

Training & Didactic Systems

Refrigeration and Air-Conditioning

Catalog WA1E/12





Our Services

- Development and production of didactic training systems
- > Teachware and documentation
- > Project engineering of complete lab's incl. furniture and lab equipment
- > Quotations on customer's demand
- Installation, commissioning and training at site

Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- > Building management systems
- Protection schemes to VDE 0100
- > Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- > Measuring systems, power supplies, accessories
- Experimental manuals, documentation

For further information please contact:

WUBKIRO - electronic GmbH & Co. KG

Dürerstr. 14

D - 97072 Würzburg

Germany

Tel. + 49 (0) 931-32231-0 Fax: + 49 (0) 931-32231-20 E-Mail: <u>info@wuekro.de</u>

Internet: <u>www.wuekro.de</u>

WUBKIRO - electronic GmbH & Co. KG

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Introduction



This new developed experimental station for refrigeration and air-conditioning training permits refrigeration and air-conditioning tests to be conducted in the normal cooling, air-conditioning and deep-freeze ranges, the electrical circuits to be set up, and measurements to be taken.

A test group should comprise not more than 2-3 trainees for each experimental station.

Experimental panels

The experimental panels consist of plastic sheets with etched symbols, on which the respective equipment is attached on the front side. The devices are equipped with quick-connectors for connection of the refrigerant lines.

The Electrical connection occures over 4-mm safety terminals. In order to ensure secure fastening, e.g. when handling the connection lines.

Dimensions of the panels (H x W): 297x130mm or wider by a whole number multiple of 65mm.

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Experimental Station Refrigeration and Air-Conditioning



Design

The "Refrigeration and Air-Conditioning" experimental station consists basically of a lab bench with back upright section, power supply and evaporator frame, and a trolley for the condensing unit.

The tests are conducted by using experimental panels.

The experimental panels can quickly clamped by setting the upper sectional rail and fixing this rail with thumb bolts.

They are interconnected by refrigerant-resistant flexible lines, the electrical connection being made by highly flexible leads with 4mm safety plugs.

The experimental station is available with a basic set of experimental panels and devices, as well as an additional extension set.

The basic equipment allows technical refrigeration instruction which is oriented on the required level of training. By means of the additional equipment, more complex experiments can be performed for advanced training.

Experimental place with power supply and evaporator frame

Possible measurements and analyses:

- Different refrigerant flow rates
- power consumption
- capacity measurements
- pressure drop rate in regulators and refrigerant conducting pipes
- variable heat fluxes on the evaporator and condenser
- net refrigeration capacity

- heat equilvalent
- compressor capacity and liequefaction pressure
- operational overheating on thermostatic butterfly valves
- over or undercharging with refrigerant plant
- fault analysis during installation and commissioning

Order No.W2700-3A

- setting of all switchgear and regulators
- pressure and temperature measurements
- start-up problems of compressor motors and their elimination
- damage to compressors due to superheated refrigerant.



Experimental Station Refrigeration and Air-Conditioning

Experimental place with power supply and evaporator frame

Consisting of:

- 1 Experimental bench W: 1800 D: 900 H: 780 mm
- Lower cabinet for mobile use
 3 drawers and central lock
 W: 420 D: 555 H: 545 mm
- 1 Trolley for the bench-type compressor and condensing unit. W:900 D: 600 H: 780 mm
- Lower cabinet with 2 drawers for fitting under the trolley.
- 3 Organisation modules for drawers
- Back upright for accommoding 3 power supply panels W: 1800 D: 320 H: 155 mm

- Power supply panel for 1-ph. connection, with key-operated switch, and 16 A circuit-breaker, indicator light, 2 SCHUKO socket, outlets and 3 laboratory terminals.

 With 25 A current- operated
 - With 25 A current- operated e.l.c.b, sensitivity= 30mA
- Power supply panel with

rocker

voltage

- 1 "emergency off" pushbutton 1 "ON" switch with illuminated
- 4 SCHUKO socket outles
- Power supply panel
 with
 3 SCHUKO sockets without
 power connection
 1 distribution board with 15
 safety sockets
 1 switch with illuminated
 rocker
 3 safety sockets with line

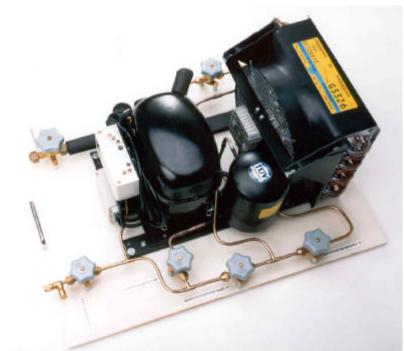
Order No. W2700-3A

- 1 Flat evaporator with two fans, built in in a case for mounting on the top of the back upright design like the experimental place.
 with additional cold insulation, transparent frontpanel adjustable in height, and two injection facilities.
 W: 540 D: 320 H: 720 mm
- I Experimental frame 2 tiers
 The experimental modules can
 quickly clamped by setting the
 upper section rail and fixing
 this rail with thumb bolts.
 W: 1220 D: 250 H: 720 mm

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> Experimental Station Refrigeration and Air-Conditioning



Compressor and

condensing unit
mounted on portable base, consisting

Compressor, condenser, refrigerant receiver and butterfly valves. Electrical connection via SCHUKO

For refrigerant R 22

Order No. W7301-1A

Like W7301-1B, but for refrigerant R 134 a

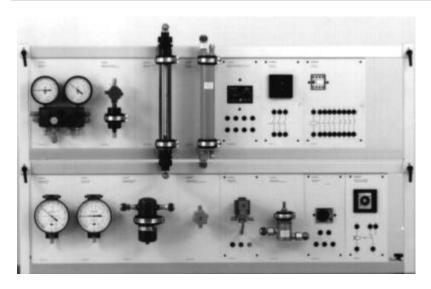
Order No. W7301-1B



Basic Set Refrigeration and Air-Conditioning

Basic Set Refrigeration and Air-Conditioning





For conducting the following experiments in the normal cooling range, air-conditioning range and deep-freeze range:

- Simple refrigeration cycle with manually operated control valve (3 experiments)
- Simple refrigeration cycle with capillary tube feed (6 experiments)
- Simple refrigeration cycle with automatic control valve (6 experiments)
- Simple refrigeration cycle with thermostatic control valve (6 experiments)
- Simple refrigeration cycle controlled by evaporator and/or room thermostat (6 experiments)
- Simple refrigeration cycle with variable refrigerant com-pounds and pressure drops
 (1 experiment)
- Simple refrigeration cycle startup and fault-finding (1 experiment)

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Order No. W7301-0A

Basic Set Refrigeration and Air-Conditioning

Basic Set Refrigeration and Air-Conditioning

The basic set is consisting of the following equipment

Exper	imental Panels	Quantity	Order number
Inspe	ction glass with filter drier	1	W7301-2A
Mass	flowmeter	1	W7301-2B
Refrig	geration manometer (pressure gauge)	1	W7301-2C
Refrig	geration manometer (Suction gauge)	1	W7301-2D
Valve	set 80 mm	1	W7301-2E
Supe	rheater	1	W7301-2F
Flow	restrictor	1	W7301-2G
Autor	natic flow restrictor	1	W7301-2H
ON/O	FF switch, 3pole	1	W3313-4A
Electr	rical control unit, -5 to +25° C including sensor	1	W7301-2J
Electr	onic control unit, -25 to +5° C including sensor	1	W7301-2K
Exten	sive instruction manuel	1	W3011-1A
	ssories for basic set consisting of: ded in the kit)		
2	Capillaries, matched to condensing unit		
3	Substitute filter drier		
4	Refrigeration-resistant flexible lines, length		
2	915mm, 5/8" dia. Refrigeration-resistant flexible lines, length		
-	1800mm, 5/8" dia.		
6	Refrigeration-resistant flexible lines, length		
	915mm, 7/16" dia.		
2	Refrigeration-resistant flexible lines, length 1800mm, 7/16" dia.		
20	Gaskets, 7/16"		
20	Gaskets, 5/8"		
	Sundries jointing pieces etc.		
20	Saftey Connecting leads, highly flexible, with plug 4mm, length 0.5m, black.		
20	dito, length 1.0m, black		
5	dito, length 1.5m, black		
5	dito, length 1.0m, blue		
5	dito, length 1.0m, green-yellow		



Extension Set Refrigeration and Air-Conditioning

Extension Set Refrigeration and Air-Conditioning

Order No. W7302-0A

For conducting the following experiments in conjunction with the basic set

- extended refrigeration cycles with constant evaporatorpressure regulators (3 experiments)
- extended refrigeration cycleswith suction pressure

regulator (2 experiments)

- extended refrigeration cycle with start-up relief (3 experiments)
- extended refrigeration cycle with hot-gas bypass regulator (3 experiments)
- extended refrigeration cycle with liquid trap (1 experiment)
- extended refrigeration cycle with temperature regulator (3 experiments)
- extended refrigeration cycle with electric evaporator defrosting (3 experiments)
- extended refrigeration cycle with periodic defrosting of evaporator (3 experiments)
- extended refrigeration cycle with four-way reversing valve (1 experiment)
- extended refrigeration cycle with hot-gas bypass regulation and injection valve (1 experiment)

Extension Set Refrigeration and Air-Conditioning

Order No. W7302-0A

The extension set is consisting of the following equipment

Experimental panels	Quantity	Order number
Manual-operated through valve 6mm	1	W7302-2A
Temperature regulator	1	W7302-2B
Evaporator pressure regulator	1	W7302-2C
Suction pressure regulator	1	W7302-2D
Hot-steam bypass (capacity regulator)	1	W7302-2E
4-way reversing valve	1	W7302-2F
Injection valve	1	W7302-2G
Moisture separator	1	W7302-2H
Defrosting time relay	1	W7302-2J
Electrical control unit -5 to + 25° C	1	W7302-2K
Solenoid valve 6 mm	2	W7302-2L
Time relay, 0,5 to 20s, delayed pickup	1	W3331-4A
3-pole contactor 16A, auxiliary switch with 2 make and 2 break contacts	1	W3321-4A
Auxiliary contactor 6A, 4 make and 4 break contacts	1	W3328-4A

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> Set of Accessories

Set of accessories for 1 to 5 work stations, for refrigerant R 22

Order No. W7302-8A

Consisting of:

Description	Quantity	
Mobile charging station	1	
Extaction valve	1	
Vacuum meter	1	
Electronic temperature meter	1	
Acid tester	1	
Liquid for testing proposes	1	
Recording manometer, -1 to 24 bar, complete with measuring disc	1	
Electronic leakage detector unit	1	
Refrigerant cylinder with 14kg refrigerant R 22	1	

Set of accessories for 1 to 5 work stations, for refrigerant R 134 a

Order No. W7302-8B

Consisting of:

Description	Quantity	
Mobile charging station	1	
Extaction valve	1	
Vacuum meter	1	
Electronic temperature meter	1	
Acid tester	1	
Liquid for testing proposes	1	
Recording manometer, -1 to 24 bar, complete with measuring disc	1	
Electronic leakage detector unit	1	
Refrigerant cylinder with 14kg refrigerant R 134 a	1	



Measuring Instruments

For conducting the tests the following measuring instruments are also necessary:



Digitalmultimeter

True rms yes Technical Characteristics:
Continuity test yes DC voltage ranges
hFE-test yes 400mV/4V/40V/400V/1000V
Logic test yes DC current ranges

Diode test yes $400\mu\text{A}/4\text{mA}/40\text{mA}/400\text{mA}/4A/20\text{A}$

RS 232 C-Interface yes Resistance ranges

Display $3 \frac{3}{4} \text{ digit}$ $400\Omega/4k\Omega/40k\Omega/400k\Omega/4M\Omega/40M\Omega$

Display height 17mm Capacity ranges

Power supply 9V battery 4nF/40nF/400nF/4μF/40μF

Dimensions (WxHxD) 87x147x34mm Inductance ranges Weight 305g 40mH/400mH

Frequency ranges incl. measuring leads 4kHz/40kHz/40kHz/4MHz

incl. interface connecting cable

Temperature ranges
and software

incl. -40...+1200 °C

manual Signal-Output

(2.7..3.2 Square wave signal 1/10/100Hz/1/2/3/4/5kHz

Order No. W4380



Electronic Power Meters Analog display

Mains connection: 230 V/ AC; 50 - 60 Hz, 15 VA Measuring ranges Voltage: 0-3/10/30/100/300/1000 V DC and AC (rms value) Input resistance: $> 1 \text{ M}\Omega$

input resistance. > 1 lvs2

Current ranges:

0-0.1/0.3/1/3/10/30A (DC + AC) Internal resistance: $50 \text{ m}\Omega$

Fuse in current path: 10 A s/o - b/o

Types of power

Active Power: 0 - 10 kW

Crest factor: 4
Reactive power:

(capacitive and inductive)

0 - 10 kVar

Apparent power: 0 - 10 kVA

Frequency range

Active power: DC to 1 kHz
Reactive power: 50 Hz
Apparent power: 50 Hz

Error limit: + 3 % (of full scale

deflection)

Dimensions:

Demonstration board:

266 x 297 x 150 mm (WxHxD)

Meter: (WxH) 230 x 183 mm Scale length: 170 mm Weight approx. 2.8kg

Order No. W5431-1C

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> Notes	



>	Notes

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Notes



FAX – Reply to: +49 (0)931 - 32231 - 20

Sender:	Receiver:		
Company	WUBKIRO - electronic GmbH & Co. KG		
Dept.	Sales Department		
Name			
Street	Dürerstr. 14		
City	97072 Würzburg / Germany		
Phone	+ 49-(0)931-32231-0		
Fax	+ 49-(0)931-32231-20		
E-Mail	info@wuekro.de		
Internet	www.wuekro.de		
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Remarks:			

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