ALTEC®

TENSION CONTROLLER
TC808

INSTRUCTION MANUAL

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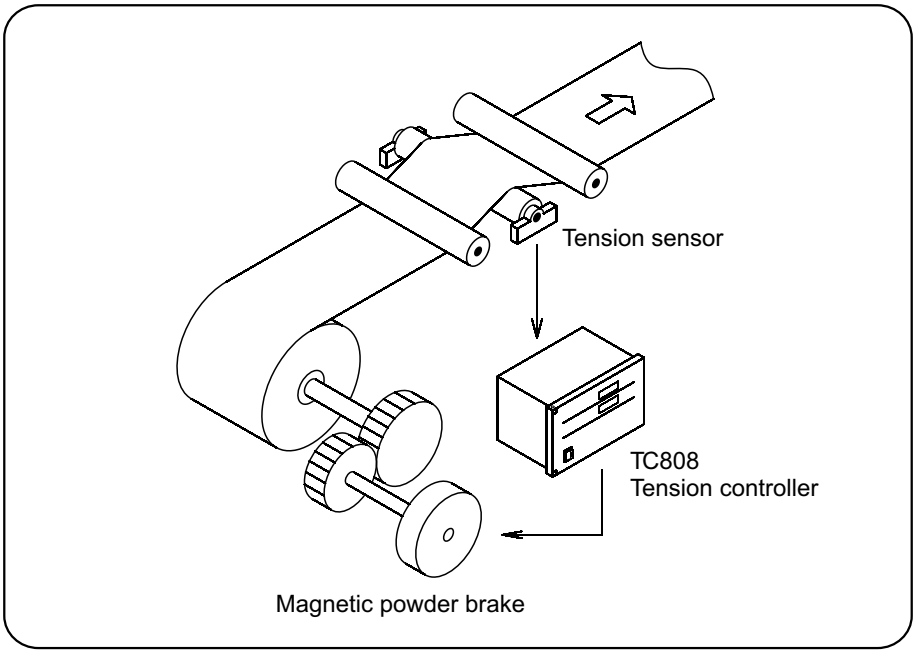


Typical installation of an unwind application

1 Introduction

The TC808 Tension Controller is an application-specific controller designed to provide you with precise control over winding and unwinding tension control applications for web and strand.

The tension controllers can be divided into manual, half-automatic and full automatic controller. According to the different needs of customers, the TC808 tension controller can be configured as manual, half-automatic or full-automatic tension controller.

For manual tension controller, the operator adjusts the actuation current of the powder clutch/brake manually to get the desired tension control.

The half-automatic tension controller also known as diameter or opened-loop tension controller, the tension controller calculates the reel radius automatically during winding or unwinding process, according to the current reel radius and setting tension, the tension controller adjusts the output to get the constant tension controls.

The full automatic tension controllers detect the web tension with tension sensor directly. According to the difference between setting tension and measured tension and the build-in PID algorithm, the controller adjusts the output automatically to get the precision constant tension control of the web.

2 Features

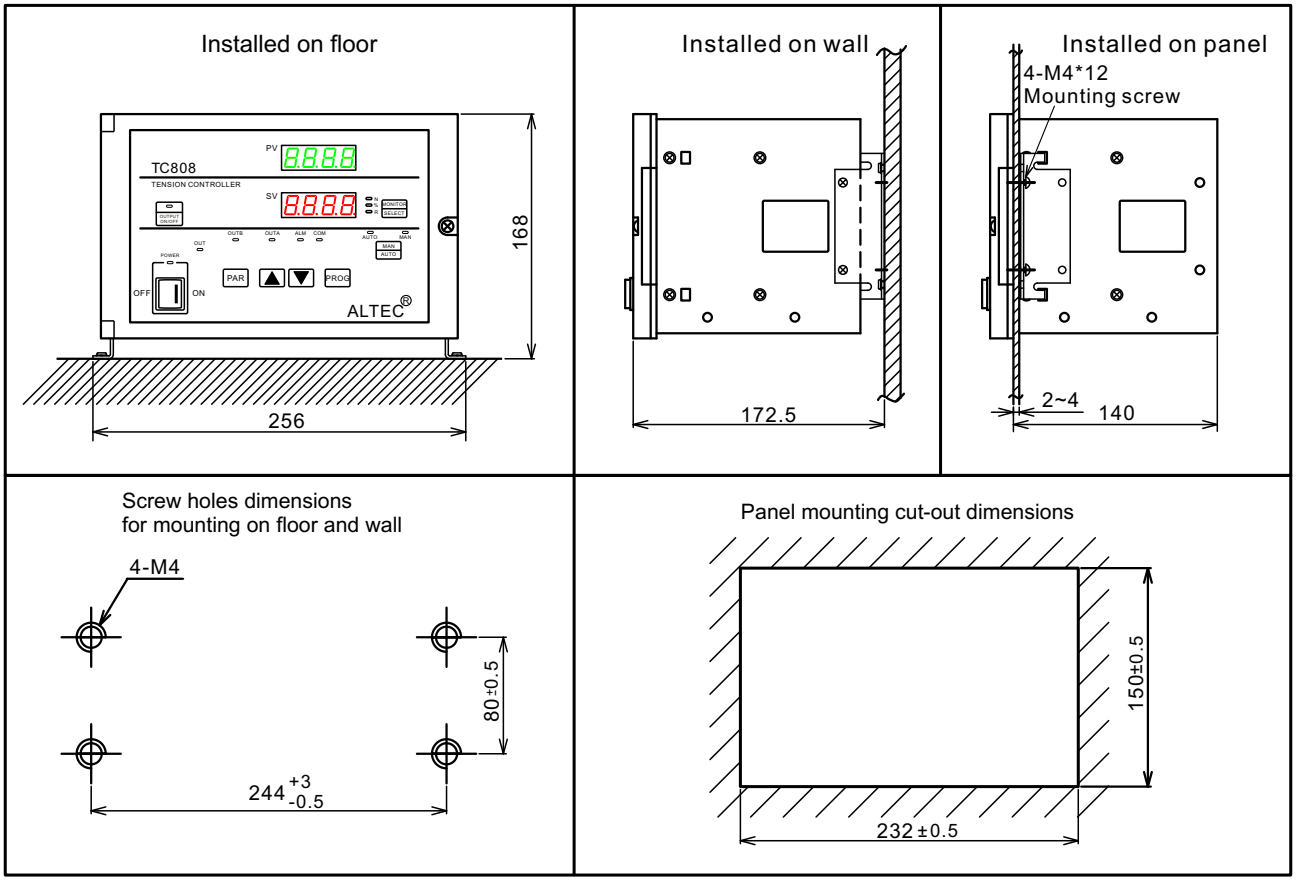
- Full digital circuit, easy tension calibration.
- Universal tension sensor input:
  1. Micro-displacment based tension sensor (signal: 200mV, power supply:5V)
  2. Strain gauge based tension sensor (signal:20mV,power supply10V)
- Diameter tension control .
- Taper tension control .
- Program tension control, multi programs for various material tension control .
- Advanced PID control algorithm provide high control precision.
- RS485/RS232 serial communications.
- Tension transmission.
- Automatic/Manual tension control.
- Reel exchange function.
- Wild range switching power supply(85~264V).
- Friendly user interface, easy to use.
- More cost efficient.

3 Order Code

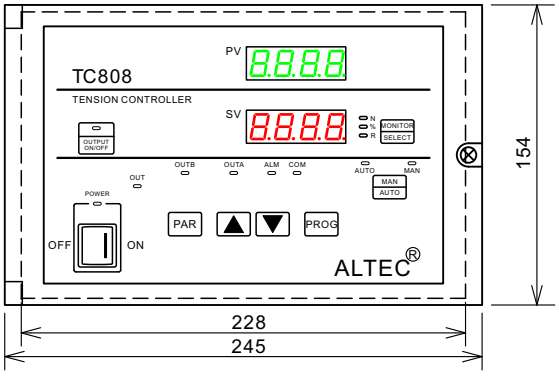
Model Number	-	Out put	Comms	Options	Comments
TC808	-				Tension Controller
		24V			24V/4A Drive powder clutch/brake
			0		None
			RS232		RS232
			RS485		RS485
			BS		Tension transmission
				0	None
				QP	Programmer/Controller

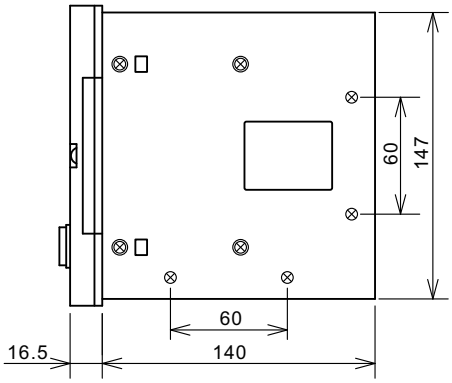
4 Installation

TC808 tension controller can be installed on floor, wall or panel.



Outline Dimensions





5 Electrical Wiring

Notice

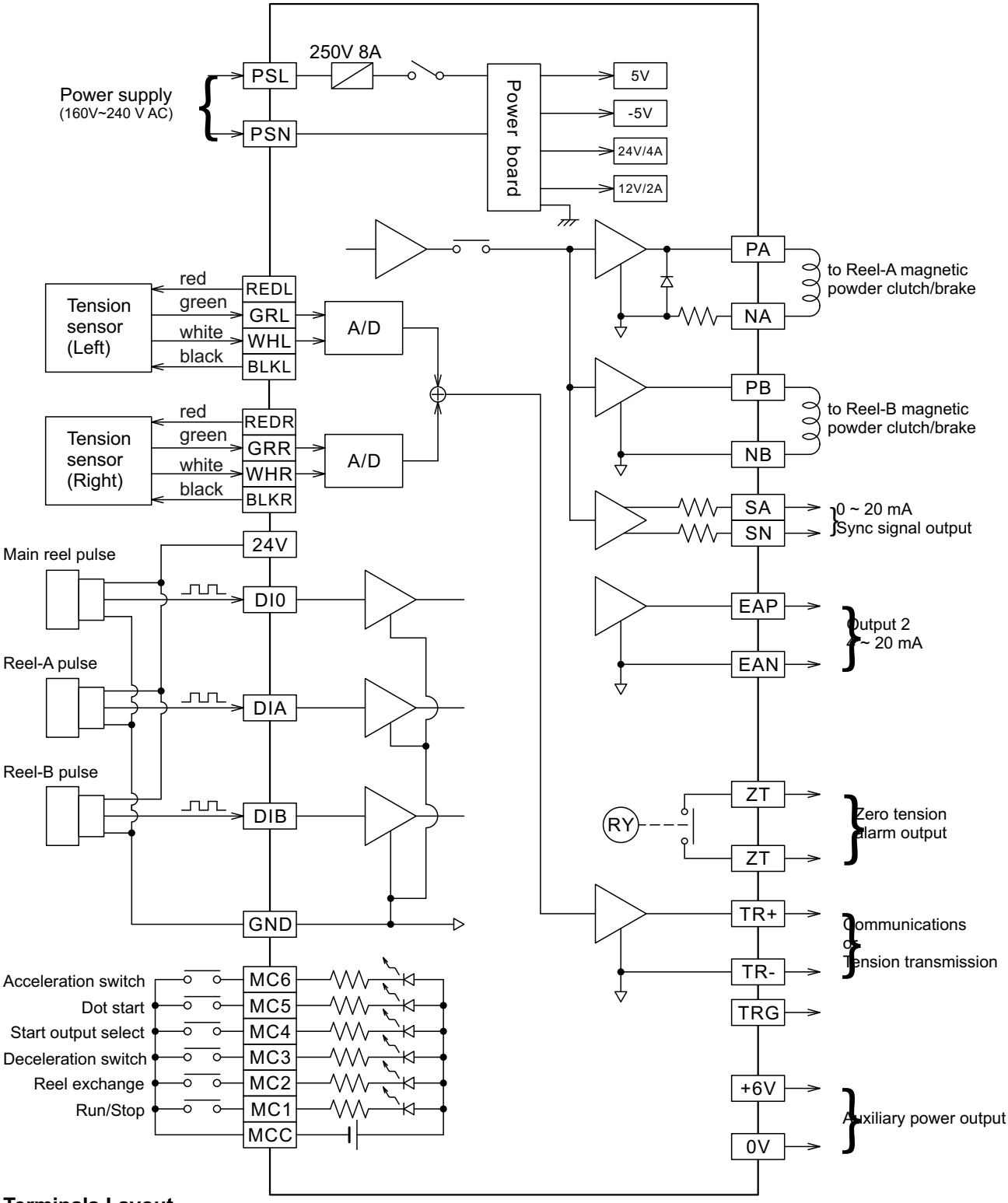
● In order to avoid electrical noise to the input signal, the signal line should be seqarated from the power line.

● If the AC power supply is connected to the I/O terminals or DC supply terminals, the tension controller will be burn out.

● Connect the tension sensor according to the wiring diagram, pay more attention to the wiring of tension sensor if two tension sensors are connected otherwise the measurement value will be incorrect.

● When one tension sensor is used, make sure to short-circuit the unused tension **signal terminals**.

5.1 Wiring Diagram



Terminals Layout

Terminal group 1

	ZT	ZT	PA	PB	MC1	MC3	MC5	GND	+24V	
PSL	PSN	ZTC	NA	NB	MCC	MC2	MC4	MC6	DI0	

Terminal group 2

DIB	WHL	BLKL	BLKR	WHR	SA	EAP	TRG	TR+		
DIA	GRL	REDL	REDR	GRR	SN	EAN	+6V	0V	TR-	

5.2 Terminals Description

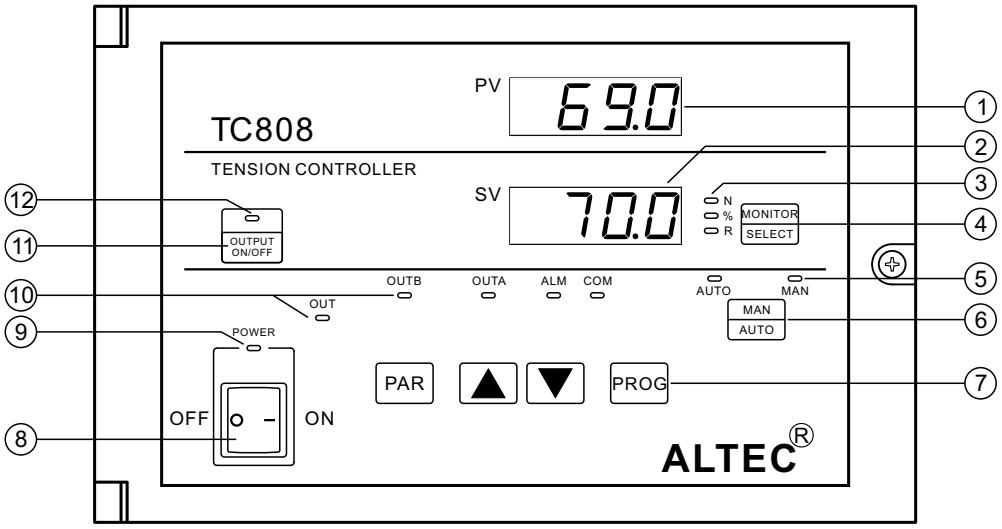
Terminal group 1

SN	Terminal	I/O	Specification	Comments
1	PSL, PSN	input	85~264V AC, 50/60 Hz	Power supply
2	ZT, ZTC	output		Zero tension alarm output(Automatic tension control mode) Reel radius lower limit alarm output(Diameter tension control mode)
3	PA, NA	output	24V/4A or 90V/10A	Output for reel A powder clutch/brake, motor
4	PB, NB	output	24V/4A or 90V/10A	Output for reel B powder clutch/brake, motor
5	MCC	input		Contact input common terminal
6	MC1	input		Run/stop
7	MC2	input		Reel exchange signal
8	MC3	input		Acceleration switch
9	MC4	input		Start output selection
10	MC5	input		Dot start signal input
11	MC6	input		Deceleration switch
12	+24V, GND	output		Power supply of proximity switch or encoder
13	DI0	input	Max Freq: 15K Hz	Main reel pulse input

Terminal group 2

SN	Terminal	I/O	Specification	Comments
1	DIA	input	Max freq: 15K Hz	Reel A pulse input
2	DIB	input	Max freq: 15K Hz	Reel B pulse input
3	GRL	input	0~200mV or 0~20mV	Left tension sensor signal+
4	WHL	input		Left tension sensor signal-
5	REDL	output	5V or 12V	Left tension sensor power supply+
6	BLKL	output		Left tension sensor power supply-
7	GRR	input	0~200mV or 0~20mV	Right tension sensor signal+
8	WHR	input		Right tension sensor signal-
9	REDR	output	5V or 12V	Right tension sensor power supply+
10	BLKR	output		Right tension sensor power supply-
11	SA,SN	output	0~20mA or 0~5V	Control signal output
12	EAP,EAN	output	0~20mA or 0~5V	Control signal output for E/P regulator
13	TR+,TR-,TRG	output	RS232/RS485	Serial communication or tension transmission
14	+6V,0V	output		Auxiliary power supply

6 Operator Interface



SN	Item	Description
①	PV Display	Indicates the Process Value, Parameter display
②	SV Display	Indicates the Setting Value, parameter value, alarm code
③	N	Tension SV displaying LED
	%	Output power displaying LED
	R	Reel radius displaying LED
④	MONITOR SELECT	Lower display selector
⑤	AUTO	Automatic mode indicator
	MAN	Manual mode indicator
⑥	MAN AUTO	Manual/Automatic mode switching key
⑦	PAR	Parameter scroll key
	▲	Raise key, increase value
	▼	Lower key, decrease value
	PROG	Programming key

SN	Item	Description
⑧	ON/OFF	Power switch
⑨	POWER	Power LED
⑩	OUT	Output power indicator higher the output, brighter the LED
	OUTB	Reel B output indicator
	OUTA	Reel A output indicator
	ALM	Zero tension alarm indicator
	COM	Communication indicator
⑪	OUTPUT ON/OFF	Output ON/OFF switch
⑫		Output ON/OFF LED lit when output is 'ON'

7 Operation

7.1 Display & Basic Operation

There are two LED displays indicate the operating parameters.

The upper display(green) indicates the measured tension value(PV) when in base condition. On modifying a parameter, the appropriate parameter appears.

The Lower display(red) indicates the setting tension value in the automatic mode. On modifying a parameter, the appropriate value appears here. This display also indicates the output power, reel diameter in some case.

When the controller is powered on, the upper display indicates the model code of the controller, and the lower display indicates the software version.

3 seconds later, the upper display will indicates the measured tension(PV) while the lower display will indicates the setting tension(SV).

The upper display will indicates the current measured reel radius when TC808 is configured as a 'Diameter Tension Controllr' or a 'Diameter-Output program tension controller'.

The type of contents displayed on the lower display is changed every time the ‘Lower display selector’ key is pressed. The type of contents displayed is indicated by the LED provided on the left side of the ‘Lower display selector’ key.

When running in Diameter-Output program tension control mode and the indicator ‘N’ is lit, the lower display will indicates the program number and segment number of the current running program. e.g. ‘L2.r3’ represent Program 2 segment 3 is running.

Press Man/Auto key, automatic operation mode and manual operation mode can be changed conveniently.

When TC808 performs automatic operation, indicator ‘**AUTO**’ will be lit, if the setting tension is displaying on the lower display at this time(LED ‘**N**’ is lit) press keys ▲ and to modify the setting tension. Adjustable range: SP H~SP L.

When the controller performs manual operation, indicator ‘**MAN**’ will be lit, if output power is displaying on the lower display at this time(LED ‘**%**’ is lit) the control output power can be modified by pressing ▲ and key.

Control output power can be turned ON and OFF by pressing ‘OUTPUT ON/OFF’ key. When indicator ‘**OUTPUT ON/OFF**’ is lit, output is ‘ON’ otherwise output is ‘OFF’, the output power becomes 0.

In automatic operation mode and when MC1 switch is turned on, indicator ‘**OUTPUT ON/OFF**’ will be lit; when MC1 switch is turned off, indicator ‘**OUTPUT ON/OFF**’ will flash, at this time the output is permissive.

The green LED ‘**OUT**’ indicates the current control output level, higher the output power level, brighter the LED. The LED will be turned off when the output becomes 0.

LED ‘**OUTA**’ indicates the output status of Reel-A, it is lit when Reel-A output is ON.
LED ‘**OUTB**’ indicates the output status of Reel-B, it is lit when Reel-B output is ON.

When measured tension is lower than ‘zero tension alarm value’(Code ALO), zero tension alarm indicator ‘**ALM**’ will be lit and at the same time relay ZT is ‘ON’, generate a alarm signal. Zero tension alarm don’t act in Run/Stop and reel exchange progress.

The indicator '**COM**' flashed when the TC808 is in active communication with a host computer.

7.2 Modifying the Operation Parameter

When the controller is in the PV/SV displaying status, press PAR key and hold for 3 seconds reveals the first parameter. The parameter value can either be modified with the ▲ or ▼ key, or left unmodified. Press PAR key again, the next parameter and its current value appears, the modified data has been saved.
If the last parameter is displayed or there's no key operation within 16 seconds, the menu times out automatically.

Operation Parameter List

SN	Mnemonic	Parameter	Adjustable Range	Comments
1	rO	Initial reel radius	0~1000mm	
2	thin	Material thickness	0.00~3.00mm	
3	FO	Start frequency	1~50 Hz	If main reel freq. F > FO, system starts If main reel freq. F < FO, system stops
4	ALO	Zero tension alarm value	0.0~999.9 Kg	Only alarms while running
5	Pon	Start output value	0~100.0%	when MC4 & MCC are shorted, start output value is Pon
6	ton	Start time	1~30.0 seconds	
7	PoFF	Stop output value	0~100.0%	
8	toFF	Stop time	1~30.0 seconds	
9	ProP	Proportional band	0.1~999.9 Kg	The smaller ProP value, the faster response The greater ProP value, the slower response
10	Int.t	Integral time	1~100 seconds	The smaller Int.t value, the faster response The greater Int.t value, the slower response
11	db	Dead band	0.1~999.9Kg	The greater db value, the more stable but slower response.
12	Pdot	Dot start output	1~100%	
13	PchA	Reel exchange output	1~100%	
14	tchA	Reel exchange time	1~30.0 seconds	
15	StoP	Reel exchange brake time	1~30.0 seconds	
16	Cinc	Acceleration coefficient	0.01~0.99	
17	CdEc	Deceleration coefficient	1.00~1.99	
18	Loc	Configuration password	0~9999	set to 808 to enter the configuration menu

7.3 Software Configuration

Specific tension contol systems need specific software configurations. TC808 must be configured porperly in order to perform the correct control funtion.

How to enter software configuration menu:

1) Press PAR key and hold for 3 seconds to enter the first level menu(i.e. operation parameter list);
2) Press PAR key to scroll the parameter to Loc and set its value to 808(the initial password);
3) Press PAR key, the first parameter appears on the upper display, at the same time the lower display will display the value of this parameter. The values can be modified by pressing keys ▲ and ▲ . After modification, press the PAR key, the next parameter appears, at the same time, the modified data has been saved in the memory.
If the last parameter is displayed or there is no key operation within 16 seconds, the controller will return back to the PV/SV display status.
After configuration, set the configuration password(code Loc) to data other than 808 in order to protect the parameter values from being inadvertent modification.

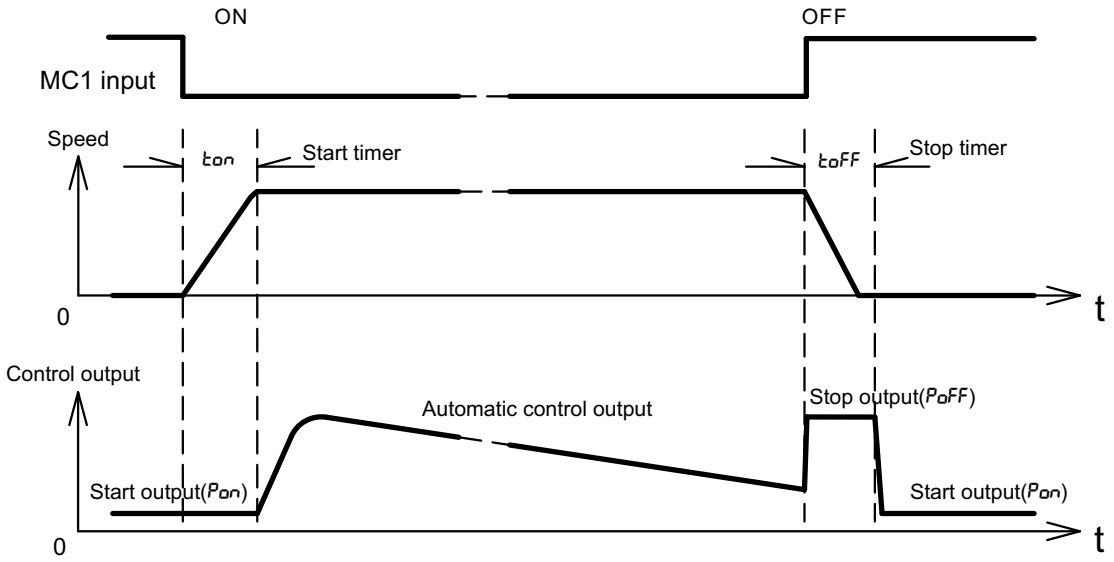
Software Configuration Paramter List

SN	Mnemonic	Parameter	Adjustable Range	Comments
1	SP H	Tension setpoint high limit	Measurement Range	always > SP L
2	SP L	Tension setpoint low limit	Measurement Range	always < SP H
3	H PL	Max output power	0.0~100.0%	
4	Sn.n	Tension sensor selection	L-Sn r-Sn L-r	select left tension sensor select right tension sensor select left & right tension sensors
5	OFSt	Input/calibration offset	-9.99~10.00	
6	Sn	Display units of input signal	tc .tc	without tenths' precision with tenths' precision
7	Addr	Instrument address	00~99	
8	bAud	Baud rate	2400, 4800, 9600, 19.2	
9	Func	Control Function	Auto d,A	Automatic tension control Diameter tension control
10	CtrL	Control algorithm	P, d r SP prog	PID control Taper tension control Program tension control
11	t1	Taper ratio	0.01~1.00	Appears if CtrL = r SP
12	Hi r	Reel radius high limit	1~999 mm	
13	Lo r	Reel radius low limit	1~999 mm	
14	CALC	Reel radius calculation	Pr1 Pr2	Thickness adding up caculation Ratio calculation
15	n1	Pulses/revolution (main reel)	1~300	Appears if CtrL = r SP or Func = d, A When pulses equal to tt, do a reel radius calculation.
16	n2	Pulses/revolution (Reel-A or Reel-B)	1~300	
17	r1	Main reel radius	20~500mm	
18	tt	Reel pulses/calculation (calculation radius)	10~3000	
19	rAL	Reel radius lower limit alarm value	1~999mm	Appears if Func = d, A
20	CC	Powder brake rated torque	1~600NM	
21	run	Wind mode	utun tun	unwinding(reel radius decrement) winding(reel radius increment)
22	out2	Output 2	0-20 4-20	0~20 mA 4~20 mA
23	OP2	out2 output mode	Auto HAnd	same with main output OP1 Manual setting
24	PL-2	2nd output value	0.0~100.0%	appears if OP2 = HAnd
25	Act	Control action	rEu dir	reverse control direct control
26	SYnt	Synchronous Run/Stop	no YES	Disable Enable
27	F, L	Input filter	0.01~99.99	
28	CAL	Tension calibration	P1 P2	zero tension calibration full-scale tension calibration

8 Operation of Tension Control System

8.1 Run/Stop

The run/stop operation of TC808 tension controller is controlled by MC1 and MCC. Connect a switch across the terminal MC1 and MCC, the switch is called **Run/Stop switch** of the tension system.



Starting procedure: Before starting, TC808 will outputs Pon to generate preparatory tension. When the Run/Stop switch(MC1-MCC) is turned on and after a overflow of time set in start timer ton, the automatic control will start. At this time, indicator '**OUTPUT ON/OFF**' will be lit. See the figure above.

Stopping procedure: When the Run/Stop switch is turned off, the controller output stop power PoFF instantly until the stop timer times up. After that, controller outputs Pon to generate preparatory tension. At this time, indicator '**OUTPUT ON/OFF**' will be turned off. See the figure above.

When '**Synchronous Run/Stop**' function is available(Synt = YES), the run/stop operation is controlled by the frequency of main reel but not the MC1 input. A proximity switch must be mounted on the main reel before using '**Synchronous Run/Stop**' function, the controller will monitor the running frequency of main reel.

When the Run/Stop switch is turned on and main reel freq. is greater than start freq. F0, system starts, indicator 'OUTPUT ON/OFF' will be lit.
When the Run/Stop switch is turned on and main reel freq. is smaller than start freq. F0, system stops, the indicator 'OUT' ON/OFF will flash.

In full automatic tension control systems, generally short-circuit MC1 and MCC, the system will run/stop according to the main reel's frequency automatically. TC808 don't act run/stop operation during reel exchange process.

Note that when the controller was configured as **Diameter Tension Controller**(Func = di A), the start timer ton must be long enough allowed the controller to have enough time to calculate out the reel radius otherwise the controller will perform incorrectly.

8.2 Start output Selection

The system start output selection is controlled by the start output selection switch(MC4-MCC). When the switch is turned on, start output is Pon saved in controller memory. When the switch is turned off, the start output is the output when system stops.

8.3 System Acceleration/Deceleration

Acceleration

The tension control system acceleration is controlled by the **Acceleration Switch(**MC3-MCC).
When the system needs to accelerate, turn on the acceleration switch, the controller enters open-looped control mode, at this time, the control output equals the current output times **Cinc**. After acceleration, turn the switch OFF, the system returns to automatic tension control mode.

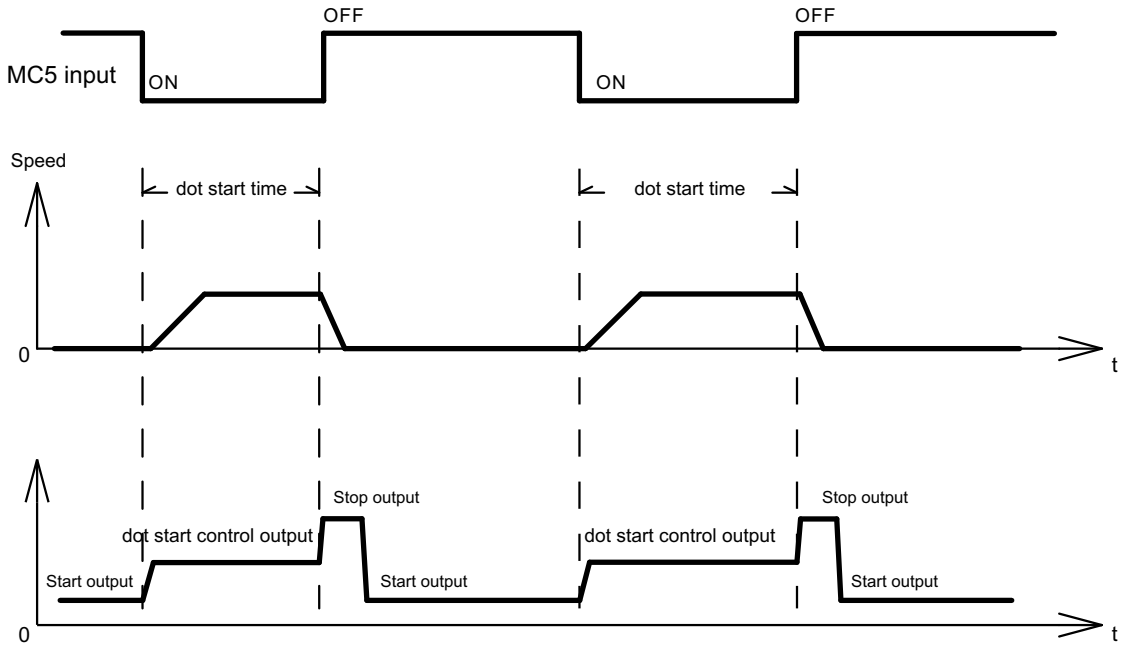
Deceleration

The tension control system deceleration is controlled by the **Deceleration Switch(**MC6-MCC).
When the system needs to decelerate, turn on the deceleration switch, the controller enters open-looped control mode, at this time, the control output equals the current output times **CdEc**. After deceleration, turn the switch OFF, the system returns to automatic tension control mode.

Note that TC808 don't act the Acceleration/Deceleration command during reel exchange, system halting, or system starting process.

8.4 Dot Start

During system testing or new materials feeding, the **"dot start"** function is necessary.
This function is controlled by the **dot start switch**(MC5-MCC, see the wiring diagram please)



Before starting dot start operation, let the system stop(turn the Run/Stop switch off) and the controller outputs **Pon** to generate the preparatory tension. When the dot start switch is turned on, TC808 outputs **Pdot** made the system start running. The controller will maintain the output **Pdot** while the dot start switch is ON.

Once the dot start switch is turned off, the controller outputs the 'stop output' **PoFF** instantly to decrease the running speed and the stop timer **toFF** starts. After the stop timer **toFF** times up, the controller outputs **Pon** to generate the preparatory tension, system halts. Awaiting for the next dot start operation.

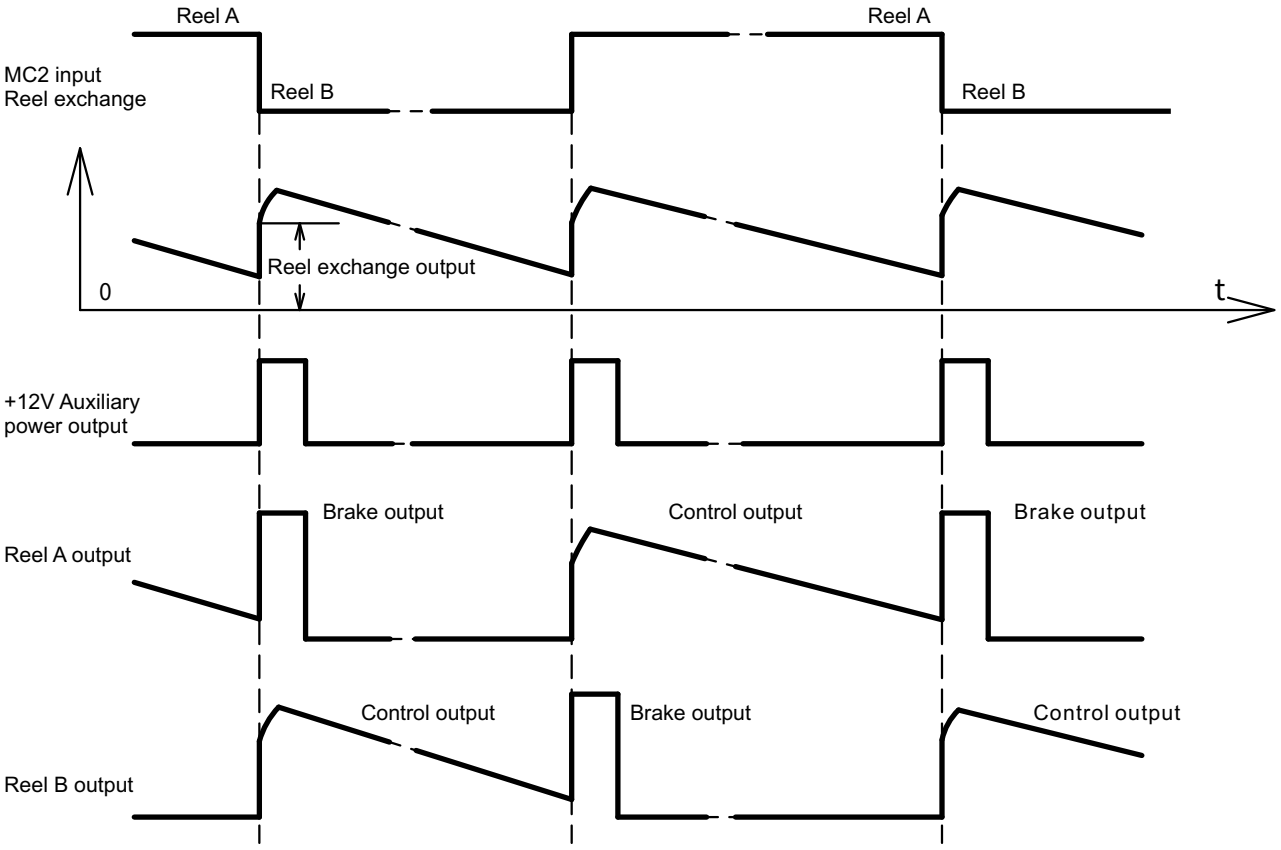
Note that TC808 don't act the dot start command during reel exchange, system halting, or system starting process.

8.5 Reel exchange

In the two-reel operation, the reel exchange is controlled by the '**reel exchange**' switch(MC2-MCC). This function is applicable when material on reel is over or full.
When the switch is turned on, reel A is active.
When the switch is turned off, reel B is active.

Exchange of unwinding reel

When the wind mode(code: run) was configured as unwinding(uEun), suppose that the reel exchange switch is off, reel A is active. At this time, if change the switch from OFF to ON, the control output exchanges to reel B and the controller enters open-looped control mode. The control output is preset to PchA. When the reel exchange timer tchA times up, the automatic control starts. At the same time, +12V auxiliary power is applied to reel A in 'reel exchange brake time'(Code StoP) preset to brake reel A. For exchanging from reel B to reel A, reverse above process. See the figure below.



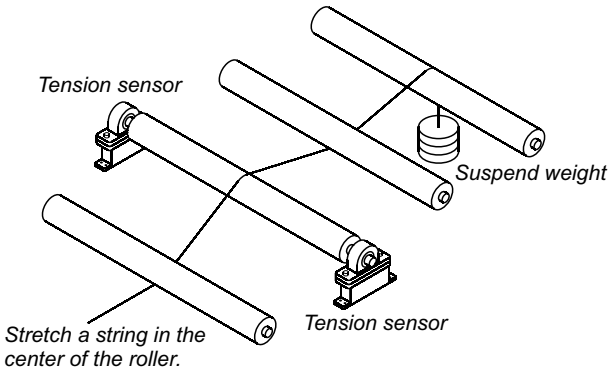
Exchange of winding reel

When the wind mode(code: run) was configured as winding(tun), suppose that the reel exchange switch is off, reel A is active. At this time, if change the switch from OFF to ON, the auxiliary power supply(+12V) will be applied to reel B and when 'reel exchange brake time'(Code StoP) times up, the control output exchanges to reel B and the controller enters open-looped control mode. The control output is preset to PchA. When the reel exchange timer tchA times up, the automatic control starts. For exchanging from reel B to reel A, reverse above process.

9 Tension Calibration

The tension controller must be calibrated after installation, and only the proper calibrated controller can get the desirable measurement precision.

Connect the tension sensor according to the wiring diagram, pay more attention to the wiring of tension sensor otherwise the measured value will be incorrect.



Input signal calibration

- When two tension sensor is used, set parameter Sn.n to L-r, connect the two sensors.
- When the left tension sensor is used, set parameter Sn.n to L-Sn, connect the tension sensor to REDL, BLKL, GRL, WHL terminals.
- When the right tension sensor is used, set parameter Sn.n to r-Sn, connect the tension sensor to REDR, BLKR, GRR, WHR terminals.

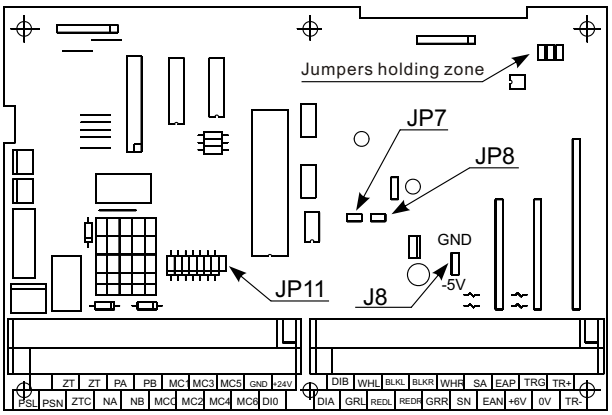
When use one tension sensor, make sure to short-circuit the unused tension **signal terminals**.

9.1 Jumpers setup

TC808 accepts various tension sensor inputs:

1. Using micro-displacment based tension sensor(signal: 200mV, power supply: 5V)
   Please short jumpers JP7, JP8 and JP11, jump J8 to GND to get 5V output.

2. Using strain gauge based tension sensor(signal: 20mV, power supply: 10V)
   Please open jumpers JP7, JP8 and JP11, jump J8 to -5V to get 10V output.



Jumpers setup

9.2 Zero Tension Calibration(P1)

Step	Button Operation	Display
1	Turn on the power switch, add no weight on the tension sensor, press PAR key until CAL appears in the upper display	CAL ----
2	Press ▲ key, P1 appears in the lower display	CAL P1
3	Press PAR key, the number in the lower display will be the value after adjustment assigned to the injected input signal	P1 15.0
4	Press ▲ and key to adjust the number in the lower display until it corresponds to the represented by the injected signal	P1 0.0
5	Press PAR key	0.0 no
6	Press ▲ key to affirm	0.0 YES
7	Press PAR key, P1 appears in the upper and lower display at the same time	P1 P1
8	5 seconds later, the scaling of the 1st point is completed	CAL ----

9.2 Full Scale Tension Calibration(P2)

(Suppose that the max load of the tension sensor is 50.0Kg in this example)

Step	Button Operation	Display
1	Load weight of 50Kg on the tension sensor, press PAR key until CAL appears in the upper display	CAL ----
2	Press key, P2 appears in lower display	CAL P2
3	Press PAR key, the number in the lower display will be the value after adjustment assigned to injected input signal	P2 45.0
4	Press ▲ and key to adjust the number in the lower display until it corresponds to the value represented by the injected signal	P2 50.0
5	Press PAR key	50.0 no
6	Press ▲ key to affirm	50.0 YES
7	Press PAR key, P2 appears in the upper and lower display at the same time	P2 P2
8	5 seconds later, the scaling of the 2nd point is completed	CAL ----

10 Use of Diameter Tension Control

10.1 Introduction

In some special tension control system, it it not convenient for tension sensor mounting or there's no need of high precision of tension control. In these conditions, TC808 could be configured as diameter tension controller.

To run TC808 as diameter tension controller, configure parameter '**Control Function**'(Code Func) as dia.

The highlight feature of diameter tension control is that there's no need of tension sensor and the mounting is easy, and this mode is applicable for taper tension control too. Ideas for printing, package machines and material cutting machines, etc.

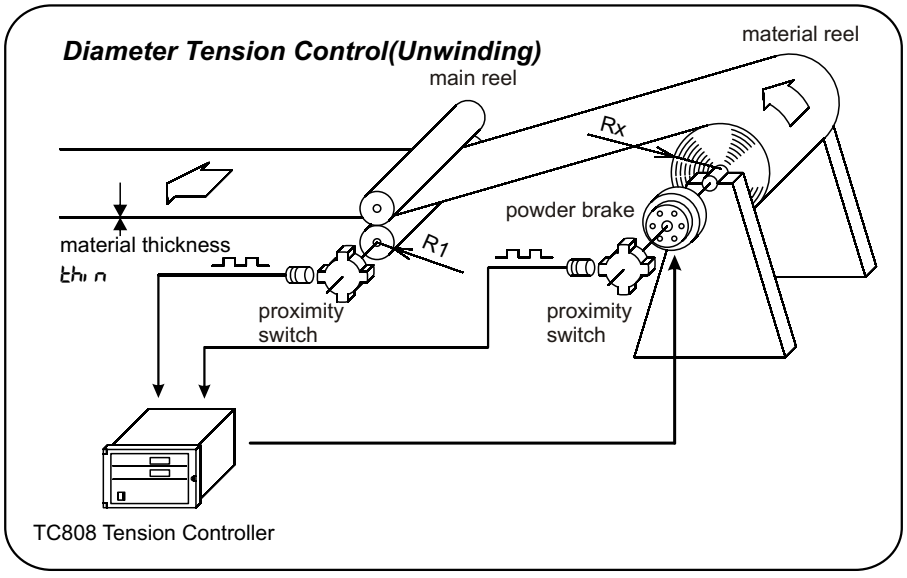
TC808 monitors the pulses generated by main reel and material reel, the CPU calculates the reel radius, according to radius, setting tension, powder brake rated torque CC, TC808 adjusts the output to control the web tension.
There are two reel radius calculation methods: Thickness adding up and ratio method.

10.2 Thickness Adding up Reel Radius Calculation

When using this method detecting the reel radius, material thickness thi n, initial reel radius r0(Press PROG key to reset r0) and reel pulses/r nr must be set properly.
The TC808 counts the pulses generated by the proximity switch mounted on material reel, according to the total pulses N and the initial reel radius, calculate the current reel radius according to the following formula:

R=R0±T*N/n (Winding: + unwinding: -)
R :Current reel radius R0 :Initial reel radius T :Material thickness N : Total pulses n : Reel pulses/r

tt: reel pulses/calculation, when pulses equal to TT, do a reel radius calculation. This parameter effect the reel radius calculation precision and the measurement interval, the smaller tt, the higher precision and response.
Parameter 'wind mode'(code run) effect the radius calculation: If run = tun, radius increases; If run = utun, radius decreases. When the system is in stop mode(the run/stop switch MC1-MCC is turned off) or manual operation mode, press PROG key, measured radius will reset to initial radius r0. The measured radius will reset to initial radius r0 automatically during reel exchange process.



In order to get the correct reel radius calculation, the parameters related must be set properly.

Pay more attention to the mounting and response speed of proximity switch and encoder.

10.3 Ratio Reel Radius Calculation

When using this method to calculate the reel radius ,the following parameter must be set properly:

n1 — main reel pulses/r

n2 — material reel pulses/r

r1 — main reel radius

TC808 monitor the pulses generated by main reel and material reel, and according to the setting parameter to calculate the reel radius. This method neither care the material thickness nor the winding or unwinding parameters.

When the system is in stop mode(the run/stop switch MC1-MCC is turned off) or manual operation mode, press PROG key, measured radius will reset to initial radius r0.

tt: reel pulses/calculation, when pulses equal to TT, do a reel radius calculation. This parameter effect the reel radius calculation precision and the measurement interval, the greater tt, the higher precision but the measurement interval becomes longer.

10.4 The Principle of Diameter Tension Control

When the material reel runs at a constant speed, the the tension torque F*Rx equals the brake torque generated by the powder brake. So, to keep the tension F a constant in the unwinding tension system, a way is to calculate the current reel radius Rx and adjust the output to the powder brake.

Output X=F*Rx/CC(%)
F — Setting tension, unit: N
Rx — material reel radius, unit: m
CC — powder brake rated torque, unit: N*M

e.g. there's a powder brake whose rated torque is 40 N*M, setting tension is 50 N, material reel radius is 300mm = 0.3m. the output X=50*0.3/40=37.5%

As the above formula shows, TC808 adjusts the output according to reel radius, the output is proportional to the reel radius and setting tension.

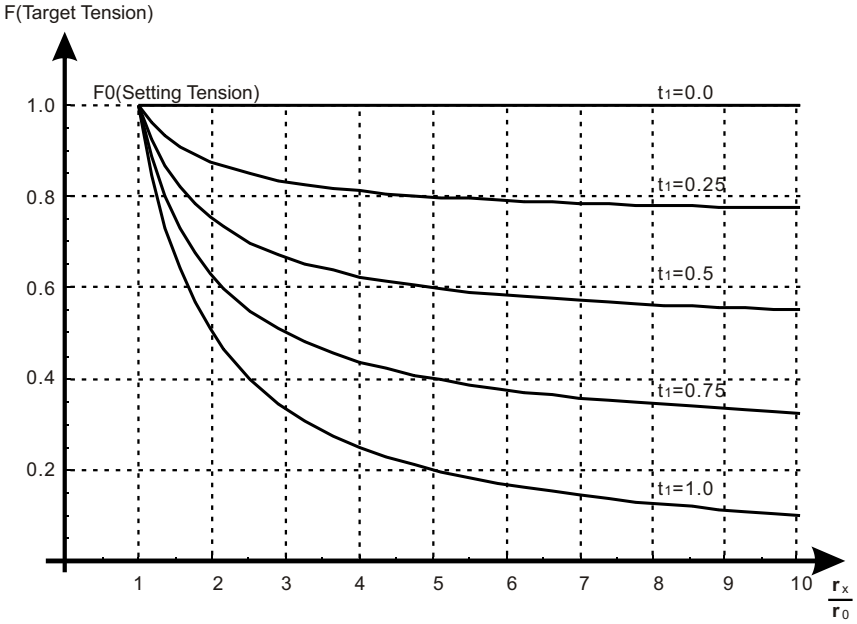
Note that when the controller is running in the manual operation mode, if there's a modification to output X, the controller will adjust the target tension F according to the formula above automatically.

11 Taper Tension Control

Set '**Control algorithm**'(Code CtrL) to rSP, TC808 is configured as **Taper Tension Controller**.

In winding tension control systems, to prevent the material from winding too tight or too loose on the reel, TC808 may be setting as **Taper Tension Controller**. This control as to increase/decrease the working tension depending on the change in winding diameter, in which the tension is controlled in accordance with the preset pattern, to suit the change in winding diameter.

The greater the taper ratio t1, the greater the change of tension when reel radius increases. If t1=0, TC808 performs constant tension control. See the figure below.



$$F = F_0\left(1 - t_1\left(1 - \frac{r_0}{r_x}\right)\right)$$

F ---------- Current target tension(kgf)
F0 ------- Setting tension(kgf)
r_x --------- Current diameter(mm)
r_0 --------- Minimum diameter(mm)
t_1 -------- Taper ratio

While TC808 is working in taper tension control mode and the lower display is indicating the setting tension, press PAR key, current target tension F appears in the lower display.

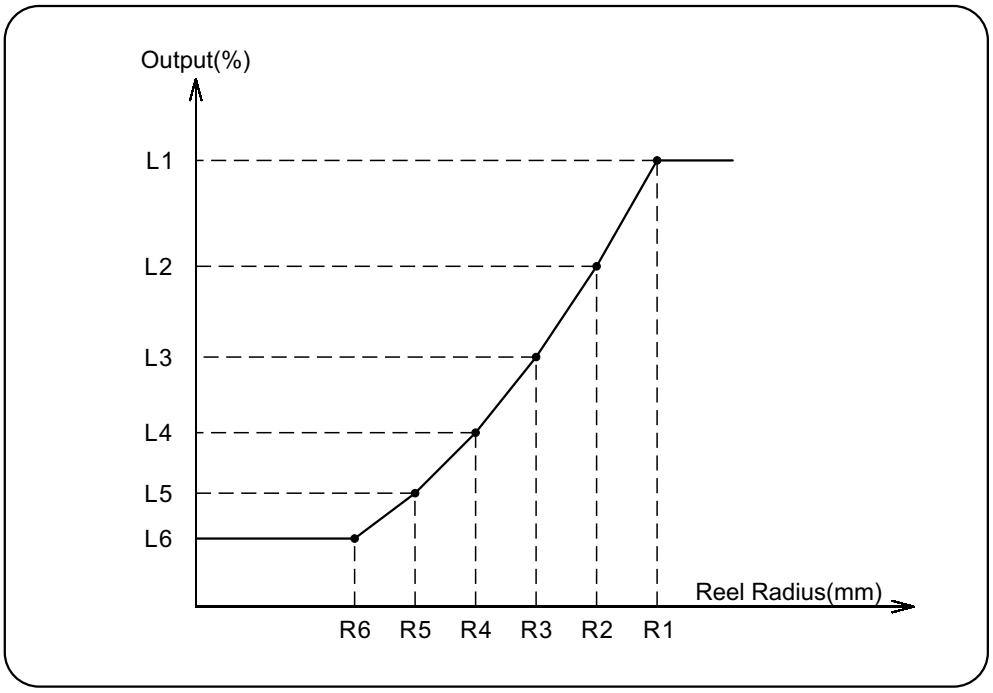
When CtrL = PId, TC808 is configured as constant tension controller which is idea for unwinding tension controls.

12 Diameter-Output Program Tension Control

12.1 Introduction

The diameter-output program tension control is a special application of diameter tension control. According to the presetting programs and the change of reel diameter, TC808 increase/decrease the output power to achieve tension control purpose. In this mode, parameter CC needn't setting.

Diameter-Output Program



12.2 Program Parameters

Diameter-Output program(curve) contains up to 6 points, each point is a diameter-output coordinate, the setting of reel radius must satisfy the following condition: r1 > r2 > r3 > r4 > r5 > r6

Prn : Program number, TC808 may store multi programs, from 1 to 10.

r1 : Material reel radius, adjustable range: End; 1~999mm.

Note that if the radius is setting as End, the following parameters are not available.

L1~L6 : Output power, adjustable range: 0~100.0%.

12.3 Program Parameters Access

First, CtrL must be configured as Prog. When the controller is in the PV/SV displaying status, press PROG key and hold for about 3 seconds, the first program parameter appears in the upper display. The value associated with this parameter is shown in the lower display. At this time, use ▲ and ▲ key to modify the parameter's value. Then, press PAR key, the next parameter appears. The modification has been saved in the memory.

If there's no key operations within 16 seconds, the display returns to the base condition .

Diameter-Output Program Parameter List

SN	Mnemonic	Parameter	Adjustable Range	Comments
1	Pr.n	Program number	1~10	Appears only when CtrL = Prog
2	r1	Radius 1	End;0~999mm	
3	L1	Output 1	0.0~100.0	
4	r2	Radius 2	End;0~999mm	
5	L2	Output 2	0.0~100.0	
…	…	…	…	…

12.4 Operations & Display

When TC808 performs **Program Tension Control**, the controller adjust the output according to the current reel radius and the presetting diameter-output program.

If the current measured reel radius is greater than R1, TC808 outputs L1(the highest output).

if the current measured reel radius is smaller than the minimum setting radius, TC808 outputs power which associates with the minimum radius.

When the program is running, the upper display indicates the current reel radius, and when LED 'N' is lit, the lower display indicates the running program number and program segment. e.g. 'L2.r3' represent Program 2 segment 3 is running.

13 Digital Communication

13.1 Overview

Digital Communication allows the controller to communicate with a PC or a networked computer system.

The RS232 standard allows a single instrument to be connected to a PC, a Programmable Logic Controller, or a similar devices using a cable length of less than 15m.

The RS485 standard allows one or more instruments to be connected(multi-dropped) using a two wire connection, with cable length of less than 1200m. 31 Instruments and one "Master" may be connected in this way.

RS485 is recommended for plant installation.

13.2 Data Format

1 start bit
7 data bits
even parity
1 stop bit

13.3 Baud Rate(bps)

300, 600, 1200, 2400, 4800, 9600, and 19.2k.

13.4 Control Characters

ASCII-HEX	Control Sign	Comments	ASCII-HEX	Control sign	Comments
02	<STX>	Start of text	30	0	
03	<ETX>	End of text	31	1	
04	<EOT>	End of transmission	32	2	
05	<ENQ>	Enquiry	33	3	
06	<ACK>	Positive acknowledge	34	4	
15	<NAK>	Negative acknowledge	35	5	
20		Space	36	6	
2D	-	Minus sign	37	7	
2E	.	Decimal point	38	8	
3E	>	Greater than	39	9	

13.5 Reading Data from the TC808 Controller

To read data, a 'poll' message is issued to the instrument. This message takes the following format:

[EOT](ADR_H)(ADR_H)(ADR_L)(ADR_L)(C1)(C2)[ENQ]

Each item in the above description represents a single ASCII character. The items in hold type and square brackets are control characters used to frame the message, whose values may be determined by reference to the table on the previous page. The bracketed item in normal type have the following significance:

ADR_H The first digit of the instrument address, the ADR_H is sent twice, as a validation mechanism.
e.g. '1'(31 HEX) for instrument address 12.
'0'(30 HEX) for instrument address 01.

ADR_L The second digit of the instrument address, the ADR_L is sent twice, as a validation mechanism.
e.g. '2'(32 HEX) for instrument address 12.
'1'(31 HEX) for instrument address 01.

C1 The first character of the mnemonic for the parameter being accessed, e.g. 'P' for Process Variable.

C2 The second character of the mnemonic for the parameter being accessed, e.g. 'V' for Process Variable.

If the instrument receives the message correctly and the mnemonic is valid it will reply with:

[STX](C1)(C2)<DATA>[EXT](BCC)

C1, C2 Echo of the mnemonic from the poll message.

DATA The value of the parameter in a given display format.
e.g. 99.9, 1.2, -999, >1234 etc.

BCC This is a block checksum that is generated for data validation. It is computed by XORing(exclusive or) all the characters after and excluding the STX, and including the ETX. Note that it may take the value of 'EOT' and care must be take when writing a protocol driver to ensure that this is not seen as an 'End of Transmission' sequence.

Example of a Parameter Read

For example, when reading PV(i.e. measured tension) from instrument at address 01, the following sequence of character will be sent and received:

Master :

ASCII:	EOT	0	0	1	1	P	V	ENQ
HEX:	04	30	30	31	31	50	56	05

If the measured tension is 24.8 Kg at address 01, the instrument returns:

Instrument :

ASCII:	STX	P	V		2	4	.	8	ETX	BCC
HEX:	02	50	56	20	32	34	2E	38	03	35

13.6 Writing Data to the TC808 Controller

To write data, a 'select' message is issued to the instrument. This message takes the following format:

[EOT](ADR_H)(ADR_H)(ADR_L)(ADR_L)[STX](C1) (C2)<DATA>[ETX](BCC)

Each item in the above description represents a single ASCII character. The items in hold type and square brackets are control characters used to frame the message, whose values may be determined by reference to the table on Page 1. The bracketed item in normal type have the following significance:

ADR_H The first digit of the instrument address, the ADR_H is sent twice, as a validation mechanism.
e.g. '1'(31 HEX) for instrument address 12.
'0'(30 HEX) for instrument address 01.

ADR_L The second digit of the instrument address, the ADR_L is sent twice, as a validation mechanism.
e.g. '2'(32 HEX) for instrument address 12.
'1'(31 HEX) for instrument address 01.

C1 The first character of the mnemonic for the parameter being accessed, e.g. 'P' for Process Variable.

C2 The second character of the mnemonic for the parameter being accessed, e.g. 'V' for Process Variable.

DATA The value of the parameter in a given display format. e.g. 99.9,1.2, -999, >1234 etc.

BCC This is a block checksum that is generated for data validation. It is computed by XORing(exclusive or) all the characters after and excluding the STX, and including the ETX.

If a parity or a address format error is detected, the instrument will not reply. Otherwise, the instrument will reply with either:

[NAK] Failed to write:BCC is incorrect, or Parameter not available or not configured, or Parameter is read only, or attempt has been made to read a parameter that is outside limits.

OR

[ACK] Parameter write was successful.

Example of a Parameter Write

For example, when writing a value of 15.0Kg to the SV(setting tension) to an instrument at address 01, the following sequence of character will be sent and received:

Master:

ASCII:	EOT	0	0	1	1	STX	S	L	1	5	.	0	ETX	BCC
HEX:	04	30	30	31	31	02	53	4C	31	35	2E	30	03	06

If the modification of SV was successful, the instrument returns:

Instrument:

ASCII:	ACK
HEX:	06

13.7 Communication Parameters List

SN	Order	ASCII/HEX	Mnemonic	Parameter	Adjustable Range
1	PV	50 56		Process value(Read only)	
2	OP	4F 50		Output power(Read only)	0~100.0%
3	SP	53 50		Current target tension	Read only
4	SL	53 4C		Setting value	SPH~SPL
5	F0	46 30	F0	Start frequency	1~50Hz
6	A0	41 30	AL0	Zero tension alarm value	0.0~999.9Kg
7	PN	50 4E	Pon	Start output value	0~100.0%
8	TN	54 4E	ton	Start time	1~360.0 sec.
9	PF	50 46	PoFF	Stop output value	0~100.0%
10	TF	54 46	toFF	Stop time	1~30.0 sec.
11	XP	58 50	ProP	Proportional band	0.1~999.9Kg
12	TI	54 49	Intt	Integral time	1~100 sec.
13	PD	50 44	Pdot	Dot start output	1~100%
14	PC	50 43	PchA	Reel exchange output	1~100%
15	TC	54 43	tchA	Reel exchange time	1~360.0 sec.
16	ST	53 54	StoP	Reel exchange brake time	1~30.0 sec.
17	C I	43 49	Cinc	Acceleration coefficient	0.01~0.99
18	CD	43 44	CdEc	Deceleration coefficient	1.00~1.99
19	LK	4C 4B	Loc	Configuration password	0~9999
20	NO	4E 4F	Pr.n	Program Number	1~10
21	r1	72 31	r1	Radius 1	End; 0~999mm
22	I1	6C 31	L1	Output 1	0.0~100.0
23	r2	72 32	r2	Radius 2	End; 0~999mm
24	I2	6C 32	L2	Output 2	0.0~100.0
...	...	...	...	...	...
25	r6	72 36	r6	Radius 6	End; 0~999mm
26	I6	6C 36	L6	Output 6	0.0~100.0
27	#1	23 31		Control output ON/OFF	
28	#2	23 32		Automaic/Manual switch	
29	#3	23 33		Switch status	Read only
...	...	...	...	...	...

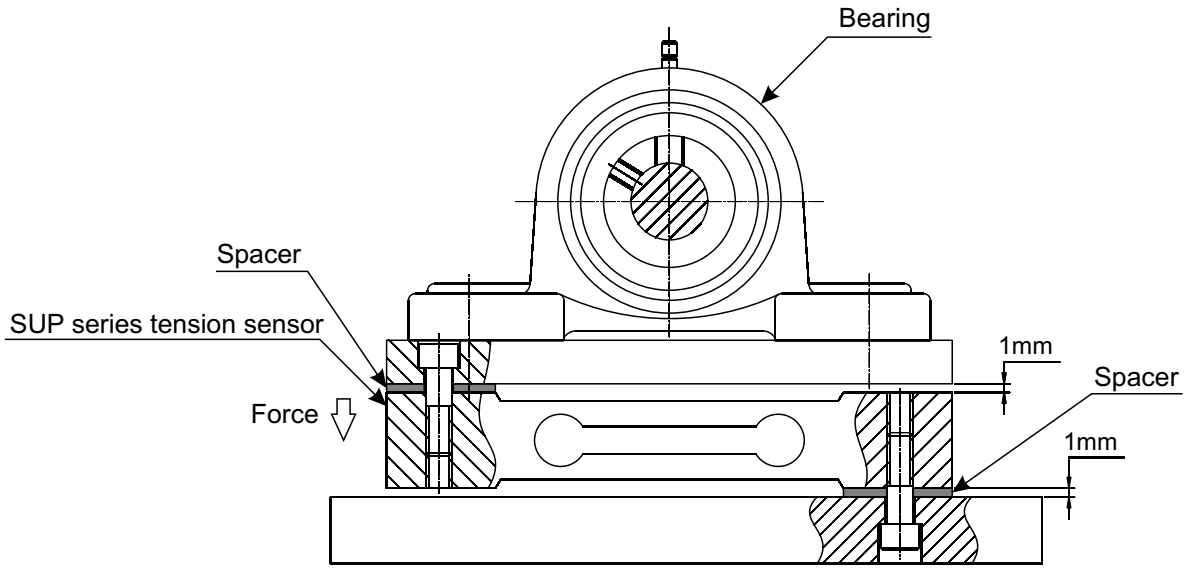
1.In manual operation mode, control output could be adjust
2.Output ON/OFF: #1=0000 output ON
#1=0001 output OFF
3.Auto/Manual switching: #2=0000 Automatic mode
#2=0001 Manual mode
4.Switch status: #3, This is a read only parameter, the return data(<256) will be converted into an 8-bits binary number, the status of every switch is corresponding to every bit in the binary number. i.e. when an bit is 1, the corresponding switch is ON; when an bit is 0, the corresponding switch is OFF. As the following table illustrated.

Bit	B7	B6	B5	B4	B3	B2	B1	B0
Switch			MC6	MC5	MC4	MC3	MC2	MC1

Appendix A: ASCII Table

MSD / LSD	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	XON	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	XOFF	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	S1	US	/	▲	O	_	o	DEL

Appendix B: The Mounting of SUP Tension Sensor



Please note that the force direction of tension sensor.

Technical Data

Tension signal input	Micro-displacement based tension sensor (signal: 200 mV, power: 5V DC) Strain gauge based tension sensor (signal: 20 mV, power: 10V DC)
Resolution	±0.2%FS ± 1 digit
Sampling rate	100 ms
Diameter detection	Proximity switch Encoder NPN transistor Max freq. 15K Hz
Control algorithm	PID
Main output	24V/4A, drive magnetic powder clutch/brake
Auxiliary output	Dual 0~20mA
Alarm	Zero tension alarm
Communications	RS232 RS485
Dimensions	246mm(W)*154mm(H)*156mm(D)
Environmental	Ambient temperature: 0~50 °C Relativity humidity: =85%
Power supply	100~220V AC, 50/60 Hz