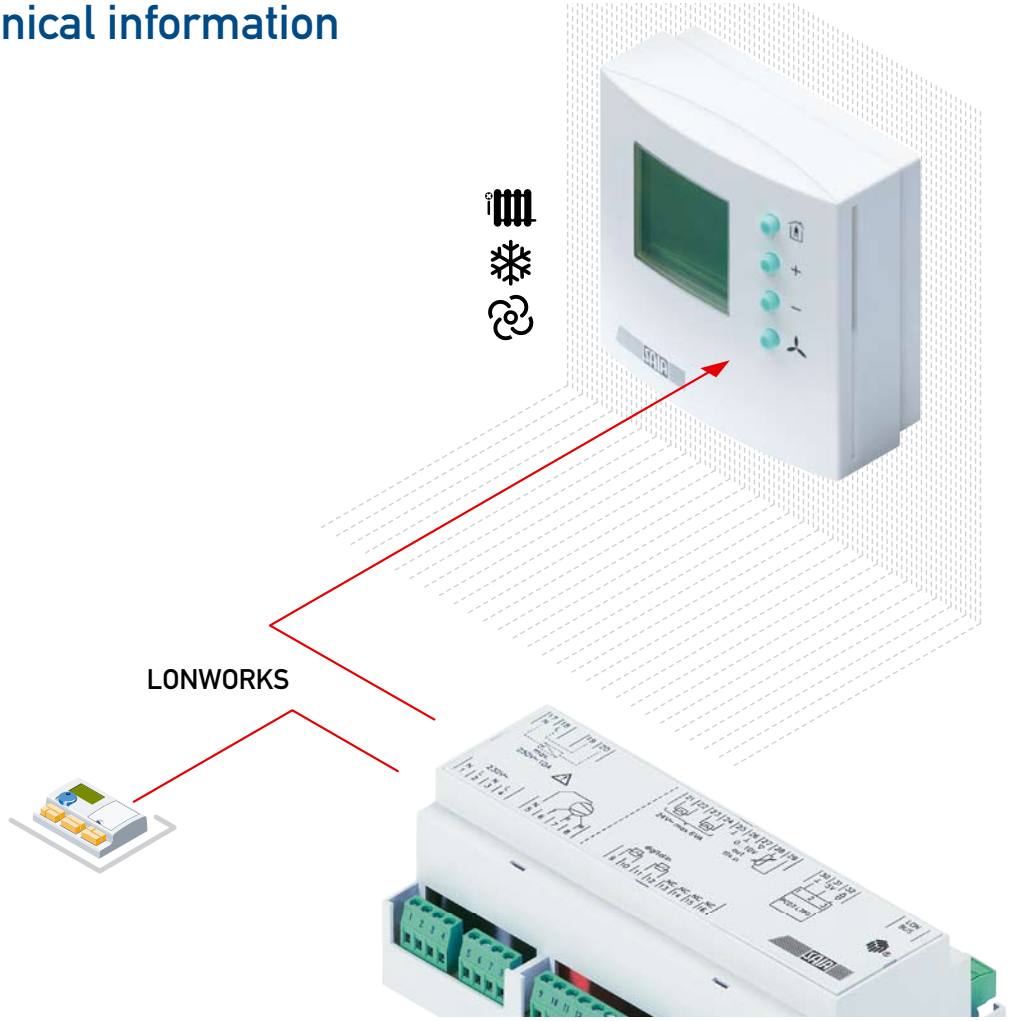
Technical information



ECO
Single room controller based on LonWorks®

Controls Division

Single room controller based on LonWorks® technology for individual regulation of temperature, air quality or humidity of single rooms depending on actual room temperature.

Advantages of the LonWorks® network combined with

- Integration of systems for lighting, blinds and comfort control within an individual room
- Access to the project even during the installation phase
- Easy connectivity to other LonWorks® devices and the Saia® DDC-Plus automation system
- Choice of system application mode between operation via the control unit or via LonWorks®
- Simple parameter setting with graphical interface via LNS-compatible, plugin configuration tool

Features of the PCD7.L750 room controller and PCD7.L760 room control unit

- Registration of room temperature either by the room control unit, circulating air sensor, or via LonWorks®
- A choice of room information can be picked up, such as temperature, presence, window contact, dew-point monitor or setpoint correction
- Signals for the heating/cooling actuating drives can be output either directly or as a variable via the LonWorks® network
- Integral transformer for each single heating or cooling actuating drive
- Fan control via 3-stage relay, or constant
- Room control according to the LonMark® standard "Fan Coil Unit Object (8020)"

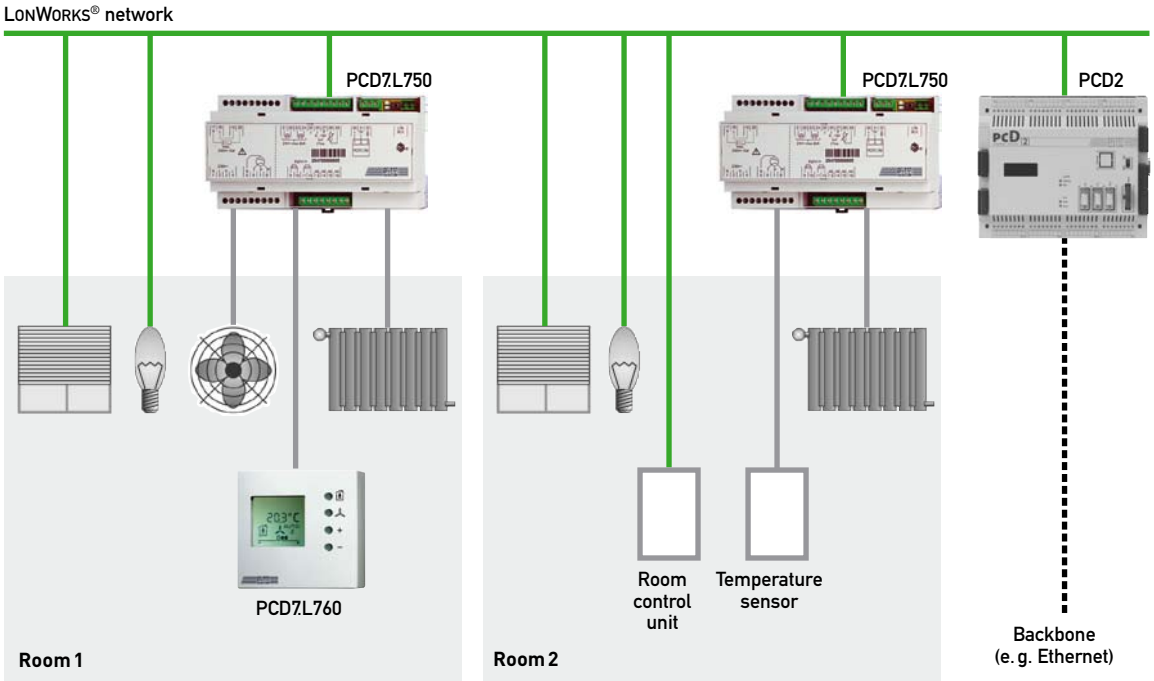
saia-burgess
Control Systems and Components

Room controller DDC-Plus ECO – PCD7.L750

The single room controller DDC-Plus ECO was conceived according to the LonMark® standard #8020. It is mainly used in connection with fan-coil or radiator/ceiling cooler systems. In normal operation, the DDC-Plus ECO works in connection with the PCD7.L760 room control unit, which saves wiring, and draws from it information about room temperature, setpoint correction, presence and fan control.

Actuating signals for the heating and cooling valve can be output directly from the controller. The device's internal transformer supplies power for 1 thermal drive. Since "Heating" and "Cooling" does not take place simultaneously, a thermal drive for heating and one for cooling can be connected directly. If several drives are to be run in parallel, this is possible with additional, external energy up to the load limit of the triac outputs (max. 1 A).

Example of an application



Example with room control unit PCD7.L760

Example with room control unit directly to LonWorks® network

The communicating single room controller that complies with the LonMark® standard

- Constructed as a PI controller with one output each for heating and cooling.
- Works in operating modes Comfort, Standby and Reduced.
- Window contact and dew-point monitor are connected directly.
- Electrical reheater up to 10 A.
- Distance of room control unit from single room controller up to 50 m.
- The controller is supplied with 24 predefined application mode (stored on a flash EPROM). This reduces engineering to the definition of just a few parameters.
- The LonWorks® data interface is integrated within the controller unit and allows both cross-communication with other LonWorks® components and communication with the overriding building management system.
- Room temperature and presence information can also be picked up via the LonWorks® network, if preferred.

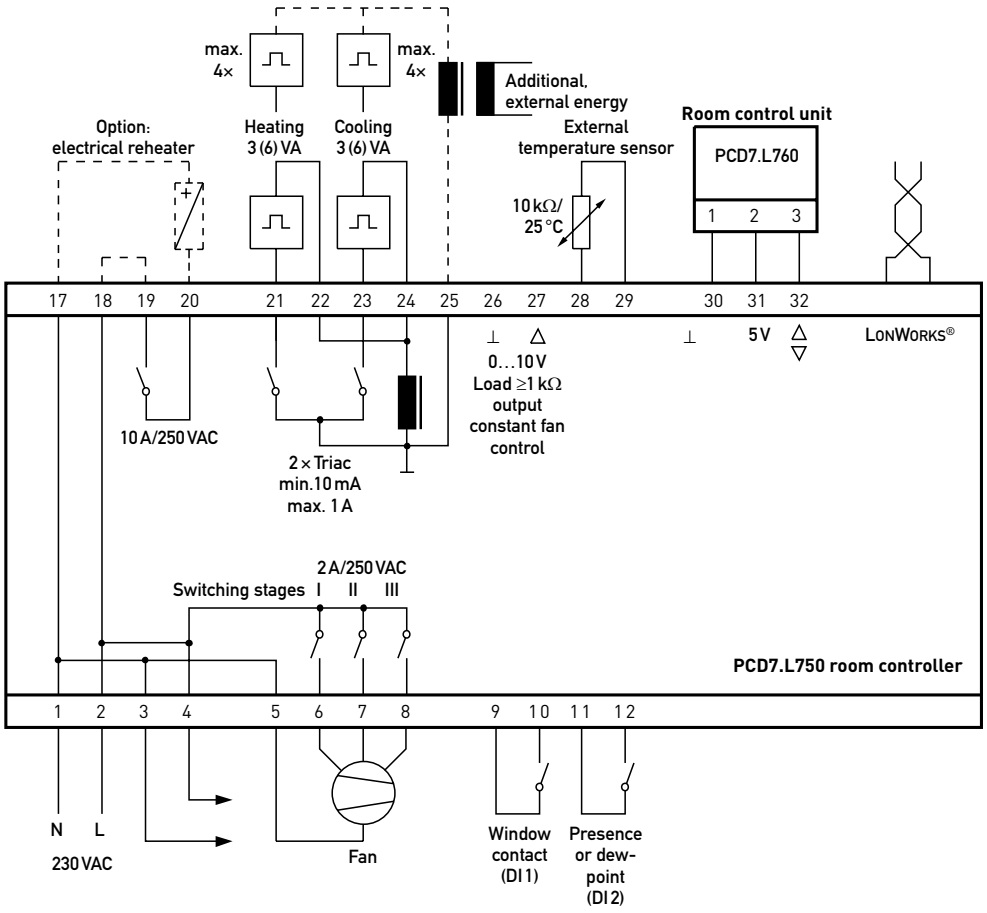
Communications connections

DDC-Plus ECO (PCD7.L750) bus communications are based on LonWorks® technology. This allows PCD7.L750 room controllers to be combined with each other and with other LonMark®-compliant devices, such as DDC-Plus systems and the devices of other manufacturers. It is therefore possible, for example, to connect an external temperature sensor via the LonWorks® bus to several room controllers. If two rooms are to be used as one, the output sequences of one PCD7.L750 can be transmitted via the LonWorks® bus to the second room controller (parallel operation).

The PCD7.L750 room controller has LonMark® certification. This guarantees that communications objects are LonMark®-compliant. DDC-Plus ECO room control incorporates the LonMark® standard "Fan Coil Unit Object (8020)".

The room controller's configuration of inputs/output has been optimized for the control of fan-coil systems. Within the scope of the control variants provided, optimum solutions are also possible for the control of ceiling coolers, heat pumps and radiators in individual rooms.

Connection diagram



Room control unit PCD7.L760

The room control unit for individual comfort

- In connection with the single room controller, room temperature is measured and adjustment of the setpoint by stages is possible.
- Setpoint correction takes place via the two buttons +/–. Parameters can be set for its effective range.
- The presence button can be used to select operating mode (presence or standby).
- Another button enables a 3-stage fan to be triggered.
- All settings, including frost protection, windows and dew-point, are displayed on the multifunctional LCD display.

Operation

The PCD7.L760 room control unit meets the different needs of room users. When the room control unit was designed, ergonomic viewpoints particularly came to the fore, alongside the modern form. The LCD display sets out the room temperature, current operating mode, fan speed, setpoint correction and the acknowledgement of window contact and dew-point monitor status.

4 buttons allow selection of application mode, fan speed (Auto, 1, 2, 3, Off) and, with +/–, adjustment of the room temperature setpoint. Simultaneous pressure on the + and – buttons will display the calculated setpoint.

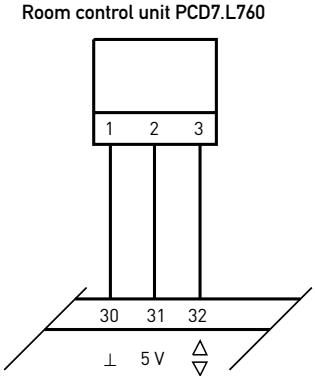
Simultaneous pressure on the operating mode and fan control buttons will active the service pin of the PCD7.L750. Advantage: During commissioning it is no longer necessary to activate the service button on the controller (the controller is usually mounted in the false ceiling, in channels under the floor, or on secondary treatment units). The service button initializes a telegram to the LonWorks® data bus containing the neuron ID of the PCD7.L750.

When all 4 buttons are pressed simultaneously for 5 seconds, the required application mode can be selected. As a protection against incorrect operation, this function is only possible during the first 10 seconds after the control unit has been plugged onto its base. At present 24 control variants are stored in the DDC-Plus ECO.

Multifunctional display

- Display “Support operation” (frost protection)
- Display “Window open”
- Display “Below dew-point”
- Display of room temperature
- Display of current setpoint
- Display of chosen application mode
- Display of operating mode presence/absence
- Display of fan operating mode: manual/auto with stages 0-1-2-3
- Display of setpoint correction: +/– 5 steps (parameters can be set for width of steps)

Connection diagram



Predefined application modes

Choice of application mode

These predefined application modes can be selected either by the appropriate key sequence on the room control unit or by the menu window “Configuration” in the plug-in software tool.

Group 1: fan coil, 4-pipe system, sequence heating-cooling at 2 separate outputs

					Presence		Dewpoint monitor DI 2	Fan at		Window contact	Note
Appl. mode	Heating output	HF	Cooling output	CF	L760	DI 2		heating	cooling		
1	X		X		X			X	X	if required	
2	X		X			X		X	X	if required	
3	X		X		X		X	X	X	if required	
7	X		X		X				X	if required	Heating with radiator, cooling with fan coil
8	X		X			X			X	if required	
9	X		X		X		X		X	if required	
13	X	X	X		X				X	if required	As above, heat valve open, currentless
14	X	X	X			X			X	if required	
15	X	X	X		X		X		X	if required	

Group 2: fan coil, 2-pipe system, heating or cooling via “Heating” output with changeover function

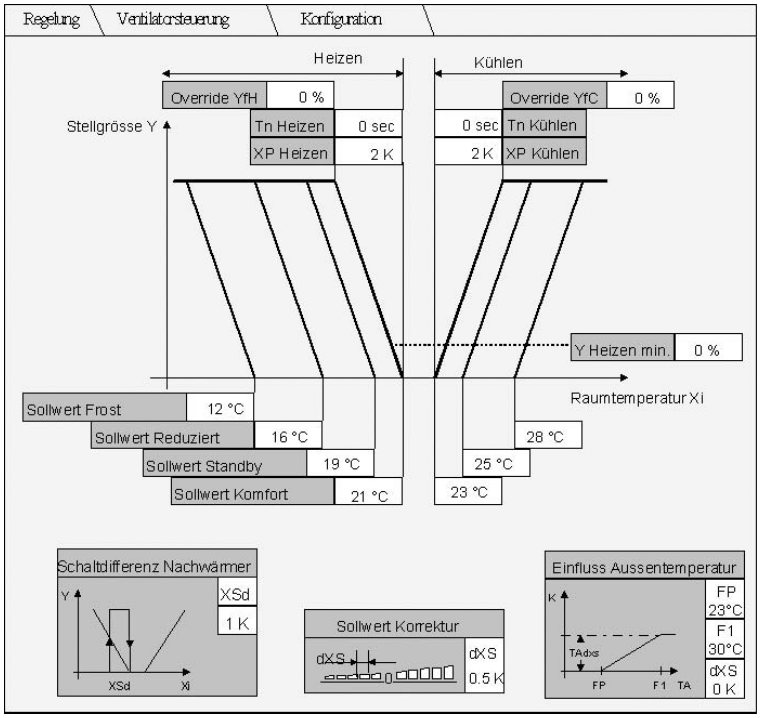
					Presence		Dewpoint monitor DI 2	Fan at		Window contact	Note
Appl. mode	Heating output	HF	Cooling output	CF	L760	DI 2		heating	cooling		
4	X				X			X	X	if required	
5	X					X		X	X	if required	
6	X				X		X	X	X	if required	
19	X	X		X	X			X	X	if required	Valve open, currentless
20	X	X		X		X		X	X	if required	
21	X	X		X	X		X	X	X	if required	

Group 3: miscellaneous applications

					Presence		Dewpoint monitor DI 2	Fan at		Window contact	Note
Appl. mode	Heating output	HF	Cooling output	CF	L760	DI 2		heating	cooling		
10	X		X		X			(X)		if required	Heating radiator/fan coil, cooling: ceiling cooler
11	X		X			X		(X)		if required	
12	X		X		X		X	(X)		if required	
16	X				X					if required	Heating only with heat pump
17	X					X				if required	
18	X				X		X			if required	
22	X				X					if required	Heat pump with cooling c/o via fanrelay
23	X					X				if required	
24	X				X		X			if required	

Key:
HF: operation inverted to “Heating” function
CF: operation inverted to “Cooling” function
Variants 10–12: fan only when heating with fan coil

Change operating modes and basic settings with the plug-in software tool



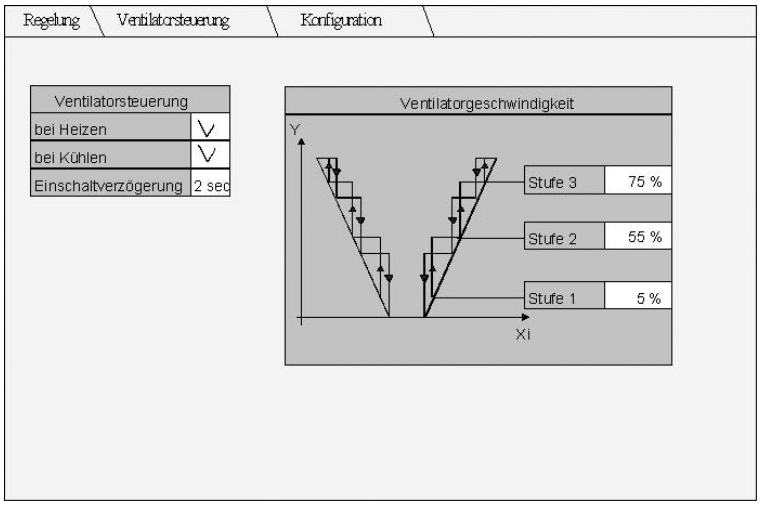
Basic settings

Operating modes and basic settings can be adjusted with the plug-in (special configuration tool for DDC-Plus ECO) supplied for LonMaker under Windows.

Via the "Control" menu window, parameters are set for

- setpoints
- control parameters (Xp, Tn)
- override values for correcting variables
- minimum opening of heating valve (window comfort)
- switching difference for electric heating
- influence of outside temperature
- width of steps for setpoint correction by room control unit

The values entered here correspond to their state on delivery.

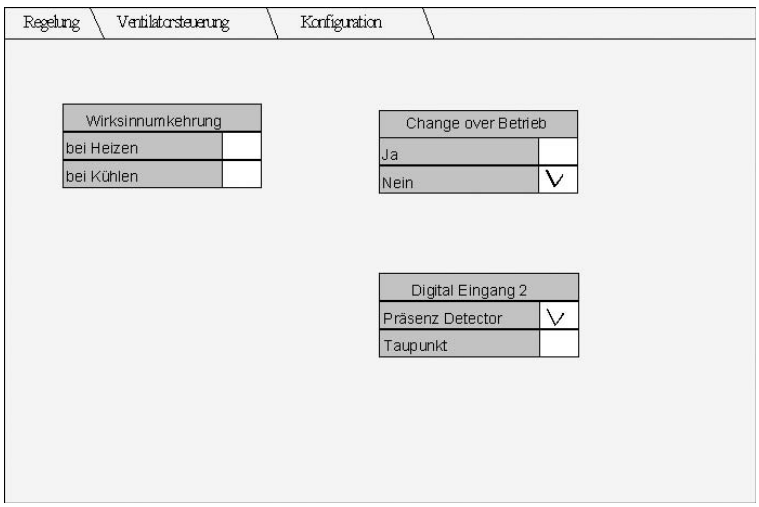


Fan control in automatic mode

Via the "Fan control" menu window, parameters are set for

- cut-in points for steps 1-2-3 (fixed hysteresis 7 %)
- rise-delay time after mains voltage recovery to avoid load peaks
- correspondence between the fan controller and the sequence branches for heating – cooling (and, or, neither nor)

The values entered here and fields designated correspond to their state on delivery.



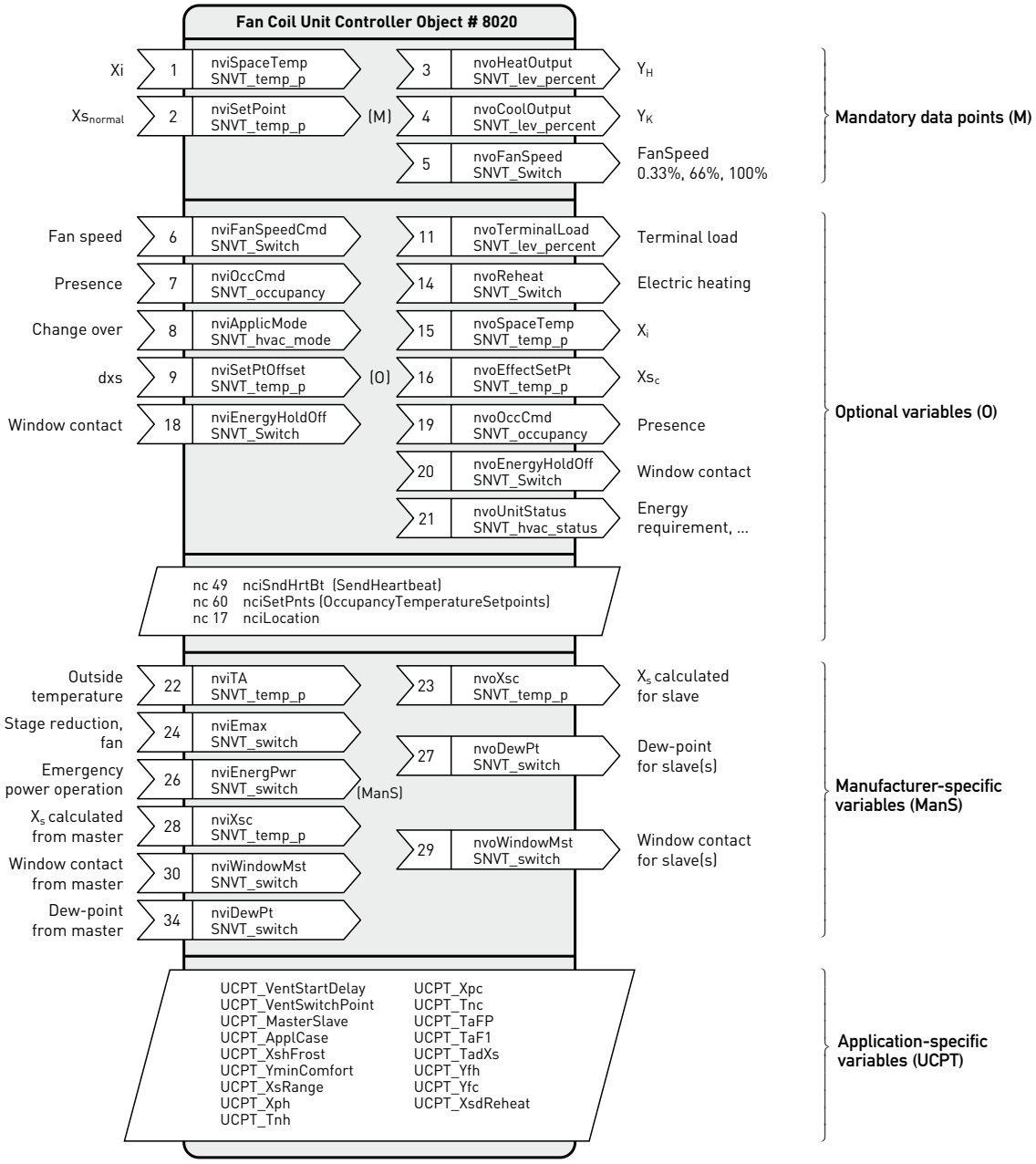
Configuration

Via the "Configuration" menu window, parameters are set for

- effective direction (currentless open, currentless closed)
- change-over operation, yes/no
- use of input DI2

The fields designated here correspond to their state on delivery.

LonMark® Standard Object "Fan Coil Unit Object (8020)"



Explanation of abbreviations:
SNVT: Standard network variable types
SCPT: Standard configuration parameter types
UCPT: Application-specific configuration parameter types

Configuration options

General options

Actual value Xi

The actual value, Xi, may originate from three different sources. These sources are: the network variables nviSpace Temp, the room control unit, or the sensor input on the room controller itself. LonMark® standard 8020 requires that the variable nviSpaceTemp should be given highest priority.

The following rules are used:

1st priority: If the variable nciNetConfig is at FG_EXTERNAL and nviSpaceTemp is binded, nviSpaceTemp will be used as Xi.

2nd priority: If a local sensor is present, it will be used.

3rd priority: If a PCD7.L760 room control unit is present and supplying valid values, Xi will be obtained from the room control unit.

Fan control

Automatic operation takes place according to the configuration variables UCPT_Applcase bit3 (Cooling) or UCPT_Applcase bit4 (Heating). If this operating mode is suppressed, only manual can be selected.

Manual operation

Via room control unit
Any connected room control unit can regulate the fan control at any time. The room control unit selects fan operation with the display sequence 0, Auto, I, II, III. The selection indicator on the room control unit only represents the active states that have been defined by the variables UCPT_ApplCase and nviEmax.

Via nviFanSpeedCmd
Fan function can be controlled parallel to the room control unit via this variable. Both input devices work in parallel subject to the rule that the more recently transmitted command has validity.

Xs

Xs is used from the nviSetPoint variable. Depending on UCPT_ApplCase.bit8, this variable is also stored in the EEPROM so that, after any voltage loss, a value unequal to the standard values from nciSetPoints can be corrected.

Xs correction

DXs is used from the nviSetPtOffset variable. If a room control unit is present, this value will also be changed by the room control unit. Cases of parallel operation may arise with this value. The rule applies that the more recently received value overwrites the previous one.

Window contact

The window contact function is controlled by the nviEnergy HoldOff variable or by the local contact, whereby both of these values are used with an OR linkage.

Presence

Presence detection takes place via the nviOccCmd variable or via contact 2, whereby the later value transmitted is always the one that is used. It is also possible to select the occupied message on the room control unit, in which case validity is again given to whichever value was set last.

Contact 2 is only used if the configuration variable UCPT_ApplCase.bit0 has been set and UCPT_ApplCase.bit1 has not been set.

If presence is confirmed, the appropriate symbol on the room control unit is activated.

Electric heating

Electric heating is preselected by the bridge on the ..L750 and used for heating operation in any 2-pipe application. Electric heating uses the switching hysteresis defined in the configuration variable UCPT_XsdReheat. No configuration parameters exist to activate electric heating, however, hardware status can be read via the variable UCPT_ApplCase.bit7.

Tip: These frequently mentioned configuration parameters, UCPT_ApplCase, are “set” automatically by the defined application mode.

Setpoints

Setpoint: Comfort

Normally active when presence is detected. The basic setpoint of 21 °C can be influenced via the push-buttons on the room control unit in steps of 0.5 °C (±2.5 K).

Setpoint: Standby

If a presence detector is connected, the desired temperature in the room will be regulated to the “Standby” temperature if no person has been detected.

Setpoint: Reduced

Using a control station with a clock function (PCD1/PCD2) the night-time room temperature can be adjusted to the “Reduced” setpoint. Activation is via the input variable nviOccCmd.

Setpoint: Frost

If a window is opened in the presence of a window contact, the room temperature is reduced to the frost setpoint. The release of cooling energy is also prevented.

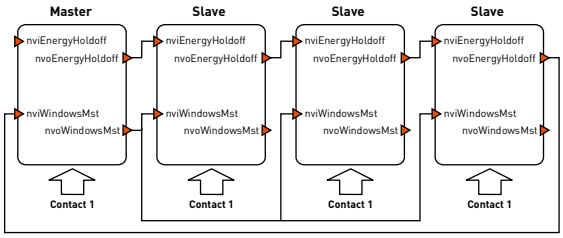
Master/Slave

Temperature measurement

The master carries out temperature measurement for all slaves. Slaves are controlled by the master transmitting the Xsc. Compared with normal operation, no changes are produced in the calculation of values and the provenance of Xi.

Cascading window contacts

In open-plan offices with modular dividing walls several controllers are working in master/slave operation. This also involves common acquisition of window contact data.

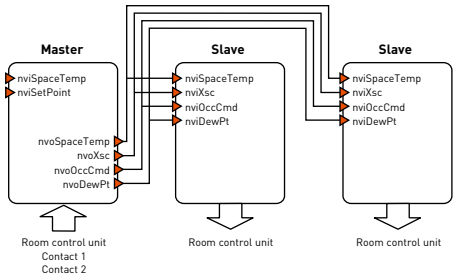


Window contacts can be cascaded so that one open window leads to an energy reduction for all controllers. This is achieved by all controllers recognizing an open window and passing on the open state with priority:

nvoEnergygHoldOff = nviEnergyHoldOff + contact 1

In the master's nviWindowMst the result of the OR linkage from this chain is accepted and passed on to all members of the group. The slaves only evaluate nviWindowMst. The temperature is reduced if nviWindowMst stands at open.

Transfer of setpoint



In any master/slave arrangement, the master controls all other devices. The cascading of Xi and Xs takes place with the formation of a group.

Binary inputs

Binary inputs are polled approx. 5× per second. As soon as their status changes and remains changed throughout 2 measuring cycles (filter), this change is evaluated as an event. Pull-up inputs are inverted and report a logical 1 for the status.

Input DI 1

Input open corresponds to a closed window/unwired input. Input closed corresponds to an open window. Any change of value is conveyed via the variable nvoEnergyHoldoff.

Input DI 2

Use as presence detector or dew-point monitor defined by UCPT_ApplCase.bit0 and UCPT_Applcase.bit1.

As presence detector:
0 = not present (standby), 1 = occupied (occupied)
Any change of value is conveyed via the variable nvoOccCmd.

As dew-point monitor:
0 = temperature > dew-point, 1 = below dew-point
Any change of value is conveyed via the variable nvoDewPt.

Special operating modes

Operating mode: emergency power

The following switching takes place for the emergency power operating mode (nviEmergPwr > 0):

- Fan steps off
- All values of correcting variables to 0
- When voltage is restored, delayed release according to UCPT_VentStartDelay

The emergency power operating mode has priority over other modes.

Operating mode: Emax

This operating mode is activated by the nviEmax variable, which is always active. NviEmax limits maximum fan output.

Operation below dew-point

As soon as the dew-point monitor addresses input DI2, cooling operation is switched off and the dew-point symbol on the room control unit is displayed.

Operation when window is open

When a window is open (Energy Hold Off) frost protection setpoints are used. No cooling is allowed in this mode. The mode is indicated by activation of the window symbol on the room control unit. If heating is switched on in support of the frost protection temperature, the frost symbol is also displayed (ice crystal).

Electric heating

This operating mode is activated by releasing the wire bridge. Relay 4 serves to replace the heating valve in this operating mode.

General information about LonMark®

LonMark® objects

To ensure interoperability, network variables are combined to form objects which, in logic terms, represent sensor, actuator or controller function. The interface is documented with LonMark® terminology, which defines the node in various objects and combines interdependent units of configuration data, real-time data and functions. The terms used here are SNVTs (Standard Network Variable Types) and SCPTs (Standard Configuration Parameter Types).

Every data point uses a predefined data format that sets out bit sequence and significance. SCPTs are stored in the EEPROM, SNVTs with ranges and default values defined in addition to the data format. To allow the definition of all configuration data, UCPTs have been introduced (User Defined Configuration Parameter Types).

Parameter setting

Every application mode has a number of parameters, such as temperature setpoints, type of output sequence (P or PI), type of fan control, etc. These parameters can be adapted to meet requirements with a suitable tool. The basic factory setting, however, can in most cases be retained.

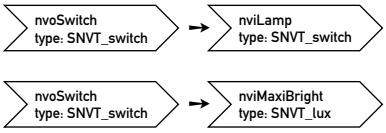
Addressing

The physical identification number (neuron ID) of every DDC-Plus ECO or LonMark®-compliant peripheral device must be brought into line with the logic address (location name) in the network structure. This can be achieved with the help of labels supplied, which show the neuron ID in bar-code form.

Network variables and binding

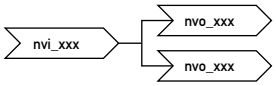
Rules for network variables

- Output variables can only be bound to input variables.
- Only variables of the same type can be connected.

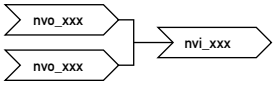


- Multiple bindings are possible.

1-to-n connections: 1 button node controls 2 (or more) lighting nodes

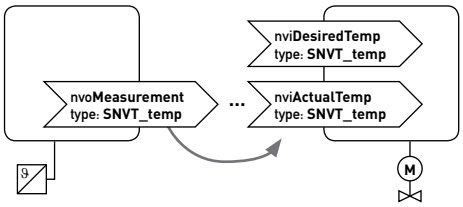


n-zu-1 connections: 2 (or more) button nodes control 1 lighting node



Use of SNVTs demonstrated by temperature control

This is to explain the significance of SNVTs for interoperability. A temperature sensor node and a temperature controller node are connected to each other via a LonWorks® network. They have the common task of regulating room temperature. For this purpose, NVs must be used to convey the actual temperature from one node to another. The output variable nvoMeasurement and die input variable nviActualTemperature are bound to each other.



Room temperature measured **20 °C**

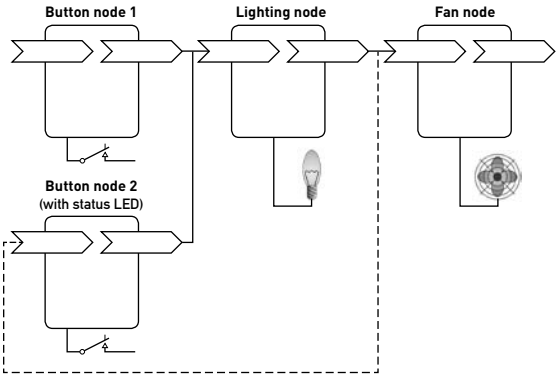
Figure transmitted: **2940** (=2740+20 °C:0.1 °C)

Temperature information received **20 °C**

Binding = Establishing relations for communication between network nodes

Binding involves assessment of the following:

- Who is communicating with whom?
- What information is being exchanged?
- How is information being exchanged?



Dew-point monitor and cable temperature sensor NTC

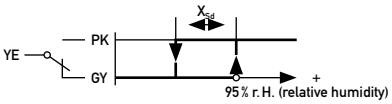
Dew-point monitor PCD7.L775

The dew-point monitor serves to prevent dew from forming on the ceiling cooler. It triggers an actuator that interrupts the flow of cooling water, or raises the temperature of the cooling water. Housing in light-grey, flame retardant thermoplastic with spring-mounted dew-point sensor. Locking relay with change-over contact.

Function

The resistance of the dew-point sensor rises with increasing relative humidity and triggers the change-over contact via a locking relay as soon as the dew-point is reached. In the absence of dew, the contact is closed GY-YE (grey-yellow) and open PK-YE (pink-yellow) (device connected to voltage supply). The additional WH output can be used to raise the temperature of cooling water.

Function diagram

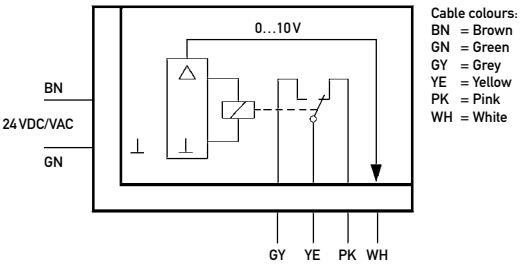


Technical data

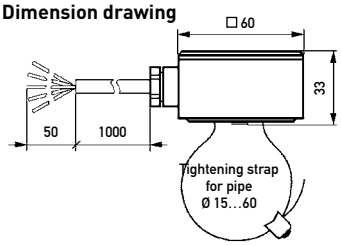
Setpoint	95 % ±4 relative humidity
Measurement range	70…85 % relative humidity
Switching difference	fixed, approx. 5 % relative humidity
Supply voltage	24 VDC/VAC, ±20 %, 50/60 Hz
Power consumption	max. 1 VA
Change-over contact [1])	1 A, 24 VDC/VAC
Output signal	0…10 V, load >10 kΩ, at approx. 70…85 % relative humidity
Reaction time 80 to 99 % rH 99 to 80 % rH	when air still max. 3 min max. 3 min
Dew formation	max. 30 min
Ambient temperature	5…40 °C
Protection class	IP 40 according to EN 60 529
Connection	cable with Pg-screw connection, length 1 m, 5 × 0.5 mm²
Assembly	Tightening strap for pipe Ø 15…60 mm and heat conducting paste supplied

[1]) When triggering relays, contactors, etc. with cos φ <0.3 it is advisable to use an RC module parallel to the coil. This reduces contact consumption and avoids high-frequency noise pulses.

Connection diagram



Dimension drawing



Project planning and mounting tips

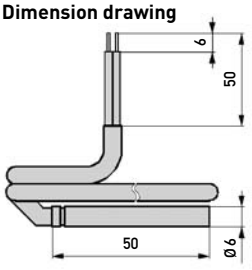
Mount device on the flow pipe at its coldest point. Use metal cleaner to prepare the surface of the pipe, apply heat conductive paste at selected points and fasten the sensor with the tightening strap (quick acting closure).

Cable temperature sensor PCD7.L771

The cable temperature sensor is used as an optional detector of ambient or recirculated air temperature in fan-coil devices. The resistance of the NTC element changes in inverse relation to temperature. The temperature coefficient is always negative, i. e. resistance falls as temperature rises. The reference point is 10 kΩ at 25 °C.

If the optional cable sensor is used (input terminals 28, 29) it takes over the acquisition of temperature data. The temperature input value of the room controller has no further function from then on.

Dimension drawing



Technical data

Single room controller PCD7.L750	
Supply voltage	230 VAC, ±10 %, 50/60 Hz
Power consumption	12 VA
Network variable	according to LONMARK®, Fan Coil Unit Controller Object #8020
Configuration	with plug-in based on LONMAKER® for Windows
Inputs	– digital 1: window contact – digital 2: e. g. for presence detector or dew-point monitor – temperature sensor: instead of room control unit – room control unit (3 wire)
Outputs	
Triac [1])	2 × pulse pauses, period 4 min, for heating/cooling (24 VAC, max. 1 A)
Relay	3 × switching contact (250 VAC, 2 A), fan 1 × switching contact (250 VAC, 10 A), electric heating
0...10 V (optional)	to external fan control via power separator
Terminals	screw terminals, connection cross-section 2.5 mm²
Mounting	can be snapped onto 35 mm top-hat rail
Dimensions	157 × 90 × 54 mm (W × H × D)
Protection class	IP 20
Ambient temperature	0...+45 °C
Ambient humidity	<85 % rH

[1]) The device's integral transformer supplies 6 VA to operate a thermal drive for a heating or cooling valve. If additional, external energy (24 VAC) is connected, 4 thermal drives can be triggered (4 × heating, 4 × cooling, but not simultaneously).

Room control unit PCD7.L760 for single room controller	
Sensor	temperature measurement range: 10...+35 °C, resolution: 0.1 K
Adjustment range for setpoint correction	±2.5 K (basic setting)
Key button for operating mode	Presence, Standby (stepper switch)
Key button for 3-stage fan control	0-auto-1-2-3 (stepper switch)
Connection	3-wire
Mounting	surface mounting
Front dimensions	76 × 76 mm
Housing colour	pure white, RAL 9010
Protection class	IP 30
Ambient temperature	0...+45 °C
Ambient humidity	<85 % rH

Ordering information

Type	Description	Weight
PCD7.L750	**Single room controller**	600 g
PCD7.L751	Base plate with strain relief	
PCD7.L752	Terminal cover	
PCD7.L760	**Room control unit**	100 g
PCD7.L761	**Room control unit** (excl. fan control)	100 g
PCD7.L762	**Room control unit** (excl. fan control and presence button)	100 g
PCD7.L775	**Dew-point monitor**	100 g
PCD7.L771	**Cable temperature sensor**	

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