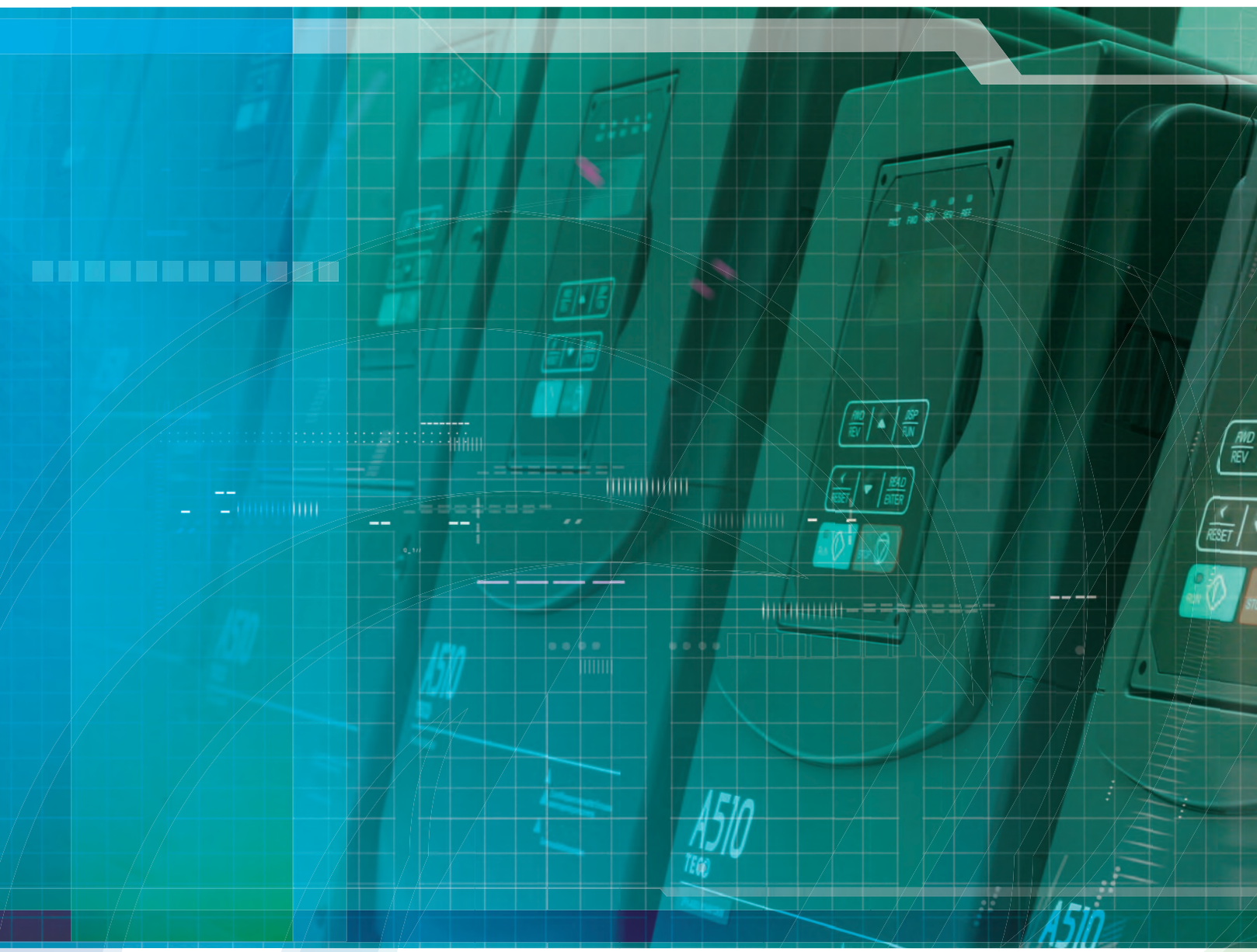
TECO

A510

Advanced Current Vector Control Drive

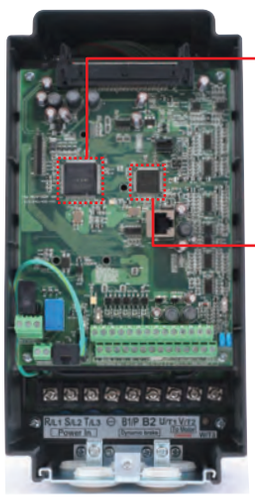
TAIWAN EXCELLENCE 2012


FWD
REV
RESET
RUN
ENTER
A510

The Complete Motor Control Solution

Contents

DUAL CORE PROCESSORS



32Bit MCU

Mass computing capability for advanced current vector control technology. Minimizes the internal loop time for higher control response.

ASIC *Above frame2 models

Prevents inrush current damage to IGBT module. Enhances the reliability and life expectancy of motor drive.

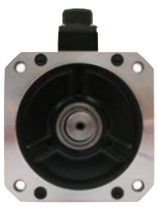
Enhanced Performance & Reliability!

HIGH EFFICIENCY PM MOTOR DRIVING

- Simple parameter settings for easy switching between induction and permanent magnet motors.
- High performance current vector control for induction and permanent magnet motors.

Induction Motor (IM)

-Cost Effective
-Mechanical Robust



Surface Permanent Magnet Motor (SPM)

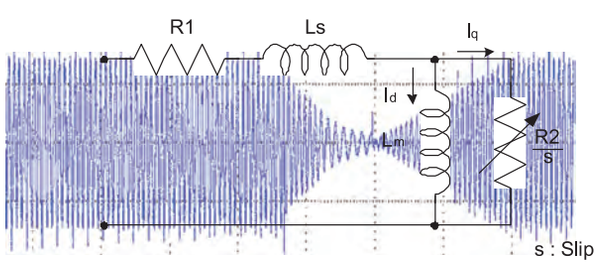
-Highly Efficient
-Compact Size
-Low Cogging Torque

Interior Permanent Magnet Motor (IPM)

-Highly Efficient
-Compact Size
-With Reluctance Torque

ADVANCED MOTOR AUTO-TUNE FUNCTION

Multiple Auto-tune Modes	
Rotational auto-tune mode	Rotary-type auto-tune for higher performance for precise control.
Static auto-tune mode	The motor shaft will be locked in static auto-tune mode.
Stator resistance measurement	Auto measure the resistor within cable and compensate accordingly.



Motor Equivalent Circuit

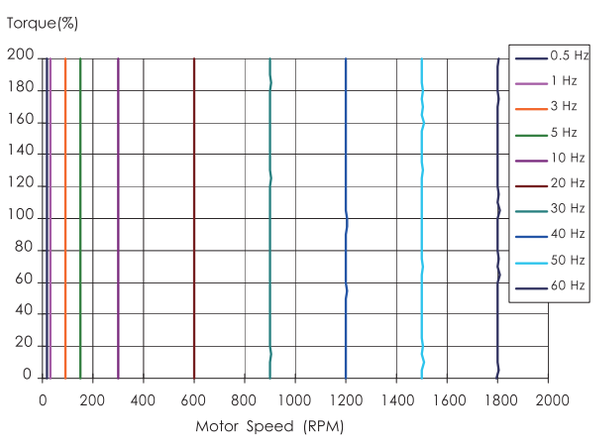
5th Kernel

A510 is loaded with 5th generation kernel has the most advanced motor tuning function to build accurate motor equivalent model automatically.

Optimized current vector control performance provides faster commissioning.

200% 0.5Hz STARTING TORQUE

SensorLess Vector (SLV) control mode achieves incredible 200% torque performance at extreme low speed 0.5Hz. Provides stable control experience for wide range of applications.



Sensor Vector Mode (SV) can output 200% holding torque.

CONFORMITY TO GLOBAL STANDARDS

- Conformity to RoHS directive and international recognized certification

RoHS

- CE cULus

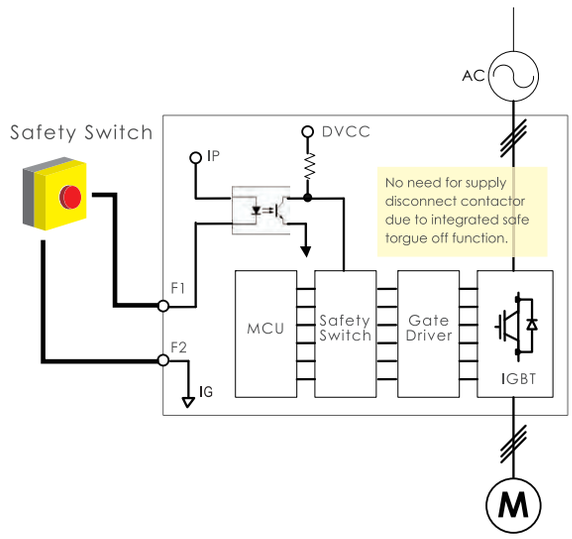
DOWN SIZE DESIGN

- New design with effective heat dissipation reduced size requiring less panel space.

*base on A510 440V 7.5HP comparison

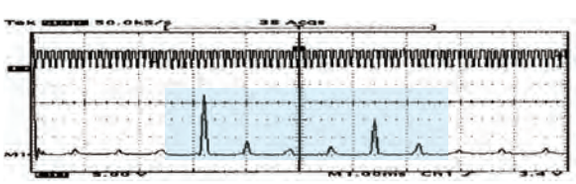
HARDWARE SAFE TORQUE OFF FUNCTION

- Built-in high reliable hardware circuit for safe torque off.



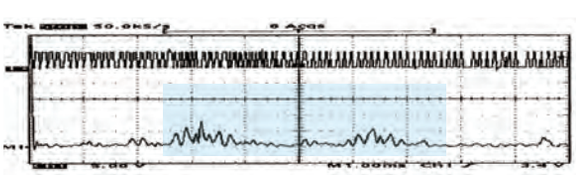
ULTRA LOW MOTOR NOISE

Traditional PWM modulation method



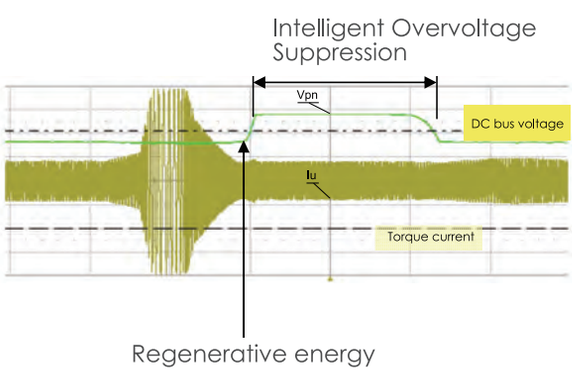
Unique Soft PWM modulation technology lowers the audible motor noise for quieter industrial environment

Soft PWM modulation method



INTELLIGENT OVER VOLTAGE SUPPRESSION

- Supress over voltage caused by regenerative loads and redirect regenerative energy back to the load. Intelligent overvoltage suppression will not only protect the drive but also removes the need for costly braking units.



The Complete Motor Control Solution

with powers for a wide range of applications

Gravitational Handling Equipment
| Crane, Elevator

Metal Processing Machine
| Press, Lathes

Plastics/Rubber Processing Machine
| Extruder, Injection Molding Machine

Tension Control Equipment
| Printing Machine, Reeling Machine

Textile Machine
| Dyeing and Finishing Machine

Wire/Cable Making Machine
| Wire Drewing Machine

SELECTION GUIDE

Dual rating design for heavy duty and normal duty applications.

ND. Selection Guide
Overload Capability Up To 120%/60sec

Driving higher horsepower motor in normal duty mode includes fans, pumps, HVAC, etc.

Example:
Select A510-2002-H model for 3HP motor in pump application. Sets 00-27=1 (ND Mode)

HD. Selection Guide
Overload Capability Up To 150%/60sec and 200%/2sec

Driving the same horsepower motor in heavy duty mode includes lifts, press, machine tools, etc.

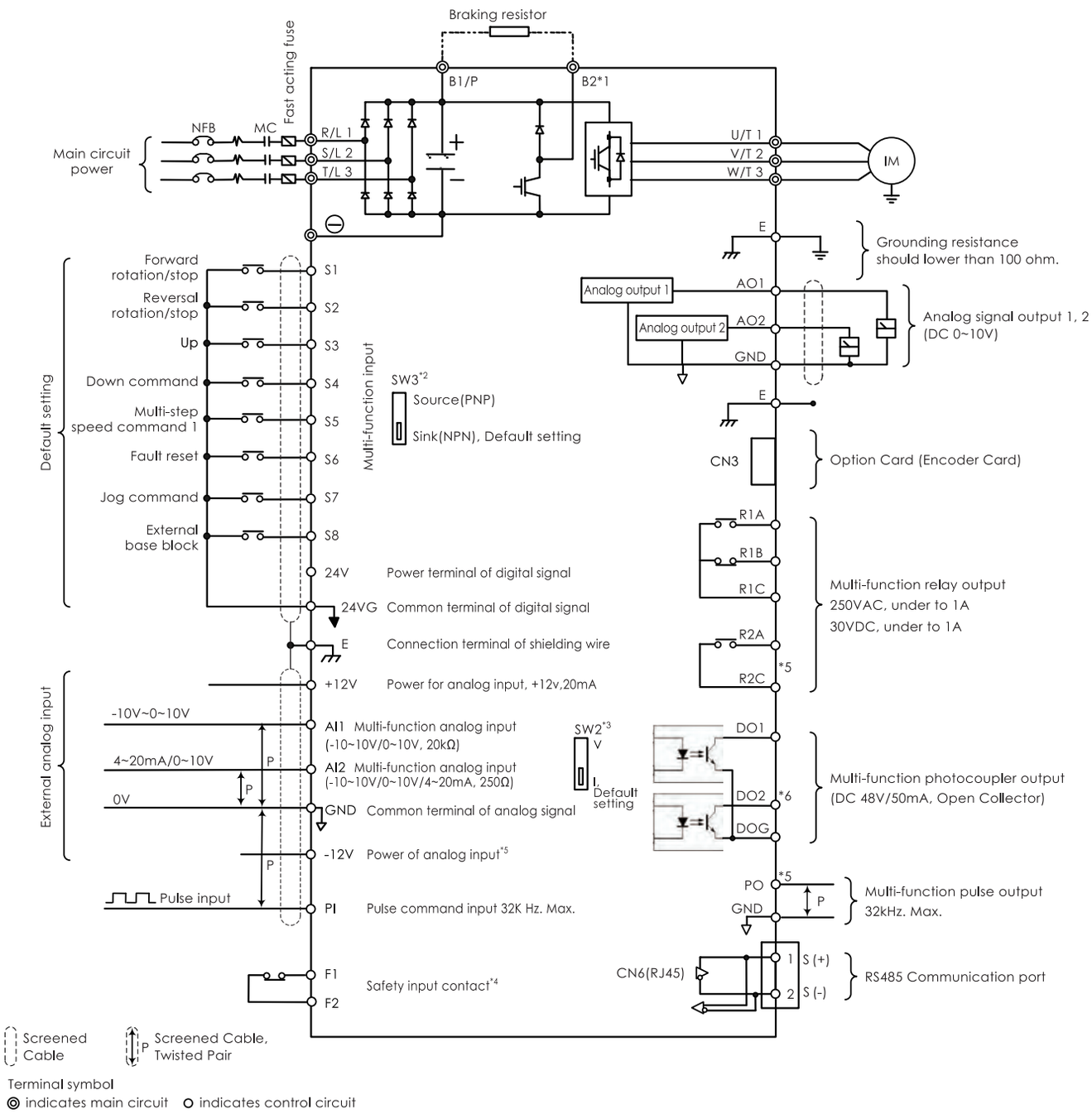
Example:
Select A510-2015-H model for 15HP motor in conveyor application. Sets 00-27=0 (HD Mode)

Maximum Applicable Motor (HP)	(kW)	Three Phase 220V				Three Phase 440V			
		Normal Duty (ND)		Heavy Duty (HD)		Normal Duty (ND)		Heavy Duty (HD)	
		Model Name	Rated Output Current	Model Name	Rated Output Current	Model Name	Rated Output Current	Model Name	Rated Output Current
1	0.75			A510-2001-H	5A			A510-4001-H3(F)	3.4A
1.5	1.1	A510-2001-H	6A						
2	1.5			A510-2002-H	8A	A510-4001-H3(F)	4.1A	A510-4002-H3(F)	4.2A
3	2.2	A510-2002-H	9.6A	A510-2003-H	11A	A510-4002-H3(F)	5.4A	A510-4003-H3(F)	5.5A
5	3.7	A510-2003-H	12A	A510-2005-H3	17.5A	A510-4003-H3(F)	6.9A	A510-4005-H3(F)	9.2A
7.5	5.5	A510-2005-H3	21A	A510-2008-H3	25A	A510-4005-H3(F)	11.1A	A510-4008-H3(F)	14.8A
10	7.5	A510-2008-H3	30A	A510-2010-H3	33A	A510-4008-H3(F)	17.5A	A510-4010-H3(F)	18A
15	11	A510-2010-H3	40A	A510-2015-H3	47A	A510-4010-H3(F)	23A	A510-4015-H3(F)	24A
20	15	A510-2015-H3	56A	A510-2020-H3	60A	A510-4015-H3(F)	31A	A510-4020-H3(F)	31A
25	18.5	A510-2020-H3	69A	A510-2025-H3	73A	A510-4020-H3(F)	38A	A510-4025-H3(F)	39A
30	22	A510-2025-H3	79A	A510-2030-H3	85A	A510-4025-H3(F)	44A	A510-4030-H3(F)	45A
40	30	A510-2030-H3	110A	A510-2040-H3	115A	A510-4030-H3(F)	58A	A510-4040-H3(F)	60A
50	37	A510-2040-H3	138A	A510-2050-H3	145A	A510-4040-H3(F)	72A	A510-4050-H3(F)	75A
60	45	A510-2050-H3	169A	A510-2060-H3	180A	A510-4050-H3(F)	88A	A510-4060-H3(F)	91A
75	55	A510-2060-H3	200A	A510-2075-H3	215A	A510-4060-H3(F)	103A	A510-4075-H3	118A
100	75	A510-2075-H3	250A	A510-2100-H3	283A	A510-4075-H3	145A	A510-4100-H3	150A
125	94	A510-2100-H3	312A	A510-2125-H3	346A	A510-4100-H3	165A	A510-4125-H3	180A
150	112	A510-2125-H3	360A	A510-2150-H3	415A	A510-4125-H3	208A	A510-4150-H3	216A
175	130	A510-2150-H3	450A			A510-4150-H3	250A	A510-4175-H3	260A
215	160					A510-4175-H3	296A	A510-4215-H3	295A
250	185					A510-4215-H3	328A	A510-4250-H3	370A
270	200					A510-4250-H3	435A		
300	220							A510-4300-H3	450A
335	250					A510-4300-H3	515A		
375	280							A510-4375-H3	523A
425	315					A510-4375-H3	585A		

Model Name

A510	–	2	001	–	H	3	F
A510 Series		Input Voltage 2 : 200V 4 : 400V	Horsepower 001 : 1HP 375 : 375HP		Type H : Standard Type (LED Display) C : Graphic Type (LCD Display)	Power Source Type Blank : Single or Three Phase 3 : Three Phase	Filter Blank : None F : Built-in

WIRING DIAGRAM



Remark:

*1: Only the main circuit of 220V1~25HP and 440V~30HP (included) or models of lower capacity with built-in braking resistor provide terminal B2. The braking resistor can be connected directly between B1 and B2.

*2: The multi-function digital input terminals S1~S8 can be set to Source (PNP) or Sink (NPN) mode by SW3.

*3: Multi-function analog input 2 (AI2) can be set to the voltage command input (0-10/-10-10v) or the current command input (4~20mA) by SW2.

*4: When integrated safety function is NOT used, connect a link across terminals F1 & F2 for the inverter output to function. External safety circuits can be interfaced with inverter using terminals F1 and F2.

*5: Terminals -12V, R2A-R2C and PO-GND are provided for 220V 3HP and 440V 5HP ratings and above.

*6: Terminals DO2 and DOE are provided for 220V 2HP and 440V 3HP ratings and above.

SPECIFICATIONS

220V Class

Inverter Capacity (HP)			1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125*2	150*2
Output Rating	Rated Output Capacity (KVA)		1.9	3	4.2	6.7	9.5	12.6	17.9	22.9	28.6	32.4	43.8	55.3	68.6	81.9	108	132	158
	HD*8	Rated Output Current (A)	5*4	8*4	11*4	17.5*4	25*4	33*4	47*4	60*4	73*6	85*5	115*5	145*5	180*5	215*5	283*5	346	415
		Maximum Applicable Motor*1 HP (KW)	1 (0.75)	2 (1.5)	3 (2.2)	5 (3.7)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)
	ND*3	Rated Output Current (A)	6	9.6	12	21	30	40	56	69	79	110	138	169	200	250	312	360	450
		Maximum Applicable Motor*1 HP (KW)	1.5 (1.1)	3 (2.2)	4 (3)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (130)
	Maximum Output Voltage (V)		Three Phase, 200V to 240V																
	Maximum Output Frequency (Hz)		Based on parameter setting 0.1~400.0 (1200.0) Hz*9																
Input Power	Rated Voltage, Frequency		Single or Three Phase,200V to 240V, 50/60Hz			Three Phase, 200V to 240V, 50/60Hz*5													
	Allowable Voltage Fluctuation		-15% ~ +10%																
	Allowable Frequency Fluctuation		±5%																
Braking Transistor			Built-in									Option (Braking Module)							
Frame Size			1		2		3		4			5		6		7		8	

440V Class

Inverter Capacity (HP)			1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	215	250*2	300*2	375*2
Output Rating	Rated Output Capacity (KVA)		2.6	3.7	4.2	7	11.3	13.7	18.3	23.6	29.7	34.3	45.7	57.2	69.3	85.4	114	137	165	198	225	270	317	400
	HD*8	Rated Output Current (A)	3.4*4	4.2*4	5.5*4	9.2*4	14.8*4	18*4	24*4	31*4	39*4	45*4	60*5	75*5	91*5	118*5	150*5	180*5	216*5	260*5	295*7	370	450	523
		Maximum Applicable Motor*1 HP (KW)	1 (0.75)	2 (1.5)	3 (2.2)	5 (4)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (132)	215 (160)	250 (185)	300 (220)	375 (280)
	ND*3	Rated Output Current (A)	4.1	5.4	6.9	11.1	17.5	23	31	38	44	58	72	88	103	145	165	208	250	296	328	435	515	600
		Maximum Applicable Motor*1 HP (KW)	2 (1.5)	3 (2.2)	4 (3)	7.5 (5.5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (132)	215 (160)	250 (185)	270 (200)	335 (250)	425 (315)
	Maximum Output Voltage (V)		Three Phase, 380V to 480V																					
	Maximum Output Frequency (Hz)		Based on parameter setting 0.1~400.0(1200.0) Hz*9																					
Input Power	Rated Voltage, Frequency		Three Phase, 380V to 480V, 50/60Hz																					
	Allowable Voltage Fluctuation		-15% ~ +10%																					
	Allowable Frequency Fluctuation		±5%																					
Braking Transistor			Built-in									Option (Braking Module)												
Frame Size			1		2		3		4			5		6		7					8			

Notes:

*1. For standard induction motors selected inverter must have an output current rating higher than the motor.

*2. 220V 125HP / 440V 250HP models or above are under development.

*3. The carrier frequency of factory default is 2kHz, if the setting value is higher than factory default, de-rating may be required.

*4. The carrier frequency of factory default is 8kHz, if the setting value is higher than factory default, de-rating may be required.

*5. The carrier frequency of factory default is 5kHz, if the setting value is higher than factory default, de-rating may be required.

*6. The carrier frequency of factory default is 6kHz, if the setting value is higher than factory default, de-rating may be required.

*7. The carrier frequency of factory default is 3kHz, if the setting value is higher than factory default, de-rating may be required.

*8. A510 model is designed to use in heavy load conditions, the factory setting takes HD (heavy load type) as the base.

*9. The maximum output frequency of each control modes is different, please read user manual for more details.

GENERAL SPECIFICATIONS

Control Characteristics	Display	LED keypad with 5-digits seven-segment display (LCD keypad option)
	Control Modes	V/F, V/F+PG, SLV, SV, PMSV, PMSLV[*1] (SVPWM Modulation)
	Output Frequency	0.1Hz～400.0Hz (1200.0Hz[*3])
	Frequency Accuracy	Digital references: ±0.01%(-10 to +40°C), Analog references: ±0.1% (25°C ±10°C)
	Speed Control Accuracy	±0.1%(Sensor Vector Control Mode, SV)[*2]，±0.5%(Sensorless Vector Control Mode, SLV)[*2]
	Frequency Setting Resolution	Digital References:0.01Hz, Analog References: 0.06Hz at 60Hz
	Output Frequency Resolution	0.01Hz
	Overload Tolerance	Heavy Duty Mode (HD.)：150% rated current for 60sec, 200% rated current for 2 sec. (Factory default) Normal Duty Mode (ND.)：120% rated current for 60sec
	Frequency Setting Signal	0 to +10V , 4 to 20mA, -10V to +10V or pulse train input
	Acceleration / Deceleration Time	0.0～6000.0 sec (separately set acceleration and deceleration time)
	Voltage / Frequency Characteristics	15 fixed and one customized v/f pattern
	Braking Torque	Approximate 20%
	Main Control Functions	Auto Tuning, Zero Servo, Torque Control, Position Control, Droop, Soft-PWM, Over-Voltage Protection, Dynamic Braking, Speed Search, Frequency Traversing, Momentary Power Loss Restart, PID Control, Automatic Torque Compensation, Slip Compensation, RS-485 Communication, Close Loop Control with PG, Simple PLC Function, Two Analog Output, Safety input contact
	Other Functions	Records of Power ON and Operation Time, Four Fault History Records and Latest Fault State Record, Energy-Saving Function, Phase Loss Protection, DC Braking, Dwell, S Curve Acceleration and Deceleration, Up / Down Operation, MODBUS Communication Protocol, Output of Pulse Multiple, Display of Engineering Unit, Local / Remote Switching, SINK / SOURCE Selection
Protection Functions	Stall Prevention	Current level can be adjusted. (In acceleration or constant speed, it can be set separately. In deceleration, it can be set with or without stall protection)
	Over Current (OC) and Output Short-Circuit (SC) Protection	It stops when the current exceeds 200% of the inverter rated current.
	Inverter Overload Protection (OL2)	Inverter will be stopped when the output is higher than below conditions. Heavy Duty Mode (HD.)：150% rated current for 60sec, 200% rated current for 2 sec. (Factory default), Carrier frequency is from 2kHz to 8kHz. Normal Duty Mode (ND.)：120% rated current for 60sec, Carrier frequency is 2kHz.
	Motor Overload Protection (OL1)	Electrical overload protection curve
	Over Voltage Protection (OV)	If the main circuit DC voltage is over 410V (220V class) / 820V (440V class), the motor stops running.
	Under Voltage (UV)	If the main circuit DC voltage is under 190V (220V class) / 380V (440V class), the motor stops running.
	Momentary Power Loss Restart	Power loss exceeds 15ms You can set the function of momentary power loss restart to up to 2 sec
	Overheat Protection (OH)	Thermistor sensor on heatsink
	Ground Fault Protection (GF)	Protection by current detection circuit
	Charge Indicator	When main circuit DC voltage ≧50V, the CHARGE LED is on.
	Output Phase Loss Protection (OPL)	If the OPL function acts, the motor stops rotation automatically
	Location	Indoor (Protected from corrosive gases and dust)
Environment Specification	Ambient Temperature	-10 to +40°C without de-rating (IP20/NEMA1), -10 to +50°C (IP00), with de-rating, its maximum operation temperature is 60°C
	Storage Temperature	-20~+70°C
	Humidity	95%RH or less (no condensation)
	Altitude and Vibration	Altitude of 1000 meters or lower, less than 5.9m/s2(0.6G)
Communication Function		Built-in RS-485 as standard (MODBUS protocol with standard RJ45)
PLC function		Built-in
Electromagnetic Interference (EMI)		Meets EN61800-3 standard, 400V 60HP or below can be built in.
Electromagnetic Compatibility (EMS)		Meets EN61800-3 standard
Certification	CE	Meets EN61800-3 (CE & RE) and EN61800-5-1(LVD)
	UL	UL508C
Option Card		Open collector type(IM) , line driver type(IM) and Line driver type for PM motor

Remark:

*1. PM sensorless control mode require specific software, this will be available on 2012 Q2. Please contact TECO for further information.

*2. Speed control accuracy will be influenced when the motor and installation condition are different.

*3. The maximum output frequency of each control modes is different, please read user manual for more details.

DIMENSIONS

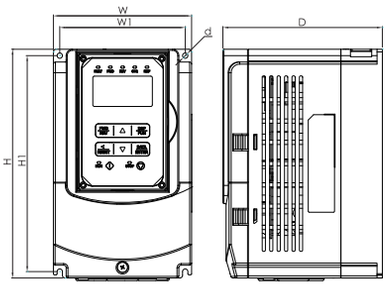


Figure A

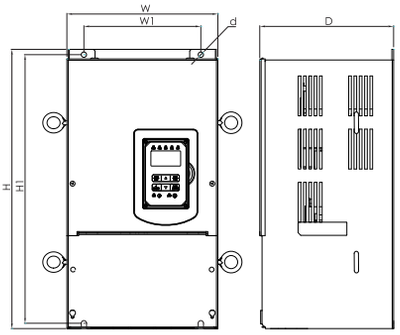


Figure B

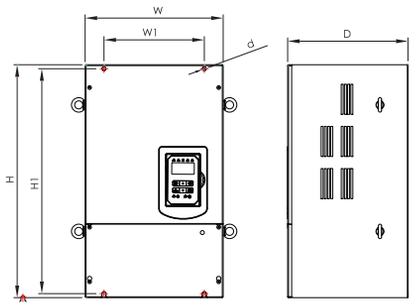


Figure C

Models	Dimensions (mm)										
	W	H	D	W1	H1	t	d	Weight (kg)	Frame	Figure	Enclosure
A510-2001-H	130	215	150	118	203	5	M5	2.2	1	A	IP20/NEMA1
A510-2002-H											
A510-4001-H3											
A510-4002-H3											
A510-4003-H3											
A510-2003-H	140	279	177	122	267	7	M5	3.8	2		
A510-2005-H3											
A510-4005-H3											
A510-4008-H3											
A510-2008-H3	210	300	215	192	286	1.6	M6	6.2	3		
A510-2010-H3											
A510-4010-H3											
A510-4015-H3											
A510-2015-H3	265	360	225	245	340	1.6	M6	10	4		
A510-2020-H3											
A510-2025-H3											
A510-4020-H3											
A510-4025-H3											
A510-4030-H3											
A510-2030-H3	284	525	252	220	505	1.6	M8	30	5	B	
A510-2040-H3											
A510-4040-H3											
A510-4050-H3											
A510-4060-H3											
A510-2050-H3	344	580	300	250	560	1.6	M8	40.5	6	C	IP00[*1]
A510-2060-H3											
A510-4075-H3											
A510-4100-H3											
A510-2075-H3	459	790	324.5	320	760	1.6	M10	74	7		
A510-2100-H3											
A510-4125-H3											
A510-4150-H3											
A510-4175-H3											
A510-4215-H3											

*1. NEMA1 kit for option.

Distributor

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