Dynamica

VELOCITY 14R Pro

Benchtop Refrigerated Centrifuge

Instruction manual

Model VELOCITY 14R Pro Benchtop Refrigerated Centrifuge

V2009

MODEL VELOCITY 14R Pro

BENCHTOP REFRIGERATED CENTRIFUGE

Thank you very much for choosing Dynamica Velocity 14R Pro centrifuge. Please read this instruction manual carefully before using the centrifuge.

Appearance or specification is subject to change without notice.

Dynamica

⚠ Safety Reminder

Symbol ⚠ is the general internationally safety sign, please read carefully and fully understand the following safety precautions.

- Read all safety Warnings and Cautions in this manual carefully.
- Safety messages are labeled as followings. The safety symbol ⚠ is in combination with words of “WARNING” and “CAUTION” to notify users the potential danger; The definitions of this two combination are as follows:

⚠ **WARNING:** Personal dangerousness

Warning notes indicate any condition or practice, which if not strictly observed, could result in personal injury or possible death.

⚠ **CAUTION:** Instrument damage

Caution notes indicate any condition or practice, which if not strictly observed or remedied, could result in damage or destruction of the equipment.

NOTE: Notes indicate an area or subject of special merit, emphasizing either the product’s capability or common errors in operation or maintenance.

- Do not use the centrifuge in the way which does not mention on this manual, Please contact Dynamica technician if you have any question.

⚠ WARNING:

- This centrifuge is not explosion-proof. Never use explosive or flammable samples.
- Do not install the centrifuge in or near places where inflammable gases are generated or chemicals are stored.
- Make sure to prepare necessary safely measures before using samples that are toxic, radioactive or contaminated with pathogenic micro-organisms.
- If the instrument, the rotor and or accessories that has been contaminated by solutions with toxic, radioactive or pathogenic materials, clean it according to the decontamination procedure that you specified.
- If the contaminated equipment requires service of Dynamica or authorized agency of Dynamica, either at the customer’s site, Dynamica or at the agent facilities, sterilize and decontaminate it in advance. Make sure to notify the service representatives of the use of such materials.
- Do not touch the power cord or switch with wet hands to avoid electrical shocks.
- Users or any hazardous materials are recommended to keep 30cm away from the

centrifuge when it is operating.

- Never forcedly release the door lock while the rotor is rotating.
- Unauthorized repairs, disassembly, and other services applied to the centrifuge are strictly prohibited.

⚠ CAUTION:

- The centrifuge must be located on the firm and level table.
- Be careful not to get your fingers or hands caught between the door hook and the table when closing the door.
- When opening the door, make sure the angle between door and the shell is more than 70 degree.
- Do not move or relocate this centrifuge while the rotor is rotating.
- If there is liquid in the chamber, towel off it immediately to avoid contaminating the sample.
- Keep the chamber clean and remove any objects before running the instrument.
- Cautions on rotors:

1） Always check for corrosion and damages on the rotor surface before using it. Do not use the rotor or bucket if such abnormality is found.

2） Do not run this centrifuge over the allowable maximum speed of the rotor, buckets, and adapters. If their maximum speeds vary, run it at the lowest maximum speed among them.

3） Do not exceed the allowable imbalance.

4） Make sure the tubes and bottles within their actual capacities.

5） Make sure all the buckets are the same type at all times.

6） If the rotor is provided with a cover, make sure it is tightly rotated on the rotor before the operation.

7） Use recommended rotors only.

- If any abnormal condition occurs during operation, stop it immediately and contact our service representative. Notify the service representative the error code.
- Earthquakes may cause damage to the centrifuge. Contact our service representative if abnormality observed.

Contents

1 Specification

Maximum speed	14,000rpm
Maximum RCF	21,780×g
Maximum capacity	6×50ml
Timer	1Minute~99hours59Minutes~HOLD (continuous running)
Settable temperature range	-20℃~40℃
Acceleration/deceleration profiles	（1~9）/（1~9）stages (9 is the fastest curve)
Driving system	Brushless DC Motor
Refrigerant	Environment protection refrigerant 134a
Program memory	9
Safety features	Cover door with dual-locks, over-speed protection, overheat protection and imbalance protection, situation diagnosis system
Power requirements	220V: Single phase, ~220-240V±10%, 50/60Hz±1Hz, 1500VA
	110V: Single phase, ~110V±10%, 60Hz±1Hz, 1500VA
Dimensions（mm）	560mm×500mm×380 mm(L*W*H)
Weight	About 60kg
Additional features	Rotor auto identification, Speed/Acceleration switch function, Pre-cooling function, Short time running function, Processing display

2 Operational Condition

2.1 Basic operational conditions

1) Power: (220V) single phase, ~220-240V±10%, 50/60Hz±1Hz, 10A, standard sine wave;

(110V) single phase, ~110V±10%, 60Hz±1Hz, 25A, standard sine wave;

Install an emergency switch that turns off the main power supply in the event of malfunction. It is ideal to install the emergency switch outside of the room or near the exit;

2) Environment temperature: 2℃～40℃;

3) Relative humidity: ≤80%;

4) No vigorous vibration and airflow around;

5) No electric dust, explosive and corrosive gases around;

2.2 Transport and storage condition

1) Storage temperature: -40℃～+55℃;

2) Relative humidity: ≤93%.

3 Installation

This section describes the instructions that you should abide by when installing the centrifuge to ensure your safety and the optimum performance. Before moving the centrifuge, the rotor must be removed.

⚠ **WARNING:**

- This centrifuge may be damaged if it is connected to an improper power source.
- Check if the power source meets the requirements.

3.1 Location

1） Locate the centrifuge on a firm and level table, ensure the feet of the centrifuge stand on the table firmly. Avoid installing on the slippery table-board that conveys vibration.

2） Ideal environment temperature is 20℃±5℃ . Temperature should not be over 30℃. Avoid direct sunlight to the instrument.

3） Keep clearances of 10 cm on both sides and 30cm behind it to ensure its cooling efficiency. After installing, this distance should be marked around the centrifuge to ensure its cooling efficiency.

4）Do not install nearby a heat-generating device or waterworks from where water may drip or splash. Such location may cause sample temperature fluctuation or malfunction of the centrifuge.

⚠ **WARNING**: No any hazardous materials are within 30cm around the centrifuge to avoid leaking due to heavy vibration of the centrifuge.

3.2 Connection of the power cord and grounding

⚠ **WARNING:**

- Do not touch the power cord with wet hands to avoid electrical shocks.
- This centrifuge must be properly grounded.

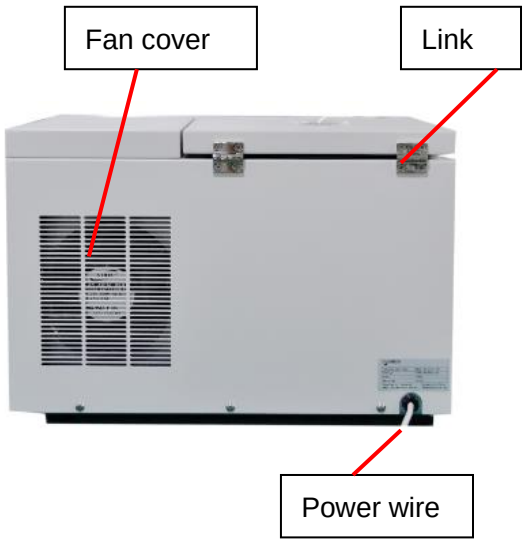
1) This centrifuge is equipped with a 3P flat plug. Grounding can be done by plugging the 3P plug into the outlet.

2) The outlet must have bigger current capacity than 10A and its earth terminal is installed properly.

4 Structure

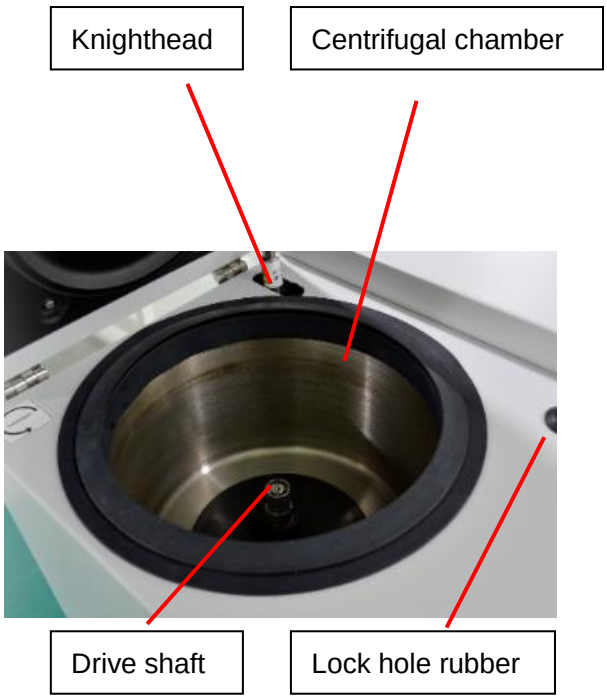
Front

Rear



Inner

Chamber



5 Operation panel

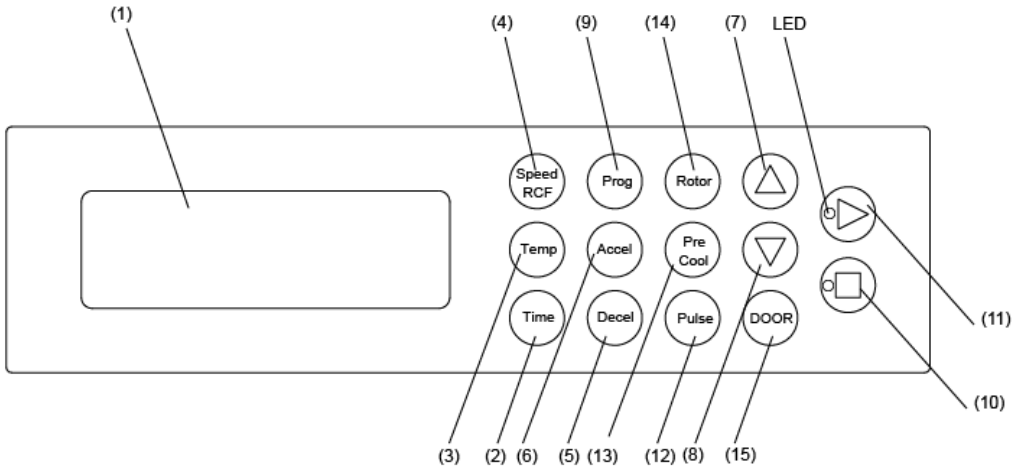


Figure 5-1 Operation Panel

NO.	Symbol	Name	Function
(1)		LCD Screen	Displays running parameters and state(Figure 5-2)
(2)	TIME	Time button	Set a running time（1min~99hours59min~HOLD）
(3)	TEMP	Temperature button	Set a control temperature of the sample
(4)	SPEED RCF	Speed/RCF button	Set speed or RCF
(5)	DECEL	Deceleration button	Set a deceleration rate. (1-9, 9 is the fastest)
(6)	ACCEL	Acceleration button	Set an acceleration rate. (1-9, 9 is the fastest)
(7)	▲	Increasing button	Increase parameter values
(8)	▼	Decreasing button	Decrease parameter values
(9)	PROG	Programmed button	Store and recall running conditions（0-9groups）
(10)	■	Stop button	Make the Rotor stop rotating. The red lamp blinks

			while decelerating and quenches when the rotor stops rotating.
(11)	▶	Start button	Make the rotor start spinning. The green lamp blinks while accelerating and keeps lighting when the speed reaches the set value.
(12)	PULSE	Pulse button	Accelerate the rotor while this button is pressed. The rotor slow down and stop while this button is released.
(13)	PRE COOL	Pre-cool button	Press this button and turn into precooling mode. Press the button for 6 seconds, the error message list will be displayed.
(14)	ROTOR	Rotor button	Input the rotor number or inquire the rotor parameters
(15)	DOOR	Door button	Door lock is released when this button is pressed.

The LCD screen display the main interface as figure 5-2. The left part shows parameters of the rotary speed, the temperature and the time. The right part shows the operation status of acceleration, deceleration, rotor ID number and program group etc. Each left parameter consists of a symbol, a value and a unit, while each of the right status consists of only a symbol and a value.

The interface displays the operation parameters when the rotor is running, these parameters can be modified only when the rotor stops or it reaches the setting point. Please refer Section 7 for detail.

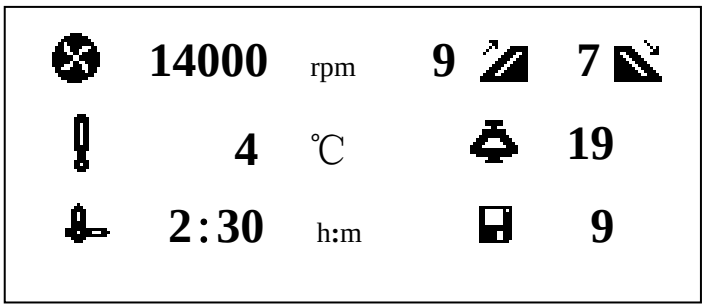


Figure 5-2 The LCD main interface

6 Preparation (Rotor)

⚠ **WARNING:**

- This centrifuge and the rotor are not explosion-proof. Never use explosive or flammable samples.
- There are restriction on the usage of biological samples and radioactive substances that require biological isolation such as pathogens and recombinant DNA for safety purposes. User must prepare necessary safety measures before treating with samples containing such substances.

1) Prepare the sample

2) Put the sample into tubes or bottles

⚠ **CAUTION:** Sample may leak from the gap between the bottle and its cap if the bottle is fully filled up.

■ Do not exceed the capacity specified in the instruction manual.

3) Balance the centrifuge tubes or bottles

⚠ **CAUTION:** There are some cases where samples of different composition due in different precipitation levels by centrifugation even if they are equal in volume, and such operation may increase the level of imbalance. Properly arrange the tubes or bottles so that the same sample is placed symmetrically.

■ See Table 6.1 for allowable imbalance tolerance of each rotor.

■ Although this centrifuge can accept sample balancing by eye, we recommend that the sample is well-balanced to prolong the life expectancy of the centrifuge.

■ Never intentionally run the centrifuge under unbalanced condition even though the imbalance tolerance is not exceeded.

4) Inspect the rotor

⚠ **CAUTION:**

- If any abnormality such as corrosion or scratches is found, stop using the rotor and contact our service representative.
- Only use the rotors we recommended.

■ Check whether the rotor and the buckets have corrosion or scratch before use.

■ Check whether the swinging bucket rotor swing smoothly by slightly spinning the rotor manually. Perform periodic maintenance on the rotor.

5) Set balanced tubes or bottles symmetrically on the rotor or rotor frame

⚠ **CAUTION:** Make sure that the cover is put on the rotor and locked securely. Otherwise, the rotor or its cover may be dislocated while rotating and damage the centrifuge or the rotor.

6) Confirm the ID code of the rotor

- This instrument can identify rotors automatically.
- Each rotor is assigned with an ID code. After the rotor is identified, the optimum temperature can be automatically controlled, and the function of over-speed protection and the speed/RCF display can be realized.
- The list of available rotor's ID code, see Table 6.1.

Table 6.1 List of rotors

Rotor type	ID code	Max. speed (rpm)	Max. RCF (×g)	Tube/bottle	Imbalance tolerance(*)	
					Mass Imbalance	Capacity Imbalance(**)
FA15A	19	14,000	18,728	1.5/2 ml tube	1.5g/ tube	5mm/ tube
FA12A	03	12,000	14,100	0.2ml microtube	0.2 g/tube	
FA15G	09	14,000	21,780	50ml TC tube	3.0 g/ tube	5mm/ tube
FA15B	16	14,000	18,990	50ml tube	3.0g/ tube	5mm/ tube
FA15C	18	14,000	20,290			
FA14C	13	14,000	20,920	50ml tube	3.0g/ tube	5mm/ tube
SW4C	05	4,000	1,780	5ml vacutainer for blood specimen collection	1.0g/ tube	2mm/ tube
FA18C	01	14,000	17,530	10ml tube	1.5 g/ tube	10mm/ tube
FA15E	08	14,000	19,700	5ml tube with V bottom	1.0g/tube	2mm/tube
FA15F	07	14,000	19,700	5ml tube with round bottom	1.0g/tube	2mm/tube
FA12B	02	12,000	13,840	1.5/2 ml tube	1.5g/ tube	5mm/ tube

* : The imbalance tolerance given in the table indicate the mass imbalance or capacity imbalance when the centrifuge tubes are place symmetrically.

** : Capacity imbalance provide a rough measure of balancing and it is not necessarily to agree with mass imbalance.

7 Operation

⚠ **WARNING:**

- Never open the door while the rotor is rotating or touch the rotating rotor.
- For your safety, do not step into the area with 30cm around the centrifuge while it is running. Users or any hazardous are recommend keeping 30 cm away from the centrifuge when it is running.

7.1 Normal Operation

1) Turn on the power switch.

■ The LCD screen displays a welcome interface and shows the accumulative total running time, in the meantime, this centrifuge starts a self-checking process for preparation. (see Figure 7-1).

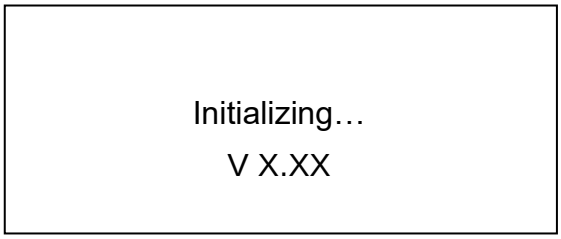


Figure 7-1 Initialization interface

■ If the self-checking fails, the screen displays an error code on its right bottom corner. Please refer the error code in the table 11-1.

NOTE: When the power is turned on, this centrifuge will take 7 seconds to self-check. During this time, the centrifuge will have no response to the buttons.

■ This centrifuge will move to a preparing interface after self-checking, and display the running parameters of the last time. For example, the Figure 7-2 shows that the speed was set to be 14000rpm, the temperature was 4℃, the running time was 2 hours and 30 minutes, the acceleration rate was 9, the deceleration rate was 7, the rotor ID was 19, and the program group number was 9.

Figure 7-2 is only an example. User's setting parameters and running parameters may be different from it.

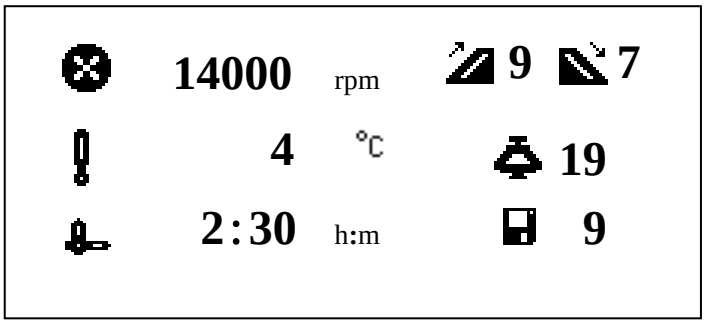


Figure 7-2 Preparation mode interface

■ The door is lock automatically.

After self-checking has passed, user can open the door by pressing DOOR button. After 6 seconds, door lock will close automatically.

2) Gently lift up the door and set the rotor on the drive shaft.

■ Place the rotor in position until it contacts the drive shaft.

■ You should feel a click when the rotor is properly placed on the drive shaft. If you do not feel anything, there may be something (e.g. dust) stuck between the rotor and the drive shaft and the rotor may be tilted. Check and clean the rotor or the shaft if needed.

■ Rotate the rotor slightly with your fingers. If the rotor vibrates obviously, place the rotor again.

3) Close the door and start running.

⚠ **CAUTION:**

- Make sure that the angle between the door and the table is more than 70 degrees, otherwise the door may fall down.
- Be carefully not to get your fingers or hands caught between the door hook and table when closing the door.

4) Set the operating parameter

⚠ **CAUTION:** Some buckets and adapters, and tubes, bottles and microplates that are sold on the market have lower allowable speeds(allowable RCF) than the rotor. Use them at the lowest allowable speed or less.

(1) Select a rotor ID.

① Press the ROTOR button.

■ The rotor symbol blinks, the rotor ID can be selected.

② Press ▲ or ▼ button to select the rotor ID.

■ The rotor ID code is given in Table 6.1or it can be obtained by rotor inquiring function

(refer to 7.6 section).

NOTE: This step can be omitted because all rotors are automatically recognized.

(2) Set the speed, running time, sample temperature, acceleration and deceleration rate.

① Press SPEED RCF button.

■ Speed symbol blinks.

When the speed unit is RCF, it indicates you can input required RCF value. Then, press the SPEED RCF button again, the speed unit becomes rpm, now you can input speed value. In the same way, you can also change rpm into RCF.

■ If no button is pressed after the symbol has been blinking for 7 seconds, the symbol will stop blinking, close the inputting mode and return to the preparation screen.

② Press ▲ and ▼ buttons to adjust the parameter.

■ The minimum speed you can set is 300 rpm with the interval of 100rpm.

■ The minimum RCF you can set is 100×g with the interval of 50×g.

■ When keep pressing ▲ and ▼ buttons, you can set the values in a fast mode.

■ There is a cycling function on ▲ and ▼ buttons. Press the ▲ button, the value will go from small value to bigger one, and reach the maximum, then turn to the minimum, while press ▼ button, the sequence is big value, the smaller one, then the minimum and the maximum.

NOTE: The centrifuge may shake slightly when it is operated under 2,600rpm, this does not indicate any problem.

③ Press the TEMP button to set sample temperature.

■ When the temperature symbol blinks, the temperature is ready to be set.

■ Press ▲ or ▼ button to set the temperature value, the range is from -20℃ to 40℃ with the interval of 1℃.

④ Press TIME button to set running time.

■ While the time symbol blinks, the running time can be set.

■ Press ▲ or ▼ button to set the running time, the range is from 1minute to 99

hours and 59minutes~HOLD with the interval of 1 minute.

⑤ Press ACCEL button to set acceleration rate.

■ While the acceleration symbol blinks, the acceleration rate can be set.

■ Press ▲ or ▼ button to set the acceleration rate, the range is from 1 to 9 with the interval of 1. Curve 9 is the highest rate.

⑥ Press DECEL button to set deceleration rate.

■ While the deceleration symbol blinks, the deceleration rate can be set.

■ Press ▲ and ▼ buttons to set the deceleration rate, the range is from 1 to 9 with the interval of 1. Curve 9 is the fastest rate.

5) Start running.

(1) Press ▶ button, to check the setting values again.

■ Press ▶ button for the first time, the screen displays the parameter verification screen. (see as the following interface)

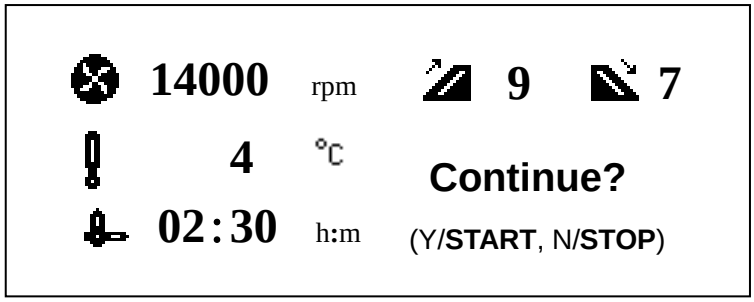


Figure 7-3 Verification of the operation parameters

■ If something is wrong with the operation parameter, press ■ button, the centrifuge will return to the preparation mode for correction or modification.

■ If no button is pressed for 7 seconds, the centrifuge will return to the preparation mode.

(2) Press ▶ button again, start running.

■ The door should be locked before the rotor starts rotating.

■ During the acceleration, the green lamp on ▶ button keeps blinking. After the speed reaches set value, the lamp stops blinking and keeps lighting.

■ After accelerating for 8 seconds, the interface will display the processing screen, see the Figure 7-4.

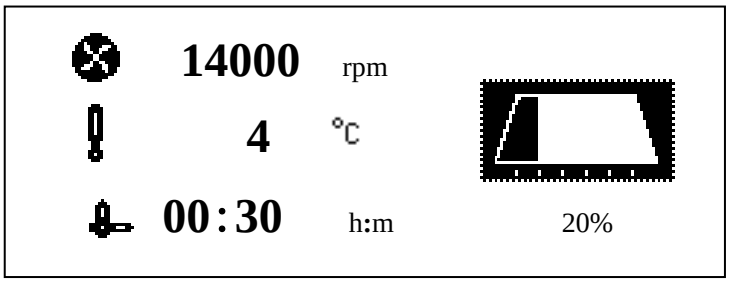


Figure 7-4 Processing Screen

The running status displays the whole process while the centrifuge operates. In this screen, the left part shows the actual running parameters, the time value is the actual operation time, not include the acceleration time. The right part is a sign of trapezium area which is being filled, indicating the whole process of the acceleration stage, the stable stage, and the deceleration stage. In the mean while, the trapezium also shows the running percentage. It also shows the running percentage. This screen makes it easier for the operator to monitor the whole running process.

This running status can not be shown in the pre-cooling mode or the short run mode. Under the short run mode, the right part of this screen displays the waving bar, and the HOLD symbol.

(3) Browse and modify the running parameters

■ You can inquire and modify the operation parameters after the centrifuge reaches its setting speed. Press the corresponding button, the Screen will return to the preparation screen and displays all setting values, refer to the section 7.1-4 for detail operations of modifying the parameters. If no button is pressed again, the centrifuge will return to its normal operation and operate in new parameters 6 seconds later.

■ The rotor ID cannot be modified when the rotor is running. After the time has been modified, the running time will not be reset to zero whereas it will continue to accumulate, and the running status screen will adjust accordingly.

(4) Error display

■ If there is anything wrong with the centrifuge, it will brake automatically and display the error number on the right bottom of the Screen. User can look up the error in the Table 11-1 and make corrective actions accordingly.

⚠ **WARNING:** Do not open the door before the rotor stops.

6) Ending the running

(1) The centrifuge will brake when it reaches the setting time or  button is pressed.

■ As the rotor decelerate, the green lamp on  button turns off, and the red one on  button starts blinking.

■ When the rotor stops, the red lamp on  button stops blinking and turns off. The instrument beeps 4 times to remind users that the operation is finished.

(2) Open the door.

■ When the operation is finished, user can open the door by pressing  button.

■ After ending the operation, the centrifuge will save the operating parameters and recall them when power switch is turning on again.

NOTE: when the running is finished, the centrifuge will brake and the rotor will decelerate at the setting deceleration rate. But if  button is pressed during the running, the rotor will decelerate at the highest deceleration rate.

(3) Take out the rotor or the sample.

⚠ **CAUTION:** Please take out the rotor when you are not using the centrifuge. It can avoid rotor corrosion and damaging the drive shaft.

■ To continue using the centrifuge, close the door to prevent dew drops in the rotor chamber, and turn off the POWER switch.

■ At the end of daily operation or if the centrifuge will not be used for a long time, open the chamber door and turn off the power to dry the rotor chamber. You can close it when it is completely dry.

7.2 RCF Operation

The maximum radius of each rotor is programmed in the memory of the centrifuge. You can run the centrifuge by simply entering the desired RCF (×g) by simply entering the RCF value.

NOTE: Refer section 7.1-4, speed/RCF conversion, to set operating parameters.

⚠ **CAUTION:** ● Do not exceed the allowable maximum RCF of the buckets, adapters, and tubes/bottles. ● RCF is calculated with the maximum radius and the rotating speed.

(1) Set the RCF value.

① Press SPEED RCF button.

■ The Speed/RCF symbol blinks.

■ When the symbol unit is rpm, it indicates you can input speed value. But press the SPEED RCF button again, the symbol unit will shift to RCF, then you can input RCF value.

■ If no button is pressed after the symbol having blinked for 4 seconds, the symbol will stop blinking, and the inputting mode will be closed.

② Press ▲ and ▼ buttons to set a RCF value.

■ The step size is 50 ×g.

(2) Set running condition

Set running time, sample temperature, acceleration and deceleration rate according to 7.1-4 section.

(3) Press ▶ button to run the machine.

① Press ▶ button to check the parameters.

■ Press ▶ button for the first time, user need to verify the parameter.

■ If the parameters are incorrect, press ■ button, the machine will return to preparation mode.

② Press ▶ button again, the machine starts to run.

■ The door is locked, and rotor starts to rotate.

■ During acceleration, the green lamp on ▶ button is blinking. When the instrument reaches to the setting speed, the green lamp on ▶ button keeps lighting.

(4) Ending the operation

① The centrifuge will brake when it reaches the setting time or ■ button is pressed.

■ As the instrument decelerate, the red lamp on ▶ button turns off, and the one on ■ button starts blinking.

■ When the rotor stops, the red lamp on ■ button stops blinking and turns off. The instrument beeps 4 times to remind users that the operation is finished.

② Press DOOR button to open the door, and take out the rotor and samples.

③ Turn off the power according to 7.2.

7.3 Programmed Operation

This centrifuge is featured with nine programmed operations stored in its memory and they can be recalled by simply pressing buttons. This function can help saving your time and the steps for setting the operational conditions.

NOTE:

- Press PROG button to recall a programmed parameter or keep pressing it to program a new group of parameter.
- Newly programmed parameters will overwrite the old ones.

1) Programming operating parameter.

(1) Turn on the power switch and set the rotor onto the drive shaft.

(2) Press PROG button and the symbol blinks. User can input serial number of program.

(3) Press ▲ or ▼ button to choose your desired program. The running parameters will display on LCD screen and change with the serial number.

(4) Modify the operating parameters please refer to section 7.1-4.

(5) Double press PROG button, and then the new parameters will be saved.

2) Recall programmed parameter.

(1) Turn on the power switch and set the rotor onto drive shaft.

(2) Press PROG button and the symbol blinks, then the instrument enter a programmed running mode.

(3) Press ▲ or ▼ button to choose your desired parameter. The parameters will change with the serial number. The serial number is from 1 to 9 that is corresponding 1 to 9 group parameters respectively.

(4) Press ▶ button to run the centrifuge, for details please refer to the section 7.1-5.

7.4 Pulse Operation

NOTE:

- Under this mode, the acceleration and braking speed is designed to run at maximum, regardless of the settings.
- Under this mode, if user keeps pressing the button, the speed will rise until it reaches the setting speed. If releases PULSE button, it starts to decelerate until it stops.
- The PULSE button works only when rotor is not rotating and the door is locked.

1) Turn on the power switch and set the rotor onto the drive shaft.

2) Check the set speed and change it when necessary.

3) Press PULSE button.

■ The rotor continues to accelerate while pressing this button, and when the centrifuge reaches the set speed, it will continue to operate at the set speed.

4) Release PULSE button.

■ The rotor starts the decelerating process, until it stops.

7.5 Pre-cooling operation

This function is designed to improve the ability to control the sample temperature. Using this function, the operator can cool the rotor chamber and the rotor in advance.

1) Press PRE COOL button, then the centrifuge enter into the pre-cooling mode.

■ The pre-cooling screen is shown as figure 7-5.

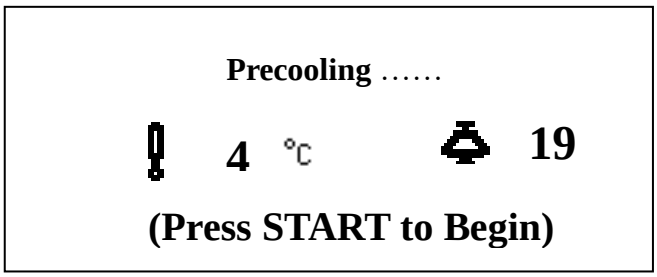


Figure 7-5 Pre-cooling interface

2) Set the temperature and rotor ID.

■ In the pre-cooling operation, depending on the selected rotor ID, the centrifuge will automatically choose the rotating speed and the acceleration rate, it is not necessary for the operator to set the operating condition. Only the temperature value and the rotor ID can be modified. Refer detail operations in section 7.1-4.

■ The centrifuge will return to the preparation mode if no button is pressed for 8 seconds.

3) Close the door and press ▶ button to run the pre-cooling.

■ During the pre-cooling process, the screen could only display the operating temperature.

■ During the pre-cooling process, the instant rotating speed can be checked by pressing the SPEED RCF button. The value will displays at left corner of the Screen and disappears 3 seconds later.

■ Before starting the pre-cooling operation, press ■ button and the centrifuge can return to the preparation mode.

4) When the rotor reaches its setting temperature, the cooling process will stop and the centrifuge will beep and return to the preparation mode 5 seconds later.

■ If ■ button is pressed during the pre-cooling operation, the cooling process will stop and the centrifuge will beep 4 times and return to the preparation mode.

5) Put samples into the rotor and run the centrifuge at normal operation. (refer to section 7.1)

7.6 Browse the rotor information

1) In the preparation mode, press ROTOR button twice, the information of the current rotor will be displayed. See Figure 7-6, take rotor 16 for example.

■ As a normal operation, set the rotor ID to be 16.

■ Press ROTOR button twice, the rotor information is displayed, as shown in the Figure 7-6.

■ The centrifuge will return to the preparation mode by pressing the ■ button.

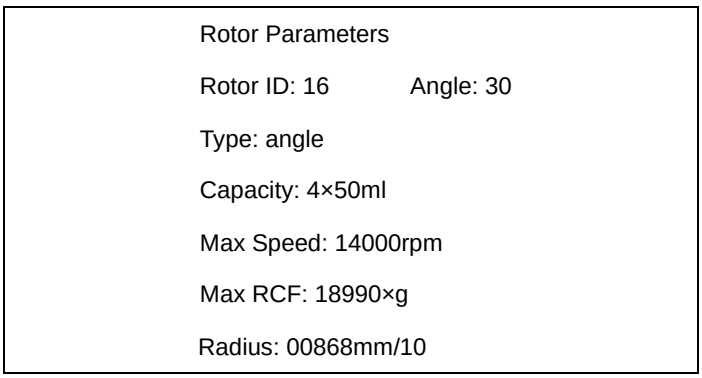


Figure 7-6 Browsing rotor parameters

Descriptions are as follows:

Rotor ID: 16;

Angle: 30°;

Type: angle rotor;

Capacity: 4×50ml;

Max Speed: 14000rpm;

Max RCF: 18990×g;

Max Radius: 86.8mm;

8 Acceleration and Deceleration Rates

User can select acceleration and deceleration curves to your jobs from nine acceleration stages, and nine braking stages, with “9” is fastest, “1” is slowest.

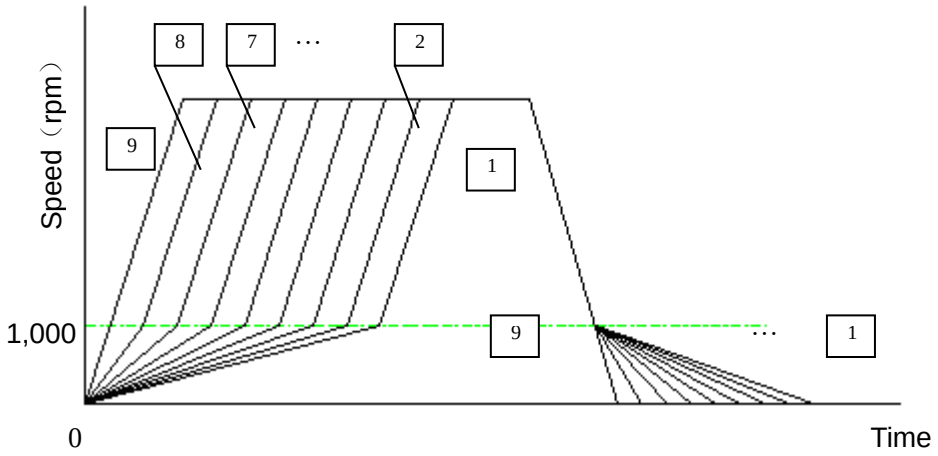


Figure 8.1 The schematic diagram of acceleration and deceleration curves

Advice for Selection of Acceleration and deceleration Rates

- To collect precipitate, it is recommended to set acceleration and deceleration grade at 9 to efficiently separate it.
- To avoid a disturbance during deceleration process, it is recommended to select the grade at 6, 5, 4 or 3.
- To separate invisible samples, such as DNA in microtubes, it is recommended to choose 7 or 8 grade of acceleration and deceleration rate.

9 Temperature Control

Temperature of the sample is controlled by detecting the rotor temperature through the temperature sensor. This centrifuge will automatically compensate changes in temperature due to difference of rotors, based on the ID code and the speed of the rotor in use. Operator only needs to set the desired temperature and let the centrifuge optimize its temperature control.

9.1 Sample temperature during the run

⚠ **CAUTION:** When a rotor at room temperature is used under the low set temperature, it will take a longer time to reach the set value. Some temperature sensitive sample may lose activity during this time. So it is necessary to cool the rotor by pre-cooling function before loading this sample in the rotor. Pre-cool the rotor according to the section 7.5.

Changes in sample temperature during operation may vary depending on the rotor type. Although the centrifuge displays the sample temperature, reading and actual difference may still arise e.g. in a short time operation; if the rotor used and the setting have significant temperature difference.

9.2 High-temperature operation

⚠ **CAUTION:** Running a rotor with a temperature set between 30℃ and 40℃ may deform the tubes or bottles as they are softened by high temperature. Perform test operation under the same conditions with the tubes or bottles to be used filled with liquid in advance, to ensure that it does not melt or deform.

Since this centrifuge is not equipped with a heater, friction heat caused by the rotating rotor is utilized to increase the rotor (sample) temperature. Therefore, the desired temperature may not be reached due to low heat quantity even if the temperature is set above the room temperature if the set speed is too low.

10 Maintenance

⚠ **CAUTION:** Using cleaning or sterilization methods other than recommended in this instruction manual may cause corrosion or deterioration to this centrifuge. Please switch off the centrifuge before cleaning.

10.1 The daily maintenance

1) Centrifuge

■ If the centrifuge is exposed to sunlight for a long time, the color of the covers may be changed and the label may be peeled off. Please cover the centrifuge with cloth after use to avoid direct exposure.

■ Wipe frost or moisture in the rotor chamber with a soft cloth. If the rotor chamber is dirty, clean with cloth or moistened sponge with a neutral detergent solution. Sterilize the centrifuge by wiping with a cloth moistened with 70% ethanol solution.

■ If dew drop are staying in the rotor chamber, dry the chamber with a soft cloth.

2) Rotor chamber

⚠ **CAUTION:** Do not pour water, neutral detergent or disinfectant solution directly into the rotor chamber. Otherwise fluids may leak into the drive unit and cause corrosion or deterioration to the drive shaft.

■ Wipe frost or moisture in the rotor chamber with a soft cloth. If the rotor chamber is dirty, clean with cloth or moistened sponge with a neutral detergent solution. Sterilize the centrifuge by wiping with a cloth moistened with 70% ethanol solution.

■ If dew drop are staying in the rotor chamber, dry the chamber with a soft cloth.

3) Drive shaft

■ Wipe the drive shaft with soft cloth if the surface is dirty.

■ To prevent scuffing of the rotor, wipe a small amount of lubricant by a cloth on the drive shaft's screw once a month.

4) The door

■ Clean and sterilize the door using the same method specified in the step 1).

5) Rotor

■ To prevent corrosion, please remove the rotor from the rotor chamber after use. If a rotor cover is provided, detach the rotor cover from the rotor to dry the inside of the tube holes.

■ If a sample is leaked in the rotor, first rinse the rotor with water, and then apply a thin

coat of silicon grease to it when it is completely dried.

- For details please refer to rotor instruction manual.

10.2 Periodic inspect and replace consumable parts

The table below lists the consumable parts of this centrifuge. It is recommended to replace those parts within its lifespan. The timing of replacement varies depending on operation environment and condition.

No.	Description	Replacement condition
1	Gas spring	The door falls naturally or lifting become heavy (around 10,000 times of opening and closing).
2	Chamber seal rubber assembly (Black motor cover at the bottom of the rotor chamber)	A crack or deterioration is observed. (Rubber parts may deteriorate faster if chemicals are splashed on the surface.)
3	Door sealing rubber (Black rubber around the top of the rotor chamber)	
4	Temperature sensor assenbly	
5	Lock hole rubber	

11 Troubleshooting

11.1 Common malfunction list

This centrifuge is designed with self-diagnosing function, i.e., a alarm code of the fault found will be displayed at the right bottom corner of the screen.

⚠ **WARNING:** Do not open the door when the rotor is rotating.

Table 11-1 Error code

Symptom		Causes	Solution
Nothing appears on the screen when the power is turned on.		·Building power circuit breaker trips. ·The fuse is blown out	·Remove the cause of the trouble and turn on the circuit breaker. ·Replace the fuse.
Error code E-xx appeared on the right corner of Screen.	E-02 Door Open	·The door is open while the rotor is rotating. ·The ▶ button is pressed while the door is open. ·the locking sensor broken	·Close the door immediately. ·Close the door, and then press the ▶ button. ·change the sensor part
	E-03 Rotor ID	The centrifuge can not identify the rotor ID. ·the rotor confirm sensor broken	Reconfirm the ID code of the rotor and make a correct selection. ·replace the confirm sensor
	E-04 Temp Ctrl	·Refrigeration ability is insufficient ·The air inlets on both sides of the centrifuge are blocked. ·Too much Dust is deposited on the radiator. ·Something is wrong with the refrigeration parts	·If the room temperature is high, lower it. ·Dredge the air inlets on the centrifuge. ·Clean the dust. ·Replace the damage part.
	E-06 Over Set	The setting speed or g-value is over the allowable range.	Check the settings and let it within the allowable range.
	E-09 Imbalance	·The imbalance is over the allowable range. ·The machine is impacted when it is running.	·Balance the sample to ensure imbalance is within the allowable range. ·Don’t push the instrument when it is running.
	E-10～86	Read Maintenance manual.	Contact our sales or service representative. Inform them the alarm code.

■ Error code E1 to E9 is mainly related to misoperation. You can continue using the centrifuge after the malfunction is removed.

11.2 Identify the malfunction

You can identify the malfunction by following the instructions.

- In the preparation mode, press the PRE COOL button for 5 seconds, then the malfunction list appears on the screen.
- Press ▲ or ▼ button to turn page, you can find the causes accordingly to the error code.
- If no button is pressed for 5 seconds or the ■ button is pressed, the centrifuge will return to the preparation mode.

12 Frequent problems and solutions

⚠ **WARNING:**

- Never open the door while the instrument is running.
- In the event when the door is opened while the rotor is still rotating, close immediately.

12.1 How to open the door

1) The condition with the power on

User can open the door only when the instrument is powered and the rotor is not rotating.

(1) When the instrument turns on the power switch, press DOOR button to open the door. But 6 seconds later, the door will be locked again.

(2) When the rotor is stopped, press DOOR button to open the door.

(3) Confirm that the rotor is not rotating through observation window.

2) The condition with the power off

If the door cannot be opened due to the power outage, try to use the following steps:

(1) Make sure that the rotor is not rotating.

- Listen carefully to make sure that no sound can be heard.
- Confirm that the rotor is not rotating through observation window.
- It will take about 30 minutes for a large-size rotor to stop completely. Please allow of a sufficient time before taking any further actions.

(2) Insert a screwdriver into the small hole to open the door.

- The small hole is located on the left upper side of the centrifuge.
- Insert a screwdriver into this hole, and then push the lock to open the door.

(3) While the screwdriver pushing the lock, you can open the door with your hand.

12.2 How to remove the rotor stuck on the shaft

When the rotor is placed on the driving shaft for a long time, or because of extensive vibration, it may be firmly stuck on the driving shaft and will be difficult to be removed. Under this condition, the driving shaft may be bended if improper operation is used.

Correct Procedures is as followings:

1） Fix the screw (included in the attachment tools of the centrifuge) into the central

thread hole of the rotor.

2） Insert the screwdriver into the thread hole of the screw. With one hand holding the rotor and the other hand turn the screw right so that the screw can go down and touch the top of the drive shaft.

3） Continue screwing the bolt down, the rotor will be lifted up from the driving shaft.

4） Remove the rotor with both hands and put it on a horizontal table.

5） Turn the screw left and remove it from the rotor.

6） Inspect the drive shaft and the rotor. If any scratches are observed on their inner surfaces, contact with the service representatives.

⚠ **WARNING:** In case that the rotor is stuck to the driving shaft, it is not allowed to remove the rotor using force. Otherwise, the drive shaft may be bended or damaged. User should remove the rotor following the above procedure.

13 Applicable rotors and tubes

⚠ **CAUTION:**

- To use the rotor properly please read the instruction manual carefully.
- Do not run the centrifuge exceeding the allowable maximum speeds of the rotor, buckets, and adapters. Some adapters, tubes and bottles have a lower speed than the rotor in use.

13.1 Table of applicable rotors

Rotor type	Maximum speed	Actual capacity (ml×No. of tubes)	Tube/bottle	
	Maximum RCF		Part name	Size(Φ×L)mm
FA12A	12,000rpm 14,100×g	0.2×48	0.2ml tube	---
FA15A	14,000rpm 18,728×g	1.5/2.0×24	1.5ml tube	Φ10.8×40.5
FA14C	14,000rpm 20,920×g	50×4	50ml tube	Φ30×116
FA15G	14,000rpm 21,780×g	50×6	50 ml TC tube	Φ30×116
FA15B	14,000rpm 18,990×g	50×4	50ml PP tube	Φ29×106
FA15C	14,000rpm 20,290×g	50×6		
SW4C	4,000rpm 1,780×g	5×4	5ml vacutainer for blood specimen collection	Φ12.3×81
FA18C	14,000rpm 17,530×g	10×10	10 ml PP tube	Φ16×82
FA15E	14,000rpm 19,700×g	5×12	5 ml tube with V bottom	Φ16.7×60
FA15F	14,000rpm 19,700×g	5×16	5ml tube with round bottom	Φ13.5×53.5

FA12B	12,000rpm 13,840×g	2×48	1.5ml tube	Φ10.8×40.5

13.2 Cleaning and sterilizing tubes and bottles

1) To choose optional conditions for cleaning and sterilizing the tubes and bottles, please refer to the following table.

Cleaning and sterilizing conditions for tubes and bottles

O: Applicable X: Inapplicable

Condition / Material			PA	PC	PP
Cleaning	Running water cleaning	Acidic detergent(pH5 or lower)	X	X	X
		Acidic detergent (higher than pH5)	O	O	O
		Alkaline detergent(higher than pH9)	O	X	O
		Alkaline detergent(pH9 or lower)	O	O	O
		Neutral detergent(pH7)	O	O	O
		Warm water (up to 70℃)	O	O	O
	Ultrasonic cleaning	Neutral detergent (pH7)	O	O	O
Sterilization	Autoclaving	115℃ (0.7kg/cm^2) 30minutes	O	O	O
		121℃ (1.0kg/cm^2) 20 minutes	X	O	O
		126℃ (1.4kg/cm^2) 15 minutes	X	X	X
	Boiling	15 to 30 minutes	O	O	O
	Ultraviolet sterilization	200-300nm	X	X	X
	Gas sterilization	Ethylene oxide	O	X	O
		Formaldehyde	O	O	O

PA: Polyallomer; PC: Polycarbonate; PP: Polypropylene

2) Cleaning PC tubes and bottles

PC materials have low chemical stability against alkaline solutions, so avoid using detergents with pH higher than 9. Note that some neutral detergents' pH is still higher than 9 even if diluted according to the instruction. Use detergent with its pH between 7.0 and 9.0.

3) Sterilize PA, PC and PP tubes and bottles by autoclave

PA begins softening at about 120℃, and PC and PP at about 130℃. So disinfect PA tubes/bottles at 115℃ (0.7kg/cm^2) for 30 minutes and PC and PP tubes/bottles at 121℃ (0.1kg/cm^2) for 20 minutes when using the autoclaving. If the temperature is exceeded,

the tubes/bottles may deform.

Please take the following instructions when using a sterilizing vessel:

(1) Place bottles in vertical position with mouths upward. If bottles are inclined, they may deform due to gravity action.

(2) Remove caps and inner covers to avoid deformation or rupture.

(3) Take the bottles out till the sterilizing chamber cools down to the room temperature.

4) The lifetime of tubes and bottles

The lifetime of plastic tubes and bottles depends on the characteristics of samples, speed of the rotor, temperature and so on.

When the plastic tubes/bottles are used for ordinary centrifugation (pH between 5.0 and 9.0), their life expectancies are defined as follows:

When operated at the maximum speed:

High quality tubes and bottles (PA, PC, PP): 30-50 times

Ordinary tubes and bottles (PA, PC, PP): about 10 times

The lifetime of the plastic tubes/bottles also depend on the treatment conditions such as cleaning and sterilization.

14 Rotating radius of applicable rotors

Table 14.1 List of the maximum radius of rotors

Name	Rotor ID	Maximum radius(cm)	Name	Rotor ID	Maximum radius(cm)	Name	Rotor ID	Maximum radius(cm)
FA12A	03	8.73	FA15G	09	9.94	FA15B	16	8.68
FA14C	13	9.55	FA15C	18	9.46	FA15A	19	8.61
SW4C	05	10.00	FA18C	01	8.00	FA12B	02	8.61
FA15E	08	9.00	FA15F	07	9.00			

15 Calculating relative centrifuge force (RCF)

An RCF can be determined by the following calculation formula:

$$RCF=1.118\times r\times n^2\times 10^{-5}$$

r-rotating radius, unit: cm, n-rotating speed, unit: r / min

16 Circuit connecting graph

The electric connecting drawing is shown as Figure 16-1. The electric system consists of control board, drive board, display board, sensors, motor, refrigerator, and fans etc. All four fuses are placed on the drive board, with signs of F1, F2, F3, F4 respectively, their specifications are:

F1, F3, F4: 10A, Φ6×30, delay type, used for the compressor, the fan and main circuit protection;

F2: 3.15A, Φ5×20, ordinary type, used for the DC POWER protection;

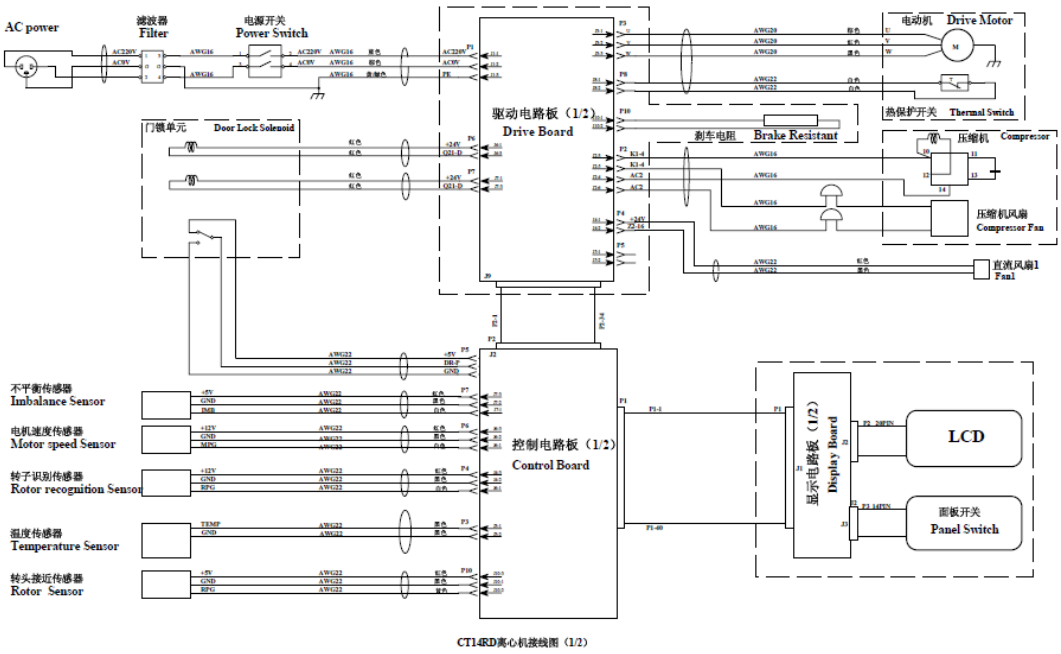


Figure 16-1 Circuit connecting graph

⚠ Unauthorized repairs, disassembly, and other services to the centrifuge are strictly prohibited.

17 Guarantee

■ Guarantee of the centrifuge

This centrifuge is guaranteed for one year from the date of installation or one and half years from out-of-factory (date depending on the first come one) while it has been operated and maintained properly.

■ Guarantee of the rotor

The rotor is guaranteed for 7 years from the date of delivery. When the rotor has been damaged by corrosion or material fatigue, please pay special attention on it and do not use the rotor any more.

We do not guarantee the centrifuge and the rotor under the following conditions even before the guarantee period expires:

(1) Failures caused by incorrect installation

(2) Failures caused by rough and/or improper operation

(3) Failures caused by transportation or displacement after installation

(4) Failures caused by unauthorized disassembly or modification

(5) Failures caused by the use of non-Dynamica components such as rotors, buckets and adapters

(6) Failures caused by natural disasters including fire, earthquakes and so on

(7) Consumable parts and parts with a limited guarantee period

After-sales Service

Periodic maintenance is recommended to assure safe and efficient operation. If the centrifuge has something wrong, do not attempt to repair it by yourself. Contact our sales or service representative.

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