Manual
Room Template

Version Management

Version	Date	Name	Description
1	15.02.2018	Stephan Hintze	Document issued
2	12.04.2018	Stephan Hintze	

General

This document describes and explains the Fupla Room Template Version 1.

The Room Template covers recently required HVAC Room automation demands, like heating, cooling, FanCoil, Presence detection. Beside this, the template is designed also to emulate a L60x Room Controller (partly), so a replacement of a L60x Room Controller by a freely programmable Device can be done quite easy.

The Room Template is dedicated to being used on PCD7.LRxx-P15 Devices, but can be used on any other programable device. In this case, some features must be removed or disabled, e.g. the SYLK Bus Wall Module (only available on PCD7.LRxx-P15) or the L60x Emulation.

The Room Template has been created with PG5 2.3.

Content

Initialisation

This page contains the mandatory and recently used FBoxes in general

- P-IRM Media – backup and restores FBox adjust parameter or symbols tagged with "S_Adjust". Those data can be modified in runtime and should keep the modified value after a power off/on.

- Heavac 4 – required to use FBoxes from HVC library

- ES Init – required to use FBoxes from E-Suite V2 library

- InitLib Red. - required to use Controller FBoxes from DDC Suite 2.7. Controller FBoxes are used from this library, because they can be parameterized in runtime as P or PI controller

- Distrib.Alarm List – optional, is used to define and collect alarms in this device and access them on a Master PLC with Advanced Alarm List to be processed for SMS/eMail and/or displayed in a Web Alarm List

- PCS Alarm Adv. – optional, to be used to define a plant coding system for this device
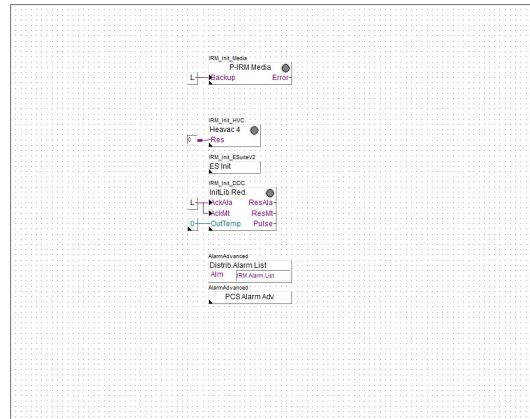
Room Application

The Room Application is designed for

- Heating

- Cooling

- Cooling 2nd stage

- CO2 Air Quality Control

- Fan

- User interaction via Wall Module

Heating and cooling can be used for 2-pipe application with Change Over, 4-pipe application with single valve drives (analog or digital PWM) or 6-way valve drive.

Cooling 2nd stage and CO2 Air Quality Control is controlling the fresh air

part via damper, supplied from a central Air Handling Unit.

Fan is controlled by Heating, Cooling and CO2 Air Quality. Up to 3 speed or continuous speed is supported.
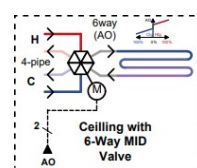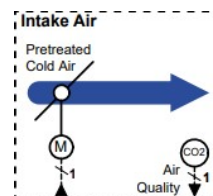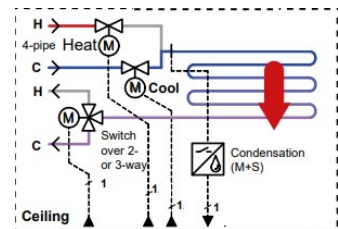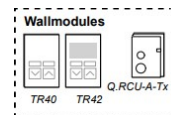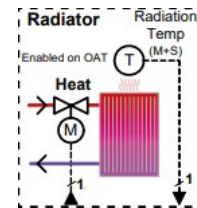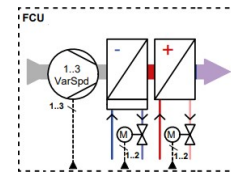
Overview Fupla Pages

The Room Application seems to be quite big, but a lot of things are ready to use and might be not necessary, e.g.

- 3 types of Wall Modules (Wired, SYLK-Bus, EnOcean)

- Heating, Cooling

- CO2 Air Quality

- Fan

Unnecessary pages can be disabled or deleted.

Page Navigator
- COB 0 :Block_General
  - 1: Initialisation
  - 2: ---------- Room ----------
  - 3: Master
  - 4: Hardware IO ; General
  - 5: WallModule ; HW Sensor
  - 6: WallModule ; HW Pres./LED/SetPt/Fan
  - 7: Serial line ; SYLK
  - 8: Wall Module ; SYLK
  - 9: Serial line ; EnOcean
  - 10: WallModule ; EnOcean
  - 11: Heat/Cool-valve ; EnOcean
  - 12: Sensor ; Range
  - 13: Alarms
  - 14: Demand Occ Mode
  - 15: Operation Mode
  - 16: Heating
  - 17: Cooling
  - 18: Heating / Cooling
  - 19: Air Quality Controller
  - 20: Fan Control

Room

First page of the room application. Contains the FBoxes

- PCS Alarm Adv. mod. – to be used to modify a specific level in the plant coding system for alarms

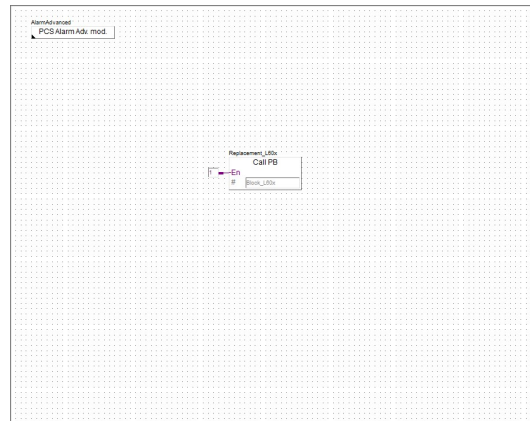- Call PB – this PB shall be called if the application runs on a programmable E-Line or IRM and should behave like a L60x room controller device.

See also chapter "L60x emulation"

Master

This page simply shows the most important data which may be written from a Master PLC

- Operation mode e.g. UnOccupied, Eco (StandBy), Occupied

- Base Temperature Set Point

- Time Delay for Presence or Dew Point detection

- Air Quality (CO2, ppm) Set Point

- Slave function, to switch from autonomous mode to a slave mode, so the signals for heating and cooling are forced by the master

- ChangeOver information for 2-pipe application

In many cases, a Master PLC changes the operation mode in the morning from UnOccupied to Eco (StandBy) and at the end of the day back to UnOccupied. Also, the Base Temperature, e.g. shifted in summer and the information for 2-pipe application, to inform the room application if heating or cooling is active.

Therefore, those symbols are predefined with a fix address, starting for flags and register with 300.

This page is by default disabled, and can be enabled at any time. Note: when the block L60x is called, the values on this page can only be viewed, but not modified, because they are overwritten by the L60x program block!

Hardware IO – General

This page is used to map physical IO to application data.

- 1xDI: Window contact

- 2xDI: Presence detection via Key Card holder or/and PIR Motion Detection

- 3xDO: Fan with up to 3 speed or/and 1xAO for frequency speed

- Heating/Cooling – depending on application type and/or drive type
  - 2xAO: continuous drive
  - 2xDO: TRIAC/PWM drive
  - 1xAO: continuous 6-way valve drive
  - 1xAO: continuous drive for ChangeOver

- 1xAO: Damper for AirQuality control or 2nd stage cooling

The outputs can be used also in a mix, e.g. 1xAO for continuous drive heating and 1xDO for PWM drive cooling.

The Media Mapping IO Symbols from the PG5 Device Configurator must be connected to the required function. It is not necessary to delete unused connections. This might be helpful when a drive must be replaced in future and the drive type is changing.

Wall Modules

Room applications usually are controlled with a Wall Module, where the End User can adjust

- Occupancy by a Presence button with feedback (LED, Icon)

- Temperature Set Point correction, relative -3.0 to +3.0 °C

- Fan Speed control

And beside this, the Wall Module measures

- Temperature

- Air Quality (CO2)

- Humidity

There are several Wall Module Types, e.g.

- Only temperature

- Temperature + Presence Button

- Temperature + Presence Button + Set Point Correction

- Temperature + Set Point Correction + …

- Temperature + Air Quality + … + Set Point Correction + …

And beside the combination of function, the Wall Module can be connected via

- Wires, means DI/DO/AI

- SYLK Bus (1 or more Wall Modules)

- EnOcean (1 or more Wall Modules)

The template covers the previous mentioned functions and connections. The connection type (Wired, SYLK Bus or EnOcean) is simply controlled by deleting/disabling or enabling the required type.

Basically, only one type should be enabled. But they can be mixed if necessary, in this case the logic must be adapted for sure.
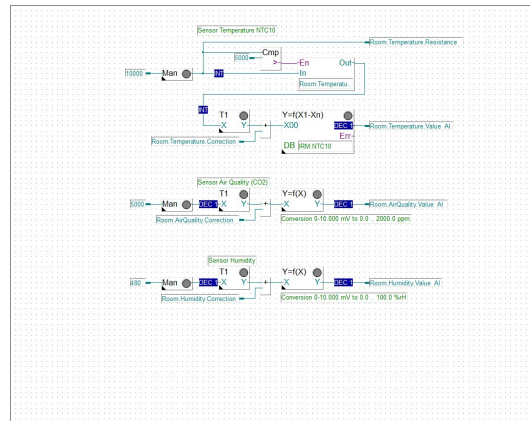
WallModule – HW Sensor

This page is by default disabled can be used to connect

- Temperature

- Rel. Humidity

- CO2 Air Quality

Sensors via terminal to the Room Application, if e.g. a simple Wall Module is used (e.g. Q.RCU-A-xxxx Series).

In this case, the page must be enabled and the UI connected to the connectors on the left side. The configuration of UI in Device Config must match with the conversion on this page:

- Temperature measured in 0-100.000 Ohm. The FBox Conversion DB n points is predefined for a NTC10 type II sensor. The DB must be adapted if another NTC sensor is used.

- Rel. Humidity measured in 0-10.000 mV. The FBox Conversion converts the mV input into a 0.0 to 100.0 % rH value.

- CO2 Air Quality measured in 0-10.000 mV. The FBox Conversion converts the mV input into a 0.0 to 2000.0 ppm value.

WallModule – HW Pres./LED/SetPt/Fan

This page is by default disabled can be used to connect

- Presence Button

- Occupancy signalization (LED)

- Manual intervention for Set Point

- Manual intervention for Fan Speed

via terminal to the Room Application, if e.g. a simple Wall Module is used (e.g. Q.RCU-A-xxxx Series).
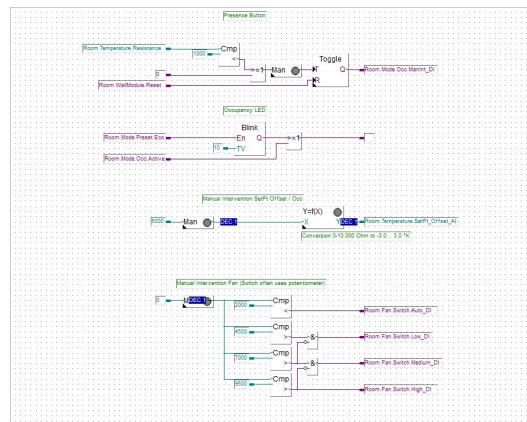
The Presence Button is often used in 2 different types:

1. A unique contact, so a UI must be defined as Digital Input or Dry Contact. In this case the UI must be connected to the connector with "0" on left side

2. The Presence Button bridges the Temperatur sensor and shortens the input. The measured resistance for Temperature will fall to 0. This is already implemented, also a mechanism that the last measured valid temperature is stored, pushing the Presence Butten over longer Period has no effect in Temperature.

The Occupance Signalisation usually is connected to a LED on Wall Module, and signalizes:

- LED Off = Mode UnOccupied

- LED flashing with 1 Hz = Mode StandBy

- LED On = Mode Occupied

Manual Intervention Set Point measured in Ohm. The FBox Conversion converts from 0 ro 10.000 Ohm into a -3.0 to +3.0 °K value.

Manual Intervention Fan Speed is often a potentiometer, where threshold values are used to define a switch position. The predefined threshold values fit to the Q.RCU-A-xxxx Series.

WallModule – SYLK

This page is by default enabled and initializes the SYLK-Bus.

By default, one SYLK-Bus WallModule is predefined. If more SYLK WallModules (max. 4) shall be used, the adjust parameter "Number of TRxx WaaModules" must be set properly.
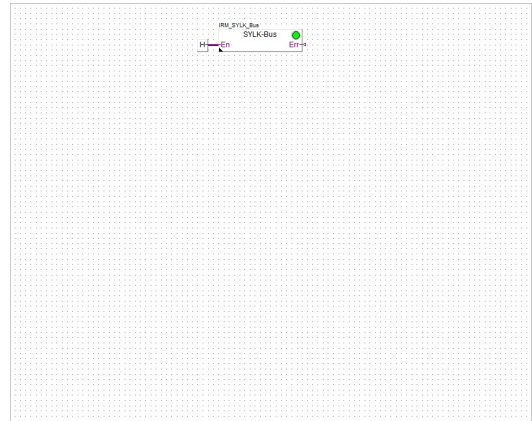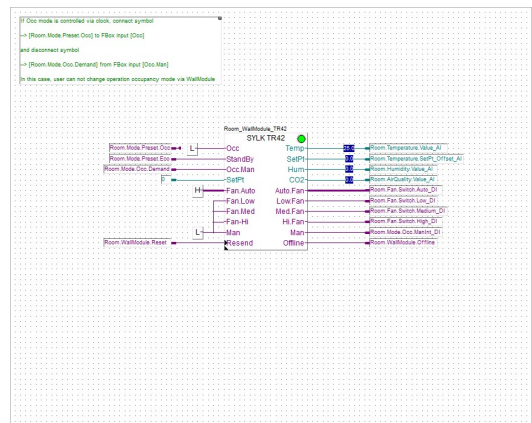

WallModule – SYLK TR42

This page is by default enabled and connects any Type of TR42 SYLK-Bus WallModule to the Room Application.

If the connected TR42 type does not support rel. Humidity or CO2 Air Quality, the FBox output will always show 0.0.

Please refer also to the SYLK TR42 FBox Help, to configure the function and Display properly.
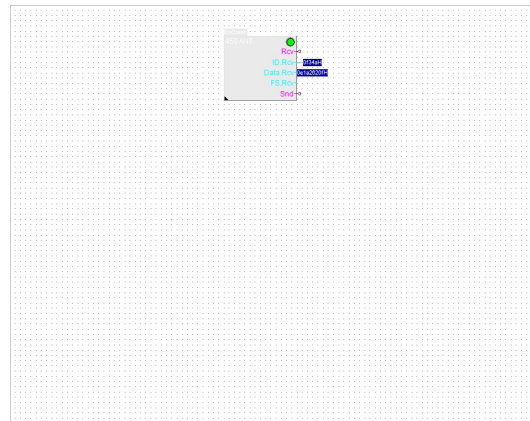
WallModule – EnOcean

This is by default disabled and can be activated if an EnOcean WallModule shall be used.

The FBox 450 ANT initializes Port 1 to receive EnOcean telegrams, received via radio from a PEHA Gateway type 450 ANT.

FBox settings and PEHA ANT 450 are matching by default, there is nothing to define. Radio telegrams should be received immediately.

WallModule – EnOcean EEP A5-10-22/23

This page contains the FBox EEP A5-10-22/23. This EnOcean Equipment Profile (EEP) FBox supports

- A5-10-22 profile for Temperature, rel. Humidity, Set Point, Fan Speed

- A5-10-23 profile for Temperature, rel. Humidity, Set Point, Fan Speed and Presence Button

The WallModule and the selected profile in the FBox must match. If the WallModule uses a different EEP, the FBox must be replaced.
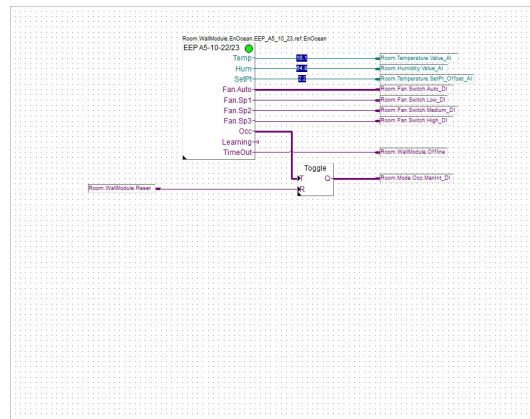
In most cases the FBox EEP A5-10-0x or EEP A5-10-0x will fit.

Please refer also to the EnOcean FBox Help, to configure the function of the FBox properly.

Note: Even if the ANT 450 Gateway is able to receive by hard any EnOcean radio telegram, the WallModule and the FBox must be connected (paired). This is done with the "Teach In" mechanism.

Sensor – Range

This page is used to detect a sensor fault

- Temperature, normal range between 5.0 and 40.0 degrees

- Rel. Humidity, normal range between 20.0 and 80.0 %

- CO2 Air Quality, normal range between 200.0 and 2000.0 ppm

Each sensor signalizes a fault, if the measured value exceeds the defined range.

The fault message has no effect in the Room Application, it is just collected in the Alarm List
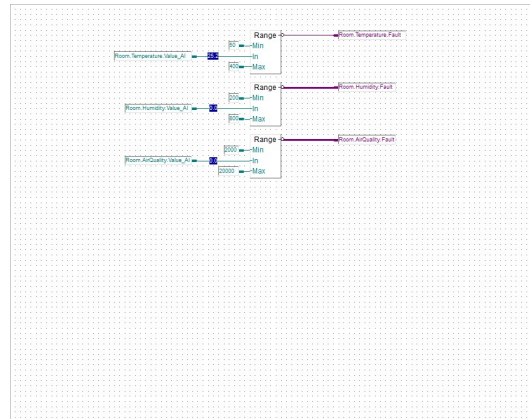
Alarms

This page is used to collect alarms and map them into the Alarm List.

The Alarm List on a E-Line C-15 or LRxx-P5 device is a distributed Alarm List, means that the alarms can be configured with Group, Priority, Plant Code System and Alarm Text and merge the Alarms in a Master PLC (PCD or pWeb Panel) to get a unique Alarm List in a Web Application.

See also page "Initialisation", FBox "Distrib.Alarm List"

Demand Occ Mode

The Occupancy Mode can be required from several functionalities

- By a Supervision system or a Master PLC, e.g. in the morning to Occupied, at the evening to Unoccupied. No User Action required, controlled by a Scheduler.

- By a Key Card holder, e.g. Hotel Application

- By a Motion Detection (PIR) and Room is in Eco Mode. Occ mode is enabled as long motion is detected. If no motion is detected, mode is set back to Eco after a coasting time, default = 10 minutes

- By a Presence Button via User action and Room is in Eco Mode. Pushing again the Presence Button will toggle between Mode Occ and Eco

- By a Presence Button via User action and Room is in UnOcc Mode. Occ mode is enabled and automatically switched back to UnOcc mode after a coasting time, default = 60 minutes
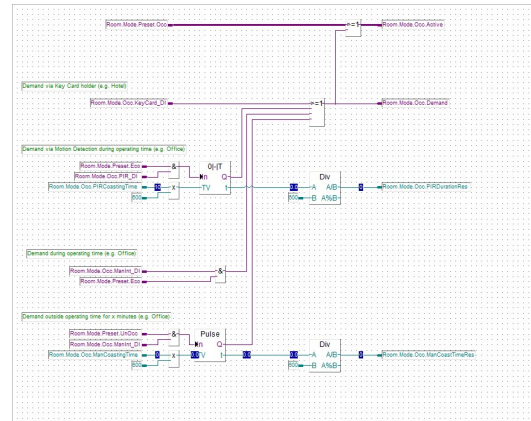
Operation Mode

FBox "Mode Control" is used to define the mode if Window open detected and when Eco and Occ are activated at the same time.

FBox "Set Point" calculates the Set Point for Heating and Cooling depending on active mode. Occ, Eco and UnOcc are using different dead-band for energy saving reasons. Also the Application type can be selected.

The FBox outputs are connected to the control functionality for Heating/Cooling,
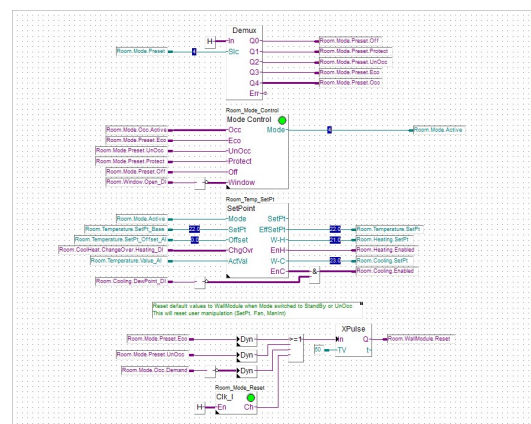
At the bottom of the page, a mode change detection is embedded. This is used to reset a WallModule (e.g. SYLK-Bus TR42) to default values when the mode is changed from Occ to any other mode, means the User is not present anymore. In addition, this can be done also at the end of the day via FBox "Clock daily pulse"
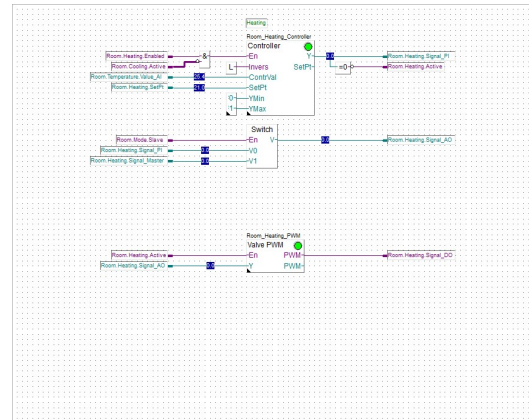
Heating

This page contains the control for Heating.

The control loop can be defined as pure P or as PI-controller.

This page prepares a 0.0 to 100.0 % and a digital signal.

Heating signal can be overruled by setting the Room Application to Slave Mode – see also page "Master".
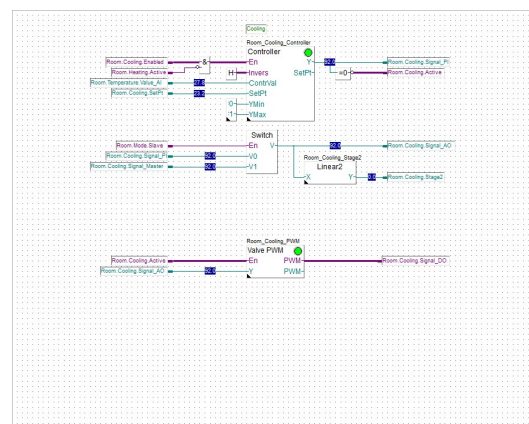

Cooling

This page contains the control for Cooling.

The control loop can be defined as pure P or as PI-controller.

The Cooling Signal can be used to activate a 2nd stage for cooing. If the cooling signal exceeds a threshold value, a 2nd cool stage signal is calculated linear to the cooling signal.

The 2nd cool stage signal usual is used to control a damper to increase air volume.

This page prepares a 0.0 to 100.0 % and a digital signal for cooling signal.

Cooling 2nd stage signal is connected to page "Air Quality Controller" where the greater signal is selected for damper signal.

Cooling signal can be overruled by setting the Room Application to Slave Mode – see also page "Master".

Heating / Cooling

When Heating and Cooling signal is acting on the same valve, the signals must be merged. This page prepares 2 signals, to be used for

- 2-pipe application with Change Over

- 4-pipe application with 6-way valve
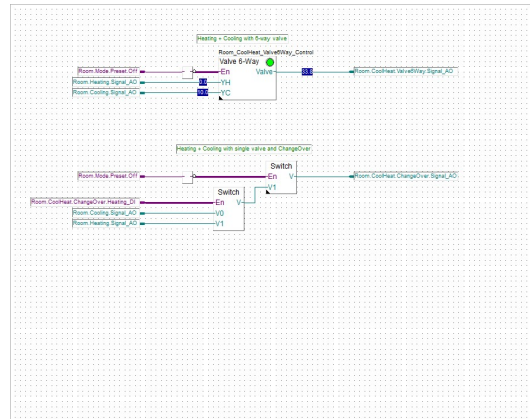
Heat/Cool-Valve EnOcean

When EnOcean is used for WallModule, valves for heating and/or Cooling might also be controlled via EnOcean.

Therefore, this page is prepared, but disabled.

The FBox 451 FU-E MSA fits for the PEHA EnOcean valve drive.

Note: Even if the ANT 450 Gateway is able to receive by hard any EnOcean radio telegram, the valve drive and the FBox must be connected (paired). This is done with the "Teach In" mechanism.

Please refer to the FBox help how the pairing is done.
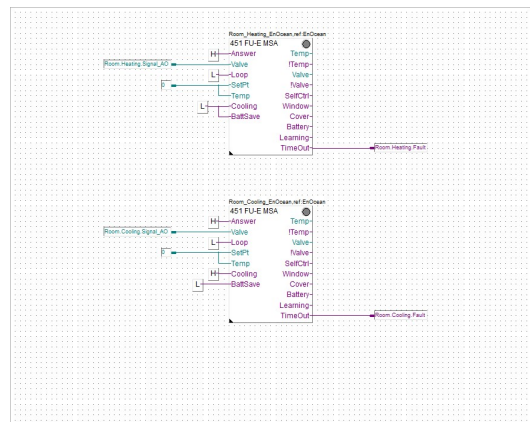
Air Quality Control

CO2 Air Quality is usually controlled by a damper, which increase the part of fresh air.

The fresh air is supplied by an Air Handling Unit and the supply temperature is usually equal or less the room temperature.

Therefore, the damper can be used also as 2nd stage for cooling and the effective signal for the damper is a maximum selection from controller signal for Air Quality and the 2nd stage cooling signal.

The effective signal for the damper is between 0.0 to 100.0 %
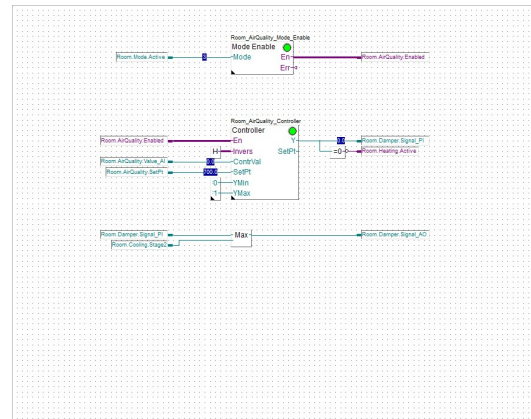
Fan Control

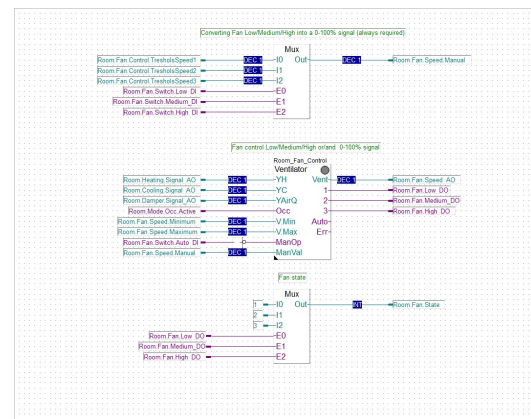Room Application often uses a Fan Coil Unit. The control of the fan is implemented on this page.

The fan can be controlled by

- Manual User intervention via Wall Module

- Heating valve signal

- Cooling valve signal

- Air Quality damper signal

Fans may have up to 3 speed or can be controlled with a continuous 0.0. to 100.0 % signal. Both functions, digital or analog control is supported.

L60x emulation

The Room Application is quite like the L60x Application, therefore a PCD7.LRxx-P5 might be used to replace a L60x.

Focus in this case is to avoid changes in the Master PLC where the L60x FBoxes are used.

So, the Room Application should be connected to the same parameter used by the L60x FBoxes.
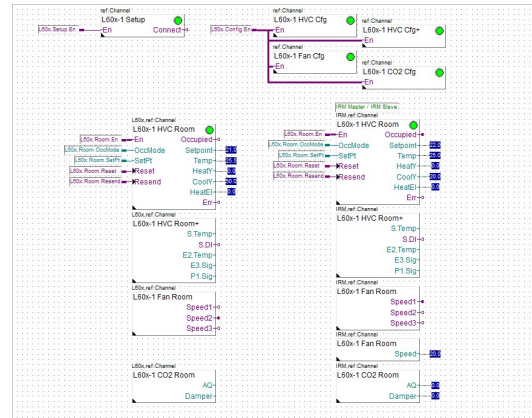
This means that the Room Application should "emulate" a L60x Room Controller. But the L60x compact controller has so many options and settings, that a real emulation will become very complex and difficult to understand, especially when some adaptions should be done.

Therefore, we decided to emulate the basic functionalities and application modes, simply by mapping the L60x Register with the Register/Flags in the Room Application.

This is done in the PB Block_L60x. As soon the PB is called, a lot of data are copied from L60x Register (= addresses used by the L60x) into the FBoxes in the Room Application or vice versa!
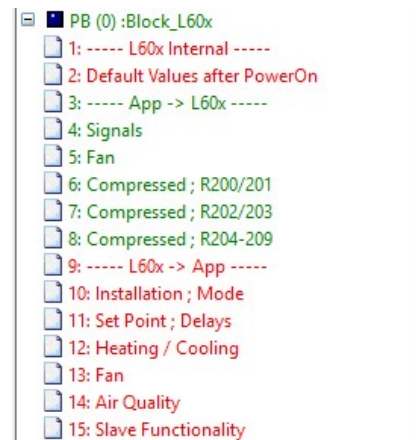
The pages with green description may be used without any impact in the Room Application, the data direction is from Room Application to L60x Registers.

The pages with red description causes impact in the Room Application, the data direction is from L60x Registers into Room Application. All data in the output connectors cannot be overwritten in the Room Application!

The following pages describe the supported features and functions of the L60x FBoxes in the Master Device. Not mentioned parameters are not supported.

L60x-1 HVC Cfg

L60x-1 HVC Cfg
-En

Application

Choice of application	>	4-pipe H/C

Master	**Roon Template**
RIO	= not supported
2-pipe H	= Heating
2-pipe, CO	= Change Over
2-pipe C, El. H	= Heating + Cooling
2-pipe, CO, El. H	= Change Over
4-pipe H/C	= Heating + Cooling
4-pipe H/C, El. H	= Heating + Cooling
2-pipe H, Y2=Y1	= Heating
2-pipe, CO, Y2=Y1	= Change Over
2-pipe C, Y2=Y1	= Cooling
Only Electr. Heating	= Heating

Hardware

Dew point (x 20 second)	>	3

Controller parameter

Basic setpoint	>	22.0
Dead band comfort mode in °K	>	2.0
Dead band standby mode in °K	>	4.0
Dead band reduced mode in °K	>	6.0
Coasting comfort mode x10min	>	1

Cooling

Proportional band °C	>	5.0
Reset time in s	>	120
Minimum	>	0
Maximum	>	100
Minimum 2nd stage	>	80.0

Heating

Proportional band °C	>	5.0
Reset time in s	>	120
Threshold value deviation	>	5.0
Minimum	>	0
Maximum	>	100

L60x-1 HVC Cfg+

L60x-1 HVC Cfg+ 🟢
-En

6-way valve		
Valve 100% ooling	>	1
Valve 0% ooling	>	45
Valve 0% heating	>	55
Valve 100% heating	>	99

L60x-1 CO2 Cfg

L60x-1 CO2 Cfg 🟢
-En

Control parameter		
Set point (ppm)	>	700
Proportional band	>	800
Minimum %	>	0.0
Maximum %	>	100.0

L60x-1 Fan Cfg

L60x-1 Fan Cfg
-En

◢ Fan		
Mode	>	Auto

Master	Roon Template
Auto	= Heating + Cooling
Always min. stage	= Heating + Cooling
On Occ min. stage	= Heating + Cooling
Stop during heating	= Cooling
Stop during cooling	= Heating

◢ Delays (*20 sec		
Coasting time	>	3

----- Treshold values (%) ---		
Speed 1	>	1
Speed 2	>	33
Speed 3	>	66

◢ Variable fan speed		
Minimum speed %	>	5
Maximum speed %	>	95

◢ Control parameter		
Setpoint room temperature °C		
Actual value room temperature		
... correction temperature °K	>	0.0
Heating signal %		
... Minimum	>	0
... Maximum	>	100
Cooling signal %		
... Minimum	>	0
... Maximum	>	100