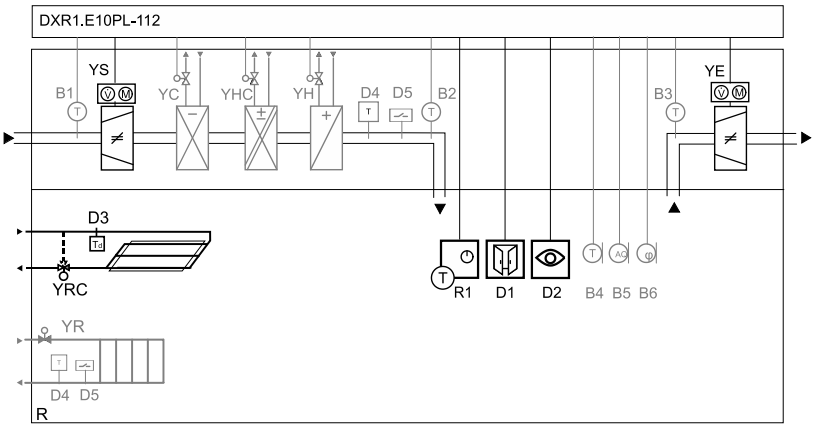
Supply and extract VAV with integrated damper actuator and heating/chilled ceiling

DXR1.E10PL-112

Supply & extract air volume control with integrated damper actuator (10 Nm)
Room temperature control
Air quality control
Relative humidity monitor
Room temperature and rapid ventilation operation via KNX PL-Link room operator unit with temperature, air quality & relative humidity measurement

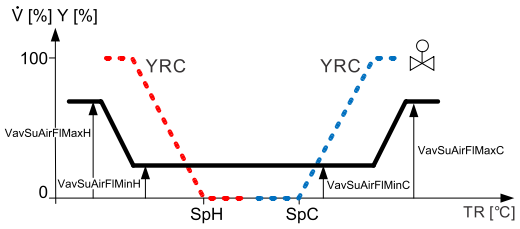
Plant diagram



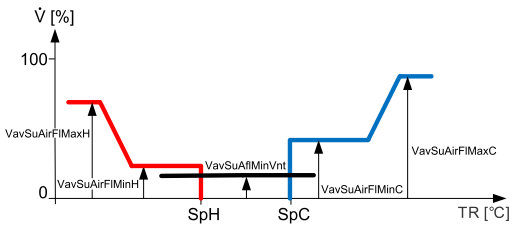
DXR1.E10PL-112	Compact room automation stations	D4	Over-temperature detector
B1	Primary air temperature sensor for air after treatment	D5	Enable radiator / heating coil electric position
		R	Room
B2	Supply air temperature sensor	R1	Room operator unit with temperature sensor
B3	Extract air temperature sensor	YS	Supply air control (integrated in DXR1) Differential pressure sensor (supply air – integrated in DXR1..)
B4	Room temperature sensor	YC	Cooling coil valve
B5	Room air quality sensor	YHC	Heating/cooling coil valve
B6	Room relative humidity sensor7	YH	Heating coil valve
D1	Window contact	YE	Extract air control (integrated in DXR1 or external actuator) Differential pressure sensor (extract air – integrated in DXR1)
D2	Presence detector	YRC	Radiant ceiling valve
D3	Condensation monitor	YR	Radiator valve

Function diagrams

Heating and cooling valve



Air flow



SpC	Effective cooling setpoint	VavSuAirFlMaxH	Max. volume, heating
SpH	Effective heating setpoint	VavSuAirFlMinC	Min. volume, cooling
TR	Room temperature	VavSuAirFlMinH	Min. volume, heating
V	Volume flow rate	Y	Output signal
VavSuAflMinVent	Min. air flow ventilation	YRC	Radiator ceiling valve
VavSuAirFlMaxC	Max. volume, cooling		

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Description of functions

Basic functions

PID control for supply VAV, temperature and air quality.
Supply air differential pressure control sensor integrated in controller.
Internal air flow controller controls supply air damper actuator (integrated in controller).
The application allows customers to adjust the room temperature setpoints and rapid ventilation via the room operator unit.
Display of room air quality on room unit.
The operating modes are Comfort, Pre-Comfort, Economy and Protection.
The air flow for heating and cooling is operated in sequence to the valves or electric reheater. Parallel operation can be configured.

— Extract air control by either 0…10 V or KNX PL-Link VAV compact controller.
Heating and cooling coils with 3-position valves controlled by triac outputs
Optimal energy efficiency by including the option for room/supply air cascade control, presence detector or window contact.

Auxiliary functions

Rapid ventilation.
Air volume flow tracking for positive and negative room air pressure.
Green Leaf (RoomOptiControl) function.
The application allows control via centralized commands (e.g. scheduler program for room operating mode).
Central optimum start control provides best room comfort at the start of occupancy.
Central operation or reset of setpoints, timed valve kick function or outside temperature dependent heating limit.
Central override functions for valves.
Seasonal compensation of room temperature setpoints.

PWM constant (incl. spring return) or PWM thermal control can be selected for valves.
0…10 V output can be selected for valves.
Room operator unit and sensor variants:
- KNX PL-Link wall-mount sensor
- KNX PL-Link wall-mount room operator unit
- KNX PL-Link flush-mount sensors
- Analog extract air temperature sensor

Presence can be detected by KNX PL-Link sensor or binary sensor.

Siemens devices

Legend	Type of unit	Data sheet	Product No.	Qty.
DXR1..	Compact room automation stations, BACnet/IP, 24 V, 1 DI, 2 UI, 1 AO, 4 triac, differential pressure sensor	A6V11393933	DXR1.E10PL-112	1
R1	KNX PL-Link room operator unit with sensors for temperature, humidity, CO_2, segmented backlit display, touchkeys	N1602	QMX3.P74	1
YE	VAV compact controller, AC 24 V, DC 0...10 V, 5 Nm, 150 s, 300 Pa	N3544	GLB181.1E/3	1
YRC	Rotary actuator for ball valves KNX / PL-Link, AC 24 V, 5 Nm, 150 s	A6V10725318	GDB111.9E/KN	1
D1	Door/window contact, white	1)	S 290/11	2)
D2	KNX PL-Link presence detector with brightness sensor	1)	UP 258D12	1 - 2

1) Further documents on www.siemens.com/gamma-td.
2) Type of operation (NO or NC). Multiple devices of the same type can be connected.

Optional [1]	Legend	Type of unit	Data sheet	Product No.	Qty.
	B1	Cable temperature sensor PVC 2 m, LG-Ni1000	N1831	QAP22	1
	B2	Cable temperature sensor PVC 2 m, LG-Ni1000	N1831	QAP22	1
	B3	Cable temperature sensor PVC 2 m, LG-Ni1000	N1831	QAP22	1
	B5	Cable temperature sensor PVC 2 m, LG-Ni1000	N1831	QAP22	1
	B6	Room air quality sensor	CE1N1961	QPA2000	1
	B7	Room relative humidity sensor	CE1N1857	QFA2000	1
	YC	2-port, 3-port valve or 3-port valves with bypass, PN16	N4847	V..P47..	1
		Motorized 3-positioning actuator for V..P47.., AC 24 V	N4864	SSP81..	1
	YHC	2-port, 3-port valve or 3-port valves with bypass, PN16	N4847	V..P47..	1
		Motorized 3-positioning actuator for V..P47.., AC 24 V	N4864	SSP81..	1
	YR	2-port, 3-port valve or 3-port valves with bypass, PN16	N4847	V..P47..	1
		Motorized 3-positioning actuator for V..P47.., AC 24 V	N4864	SSP81..	1
	YH	2-port, 3-port valve or 3-port valves with bypass, PN16	N4847	V..P47..	1
		Motorized 3-positioning actuator for V..P47.., AC 24 V	N4864	SSP81..	1

[1] Can be combined according to available on-board I/Os on controller.

Variants					
	$R1_a$	Wall-mounted sensors and room operator units for KNX PL-Link	A6V10733768	QMX2.P33	1
	$R1_b$	Wall-mounted sensors and room operator units for KNX PL-Link	A6V10733768	QMX2.P43	1
	$R1_c$	Wall-mounted room operator unit for KNX PL-Link, KNX S-mode and KNX LTE-Mode	N1602	QMX3.P34	1
	$R1_d$	KNX PL-Link flush-mount room sensors	N1411	AQR253… AQR257…	1
	$R1_e$	KNX PL-Link wall-mount room sensor for temperature	N1602	QMX3.P30	1
	$R1_f$	Room sensor KNX for temperature and humidity	N1602	QMX3.P40	1
	$R1_g$	Room sensor KNX for temperature, humidity, CO2	N1602	QMX3.P70	1
	YE_a	VAV Compact Controller, AC 24 V, KNX PL-Link, 10 Nm, 150 s, 300 Pa	N3547	GLB181.1E/KN	1
	YE_b	VAV compact controller, AC 24 V, KNX PL-Link, 5 Nm, 150 s, 300 Pa	N3547	GDB181.1E/KN	1
	YE_c	VAV compact controller, AC 24 V, KNX PL-Link, 10 Nm, 150 s, 300 Pa	N3544	GLB181.1E/3	1

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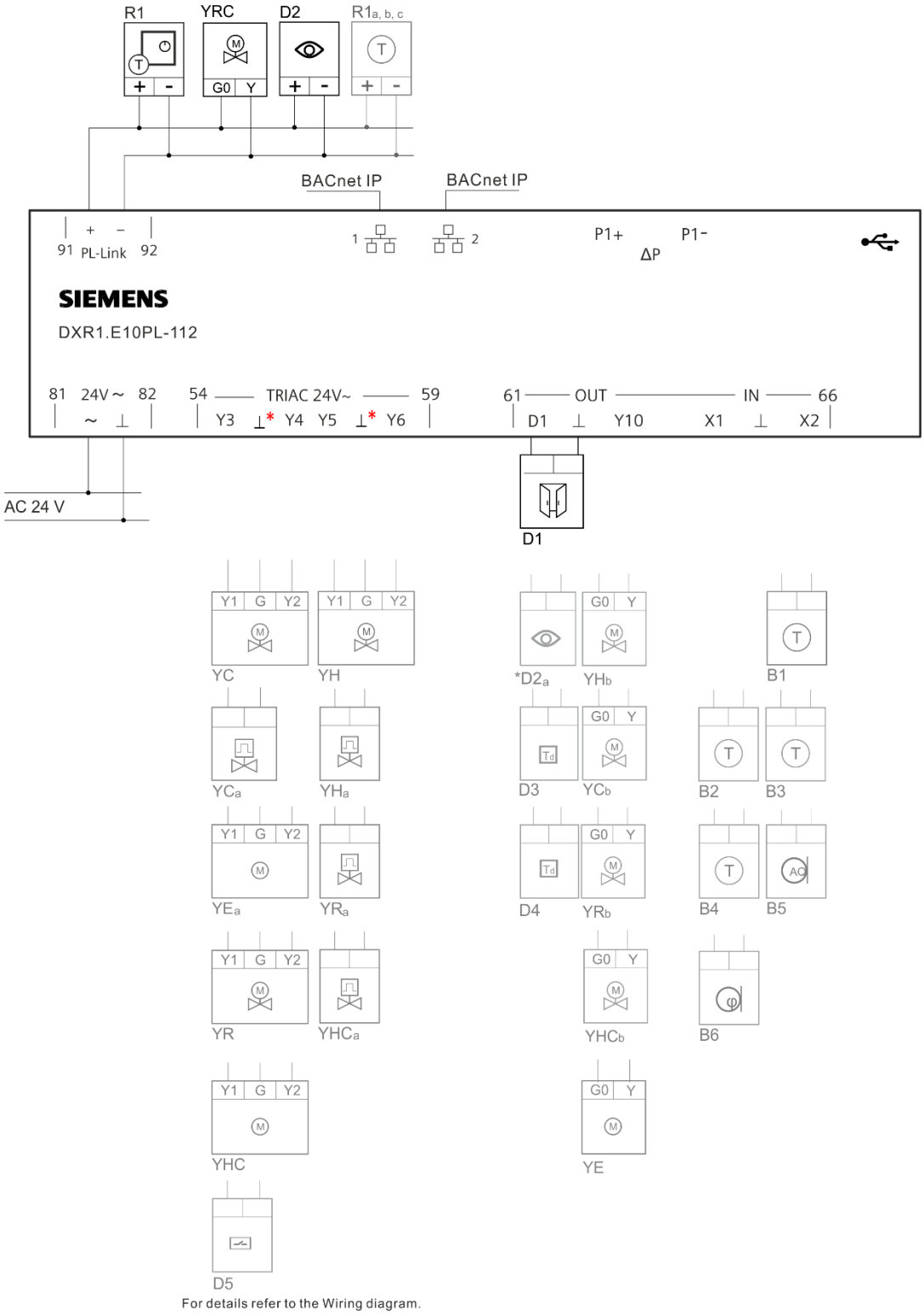
Connection diagram



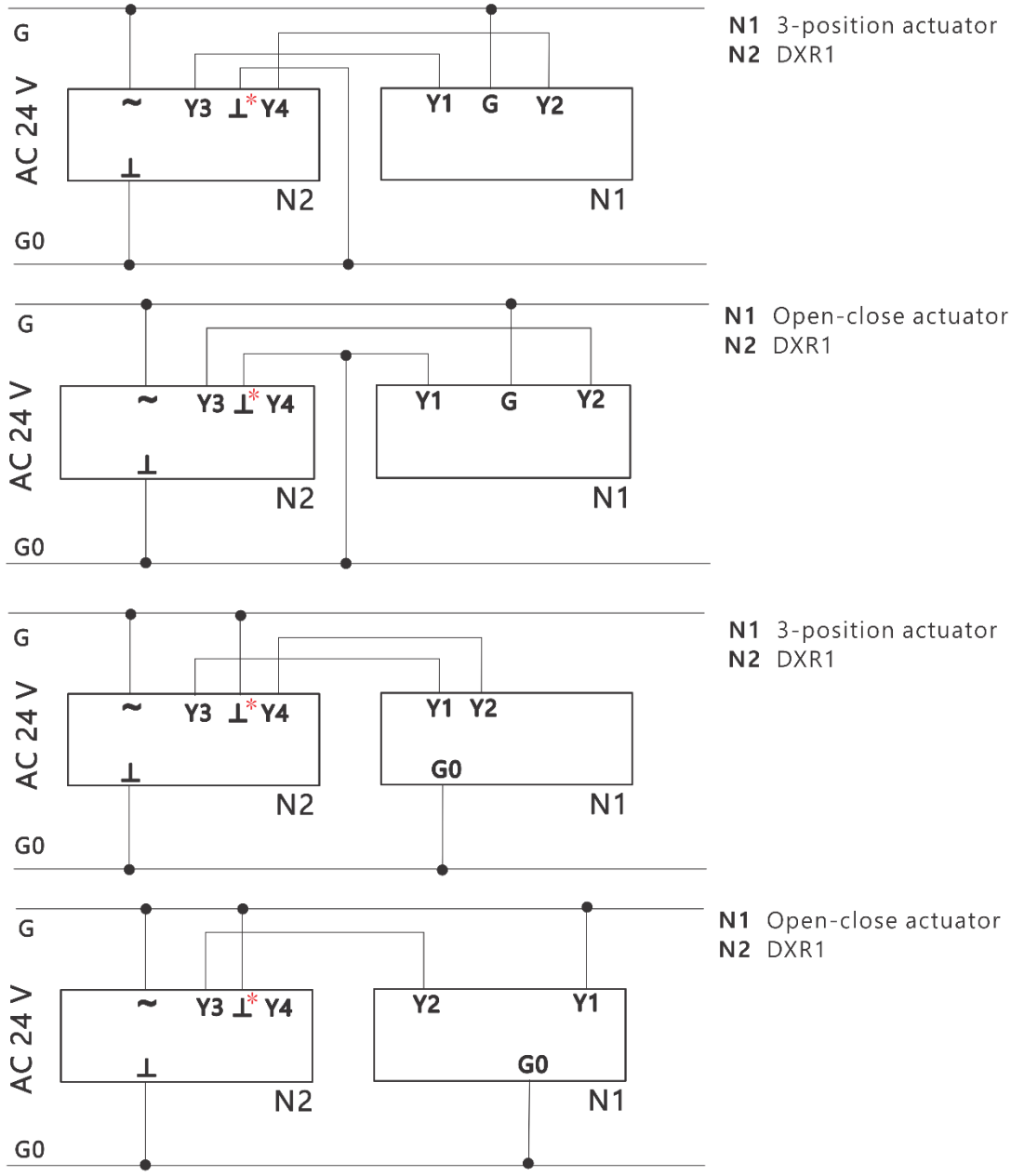
For details refer to the Wiring diagram.

⊥ internally connected

⊥* internally connected, but not internally connected with ⊥

* 3rd party device

Wiring diagram



Supply and extract VAV with integrated damper actuator and heating/chilled ceiling

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Application configuration

	Equipment	Channel/Signal	Settings example
On-board output	Supply air VAV position (integrated actuator)	Y1, Y2; 3-position	Y1, Y2; 3-position
On-board input	Supply air VAV differential air pressure (integrated sensor) (YS)	P1	P1
	Window contact (D1)	D1; Normally closed X1; Normally closed X2; Normally closed	D1; Normally closed
KNX PL-Link devices	Room operator unit device 1	QMX2.P33 QMX2.P43 QMX3.P34 QMX3.P74	QMX3.P74
	Sensor device 2 (D2)	UP 258D12	UP 258D12
	VAV box extract	GDB181.1E/KN; Air volume flow control GLB181.1E/KN; Air volume flow control GDB181.1E/KN; Position control GLB181.1E/KN; Position control	GLB181.1E/KN; Air volume flow control
	Radiant ceiling device	GDB111.9E/KN	GDB111.9E/KN
HVAC	Supply air VAV	Supply air VAV 12, press, duct area, ctr. Supply air VAV 13, press, flow conv, ctr. Supply air VAV 15, press, dependent ctrl.	Supply air VAV 13, press, flow conv, ctr.
	Extract air VAV	Extract air VAV 11, external air flow ctr. Extract air VAV 12, press, duct area, ctr. Extract air VAV 13, press, flow conv, ctr. Extract air VAV 15, press.dependent ctr.	Extract air VAV 11, external air flow ctr.
	Radiant ceiling	Chilled ceiling with chilled water 11 Ceiling heat./chilled ceiling 2-pipe 11 Ceiling heat./chilled ceiling 4-pipe 13 Ceiling heating with hot water 11 Ceiling heat./chilled ceiling 4-pipe 15	Ceiling heat./chilled ceiling 4-pipe 15

Optional configuration

	Equipment	Channel/Signal	Settings example
On-board output	Cooling coil valve position	Water; Y3, Y4; 3-position Water; Y3; Pulse width modulation spring return Water; Y10; 0...10 V	
	Heating and cooling coil valve position	Water; Y3, Y4; 3-position Water; Y5, Y6; 3-position Water; Y3; Pulse width modulation spring return Water; Y5; Pulse width modulation spring return Water; Y10; 0...10 V	
	Heating coil valve position	Water; Y3, Y4; 3-position Water; Y5, Y6; 3-position Water; Y3; Pulse width modulation spring return Water; Y5; Pulse width modulation spring return Water; Y10; 0...10 V Electric 1-stage; Y3; Normally open Electric 1-stage; Y5; Normally open Electric 2-stage; Y3, Y4; Normally open Electric 2-stage; Y5, Y6; Normally open Electric 3-stage; Y3, Y4, Y5; Normally open Electric 3-stage; Y4, Y5, Y6; Normally open Electric modulating; Y10; 0...10 V	
	Extract air VAV position	Y1, Y2; 3-position Y3, Y4; 3-position Y5, Y6; 3-position Y10; 0...10 V Air volume flow; Y10; 0...10 V	
	Enable heating coil valve position	Y3; Normally open Y5; Normally open	
	Radiant ceiling valve position	Chilled; Y3, Y4; 3-position Chilled; Y5, Y6; 3-position Chilled; Y3; Pulse width modulation spring return Chilled; Y5; Pulse width modulation spring return Chilled; Y10; 0...10 V Heating/chilled; Y3, Y4; 3-position Heating/chilled; Y5, Y6; 3-position Heating/chilled; Y3; Pulse width modulation spring return Heating/chilled; Y5; Pulse width modulation spring return Heating/chilled; Y10; 0...10 V Heating; Y3, Y4; 3-position Heating: Y5, Y6; 3-position Heating: Y3; Pulse width modulation spring return Heating: Y5; Pulse width modulation spring return Heating: Y10; 0...10 V	
	Radiator valve position	Water; Y3, Y4; 3-position Water; Y5, Y6; 3-position Water; Y3; Pulse width modulation spring return Water; Y5; Pulse width modulation spring return Water; Y10; 0...10 V Electric 1-stage; Y3; Normally open Electric 1-stage; Y5; Normally open Electric modulating; Y10; 0...10 V	
	Enable radiator electric position	Y3; Normally open Y5; Normally open	
On-board input	Extract air VAV differential air pressure (YE)	X1; 0...10 V X2; 0...10 V P1	

Optional configuration

	Equipment	Channel/Signal	Settings example
	Extract air VAV air volume flow	X1; 0...10 V X2; 0...10 V	
	Extract air temperature (B3)	X1; Ni1000 X1; 0…10 V X1; NTC100K X1; NTC10K X1; PT1K_EU X1; PT1K_NA X2; Ni1000 X2; 0…10 V X2; NTC100K X2; NTC10K X2; PT1K_EU X2; PT1K_NA	
	Primary air temperature for air after-treatment (B1)	X1; Ni1000 X1; 0…10 V X1; NTC100K X1; NTC10K X1; PT1K_EU X1; PT1K_NA X2; Ni1000 X2; 0…10 V X2; NTC100K X2; NTC10K X2; PT1K_EU X2; PT1K_NA	
	Heating coil over-temperature detection (D4)	D1; Normally closed X1; Normally closed X2; Normally closed	
	Room air quality (B6)	X1; 0…10 V X2; 0…10 V	
	Room temperature (B4)	X1; Ni1000 X1; 0…10 V X1; NTC100K X1; NTC10K X1; PT1K_EU X1; PT1K_NA	
	Relative humidity for room (B6)	X1; 0…10 V X2; 0…10 V	
	Supply air temperature (B2)	X2; Ni1000 X2; 0…10 V X2; NTC100K X2; NTC10K X2; PT1K_EU X2; PT1K_NA	
	Presence detector (D2)	D1; Normally open	
	Radiator over-temperature detector (D4)	D1; Normally closed X1; Normally closed X2; Normally closed	
	Condensation monitor	D1; Normally closed X1; Normally closed X2; Normally closed	
KNX PL-Link devices	Sensor device 1 (D2)	Base module AQR2570Nx Base module AQR2576Nx QMX3.P30 QMX3.P70 QMX3.P40	

Optional configuration

	Equipment	Channel/Signal	Settings example
HVAC	Chilled water	Chilled water cooling coil 11 Chilled water cooling coil 12, sply.temp	
	Heating/cooling coil	Heating/cooling coil 2-pipe system 11 Heat/cool.coil 2-pipe sys.12, sply.temp. Heating/cooling coil 4-pipe system 13 Heat/cool.coil 4-pipe sys.14, sply.temp. Heating/cooling coil 4-pipe system 15 Heat/cool.coil 4-pipe sys.16, sply.temp.	
	Heating coil	Hot water heating coil 11 Hot water heat.coil 12, sply.temp.ctrl. Electric heating coil 11, mod.output Electric heating coil 12, sply.temp.ctrl Electric heating coil 13, 1 binary outp. Electric heating coil 14, 2 binary outp. Electric heating coil 15, 3 binary outp.	
	Radiator	Hot water radiator 11, mod./2-pos.ctrl. Electric radiator 11, modulating Electric radiator 12, one binary output	

Default values

	Parameter	Range	Default value
Temperature setpoints	Cooling setpoint for Comfort	0 … 50 °C	24 °C
	Delta cooling setpoint for Pre-comfort	0 … 10 K	1 K
	Cooling setpoint for Economy	0 … 50 °C	35 °C
	Cooling setpoint for Protection	0 … 50 °C	40 °C
	Heating setpoint for Comfort	0 … 50 °C	21 °C
	Delta heating setpoint for Pre-comfort	0 … 10 K	1 K
	Heating setpoint for Economy	0 … 50 °C	15 °C
	Heating setpoint for Protection	0 … 50 °C	12 °C
Ventilation Control	Setpoint room air quality for comfort	0 … 2000 ppm	900 ppm
	Setp. room air quality for pre-comfort	0 … 2000 ppm	1100 ppm
	Setpoint room air quality for economy	0 … 2000 ppm	1500 ppm
	Setpoint room air quality for protection	0 … 2000 ppm	1500 ppm
Supply air VAV	Supply air VAV max.air vol.flow f.cool	0 … 10’000 m^3/h	100 m^3/h
	Supply air VAV min.air vol.flow f.cool	0 … 10’000 m^3/h	50 m^3/h
	Supply air VAV max.air vol.flow f.heat	0 … 10’000 m^3/h	100 m^3/h
	Supply air VAV min.air vol.flow f.heat.	0 … 10’000 m^3/h	50 m^3/h
	Supply air VAV min.air vol.flow f.vent.	0 … 10’000 m^3/h	0 m^3/h
	Supply air VAV box coefficient	0 … 10’000 $m^3/h/SqrtPa$	150 $m^3/h/SqrtPa$
Room operator unit	Room unit, display temperature	None Display room temperature	Display room temperature
	Room unit, display windows status	Yes, No	No
	Room unit, display air quality	None Display room air quality	None
	Room unit, air quality display	Numeric (in ppm) Symbolic (with the symbols +, ++, and +++) Textual (Poor, Ok, Good)	Textual
	Room unit, display heat./cool. status	Yes, No	Yes
	Enable operation: room temp. setpoint	Yes, No	Yes
	Room unit, room temp. setpoint display	Absolute temperature setpoint Relative setpoint shift	Absolute temperature setpoint

Default values

	Parameter	Range	Default value
	Enable operation: fan speed setpoint	Yes, No	No
	Enable operation: presence button	Yes, No	No
	Enable operation: temporary Comfort	Yes, No	No
	Enable operation: room op. mode	Yes, No	No
	Enable operation: Green Leaf	Yes, No	No

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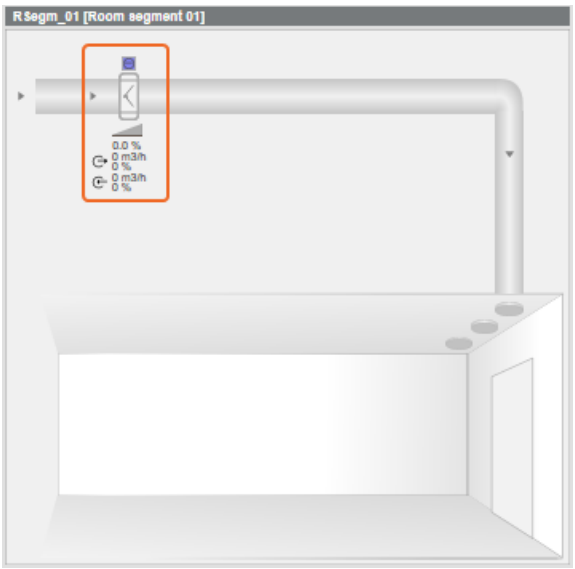
Engineering

ABT Site engineering tool is required to configure the DXR1 automation stations.
See the Siemens Download Center at www.siemens.com/bt/download for the latest application configuration and workflow tutorials.
Option combination according to available on-board I/Os on controller.
B3 (optional extract air temperature sensor) to be configured under “Room temperature” in order to serve for room temperature control.
$D2_a$ (on-board presence detector) to be configured in ABT Site under “Presence detector 2” for maximum combination of optional devices. Type of operation (NO or NC). Multiple devices of the same type can be connected.

Management station



Sample presentation of a VAV application on the Desigo CC management station.

[UH] Would expect a picture that represents the configuration described in this application sheet.

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