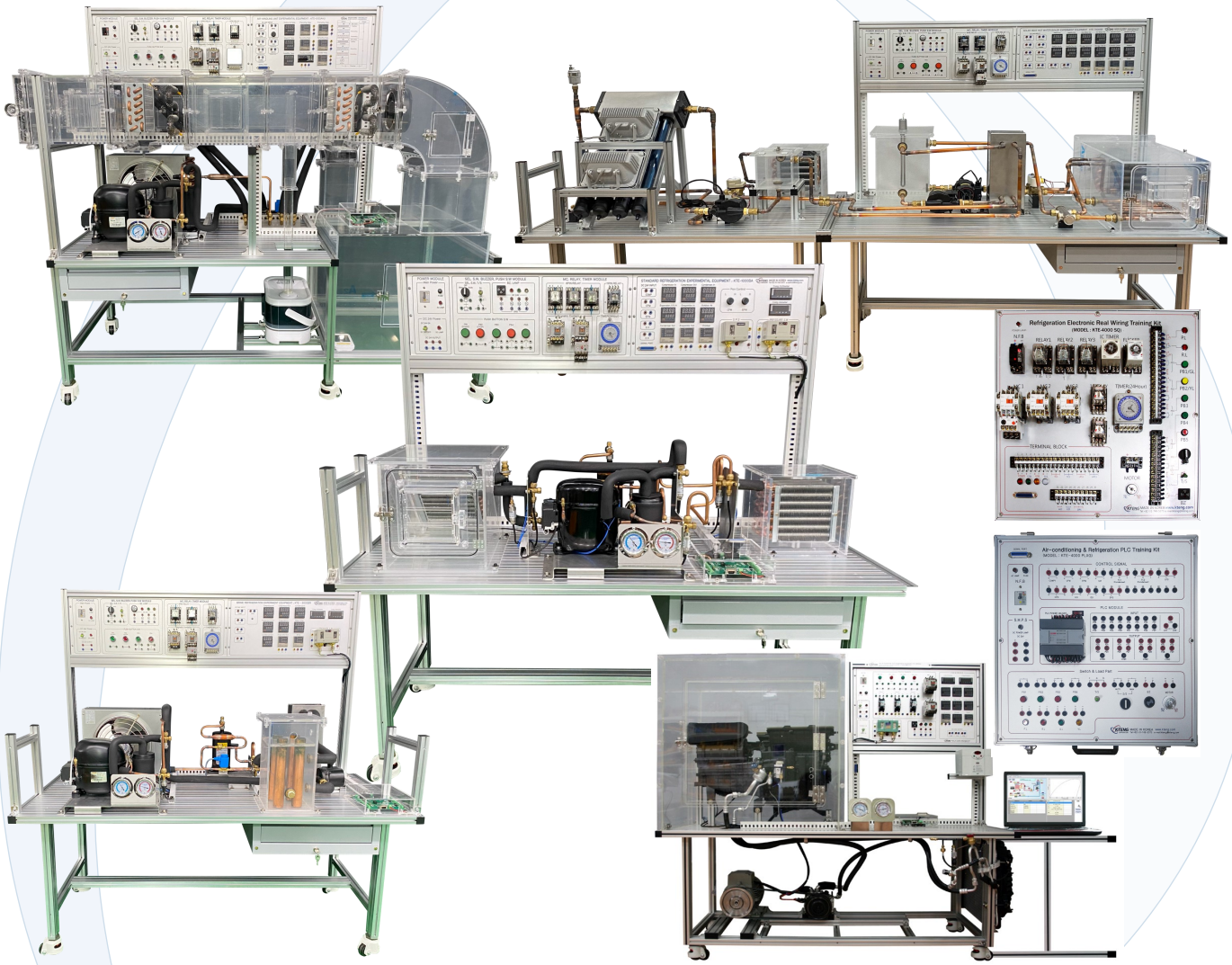
Air-conditioning Refrigeration Facilities' Perservation, Control and Measurement Experimental Equipment Catalog



Air Conditioning Refrigeration, Boiler, Solar, Geothermal Modular AI system

Contacts QR

New & Renewable Energy Technology

Refrigeration & Air-conditioning Energy Saving Technology

https://www.kteng.co.kr/

KTENG CORPORATION

H.P : +1 971 430 1410
Email : ktengusa@kteng.co.kr

1. Educational Experiment Detail Information

- ☑ **ER01 Operation of temperature and pressure control circuit**
- ☑ **ER02 Cooling, Refrigeration system measurement analysis and automatic control practice operation**
- ☑ **ER03 Heat pump system measurement analysis and automatic control practice operation**
- ☑ **ER04 Evaporation Pressure Parallel Control system measurement analysis and automatic control practice operation**
- ☑ **ER05 Binary refrigeration system measurement analysis and automatic control practice operation**
- ☑ **ER06 AHU(Air Handling Unit) system measurement analysis and automatic control practice operation**
- ☑ **ER07 Geothermal heat pump system measurement analysis and automatic control practice operation**
- ☑ **ER08 Solar heat hot water boiler system measurement analysis and automatic control practice operation**
- ☑ **ER09 Freezer Configuration Job Training**

Educational Experiment Performance

It helps to understand the basic principles of overall system and to improve practical skills through Automatic Control, Schematic configuration & Sequence Schematic preparation, temperature, Pressure data Measurement & storage, P-h chart plotting & Graph Analysis using Air Conditioning System, Standard Refrigeration Equipment System, Experiment Equipment.

In addition, it helps to improve the practical skills and the skills to check & repair the system required by Air Conditioning Refrigeration Industry by directly designing and operating the refrigeration system resulting in becoming equipped with the substantial practical skills to directly applicable to the field.

Applicable Educational Institution

- University of Science & Engineering: Air Conditioning, Refrigeration System Performance Experiment & Analysis, Design skills practical skills training
- Korea Polytechnic University & Colleges: Educational System Build
- Career College, Technical High School: Field Practical Performance
- Overseas P/J : Order type education

2. Advanced Education & Operation profile (Textbook provided)

◎ KTE-ER01 Operation of temperature and pressure control circuit

01. Temperature switch Sequence Circuit configuration operation
02. Temperature switch PLC programming configuration operation
03. Pressure switch Sequence Circuit configuration operation
04. Pressure switch PLC programming configuration operation

◎ KTE-ER02 Cooling, Refrigeration system measurement analysis and automatic control practice operation

01. Standard Refrigeration System Measurement and Analysis Using Software
02. Performance Measurement and Analysis of a Standard Refrigeration System According to the transition of condensation temperature
03. Performance Measurement and Analysis of a Standard Refrigeration System According to the transition of evaporation temperature
04. Temperature control Sequence Circuit of Standard Refrigeration System configuration operation
05. Temperature control PLC programming of Standard Refrigeration System configuration operation
06. Practicing to configure and operation Pump Down Sequence Control Circuit of Standard Refrigeration System
07. Practicing to configure and operation Pump Down PLC programming of Standard Refrigeration System

◎ KTE-ER03 Heat pump system measurement analysis and automatic control practice operation

01. Heat pump System Measurement and Analysis Using Software
02. Cooling performance Measurement and Analysis of a Heat pump System
03. Heating performance Measurement and Analysis of a Heat pump System
04. Configuration Sequence Circuit reversing refrigerant flow direction for Heat pump system and operation
05. Configuration Manual control Sequence Circuit for Heat pump system and operation
06. Configuration Manual control PLC programming for Heat pump system and operation
07. Configuration Automatic control Sequence Circuit for Heat pump system and operation
08. Configuration Automatic control PLC programming for Heat pump system and operation

2. Advanced Education & Operation profile (Textbook provided)

◎ KTE-ER04 Evaporation Pressure Parallel Control system measurement analysis and automatic control practice operation

01. Measurement and Analysis a Evaporation pressure parallel control Refrigeration system Using Software
02. Measurement and Analysis of a Evaporation pressure parallel control system
03. Configuration Manual control Sequence Circuit for Evaporation pressure parallel control system and operation
04. Configuration Manual control PLC programming for Evaporation pressure parallel control system and operation
05. Configuration Temperature Automatic control Sequence Circuit for Evaporation pressure parallel control system and operation
06. Configuration Temperature Automatic control PLC programming for Evaporation pressure parallel control system and operation
07. Configuration low temperature low pressure series circuit Sequence Circuit for Evaporation pressure parallel control system and operation
08. Configuration low temperature low pressure series circuit PLC programming for Evaporation pressure parallel control system and operation
09. Configuration pump down Sequence Control Circuit for Evaporation pressure parallel control system and operation
10. Configuration pump down Control Circuit PLC programming for Evaporation pressure parallel control system and operation
11. Configuration compulsory pump down Sequence Control Circuit for Evaporation pressure parallel control system and operation
12. Configuration compulsory pump down PLC programming for Evaporation pressure parallel control system and operation

◎ KTE-ER05 Binary refrigeration system measurement analysis and automatic control practice operation

01. Measurement and Analysis a Binary refrigeration system Using Software
02. Performance measurement and Analysis a Binary refrigeration system
03. Configuration Manual Sequence control circuit for Binary refrigeration system and operation
04. Operation Manual control PLC programming for Binary refrigeration system and operation
05. Configuration temperature automatic control Sequence circuit at No.1 cycle stage of Binary refrigeration system
06. Configuration temperature automatic control Sequence circuit at No.2 cycle stage of Binary refrigeration system

2. Advanced Education & Operation profile (Textbook provided)

◎ KTE-ER06 AHU(Air Handling Unit) system measurement analysis and automatic control practice operation

01. Psychrometric Chart drawing Using Software
02. Measurement analysis pre-cooling and re-cooling of Air handling system
03. Measurement analysis Heating and humidification of Air handling system
04. Configuration temperature control sequence circuit for mixture and heating between returned air and outside air of air handling system and operation
05. Configuration temperature control sequence circuit for mixture and cooling between returned air and outside air of air handling system and operation
06. Configuration temperature control sequence circuit for mixture and humidification between outside air and returned air of air handling system and operation
07. Configuration reheating sequence circuit for mixture and preheating, cleaning between outside air and returned air of air handling system and operation
08. Configuration sequence circuit for pre-cooling of outside air and mixture of returned air and then cleaning and heating of air handling system and operation
09. Configuration sequence circuit for pre-cooling of outside air and mixture of returned air and then re-cooling of air handling system and operation

◎ KTE-ER07 Geothermal heat pump system measurement analysis and automatic control practice operation

01. Measurement and analysis a Geothermal heat pump system Using Software
02. Performance analysis and diagnosis of Geothermal heat pump system
03. Configuration a Self-holding STOP priority circuit heating and cooling sequence control circuit of Geothermal heat pump system and operation
04. Configuration temperature Automatic control cooling and heating sequence control circuit of Geothermal heat pump system and operation
05. Configuration low pressure Automatic control cooling and heating sequence control circuit of Geothermal heat pump system and operation
06. Configuration Manual control cooling and heating sequence control circuit of Geothermal heat pump system and operation
07. Configuration cooling and heating temperature Automatic control sequence control circuit of Geothermal heat pump system and operation
08. Configuration cooling and heating temperature, pressure Automatic control sequence control circuit of Geothermal heat pump system and operation

2. Advanced Education & Operation profile (Textbook provided)

◎ KTE-ER08 Solar heat hot water boiler system measurement analysis and automatic control practice operation

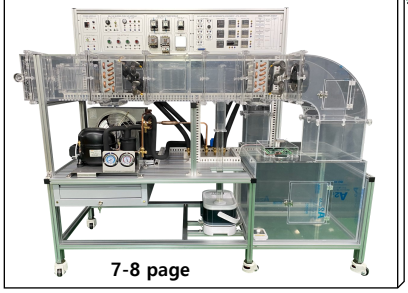
01. Measurement and analysis a Solar heat hot water boiler system Using Software
02. Configuration a Solar heat hot water boiler system and performance measurement and analysis
03. Configuration a temperature control heat storage tank sequence control circuit of Solar heat hot water boiler system and operation
04. Configuration the difference control heat collecting circulation pump sequence control circuit of Solar heat hot water boiler system and operation
05. Configuration the heat Storage/Emission Convertible Circuit Using 3-Way Valve of Solar heat hot water boiler system and operation
06. Configuration the charging of heat collecting material sequence control circuit of Solar heat hot water boiler system and operation
07. Configuration the heat transfer medium of heat storage tank charging sequence control circuit of Solar heat hot water boiler system and operation
08. Configuration a auxiliary heater sequence control circuit of Solar heat hot water boiler system and operation

◎ KTE-ER09 Freezer Configuration Job Training

01. Cooper pipe cutting & bending work
02. Flaring & Tube expanding work
03. Refrigeration system piping & fitting work
04. Refrigeration system refrigerant charging work
05. Condensing unit configuration
06. Cold room configuration
07. Small refrigeration unit configuration
08. Air-conditioning installation, movement work

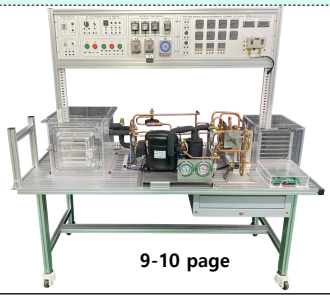
3. Education Equipment Contents

Air Handling Unit [KTE-1000AHU]



7-8 page

4-Way Reverse Valve Heat Pump [KTE-3000HD]

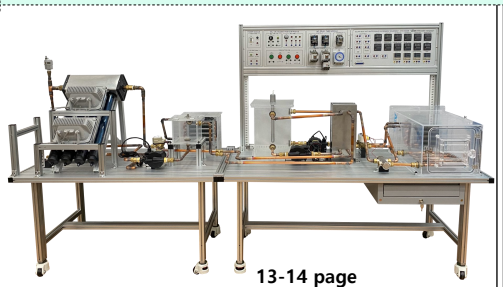


9-10 page

Geothermal Heat Pump [KTE-7000GH]

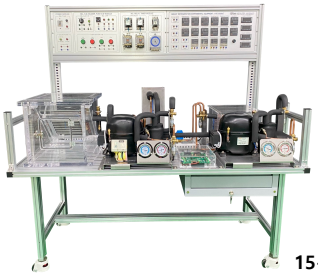
11-12 page

Solar Water Heating & Boiler [KTE-7000SB]



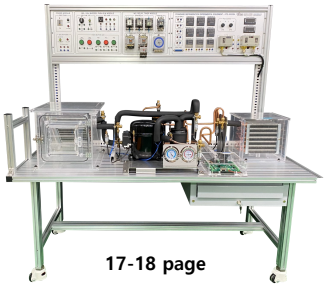
13-14 page

Binary Refrigeration [KTE-5000LT]



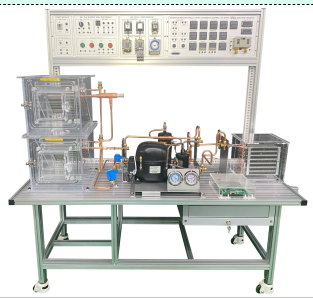
15-16 page

Standard Refrigeration [KTE-1000BA]



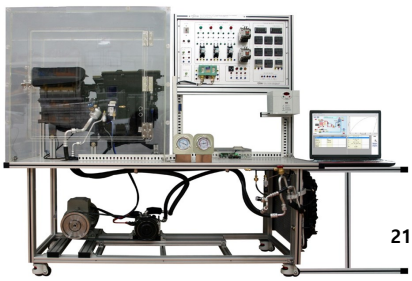
17-18 page

Evaporation Pressure Parallel Control [KTE-2000EP]



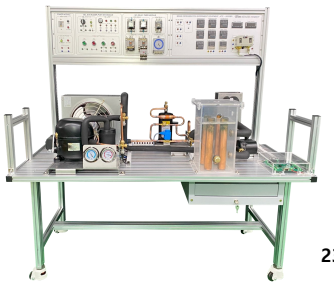
19-20 page

Vehicle Refrigeration [KTE-9000AU]



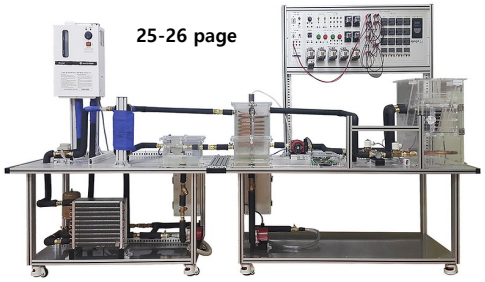
21-22 page

Brine Refrigeration Trainer [KTE-6000BR]



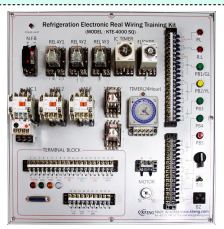
23-24 page

Boiler Control [KTE-1000BO]



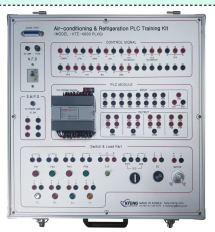
25-26 page

Real Wiring Refrigeration Automatic Control [KTE-4000SQ]



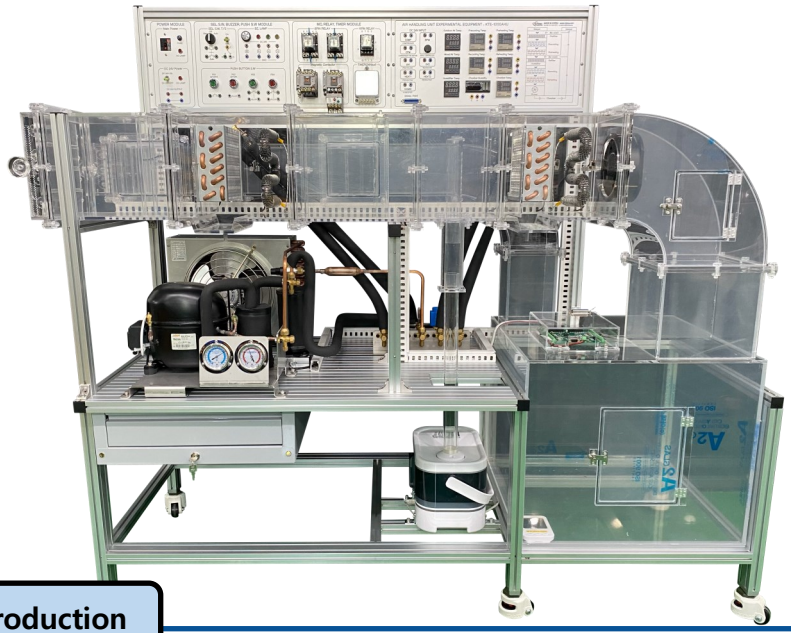
27 page

Air Conditioning Refrigeration PLC Control [KTE-4000PL]



28 page

Air Handling Unit Experiment Equipment [KTE-1000AHU]



Equipment Introduction

- ☑ The AI air conditioning practice equipment can operate type 1 air conditioning (cooling, heating, humidification, blowing), type 2 air conditioning (pre-cooling, pre-heating, humidification, re-cooling, re-heating, and blowing). It can be operated by configuring a temperature and humidity control circuit in the actual control panel. Temperature and humidity sensors are attached to perform the AI function so that the measured data satisfies the AI function on the PC.
- ☑ Temperature and humidity sensors are attached to the entrance and exit of all heat exchangers to perform the AI function, and the measured data are configured to satisfy the AI function on the PC.
- ☑ Heating/cooling, humidification, and dehumidification experiments are possible, indoor temperature and humidity changes according to changes in blower air volume, and pressure loss measurement experiments of filters and coils are possible. Temperature and humidity sensors are attached to perform the AI function, and the measured data are configured to satisfy the AI function on the PC.
- ☑ During pre-cooling, pre-heating, humidification, humidification, re-cooling, re-humidification, re-humidification, and blowing operations, wet air leads can be analyzed manually, automatically, and temperature and humidity sensors are attached to perform the AI function, so the measured data are configured to satisfy the AI function on the PC.
- ☑ It provides a DAQ program that can measure the amount of heat exchange at temperature, humidity, enthalpy, and each location in real time, store it in a Microsoft Excel program, and graph and analyze each data.
- ☑ AI air conditioning practice equipment can measure, calculate, and adjust the temperature, humidity, enthalpy and heat exchange at each location in real time with big data while driving, and store them in Microsoft Excel programming. It includes a DAQ program with AI capabilities that can graph and analyze each big data.

Education Contents

01. Psychrometric Chart drawing using software
02. Measurement analysis pre-cooling and re-cooling of Air handling system
03. Measurement analysis heating and humidification of Air handling system
04. Configuration temperature control sequence circuit for mixture and heating between RA and OA of air handling system and operation
05. Configuration temperature control sequence circuit for mixture and cooling between RA and OA of air handling system and operation
06. Configuration temperature control sequence circuit for mixture and humidification between OA and RA of air handling system and operation
07. Configuration reheating sequence circuit for mixture and preheating, cleaning between OA and RA of air handling system and operation
08. Configuration sequence circuit for pre-cooling of OA and mixture of RA and then cleaning and heating of air handling system and operation
09. Configuration sequence circuit for pre-cooling of OA and mixture of RA and then re-cooling of air handling system and operation

Equipment Characteristics

◈ Cycle composition :

[Fresh air → mixed air → filter 1 → pre heater → pre cooler → humidifier → filter 2 → re heater → re cooler → blower → room → return air]

◈ Being practicable to operate on manual, temperature and humidity control with connecting by sequence and drawing a psychometric chart, displaying by digital sign data of temperature and pressure

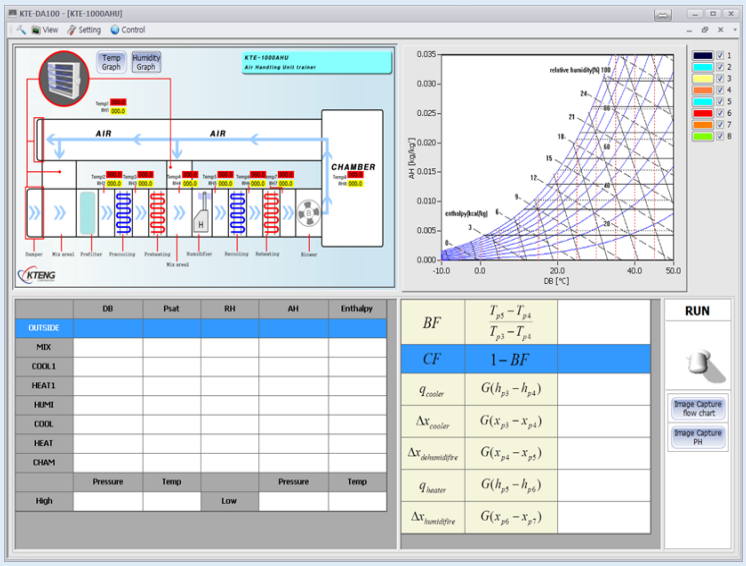
◈ From attached K-type thermocouple and electronic humidity sensor for AI communication. Therefore, it can be automatically stored using Microsoft Excel programming within each section's temperature and humidity.

[Fresh air → mixed air → filter 1 → pre heater → pre cooler → humidifier → filter 2 → re heater → re cooler → blower → room → return air]

◈ Experiment factors

- Cooling & heating capacity of room chamber
- Bypass factor
- Humidification
- Dehumidification
- Psychrometric chart
- Temperature data
- Can be saved on every minute until 1,440 min as excel file after click the "SAVE"

AI Air Conditioning Automatic Measurement Program



Functions

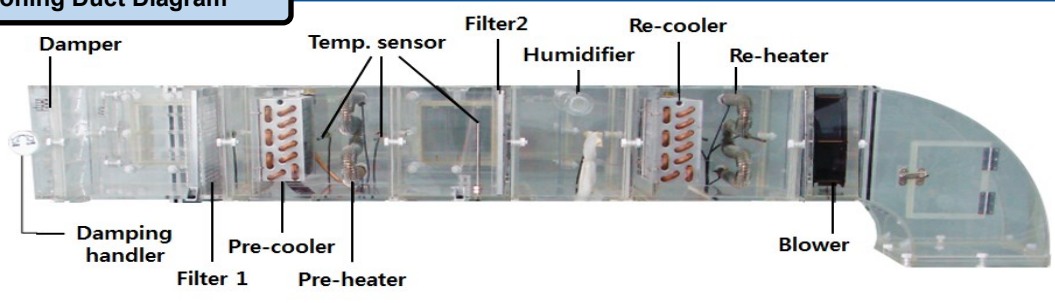
☑ It is possible to monitoring measured temperature and humidity data in real time

☑ The enthalpy data measured in the air conditioning system can be monitored in real time.

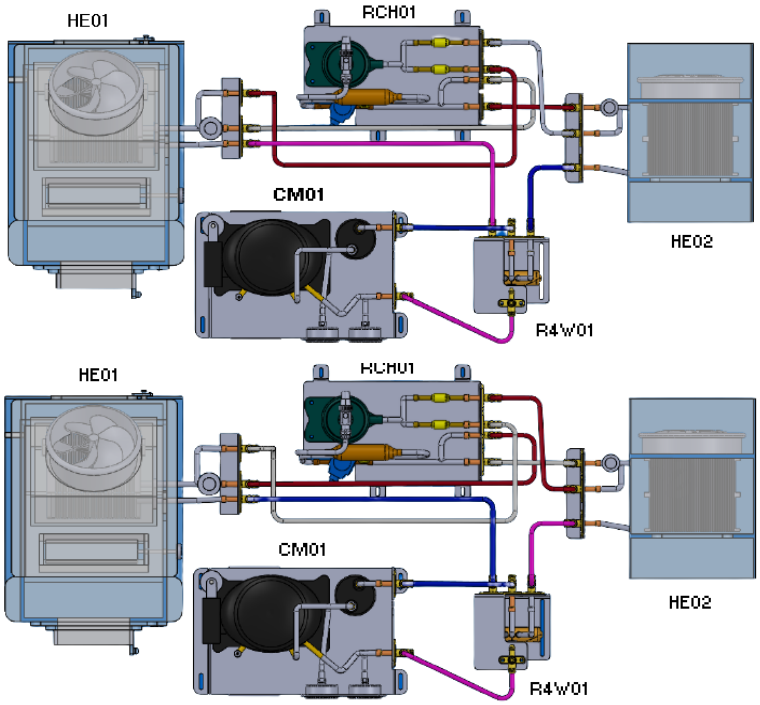
☑ Can be saved on every minute until 1,440 min as excel file after click the "SAVE"

☑ Data on psychrometric charts are displayed in real time monitor by using measured temperature and humidity.

AI Air Conditioning Duct Diagram



4-Way Reverse Valve Heat Pump Experimental Equipment [KTE-3000HD]



Equipment Introduction

- ▶ Refrigerant flow direction switch operation experiment by 4-way valve
- ▶ 4-way valve control heat pump cooling & heating operation characteristic experiment
- ▶ DAQ program supply tools with that temperature, pressure, enthalpy, amount of the exchanged heat in each position can be measured in real time, and then saved by Microsoft Excel, so that saved data can be show and analysis by graph

Equipment Characteristics

◈ Cooling cycle : Compressor → 4 way valve → Heat exchanger 2 → Check valve 2 → Receiver → Filter Dryer → Sight Glass → Solenoid valve → Manual expansion valve → Heat exchanger 1 → Liquid separator → Compressor

◈ Heating cycle : Compressor → 4 way valve → Heat exchanger 1 → Check valve 1 → Receiver → Filter Dryer → Sight Glass → Solenoid valve → Manual expansion valve → Heat exchanger 2 → Liquid separator → Compressor

◈ Being practicable to operate on manual, thermal control or pump down with connecting by sequence control system

◈ Function for specification of refrigerator performance automatic measuring & data acquisition and system monitoring program

◈ Being practicable to measure temperature at each of compressor inlet and outlet, condenser inlet and outlet, expansion valve inlet and outlet, evaporator outlet, inside chamber and outside air using thermocouples of K-type

◈ Measure of pressure : Being practicable to measure within the range of –1 ~ 35 bar at each of compressor inlet and outlet, condenser outlet, expansion valve inlet by pressure sensors which are installed

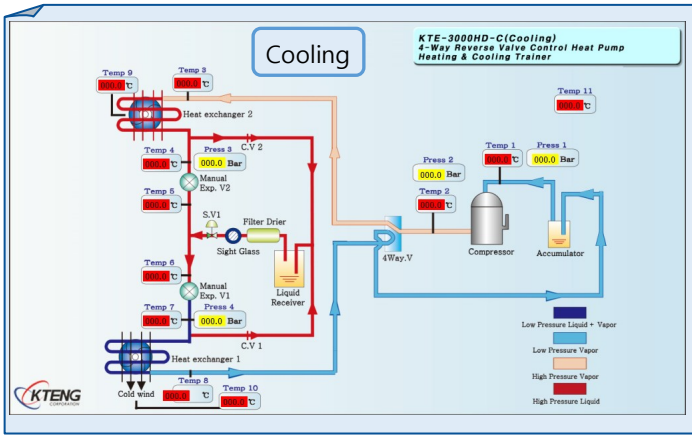
◈ Experiment factors

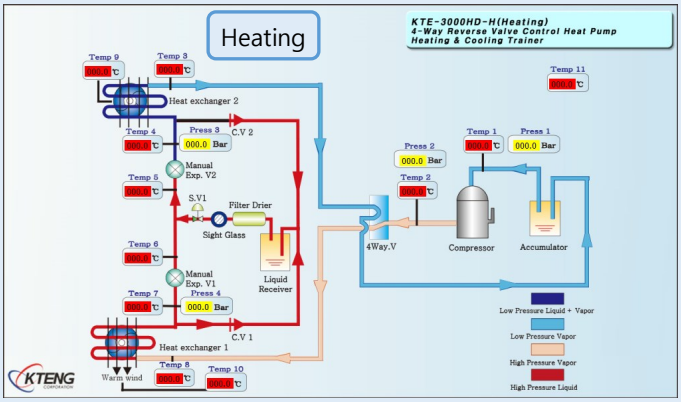
- Refrigeration effect
- Compressor work
- Condensing effect
- Evaporating latent heat
- Amount of flash gas at expansion valve outlet
- Dry ratio and humidity at expansion valve outlet
- Coefficient of performance
- Temperature and Pressure data which are measured
- Being saved on every minute until 1,440min as excel file after click the “SAVE”

Education Contents

01. Heat pump System Measurement and Analysis Using Software
02. Cooling performance measurement and analysis of a Heat pump system
03. Heating performance measurement and analysis of a Heat pump system
04. Configuration sequence circuit reversing refrigerant flow direction for Heat pump system and operation
05. Configuration manual control sequence circuit for Heat pump system and operation

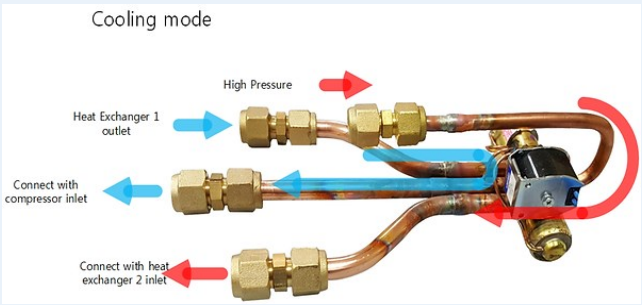
AI 4-Way Reverse Valve Heat Pump Program

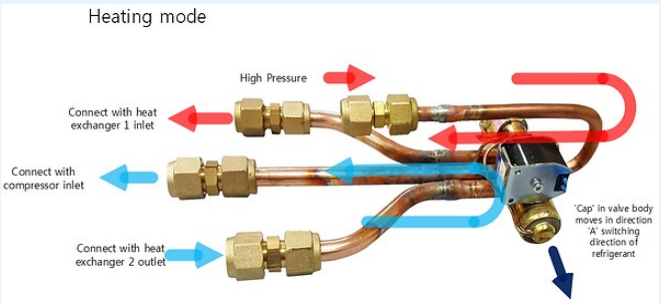




- ☑ It is possible to monitor the temperature and pressure measured by the heat pump system performance in real time.
- ☑ It is possible to monitor enthalpy data measured by the heat pump system in real time.
- ☑ The amount of heat exchange, the amount of compression, the latent heat of evaporation, the amount of flash gas, and the drying degree are automatically calculated and stored.
- ☑ The cooling and heating performance coefficients can be automatically calculated and stored in real-time . using temperature and pressure big data.
- ☑ Temperature, pressure, enthalpy, and all big data can be stored as Excel files every second.
- ☑ it is possible to monitor the mollier chart in real time.

4-Way Reverse Valve Heat Pump Principle of Operation





Cooling Operation

- The valve is not powered during cooling operation, a compressed high-pressure refrigerant is connected to the heat exchanger

Hearing Operation

- Power the valve during heating operation. When power is applied to the valve, the cap inside the body moves in the direction of A, and changes the direction of refrigerant flow.

- The compressed high-pressure refrigerant is connected to the heat exchanger on the first side to deliver high temperature.

Geothermal Heat Pump Experiment Equipment [KTE-7000GH]

Equipment Introduction

▶ This equipment helps to understand the efficiency of burying system of heat exchanger due to Geothermal environment being configured by type of soil heat exchanger, core component of Geothermal system.

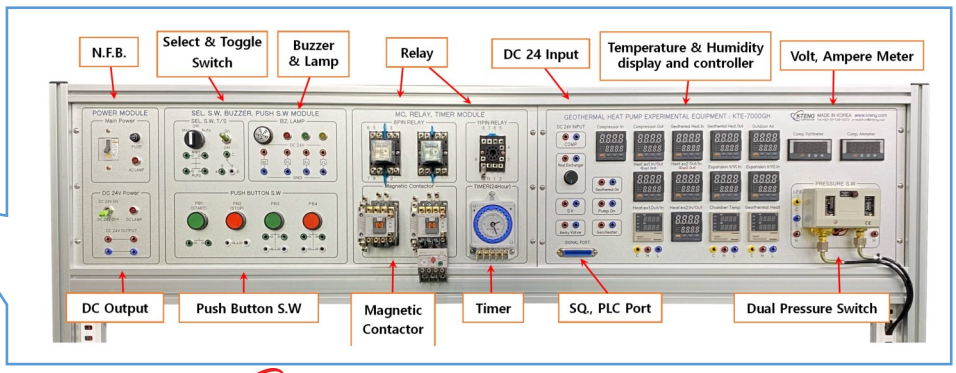
▶ This equipment generates heat energy by vapor-condensing coolant while maintaining relatively constant temperature all the year round in found circulating circuit.

▶ This equipment is possible to experience the conversion of hearing and cooling operations by using 4-way valve

Education Contents

01. Measurement and analysis a Geothermal heat pump system using software
02. Performance analysis and diagnosis of Geothermal heat pump system
03. Configuration a self-holding STOP priority circuit heating and cooling sequence control circuit of Geothermal heat pump system and operation
04. Configuration temperature automatic control cooling and heating sequence control circuit of Geothermal heat pump system and operation
05. Configuration low pressure automatic control cooling and heating sequence control circuit of Geothermal heat pump system and operation
06. Configuration manual control cooling and heating sequence control circuit of Geothermal heat pump system and operation
07. Configuration cooling and heating temperature automatic control sequence control circuit of Geothermal heat pump system and operation
08. Configuration cooling and heating temperature, pressure automatic control sequence control circuit of Geothermal heat pump system and operation

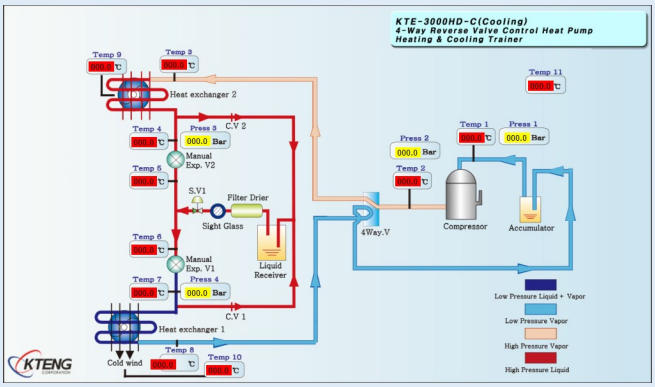
AI-7000GH Control Panel

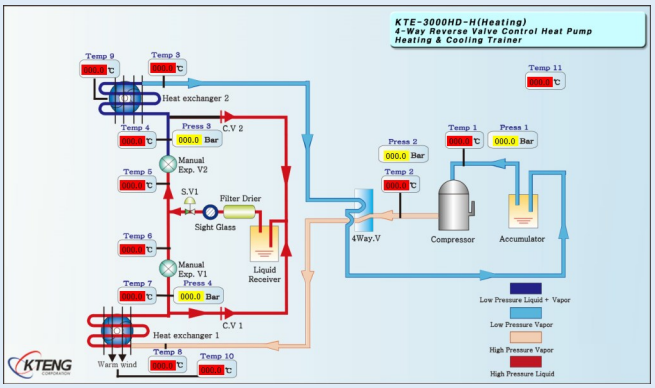


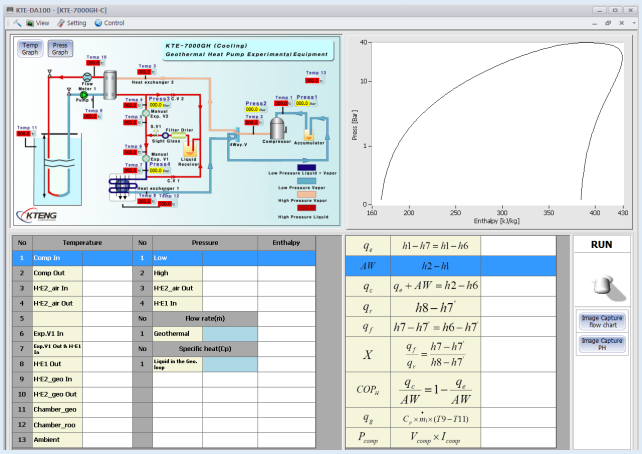
Equipment Characteristics

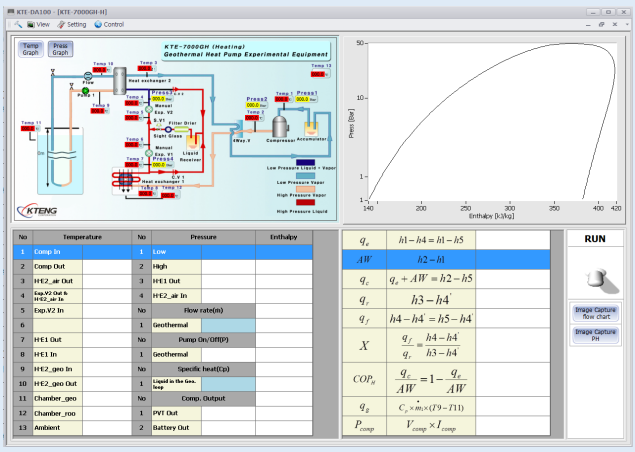
- Test and practice of the 4-way valve control sequence circuit
- Test on forced geothermal heat pump using artificial ground
- Education on the structure and principle of heat pump using geothermal
- Cooling cycle : Compressor → Reversing Valve (4 way valve) → Geothermal system → Check valve 2 → Receiver → Filter dryer → Sight glass → Solenoid Valve → Manual expansion valve 1 → Heat exchanger 1 → Accumulator → Compressor
- Heating cycle : Compressor → Reversing Valve (4 way valve) → Heat exchanger 1 → Check valve 1 → Receiver → Filter dryer → Sight glass → Solenoid Valve → Manual expansion valve 2 → Geothermal system → Accumulator → Compressor
- Being practicable to operate on manual, temperature and humidity control with connecting by sequence and drawing a psychometric chart, displaying by digital sign data of temperature and pressure
- Saving of data in every sec by excel file on PC
- Experiment factors
  - Refrigeration effect
  - Compressor work
  - Condensing effect
  - Evaporating latent heat
  - Amount of flash gas at expansion valve outlet
  - Dry ratio and humidity at expansion valve outlet
  - Temperature and Pressure data which are measured
  - Coefficient of Performance
  - Being saved on every minute until 1,440 min as excel file after click the “SAVE”

Geothermal Heat Pump Equipment AI Program

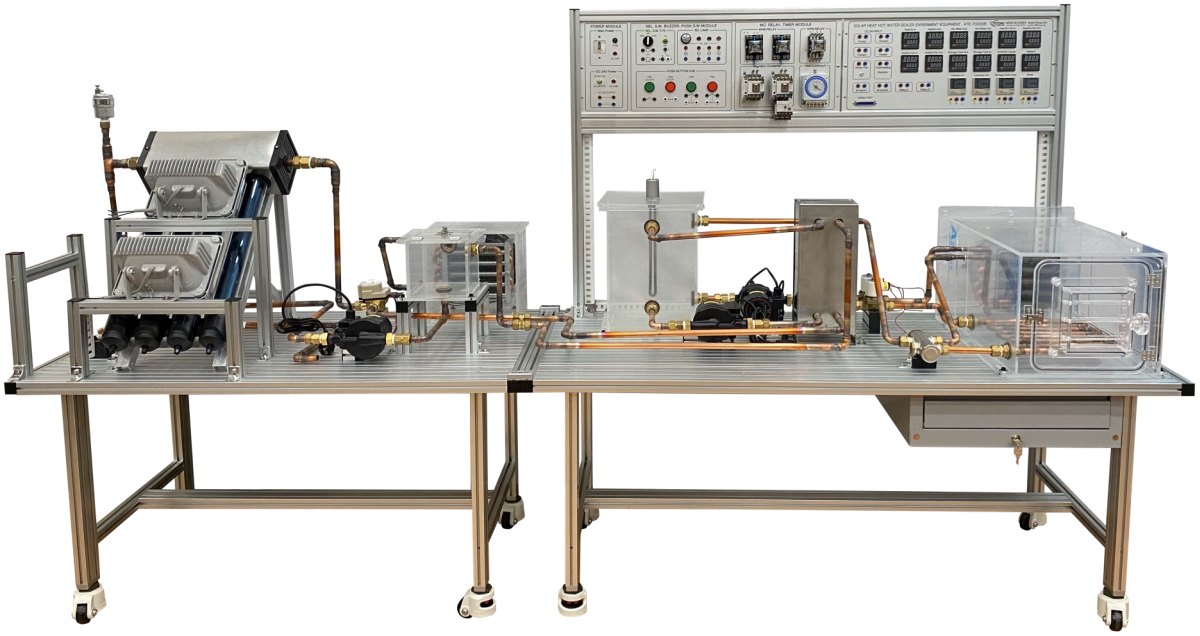








Solar Heat Hot Water Boiler Experiment Equipment [KTE-7000SB]



Equipment Introduction

- ▶ Understanding of the solar heat collector, storage and control of heat, comparative test and practice after calculating heat by each load through installation of three types of loads
- ▶ Test on the performance of solar heat boiler using artificial and natural suns
- ▶ Understanding of the structure and operating principles of solar heat boiler
- ▶ Test and practice on the operation by collecting natural sunlight after installation of solar heat collector in the outside
- ▶ Education on system control by controlling the system using the control system

Equipment Characteristics

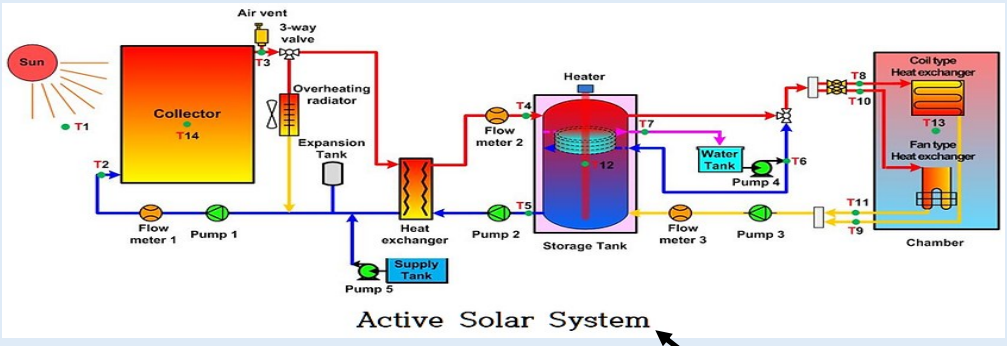
- ◈ It is possible to have radiation energy experiment using an artificial (halogen) or natural solar lamp
- ◈ Calculating the rate of heat collection and measure efficient
- ◈ The load is disassembling type, It is easy to using other load by connecting main system
- ◈ Utilizing other load with boiler by separating each part. (Load & Boiler)
- ◈ Measuring temperature at each position of solar energy collector, heat storage, load of equipment
- ◈ Monitoring and saving of data during performance test
- ◈ Understand on the working principle of solar heating water boiler system
- ◈ Automatic control practice of solar heat system
- ◈ Practice for load rate calculation of various heat exchangers

Education Contents

01. Measurement and analysis a solar heat hot water boiler system using software
02. Configuration a solar heat hot water boiler system and performance measurement and analysis
03. Configuration a temperature control heat storage tank sequence control circuit of solar heat hot water boiler system and operation
04. Configuration the difference control heat collecting circulation pump sequence control circuit of solar heat hot water boiler system and operation
05. Configuration the heat storage/emission convertible circuit using 3-way valve of solar heat hot water boiler system and operation
06. Configuration the changing of heat collecting material sequence control circuit of solar heat hot water boiler system and operation
07. Configuration the heat transfer medium of heat storage tank charging sequence control circuit of solar heat hot water boiler system and operation
08. Configuration a auxiliary heater sequence control circuit of solar heat hot water boiler system and operation

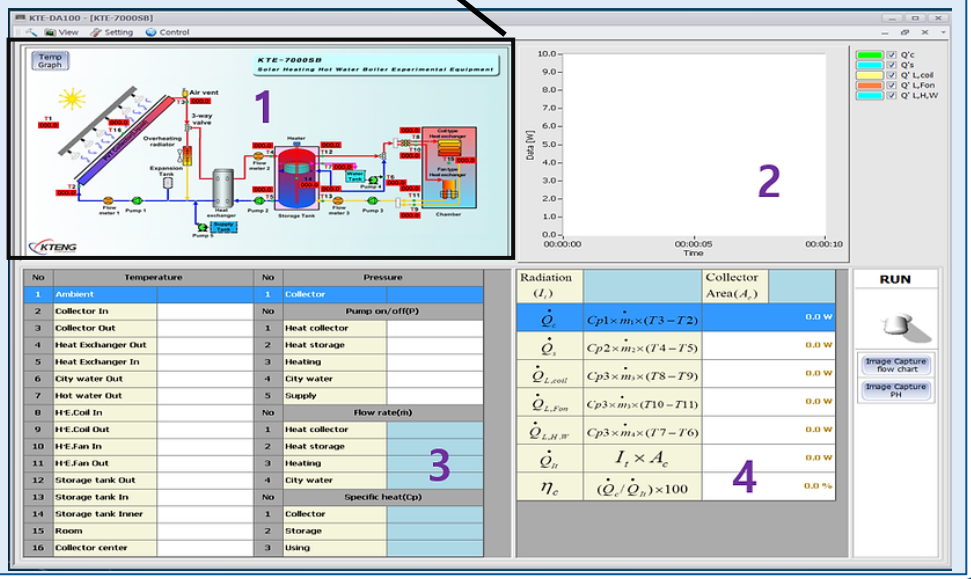
Solar Heat Hot Water Boiler Equipment AI Program

- ☑ Real time monitoring temperature of collector and heat storage and load in PC which was installed exclusive software.
- ☑ In case of solar heating system, it should fill out heat capacity (Cp) manually and be applied calculate formula.
- ☑ It used to water, water and propylene glycol (PG), water and ethylene glycol (EG) as heat materials.
- ☑ Select the data acquisition interval in software.
- ☑ Drawing the temperature and calorie value by graph.
- ☑ Upon start, it setting the excel file name and save the data to prevent the data remove by unexpected conditions such as black out or program shut down.
- ☑ Battery consumption circumstance real time monitoring function.
- ☑ Including the flow diagram to help understanding of equipment.
- ☑ Saving the flow diagram by JPG file.
- ☑ Make a graph using the real time data which was user select.

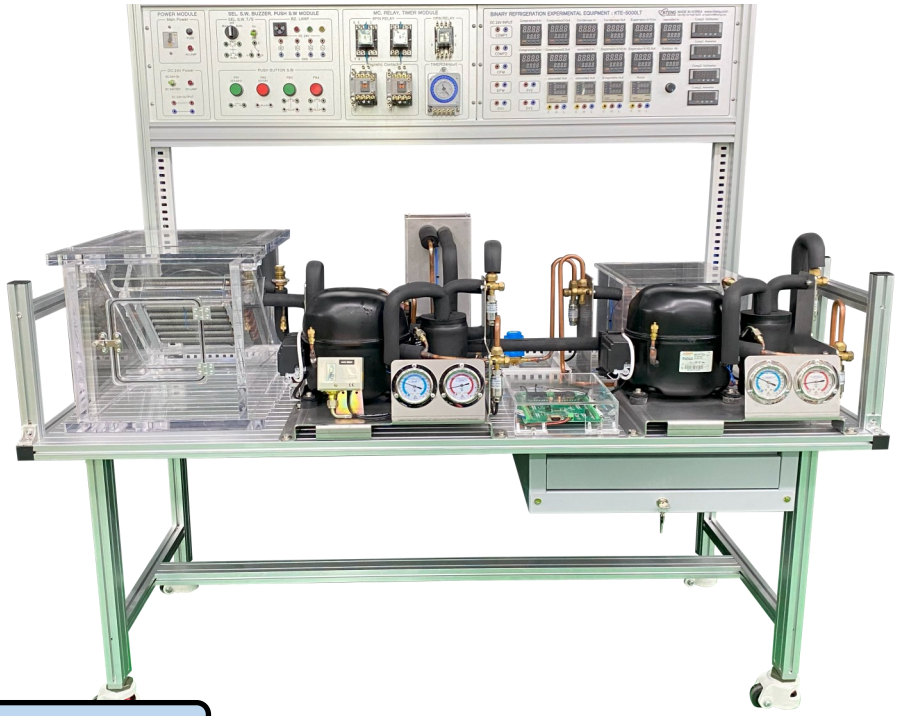


Composition of main user interface

(1) Schematic diagram of equipment.
(2) p-h diagram.
(3) Data table for temperature, pressure and enthalpy.
(4) Sort of Calculation value like as COP, cooling capacity



Binary Refrigeration Experimental Equipment [KTE-5000LT]



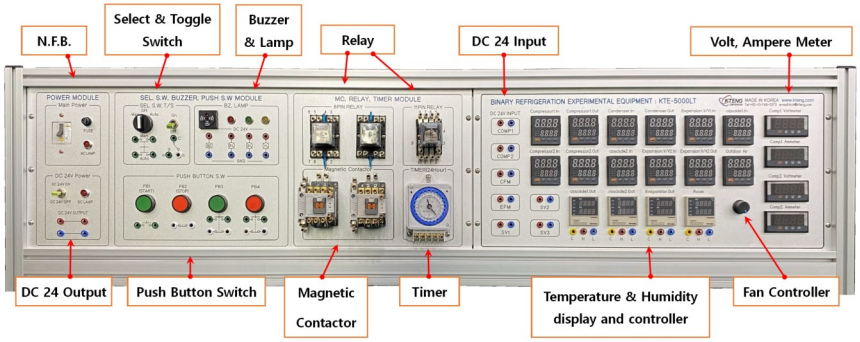
Equipment Introduction

- ▶ Operation characteristic experiment by 2-stage side refrigerant type (R-404a, R-23).
- ▶ Drawing Pressure-Enthalpy diagram with excel file data by using refrigeration utilities.
- ▶ Operating test about variation of evaporating pressure by using the evaporator.
- ▶ DAQ program supply tools with that temperature, pressure, enthalpy, amount of the exchanged heat in each position can be measured in real time, and then saved by Microsoft Excel, so that saved data can be show and analysis by graph.

Education Contents

01. Measurement and Analysis a Binary refrigeration system using software
02. Performance measurement and analysis a Binary refrigeration system
03. Configuration manual sequence control circuit for Binary refrigeration system and operation
04. Operation manual control PLC programming for Binary refrigeration system and operation
05. Configuration temperature automatic control sequence circuit at No.1 cycle stage of Binary refrigeration system
06. Configuration temperature automatic control sequence circuit at No.2 cycle stage of Binary refrigeration system

Control panel device component



Equipment Characteristics

◈ High temperature cycle : Compressor 1 → Condenser → Filter Dryer → Sight Glass → Solenoid Valve 1 → Manual Expansion Valve 1 → Cascade Evaporator → Compressor 1

◈ Low temperature cycle : Compressor 2 → Cascade Condenser → Filter Dryer → Sight Glass → Solenoid Valve 2 → Manual Expansion Valve 2 → Evaporator → Compressor 2

◈ Being practicable to operate on manual, thermal control or pump down with connecting by sequence or PLC control system

◈ Function for specification of refrigerator performance automatic measuring & data acquisition and system monitoring program

◈ Being practicable to measure temperature at each of compressor inlet and outlet, condenser inlet and outlet, expansion valve inlet and outlet, evaporator outlet, inside chamber and outside air using thermocouples of K-type

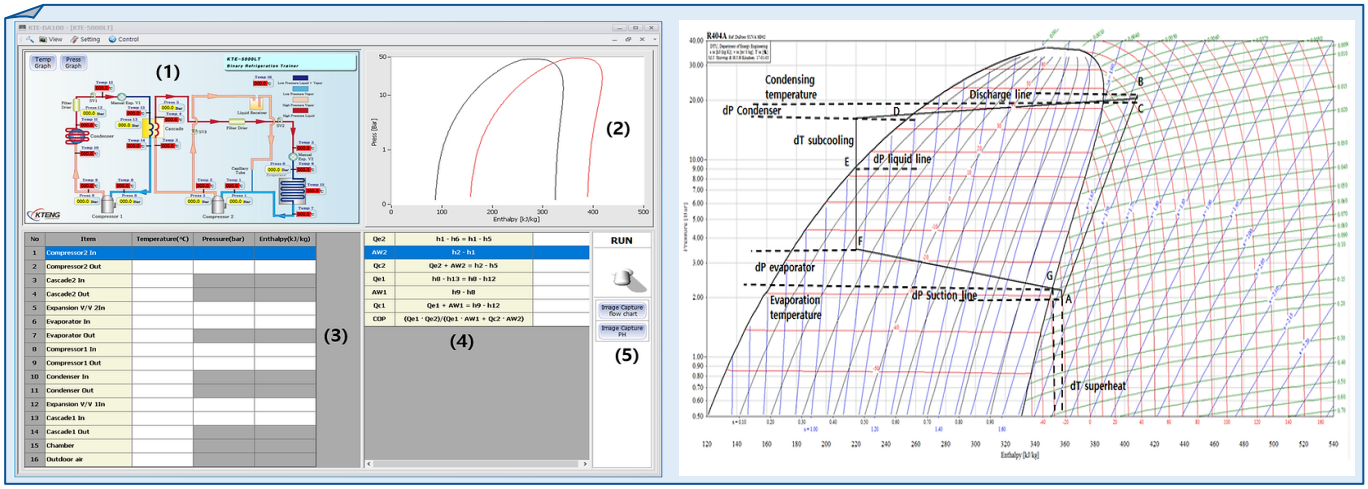
◈ Measure of pressure : Being practicable to measure within the range of –1 ~ 35 bar at each of compressor inlet and outlet, condenser outlet, expansion valve inlet by pressure sensors which are installed

◈ Experiment factors

- Refrigeration effect
- Condensing effect
- Amount of flash gas at expansion valve outlet
- Coefficient of Performance
- Compressor work
- Evaporating latent heat
- Dry ratio and humidity at expansion valve outlet
- Temperature and Pressure data which are measured

- Being saved on every minute until 1,440 min as excel file after click the “SAVE”

Binary Refrigeration Equipment AI Program



◈ Composition of main user interface ◈

(1) Schematic diagram of system show Temperature, pressure. (in realtime.)
(2) p-h chart.
(3) Data table for temperature, pressure and enthalpy.
(4) Sort of Calculation value like as COP, cooling capacity and heating capacity.
(5) Start switch and capture button.

◈ Binary Refrigeration Trainer ◈

① Main menu, It is for setting of software or hardware and initialization of resister information
② It is for select flow chart of each refrigeration system
③ The temperature and pressure data text are shown
④ It is for select p-h diagram of each refrigeration system
⑤ Performance data (qe, Aw, qc, qf, qr, x, y, COP) automatically calculated are shown
⑥ It is for start, stop, save data and finish of program and observe running statues
⑦ It is for saving flow chart and p-h diagram

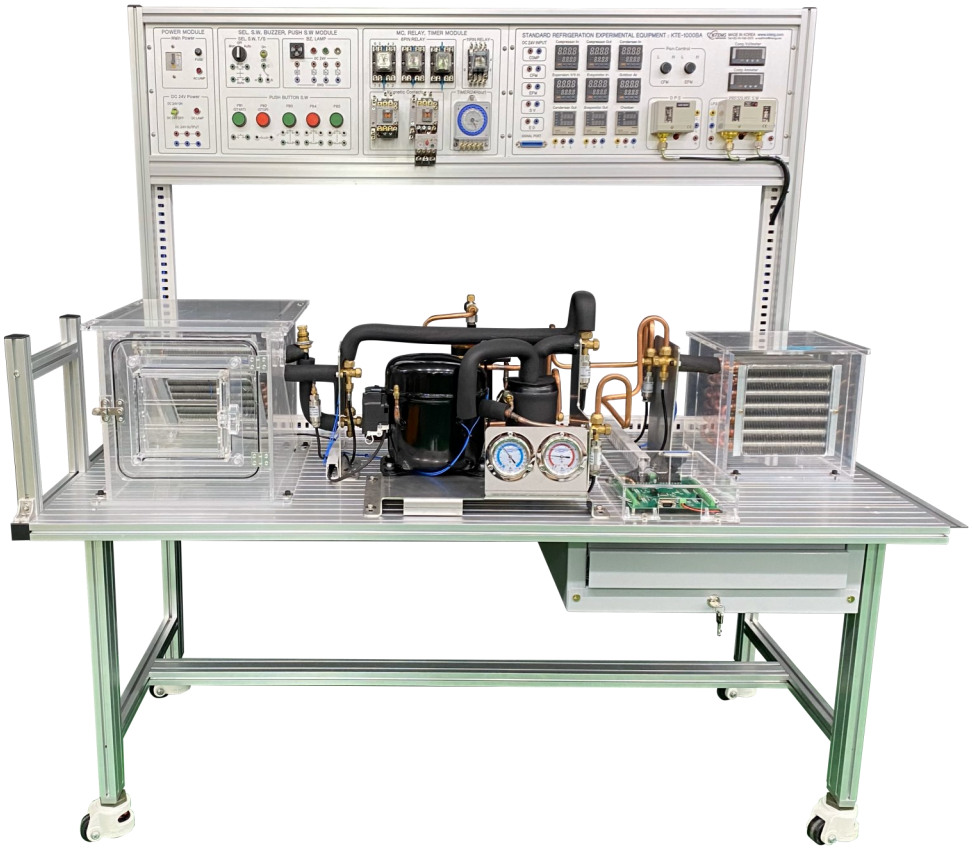
◈ Drawing each P-h diagram as each refrigerant ◈

(1) Condition
1) Evaporating temperature : -15℃
2) Condensing temperature : 30℃
3) Temperature at inlet of compressor: -15℃(Dry gas)
4) Temperature at inlet of expansion valve: -25℃(sub-cooling temp. 5℃)

(2) Formula
1) Refrigeration ability (Qe) = ha — he
2) Compressor work (W) = hb — ha
3) Condensing load (Qc) = hb — he = Qe + W
4) Coefficient of performance (COP) = Qe/W
5) Compression Ratio (Pr) = P2/P1

(3) Comparing each Coefficient of performance as each refrigerant

Standard Refrigeration Experiment Equipment [KTE-1000BA]



Equipment Introduction

- It consists of a compressor, a condenser (with a thin motor), a receiver, a filter dryer, a site glass, a solenoid valve, a manual expansion valve, and a nugget (with a thin motor) high-pressure and low-pressure gauge.
- This equipment can be operated by configuring circuits in the control panel.
- It provides a DAQ program that can measure the amount of heat exchange at temperature, pressure, enthalpy, and each location in real time, store it in a Microsoft Excel program, and graph and analyze each data.

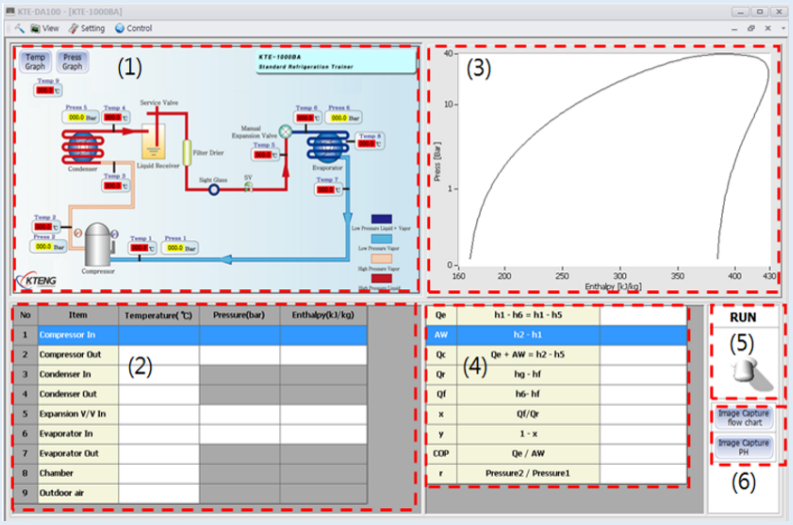
Education Contents

01. Standard Refrigeration System Measurement and Analysis Using Software
02. Measurement and analysis of the performance of the standard freezing system according to the condensation temperature change (high temperature control)
03. Measurement and analysis of the performance of a standard freezing system based on the change in evaporation temperature (low temperature control)
04. Operation of the temperature control sequence circuit configuration of the standard refrigeration system
05. Operation of the temperature control PLC programming of the standard refrigeration system
06. Configuration operation of the pump-down sequence control circuit of the standard refrigeration system
07. Operation of the pump-down PLC programming of the standard refrigeration system Practicing to configure and operation pump down PLC programming of Standard Refrigeration System

Equipment Characteristics

- ▶ Cycle Composition : Compressor → Condenser → Filter Dryer → Sight Glass → Expansion Value → Evaporator → Compressor
- ▶ Being practicable to operate on manual, thermal control or pump down with connecting by sequence or PLC control system
- ▶ Function for specification of refrigerator performance automatic measuring & data acquisition and system monitoring program
- ▶ Being practicable to measure temperature at each of compressor inlet and outlet, condenser inlet and outlet, expansion valve inlet and outlet, evaporator outlet, inside chamber and outside air using thermocouples of K-type
- ▶ Measure of pressure : Being practicable to measure within the range of –1 ~ 35 bar at each of compressor inlet and outlet, condenser outlet, expansion valve inlet by pressure sensors which are installed
- ▶ Experiment factors
  - Refrigeration effect
  - Compressor work
  - Condensing effect
  - Evaporating latent heat
  - Amount of flash gas at expansion valve outlet
  - Dry ratio and humidity at expansion valve outlet
  - Performance coefficient
  - Temperature and Pressure date which are measured
  - Being saved on every minute until 1,440 min as excel file after click the "SAVE"

Structure of Data Aquisition (DA100 Program)



1. Diagram of Standard Refrigeration System: Compressor → Condenser → Filter Dryer → Sight Glass → Solenoid Valve → Manual Expansion Valve → Evaporator → Compressor
2. Measuring of Temperature, Pressure, Enthalpy
3. Drawing P-h diagram on real time
4. Refrigerating effect (qe), Compressor work (Aw), Condensation effect (qc), Coefficient of Performance (COP)
5. Feature of save data
6. Feature of capture for P-h diagram

Features of DA100 program

- ◑ Monitoring the measured data of temperature and pressure in real time
- ◑ Monitoring the measured data of enthalpy on a refrigeration system in real time
- ◑ Monitoring factors like as refrigeration effect, compressor work, evaporating, latent heat, amount of falssh gas at expansion valve outlet, dry ratio at expansion valve outlet, coefficient of performance in the abstract with temperature and pressure data which are measured in real time
- ◑ Being saved data all temperature, pressure and enthalpy as excel micro office
- ◑ Experiment for drawing a P-h diagram as measured temperature and pressure

Evaporation Pressure Parallel Control Experimental Equipment [KTE-2000EP]

Equipment Introduction

- Refrigerant distribution measuring test by changing temperature of the low and high temperature evaporator
- Testing refrigerant distribution effect for the refrigerator
- Operating test about variation of evaporating pressure by using the evaporator
- DAQ program supply tools with that temperature, pressure, enthalpy, amount of the exchanged heat in each position can be measured in real time, and then saved by Microsoft Excel, so that saved data can be show and analysis by graph

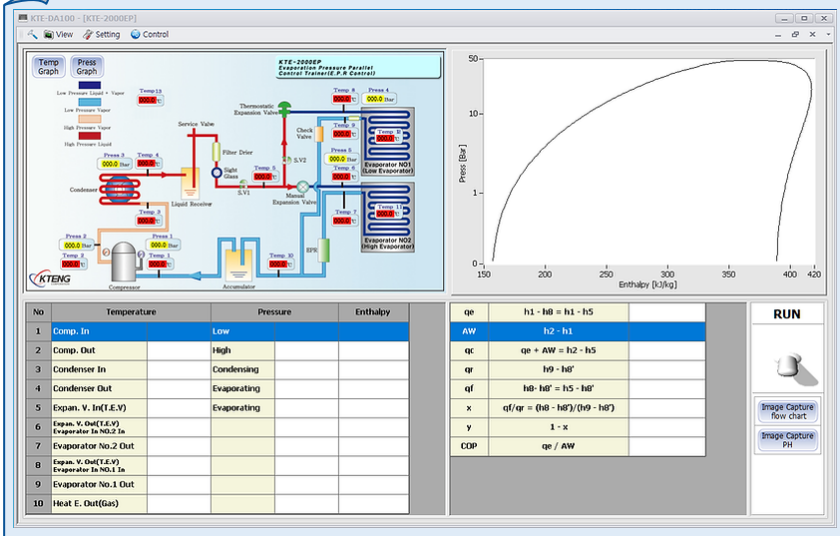
Education Contents

01. Measurement and Analysis a Evaporation pressure parallel control Refrigeration system using software
02. Measurement and Analysis of a Evaporation pressure parallel cotrol system
03. Configuration manual control sequence circuit for Evaporation pressure parallel control system and operation
04. Configuration manual control PLC programming for Evaporation pressure parallel control system and operation
05. Configuration temperature automatic control sequence circuit for Evaporation pressure parallel control system and operation
06. Configuration temperature automatic control PLC programming for Evaporation pressure parallel control system and operation
07. Configuration low temperature low pressure series circuit sequence circuit for Evaporation pressure parallel control system and operation
08. Configuration low temperature low pressure series circuit PLC programming for Evaporation pressure parallel control system and operation
09. Configuration pump down sequence control circuit for Evaporation pressure parallel control system and operation
10. Configuration pump down control circuit PLC programming for Evaporation pressure parallel control system and operation
11. Configuration compulsory pump down sequence control circuit for Evaporation pressure parallel control system and operation
12. Configuration compulsory pump down PLC programming for Evaporation pressure parallel control system and operation

Equipment Characteristics

- Cycle composition : Compressor → Condenser → Filter Dryer → Sight Glass → Solenoid Valve → Manual Expansion Valve → Low Temperature Evaporator (installed a check valve at outlet) → High Temperature Evaporator (installed an E.P.R at outlet) → Accumulator → Compressor
- Being practicable to operate on manual, thermal control or pump down with connecting by sequence or PLC control system
- Function for specification of refrigerator performance automatic measuring & data acquisition and system monitoring program
- Being practicable to measure temperature at each of compressor inlet and outlet, condenser inlet and outlet, expansion valve inlet and outlet, evaporator outlet, inside chamber and outside air using thermocouples of K-type
- Measure of pressure : Being practicable to measure within the range of –1 ~ 35 bar at each of compressor inlet and outlet, condenser outlet, expansion valve inlet by pressure sensors which are installed
- Experiment factors
  - Refrigeration effect
  - Condensing effect
  - Amount of flash gas at expansion valve outlet
  - Coefficient of Performance
  - Compressor work
  - Evaporating latent heat
  - Dry ratio and humidity at expansion valve outlet
  - Temperature and Pressure data which are measured
  - Being saved on every minute until 1,440 min as excel file after click the “SAVE”

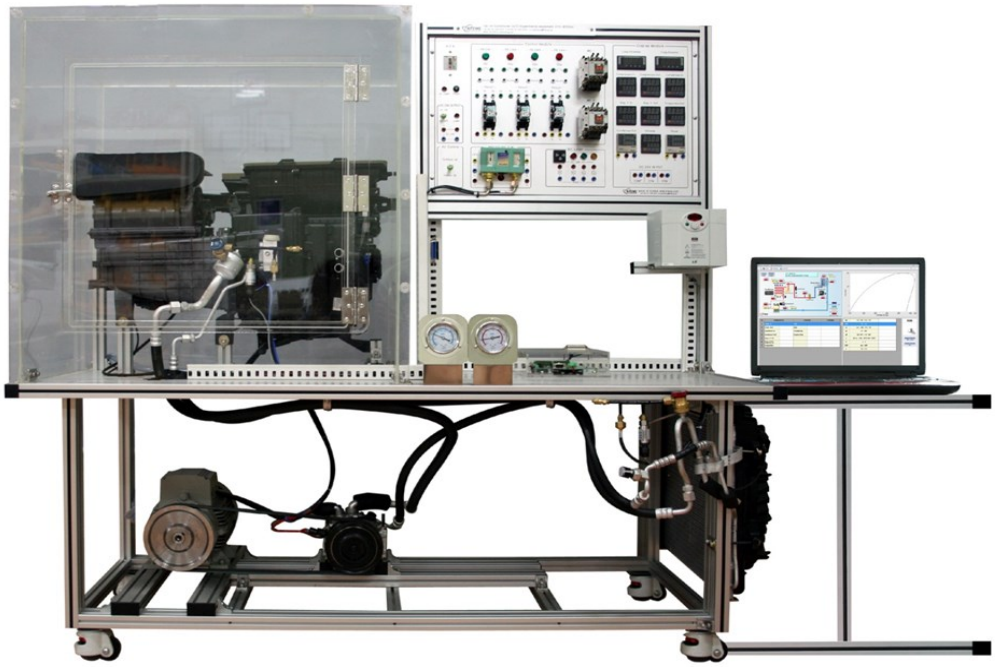
Application Refrigeration Utility AI Program



(1) Choose your respecting refrigeration system cycle on 'Select cycle type'
  ① One stage cycle
  ② Two stage cycle
(2) Evaporating Temperature (℃) or evaporating pressure (bar) on running.
(3) Condensing Temperature (℃) or condensing pressure (bar) on running.
(4) Superheat : Superheating temperature (˚K) from outlet of evaporator to inlet of compressor.
(5) Sub Cooling : Sub cooling temperature (˚K) from outlet of condenser (or saturating line on p- h chart) to in front of expansion valve.

(6) DP Evaporator : Temperature (or pressure) Difference between outlet of expansion valve and outlet of evaporator.
(7) DP Condenser : Temperature (or pressure) Difference between inlet of condenser and inlet of expansion valve.
(8) DP Suction line : Temperature (or pressure) Difference between outlet of evaporator and inlet of compressor.
(9) DP Liquid line : Temperature (or pressure) Difference at inlet of expansion valve after isolation expansion process.
(10) DP Discharge line : Temperature (or pressure) Difference between outlet of compressor and inlet of condenser.

Vehicle Refrigeration Experimental Equipment [KTE-9000AU]



Equipment Introduction

- ◈ This experimental device is designed to facilitate the operation, repair, and experiment of the system using cooling and heating modules used in vehicles.
- ◈ Data acquisition equipment (DA100) can be used to monitor real-time with a PC and experimental data can be stored on the PC.
- ◈ This experimental device is designed to help you understand each part of the vehicle cooling and heating system

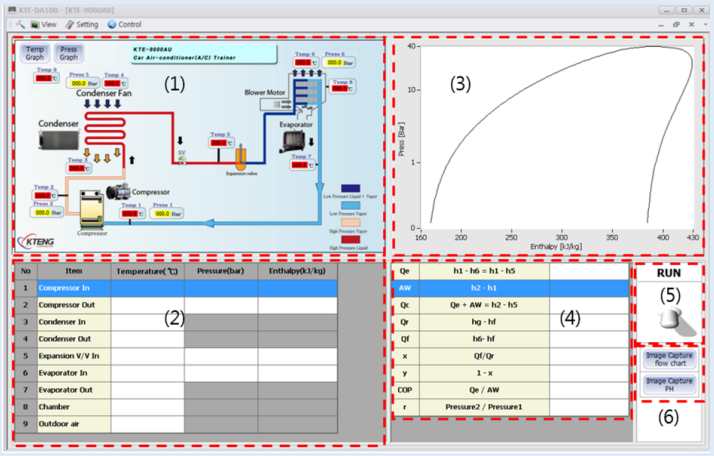
Equipment Characteristics

◎ Experiment with measuring the cooling performance of the vehicle by understanding the vehicle air conditioning system and learning how to operate it accordingly
◎ Experiments and Performance Analysis according to Engine RPM
◎ Experiment and Performance Analysis according to Refrigerant Charges
◎ Ability to experiment with temperature
◎ Performance test function based on condensation load

Education Contents

01. Practice the operation and experimentation of each part of the vehicle air conditioner
02. Practice of cooling experiments for vehicle air conditioners
03. Maintenance Practice of Vehicle Air Conditioner
04. Experimental practice for measuring refrigeration capacity based on the compressor-driven RPM
05. Real-time data recording and monitoring practice with acquisition devices

Vehicle Refrigeration Equipment AI Program

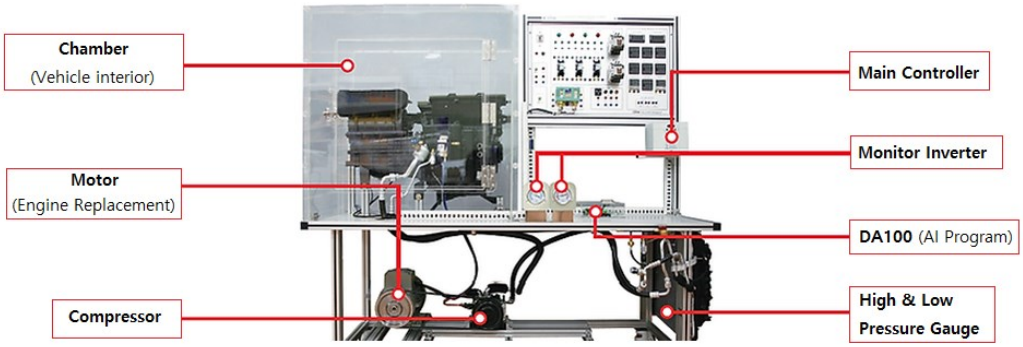


(1) Vehicle air conditioning system diagram :
compressor → Condenser → microwave valve → Manual expansion valve → evaporator → compressor

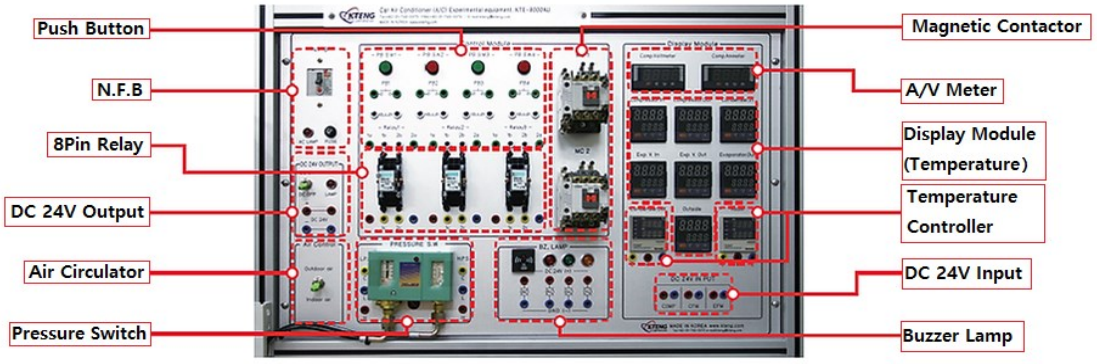
(2) Temperature, pressure, and enthalpy measurements

(3) Monitoring real-time P-H chart construction cooling effect (qe), heat equivalent on compression days (Aw), condenser emission heat (qc), latent heat of evaporation (qr), Humidity (y) immediately

Equipment Component



Equipment Control Panel



Brine Refrigeration Experimental Equipment [KTE-6000BR]

Equipment Introduction

- ☑ Brine is an antifreeze that is a heat-carrying medium that is cooled by refrigerant through an evaporator and transmits a freezing effect to the object to be cooled.
- ☑ With the refrigeration system using such a brine system, the degree of cooling of the object to be cooled according to the concentration of brine used as a secondary coolant can be identified in real time, and accordingly, freezing performance measurement experiments can be conducted.
- ☑ This equipment is designed to standardize, miniaturize, and set up the complex, large-scale, and concealed ice shaft refrigeration devices and automatic control operation panels for easy access for experimental practitioners.
- ☑ Students can improve your practical skills by integrating experiments required to configure ice shaft refrigeration devices, designing and configuring automatic control circuits required for practice and operation.

Education Contents

01. Experimental practice of configuring c contact circuit using relay (Ry)
02. Experimental practice of configuring a and b contact circuit using an electronic contactor (MC)
03. Operation of stop-priority magnetic retention circuit configuration brine refrigeration machine
04. Configuring and operating the temperature switch low temperature control adjustment circuit
05. Pressure switch Low Pressure Control Low Pressure Control (LPS) Adjustment Circuit Configuration Operation
06. Manual control circuit configuration operation of the brine (ice shaft) refrigeration system
07. Configuration operation of the temperature automatic control circuit of the brine (ice shaft) refrigeration system
08. Configuration operation of the pump down control circuit of the brine (ice shaft) refrigeration system
09. Operation of the forced pump down control circuit configuration of the ice shaft refrigeration system

Equipment Characteristics

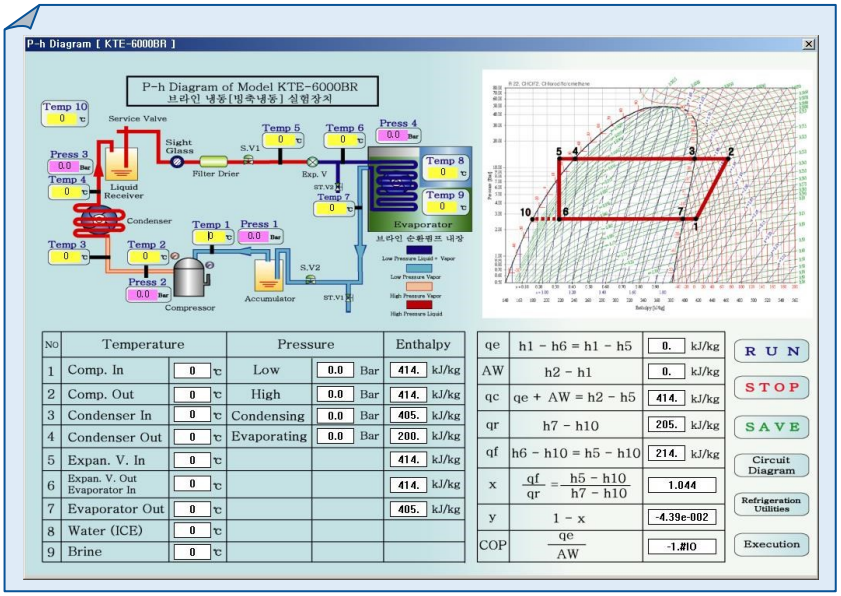
◎ It is an equipment that can compare the degree of cooling according to the brine concentration through heat exchange experiments between the evaporator cooling coil and the brine.
◎ Heat Exchange Experiment of Brine and Coolant
◎ An Experiment and Analysis of the Operation Initial Load Characteristics of Ice Storage Refrigeration System
◎ Experiment on the change of load and the temperature of the brine and evaporator according to the operation time of the ice storage refrigeration system
◎ An Experiment on the Characteristics of Water Ice Making and Sea Ice
◎ Comparative experiment of heat capacity by brine type
◎ A Comparative Experiment on Ice Storage Capacity by Ice Ball Type
◎ Can be wired to actual electrical components for realise

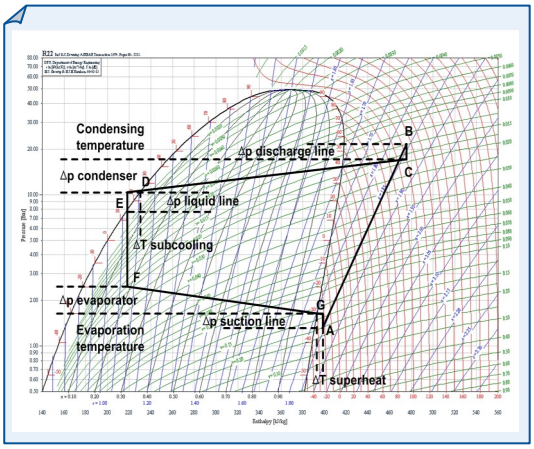
Brine Refrigeration Equipment AI Program

☑ **How to utilize the Mollere (P-h) leading automatic writing program** ☑

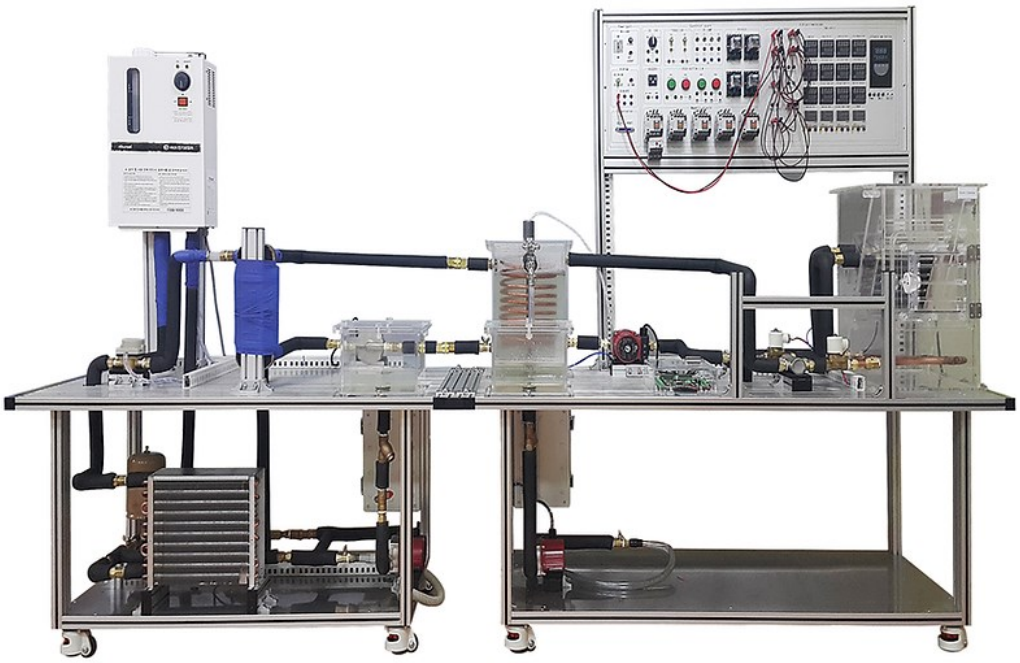
① Select the relevant refrigeration cycle from the Select cycle type.
- One stage cycle: 1-speed refrigeration cycle
- Two-stage cycle: Two-stage expansion refrigeration cycle

② Evaporating Temperature: Enter the evaporation temperature or evaporation pressure during operation.
③ Condensing Temperature: Enter condensation temperature or condensation pressure during operation.
④ Superheat: Input the super heating temperature of the refrigerant from the evaporator outlet side to the compressor inlet side.
⑤ Subcooling: Enter the temperature of subcooling from the condenser outlet point (or saturation liquid line on the p-h line) to just before the expansion valve.
⑥ DP Evaporator: Enter the pressure difference (or temperature difference) between the expansion valve outlet point (or the evaporator inlet point) and the evaporator outlet point.
⑦ DP Condenser: Enter the pressure or temperature difference from the condenser inlet point to the expansion valve inlet point.
⑧ DP Conduction line : Enter the pressure or temperature difference from the evaporator outlet point to the compressor inlet point.
⑨ DP Liquid line: Enter the pressure or temperature difference after adiabatic expansion at the inlet point of the expansion valve.
⑩ DP Discharge line : Enter the pressure or temperature difference from the compressor outlet point to the condenser inlet point.





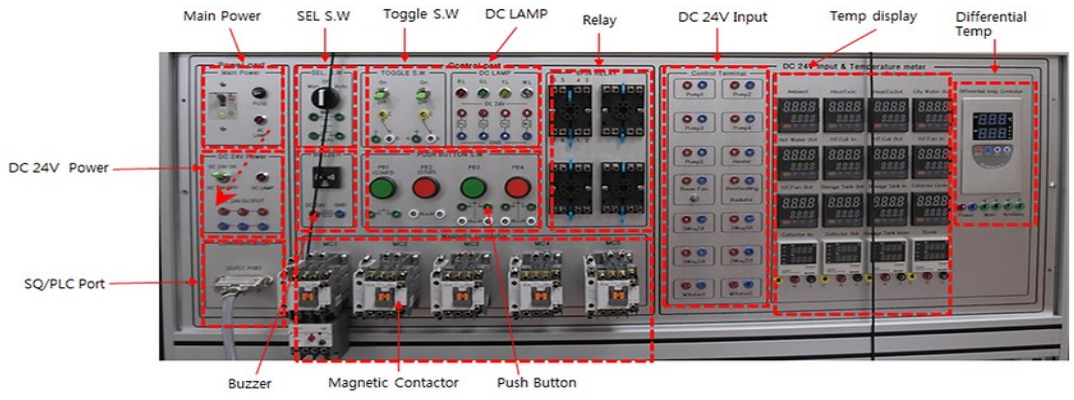
Boiler Control Experiment Equipment [KTE-1000BO]



Equipment Introduction

- KTE-1000BO (boiler facility control experimental equipment) uses heat storage technology and system control technology.
- In addition to the basic heating control system, this device is designed to operate an overheating prevention (heat dissipation) system control method that maintains the temperature inside the heat storage tank evenly by using a differential temperature controller, or automatically switches the three-way valve when the heat storage tank is overheated to lower the overheated heat storage temperature.
- It is a device configured to easily understand the heating and hot water supply principles of the facility through the hot water production-heat exchange-storage-release process.
- In detail, it is designed to understand and practice the components of the boiler, operating conditions, pipe composition, piping circuits, heating-water supply system control, and heat storage heating principles.
- It is possible to calculate the heat exchange amount and design appropriately using the temperature of each inlet-outlet of the heat storage tank and heat exchanger.

Control Panel and Operating Panel



Equipment Characteristics

This device is composed of three systems : heat source, heat storage, and load.

(1) Heat source part

- The supplied circulating water is heated through the boiler and exchanges heat with heat storage water through a plate heat exchanger by the circulation pump.
- After heat exchange, the circulating water whose temperature has been lowered is returned to the boiler and re-heated.

(2) Heat storage part

- The hot water that obtains heat from the plate heat exchanger circulates through the heat storage tank and the heat exchanger cycle and continuously exchanges heat with the heat storage tank to store heat.
- The heat storage tank is connected to inlet and outlet pipes to supply hot water (heating water) to the load, and a hot water coil is passed inside to heat the hot water.

(3) Load part

- The load section is responsible for actual heating by supplying stored hot water to each load device through a distributor and control valve.
- The load device is designed to test the performance of each heat exchanger through two types of heat exchangers, Fan Type and Coil Type, considering various heat exchange methods.
- The hot water that has completed heat exchange is returned to the heat storage tank.

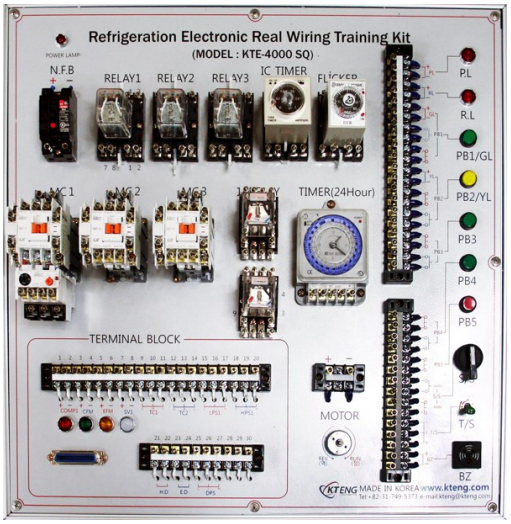
Education Contents

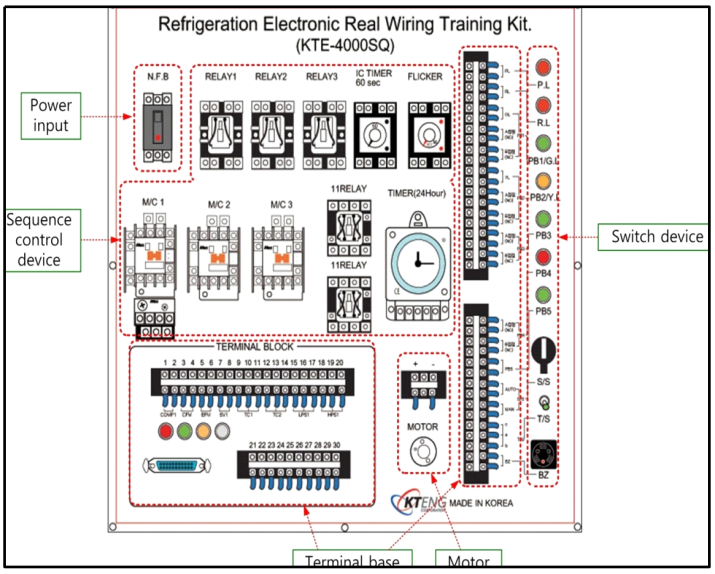
01. Theory of operation principle of regenerative boiler
02. Operation control switch circuit configuration of boiler equipment (push button, selector switch)
03. Constructing basic electrical and electronic circuits
04. “c” contact circuit configuration operation experiment using relay (Ry)
05. Experimental operation of “a” and “b” contact circuit configuration using magnetic contactor (MC)
06. Configuring and operating a stop-priority self-sustaining circuit
07. Constructing a heat storage-heat dissipation operation conversion circuit using a three-way valve
08. Boiler circulating water charging circuit configuration and practice
09. Configuration of overheating prevention operation circuit using temperature controller
10. Configuration of electric valve operation circuit in each room using temperature controller
11. Configuring the boiler heating and auxiliary heater operation circuit
12. Configuration of overheating prevention operation circuit using temperature controller

Heat Storage Tank

- The heat storage tank stores the heat obtained from the boiler and converts it into useful heat energy.
- An auxiliary heater (1kW) is provided in case the temperature rise in the heat storage tank is slow at the beginning of the experiment or when the load increases rapidly.

Real Wiring Refrigeration Automatic Control Training Equipment [KTE-4000SQ]





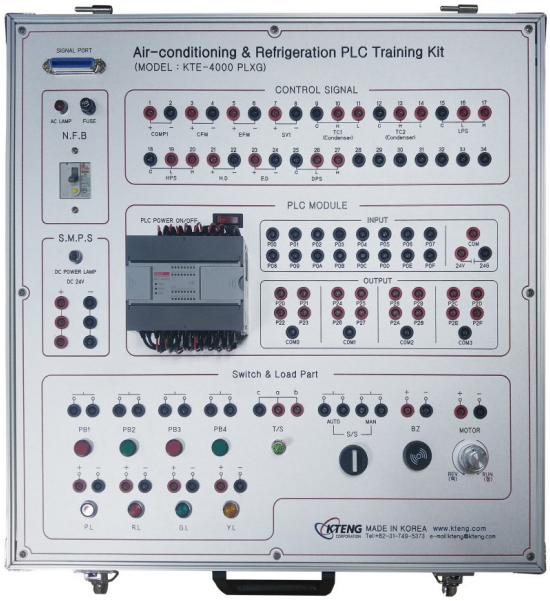
Equipment Introduction

- ☑ The circuit configuration used in the air-conditioning freezing national technical qualification test (skilled workers, industrial engineers) and refrigeration technology competition.
- ☑ Banana jack cables reduce wiring time and enable safe practice.
- ☑ It can be connected and controlled with the refrigeration equipment system using a 36-pin connector.
  - ▶ Standard Freezing System
  - ▶ Refrigerant parallel expansion valve control system
  - ▶ Evaporative Pressure Parallel Control System
  - ▶ ICE SHAFT REFRIGERATION SYSTEM
  - ▶ Air conditioning system for four-way valve heat pump
  - ▶ a two-way freezing system
  - ▶ air conditioning system
- ☑ It is manufactured in the form of a bag for easy movement and storage.
- ☑ Each element is manufactured in a detachable form so that it can be easily replaced in the event of a defect.

Education Contents

- ◎ Associated control panel kit for each refrigeration equipment: Temperature-pressure-power control and defrost control to boiler or heating equipment or building automation equipment, available for practicing and experiment of all of working schematic in the manual book of air-conditioning and refrigeration control working.
- ◎ Training sequence based on: Available for practicing and experiment of basic wiring or application circuit for electric power refrigeration step by step.
- ◎ Training design variable circuit: Available for practicing and experiment of designing variable application circuit by using control devices such as magnetic contactor(MC), relay(Ry), push-button switch(PB), select switch(S/SW), toggle switch(T/S), buzzer(BZ), Timer(T), defrosting timer(D-T), power lamp(PL), running lamp(RL), and stop lamp(GL).
- ◎ Training wiring work: Wiring and test training available with banana jack cables.
- ◎ Stability: Available for training and experiment of wiring by adapt power DC24V with stability.
- ◎ Wiring practice with banana jack cables with easy and simple: Wiring training available by using wire as banana jack cable.

Air Conditioning Refrigeration PLC Control Training Equipment [KTE-4000PLC]



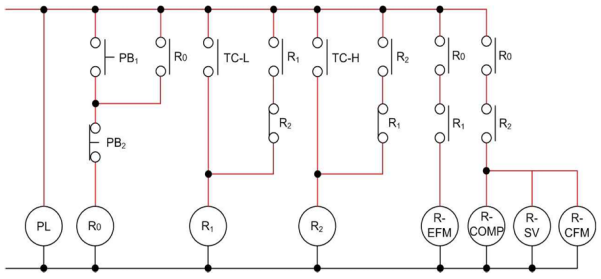
Equipment Introduction

- ☑ It is the thread wiring plc control test system for controlling renewable energy generating test system, it can conduct the basic electric circuit practice, national skill certificate circuit practice, and also renewable energy generating system PLC control can be programmed and practice, and throughout screen, generating power can be monitored in real time.
- ☑ Basic sequence education : Connects the thread wire with various new renewable device and banana jack, and by using plc, after programming, it can be operated.
- ☑ Various circuit sequence design practice : It uses relay (ry), push button switch (pb), select switch (s/sw), toggle switch (t/s), buzzer (bz), power lamp (pl), run lamp (rl), stop lamp (gl), and input and output consists of outside power input part, signal input part, various information save part, cpu output part and communication part, so you can experience various new recycle device control plc.
- ☑ Safety : DC24V input power is selected for safety thread wiring test and practice.
- ☑ Simple wiring practice using banana jack : Not only wiring using wires, but inserting banana jack, easy and simple wiring practice is available.

Education Contents

1. Practice to configure a basic PLC circuit for main device
2. PLC LD programming of Lock up circuit and operate a refrigeration system
3. PLC LD programming of adjusting circuit by a temp S/W and operate a refrigeration system
4. PLC LD programming of adjusting circuit by a pressure S/W and operate a refrigeration system
5. PLC LD programming of pump down control adjusting circuit and operate a refrigeration system
6. PLC LD programming of defrost control adjusting circuit and operate a refrigeration system

PLC transfer control circuit



R0, R1, R2 : Relay extra
R_COMP : Relay for Compressor
R_CFM : Relay for CFM
R_SV : Relay for Solenoid V/V

PRICE LIST

Refrigeration & Air - Conditioning

Educational Equipments

MODEL	*ITEM*	*UNIT PRICE*
KTE-1000BA	**Standard Refrigeration Equipment**	**$18,000**
KTE-3000HD	**4-Way Valve Heat Pump Heating & Cooling Equipment**	**$28,000**
KTE-2000EP	**Evaporation Pressure Parallel Control Equipment (E.P.R Control)**	**$29,000**
KTE-5000LT	**Binary Refrigeration Equipment**	**$37,000**
KTE-1000AHU	**Air - Handling Unit Equipment**	**$35,500**
KTE-7000GH	**Geothermal Heat Pump Equipment**	**$38,000**
KTE-7000SB	**Solar Heat Hot Water Boiler Equipment**	**$39,000**
KTE-1000MOH	**Heating Pump Modular System Equipment**	**$18,000**
KTE-9000AU	**Vehicle Air Conditioner Equipment**	**$28,000**
KTE-6000BR	**Brine Refrigeration Equipment**	**$26,000**
KTE-1000BO	**Boiler Control Equipment**	**$29,000**
KTE-4000SQ	**Real Wiring Refrigeration Automatic Control Equipment**	**$5,600**
KTE-4000PLC	**Air-Conditioning & Refrigeration PLC Training Kit Equipment**	**$6,700**

- The prices given above are factory (EXW) prices
- Pricing terms for overseas trade could be negotiated later.

Renewable Energy / Refrigeration & Air-conditioning & Welding

Automation controls(PLC) / Robot controls / Electric & Electronics(LED lighting)

Firefighting & safety / Big data & ICT / Automobile & ship / Nano chemical

3E EDUCATION ENGINEERING ENVIRONMENT

KTENG CORPORATION

Soyoung Kim
U.S. Branch Director

www.kteng.co.kr
M. +1 971 430 1410
Email. ktengusa@kteng.co.kr
1000 W Columbia Way Unit 631
Vancouver WA 98660

For Korea :
kcs@kteng.com
+82 31-713-5373

For Outside of Korea :
overseas@kteng.com
+82 10 9957 0719

For USA :
ktengusa@kteng.co.kr
+1 971 430 1410