LG
Life's Good

ENGLISH

Operation & Maintenance MANUAL

CHILLER
AIR-COOLED SCREW

Please read this manual carefully before operating your set and retain it for future reference.

MODEL: MCAW(B) Series

www.lge.com

For your records

Staple your receipt to this page in case you need it to prove the date of purchase or for warranty purposes. Write the model number and the serial number here:

Model number :

Serial number :

You can find them on a label on the side of each unit.

Dealer's name :

Date of purchase :

SAFETY CAUTIONS

Installing, starting up, and servicing this equipment can be hazardous due to system pressures, electrical components, and equipment location (roof, elevated structures, etc). Only trained, qualified installers and service technicians should install, start up, and service this equipment. When working on this equipment, observe precautions in the literature, and on tags, stickers, and labels attached to the equipment, and any other safety precautions that apply. Follow all safety codes. Wear safety glasses and work gloves. Be care of handing, rigging, and setting this equipment, and in handing all electrical components.

To prevent injury to the user or other people and property damage, the following instructions must be followed.

- Incorrect operation due to ignoring instruction of the manual will cause harm or damage. The seriousness is classified by the following indications.
- We do not have any responsibility for any failure caused by careless management and natural disaster, and power cord failure regardless of warranty period.
- The content in the manual could be changed for the improvement of product without notice.

⚠ WARNING

This symbol indicates the possibility of death or serious injury.

⚠ CAUTION

This symbol indicates the possibility of injury or damage to properties only.

Meanings of symbols used in this manual are as shown below.

Be sure not to do.

Be sure to follow the instruction.

WARNING

- All wiring must comply with local requirements and the instructions given in this manual.
  - If the power source capacity is inadequate or electric work is performed improperly, electric shock or fire may result.
- Ask the dealer or an authorized technician to install the chiller.
  - Improper installation by the user may result in water leakage, electric shock, or fire.
- Always ground the product.
  - There is risk of fire or electric shock.
- Always install dedicated circuit and breaker.
  - Improper wiring or installation may cause fire or electric shock.
- For re-installation of the installed product, always contact a dealer or an Authorized Service Center.
  - There is risk of fire, electric shock, explosion, or injury.
- Do not install, remove, or re-install the unit by yourself (customer).
  - There is risk of fire, electric shock, explosion, or injury.
- Do not store or use flammable gas or combustibles near the chiller.
  - There is risk of fire or failure of product.
- Use the correctly rated breaker or fuse.
  - There is risk of fire or electric shock.
- Do not install the product on a defective installation stand.
  - It may cause injury, accident, or damage to the product.
- When installing and moving the chiller to another site, do not charge it with a different refrigerant from the refrigerant specified on the unit.
  - If a different refrigerant or air is mixed with the original refrigerant, the refrigerant cycle may malfunction and the unit may be damaged.

- Do not reconstruct to change the settings of the protection devices.
  - If the pressure switch, thermal switch, or other protection device is shorted and operated forcibly, or parts other than those specified by LGE are used, fire or explosion may result.
- Ventilate before operating chiller when gas leaked out.
  - It may cause explosion, fire, and burn.
- Securely install the cover of control box and the panel.
  - If the cover and panel are not installed securely, dust or water may enter the air-cooled unit and fire or electric shock may result.
- If the chiller is installed in a small room, measures must be taken to prevent the refrigerant concentration from exceeding the safety limit when the refrigerant leaks.
  - Consult the dealer regarding the appropriate measures to prevent the safety limit from being exceeded. Should the refrigerant leak and cause the safety limit to be exceeded, hazards due to lack of oxygen in the room could result.
- Do not damage or use an unspecified power cord.
  - There is risk of fire, electric shock, explosion, or injury.
- Use a dedicated outlet for this appliance.
  - There is risk of or electrical shock.
- Be cautious that water could not enter the product.
  - There is risk of fire, electric shock, or product damage.
- Do not touch the power switch with wet hands.
  - There is risk of fire, electrical shock, explosion, or injury.
- When the product is soaked (flooded or submerged), contact an Authorized Service Center.
  - There is risk of fire or electric shock.
- Take care to ensure that nobody could step on or fall into the air-cooled unit.
  - This could result in personal injury and product damage.
- Follow the permitted pressure level
  - Follow the regulated pressure for cold water, cooling water, refrigerant etc.
  - It can cause electricity leakage or burn/frostbite eruption or leakage.
- Be cautious of fire, earthquake and lightning
  - If there is natural disaster such as fire or earth-quake, or risk of lightning , immediately stop operating the unit
  - If you continue to operate the unit, it can cause a fire or electric shock.
- Be careful of the rotating part
  - Be careful not to put your finger or a stick in the rotating part of the fan or pump.
  - Do not operating the fan with the protective net removed. It can cause body injury.
- Use of undesignated refrigerant and oil is prohibited.
  - Do not use undesignated refrigerant, freezer oil and brine.
  - It can have a critical effect on the compressor and component defects.
  - If you would like to use a substitute for the refrigerant, please contact the manufacturer.
- Redesigning the control box is prohibited
  - Lock the control box with possible locking device and if you need to open the control box inevitably, turn off the main power first.
  - Do not touch the wiring or parts within the control box.
  - It can cause electric shock, fire or defects.
- Be careful of leakage
  - If you find a leakage in the connected part such as pump, piping etc., immediately stop the operation.
  - It can cause electric shock, leakage or defects.
- Changing the set value is prohibited
  - Do not change the set value of the safety device.
  - If you operate the product with incorrectly set values, it can cause defect, fire or explosion.
  - When you change the control setting value, please consult with the specialized expert.
- Electric shock prevention
  - When installing the freezer, always ground the wire.
  - It can cause electric shock.
- Follow all safety codes
  - When working on this equipment, observe precautions in the literature, and on tags, stickers, and labels attached to the equipment, and any other safety precautions that apply.

- Wear safety equipment
  - Wear safety glasses and work gloves.
  - Use care in handing, rigging, and setting this equipment, and in handling all electrical components.
- Shut off all power to this equipment during installation and service.
  - Electrical shock can cause personal injury and death.
  - There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.
- Always run fluid through heat exchangers when adding or removing refrigerant charge.
  - It prevents potential damage to heat exchanger tubes.
  - Use appropriate brine solutions in cooler fluid loops to prevent the freezing of heat exchangers when the equipment is exposed to temperatures below 32℉ (0℃).
- Do not vent refrigerant relief valves within a building.
  - Outlet from relief valves must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigeration and Air Conditioning Engineers) 15 (Safety Code for Mechanical Refrigeration).
  - The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.
  - Provide adequate ventilation in enclosed or low overhead areas. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness or death. Misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation.
- Do not attempt to umbrage factory joints when servicing this equipment. Cut lines with a tubing cutter as required when performing service.
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- Do not attempt to umbrage factory joints when servicing this equipment. Cut lines with a tubing cutter as required when performing service.
  - Compressor oil is flammable and there is no way to detect how much oil may be in any of the refrigerant lines.
  - Use a pan to catch any oil that may come out of the lines and as a gage for how much oil to add to system.
- Do not re-use compressor oil.
  - It may cause damage to the product.
- Do not leave refrigerant system open to air any longer than necessary.
  - Seal circuits being serviced and charge with dry nitrogen to prevent oil contamination when timely repairs cannot be completed.

CAUTION

Installation

- Always check for gas (refrigerant) leakage after installation or repair of product.
  - Low refrigerant levels may cause failure of product.
- Do not install the product where the noise or hot air from the air-cooled unit could damage the neighborhoods.
  - It may cause a problem for your neighbors.
- Keep level even when installing the product.
  - To avoid vibration or water leakage.
- Do not install the unit where combustible gas may leak.
  - If the gas leaks and accumulates around the unit, an explosion may result.
- Use power cables of sufficient current carrying capacity and rating.
  - Cables that are too small may leak, generate heat, and cause a fire.
- Do not use the product for special purposes, such as preserving foods, works of art, etc. It is a consumer chiller, not a precision refrigeration system.
  - There is risk of damage or loss of property.
- Keep the unit away from children.
  - It can cause the injury, such as cutting the finger. Also the damaged fin may result in degradation of capacity.

- When installing the unit in a hospital, communication station, or similar place, provide sufficient protection against noise.
  - The inverter equipment, private power generator, high-frequency medical equipment, or radio communication equipment may cause the chiller to operate erroneously, or fail to operate. On the other hand, the chiller may affect such equipment by creating noise that disturbs medical treatment or image broadcasting.
- Do not install the product where it is exposed to sea wind (salt spray) directly.
  - It may cause corrosion on the product. Corrosion could cause product malfunction or inefficient operation.
- Do not use the chiller in special environments.
  - Oil, steam, sulfuric smoke, etc. can significantly reduce the performance of the chiller or damage its parts.
- Make the connections securely so that the outside force of the cable may not be applied to the terminals.
  - Inadequate connection and fastening may generate heat and cause a fire.
- Be sure the installation area does not deteriorate with age.
  - If the base collapses, the chiller could fall with it, causing property damage, product failure, or personal injury.
- Be very careful about product transportation.
  - When transporting the chiller, always consult with the specialized expert.
  - When transporting the chiller, make sure to comply with the method regulated in the manual. If not, it can cause overturn, fall etc.
- Safely dispose of the packing materials.
  - Packing materials, such as nails and other metal or wooden parts, may cause stabs or other injuries.
  - Tear apart and throw away plastic packaging bags so that children may not play with them. If children play with a plastic bag which was not torn apart, they face the risk of suffocation.
- Turn on the power at least 12hours before starting operation.
  - Starting operation immediately after turning on the main power switch can result in severe damage to internal parts. Keep the power switch turned on during the operational season.
- Do not touch any of the refrigerant piping during and after operation.
  - It can cause a burn or frostbite.
- Do not operate the chiller with the panels or guards removed.
  - Rotating, hot, or high-voltage parts can cause injuries.
- Do not directly turn off the main power switch after stopping operation.
  - Otherwise it may result in oil supply shortage or other problems.
- Use a firm stool or ladder when cleaning or maintaining the chiller.
  - Be careful and avoid personal injury.
- Be careful of disposal
  - When disposing the device, request to the specialized expert.
- Be careful of high voltage
  - Install separate wiring for the power and always install and use dedicated power supply and circuit breaker.
  - It can cause electric shock or fire.
- Be careful of high temperature
  - Because the machine part can be hot, do not touch it with any part of your body.
  - It can cause burns.
- Be careful of restarting
  - When the safety device of the product operates, resolve the cause before re-operating.
  - If you repeat this arbitrarily, it can cause fire and defect.
- Be careful of device installation
  - Be careful of the clearance of the device during the installation and make sure there are no surrounding obstacles for the air cooling type and that it is well ventilated.
- Be careful of sound or odor
  - If you hear a weird sound or smell weird odor, immediately stop operating the unit and contact the service center.
  - It can cause fire, explosion and injury.
- Check
  - Execute the periodic check. If an issue is found, stop operating the unit and contact the service center.
  - Insufficient check can cause fire, explosion and defect.
- It can cause an injury.
  - Use appropriate tools used for the repair and make sure to calibrate the measuring devices precisely before use.
  - If you use inappropriate tools etc, it can cause an accident.

- Be careful of air cooling type heat exchanger
  - Because the condenser of the air cooling type device is sharp, do not touch the condenser.
  - Protective net must always be kept installed.
  - It can cause an injury.
- It can cause an injury.
  - Check the safety label of the safety device.
  - Follow upper precautions and labels. If not, it can cause injury or damage such as a fire etc.
  - To prevent the generation of condensed water, the connectinga pipe to the evaporator, as well as the evaporator itself, must be insulated.
- Do not use jumpers or other tools to short out components, or to bypass or otherwise depart from recommended procedures
  - Any short-to-ground of the control board or accompanying wiring may destroy the electronic modules or electrical components.
- Do not attempt to bypass or alter any of the factory wiring.
  - Any compressor operation in the reverse direction will result in a compressor failure that will require compressor replacement.
- Consult a water treatment specialist for proper treatment procedures.
  - Hard scale may require chemical treatment for its prevention or removal
- Water must be within design flow limits, clean and treated.
  - This makes it possible to ensure proper machine performance and reduce the potential of tubing damage due to corrosion, scaling, erosion, and algae.
  - LG assumes no responsibility for chiller or condenser damage resulting from untreated or improperly treated water.
- Harsh chemical, household bleach or acid cleaners should not be used to clean outdoor or indoors coils of any kind
  - These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the Environmentally Sound Coil Cleaner.
- Do not use high-pressure water or air to clean coils
  - It may cause fin damage
  - High Velocity Water or Compressed Air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdown may occur.
- Do not overcharge system
  - Overcharging results in higher discharge pressure with higher cooling fluid consumption, possible compressor damage and higher power consumption.
- Do not add oil at any other location
  - It may cause improper unit operation
- Compressor oil is pressurized.
  - Use proper safety precautions when relieving pressure.
- Turn controller power off before servicing controls.
  - This ensures safety and prevents damage to controller.
- Rig the unit from the top of heat exchanger only.
  - Rigging from the bottom heat exchanger will cause the unit to be lifted unsafely.
  - Personal injury or damage to the unit may occur
- Welding is not recommended in the cooler heads or nozzles.
  - In the event that welding must be performed, remove the chilled water flow switch and entering an leaving fluid thermistors before welding.
  - Reinstall flow switch and thermistors after welding is complete. Failure to remove these devices may cause component damage.

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TABLE OF CONTENTS

CONTROL SYSTEM

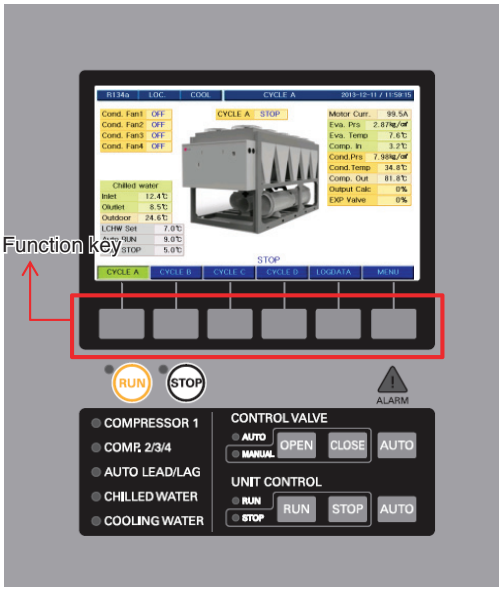
Components of control panel and main parts

Controller

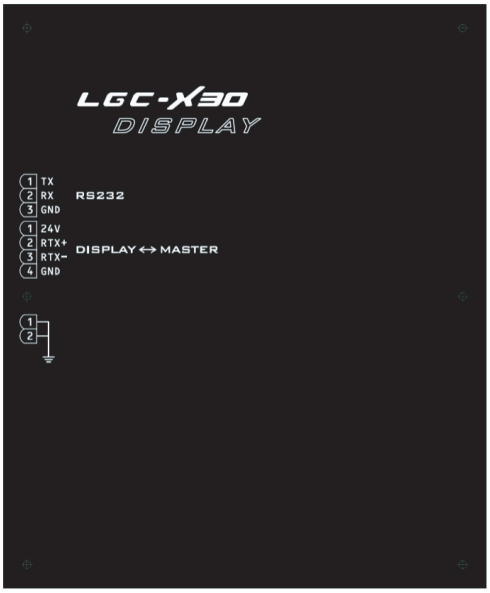
HMI with 7 inch Color LCD is composed as a graphic type.

There are start/stop, control valve and unit control, compressor, auto lead lag lamp and chilled water/cooling water lamp keys.

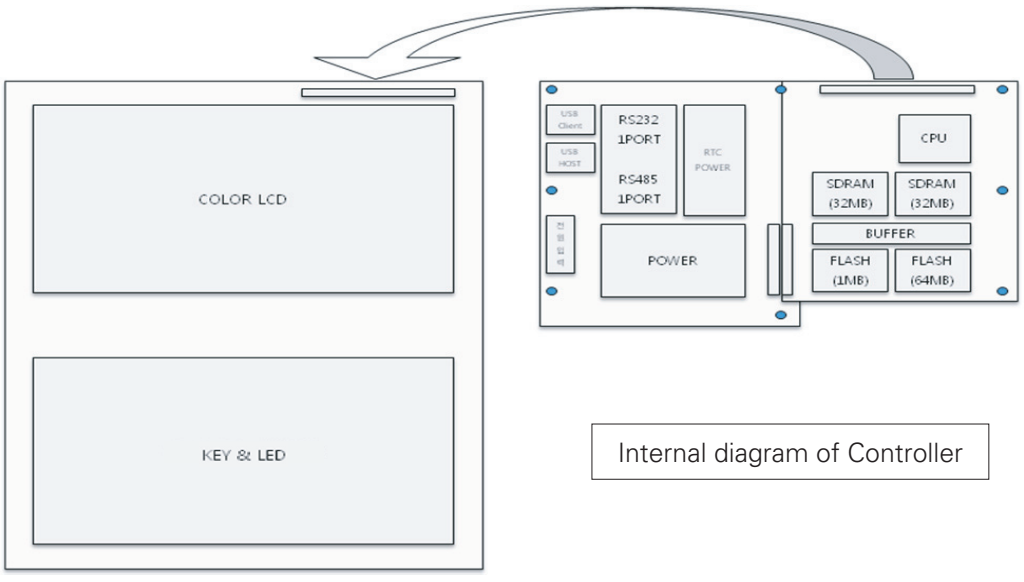
There are 'function keys' at the bottom of the screen that change according to the current screen to be able to access lower categories.



Front of controller



Back of controller



Internal diagram of Controller

Figure 14. Controller

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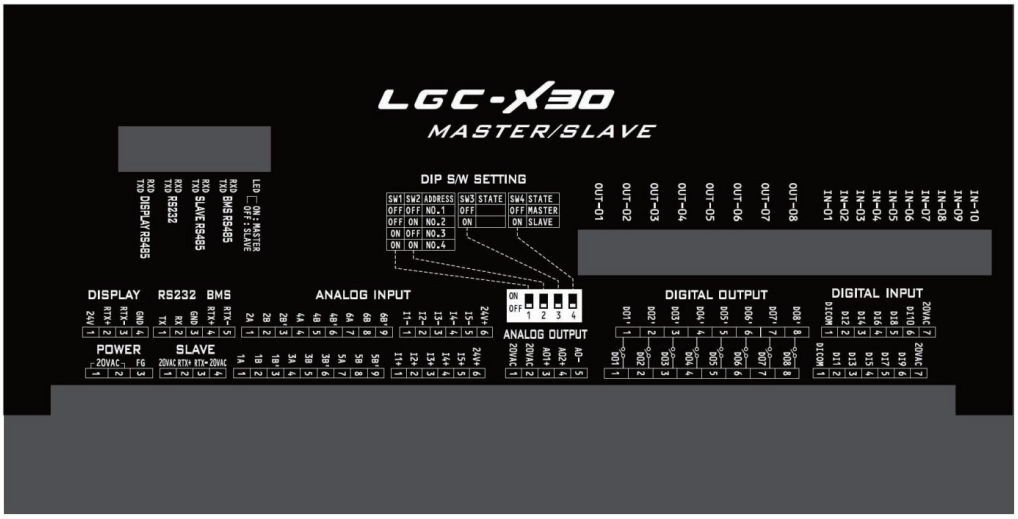
Master board and slave board have the same hardware, and they are set as master or slave by DIP switch setting. For user convenience, analogue input/output, digital input/output are composed with RS232, RS485 communication connections.



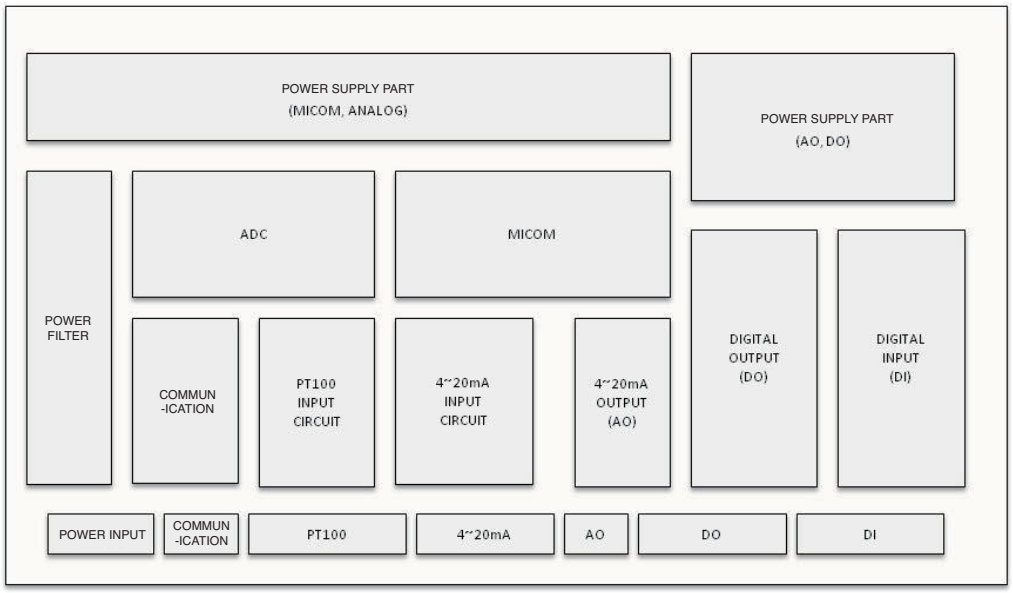


Figure 15. Internal diagram of master/slave board

Controller system composition diagram

Master, slave, HMI, Relay board communicates with RS485, and in one master/slave board, there are analog input(temp. 12 channel, current 10 channel), analog output(current 4 channel), digital input(20 channel), digital output(16 channel).
Relay board controls Solenoid valve in 2 comp.

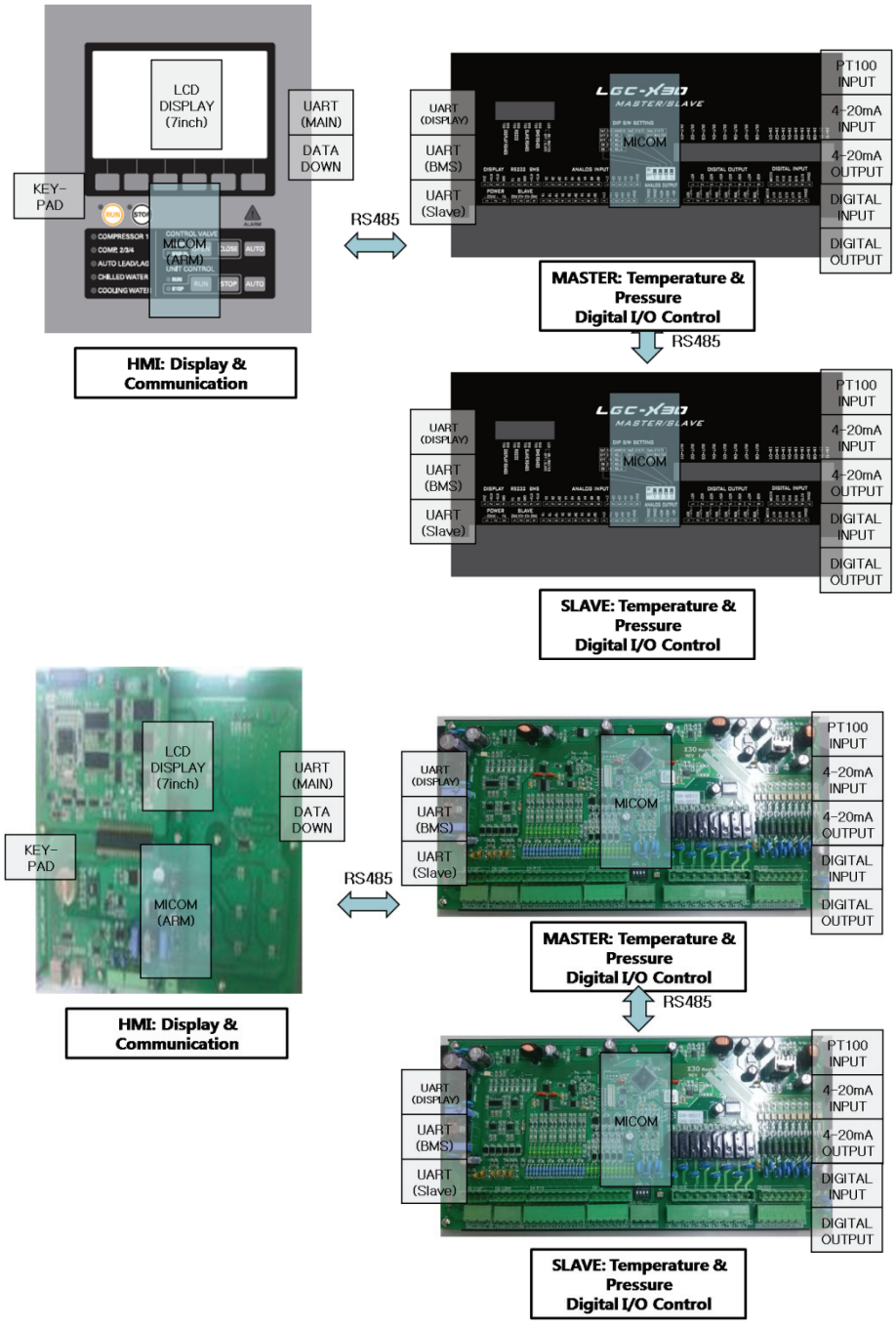


Figure 16. Controller block diagram

Other control parts

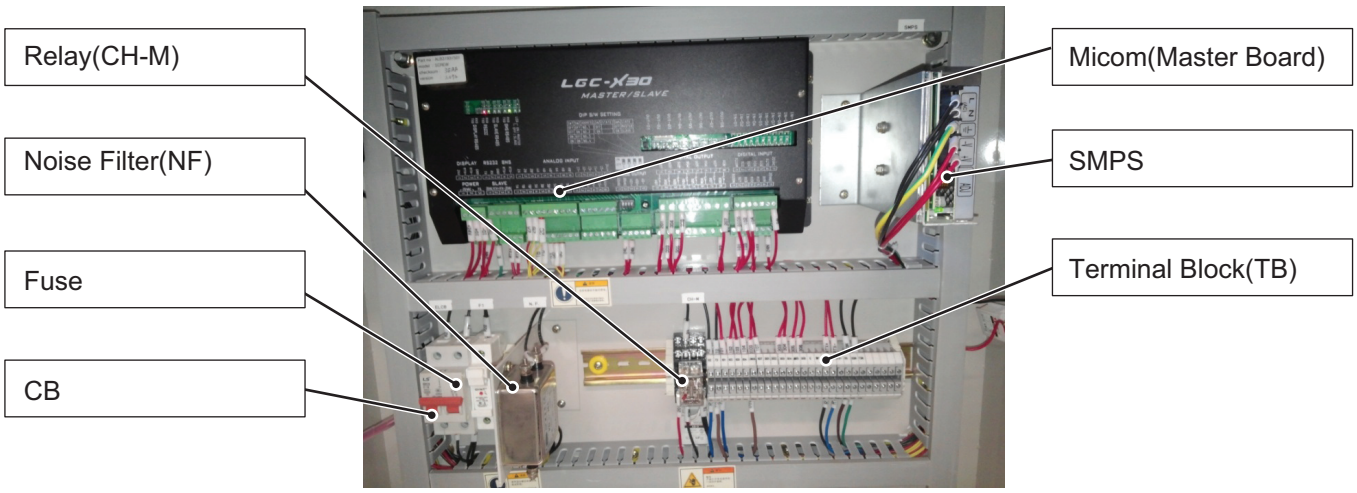


Figure 17. control system

TAG NAME	USE
CB	Control power circuit breaker
NF	Protect for noise
SMPS	Supply control power
Fuse	Protect control power
Realy	Auxiliary relay for slave board
TB	Supply control signal and power source
MICOM	Control device use micro processor

❉ The above configuration may change according to design enhancement, type, or user convenience, so please refer to the approved drawings for details.

Control related option parts

BACnet converter

Our controller basically supports Modbus communication protocol.
If the higher level communication protocol is BACnet, you need to apply a separate BACnet converter to change protocol.
Communication converter is attached inside control panel.
Please refer to the following table for meaning and description of each lamp.

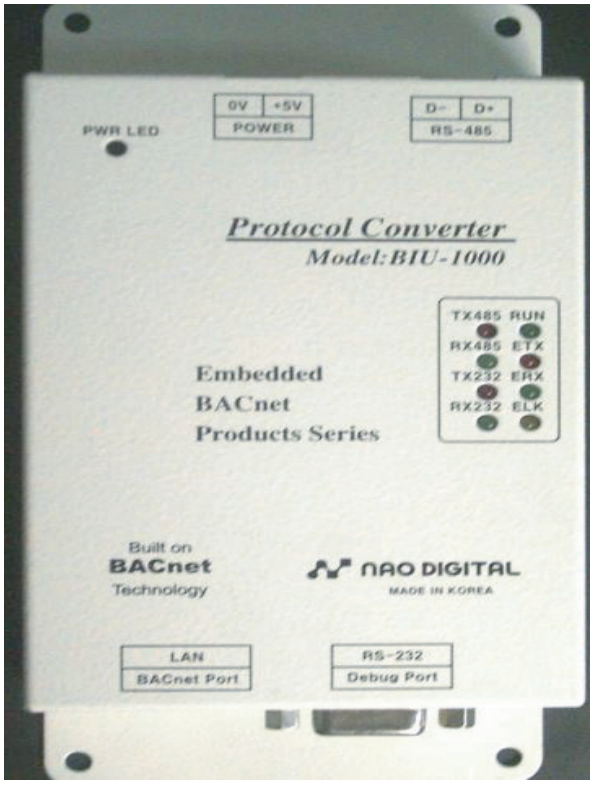


Figure 18. Converter

LED name	Status	Description
TX485 RX485	Flashing	Normal data communication with Micom
	Off	Error, check communication line
TX232 RX232	Flashing	Normal data communication with BACnet
	Off	Error, check communication line
RUN	Flashing each sec.	Board finished Power-on test, and normally operating
	Maintaining On/Off state	Error, press reset button or turn power off and on again
ETX ERX ELK	Ethernet Line status LED	ELK is always on when LAN cable is connected, and ERX flashes on data reception, and ETX flashes on data transmission.

Table 4. Converter lamp names

Basic control algorithm

Unique P(proportional), I(integral), and D(differential) algorithms applied to chilled water temp. control, and compared to the existing method, it enabled optimal control by minimizing time to approach the target value, remaining deviation, Under-shoot and Over-shoot during initial start-up and automatic/manual conversion of operation.

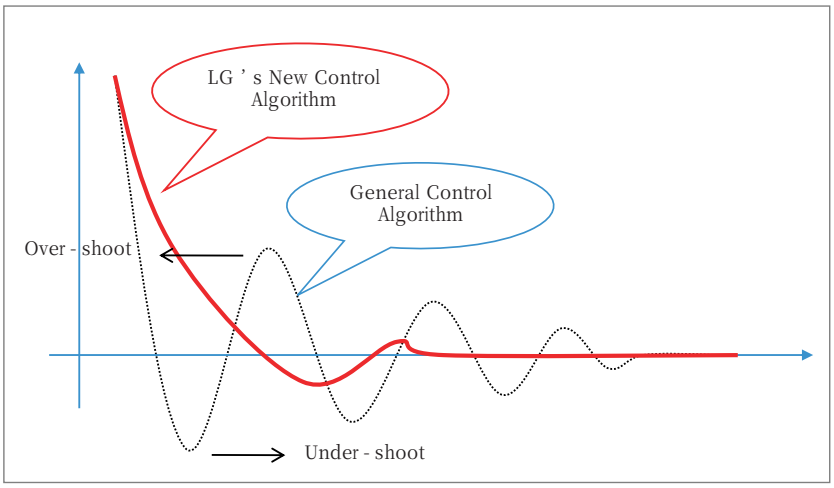


Figure 19. Control algorithm

- Soft loading
  - Approach to the control target value with Soft start-up
  - Solved unnecessary stops due to valve opening during start-up

- Advanced control
  - Advanced high class control algorithm development for high precision compared to existing PID control method
  - Prevention of temp. cycling due to Overshoot/Undershoot during conversion from manual mode to automatic mode
  - Reinforced safety control(Intensive safety control): By executing preventive control before chiller reaching abnormal stop point, it minimized unnecessary stops of the chiller.

BMS support function

Screw chiller's basic communication protocol is Modbus protocol, and it can be compatible with higher level communication methods.

Communication protocol support

- Communication method
  - Basic: RS-485
  - Option: Ethernet
- Protocol
  - Basic: MODBUS
  - Option: BACnet, TCP/IP

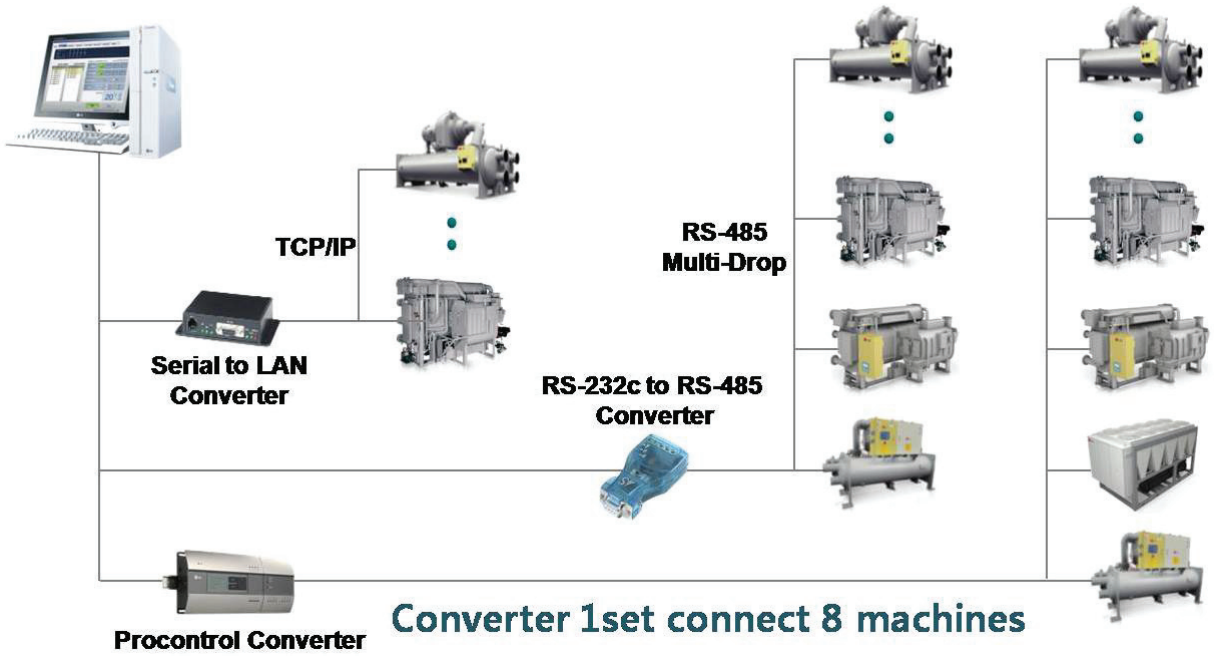


Figure 20. Detail diagram of BMS

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Control screen (Product function)

Control related option parts

• User setting

User setting	Exapansion valve setting	System information(output)	Account management
Operation mode setting	Suction super heat setting	Chilled water pump operation	Management No. 1
Control mode setting	Expansion valve setting C1	Abnormal status	Management No. 2
Chilled water outlet temp.	Expansion valve setting C2	Operation status	Management No. 3
Ice storage outlet temp.	Expansion valve setting C3	Remote operation setting	System setting password
Chilled water temp. P	Expansion valve setting C4	Schedule operation setting	Operating remaining time
Chilled water temp. I	Expansion valve pressure protection	Buzzer	Chilled water inlet temp.
Chilled water temp. D	Expansion valve starting rate	Compressor valve 25%	Chilled water outlet temp.
Automatic start temp. (set value+)	Expansion valve calculation time	Compressor valve 50%	Outside air temp.
Automatic stop temp. (set value-)	Expansion valve dead zone	Compressor valve 75%	Current limit
Freezing prevention operation function	Expansion valve minimum	Condenser fan1	Remote control temp. setting
Freezing prevention operation0 temp.	Expansion valve maximum	Condenser fan2	Compressor discharge temp.
Motor current limit	Expansion valve pressure protection opening rate	Condenser fan3	Compressor suction temp.
	Expansion valve opening rate	Condenser fan4	Evaporator pressure
		Compressor operation	Condenser pressure
		Exapansion valve	Current
		Inverter	Exapansion valve AO
			Compressor inverter
LEAD/LAG setting	**Manual Operation**		
Lead/Lag select	Control valve #1		
LAG start load(%Current)	Control valve #2		
LAG start delay time	Control valve #3		
LAG stop load(%Current)	Control valve #4		
LAG stop delay time	Expansion valve #1		
Cycle A sequence setting	Expansion valve #2		
Cycle B sequence setting	Expansion valve #3		
Cycle C sequence setting	Expansion valve #4		
Cycle D sequence setting			
Scheduled time operation setting	**System information(input)**	**System information(timer)**	
Pattern setting(operation)	Chilled water flow rate interlock	Chilled water pump stop delay timer	
Pattern setting(stop)	Chilled water pump interlock	Condenser operation timer	
Pattern setting(temp.)	Remote control operation signal	Condenser stop timer	
Pattern setting(current)	External abnormal signal	Flow rate vibration ignore timer	
	Condenser fan1 status	Refrigerant pressure ratio maximum timer	
System information	Condenser fan2 status	Refrigerant pressure ratio minimum timer	
Input status check	Condenser fan3 status	Refrigerant differential pressure timer	
Output status check	Condenser fan4 status	Operation valve opening delay1 timer	
Timer check	Compressor operation check	Operation valve opening delay2 timer	
Operation information saving period	Pressure status	Oil pressure check timer	
Communication address (Machine No.)	Oil status	During start-up valve closing timer	
Communication speed	Motor status	During stop valve closing timer	
Language selection	Power supply status	Valve opening delay timer	
Temp. unit selection	Expansion valve status	Compressor start-up check timer	
Pressure unit selection		Re-start-up prevention timer	
Flow amount unit selection		Operation valve opening delay3 timer	
Screen brightness adjustment		Compressor stop delay timer	

• System setting

Control information setting	Abnormality condition setting	Sensor correction setting	Sensor setting
Ice storage mode	Chilled water temp. minimum	Chilled water inlet temp.	Power limit
Control calculation period	Refrigerant pressure ratio minimum	Chilled water outlet temp.	Remote control temp.
Control temp. dead zone	Cmpressor discharge temp. high temp.	Outside air temp.	Evaporator pressure
Motor rated current1	Evaporator pressure low	Power limit	Condenser pressure
Motor rated current2	Condenser pressure high	Remote control temp. setting	Current
Motor rated current3	Refrigerant differential pressure low	Compressor discharge temp.	Expansion valve AO
Motor rated current4		Compressor suction temp.	Compressor inverter
Model selection		Evaporator pressure	
Operation time limit		Condenser pressure	
Condenser fan calculation period		Current	
Softloading output period			
Softloading valve output			
Control valve selection	**Safety control setting**		
Compressor quantity selection	Compressor discharge temp. high temp. prevention		
Condenser fan operation pressure	Evaporator pressure low prevention		
Condenser fan step pressure	Condenser pressure high prevention		
Economizer valve opening temp.			
Liquid valve opening temp.			
Liquid valve closing temp.			
Timer setting			
Chilled water pump stop delay timer			
Condenser operation timer			
Condenser stop timer			
Flow rate vibration ignore timer			
Refrigerant pressure ratio minimum timer			
Refrigerant pressure ratio maximum timer			
Refrigerant differential pressure check timer			
Operation valve opening delay1 timer			
Operation valve opening delay2 timer			
Oil pressure check timer			
During start-up valve opening timer			
During stop valve closing timer			
Valve opening delay timer			
Compressor start-up check timer			
Re-start-up prevention timer			
Operation valve opening delay3 timer			
Compressor stop delay timer			

Control menu composition

How to operate menu and names of the operation panel`

Screw chiller control device display has the basic screen that can check the current operation status, main menu for user to conveniently use screw chiller such as user setting, problem/caution information, etc., and system menu for sensor setting, system related setting.

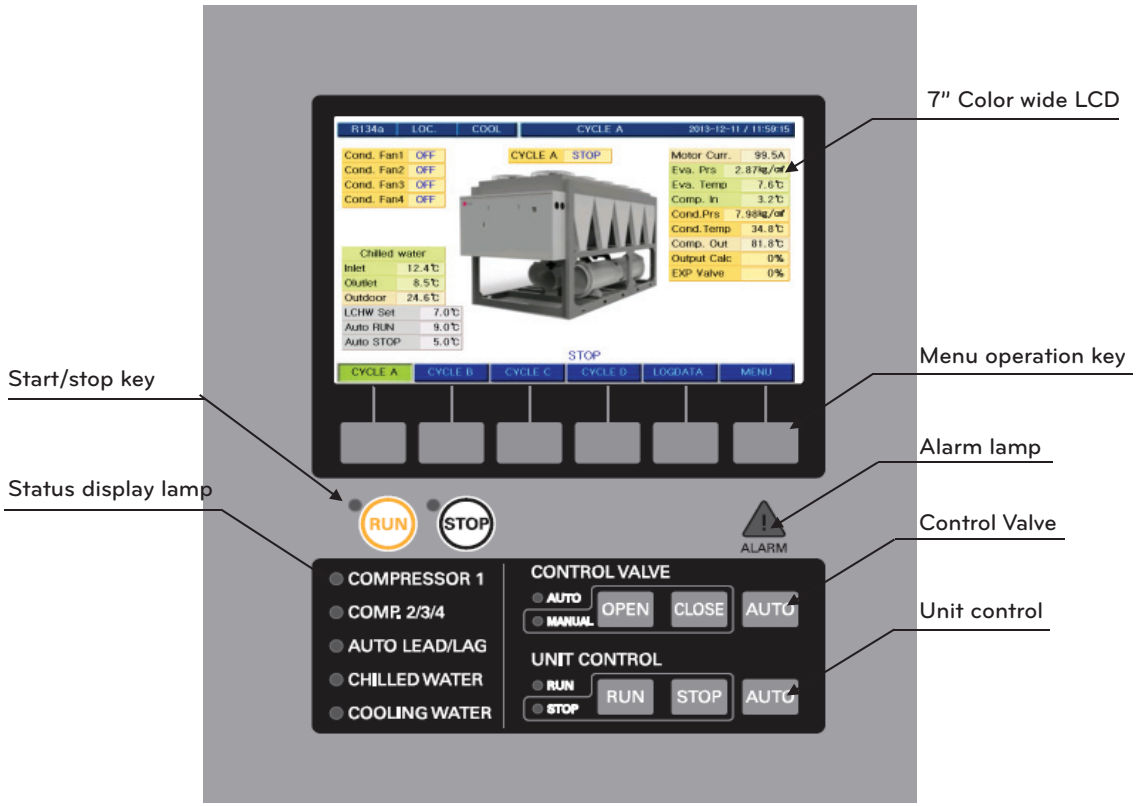

Figure 21. Front of controller

Names of Operation part

Name	Description
LCD screen	It is the color LCD display showing operation information and status as text(Korean, English, Chinese) or animation graphic.
Menu operation key	It is the key to operate menu displayed on the LCD display such as selection of the displaying screen and setting of operation condition, etc. The functions of the operation keys are displayed at the bottom of the LCD screen, and the functions of the operation key change as the selected screen.
Control Valve manual operation key	It is the key to operate(open/close) the Solenoid valve manually.
	When "manual" indicator lamp is on, it is the state where manual operation is possible.
	Open/close key only operates while the key is pressed down.
Unit Control manual operation key	It is the key to start/stop manually.
	When "manual" indicator lamp is on, it is the state where manual operation is possible, and it works when it is pressed down for about 1.5 sec. or longer.
Alarm lamp	When problem or caution warning occurs the alarm lamp is turned on.
	When the alarm lamp is on, the message on the alarm is displayed on the message display line in the LCD screen. At this time, if you press release key, buzzer stops and release key disappears. And when the problem alarm disappears, the message also disappears.
Start/stop key	It is the key to start/stop the chiller.
	It works when you press it down for about 1.5 sec. or longer, and operation indicator lamp is on during operation and stop indicator lamp is on when it is stopped.
Status indicator lamp	It displays the operation/stop status of chiller and devices attached to the chiller and the status of the chilled water and the indicator lamp is on when operated.

Table 5. Names of operation part

⚠ CAUTION

Do not touch controller with sharp parts.
It may cause controller damage.

Names of Color LCD screen display part

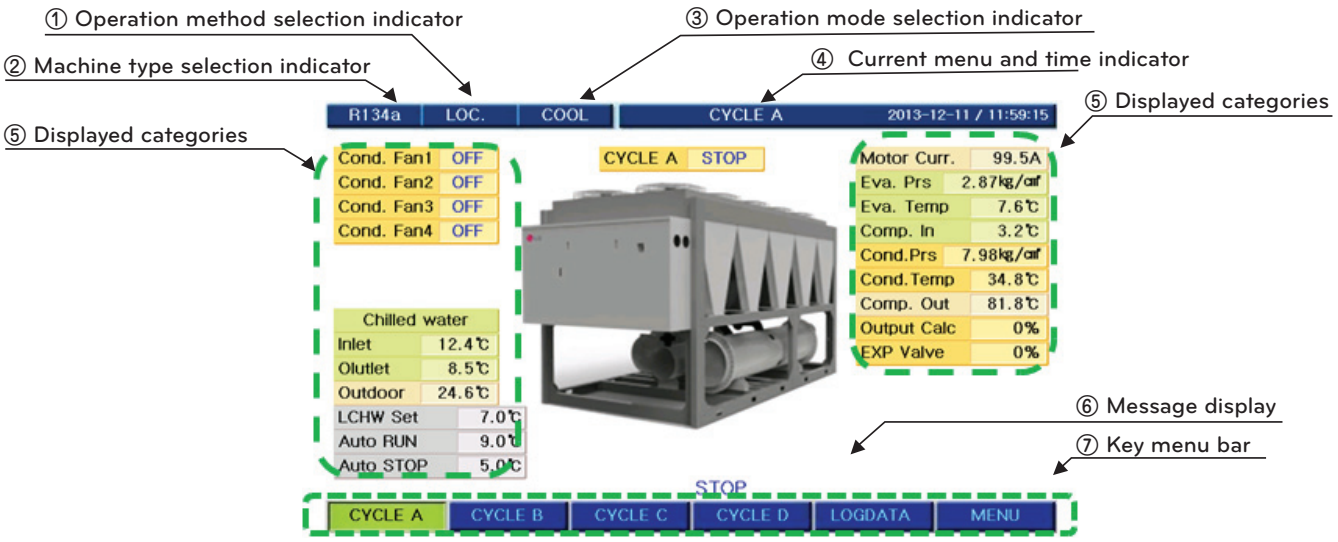

Figure 22. LCD screen diagram

① Operation method selection indicator
There are local operation for direct operation at the site, scheduled operation for automatic operation at the set time, and remote operation to operate from a remote place, and the indicator of the screen display shows the currently selected operation method

② Machine type selection indicator
You can select among R134a,R22. (When it is selected, it automatically resets the main board and chagnes to the corresponding model.)

③ Operation mode selection indicator
There is only a cooling operation in the ventilation chiller, so only cooling will be displayed, and if it is for low temp., it will be displayed as cooling and ice removing according to the setting. (Refer to the user setting of main menu and control mode)

④ Current time indicator
It displays the current year, month, day, day of week, hour, and min.

⑤ Message display
It displays the functions for menu operation key.

⑥ Key menu bar
It displays the status of start/stop and operation, and messages such as problem/caution alarm, etc.

Basic screen

It is the screen displaying input value and calculated output status value of each sensor attached to the main body of the chiller.

1) Cycle A

- It shows animation screen and related DATA of the entire cycle A.
  - Movement path : CYCLE A

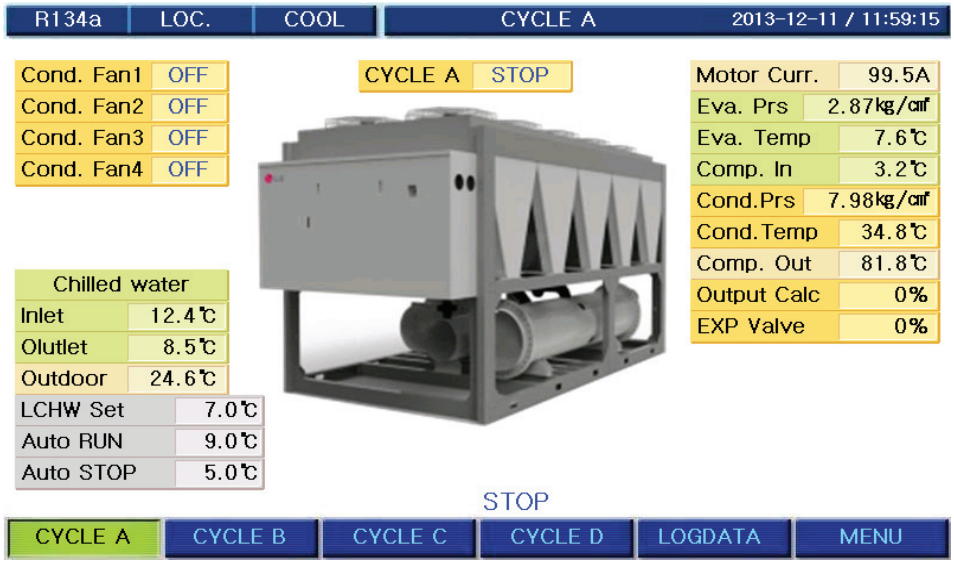

Figure 23. Cycle A screen

2) Cycle B

- It shows animation screen and related DATA of the entire cycle B.
  - Movement path : CYCLE B

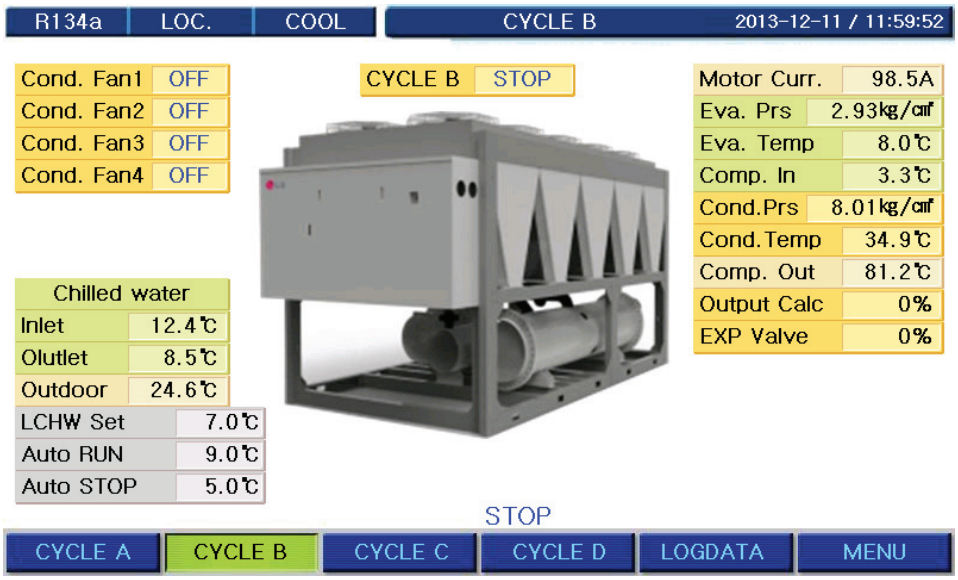

Figure 24. Cycle B screen

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3) Cycle C

- It shows animation screen and related DATA of the entire cycle C.
  - Movement path : CYCLE C

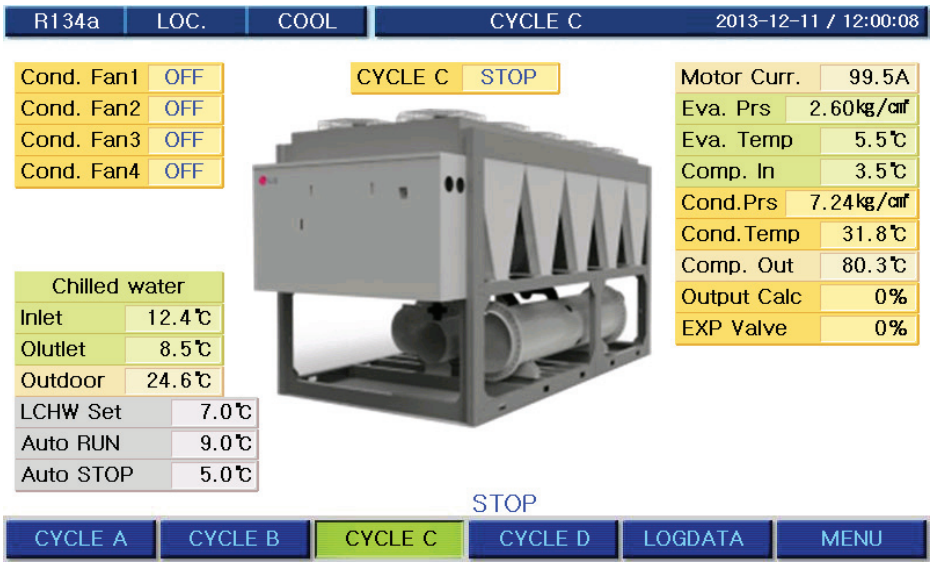


Figure 25. Cycle C screen

4) Cycle D

- It shows animation screen and related DATA of the entire cycle D.
  - Movement path : CYCLE D

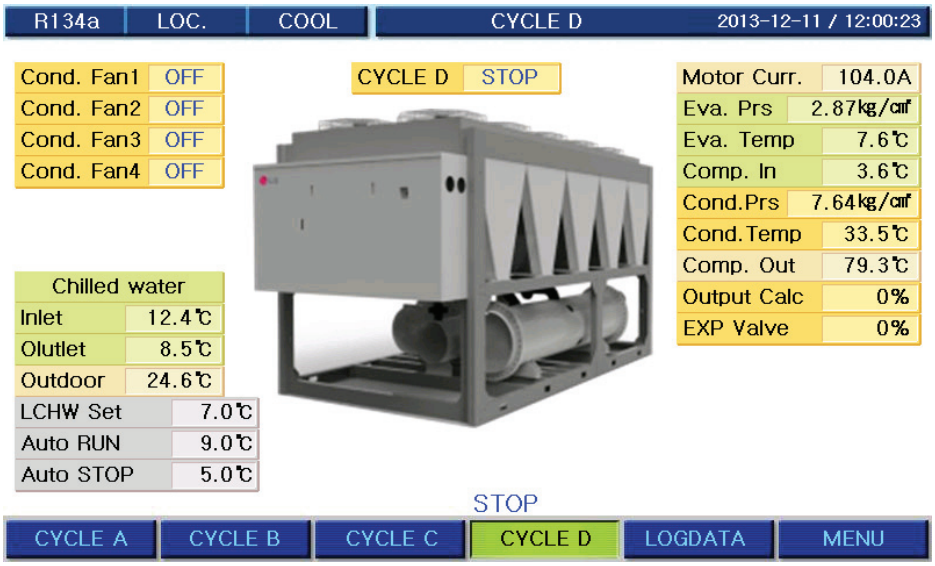


Figure 26. Cycle D screen

5) History

- It shows operation information, operation history, and problem history DATA.
  - Movement path : LOGDATA

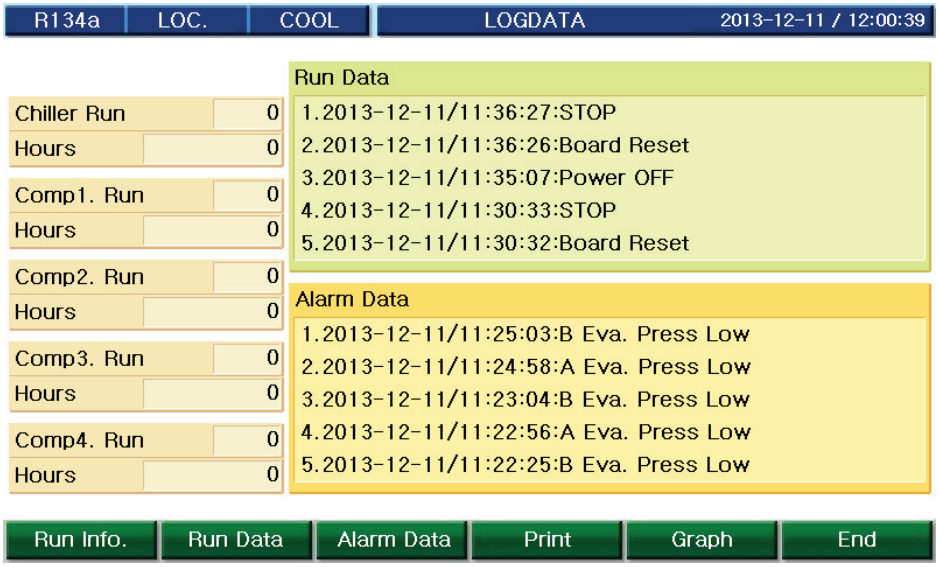


Figure 27. Operation history screen

6) Menu

- It shows the menu screen.
  - Movement path : MENU

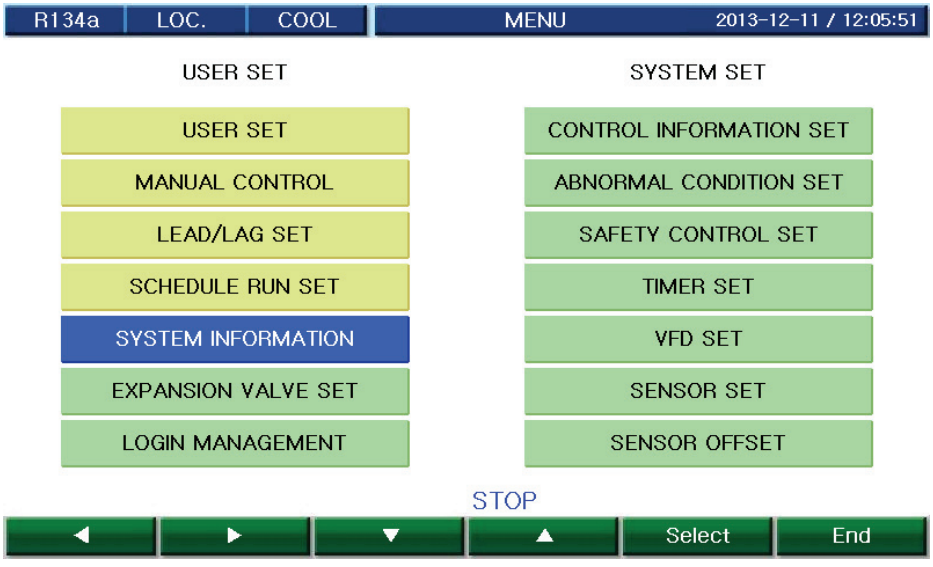


Figure 28. Menu screen

Screen display category list

✔: category that can be displayed

No.	Item	Display boundary	R134a	R22	Remark
1	Condenser Fan1	ON/OFF	✔	✔	
2	Condenser Fan2	ON/OFF	✔	✔	
3	Condenser Fan3	ON/OFF	✔	✔	
4	Condenser Fan4	ON/OFF	✔	✔	
5	Chilled water inlet temp.	-40.0~140.0°C	✔	✔	
6	Chilled water outlet temp.	-40.0~140.0°C	✔	✔	
7	Outdoor air temp.	-40.0~140.0°C	✔	✔	
8	Chilled water outlet setting	3~30.0°C	✔	✔	
9	Automatic operation setting	Calculated value	✔	✔	
10	Automatic stop setting	Calculated value	✔	✔	
11	Motor current	0~1999A	✔	✔	
12	Evaporator pressure	0.00~30.00kg/cm²	✔	✔	
13	Evaporator (refrigerant) temp.	-26.1~57.2°C	✔	✔	
14	Compressor inlet temp	-40.0~140.0°C	✔	✔	
15	Condenser pressure	0.00~30.00kg/cm²	✔	✔	
16	Condenser (refrigerant) temp.	-26.1~57.2°C	✔	✔	
17	Compressor outlet temp	-40.0~140.0°C	✔	✔	
18	Output calculation	Calculated value	✔	✔	
19	Expansion valve	Calculated value	✔	✔	

❋ Note

1. R134a(high pressure): standard, R123(low pressure): option
2. In low pressure, it is displayed as “motor bearing temp.”
3. If current sensor boundary set value is less than 200A, it is displayed with 1 decimal point.
4. For ice removing(for low temperature), -10.0~50.0°C

Table 6. Screen display category

7) Main menu

• Main menu mainly has user setting and system setting as in the following figure.

- User setting, interface operation setting, timer operation setting, and system information can be set by all users.
- Account management, sensor correction, control information setting, abnormality condition setting, safety control setting, timer setting, VGD/VFD setting, and sensor setting can only be set by system manager, and it can only be set by password input.

• Menu screen

- Movement path : MENU

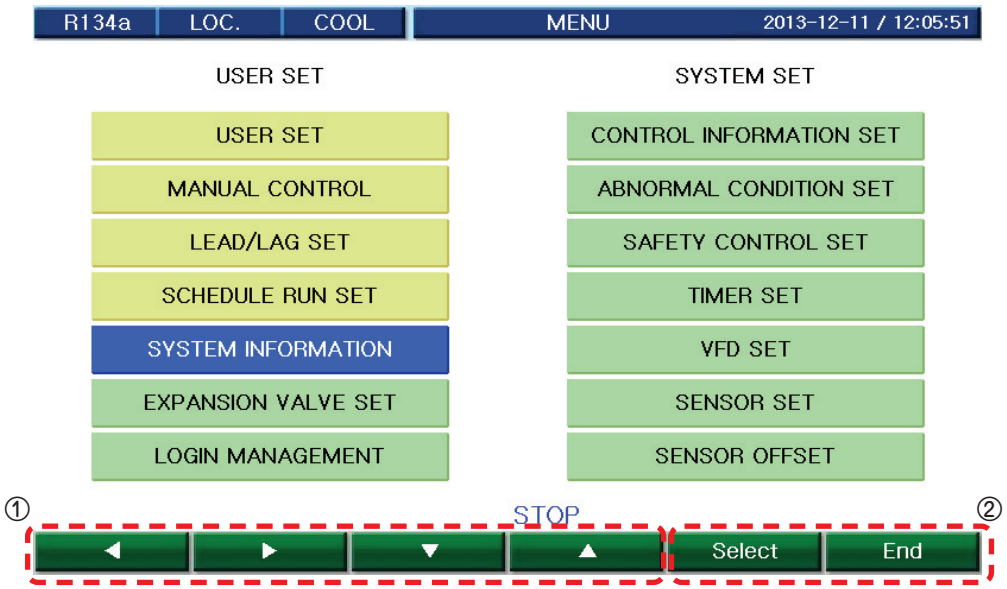


Figure 29. Input status check screen

① Move using button and when you select a menu, it moves to sub menu.

② If you press 'select' key, the screen will convert to the selected menu screen, and when you press 'End' key, it returns to the default screen.

- Main menu categories in detail

Displayed category	Usage
User setting	Menu for user to set values required for chiller operation such as control temp. PID, etc.
Lead/Lag setting	Menu to set categories used in Multi Comp.
Timer operation setting	Menu to set time for chiller to automatically start/stop at the designated time and the temperature for each time period
System information	Menu to check overall system information such as I/O, timer operation, version, current time, operation information saving period, communication address, communication speed, language setting, model selection, etc.
Account management	Menu to change password and management number
Sensor correction	Menu to correct each sensor display value
Control information setting	Menu to set the most basic information in the chiller operation
Safety control setting	Menu to set categories related to safety control to prevent abnormal stops during chiller operation
Abnormality condition setting	Menu to set abnormal stop conditions of the chiller
Timer setting	Menu to set abnormal stop conditions of the chiller
VGD/VFD setting	Menu to set VFD correlation coefficient. This menu is nonuse
Sensor setting	Menu to set 4~20mA sensor setting

Table 7. Main menu categories

User setting

- Operation method setting screen is composed of menu selecting operation method classified as local, timer, and remote, and operation mode selection selecting ice removing and cooling. Provided that, "operation mode selection" menu is displayed only when ice removing mode is used in the system function setting.

  - Movement path : MENU ➡ USER SET ➡ Select

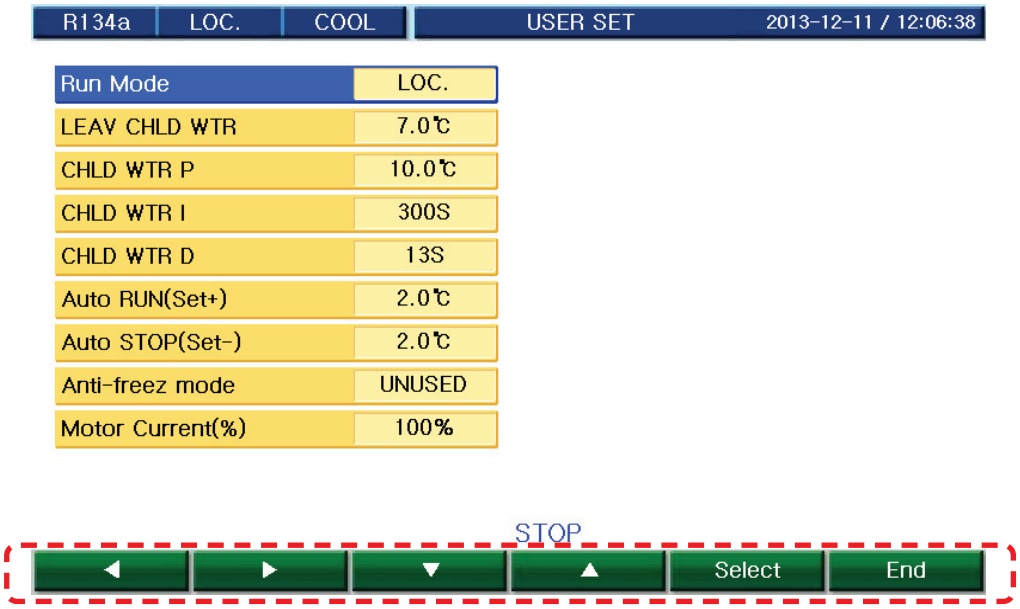


Figure 30. User setting menu

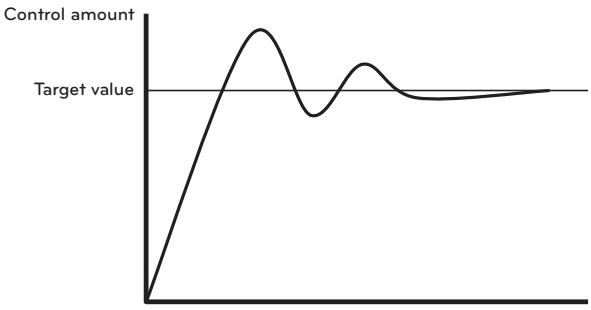
1. In the above user setting menu screen, select "arrow key" to select desired category.
2. During the selection, you can use "increase" and "decrease" button to change the set value. ("password setting" method is the same.)

Item	Setting boundary	Standard Value	Unit	Time to set
Setting of operation mode	Local/Scheduled /Remote	Local		Always
Setting of control mode	Cooling /Ice making	Cooling		Always(*)
Temperature of chilled water outlet	3.0~30.0°C	7	0.1	Always
Temperature of ice making outlet	-20~30.0°C	-5	0.1	Always
Temperature of chilled water P	1~10°C	10	0.1	Always
Temperature of chilled water I	0~3600 sec.	300	1	Always
Temperature of chilled water D	0~360 sec.	13	1	Always
Automatic operation temperature (setting value+)	0.0~10.0°C	2	0.1	Always
Automatic stop temperature (setting value-)	0.0~10.0°C	2	0.1	Always
Function of freezing prevention operation	Used/Unused	Unused		Always
Temperature of anti-freezing operation	0.0~10.0°C	3	0.1	Always
Limit on motor current	1~100%	1	1	Always

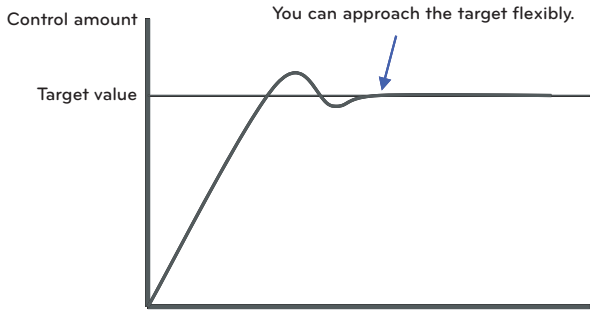
(*) Display and application are allowed only when the chiller is designed for ice making (low temperature).

P.I.D temperature control

Unique P (proportional), I (integral) and D (differential) algorithm is applied to control of chilled water temperature to minimize access time to the target comparing to the conventional method, to minimize residual deviation, and to execute optimal control by minimizing under-shoot and over-shoot during initial startup and conversion between automatic and manual operation.



<Conventional control method>



<New PID control of LG>

(1) Temperature of Chilled water outlet
The menu is used for setting P.I.D control temperature at chilledd water outlet during air-cooling operation.
The temperature is the target setting temperature at PID control operation.
This item is not displayed when operation is set to scheduled operation.

(2) Temperature of Chilled water P value (Proportional)
P value is set in the proportional control zone used for PID controlling of chilled water temperature during air-cooling operation.

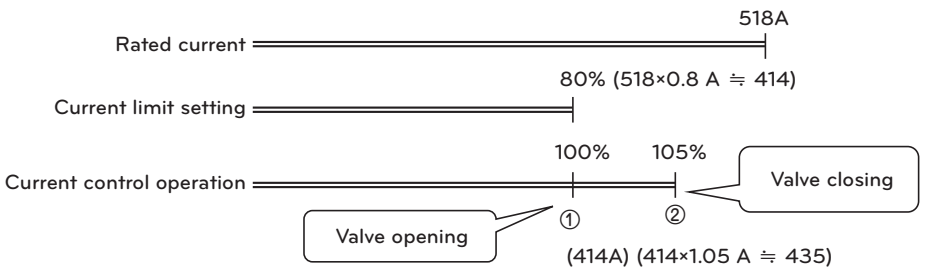
ChilledI value is set in the integrated control zone used for PID controlling of chilled water temperature during air-cooling operation.

(4) Temperature of Chilled water D value (Differential)
Set the D value for a differential control block used in PID control on chilled water in cooling mode.

(5) Temperature of Chilled water outlet – Ice making
The menu is used for setting control temperature at the outlet in the Ice making mode.

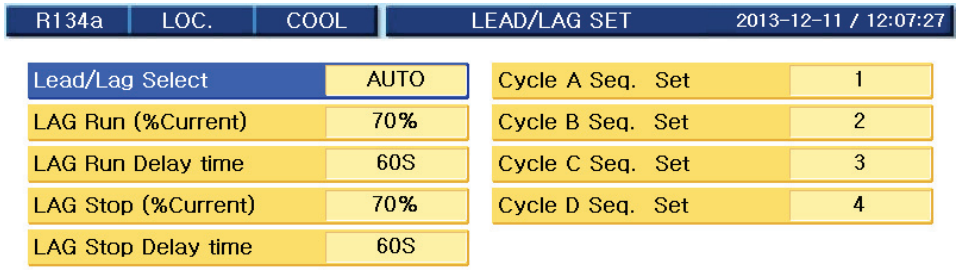
- Current limiting operation -

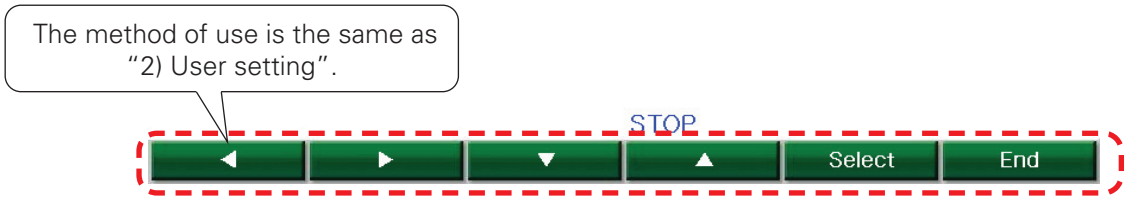
For example, if the rated current is 518A and current limit setting is 80%, the valve opening stops at point ① where the current is 80% of rated current as shown in the following figure and the valve closes at point ② where the current limit setting of 105% is set until the current reaches point ①. When current drops below point ①, normal temperature control is resumed.



Linked operation setting

- Movement path : MENU ➡ LEAD/LAG SET ➡ Select





The screen is used for setting linkage of two compressors.

Dual mode setting items

'Menu/Dual Operation Setting' menu is displayed when the screw chiller is set to operate two compressors.
It is allowed to set the items relevant to interlocked operation as follows on the linkaged operation mode setting screen.

Item	Setting boundary	Standard Value	Unit	Time to set
Setting of LEAD/LAG conversion type	Auto/Manual	Auto		Stop
LAG compressor start-up load(current %)	50~100%	70	1	Always
LAG compressor start-up delay time	30~3600sec.	60	1	Always
LAG compressor stop load(current %)	20~100%	70	1	Always
LAG compressor stop delay time	30~3600sec.	60	1	Always
Cycle A sequence setting	1~4	1	1	Always
Cycle B sequence setting	1~4	2	1	Always
Cycle C sequence setting	1~4	3	1	Always
Cycle D sequence setting	1~4	4	1	Always

1. Setting of LEAD/LAG conversion type
   Set the LEAD/LAG conversion type auto or manual. If setting value is auto, compressor start-up by compressor operating time. And setting value is manual, compressor start-up by "Cycle A,B,C,D sequence setting" value, step-by-step.
2. LAG compressor start-up load(current %)
   'Current control proximity (value of current value comparing against current limit settings in percentage)' is set in percent. If the current control proximity exceeds set percent, the subordinate compressor operates after time set in 'Subordinate compressor operating load.' In such a case, the indicator of the operation key on the subordinate compressor shall be kept turned on. If the stop key indicator of the subordinate compressor is not turned on, LAG compressor does not operate.
3. LAG compressor stop load(current %)
   Percentage of 'Current control proximity' is set. If the current control proximity is below the set percent, the subordinate compressor stops after time set in 'LAG compressor operation delay.' In such a case, the indicator of the operation key on the LAG compressor shall be kept turned on. Pressing the stop key lights the stop key indicator, and operation of the LAG compressor is not allowed.
4. LAG compressor start-up delay time
   When 'Proximity value of current control' reaches operational conditions, time for delaying operation of subordinate compressor is set. The subordinate compressor can be started upon only after operational conditions of the compressor are kept for the setting time.
5. LAG compressor stop delay time
   When 'Proximity value of current control' reaches shutdown conditions, time for delaying shutdown of subordinate compressor is set. The subordinate compressor can be stopped upon only after shutdown conditions of the compressor are kept for the setting time.

Interlinked operation

1. Of the two controllers, one is used set for the superordinate compressor, and the other for the subordinate compressor.
2. Pressing the operation button of the subordinated to light the operation LAMP.
   (The subordinate compressor does not start up at this moment.)
3. Pressing the operation button of the superordinate compressor allows startup of the compressor.
4. The subordinate compressor starts up when the current limiting proximity of the superordinate compressor exceeding percentage set in 'LAG compressor startup point' is kept during time set in 'LAG compressor startup delay time.'
5. The subordinate compressor is stop when the current limiting proximity of the superordinate compressor below percentage set in 'LAG compressor shutdown point' is kept during time set in 'LAG compressor startup delay time.'
6. Execute scheduled operation after setting 'Select interlocked conversion mode' to automatic when starting up or shutting down the chiller in scheduled operation.

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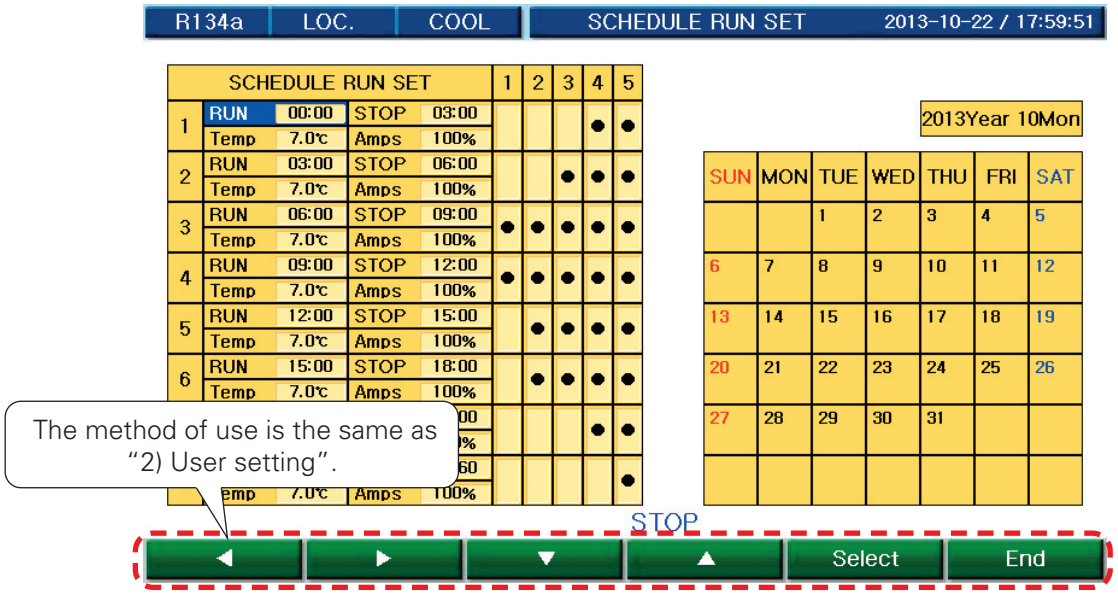
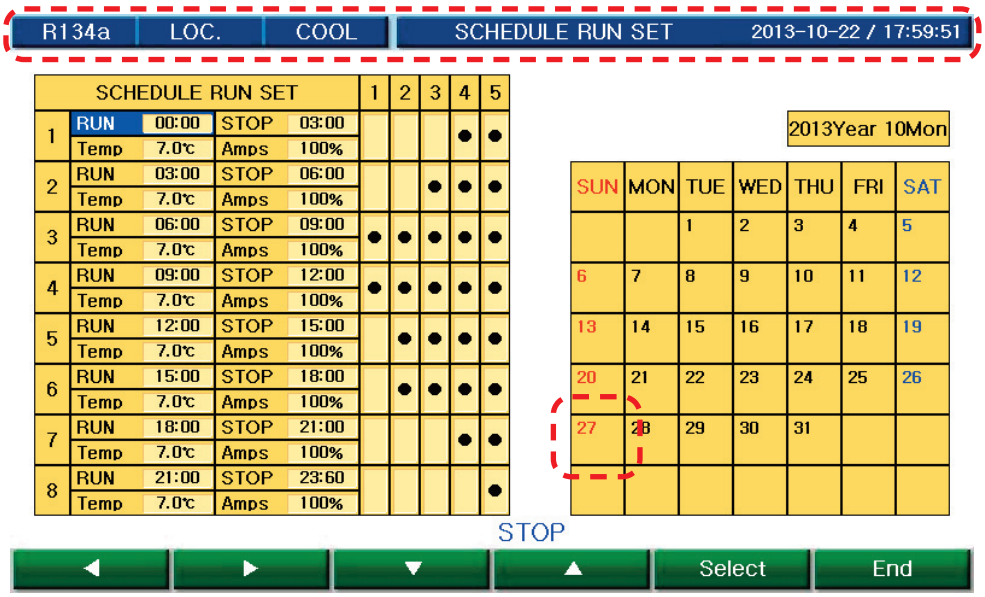
Reserved operation setting

- Movement path : MENU ➡ SCHEDULE RUN SET ➡ Select





『For setting methods, refer to "E.g.)".』

Example)

① You can set the Schedule in 8 patterns. (start/stop time, temperature and current value setting)

② Each pattern is classified into 5 categories.

③ Select one of the "5 categories" by choosing the date of scheduled operation in the calendar.

▶ Description of example of scheduled operation

① Aug 1, 2009: Run at 06/Stop at 09, Run at 09/Stop at 12

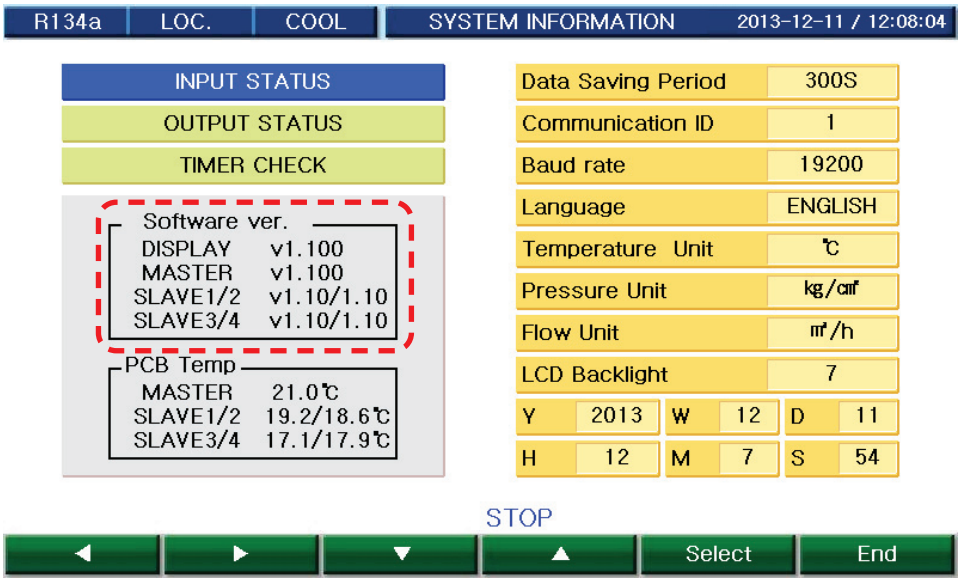
② Aug 9, 2009: Run at 06/Stop at 09, Run at 09/Stop at 12
Run at 12:00/ Stop at 15:00, Run at 15:00/Stop at 18:00

• It is allowed to set operation time, stop time, applicable weekdays and control temperature at each step.

Make sure that the current date and time have been correctly set on the user's settings.

System info

- Movement path : MENU ➡ SYSTEM INFORMATION ➡ Select



The screen displays the versions of the programs applied to the MICOM (master, slave and display). 'Program version number' is indicated for follow-up management, and will be useful for troubleshooting of the microprocessor.

Year, month, day, day of week, hour, minute and second

Here, you can set the date and hour. The data and the hours are the references for information storage time, abnormal conditions/cautions time, and scheduled operation time. The time is the reference value for operation of the microprocessor, and it is required to check the time for any deviation from the current time.

Storage cycle of operation information

Storage cycle of operation information is set on this screen. Operation information is measured values by the sensors displayed on the basic careen, and stored every cycle stipulated in the operation information storage cycle time during operation of the chiller. Information of abnormal conditions is, however, stored in the memory of the microprocessor whenever they take place independent from the storage cycle.

Adjusting screen brightness

The menu is used for adjusting brightness of LCD. Pressing 'Increment' key increases figure to make LCD brighter, and pressing 'Decrement' key reduces figure to make LCD darker.

Pressing 'End' key terminates adjustment of LCD brightness.

Signal speed setting

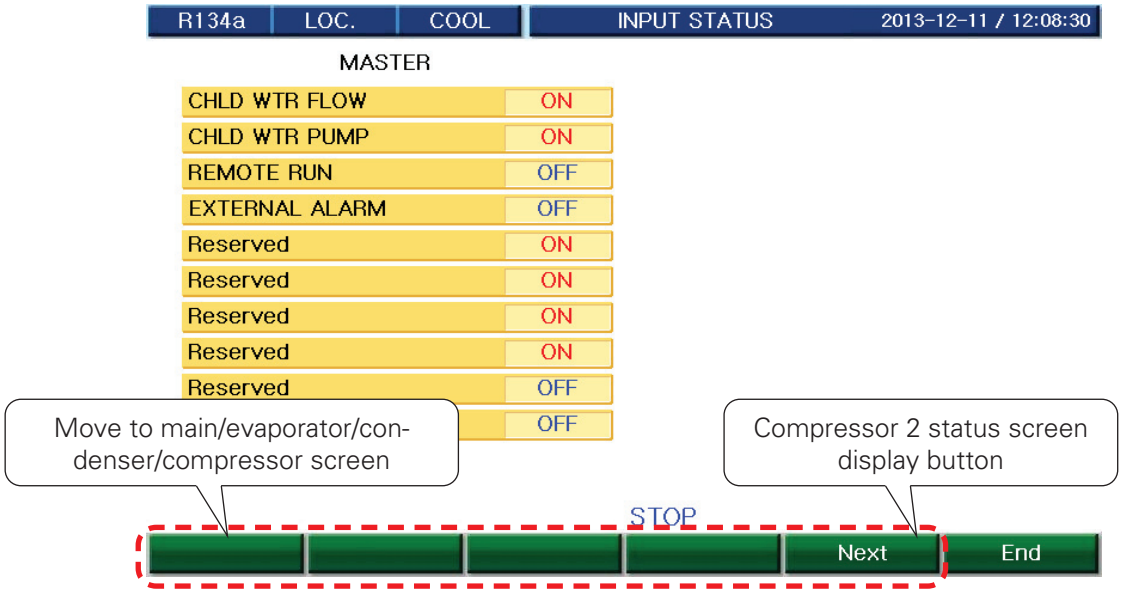
Signal speed is set to one of 9,600, 19,200 and 38,400 bps.

• Checking input conditions

This menu shows the ON (Closed circuit) and OFF (Open circuit) status of the digital input port. This menu is used for checking conditions of the input signal contact connected to the control panel of the chiller. It is required to refer to the control circuit diagram when checking the digital input to prevent other signals from being entered in the input terminal of the MIICOM. If other communication lines are mixed, it can damage the board of MICOM.

ENGLISH

- Movement path : MENU ➡ SYSTEM INFORMATION ➡ INPUT STATUS ➡ Select



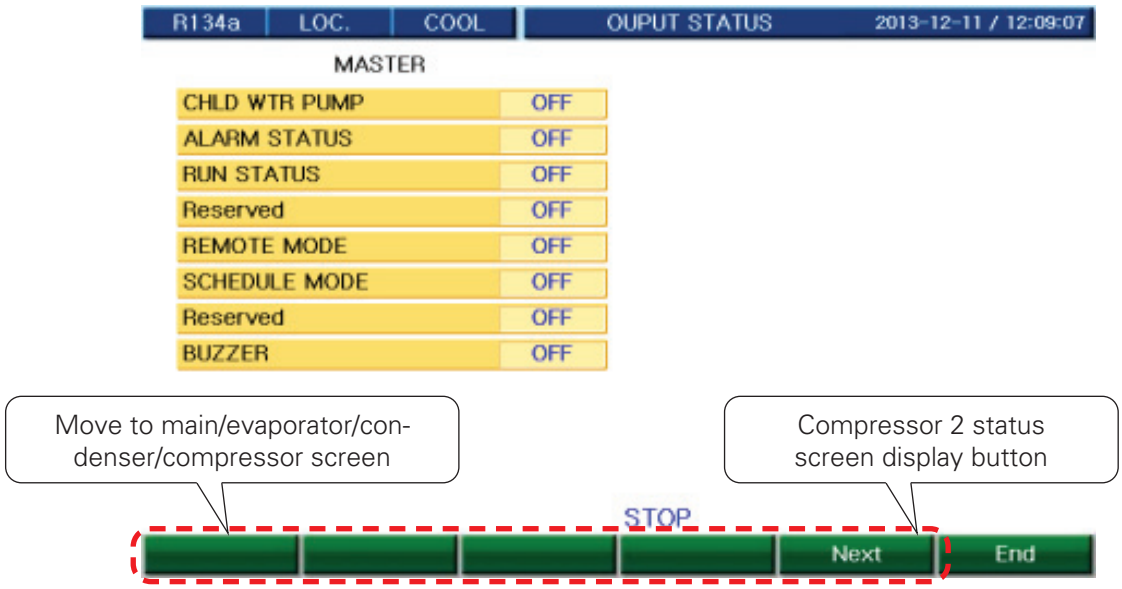
<Items of digital inputs>

Displayed Items	Display	Contact condition	Remark
Chilled water flow interlock	ON/OFF	Close : Flow normal	
Chilled water pump interlock	ON/OFF	Close : Pump in operation	
Remote operation signal	ON/OFF	Close : During remote operation	
External abnoraml condition signal	ON/OFF	Close : Upon external abnormal condition	
Condenser fan1 status	ON/OFF	Close : Condenser fan1 is normal	SLAVE1~4
Condenser fan2 status	ON/OFF	Close : Condenser fan2 is normal	SLAVE1~4
Condenser fan3 status	ON/OFF	Close : Condenser fan3 is normal	SLAVE1~4
Condenser fan4 status	ON/OFF	Close : Condenser fan4 is normal	SLAVE1~4
Compressor operation check	ON/OFF	Close : Compressor in operation	SLAVE1~4
Pressure switch status	ON/OFF	Close : Pressure is normal	SLAVE1~4
Oil status	ON/OFF	Close : Oil level is normal	SLAVE1~4
Motor status	ON/OFF	Close : Compressor is normal	SLAVE1~4
Power supply status	ON/OFF	Close : Power is normal	SLAVE1~4
Expansion valve status	ON/OFF	Close : Expansion valve is abnormal	SLAVE1~4

Checking output conditions

The output conditions are displayed as ON (Closed circuit)/OFF (Open circuit) of the analog output. This menu is used for displaying output conditions resulted from internal operation of the MICOM, and is configure in such a way that the output results from operation of the MICOM can be verified. If actual output conditions are deviated from those on the menu, it is required to check the conditions of the board and the wiring of the MICOM.

- Movement path : MENU ➡ SYSTEM INFORMATION ➡ OUTPUT STATUS ➡ Select



<Items of output items>

Displayed items	Display	Contact condition	Remark
Chilled water pump operation	ON/OFF	Closed in defrosting mode	For customer:
Abnormal conditions	ON/OFF	Closed upon abnormal condition	For customer:
S operation	ON/OFF	Closed during operation of compressor	
1M operation	ON/OFF	Closed during operation of compressor	
2M operation	ON/OFF	Closed during operation of compressor	
Economizer valve	ON/OFF	Closed upon valve operation	Optional
Fluid valve	ON/OFF	Closed upon valve operation	Optional
Buzzer	ON/OFF	Closed upon abnormal condition	
Expansion valve AO	0~100 %		Optional
Compressor valve 25%	0~100 %	Closed upon capacity controlling	
Compressor valve 50%	0~60Hz	Closed upon capacity controlling	
Compressor valve 75%	ON/OFF	Closed upon capacity controlling	
Cooling tower fan	ON/OFF	Closed during operation of cooling fan	
Cooling water pump	ON/OFF	Closed during operation of pump	

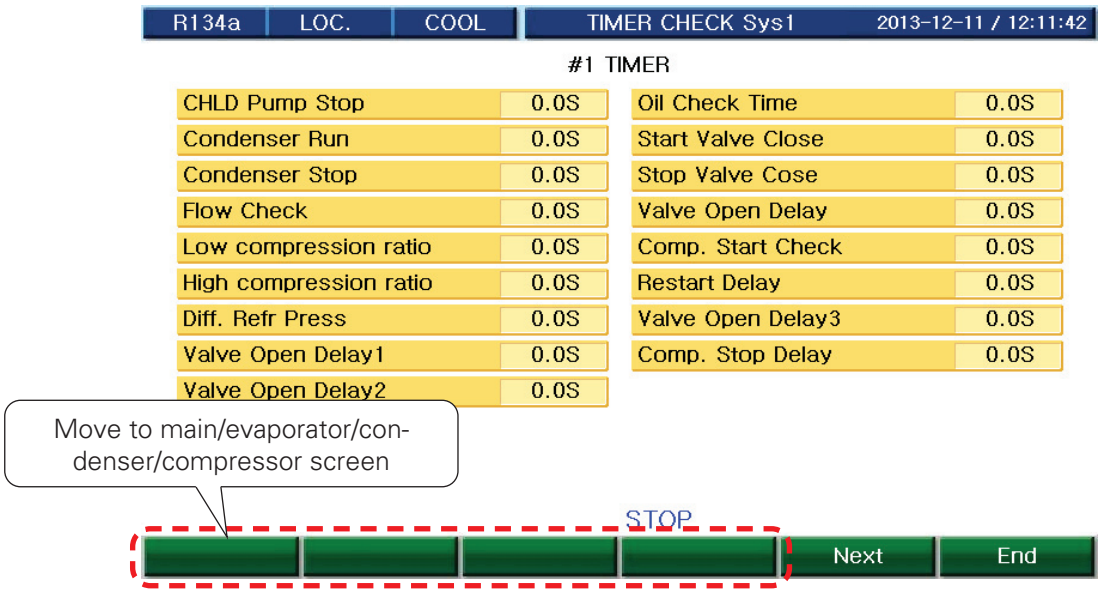
Displayed items	Display	Contact condition	Remark
Cooling water pump	ON/OFF	Closed during operation of pump	
Ice making mode selection	ON/OFF	Closed in defrosting mode	
Refrigerant shutoff control valve	ON/OFF	Closed upon valve operation	
Operating condition	ON/OFF	Closed during operation input	For customer:
S operation 2	ON/OFF	Closed during operation of compressor	
1M operation 2	ON/OFF	Closed during operation of compressor	
2M operation 2	ON/OFF	Closed during operation of compressor	
Refrigerant shutoff valve 2	ON/OFF	Closed upon valve operation	
Fluid valve 2	ON/OFF	Closed upon valve operation	Optional
Expansion valve AO	0~100 %	Closed upon applying expansion valve	Optional
Compressor 2 valve 25%	ON/OFF	Closed upon capacity controlling	
Compressor 2 valve 50%	ON/OFF	Closed upon capacity controlling	
Compressor 2 valve 75%	ON/OFF	Closed upon capacity controlling	
Economizer valve 2	ON/OFF	Closed upon valve operation	Optional

☞ ON : Relay Close, OFF : Relay Open

• Check timer conditions

This indicates the working status of all kinds of timers under arithmetic operation in MICOM.
The menu allows easier checking of operation status. You cannot set the values in this menu.

- Movement path : MENU ➡ SYSTEM INFORMATION ➡ TIMER CHECK ➡ Select



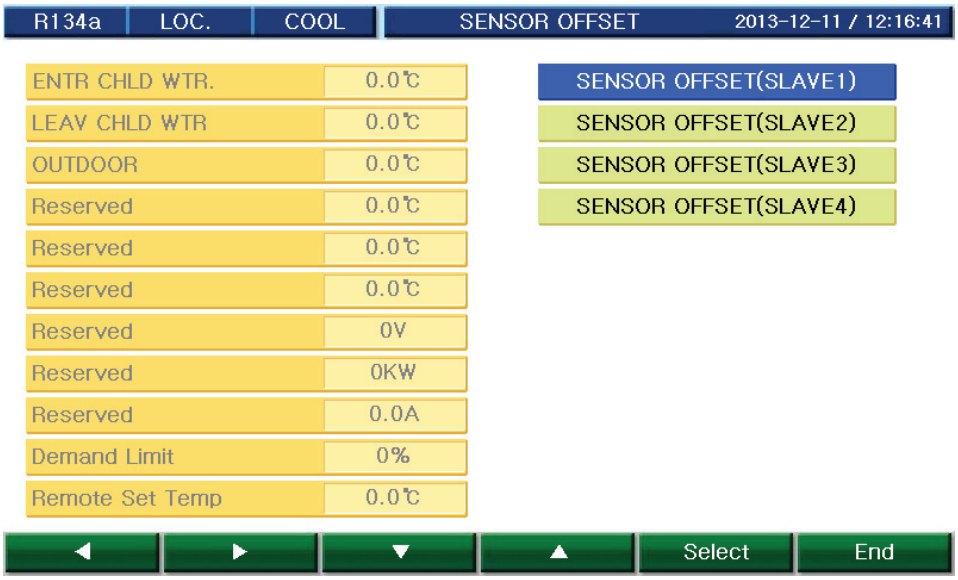
<Timer items displayed>

Displayed Items	Display range	Initial value(Sec.)
Chilled water pump stop delay timer	1~1800	300
Condenser operation timer	1~60	5
Condenser stop timer	1~180	60
Flow rate vibration ignore timer	1~60	2
Refrigerant pressure ratio minimum timer	1~600	60
Refrigerant pressure ratio maximum timer	1~600	60
Refrigerant differential pressure timer	1~600	60
Operation valve opening delay1 timer	1~1800	60
Operation valve opening delay2 timer	1~1800	60
Oil pressure check timer	1~1800	60
During start-up valve closing timer	1~60	50
During stop valve closing timer	1~600	30
Valve opening delay timer	1~600	30
Compressor start-up check timer	5~60	10
Re-start-up prevention timer	5~1800	300
Operation valve opening delay3 timer	1~600	60
Compressor stop delay timer	1~600	60

Sensor offset

The output conditions are displayed as ON (Closed circuit)/OFF (Open circuit) of the analog output. This menu is used You can calibrate the values of each sensor. The calibration range is -5°C~5°C for temperature, -2kg/cm^2~2kg/cm^2 for pressure, -50m^3/h~50m^3/h, for flux and 200~200A/V/KW for current, voltage or power.

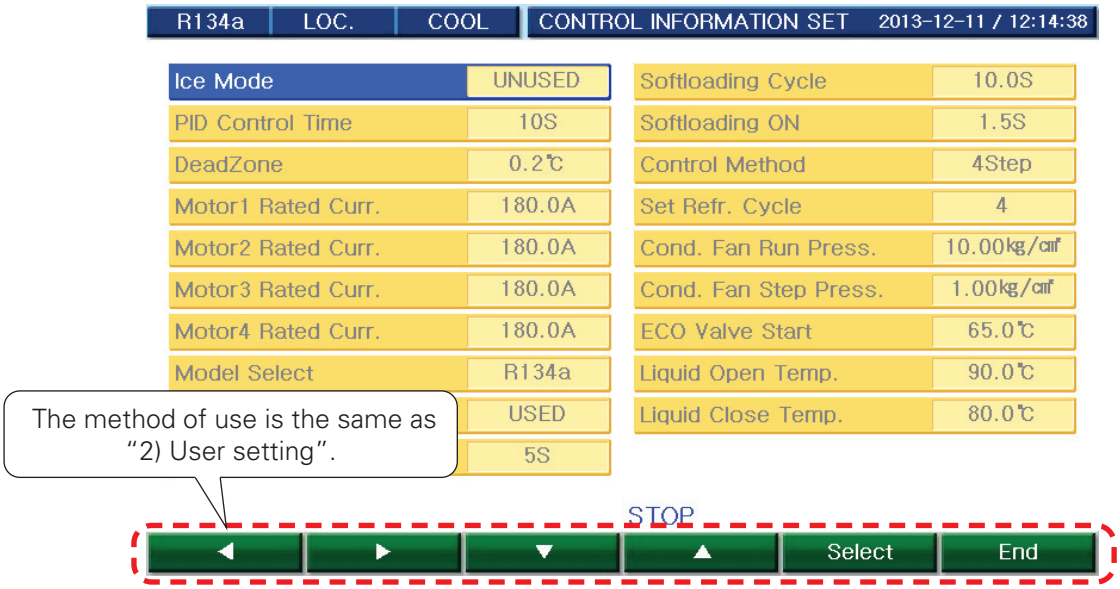
- Movement path : MENU ➡ SENSOR OFFSET ➡ Select



Control information setting

This is the setting related to the basic control values of the chiller. If you move to an item in the menu bar and press "Select" key, then, the key menu will alternate between Previous, Next, Down and Up, with the cursor blinking on the setting value. You can set the values by selecting the cipher with Previous or Next key, changing the value with Up or Down key and pressing "OK."

- Movement path : MENU ➡ CONTROL INFORMATION SET ➡ Select



No.	Item	Setting range	Initial value	Remark
1	Ice storage mode	ON/OFF	OFF	
2	PID control calculation period	1~50	10	
3	Control temp. dead zone	0~5	2	
4	Motor rated current1	40~300	180	
5	Motor rated current2	40~300	180	
6	Motor rated current3	40~300	180	
7	Motor rated current4	40~300	180	
8	Model selection	R134a/R22	R134a	
9	Operation time limit	USED/UNUSED	USED	
10	Condenser fan calculation period	1~60	5	
11	Softloading output period	1~60	10	
12	Softloading valve output	5~10	1.5	
13	Control valve selection	4Step/Stepless1/Stepless2	4Step	
14	Compressor quantity selection	1/2/3/4	3	
15	Condenser fan operation pressure	5~30	10	
16	Condenser fan step pressure	1~10	1	
17	Economizer valve opening temp.	30~99	65	
18	Liquid valve opening temp.	50~130	90	
19	Liquid valve closing temp.	50~130	80	

⚠ CAUTION

When changing the setting value, check the specification with the manufacturer before making the changes.
Because there are issues of system damage due to the changes in the setting value, make sure to consult the manufacturer for the setting.

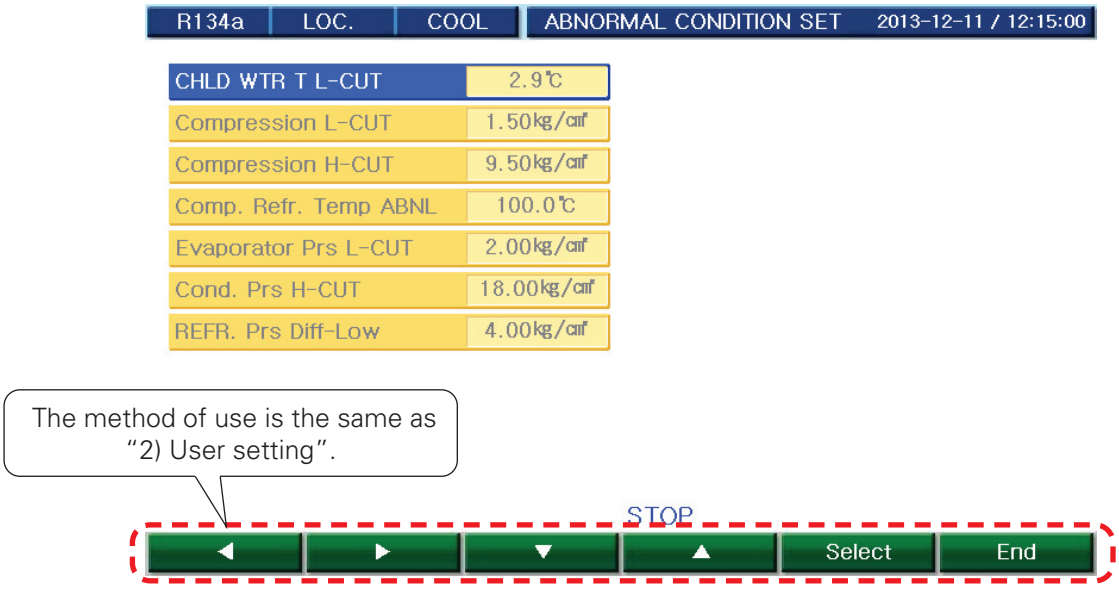
1. PID control calculation period
   Output value is calculated once at the set time based on the cold water outlet temperature and old water outlet temperature deviation.
2. Control temperature dead zone
   If the cold water outlet temperature is within cold water outlet temperature value ± "Cold water control temperature undetected zone", the controller does not control the cold water outlet temperature and stops the operation.
3. Motor rated current
   Set the rated current of the screw compressor motor.
4. Motor rated voltage
   Set the rated voltage of the compressor motor. There is no control function and it is used for display. Separate voltage sensor must be installed.
5. Model selection
   Set the machine type. This controller is set to automatically change the control method based on the machine type setting.
   For setting the machine type, please make changes after consulting with the corporate experts.
   Arbitrary change can damage the machine.
6. Softloading output period

7. Softloading valve output
   This is used when control valve selection set to “Stepless”
   Flexible start output cycle refers to the start interval of the softloading valve output is set by the maximum time of ON(Close) output of the valve within the softloading output period.
8. Control valve selection
   Select the output method of the capacity control valve of the compressor. The capacity control type is set when installing the compressor. Therefore check and set the pressure model.
9. Motor rated current2,3,4
   Select the rated current of compressor 2,3,4.
10. Communication mode selection
    2 types of communication method can be set for the controller to communicate externally.Check and set up the connected system.
11. Economizer valve opening temperature
    This is used when economizer is installed on the screw chiller.
    Reference temperature of the setting is the compressor discharge temperature value. Check if the economizer is installed.
12. Liquid valve opening temperature
13. Liquid valve closing temperature
    Liquid valve is operated to protect the compressor when the discharge temperature of the compressor suddenly surges. Reference temperature value is the compressor discharge temperature and separate valve must be installed for use.

Abnormal condition setting

Here, you can set the values of abnormal stop of the chiller. If you move to an item in the menu bar and press "Select" key, then, the key menu will alternate between Previous, Next, Down and Up, with the cursor blinking on the setting value. You can set the values by selecting the cipher with Previous or Next key, changing the value with Up or Down key and pressing "OK."

- Movement path : MENU ➡ ABNORMAL CONDITION SET ➡ Select

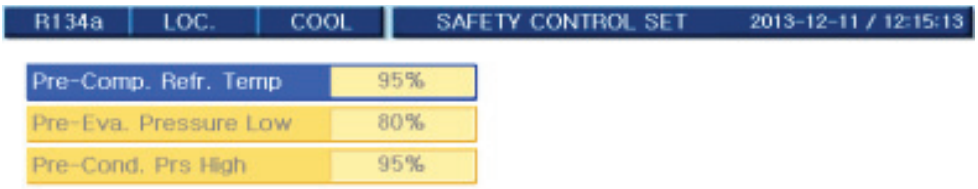


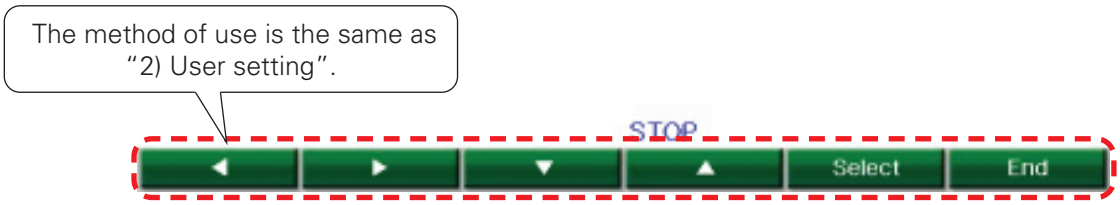
1. limit of chilled water temperature
   This is the menu to set the lower limit of outlet temperature so that the cold water does not freeze. When the cold water outlet temperature is lower than the 'Cold water outlet temperature lower limit', the chiller will stop in error.
2. Compressor discharge temperature high
   This is the menu to set the compressor discharge temperature upper limit. Evaporator during chiller operation
3. Refrigerant pressure ratio
   This is the menu to set the refrigerant pressure ratio lower and higher limit. If the condenser pressure/evaporator pressure value is lower or higher than the setting value during the chiller operation, the chiller stops in error.
4. Evaporator pressure low
   This is the menu to set the evaporator pressure lower limit. If the evaporator pressure is lower than the setting value during the chiller operation, the chiller stops in error.
5. Condenser pressure high
   This is the menu to set the condenser pressure upper limit. If the condenser pressure is lower than the setting value during the chiller operation, the chiller stops in error.
6. Refrigerant differential pressure low
   This is the menu to set the minimum differential pressure of evaporator/condenser. If the refrigerant differential pressure is lower than the setting value, the chiller stops.

Safety control setting

Here, you can set the values of safety control of chiller. If you move to an item in the menu bar and press "Select" key, then, the key menu will alternate between Previous, Next, Down and Up, with the cursor blinking on the setting value. You can set the values by selecting the cipher with Previous or Next key, changing the value with Up or Down key and pressing "OK."

- Movement path : MENU ➡ SAFETY CONTROL SET ➡ Select





No	Setting items	Setting range	Default value	Remark
1	Prevention of compressor discharge temperature high	50~100	95	
2	Prevention of evaporator pressure low	50~100	80	
3	Prevention of condenser pressure high	50~100	95	

1. Prevention of compressor discharge temperature high
   If the compressor discharge reaches 95% of “Temperature reaching compressor discharge temperature high” during the operation, the capacity control valve controls in the direction of closing to run the control to prevent the chiller from stopping from an error.
   Though the setting value can be changed based on the operating condition of the installation site of the chiller, please consult with an expert and set up accordingly because the incorrect setting can impact the temperature control of the chiller.
2. Prevention of evaporator pressure low
   This is the item to set the preventive control with evaporator pressure lower limit. If the evaporator pressure is below the setting value during chiller operation, capacity control valve is controlled in the direction of closing. The standard value of the setting is the “evaporator pressure low” and you can refer to the error setting menu.
3. Prevention of condenser pressure high
   This is the item to set the preventive control with condenser pressure upper limit. If the condenser pressure is above the setting value during chiller operation, capacity control valve is controlled in the direction of closing. The standard value of the setting is the “condenser pressure high” and you can refer to the error setting menu.

Timer setting

Here, you can set the values of timer required for operating the chiller.

Moving the menu selection bar to an item to set, and pressing Select key change the key menu to Previous, Next, Increment and Decrement to show a blinking cursor on the setting. You can set the values by selecting the cipher with Previous or Next key, changing the value with Up or Down key and pressing "OK".

- Movement path : MENU ➡ TIMER SET ➡ Select

Displayed Items	Setting range	Default value(Sec.)
Chilled water pump stop delay timer	1~1800	300
Condenser operation timer	1~60	50
Condenser stop timer	1~180	60
Flow rate vibration ignore timer	1~60	20
Refrigerant pressure ratio minimum timer	1~600	60
Refrigerant pressure ratio maximum timer	1~600	60
Refrigerant differential pressure check timer	1~600	60
Operation valve opening delay1 timer	1~1800	60
Operation valve opening delay2 timer	1~1800	60
Oil pressure check timer	1~1800	60
During start-up valve opening timer	1~60	50
During stop valve closing timer	1~600	30
Valve opening delay timer	1~600	60
Compressor start-up check timer	5~60	10
Re-start-up prevention timer	5~1800	300
Operation valve opening delay3 timer	1~600	60
Compressor stop delay timer	1~600	60

1. Chilld water pump stop delay timer
   Operation time of the cold water pump is set after the compressor stops. The standard of timer operation is the compressor stop signal and you can be set up to 30 minutes.
2. Condenser operation timer
   Operation signal output time of the cooling water pump is set after the operation of cold water pump.
   Check the condition including electric equipment of installation site to change the setting value. (only water cooled)
3. Condenser stop timer
   Operation time of cooling water pump is set after the compressor stops. Timer operation
   Reference is the compressor stop signal and can be set up to 3 minutes. (only water cooled)
4. Flow vibration ignore time
   It is set to ignore the error signal from flux vibration during the cold/cooling water pump operation. Because there is risk of pipes freezing due to incorrect time setting, please be careful.
5. Operation valve opening delay 1,2,3 timer
   Set the open delay time by each step when operating the screw compressor.
   This is used for selecting the control valve of “control information setting” as step.
6. Oil pressure check timer
   This delays the operation of oil condition switch. If the time set to open the oil switch during the operation elapse, oil error is displayed and the system stops.

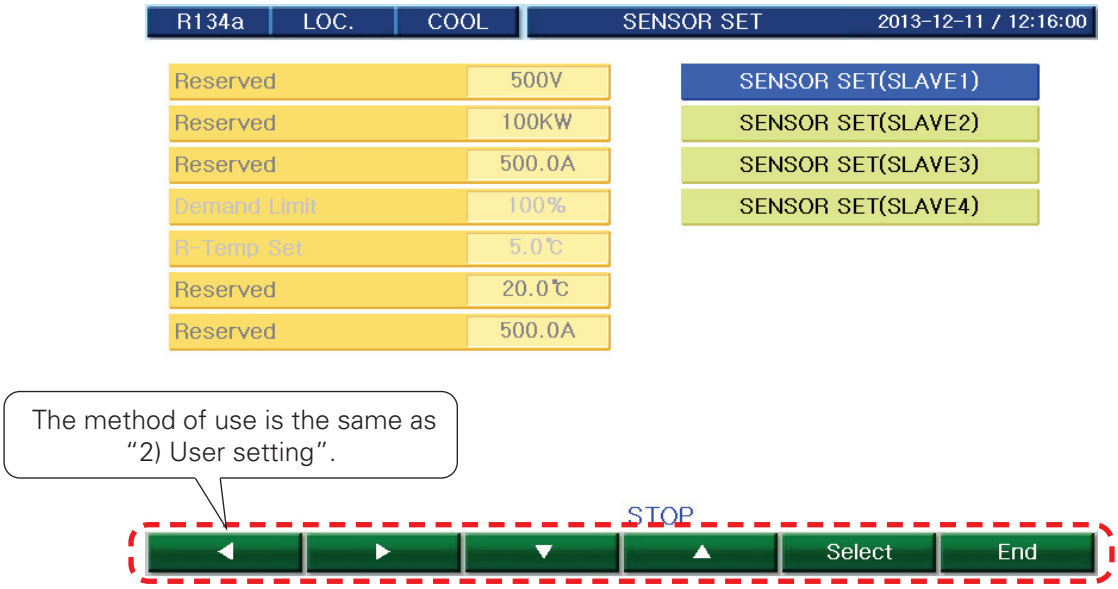
8. Valve close timer when starting
   Set the closed maintenance time of the valve before the compressor operation.
9. Valve close timer when stopping
   Set the close time of 25% valve when compressor is stopping.
10. Valve open delay timer
    Set the time to maintain to 25% valve closed condition after the compressor starts.
11. Compressor start check timer
    This is maximum input time of 2M (Delta) signal after the compressor power signal output.
    If there is no input of 2M (Delta) signal even after the set time, “Operation failure” error displayed.
12. Re-start prevention timer
    Set the start interval of the compressor. Compressor is will not operate again if this time is not elapsed after the compressor stops.

Sensor setting

This menu, which is for accurate setting of each pressure and current sensor is valid only to selected sensors.

You can complete the setting by manually changing the AD values of capacity control valve and diffuser valve to Min/Max and, then changing "Reserved" to ON to select the applicable setting (Min setting, Max setting).

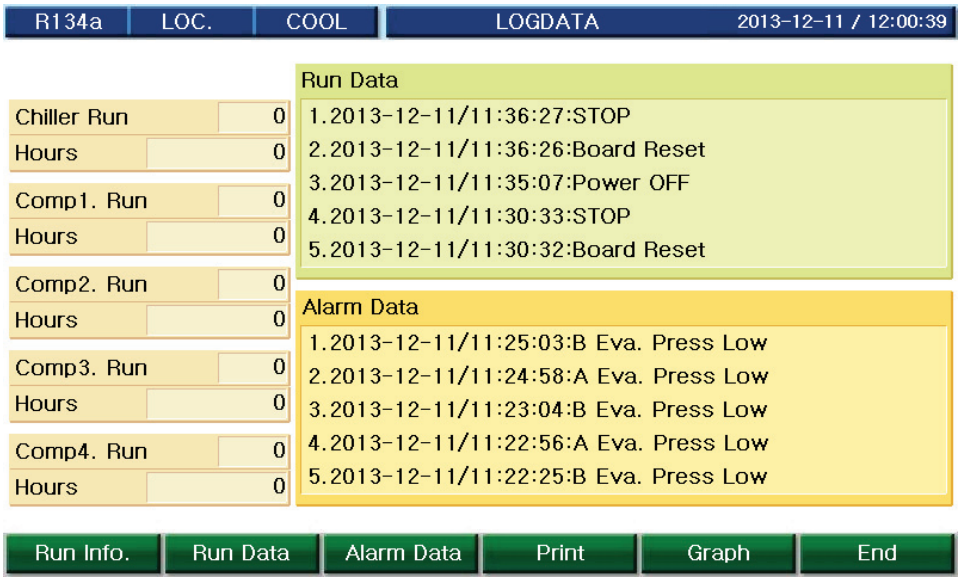
- Movement path : MENU ➡ SENSOR SET ➡ Select



History

A menu for checking the operation data, temp control graphs, start/stop information, saved in MICOM of chiller. The menu allows viewing the total cumulative operation count (including start/stop) of the chiller or main peripheral devices and total cumulative operation hours.

- Movement path : LOGDATA ➡ Run Info.



『It shows the history data.』

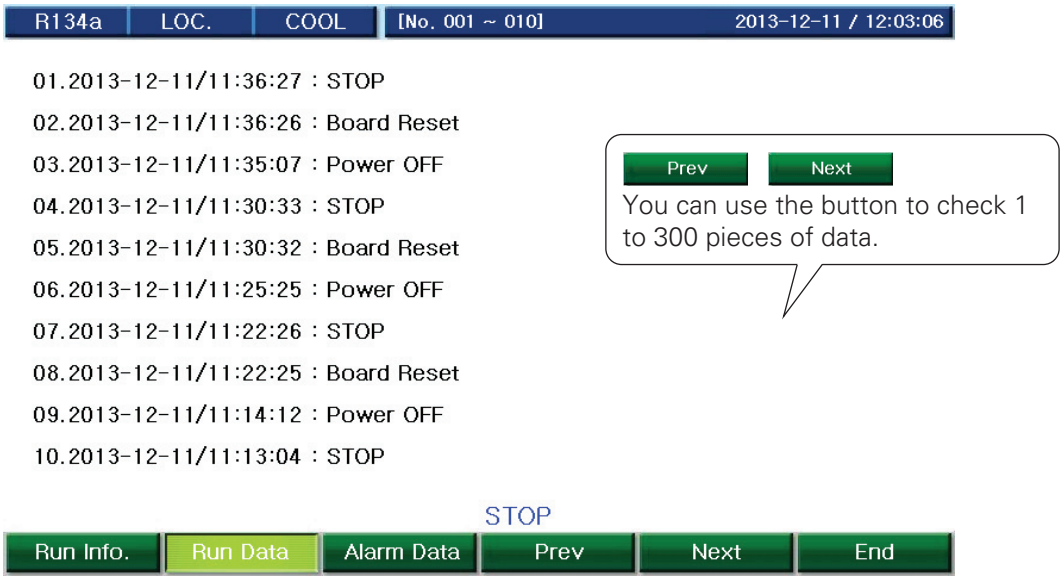
Operation information

- Movement path : LOGDATA ➡ Run Data

『It shows the operation data.』

Operation history

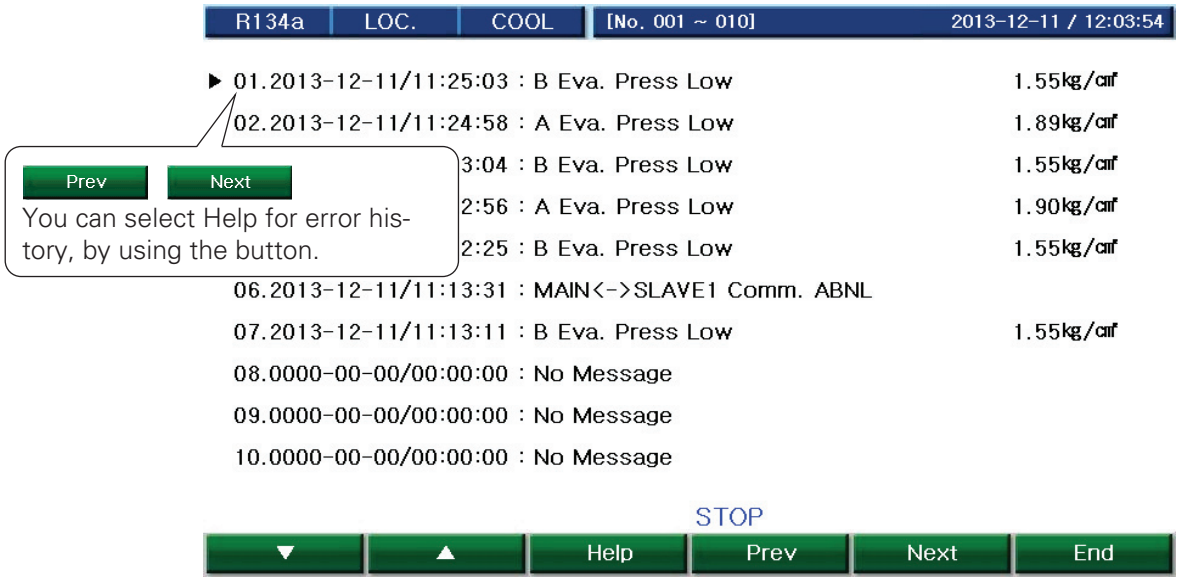
- Movement path : LOGDATA ➡ Run Data



『It shows the operation history.』

Error history

- Movement path : LOGDATA ➡ Alarm Data



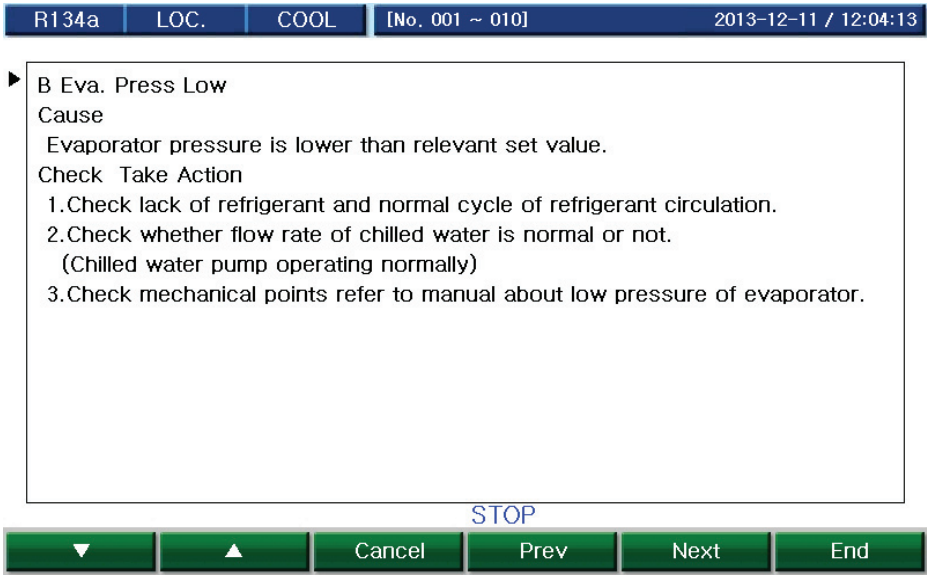
『It shows the error history data.』

Help feature

This menu displays tips for Error/alarming messages. If you press Help key in the Error/Caution display, a Help screen for the pertinent message will appear.

Pressing the Previous key will retrieve tips for the previous message number and Next key, tips for the next message number.

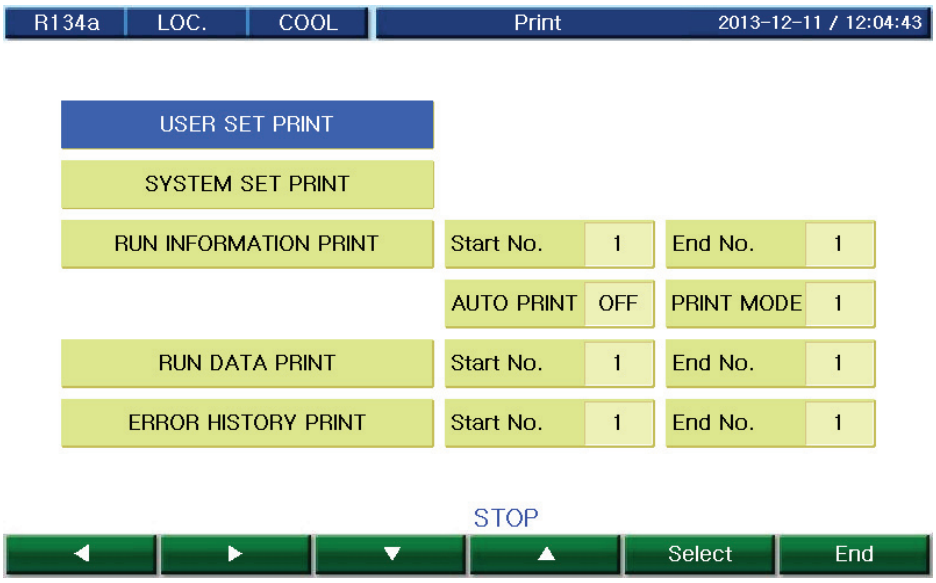
- Movement path : LOGDATA ➡ Alarm Data ➡ Help



『It shows the tips for error history data selected.』

Printing feature

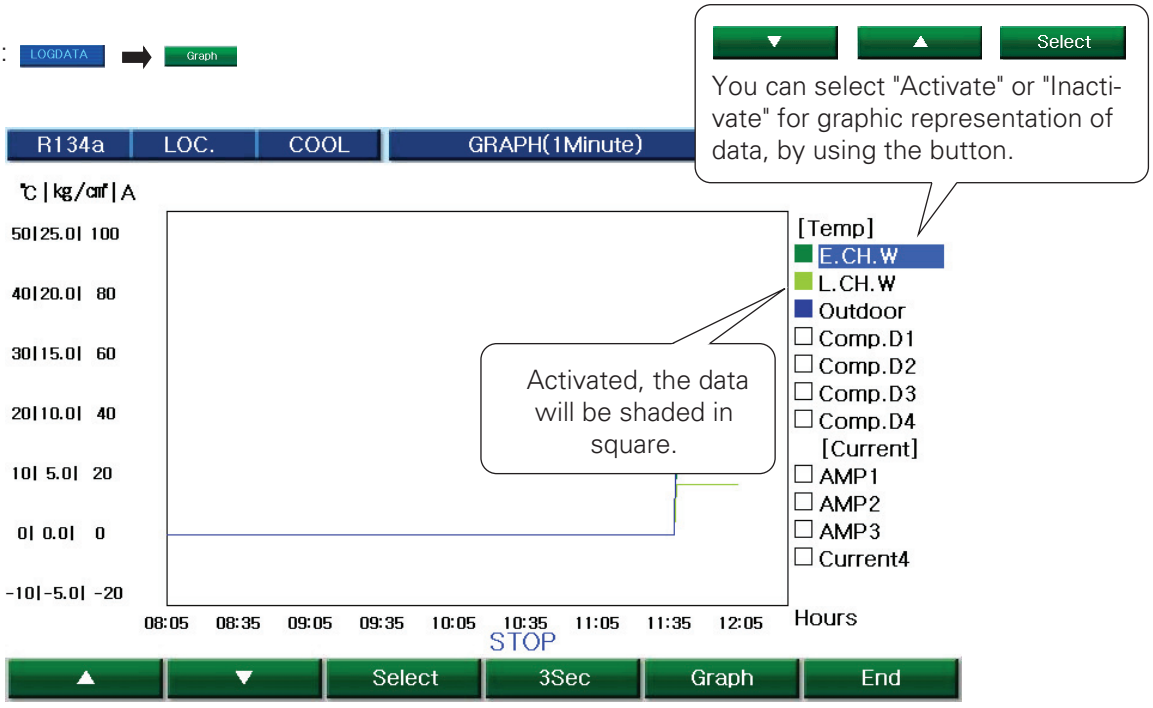
- Movement path : LOGDATA ➡ Print



① User-set printing: Print the user setting values through the menu.
② System-set printing: Print the system setting values currently configured.
③ Operation info printing: Print 1 to 300 pieces of operation info.
- Auto-print: Print the operation info seamlessly, at a certain interval of time.
Print mode: “1” - Displays all data; “2” - Displays only the unit of print (for test-runner)
④ Operation history printing: Print 1 to 300 pieces of operation history.
⑤ Error history printing: Print 1 to 300 pieces of error history.

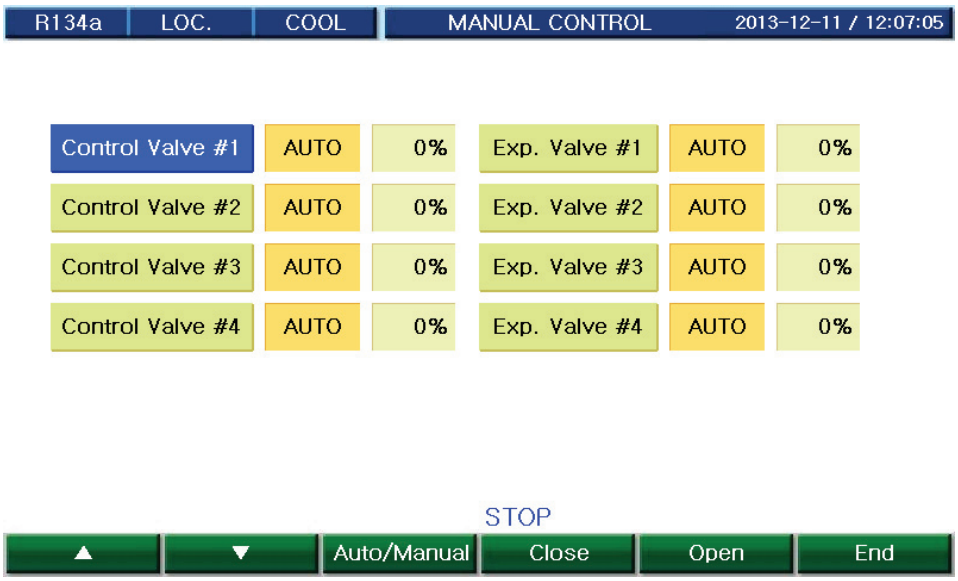
Graphs

- Movement path : LOGDATA ➡ Graph



『It shows the graphics for the data selected.』

Manual operation display



Control Valve

Operate the control valve (Capacity control valve) to manual from the menu.

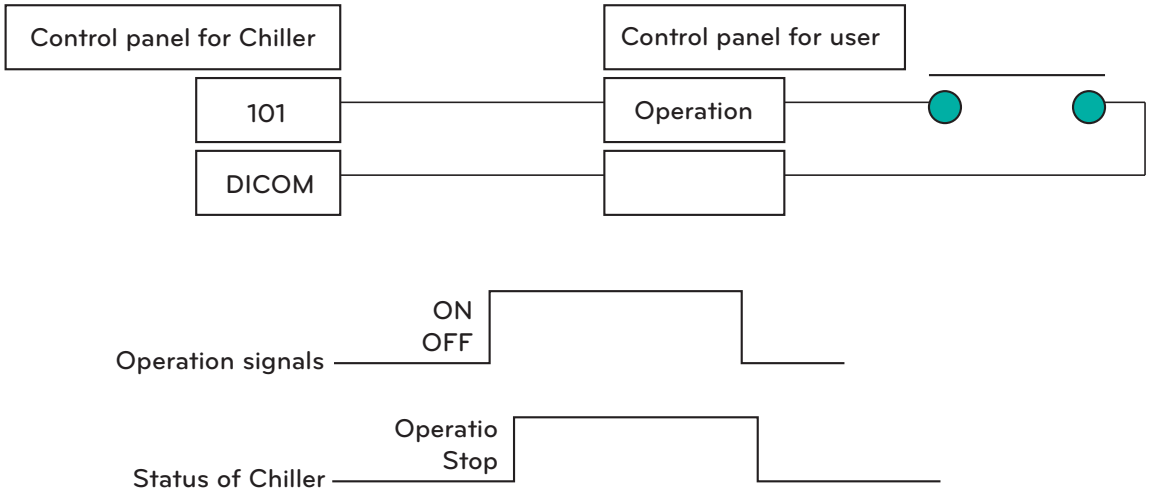
It is designed to function as same as the Auto/Manual shifting keys or Open/Close keys for control valves, in the front of the display.

When stopped, it cannot be opened manually because it is closed by force through the circuit.

Connecting of the remote control signals and status signals

The method of connecting remote Start/Stop signals

1. Non-voltage contact sequential signal two-wire



❊ Min. Start/Stop pulse maintaining hours: Min. 2 sec.

Power panel and connecting signal

Signal name	Signal type	Meaning	Cautions
Chilled water pump interlock	Input (non-voltage contact)	This is an interlock for checking the operation of an electronic contact for starting a pump. If there is no input signal during the start,the chiller may not start. If there is no input signal while the machine is running, an error may occur.	The status of contacts is monitored in a power output of DC 24V. Make sure the contact resistance does not go above 100Ω. (It must be avoided to mix other power lines into the same conduit.)
Chilled water pump Start/Stop	Output (non-voltage contact)	Signals to start/stop the pump. Access this only whet you try to interlock. It into the start/stop signals from the chiller.	Use this only with a resistance load of AC250V 0.1A or below.

Signals of access to the central monitoring panel

Signal name	Signal type	Meaning	Cautions
Check motor start Contact point for signal	Output (Zero voltage contacts)	ON when there is start signal input OFF when there is stop signal input	AC250V 0.1A Use this only within the limit of resistance load.
For indication of Start/Stop Contacts	Output (Zero voltage contacts)	ON when chiller starts OFF when chiller stops	
Contacts for error display	Output (Zero voltage contacts)	ON when there is error in chiller	
For indicating remote operation	Output (Zero voltage contacts)	When remote operation mode is selected ON	
Contacts for alarm display	Output (Zero voltage contacts)	ON upon an alarm	

START-UP

Pre Start-Up

Do not attempt to start the chiller until the following checks have been completed.

- Check auxiliary facilities, such as the chilled water circulating pump, air-handling equipment, or other equipments to which the chiller supplies liquid are operational. Consult manufacturer's instructions. If the unit has field-installed accessories, be sure all are properly installed and wired correctly. Refer to unit wiring diagrams.
- Open compressor suction and discharge shutoff valves.
- Open liquid line, oil line, and economizer service valves.
- Fill the chiller fluid circuit with clean water (with recommended inhibitor added) or other non-corrosive fluid to be cooled. Bleed all air out of high points of system. An air vent is included with the cooler. If outdoor temperatures are expected to be below 32°F(0°C), sufficient inhibited propylene glycol or other suitable corrosion inhibited antifreeze should be added to the chiller water circuit to prevent possible freeze-up. The chilled water loop must be cleaned before the unit is connected.
- Check and inspect all water piping. Make sure flow direction is correct and that piping is made to the correct connection on evaporator and condenser. Open all water flow valves to the evaporator.
- Turn on the chilled water pump manually, measure the water pressure drop across the evaporator, and check that water flow is correct per the design flow rates.
- Check all electrical connections in control panel to be sure they are tight and provide good electrical contact. Connections are tightened at the factory, but can loosen enough in shipment to cause a malfunction.
- Check the actual line voltage to the unit to make sure it is the same as called for on the compressor nameplate, within + 10%, and that phase voltage unbalance does not exceed 5%. Verify that adequate power supply and capacity is available to handle load.
  To determine percent voltage imbalance: The maximum voltage deviation is the largest difference between a voltage measurement across 2 legs and the average across all 3 legs.
- Verify power supply phase sequence. Fan motors are 3 phase. Check rotation of fans by using the quick test. Fan rotation is counterclockwise as viewed from top of unit. If fan is not turning counterclockwise, reverse 2 of the power wires at the main terminal block.
- Oil separator heaters must be firmly seated under the oil separator, and must be energized for 24 hours prior to start-up. The oil separator should be warm to touch.
- If wind velocity is expected to be greater than 8 km/h wind baffles and brackets must be field-fabricated.

Start-Up Procedure

Do not manually operate contactors. Serious damage to the machine may result. The following procedure should be followed.

- Be sure that water side load such as air-handling equipment, or other equipment to which the chiller supplies liquid are working. Starting of the water side load equipments can be delayed if the chilled water temperature is too high.
- Be sure that water circulating pump is operating if not on automatic control from the chiller.
- Check and inspect all fuses. All fuses inside of the power panel and control panel should be properly located and maintained.
- Switch on the unit circuit breaker and switch on the start switch installed on the door of control panel.
- Check and inspect the status of the LEDs of the CONTROLLER (Programmable Logic Controller) and the HMI (Haman Machine Interface) unit. The HMI unit should display welcome screen after switching on.
- Check and inspect the voltage monitoring relay inside of the power panel. The relay should not indicate any fault code.
- Using the HMI unit, configure chilled water leaving temperature setpoint.
- Start the system by setting the unit start menu on HMI Unit.
- After running the unit for a short time, check the oil level in each compressor, rotation of condenser fans and check for flashing in the refrigerant sight glass.
- Ambient temperature during unit operating must be within50°F ~ 129.2°F(10°C ~ 54°C).

- To obtain proper temperature control, water loop volume must be within allowable range of the volume. After the above procedure, allow unit to operate and confirm that everything is functional properly. Check to see that chilled water leaving temperature agrees with the setpoint. Additionally, check all sensors to have valid reading values through the HMI unit. The CONTROLLER uses 5 thermistors to sense temperatures and the thermistors include: Ambient, Condenser Refrigerant Leaving, Compressor Discharge, Chilled Water Entering, and Chilled Water Leaving.

Operation Limits

Temperature

Temperature limits during the operation of the unit are as follows.
Maximum ambient temperature: 129.2°F(54°C)
Minimum ambient temperature: 41°F(5°C)
Maximum outlet water temperature: 59°F(15°C)
Minimum outlet water temperature: 41°F(5°C)
– Temperature of inlet water must not exceed 68°F(20°C) during continuous operation.

Voltage

Permitted maximum voltage and minimum voltage are displayed on PDB. And if you need other electric data, please refer to PDB.
When using the 3 phase voltage, never operate the motor of the compressor when the imbalance among the phases exceed 5%
The formula to calculate the voltage imbalance is as follows.
% Voltage Imbalance = 100 x (Max Voltage from average voltage / Average Voltage)
Max Voltage from average voltage is the absolute value of the maximum gap from the average voltage of the 2 phases.

Example)
Voltage source 400-3phase (1, 2, 3)-50Hz
12: 405V / 23: 394V / 31: 410V
Average voltage: (405 + 394 + 410) / 3 = 403
Difference between average voltage and each voltage:
Average – 12 = |403 – 405| = 2V
Average – 23 = |403 – 394| = 9V
Average – 31 = |403 – 410| = 7V
Maximum voltage compared to average voltage: 9V
% Voltage imbalance: 100 x (9 / 403) = 2.23%
Because the permitted range of the imbalance the voltage is less than 5%, the device can operate.

Flow Rate

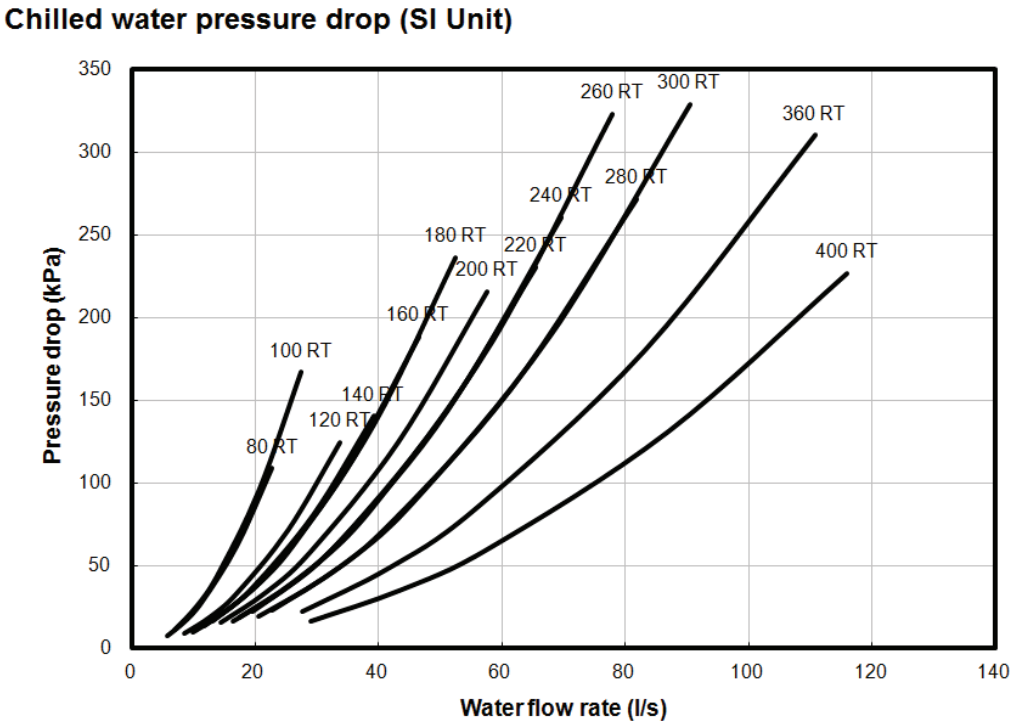
The basic flow rate of the chiller must follow the values of the table showing the maximum, minimum and designed flow rate.
Higher or lower flow rates are permitted to make the lower or higher temperature rise.
In order to assure appropriate heat exchange and turbulent flow inside the evaporator, the flow rate must exceed the Minimum flow rate.

Model		Minimum		Nominal		Maximum	
		gpm	l/s	gpm	l/s	gpm	l/s
50Hz	MCAW008BA12	88.8	5.6	178.1	11.2	356.6	22.5
	MCAW010BA12	109.4	6.9	219	13.8	437.5	27.6
	MCAW012BA12	139.5	8.8	278.7	17.6	558	35.2
	MCAW014BA22	161.7	10.2	323.4	20.4	648.3	40.9
	MCAW016BA22	177.5	11.2	353.6	22.3	708.5	44.7
	MCAW018BA22	214	13.5	427.2	27	856	54
	MCAW020BA22	240.1	15.2	482	30.4	965.3	60.9
	MCAW022BA22	258.4	16.3	516.9	32.6	1035	65.3
	MCAW024BA22	282.1	17.8	562.5	35.5	1125.4	71
	MCAW026BA22	315.4	19.9	632	39.9	1264.9	79.8
	MCAW028BA22	339.2	21.4	678.2	42.8	1356.8	85.6
	MCAW030BA32	364.6	23	729.3	46	1459.8	92.1
	MCAW036BA32	404.2	25.5	809	51	1620	102.2
	MCAW040BA32	439.1	27.7	878.5	55.4	1757.8	110.9
	MCAW045BA42	540.5	34.1	1078.8	68.1	2158.8	136.2
	MCAW050BA42	586.5	37	1171.5	73.9	2345.8	148

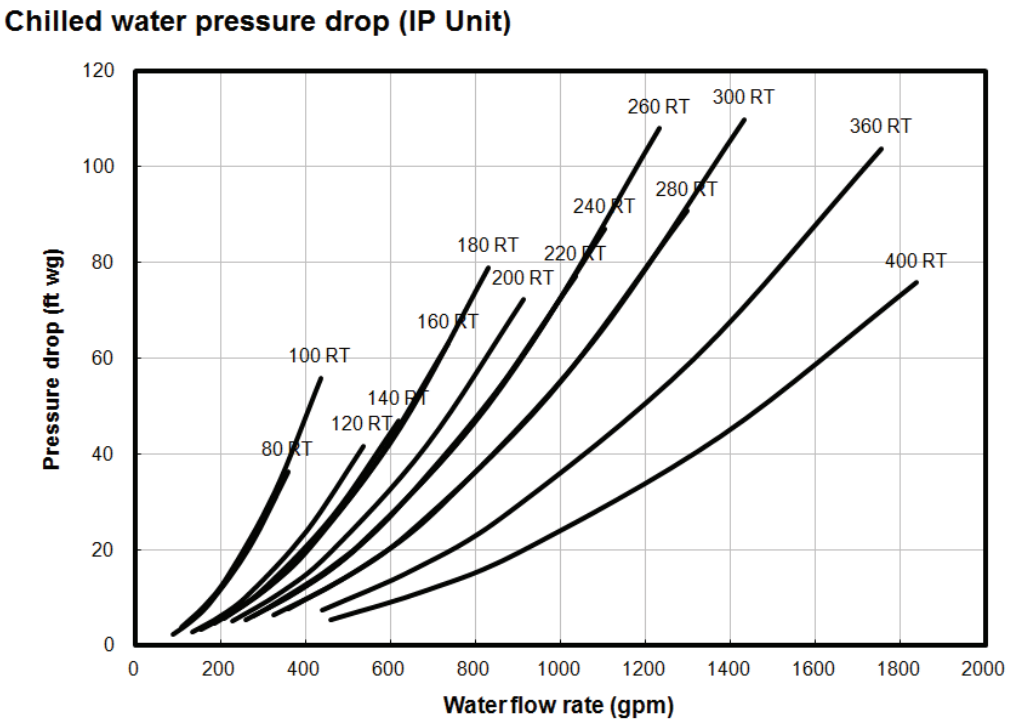
Model		Minimum		Nominal		Maximum	
		gpm	l/s	gpm	l/s	gpm	l/s
60Hz	MCAW008BA12	90.3	5.7	179.2	11.3	358.2	22.6
	MCAW010BA12	109.4	6.9	217.7	13.7	435.9	27.5
	MCAW012BA12	134.7	8.5	267.6	16.9	535.7	33.8
	MCAW014BA22	155.3	9.8	310.2	19.6	621.3	39.2
	MCAW016BA22	183.9	11.6	368.2	23.2	737	46.5
	MCAW018BA22	207.6	13.1	415.5	16.2	832.1	52.5
	MCAW020BA22	228.2	14.4	456.9	28.8	914.6	57.7
	MCAW022BA22	260	16.4	518.3	32.7	1038.2	65.5
	MCAW024BA22	275.8	17.4	551.7	34.8	1104.8	69.7
	MCAW026BA22	309.1	19.5	616.9	38.9	1234.7	77.9
	MCAW028BA22	324.9	20.5	648.8	40.9	1298.1	81.9
	MCAW030BA32	358.2	22.6	716.5	45.2	1434.5	90.5
	MCAW036BA32	439.1	27.7	877.5	55.4	1757.8	110.9
	MCAW040BA32	459.7	29	919.1	58	1840.2	116.1
	MCAW045BA42	518.3	32.7	1036.6	65.4	2074.8	130.9
	MCAW050BA42	584.9	36.9	1170.1	73.8	2342.7	147.8

Pressure Drop

Chilled water pressure drop (SI Unit)



Chilled water pressure drop (English Unit)



NOTE

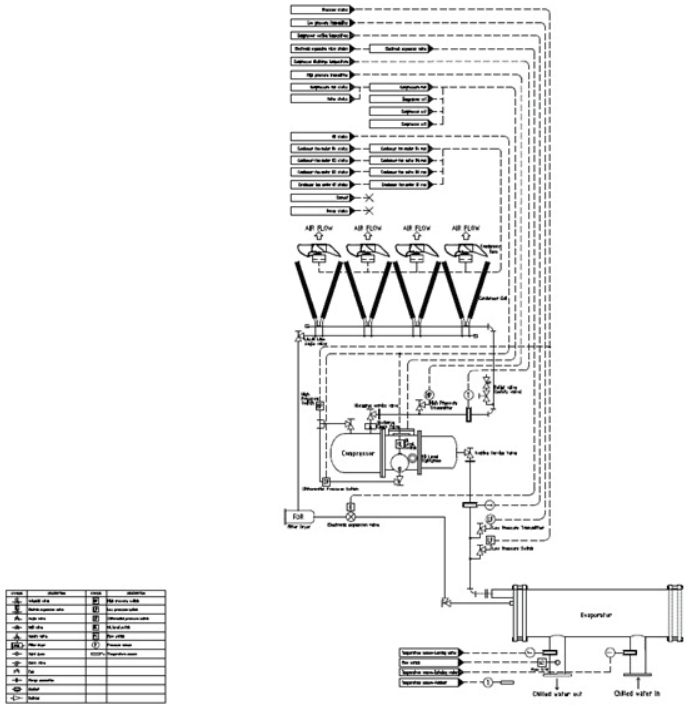
For flow out of this range, consult LG.

ENGLISH

SERVICE

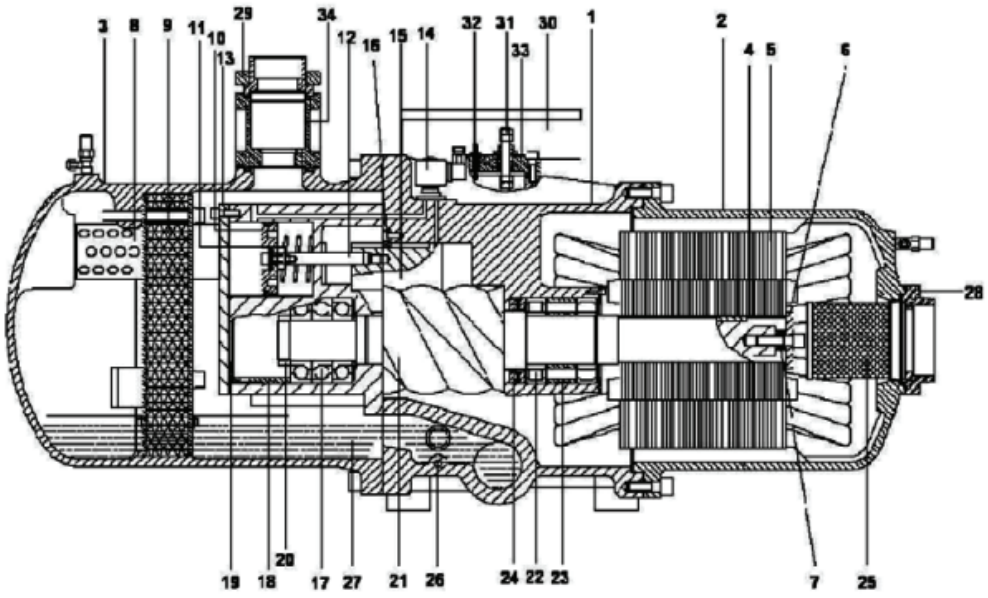
Cycle Components

The structure of the air-cooled cooling cycle is shown in the below.



Compressor

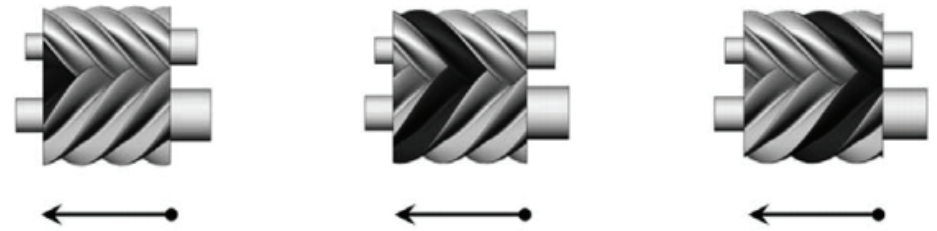
The unit is equipped with semi-hermetic screw compressor developed especially for applications in air-conditioning. The construction of the compressor is shown in the below.



Number	Description	Number	Description
1	Compressor casing	18	Discharge fixed ring
2	Motor casing	19	Disc spring
3	Oil separator	20	Bearing lock nut
4	Motor rotor assembly	21	Male rotor
5	Motor stator assembly	22	Suction bearings
6	Motor rotor washer	23	Suction bearings inner/outer spacer ring
7	Motor rotor spacer ring	24	Oil guiding ring
8	Oil separator baffle	25	Suction filter
9	Oil separator cartridge	26	Oil heater
10	Piston	27	Refrigeration Lubricant
11	Piston spring	28	Suction flange
12	Piston rod	29	Discharge flange
13	Bearing seatAfs cover plate	30	Cable box
14	Modulation solenoid valve	31	Power bolt
15	Modulation slide valve	32	Thermostat terminals
16	Slide valve key	33	Motor cable cover plate
17	Discharge bearings	34	Discharge check valve

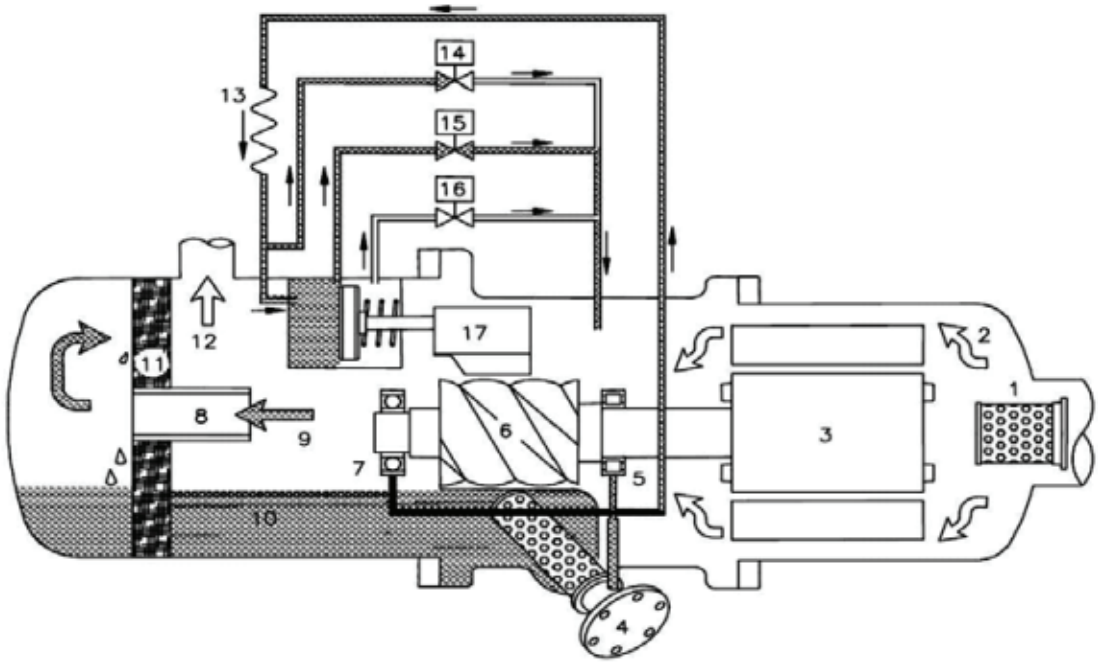
As shown in the below, during rotation of the rotors the meshing shifts from the suction side to the discharge side. The meshing rotors enclose a working space, which is continuously reduced as it moves in the axial direction. This causes a V-shaped lobe space to form between each of the male and female lobes. This lobe space increases to a maximum size (suction and sealing process). As the rotors rotate further, the new meshing on the suction side closes the V-shaped lobe space. The lobe space is then constantly reduced by continuing intermeshing of the lobes (compression process).

The reduction in lobe space takes place on the lower side of the rotors towards the discharge side. The volume is steadily reduced and it is thereby compressed in the sealed condition. As soon as the peaks of the rotor teeth are free to the outlet port, the vapor is discharge to the high-pressure side and flows to the oil separator where the high-pressure gas will be separated from the lubrication oil. The size and geometry of the discharge port determine the so called "internal volume ratio (Vi)" of the compressor. This ratio must have a defined relation-ship to operating pressure ratio to avoid losses in efficiency due to under or over compression.



The screw compressor is equipped with 4-step capacity control system. The capacity control system is consisting of a modulation slide valve, piston rod, cylinder, piston and piston rings. The slide valve and the piston are connected by a piston rod. The principle of operation is using the oil pressure to drive the piston in the cylinder. The positive pressure differential causes the piston to move toward the right side in the cylinder. When the slide valve moves toward the right side, the effective compression volume in the compression chamber increases.

This means the displacement of refrigerant gas also increases, as a result the refrigeration capacity also increases. However, when any of the step solenoid valve is energized, the high pressure oil in the piston cylinder bypasses to the suction port causing the piston and the slide valve to moved toward the left side, then some of the refrigerant gas by pass from the compression chamber back to the suction end. As a result, the refrigeration capacity decreases because of the reduction of displacement of refrigerant gas flowing in the system. The piston spring is used to push the piston back to its original position, i.e. minimum load position in order to reduce the starting current for the next starting-up. If the compressor started at full load capacity it may result in over current start. The capillary is used to maintain and restrain a suitable amount of oil flow into the cylinder. If the oil filter cartridge, capillary, or modulation solenoid valves are not working well in the capacity control system, this may result in the abnormality and ineffectiveness of the capacity control system.



The main functions of the lubrication oil in the screw compressor are lubrication, internal sealing, cooling and capacity control. The positive oil pressure in the cylinder pushes the piston and the slide valve that is connected by a piston rod to move forward and backward in the compression chamber. The design with positive pressure differential lubrication system in the screw compressor is available to omit an extra oil pump in the compressor like reciprocating compressor. However, in some special applications, it is still necessary to install an extra oil pump to the compressor for safety.

The bearings used in the compressor required a small but steady quantity of oil for lubrication; the oil injection into the compression chamber creates an oil sealing film in the compression housing for increasing the efficiency and absorbing a part of heat of compression. In order to separate the oil from the mixed refrigerant gas, an oil separator is required to ensure the least amount of oil carried into the system. Pay more attention to the oil temperature, which has a very significant factor to the compressor bearings' life. High oil temperature will reduce the oil viscosity and cause the poor lubrication and heat absorption in the compressor as well. The oil viscosity is recommended to keep over 10mm2 / s at any temperature. The oil temperature just keeps above system condensing temperature to avoid the refrigerant migration into system in the summer. There is high oil viscosity in the low ambient temperature circumstance, it could cause compressor in heavy duty to be started up resulting less oil pressure in oil line to load the compressor. The better solution is to have higher condensing temperature in a short time by warming up the oil.

The compressor is equipped two oil sight glasses as a standard, one is the oil high level sight glass, and the other is the oil low level sight glass. The normal oil level in the compressor oil tank should be maintained above the top of the low oil sight glass and in the middle level of high oil sight glass when compressor is running.

Condenser

Maintenance and cleaning of condenser coil

Periodically cleaning the surface of the coil is essential in maintaining the normal operation of the unit. By removing any contaminant or hazardous substance on the coil, you can extend the life of the coil and the unit. The following maintenance and cleaning method is recommended as part of the periodical maintenance activity to extend the life of the coil.

- Remove fiber on surface: Use the vacuum cleaner to clean any fiber or dust on the surface. If you cannot use the vacuum cleaner, use a soft non-metallic brush to clean the surface. When using both methods to clean the surface, clean in the same direction as the pin. Because the pin can bend very easily, you can bend the pin or scratch the protective coating on the surface by applying the cleaning utensil across the pin.

If you use a water hose to clean the coil, be careful as dust or fiber can get inside the coil. Completely remove any fiber or dust on the surface before cleaning it with clean water.

⚠ CAUTION

If you use a water hose to clean the coil, be careful as dust or fiber can get inside the coil. Completely remove any fiber or dust on the surface before cleaning it with clean water.

- Periodical water cleaning: Periodically cleaning the pin with water helps the maintenance of the coil installed on the coast or industrial site. But due to the fragility of the installed coil, you must rinse the coil with water at low speed in order to prevent any damage to the coil. It is recommended to clean once every one to two months.

⚠ CAUTION

Never use any type of cleaner such as chemical, bleach, acid or alkali cleaner etc. on the coil. These types of cleaners can accelerate the corrosion of the pin and tube, and make it difficult to rinse with water.

⚠ CAUTION

Never clean the coil using high speed water or pressured air. Doing so can bend the coil and increase the pressure drop on the air side of the condenser. This can result in performance deterioration or cause the product to stop operating.

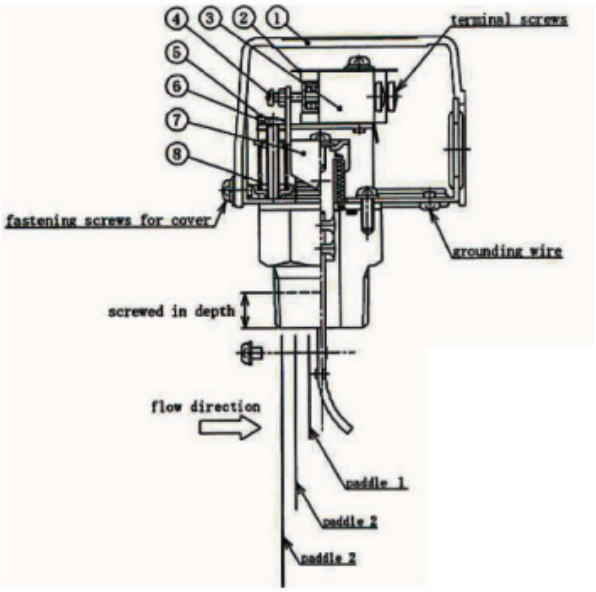
Condenser fan

The fan motor and the fan must be fixated firmly on the top plate of the condenser with the metallic bracket. Shroud protects the parts from the fan rotating in high speed. Assembly of the condenser fan is as shown in the picture as follows. Apply the grease on the exposed part of the motor to protect it from the rain. You have to apply the grease again on the fan axis and then reinstall the Shroud. Also there is an axis support on the fan axis of the fan motor, which must be inserted accurately at this location for maximum performance of the fan motor. And then the bolt must be firmly tightened.

Cooler

Flow switch(Option)

Flow Switch is installed on the water outlet nozzle for all units as factory setting. The following pictures show the Flow Switch in generally installed method.



No.	parts name	Qty
①	cover	1
②	insulation plate	1
③	microswitch	1
④	adjusting screw	1
⑤	metal fitting for flow adjusting screw	1
⑥	flow adjusting screw	1
⑦	actuating plate	1
⑧	adjusting spring	1

Table 17

Refrigerant Cycle

Leakage test

As described in the installation manual, the unit is sufficiently charged with R134a refrigerant as factory setting. If the refrigerant pressure is lower than the factory setting, you must check for leakage. If the pressure inside the unit has dropped, use the Nitrogen to do a leakage test. When repairing the leaking part, you must use good refrigeration practice. After the leakage is repaired, any water inside the chiller must be removed and vacuumed.

Charging / Remove the refrigerant

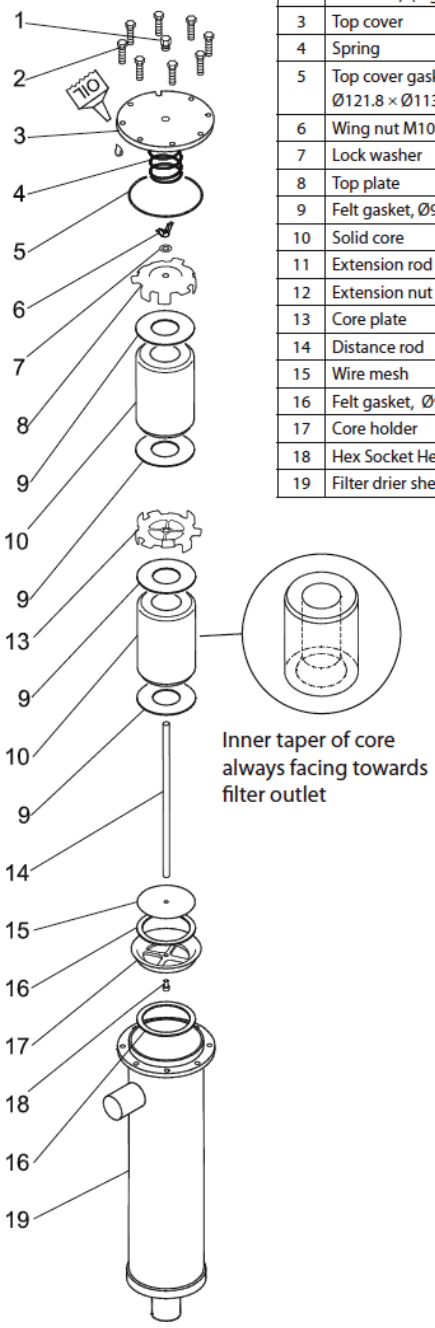
Connect coupling to the refrigerant charging port. In order to avoid the damage to the tube from residual water freezing within the evaporator, circulate the water in the evaporator (EVA) while charging or removing the refrigerant to the designated amount. For the amount of refrigerant to charge, refer to the installation manual or PDB.

Charging / Remove the oil

Connect coupling in the oil port. In order to avoid the damage to the tube from residual water freezing within the evaporator, circulate the water in the evaporator (EVA) while charging or removing oil to the designated amount. Check whether the oil level is above in the Sight Glass window. Remove the coupling and insert the oil port cap. After inserting the oil, operate the product and check whether the oil level is above with the naked eye. If not, supplement the oil.

Filter Drier

The filter drier is installed on the liquid line from condenser outlet to economizer. Differential pressure between the inlet and outlet of the filter drier must be checked periodically.



Pos.	Description
1	Plug , $^1/_4$ in. NPT
2	Top cover bolts M8 × 35 or M12 × 40, (high pressure)
3	Top cover
4	Spring
5	Top cover gasket Ø121.8 × Ø113.6 × 0.8mm
6	Wing nut M10 (torque max. 3 Nm)
7	Lock washer
8	Top plate
9	Felt gasket, Ø95.5 × Ø45.5 × 2 mm
10	Solid core
11	Extension rod
12	Extension nut
13	Core plate
14	Distance rod
15	Wire mesh
16	Felt gasket, Ø95.5 × Ø78 × 2 mm
17	Core holder
18	Hex Socket Head Screw M6
19	Filter drier shell

Oil Heater

The oil heater prevents poor lubrication due to too low viscosity. The oil heater is also installed on the oil separator. The 150W oil heater has 220VAC power input.

Control System

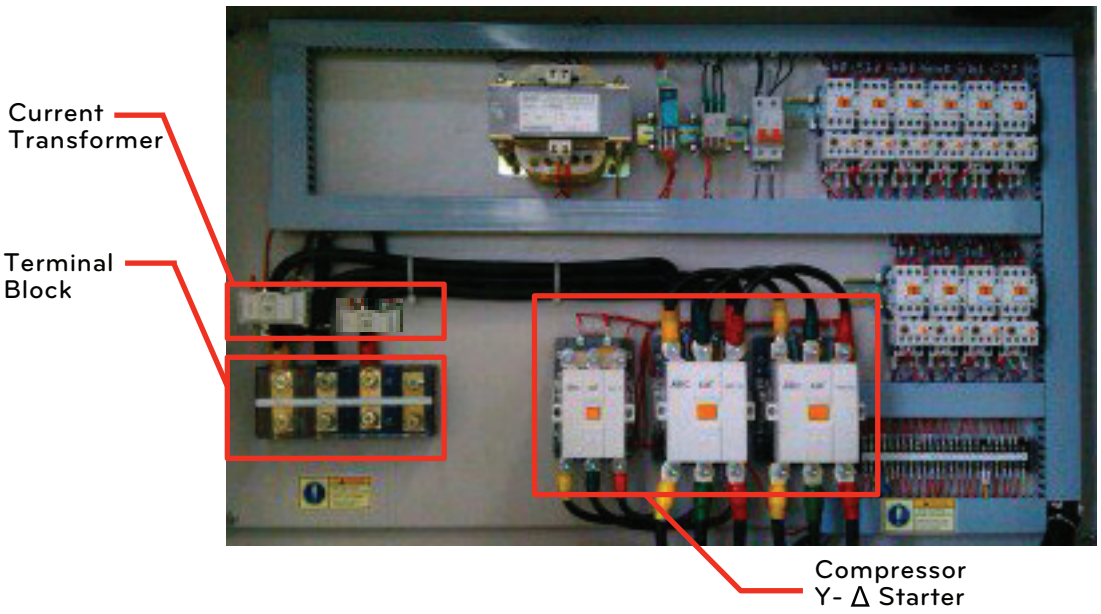
The structures of the power panel and control panel are shown in the below. The power panel in the left is composed of the electrical components related to main power, and the control in the right is composed of low-voltage components such as the CONTROLLER and the HMI unit.

Power Panel

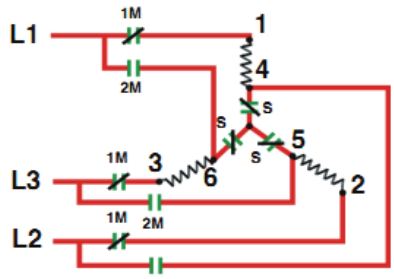
On the left side of the power panel, terminal blocks for main power connection are prepared. The field supplied main power lines and neutral line for control power are connected to these terminal blocks.

There are three magnetic contactors for the wye-delta starting of the compressor and OCR (Over Current Relay) for the compressor. For wye-delta starting, there are three magnetic contactors installed inside of the power panel.

By the wye-delta starter, the starting inrush current is reduced by 1/3 of direct starting method. The line voltage(VL) of the both of wye and delta winding configuration is rate voltate, but the phase voltages(VP) of the wye winding configuration is reduced by 1/3 of the delta winding configuration. Additionally, the line current (IL) is also reduced by 1/3 of the delta winding configuration. Consequently, the current of the wye winding configuration is reduced by 1/3 of delta winding configuration. Using the principle, the compressor starts with the wye winding configuration. And the winding configuration is changed into delta configuration after few seconds for the normal operation of the compressor.



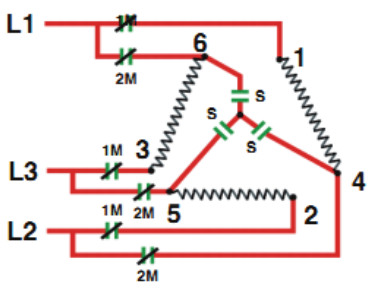
Wye Starting



$$V_{P=}\frac{V_L}{\sqrt{3}}$$

$$I_{L=}I_P$$

Delta Running

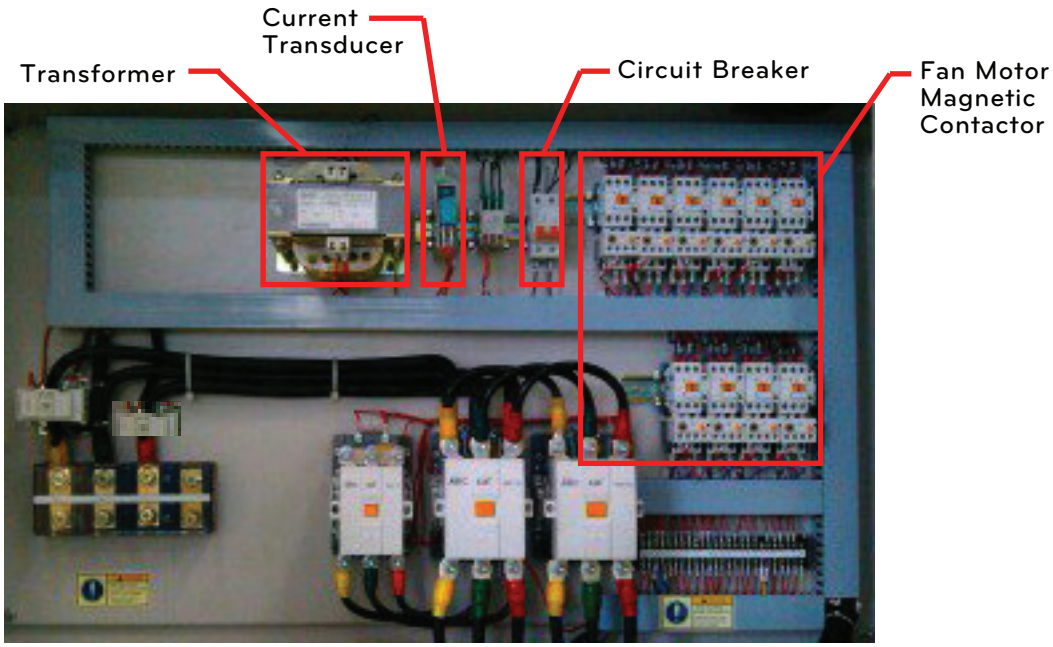


$$V_{P=}V_L$$

$$I_{L=}\sqrt{3}xI_P$$

There is one magnetic contactor for each condenser fan.

On the right bottom side of the power panel, voltage monitoring relay is installed to monitor proper power input. There are three fuses installed for the power input to the voltage monitoring relay. The ventilation fan of the power panel is controlled by the thermostat. If the ambient temperature inside of the power panel is over 95°F(35°C), the ventilation fan runs.



Condenser Fan OCR

The condenser fan OCR is also thermal type and used to protect the condenser fan from overload condition. The OCR contact used for the control system is normally closed, and the OCR contact switch is to be opened if it detects excessive current.

The OCR needs manual reset by switch on the OCR to be recovered to normal after tripping. The tripping point ranges and factory settings are shown in the below table.

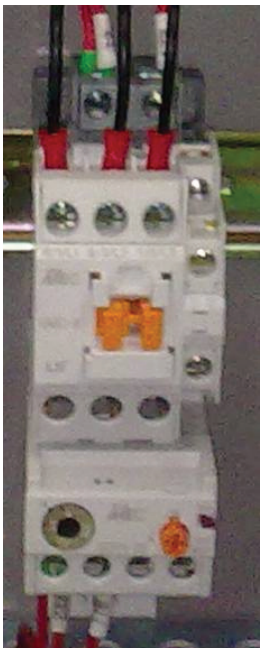
Model	Range(A)	Trip(A)
MCAW Series	2.5~4.0	4.0

Compressor Contactor

Compressor Contactor controls the start, stop and static range of the compressor motor when the product is operating.

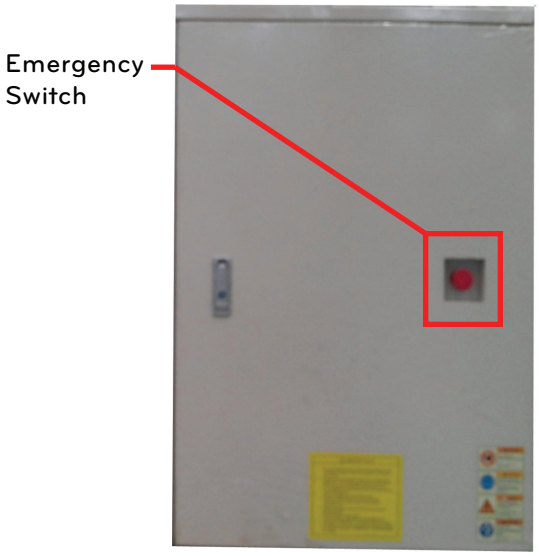
Fan Contactor

Fan Contactor controls the start, stop and static range of the fan motor when the product is operating.

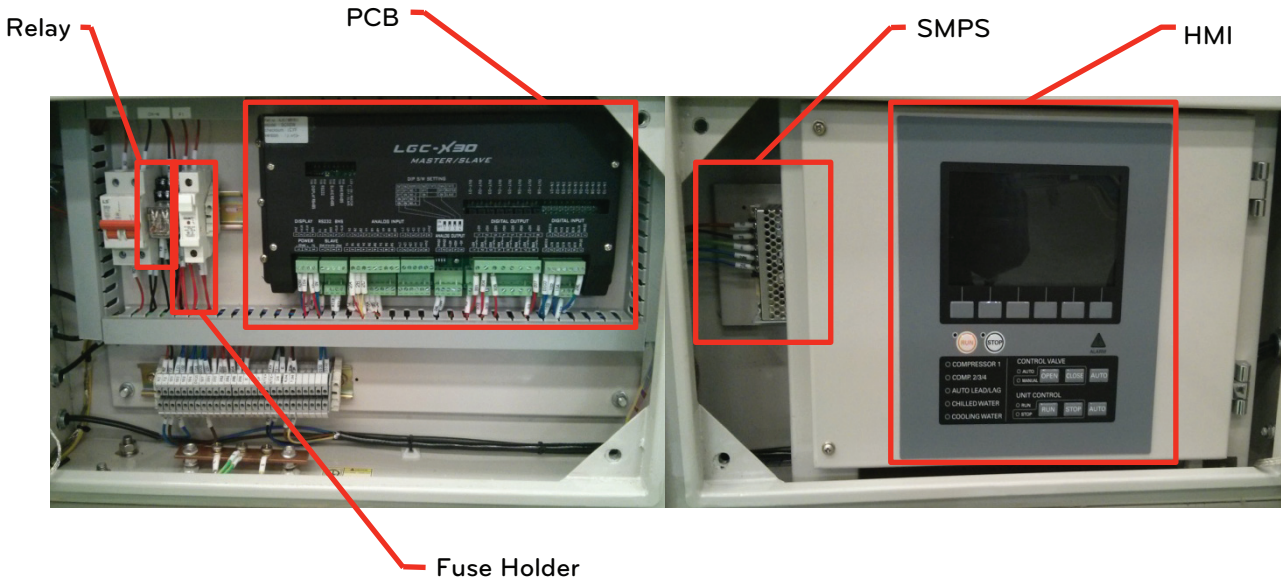


Control Panel

On the external door of the control panel there is emergency switch for the instant cutting out of control outputs from the CONTROLLER. By pushing the emergency switch, the 220VAC power supplied to the CONTROLLER relay outputs are cut out instantly. By turning the switch in clock-wise direction, the power to the output is recovered.



In the control panel, the CONTROLLER is installed as a central control station. The CONTROLLER is assembled with the HMI unit in a black case.



Maintenance Schedule

Check Point	Daily	Monthly	Every 2 Months	Every 3 Months	Every 6 Months	Yearly	Every 2 Years	Every 3 Years	Every 6 Years
	IOh	500h	1000	1500	2500	5000	10000	15000	30000
1. Cycle Status	Check								
2. Electrical Components		Check	Check monthly						
3. Safety Switches		Check	Check monthly						
4. Water Loop System		Check		Clean	Check every 6 months				
5. Condenser Cleanness				Check	Check every 6 months Clean if operating pressure of chiller is out of range				
6. Cooling Tower Cleanness				Check	Clean	Clean yearly			
7. Refrigerant System Tightness		Check	Check monthly						
8. Oil Filter			Check	Clean	Check every 6 months Clean if needed				
9. Dryer Filter		Check				Replace	Replace yearly		
10. Oil Level		Check	Check yearly						
11. Oil Color		Check					Replace		
12. Compressor Insulation						Check	Check yearly		
13. Temperature Sensor				Check	Check every 6 months				
14. Compressor Bearing							Check		Check or Replace

TROUBLE SHOOTING

CAUTION

If a stoppage occurs more than once as a result of any of the safety devices, determine and correct the cause before attempting another restart.

General Malfunction

Before specific alarm trouble shooting, general troubles and their possible remedies are introduced. When the unit does not run at all, you have to check power supply to the chiller, refrigerant, configuration, and alarm invocation. For the power supply check, you have to check voltage applied to the terminal block inside of the power panel. If the power is absent, please check power feeder and check whether any protective device is tripped.

When the power is applied properly, refrigerant pressure must be inspected by pressure gauge installed on the chiller, when the pressure is out of range, please check whether any leakage point is by soap bubble test. If there is problem with the configuration of the CONTROLLER or too much delay is configured, the chiller will not start or the start is delayed for long time. Please recover the configuration value to factory setting before starting the chiller. Lastly, alarm invocation has to be checked. You can find whether any alarm is invoked through the HMI unit. Follow specific alarm trouble shooting procedure if any alarm is invoked.

Normally, the compressor of the chiller will cycle according to the chilled water leaving temperature, the compressor shutdown temperature and the compressor restart temperature. But the case where the compressor runs too long without cycling can be encountered. When the refrigerant is not enough, the chiller will operate continuously because the chiller cannot work at 100% power. At this case, the leakage is also to be inspected. When magnetic contactors for the compressor are mechanically welded, the chiller operation will be continued, because the CONTROLLER cannot stop the compressor by control signal even if the compressor must be stopped. When there is no problem with the refrigerant and compressor contactor, Air inside of the water loop can be a cause, because air inside of water loop obstructs thermal exchange. When the problem is revealed, the air must be purged. When there is non-condensables in the refrigerant circuit, remove the refrigerant and recharge.

Even after running condenser fan and chilled water pump, the compressor will not run caused by alarm or trouble with temperature reading. Please follow specific alarm trouble shooting procedure at this case.

Symptom	Possible Cause	Possible Remedy
Unit does not run	Check for power to unit	Check over current protection device Check no-fused disconnect (if equipped) Restore power to unit
	Low refrigerant charge	Check for leak and add refrigerant
	Wrong or incorrect unit configuration	Check unit configuration
	Active alarm	Check Alarm status. See separate alarm trouble shooting procedure and follow trouble shooting instructions Check the PLC input channels also to verify alarm status Input
	Active operating mode	Check fulfillment of oil heating time Check fulfillment of comp start delay time Check chilled water temp out Check water flow
Compressor operates too	Low refrigerant charge	Check for leak and add refrigerant
long continuously	Compressor or control contacts welded	Replace the contactors
	Air in chilled water loop	Purge water loop
	Non-condensables in refrigerant circuit	Remove refrigerant and recharge
Circuit does not run	Active alarm	Check Alarm status. See separate alarm trouble shooting procedure and follow trouble shooting instructions
	Active operating mode	Check for temperature inputs. See operation and control. Check capacity control overrides Check the PLC input channels also to verify alarm status Input

Alarm

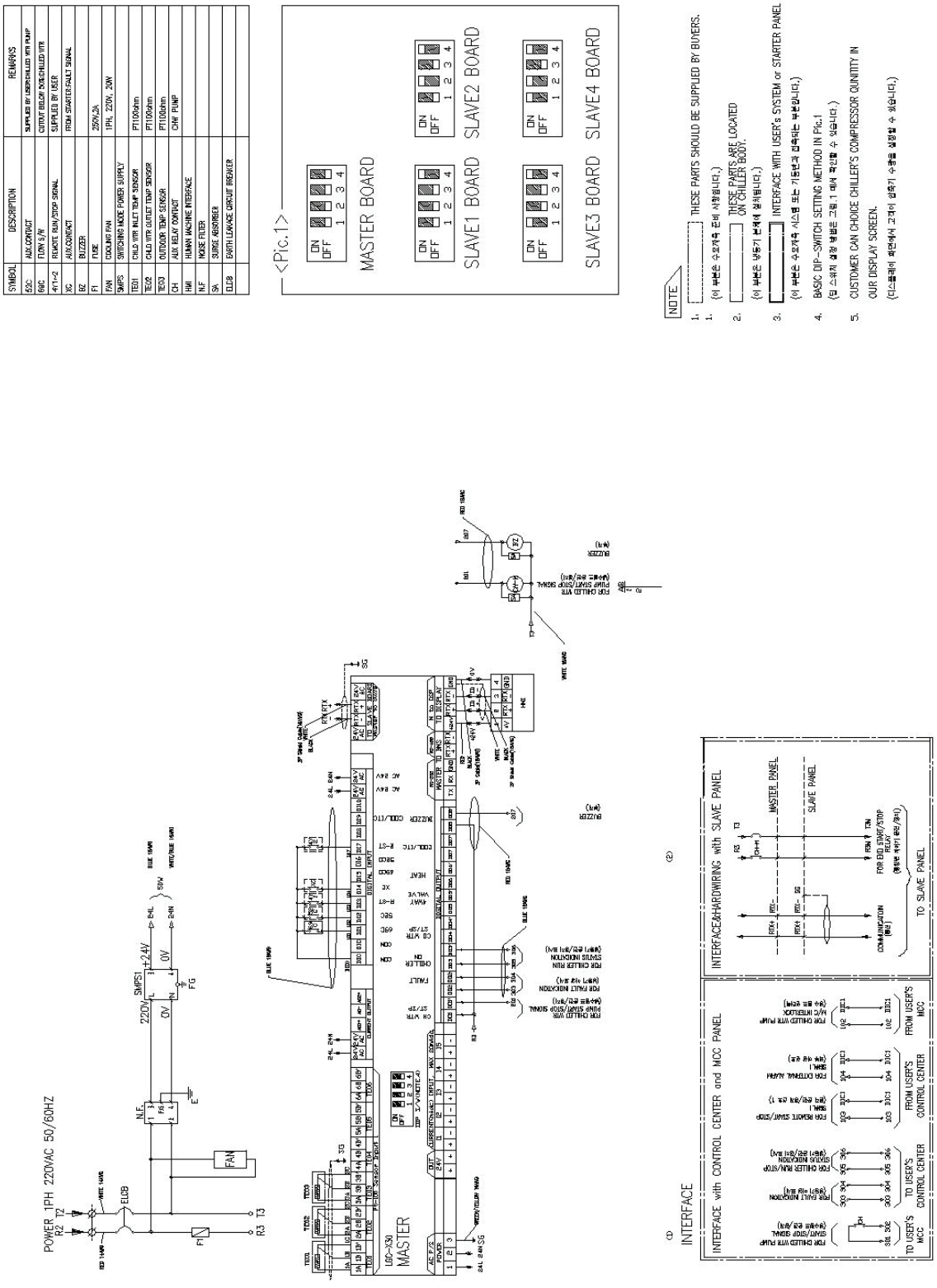
Specific alarms, their recognition method, and their possible causes are listed here. To clear alarm and recover from the alarm, clear the alarm history after correction of the cause of the alarm.

The emergency trouble means that the emergency switch installed on the right side of the control panel is pushed by operator. This switch input is normally closed and the trouble means the switch input is opened. When the emergency switch is opened output power for the output control from the CONTROLLER is disconnected. By pulling the emergency switch, the alarm can be corrected.

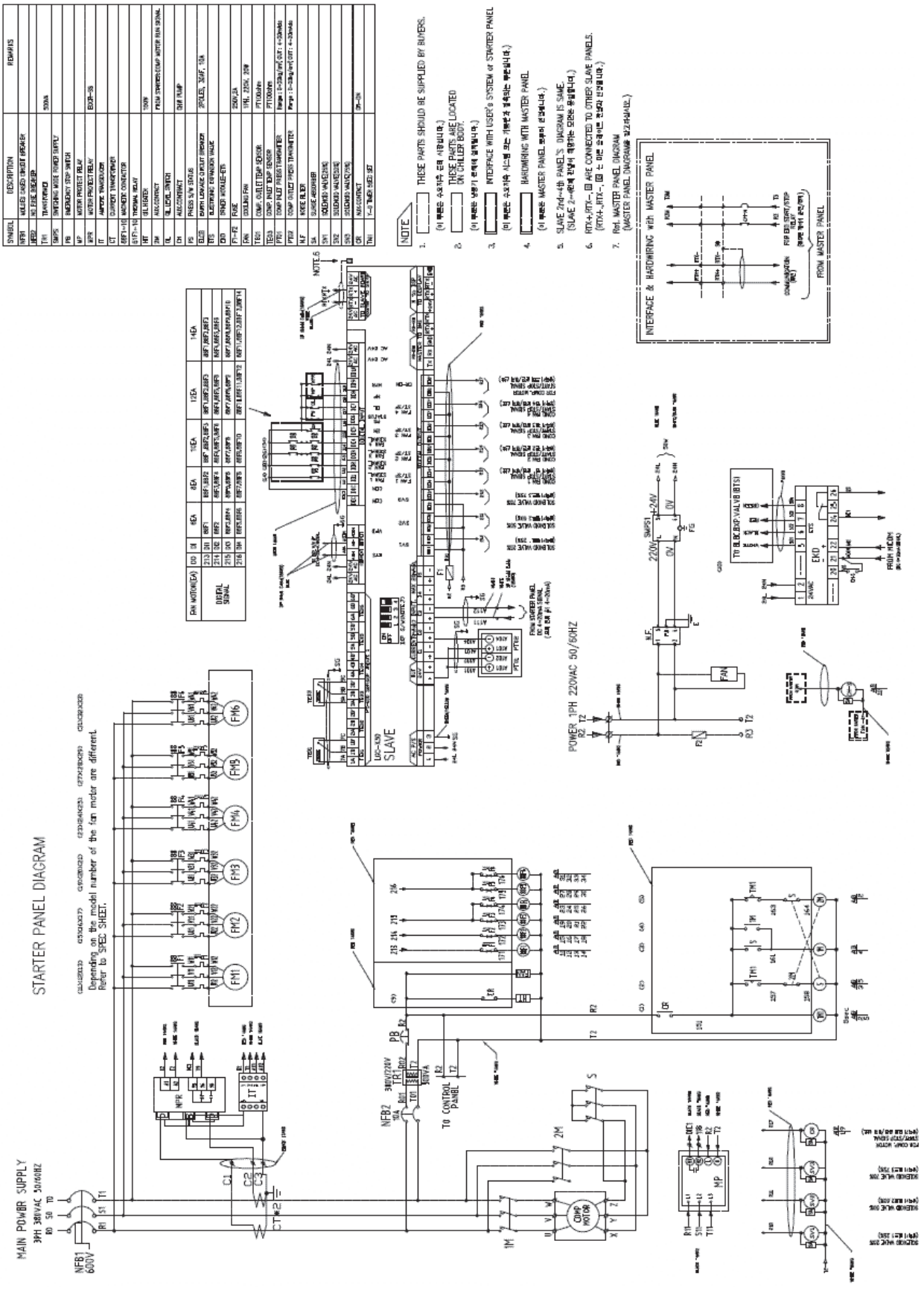
ENGLISH

APPENDIX

Wiring Diagram (Control box)

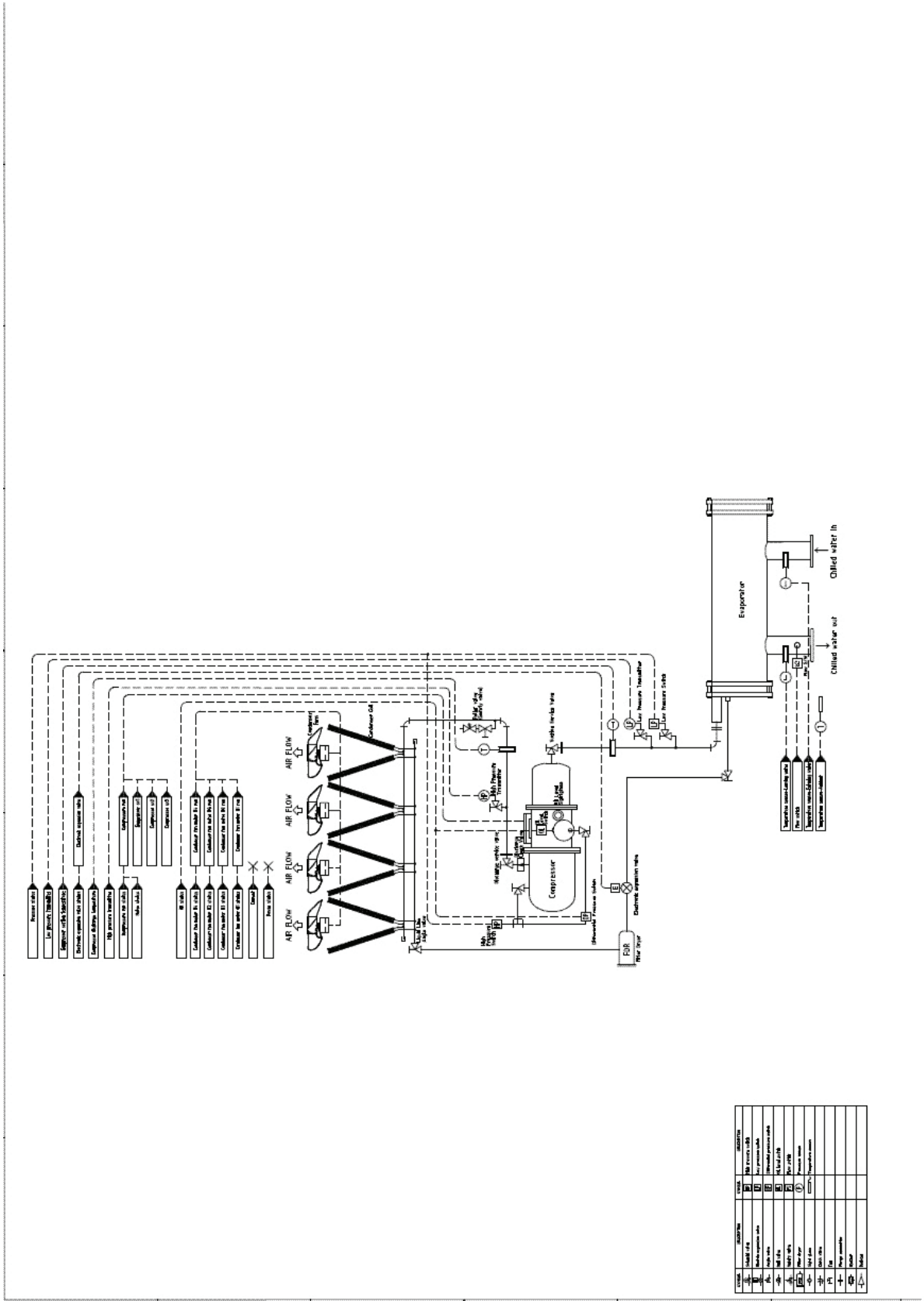


Wiring Diagram (Power box)

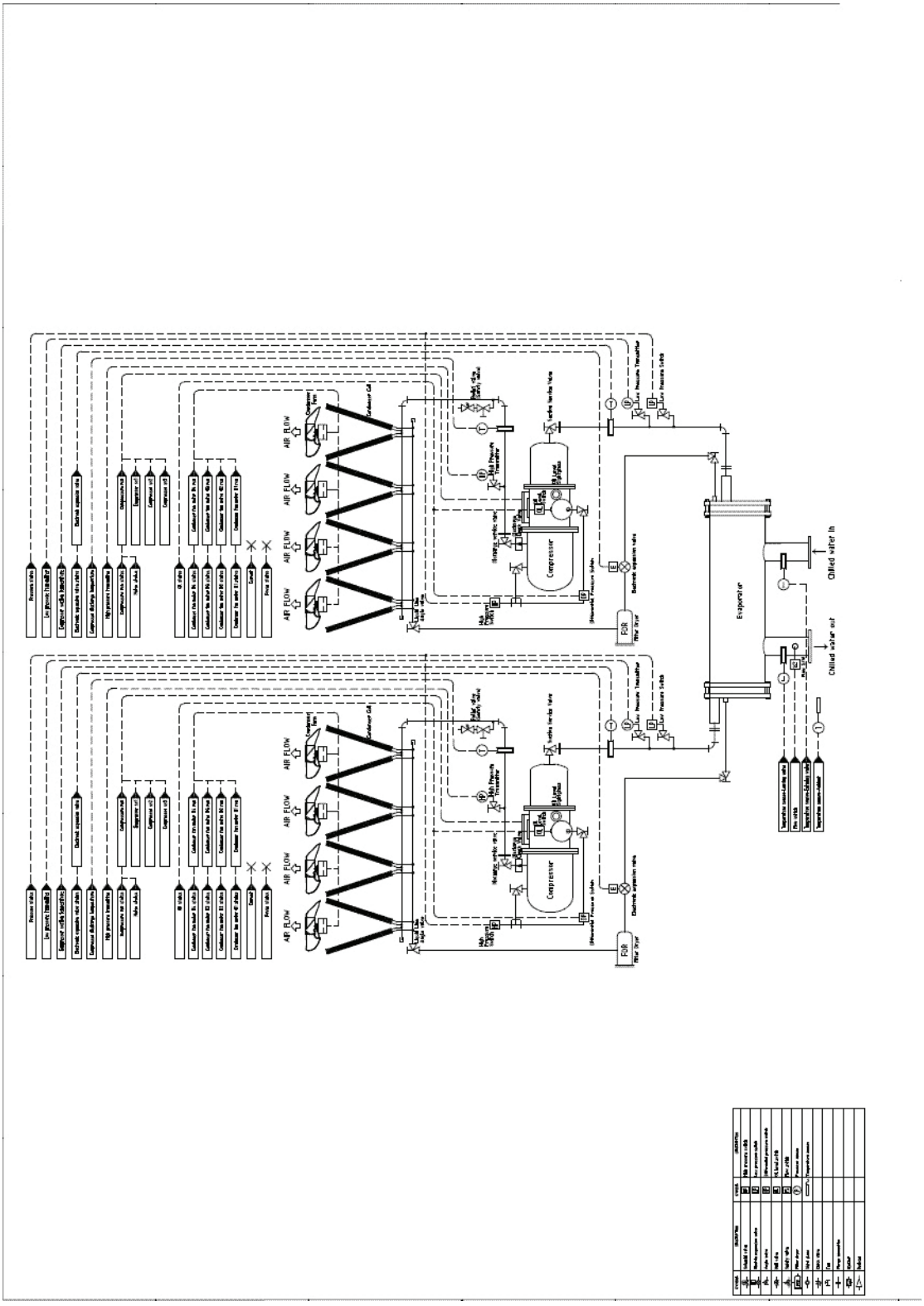


ENGLISH

Cycle Diagram(1COMP)

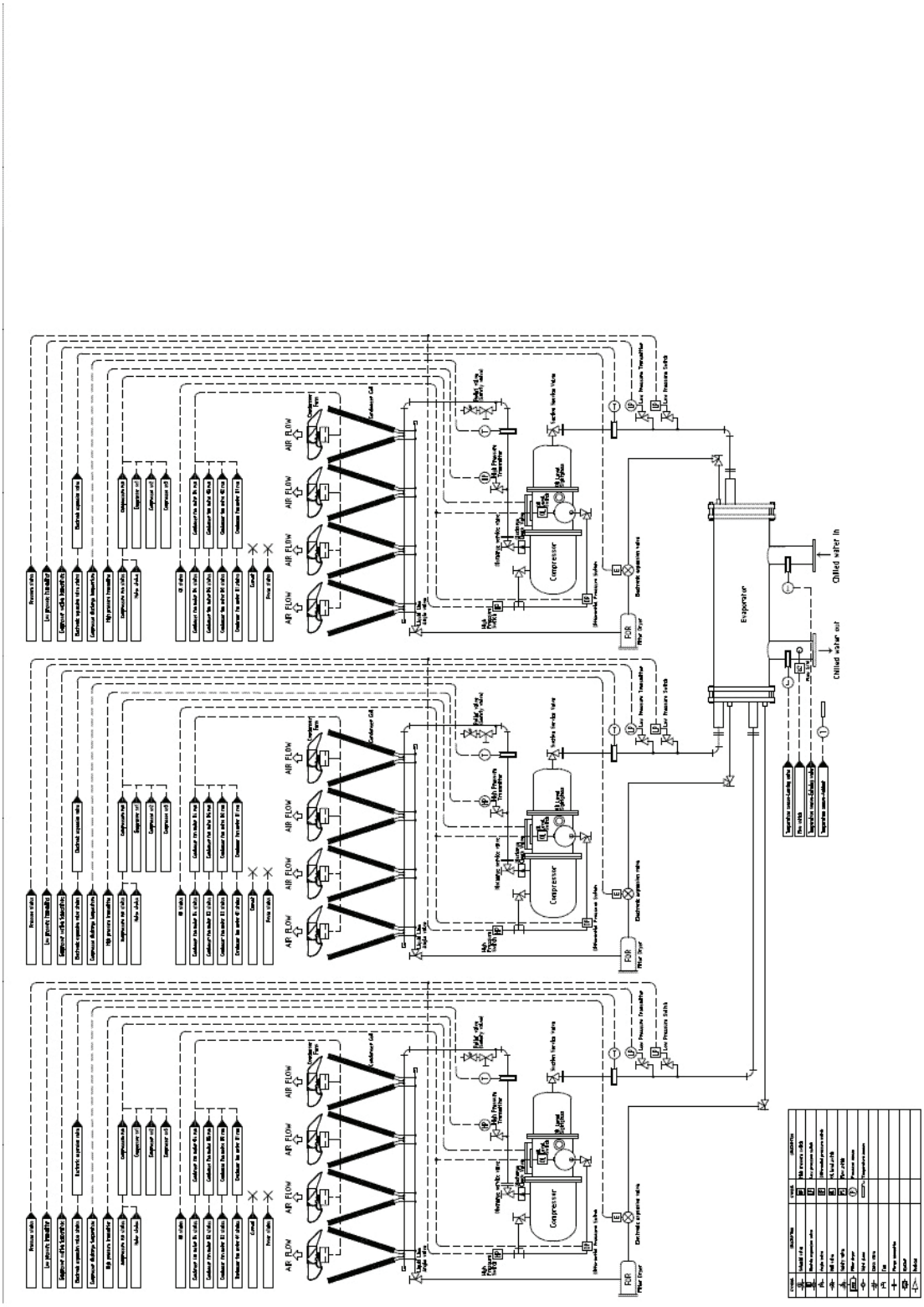


Cycle Diagram(2COMP)

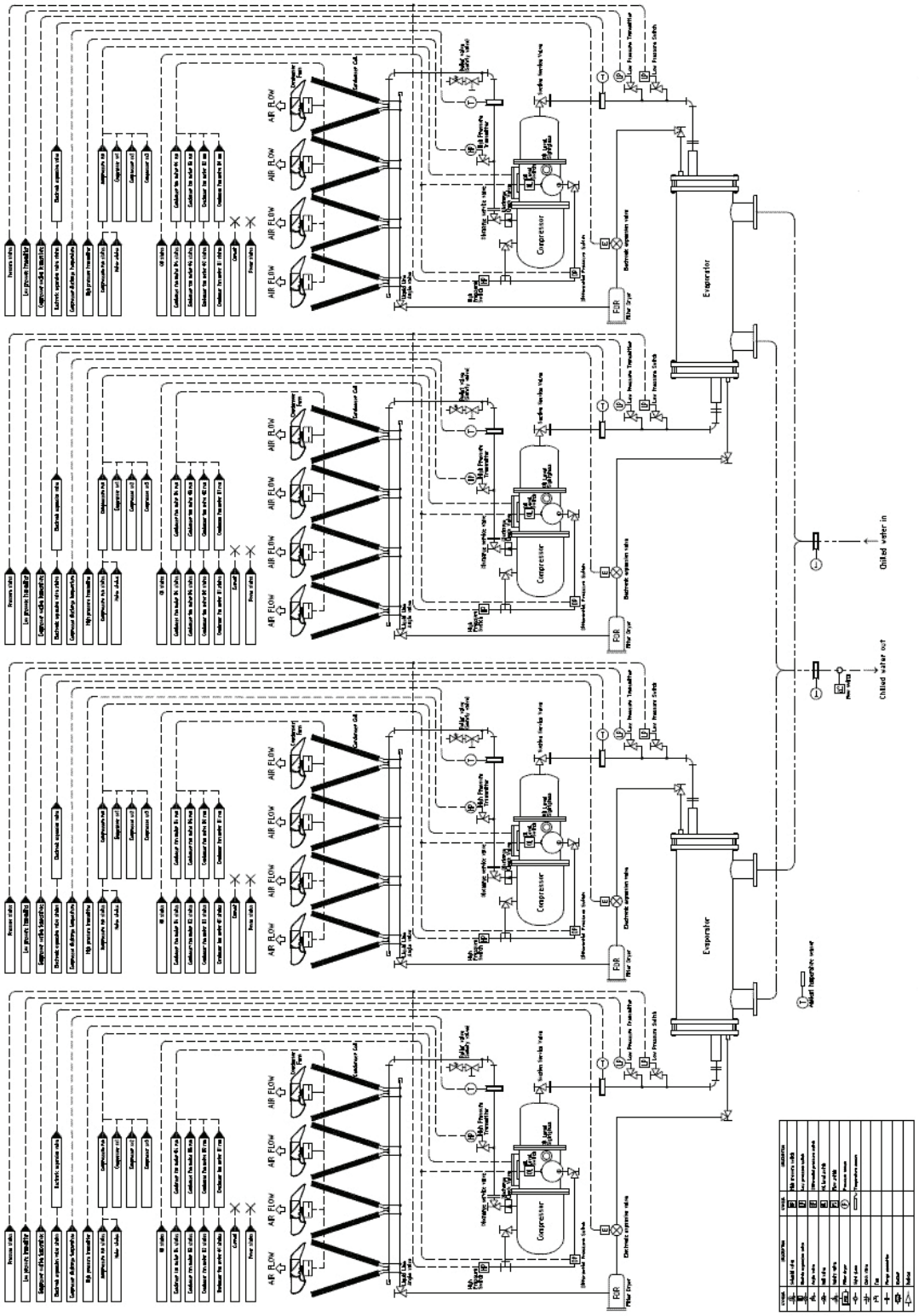


ENGLISH

Cycle Diagram(3COMP)



Cycle Diagram(1COMP)



Checklist for installation, and operation

1. Project information

Contents	Description
PJT name	
Address	
Installing contractor	
Sales office	
Start-up performer	

2. Model information

Contents	Description
Unit	Model: Serial:
Compressor A	Model: Serial:
Compressor B	Serial:

3. PRELIMINARY EQUIPMENT CHECK

Contents	Check	
Is there any physical damage?	Yes	No
→ If yes, where?		
Will this prevent start-up.	Yes	No
All screws and bolts are tight.	Yes	No
Power supply agrees with the unit nameplate.	Yes	No
Electrical power wiring is installed properly.	Yes	No
Unit is properly grounded.	Yes	No
Electrical circuit protection has been sized and installed properly.	Yes	No
All terminals are tight.	Yes	No
All Plug assemblies are tight.	Yes	No
Oil heaters energized for 8 hours before start-up.	Yes	No
Relief valve vents piping per local codes.	Yes	No

4. Chilled Water System Check

Contents	Check	
All chilled water valves are open.	Yes	No
All piping is connected properly.	Yes	No
Drain pipe is not clogged.	Yes	No
There is no leakage.	Yes	No
All air has been purged from the system.	Yes	No
Chilled water pump is operating with the correct rotation.	Yes	No
Chilled water pump starter interlocked with chiller.	Yes	No
Chilled water flow switch is operational.	Yes	No
Inlet piping to cooler includes strainer.	Yes	No

5. START-UP & OPERATION

Contents	Check	
All refrigerant line service valves are open, (discharge, suction, economizer, oil line part...)	Yes	No
There is leakage of refrigerant. (Comp, Condenser, Economizer, Cooler...)	Yes	No
Voltage at terminal block is within 10%	Yes	No
Voltage imbalance is within 2%	Yes	No
There is no abnormal noise or vibration	Yes	No
Alarm is not generated, and the unit operates normally.	Yes	No
Compressor capacity	%	
Ambient air temperature	C	
Chilled water inlet temperature	C	
Chilled water inlet temperature	C	
Brine concentration	%	
Cooler pressure drop	psig	
Chilled water flow rate	Gpm(l/s)	
Refrigerant high pressure	psig	
Refrigerant low pressure	psig	
Additional refrigerant charge	lbs	
Additional oil charge	lbs	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