Digital Ratio Controller

RSC-406 Control Panel

USER'S MANUAL

RATIO CONTROLLER

SPEED

○ RUN
○ PRG   RATIO %
○ ERR

MODE ▲ ▼ SET
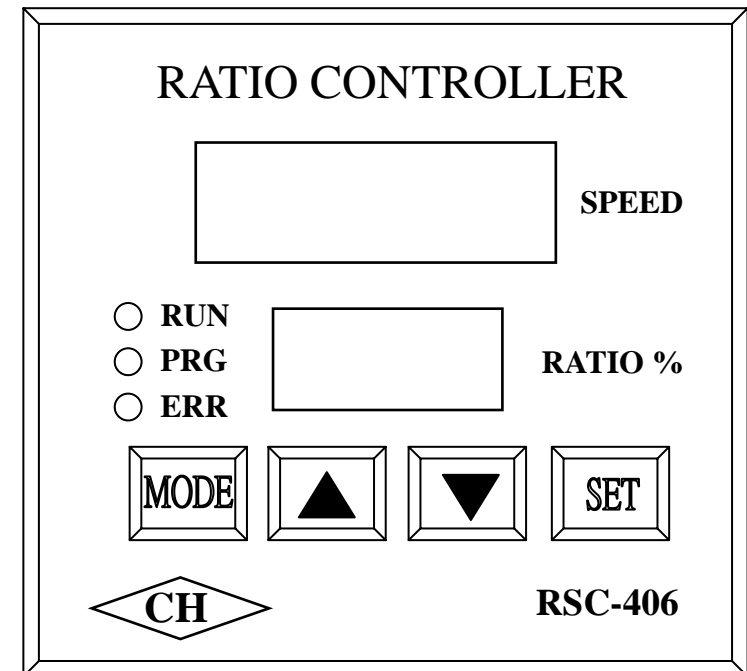
CH   RSC-406

Prelude

Thank you for applying our RSC-406 Ratio Controller (abb.406) to you machinery equipment. Since the control systems change quickly with time, previous customers cannot use them until they acquaint all complicate parameters and programs very well. Now we develop the 406 series with strong function and simple operation.

Please read this manual before operating 406. Also please keep this manual properly in order to arrange electric wires, set up parameters and trouble-shooting if required in the future.

☆ **NOTE:**

(1).Must not arrange the electric wires or unload the connector of 406 when electricity is supplying.

(2).Terminals 6~21 are reserved for signals feedback and output, please do not connect with other purposes.

(3).Terminals 20(+) and 21(-) must not connect with AC voltage or wrong power source.

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

The parameters of 406 have been set up properly, except on special occasion, please do not re-set them.

Contents

Ⅵ.Press ▲ or ▼ to modify the ratio value, which will show on Green LED of 406 control panel.

Ⅶ.States on Test-run.
   Condition: Parameter 01 is set at 13
   1. Normal
   2. Starting master motor, but slave motor motionless.
       Cause:
       a. Start contacts (Terminals 15 & 16) no short-circuited
       b. Ratio set 0000 or Ratio "K" is 0000
       c. Channels of Encoder E1 on master motor input contrary
           ※If Parameter 01set >8, this supposition is false.
       d. Signals of Encoder E1 on master motor no connect with Terminals 11 & 12 of 406, meanwhile RUN lamp will be blink.
       e. Wrong connection on Terminals 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 Parameter 01set >8, this supposition is false.
     b. Wrong connection of Encoder E2 input on slave motor or E2 abnormality.
     c. D/A abnormal, and total voltage output DC 10V
     d. Ratio set too high.
   4. Unstable speed of slave motor
     Modifying Parameter 01 from 0013 to 0009, and test again. If test is O.K., it means the motor torque is insufficient to overcome the moment of inertia. Then modify Parameter 02 to be 40, Parameter 03 to be 20, and time of speed adjustment of inverter to be 2~3 sec.

※The Contents of this manual may be revised without prior notice.
   Address comments concerning this manual to:
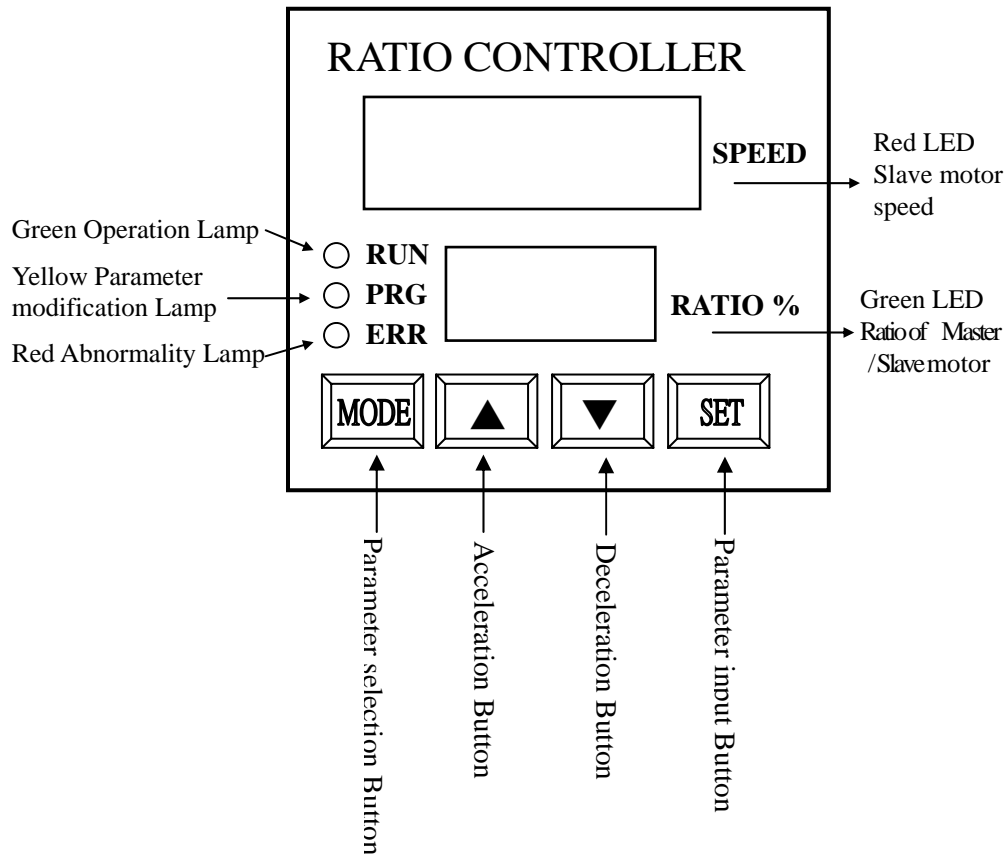   Chih Horng Scientific Co.

15. Note for Test-Run RSC-406

Ⅰ.Please confirm all cable conjunction to be correct first.

   1. Power supply must be AC 220V±10% and connect with Terminals 1 & 2 of 406.

   2. Channels A.B of Encoder (E1) on master motor, their signals output must connect with Terminals 11 & 12 of 406.

   3. Channels A.B of Encoder (E2) on slave motor, their signals output must connect with Terminals 13 & 14 of 406.

    ※Please use metal shielded cable for connections of encoders on master (slave) motor. The metal shielded net can connect with Terminal 10 of 406.

   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 406 D/A output have to connect with Analogue cycle command contact of slave motor inverter.

    ※The voltage output of Terminal 20 is +0~10 VDC.

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

Ⅲ.Time of speed adjustment of slave motor inverter should be set < 0.5 sec. 0.3 sec. would be better to get good effect.

   ※If the time of speed adjustment have to be set> 1 sec. for special requirements, please consult our engineer.

Ⅳ.Starting frequency of slave motor inverter would be better at 0.3Hz.

Ⅴ.Cable from 406 D/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.

1.Characteristics of Control Panel RSC-406

1.This control system can meet with various kinds of DC Drivers, inverters, motor drivers, etc. to make ratio synchronous control.

2.For the accurate speed synchronous control of multi-motors, there is a special design-signal tracing mode which can clearly show the tiny speed change under test-run or operation, in order to select the most suitable parameter for getting the best performance of mechanical operation and design accuracy.

3. 406 has two LED displays (Red and Green) for showing ratio speed and linear speed.

4. 406 is equipped with self-diagnosis, which will find out the abnormal operation and help trouble-shooting.

5.The parameters of 406 can be adjusted according to the requirements of machinery and production, such as the adjustment for different mechanical gear proportion, selection of programming, calculus rate, time of load change and so on.

6. 406 is a closed–loop design. It can get an accurate ration synchronous control of multi-motors by input the feedback signals from encoders A.B Channels. This design is also with high interference resistance.

7. 406 has simplified the parameters input. There are only few basic parameters needed to be input, which makes operation simple and more convenient.

8.The self-diagnosis of 406 can detect and correct the connection of encoders A.B channels automatically. It can save the time to re-connect the encoders.

2. Functions of Control Panel

RATIO CONTROLLER

SPEED → Red LED Slave motor speed

Green Operation Lamp → ○ **RUN**

Yellow Parameter modification Lamp → ○ **PRG**

Red Abnormality Lamp → ○ **ERR**

RATIO % → Green LED Ratio of Master /Slave motor

| MODE | ▲ | ▼ | SET |

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)

2. Method for moving decimal point:

   SET + ▲ or ▼ to move the decimal points of Speed and Ratio.

14. Trouble-Shooting Chart

LED Red	ERR Lamp	RUN Lamp	Problem & Cause	Recovery
0000		Blink	Slave motor speed: 0 E1 signal no input	Check E1 encoder/coupling/ signal cable
3333	ON		Slave motor speed: 0 Signal cables for E1/E2 connected contrary	Re-connect signal cables for E1/E2
6666	ON		Slave motor speed: 0 A.B channels of signal cable for E1 connected contrary	Re-connect the A.B channels of signal cable for E1
9999	ON		Slave motor speed: 0 A.B channels of signal cable for E2 connected contrary	Re-connect the A.B channels of signal cable for E2
5555	ON		Self-diagnosis appears internal abnormality	Replace another new RSC-406 controller
	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/A output 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 406. Modify Parameter 02 bigger. 2.Time of Speed adjustment of Inverter set improperly. Re-set the time at 0.3 sec.
			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 revolution with ordered specification.

13. Setting of Linear Speed Ratio "K" and Linear Speed
"K" (Values are both set at 1000 by factory)

Example:

25M/min

A (Master motor)

20M/min
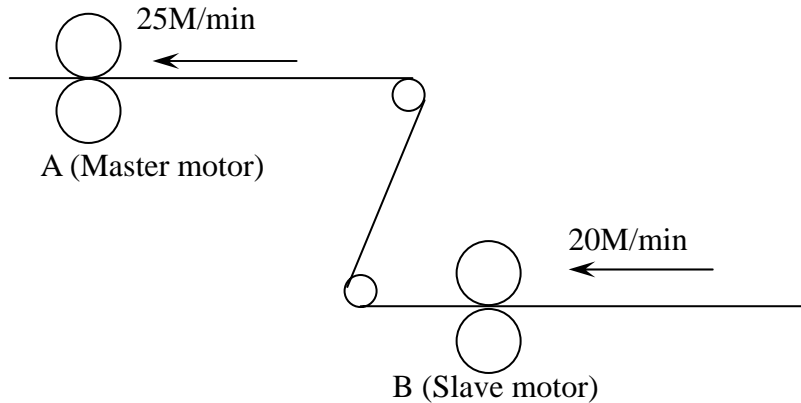
B (Slave motor)

Hypothesis: A (Master motor) 25M/min and B (Slave motor)
20M/min are the actual speed

How to get the Ratio "K":
In order to keep up with the actual speed 25M/min,
Formula: A/B = 25/20 = 1.25, then Ratio "K" (Parameter 04)
should be set at 1250 to get synchronous movement.

How to get the Speed "K":
The speed displays on LED is 15M/min, which must be modified
to 25M/min same as the actual speed,
Formula: Actual speed/Display speed = 25/15 = 1.666…, then the
Speed "K" (Parameter 05) should be set at 1666 to make speed
display 25M/min.
Press MODE + ▲ can accelerate, even on operation.
Press MODE + ▼ can decelerate, even on operation.

3. External Dimensions for Installation

100m/m

100m/m

RATIO CONTROLLER

SPEED

○ RUN
○ PRG
○ ERR

RATIO %

MODE   ▲   ▼   SET

CH

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160m/m

90m/m

Panel opening: 92 x 92 m/m

4. Standard Connections

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

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

VR input

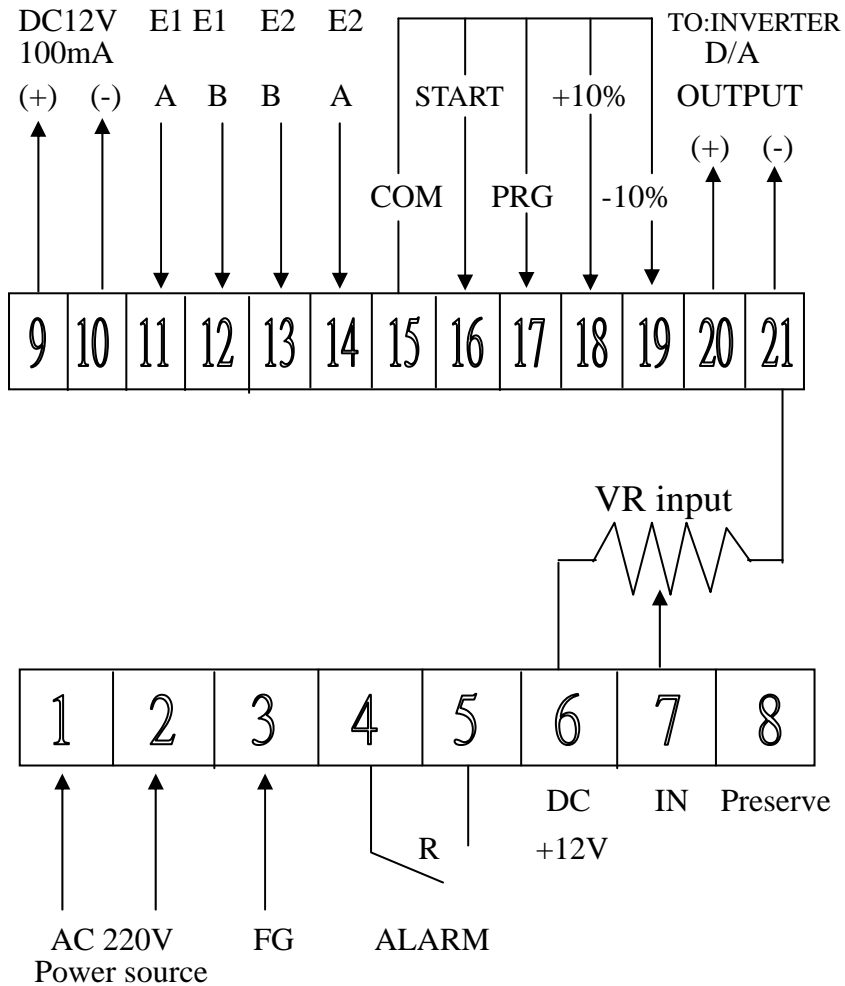| 1	2	3	4	5	6	7	8

R   DC +12V   IN   Preserve

AC 220V   FG   ALARM
Power source
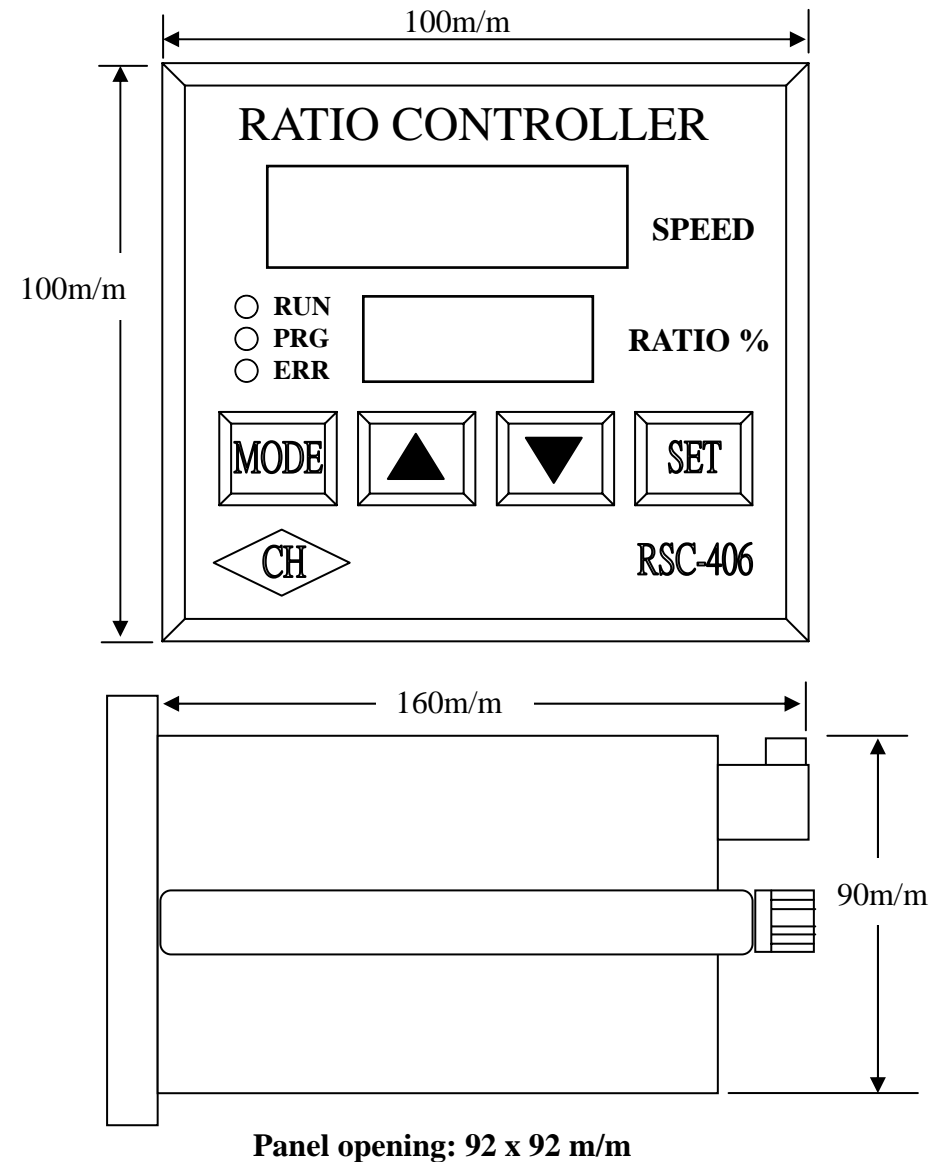
12. Parameter 01 Programming

Parameter No.	Range	Position Trace	V/R Input	Display Content	Self-Diagnosis E1/E2 Channels
	0000	NO	NO	Linear speed	NO
	0001	NO	NO	Signal trace	NO
	0002	NO	YES	Linear speed	NO
	0003	NO	YES	Signal trace	NO
	0004	YES	NO	Synchronous linear speed	NO
01	0005	YES	NO	Synchronous signal trace	NO
	0006	YES	YES	Synchronous linear speed	NO
	0007	YES	YES	Synchronous signal trace	NO
	0008	NO	NO	Linear speed	YES
	0009	NO	NO	Signal trace	YES
	0010	NO	YES	Linear speed	YES
	0011	NO	YES	Signal trace	YES
	0012	YES	NO	Synchronous linear speed	YES
	0013	YES	NO	Synchronous signal trace	YES
	0014	YES	YES	Synchronous linear speed	YES
	0015	YES	YES	Synchronous signal trace	YES

Synchronous signal trace (signal trace) can display the signal difference between E1 and E2.
Synchronous linear speed (linear speed) can display the speed or revolution of slave motor.
Self-diagnosis E1/E2 channels can detect the A.B channels of encoders E1/E2. It can correct automatically if the connections of channels are reverse. Please note encoders E1 (master motor) and E2 (slave motor) must not be connected reverse.
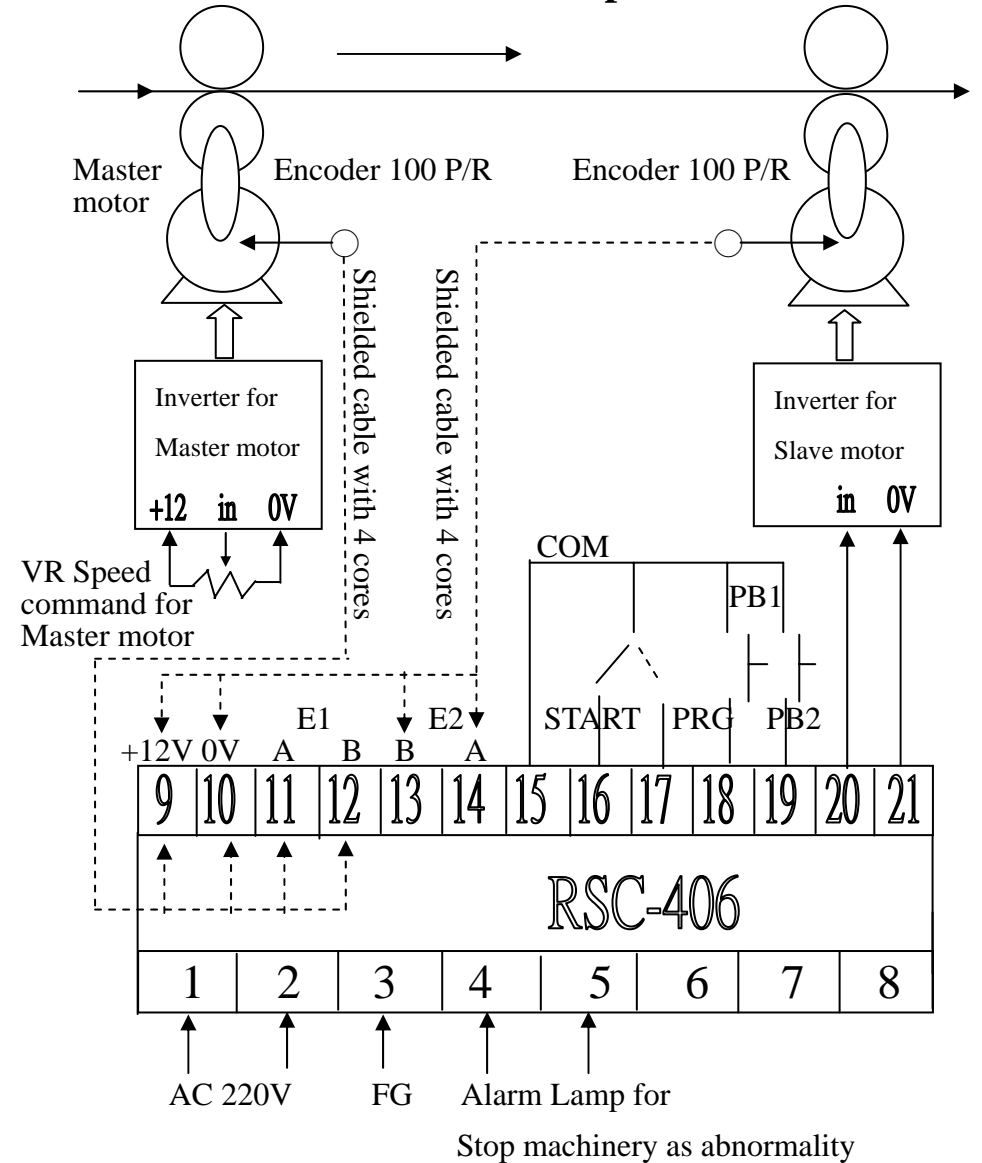
11. Function: Parameters Table

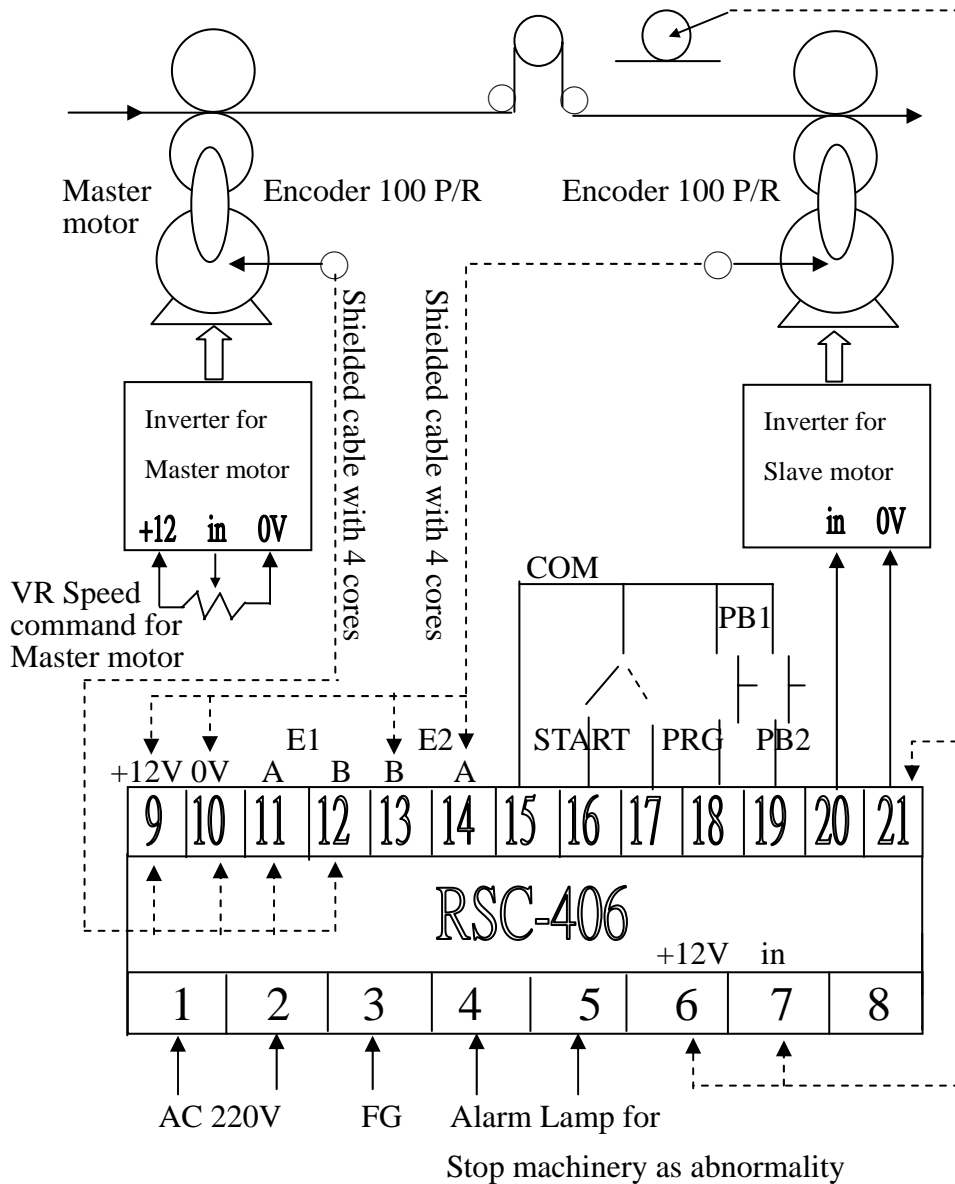| Parameter No.	Function	Range	Factory Setting	User Setting
01	406 Function Selection	0~15	13	
02	Response time	1~99	10	
03	Complementary Time	1~99	1	
04	Ratio "K"	100~9999	1000(100%)	
05	Linear Speed "K"	100~9999	1000(100%)	
06	*Additional Voltage per Start	0~255	30	
07	Speed Adjustment	0~255	100(10.0%)	

※Additional Voltage per Start: There will be an additional voltage as start the system. The max additional voltage is 10 VDC divided to 4096 ranks. Each rank is 0.0024 VDC. Factory setting is 30, so additional voltage will be 0.0024 x 30 = 0.072 VDC.

General speaking, parameters 01~07 have been set by factory. Except for special requirements, it does not need to modify.

5. Connections of Control Loop

Master motor

Encoder 100 P/R

Encoder 100 P/R

Inverter for Master motor

+12 in 0V

VR Speed command for Master motor

Inverter for Slave motor

in 0V

Shielded cable with 4 cores

Shielded cable with 4 cores

COM

PB1

START PRG PB2

+12V 0V A B   B A

E1   E2

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

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1	2	3	4	5	6	7	8

AC 220V   FG   Alarm Lamp for

Stop machinery as abnormality

7. Connections of VR Feedback Control

Master motor

Encoder 100 P/R

Encoder 100 P/R

Inverter for Master motor

+12   in   0V

Inverter for Slave motor

in   0V

Shielded cable with 4 cores

Shielded cable with 4 cores

VR Speed command for Master motor

COM

PB1

E1   E2   START   PRG   PB2

+12V 0V   A   B   B   A

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

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+12V   in

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

AC 220V   FG   Alarm Lamp for

Stop machinery as abnormality

10. Parameters Setting Method

Example: (1) Modify Parameter 01 (function programming) from 13 to 12.
(2) Assure Terminals 15 & 17 are short-circuited, and Terminals 15 & 16 are open-circuited.

Step 1. Press MODE button

☼ PRG blink

| 01 | Red LED

| 0013 | Green LED

Step 2. Press ▲ or ▼ button to modify value

☼ PRG blink

| 01 | Parameter no.

| 0012 | Value (programming)

Step 3. Press SET button to confirm the value modification finished.

Accomplishing setting, system will return to operation level. If need to modify other parameters, just repeat the procedure above.
Press MODE button on and on, the red LED will display from 01~07 in a circle.

Parameter
Setting

Terminals 15 & 17 are parameters setting. When short-circuited, it is ready for setting or modifying. Please refer to the pages 13 & 14 for the parameters table and their setting method.
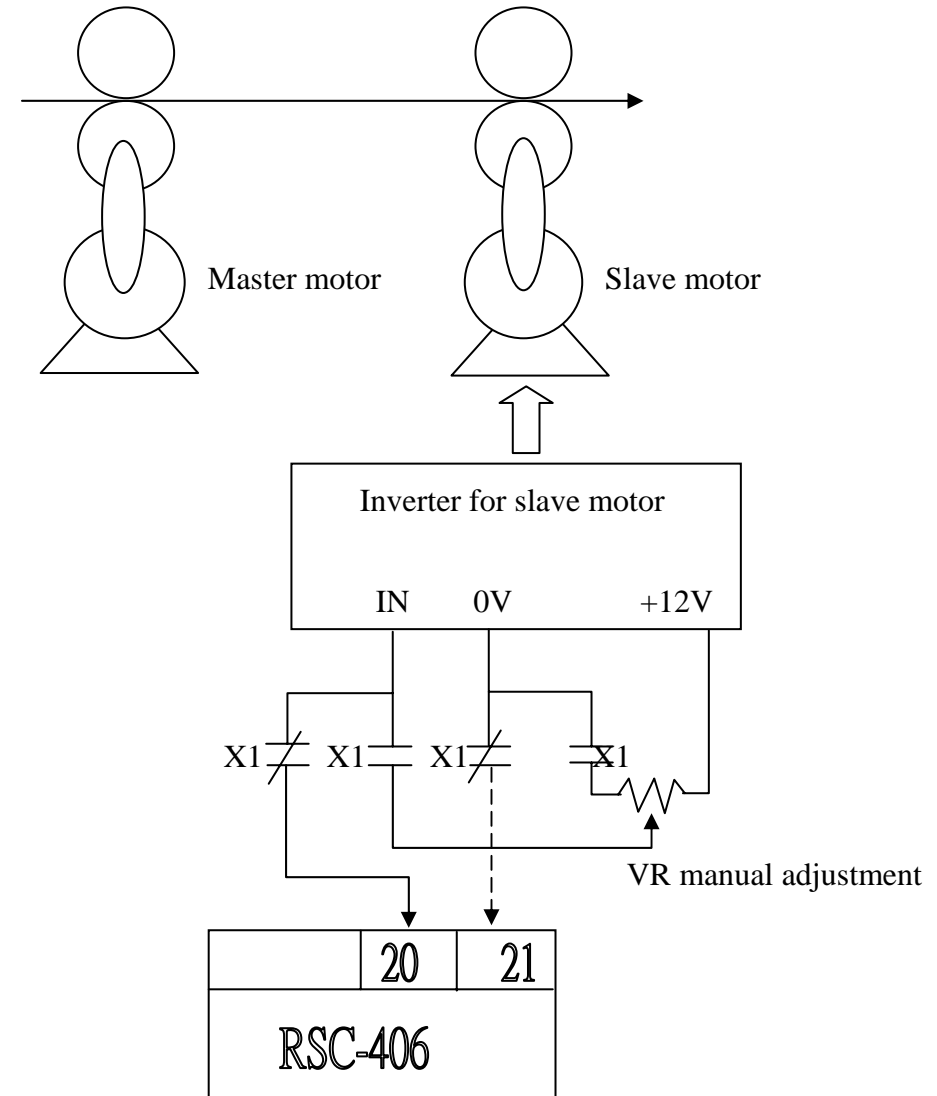
Speed
Adjustment

Terminals 15 & 18 are ratio acceleration contact A.
Terminals 15 & 19 are ratio deceleration contact A.
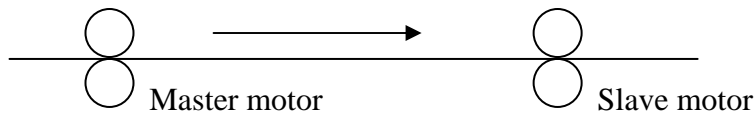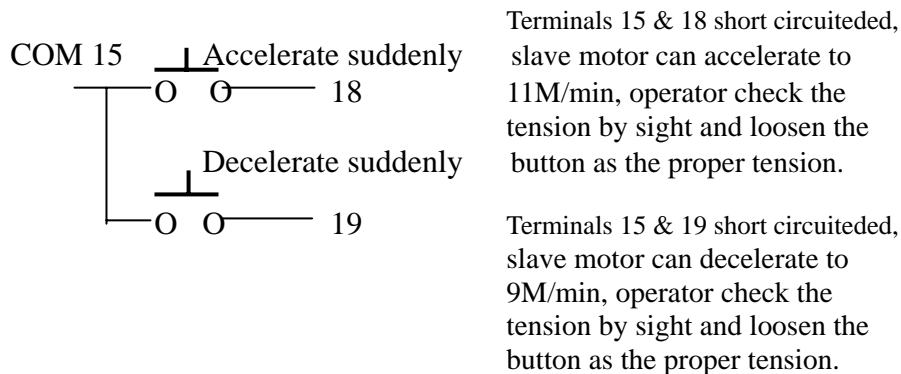※Speed rate can be modified on Parameter 07.

D/A Output

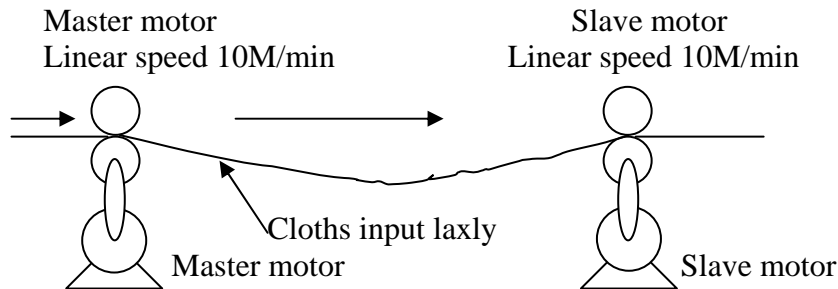Terminals 20 & 21 are D/A output 0~10V to inverter or DC controller. Please use metal shielded cable and isolate from power lines.
※Power source (+) and (-) must not be reverse.

7. Connections of Auto/Manual Control Switch

Master motor   Slave motor

Inverter for slave motor

IN   0V   +12V

X1   X1   X1   X1

VR manual adjustment

20	21

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8. Application of Speed Adjustment

Upon machinery start, motors will move synchronously. Operator put in cloths (material) which will look like lax. At the time, press button to make Terminals 15 & 18 short-circuited, then the speed of slave motor will suddenly increase 10% (Percentage can be set on Parameter 07). On the contrary, if want to let cloths (material) slacken from a tense state. Press button to make Terminals 15 & 19 short-circuited**.**

Master motor
Linear speed 10M/min

Slave motor
Linear speed 10M/min

Cloths input laxly
Master motor

Slave motor

COM 15 — Accelerate suddenly
O   O — 18

Decelerate suddenly
O   O — 19

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

Terminals 15 & 19 short circuiteded, slave motor can decelerate to 9M/min, operator check the tension by sight and loosen the button as the proper tension.

Master motor   Slave motor

9. Explanations of Terminals

Power source
Terminals 1 & 2 are AC power input.
Specification: AC 220V ± 10% 50/60 Hz
Terminal 3 is F.G. (earth contact)

Alarm
Terminals 4 & 5 are error output contact A. When the signal difference between E1 and E2 cumulates up to 1000 P/R, Relay output; the difference less than 1000 P/R, Relay no output. Relay capacity: 1A 250 VAC

External Control
Terminals 6, 7 & 21 are external ratio control input. It is usually variable resistor control. VR resistance 2~5KΩ. Ratio adjustable range 25.5% (±12.7%)

E1 and E2 Encoder inputs
Terminals 9 (+) and 10 (-) are power source of encoder, DC 12V±3%, 100mA (MAX)
Terminals 11 & 12 are signal inputs of encoder on master motor.
Terminals 13 & 14 are signal inputs of encoder on slave motor.

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