Operation Manual

Goodrive35-07 Series
VFDs for Tension Control

SHENZHEN INVT ELECTRIC CO., LTD.

Preface

Thank you for choosing Goodrive35-07 series variable-frequency drive (VFD) for tension control.

If not otherwise specified in this manual, the VFD always indicates Goodrive35-07 series VFDs for tension control, which focus on the textile industry, printing and packaging industry, plastic machinery industry, paper industry, cable manufacturing industry. It has the function of tension control and coil diameter calculation and meets the requirements of medium and high-end winding applications.

In the algorithm, the tension control module is special for the tension control of winding/unwinding and the comprehensive solutions of the whole processing segments.

The use of Goodrive35-07 series VFDs can not only replace torque motor, dc motor, such as tension controller and independently constitute a tension control system, and compared with traditional tension controller and frequency converter control scheme, the use of the frequency converter can make the system more concise, reduce cost, easy to maintain and gain more stable control effect.

The VFD can replace the torque motor, DC motor, tension controller to build up the tension control system independently. And for the traditional control solution of tension controller and VFD solutions, this VFD can facilitate the whole system, reduce the cost and stabilize the control performance.

If the end user is a military unit or the product is used for weapon manufacturing, please comply with relevant export control regulations in the Foreign Trade Law of the People's Republic of China, and complete necessary formalities.

Our company reserves the right to update the information of our products.

Contents

1 Product selection

1.1 Model description

GD35-07 - 5R5G - 4 - * *

① ② ③ ④

Table 1-1 Product model and description

Key	No.	Instruction	Content
Abbreviation	①	Abbreviation	GD35-07: Special for tension control
Rated power	②	Power range +Load type	5R5:5.5kW G: Constant torque load
Voltage degree	③	Voltage degree	2:AC 3PH 220V(-15%)－240V(+10%) 4:AC 3PH 380V(-15%)－440V(+10%) 6:AC 3PH 520V(-15%)－690V(+10%)
Lot No.	④	Lot No.	C1: Support 24V incremental encoder; D1: support rotary transformer Pulse+direction pulse input reference (optional); H1: support 5V/12V incremental encoder, Pulse + direction pulse input reference

1.2 Selection table

Model	Output power (kW)	Input current (A)	Output current (A)
GD35-07-1R5G-4-C1/D1/H1	1.5	5.0	3.7
GD35-07-2R2G-4-C1/D1/H1	2.2	5.8	5
GD35-07-004G-4-C1/D1/H1	4	13.5	9.5
GD35-07-5R5G-4-C1/D1/H1	5.5	19.5	14
GD35-07-7R5G-4-C1/D1/H1	7.5	25	18.5
GD35-07-011G-4-C1/D1/H1	11	32	25
GD35-07-015G-4-C1/D1/H1	15	40	32
GD35-07-018G-4-C1/D1/H1	18.5	47	38
GD35-07-022G-4-C1/D1/H1	22	56	45
GD35-07-030G-4-C1/D1/H1	30	70	60
GD35-07-037G-4-C1/D1/H1	37	80	75

Model	Output power (kW)	Input current (A)	Output current (A)
GD35-07-045G-4-C1/D1/H1	45	94	92
GD35-07-055G-4-C1/D1/H1	55	128	115
GD35-07-075G-4-C1/D1/H1	75	160	150

1.3 I/O PG card

EC-PG 3 01 - 24
① ② ③ ④ ⑤

No.	Instruction	Content
①	Product type	EC- Extension card
②	Card type	PG: P/G card
③	Technical version	Odds(1,3,5) are used to shown the technical version(the first generation, second generation and third generation) **Note: 3 means special for GD3XX series products.**
④	Code	03: PG port of UVW encoder
		04: PG port of rotary transformer (standard) + pulse direction reference (optional)
		05: PG port of incremental encoder + pulse direction reference
⑤	Power supply	00:Null
		05:5V
		12:12-15V
		24:24V

1.4 I/O PG selection table

Model	Instruction	Specification
EC-PG301-24	24V I/O incremental PG card	24V incremental ABZ encoder, support differential, OC and push-pull input, Max. 100kHz, standard for Goodrive35-07 series C1 VFDs
EC-PG304-05	5V I/O resolver PG card	Rotary transformer encoder, Max. 500kHz, standard for Goodrive35-07 series D1 VFDs
EC-PG304-00	I/O resolver PG card	Rotary transformer encoder, Max. 500kHz, support pulse reference, optional for Goodrive35-07 series D1 VFDs

Model	Instruction	Specification
EC-PG305-12	5V/12V I/O multi-function incremental PG card	5V/12V incremental ABZ encoder, Max. 300kHz, standard for Goodrive35-07 series H1 VFDs

1.5 Basic control circuit

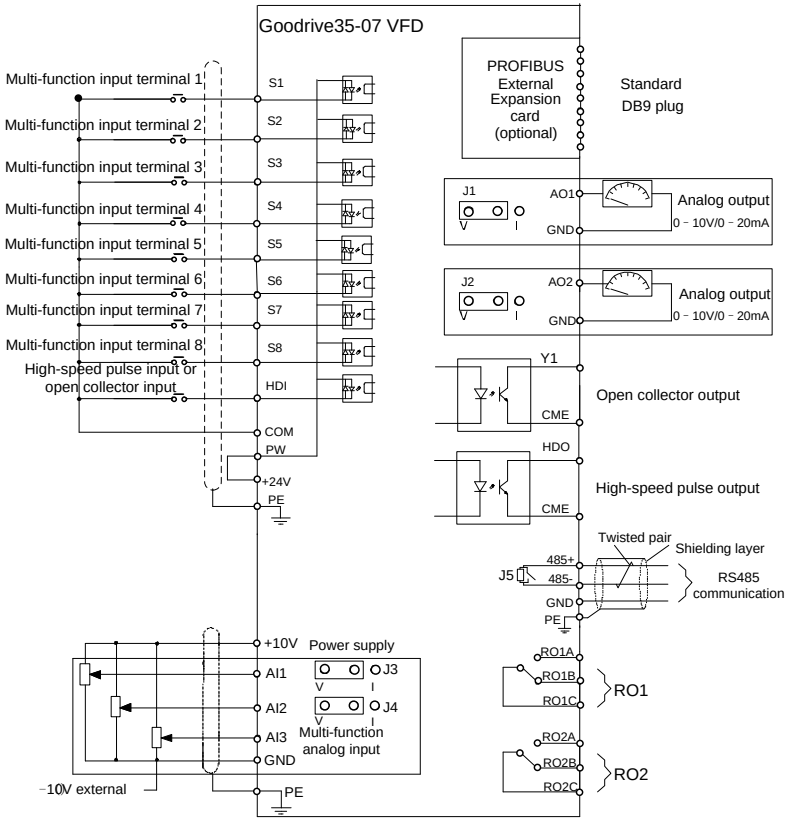
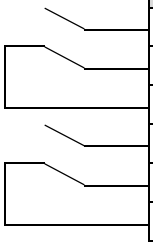
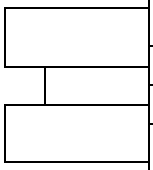


Figure 1-1 Wiring of the control circuit

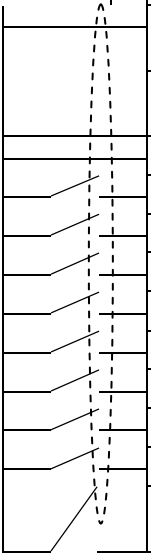
Terminal name	Description
+10V	Local power supply +10V
AI1	1. Input range: AI1/AI2 voltage and current can be chose: 0 – 10V/0 – 20mA;AI1 can be shifted by J3; AI2 can be shifted by J4 AI3:-10V – +10V 2. Input impedance: voltage input: 20kΩ; current input: 500Ω 3. Resolution: the min. one is 5mV when 10V corresponds to 50Hz 4. Deviation ±1%, 25℃
AI2	
AI3	
GND	Reference ground of the 10V power supply
AO1	1. Output range: 0 – 10V or -20 – 20mA 2. The voltage or the current output is depended on the jumper. AO1 is switched by J1 and AO2 is switched by J2 3. Deviation±1%,25℃
AO2	



Terminal	Description
RO1A	RO1 relay output, RO1A NO, RO1B NC, RO1C common terminal Contactor capability: 3A/AC250V,1A/DC30V
RO1B	
RO1C	
RO2A	RO2 relay output, RO2A NO, RO2B NC, RO2C common terminal Contactor capability: 3A/AC250V,1A/DC30V
RO2B	
RO2C	



Terminal	Description
HDO	1. Switch input: 200mA/30V 2. Output frequency range: 0 – 50kHz
COM	Reference ground of the +24V power supply
CME	Common terminal of the open collector pole output
Y	1.Switch capability: 200mA/30V 2.Output frequency range: 0 – 1kHz
485+	485 communication interface and 485 differential signal interface For standard 485 communication interface, please use shielded twisted pairs.
485-	

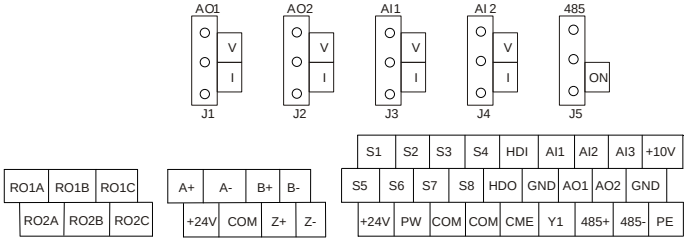


Terminal	Description	
PE	Grounding terminal for safe protection	
PW	External power input terminal for digital input circuits Voltage range: 12 – 24V	
+24V	The VFD provides power supply for users with a max. output current of 200mA	
COM	Reference ground of the +24V power supply	
S1	Switch input 1	1. Internal impedance:3.3kΩ 2. 12 – 30V voltage input is available 3. The terminal is the dual-direction input terminal supporting both NPN and PNP 4. Max input frequency:1kHz 5. All are programmable digital input terminal. User can set the terminal function through function codes
S2	Switch input 2	
S3	Switch input 3	
S4	Switch input 4	
S5	Switch input 5	
S6	Switch input 6	
S7	Switch input 7	
S8	Switch input 8	
HDI	Except for S1 – S8, this terminal can be used as high frequency input channel. The max. input frequency: 50kHz	

1.6 I/O PG card wiring diagram

1.6.1 C1 terminal (EC-PG301-24) and the wiring diagram

1.6.1.1 Terminal arrangement

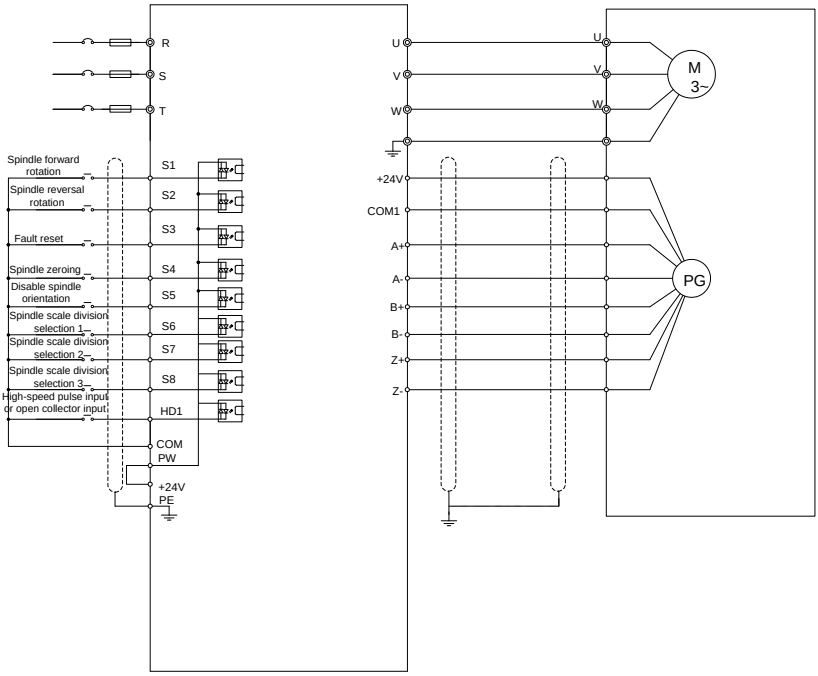


1.6.1.2 Terminal description

Terminal	Instruction
+24V	Power supply, provide 24V, 200mA power supply
A+, A-, B+, B-, Z+, Z-	Signal input
COM1	Grounding terminal of the encoder

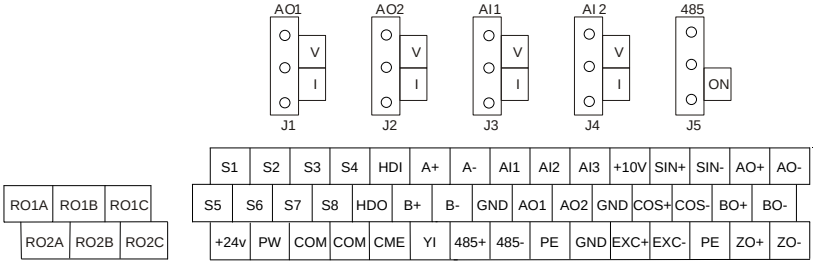
Note: refer to section 1.5 Basic control circuit for detailed information of AO1, AO2, AI1, AI2, 485 and other terminals.

1.6.1.3 Wiring diagram



1.6.2 D1 terminal (EC-PG304-00) and the wiring diagram

1.6.2.1 Terminal arrangement



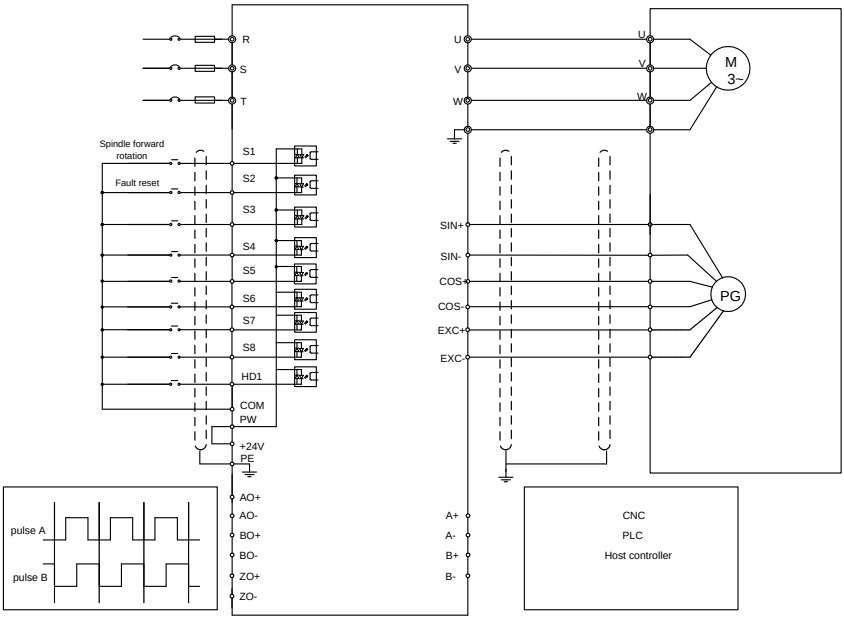
1.6.2.2 Terminal description

Terminal	Instruction
EXC+, EXC-	10kHz Exciting signal of the encoder, the Max. current is 100mA
SIN+, SIN- , COS+ and COS-	Signal input

Terminal	Instruction
A+, A-, B+, B-	Pulse reference signal, default as 5V input and external limiting resistor is needed if the input is above 10V
AO+, AO-, BO+, BO-, ZO+, ZO-	Encoder signal output, 5V differential signal and the ratio of frequency-division is 1:1

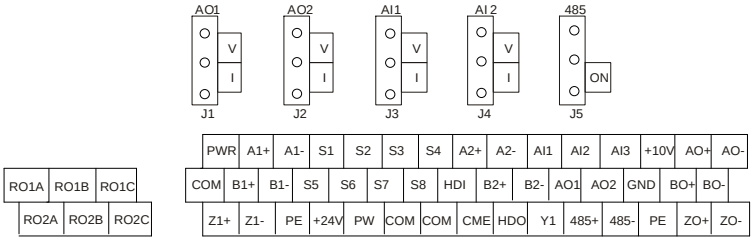
Note: refer to section 1.5 Basic control circuit for detailed information of AO1, AO2, AI1, AI2, 485 and other terminals.

1.6.2.3 Wiring diagram



1.6.3 H1 terminal (EC-PG305-12) and the wiring diagram

1.6.3.1 Terminal arrangement

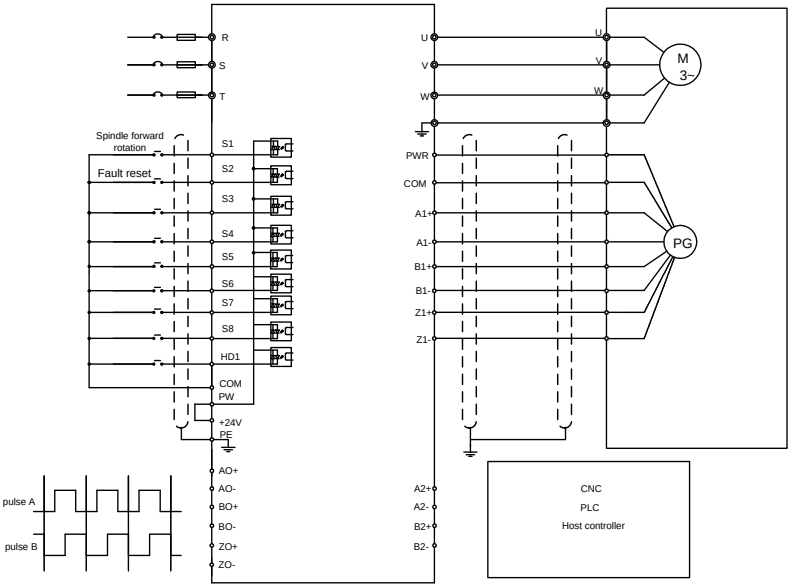


1.6.3.2 Terminal description

Terminal	Instruction
PWR	Power supply, provide 5V/12V, 200mA power supply, switch by the DIP
A1+, A1-, B1+, B1-, Z1+, Z1-	Signal input of the encoder, open collector and pull and pushing
A2+, A2-, B2+, B2-,	Pulse reference signal, default as 5V input. External current-limiting resistor is needed when the input voltage is above 10V
AO+, AO-, BO+, BO-, ZO+ and ZO-	Encoder signal output, 5V differential signal and the ratio of frequency-division is 1:1
COM	Grounding terminal of the encoder

Note: refer to section 1.5 Basic control circuit for detailed information of AO1, AO2, AI1, AI2, 485 and other terminals.

1.6.3.3 Wiring diagram

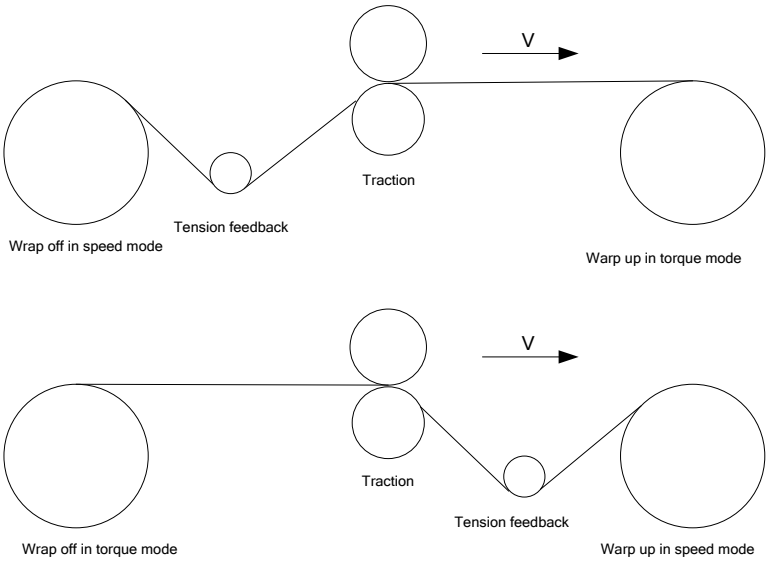


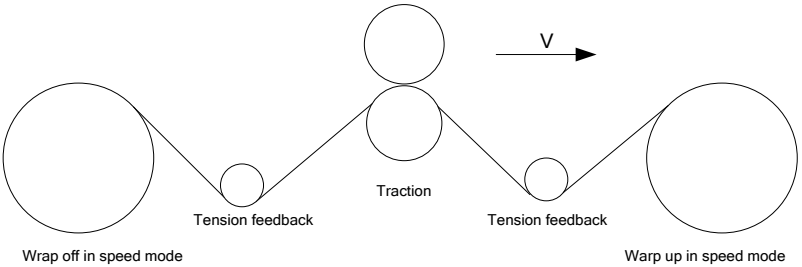
2 Tension control solutions

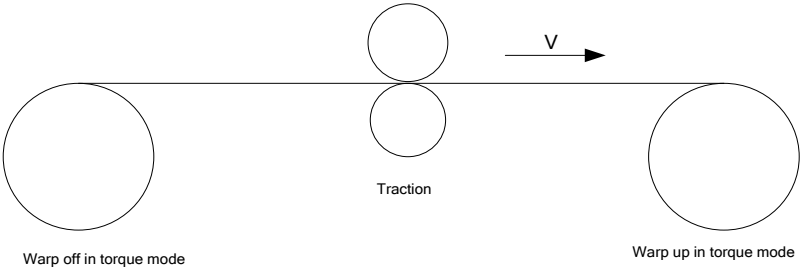
In many fields of industrial production, precise tension control is needed to maintain a constant output tension of the drive equipment, in order to improve the quality of the products. In the winding and unwinding of some industries such as paper processing, printing and dyeing, packing, wire and cable manufacturing, textile, fiber, optic cable, leather, metal foil material processing and so on, tension needs to keep constant.

The VFD controls the tension through the output torque or speed of the motor. There are three kinds of control modes: tension speed control mode, open loop tension torque control mode and close-loop tension torque control mode.

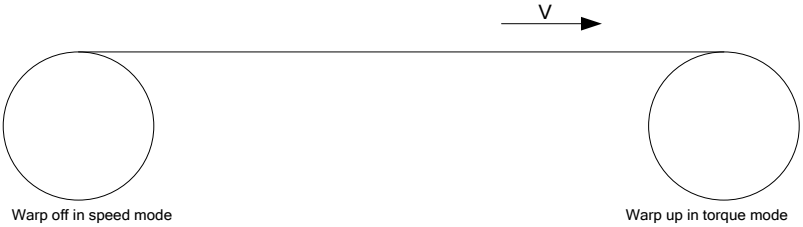
2.1 Sketch map of tension control

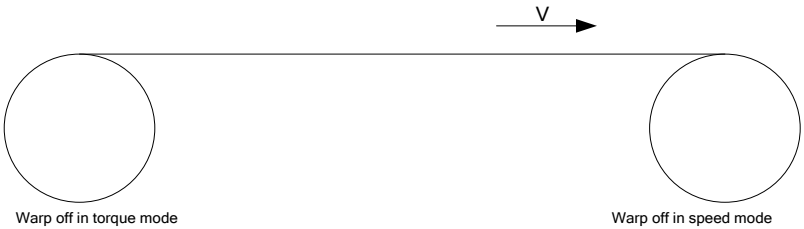






In some special situations, if the coil diameter can be counted through thickness, the following modes are available:

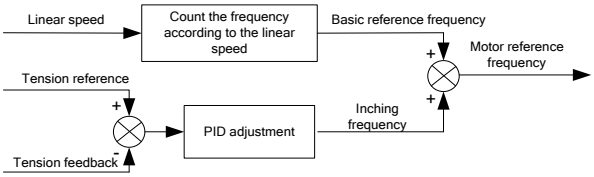




2.2 Speed control

The detection feedback signal is needed in the close loop adjustment. PID calculation is carried out according to the feedback signal for the motor speed adjustment, linear speed and stable tension control. If tension rod or floating roller is used for feedback, changing the setting value (PID reference) may change the actual tension, at the same time, changing the mechanical configuration such as tension rocker or floating roller weight can also change the tension.

The control principle is:



Relevant modes:

(1) Input module of linear speed: this part is important for the calculation of the basic setting frequency according to the linear speed and the calculation of coil diameter according to the linear speed.

(2) Calculation module of the real-time coil diameter: the calculation of coil diameter determines the control performance. The coil diameter can be calculated according to the output frequency of the VFD and the linear speed or be calculated through the thickness or sensor, of which, the linear speed is widely used for the calculation and if using this method, it is necessary to select whether enable the function of coil diameter limiting.

(3) PID adjustment module: mainly set in P09 group and there are other PID parameters in P26 group. The linear speed synchronization and stable tension can be kept through PID adjustment, but PID parameters can be adjusted according to the site commissioning. Parameters can be switched

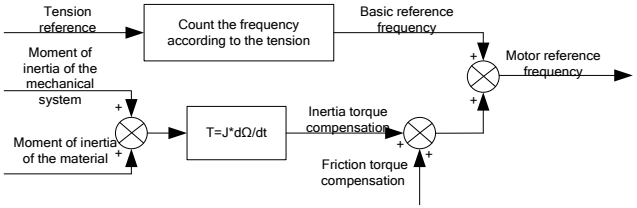
between two groups of PID parameters to PID improvement.

(4) Detection and processing module of materials break. The function is valid when enabling the materials detection.

(5) Pre-drive: if the pre-drive function terminal is valid, when automatic volume-changing, after starting the VFD, the drum will run at the setting linear speed, if the terminal is invalid, the VFD will automatically switch to the corresponding control mode.

2.3 Open loop tension torque control

Open loop means no tension feedback signal; the mode controls the tension through the motor torque control directly. The rotation speed changes with the linear speed of the material automatically. The basic is: in frizzy control system, the relationship between the tension F of the roller with materials, current coil diameter D and output torque of the shaft is: T = F × D /2. If the output torque can be adjusted according to the variation of coil diameter, the tension can be controlled. In order to ensure the constant tension in the process of acceleration and deceleration, there is internal friction compensation module and inertia compensation module in the VFD to calculate the real time the moment of inertia, and compensate the torque according to the current speed rate of change. The torque control principle diagram is as follows:



Relevant modes:

(1) Linear speed input modes: Linear speed input modes: two functions, one is used to count the synchronous frequency in torque control system according to the linear speed; the other is used to count the coil diameter according to the linear speed.

(2) Tension setting modes: Set the tension with the control system, need to adjust according to the actual situation. After confirmation, the value remains the same, and for some need to improve the winding, tension taper function can be selected to raise the tension with the increasing coil diameter. ,

(3) Coil diameter real time calculation module: Coil diameter calculation directly determines the effect of the control. There are several kinds of coil diameter calculation methods. Linear speed, output

frequency, thickness and sensor are available. The most convenient is to calculate through the thickness. And it is necessary to enable the coil diameter changing limit when using linear speed to calculate the coil diameter.

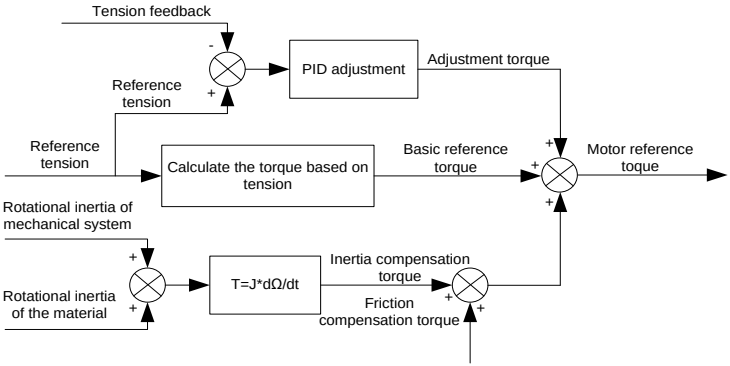
(4) Torque compensation module: include friction torque compensation and inertia torque compensation. Of which, the friction torque compensation is used to eliminate the impact of friction and tension, and it needs to be adjusted according to actual requirements; the inertia torque compensation includes the moment of inertia moment of mechanical systems and materials. In order to keep the tension stable in ACC/DEC, the compensation torque is required. But in some cases which do not need tension control, disabling the inertia torque compensation can also meet the requirements.

(5) Detection and processing module of materials break. The function is valid when enabling the materials detection.

(6) Pre-drive: if the pre-drive function terminal is valid, when automatic volume-changing, after starting the VFD, the drum will run at the setting linear speed, if the terminal is invalid, after an interval, the VFD will automatically switch to the corresponding control mode.

2.4 Close-loop tension torque control mode

Close-loop tension torque control mode is similar to open-loop tension torque control mode, the difference is that the former has tension detection sensor installed on wind/unwind side. This mode supports all the function modules of open-loop tension torque control, in additional, it is added with an additional tension feedback PID close-loop regulator module. Its control schematic is shown below:



3 Tension control parameter

The function group numbers correspond to the level-1 menus, the function codes correspond to the level-2 menus, and the function parameters correspond to the level-3 menus.

The function code table contains:

Column 1 "Function code": Code of the function group and parameter

Column 2 "Name": Full name of the function parameter.

Column 3 "Default": Factory setting of the function parameter. If the value of the parameter is detected or recorded, the value cannot be restored to the factory setting.

Column 4 "Setting range": The valid setting range of the function parameters, displayed on the keypad.

Column 5 "Default": Initial value set in factory.

Column 6 "Modify": Whether the parameter can be modified, and conditions for the modification.

"○" indicates that the value of the parameter can be modified when the VFD is in stopped or running state.

"◎" indicates that the value of the parameter cannot be modified when the VFD is in running state.

"●" indicates that the value of the parameter is detected and recorded, and cannot be modified.

3.1 Relevant function codes of Goodrive35-07 close loop vector

Function code	Name	Description	Setting range	Default	Modify
P00.00	Speed control mode	0: SVC 1 (Applicable to both AMs and SMs) 1: SVC mode 2 (for AM) 2: Space voltage vector control mode 3: Closed-loop vector control mode **Note: AM indicates the asynchronous motor, while SM indicates synchronous motor. If a vector control mode is used, enable the VFD to perform motor parameter autotuning first.**	0–3	2	◎
P00.01	Channel of running commands	0: Keypad (the indicator is off) 1: Terminal (the indicator blinks) 2: Communication (the indicator is on)	0–2	0	○
P00.02	Communication	0: Modbus	0–3	0	○

Function code	Name	Description	Setting range	Default	Modify
	mode of running commands	1: PROFIBUS/ CAN communication 2: Ethernet 3: Reserved **Note: The options 1, 2, and 3 are add-on functions and are available only when corresponding expansion cards are configured.**			
P00.03	Max. output frequency	P00.04–400.00Hz	P00.04–400.00	50.00Hz	◎
P00.04	Upper limit of unning frequency	P00.05–P00.03 (Max. frequency)	P00.05–P00.03	50.00Hz	◎
P00.05	Lower limit of unning frequency	0.00Hz–P00.04 (Upper limit of running frequency)	0.00–P00.04	0.00Hz	◎
P00.06	Setting channel of A frequency command	0: Keypad (P00.10) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication 9: PROFIBUS/CANopen communication 10: Ethernet communication 11: Reserved 12: Pulse train AB	0–12	0	○
P00.07	Setting channel of B frequency command		0–12	1	○
P00.08	Reference object of B frequency command	0: Max. output frequency 1: A frequency command	0–1	0	○
P00.09	Combination mode of setting source	0: A 1: B 2: A+B 3: A-B 4: Max(A, B) 5: Min(A, B)	0–5	0	○

Function code	Name	Description	Setting range	Default	Modify
P00.10	Frequency set through keypad	0.00 Hz–P00.03 (Max. output frequency)	0.00–P00.03	50.00Hz	○
P00.11	ACC time 1	0.0–3600.0s	0.0–3600.0	Model depended	○
P00.12	DEC time 1	0.0–3600.0s	0.0–3600.0	Model depended	○
P00.13	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running.	0–2	0	○
P00.15	Motor parameter autotuning	0: No operation 1: Rotary autotuning 2: Static autotuning (Empty-load current and mutual inductance are autotuned.) 3: Static autotuning (Empty-load current and mutual inductance are not autotuned.)	0–3	0	◎
P00.18	Function parameter restore	0: No operation 1: Restore default values 2: Clear fault records	0–2	0	◎
P01.25	DEC time for emergency stop	0.0–60.0s	0.0–60.0	2.0s	○
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0–1	0	◎
P02.01	Rated power of AM 1	0.1–3000.0kW	0.1–3000.0	Model depended	◎
P02.02	Rated frequency of AM 1	0.01Hz–P00.03 (Max. output frequency)	0.01–P00.03	50.00Hz	◎
P02.03	Rated speed of AM 1	1–36000rpm	1–36000	Model depended	◎
P02.04	Rated voltage of AM 1	0–1200V	0–1200	Model depended	◎
P02.05	Rated current of AM 1	0.8–6000.0A	0.8–6000.0	Model depended	◎
P02.06	Stator resistance of	0.001–65.535Ω	0.001–65.535	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
	AM 1				
P02.07	Rotor resistance of AM 1	0.001–65.535Ω	0.001–65.535	Model depended	○
P02.08	Leakage inductance of AM 1	0.1–6553.5mH	0.1–6553.5	Model depended	○
P02.09	Mutual inductance of AM 1	0.1–6553.5mH	0.1–6553.5	Model depended	○
P02.10	No-load current of AM 1	0.1–6553.5A	0.1–6553.5	Model depended	○
P02.15	Rated power of SM 1	0.1–3000.0kW	0.1–3000.0	Model depended	◎
P02.16	Rated frequency of SM 1	0.01Hz–P00.03 (max. output frequency)	0.01–P00.03	50.00Hz	◎
P02.17	Number of pole pairs of SM 1	1–100	1–100	2	◎
P02.18	Rated voltage of SM 1	0–1200V	0–1200	Model depended	◎
P02.19	Rated current of SM 1	0.8–6000.0A	0.8–6000.0	Model depended	◎
P03.11	Torque setting method	0: Torque control is invalid 1: Keypad (P03.12) 2: AI1 (100% corresponding to three times the motor rated current) 3: AI2 (Same as the above) 4: AI3 (same as the above) 5: Pulse frequency HDI (same as the above) 6: Multi-step torque (same as the above) 7: Modbus communication (same as the above) 8: PROFIBUS/CANopen communication (same as the above)	0–13	0	○

Function code	Name	Description	Setting range	Default	Modify
		9: Ethernet communication (same as the above) 10: AI1+ AI2 11: AI1+ AI3 12: AI2+ AI3 13: Reserved			
P03.12	Torque set through keypad	-300.0%–300.0% (of the motor rated current)	-300.0–300.0	50.0%	○
P03.13	Torque reference filter time	0.000–10.000s	0.000–10.000	0.100s	○
P03.14	Setting source of forward rotation frequency upper limit in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDI 5: Multi-step setting (same as the above) 6: Modbus communication (same as the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as the above) 9: Reserved	0–9	0	○
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDI 5: Multi-step setting (same as the above) 6: Modbus communication (same as the above) 7: PROFIBUS/CANopen communication (same as the above) 8: Ethernet communication (same as	0–9	0	○

Function code	Name	Description	Setting range	Default	Modify
		the above) 9: Reserved			
P03.16	Forward rotation frequency upper limit set through keypad in torque control	0.00Hz–P00.03	0.00–P00.03	50.00Hz	○
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control	0.00 Hz–P00.03	0.00–P00.03	50.00Hz	○
P03.18	Setting source of electromotive torque upper limit	0: Keypad (P03.20) 1: AI1 (100% corresponding to triple the motor rated current) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDI (same as the above) 5: Modbus communication (same as the above) 6: PROFIBUS/CANopen communication (same as the above) 7: Ethernet communication (same as the above) 8: Reserved	0–8	0	○
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1: AI1 (100% corresponding to triple the motor rated current) 2: AI2 (same as the above) 3: AI3 (same as the above) 4: Pulse frequency HDI (same as the above) 5: Modbus communication (same as the above) 6: PROFIBUS/CANopen	0–8	0	○

Function code	Name	Description	Setting range	Default	Modify
		communication (same as the above) 7: Ethernet communication (same as the above) 8: Reserved			
P03.20	Electromotive torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	0.0–300.0	180.0%	○
P03.21	Braking torque upper limit set through keypad	0.0–300.0% (of the motor rated current)	0.0–300.0	180.0%	○
P03.22	Weakening coefficient in constant power zone	0.01–2.00 A larger value indicates a smaller weak magnetic field and a greater excitation current.	0.01–2.00	1.00	○
P03.23	Lowest weakening point in constant power zone	10%–50%	10–50	10%	○
P03.24	Max. voltage limit	0.0–120.0%	0.0–120.0	100.0%	○
P03.25	Pre-exciting time	0.000–10.000s	0.000–10.000	0.000s	○
P03.26	Flux-weakening proportional gain	0–8000	0–8000	1200	○
P03.27	Flux-weakening integral gain	0–8000	0–8000	1200	○
P03.28	Flux-weakening control mode selection	0–2	0–2	0	○
P03.29	Torque control mode selection	Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved	0–0x1	0x01	○

Function code	Name	Description	Setting range	Default	Modify
P03.30	Low speed friction torque	0.0%–50.0%	0.0–50.0	0.0%	○
P03.31	High speed friction torque	0.0%–50.0%	0.0–50.0	0.0%	○
P03.32	Corresponding frequency of high speed friction torque	0.00Hz–400.00Hz	0.00–400.00	50.00Hz	○
P03.33	Low speed threshold	0.00–20.00Hz	0.00–20.00	1.00Hz	○
P05.12	Virtual terminal setting	0x000–0x1FF (0: Disable. 1: Enable) BIT0: S1 virtual terminal Bit 1: S2 virtual terminal Bit 2: S3 virtual terminal Bit 3: S4 virtual terminal Bit 4: S5 virtual terminal Bit 5: S6 virtual terminal Bit 6: S7 virtual terminal Bit 7: S8 virtual terminal Bit 8: HDI virtual terminal	0x000–0x1FF	0x000	◎
P05.32	AI1 lower limit	0.00V–P05.34	0.00–P05.34	0.00V	○
P05.37	AI2 lower limit	0.00V–P05.39	0.00V–P05.30	0.00V	○
P05.50	HDI frequency lower limit	0.00 kHz–P05.52	0.00–P05.52	0.00kHz	○
P07.02	Function of QUICK/JOG	0: No function 1: Jogging. Press QUICK/JOG to begin the jogging running. 2: Shift the display state by the shifting key. Press QUICK/JOG to shift the displayed function code from right to left. 3: Shift between forward rotations and reverse rotations. Press QUICK/JOG to shift the direction of the frequency commands. This function is only valid	0–8	1	◎

Function code	Name	Description	Setting range	Default	Modify
		in the keypad commands channels. 4: Clear UP/DOWN settings. Press QUICK/JOG to clear the set value of UP/DOWN. 5: Coast to stop. Press QUICK/JOG to coast to stop. 6: Shift the given manner of running commands. Press QUICK/JOG to shift the given manner of running commands. 7: Quick commission mode (committee according to the non-factory parameter) 8: Custom quick commissioning mode **Note: If value 8 is selected, you can add 16 custom function codes and and perform quick modification and deletion operations on them.**			
P07.05	Selection 1 of parameters to be displayed in the running state	Bit0: Running linear speed Bit1: Setting linear speed Bit2: Present roll diameter Bit3: Running frequency (Hz on) Bit4: Set frequency (Hz blinking) Bit5: Bus voltage (V on) Bit6: Output voltage (V on) Bit7: Output current (A on) BIT8: PID reference (% flickering) BIT9: PID feedback value (% on) BIT10: input terminals state BIT11: output terminals state BIT12: torque set value (% on) BIT13: pulse counter value BIT14: length value BIT15: PLC and the current stage in multi-step speed	0x0000–0xFFFF	0x0FFF	○
P07.06	Selection 2 of parameters to be displayed in	Bit0: Reserved Bit1: Reserved Bit2: PLC and actual step number of	0x0000–0xFFFF	0x0000	○

Function code	Name	Description	Setting range	Default	Modify
	the running state	multi-step speed Bit3: AI1 (Voltage) Bit4: AI2 (Voltage) Bit5: AI3 (Voltage) Bit6: ramp frequency given value (Hz on) Bit7: linear speed Bit8: AC inlet current (A on) Bit9: upper limit frequency (Hz on) Bit10–14: reserved Bit15: reference tension			
P07.07	Selection of parameters to be displayed in the stopped state	Bit0: Set linear speed (linear speed blinking slowly) Bit1: Present roll diameter BIT2: Set frequency (Hz on, blinking slowly) Bit3: Bus voltage (V on) Bit4: Input terminal state Bit5: Output terminal state Bit6: PID reference value (% blinking) Bit7: PID feedback value (% on) Bit8: AI2 (V on) Bit9: AI3 (V on) Bit10: HDI frequency Bit11: PLC and the current stage in multi-step speed Bit12: pulse counters Bit13: length value Bit14: upper limit frequency (Hz on) Bit15: reference tension	0x0000–0xFFFF	0x00FF	○
P07.27	Present fault type	37: Encoder disconnection fault (ENC1O) 38: Encoder reversal fault (ENC1D) 39: Encoder Z-pulse disconnection fault (ENC1Z) 43: Motor overtemperature fault (OT)	0–43	0	●
P07.28	Last fault type		0–43	0	●
P07.29	2nd-last fault type		0–43	0	●
P07.30	3rd-last fault type		0–43	0	●
P07.31	4th-last fault type		0–43	0	●

Function code	Name	Description	Setting range	Default	Modify
P07.32	5th-last fault type		0–43	0	●
P08.15	Bus voltage regulator gain	0.0–1000.0	0.0–1000.0	12.0	○
P08.16	Speed-loop differential gain	0.00–10.00s	0.00–10.00	0.00s	○
P08.17	Upper limit of inertia compensation torque	0.0–150.0%	0.0–150.0	20.0%	○
P08.18	Inertia compensation filter times	0–10	0–10	7	○
P08.19	High-frequency current-loop proportional coefficient	0–20000	0–20000	1000	○
P08.20	Integral coefficient of high-frequency current loop	0–20000	0–20000	1000	○
P08.21	Current-loop high-frequency switching threshold	0.0–100.0% (of the max. frequency)	0.0–100.0	100.0%	○
P08.22	Inertia identification torque	0.0–100.0% (of the motor rated torque)	0.0–100.0	10.0%	◎
P08.23	Inertia identification	0: No operation 1: Enable	0–1	0–1	◎
P08.24	System inertia	0.000–30.000kgm^2	0.000–30.000	0.000 kgm^2	○
P08.25	Enabling inertia compensation	0: Disable 1: Enable	0–1	0	○
P08.40	PWM selection	Ones place: PWM mode 0: PWM mode 1, 3PH modulation and 2PH modulation 1: PWM mode 2, 3PH modulation Tens place: Low-frequency carrier	0x00–0x11	0x01	◎

Function code	Name	Description	Setting range	Default	Modify
		frequency selection 0: Reduce carrier frequency at a low frequency 1: Do not reduce carrier frequency at a low frequency			
P08.41	Overmodulation selection	Ones place: Overmodulation selection 0: Disable 1: Enable Tens place: Deepened overmodulation coefficient 0–9	0x00–0x91	0x01	○
P08.42	Keypad digital control setting	LED ones place: Frequency setting selection 0: Controls through both the ∧/∨ key and digital potentiometer are valid. 1: Only the ∧/∨ key can be used for the control. 2: Only control through the digital potentiometer is valid. 3: Controls through the ∧/∨ key and digital potentiometer are invalid. LED tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority LED hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received LED thousands place: Indicates whether	0x0000–0x1223	0x1103	○

Function code	Name	Description	Setting range	Default	Modify
		to enable the integral function through the /\ /\/ key and digital potentiometer. 0: Enable the integral function 1: Disable the integral function			
P11.03	Overvoltage stalling protection	0: Disable 1: Enable	0–1	0	○
P11.04	Overvoltage stalling protection voltage	120–150% (standard bus voltage) (380V)	120–150	136%	○
		120–150% (standard bus voltage) (220V)	120–150	120%	
P11.14	Speed deviation detection value	0.0–50.0%	0.0– 50.0	10.0%	○
P11.15	Speed deviation detection time	0.0–10.0s (0.0 indicates no speed deviation protection)	0.0–10.0	0.5s	○
P11.16	Open-loop vector and VF 0Hz output selection	0: Output without voltage 1: Output with voltage	0–1	0	○
Group P09—PID control					
P09.00	PID reference source	0: Keypad (P09.01) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Multi-step running 6: Modbus communication 7: PROFIBUS/CANopen communication 8: Ethernet communication 9: Reserved	0–9	0	○
P09.01	PID reference preset through keypad	-100.0%–100.0%	-100.0–100.0	0.0%	○
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDI	0–8	0	○

Function code	Name	Description	Setting range	Default	Modify
		4: Modbus communication 5: PROFIBUS/CANopen communication 6: Ethernet communication 7: (AI1+AI2)/2 8: (AI2+AI3)/2			
P09.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0–1	0	○
P09.04	Group 1 proportional gain 1	0.000–30.000	0.000–30.000	0.300	○
P09.05	Group 1 proportional gain 2	0.000–30.000 **Note: Valid when P26.39=5.**	0.000–30.000	0.300	○
P09.06	Group 1 integral time	0.000–30.000s	0.000–30.000	5.000s	○
P09.07	Group 1 differential time	0.000–10.000s	0.000–10.000	0.000s	○
P09.08	Sampling cycle (T)	0.001–30.000s	0.001–30.000	0.010s	○
P09.09	PID control deviation limit	0.0–100.0%	0.0–100.0	0.0%	○
P09.10	PID output upper limit	P09.11–100.0% (Max. frequency or voltage)	P09.10–100.0	100.0%	○
P09.11	PID output lower limit	-100.0%–P09.10 (Max. frequency or voltage)	-100.0–P09.09	-50.0%	○
P09.12	Feedback offline detection value	0.0–100.0%	0.0–100.0	0.0%	○
P09.13	Feedback offline detection time	0.0–3600.0s	0.0–3600.0	1.0s	○
P09.14	PID control selection	LED ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit	0x0000–0x1111	0x0001	○

Function code	Name	Description	Setting range	Default	Modify
		LED tens place, hundreds place: Reserved LED thousands place: zero speed integral clearing selection 0: Disable 1: Enable **Note: Zero speed corresponds to P03.33 when P26.00 is 0.**			
P09.15	PID input deviation limit	0.0–200.0%	0.0–200.0	200.0%	○
P09.16	ACC/DEC time of PID command	0.0–1000.0s	0.0–1000.0	0.0s	○
P09.17	PID output filter time	0.000–10.000s	0.000–10.000	0.000s	○
P09.18	Low speed PID output upper and lower limits	-100.0–100.0% **Note: Valid when P26.00 is 0. The corresponding low-speed threshold is P03.33.**	-100.0–100.0	3.0%	○
P09.19	Zero-speed PID output upper limit	P09.20–100.0% (Max. frequency or voltage) **Note: Valid when P28.23=1 and the present linear speed is less than P26.13.**	P09.20–100.0	3.0%	○
P09.20	Zero-speed PID output lower limit	-100.0%–P09.19 (Max. frequency or voltage) **Note: Valid when P28.23=1 and the present linear speed is less than P26.13.**	-100.0–P09.19	-3.0%	○
Group P18—Viewing of status in closed-loop control					
P18.00	Actual frequency of encoder	-999.9–999.9Hz **Note: P18.00 is only displayed in V/F and closed-loop modes. In open loop mode, it is not displayed.**	-999.9–999.9	0.0Hz	●
P18.01	Encoder position count value	0–65535	0–65535	0	●
P18.02	Encoder Z	0–65535	0–65535	0	●

Function code	Name	Description	Setting range	Default	Modify
	pulse position				
P18.11	Z pulse direction	0: Forward 1: Reverse	0–1	0	●
P18.12	Z pulse angle	0–359.99	0–359.99	0	●
P18.13	Z pulse error times	0–65535	0–65535	0	●
P18.14	Pg1 pulse count MSB	0–65535	0–65535	0	●
P18.15	Pg1 pulse count LSB	0–65535	0–65535	0	●
P18.20	Count value of resolver	0–65535	0–65535	0	●
P18.21	Resolver angle	0–359.99	0–359.99	0	●
P18.22	Magnetic pole angle	0–359.99	0–359.99	0	●
Group P20—Encoders					
P20.00	Encoder type selection	0: Incremental encoder 1: Reserved 2: Resolver-type encoder 3: Reserved	0–3	0	◎
P20.01	Encoder PPR	0–60000	0–60000	1024	◎
P20.02	Encoder direction	Ones place: AB direction 0: Forward; A precedes B 1: Reverse, B precedes A Tens place: Z pulse direction 0: Forward 1: Reverse	0x00–0x11	0x00	◎
P20.03	Detection time of encoder offline fault	0.0–100.0s	0.1–100.0	0.5s	○
P20.04	Detection time of encoder reversal fault	0.0–100.0s	0.1–100.0	0.8s	○
P20.05	Filter times of encoder detection	Ones place: Low-speed filter times Tens place: High-speed filter times	0x00–0x99	0x33	○
P20.06	Speed ratio	0–65.535	0–65.535	1.000	○

Function code	Name	Description	Setting range	Default	Modify
	between motor and encoder				
P20.07	Control parameters of SM	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Resolver speed measurement mode Bit4: Z pulse capture mode Bit12: Clear the Z pulse arrival signal after stop	0x0000–0xFFFF	0x0003	○
P20.08	Enable Z pulse offline detection	0: Z pulse offline detection disabled 1: Z pulse offline detection enabled	0–1	0	○
P20.09	Initial angle of Z pulse	0–359.99	0–359.99	0	○
P20.10	Pole initial angle	0–359.99	0–359.99	0	○
P20.11	Initial pole angle autotuning	0: No operation 1: Rotary autotuning 2: Static autotuning (suitable for resolver-type encoder feedback)	0–2	0	◎

3.2 Tension control special function group

Function code	Name	Description	Setting range	Default	Modify
Group P26—Tension control function group 1					
P26.00	Tension control mode	0: Invalid 1: Tension speed control 2: Open loop tension torque control 3: Close-loop tension torque control **Note:** ✧ Option 1: The default is close-loop tension speed control, namely internal PID enabling. For commissioning the constant linear speed mode without PID, it is necessary to set P09.09 and P09.10 to 0%. ✧ Option 2: Open-loop tension means the feedback signal without	0–3	0	◎

Function code	Name	Description	Setting range	Default	Modify
		tension, which is applicable to most of torque control applications. ✧ Option 3: Close-loop tension means feedback signal with tension, which is only applicable to applications where tension detection sensor is installed.			
P26.01	Winding/unwinding mode	0: Winding 1: Unwinding The motor forward rotation direction is the winding direction. When using the tension control mode, check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the unwinding mode by setting P26.01 to 1 or changing the winding/unwinding switchover terminals.	0–1	0	○
P26.02	Reel mechanical transmission rate	Reel mechanical transmission rate = Motor rotation speed/Reel rotation speed = Reel diameter/Motor shaft diameter	0.01–300.00	1.00	○
P26.03	Speed control mode startup material winding	Ones place: Whether zero speed reverse is allowed for unwinding 0: Allow 1: Not allow Tens place: Reserved	0x00–0x11	0x00	○
Linear speed calculation: P26.04–P26.15					
P26.04	Max. frequency of main traction	0.00–300.00Hz	0.00–300.00	50.00Hz	○
P26.05	Diameter of main traction	0–6000.0mm	0–6000.0	99.0mm	○
P26.06	Main traction drive ratio	Master traction drive ratio = Motor rotation speed/Master traction roller rotation speed = Master traction roller diameter/Motor shaft diameter	0–60.000	1.000	○

Function code	Name	Description	Setting range	Default	Modify
P26.07	Motor pole pairs of main traction	1–1000	1–1000	2	○
P26.08	Max. linear speed	0.0–6000.0m/min **Note: It can be determined by setting P26.04–P26.07.**	0.0–6000.0	1000.0 m/min	○
P26.09	Linear speed input source selection	0: Keypad (commissioning or optional when functioning as the master) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (0x200F) 6: PROFIBUS/CANopen communication (0.0–100.0%) 7: Pulse train AB	0–7	0	◎
P26.10	Linear speed set through keypad	0.0–100.0% (of the max. linear speed) Applicable to commissioning or functioning as the master	0.0–100.0	20.0%	○
P26.11	Pulse train AB PPR	0–20000 Applicable to setting linear speed of pulse train AB	0–20000	1024	○
P26.12	Linear speed filter times of pulse train AB	0–15 Filter time: (2^N)*0.125ms Applicable to setting linear speed of pulse train AB	0–15	8	○
P26.13	Tension control zero speed threshold	0.00–10.00% (of the max. linear speed) Determines the zero speed threshold for tension control operation	0.00–10.00	0.35%	○
P26.14	Linear speed ACC time	0.00–600.00s Set the function code to 0 when it serves as a slave to the main traction.	0.00–600.00	0.00s	○
P26.15	Linear speed DEC time	0.00–600.00s Set the function code to 0 when it serves as a slave to the main traction.	0.00–600.00	0.00s	○
Roll diameter calculation P26.16–P26.35					
P26.16	Roll diameter	0: Not calculated	0–10	0	◎

Function code	Name	Description	Setting range	Default	Modify
	calculation method selection	1: Linear speed 2: Strip revolution counting thickness 3: Wire revolution counting thickness 4: Strip length recording thickness 5: Wire revolution counting thickness 6: AI1 measurement 7: AI2 measurement 8: AI3 measurement 9: Modbus communication (0x2012) 10: PROFIBUS/CANopen communication (0.0–100.0%)			
(1) Initial roll diameter settings P26.17–P26.22					
P26.17	Min. empty-roll diameter	0.0–5000.0mm Upon first power-on, if the winding mode is selected, the present roll diameter is equal to the minimum empty-roll diameter.	0.0–5000.0	50.0mm	○
P26.18	Max. roll diameter	0.0–5000.0mm Upon first power-on, if the unwinding mode is selected, the present roll diameter is equal to the maximum roll diameter.	0.0–5000.0	1000.0mm	○
P26.19	Initial roll diameter 1	0.0–5000.0mm When multiple sizes of empty reels are available, the initial reel diameter can be set by selecting the S terminal.	0.0–5000.0	100.1mm	○
P26.20	Initial roll diameter 2			100.2mm	○
P26.21	Initial roll diameter 3			100.3mm	○
P26.22	Number of initial material turns	0–100 Upon power-on or roll diameter reset, calculate the initial superposed roll diameter based on the material thickness P26.29–P26.31.	0–100	0	○
(2) Parameters related to the roll diameter linear speed P26.23–P26.29					
P26.23	Roll diameter calculation delay time	0.0–100.0s After start-up, no roll diameter calculation is performed during the	0.0–100.0	2.0s	○

Function code	Name	Description	Setting range	Default	Modify
		delay time.			
P26.24	Min. linear speed for roll diameter calculation	0.0–100.0% (of the max. linear speed) If the speed is less than this linear speed, the roll diameter calculation will not be performed.	0.0–100.0	2.0 %	○
P26.25	Min. frequency for roll diameter calculation	0.00–50.00Hz If the frequency is less than this running frequency, the roll diameter calculation will not be performed.	0.00–50.00	0.30Hz	○
P26.26	Roll diameter filter time	0.000–60.000s	0.000–60.000	1.000s	○
P26.27	Reverse direction change restriction in roll diameter calculation	0:No 1: Restrict changes in reverse direction **The restriction is used to prevent oscillation in the calculation of the diameter of an elliptical scroll.**	0–1	0	○
P26.28	Roll diameter change rate restriction selection	0:No 1: Automatic restriction according to the running frequency	0–1	0	○
P26.29	Max. material thickness	0.01–100.00mm This involves the upper limit of the roll diameter change rate.	0.01–100.00	0.10 mm	○
(3) Parameters related to the roll diameter thickness P26.30–P26.34					
P26.30	Material thickness	0.01–100.00mm	0.01–100.00	0.10mm	○
P26.31	Min. material thickness	0.01–100.00mm	0.01–100.00	0.10mm	○
P26.32	Number of coils per layer	Applicable to wires.	1–10000	1	◎
P26.33	Revolution counting function selection	0: Digital terminal input (reel side) 1: Programmable card input (motor side)	0–1	0	◎
P26.34	Number of pulses per	Applies to P26.33=0, reflecting the number of pulses per turn at the digital	1–60	1	◎

Function code	Name	Description	Setting range	Default	Modify
	revolution	terminal input			
(4) Parameters related to the present roll diameter P26.35–P26.38					
P26.35	Present roll diameter	0.0–5000.0mm	0.0–5000.0	0.0mm	◎
P26.36	Roll diameter set value	0.0–100.0% (of the max. roll diameter)	0.0–100.0	80.0%	○
P26.37	Settings related to present roll diameter	Ones place: At stop 0: Remain current roll diameter 1: Restore to initial roll diameter Tens place: Power off at running 0: Remain current roll diameter 1: Restore to initial roll diameter	0x00–0x11	0x00	○
P26.38	Roll diameter reset selection	Ones place: Applicable to all calculation methods 0: Reset only allowed at stop 1: Reset allowed at running Tens place: Applicable to thickness calculation for roll diameter 0: Reset allowed when P26.36 is not reached 1: Reset only allowed when P26.36 is reached	0x00–0x11	0x00	○
Tension control PID-specific functions P26.39–P26.60					
P26.39	PID parameter adjustment source	0: Group P09 1: Roll diameter (max. roll diameter) 2: Main reference frequency (max. Frequency) 3: Running linear speed (max. linear speed) 4: ACC/DEC (max. linear speed) 5: Deviation 1 (max. roll diameter) 6: Deviation 2 (Reference 100%) 7: Terminal	0–7	0	○
P26.40	Tension feedback PID control selection	Ones place: Output reference 0: Relative to max. output frequency 1: Relative to main reference frequency	0x00–0x11	0x00	○

Function code	Name	Description	Setting range	Default	Modify
		Tens place: PID reference value taper changes 0: Disable 1: Enable			
P26.41	Group 2 proportional gain 1	0.000–30.000	0.000–30.000	0.300	○
P26.42	Group 2 proportional gain 2	0.000–30.000 Applicable when P26.39=5	0.000–30.000	0.300	○
P26.43	Group 2 integral time	0.000–30.000s	0.000–30.000	5.000s	○
P26.44	Group 2 differential time	0.000–10.000s	0.000–10.000	0.000s	○
P26.45	PID parameter adjustment reference point 1	0.0–100.0% When P26.39=1 or 5, the reference base value is the maximum roll diameter. Switch linearly from the first group, second group, and third group PID according to the roll diameter from small to large. When P26.39=2, the reference base value is the maximum frequency. Switch linearly from the first group, second group, and third group PID according to the running frequency from small to large. When P26.39=3, the reference base value is the maximum linear speed. Switch linearly from the first group, second group, and third group PID according to the linear speed from small to large. When P26.39=4, only P26.45 is used, and the reference base value is the maximum linear speed. The first group of PID parameters is for those less than (P26.45 * maximum linear	0.0–P26.46	10.0%	○
P26.46	PID parameter adjustment reference point 2		P26.45–P26.47	50.0%	○
P26.47	PID parameter adjustment reference point 3		P26.46–100.0	80.0%	○

Function code	Name	Description	Setting range	Default	Modify
		speed), the second group is for constant speed, and the third set is for acceleration and deceleration. When P26.39=6, the reference base value is the given maximum value. Switch linearly from the first group, second group, and third group PID according to the deviation from small to large.			
P26.48	Group 3 proportional gain 1	0.000–30.000	0.000–30.000	0.300	○
P26.49	Group 3 proportional gain 2	0.000–30.000 Applicable when P26.38=5	0.000–30.000	0.300	○
P26.50	Group 3 integral time	0.000–30.000s	0.000–30.000	5.000s	○
P26.51	Group 3 differential time	0.000–10.000s	0.000–10.000	0.000s	○
P26.52	Differential filter times	0–100	0–100	0	○
P26.53	Differential action limit amplitude	0.0–100.0%	0.0–100.0	20.0%	○
P26.54	Differential separation threshold	0.0–100.0% The differentiation does not work when the current deviation/reference value is less than P26.54.	0.0–100.0	5.0%	○
Applicable to PID control of pendulum or floating rod					
P26.55	PID reference conversion	0: Invalid 1: Enable	0–1	0	○
P26.56	PID reference initial value	0.0–100.0%	0.0–100.0	10.0%	○
P26.57	PID reference final value	0.0–100.0% Generally, it equals to the PID set value.	0.0–100.0	50.0%	○
P26.58	PID reference	0.00–60.00s	0.00–	5.00s	○

Function code	Name	Description	Setting range	Default	Modify
	initial value hold time		60.00		
P26.59	Conversion time from PID reference initial value to final value	0.00–60.00s	0.00–60.00	5.00s	○
P26.60	Conversion time from PID reference final value to initial value	0.00–60.00s	0.00–60.00	5.00s	○
Group P27—Tension control function group 2					
Tension reference P27.00–P27.09					
P27.00	Tension setting	Ones place: Tension setting source 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (0x2010) 6: PROFIBUS/CANopen communication (0.0–100.0%) Tens place: Multiplication selection of max. tension P27.02 0: 1 1: 10	0x00–0x16	0x00	◎
P27.01	Tension set through keypad	0.0–100.0% (of the max. tension)	0.0–100.0	10.0%	○
P27.02	Max. tension	Related to the tens place of P27.00. When the tens place of P27.00 is 0, the setting range is 0–60000N. When the tens place of P27.00 is 1, the setting range is (0–60000)*10N.	0–60000	3000N	○
P27.03	Tension offset value at zero speed	-100.0–300.0% (reference tension) Applicable to winding mode, superimposed on a reference tension	-100.0–300.0	0.0%	○

Function code	Name	Description	Setting range	Default	Modify
P27.04	Speed lower limit for zero-speed tension offset	0.0–100.0% (of the max. frequency) Applicable to winding mode. When the running frequency is lower than P27.04, P27.03 is effective.	0.0–100.0	1.0%	○
P27.05	Upper-limit frequency source of torque control	0: P03.14, P03.15 1: Forward rotation limit set by line speed 2: Reverse rotation limit set by line speed 3: Forward and reverse rotations limit set by line speed	0–3	3	○
P27.06	Running frequency upper limit offset of tension control	0.0–100.0% (of the max. frequency) Applicable to P27.05=1, 2, or 3.	0.0–100.0	5.0%	○
P27.07	Torque control mode zero-speed material winding	Ones place: Reverse winding during unwinding 0: Enable 1: Disable Tens place: Active winding during winding 0: Enable 1: Disable If disabled, at the zero speed, PID torque output is 0, and torque output is 0. If enabled, at the zero speed, whether negative torque is allowed is determined by the following: When P26.00=2, set through P27.08. When P26.00=3, set through P09.19 and P09.20.	0x00–0x11	0x00	○
P27.08	Tension torque compensation negative torque selection	Ones place: Valid when P26.00=2. When friction torque compensation and inertia torque compensation are combined, the torque may appear as negative torque.	0x00–0x11	0x11	○

Function code	Name	Description	Setting range	Default	Modify
		0: Negative torque compensation is not allowed When unwinding, the minimum value is 0. When winding, the minimum value is the empty-roll torque. 1: Negative torque compensation is allowed Tens place: Valid when P26.00=3. PID output reference 0: Reference tension torque (related to the present roll diameter). Whether it can be compensated as negative depends on the upper and lower limits of PID. 1: Motor rated current			
P27.09	Torque control zero-speed stop mode	0: Coast to stop 1: Decelerate to stop	0–1	0	○
Friction torque compensation P27.10–P27.17					
P27.10	System mechanical parameters identification	0: No operation 1: Enabling system mechanical inertia identification 2: Enabling mechanical friction torque identification	0–2	0	◎
P27.11	Friction torque compensation selection	0: No 1: Frequency 2: Linear speed	0–2	0	○
P27.12	Static friction torque compensation coefficient	0.0–100.0% (of the rated motor torque) This parameter can be manually set or obtained through identification when P27.10=2	0.0–100.0	0.0%	○
P27.13	Sliding friction torque compensation coefficient	0.0–100.0% (of the rated motor torque) This parameter can be manually set or obtained through identification when P27.10=2	0.0–100.0	0.0%	○
P27.14	High speed	0.0–50.0% (of the rated motor torque)	0.0–50.0	0.0%	○

Function code	Name	Description	Setting range	Default	Modify
	torque compensation coefficient	This parameter can be manually set or obtained through identification when P27.10=2			
P27.15	Compensation reference of static friction torque	0.0–100.0% Used for friction compensation reference 1. When the ones place of P27.14 is 1, 100% corresponds to the max. output frequency. When the ones place of P27.14 is 2, 100% corresponds to the max. linear speed.	0.0–P27.16	1.0%	○
P27.16	Compensation reference of sliding friction torque	0.0–100.0% Used for friction compensation reference 2. When the ones place of P27.14 is 1, 100% corresponds to the max. output frequency. When the ones place of P27.14 is 2, 100% corresponds to the max. linear speed. **Note: If P27.16=P27.15, the reference 1 and reference 2 coincide, and the sliding friction is directly superimposed.**	P27.15–P27.17	3.0%	○
P27.17	Compensation reference of high-speed friction torque	0.0–100.0% Used for friction compensation reference 3. When the tens place of P27.14 is 1, 100% corresponds to the max. output frequency. When the tens place of P27.14 is 2, 100% corresponds to the max. linear speed. If P27.17=P27.16, high-speed friction compensation is invalid. If P27.17=P27.15, the sliding friction is directly superimposed and the high-speed friction compensation is invalid. **Note: When P27.10=2, if the max.**	P27.16–100.0	100.0%	○

Function code	Name	Description	Setting range	Default	Modify
		frequency exceeds 50.00Hz, P27.17=50.00/P00.03.			
Rotational inertia torque compensation P27.18–P27.28					
(1) Calculating torque inertia torque compensation					
P27.18	Enabling rotational inertia torque compensation	Ones place: DEC phase 0: Disable 1: Enable Tens place: ACC phase 0: Disable 1: Enable If ones place and tens place are 0, manual acceleration and deceleration tension torque compensation function is activated.	0x00–0x11	0x00	○
P27.19	Rotational inertia torque compensation calculation method	0: Based on running frequency 1: Based on linear speed	0–1	0	○
P27.20	Identification system mechanical inertia torque keypad setting	-50.0% –50.0% (of the rated motor torque)	-50.0–50.0	20.0%	◎
P27.21	Identification system mechanical inertia	0.000–30.000kg.m^2 This parameter can be manually set or obtained through identification when P27.10=1	0.000–30.000	0.000 kg.m^2	○
P27.22	Material density	0–30000kg/m^3 Used for online calculation of material inertia	0–30000	0 kg/m^3	○
P27.23	Reel width	0.000–60.000m Used for online calculation of material inertia	0.000–60.000	0.000m	○
P27.24	DEC inertia compensation coefficient	0.0–100.0% (of inertia torque compensation)	0.0–100.0	20.0%	○
P27.25	ACC inertia	0.0–100.0% (of inertia torque	0.0–100.0	25.0%	○

Function code	Name	Description	Setting range	Default	Modify
	compensation coefficient	compensation)			
P27.26	Upper limit of rotational inertia compensation torque	0.0–50.0% (of the rated motor torque) Used to specify the rotational inertia compensation torque limit.	0.0–50.0	5.0%	○
P27.27	Linear speed ACC/DEC determination method	0: Dynamic (faster) 1: Static Valid when both acceleration and deceleration times of the linear speed are 0.	0–1	0	○
P27.28	Rotational inertia torque compensation at zero speed	0: Yes 1: No Valid when the present linear speed is less than P26.13.	0–1	0	○
(2) Manual acceleration and deceleration tension torque compensation					
P27.29	ACC/DEC tension compensation reference selection	0: Relative to max. tension 1: Relative to reference tension	0–1	0	○
P27.30	ACC tension compensation	0.0–500.0% When P27.29=0, relative to the max. tension. When P27.29=1, relative to the reference tension.	0.0–500.0	0.0%	○
P27.31	DEC tension compensation				
P27.32	Ramp when ACC/DEC tension reached	0.0–100.0%/s When P27.29=0, relative to the max. tension. When P27.29=1, relative to the reference tension.	0.0–100.0	5.0%/s	○
Group P28—Tension control enhanced functions					
Tension taper control					
P28.00	Tension taper coefficient source	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI	0–4	0	◎

Function code	Name	Description	Setting range	Default	Modify
P28.01	Tension taper set through keypad	0.0–100.0% (of the given tension)	0.0–100.0	0.0%	○
P28.02	Tension taper compensation correction	0.0–5000.0mm	0.0–5000.0	0.0mm	○
P28.03	Tension taper curve selection	0: Inverse proportional curve 1: Multi-point curve **Note:** ✧ The empty roll diameter D0 means the tension decreases by 0%; the full roll diameter D_{max} means the tension decreases by the value based on the setting in P28.01. ✧ The empty roll diameter D0 means the tension decreases by 0%; the roll diameter value 1 means the tension decreases by the value of P28.05; the roll diameter value 2 means the tension decreases by the value of P28.07; the full roll diameter D_{max} means the tension decreases by the value based on the setting in P28.01.	0–1	0	○
P28.04	Roll diameter value 1	0.0–5000.0mm	0.0–5000.0	200.0mm	○
P28.05	Tension taper coefficient for roll diameter value 1	0.0–50.0% (of the set tension)	0.0–50.0	3.0%	○
P28.06	Roll diameter value 2	0.0–5000.0mm	0.0–5000.0	500.0mm	○
P28.07	Tension taper coefficient for roll diameter value 2	0.0–50.0% (of the set tension)	0.0–50.0	7.0%	○
Pre-drive function					

Function code	Name	Description	Setting range	Default	Modify
P28.08	Pre-drive speed gain	0.0–1000.0%	0.0–1000.0%	100.0%	○
P28.09	Pre-drive control selection	Ones place: Pre-drive torque limit 0: Set based on P03.20, P03.21 1: Set based on P28.10 2: Set based on output torque 3: Set based on tension (P27.00) Tens place: Pre-drive initial roll diameter selection 0: Set through initial roll diameter selection terminal 1: AI1 input 2: AI2 input 3: AI3 input 4: Roll diameter for linear speed calculation 5: Modbus communication (Address: 0x2012) 6: PROFIBUS communication Hundreds: Pre-drive linear speed reference source 0: Linear speed input source (P26.09) 1: Keypad (P26.10) 2: AI1 3: AI2 4: AI3 5: HDI **Note:** ✧ If the tens place is set to 4, P26.09 and P05.52 should be set. P05.52 corresponds to the number of pulses generated at the maximum linear speed (m/s). ✧ During pre-driving operation, the acceleration time is P08.00, and the deceleration time is P08.01.	0x000–0x563	0x000	○
P28.10	Pre-drive torque limit setting	0.0–200.0%	0.0–200.0	100.0%	○

Function code	Name	Description	Setting range	Default	Modify
P28.11	Roll diameter calculation delay after pre-drive	0.0–100.0s	0.0–100.0	5.0s	○
P28.12	Pre-drive linear speed offset	-200.0%–200.0% Pre-drive linear speed = reference * P28.08 + P28.12	-200.0–200.0	0	○
Feeding interrupt detection					
P28.13	Feeding interrupt detection mode	0: Disable 1: Detect based on digital value 2: Detect based on roll diameter calculation value 3: Detect based on feedback position	0–3	0	◎
P28.14	Feeding interrupt detection start delay time	0.00–200.00s	0.00–200.00	10.00s	○
P28.15	Frequency lower limit of feeding interrupt detection	0.00–300.00Hz	0.00–300.00	10.00Hz	○
P28.16	Error range of feeding interrupt detection	0.1–50.0% (of the max. roll diameter)	0.1–50.0	10.0%	○
P28.17	Determination delay time of feeding interrupt detection	0.1–60.0s	0.1–60.0	1.0s	○
P28.18	Handling mode of feeding interrupt	Ones place: Stop mode 0: Decelerate to stop in emergency manner 1: Coast to stop Tens place: Alarm mode 0: Stop in enabled stop mode without reporting an alarm	0x000–0x111	0x000	○

Function code	Name	Description	Setting range	Default	Modify
		1: Report an alarm and coast to stop Hundreds place: Roll diameter memory function of feeding interrupt 0: Disable 1: Enable **Note: The hundreds place is valid when P28.13 is set to 2.**			
Simple brake function					
P28.19	Stop braking frequency	0.00–300.00Hz	0.00–300.00	1.50Hz	○
P28.20	Stop braking time	0.0–600.0s	0.0–600.0	0.0s	○
Revolution counting and length recording					
P28.21	Number of material turns on the reel	-100–32767(0x1c14), revolution counting	-100–32767	0	◎
P28.22	Length of material on the reel	0–65535m(0x1c15), length recording	0–65535	0m	◎
Zero-speed PID parameter selection					
P28.23	Zero-speed PID parameter enabling	0: Invalid 1: Valid. Select P28.24–P28.26 as PID parameters (as zero speed when the linear speed is less than P26.13).	0–1	0	○
P28.24	Proportional gain at zero speed	0.000–30.000	0.000–30.000	0.300	○
P28.25	Integral time at zero speed	0.000–30.000s	0.000–30.000	5.000s	○
P28.26	Zero speed differential time	0.000–30.000s	0.000–30.000	0.000s	○
Other functions					
P28.30	QUICK key parameter lock selection	0: Do not lock 1: Lock This function is valid when P07.02 is 8, that is the custom quick commissioning mode is enabled. When P28.30 is 1, users cannot add or	0–1	0	○

Function code	Name	Description	Setting range	Default	Modify
		delete function codes in custom quick commissioning mode.			
Group P05—Input terminal functions					
P05.01	Function of S1	0: Invalid 1: Forward rotation operation (FWD) 2: Reverse rotation operation (REV) 3: 3-wire control operation (SIn) 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset (including feeding interrupt fault reset) 8: Operation pause 9: External fault input 10: Increasing frequency setting (UP) 11: Decreasing frequency setting (DOWN) 12: Frequency setting clear 13: Shift between A setting and B setting 14: Shift between combination setting and A setting 15: Shift between combination setting and B setting 16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi- step speed terminal 4 20: Multi- step speed pause 21: ACC/DEC time 1 22: ACC/DEC time 2 23: Simple PLC stop reset 24: Simple PLC pause 25: PID control pause 26: Forward rotation limit 27: Reverse rotation limit 28: Electronic gear selection 29: Torque control disabling 30: ACC/DEC disabling	0–79	1	◎
P05.02	Function of S2			4	◎
P05.03	Function of S3			7	◎
P05.04	Function of S4			0	◎
P05.05	Function of S5			0	◎
P05.06	Function of S6			0	◎
P05.07	Function of S7			0	◎
P05.08	Function of S8			0	◎
P05.09	Function of HDI			0	◎

Function code	Name	Description	Setting range	Default	Modify
		31: Pulse ascending 32: Length reset 33: Cancel the frequency change setting temporarily 34: DC braking 35: Shift the motor 1 into motor 2 36: Shift the command to the keypad 37: Shift the command to the terminals 38: Shift the command to the communication 39: Pre-magnetized command 40: Consumption power clear 41: Consumption power holding 42: Keypad setting of the torque upper limit 43: Position reference input (only S8 valid) 44: Spindle direction prohibit 45: Spindle returning /Local position returning 46: Zero position selection 1 47: Zero position selection 2 48: Spindle scaling selection 1 49: Spindle scaling selection 2 50: Spindle scaling selection 3/Pulse superposition enabling 51: Switching terminal of position control and speed control 52: Pulse input disabled 53: Position deviation clear 54: Position proportional gain switch 55: Digital position cycle positioning enabled 56: Emergency stop 57: Roll diameter reset 58: Winding/unwinding switchover 59: Initial roll diameter selection 1 60: Initial roll diameter selection 2 61: Pre-drive			

Function code	Name	Description	Setting range	Default	Modify
		62: Roll diameter calculation stop 63: Clear feeding interrupt signal 64: Manual brake trigger 65: Feeding interrupt fault trigger 66: Revolution counting input 67: Tension control mode switchover 68: Motor overtemperature fault input 69: Resolution counting reset 70: Switch PID polarities 71: Roll diameter calculation switchover 72: DEC trigger input after resolution reached 73: Material thickness correction trigger input 74: Present roll diameter correction trigger input 75: Auto deceleration enabling 76–79: Reserved			
Group P06—Output terminals					
P06.01	Y1 output	0: Invalid 1: In operation 2: Forward rotation operation 3: Reverse rotation operation 4: Jogging operation 5: VFD fault (including feeding interrupt fault) 6: Frequency degree test FDT1 7: Frequency degree test FDT2 8: Frequency arrival 9: Zero speed running 10: Upper limit frequency arrival 11: Lower limit frequency arrival 12: Ready for operation 13: In pre-exciting 14: Overload pre-alarm 15: Underload pre-alarm 16: Completion of simple PLC stage 17: Completion of simple PLC cycle	0–40	0	○
P06.02	HDO output selection			0	○
P06.03	RO1 output selection			1	○
P06.04	RO2 output selection			5	○

Function code	Name	Description	Setting range	Default	Modify
		18: Reach set counting value 19: Reach specified counting value 20: External fault is valid 21: Reserved 22: Reach running time 23: Modbus communication virtual terminals output 24: PROFIBUS/CANopen communication virtual terminals output 25: Ethernet communication virtual terminals output 26: DC bus voltage established 27: Reserved 28: Pulse superposing 29: Reserved 30: Positioning finished 31: Zero returning 32: Spindle scaling 33: Speed limit reached in torque control 34: Specified roll diameter reached 35: Max. roll diameter reached 36: Empty-roll diameter reached 37: Feeding interrupt alarm output 38: Brake output 39: Material thickness correction trigger output 40: Automatic DEC command trigger output			
P06.14	AO1 output selection	0: Invalid 1: Set frequency 2: Ramps reference frequency 3: Running speed 4: Output current (relative to 2 times the rated current of the VFD) 5: Output current (relative to 2 times the rated current of the motor) 6: Output voltage (relative to 1.5 times the rated voltage of the VFD) 7: Output power (relative to 2 times the rated power of the motor)	0–32	0	○
P06.15	AO2 output selection				
P06.16	HDO high-speed pulse output				

Function code	Name	Description	Setting range	Default	Modify
		8: Set torque value (relative to 2 times the rated torque of the motor) 9: Output torque (relative to 2 times the rated torque of the motor) 10: Analog AI1 input value 11: Analog AI2 input value 12: Analog AI3 input value 13: Input value of high-speed pulse HDIA 14: Set value 1 of Modbus communication 15: Set value 2 of Modbus communication 16: Set value 1 of PROFIBUS/CANopen communication 17: Set value 2 of PROFIBUS/CANopen communication 18: Set value 1 of Ethernet communication 19: Set value 2 of Ethernet communication 20–21: Reserved 22: Torque current (bipolar, 100% corresponds to 10 V) 23: Excitation current (100% corresponds to 10 V) 24: Setting frequency (bipolar) 25: Ramp reference frequency (bipolar) 26: Operation speed (bipolar) 27: Present tension 28: Present linear speed 29: Present roll diameter 30: Winding/unwinding length (0.0–100.0% of the set length, reserved) 31–32: Reserved			
Group P19—Tension specific status viewing					
P19.00	Actual control mode	0: Invalid tension control 1: Tension speed control 2: Open loop tension torque control	0–3	0	●

Function code	Name	Description	Setting range	Default	Modify
		3: Close-loop tension torque control			
P19.01	Actual winding/unwinding mode	0: Winding 1: Unwinding	0–1	0	●
P19.02	Initial roll diameter	0.0–5000.0mm In winding mode, the Initial roll diameter is the empty-roll diameter. In unwinding mode, the initial roll diameter is the maximum roll diameter.	0.0–5000.0	0.0 mm	●
P19.03	Actual empty-roll diameter	0.0–5000.0mm	0.0–5000.0	0.0 mm	●
P19.04	Roll diameter change rate	0.0–655.35mm/s	0–655.35	0.00mm/s	●
P19.05	Present roll diameter	0.0–5000.0mm	0.0–5000.0	0.0 mm	●
P19.06	No-load current	0.0–1000.0A No-load current after superimposing Group P10 with the compensation	0.0–1000.0	0.0	●
P19.07	Set linear speed	0.0–6000.0m/min	0.0–6000.0	0.0m/min	●
P19.08	Present linear speed	0.0–6000.0m/min	0.0–6000.0	0.0m/min	●
P19.09	Linear speed ACC/DEC flag	0: Constant speed; 1: DEC; 2: ACC	0–2	0	●
P19.10	Calculated max. linear speed	0.0–6000.0m/min	0.0–6000.0	0.0m/min	●
P19.11	Main reference frequency	0.00–600.00Hz Calculated from the linear speed and the present roll diameter, without using the maximum frequency limit.	0.00–600.00	0.00Hz	●
P19.12	Actual proportional gain	0.000–30.000	0.000–30.000	0.000	●
P19.13	Actual integral time	0.000–30.000s	0.000–30.000	0.000s	●
P19.14	Proportional	0–65535	0–65535	0	●

Function code	Name	Description	Setting range	Default	Modify
	output value				
P19.15	Integral output value	0–65535	0–65535	0	●
P19.16	PID upper limit	-100.0%–100.0% (Max. frequency or voltage)	-100.0–100.0	0.0	●
P19.17	PID lower limit	-100.0%–100.0% (Max. frequency or voltage)	-100.0–100.0	0.0	●
P19.18	PID output frequency	-99.99–99.99Hz	-99.99–99.99	0.00Hz	●
P19.19	Pulse train AB actual-measured running frequency	-300.0–300.0Hz	-300.0–300.0	0.0Hz	●
P19.20	Set tension	0–65535N **Note: If the reference exceeds 65535N, it is not applicable.**	0–65535	0N	●
P19.21	Tension taper coefficient	0.0–100.0%	0.0–100.0	0.0%	●
P19.22	Actual tension	0–30000N Tension reference calculated from the tension offset and taper.	0–30000	0N	●
P19.23	Basic torque reference value	-300.0–300.0% (of the rated motor torque) Torque calculated from the actual tension (P19.22) reference and the present roll diameter.	-300.0–300.0	0.0%	●
P19.24	Friction compensation torque value	-300.0–300.0% (of the rated motor torque)	-300.0–300.0	0.0%	●
P19.25	System rotational inertia	0–655.35 $kg.m^2$ System rotational inertia = System mechanical inertia + present material inertia	0–655.35	0.00 $kg.m^2$	●
P19.26	Inertia compensation interval frequency	-99.99–327.67Hz	-99.99–327.67	0.00Hz	●

Function code	Name	Description	Setting range	Default	Modify
	variation range				
P19.27	Torque compensation value of system rotational inertia	-300.0–300.0% (of the rated motor torque)	-300.0–300.0	0.0%	●
P19.28	ACC/DEC phase torque compensation value	-300.0–300.0% (of the rated motor torque)	-300.0–300.0	0.0%	●
P19.29	Reference value after torque compensation	-300.0–300.0% (of the rated motor torque)	-300.0–300.0	0.0%	●
P19.30	Reference tension corresponding to torque current value	-300.0%–300.0% (of the motor rated current) Ratio of P19.23 to the motor rated current	-300.0–300.0	0.0%	●
P19.31	PID output torque	-300.0–300.0% (of the rated motor torque)	-300.0–300.0	0.0%	●
P19.32	Measured tension	0–30000N Tension value feedback from the tension detection sensor	0–30000	0N	●
P19.33	Number of material turns on the reel	-100–32767	-100–32767	0	●
P19.34	Length of material on the reel	0–65535m (length recording)	0–65535	0m	●
P19.35	Length increment	0.0–6553.5m	0–6553.5	0.0m	●
P19.36	ACC/DEC determination time	0–400ms	0–400	0	●

4 Detailed description of tension control parameters

4.1 Description of function codes related to GD35-07 closed-loop vector

Function code	Name	Description	Default	Modify
P01.25	DEC time for emergency stop	0.0–60.0s	2.0s	○

DEC time during emergency stop (terminal function set to 56).

Function code	Name	Description	Default	Modify
P03.22	Weakening coefficient in constant power zone	0.01–2.00 A larger value indicates a smaller weak magnetic field and a greater excitation current.	1.00	○
P03.23	Lowest weakening point in constant power zone	10%–50%	10%	○
P03.24	Max. voltage limit	0.0–120.0%	100.0%	○
P03.26	Flux-weakening proportional gain	0–8000	1200	○
P03.27	Flux-weakening integral gain	0–8000	1200	○
P03.28	Flux-weakening control mode selection	0–2	0	○
P03.29	Torque control mode selection	Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved	0–0x01	○

P03.22: The larger parameter value setting indicates a more obvious weak magnetic effect in the constant power zone. This parameter takes effect when P03.26 is 0.

P03.24: The max. voltage limit is the percentage of the max. output voltage of the VFD to the motor rated voltage parameter.

P03.28: This parameter takes effect when P03.26 is set to a non-zero value. Generally, you do not need to modify this parameter.

P03.29: In flux-weakening control, the effect of option 0 and option 1 in ones place is different. Please select according to the on-site situation.

The response characteristics of the flux-weakening controller are related to P03.26 and P03.27. These parameters can be adjusted appropriately.

Function code	Name	Description	Default	Modify
P03.30	Low speed friction torque	0.0%–50.0%	0.0%	○
P03.31	High speed friction torque	0.0%–50.0%	0.0%	○
P03.32	Corresponding frequency of high speed friction torque	0.00Hz–400.00Hz	50.00Hz	○
P03.33	Low speed threshold	0.00–20.00Hz	1.00Hz	○

P03.30 is the compensation value of friction torque when the frequency is below P03.33.

P03.31 is the compensation value of high-speed (>P03.32) friction torque. The friction torque between low speed threshold P03.33 and high speed threshold P03.32 is the liner proportion of P03.30 and P03.31.

Note: Torque compensation is valid only in the torque control mode (P03.11≠0).

Function code	Name	Description	Default	Modify
P07.02	Function of QUICK/JOG	0: No function 1: Jogging. Press QUICK/JOG to begin the jogging running. 2: Shift the display state by the shifting key. Press QUICK/JOG to shift the displayed function code from right to left. 3: Shift between forward rotations and reverse rotations. Press QUICK/JOG to shift the direction of the frequency commands. This function is only valid in the keypad commands channels. 4: Clear UP/DOWN settings. Press QUICK/JOG to clear the set value of UP/DOWN. 5: Coast to stop. Press QUICK/JOG to coast to stop. 6: Shift the given manner of running	1	◎

Function code	Name	Description	Default	Modify
		commands. Press QUICK/JOG to shift the given manner of running commands. 7: Quick commission mode (commission according to the non-factory parameter) 8: Custom quick commissioning mode		

Adding customized debugging shortcut mode. When P07.02 is set to 8, sixteen function codes can be added and these function codes can be modified, added or deleted as needed.

How to add function codes: switch to function code displaying interface, e.g. P00.00, then press QUICK/JOG key, which will make all the digits in P00.00 flash, press DATA/ENT and the addition is done. After adding 16 function codes, the keypad will display "FULL" for any additional addition.

How to delete function codes: Press QUICK/JOG key to enter customized debugging shortcut mode, then in function code displaying interface eg V00.00, press PRG/ESC key and all the digits in V00.00 will flash, press DATA/ENT key and deletion is done. After all the function codes are deleted, the keypad will display "NULL".

How to modify function codes: Press QUICK/JOG key to enter customized debugging shortcut mode, then in function code displaying interface eg V00.00, press DATA/ENT key to display the value of P00.00, modify the value by ▲, ▼ and 》/SHIFT, press DATA/ENT again to confirm and complete the modification.

Function code	Name	Description	Default	Modify
P08.15	Bus voltage regulator gain	0.0–1000.0	12.0	○

The regulator gain during overvoltage stall is only valid in vector control mode. Increasing the value can speed up the adjustment response to avoid overvoltage fault.

Function code	Name	Description	Default	Modify
P08.16	Speed-loop differential gain	0.00–10.00s	0.00s	○

Speed loop differential gain can increase the damping characteristics of the speed regulator and reduce overshoot in specific situations, generally without the need for setting.

Function code	Name	Description	Default	Modify
P08.17	Upper limit of inertia	0.0–150.0% (of the rated motor torque)	20.0%	○

Function code	Name	Description	Default	Modify
	compensation torque			
P08.18	Inertia compensation filter times	0–10	7	○

P08.17 is used to limit the max. inertia compensation torque to prevent inertia compensation torque from being too large.

P08.18 is the filter times of inertia compensation torque, used to smooth inertia compensation torque.

Function code	Name	Description	Default	Modify
P08.19	High-frequency current-loop proportional coefficient	0–20000	1000	○
P08.20	Integral coefficient of high-frequency current loop	0–20000	1000	○
P08.21	Current-loop high-frequency switching threshold	0.0–100.0% (of the max. frequency)	100.0%	○

In the closed-loop vector control mode (P0.00=3), when the frequency is lower than the current-loop high-frequency switching threshold (P08.21), the current-loop PI parameters are P03.09 and P03.10; and when the frequency is higher than the current-loop high-frequency switching threshold (P03.39), the current-loop PI parameters are P08.19 and P08.20.

Function code	Name	Description	Default	Modify
P08.22	Inertia identification torque	0.0–100.0% (of the motor rated torque)	10.0%	◎
P08.23	Inertia identification	0: No operation 1: Start identification	0	◎
P08.24	System inertia	0.000–30.000kgm^2	0.000 kgm^2	○
P08.25	Enabling inertia compensation	0: Disable 1: Enable	0	○

P08.22 specifies the inertia identification torque. Due to friction force, it is required to set certain identification torque for the inertia identification to be performed properly.

When P08.23 is set to 1: Start identification, press “RUN” on the keypad to enter into the program until the keyboard displays "- END -". The identified system inertia is saved in P08.24. You can manually modify P08.24.

When P08.25 is set to 1, the VFD automatically calculates the inertia compensation, which helps to improve the dynamic response characteristics of the system.

Function code	Name	Description	Default	Modify
P11.14	Speed deviation detection value	0.0–50.0%	10.0%	○
P11.15	Speed deviation detection time	0.0–10.0s	0.5s	○

Speed deviation protection is invalid when P11.15=0.0.

Function code	Name	Description	Default	Modify
P18.00	Actual frequency of encoder	-999.9–999.9	0.0Hz	●
P18.01	Encoder position count value	0–65535	0	●
P18.02	Encoder Z pulse position	0–65535	0	●

P18.00 indicates the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative.

P18.01 indicates the encoder count value, quadruple frequency.

P18.02 indicates the corresponding count value of encoder Z pulse.

Function code	Name	Description	Default	Modify
P18.14	Pg1 pulse count MSB	0–65535	0	○
P18.15	Pg1 pulse count LSB	0–65535	0	○

Encoder pulse count value. The count value is accumulated only if the VFD is powered on.

Function code	Name	Description	Default	Modify
P18.20	Count value of resolver	0–65535	0.00	●
P18.21	Resolver angle	0–359.99	0.00	●

P18.20 indicates the count value of the resolver.

P18.21 indicates the pole position angle read by the resolver-type encoder.

Function code	Name	Description	Default	Modify
P18.22	Magnetic pole angle	0–359.99	0.00	●

Present pole position.

Function code	Name	Description	Default	Modify
P20.01	Encoder PPR	0–60000	1024	◎

Number of pulses generated when the encoder revolves for one circle.

Function code	Name	Description	Default	Modify
P20.02	Encoder direction	Ones place: AB direction 0: Forward; A precedes B 1: Reverse, B precedes A Tens place: Z pulse direction 0: Forward 1: Reverse	0x00	◎

Ones place: Encoder AB direction

When an encoder disconnection fault (ENC1O) or encoder reversal fault (ENC1D) fault is reported, adjusting P04.06 can change the AB pulse direction without readjusting the wiring of the encoder AB pulse.

Tens place: Z pulse direction

When using the spindle stopping function, if the direction of forward and reverse stopping need to be the same, it is necessary to adjust the function code to ensure the counting value of P18.02 is the same in the forward and reverse rotation. There is no need to modify the parameter in other modes.

Function code	Name	Description	Default	Modify
P20.03	Detection time of	0.1–100.0s	0.5s	○

Function code	Name	Description	Default	Modify
	encoder offline fault			

Indicates the detection time of encoder offline fault.

Function code	Name	Description	Default	Modify
P20.04	Detection time of encoder reversal fault	0.1–100.0s	0.8s	○

Indicates the detection time of encoder reversal fault.

Function code	Name	Description	Default	Modify
P20.05	Filter times of encoder detection	Ones place: Low-speed filter times Tens place: High-speed filter times	0x33	○

Ones place: Low-speed filter time, corresponding to $2^{(0–9)}$×125μs;

Tens place: High-speed filter times, corresponding to $2^{(0–9)}$×125μs.

Function code	Name	Description	Default	Modify
P20.06	Speed ratio between motor and encoder	0–65.535	1.000	○

You need to set the function parameter when the encoder is not installed on the motor shaft and the drive ratio is not 1.

Function code	Name	Description	Default	Modify
P20.07	Control parameters of SM	Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Resolver speed measurement mode Bit4: Z pulse capture mode Bit12: Clear the Z pulse arrival signal after stop	0003	○

Generally, this parameter do not need to be changed.

Function code	Name	Description	Default	Modify
P20.08	Enabling pulse Z disconnection detection	0: Disable 1: Enable	0	○

ENC1Z indicates pulse Z disconnection fault. When an incremental encoder is used for the synchronous machine, you can enable pulse Z detection to prevent inaccurate orientation or synchronous machine control failure caused due to pulse Z loss.

Function code	Name	Description	Default	Modify
P20.09	Initial angle of Z pulse	0–359.99	0.00	○

Relative electric angle between the encoder Z pulse and the motor pole position.

Function code	Name	Description	Default	Modify
P20.10	Pole initial angle	0–359.99	0.00	○

Relative electric angle between the encoder position and the motor pole position.

Function code	Name	Description	Default	Modify
P20.11	Initial pole angle autotuning	0: No operation 1: Rotary autotuning 2: Static autotuning (suitable for resolver-type encoder)	0	◎

After setting the value to 1 or 2, the keypad will display "-RUN-", then press "-RUN-" to begin the autotuning until the keypad display "-END-". The identified initial angle is saved in P20.09 and P20.10.

The pole initial angle obtained through rotary autotuning is accurate. Rotary autotuning is recommended in most cases, in which the motor needs to be decoupled from the load.

4.2 Tension control function group 1

Function code	Name	Description	Default	Modify
P26.00	Tension control mode	0: Invalid 1: Tension speed control 2: Open loop tension torque control 3: Close-loop tension torque control	0	◎

0: The tension control function is invalid, and the general VFD functions are available.

1: Tension speed control

In the case where there is tension detection feedback signal (such as a tension sensor or tension pendulum), the VFD controls the output frequency through PID tension closed-loop regulation to make the tension reach the set tension and keep the line speed constant. Its control mode can be SVPWM, the speed sensorless vector control, or closed-loop vector control. For precise tension control, it is recommended to operate in closed-loop vector control mode.

In scenarios of winding and unwinding control without tension detection feedback signal, if constant line speed control is required and the PID function is disabled, it can be achieved through the following methods.

- When the motor is equipped with an encoder, select the closed-loop vector control mode, combined with the thickness of the material (P26.18), and set P26.21 = 1, P26.13 = 5 or 6 to calculate the roll diameter, control the motor output frequency under different diameters, and keep linear speed constant.
- When the motor is not equipped with an encoder, combined with the thickness of the material (P26.18), and set P26.13 = 7 or 8 to calculate the roll diameter, control the motor output frequency under different diameters, and keep linear speed constant.
- If the linear speed sensor is installed outside, through the selection of thickness calculation function of roll diameter (P26.13 = 9), to calculate the roll diameter, then control the operation frequency through the setting linear speed and current roll diameter and keep linear speed constant.

2: Open loop tension torque control

No tension detection feedback signal is required. The VFD control the tension on the material constant by controlling the motor output torque, and is recommended to operate in the closed-loop vector control mode with an encoder installed.

3: Close-loop tension torque control

The close-loop tension torque control has high tension control accuracy and is applicable only when there is a tension detection sensor installed. It is recommended to operate in close-loop vector control mode where encoder is installed.

Function code	Name	Description	Default	Modify
P26.01	Winding/unwinding mode	0: Winding 1: Unwinding	0	○

Set the winding mode, it can be used with switch terminals.

The motor forward rotation direction is the winding direction. When using the tension control mode,

check whether the motor rotation direction is correct in the winding mode; if not, change the rotation direction by swapping two phase wires of the motor. After the rotation direction is corrected, the winding mode can be switched to the unwinding mode by setting P26.01 to 1 or changing the winding/unwinding switchover terminals.

Function code	Name	Description	Default	Modify
P26.02	Reel mechanical transmission rate	0.01–300.00	1.00	○

Mechanical transmission rate = Motor rotation speed/Reel rotation speed = Reel diameter/Motor shaft diameter. Please set the mechanical transmission rate correctly.

Function code	Name	Description	Default	Modify
P26.03	Speed control mode startup material winding	Ones place: Whether zero speed reverse is allowed for unwinding 0: Allow 1: Not allow Tens place: Reserved	0x00	○

When the VFD starts as a slave, the master input linear speed is 0, and the unwinding mode is selected in the tension speed control mode with tension feedback signal, if the ones place of P26.03 is 0, the unwinding VFD can actively operate to wind the material; if the ones place is 1, the speed remains at 0 after the unwinding VFD starts.

Function code	Name	Description	Default	Modify
P26.04	Max. frequency of main traction	0.00–300.00Hz	50.00Hz	○
P26.05	Diameter of main traction	0–6000.0mm	99.0mm	○
P26.06	Main traction drive ratio	0–60.000 Master traction drive ratio = Motor rotation speed/Master traction roller rotation speed = Master traction roller diameter/Motor shaft diameter	1.000	○
P26.07	Motor pole pairs of main traction	1–1000	2	○

After correctly setting the parameters P26.04–P26.07, the maximum linear speed value P19.08 in the tension system can be obtained, which can be used as a reference value for setting the maximum linear speed P26.08.

Function code	Name	Description	Default	Modify
P26.08	Max. linear speed	0.0–6000.0m/min	1000.0m/min	○

Its value should be run with the actual linear speed of the largest output frequency for the traction hosts.

Function code	Name	Description	Default	Modify
P26.09	Linear speed input source selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (communication address 0x200F) 6: PROFIBUS/CANopen communication (0.0–100.0%) 7: Pulse train AB	0	◎

The function code is used to select the input mode and channel of linear speed. 100% corresponds to the maximum speed.

0: Selected for system commissioning or as the master. It is specified by P26.10.

1, 2, 3: It is determined by analog input voltage or current. 10V or 20mA corresponds to 100%.

4: It is determined by external input pulse frequency. P05.52 corresponds to 100%.

5: Given by the host controller communication. Its communication address is 0x200F.

6: Communication expansion card is required. It is given by the host controller.

7: Pulse train AB. It is based on the master traction reel or motor encoder pulse frequency-division reference.

Function code	Name	Description	Default	Modify
P26.10	Linear speed set through keypad	0.0–100.0%	20.0%	○

When P26.09 is 0, the set linear speed value is determined by the function code P26.10. It is applicable to commissioning or master mode.

Function code	Name	Description	Default	Modify
P26.11	Pulse train AB	0–20000	1024	○

Function code	Name	Description	Default	Modify
	PPR			
P26.12	Linear speed filter times of pulse train AB	0–15 Filter time: (2^N)*0.125ms	8	○

When P26.09=7, P26.11 and P26.12 should be set, where P26.11 is the number of lines installed on the encoder of the main traction reel or motor, and P26.12 is the measured number of line speed filters.

Function code	Name	Description	Default	Modify
P26.13	Tension control zero speed threshold	0.00–10.00% (of the max. linear speed) Determines the zero speed threshold for tension control operation	0.35 %	○

P26.13 specifies the zero speed threshold for tension system determination, below which it is considered a zero speed state.

Function code	Name	Description	Default	Modify
P26.14	Linear speed ACC time	0.00–600.00	0.00s	○
P26.15	Linear speed DEC time	0.00–600.00	0.00s	○

When the tension control-specific VFD works as the master, set P26.14 and P26.15 to control the linear speed ACC/DEC time; when it works as a slave, set P26.14 and P26.15 to 0.

Function code	Name	Description	Default	Modify
P26.16	Roll diameter calculation method selection	0: Not calculated 1: Linear speed 2: Strip revolution counting thickness 3: Wire revolution counting thickness 4: Strip length recording thickness 5: Wire length recording thickness 6: AI1 measurement 7: AI2 measurement 8: AI3 measurement 9: Modbus communication (0x2012) 10: PROFIBUS/CANopen communication (0.0–100.0%)	0	◎

0: Control applications without winding. Do not need roll diameter calculation.

1: Calculate the roll diameter based on the linear speed and VFD output frequency.

2, 3: The roll diameter is calculated through thickness. The roll diameter can be calculated by using an external sensor at the end of the roll to record the revolution count, or indirectly through the PG card measured speed pulse. The value of P26.30 is required for these methods.

4, 5: The roll diameter is calculated through linear speed length recording and drum perimeter. The values of P26.30 and P26.32 are required.

6, 7, 8: For applications where the roll diameter detected with a roll diameter detection sensor, in which P26.13 (Max. roll diameter) must be set correctly.

9, 10: The roll diameter can be written directly through communication.

Function code	Name	Description	Default	Modify
P26.17	Min. empty-roll diameter	0.0–5000.0mm	50.0 mm	○
P26.18	Max. roll diameter	0.0–5000.0mm	1000.0 mm	○
P26.19	Initial roll diameter 1	0.0–5000.0mm	100.1 mm	○
P26.20	Initial roll diameter 2	0.0–5000.0mm	100.2mm	○
P26.21	Initial roll diameter 3	0.0–5000.0mm	100.3 mm	○

These parameters specify the diameter of empty and full roll. In winding mode, initial roll diameter 1, 2, 3 are the empty-roll diameter and in unwinding mode, initial roll diameter 1, 2, 3 are the full-roll diameter. When multiple sizes of empty rolls are available, the initial roll diameter can be set by selecting the terminals, with P26.17 being the minimum size of empty-roll diameter. If the initial roll diameter is selected through terminals S1 and S2, terminals S1 and S2 should be configured to press the locking switch, as explained below:

S1	S2	Initial roll diameter (winding)	Initial roll diameter (unwinding)
OFF	OFF	P26.17	P26.18
ON	OFF	P26.19	P26.19
OFF	ON	P26.20	P26.20
ON	ON	P26.21	P26.21

Upon first power-on, if the winding mode is selected, the present roll diameter is equal to the minimum empty-roll diameter; if the unwinding mode is selected, the present roll diameter is equal to the maximum roll diameter.

If the terminal is valid, the present roll diameter is the selected initial roll diameter; if it is invalid, the present roll diameter remains unchanged.

Function code	Name	Description	Default	Modify
P26.22	Number of initial material turns	0–100	0–100	○

Upon power-on or roll diameter reset, calculate the initial superposed roll diameter based on P26.22 and the material thickness P26.29–P26.31.

Parameters related to the roll diameter calculation with linear speed P26.23–P26.29

Function code	Name	Description	Default	Modify
P26.23	Roll diameter calculation delay time	0.0–100.0s	2.0s	○
P26.24	Min. linear speed for roll diameter calculation	0.0–100.0% (of the max. linear speed)	2.0%	○
P26.25	Min. frequency for roll diameter calculation	0.00–50.00Hz	0.50Hz	○

After GD35-07 is started, if the delay time is within P26.23, or the present system linear speed is less than P26.24, or the present running frequency is less than P26.25, the roll diameter calculation with linear speed will not be performed.

Function code	Name	Description	Default	Modify
P26.26	Roll diameter filter time	0.000–60.000s	1.000s	○

Increasing the filter time can prevent the calculation value change rapidly.

Function code	Name	Description	Default	Modify
P26.27	Reverse direction change restriction in roll diameter calculation	0:No 1: Restrict changes in reverse direction	0	○

Applicable to the set the roll diameter calculation with linear speed.

P26.27=0: Regardless of winding or unwinding, the calculated roll diameter is not limited.

P26.27=1: During winding, the present roll diameter cannot be reduced; during unwinding, the present roll diameter cannot be increased.

Function code	Name	Description	Default	Modify
P26.28	Roll diameter change rate restriction selection	0:No 1: Automatic restriction according to the running frequency	0	○
P26.29	Max. material thickness	0.01–100.00mm	0.10 mm	○

Applicable to the set the roll diameter calculation with linear speed.

P26.28=0: The calculated roll diameter is limited by P26.27.

P26.28=1: It is necessary to automatically calculate the roll diameter change rate based on the running frequency with P26.29, in order to limit the calculated roll diameter change. At the same time, the result is limited by P26.27.

Parameters related to the roll diameter calculation with thickness P26.30–P26.34

Function code	Name	Description	Default	Modify
P26.30	Material thickness	0.01–100.00mm	0.10mm	○
P26.31	Min. material thickness	0.01–100.00mm	0.10mm	○
P26.32	Number of coils per layer	1–10000 Indicates the number of turns of wire wound on each layer when the material is wire.	1	◎
P26.33	Revolution counting function selection	0: Digital terminal input (reel side) 1: Programmable card input (motor side)	0	◎
P26.34	Number of pulses per revolution	1–60 Applies to P26.33=0, reflecting the number of pulses per turn at the digital terminal input	1	◎

P26.33=0: The roll diameter is calculated according to the revolution counting of the external proximity switch, which is suitable for situations with low revolution counting pulse frequency. At the

same time, reduce the terminal input filter time of Group P5.

P26.33=1: The roll diameter is calculated according to the revolution counting of PG card measured speed pulse, which is suitable for situations with an encoder installed on the motor side.

Function code	Name	Description	Default	Modify
P26.35	Present roll diameter	0.0–5000.0mm	0.0 mm	○

In the stopped state, the value can be manually modified. When the value is written to 0, the value is reset to the minimum roll diameter for winding mode, and reset to the maximum roll diameter for unwinding mode.

Function code	Name	Description	Default	Modify
P26.36	Roll diameter set value	0.0–100.0% (of the max. roll diameter)	80.0%	○

When the roll diameter reaches P26.36, a relay output signal can be selected. It can also be used with the settings of P26.38 in the thickness calculation method to determine whether the roll diameter reset is effective before the present roll diameter value reaches P26.36, avoiding erroneous reset operations.

Function code	Name	Description	Default	Modify
P26.37	Settings related to present roll diameter	0x00–0x11 Ones place: At stop 0: Remain current roll diameter 1: Restore to initial roll diameter Tens place: Power off at running 0: Remain current roll diameter 1: Restore to initial roll diameter	0x00	○

Used to select the roll diameter value of the roll diameter to be held during shutdown and power-off.

0X00: The roll diameter remains unchanged from the current calculated value.

0x01: If a power failure occurs during operation, the current roll diameter is retained, and if no power failure occurs during operation, the roll diameter is restored to the initial roll diameter after the normal stop.

0x10: If a power failure occurs during operation, the initial roll diameter is restored, and if no power failure occurs during operation, the current roll diameter is retained after the normal stop.

0x11: If a power failure occurs during operation, the initial roll diameter is restored, and if no power

failure occurs during operation, the roll diameter is restored to the initial roll diameter after the normal stop.

Function code	Name	Description	Default	Modify
P26.38	Roll diameter reset selection	0x00–0x11 Ones place: Applicable to all calculation methods 0: Reset only allowed at stop 1: Reset allowed at running Tens place: Applicable to thickness calculation for roll diameter 0: Reset allowed when P26.36 is not reached 1: Reset only allowed when P26.36 is reached	0x00	○

When the diameter reset terminal is valid:

Ones place=0: in the stopped state, reset the current roll diameter to the initial value.

Ones place=1: it can be reset under the running state, and when the terminal is valid, the current roll diameter stays unchanged.

Tens place=0: when selecting the thickness calculation roll diameter method, the roll diameter can be reset as long as the ones place is set properly;

Tens place=1: the roll diameter can be reset only if the roll diameter reaches the value set in P26.16.

Function code	Name	Description	Default	Modify
P26.39	PID parameter adjustment source	0: Group P09 1: Roll diameter 2: Main reference frequency 3: Running linear speed 4: ACC/DEC 5: Deviation 1 (max. roll diameter) 6: Deviation 2 (Reference 100%)	0	○
P26.40	Tension feedback PID control selection	0x00–0x11 Ones place: Output reference 0: Relative to max. output frequency 1: Relative to main reference frequency Tens place: PID reference value taper changes	0x00	○

Function code	Name	Description	Default	Modify
		0: Disable 1: Enable		
P26.41	Group 2 proportional gain 1	0.000–30.000	0.300	○
P26.42	Group 2 proportional gain 2	0.000–30.000	0.300	○
P26.43	Group 2 integral time	0.000–30.000s	5.000s	○
P26.44	Group 2 differential time	0.000–10.000s	0.000s	○
P26.45	PID parameter adjustment reference point 1	0.0–P26.46	10.0%	○
P26.46	PID parameter adjustment reference point 2	P26.45–P26.47	50.0%	○
P26.47	PID parameter adjustment reference point 3	P26.46–100.0%	80.0%	○
P26.48	Group 3 proportional gain 1	0.000–30.000	0.300	○
P26.49	Group 3 proportional gain 2	0.000–30.000	0.300	○
P26.50	Group 3 integral time	0.000–30.000s	5.000s	○
P26.51	Group 3 differential time	0.000–10.000s	0.000s	○
P26.52	Differential filter times	0–100	0	○
P26.53	Differential action limit amplitude	0.0–100.0%	20.0%	○
P26.54	Differential separation threshold	0.0–100.0% The differentiation does not work if (the deviation value between the current reference and feedback)/reference is less than P26.54.	5.0%	○

P09.04, P09.05, P09.06, and P09.07 are the first set of PID parameters.

P26.41, P26.42, P26.43, and P26.44 are the second set of PID parameters.

P26.48, P26.49, P26.50, and P26.51 are the third set of PID parameters. The adjustment function of the third set of P, I, and D parameters is stronger than that of the second set, and the second set of P, I, and D parameters has a stronger adjustment effect than the first set.

P09.05, P26.42, and P26.49 are applicable only when P26.39=5.

P26.39 is used to select the basis for PID parameter change to optimize PID adjustment effect.

0: Only first set of PID parameters is used.

1: P26.45–P26.47. The reference value is the current roll diameter, the reference base value is the maximum roll diameter, P26.45 corresponds to the first set of PID parameters, P26.46 corresponds to the second set of PID parameters, P26.47 corresponds to the third set of PID parameters, and the PID parameters change linearly in the middle value.

2: P26.45–P26.47. The reference value is the main reference frequency, the reference base value is the maximum frequency, P26.45 corresponds to the first set of PID parameters, P26.46 corresponds to the second set of PID parameters, P26.47 corresponds to the third set of PID parameters, and the PID parameters change linearly in the middle value.

3: P26.45–P26.47. The reference value is the current linear speed, the reference base value is the maximum linear speed, P26.45 corresponds to the first set of PID parameters, P26.46 corresponds to the second set of PID parameters, P26.47 corresponds to the third set of PID parameters, and the PID parameters change linearly in the middle value.

4: Only P26.45 is used, with the reference value being the linear speed state and the reference base value being the maximum linear speed. If the current linear speed is less than P26.45 * the maximum linear speed, the first set of PID parameters is used. If the current linear speed is constant, the second set of PID parameters is used. If the current linear speed is in an ACC/DEC state, the third set of PID parameters is used.

5: P26.45–P26.47. The reference value is the current roll diameter, the reference base value is the maximum roll diameter, P26.45 corresponds to the first set of PID parameters, P26.46 corresponds to the second set of PID parameters, P26.47 corresponds to the third set of PID parameters, and the PID parameters change linearly in the middle value.

Among them, if the current roll diameter is less than P26.45 * the maximum roll diameter, P09.04 in the first set is the maximum proportional gain, and P09.05 is the minimum proportional gain. As the deviation between the reference and feedback decreases, it gradually linearizes from P09.04 to P09.05. When the deviation is 0, the proportion will be P09.05. The description for the second set and third set are similar to the above.

6: P26.45–P26.47. The reference value is the deviation between the reference and feedback, the

reference base value is the maximum reference value, P26.45 corresponds to the first set of PID parameters, P26.46 corresponds to the second set of PID parameters, P26.47 corresponds to the third set of PID parameters, and the PID parameters change linearly in the middle value.

Ones place of P26.40: used to cope with PID control value. When it is set to 0, use the max. output frequency as the base; when it is set to 1, use the current running frequency as the base. Tens place of P26.40: specifies whether the PID reference value varies according to the tension taper curve.

Function code	Name	Description	Default	Modify
P26.55	PID reference conversion	0: Invalid 1: Enable	0	○
P26.56	PID reference initial value	0.0–100.0%	10.0%	○
P26.57	PID reference final value	0.0–100.0% (Generally, it equals to the PID set value.)	50.0%	○
P26.58	PID reference initial value hold time	0.00–60.00s	5.00s	○
P26.59	Conversion time from PID reference initial value to final value	0.00–60.00s	5.00s	○
P26.60	Conversion time from PID reference final value to initial value	0.00–60.00s	5.00s	○

Applicable to tension feedback applications with buffering, such as pendulum or floating rod. The PID reference transformation function P26.55–P26.60 can be used. If P26.55 is enabled, when GD35-07 starts, the PID reference will set P26.56 as the reference value and maintain P26.58, then increase from P26.56 to P26.57 according to the time set by P26.59; when GD35-07 stops, the PID reference decreases from P26.57 to P26.56 according to the time set by P26.60, and then executes the deceleration to stop command.

4.3 Tension control function group 2

Function code	Name	Description	Default	Modify
P27.00	Tension setting	Ones place: Tension setting source	00	◎

Function code	Name	Description	Default	Modify
	source selection	0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (communication address 0x2010) 6: PROFIBUS/CANopen communication (0.0–100.0%) Tens place: Multiplication selection of max. tension 0: 1 1: 10		

The ones place is used to select the tension input method and channel.

0: Set by P27.01.

1, 2, 3: It is determined by analog input voltage or current. 10V or 20mA corresponds to 100%.

4: It is determined by external pulse input pulse frequency. P05.52 corresponds to 100%.

5: Given by the host controller communication. Its communication address is 0x2010.

6: Communication expansion card is required. It is given by the host controller.

The tens place specifies the maximum tension corresponding to 100%.

0: Maximum tension P27.02

1: Maximum tension P27.02*10.

Function code	Name	Description	Default	Modify
P27.01	Tension set through keypad	0.0–100.0% (of the max. tension)	10.0%	○

When P27.00 is 0, the tension is determined by the function code P27.01.

Function code	Name	Description	Default	Modify
P27.02	Max. tension	When the tens place of P27.00 is 0, the setting range is 0–60000N. When the tens place of P27.00 is 1, the setting range is (0–60000)*10N.	3000N	○

The function code is used to determine the maximum tension that the material can withstand.

Function code	Name	Description	Default	Modify
P27.03	Tension offset value at zero speed	-100.0–300.0% (reference tension)	0.0%	○
P27.04	Speed lower limit for zero-speed tension offset	0.0–100.0% (of the max. frequency)	1.0%	○

P27.03 is applicable to winding mode, which sets the additional tension that the system increases at zero speed. When the set tension is low, this parameter can be appropriately set to improve the acceleration process.

P27.04 is applicable to winding mode, setting the zero-speed threshold. When running frequency is lower than P27.04, the zero-speed tension is increased by P27.03.

Function code	Name	Description	Default	Modify
P27.05	Upper-limit frequency source of torque control	0: P03.14, P03.15 1: Set forward rotation limit based on linear speed calculation 2: Set reverse rotation limit based on linear speed calculation 3: Set forward and reverse rotations limit based on linear speed calculation	0	○

0: The frequency upper limit is determined by P03.14 and P03.15.

1, 2, and 3: the frequency obtained from the linear speed calculation is the frequency upper limit.

Function code	Name	Description	Default	Modify
P27.06	Running frequency upper limit offset of tension control	0.0–100.0% (of the max. frequency)	5.0%	○

When tension torque control mode is selected (P26.00=2 or 3), it can be used to set the bias value of the torque control frequency upper limit, that is, adding this value to the frequency upper limit as the frequency upper limit, but the sum result is ultimately limited by the maximum output frequency P00.03.

Note: When the linear speed input is smaller than P26.13, the frequency upper limit of the tension

torque control is P27.04, independent of the setting of P27.05.

Function code	Name	Description	Default	Modify
P27.07	Torque control mode zero-speed material winding	0x00–0x11 Ones place: Reverse winding during unwinding 0: Enable 1: Disable Tens place: Active winding during winding 0: Enable 1: Disable	0x00	○

If disabled, at the zero speed, the output torque is 0, and the PID output is 0 also.

If enabled, at the zero speed, whether negative torque is allowed is determined by the following settings:

When P26.00=2, set through the ones place of P27.08.

When P26.00=3, set through P09.19 and P09.20.

Function code	Name	Description	Default	Modify
P27.08	Tension torque compensation negative torque selection	0x00–0x11 Ones place: whether the tension torque can be compensated as negative 0: Negative torque compensation is not allowed 1: Negative torque compensation is allowed Tens place: PID output reference 0: Reference tension torque (related to the present roll diameter) 1: Motor rated current	0x00	○

Ones place of P27.08 (applicable to P26.00 only):

If the ones place is 0, negative torque compensation is not allowed. At this time, the minimum output torque is 0 in unwinding mode, and is the empty-roll torque in winding mode.

If the ones place is 1, when friction torque compensation and inertia torque compensation are combined, the output torque is allowed to be negative.

Tens place of P27.08 (only applicable to P26.00=3, whether it can be compensated as negative depends on the upper and lower limits of PID):

If the tens place is 0, the output PID refers to the current reference tension torque.

If the tens place is 1, the output PID refers to the motor rated current.

Function code	Name	Description	Default	Modify
P27.09	Torque control zero-speed stop mode	0–1 0: Coast to stop 1: Decelerate to stop	0	○

P27.09 is applicable to the stop mode of the VFD when the set linear speed decreases to 0 during the stop command in torque control mode.

Function code	Name	Description	Default	Modify
P27.10	System mechanical parameters identification	0: No operation 1: Enabling system mechanical inertia identification 2: Enabling mechanical friction torque identification	0	◎

P27.10 is used for mechanical inertia identification when it is 1.

In vector control mode, when P27.10 is set to 2, the automatic identification of mechanical friction torque will be carried out. At this time, the keypad displays -GuB-. After the run key is pressed, the motor will run. Please pay attention to safety. After the keypad displays -End-, the identification is complete. After that, the values of P27.12, P27.13, P27.14, and P27.17 will be automatically changed, and can also be manually modified.

Only after the normal identification is completed, P27.10 will automatically change to 0. If the machine is manually stopped during the identification, P27.10 will still be 2. If mechanical friction torque identification is no longer needed, please manually change P27.10 to 0.

Function code	Name	Description	Default	Modify
P27.11	Friction torque compensation selection	0: Disable 1: Frequency 2: Linear speed	0	○
P27.12	Static friction compensation coefficient	0.0–100.0% (of the rated motor torque) This parameter can be manually set or obtained through identification when P27.10=2	0.0%	○
P27.13	Sliding friction compensation	0.0–100.0% (of the rated motor torque) This parameter can be manually set or	0.0%	○

Function code	Name	Description	Default	Modify
	coefficient	obtained through identification when P27.10=2		
P27.14	High speed torque compensation coefficient	0.0–50.0% (of the rated motor torque) This parameter can be manually set or obtained through identification when P27.10=2	0.0%	○
P27.15	Compensation reference of static friction torque	0.0–100.0%	1.0%	○
P27.16	Compensation reference of sliding friction torque	0.0–100.0%	3.0%	○
P27.17	Compensation reference of high-speed friction torque	0.0–100.0% This parameter can be manually set or obtained through identification when P27.10=2	100.0%	○

In the process of material winding or unwinding, there is frictional resistance objectively. In the case of winding, for example, the frictional resistance will make the material tension smaller. By appropriately setting the frictional compensation value, the frictional resistance can be overcome to a certain extent, improving the tension control effect. Some system has inconsistent resistance values at high speed and low speed, and constant tension cannot be obtained throughout the entire process only by using constant friction compensation torque. Proper setting of P27.15–P27.17 can compensate for the effect caused by systems. Taking winding as an example, each compensation coefficient and each compensation reference point meet the following curve settings.

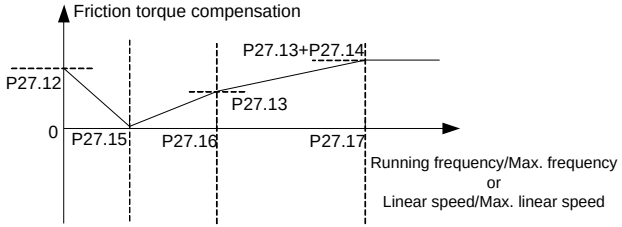


Figure 4-1 Friction torque compensation curve in winding mode

When P27.11=0, the friction compensation is invalid.

When P27.11=1, linear compensation torque is applied based on frequency.

When P27.11=2, linear compensation torque is applied based on linear speed.

Note: When P27.11=2, if the max. frequency exceeds 50.00Hz, P27.17=50.00/P00.03.

If P27.16=P27.15, the sliding friction is directly superimposed.

If P27.17=P27.16, the high-speed friction compensation is invalid.

If P27.17=P27.15, the sliding friction is directly superimposed and the high-speed friction compensation is invalid.

Function code	Name	Description	Default	Modify
P27.18	Enabling rotational inertia compensation	0x00–0x11 Ones place: DEC phase 0: Disable 1: Enable inertia compensation Tens place: ACC phase 0: Disable 1: Enable inertia compensation	0x00	○

Set it to 00: The rotational inertia compensation is not enabled. At this time, linear torque compensation can be performed in conjunction with P27.29, P27.30, P27.31, and P27.32 during the acceleration and deceleration phases.

Set it to 01: The rotational inertia compensation is enabled for DEC phase.
Set it to 10: The rotational inertia compensation is enabled for ACC phase. At this time, torque compensation is automatically performed based on the inertia and frequency change rate calculated with P27.21, P27.22, P27.23, P27.24, P27.25, and P27.26.

Note:

- The acceleration and deceleration phase signs can be viewed through P19.09.
- The value of P27.18 can be determined by observing the compensated torque value through P19.27, as well as modifying the acceleration and deceleration inertia compensation coefficients.

Function code	Name	Description	Default	Modify
P27.19	Rotational inertia torque compensation calculation method	0: Based on running frequency 1: Based on running linear speed	0	○

When P27.19 is 0, calculate the rotational inertia to be compensated for acceleration and

deceleration based on the running frequency.

When P27.19 is 1, calculate the rotational inertia to be compensated for acceleration and deceleration based on the running linear speed.

Function code	Name	Description	Default	Modify
P27.10	System mechanical parameters identification	0: No operation 1: Enabling system mechanical inertia identification 2: Enabling mechanical friction torque identification	0	◎
P27.20	Identification torque keypad setting	-50.0% –50.0% (of the rated motor torque)	20.0%	◎
P27.21	Identification system mechanical inertia	0.000–30.000kg.m^2	0.000 kg.m^2	○

P27.20 is the torque keypad setting value used for system mechanical inertia identification.

P27.21 is a fixed value that includes the inertia of the motor, drive system, empty shaft, etc., and is independent of the material roll diameter.

In vector control mode, when P27.10 is set to 1, the automatic identification of mechanical inertia will be carried out. At this time, the keypad displays -GuA-. After the run key is pressed, the motor will run. Please pay attention to safety. After the keypad displays -End-, the identification is complete. The identified inertia value will be saved in P27.21. Only after the normal identification is completed, P27.10 will automatically change to 0. If the machine is manually stopped during the identification, P27.10 will still be 1. If inertia identification is no longer needed, please manually change P27.10 to 0.

Function code	Name	Description	Default	Modify
P27.22	Material density	0–30000kg/m^3	0 kg/m^3	○
P27.23	Reel width	0.000–60.000m	0.000m	○

P27.22 and P27.23 are used to calculate the material rotational inertia.

Function code	Name	Description	Default	Modify
P27.24	DEC inertia compensation coefficient	0.0–100.0%	20.0%	○
P27.25	ACC inertia	0.0–100.0%	25.0%	○

Function code	Name	Description	Default	Modify
	compensation coefficient			
P27.26	Upper limit of rotational inertia compensation torque	0.0–50.0%	5.0%	○

When the acceleration and deceleration time of the master linear speed is relatively short, P27.25 can be set larger. Conversely, it can be set smaller. It needs to be adjusted according to the actual control effect. If there is roll looseness during the acceleration process, increase P27.25.

P27.26 is used to limit the upper limit of rotational inertia compensation torque.

Function code	Name	Description	Default	Modify
P27.27	Linear speed ACC/DEC determination method	0: Dynamic (faster) 1: Static	0	○
P27.28	Rotational inertia torque compensation at zero speed	0: Yes 1: No	0	○

P27.28 is used to select whether to compensate when the present linear speed is less than P26.13.

Function code	Name	Description	Default	Modify
P27.29	ACC/DEC tension compensation reference selection	0: Based on max. tension 1: Based on reference tension	0	○
P27.30	ACC tension upper limit	0.0–500.0% When P27.29=0, relative to the max. tension. When P27.29=1, relative to the reference tension.	0.0%	○
P27.31	DEC tension upper limit		0.0%	○
P27.32	ACC/DEC tension change rate	0.0–100.0%/s When P27.29=0, relative to the max. tension.	5.0%/s	○

Function code	Name	Description	Default	Modify
		When P27.29=1, relative to the reference tension.		

In open loop tension torque control, if the rotational inertia compensation is disabled, these four function codes can be set to compensate for torque values during linear speed acceleration and deceleration phases, overcoming the inertia and improving the tension control effect during the ACC/DEC control. When the linear speed is stable, the compensation torque is 0, P27.30 is the upper limit for additional increased tension. If the increased tension is larger than P27.30, maintain the value of P27.30. Similarly, P27.31 is the upper limit for additional decreased tension. If the decreased tension is larger than P27.31, maintain the value of P27.31. During the ACC/DEC phases, the compensation tension value is based on the selection in P27.29.

4.4 Tension control enhanced functions

Function code	Name	Description	Default	Modify
P28.00	Tension taper coefficient source	0–4 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI	0	◎
P28.01	Tension taper set through keypad	0.0–100.0%	0.0%	○
P28.02	Tension taper compensation correction	0.0–5000.0mm	0.0mm	○
P28.03	Tension taper curve selection	0: Inverse proportional curve **Note:** The empty roll diameter D0 means the tension decreases by 0%; the full roll diameter D_{max} means the tension decreases by the value based on the setting in P28.01. 1: Multi-point curve **Note:** The empty roll diameter D0 means the tension decreases by 0%; the roll diameter value 1 means the tension decreases by the value of P28.05; the roll diameter value 2 means the tension decreases by the value of P28.07; the full roll diameter D_{max} means the tension	0	○

Function code	Name	Description	Default	Modify
		decreases by the value based on the setting in P28.01.		
P28.04	Roll diameter value 1	0.0–5000.0mm	200.0mm	○
P28.05	Tension taper coefficient for roll diameter value 1	0.0–50.0% (of the set tension)	3.0%	○
P28.06	Roll diameter value 2	0.0–5000.0mm	500.0mm	○
P28.07	Tension taper coefficient for roll diameter value 2	0.0–50.0% (of the set tension)	7.0%	○

Tension taper function can decrease accordingly as the roll diameter increases, in order to prevent damage to the roll and improve the product curl effect.

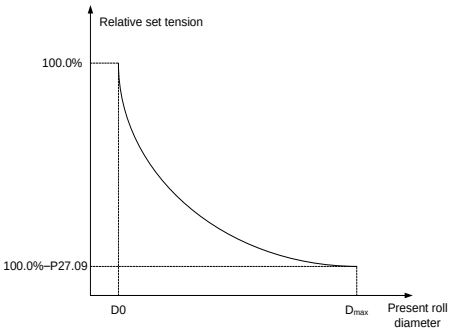


Figure 4-2 Current tension inverse proportional curve (P28.03=0)

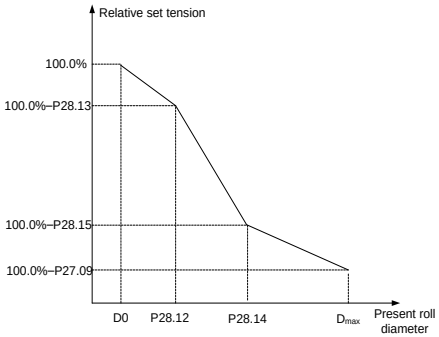


Figure 4-3 Current tension polyline taper curve (P28.03=1)

The horizontal axis represents the current roll diameter, the vertical axis represents the current tension, D0 represents the empty-roll diameter, and Dmax represents the full-roll diameter.

Function code	Name	Description	Default	Modify
P28.08	Pre-drive speed gain	0.0–1000.0%	100.0%	○

When P28.08 is used for automatic roll changing, the matching relationship of the line speed can be adjusted. 100.0% represents the synchronization of the pre-drive linear speed and the winding linear speed. Adjusting this parameter can make the linear speed greater than or less than the linear speed

of the material in operation.

Function code	Name	Description	Default	Modify
P28.09	Pre-drive control selection	0x000–0x563 Ones place: Pre-drive torque limit 0: Set based on P03.20, P03.21 1: Set based on P28.10 2: Set based on output torque 3: Set based on tension (P27.00) Tens place: Pre-drive initial roll diameter selection 0: Set through initial roll diameter selection terminal 1: AI1 input 2: AI2 input 3: AI3 input 4: Roll diameter for linear speed calculation 5: Modbus communication (Address: 0x2012) 6: PROFIBUS communication Hundreds: Pre-drive linear speed reference source 0: Linear speed input source (P26.09) 1: Keypad (P26.10) 2: AI1 3: AI2 4: AI3 5: HDI	0x000	○
P28.10	Pre-drive torque limit setting	0.0–200.0%	100.0%	○

Ones place of P28.09: used to limit the output torque when the pre-drive is enabled

Tens place of P28.09: used to select the roll diameter calculation method during pre-drive. If it is set to 4 when, P26.09 and P05.52 should be set. P05.52 corresponds to the number of pulses generated at the maximum linear speed (m/s).

Hundreds place of P28.09: used for pre-drive linear speed reference source. If 0 is selected, the adopted linear speed is consistent with the linear speed obtained from the linear speed input source P26.09.

Note: During pre-driving operation, the acceleration time is P08.00, and the deceleration time is P08.01.

Function code	Name	Description	Default	Modify
P28.11	Roll diameter calculation delay after pre-drive	0.0–100.0s	5.0s	○

When the pre-drive function is enabled and the pre-drive terminal is canceled, the roll diameter calculation only starts after the delay time, which can prevent excessive fluctuations in the roll diameter calculation in the short period of time after the pre-drive is completed.

Function code	Name	Description	Default	Modify
P28.12	Pre-drive linear speed offset	-200.0%–200.0% Pre-drive linear speed = reference * P28.08 + P28.12	0	○

When the pre-drive function is enabled, the pre-drive linear speed = reference * P28.08 + P28.12.

Function code	Name	Description	Default	Modify
P28.13	Feeding interrupt detection mode	0: Disable 1: Detect based on digital value 2: Detect based on roll diameter calculation value 3: Detect based on feedback position	0	◎
P28.14	Feeding interrupt detection start delay time	0.00–200.00s	10.00s	○
P28.15	Frequency lower limit of feeding interrupt detection	0.00–300.00Hz	10.00Hz	○
P28.16	Error range of feeding interrupt detection	0.1–50.0% (of the max. roll diameter)	10.0%	○
P28.17	Determination delay time of feeding interrupt detection	0.1–60.0s	1.0s	○

When P28.13=0, feeding interrupt detection is not performed.

When P28.13 is set to a non-zero value, the following two conditions must be met before conducting the feeding interrupt detection:

- The VFD start running time is longer than P28.14.
- The VFD running frequency is greater than P28.15.

P28.13=1: If the above two conditions are met, it is considered as material feeding interrupt when a pulse signal is detected at the feeding interrupt position.

P28.13=2: It is necessary to combine P28.16 and P28.17 for material feeding interrupt detection, which is effective for setting roll diameter calculation with linear speed.

P28.13=3: It is necessary to combine P09.12 and P09.13 for material feeding interrupt detection, which is only suitable for situations with position feedback signals.

When the material feeding interrupt is detected, the keypad displays brEAk, and the VFD operates according to the action selected in P28.18.

When P28.13=2: the following two conditions need to be met simultaneously before the material feeding interrupt is considered.

Condition 1: The variation range of roll diameter value exceeds P28.16;
Condition 2: The roll diameter value lasts for an anomalous variation time of P28.17.

Function code	Name	Description	Default	Modify
P28.18	Handling mode of feeding interrupt	0x000–0x111 Ones place: Stop mode 0: Decelerate to stop in emergency manner 1: Coast to stop Tens place: Alarm mode 0: Stop in enabled stop mode without reporting an alarm 1: Report an alarm and coast to stop Hundreds place: Roll diameter memory function of feeding interrupt 0: Disable 1: Enable **Note: The hundreds place is valid when P28.13 is set to 2.**	0x000	○

This function code determines how the VFD acts when the keypad displays brEAk to report the material feeding interrupt. The alarm can be cleared by stopping the VFD and pressing the reset button.

Function code	Name	Description	Default	Modify
P28.19	Stop braking frequency	0.00–300.00Hz	1.50Hz	○

Function code	Name	Description	Default	Modify
P28.20	Stop braking time	0.0–600.0s	0.0s	○

During coasting to stop, if the running frequency is less than P28.19, the VFD outputs a braking signal, and after the duration time of P28.20, the brake signal is invalid. During brake signal output, the starting command is invalid.

Function code	Name	Description	Default	Modify
P28.21	Number of material turns on the reel	-100–32767	0	◎

P28.21 saves the number of turns that the material is wound around on the spindle side. The number of turns can be increased or decreased based on the winding and unwinding modes. It is also valid in the non-tension control mode.

There are two methods of revolution counting:

Method 1: select the digital revolution counting function through P26.33, which is suitable for applications with proximity switches mounted at the material spindle end. It can receive lower recognition pulse frequency and reduce the input filter time of group P5 terminals.

Method 2: It is suitable for situations where an encoder is installed on the motor side. By selecting the PG card revolution counting function through P26.33, the number of circles can be automatically increased or decreased.

Function code	Name	Description	Default	Modify
P28.22	Length of material on the reel	0–65535m	0m	◎

The length can be recorded in following two situations. The precision depends on the current roll diameter and the number of material turns on the roll. The length will be accumulated during winding and the length will be reduced during unwinding.

Case 1: select the digital revolution counting function through P26.33, which is suitable for applications with proximity switches mounted at the material spindle end. It can receive lower recognition pulse frequency and reduce the input filter time of group P5 terminals.

Case 2: When an encoder is installed on the motor side, automatic length recording can be achieved by selecting the PG card revolution counting function through P26.33.

Function code	Name	Description	Default	Modify
P28.23	Zero-speed PID	0: Invalid	0	○

Function code	Name	Description	Default	Modify
	parameter enabling	1: Valid. Select P28.24–P28.26 as PID parameters (as zero speed when the linear speed is less than P26.13).		
P28.24	Proportional gain at zero speed	0.000–30.000	0.300	○
P28.25	Integral time at zero speed	0.000–30.000s	5.000s	○
P28.26	Zero speed differential time	0.000–30.000s	0.000s	○
P09.19	Zero-speed PID output upper limit	P09.20–100.0% (Max. frequency or voltage)	3.0%	○
P09.20	Zero-speed PID output lower limit	-100.0%–P09.19 (Max. frequency or voltage)	-3.0%	○

When using tension closed-loop PID control, if P28.23=1 and the current linear speed is less than the tension control zero speed threshold P26.12, then activate the zero speed PID parameters P28.24–P28.26, P09.19, and P09.20.

4.5 Tension-specific input/output terminal functions

Function code	Name	Description	Default	Modify
Group P05—Input terminal functions				
P05.01	Function of S1	7: Fault reset (including feeding interrupt fault reset) 32: Length reset 56: Emergency stop 57: Roll diameter reset 58: Winding/unwinding switchover 59: Initial roll diameter selection 1 60: Initial roll diameter selection 2 61: Pre-drive 62: Roll diameter calculation stop 63: Clear feeding interrupt signal 64: Manual brake trigger 65: Feeding interrupt fault trigger 66: Revolution counting input 67: Tension control mode switchover 68: Motor overtemperature fault input	1	◎
P05.02	Function of S2		4	◎
P05.03	Function of S3		7	◎
P05.04	Function of S4		0	◎
P05.05	Function of S5		0	◎
P05.06	Function of S6		0	◎
P05.07	Function of S7		0	◎
P05.08	Function of S8		0	◎
P05.09	Function of HDI		0	◎

Function code	Name	Description	Default	Modify
		69: Resolution counting reset 70: Switch PID polarities 71: Roll diameter calculation switchover 72: DEC trigger input after resolution reached 73: Material thickness correction trigger input 74: Present roll diameter correction trigger input 75: Auto deceleration enabling 76–79: Reserved		

32: Length reset
If the reset is valid, P27.42 is cleared.

56: E-stop
If the terminal is valid, the VFD slows down and stops according to the time set in P01.25.

57: Roll diameter reset
Reset the roll diameter when changing a new roll. Reset it to the empty-roll diameter in winding mode and to the fill-roll diameter in unwinding mode. P27.37 and P27.42 are cleared.

58: Wind/unwind switchover
The terminal can be used to switch the mode. If it is invalid, the mode is determined by P26.01.

59–60: initial roll diameter
In winding mode, different empty-roll diameters can be selected through 59 and 60. In unwinding mode, different full-roll diameters can be selected through 59 and 60. The empty-roll diameter is P26.12. The initial roll diameter selection terminal needs to be equipped with a push-lock type button so that the initial roll diameter can be known by the button. If you want the current roll diameter to be the initial roll diameter as well, you need to configure the roll diameter reset terminal, and the button is of the loose-reset type.

61:Pre-drive
During automatic roll changing, the pre-drive function can be used to make the empty roll runs at the linear speed corresponding to the material. It is independent from the start command. After the start command is given, press the pre-drive terminal to start pre-drive. If the pre-drive is canceled, run the corresponding tension control mode.

62: Roll diameter calculation stop
Press the terminal during running to stop the roll diameter calculation.

63: Clear feeding interrupt signal

When the material feeding interrupt detection is enabled and the keypad reports the fault, you can clear the fault display through this terminal or the keypad. Otherwise, it cannot run.

64: Manual brake trigger
Press the terminal to output the braking signal. If a braking device is connected, the brake will act until the terminal is invalid.

65: Feeding interrupt fault trigger
It is used to manually trigger the material feeding interrupt. The VFD operates according to the action selected in P27.34.

66: Revolution counting input
It is used to calculate the roll diameter through revolution counting and thickness. When the terminal is valid, it is handled as selected in P26.20.

67: Tension control mode switchover
Used to switch between open-loop tension torque control and closed-loop speed mode (switching is possible when there is no tension feedback signal and the thickness is used to calculate the roll diameter), and when invalid, the control mode is determined by P26.00.

69: Resolution counting reset
If the reset is valid, P27.37 is cleared.

70: Switch PID polarities
The switching action is only effective in the stop state.

71–75: Special function for roll dyeing machine. It should be used with the PLC programming.

71: Roll diameter calculation switchover
At the zero speed, the switchover is achieved by the PLC given the command.

72: DEC trigger input after resolution reached
The command can be actively given by the PLC, or generated automatically from the output terminal of another VFD configured with function 40 (which needs to be wired to the input terminal of that VFD) if the auto-deceleration enabling terminal is active.

73: Material thickness correction trigger input
The command can be actively given by the PLC, or generated automatically from the output terminal of another VFD configured with function 39 (which needs to be wired to the input terminal of that VFD) if the auto-deceleration enabling terminal is active.

74: Present roll diameter correction trigger input
At the zero speed, the switchover is achieved by the PLC given the command.

75: Auto deceleration enabling
It should be used with the input terminal function 72 and terminal function 73.

Function code	Name	Description	Default	Modify
Group P06—Output terminal functions				
P06.01	Y1 output	34: Specified roll diameter reached 35: Max. roll diameter reached 36: Empty-roll diameter reached 37: Feeding interrupt alarm output 38: Brake output 39: Material thickness correction trigger output 40: Automatic DEC command trigger output	0	○
P06.02	HDO output selection		0	○
P06.03	RO1 output selection		1	○
P06.04	RO2 output selection		5	○

34: Specified roll diameter reached

When the current roll diameter reaches P26.16, the digital signal is output. If it is less than P26.16, the signal is automatically canceled.

35: Max. roll diameter reached

In winding mode, when the current roll diameter reaches P26.13, the digital signal is output. If it is less than P26.13, the signal is automatically canceled.

36: Empty-roll diameter reached

In unwinding mode, when the current roll diameter reaches the empty-roll diameter, the digital signal is output. If the value is less than that, the signal is automatically canceled.

37: Feeding interrupt alarm output

When the material feeding interrupt occurs and P27.34 is selected to 0x1x, an alarm signal is output. When the material feeding interrupt signal is cleared, the alarm signal will be automatically cleared.

38: Brake output

In the stop state, when the running frequency is less than P27.35, a braking signal is output. The signal duration is P27.36.

39: Material thickness correction trigger output

Effective only when the auto-deceleration enabling input terminal function is active.

40: Automatic DEC command trigger output

Effective only when the auto-deceleration enabling input terminal function is active.

Function code	Name	Description	Default	Modify
Group P06—Output terminal functions				
P06.14	AO1 output selection	27: Present tension 28: Present linear speed	0	○

Function code	Name	Description	Default	Modify
P06.15	AO2 output selection	29: Present roll diameter 30: Winding/unwinding length (0.0–100.0% of the set length, reserved) 31–32: Reserved	0	○
P06.16	HDO high-speed pulse output		0	○

27: Present tension

28: Present linear speed

29: Present roll diameter output

4.6 Instruction of tension-specific communication parameters

1. Modbus communication

Based on Goodrive300, there are another 3 kinds of function parameters of Modbus for Goodrive35-07. Refer to communication protocol of Goodrive300 for related commissioning and the new functions are as below:

Function description	Address definition	Data description	R/W characteristics
Communication-based setting address	200FH	Set linear speed reference (0–1000, in which 1000 corresponds to 100.0%)	W
	2010H	Tension value reference (0–1000, in which 1000 corresponds to 100.0%)	W
	2011H	Actual linear speed reference (0–1000, in which 1000 corresponds to 100.0%)	W
	2012H	Present roll diameter reference (0–1000, in which 50000 corresponds to 5000.0mm)	W

2: PROFIBUS/CANopen protocol

Based on Goodrive300, there are another 3 kinds of function parameters of PROFIBUS/CANopen for Goodrive35-07. Communication expansion card is required when the parameter is given through the communication protocol. Refer to communication protocol of Goodrive300 for related commissioning and the new functions are as below:

Function code	Name	Description	Default	Modify
Group P15—PROFIBUS communication				
P15.02	Received PZD2	14: Set linear speed reference (0–1000, in which 1000 corresponds to 100.0%) 15: Tension value reference (0–1000, in which 1000 corresponds to 100.0%)	0	○
P15.03	Received PZD3		0	○
P15.04	Received PZD4		0	○
P15.05	Received PZD5		0	○

Function code	Name	Description	Default	Modify
P15.06	Received PZD6	16: Actual linear speed reference (0–1000, in which 1000 corresponds to 100.0%) 17: Present roll diameter reference (0–1000, in which 50000 corresponds to 5000.0mm) 18–20: Reserved	0	○
P15.07	Received PZD7		0	○
P15.08	Received PZD8		0	○
P15.09	Received PZD9		0	○
P15.10	Received PZD10		0	○
P15.11	Received PZD11		0	○
P15.12	Received PZD12		0	○

4.7 Tension specific status viewing

Function code	Name	Description	Default	Modify
P19.00	Actual control mode	0–3 0: Invalid tension control 1: Tension speed control 2: Open loop tension torque control 3: Close-loop tension torque control	0	●
P19.01	Actual winding/unwinding mode	0: Winding 1: Unwinding	0	●
P19.02	Initial roll diameter	0.0–5000.0mm In winding mode, the Initial roll diameter is the empty-roll diameter. In unwinding mode, the initial roll diameter is the full-roll diameter.	0.0 mm	●
P19.03	Actual empty-roll diameter	0.0–5000.0mm	0.0 mm	●
P19.04	Roll diameter change rate	0.0–655.35mm/s	0.00mm/s	●
P19.05	Present roll diameter	0.0–5000.0mm	0.0 mm	●
P19.06	No-load current	0.0–1000.0A No-load current after superimposing Group P10 with the compensation	0.0A	●
P19.07	Set linear speed	0.0–6000.0m/min	0.0m/min	●
P19.08	Present linear speed	0.0–6000.0m/min	0.0m/min	●
P19.09	Linear speed ACC/DEC flag	0–2 0: Constant speed; 1: DEC; 2: ACC	0	●

Function code	Name	Description	Default	Modify
P19.10	Calculated max. linear speed	0.0–6000.0m/min	0.0m/min	●
P19.11	Main reference frequency	0.00–600.00Hz Calculated from the linear speed and the present roll diameter, without using the maximum frequency limit	0.00Hz	●
P19.12	Actual proportional gain	0.000–30.000	0.000	●
P19.13	Actual integral time	0.000–30.000s	0.000s	●
P19.14	Proportional output value	0–65535	0	●
P19.15	Integral output value	0–65535	0	●
P19.16	PID upper limit	-100.0%–100.0% (Max. frequency or voltage)	0.0%	●
P19.17	PID lower limit	-100.0%–100.0% (Max. frequency or voltage)	0.0%	●
P19.18	PID output frequency	-99.99–99.99Hz	0.00Hz	●
P19.19	Pulse train AB actual-measured running frequency	-300.0–300.0Hz	0.0Hz	●
P19.20	Set tension	0–65535N **Note:** If the reference exceeds 65535N, it is not applicable.	0N	●
P19.21	Tension taper coefficient	0.0–100.0%	0.0%	●
P19.22	Actual tension	0–30000N Tension reference calculated from the tension offset and taper	0N	●
P19.23	Basic torque reference value	-300.0–300.0% (of the rated motor torque) Torque calculated from the actual tension (P19.22) reference and the present roll diameter.	0.0%	●
P19.24	Friction compensation torque value	-300.0–300.0% (of the rated motor torque)	0.0%	●

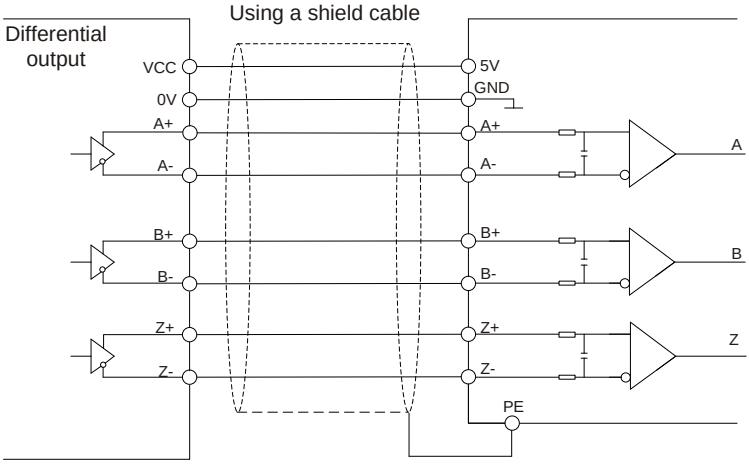
Function code	Name	Description	Default	Modify
P19.25	System rotational inertia	0–655.35 kg.m^2 System rotational inertia = System mechanical inertia + present material inertia	0.00 kg.m^2	●
P19.26	Inertia compensation interval frequency variation range	-99.99–327.67Hz	0.00Hz	●
P19.27	Torque compensation value of system rotational inertia	-300.0–300.0% (of the rated motor torque)	0.0%	●
P19.28	ACC/DEC phase torque compensation value	-300.0–300.0% (of the rated motor torque)	0.0%	●
P19.29	Reference value after torque compensation	-300.0–300.0% (of the rated motor torque)	0.0%	●
P19.30	Reference tension corresponding to torque current value	-300.0%–300.0% (of the motor rated current) Ratio of P19.23 to the motor rated current	0	●
P19.31	PID output torque	-300.0–300.0% (of the rated motor torque)	0.0%	●
P19.32	Measured tension	0–30000N Tension value feedback from the tension detection sensor	0N	●
P19.33	Number of material turns on the reel	-100–32767	0	●
P19.34	Length of material on the reel	0–65535m Length recording function	0m	●
P19.35	Length increment	0.0–6553.5m	0.0m	●
P19.36	ACC/DEC determination time	0–400ms	0ms	●

You can find the related parameters through the group P19.

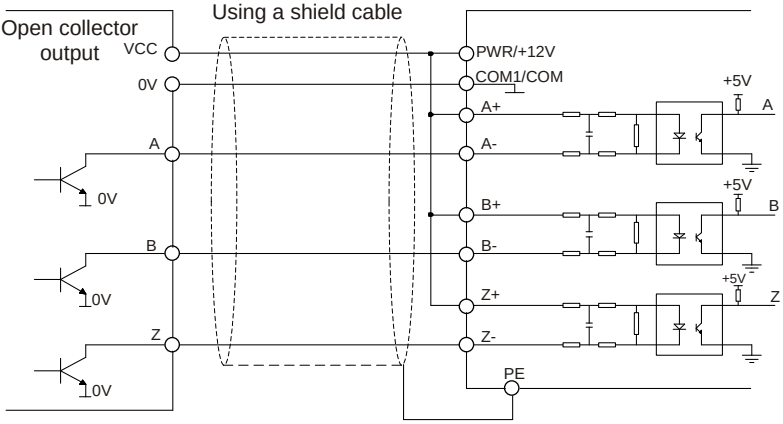
5 Commissioning instruction for tension control

5.1 Connection mode of encoder ports

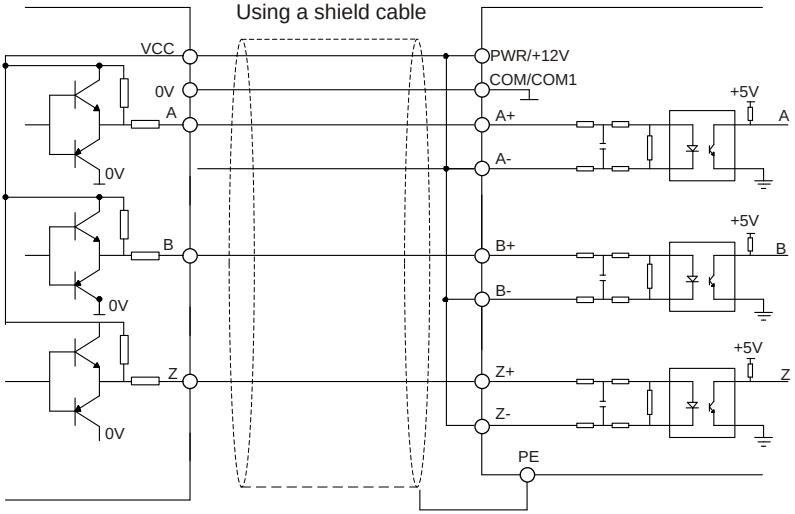
1. Differential output (for H1)



2. Open collector output (for C1 and H1)



3. Complementary output (for C1 and H1)



Note:

- The above diagrams are the examples given according to the common encoder interface connection. The signal and connection mode also apply to H1 interface.
- Differential output diagram takes C1 interface as an example. The H1 interface adopts optocoupler isolation, and the external wiring is the same as the C1 interface.
- With the addition of external current limiting measures, C1 and H1 types can be suitable for higher voltage level encoder signals or pulse reference signal inputs.

5.2 Commissioning procedure

1. Motor parameter autotuning, preferably dynamic autotuning.

Step 1 Set P00.18=1 to restore to default settings.

Step 2 Set P00.03, P00.04 and motor nameplate parameters in group P02.

Step 3 Perform motor parameter autotuning:

a. Set P00.15=1 to perform rotary parameter autotuning.

b. Set P00.15=2 to perform static parameter autotuning.

If the motor can be disconnected from load, you can perform rotary parameter autotuning; otherwise, perform static parameter autotuning. The parameters obtained from autotuning are automatically saved to motor parameters in group P02.

2. Perform closed-loop vector control parameter adjustment if an encoder is installed on the motor side.

1) Commissioning procedure for closed-loop vector control on AMs

Step 1 Verify whether the encoder installation and parameter settings are correct.

Set P20.01 (encoder pulse-per-revolution), set P00.00=2 and P00.10=20Hz, and run the VFD, at this point, the motor rotates at 20Hz, observe whether the speed measurement value of P18.00 is correct, if the value is negative, it indicates the encoder direction is reversed, under such situation, set P20.02 to 1; if the speed measurement value deviates greatly, it indicates P20.01 is set improperly. Check whether P18.02 (encoder Z pulse count value) fluctuates. If yes, it indicates the encoder suffers interference or P20.01 is set improperly. Then check the wiring and the shield layer.

Step 2 Perform closed-loop vector pilot-run.

Set P00.00=3, and perform closed-loop vector control, and adjust P00.10 and speed loop and current loop PI parameters in group P03 to implement stable run in the entire range.

Step 3 Perform flux-weakening control.

Set the flux-weakening regulator gain P03.26 to a value ranging from 0 to 2000, and check the flux-weakening control effect. You can adjust P03.22–P03.24 as needed.

2) Commissioning procedure for closed-loop vector control on SMs

For SMs, the autotuning commissioning of the initial magnetic pole position is required under closed-loop vector control after the motor parameter identification.

Step 1 Set P00.00=3 (closed-loop vector control), and encoder parameters P20.00 and P20.01.

When the encoder is a resolver-type encoder, set the encoder pulse count value to (resolver pole pair count x 1024). For example, if the pole pair count is 4, set P20.01 to 4096.

Step 2 Verify whether the encoder is installed and set properly.

When the motor stops, check whether P18.21 (resolver angle) fluctuates. If it fluctuates sharply, check the wiring and grounding. Rotate the motor slowly, and check whether P18.21 changes accordingly. If yes, it indicates that the motor is connected correctly; if the value of P18.02 remains unchanged as a non-zero value after multiple turns of rotation, it indicates that the encoder Z signal is correct.

Step 3 Autotune the initial position of magnetic pole.

Set P20.11 to 1 (rotary autotuning) or 2 (static autotuning), and press the RUN key to run the VFD.

a. Rotary autotuning (P20.11=1)

Detect the present magnetic pole position when autotuning starts, and then accelerate to 10Hz to autotune the magnetic pole position of encoder Z pulses, and then decelerate to stop. During

running, if the ENC1O or ENC1D fault occurs, set P20.02=1 and carry out autotuning again. After autotuning is completed, the angle obtained from autotuning is saved to P20.09 and P20.10 automatically.

b. Static autotuning (P20.11=2)

In the scenarios where the load can be disconnected, you are recommended to adopt rotary autotuning (P20.11=1) for high angle precision. If the load cannot be disconnected, you can adopt static autotuning (P20.11=2). The magnetic pole position obtained from autotuning is saved to P20.09 and P20.10 automatically.

Step 4 Perform closed-loop vector pilot-run.

Adjust P00.10 and speed loop and current loop PI parameters in group P03 to implement stable run in the entire range. If oscillation occurs, reduce the value of P03.00, P03.03, P03.09 and P03.10. If current oscillation noise occurs during low speed running, adjust P20.05.

Note: You must re-determine P20.02 (encoder direction) and perform magnetic pole position autotuning again if the motor or encoder wires are swapped.

3. Commissioning procedure for dedicated function VFD (parameters of groups P26 and P27 are required)

When the dedicated VFD works as the master, set P26.14 and P26.15. When it works as a slave, set P26.14 and P26.15 to 0.

1) Tension speed mode

Step 1 Set P26.00, P26.01, and P26.02.

Function code	Name	Description	Default	Modify
P26.00	Tension control mode	0: Invalid 1: Tension speed control 2: Open loop tension torque control 3: Close-loop tension torque control	0	◎
P26.01	Winding/unwinding mode	0: Winding 1: Unwinding	0	○
P26.02	Reel mechanical transmission rate	0.01–300.00 =Motor rotation speed/reel rotation speed=Reel diameter/motor shaft diameter	1.00	○

Step 2 Confirm the max. linear speed P26.08.

Set P26.04, P26.05, P26.06, and P26.07, check the value of P19.10, and use it as the max. linear speed P26.08.

Function code	Name	Description	Default	Modify
P26.04	Max. frequency of main traction	0.00–300.00Hz	50.00Hz	○
P26.05	Diameter of main traction	0–6000.0mm	99.0mm	○
P26.06	Main traction drive ratio	0–60.000 = Motor rotation speed/Master traction roller rotation speed = Master traction roller diameter/Motor shaft diameter	1.000	○
P26.07	Motor pole pairs of main traction	1–1000	2	○
P26.08	Max. linear speed	0.0–6000.0m/min The value is determined by setting P26.04–P26.07.	1000.0m/min	○
P19.10	Calculated max. linear speed	0.0–6000.0m/min	0.0 m/min	●

Step 3 Confirm the max. output frequency and frequency upper limit.

Set P26.09=0 and P26.10=100%. Set the minimum roll diameter P26.17 and maximum roll diameters P26.18 involved in the processing of the reel. Set the current roll diameter P26.35 to the value of P26.17, and then check the value of P19.11. Use the value as the maximum output frequency P00.03 and upper limit of running frequency P00.04.

Function code	Name	Description	Default	Modify
P00.03	Max. output frequency	P00.04–400.00Hz	50.00Hz	◎
P00.04	Upper limit of running frequency	P00.05–P00.03 (Max. frequency)	50.00Hz	◎
P26.09	Input source of linear speed	0: Keypad (commissioning or optional when functioning as the master) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (0x200F) 6: PROFIBUS/CANopen communication (0.0–100.0%) 7: Main traction encoder frequency-division input	0	◎

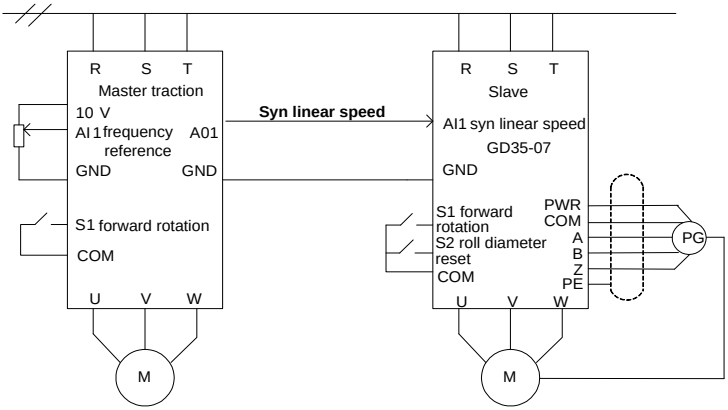
Function code	Name	Description	Default	Modify
P26.10	Linear speed set through keypad	0.0–100.0% (of the max. linear speed) It is for commissioning or optional when functioning as the master.	20.0%	○
P26.17	Min. empty-roll diameter	0.0–5000.0mm Upon first power-on, if the winding mode is selected, the present roll diameter is equal to the minimum empty-roll diameter.	50.0 mm	○
P26.18	Max. roll diameter	0.0–5000.0mm Upon first power-on, if the unwinding mode is selected, the present roll diameter is equal to the maximum roll diameter.	1000.0 mm	○
P26.35	Present roll diameter	0.0–5000.0mm	0.0 mm	◎
P19.11	Main reference frequency	0.00–600.00Hz	0.00Hz	●

Step 4 Set the linear speed calculation channel P26.09.

Function code	Name	Description	Default	Modify
P26.09	Input source of linear speed	0: Keypad (commissioning or optional when functioning as the master) 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (0x200F) 6: PROFIBUS/CANopen communication (0.0–100.0%) 7: Pulse train AB	0	◎
P26.11	Pulse train AB PPR	0–20000 Applicable to setting linear speed of pulse train AB	1024	○
P26.12	Linear speed filter times of pulse train AB	0–15 Filter time: (2^N)*0.125ms Applicable to setting linear speed of pulse train AB	8	○
P19.19	Main traction running frequency	-300.0–300.0Hz When the wiring is normal, P19.19 is the	0.00Hz	●

Function code	Name	Description	Default	Modify
		running frequency of the master traction VFD.		

(1) If P26.09=1, 2, or 3, the linear speed channel can be wired as follows.



Note: Check the minimum and maximum values of AI1 input through P17.19, and input them to P05.32 and P05.34 respectively to eliminate zero drift. Perform the similar operation for AI2.

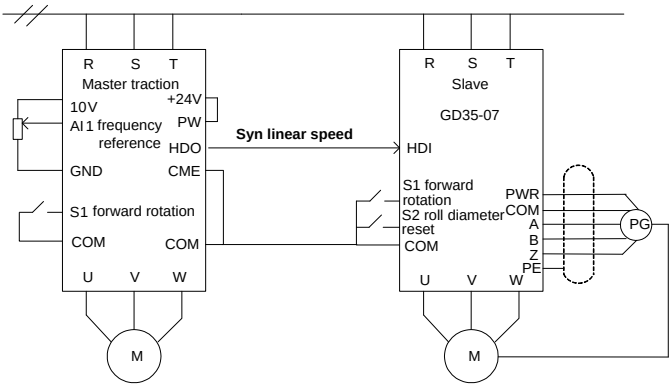
Function code	Name	Description	Default	Modify
P17.19	AI1 input voltage	0.00–10.00V	0.00V	●
P19.20	AI2 input voltage	0.00–10.00V	0.00V	●
P05.32	AI1 lower limit	0.00V–P05.34	0.00V	○
P05.33	Corresponding setting of AI1 lower limit	-300.0%–300.0%	0.0%	○
P05.34	AI1 upper limit	P05.32–10.00V	10.00V	○
P05.35	Corresponding setting of AI1 upper limit	-300.0%–300.0%	100.0%	○
P05.37	AI2 lower limit	0.00V–P05.39	0.00V	○
P05.38	Corresponding setting of AI2 lower limit	-300.0%–300.0%	0.0%	○
P05.39	AI2 upper limit	P05.37–10.00V	10.00V	○
P05.40	Corresponding setting of AI2 upper	-300.0%–300.0%	100.0%	○

Function code	Name	Description	Default	Modify
	limit			

Note: To ensure real-time linear speed between the slave and the master traction, set the AO in the main traction VFD (P06.14–P06.15) to "0: Running frequency".

Function code	Name	Description	Default	Modify
P06.14	AO1 output selection	0: Running frequency 1: Set frequency 2: Ramp frequency	0	○
P06.15	AO2 output selection		0	○

(2) If P26.09=4, the linear speed channel can be wired as follows.



Master traction VFD parameter settings:

Function code	Name	Description	Default	Modify
P06.00	HDO output type	0: Open collector high-speed pulse output 1: Open collector output	0	◎
P06.27	HDO output lower limit	-300.0%–P06.29	0.0%	○
P06.28	HDO output corresponding to lower limit	0.00–50.00kHz	5.0kHz	○
P06.29	HDO output upper limit	P06.27–300.0%	100.0%	○
P06.30	HDO output corresponding to upper limit	0.00–50.00kHz	45.0kHz	○

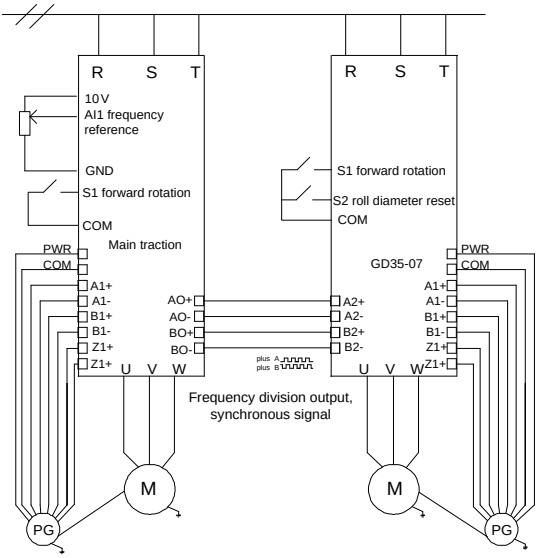
Function code	Name	Description	Default	Modify
P06.16	AO1 output selection	0: Running frequency 1: Set frequency 2: Ramp frequency	0	○

Slave VFD (GD35-07) parameter settings:

Function code	Name	Description	Default	Modify
P05.00	HDI input type	0: HDI is high-speed pulse input 1: HDI is digital input	0	◎
P05.50	HDI frequency lower limit	0.000 KHz–P05.52	5.0kHz	○
P05.51	Corresponding setting of HDI lower limit frequency	-300.0%–300.0%	0.0%	○
P05.52	HDI frequency upper limit	P05.50–50.000kHz	45.0kHz	○
P05.53	Corresponding setting of HDI upper limit frequency	-300.0%–300.0%	100.0%	○

(3) If P26.09=7, the linear speed channel can be wired as follows.

Function code	Name	Description	Default	Modify
P26.11	Pulse train AB PPR	0–20000 Applicable to setting linear speed of pulse train AB	1024	○
P26.12	Linear speed filter times of pulse train AB	0–15 Filter time: (2^N)*0.125ms Applicable to setting linear speed of pulse train AB	8	○



Use the frequency-division AB pulse of the encoder of the master traction VFD as the linear speed input source of the slave GD35-07. After the wiring, set P26.07, run the master traction VFD, and check the value of P19.19 of the slave GD35-07. If the wiring is correct, P19.19=the running frequency of the master traction VFD.

Function code	Name	Description	Default	Modify
P19.19	Pulse train AB actual-measured running frequency	-300.0–300.0Hz	0.00Hz	●

Step 5 Set ACC/DEC time.

a. Set P26.14 and P26.15 to 0.

b. Set P00.11 and P00.12 to 0.

Function code	Name	Description	Default	Modify
P26.14	Linear speed ACC time	0.00–600.00s Set the function code to 0 when it serves as a slave to the main traction.	0.00s	○
P26.15	Linear speed DEC time	0.00–600.00s Set the function code to 0 when it serves as a slave to the main traction.	0.00s	○

Function code	Name	Description	Default	Modify
P00.11	ACC time 1	0.0–3600.0s	Model depended	○
P00.12	DEC time 1	0.0–3600.0s	Model depended	○

Step 6 Select the roll diameter calculation method (as needed)

If there is no need for roll diameter calculation, such as surface winding and unwinding, set P26.17=P26.18=fixed roll diameter value related to the reel.

(1) Set the initial roll diameters (P26.17–P26.18).

Function code	Name	Description	Default	Modify
P26.17	Min. empty-roll diameter	0.0–5000.0mm Upon first power-on, if the winding mode is selected, the present roll diameter is equal to the minimum empty-roll diameter.	50.0 mm	○
P26.18	Max. roll diameter	0.0–5000.0mm Upon first power-on, if the unwinding mode is selected, the present roll diameter is equal to the maximum roll diameter.	1000.0 mm	○
P26.19	Initial roll diameter 1	0.0–5000.0mm When multiple sizes of empty reels are available, the initial reel diameter can be set by selecting the S terminal.	100.1mm	○
P26.20	Initial roll diameter 2		100.2mm	○
P26.21	Initial roll diameter 3		100.3mm	○

(2) Select the roll diameter calculation method (P26.16).

The linear speed method (P26.16=1) is suitable for situations with linear speed input sources (P26.09). It is used together with parameters P26.23–P26.29.

Function code	Name	Description	Default	Modify
P26.23	Roll diameter calculation delay time	0.0–100.0s After start-up, no roll diameter calculation is performed during the delay time.	5.0s	○
P26.24	Min. linear speed for roll diameter calculation	0.0–100.0% (of the max. linear speed) If the speed is less than this linear speed, the roll diameter calculation will not be performed.	10.0 %	○
P26.25	Min. frequency for	0.00–50.00Hz	3.00Hz	○

Function code	Name	Description	Default	Modify
	roll diameter calculation	If the frequency is less than this running frequency, the roll diameter calculation will not be performed.		
P26.26	Roll diameter filter time	0.000–60.000s	1.000s	○
P26.27	Reverse direction change restriction in roll diameter calculation	0:No 1: Restrict changes in reverse direction The restriction is used to prevent oscillation in the calculation of the diameter of an elliptical scroll.	0	○
P26.28	Roll diameter change rate restriction selection	0:No 1: Automatic restriction according to the running frequency	0	○
P26.29	Max. material thickness	0.01–100.00mm This involves the upper limit of the roll diameter change rate.	0.10 mm	○

When there is no linear speed input source, consider using the thickness calculation method (P26.16=2–5), which includes the revolution counting thickness method (P26.16=2–3) and the length recording thickness method (P26.16=4–5).

(3) If an encoder is installed on the motor side or a digital measurement pulse is installed on the reel side, select the revolution counting thickness method (P26.16=2–3) and set parameters P26.29–P26.34. If the processed material is wire, set P26.32 as well.

Function code	Name	Description	Default	Modify
P26.30	Material thickness	0.01–100.00mm	0.10 mm	○
P26.31	Min. material thickness	0.01–100.00mm	0.10 mm	○
P26.32	Number of coils per layer	1–10000 Applicable to wires.	1	○
P26.33	Revolution counting function selection	0: Digital terminal input (reel side pulse) 1: Programmable card input (motor side pulse)	0	◎
P26.34	Number of pulses per revolution	1–60 Applies to P26.33=0, reflecting the number of pulses per turn at the digital terminal input	1	◎

(4) If the revolution counting thickness method cannot be used, select the length recording thickness method (P26.16=4–5) and set parameters P26.29–P26.32. If the processed material is wire, set P26.32 as well.

Function code	Name	Description	Default	Modify
P26.30	Material thickness	0.001–65.535mm	0.010 mm	○
P26.31	Min. material thickness	0.001–65.535mm	0.010 mm	○
P26.32	Number of coils per layer	1–10000 Applicable to wires.	1	◎

The AI and communication measured roll diameter method (P26.16=6–10) is suitable for situations with external roll diameter calculation input.

Step 7 Set the PID function.

(1) Set the PID reference (P09.00 and P09.01) and PID feedback (P09.02).

Function code	Name	Description	Default	Modify
P09.00	PID reference source	0: P09.01 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Multi-step running 6: Modbus communication 7: PROFIBUS/CANopen communication 8: Ethernet communication 9: Reserved	0	○
P09.01	PID digital setting	-100.0%–100.0%	0.0%	○
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: High-speed pulse HDI 4: Modbus communication 5: PROFIBUS/CANopen communication 6: Ethernet communication 7: (AI1+AI2)/2 8: (AI2+AI3)/2	0	○

(2) Set the PID output characteristics (P09.03).

Function code	Name	Description	Default	Modify
P09.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0	○
P26.40	Tension feedback PID control selection	0x00–0x11 Ones place: Output reference 0: Relative to max. output frequency 1: Relative to main reference frequency Tens place: PID reference value taper changes 0: Disable 1: Enable	0x00	○

(3) Select the PID parameter adjustment source (P26.39).

Function code	Name	Description	Default	Modify
P26.39	PID parameter adjustment source	0: Group P09 1: Roll diameter 2: Main reference frequency 3: Running linear speed 4: ACC/DEC 5: Deviation 1 (max. roll diameter) 6: Deviation 2 (Reference 100%)	0	○

(4) Set the PID parameter adjustment reference point (P26.45–P26.47).

Function code	Name	Description	Default	Modify
P26.45	PID parameter adjustment reference point 1	0.0–100.0% (1) When P26.39=1 or 5, the reference base value is the maximum roll diameter. Switch linearly from the first group, second group, and third group PID according to the roll diameter from small to large. (2) When P26.39=2, the reference base value is the maximum frequency. Switch linearly from the first group, second group, and third group PID according to the running frequency from small to large. (3) When P26.39=3, the reference base	10.0%	○
P26.46	PID parameter adjustment reference point 2		50.0%	○
P26.47	PID parameter adjustment reference point 3		80.0%	○

Function code	Name	Description	Default	Modify
		value is the maximum linear speed. Switch linearly from the first group, second group, and third group PID according to the linear speed from small to large. (4) When P26.39=4, only P26.45 is used, and the reference base value is the maximum linear speed. The first group of PID parameters is for those less than (P26.45 * maximum linear speed), the second group is for constant speed, and the third set is for acceleration and deceleration. (6) When P26.39=6, the reference base value is the given maximum value. Switch linearly from the first group, second group, and third group PID according to the deviation from small to large.		

(5) Set parameters in first group (P09.04–P09.07), second group (P26.41–P26.44), and third group (P26.48–P26.51), among which P09.05, P26.42, and P26.49 are valid only when P26.39=5.

Function code	Name	Description	Default	Modify
P09.04	Group 1 proportional gain 1	0.000–30.000	0.300	○
P09.05	Group 1 proportional gain 2	0.000–30.000 Applicable when P26.39=5	0.300	○
P09.06	Group 1 integral time	0.000–30.000s	5.000s	○
P09.07	Group 1 differential time	0.000–10.000s	0.000s	○
P26.41	Group 1 proportional gain 2	0.000–30.000	0.300	○
P26.42	Group 2 proportional gain 2	0.000–30.000 Applicable when P26.39=5	0.300	○
P26.43	Group 2 integral time	0.000–30.000s	5.000s	○
P26.47	Group 2 differential time	0.000–10.000s	0.000s	○

Function code	Name	Description	Default	Modify
P26.48	Group 3 proportional gain 1	0.000–30.000	0.300	○
P26.49	Group 3 proportional gain 2	0.000–30.000 Applicable when P26.39=5	0.300	○
P26.50	Group 3 integral time	0.000–30.000s	5.000s	○
P26.51	Group 3 differential time	0.000–10.000s	0.000s	○

(6) Adjust PID parameter values based on the on-site conditions.

(7) When the reference linear speed of the master traction is detected to be less than the zero speed threshold (P26.13), the zero speed PID function can be activated.

Function code	Name	Description	Default	Modify
P28.23	Zero-speed PID parameter enabling	0: Invalid 1: Valid. Select P28.24–P28.26 as PID parameters (as zero speed when the linear speed is less than P26.13).	0	○
P28.24	Proportional gain at zero speed	0.000–30.000	0.300	○
P28.25	Integral time at zero speed	0.000–30.000s	5.000s	○
P28.26	Zero speed differential time	0.000–30.000s	0.000s	○
P09.19	Zero-speed PID output upper limit	P09.20–100.0% (Max. frequency or voltage)	3.0%	○
P09.20	Zero-speed PID output lower limit	-100.0%–P09.19 (Max. frequency or voltage)	-3.0%	○

(8) For PID control of pendulum or floating rod, the PID reference transformation function (P26.55–P26.60) can be used.

Function code	Name	Description	Default	Modify
P26.55	PID reference conversion	0: Invalid 1: Enable	0	○
P26.56	PID reference initial value	0.0–100.0%	10.0%	○

Function code	Name	Description	Default	Modify
P26.57	PID reference final value	0.0–100.0% Generally, it equals to the PID set value.	50.0%	○
P26.58	PID reference initial value hold time	0.00–60.00s	5.00s	○
P26.59	Conversion time from PID reference initial value to final value	0.00–60.00s	5.00s	○
P26.60	Conversion time from PID reference final value to initial value	0.00–60.00s	5.00s	○

Step 8 Enable the material feeding interrupt detection and pre-drive function based on the on-site situation.

2) Open loop tension torque control mode

Step 1–6 are the same as that in the tension speed mode (P26.00=1).

Step 7 Confirm the max. tension (P27.02).

Set P27.00=0 and P27.01=100%, set P26.35 to the maximum roll diameter that exists during processing, adjust the value of P27.02, and set P19.30 to 100%. Then the value of P27.02 is the max. tension that needs to be set.

Note: If P19.30 cannot reach 100.0% by adjusting the maximum tension value P27.02, consider amplifying the value of P27.02 by 10 times by setting the tens place of P27.00 to 1.

Function code	Name	Description	Default	Modify
P27.00	Tension setting	0x00–0x16 Ones place: Tension setting source 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (0x2010) 6: PROFIBUS/CANopen communication (0.0–100.0%) Tens place: Multiplication selection of max.	0x00	◎

Function code	Name	Description	Default	Modify
		tension P27.02 0: 1 1: 10		
P27.01	Tension set through keypad	0.0–100.0% (of the max. tension)	10.0%	○
P27.02	Max. tension	Related to the tens place of P27.00. When the tens place of P27.00 is 0, the setting range is 0–60000N. When the tens place of P27.00 is 1, the setting range is (0–60000)*10N.	3000N	○
P26.34	Present roll diameter	0.0–5000.0mm	0.0 mm	◎
P19.30	Tension corresponding to torque current value	-300.0%–300.0% (of the rated current)	0	●

Step 8 Confirm the reference tension P27.00 and P27.01.

Function code	Name	Description	Default	Modify
P27.00	Tension setting source selection	0x00–0x16 Ones place: Tension setting source 0: Keypad 1: AI1 2: AI2 3: AI3 4: High-speed pulse HDI 5: Modbus communication (0x2010) 6: PROFIBUS/CANopen communication (0.0–100.0%) Tens place: Multiplication selection of max. tension P27.02 0: 1 1: 10	0x00	◎

Step 9 Compensate the friction torque (consider whether to increase the value based on the actual conditions).

(1) Enable the friction torque compensation P27.11.

a. If P27.11=0, the friction torque compensation is not applied.

b. If P27.11=1, the friction torque compensation is applied according to the running frequency.

c. If P27.11=2, the friction torque compensation is applied according to the running linear speed.

Function code	Name	Description	Default	Modify
P27.11	Friction torque compensation selection	0: Disable 1: Frequency 2: Linear speed	0	○

(2) Obtain static friction torque compensation coefficient, sliding friction torque compensation coefficient, and high speed friction torque compensation coefficient.

Method 1: Automatic identification of mechanical friction torque compensation coefficient

a) When the shaft is empty, set P27.10=2 and the keypad displays -GuB-.

b) After the run key is pressed, the motor runs and enters the identification of mechanical friction parameters.

c) When the keypad displays -End-, the identification ends and the values of P27.12 to P27.14 and P27.17 are obtained.

Method 2: Manual commissioning and setting of mechanical friction torque compensation coefficient (applicable for closed-loop vector control)

a) When the shaft is empty, set P26.00=0, P03.11= 01, P00.00= 3.

b) Gradually increase the set torque value P03.12 and observe the empty shaft speed.

If there is a tendency for the empty shaft to rotate, set P27.11=P17.09 and P27.12=P17.09+1.0%.

Continue to increase the set torque value P03.12. Set P27.14=P17.09-P27.13 when the empty shaft rises close to the torque control frequency upper limit with an acceleration time close to that of the master traction VFD.

Function code	Name	Description	Default	Modify
P27.10	System mechanical parameters identification	0: No operation 1: Enabling system mechanical inertia identification 2: Enabling mechanical friction torque identification	0	◎
P27.11	Friction torque compensation selection	0: Disable 1: Frequency 2: Linear speed	0	○
P27.12	Static friction	0.0–100.0% (of the rated motor torque)	0.0%	○

Function code	Name	Description	Default	Modify
	torque compensation coefficient	This parameter can be manually set or obtained through identification when P27.10=2.		
P27.13	Sliding friction torque compensation coefficient	0.0–100.0% (of the rated motor torque) This parameter can be manually set or obtained through identification when P27.10=2.	0.0%	○
P27.14	High speed friction torque compensation coefficient	0.0–50.0% (of the rated motor torque) This parameter can be manually set or obtained through identification when P27.10=2.	0.0%	○

(3) Adjust the reference point of friction torque compensation (P27.15–P27.17) according to the actual conditions.

Function code	Name	Description	Default	Modify
P27.15	Compensation reference of static friction torque	0.0–P27.16 Used for friction compensation reference 1. When P27.11 is 1, 100% corresponds to the max. output frequency. When P27.11 is 2, 100% corresponds to the max. linear speed.	1.0%	○
P27.16	Compensation reference of sliding friction torque	P27.15–P27.17 Used for friction compensation reference 2. When P27.11 is 1, 100% corresponds to the max. output frequency. When P27.11 is 2, 100% corresponds to the max. linear speed. **Note: If P27.16=P27.15, the reference 1 and reference 2 coincide, and the sliding friction is directly superimposed.**	3.0%	○
P27.17	Compensation reference of high-speed friction torque	P27.16–100.0% Used for friction compensation reference 3. When P27.11 is 1, 100% corresponds to the max. output frequency. When P27.11 is 2, 100% corresponds to the max. linear speed. If P27.17=P27.16, the high-speed friction	100.0%	○

Function code	Name	Description	Default	Modify
		compensation is invalid. If P27.17=P27.15, the sliding friction is directly superimposed and the high-speed friction compensation is invalid. **Note: When P27.10=2, if the max. frequency exceeds 50.00Hz, P27.17=50.00/P00.03.**		

Note:

- If P27.16=P27.15, the reference 1 and reference 2 coincide, and the sliding friction is directly superimposed.
- If P27.17=P27.16, high-speed friction compensation is invalid. If P27.17=P27.15, the sliding friction is directly superimposed and the high-speed friction compensation is invalid.

Step 10 Compensate the inertia torque (consider the increase the value based on the impact on processing during acceleration and deceleration in the field).

The inertia compensation function is not necessary. For an empty roll, inertia compensation may be required if the set torque is very small. If the torque is set to be high for an empty roll, inertia compensation is generally not required. In addition, the influence of rotational inertia can also be reduced by increasing the acceleration and deceleration time of the traction host.

There are two methods of inertia compensation. One is real-time inertia calculation and compensation, the other is manual tension compensation during acceleration and deceleration.

Method 1: Real-time inertia calculation and compensation (P27.18=01 or 10)

a) Obtain the mechanical system's inherent inertia P27.21 (estimate and set this parameter directly, or, in an empty roll, obtain this parameter through the inertia identification P27.10=1).

b) Set P27.22 and P27.23 to calculate the inertia of the material itself.

c) Select the rotational inertia torque compensation method P27.19.

d) Set P27.24 and P27.25. The shorter the acceleration and deceleration time, the greater the value should be.

e) Set P27.26 to limit the upper limit of rotational inertia compensation torque.

Function code	Name	Description	Default	Modify
P27.18	Enabling rotational inertia torque	0x00–0x11 Ones place: DEC phase 0: Disable	0x00	○

Function code	Name	Description	Default	Modify
	compensation	1: Enable Tens place: ACC phase 0: Disable 1: Enable **If ones place and tens place are 0, manual acceleration and deceleration tension torque compensation function is activated.**		
P27.19	Rotational inertia torque compensation calculation method	0: Based on running frequency 1: Based on linear speed	0	○
P27.20	Identification system mechanical inertia torque keypad setting	-50.0% –50.0% (of the rated motor torque)	20.0%	◎
P27.21	Identification system mechanical inertia	0.000–30.000kg.m^2 This parameter can be manually set or obtained through identification when P27.10=1	0.000 kg.m^2	○
P27.22	Material density	0–30000kg/m^3 Used for online calculation of material inertia	0 kg/m^3	○
P27.23	Reel width	0.000–60.000m Used for online calculation of material inertia	0.000m	○
P27.24	DEC inertia compensation coefficient	0.0–100.0% (of inertia torque compensation)	20.0%	○
P27.25	ACC inertia compensation coefficient	0.0–100.0% (of inertia torque compensation)	25.0%	○
P27.26	Upper limit of rotational inertia compensation torque	0.0–50.0% (of the rated motor torque) Used to specify the rotational inertia compensation torque limit.	5.0%	○

Method 2: Manual tension compensation (P27.18=00)

a) Select the compensation reference through P27.29.

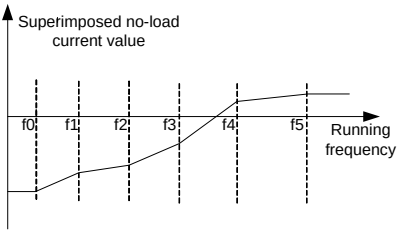
b) Set P27.30 and P27.31.

c) Set P27.32.

Function code	Name	Description	Default	Modify
P27.29	ACC/DEC tension compensation reference selection	0–1 0: Relative to max. tension 1: Relative to reference tension	0	○
P27.30	ACC tension compensation	0.0–500.0% When P27.29=0, relative to the max. tension. When P27.29=1, relative to the reference tension.	0.0%	○
P27.31	DEC tension compensation		0.0%	○
P27.32	Ramp when ACC/DEC tension reached	0.0–100.0%/s When P27.29=0, relative to the max. tension. When P27.29=1, relative to the reference tension.	5.0%/s	○

Step 11 Setting of open-loop vector low-frequency torque correction curve

For P00.00=0, the torque linearity at low frequencies is improved by changing the superposition coefficient value of no-load current at different frequency points.



Function code	Name	Description	Default	Modify
P10.01	Open-loop vector 0 low-frequency torque correction	0–1 0: Invalid 1: Valid	0	○
P10.02	Reference compensation frequency 0	0.00Hz–P10.04	6.00Hz	○
P10.03	Frequency 0	-100.0–200.0%	-50.0	○

Function code	Name	Description	Default	Modify
	torque correction coefficient			
P10.04	Reference compensation frequency 1	P10.02–P10.06	8.00Hz	○
P10.05	Frequency 1 torque correction coefficient	-100.0–200.0%	-20.0	○
P10.06	Reference compensation frequency 2	P10.04–P10.08	15.00Hz	○
P10.07	Frequency 2 torque correction coefficient	-100.0–200.0%	0	○
P10.08	Reference compensation frequency 3	P10.06–P10.10	20.00Hz	○
P10.09	Frequency 3 torque correction coefficient	-100.0–200.0%	0	○
P10.10	Reference compensation frequency 4	P10.08–P10.12	25.00Hz	○
P10.11	Frequency 4 torque correction coefficient	-100.0–200.0%	0	○
P10.12	Reference compensation frequency 5	P10.10–50.00kHz	30.00Hz	○
P10.13	Frequency 5 torque correction coefficient	-100.0–200.0%	0	○

Step 12 Commissioning of closed-loop tension torque control

On the basis of the above commissioning step 10, simply change P26.00 to 3. For situations where the linear speed is low and the system acceleration and deceleration time is long, skip steps 9 and 10, and directly change P26.00 to 3 to run. At this point, it is necessary to commission the PID function. The PID parameters default to the first group of P09 parameters. If they cannot meet the

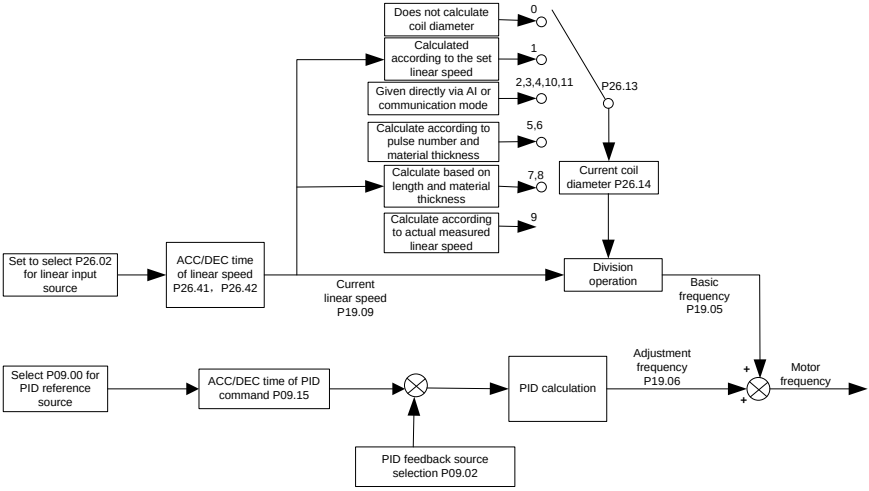
requirements, please set P26.39 to adjust the parameters.

The detailed description is the same as that when P26.00=1, that is the Step 7 in tension speed mode commissioning.

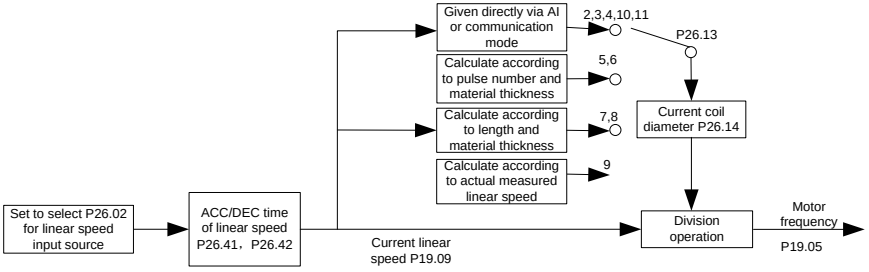
Step 13 Enable the material feeding interrupt detection and pre-drive function based on the on-site situation.

5.3 Tension control mode flowchart

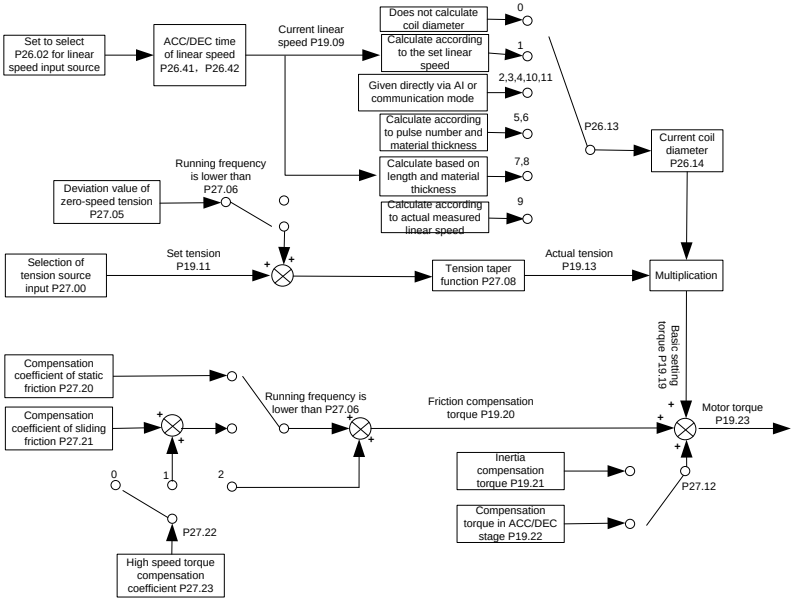
1. Closed-loop tension speed control mode (P26.00=1, P09.10 and P09.11 cannot be both 0.0%)



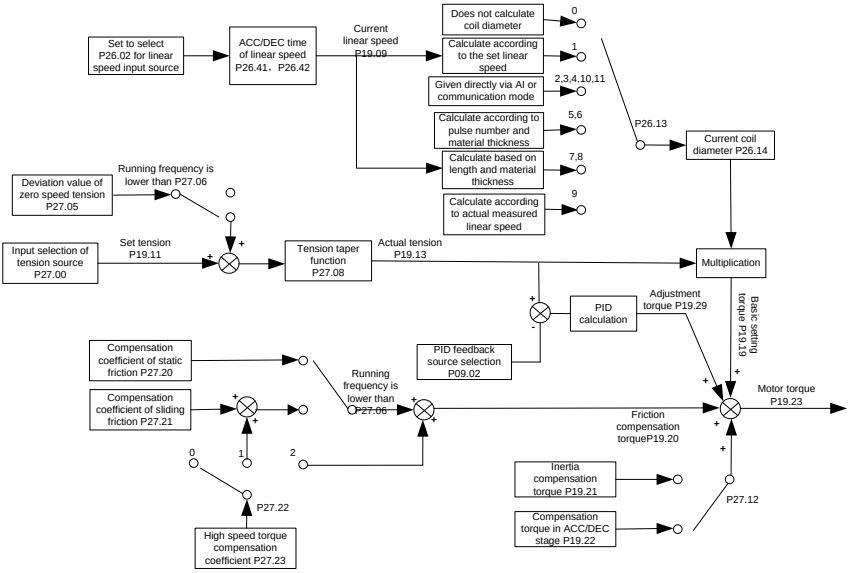
2. Open-loop tension constant linear speed control mode (P26.00=1, P09.10= 0.0%, P09.11=0.0%)



3. Open-loop tension torque control mode (P26.00=2)



4. Closed-loop tension torque control mode (P26.00=3)

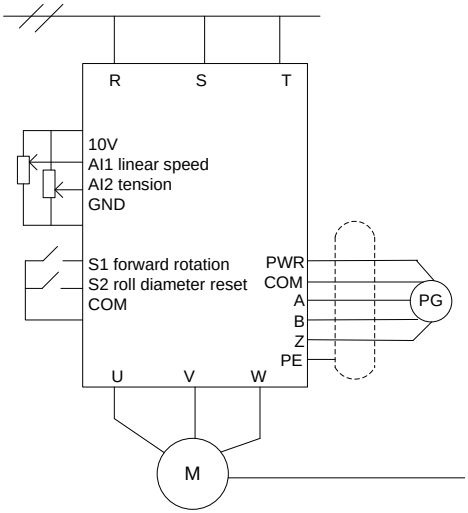


5.4 Goodrive35-07 applications

Application 1: Winding control system of coating machine production

The coating machine production line consists of multiple traction sections and winding sections. The traction section is synchronized by multiple VFDs through a synchronous controller to achieve linear speed synchronization. The traction section equipment mainly completes the processing of the fabric. After processing, the fabric is wound on the shaft through the final stage of traction and controlled to be wound at a constant tension. Winding device is composed of two winding parts, which are used for winding paper and fabric. Every moment, there are two sets of winding VFD working, one for fabric winding and the other for paper winding. The final product is fabric, while paper serves as a cushion and can be recycled. Each winding section is controlled by two VFDs, each controlling two winding motors to ensure that the traction motor does not stop and can be switched to another one. In this way, the winding control section is controlled by four VFDs respectively. Goodrive35-07 has the following solution for this type of application.

Wiring diagram of one of the VFDs:



Among them, the traction control and winding control of the VFD are both given linear speed signals through the same potentiometer analog quantity. AI1 provides synchronous linear speed, AI2 provides tension, and every two VFDs share a control cabinet. The winding VFD adopts terminal control mode. Due to the increasing diameter of the fabric during winding, when each axis is full of fabric, the machine needs to be stopped to remove the rolled fabric, and a diameter reset operation is required.

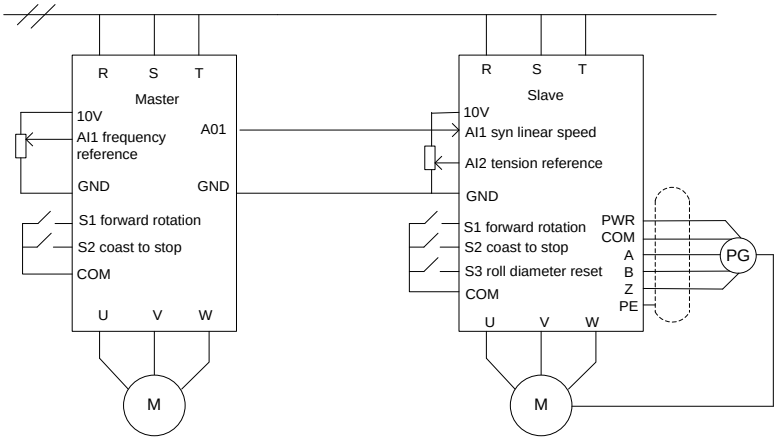
The parameters are listed in the following.

Function code	Setting	Remarks
Basic parameters		
P00.00	3	Closed-loop vector control
P00.01	1	Terminal control mode
P00.03	200.00Hz	Max. output frequency
P03.14	1	Set through AI1
P03.15	1	Set through AI1
P03.16	200.00Hz	Forward rotation upper-limit frequency in torque control set through the keypad
P03.17	200.00Hz	Forward rotation upper-limit frequency in torque control set through the keypad
P05.01	01	FWD run
P05.02	57	Rolling diameter reset
P05.32	0.04v	Lower limit voltage of AI1
P05.34	6.00v	Upper limit voltage of AI1
P05.37	0.03v	Lower limit voltage of AI2
Parameters for special functions		
P26.00	2	Open-loop tension torque control
P26.01	0	Winding
P26.02	66.00	Reel mechanical transmission rate
P26.08	26.0m/Min	Max. linear speed
P26.09	1	AI1 reference linear speed
P26.16	1	Roll diameter for linear speed calculation
P26.17	90.0mm	Min. empty-roll diameter
P26.18	1200.0mm	Max. roll diameter
P26.24	15.0%	Min. linear speed for roll diameter calculation
P26.28	1	The roll diameter change restriction function is enabled to limit the increased size of the roll diameter per second.
P26.29	1.00mm	Max. material thickness (present material thickness 0.40mm)
P27.00	02	AI2 reference tension
P27.02	6000N	Max. tension
P27.05	0	Upper limit frequency in torque control is determined by group P03.
P27.06	13.0%	Running frequency upper limit offset of tension control
P28.01	10.0%	Tension taper set through keypad
Parameters for torque compensation		
P27.04	2.0%	Speed lower limit for zero-speed tension offset

Function code	Setting	Remarks
P27.11	1	Compensate the friction torque based on the frequency.
P27.12	2.0%	Static friction compensation coefficient
P27.13	2.5%	Sliding friction compensation coefficient
P27.14	6.0%	High speed torque compensation coefficient
P27.15	1.0%	Compensation reference of static friction torque
P27.16	3.0%	Compensation reference of sliding friction torque
P27.17	80.0%	Compensation reference of high-speed friction torque
P27.18	0	Disable the inertia compensation function

Application 2: Winding control system of sizing machine production

The main process of a sizing machine is to size the yarn. After boiling the sizing materials in a boiler, when the temperature reached the required value, the sizing material is transported to the sizing tank. The unwinding part of the yarn is driven by the front traction motor when it is turned on, and then it is sequentially sized through the high-temperature sizing tank, pre dried, and dried equipment. Then, it is required to control the yarn to maintain a constant tension for winding, so that the formed yarn is more conducive to the next weaving operation. Goodrive35-07 has the following solution for this type of application. The wiring diagram is as follows.



In the figure, the linear speed is determined by controlling the current running frequency of the host. The synchronous linear speed of the winding slave is output by the host AO at the ramp frequency and input through AI1. The tension setting value is input by the analog AI2 and can be adjusted according to the actual situation. Among them, tension setting is divided into two situations: winding tension and tension set under normal operation. When the online speed is greater than 10.0m/min, tension setting switches from unwinding tension to setting tension under normal operation.

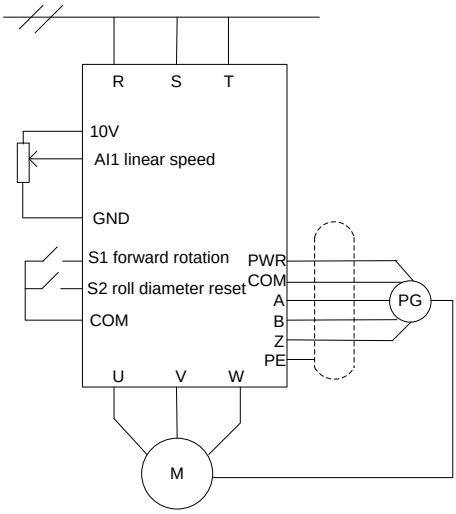
Parameters for the winding slave

Function code	Setting	Remarks
Basic parameters		
P00.00	3	Closed-loop vector control
P00.01	1	Terminal control mode
P00.03	100.00Hz	Max. output frequency
P03.14	1	Set through AI1
P03.15	1	Set through AI1
P03.16	100.00Hz	Forward rotation upper-limit frequency in torque control set through the keypad
P03.17	100.00Hz	Forward rotation upper-limit frequency in torque control set through the keypad
P05.01	01	FWD run
P05.02	06	Coast to stop
P05.03	57	Rolling diameter reset
P05.32	0.06v	Lower limit voltage of AI1
P05.37	0.11v	Lower limit voltage of AI2
Parameters for special functions		
P26.00	2	Open-loop tension torque control
P26.01	0	Winding
P26.02	14.57	Reel mechanical transmission rate
P26.08	70.0m/Min	Max. linear speed
P26.09	1	AI1 reference linear speed
P26.16	1	Roll diameter for linear speed calculation
P26.17	110.0mm	Min. empty-roll diameter
P26.18	800.0mm	Max. roll diameter
P26.24	8.0%	Min. linear speed for roll diameter calculation
P27.00	02	AI2 reference tension
P27.02	6000N	Max. tension
P27.05	0	Upper limit frequency in torque control is determined by group P03.
P27.06	5.0%	Running frequency upper limit offset of tension control
P28.01	5.0%	Tension taper set through keypad
Parameters for torque compensation		
P27.03	4.0%	Tension boost value at zero speed
P27.04	6.0%	Speed lower limit for zero-speed tension offset
P27.11	1	Compensate the friction torque based on the frequency.
P27.12	4.0%	Static friction compensation coefficient
P27.13	5.0%	Sliding friction compensation coefficient

Function code	Setting	Remarks
P27.14	8.0%	High speed torque compensation coefficient
P27.15	1.0%	Compensation reference of static friction torque
P27.16	3.0%	Compensation reference of sliding friction torque
P27.17	80.0%	Compensation reference of high-speed friction torque
P27.18	0x11	Enable inertia compensation
P27.21	0.397	Identified mechanical system inertia
P27.22	1500kg/m^3	Material density
P27.23	1.600m	Axis width
P27.24	0.0%	DEC rotational inertia compensation coefficient
P27.25	5.0%	ACC rotational inertia compensation coefficient

Application 3: Winding control system of aluminum polishing equipment

The process of this equipment is to use polishing tools to polish the aluminum plate in operation. It is required that the aluminum plate runs at a constant linear speed and maintains a certain tension for better polishing effect. Usually, the unwinding tension of the untreated aluminum plate coils is controlled by magnetic particle controllers, while VFDs control the winding. The winding speed must be constant, and there is no tension feedback signal on the winding side. Goodrive35-07 has a solution for this type of application, which calculates the coil diameter through the thickness and adjusts the motor frequency in real-time to ensure a constant linear speed. The accuracy of thickness calculation coil diameter reaches 0.1mm, so the diameter of the coil will increase by 0.1mm after winding one layer of aluminum plate instead of a sudden change in diameter, making the line speed control more stable. The wiring diagram is as follows.



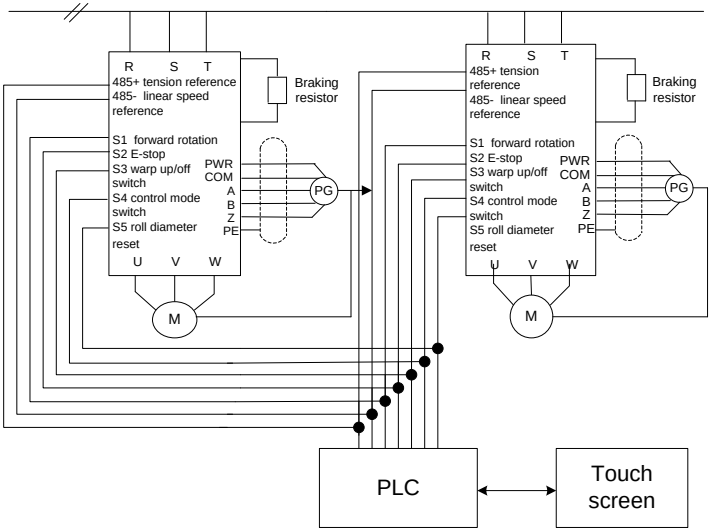
In this application, only constant linear speed needs to be controlled, and the tension is controlled by the magnetic particle brake on the unwinding side. Therefore, the PID adjustment function is canceled, and its output upper and lower limits can be set to zero. Due to the use of thickness calculation method for coil diameter, once the coil diameter value is accidentally reset, its value will not be recalculated accurately like linear speed calculation. Therefore, Goodrive35-07 provides the function of resetting the coil diameter only when it reaches the set value during thickness calculation. For situations where an encoder cannot be installed on the motor side, Goodrive35-07 also provides another thickness calculation method for roll diameter, that is set P26.16 to 4, which can also achieve relatively constant linear speed control.

The parameters are listed in the following.

Function code	Setting	Remarks
Basic parameters		
P00.00	3	Closed-loop vector control
P00.01	1	Terminal control mode
P00.03	26.00Hz	Max. output frequency
P00.04	26.00Hz	Frequency upper limit
P00.11	0.1s	ACC time of frequency
P00.12	0.1s	DEC time of frequency
P05.01	01	FWD run
P05.02	57	Rolling diameter reset
P05.32	0.03v	Lower limit voltage of AI1
P09.10	0.0%	PID output upper limit
P09.11	0.0%	PID output lower limit
Parameters for special functions		
P26.00	1	Tension speed control mode
P26.01	0	Winding
P26.02	129.54	Reel mechanical transmission rate
P26.08	10.0m/Min	Max. linear speed
P26.09	1	AI1 reference linear speed
P26.14	20.00s	Linear speed ACC time
P26.15	5.00s	Linear speed DEC time
P26.16	2	Strip roll diameter calculation through thickness
P26.17	530.0mm	Min. empty-roll diameter
P26.18	1300.0mm	Max. roll diameter
P26.30	0.40mm	Material thickness
P26.33	1	PG card input
P26.36	80.0%	Roll diameter set value
P26.38	0x10	Roll diameter reset selection

Application 4: Winding control system of dyeing machine with constant linear speed and tension

The process of a dyeing machine is to dye fabrics, and its control process is as follows: first, the unstained fabric is wound onto one of the rollers through a feeding motor. A proximity switch for counting is installed on the drive shaft of the roller to calculate the number of turns of the entire roll of fabric. With an encoder installed, the revolution counting function can also be completed through PG card input. The operator only needs to measure the diameter of the entire roll of fabric, and calculate the thickness of the fabric by combining the number of turns. If the thickness of the fabric is known, the step of measuring the diameter can be skipped. After the winding is completed, one end of the fabric is manually rolled onto another roller, and it can start working normally after being tightly wrapped. At this time, the two rollers run in the same direction. After dyeing in one direction, according to the process requirements, the motor direction needs to be switched. The fabric is dyed back and forth multiple times. The torque control is required on the winding side and speed control is required on the unwinding side. Constant tension on the fabric and constant linear speed of the fabric passing through the dye solution are required. The wiring diagram is as follows.



In this application, only the linear speed needs to be controlled. The tension is set according to different fabrics. At zero linear speed, the given tension value is adjusted and determined by the tension on the winding side. Note that after each batch of fabric is dyed, a roll diameter reset operation needs to be performed. This control situation is quite complex and requires PLC to perform some timing control and terminal switching command control according to process requirements.

The parameters of two VFDs are basically the same. The parameters of one VFD are as follows.

Function code	Setting	Remarks
Basic parameters		
P00.00	3	Closed-loop vector control
P00.01	1	Terminal control mode
P00.03	64.00Hz	Max. output frequency
P00.04	64.00Hz	Upper limit frequency
P00.11	0.2s	ACC time of frequency
P00.12	0.2s	DEC time of frequency
P01.25	2.0s	Emergency stop time
P03.16	64.00Hz	Forward rotation upper-limit frequency in torque control set through the keypad
P03.17	64.00Hz	Reverse rotation upper-limit frequency in torque control set through the keypad
P05.01	01	FWD run
P05.02	58	Winding/unwinding switchover
P05.03	67	Control mode switchover
P05.04	57	Rolling diameter reset
P05.05	07	Fault reset
P05.06	56	Emergency stop
P06.03	05	VFD fault
P09.09	0.0%	PID output frequency upper limit
P09.10	0.0%	PID output frequency lower limit
Parameters for special functions		
P26.00	1	Tension speed mode
P26.01	0	Winding
P26.02	17.87	Mechanical transmission ratio
P26.08	120.0m/Min	Max. linear speed
P26.09	5	The linear speed is given through the Modbus communication.
P26.14	20.00	Linear speed ACC time
P26.15	5.00	Linear speed DEC time
P26.16	2	Roll diameter calculation through thickness
P26.17	360.0mm	Min. empty-roll diameter
P26.18	1000.0mm	Max. roll diameter
P26.30	0.700mm	Material thickness
P26.33	1	Revolution counting through PG card input
P27.00	05	The tension is given through the Modbus communication.
P27.02	1000N	Max. tension

Function code	Setting	Remarks
P27.05	3	Upper limit frequency in torque control is determined by linear speed calculation.
P27.06	12.0%	Running frequency upper limit offset of tension control
Parameters for torque compensation		
P27.04	5.0%	Speed lower limit for zero-speed tension offset
P27.11	1	Compensate the friction torque based on the frequency.
P27.12	2.0%	Static friction compensation coefficient
P27.13	2.5%	Sliding friction compensation coefficient
P27.14	10.0%	High speed torque compensation coefficient
P27.15	1.0%	Compensation reference of static friction torque
P27.16	3.0%	Compensation reference of sliding friction torque
P27.17	80.0%	Compensation reference of high-speed friction torque
P27.18	0	Disable the inertia compensation function

Appendix A Dimension drawings

A.1 Wall-mounting dimensions

Figure A-1 Wall mounting diagram for 1.5–30kW VFD models

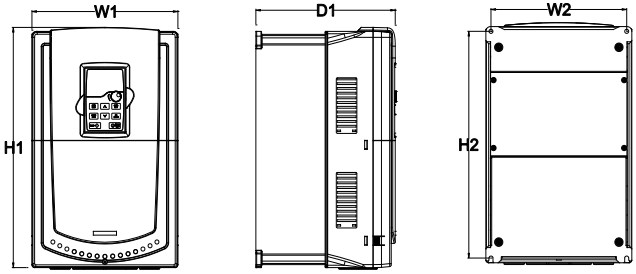


Figure A-2 Wall mounting diagram for 37–75kW VFD models

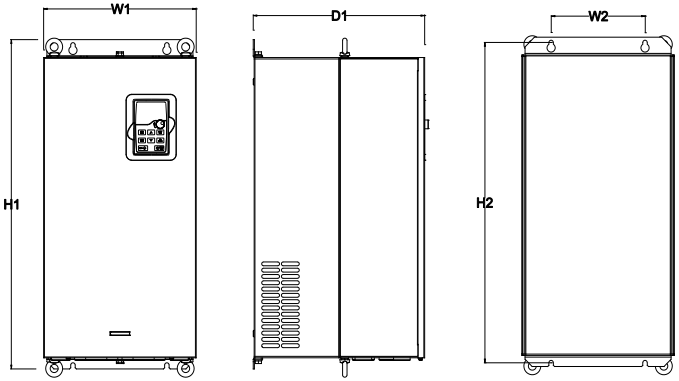


Table A-1 Wall-mounting dimensions (unit: mm)

VFD model	W1	W2	H1	H2	D1	Hole diameter
1.5kW–2.2kW	126	115	193	175	174.5	ø 5
4kW–5.5kW	146	131	263	243.5	181	ø 6
7.5kW–11kW	170	151	331.5	303.5	216	ø 6
15kW–18.5kW	230	210	342	311	216	ø 6
22kW–30kW	255	237	407	384	245	ø 7
37kW–55kW	270	130	557	540	325	ø 7
75kW	325	200	682	661	365	ø 9.5

A.2 Flange mounting dimensions

Figure A-3 Flange mounting diagram for 1.5–30kW VFD models

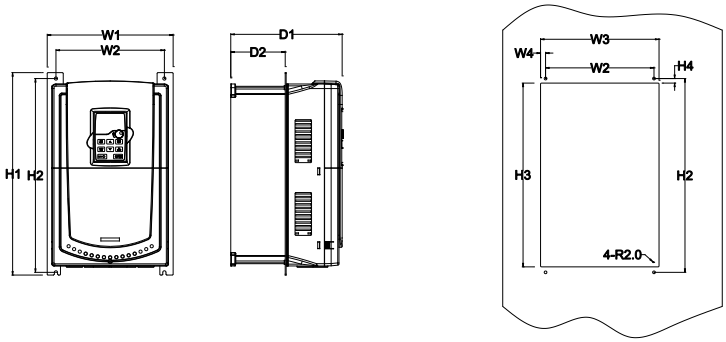


Figure A-4 Flange mounting diagram for 37–75kW VFD models

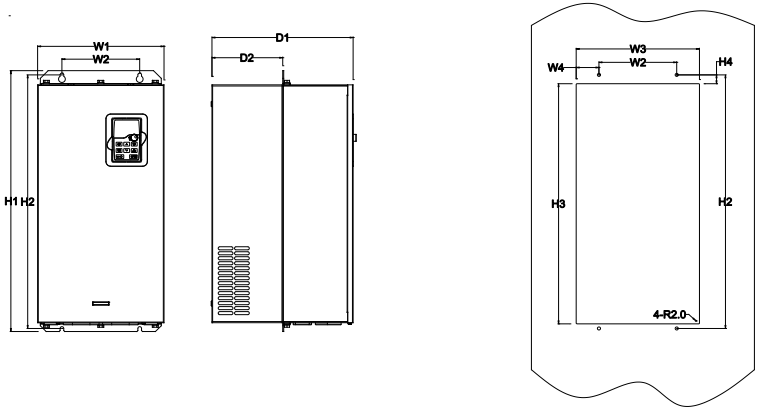


Table A-2 Flange mounting dimensions (unit: mm)

VFD model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Hole diameter
1.5kW–2.2kW	150	115	130	7.5	234	220	190	16.5	174.5	65.5	ø 5
4kW–5.5kW	170	131	150	9.5	292	276	260	10	181	79.5	ø 6
7.5kW–11kW	191	151	174	11.5	370	351	324	15	216.2	113	ø 6
15kW–18.5kW	250	210	234	12	375	356	334	10	216	108	ø 6
22kW–30kW	275	237	259	11	445	426	404	10	245	119	ø 7
37kW–55kW	270	130	261	65.5	557	540	516	17.5	325	167	ø 7
75kW	325	200	317	58.5	682	661	626	23.5	363	182	ø 9.5

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