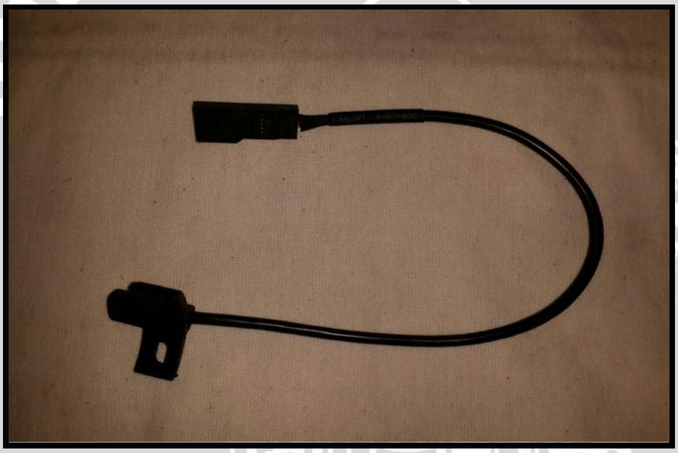
LAMPIRAN

Foto Alat

Alat Tampak Depan

Variable Frequency Drive

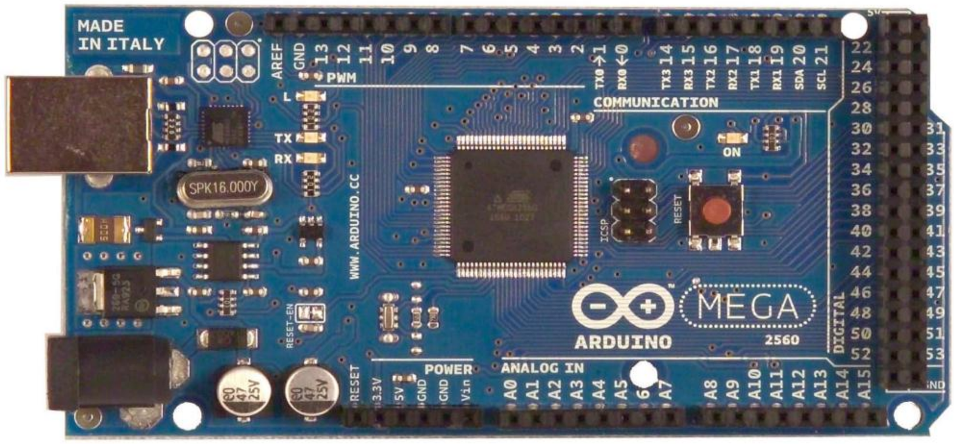
Motor Induksi 3 Fasa

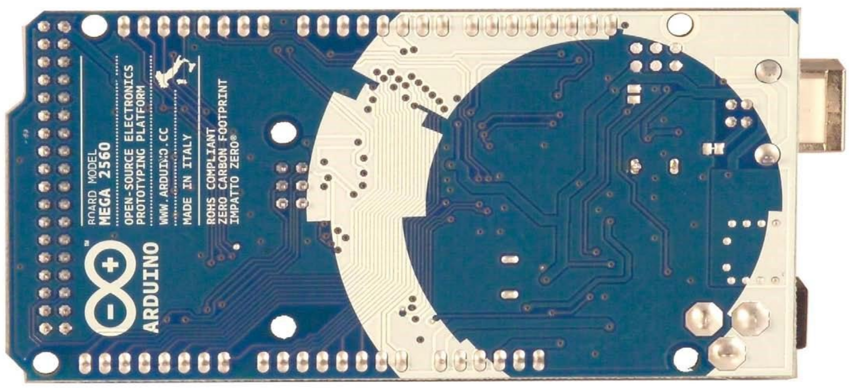


Sensor *Hall Effect*

Datasheet

Arduino Mega 2560





The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

Schematic & Reference Design

EAGLE files: arduino-mega2560-reference-design.zip

Schematic: arduino-mega2560-schematic.pdf

Summary

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

Power

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins.

Memory

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- **External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2).** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- **PWM: 0 to 13.** Provide 8-bit PWM output with the analogWrite() function.
- **SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS).** These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Uno, Duemilanove and Diecimila.
- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- **I^2C: 20 (SDA) and 21 (SCL).** Support I^2C (TWI) communication using the Wire library (documentation on the Wiring website). Note that these pins are not in the same location as the I^2C pins on the Duemilanove or Diecimila.

The Mega2560 has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function.

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with analogReference().
- **Reset.** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Communication

The Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega8U2 on the board channels one of these over USB and provides a virtual com port to software on the computer (Windows machines will need a .inf file, but OSX and Linux machines will recognize the board as a COM port automatically. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATmega8U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Mega2560's digital pins. The ATmega2560 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation on the Wiring website for details. For SPI communication, use the SPI library.

Programming

The Arduino Mega can be programmed with the Arduino software (download). For details, see the reference and tutorials.

The ATmega2560 on the Arduino Mega comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

The ATmega8U2 firmware source code is available in the Arduino repository. The ATmega8U2 is loaded with a DFU bootloader, which can be activated by connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See this user-contributed tutorial for more information.

Automatic (Software) Reset

Rather then requiring a physical press of the reset button before an upload, the Arduino Mega2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Mega2560 is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Mega2560. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Mega2560 contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

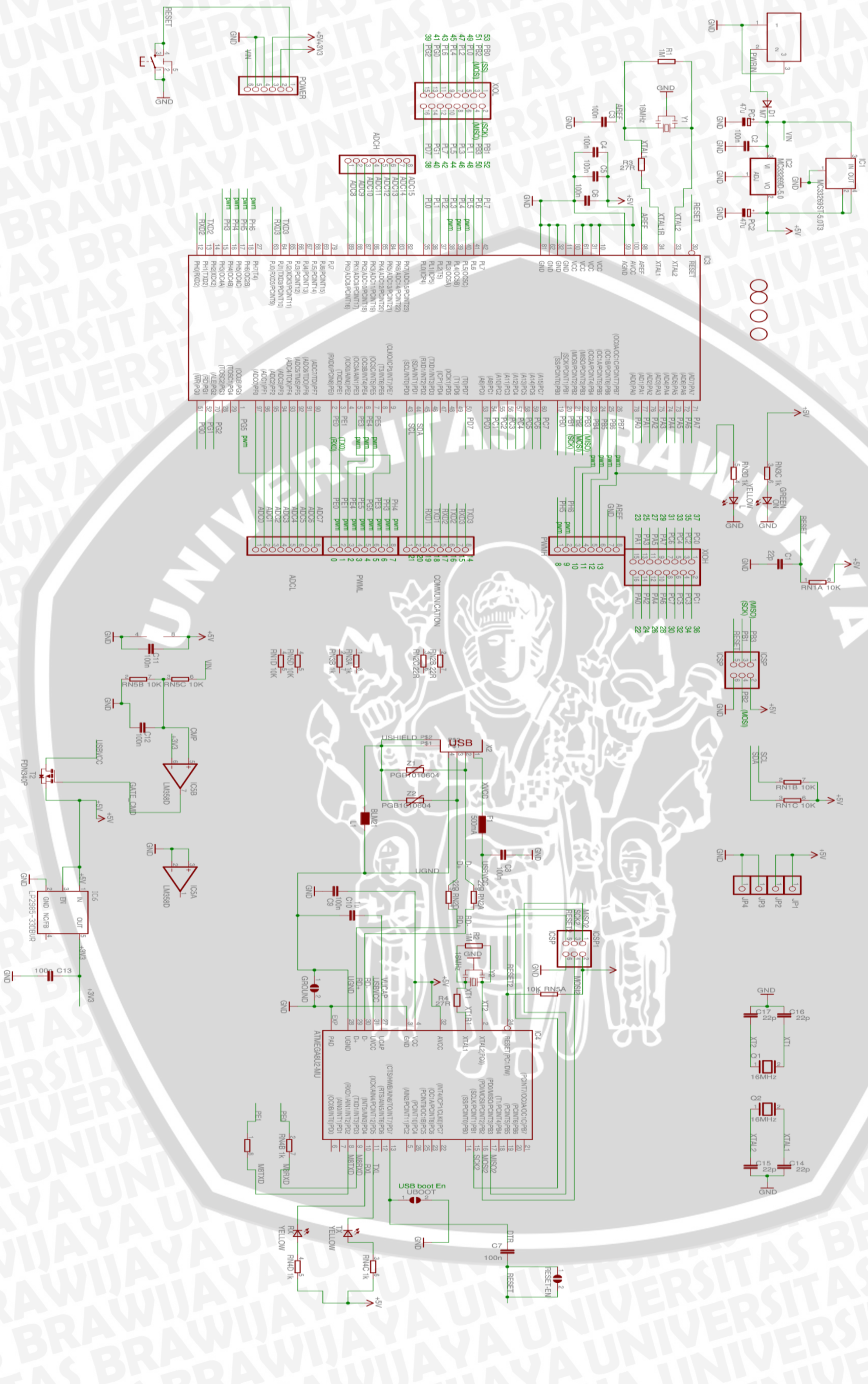
USB Overcurrent Protection

The Arduino Mega2560 has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics and Shield Compatibility

The maximum length and width of the Mega2560 PCB are 4 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

The Mega2560 is designed to be compatible with most shields designed for the Uno, Diecimila or Duemilanove. Digital pins 0 to 13 (and the adjacent AREF and GND pins), analog inputs 0 to 5, the power header, and ICSP header are all in equivalent locations. Further the main UART (serial port) is located on the same pins (0 and 1), as are external interrupts 0 and 1 (pins 2 and 3 respectively). SPI is available through the ICSP header on both the Mega2560 and Duemilanove / Diecimila. *Please note that I^2C is not located on the same pins on the Mega (20 and 21) as the Duemilanove / Diecimila (analog inputs 4 and 5).*



Littelfuse
Expertise Applied | Answers Delivered

Hall Effect Sensors
Flange Mount > 55100

Description

The 55100 is a miniature flange mounting hall effect sensor 25.5mm (1.004") x 11.00m (0.433") and only 3.00mm (0.118") high with a choice of digital or programmable analogue outputs. It is available as three-wire (voltage output) or two-wire (current output) versions. It's case design enables screw or adhesive mounting and capable of switching up to 28Vdc and 20mA. It comes with a range of sensitivity, cable length and connector options.

Features

- Magnetically operated position sensor
- Digital or programmable analog types available
- Medium, high or programmable sensitivities
- Three-wire (voltage output) or two-wire (current output) versions
- Open Drain Output
- Reverse/Over voltage protection
- Built in temperature compensation
- Vibration 50g max. @ 50-2,000Hz
- Shock 150g max. @ 11ms ½ Sine

Benefits

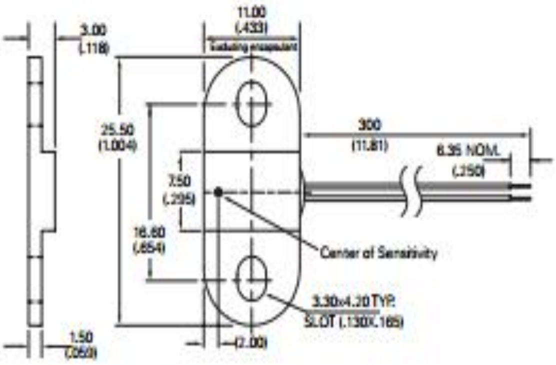
- High switching speed up to 10kHz
- Long life - up to 20 billion operations
- Unaffected by harsh environments
- Operates in static or dynamic magnetic field
- Customer selection of cable length and connector type

Applications

- Position and limit sensing
- RPM measurement
- Flow metering
- Commutaion of brushless dc motors
- Angle sensing
- Magnetic encoders

Dimensions

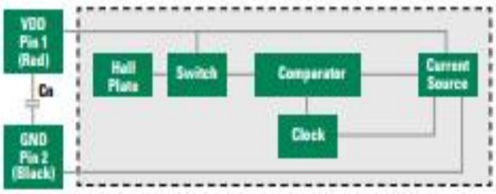
Dimensions in mm (inch)



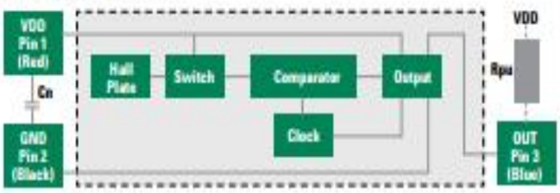
Note: Two-wire version illustrated.

Block Diagram

Two-wire Version



Three-wire Version



Notes:

1. Add capcitor **Cn** as shown, close to the sensor , for transient suppression if required.
2. Add pull-up resistor **Rpu** as shown for sinking output. The Rpu value should be calculated using your supply voltage while keeping the ON state current at a level below the maximum. Rpu = VDD/Io;

   Rpu = 12Vdc/10mA = 1.2kOhm

Electrical Ratings

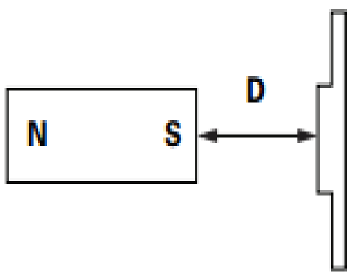
Hall Type				Digital Switch Three-Wire (Voltage Output)	Digital Switch Two-Wire (Current Output)	A - Analogue (Programmable Only) [2]
Supply Voltage [1]	Absolute Ratings Operate Overvoltage Protection		Vdc Vdc Vdc - max.	-15 to +28 +3.8 to +24 32	-15 to +28 +3.75 to +24 32	8.5 4.5 - 5.5 19.5
Output High Voltage			Vdc - min.	Sinking output	N/A	4.65
Output Low Voltage			Vdc - max.	0.4 @ 20mA	N/A	0.35
Output Current (continuously on)			mA - max.	20	N/A	-1.0 to +1.0
Current Consumption Over Temperature Range		Low High	mA - min. mA - max.	1.6 - 5.2 1.6 - 5.2	5.0 - 6.9 12.0 - 17.0	2.0 - 10.0 2.0 - 10.0
Switching Speed			kHz - max	10	10	2
Temperature	Operating		°C	-40 to +100	-40 to +100	-40 to +100

Notes:

1. As long as Tj (Junction Temperature) is not exceeded. It is recommended to operate within the normal Operate Supply Voltage of +24Vdc maximum. Operating beyond Absolute Ratings may cause permanent damage to the Hall IC.
2. Preprogrammed by Littelfuse or Customer pending agreement.
3. For custom modifications to the wire length or size, or adding a special connector, please contact Littelfuse.

Hall Options

Select Option	Hall Type	Sensitivity Gauss (typ.)	Activate - D mm (inch)
2M	2 Wire Switch	120	13.5 (.531)
2H	2 Wire Switch	57	18.5 (.728)
3M	3 Wire Switch	130	12.5 (.492)
3H	3 Wire Switch	59	18.0 (.709)
AP	Analog	Programmable	Consult Littelfuse

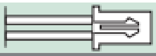


Note: Active distances are approximate using NEFEB Magnet 21 x 7 x 4.7 (.827l x .276W x .185H) LITTELFUSE P/N H-58

Cable Length Specification

Cable Type: 24 AWG 7/32 PVC 105°C UL1430/UL1569	
Select Option	Cable Length mm (inch)
02	300 (11.81)

Termination Specification

Termination Options		
Select Option	Description (Two-wire versions illustrated)	
A	Tinned leads (6.4±0.76)mm	
F	Untinned leads (6.4±0.76)mm	
E	JST type XHP 2.5mm pitch	

Part Numbering System

55100 - XX - XX - X

Series

Hall Option
2M, 2H, 3M, 3H, or AP

Cable Length
02

Termination
A, E, or F

Packaging

Packaging Option	Packaging Specification	Quantity	Quantity & Packaging Code	Taping Width
Bulk	Bulk	500	N/A	N/A

HYRIA INVERTER

SL *Series Inverter Manual*

1 General

1.1 General technical specifications

•Input & Output

- Input Voltage Range: 380/220V ± 15%
- Input Frequency Range: 47 ~ 63Hz
- Output Voltage Range: 0 ~rated input voltage
- Output Frequency Range: 0 ~ 600Hz

•I/O features

- Programmable Digital Input: Provide 6 terminals which can accept ON-OFFinputs.
- Programmable Analog Input: AI1 can accept input of 0 ~10V; AI2 can accept input of 0~10V or 0~20mA.
- Open Collector Output: Provide 2 output terminal.
- Relay Output: Provide 1output terminal.
- Analog Output:Provide 1analog output terminal, 0/4~20 mA or 0~10 V is Available.

•Technical features

- Control Mode:Sensorless Vector Control (SVC), V/F Control.
- Overload Capacity: 60s with 150% of rated current and 10s with 180% of rated current.
- Starting Torque: 150% of rated torque at 0.5Hz (SVC).
- Speed Adjusting Range: 1:100 (SVC).
- Speed Accuracy: + 0.5% of maximum speed (SVC).
- Carrier Frequency: 1.0KHz ~15.0KHz.

• Function features

- Reference Frequency Source: keypad, analog input, serial communication,multi-step speed, PID and so on.
- PID Control Function.
- Multi-Step Speed Control Function: 8 steps speed can be set.
- Traverse Control Function.
- Non-Stop when power is instantaneously cut off.
- Speed tracking restart function: make the revolving motor spindle realize non-impact smooth start
- QUICK/JOG Key: User-defined shortcut key.
- Automatic Voltage Regulation (AVR) Function: Automatically keep the output voltage stable when input voltage fluctuating.
- Up to 25 fault protections: protect from overcurrent, overvoltage, undervoltage, overtemperature, phase loss and overload etc.

1.2Description of name plate

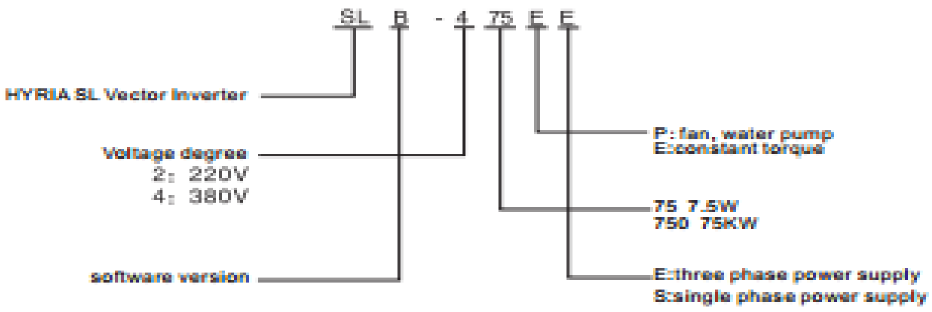


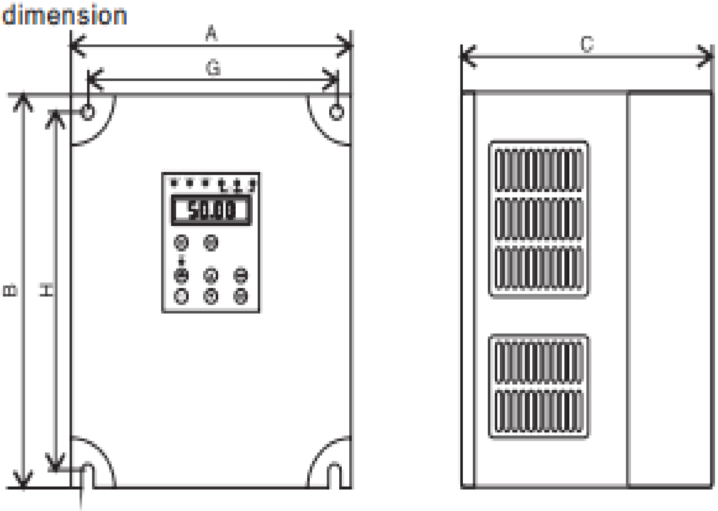
Figure1-1 Nameplate description

1.3Selection guide

Model No.	Input voltage	Rated output power(KW)	Rated input current(A)	Rated output current(A)	Motor power
SL-207EE	Single & Three Phase 220V -15% +15%	0.75	5.0	4.5	0.75
SL-215EE		1.5	7.7	7	1.5
SL-222EE		2.2	11.0	10	2.2
SL-240EE		3.7	17.0	16	3.7
SL-255EE		5.5	21.0	20	5.5
SL-275EE		7.5	31.0	30	7.5
SL-2110EE		11.0	43.0	42	11.0
SL-2150EE		15.0	56.0	55	15.0
SL-2180EE		18.5	71.0	70	18.5
SL-2220EE		22.0	81.0	80	22.0
SL-2300EE		30.0	112.0	110	30.0
SL-2370EE		37.0	132.0	130	37.0
SL-2450EE		45.0	163.0	160	45.0
SL-407EE	Three phase 380V -15%+15%	0.75	3.4	2.5	0.75
SL-415EE		1.5	5.0	3.7	1.5
SL- 422EE		2.2	5.8	5	2.2
SL-440EE/455PE		4.0/5.5	10/15	9/13	4.0/5.5
SL-455EE/475PE		5.5/7.5	15/20	13/17	5.5/7.5
SL-475EE/4110PE		7.5/11.0	20/26	17/25	7.5/11.0
SL-4110EE/4150PE		11.0/15.0	26/35	25/32	11.0/15.0
SL -4150EE/4180PE		15.0/18.5	35/38	32/37	15.0/18.5
SL-4180EE/4220PE		18.5/22.0	38/46	37/45	18.5/22.0
SL -4220EE/4300PE		22.0/30.0	46/62	45/60	22.0/30.0
SL -4300EE/4370PE		30.0/37.0	62/76	60/75	30.0/37.0
SL -4370EE/4450PE		37.0/45.0	76/90	75/90	37.0/45.0
SL-4450EE/4550PE		45.0/55.0	90/105	90/110	45.0/55.0
SL -4550EE/4750PE		55.0/75.0	105/140	110/150	55.0/75.0
SL-4750EE/4900PE		75.0/90.0	140/160	150/176	75.0/90.0
SL -4900EE/41100PE		90.0/110.0	160/210	176/210	90.0/110.0

Model No.	Input voltage	Rated output power(KW)	Rated input current(A)	Rated output current(A)	Motor power
SL -41100EE/41320PE	Three phase 380V -15%+15%	110.0/132.0	210/240	210/253	110.0/132.0
SL -41320EE/41600PE		132.0/160.0	240/290	253/300	132.0/160.0
SL-41600EE/41850PE		160.0/185.0	290/330	300/340	160.0/185.0
SL-41850EE/42000PE		185.0/200.0	330/370	340/380	185.0/200.0
SL-42000EE/42200PE		200.0/220.0	370/410	380/420	200.0/220.0
SL-42200EE/42500PE		220.0/250.0	410/460	420/470	220.0/250.0
SL-42500EE/42800PE		250.0/280.0	460/500	470/520	250.0/280.0
SL-42800EE/43150PE		280.0/315.0	500/580	520/600	280.0/315.0
SL-31500EE/35000PE		315.0/350.0	580/620	600/640	315.0/350.0
SL-35000EE/40000PE		350.0/400.0	620/670	640/690	350.0/400.0
SL-40000EE/50000PE		400.0/500.0	670/835	690/860	400.0/500.0
SL-50000EE/56000PE		500.0/560.0	835/920	860/950	500.0/560.0
SL-56000EE/63000PE		560.0/630.0	920/1050	950/1100	560.0/630.0
SL-63000EE/70000PE		630.0/700.0	1050/1250	1100/1300	630.0/700.0

1.4Outside dimension



Model No.	A (mm)	B (mm)	C (mm)	G (mm)	H (mm)	Φd
207 215	125	170	162	112	157	4
222	150	220	175	137	205	5
240 255	217	300	210	202	288	6
275 2110	270	380	248	254	365	6

Model No.	A (mm)	B (mm)	C (mm)	G (mm)	H (mm)	Φd
407 415	125	170	162	112	157	4
422 440	150	220	175	137	205	5
455 475	217	300	210	202	288	6
4110 4150	229	294	227	204	284	6
4185 4220 4300	297	450	253	270	432	6
4370 4450	341	696.5	335.5	240	650.5	10.5
4550 4750	368	756	327	286	710	10.5
4900 41100 41320	570	796	325	420	747	12
41600 41850	695	980	325	580	932	12
42000 42200 42500 42800 43150	890	1160	360	750	1112	/
43550 44000	cabinet 660(A)*2000(B)*600(C)					

3.1 Environmental requirement

3.1.1 Temperature

The ambient temperature is among -10℃ to +40℃ and the inverter has to derate by 4% for every additional 1℃ if the ambient temperature exceeds 40℃.

3.1.2 Humidity

Relative humidity of the air: ≤ 95%. No condensation is allowed.

3.1.3 Altitude

The inverter can run at the rated power if the installation site is less than 1000m (including 1000m) above the sea level. But it has to derate if the altitude exceeds 1000m.

See the following figure for details:

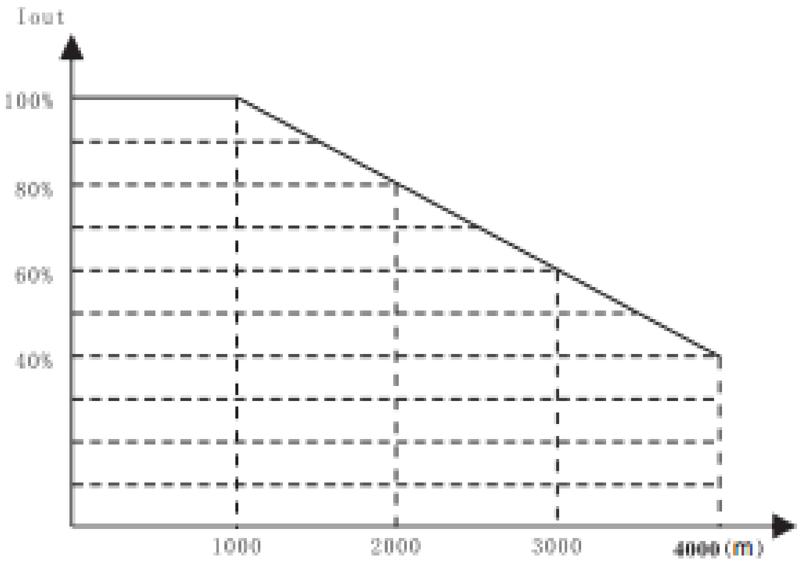


Figure 3.1 Relationship between output current and altitude

3.1.4 Impact Or Shock

The inverter can not bear fierce impact or shock.

The inverter should keep away from place where vibration frequently occur.

3.1.5 Electromagnetic radiation

The inverter should keep away from the electromagnetic radiation source.

3.1.6 Water

The inverter should keep away from water and condensation.

3.1.7 Air contamination

The inverter should keep away from contaminative air, such as corrosive gas, oil mist and conductive dust.

3.1.8 Storage enviroment

The inverter should keep away from direct sunlight, oil mist, and steam environment.

3.2Installation interval and distance

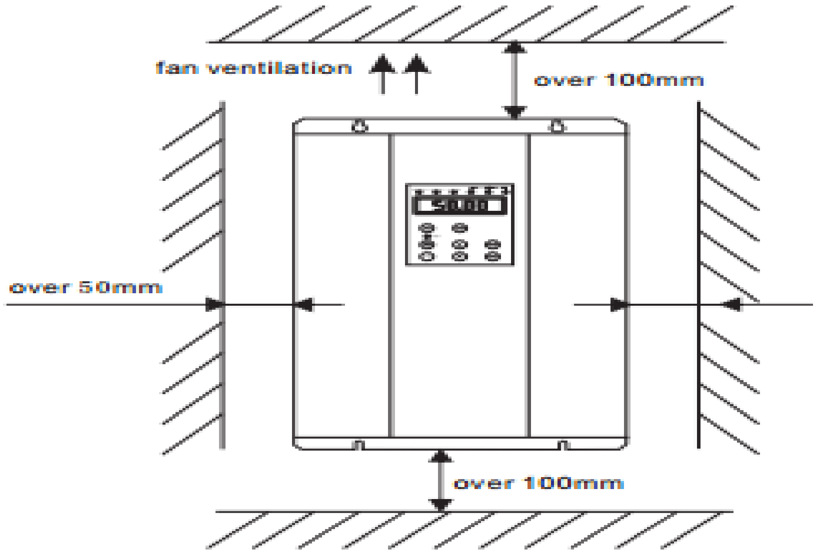
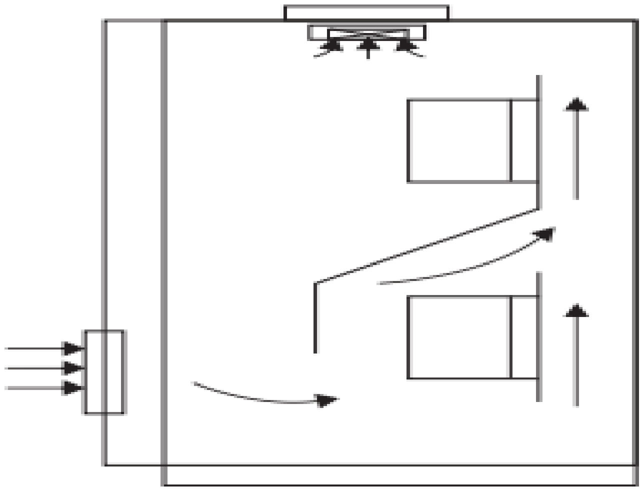


figure 3-2 Installation interval

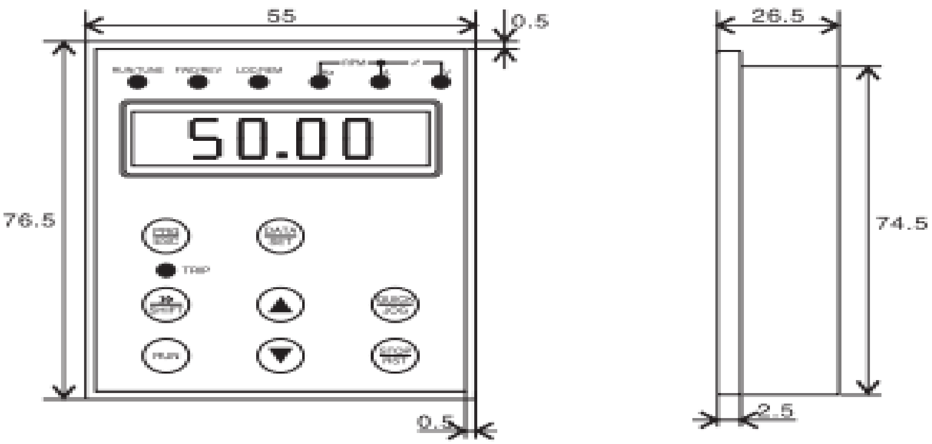


Installation of multiple inverters

Baffler should be mounted when two inverters be installed up and down

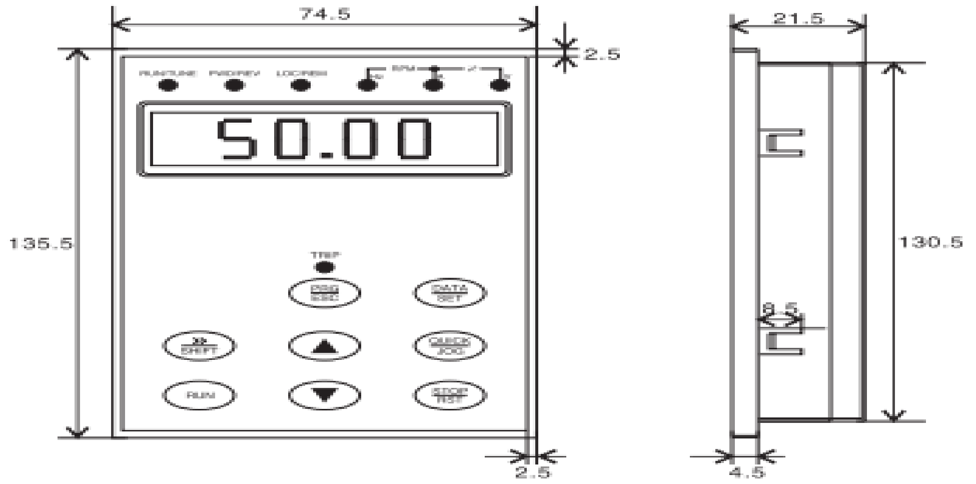
3.3Operation keypad installation size (small)

Unit: mm



3.4Operation keypad installation size (big)

Unit: mm



4.1Connection of peripheral devices

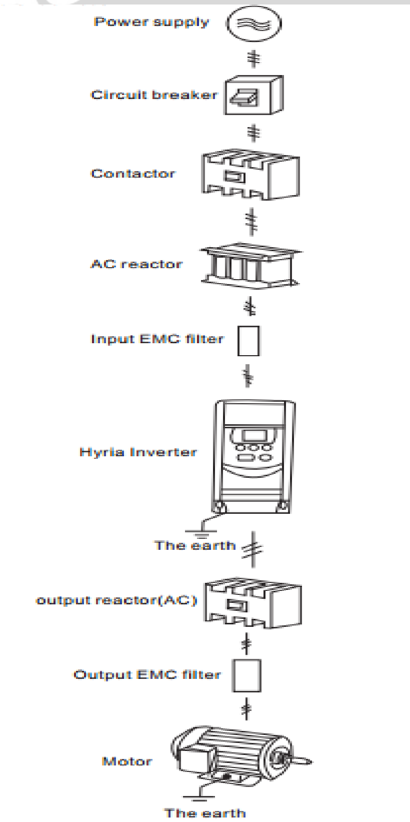


Figure 4.1 Connection of peripheral devices.

4.2 Terminal configuration

4.2.1 Main circuit terminals

HY0D4043B~HY02D243B HY0D4023B~HY03D4023B

R	S	T	P	Pr	U	V	W	⏚
⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕

HY04D043B~HY05D043B HY04D023B

⏚	R	S	T	P	Pr	U	V	W
⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕

HY11D043B~HY30D043B

R	S	T			⏚		U	V	W
⊕	⊕	⊕			⊕		⊕	⊕	⊕

R	S	T	P	P1	N	U	V	W	⏚

Figure 4-7 Main circuit terminals (55-75kw)

R	S	T	+	–	⏚	U	V	W	⏚

Figure4-8 Main circuit terminals (90-220kw)

R	S	T	⏚		U	V	W

Figure4-9 Main circuit terminals (280-400kw)

Functions instruction:

Terminals	Function Description
R、S、T	Terminals of 3 phase AC input
P+、P–	Spare terminals of external braking unit
P+、PB	Spare terminals of external braking resistor
P+、P1	Spare terminals of external DC reactor
P–	Terminal of negative DC bus
U、V、W	Terminals of 3 phase AC output
PE	Grounding terminals

(Note: The terminal configuration above is consult only, if there is fluctuation, according to the real object please.)

4.2.2 Control circuit terminals

AO1	GND	AI1	+10V	X2	COM	X5	+24V	Y2	TA
485+	485–	AI2	X1	X3	X4	X6	Y1	TB	TC

Figure 4-10 Control circuit terminals

4.3 Wiring control circuits

4.3.1 Precautions

Use shielded or twisted-pair cables to connect control terminals. Connect the ground terminal (PE) with shield wire.The cable connected to the control terminal should leave away from the main circuit and heavy current circuits (including power supply cable, motor cable, relay and contactor connecting cable) at least 20cm and parallel wiring should be avoided. It is suggested to apply perpendicular wiring to prevent inverter malfunction caused by external interference.

4.3.2 **Control circuit terminals**

Terminal No.	Function
X1～X6	ON-OFF signal input, optical coupling and COM. Input voltage range:9～30V Input impedance:3.3KΩ
+24V	Local power supply of +24V.Maximum output current: 200mA
COM	Common ground terminal for digital signal and +24V (or external power supply).
AI1	Analog input: 0~10V Input impedance: 10 KΩ
AI2	Analog input: 0~10V/ 0~20mA, switched by J3. Input impedance: 10 KΩ(/ (voltage input) / 250Ω(current input). when current input is 0-20mA the correspondent voltage is 5V
+10V	Supply +10V to inverter
GND	+10V reference zero electric potential
Y1~Y2	COM is the correspondent common port of open circuit collector
AO1	Analog output terminal,providing voltage or current output which can be switched by J4. (0-20mA) --- Output range: 0~10V/ 0~20mA.
TA、TB、TC	TABC electric relay output, TA common port, TB normally closed,TC normally open contact capacity: AC250V/3A， DC30V/1A

4.3.3**Jumpers and control board**

Jumper	Function
J3	Switch between (0~1 0V) voltage input and (0~20mA) current input. Jumper 1、2 is voltage input; 2、3is current input
J4	Switch between (0~10V) voltage input and (0~20mA) current input. Jumper 1、2is voltage input; 2、3 is current input

4.5.2 Specification of Input AC reactor, output AC reactor, DC reactor

Inverter capacity KW	Input AC reactor		Output AC reactor		DC reactor	
	Current (A)	Inductance (mH)	Current (A)	Inductance (mH)	Current (A)	Inductance (mH)
SL-4300EE/4370PE	60	0.24	63	80	80	0.86
SL-4370EE/4450PE	75	0.235	80	100	100	0.70
SL -4450EE/4550PE	91	0.17	100	120	120	0.58
SL -4550EE/4750PE	112	0.16	125	146	146	0.47
SL -4750EE/4900PE	150	0.12	160	200	200	0.35
SL -4900EE/41100PE	180	0.10	200	238	238	0.29
SL -41100EE/41320PE	220	0.09	224	291	291	0.24
SL -41320EE/41600PE	265	0.08	280	326	326	0.215
SL-41600EE/41850PE	300	0.07	315	395	395	0.177
SL-42000EE/42200PE	360	0.06	400	494	494	0.142
SL-42200EE/42500PE	400	0.05	560	557	557	0.126
SL -4280EE/43150PE	560	0.03	600	700	700	0.10
SL-43150EE/43500PE	640	0.0215	630	800	800	0.08
SL-44000EE/45000PE	754	0.15	720	1000	1000	0.04
SL-46300EE/47000PE	1180	0.01	1250	1540	1540	0.015

4.6 Wiring main circuit

4.6.1 Wiring at input side of main circuit

4.6.1.1Circuit breaker

It is necessary to connect a circuit breaker which is compatible with the capacity ofinverter between 3ph AC power supply and power input terminals (R, S and T). The capacity of breaker is I.5~2 times to the rated current of inverter. Please refer to the chapter of Specifications of Breaker, Cable, and Contactor for details.

4.6.1.2 Contactor

In order to cut off the input power effectively when something is wrong in the system,contactor should be installed at the input side to control the on/off of the main circuit power supply.

4.6.1.3 AC reactor

High current in the input power circuit may cause damage to the rectifying components.It is appropriate to use AC reactor in the input side for the avoidance of high-voltage input of the power supply and improvement of the power factors.

6.1.4 Input EMC filter

The surrounding device may be disturbed by the cables when the inverter is working.EMC filter can minimize the interference. Just like the following figure.

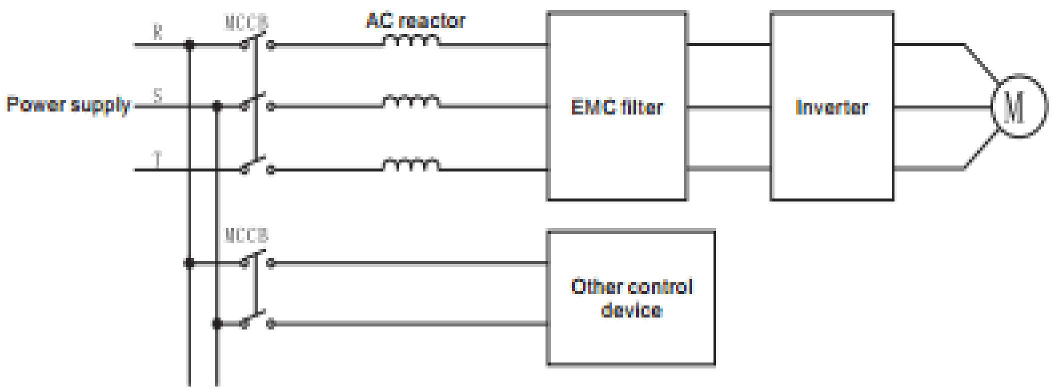


Figure 4-12 Wiring at input side of main circuit

4.6.2 Wiring at inverter side of main circuit

4.6.2.1 DC reactor

Inverters are equipped with internal DC reactors for the improvement of power factors and the avoidance of damage from high input current to the rectifying components because of the high-capacity transformer. The device can also cease the damage to the rectifying components which are caused by supply net voltage transients and harmonic waves

4.6.2.2 Braking unit and braking resistor

In order to dissipate the regenerative energy generated by dynamic braking, the braking resistor should be installed at (P+) and PB terminals. The wire length of the braking resistor should be less than 5m.

The temperature of braking resistor will increase because the regenerative energy will be transformed to heat. Safety protection and good ventilation is recommended.

Inverter above 11KW need connect external braking unit which should be installed at (P+) and (P-) terminals. The cable between inverter and braking unit should be less than 5m. The cable between braking unit and braking resistor should be less than 10m.

Note: Be sure that the electric polarity of (+) (-) terminals is right; it is not allowed to connect (+) with (-) terminals directly, otherwise damage or fire could occur.

4.6.3 Wiring at motor side of main circuit

4.6.3.1 Output Reactor

When the distance between inverter and motor is more than 50m, inverter may be tripped by over-current protection frequently because of the large leakage current resulted from the parasitic capacitance with ground. And at the same time to avoid the damage of motor insulation, the output reactor should be installed.

4.6.3.2 Output EMC filter

EMC filter should be installed to minimize the leak current caused by the cable and minimize the radio noise caused by the cables between the inverter and cable. Just see the following figure.

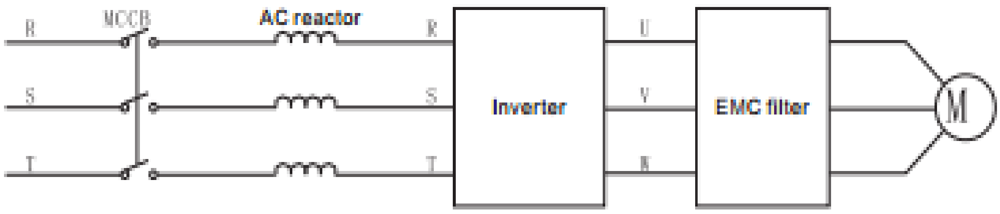


Figure 4-13 Wiring at motor side of main circuit

4.6.4 Wiring of regenerative unit

Regenerative unit is used for putting the electricity generated by braking of motor to the grid. Compared with traditional 3 phase inverse parallel bridge type rectifier unit, regenerative unit uses IGBT so that the total harmonic distortion (THD) is less than 4%. Regenerative unit is widely used for centrifugal and hoisting equipment.

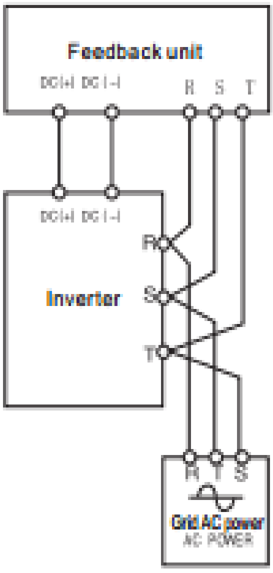


Figure 4-14 Wiring of regenerative unit.

4.6.5 Wiring of Common DC bus

Common DC bus method is widely used in the paper industry and chemical fiber industry which need multi-motor to coordinate. In these applications, some motors are in driving state while some others are in regenerative braking (generating electricity) state. The regenerated energy is automatically balanced through the common DC bus, which means it can supply to motors in driving state. Therefore the power consumption of whole system will be less compared with the traditional method (one inverter drives one motor).

When two motors are running at the same time (i.e. winding application), one is in driving state and the other is in regenerative state. In this case the DC buses of these two inverters can be connected in parallel so that the regenerated energy can be supplied to motors in driving state whenever it needs. Detailed wiring is shown in the following figure:

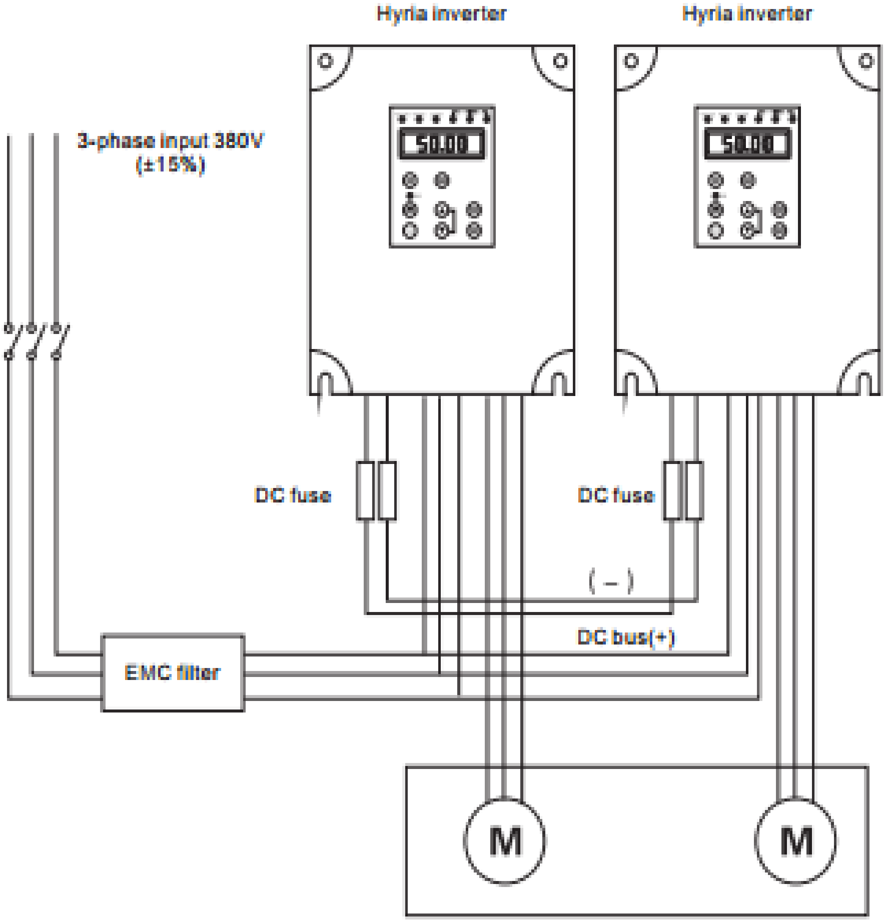


Figure 4-15 Wiring of common DC bus.

Note: When two inverters be wired to bus directly, same model types are suggested, and be powered on at the same time.

4.6.6 Ground wiring (PE)

Ground the PE terminal of the inverter with grounding resistors for the insurance of safety and avoidance of electrical shock and fire. It is appropriate to use thick and short multiple copper core wires whose sectional area is larger than 3.5mm². It is not recommended to use the public earth wire; otherwise, the grounding wires may complete the circuit.

4.7 Installation guidline to EMC compliance

4.7.1 General description of EMC

EMC is the abbreviation of electromagnetic compatibility, which means the device or system has the ability to work normally in the electromagnetic environment and will not generate any electromagnetic interference to other equipments. EMC includes two subjects: electromagnetic interference and electromagnetic anti-jamming. According to the transmission mode, Electromagnetic interference can be divided into two categories: conducted interference and radiated interference.

Conducted interference is the interference transmitted by conductor. Therefore, any conductors (such as wire, transmission line, inductor, capacitor and so on) are the transmission channels of the interference.

Radiated interference is the interference transmitted in electromagnetic wave, and the energy is inverse proportional to the square of distance.

Three necessary conditions or essentials of electromagnetic interference are:interference source, transmission channel and sensitive receiver. For customers, the solution of EMC problem is mainly in transmission channel because of the device attribute of disturbance source and receiver can not be changed

EMC ability varies with different electrical and electronic device which are different in EMC standards or grades.

4.7.2 EMC features of inverter

Like other electric or electronic devices, inverter is not only an electromagnetic interference source but also an electromagnetic receiver. The operating principle of inverter determines that it can produce certain electromagnetic interference noise. And the same time inverter should be designed with certain anti-jamming ability to ensure the smooth working in certain electromagnetic environment. The following is its EMC features:

4.7.2.1 Input current is non-sine wave. The input current includes large amount of high-harmonic waves that can cause electromagnetic interference, decrease the grid power factor and increase the line loss.

4.7.2.2 Output voltage is high frequency PMW wave, which can increase the temperature rise and shorten the life of motor. And the leakage current will also increase, which can lead to the leakage protection device malfunction and generate strong electromagnetic interference to influence the reliability of other electric devices.

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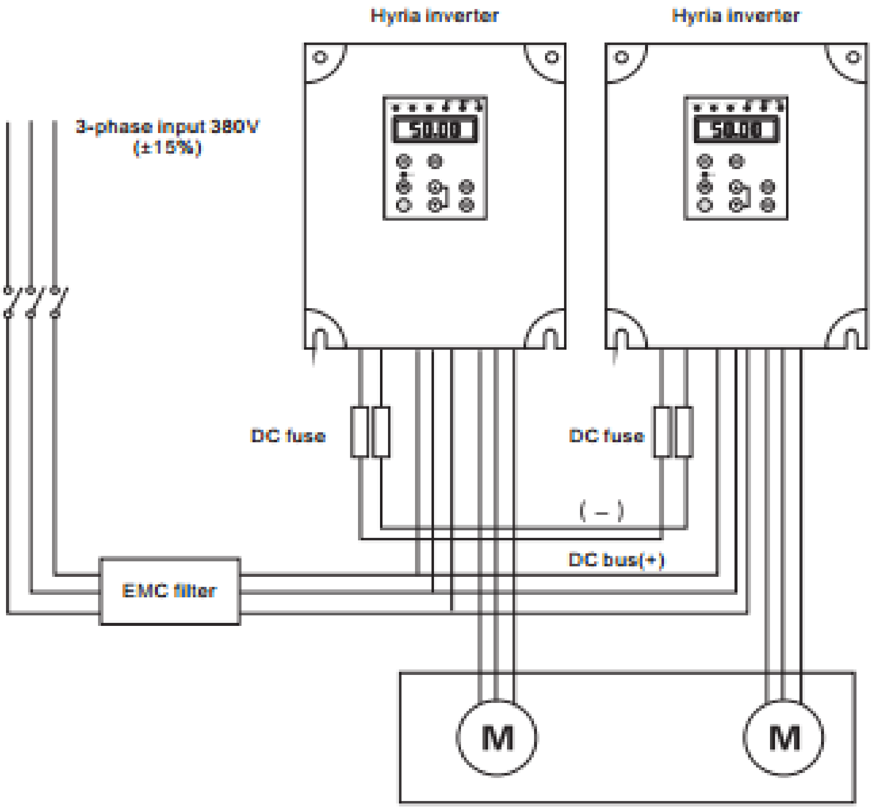

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4.7.2.3 As the electromagnetic receiver, too strong interference will damage the inverter and influence the normal using of customers.

4.7.2.4 In the system, EMS and EMI of inverter coexist. Decrease the EMI of inverter can increase its EMS ability.

4.7.3 EMC Installation Guideline

In order to ensure all electric devices in the same system to work smoothly, this section,based on EMC features of inverter, introduces EMC installation process in several aspects of application (noise control, site wiring, grounding, leakage current and power supply filter). The good effective of EMC will depend on the good effective of all of these five aspects.

4.7.3.1 Noise control

All the connections to the control terminals must use shielded wire. And the shield layer of the wire must ground near the wire entrance of inverter. The ground mode is 360 degree annular connection formed by cable clips. It is strictly prohibitive to connect the twisted shielding layer to the ground of inverter, which greatly decreases or loses the shielding

Connect inverter and motor with the shielded wire or the separated cable tray. One side of shield layer of shielded wire or metal cover of separated cable tray should connect to ground, and the other side should connect to the motor cover. Installing an EMC filter can reduce the electromagnetic noise greatly.

4.7.3.2 Site configuration

Power supply configuration: the power should be separated supplied from electrical transformer. Normally it is 5 core wires, three of which are fire wires, one of which is the neutral wire, and one of which is the ground wire. It is strictly prohibitive to use the same line to be both the neutral wire and the ground wire.

Device categorization: there are different electric devices contained in one control cabinet, such as inverter, filter, PLC and instrument etc, which have different ability of emitting and withstanding electromagnetic noise. Therefore, it needs to categorize these devices into strong noise device and noise sensitive device. The same kinds of device should be placed in the same area, and the distance between devices of different category should be more than 20cm.

Wire Arrangement inside the control cabinet: there are signal wire (light current) and power cable (strong current) in one cabinet. For the inverter, the power cables are categorized into input cable and output cable. Signal wires can be easily disturbed by power cables to make the equipment malfunction. Therefore when wiring, signal cables and power cables should be arranged in different area. It is strictly prohibitive to arrange them in parallel or interlacement at a close distance (less than 20cm) or tie them together. If the signal wires have to cross the power cables, they should be arranged in 90 angles. Power input and output cables should not either be arranged in interlacement or tied together, especially when installed the EMC filter. Otherwise the distributed capacitances of its input and output power cable can be coupling each other to make the EMC filter out of function.

4.7.3.3 Grounding

Inverter must be ground safely when in operation. Grounding enjoys priority in all EMC methods because it does not only ensure the safety of equipment and persons, but also is the simplest, most effective and lowest cost solution for EMC problems. Grounding has three categories: special pole grounding, common pole grounding and series-wound grounding. Different control system should use special pole grounding,and different devices in the same control system should use common pole grounding,and different devices connected by same power cable should use series-wound grounding.

4.7.3.4 Leakage Current

Leakage current includes line-to-line leakage current and over-ground leakage current.Its value depends on distributed capacitances and carrier frequency of inverter. The over-ground leakage current, which is the current passing through the common ground wire, can not only flow into inverter system but also other devices. It also can make leakage current circuit breaker, relay or other devices malfunction. The value of line-to-line leakage current, which means the leakage current passing through distributed capacitors of input output wire, depends on the carrier frequency of inverter, the length and section areas of motor cables. The higher carrier frequency of inverter, the longer of the motor cable and/or the bigger cable section area, the larger leakage current will occur.

Countermeasure:

Decreasing the carrier frequency can effectively decrease the leakage current. In the case of motor cable is relatively long (longer than 50m), it is necessary to install AC reactor or sinusoidal wave filter at the output side, and when it is even longer, it is necessary to install one reactor at every certain distance.

4.7.3.5 EMC Filter

EMC filter has a great effect of electromagnetic decoupling, so it is preferred for customer to install it.

1. For inverter, noise filter has following categories.
2. Install noise isolation for other equipment by means of isolation transformer or power filter.

5. Operation

5.1 Keypad description

5.1.1 Keypad schematic diagram

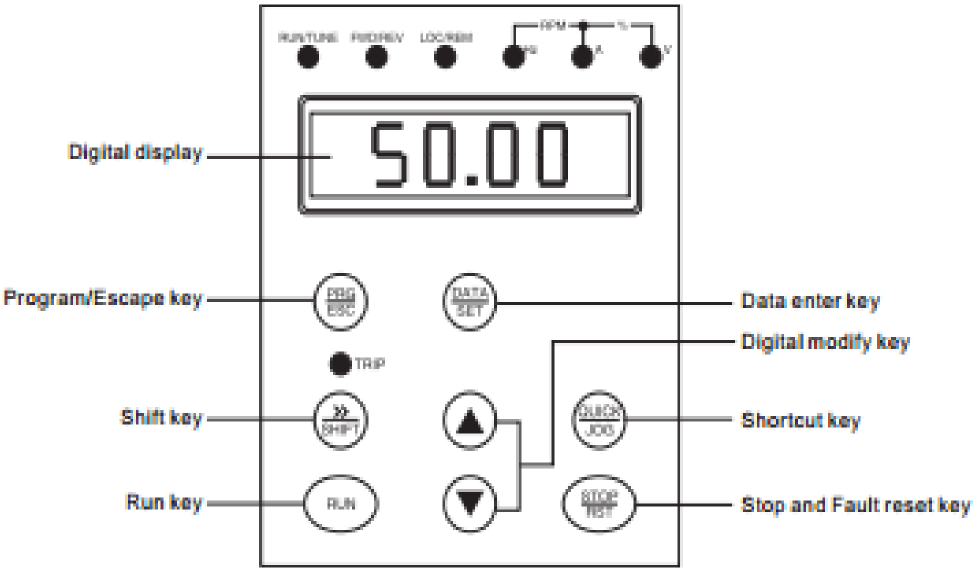


Figure 5-1 Keypad schematic diagram.

5.1.2 Key function description

Button Symbol	Name	Function Description
PRG/ESC	Program/Escape	Enter or escape from the first-level menu.
DATA/SET	Data enter key	Progressively enter menu and confirm parameters.
▲	Digital modify	Progressively increase data or function codes.
▼	Digital modify	Progressive decrease data or function codes.
DATA/SET + QUICK/JOG	Combination key	In parameter setting mode, press this button to cyclically display parameters by left shift. Press DATA/ENT at first, and then QUICK/JOG.
» SHIFT	Shift key	In parameter setting mode, press this button to select the bit to be modified. In other modes, cyclically displays parameters by right shift.
RUN	Run key	Start to run the inverter in keypad control mode.
STOP/RST	Stop key/Fault reset key	In running state, restricted by P1.10, can be used to stop the inverter. When fault alarm, can be used to reset the inverter without any restriction.
QUICK/JOG	Shortcut key	Determined by Function Code P1.09 0.Shortcut menu QUICK function. Enter or escape from the first-level menu. 1.FDW/REV switching. 2.Clear UP/DOWN setting.
RUN + STOP/RST	Combination key	Pressing the RUN and STOP/RST at the same time can achieve inverter coast to stop.

A-Y3A/A-Y3 SERIES MOTOR

EFF2

BEARING SIZE

Frame Size	Poles	Drive End	Non-Drive End
		International type	International type
56	2-4	62012Z	62012Z
63	2-4	62012Z	62012Z
71	2-6	62022Z	62022Z
80	2-8	62042Z	62042Z
90	2-8	62052Z	62052Z
100	2-8	62062Z	62062Z
112	2-8	63062Z	63062Z
132	2-8	63082Z	63082Z
160	2-8	63092ZC3	63092ZC3
180	2-8	6311C3	6311C3
200	2-8	6312C3	6312C3
225	2-8	6313C3	6313C3
250	2-8	6314C3	6314C3
280	2	6314C3	6314C3
	4-8	6317C3	6317C3
315	2	6317C3	6317C3
	4-10	NU319C3	6319C3
355	2	6319C3	6319C3
	4-10	NU322C3	6322C3
400	4-10	NU326C3	6326C3

MAIN DATA FOR TERMINAL BOX

Classified number	Frame size	Max.F.Amps	Entery hole size
			International standard
1	H56-80	2.6	2×M20×1.5
2	H90-100	6.8	2×M25×1.5
3	H112-132	15.4	2×M32×1.5
4	H160-180	42.5	2×M40×1.5
5	H200-225	84.2	2×M50×1.5
6	H250-280	166.6	2×M63×1.5
7	H315	358	2×M63×1.5
8	H355	546	2×M63×1.5
9	H400	600	3XM63X1.5

TECHNICAL DATA OF A-Y3 SERIES EFF2

NO.	Type (Frame reference and size)	Amps (A) 380V (Full load current at rated voltage)	Amps (A) 400V	Amps (A) 415V	Power kW (Rated power)	Power HP	Speed r/min (Full load speed in revolutions per minute)	EFF. % (Efficiency)	P.F. CosΦ (Power factor)	LRT/RLT (Direct on line starting torque ratio)	LRA/RLA (Direct on line starting current ratio)	BDT/RLT (Direct on line pull out torque ratio)	Noise LwdB(A) (Mean sound pressure level @1m on no load)	Weight kg (Weight)	J kgm2 (Rotor inertia WK²)
1	A-Y3-80M1-2	1.77	1.74	1.68	0.75	1	2840	75.0	0.83	2.2	6.1	2.3	67	16	0.00075
2	A-Y3-80M2-2	2.61	2.48	2.39	1.1	1.5	2840	76.2	0.84	2.2	6.9	2.3	67	17	0.00090
3	A-Y3-90S-2	3.46	3.28	3.16	1.5	2	2850	78.5	0.84	2.2	7.0	2.3	72	20	0.00120
4	A-Y3-90L-2	4.85	4.61	4.45	2.2	3	2855	81.0	0.85	2.2	7.0	2.3	72	23	0.00140
5	A-Y3-100L-2	6.34	6.03	5.81	3	4	2860	82.6	0.87	2.2	7.5	2.3	76	30	0.00290
6	A-Y3-112M-2	8.2	7.79	7.51	4	5.5	2880	84.2	0.88	2.2	7.5	2.3	77	41	0.00550
7	A-Y3-132S1-2	11.1	10.53	10.15	5.5	7.5	2900	85.7	0.88	2.2	7.5	2.3	80	57.5	0.01090
8	A-Y3-132S2-2	14.9	14.1	13.6	7.5	10	2900	87.0	0.88	2.2	7.5	2.3	80	60.5	0.01260
9	A-Y3-160M1-2	21.2	20.2	19.5	11	15	2930	88.4	0.89	2.2	7.5	2.3	86	107	0.03770
10	A-Y3-160M2-2	28.6	27.2	26.2	15	20	2930	89.4	0.89	2.2	7.5	2.3	86	114	0.04990
11	A-Y3-160L-2	34.7	33.0	31.8	18.5	25	2930	90.0	0.90	2.2	7.5	2.3	86	133	0.05500
12	A-Y3-180M-2	41	39.0	37.6	22	30	2940	90.5	0.90	2.0	7.5	2.3	89	165	0.07500
13	A-Y3-200L1-2	55.4	52.6	50.7	30	40	2950	91.4	0.90	2.0	7.5	2.3	92	218	0.12400
14	A-Y3-200L2-2	67.9	64.5	62.2	37	50	2950	92.0	0.90	2.0	7.5	2.3	92	230	0.13900
15	A-Y3-225M-2	82.1	78.0	75.2	45	60	2960	92.5	0.90	2.0	7.5	2.3	92	290	0.23300
16	A-Y3-250M-2	100	94.8	91.4	55	75	2970	93.0	0.90	2.0	7.5	2.3	93	359	0.31200
17	A-Y3-280S-2	135	129	124	75	100	2975	93.6	0.90	2.0	7.0	2.3	94	475	0.57900
18	A-Y3-280M-2	160	152	147	90	125	2975	93.9	0.91	2.0	7.1	2.3	94	510	0.67500
19	A-Y3-315S-2	195	186	179	110	150	2975	94.0	0.91	1.8	7.1	2.2	96	875	1.18000
20	A-Y3-315M-2	233	222	214	132	180	2975	94.5	0.91	1.8	7.1	2.2	96	963	1.82000
21	A-Y3-315L1-2	279	265	256	160	220	2975	94.6	0.92	1.8	7.1	2.2	99	1010	2.08000
22	A-Y3-315L2-2	348	331	319	200	270	2975	94.8	0.92	1.8	7.1	2.2	99	1138	2.38000
23	A-Y3-355M-2	433	412	397	250	340	2980	95.2	0.92	1.6	7.1	2.2	103	1900	3.00000
24	A-Y3-355L-2	545	518	499	315	430	2980	95.4	0.92	1.6	7.1	2.2	103	2300	3.50000

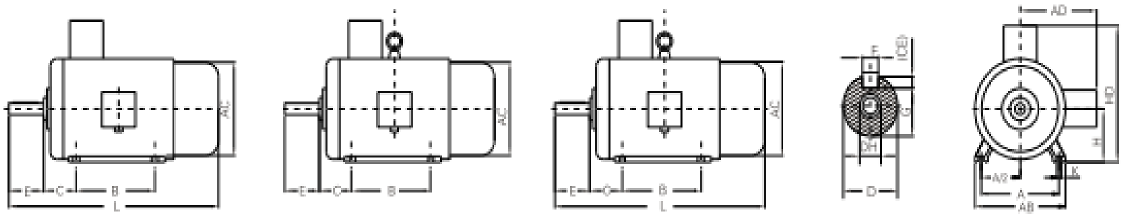
NO.	Type (Frame reference and size)	Amps (A) 380V (Full load current at rated voltage)	Amps (A) 400V	Amps (A) 415V	Power kW (Rated power)	Power HP	Speed r/min (Full load speed in revolutions per minute)	EFF. % (Efficiency)	P.F. CosΦ (Power factor)	LRT/RLT (Direct on line starting torque ratio)	LRA/RLA (Direct on line starting current ratio)	BDT/RLT (Direct on line pull out torque ratio)	Noise LwdB(A) (Mean sound pressure level @1m on no load)	Weight kg (Weight)	J kgm2 (Rotor inertia WK²)
1	A-Y3-80M1-4	1.57	1.49	1.44	0.55	0.75	1390	71	0.75	2.4	5.2	2.3	58	15	0.00180
2	A-Y3-80M2-4	2.05	1.59	1.88	0.75	1	1380	73	0.76	2.3	6.0	2.3	58	15.5	0.00210
3	A-Y3-90S-4	2.85	2.71	2.61	1.1	1.5	1390	76.2	0.77	2.3	6.0	2.3	61	19	0.00230
4	A-Y3-90L-4	3.72	3.54	3.41	1.5	2	1400	78.5	0.78	2.3	6.0	2.3	61	23	0.00270
5	A-Y3-100L1-4	5.09	4.90	4.72	2.2	3	1410	80	0.81	2.3	7.0	2.3	64	29	0.00540
6	A-Y3-100L2-4	6.78	6.39	6.16	3	4	1410	82.6	0.82	2.3	7.0	2.3	64	31	0.00670
7	A-Y3-112M-4	8.8	8.36	8.06	4	5.5	1435	84.2	0.82	2.3	7.0	2.3	65	42	0.00950
8	A-Y3-132S-4	11.7	11.2	10.8	5.5	7.5	1440	85.7	0.83	2.3	7.0	2.3	71	63.5	0.02140
9	A-Y3-132M-4	15.6	14.8	14.3	7.5	10	1450	87	0.84	2.3	7.0	2.3	71	72	0.02960
10	A-Y3-160M-4	22.5	21.4	20.6	11	15	1460	88.4	0.84	2.2	7.0	2.3	75	110	0.07470
11	A-Y3-160L-4	30	28.5	27.5	15	20	1460	89.4	0.85	2.2	7.5	2.3	75	129	0.09180
12	A-Y3-180M-4	36.3	34.5	33.3	18.5	25	1470	90	0.86	2.2	7.5	2.3	76	160	0.13900
13	A-Y3-180L-4	43.2	40.8	39.3	22	30	1470	90.5	0.86	2.2	7.5	2.3	76	178	0.15800
14	A-Y3-200L-4	57.6	55.1	53.1	30	40	1470	91.4	0.86	2.2	7.2	2.3	79	228	0.26200
15	A-Y3-225S-4	70.2	66.7	64.3	37	50	1475	92	0.87	2.2	7.2	2.3	81	288	0.40600
16	A-Y3-225M-4	84.9	80.7	77.8	45	60	1475	92.5	0.87	2.2	7.2	2.3	81	313	0.46900
17	A-Y3-250M-4	103	98.1	94.6	55	75	1480	93	0.87	2.2	7.2	2.3	83	376	0.66000
18	A-Y3-280S-4	138.3	131	127	75	100	1480	93.6	0.88	2.2	6.8	2.3	86	508	1.12000
19	A-Y3-280M-4	165	157	152	90	125	1480	93.9	0.88	2.2	6.8	2.3	86	581	1.64000
20	A-Y3-315S-4	201	191	184	110	150	1480	94.5	0.88	2.1	6.9	2.2	93	846	3.10000
21	A-Y3-315M-4	240	228	220	132	180	1480	94.8	0.88	2.1	6.9	2.2	93	940	3.62000
22	A-Y3-315L1-4	288	273	264	160	220	1480	94.9	0.89	2.1	6.9	2.2	97	1044	4.13000
23	A-Y3-315L2-4	360	342	329	200	270	1480	94.9	0.89	2.1	6.9	2.2	97	1162	4.73000
24	A-Y3-355M-4	443	421	406	250	340	1490	95.2	0.90	2.1	6.9	2.2	101	1700	6.50000
25	A-Y3-355L-4	559	531	511	315	430	1490	95.2	0.90	2.1	6.9	2.2	101	1900	8.20000

TECHNICAL DATA OF A-Y3 SERIES EFF2

	Frame reference and size	Full load current at rated voltage			Rated power		Full load speed in revolutions per minute	Efficiency	Power factor	Direct on line starting torque ratio	Direct on line starting current ratio	Direct on line pull out torque ratio	Mean sound pressure level @1m on no load	Weight	Rotor inertia WK²
NO.	Type	Amps (A) 380V	400V	415V	Power kW	HP	Speed r/min	EFF. %	P.F. CosΦ	LRT/RLT	LRA/RLA	BDT/RLT	Noise LwdB(A)	Weight kg	J kgm2
1	A-Y3-80M1-6	1.3	1.23	1.19	0.37	0.5	880	62	0.70	1.9	4.7	2.0	54	15	0.00160
2	A-Y3-80M2-6	1.8	1.70	1.64	0.55	0.75	880	65	0.72	1.9	4.7	2.1	54	16	0.00190
3	A-Y3-90S-6	2.29	2.18	2.10	0.75	1	905	69	0.72	2.0	5.3	2.1	57	20	0.00290
4	A-Y3-90L-6	3.18	3.02	2.91	1.1	1.5	905	72	0.73	2.0	5.5	2.1	57	23	0.00350
5	A-Y3-100L-6	4	3.80	3.66	1.5	2	920	76	0.75	2.0	5.5	2.1	61	29	0.00690
6	A-Y3-112M-6	5.6	5.29	5.10	2.2	3	935	79	0.76	2.0	6.5	2.1	65	41	0.01400
7	A-Y3-132S-6	7.4	7.03	6.78	3	4	960	81	0.76	2.1	6.5	2.1	69	59	0.02860
8	A-Y3-132M1-6	9.75	9.26	8.93	4	5.5	960	82	0.76	2.1	6.5	2.1	69	66	0.03570
9	A-Y3-132M2-6	12.9	12.3	11.8	5.5	7.5	960	84	0.77	2.1	6.5	2.1	69	76.5	0.04490
10	A-Y3-160M-6	17.2	16.3	15.8	7.5	10	970	86	0.77	2.0	6.5	2.1	73	106	0.08100
11	A-Y3-160L-6	24.5	23.3	22.4	11	15	970	87.5	0.78	2.0	6.5	2.1	73	122	0.11600
12	A-Y3-180L-6	31.6	30.0	28.9	15	20	970	89	0.81	2.0	7.0	2.1	73	167	0.20700
13	A-Y3-200L1-6	38.6	36.6	35.3	18.5	25	980	90	0.81	2.1	7	2.1	76	236	0.31500
14	A-Y3-200L2-6	44.7	42.5	41.0	22	30	980	90	0.83	2.0	7	2.1	76	247	0.36000
15	A-Y3-225M-6	59.3	56.3	54.3	30	40	980	91.5	0.84	2.0	7	2.1	76	287	0.54700
16	A-Y3-250M-6	71	67.5	65.1	37	50	980	92	0.86	2.1	7	2.1	78	355	0.84300
17	A-Y3-280S-6	86	81.7	78.1	45	60	980	92.5	0.86	2.1	7	2	80	444	1.39000
18	A-Y3-280M-6	104	99.5	95.9	55	75	980	92.8	0.86	2.1	7	2	80	498	1.65000
19	A-Y3-315S-6	142	135	130	75	100	985	93.5	0.86	2.0	6.7	2	85	859	4.11000
20	A-Y3-315M-6	169	161	155	90	125	985	93.8	0.86	2.0	6.7	2	85	950	4.78000
21	A-Y3-315L1-6	207	196	189	110	150	985	94	0.86	2.0	6.7	2	85	1031	5.45000
22	A-Y3-315L2-6	245	232	224	132	180	985	94.2	0.87	2.0	6.7	2	85	1107	6.12000
23	A-Y3-355M1-6	292	278	268	160	220	990	94.5	0.88	1.9	6.7	2	92	1550	9.50000
24	A-Y3-355M2-6	365	347	335	200	270	990	94.5	0.88	1.9	6.7	2	92	1600	10.40000
25	A-Y3-355L-6	457	434	418	250	340	990	94.5	0.88	1.9	6.7	2	92	1700	12.40000

	Frame reference and size	Full load current at rated voltage			Rated power		Full load speed in revolutions per minute	Efficiency	Power factor	Direct on line starting torque ratio	Direct on line starting current ratio	Direct on line pull out torque ratio	Mean sound pressure level @1m on no load	Weight	Rotor inertia WK²
NO.	Type	Amps (A) 380V	400V	415V	Power kW	HP	Speed r/min	EFF. %	P.F. CosΦ	LRT/RLT	LRA/RLA	BDT/RLT	Noise LwdB(A)	Weight kg	J kgm2
1	A-Y3-80M1-8	0.83	0.84	0.80	0.18	0.25	645	51	0.61	1.8	3.3	1.9	52	15	0.00250
2	A-Y3-80M2-8	1.10	1.10	1.06	0.25	0.34	645	54	0.61	1.8	3.3	1.9	52	16	0.00300
3	A-Y3-90S-8	1.49	1.41	1.36	0.37	0.5	675	62	0.61	1.8	4	1.9	56	20	0.00510
4	A-Y3-90L-8	2.17	2.07	1.99	0.55	0.75	680	63	0.61	1.8	4	2	56	23	0.00650
5	A-Y3-100L1-8	2.43	2.31	2.22	0.75	1	680	70	0.67	1.8	4	2	59	29	0.00900
6	A-Y3-100L2-8	3.36	3.20	3.08	1.1	1.5	680	72	0.69	1.8	5	2	59	31	0.01100
7	A-Y3-112M-8	4.4	4.18	4.03	1.5	2	690	74	0.70	1.8	5	2	61	41	0.02450
8	A-Y3-132S-8	6.0	5.66	5.46	2.2	3	710	79	0.71	1.8	6	2	64	61	0.03140
9	A-Y3-132M-8	7.8	7.41	7.15	3	4	710	80	0.73	1.8	6	2	64	74	0.03950
10	A-Y3-160M1-8	10.3	9.76	9.41	4	5.5	720	81	0.73	1.9	6	2	68	95.5	0.07530
11	A-Y3-160M2-8	13.6	12.9	12.5	5.5	7.5	720	83	0.74	1.9	6	2	68	107	0.09310
12	A-Y3-160L-8	17.8	16.9	16.3	7.5	10	720	85.5	0.75	1.9	6	2	68	128	0.12600
13	A-Y3-180L-8	25.5	24.2	23.3	11	15	730	87.5	0.75	2	6.5	2	70	169	0.20300
14	A-Y3-200L-8	34.1	32.4	31.2	15	20	730	88	0.76	2	6.6	2	73	236	0.33900
15	A-Y3-225S-8	41.1	39.0	37.6	18.5	25	730	90	0.76	1.9	6.6	2	73	274	0.49100
16	A-Y3-225M-8	48.9	45.0	43.4	22	30	730	90.5	0.78	1.9	6.6	2	73	290	0.54700
17	A-Y3-250M-8	63	60.2	58.1	30	40	735	91	0.79	1.9	6.5	2	75	370	0.83400
18	A-Y3-280S-8	78	73.9	71.2	37	50	740	91.5	0.79	1.9	6.6	2	76	488	1.65000
19	A-Y3-280M-8	94	89.4	86.1	45	60	740	92	0.79	1.9	6.6	2	76	563	1.93000
20	A-Y3-315S-8	111	106	102	55	75	735	92.8	0.81	1.8	6.6	2	82	852	4.79000
21	A-Y3-315M-8	150	143	138	75	100	735	93.5	0.81	1.8	6.2	2	82	933	5.58000
22	A-Y3-315L1-8	178	169	163	90	125	735	93.8	0.82	1.8	6.4	2	82	1027	6.37000
23	A-Y3-315L2-8	217	206	199	110	150	735	94	0.82	1.8	6.4	2	82	1117	7.23000
24	A-Y3-355M1-8	261	248	239	132	180	740	93.7	0.82	1.8	6.4	2	90	2000	7.90000
25	A-Y3-355M2-8	315	299	288	160	220	740	94.2	0.82	1.8	6.4	2	90	2150	10.30000
26	A-Y3-355L-8	387	368	355	200	270	740	94.5	0.83	1.8	6.4	2	90	2250	12.30000
27	A-Y3-315M-10	100	95	91	45	60	590	91.5	0.75	1.5	6.2	2	82	818	4.79000
28	A-Y3-315M-10	121	115	111	55	75	590	92	0.75	1.5	6.2	2	82	903	5.58000
29	A-Y3-315L1-10	162	154	148	75	100	590	92.5	0.76	1.5	5.8	2	82	1007	6.37000
30	A-Y3-315L2-10	191	181	175	90	125	590	93	0.77	1.5	5.9	2	82	1100	7.23000
31	A-Y3-355M1-10	230	218	211	110	150	590	93.2	0.78	1.3	6.0	2	90	1800	7.90000
32	A-Y3-355M2-10	275	261	252	132	180	590	93.5	0.78	1.3	6.0	2	90	2000	10.30000
33	A-Y3-355L-10	334	317	305	160	220	590	93.5	0.78	1.3	6.0	2	90	2500	12.30000

MOUNTING DATA FOR A-Y3

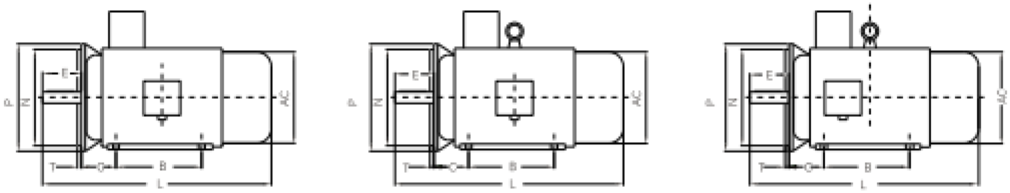


H80–90 H100–132 H160–355 H80–355

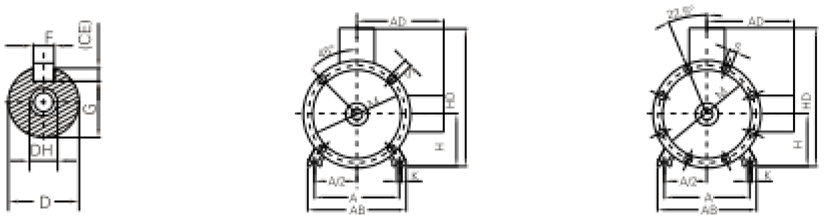
Frame with feet and end-shield without flange(IM B3)

FRAME SIZE	POLES	A	A/2	B	C	D	E	F	G	H	K	AB	AC	AD	HD	L	DH*
80M	2 4 6 8	125	62.5	100	50	19	40	6	15.5	80	10	165	155	145	220	295	M6×16
90S	2 4 6 8	140	70	100	56	24	50	8	20	90	10	180	175	155	250	320	M8×19
90L	2 4 6 8	140	70	125	56	24	50	8	20	90	10	180	175	155	250	345	M8×19
100L	2 4 6 8	160	80	140	63	28	60	8	24	100	12	205	196	180	270	385	M10×22
112M	2 4 6 8	190	95	140	70	28	60	8	24	112	12	230	220	190	300	400	M10×22
132S	2 4 6 8	216	108	140	89	38	80	10	33	132	12	270	259	210	345	470	M12×28
132M	2 4 6 8	216	108	178	89	38	80	10	33	132	12	270	259	210	345	510	M12×28
160M	2 4 6 8	254	127	210	108	42	110	12	37	160	15	320	315	255	420	615	M16×36
160L	2 4 6 8	254	127	254	108	42	110	12	37	160	15	320	315	255	420	660	M16×36
180M	2 4 6 8	279	139.5	241	121	48	110	14	42.5	180	15	355	355	280	455	700	M16×36
180L	2 4 6 8	279	139.5	279	121	48	110	14	42.5	180	15	355	355	280	455	740	M16×36
200L	2 4 6 8	318	159	305	133	55	110	16	49	200	19	395	397	305	505	770	M20×42
225S	4 8	356	178	286	149	60	140	18	53	225	19	435	445	335	560	815	M20×42
225M	2	356	178	311	149	55	110	16	49	225	19	435	445	335	560	820	M20×42
	4 6 8	356	178	311	149	60	140	18	53	225	19	435	445	335	560	845	M20×42
250M	2	406	203	349	168	60	140	18	53	250	24	490	485	370	615	920	M20×42
	4 6 8	406	203	349	168	65	140	18	58	250	24	490	485	370	615	920	M20×42
280S	2	457	228.5	368	190	65	140	18	58	280	24	550	547	410	680	995	M20×42
	4 6 8	457	228.5	368	190	75	140	20	67.5	280	24	550	547	410	680	995	M20×42
280M	2	457	228.5	419	190	65	140	18	58	280	24	550	547	410	680	1045	M20×42
	4 6 8	457	228.5	419	190	75	140	20	67.5	280	24	550	547	410	680	1045	M20×42
315S	2	508	254	406	216	65	140	18	58	315	28	635	620	530	845	1185	M20×42
	4 6 8 10	508	254	406	216	80	170	22	71	315	28	635	620	530	845	1220	M20×42
315M	2	508	254	457	216	65	140	18	58	315	28	635	620	530	845	1290	M20×42
	4 6 8 10	508	254	457	216	80	170	22	71	315	28	635	620	530	845	1325	M20×42
315L	2	508	254	508	216	65	140	18	58	315	28	635	620	530	845	1290	M20×42
	4 6 8 10	508	254	508	216	80	170	22	71	315	28	635	620	530	845	1325	M20×42
355M	2	610	305	560	254	75	140	20	67.5	355	28	730	698	655	1010	1500	M20×42
	4 6 8 10	610	305	560	254	95	170	25	86	355	28	730	698	655	1010	1530	M20×42
355L	2	610	305	630	254	75	140	20	67.5	355	28	730	698	655	1010	1500	M20×42
	4 6 8 10	610	305	630	254	95	170	25	86	355	28	730	698	655	1010	1530	M20×42

MOUNTING DATA FOR A-Y3



H80–90 H100–132 H160–355

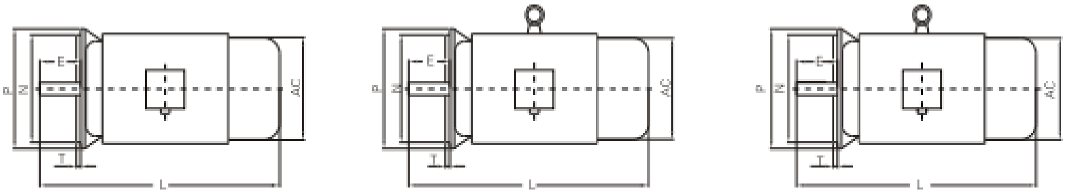


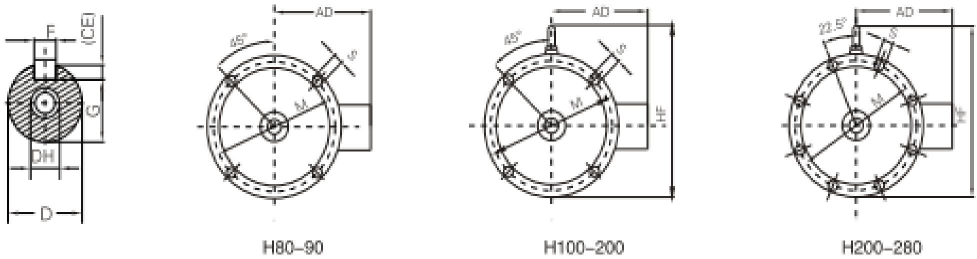
H80–200 H225–355

FRAME WITH FEET AND END-SHIELD WITH FLANGE(IM B35)

FRAME SIZE	POLES	A	A/2	B	C	D	E	F	G	H	K	M	N	P	S	T	FLANGE HOLES	AB	AC	AD	HD	L	DH*
80M	2 4 6 8	125	62.5	100	50	19	40	6	15.5	80	10	165	130	200	12	3.5	4	165	155	145	220	295	M6 × 16
90S	2 4 6 8	140	70	100	56	24	50	8	20	90	10	165	130	200	12	3.5	4	180	175	155	250	320	M8 × 19
90L	2 4 6 8	140	70	125	56	24	50	8	20	90	10	165	130	200	12	3.5	4	180	175	155	250	345	M8 × 19
100L	2 4 6 8	160	80	140	63	28	60	8	24	100	12	215	180	250	15	4	4	205	196	180	270	385	M10×22
112M	2 4 6 8	190	95	140	70	28	60	8	24	112	12	215	180	250	15	4	4	230	220	190	300	400	M10×22
132S	2 4 6 8	216	108	140	89	38	80	10	33	132	12	265	230	300	15	4	4	270	259	210	345	470	M12×28
132M	2 4 6 8	216	108	178	89	38	80	10	33	132	12	265	230	300	15	4	4	270	259	210	345	510	M12×28
160M	2 4 6 8	254	127	210	108	42	110	12	37	160	15	300	250	350	19	5	4	320	315	255	420	615	M16×36
160L	2 4 6 8	254	127	254	108	42	110	12	37	160	15	300	250	350	19	5	4	320	315	255	420	660	M16×36
180M	2 4 6 8	279	139.5	241	121	48	110	14	42.5	180	15	300	250	350	19	5	4	355	355	280	455	700	M16×36
180L	2 4 6 8	279	139.5	279	121	48	110	14	42.5	180	15	300	250	350	19	5	4	355	355	280	455	740	M16×36
200L	2 4 6 8	318	159	305	133	55	110	16	49	200	19	350	300	400	19	5	4	395	397	305	505	770	M20×42
225S	4 8	356	178	286	149	60	140	18	53	225	19	400	350	450	19	5	8	435	445	335	560	815	M20×42
225M	2	356	178	311	149	55	110	16	49	225	19	400	350	450	19	5	8	435	445	335	560	820	M20×42
	4 6 8	356	178	311	149	60	140	18	53	225	19	400	350	450	19	5	8	435	445	335	560	845	M20×42
250M	2	406	203	349	168	60	140	18	53	250	24	500	450	550	19	5	8	490	485	370	615	920	M20×42
	4 6 8	406	203	349	168	65	140	18	58	250	24	500	450	550	19	5	8	490	485	370	615	920	M20×42
280S	2	457	228.5	368	190	65	140	18	58	280	24	500	450	550	19	5	8	550	547	410	680	995	M20×42
	4 6 8	457	228.5	368	190	75	140	20	67.5	280	24	500	450	550	19	5	8	550	547	410	680	995	M20×42
280M	2	457	228.5	419	190	65	140	18	58	280	24	500	450	550	19	5	8	550	547	410	680	1045	M20×42
	4 6 8	457	228.5	419	190	75	140	20	67.5	280	24	500	450	550	19	5	8	550	547	410	680	1045	M20×42
315S	2	508	254	406	216	65	140	18	58	315	28	600	550	660	24	6	8	635	620	530	845	1185	M20×42
	4 6 8 10	508	254	406	216	80	170	22	71	315	28	600	550	660	24	6	8	635	620	530	845	1220	M20×42
315M	2	508	254	457	216	65	140	18	58	315	28	600	550	660	24	6	8	635	620	530	845	1290	M20×42
	4 6 8 10	508	254	457	216	80	170	22	71	315	28	600	550	660	24	6	8	635	620	530	845	1325	M20×42
315L	2	508	254	508	216	65	140	18	58	315	28	600	550	660	24	6	8	635	620	530	845	1290	M20×42
	4 6 8 10	508	254	508	216	80	170	22	71	315	28	600	550	660	24	6	8	635	620	530	845	1325	M20×42
355M	2	610	305	560	254	75	140	20	67.5	355	28	740	680	800	24	6	8	730	698	655	1010	1500	M20×42
	4 6 8 10	610	305	560	254	95	170	25	86	355	28	740	680	800	24	6	8	730	698	655	1010	1530	M20×42
355L	2	610	305	630	254	75	140	20	67.5	355	28	740	680	800	24	6	8	730	698	655	1010	1500	M20×42
	4 6 8 10	610	305	630	254	95	170	25	86	355	28	740	680	800	24	6	8	730	698	655	1010	1530	M20×42

MOUNTING DATA FOR A-Y3

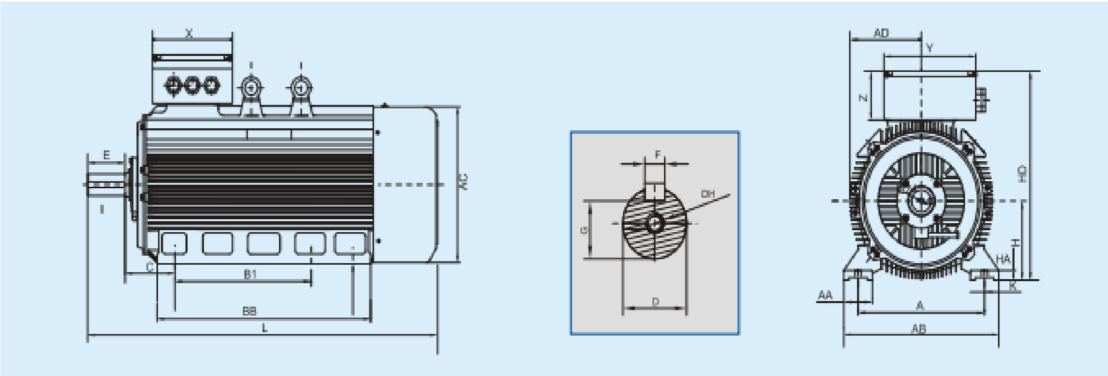




FRAME WITHOUT FEET AND END-SHIELD WITH FLANGE(IM B5)

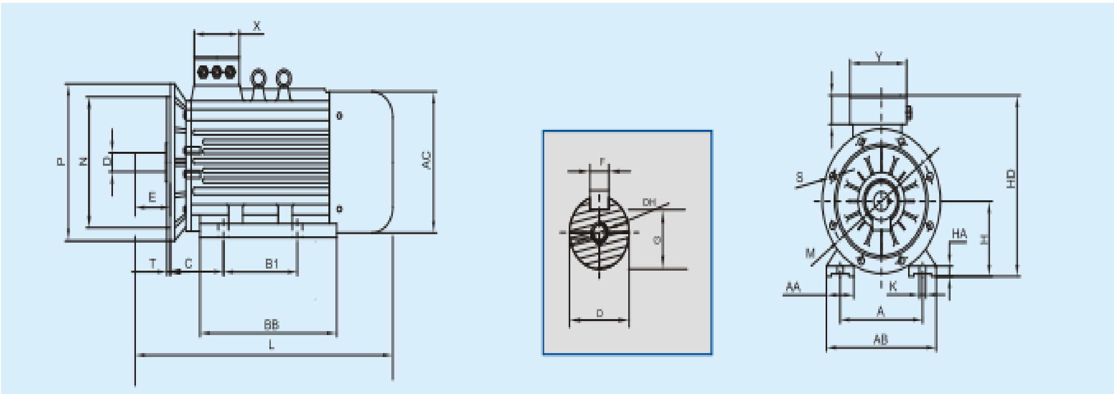
FRAME SIZE	POLES	D	E	F	G	M	N	P	S	T	FLANGE HOLES	AC	AD	HF	L	DH*
80M	2 4 6 8	19	40	6	15.5	165	130	200	12	3.5	4	155	145	185	295	M6 × 16
90S	2 4 6 8	24	50	8	20	165	130	200	12	3.5	4	175	155	195	320	M8 × 19
90L	2 4 6 8	24	50	8	20	165	130	200	12	3.5	4	175	155	195	345	M8 × 19
100L	2 4 6 8	28	60	8	24	215	180	250	15	4	4	196	180	245	385	M10 × 22
112M	2 4 6 8	28	60	8	24	215	180	250	15	4	4	220	190	265	400	M10 × 22
132S	2 4 6 8	38	80	10	33	265	230	300	15	4	4	259	210	315	470	M12 × 28
132M	2 4 6 8	38	80	10	33	265	230	300	15	4	4	259	210	315	510	M12 × 28
160M	2 4 6 8	42	110	12	37	300	250	350	19	5	4	315	255	385	615	M16 × 36
160L	2 4 6 8	42	110	12	37	300	250	350	19	5	4	315	255	385	660	M16 × 36
180M	2 4 6 8	48	110	14	42.5	300	250	350	19	5	4	355	280	430	700	M16 × 36
180L	2 4 6 8	48	110	14	42.5	300	250	350	19	5	4	355	280	430	740	M16 × 36
200L	2 4 6 8	55	110	16	49	350	300	400	19	5	4	397	305	480	770	M20 × 42
225S	4 8	60	140	18	53	400	350	450	19	5	8	445	335	535	815	M20 × 42
225M	2	55	110	16	49	400	350	450	19	5	8	445	335	535	820	M20 × 42
	4 6 8	60	140	18	53	400	350	450	19	5	8	445	335	535	845	M20 × 42
250M	2	60	140	18	53	500	450	550	19	5	8	485	370	595	920	M20 × 42
	4 6 8	65	140	18	58	500	450	550	19	5	8	485	370	595	920	M20 × 42
280S	2	65	140	18	58	500	450	550	19	5	8	547	410	650	995	M20 × 42
	4 6 8	75	140	20	67.5	500	450	550	19	5	8	547	410	650	995	M20 × 42
280M	2	65	140	18	58	500	450	550	19	5	8	547	410	650	1045	M20 × 42
	4 6 8	75	140	20	67.5	500	450	550	19	5	8	547	410	650	1045	M20 × 42

IM B3 H400-450
MOUNTING AND OVERALL DIMENSIONS OF IM B3 H400-450



Type								Mounting Dinensions									Overall Dimensions						
	Poles	A	AA	AB	AC	B1	BB	C	D	DH	E	F	G	H	HA	HD	K	L	AD	Eyeboit	X	Y	Z
400L	4								ϕ110		210	28	100					1925					
400L	6.8.10	686	125	810	855	710	1090	280	ϕ120	M24X54	210	32	109	400	30	1080	ϕ36	1925	430	2xM36	430	540	225
450L	4								ϕ130		210	32	119					2200					
450L	4.6.8.10	800	190	1000	930	1000	1300	300	ϕ140	M24X54	210	32	129	450	52	1380	ϕ42	2200	480	2xM36	500	595	410

IM B35 H400-450
MOUNTING AND OVERALL DIMENSIONSOF IM B35 H400-450



Type								Mounting Dinensions										Overall Dimensions								
	Poles	A	AA	AB	AC	B1	BB	C	D	E	F	H	HA	HD	DH	K	L	M	N	P	S	T	Eyeboit	X	Y	Z
400L	4								ϕ110	210	28						1925									
400L	6/8/10	686	125	810	855	710	1090	280	ϕ120	210	32	400	30	1080	M24X54	ϕ36	1925	940	880	1000	8xϕ28	6	2xM36	430	540	225
450L	4	800	190	1000	930	1000	1300	300	ϕ130	210	32	450	52	1380		ϕ42	2200	1080	1000	1150	8xϕ28	6	2xM36	500	595	410
450L	6/8/10								ϕ140	210	32				M24X54		2200									

Listing Program

```
/*****************************************************/
// NAMA   : Dany Octodoputra
// NIM    : 105060307111012
// JUDUL  : Sistem Pengontrolan Kecepatan Propeller Pada Wind Tunnel Menggunakan Kontrol
Logika Fuzzy
/****************************************************/
#include <FuzzyRule.h>
#include <FuzzyComposition.h>
#include <Fuzzy.h>
#include <FuzzyRuleConsequent.h>
#include <FuzzyOutput.h>
#include <FuzzyInput.h>
#include <FuzzyIO.h>
#include <FuzzySet.h>
#include <FuzzyRuleAntecedent.h>

int AnFback = A0;
int AnSpoint = A1;
int outPWM = 9;
int d, spoint, rpm, e, e_old, ce;

// besarnya RPM pada vout = 5volt
int const fullRPM = 8580;

// class fuzzy
Fuzzy* fuzzy = new Fuzzy();

// fuzzyset error
FuzzySet* e_vlp = new FuzzySet(-8000, -8000, -6000, -3000);
FuzzySet* e_lp = new FuzzySet(-6000, -3000, -3000, 0);
FuzzySet* e_z = new FuzzySet(-3000, 0, 0, 3000);
FuzzySet* e_mp = new FuzzySet(0, 3000, 3000, 6000);
FuzzySet* e_fp = new FuzzySet(3000, 6000, 8000, 8000);
```

```
// fuzzyset change error
FuzzySet* ce_vlp = new FuzzySet(-800, -800, -600, -300);
FuzzySet* ce_lp = new FuzzySet(-600, -300, -300, 0);
FuzzySet* ce_z = new FuzzySet(-300, 0, 0, 300);
FuzzySet* ce_mp = new FuzzySet(0, 300, 300, 600);
FuzzySet* ce_fp = new FuzzySet(300, 600, 800, 800);

// fuzzyset singleton output
FuzzySet* o_vlp = new FuzzySet(50, 50, 50, 50);
FuzzySet* o_lp = new FuzzySet(100, 100, 100, 100);
FuzzySet* o_z = new FuzzySet(150, 150, 150, 150);
FuzzySet* o_mp = new FuzzySet(200, 200, 200, 200);
FuzzySet* o_fp = new FuzzySet(255, 255, 255, 255);


int ReadRPM()
{
 d = analogRead(AnFback);
 rpm = (d/1024)*fullRPM;
 return(rpm);
}

int ReadSpoint()
{
 d = analogRead(AnSpoint);
 spoint = (d/1024)*fullRPM;
 return(spoint);
}

void setup(){
 e =0; ce = 0;
 // fuzzy input error
 FuzzyInput* error = new FuzzyInput(1);
 error->addFuzzySet(e_vlp);
 error->addFuzzySet(e_lp);
 error->addFuzzySet(e_z);
```

```
error->addFuzzySet(e_mp);
error->addFuzzySet(e_fp);
fuzzy->addFuzzyInput(error);

// fuzzy input change error
FuzzyInput* cerror = new FuzzyInput(2);
cerror->addFuzzySet(ce_vlp);
cerror->addFuzzySet(ce_lp);
cerror->addFuzzySet(ce_z);
cerror->addFuzzySet(ce_mp);
cerror->addFuzzySet(ce_fp);
fuzzy->addFuzzyInput(cerror);

// fuzzy output
FuzzyOutput* output = new FuzzyOutput(1);
output->addFuzzySet(o_vlp);
output->addFuzzySet(o_lp);
output->addFuzzySet(o_z);
output->addFuzzySet(o_mp);
output->addFuzzySet(o_fp);
fuzzy->addFuzzyOutput(output);

// consequent
FuzzyRuleConsequent* thenVLP = new FuzzyRuleConsequent();
thenVLP->addOutput(o_vlp);
FuzzyRuleConsequent* thenLP = new FuzzyRuleConsequent();
thenLP->addOutput(o_lp);
FuzzyRuleConsequent* thenZ = new FuzzyRuleConsequent();
thenZ->addOutput(o_z);
FuzzyRuleConsequent* thenMP = new FuzzyRuleConsequent();
thenMP->addOutput(o_mp);
FuzzyRuleConsequent* thenFP = new FuzzyRuleConsequent();
thenFP->addOutput(o_fp);

// antecedent baris 1
FuzzyRuleAntecedent* antecedent1_1 = new FuzzyRuleAntecedent();
antecedent1_1->joinWithAND(e_vlp, ce_vlp);
```

```
FuzzyRuleAntecedent* antecedent1_2 = new FuzzyRuleAntecedent();
antecedent1_2->joinWithAND(e_lp, ce_vlp);
FuzzyRuleAntecedent* antecedent1_3 = new FuzzyRuleAntecedent();
antecedent1_3->joinWithAND(e_z, ce_vlp);
FuzzyRuleAntecedent* antecedent1_4 = new FuzzyRuleAntecedent();
antecedent1_4->joinWithAND(e_mp, ce_vlp);
FuzzyRuleAntecedent* antecedent1_5 = new FuzzyRuleAntecedent();
antecedent1_5->joinWithAND(e_fp, ce_vlp);
// antecedent baris 2
FuzzyRuleAntecedent* antecedent2_1 = new FuzzyRuleAntecedent();
antecedent2_1->joinWithAND(e_vlp, ce_lp);
FuzzyRuleAntecedent* antecedent2_2 = new FuzzyRuleAntecedent();
antecedent2_2->joinWithAND(e_lp, ce_lp);
FuzzyRuleAntecedent* antecedent2_3 = new FuzzyRuleAntecedent();
antecedent2_3->joinWithAND(e_z, ce_lp);
FuzzyRuleAntecedent* antecedent2_4 = new FuzzyRuleAntecedent();
antecedent2_4->joinWithAND(e_mp, ce_lp);
FuzzyRuleAntecedent* antecedent2_5 = new FuzzyRuleAntecedent();
antecedent2_5->joinWithAND(e_fp, ce_lp);
// antecedent baris 3
FuzzyRuleAntecedent* antecedent3_1 = new FuzzyRuleAntecedent();
antecedent3_1->joinWithAND(e_vlp, ce_z);
FuzzyRuleAntecedent* antecedent3_2 = new FuzzyRuleAntecedent();
antecedent3_2->joinWithAND(e_lp, ce_z);
FuzzyRuleAntecedent* antecedent3_3 = new FuzzyRuleAntecedent();
antecedent3_3->joinWithAND(e_z, ce_z);
FuzzyRuleAntecedent* antecedent3_4 = new FuzzyRuleAntecedent();
antecedent3_4->joinWithAND(e_mp, ce_z);
FuzzyRuleAntecedent* antecedent3_5 = new FuzzyRuleAntecedent();
antecedent3_5->joinWithAND(e_fp, ce_z);
// antecedent baris 4
FuzzyRuleAntecedent* antecedent4_1 = new FuzzyRuleAntecedent();
antecedent4_1->joinWithAND(e_vlp, ce_mp);
FuzzyRuleAntecedent* antecedent4_2 = new FuzzyRuleAntecedent();
antecedent4_2->joinWithAND(e_lp, ce_mp);
FuzzyRuleAntecedent* antecedent4_3 = new FuzzyRuleAntecedent();
antecedent4_3->joinWithAND(e_z, ce_mp);
```

```
FuzzyRuleAntecedent* antecedent4_4 = new FuzzyRuleAntecedent();
antecedent4_4->joinWithAND(e_mp, ce_mp);
FuzzyRuleAntecedent* antecedent4_5 = new FuzzyRuleAntecedent();
antecedent4_5->joinWithAND(e_fp, ce_mp);
// antecedent baris 5
FuzzyRuleAntecedent* antecedent5_1 = new FuzzyRuleAntecedent();
antecedent5_1->joinWithAND(e_vlp, ce_fp);
FuzzyRuleAntecedent* antecedent5_2 = new FuzzyRuleAntecedent();
antecedent5_2->joinWithAND(e_lp, ce_fp);
FuzzyRuleAntecedent* antecedent5_3 = new FuzzyRuleAntecedent();
antecedent5_3->joinWithAND(e_z, ce_fp);
FuzzyRuleAntecedent* antecedent5_4 = new FuzzyRuleAntecedent();
antecedent5_4->joinWithAND(e_mp, ce_fp);
FuzzyRuleAntecedent* antecedent5_5 = new FuzzyRuleAntecedent();
antecedent5_5->joinWithAND(e_fp, ce_fp);


// rule
FuzzyRule* rule1_1 = new FuzzyRule(1, antecedent1_1, thenFP);
fuzzy->addFuzzyRule(rule1_1);
 FuzzyRule* rule1_2 = new FuzzyRule(2, antecedent1_2, thenFP);
fuzzy->addFuzzyRule(rule1_2);
FuzzyRule* rule1_3 = new FuzzyRule(3, antecedent1_3, thenFP);
fuzzy->addFuzzyRule(rule1_3);
FuzzyRule* rule1_4 = new FuzzyRule(4, antecedent1_4, thenMP);
fuzzy->addFuzzyRule(rule1_4);
FuzzyRule* rule1_5 = new FuzzyRule(5, antecedent1_5, thenZ);
fuzzy->addFuzzyRule(rule1_5);

FuzzyRule* rule2_1 = new FuzzyRule(6, antecedent2_1, thenFP);
fuzzy->addFuzzyRule(rule2_1);
 FuzzyRule* rule2_2 = new FuzzyRule(7, antecedent2_2, thenFP);
fuzzy->addFuzzyRule(rule2_2);
FuzzyRule* rule2_3 = new FuzzyRule(8, antecedent2_3, thenMP);
fuzzy->addFuzzyRule(rule2_3);
FuzzyRule* rule2_4 = new FuzzyRule(9, antecedent2_4, thenZ);
fuzzy->addFuzzyRule(rule2_4);
```

```
  FuzzyRule* rule2_5 = new FuzzyRule(10, antecedent2_5, thenLP);
  fuzzy->addFuzzyRule(rule2_5);

  FuzzyRule* rule3_1 = new FuzzyRule(11, antecedent3_1, thenFP);
  fuzzy->addFuzzyRule(rule3_1);
   FuzzyRule* rule3_2 = new FuzzyRule(12, antecedent3_2, thenMP);
  fuzzy->addFuzzyRule(rule3_2);
  FuzzyRule* rule3_3 = new FuzzyRule(13, antecedent3_3, thenZ);
  fuzzy->addFuzzyRule(rule3_3);
  FuzzyRule* rule3_4 = new FuzzyRule(14, antecedent3_4, thenLP);
  fuzzy->addFuzzyRule(rule3_4);
  FuzzyRule* rule3_5 = new FuzzyRule(15, antecedent3_5, thenVLP);
  fuzzy->addFuzzyRule(rule3_5);

  FuzzyRule* rule4_1 = new FuzzyRule(16, antecedent4_1, thenMP);
  fuzzy->addFuzzyRule(rule4_1);
   FuzzyRule* rule4_2 = new FuzzyRule(17, antecedent4_2, thenZ);
  fuzzy->addFuzzyRule(rule4_2);
  FuzzyRule* rule4_3 = new FuzzyRule(18, antecedent4_3, thenLP);
  fuzzy->addFuzzyRule(rule4_3);
  FuzzyRule* rule4_4 = new FuzzyRule(19, antecedent4_4, thenVLP);
  fuzzy->addFuzzyRule(rule4_4);
  FuzzyRule* rule4_5 = new FuzzyRule(20, antecedent4_5, thenVLP);
  fuzzy->addFuzzyRule(rule4_5);

  FuzzyRule* rule5_1 = new FuzzyRule(21, antecedent5_1, thenZ);
  fuzzy->addFuzzyRule(rule5_1);
  FuzzyRule* rule5_2 = new FuzzyRule(22, antecedent5_2, thenLP);
  fuzzy->addFuzzyRule(rule5_2);
  FuzzyRule* rule5_3 = new FuzzyRule(23, antecedent5_3, thenVLP);
  fuzzy->addFuzzyRule(rule5_3);
  FuzzyRule* rule5_4 = new FuzzyRule(24, antecedent5_4, thenVLP);
  fuzzy->addFuzzyRule(rule5_4);
  FuzzyRule* rule5_5 = new FuzzyRule(25, antecedent5_5, thenVLP);
  fuzzy->addFuzzyRule(rule5_5);
}
```

```
void loop(){
  e = ReadSpoint()-ReadRPM();
  ce = e - e_old;
  fuzzy->setInput(1, e);
  fuzzy->setInput(2, ce);
  fuzzy->fuzzify();
  float output = fuzzy->defuzzify(1);
  analogWrite(outPWM, output);
  e_old = e;
  delay(100);
}
```