Supreme Accuracy Power Roll-up/Put-in

Micro Tension Controller

DRC-607

USER'S MANUAL

TENSION CONTROLLER

VALUE

RUN
PRG
ERR

RATTO %

MODE

SET

CH

DRC-607

Contents

Thank you for using DRC-607 Supreme Accuracy Power Roll-up/Put-in Tension Controller. This system was specifically developed for clients who process materials that are either made of thin film, non-woven cloth, paper, or ultra fine fiber, etc. to match with the requirements of high speed and huge difference of rollers' diameter, re-roll after strip, and roller auto-change. Please read this user's manual before using 607 so as to become familiar with subsequent wiring, parameters setting, and troubleshooting. Please keep this user's manual handy for future reference.

Caution

- Forbid to wire or install/remove the connector of 607 Controller when the power is turned on, in order to avoid any risk or damage to 607 Controller.
- Terminals 6-21 of 607 Controller are for signals input and output, please do not connect with AC power to prevent damage from occurring.
- Do not connect D/A output terminals 20(+) and 21(-) of 607 controller to AC power or allow the wrong voltage to enter.
- Do not remove the housing of the controller or perform voltage resistance tests on components of the controller.
- Record and keep parameters of 607 Controller after test-run.

2. Characteristics of DRC-607

- 607 Controller can work with inverters and DC motors to perform the high precision tension control of material roll-up/put-in.
- Working with VR detector, 607 Controller can perform micro tension control as well as calculate external diameter and roller-change automatically.
- As far as controlling sequence is concerned, all it takes is putting an encoder to master motor shaft to enable 607 system to start with the master system consequently. In addition, for pure digital computation purposes, the functions will remain the same as long as parameters are the same. Thus no more calibration is required.
- 607 control system automatically adjusts and controls the modifying volume based on the diameter of material roll-up/put-in roller. Consequently, VR stoke can be shortened and control of material roll-up/put-in between huge difference rollers' diameter achieved. The requirement for high precision tension control can also be accomplished.
- The 607 possesses red and green LED dual display function. The red LED displays the rotating speed of slave motor, difference of E1/E2, output of D/A, input of A/D and the change in external diameter (See parameter Pr09 for details) while the green LED displays the initial value.
- According to mechanical and production changes, parameters of the 607 such as ratio of mechanical gear, function selections of the software, ratio of calculus, times setting of VR input can be adjusted accordingly.
- Function of 4 divide of encoder can be set up internally, using encoder of lower revolution without compromising precision. For instance, a motor of 200P/R can be resolved to 0,1,2,3...799,800.
- The 607 has a unique design to separate different power sources. For this reason, it is superior in resisting interference.

3. Functions of the Control Panel
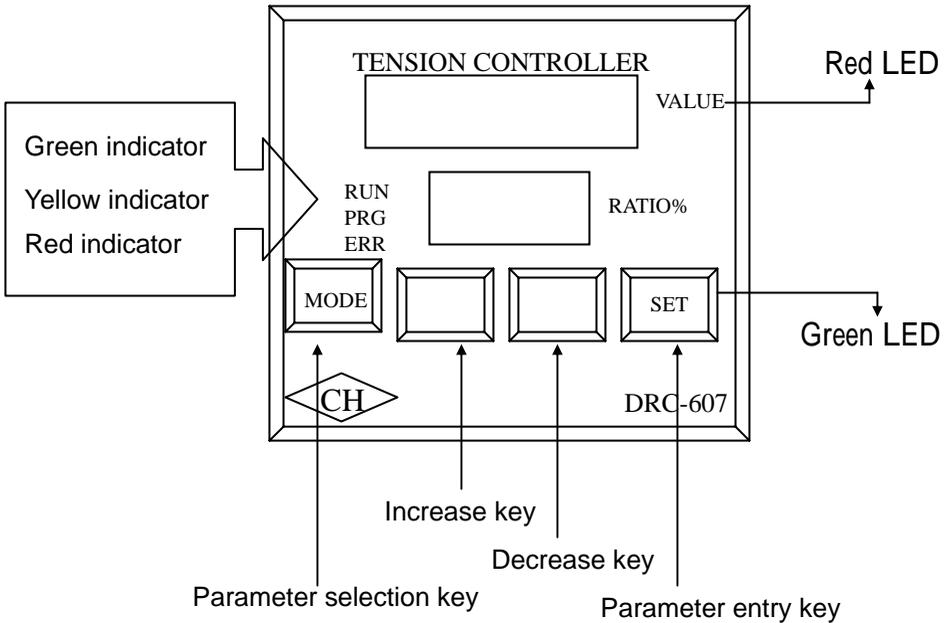
- The upper red LED displays the content of parameters when changing parameters. After the setting is completed, display mode can be selected through parameter 9.
- The lower green LED displays the parameter number when changing parameters. After the setting is completed, it displays proportion setting.

4. External Dimensions & Opening for Installation

Dimensions of the opening on the panel of the control box
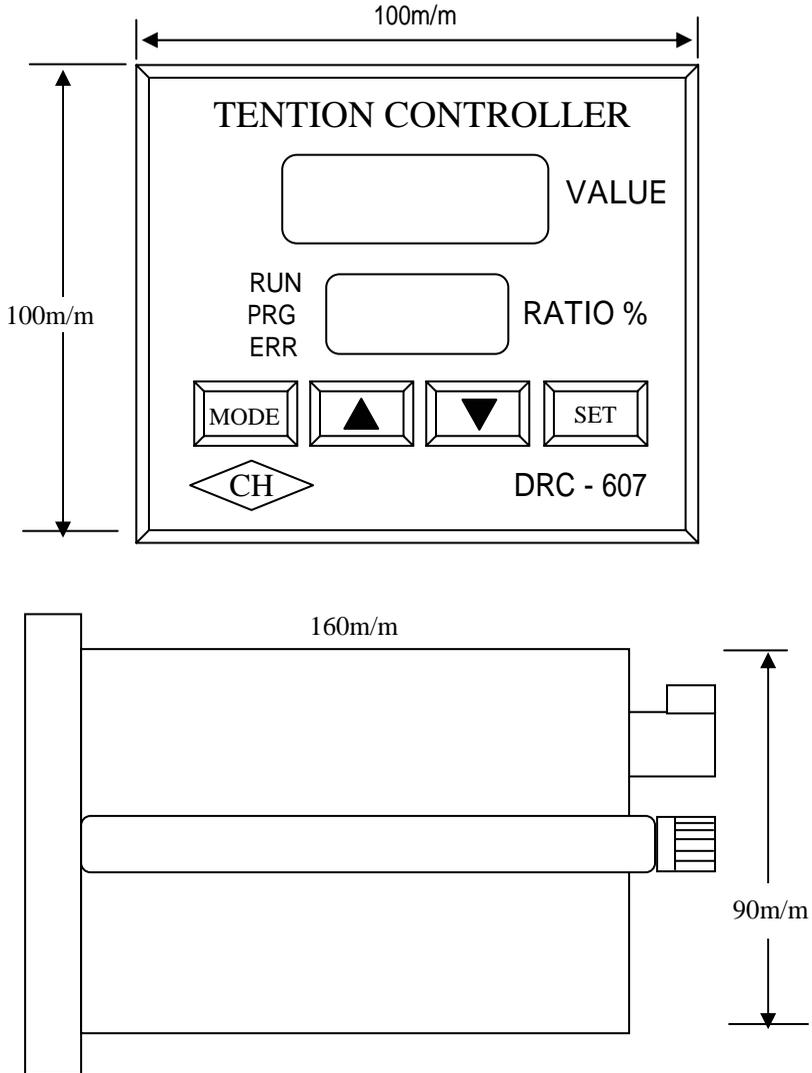
Panel opening: 92 x 92 m/m

5. Diagram of Terminal Connection
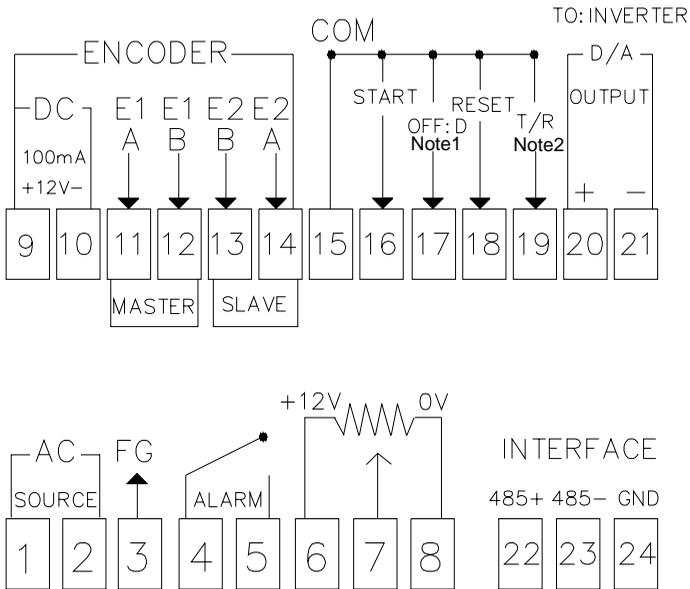
Note 1: When terminals 15 and 17 are short-circuited, 607 accepts VR input signal, but does not perform external diameter calculation. When they are open, 607 both accepts VR input signal and perform external diameter calculation.

Note 2: When terminals 15 and 17 are open, proportion sequential control starts. When they are short-circuited, tension control is engaged. When the system starts, wait till proportion sequential control stabilizes and manual arrangement is in position before engaging tension control.

6 Wiring of Control Loop Diagram

Roller Auto-change

Roller A   Roller B

VR detection

Pressure tank

E1   E2   E3

INV   INV   INV

E/P

DRC 607   DRC 607

Master Speed Command

Tension Command
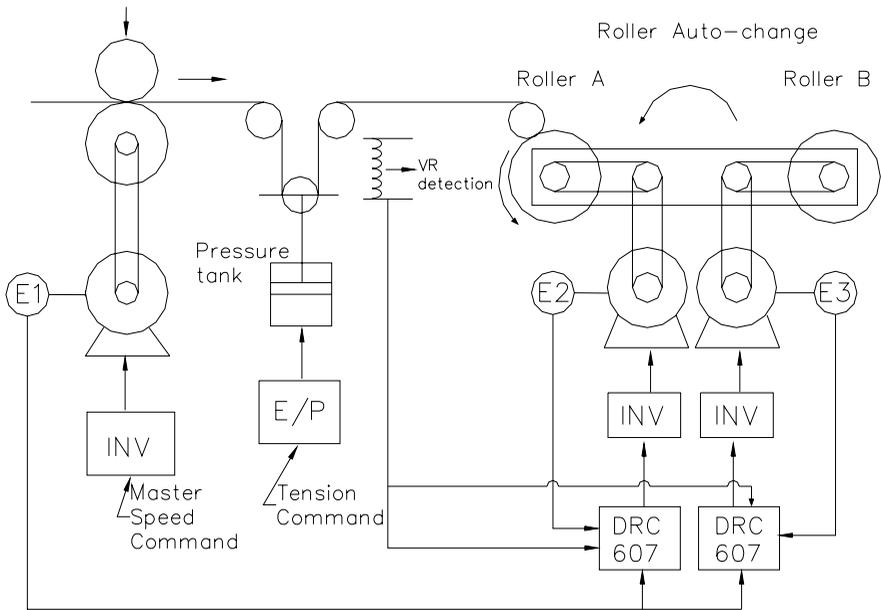
7. Procedure of Roller Auto-Change

		Roller			Roller	
Roller A positioning manual roll-up	INV		ON	INV		OFF
	Terminal 607	15	COM	Terminal 607	15	COM
		16	ON		16	OFF
		17	ON		17	OFF
		18	OFF		18	OFF
		19	OFF		19	OFF

		Roller			Roller	
Automatic engagement of tension control	INV		ON	INV		OFF
	Terminal 607	15	COM	Terminal 607	15	COM
		16	ON		16	OFF
		17	OFF		17	OFF
		18	OFF		18	OFF
		19	ON		19	OFF

		Roller			Roller	
Replacement of roller B	INV		ON	INV		OFF
	Terminal 607	15	COM	Terminal 607	15	COM
		16	ON		16	ON
		17	OFF		17	OFF
		18	OFF		18	OFF
		19	ON		19	OFF

		Roller			Roller	
Roller B positioning cut startup	INV		ON	INV		OFF
	Terminal 607	15	COM	Terminal 607	15	COM
		16	ON		16	ON
		17	OFF		17	OFF
		18	OFF		18	OFF
		19	ON		19	OFF

Cut complete and re-roll complete	Roller		Roller	
	INV	ON	INV	OFF
	Terminal 607	15 COM	Terminal 607	15 COM
		16 OFF		16 ON
		17 OFF		17 OFF
		18 OFF		18 OFF
		19 OFF		19 ON

Roll-up complete and roller A startup	Roller		Roller	
	INV	ON	INV	OFF
	Terminal 607	15 COM	Terminal 607	15 COM
		16 ON		16 ON
		17 OFF		17 OFF
		18 OFF		18 OFF
		19 OFF		19 ON

Replacement of roller A	Roller		Roller	
	INV	ON	INV	OFF
	Terminal 607	15 COM	Terminal 607	15 COM
		16 ON		16 ON
		17 OFF		17 OFF
		18 OFF		18 OFF
		19 OFF		19 ON

Roller A positioning cut startup	Roller		Roller	
	INV	ON	INV	OFF
	Terminal 607	15 COM	Terminal 607	15 COM
		16 ON		16 ON
		17 OFF		17 OFF
		18 OFF		18 OFF
		19 OFF		19 ON

Note: Power is supplied by one of the 607s to VR detector. VR signals are entered into two 607s simultaneously at terminals 7 and 8.

8 Description of Terminals

Power	Terminals 1 and 2 are the AC power source with AC220V±10% and 50/60HZ. Terminal 3 is the third grounding.
Warning output	Terminals 4 and 5 are the A contacts for error output. RELAY outputs when the signal cumulative differential of E1 and E2 reaches the preset value of parameter Pr17. RELAY is back to non-output status when the differential is smaller than the preset value with the capacity of the RELAY connecting point being 1A 250VAC.
A/D input	Terminals 6, 7, and 8 are for A/D input with resolution of 2^{10} and input impedance of 100K . They are the input contacts for VR detector.
E1 and E2	Terminals 9(+) and 10(-) are the power source for encoder with DC12V ±3% and 100mA (MAX).
Encoder input	Terminals 11 and 12 are for inputting signals to master motor encoder. Terminals 13 and 14 are for the feedback of signals to roll-up/put-in motors.
System initiation	System initiates when terminals 15 and 16 are short-circuited. It stops when the contacts are open.
Setting parameters	When terminals 15 and 17 are short-circuited, 607 accepts tension detector to input command without calculating external diameter.
Reset external diameter	When terminals 15 and 18 are short-circuited, 607 automatically calculates recovery of external diameter. Note 1: Recovery of roller diameter can only be performed when roll-up/put -in stops.

Control mode	Terminals 15 and 19 OFF: ratio control (do not accept tension signals). ON: tension control.
D/A output	Terminals 20(+) and 21(-) are for D/A to output 0-10V to inverter or DC controller. Use metallic meshed insulated wires for wiring and make sure to keep them insulated from power wires. /erse the positive (+) and the negative (-).
Communication interface	Terminals 22, 23, and 24 are the 485 communication interface.

9. Setting Parameters

Basic requirements: Password: Parameter 1 needs to be set at 1000 to
protect it from being changed.

Procedures:

1. Press Mode, the panel shows that you have entered parameter 1

Red

RUN

Yellow light flashes   PRG | Pr01 | Green display screen

ERR

2. Press SET, the panel shows

Caption

PRG | Pr01 | Green caption flashes

3. Select either   or   to adjust the red LED number to 1000

Red LED

| Pr01 |

Green LED flashes

Press SET again to enter

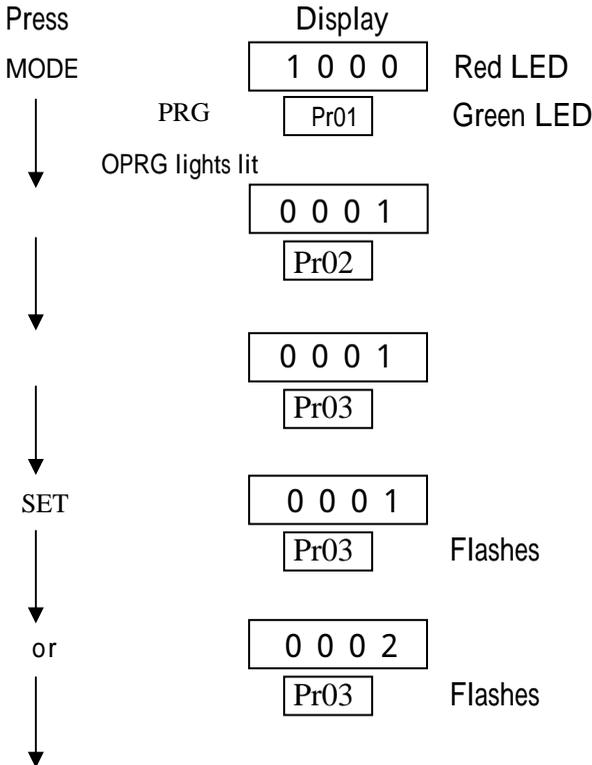4. The panel shows: indicating you are now in parameter 2

| Pr02 |

5. If parameter 2 needs to be changed, press SET to enter the change mode.
Then press   or   to make the desired selection. Press SET when finished,
the panel will move to parameter 3. Repeat above steps.

6. If you just want to change the phase of parameter 5, press   to move the phase of parameter to

	Red LED
Pr05	Green LED
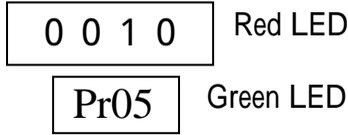
Then press SET to enter the change mode. Press SET after the change is made. Then press MODE to return to the operate mode.

Example: The procedures needed to change parameters 3 and 10 are demonstrated as follows:

Press   Display

MODE   Red LED

      PRG   Pr01   Green LED

OPRG lights lit

                  Pr02

                  Pr03

SET   Pr03   Flashes

or   Pr03   Flashes

SET

Pr04

↓

Pr05

.
Pr09

↓

.
Pr10

SET

.
Pr10	Flashes

↓

or

.
Pr10

↓

SET

Pr11

↓

MODE

1000	Standard panel value setting OK
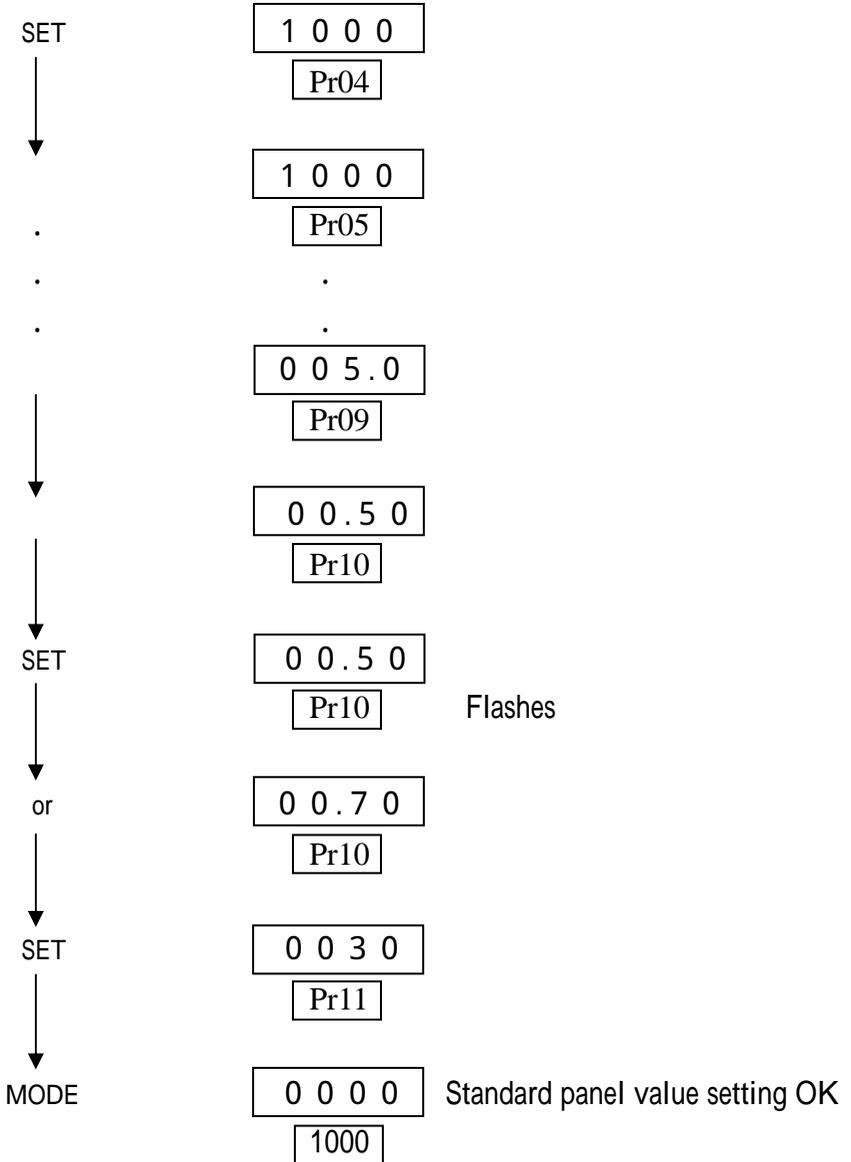
10. Table of Parameters

Parameter Code	Description	Range	Pre-shipment Setting	Note
Pr01	Enter password	0000 - 9999	1000	
Pr02	P (proportion) sensitivity revised value (the larger the faster of the reaction)	1 - 10	1	
Pr03	I (integral) sensitivity revised value (the larger the faster of the reaction)	1 - 10	1	
Pr04	Proportion value revised K value	0001 - 9999	1000	
Pr05	Line speed revised K value (0.0001 – 0.9999)	0001 - 9999	1000	
Pr06	Error judgment, PPR	0001 - 9999	1000	
Pr07				
Pr08	Inactive			
Pr09	0: RPM 1: E1 - E2 3: VR position 5: Inverse ratio of external diameter	0 - 5	1 (E1-E2)	
Pr10	Operating mode 0: Speed tracking 1: Angle tracking	0 - 1	0	
Pr11	/A output limit 0: No 1: Yes	0 - 1	0	
Pr12	ENCODER number per rotation (x 10)	10 - 60	20 (200P/R)	
Pr13	Highest RPM of the motor (x 100)	8 - 40	18(1800)	
Pr14				
Pr15				
Pr16	Inactive			
Pr17				
Pr18				

Pr.19	Position of decimal point in upper row	0 - 3	0	
Pr.20	Position of decimal point in lower row	0 - 4	0	
Pr.21	Master ENCODER reverse setting 　　: Normal 　　: Reverse	0/1	0	
Pr.22	Slave ENCODER reverse setting 　　: Normal 　　: Reverse	0/1	0	
Pr.23	Upper limit for proportion setting	00000 - 19999	12000	
Pr.24	Lower limit for proportion setting	0000 - 9999	05000	
Pr.25	Display proportion setting key lock	0 - 1	0	
Pr.26	A/D input integral	1 - 200 (0.01 - 2.05)	5	
Pr.27	E1-E2 differential non-response range	0 - 10	4	
Pr.28	Inactive			
Pr.29	Inactive			
Pr.30	Tension setting point	0 - 10.00V	5.00V	
Pr.31	Tension 10V input corresponding value	0 - 2000	1000	1:1
Pr.32	VR offset setting center, accelerating offset setting of Pr.35 calculating speed	0 - 5.00V	±2.00(V)	
Pr.33	Tension non-response range	1 - 255		
Pr.34	Tension P value (proportion revised value)	0 - 10.00	0.40	
Pr.35	Tension I value (integral revised value)	0 - 255	10	
Pr.36	Startup deviation delay time	0 - 10.0	1	
Pr.37	P limit range (maximum proportion revision)	0 - 25.5%	100	
Pr.38	I limit range (maximum proportion revision)	0 - 1000	1000	

11. Description of Parameters

Pr01   Password: Preset at 1000. If it isn't 1000, press   or   till it
        is. Then press SET to complete this step.

Pr02   Controlling reaction sensitivity: Setting range 1 - 10 with a
        minimum of 1 and a maximum of 10. Setting has to be made in
        conjunction with Pr03 when tracking positions.

Pr03   Setting position tracking sensitivity: Range 1- 10 with a minimum
        of 1 and a maximum of 10. This parameter is not used if Pr10 is
        set to track speed.

Pr04   Setting basic external diameter: Range 100 - 1200 with 1000 at
        time of roll-up and 100 - 200 at time of put-in. Motor RPM is set
        according to roller diameter ratio.

Pr05   Display revised K value: Range 0.001 – 9.999, which is used
        when Pr09 is set at 0. Adjustment is made by dividing actual
        speed by indicated speed with the quotient rounded off to the
        third place to the right of the decimal point.
        Actual speed/Indicated speed = XXXX

Pr06   Setting E1-E2 differential: Range 1 – 9999P/R. The RELAY
        outputs when E1-E2 differential is equal to or larger than the
        preset value. This function can be used for protection purposes.
        The setting has to be 500 or above.

Note: It is valid only when Pr10 is set at 1.

Pr07   Reserved

Pr08   Reserved

Pr09   Red LED display selection

       0: RPM display

       1: E1 – E2 display. Select this when test-run. Then adjust Pr02
and Pr03 according to E1 – E2 to make control smoother.

       3: A/D input voltage value: indicating the A/D input voltage
value of terminals 7 and 21, and is able to determine whether A/D
is input.

       5: Being able to indicate external diameter inverse ratio revision.
Pr04 calculates changes according to external diameter.

Pr10   Operation control mode

       0: Tracking speed

       1: Tracking position the whole time

Pr11   A/D input operation mode

       0: No input

       1: Reserved

       2: Tension revision input value

Pr12   Per rotation resolution PPR input value ($\div$10) from motor
Encoder: enter 20 when using 200 PPR Encoder while enter 60
when using 600 PPR Encoder.

Pr13   Setting RPM ($\div$100) when slave motor is at its top speed: if motor
is 4P, top frequency of inverter is set at 90Hz, rpm 2700, set at
27. If motor is 6P, top frequency of inverter is set at 60Hz, rpm
1200, set at 12.

Pr14   Reserved

Pr15   Reserved

Pr16   Reserved

Pr17   Reserved

Pr18   Reserved

Pr19   Change the decimal point position of the red LED

    0: 0000.

    1: 000.0

    2: 00.00

    3: 0.000

Pr20   Change the decimal point position of the green LED

    0: 0000.

    1: 000.0

    2: 00.00

    3: 0.000

Pr21   Master input encoder phase: 0 is positive phase and 1 is reverse. At startup, if the phase of master encoder is incorrect, 607 will detect automatically and display Err02. Simply change this parameter to avoid inconvenience caused by possible re-wiring.

Pr22	Phase of slave motor encoder: 0 is positive phase and 1 is reverse. At startup, if the phase of slave encoder is incorrect, 607 will display Err04. Simply change this parameter to avoid inconvenience caused by possible re-wiring.
Pr23	Upper limit for proportion value setting: proportion 0.001 - 9.999 if set at 2.000, proportion value can only go as high as 2.000 by pressing .
Pr24	Lower limit for proportion value setting: proportion 0.001 - 9.999 if set at 0.500, proportion value can only go as low as 0.500 by pressing .
Pr25	Display proportion setting lock: 0. Inactive 1: Locked according to current display value. Do not change proportion setting.
Pr26	Terminals 7(+) and 8(-). The larger the number selected, the more stable the A/D input integral time and the longer the response time.
Pr27	Setting encoder E1 - E2 differential insensitivity range.
Pr28	Reserved
Pr29	Reserved
Pr30	Setting point for tension revision (set Pr09 at 3). Assume at time of A/D input, VR detects the top value to be 8.00 with the bottom value stand at 3.00. Set this parameter at 5.50.

Pr31   The K value that displays corresponding to A/D input 0-10VDC.
        Example: if set at 1000, it will be 0-10VDC with the displayed
        number being 0-1000.

Pr32   When calculating tension control, if VR center differential is
        larger than this setting, the calculating speed of Pr35 tension I
        value doubles.

Pr33   Setting tension insensitivity range. If the setting is 3, it means
        insensitivity range to be within ±3 of Pr30's setting point.

Pr34   is the tension P value and the revised K value, which is the
        instantaneous revision detected by VR. The larger the number
        means the more the revision.

Pr35   is the tension I value and the revised K value, which is the revised
        speed derived from calculating the external diameter. The larger
        the setting means the faster the external diameter revision.

Pr36   is the differential revision delay time at startup with an increment
        of 0.1 second.

Pr37   is the P value limit range. If set at 150, it will be top revision
        amount ±15%. This parameter has to be set in conjunction with
        Pr34.

Pr38   is the I value revision range. This parameter is set according to
        roller diameter ratio (full roller ÷ empty roller).

12. Cautions for Test-Run

1. Check the following items.

- Make sure the power that enters 607's terminals 1 and 2 is AC220V±10%.
- Make sure the A and B output signals coming from master motor's encoder (E1) are directed to 607's terminals 11 and 12.
- Make sure the A and B output signals coming from roller motor's encoder (E2) are directed to 607's terminals 13 and 14. Connect the insulation net of the master (slave) encoder's insulation wires to terminal 10 of 607.
- Terminals 15 and 16 have to be short-circuited at time of synchronization.
- Make sure VR detector is connected to terminals 6, 7, and 8 and signals are not inversely connected.
- The D/A output from terminals 20(+) and 21(-) of 607 has to be directed to the analog frequency number command contact of slave motor's inverter.

2. Master motor's acceleration/deceleration time setting has to be larger than 5. It would be best to be larger than 10.

3. Slave motor's acceleration/deceleration time setting has to be smaller than 5. It would be best to be smaller than 3.

Note: Contact us if acceleration/deceleration time setting needs to be larger than 1 second.

4. The best startup frequency for slave motor's inverter is 0.1Hz.

5. The cord used for 607's D/A output to inverter has to be insulated and separated from the power cord. Connect the insulation net to the 0V contact for input of inverter's signals.

6. Under normal circumstances, terminal 15 of 607 should be short-circuited with terminals 16 and 19 while terminals 17 and 18 are open.

7. To adjust the proportion value, simply press the   and   on the control panel. It is indicated on the green LED.

8. The following procedures are for the first test-run of 607:

- Calibrate basic speed proportion as follows:

    (1) Set Pr10 at 0 and Pr9 1.

    (2) Open terminals 15 and 19.

    (3) Pr04 set at 1000 at time of roll-up.

    Settings at time of put-in to be $1000 \times \dfrac{1}{\text{Roller diameter ratio}}$

   Example: empty roller is 100mm, full roller is 400mm, roller diameter ratio 4:1

    $1000 \times 1/4 = 250$ (Pr04)

    (4) Start up the master and roller calibration speed.

    (5) For speed revision proportion, press   or   to synchronize roller surface speed calibration with main speed.

    (6) Check to see if the change of E1-E2 on the red LED is single digit (it would be best to change between +1 and -1). Adjust inverter's acceleration/deceleration time and Pr02 and Pr03 if the change is double digit or more, to bring the change down to single digit.

- Check VR detector input OK.

high
VR
low

Voltage output
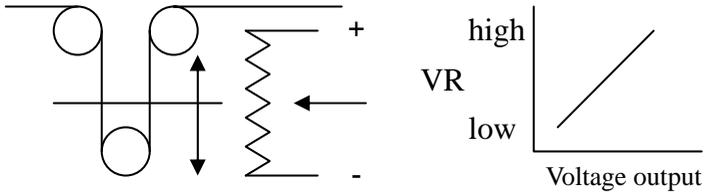
1. Set Pr09 at 3 and observe VR variations. Manually move VR wheel.
   The number has to be increasing between the lowest and highest points
   with the varying number of DC 4V at the least.

Example   8V

1V

1.00   8.00   Displayed value
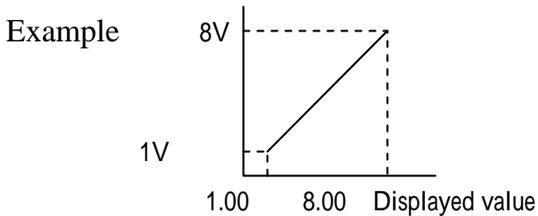
2. Set Pr30 VR center point.
   (Highest number + lowest number) ÷ 2 = Pr30 setting
3. Set Pr33 insensitivity range of basically 1-5 digits.
4. Set Pr34 at 0.20-1.00 according to
   (Highest number - lowest number) x Pr34 = 20-30% of green LED basic
   proportion
5. Set Pr35 at 5-30. This value is decided according to the thickness of the
   material and production speed. The thicker the material means the larger
   the number.
- Engage synchronization test-run. The speed starts at 10%. Adjust
   various 607 parameters to the best conditions before accelerating to
   100%.

9. Troubleshooting at test-run.

Requirements: Set both Pr09 and Pr10 at 1.

1. Normal.

2. Master starts while slave motor does not.

Possible causes:

(1) START contacts (terminals 15 and 16) are not short-circuited.

(2) Proportion set at 0000 or proportion K value being 0000.

(3) Inversely input E1 of master motor encoder.

Note: 416 displays Err 2 if the phase of master motor encoder is inversely connected.

(4) E1 signal of master motor encoder not connected to terminals 11 and 12 of 406. The RUN light flashes.

(5) D/A output points 20(+) and 21(-) wrongly connected or D/A malfunctions.

3. Master starts. Slave motor is at full speed.

Possible causes:

(1) The A and B phases of the slave encoder are inversely connected. 607 displays Err4 if slave motor is inversely connected.

(2) Slave encoder E2 input circuits are wrongly connected or E2 malfunctions.

(3) D/A malfunctions. Total voltage DC10V output.

(4) Proportion setting is too high.

4. Slave motor speed is unstable.

Change Pr10 to 0 before re-test. If normal, meaning slave motor torsion is not big enough to overcome inertia. Change Pr02 and Pr03 before re-test. If not working, meaning position cannot be used to track module and Pr10 needs to be changed to 0.

5. VR wheel is overly vibrating.

Adjust the open proportion value of terminals 15 and 19. Check to see the stability of the roll-up motor is within ±0.1Hz. If not, adjust as stated in the previous item. If yes, change the variations of Pr34 and Pr35 for best results.

13. Troubleshooting

Red LED display	ERR light	RUN light	Abnormalities	Solutions
		flashes	Motor speed zero. E1 signal not entered	Check to see if E1 encoder and roller connector are out of order and if the signal cord is problematic
number appears	lit		Slave motor speed zero. E1/E2 signal cords inversely connected	E1/E2 signal cords switched places
Err. 2			Slave motor speed zero. E1 signal cords A and B inversely connected	E1 signal cord A and B switched places or parameter 21 changed.
Err. 4			Slave motor speed zero. E2 signal cords A and B inversely connected	E2 signal cords A and B switched places or parameter 22 changed.
	lit		Slave motor at full speed	1. Proportion value wrongly set (proportion set overly high) 2. Check to see if encoder E2 is out of order 3. Is circuit wrongly wired 4. Controller D/A out of order
	lit		Slave motor speed zero. Problematic D/A output to inverter circuit or inverter malfunctions	Check to see if D/A signal cords are properly connected to inverter and if inverter is down or malfunctions
			Slave motor speed unstable	1. 416 calculates too fast. Inverter cannot catch up. Lower parameters 02 and 03 2. Acceleration/deceleration time of inverter improperly set. Adjust the time to 0.3 second 3. Insufficient motor torsion (increase horsepower)
			Proportion value originally set to be able to synchronize, but to be adjusted to other proportion soon	1. Encoder and motor axis skid. Check fixed position and roller connector 2. Encoder signal left out. Check single rotation signal and specifications for omissions

Understand the normal conditions under which DRC-607 operates before deciding whether it is problematic. Its normal conditions are described as follows:

1. On power on, its control panel display LED has to be lit. If no number displays, check to see if terminals 1 and 2 have 220V AC power. If the power supply is OK, it means the power supply is problematic and needs to be replaced.

2. At startup (terminals 15 and 16 have to be short-circuited), after terminals 15 and 16 are short-circuited, which means 607 starts carrying out its assignment or waiting for instructions. There are 3 LED lights to the left of 607 panel. The RUN light can be used to determine the following statuses:

1. Terminals 15 and 16 are open. RUN light is off.

2. Terminals 15 and 16 are short-circuited. RUN light is on.

Standby: flashes

Working: all lit. As long as the E1 encoder phase of the master correctly transmitted into 607, this light has to be fully lit. If it still flashes, it means master encoder signal has not yet reached terminals 11 and 12 of 416. Check the cord.

3. ALM light is on when E1-E2 value exceeds the preset value of Pr06. Note: This feature become inactive when Pr10 is set at 0 because E1-E2 value does not exceed the preset value of Pr06 in speed tracking mode.