SIEMENS

3347

Temperature Controller (Heat Pumps) RWD45

For comfort control in HVAC & R systems

Stand-alone electronic controller
Programmable controller with pre-configured applications
Three universal inputs for Ni1000, Pt1000 or active DC0…10V
Four 2-position (On/Off) outputs and one modulating DC0…10V output
Modulating DC0…10V for economiser or 2nd independent control loop
Suitable for 1, 2 and 3-stage compressor
Adjustable compressor delay times
Entering or changing of parameters via push buttons or software tool
PC connection for downloading canned applications via software tool
DIN rail or panel mount

Use

The RWD45 controller is intended for Heating, Ventilating, Air-conditioning and Refrigeration systems including Heat Pumps.

Control equipment

- Single, dual or triple compressor Heat Pump units
- Single, dual stage heating and cooling equipment
- Single, dual stage cooling equipment
- Single, dual stage heating equipment
- Equipment with DC0…10V input

Functions summary

- Controller
  - Stand alone controller with four 2-pos (On/Off) outputs and one DC 0…10V output

- Universal input X1 for the main temperature sensor.

- Universal input X2 for the following auxiliary functions.
  - On/Off (standby)
  - Remote setpoint
  - Alarm
  - Filter alarm
  - Setpoint compensation
  - Sensor averaging
  - Winter/Summer setpoint changeover
  - Sensor select

- Universal input X3 for the following functions.
  - Economiser sensor
  - 2nd independent control sensor

- Digital input D1 for the following digital functions.
  - Day/night change over setpoint
  - On/Off (standby)
  - Alarm
  - Filter alarm

Type summary

Input		*Outputs*		*Supply Voltage*	*Type*
Analog	Digital	Analog	Digital		
3	1	1	4	AC 24 V	**RWD45**

Accessories

Name	*Type*
Protective single enclosure for wall mounting	**ARG62.21**
Protective multiple enclosure for wall mounting	**ARG62.22**
Time Clock	**SEH62.1**
Transformer (30VA)	**SEM62.1 & SEM62.2**

Equipment combinations

The following units can be connected to RWD45 controllers.

Units	*Data sheet no.*
Sensors with Ni 1000 temperature sensing element	17... to 18…
Sensors with Pt 1000 temperature sensing element	1846
Sensors with DC0…10V measuring signal	17…to 19…
Room temperature sensor with setpoint adjuster QAA25 or QAA25/AP	1721/1748
Remote setpoint adjuster, FZA21.11 & FZA61.11	19…
Air damper actuators with DC0…10V	46…
Valve actuators with DC0…10V	45…
Other equipment with 2 position inputs Examples: compressors, electric heaters, fans	

Other combinations with third party units are possible, provided input and output specifications match the RWD45

Temperature control with modulating economiser

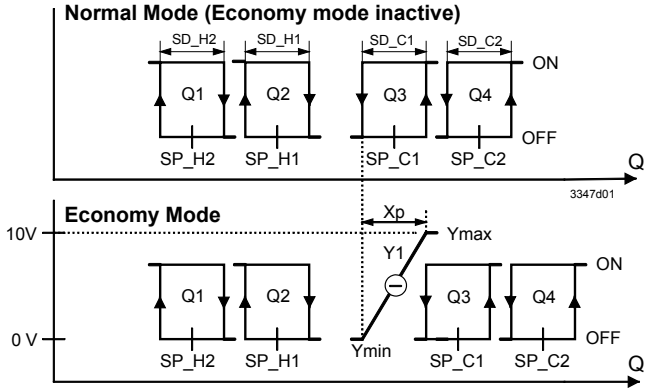
The input X1 detects the actual temperature and compares it with the setpoints. Depending on the deviation, the controller acts accordingly with its outputs to achieve the desired setpoints.
Economy mode is when the economiser output Y1 (cooling/heating) is the first output stage and is active only when the measured value of input X3 is within the maximum and minimum temperature limits for economy mode to operate.
Normal Mode is when economiser control is inactive. The first output stage (cooling/heating) is energised by the Q… output. In this case, the measured value of input X3 is not within the temperature limits for economy mode to operate.
Example for economy cooling: The economiser output Y1 will operate the outside air dampers and allow outdoor air as the first stage cooling if outdoor air temperature (X3) is within the maximum and minimum limits for economy mode. When outside air dampers are fully open, and further cooling is required, Q… outputs will energise the compressor stages. If the outdoor air temperature exceeds the minimum and maximum limits, the controller reverts back to normal mode. The purpose is to use outdoor air for free cooling when the conditions are suitable, thus saving on compressor run time and energy.

Applications

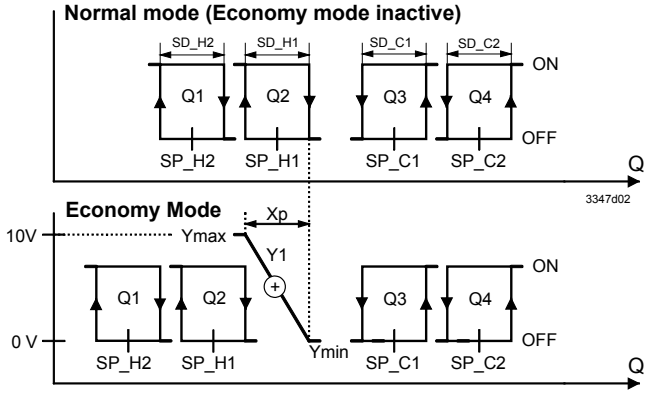
The controller has standard pre-configured applications. The respective application and setting parameters are entered via push buttons on the controller or a software tool. Refer to page 16 or the Installation & Commissioning guide for application numbers.

The RWD45 controller can be programmed as follows:

2-stage heating and cooling with economiser cooling
Application #10…#19

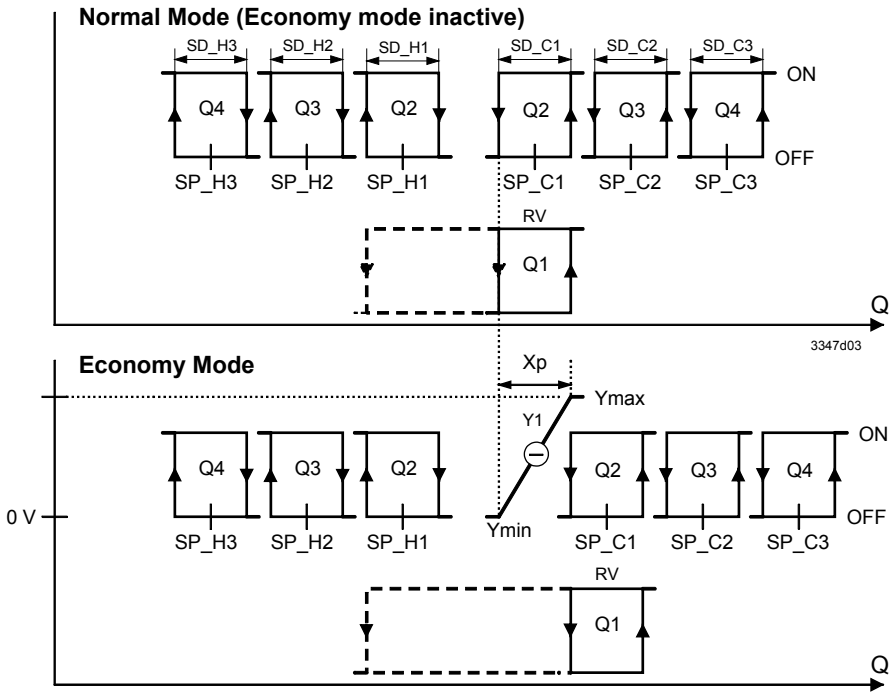


2-stage heating and cooling with economiser heating
Application #40..#49

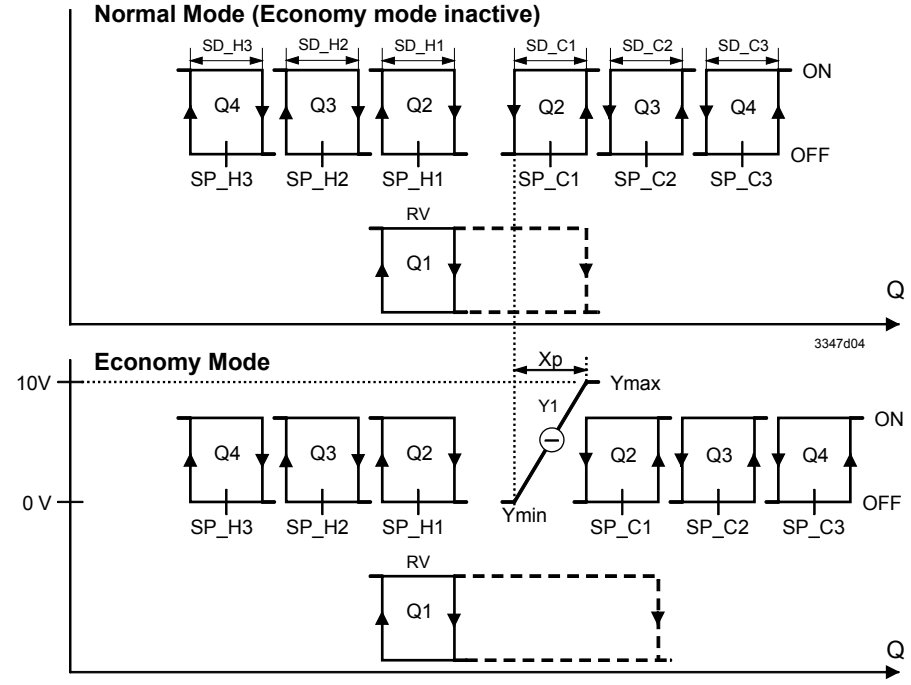


SP_H…	Setpoint heating stage…	Y1	Economy heating or cooling
SP_C…	Setpoint cooling stage…	Xp	P band for Y1
SD_…	Switching differential	⊕	Heating
Q	Load	⊖	Cooling

3-stage compressor, reversing valve in cooling & economiser cooling
Application #20…#29



3-stage compressor, reversing valve in heating & economiser cooling
Application #30…#39

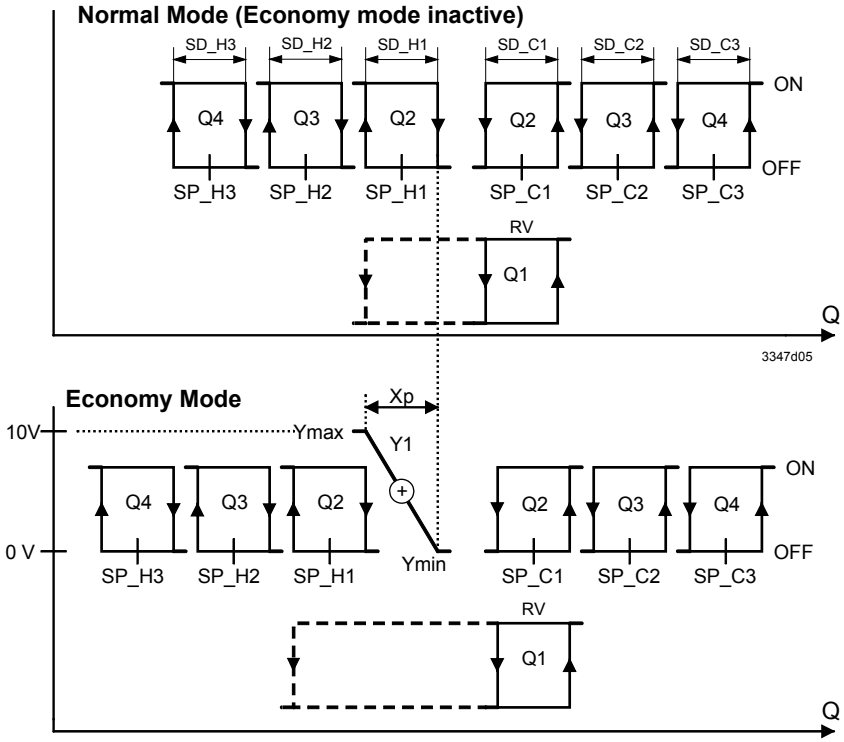


SP_H…	Setpoint heating stage…	Q1	Reversing valve
SP_C…	Setpoint cooling stage…	Q2	Compressor 1
SD_…	Switching differential	Q3	Compressor 2
Q	Load	Q4	Compressor 3

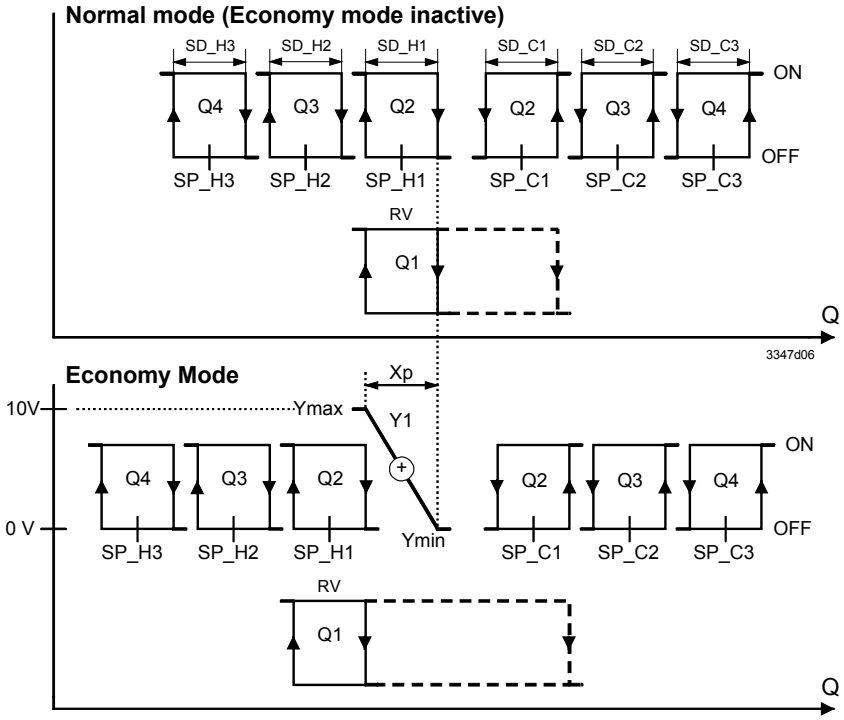
Reversing valve (RV)

For application with RV outputs, Q1energises the reversing valve (RV) on cooling or heating demand. It depends on the heat pump internal equipment circuitry. The reversing valve can be set to stay ON or OFF in the dead zone.

3-stage compressor, reversing valve in cooling & economiser heating
Application #50…#59



3-stage compressor, reversing valve in heating & economiser heating
Application #60…#69



SP_H…	Setpoint heating stage…	Q1	Reversing valve
SP_C…	Setpoint cooling stage…	Q2	Compressor 1
SD_…	Switching differential	Q3	Compressor 2
Q	Load	Q4	Compressor 3

Temperature control with an additional Independent loop

The input X1 detects the actual temperature and compares it with the setpoints. Depending on the deviation, the controller acts accordingly with its outputs to achieve the desired setpoints. In addition to above, input X3 and output Y1 are configured as a 2nd independent control loop. The input X3 detects the measured variable and compares it with the setpoint. Depending on the deviation, the controller generates a DC0…10V signal to adjust the regulating unit(s) between 0…100%. The output Y1 can be programmed as P or PI control.

2-stage heating and cooling. Application #70…#79

The Q outputs are configured as per normal mode in application #10…#19.

3-stage compressor with reversing valve in cooling demand. Application #80…#89

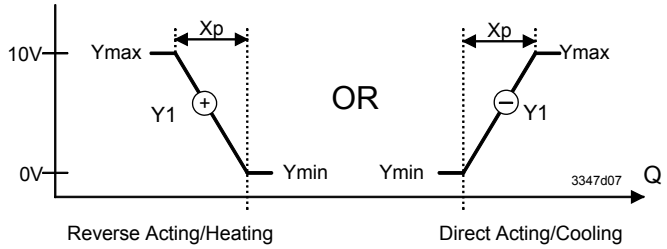
The Q outputs are configured as per normal mode in application #20…#29.

3-stage compressor with reversing valve in heating demand. Application #90…#99

The Q outputs are configured as per normal mode in application #30…#39.

Y1, direct or reverse acting sequence Application #70…#99

The 2nd independent output Y1 can be programmed as follows:



Y1 configured as an active output sensor indication of X1

The output Y1 can be programmed as a DC0…10V output corresponding to a temperature range of 0…50°C for sensor input X1. When this function is selected there is no economiser or a 2nd independent control loop.

X1 input (Ni 1000, Pt 1000)	*Y1 output*
0…50°C	DC0…10V

Universal input X1

The universal input X1 is used as the primary input for Ni 1000 sensor, Pt 1000 sensor or a DC0…10V active input.

Universal input X2

The universal input X2 is used as the secondary input for Ni 1000 sensor, Pt 1000 sensor, digital input, active/passive remote setpoint transmitter or a DC0…10V active input.

Universal input X3

The universal input X3 is used as the economiser or 2nd independent control input for Ni 1000 sensor, Pt 1000 sensor, a DC0…10V active input.

Digital input D1

The digital input D1 is used to enable the digital functions. Changeover occurs via potential-free contact between terminals D1-GND.

Delay times

The controller has adjustable output delay times to protect equipment from switching on/off frequently.

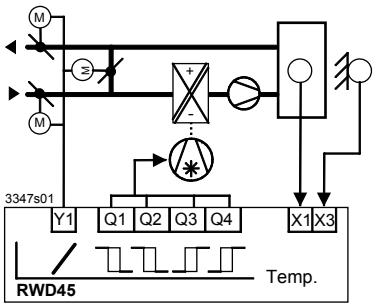
Delay	*Range*
Minimum On time	0…4096sec
Minimum Off time	0…4096sec
Inter-stage delay (stage 1⇒ stage 2 ⇒ stage 3)	0…4096sec
Changeover delay (heating ⇔ cooling)	0…4096sec
Winter ⇔ Summer setpoint changeover	0…23Hours 59min

Applications

Example: Main loop

Air conditioning plant with temperature control. 2-stage heating and 2-stage cooling with economy cooling.

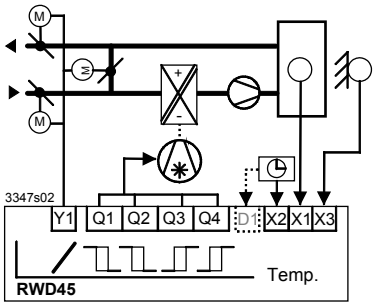
X1 Room temperature
X3 Outside air temperature
Q1 Heating stage 2
Q2 Heating stage 1
Q3 Cooling stage 1
Q4 Cooling stage 2
Y1 Modulating dampers



Auxiliary and digital functions

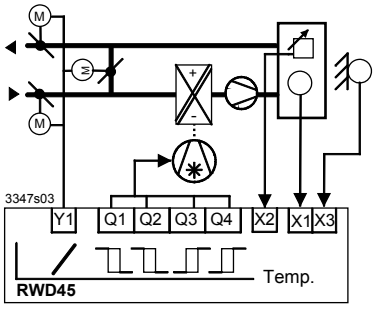
Standby ⏻

A switch contact (via time clock, thermostat) between X2–M or digital input D1-GND is used to enable the standby mode. During standby mode, all Q outputs are OFF.
If X2 is used as a standby function then D1 can be set as a day/night, filter alarm or an alarm.

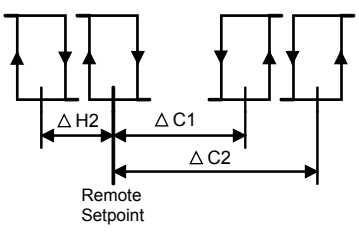


Remote setpoint

A remote setpoint transmitter or an integrated sensor with setpoint (QAA25, QAA25/AP), connected to X2 enables remote adjustment.

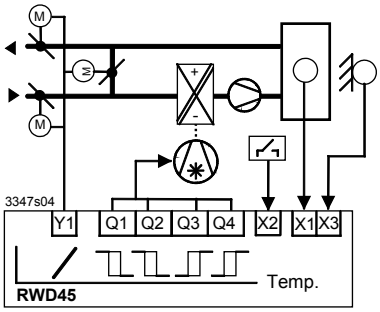


Heating stage 1 is the remote setpoint and the reference setpoint. A shift setpoint (Δ) is set between the stages.
The example shown is the remote setpoint parameters for a 2-stage compressor.



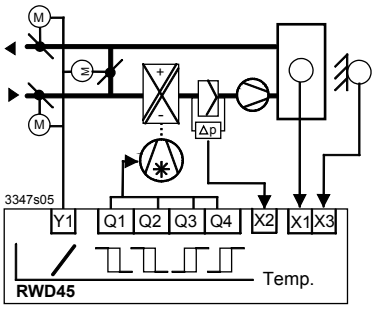
Alarm

A switch contact between X2–M or D1–GND is used to enable the alarm function. When the contact is closed, all Q outputs are OFF and the alarm icon flashes on the LCD.
The alarm function overrides all the other auxiliary and digital functions.
If X2 is used as an alarm function then D1 can be set as a day/night, standby or a filter alarm.



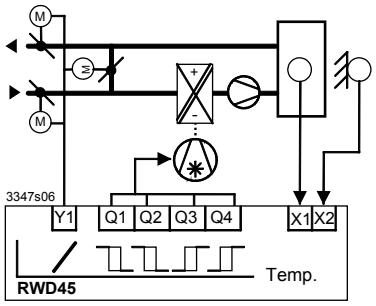
Filter alarm

A switch contact (via air pressure switch) between X2–M or D1–GND is used to implement a filter alarm indication. All Q outputs are not affected by filter alarm function.
If X2 is used as a filter alarm function then D1 can be set as a day/night, standby or an alarm.



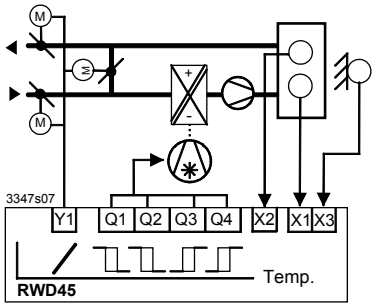
Setpoint compensation

The main setpoints are shifted over a range corresponding to a range measured by input X2. The most common application is to shift the main setpoints according to outside air temperature.



Sensor averaging

Two signals are connected to X1 and X2. The average between both is the controlling signal used by controller.

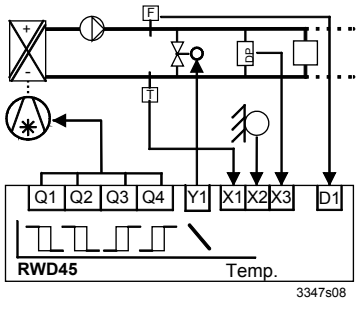


Winter/Summer setpoint changover

This application is used mainly on water heat pumps supplying two pipe FCU or radiator systems.

Digital changeover (X2 = Digital input)

When the contact is closed, summer setpoints are selected and only cooling is active.
When the contact is open, winter setpoints are selected and only heating is active.

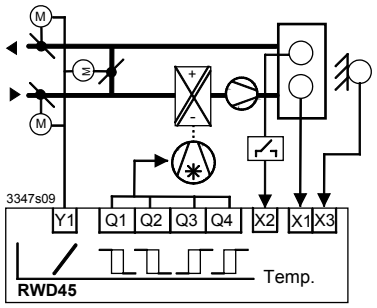


Analog changeover (X2 = outside air temperature sensor)

When the X2 > summer changeover setpoint, summer setpoints are selected and only cooling is active. When the X2 < winter changeover setpoint, winter setpoints are selected and only heating is active.
The above application, X3 and Y1 is used as the 2nd independent control for a pressure bypass system. D1 is set as an Alarm. If the flow switch detects no flow, the RWD45 outputs will be OFF.

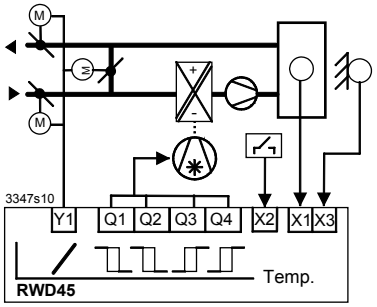
Sensor select

Two sensors connected to X1 and X2. A switch on the wall is used to select the controlling sensor. When the switch breaks, the controller selects X1 as the controlling signal.



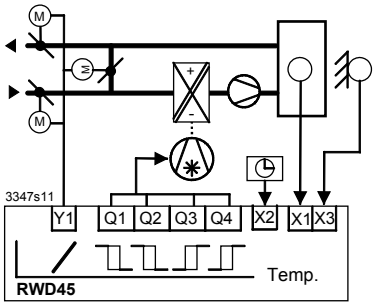
Main loop active

Default value for X1 is active DC0…10V and X2 is the standby mode input.



Day/night setpoint

A switch contact between D1-M can be used to implement setpoint changeover for day/night operation. When contact is open, the setpoints for day operation are selected. When contact is closed, the setpoints for night operation are selected.
During night operation, the remote setpoint and setpoint compensation functions are not applicable.



Mechanical Design

Housing

The RWD45 controllers are as per DIN 43 880 Gr. 1 requirements.

Protective housing ARG62.21/ARG62.22

A protective housing is used to protect the controller when mounted outside a control panel, such as on ducts, walls and in plant rooms. Furthermore, the protective housing prevents inadvertent contact with voltage supplying parts such as the connecting terminals.

The RWD45 clips into the protective housing.

The cable entries are located at the top and the bottom of the protective housing.

The front has an opening for the LCD display and the programming buttons.

Mounting options

The RWD45 universal controllers can be mounted as follows:

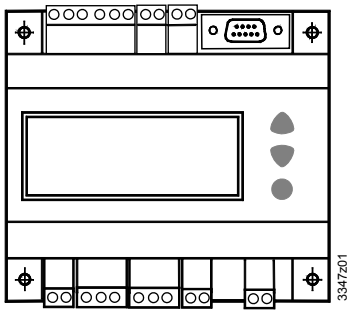
- In a standard electrical control cabinet as per DIN 43 880
- Wall mounted in a protective housing
- Front mounting with standard available installation elements

Terminals

Plug-in screw terminals

Operating and display elements

The RWD45 is operated by the buttons on the controller front. Additional tools are not necessary. A 9-pin port is provided for optional programming via the software tool.



LCD

The LCD shows the following information for normal operation:

- Current operating values (maximum 4 digits)
- Current setpoints (day/night)
- Application number
- Output status
- Auxiliary input value
- Selected auxiliary function

Operating buttons

The controller has three operating buttons for the following functions:

SELECT ●

The SELECT ● button is used to enter or save the value adjustment.

▲▼

The ▲▼ operating buttons are used for viewing and adjusting parameters.

Parameter setting

To configure the controller, follow the instructions supplied with the controller.

Software Tool

A software tool for controller application selection and parameter adjustment is available. It is a user-friendly Windows® 95 (or above) based software tool which provides you a printout of the controller settings

Engineering notes

Intended use

Use this controller only for applications as described in the description on the title page (bold print) and the section "Use". Additionally, observe all conditions and restrictions imposed in this section and in "Technical data".

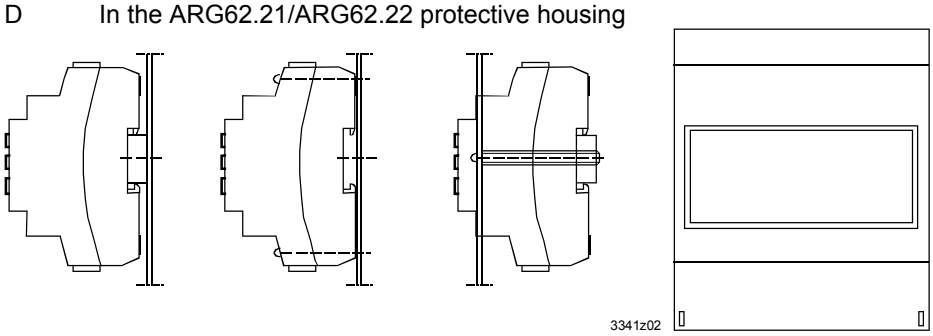
⚠

The sections marked with a warning symbol contain technical safety requirements and restrictions. Observe all of these warnings as they directly relate to the protection of personnel and equipment.

Installation notes

The RWD45 controllers can be mounted as follows:
Observe all local installation and mounting regulations.

A On a DIN rail (EN 50 022-35 x 7.5) at least 120 mm long
B Wall mounted with 2 screws
C Front mounted using standard elements.
e.g. 1x DIN rail 150 mm long
2x hexagonal placeholders 50 mm, washers and screws
D In the ARG62.21/ARG62.22 protective housing



A **B** **C** **D**

Electrical installation

Standard cables can be used for the controller. However, when mounting in an environment greatly exposed to EMC, use only shielded cables.

⚠

- The RWD45 is designed for AC 24 V operating voltage.

The low voltage must comply with the requirements for safety extra-low voltage (SELV) as per EN 60730.

Use safety insulating transformers with double insulation as per EN 60742; they must be designed for 100 % on-time.

When using several transformers in one system, the connection terminals G0 must be galvanically connected.

Supplying voltages above AC 24 V to low voltage connections may damage or destroy the controller or any other connected devices. Additionally, connections to voltages exceeding AC 42 V endanger personnel safety.

Commissioning notes

A booklet is supplied with the RWD45 controller for commissioning.

Observe the following:

- The controller must be configured for plant-specific operation using standard application number.
- Plant specific fine tuning can be performed if required (refer to the commissioning booklet).
- Power supply to the controller and the connected devices must be guaranteed
- Values and settings entered are retained after lost of power.

Technical data

General data

⚠ Power supply	Operating voltage	AC 24 V ±20 %
	Safety extra-low voltage (SELV) as per	EN 60730
	Frequency	50 Hz/60 Hz
Power consumption		4 VA
LCD	Actual and nominal values	Max 4 digits
Display resolution for (these values do not relate to the controller accuracy)	Ni 1000 Ω	0.5 °C
	Pt 1000 Ω	0.5 °C
	Active sensor	Depends on the setting range
Environmental conditions	Transport	IEC721-3-2
	Climatic conditions	Class 2K3
	Temperature	−25...+70 °C
	Humidity	<95 % r.h.
	Mechanical conditions	Class 2M2
Environmental conditions	Operation	IEC721-3-3
	Climatic conditions	Class 3K5
	Temperature	0...+50 °C
	Humidity	<95 % r.h.
IP code	Housing	IP 20 as per EN 60529
	Front and with ARG62.21	IP 30 as per EN 60529
	Front and with ARG62.22	IP 30 as per EN 60529
Product standards	Automatic electrical controls for household and similar use	EN 60730
CE conformity	In accordance with European Union directives	
	Electromagnetic compatibility EMC	89/336 EEC
	Low voltage directive	73/23 EEC
	Emissions	EN 50081-1
	Immunity	EN 50082-1
	Safety	EN 60730
Other international approval	C tick compliance	N474
Terminals	Screw terminals for cables with	min. 0.5 mm dia. max. 2 x 1.5 mm² or 2.5 mm²
Weight without packaging	RWD45	0.330kg

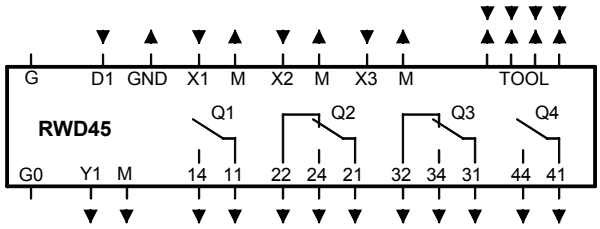
Analog inputs X1, X2

Ni 1000 Ω at 0 °C	Controller Measuring Range	−50…+150 °C
	Max. cable length for dia. 0.6 mm	max. 300 m
Pt 1000 Ω at 0 °C	Controller Measuring Range	−20…+180 °C
	Max. cable length for dia. 0.6 mm	max. 300 m
Analog voltages (for measured variables in °C, % or without unit)	Range	DC 0…10 V corresponding to adjustable range from –100 to 2400 (°C, % or no unit)
	Max. cable length for dia. 0.6 mm	max. 300 m
	Range	0...1000 Ω & 0..10V corresponding to

Remote setpoints X2	Max. cable length for dia. 0.6 mm	adjustable range from –100 to 2400 (°C, °F) max. 300 m
Digital input D1	Polling voltage for control commands (D…M) Current consumption	DC 15 V ＜10 mA
Analog outputs Y1	Range Maximum Current	DC0…10V ± 1mA
Digital outputs Q..	Relay contacts (potential-free)	
	Voltage	AC 24...230 V
	Maximum rating	AC 230 V, 4 A resistive, 3 A ind. (per relay terminal)
	Minimum rating	DC 30 V, 4 A AC 19.2 V, 20 mA DC 5 V, 100 mA

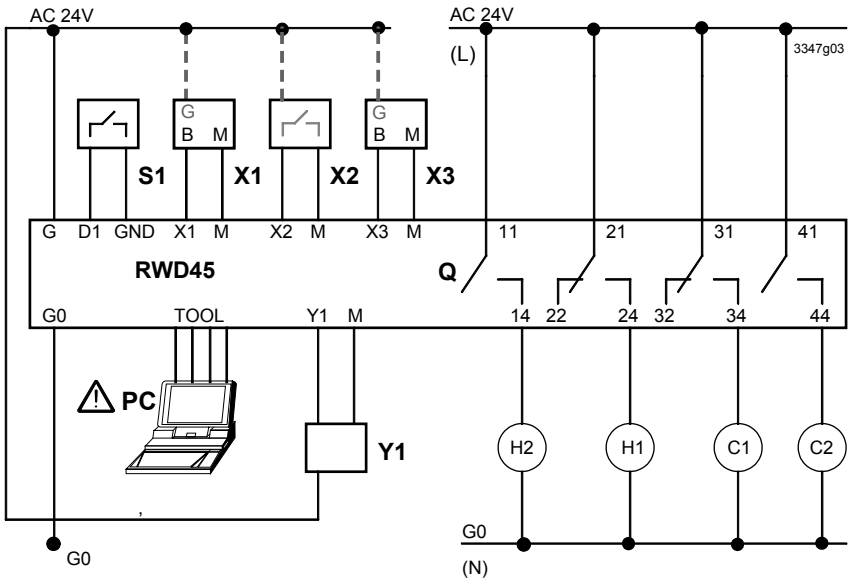
Diagrams

Internal diagram

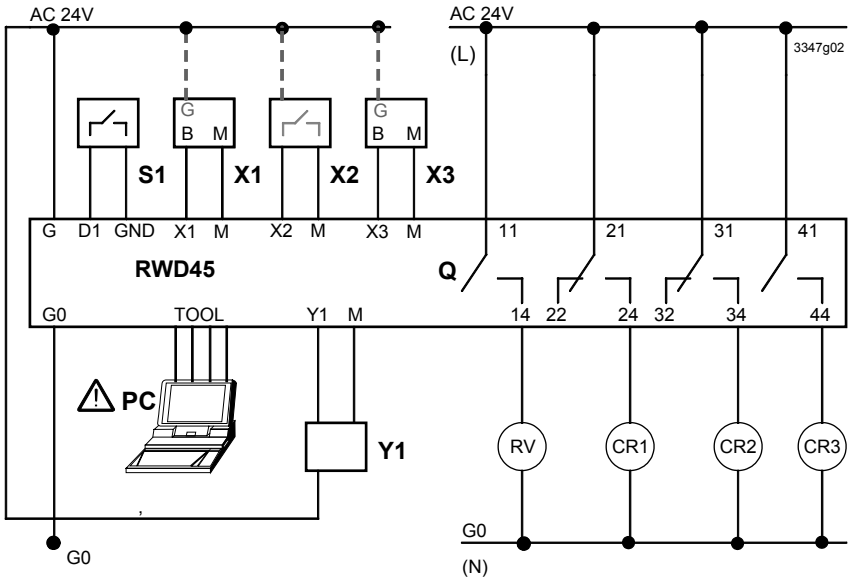


D1	Digital Input
G, G0	AC24V supply (⚠ SELV AC 24 V Power supply)
M	Ground (G0) for signal inputs and universal inputs
Q...	Relay outputs, various voltages permissible
X1	Signal input (Main input: Ni 1000, Pt 1000 and DC0 …10 V)
X2	Signal input (Aux. Input: Ni 1000, Pt 1000, DC0 …10 V and remote setting unit)
X3	Signal input (Eco. sensor or 2nd Ind. input: Ni1000, Pt1000, DC0…10V)
Y1	Analog output (DC0…10V)
Tool	Communication port with PC (9-pin plug)

2-stage heating & cooling. Y output for Economiser or 2nd Ind. control. Applications #10…#19, #40…#49, #70…#79



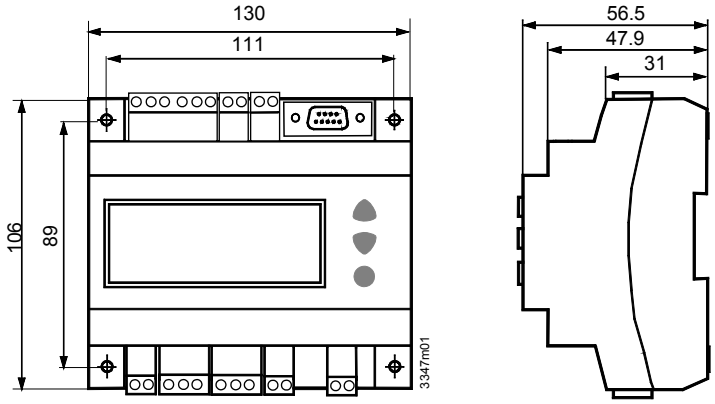
3-stage compressor with reversing valve. Y output for economiser or 2nd Ind. Control. Applications #20…#39, #50…#69, #80…#99

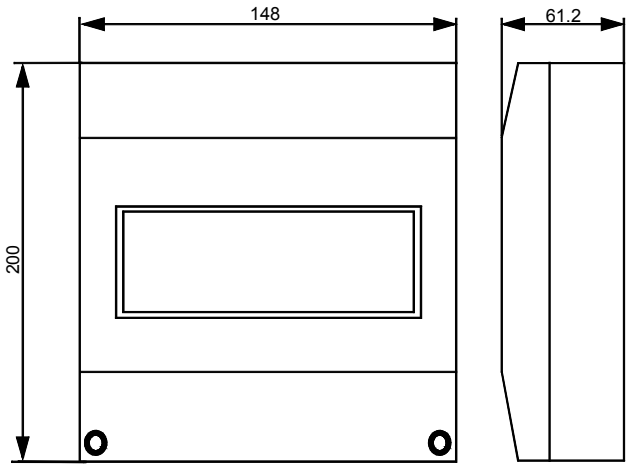


CR1	Compressor 1
CR2	Compressor 2
CR3	Compressor 3
RV	Reversing valve
H1,H2	Heat 1 & Heat 2
C1,C2	Cool 1 & Cool 2
Y1	Control equipment with DC0…10V input (eg. Actuators,…)
X1	Main temperature sensor
X2	Auxiliary sensor or switch
X3	Outside air temperature sensor or 2nd Independent control sensor
S1	Switch or time clock
PC	Personal computer

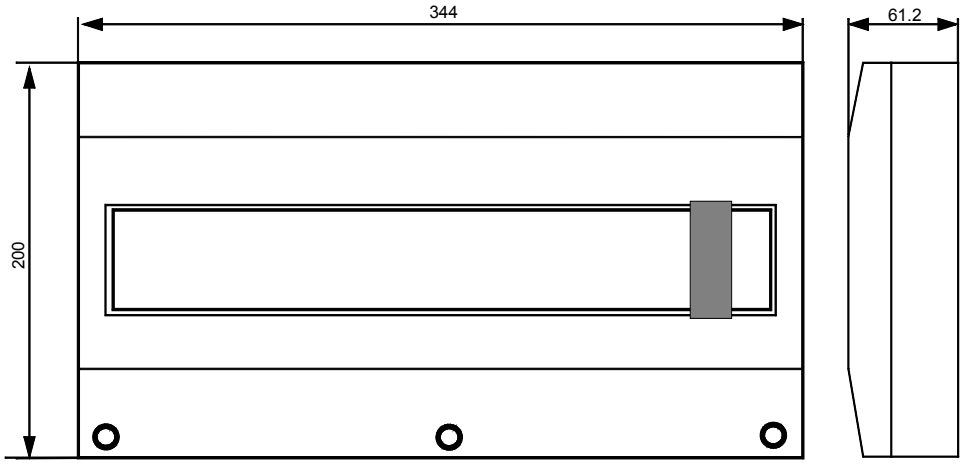
⚠ Please note that the TOOL signal ground is galvanically connected to G0 inside the controller. If the signal line of the computer is grounded to Earth, the G0 line after TOOL connection will be earthed as well. This will change the SELV to a PELV.

Dimensions



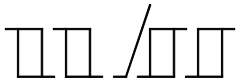
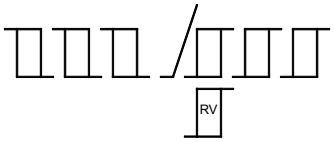
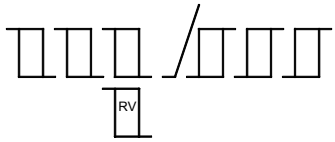


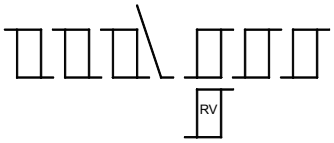
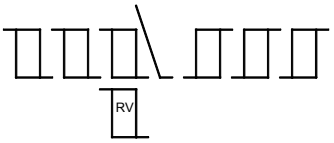
ARG62.21

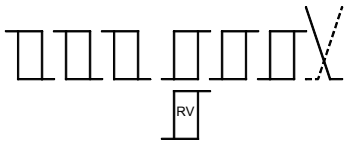
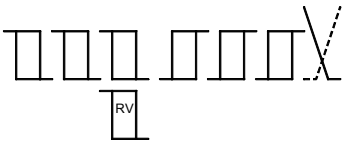


ARG62.22

Appendix- RWD45 Application numbers

H = Heating C = Cooling Cr = Compressor RV = Reversing valve Eco = Economy	**Main Loop**		
			
Auxiliary Loop	#1x (2H2C + Eco Cool)	#2x (3stage Cr + RV cool + Eco Cool)	# 3x (3stage Cr + RV heat + Eco Cool)
#x0 (Standby)	#10	#20	#30
#x1 (Remote setpoint)	#11	#21	#31
#x2 (Alarm)	#12	#22	#32
#x3 (Filter Alarm)	#13	#23	#33
#x4 (Comp. Shift)	#14	#24	#34
#x5 (Avg. X1, X2)	#15	#25	#35
#x6 (Win/Sum Digital)	N/A	N/A	N/A
#x7 (Win/Sum Analog)	N/A	N/A	N/A
#x8 (Sensor Select)	#18	#28	#38
#x9 (Active Input)	#19	#29	#39

H = Heating C = Cooling Cr = Compressor RV = Reversing valve Eco = Economy	**Main Loop**		
			
Auxiliary Loop	#4x (2H2C + Eco Heat)	#5x (3stage Cr + RV cool + Eco Heat)	#6x (3stage Cr + RV heat + Eco Heat)
#x0 (Standby)	#40	#50	#60
#x1 (Remote setpoint)	#41	#51	#61
#x2 (Alarm)	#42	#52	#62
#x3 (Filter Alarm)	#43	#53	#63
#x4 (Comp. Shift)	#44	#54	#64
#x5 (Avg. X1, X2)	#45	#55	#65
#x6 (Win/Sum Digital)	N/A	N/A	N/A
#x7 (Win/Sum Analog)	N/A	N/A	N/A
#x8 (Sensor Select)	#48	#58	#68
#x9 (Active Input)	#49	#59	#69

H = Heating C = Cooling Cr = Compressor RV = Reversing valve Ind = Independent	**Main Loop**		
			
Auxiliary Loop	#7x (2H2C + Ind Y)	#8x (3stage Cr + RV cool + Ind Y)	#9x (3stage Cr + RV heat + Ind Y)
#x0 (Standby)	#70	#80	#90
#x1 (Remote setpoint)	#71	#81	#91
#x2 (Alarm)	#72	#82	#92
#x3 (Filter Alarm)	#73	#83	#93
#x4 (Comp. Shift)	#74	#84	#94
#x5 (Avg. X1, X2)	#75	#85	#95
#x6 (Win/Sum Digital)	#76	#86	#96
#x7 (Win/Sum Analog)	#77	#87	#97
#x8 (Sensor Select)	#78	#88	#98
#x9 (Active Input)	#79	#89	#99