Lindab **Pascal System Management**

Design manual for air systems

Pascal System Management overview

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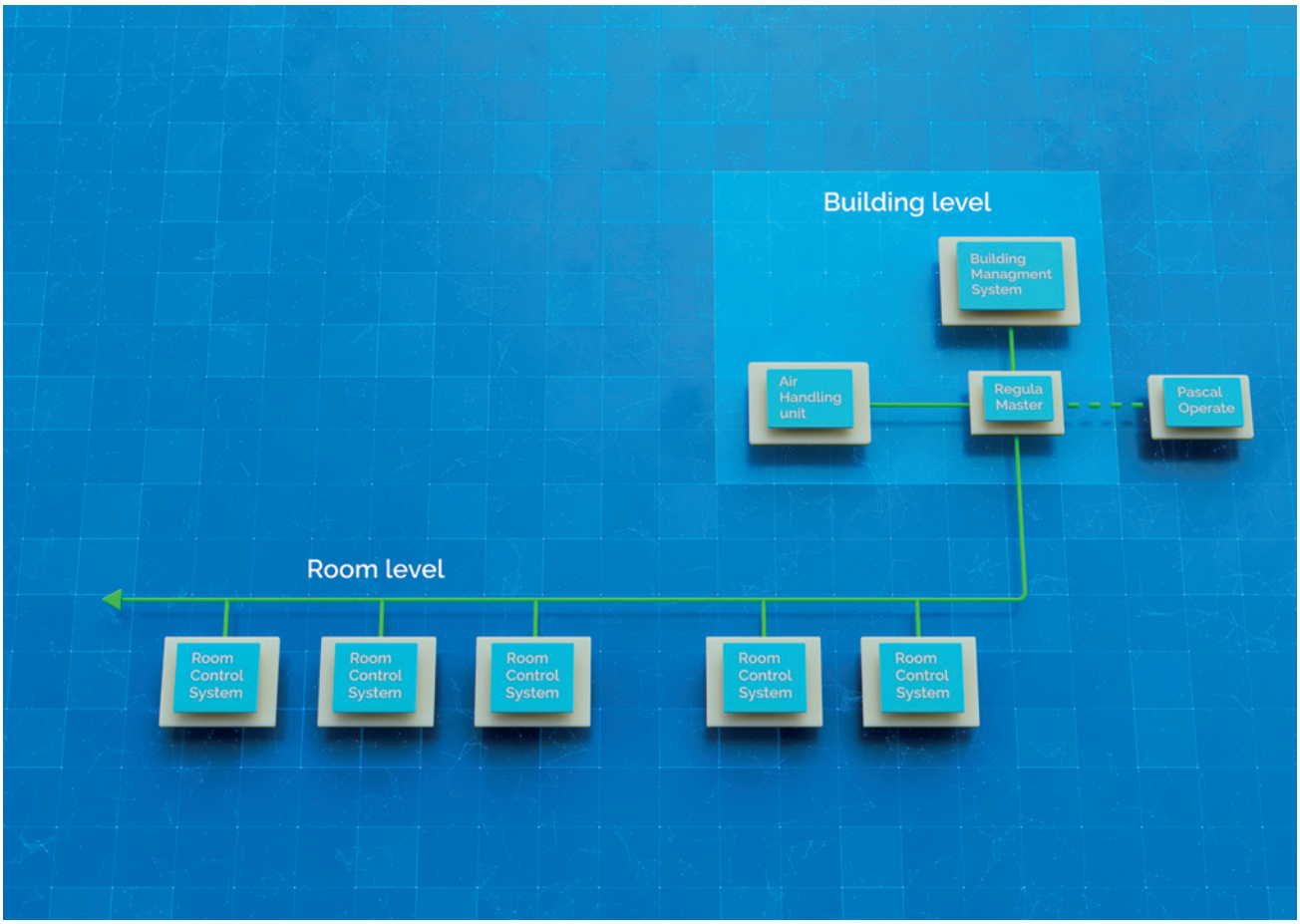
Pascal System Management simplified overview

After designing the Regula room control solutions, it is time to connect the dots.
Pascal System Management is the solution that is placed on top of the Regula room control solution and binds them together. Pascal System Management is collecting data from all the room controllers and using this to optimize the control and the airflow to the entire ventilation system. This will turn the DCV/VAV room solutions in to a building solution. With optimized energy consumption.
Pascal System Management will help insuring the good indoor climate at the lowest possible energy consumption.
Pascal System Management can be connected to an overall BMS for further great benefits.
Pascal System Management can also be used as a stand-alone system.
It comes with Pascal Operate which is an integrated web configuration tool for setup and commissioning via PC.

If you want to connect the DCV system to an overall BMS system this has already been prepared in Pascal System Management:

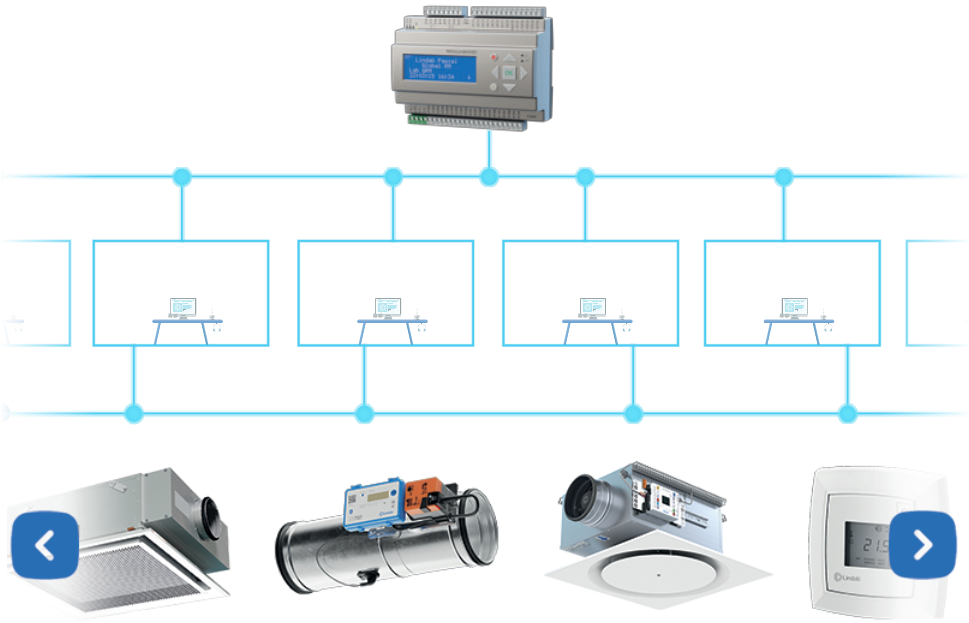
- **One access point for BMS connection**
- **Possible to both read and adjust parameters from BMS**
- **Deliver all needed ventilation data from every room and section**
- **Communicate via Modbus TCP/IP, BACnet TCP/IP and Exoline TCP/IP**
- **Full parameter and signal lists available**



Pascal System Management

Designing Pascal System Management

Pascal System Management is the overall communication. The easy setup in Regula Master secures communication with all components in every room connected through your GRM/SRM/LRM.



Designing step by step

Designing a Pascal system is simple and can basically be done in few steps, as listed below here.

Details of each step follow on this page and a number of design principles can be found on the following pages.

1. Define Regula room control solution
2. Define extract strategy
3. Define system layout
    - Identify system size.
    - Select numbers and placement of Single or Local Regula Master.
    - Select numbers of Global Regula Master.

Premises for the system
To achieve a well functioning DCV system with Pascal a few premises should be met:

- Only one volume flow regulator must be between the fan and the diffusers in the system.
- Working pressure in the system must be below 200 Pa (calculated after AHU silencers).
- For systems with a working pressure exceeding 200 Pa, pressure limitation must be established on a zone level.
- Design the duct system as if it was a CAV system.

Regula room control

Supply Regula Combi
The system regulates the room temperature by using a standard Supply Regula Combi (SRC) room controller in each room. More supply Regula Combis are feasible for multiple temperature zones, for example in landscape offices.

Demand control
Presence control and/or CO_2 are optional. Both are available for external control by connecting demand control sensors to the Supply Regula Combi (SRC), typically via the Regula Connect Pascal card placed on the ACB, the DBV, or the FTCU/VRU.

Supply regulation
For single offices, small open offices and similar room types a solution with regulation directly in each plenum box type MBV is being used. For large offices or other rooms with a large number of supply diffusers a solution with VRU/FTCU regulation in the supply duct can be chosen. Note that using a VRU/FTCU solution will require installation of a silencer after the VRU/FTCU.

Supply diffuser
Choose the desired diffuser type, e.g. with integrated presence sensor and select the right dimension, according to technical data. Diffusers should be placed properly in the room to meet the given comfort demands in the room. Room calculations could be made in Lindab´s IT tool www.lindQST.com.

Pascal System Management

Extract strategy

Extract principle
Extract in the rooms can be done by a central extract regulation, using overpressure valves or an extract diffuser placed in the room. For a room balanced solution extract dampers can be placed in the ducts into the rooms controlled and balanced by Regula Master. A Regula Master unit can handle up to 16 extract units.

Extract control
Define which supply units that affects which extract units and place the necessary FTCU/VRU dampers. Regula Master will register actual supply airflows in all selected rooms and control the corresponding extract units.

Extract balance
For a total balance of supply and extract on a floor level, areas with constant extract flow has to be taken into account. Typically the replacement air is taken from nearby rooms, therefore this can be corrected in the extract regulation of the given rooms, to secure a total balance.
External extract can be included with a FTMU.

System layout

System size
For small systems (up to 26 rooms) a Single Regula Master can handle all the regulation of the system. For larger systems the main unit must be a Global Regula Master controlling up to 8 Local Regula Master (up to 8 x 26 rooms). For even bigger systems a number of Global Regula Master can be connected in cascade to control an unlimited number of rooms. A system is equal to the AHUs area.

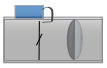
Local Regula Master
In systems with Local Regula Master the placement of the units should be close to the units it shall control. But also an appropriate wiring should be taken into account when choosing numbers and placement of Local Regula Master.
Local Regula Master shall therefore be physically placed on the floor level, typically placed in a secondary room.

Global/Single Regula Master
Global/Single Regula Master shall be placed close to the AHU, since it has to control the fan speed.
It is recommended to have GRM/SRM connected to a router/network (IP) together with LRM. Secure internet access so the system can be accessed from an office PC.

Symbol and cable overview


FTCU
Airflow and temperature measuring (Ultralink)


EUC (FTCU)
Airflow regulaator & temperature measuring (Ultralink).


VRU
Airflow regulator


Silencer
Sound attenuator


MBV with ceiling diffuser
Plenumbox, Airflow regulator


DBV
Straight through airflow regulator


ACB
Active Chilled Beam


OLR
Pressure control valve


SRC
Room controller


Supply fan
Extract fan


Extract airflow


Supply airflow


Presence sensor


Humidity sensor


CO_2 sensor


Temperature sensor (extern)

2-10 V flow signal

RJ45 Signal cable

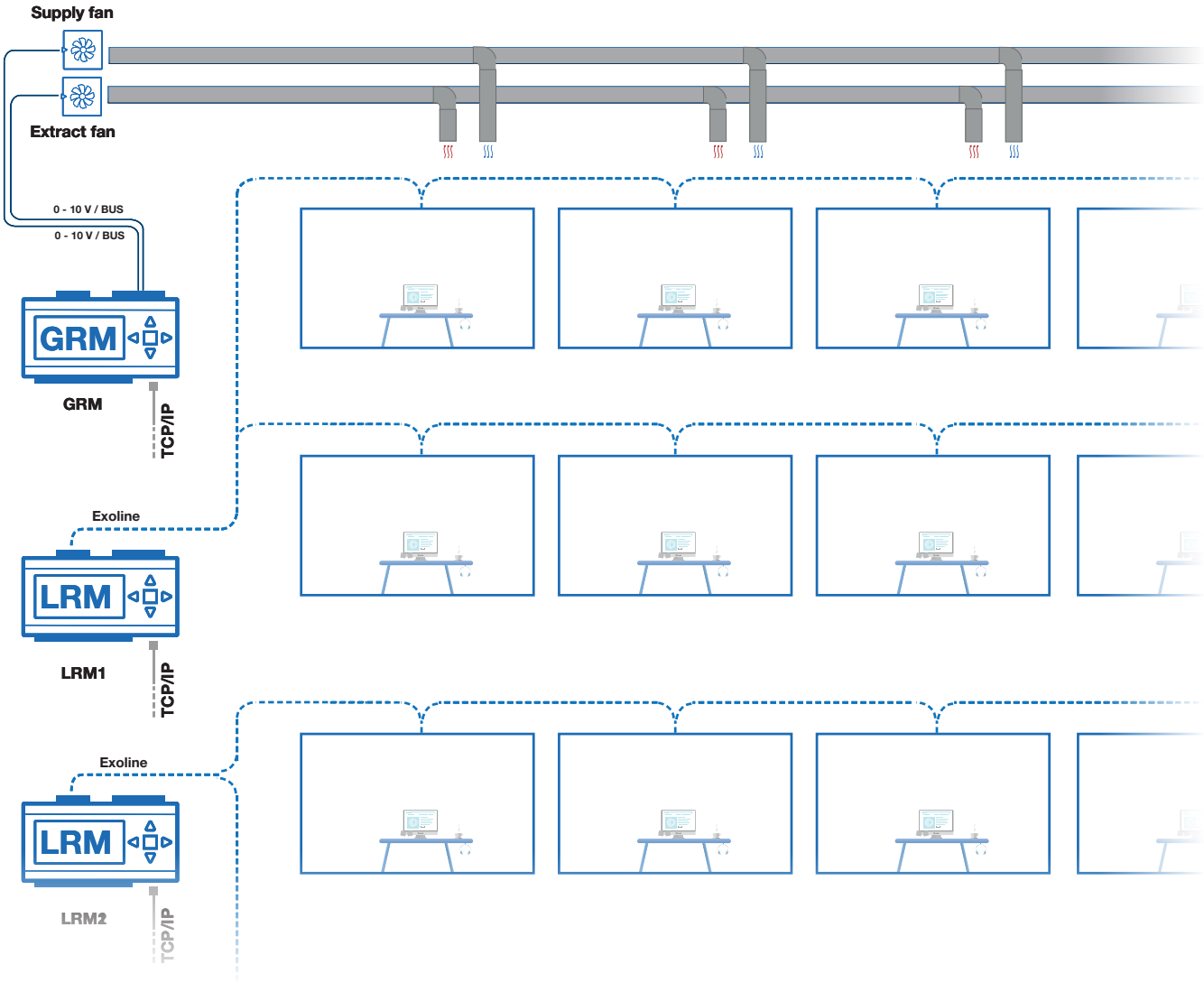
Exoline RS485/Exoline TCP,
Bus communication.

Pascal System Management

System example

In a larger system with a GRM and upto 8 LRM's, then the GRM's task is to collect control-information from the LRM's and comunicate airflow needs to the AHU controller. The GRM comminicates with LRM's via a TCP/IP connection. Pascal Operate can be accessed from the IP of the GRM and will give access to all levels of the Pascal system.

The LRM's are wired with bus connection to all the room controllers in there section. They will collect the information from the room level.
Below is a sketched system example with the connection of the GRM to AHU and TCP/IP. The LRM's with ECOline bus connection to all room controllers and TCP/IP connection for communication to GRM.



Component description

Component overview

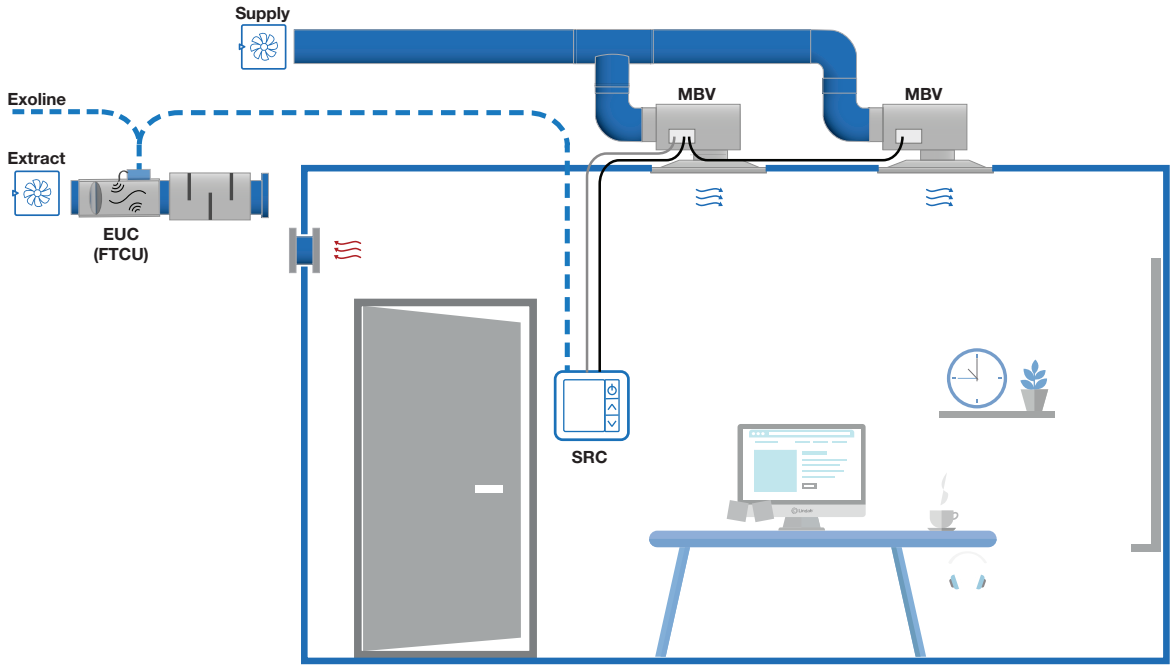
In Pascal System Management the only component needed to connect all of the Regula room controllers is Regula Master HTML. It comes with three different modes; GRM, LRM and SRM for different purposes.
In the list below is also the different room controller types and modes. ERC and SRC are both modes in Regula Combi. EUC is a mode in FTCU, when used for extract only.

	Product	Description	Function
Regula and communication equipment	GRM/SRM	Global Regula Master / Single Regula Master	• Collects damper positions from all LRM. • Controls fan speed to minimize energy consumption.
	LRM	Local Regula Master	• Collects airflows and damper positions from SRC. • Controls ERC airflow based on SRC values. • Communicates all damper positions to GRM. • Performs operating control.
	SRC	Supply Regula Combi	• Room control with temperature regulation. • Control of supply airflows in MBBV or VRU. • Communicates airflows and damper position to SRM/LRM. • Max. 26 pcs. per SRM/LRM.
	ERC	Extract Regula Combi	• Control of extract airflow in VRU. • Communicates damper positions to LRM/SRM. • Max. ERC/EUC 16 pcs. per SRM/LRM.
	EUC	Extract Ultralink Controller	• A FTCU connected directly to SRM/LRM. • Max. ERC/EUC 16 pcs. per SRM/LRM.
	Exoline RS485/Exoline TCP	BUS communication	• Communicates parameters between SRC/ERC and LRM/SRM/GRM.
	2-10 V flow	Flow signal	• Controls airflows from SRC / ERC to MBB / DBV / VRU / FTCU.
	2-10 V position	Damper position signal	• Indicates damper position from regulator unit to controller
	TCP, Modbus, BACnet, EXOline	Bus commuication	• Communication to BMS.

Design manual

1.

Supply: Demand controlled with temperature regulator and MBV.
Extract: Central regulation with overpressure valve.



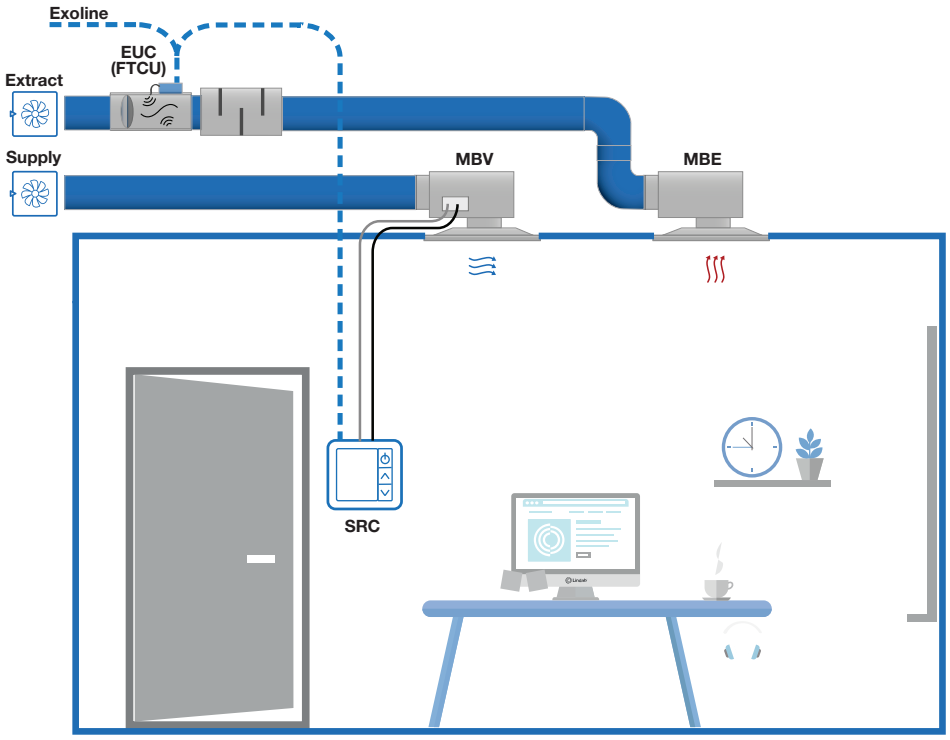
- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition and room temperature.
- SRC measures actual room temperature and gives 2-10 V flow signal to MBV.
- MBV regulates to correct air flow regardless of pressure.
- Multiple MBV controlled by same SRC can be wired with parallel signal (max 10 per SRC).
- MBV indicates actual damper position to SRC by a 2-10 V position signal.
- SRC communicates airflow and damper position to LRM/SRM.
- Extract controlled centrally in corridor with an extract controller.
- Extract from room via overpressure valve can also be done above the suspended ceiling.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

2.

Supply: Demand controlled with temperature regulation and MBV.
Extract: Central regulation with extract diffuser.



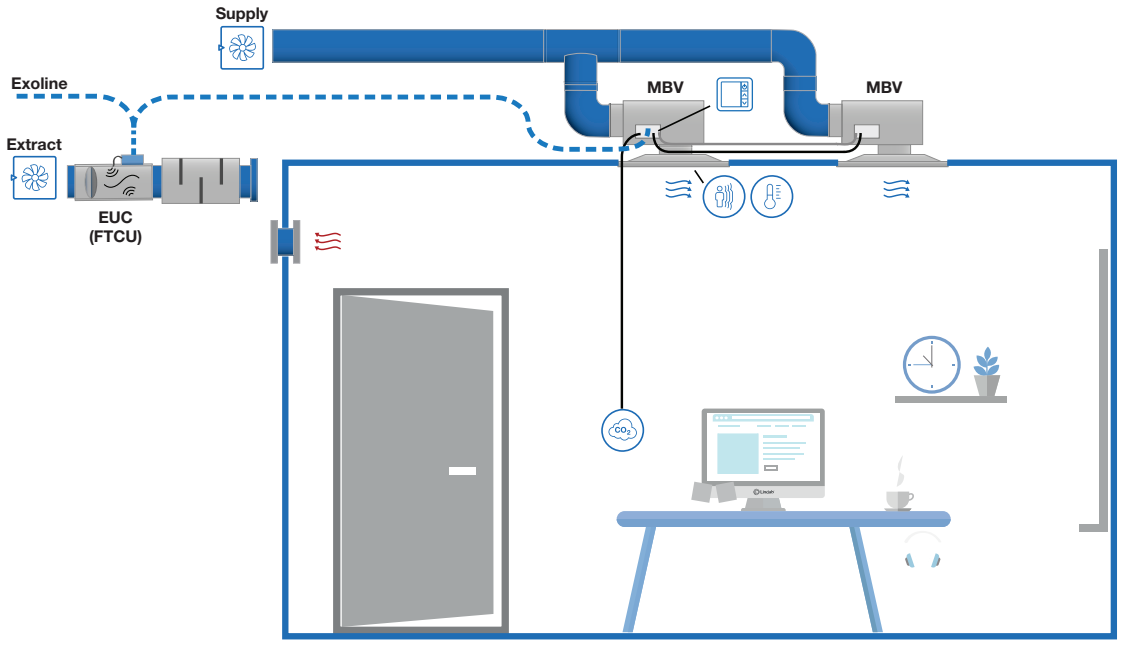
- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition and room temperature.
- SRC measures actual room temperature and gives 2-10 V flow signal to MBV.
- MBV regulates to correct air flow regardless of pressure.
- Multiple MBV controlled by same SRC can be wired with parallel signal (max 10 per SRC).
- MBV indicate actual damper position to SRC by a 2-10 V position signal.
- SRC communicates airflow and damper position to LRM/SRM.
- Extract controller gets regulation communication signal from SRM/LRM.
- Extract can also be above the suspend ceilling.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

3.

Supply: Demand controlled with indoor climate sensor regulation and MBV.
Extract: Central regulation with overpressure valve.



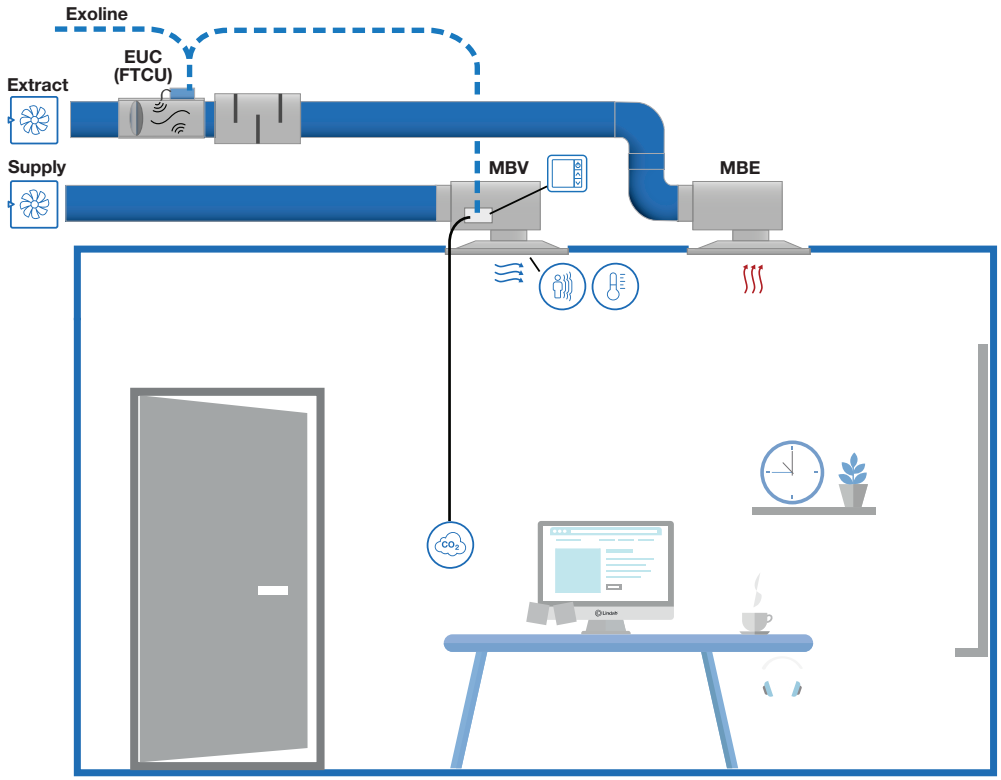
- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition, room temperature,
- presence and CO_2-level.
- Integrated temperature sensor (in diffuser) measures actual room temperature.
- External CO_2 sensor measures CO_2 level in room (optional).
- Integrated presence sensor defects occupancy in room.
- SRC gives 2-10 V flow signal to MBV according to room temperature and CO_2 level (highest demand).
- If no presence in the room SRC regulates MBV to “standby mode”.
- MBV indicate actual damper position to SRC by a 2-10 V position signal.
- SRC communicates airflow and damper position to SRM/LRM.
- Extract from room via overpressure valve can also be done above the suspended ceiling.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

4.

Supply: Demand controlled with indoor climate sensor regulation and MBV.
Extract: Central regulation with extract diffuser.



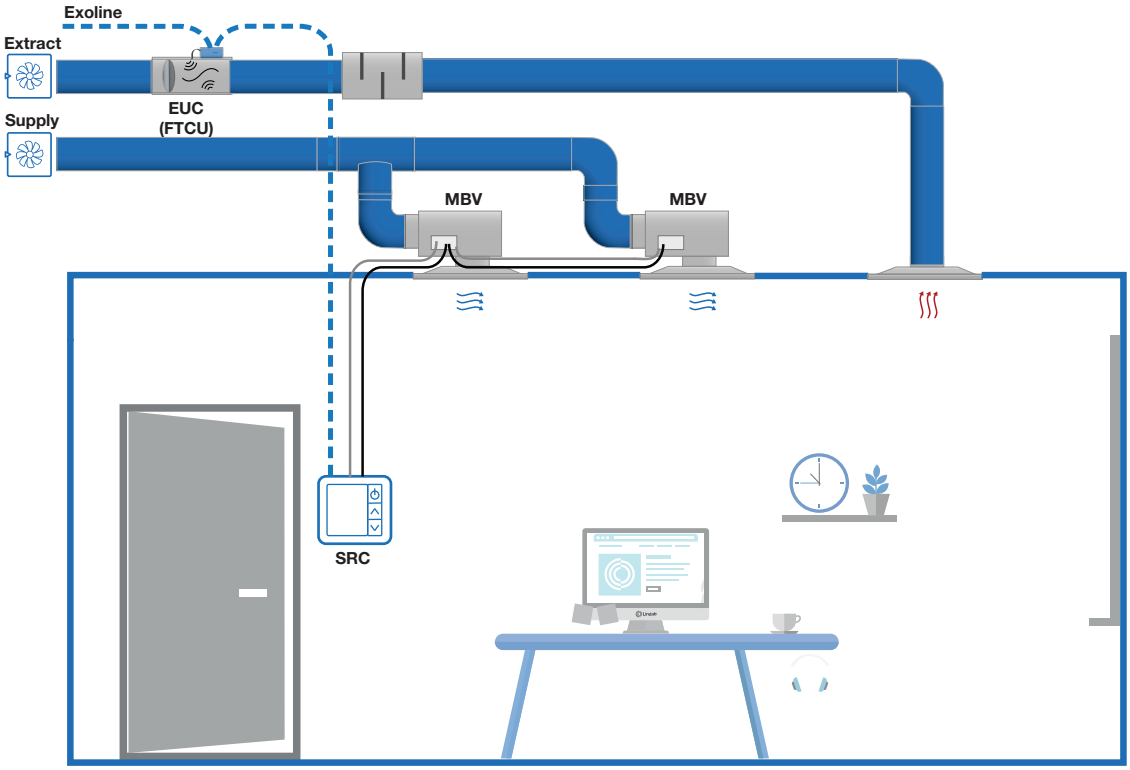
- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition, room temperature,
- presence and CO_2-level.
- Integrated temperature sensor (in diffuser) measures actual room temperature and gives 2-10 V flow signal to MBV.
- MBV regulates to correct air flow regardless of pressure.
- Multiple MBV controlled by same SRC can be wired with parallel signal (max 10 per SRC).
- MBV indicate actual damper position to SRC by a 2-10 V position signal.
- SRC communicates airflow and damper position to LRM/SRM.
- Extract controller gets regulation communication signal from SRM/LRM.
- Extract can also be above the suspend ceilling.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

5.

Supply: Demand controlled with temperature regulator and MBV.
Extract: Balanced airflow with EUC.



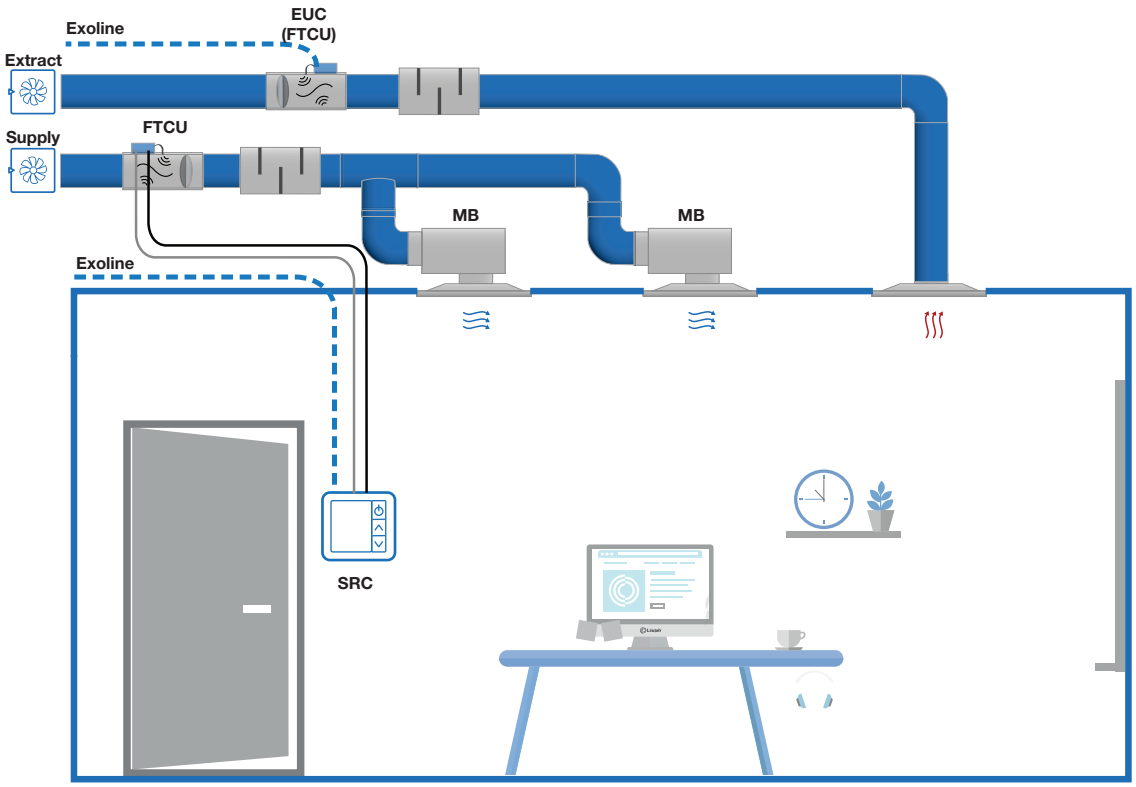
- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition and room temperature.
- SRC measures actual room temperature and gives 2-10 V flow signal to MBV.
- MBV regulates to correct air flow regardless of pressure.
- Multiple MBV controlled by same SRC can be wired with parallel signal (max 10 per SRC).
- MBV indicate actual damper position to SRC by a 2-10 V position signal.
- SRC communicates airflow and damper position to SRM/LRM.
- EUC (FTCU) receives airflow setpoint from SRM/LRM and regulates with a 2-10 V flow signal, to obtain room balance.
- EUC communicates damper position and actual flow to LRM/SRM.
- If VRU is used instead of FTCU an ERC is required. There will only be damper position feedback.
- Max. 16 ERC/EUC per SRM/LRM.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

6.

Supply: Demand controlled with temperature regulator and FTCU.
Extract: Balanced airflow with EUC.



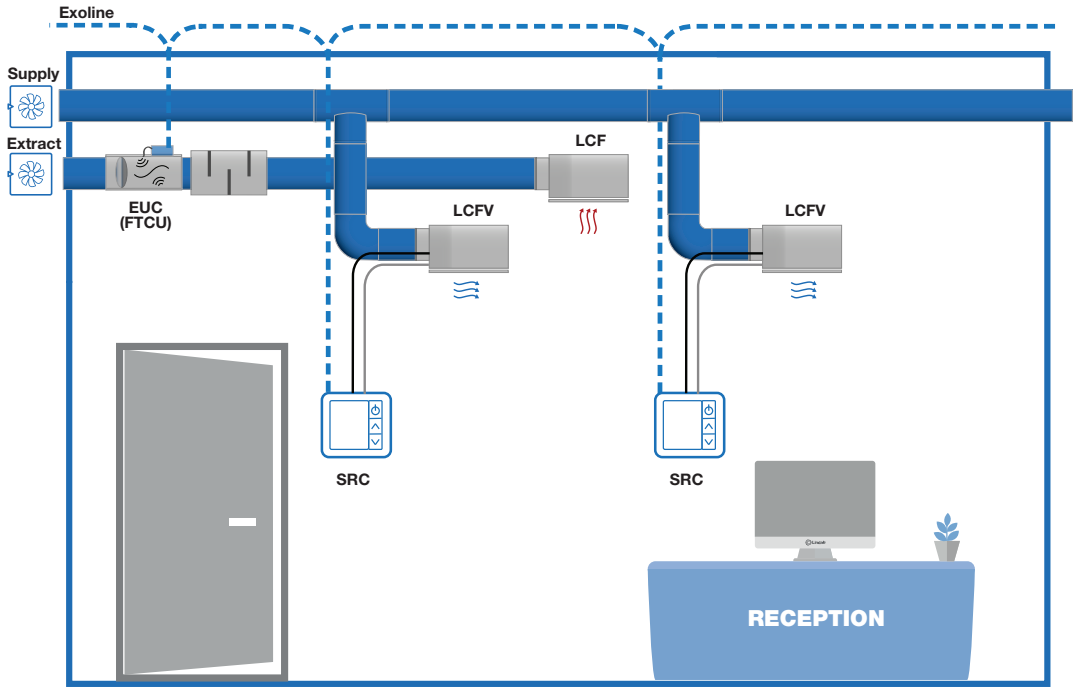
- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition and room temperature
- *note when using FTCU on supply is has analog connection to SRC.
- SRC measures actual room temperature and gives 2-10 V flow signal to supply FTCU/VRU.
- FTCU/VRU regulates to correct air flow regardless of pressure.
- FTCU/VRU indicate actual damper position to SRC by a 2-10 V position signal.
- SRC communicates airflow and damper position to LRM/SRM.
- EUC (FTCU) receives airflow setpoint from SRM/LRM and regulates with a 2-10 V flow signal, to obtain room balance.
- EUC communicates damper position and actual flow to LRM/SRM.
- If VRU is used instead of FTCU an ERC is required. There will only be damper position feedback.
- Max. 16 ERC/EUC per SRM/LRM.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

7.

Supply: Demand controlled with temperature regulator and LCFV.
Extract: Balanced airflow with EUC and LCF.



- Pascal System Management is connected to the room controllers (EUC & SRC's) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Each supply air controller (SRC) gives feedback to Pascal System Management; damperposition and room temperature.
- SRC measures actual room temperature and gives 2-10 V flow signal to LCFV.
- LCFV regulates to correct airflow regardless of pressure.
- LCFV indicate actual damper position to SRC by a 2-10 V feedback position signal.
- SRC communicates airflow and damper position to SRM/LRM.
- EUC (FTCU) receives airflow setpoint from SRM/LRM and regulates with a 2-10 V flow signal, to obtain room balance.
- EUC communicates damper position and actual flow to LRM/SRM.

Options:

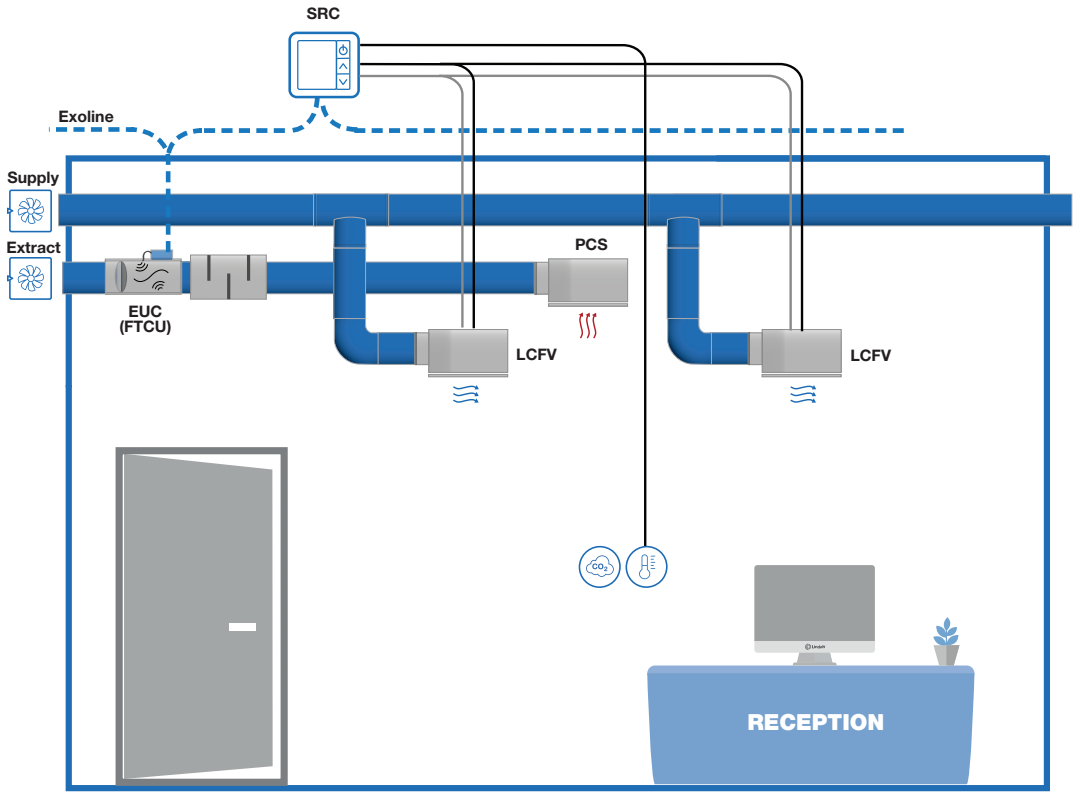
- Multiple LCFV controlled by same SRC can be wired with parallel signal (max 10 per SRC).
- LCFV can be with integrated presence sensor (-P).
- If VRU is used instead of FTCU an ERC is required. There will only be damper position feedback.
- Max. 16 ERC/EUC per SRM/LRM.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

8.

Supply: Demand controlled with temperature regulator and LCFV.
Extract: Balanced airflow with EUC and LCF.



- Pascal System Management is connected to the room controllers (EUC & SRC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- Supply air controller (SRC) gives feedback to Pascal System Management; damperposition, room temperature, presence and CO_2-level
- SRC measures actual room temperature and gives 2-10 V flow signal to LCFV.
- LCFV regulates to correct airflow regardless of pressure.
- LCFV indicate actual damper position to SRC by a 2-10 V feedback position signal.
- SRC communicates airflow and damper position to SRM/LRM.
- EUC (FTCU) receives airflow setpoint from SRM/LRM and regulates with a 2-10 V flow signal, to obtain room balance.
- EUC communicates damper position and actual flow to LRM/SRM.

Options:

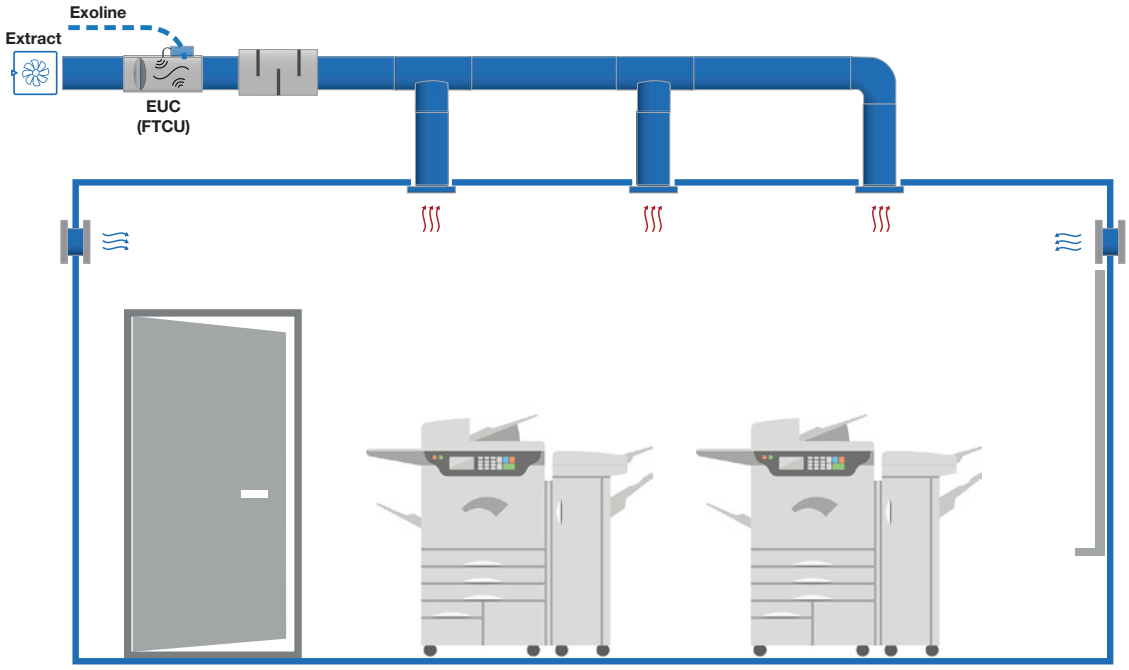
- Multiple LCFV controlled by same SRC can be wired with parallel signal (max 10 per SRC).
- LCFV can be with integrated presence sensor (-P).
- If VRU is used instead of FTCU an ERC is required. There will only be damper position feedback.
- Max. 16 ERC/EUC per SRM/LRM.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

9.

Supply: Overpressure from other rooms.
Extract: Constant airflow with EUC.



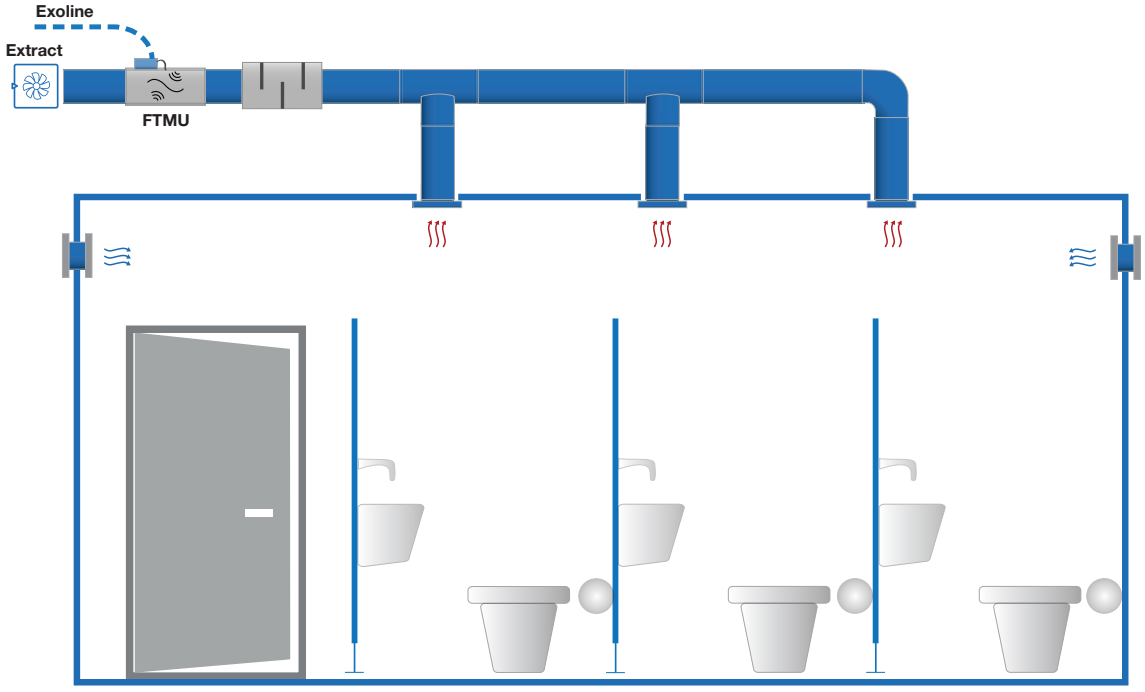
- Pascal System Management is connected to the room controller (EUC) via Exoline bus communication.
- Extract controller (EUC) gives feedback to Pascal System Management; damperposition and actual airflow.
- The constant extract flow is assigned to ERC/EUC in SRM/LRM.
- EUC (FTCU) regulates constant extract flow regardless of pressure.
- The actual flow is measured by EUC (FTCU).
- EUC measures the airflow and damper position is communicated via Exoline to SRM/LRM.
- The constant extract from this room must be compensated on the extract in other rooms.
- If VRU is used instead of FTCU an ERC is required. There will only be damper position feedback.
- Max. 16 ERC/EUC per SRM/LRM.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

10.

Supply: Overpressure from other rooms.
Extract: Separate extract fan. Airflow measuring with FTMU to obtain balance in section.



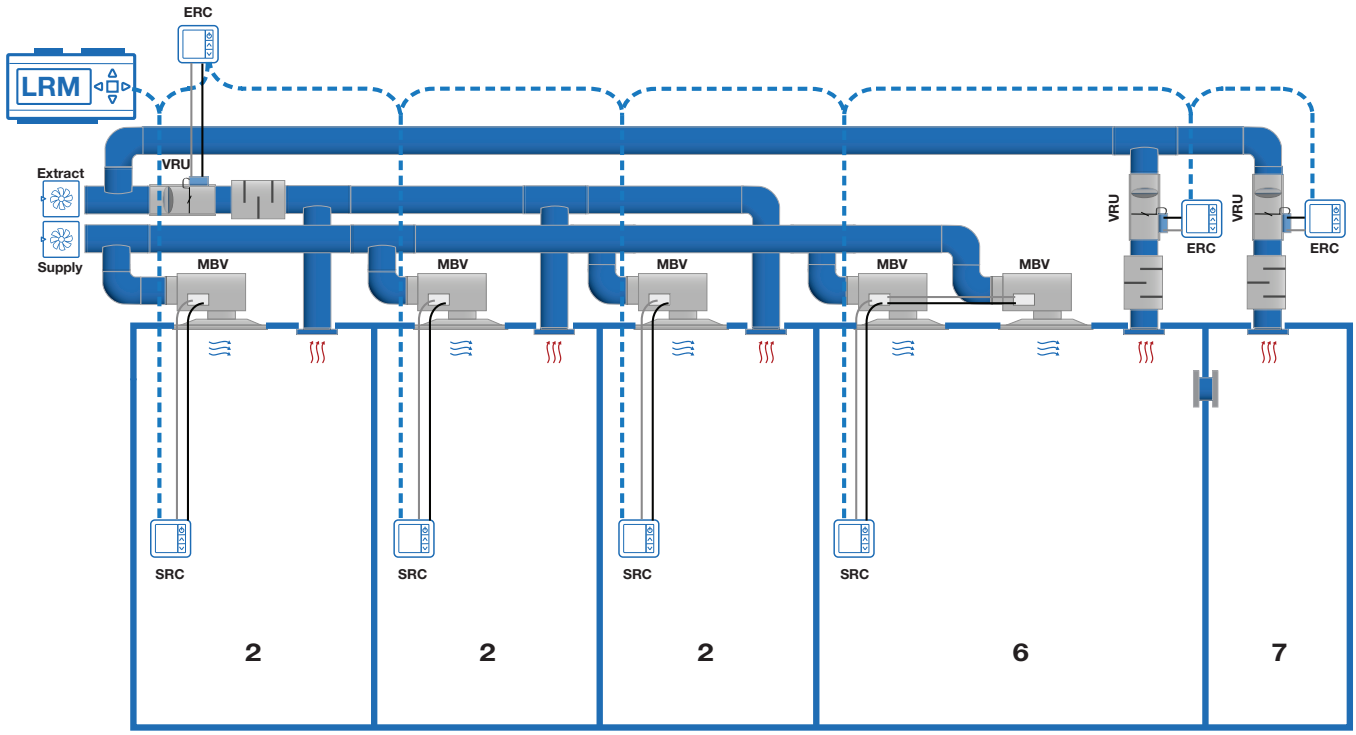
- Pascal System Management is connected to an FTMU on a seperate extract fan system via Exoline bus communication.
- FTMU communicates actual airflow to Pascal System Management.
- Pascal System Management balances the extract from the seperate extract fan.
- Max. 8 FTMU per SRM/LRM.

Complete wiring diagram for this room configuration ::: click here :::

Design manual

Combined Pascal building solution example with different room types. Can be combined to fit the exact building layout.

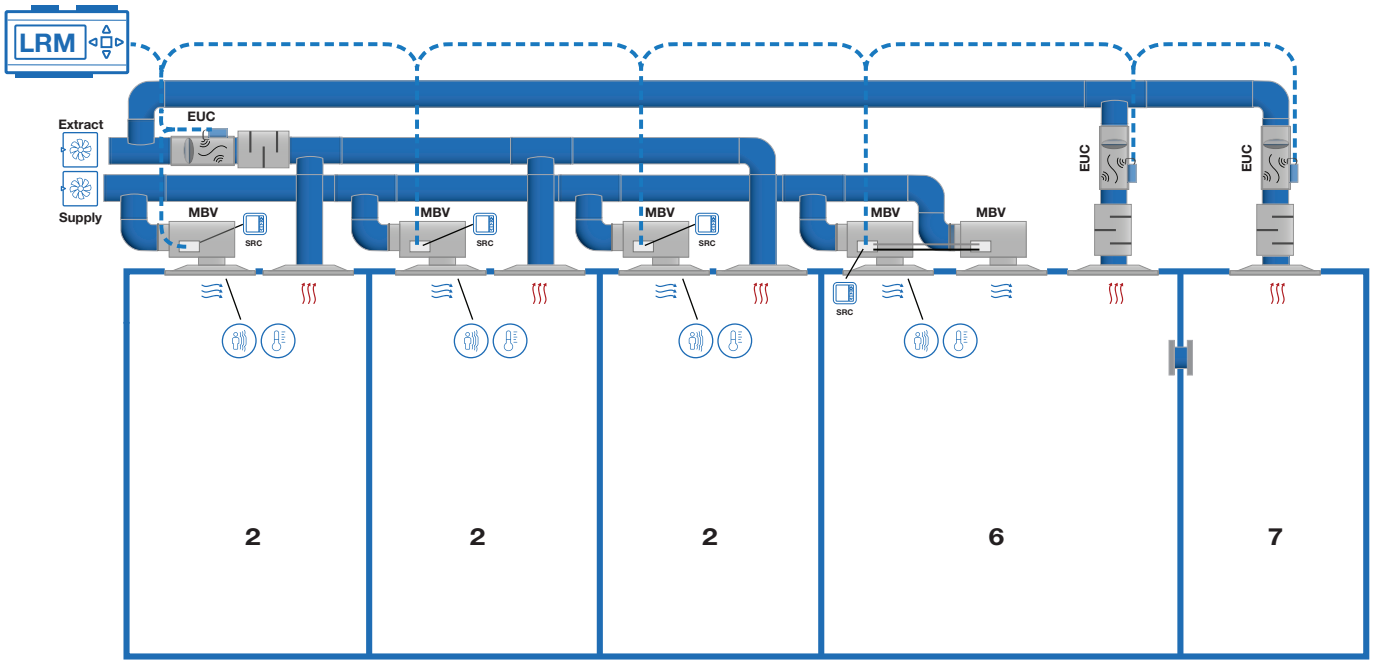
Supply: Demand controlled with temperature regulator and MBV.
Extract: Balanced airflow with ERC and VRU.



- SRC regulates supply airflow in MBV and communicates this airflow to SRM/LRM.
- SRM/LRM regulates extract ERC to rooms (2).
- SRM/LRM regulates extract ERC to rooms (6) to secure room balance minus constant extract (7).
- SRM/LRM secures constant extract flow with regulation ERC to rooms (7).
- SRC and EUC/ERC communicates damper positions to SRM/LRM.
- Damper positions for both supply and extract are used for fan optimizer function.

Design manual

Supply: Demand controlled with SRC on MBV and external sensors.
Extract: Balanced airflow with EUC.

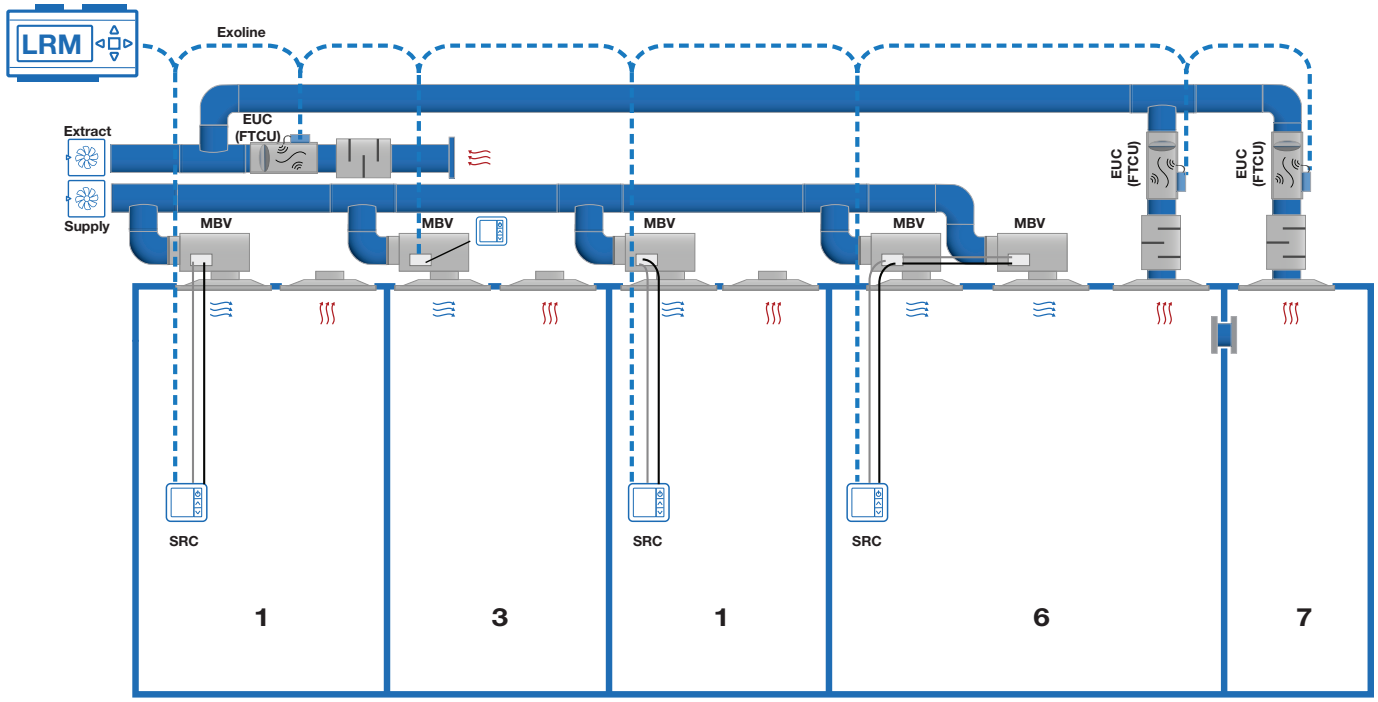


- SRC regulates supply airflow in MBV and communicates this airflow to SRM/LRM.
- SRM/LRM regulates extract EUC to rooms (2).
- SRM/LRM regulates extract EUC to rooms (6) to secure room balance minus constant extract (7).
- SRM/LRM secures constant extract flow with regulation EUC to rooms (7).
- SRC and EUC/ERC communicates damper positions to SRM/LRM.
- Damper positions for both supply and extract is used for fan optimizer function.

Design manual

Combined Pascal building solution example with different room types. Can be combined to fit the exact building layout.

Supply: Demand controlled with mixed solutions, temperature regulation and MBV.
Extract: Mixed solutions balanced with EUC.

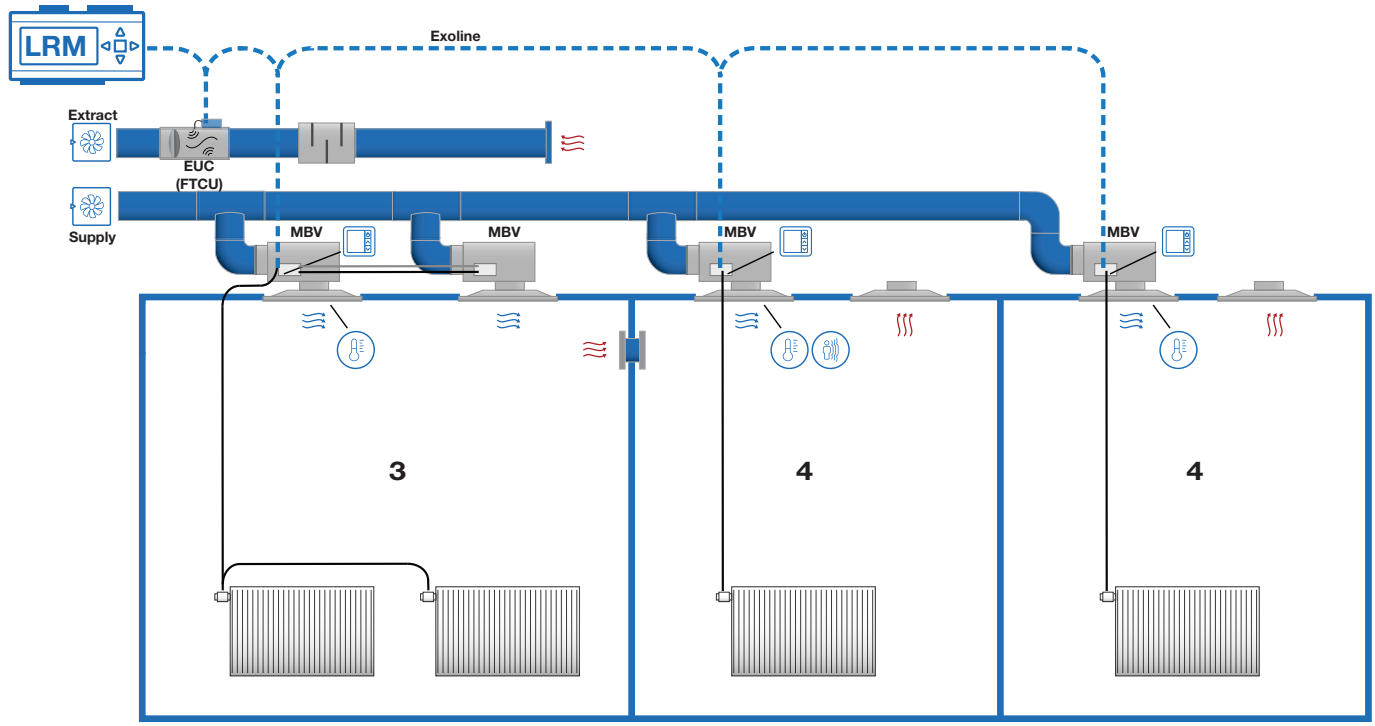


- SRC regulates supply airflow in MBV and communicates this airflow to SRM/LRM.
- SRM/LRM regulates extract ERC/EUC to rooms (1) and (3).
- SRM/LRM regulates extract ERC/EUC to rooms (6) to secure room balance minus constant extract (7).
- SRM/LRM secures constant extract flow with regulation ERC/EUC to rooms (7).
- SRC and EUC (FTCU) communicates damper positions to SRM/LRM.
- Damper positions for both supply and extract is used for fan optimizer function.
- If VRU is used instead of FTCU an ERC is required. There will only be damper position feedback.

Design manual

Solutions with valve control for room heating

Supply: Demand controlled with SRC on MBV, external sensors and heating.
Extract: Balanced airflow with EUC.

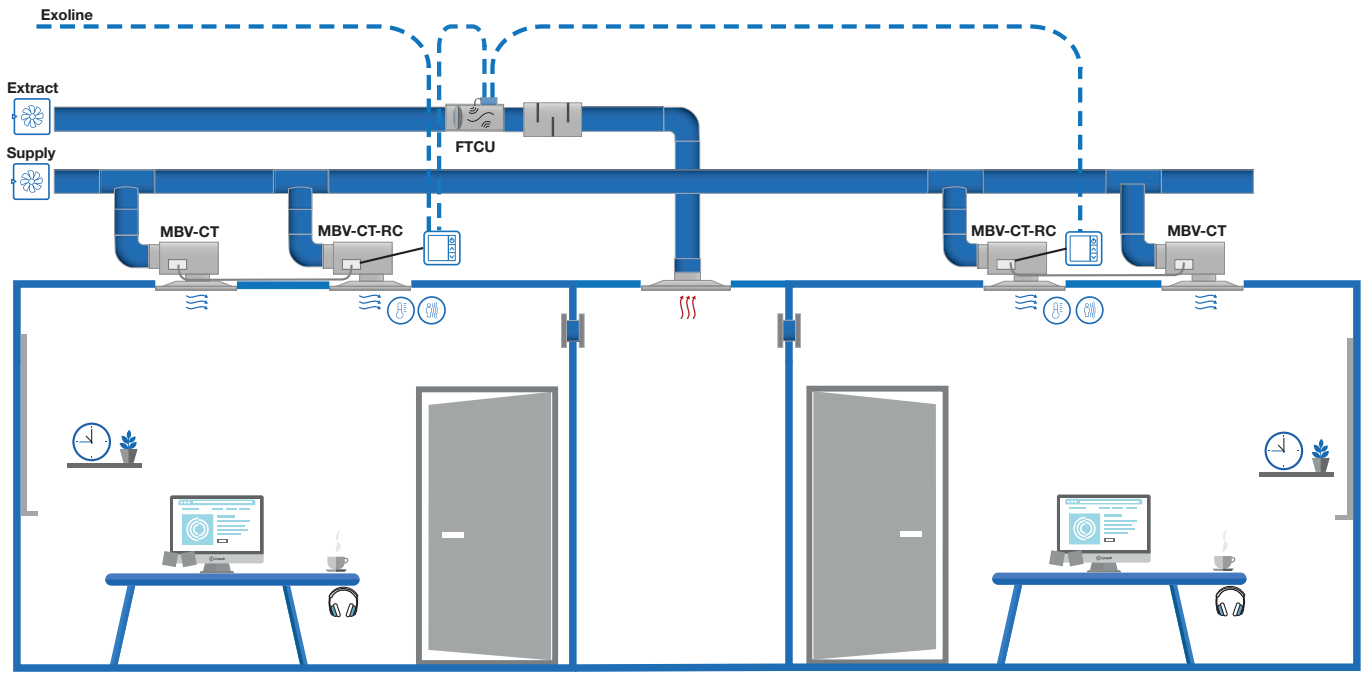


- SRC supply airflow in MBV and communicates this airflow to LRM.
- SRC is mounted on MBV with Regula Control card for easy wiring.
- Temperature and/or Presence sensors integrated in diffusers.
- Room heating is controlled from SRC with 0-10 V or 24 V control signal.
- LRM communicates directly to EUC with airflow.
- Supply and Extract are connected and balanced in SRM/LRM via Exoline.
- Room heating is controlled from SRC with 0-10 V or 24 V control signal.
- Damper positions for both supply and extract is used for fan optimizer function.

Design manual

Single offices with different heat load

Supply: Demand controlled with SRC on MBV. SRC controls several MBVs.
Extract: Central from hallway, balanced airflow with EUC and several SRCs.

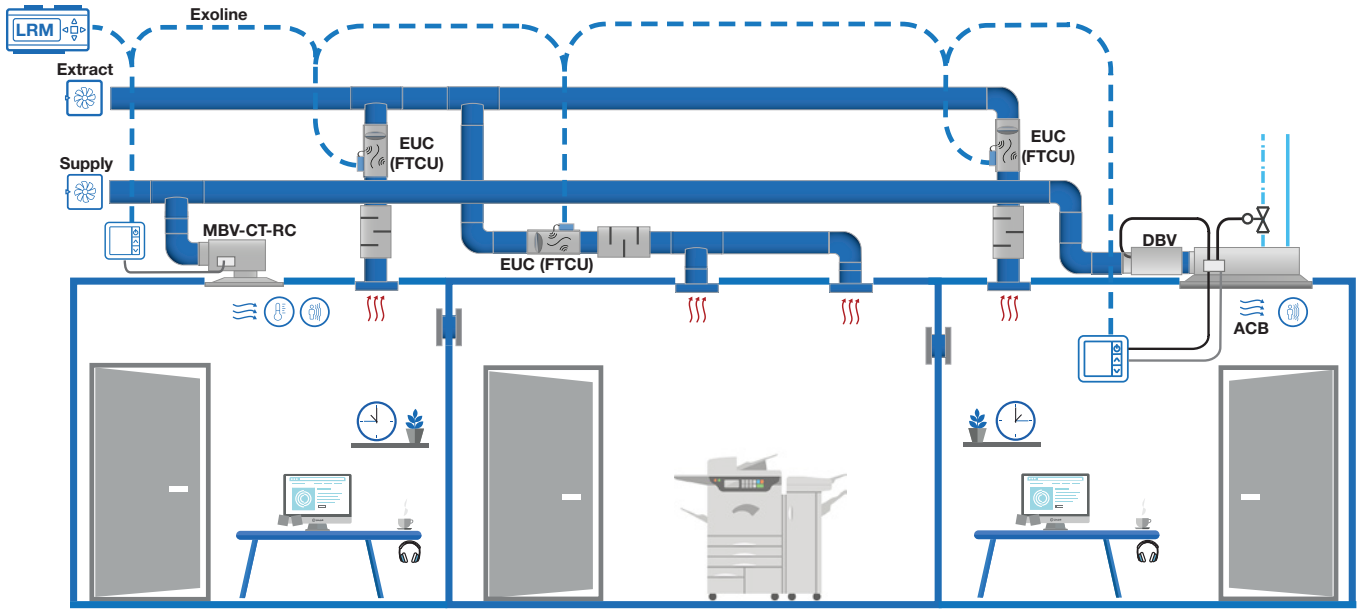


- SRC Room controllers mounted on MBV with integrated sensor in ceiling diffuser. Controlling airflow to large temperature zone with parallel connected MBVs.
- Central extract from hallway with overflow to each office. Airflow regulated with FTCU.

Design manual

Air and water solution

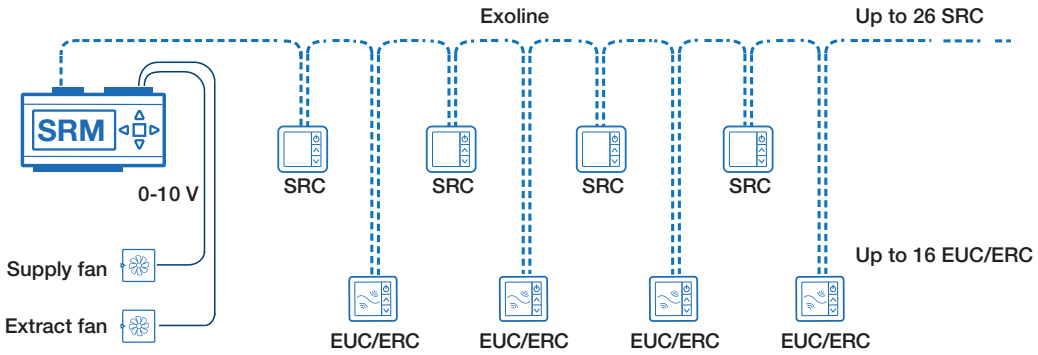
Supply: Single offices with different heat load.
Extract: Ballanced between offices and printer station.



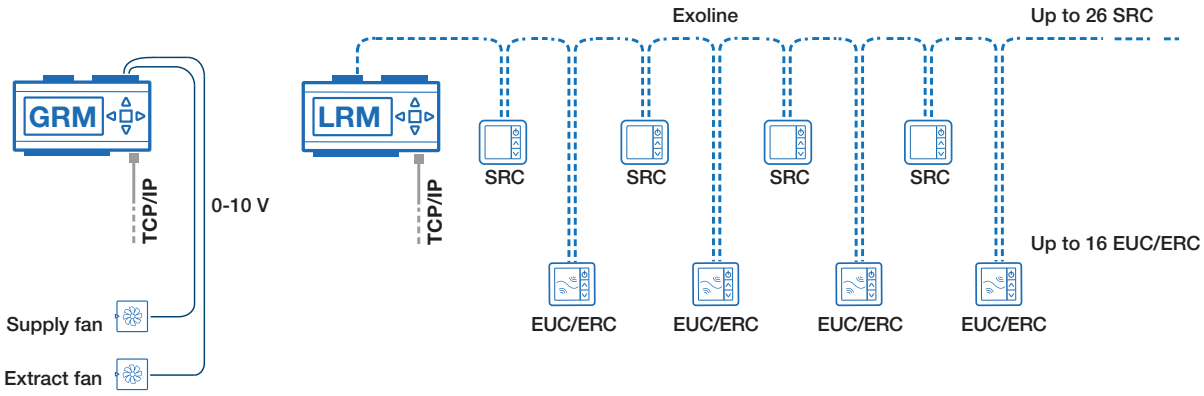
- Single offices with different heat load.
- ACB solution with room controller for temperaure regulation. Presence sensor integrated in ACB.
- MBV solution with presence and temperature sensor intregreted in ceiling diffuser.
- Constant extract with FTCU in ”printer room?” balanced with overflow from offices. Variable extract in the offices to compensate the total supply airflow to balance section.

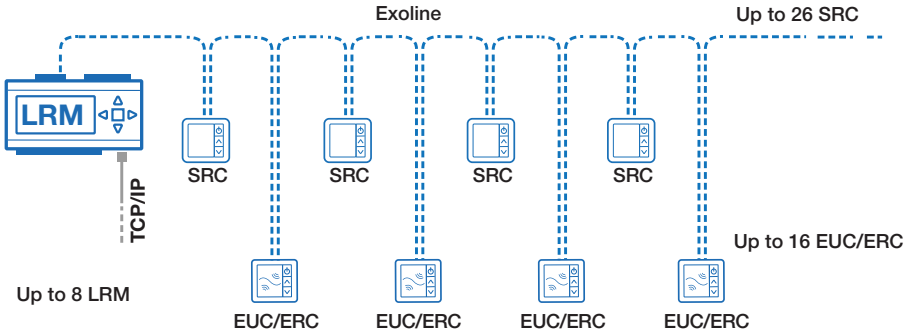
Design manual

System layout - small AHU
Single Regula Master (SRM)



System layout - medium AHU.
Global Regula Master and 2-8 Local Regula Masters.





Most of us spend the majority of our time indoors. Indoor climate is crucial to how we feel, how productive we are and if we stay healthy.

We at Lindab have therefore made it our most important objective to contribute to an indoor climate that improves people's lives. We do this by developing energy-efficient ventilation solutions and durable building products. We also aim to contribute to a better climate for our planet by working in a way that is sustainable for both people and the environment.

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