

2023

MD500-PLUS

Quick Guide

IE2



Introduction

The MD500-PLUS series AC drive is a general-purpose high-performance vector control AC drive designed to control and regulate the speed and torque of three-phase AC asynchronous motors and permanent magnet synchronous motors. It

can be used to drive textile machines, paper machines, wire drawing machines, machine tools, packaging machines, food machines, fans, water pumps, and other automated production equipment.

This quick guide describes the safety features, wiring, commissioning and basic parameter Settings.

List of documentation for MD500-PLUS drive

Additionally to this quick guide, please refer to the following documentation.

Document name	Contents	Download link
MD500-PLUS Commissioning Guide_EN_A04_19011579	Describes the commissioning procedure of MD500-PLUS.	https://www.inovance.eu/fileadmin/downloads/Manuals/EN/MD500-PLUS/MD500-PLUS_Commissioning_Guide_EN_A04_19011579.pdf
MD500-PLUS Hardware Guide_EN_A00_19011577	Describes the hardware features of MD500-PLUS.	https://www.inovance.eu/fileadmin/downloads/Manuals/EN/MD500-PLUS/MD500-PLUS_Hardware_Guide_EN_A00_19011577.pdf
MD500-PLUS Installation Guide_EN_A05_19011582	Provides detailed information about the installation of MD500-PLUS.	https://www.inovance.eu/fileadmin/downloads/Manuals/EN/MD500-PLUS/MD500-PLUS_Installation_Guide_EN_A05_19011582.pdf
MD500-PLUS Quick Installation and Commissioning Guide_EN_A03_19011581	Provides a quick description of MD500-PLUS installation and commissioning procedures.	https://www.inovance.eu/fileadmin/downloads/Manuals/EN/MD500-PLUS/MD500-PLUS_Quick_Installation_and_Commissioning_Guide_EN_A04_19011581.PDF
MD500-PLUS Software Guide_EN_A03_19011580	Provides detailed description about MD500-PLUS parameters.	https://www.inovance.eu/fileadmin/downloads/Manuals/EN/MD500-PLUS/MD500-PLUS_Software_Guide_EN_A04_19011580.pdf
KB-MD500-0002_PID control with MD500-PLUS drive_EN_v1.0_202220304	Technical bulletin that describes the parameter settings of MD500-PLUS when using PID control for external process.	Please contact INOVANCE to receive this document.

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1. Fundamental Safety Instructions

1.1 Safety Precautions.

This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe personal injuries, or equipment damage. "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions. Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty. Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

1.2 Safety Levels and Definitions.



Indicates that failure to comply with the notice will result in death or severe personal injuries.



Indicates that failure to comply with the notice may result in death or severe personal injuries.



Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage

1.3 General Safety Instructions.

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.

Unpacking	
	• Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking. • Do not install the equipment if you find water seepage or missing or damaged components upon unpacking. • Do not install the equipment if you find the packing list does not conform to the equipment you received.
	• Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking. • Unpack the Package by following the unpacking sequence. Do not strike the package violently. • Check whether there is damage, rust, or injuries on the Surface of the equipment and equipment accessories before unpacking. • Check whether the Package contents are consistent with the packing list before unpacking.
Storage and Transportation	
	• Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage. • Before hoisting the equipment, ensure the equipment components such as the front cover and terminals block are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.

- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.



- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation



- The equipment must be operated only by professionals with electrical knowledge.



- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electrical shock.
- When installing the equipment in a closed environment (such as cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.



- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal shavings, oil and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.



- Do not connect the input power supply to the output of the equipment. Failure to comply will result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and the motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at both ends.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.



- During wiring follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on



- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.



- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation



- The equipment must be operated only by professionals. Failure to comply will result in death or personal injuries.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.



- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance



- Equipment installation, wiring maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.
- Before maintenance, cut off all power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.



- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power ON. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.



- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace the quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal	
 WARNING	- Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. - Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

1.4 Safety Labels.

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions of the safety labels.

Safety Signs		Description
T1 to T12 models		- Read through the safety instructions before operating the equipment. Failure to comply may result in equipment damage, personal injuries, or even death. - Do not touch terminals or remove the cover while the power is on or within 10 minutes after the power is turned off. Failure to comply may result in an electric shock.
T13 models		- Read through the safety instructions before operating the equipment. Failure to comply may result in equipment damage, personal injuries, or even death. - Do not touch terminals or remove the cover while the power is on or within 15 minutes after the power is turned off. Failure to comply may result in an electric shock.

2. Environment.

When installing MD500-PLUS drive please observe the environmental conditions described in table 1 below, for a long life and safe operation.

Table 1. Environmental conditions in the installation location of MD500-PLUS drive.

Installation location	Indoors
Grid overvoltage	Overvoltage Class III (OVC III)
Temperature	Installation/Operation: -10°C to $+50^{\circ}\text{C}$ (-10°C to $+40^{\circ}\text{C}$: no derating; above $+40^{\circ}\text{C}$: derate 1.5% for every additional 1°C) Storage/Transportation: -20°C to $+60^{\circ}\text{C}$
Humidity	Below 95% RH, non-condensing
Environment	Pollution degree: 2 or below
Altitude	≤ 1000 m: No de-rating Above 1000 m: Derate 1% for every additional 100 m Above 2000 m (0.4 - 3 kW models): consult INOVANCE Above 3000 m (3.7 kW and above models): consult INOVANCE

3. Product model list, frames and dimensions.

The following table below lists the MD500-PLUS drive models and frames.

Table 2. MD500-PLUS drive models and frames.

Frame	Three Phase 380–480 V models	Three Phase 200–240 V models	Single Phase 200–240 V models
T1	MD500T0.4G/0.7PB-PLUS MD500T0.7G/1.1PB-PLUS MD500T1.1G/1.5PB-PLUS MD500T1.5G/2.2PB-PLUS MD500T2.2G/3.0PB-PLUS MD500T3.0G/3.7PB-PLUS	MD500-2T0.4G/0.7PB-PLUS MD500-2T0.7G/1.1PB-PLUS MD500-2T1.1G/1.5PB-PLUS MD500-2T1.5G/2.2PB-PLUS	-
T2	MD500T3.7G/5.5PB-PLUS MD500T5.5G/7.5PB-PLUS	MD500-2T2.2G/3.7PB-PLUS MD500-2T3.7G/5.5PB-PLUS	MD500-2S0.4GB-INT MD500-2S0.7GB-INT MD500-2S1.5GB-INT MD500-2S2.2GB-INT
T3	MD500T7.5G/11PB-PLUS MD500T11G/15PB-PLUS	MD500-2T5.5G/7.5PB-PLUS	-
T4	MD500T15G/18.5PB-PLUS	MD500-2T7.5G/11PB-PLUS	-
T5	MD500T18.5G/22PB-PLUS MD500T22G/30PB-PLUS	MD500-2T11G/15PB-PLUS	-
T6	MD500T30G/37PB-PLUS MD500T37G/45PB-PLUS	MD500-2T15G/18.5PB-PLUS MD500-2T18.5G/22PB-PLUS	-
T7	MD500T45G/55PB-PLUS MD500T55G/75PB-PLUS	MD500-2T22G/30P-PLUS MD500-2T30G/37P-PLUS	-
T8	MD500T75G/90PB-PLUS MD500T90G/110P-PLUS MD500T110G/132P-PLUS	MD500-2T37G/45PB-PLUS MD500-2T45G/55P-PLUS MD500-2T55G/75P-PLUS	-
T9	MD500T132G/160P-PLUS MD500T160G/200P-PLUS	MD500-2T75G/90P-PLUS	-
T10	MD500T200G/250P(-L)-PLUS MD500T220G/280P(-L)-PLUS	-	-
T11	MD500T250G/315P(-L)-PLUS MD500T280G/355P(-L)-PLUS	-	-
T12	MD500T315G/400P(-L)-PLUS MD500T355G/450P(-L)-PLUS MD500T400G/500P(-L)-PLUS	-	-

Notes:

- B: with built-in braking unit
- (-L): with built-in output reactor (dV/dt filter)

4. External dimensions and mounting dimensions of MD500-PLUS drives.

4.1 Dimensions of T1 to T4 frames models.

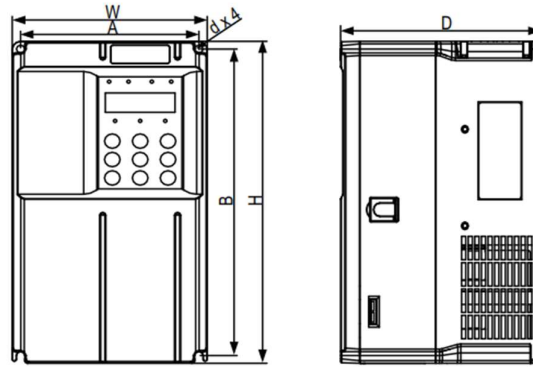


Figure 1. External dimensions and mounting dimensions of T1 to T4 frames models.

Table 3. External and mounting dimensions of T1 to T4 frames models.

Frame	Mounting Holes Spacing mm (in.)		External Dimensions mm (in.)			Mounting Holes Diameter mm (in.)	Mass kg (lb)
	A	B	H	W	D		
T1	119 (4.7)	189 (7.5)	200 (7.9)	130 (5.1)	150 (6.0)	Ø5 (0.2)	1.6 (3.5)
T2	119 (4.7)	189 (7.5)	200 (7.9)	130 (5.1)	160 (6.4)	Ø5 (0.2)	2.0 (4.4)
T3	128 (5.0)	238 (9.4)	250 (9.9)	140 (5.5)	168.3 (6.7)	Ø6 (0.2)	3.3 (7.3)
T4	166 (6.5)	266 (10.5)	280 (11.0)	180 (7.1)	169 (6.7)	Ø6 (0.2)	4.3 (9.5)

4.2 Dimensions of T5 to T6 models.

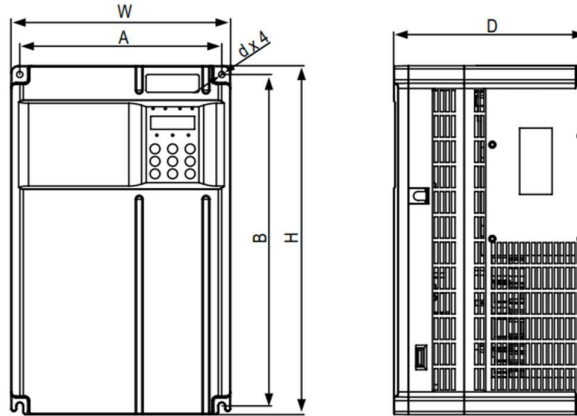


Figure 2. External dimensions and mounting dimensions of T5 to T6 frames models.

Table 4. External and mounting dimensions of T5 to T6 frames models.

Frame	Mounting Holes Spacing mm (in.)		External Dimensions mm (in.)				Mounting Holes Diameter mm (in.)	Mass kg (lb)
	A	B	H	H1	W	D		
T5 (without DC reactor)	195 (7.7)	335 (13.2)	350 (13.8)	-	210 (8.3)	193.4 (7.6)	Ø6 (0.2)	7.6 (16.8)
T5 (-T, with built-in DC reactor)	195 (7.7)	335 (13.2)	350 (13.8)	-	210 (8.3)	193.4 (7.6)	Ø6 (0.2)	10.0 (22.0)
T6	230 (9.1)	380 (15.0)	400 (15.8)	-	250 (9.9)	220.8 (8.7)	Ø7 (0.3)	17.5 (38.6)

4.3 Dimensions of T7 to T9 models.

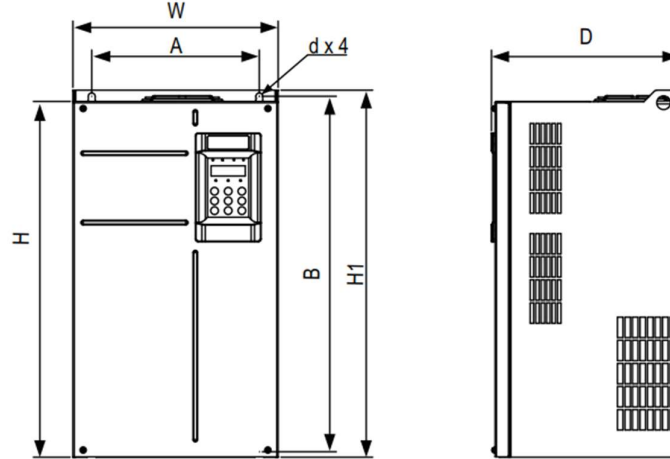


Figure 3. External dimensions and mounting dimensions of T7 to T9 frames models.

Table 5. External and mounting dimensions of T7 to T9 frames models.

Frame	Mounting Holes Spacing mm (in.)		External Dimensions mm (in.)				Mounting Holes Diameter mm (in.)	Mass kg (lb)
	A	B	H	H1	W	D		
T7	245 (9.7)	523 (20.6)	525 (20.7)	542 (21.4)	300 (11.8)	275 (10.8)	Ø10 (0.4)	35 (77.2)
T8	270 (10.6)	560 (22.1)	554 (21.8)	580 (22.9)	338 (13.3)	315 (12.4)	Ø10 (0.4)	51.5 (113.5)
T9	320 (12.6)	890 (35.1)	874 (34.4)	915 (36.1)	400 (15.8)	320 (12.6)	Ø10 (0.4)	85 (187.4)

4.4 Dimensions of T10 to T12 models.

4.4.1 Models without output reactor.

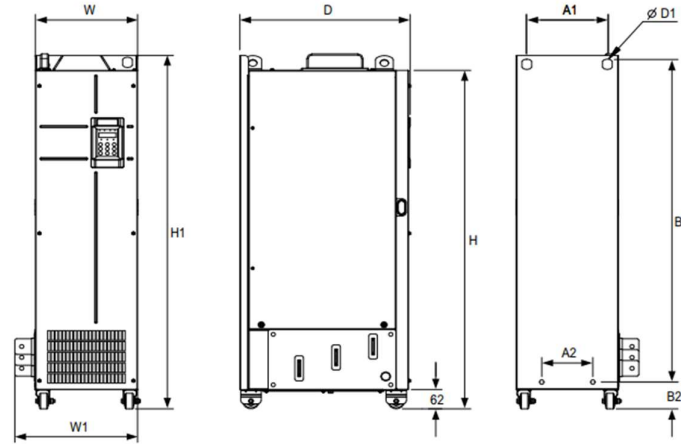


Figure 4. External dimensions and mounting dimensions of T10 to T12 frames models without output reactor.

Table 6. External dimensions and mounting dimensions of T10 to T12 frames models without output reactor.

Frame	Mounting Holes Spacing mm (in.)				External Dimensions mm (in.)					Mounting Holes Diameter mm (in.)	Mass kg (lb)
	A1	A2	B1	B2	H	H1	W	W1	D		
T10	240 (9.5)	150 (5.9)	1035 (40.8)	86 (3.4)	1086 (42.8)	1134 (44.7)	300 (11.8)	360 (14.2)	500 (19.7)	φ13 (0.5)	110 (242.5)
T11	225 (8.9)	185 (7.3)	1175 (46.3)	97 (3.8)	1248 (49.2)	1284 (50.6)	330 (13)	390 (15.4)	545 (21.5)	φ13 (0.5)	155 (341.7)
T12	240 (9.5)	200 (7.9)	1280 (50.4)	101 (4)	1355 (53.4)	1405 (55.4)	340 (13.4)	400 (15.8)	545 (21.5)	φ16 (0.6)	185 (407.9)

4.4.2 Models with output reactor.

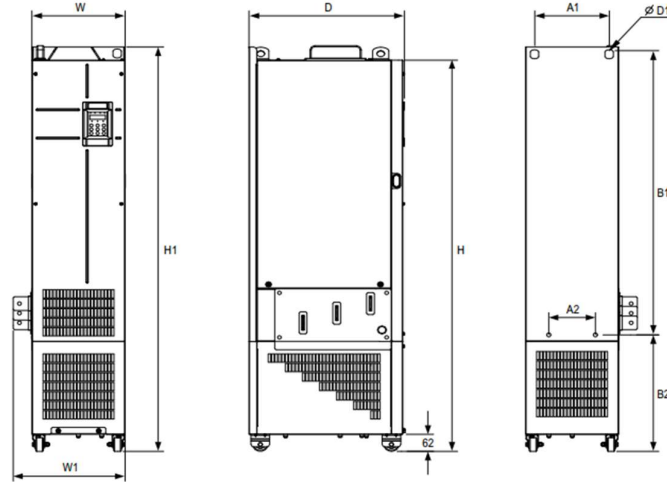


Figure 5. External dimensions and mounting dimensions of T10 to T12 frames models with output reactor.

Table 7. External dimensions and mounting dimensions of T10 to T12 frames models with output reactor.

Frame	Mounting Holes Spacing mm (in.)				External Dimensions mm (in.)					Mounting Holes Diameter mm (in.)	Mass kg (lb)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
T10	240 (9.5)	150 (5.9)	1035 (40.8)	424 (16.7)	1424 (56.1)	1472 (58.0)	300 (11.8)	360 (14.2)	500 (19.7)	φ13 (0.5)	160 (352.7)
T11	225 (8.9)	185 (7.3)	1175 (46.3)	435 (17.1)	1586 (62.5)	1622 (63.9)	330 (13.0)	390 (15.4)	545 (21.5)	φ13 (0.5)	215 (474.0)
T12	240 (9.5)	200 (7.9)	1280 (50.4)	432 (17.0)	1683 (66.3)	1733 (68.3)	340 (13.4)	400 (15.8)	545 (21.5)	φ16 (0.6)	245 (540.1)

5. Mounting clearances.

Reserve sufficient clearances as indicated in the clauses below.

5.1 T1 to T9 frames models.

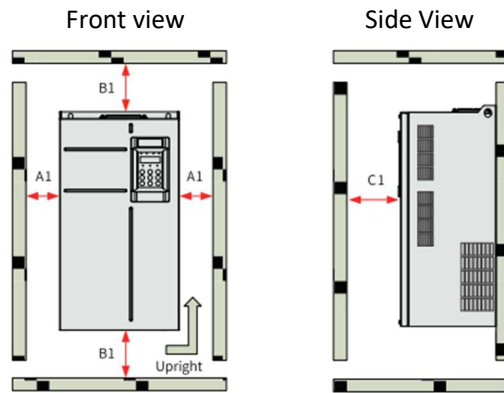


Figure 6. Installation clearances of T1 to T9 frames models.

Table 8. Installation clearances of T1 to T9 frames models.

Rated power	Clearance (mm)		
0.4 kW to 15 kW	A1 ≥ 10	B1 ≥ 100	C1 ≥ 40
18.5 kW to 22 kW	A1 ≥ 10	B1 ≥ 200	C1 ≥ 40
30 kW to 37 kW	A1 ≥ 50	B1 ≥ 200	C1 ≥ 40
45 kW to 160 kW	A1 ≥ 50	B1 ≥ 300	C1 ≥ 40

Note: A1 distances are also applicable to side-by-side mounting.

5.2 T10 to T12 frames models.

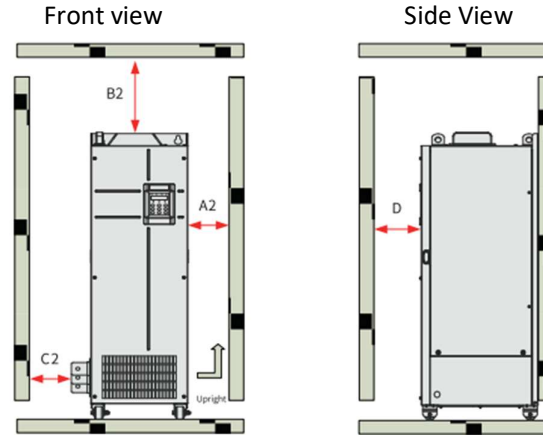


Figure 7. Installation clearances of T10 to T12 frames models.

Table 9. Installation clearances of T10 to T12 frames models.

Rated power	Clearance (mm)			
200kW to 400kW	A2 ≥ 10	B2 ≥ 250	C2 ≥ 20	D2 ≥ 20

6. Basic keypad operation.

Figure 8 below describes the keys and LED indicators of the built-in keypad of MD500-PLUS drive.

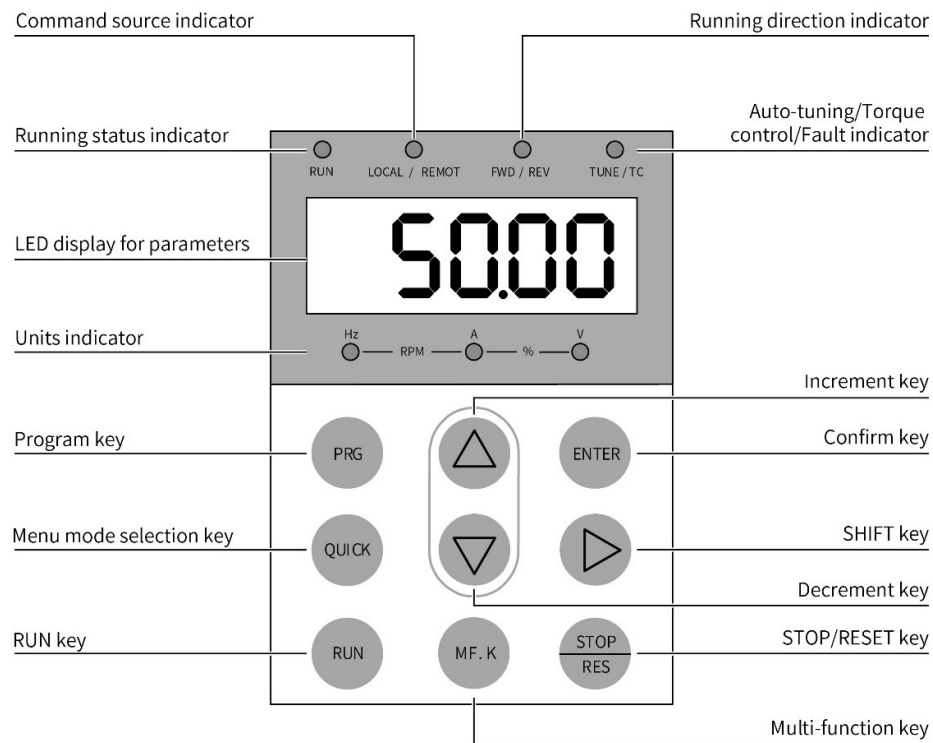


Figure 8. Keys and LED indicators of the built-in keypad of MD500-PLUS drive.

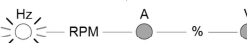
Table 10 below describes the functions of the keys of the built-in keypad of MD500-PLUS drive.

Table 10. Functions of the keys of built-in keypad of MD500-PLUS drive.

Key	Name	Function
	Program key	Used to return to the previous level or go to Level I menu.
	Confirm key	Used to access the next menu level or confirm a mode, parameter setting, or a reference value.
	Increment key	Used to increase the parameter number/setting value currently displayed.
	Decrement key	Used to decrease the parameter number/setting value currently displayed.
	SHIFT key	Used to select cyclically the displayed parameter, in the STOP or RUNNING status. Select cyclically the digit to be modified when editing a parameter number/value.
	RUN key	Start the AC drive when operation command by keypad is selected.
	STOP/RESET key	Stop the AC drive when the drive is in RUNNING status. Perform a reset operation when the drive is in the FAULT status.
	Multi-function key	Perform a operation mode as defined by the setting of F7-01 (MF.K key function selection).
	Menu mode selection key	Switchover between menu modes as defined by the setting of FP-03 (user-defined and/or modified parameters display selection).

Table 11 below describes the functions of the LED indicators of the built-in keypad of MD500-PLUS drive.

Table 11. Functions of the LED indicators of the built-in keypad of MD500-PLUS.

Status	Indication
RUN Running status indicator	 RUN OFF indicates the STOP status.
	 RUN ON indicates the RUNNING status.
LOCAL/REMOT Running command indicators	 LOCAL/ REMOT OFF indicates under operating panel control.
	 LOCAL/ REMOT ON indicates under input terminal control.
	 LOCAL/ REMOT FLASHING indicates under serial communication control.
FWD/REV Forward and reverse rotation indicators	 FWD/REV OFF indicates forward rotation (FWD)
	 FWD/REV ON indicates reverse rotation (REV).
TUNE/TC Auto-tuning, torque control and fault indicators	 TUNE/TC OFF indicates that the AC drive is in normal status, in speed control mode.
	 TUNE/TC ON indicates that the AC drive is in normal status, in torque control mode.
	 TUNE/TC FLASHING slowly (once per second) indicates that the AC drive is performing auto-tuning.
	 TUNE/TC FLASHING quickly (4 times per second) indicates that the AC drive is in fault.
	Indicates that the output frequency displayed value is in Hz.
	Indicates that the output current displayed value is in A.
	Indicates that the voltage (output or DC bus) displayed value is in V.
	Indicates that the speed displayed value is in RPM.
	Indicates that the displayed value is in %.

Figures 9 and 10 below show the procedure to view and modify the value set in a parameter.

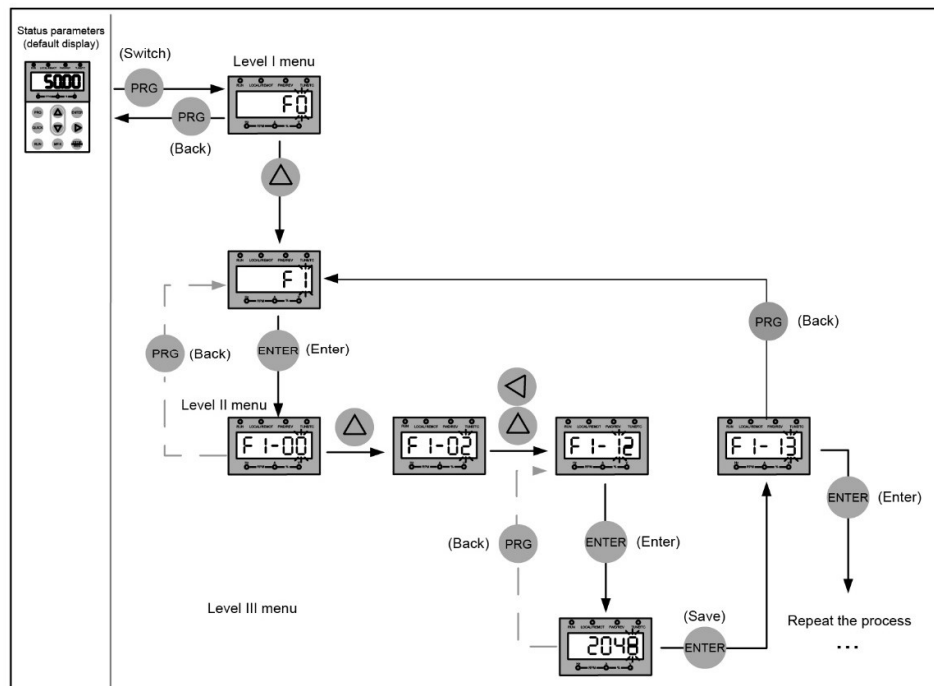


Figure 9. How to view the value set in a parameter.

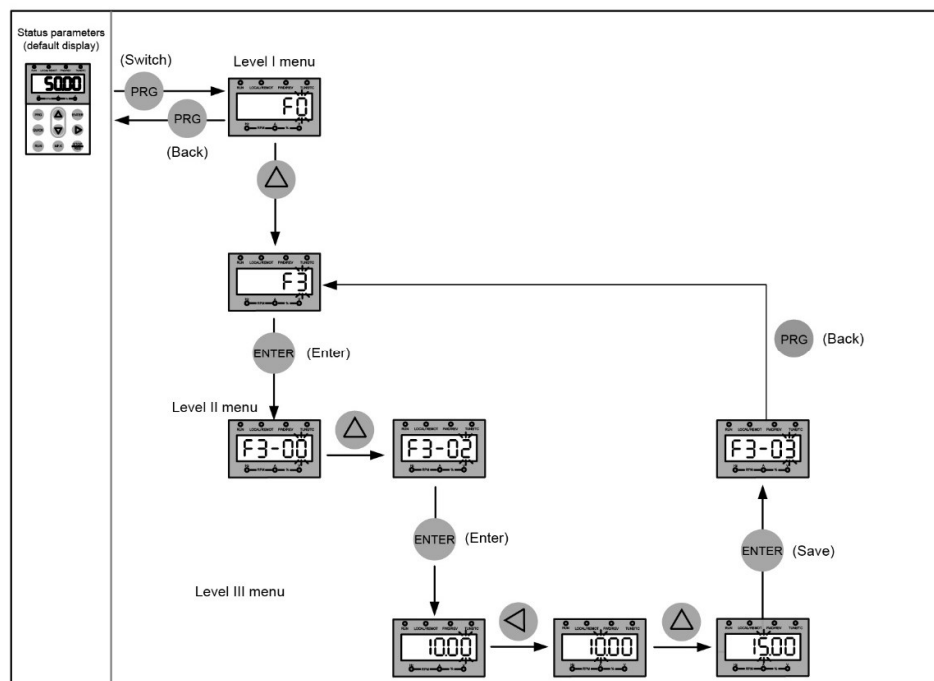


Figure 10. How to edit/modify the value set in a parameter.

7. Wiring diagram.

The figure 11 below describes the wiring diagram of MD500-PLUS.

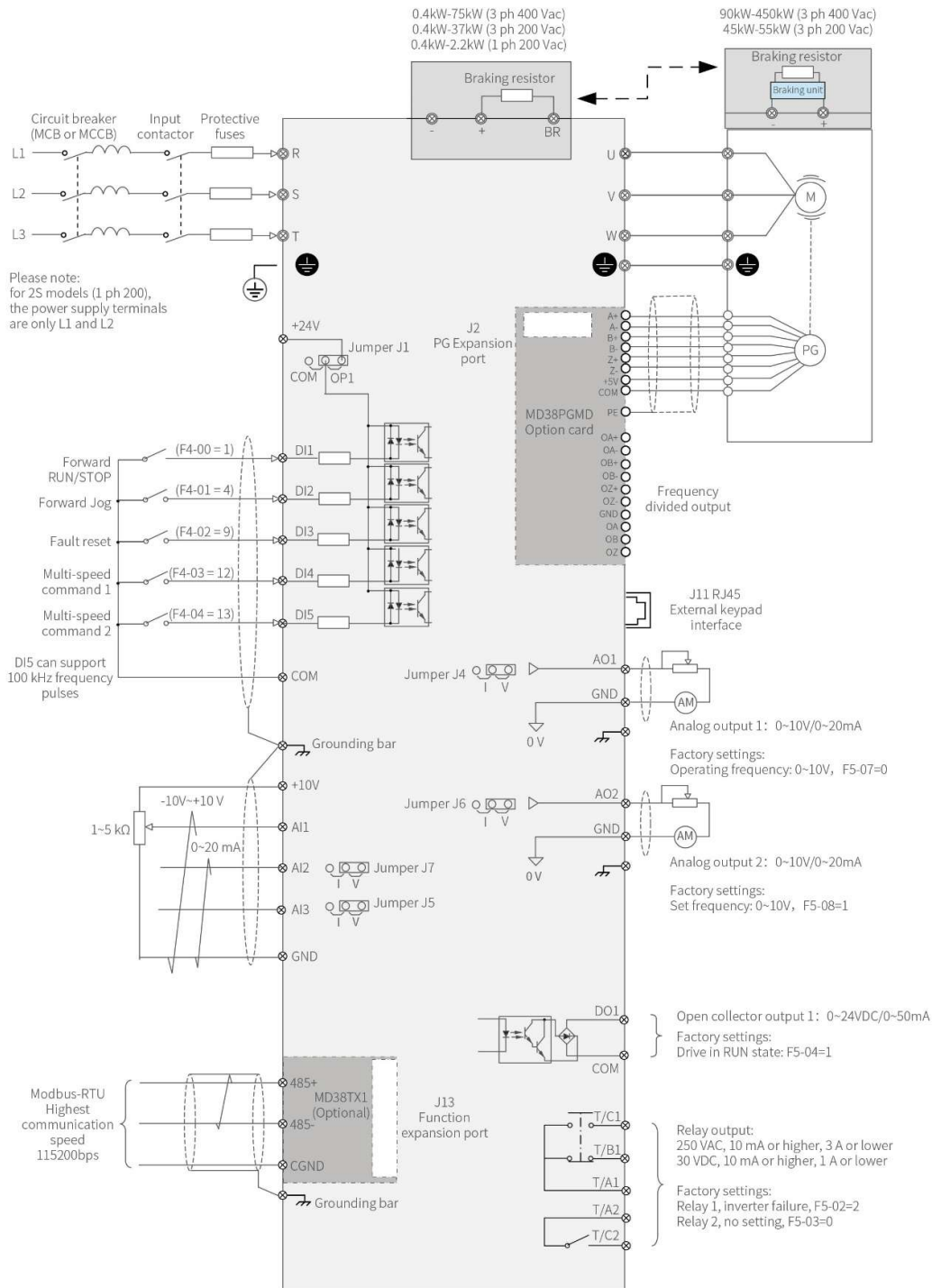


Figure 11. Wiring diagram of MD500-PLUS.

Table 12 below describes the main circuit (power) terminals of MD500-PLUS drive.

Table 12. Main circuit terminals.

Terminal(s)	Function	Description
R, S, T	Three-phase power supply input terminals (T and 2T models)	Connected to AC three-phase power supply.
L/L1, N/L2	Single-phase power supply input terminals (2S models)	Connected to AC single-phase power supply.
(+), (-)	Positive and negative terminals of DC bus	Connected to an external braking unit, regenerative converter, or other drives in common DC bus architecture.
(+), BR	Braking resistor connection terminals	Connected to the braking resistor of models with built-in braking unit: T up to/including 75 kW, 2T up to/including 37 kW and all 2S models.
U, V, W	Output terminals	Connected to a three-phase motor.
	Grounding terminals (PE)	Used for protective grounding.

Figure 12 below shows the control circuit terminals layout.

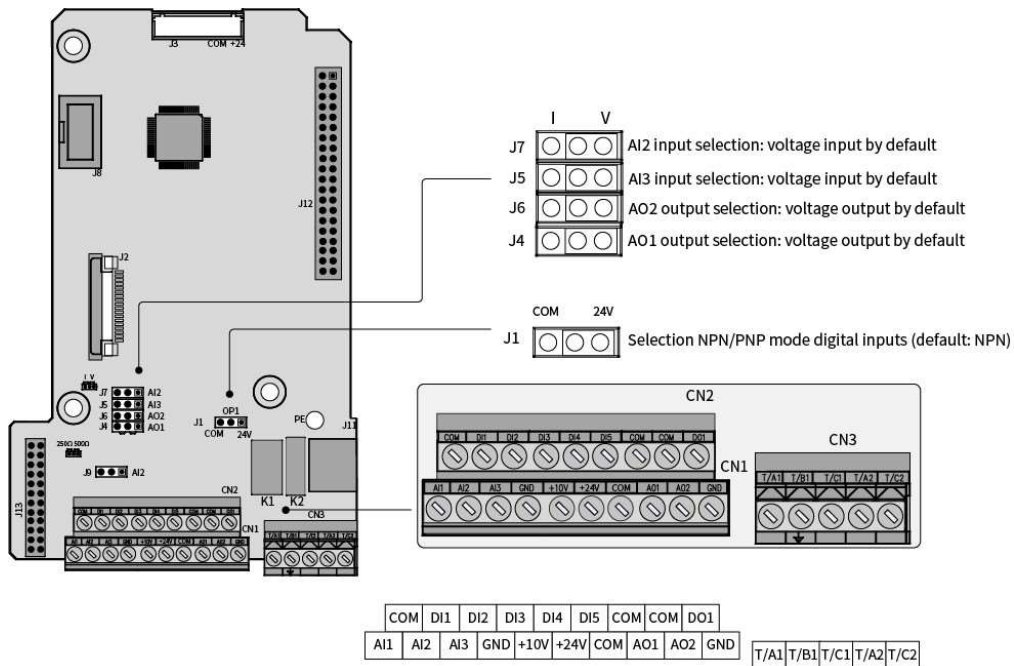


Figure 12. Control circuit terminals layout.

Table 13 below describes the control circuit terminals of MD500-PLUS.

Table 13. Control circuit terminals of MD500-PLUS.

Type	Terminal(s)	Function	Description
Power supply	+10V-GND	+10V reference voltage	Provides +10V reference voltage to a potentiometer or another external device. Maximum output current: 10 mA. Normally used to supply a potentiometer with an impedance between 1 k Ω and 5 k Ω .
	+24V-COM	+24V power supply	Provides +24V supply to an external device. Normally used to supply digital inputs/outputs and/or external sensors. Maximum output current: 200 mA.
Analog inputs	AI1-GND	Analog input 1	Range: -10VDC to +10VDC Input impedance: 22 k Ω
	AI2-GND	Analog input 2	Range: -10VDC to +10VDC, or 0-20 mA, selectable by the jumper J7 on the control board. Input impedance: 22 k Ω (voltage mode) or 500 Ω (current mode).
	AI3-GND	Analog input 3	Range: -10VDC to +10VDC, or 0-20 mA, selectable by the jumper J5 on the control board. Input impedance: 22 k Ω (voltage mode) or 500 Ω (current mode). Supports the connection PT100, PT1000, KTY-84-130, and PTC-130 temperature detection devices, selectable by parameter F9-56.
Digital inputs	DI1-COM	Digital input 1	Isolated inputs by optocoupler. Maximum frequency: 100 Hz. NPN/PNP selection by jumper J1. Input impedance: 1.39 k Ω
	DI2-COM	Digital input 2	
	DI3-COM	Digital input 3	
	DI4-COM	Digital input 4	
	DI5-COM	Digital input 5	
Analog outputs	AO1-GND	Analog output 1	Selection voltage or current by jumper J4. Maximum impedance of the load in current mode is 500 Ω . Output voltage range: 0-10 V Output current range: 0-20 mA
	AO2-GND	Analog output 2	Selection voltage or current by jumper J6. Maximum impedance of the load in current mode is 500 Ω . Output voltage range: 0-10 V Output current range: 0-20 mA

Table 13. Control circuit terminals of MD500-PLUS (continued).

Type	Terminal(s)	Function	Description
Digital outputs	DO1-COM	Digital output 1	NPN transistor digital output. Maximum output voltage: 24 V Maximum output current: 50 mA
Relay outputs	T/A1-T/B1	Normally closed contact relay 1	Contact driving capacity: 250 VAC, 3 A, $\cos\phi = 0.4$ 30 VDC, 1 A
	T/A1-T/C1	Normally open contact relay 1	
	T/A2-T/C2	Normally open contact relay 2	
Auxiliary ports	J13	Extension card port	Provides the interface to optional cards, such as bus communication and I/O expansion card.
	J2	Feedback card port	Provides the interface to optional cards for connecting feedback resolver/encoder.
	J11	Port for external operating panel	Allows to connect and external/remote operating panel.
Jumpers	J1	DI SINK/SOURCE mode selection	To select if the digital inputs are used in SINK (NPN) or SOURCE (PNP) mode.
	J4	AO1 output selection	To select if the analog output generates a voltage (default) or current signal.
	J6	AO2 output selection	
	J5	AI3 input selection	To select if the analog input signal is voltage or current.
	J7	AI2 input selection	

Figure 13 below shows how to make the wiring of the digital inputs in source (PNP) mode.

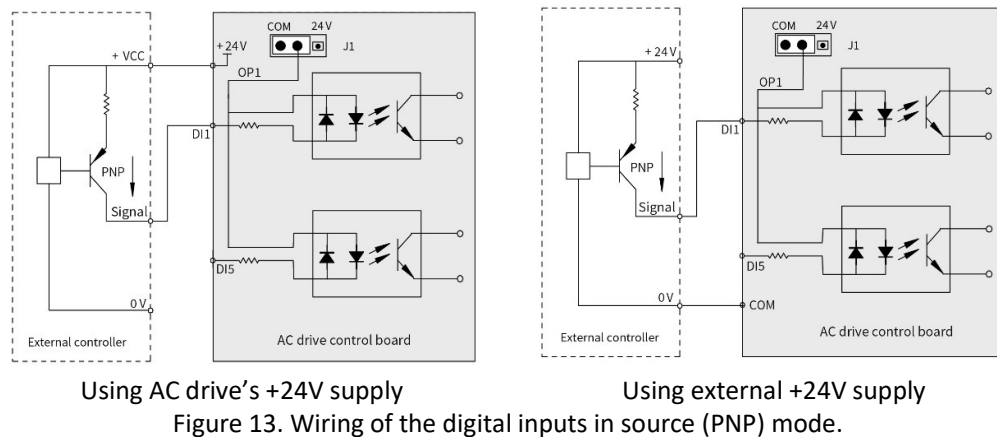


Figure 14 below shows how to make the wiring of the digital inputs in sink (NPN) mode.

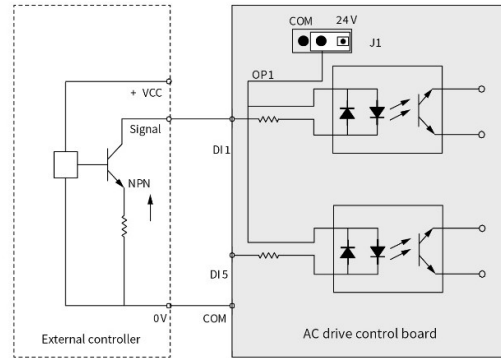


Figure 14. Wiring of the digital inputs in sink (NPN) mode.

8. Step by Step start-up procedure.

Please follow below procedure in order to set up the MD500-PLUS drive. Before applying power to the drive ensure that the AC drive model is suitable for the power supply voltage available on the installation.

We recommend for a quick start to prove the installation and the initial running of the motor, to use the simple V/f control mode. At a later stage, the user –depending on the application requirements– may elect to use higher functionality of SVC (open loop vector control) or FVC (closed loop vector control).

8.1 Steps common to all control modes.

Step 1. Restore parameters to factory default.

Set parameter FP-01=1 in order to restore the drive parameters to factory default. When setting FP-01=1, all parameters are restored except G/P type selection (F0-00), motor parameters (F1-XX), maximum frequency (F0-10) and frequency resolution (F0-22).

Step 2. Set G/P type selection (F0-00), maximum frequency (F0-10), frequency upper limit (F0-12), frequency lower limit (F0-14) and frequency resolution (F0-22).

Step 3. Set operation (RUN) command source by setting parameter F0-02 (0: LED operating panel/LCD operating panel/Software; 1: Terminals; 2: Communication).

Step 4. Set the main frequency setpoint source by setting parameter F0-03.

Step 5. Set the motor control mode by parameter F0-01.

Step 6. Set the acceleration and deceleration times in parameters F0-17 and F0-18. If more than one acceleration/deceleration time is required, refer to parameters F8-03 to F8-08.

Step 7. Set motor parameters (F1-00 to F1-05).

Step 8. Configure the digital and analog inputs by parameters F4-XX.

Step 9. Configure the digital and analog outputs by parameters F5-XX.

Depending on the motor type and control mode, please follow the relevant clauses indicated in the table 14 below.

Table 14. Relevant clauses for each motor type and control mode.

Motor type	Control mode	Relevant clauses & sequence
Induction motor	V/f control	4.2 -> 5
	Sensorless vector control (SVC)	4.3 -> 4.4 -> 4.8 -> 5
	Feedback vector control (FVC)	4.3 -> 4.5 -> 4.8 -> 5
PM synchronous motor	Sensorless vector control (SVC)	4.3 -> 4.6 -> 4.8 -> 5
	Feedback vector control (FVC)	4.3 -> 4.7 -> 4.8 -> 5

8.2 When using V/f control for induction motor.

Only in case of using **V/f control for induction motor** (F1-00=0 or 1, F0-01=2), perform these steps:

Step 10. Optionally the V/f characteristic can be set in parameters F3-00 to F3-08.

Step 11. If braking resistor is used set F3-10=0 and F3-23=0.

Note: V/f control can be useful to test easily that the drive is able to run the motor.

8.3 When using vector control modes.

Only in case of using **vector control modes**, perform this step.

Step 12. Set the values of the speed loop P gains (F2-00, F2-03) to a low value (not higher than 10), to avoid system instability. This should be done if the motor is not coupled to the load. Later the values of these gains can be increased to tune the drive to the required performance.

8.4 When using sensorless vector control (SVC) for induction motor.

In case of using **sensorless vector control (SVC) for induction motor** (F1-00=0 or 1, F0-01=0).

Step 13. Perform motor auto-tuning:

If the motor cannot be decoupled from the load, perform static auto-tuning (F1-37=1 or 3). F1-37=3 is able to perform a complete identification of the motor parameters without moving the motor.

If the motor can be decoupled from the load, perform dynamic auto-tuning (F1-37=2).

8.5 When using closed loop vector control (FVC) for induction motor.

In case of using **closed loop vector control (FVC) for induction motor** (F1-00=0 or 1, F0-01=1).

Step 14. Set the encoder related parameters (F1-27, F1-28).

Step 15. Perform motor auto-tuning:

If the motor cannot be decoupled from the load, perform static auto-tuning (F1-37=1 or 3). F1-37=3 is able to perform a complete identification of the motor parameters without moving the motor.

If the motor can be decoupled from the load, perform dynamic auto-tuning (F1-37=2).

8.6 When using sensorless vector control (SVC) for PM synchronous motor.

In case of using **sensorless vector control (SVC) for PM synchronous motor** (F1-00=2, F0-01=0).

Step 16. Set the back EMF voltage parameter (F1-19) to a value close to the real value. When the value is not known precisely, it is recommended to set a value lower than the real value. If a value too high is set, the output current of the drive will be too high, causing overcurrent trips and eventually could damage the motor.

Step 17. Perform motor auto-tuning:

If the motor cannot be decoupled from the load, perform static auto-tuning (F1-37=11 or 13). F1-37=13 is able to perform a complete identification of the motor parameters without moving the motor (except the back EMF voltage, parameter F1-19).

If the motor can be decoupled from the load, perform dynamic auto-tuning (F1-37=12).

8.7 When using closed loop vector control (FVC) for PM synchronous motor.

In case of using **closed loop vector control (FVC) for PM synchronous motor** (F1-00=2, F0-01=1).

Step 18. Set the encoder related parameters (F1-27, F1-28).

Step 19. Set the back EMF voltage parameter (F1-19) to a value close to the real value. When the value is not known precisely, it is recommended to set a value lower than the real value. If a value too high is set, the output current of the drive will be too high, causing overcurrent trips and eventually could damage the motor.

Step 20. Perform motor auto-tuning:

If the motor cannot be decoupled from the load, perform static auto-tuning (F1-37=11 or 13). F1-37=13 is able to perform a complete identification of the motor parameters without moving the motor (except the back EMF voltage, parameter F1-19).

If the motor can be decoupled from the load, perform dynamic auto-tuning (F1-37=12).

8.8 Steps common to all vector control modes.

Step 21. Once the motor has been coupled to the load, tune the speed loop gains (F2-00, F2-01, F2-03, F2-04) in order to obtain the desired/required performance, without having oscillation and/or too high overshoot during acceleration/deceleration or load changes.

Step 22. If required, change the Settings of the torque limits for both motoring (F2-09, F2-10) and regenerating conditions (F2-11, F2-12).

8.9 Additional parameter settings applicable to all control modes.

If the drive has to control a motor that is already rotating at start, we may have to set parameters F6-00 to F6-04.

The stop mode can be set in parameter F6-10 (=0: controlled deceleration; =1: coast to stop).

To activate the phase loss detection (Error 13) before startup, please set parameter F9-06=1.

To define the behaviour of the drive in case of power loss, refer to parameters F9-59 to F9-62.

For external process PID control refer to parameters FA-00 to FA-27 and F8-49 to F8-52. Please consult a dedicated technical bulletin for setting external process PID control in MD500-PLUS.

9. Concise list of parameters.

Table 15 below lists the parameter groups with a short description. For more detailed information refer to the “MD500-PLUS Software Guide” listed in the clause “**List of documentation for MD500-PLUS drive**” of this document.

Table 15. Parameter groups description.

Parameter group	Description
F0	Standard parameters
F1	Motor parameters
F2	Vector control parameters
F3	V/f control parameters
F4	Input terminals
F5	Output terminals
F6	Start/Stop control
F7	Keypad operation and LED display parameters
F8	Auxiliary function parameters
F9	Fault and Protection Parameters
FA	PID Function Parameters
FB	Wobble function, fixed length and count
FC	Multi-Reference and simple PLC Function
FD	Communication Parameters
FP	User parameters
A0	Torque control and limit parameters
A1	Virtual DI/DO Parameters
A2	Motor 2 parameters
A5	Control optimization parameters
A6	AI curve setting parameters
A9	Vector control enhancement parameters
AC	AI/AO correction
AF	Process data objects address mapping parameters
B0	Control mode, line speed, winding diameter related parameters
B1	Tension control setting parameters
B2	Taper parameters
B7	Brake control parameters
B8	Motor 3 parameters
B9	Motor 4 parameters
U0	Monitoring parameters
U1	Tension control monitoring parameters

10. Troubleshooting.

The AC drive MD500-PLUS is equipped with a set of protection functions in order to protect the motor, the electrical installation, the machine and/or the drive itself. When the AC drive detects a failure, enters in alarm state, removes RUN status, and indicates the alarm code in the LED display of the keypad. In order to be able to reset the AC drive from the alarm state, we should first solve the cause of the failure, and then press the key STOP/RESET.

10.1 Display of Alarms and Faults.

When a fault occurs during running, the AC drive stops output immediately, the fault indicator (LED) "TUNE/TC" blinks, and the contact of the fault relay changes state. The operating panel displays the fault code (example: E23.00). Figure 15 below shows the fault display in MD500-PLUS LED keypad.

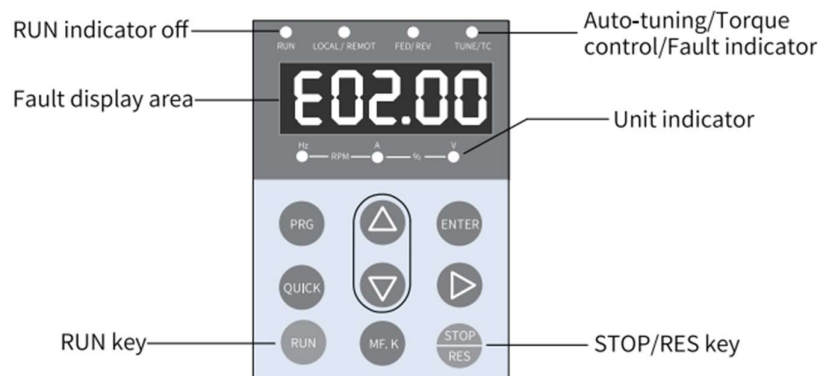


Figure 15. Faults display in MD500-PLUS LED keypad.



Caution

Do not repair or modify the AC drive by yourself. In case of any fault that cannot be rectified, contact the agent or Inovance for technical support.

Table 16 below describes the error codes of the faults that can be detected by MD500-PLUS drive.

Table 16. Error codes in MD500-PLUS drive.

Error code(s)	Basic description
E02.00	Overcurrent during acceleration
E03.00	Overcurrent during deceleration
E04.00	Overcurrent during operation at constant speed
E05.00	Overvoltage during acceleration
E06.00	Overvoltage during deceleration
E07.00	Overvoltage during operation at constant speed
E09.00	Undervoltage
E10.00	AC drive overload
E11.00	Motor overload
E12.00	Input phase loss
E13.00	Output phase loss
E14.00	IGBT overtemperature
E15.01	External fault (normally open)
E15.02	External fault (normally closed)
E16.01	Modbus communication timeout
E16.11	CANopen communication timeout
E16.12	Inconsistency in PDO mapping
E16.21	CANlink heartbeat timeout
E16.22	CANlink station number conflict
E17.00	Contact fault
E18.00	Abnormal current sampling
E19.02	Fault in auto-tuning on the synchronous motor magnetic pole position angle
E19.06 E19.07 E19.08	Fault in auto-tuning of the stator resistance
E19.09 E19.10	Fault in auto-tuning of the asynchronous motor transient leakage inductance
E19.11	Inertia auto-tuning fault
E19.20	Timeout in auto-tuning of the synchronous motor no-load zero position angle
E19.23	Fault in auto-tuning of the synchronous motor magnetic pole position
E19.24	Error in auto-tuning of the asynchronous motor transient leakage inductance
E20.00	Encoder disconnected
E20.01	Encoder fault
E20.02	Encoder disconnected
E20.04	Encoder fault during synchronous motor no-load auto-tuning
E20.06	Encoder fault during synchronous motor with-load auto-tuning
E20.07 E20.08	Encoder fault during synchronous motor no-load auto-tuning
E20.09	Encoder fault during synchronous motor auto-tuning
E20.10	Synchronous motor encoder fault
E20.11	The encoder is faulty during asynchronous motor FVC no-load auto-tuning
E20.12	Excessive deviation between the encoder feedback speed and the speed estimated by SVC
E20.13	Resolver disconnected
E20.17	Serial encoder disconnected
E21.01 E21.02 E21.03 E21.04	EEPROM read/write fault
E22.00	Auto-tuned stator resistance out of range
E22.01	Auto-tuned asynchronous motor rotor resistance out of range
E22.02	Auto-tuned asynchronous motor no-load current and mutual inductance out of range
E22.03	Auto-tuned synchronous motor back EMF out of range
E22.04	Inertia auto-tuning fault
E23.00	Short-circuit to ground
E24.00	Short-circuit between output phases
E25.00	Rectifier fault
E26.00	Accumulative running time reached
E27.00	User-defined fault 1
E28.00	User-defined fault 2
E29.00	Accumulative power on time reached
E30.00	Load lost
E31.00	PID feedback lost during operation
E40.00	Instantaneous current limit fault
E42.00	Excessive speed deviation
E43.00	Motor overspeed
E45.00	Motor overtemperature
E60.00	AC drive overtemperature
E61.00	Braking transistor overload
E62.00	Braking transistor short circuit

For more detailed information of the alarm codes, and the possible causes and solutions, please consult the guide “MD500-PLUS Commissioning Guide_EN_A04_19011579”.