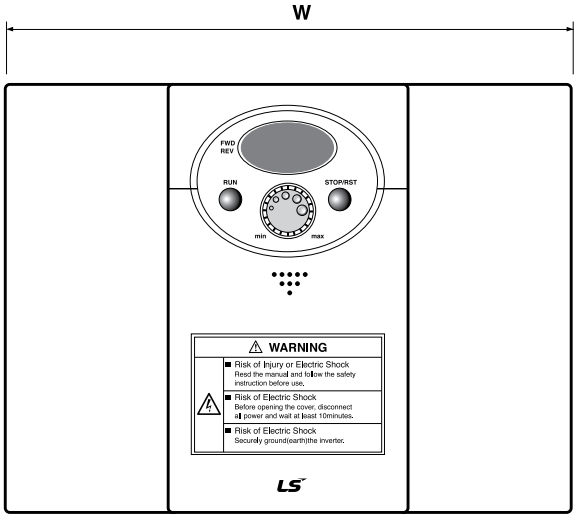
## ■ 0.4, 0.75kW

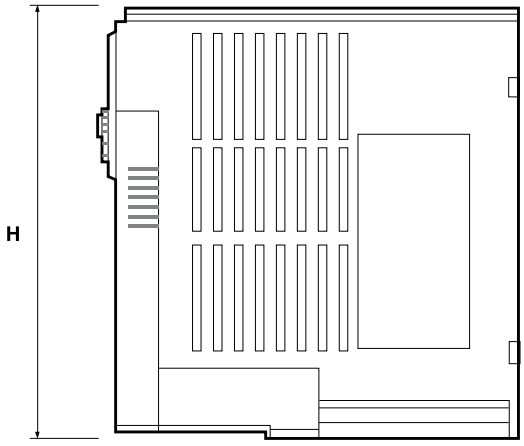


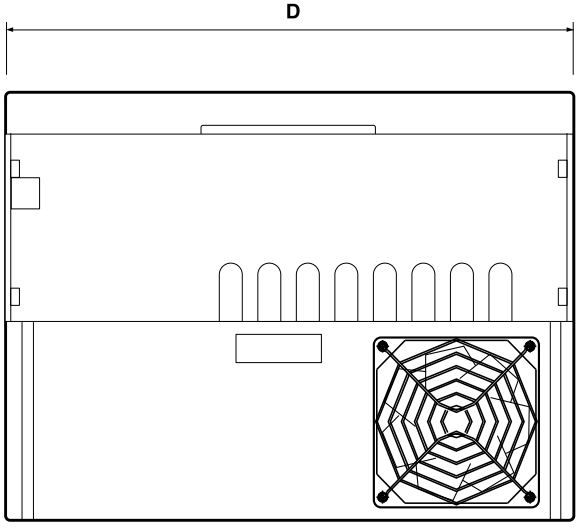



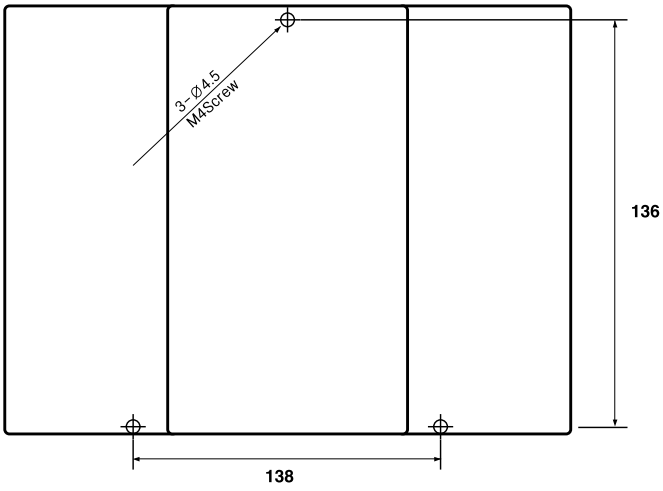

| Applied drives | W | H | D | W (kg) |
|---|---|---|---|---|
| SV004iC5-1 | 79 | 143 | 143 | 0.87 |
| SV004iC5-1F | 79 | 143 | 143 | 0.95 |
| SV008iC5-1 | 79 | 143 | 143 | 0.89 |
| SV008iC5-1F | 79 | 143 | 143 | 0.97 |
| SV004iC5-2 | 79 | 143 | 143 | 0.89 |
| SV008iC5-2 | 79 | 143 | 143 | 0.89 |

## ■ 1.5, 2.2kW

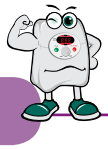



| Applied drives | W | H | D | W (kg) |
|---|---|---|---|---|
| SV015iC5-1 | 156 | 143 | 143 | 1.79 |
| SV015iC5-1F | 156 | 143 | 143 | 1.94 |
| SV022iC5-1 | 156 | 143 | 143 | 1.85 |
| SV022iC5-1F | 156 | 143 | 143 | 2 |



FUTURING SMART ENERGY

Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact a qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

**LSIS Co., Ltd.**



www.lsis.com