LABCONTROL

TROX® TECHNIK
The art of handling air

Paul Absolon

Trox Belgium

Labcontrol Product Manager

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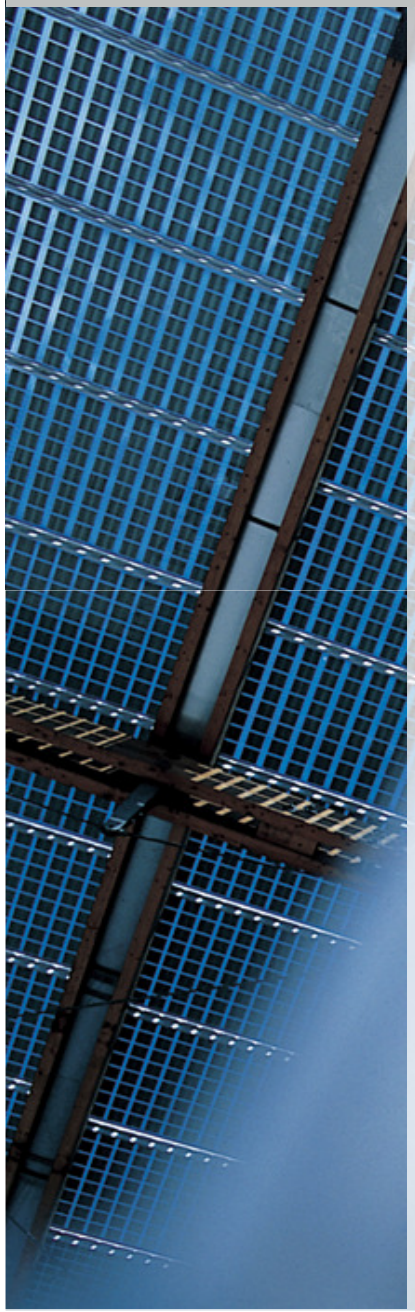

DIN 1946 Part 7 Lab ventilation

DIN EN 14175 Fume hoods

Different Lab Ventilation Layouts

Requirements for Labcontrol Systems

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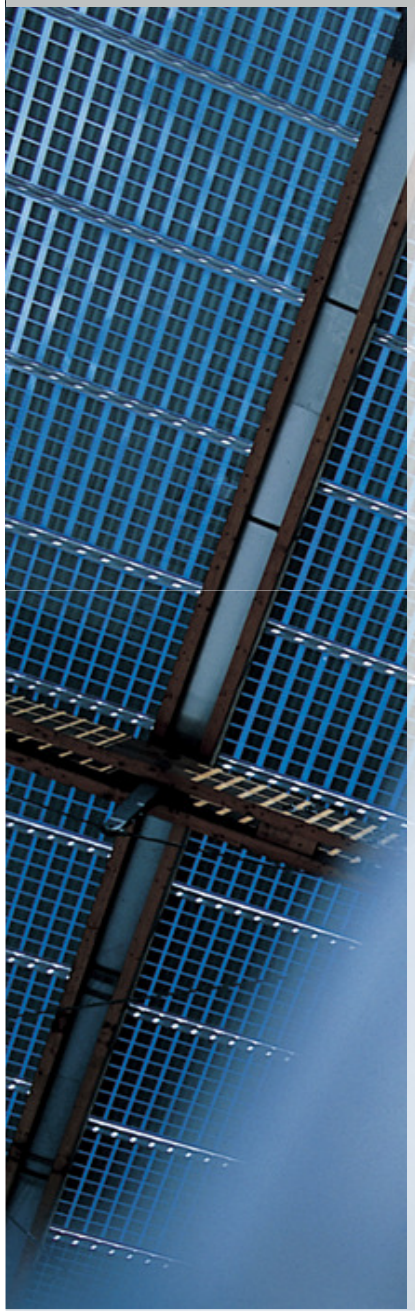

DIN 1946 Part 7 Lab ventilation

minimum exhaust according to DIN 1946, P7 (25 $m^3/h/m^2$)

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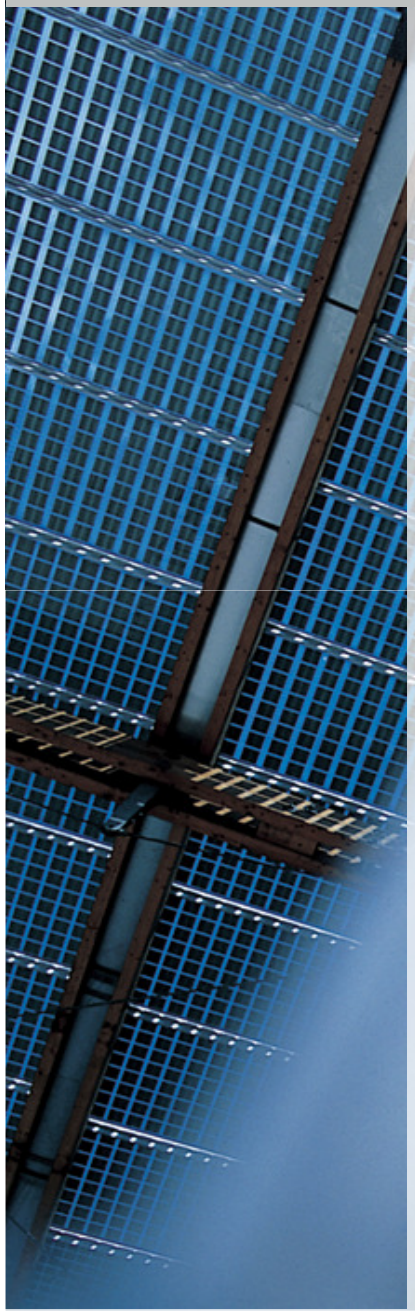

DIN EN 14175 Fume hoods

No Fixed Value is given for :

Min Volume Flow
Min Face Velocity

Manufacturer Guaranteed

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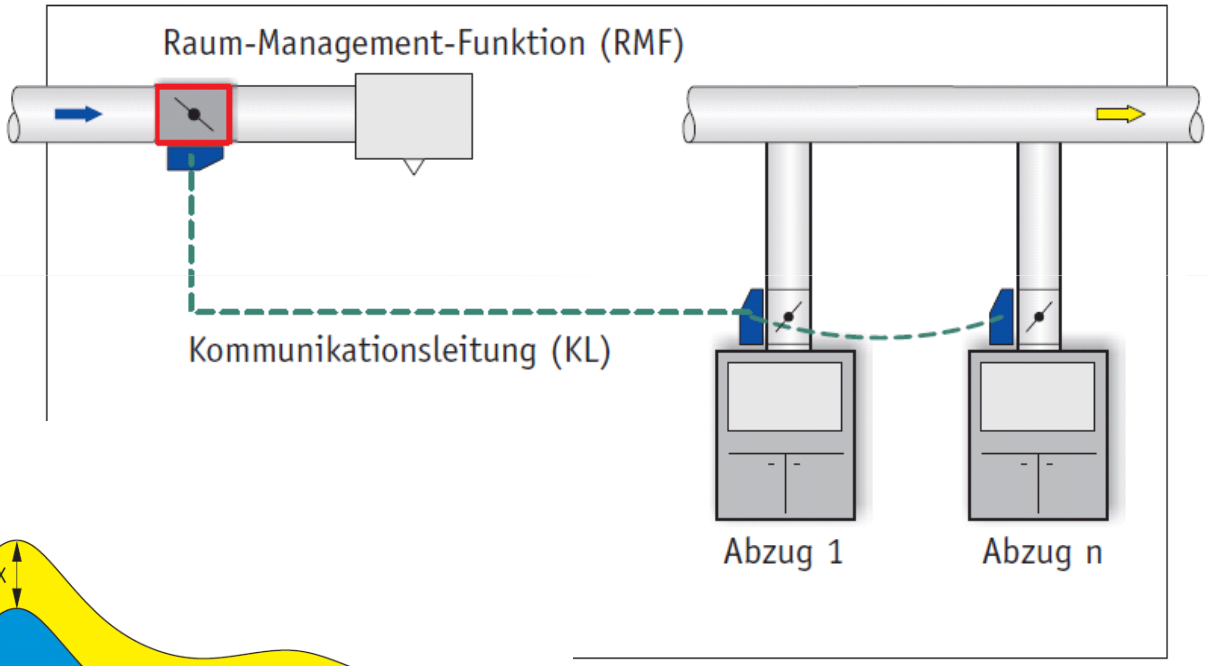
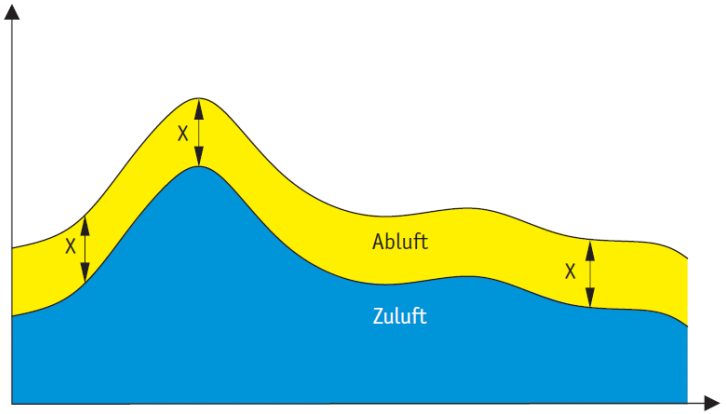
Fume Hoods compensated by Supply Air





x = Konstante Differenz Zuluft/Abluft
zur Sicherstellung der Überströmung

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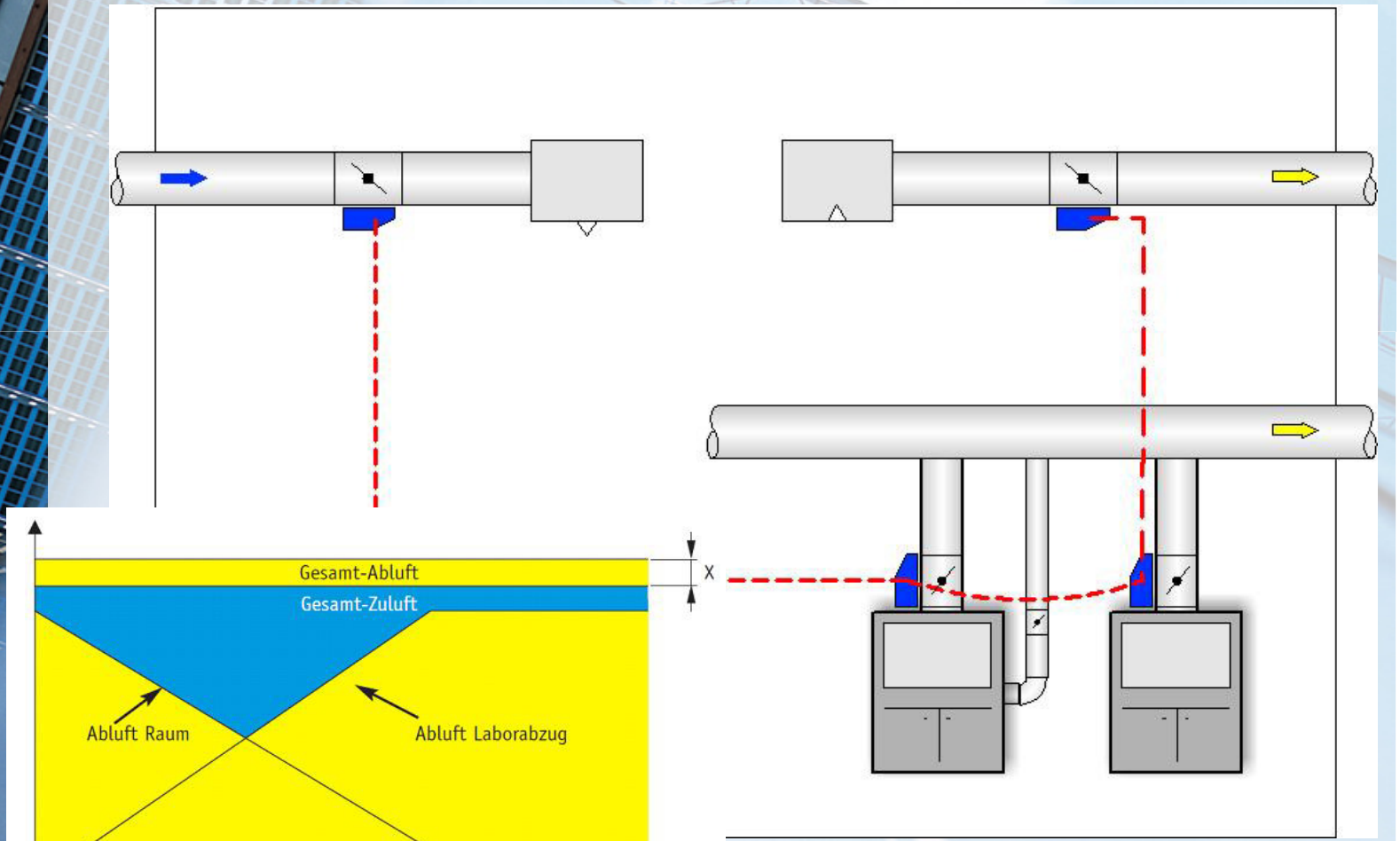
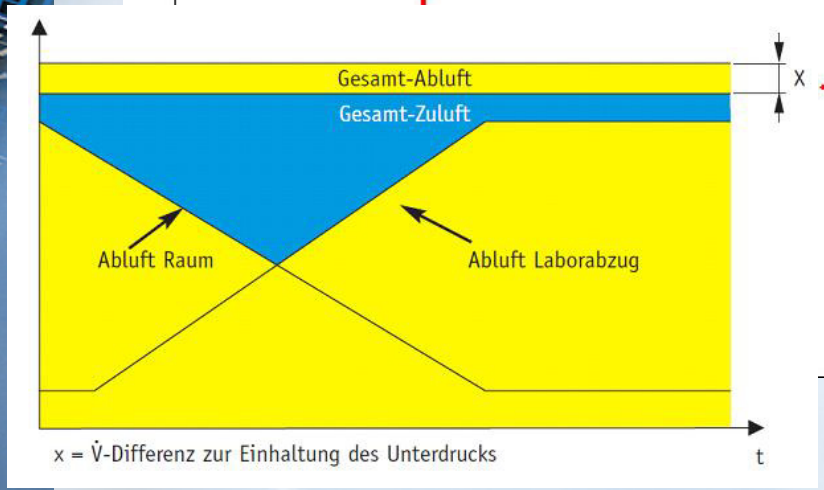
Fume Hoods comp Supply/Extract Air





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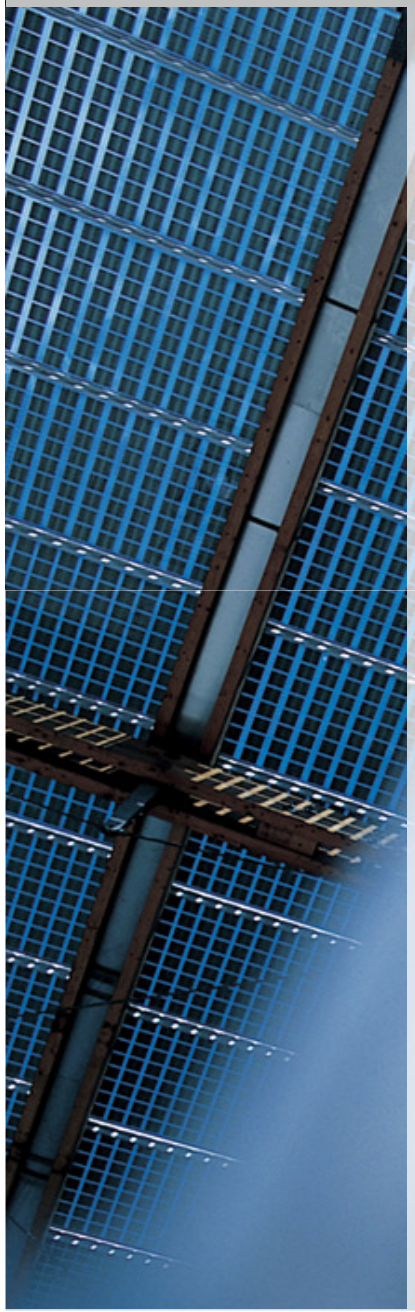

Which requirements can be fullfilled with LABCONTROL Systems?

- **Fast Control Circuits**
- **Volume Flow Control**
  - With temperature control concepts
  - Room balance concepts with many Master units
- **Room Pressure Control**
  - Volume flow pressure cascade with:
    Duct pressure control / Room pressure control
- **Fume Hood Control**
  - variable with distance sensor, 2- or 3-point control, Face velocity sensor
  - constant volume flow
- **Monitoring concepts**
- **Easy installation and wiring**
- **Far distance maintenance**

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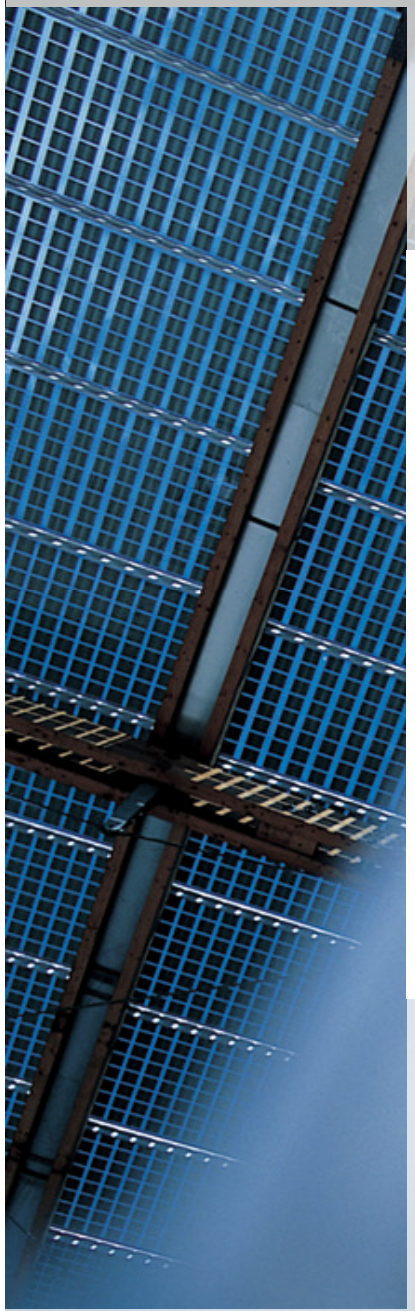

Next generation of the Controller hard- and software

EASYLAB - TCU3

Targets for the development of EASYLAB

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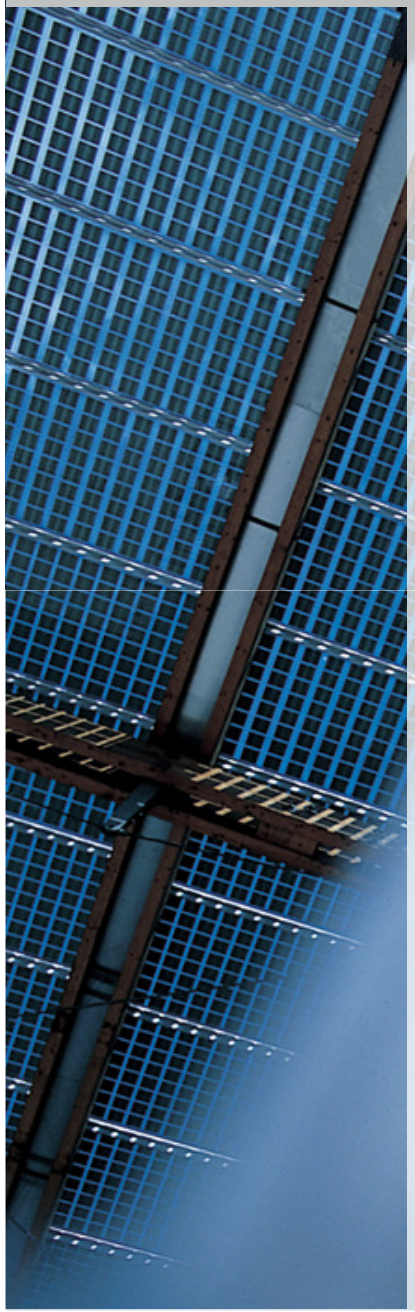

This wishes should be fullfilled

- **EASY to adapt**
- **EASY to install**
- **EASY to design**
- **EASY to use**
- **EASY to commission**

EASY to adapt

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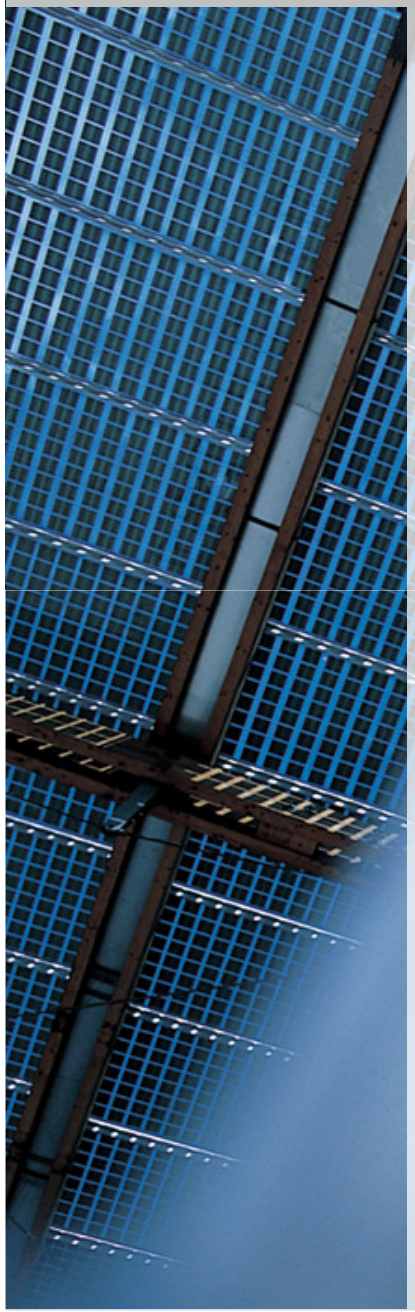

The *modulare priciples* make it possible:

- Volume flow controller with buffle measurement or according to the venturi principle
- Plug and Play connection between the controllers
- Adaptable User terminals
- Flexible Adaptation of the digital communication
- Controller connections easy to reach
- Possible UPS
- Failure diagnostics very easy to handle
- Flexible power supply 24V AC / 230V AC
- If needed auto zero function possible

Lets have a closer look at those points …

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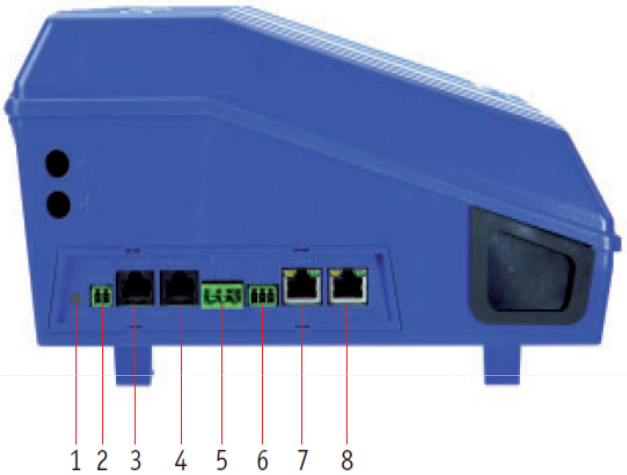
EASY to install



Terminal assignment out side:

1 LED for failure indication

2 Connection for sash window contact EN 14175 (500mm)

3 Connection user terminal 1

4 Connection user terminal 1

5 Connection Actuator

6 Connection face velocity sensor (VS-TRD)

7 Communication line

8 Communication line

9 Cable bushing on both sides

10 Connection fume hood light (expansions modul EM-LIGHT)

TCU3 - System design

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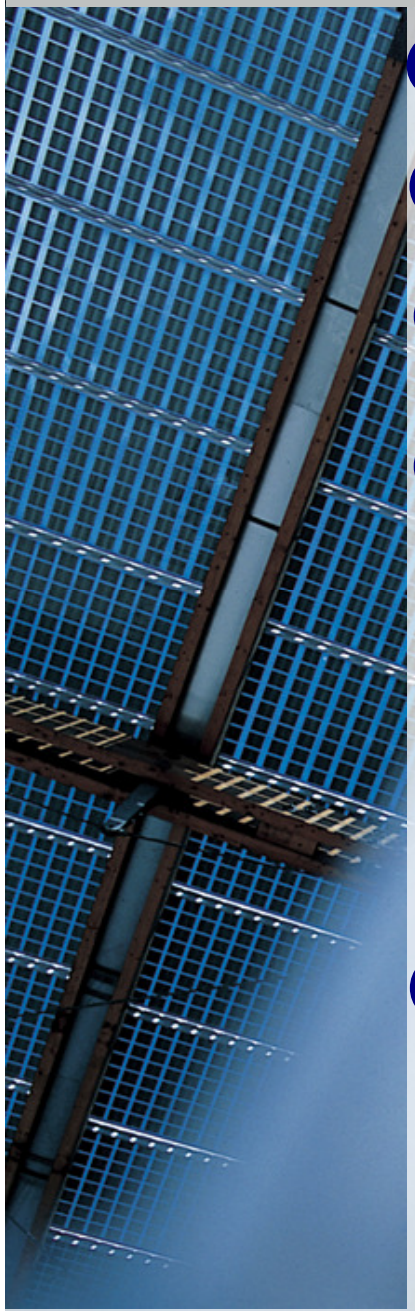
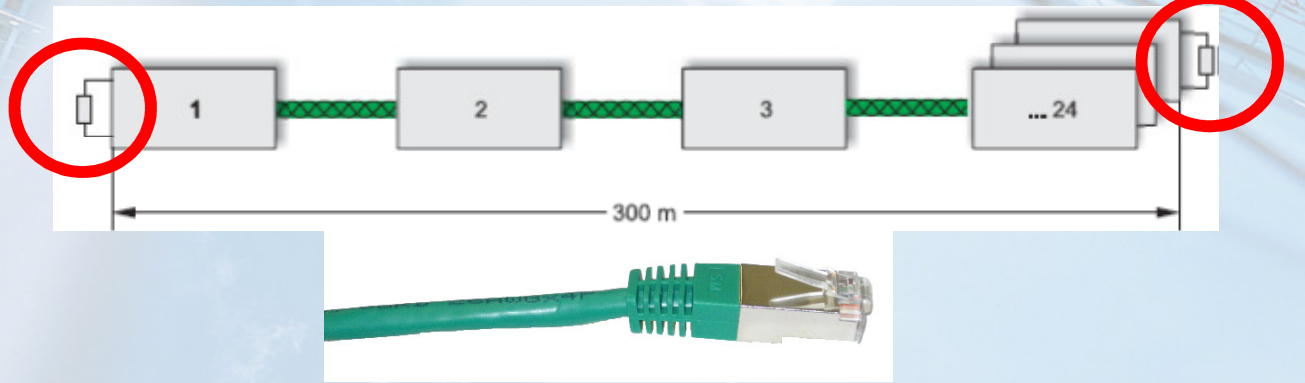


- Max. 24 controllers in a EASYLAB-System
- Controller connection over a comunication line KL
- Only line network topology max. 300 m
- Termination on the start / end of line necessary!



- Plug-In Standard-Patchkabel (green)
  Cable typ: S-FTP

EASYLAB Regler TCU3

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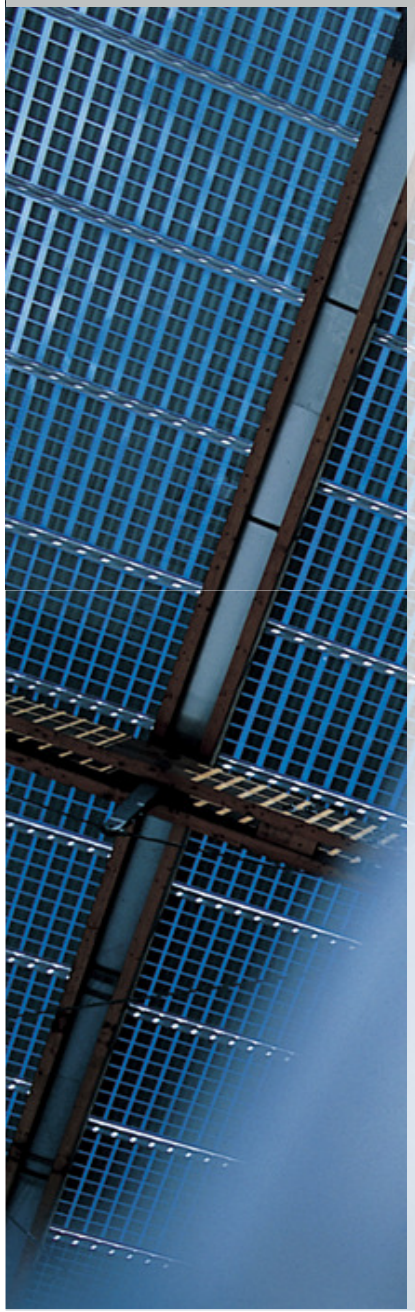

A Fast Runner is needed

Precision Motor (Belimo)
0-90° <= 3 s
Accuracy 0,2°
8 Nm

Is use for all elab vav systems

Exception :

TVJ/TVT big vav systems (15Nm)

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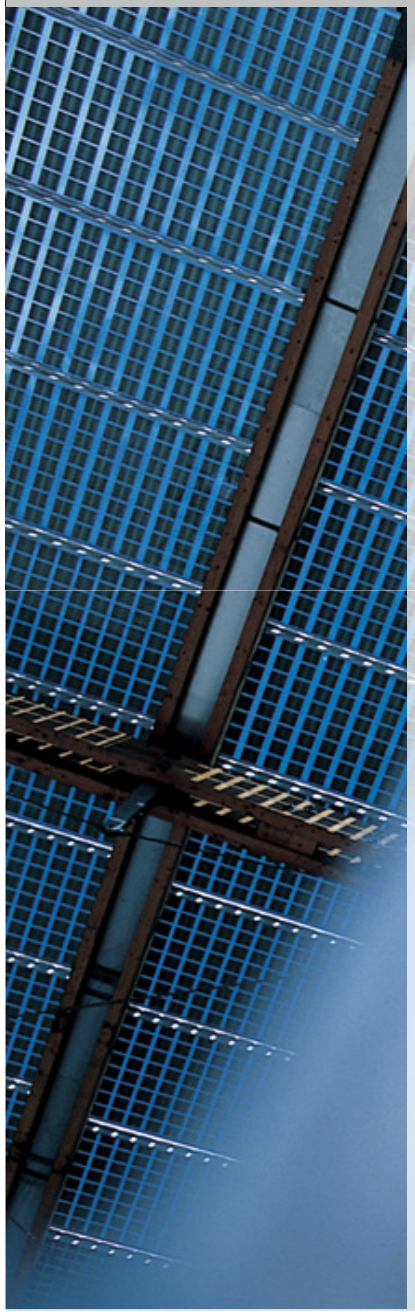

Overview

- **EM-TRF / EM-TRF-USV**
  Power supply 230 V / USV function
- **EM-LON**
  LonWorks®-Gateway
- **EM-AUTOZERO**
  automatic zero point adjustment
- **EM-LIGHT**
  connection for fume hood light

EASYLAB expansion module

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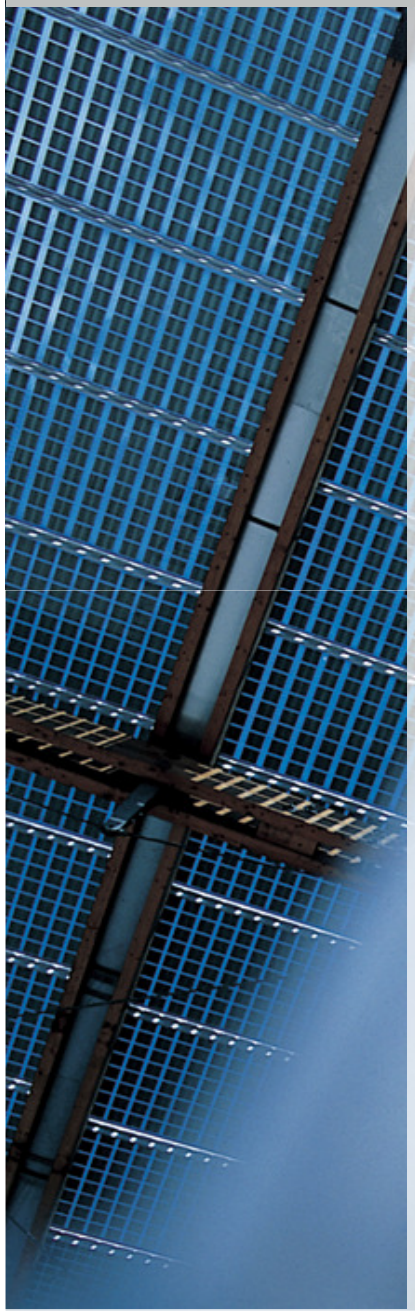
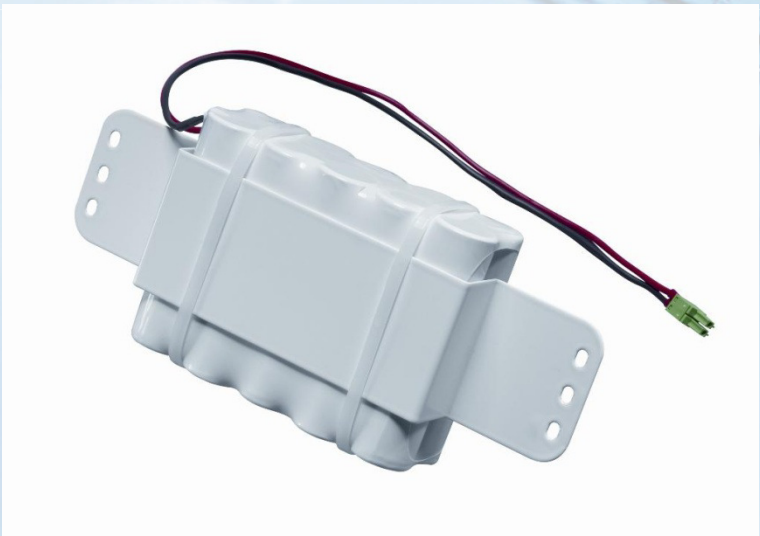


- **EM-TRF** — power supply 230 V AC
- **EM-TRF-USV** — power supply 230 V AC + USV function incl. Accu
- **Mounting in the factory or retrofit**



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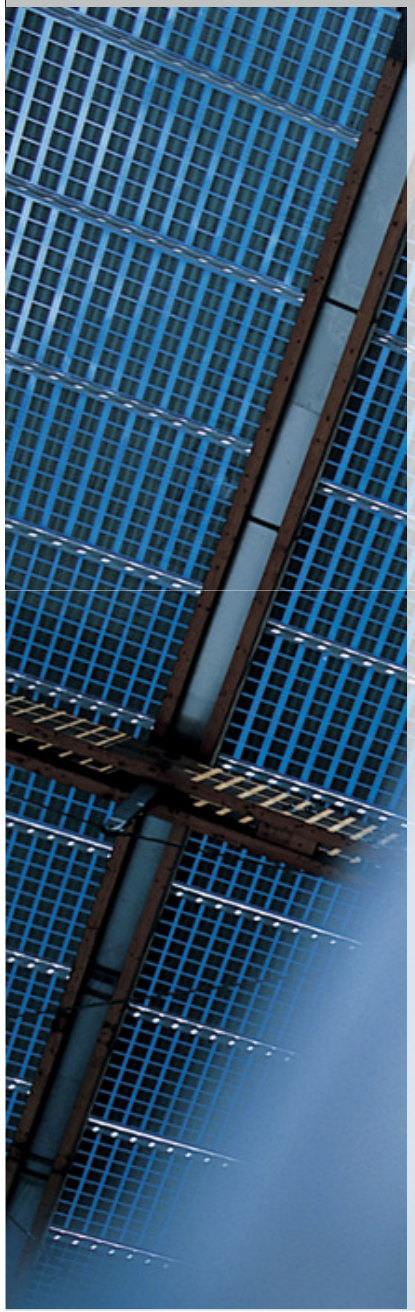
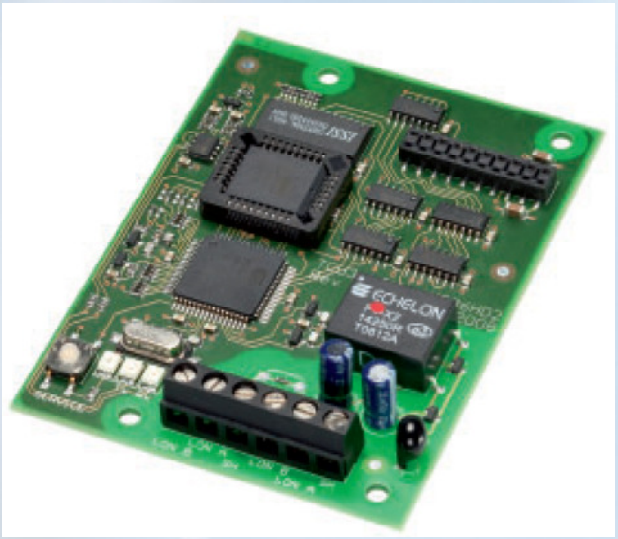
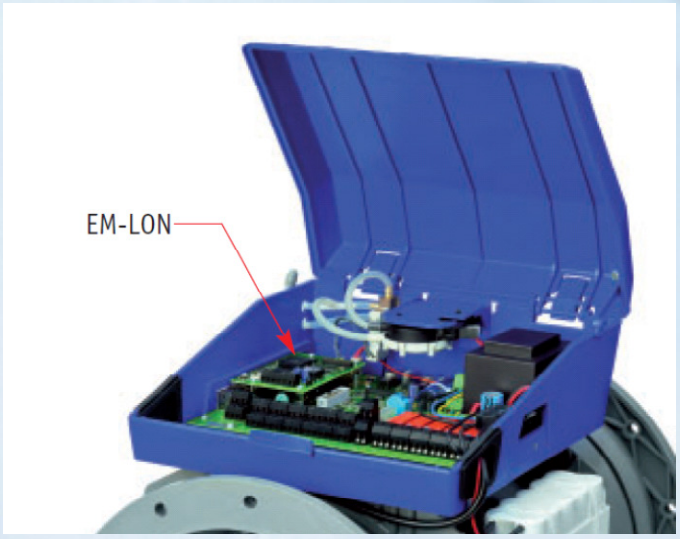


EM-LON

- **LonWorks®- gateway FT10**
  Free Topology Network
- **Automatic detection of the module**
  no configuration necessary!
- **Mounting in the factory or retrofit**





EASYLAB expansion module

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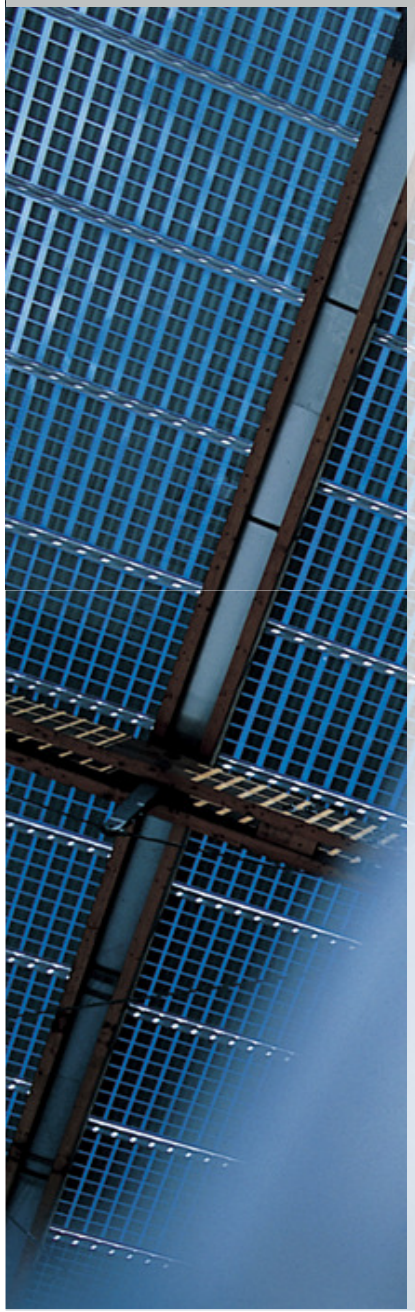
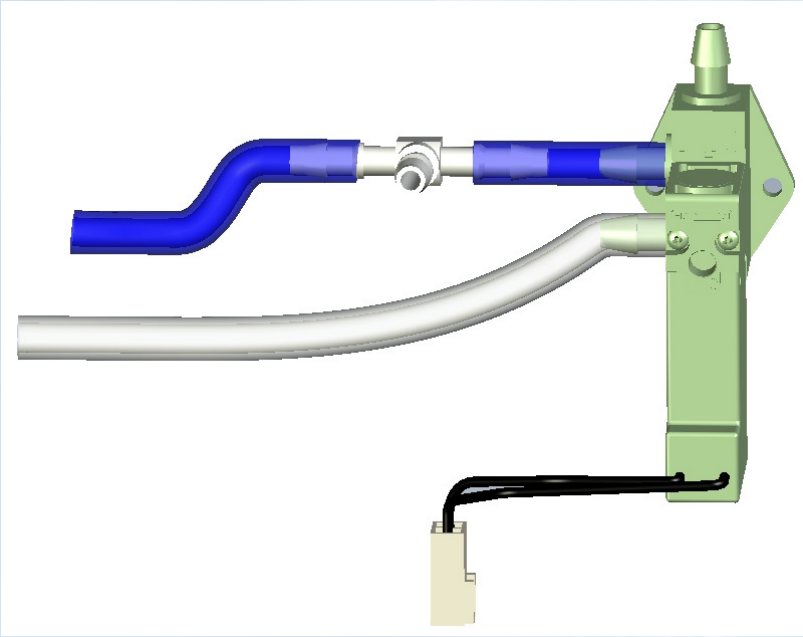


EM-AUTOZERO automatic zero point adjustment

- **Mounting in the factory or retrofit**
- **Plug-In electrical connection**
- **Automatic detection of the module**
  no configuration necessary!



EASYLAB expansion module

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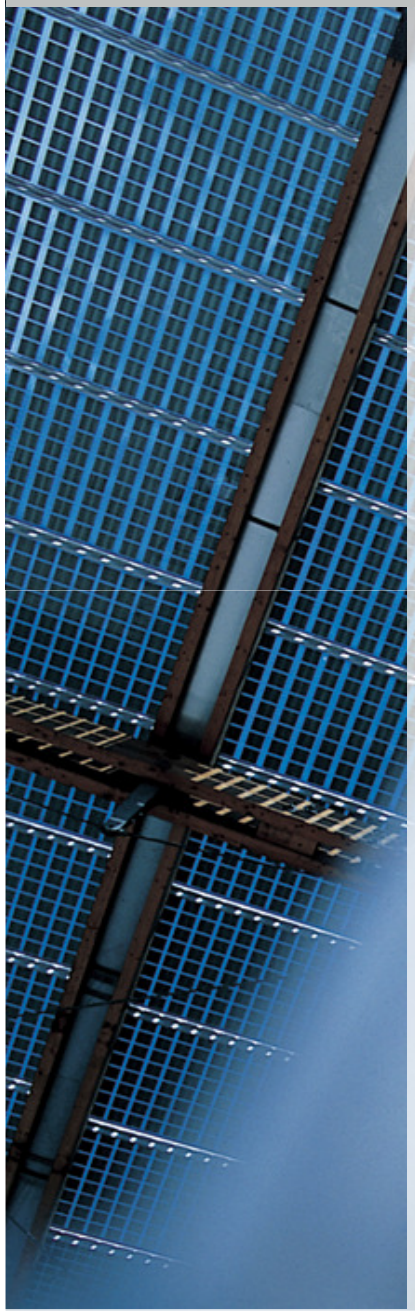
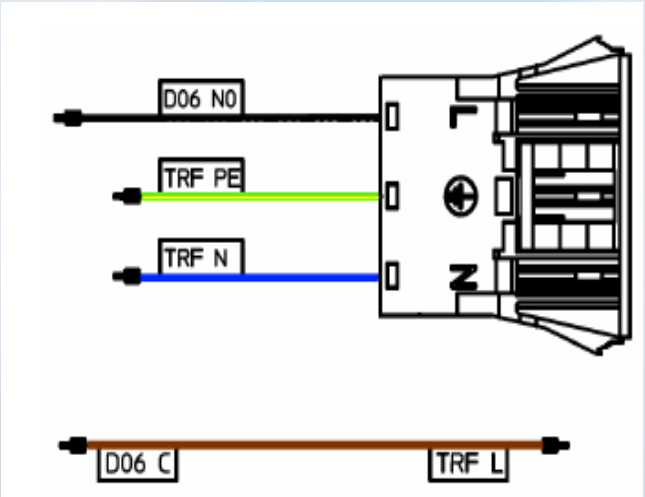


EM-LIGHT

connect for fume hood light

- **For fume hood controller**
  mounting in the factory or retrofit
- **Matching plug not in scope of delivery**



Adapting user terminals for fume hood

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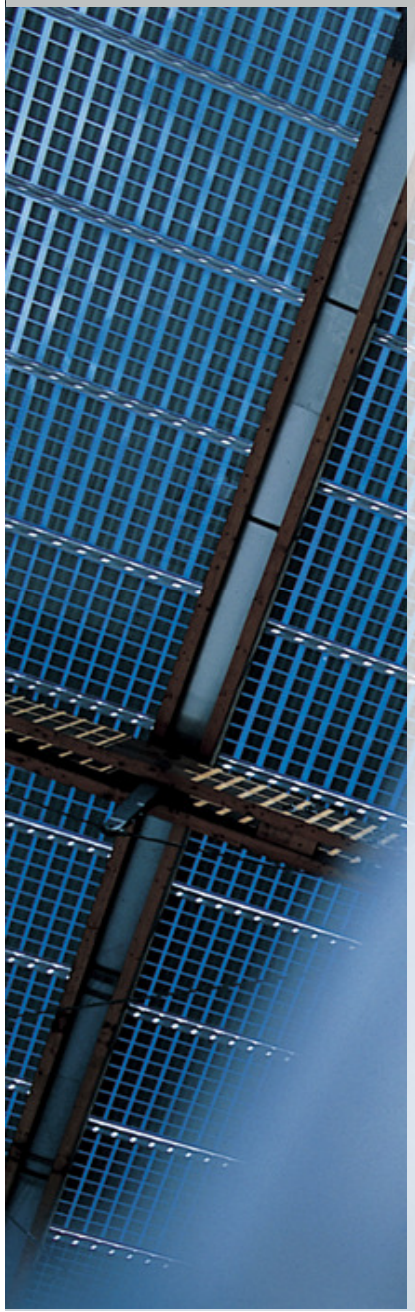
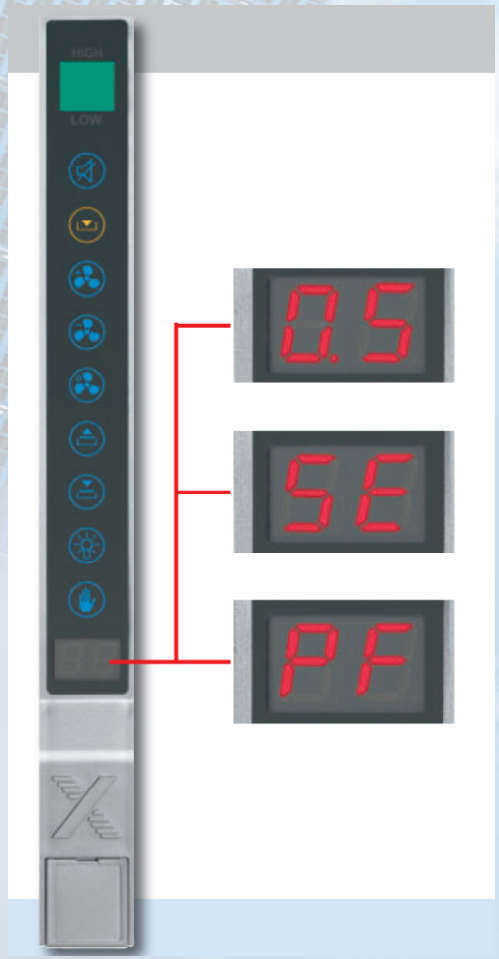
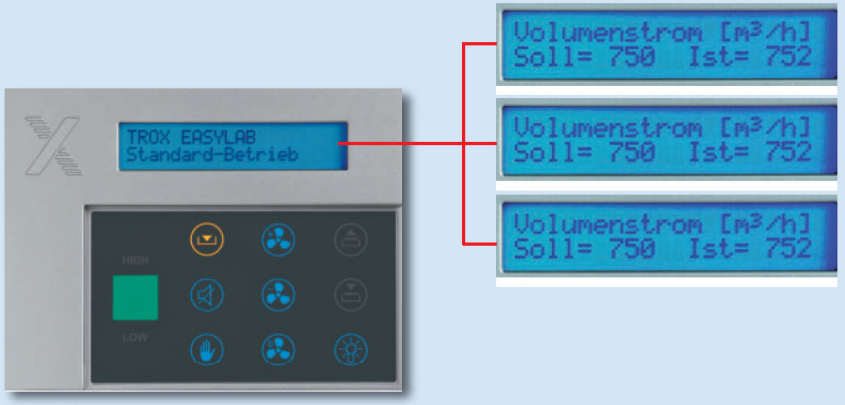


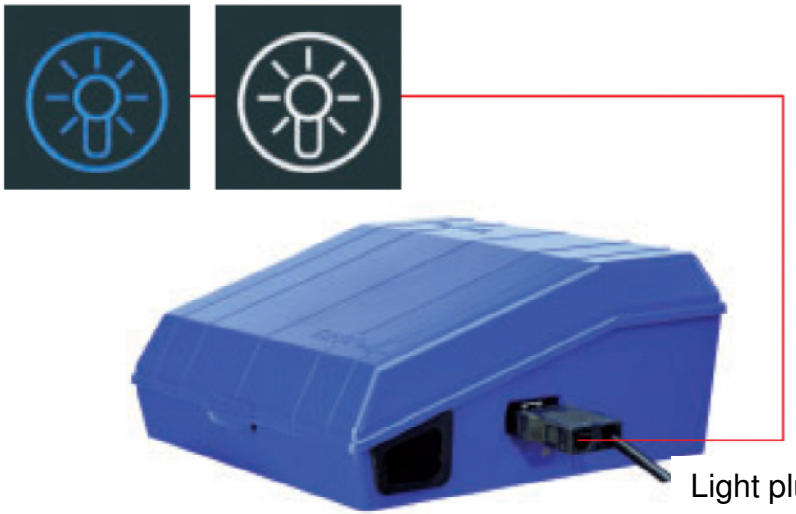
A lot of additional!

- Set and current values
- Alarm and fault indication

EASY to use







EASYLAB – User terminal for room

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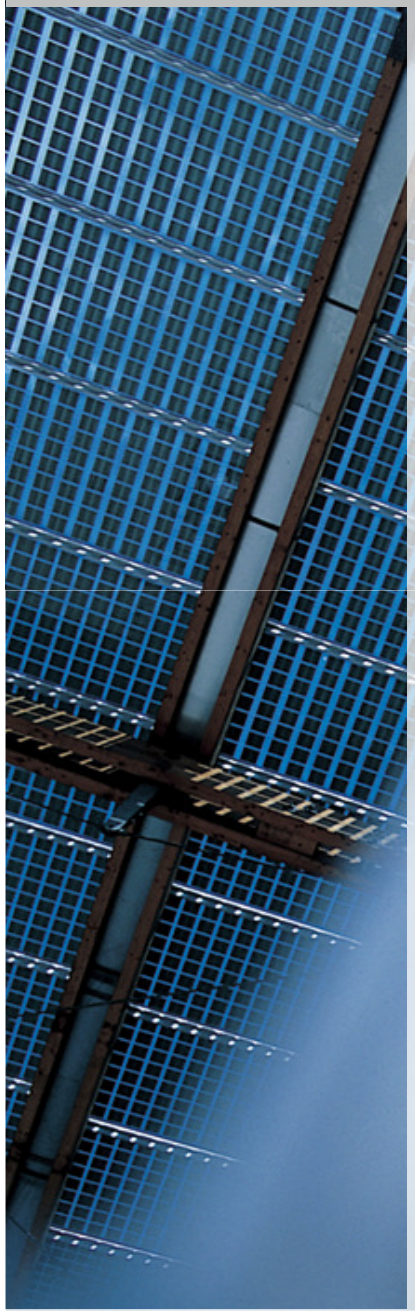

New terminals – the next generation

Complete new room scenes can be done

EASYLAB – user terminals

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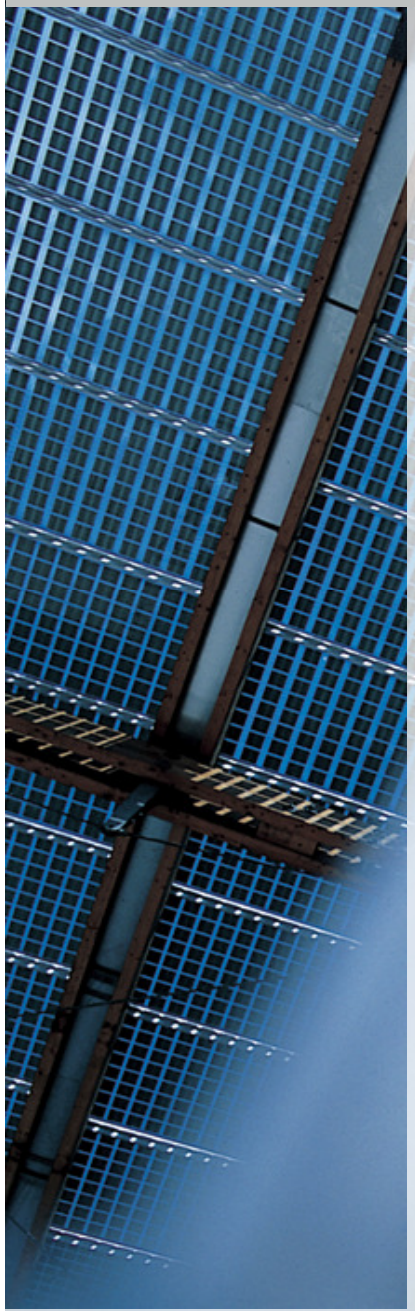
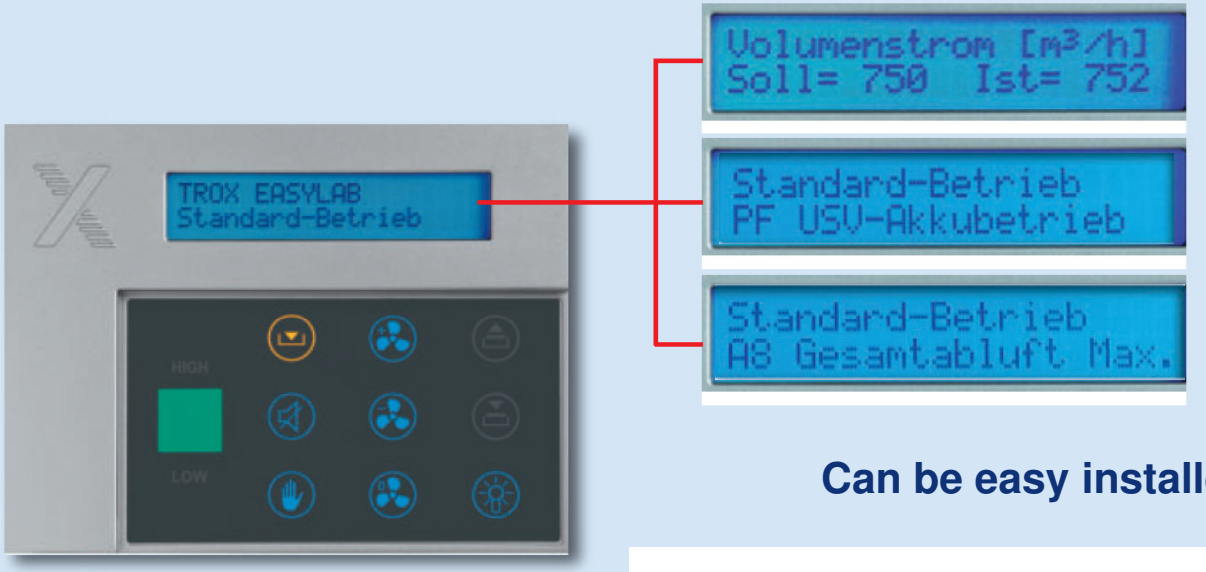
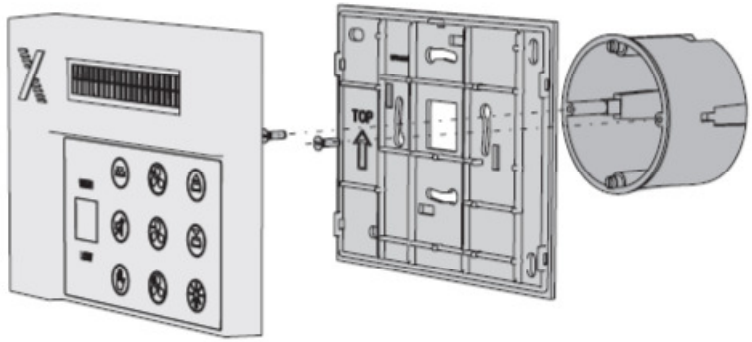


The room terminal:

A lot of extra information and modes can be modified!



Can be easy installed:



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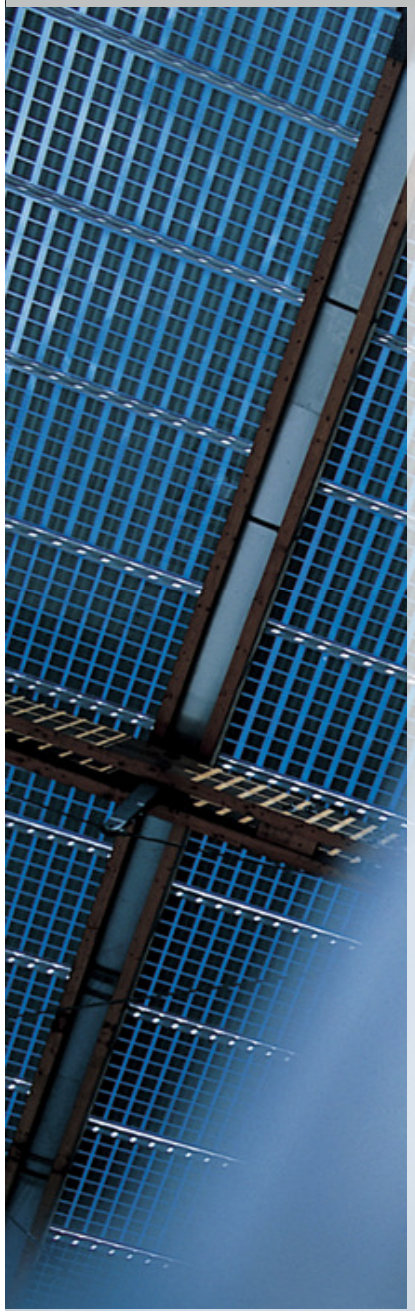

Take you right to work whenever you want!

Complete new solutions:

Hand-mode

Enables the possibility of from the BMS independed user modes (if wanted with timer!)

That is fast!!

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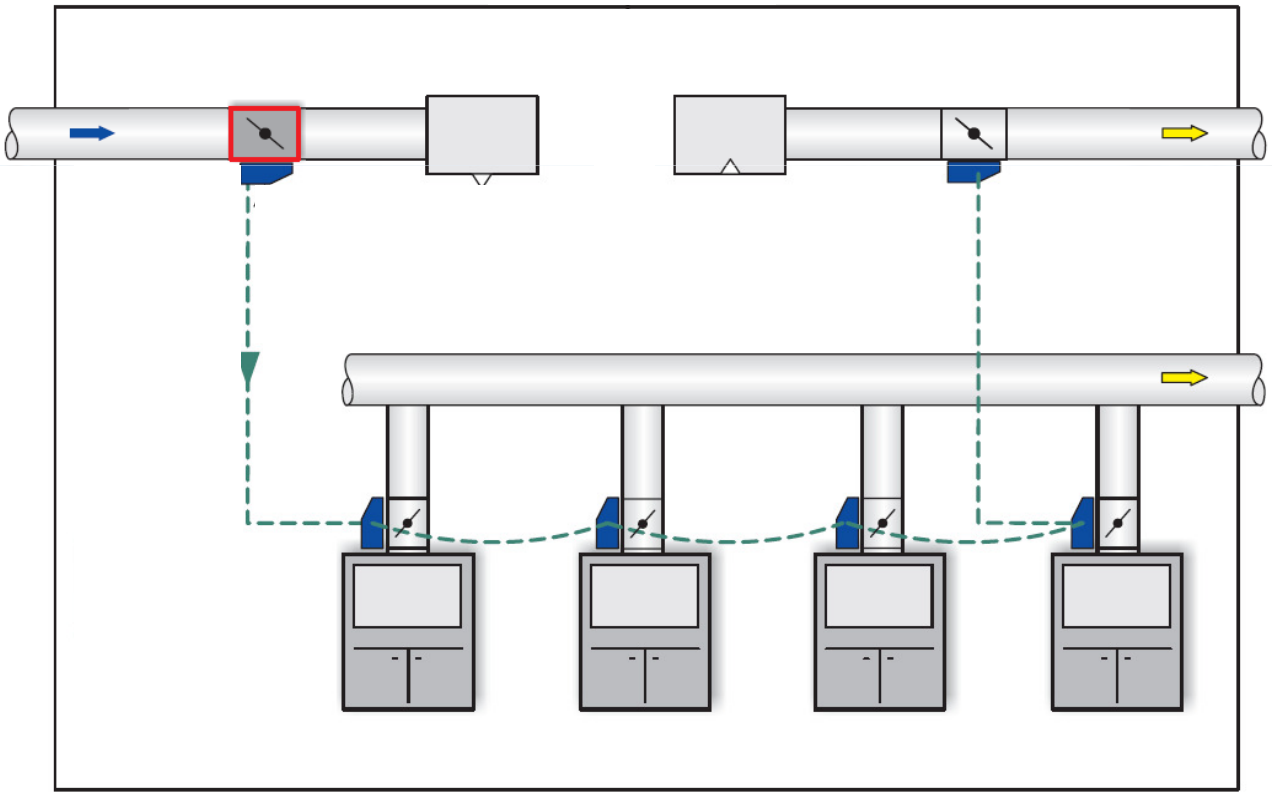
The wiring can be done within minutes!



EASYLAB compatible

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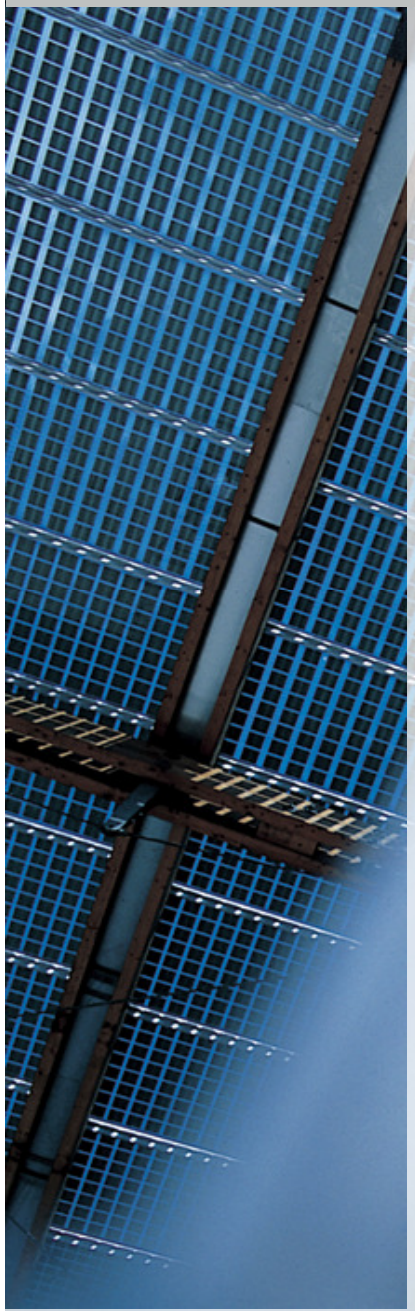

EASYLAB can for sure be combined with all volume flow controller series!

TVLK –
high precision injection moulded part with baffle

Complete new development !!!

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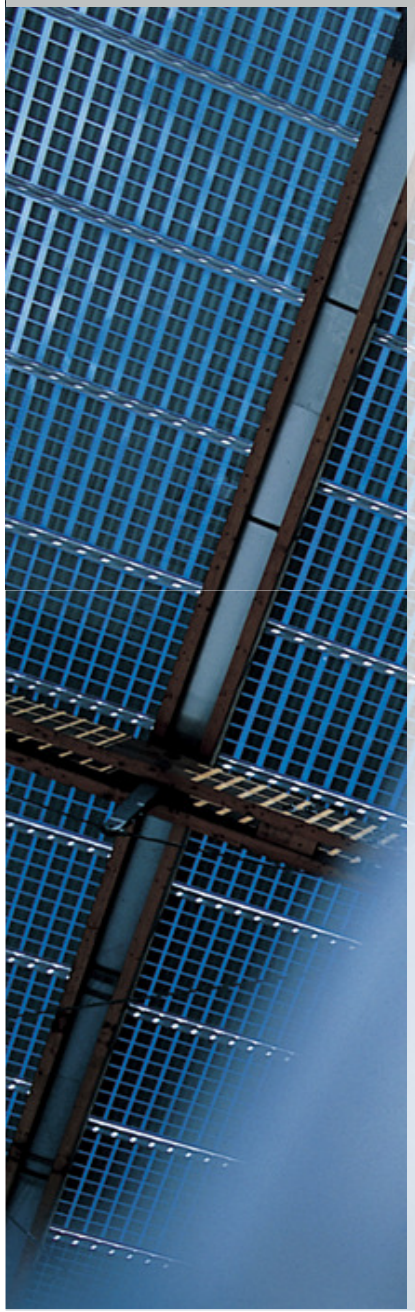
TVLK – and as venturi option



TVLK – venturi option

Why should you miss the cleaning possibility?

Everything started with the fume hood …

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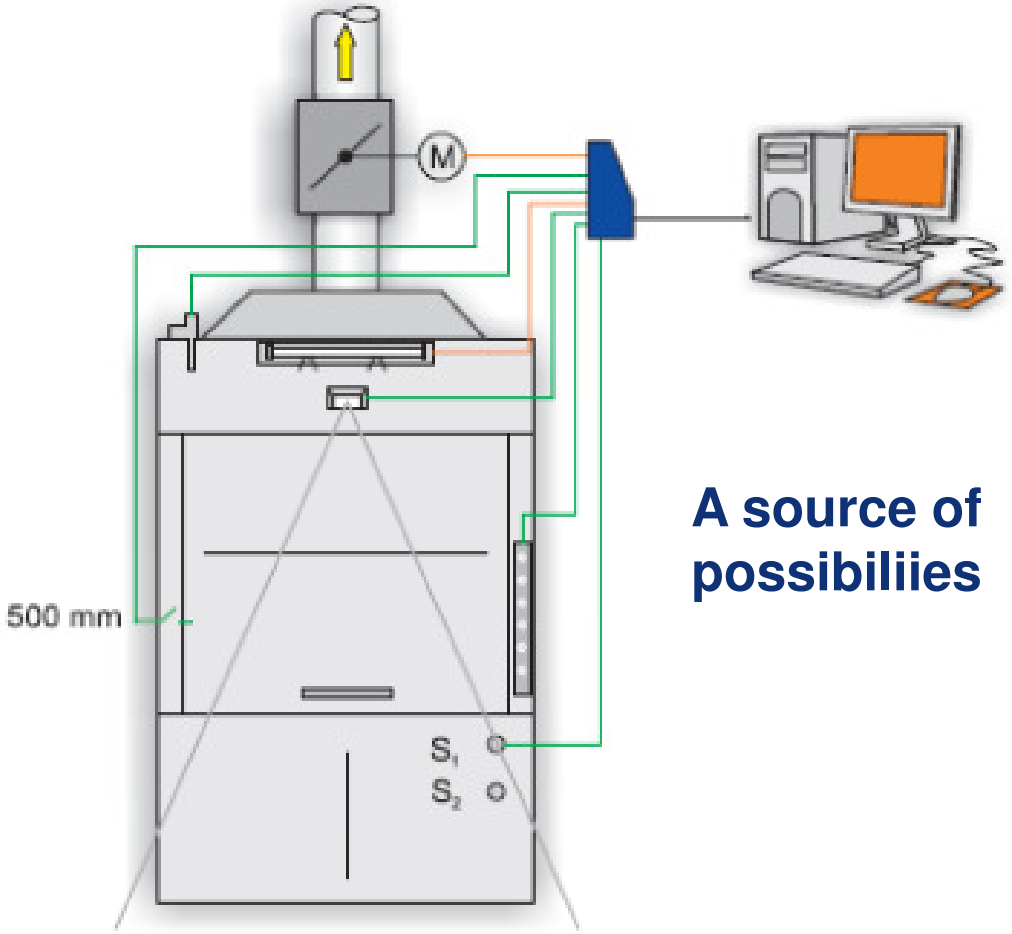
The fume hood – the start of LABCONTROL



A source of possibiliies

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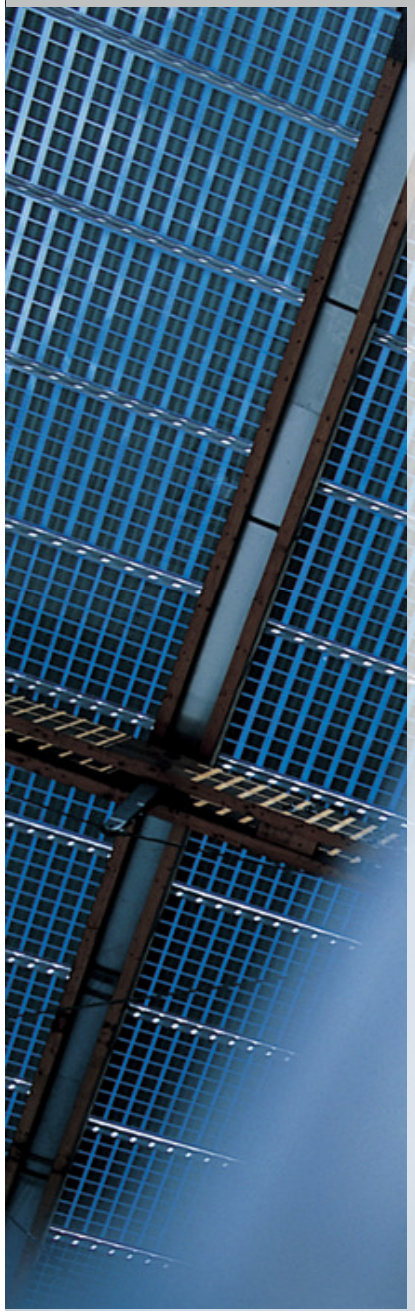
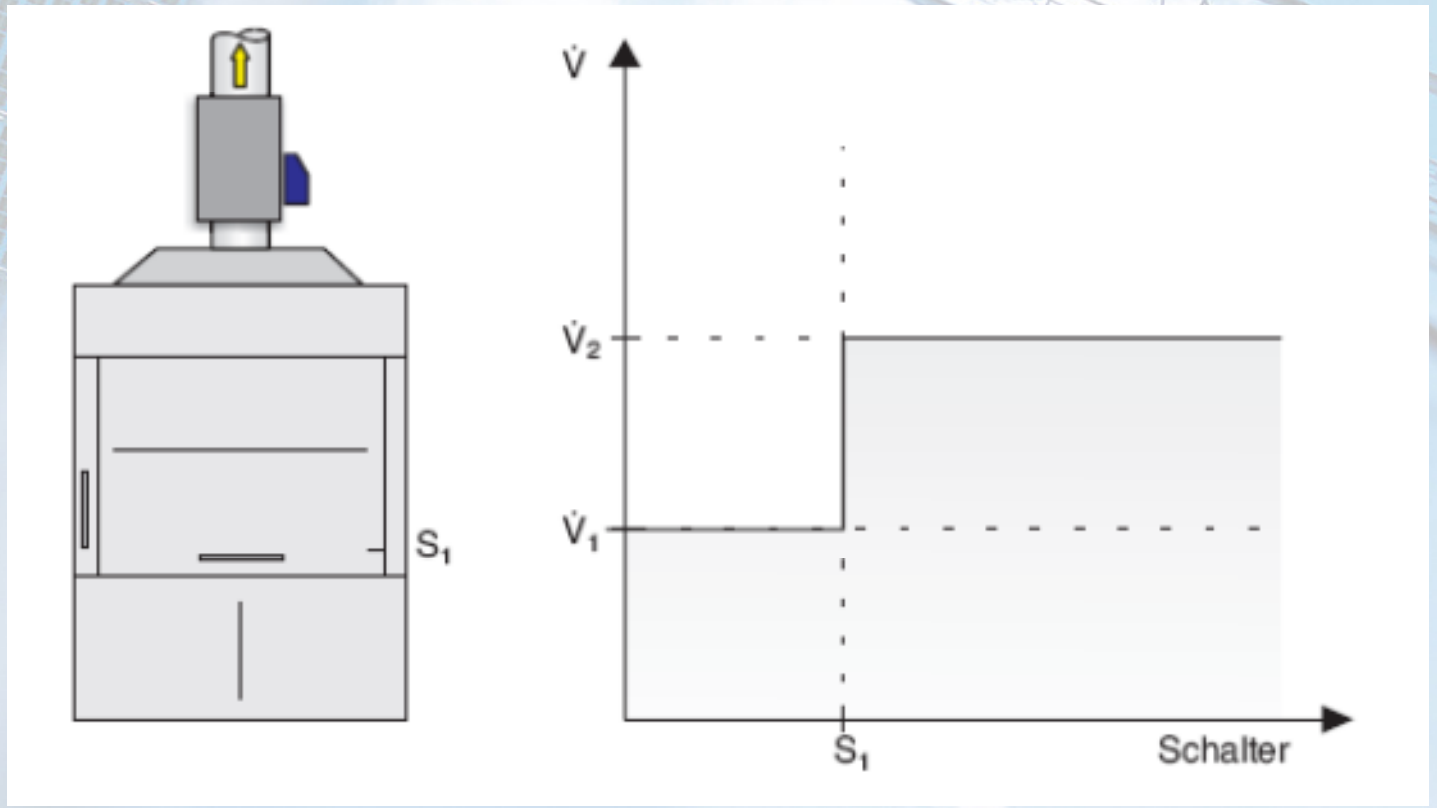


Fume Hood with two volume flows



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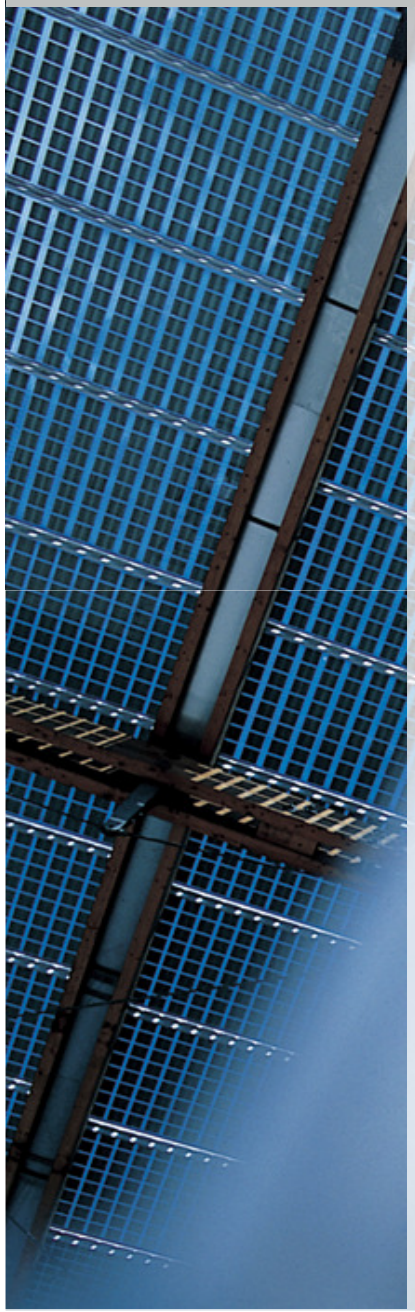
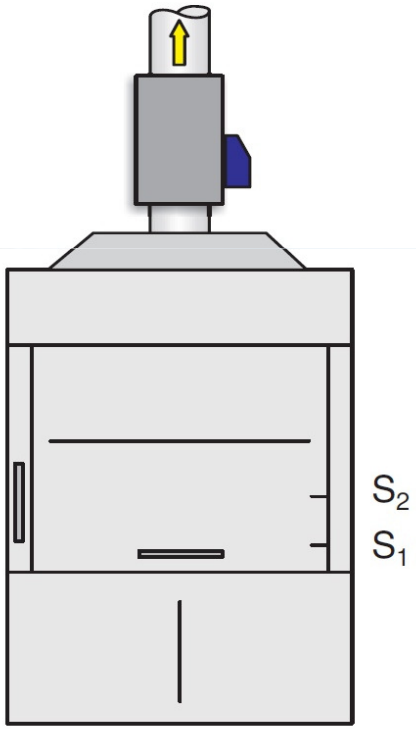
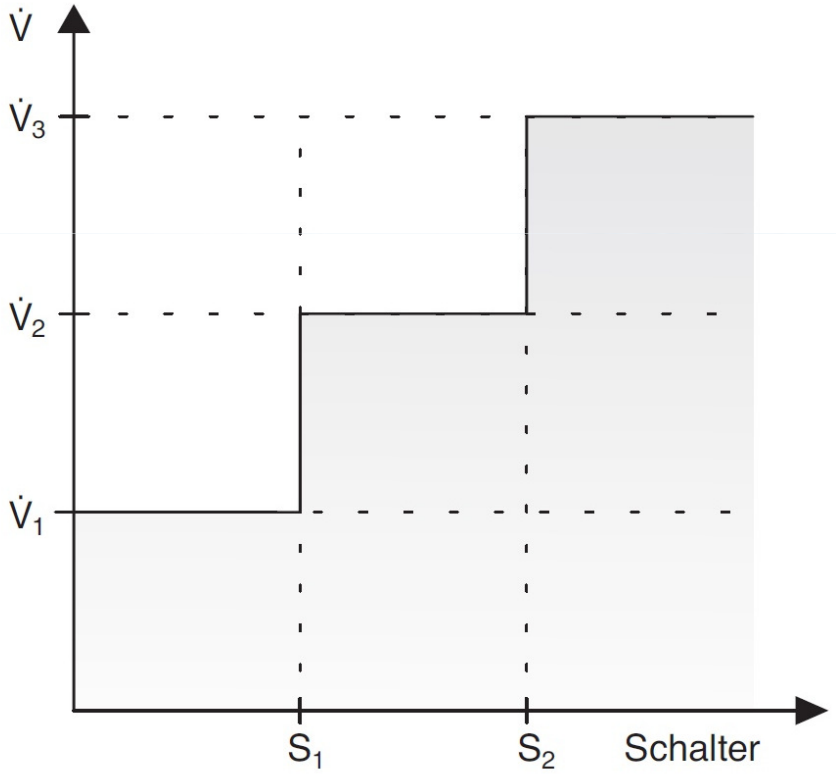


Fume hood with 3 voume flows switchable





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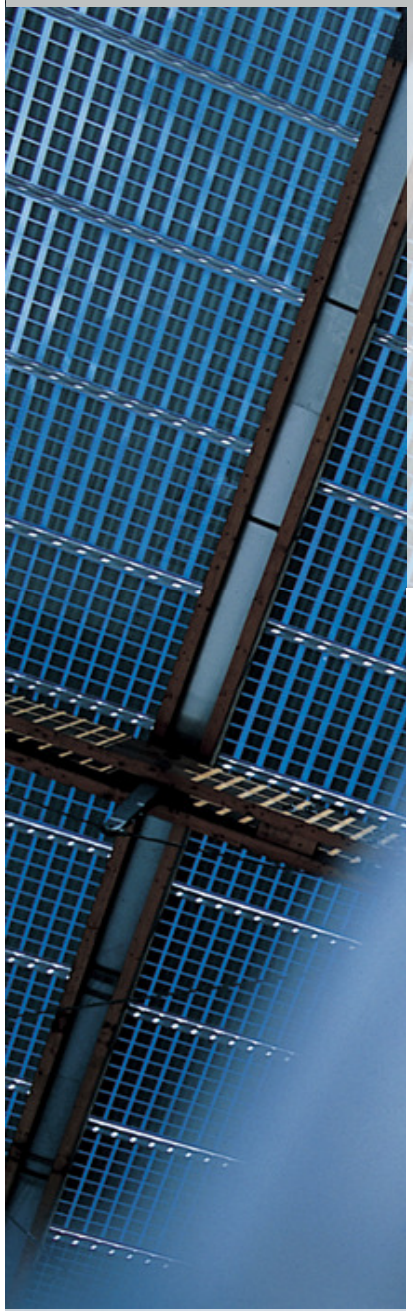
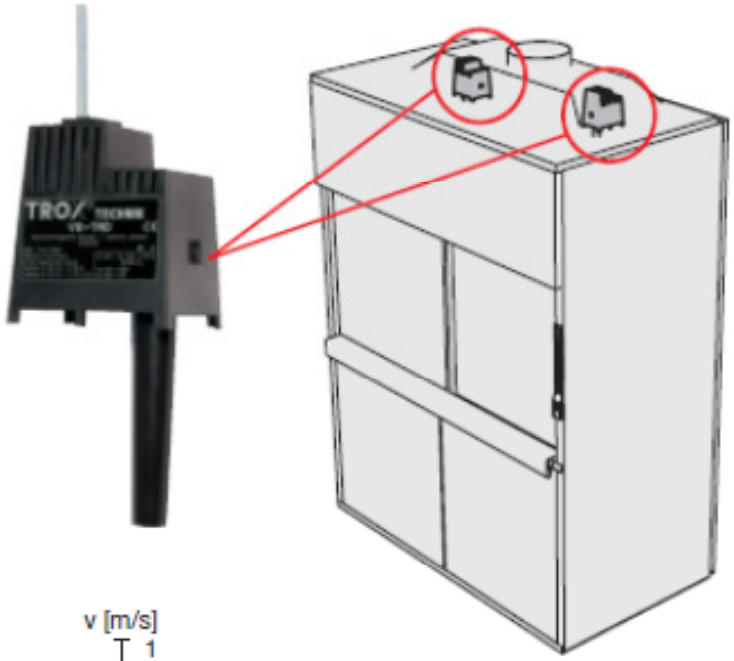
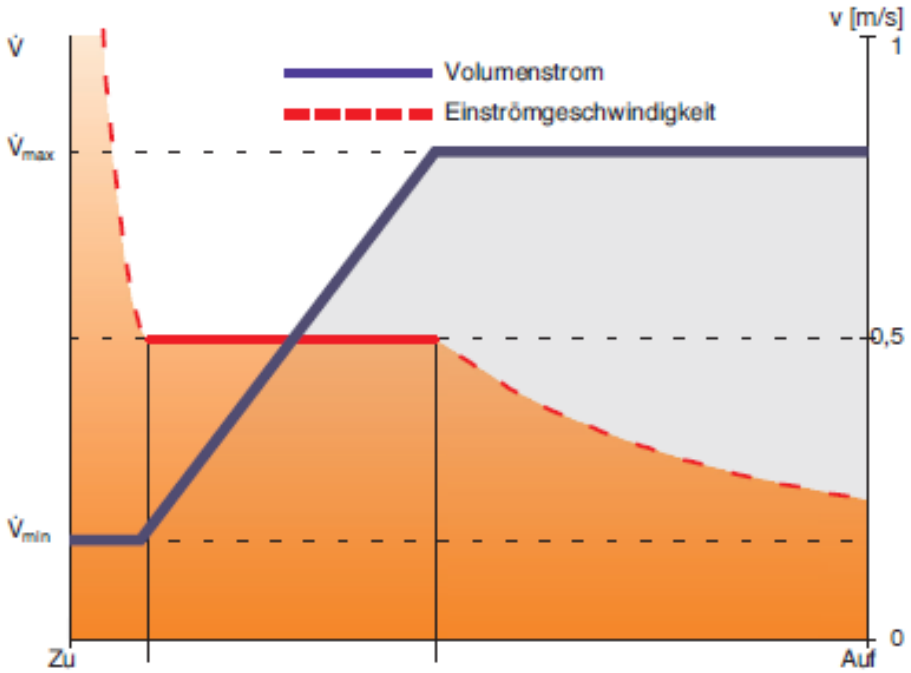


Face velocity control





Inklusive: …

LABCONTROL VS-TRD

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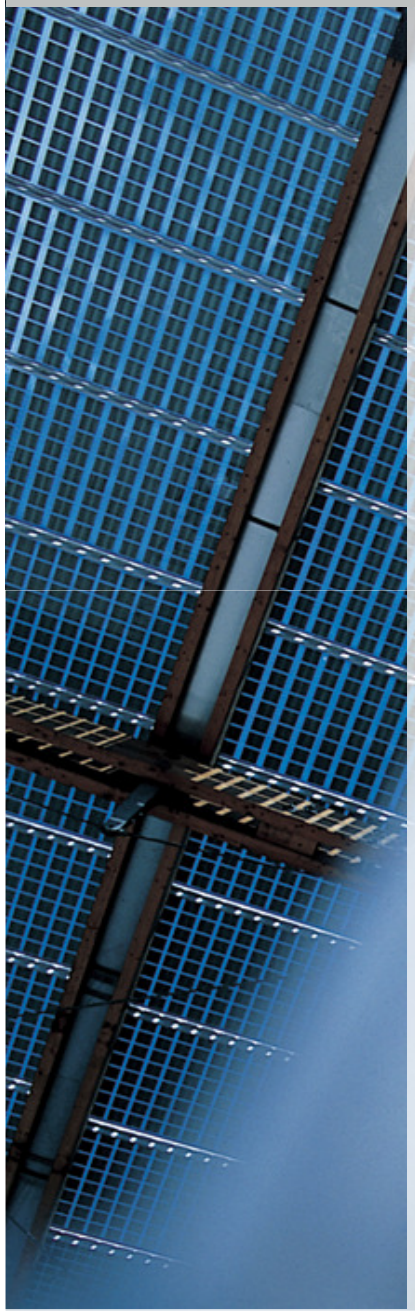
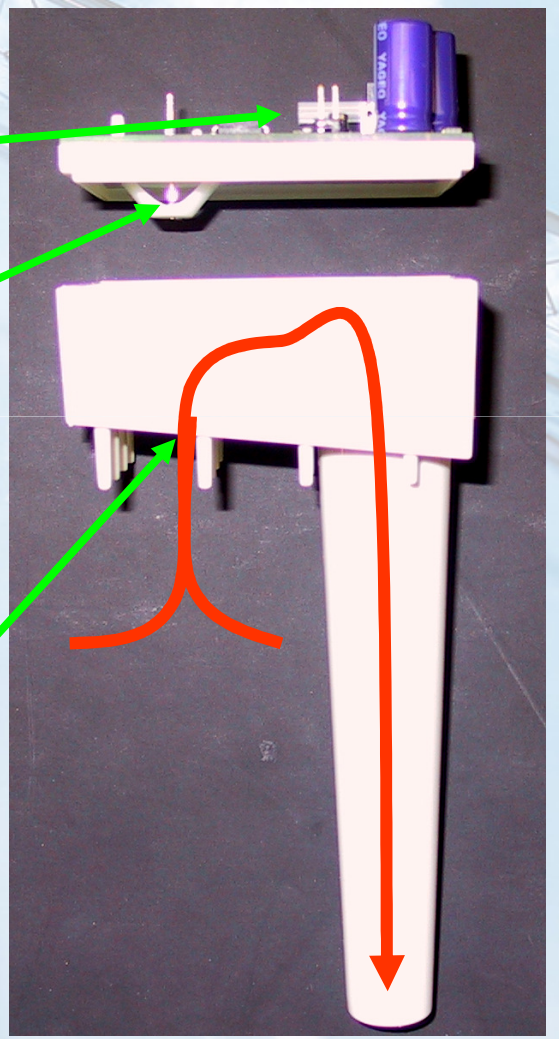


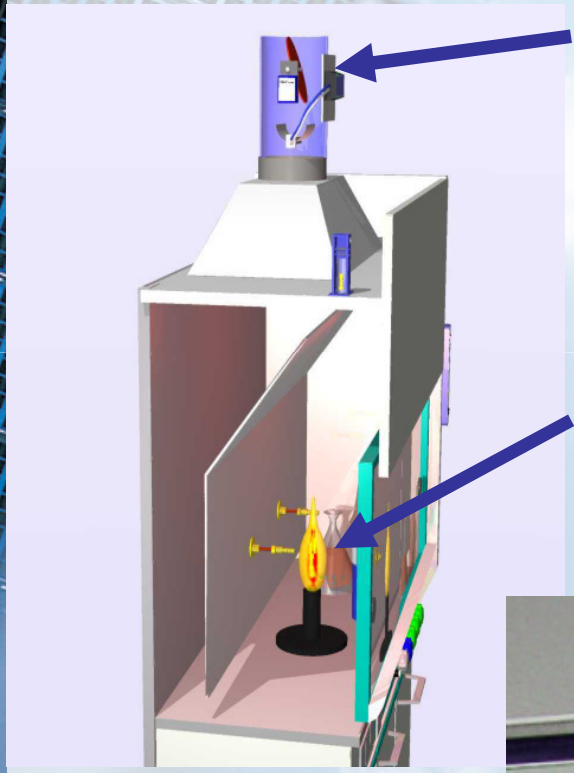
Circuit board outside the airstream

Measuring unit

room air inlet from downside => better resistent against room turbulences

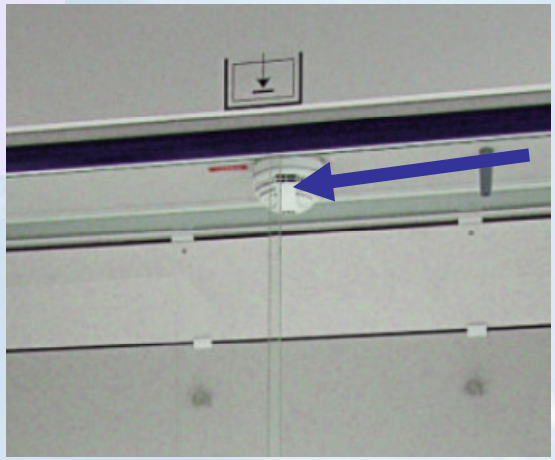


… Reaction on thermal loads!



Adapted voöume flow to Vmax

Heat source



Alternative:

Smoke or
fire detection

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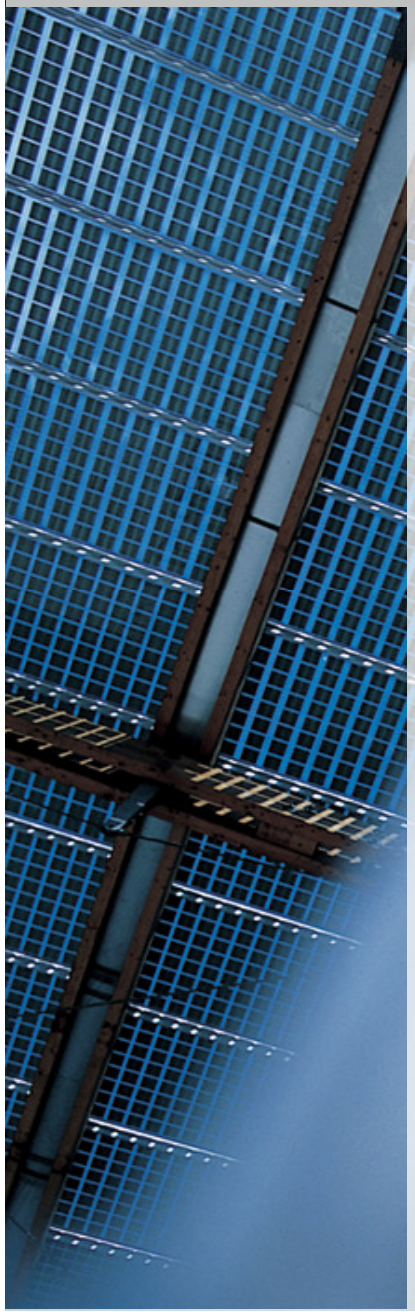
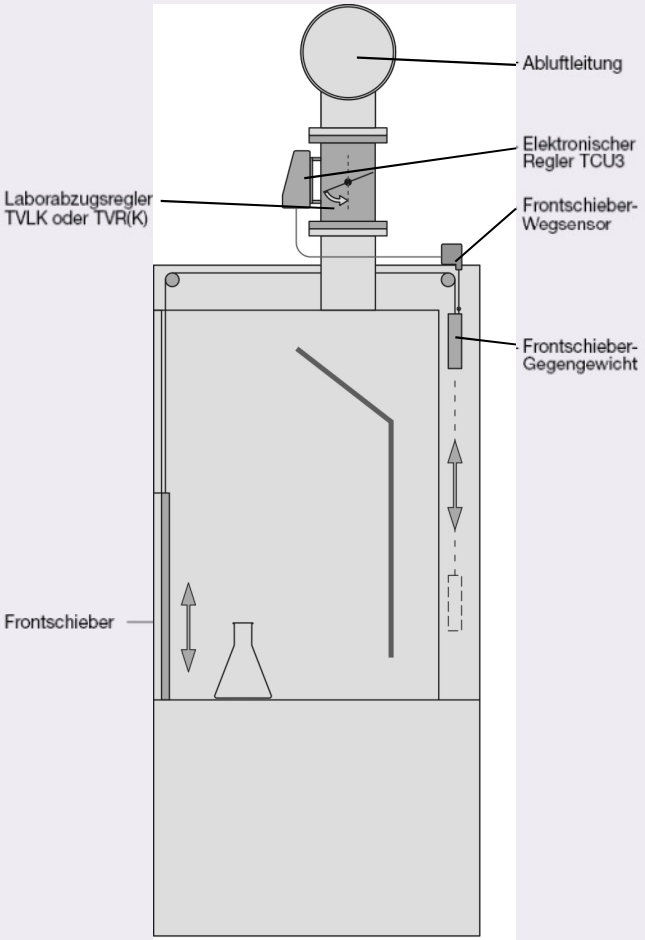
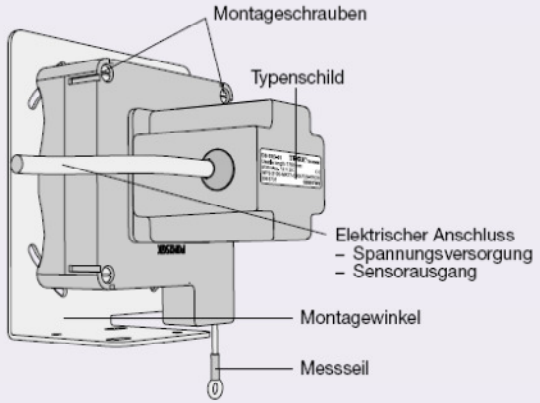
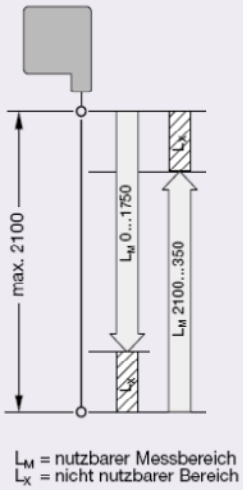


Distance sensor – *We can do as well!*







L_M = nutzbarer Messbereich
L_X = nicht nutzbarer Bereich

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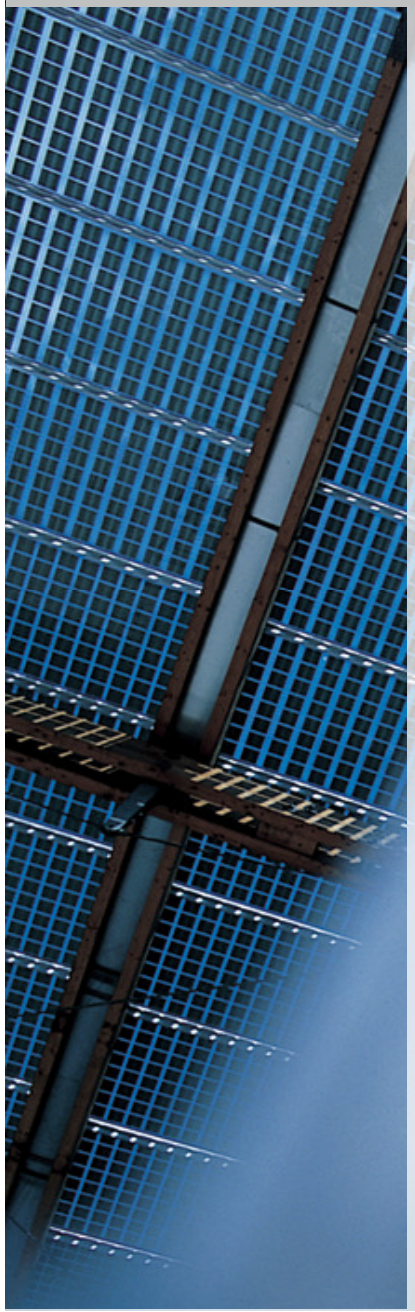
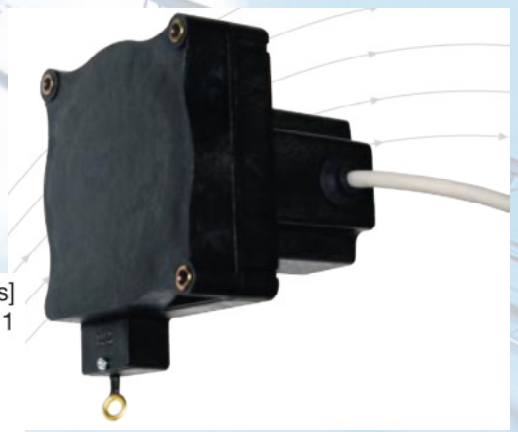
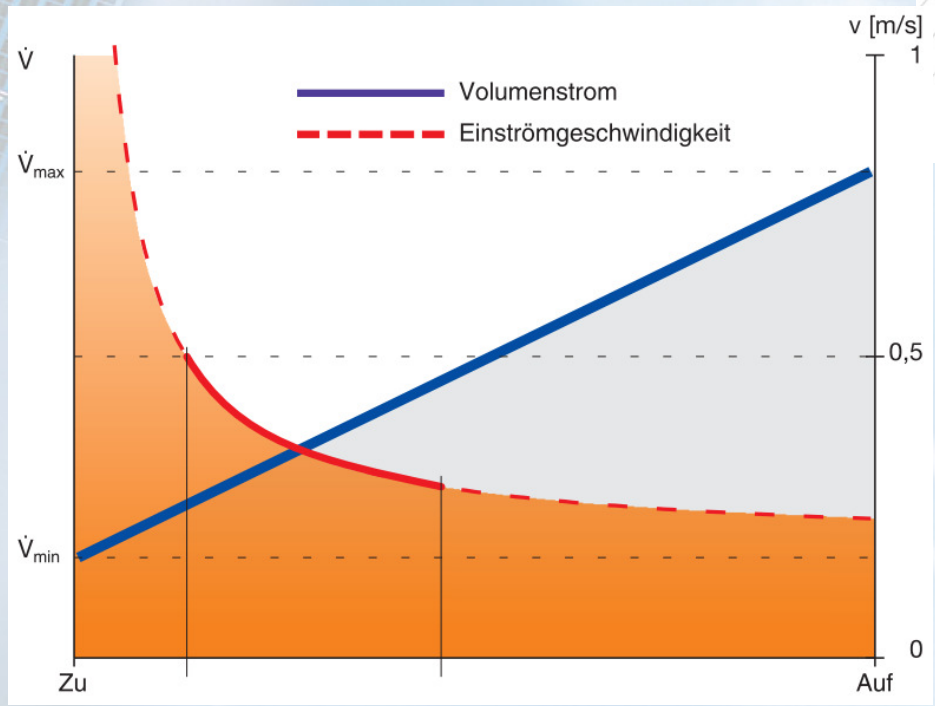


Simply have a look on the costs!

The linear function …





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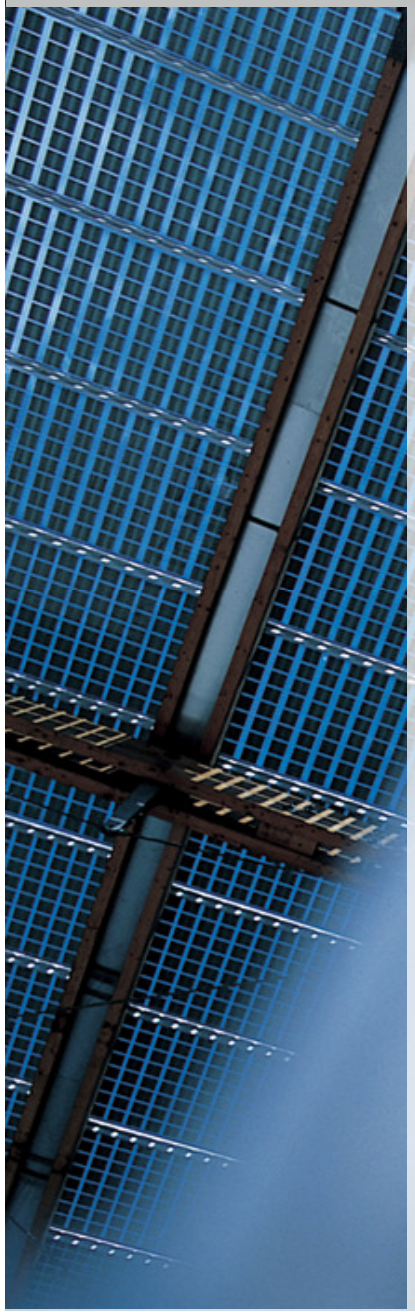
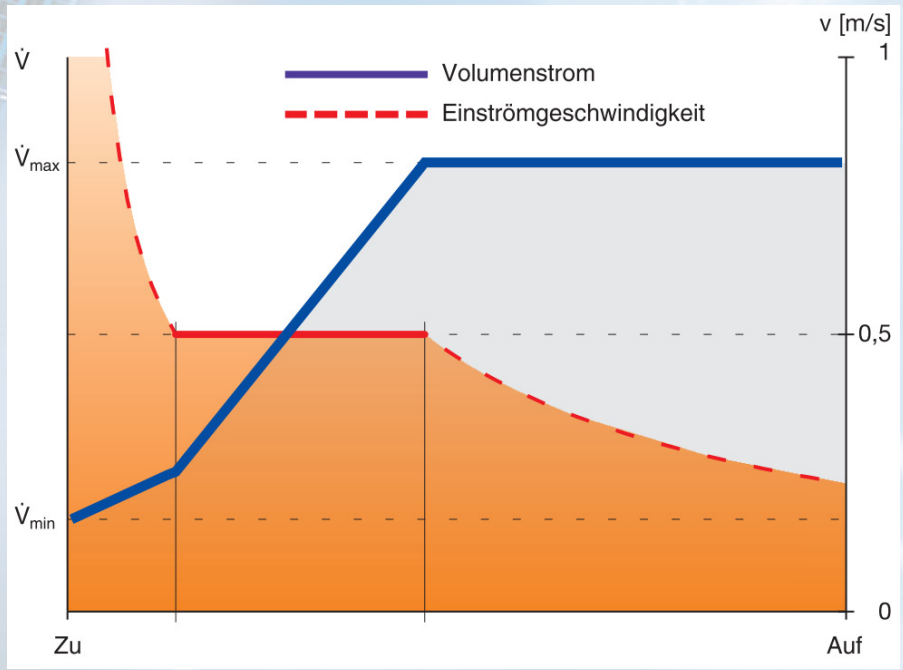
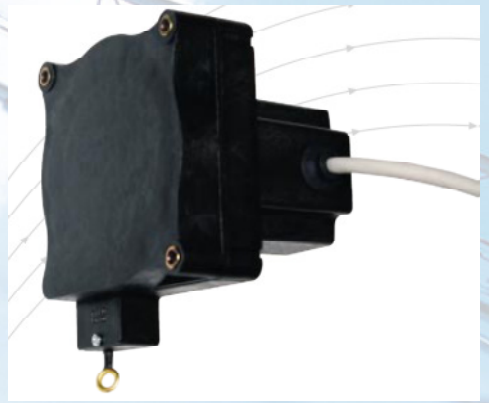


Simply a little bit safer!

The optimized function …





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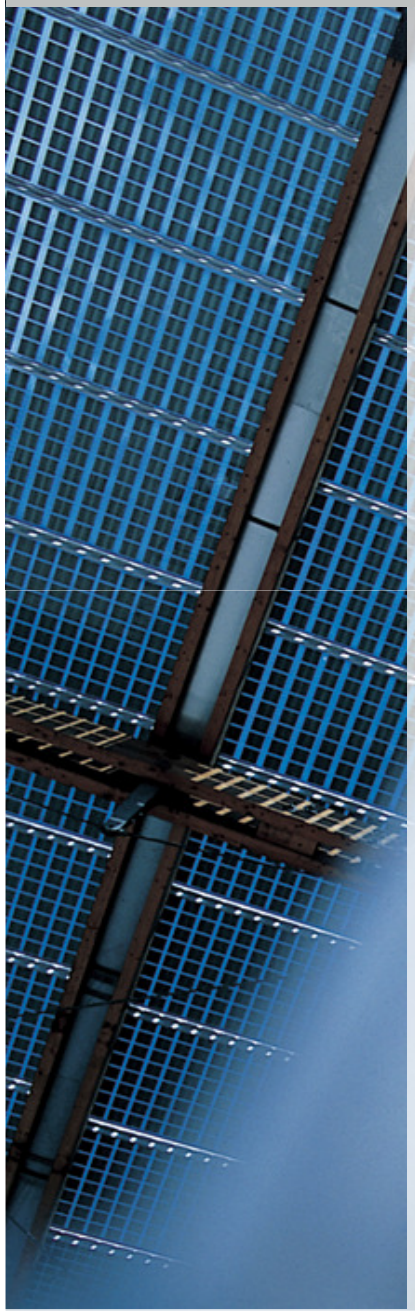

- Some screenshots for fume hood config

Fume Hood Config

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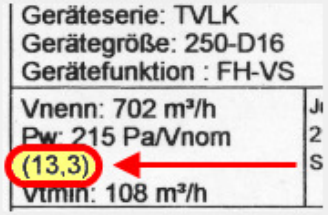
Device - Basic configuration

Device name: TroxBelgium | DemoRoom | Fumehood | ID - 1

C-value: 25.4 based on l/s

You will find the valid C-value for this volume flow controller on the device product label.



Technical Vmin: 198 m³/h (lower volume flow limit of volume flow controller)

Technical Vnominal: 1296 m³/h (upper volume flow limit of volume flow controller)

Load configuration settings from file

Select a file to load existing configuration settings.

Load configuration file

Continue to transmit configuration settings

Operation mode preset for this fume cupboard controller

(•) Room operation mode presets will be taken over

Modification of room operation mode

- [ ] Room mode High is changed to Fume cupboard Standard mode
- [ ] Room mode Shut off is changed to Fume cupboard Standard mode
- [ ] Room mode Standard is changed to Fume cupboard Shut off mode
- [ ] Room mode Low is changed to Fume cupboard Standard mode
- [ ] Room mode Low is changed to Fume cupboard Shut off mode

( ) Room operation mode presets will be ignored / Local presets are possible

Fume Hood Config

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Control concept for fume cupboard control

- (●) FH-VS Face velocity sensor at AI5
  Control concept to guarantee a defined face velocity
- ( ) FH-DS Sash distance sensor at AI4
  Linear control concept
- ( ) FH-DV Sash distance sensor at AI4
  Security optimized control concept
- ( ) FH-3P 3 point control via 2 switch contacts at DI2 and DI3
- ( ) FH-2P 2 point control via one switch contact at DI2
- ( ) FH-F Fixed value control

Equipment components

- [x] Alarm Sash monitoring EN 14175 — Via switching input DI1
- [ ] Fume scrubber (DI4)
- [ ] Supportive flow technology (DI5)
- [ ] Automatic sash device (Third-party supplier)
  (While using TROX FSE this configuration should be deactivated)
- [ ] Motion detector
- [ ] Smoke extraction function
- [ ] Operation mode dependent relay switching (e.g. fans)
- [x] Integration of switchable constant volume flows into room balance
  (Hoods, snorkels, etc. with switching output)
- [x] Integration of variable volume flows into room balance
  (Hoods, snorkels, etc. with 0-10V analogue output)

Cancel | Previous | Next

Strategy 2

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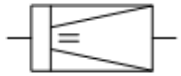
Integration of switchable constant volume flows into room balance



☐ Constant volume flow (DI1)				
☑ Constant volume flow (DI2)	101	m³/h	Exhaust air	Make contact = Integrates constant volume flow
☐ Constant volume flow (DI3)				
☐ Constant volume flow (DI4)				
☐ Constant volume flow (DI5)				
☐ Constant volume flow (DI6)				

Strategy 2

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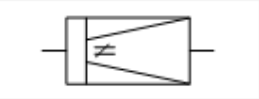
Integration of variable volume flows into room balance



☑ Variable volume flow (AI2)	Exhaust air	Characteristic	min	2.00	V	equals	min	0	m³/h
			max	10.00	V	equals	max	202	m³/h
		Signal smoothing (1-50)		50					
☑ Variable volume flow (AI3)	Supply air	Characteristic	min	2.00	V	equals	min	0	m³/h
			max	10.00	V	equals	max	299	m³/h
		Signal smoothing (1-50)		50					
☐ Variable volume flow (AI4)									
☐ Variable volume flow (AI5)									

Strategy 2

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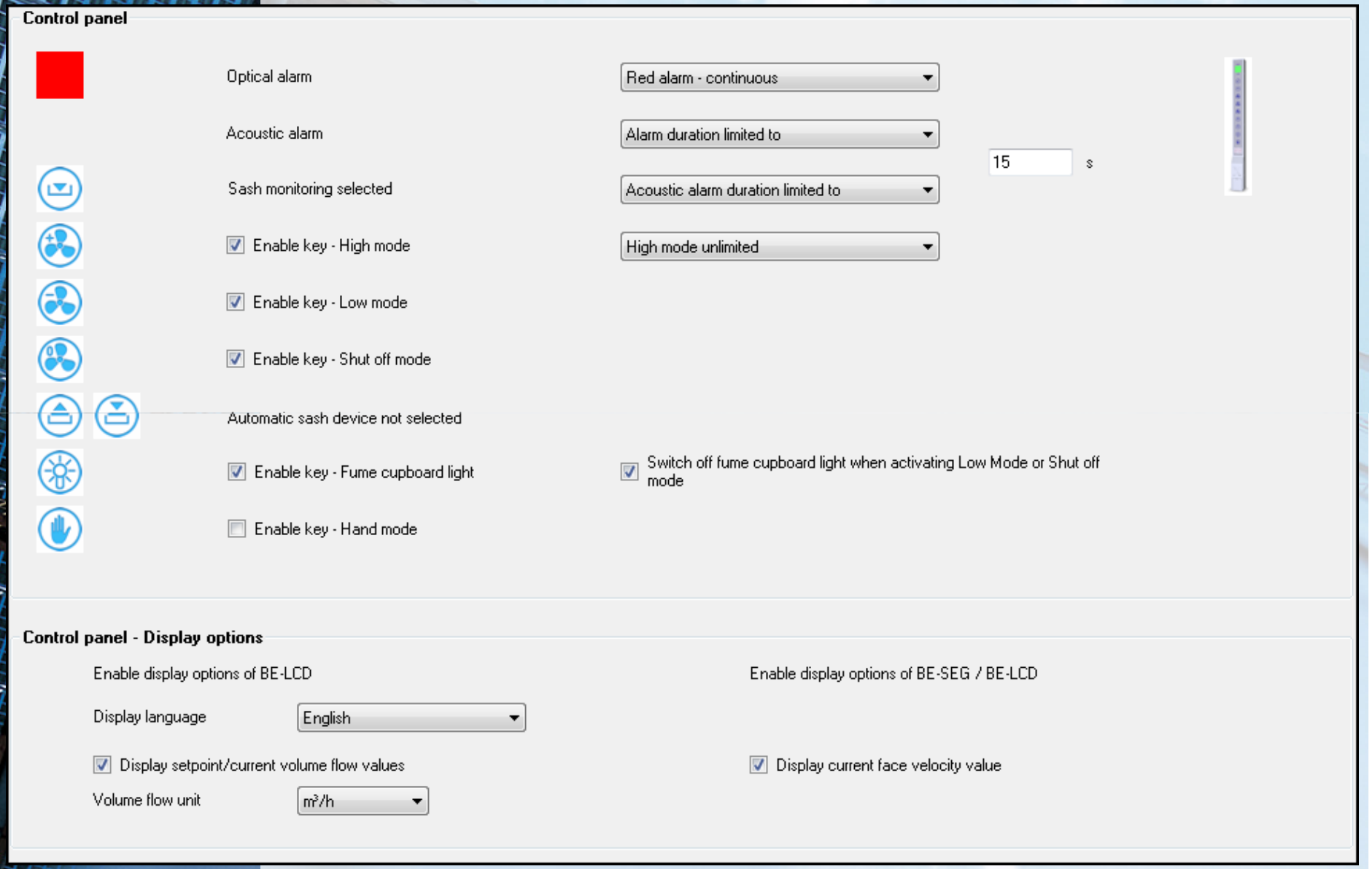

Fume Hood Config

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Control concept: Face velocity transducer - Control strategy to guarantee a defined face velocity

Volume flow set values

Standard mode / Vmin	202	m³/h
Standard mode / Vmax	698	m³/h
High mode	698	m³/h
Low mode	202	m³/h

☑ Consider diversity control (Limit volume flow to allowed maximum of Total room exhaust air)

Face velocity

Setpoint	0.50	m/s						
Tolerance around setpoint (+/-)	0.05	m/s	Characteristic	min	2.00	V	equals	min 0.00 m/s
				max	10.00	V	equals	max 1.00 m/s
			Signal smoothing (1-50)		50			
Time target - Setpoint adaption open sash	3	s						
Time target - Setpoint adaption close sash	7	s						

Strategy 2

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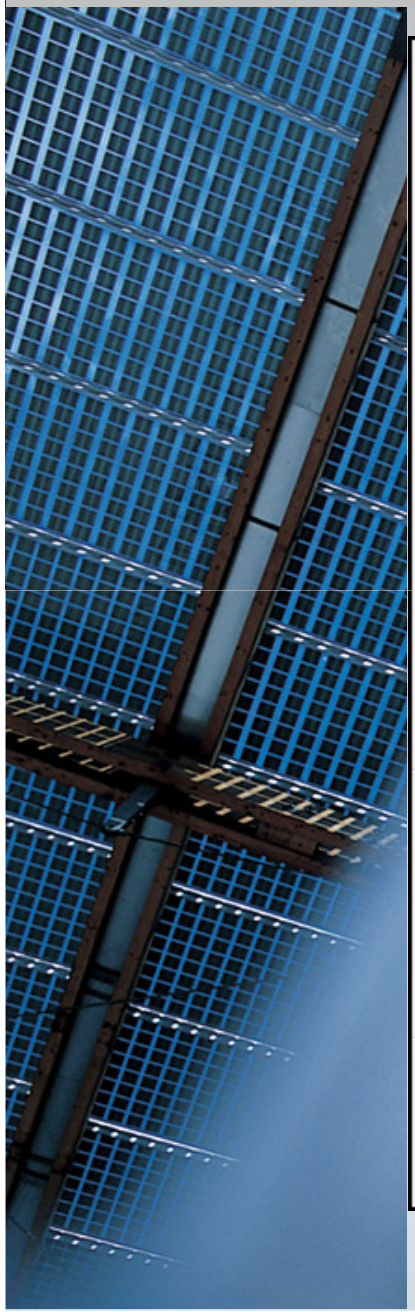

Controller alarm settings

Category 1 (Smoke extraction / UPS Battery operation)
☑ Activate monitoring

Category 2 (Volume flow control functions)
☑ Volume flow monitoring (Standard mode, High mode)
☐ Volume flow monitoring (Low mode)
Alarm delay time 10 s

☑ Face velocity monitoring (Standard mode, High mode)
Trigger alarm below 0.30 m/s

Category 3 (Hardware failure)
☑ Activate monitoring

Service interval

Specified service period 365 days
Period since last service 285 days

☐ Signaling at end of service interval
Reset service interval

Fume Hood Config

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Volume flow measuring point

- (•) Use internal volume flow transducer
- ( ) Use external volume flow transducer at terminal AI1 (e.g. Ex-Controller)

Characteristic min 0 Pa
max 300 Pa

Signal smoothing (1-50) 50

Attention: Factory settings
Values are dependent on used transducer.

Modification only by instructed technical staff !

Volume flow control

Control tolerance 4.0 % with additional absolute tolerance of 4 l/s equals 14 m³/h

- (•) Automatic calculation of limit value to achieve maximum actuating value

Open damper	132	m³/h
Close damper	132	m³/h

- ( ) Manual adaption of limit to achieve maximum actuating value.

Open damper

Minimum actuating value	1.00	[0.01 ... 100]	Maximum actuating value	4.00 [0.01 ... 100]

Close damper

Minimum actuating value	1.00	[0.01 ... 100]	Maximum actuating value	5.00 [0.01 ... 100]

Fume Hood Config

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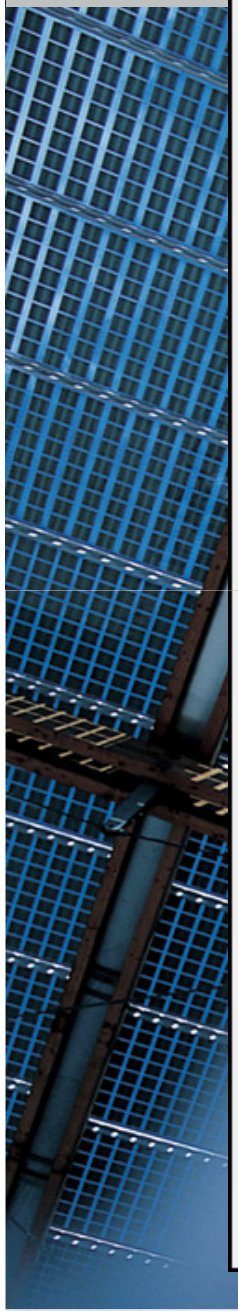

Analogue output A01 - Current volume flow (Fume cupboard)

Characteristic	min	2.00	V	equals	min	0	m³/h
	max	10.00	V	equals	max	1296	m³/h

Analogue output A02 - Total volume flows (Room)

(●) Total exhaust air	Fume cupboards / Room exhaust air / Integrated exhaust air / Constant exhaust air
( ) Total supply air	Room supply air / Integrated supply air / Constant supply air
( ) Setpoint supply air	Total exhaust air minus integrated and constant supply air and consideration of a volume flow balance

Constant exhaust air, constant supply air as well as volume flow balance values require a configuration within a controller with Room-Management-Function.

Characteristic	min	2.00	V	equals	min	0	m³/h
	max	10.00	V	equals	max	0	m³/h

Analogue output A03 - Damper position

Characteristic	min	2.00	V	equals	0 % Damper position (Damper closed)
	max	10.00	V	equals	100 % Damper position (Damper open)

Analogue output A04 - Actuator

Characteristic	min	2.00	V	equals	0 % Damper position (Damper closed)
	max	10.00	V	equals	100 % Damper position (Damper open)

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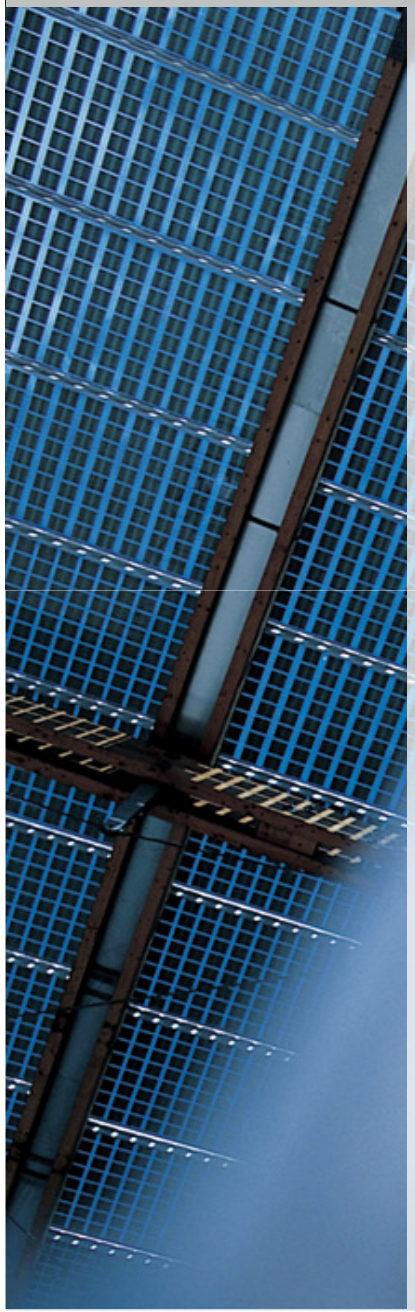
The art of handling air



Roome Controller Config

TROX® TECHNIK
The art of handling air

Room controller

- [ ] Integration of switchable constant volume flows into room balance (Hoods, snorkels, etc. with switching output)
- [ ] Integration of variable volume flows into room balance (Hoods, snorkels, etc. with 0-10V analogue output)
- [x] Diffusor volume flow optimisation

Room-Management-Function (RMF)

- [x] Activate Room-Management-Function (RMF) (Centralised room configuration and integration for room operation mode presets, shift signals, etc.)
- [ ] Support EASYLAB Room control panel
- [ ] Sun blinder control
- [x] Room operation mode preset via switching inputs (DI)
- [ ] Shut off for all room exhaust controller within Low Mode
- [x] Diversity Monitoring / Diversity control
- [x] External volume flow shift — Volume flow shift via LonWorks®/BACnet/Modbus
- [x] Pressure control — internal

with two alternative setpoints (switchable via LonWorks®/BACnet/Modbus)

- [ ] Use door contact DI5
- [x] Room exhaust air optimisation

Room Controller config

TROX® TECHNIK
The art of handling air

Volume flow split-up if several room controllers

Within RMF selected mode: Automatic split-up 100 %

Only if manual volume flow split-up is selcted within RMF:

Supply air fraction of this controller 50 %

UPS function

Mode during supply voltage failure

- (•) Keep up normal controller action
- ( ) Special operation mode - Open mode
- ( ) Special operation mode - Shut off mode
- ( ) Keep operation mode / Keep damper position

Controller alarm settings

Category 1 (UPS Battery operation) [x] Activate monitoring

Category 2 (Volume flow control functions)

[x] Activate volume flow monitoring (Standard mode, High mode)

[ ] Activate volume flow monitoring (Low mode)

Alarm delay time 30 s

Category 3 (Hardware failure) [x] Activate monitoring

Diffusor volume flow optimisation

Shut off 1 (DO5) if volume flow is below volume flow limit 1	500	m³/h	Switching tolerance 1	5	%
Shut off 2 (DO6) if volume flow is below volume flow limit 2	500	m³/h	Switching tolerance 2	5	%

Room Controller config

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Analogue output A01 - Current volume flow (controller)

Characteristic	min	2.00	V	equals	min	0	m³/h
	max	10.00	V	equals	max	1458	m³/h

Analogue output A02 - Total volume flows (Room)

- (•) Total exhaust air — Fume cupboards / Room exhaust air / Integrated exhaust air / Constant exhaust air
- ( ) Total supply air — Room supply air / Integrated supply air / Constant supply air
- ( ) Setpoint supply air — Total exhaust air minus integrated and constant supply air and consideration of a volume flow balance

Constant exhaust air, constant supply air as well as volume flow balance values require a configuration within a controller with Room-Management-Function.

Characteristic	min	2.00	V	equals	min	0	m³/h
	max	10.00	V	equals	max	0	m³/h

Analogue output A03 - Damper position

Characteristic	min	2.00	V	equals	0 % Damper position (Damper closed)
	max	10.00	V	equals	100 % Damper position (Damper open)

Analogue output A04 - Actuator

Characteristic	min	2.00	V	equals	0 % Damper position (Damper closed)
	max	10.00	V	equals	100 % Damper position (Damper open)

Room Controller config

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Room operation mode preset via switching contacts (Digital inputs DI1-DI6)

☑ Room operation mode preset via DI1	Shut off mode	Make contact = Activates function
☑ Room operation mode preset via DI2	Low mode	Make contact = Activates function
☑ Room operation mode preset via DI3	Standard mode	Make contact = Activates function
☐ Room operation mode preset via DI4		
☐ Room operation mode preset via DI5		
☐ Room operation mode preset via DI6		

☑ If no valid room operation mode preset is given by switching contacts, the preset is Standard mode.

Room Controller config

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Volume flow settings for the room

Exhaust air

Minimum Total room exhaust air

High mode	698	m³/h	
Standard mode	698	m³/h	(compliant with DIN 1946 Part 7 25m³/h per m² Lab floor space)
Low mode	400	m³/h	
Total amount unmeasured Constant exhaust air	0	m³/h	(e.g. Exhaust by RN controller)

Supply air

Total amount unmeasured Constant supply air	0	m³/h	(e.g. Supply air by RN controller)

Volume flow split-up

- [x] Automatic split-up for Exhaust air volume flows (to all exhaust controllers of room)
- [x] Automatic split-up for supply air volume flows (to all supply air controllers of room)

Room Controller config

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Diversity Monitoring / Diversity control

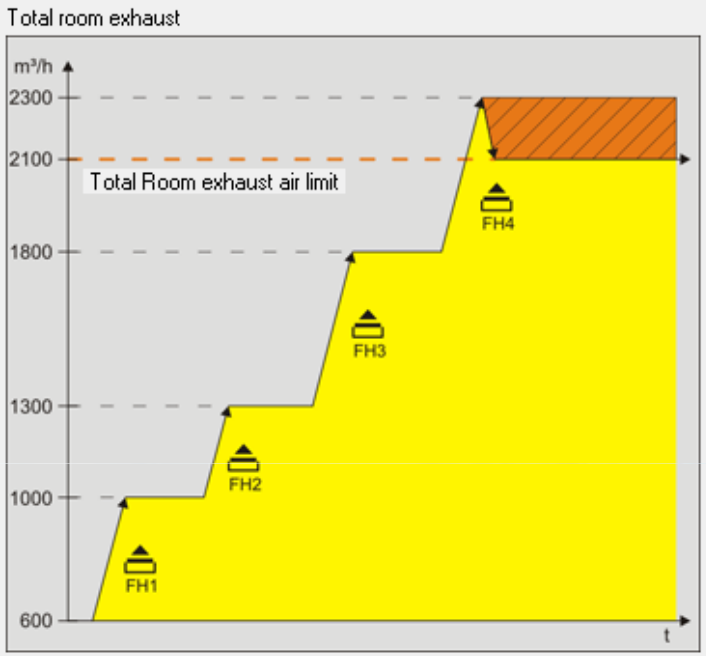
Total room exhaust air limit: 2100 m³/h
(defined by air conditioning plant layout)

Monitor the adjusted limit

Control the adjusted limit (Selective diversity control)

Tolerance around limit value: 200 m³/h

Reaction rate of diversity control: 1.00 [0.01 ... 100] % per s



Room exhaust air optimisation

Sum of technical Vmin of all Room exhaust air controller: 1800 m³/h

Tolerance for switching off the Room exhaust air controller: 10 %

Delay time for switching off the Room exhaust air controller: 0 s

Room Controller config

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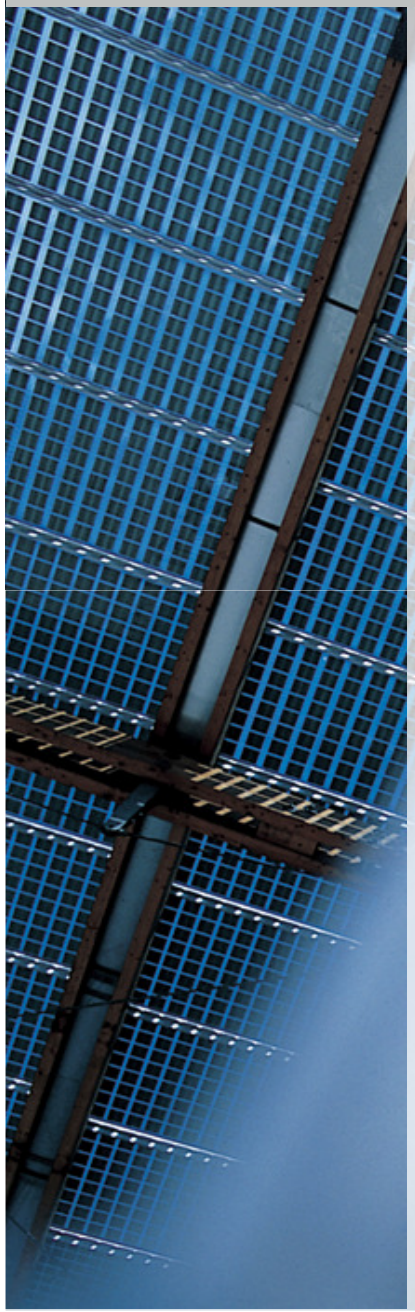

External volume flow shift via LonWorks®/BACnet/Modbus

Adjusting room air exchange rate (e.g. for external temperature control)

Characteristic	min	0 %	equals	min	0	m³/h	(Minimum volume flow shift)
	max	100 %	equals	max	0	m³/h	(Maximum volume flow shift)

Room Controller config

TROX® TECHNIK
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Pressure control - Pressure measuring point (AI5)

Characteristic	min	0.00	Volt	equals	min	-50	Pa	Signal smoothing (1-50) 50
	max	10.00	Volt	equals	max	50	Pa	

Pressure control - Parameters of pressure setpoint 1

Pressure setpoint	30	Pa	Control tolerance	5 Pa
Supply-Exhaust air balance	100	m³/h		

(Positive value for overpressure / Negative value for depression)

(•) Automatic calculation of limit value to achieve maximum actuating value

Increase pressure	15	Pa
Decrease pressure	15	Pa

( ) Manual adaption of limit to achieve maximum actuating value.

Increase pressure

Minimum actuating value	0.30	[0.01 ... 100]	Maximum actuating value	7.00 [0.01 ... 100]

Decrease pressure

Minimum actuating value	0.60	[0.01 ... 100]	Maximum actuating value	14.00 [0.01 ... 100]

Shift limits	min	0	m³/h	Recommended values	-50 m³/h
	max	0	m³/h		50 m³/h

Room Controller config

TROX® TECHNIK
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Alarm settings RMF alarm

F1 Room alarms based on category 1 (Smoke extraction / UPS Battery operation) ☑ Activate monitoring

F2 Room alarms based on category 2 (Volume flow control) ☑ Activate monitoring (Standard mode, High mode)

☐ Activate monitoring (Low mode)

F3 Room alarms based on category 3 (Hardware failure) ☑ Activate monitoring

A7 Minimum Total exhaust air too low ☑ Activate monitoring

Minimum Total exhaust air — Tolerance: 10.0 %

Alarm delay time: 30 s

Room Controller diagnostics

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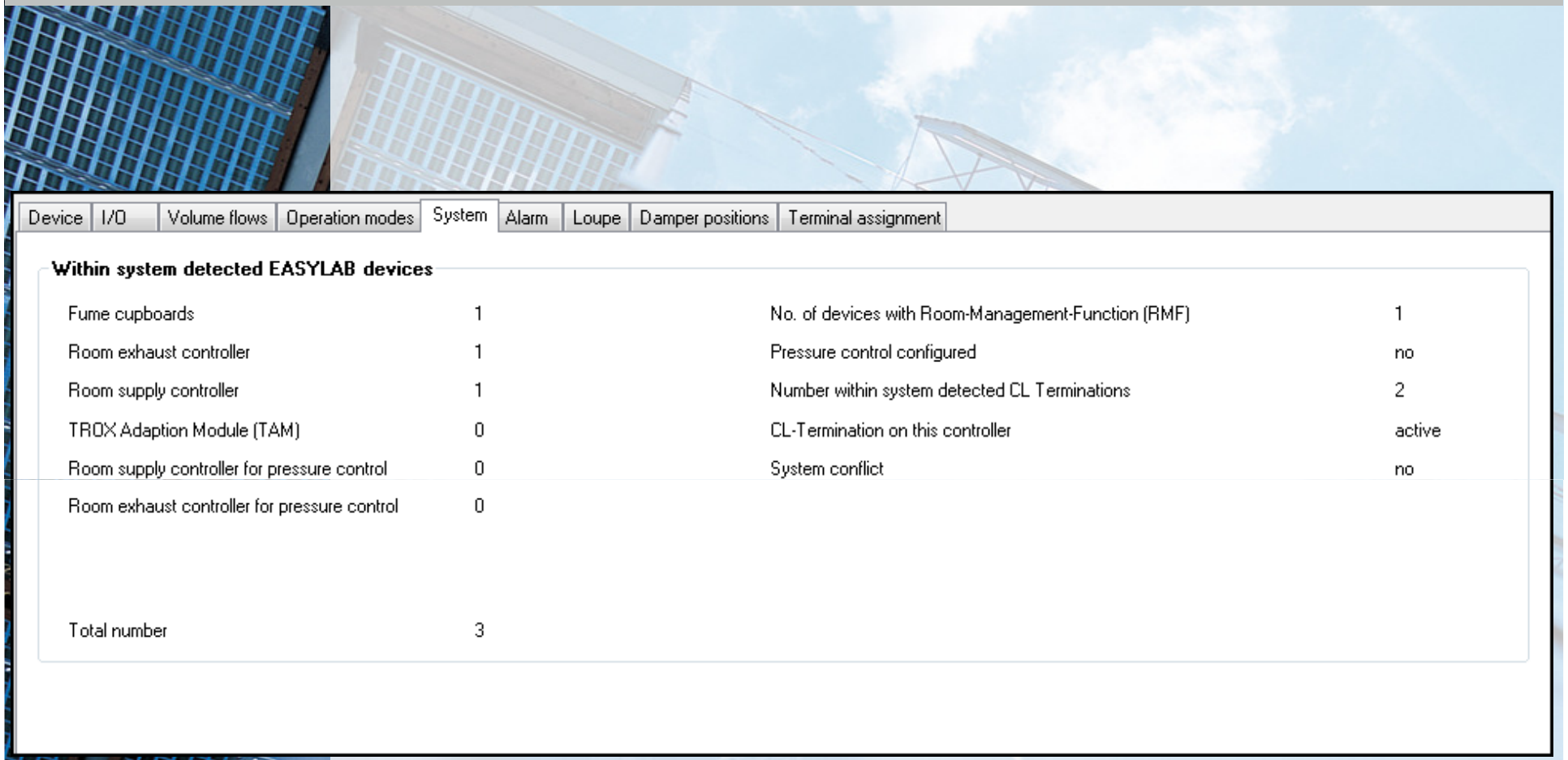

Room Controller Diagnostics

TROX® TECHNIK
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Device | I/O | Volume flows | Operation modes | System | Alarm | Loupe | Damper positions | Terminal assignment

Detailed information about integrated volume flows on this fume cupboard controller

Integrated volume flows	Exhaust air	Supply air	
DI 1 not configured as constant volume flow			
DI 2 not configured as constant volume flow			
DI 3 not configured as constant volume flow			
DI 4 not configured as constant volume flow			
DI 5 not configured as constant volume flow			
DI 6 not configured as constant volume flow			
AI 2 not configured as variable volume flow			
AI 3 not configured as variable volume flow			
AI 4 not configured as variable volume flow			
AI 5 not configured as variable volume flow			
LonWorks®/BACnet/Modbus	0	0	m³/h
Sum	0	0	m³/h

Fume cupboard controller

Setpoint volume flow (Diversity factor = 100%)	432	m³/h
Setpoint volume flow (Diversity factor <= 100%)	432	m³/h
Current volume flow	414	m³/h
Damper position	39	% opened

System

Setpoint Total exhaust air	400	m³/h
Current Total exhaust air	652	m³/h
Setpoint Total supply air	652	m³/h
Current Total supply air	670	m³/h
Total integrated exhaust air	0	m³/h
Total integrated supply air	0	m³/h
Total volume flow Fume cupboards	410	m³/h
Total volume flow Room exhaust controller	241	m³/h
Total volume flow Room supply controller	670	m³/h
Constant exhaust air	0	m³/h
Constant supply air	0	m³/h
Configured balance (Supply - Exhaust air)	0	m³/h
Volume flow shift - Pressure	0	m³/h
Volume flow shift - Temperature	0	m³/h

Room Controller config

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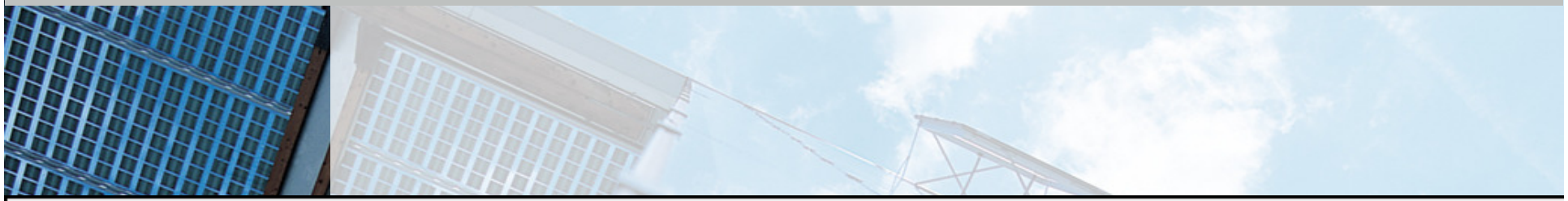

Device | I/O | Volume flows | Operation modes | System | Alarm | Loupe | Damper positions | Terminal assignment

Detailed information about controller damper positions in system

	Damper position min [%]	Controller in operation mode Shut off	Damper position max [%]	Controller in operation mode Open
Fume cupboards	31	not present	31	not present
Room exhaust controller	35	not present	35	not present
Fume cupboards/Room exhaust controller	31	not present	35	not present
Room supply controller	54	not present	54	not present

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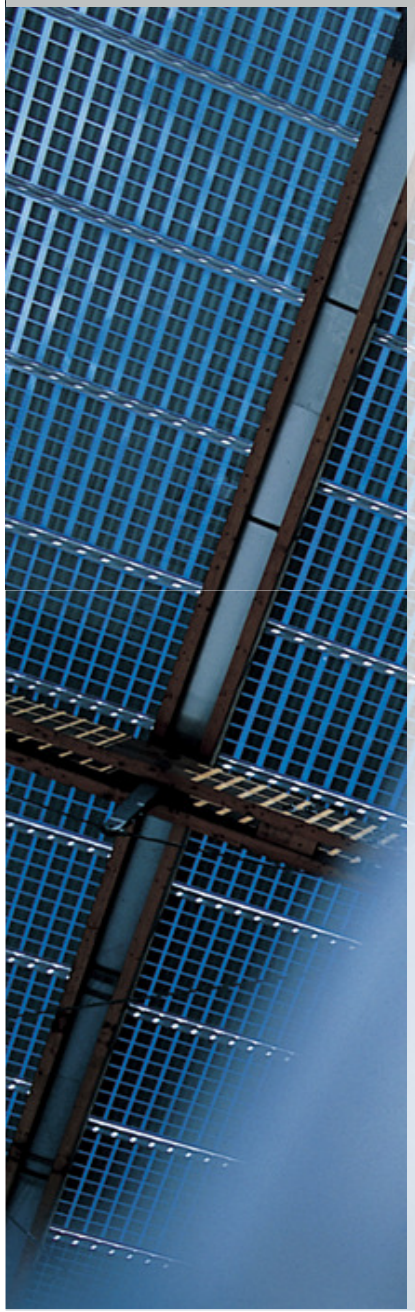

Room-Example 1

1. Fume hoods with variable volume flow
2. Cupboards with constant 24h exhaust air
3. Room supply air is following the total exhaust
4. Room not airtight: No sealings on the doors
5. Room underpressure by volume flow difference

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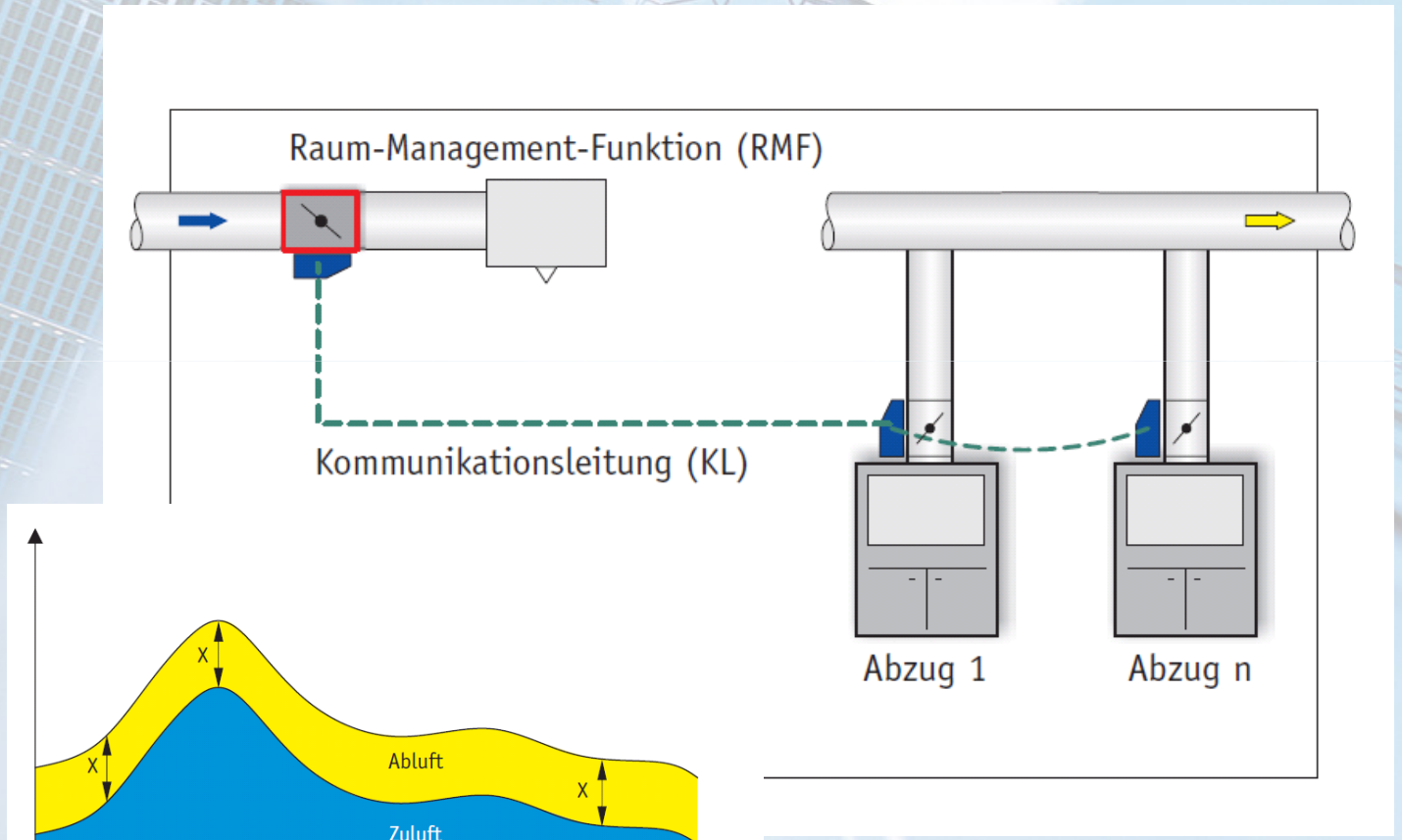
The art of handling air

Room-Example 1



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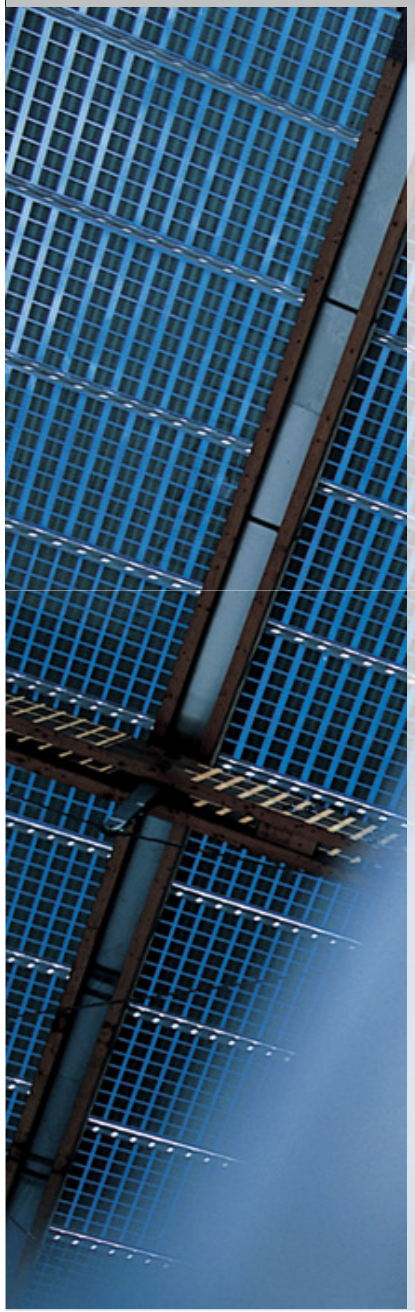

Room-Example 2

1. Fume hoods with variable volume flow
2. Room exhaust is working vice versa to the hoods
3. Cupboards with constant 24h exhaust air
4. Room supply air is following the total exhaust
5. Room not airtight: No sealings on the doors
6. Room underpressure by volume flow difference

EASYLAB – room example

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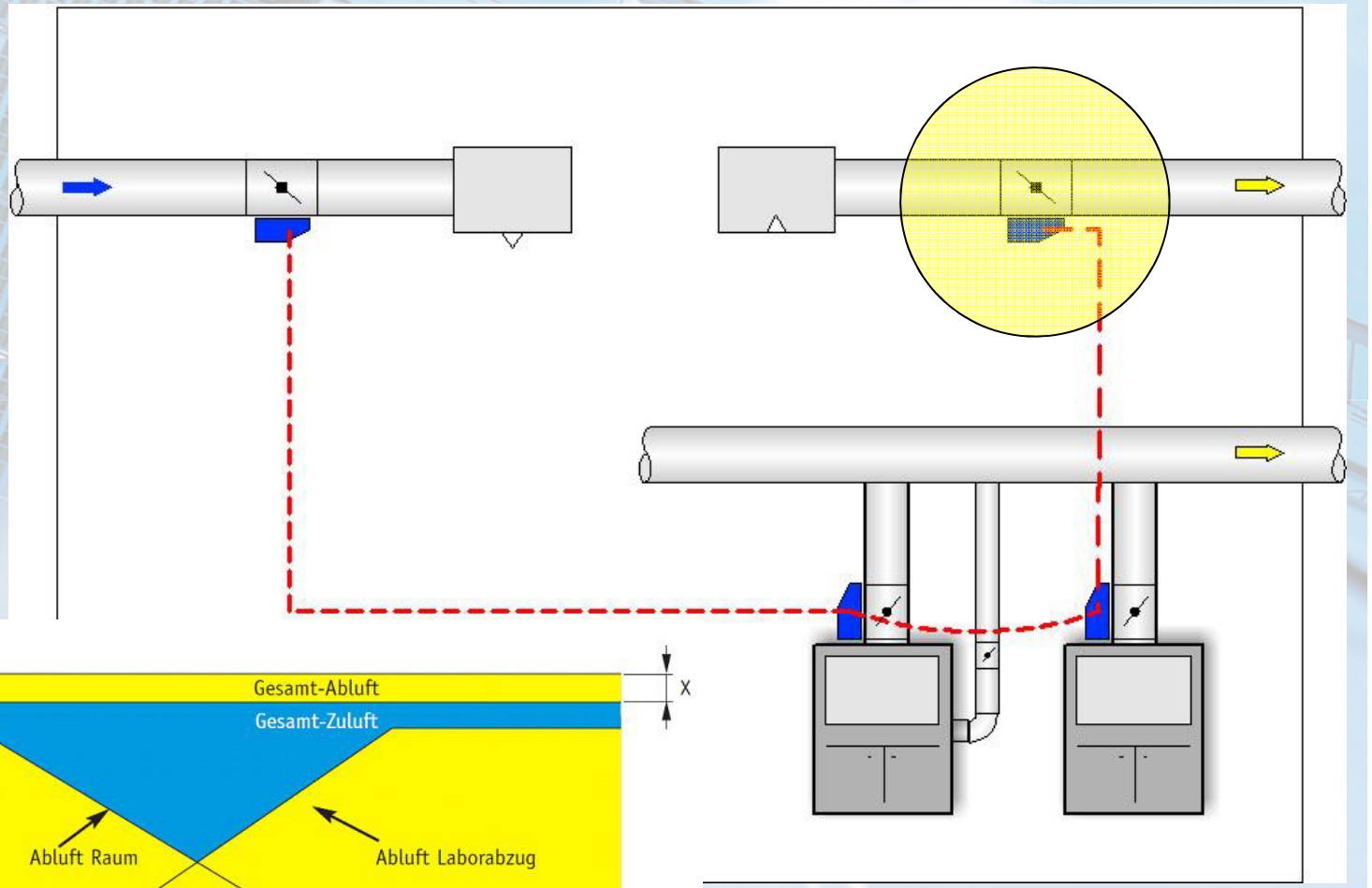
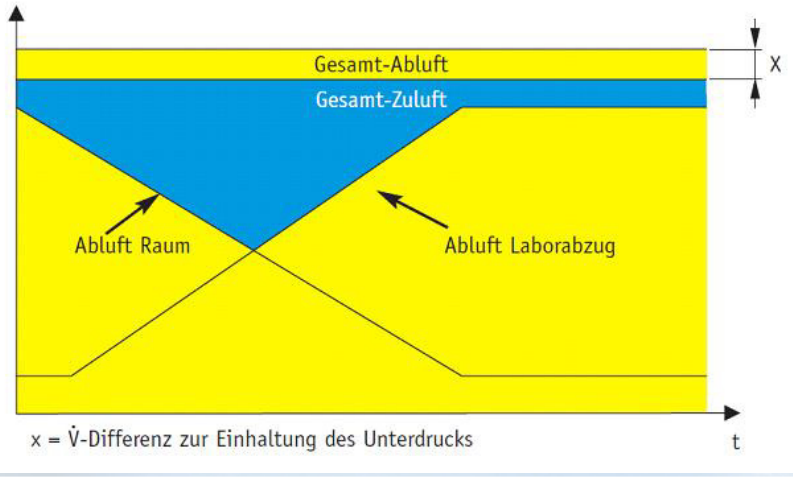
Room-Example 2





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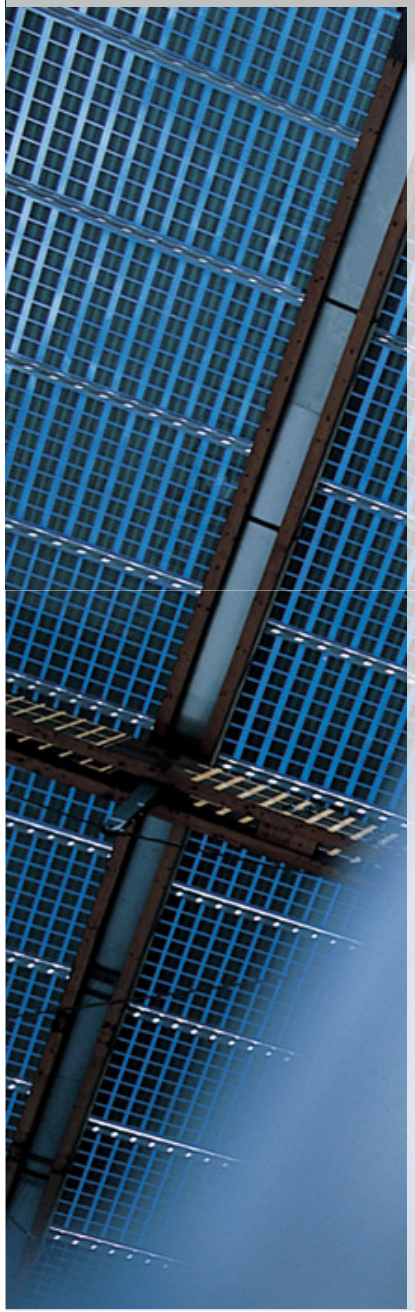

Room-Example 3

1. Fume hoods with variable volume flow
2. Room exhaust is working vice versa to the hoods
3. Local exhaust with ON / OFF
4. functionSnorkels with manual dampers
5. Cupboards with constant 24h exhaust air
6. Room supply air is following the total exhaust
7. Room not airtight: No sealings on the doors
8. Room underpressure by volume flow difference

EASYLAB – room example

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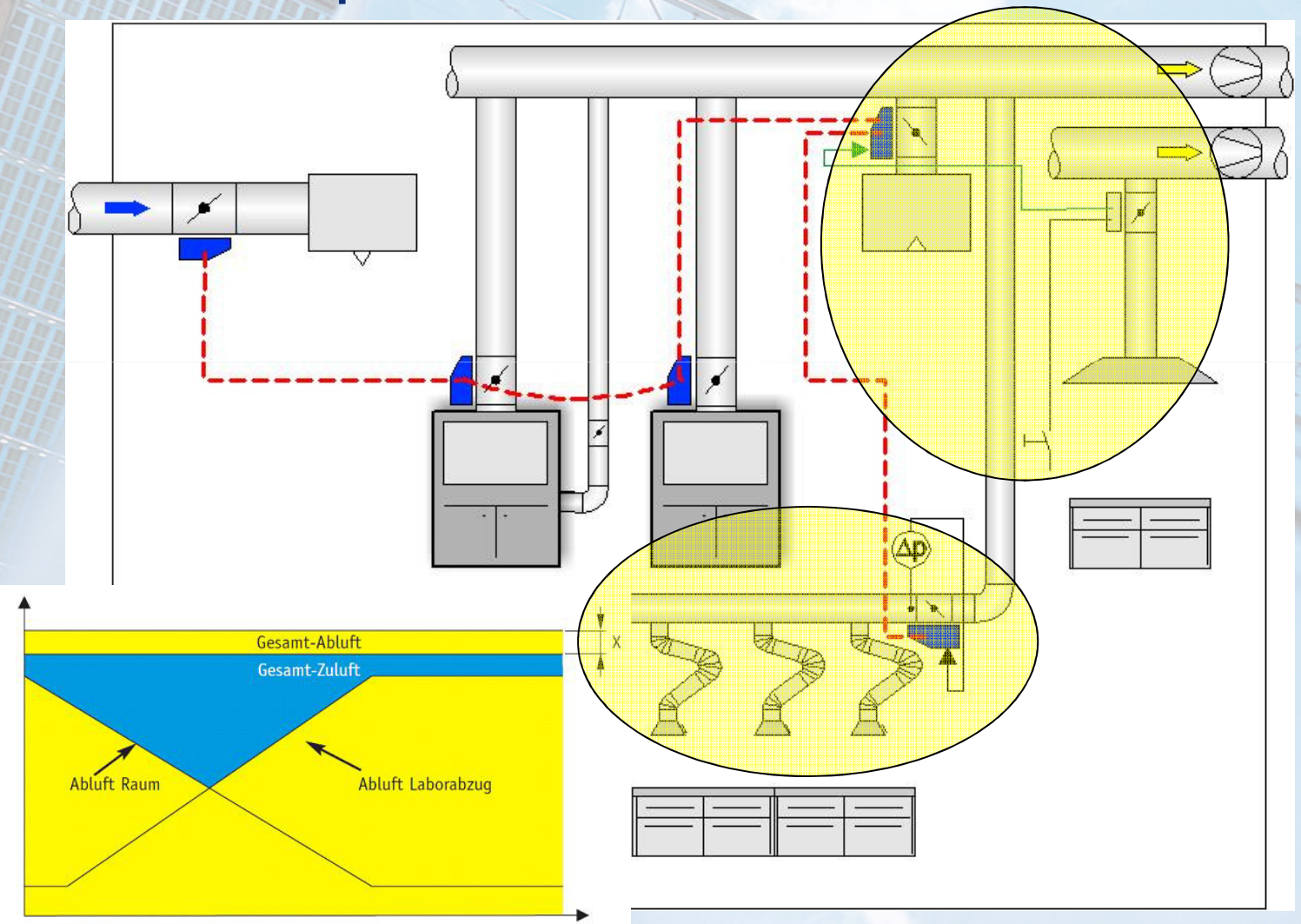
Room-Example 3



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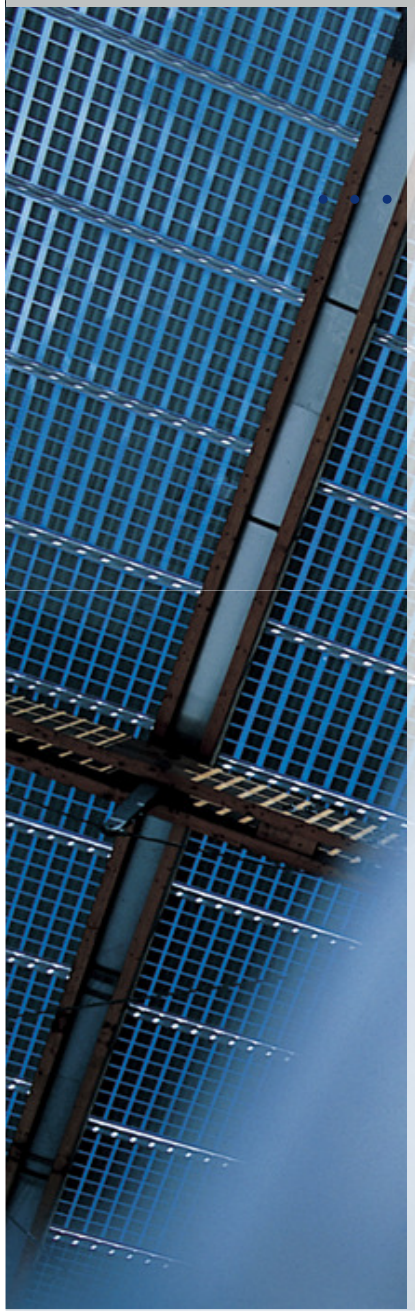

Room-Example 4

1. Many fume hoods with variable volume flow
2. Room exhaust is working vice versa to the hoods
3. Local exhaust with ON / OFF function
4. Snorkels with manual dampers
5. Cupboards with constant 24h exhaust air
6. Two Room supply air is following the total exhaust (devided air 50% / 50%)
7. Room more airtight: Sealings on the doors
8. Room is pressure controlled volume flow / pressure cascade

EASYLAB – room example

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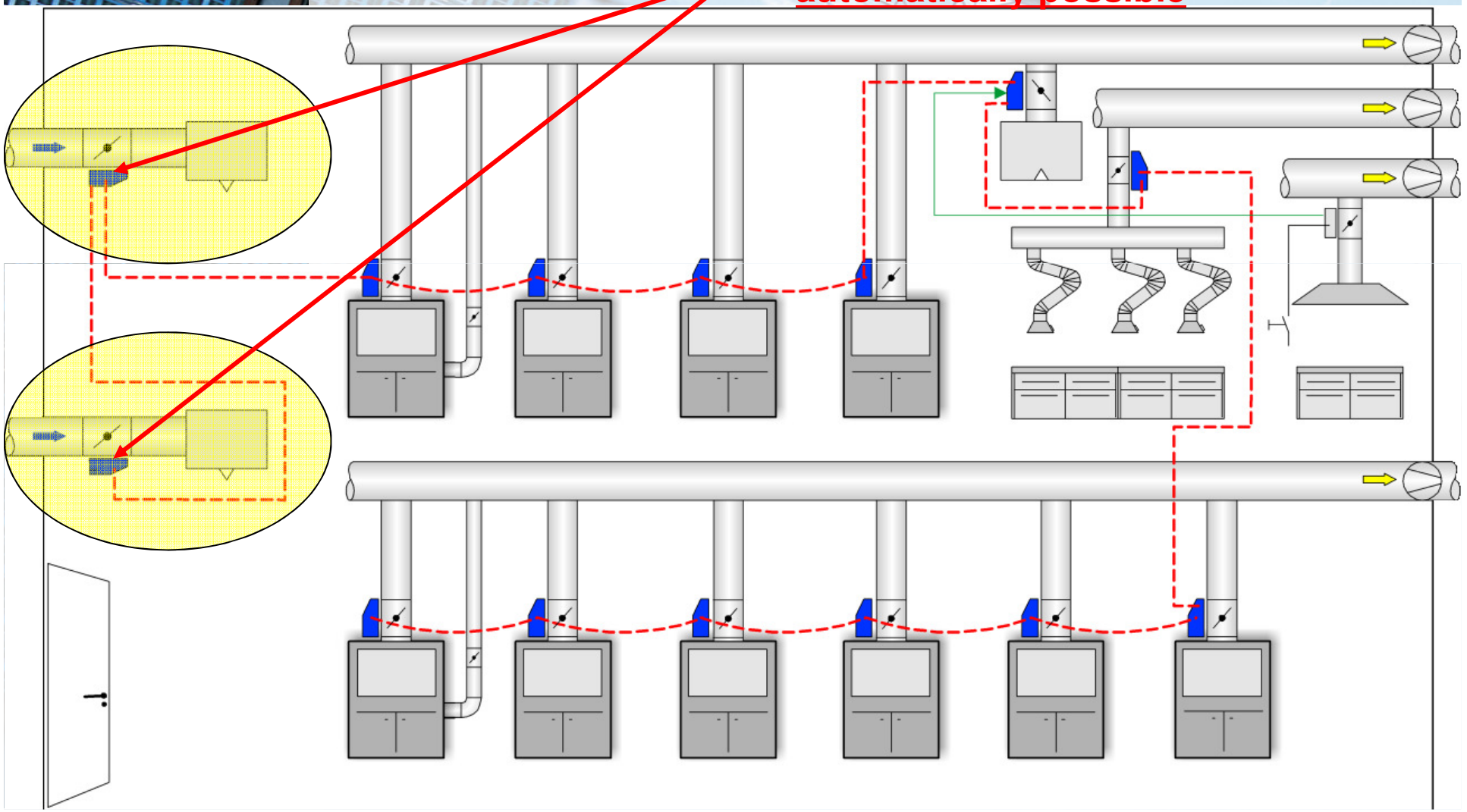
Room-Example 4

With EASYLAB automatically possible



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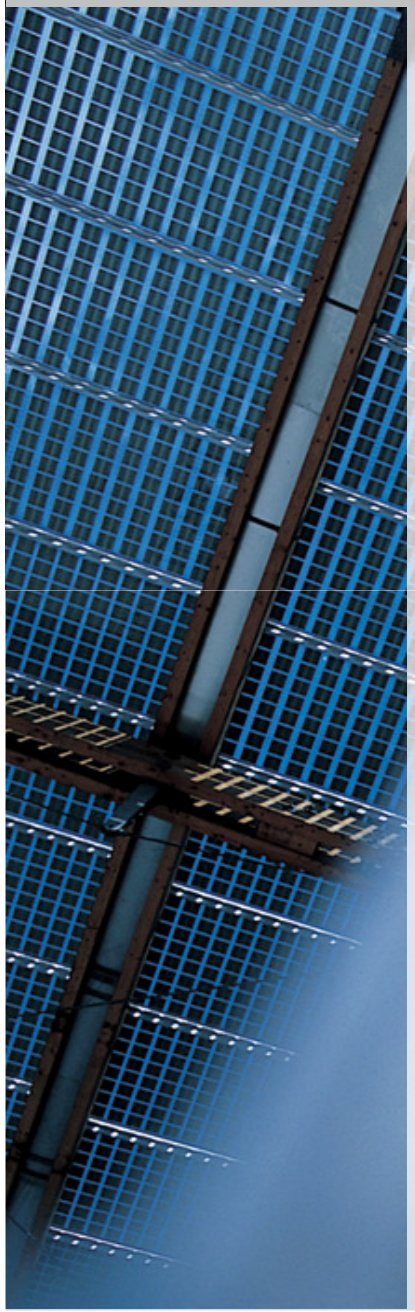
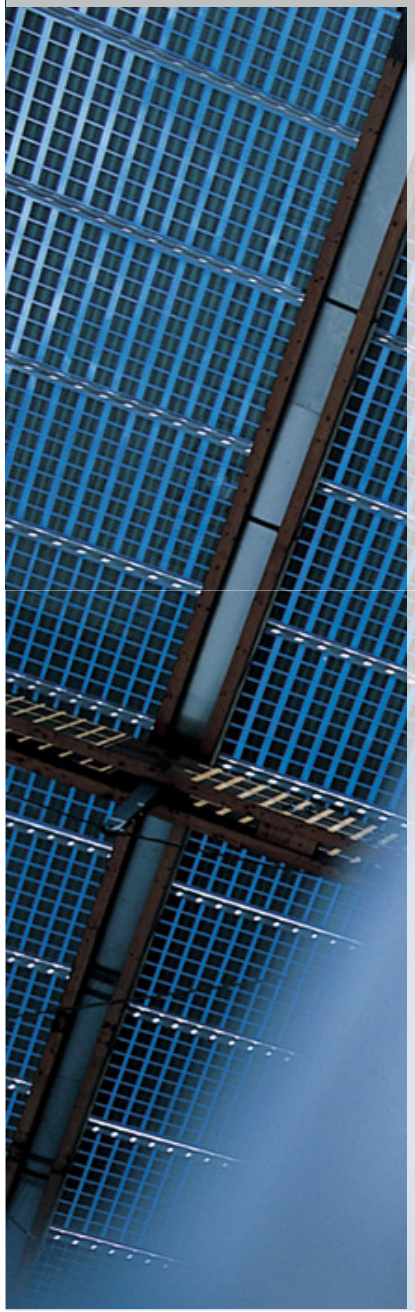
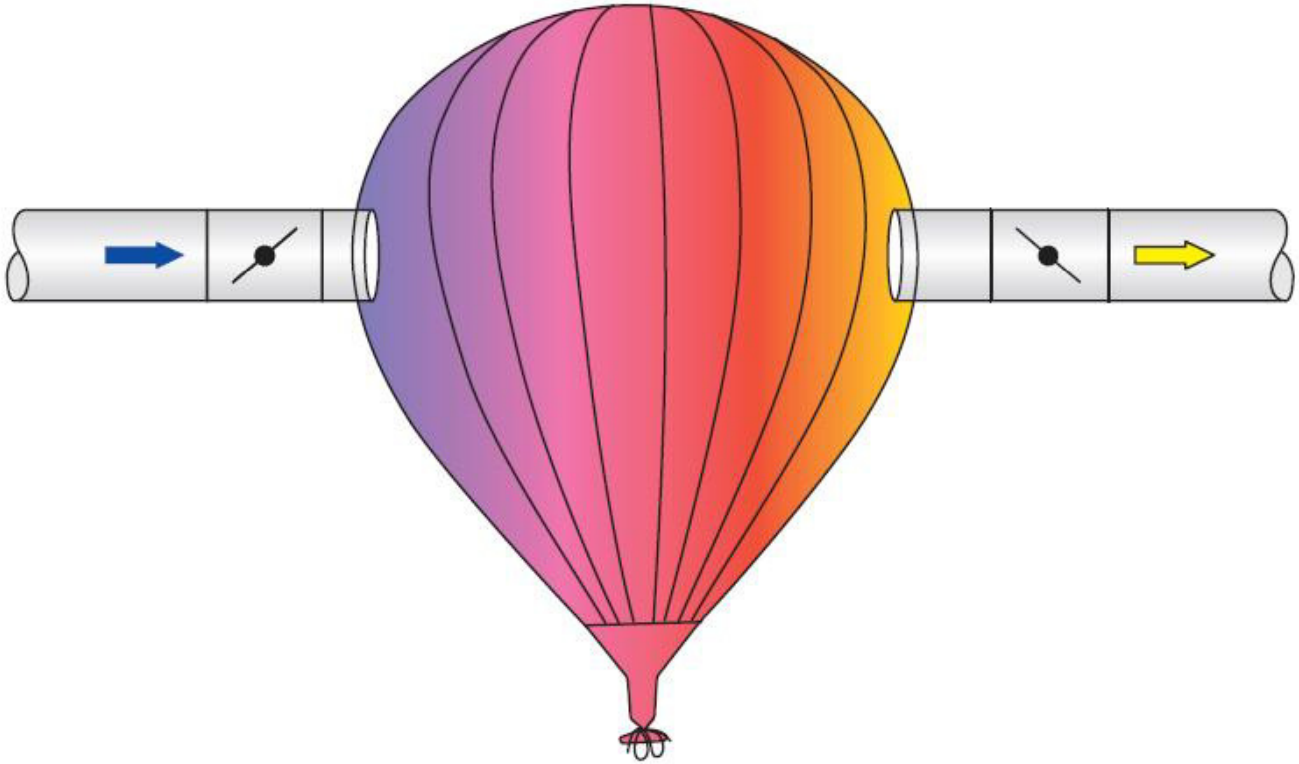


Room-Example 5

1. Fume hoods with variable volume flow
2. Room exhaust is working vice versa to the hoods
3. Local exhaust with ON / OFF function
4. Snorkels with manual dampers
5. Cupboards with constant 24h exhaust air
6. Room supply air is following the total exhaust
7. Room more airtight: Sealings on the doors
8. Room is pressure controlled
   volume flow / pressure cascade



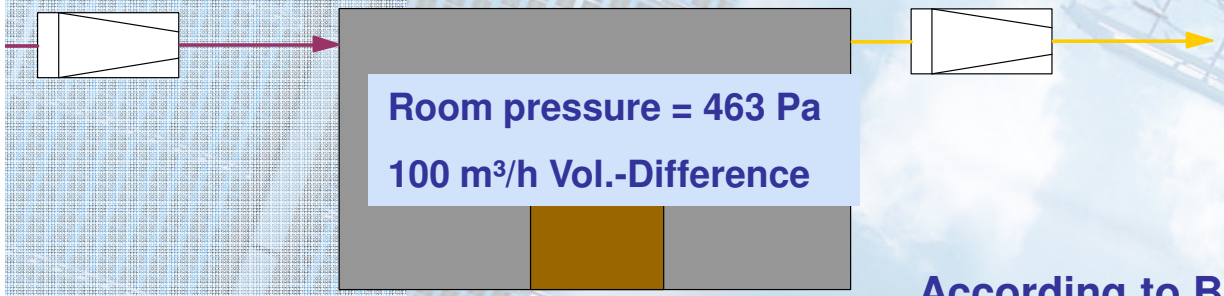
Not so easy to keep him on the same size



Physical Backround

Roomleakage: 0,001 m²

About 1 mm gap below the door



Guilty!

‡ = Volume flow difference

A = Roomleakage

ρ density of air 1,2 kg/m³

According to Bernoulli:

$$\Delta p = \frac{\rho}{2} * \left(\frac{\dot{V}}{A}\right)^2$$

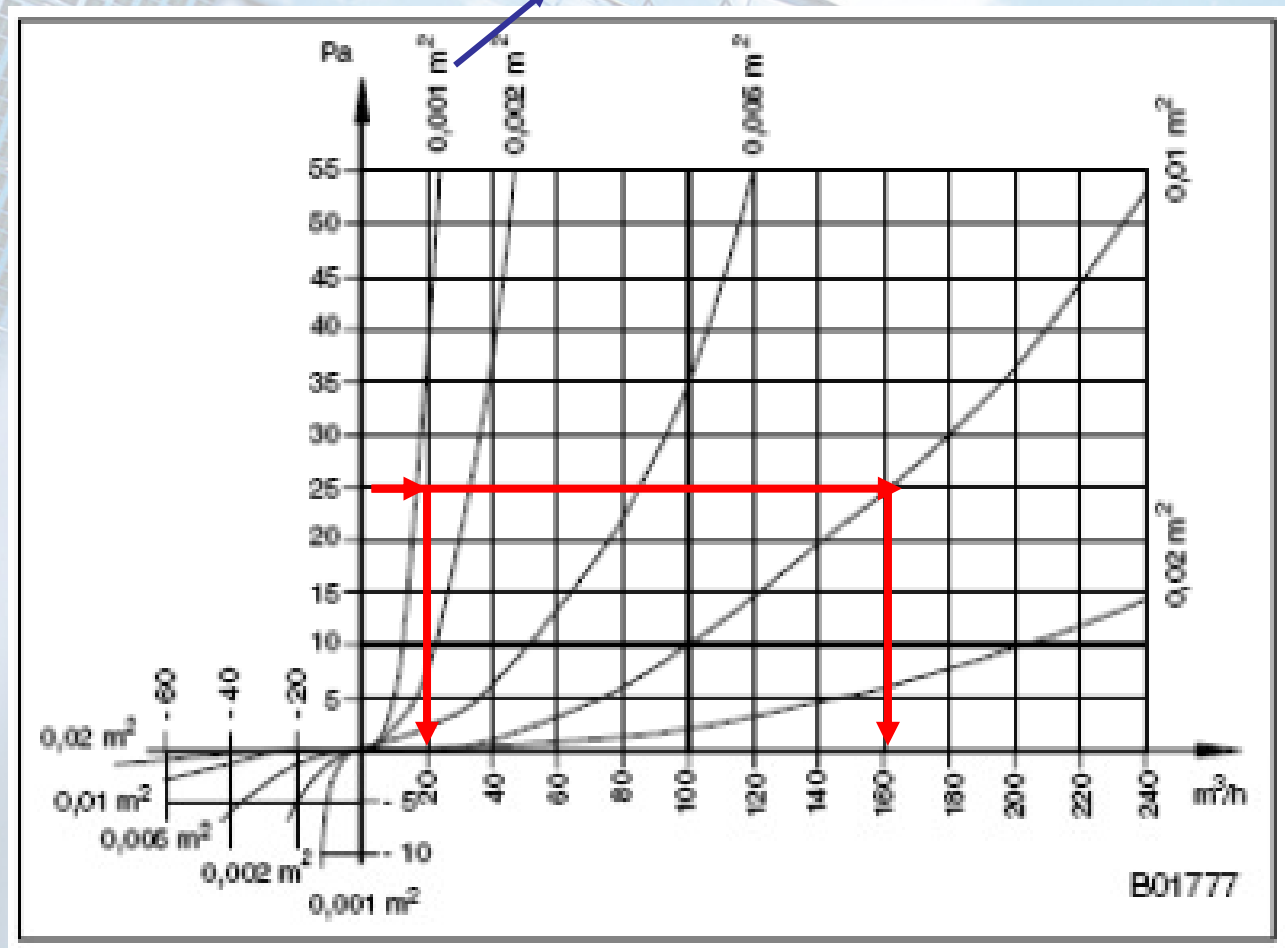
If the area is nearly zero this part of the formular is nearly unlimited!

Then little canges in the volume flow have extreme effects

The volume flow difference is independet of the room size!

$$\Delta p = \frac{\rho}{2} * \left(\frac{\dot{V}}{A * \mu} \right)^2$$

about 1mm gap



EASYLAB – Basics of pressure control

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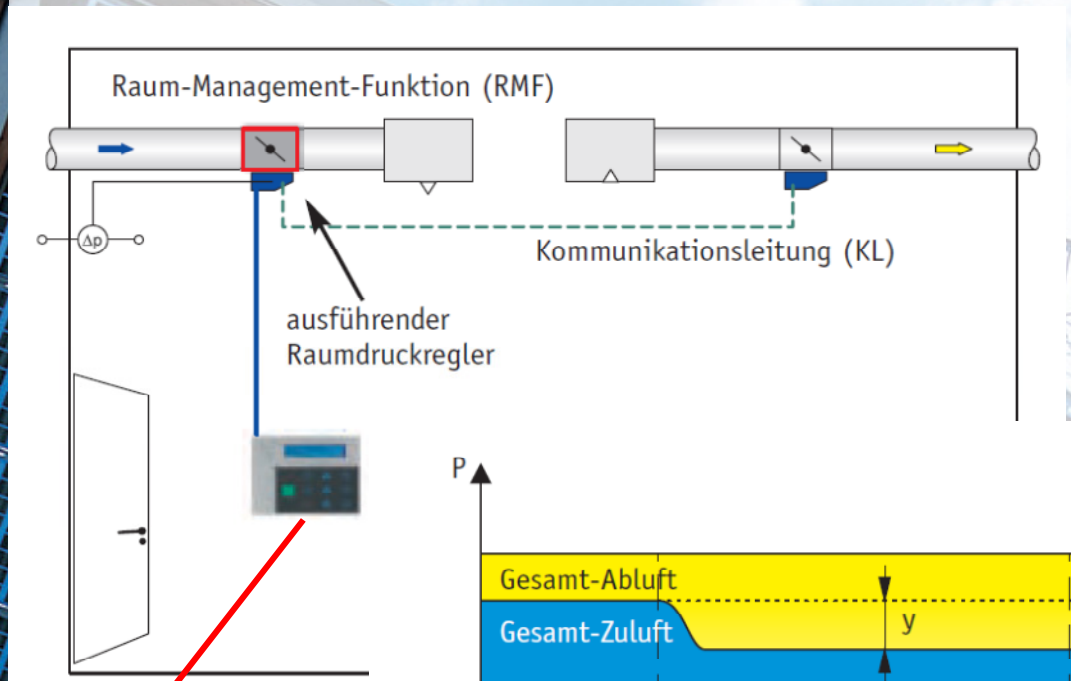

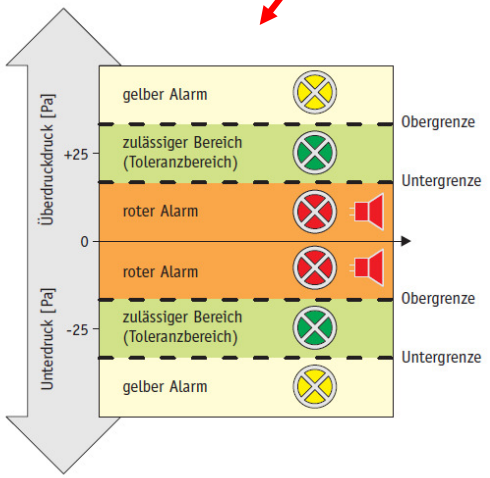

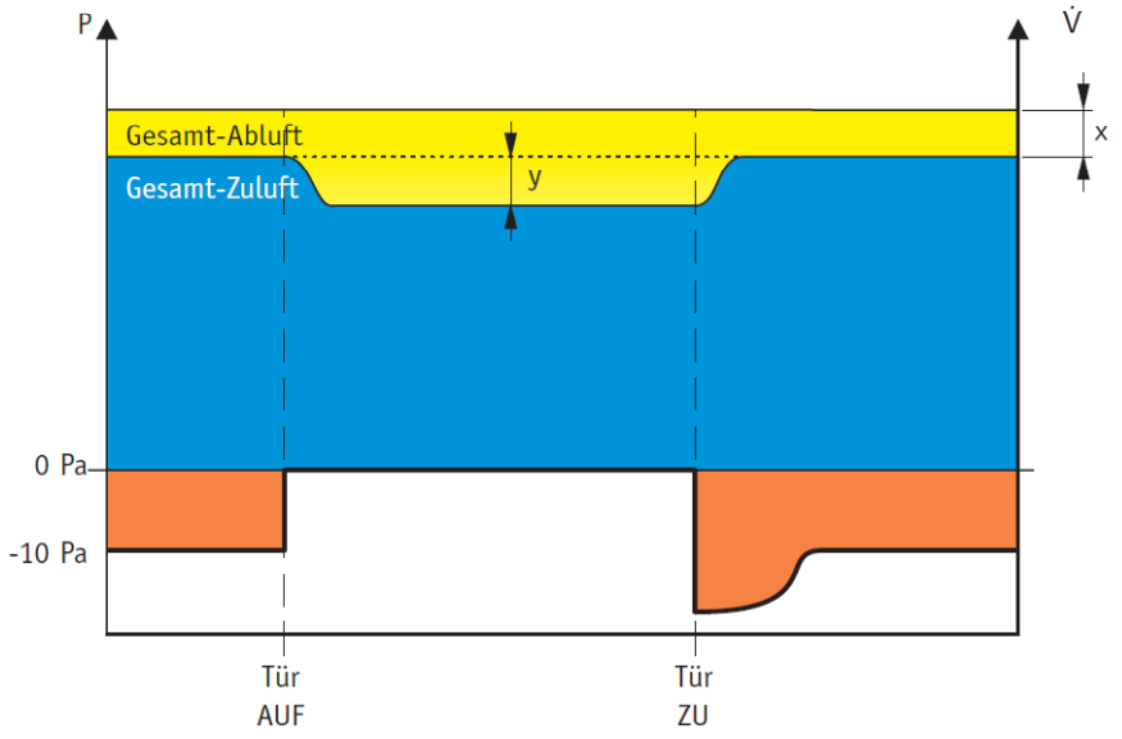

EASYLAB – room example

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Room-Example 5