+ COMMUNICATION CONTROLLER

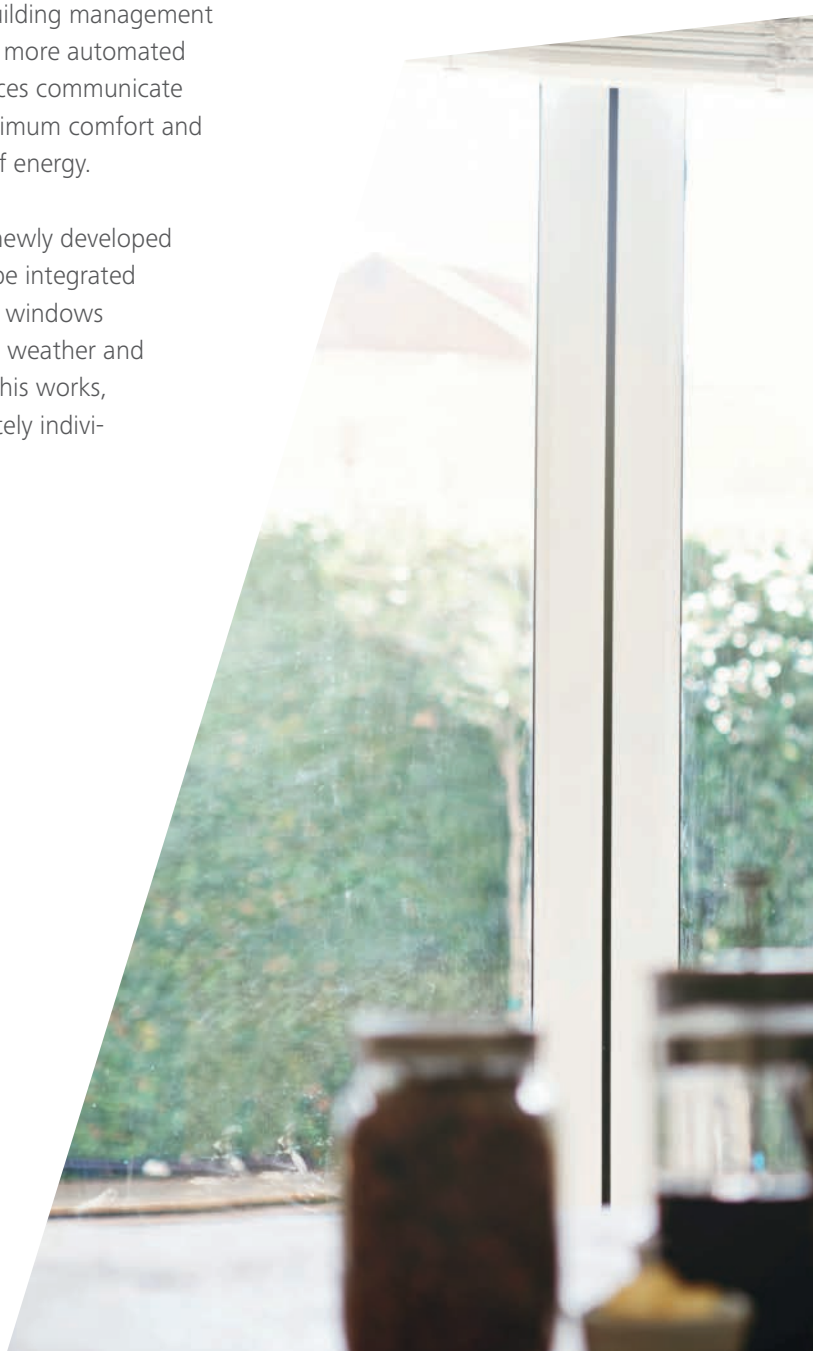
Language connects us. And information technology, too.

The windows speak ACB

Before the alarm clock has even gone off, the rolling shutters slowly move up. Sunlight falls into the room. In the kitchen, the coffee brewer starts up automatically. At the same time, the heating adjusts to a comfortable temperature in the bathroom and the television in the living room jumps to the latest news. All of this may sound like luxury or like futuristic thinking, but this has long been the daily routine in many households thanks to modern bus systems.

Even large building complexes such as schools, offices or hotels are regulated by what is referred to as a building management system (BMS), which is becoming more and more automated these days. In these systems, all "smart" devices communicate with each other in order to offer the user maximum comfort and convenience and to provide benefits in terms of energy.

Using Advanced Communication Bus (ACB), the newly developed bus system by D+H, window drives can now also be integrated directly into existing building automation. This way, windows open and close fully automatically depending on the weather and ambient air conditions. Would you like to learn how this works, accurate to the percent, synchronously or also completely individualised? If so, then this brochure is right for you.

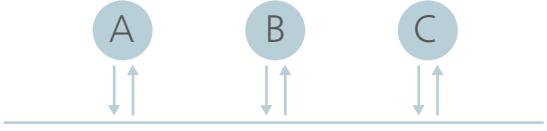


Content

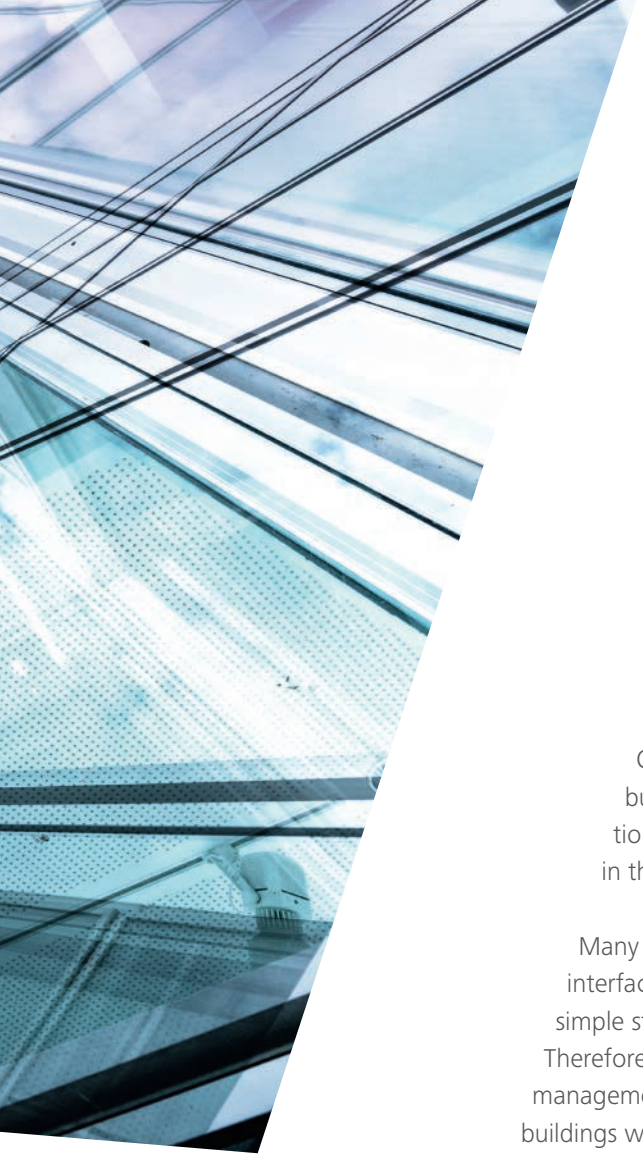
What is a bus system?

Generally speaking, the term "bus" in information technology refers to a system for transmitting data between multiple nodes in a network using a shared transmission path. Today, there are all different kinds of bus systems, such as in cars (CAN bus) or in smart homes (KNX, LON, BACnet etc.). In most cases, the most important nodes in a smoke vent and ventilation network are a building management system, the window drives and, if necessary, the control panels.

Protocols are used as transmission paths in order to meet the requirements for system-internal, secure and stable communication. These protocols can be transported both via radio signal or via cable. Through a predetermined kind of information exchange to one of these protocols, the individual devices can "talk with each other", i.e. exchange information – in other words, "bus communication". ACB drives are only able to be operated in ventilation mode using the building management system. The use of smoke vent (SHEV) functions like high speed requires that they are integrated into the D+H digital smoke vent control panel.



Multiple nodes – One transmission path



Modbus: The English behind the transmission protocols

Over time, a wide variety of transmission systems have been developed by various manufacturers. On an international level, though, only some of these systems meet recognised standards. One of the protocols that meets international standards is Modbus RTU. It is an indispensable element in industrial communication, but it has also arrived on the scene in international markets in the "living" sector.

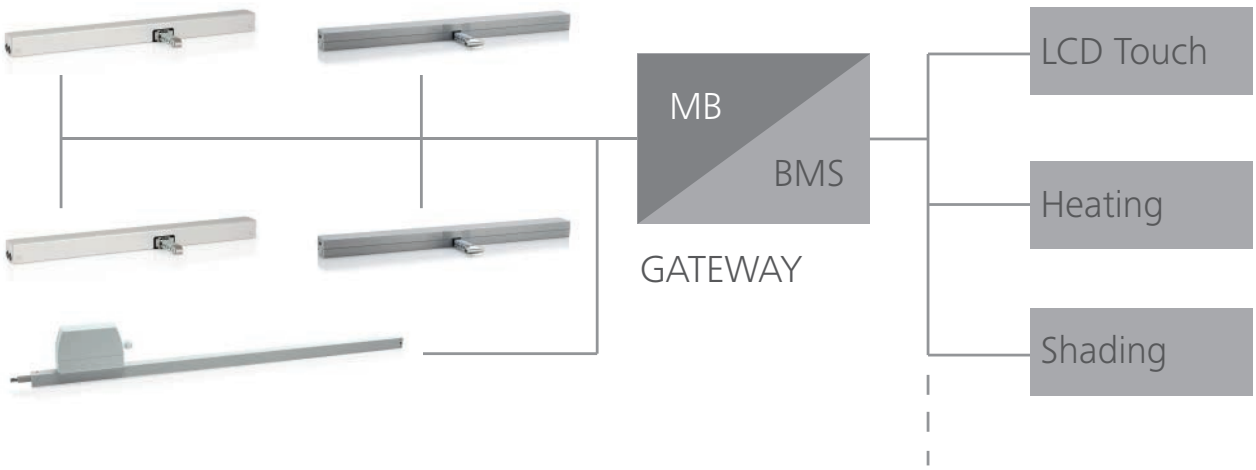
Many applications and devices are equipped with a Modbus interface. Modbus is easy to integrate thanks to its relatively simple structure and is highly stable compared to other systems. Therefore, it is a language that is ideally suited for building management systems. Gateways, as they are called, are used in buildings where other bus systems, such as BACnet or KNX, take over control of all technical functions. They translate the other information languages into the common Modbus protocol – in that respect, there is no language that Modbus cannot speak. You could say that Modbus is the English, that is, the universal language of transmission protocols.

Based on the advantages of this system, D+H decided to structure their ACB technology around the open Modbus RTU protocol. This means that every planner has the option to integrate ventilation elements into almost any building system. And every manufacturer around the world can conveniently equip their products with Modbus. No matter whether they are controllers, gateways, sensors or touch displays, all devices communicate over an open interface. Therefore, all ventilation commands for D+H ACB components are also freely accessible using the ACB planning manual.

Find the planning manual here

Modbus RTU – A technical look

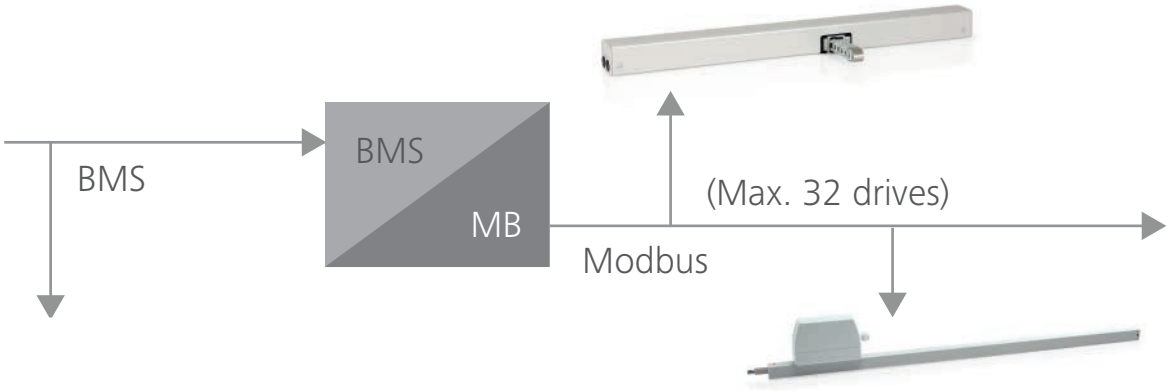
The RTU after Modbus stands for Remote Terminal Unit. Why remote? This relates to the master/slave architecture of the Modbus RTU protocol. It works as follows: A device, such as the building management system, a computer or a touch display, takes over the master management function and sends instructions to the "remote" slave – for example, a D+H drive. This drive receives the signal and executes the instruction.



Correct and reliable planning

For project planning, it is important right at the start to know how many windows and thus how many drives are required for the project. The number of Modbus slave drives per Modbus master is limited to 32 nodes. This ensures virtually delay-free drive communication.

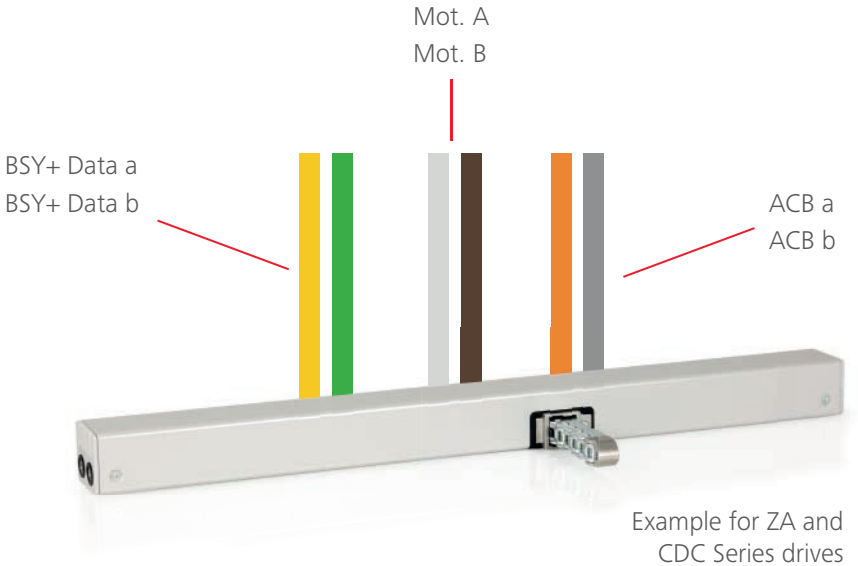
The reason for the limitation of the number of drives is the maximum cable length in the Modbus system of 200 m. Since each drive has connection power of approx. 2 m, this adds up to 64 m of cable length for 32 drives. This means that there is a length of 136 m remaining. However, at an average distance of 4 m between two windows, a further 128 m (4 m x 32 m) is added to that 64 m, which together comes out to a cable length of nearly 200 m.



Up to 32 drives can be connected
to a single Modbus master.

How are the ACB drives cabled?

After the number of drives is planned out and the number of the required Modbus masters is known, cabling can then be planned. In principle, the following connections are required for ACB drives: The data connection to the Modbus as well as a supply for the drives with 24 V DC or 230 V AC.

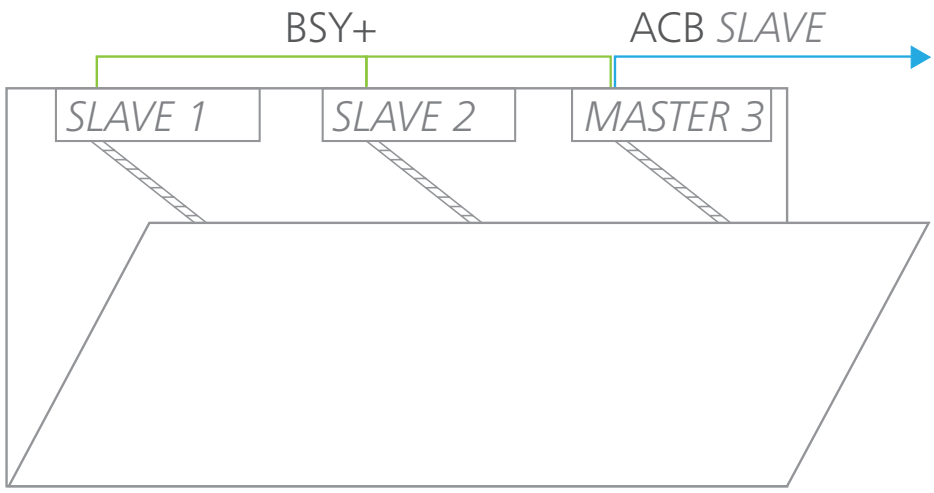


Example for ZA and CDC Series drives

The building management system directly controls the window drives.

Synchronisation of multiple window drives

If windows are to be equipped with more than one drive, this is made possible thanks to the synchronisation of multiple drives on a single sash. To do so, they are connected with one another using BSY+ technology, developed by D+H. There is a BSY+ master drive within the synchronised drives. This is controlled via ACB and then distributes the signals to the BSY+ nodes.



The 24 volt supply voltage

The PS-S1-20 and PS-S1-40 power supply units from D+H are best suited for the supply of 24 volts. These compact switching power supply units provide a perfectly smoothed and stabilised DC voltage of 24 volts. Output currents of both 20 amperes and 40 amperes are available.

These power supply units are used for the decentralized supply of the drives. Supplying all drives centrally from a single point is not necessary. Rather, it is useful to keep the paths as short as possible and situate the supply nearby in order to keep the cable cross-sections, and thus also the costs, as low as possible.

The maximum drive current per cable is important for the cable calculation. For this purpose, it is necessary to know the current for each drive:

Drive	**Current consumption**
ZA[1] Series	0.5 A - 1.4 A
CDC Series	0.6 A - 1.0 A
VCD Series	0.35 A

For [1]: The high-speed version of the ZA-1-ACB is not considered, since it is not used for SHEV purposes. The speed in ventilation mode is limited to 7mm/s.

Sample calculation: Which power supply unit do you need to supply your window drives?

Let's assume that 20 windows, each with three "CDC-0252-800-ACB" chain drives, need to be controlled in your building. You can see from the table above that the maximum current consumption is 1 A for each of these window drives. In this case, for 20 windows with three drives each, the total current consumption would be 60 A.

For a single **20 A power supply unit,** this results in the following calculation:

$$\frac{20\ \text{A}}{3\ \text{A}} = 6.6 \text{ windows per power supply unit}$$

The result is a utilisation of 6 windows (18 drives) per 20 A power supply unit. If you are using 20 A power supply units, this means that for your requirements of 20 windows, each with three window drives, you will need four 20 A power supply units.

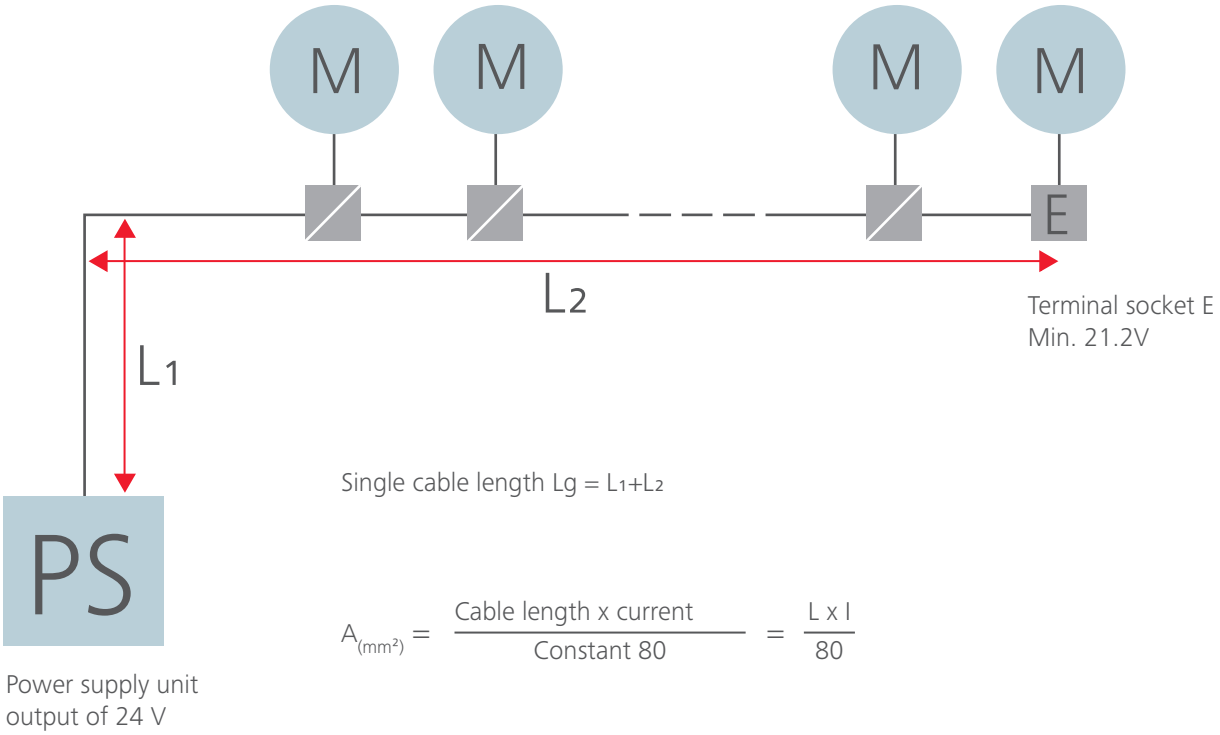
Using a **40 A power supply unit,** the calculation works out to the following:

$$\frac{40\ \text{A}}{3\ \text{A}} = 13.3 \text{ windows per power supply unit}$$

The result is a utilisation of 13 windows (39 drives) per 40 A power supply unit. If you are using 40 A power supply units, this means that for your requirements of 20 windows, each with three window drives, you will need two 40 A power supply units.

The 24 V cable calculation

The cable calculation is selected according to the familiar formula:



Single cable length $Lg = L_1 + L_2$

$$A_{(mm^2)} = \frac{\text{Cable length x current}}{\text{Constant 80}} = \frac{L \times I}{80}$$

Total current	1	2	3	4	5	6	7	8	9	10	A
3 x 1.5 mm²	120	60	40	30	24	20	17	15	13	12	m
3 x 2.5 mm²	200	100	65	50	40	33	28	25	22	20	m
* 5 x 2.5 mm²	400	200	130	100	80	65	56	50	44	40	m
** 7 x 2.5 mm²	600	300	200	150	120	100	85	75	67	60	m

* Connect 2 wires per drive line in parallel.

** Connect 3 wires per drive line in parallel.

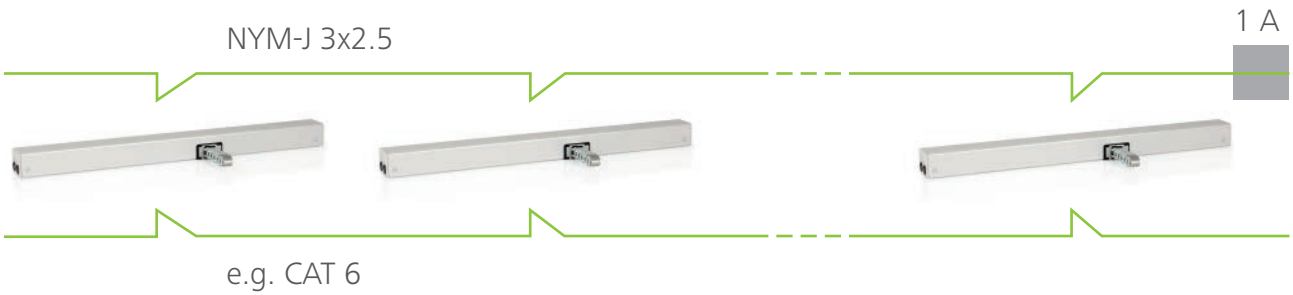
The protective earth must not be connected!

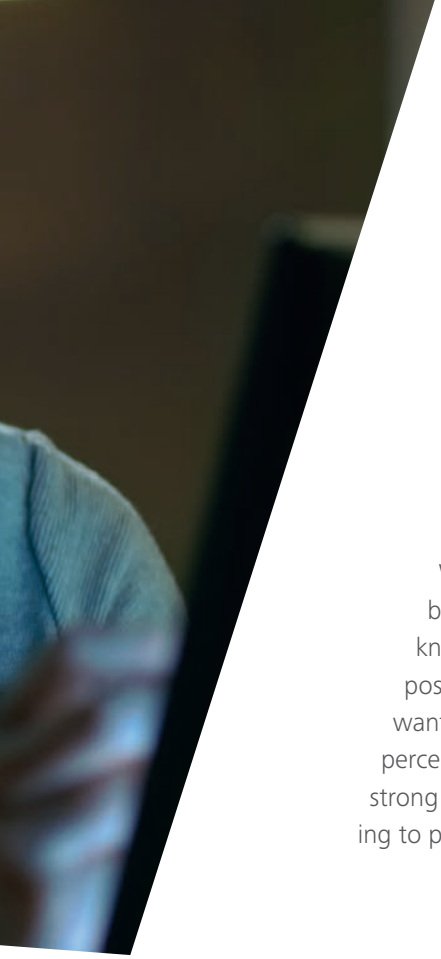
The 230 volt supply voltage

Cabling of 230 volts proves to be very straightforward, since a pure parallel connection of all drives to a 10 A fuse (B-characteristic) can be made here.

In 230 V systems, a separate cable for voltage and data must be used. For example, here, the Y(st)Y cable type is suitable. The bus wires are connected using a two-wire cable. Shielding is not absolutely necessary, but may often be useful. Therefore, a CAT cable is especially well-suited for the cabling (STP or USTP).

Topologically, the drives must be arranged in a line, with spur lines no longer than 15 m. The maximum length of a network should not exceed 200 m.





Programming made easy

We have explained how ACB drives for ventilation purposes can be controlled directly by the building automation. But did you know that this control can be highly precise? Control with perfect positioning is an aspect of the programming. In summer, do you want the window to create a small gap by opening up only 12.9 percent? Or would you rather have an 80 percent opening for a strong breeze to air out the building? You can find all details relating to programming in the D+H planning manual.

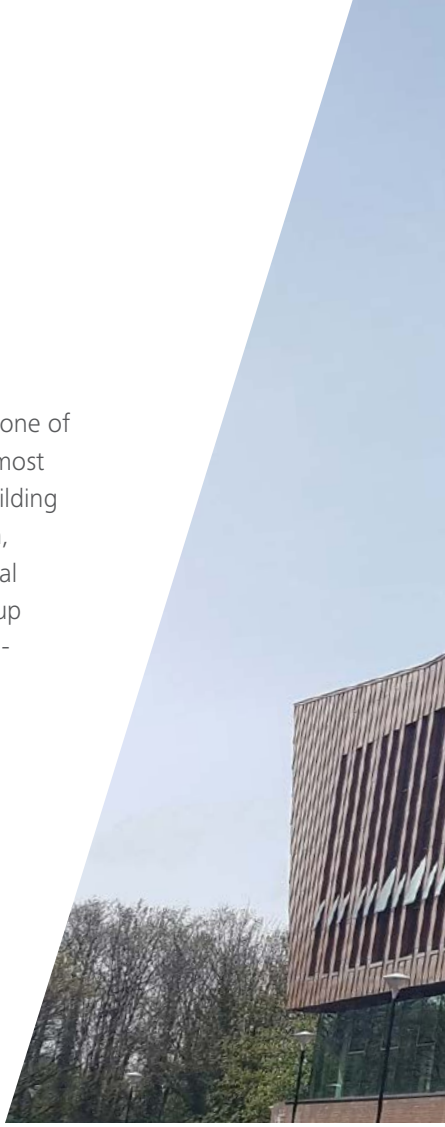
ACB drives: Excellence through innovation

Supply voltage:	24 V DC or 230 V AC
Available drives:	ZA Series, CDC Series, VCD Series, as well as all BSY+ drives by using the BSY+/ACB converter
Technology:	Modbus RTU
Maximum nodes:	32 Modbus slaves per Modbus master
Synchronous groups:	Max. 7 BSY+ slaves + 1 BSY+ master = 1 Modbus slave
24V DC power supply unit:	20 A and 40 A
Cable:	Voltage- NYM, NYY and comparable, Data – 2 wire plus common, twisted, e.g. CAT 6
Ventilation application:	Max. 7mm/s running speed

Window automation in the Glucksman Library

The Glucksman Library at the University of Limerick is one of the largest campus libraries in Ireland, and one of the most digitally advanced in the world. In 2018, the existing building was expanded by a 7,600 square metre building addition, and it was also radically redesigned, from a quiet traditional reading and learning area to livelier, technology-driven group and community spaces. In order to enable a healthy, concentrated work atmosphere, Irish D+H partner Window & Door Accessories took over the installation and commissioning of a window automation system.

The project consists of 246 CDC-1-ACB 24 V chain drives that are operated directly by the building management system via Modbus. The building management system is able to control each window with perfect positioning, either individually or in groups, using the ACB technology. The opening and closing speeds of the drives can also be regulated separately. Thanks to their barely audible operating noise, D+H drives ensure a comfortable learning environment and an optimal indoor climate at all times.



Benefits as a result of integrating ACB

+ Direct control of the drives using the building management system
+ Individualised control of multiple drives on a single cable
+ Position control accurate down to the percent
+ Feedback about the ACTUAL position of the drives
+ Optimal display of possible error messages
+ Fewer cables and lower wiring effort thanks to bi-directional communication

Architect: RKD Architects
Completion: 2018

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