Supreme Accuracy Ratio

ＲＳＣ－４１６

（Super ４０６）

USER'S   MANUAL

←———— 100 m/m ————→

TENSION   CONTROLLER

TENSION

○ RUN
○ PRG
○ ERR

TENSION.SET   100 m/m

| MODE | ▲ | ▼ | SET |
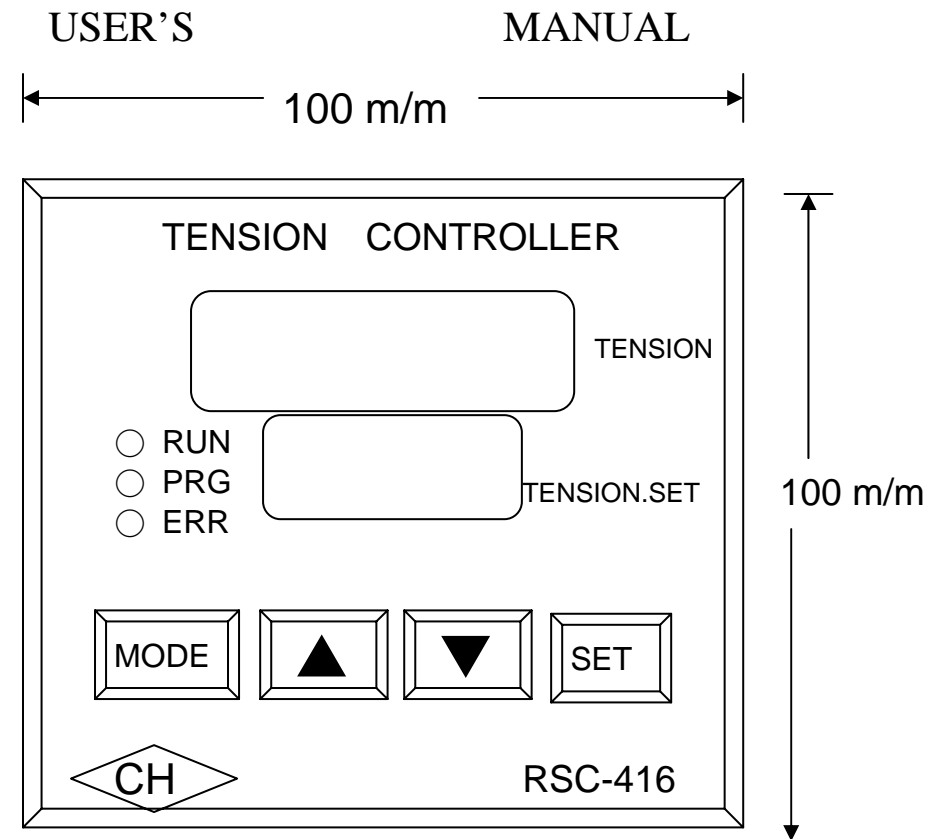
◁CH▷   RSC-416

Thank you for applying our RSC-416 Supreme Accuracy Ratio Controller (abb. 416) to you machinery equipment. According to the increasing demand for particular control from various clients, we strengthen the original RSC-406 and develop this follow-up ratio controller with stronger function.

Please read this manual carefully before operating 416, Please also keep this manual properly in order to arrange electric wires, set up parameters and trouble-shooting if required in the future.

☆CAUTION：

(1)forbid to arrange the electric wires or unload the connector of 416 when electricity is supplying, in order to avoid any risk or damage to 416 controller.

(2)Terminals 6 ~ 21are for signals input and output, please do not connect with AC power source to avoid any damage.

(3)Forbid to connect D/A output Terminals 20(+) and 21(-) with AC power source or other wrong voltage.

(4)please do not take apart the housing of controller, and do not test voltage resistance on components of controller inside, either.

(5)The parameters of 416 have been set up properly by factory, If necessary, you can re-set the parameters for particular controlling requirements, please record the revised value and keep properly.

Contents

More information about trouble-shooting

The normal status of RSC-416 under operation:

1. When electricity AC220V is supplying, LED panel of 416 will display numerals. If no numerals displayed, please check power 220VAC is supplied and connected to Terminals 1 and 2. If the power is supplied with correct connection, it means the power supplying system of 416 is out of order and have to replace another one.

2. Before operating 416, Terminals 15 & 16 must be short-circuited first. After Terminals 15 & 16 short-circuited, 416 is on operation or waiting for operation, please check the 3 LED lamps on the left side of panel. The top one is RUN lamp can judge the following conditions.

   (1) Terminals 15 & 16 in open-circuited, RUN lamp is off.

   (2) Terminals 15 & 16 in short-circuited, RUN lamp is on.

   Standby：Run lamp is blink.

   On operation：RUN lamp is on. When the signals of encoder E1 on master motor get in 416 correctly, lamp RUN must be on. If the lamp is blink, which means the signals don't get in Terminals 11 & 12. Please check the lines.

3. Lamp ALM is on, which means the differential value of E1-E2 is $\geqq$ set value of Pr06.

17. Trouble-Shooting Chart

RED LED	ERR	RUN	Problem/Cause	Solution
0 0 0 0		Flash	Slave motor speed:0. no E1signal input	Check E1encoder and coupling signal cable
number	ON		Slave motor speed:0. Signal cables for E1/E2 connected contrary	Re-connect signal cables for E1/E
Err. 2			Slave motor speed:0. A.B channels of signal cable for E2 connected contrary	Re-connect the A.B channels of signal cables for E1, or modify Pr21
Err. 4			Slave motor speed:0. A.B channels of signal cable for E2 connected contrary	Re-connect the A.B channels of signal cables for E2, or modify Pr22
	ON		Slave motor full speed	1.Ratio "K" too high 2.Check encoder E2 3.Check connections 4.Check D/A of controller
	ON		Slave motor speed:0. Wrong connection between D/Aoutput and Inverter, or Inverter abnormal	Check the connection of D/A to Inverter Check Inverter: default or abnormality
			Slave motor unstable speed, sudden fast and sudden slow	1.Inverter can't catch up with the fast calculation of 416. Modify Pr02, Pr03 smaller. 2.Time of speed adjustment of Inverter set improperly. Re-set the time at 0.3sec. 3.Motor torque insufficient. (increase horsepower)
			Synchronous movement unstable. Ratio value set repeatedly.	1.Slip of encoder and motor. Check their fixation and coupling 2.Encoder signals missing. Check signals per evolution With ordered specification.

1. Characteristics of RSC-416(Super 406)

1、This control system can match inverters, DC Drivers to make a consequent start under motors connected in series or in parallel. No matter the speed is high or low, this system can always get the ultra high accuracy performance of thorough ratio control and position control.

2、For the accurate speed synchro-control of multi-motors, there is a special design-thorough signal tracking model which can clearly show the tiniest speed under test-run of operation, in order to select the most suitable parameter for getting the best performance of mechanical operation and design accuracy.

3、416 has two LED displays(RED & GREEN). RED LED displays for E1/E2 differential value on speed of slave motor, A/D input value or D/A output value. (Please refer to explanations of parameter Pr09 for details) Green LED displays ratio setting value.

4、416 is equipped with self-diagnosis, which will find out the abnormal operation and help trouble-shooting.

5、The values on parameters of 416 can be modified according to the requirements of machinery and production, such as the adjustment for various mechanical gear proportion, selection of programming, calculus rate, time of load change and so on.

6、416 is a closed-loop design. It can get an accurate ratio synchro-control of multi-motors by input the feedback signals from encoders A.B channels. This design is also with high interference resistance.

7、416 has simplified the parameters input. There are only few basic parameters needed to be set, which makes operation simple and more convenient.

8、Encoder 4-divider built-inside can improve the resolution of encoder to 4 times.

9、RSC-416 series has several lateral controllers to fulfill the clients' various demand. Please refer to 416's Family on this manual.

2. Introduction for 416 Family

1 · Standard type：RSC-416

　Ratio setting range:9.999 ~ 0.001。

2 · High accuracy connected in series：RSC-416A

　Ratio setting range:0.0001~2.9999。
　Using RS-232 interface for series-connected function.
　Note：RS-232 is for internal connection only, which is not a
　　　　standard type.

3 · Communication interface: RSC-416H

　Using RS-485 interface to connect with PLC or computer.

4 · Tension control: TC-416T

　Getting high accuracy tension control with feedback signals
　 by (LOAD CELL)

　　b. Wrong connection of Encoder E2 input on slave motor
　　　or E2 abnormality.
　　c. D/A abnormal and full voltage output DC10V
　　d. Ratio value set too high.
4.Unstable speed of slave motor
　　Modifying Pr01 to be 0 and test again. If test is OK, it means
　the motor torque is insufficient to overcome the moment of
　inertia. Please modify Pr02 and Pr03, then try again. If fail still,
　it means the positional tracking mode is not workable under
　this situation, you might try A/D power input of main speed.

※ The contents of this manual may be revised without prior notice.
※ Address your comments concerning this manual to:
　CHIH HORNG SCIENTIFIC CO., LTD.

VI. Push △ or ▽ to modify the ratio value, which will be shown on Green LED of 416 control panel.

VII. Status on Test-run.
 Condition: Pr01 is set at 1, and Pr09 is set at 1.
  1.Normal
  2.Starting master motor, but slave motor motionless.
  Cause：a. START contacts (Terminals15,16) on short-circuited.
      b. Ratio set 0000 or Ratio "K" is 0000.
      c. Channels of Encoder E1 on master motor input contrary.
      ※ If channels of encoder on master motor connect contrary, 416 will display Err2.
      d. Signals of Encoder E1 on master motor no connect with Terminals 11 & 12 of 416, meanwhile RUN lamp will be blink
      e. Wrong connection on Terminal 20(+) and 21(-) of D/A output, or D/A abnormality.
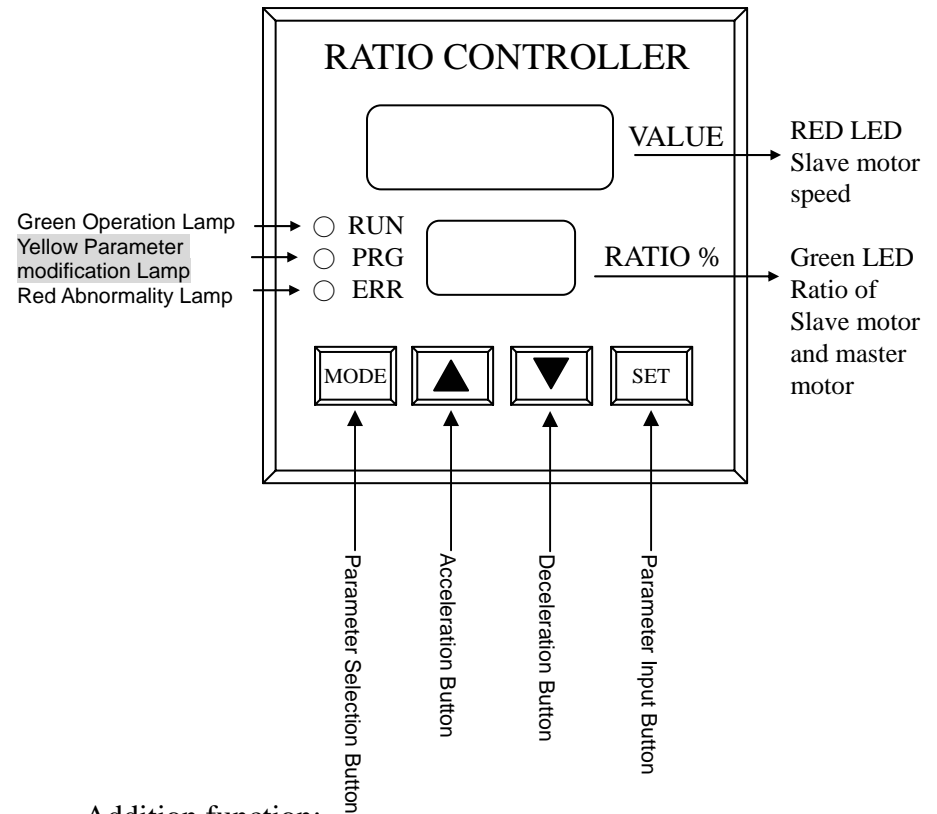 3.Starting master motor, and slave motor full speed.
   Cause：a. Channels A.B of Encoder E2 on slave motor input contrary.
      ※ If slave motor connect contrary, 416 will display Err4. If the load of slave motor is high inertia, the time for acceleration / deceleration of inverter on slave motor must be≧5 sec. Thus please modify Pr10 to be 0, Pr11 to be 1, Pr14 to be 0.1S, Pr15 to be 0.1S, Pr16 to be 0.0V, Pr17 to be 1.00V, Pr18 set as input the value of max. frequency of master motor. (Adopt the value to 3 figures after decimal point)
Note: Value "K" set on Pr18 is very important. If set wrongly, slave motor will act wrongly, even out of control. If this problem happened, please modify Pr10 to be 2, Pr04 to be 1000, and modify the panel value on 416 to be 1.000, then set Pr18 as per the actual value got by master motor RPM÷slave motor RPM. The problem should be solved.

3. Functions of Control Panel

Green Operation Lamp
Yellow Parameter modification Lamp
Red Abnormality Lamp

RATIO CONTROLLER
○ RUN
○ PRG
○ ERR
MODE ▲ ▼ SET

VALUE
RED LED
Slave motor speed

RATIO %
Green LED
Ratio of Slave motor and master motor

Parameter Selection Button
Acceleration Button
Deceleration Button
Parameter Input Button

Addition function:

1. Method for modifying speed:

MODE + ▲ → speed from slow to fast (Acceleration)

MODE + ▼ → speed from fast to slow (Deceleration)

4. External Dimensions & opening for Installation

RATIO CONTROLLER

VALUE

○ RUN
○ PRG
○ ERR

RATIO %

MODE ▲ ▼ SET

◇ CH ◇

RSC - 416

100m/m

100m/m

160m/m

90m/m

Panel opening: 92 x 92 m/m
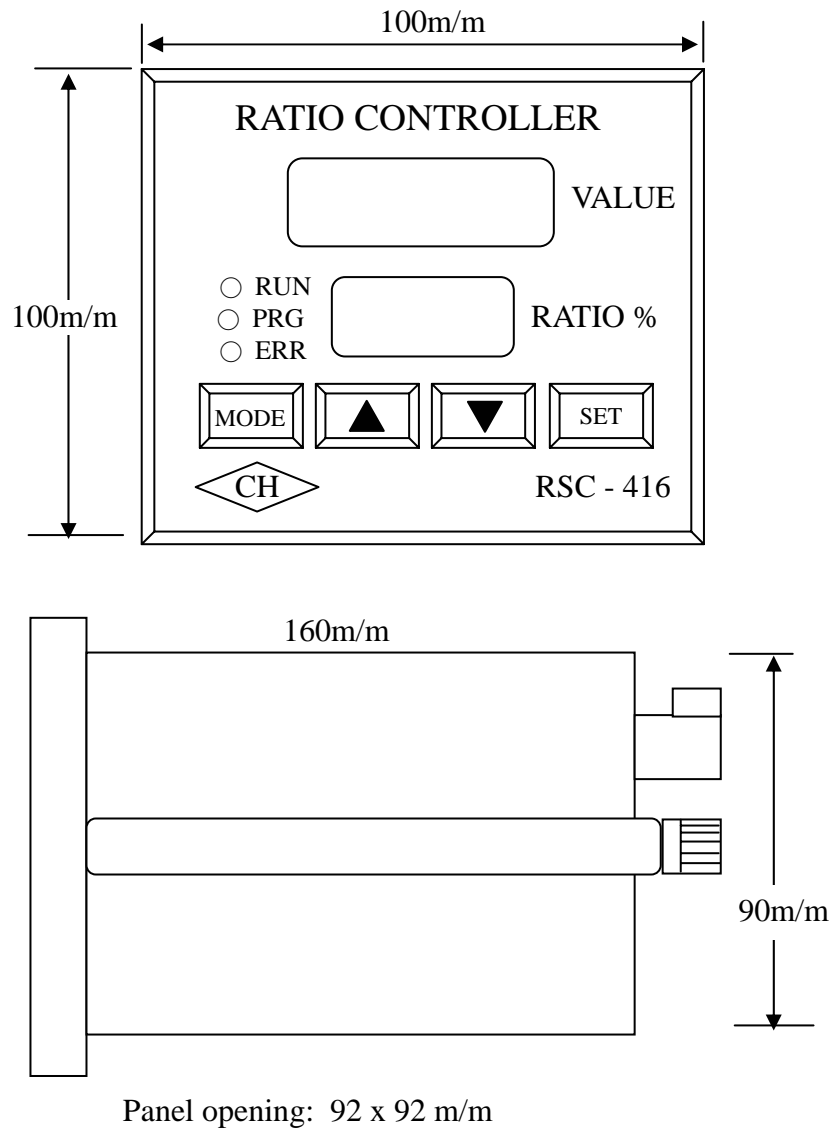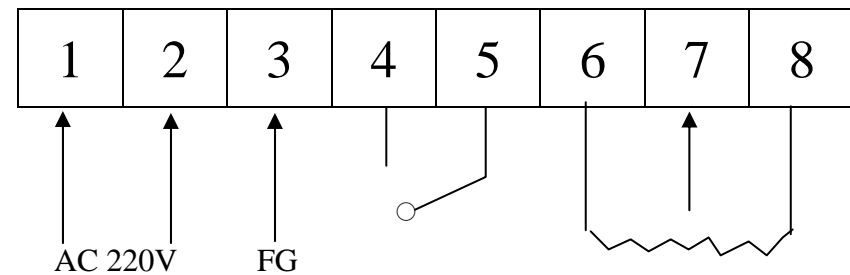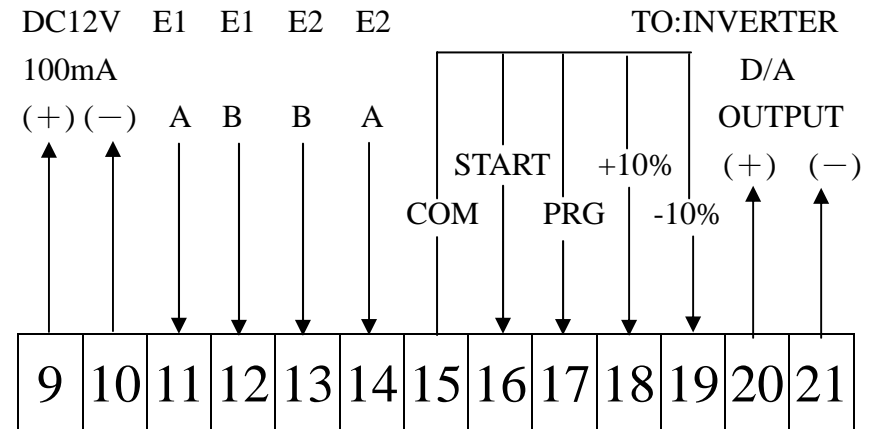
16. Caution for Test-Run and Operation

I. Please confirm all cable conjunction to be correct first.
 1. Power supply must be AC220V±10% and connect with Terminals 1 & 2 of 416.
 2. Channels A,B of Encoder(E1) on master motor, their signals output must connect with Terminals 11 & 12 of 416.
 3. Channels A,B of Encoder(E2) on slave motor, their signals output must connect with Terminals 13 & 14 of 416.
  ※ Please use metal shielded cable for connections of encoders on master(slave) motor. The metal shielded net can connect with Terminal 10 of 416.
 4. Terminals 15&16 must be short-circuited as serial movement.
 5. For parameter modification, Terminals 15 &16 have to be open-circuited and Terminal 15&17 short-circuited.
 6. Terminals 20(+)& 21(-) of 416 D/A output have to connect with analogue cycle command contact of slave motor inverter.

II. Time of speed adjustment of master motor drive should be set ＞ 5sec. 10sec. would be better to get good effect.

III. Time of speed adjustment of slave motor inverter should be set ＜ 0.5 sec. 0.3sec. would be better to get good effect.
 ※ If the time of speed adjustment have to be set ＞1sec.. For special requirements, please consult our engineer.

IV. Starting frequency of slave motor inverter would be better at 0.1HZ.

V. Cable from 416D/A output to inverter should be metal shielded and isolate from power line. The metal shielded net is connected with 0V contact of signal input of inverter.

Pr22   Channel input of encoder on slave motor:
        0: normal; 1: contrary
        After system start, if channel of encoder on slave motor
        connected wrongly, 416 displays Err02, please change the
        setting value on Pr22.

Pr23   Max. ratio value: 0.001 ~ 9.999, if set value at 2.000,
        push △ up to 2.000(Max.). It couldn't be over.

Pr24   Min. ratio value: 0.001 ~ 9.999. If set value at 0.500,
        push ▽ down to 0.500 and stop. It can't be over.

Pr25   Lock ratio value on panel:
        0: no work;
        1: lock the ratio value on panel and can't change it.

Pr26   Time for integral of A/D power input to Terminals 7(+) and
        21(-). The number is bigger, the system is steadier, but with
        slower response.

Pr27   Reserve

Pr28   Input of interface connected in series:
        0: no work;
        1: controller outputs signals thru interface connected in
        series (Terminals 23 and 24)

Pr29   Out put of interface connected in series:
        0: no work
        1: controller outputs signals thru interface connected in
           series (Terminals 22 and 24)
        2: BYPASS the controller (The controller doesn't accept
           controller connected in series).

5.Terminal connection for RSC-416／416A

DC12V   E1   E1   E2   E2   TO:INVERTER
100mA   D/A
(＋)(－)   A   B   B   A   OUTPUT
                              START   +10%   (＋)   (－)
                        COM   PRG   -10%

| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

AC 220V   FG

Note: Don't connect FG with the earthing of signal shielded lines.

5-1. Terminal Connection for 416A and 416H

DC12V E1 E1 E2 E2   TO:INVERTER
100mA   D/A
(＋)(－) A B B A   OUTPUT
                    START +10% (＋)(－)
              COM PRG -10%

9	10	11	12	13	14	15	16	17	18	19	20	21

Interface

DC
+12V in   0V

1	2	3	4	5	6	7	8		22	23	24

out in COM

AC220V FG

RS-232
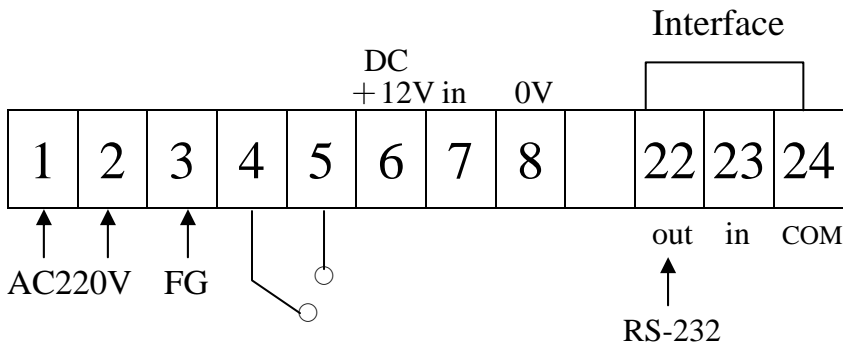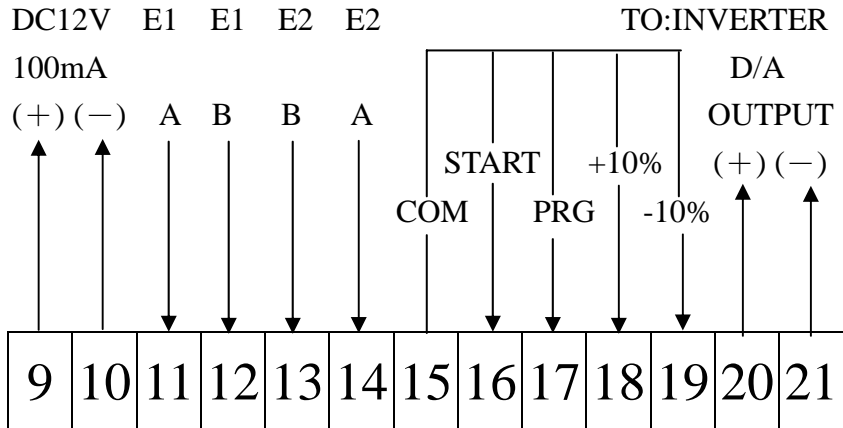
Pr16   Min. voltage of A/D input (system judge): range 0.0 ~ 2.55VDC, when A/D input voltage≧ set value, data read into 416. Suggest set value under 0.1VDC.

Pr17   Adjustment A/D voltage input ± 0.0 ~ 2.55VDC. Through the calculation of encoder, adjust A/D voltage input, that is D/A output = A/D input × K ± voltage value set on Pr17.

Pr18   Adjustment "K" of A/D input：0.001 ~ 9.999.
         Formula：A/D input × K → CPU main controller.

Pr19   Position of decimal point on RED LED
         0：0 0 0 0．
         1：0 0 0．0
         2：0 0．0 0
         3：0．0 0 0

Pr20   Position of decimal point on GREEN LED
         0：0 0 0 0．
         1：0 0 0．0
         2：0 0．0 0
         3：0．0 0 0
         4：．0 0 0 0

Pr21   Channel input of encoder on master motor 0: normal, 1:contrary. After system start, due to wrong rotary direction and channel connection, 416 displays Err01. Please change the setting value to resolve the problem.

Pr10   Operative control mode:
        0：speed tracking only
        1：position tracking in whole course
        2：A/D in open-loop
           A/D input $\times$ proportion $=$ D/A output

Pr11   A/D input mode:
        0: not work
        1: main speed input
   2: A/D as the set value of ratio input

Pr12   Resolution (PPR) of encoder on motor($\div 10$)：e.g. encoder
        with 200 PPR, set value at 20; encoder with 600PPR, set
        value at 60.

Pr13   RPM setting method as slave motor in highest speed: e.g.
        4P motor, the highest frequency of inverter set to be 90Hz，
        rpm$\fallingdotseq$2700, please set RPM to be 27; 6P motor, the highest
        speed of inverter is 60Hz，rpm$\fallingdotseq$1200, please set to be 12.

Pr14   Accelerating time of A/D input: 0.1 ~ 100.0S. This
        parameter is workable when Pr11 set at 1. Set value is based
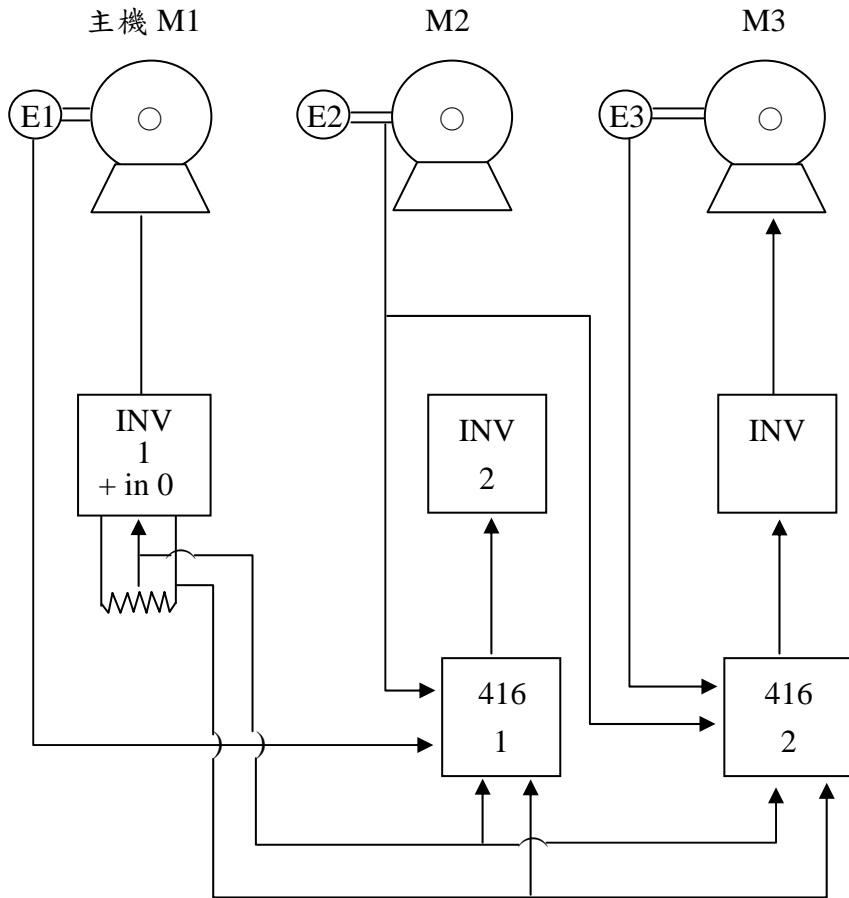   on the accelerating time of inverter on master motor subtract
        0.1 ~ 0.5S.

Pr15   Decelerating time of A/D input: 0.1 ~ 100.0S.
        Setting method same as Pr14.

6. Wiring of Control Loop
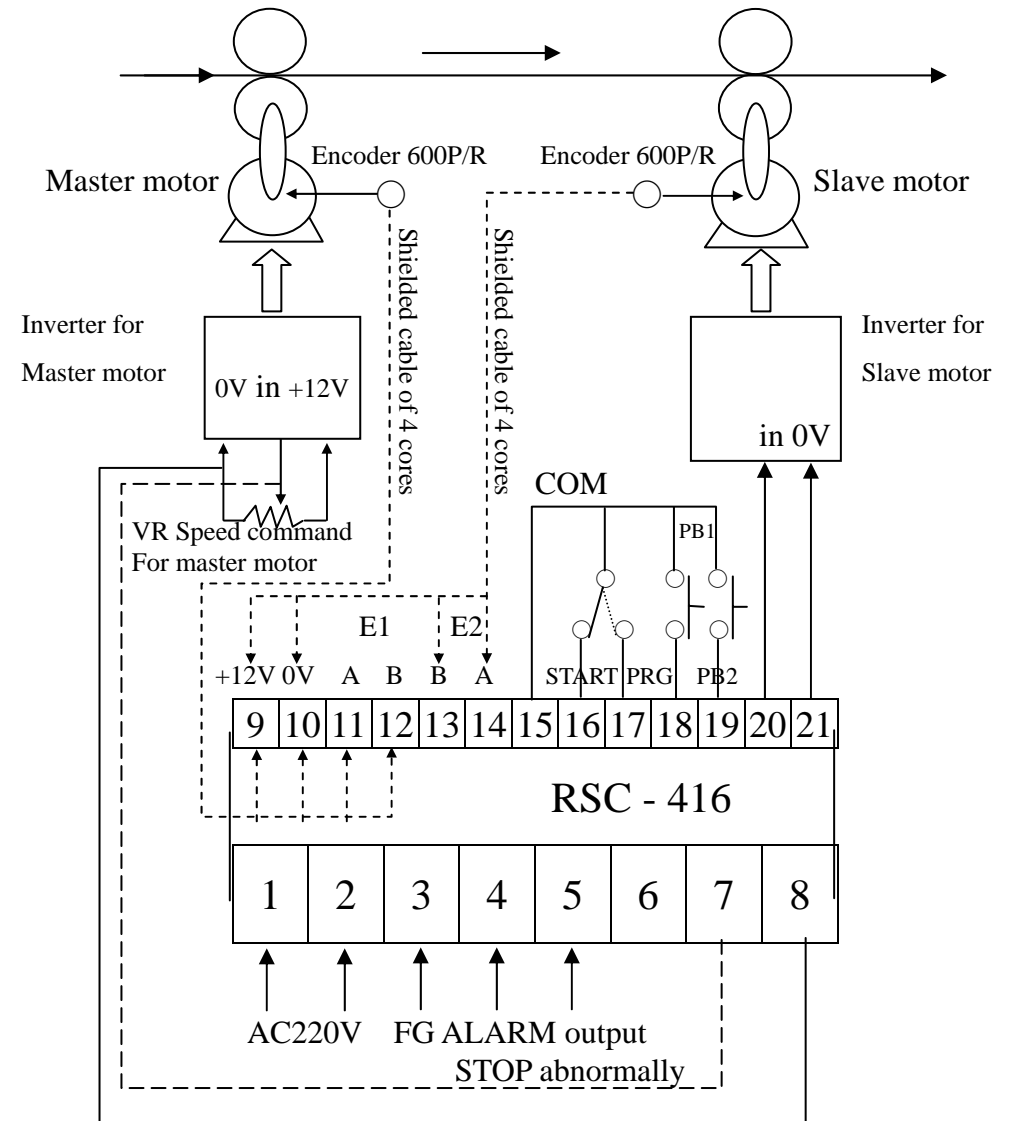
Terminal 7,8 main speed / ratio adjustment A/D input

7. Wiring of Series-connected Control in 3 groups

主機 M1　　　　　M2　　　　　M3

Pr06　Allowance of E1-E2: range1 ~ 9999P/R. When allowance of E1-E2≧set value. RELAY output for system protection. Please set value≧500.

$$\frac{\text{Actual speed}}{\text{Display speed}} = X.XXX \cdot \cdot \cdot$$

Pr07　Speed adjustment rate of electronic speed adjuster: range 0.1 ~ 25.5%, when Pr08 set at 0. Please refer to this manual for application.

Pr08　Moving mode of auxiliary contact: 0 is for speed adjustment, 1 is for external ratio adjustment. Auxiliary contacts are Terminals 18(+) , 19(-) and 15 is COM.

Pr09　Red LED available:

　　0: Speed display

　　1: Display value for E1-E2, use this function when test-run, then adjust Pr02 and Pr03 as per the value of E1-E2 to make control smoother.

　　2: D/A voltage output: display voltage of Terminals 20(+) and 21(-) for checking D/A status.

　　3: A/D voltage input: display voltage input of Terminals 7 and 21 for checking A/D status.

　　4: Change A/D input to D/A output: checking whether the voltage is working as per the set values of Pr14 and15.

15. Explanation of Parameters

Pr01   Pass-code must be 1000(fixed value). Please push △ or
        ▽ on Control Panel to reach to 1000, then push SET to
        pass through and get in other parameters setting.

Pr02   Sensibility for response: range 1 ~ 10. 1 is the slowest, 10 is
        the fastest. On position tracking, this parameter should be
        matched Pr03.

Pr03   Sensibility for position tracking: range 1 ~ 10. 1 is the
        slowest, 10 is the fastest. When Pr10 set as speed tracking,
        this parameter is no work.

Pr04   Ratio value adjustment "K": range 0.001 ~ 9.999 multiply.
        This adjustment coefficient is particular for adjusting the
        machinery dece3lerating rate and different roller diameter in
        416 internal calculation, actual rate of E1 / E2 comes from
        ratio on panel x adjustment "K".

Pr05   Linear speed adjustment "K": range 0.001 ~ 9.999. When
        Pr09 set at 0, adjustment is as per actual speed ÷ display speed.
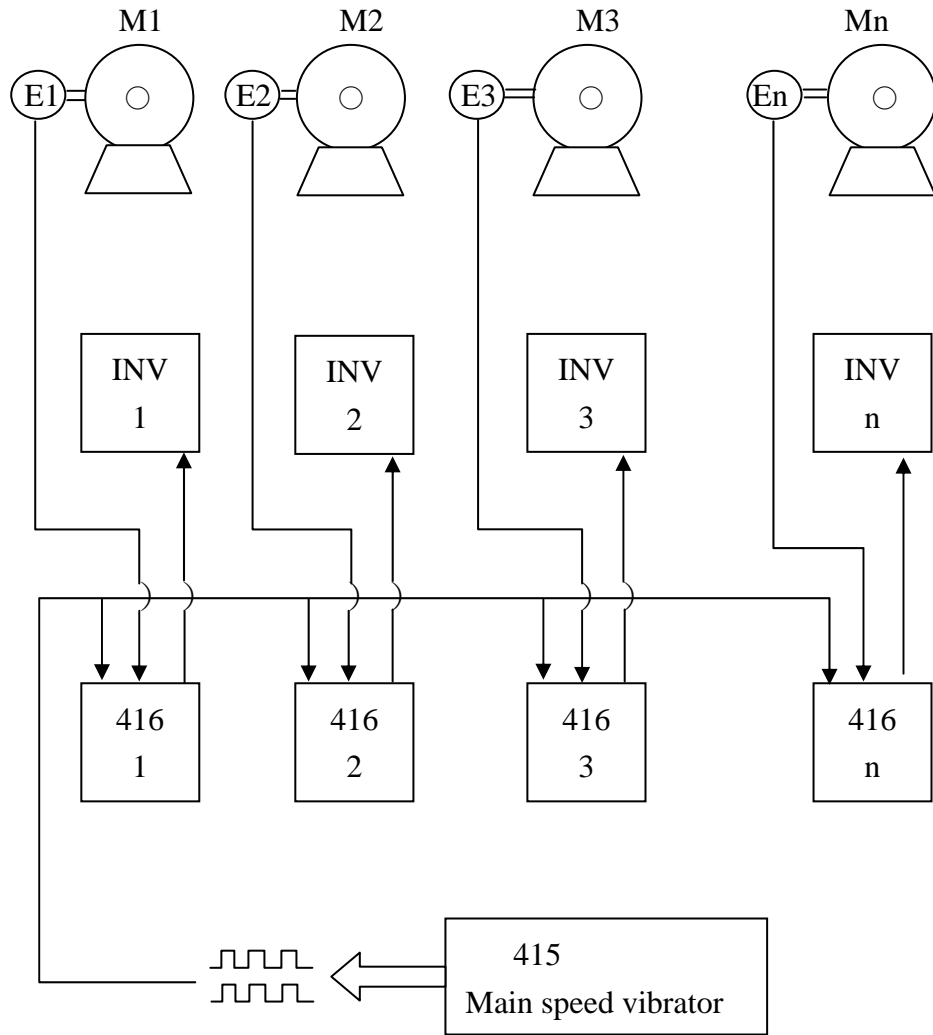   Adopt the value to 3 figures after decimal point and set.

$$\frac{\text{Actual speed}}{\text{Display speed}} = \text{X.XXX} \cdot \cdot \cdot$$

8. Wiring of Series-connected Control over 4 groups

Model: R S C － 4 1 6 A
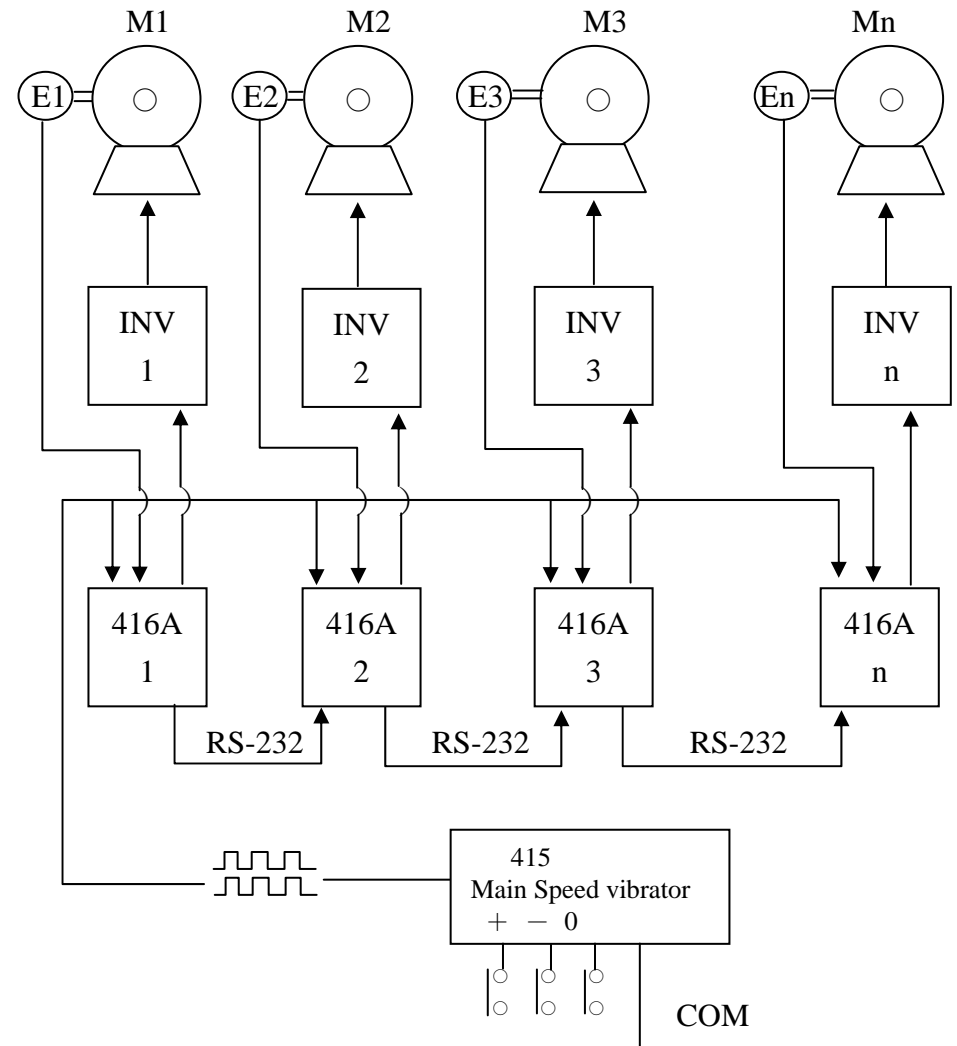
9. Wiring of Parallel-connected Control of multi-groups

Pr13	Max. RPM of motor(x 100)	8~40	18(1800)	
Pr14	Time of A/D acceleration	0.1~99.9 Sec	5.0	
Pr15	Time of A/D deceleration	0.1~99.9 Sec	5.0	
Pr16	Min. voltage for A/D working	0~2.55V	00.00V	
Pr17	Max. voltage for main Speed adjustment	0~2.55	1.00(V)	
Pr18	A/D main speed adjustment K／ Max. value for A/D ratio adjustment	0000~9999	1000	
Pr19	Decimal point position on red LED	0~3	0	
Pr20	Decimal point position on green LED	0~4	0	
Pr21	Connection of encoder on master motor 0：Normal 1：Contrary	0/1	0	
Pr22	Connection of encoder on slave motor 0：Normal 1：Contrary	0/1	0	
Pr23	Max. ratio value	00000~19999	12000	
Pr24	Min. ratio value	0000~9999	05000	
Pr25	Lock the ratio value on panel	0~1	0	
Pr26	Integral time of A/D power input	1~200 (0.01~2.05)	30	
Pr27	Reserve			
Pr28	Signals input by interface connected in series	0~1	0	
Pr29	Signals output by interface connected in series	0~1	0	

Note: When 416 application is connected to signals of A/D power input, Pr14~Pr18 have to be set up. Pr11 sets at 1 or 2.
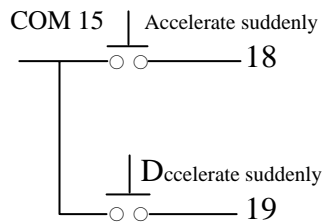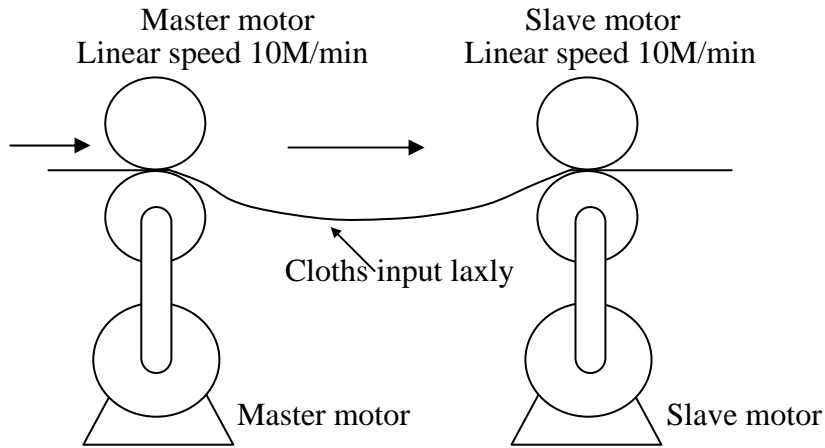
14. Parameters Table

No.	Function	Range	Factory setting	User setting
Pr01	Pass-code	0000~9999	1000	
Pr02	P (Proportion) sensitive adjustment: 1-10 (the number is bigger, the response is faster)	1 ~ 10	1	
Pr03	I (integral) sensitive adjustment:1-10 (the number is bigger, the response is faster)	1 ~ 10	1	
Pr04	Ratio adjustment "K"	0001~9999	1000	
Pr05	Linear speed adjustment "K" (0.0001 – 0.9999)	0001~9999	1000	
Pr06	Error judge, PPR	0001~9999	1000	
Pr07	Percentage of speed adjustment	0000~1000	0100 (10.0%)	
Pr08	Moving mode of auxiliary contact: rated speed adjust / ratio speed adjust E1-E2	0: rated 1: ratio		
Pr09	Display mode: linear/speed/ angle/voltage / output/ voltage/input/ target voltage via speed adjustment	0~4	1 (E1-E2)	
Pr10	Operating mode: 0: speed tracking / 1: angle tracking / 2: open-loop	0~2	1	
Pr11	A/D mode: 0: no work / 1: as per main speed / 2: ratio adjustment	0~2	0	
Pr12	Resolution of encoder(x 10)	10~60	20(200P/R)	

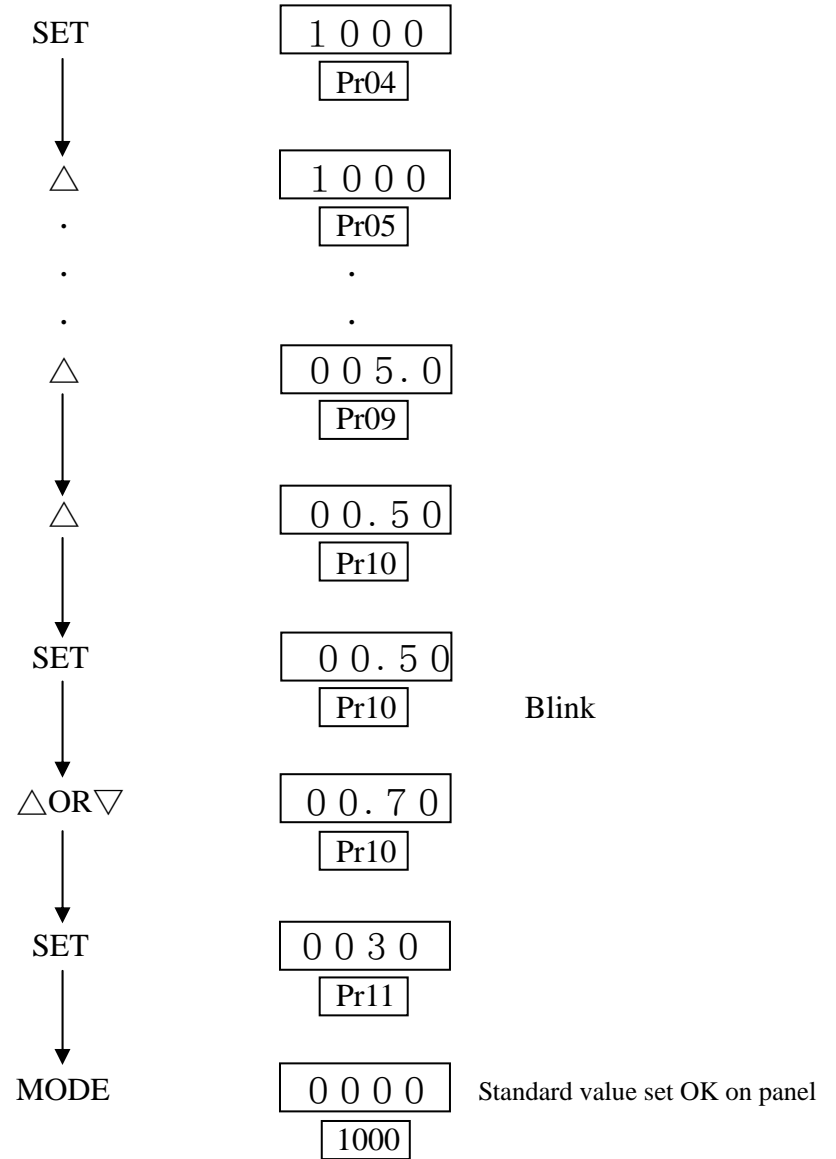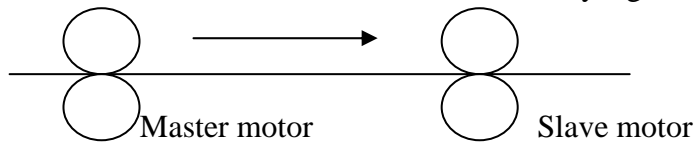## 10. Wiring of Auto / Manual Control Shift
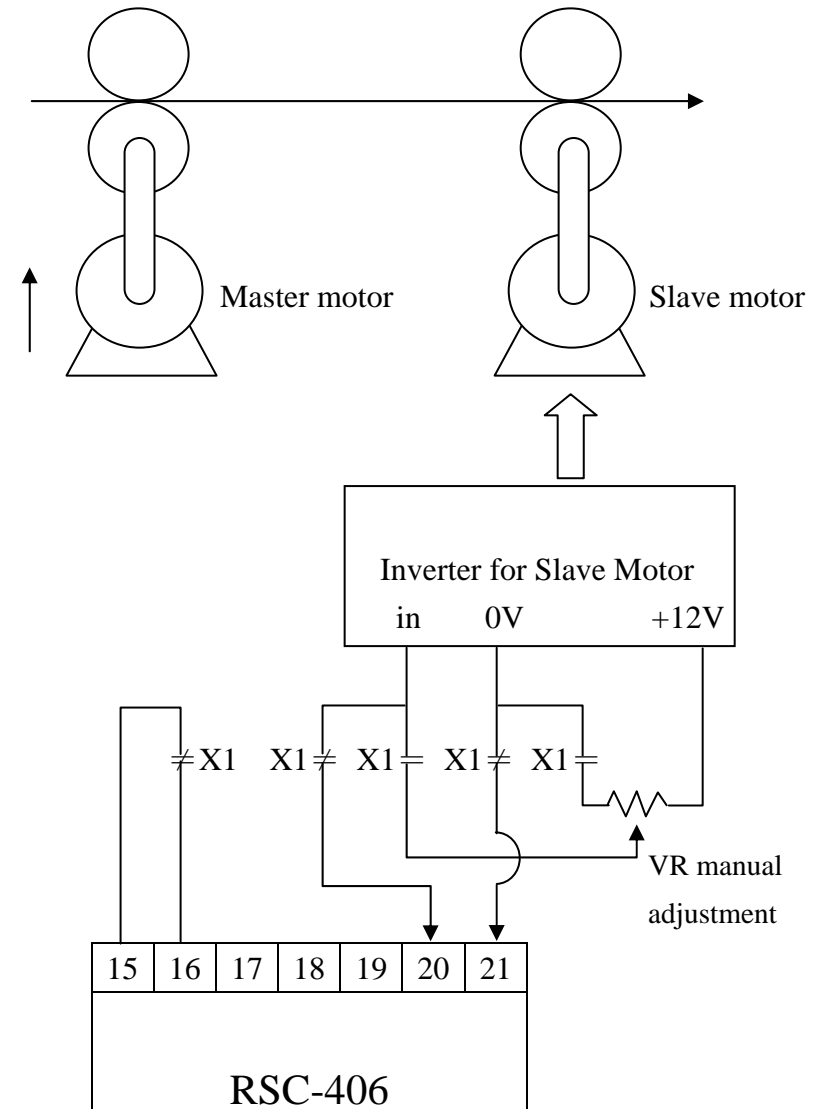
11. Application of Speed Adjustment

Once upon machinery start, motors will move synchronously.
Operator put in cloths(material) which will look like lax. At the time,
push button to make Terminals 15 & 18 short-circuited, then the speed
of slave motor will suddenly increase 10%（Percentage can be set up
on Pr07）. On the contrary, if want to let cloths (material) slacken
from a tense state. Push button to make Terminals 15 &19
short-circuited.

Master motor   Slave motor
Linear speed 10M/min   Linear speed 10M/min

Cloths input laxly

Master motor   Slave motor

COM 15 | Accelerate suddenly
       ○ ○   18

       | Dccelerate suddenly
   ○ ○   19

Master motor   Slave motor

Terminals 15 & 18 short circuited, slave
motor can accelerate to 11 M/min, operator
check the tension by sight and loosen the
button as the proper tension.

Terminals 15 & 19 short circuited, slave
motor can decelerate to 9 M/min, operator
check the tension by sight and loosen the

SET | 1 0 0 0 |
            | Pr04 |

△ | 1 0 0 0 |
. | Pr05 |
.   .
.   .

△ | 0 0 5 . 0 |
            | Pr09 |

△ | 0 0 . 5 0 |
            | Pr10 |

SET | 0 0 . 5 0 |
            | Pr10 | Blink

△OR▽ | 0 0 . 7 0 |
            | Pr10 |

SET | 0 0 3 0 |
            | Pr11 |

MODE | 0 0 0 0 | Standard value set OK on panel
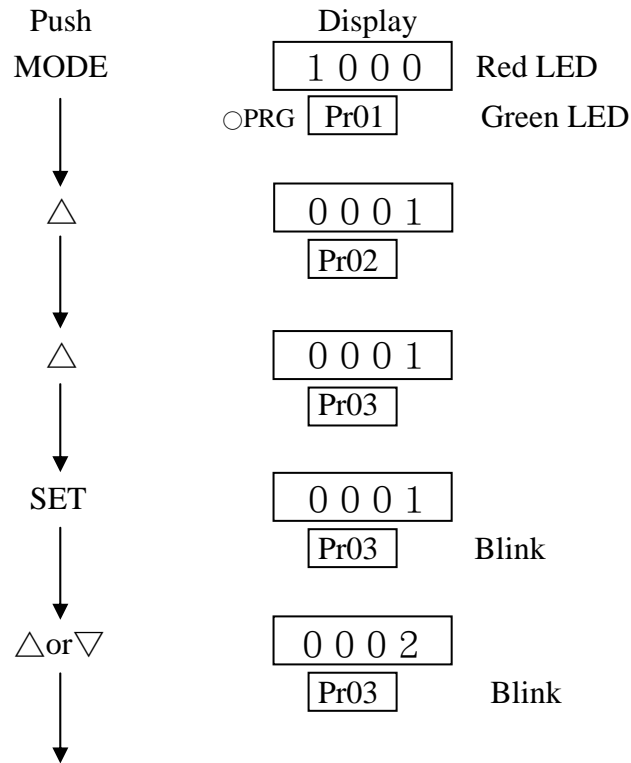 | 1000 |

Step 5. If want to modify Pr02, push SET getting in modifiable mode.
Push △or▽ button to select the required function 改 and
value. After modifying, push SET button, panel displays Pr03.
Repeat the same procedure to modify the parameter value.

Step 6. If want to modify Pr05 only, push △ to change the parameter
to be Pr05.

| 0 0 1 0 | Red LED

| Pr05 | Green LED
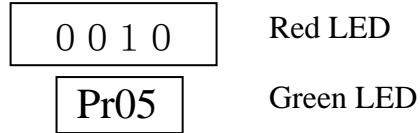
Push SET getting in modifiable mode. Push SET button after
Modification. Push MODE and system goes back to operating
mode.

Example: If want to modify Pr03 and Pr10, here are the steps.

Push   Display
MODE | 1 0 0 0 | Red LED
              ○PRG | Pr01 | Green LED

△ | 0 0 0 1 |
              | Pr02 |

△ | 0 0 0 1 |
              | Pr03 |

SET | 0 0 0 1 |
              | Pr03 | Blink

△or▽ | 0 0 0 2 |
              | Pr03 | Blink

12. Explanation of Terminals

Power   Terminals 1 & 2 are AC power input.
               Specification: AC220V ±10%，50/60HZ
               Terminal 3 is F.G. (3rd earth contact)

Alarm   Terminals 4 & 5 are error output contact A. When the
               signal differential value between E1 and E2 cumulates
               up to the set value on Pr17, Relay output; the
               differential value less than the set value, Relay no
               output. Relay capacity: 1A 250VAC.

A/D Input   Terminals 6,7 & 21 are A/D input with resolution 210
               and input resistance 100KΩ. It is available for main
               speed input or ratio adjustment control. Adjustment
               quantity 100.0%，（±50%）.

E1 and E2   Terminals 9(+) and 10(-) are power source of encoder,
               DC12V±3%，100mA(MAX)。

Encoder input   Terminals 11 & 12 are encoder signal inputs of
               master motor.
               Terminals 13 & 14 are encoder signal feedback of
               slave motor.

Start System   Terminals 15 & 16 are to start system. It's auto-control
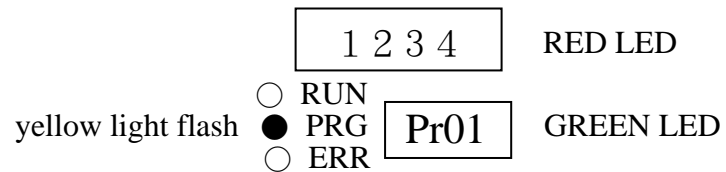   level when short-circuited.

Parameter Setting
Terminals 15 & 17 are contacts of parameters setting. When they are short-circuited, it is ready for value setting or modifying. Please refer to the parameter setting method and the parameters table on this manual.

Speed Adjustment
Terminals 15 & 18 are ratio acceleration contact A.
Terminals 15 & 19 are ratio deceleration contact A.
＊Differential speed rate can be modified on Pr07.

D/A output
Terminals 20(+)、21(-) are D/A output 0 ~ 10V to inverter or DC controller. Please use metal shielded cable and isolate from power lines.
＊Power source (+) and (-) must not be reverse.

Communication Interface
Terminals reserved for 416A and 416H.
Terminals 22 is output of 232 or 485.
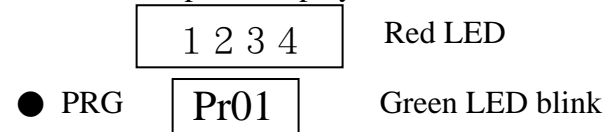Terminals 23 is input of 232 or 485.
Terminals 24 is COM of interface.

13. Parameters Table

Before modifying
1. Assure Terminals15 and 17 are short-circuited.(*)
2. Pass-code: Pr01 must be 1000
(*) If Terminals 15 and 17 are open-circuited,
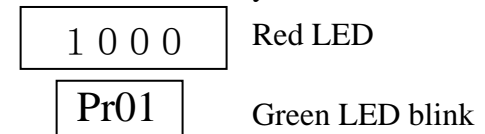you can view the parameter's value only, but not modify.

Step 1. Push MODE button，panel displays Pr01

| 1 2 3 4 | RED LED |

○ RUN
yellow light flash ● PRG | Pr01 | GREEN LED
○ ERR

Step 2. Push SET button, panel displays

| 1 2 3 4 | Red LED |

● PRG | Pr01 | Green LED blink

Step 3. Push △ or ▽ button to modify Red LED to 1000

| 1 0 0 0 | Red LED

| Pr01 | Green LED blink

Push SET button again for confirmed modification.

Step 4. Panel displays: parameter setting is in Pr02.

| 0 0 0 1 |

| Pr02 |