

Computer controlled vapour-compression refrigeration unit – RA1-MKII

The RA1-MKII is a self contained computer controlled vapour-compression refrigeration system with automatic recording of all important process variables using an integral USB interface device.

Compressor speed and power supplied are displayed on the PC. The hermetically sealed refrigerant exiting the compressor passes through a condenser, receiver, filter, variable area flowmeter, expansion valve and evaporator before returning to the inlet side of the compressor.

**AUTOMATIC DATA LOGGING WITH REALTIME DISPLAY
SELF CONTAINED UNIT**

RA1 unit sat on water reservoir



Features

- ▶ Complete system enabling demonstration of the most common refrigeration system used today
- ▶ Computer controlled with automatic recording of measured and calculated variables using a PC
- ▶ Overall performance of the system is calculated and displayed continuously enabling the effect of changes in the system to be evaluated
- ▶ Submersible variable speed pumps supply water at stable temperature and pressure from the reservoir to the condenser and evaporator eliminating fluctuations
- ▶ Condenser and evaporator both use plate heat exchangers enabling a full energy balance to be carried out while varying the operating conditions on both sides of the compressor
- ▶ Separation of the refrigerant and water circuits aids understanding of the refrigeration system and the function of the various components
- ▶ Real-time superheat conditions in the condenser and evaporator are calculated and displayed.
- ▶ Real-time display of Coefficient of Performance (COP)
- ▶ Expansion valve setting can be varied by the operator to change the operating point (evaporator superheat setting)
- ▶ Use of the refrigerant flowmeter as a sight glass enables observation of any vapour bubbles downstream of the compressor when conditions are not optimal
- ▶ Alarms protect the equipment from misuse by switching the compressor off if pressures, temperatures, flowrates, pumps drift outside acceptable limits. Advanced warnings enable the operator to take remedial action before the compressor is switched off
- ▶ Bourdon type gauges indicate the pressure and corresponding refrigerant saturation temperature on both sides of the compressor independent from the electronic systems

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Applications

ChE ME CE IP

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Instructional capabilities

- ▶ Demonstration of the vapour - compression thermodynamic cycle
- ▶ Analysis of the heat transfer processes in the condenser and evaporator
- ▶ Investigation of the effect of:
 - The effect of varying compressor speed on refrigerant pressures and temperatures in the system
 - The effect of varying cooling water flowrate through the condenser
 - The effect of varying heating water flowrate through the evaporator
 - The effect of adjusting the setting of the Expansion Valve to vary the operating point (evaporator superheat setting) for different load conditions

On the operation of the system and the resulting Coefficient of Performance (COP)

- ▶ Thermodynamic system modelling
- ▶ Performing a full energy balance across the system

Technical specifications

Refrigeration system	Vapour-compression type
Refrigerant	R134a
Hermetically sealed compressor speed range	2000 to 4400 RPM
Hermetically sealed compressor supply	24V DC to speed controller of brush-less 3 phase DC motor
Hermetically sealed compressor rating	7.11 cm ³ (0.434 cu in) for high evaporator temperature with 7.2°C rating point
Condenser	Brazed plate heat exchanger using water as heat transfer medium
Evaporator	Brazed plate heat exchanger using water as heat transfer medium)
Water reservoir	Working capacity 400 litres
Temperature sensors	NTC Thermistor
Refrigerant flowmeter	Variable area flowmeter

Requirements

Scale



- ▶ Electricity supply: Single phase (see ordering codes)

The system is designed to be used with a personal computer (not supplied). The computer must have a USB port and run WinXP to Win10

Overall dimensions

Bench mounted refrigeration unit with separate floor standing water reservoir

Length of refrigeration unit	0.95m
Width	0.52m
Height	0.50m
Length of water reserve	1.09m
Width	0.71m
Height	0.79m

Packed and crated shipping specifications

Volume	1.26m ³
Gross weight	160Kg

note: Refrigeration unit is located on top of the water reservoir when installed.

Complimentary products

RA2 Air Conditioning Unit
RA3 Air Conditioning Unit
TH & HT Series

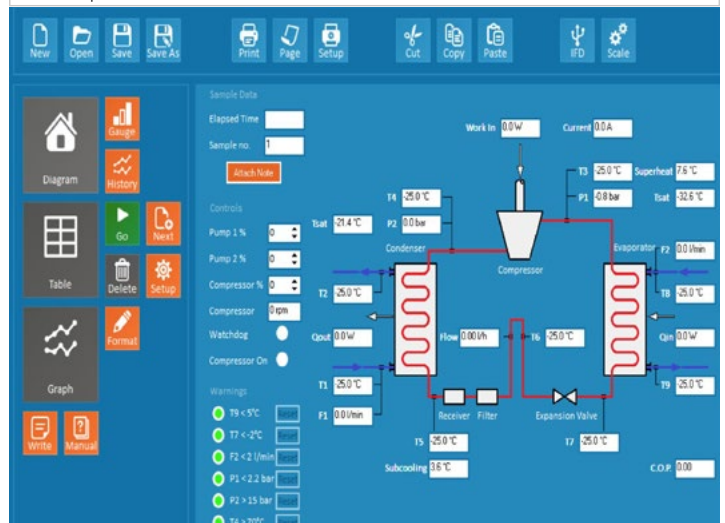
Software

Computer Controlled system with automatic data acquisition of sensor values with tabulated and graphic options.

Diagrammatic representation of the equipment, complete with real-time demonstration of the various sensor outputs and instantaneous Coefficient of Performance (COP)

Operator control of compressor speed (motor speed), condenser cooling water flowrate (pump speed) and evaporator heating water flowrate (pump speed).

Misuse protection alarms



Ordering specification

- ▶ Complete refrigeration system enabling demonstration of the vapour-compression refrigeration cycle
- ▶ Computer controlled system with automatic recording of process variables using an integral USB interface
- ▶ Measurement sensors include:
 - 9x Thermistor sensors measuring temperatures throughout the system
 - 2x Turbine type flow meters measuring flow of water through the condenser and evaporator
 - 2x Electronic sensors measuring pressures before and after the compressor
 - 2x Bourdon type refrigeration pressure gauges (with scale indicating equivalent refrigerant saturation temperature)
 - 1x Variable area flowmeter measuring refrigerant flowrate
 - 1x DC Current shunt measuring current to the compressor motor
- ▶ Bench mounted refrigeration unit supplied complete with large water reservoir to isolate the process from fluctuations in temperature or pressure in the mains water supply
- ▶ Comprehensive instruction manual supplied

Ordering codes

- ▶ RA1-MKII-A 230V/1ph/50Hz 5 Amps
- ▶ RA1-MKII-B 110V/1ph/60Hz 10 Amps
- ▶ RA1-MKII-G 220V/1ph/60Hz 5 Amps

Armfield standard warranty applies with this product

Knowledge base

- > 28 years' expertise in research & development technology
- > 50 years' providing engaging engineering teaching equipment

Benefit from our experience, just call or email to discuss your laboratory needs, latest project or application.

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