INOVANCE

User Guide

MD330H Tension Control AC Drive

User Guide

A01
Data code 19010571

Contents

Safety Information and Precautions

This User Guide is packaged together with the product for MD330H AC Drive. It contains basic information for quick start of the AC drive. For safety and more information, please refer to the MD380 User Manual, which can be downloaded on website: http://www.inovance.cn.

- **Electrical Safety**

Extreme care must be taken at all times when working with the AC Drive or within the area of the AC Drive. The voltages used in the AC Drive can cause severe electrical shock or burns and is potentially lethal. Only authorized and qualified personnel should be allowed to work on AC Drives.

- **Machine/System Design and Safety of Personnel**

Machine/system design, installation, commissioning startups and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and the contents of this manual. If incorrectly installed, the AC Drive may present a safety hazard.

The AC Drive uses high voltages and currents (including DC), carries a high level of stored electrical energy in the DC bus capacitors even after power OFF. These high voltages are potentially lethal.

The AC Drive is NOT intended to be used for safety related applications/functions. The electronic "STOP &START" control circuits within the AC Drive must not be relied upon for the safety of personnel. Such control circuits do not isolate mains power voltages from the output of the AC Drive. The mains power supply must be disconnected by an electrical safety isolation device before accessing the internal parts of the AC Drive.

Safety risk assessments of the machine or process system which uses an AC Drive must be undertaken by the user and or by their systems integrator/designer. In particular the safety assessment/design must take into consideration the consequences of the AC Drive failing or tripping out during normal operation and whether this leads to a safe stop position without damaging machine, adjacent equipment and machine operators/users. This responsibility lies with the user or their machine/process system integrator.

The system integrator/designer must ensure the complete system is safe and designed according to the relevant safety standards. Inovance Technology and Authorized Distributors can provide recommendations related to the AC drive to ensure long term safe operation.

- **Electrical Installation -Safety**

Electrical shock risk is always present within an AC Drive including the output cable leading to the motor terminals. Where dynamic brake resistors are fitted external to the AC Drive, care must be taken with regards to live contact with the brake resistors, terminals which are at high DC voltage and potentially lethal. Cables from the AC Drive to the dynamic brake resistors should be double insulated as DC voltages are typically 600to 700 VDC.

Mains power supply isolation switch should be fitted to the AC Drive. The mains power supply must be disconnected via the isolation switch before any cover of the AC Drive can be removed or before any servicing work is undertaken. Stored charge in the DC bus capacitors of the PWM inverter is potentially lethal after the AC supply has been disconnected. The AC supply must be isolated at least 10 minutes before any work can be undertaken as the stored charge will have been discharged through the internal bleed resistor fitted across the DC bus capacitors.

Whenever possible, it is good practice to check the DC bus voltage with a VDC meter before accessing the inverter bridge. Where the AC Drive input is connected to the mains supply with a plug and socket, then upon disconnecting the plug and socket, be aware that the plug pins may be exposed and internally connected to the DC bus capacitors (via the internal bridge rectifier in reversed bias). Wait 10 minutes to allow stored charge in the DC bus capacitors to be dissipated by the bleed resistors before commencing work on the AC Drive.

Electrical Shock Hazard. Ensure the protective earthing conductor complies with technical standards and local safety regulations. Because the leakage current exceeds 3.5 mA in all models, IEC 61800-5-1 states that either the power supply must be automatically disconnected in case of discontinuity of the protective earthing conductor or a protective earthing conductor with across-section of at least 10 mm^2 (Cu) or 16 mm^2 (Al) must be used. Failure to comply may result in death or serious injury.

When using an earth leakage circuit breaker, use a residual current operated protective device (RCD) of type B (breaker which can detect both AC and DC). Leakage current can cause unprotected components to operate incorrectly. If this is a problem, lower the carrier frequency, replace the components in question with parts protected against harmonic current, or increase the sensitivity amperage of the leakage breaker to at least 200 mA per drive.

Factors in determining leakage current:

• Size of the AC drive
• AC drive carrier frequency
• Motor cable type and length
• EMI/RFI filter

■ **Standards compliance**

The following table lists the certificates and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification	Directive Name		Standard
CE	EMC Directive	2014/30/EU	EN 61800-3
	LVD Directive	2014/35/EU	EN 61800-5-1
	RoHS Directive	2011/65/EU	EN 50581
TUV	-		EN 61800-5-1
UL	-		UL508C/UL61800-5-1
			C22.2 No.14-13

Note:

- The above EMC directives are complied with only when the EMC electric installation requirements are strictly observed.
- Machines and devices used in combination with this drive must also be CE certified and marked. The integrator who integrates the drive with the CE mark into other devices has the responsibility of ensuring compliance with CE standards and verifying that conditions meet European standards.
- The installer of the drive is responsible for complying with all relevant regulations for wiring, circuit fuse protection, earthing, accident prevention and electromagnetic (EMC regulations). In particular fault discrimination for preventing fire risk and solid earthing practices must be adhered to for electrical safety (also for good EMC practice).
- For more information on certification, consult our distributor or sales representative.

1 Product Information

1.1 Overview

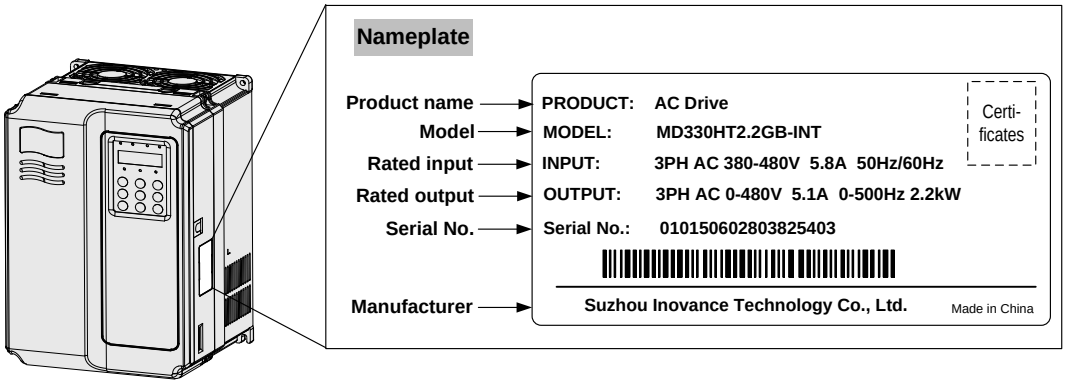
This User Guide mainly focuses on winding tension control. Refer to *MD380 AC Drive Advanced User Guide* for other detailed information.

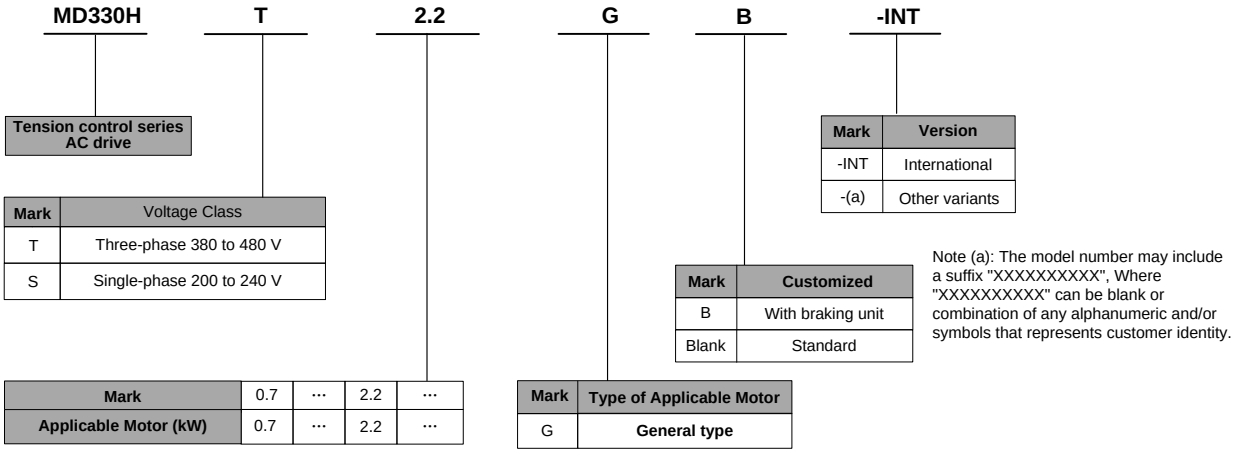
If tension control is disabled (B0-00 = 0), the MD330H functions are as an MD380.

The MD330H AC drive automatically calculates the changing winding diameter and produces constant tension during diameter change. The MD380 is sufficient to meet the tension control application without winding diameter change. If the coil diameter computing conditions are not met, re-evaluate the solution and use the MD330H with caution.

If tension control mode is enabled (B0-00 ≠ 0), the output frequency and torque of the AC drive are determined by the tension and frequency source and torque source will become ineffective. However, maximum output frequency (F0-10) and frequency reference upper limit (F0-12) will still be effective.

1.2 Nameplate and Designation Rule





1.3 General Specifications

Voltage class		Single-phase 220 VAC				Three-phase 380 VAC							
Model: MD330HxxxG(B)*-INT		S0.4	S0.7	S1.5	S2.2	T0.7	T1.5	T2.2	T3.7	T5.5	T7.5	T11	T15
Frame Size		B				B			C		D		
Dimension[2]	Height Width Depth	[H] : 186 mm [W] : 125 mm [D] : 164 mm				[H] :186 mm [W] : 125 mm [D] : 164 mm			[H] : 248 mm [W] : 160 mm [D] : 183 mm		[H] : 322 mm [W] : 208 mm [D] : 192 mm		
Drive Input	Rated Input Voltage	Single phase 220V (-15% to +20%)				Three-phase 380V (-15% to +10%)							
	Rated Input Current, [A]	5.4	8.2	14	23	3.4	5	5.8	10.5	14.6	20.5	26	35
	Rated input frequency	50/60 Hz, ±5%											
	Power Capacity, [kVA]	1	1.5	3	4	1.5	3	4	5.9	8.9	11	17	21
Drive Output	Applicable Motor [Kw]	0.4	0.75	1.5	2.2	0.75	1.5	2.2	3.7	5.5	7.5	11	15
	Output Current ,[A]	2.3	4	7	9.6	2.1	3.8	5.1	9	13	17	25	32
	Default carrier frequency (kHz)	6	6	6	6	6	6	6	6	6	6	6	6
	Overload Capacity	150% for 60 Sec											
	Maximum output frequency	50 Hz to 500 Hz											
Braking Resistor	Recommended Power, [kW]	0.08	0.08	0.1	0.1	0.15	0.15	0.25	0.3	0.4	0.5	0.8	1
	Recommended Resistance, minimum [Ω]	200	150	100	70	300	220	200	130	90	65	43	32
	Thermal design power (kW)	0.016	0.03	0.055	0.072	0.027	0.05	0.066	0.12	0.195	0.262	0.445	0.553
Enclosure		IP20											

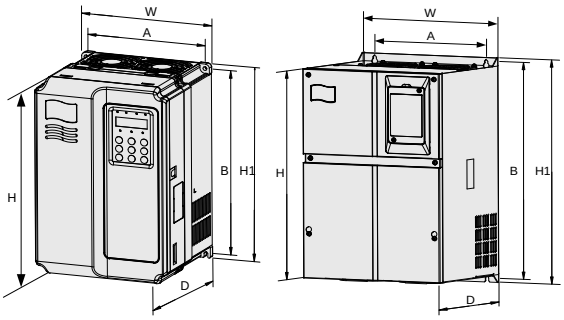
*, “B” denotes build-in brake function.

Voltage class		Three-phase 380 VAC										
Model: MD330HxxxG(B)*-INT		T18.5	T22	T30	T37	T45	T55	T75	T90	T110	T132	T160
Frame Size		E			F			G		H		
Dimension[2]	Height Width Depth	[H] : 463 mm [W] : 285 mm [D] : 228 mm			[H] : 600 mm [W] : 385 mm [D] : 265 mm			[H] : 700 mm [W] : 473 mm [D] : 307 mm		[H] :930 mm [W] :579 mm [D] : 380 mm		
Drive Input	Rated Input Voltage	Three-phase 380V (-15% ~ +10%)										
	Rated Input Current, [A]	38.5	46.5	62	76	92	113	157	180	214	256	307
	Rated input frequency	50/60 Hz, ±5% (47.5 to 63 Hz)										
	Power Capacity, [kVA]	24	30	40	57	69	85	114	134	160	192	231
Drive Output	Applicable Motor [Kw]	18.5	22	30	37	45	55	75	90	110	132	160
	Output Current ,[A]	37	45	60	75	91	112	150	176	210	253	304
	Default carrier frequency (kHz)	6	6	6	5	5	4	3	3	3	3	3
	Overload Capacity	150% for 60 Sec										
	Maximum output frequency	50 Hz to 500 Hz										
Braking Resistor	Recommended Power, [kW]	1.3	1.5	2.5	3.7	4.5	5.5	7.5	9	5.5 x 2	6.5 x 2	8 x 2
	Recommended Resistance, minimum [Ω]	25	22	16	13.3	13.3	10	6.7	6.7	10 x 2	6.7 x 2	6.7 x 2
Thermal design power (kW)		0.651	0.807	1.01	1.2	1.51	1.8	1.84	2.08	2.55	3.06	3.61
Enclosure		IP20										

*, “B” denotes build-in brake function.

Voltage class			380 to 480 VAC						
Model: MD330HxxxG-L			T200	T220	T250	T280	T315	T355	T400
Frame size			I				J		
Dimension(2)		Height Width Depth	[H1] :1060 mm [W] : 650 mm [D] : 377 mm				[H1] :1358 mm [W] : 800 mm [D] : 400 mm		
Drive Input	Rated Input Voltage		Three-phase 380V (-15% ~ +10%)						
	Rated Input Current, [A]		385	430	468	525	590	665	785
	Rated input frequency		50/60 Hz, ±5%						
	Power Capacity, [kVA]		250	280	355	396	445	500	565
Drive Output	Applicable Motor	[kW]	200	220	250	280	315	355	400
	Output Current ,[A]		377	426	465	520	585	650	725
	Default carrier frequency (kHz)		3	3	3	3	3	3	3
	Overload Capacity		150% for 60 Sec						
	Maximum output frequency		50 Hz to 500 Hz						
Braking Resistor	Recommended Power, [kW]		20	22	12.5 x 2	14 x 2	16 x 2	17 x 2	14 x 3
	Recommended Resistance, minimum [Ω]		2.5	2.5	2.5 x 2	2.5 x 2	2.5 x 2	2.5 x 2	2.5 x 3
Thermal design power (kW)			4.42	4.87	5.51	6.21	7.03	7.81	8.51
Enclosure			IP20						

(2): The dimensions are shown below.

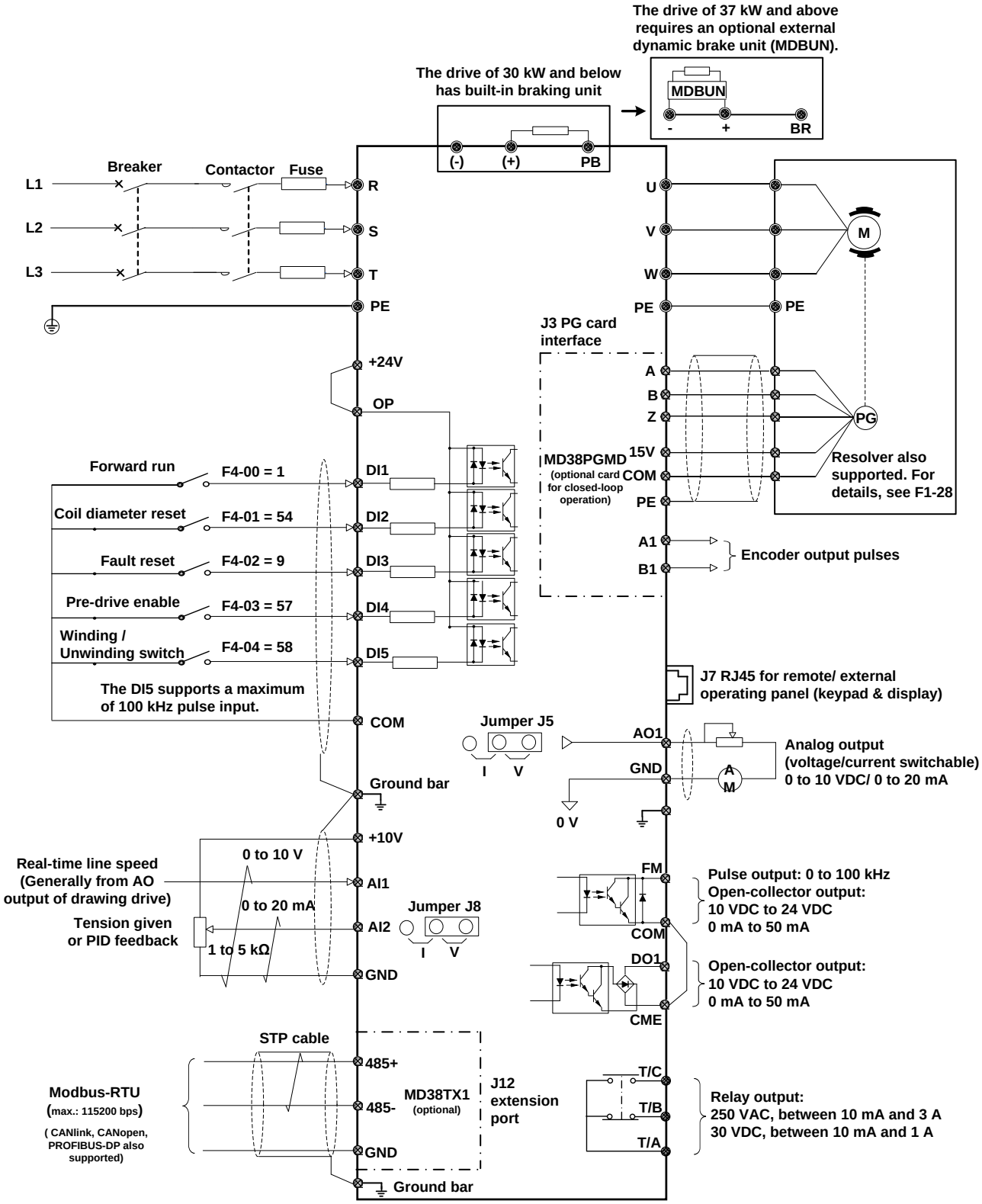


1.4 Environment

Altitude	Below 1000 m. 1% derating current per 100 m at 1000 m to 3000 m. Maximum 3000 m. For altitudes above 3000 m, contact Inovance regarding PELV.
Storage temperature	-25°C to +70°C
Operating temperature	-10°C to +40°C. 1.5% derating current per 1°C at 40°C to 50°C. Maximum 50°C.
Maximum humidity	≤ 95% RH, non-condensing
Vibration	≤ 0.6 g
Pollution degree	PD2
Overvoltage category	OVCIII
Power supply system	TT/TN
	IT
Enclosure	IP20

2 Wiring

2.1 Typical System Connection



2.2 Terminal Description

✓ **Terminals of Main Circuit**

Figure 2-1: Single phase AC drive main circuit terminal

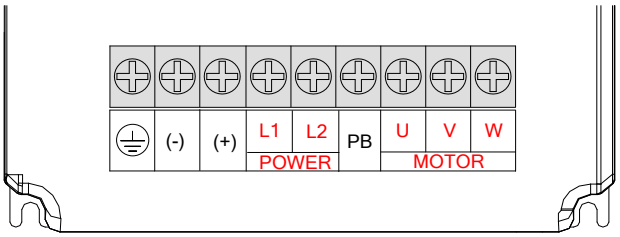


Table 2-1 Description of main circuit terminals of single-phase AC drive

Terminal	Name	Description
L1, L2	Single-phase power input terminals	Connect to the single-phase 220VAC power supply.
(+), (-)	Positive and negative terminals of DC bus	Common DC bus input point.
(+), PB	Terminals for connecting braking resistor	Connect to a braking resistor.
U, V, W	AC drive output terminals	Connect to a three-phase motor.
⏚	Grounding terminal	Must be grounded.

Figure 2-2: Single phase AC drive main circuit terminal

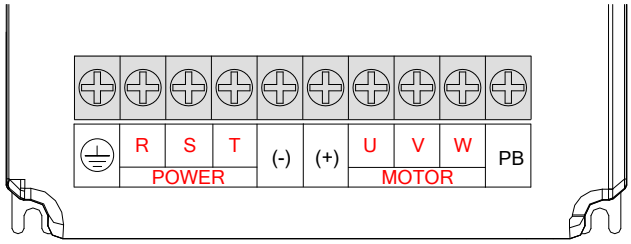
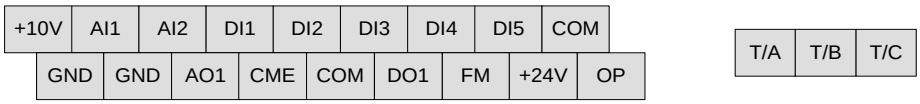


Table 2-2 Description of main circuit terminals of three-phase AC drive

Terminal	Terminal Name	Description
R, S, T	Three-phase power input terminals	Connect to the three-phase AC power supply.
(+), (-)	Positive and negative terminals of DC bus	Common DC bus input point.
(+), PB	Terminals for connecting braking resistor	Connected to external braking resistor for AC drive units.
U, V, W	AC drive output terminals	Connect to a three-phase motor.
⏚	Grounding terminal	Must be grounded.

✓ **Terminals of Main Control Board**

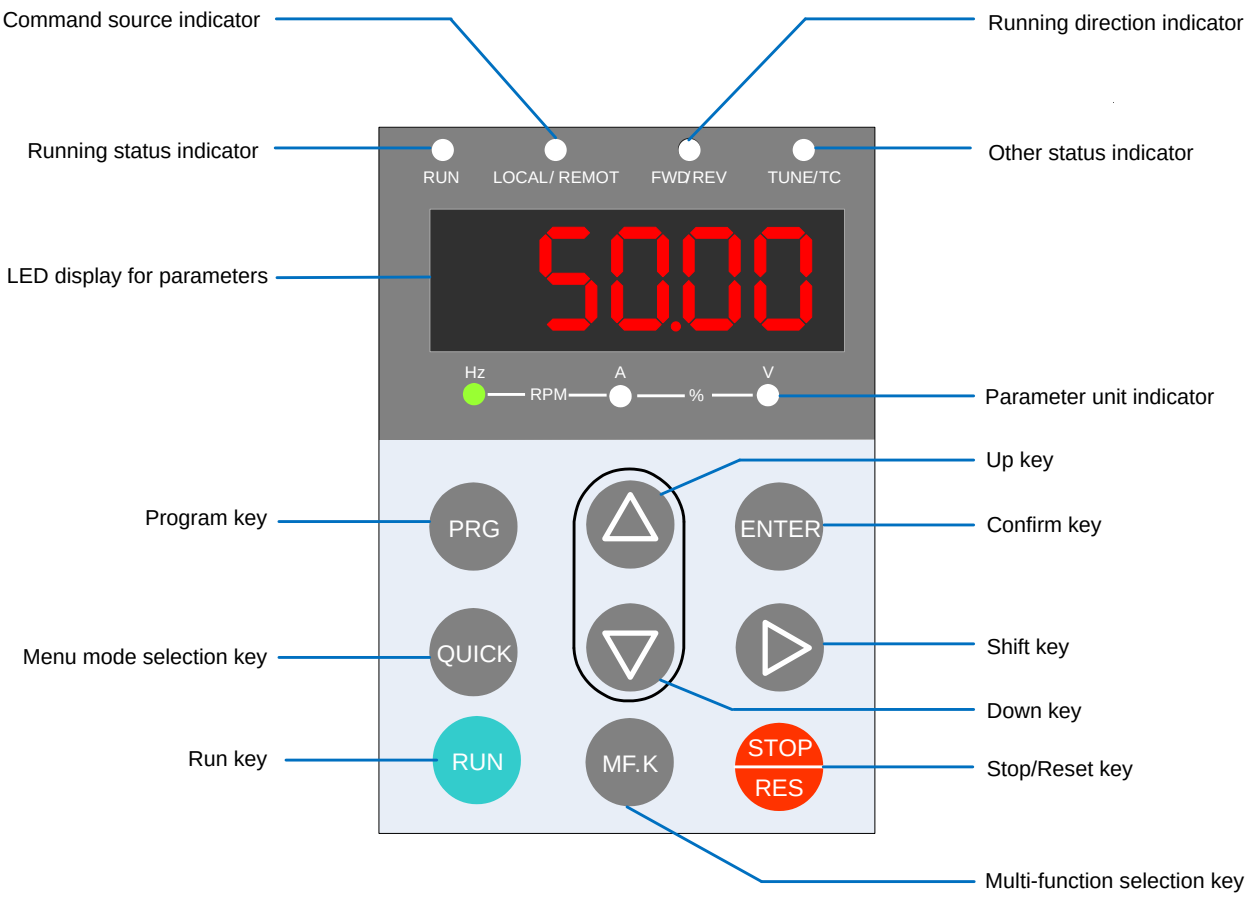


Terminal	Name	Description
+10V-GND	+10 VDC power supply	Provides +10V power supply to an external unit. Generally used to supply an external potentiometer of 1 to 5 kΩ. Maximum output current: 10 mA
+24V-COM	+24 VDC power supply	Provides +24V power supply to an external unit. Generally used to supply the DI/DO terminals and external sensors. Maximum output current: 170 mA.
OP	Input terminal for external power supply	Connected to +24 V by default. When DI1 to DI5 need to be driven by external signals, OP must be disconnected from + 24 V and connected to an external power supply.
AI1-GND	Analoginput1	Voltage range of inputs: 0 to 10 VDC; Input impedance: 22 kΩ
AI2-GND	Analoginput2	Either a voltage or a current input, determined by jumper J9; Input voltage range: 0 to 10 VDC Input current range: 0 to 20 mA; Input impedance: 22 kΩ (voltage input), 500 Ω(current input).
DI1-COM	Digital input 1	Optically-coupled isolation compatible with dual-polarity inputs Input impedance: 2.4 kΩ Voltage range for inputs: 9 to 30 V
DI2-COM	Digital input 2	
DI3-COM	Digital input 3	
DI4-COM	Digital input 4	
DI5-COM	High-speed pulse input	In addition to having the same features as DI1 to DI4, DI5 can also be used for high-speed pulse inputs. Maximum input frequency: 100 kHz Input impedance: 1.03 kΩ
AO1-GND	Analog output 1	Either a voltage or a current output, determined by jumper J5. Output voltage range: 0 to 10 V Output current range: 0 to 20 mA.
DO1-CME	Digital output 1	Optically-coupled isolation, dual-polarity open-collector output. Output voltage range: 0 to 24 V Output current range: 0 to 50 mA. Note that CME and COM are internally insulated, but are shorted externally by a jumper. In this case, DO1 is driven by +24 V by default. Remove the jumper link if you need to apply external power to DO1

Terminal	Name	Description
FM-COM	High-speed pulse output	Controlled by F5-00 (FM terminal output selection). Maximum output frequency: 100 kHz. When used as an open-collector output, the specification is the same as for DO1.
T/A-T/B	Normally closed terminal	Contact driving capacity: 250 VAC, 3 A, Cos f = 0.4, 30 VDC, 1 A. Applies to overvoltage Category II circuit
T/A-T/C	Normally open terminal	
Auxiliary interfaces	-	
J12	Extension card interface	28-core terminal Connect to an optional card (I/O extension card, PLC card and various bus cards)
J3	PG card interface	Support various types of PG cards: OC, differential, UVW and resolver
J7	External operation panel interface	Connect to external operation panel.

3 Operating Panel (Keypad & Display)

3.1 Built-in LED Operating Panel

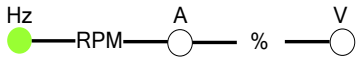
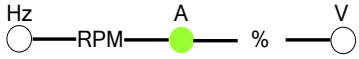
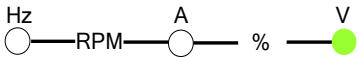
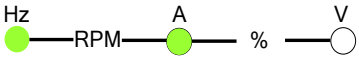
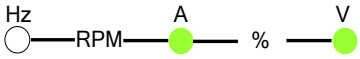


✓ **Status Indicators**

There are four red LED status indicators at the top of the operating panel.

Indicator	Indication
○ **RUN**	OFF indicates the STOP status.
	ON indicates the RUNNING status.
○ **LOCAL/REMOT**	OFF indicates under operating panel control.
	ON indicates under terminal control.
	FLASHING indicates under serial communication control.
○ **FWD/REV**	ON indicates reverse motor rotation.
	OFF indicates forward motor rotation.
○ **TUNE/TC**	ON indicates torque control mode.
	FLASHING SLOWLY (once a second) indicates auto-tuning status.
	FLASHING QUICKLY (four times a second) indicates a fault condition.

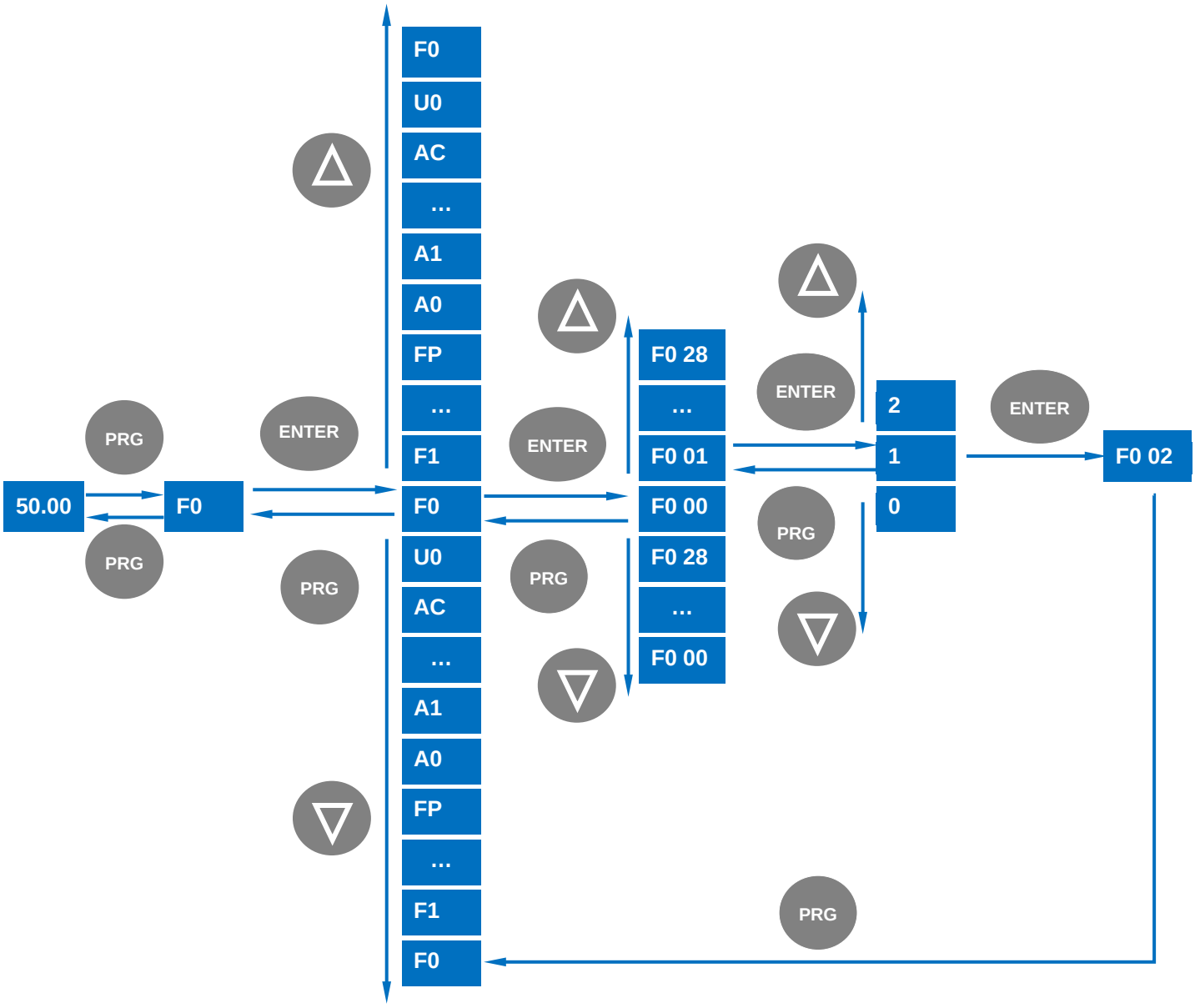
✓ **Parameter unit indicator**

Indicator Appearance	Meaning
	Hz for frequency
	A for current
	V for voltage
	RPM for motor speed
	Percentage

✓ **Keys on Operating Panel**

Key	Key Name	Function
	Program	• Enter or exit Level I menu. • Return to the previous menu.
	Confirm	• Enter each level of menu interface. • Confirm displayed parameter setting.
	Up	• When navigating a menu, it moves the selection up through the screens available. • When editing a parameter value,it increases the displayed value. • When the AC drive is in RUN mode,it increases the speed.
	Down	• When navigating a menu, it moves the selection down through the screens available. • When editing a parameter value,it decreases the displayed value. • When the AC drive is in RUN mode,it decreases the speed.
	Shift	• Select the displayed parameters in turn in the stop or running state. • select the digit to be modified when modifying parameters.
	RUN	• Start the AC drive in the operation panel control mode.
	Stop/Reset	• Stop the AC drive when the drive is in the RUNNING status. • Perform a reset operation when the drive is in the FAULT status. Note: The functions of this key can be restricted by using function F7-
	Multifunction	Performafunctionswitchoverasdefinedbythesettingof F7-01,for example to quickly switch command source or direction.
	Menu mode selection	Press it to switchover between menu modes as defined by the setting of FP-03.

✓ **Operations of Parameters**

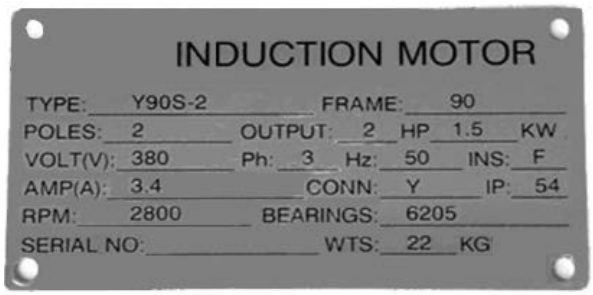


✓ **Parameter arrangement**

Parameter Group	Description	Remark
F0 to FF	Standard parameter group	Standard function parameters
A0 to AC	Advanced parameter group	AI/AO correction
U0 to U3	RUNNING status parameter group	Display of basic parameters

4 Quick Setup

4.1 Setup Flowchart

START	Para. No.	Parameter Name	Default	Commissioning
Before power on				
Installation and wiring		Correctly make wiring and carefully check to ensure that there is not short circuited in main circuit or control circuit.		
Restore parameters	**FP-01**	Parameter initialization	0	1
		0: No operation 01: Restore factory parameters except motor parameters 02: Clear records 04: Backup current user parameters 501: Restore user backup parameters NOTE: It is recommended to "Restore default settings" prior to commissioning the AC drive.		
Set motor parameters		Motor Nameplate		
				
	F1-01	Rated motor power	model dependent	1.5
		Unit: kW		
	F1-02	Rated motor voltage	model dependent	380
		Unit: V		
	F1-03	Rated motor current	model dependent	3.4
		Unit: A		
	F1-04	Rated motor frequency	model dependent	50
		Unit: Hz		
	F1-05	Rated motor speed	model dependent	2800
		Unit: RPM		

If an encoder is used

Set encoder parameters	**F1-27**	Encoder pulses per revolution	1024	
		1 to 65535 PPR		
	F1-28	Encoder type	0	
		0: ABZ incremental encoder 2: Resolver		
	F1-30	A/B phase sequence of ABZ incremental encoder	0	
		0: Forward 1: Reserve		
	F1-31	Encoder installation angle	0.0	
		0.0°to 359.9°		
	F1-34	Number of pole pairs of resolver	1	
		1 to 65535		
Perform motor auto tuning	**F1-37**	Auto-tuning selection	0	3
		0: No auto-tuning 1: Static auto-tuning 1 2: Dynamic auto-tuning 3: Static auto-tuning 2 (new, identify all motor parameters) NOTE: Motor won't rotate at this stage. Steps of auto-tuning: 1. Make sure the UVW connection between AC drive and motor is not cut off by output contactor; if it is cut off, then manually handle with the output contactor; 3. Set F1-37 = 1 or 3, press  , then LED on panel will display letters 'TUNE'; 4. Press the key  on panel, then motor starts auto-tuning, it usually takes about 30 seconds to finish this auto-tuning, wait until LED stops displaying 'TUNE'; 5. Restore F0-02 to the default value 1.		
Select command source	**F0-02**	Command source selection	1	
		0: Operating panel (keypad & display) (LED off) 1: Terminal I/O control (LED on) 2: Serial comms. (LED flashing)		
Select Control mode	**F0-01**	Control mode selection	0	
		0: SVC control 1: FVC control 2: V/F control		

Trial run motor to check if motor runs normally and in right direction	**F0-08**	Preset frequency	50.00	
	--	Remove reel and let motor shaft freely, set F0-08=10, 20, 50Hz to trial run motor, ensure that the motor runs normally (Especially when the motor with encoder) and in right direction (When in open-loop torque mode B0-00 = 1, the actual unwinding direction is reverse to this trial run direction) . If the direction is not right, we can set F0-09 to change motor direction.		
Set AI1 analog input linear corresponding relationship	**F4-13**	AI curve 1 minimum input	0.00	0.00
		0 V to F4-15;		
	F4-14	Corresponding percentage of AI1 minimum input	0.0	0.0
		-100.0% to 100.0%		
	F4-15	AI1 maximum input	10.00	
		F4-13 to 10.00 V		
	F4-16	Corresponding percentage of AI1 maximum input	100.0	
		-100.0% to 100.0%		
Set AI2 analog input linear corresponding relationship	**F4-18**	AI curve 2 minimum input	0.00	
		0V to F4-20		
	F4-19	Corresponding percentage of AI2 minimum input	0.0	
		-100.0% to 100.0%		
	F4-20	AI2 maximum input	10.00	
		F4-18 to 10.00 V		
	F4-21	Corresponding percentage of AI2 maximum input	100.0	
		-100.0% to 100.0%		
Set AI3 analog input linear corresponding relationship if it is used	**F4-23**	AI curve 3 minimum input	0.00	
		0 V to F4-20		
	F4-24	Corresponding minimum input percentage of AI3	0.0	
		-100.0% to 100.0%		
	F4-25	AI3 maximum input	10.0	
		F4-18 to 10.00 V		
	F4-26	Corresponding maximum input percentage of AI3	100.0	

Set DI function	**F4-00**	DI1 function selection	1	
		0: No function 1: Forward run (FWD) 2: Reverser run (REV) 3: Three-wire control 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Terminal UP 7: Terminal DOWN 8: Coast to stop 9: Fault reset (RESET) 10: RUN disabled 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Terminal 1 for acceleration/deceleration time selection 17: Terminal 2 for acceleration/deceleration time selection 18: Frequency reference setting channel switchover 19: UP and DOWN setting clear (terminal, operation panel) 20: Command source switchover 1 21: Acceleration/Deceleration prohibited 22: PID disabled 23: PLC state reset 24: Wobble disabled 25: Counter input 26: Counter reset 27: Length signal pulses count 28: Length reset 29: Torque control prohibited 30: Pulse input as frequency reference (valid only for DI5) 31: Reserved 32: Immediate DC injection braking 33: External fault NC input 34: Frequency modification enabled 35: PID operation direction reverse 36: External stop 1 37: Command source switchover 2 38: PID integral disabled 39: Switchover between main frequency reference and preset frequency 40: Switchover between auxiliary frequency reference and preset frequency 41: Motor selection 42: Reserved 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2		

		46: Speed control/Torque control 47: Emergency stop (ES) 48: External stop 2 49: Deceleration DC injection braking 50: Clear running time this time 51: Two-wire control/Three-wire control 52: Reverse running prohibited 53: Reserved 54: Winding diameter reset 55: Initial winding diameter selection terminal 1 56: Initial winding diameter selection terminal 2 57: Pre-drive input terminal 58: Winding & unwinding switchover 59: Winding diameter calculation stop 60: Tension control prohibited 61: Circle counting signal 62: Thickness selection terminal 1 63: Thickness selection terminal 2		
	F4-01	DI2 function selection	4	
		Setting range same as DI1		
	F4-02	DI3 function selection	9	
		Setting range same as DI1		
	F4-03	DI4 function selection	12	
		Setting range same as DI1		
	F4-04	DI5 function selection	13	
		setting range same as DI1		
	F4-05	DI6 function selection	0	
		Setting range same as DI1		
	F4-06	DI7 function selection	0	
		Setting range same as DI1		
	F4-07	DI8 function selection	0	
		Setting range same as DI1		
	F4-08	DI9 function selection	0	
		Setting range same as DI1		
	F4-09	DI10 function selection	0	
If any digital output is used		Setting range same as DI1		
Set DO function	**F5-00**	FM output mode selection	0	
		0: Pulse output (FMP), the frequency of which represents the value of variable which is assigned by F5-06 1: Digital output (FMR), the value of which represents the status of variable which is assigned by F5-01		
	F5-01	FM function selection	0	

	0: No output 1: AC Drive running 2: Fault output 3: Frequency-level detection FDT1 output 4: Frequency reached 5: Zero-speed running (no output at stop) 6: Motor overload pre-warning 7: AC drive overload pre-warning 8: Set count value reached 9: Designated count value reached 10: Length reached 11: PLC cycle completed 12: Accumulative running time reached 13: Frequency limited 14: Torque limited 15: Ready for RUN 16: Reserved 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage status output 20: Communication setting 21,22: Reserved 23: Zero-speed running 2 (having output at stop) 24: Accumulative power-on time reached 25: Frequency level detection FDT2 output 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing duration reached 31: AI1 input limit exceeded 32: Load lost 33: Reverse running 34: Zero current status 35: temperature reached 36:Software current limit exceeded 37: Frequency lower limit reached (having output at stop) 38: Alarm output 39: Motor overheat warning 40: Current running time reached 41: Fault output (no output at undervoltage)		
F5-02	Relay function selection (T/A-T/B-T/C)	2	
	Setting range same as FM;		
F5-03	Relay function selection (P/A-P/B-P/C)	0	
	Setting range same as FM; the relay P/A-P/B-P/C is on extension I/O card.		
F5-04	DO1 function selection	1	

		Setting range same as FM		
	F5-05	Extension card DO2 function selection	4	
		Setting range same as FM		
	F5-06	FM (pulse signal) function selection	0	
Set mechanical transmission ratio	B0-03	Mechanical transmission ratio	1.00	
		Set correctly according to actual value.		
Set line speed	B0-04	Linear speed setting channel	0	1
		0: No input 1: AI1 2: AI2 3: AI3 4: PULSE 5: Serial communication (1000H) 6: Digital setting (B0-05)		
	B0-05	Maximum speed	1000.0 m/min	
		0.0 to 6500.0 m/min		
Set relative parameters of coil diameter	B0-07	Winding diameter calculation method	0	0
		0: Calculated based on linear speed 1: Calculated based on accumulative thickness 2: AI1 3: AI2 4: AI3 5: Digital setting (B0-14) 6: Serial communication (1000H)		
	B0-08	Maximum winding diameter	500.0 mm	
		Set it according to actual value.		
	B0-09	Reel diameter	100.0 mm	
		Set it according to actual value;		
Select tension control mode	B0-00	Tension control mode selection	0	1 or 2
		0: Disabled 1: Open-loop tension torque control 2: Closed-loop tension speed control 3: Closed-loop tension torque control 4: Constant linear speed control		
Select curling mode	B0-01	Winding mode	0	
		0: Winding; 1: Unwinding;		

If adopting open-loop torque mode B0-00=1				
Set target tension	**B1-00**	Tension setting source	0	
		0: B1-01 1: AI1 2: AI2 3: AI3 4: PULSE 5: Serial communication (1000H)		
	B1-01	Tension digital setting	50 N	
		0 to 65000 N		
	B1-02	Maximum tension	200 N	
If adopting closed-loop speed/torque mode B0-00=2/3		0 to 65000 N. When B1-00 ≠ 0, the corresponding maximum tension of tension setting source;		
Set PID	**FA-00**	PID given source	0	
		0: FA-01 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference (1000H) 6: Multi-reference		
	FA-01	PID digital setting	50.0%	
		0.0% to 100.0% Generally 50% is corresponding to the balance position of swing rod and dancing roller..		
	FA-02	PID feedback source	0	1
		0: AI1 1: AI2 2: AI3 3: AI1-AI2 4: Pulse reference (DI5) 5: Communication reference (1000H) 6: AI1+AI2 7: MAX (|AI1|, |AI2|) 8: MIN (|AI1|, |AI2|)		
If adopting constant linear speed control mode B0-00=4				
Set target linear speed	**B0-41**	Constant linear speed setting source	0	
		0: AI1 1: AI2 2: AI3 3: PULSE 4: Serial communication (1000H)		
Finish				

5 Parameter Table

5.1 Introduction

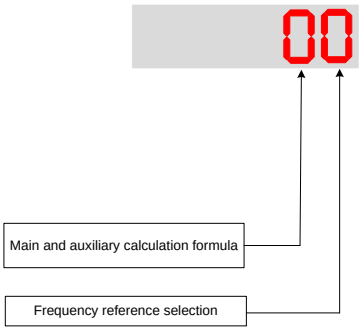
Group F and Group A are standard function parameters. Group U includes the monitoring function parameters and extension card communication parameters.

The parameter description tables in this chapter use the following symbols. The symbols in the parameter table are described as follows:

Symbol	Meaning
☆	The parameter can be modified when the AC drive is in either stop or running state.
★	The parameter cannot be modified when the AC drive is in the running state.
●	The parameter is the actually measured value and cannot be modified.
*	The parameter is a factory parameter and can be set only by the manufacturer.

5.2 Standard Function Parameters

Parameter No.	Parameter Name	Setting Range	Default	Property
Group F0: Standard Parameters				
F0-00	G/P type display	1: G type 2: P type	1	●
F0-01	Motor1controlmode	0: SVC control 1: FVC control 2: V/F control	0	★
F0-02	Command source selection	0: Operating panel (keypad & display) (LED off) 1: Terminal I/O control (LED on) 2: Serial comms. (LED flashing)	0	☆
F0-03	Main frequency reference setting channel selection	0: Digital setting (non-retentive at power down) 1: Digital setting (retentive at power down) 2: AI1 3: AI2 4: AI3 5: Pulse reference 6: Multi-reference 7: Simple PLC 8: PID reference 9: Serial comms.	0	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F0-04	Auxiliary frequency reference setting channel selection	0: Digital setting (non-retentive at power down) 1: Digital setting (retentive at power down) 2: AI1 3: AI2 4: AI3 5: Pulse reference 6: Multi-reference 7: Simple PLC 8: PID reference 9: Serial comms.	0	★
F0-05	Base value of range of auxiliary frequency reference for main and auxiliary calculation	0: Relative to maximum output frequency 1: Relative to main frequency reference	0	☆
F0-06	Range of auxiliary frequency reference for main and auxiliary calculation	0% to 150%	100%	☆
F0-07	Final frequency reference setting selection	 Unit's position: Frequency reference selection 0: Main frequency reference 1: Main and auxiliary calculation (based on ten's position) 2: Switchover between main and auxiliary 3: Switchover between main and "main & auxiliary calculation" 4: Switchover between auxiliary and "main & auxiliary calculation" Ten's position: Main and auxiliary calculation formula 0: Main + auxiliary 1: Main – auxiliary 2: Maximum (main, auxiliary) 3: Minimum (main, auxiliary)	00	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F0-08	Preset frequency	0.00 to maximum output frequency (F0-10)	50.00 Hz	☆
F0-09	Running direction	0: Run in the default direction 1: Run in the direction reverse to the default direction	0	☆
Set this parameter (F0-09) correctly to ensure the running direction of the motor satisfies winding/unwinding. Method to determine running direction: Disable tension control (B0-00 = 0). The motor runs in speed control mode, and it is normal if the running direction of the motor is the same as the winding direction (reverse to unwinding direction). If not, change the setting of F0-09. Note: Set this parameter correctly by judging the running direction for the first time use. At winding/unwinding switchover, directly change the setting of B0-01 or change the status of the DI (58: winding & unwinding switchover). In this case, you need not change the setting of F0-09 to avoid conflict.				
F0-10	Maximum output frequency	50.00 to 500.00 Hz	50.00 Hz	★
F0-11	Setting channel of frequency upper limit	0: Set by F0-12 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference	0	★
F0-12	Frequency reference upper limit	F0-14 to F0-10	50.00 Hz	☆
F0-13	Frequency reference upper limit offset	0.00 Hz to maximum output frequency (F0-10)	0.00 Hz	☆
F0-14	Frequency reference lower limit	0.00 Hz to frequency upper limit (F0-12)	0.00 Hz	☆
F0-15	Carrier frequency	Model dependent	Model dependent	☆
F0-16	Carrier frequency adjusted with temperature	0: Disabled 1: Enabled	1	☆
F0-17	Acceleration time1	0.00s to 650.00s (F0-19 = 2) 0.0s to 6500.0s (F0-19 = 1) 0s to 65000s (F0-19 = 0)	Model dependent	☆
F0-18	Deceleration time1	0.00s to 650.00s (F0-19 = 2) 0.0s to 6500.0s (F0-19 = 1) 0s to 65000s (F0-19 = 0)	Model dependent	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F0-19	Acceleration/deceleration time unit	0: 1s 1: 0.1s 2: 0.01s	1	★
F0-25	Acceleration/deceleration time base frequency	0: Maximum output frequency (F0-10) 1: Frequency reference 2: 100 Hz	0	★
F0-28	Serial port comms. protocol	0: Modbus protocol 1: Profibus-DP protocol or CANopen protocol	0	★
Group F1: Motor 1 Parameters				
F1-00	Motor type selection	0: Common asynchronous motor 1: Variable frequency asynchronous motor	0	★
F1-01	Rated motor power	0.1 to 1000.0 kW	Model dependent	★
F1-02	Rated motor voltage	1 to 2000 V	Model dependent	★
F1-03	Rated motor current	0.01 to 655.35 A (AC drive power ≤ 55 kW) 0.1 to 6553.5 A (AC drive power > 55 kW)	Model dependent	★
F1-04	Rated motor frequency	0.01 Hz to maximum output frequency	Model dependent	★
F1-05	Rated motor speed	1 to 65535 rpm	Model dependent	★
F1-06	Stator resistance	0.001 to 65.535 Ω (AC drive power ≤ 55 kW) 0.0001 to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-07	Rotor resistance	0.001 to 65.535 Ω (AC drive power ≤ 55 kW) 0.0001 to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-08	Leakage inductive reactance	0.01 to 655.35 mH (AC drive power ≤ 55 kW) 0.001 to 65.535 mH (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-09	Mutual inductive reactance	0.1 to 6553.5 mH (AC drive power ≤ 55 kW) 0.01 to 655.35 mH (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-10	No-load current	0.01 A to F1-03 (AC drive power ≤ 55kW) 0.1 A to F1-03 (AC drive power > 55kW)	Auto-tuning dependent	★
F1-27	Encoder pulses per revolution	1 to 65535	1024	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F1-28	Encoder type	0: ABZ incremental encoder 2: Resolver	0	★
F1-30	A/B phase sequence of ABZ incremental encoder	0: Forward 1: Reserve	0	★
F1-34	Number of pole pairs of resolver	1 to 65535	1	★
F1-36	Encoder wire-break fault detection time	0.0s: No detection 0.1s to 10.0s	0.0s	★
F1-37	Motor auto-tuning method selection	0: No auto-tuning 1: Static auto-tuning 1 2: Dynamic auto-tuning 3: Static auto-tuning 2	0	★
Group F2: Vector Control Parameters				
F2-00	Speed loop proportional gain 1	1 to 100	30	☆
F2-01	Speed loop integral time 1	0.01s to 10.00s	0.50s	☆
F2-02	Switchover frequency 1	0.00 to F2-05	5.00 Hz	☆
F2-03	Speed loop proportional gain 2	1 to 100	20	☆
F2-04	Speed loop integral time 2	0.01s to 10.00s	1.00s	☆
F2-05	Switchover frequency 2	F2-02 to maximum output frequency	10.00 Hz	☆
F2-06	SVC/FVC slip compensation gain	50% to 200%	100%	☆
F2-07	SVC torque filter time constant	1 to 31	28	☆
F2-09	Torque limit source in speed control	0: F2-10 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Serial comms. 6: Minimum (AI1, AI2) 7: Maximum (AI1, AI2)	0	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F2-10	Digital setting of torque limit in speed control	0.0% to 200.0%	150.0%	☆
F2-13	Excitation adjustment proportional gain	0 to 60000	2000	☆
F2-14	Excitation adjustment integral gain	0 to 60000	1300	☆
F2-15	Torque adjustment proportional gain	0 to 60000	2000	☆
F2-16	Torque adjustment integral gain	0 to 60000	1300	☆
F2-17	Speed loop integral separation selection	0: Disabled 1: Enabled	0	☆
F2-21	Maximum torque coefficient of field weakening area	50% to 200%	100%	☆
F2-22	Regenerative power limit selection	0: Disabled 1: Enabled in the whole process 2: Enabled at constant speed 3: Enabled during deceleration	0	☆
F2-23	Regenerative power limit	0.0% to 200.0%	Model dependent	☆
Group F3: V/F Control Parameters				
F3-00	V/F curve setting	0: Linear V/F 1: Multi-point V/F 2: Square V/F 3: 1.2-power V/F 4: 1.4-power V/F 6: 1.6-power V/F 8: 1.8-power V/F 9: Reserved 10: V/F complete separation 11: V/F half separation	0	★
F3-01	Torque boost	0.0%: fixed torque boost 0.1% to 30%	Model dependent	☆
F3-02	Cut-off frequency of torque boost	0.00 Hz to maximum output frequency	50.00 Hz	★
F3-10	V/F over-excitation gain	0 to 200	64	☆

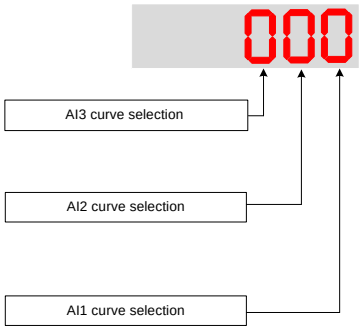
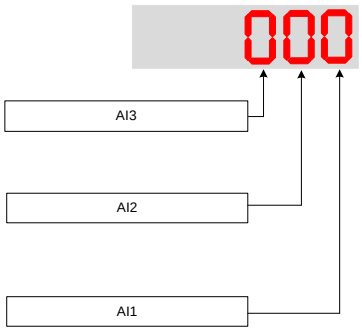
Parameter No.	Parameter Name	Setting Range	Default	Property
F3-11	V/F oscillation suppression gain	0 to 100	40	☆
F3-18	Current limit level	50% to 200%	150%	★
F3-19	Current limit selection	0: Disabled 1: Enabled	1	★
F3-20	Current limit gain	0 to 100	20	☆
F3-21	Compensation factor of speed multiplying current limit level	50% to 200%	50%	★
F3-22	Voltage limit	650 to 800 V	220 V: 380 V 380 V: 760 V	★
F3-23	Voltage limit selection	0: Disabled 1: Enabled	1	★
F3-24	Frequency gain for voltage limit	0 to 100	30	☆
F3-25	Voltage gain for voltage limit	0 to 100	30	☆
F3-26	Frequency rise threshold during voltage limit	0 to 50 Hz	5 Hz	★
F3-27	Slip compensation time constant	0.1 to 10s	0.5	☆
Group F4: Input Terminals				
F4-00	DI1 function selection	0: No function 1: Forward run (FWD) 2: Reverser run (REV) 3: Three-wire control 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Terminal UP 7: Terminal DOWN 8: Coast to stop 9: Fault reset (RESET) 10: RUN disabled	1	★
F4-01	DI2 function selection		4	★
F4-02	DI3 function selection		9	★
F4-03	DI4 function selection		12	★
F4-04	DI5 function selection		13	★
F4-05	DI6 function selection		0	★

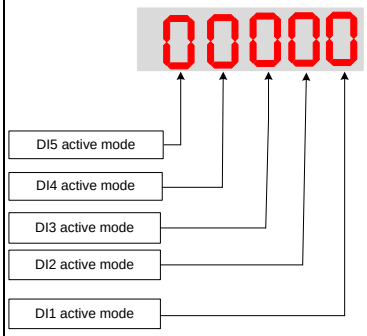
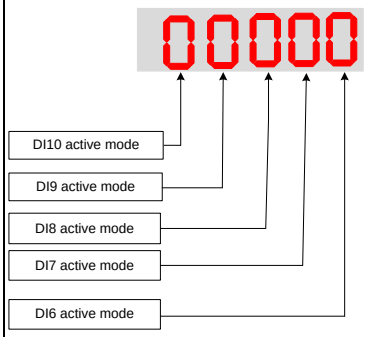
Parameter No.	Parameter Name	Setting Range	Default	Property
F4-06	DI7 function selection	11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Terminal 1 for acceleration/deceleration time selection 17: Terminal 2 for acceleration/deceleration time selection 18: Frequency reference setting channel switchover 19: UP and DOWN setting clear (terminal, operation panel) 20: Command source switchover 1 21: Acceleration/Deceleration prohibited 22: PID disabled 23: PLC state reset 24: Wobble disabled 25: Counter input 26: Counter reset 27: Length signal pulses count 28: Length reset 29: Torque control prohibited 30: Pulse input as frequency reference (valid only for DI5) 31: Reserved 32: Immediate DC injection braking 33: External fault NC input 34: Frequency modification enabled 35: PID operation direction reverse	0	★
F4-07	DI8 function selection		0	★
F4-08	DI9 function selection		0	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F4-09	DI10 function selection	36: External stop 1 37: Command source switchover 2 38: PID integral disabled 39: Switchover between main frequency reference and preset frequency 40: Switchover between auxiliary frequency reference and preset frequency 41: Motor selection 42: Reserved 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control 47: Emergency stop (ES) 48: External stop 2 49: Deceleration DC injection braking 50: Clear running time this time 51: Two-wire control/Three-wire control 52: Reverse running prohibited 53: Reserved 54: Winding diameter reset 55: Initial winding diameter selection terminal 1 56: Initial winding diameter selection terminal 2 57: Pre-drive input terminal 58: Winding & unwinding switchover 59: Winding diameter calculation stop 60: Tension control prohibited 61: Circle counting signal 62: Thickness selection terminal 1 63: Thickness selection terminal 2	0	★

Parameter No.	Parameter Name	Setting Range	Default	Property
DI function: DI function greatly facilitates the realization of tension control and operation. Users have a variety of function choices by setting the DI functions. Description of DI function 54 to DI function 63: 1) DI function 54: Winding diameter reset Winding diameter reset is a necessary step to realize tension control upon roll replacing. It ensures accurate instantaneous winding diameter upon start after roll replacing, normal start of the system as well as proper material tension. 2) DI function 55/56: Initial winding diameter selection terminal 1/2 Users can switch over the initial winding diameter selection based on different winding shaft or material. Refer to parameter B0-10 (initial winding diameter source) for detailed information. 3) DI function 57: Pre-drive input terminal The AC drive switches over to pre-drive speed mode when this function is active. Deactivate this function to resume tension control after roll replacing is completed. 4) DI function 58: Winding & unwinding switchover User can perform winding/unwinding switchover conveniently without modifying the function parameter. Refer to parameter B0-01 (selection of winding or unwinding) for detailed information. 5) DI function 59: Winding diameter calculation stop The winding diameter calculation will be stopped when this function is active. 6) DI function 60: Tension control prohibited The tension control will be prohibited when this function is active. The MD330H AC drive will become general AC drive (frequency source and torque source will be effective). 6) DI function 61: Circle counting signal Select this function and input the circle counting signal from the DI terminal when winding diameter is calculated via thickness accumulation. 7) DI function 62/63: Thickness selection terminal 1/2 Users can switch over the thickness selection based on different material thickness. Refer to parameter B0-31 (material thickness setting source) for detailed information.				
F4-10	DI filter time	0.000s to 1.000s	0.010s	☆
F4-11	Terminal I/O control mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0	★
F4-12	Terminal UP/DOWN rate	0.001 to 65.535 Hz/s	1.000 Hz/s	☆
F4-13	AI curve 1 minimum input	0.00 V to F4-15	0.00 V	☆
F4-14	Corresponding percentage of AI curve 1 minimum input	-100.00% to 100.0%	0.0%	☆
F4-15	AI curve 1 maximum input	F4-13 to 10.00 V	10.00 V	☆
F4-16	Corresponding percentage of AI curve 1 maximum input	-100.00% to 100.0%	100.0%	☆

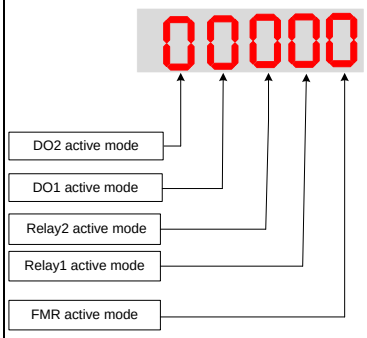
Parameter No.	Parameter Name	Setting Range	Default	Property
F4-17	AI1 filter time	0.00s to 10.00s	0.10s	☆
F4-18	AI curve 2 minimum input	0.00 V to F4-20	0.00 V	☆
F4-19	Corresponding percentage of AI curve 2 minimum input	-100.00% to 100.0%	0.0%	☆
F4-20	AI curve 2 maximum input	F4-18 to 10.00 V	10.00 V	☆
F4-21	Corresponding percentage of AI curve 2 maximum input	-100.00% to 100.0%	100.0%	☆
F4-22	AI2 filter time	0.00s to 10.00s	0.10s	☆
F4-23	AI3 curve minimum input	-10.00 V to F4-25	0.00 V	☆
F4-24	Corresponding percentage of AI curve 3 minimum input	-100.00% to 100.0%	0.0%	☆
F4-25	AI curve 3 maximum input	F4-23 to 10.00 V	10.00 V	☆
F4-26	Corresponding percentage of AI curve 3 maximum input	-100.00% to 100.0%	100.0%	☆
F4-27	AI3 filter time	0.00s to 10.00s	0.10s	☆
F4-28	Pulse minimum input	0.00 kHz to F4-30	0.00 kHz	☆
F4-29	Corresponding percentage of pulse minimum input	-100.00% to 100.0%	0.0%	☆
F4-30	Pulse maximum input	F4-28 to 100.00 kHz	50.00 kHz	☆
F4-31	Corresponding percentage of pulse maximum input	-100.00% to 100.0%	100.0%	
F4-32	Pulse filter time	0.00s to 10.00s	0.10s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F4-33	AI curve selection	Curve 1 (2 points, see F 4-13 t o F4-16) Curve 2 (2 points, see F 4-18 to F4-21) Curve 3 (2 points, see F 4-23 to F4-23) Curve 4 (4 points, see A6-00 to A6-07) Curve 5 (4 points, see A6-08 to A6-15)  Unit's position: AI1 curve selection Ten's position: AI2 curve selection Hundred's position: AI3 curve selection	321	☆
F4-34	Setting selection when AI less than minimum input	000 to 111 0: Corresponding percentage of minimum input 1: 0.0%  Unit's position: AI1 Ten's position: AI2 Hundred's position: AI3	000	☆
F4-35	DI1 delay	0.0s to 3600.0s	0.0s	☆
F4-36	DI2 delay	0.0s to 3600.0s	0.0s	★
F4-37	DI3 delay	0.0s to 3600.0s	0.0s	★

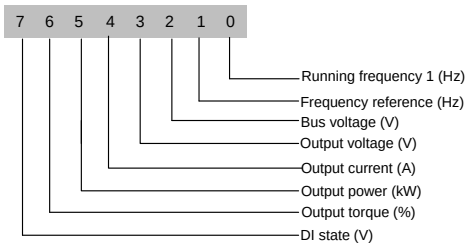
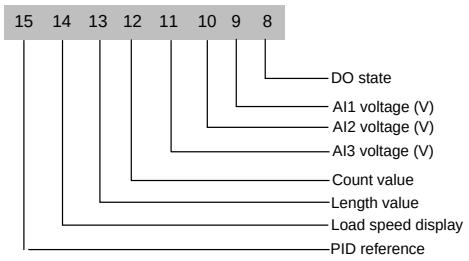
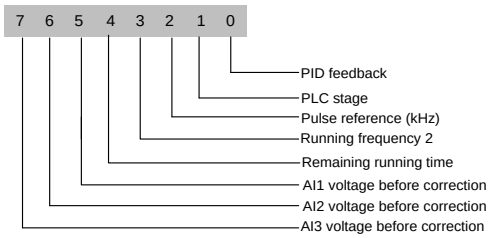
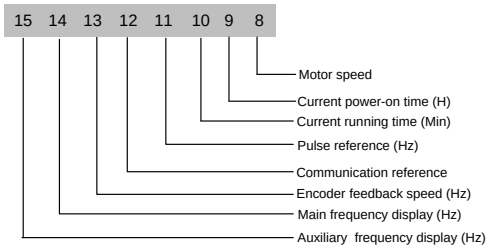
Parameter No.	Parameter Name	Setting Range	Default	Property
F4-38	DI active mode selection 1	0: High level active 1: Low level active  Unit's position: DI1 active mode Ten's position: DI2 active mode Hundred's position: DI3 active mode Thousand's position: DI4 active mode Ten thousand's position: DI5 active mode	00000	★
F4-39	DI active mode selection 2	0: High level active 1: Low level active  Unit's position: DI6 active mode Ten's position: DI7 active mode Hundred's position: DI8 active mode Thousand's position: DI9 active mode Ten thousand's position: DI10 active mode	00000	★
Group F5: Output Terminals				
F5-00	FM terminal output mode	0: Pulse output (FMP) 1: Digital output (FMR)	0	☆
F5-01	FMR function selection	0: No output 1: AC drive running 2: Fault output	0	☆
F5-02	Relay (T/A-T/B-T/C) function selection		2	☆

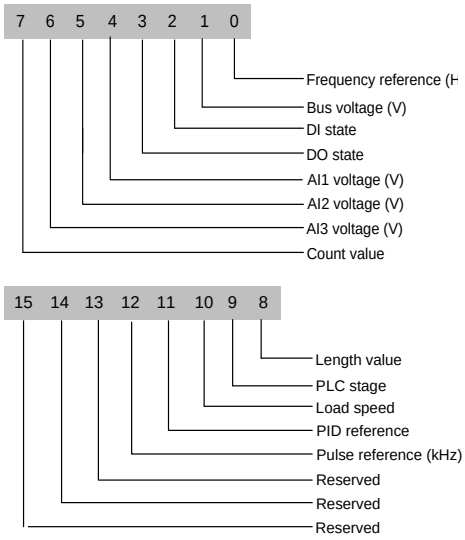
Parameter No.	Parameter Name	Setting Range	Default	Property
F5-03	Extension card relay (P/A-P/B-P/C) function selection	3: Frequency level detection 1 output 4: Frequency reached 5: Zero-speed running (no output at stop) 6: Motor overload pending 7: AC drive overload pending 8: Set count value reached 9: Designated count value reached 10: Length reached 11: PLC cycle completed 12: Accumulative running time reached 13: Frequency limited 14: Torque limited 15: Ready for RUN 16: AI1 > AI2 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage 20: Communication setting 21: Reserved 22: Reserved 23: Zero-speed running 2 (having output at stop) 24: Accumulative power-on time reached 25: Frequency level detection 2 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing reached 31: AI1 input exceeding limit 32: Load lost 33: Reverse running 34: Zero current 35: IGBT temperature reached 36: Output current exceeding limit 37: Frequency lower limit reached (having output at stop) 38: Alarm output 39: Motor overheat pending 40: Current running time reached 41: Fault output	0	☆
F5-04	DO1 function selection		1	☆
F5-05	Extension card DO2 function selection		4	☆
F5-06	FMP function selection	0: Running frequency 1: Frequency reference 2: Output current	0	☆
F5-07	AO1 function selection		0	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F5-08	AO2 function selection	3: Output torque (absolute value) 4: Output power 5: Output voltage 6: Pulse input 7: AI1 8: AI2 9: AI3 10: Length 11: Counting value 12: Communication reference 13: Motor speed 14: Output current 15: Output voltage 16: Output torque (actual value) 18: External taper output 19: Winding diameter output 20: Tension output	1	☆
AO/FMP function: In addition to AC drive, PLC or external actuator also affects the realization of tension control. Users have more tension control methods by using the tension control related variables output by the AC drive. Description of AO/FMP function 18 and 19: 1) AO/FMP function 18: External taper output Select this function to output taper to realize tension taper control when the material tension is determined by external actuator. 2) AO/FMP function 19: Winding diameter output Select this function to output winding diameter calculated by AC drive for external devices.				
F5-09	Maximum FMP output frequency	0.01to100.00 kHz	50.00 kHz	☆
F5-10	AO1 zero offset coefficient	-100.0% to 100.0%	0.0%	☆
F5-11	AO1 gain	-10.00 to 10.00	1.00	☆
F5-12	AO2 zero offset coefficient	-100.0% to 100.0%	0.00%	☆
F5-13	AO2 gain	-10.00 to 10.00	1.00	☆
F5-17	FMR output delay	0.0s to 3600.0s	0.0s	☆
F5-18	Relay1 output delay	0.0s to 3600.0s	0.0s	☆
F5-19	Relay2 output delay	0.0s to 3600.0s	0.0s	☆
F5-20	DO1 output delay	0.0s to 3600.0s	0.0s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F5-21	DO2 output delay	0.0s to 3600.0s	0.0s	☆
F5-22	DI active mode selection 1	0: Positive logic active 1: Negative logic active  Unit's position: FMR active mode Ten's position: Relay1 active mode Hundred's position: Relay2 active mode Thousand's position: DO1 active mode Ten thousand's position: DO2 active mode	00000	☆
F5-23	AO1 output signal selection	0: Voltage signal 1: Current signal	0	★
Group F6: Start/Stop Control				
F6-00	Start mode	0: Direct start 1: Catching a spinning motor 2: Pre-excited start	0	☆
F6-01	Mode of catching a spinning motor	0: From stop frequency 1: From zero speed 2: From maximum output frequency	0	★
F6-02	Speed of catching a spinning motor	1 to 100	20	☆
F6-03	Start frequency	0.00 to10.00 Hz	0.00 Hz	☆
F6-04	Start frequency holding time	0.0s to 100.0s	0.0s	★
F6-05	DC injection braking 1 level/pre-excitation level	0% to 100%	50%	★
F6-06	DC injection braking 1 active time/pre-excitation active time	0.0s to 100.0s	0.0s	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F6-07	Acceleration/deceleration mode	0: Linear acceleration/deceleration 1: Static S-curve acceleration/deceleration	0	★
F6-08	Time proportion of S-curve start segment	0.0% to (100.0%-F6-09)	30.0%	★
F6-09	Time proportion of S-curve end segment	0.0% to (100.0%-F6-08)	30.0%	★
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0	☆
F6-11	DC injection braking 2 start frequency	0.00 Hz to maximum output frequency	0.00 Hz	☆
F6-12	DC injection braking 2 delay time	0.0 to 100.0s	0.0s	☆
F6-13	DC injection braking 2 level	0% to 100%	50%	☆
F6-14	DC injection braking 2 active time	0.0s to 100.0s	0.0s	☆
F6-15	Braking use ratio	0% to 100%	100%	☆
F6-18	Catching a spinning motor current limit	30% to 200%	Model dependent	★
F6-21	Demagnetization time (effective for SVC)	0.00s to 5.00s	Model dependent	☆
Group F7: Keypad Operation and LED Display				
F7-01	MF.K key function selection	0: MF.K key disabled 1: Switchover from remote control (terminal or communication) to keypad control 2: Switchover between forward rotation and reverse rotation 3: Forward jog 4: Reverse jog	0	★
F7-02	STOP/RESET key function	0: STOP/RESET key enabled only in keypad control 1: STOP/RESET key enabled in any operation mode	1	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F7-03	LED display running parameters 1	0000 to FFFF   If a parameter needs to be displayed during running, set corresponding bit to 1, and set F7-03 to hexadecimal equivalent.	1F	☆
F7-04	LED display running parameters 2	0000 to FFFF   If a parameter needs to be displayed during running, set corresponding bit to 1, and set F7-04 to hexadecimal equivalent.	0	☆

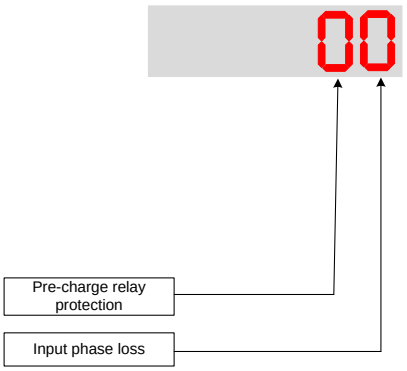
Parameter No.	Parameter Name	Setting Range	Default	Property
F7-05	LED display stop parameters	0000 to FFFF  If a parameter needs to be displayed during running, set corresponding bit to 1, and set F7-05 to hexadecimal equivalent.	33	☆
F7-06	Load speed display coefficient	0.0001 to 6.5000	1.0000	☆
F7-07	Heatsink temperature of AC drive IGBT	0.0 to 100.0°C	-	●
F7-08	Product SN	-	-	●
F7-09	Accumulative running time	0 to 65535h	-	●
F7-10	Performance software version	-	-	●
F7-11	Function software version	-	-	●
F7-12	Number of decimal places for load speed display	10 to 23	21	☆
F7-13	Accumulative power-on time	0 to 65535h	-	●
F7-14	Accumulative power consumption	0 to 65535kWh	0 kWh	●
Group F8: Auxiliary Functions				
F8-00	Jog running frequency	0.00 Hz to maximum output frequency	2.00 Hz	☆
F8-01	Jog acceleration time	0.0 to 6500.0s	20.0s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F8-02	Jog deceleration time	0.0 to 6500.0s	20.0s	☆
F8-03	Acceleration time 2	0.0 to 6500.0s	Model dependent	☆
F8-04	Deceleration time 2	0.0 to 6500.0s	Model dependent	☆
F8-05	Acceleration time 3	0.0 to 6500.0s	Model dependent	☆
F8-06	Deceleration time 3	0.0 to 6500.0s	Model dependent	☆
F8-07	Acceleration time 4	0.0 to 500.0s	Model dependent	☆
F8-08	Deceleration time 4	0.0 to 6500.0s	Model dependent	☆
F8-09	Frequency jump 1	0.00 Hz to maximum output frequency	0.00 Hz	☆
F8-10	Frequency jump 2	0.00 Hz to maximum output frequency	0.00 Hz	☆
F8-11	Frequency jump band	0.00 Hz to maximum output frequency	0.00 Hz	☆
F8-12	Forward/Reverse rotation dead-zone time	0.0 to 3000.0s	0.0s	☆
F8-13	Reverse control	0: Enabled 1: Disabled	0	☆
F8-14	Running mode when frequency reference lower than frequency lower limit	0: Run at frequency lower limit 1: Stop 2: Run at zero speed	0	☆
F8-15	Droop control	0.00 to 10.00	0.00	☆
F8-16	Accumulative power-on time threshold	0 to 65000 h	0 h	☆
F8-17	Accumulative running time threshold	0 to 65000 h	0 h	☆
F8-18	Startup protection	0: Disabled 1: Enabled	0	☆
F8-19	Frequency detection value (FDT1)	0.00 Hz to maximum output frequency	50.00 Hz	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F8-20	Frequency detection hysteresis (FDT hysteresis 1)	0.0% to 100.0% (FDT1 level)	5.0%	☆
F8-21	Detection range of frequency reached	0.00-100% (maximum output frequency)	0.0%	☆
F8-22	Frequency jump during acceleration/deceleration	0: Disabled 1: Enabled	0	☆
F8-25	Frequency switchover point between acceleration time 1 and acceleration time 2	0.00 Hz to maximum output frequency	0.00 Hz	☆
F8-26	Frequency switchover point between deceleration time 1 and deceleration time 2	0.00 to maximum output frequency	0.00 Hz	☆
F8-27	Terminal jog preferred	0: Disabled 1: Enabled	0	☆
F8-28	Frequency detection value (FDT2)	0.00 to maximum output frequency	50.00 Hz	☆
F8-29	Frequency detection hysteresis (FDT hysteresis 2)	0.0% to 100.0% (FDT2 level)	5.0%	☆
F8-30	Detection value 1 of any frequency reached	0.00 Hz to maximum output frequency	50.00 Hz	☆
F8-31	Detection amplitude of any frequency reached	0.0% to 100.0% (maximum output frequency)	0.0%	☆
F8-32	Detection value 2 of any frequency reached	0.00 Hz to maximum output frequency	50.00 Hz	☆
F8-33	Detection amplitude of any frequency reached	0.0% to 100.0% (maximum output frequency)	0.0%	☆
F8-34	Zero current detection level	0.0% to 300.0% The value 100% corresponds to the rated motor current	5.0%	☆
F8-35	Zero current detection delay	0.01 to 600.00s	0.10s	☆

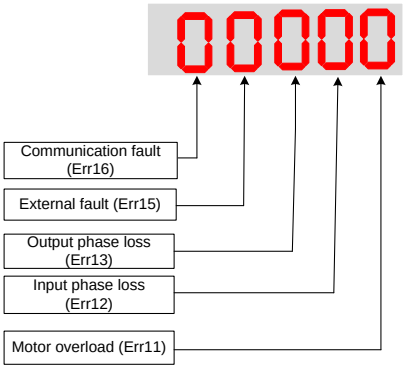
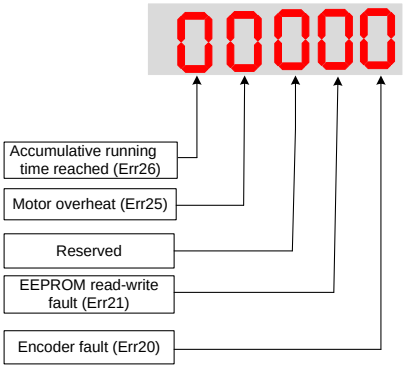
Parameter No.	Parameter Name	Setting Range	Default	Property
F8-36	Output overcurrent threshold	0.0% (no detection) 0.1% to 300.0% (rated motor current)	200.0%	☆
F8-37	Output overcurrent detection delay time	0.00 to 600.00s	0.00s	☆
F8-38	Any current reaching 1	0.0% to 300.0% (rated motor current)	100.0%	☆
F8-39	Any current reaching 1 amplitude	0.0% to 300.0% (rated motor current)	0.0%	☆
F8-40	Any current reaching 2	0.0% to 300.0% (rated motor current)	100.0%	☆
F8-41	Any current reaching 2 amplitude	0.0% to 300.0% (rated motor current)	0.0%	☆
F8-42	Timing function	0: Disabled 1: Enabled	0	★
F8-43	Timing duration source	0: F8-44 1: AI1 2: AI2 3: AI3 (100% of analog input corresponds to the value of F8-44)	0	★
F8-44	Timing duration	0.0 to 6500.0 min	0.0 min	★
F8-45	AI1 input voltage lower limit	0.00 V to F8-46	3.10 V	☆
F8-46	AI1 input voltage upper limit	F8-45 to 10.00 V	6.80 V	☆
F8-47	IGBT temperature threshold	0.00 V to F8-46	75°C	☆
F8-48	Cooling fan working mode	0: Working during running 1: Working continuously	0	☆
F8-49	Wakeup frequency	Hibernating frequency (F8-51) to maximum output frequency (F0-10)	0.00 Hz	☆
F8-50	Wakeup delay time	0.0 to 6500.0s	0.0s	☆
F8-51	Hibernating frequency	0.00 Hz to wakeup frequency (F8-49)	0.00 Hz	☆
F8-52	Hibernating delay	0.0 to 6500.0s	0.0s	☆

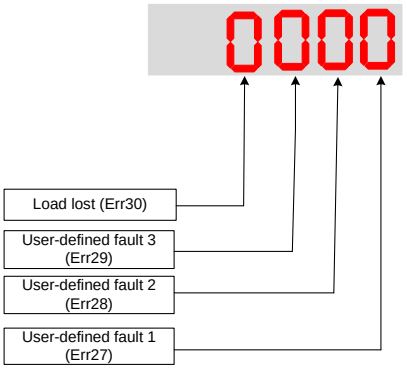
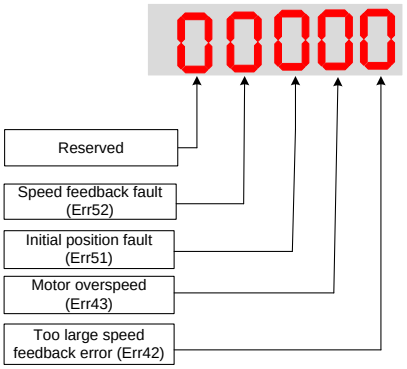
Parameter No.	Parameter Name	Setting Range	Default	Property
This feature can achieve sleep and wake-up function. After giving the start command, and if it is in a sleep state, when the setting frequency more than F8-49 (wake-up frequency), and the time duration exceeds more than F8-50 (wake-up delay time), the system will wake up to run. When the system is in running state, if the setting frequency less than F8-51 (sleep frequency), and the time duration exceeds F8-52 (sleep delay time), the system will go into sleep state (shut down). Set F8-49 (wake-up frequency) and F8-51 (sleep frequency) to 0, the sleep and wake-up function is invalid.				
F8-53	Current running time reached	0.0 to 6500.0 min	0.0 min	☆
F8-54	Output power correction coefficient	0.00% to 200.0%	100.0%	☆
Group F9: Fault and Protection				
F9-00	Motor overload protection selection	0: Disabled 1: Enabled	1	☆
F9-01	Motor overload protection gain	0.20 to 10.00	1.00	☆
F9-02	Motor overload pre-warning coefficient	50% to 100%	80%	☆
F9-03	Overvoltage protection gain	0 (no overvoltage stall) to 100	30	☆
F9-04	Overvoltage stall protective voltage	120% to 150%	130%	☆
F9-05	Overcurrent stall gain	0 to 100	20	☆
F9-06	Overcurrent stall protective current	100%-200%	150%	☆
F9-07	Short-circuit to ground upon power-on	0: Disabled 1: Enabled	1	☆
F9-09	Auto reset times	0 to 20	0	☆
F9-10	Selection of DO action during auto reset	0: Not act 1: Act	0	☆
F9-11	Delay of auto reset	0.1s to 100.0s	1.0s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-12	Input phase loss/pre-charge relay protection	 Unit's digit: Input phase loss Ten's digit: Pre-charge relay protection protection 0: Disabled 1: Enabled	11	☆
F9-13	Power output phase loss protection	0: Disabled 1: Enabled	1	☆
F9-14	1st fault type	0: No fault 1: Reserved 2: Overcurrent during acceleration	-	●
F9-15	2nd fault type		-	●

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-16	3rd (latest) fault type	3: Overcurrent during deceleration 4: Overcurrent at constant speed 5: Overvoltage during acceleration 6: Overvoltage during deceleration 7: Overvoltage at constant speed 8: Pre-charge resistor overload 9: Undervoltage 10: AC drive overload 11: Motor overload 12: Power input phase loss 13: Power output phase loss 14: IGBT overheat 15: External device fault 16: Communication fault 17: Contactor fault 18: Current detection fault 19: Motor auto-tuning fault 20: Encoder/PG card fault 21: EEPROM read-write fault 22: AC drive hardware fault 23: Short circuit to ground 24: Reserved 25: Reserved 26: Accumulative running time reached 27: User-defined fault 1 28: User-defined fault 2 29: Accumulative power-on time reached 30: Load lost 31: PID feedback lost during running 40: Fast current limit timeout 41: Motor switchover fault during running 42: Too large speed feedback error 43: Motor overspeed 45: Motor overheat 51: Initial position fault 55: Load distribution slave fault	-	●
F9-17	Frequency upon 3rd fault	-	-	●
F9-18	Current upon 3rd fault	-	-	●
F9-19	Bus voltage upon 3rd fault	-	-	●
F9-20	DI state upon 3rd fault	-	-	●
F9-21	DO state upon 3rd fault	-	-	●

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-22	AC drive state upon 3rd fault	-	-	●
F9-23	Power-on time upon 3rd fault	-	-	●
F9-24	Running time upon 3rd fault	-	-	●
F9-27	Frequency upon 2nd fault	-	-	●
F9-28	Current upon 2nd fault	-	-	●
F9-29	Bus voltage upon 2nd fault	-	-	●
F9-30	DI state upon 2nd fault	-	-	●
F9-31	DO state upon 2nd fault	-	-	●
F9-32	AC drive state upon 2nd fault	-	-	●
F9-33	Power-on time upon 2nd fault	-	-	●
F9-34	Running time upon 2nd fault	-	-	●
F9-37	Frequency upon 1st fault	-	-	●
F9-38	Current upon 1st fault	-	-	●
F9-39	Bus voltage upon 1st fault	-	-	●
F9-40	DI state upon 1st fault	-	-	●
F9-41	DO state upon 1st fault	-	-	●
F9-42	AC drive state upon1st fault	-	-	●
F9-43	Power-on time upon 1st fault	-	-	●
F9-44	Running time upon 1st fault	-	-	●

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-47	Fault protection action selection 1	0: Coast to stop 1: Stop according to the stop mode 2: Continue to run  Unit's position: Motor overload (Err11) Ten's position: Input phase loss (Err12) Hundred's position: Output phase loss (Err13) Thousand's position: External fault (Err15) Ten thousand's position: Communication fault (Err16)	00000	☆
F9-48	Fault protection action selection 2	 Unit's position: Encoder fault (Err20) 0: Coast to stop 1: Switch over to V/F control, stop according to stop mode 2: Switch over to V/F control, continue to run Ten's position: EEPROM read-write fault (Err21) 0: Coast to stop 1: Stop according to the stop mode Hundred's position: Reserved Thousand's position: Motor overheat (Err25) Same as F9-47 Ten thousand's position: Accumulative running time reached (Err26) Same as F9-47	00000	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-49	Fault protection action selection 3	0: Coast to stop 1: Stop according to the stop mode 2: Continue to run at 7% of rated motor frequency and restore to the frequency reference if the load recovers  Unit's position: User-defined fault 1 (Err27) Ten's position: User-defined fault 2 (Err28) Hundred's position: User-defined fault 3 (Err29) Thousand's position: Load lost (Err30)	00000	☆
F9-50	Fault protection action selection 4	0: Coast to stop 1: Stop according to the stop mode 2: Continue to run  Unit's position: Too large speed feedback error (Err42) Ten's position: Motor overspeed (Err43) Hundred's position: Initial position fault (Err51) Thousand's position: Speed feedback fault (Err52) Ten thousand's position: Reserved	00000	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-54	Frequency selection for continuing to run upon fault	0: Current running frequency 1: Frequency reference 2: Frequency upper limit 3: Frequency lower limit 4: Backup frequency upon abnormality	0	☆
F9-55	Backup frequency upon abnormality	0.0% to 100.0% (maximum frequency)	100.0%	☆
F9-56	Type of motor temperature sensor	0: No temperature sensor 1: PT100 2: PT1000	0	☆
F9-57	Motor overheat protection threshold	0°C to 200°C	110°C	☆
F9-58	Motor overheat warning threshold	0°C to 200°C	90°C	☆
F9-59	Power dip ride-through function selection	0: Disabled 1: Bus voltage constant control 2: Decelerate to stop	0	★
F9-60	Threshold of power dip ride-through function disabled	80% to 100%	90%	★
F9-61	Judging time of bus voltage recovering from power dip	0.0s to 100.0s	0.5s	★
F9-62	Threshold of power dip ride-through function enabled	60% to 100%	80%	★
F9-63	Load lost protection	0: Disabled 1: Enabled	0	☆
F9-64	Load lost detection level	0.0% to 100.0%	10.0%	☆
F9-65	Load lost detection time	0.0s to 60.0s	1.0s	☆
F9-67	Overspeed detection level	0.0% to 50.0% (maximum output frequency)	20.0%	☆
F9-68	Overspeed detection time	0.0s: No detection 0.1-60.0s	1.0s	☆
F9-69	Detection level of speed error	0.0% to 50.0% (maximum output frequency)	20.0%	☆

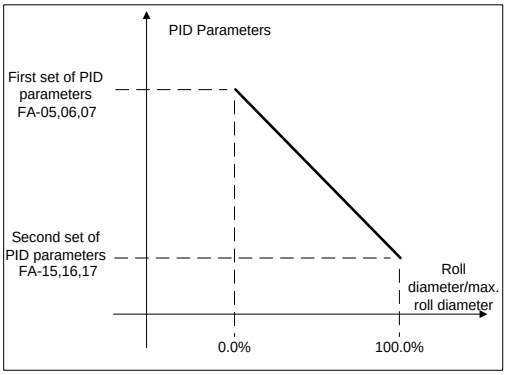
Parameter No.	Parameter Name	Setting Range	Default	Property
F9-70	Detection time of speed error	0.0s to 60.0s	5.0s	☆
Group FA: PID Function				
FA-00	PID reference setting channel	0: FA-01 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference (1000H) 6: Multi-reference	0	☆
FA-01	PID digital setting	0.0% to 100.0%	50.0%	☆
FA-02	PID feedback setting channel	0: AI1 1: AI2 2: AI3 3: AI1-AI2 4: Pulse reference (DI5) 5: Communication reference (1000H) 6: AI1+AI2 7: MAX (|AI1|, |AI2|) 8: MIN (|AI1|, |AI2|)	0	☆
FA-03	PID operation direction	0: Forward action 1: Reverse action	0	☆
FA-04	PID reference and feedback range	0 to 65535	1000	☆
FA-05	Proportional gain Kp1	0.0 to 1000.0	20.0	☆
FA-06	Integral gain Ki1	0: Stop integral 0.01s to 10.00s	2.00s	☆
FA-07	Differential gain Kd1	0.000 to 10.000s	0.000s	☆
FA-08	PID output limit in reverse direction (ineffective in tension mode)	0.00 Hz to maximum output frequency	2.00 Hz	☆
FA-09	PID deviation limit	0.0% to 100.0%	0.0%	☆
FA-10	PID differential limit	0.00% to 100.00%	0.50%	☆
FA-11	PID reference change time	0.00s to 650.00s	0.00s	☆
FA-12	PID feedback filter time	0.00s to 60.00s	0.00s	☆
FA-13	PID output filter time	0.00s to 60.00s	0.00s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
FA-14	Speed closed-loop limit selection	0: Limited according to FA-23 and FA-24 1: Limited as FA-23 (Hz)	0	☆
FA-15	Proportional gain Kp1	0.0 to 999.9	20.0	☆
FA-16	Integral gain Ki1	0: Stop integral 0.01s to 10.00s	2.00s	☆
FA-17	Differential gain Kd1	0.000 to 10.000s	0.000s	☆
FA-18	PID parameter switchover condition	0: No switchover 1: Switchover via DI 2: Automatic switchover based on deviation 3: Automatic switchover based on running frequency 6: Switched over automatically according to winding diameter 7: Switched over according to maximum roll percentage	0	☆

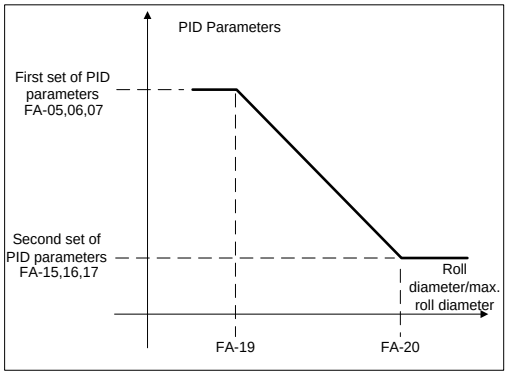
6: Use the first set of PID parameters when the roll is empty and the second set of PID parameters when the roll is full. The PID parameters are in linear change between the roll is empty and full.

7: Use the first set of PID parameters when the roll is empty and the second set of PID parameters when the roll is full. PID parameters are in linear change at certain range (decided by FA-19 and FA-20) between the roll is empty and full.

See following figure for details:

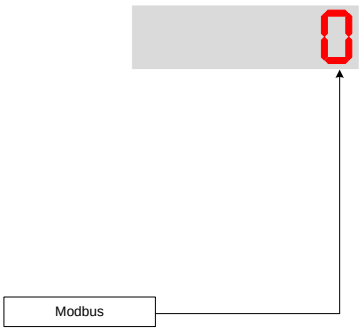


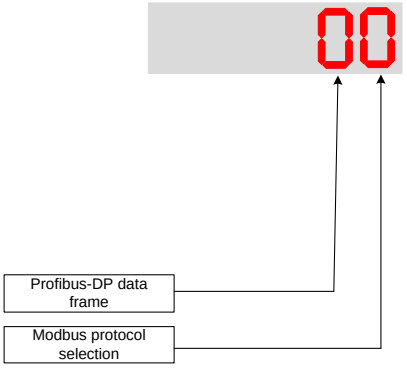
6: Switched over automatically according to roll diameter



7:Switched over according to max. roll percentage

FA-19	PID parameters switchover deviation 1	0.0% to FA-20	20.0%	☆
FA-20	PID parameters switchover deviation 2	FA-19 to 100.0%	80.0%	☆
FA-21	PID initial value	0.0% to 100.0%	0.0%	☆
FA-22	PID initial value active time	0.00s to 650.00s	0.00s	☆
FA-23	Speed closed loop limit	0.0 to 100.0% (Hz)	50.0% (Hz)	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
FA-24	Speed closed loop limit bias	0.00% to 100.00%	5.00%	☆
In order to ensure the stability of the system, the closed-loop adjustment should be limited when open-loop reference in cooperation with closed-loop adjustment method is used. Consequently, in speed closed-loop adjustment, limit the closed-loop adjustment based on open-loop frequency (relative to linear speed). The speed closed-loop adjustment is also relative to maximum frequency (corresponds to max, linear speed). When FA-14 = 0: Limit the closed-loop adjustment output frequency based on open-loop frequency and maximum frequency. Closed-loop adjustment limit = open-loop frequency × (FA-23) + maximum frequency x (FA-24) When FA-14 = 1: The closed-loop adjustment limit is fixed and defined by FA-23.				
FA-25	Wire break detection upper limit position	FA-26 to 100.0%	100.0%	☆
FA-26	Wire break detection lower limit position	0.0% to FA-25	0.0%	☆
FA-27	Wire break detection time	0.0s to 20.0s	0.0s	☆
FA-28	Selection of PID operation at stop	0: Disabled 1: Enabled	0	☆
Group Fd: Communication Parameters				
Fd-00	Baud rate	 Unit's position: Modbus 0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5005	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
Fd-01	Data format	0: No check (8,N,2) 1: Even parity check (8,E,1) 2: Odd Parity check (8,O,1) 3: No check (8,N,1) Valid for Modbus	0	☆
Fd-02	Local address	0: Broadcast address; 1 to 247 Valid for Modbus, Profibus-DP and CANlink	1	☆
Fd-03	Response delay	0 to 20ms Valid for Modbus	2 ms	☆
Fd-04	Communication timeout	0.0s: invalid 0.1s to 60.0s Valid for Modbus, Profibus-DP and CANopen	0.0s	☆
Fd-05	Modbus protocol selection and Profibus-DP data format	 Unit's position: Modbus protocol selection 0: Non-standard Modbus protocol 1: Standard Modbus protocol Ten's position: Profibus-DP data frame 0: PPO1 format 1: PPO2 format 2: PPO3 format 3: PPO5 format	30	☆
Fd-06	Current resolution read by communication	0: 0.01 A 1: 0.1 A	0	☆
Fd-08	CANlink communication timeout time	0.0s (Invalid) 0.1s to 60.0s	0	☆
Group FF: Manufacturer Parameters, Access Denied				
Group FP: Function Parameter Management				
FP-00	User password	0 to 65535	0	☆

<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Setting Range</th><th>Default</th><th>Property</th></tr>
<tr><td>FP-01</td><td>Parameter initialization</td><td>0: No operation
01: Restore factory parameters except motor parameters
02: Clear records
04: Backup current user parameters
501: Restore user backup parameters</td><td>0</td><td>★</td></tr>
<tr><td>FP-02</td><td>Parameter display property</td><td><table><tr><th>Value of FP-02</th><th>Group A</th><th>Group U</th></tr><tr><td>00</td><td>Not displayed</td><td>Not displayed</td></tr><tr><td>01</td><td>Not displayed</td><td>Displayed</td></tr><tr><td>10</td><td>Displayed</td><td>Not displayed</td></tr><tr><td>11 (default)</td><td>Displayed</td><td>Displayed</td></tr></table></td><td>11</td><td>☆</td></tr>
<tr><td>FP-03</td><td>Selection of individualized parameter display</td><td><table><tr><th>Value of FP-03</th><th>User-modified Group</th><th>User-defined Group</th></tr><tr><td>00</td><td>Not displayed</td><td>Not displayed</td></tr><tr><td>01</td><td>Not displayed</td><td>Displayed</td></tr><tr><td>10</td><td>Displayed</td><td>Not displayed</td></tr><tr><td>11 (default)</td><td>Displayed</td><td>Displayed</td></tr></table></td><td>00</td><td>☆</td></tr>
<tr><td>FP-04</td><td>Selection of parameter modification</td><td>0: Modifiable
1: Not modifiable</td><td>0</td><td>☆</td></tr>
<tr><td colspan="5">Group B0: Control Mode, Linear Speed, and Winding Diameter</td></tr>
<tr><td>B0-00</td><td>Tension control mode</td><td>0: Disabled
1: Open-loop tension torque control
2: Closed-loop tension speed control
3: Closed-loop tension torque control
4: Constant linear speed control</td><td>0</td><td>★</td></tr>
</table>

Parameter No.	Parameter Name	Setting Range	Default	Property
Use B0-00 to select tension control mode. 0: Disabled The MD330H functions as a general-purpose AC drive. Users can perform basic operations such as direction judgment and motor auto-tuning. 1: Open-loop torque control There are no tension/position detection and feedback. The AC drive runs in torque mode. The material tension is controlled by the output torque of the AC drive. It is recommended to use FVC to achieve the desired control effect. 2: Closed-loop speed control There are tension/position detection and feedback. The AC drive runs in speed mode. Based on the main frequency reference calculated according to linear speed and winding diameter and combined with the PID closed-loop calculation, the AC drive controls the output frequency to maintain stable tension and position. Select SVC, V/F or FVC according to the situation. 3: Closed-loop torque control There is tension detection and feedback. The AC drive runs in torque mode. Based on the torque reference in open-loop torque control mode and combined with PID closed-loop calculation, the AC drive controls the output torque to maintain the set tension. It is recommended to use FVC to achieve the desired control effect. 4: Constant linear speed control The AC drive runs in speed mode. The AC drive adjusts the running frequency according to the change of winding diameter to maintain constant linear speed. Select SVC, V/F or FVC according to the situation.				
B0-01	Winding mode	0: Winding 1: Unwinding	0	☆
The winding mode is decided both by B0-01 and DI function 58 (winding & unwinding switchover). The winding mode is determined by this parameter when DI function 58 is inactive, and is opposite to the setting of this parameter when DI function 58 is active.				
B0-02	Unwinding reverse tightening selection	0: Disabled 0.1 to 6500.0 m/min: linear speed of reverse tightening	0	☆
It is used to determine the action of the unwinder when the material is at zero speed in tension control. If B0-02 is set to 0 at zero speed, the unwinding shaft will not output torque and the material will not be tightened. If B0-02 is set to 0.1 to 6500.0 m/min, the unwinding shaft will rotate reversely according to the linear speed reference under no load or material being loosened, and will output the torque to tighten the material at zero speed.				
B0-03	Mechanical transmission ratio	0.01 to 300.00	1.00	☆
When the winding diameter is calculated based on the linear speed (B0-07 = 0), B0-03 is defined as the ratio of motor speed to winding shaft speed. Set this parameter according to the actual mechanical transmission structure. A larger value means a larger winding diameter. Correct this parameter based on the deviation between the calculated winding diameter and the actual value.				

Parameter No.	Parameter Name	Setting Range	Default	Property
B0-04	Linear speed setting channel	0: No input 1: AI1 2: AI2 3: AI3 4: PULSE 5: Serial communication (1000H) 6: Digital setting (B0-05)	0	★
0: No input 1 to 5: If 1 to 5 are selected as the linear speed source, set maximum linear speed (B0-05) properly according to per-unit. 6: The linear speed is set directly in B0-05 to satisfy the needs such as DP communication or commissioning.				
B0-05	Maximum speed	0.0 to 6500.0 m/min	1000.0 m/min	☆
It sets the maximum linear speed. The value means the actual linear speed corresponding to 100.0% of B0-04 values 1 to 5. This parameter can be set different from the maximum linear speed required by production. When winding diameter is calculated based on linear speed (B0-07 = 0), a larger value means a larger winding diameter. Correct this parameter based on the deviation between the calculated winding diameter and the actual value.				
B0-06	Minimum linear speed for winding diameter calculation	0.0 to 6500.0 m/min	20.0 m/min	☆
When winding diameter is calculated based on linear speed (B0-07 = 0), if the linear speed is lower than B0-06, the winding diameter value will be maintained. If the linear speed is higher than B0-06, winding diameter calculation will be carried out. Set B0-06 properly to solve the problem of inaccurate calculation of winding diameter in situations such as low running frequency or acceleration.				
B0-07	Winding diameter calculation method	0: Calculated based on linear speed 1: Calculated based on accumulative thickness 2: AI1 3: AI2 4: AI3 5: Digital setting (B0-14) 6: Serial communication (1000H)	0	★

Parameter No.	Parameter Name	Setting Range	Default	Property
0: Calculated based on linear speed The winding diameter is calculated based on linear speed and running frequency in real-time without error accumulation. Material thickness does not involve in the calculation. Set following parameters: 1) Linear speed: See parameter B0-04, B0-05 and B0-41. 2) Mechanical transmission ratio: B0-03. Note: Winding diameter calculation via linear speed only applies to center winding and is not suitable for surface winding. 1: Calculated based on accumulative thickness The winding diameter is calculated based on material thickness and circle counting signal with error accumulation. Linear speed does not involve in the calculation. Set following parameters: 1) Material thickness: B0-31 to B0-36. 2) Circle counting signal source: DI function 61 (circle counting signal) 3) Calculation relationship: B0-29 (number of pulses per revolution), B0-30 (number of circles per layer, for wire) 2: AI1 3: AI2 4: AI3 5: Digital setting (B0-14) 6: Communication setting (1000H) Input the winding diameter directly detected by sensor or calculated by other external devices through channel 2 to 6. Set maximum winding diameter (B0-08) properly according to per-unit. If AI1 is selected as the winding diameter calculation channel, 100.0% input of AI1 corresponds to B0-08 (maximum winding diameter).				
B0-08	Maximum winding diameter	0.1 to 6000.0 mm	500.0 mm	☆
B0-08 corresponds to actual full winding diameter. In tension control mode, B0-08 acts as follows: 1) Winding diameter calculation upper limit 2) To calibrate winding diameter related values, see parameters B0-07 and B0-10 3) Unwinding diameter reset value, see parameter B0-10.				
B0-09	Reel diameter	0.1 to 6000.0 mm	100.0 mm	☆
B0-09 corresponds to actual value of empty winding. In tension control mode, B0-09 acts as follows: 1) Winding diameter calculation lower limit 2) Rewinder winding diameter reset value, see parameter B0-10.				

<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Setting Range</th><th>Default</th><th>Property</th></tr>
<tr><td>B0-10</td><td>Setting channel of initial winding diameter</td><td>0: Digital setting
Supported by DI55 and DI56
00: B0-08/B0-09
01: B0-11
10: B0-12
11: B0-13
1: AI1
2: AI2
3: AI3
4: Serial communication (1000H)</td><td></td><td>★</td></tr>
<tr><td colspan="5">Note: The winding diameter changes due to reasons such as roll replacing or system stop caused by fault. Activate DI function 54 (winding diameter reset) to reset the winding diameter to ensure accurate winding diameter upon system startup.
Use B0-10 to select the setting channel of initial winding diameter.
0: Digital setting
Initial winding diameter is decided by DI function 55/56 (initial winding diameter selection terminal 1/2) and winding mode.
For example:
If setting channel of initial winding diameter is digital setting (B0-10 = 0), and DI1 is allocated with function 55 and DI2 is allocated with function 56, the setting channel of initial winding diameter is shown in the following table:
<table>
<tr><th>DI2</th><th>DI1</th><th>Setting channel of initial winding diameter</th></tr>
<tr><td>0</td><td>0</td><td>B0-09 (winding) or B0-08 (unwinding)</td></tr>
<tr><td>0</td><td>1</td><td>B0-11</td></tr>
<tr><td>1</td><td>0</td><td>B0-12</td></tr>
<tr><td>1</td><td>1</td><td>B0-13</td></tr>
</table>
B0-08 or B0-09 is the initial winding diameter source by default.
1: AI1
2: AI2
3: AI3
4: Serial communication (1000H)
Set maximum winding diameter (B0-08) properly according to per-unit when initial winding diameter is input via channel 1 to 4.</td></tr>
<tr><td>B0-11</td><td>Initial winding diameter 1</td><td>0.1 to 6000.0 mm</td><td>100.0 mm</td><td>☆</td></tr>
<tr><td>B0-12</td><td>Initial winding diameter 2</td><td>0.1 to 6000.0 mm</td><td>100.0 mm</td><td>☆</td></tr>
<tr><td>B0-13</td><td>Initial winding diameter 3</td><td>0.1 to 6000.0 mm</td><td>100.0 mm</td><td>☆</td></tr>
<tr><td>B0-14</td><td>Current winding diameter</td><td>0.1 to 6000.0 mm</td><td>0.0 mm</td><td>☆</td></tr>
</table>

Parameter No.	Parameter Name	Setting Range	Default	Property
B0-14 displays current winding diameter on a real-time basis. Current winding diameter can be modified by changing the value of B0-14. The calculated winding diameter will replace B0-14 (B0-07 = 5 exclusive). Users can use B0-14 as a way to reset the winding diameter. If winding diameter is calculated based on linear speed (B0-07 = 1), B0-14 indicates the number of pulses corresponding to each revolution of winding shaft.				
B0-15	Winding diameter filter time (effective only when B0-07 = 0)	0.00 to 10.00s	5.00s	☆
When winding diameter is calculated based on linear speed (B0-07 = 0), set this parameter to filter the winding calculation result and suppress fluctuation of winding diameter by setting B0-15. A larger value means more smooth calculation of winding diameter. But the change delay of winding diameter will be longer. Rule: The time that calculated winding diameter lags actual winding diameter roughly equals to B0-15 when winding diameter is in linear change. If winding diameter is calculated based on linear speed (B0-07 = 1), B0-15 indicates the number of circles corresponding to each layer (for wire).				
B0-16	Winding diameter change ratio limit (effective only when B0-07 = 0)	0: No limit 0.1 to 1000.0 mm/s	0	☆
Users can limit the winding diameter change ratio by setting B0-16 to a non-zero value to avoid drastic fluctuation of winding diameter calculation when abnormality happens. Too small value will excessively limit the change of winding diameter and delay the calculation of winding diameter. Set B0-16 properly based on the actual situation.				
B0-17	Winding diameter change direction limit	0: No limit 1: Decrease prohibited during winding, increase prohibited during unwinding	0	☆
This parameter is effective only when winding diameter is calculated based on linear speed (B0-07=0). Set B0-17 to limit the winding diameter change direction. Properly set winding diameter change ratio limit (B0-16) before using this parameter. Otherwise, abnormal change of winding diameter and inaccurate calculation of winding diameter may occur.				
B0-18	Winding diameter reset during running	0: Disabled 1: Enabled	0	★
If this parameter is enabled, the winding diameter can be reset in running status.				
B0-19	Pre-drive frequency gain & synchronous frequency gain	-100.0% to 100.0%	0.0%	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
Pre-drive function is for automatic roll replacing. To avoid impact upon roll replacing, the linear speed of the new roll must match the material linear speed. Use DI function 57 (pre-drive input terminal) and set B0-19 properly realize smooth roll replacing. When applying this function, you must obtain a relatively accurate linear speed and winding diameter. Relatively accurate linear speed and winding diameter must be obtained to use B0-19. During pre-drive, the running frequency is automatically calculated based on linear speed and winding diameter to match the material linear speed. If linear speed slightly mismatches during commissioning, set B0-19 to increase/decrease pre-drive running frequency to have a better match.				
B0-20	Pre-drive torque limit source (effective when B0-00 = 1 or 3)	0: F2-09 1: Based on tension	0	★
The target torque is automatically gained when tension is controlled by torque. On normal occasions, users can also use F2-09 to select the target torque. Set B0-20 according to the actual situation. 0: F2-09 1: Target torque controlled by tension control open-loop torque setting (it is recommended to use when B0-00 = 1 or 3)				
B0-21	Pre-drive torque correction coefficient	-100.0% to 100.0%	0.0%	☆
B0-21 is effective only when B0-20 = 1. Use B0-21 to correct the torque in pre-drive mode.				
B0-22	Pre-drive winding diameter calculation delay (effective only when B0-07 = 0)	0.0s to 6500.0s	2.0s	☆
Set B0-22 to delay the calculation of winding diameter to avoid inaccurate or instable calculation during pre-drive period.				
B0-23	Pre-drive acceleration time	0.0 to 6500.0s	0.0s	☆
B0-24	Pre-drive deceleration time	0.0 to 6500.0s	0.0s	☆
B0-25	Pre-drive winding diameter calculation function (effective only when B0-07 = 1)	0: Disabled 1: Enabled	0	☆
Winding diameter increases/decreases along with the increase of winding shaft revolutions when winding diameter is calculated based on thickness accumulation. Set this parameter to avoid error accumulation caused by ineffective calculation of winding diameter during pre-drive period.				

Parameter No.	Parameter Name	Setting Range	Default	Property
B0-26	Winding frequency limit (relative to current linear speed)	0.0% to 100.0%	50.0%	☆
B0-27	Winding frequency limit offset (relative to maximum linear speed)	0.00 to 100.00%	5.00%	☆
B0-28	Winding frequency limit selection (effective when B0-00 = 1 or 3)	0: Disabled (only limit by maximum frequency F0-10) 1: Limit by B0-26 and B0-27	0	☆
B0-28 is set to 0 by default. Set B0-26 to B0-28 to define the winding frequency upper limit to prevent occurrence of uncontrollable speed when material absence happens. When B0-28 is set to 1, the winding frequency upper limit is calculated based on the synchronous frequency (the corresponding rewinder running frequency to current linear speed) and maximum frequency (the corresponding rewinder running frequency to maximum linear speed) as shown in the following formula: Winding frequency upper limit = sync. frequency x (1 + B0-26) + maximum frequency x B0-27				
B0-29	Number of pulses per revolution	1 to 60000	1	☆
B0-30	Revolutions per layer	1 to 10000	1	☆
B0-31	Setting channel of material thickness	0: Digital setting Supported by DI63 and DI62 00: B0-32 01: B0-33 10: B0-34 11: B0-35 1: AI1 2: AI2 3: AI3	0	★

<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Setting Range</th><th>Default</th><th>Property</th></tr>
<tr><td colspan="5">Use B0-31 to select the setting channel of material thickness.
0: Digital setting
DI function 62/63 (thickness selection terminal 1/2) affects setting channel of material thickness.
For example:
If setting channel of material thickness is digital setting (B0-31 = 0), DI1 selects DI function 62 and DI2 selects DI function 62, the material thickness setting source is as following table:
<table>
<tr><th>DI2</th><th>DI1</th><th>Initial winding diameter source</th></tr>
<tr><td>0</td><td>0</td><td>Decided by B0-32</td></tr>
<tr><td>0</td><td>1</td><td>Decided by B0-33</td></tr>
<tr><td>1</td><td>0</td><td>Decided by B0-34</td></tr>
<tr><td>1</td><td>1</td><td>Decided by B0-35</td></tr>
</table>
1: AI1
2: AI2
3: AI3
Set maximum thickness (B0-36) properly according to per-unit when initial winding diameter is input via channel 1 to 3.</td></tr>
<tr><td>B0-32</td><td>Material thickness 0</td><td>0.00 to 100.00 mm</td><td>0.01 mm</td><td>☆</td></tr>
<tr><td>B0-33</td><td>Material thickness 1</td><td>0.00 to 100.00 mm</td><td>0.01 mm</td><td>☆</td></tr>
<tr><td>B0-34</td><td>Material thickness 2</td><td>0.00 to 100.00 mm</td><td>0.01 mm</td><td>☆</td></tr>
<tr><td>B0-35</td><td>Material thickness 3</td><td>0.00 to 100.00 mm</td><td>0.01 mm</td><td>☆</td></tr>
<tr><td>B0-36</td><td>Maximum thickness</td><td>0.00 to 100.00 mm</td><td>1.00 mm</td><td>☆</td></tr>
<tr><td>B0-41</td><td>Constant linear speed setting source</td><td>0: AI1
1: AI2
2: AI3
3: PULSE
4: Serial communication (1000H)</td><td>0</td><td>☆</td></tr>
<tr><td colspan="5">Use B0-41 to select the constant linear speed setting source in constant linear speed control.
Perform per-unit according to maximum linear speed (B0-05).</td></tr>
<tr><td>B0-42</td><td>Selection of winding diameter reset</td><td>0: Winding diameter not reset at stop
1: Winding diameter reset automatically at stop</td><td>0</td><td>☆</td></tr>
<tr><td colspan="5">If B0-42 is enabled, winding diameter will be reset automatically at stop.</td></tr>
<tr><td colspan="5">Group B1: Tension Setting</td></tr>
<tr><td>B1-00</td><td>Tension setting source</td><td>0: B1-01
1: AI1
2: AI2
3: AI3
4: PULSE
5: Serial communication (1000H)</td><td>0</td><td>★</td></tr>
</table>

Parameter No.	Parameter Name	Setting Range	Default	Property
0: B1-01 digital setting 1 to 5: Input via channel 1 to 5 indicates the percentage of the target tension relative to the maximum tension. Set maximum tension (B1-02) properly according to per-unit.				
B1-01	Tension digital setting	0 to 65000 N	50N	☆
B1-02	Maximum tension	0 to 65000 N	200N	☆
B1-02 is corresponding to 100.00% input of channel 1 to 5 of B1-00. Set B1-02 to adjust the tension without changing the AI or pulse input signal or curve.				
B1-03	Zero-speed threshold	0.0% to 20.0%	0.0%	☆
On some occasions, large start-up friction may exist to hamper the start of the system. Apply torque compensation during start-up and remove it after the system is in normal running status to maintain constant tension. Apply tension compensation according to B1-04 when running frequency is lower than B1-03. Tension compensation is not required when running frequency is higher than B1-03.				
B1-04	Zero-speed tension rise	0.0% to 1000.0%	0.0%	☆
B1-04 corresponds to the percentage of set tension. Set B1-04 properly according to the material tension withstanding range. The setting of B1-04 should be as small as possible on condition that the system can be start normally.				
B1-05	Frequency acceleration time in torque control mode	0.0s to 6500.0s	1.0s	☆
B1-06	Frequency deceleration time in torque mode	0.0s to 6500.0s	1.0s	☆
Set B1-05 and B1-06 to change the slope of the frequency upper limit with time. In the tension control mode, the frequency upper limit affects the motor output. Set above parameters properly according to output demand. For example: for winding, set B1-05 less than the drive motor acceleration time to build up tension as soon as possible upon start-up. And set B1-06 more than drive motor deceleration time to maintain the tension to avoid material looseness and piling upon stop. Users can flexibly set above parameters according to the actual situation or control the motor start and stop temporal logic via PLC.				
B1-07	Friction force compensation coefficient	0.0% to 50.0%	0.0%	☆

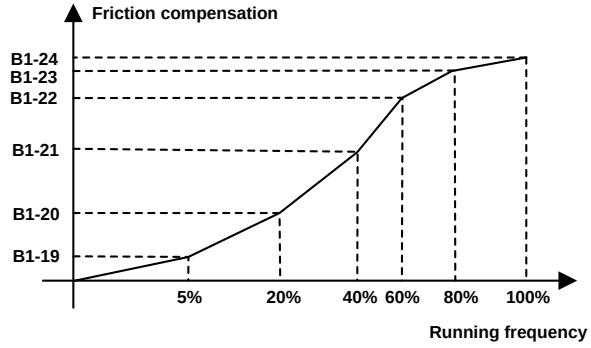
Parameter No.	Parameter Name	Setting Range	Default	Property
It is recommended to set B1-07 when the selection of tension control mode is open-loop tension torque control (B0-00 = 1). During stable running of the motor, the output torque is used to build up the tension as well as to overcome the rotational friction. Compensate the friction torque if the rotational friction cannot be neglected. In the tension control mode, the AC drive automatically sets the target torque according to the tension setting and the winding diameter. Based on the setting of B1-07, increase (winding)/decrease(unwinding) the target torque to eliminate the influence of friction on the material tension. The value of B1-07 corresponds to the percentage of the rated torque of the AC drive.				
B1-08	Mechanical flywheel inertia	0 to 65535 NM^2	0 NM^2	☆
In the open-loop tension torque control mode, the output torque is used to build up the tension as well as to overcome inertia of the system during acceleration/deceleration. Apply inertia compensation if any one of following happens: 1) The material tension is too small during winding acceleration. 2) The material tension is too large during winding deceleration. 3) The material tension is too large during unwinding acceleration. 4) The material tension is too small during unwinding deceleration. The system inertia usually consists of mechanical inertia and material inertia. Set the parameters according to the relationship between the two values. For example, if the material is heavier, you can only set the material inertia related parameters. If the winding shaft is heavier, you can only set the winding shaft inertia related parameters. Note: The linear speed must be accurately obtained to apply inertia compensation. Set B1-08 according to the actual mechanical flywheel inertia. For general cylindrical winding shaft, calculate the theoretical mechanical flywheel inertia according to the following formula: $GD_m^2 = \frac{\pi g}{8i^2}\gamma b\ (D^4 - D_0^4)$ Where g is the gravity acceleration of 9.8 m/s^2, γ is the mechanical material density, b is the mechanical shaft length, D is the mechanical shaft outer diameter, D_0 is the mechanical shaft inner diameter (solid shaft is 0) and i is the transmission ratio. The unit adopts international unit system. Adjust the setting value of B1-08 according to the actual change of material tension during acceleration and deceleration.				
B1-09	Correction coefficient of acceleration inertia compensation	0.0% to 200.0%	100.0%	☆
B1-10	Correction coefficient of deceleration inertia compensation	0.0% to 200.0%	100.0%	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
The effect of inertia compensation may not be satisfying due to the deviation between theoretical inertia and actual inertia. Fine adjustment can be done by setting B1-09 and B1-10 to optimize the control effect. Take the winding acceleration as an example, if the material tension is too small, you can increase the setting of parameter B1-09 to enhance the compensation effect, otherwise reduce the setting of the parameter. B1-09 and B1-10 facilitates commissioning.				
B1-11	Material density	0 to 65535 kg/m^3	0 kg/m^3	☆
B1-12	Material width	0 to 65535 mm	0 mm	☆
Set B1-11 and B1-12 according to the actual material properties and set mechanical transmission ratio (B0-03) correctly. The AC drive automatically calculates the flywheel inertia of the material according to B1-11 and B1-12, empty winding diameter and material winding diameter.				
B1-13	Inertia compensation exit delay	0.000s to 1.000s	0.000s	☆
B1-14	Selection of parameter auto-tuning	Unavailable		
B1-15	Torque direction limit (effective when B0-00 = 1 or 3)	0: Disabled 1: Torque reverse prohibited	0	☆
The torque value may be negative after taking friction and inertia compensation into calculation. Use B1-15 to decide the action after reverse torque happens. Torque direction is not limited (B1-15 = 0) by default.				
B1-16	Torque closed-loop limit	0.0% to 100.0%	50.0%	☆
Use B1-16 to limit the percentage of torque closed-loop adjustment relative to open-loop torque reference in closed-loop tension torque control (B0-00 = 3).				
B1-17	Friction force compensation correction coefficient	-50.0% to 50.0%	0.0%	☆
Friction is not constant in most operating conditions and may vary due to change of running frequency, winding diameter. Use B1-17 and B1-07 to get satisfying friction compensation effect. Refer to B1-18 for detailed information. B1-07 corresponds to the percentage of the rated torque of the AC drive.				
B1-18	Friction force compensation curve	0: Frequency 1: Linear speed 2: Multi-friction force compensation curve 1 3: Multi-friction force compensation curve 2 4: Compensation based on winding diameter	0	★

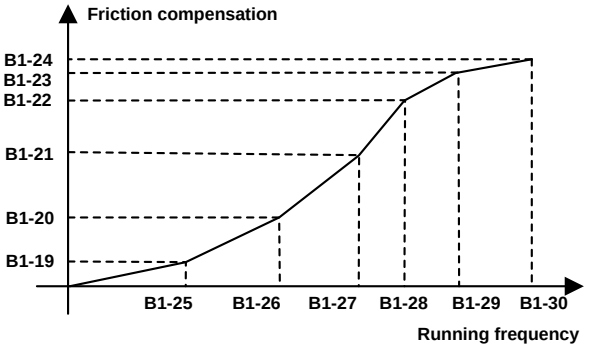
Parameter No.	Parameter Name	Setting Range	Default	Property
Five friction compensation methods are provided: 0: Compensation based on running frequency On some occasions, the friction force varies due to change of running frequency. In this method, the friction force compensation is defined by the following formula: $\text{Friction compensation torque} = B1.07 \times \left(1 + \frac{\text{Running frequency}}{\text{Maximumfrequency}} \times B1.17\right)$ 1: Compensation based on linear speed In this method, the friction force compensation is defined by the following formula: $\text{Friction compensation torque} = B1.07 \times \left(1 + \frac{\text{Linear speed}}{\text{Maximum linear speed}} \times B1.17\right)$ 2: Multi-friction compensation curve 1 On some occasions, the friction force does not change linearly along with the change of frequency. Realize friction force compensation by using multi-friction compensation curve. See parameters B1-19 to B1-24 for details. 3: Multi-friction compensation curve 2 Compensation curve 2 is more flexible compared with the compensation curve 1. But you have to set more parameters. See B1 to 19 to B1-30 for details. 4: Compensation based on winding diameter In this method, the friction force compensation is defined by the following formula: $\text{Friction compensation torque} = B1.07 \times \left(1 + \frac{\text{Current winding diameter}}{\text{Maximumroll diamwter}} \times B1.17\right)$				
B1-19	Multi-friction force compensation torque 1	0.0% to 50.0%	0.0%	☆
B1-20	Multi-friction force compensation torque 2	0.0% to 50.0%	0.0%	☆
B1-21	Multi-friction force compensation torque 3	0.0% to 50.0%	0.0%	☆
B1-22	Multi-friction force compensation torque 4	0.0% to 50.0%	0.0%	☆
B1-23	Multi-friction force compensation torque 5	0.0% to 50.0%	0.0%	☆
B1-24	Multi-friction force compensation torque 6	0.0% to 50.0%	0.0%	☆
B1-25	Multi-friction force compensation inflexion 1	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-26	Multi-friction force compensation inflexion 2	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-27	Multi-friction force compensation inflexion 3	0.00 Hz to maximum frequency	0.00 Hz	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
B1-28	Multi-friction force compensation inflexion 4	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-29	Multi-friction force compensation inflexion 5	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-30	Multi-friction force compensation inflexion 6	0.00 Hz to maximum frequency	0.00 Hz	☆

Parameters B1-19 to B1-30 are for multi-friction force compensation curve 1/2.
When B1-18 = 2, parameters B1-19 to B1-24 will be effective. When B1-18 = 3, parameters B1-19 to B1-30 will be effective.
Multi-friction force compensation curve is showed in the following figures. Users can set multi-friction force compensation curve flexibly according to the actual situation.
B1-18 = 2, multi-friction force compensation curve 1:



B1-18 = 3, multi-friction force compensation curve 2:



Group B2: Tension Taper				
B2-00	Taper curve	0: Curved 1: Multi-taper (unavailable)	0	★

Parameter No.	Parameter Name	Setting Range	Default	Property
On some occasions, tension has to be reduced with the increase of the winding diameter to ensure the winding is flat. Set taper properly to achieve this purpose. B2-00 is effective only in winding mode (B0-01 = 0). Use B2-00 to select the taper curve generation mode. 0: Curve taper The curve taper curve is generated according to the taper setting and the taper compensation correction (B2-03). See B2-03 for details. 1: Multi-taper Not available				
B2-01	Setting channel of tension taper	0: Set by B2-02 1: AI1 2: AI2 3: AI3	0	★
B2-02	Tension taper	0.0 to 100.0%	0.0%	☆
B2-03	Correction value of tension taper compensation (effective only when B2-00 = 0)	0 to 10000 mm	0 mm	☆
Use taper compensation correction and taper setting together to get curve taper. The value of taper is defined by the following formula: $F = F_0 * \{1 - K * [1 - (D_0 + D_1)/(D + D_1)]\}$ Where F is the setting tension after taper, F_0 is the setting taper before taper (defined by B0-14), K is the value of the taper (defined by B2-01), D_0 is the empty winding diameter (defined by B0-09), D is the current winding diameter (defined by B0-14) and D_1 is the taper compensation correction.				
B2-04	Closed-loop tension taper function (unavailable)	0: Disabled 1: Enabled	0	★
B2-05	Setting channel of maximum external taper	0: Set by B2-06 1: AI1 2: AI2 3: AI3	0	★
On some occasions, the material tension is determined by the external actuator. Realize tension taper control by controlling the external actuator through external taper output function. The maximum value of external taper determines the maximum taper output value (corresponding to empty winding) when external taper output (function 18) is selected for FMP or AO (F5-06 to F5-08). B2-05 determines the source of maximum external tapper. 0: Set by B2-06 1 to 3: Set by AI1 to AI3				
B2-06	Maximum external taper	0.0% to 100.0%	100.0%	☆

5.3 Monitoring Function Parameters

Parameter No.	Parameter Name	Minimum Unit	Communication Address
Group U0: Standard Monitoring Parameters			
U0-00	Running frequency (Hz)	0.01 Hz	7000H
U0-01	Frequency reference (Hz)	0.01 Hz	7001H
U0-02	Bus voltage (V)	0.1 V	7002H
U0-03	Output voltage (V)	1 V	7003H
U0-04	Output current (A)	0.01 A	7004H
U0-05	Output power (kW)	0.1 kW	7005H
U0-06	Output torque (%)	0.1%	7006H
U0-07	DI state	1	7007H
U0-08	DO state	1	7008H
U0-09	AI1 voltage (V)	0.01 V	7009H
U0-10	AI2 voltage (V)/current (mA)	0.01 V/0.01 mA	700AH
U0-11	AI3 voltage (V)	0.01 V	7007BH
U0-12	Count value	1	700CH
U0-13	Length value	1	700DH
U0-14	Load speed	1	700EH
U0-15	PID reference	1	700FH
U0-16	PID feedback	1	7010H
U0-17	PLC stage	1	7011H
U0-18	Pulse reference (Hz)	0.01 kHz	7012H
U0-19	Feedback speed	0.01 Hz	7013H
U0-20	Remaining running time	0.1 Min	7014H
U0-21	AI1 voltage before correction	0.001 V	7015H
U0-22	AI2 voltage (V)/current (mA) before correction	0.001 V/0.01 mA	7016H
U0-23	AI3 voltage before correction	0.001 V	7017H
U0-24	Linear speed	1 m/Min	7018H
U0-25	Current power-on time	1 Min	7019
U0-26	Current running time	0.1 Min	701AH
U0-27	Pulse reference	1 Hz	701BH
U0-28	Communication reference	0.01%	701CH
U0-29	Encoder feedback speed	0.01 Hz	701DH
U0-30	Main frequency X	0.01 Hz	701EH
U0-31	Auxiliary frequency Y	0.01 Hz	701FH
U0-32	Viewing any register address value	1	7020H
U0-34	Motor temperature	1°C	7022H
U0-35	Target torque	0.1%	7023H
U0-36	Resolver position	1	7024H
U0-37	Power factor angle	0.1°	7025H
U0-38	ABZ position	1	7026H
U0-39	Target voltage upon V/F separation	1 V	7027H
U0-40	Output voltage upon V/F separation	1V	7028H
U0-41	DI state visual display	1	7029H
U0-42	DO state visual display	1	702AH

Parameter No.	Parameter Name	Minimum Unit	Communication Address
U0-43	DI function state visual display 1 (functions 01 to 40)	1	702BH
U0-44	DI function state visual display 2 (functions 41 to 80)	1	702CH
U0-45	Fault information	1	702DH
U0-58	Phase Z counting	1	703AH
U0-59	Frequency reference	0.01%	703BH
U0-60	Running frequency	0.01%	703CH
U0-61	AC drive state	1	703DH
U0-62	Current fault code	1	703EH
U0-63	Sent value of point-point communication	0.01%	703FH
U0-64	Number of slaves	1	7040H
U0-65	Torque upper limit	0.1%	7041H
Group U1: Tension Monitoring Parameters			
U1-00	Linear speed display	0.1 m/min	7100H
U1-01	Winding diameter display	0.1 mm	7101H
U1-02	Frequency calculated from linear speed	0.01 Hz	7102H
U1-03	Setting tension	1 N	7103H
U1-04	Taper back tension	1 N	7104H
U1-05	Tension target torque	0.1%	7105H
U1-06	PID output	0.01 Hz	7106H
U1-07	Accelerated speed	0.1 m/min/s	7107H

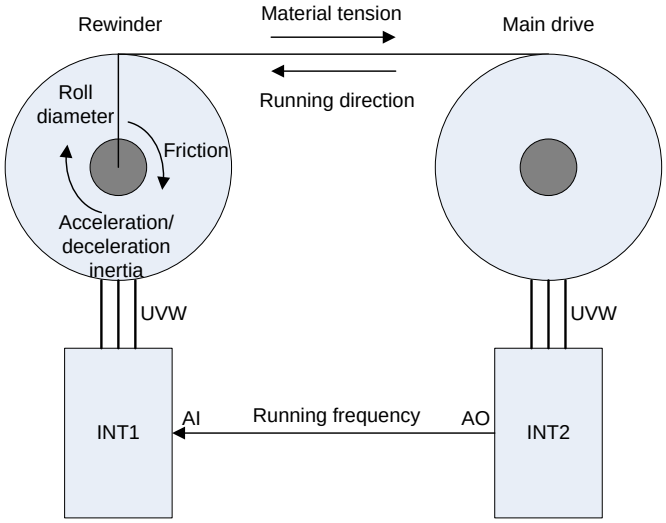
6 Typical Applications

6.1 Tension Control Principle

6.1.1 Open-loop Torque Control

Features:

- Without pendulum (dancer roll) or tension sensor;
- Open loop tension control, suitable for situations with lower tension control accuracy.

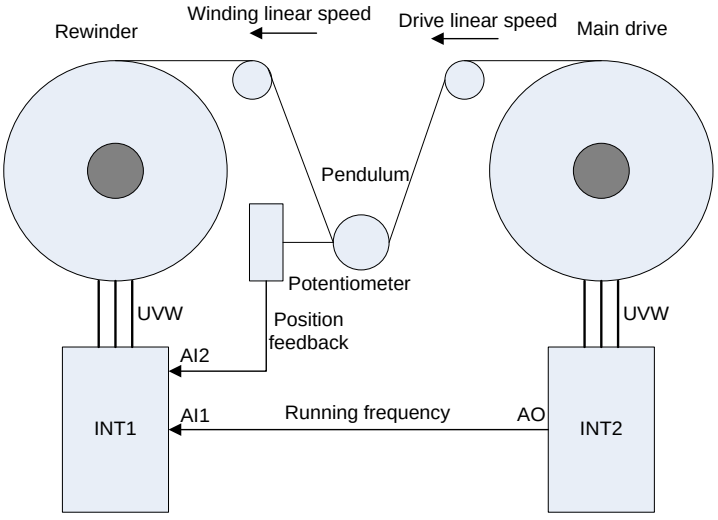


Winding diameter is calculated based on linear speed in open-loop tension torque control. The output torque is calculated according to the material tension. Perform friction torque and inertia torque compensation during acceleration/deceleration according to the actual situation of the system.

6.1.2 Closed-loop Speed Control

Features:

- Material tension feedback from pendulum (dancer roll) or tension sensor
- Constant pendulum position or constant tension control through closed-loop adjustment of AC drive output frequency
- To realize closed-loop speed control through synchronous frequency reference (related to linear speed) in cooperation with speed closed-loop adjustment, suitable to situations with speed adjustment margin (pendulum or elastic material available)



Two AI channels respectively receive the signal from the pendulum position potentiometer and the running frequency signal from the main drive. The winding diameter is calculated based on linear speed. Synchronous

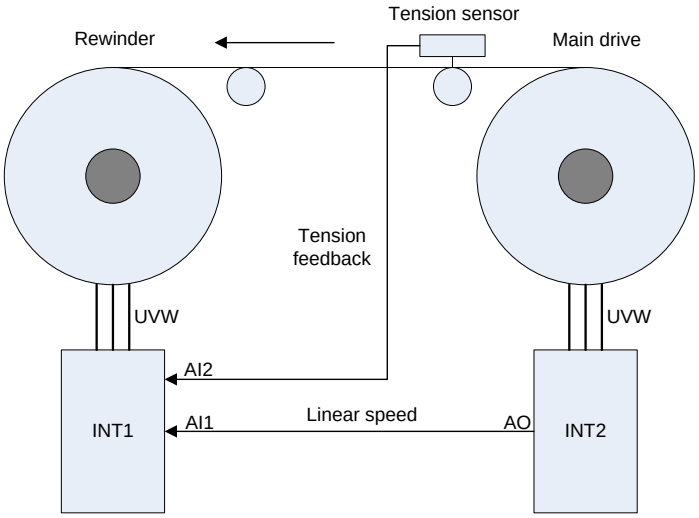
frequency is determined by the linear speed and the winding diameter. Output frequency is determined by synchronous frequency and pendulum position feedback closed-loop adjustment.

Compared with the “main frequency + PID” control method of the general purpose AC drive, the main frequency reference of MD330H which can follow the change of the linear speed is more accurate due to involvement of winding diameter calculation, making pendulum position control more stable.

6.1.3 Closed-loop Torque Control

Features:

- Material tension from tension sensor
- Closed-loop adjustment of the AC drive output torque to achieve constant tension control
- Open loop torque control integrated, to realize closed-loop torque control through open-loop tension calculation in cooperation with tension closed-loop adjustment.
- High tension control accuracy, suitable to situations where rigid material is used or there is no speed adjustment margin



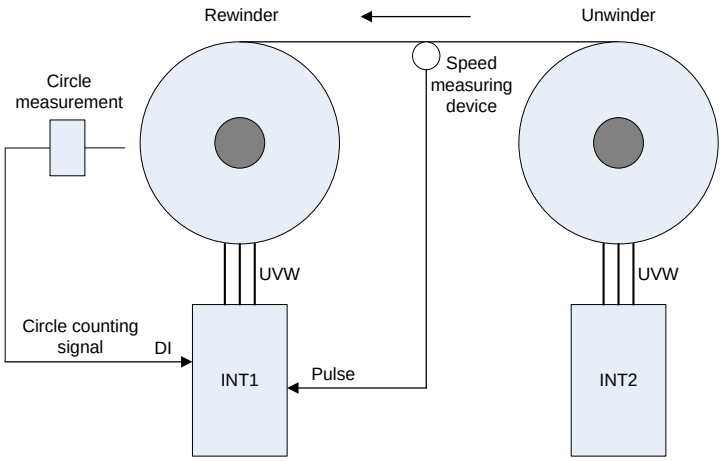
Two AIs respectively receive the signal from the pendulum position potentiometer and the running frequency signal from the main drive. This mode provides the tension reference with open-loop control and implements closed-loop adjustment with the tension sensor. The winding diameter calculation is reserved and setting of the inertia and the friction torque compensation is not required due to closed-loop adjustment (you can also set the inertia and the friction torque compensation to optimize the response speed).

Users can also use closed loop speed control in situation where the tension sensor is used for elastic material (with speed adjustment margin) to avoid elastic oscillation.

6.1.4 Constant Linear Speed Control

Features:

- Suitable to the situation where main drive is not available and either of the rewinder or unwinder works as the main drive in constant linear speed.



1. Rewinder working as the main drive

The winding diameter must be got to keep the material running in constant linear speed. Two ways of getting the winding diameter are shown in the preceding figure:

1) Calculate the winding diameter by using thickness accumulation method based on the DI circle counting signal.

2) Install an additional speed measuring device and send pulse signals to the AC drive. Calculate the winding diameter by using linear speed method to realize closed-loop speed control through.

You can choose either way or other applicable ways.

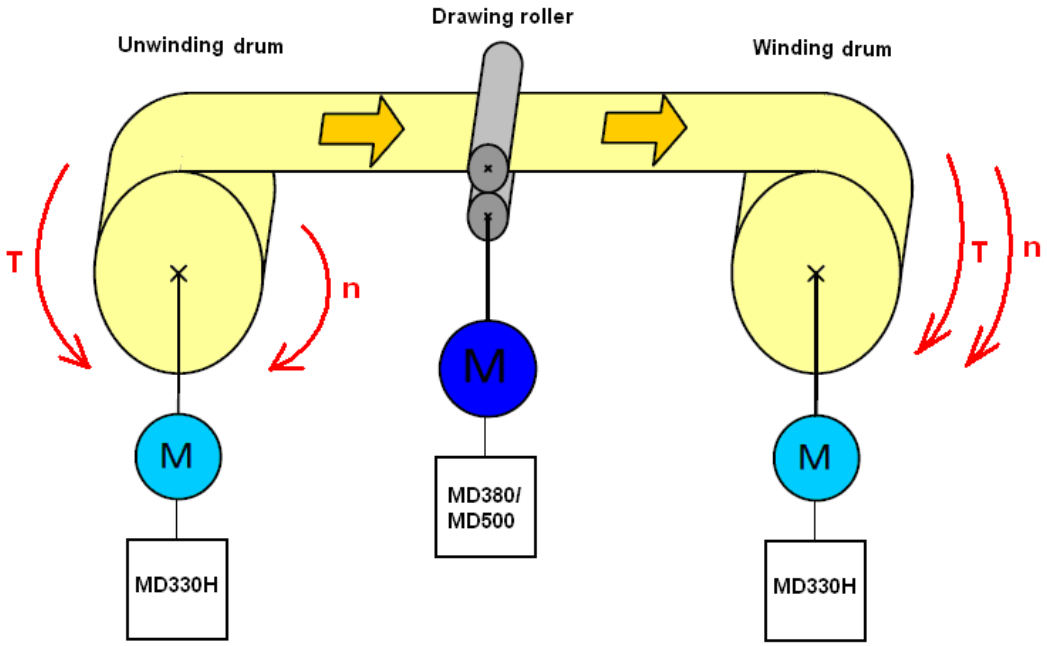
Frequency is calculated based on linear speed and winding diameter to realize constant linear speed running without main drive.

Select any one of the three control modes for the unwinder (*section 6.1.1 to chapter 6.1.3*) according to the actual situation.

Note: The preceding four typical applications are only for the description of four applicable tension control occasions. Users can use any other application according to the actual situation.

6.2 Open-Loop Torque Winding/Unwinding Application

6.2.1 Typical Schematic Diagram Of Open Loop Torque Control Mode



When we talk about open-loop torque control, herein open-loop means MD330H without tension feedback. In this condition, MD330H continuously adjusts the output torque with the change of the coil diameter to maintain constant tension on the material, and the output frequency is automatically adapted according to the actual output torque and the actual line speed of system.

According to the formula F=T/R (wherein F is tension on the material; T is torque of winding drum; R is coil radius), if the torque continuously varies according to the change of the coil radius, the tension can be constant. This is the principle of open-loop torque control.

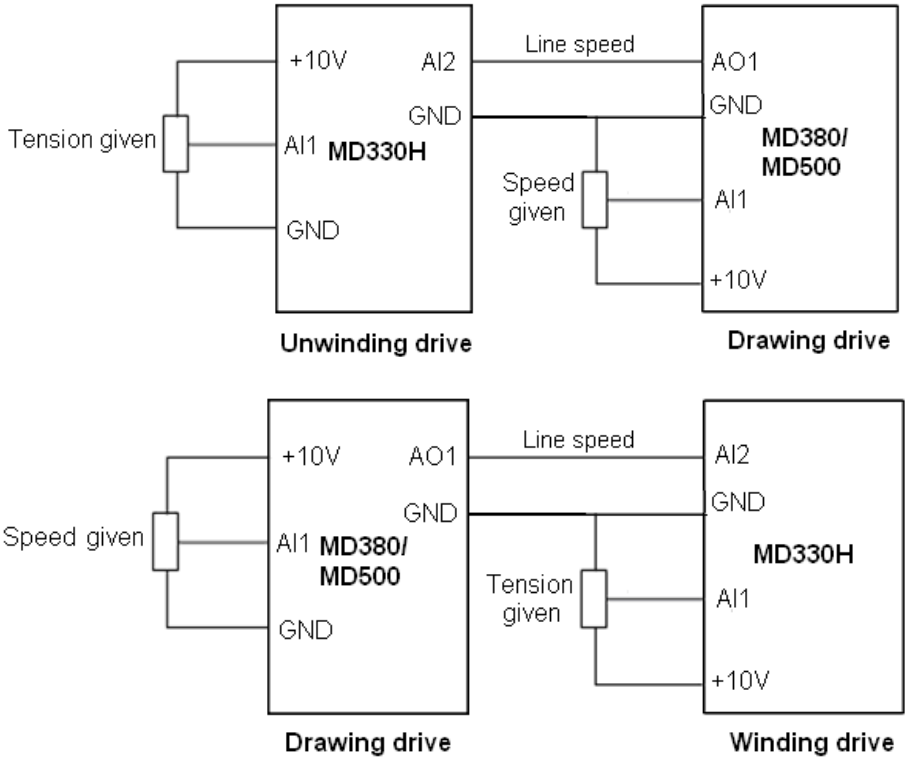
Furthermore, there are still two hypothetical conditions: one is the tension on the material from the torque of winding drum only, the other is the torque of winding drum mainly acts on the material.

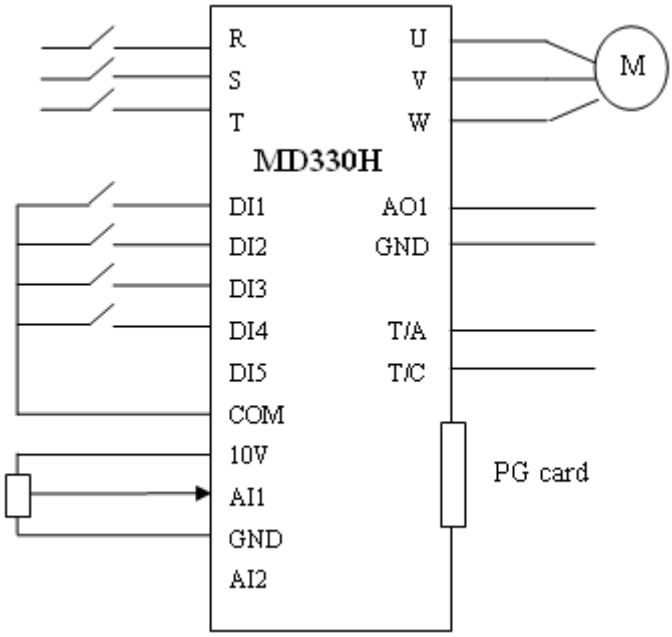
Therefore, open-loop control mode is not suitable for the following cases:

1) No coil radius change. For example, surface friction winding.
2) The tension on the material also from other devices, such as counterweight of floating roller, magnetic particle clutch and so on.
3) The torque of winding drum mainly used to overcome large inertia and friction, for example large-sized cable winding.

When MD330H works at torque mode, in principle, it requires SVC or VC control (F0-01=0 or 1). However, for achieving more accurate output torque, VC control mode must be adopted. In other words, the induction motor must be equipped with encoder. MD330H standardly equip with MD38PGMD card, supporting multiple encoders with OC, differential and pull-push output signal.

6.2.2 Typical Wiring of Open Loop Torque Control Mode

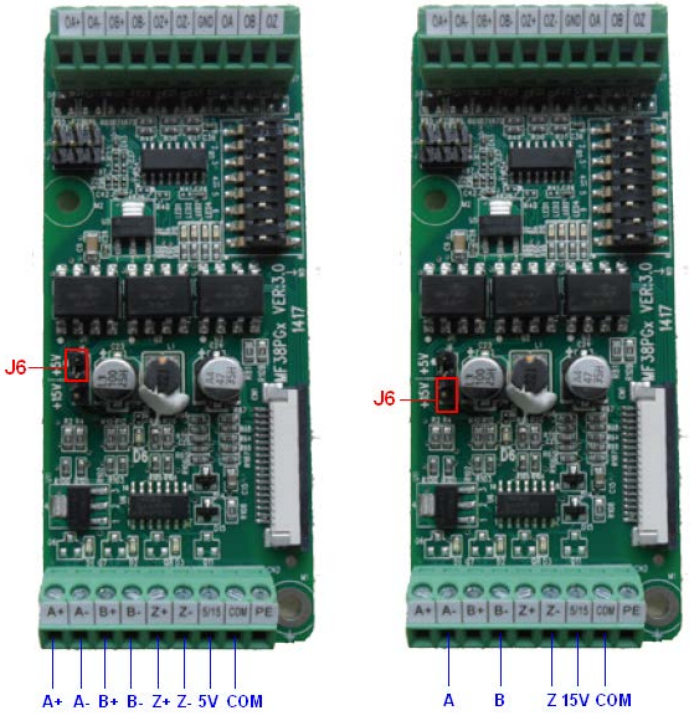




Control terminal configuration

DI1: Forward run
DI2: Coil diameter reset
DI3: Pre-drive enable
(Used only when auto-switch reeling drum)
DI4: Fault reset

AI1: Tension setting (B1-00=1)
AI2: Line speed input (B0-07=0; B0-04=2)
AO1: Indicate running frequency (If needed)
TA/TC: Fault output (If needed)



Encoder wiring:

When using encoder with OC or pull-push output signal, J6 jumper must be moved to lower 2 pin to select 15V power supply.

6.2.3 Parameter Setting

1) Set motor parameters, and trial run in speed mode to ensure that motor can run normally.

Parameter No.	Setting value	Remark
B0-00	0	Non-tension control mode (Speed control mode)
F0-01	1	Vector control mode, must do auto-tuning!
F0-02	0	Please temporarily keep default value 0, in order to do auto-tuning!
F1-01	-	Rated power, set according to motor's nameplate
F1-02	-	Rated voltage, set according to motor's nameplate
F1-03	-	Rated current, set according to motor's nameplate
F1-04	-	Rated frequency, set according to motor's nameplate

Parameter No.	Setting value	Remark
F1-05	-	Rated rotation speed, set according to motor's nameplate
F1-27	-	Encoder PPR, set according to specification of encoder
F1-37	1 or 2	1: Static auto-tuning; 2: Dynamic auto-tuning, requiring motor with no-load;

After finishing auto-tuning, set F0-08=10Hz, 30Hz, 50Hz, press RUN key to trial run the motor. If the motor runs smoothly and the actual current less than 50% rated current, basically we can think the motor runs normally.

If it is unwinding motor, we should pay attention to motor direction, make sure the running direction in speed mode is opposite to those in tension control mode. If the running direction is reverse, we can set F0-09=1 to change running direction.

2) General application parameters setting.

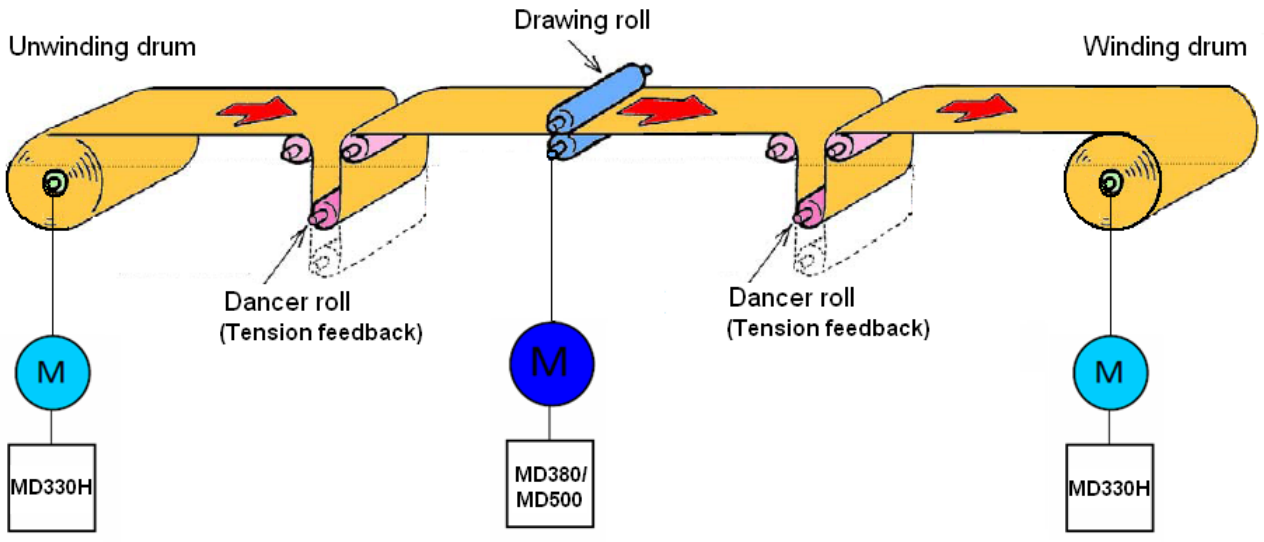
Parameter No.	Setting Value	Remark
F0-02	1	Using terminal to start/stop
F0-17	2	Acceleration time
F0-18	2	Deceleration time
F4-00	1	DI1: Forward run
F4-01	54	DI2: Coil diameter reset
F4-02	57	DI3: Pre-drive enable, used only when needed.
F4-03	9	DI4: Fault reset

3) Tension application parameters setting.

Parameter No.	Setting value	Remark
B0-00	1	Open-loop torque mode
B0-01	-	0: Winding; 1: Unwinding
B0-02	-	Keep tightening before start-up (For unwinding only), 0.1~6500 m/min
B0-03	-	Gear ratio=Motor speed / reeling drum speed
B0-04	2	Select AI2 as line speed input channel
B0-05	-	Max. Line speed, m/min
B0-06	-	Coil diameter calculation starting line speed Generally set to 2%~10% (B0-05).
B0-07	-	Coil diameter calculation through line speed
B0-08	-	Max. Coil diameter
B0-09	-	Min. Coil diameter
B1-00	1	Select AI1 as tension given
B1-02	-	Max. tension (0~65000 N)
B1-03	-	Speed upper limit for start-up tension compensation (0~20% Max. frequency)
B1-04	-	Start-up tension compensation (0~100% setting tension), increase this value when difficultly start up.
B1-07	-	Normal running friction compensation (0~50% rated torque)

6.3 Close-loop Speed Winding/Unwinding Application

6.3.1 Typical schematic Diagram of Closed-Loop Speed Control Mode



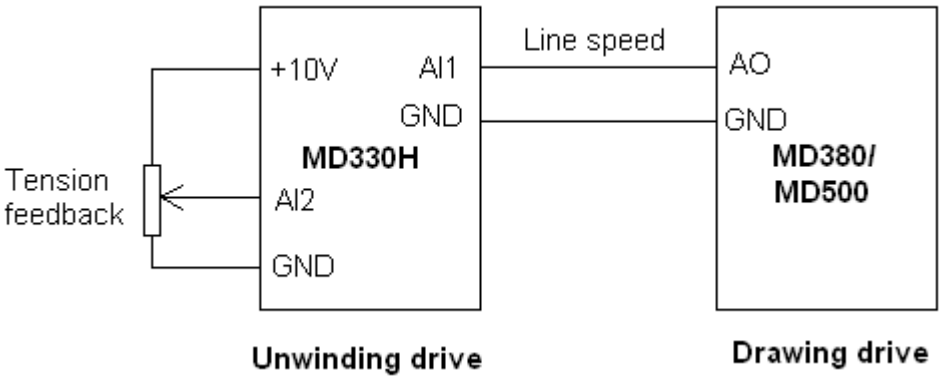
When we talk about close-loop speed control, herein close-loop means MD330H with tension feedback. As shown above diagram, the dancer roll feeds back the real-time tension to MD330H.

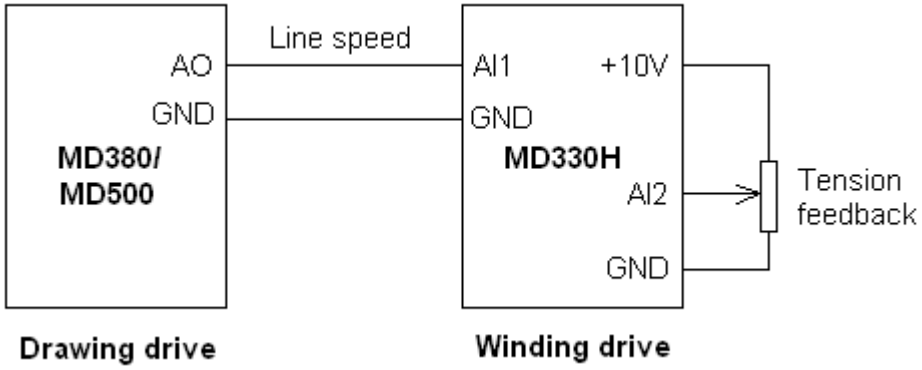
The control principle is like this: MD330H accepts the line speed (generally from drawing drive), and then calculate coil diameter. Based on the line speed and calculated real-time coil diameter, a basic matching frequency can be calculated out (f1); In addition, MD330H accepts real-time tension feedback signal, adopts internal PID algorithm to maintain the tension stable (generally it shown as dancer roll keeps in middle balance position), and the PID regulator will generate a fine-tuning frequency (f2). Therefore, the final output frequency will be f=f1+f2.

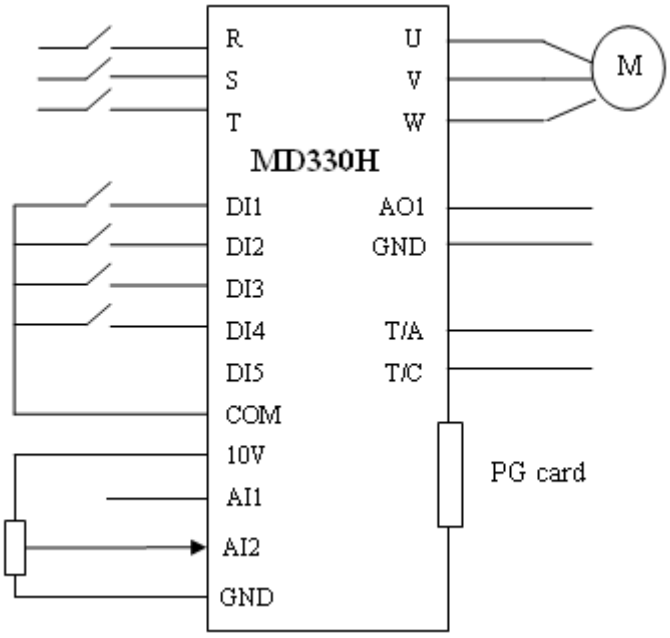
In this control mode, we set PID target value by FA-00, however sometimes it doesn't stand for real tension, such as dancer roll and swing rod, it actually reflects the position, and the different position doesn't mean different tension. If we want to adjust the actual tension, we should change mechanical structure, for example changing balance weight of dancer roll or swing rod.

When MD330H works at speed mode, in principle, it can work in V/F, SVC and VC control mode (F0-01=2, 0, 1). For achieving more accurate speed, VC control mode is recommended. In VC control mode, the induction motor must be equipped with encoder. By default, MD330H equips with MD38PGMD card, supporting multiple encoders with OC, differential and pull-push output signal.

6.3.2 Typical Wiring of Closed-Loop Speed Control Mode





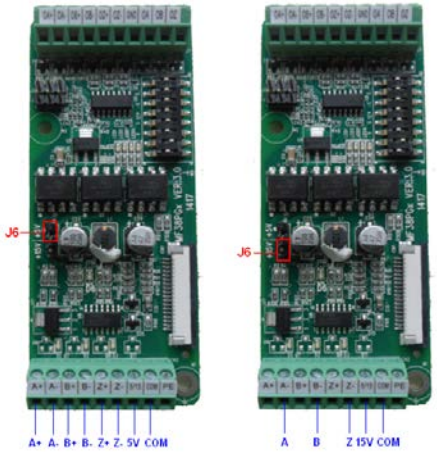


Control terminal configuration

DI1: Forward run
DI2: Coil diameter reset
DI3: Pre-drive enable
(Used only when auto-switch reeling drum)
DI4: Fault reset

AI1: Line speed input (B0-07 = 0; B0-04 = 1)
AI2: Tension feedback (FA-02 = 1)

AO1: Indicate running frequency (If needed)
TA/TC: Fault output (If needed)



Encoder wiring:

When using encoder with OC or pull-push output signal, J6 jumper must be moved to lower 2 pin to select 15V power supply.

6.3.3 Parameter Setting

1) Set motor parameters, and trial run in speed mode to ensure that motor can run normally.

Parameter No.	Setting Value	Remark
B0-00	0	Non-tension control mode (Speed control mode)
F0-01	0, 1, 2	If set to 0 and1, must do auto-tuning!
F0-02	0	Please temporarily keep default value 0, in order to do auto-tuning!
F1-01		Rated power, set according to motor 's nameplate
F1-02		Rated voltage, set according to motor 's nameplate
F1-03		Rated current, set according to motor 's nameplate
F1-04		Rated frequency, set according to motor 's nameplate
F1-05		Rated rotation speed, set according to motor 's nameplate
F1-27		Encoder PPR, set according to specification of encoder
F1-37	1 or 2	1: Static auto-tuning; 2: Dynamic auto-tuning, requiring motor with no-load;

After finishing auto-tuning, set F0-08=10Hz, 30Hz, 50Hz, press RUN key to trial run the motor. If the motor runs smoothly and the actual current less than 50% rated current, basically we can think the motor runs normally.

2) General application parameters setting.

Parameter No.	Setting Value	Remark
F0-02	1	Using terminal to start/stop
F0-17	2	Acceleration time
F0-18	2	Deceleration time
F4-00	1	DI1: Forward run
F4-01	54	DI2: Coil diameter reset
F4-02	57	DI3: Pre-drive enable, used only when needed.
F4-03	9	DI4: Fault reset

3) Tension application parameters setting.

Parameter No.	Setting Value	Remark
B0-00	2	Close-loop speed mode
B0-01	-	0: Winding; 1: Unwinding
B0-03	-	Gear ratio=Motor speed / reeling drum speed
B0-04	1	Select AI1 as line speed input channel
B0-05	-	Max. Line speed, m/min
B0-06	-	Coil diameter calculation starting line speed Generally set to 2%~10% (B0-05).
B0-07	0	Coil diameter calculation through line speed
B0-08	-	Max. Coil diameter

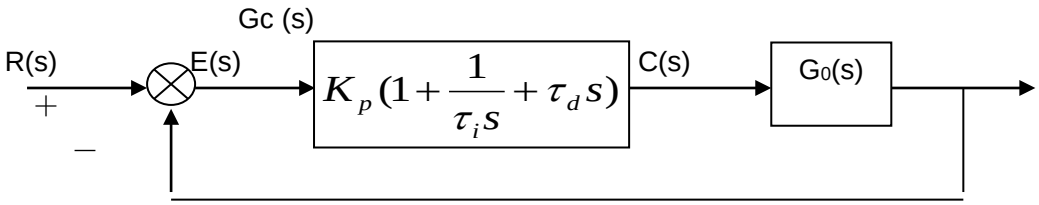
Parameter No.	Setting Value	Remark
B0-09	-	Min. Coil diameter
FA-00	0	PID target value set by FA-01
FA-01	50%	PID target value digital setting, generally set to 50% corresponding to middle balance position of dancer roll or swing rod.
FA-02	1	AI2 as PID feedback
FA-03	-	PID action direction. 0: Forward direction; 1: Reverse direction; Unwinding: set to 1; Winding: set to 0;
FA-05	-	Proportional gain Kp1
FA-06	-	Integral time Ti1
FA-07	-	Differential gain Td1

6.3.4 PID Fine Tuning Guidance

PID regulator time domain equation:

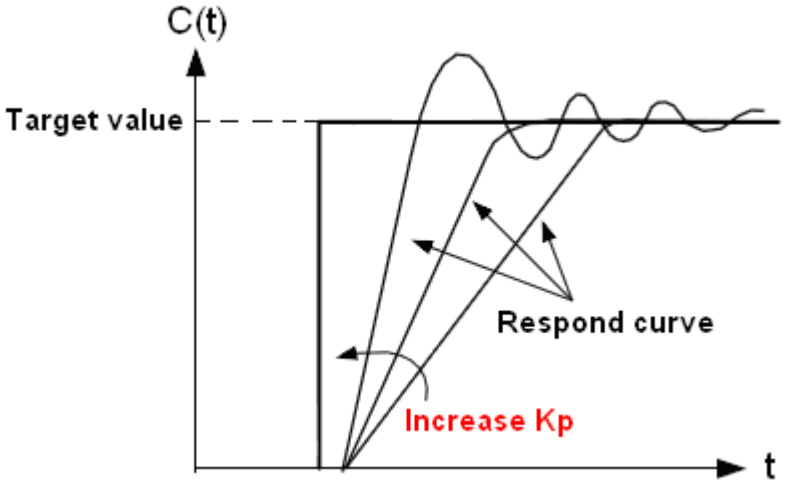
$$m(t) = K_p[e(t) + \frac{1}{\tau_i}\int_0^t e(t)dt + \tau_d \frac{de(t)}{dt}]$$

Principle block diagram of typical PID control system:



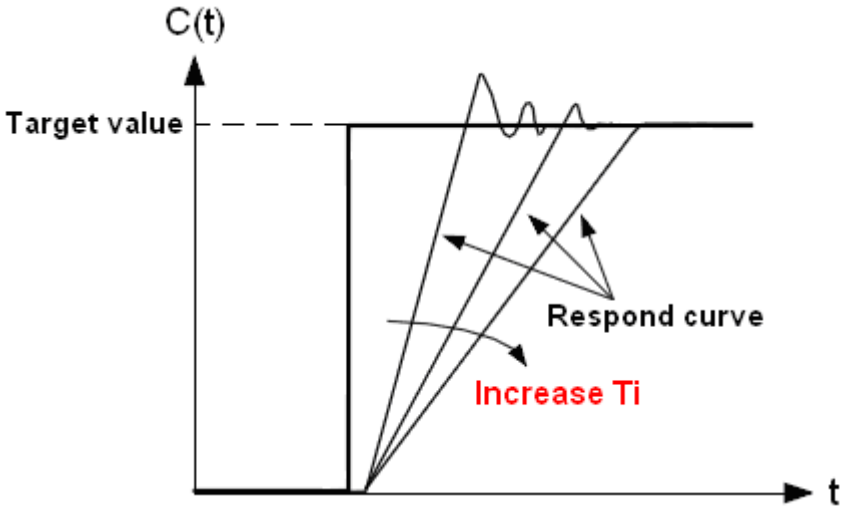
The role of proportional gain Kp (FA-05):

The larger the proportional gain, the faster the system response. Too large setting will cause system oscillation, but too small setting will slow the system response.



The role of integral time Ti (FA-06):

The shorter the integral time is, the faster the system response is. Too short setting will cause overshoot and system oscillation. But too long setting will slow system response and make the controlled variable unstable.



The role of differential gain Td1 (FA-07):

"Predictable" and "advance" are the obvious advantages of differential control law, which can not only detect the variation tendency of the error signal, but also generate an effective early corrective action before the error appears. Therefore, differential control contributes to the stability of the system, reduces dynamic error and inhibits excessive overshoot.

It must be pointed out that the differential control is especially suitable for the large time-delay control system, rather than the general small time-delay system. Moreover, if the differential gain is too large, it will result in oscillation and instability of the system. Therefore, generally we don’t need to set differential gain for most of applications, and we must cautiously increase its value even if it is used.

7 Function Diagrams

7.1 Main Function Diagrams

The torque and running frequency are the target control variables. When any one of the four tension control modes is selected, refer to section 7.1 first, and then section7.2 and related parameter description to realize tension control functions.

The value of parameter B0-00 determines how the tension control is implemented. The following diagrams show the four tension control modes.

Figure 7-1 Open-loop tension torque control (B0-00 = 1)

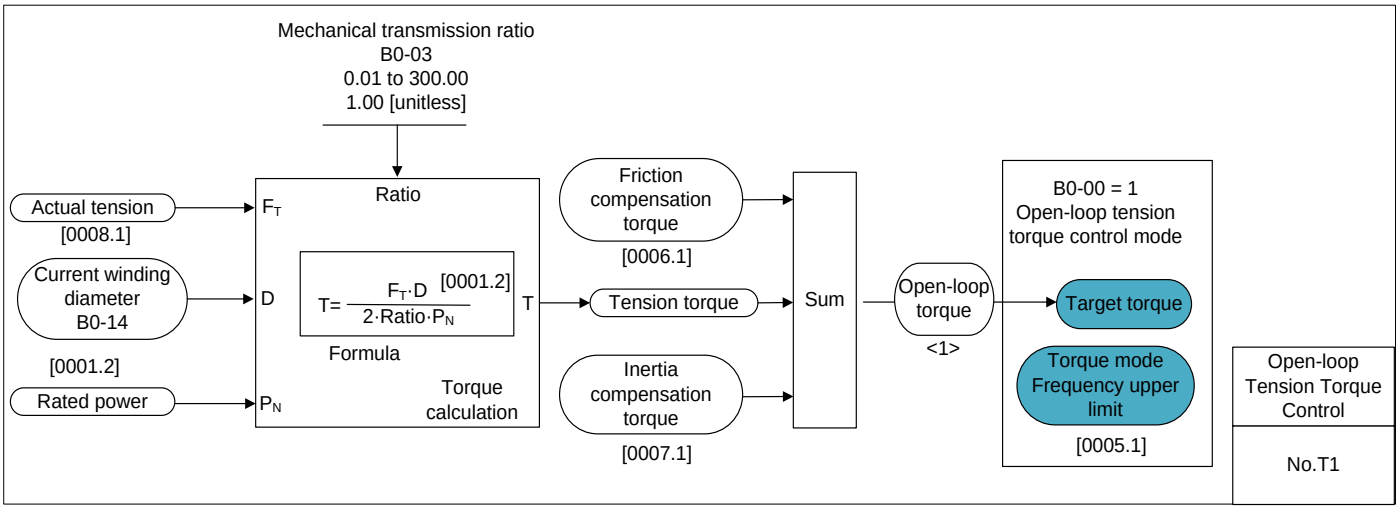


Figure 7-2 Closed-loop tension speed control (B0-00 = 2)

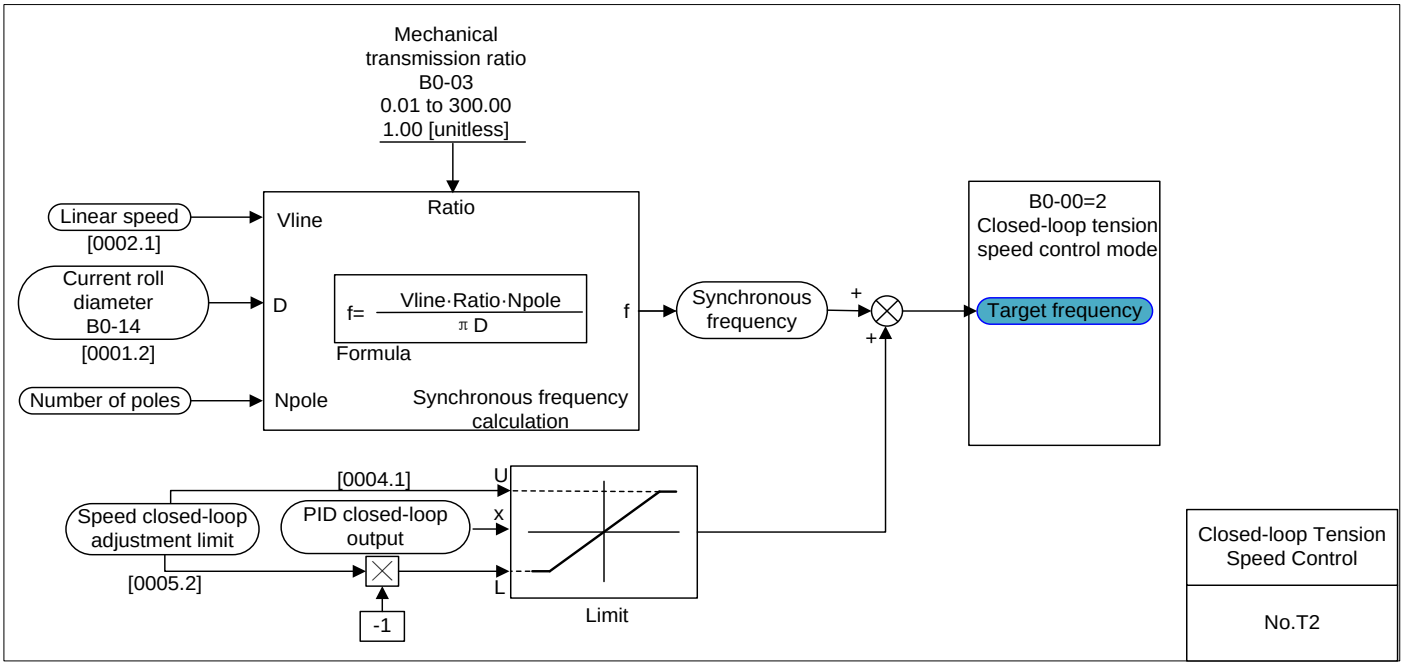


Figure 7-3 Closed-loop tension torque control (B0-00 = 3)

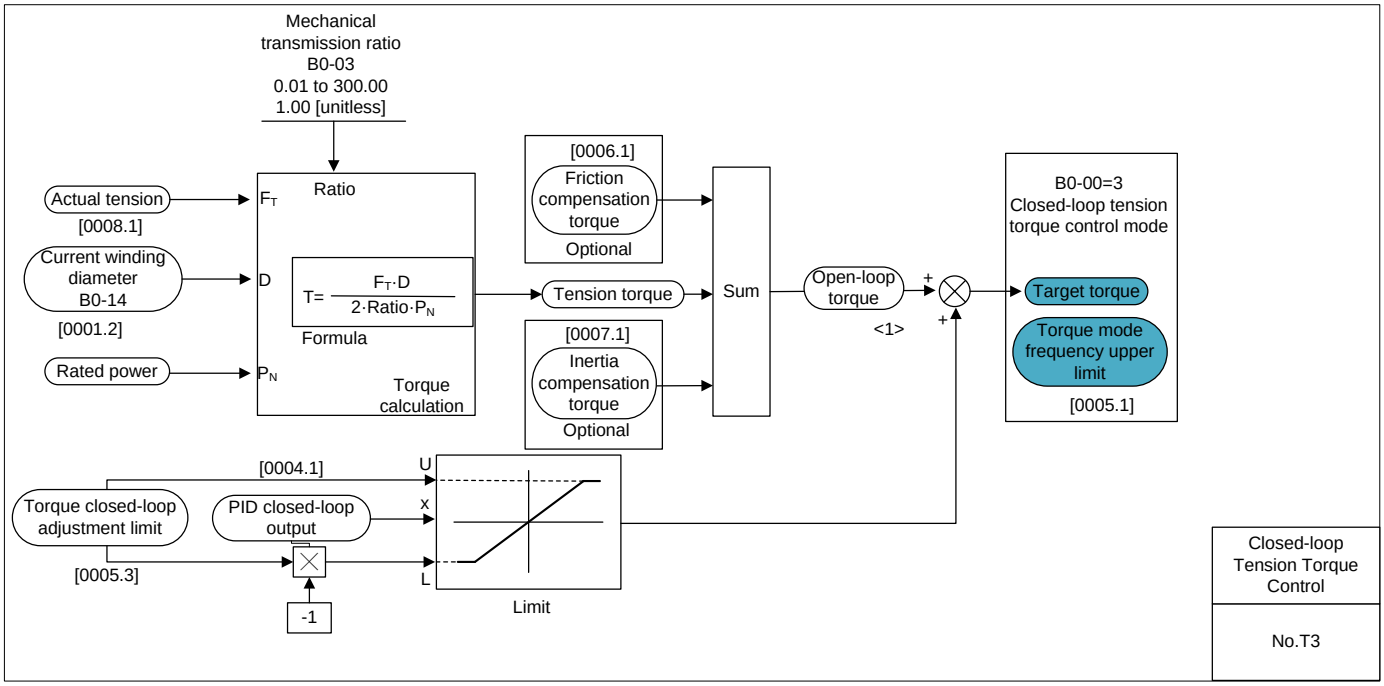
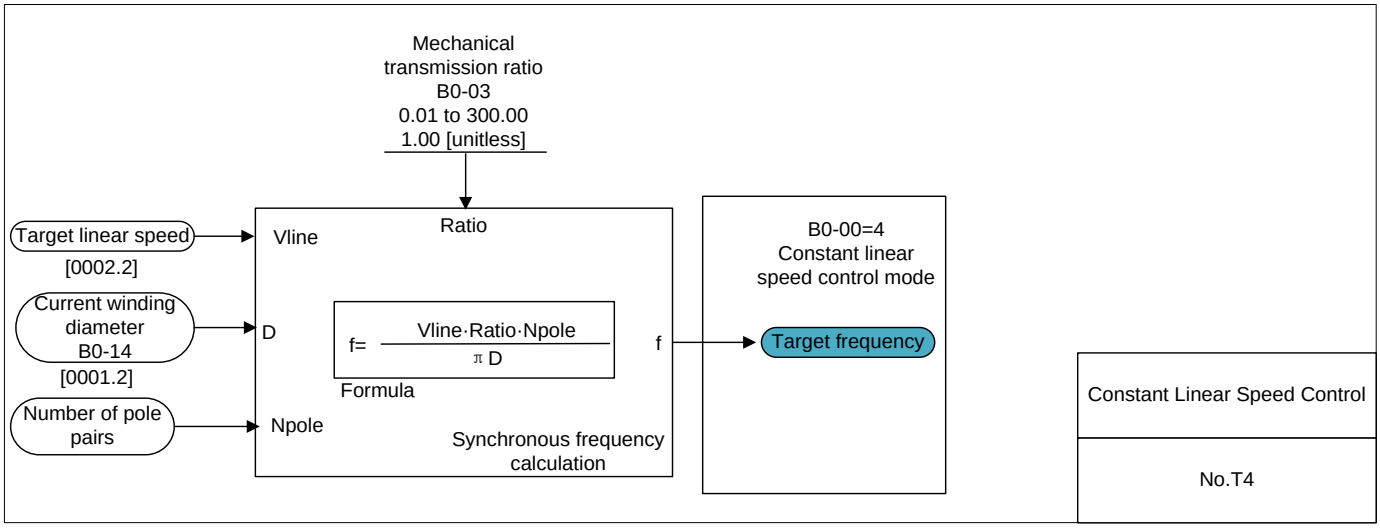


Figure 7-4 Constant linear speed control (B0-00 = 4)



Additional function: Refer to figure 7-12 and figure 7-13 for external taper output and pre-drive function.

7.2 Sub Function Diagrams

Figure 7-5 Winding diameter calculation function

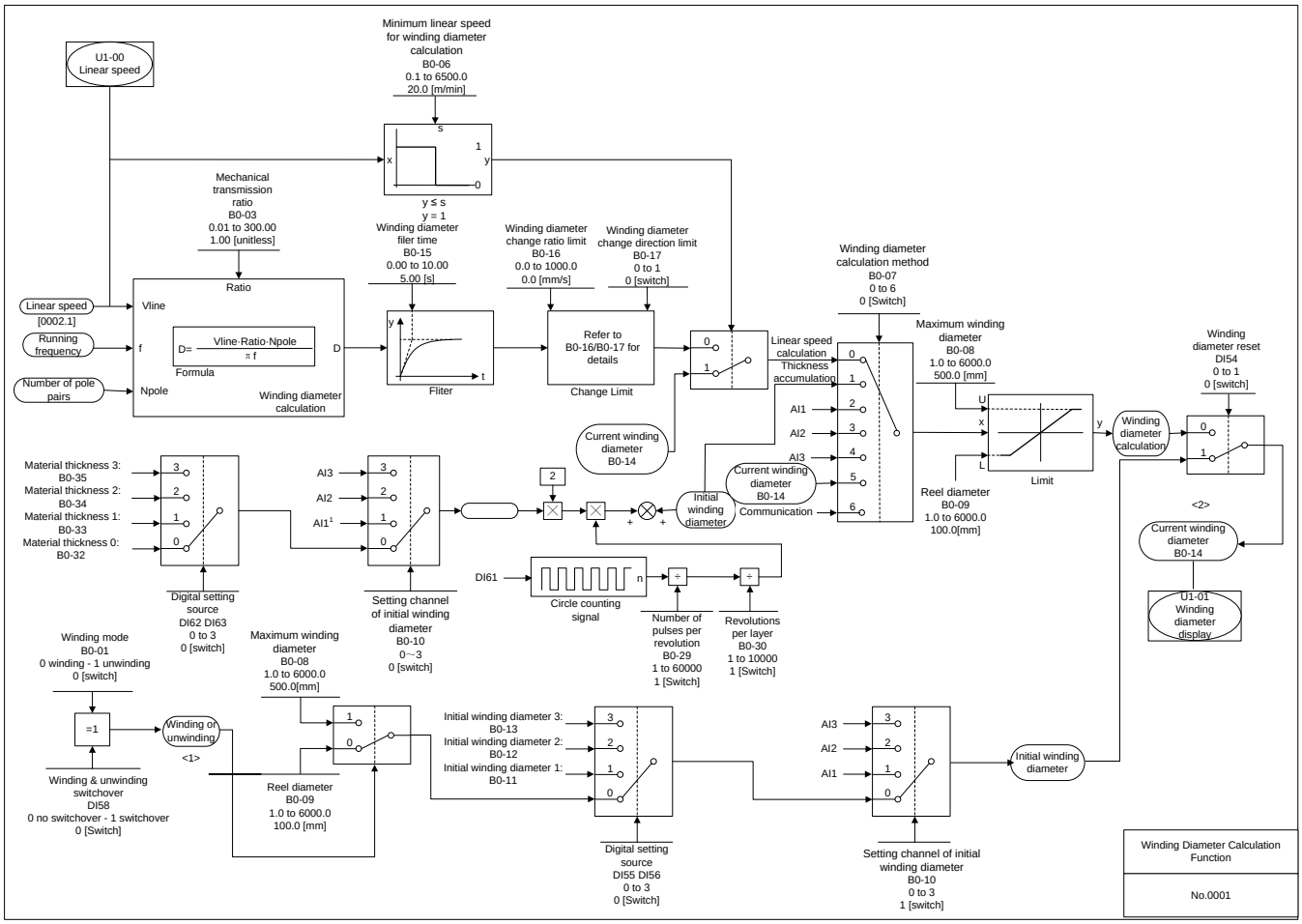


Figure 7-6 Linear speed source function

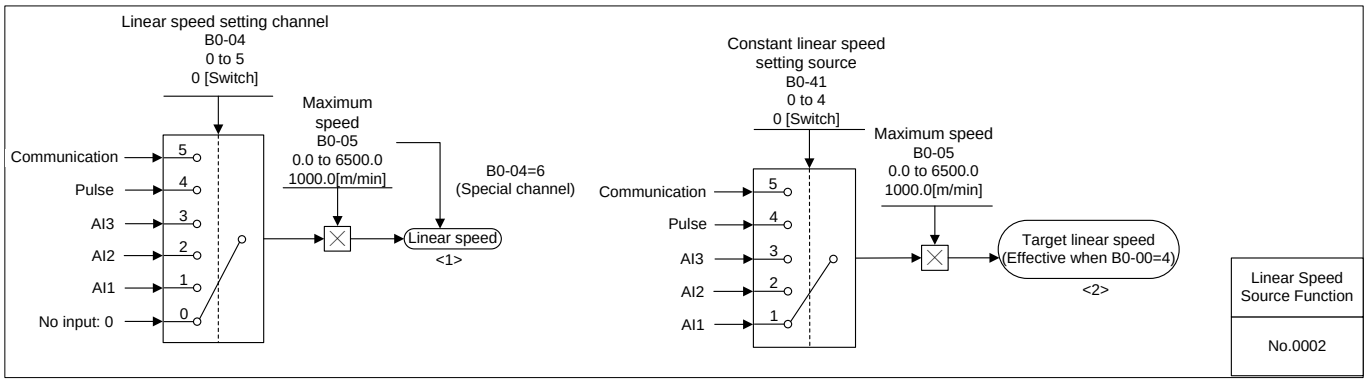


Figure 7-7 Tension setting function

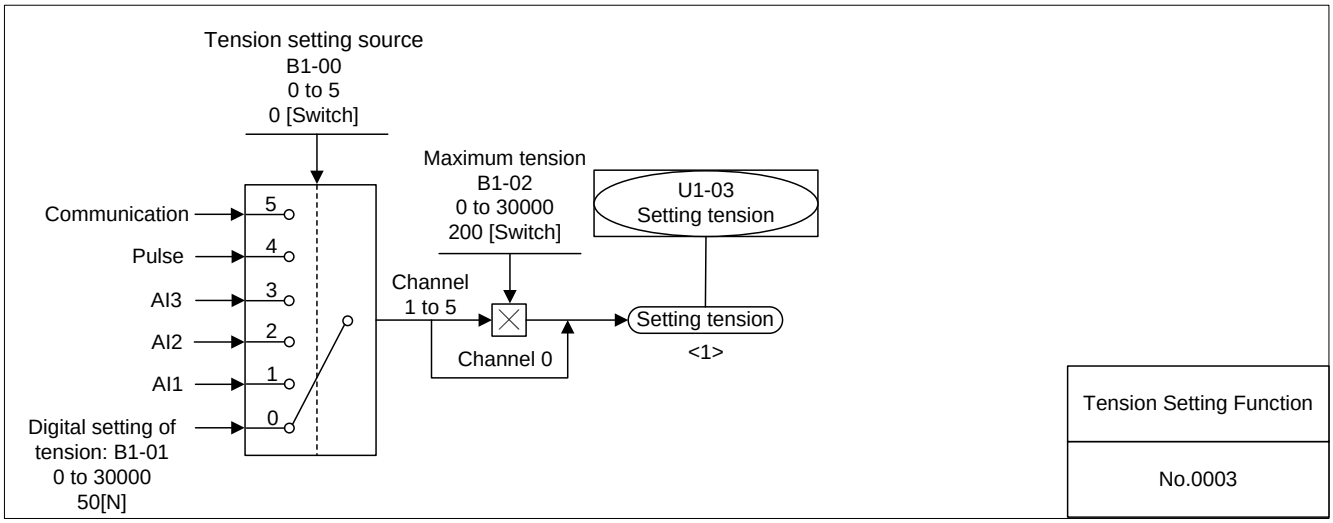


Figure 7-8 PID Closed-loop adjustment function

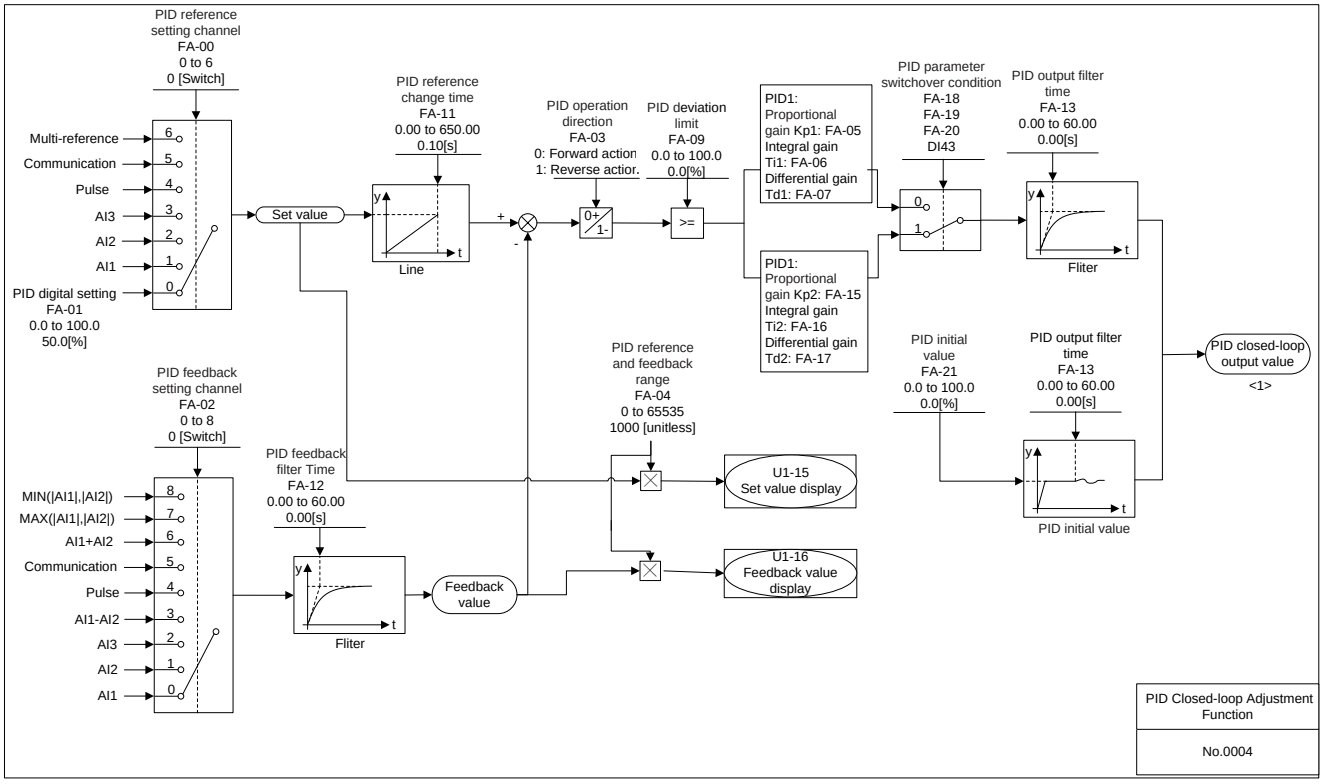


Figure 7-9 Frequency/torque limit function

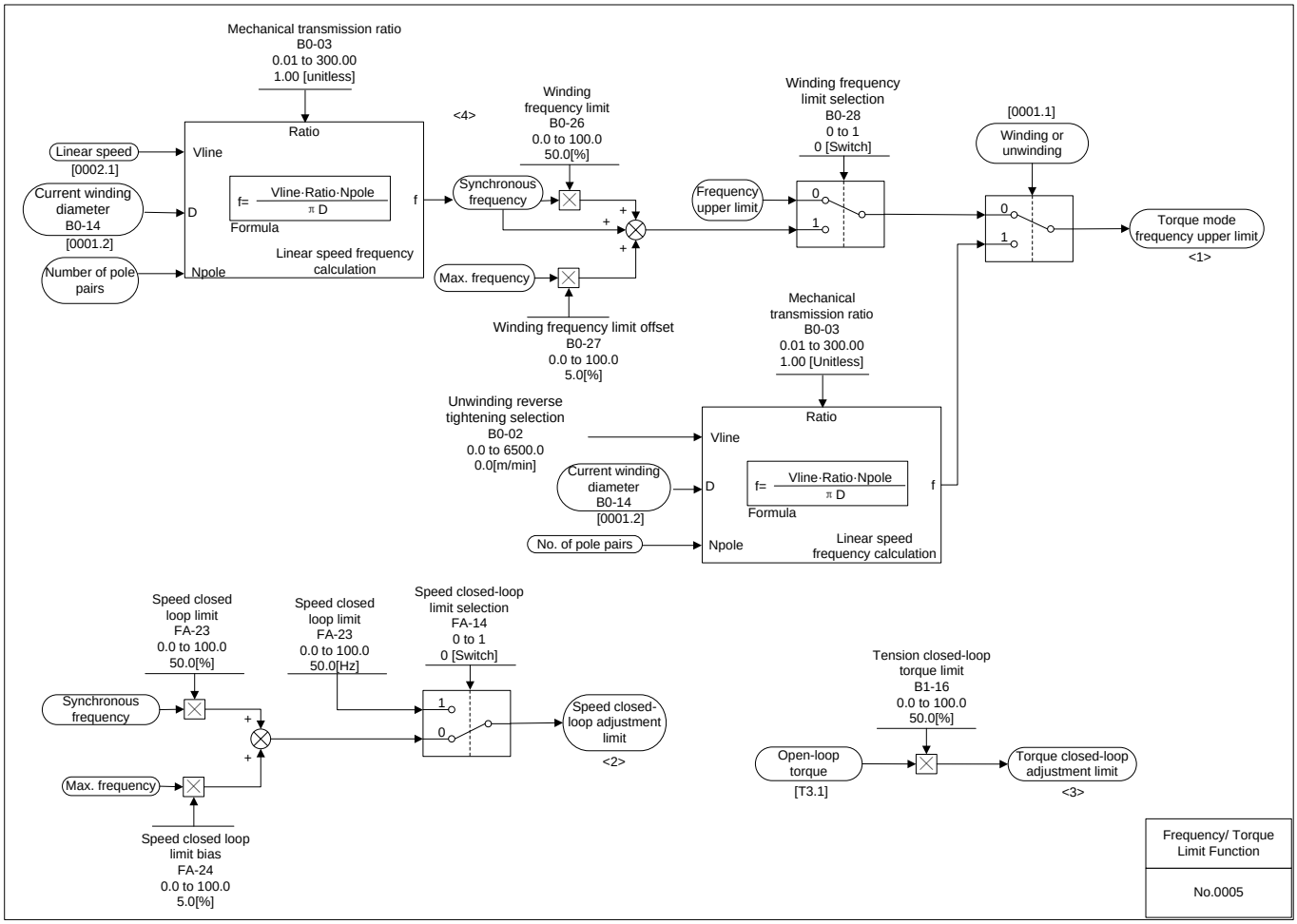


Figure 7-10 Friction torque compensation function

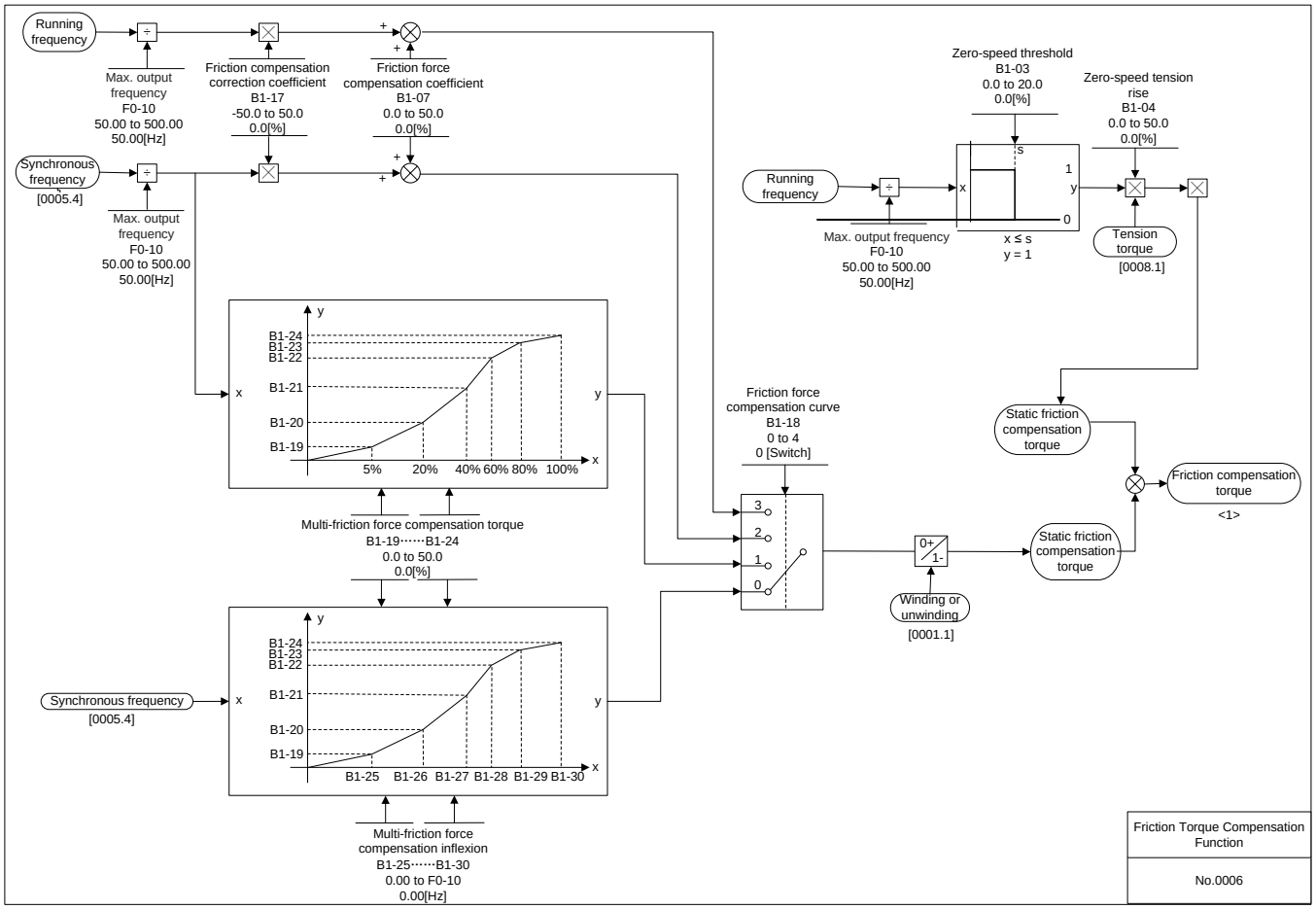


Figure 7-11 Inertia torque compensation function

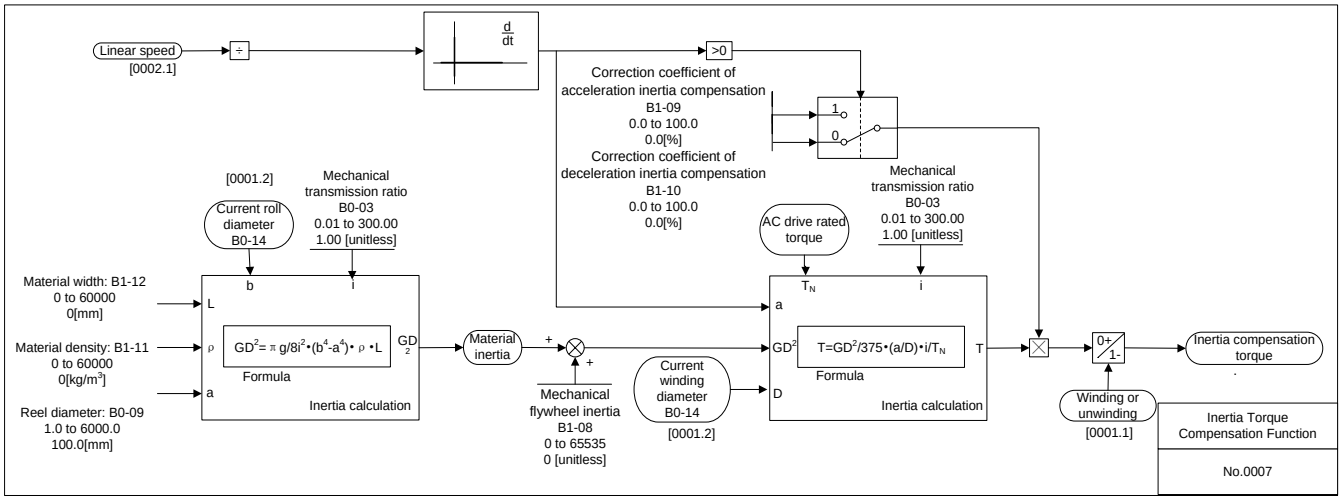


Figure 7-12 External taper output function

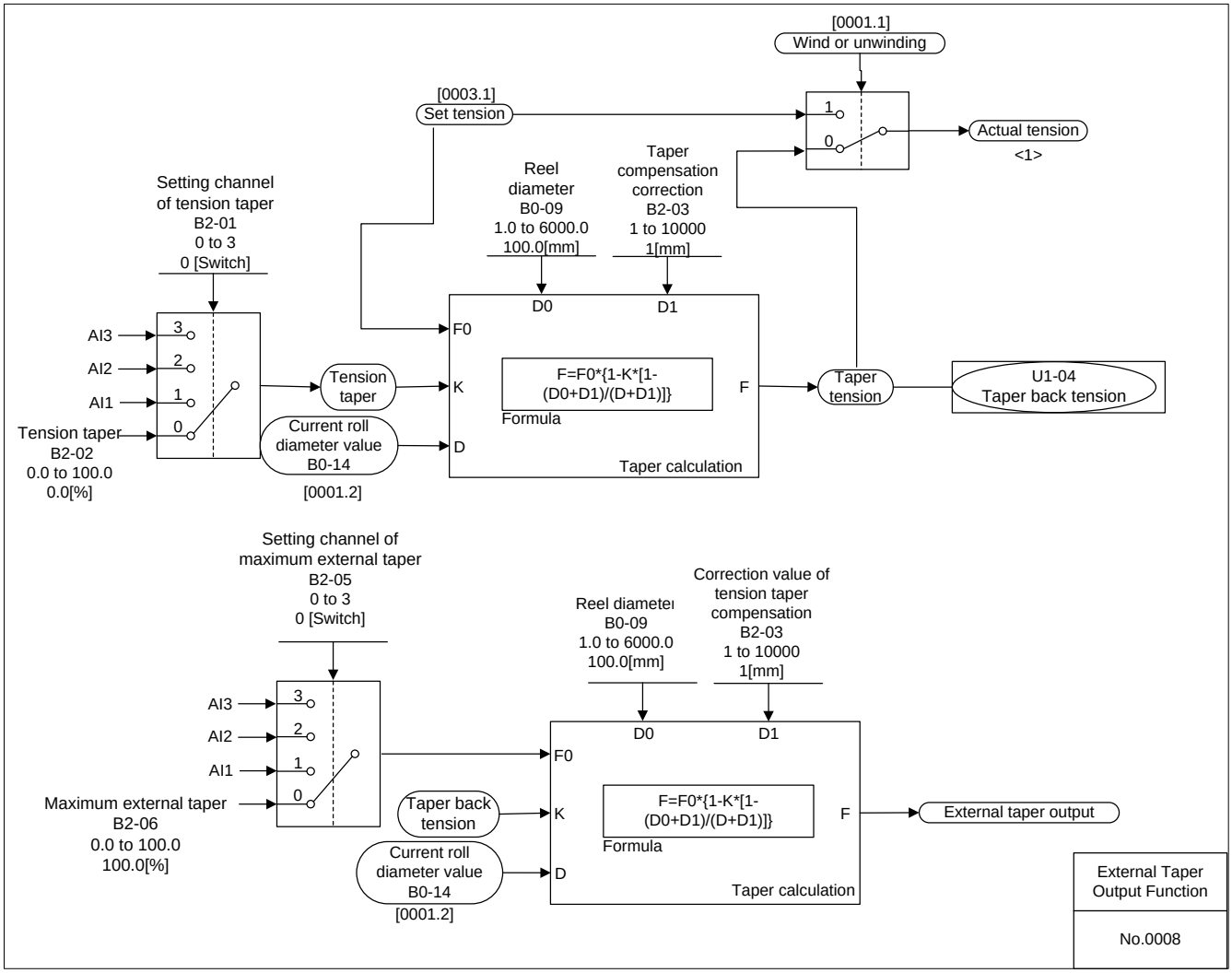
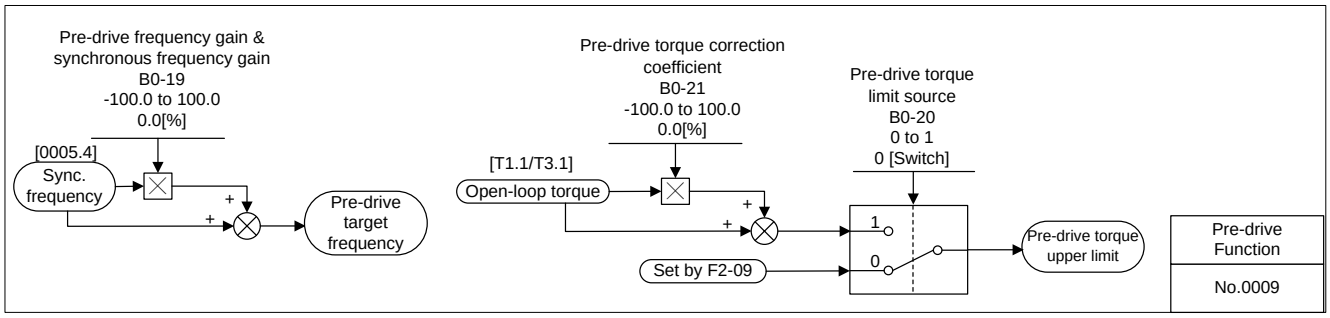


Figure 7-13 Pre-drive function



8 Troubleshooting

8.1 Fault Codes

Display	Fault Name	Possible Causes	Solutions
Err02	Overcurrent during acceleration	Ground fault or short circuit exists in the output circuit.	Check whether short-circuit occurs on the motor, motor cable or contactor.
		Control mode is SVC or FVC but motor auto-tuning is not performed.	Set motor parameters according to motor nameplate and perform motor auto-tuning.
		Acceleration time is too short.	Increase acceleration time.
		The overcurrent stall prevention parameters are set improperly.	Ensure that current limit is enabled (F3-19 = 1). The setting of current limit level (F3-18) is too large. Adjust it between 120% and 150%. The setting of current limit gain (F3-20) is too small. Adjust it between 20 and 40.
		Customized torque boost or V/F curve is not appropriate.	Adjust the customized torque boost or V/F curve.
		The spinning motor is started.	Enable the catching a spinning motor function or start the motor after it stops.
		The AC drive suffers external interference.	View historical fault records. If the current value is far from the overcurrent level, find interference source. If external interference does not exist, it is the drive board or hall device problem.
Err03	Overcurrent during deceleration	Ground fault or short circuit exists in the output circuit.	Check whether short-circuit occurs on the motor, motor cable or contactor.
		Control mode is SVC or FVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
		Acceleration time is too short.	Increase acceleration time.
		The overcurrent stall prevention parameters are set improperly.	Ensure that current limit is enabled (F3-19 = 1). The setting of current limit level (F3-18) is too large. Adjust it between 120% and 150%. The setting of the current limit gain (F3-20) is too small. Adjust it between 20 and 40.
		Braking unit and braking resistor are not installed.	Install braking unit and braking resistor.
		The AC drive suffers external interference.	View historical fault records. If the current value is far from the overcurrent level, find interference source. If external interference does not exist, it is the drive board or hall device problem.

Display	Fault Name	Possible Causes	Solutions
Err04	Overcurrent at constant speed	Ground fault or short circuit exists in the output circuit.	Check whether short-circuit occurs on the motor, motor cable or contactor.
		Control mode is SVC or FVC but motor auto-tuning is not performed.	Set motor parameters according to motor nameplate and perform motor auto-tuning.
		The overcurrent stall prevention parameters are set improperly.	Ensure that current limit is enabled (F3-19 = 1). The setting of current limit level (F3-18) is too large. Adjust it between 120% and 150%. The setting of current limit gain (F3-20) is too small. Adjust it between 20 and 40.
		The AC drive power class is small.	If output current exceeds rated motor current or rated output current of the AC drive during stable running, replace a drive of larger power class.
		The AC drive suffers external interference.	View historical fault records. If the current value is far from the overcurrent level, find interference source. If external interference does not exist, it is the drive board or hall device problem.
Err05	Overvoltage during acceleration	Input voltage is too high.	Adjust input voltage to normal range.
		An external force drives motor during acceleration.	Cancel the external force or install a braking resistor.
		The overvoltage stall prevention parameters are set improperly.	Ensure that the voltage limit function is enabled (F3-23 = 1). The setting of voltage limit (F3-22) is too large. Adjust it between 700 V and 770 V. The setting of frequency gain for voltage limit (F3-24) is too small. Adjust it between 30 and 50.
		Braking unit and braking resistor are not installed.	Install braking unit and braking resistor.
		Acceleration time is too short.	Increase acceleration time.
Err06	Overvoltage during deceleration	The overvoltage stall prevention parameters are set improperly.	Ensure that the voltage limit function is enabled (F3-23 = 1). The setting of voltage limit (F3-22) is too large. Adjust it between 700 V and 770 V. The setting of frequency gain for voltage limit (F3-24) is too small. Adjust it between 30 and 50.
		An external force drives motor during deceleration.	Cancel the external force or install braking resistor.
		Deceleration time is too short.	Increase deceleration time.

Display	Fault Name	Possible Causes	Solutions
		Braking unit and braking resistor are not installed.	Install braking unit and braking resistor.
Err07	Overvoltage at constant speed	The overvoltage stall prevention parameters are set improperly.	Ensure that the voltage limit function is enabled (F3-23 = 1). The setting of voltage limit (F3-22) is too large. Adjust it between 700 V and 770 V. The setting of frequency gain for voltage limit (F3-24) is too small. Adjust it between 30 and 50. The setting of frequency rise threshold during voltage limit (F3-26) is too small. Adjust it between 5 Hz and 20 Hz.
		An external force drives motor during running.	Cancel the external force or install a braking resistor
Err08	Pre-charge resistor fault	Bus voltage fluctuates around undervoltage threshold continuously.	Contact the agent or Inovance.
Err09	Undervoltage	Instantaneous power failure occurs	Enable the power dip ride through function (F9-59 ≠ 0).
		The AC drive's input voltage is not within the permissible range.	Adjust the voltage to normal range.
		The bus voltage is abnormal.	Contact the agent or Inovance.
		The rectifier bridge, the buffer resistor, the drive board or the control board are abnormal.	Contact the agent or Inovance.
Err10	Drive overload	Load is too heavy or locked-rotor occurs on motor.	Reduce load or check motor and mechanical conditions.
		The AC drive power class is small.	Replace a drive of larger power class.
Err11	Motor overload	F9-01 (Motor overload protection gain) is set improperly.	Set F9-01 correctly.
		Load is too heavy or locked-rotor occurs on motor.	Reduce load or check motor and mechanical conditions.
Err12	Power input phase loss	Input phase loss occurs.	Eliminate faults in external circuitry.
		Drive board, lightning protection board, control board, or rectifier bridge is abnormal.	Contact the agent or Inovance.
Err13	One drive output phase loss	Motor winding is damaged.	Check resistance between motor wires. Replace motor is winding is damaged.
		The cable connecting the AC drive and the motor is abnormal.	Check for wiring errors and ensure the output cable is connected properly.
		The AC drive's three-phase outputs are unbalanced when the motor is running.	Check whether the motor three-phase winding is normal.
		The drive board or the IGBT is abnormal.	Contact the agent or Inovance.
Err14	IGBT overheat	The ambient temperature is too high.	Lower the ambient temperature.

Display	Fault Name	Possible Causes	Solutions
		The ventilation is clogged.	Clean the ventilation.
		The fan is damaged.	Replace the cooling fan.
		Thermally sensitive resistor of IGBT is damaged.	Replace the damaged thermally sensitive resistor.
		The AC drive IGBT is damaged.	Replace the AC drive IGBT.
Err15	External equipment fault	External fault signal is input via DI.	Confirm that the mechanical condition allows restart (F8-18) and reset the operation.
		External fault signal is input via virtual I/O.	Confirm that the virtual I/O parameters in group A1 are set correctly and reset the operation.
Err16	Communication fault	Host computer is in abnormal state.	Check the cable of host computer.
		Communication cable is abnormal.	Check the communication cables.
		The serial port communication protocol (F0-28) of extension communication card is set improperly.	Set F0-28 of extension communication card correctly.
		Communication parameters in group Fd are set improperly.	Set communication parameters in group Fd properly.
		After all the preceding checking is done but the fault still exists, restore the default settings.	
Err17	Contactor fault	Drive board and power supply are abnormal.	Replace drive board or power supply board.
		Contactor is abnormal.	Replace contactor.
		The lightning protection board is abnormal.	Replace the lightning protection board.
Err18	Current detection fault	The hall is abnormal.	Replace the hall .
		The drive board is abnormal.	Replace the drive board.
Err19	Motor tuning fault	Motor parameters are not set according to nameplate.	Set motor parameters correctly according to nameplate.
		Motor auto-tuning times out.	Check the cable connecting AC drive and motor.
		The encoder is abnormal.	Check whether F1-27 (encoder pulses per revolution) is set correctly. Check whether signal lines of encoder are connected correctly and securely.
Err20	Encoder fault	Encoder is not matched.	Set the type of encoder correctly.
		Encoder wiring is incorrect.	Check the PG card power supply and phase sequence.
		Encoder is damaged.	Replace encoder.
		PG card is abnormal.	Replace PG card.
Err21	EEPROM read-write fault	The EEPROM chip is damaged.	Replace the main control board.
Err23	Short circuit to ground	Motor is short circuited to the ground.	Replace cable or motor.

Display	Fault Name	Possible Causes	Solutions
Err26	Accumulative running time reached	Accumulative running time reaches the setting value.	Clear the record through parameter initialization.
Err27	User-defined fault 1	User-defined fault 1 is input via DI.	Reset the operation.
		User-defined fault 1 is input via virtual I/O.	
Err28	User-defined fault 2	User-defined fault 2 is input via DI.	Reset the operation.
		User-defined fault 2 is input via virtual I/O.	
Err29	Accumulative power-on time reached	Accumulative power-on time reaches the setting value.	Clear the record through parameter initialization.
Err30	Off load fault	The output current of AC drive is smaller than F9-64 (load loss detection level).	Check whether load is disconnected or the setting of F9-64 and F9-65 (load lost detection time) satisfies actual running condition.
Err31	PID feedback lost during running	PID feedback is smaller than the setting value of FA-26 (detection level of PID feedback loss).	Check PID feedback or set FA-26 properly.
Err40	Quick current limit	Load is too heavy or locked-rotor occurs on motor.	Reduce load or check motor and mechanical conditions.
		The AC drive power class is small.	Replace a drive of larger power class.
Err41	Motor switchover fault during running	Motor switchover via terminal during drive running of the AC drive.	Perform motor switchover after the AC drive stops.
Err42	Speed error	Encoder parameters are set improperly.	Set encoder parameters properly.
		Motor auto-tuning is not performed.	Perform motor auto-tuning.
		F9-69 (detection level of speed error) and F9-70 (detection time of speed error) are set incorrectly.	Set F9-69 and F9-70 correctly based on actual condition.
Err43	Motor overspeed	Encoder parameters are set improperly.	Set encoder parameters properly.
		Motor auto-tuning is not performed.	Perform motor auto-tuning.
		F9-67 (overspeed detection level) and F9-68 (overspeed detection time) are set incorrectly.	Set F9-67 and F9-68 correctly based on the actual situation.
Err45	Motor overtemperature	Cable connection of temperature sensor becomes loose	Check cable connection of temperature sensor.
		The motor temperature is too high.	Decrease carrier frequency or take other measures to cool the motor.
Err61	Two or three drive output phases loss	Resistance of braking resistor is too small.	Replace a braking resistor of larger resistance.
Err62	Short-circuit of braking circuit	Braking IGBT is abnormal.	Contact the agent or Inovance.

8.2 Common Symptoms and Diagnostics

Fault Name	Possible Causes	Solutions
There is no display at power-on. 	The mains voltage is not input or too low.	Check the power supply.
	The switching power supply on drive board of the AC drive is faulty.	Check bus voltage. Check that the 24Voutputand +10 V output on the control board are normal.
	Wires between control board and drive board and between control board and operating panel break.	Re-connect the 8-pin wire and 40-pin wire.
	Pre-charge resistor of the AC drive is damaged.	Contact the agent or Inovance.
	Control board or operating panel is faulty.	
	Rectifier bridge is damaged.	
"HC" is displayed at power-on. 	Wire between drive board and control board is in poor contact.	Re-connect the 8-pin wire and 28-pin wire.
	Related components on control board are damaged.	Contact the agent or Inovance.
	The motor or motor cable is short circuited to ground.	
	The hall is damaged.	
	The mains voltage is too low.	
The display is normal upon power-on, but "HC" is displayed after start and the motor stops immediately. 	The cooling fan is damaged or locked-rotor occurs.	Replace the fan.
	Short circuit exists in wiring of control terminals.	Eliminate short circuit fault in control circuit wiring.
Err14 (IGBT overheat) is detected frequently. 	The setting of carrier frequency is too high.	Reduce carrier frequency (F0-15).
	The cooling fan is damaged, or ventilation is clogged.	Replace the fan or clean the ventilation.
	Components inside the AC drive are damaged (thermistor or others).	Contact the agent or Inovance.
Err17 is detected upon power-on or running.	The pre-charge relay or contactor is not closed.	Check whether the relay or contactor cable is loose.
		Check whether the relay or contactor is faulty.

Fault Name	Possible Causes	Solutions
		Check whether 24 V power supply of the contactor is faulty.
		Contact the agent or Inovance.
"Err23" is displayed at power-on.	Motor or motor output cable is short circuited to ground.	Use a megger to measure insulation resistance of motor and motor cable.
	The AC drive is damaged.	Contact the agent or Inovance.
The motor does not rotate after the AC drive runs.	It is motor or motor cable problem.	Check that wiring between AC drive and motor is normal.
	Related AC drive and motor parameters are set improperly.	Restore the factory parameters and re-set the following parameters properly: Encoder parameters Motor ratings, such as rated motor frequency and rated motor speed Motor 1 control mode (F0-01) and command source selection (F0-02) F3-01 (torque boost) in V/F control under heavy-load start.
	Cable connection between drive board and control board is in poor contact.	Re-connect wirings and ensure secure connection.
	The drive board is faulty.	Contact the agent or Inovance.
The DI terminals are disabled.	Related parameters are set incorrectly.	Check and set parameters in group F4 again.
	External signals are incorrect.	Re-connect external signal cables.
	Jumper across OP and +24 V becomes loose.	Re-confirm the jumper bar across OP and +24 V.
	The control board is faulty.	Contact the agent or Inovance.
Motor speed does not rise in FVC control.	Encoder is faulty.	Replace encoder and re-confirm cable connection.
	Encoder connection is incorrect or in poor contact.	Re-connect the encoder to ensure in good contact.
	PG card is faulty.	Replace the PG card.
	Drive board is faulty.	Contact the agent or Inovance.
The AC drive detects overcurrent and overvoltage frequently.	Motor parameters are set improperly.	Set motor parameters or perform motor auto-tuning again.
	Acceleration/deceleration time is improper.	Set proper acceleration/deceleration time.
	Load fluctuates.	Contact the agent or Inovance.

Revision History

Date	Version	Change Description
June 2017	A00	First issue. Related firmware version: F7-16 = 331.15
April 2019	A01	Updated the cover; Updated certification description in Preface.

Shenzhen Inovance Technology Co., Ltd.

Add.: Building E, Hongwei Industry Park, Liuxian Road, Baocheng No. 70 Zone, Bao'an District, Shenzhen
Tel: +86-755-2979 9595
Fax: +86-755-2961 9897
Service Hotline: 400-777-1260
http: //www.inovance.com

Suzhou Inovance Technology Co., Ltd.

Add.: No. 16 Youxiang Road, Yuexi Town, Wuzhong District, Suzhou 215104, P.R. China
Tel: +86-512-6637 6666
Fax: +86-512-6285 6720
Service Hotline: 400-777-1260
http: //www.inovance.com