TD3300 Variable Speed Drive for Tension Control

User Manual

Version: V1.1
Revision Date: March 21, 2005
BOM: 31010932

Emerson Network Power provides customers with technical support. Users may contact the nearest Emerson local sales office or service center.

Emerson Network Power Co., Ltd.

Address: No.1 Kefa Rd., Science & Industry Park, Nanshan District 518057, Shenzhen China

Homepage: www.emersonnetworkpower.com.cn

Customer Service Hotline: 800-820-6510,

(86) 21-23017141,(86) 755-86010800

E-mail: support@emersonnetwork.com.cn

Publishing Notice

Summary:

The manual gives a comprehensive descriptions of the functions of TD3300 variable speed drive for tension control applications. The manual can also be used as reference for tension control system composed of TD3300 drive. Note that this manual should be used combined with TD3000 user manual.

Readers:

Users

Variable Speed Drive engineers

Installation and maintenance personnel

Technical support engineers

Content

Chapter 1 Preface

Thank you for using TD3300 series drive made by Emerson Network Power Co., Ltd.

This manual mainly deals with the control functions of TD3300, and it must be used together with the user manual of TD3000.

TD3000 drive can control the drving machine to make it track the speed change of the system automatically, and it can also control the output torque to make the tension of the belt or string constant. Rolling control is the typical application of this drive. As to the reeling in and reeling out control, the drive has a built-in reel diameter calculating module that enables the system to adapt the change of reel diameter automatically.

TD3300 can realize the functions of torque motor, DC motor, and tension controller and it itself is a tension control system, besides, it can make the system much more simpler, cheap and easy-to-maintain compared with the system that uses traditional tension controller.

Read the manual carefully before using this drive.

Chapter 2 Commissioning

2.1 To Determine Tension Control Method

The main function of the drive is to maintain a constant tension on the wire or belt by controling motor' s speed or output torque. You can select from 3 control methods set in F3.06.

	Open loop tension control (torque mode)	Close loop tension control (torque mode)	Close loop control (speed mode)
Typical application	To roll out or roll up belt/wire	Apply to all stages of tension control. Precise control. Strong inteference immunity. Capable of processing different belts. .	Apply to all stages of tension control. High precision. Strong inteference immunity. Capable of processing steel/iron wire.
Limit	Applied to release or roll up belt/wire only	High cost of sensor, special requirement for installation place.	Tension feedback required, control performance depends on PID configuration.
System components	Speed measurement encoder is a must.	Speed measurement encoder and tension sensor are requisite.	Tension detector (Speed measurement encoder is optional)
Cost	Low	Higher	High
Drive work mode	Close loop vector control	Close loop vector control	Open/closed loop vector control
PID	No	YES	YES
Reel diameter calculation	YES	YES	On occasions of release/roll up reel
Remark	Demand precise drive' s torque	Demand accurate drive' s torque	1. Two sets of PID recommended, set based on reel, frequency and line speed to achieve better control effects. 2. The accuracy of line speed detection is very important.

Suggestion: adopt open loop tension control as possible. If presice control is required, close loop tension control (speed mode) is recommended.

1） The open loop tension control does not need tension feedback, hence the system is simple. However, the drive must adopt close loop vector control and speed measurement encoder should be installed. Since it applies to reel release/roll up only, for other stages of tension control, you have to choose close loop tension control.

In addition, the compensation of moment of inertia is necessary for this mode. If the moment of inertia of a system is very great but the tension to be controlled is small, it is unsuitable to choose this mode.

Using this mode, you can save tension feedback devices, neglect PID parameters without sacrificing system performance.

2） The close loop tension control (speed mode) requires tension feedback device and its control effect depends on PID parameters. One of its advantage is that you may choose open loop vector control for the drive, so that you may not install speed measurement encoder.

2.2 Test Procedure

2.2.1 Choosing Open Loop Tension Control

1. Set F1.01~F1.05 according to motor’s nameplate.

2. Set F1.09=1 and F1.10=1, start self tuning process to obtain F1.11~F1.16.

3. Set encoder correctly and then run it under normal speed control mode. Do not proceed to the next step if the encoder does not run normally.

4. Set F3.06=3 to choose open loop tension control.

5. Set the direction of torque. You may set F8.17 or set any of F5.01~F5.08 at “24”, and then control the direction of output torque by terminal X1~X8.

6. Set F8.08=0（disable reel diameter calculation function). You may set F8.16 at the value of empty reel first. If the test lasts for rather long time, the change in reel diameter can not be ignored, you should set F8.16 at the actual reel diameter every time you start the drive.

7. Disable the inertia compensation, decelerate and accelerate slowly and observe whether the tension control is normal, otherwise, check parameter setting. Do not continue the next step until the tension control is normal.

8. Enable inertia compensation: set F2.19 and F2.20. Refer to Chapter 3 and 4. Since the inertia tuning can be done under close loop vector control and keypad mode, you must set F0.02=1. Set F2.21=1 to start inertia tuning. The results will be saved in FC0.9, FC.10 and FC.12. You may also change them manually. Reduce the acceleration and deceleration time gradually and observe whether the tension is constant. Otherwise, please adjust FC.12 (system inertia compensation factor).

9. Enable reel diameter calculation function (F8.08≠0),set FC.00 and make sure the accuracy of reel diameter.

10. When the reel is nearly full, adjust FC.11, to achieve stable tention during acceleration and deceleration.

11. Please set other parameters with reference to Chapter 3 and 4.

12. It is recommended to note down the parameters that you have confirmed for later use in case that you mis-modify them.

Note：

1）Reel diameter source（F8.08): the value of reel diameter can be input directly from sensor or by calculation. The value must be saved even if power failure, unless a reset command is given.

2）Friction and inertia compensation factor (FC0.9, FC.10, FC.12）can be obtained by system tuning, so you need not change them.

3）In this mode, you can skip F7 parameters.

2.2.2 Choosing Close loop Tension Control (Torque Mode)

After wiring correctly, you may do the followings:

1. Set F1.01~F1.05 according to motor’s nameplate.

2. Set F1.09=1 and F1.10=1, start self tuning process to obtain F1.11~F1.16.

3. Set encoder correctly and then run it under normal speed control mode. Do not proceed to the next step if the encoder does not run normally.

4. Set F3.06=2 to choose close loop tension control.

5. Set the direction of torque. You may set F8.17 or set any of F5.01~F5.08 at “ 24”, and then control the direction of output torque by terminal X1~X8.

6. Set F8.08=0（disable reel diameter calculation function). You may set F8.16 at the value of empty reel first. If the test lasts for rather long time, the change in reel diameter can not be ignored, you should set F8.16 at the actual reel diameter every time you start the drive.

7. Disable the inertia compensation, decelerate and accelerate slowly and observe whether the tension control is normal, otherwise, check parameter setting. Do not continue the next step until the tension control is normal.

8. Enable inertia compensation: set F2.19 and F2.20. Refer to Chapter 3 and 4. Since the inertia tuning can be done under close loop vector control and keypad mode, you must set F0.02=1. Set F2.21=1 to start inertia tuning. The results will be saved in FC0.9, FC.10 and FC.12. You may also change them manually. Reduce the acceleration and deceleration time gradually and observe whether the tension is constant. Otherwise, please adjust FC.12 (system inertia compensation factor).

9. Enable reel diameter calculation function (F8.08≠0), set FC.00 and make sure the accuracy of reel diameter.

10. Tune PID parameters to achieve stable tention control. You may set the two sets of PID at the same values first, e.g. P =25，I=1.5, D=0.5, sample cycle: 0. Fine tuning one set of PID until tension balance is achieved.

11. Enable reel diameter calculation function (F8.08≠0),set FC.05 at the max. Value, start the system, fine tune PID to make tension control stable.

12. When the reel is nearly full, adjust FC.11, to maintain constant tention during acceleration and deceleration.

13. Please set other parameters with reference to Chapter 3 and 4.

14. It is recommended to note down the parameters that you have confirmed for later use in case that you mis-modify them.

2.2.3 Choosing Close loop Tension Control (Speed Mode)

After wiring correctly, you may do the followings:

1. Set F1.01~F1.05 according to motor’s nameplate.

2. Set F1.09=1 and F1.10=1, start self tuning process to obtain F1.11~F1.16.

3. Set F3.06=1 to choose close loop tension control (speed mode).

4. Set the direction of rotation. If the current rotation is wrong, you may exchange either two connections of U, V and W.

5. Set F8.08=0（disable reel diameter calculation function). You may set F8.16 at the value of empty reel first. If the test lasts for rather long time, the change in reel diameter can not be ignored, you should set F8.16 at the actual reel diameter every time you start the drive.

6. Enable reel diameter calculation function (F8.08≠0), set FC.00 and make sure the accuracy of reel diameter.

7. Tune PID parameters to achieve stable tention control. You may set the two sets of PID at the same values first, e.g. P =25，I=1.5, D=0.5, sample cycle: 0. Fine tuning one set of PID until tension balance is achieved.

8. Enable reel diameter calculation function (F8.08≠0),set FC.05 at the max. Value, start the system, fine tune PID to make tension control stable.

9. Please set other parameters with reference to Chapter 3 and 4.

10. It is recommended to note down the parameters that you have confirmed for later use in case that you mis-modify them.

2.2.4 Reel Diameter Calculating Method

You should selecte analog input if external reel diameter sensor is used.

If the line speed signal can be obtained accurately, you may choose line speed calculating method, but the initial reel diameter should be set correctly. If the line speed is low, the error of calculated reel diameter will become bigger, to ensure the accuracy, you should set a proper lower limit of line speed. When the line speed is lower than this value, the system will deem the reel diameter remains the same, without impairing the control effect, though actually, the reel diameter changes slowly. However, try to avoid working at low speed for long time.

You can also get the reel diameter using thickness integration method. The calculation unit will figure out the diameter accoring to the number of rotations and material thickness. The number of rotations can be obtained from external counter or motor' s speed measuring encoder. Generally, using this method may cause bigger error. If the materials of belt or wire changed frequently, the thickness should be set accordingly.

When changing the reel, the reel diameter should be reset or set manually.

2.3 Special Function Introduction

2.3.1 Belt Broken Detection (F2.26=1)

Belt broken is detected based on abnormal changes in reel diameter. If the reel diameter calculated keeps shrinking during rolling up, or increasing during rolling out, then belt(string) broken might have happened. Here, the reel diameter is calculated by line speed. No matter which reel diameter calculating method is selected, the calculating unit calculates the reel diameter using line speed. If the reel diameter is not calculated using line speed, then the above result is only for

judgement of belt broken. Therefore, if you want to use this function, you must ensure that the line speed is accurate.

The detection error of line speed may cause slight bias of the calculated reel, and might result in faulse alarm, so, the sensitivity of belt broken detection should be adjusted. Three parameters can be used to adjust the sensitivity, they are: lower limit of frequency for belt broken detection (F2.27), detection time (F2.28), and detection error (F2.29). Belt broken protection is enabled when the above three contions are satisfied and F2.26 is set to 1.

2.3.2 Automatic Reel Change

Note that you should prepare two sets of TD3300 to use this function.

This function is helpful for uninterrupted operation and it can increase the efficiency. It needs external controller to give a signal.

The reel diameter remains after power off to ensure the continuance of operation, but when a new reel is installed, the value must be reset to initial diameter through the reset terminal. There are 3 programmable terminals corresponding to the reel diameter reset function, whose parameter are F8.12, F8.13, F8.14. In addition, three terminals among X1~X8 should be set as pre-drive input, memorizing torque signal, memorized torque enabling signal. Besides, you should also set F2.22~F2.23. The process is as follows:

A. Pre-driving Process

The drive that controls the new reel (to replace the old one) receives the pre-driving command, and it operates at the frequency calculated according to the reference line speed and initial reel diameter regardless of F3.06, thus the line speed of the new reel is the same with that of the system. When the pre-driving signal is cancelled, the control mode will shift back to tension control mode.

B. Memorizing torque

Before changing the reel, the " memorizing torque" signal will be given and the drive that controls the reel to be replaced will memorize the present torque .

C. Memorized torque enabling signal

After the new reel is installed and before the old reel is removed, no matter what kind of tension control mode is selected, the memorized torque enabling signal can make the drive that controls the old reel enter torque control mode, and the reference torque is the torque memorized by the drive before.

D. Torque boost

When the memorized torque enabling signal is active, the drive starts the torque control according to the memorized torque. After the preset torque boost delay time, the drive' s output torque will be boosted according to the preset torque boost ratio, so as to achieve bigger tension to break the string or belt.

After the reel is changed, the pre-driving signal will be cancelled, and the drive that controls the replaced reel stops operation. Up to now, the reel changing process is over.

Chapter 3 Parameters

3.1 Notes for Parameter Tables

1. TD3300 drive’ s function parameters are divided into 16 groups according to their functions, each group contains several function codes that can be set to different values. When use keypad operation, the parameter group corresponds to first level menu, function code corresponds to second level menu, function code's setting value corresponds to third level menu.

2. The symbol like F×.×× appearing in the table of functions or somewhere else in this manual stands for No. "××" function code in No. "×" group in the functions table. For example, “ F2.01” stands for No. 1 function code in No. 2 group.

3. Notes for the function tables:

Column 1 "type": Name and serial number of function parameters;

Column 2 "function code": Serial number of function parameters;

Column 3 "Name":Complete name of function parameters;

Column 4 "LCD display":function parameters' name which is displayed in on the LCD of Keypad;

Column 5 "Setting range":function parameters' valid setting range, displayed on the LCD of keypad;

Column 6 "Minimum Unit":function parameters' minimum unit;

Column 7 "Factory setting": function parameters' primary setting value before delivery;

Column 8 "change": function parameters' revise characteristic(that is whether the function parameter can be revised):

In the column “ change” of the table of functions,

“ O” means that the parameter can be changed during drive's running and stopping state;

“ ×” means that the parameter can not be changed during running;

“ *” means that the actually measured or fixed parameters can not be changed;

“ —” means that the parameter is set by the manufacturer and can not be changed by the user.

Column 9 "PROFIBUS parameter No.": parameters' serial number used by PROFIBUS;

Column 10 "User's Setting": Convenient for users to store revised setting value;

Note:

1. " Factory parameters" includes the important parameters set by the manufacturer and these parameters are forbid to be changed. Otherwise, fault or material loss may occur.
2. The words displayed by the LCD are given in this chapter and the parameter name and descriptions my differ with the actual ones.

3.2 Functional Parameters

3.2.1 F0 Basic Function

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F0.00	User password setting	User password	0~9999	1	0	○	0	
F0.01	Language selection	Language selection	0:Chinese 1:English	1	0	○	1	
F0.02	Control mode	Control mode	0:Open loop vector 1:Close loop vector	1	0	×	2	
F0.03	Frequency selector	Frequency setting mode	0: digital setting1 1: digital setting2 2: AI1 setting 3: AI2 setting 4: AI3 setting 5: PID setting 6: Communication setting	1	0	×	3	
F0.04	Digital setting of frequency	Frequency setting	(F0.09)~(F0.08)	0.01Hz	50.00Hz	○	4	
F0.05	Control modes selection	Control modes	0: Panel control 1: terminal control 2: serial port ocntrol	1	0	×	5	
F0.06	Setting ratio of communication frequency	Communication setting ratio	0.1~3000.0%	0.1%	100.0%	○	6	
F0.07	Highest output	Highest frequency	MAX{50.00~(F0.08)}~ 400.0Hz	0.01Hz	50.00Hz	×	7	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
	frequency							
F0.08	High frequency limit	High frequency limit	(F0.09)~(F0.07)	0.01Hz	50.00Hz	○	8	
F0.09	Low frequency limit	Low frequency limit	0.00~(F0.08)	0.01Hz	0.00Hz	○	9	
F0.10	Acc time1	Acc time1	0.1~3600s	0.1s	20.0s	○	10	
F0.11	Dec time1	Dec time1	0.1~3600s	0.1s	20.0s	○	11	
F0.12	Parameter initialization	Parameters refreshing Note:After executing 1~4 steps restores to zero automatically.	0:No operation 1:clear memory information 2:Recover factory setting 3:Parameter uploading 4:Parameter downloading	1	0	×	12	

3.2.2 F1 Motor's Parameters

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F1.00	Gearing ratio	Gearing ratio	0.00~300.00	0.01	1.00	○	30	
F1.01	Motor rated power	Rated power	0.4~999.9kW	0.1kW	drive's rated values	×	31	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F1.02	Motor rated voltage	Rated voltage	0~drive's rated voltage	1V	drive's rated values	×	32	
F1.03	Motor rated current	Rated current	0.1~999.9A	0.1A	drive's rated values	×	33	
F1.04	Motor rated frequency	Rated frequency	1.00Hz~400.0Hz	0.01Hz	50.00Hz	×	34	
F1.05	motor rated speed	Rated speed	1~24000rpm	1rpm	1440rpm	×	35	
F1.06	Motor overload protection mode selection	Over load protection	0:No action 1:Common motor 2:variable frequency motor	1	0	○	36	
F1.07	Motor overload protection factor selection	Protection Factor	20.0~110.0%	0.1%	100.0%	○	37	
F1.08	Motor pre-excitation selection	Pre-excitation selection	0: enabled under certain conditions 1: enabled all the time	1	1	×	38	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F1.09	Motor auto-tuning protection	Tuning protection	0:Tuning disable 1:Tuning enable	1	0	×	39	
F1.10	Motor auto-tuning process	Tuning process	0:No operation 1:start tuning 2:Start tuning operation Note: start tuning at 0→1 and changed to 0 after finishing tuning automatically; start macro tuning at 0→2 and changed to 0 after finishing tuning automatically.	1	0	×	40	
F1.11	Stator resistance	Stator resistance	0.000~9.999Ω	0.001Ω	motor parameter	×	41	
F1.12	Stator inductance	Stator inductance	0.0~999.9mH	0.1mH	motor parameter	×	42	
F1.13	Rotor resistance	Rotor resistance	0.000~9.999Ω	0.001Ω	motor parameter	×	43	
F1.14	Rotor inductance	Rotor inductance	0.0~999.9mH	0.1mH	motor parameter	×	44	
F1.15	Mutual inductance	Mutual inductance	0.0~999.9mH	0.1mH	motor parameter	×	45	
F1.16	Exciting current with no load	Exciting current with no load	0.0~999.9A	0.1A	motor parameter	×	46	

3.2.3 F2 Auxiliary Parameters

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F2.00	Start mode	Start mode	0:start from start frequency 1:first braking then restart 2:flying restart	1	0	×	60	
F2.01	Start frequency	Start frequency	0.00~10.00Hz	0.01Hz	1.00Hz	×	61	
F2.02	Start frequency holding time	Start holding time	0.0~10.0s	0.1s	0.0s	×	62	
F2.03	DC braking current at start	Brake current at start	0.0~150.0%(drive's rated current)	0.1%	0.0%	×	63	
F2.04	DC braking time at start	Brake time at start	0.0(DC inhection braking disabled), 0.1~30.0s	0.1s	0.0s	×	64	
F2.05	delay time for starting the drive	delay time for starting the drive	0.00~36.00S	0.01S	0	×	65	
F2.06	High frequency limit selection	Selection of frequency limit	0: F0.08 limit 1: AI1 limit 2: AI2 limit 3: AI3 limit	1	0	×	66	
F2.07	Offset of high frequency limit	Offset of frequency limit	0.0%~20.0%	0.1%	0.0%	×	67	
F2.08	FWD/REV delay time	FWD/REV interval	0.1~3600S	0.1S	2.0s	×	68	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F2.09	Stopping mode	Stopping mode	0:Dec-to-stop 1 1:Coast to stop 2:Dec-to-stop 2	1	0	×	69	
F2.10	Initial frequency of DC injection braking	Initial frequency of DC injection braking	0.00~10.00Hz	0.01Hz	0.00Hz	×	70	
F2.11	DC braking current	DC braking current	0.0~150.0%(drive's rated current)	0.1%	0.0%	×	71	
F2.12	DC braking time	Brake time	0.0(DC injection braking is disabled), 0.1~30.0s	0.1s	0.0s	×	72	
F2.13	Jog frequency setting	Jog frequency	0.10~10.00Hz	0.01Hz	2.00Hz	×	73	
F2.14	Jog Acc time setting	Jog Acc time	0.1~60.0s	0.1s	1.0s	○	74	
F2.15	Jog Dec time setting	Jog Dec time	0.1~60.0s	0.1s	1.0s	○	75	
F2.16	Gain of pre-dring speed	Gain of speed	0: digital setting 1: AI1 setting 2: AI2 setting 3: AI3 setting	1	0	○	76	
F2.17	Setting of gain of pre-driving speed	Setting of speed gain	-50.0~50.0%	0.1	0%	○	77	
F2.18	Effective range of speed gain	Effect of speed gain	0: active in automatic reel changing process 1: active all the time	1	0	○	78	
F2.19	Inertia auto-learning function 1	Identified torque 1	0.0%~100.0%	0.1	30.0%	×	79	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F2.20	Inertia auto-learning function 2	Identified torque 2	0.0%~100.0%	0.1	80.0%	×	80	
F2.21	System inertia adjustment	Inertia adjustment	0: No operation 1: Start speed adjusting Note: 0→1, start tuning, change to 0 after the tuning is over.	1	0	×	81	
F2.22	Torque boost ratio	Torque boost ratio	0.0~300.0%	0.1	0.0%	○	82	
F2.23	Delay for torque boost	Delay for torque boost	0.01~99.99S	0.01	0.01s	○	83	
F2.24	Length setting	Length setting	0~30000m	1	0	○	84	
F2.25	Action selection when preset length is arrived	Activated when the preset length is arrived	0: stop 1: continue to operate	1	1	○	85	
F2.26	Belt-broken function selection	Selection of belt-broken detection	0: disabled 1: enabled	1	0	×	86	
F2.27	Lower limit of belt-broken detecting freq.	Freq. of belt-broken detection	0.00Hz~F0.08	0.01	10.00Hz	○	87	
F2.28	Belt-broken detection time	Belt-broken detection time	0.00~99.99S	0.01	1.00s	○	88	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F2.29	Belt-broken detection error	Belt-broken detection error	0.0~100.0%	0.1	10.0%	○	89	
F2.30	Present length	length	0~30000 m	1	0	○	90	
F2.31	Skip frequency 1	Skip frequency 1	(F0.09)~(F0.08)	0.01Hz	0.00Hz	×	91	
F2.32	Skip frequency 2	Skip frequency 2	(F0.09)~(F0.08)	0.01Hz	0.00Hz	×	92	
F2.33	Skip frequency 3	Skip frequency 3	(F0.09)~(F0.08)	0.01Hz	0.00Hz	×	93	
F2.34	Range of skip frequency	Range	0.00~30.00Hz	0.01Hz	0.00Hz	×	94	
F2.35	Carrier frequency adjustment	Carrier frequency	2.0kHz~16.0kHz	0.1kHz	set according to model	×	95	
F2.36	Locking up function selection upon a fault	Locking up upon fault	0: disabled 1: enabled	1	0	×	96	
F2.37	Automatic resetting times upon a fault	Resetting times	0(no automatic reset functions), 1~3	1	0	×	97	
F2.38	Reset interval	Reset interval	2~20s	1s	5s	×	98	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F2.39	Function selection of over-voltage stall	Over-voltage stall	0: Disabled 1: Enabled	1	0: built-in brak unit 1:External brak unit	×	99	
F2.40	Stall over-voltage point	Stall over-voltage point	120~150.0%(rated voltage peak)	0.1%	130.0%	×	100	
F2.41	Stall over-current point 1	Stall over-current 1	20.0~200.0%(Below the motor’ s rated frequency)	0.1%	150.0%	×	101	
F2.42	Stall over-current point 2	Stall over-current 2	20.0~150.0%(Above the motor’ s rated frequency)	0.1%	120.0%	×	102	
F2.43	Frequency setting accuracy	Frequency setting accuracy	1.0kHz~50.0kHz(Maximum frequency)	0.1kHz	20.0kHz	×	103	
F2.44	Droop control	Droop control	0.00 ~9.99Hz	0.01Hz	0.00Hz	×	104	

3.2.4 F3 Vector Control

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F3.00	ASRproportional gain 1	ASR1-P	0.000~6.000	0.001	1.000	×	120	
F3.01	ASR integration time 1	ASR1-I	0(No effect), 0.000-32.00s	0.001S	1.000	×	121	
F3.02	ASRproportional gain 2	ASR2-P	0.000~6.000	0.001	2.000	×	122	
F3.03	ASR integration time 2	ASR2-I	0(no effect), 0.000-32.00s	0.001S	0.500	×	123	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F3.04	ASR switching frequency	Switching frequency	0.00~400.0Hz	0.01Hz	5.00	×	124	
F3.05	Gain of slip compensation	Gain of slip compensation	50.0~250.0%	0.1%	100.0%	×	125	
F3.06	Tension control selection	Tension control selection	0: Disabled 1: Close loop tension control mode1 2: Close loop tension control mode2 3: Open loop control mode	1	0	×	126	
F3.07	Selection of l;imit of motoring torque	Selection of motoring torque	0: digital limit 1: AI1 limit 2: AI2 limit 3: AI3 limit	1	0	×	127	
F3.08	Limit of motoring torque	Limit of motoring torque	0.0~200.0%(drive's rated current)	0.1%	150.0%	×	128	
F3.09	Braking torque selection	Braking torque selection	0: digital limit 1: AI1 limit 2: AI2 limit 3: AI3 limit	1	0	×	129	
F3.10	Braking torque limit	Braking torque limit	0.0~200.0%(drive's rated current)	0.1%	150.0%	×	128	
F3.11	Switching torque	Switching torque	0 ~100 %(initial torque)	1	0	×	129	
F3.12	Torque changing time	Torque changing time	0.0~120.0s	0.1	0.1	×	130	

3.2.5 F5 Terminals for Digital Value

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F5.00	FWD/REV running mode	control mode	0: 2-wire mode 1 1: 2-wire mode 2 2: 3-wire mode	1	0	×	170	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
F5.01	Functions of digital input termals X1～X8	Function of terminal X1	0: No function(can be selected repeatedly) 1: Pre-driving signal input 2: Memorized torque signal input 3: Memorized torque enabling signal 4: tension control enabling signal 5: PID stopping signal input 6: External fault normally open input 7: External fault normally closed input 8: External reset signal input (RESET) 9: Forward jog signal input(JOGF) 10: Reverse jog signal input(JOGR) 11: Coast-to-stop(FRS) 12: Reel diameter reset 1 command 13: Reel diameter reset 2 command 14: Reel diameter reset 3 command 15: Acc/Dec disabling command 16: 3-wire control mode 17: Normally open contracts input for external stopping signal 18: Normall closed contacts input terminal for external stopping signal 19: Pre-exciting command at start 20: DC injection braking signal input at stop 21: Command of changing reeling mode 22: counter's clearing signal input 23: counter's triggering signal input 24: tension direction switching	1	0	×	171	
F5.02		Function of terminal X2			0		172	
F5.03		Function of terminal X3			0		173	
F5.04		Function of terminal X4			0		174	
F5.05		Function of terminal X5			0		175	
F5.06		Function of terminal X6			0		176	
F5.07		Function of terminal X7			0		177	
F5.08		Function of terminal X8			0		178	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F5.09	Function selection for open collector output terminal Y1	Function of terminal Y1	0: drive ready for operation(READY) 1: Drive running signal 1(RUN1) 2: Drive running signal 2(RUN2) 3: Drive running at zero speed 4: Freq./ speed arriving signal 5: Freq./speed conformance 6: Preset counter arriving signal 7: Specified counter arriving signal 8: reserved 9: Locking in under-voltage status(P.OFF) 10: Pre-alarm of drive overload 11: Stopping due to external fault 12: Pre-alarm for motor overload 13: Torque limiting 14: Reel diameter reaches the maximum reel diameter 15: Reel diameter reaches the hollow reel diameter 16: Reel diameter reaches the specified reel diameter 17: reserved 18: Length arriving 19: output signal of belt-broken detection 20: Protection at stall	1	4	×	179	
F5.10	Function selection for open collector output terminal Y2	Function of terminal Y2			5		180	
F5.11	Function selection of programmable relay output PA/B/C	Function of relay			1		181	
F5.12	Preset counting value arrives	Preset counting value	0~9999	1	0	×	182	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F5.13	Specified counting value arrives	Specified counting value	0~(F5.12)	1	0	×	183	
F5.14	Detection width upon speed arrives	Equaivalent range	0.0~20.0%(F0.07)	0.1%	5.0%	○	184	
F5.15	FDT level	FDT level	0.0~100.0%(F0.07)	0.1%	80.0%	○	185	
F5.16	FDT signal(lag)	FDT signal	0.0~100.0%(F0.07)	0.1%	5.0%	○	186	
F5.17	Pre-alarm of drive overload setting	Prealarm at overload	20.0~100.0%(drive's rated current)	0.1%	100.0%	○	187	
F5.18	Pre-alarm for motor overload setting	Prealarm at motor overload	100.0~250.0%(motor's rated current)	0.1%	100.0%	○	188	
F5.19	Output coefficient of frequency meter	Frequency output	100.0 ~999.9	0.1	200.0	○	189	

3.2.6 F6 Analog Value Terminal

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F6.00	AI1 voltage input selection	AI1 selection	0: 0~10V 1: 0~5V 2: 10~0V 3: 5~0V 4: 2~10V 5: 10~2V	1	0	×	200	
F6.01	AI2 voltage/current input selection	AI2 selection	0: 0~10V/0~20mA 1: 0~5V/0~10mA 2: 10~0V/20~0mA 3: 5~0V/10~0mA 4: 2~10V/4~20mA 5: 10~2V/20~4mA	1	0	×	201	
F6.02	AI3 voltage input selection	AI3 selection	0: 0~10V 1: 0~5V 2: 10~0V 3: 5~0V 4: 2~10V 5: 10~2V	1	0	×	202	
F6.03	Time constant of AI1 filter	Time constant of AI1 filter	0.012~5.000s	0.001s	0.1s	○	203	
F6.04	Time constant of AI2 filter	Time constant of AI2 filter	0.012~5.000s	0.001	0.1s	○	204	
F6.05	Time constant of AI3 filter	Time constant of AI3 filter3	0.012~5.000s	0.001	0.1s	○	205	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F6.06	Function of AO1 multi-function analog output terminal	AO1 Selection	0: running freq./speed(0~MAX) 1: setting freq./speed(0~MAX) 2: ASR speed error 3: Output current (0~2 times of rated current) 4: Current of torque command 5: Estimated torque current 6: Output voltage(0~1.2 times of rated voltage) 7: Feedback flux current 8: AI1 setting input 9: AI2 setting input 10: AI3 setting input 11: Reel diameter(0-100%Maximum reel diameter) 12: tension(0-100%Maximum tension) 13: Line speed 14: Length	1	0	○	206	
F6.07	Function of AO2 multi-function analog output terminal	AO2 Selection			0		207	
F6.08	AO1 offset adjustment	AO1 offset adjustment	-99.9~100.0%	0.1%	0.0%	○	208	
F6.09	setting of AO1 gain	AO1 gain	-10.00~+10.00	0.01	1.00	○	209	
F6.10	AO2 offset adjustment	AO2 offset adjustment	-99.9~+100.0%	0.1%	0.0%	○	210	
F6.11	Setting of AO2 gain	AO2 gain	-10.00~+10.00	0.01	1.00	○	211	

3.2.7 F7 PID

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F7.00	Selection of reference input channel	Reference selection	0: Input via keypad 1: AI1 2: AI2 3: AI3	1	0	×	230	
F7.01	digital setting of reference	Digital setting	0.00~10.00V	0.01	5.00	○	231	
F7.02	Selection of feedback value	Feedback selection	0: AI1 1: AI2 2: AI3 3: Feedback of linespeed	1	0	×	232	
F7.03	Proportional ain P1	Proportional gain 1	0.0~999.9%	0.1%	0.0%	○	233	
F7.04	Integration time Ti1	Integration time 1	0.00(no integration), 0.01~99.99s	0.01s	0.00s	○	234	
F7.05	Differential timeTd1	Differential time1	0.00(no differential), 0.01~99.99s	0.01s	0.00s	○	235	
F7.06	Proportional gain P2	Proportional gain 2	0.0~999.9%	0.1%	0.0%	○	236	
F7.07	Integration time Ti2	Integration time 2	0.00(no integration), 0.01~99.99s	0.01s	0.00s	○	237	
F7.08	Differential timeTd2	Differential time2	0.00(no differential), 0.01~99.99s	0.01s	0.00s	○	238	
F7.09	Sampling cycle T	Sampling cycle	0.00(do not select sampling cycle), 0.01~99.99s	0.01s	1.00s	○	239	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F7.10	PID parameter adjustment	PID parameter adjustment	0:Reel diameter 1:Frequency 2: Line speed	1	0	○	240	
F7.11	Limit of error	Limit of error	0.0~20.0%(reference of close loop)	0.1%	0.0%	○	241	
F7.12	Upper limit Clamping	Upper limit Clamping	0.0~100.0%	0.1%	50.0%	○	242	
F7.13	Lower limit Clamping	Lower limit Clamping	0.0~100.0%	0.1%	50.0%	○	243	

3.2.8 F8 Tension Control Function 1

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F8.00	Reeling mode	Reeling mode	0: reeling in mode 1: reeling out mode	1	0	×	260	
F8.01	Methods of setting tension	Selection of tension	0: digital setting 1: AI1 setting 2: AI2 setting 3: AI3 setting 4: digital setting, be able to be changed by the UP and DOWN keys	1	0	×	261	
F8.02	Digital setting of tension	Tension setting	0~30000N	1N	0	○	262	
F8.03	Maximum tension	Maximum tension	0~30000N	1N	0	×	263	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F8.04	Methods of setting tension at zero speed	Selection of tension at zero speed	0: digital setting 1: AI1 setting 2: AI2 setting 3: AI3 setting 4: No special setting	0	4	×	264	
F8.05	tension at zero speed	tension at zero speed	0~30000N	1N	0	○	265	
F8.06	Selection of conicity of tension	Selection of conicity of tension	0: digital setting 1: AI1 setting 2: AI2 setting 3: AI3 setting	1	0	×	266	
F8.07	Conicity of tension	Conicity of tension	0~100%	1%	0	○	267	
F8.08	Sources of reel diameter	Selection of reel diameter	0: No calculating 1: Calculate via line speed 2: AI1 setting 3: AI2 setting 4: AI3 setting 5: Calculate via number of revolutions	1	0	×	268	
F8.09	Maximum reel diameter	Maximum reel diameter	0-9999mm	1mm	0	×	269	
F8.10	Empty reel diameter	Hollow reel diameter	0-9999mm	1mm	0	×	270	
F8.11	Initial reel diameter	Initial reel diameter	0: digital setting 1: AI1 setting 2: AI2 setting 3: AI3 setting	1	0	×	271	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F8.12	Digital setting 1 of initial reel diameter	Initial reel diameter 1	0-9999mm	1mm	0	○	272	
F8.13	Digital setting 2 of initial reel diameter	Initial reel diameter 2	0-9999mm	1mm	0	○	273	
F8.14	Digital setting 3 of initial reel diameter	Initial reel diameter 3	0-9999mm	1mm	0	○	274	
F8.15	Reel diameter arriving	Reel diameter setting	0-9999mm	1mm	0	○	275	
F8.16	Present reel diameter	Reel diameter	0-9999mm	1mm	0	×	276	
F8.17	Setting of tension' s direction	Setting of tension' s direction	0: Forward 1: Reverse		0	×	277	

3.2.9 F9 Communication and Bus

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F9.00	Baud rate selection	baud rate selection	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS 6: 125000BPS	1	3	×	290	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F9.01	Data format	Data format	0: N, 8, 1(1 start bit, 8-bit data bit, 1 stop bit, no parity) 1: E, 8, 1(1 start bit, 8-bit data bit, 1 stop bit, no parity, even parity) 2: O, 8, 1(1 start bit, 8-bit data bit, 1 stop bit, no parity, odd parity)	1	0	×	291	
F9.02	Local address	Local address	2~126	1	2	×	292	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
F9.03	Selection of PPO mode	PPO mode	0: Disabled 1: PPO1 2: PPO2 3: PPO3 4: PPO4 5: PPO5	1	0	×	293	
F9.04	Connection value of PZD2	Connection value of PZD2	0~20 (corresponding to FF.00~FF.20)	1	0	×	294	
F9.05	Connection value of PZD3	Connection value of PZD3	0~20 (corresponding to FF.00~FF.20)	1	0	×	295	
F9.06	Connection value of PZD4	Connection value of PZD4	0~20 (corresponding to FF.00~FF.20)	1	0	×	296	
F9.07	Connection value of PZD5	Connection value of PZD5	0~20 (corresponding to FF.00~FF.20)	1	0	×	297	
F9.08	Connection value of	Connection	0~20 (corresponding to FF.00~FF.20)	1	0	×	298	

	PZD6	value of PZD6						
F9.09	Connection value of PZD7	Connection value of PZD7	0~20 (corresponding to FF.00~FF.20)	1	0	×	299	
F9.10	Connection value of PZD8	Connection value of PZD8	0~20 (corresponding to FF.00~FF.20)	1	0	×	300	
F9.11	Connection value of PZD9	Connection value of PZD9	0~20 (corresponding to FF.00~FF.20)	1	0	×	301	
F9.12	Connection value of PZD10	Connection value of PZD10	0~20 (corresponding to FF.00~FF.20)	1	0	×	302	

3.2.10 FA Enhanced Functions

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
FA.00	Action selection of fault relay in fault reset	Fault output	0: No output(fault contacts do not activate) 1: Output(fault contacts activate)	1	0	○	320	
FA.01	Action selection of fault relay in P.OFF period	POFF output	0: No output(fault contacts do not activate) 1: Output(fault contacts activate)	1	0	○	321	
FA.02	Selection of functions of STOP key in external control	Function of STOP key	0~15(see chapter 6 for settings)	1	0	×	322	
FA.03	Cooling fan control	Fan control	0: Auto operation mode 1: Operate all	1	1	○	323	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
			the time					
FA.04	Action selection when external freq. / speed commands loses(open loop)	Actions upon the missing of freq./speed commands Note: Only valid at 4~20mA /2~10V/20~4mA/ 10~2V.	0: Stop(E022) 1: Operate according to the setting of F0.04 2: Run at upper limit speed 3: Run at lower limit speed 4: Operate according to the setting of FA.09	1	0	×	324	
FA.05	Detection time of communication overtime	Communication overtime	0.0(disabled), 0.1~100.0s	0.1s	0.0s	×	325	
FA.06	Action selection for communication failure	Communication failure	0: Stop(E017) 1: Operate according to the setting of F0.04 2: Run at upper limit speed 3: Run at lower limit speed 4: Operate according to the setting of FA.09	1	0	×	326	
FA.07	Action selection when reference of PID misses	Reference loss Note: only valid for 4~20mA/2~10V /20~4mA/10~2V input	0: Stop(E022) 1: 100% AI operation 2: 50% AI operation 3: 25% AI operation	1	0	×	327	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
FA.08	Action selection when feedback of PID misses	Feedback loss Note: only valid for 4~20mA /2~10V/20~4mA /10~2V input.	0: Stop(E021) 1: Operate according to the setting of F0.04 2: Run at upper limit speed 3: Run at lower limit speed 4: Operate according to the setting of FA.09	1	0	×	328	
FA.09	Abnormal backup freq./speed setting	Abnormal speed	0.0~100.0%(speed setting before abnormality happens)	0.1%	0.0%	×	329	
FA.10	Ratio of working time of braking kit to drive' s total working time (%)	Ratio of working time of braking kit to drive' s total working time (%)	0: No braking 1: 2% 2: 5% 3: 10% 4: 20% 5: 50% 6: 80% 7: 100%	1	1	○	330	
FA.11	UP/DOWM setting speed limit	Speed of increasing / decreasing frequency	0.10~99.99Hz/s	0.01Hz/s	1.00Hz/s	○	331	
FA.12	Input phase failure protection	Input phase failure	0: Protection function is disabled 1: alarm 2: Protection is activated	1	2	○	332	
FA.13	Output phase failure protection	Output phase failure	0: Protection function is disabled 1: alarm 2: Protection is activated	1	2	○	333	
FA.14	Load missing protection of drive	Load missing protection of drive	0: Protection function is disabled 1: alarm 2: Protection is activated	1	0	○	334	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
FA.15	Load missing protection level	Load missing protection level	0.0~100.0%(rated current)	0.1%	30.0%	×	335	
FA.16	Detection time of load missing protection	Detection time of load missing protection	0.0~99.9s	0.1s	1.0s	×	336	

3.2.11 FB Function of PG

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
Fb.00	Selection of number of pulses per revolution of PG	Selection of number of pulses	1~9999	1	1000	×	350	
Fb.01	Selection of PG direction	Selection of PG direction	0: Forward 1: Reverse	1	0	×	351	
Fb.02	Action upon PG failure	Action upon PG failure	0: Coast to stop(E025) 1: Continue to run(only for V/F close loop)	1	0	×	352	
Fb.03	Detection time for PG failure	Detection time for PG failure	2.0~10.0s	0.1s	2.0s	×	353	
Fb.04	Zero-speed detection value	Zero-speed detection value	0.0(protection function is disabled) 0.1~999.9rpm	0.1rpm	0.0rpm	×	354	

3.2.12 FC Tension Control Function 2

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
FC.00	Selection of line speed input	Selection of line speed input	0: digital setting 1: AI1 setting 2: AI2 setting 3: AI3 setting 4: X8 pulse input 5: Communication setting	1	0	×	370	
FC.01	Digital setting of line speed	Line speed setting	0.0-3000.0m/min	0.1 m/min	0	○	371	
FC.02	Number of pulses per meter	Number of pulses per meter	0~3000.0	0.1	0	○	372	
FC.03	Maximum line speed	Maximum line speed	0.0-3000.0m/min	0.1m/min	0	×	373	
FC.04	Minimum line speed	Minimum line speed	0.0-3000.0m/min	0.1m/min	0	○	374	
FC.05	Time constant of filter of reel diameter	Time constant of filter	0.000-9.999s	0.001S	0.100	○	375	
FC.06	Thickness of belt	Thickness of each layer	0.01-99.99mm	0.01mm	0.01	○	376	
FC.07	Number of revolutions for each layer	Number of revolutions for each layer	1-9999	1	1	○	377	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User setting
FC.08	Selection of counting number of revolutions	Selection of counting number of revolutions	0:X8 input 1:PG input	1	0	○	378	
FC.09	Breakaway torque compensation	Compensation for stiction torque	0-100.0%	0.1%	0	○	379	
FC.10	Sliding friction torque compensation	Compensation for sliding stiction torque	0-100.0%	0.1%	0	○	380	
FC.11	Compensation coefficient for belts or strings' inertia	Compensation coefficient for belts or strings' inertia	0~30000	1	0	○	381	
FC.12	Compensation coefficient for system's inertia	Compensation coefficient for system's inertia	0.00~300.00	0.01	0	○	382	

3.2.13 Fd Displayed Parameters

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
Fd.00	LED displayed parameters selection 1 in running status	Running display 2	1~255 (Please refer to Chapter 6 for the settings)	1	95	○	400	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
Fd.01	LED displayed parameters selection 2 in running status	Running display 2	0~255 (Please refer to Chapter 6 for the settings)	1	0	○	401	
Fd.02	Isplayed parametersby LED in stopping status (flash)	Stop display	0:frequency setting (Hz)/(speed(rpm)) 1:External counting value(no unit) 2:Digital value input(no unit) 3:Digital value output(no unit) 4:Analog input AI1(V) 5:Analog input AI2(V) 6:Analog input AI3(V) 7:DC bus voltage(V-AVE) 8: Reel diameter 9: tension setting 10: Length	1	0	○	402	
Fd.03	Switching between freq. display and speed display	Display changing	0: frequency(Hz) 1: speed(rpm)	1	0	○	403	
Fd.04	Coefficient of line speed	Coefficient of line speed	0.1~999.9%	0.1%	1.0%	○	404	
Fd.05	IPM heatsink temperature	heatsink temperature1	0.0~100.0℃	0.1℃	Actual detected value	*	405	
Fd.06	Rectifier module heatsink temperature	heatsink temperature 2	0.0~100.0℃	0.1℃	Actual detected value	*	406	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
Fd.07	Type of 1st fault	Fault 1	0:No abnormal record(clear abnormal record) 1:Acc over current(E001) 2:Dec over current(E002) 3:Over current in constant speed(E003) 4: over voltage in Acc process(E004) 5:over voltage in Dec process(E005) 6: Over voltage in constant speed(E006) 7:Control power supply over voltage(E007) 8: input phase failure(E008) 9:output phase failure(E009) 10: power module Fault (E010) 11:heatsink overheat(E011) 12:rectifier over heat(E012) 13:drive overload(E013) 14:motor overload(E014) 15:External equipment Fault (E015) 16:W/R Fault (E016) 17:COM Fault (E017) 18:Contactor doesn't close(E018) 19:Current detection Fault (E019) 20: CPU fault(E020) 21: Cable-broken of close-loop feedback (E021) 22: Cable-broken of external reference input (E022) 23: Keypad w/r error (E023) 24: Tuning error (E024) 25:PG error (E025)	1	0	*	407	
Fd.08	Type of 2nd fault	Fault 2					408	
Fd.09	Type of 3rd fault	Fault 3					409	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
Fd.10	Bus voltage at last fault	Fault voltage	0~999V	1V	0V	*	410	
Fd.11	Output current at last fault	Fault current	0.0~999.9A	0.1A	0.0A	*	411	
Fd.12	Running frequency at last fault	Fault frequency	0.00Hz~400.0Hz	0.01Hz	0.00Hz	*	412	
Fd.13	Input terminal's state at last fault	Fault terminal 1	0~1023	1	0	*	413	
Fd.14	Output terminal's state at last fault	Fault terminal 2	0~15	1	0	*	414	
Fd.15	Total operating time	operating time	0~65535 hour	1 hour	0 hour	*	415	

3.2.14 FE Reserved Parameters

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User's setting
FE.00	Factory password setup	Factory password	**** Note:input password correctly, display FE.01~FE.14.	1	factory setting	—	430	

3.2.15 FF Communication Parameters

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User' s setting
FF.00	Running frequency	FF parameters will not be displayed in LED and LCD.	running frequency(Hz)	0.01 Hz	—	*	470	
FF.01	Running speed		running speed(rpm)	1rpm	—	*	471	
FF.02	Preset frequency		preset frequency (Hz)	0.01 Hz	—	*	472	
FF.03	Preset speed		preset speed(rpm)	1rpm	—	*	473	
FF.04	Output voltage		output voltage (V-RMS)	1V	—	*	474	
FF.05	Output urrent 1		output current (A-RMS)	0.1A	—	*	475	
FF.06	Reel diameter		Reel diameter (mm)	1mm	—	*	476	
FF.07	Line speed		line speed(m/s)	0.1m/s	—	*	477	
FF.08	Preset line speed		preset line speed(m/s)	0.1m/s	—	*	478	
FF.09	External count value		External count value(no unit)	1	—	*	479	
FF.10	Motor output torque		motor output torque(%)	0.1%	—	*	480	
FF.11	Length		Length(m)	1m	—	*	481	
FF.12	Digital input terminal's state		0~1023	1	—	*	482	
FF.13	Digital output terminal's state		0~15	1	—	*	483	

Func. Code	Name	Display in LCD	Range of settings	Min. unit	Factory setting	Change	Profibus Code	User' s setting
FF.14	Analog input AI1	FF parameters will not be displayed in LED and LCD.	Analog input AI1 (V)	0.01V	—	*	484	
FF.15	Analog input AI2		Analog input AI2 (V)	0.01V	—	*	485	
FF.16	Analog input AI3		Analog input AI3 (V)	0.01V	—	*	486	
FF.17	Analog output AO1		Analog output AO1 (V)	0.01V	—	*	487	
FF.18	Analog output AO2		Analog output AO2(V)	0.01V	—	*	488	
FF.19	DC bus voltage		Bus voltage(V)	1V	—	*	489	
FF.20	tension		tension (N)	1N	—	*	490	

Chapter 4 Parameter Descriptions

🕮 Notes:

This chaper introduces the functional parameters of TD3300 drive and some changed parameters of TD3000 drive. Refer to TD3000 User Manual for other parameters.

4.1 Basic Functions

F0.00 User’ s password	Setting range: 0~9999

After the parameter is set, all the parameters will not be displayed.

Refer to TD3000 User Manual for the using of password.

F0.03 Frequency setting mode	Setting range: 0~6

When F3.06 is set to 0, the frequency setting modes when tension control mode is not selected.

0, 1: Refer to TD3000 User Manual for details.

2, 3, 4: Select the analog setting

5: PID setting

Select analog close loop control, and the frequency setting is adjusted by PID.

6: Communication setting

Preset frequency f=f1×F0.06; f1 is the digital setting frequency set via RS485, and F0.06 is the frequency setting ratio.

F0.06 Frequency (set via RS485) setting ratio	Setting range: 0.1~3000.0%

4.2 Motor’ s Parameters

F1.00 Gearing ratio	Setting range: 0.00~300.00

I=n/n1

I is the gearing ratio, n is the motor speed, n1 is the speed of reel

In tension control, gearing ratio much be set correctly.

4.3 Auxiliary parameters

F2.05 Delay time for start	Setting range: 0.00~36.00s

The delay time starts from the time when the drive receives the operating command to the time when the drive begin to output power, it is used in the application where delayed start is required.

F2.06 Selection of upper frequency limit	Setting range: 0, 1, 2, 3

F2.06 decides the methods of setting the upper frequency limit.

0: digital setting of F0.08

1: AI1 anlog setting

2: AI2 anlog setting

3: AI3 anlog setting

In tension control mode, the upper frequency limit set by analog value can be used as the frequency limit of tension control.

F2.07 Offet of high frequency limit	Setting range: 0.0%~20.0%

Offset of high frequency limit is set by F2.07, 100.0% corresponds to the maximum output frequency——F0.07.

The high limit of operating frequency is the value added by the settings of F2.06 and F2.07.

F2.16 Setting modes of gain of pre-dring speed signal	Setting range: 0, 1, 2, 3

0: digital setting 1: AI1 setting 2 : AI2 setting 3 : AI3 setting

When setting the gain via analog value, the corresponding gain is -50%~50%, for example, if the analog value is 0~10V, then 0V corresponds to -50%, 5V corresponds to 0, and 10V corresponds to 50%.

F2.17 Gain of pre-driving speed signal	Setting range: -50.0%~50.0%

In pre-driving process, F2.17 is used to adjust the synchronuous tracking frequency.

F2.18 Effective range of speed gain	Setting range: 0, 1

0. Speed gain is active in automatic reel changing process

1.Speed gain is active in the whole process

F2.18 is used to select the effective range of pre-driving speed gain. If it is set to 0, it is only active in antomatic reel changing process, if it is set to 1 the synchronous command in close loop tension control mode1 is also active.

F2.19 Inertial auto-learning function 1	Setting range: 0.0%~100.0%
F2.00 Inertial auto-learning function 2	Setting range: 0.0%~100.0%
F2.21 System inertia adjustment	Setting range: 0, 1

The above three parameters are used to realize the inertia auto-learning function. When F2.21 is set to 1, the keypad display will prompt " Start identification?" . Press " RUN" key, the drive will operate two times according to the torques set by F2.19 and F2.20. The drive decelerates to stop each time after it accelerates to 40Hz, and it obtains system inertia compensation coefficient and friction compensation coefficient after running two times, and the coefficients are automatically saved in FC.12 and FC.10 respectively. Inertia identification is only active in keypad control mode, and F2.21 is restored to 0 after the identification process is over.

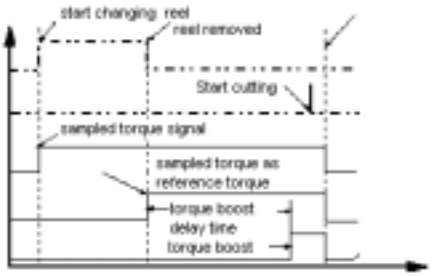
The identification results vary according to the different preset identified torque. The rule of presetting the torque is: the difference between the two identified torques should not be too small, and the identified torque should not be set too high, otherwise the Acceleration time is too short, and the identified results may have big error. Besides, if over-volt fault is reported in inertia tuning process, the preset torque of F2.20 can be reduced.

Inertia tuning must be done in close-loop vector mode(F0.02=1), and the control mode should be keypad control mode.

F2.22 Torque boost ratio	Setting range: 0.0%~300.0%
F2.23 Torque boost delay time	Setting range: 0.01~99.99S

In automatic reel changing process, when the memorized torque enabling signal is active, the drive may perform the torque control according to the memorized torque, after the delay time set in F2.23, it then boosts the torque according to the setting of F2.22.

These two parameters are used in the antomatic reel changing logic control. The mechanical action sequence and the drive' s signal sequence are shown in the following Fig 4-1 :



The dashed line indicates mechanical time sequence, the solid line indicates drive' s action time sequence.

Fig. 4-1 Automatic reel changing figure

F2.24 Length setting	Setting range: 0~30000m
F2.25 Action selection when preset length is arrived	Setting range: 0, 1

Lenth calculating module can calculate the length of string or belt, when the length exceeds the setting of F2.24, the output terminal will output a signal. The drive will stop if F2.25 is set to 0, and will continue to operate if F2.25 is set to 1.

F2.26 Belt-broken function selection	Setting range: 0, 1

0: Disabled Belt-broken function is disabled.

1: Enabled Belt-broken function is enabled.

F2.27 Lower limit of belt-broken detecting freq.	Setting range: 0.00Hz~F0.08

When the frequency is lower than the setting of F2.27, belt-broken detection is disabled.

F2.28 Belt-broken detection time	Setting range: 0.00~99.99s
F2.29 Belt-broken detection error	Setting range: 0.0%~100.0%

If the changing range of reel diameter calculated via line seed exceed the setting of F2.29 and the lasting time exceeds the setting of F2.28, the belt broken function is enabled.

F2.30 Present length	Setting range: 0~30000m

F2.30 is used to store the calculated length.

4.4 Vector Control Function

F3.06 tension control selection	Setting range: 0, 1, 2, 3

0: Disabled

Do not select tension control and the drive is used as a general purpose drive.

1: Close loop tension control mode1

Speed mode, tension adjustment

2: Close loop tension control mode2

Torque Mode, tension adjustment

3: Open loop tension control

Torque Mode, no tension adjustment

F3.07 motoring torque selection	Setting range:0, 1, 2, 3 (it is used to limit the torque current output by speed regulator)

0: digital limiting

Motoring torque is limited by the setting of F3.08.

1: AI1 limiting

2: AI2 limiting

3: AI3 limiting

If the torque limit is set via analog value, the maximum analog value corresponds to the 200% of drive's rated current.

F3.08 digital limiting of motoring torque	Setting range: 0.0~200% (drive's rated current)

Torque limit of 0.0 ～200% is the percentage value of the drive's rated current; If the torque limit is 100%, then the torque current limit is the drive' s rated current.

F3.09 Braking torque selection	Setting range: 0, 1, 2, 3 (it is used to limit the torque current output by speed regulator)

0: Digital limiting

Braking torque is limited by the setting of F3.10.

1: AI1 limiting

2: AI2 limiting

3: AI3 limiting

If the torque limit is set via analog value, the maximum analog value corresponds to the 200% of drive's rated current.

F3.10 digital limiting of braking torque	Setting range: 0.0~200% (drive's rated current)

Torque limit of 0.0 ～200% is the percentage value of the drive's rated current; If the torque limit is 100%, then the torque current limit is the drive' s rated current.

Motoring torque limit and braking torque limit restrict the output torque in motoring status and braking status respectively, as shown in the Fig. below:

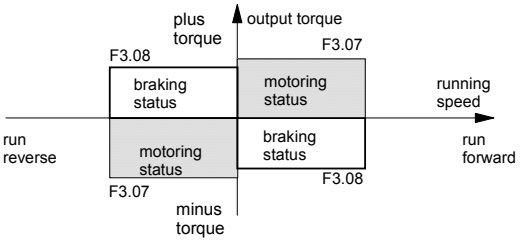


Fig. 4-2 Torque limiting function

F3.11 Switching torque	Setting range: 0~100%

When the tension control mode is close loop tension control mode 2 or open loop tension control mode, the drive first operates in speed mode (F3.06 is set to 0), and then judges the torque. When the output torque exceeds the setting of F3.11, the drive switches to tension control mode.

Switching torque is defined as the percentage of initial torque command. If it is set to 0, then the drive starts in tension control mode.

🕮 Warning

Pay attention to the safety when switching between speed control and torque control.

F3.12 Torque changing time	Setting range: 0.0~120.0s

When the torque changes from 0 to 100% motor' s rated torque, or changes from 100%motor' s rated torque to 0, F3.12 is used to limit the changing rate of output torque when the drive operates in torque mode(F3.06 is set to 2 or 3).

4.5 Digital Input/Output Terminal

F5.01 Function of terminal X1	Setting range: 0~28
F5.02 Function of terminal X2	Setting range: 0~28
F5.03 Function of terminal X3	Setting range: 0~28
F5.04 Function of terminal X4	Setting range: 0~28
F5.05 Function of terminal X5	Setting range: 0~28
F5.06 Function of terminal X6	Setting range: 0~28
F5.07 Function of terminal X7	Setting range: 0~28
F5.08 Function of terminal X8	Setting range: 0~28

Table 4-1 Functions of multi-function input terminals

Settings	Functions	Settings	Functions
0	No function(can be selected repeatedly)	15	Acc/Dec disabling command
1	Pre-driving signal input	16	3-wire control mode(used in conjunction with FWD/REV)
2	Memorized torque signal input	17	Normall open contacts input for external stopping signal(no alarm at stopping, recoverable)
3	Memorized torque enabling signal	18	Normall closed contacts input terminal for external stopping signal(no alarm at stopping, recoverable)
4	tension control enabling signal	19	Pre-exciting command at start
5	PID stopping signal input	20	DC injection braking signal input at stop
6	External fault normally open input	21	Command of changing reeling mode
7	External fault normally closed input	22	counter's clearing signal input
8	External reset signal input (RESET)	23	counter's triggering signal input
9	Forward jog signal input (JOGF)	24	tension direction switching terminal
10	Reverse jog signal input (JOGR)	25	Switching between panel control and terminal control
11	Coast-to-stop (FRS)	26	Reserved
12	Reel diameter reset 1 command	27	Terminal used to temporarily stopping the calculation of reel diameter
13	Reel diameter reset 2 command	28	Terminal for reseting the length

Settings	Functions	Settings	Functions
14	Reel diameter reset 3 command		

1: Pre-driving signal input

After tension control function is selected, the drive operates in pre-dring status when the pre-driving terminal is ON.

2: Memorized torque signal input

After tension control function is selected, the drive memorizes the present output torque when the torque memorizing terminal is ON.

3: Memorized torque enabling signal

After tension control function is selected, when the memorized torque enabling terminal is ON, the drive is switched to torque mode, and the reference torque is the memorized torque.

4: tension control enabling signal

After tension control function is selected, tension control enabling signal input terminal is used to select speed control or tension control. When the tension control enabling signal input terminal is ON, tension control function is disabled and the drive is used as a general purpose drive (F3.06 is set to 0). When the tension control enabling signal input terminal is OFF, the drive operates in tension control mode. When F3.06 is set to 2 or 3, torque switching should be judged, if this function terminal is not set, then it is set to OFF defaultly, that is tension control is enabled all the time.

5: PID stopping signal input

When the terminal is ON, PID regulation is stopped and its output maintains constant.

12, 13 and 14: Reel diameter reset instruction

It is used to reset the reel diameter. When the terminal is ON, the reel diamter is reset to its initial value. Three reel diameter resetting terminals correspond to three different initial reel diameters set by F8.12, F8.13 and F8.14 respectively.

21: Reeling mode switching command

It is used to switch the reeling mode and used in conjunction with F8.00. When the terminal is OFF, the present reeling mode is maintained, when the terminal is ON, the reeling mode is changed to another mode.

Table 4-2 Reeling mode switching command

F8.00	Terminal status	Actual reeling mode
0	ON	reeling out mode
0	OFF	reeling in mode
1	ON	reeling in mode
1	OFF	reeling out mode

24: tension direction switching

It' s used to switch the output torque and is used in conjunction with F8.17. When the terminal is OFF, the output torque setting direction is maintained, and when the terminal is ON, the output torque is reverse.

Table 4-3 Torque direction switching

F8.15	Terminal status	Direction of drive' s output torque
0	ON	reverse
0	OFF	forward
1	ON	forward
1	OFF	reverse

27: terminal used for stopping the reel diameter calculation

When this terminal is ON, the calculation of reel diameter is stopped and maintained at the present value.

28: Length reset terminal

When this terminal is ON, at this time the setting of F2.30 is reset to 0.

F5.09 Function selection of open collector output terminal Y1	Setting range:0~20
F5.10 Function selection of open collector output terminal Y2	Setting range:0~20
F5.11 Function selection of programmable relay output PA/PB/PC	Setting range:0~20

Table 4-4 Open collector output and relay output functional table

Setting	Functions	Setting	Functions
0	drive ready for operation(READY)	11	Stopping due to external fault
1	Drive running signal 1 (RUN1)	12	Pre-alarm for motor overload
2	Drive running signal 2 (RUN2)	13	Torque limiting
3	Drive running at zero speed	14	Reel diameter reaches the maximum reel diameter
4	Freq./speed arriving signal	15	Reel diameter reaches the hollow reel diameter
5	Freq./ speed conformance signal	16	Reel diameter reaches the preset reel diameter
6	Preset counter arriving signal	17	reserved
7	Specified counter arriving signal	18	Length arriving
8	reserved	19	output signal of belt-broken detection
9	Locking in under-voltage status(P.OFF)	20	Protection at stall
10	Pre-alarm of drive overload		

14: Reel diameter reaches the maximum reel diameter

When reeling in, the reel diameter reaches the maximum reel diameter, and the output terminal outputs a signal.

15: Reel diameter reaches the hollow reel diameter

When reeling out, the reel diameter reaches the hollow reel diameter, and the output terminal outputs a signal.

16: Reel diameter reaches the preset value

When reeling in, if the reel diameter exceeds the preset reel diameter, the output terminal will output a signal; when reeling out, if the reel diameter is smaller than the preset reel diameter, the output terminal will also output a signal.

18: The calculated length arrives the preset length

When the calculated length exceeds the preset length (F2.24), the output terminal will output a signal.

19: output signal of belt-broken detection

When the belt broken detection module detects there is a belt broken, the output terminal outputs a signal.

4.6 Analog Input/Output Terminals

F6.03 Time constant of AI1 filter	Setting range:0.01~5.000s
F6.04 Time constant of AI2 filter	Setting range:0.01~5.000s
F6.05 Time constant of AI3 filter	Setting range:0.01~5.000s

Filtering time constant of analog input is defined and the constant is used to reduce the disturbance of analog input signal.

F6.06 Function of A01 multi-function analog output terminal	Setting range:0~13
F6.07 Function of A02 multi-function analog output terminal	Setting range:0~13

Two analog output terminals of AO1 and AO2 can output 0～20mA current signal.

The drive' s status signal represented by analog output signal can be set by F6.08 and F6.09, as shown in the table below.

Table 4-5 Function of analog output terminals

Setting of F6.08/F6.09	Drive' s status	Explanations
0	running freq./speed	0 ～Maximum running freq., corresponding to 0 ～ 20mA analog output.
1	setting freq./speed	0 ～Maximum frequency setting, corresponding to 0 ～ 20mA analog output.
2	ASR speed error	Error: －50% ～＋50% maximum frequency, corresponding to 0～20mA analog output.
3	Output current	0 ～2×rated current, corresponding to 0 ～20mA analog output.
4	Current of torque command	－200% ～＋200% rated torque current, corresponding to 0 ～20mA analog output.
5	Estimated torque current	－200% ～＋200% rated torque current, corresponding to 0 ～20mA analog output.
6	Output voltage	0 ～1.2×Maximum rated voltage, corresponding to 0～20mA analog output.
7	Feedback flux current	0 ～100% rated flux current, corresponding to 0 ～ 20mA analog output.
8	AI1 setting input	AI1 Analog value input range, corresponding to 0 ～ 20mA analog output.
9	AI2 setting input	AI2 Analog value input range, corresponding to 0 ～ 20mA analog output.
10	AI3 setting input	AI3 Analog value input range, corresponding to 0 ～ 20mA analog output.
11	Reel diameter	0 ～Maximum reel diameter, corresponding to 0～

Setting of F6.08/F6.09	Drive’ s status	Explanations
		20mA analog output.
12	tension	0 ～Maximum tension, corresponding to 0～20mA analog output.
13	Line speed	0~Highest line speed, corresponding to 0~20mA analog output.

4.7 PID Functions

F7.00 Selection of reference input channel	Setting range:0、1、2、3

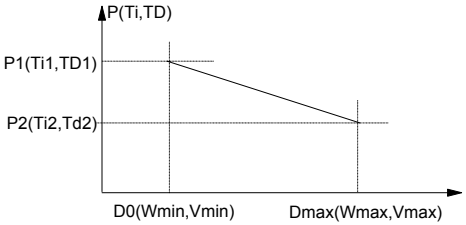
0: digital setting via panel

1: AI1 setting

2: AI2 setting

3: AI3 setting

This parameter is used to define the input mode of PID command. Example: When tension control mode selects close loop tension control, that is, when F3.06 is set to 1 or 2, the instruction of PID is the voltage corresponding to the tension setting. 0~Maximum tension corresponds to 0~10V.



F7.01 digital setting of reference	Setting range:0.00~10.00V
F7.02 Selection of feedback input channel	Setting range:0、1、2、3

0: AI1 setting 1: AI2 setting 2: AI3 setting 3: Line speed feedback

Selecting line-speed feedback means the voltage value corresponding to the line speed detected by the line speed detection module. 0~Highest line speed corresponds to 0~10V.

F7.03 proportional gain P1	Setting range:0.0~999.9%

F7.04 integration timeTi1	Setting range:0.0(no integration)~99.99s
F7.05 integration time Td1	Setting range:0.0(no differential)~99.99s
F7.06 proportional gain P2	Setting range:0.0~999.9%
F7.07 integration time Ti2	Setting range:0.0(no integration)~99.99s
F7.08 integration time Td2	Setting range:0.0(no differential)~99.99s
F7.09 sampling cycle T	Setting range:0.00(do not select sampling cycle)~99.99s

F7.10 PID parameter adjustment	Setting range:0、1、2

0: Reel diameter

1: Frequency

2: Line speed

PID parameters can be selected between 2 sets of parameters selected by F7.10.

4.8 Tension Control Function 1

F8.00 Reeling mode	Setting range:0、1

0: reeling in mode

1: reeling out mode

Reeling mode should be set correctly.

F8.01 Methods of setting tension	Setting range: 0, 1, 2, 3, 4

0: digital setting. The tension is set by F8.02.

1: AI1 setting.

2: AI2 setting.

3: AI3 setting.

When the tension is set in analog value, the maximum analog value corresponds to the setting of F8.03, please refer to " Analog Input/Output Termianl" in TD3000 User Manual.

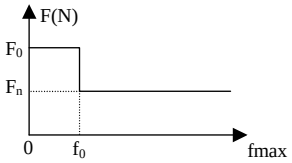
4: digital setting, changed by UP and DOWN keys on the panel.

The tension is set by F8.02, and the setting can be changed by UP and DOWN keys on the panel.

F8.02 Digital setting of tension	Setting range: 0~30000N
F8.03 Maximum tension	Setting range: 0~30000N

F8.04 Methods of setting tension at zero speed	Setting range: 0, 1, 2, 3, 4
F8.05 Tension at zero speed	Setting range: 0.0~30000N

Zero-speed tension F_0 is the sum of stiction and operation tention Fn. It applies to frequency ranging from 0 to 1.5%fmax.



0: digital setting, set by F8.05

1: AI1 setting 2: AI2 setting 3: AI3 setting

4: No special setting. (It means the zero-speed tension is the same with operation tention, i.e. the stiction is ignored.)

When set in analog value, the maximum value corresponds to F8.03 (Maximum tension).

F8.06 Selection of conicity of tension	Setting range: 0、1、2、3

0: digital setting, set by F8.07

1: AI1 setting 2: AI2 setting 3: AI3 setting

When it is set in analog value, the maximum conicity of tension is 100%.

F8.07 Conicity of tension	Setting range: 0~100%

In common reeling process, the tension should be reduced with the increase of reel diameter, so as to prevent damaging the reel and improve the reeling effects. It can be calculated by the formula below:

$F=F_0\times[1-K\ (1-D_0/D)\ ]$

Where:

F: actual tension output

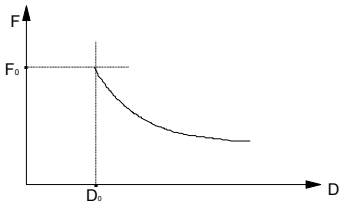
F_0: reference tension

K: conicity of tension（setting method decided by F8.06）

D_0: empty reel diameter （set by F8.10）

D: actual reel diameter

Look at the curve below:



F8.08 Sources of reel diameter	Setting range: 0、1、2、3、4

0: No calculating

1: Calculate via line speed

The reel diameter is calculated via line speed and angular velocity, the line speed can be selected by FC.00.

1: AI1 setting

2: AI2 setting

3: AI3 setting

When the reel diameter is set in analog value, the maximum value corresponds to the setting of F8.09 (Maximum reel diameter).

4: Thickness integration method

Calculate the reel diameter via thickness of belt and the number of revolvutions of reel. See parameters FC for thickness of belt and the calculating method of number of revolutions of reel.

F8.09 Maximum reel diameter	Setting range: 0~9999mm

F8.10 Empty reel diameter	Setting range: 0~9999mm

Empty reel diameter is the axis diameter of the reel. The reel diameter is calculated based on F8.10 and F8.09.

F8.11 Initial reel diameter	Setting range: 0, 1, 2, 3

0: digital setting. Initial reel diameter is set by F8.12.

1: AI1 setting

2: AI2 setting

3: AI3 setting

When the initial reel diameter is set in analog value, the maximum analog value corresponds to the setting of F8.09 (Maximum reel diameter).

F8.12 Digital setting 1 of initial reel diameter	Setting range: 0~9999mm
8.13 Digital setting 2 of initial reel diameter	Setting range: 0~9999mm
8.14 Digital setting 3 of initial reel diameter	Setting range: 0~9999mm

When setting the initial reel diameter in digital mode(digital setting), three reel diameter resetting terminals are reset to three initial reel diameters respectively.

F8.15 Reel diameter arriving	Setting range: 0~9999mm

If you have defined a " reel diameter arriving" terminal, i.e. set any of F5.09~F5.11 at " 16" , when the reel diameter reaches F8.15, the corresponding terminal will be activated.

F8.16 Present reel diameter	Setting range: 0~9999mm

Actual calculated reel diameter and reel diameter storage unit can be modified at stop. The initial reel diameter can be input before the drive starts so you need not reset it.

F8.17 Setting of tension' s direction	Setting range: 0、1

In tension control, F8.17 sets the direction of output torque. The direction can also be changed by changing the wire connections of any two phases.

4.9 Tension Control Function 2

FC.00 Selection of line speed input	Setting range: 0、1、2、3、4、5

0: digital setting, line speed is set by FC.01.

1: AI1 setting

2: AI2 setting

3: AI3 setting

4: X8 pulse input

5: Communication input

Note：1） The simplest way for analog input is to take the output frequency of up-level drive (e.g. TD3000), whose output frequency is in direct proportion to line speed, as line speed input. The max. output corresponds to FC.03 (max. line speed). But if the system is only to reel in/reel out, you should choose pulse or analog sampling, because the output frequency is not in direct proportion to the line speed.

2） Pulse: The line speed can be acquired from speed measurement encoder. Pulse signals can be detected by terminal X8. You must set FC.02 which is the number of pulses from encoder for every meter of belt passed.

3） Communication: The line speed signal is input from RS485, the main reference word in the protocol is processed as line speed. It' s range is 0~2000H（0~8192), corresponding to 0~max. line speed (FC.03). The final setting is modulated by F0.06.

FC.01 Digital setting of line speed	Setting range: 0~3000.0m/min

FC.02 Number of pulses per meter	Setting range: 0~3000.0

At FC.00=4, the number of pulses per meter is set to calculate the line speed.

FC.03 Highest line speed	Setting range: 0~3000.0m/min

FC.03 set the line speed corresponding to the full input analog value.

FC.04 Lowest line speed	Setting range: 0~3000.0m/min

When the detected line speed is lower than that set in FC.04, the drive stops calculating the reel diameter and maintain the present reel diameter.

FC.05 Time constant of filter of reel diameter	Setting range: 0.01~9.999

FC.05 is used to set the time constant of filter of reel diameter to reduce the disturbance of reel diameter.

FC.06 Thickness of each layer	Setting range: 0.00~99.99mm

FC.06 defines the thickness of belt, and the thickness can be used to calculate the reel diameter that is calculated in thickness integration methods.

FC.07 Number of revolutions for each layer	Setting range: 1~9999

As to the string, FC.07 is used to set the number of revolutions for one layer, and the setting can be used to calculate the reel diameter that is calculated in reel diameter integration methods.

FC.08 Methods of counting revolutions	Setting range: 0、1

0: Pulse of terminal X8 is used to count the revolutions

When using the pulse of terminal X8 to count the number of revolutions, the reel revovles one time if one pulse is detected.

1: PG pulse is used to count the number of revolutions

If a PG is installed on a motor, the number of revolutions can be calculated automatically according to the pulse signal of PG.

FC.09 Breakaway torque compensation	Setting range: 0.~100%

The setting of " 100%" corresponds to the rated torque of motor. The parameter is set to overcome the stiction torque when the motor starts. After the motor has start, the stiction torque compensation is invalid.

FC.10 Sliding friction torque compensation	Setting range: 0~100%

100% corresponds to the rated torque of motor. The parameter is set to overcome the friction torque when the system operates.

After the system inertia identification module starts operation, the module will store the compensation coefficient of friction torque in FC.09 and FC.10 automatically.

FC.11 Compensation coefficient for belt/string inertia	Setting range: 0~30000

When F3.06=2, 3, the drive work at torque mode. Duing acceleration and deceleration, the system needs extra torque to conteract system' s moment of inertia. Otherwise, the tention will be insufficient during acceleration and surplus during deceleration when reeling in, and vise versa during reeling out.

The moment of inertia for this system can be devided into belt/string inertia and system inertia (FC.12).

FC.11 is set as: density of belt/string (kg/m^3)×length of reel(m).

FC.12 System inertia compensation coefficient	Setting range:0.00~300.00

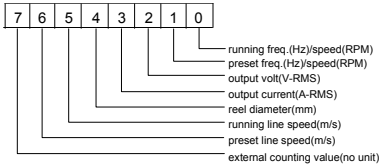
FC.12 is used to conteract the additional torque occurred during acceleration or deceleration. After the system-inertia identification is started, the coefficient will be stored in FC.12 automatically. It can also be adjusted manually.

4.10 Display and Checking Function

Fd.00 Operating parameters 1 displayed by LED	Setting range:1~255

Fd.00 can select 8 kinds of drive' s basic operating parameters. Whether to display the parameter is controlled by one bit of the 8-bit binary code: " 1" means to display the parameter, and " 0" means do not display the this parameter.

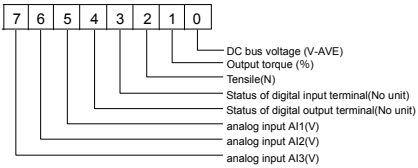
For example, bit0 decides whether to display the operating frequency or not. At bit0=0, LED will not display the parameter, at bit0=1, LED will display the parameter. The parameters to be displayed Fd.00, and their relationships to the bits of the binary code are shown below.



Fd.01 Operating parameters 2 displayed by LED	Setting range:0~255

Fd.00 can select 8 kinds of drive' s basic operating parameters. Whether to display the parameter is controlled by one bit of the 8-bit binary code: " 1" means to display the parameter, and " 0" means do not display the this parameter.

The parameters to be displayed Fd.00, and their relationships to the bits of the binary code are shown below.



Chapter 5 Troubleshooting

5.1 Fault Alarm and Troubleshooting

When the drive is abnormal, protection function acts:LED displays fault code, LCD displays fault name, fault output relay acts, the drive stops output and the motor coasts to stop (the action when fault alarm occurs is decided by enhanced function).

TD3000 series drive's fault contents and troubleshooting is shown in Table 7-1, fault codes' display range is E001～E028.

After fault alarm occurs, fault phenomenon should be recorded in detail, the fault should be processed according to Table7-1.

Table 5-1 Alarms and Troubleshooting

Fault code	Type of faults	Possible fault reasons	Troubleshooting
E001	Acc overcurrent	1)Acc time including the tuning process is too short. 2)V/F curve or torque boost setup is not suitable. 3)Restart the motor in running when momentary stop occurs. 4)drive capacity is too low 5)PG fault or PG cable broken in Acc process	1)Adjust Acc time 2) Adjust V/F curve or torque boost 3)Set up start mode as speed tracking restart 4) Select drive with proper capacity 5) Check the PG and its wire connection
E002	Drive Dec over current	1)Dec time is too short. 2)Potential load or load inertia is too big 3) Inadequate Drive‘ s power 4) PG fault or PG cable broken in Dec process	1)Please prolong Dec time 2) Add suitable braking device 3) Adjust utility rate 4) Select drive with proper capacity 5) Check the PG and its wire connection

Fault code	Type of faults	Possible fault reasons	Troubleshooting
E003	Overcurrent at constant speed running	1) Acc time is short. 2) V/F curve is not suitable. 3) Restart the motor in running when momentary stop occurs. 4) PG cable broken in close loop vector high speed running process 5) Too heavy load	1) Check input power supply 2) Check whether input phase loss occurs 3 Select drive with proper capacity 4) Set up start mode as speed tracking restart 5) Check the PG and its wire connection 6) Check the load or replace the drive with the one with higher capacity
E004	Acc over voltage	1) Input voltage abnormal(including the tuning process) 2) In vector control mode, Speed regulator's parameters aren't correct 3) Start the spinning motor (without speed tracking)	1) Check inputpower supply 2) Adjust Speed regulator's parameters, 3) Please refer F3 Parameter group description. 3) Set up start mode as speed tracking restart
E005	Dec overvoltage	1) Dec time is too short(including the tuning process) 2) Load inertia is too big 3) Input voltage abnormal	1) Adjust Dec time 2) Connect external braking resistor or braking unit 3) Check inputpower supply
E006	Overvoltage at constant speed running	1) Abnormal change of input voltage 2) Inproper parameters of PI regulator	1) Mount input reactor 2) Adjust the parameters of PI regulator, Please refer to F3 Parameter group description.
E007	Overvoltage of control power supply	Abnormal input voltage	Check input voltage Ask for service
E008	Phase missing at input side	Phase missing of input R.S.T	1) Check input wiring 2) Check input voltage
E009	Phase missing at output side	1) Phase missing output of U.V.W(or three phase load are highly unsymmetric) 2) Drive or motor's cables broken, or too long preexciting time	Check drive's output wiring(or whether the load is symmetric)

Fault code	Type of faults	Possible fault reasons	Troubleshooting
E010	IPM fault	1) Instantaneous overcurrent inside drive 2) Short circuits in output 3 phases or earthing 3) Blocked air duct or damaged fan 4) Internal short circuit of bridge in IPM	1) Refer to overcurrent solutions 2)Re-wiring 3) Clear air duct or replace fan 4) Ask for service
E011	Overheat of IPM heatsink	1)Too high ambient temperature 2)Blocked air duct 3)Damaged fan 4)Abnormal temperature detection circuit	1)Lower the ambient temperature 2) Clear air duct 3) Replace fan 4) Ask for service
E012	Overheat of rectifier bridge heatsink	1) Too high ambient temperature 2) Blocked air duct 3) Damaged fan 4)Abnormal temperature detection circuit	1)Lower the ambient temperature 2) Clear air duct 3) Replace fan
E013	Drive overload	1) Too short Acc time 2) V/F curve is not suitable 3) Restart the motor in running after momemtary stop 4) Very low mains voltage 5)Heavy load 6)PG reverse in close loop vector control running state	1) Prolong Acc time 2) Adjust V/F curve 3) Set start mode as speed tracing start 4) Check mains voltage 5) Select a drive of higher capacity 6) Adjust the PG wiring or functions setup
E014	Motor overload	1) V/F curve is not suitable 2) Very low mains voltage 3)General motor runs with heavy load at low speed for long term. 4)Wrong setting of motor overload protection factor 5)Motor choked or sudden change of load 6)PG reverse in close loop vector control running state	1) Adjust V/F curve 2) Check mains voltage 3) Select special motors for long term low speed running 4) Setup motor overload protection factor right 5) Check load 6) Adjust the PG wiring or functions setup
E015	Peripheral fault	Close of external fault terminals	Check the reason
E016	E^2PROM read or write fault	1)Fault occurs in the read-write of control parameters 2) Bad E^2PROM	1) Press STOP/RESET to reset 2) Ask for service

Fault code	Type of faults	Possible fault reasons	Troubleshooting
E017	communication fault	1) Wrong baud rate setup 2) Communication fault in serial communication channel interference 3) Communication time is too long	1) Adjust the baud rate 2) Check the communication cables, whether they are connected well 3) Retry
E018	Contactor not activated	1) Very low mains voltage 2) Damaged contactor 3) Damaged soft start Resistor 4) Damaged control loop	1) Check mains voltage 2) Replace contactor of main loop or ask for service 3) Change the resistor and ask for service 4) Ask for service
E019	Current detecting circuit fault	1) Loose wiring or terminal connections 2) Damaged auxiliary power source 3) Damaged Hall component 4) Abnormal amplifier circuit or current detecting device	Ask for service
E020	CPU fault	1) Severe interference or double DSP communication error	1) Press STOP/RESET to reset; 2) Ask for service
E021	Analog close loop feedback cable broken error	In PID running mode, when the analog feedback channel is selected as 4 or 5, the feedback input signal cable is broken or is lower than 1V/2mA	1) Check wiring and re-wire again 2) Adjust the feedback signal input type
E022	External analog voltage/current input signal cable broken fault	1) When select analog input mode(or PID close loop input) by F0.03, the analog input channel is selected as 4 or 5, the analog input signal cable is broken or is lower than 1V/2mA 2) When selecting torque control mode and the analog torque input channel is selected as 4 or 5, the analog input signal cable is broken or is lower than 1V/2mA	1) Check wiring and re-wire again 2) Adjust the feedback signal input type
E023	Keyboard E^2PROM error	1) Read/write error of keyboard control parameters 2) E^2PROM is damaged	1) Reset by pressing STOP/RESET key, ask for services 2) Ask for services

Fault code	Type of faults	Possible fault reasons	Troubleshooting
E024	tuning error	1) Improper setting of motor rated parameters 2) Significant deviation of parameters obtained after tuning comparing with the standard parameters 3) Tuning time out	1) Set the rated parameters according to the motor's nameplate 2) Check whether the motor is connected with the load 3) Check motor connection and parameter setting
E025	Encoder error	1) When vector control with speed sensor is used, the PG signal line is broken 2) When vector control with speed sensor is used, the PG signal line connection is reversed	1) Check encoder connection, make the new connection 2) Check encoder connection, adjust connection, or adjust the PG direction
E026	drive is cut from load	1) In vector control mode, the load disappears or is reduced 2) Relevant functions about load missing aren't setup correctly	1) Check the load 2) Setup proper load missing protection parameters
E027	Brake unit fault	Brake circuit fault	Ask for services
E028	Parameters setup error	1) Motor's rated parameters are not setup correctly, the setup parameters exceed the limit value of rated motor's parameters 2) The drive doesn't match the motor with rated capacity 3) Set up PG close loop PID (F7.00=2) at the same time the vector control mode is also setup	1) Set up the motor's parameters correctly 2) Select the drive which matches the motor 3) Run PG close loop PID, set up V/F control mode
E029	Belt/string broken	Belt/string broken detected	Connect the broken belt/string, or replace with new reel. Reset.

5.2 Alarm Reset

When faults start locking function is selected, if the fault hasn't been reset before power off, then the fault will be displayed after re-powering again.

When keyboard control mode is selected, the reset function of the keyboard is also active and the reset function of host is not active.

When terminal control mode is selected, the reset function of the keyboard can be selected by FA.02 function code and the reset function of host is not active.

When host control mode is selected, the reset function of the keyboard can be selected by FA.02 function code and the reset function of host is active.

When the input terminal function is setup as 8, the terminal reset function is valid.

Chapter 6 Applications

6.1 Close Loop Tension Control (Speed Mode)-- Application in Copper Wire Drawbench

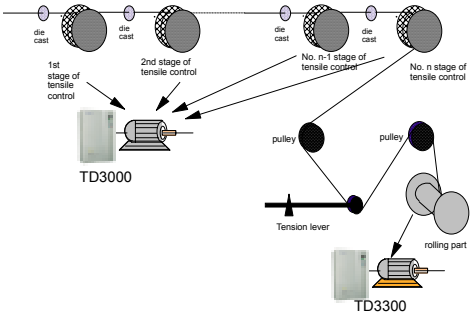


Fig. 6-1 Structure Of Drawbench

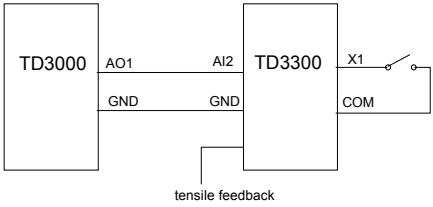


Fig. 6-2 Control Diagram

The pulling section is drived by a TD3000 general purpose drive that operates in open loop vector control mode. A external potentialmeter is used to adjust the frequency setting. AO1 can be set as analog operation frequency output. 0~20mA corresponds to 0~Maximum frequency. The driving section controls the system' s operation speed.

The reeling in part is controlled by a TD3300 drive that is in close-loop tension control mode1, and the reel diameter is calculated via the line speed. The line speed signal is input via AI2. The highest line speed is set to the line speed corresponding to the maximum operation frequency of TD3300. Slip occurs in drawing process due

to mechanical reasons, so the highest line speed should be lower than that calculated via mechanical theory. tension feedback signal is detected by the tension sensor, and input via AI3. A suitable lowest line speed parameter should be set. Multi-function terminal X1 can be set as the reel diameter reset function and the reel diameter should be reset when changing the reel.

Parameter Setting

Parameter	Description	Setting	Remark
F0.02	Control mode	0	Depend on your system
F1.00	Gearing ratio	As per actual conditions	Important
F1.01-F1.16	Moter parameters	Moter parameters	Usually by tuning automatically
F3.00-F3.05	ASR	Same as TD3000	
F3.06	Tension control selection	1	Important
F3.07-F3.10	Torque limit	As per actual conditions	
F3.11	Switching torque	As per actual conditions	Considering impact to the system
F3.12	Torque changing time	As per actual conditions	Considering impact to the system
F7.02	Feedback select	1	AI2 effective, consistent with actual conditions
F7.03-F7.11	PID control	As per actual conditions	Tune carefully
F7.12	Upper limit clamping	As per actual conditions	Add to sync speed, for high speed control
F7.13	Lower limit clamping	As per actual conditions	Subcontract by sync speed, for low speed control
F8.00	Reeling mode	0	Reeling in
F8.01	Methods of setting tension	0	Digital setting, consistent with actual conditions
F8.02	Digital setting of tension	As per actual conditions	F8.00 valid, must less than F8.03
F8.03	Max. tension	As per actual conditions	Associated with the setting of potentiometer
F8.04-F8.05	Tension at zero	As per actual	As per actual

Parameter	Description	Setting	Remark
	speed	conditions	conditions
F8.06-F8.07	Conicity of tension	As per actual conditions	Typical value: 50%
F8.08	Sorce of reel diameter	1	Important
F8.09	Max. reel diameter	**	Calulated value
F8.10	Empty reel diameter	**	Calulated value, min. reel diameter
F8.11-F8.14	Initial reel diameter	**	Upon reel installed, important
F8.15	Reel diameter arriving	**	Important for fixed length control
F8.16	Present reel diameter	**	Automatic refresh, modifiable manually
F8.17	Setting of tension direction	0	Important
FC.00-FC.04	Line speed input select	As per actual conditions	Important
FC.05	Time constant of filter of reel diameter	As per actual conditions	For occasions of severe interference
FC.06	Thickness of belt	As per actual conditions	When choosing thickness integration method
FC.07	Number of revolutions for each layer	As per actual conditions	

6.2 Open Loop Tension Control --Application in Spliting Machine

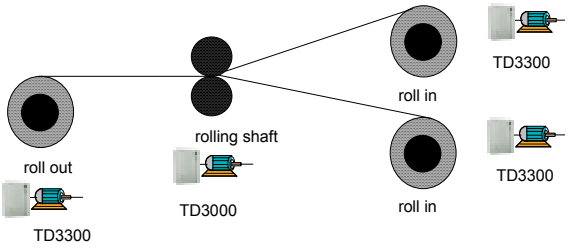


Fig. 6-3 Diagram of Spliting Machine

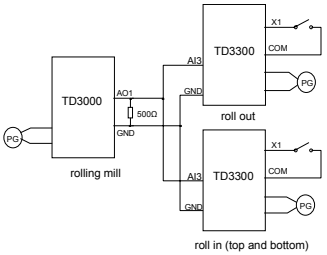


Fig. 6-4 Control Diagram

TD3000 drives the rolling mill and control the operating speed of the whole system. AO1 is set to analog output of operating frequency. 0~20mA corresponds to 0~Maximum frequency, and the signal is converted into a 0~10V signal via a series connected 500 ohm resistor. The reeling out motor and the upper and lower reeling in motors are all controlled by TD3300 drives that operate in open loop control mode. The reel diameter is calculated via line speed that is obtained via the output of AO1 of the drive that controls the rolling mill. A suitable lowest line speed parameter should be set and terminal X1 should be set to be enabled with resetting function. Thus the reel diameter can be reset when changing the reel. Good control effects can be obtained by setting a proper compensation coefficient. The reel diameter can be calculated via thickness integration method and the signal of calculating the number of revolutions can be fedback via PG.

Parameter Setting

Parameter	Description	Setting	Remark
F0.02	Control method	1	
F0.05	Control mode	As per actual	

Parameter	Description	Setting	Remark
	select	conditions	
F0.07--F0.08	Max freq.	As per actual conditions	
F0.10-F0.11	Acc/Dec time	As per actual conditions	Generally <2S
F1.00	Gearing ratio	As per actual conditions	Important
F1.08	Motor pre-excitation	0	
F1.01-F1.16	Motor parameters	Motor parameters	Usually by tuning
F2.05	Drive start delay time	As per actual conditions	Usually not set
F3.00-F3.05	ASR	Same as TD3000	
F3.06	Tension control mode select	3	Important
F3.07-F3.10	Torque limit	As per actual conditions	
F5.01	X1 function	12	Reel diameter reset
F6.02	AI3 voltage input select	0	
F8.00	Reeling mode	0	Reeling in
F8.01	Tension setting select	0	Digital setting
F8.02	Digital setting of tension	As per actual conditions	F8.00 effective
F8.04-F8.05	Tension at zero-speed	As per actual conditions	As per actual conditions
F8.06-F8.07	Conicity of tention	As per actual conditions	Typical value: 50%
F8.08	Source of reel diameter	1	consistent with reel diameter calculation
F8.09	Max. Reel diameter	As per actual conditions	
F8.10	Empty reel diameter	As per actual conditions	
F8.11-F8.14	Initial reel diameter	As per actual conditions	Upon reel installed important
F8.15	Reel diameter arriving	As per actual conditions	Important for fixed length control
F8.16	Present reel	**	Automatic refresh,

Parameter	Description	Setting	Remark
	diameter		modifiable manually
F8.17	Direction of tension	As per actual conditions	Important
FB group	Set according to PG		
FC.00	Source of line speed	3	Important
FC.03	Max line speed	As per actual conditions	
FC.04	Min line speed	As per actual conditions	

Emerson Network Power Co. Ltd.

Maintenance Record

Customer’s Company:	
Address:	
Post code:	Contact person:
Tel:	Fax:
SN:	
Power:	Model:
Contract No.:	Date of purchase:
Service provider:	
Contact person:	Tel:
Servicing person:	Tel:
Date of servicing:	
Customer’s opinion about the service: ☐Excellent ☐Satisfactory ☐ Acceptable ☐ Unsatisfactory Other comments: Signature： DD MM YYYY	
Customer Service Center Visit Record： ☐by phone call ☐by questionnaire Others: Signature: DD MM YYYY	

Note: The form becomes invalid if the customer cannot be revisited.

Warranty Agreement

1. The scope of warranty is confined to the drive only.
2. Warranty period is 18 months, ENP conducts free maintenance and repair services to the drive that has fault or damage under the normal operation conditions.
3. The warranty period starts from the date the product is delivered, and the user, distributor and the manufacturer should negotiate under special conditions.
4. Even within 18 months, maintenance should also be charged in case of the following situations:

■ Damages incurred to the drive due to mis-operations which are not in compliance with the User Manual;

■ Damages to the drive due to fire, flood, abnormal voltage, etc;

■ Damages incurred to the drive due to the improper use of drive functions.

5.The service fee will be charged according to the actual costs. If there are any maintenance contracts, priority will be put to the contract.
6.Please keep this paper and show this paper to the maintenance unit when the product needs to be repaired.
7. If you have any other question, please contact the distributor or ENPC directly.

ENP Services China
Emerson Network Power Co., Ltd.

Address: NO.6 Keyuan Road, 3F.SSIP Building. Shenzhen Science & Industry Park, Nanshan District, 518057, Shenzhen, PRC

Customer Service Hotline: 800-820-6510, (86) 21-23017141, (86) 755-86010800

To Customers：

Thank you for choosing our products.

We are ever trying to improve the product’ s quality and provide you with better service. We need your help to point out the problems. Could you please fill in the form after the product has been operated for 1 month, and then mail or fax the form to the Customer Service Center of Emerson Network Power Co. Ltd? We will send you an exquisite souvenir upon receiving the completed Product Quality Feedback Form. Your efforts are much appreciated! Furthermore, if you can give us some advices on improving the product and service quality, you will be given a special award**.** Thank you very much!

Emerson Network Power Co., Ltd.

Product Quality Feedback Form

Customer name		Tel	
Address		Zip code	
Model		Date of use	
Machine SN			
Appearance or			
Performance			
Package			
Material			
Quality problem during			
Suggestion about improvement			

Address: NO.6 Keyuan Road, 3F.SSIP Building. Shenzhen Science & Industry Park, Nanshan District, 518057, Shenzhen, PRC Tel: (86)755-86010800