Functional description

The GC10 room group controller automatically and decentrally balances the setpoints for laboratory room control (room supply and exhaust air). The room air change rate requirements of DIN 1946, Part 7 are taken into account and are freely programmable. Negative room pressure (in laboratories) or positive room pressure (in clean rooms) may be adjusted by a percentage relative to the room exhaust air or with a fixed offset (e.g. 300 m^3/h).

The negative room pressure is determined using the following formula:

Room supply air= exhaust air * 0,9	Negative room pressure = 10%
Room supply air= exhaust air - 300	Offset = 300 m^3/h

And the positive room pressure is calculated with the following formula:

Room supply air= exhaust air * 1,1	Positive room pressure = 10%
Room supply air= exhaust air + 300	Offset= 300 m^3/h

Where there is sufficient air intake and circulation (e.g. around doors), the room supply/exhaust air ratio should be established using a calculated percentage rather than a fixed offset. The percentage ratio should be approx. 10...15% in order to compensate possible inaccuracies of approx. 10% in the entire system (e.g. excessively low upstream and downstream flow routes).

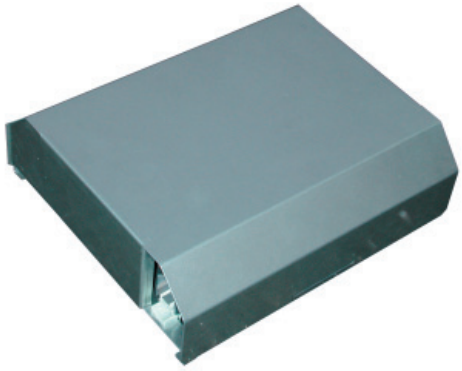
In airtight rooms, i.e. where there is insufficient air intake and circulation, a fixed offset must be added (positive room pressure) or subtracted (negative room pressure.

Room balance in laboratories

Demand-related volume flows change very quickly (< 2 s) in laboratories and must be compensated at a sufficiently high control speed in the supply and exhaust air. The prescribed negative or positive room pressure in the laboratory must be maintained safely and conclusively at all times. Via the analogue inputs, the SCHNEIDER GC10 room group controller balances up to 10 connected consumer loads with the individual exhaust air volume flow actual values and cumulates the total and the difference to a prefined value. These values are used setpoints for the SCHNEIDER VAV-A variable volume flow controllers which regulate the required volume flow for the room supply air (total) and the additional room exhaust air (difference).

LON integration

Optionally, LON integration is possible with an FTT-10A field bus module. making a cost-efficient, room by room connection to a multisupplier BMS possible. The GC10 takes on the function of router for each laboratory. thus considerably reducing the number of routers required in a project.



By means of the LON control, the GC10 room group controller fulfills the function of a DDC sub-station. Summated balances (room supply/exhaust air) are available in the BMS as standard network variable types (SNVT).

Building Management System

The building management system (BMS) can be integrated anywhere in the LON network. Malfunction notification, room by room daytime/night-time switching as well as room exhaust and supply air actual values are available via SNVTs.

Performance features

- Microprocessor controlled monitoring system
- 10 analogue inputs (exhaust air actual values of the fume hoods/load consumers) are summated and assigned to one or more analogue outputs (max. 4)
- Groupings are freely programmable. Any number of inputs (x) up to a total of 10 (x = 1 to 10) can be connected to any number of outputs (y) up to a total of 4 (y = 1 to 4). Thus, with a GC10, the ventilation (supply air) of a maximum of 4 laboratories can be regulated when the total number of fume hoods present in the 4 laboratories is ≤ 10
- Setpoint balancing for room supply air and an additional room exhaust air (difference in relation to the freely programmable room air change rate)
- Decentralized, automatic balancing, relieving the load on the building services management system (BSM)
- 4 digital inputs for switchable consumer loads, room control panel (cancel night-time operation) etc.
- 2 relay outputs for daytime/night-time switching of fume hoods and room group alarms
- Optional extension to 10 additional digital inputs for addition of individual fume hood alarms
- Optional internal transformer for direct supply 230V AC and for provision of the supply voltage 24V AC for a maximum of 4 connected VAV-A (variable volume flow controllers)
- Mains voltage failure-safe storage of all system data in the EEPROM
- Router functionality for the laboratory with LON300 field bus module, Transceiver FT-X1 (FTT-10A)
- Free programming of inputs and outputs via the LON network as well as retrieval of the summated room balance and the analogue inputs Ain1...Ain10

Ordering code: Room group controller ● Technical data

Ordering code: **Room group controller with 10 analogue inputs**

GC10 - T - 3 - 0 - 0 - 0

Type

Supply

internal transformer Primary: 230V AC, Sec.: 24V AC/30VA	**T**
external on-site transformer	**E**

Relay equipment

no internal relay populated	**0**
2 internal relays populated K3 = daytime/night-time switching by the BSM K4 = Group alarm to the BSM	**2**
3 internal relays popoulated K2 = Control of the room control device optical display Day/Night K3 = daytime/night-time switching by the BSM K4 = Group alarm to the BSM	**3**

Additional terminal rows for room functions from/to DDC

0	no additional terminal rows
K	Room group alarm of 10 fume hoods to the DDC and daytime/night-time switching of 10 fume hoods (room by room) from the DDC

Individual alarm inputs

0	= without	**S**	= with 10 individual alarm inputs

LON300 field bus module, FT-X1 (FTT-10A)

0	= without	**L**	= with LON300 field bus module

Ordering example: Room group controller GC10

Internal transformer for 230VAC supply, 3 relays, no additional terminal rows for room functions, without individual alarm inputs, without LON module

Make: SCHNEIDER **Type: GC10-T-3-0-0-0**

Functional description
Room air control with room group controller and I/O connection to the Building Management System (BMS)

Room plan 1 shows the interconnection of up to 10 fume hood controllers (Ain1 to Ain10) with the GC10 group controller. The group controller can control up to four freely configurable volume flow controllers for room supply/exhaust air volume flow controllers for room supply/exhaust air (Aout1 to Aout4). The internal transformer (optional) provides the supply voltage 24V AC for a maximum of 4 volume flow controllers(VAV-A), which simplies planning and makes implementation more cost-efficient.

which means that any type of configuration is possible. For example, up to four laboratories each with a room supply volume flow controller and a maximum of 10 fume hoods can be automatically controlled. As shown in Room plan 1, as well at the room supply air an additional room exhaust air can be configured.

Here the parallel connection to the building management system (BMS) and/or DDC is done via the input/output interface and can easily be implemented with the optional additional terminal rows. The group alarm is generated by serial connection of the individual alarm contacts and daytime/night-time switching of the fume hoods is done parallelly via the input octocoupler of each fume hood controller.

At least one cable IY(St)Y 2x2x0,8 is required for this functionality. If the optional room control device RBG100 is also to be connected to enable room by room cancellation of night-time operation, a further IY(St)Y 3x2x0,8 cable is necessary. This makes it possible to implement the functions Light-day, Light-night and Button-Cancel night-time operation. When requested to cancel night-time operation e,g. for one night, the BMS/DDC switches to daytime operation, which ensures safe working conditions (8 air changes) in the laboratory at night..

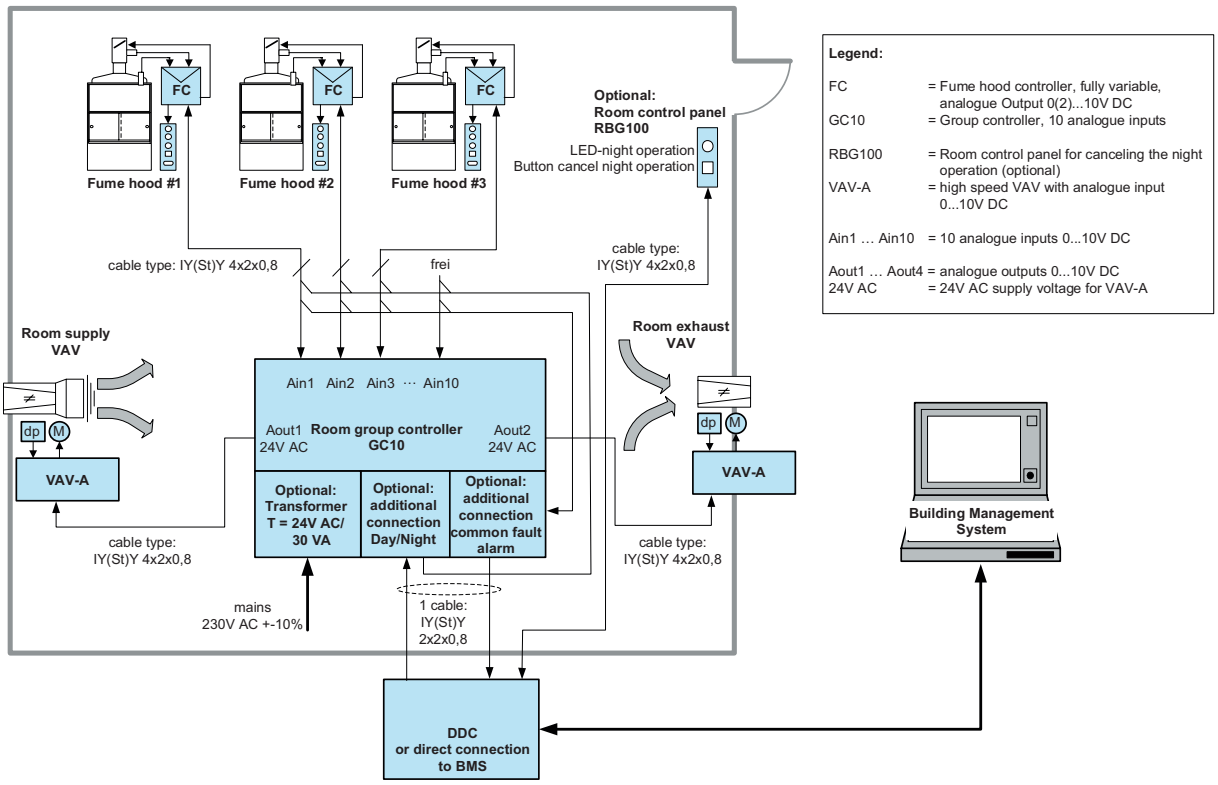
The BMS/DDC must reserve both a digital input and a digital output for each function that is to be implemented.

Table 1 shows the relationship between the function and the digital input/output of the controlling BMS/DDC.

Table 1:

Function	BMS/DDC digital input/output
Room group alarm	Input
Room by room daytime/ night-time switching	Output
RBG100 Light-day	Output
RBG100 Light-night	Output
RBG100 Button-cancel night-time operation	Input

Room plan 1:
GC10 room group controller with FC500 fume hood controller and volume flow controller for room supply/exhaust air (VAV-A), analogue and I/O connection to the BMS



Functional description
Room ventilation control with room group controller and LON connection to the Building Management System (BMS)

Room plan 2 shows the interconnection of up to 10 fume hood controllers (Ain1 to Ain10) with the GC10 group controller. The group controller can control up to four freely configurable volume flow controllers for room supply/exhaust air volume flow controllers for room supply/exhaust air (Aout1 to Aout4). The internal transformer (optional) provides the supply voltage 24V AC for a maximum of 4 volume flow controllers, which simplies planning and makes implementation more cost-efficient.

The analogue inputs Ain1 to Ain10 are summated and can be combined in any number of groups on the analogue outputs Aout1 to Aout4, making any type of configuration possible. For example, up to four laboratories each with a room supply volume flow controller and a maximum of 10 fume hoods can be automatically controlled. As shown in Room plan 2, as well at the room supply air an additional room exhaust air can be configured.

LON integration

A cost-efficient connection to the building management system (BMS) is achieved via the LON network through the optional field bus module LON300 (FTT-10A).

With the extension of the digital alarm inputs (optional) all alarms of the individual fume hoods can be captured and passed on to the building management system (BMS) via the LON network.

Thus the GC10 room group controller fulfills the function of a DDC substation or a router.

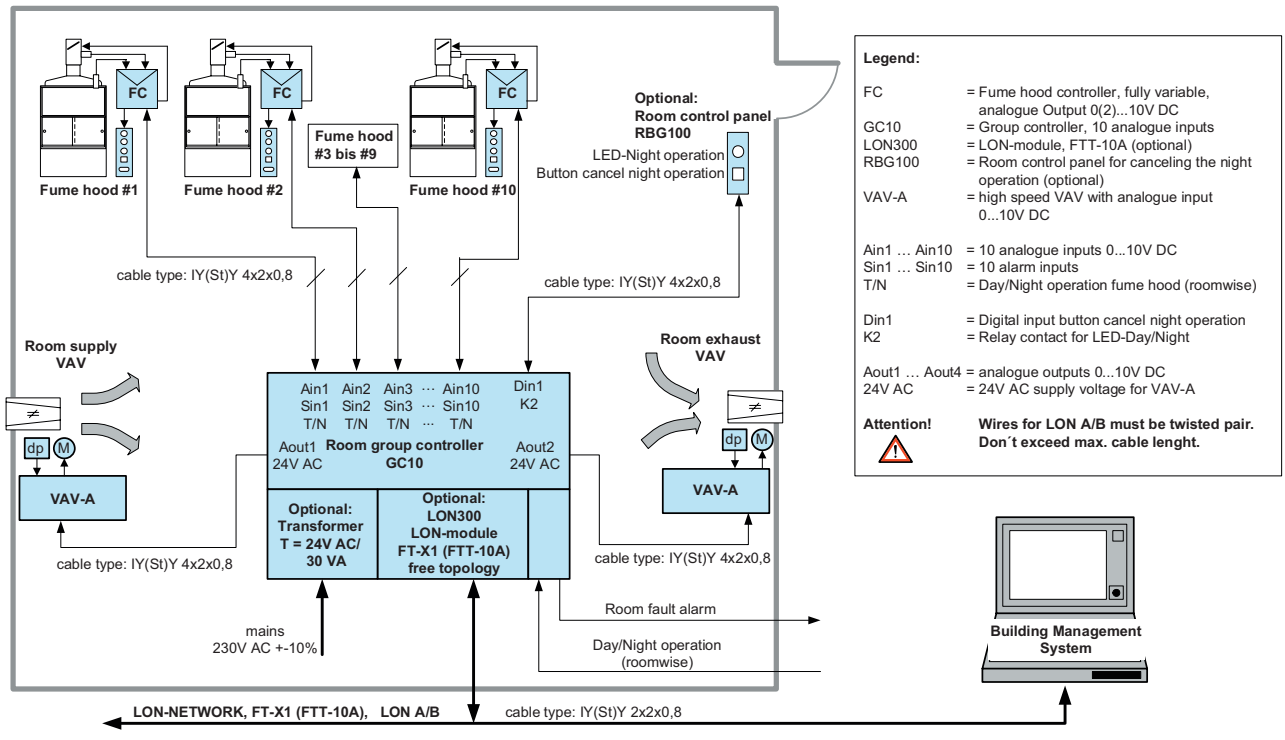
The following data are available on the BMS as stanard network variable types (SNVT):

- Exhaust air actual values of fume hoods Ain1...Ain10 and other consumer loads
- Summated room balances (room supply/exhaust air)
- Individual fume hood alarms
- Fume hood daytime/night-time switching
- Control and monitoring of the room control device

Extended functions may also be implemented, e.g. remote maintenance. Through switching between daytime/night-time and retrieval and comparison of the individual exhaust air actual values, this function can be checked in every fume hood.

The GC10 room group controller combines analogue technology with the advantages of LON bus technology and offers cost-efficient and safe room by room control and visualization via the BMS.

Room plan 2:
GC10 room plan controller FC500 fume hood controller and volume flow controller room supply/exhaust air (VAV-A), analogue and LON connection via the BMS



Room air change rate

Laboratories with multiple fume hoods and extraction units have complex room supply and exhaust air control requirements.

The room air change is defined in DIN 1946, Part 7 and can be calculated with the following rule of thumb:

25m³/h x m²

25m³ per hour exhaust air volume flow, multiplied by the laboratory main floor space in m².

With this formula the prescribed 8 times room air change rate can be achieved. During night-time operation the reduced figure of 4 times room air change rate is sufficient.

In addition to the room air change requirements specified by DIN 1946, Part 7, air flow balance and maintenance of protective pressure (negative pressure in laboratories and positive pressure in clean rooms) as well as comfort criteria such as temperature, humidity and air movement must be taken into account.

High-speed volume flow controllers

High-speed variable exhaust air control (< 2 s) via fume hoods requires high-speed room supply air control (< 3 s).

The high-speed control times mean that the defined negative room pressure can be maintained under all operating conditions.

This applies both for the increase in exhaust air volume flow brought about by opening the sash and the reduction in exhaust air volume flow caused by closing the sash or by external switching to reduced operation (night-time reduction).

Minimum room air change

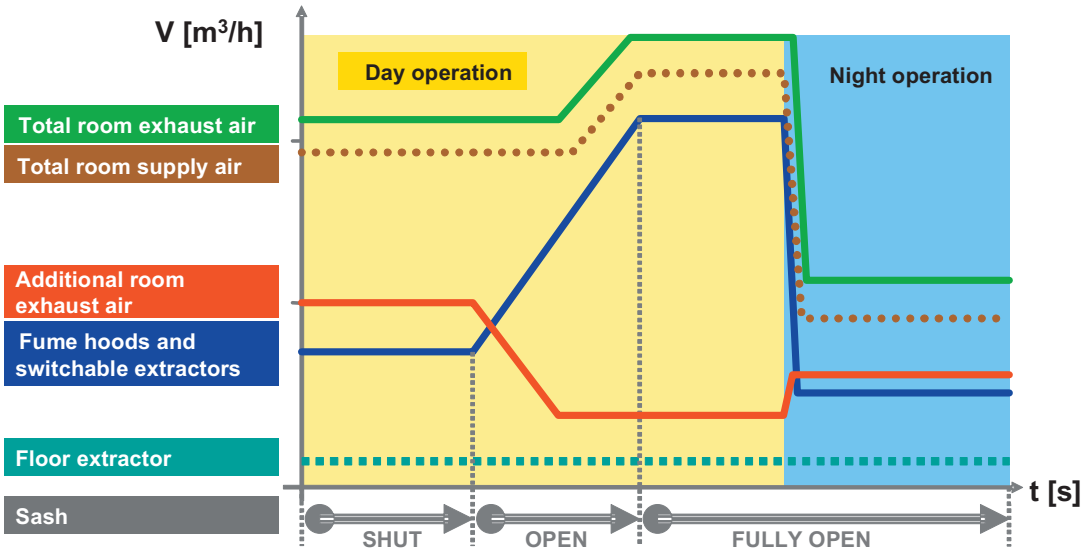
When a specific minimum level of room air change must be maintained, which cannot be fully achieved by the extraction units (fume hoods and other consumer loads), an additional volume flow controller for the room exhaust air is necessary. Via the GC10 group controller the additional room exhaust air controller always controls the difference between the technically induced exhaust air of the extraction units and the required mimimum exhaust air volume flow.

Room supply air is compensated based on the room exhaust air. Negative room pressure is achieved by supplying only approx. 90% (programmable) of the room exhaust air as supply air to the laboratory.

Diagram 1 shows the addition of the total room exhaust air and compensation of the total room supply air as well as the increase in exhaust air on fume hoods and switchable consumer loads e.g. through opening of the sash and resulting reduction in the additional room exhaust air (difference to the minimum room air change). The minimum room air change is thus always maintained at a constant level and is only increased when the exhaust air requirements of the fume hoods and switchable consumer loads increases further.

During night-time operation a fixed reduced value is regulated, independent of the sash position of the fume hoods.

Diagramm 1:



Functional description
Room control with room group controller

Room plan 3 shows the interconnection of up to 10 fume hood controllers (Ain1 to Ain10) with the GC10 group controller. The group controller can control up to four freely configurable volume flow controllers for room supply/exhaust air volume flow controllers for room supply/exhaust air (Aout1 to Aout4). The internal transformer (optional) provides the supply voltage 24V AC for a maximum of 4 volume flow controllers, which simplies planning and makes implementation more cost-efficient.

The analogue inputs Ain1 to Ain10 are summated and can be combined in any number of groups on the analogue outputs Aout1 to Aout4, making various configurations possible. For example, up to four laboratories each with a room supply volume flow controller and a maximum of 10 fume hoods can be automatically controlled. As shown in Room plan 3, both volume flow control of the room supply air and of the room exhaust air is configurable.

As shown in Room plan 3, up to four laboratories each with a room supply air volume flow controller and a maximum of 10 fume hoods can be automatically controlled.

With the extension of the digital malfunction alarm inputs (optional) all alarms of the individual fume hoods can be captured and passed on to the building management system (BMS) via the LON network.

LON connection

A cost-efficient connection to the to the multisupplier BMS can be achieved via the LON network through the optional field bus module LON300 (FTT-10A).

Thus the GC10 room group controller fulfills the function of a DDC sub-station or a router.

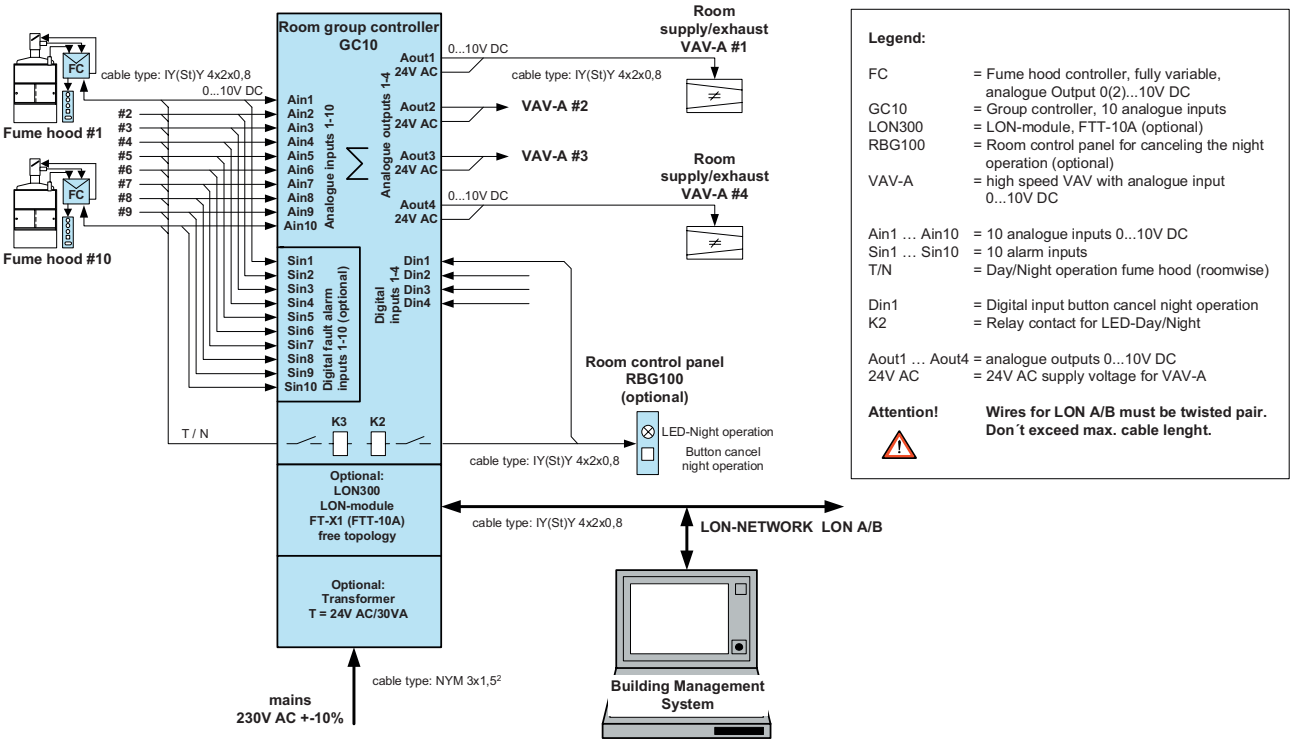
The following data are available on the BMS as standard network variable types (SNVT):

- Fume hood actual values and other consumer loads
- Summated room balances (room supply/exhaust air
- Individual fume hood controller alarms
- Daytime/night-time switching of fume hood controllers
- Control and monitoring of the room control device

Extended functions may also be implemented, e.g. remote maintenance. Through switching between daytime/night-time and retrieval and comparison of the individual exhaust air actual values, this function can be checked in every fume hood.

The GC10 room group controller combines analogue technology with the advantages of LON bus technology and offers cost-efficient and safe room by room control and visualization via the BMS.

Room plan 3:
Room air control



Functional description
Cascading room group controller

Room plan 4 shows the connection of 19 fume hoods (Ain1 to Ain9) with the GC10#1 group controller and (Ain1 bis Ain10) with the GC10#2 group controller. The GC10#2 analogue output Aout1 is connected to the GC10#1 analogue input Ain10. The internal transformer (optional) provides the supply voltage 24V AC for a maximum of 4 volume flow controllers, which simplies planning and makes implementation more cost-efficient.

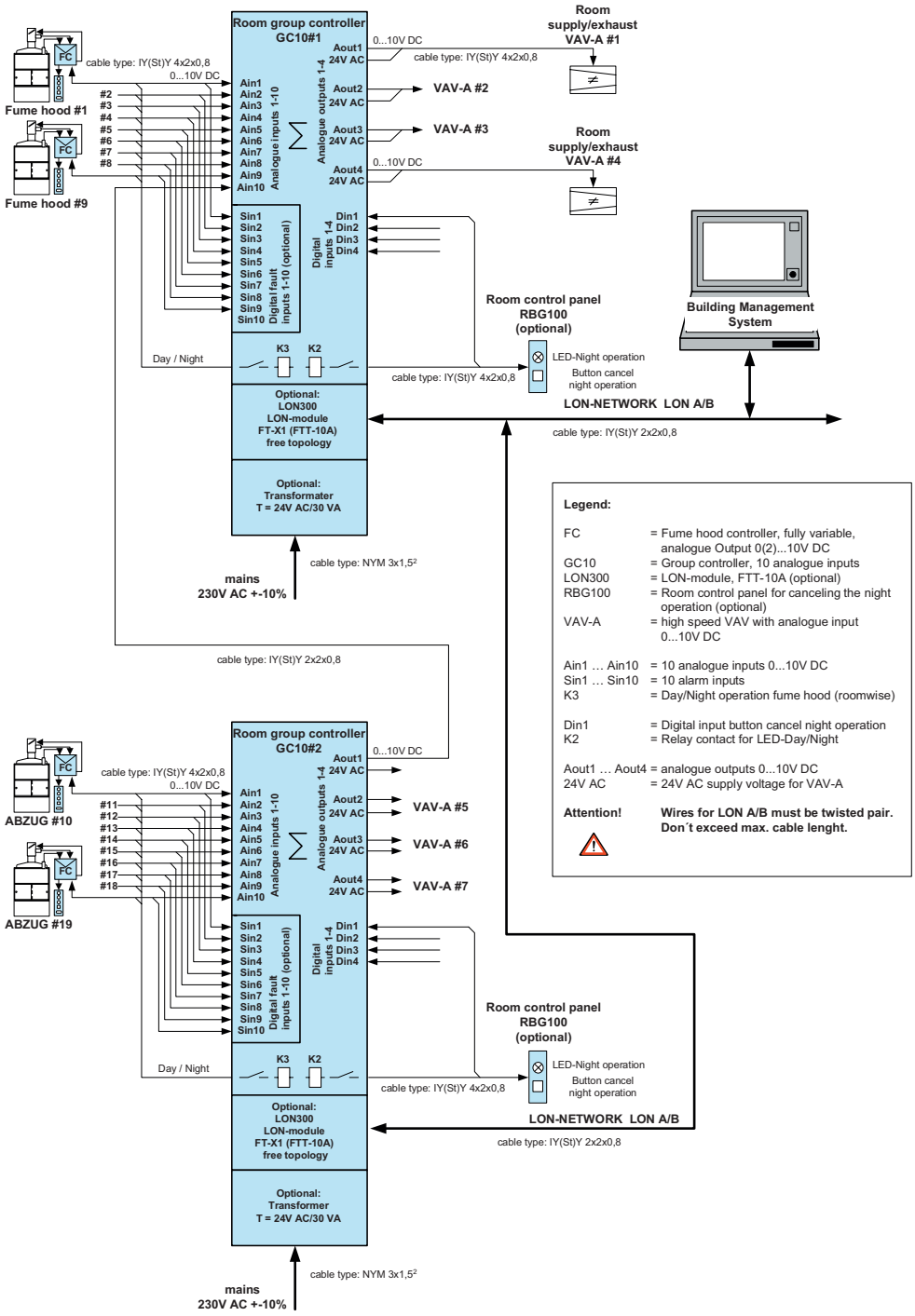
Through appropriate programming the following configurations, among others, are possible:

19 fume hood controllers on 1 to 7 volume flow controllers (VAV´s). By cascading further group controllers the number of analogue inputs increases to 9 and the number of analogue outputs increases to three for each additional GC10 room group controller.

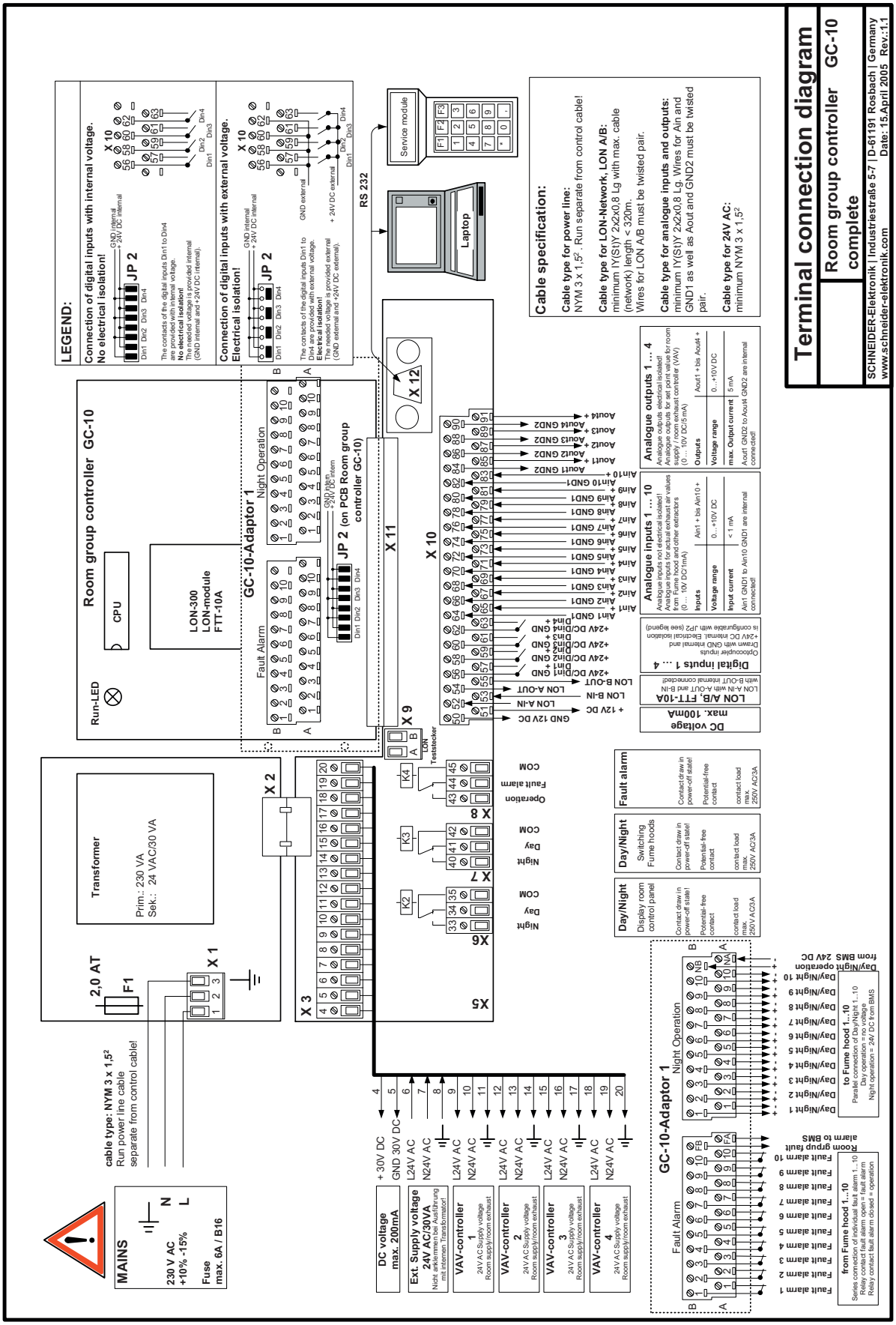
Any number of groupings are possible.

The LON connection guarantees the cost-efficient functionality of a DDC sub-station or a router.

Room plan 4: Cascading room group controller



Terminal diagram:
GC10 room group controller



■ General	
Nominal voltage **Supply voltage internal transformer**	230V AC/50/60Hz/+-15% 24V AC/30VA
Nominal voltage external on-site supply	24V AC/50/60Hz/+-15%/ 30VA (external protection from overload)
Max. charging rate	1 A
Max. power input	30 VA
Operating temperature	0 °C bis +55 °C
Humidity	max. 80 % relative, non-condensing

■ Case	
Protection type	IP 20
Material	Sheet steel
Colour	grey-white, RAL 9002
Dimensions (LxWxH)	(290 x 208 x 100) mm
Weight	approx. 2.8 kg
Terminals	screw terminal 1.5 mm^2

■ Digital outputs	
Number	3 relays (optional)
Contact type	changeover contact
Max. switching voltage	250V AC
Max. continuous current	3A

■ Digital inputs (electrical isolated)	
Number	4 optocouplers
Max. input voltage	24V DC +-15%
Max. input current	10mA (per input)

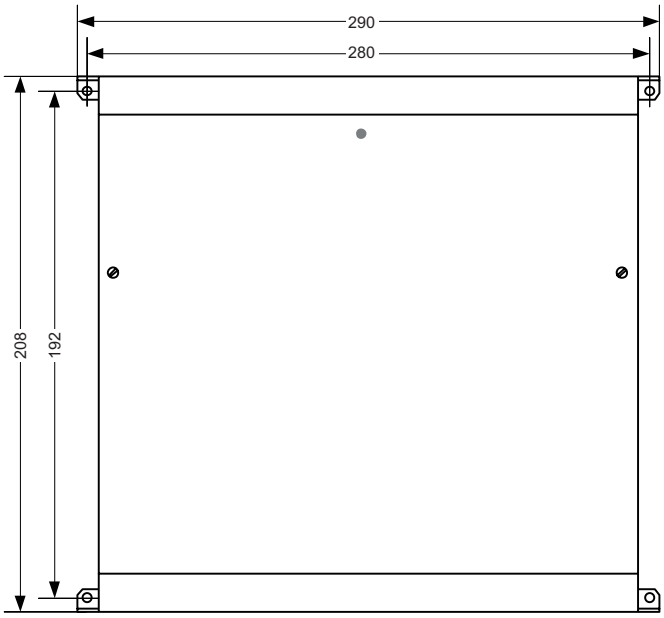
■ Analogue inputs Exhaust air actual values of the fume hoods and switchable consumer loads	
Number	10
Voltage/current	0(2)...10VDC, 1mA
Extension	Infinite, through cascading

■ Analogue outputs Setpoints for volume flow controllers room supply/ exhaust air	
Number	4
Voltage/current	0(2)...10VDC, 5mA

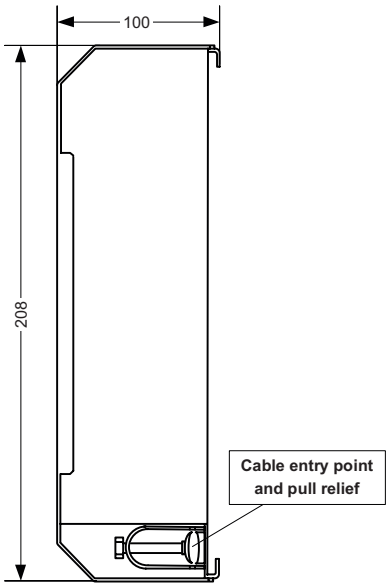
■ Extension digital Störmeldeeingänge (option)	
Number	10 optocouplers
Max. input voltage	24V DC +-15%
Max. input current	10mA (per input)

■ Extension LON300 field bus module (option)	
Transceiver	FT-X1 (FTT-10A), free topology
Network variable	Standard network variable type (SNVT) in accordance with LonMark specification

Case GC10: Top view



Case GC10: Side view



Tender specification GC10

GC10 room group controller for balancing room supply air (sum) and room exhaust air volume flows (difference to maintenance of the room air change rate). Balancing of 10 connected consumer loads. 4 analogue outputs and 4 digital inputs, optically decoupled. Extendible through cascading of 9 digital inputs and 3 analogue inputs for each additional room group controller.
All inputs and outputs are freely programmable and can be adapted to existing room volume flow controllers and/or frequency inverters.
Room group controller with integrated microprocessor and 2 independent watchdog switches. All system data are saved in the mains voltage failure-safe EEPROM. Separate terminal board for fast, simple cable connection. Suitable for all types of fume hood.
Internal power supply 230V AC for providing supply voltage 24V AC/30VA for up to 4 VAVs for room supply/exhaust air. Programming via RS232 interface with laptop or service module or optionally via the LON network.

Optional extensions:
Retrofittable terminal rows for room functions from/to DDC.
Redundant room pressure control.
Monitoring of the exceedance of a programmable maximum room air volume flow with optical and/or acoustic alarm (transparent signalling of the utilization factor.
LON connection via retrofittable LON module LON300, with FTT-10A, free topology, standard network variables (SNVT) wih router functionality.

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