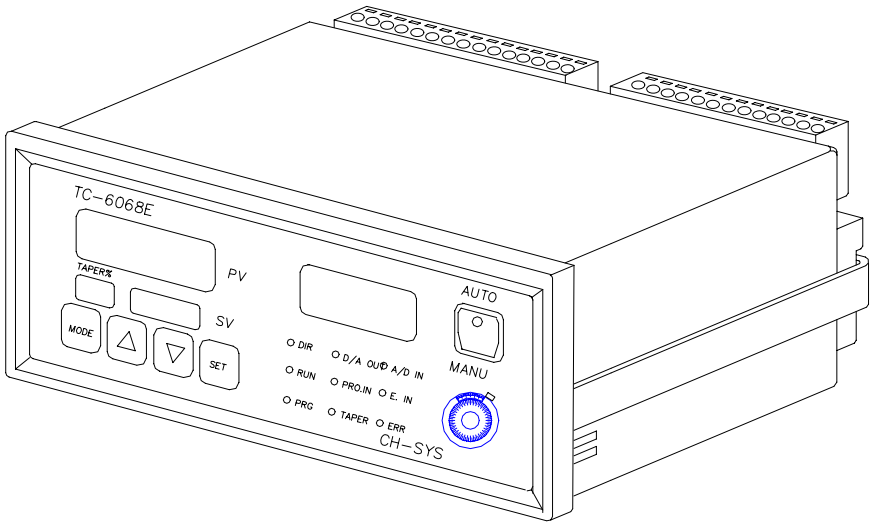
TC-6068E
High Accuracy Tension Controller

USER MANUAL



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1. TC-6068E Features

Applications:

TC6068E is an ultrahigh accuracy feedback control system specifically designed for plastic, thin film, gluing, electric wire, steel plate, starching yarn, joining warp, and paper industries.

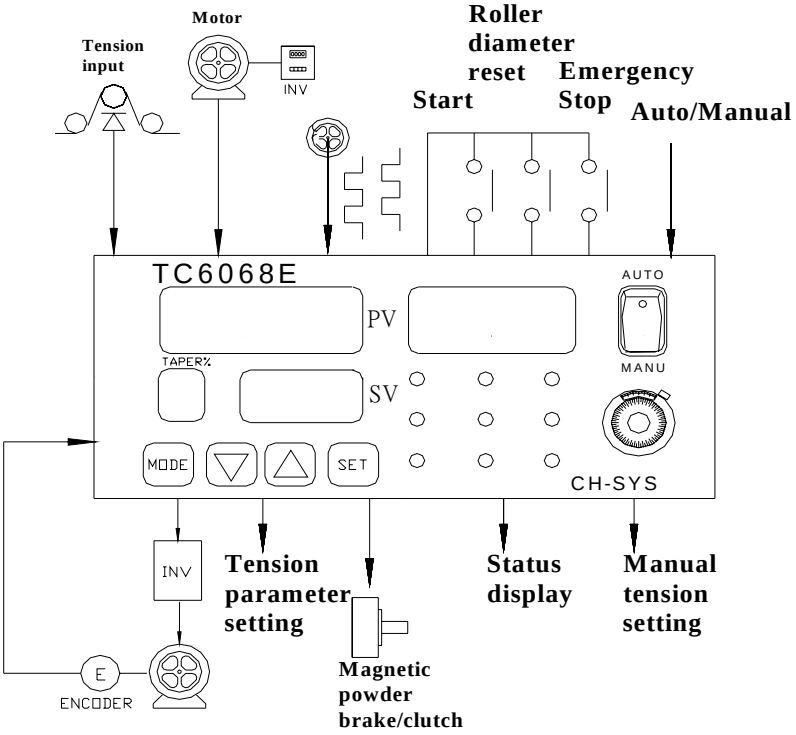
Features:

一、 Easy-to-input COSθ curve tension decrease.
二、 Tension feedback control stops performing mathematical calculations at shutdown.
三、 Possessing DC24V, 3A power for magnetic powder driver.
四、 Possessing unique start-up, acceleration/deceleration, emergency stop, and compensation functions.
五、 Its unique manual/automatic control mode shifting function prevents vibrations from occurring.
六、 Structural gross weight deduction and tension correction are digitally entered for ease of use.
七、 Command-type contact point output makes it possible for users to tailor the settings to their own requirements.
八、 Powerful features, easy to use, and cost-effective.
九、 Password protected with fixed numbers avoids confusion.

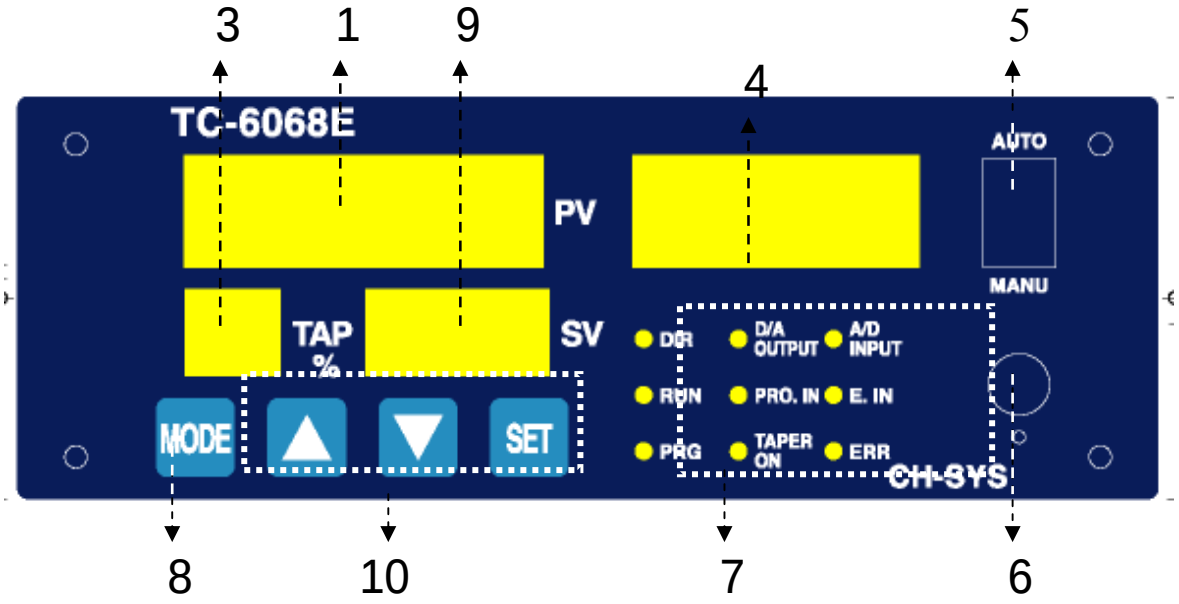
2. TC-6068E Electrical Characteristics

Voltage	AC220V ±10% 50/60H2	
Power	100W max.	
Encoder/Limit Switch power supply	DC-12VDC±5% 100mA	
Encoder input	A A/B phase(difference 90°) NPN input photo coupling isolated	Resonance frequency 10K Hz
Shaft Limit Switch input	NPN input photo coupling isolated	Resonance speed 50Hz/Sec
Control contact input	NPN input photo coupling isolated	
Tension detect EXG power supply	DC-10V±0.5VDC 80mA	
Tension detector signal input	0-20mVDC 0-30mVDC for 250/450 kg	Specifications 5.10.20.30.50.100.250KG.450 KG
A/D input analysis	Tension input:12 Bit A/D Master speed input:12 Bit A/D	DC:0-20mV DC:0-10V
D/A output analysis	Tension control output D/A 12 Bit	DC:0-10V
Relay output	a contact 250V AC, ≦1A	
Magnetic powder brake/ clutch control electric current	3.0A, DC 24V	PWM output

3. TC-6068E Operation Diagram

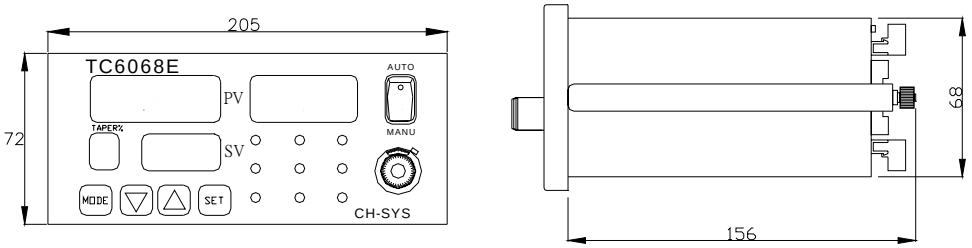


4. Control Panel Description



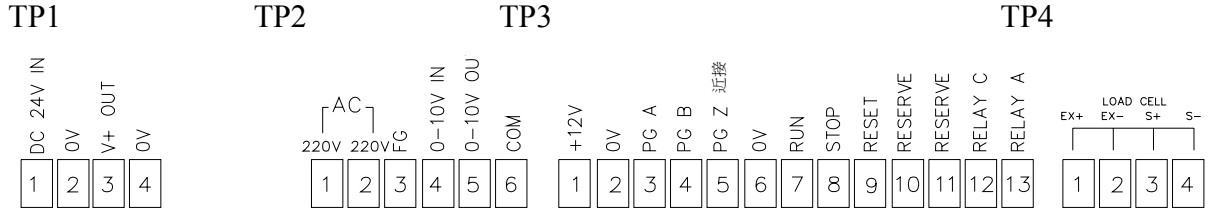
1. Tension display
2. Tension setting display
3. Tension unwind (TAPER) display at %
4. Outer diameter/output/tension decrement display
5. Auto/Manual shift key
6. Manual input of basic value
7. Status display
8. Parameter Enter key
9. Parameter value display
10. Tension setting/Changeover of Parameter items/Parameter value modification

5. External Dimensions and Fastening Positions



Panel Opening: 196 mm x 70mm

6. Terminals Connection Diagram and Details



Terminal #			Terminal #	
TP1 1	DC power input 3V (+24V)		**TP3 1**	Power for encoder/limit switch +12V ≦50mA
2	DC power input 3V (-0V)		**2**	Power for encoder/limit switch -0V ≦50mA
3	Magnetic powder brake/clutch control output (+24V)		**3**	Encoder input channel A
4	Magnetic powder brake/clutch control output (-0V)		**4**	Encoder input channel B
TP2 1	Power input AC220V 50/60Hz		**5**	Shaft limit switch signal input
2	Power input AC220V 50/60Hz		**6**	COM for control signal
3	FG ground wire		**7**	Control input RUN
4	A/D input master speed simulate DC 0-10V		**8**	Emergency stop
5	D/A out put tension control 0-10V		**9**	RESET
6	COM for A/D D/A out 0V		**10**	Reserved
TP4 1	EXG+ (green) tension transducer input		**11**	Reserved
2	EXG- (black) tension transducer input		**12**	Relay output contact 250V≦ 1A
3	SIG+ (red) tension transducer contact		**13**	Relay output contact 250V≦ 1A
4	SIG- (white) tension transducer contact			

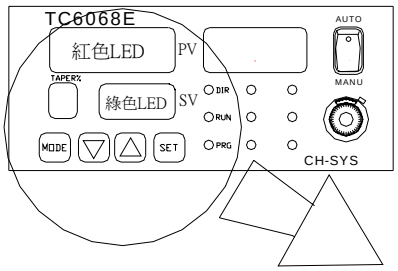
7. TC-6068E Parameter Clusters Flowchart

Description: TC-6068E has two major parameter clusters.

A: Pr. 01 Items: Various functions adjusting parameters no.01-no.36

B: Pr. 02 Items: Tension zeroing and tension correction no.01-no.02

Relevant keys and prompts as follows on entering parameter mode:



Red LED	display the content of parameter
Green LED	display parameter cluster and parameter no.
MODE	parameter enter (set) mode
SET	enter parameter no. and value input
▽ △	select parameter no. or modify parameter value
PRG	light on as enter parameter mode

1. How to enter parameter

Panel display	**General display value**	**Parameter cluster no.**	**Pr. Cluster item no.**
Operation method		press MODE one time	press SET one time
Mode explanation		Select parameter no.	Select Pr.Cluster item no.

2. How to modify parameter (Pr. Cluster) value

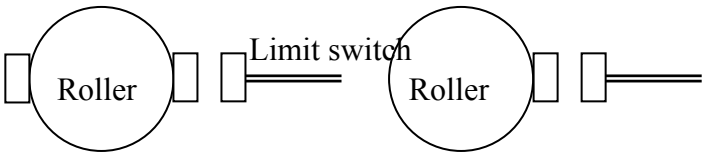
Panel display	**Parameter cluster no.**	**Pr. Cluster item no.**
Mission explanation	How to modify the value of parameter no.	How to modify the value of Pr. Cluster item no. (Pr01, Pr02)
Operation method	1 press ▽ △ to select the parameter no. that will be modified 2 press SET one time to display its value (content) 3 press ▽ △ to modify the value 4 press SET back to parameter selection mode	1 press ▽ △ to select the pr. Cluster item no. that will be modified. 2 press SET one time to display its value (content) 3 press ▽ △ to modify the value 4 press SET back to pr. Cluster selection mode

8. TC-6068E Parameter Pr.01 Explanation

Pr. 01 item no.	Description	Unit	Range	Factory Setting
NO—01	Irresponsive area	1Dight kg/N/LB	0-255	3
NO—02	Execution mode	1, 2, 3	1: fixed tracking 2: SPAN decay 3: curve decay	3
NO—03	Tension unwind (TAPER) percentage	%	0-50%	10
NO—04	Password protected access		0-9999	1234
NO—05	Min. outer diameter (empty spool diameter)	mm	0000-9999	100
NO—06	Max. outer diameter (full spool diameter)	mm	000-999	1000
NO—07	Encoder pulse input setting selection	1, 2	1: Single channel pulse 2:AB channel pulse (difference 90 degrees)	2
NO—08	Signal length in encoder	mm	0.001-9.999	0.300
NO—09	Spool limit input per rotation	P/R	1-100	1
NO—10	Tension reduction percentage at stoppage	%	0-100%	10%
NO—11	Tension control output compensation percentage at emergency stop	%	0-100%	10%
NO—12	Wind/unwind selection	0, 1	0: wind 1: unwind	0
NO—13	Tension average frequency	0.01 Sec./Time	1-200	10
NO—14	Master speed average frequency	0.01 Sec./Time	1-200	20
NO—15	Panel tension display average frequency	0.01 Sec./Time	1-200	50
NO—16	PK setting	K	0.00-99.99	1.00
NO—17	IK setting	Sec.	0.00-99.99	10.00
NO—18	Section 2 IK value	Sec.	0.00-99.99	3.00
NO—19	Section 2 difference for usage diagnosis	1 Digit kg/N/LB	1-9999	50

Pr.01 item no.	Description	Unit	Range	Factory Setting
NO—20	Min. error for I replace	1 Digit kg/N/LB	1-9999	1.00
NO—21	Max. error for I replace	1 Digit kg/N/LB	1-999	100
NO—22	Accumulation start base voltage	VDC	0.00-10.00	1.00V
NO—23	Upper Limit for I react value	VDC	00.0-10.0	10.00
NO—24	PID execution time	Sec.	0.01-2.55	0.05
NO—25	Upper limit for tension feedback	1 Digit kg/N/LB	0000-9999	1000
NO—26	Lower limit for tension feedback	1 Digit kg/N/LB	0000-9999	50
NO—27	Specified output method for RELAY 1	1-7	1=Start 2=Output OVER 3=Feedback HI 4=Feedback LOW 5=Feedback abnormal 6=Feedback normal 7=	7
NO—28	Master speed input K value			
NO—29	Top row right side display method	1-3	1: Outer diameter 2: Output percentage 3: Master speed input value	
NO—30	Tension decimal point	0-3		
NO—31	Tension setting value	1-9999		
NO—32	Tension feedback K value	0.001-9.999		
NO—33	Tension feedback OFFSET zero adjust	±1000		
NO—34	Hysteresis K value as per accelerate or decelerate	1-1000		
NO—35	Tension increase percentage as accelerate	1-1000		
NO—36	Tension decrease percentage as decelerate	1-1000		

TC6068E Pr01 ParameterCluster Explanation

Pr.01 item no.	Parameter Function	Parameter Content Definition
NO—01	Tension control irresponsive area	This parameter shows preset tension. The digit is for adjusting irresponsive range. Unit: Kg/N/LB
NO—02	Tension control decrease setting	Tension decrease curve setting at winding. There are linear and COS θ curve tension decrease methods. Refer to"9. Tension Decrease Function Description" for detail.
NO—03	Tension control tension decrement percentage (empty spool to full spool)	This parameter is preset at empty spool tension x (1-NO-03 setting %) = full spool tension. E.g.: empty spool tension setting 10.00Kg, Pr01 parameter NO03 set at 30% with full spool tension of 7.00Kg(internally calculated). Meantime, panel setting remains at 10.00Kg
NO—04	Access password	Factory setting: 1234. Access password has to be set at 1234 in order for Pr01-NO05-38 parameters and parameters within Pr02 cluster to be changed. Otherwise, items within parameter cannot be accessed to be changed. This parameter is protected.
NO—05	Setting min. outer diameter (empty spool)	Empty spool diameter input point. Tension unwinding and speed control utilize the diameter as base calculation point.
NO—06	Setting max. outer diameter (full spool)	Full spool outer diameter input point. Tension unwinding and speed control utilize this value as final calculation point.
NO—07	Encoder input selection	0: single channel pulse input A or B channel 1: A/B channel (difference 90^{O}) pulse input
NO—08	Length represented by each signal in encoder	
NO—09	Setting number of pulse input by limit switch per spool rotation	Value set: 2 Value set: 1 
NO—10	Setting tension control output decrease percentage at stoppage	At stoppage, TC-6068E calculated value can set output percentage of D/A2 through this parameter to avoid excessive stoppage tension.
NO—11	Setting tension output compensation on e. stop	Eliminating spool inertia on emergency stop.
NO—12	Control mode	0: Wind 1: Unwind. Setting TC-6068E on Wind or Unwind control mode.
NO—13	Bias voltage of master speed D/A2 output	Setting bias voltage of spool motor at base speed on stoppage.

Parameter #	Parameter Function	Parameter Content Definition
NO—14	These 3 items represent A/D input filter constant with a unit measure of 0.01 second NO—14 : A/D 1 Tension feedback input filter NO—15 : A/D 2 Master speed input filter NO—16 : Tension display filter	
NO—15		
NO—16		
NO—17	PK setting	Setting instantaneous compensation for discrepancy between feedback tension and preset tension. The larger the number, the more the compensation.
NO—18	Section 1 IK setting	
NO—19	Section 2 IK setting	IK is D/A 1 base point correction parameter when actual feedback tension differs from preset tension. These 2 parameters are inversely proportionate, i.e. the smaller the preset time, the faster the corrected time. Note: Time setting of NO—19 must be smaller than that of NO—18.
NO—20	Setting Section 2 IK value NO—19 usage diagnosis	E.g. Set this parameter to 50 Digit (5.0N) with tension set at 80.0N. Actual feedback tension and its calculation as follows: A: When (Actual value-preset value) < No—01 preset value NO—17, NO—18, NO—19 do not compensate. B: When (actual value-preset value) > NO—20 preset value (5.0N), NO—17 compensates and perform NO—18 correction.
NO—21	Setting tension control base value %	This parameter is IK base value (D/A output start value), i.e. each time after tension falls back, start performing tension control calculation from this base value.
NO—22	IK value response upper limit	Setting max. range for IK correction to avoid excessive tension control.
NO—23	Tension PID control response time	If set at 0.05 sec., tension actual feedback is read and compared with preset value every 0.05 sec. to perform tension control correction.
NO—24	Communication site	Communication address when initiating MODBUS PRU and PLC or linking up with computer.
NO—25	Communication speed	Working with PLC or computer communication speed selection parameter.
NO—26	These 3 items show decimal point setting displayed by TC-6068E LED.	0 : 0 digit to right of decimal point, displayed as 0000 1 : 1 digit to right of decimal point, displayed as 000.0 2 : 2 digit to right of decimal point, displayed as 00.00 3 : 3 digit to right of decimal point, displayed as 0.000
NO—27		
NO—28		

※ Refer to Pr01 table of parameters for parameters not listed here.

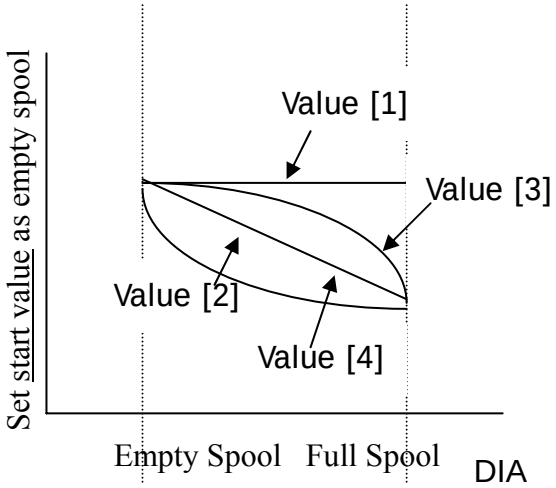
9. Tension Diminishing Function

1. To cope with the fact of decreasing tension due to increasing outer diameter during winding process for most soft materials, TC-6068E is specifically designed to make it easy for users to simply select the decreasing method and final decreasing rate in order to perform desired tension decrease. According to expert analyses, the optimum decreasing condition is COSθ angle.

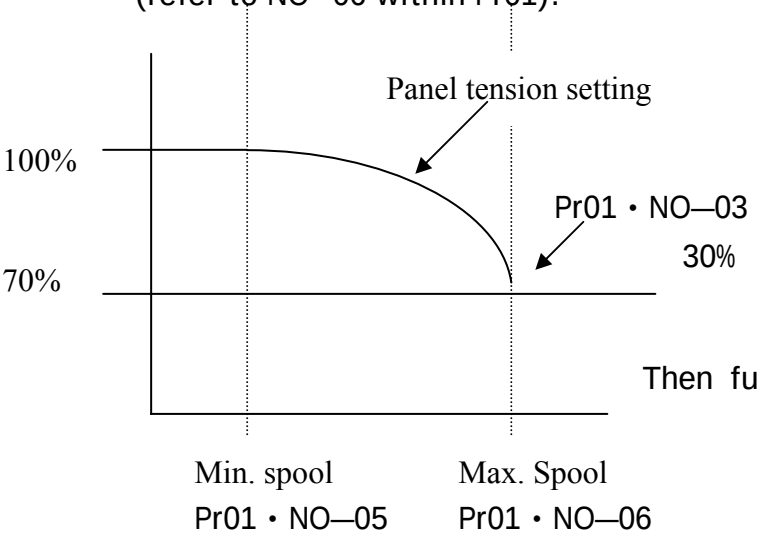
2. Setting Function

- Setting Decreasing Method: NO—02 within parameter Pr01.

  Value [1]: Denoting no decrease function
  Value [2]: Denoting diameter decrease method
  Value [3]: Denoting COSθ decrease method
  Value [4]: Denoting SINθ decrease method



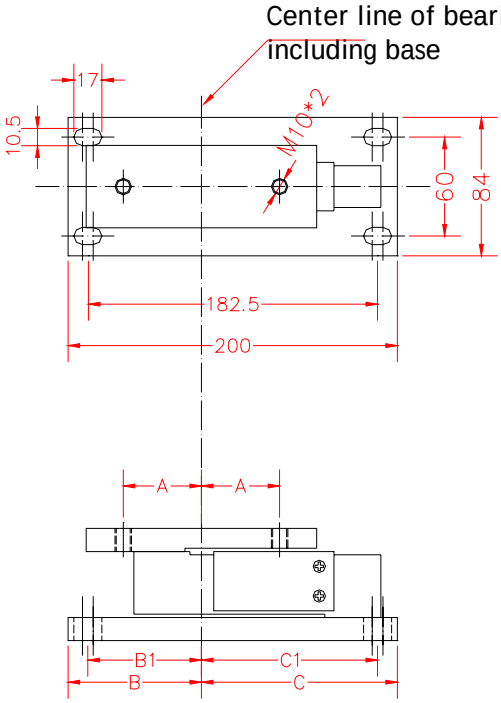
- Setting Decreasing Rate: NO—03 within Parameter Pr01.
  Application requirement: This setting is valid only if NO—02 within Parameter Pr01 is set at [2] or [3].
  Preset value: Being the tension decreasing percentage from empty to full spool.
  Explanation: If tension is set at 30, tension decreases by 30% at maximum spool (refer to NO—06 within Pr01).



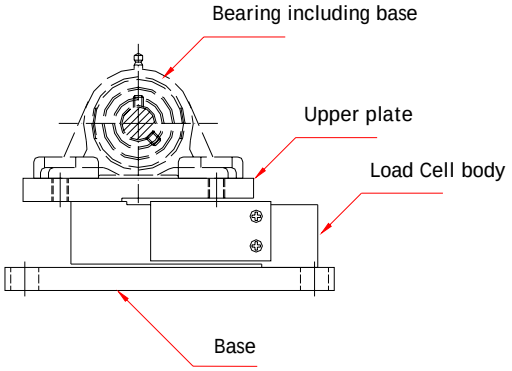
E.g.: If decreasing rate is 30%
And beginning tension is 200.0N,
Then full spool tension is 200.0N x (1-0.3)
=140.0N (actual value)

Side view for assembly of 1040 Load Cell and Bearing including base

10. Tension detector Device and Checkup



Side view for assembly of 1040 Load Cell and Bearing including base



Distance of fastening screws of bearing on upper plate

hole dia. of bearing	length A	length B	length C	length B1	length C1
ø20mm	47.5mm	81mm	119mm	68.5mm	106.5mm
ø25mm	52.5mm	86mm	114mm	73.5mm	101.5mm

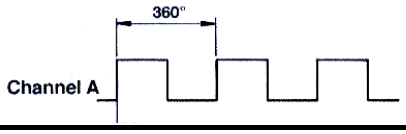
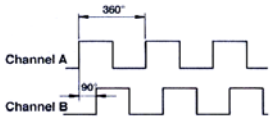
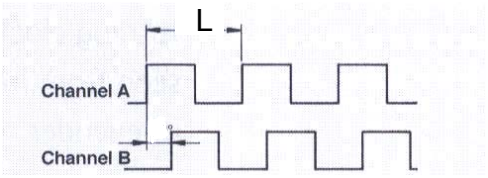
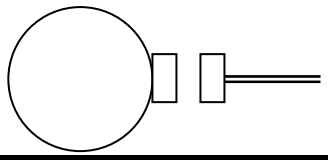
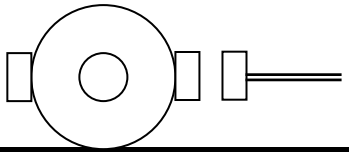
11. Principles for Outer Diameter Calculation and Setting Preset Value

Outer diameter calculation for TC-6068E is based on the following equation to work out diameter.

$$\text{Outer Diameter} = \frac{\text{Encoder signal volume} \times \text{Length represented by signal}}{\text{Limit signal volume} \times 3.141593}$$

Setting preset value:

Relevant parameters are set within NO—07 NO—08 NO—09 of Pr01 parameter.

Pr01 item no.	Set value	Function
NO—07	1	Channel A pulse input 
	2	Channels A.B difference90 degrees 
NO—08	Encoder signal length per number L = 0.000 ~2.000mm	
NO—09	1	Limit Switch 1 
	2	Limit Switch 2 

12. Specifying Relay Output

TC-6068E has 2 sets of flexible relay contact output functions.
Function selections are set within NO—27 NO—28 of Parameter Pr01 cluster.
NO—27: Relay1
NO—28: Relay2

Pr01 cluster	Set value	Function
NO—27 NO—28	0	Specifying communication
	1	Start output
	2	Motor rotation output
	3	Motor reverse rotation output
	4	Tension output 0%
	5	Tension output 100%
	6	Tension feedback > upper limit HI
	7	Tension feedback < lower limit LO
	8	Normal feedback