

Preface

Thank you for choosing DELTA's high-performance VFD-F Series. The VFD-F Series is manufactured with high-quality components and materials and incorporates the latest microprocessor technology available.

Getting Started

This quick start will be helpful in the installation and parameter setting of the AC motor drives. To guarantee safe operation of the equipment, read the following safety guidelines before connecting power to the AC motor drives. For detail information, refer to the VFD-F User Manual on the CD supplied with the drive.

DANGER!

1. AC input power must be disconnected before any wiring to the AC motor drive is made.
2. A charge may still remain in the DC-link capacitors with hazardous voltages, even if the power has been turned off. To prevent personal injury, please ensure that power has turned off before opening the AC motor drive and wait ten minutes for the capacitors to discharge to safe voltage levels.
3. Never reassemble internal components or wiring.
4. The AC motor drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals. Never connect the AC motor drive output terminals U/T1, V/T2, and W/T3 directly to the AC mains circuit power supply.
5. Ground the VFD-F using the ground terminal. The grounding method must comply with the laws of the country where the AC motor drive is to be installed. Refer to the Basic Wiring Diagram.
6. VFD-F series is used only to control variable speed of 3-phase induction motors, NOT for 1-phase motors or other purpose.
7. VFD-F series shall NOT be used for life support equipment or any life safety situation.

WARNING!

1. DO NOT use Hi-pot test for internal components. The semi-conductor used in AC motor drive easily damage by high-pressure.
2. There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. To prevent damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.
3. Only quality person is allowed to install, wire and maintain AC motor drive.

CAUTION!

1. Some parameters settings can cause the motor to run immediately after applying power.
2. DO NOT install the AC motor drive in a place subjected to high temperature, direct sunlight, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.
3. Only use AC motor drives within specification. Failure to comply may result in fire, explosion or electric shock.
4. To prevent personal injury, please keep children and unqualified people away from the equipment.
5. When the motor cable between AC motor drive and motor is too long, the layer insulation of the motor may be damaged. Please use a frequency inverter duty motor or add an AC output reactor to prevent damage to the motor. Refer to appendix B Reactor for details.
6. The rated voltage for AC motor drive must be $\leq 240V$ ($\leq 480V$ for 460V models) and the mains supply current capacity must be $\leq 5000A$ RMS ($\leq 10000A$ RMS for the $\geq 40hp$ (30kW) models).

Specifications

Voltage Class		230V Class											
Model Number VFD-XXXF23X	007	015	022	037	055	075	110	150	185	220	300	370	
Max. Applicable Motor Output (kW)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	
Max. Applicable Motor Output (HP)	1.0	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50	
Output Rating	Rated Output Capacity (kVA)	1.9	2.5	4.2	6.5	9.5	12.5	18.3	24.7	28.6	34.3	45.7	55
	Rated Output Current (A)	5.0	7.0	11	17	25	33	49	65	75	90	120	145
	Maximum Output Voltage (V)	Proportional to Input Voltage											
	Rated Frequency (Hz)	0.10-120.00Hz											
Input Rating	Carrier Frequency (kHz)	4-10					3-9			2-6			
	Rated Input Current (A)	5.7	7.6	15.5	20.6	26	34	50	60	75	90	110	142
	Rated Voltage	3-phase 180-264 V											
	Frequency Tolerance	47 – 63 Hz											

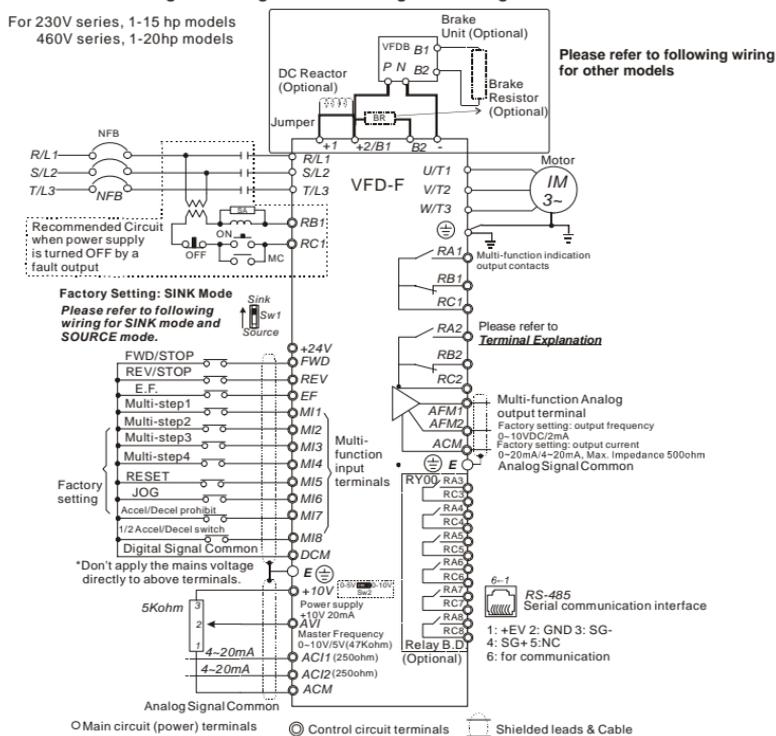
Voltage Class		460V Class																				
Model Number VFD-XXXF43X	007	015	022	037	055	075	110	150	185	220	300	370	450	550	750	900	1100	1320	1600	1850	2200	
Max. Applicable Motor Output (kW)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	
Max. Applicable Motor Output (hp)	1.0	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	215	250	300	
Output Rating	Rated Output Capacity (kVA)	2.3	3.2	4.2	6.5	10	14	18	25	29	34	46	56	69	84	114	137	168	198	236	281	350
	Rated Output Current (A)	2.7	4.2	5.5	8.5	13	18	24	32	38	45	60	73	91	110	150	180	220	260	310	370	460
	Maximum Output Voltage (V)	3-phase Proportional to Input Voltage																				
	Output Frequency (Hz)	0.10-120.00Hz																				
Input Rating	Carrier Frequency (kHz)	4-10					3-9					2-6										
	Rated Input Current (A)	3-phase																				
	Rated Voltage	3-phase 342-528 V																				
	Voltage Tolerance	-15→+10% (342-528 V)																				
Frequency Tolerance	± 5% (47-63Hz)																					

General Specification			
Control Characteristics	Control System	SPWM (Sinusoidal Pulse Width Modulation, carrier frequency 2-10kHz)	
	Output Frequency Resolution	0.01Hz	
	Torque Characteristics	Including the auto-torque, auto-slip compensation; starting torque can be 150% at 1.0Hz	
	Overload Endurance	120% of rated current for 1 minute	
Operating Characteristics	Accel/Decel Time	1-36000/0.1-3600.0/0.01-360.00 seconds (3 Independent settings for Accel/Decel Time)	
	V/f Pattern	Adjustable V/f pattern	
	Stall Prevention Level	20 to 150%, Setting of Rated Current	
	Frequency Setting	Keypad	Setting by  
		External Signal	1 set of AVI analog voltage DC0+10V/0+5V, 2 sets of ACI analog current 0/4-20mA, 15 Multi-Function Inputs, RS-485 interface (MODBUS), External terminals UP/DOWN Key
	Operation Setting Signal	Keypad	Set by RUN, STOP and JOG
		External Signal	Operation by FWD, REV, JOG and communication operation
	Multi-Function Input Signal	Multi-step selection 0 to 15, Jog, accel/decel inhibit, first to forth accel/decel switches, counter, external Base Block (NC, NO), JOG, auxiliary motor start/maintenance	
Multi-Function Output Indication	AC Drive Operating, Frequency Attained, Desired Frequency Attained, Zero speed, Base Block, Fault Indication, Local/Remote indication, and Auxiliary Motor Output		
Analog Output Signal	2 sets of Analog frequency/current signal output		

General Specification		
Other Functions	AVR, 2 kinds of S-Curve, Over-Voltage, Over-Current Stall Prevention, Fault Records, Reverse inhibition, DC Brake, Momentary Power Loss restart, Auto torque and slip compensation, PID Control, Parameter Lock/Reset, Frequency Limits, Adjustable Carrier Frequency, 4 sets of Fan & Pump Control,	
Protection	Self-testing, Over Voltage, Over Current, Under Voltage, Overload, Overheating, External Fault, Electronic thermal, Ground Fault, Phase-loss	
Built-in Reactor	DC Reactor: 25~215HP AC Reactor: 250~300HP	
Built-in Brake Chopper	1~20HP	
Cooling Methods	Forced Fan-cooled	
Environmental Conditions	Installation Location	
	Pollution Degree	Altitude 1,000 m or lower, keep from corrosive gasses, liquid and dust 2
	Ambient Temperature	-10°C to 40°C Non-Condensing and not frozen
	Storage/ Transportation Temperature	-20°C to 60°C
	Ambient Humidity	Below 90% RH (non-condensing)
Approvals	Vibration 9.80665m/s ² (1G) less than 20Hz, 5.88m/s ² (0.6G) at 20 to 50Hz CE E U	

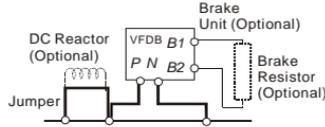
Basic Wiring Diagram

Users must connect wiring according to the following circuit diagram shown below.

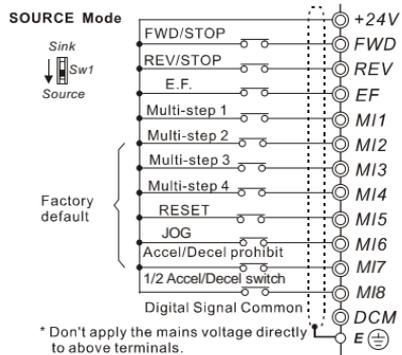
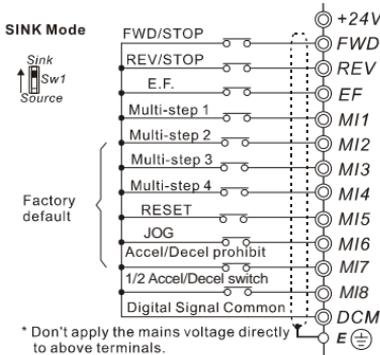


NOTE : Do not plug a Modem or telephone line to the RS-485 communication port, permanent damage may result. Pins 1 & 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

For 230V series, 20hp and above models
460V series, 25hp and above models

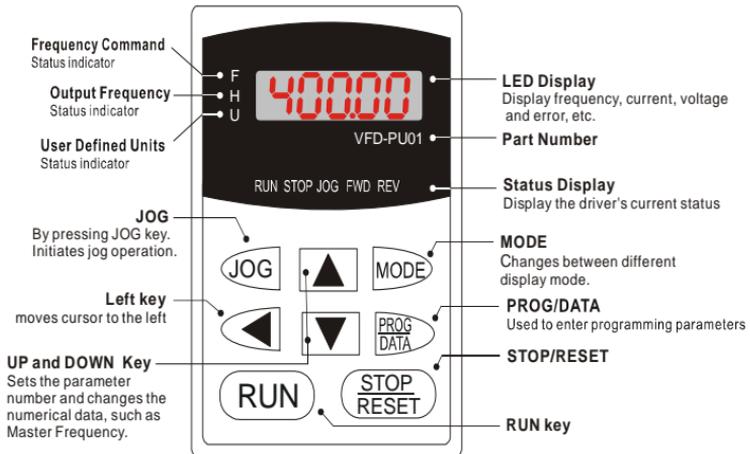


Wiring for SINK mode and SOURCE mode



VFD-PU01

① Description of the Digital Keypad VFD-PU01



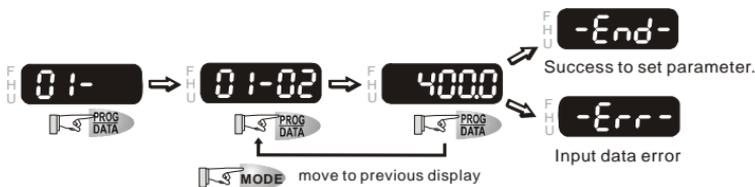
② Operation steps of the Digital Keypad VFD-PU01

Selecting mode



Note : In the selection mode, press to set the parameters.

Setting parameters



NOTE :In the parameter setting mode, you can press to return the selecting mode.

To shift data



To modify data

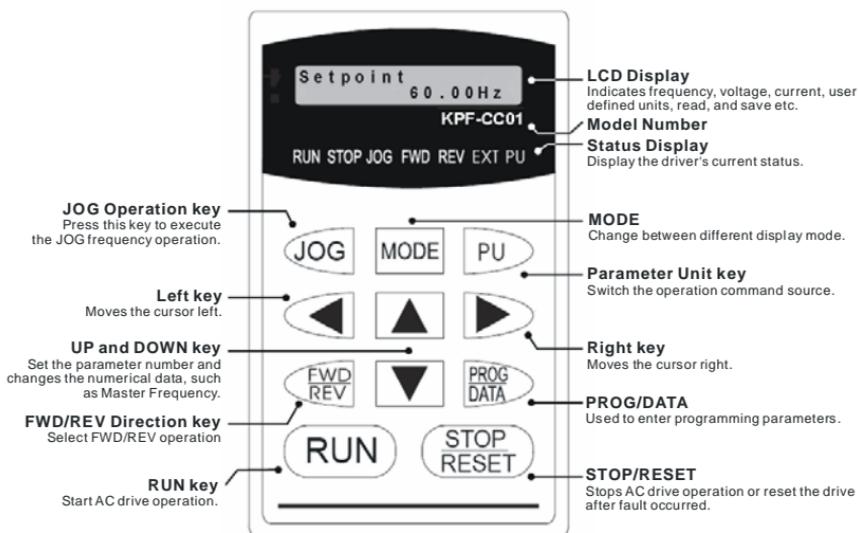


Setting direction



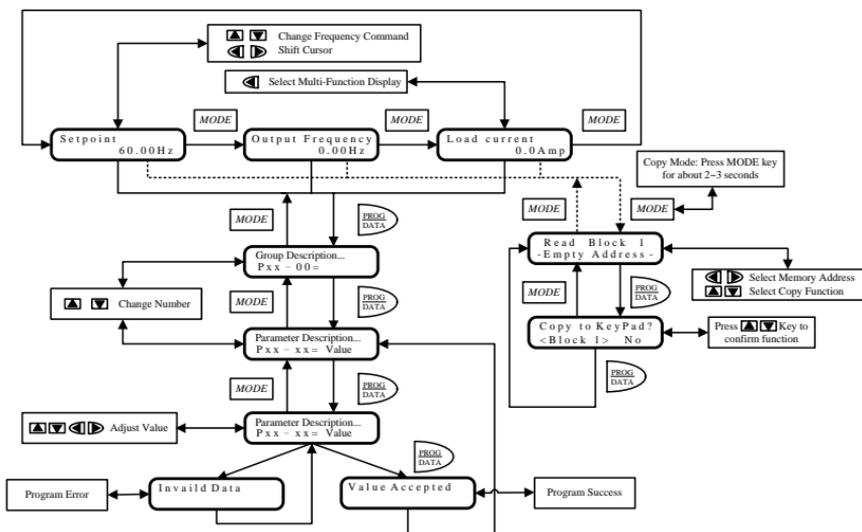
KPF-CC01

① Description of the Digital Keypad KPF-CC01



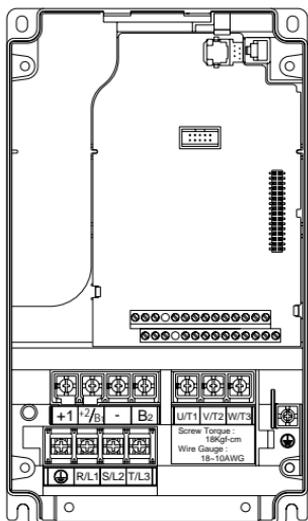
② KPF-CC01 Operation Flow Chart

KPF-CC01 Operation Flow Chart



Power Terminals and Control Terminal

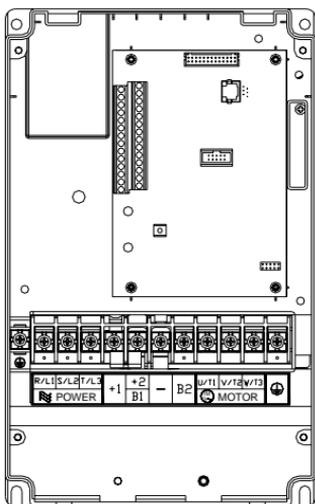
1HP to 5HP (VFD007F23A/43A, VFD015F23A/43A, VFD022F23A/43A, VFD037F23A/43A)



Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 18 kgf-cm (15.6 in-lbf)
Wire Gauge: 10-18 AWG
Wire Type: Stranded copper only, 75° C

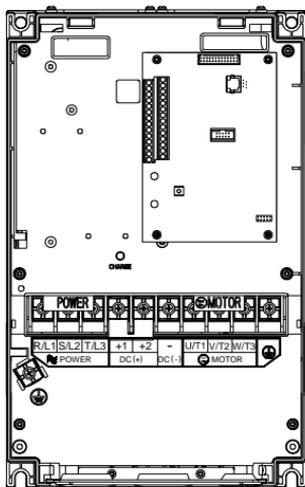
7.5 HP to 20 HP (VFD055F23A/43B, VFD075F23A/43B, VFD110F23A/43A, VFD150F43A)



Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 30Kgf-cm (26 in-lbf)
Wire: 12-8 AWG
Wire Type: Stranded copper only, 75° C
NOTE: If wiring of the terminal utilizes the wire with a 6AWG-diameter, it is thus necessary to use the Recognized Ring Terminal to conduct a proper wiring.

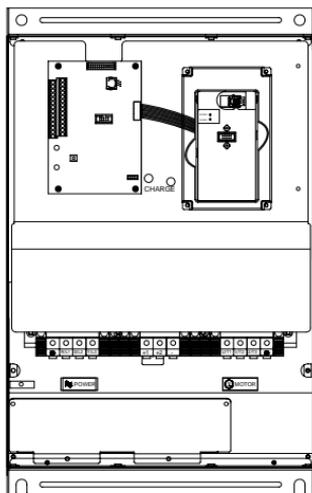
20 HP to 40 HP (VFD150F23A, VFD185F23A/43A, VFD220F23A/43A, VFD300F43A)



Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 30Kgf-cm (26 in-lbf)
Wire: 8-2 AWG
Wire Type: Stranded copper only, 75° C
NOTE: If wiring of the terminal utilizes the wire with a 1AWG-diameter, it is thus necessary to use the Recognized Ring Terminal to conduct a proper wiring.

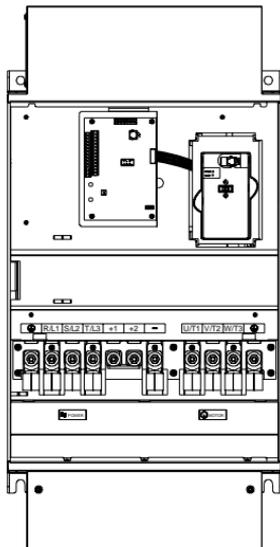
50 HP to 60 HP (VFD370F43A, VFD450F43A)



Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 57kgf-cm (49.5 in-lbf) min.
Wire Gauge: VFD370F43A: 3AWG
VFD450F43A: 2AWG
Wire Type: Stranded copper only, 75° C

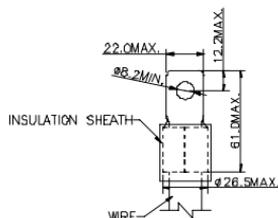
150HP (VFD1100F43A)



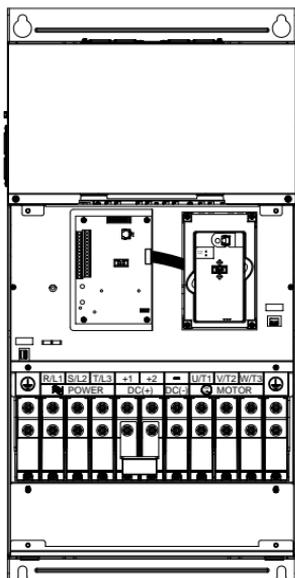
Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 80kgf-cm (69 in-lbf)
Wire Gauge: 300 MCM
Wire Type: Stranded copper only, 75°C

NOTE: It needs following additional terminal when wiring, and add insulation sheath on position where following figure shows.



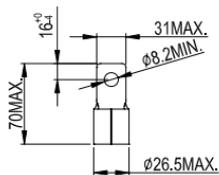
150 HP to 215 HP (VFD1100F43C, VFD1320F43A, VFD1600F43A)



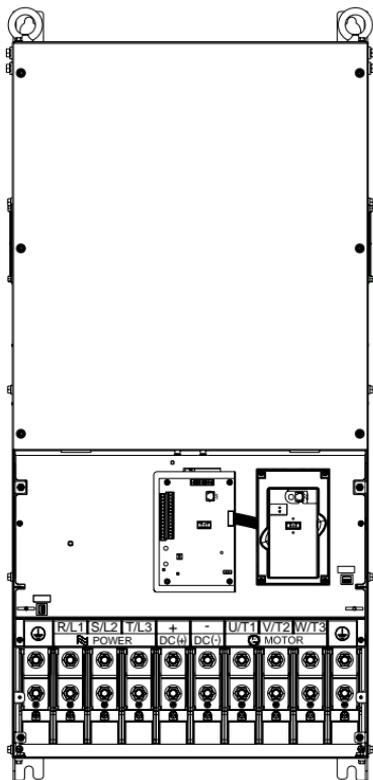
Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 300kgf-cm (260 in-lbf)
Wire Gauge: 1/0 AWG*2-300 MCM*2
Wire Type: Stranded copper only, 75°C

NOTE: It needs following additional terminal when wiring. The additional terminal dimension should comply with the following figure.



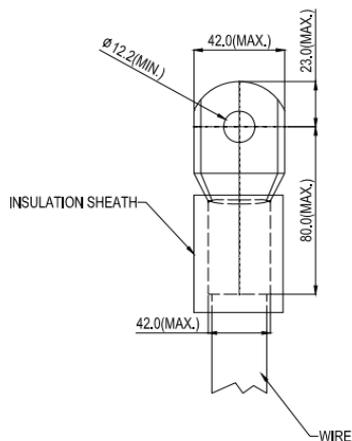
250 HP to 300 HP
(VFD1850F43A, VFD2200F43A)



Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG

Power Terminal
Torque: 408kgf-cm (354 in-lbf)
Wire Gauge: 500 MCM (max)
Wire Type: Stranded copper only, 75°C

NOTE: It needs following additional terminal when wiring, and add insulation sheath on position where following figure shows.



Terminal Explanations

Terminal Symbol	Explanation of Terminal Function
R/L1, S/L2, T/L3	AC line input terminals
U/T1, V/T2, W/T3	AC drive output terminals motor connections
+1,+2	Connections for DC Link Reactor (optional)
+2/B1~B2	Connections for Brake Resistor (optional)
+2~ -,+2/B1~ -	Connections for External Brake Unit (VFDB series)
\oplus	Earth Ground

Control Terminals Explanations

Terminal Symbols	Terminal Functions	Factory Settings
FWD	Forward-Stop command	
REV	Reverse-Stop command	
EF	External fault	
MI1	Multi-function Input 1	Factory default: Multi-step speed command 1
MI2	Multi-function Input 2	Factory default: Multi-step speed command 2
MI3	Multi-function Input 3	Factory default: Multi-step speed command 3
MI4	Multi-function Input 4	Factory default: Multi-step speed command 4
MI5	Multi-function Input 5	Factory default: RESET
MI6	Multi-function Input 6	Factory default: JOG
MI7	Multi-function Input 7	Factory default: Accel/Decel prohibit
MI8	Multi-function Input 8	Factory default: Accel/Decel time switch 1
+24V	DC Voltage Source	(+24V, 20mA), used for source mode.
DCM	Digital Signal Common	Used as common for digital inputs and used for sink mode.
RA 1	Multi-function Relay1 output (N.O.) a	1.5A(N.O.)/1A(N.C.) 240VAC 1.5A(N.O.)/1A(N.C.) 24VDC Refer to Pr.03-00 to Pr.03-01
RB 1	Multi-function Relay1 output (N.C.) b	
RC 1	Multi-function Relay1 common	
RA 2	Multi-function Relay2 output (N.O.) a	
RB 2	Multi-function Relay2 output (N.C.) b	
RC 2	Multi-function Relay2 common	
+10V	Potentiometer power source	+10V 20mA
AVI	Analog voltage Input	0 to +10V correspond to Max. operation frequency
ACI 1/2	Analog current Input	4 to 20mA correspond to Max. operation frequency
AFM 1	Analog frequency /current meter 1	0 to 10V correspond to Max. operation frequency
AFM 2	Analog frequency /current meter 2	4 to 20mA correspond to 2 times of output current
ACM	Analog control signal (common)	

* Control signal wiring size: 18 AWG (0.75 mm²).

SUMMARY OF PARAMETER SETTINGS

✎: The parameter can be set during operation

Group 0 AC Drive Status Parameter

Parameter	Functions	Settings	Factory Setting	Customer
00-00	Software Version	Read only		
00-01	AC Drive Status Indication 1	00: No Fault occurred 01: oc (over current) 02: ov (over voltage) 03: oH (over temperature) 04: oL (overload) 05: oL1 (electronic thermal relay) 06: EF (external Fault) 07: occ (AC drive IGBT fault) 08: cF3 (CPU failure) 09: HPPF (Hardware Protection Failure) 10: ocA (current exceed during Acceleration) 11: ocd (current exceed during Deceleration) 12: ocn (current exceed during Steady State) 13: GFF (Ground Fault) 14: Lv (Low voltage) 15: cF1 (input data abnormal) 16: cF2 (output data abnormal) 17: bb (Base Block) 18: oL2 (over load2) 19: Reserved 20: codE (software or password protection) 21: EF1 (external Emergency Stop) 22: PHL (phase loss) 23: Lc (Low Current) 24: Fbl (Feedback Loss) 25: Reserved 26: FAnP (Fan Power Fault) 27: FF1 (Fan 1 fault) 28: FF2 (Fan 2 fault) 29: FF3 (Fan 3 fault) 30: FF123 (Fan 1, 2, 3 fault) 31: FF12 (Fan 1, 2 fault) 32: FF13 (Fan 1, 3 fault) 33: FF23 (Fan 2, 3 fault) 34: Fv (Gate Drive Low Voltage Protect)	Read	
00-02	AC Drive Status Indication 2	Bit 0~1: 00: Run led is off and stop led is on. 01: Run led is blink and stop led is on. 10: Run led is on and stop led is blink. 11: Run led is on and stop led is off. Bit 2: 1: Jog on. Bit 3~4: 00: Rev led is off and FWD led is on. 01: Rev led is blink and FWD led is on. 10: Rev led is on and FWD led is blink. 11: Rev led is on and FWD led is off. Bit 5-7: Reserved Bit 8: Master frequency source via communication interface	Read	

Parameter	Functions	Settings	Factory Setting	Customer
		Bit 9: Master frequency source via analog Bit10: Running command via communication interface Bit11: Parameter locked Bit12~15: Reserved		
00-03	Frequency Setting	Read only	Read	
00-04	Output Frequency	Read only	Read	
00-05	Output Current	Read only	Read	
00-06	DC-BUS Voltage	Read only	Read	
00-07	Output Voltage	Read only	Read	
00-08	Output Power Factor	Read only	Read	
00-09	Output Power (kW)	Read only	Read	
00-10	Feedback Signal Actual Value	Read only	Read	
00-11	Feedback Signal (%)	Read only	Read	
00-12	User Target Value (Low bit) uL 0-99.99	Read only	Read	
00-13	User Target Value (High bit) uH 0-9999	Read only	Read	
00-14	PLC time	Read only	Read	

Group 1 Basic Parameter (Twice the value for 460V class)

Parameter	Functions	Settings	Factory Setting	Customer
01-00	Maximum Output Frequency	50.00~120.00Hz	60.00	
01-01	Maximum Voltage Frequency (Base Frequency)	0.10~120.00 Hz	60.00	
01-02	Maximum Output Voltage	230V series: 0.1~255.0V 460V series: 0.2~510.0V	220.0 440.0	
01-03	Mid-point Frequency	0.10~120 Hz	1.50	
01-04	Mid-point Voltage	230V series: 0.1~255.0V 460V series: 0.2~510.0V	5.5 11.0	
01-05	Minimum Output Frequency	0.10~20.00 Hz	1.50	
01-06	Minimum Output Voltage	230V series: 0.1~50.0V 460V series: 0.2V~100.0V	5.5 11.0	
01-07	Upper Bound Frequency	0.00~120.00 Hz	60.00	
01-08	Lower Bound Frequency	0.00~120.00 Hz	0.00	
∕01-09	Acceleration Time 1	0.1~3600.0 Sec	10.0/ 60.0	
∕01-10	Deceleration Time 1	0.1~3600.0 Sec	10.0/ 60.0	
∕01-11	Acceleration Time 2	0.1~3600.0 Sec	10.0/ 60.0	
∕01-12	Deceleration Time 2	0.1~3600.0 Sec	10.0/ 60.0	
∕01-13	Acceleration Time 3	0.1~3600.0 Sec	10.0/ 60.0	

Parameter	Functions	Settings	Factory Setting	Customer
↗01-14	Deceleration Time 3	0.1~3600.0 Sec	10.0/ 60.0	
↗01-15	Acceleration Time 4	0.1~3600.0 Sec	10.0/ 60.0	
↗01-16	Deceleration Time 4	0.1~3600.0 Sec	10.0/ 60.0	
↗01-17	JOG Acceleration Time	0.1~3600.0 Sec	10.0/ 60.0	
↗01-18	JOG Deceleration Time	0.1~3600.0 Sec	10.0/ 60.0	
↗01-19	JOG frequency	0.0 Hz~120.00 Hz	6.00	
01-20	S Curve Delay Time in Accel	0.00~2.50sec	0.00	
01-21	S Curve Delay Time in Decel	0.00~2.50sec	0.00	
↗01-22	Modulation Index	0.90~1.20	1.00	
01-23	Accel/Decel Time Unit	00: Unit is 1 Sec 01: Unit is 0.1 Sec 02: Unit is 0.01 Sec	01	

Group 2 Digital Output/Input Parameter

Parameter	Functions	Settings	Factory Setting	Customer
↗02-00	Source of Frequency Command	00: via keypad 01: via analog input AVI 02: via analog input ACI1 03: via analog input ACI2 04: via RS485 serial communication 05: via External Reference	00	
↗02-01	Source of Operation Command	00: Controlled by the digital keypad 01: Controlled by the external terminals, keypad STOP enabled. 02: Controlled by external terminals, keypad STOP disabled. 03: Controlled by the RS-485 communication interface, keypad STOP enabled. 04: Controlled by the RS-485 communication interface, keypad STOP disabled.	00	
02-02	Stop Method	00: Stop = ramp to stop, E.F. (External Fault) = coast to stop 01: Stop = coast to stop, E.F. = coast to stop 02: Stop = ramp to stop, E.F. = ramp to stop 03: Stop = coast to stop, E.F. = ramp to stop	00	
↗02-03	PWM Carrier Frequency Selections	1~10HP: 4000~10000Hz 15~30HP: 3000~9000Hz ≥ 40HP: 2000~6000Hz	9000Hz 6000Hz 4000Hz	

Parameter	Functions	Settings	Factory Setting	Customer
02-04	Forward/Reverse Enable	00: Forward enabled 01: Reverse disabled 02: Forward disabled	00	
02-05	2-wire/3-wire Operation Control Modes	00: 2-wire (#1), FWD/STOP, REV/STOP 01: 2-wire (#2), RUN/STOP, REV/FWD 02: 3-wire	00	
02-06	Line Start Lockout	00: Disabled 01: Enabled	01	
02-07	Loss of ACI Signal	00: Decelerate to 0Hz 01: E.F. 02: Continue operation by the last frequency command	01	
∕02-08	Start-up Display Selection	Bit0-1: 00 = F LED 01 = H LED 10 = U LED (special display) 11 = Fwd / Rev Bit2: 0 = Fwd LED / 1 = Rev LED Bit3-5: 000 = 1st 7-step 001 = 2nd 7-step 010 = 3rd 7-step 011 = 4th 7-step 100 = 5th 7-step Bit6-7: Reserved	00	
∕02-09	Special Display	00: A displays output current of AC drive 01: U displays DC-Bus voltage of AC drive 02: E displays RMS of output voltage 03: P displays feedback Signal 04: PLC display auto procedure state	00	
∕02-10	User Defined Coefficient	0.01-160.00	1.00	
∕02-11	Flying Start	00: Disable 01: Enable (Dc brake disabled)	00	
∕02-12	Flying Start Frequency	00: Trace from master frequency command 01: Trace from maximum setting frequency 01-00	00	
∕02-13	Master Frequency Memory Setting	00: Do not remember the last known frequency 01: Remember the last known frequency	01	

Group 3 Output Function Parameters

Parameter	Functions	Settings	Factory Setting	Customer
03-00	Multi-function Output terminal 1	00: No function 01: Motor No.1	00	
03-01	Multi-function Output terminal 2	02: Motor No.2 03: Motor No.3	00	
03-02	Multi-function Output terminal 3	04: Motor No.4 05: Motor No.5	00	
03-03	Multi-function Output terminal 4	06: Motor No.6 07: Motor No.7	00	
03-04	Multi-function Output terminal 5	08: Motor No.8 09: Auxiliary 1 output	00	

Parameter	Functions	Settings	Factory Setting	Customer
03-05	Multi-function Output terminal 6	10: Auxiliary 2 output 11: Auxiliary 3 output	00	
03-06	Multi-function Output terminal 7	12: Auxiliary 4 output 13: Auxiliary 5 output	00	
03-07	Multi-function Output terminal 8	14: Auxiliary 6 output 15: Auxiliary 7 output 16: Indication during operation 17: Master frequency attained 18: Zero Speed (including shutdown) 19: Over-torque 20: External Fault 21: Low voltage detection 22: Operation Mode indication 23: Fault indication 24: Master Frequency Attained 1 25: Master Frequency Attained 2 26: Over Temperature indication 27: Drive Ready 28: External Emergency Stop (EF1) 29: Software Brake Output 30: OL or OL1 Overload Warning 31: Dwell Indication (sleep) 32: Low Current Indication 33: PID Feedback Error Indication 34: PLC Program Running 35: PLC Program Step Completed 36: PLC Program Completed 37: PLC Program Operation Paused	00	
03-08	Master Frequency Attained 1	0.00~120.00 Hz	0.00	
03-09	Master Frequency Attained 2	0.00~120.00 Hz	0.00	
03-10	Analog Output 1, (AFM1) 0~10Vdc	00: Output frequency 01: Output current	00	
03-11	Analog Output 2, (AFM2) 0/4~ 20mA	02: Output voltage 03: Frequency command 04: Power factor loading	01	
∕03-12	Analog Output Gain 1	01~200%	100	
∕03-13	Analog Output Gain 2	01~200%	100	
03-14	Analog Output 2 Selection (AFM2 Definition)	00: 0~20mA 01: 4~20mA	01	
03-15	DC Fan Control	00: Fan runs on power up. 01: Fan begins upon a RUN command. Fan stops 1 minute after a STOP command. 02: Fan begins upon a RUN command. Fan stops after a STOP command 03: Fan is controlled by temperature. Approximately a 60°C temperature will start the fan.	00	

Group 4 Input Function Parameters

Parameter	Functions	Settings	Factory Setting	Customer
04-00	Multi-function Input terminal 1	00: No function	01	
04-01	Multi-function Input terminal 2	01: Multi-Speed terminal 1 02: Multi-Speed terminal 2 03: Multi-Speed terminal 3	02	
04-02	Multi-function Input terminal 3	04: Multi-Speed terminal 4 05: Reset (NO)	03	
04-03	Multi-function Input terminal 4	06: Reset (NC) 07: Jog operation (JOG)	04	
04-04	Multi-function Input terminal 5	08: Accel/Decel disable 09: Accel/Decel 2 selection	05	
04-05	Multi-function Input terminal 6	10: Accel/Decel 3 selection 11: B.B. (NO) input	07	
04-06	Multi-function Input terminal 7	12: B.B. (NC) input 13: Increase Frequency	08	
04-07	Multi-function Input terminal 8	14: Decrease Frequency 15: Emergency stop (NO) 16: Emergency stop (NC) 17: AVI (open), AC1 (close) 18: KEYPAD (open), EXT (close) 19: PID disable 20: Auxiliary 1 input 21: Auxiliary 2 input 22: Auxiliary 3 input 23: Auxiliary 4 input 24: Auxiliary 5 input 25: Auxiliary 6 input 26: Auxiliary 7 input 27: Motor No.1 output disable 28: Motor No.2 output disable 29: Motor No.3 output disable 30: Motor No.4 output disable 31: All motor output disable 32: Run PLC Program 33: Pause PLC Program	09	
04-08	Digital Input Terminal Response Time	01~20	01	
04-09	AVI Minimum voltage	0.0~10.0V	0.0	
04-10	AVI Maximum voltage	0.0~10.0V	10.0	
04-11	AVI Minimum frequency (percentage of Pr.1-00)	0.00~100.00%	0.00	
04-12	AVI Maximum frequency (percentage of Pr.1-00)	0.00~100.00%	100.00	
04-13	AC11 Minimum current	0.0~20.0mA	4.0	
04-14	AC11 Maximum current	0.0~20.0mA	20.0	
04-15	AC11 Minimum frequency (percentage of Pr.1-00)	0.0~100.0%	0.00	
04-16	AC11 Maximum frequency (percentage of Pr.1-00)	0.0~100.0%	100.00	
04-17	AC12 Minimum current	0.0~20.0mA	4.0	
04-18	AC12 Maximum current	0.0~20.0mA	20.0	

Parameter	Functions	Settings	Factory Setting	Customer
04-19	ACI2 Minimum frequency (percentage of Pr.1-00)	0.00~100.00%	0.00	
04-20	ACI2 Maximum frequency (percentage of Pr.1-00)	0.00~100.00%	100.00	
04-21	Analog Input Delay AVI	0.00~10.00 Sec	0.50	
04-22	Analog Input Delay ACI1	0.00~10.00 Sec	0.50	
04-23	Analog Input Delay ACI2	0.00~10.00 Sec	0.50	
04-24	Summation of External Frequency Sources	00: No functions 01: AVI+ACI1 02: ACI1+ACI2 03: ACI2+AVI 04: Communication master frequency +AVI 05: Communication master frequency +ACI1 06: Communication master frequency +ACI2	00	

Group 5 Multi-step Speed Frequency Parameters

Parameter	Functions	Settings	Factory Setting	Customer
↗05-00	1 st Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-01	2 nd Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-02	3 rd Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-03	4 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-04	5 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-05	6 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-06	7 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-07	8 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-08	9 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-09	10 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-10	11 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-11	12 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-12	13 th Step Speed Frequency	0.00~120.00 Hz	0.00	
↗05-13	14 th Step Speed Frequency	0.00~120.00 Hz	0.00	

Parameter	Functions	Settings	Factory Setting	Customer
05-14	15 th Step Speed Frequency	0.00~120.00 Hz	0.00	
05-15	PLC Mode	00: Disable PLC Operation 01: Execute one program cycle 02: Continuously execute program cycles 03: Execute one program cycle step by step 04: Continuously execute program cycles step by step	00	
05-16	PLC Forward/ Reverse Motion	00 to 32767 (00: FWD 01: REV)	00	
05-17	Time Duration Step 1	0.0 to 65500 sec	0.0	
05-18	Time Duration Step 2	0.0 to 65500 sec	0.0	
05-19	Time Duration Step 3	0.0 to 65500 sec	0.0	
05-20	Time Duration Step 4	0.0 to 65500 sec	0.0	
05-21	Time Duration Step 5	0.0 to 65500 sec	0.0	
05-22	Time Duration Step 6	0.0 to 65500 sec	0.0	
05-23	Time Duration Step 7	0.0 to 65500 sec	0.0	
05-24	Time Duration Step 8	0.0 to 65500 Sec	0.0	
05-25	Time Duration Step 9	0.0 to 65500 Sec	0.0	
05-26	Time Duration Step 10	0.0 to 65500 Sec	0.0	
05-27	Time Duration Step 11	0.0 to 65500 Sec	0.0	
05-28	Time Duration Step 12	0.0 to 65500 Sec	0.0	
05-29	Time Duration Step 13	0.0 to 65500 Sec	0.0	
05-30	Time Duration Step 14	0.0 to 65500 Sec	0.0	
05-31	Time Duration Step 15	0.0 to 65500 Sec	0.0	
05-32	Time Unit Settings	00: 1 Sec 01: 0.1 Sec	00	

Group 6 Protection Function Parameters (Twice the value for 460V class)

Parameter	Functions	Settings	Factory Setting	Customer
06-00	Over-voltage Stall Prevention	230V: 330.0~410.0VDC 460V: 660.0~820.0VDC 00: Disable	390.0 780.0	
06-01	Over-current Stall Prevention during Acceleration	20~150% 00: Disable	120	
06-02	Over-current Stall Prevention during operation	20~150% 00: Disable	120	

Parameter	Functions	Settings	Factory Setting	Customer
06-03	Over-torque Detection Selection	00: Over-torque detection disabled. 01: Over-torque detection enabled during constant speed operation (OL2), and operation continues. 02: Over-torque detection enabled during constant speed operation (OL2), and operation halted. 03: Over-torque detection enabled during operation (OL2), and operation continues. 04: Over-torque detection enabled during operation (OL2), and operation halted.	00	
06-04	Over-torque Detection Level	30~150%	110	
06-05	Over-torque Detection Time	0.1~60.0 Sec	0.1	
06-06	Electronic Thermal Relay Selection	00: Operate disabled. 01: Operate with a standard motor. 02: Operate with a special motor.	02	
06-07	Electronic Thermal Characteristic	30~600 Sec	60	
06-08	Low Current Detection Level	00~100% (00 disabled)	00	
06-09	Low Current Detection Time	0.1~ 3600.0 Sec	10.0	
06-10	Low Current Detection Treatment	00: Warn and Ramp to stop 01: Warn and Coast to stop 02: Warn and keep operating	01	
06-11	Present Fault Record	00: No Fault	00	
06-12	Second Most Recent Fault Record	01: Oc (over-current) 02: Ov (over-voltage)	00	
06-13	Third Most Recent Fault Record	03: OH (over temperature) 04: OL (over load)	00	
06-14	Fourth Recent Fault Record	05: oL1 (over load 1) 06: EF (external fault) 07: Occ (IGBT module is abnormal) 08: cF3 (driver's internal circuitry abnormal) 09: HPPF (hardware protection failure) 10: OcA (over-current during acceleration) 11: Ocd (over-current during deceleration) 12: Ocn (over-current during steady state operation) 13: GFF (Ground Fault) 14: Lv (Low voltage) 15: cF1 (EEPROM WRITE failure) 16: cF2 (EEPROM READ failure) 17: bb (Base block) 18: OL2 (over load2) 19: Reserved 20: Code (software/password protection) 21: EF1 (Emergency stop) 22: PHL (phase-loss)	00	

Parameter	Functions	Settings	Factory Setting	Customer
		23: Lc (Low Current) 24: Fbl (Feedback Loss) 25: Reserved 26: FAnP (Fan Power Fault) 27: FF1 (Fan 1 fault) 28: FF2 (Fan 2 fault) 29: FF3 (Fan 3 fault) 30: FF123 (Fan 1, 2, 3 fault) 31: FF12 (Fan 1, 2 fault) 32: FF13 (Fan 1, 3 fault) 33: FF23 (Fan 2, 3 fault) 34: Fv (Gate Drive Low Voltage Protect)		
06-15	Parameter Reset	00~65535 09: Reset parameters (50Hz, 220/380) 10: Reset parameters (60Hz, 220/440)	00	
06-16	Parameter Protection Password Input	00~65535	00	
06-17	Parameter Protection Password Setting	00~65535 00: No password protection	00	

Group 7 AC Drive and Motor Parameters

Parameter	Functions	Settings	Factory Setting	Customer
07-00	Identity Code of AC Drive	Display by model type	##	
07-01	Rated Current of AC Drive	Display by model type	##	
↗07-02	Full-load Current of Motor	30~120%	100%	
↗07-03	No-load Current of Motor	1~99%	30%	
↗07-04	Auto Slip Compensation Gain	0.0~3.0	0.0	
07-05	Rated Slip Frequency of Motor	0.00~20.00Hz	0.00	
↗07-06	Auto Torque Compensation Gain	0.0~10.0	0.0	
↗07-07	Torque Compensation Gain by Manually	0.0~10.0	0.0	
07-08	Calculate Total Running Time of the Motor (Min)	00 to 1439 Min	00	
07-09	Calculate Total Running Time of the Motor (Day)	00 to 65535 Day	00	

Group 8 Special Parameters (Twice the value for 460V class)

Parameter	Functions	Settings	Factory Setting	Customer
08-00	DC Brake Current Level	00~100%	00	
08-01	DC Brake Time during Start-up	0.0~60.0 Sec	0.0	

Parameter	Functions	Settings	Factory Setting	Customer
08-02	DC Brake Time during Stopping	0.00~60.00 Sec	0.0	
08-03	Start-point for DC Brake	0.00~120.00 Hz	0.00	
08-04	Momentary Power Loss Operation Selection	00: Disable 01: Trace from top downward 02: Trace from bottom upward	00	
08-05	Maximum Allowable Power Loss Time	0.1~5.0 Sec	2.0	
08-06	Speed Search Time	0.1~5.0 Sec	0.5	
08-07	Maximum Speed Search Current	30~150%	110	
08-08	BB speed search method	00: Trace from top downward 01: Trace from bottom upward	00	
08-09	Auto Restart Times after Fault	00~10	00	
08-10	Auto Restart Time after Fault	00 to 60000 sec	600	
08-11	Operation Frequency Inhibition 1 UP	0.00~120.00 Hz	0.00	
08-12	Operation Frequency Inhibition 1 DOWN	0.00~120.00 Hz	0.00	
08-13	Operation Frequency Inhibition 2 UP	0.00~120.00 Hz	0.00	
08-14	Operation Frequency Inhibition 2 DOWN	0.00~120.00 Hz	0.00	
08-15	Operation Frequency Inhibition 3 UP	0.00~120.00 Hz	0.00	
08-16	Operation Frequency Inhibition 3 DOWN	0.00~120.00 Hz	0.00	
08-17	Automatic Energy-saving	00: Energy-saving operation disabled 01: Energy-saving operation enabled	00	
08-18	Automatic Voltage Regulation (AVR)	00: AVR function enabled 01: AVR function disabled 02: AVR function disabled for deceleration	00	
↗08-19	Software Setting of the Brake Level (the action level of the brake resistor)	230V: 370~410VDC 460V: 740~820VDC 00:Disable	380.0 760.0	
↗08-20	Vibration Compensation Factor	00~1000	00	

Group 9 Communication Parameters

Parameter	Functions	Settings	Factory Setting	Customer
↗09-00	Communication Address	01-254 00:Disable	01	
↗09-01	Transmission Speed (Baud Rate)	00: Baud rate 4800 01: Baud rate 9600 02: Baud rate 19200 03: Baud rate 38400	01	

Parameter	Functions	Settings	Factory Setting	Customer
∕09-02	Transmission Fault Treatment	00: Warn and keep operating 01: Warn and RAMP to stop 02: Warn and COAST to stop 03: No warning and no display	03	
09-03	Over Time Detection during Transmission	00: Disable 01: Enable	00	
09-04	Communication Format	00: 7-bit for ASCII 01: 8-bit for ASCII 02: 8-bit for RTU	00	
09-05	Even/Odd Parity and Stopping Parity Setting	00: None parity + 2 stop bit 01: Even parity + 2 stop bit 02: Odd parity + 2 stop bit 03: None parity + 1 stop bit 04: Even parity + 1 stop bit 05: Odd parity + 1 stop bit	00	
∕09-06	Communication Operation Command 1	Bit0~1: 00: Disable 01: Stop 10: Start-up 11: JOG start-up Bit2~3: Reserved Bit4~5: 00: No function 01: FWD command 10: REV command 11: Change direction command Bit6~7: 00: 1 st step accel/decel speed 01: 2 nd step accel/decel speed 10: 3 rd step accel/decel speed 11: 4 th step accel/decel speed Bit8~11: 0000: Master speed 0001: 1st step speed 0010: 2nd step speed 0011: 3rd step speed 0100: 4th step speed 0101: 5th step speed 0110: 6th step speed 0111: 7th step speed 1000: 8th step speed 1001: 9th step speed 1010: 10th step speed 1011: 11th step speed 1100: 12th step speed 1101: 13th step speed 1110: 14th step speed 1111: 15th step speed Bit12: Select Bit6~11 function Bit13~15 Reserved	00	
∕09-07	Communication Frequency Setting	0~120.00Hz	60.00	
∕09-08	Communication Operation Command 2	Bit0: 1: EF ON Bit1: 1: Reset Bit2: 0: BB OFF, 1: BB ON Bit3~15: Reserved	00	

Group 10 PID Controls

Parameter	Functions	Settings	Factory Setting	Customer
10-00	Input Terminal for PID Feedback	00: No function 01: Input via AVI 02: Input via AC11 03: Input via AC12 04: Input via External Reference	00	
10-01	PID Control Detection Signal Reference	0.0-6550.0	1000.0	
10-02	PID Feedback Control Method	00: Negative feedback control 01: Positive feedback control	00	
10-03	Proportional Gain (P)	0.0~10.0	1.0	
10-04	Integral Time (I)	0.00~100.00 Sec	1.00	
10-05	Differential Time (D)	0.00~1.00 Sec	0.00	
10-06	Upper Bound for Integral Control	00~200%	100	
10-07	Primary Low Pass Filter Time	0.0~2.5 Sec	0.0	
10-08	PID Feedback Signal Range	0.0~6550.0	600.0	
10-09	PID Feedback Signal Fault Treatment Time	0.0~3600.0 Sec 0.0: Disable	0.0	
↗10-10	PID Feedback Signal Fault Treatment	00: Warn and RAMP stop 01: Warn and COAST stop 02: Warn and keep operating	01	
↗10-11	PID Minimum Output Frequency	0: By PID controller 1: By AC drive	01	

Group 11 Fan and Pump Control Parameters

Parameter	Functions	Settings	Factory Setting	Customer
11-00	V/f Curve Selection	00: Determined by group 01 01: 1.5 power curve 02: 1.7 power curve 03: 2 power curve 04: 3 power curve	00	
11-01	Circulative Control	00: No function 01: Time circulation (by time) 02: Fixed amount circulation (by PID) 03: Fixed amount control (an AC drive runs with 4 motors)	00	
11-02	Multiple Motors Control	01~04	01	
11-03	Time Circulation Time Setting	00~65500 Min	00	
11-04	Motor Switch Delay Time	0.0~3600.0 sec	1.0	
11-05	Motor Switch Delay Time during Fixed Amount Circulation	0.0~3600.0 sec	10.0	

Parameter	Functions	Settings	Factory Setting	Customer
11-06	Motor Switch Frequency during Fixed Amount Circulation	0.00 to 120.00 Hz	60.00	
11-07	Enter Sleep Process Time	0.0~3600.0sec 0.0: Sleep function disable	0.0	
11-08	Sleep Frequency of Sleep Process	0.00 to 11-09 (Wake up Frequency)	0.0	
11-09	Wake Up Frequency of Sleep Process	0.00 to 120.0Hz	0.0	
11-10	Treatment of Fixed Amount Circulation Malfunction	00: Turn off all motors 01: Turn off AC drive	00	
11-11	Stop Frequency of Auxiliary Motor	0.00~120.00Hz	0.00	

Fault Codes

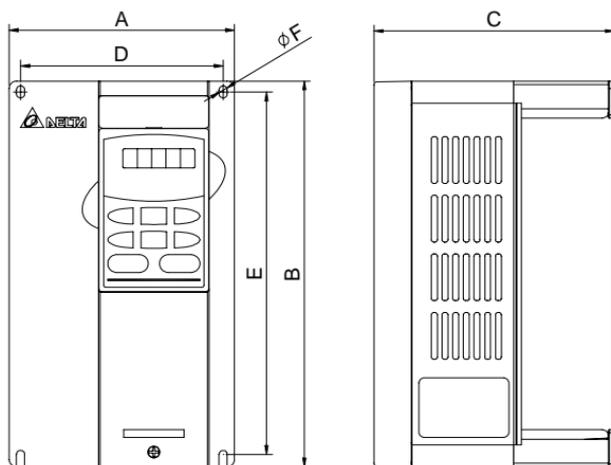
Fault Name	Fault Descriptions	Corrective Actions
codE	Software protection failure	Return to the factory.
HPF.1	GFF hardware error	Return to the factory.
HPF.2	CC (Current Clamp)	Return to the factory.
HPF.3	OC hardware error	Return to the factory.
HPF.4	OV hardware error	Return to the factory.
HPF.5	OH hardware error	Return to the factory.
oc	Over current Abnormal increase in current.	<ol style="list-style-type: none"> 1. Check whether the motors horsepower corresponds to the AC drive output power. 2. Check the wiring connections between the AC drive and motor for possible short circuits. 3. Increase the Acceleration time. 4. Check for possible excessive loading conditions at the motor. 5. If there are any abnormal conditions when operating the AC drive after short-circuit being removed, it should be sent back to manufacturer.
ov	Over voltage The DC bus voltage has exceeded its maximum allowable value.	<ol style="list-style-type: none"> 1. Check whether the input voltage falls within the rated AC drive input voltage. 2. Check for possible voltage transients. 3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional brake resistor. 4. Check whether the required brake power is within the specified limits.

Fault Name	Fault Descriptions	Corrective Actions
oH	Overheating Heat sink temperature too high	<ol style="list-style-type: none"> 1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects from the heatsinks and check for possible dirty heat sink fins. 4. Check the fan and clean it. 5. Provide enough spacing for adequate ventilation.
LU	Low voltage The AC motor drive detects that the DC bus voltage has fallen below its minimum value.	<ol style="list-style-type: none"> 1. Check whether the input voltage falls within the AC motor drive rated input voltage range. 2. Check whether the motor has sudden load. 3. Check for correct wiring of input power to R-S-T (for 3-phase models) without phase loss.
oL	Overload The AC motor drive detects excessive drive output current.	<ol style="list-style-type: none"> 1. Check whether the motor is overloaded. 2. Reduce torque compensation setting in Pr.7-02. 3. Take the next higher power AC motor drive model. <p>NOTE: The AC motor drive can withstand up to 150% of the rated current for a maximum of 60 seconds.</p>
oL1	Overload 1 Internal electronic overload trip	<ol style="list-style-type: none"> 1. Check for possible motor overload. 2. Check electronic thermal overload setting. 3. Use a higher power motor. 4. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current Pr.7-00.
oL2	Overload 2 Motor overload.	<ol style="list-style-type: none"> 1. Reduce the motor load. 2. Adjust the over-torque detection setting to an appropriate setting. (Pr. 06-03 to Pr. 06-05)
EF	External Fault	<ol style="list-style-type: none"> 1. Input EF (N.O.) on external terminal is closed to GND. Output U, V, W will be turned off. 2. Give RESET command after fault has been cleared.
CE--	Communication error	<ol style="list-style-type: none"> 1. Check the connection between the AC drive and computer for loose wires. 2. Check if the communication protocol is properly set.
ocR	Over-current during acceleration	<ol style="list-style-type: none"> 1. Short-circuit at motor output: Check for possible poor insulation at the output lines. 2. Torque boost too high: Decrease the torque compensation setting in Pr.7-02. 3. Acceleration Time too short: Increase the Acceleration Time. 4. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.
ocd	Over-current during deceleration	<ol style="list-style-type: none"> 1. Short-circuit at motor output: Check for possible poor insulation at the output line. 2. Deceleration Time too short: Increase the Deceleration Time. 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.

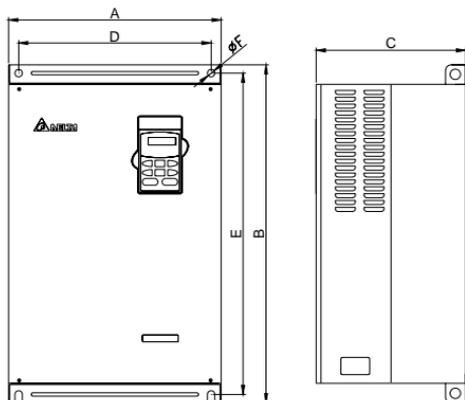
Fault Name	Fault Descriptions	Corrective Actions
OCN	Over-current during steady state operation	<ol style="list-style-type: none"> Short-circuit at motor output: Check for possible poor insulation at the output line. Sudden increase in motor loading: Check for possible motor stall. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.
EF1	Emergency stop	<ol style="list-style-type: none"> When the multi-function input terminals MI1 to MI6 are set to emergency stop, the AC motor drive stops output U, V, W and the motor coasts to stop. Press RESET after fault has been cleared.
cF1	Internal EEPROM can not be programmed.	<ol style="list-style-type: none"> Turn off the power. Check whether the input voltage falls within the rated AC drive input voltage. Turn on the power.
cF2	Internal EEPROM can not be read.	<ol style="list-style-type: none"> Check the connections between the main control board and the power board Reset the drive to the factory settings.
cF33	U-phase error	Return to the factory.
cF34	V-phase error	Return to the factory.
cF35	W-phase error	Return to the factory.
cF36	OV or LV	Return to the factory.
cF37	Isum error	Return to the factory.
cF38	OH error	Return to the factory.
bb	External Base Block.	<ol style="list-style-type: none"> When the external input terminal (B.B) is active, the AC motor drive output will be turned off. Deactivate the external input terminal (B.B) to operate the AC motor drive again.
cFA	Auto accel/decel failure	<ol style="list-style-type: none"> Check if the motor is suitable for operation by AC motor drive. Check if the regenerative energy is too large. Load may have changed suddenly.
GF	Ground fault	<p>When (one of) the output terminal(s) is grounded, short circuit current is more than 50% of AC motor drive rated current, the AC motor drive power module may be damaged.</p> <p>NOTE: The short circuit protection is provided for AC motor drive protection, not for protection of the user.</p> <ol style="list-style-type: none"> Check whether the IGBT power module is damaged. Check for possible poor insulation at the output line.
AnLEr PGErr	Analog feedback error or ACI open circuit	<ol style="list-style-type: none"> Check parameter settings and wiring of Analog feedback (Pr.10-00). Check for possible fault between system response time and the feedback signal detection time (Pr.10-08).
FRnP	Fan Power Fault (150~300HP)	Return to the factory.
FF1	Fan 1 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.

Fault Name	Fault Descriptions	Corrective Actions
FF2	Fan 2 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
FF3	Fan 3 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
FF 123	Fan 1, 2, 3 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
FF 12	Fan 1, 2 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
FF 13	Fan 1, 3 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
FF23	Fan 2, 3 fault (150~300HP)	Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
F _U	Gate drive low voltage protect	Return to the factory.

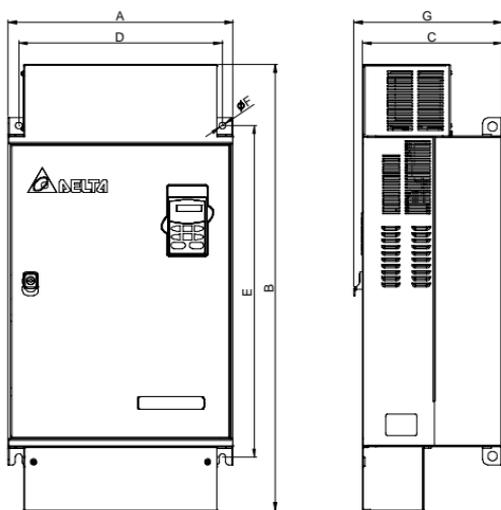
Dimensions are in mm [inch]



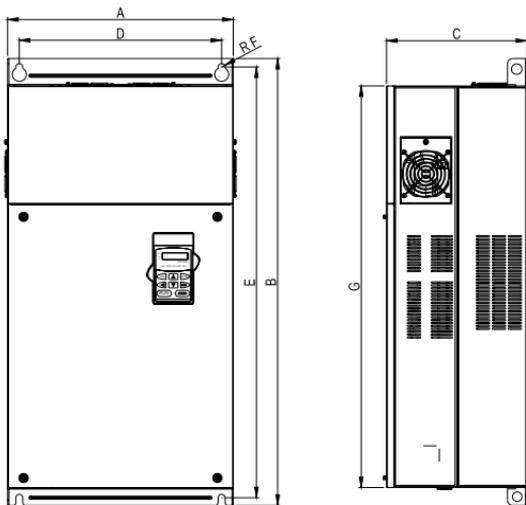
Model Name	A	B	C	D	E	F
007F23A/43A, 015F23A/43A, 022F23A/43A, 037F23A/43A	150.0 [5.91]	260.0 [10.24]	160.2 [6.31]	135.0 [5.32]	244.3 [9.63]	6.5 [0.26]
055F23A/43B, 075F23A/43B, 110F23A/43A, 150F43A	200.0 [7.88]	323.0 [12.72]	183.2 [7.22]	185.6 [7.31]	303.0 [11.93]	7.0 [0.28]
150F23A, 185F23A/43A, 220F23A/43A, 300F43A	250.0 [9.84]	403.8 [15.90]	205.4 [8.08]	226.0 [8.90]	384.0 [15.12]	10.0 [0.39]



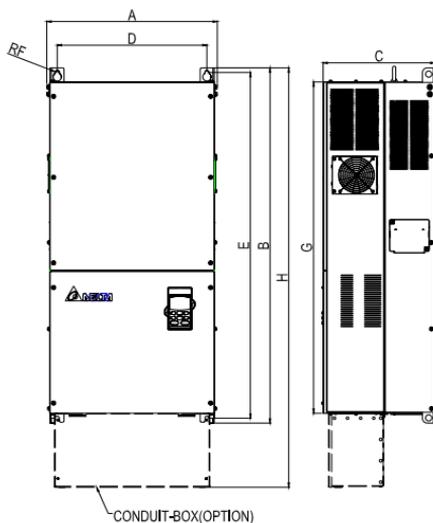
Model Name	A	B	C	D	E	F
370F43A, 450F43A, 550F43A	370.0 [14.57]	589.0 [23.19]	260.0 [10.24]	335.0 [13.19]	560.0 [22.05]	13.0 [0.51]
300F23A, 370F23A, 750F43A, 900F43C	370.0 [14.57]	595.0 [23.43]	260.0 [10.24]	335.0 [13.19]	560.0 [22.05]	13.0 [0.51]



Model Name	A	B	C	D	E	F	G
900F43A, 1100F43A	425.0 [16.73]	850.0 [33.46]	264.0 [10.39]	385.0 [15.16]	631.0 [24.84]	13.0 [0.51]	280.0 [11.02]



Model Name	A	B	C	D	E	F	G
1100F43C, 1320F43A, 1600F43A	425.0 [16.73]	850.0 [33.46]	264.0 [10.39]	381.0 [15.00]	819.5 [32.26]	6.5 [0.26]	764.0 [30.08]



Model Name	A	B	C	D	E	F	G	H
1850F43A, 2200F43A	547.0 [21.54]	1150.0 [45.28]	360.0 [14.17]	480.0 [18.90]	1119.0 [44.06]	6.5 [0.26]	1072.6 [42.23]	1357.6 [53.45]