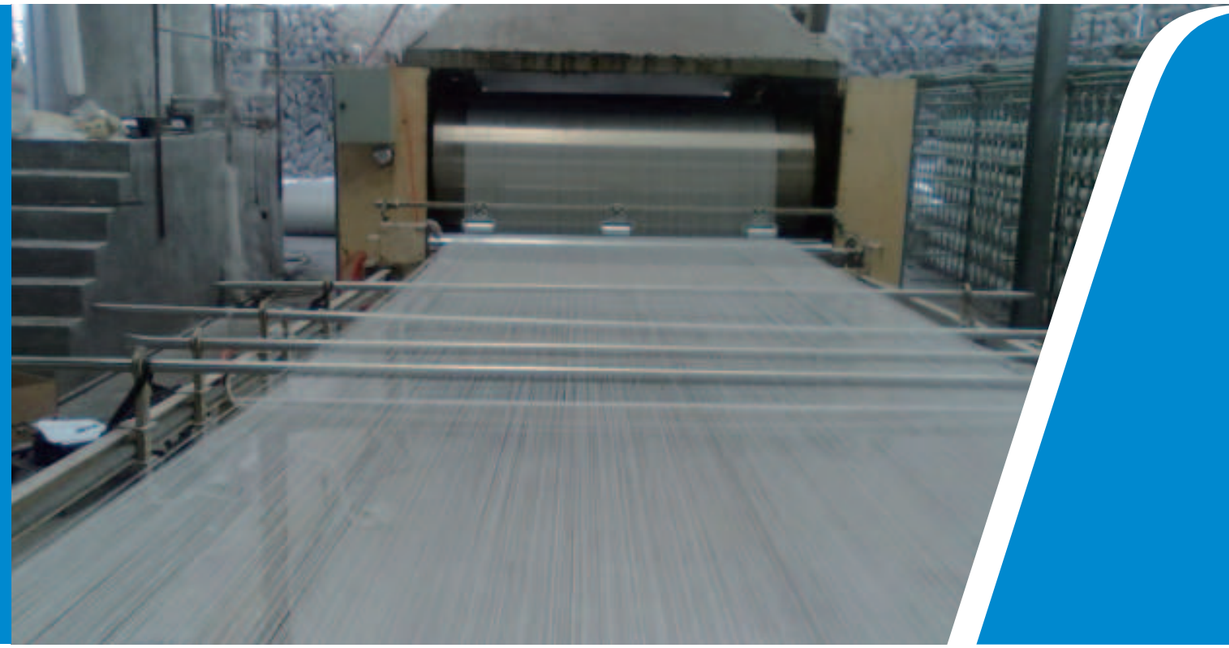
Goodrive35-07

inverters special for tension control



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Goodrive35-07
Product introduction

As a high-performance close loop vector inverter, Goodrive35-07 inverter special for tension control uses the tension control module in the algorithm, realizing the tension control in the process of wrapping up/off.

Goodrive35-07 inverter special for tension control can not only constitute a tension control system by completely replacing torque motor, DC motor and tension controller, but also compared with the traditional tension controller plus inverter control scheme, it can make the system more concise, reduce cost, easy to maintain and get more stable control effect.

Product model

GD35-07 – 5R5G – 4 – * *

① ② ③ ④

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

Selection table

Model	Output power (kW)	Input current (A)	Output current (A)
GD35-07-004G-4-XX	4	13.5	9.5
GD35-07-5R5G-4-XX	5.5	19.5	14
GD35-07-7R5G-4-XX	7.5	25	18.5
GD35-07-011G-4-XX	11	32	25
GD35-07-015G-4-XX	15	40	32
GD35-07-018G-4-XX	18.5	47	38
GD35-07-022G-4-XX	22	56	45
GD35-07-030G-4-XX	30	70	60
GD35-07-037G-4-XX	37	80	75
GD35-07-045G-4-XX	45	94	92
GD35-07-055G-4-XX	55	128	115
GD35-07-075G-4-XX	75	160	150

I/O PG model

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	01: PG port of incremental encoder
		02: PG port of SIN/COS encoder
		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

I/O PG selection table

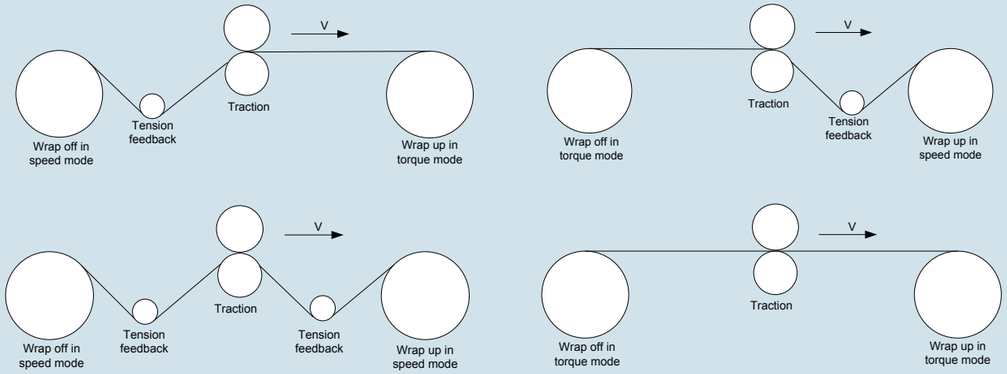
Model	Instruction	Specification
EC-PG301-24	24V I/O incremental PG card	24V incremental ABZ encoder, support differential, OC and push-pull input, Max. 100kHz, standard for Goodrive35-07 series C1 inverters
EC-PG304-05	5V I/O resolver PG card	Rotary transformer encoder, Max. 500kHz, standard for Goodrive35-07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

Product specifications

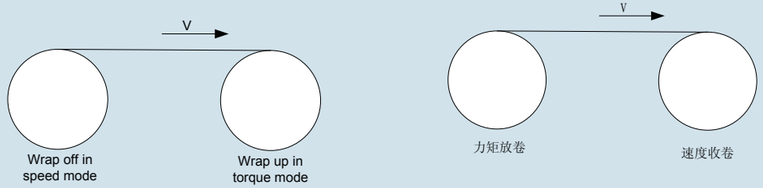
Close loop vector control performance	Speed control range	1:1000
	Speed control precision	±0.02%
	Corresponding time of torque	<10ms
	Torque control precision	5%
	Starting frequency /starting torque	0Hz/200%
Function	Linear speed and tension reference	Analog 0~10V/0~20mA, -10V~+10V, high-speed pulse, communication reference
	Various coil diameter calculation methods	Linear speed calculation, thickness calculation
	Coil diameter calculation precision	0.1mm
Peripheral interface	Analog input	2 channels (AI1, AI2) 0~10V/0~20mA, 1 channel (AI3) -10V~10V
	Analog output	2 channels (AO1, AO2) 0~10V/0~20mA
	Digital input	8 common input, Max. frequency 1kHz, internal impedance: 3.3kΩ1 high-speed input, Max. frequency 50kHz
	Digital output	1 high-speed output, Max. frequency 50kHz 1 Y terminal open collector output
	Relay output	2 programmable relay output RO1A NO, RO1B NC, RO1C common terminal RO2A NO, RO2B NC, RO2C common terminal Contact capacity: 3A/AC250V, 1A/DC30V
Others	Communication manner	MODBUS communication as standard, PROFIBUS, Ethernet and CANopen communication as optional
	Installation manner	Wall mounting, Flange mounting
	Braking unit	≤30kW built-in, other optional external
	EMC filter	Built-in C3 filter, conform to the requirements of IEC61800-3 category C3External filter as optional, conform to the requirements of IEC61800-3 category C2

Tension control solutions

Typical sketch maps of tension control



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

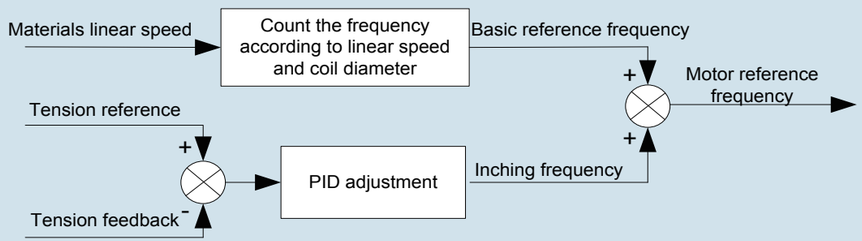


Product features

Tension control in speed mode

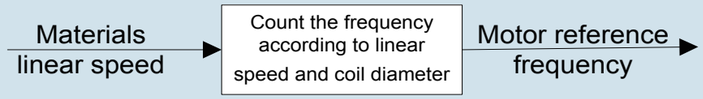
■ Close loop tension control in speed mode

It needs the tension feedback signal to constitute close loop adjustment and adjusts the motor speed directly according to the feedback signal, synchronizing synchronous linear speed and stabilizing tension control. The schematic diagram is shown below:



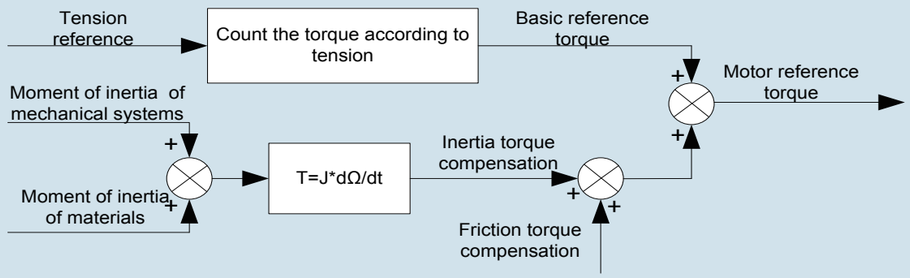
Open loop tension control in speed mode

It is applicable to the situation of GD35-07 as the master and tension feedback signal in no need, and with coil diameter calculation, it can realize constant linear speed control. The schematic diagram is shown below:



Open loop tension control in torque mode

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 materials automatically. The basic is: in winding control system, the relationship among 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. The schematic diagram is shown below:



Various coil diameter calculation methods

Count the coil diameter through the linear speed (set or measured) and output frequency

Formula is:

$$D = \frac{v \times i \times p}{60 \times \pi \times f}$$

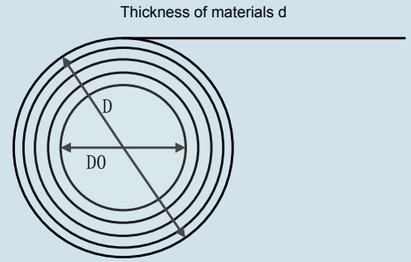
v is current linear speed, i is drive ratio, p is the number of motor pole pairs and f is current running frequency.

Count the coil diameter through the PG card or optoelectronic switch to count the circle

The coil diameter changes by 0.1mm increment increasingly, and compared with the method of counting the coil diameter at a time after a circle variation, the method is more stable.

Wrap up: D=D0+2nd Wrap off: D=D0-2nd,

D0 is shaft diameter, n is the number of circles and d is thickness of materials.



Count the coil diameter through the sensor

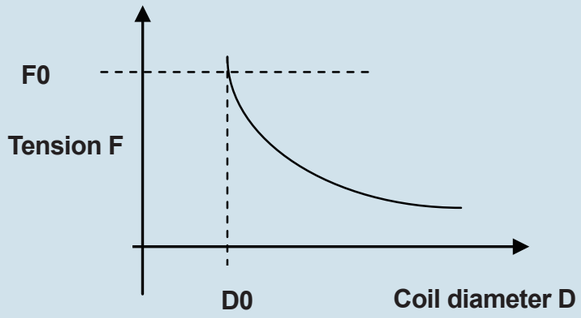
Use the sensor to measure the coil diameter directly and input the signal via the analog interface.

Tension taper

The elongation of some materials is large, so constant tension control may cause distortion inside. When the coil diameter increases, tension taper setting will reduce tension correspondingly to avoid shaft damage and improve winding effect.

Formula is: $F = F_0 \times [1 - k(1 - \frac{D_0 + D_1}{D + D_1})]$

F is the actual output tension, F0 is set tension, K is coefficient of tension taper, D0 is blank coil diameter, D is current coil diameter and D1 is set compensation correction of tension taper.



Cycle and length counting

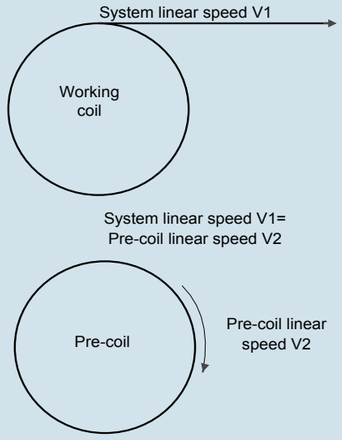
Use the PG card or optoelectronic switch to count the number of cycles and the length of the materials on the shaft, and change the number of cycles and the length automatically according to the actual state of wrapping up/off.

Moment of inertia and friction compensation

Compensate the torque of system moment inertia during ACC/DEC and the friction of the system in running, and thus maintain the tension of materials in a stable range.

Pre-drive

The pre-drive function synchronizes the pre-coil linear speed with the system linear speed to realize automatic coil changing. During pre-drive, set output torque limit to avoid too large tension may cause materials damage when coil changing.



PID adjustment processing

The deviation between the tension feedback signal and the set value is large when starting. At this time, PID adjustment will take a great effect by making the swinging rod or tension change to the set value quickly, which may cause impact on the materials or even material loss. PID reference ACC/DEC time setting can make the tension feedback signal change to the set value slowly, make the start more stable and avoid materials damage to a certain extent.

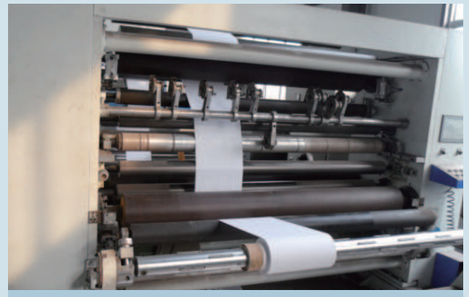
Material-lack detection and processing

Automatically detect material-lack abnormality, and simultaneously select stop protection mode and alarm.

Applicable industries

Focusing on the textile industry, printing and packaging industry, plastic machinery industry, paper industry and cable manufacturing industry, Goodrive35-07 inverter special for tension control meets the requirements of medium and high-end winding applications. For example, slasher, slitting winder, laminating machine and jig dyeing machine are applied to winding tension control.

Textile



Paper making

Printing

Packaging

Metal processing

Cable

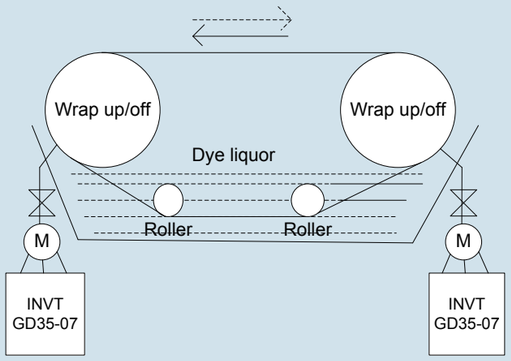
Applications

Application of jig dyeing machine

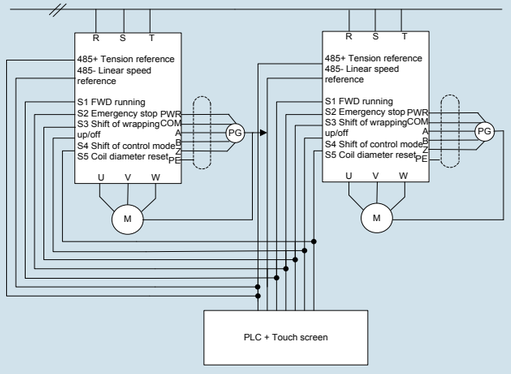
In textile industry, the process of jig dyeing machine is to dye the cloth and it decides the appearance and color of the cloth directly. The process requirements are:

(1) Wrap up and off at constant linear speed and in constant tension control;
(2) The system starts and stops stably and quickly;
(3) Need no tension feedback signal and linear speed sensor.

Flow chart



Wiring diagram



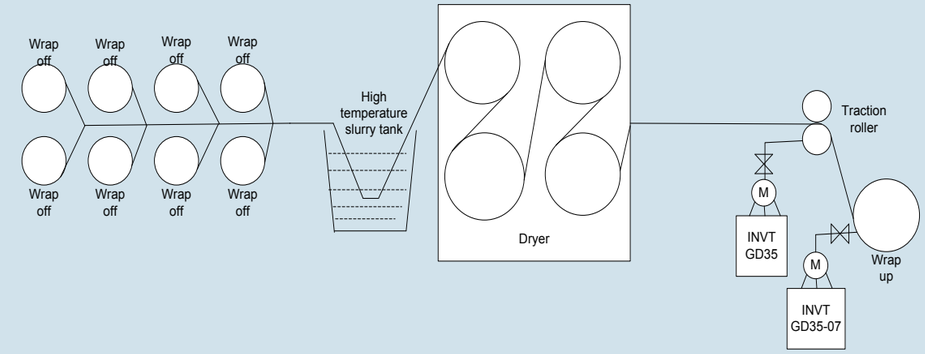
Scheme features

- Two GD35-07 inverters realize constant linear speed and constant tension control;
- Tension and linear speed can be set via touch screen;
- PLC and inverter communication realizes the shift between wrapping up/off and tension control mode;
- Cycle and length counting, PLC can read the number of cycles and length of the coils;
- The encoder is installed at the motor side for speed detection and the inverters work in close loop vector control mode;
- Accurate cloth thickness setting can ensure constant linear speed and accurate counting of thickness and length;
- Two inverters in common DC bus can save energy and a braking resistor should be added.

Application of slasher

The slasher is an important process in textile industry. After boiling the slurry, when the temperature reaches the value, transfer the slurry to the slurry tank, then wind up the yarn at wrapping off side through the traction of the motor, carry out sizing through the high temperature slurry tank into the dryer and finally wrap up for next operation.

Flow chart



Scheme features

- The motor for the control of wrapping up is installed with encoder, and it is driven by a GD35-07 inverter in open loop torque control mode; the motor for the control of traction device is driven by a GD35 inverter;
- Tension including starting tension and normal running tension can be set via touch screen and input to the inverter via analog; the set tension can be shifted when the linear speed is 10m/Min.
- The linear speed including zero speed, snail speed, I and II is controlled via ACC, DEC and emergency stop buttons, and input to the inverter via analog.

Wiring diagram