

ABB i-bus® KNX Application Manual Shutter Control

Description of the symbols:

 Sample

 Note

 Tip

 Disadvantage

 Advantage

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General

ABB i-bus® KNX systems offer an attractive solution which fulfils the highest standards in residential, commercial and public buildings. Quality of living, comfort and safety can be easily combined with cost-effectiveness and environmental awareness using ABB i-bus® KNX systems.

The ABB i-bus® KNX products cover the entire range of applications in buildings: from illumination and blind control to heating, ventilation, energy management, security and surveillance. These demands can be realised cost-effectively with minimal planning and installation effort using the ABB i-bus®. Furthermore, the flexible usage of rooms and the continuous adaptation to changing requirements are simple to realise.

Important for the realisation of the elevated demands of building users is however, professional and detailed planning. This application manual – from practical application for practical usage – is intended to assist simpler planning and implementation of a project.

Planning of a project

One of the main considerations when planning a building control with the ABB i-bus® KNX is whether the actuators for the circuits are installed on a centralised or distributed basis.

Central installation

In smaller properties, houses or apartments, all wiring to consumers can be brought to a central point.



A central installation is more transparent, fewer ABB i-bus® KNX components are required and the cost per channel is lower.



A central installation requires more wiring effort and expense.

Distributed installation

In a distributed installation the devices are installed in the vicinity of the load.



A distributed installation requires less wiring effort on the load end.



A distributed installation significantly increases the cost per channel. The overall system can quickly lose transparency and devices may possibly be difficult to access. As the number of ABB i-bus® KNX devices increases with a distributed installation, the programming effort also increases. Additional power supplies and couplers may be necessary, which will also increase costs.

Preface/General

Conclusion

During planning, it is increasingly significant to consider the constructive features of a building. In practical use, a combination of central and distributed installation has proven to be useful. Distributed installation is not possible, for example, in a dwelling due to space considerations. For larger buildings, a central installation can mean a room, a hall or a floor, which still complies with a distributed installation in terms of the overall concept.

A further solution for a distributed, room-oriented application are the Room Controller RC/A x.2 and Room Master RM/S x.1 from ABB.

For further information refer to the Room Controller and Room Master product manual.

ABB i-bus® KNX application manual Shutter Control

All the possible circuit configurations are explained after a brief introduction in this application manual, e.g. operation from one or more points. The many application examples are complemented by information, tips, benefits and disadvantages which offer a quick and simple insight into the advantages of the different control functions, e.g. timer control, sensor-dependent control.

The selection possibilities of the individual control functions and their combination possibilities are very comprehensive. The checklist from ABB has proven to be very useful for simplification of the engineering involved.

A checklist template can be found in the Appendix.



The application manual is intended for persons who already have acquired basic knowledge in ABB i-bus® KNX (basic functions, topology, addressing, ...), e.g. in a certified ABB i-bus® KNX training session.

Introduction

1. Introduction

The control of motor drives is one of the main applications of the ABB i-bus® KNX.

The following applications can be operated with motor drives:

- Blinds with and without louvres, e.g. in commercial buildings such as offices, hospitals, schools
- Roller blinds, e.g. like in dwellings
- Electrically operated windows
- Skylights, e.g. in factory halls
- Electrically operated curtains
- Doors, e.g. garage doors
- Awnings
- Partitions
- Ventilation flaps

Up to now, only on-site operation of drives was possible in most cases. This makes the use of additional functions such as wind monitoring devices or central/group controls more difficult.

The implementation of such functions can only be undertaken with a lot of effort and was expensive for this reason. Implementation is not a problem with the ABB i-bus® KNX.

There is complete flexibility for the following :

- On-site control
- Group/central operation
- UP/DOWN functions
- STOP functions
- Louvre adjustment
- Move to position
- Safety monitoring, e.g. with weather sensors
- Timer control, e.g. with absence of the occupants
- Inhibiting/interlocking a drive
- Automatic function



Automatic shading should be implemented in a school so that lessons are not interrupted. However, darkening of each individual classroom must still be possible when required, e.g. when showing a film or beamer presentation.



Important preliminary considerations of such a project have proven useful for optimum planning of a project. This includes selection of the circuit and control functions.

Introduction

1.1. Selection of the required circuit and control functions

The blind and roller blind control with ABB i-bus® KNX is characterised by a high level of flexibility. This includes a large range of individual control functions and their combination possibilities.

The following functions are available:

Circuit design

- Switching from one or more positions
- Central and group switching

Control functions

- Timer control
 - Devices for implementing the function Time
 - Timer control combined with conditions
- Movement to positions
 - Automatic function
 - Realisation with standard drives
- Sensor-dependent control
 - Weather
 - Temperature
 - Sun position

2. Circuit design

To plan a useful circuit design, the different circuit configurations must be reviewed in the preliminary considerations and then selected appropriately:

- Switching of one or more positions
- Central and group switching

2.1. Switching of one or more positions

Even with the use of intelligent electrical installation systems such as ABB i-bus® KNX, the basic functions for every application with blind actuators incorporate local operation of one or more drives using push buttons. These are generally tried-and-tested and proven in practice.



The blinds in a conference room should be moved as required. One or more drives are operated using a local button.

The following principle has proven itself in practice:

- Long button push: the blind moves UP, a logical 0 is sent, or DOWN and a logical 1 is sent (1 bit telegram).
- Short button push: the blind stops (1 bit telegram).
- Repeated short button push after the STOP telegram: the blind moves in steps or the louvers are adjusted.

The operating principle can be implemented with ABB i-bus® KNX bus push buttons or with conventional push buttons in conjunction with a binary input.

2.1.1. ABB i-bus® KNX push buttons

With this solution, the functions are implemented with both sides of the ABB i-bus® KNX push button, i.e. one end is used for UP and the other is used for DOWN. Both ends enable the STOP function and the louvre adjustment.

Circuit design

2.1.2 Conventional push buttons with binary input

If a Binary Input is used, e.g. US/U x.x or BE/S x.x, it is possible to operate with just a single input and one push button. Here an alternate long button push operates the UP/DOWN function and a short button push the STOP function or louvre adjustment.



Only one channel and push button are required. The parameterisation offers a high level of flexibility. You can also connect (rotary) switches.

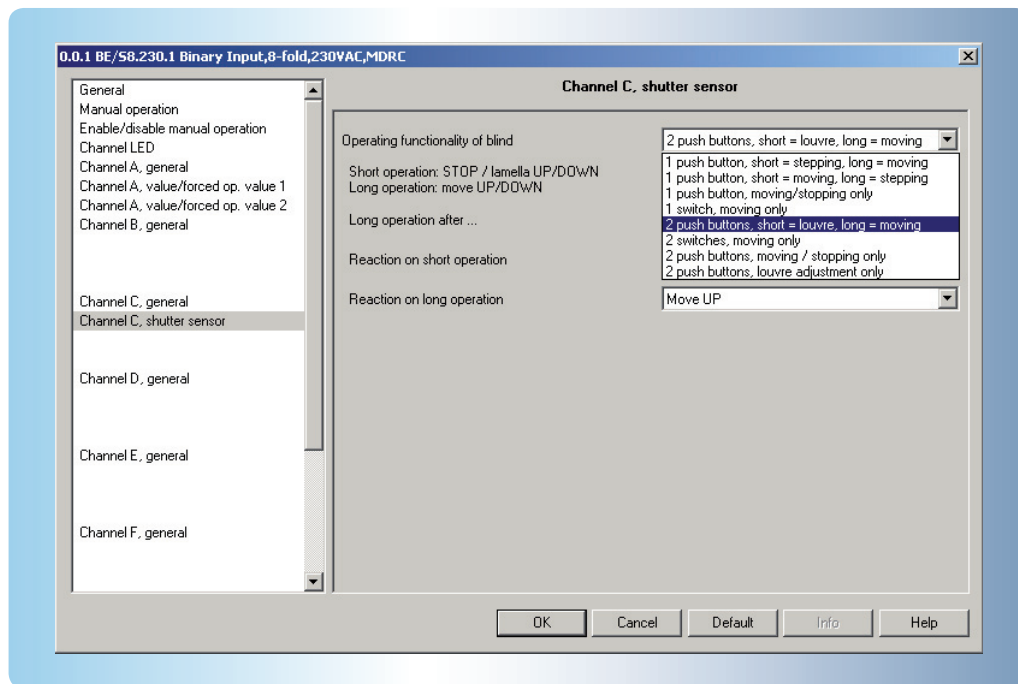


Fig. 1: Parameter window Shutter sensor of the binary input



If the blind is in the middle position, it is not clear beforehand the direction in which the blind will move after a long button push. This type of operation is unconventional for blinds.



- Sending a 1 bit telegram with the value 0 for UP, or the value 1 for DOWN is defined in the ABB i-bus® KNX and should be observed with central telegrams.
- The assignment of the functions for short and long operation as described above has proven useful in practice. The functions can be swapped as both telegrams are 1 bit telegrams.
- The functions behind the short and long operation can be assigned on two different push buttons. This is not implemented for economy reasons with room buttons (double the number of push buttons), but is frequently used in control panels or LCD displays.
- The group addresses of these functions, move UP/DOWN, STOP or louvre adjustment are different!

Circuit design

2.1.3. Drive control

The drives are controlled by a changeover contact in the blind actuator. The corresponding winding in the drive is controlled to comply with the direction of motion. It is not possible to activate both drive windings simultaneously. This would cause the destruction of the drive.

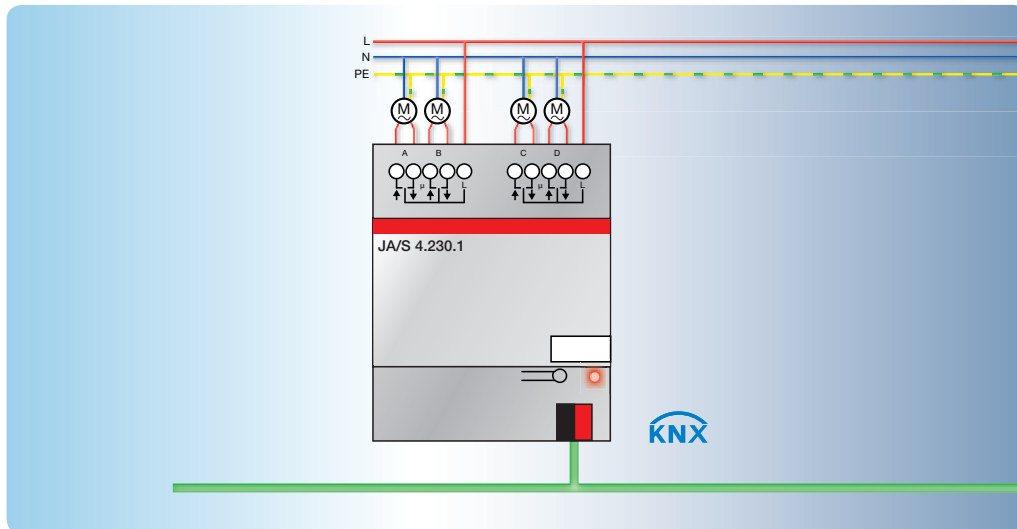


Fig. 2: Connection schematic ABB i-bus® KNX Shutter Actuator JA/S 4.230.1

There are conventional actuators which can be programmed as a Switch Actuator or a Shutter Actuator. When used as a blind output, two relays are used which are mutually exclusive using software. A mechanical interlock is not available which in the most unfavourable cases, e.g. with a software problem, can cause damage to the motor.

In the parameters of the Shutter Actuators, e.g. MDRC devices JA/S x.x or modules of the Room Controller JA/M 2.x.1, it is still possible to make every channel a switch channel. Here, only one end of the changeover contact is used, see Fig. 3. The number of parameters is reduced using software so that it fits classical switching functions, e.g. ventilation flaps or lights.

Circuit design

The following circuit shows the switch actuator function using the ventilation flap connection as an example:

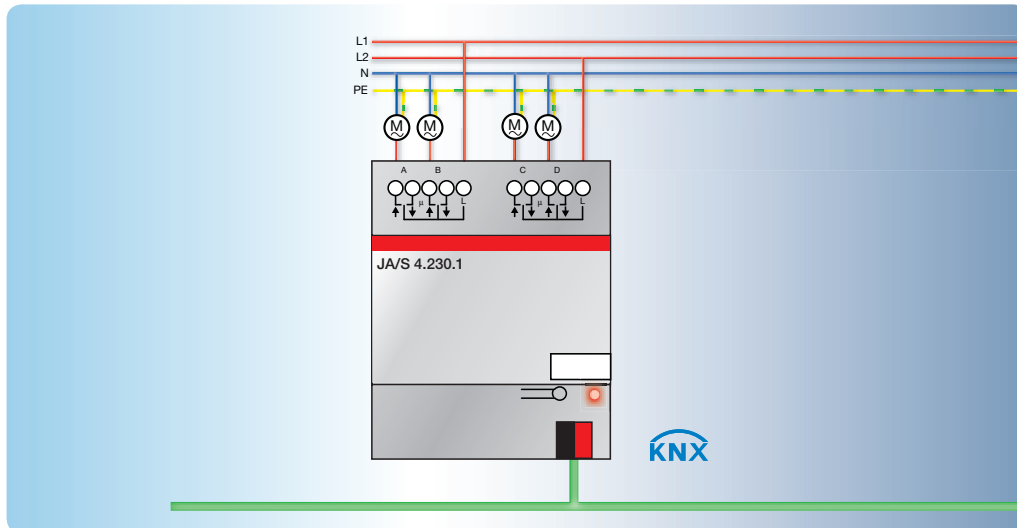


Fig. 3: Connection schematic ABB i-bus® KNX Shutter Actuator JA/S 4.230.1 with switch actuator/ventilation flap function

The shutter actuators have 6 A relays installed which are practically always sufficient for the drives which are to be connected.



Unlike switch actuators and lamps, several loads (drives) will not be connected in parallel to the channels of the shutter actuators. If a drive was still operating and the other was already in its end position and switched off via an end limit switch, reverse voltage will occur on the drive with a danger of damage.



If this type of installation is still demanded, operation with isolating relays is required.

For further information see **Parallel connection of several drives, chapter 2.1.3.4.**

Circuit design

2.1.3.1. DC drives

In addition to 230 V AC drives, there are also DC drives. Their area of application is with electrically operated windows and internal blinds.

On DC drives, the direction of operation is reversed by changing the polarity on the drive.

In principle, the respective actuators function exactly as with the AC drives, see Fig. 4.

The application software is also the same.

The DC voltage supply is applied externally. The shutter actuator permits a voltage between 12 and 48 V.

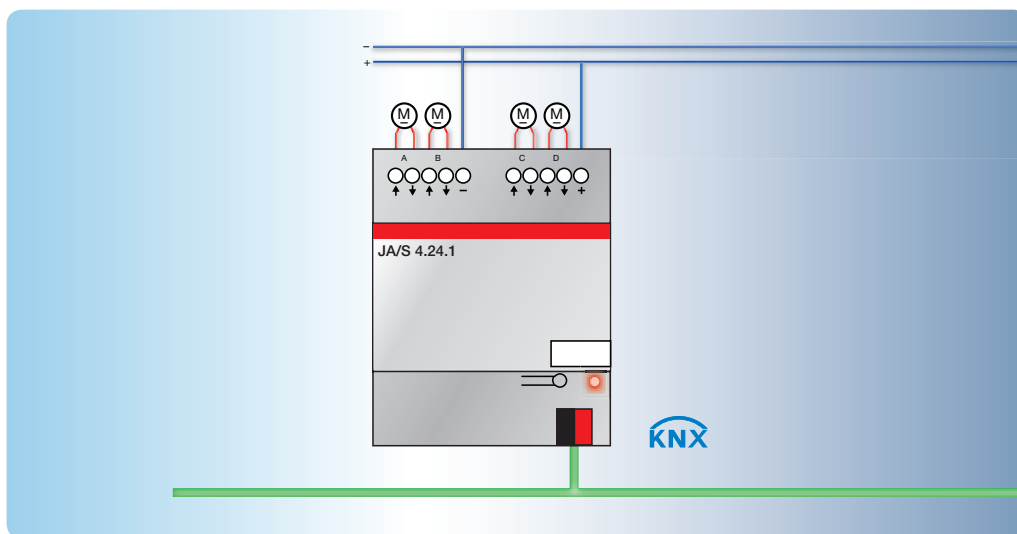


Fig. 4: Connection schematic ABB Shutter Actuator JA/S 4.24.1 with DC motors

2.1.3.2. Reversal time or Pause on change in direction

An important parameter in the shutter actuators is the so-called reversal time. It defines how long the drive remains stationary when moving in one direction after a telegram to move in the other direction is received.



This time is important for the protection of the motor or the connected mechanical components. The default value is 500 ms and should be corrected if necessary after consulting the manufacturer of the drive.

Circuit design

2.1.3.3. End limit stop

Blind drives feature an end limit stop in the housing. If the drive reaches the end position at the top or bottom and with closed or opened windows, the drive must be stopped. The drive is disconnected from the voltage supply. This is achieved using end limit switches. There are two possibilities for an end limit stop:

- Mechanical end limit switches
- End limit stop via overcurrent or undercurrent

Mechanical end limit switches

The drive operates the blind until the respective end limit position is reached. The circuit is interrupted here.

End limit stop via overcurrent or undercurrent

With an end limit stop initiated by overcurrent or undercurrent, the drive moves to the respective end position and is mechanically blocked. The resulting increase (drive in upper end position) or reduction in current (drive in lower end position) is detected and switch off is initiated.



The motor also switches off when an obstacle is detected.



The drive and the shutters to be controlled must be matched to one another, i.e. correctly configured. Otherwise the drive will not operate correctly, i.e. the shutter may stop in the middle or too late in the end position. This can damage the shutter.



To guarantee an exact position feedback of the shutters, (also refer to chapter 3.2 Positioning) the travel time of the shutter must be entered for the Shutter Actuator in the application. After the travel time has elapsed, the changeover contact is switched to a no-voltage state. Using a further parameter, the time for shut down can be selected to be longer than the real run time, ensuring the drive reaches the end positions even under unfavourable conditions. End limit position switch off is mandatory. The isolation of the relay in the Shutter Actuator is only an additional protective measure.

Circuit design

2.1.3.4. Parallel connection of several drives

Normally only one drive is connected per channel, otherwise reverse voltages may occur with the parallel connection of several drives to a channel.

Background:

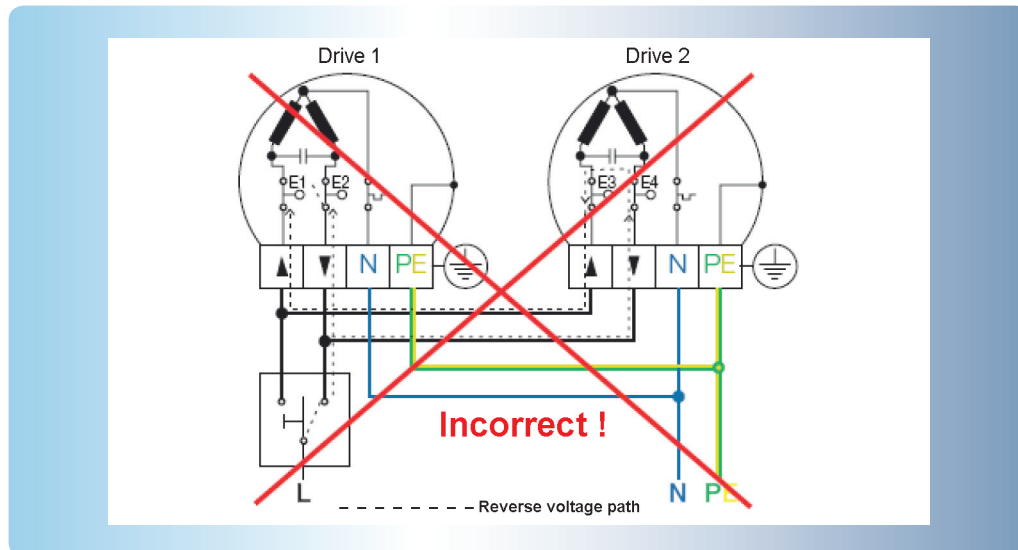


Fig. 5: Source: Berker

Both drives are controlled in the same direction of operation when the switch is actuated. When drive 1 has reached the end position, end position switch E2 opens. Drive 2 is still in operation and puts drive 1 back into operation moving in the opposite direction via a reverse voltage on its capacitor. Thus E2 is closed again after a short time. As a result, drive 1 again operates in the original direction of motion until contact E2 is reopened. These switching processes can be recognised by oscillation of the blinds.

As the reverse voltage can be up to 1000 V and many changes of direction occur over a short time, end position switch E2 is overloaded. This irrevocably leads to welding of the contacts.

Accordingly the end limit stop is put out of operation in this direction of movement.

The result: destruction of the motor and/or the blind.

Should parallel installation be required however, it can be implemented in two ways:

- Use of isolating relays
- Shutter Actuator JA/S 2.230.1

Use of isolating relays

Isolating relays are used between the motors and the changeover contacts of the Shutter Actuator and electrically isolate the motors from one another, so that there are no problems caused by reverse voltages.



There is increased installation and wiring effort which leads to higher costs.

Circuit design

Shutter Actuator JA/S 2.230.1

One exception is the use of the Shutter Actuator JA/S 2.230.1. It allows for the connection of two drives to a single channel. These are of course internally isolated by an isolating relay.

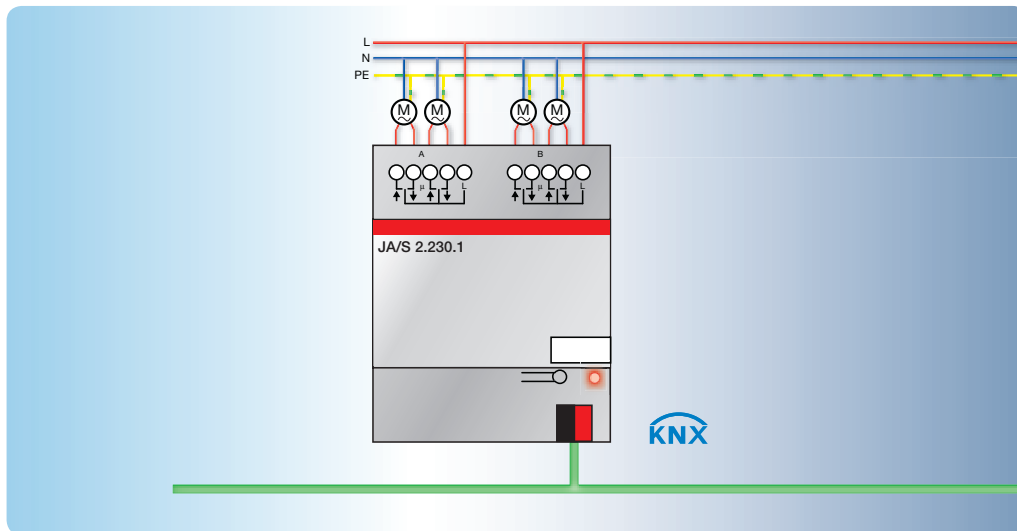


Fig. 6



Both drives on channel A or B run in parallel and cannot be operated separately. This fact must be considered in the planning stage.



This solution is often used to save costs.



An alternative here is the use of the Shutter Actuator RA/S 4.230.1, a 4-channel device.

The difference to the other Shutter Actuators is the reduced software functionality features:

- UP/DOWN
- STOP
- Louvre adjustment
- Wind monitor function

The price of the 2 x 2-fold Shutter Actuator JA/S 2.230.1 and the Shutter Actuator RA/S 4.230.1 is practically the same.

Circuit design

2.1.4. Bus voltage failure, bus voltage recovery, programming

To prevent uncontrolled movement or stopping at bus voltage failure, bus voltage recovery or programming, there are many setting options in the ETS with the Shutter Actuator JA/S x.x and with the Shutter Actuator Module of the Room Controller.

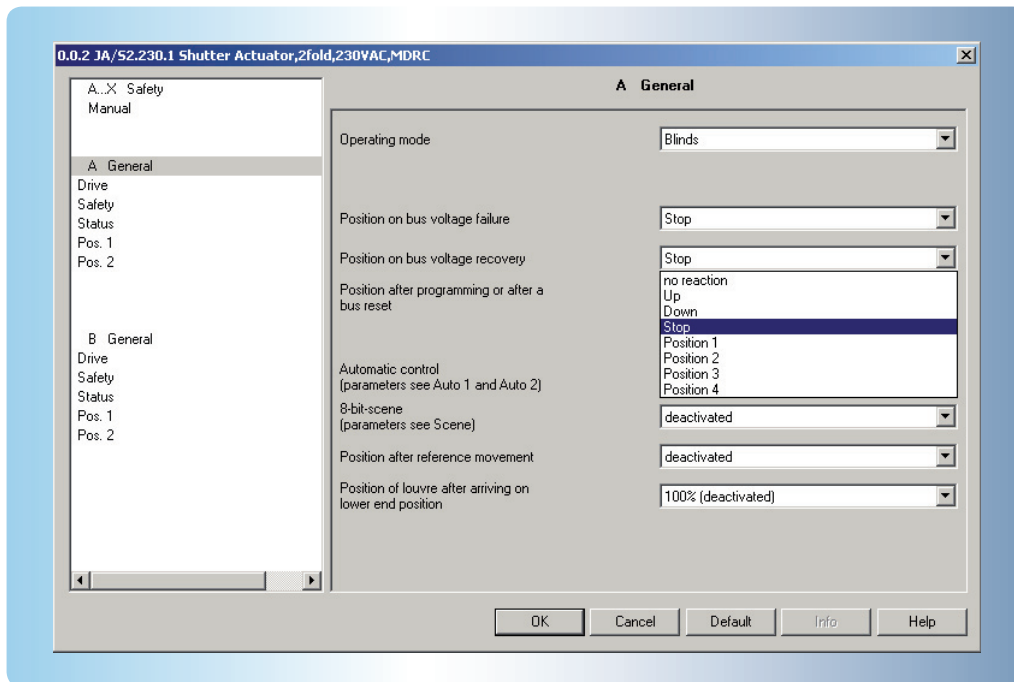


Fig. 7

No reaction here means that this telegram is executed up until the end, e.g. when the drive is operating.

No position can be set with bus voltage failure.

2.1.4.1. Status messages

Unlike switchable illumination (simply ON or OFF), the motion of drives is a dynamic process. Therefore it is frequently interesting to receive status messages with blinds. The following messages are available for each channel:

- Position (blind height and position of the louvres, each are a 1 byte telegram)
- End limit position reached (1 bit, both for top or bottom)
- Manual operation

Additionally, a status byte is available, which will inform you whether functions Automatic or Safety are present.

Circuit design

Standard Motor Interface (SMI)

With the use of conventionally available Shutter Actuators and drives, it is not possible to receive feedback messages directly from the drive, e.g. the position or faults.

This fact changes with the use of intelligent drives which can communicate with the actuator.

A standard for this approach is characterised by the use of the Standard Motor Interface (SMI).

ABB already has a ABB i-bus® KNX Shutter Actuator for SMI motors, the JA/S 4.SMI.1M.

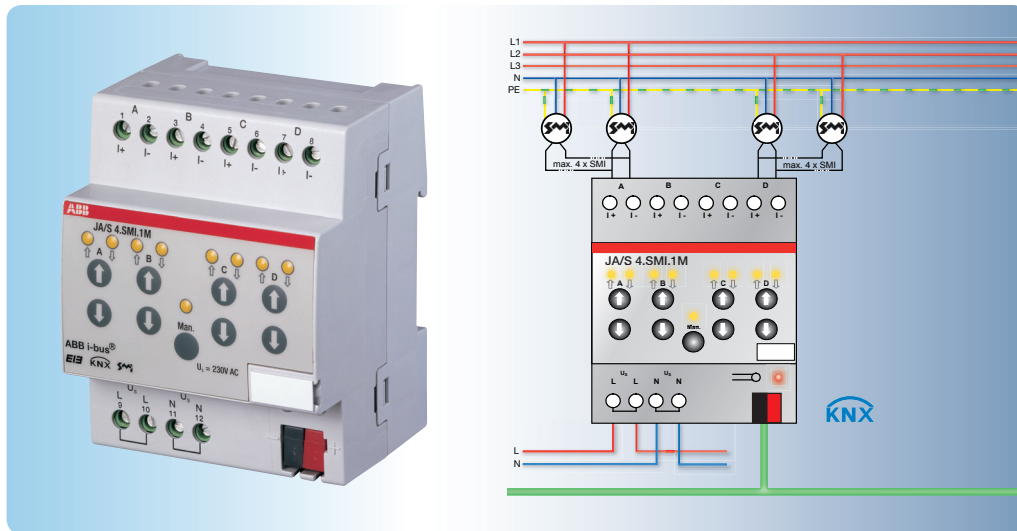


Fig. 8: Shutter Actuator JA/S 4.SMI.1M and connection schematic

For further information see www.smi-group.com and manual JA/S 4.SMI.1M

Circuit design

2.2 Group and central circuits

A very important function of the ABB i-bus® KNX systems is the realisation of group and central circuits. Here the complete building, a floor, or an area composed of a combination of functions can be switched from one or more locations. Using conventional methods, the realisation would require considerable additional installation time and expense. Using the ABB i-bus® KNX this is simply possible using the respective programming.



1. In a dwelling, all roller blinds in the living room, all drives on the ground floor as well as all roller blinds in the house can be controlled via push buttons.
2. The shading of an office building is retracted every evening; the facade of the building has a uniform appearance.
3. The caretaker of a school can centrally raise or lower the shading of each individual classroom using a visualisation system.

With a central telegram for drives, a separate push button is configured for both UP/DOWN telegrams. A TOGGLE push button is not useful here, as it is unclear which telegram is executed next. A free field of vision to the shading may also not exist.

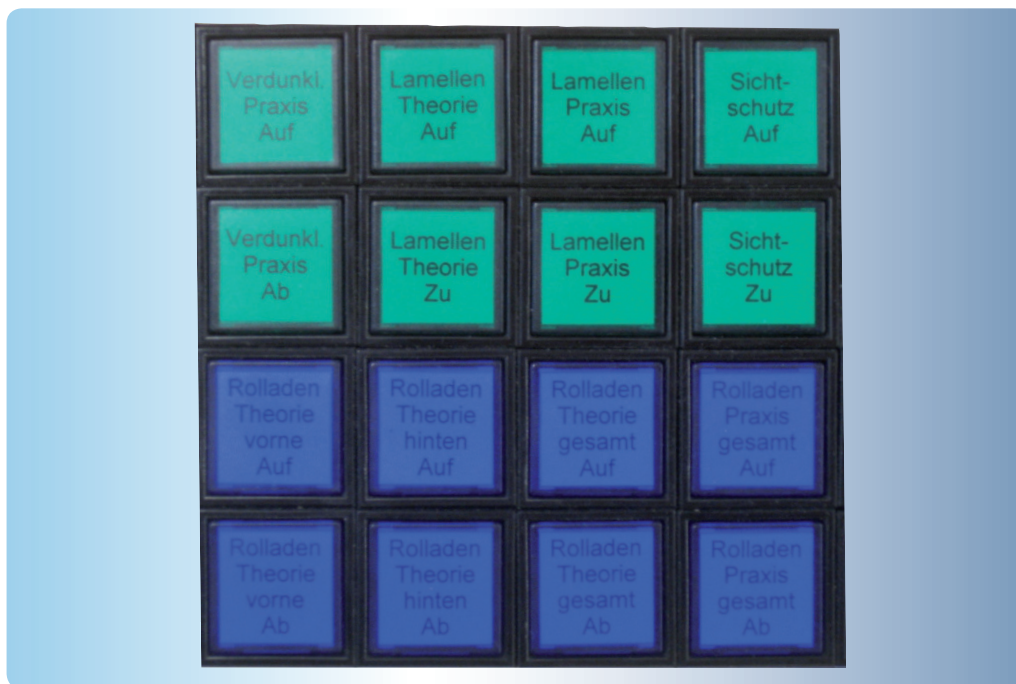


Fig. 9: Push button for shading on the control panel of the Edison training room at ABB

If all external blinds are open, and all internal curtains are to close simultaneously in an office building via a central telegram, a group address with logical 0 for *Open blinds* and a logical 1 for *Close blinds* must be sent.

There are different possibilities available for implementation:

- Move the Shutter Actuator via the Position function, see chapter 3.2 Positions
- By inverting the value of a group address, e.g. with the Logic Module LM/S 1.1 or Application Unit ABL/S 2.1
- By sending two group addresses with a push button

Circuit design

2.2.1. Sending two group addresses

Sending two group addresses is possible, when a group address is sent on the rising edge, when a push button is pressed as well as on the falling edge when the push button is released. Both addresses can contain different values.

Devices already featuring this capability are the Binary Inputs BE/S x.x.

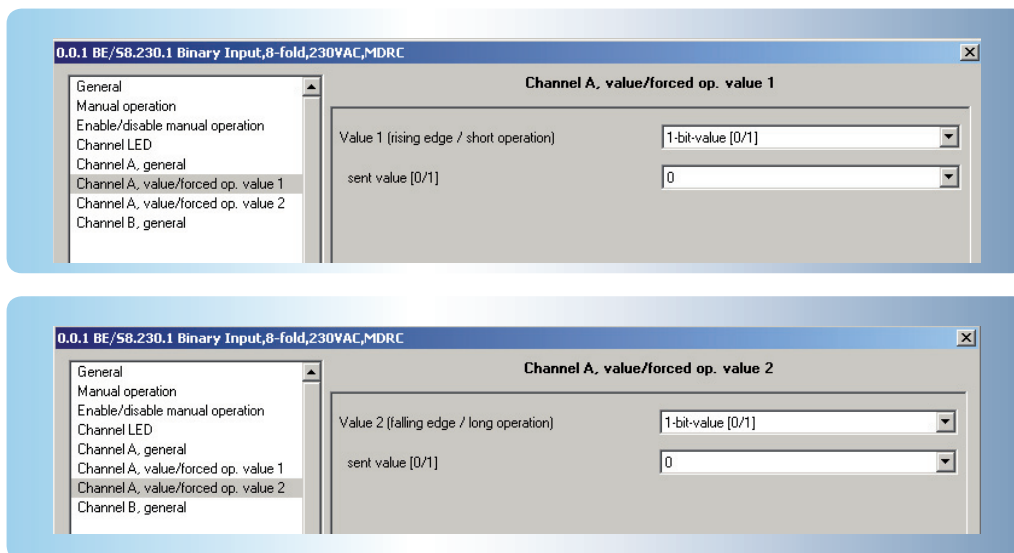
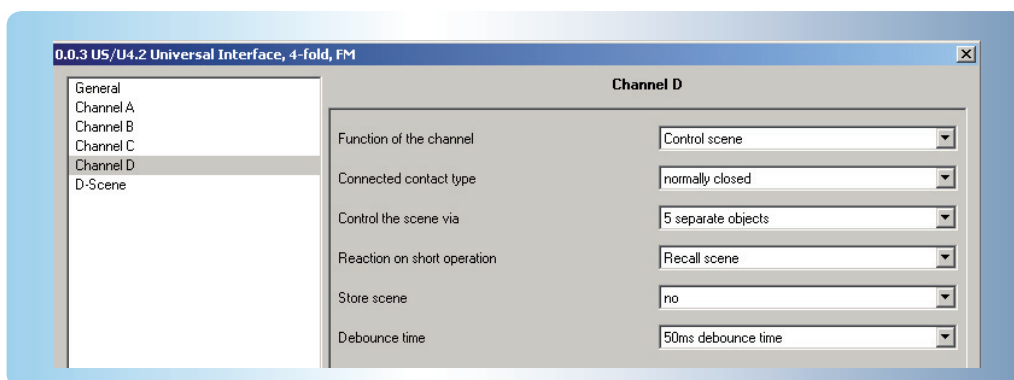


Fig. 10: Parameter settings of the binary input

The Busch-*triton*® switch sensor or the inputs (e.g. BE/S x.x and US/U x.2) with the function 1 bit light scene also enable this function, where two actuator group types use 1 bit with the presetting ON or OFF. Further information about the function Scene can be found in the application manual Lighting.



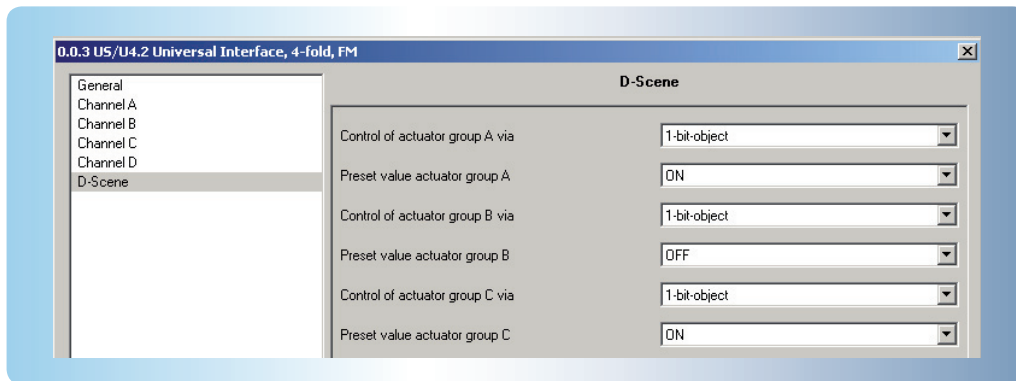


Fig. 11: Parameter settings of the Universal Interface US/S x.2

2.2.2. Central telegram and status feedback

The description of the available status messages with Shutter Actuators are described in chapter 2.1.4.1 Status messages. It is important to observe the telegram traffic caused by status feedback messages of the individual drives during the implementation of a central group address.



In an office building with twin-face-facade, all windows are electrically operated via the ABB i-bus® KNX. This telegram is implemented via a visualisation system. All drives practically move at the same time and report by telegram when they have reached their final positions, e.g. closed, not closed, maybe their position also. This is also shown in the visualisation UP, DOWN, system.
A corresponding communication object is available in the Shutter Actuators JA/S x.x. The consequence is that the quantity of both line and area telegrams will dramatically increase on the bus.



This approach will lead to an increased bus load and may even cause an overload which will result in the loss of data where the states of the windows are not correctly represented.



In order to avoid a possible overload of the bus, the central telegram is staggered, e.g. telegram is implemented by storey or facade. Staggered sending is easily implemented with the Application Unit ABL/S 2.1.

Circuit design

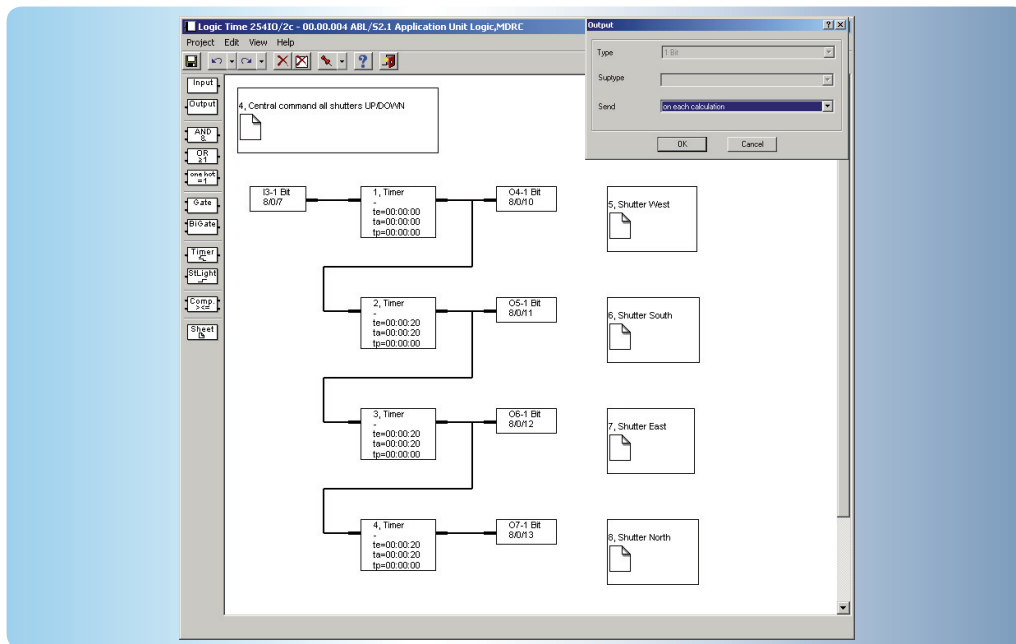


Fig. 12: Central blind control with Application Unit ABL/S 2.1

When triggering the telegram via the group address 8/0/7, the west facade moves first, followed 20 s later by the south facade, another 20 s later by the east facade and finally the north facade with a total delay of one minute. The can be subdivided even more if required with the objective of sending the feedback telegrams on the bus at different times.



The outputs should be parameterised so that a new value of the communication object sends this value. This ensures that if an identical motion telegram is received a number of times, e.g. move UP, it will also be undertaken a number of times.

Control functions

3. Control functions

The following control functions are available to operate the shading, windows, skylights and awnings of a building as comfortably as possible:

- Timer control
- Movement to positions
- Sensor-dependent control
 - Weather-dependent control
 - Temperature dependent control
 - Sun position-dependent control

3.1. Timer control

Timer control is an interesting application for electric drives as it allows determined drives to be operated automatically as a time-dependent function. In addition to the classic possibilities offered by timer control, this may also be combined with different conditions.

3.1.1. Devices for implementation of the function Time

With a bus system such as the ABB i-bus® KNX it is easy to control the timer with a central time control clock.



1. In a dwelling the blinds should be raised every morning at 8 a.m. and lowered in the evening at 8 p.m.
2. In an office building the sun screen should be lowered in the evening after the office closes.



The switch actuators alone do not provide the possibility of switching at certain times. This would be too complex as each device would require its own timer (quartz).

Possible devices for realisation of a timer control are:

- Classic ABB i-bus® KNX clocks with 2 ... 4 channels
- LCD Display MT701
- Controlpanel and Busch-ComfortTouch® panels
- Application Unit ABZ/S 2.1 with application Times/Quantities
- Visualisation software

Control functions

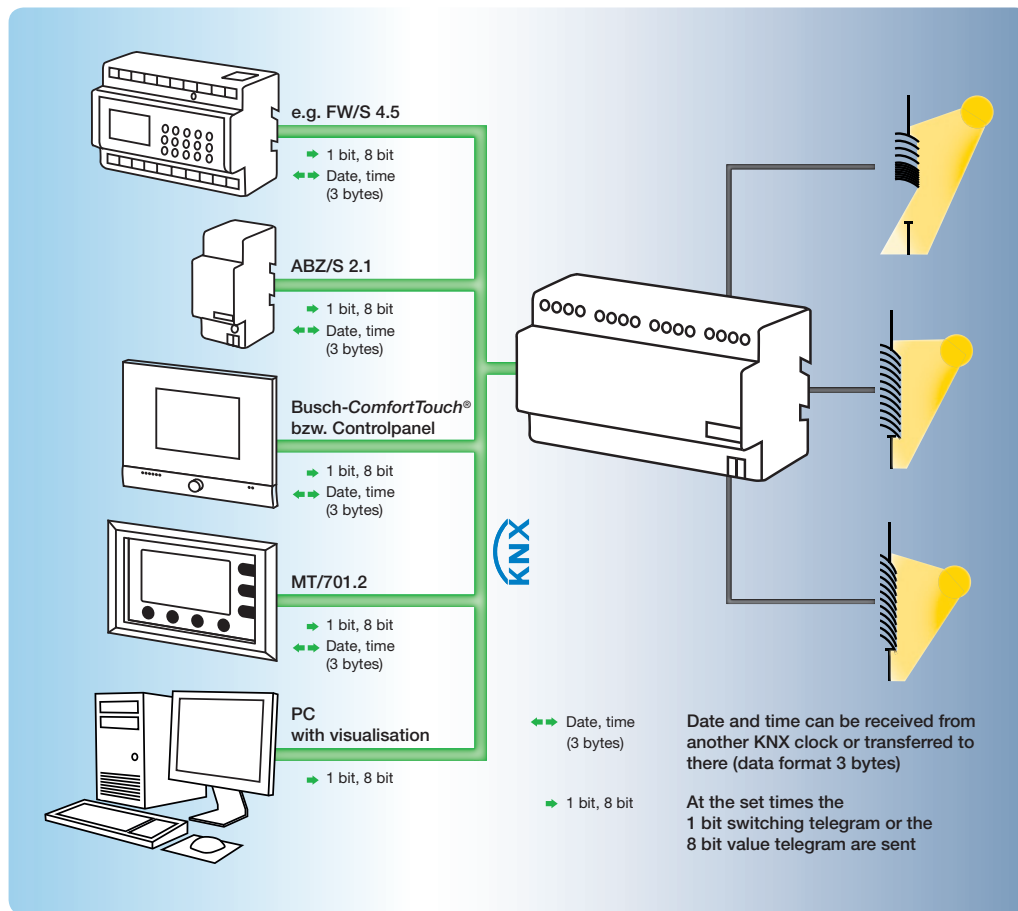


Fig. 13: Overview ABB i-bus® KNX devices with function Time

For further information see the application manual *Lighting and lighting control, Devices for implementation of the function Time*

3.1.2. Timer control combined with conditions

In addition to the timer control, linking to different conditions is possible:

- External brightness
- Presence of persons

These functions can be implemented with additional intelligence such as the Application Unit ABL/S 2.1 or the Logic Module LM/S 1.1. The functions Safety and Automatic are the exception, e.g. wind and rain. These already have a high priority in the Shutter Actuator and always have a higher priority for safety reasons. No external logic except the parameter settings in the Shutter Actuator is required.

For further information see chapter 3.3 Sensor-dependent controls

Control functions

3.1.2.1. Linking with external brightness



The blinds in a dwelling should be raised every morning at 8 a.m. and lowered in the evening at 8 p.m. The external brightness should also be considered. This means that the blinds open at 8 a.m. in the morning, provided that it is bright outside and close at 8 p.m. in the evening, provided that it is dark outside.

Solution with Application Unit ABL/S 2.1

For the closing movement, the operating push button with group address 0/0/3 enables the function with a logical 1. The clock and the Brightness sensor send a logical 1 in the evening.

The drive closes the blinds if both conditions are fulfilled; AND condition: dark and 8 p.m.



Logical 1 lowers, logical 0 raises the shutters. The timer only has the function of setting a 0 filter, i.e. a logical 0 and as a result the UP telegram is inhibited.

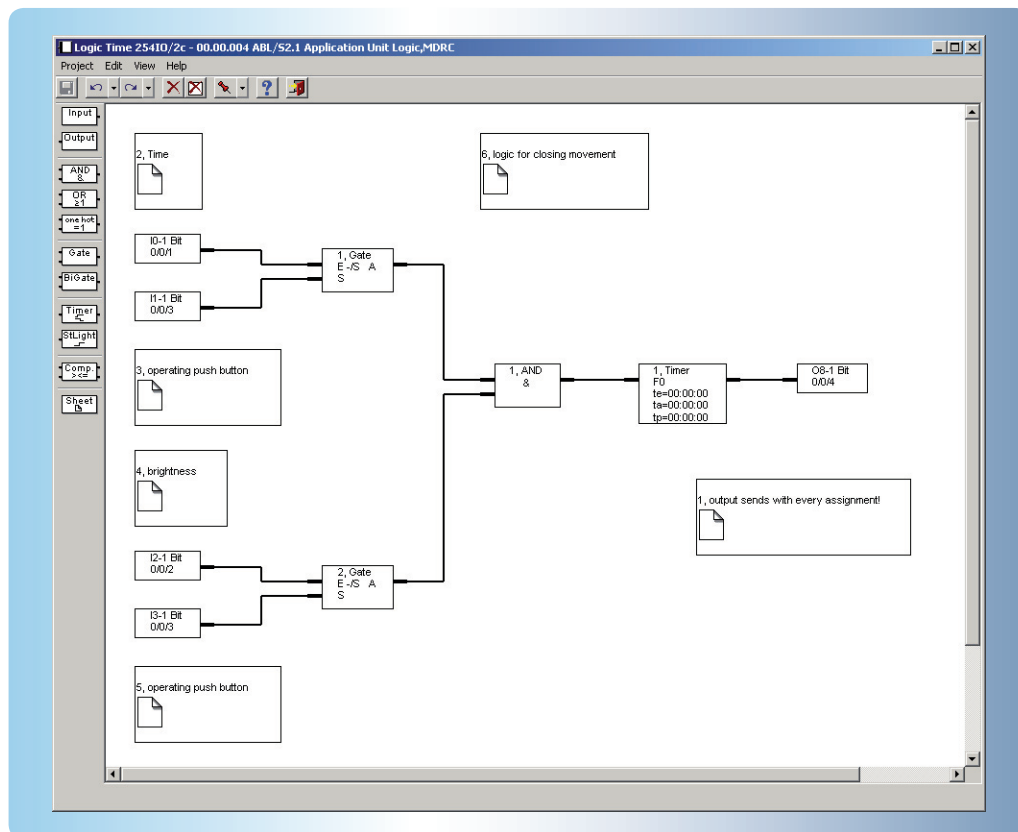


Fig. 14: Logic for closing movement



The parameter settings must be observed. The output sends on each calculation.

For the opening movement, the operating push button with group address 0/0/3 enables the function with a logical 1. The clock and the light evaluation switch send a logical 0 in the morning. The drive opens the blinds if both conditions are fulfilled; OR condition for logical 0: bright and 8 p.m.

Control functions



Both states must be 0. Only in this way is the result of the operation a logical 0 and the drive operates to open the shutters. The timer only has the function of setting a 1 filter, i.e. logical 1 and consequently to inhibit a move DOWN telegram.

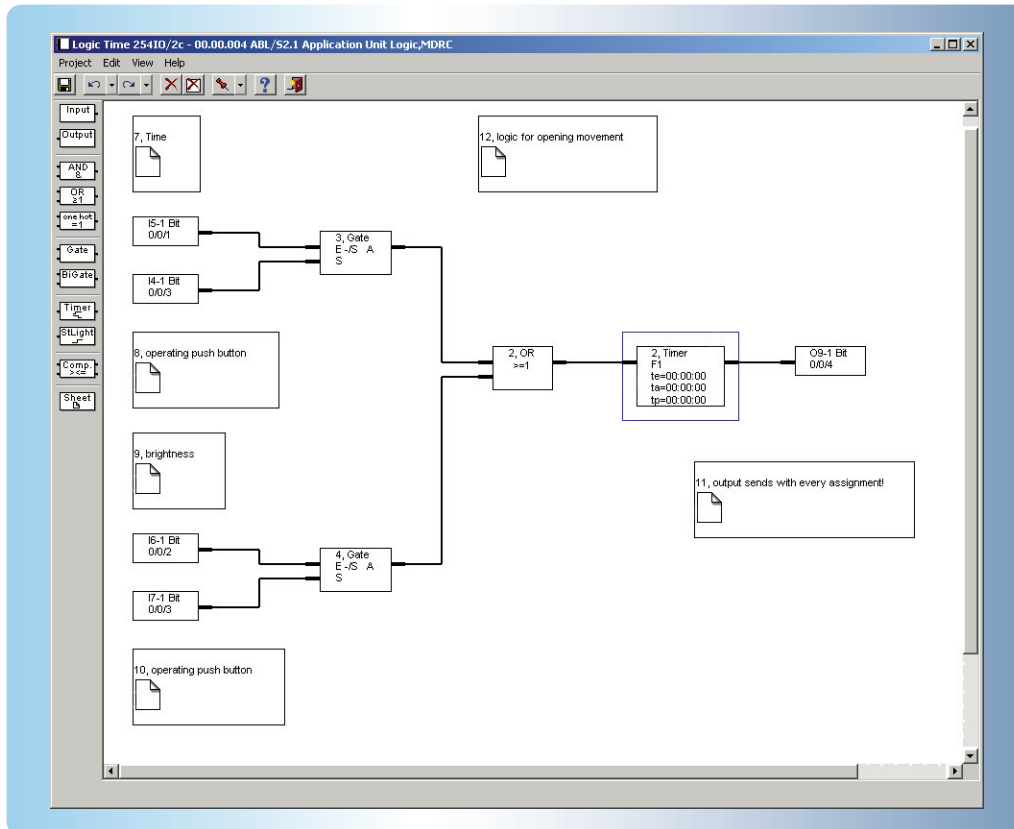


Fig. 15: Logic for opening movement



The parameter settings must be observed. The output sends on each calculation.



If the input signal is stored in all gates during the inhibit phase, after the function is enabled using the enable button, the original motion telegram is executed retrospectively.

Control functions

3.1.2.2. Link with presence of persons



The shading of an office building closes in the evening after the office closes. Presence detectors also detect whether there are persons located in the rooms. Using linked conditions, the shading only closes at 5 p.m. in rooms which are not occupied. The shading of the other rooms only automatically closes when persons have left those rooms.

Solution with Application Unit ABL/S2.1 or Logic Module LM/S 1.1

Just one gate is sufficient to implement this function.

The clock sends a telegram with the address 0/0/5 and the value 1 at 5 p.m. The presence detector disables the telegram of the timer with a detected presence via the control input or enables it when no presence is detected. By setting the parameter *Save during blocking phase*, the drive closes if the room is unoccupied later than 5 p.m.

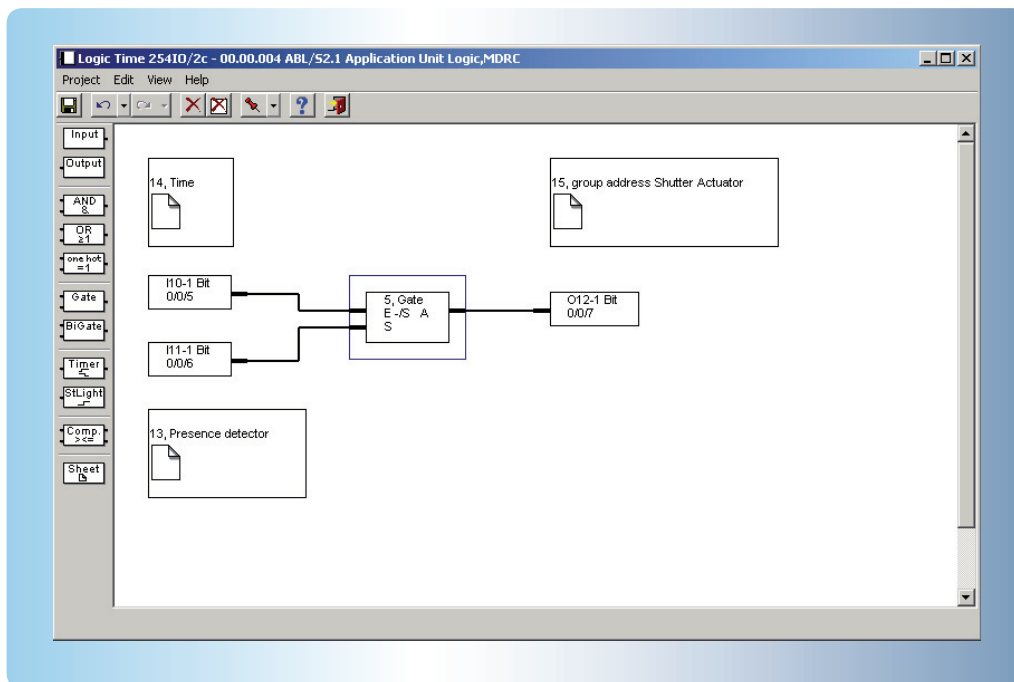


Fig. 16: Logic with Application Unit ABL/S 2.1

Control functions

3.2. Movement to positions

Movement to a position is a significant function in the area of motor operated applications in the field of building automation. This function is available in all MDRC Shutter Actuators JA/S x.x as well as in Shutter Actuator Module JA/M of the Room Controller.

3.2.1. Function Automatic

Using the function Automatic, it is unnecessary for the user to set these positions manually on-site.



1. The shading of a public building moves to a shutter height of 50 % when a button is pressed in the room. In this manner, the sun does not shine directly into the room, will not dazzle the occupants and natural light still permeates the room.
2. Louvres are installed in a conservatory to protect against the sun. A brightness sensor detects the external brightness. When a certain value is exceeded, the shutters move down by 80 % and the louvres close up to 75 %.



Electrically operated windows are installed in the upper third of the glazed facade of an office building. The window opens via a push button in the room. The windows can move to three positions dependent on the wind speeds.



This function Automatic offers a high level of comfort and is economic. The heat irradiation from the sun is reduced and a diffused external lighting source is still provided.

The function *Positioning* is comparable with a scene.

For further information see application manual Lighting and lighting control, Scene

The communication between the sensor which recalls or stores the position and the Shuter Actuator is via a 1 bit telegram. In this way every sensor can be used without additional devices.

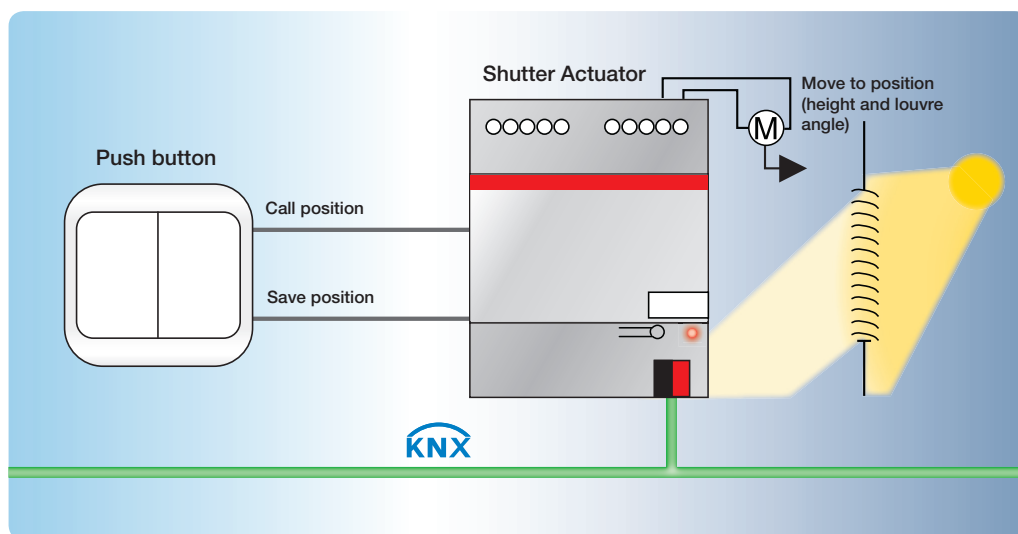


Fig. 17: Shutter Actuator with the function *Positioning*

Control functions



It is possible to define a position via the parameters of the Shutter Actuator, as well as to save the setting of a modified position.



Using a ABB i-bus® KNX push button two positions should be recalled and stored. Using the left rocker, switch position 1 is recalled with a short button push and stored with a long button push. Using the right rocker switch, position 2 is recalled with a short button push and stored with a long button push. The software function Shutter is used with the push buttons. This can differentiate between long and short button actuation.



Using a further rocker switch of the ABB i-bus® KNX push button, normal UP/DOWN, stop and possibly even louvre adjustment can be operated.

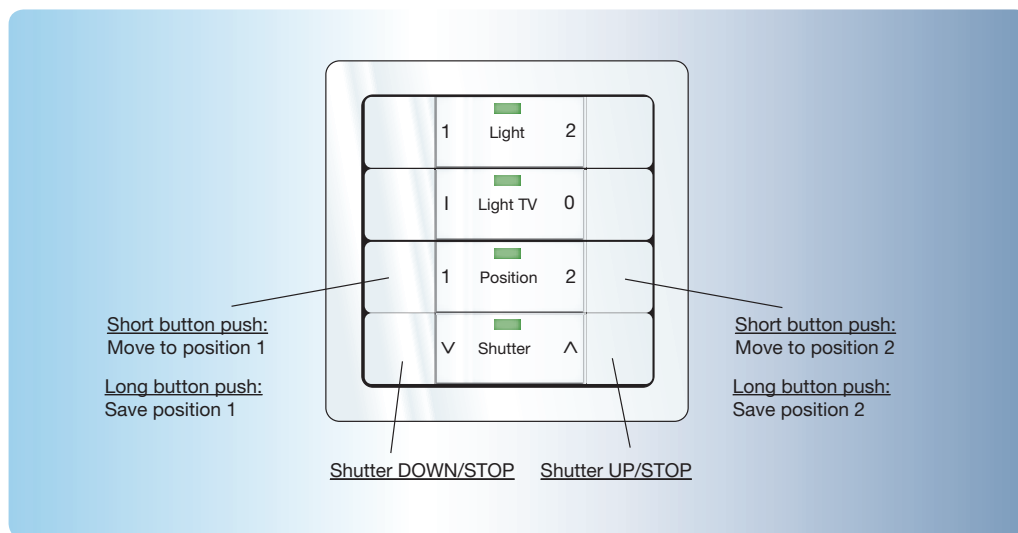


Fig. 18: ABB i-bus® KNX push button with 4 rockers

3.2.2. Realisation with standard drives

Conventional standard drives in the field of intelligent installations have no option for position feedback. For this reason the drive is moved over time, i.e. the run time is measured when the drive moves.

Important here is a knowledge of the total travel time. In this way the drive can be positioned accordingly.

There are two possibilities for positioning:

1. Indirect positioning
2. Direct positioning

Control functions

3.2.2.1. Indirect positioning

With earlier shutter actuators it was necessary to move to the end limit position – either the upper or lower position – before every positioning motion. From this defined position the drive is then moved over time to the actual desired position.

3.2.2.2. Direct positioning

Today, direct positioning of the drive can move from any position directly to the next.



Indirect positioning can also be set on the Shutter Actuators with positioning for reasons of compatibility with older components.

Travel time

Important is the entry of the total travel time of the drive from top to bottom or from bottom to top. This ensures that the highest possible accuracy is achieved. As it is not possible to distinguish between upward and downward motion, the mean value of both times is used. Practical application has shown that there is a slight difference between both times. The run times should be determined by measurement and entered in the parameters of the Shutter Actuator.

If an upper or lower end position is reached, the timer is again set to zero.



Should you only move between the positions without ever reaching an end limit, there is a danger of inaccuracy. This case will practically never occur in practice. If this is the case however, reference run *Movement to the end limit* can be activated via a ABB i-bus® KNX telegram.



In an office building a reference run should be undertaken at least twice a day to ensure the highest possible level of accuracy. The reference run is initiated using a timer program before work starts at 6:45 a.m. and during lunch break at 12:45 p.m. These times have been selected to run this function outside of normal working hours. The reference run is ended when the drives return to the original position. This can be set in the parameters, it ensures that the previous state is re-established.

Control functions

Positioning of the louvres

In addition to the blind height, the louvres can also be moved to a defined angle. As in Chapter 2.1 Switching of one or more positions, the louvre positioning is achieved by stepwise motion of the drive.

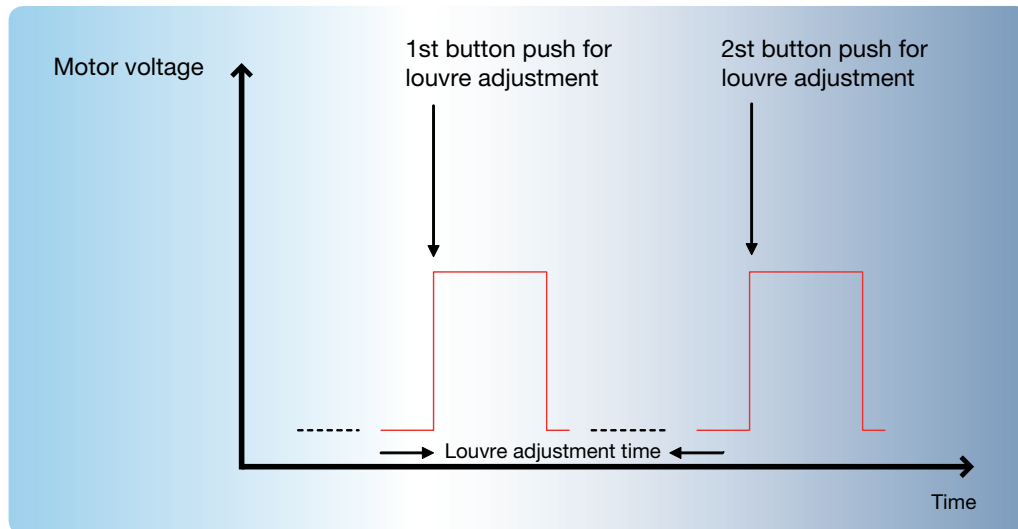


Fig. 19: Stepwise motion of the louvre adjustment

Louvre adjustment with MDRC Shutter Actuator JA/S x.x

With the MDRC Shutter Actuators JA/S x.x, the switch on duration of the louvre adjustment and the number of stages from fully closed to fully open can be set. The shorter the switch-on duration, the more exact the positioning. The number of steps must be deduced by testing.

Louvre adjustment with the Shutter Actuator Module of the Room Controller RC/A x.2

With the Shutter Actuator Module of the Room Controller RC/A x.2, the total motion time of the *Louvre adjustment* is parameterised. The number of louvre steps is also determined here. Multiplied with the switch-on duration, this results in the overall motion time of the *Louvre adjustment*.



If the drive is blocked, e.g. shutter has frozen in place or there is an obstacle, it is not possible to detect this from the Shutter Actuator due to a lack of status feedback. There is an undefined relation between the position of the drive and the detected time.
After removal of the block and movement to the end limit position, the position is once again clear and the timer is reset to 0.

3.2.2.3. Implementation with intelligent drives

Intelligent SMI drives where there is a direct position feedback have only recently become available.

For further information see chapter 2.1.4.1 Status messages or www.smi-group.com

Control functions

3.3. Sensor-dependent control

Sensor dependent control is a very important function in the field of intelligent installations. This functionality is contained in the software of the Shutter Actuator and serves the needs of safety, economy and comfort.

A differentiation is made between:

- Weather-dependent control
- Temperature dependent control
- Sun position-dependent control

3.3.1. Weather-dependent control

The forces of nature act directly on an external blind or sun screen. These forces can be damaging for the shutter, blinds or the drive:

- Wind, e.g. damage to the sun screen
- Rain, e.g. the sun screen or the awning made of fabric may not become wet; there is a danger of damage from mildew
- Frost, e.g. the service life of the fabric is reduced and there is a danger that all mechanical parts will freeze solid, e.g. in the guide rails

Safety-relevant sensors are very important even with electrically operated windows and skylights:

- Wind, there is a danger of wind damage to the window, e.g. due to the sail effect
- Rain, ingress of water in the building

Changes in the weather can be detected by safety-relevant sensors from ABB and the drive (e.g. sun screen) can be controlled as required. The response to the weather is set directly in the Shutter Actuators.



The sun screen in a school should be moved to a predetermined position if a defined brightness value is exceeded. The sun screen will re-open if the brightness value falls below the threshold. If it is very windy, the sun screen may not be deployed for safety reasons.

The corresponding telegram from the brightness sensor, 1 bit if the set brightness value is undershot or overshoot, is linked with the UP/DOWN communication object or the communication object Position with the Shutter Actuator.

The value 0 of the telegram moves the drive UP, the value 1 moves it DOWN.



Safety functions are used with wind, rain and frost. Wind monitoring in particular is required for most systems. For this reason, this function is already integrated into the Shutter Actuators, i.e. there are separate communication objects in existence here.

An important basic principle is that the safety functions have a higher priority than classic basic functions. If a safety event occurs, these functions are inhibited, e.g. on-site operation. Furthermore, the drive moves to a freely selectable safety position, e.g. close window with rain or raise shutter with wind.

Control functions



In the Shutter Actuator, a sequence of priority can be defined in addition to the functions wind, rain, frost, forced operation and blocking.

In order to achieve safe communication between the Weather Station and the Shutter Actuator, the signals between both devices are monitored. For this purpose it is necessary that a data telegram is cyclically sent from the sensor on the bus. The Shutter Actuator expects this signal regularly. If it does not arrive, the drive is brought to the safety position

3.3.1.1. Wind monitor

As the wind is one of the greatest threats for a sun screen, the possible settings are shown using the wind monitor.

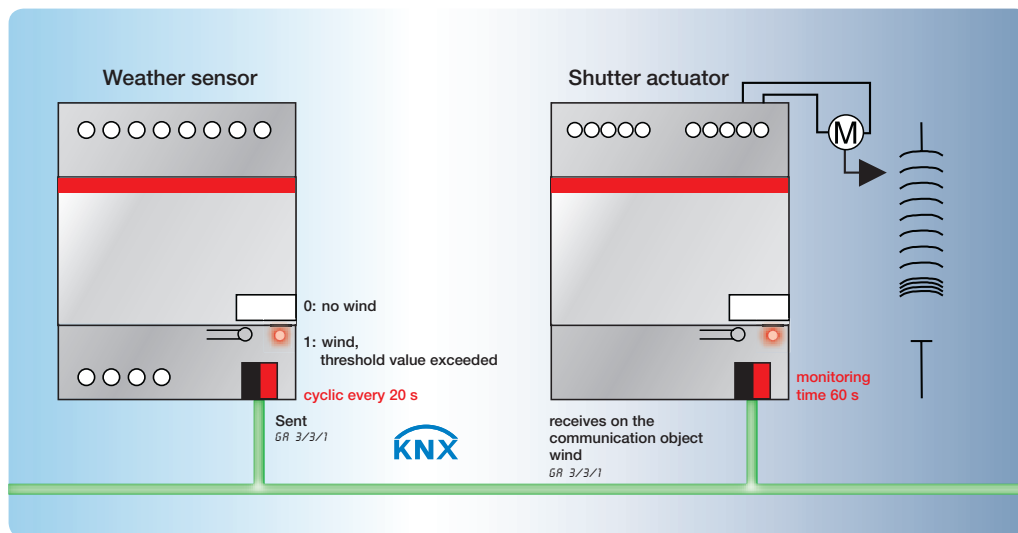


Fig. 20

The times can be freely set. In practice it is normally sufficient to set the cycle time of the sensor to 20 to 30 seconds. The monitoring time in the actuator should be programmed to double or triple time duration. This ensures that the function Safety is not implemented immediately in case of loss of one telegram, i.e. in an unfavourable case, strong wind and failure of the sensor, the drive then opens at the very latest after the monitoring time. Furthermore, after the removal of the function Safety on the parameters you can set how the drive should react. It is interesting here to set the parameters to *move to saved position*, i.e. the state existing beforehand, e.g. the position of the sunscreen, is reassumed.

Control functions

Settings in Shutter Actuator JA/S x.x parameters

- 1 wind monitor is active, 3 are possible
- Monitoring period 60 s

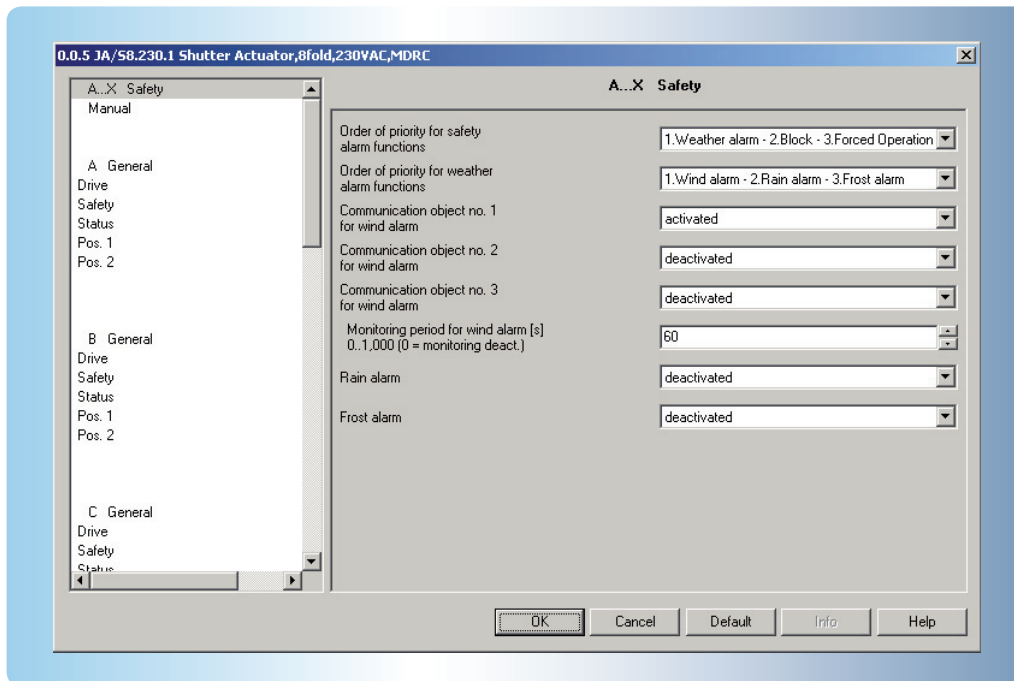


Fig. 21: Settings in Shutter Actuator JA/S x.x

Assignment of wind alarm no. 1 on wind monitor no. 1

- Position on wind alarm: Move UP
- Position when retracted: move to saved position

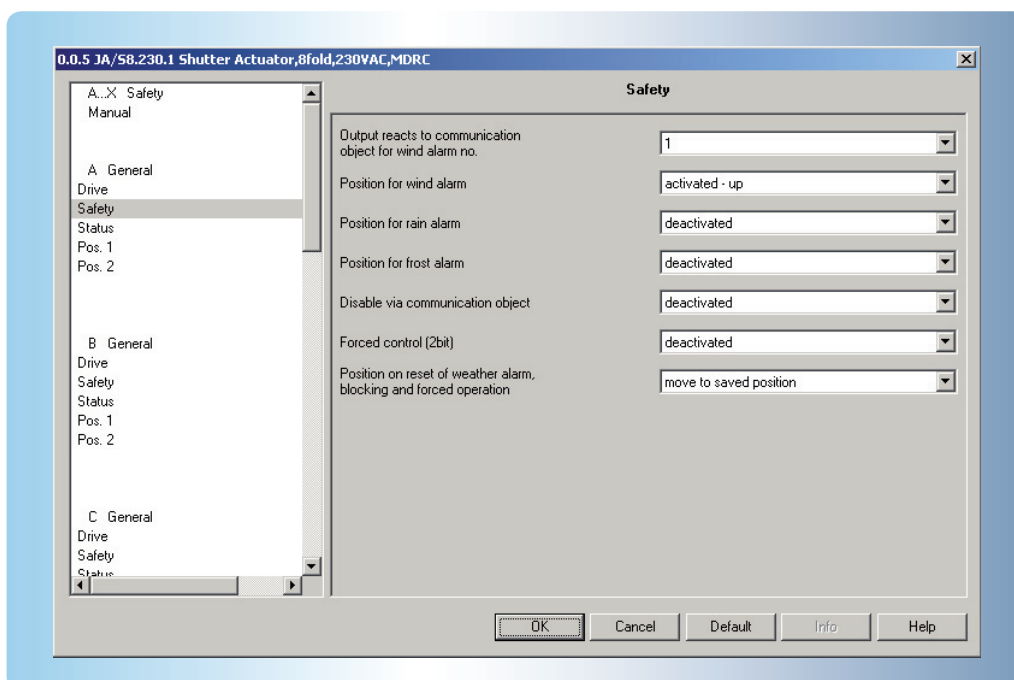


Fig. 22: Setting options for every individual wind alarm, here no. 1

Control functions

Blocking function feature

One distinctive feature is provided by the *Blocking* function which operates without cyclic monitoring. For this purpose, a 1 bit *Blocking* communication object is available. Before the drive is blocked, it can be moved UP, DOWN or to another position.



Electrically operated curtains and windows are fitted on an office floor. In order to avoid damage, the window may not be open at the same time as the curtains are closed

This blocking is implemented with the assistance of the function *Blocking*.

3.3.1.2. Weather-dependent sensors

At the moment, the following weather dependent sensors are available for the ABB i-bus® KNX system:

Brightness Sensor HS/S 3.1 with 3 brightness threshold values



Fig. 23: Brightness Sensor HS/S 3.1

Weather Station WZ/S 1.1 with Weather Sensor WES/A 2.1

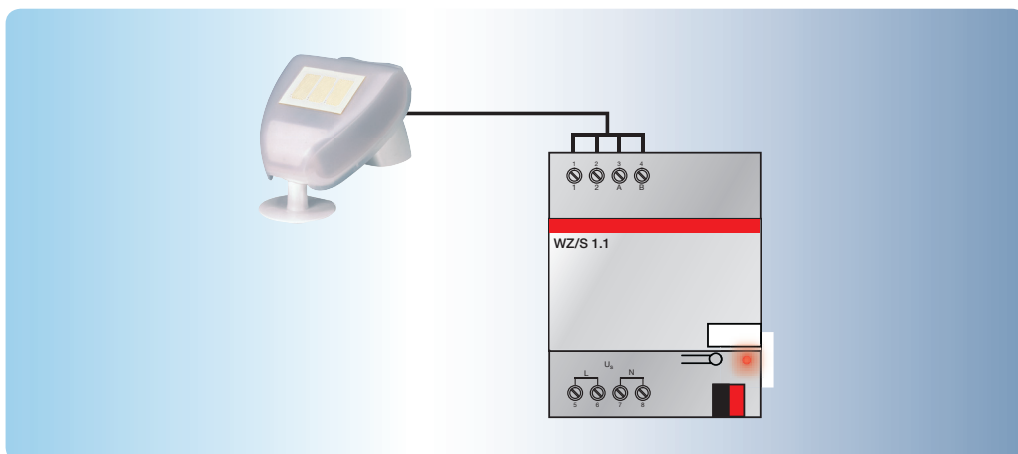


Fig. 24: Weather Station WZ/S 1.1 with Weather Sensor WES/A 2.1



The relevant weather data mentioned above is available with the Weather Station WZ/S 4.1: Brightness from three directions, wind, rain, temperature.

Control functions

Weather Station WS/S 4.1 with external sensors

As in principle it is a 4-fold analogue input with special software, any analogue weather sensors, i.e. 0 ... 10 V, 0 ... 20 mA, etc. can be used.

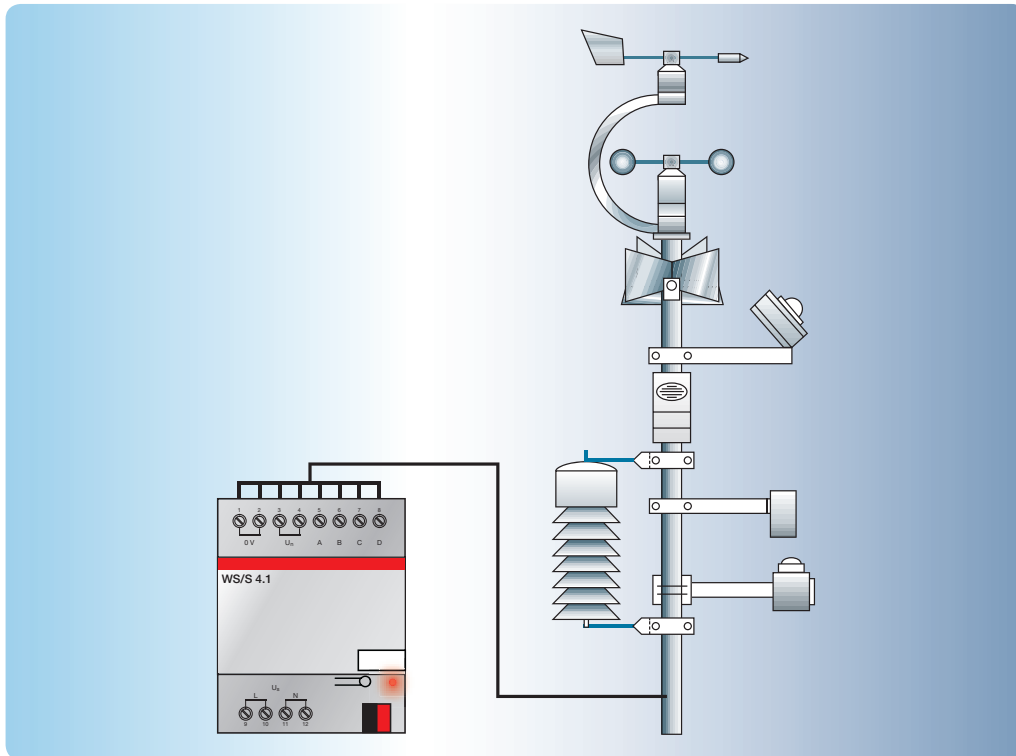


Fig. 25: Weather Station WS/S 4.1 with external sensors

Analogue Input AE/S 4.2

The software of the Analogue Input AE/S 4.2 has fewer functions than the Weather Station WS/S 4.1. The parameters are not adapted to the weather sensors.



Fig. 26: Analogue Input AE/S 4.2

Control functions

3.3.2. Temperature dependent control

Temperature-dependent controls are very economical, as shutters, roller blinds and awnings always are related to heat and cold protection. Heating up of the building is prevented by the reduction of the sun's rays. With closed roller blinds, i.e. typical for a dwelling, the insulation effect of the window is enhanced. This reduces cooling down of the building.

The following automatic functions are available:

- Automatic sun screening
- Automatic heating/cooling
- Night cool down

3.3.2.1. Automatic sun screening

With the *Automatic sun screen* there is a link between a Light Sensor and a Shutter Actuator:

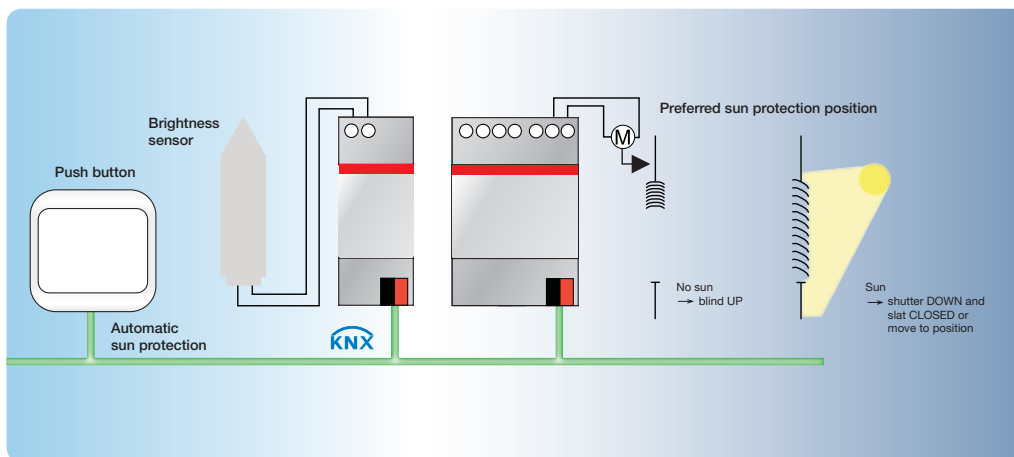


Fig. 27: Establishment of automatic sun screening

The *Automatic sun screen* function is already included in the Shutter Actuator JA/S x.x.

For further information see product manual Shutter Actuators JA/S x.x

Control functions

3.3.2.2. Automatic heating/cooling

The following parameters are linked for the function *HEATING/COOLING automatic*:

- Sun
- Blind
- Presence of persons
- Heating or cooling period

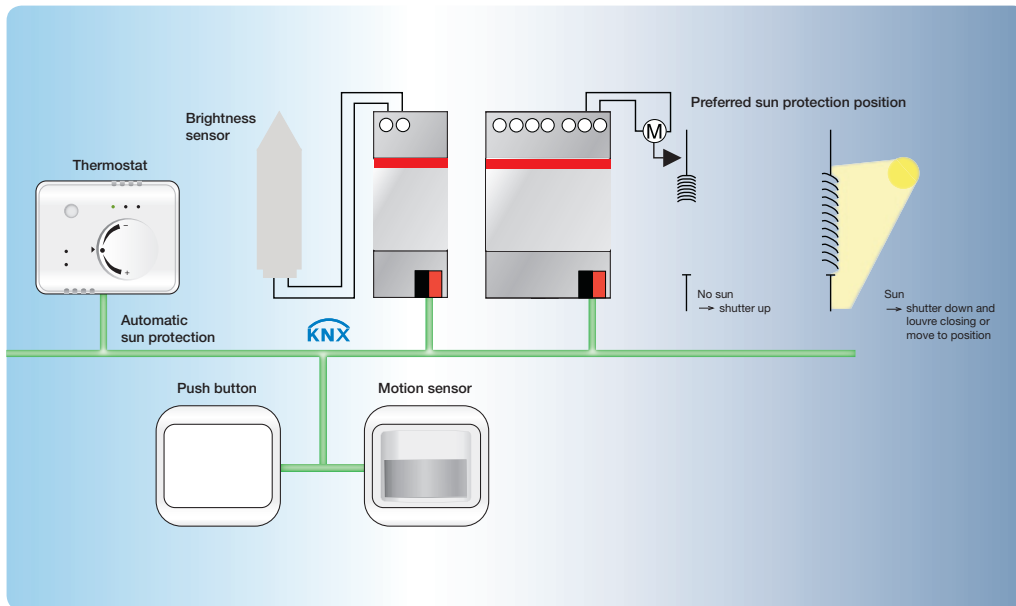



Fig. 28

This function is included in the Shutter Actuators.

For further information see product manual Shutter Actuators JA/S x.x

3.3.2.3. Night cool down

Using the Night cool down automatic function it is possible to implement cooling of rooms by temperature dependent ventilation.



The window of a production hall should be opened for cooling early in the morning before work starts in summer.

It is not useful to always open the window at fixed times. With the climate in central Europe it may be necessary to suspend this function because of a cool day or night in summer.

Control functions

Implementation of night cool down

The internal and external temperatures must be measured for this function:

- Internal temperature via thermostat; for several rooms a reference room should be selected or even the mean value of several rooms.
- External temperature via Weather Station.

Two conditions must also be fulfilled:

- Comparator: The internal temperature is higher than the external temperature.
- Threshold: The external temperature is greater than a defined fixed value, e.g. 18 degrees.

The two conditions – comparator and threshold – can be detected using a Logic Module LMS 1.1.



There is an enable button and a clock with set time window. In this time period, e.g. between 5 a.m. and 6 a.m. the automatic function *Night cool down* occurs. With value 1 the window is opened and closed with value 0.

The principle schematic appears as follows:

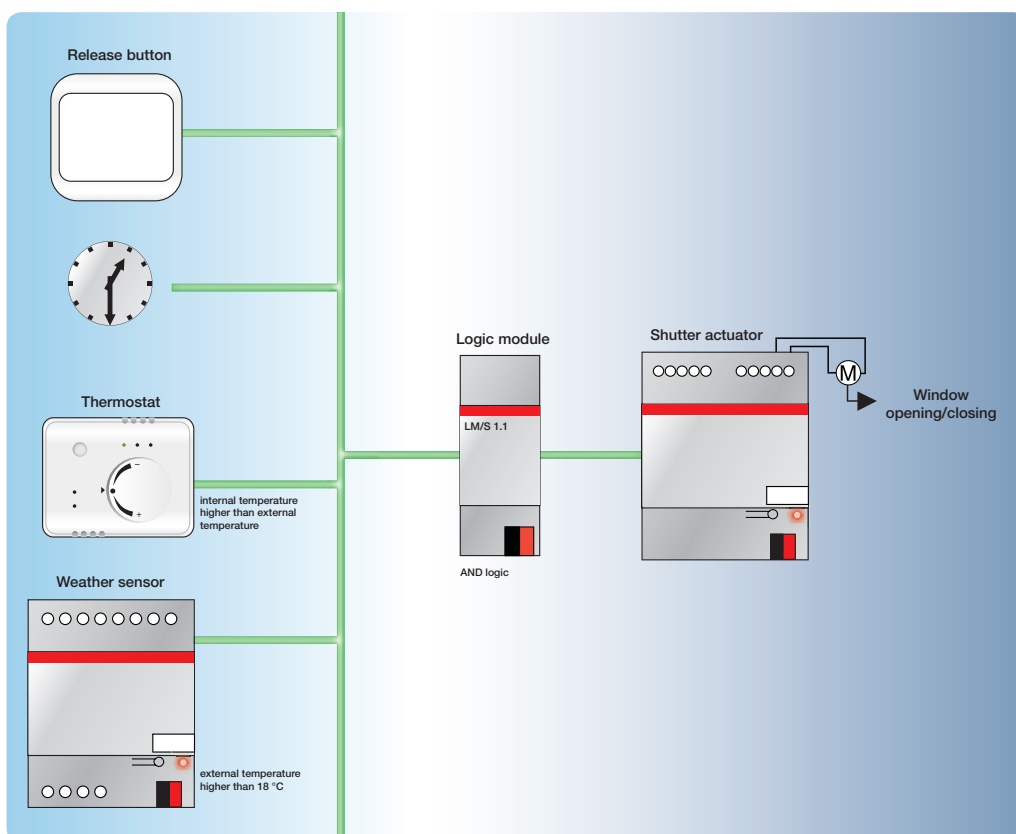


Fig. 29: Principle schematic

Control functions

Parameter settings and communication objects in the Logic Module LM/S 1.1

Two temperature comparators are required. One sends a logical 1 when the internal temperature is greater than the external temperature; the other one is inverted and sends a 0 when the external temperature is higher than the internal temperature.

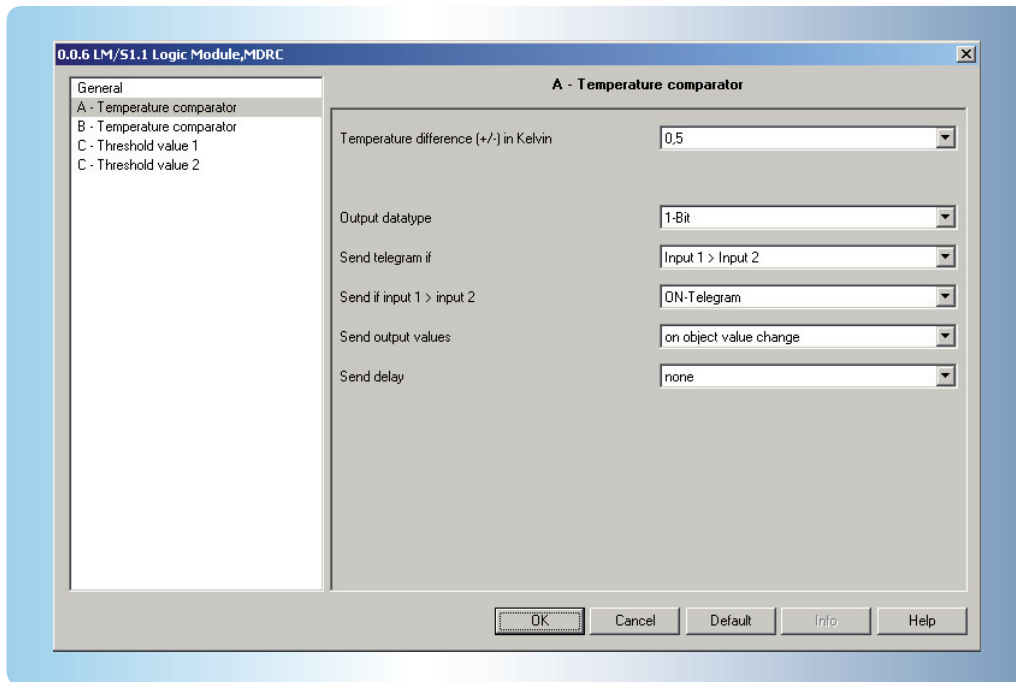


Fig. 30: Logic Module LM/S 1.1, temperature comparator A

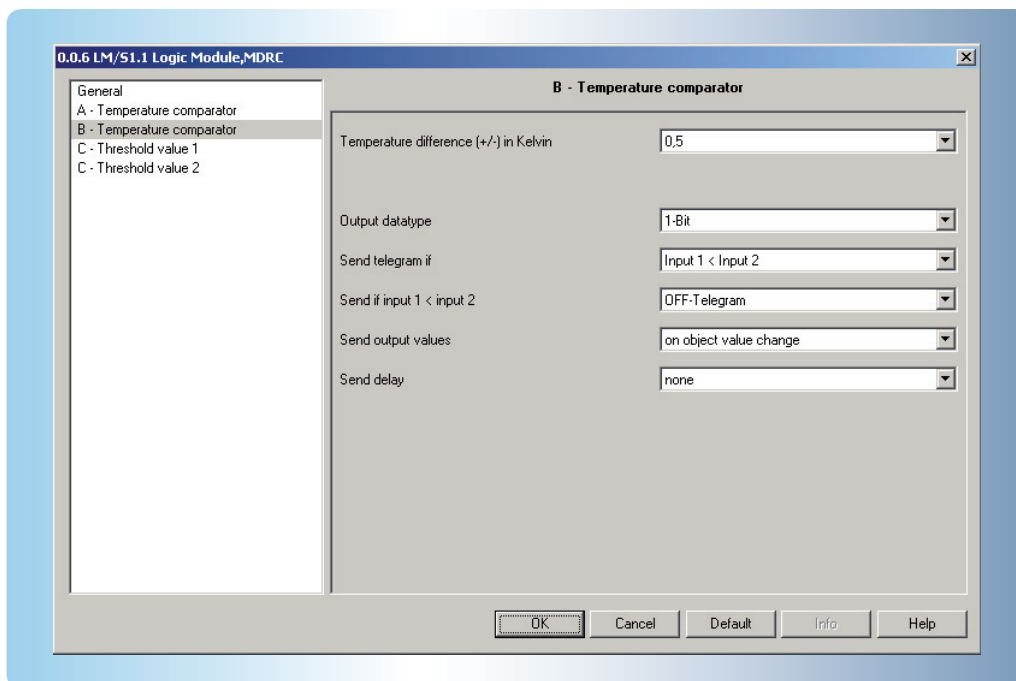


Fig. 31: Logic Module LM/S 1.1, temperature comparator B

Control functions

The threshold is a defined value. This is compared to the current external temperature. If it is greater for example than 18 °C, the condition is fulfilled and logic 1 is sent. This will prevent an extreme cool down during cool nights.

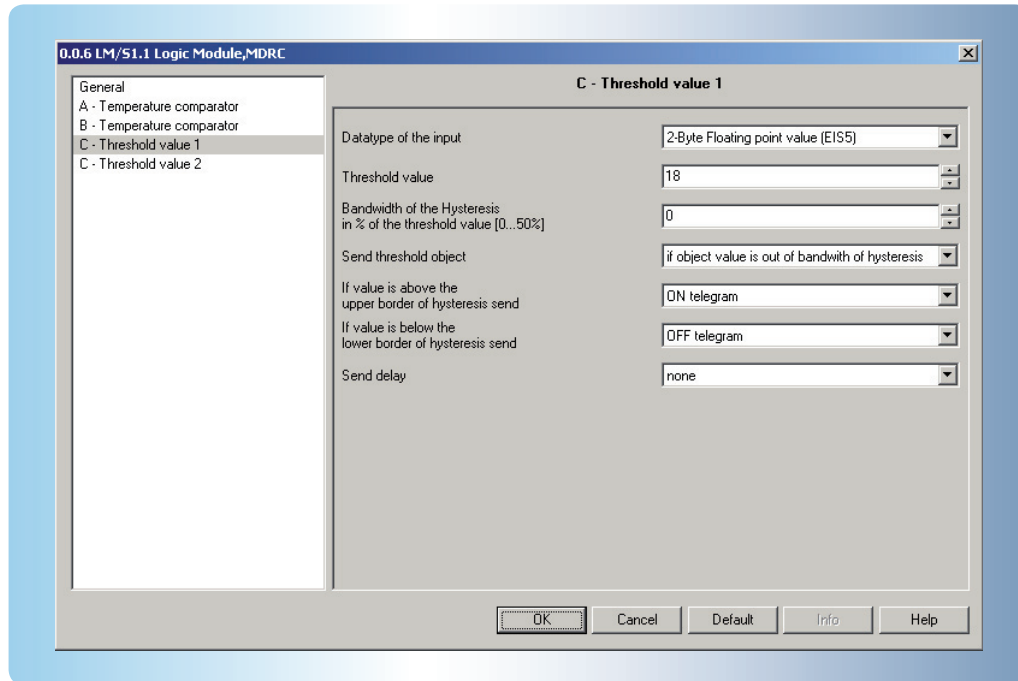


Fig. 32: Logic Module LM/S 1.1, function Threshold value

For optimisation of this control you can also set the internal temperature to a minimum value, e.g. greater than 22 °C. This will avoid night cool down with a low room temperature. For this purpose, only one further threshold function is required in the LM/S 1.1 and one additional input in the AND gate.

If all conditions are fulfilled, the window can be opened via an AND function with a further Logic Module LM/S 1.1. If at least one condition is not fulfilled, the window will be closed again.

Logic module objects with group addresses:

Parent	Number	Group Addr...	Description	Name
3.0.7 LM/S1....	0	4/0/1	Enabling	A:Logic input 1
	1	4/0/2	Timer	A:Logic input 2
	2	4/0/5	Comparison inside and outside temperature	A:Logic input 3
	3	4/0/6	Outside temperature higher than 18 degrees	A:Logic input 4
	8	4/0/7	control shutter	A:Logic output
3.0.2 LM/S1....	0	4/0/3	Inside temperature	A:T.Comparator input 1
	1	4/0/4	Outside temperature	A:T.Comparator input 2
	2	4/0/5	Comparison inside and outside temperature	A:T.Comparator output
	16	4/0/3	Inside temperature	B:T.Comparator input 1
	17	4/0/4	Outside temperature	B:T.Comparator input 2
	18	4/0/5	Comparison inside and outside temperature	B:T.Comparator output
	32	4/0/4	Outside temperature	C:Threshold value input 1
	33	4/0/6	Outside temperature higher than 18 degrees	C:Threshold value T.value 1
	34			C:Threshold value input 2
	35			C:Threshold value T.value 2

Fig. 33: Group addresses of the communication objects

Control functions

3.3.3. Sun position dependent control

A further stage in intelligent sun screening is the sun position-dependent control of blinds. Two function types are available here:

- Anti-glare protection
- Daylight redirection

Anti-glare protection

Anti-glare protection protects against direct, glaring sunlight with the admission of the maximum level of diffused light.

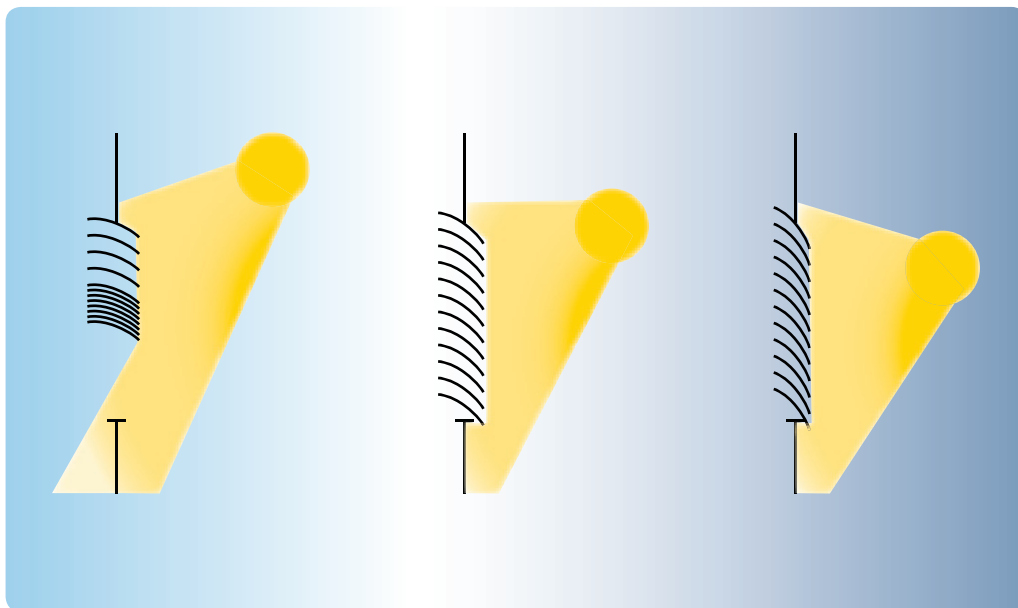


Fig. 34: Blind setting dependent on sun position

In order to implement optimum anti-glare protection, it is important to set the blind height and, if required, the angle of the louvres, so that they comply with the above mentioned characteristics. The height and louver position is automatically adjusted to track the position of the sun. For a full range of functionality, blinds with louvres are necessary. However, this application can also be employed in houses with shutters.



If the sun shine, the shutters should close to avoid heating up of a house in summer. The function Anti-glare protection can be employed here. The shutters are only moved when the respective windows are subject to sunshine. The positioning of the shutters is implemented via the shutter height. This is programmed to ensure that the viewing and air slots between the shutters always stay open. Furthermore, the shutters are opened immediately when the window is in the shade again.

Control functions



Maximum admission of daylight without direct sunlight. Rooms are only shaded when absolutely necessary. Accordingly, less artificial light is required.

Direction of daylight

Redirection of daylight protects against direct, glaring sunlight. The natural brightness is optimally exploited through selective direction of the sunlight into the room.

The objective of this application is controlled inflow of sunlight to the room. The sunlight is directed onto the ceiling by tracking of the louvre angle, where it brightens the room through indirect but natural lighting.



Fig. 35: Optimum daylight utilization through louvre angle tracking



Maximum admission of natural light into the room without direct glare.



Additional room heating during the summer months.



The inner surfaces of the louvres must be reflective for the best results.

Control functions

Function of a sun position-dependent blind control

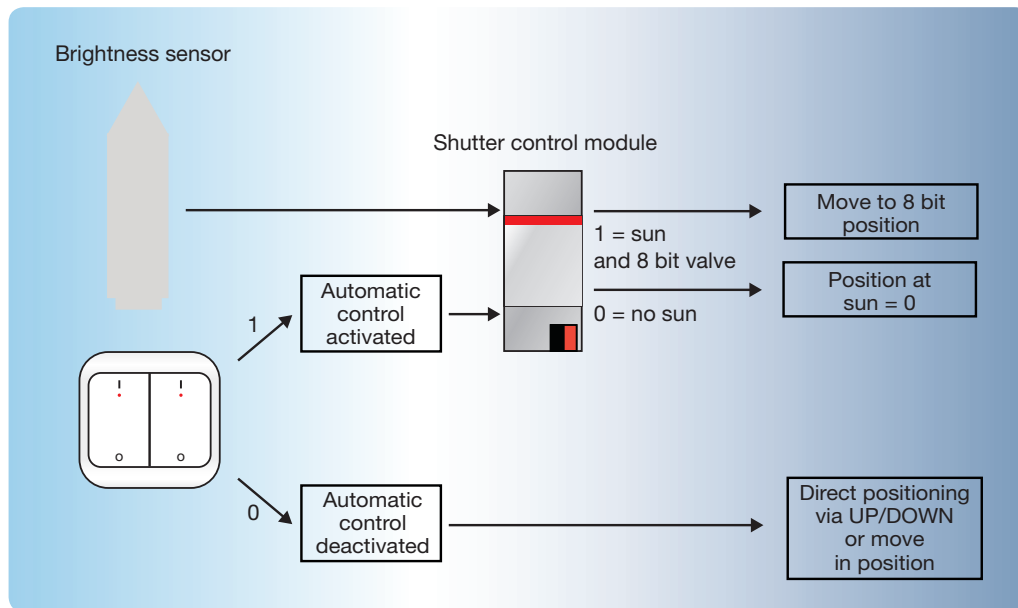


Fig. 36: Function chart of sun-dependent blind control

The brightness sensor detects whether the sun shines onto the facade and thus into the rooms. Ideally, each facade should feature a sensor. In Europe, for example, three sensors for South, West and East.

A corresponding brightness threshold is set in the sensors. If this threshold is exceeded, the sun position-dependent control tracks the position of the sun.



The quality of the light sensor with the accuracy of the brightness threshold is decisive to ensure a good function.

The use of the Weather Sensor WES/A 2.1 with the Weather Unit WZ/S 1.1 is not recommended!

The Weather Station WES/A 4.1 offers all options together with high-quality external sensors.

The Shutter Control Unit JSB/S 1.1 as the central intelligent module assumes the sun protection control and controls the position via an 8 bit telegram. It is necessary to set some parameters for correct JSB/S function incl.:

- Alignment of the building with regard to its geographical orientation
- Date and time
- Building location (longitude and latitude)
- Geometry of the window and sun protection



A local push button should be available to switch off the automatic control. For example, in winter, the occupants may desire the sun to shine directly into the building for the purpose of heating the building or personal well-being.

If other buildings or objects, e.g. trees, are located in front of a facade, they will be a source of shadow. They can be included in the calculation by entering the corresponding data (distance and size).

The course of the shadow cast is calculated as well as the exact time period for which a window is subject to the shadow of the shadow-caster.

Control functions

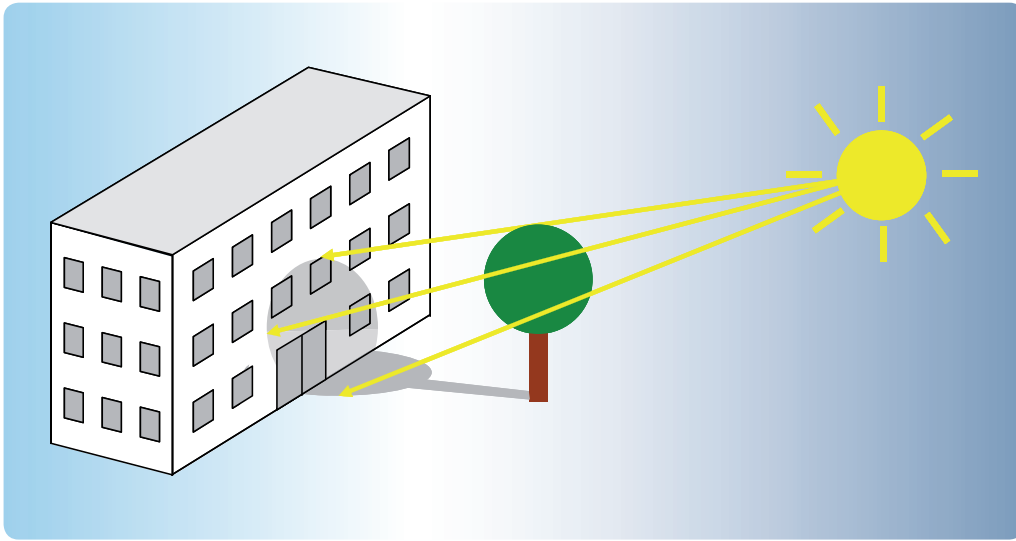


Fig. 37: Influence of a shadow caster



The functions anti-glare protection and daylight redirection with the assistance of Shutter Control Unit JSB/S 1.1 only function with the Shutter Actuators JA/S from ABB. Only these devices feature the necessary parameters and communication objects as explained in the following.

Detailed information regarding the planning and programming can be found in the product manual of the Shutter Control Unit JSB/S 1.1

Communication between Shutter Control Unit JSB/S 1.1 and ABB i-bus® KNX blind actuators

The JSB/S 1.1 controls the blind actuators via three communication objects:

- Sun (yes/no, 1 bit)
- Position sun screen (blind height, 1 byte)
- Position louvres (louvre angle, 1 byte)

Using the communication object *Sun* (value 1), the outputs of the blind actuator are informed that the sun is shining on the respective window, or alternatively that the programmed brightness value is exceeded. The blind is moved into a position compliant with the programming (blind height and/or louvre angle).

If the communication object *Sun* has the value 0 (brightness threshold undershoot), the drive will move in accordance with the programming in the blind actuator, e.g. UP or to any other position.

Control functions

In the following, you can see the required implementation parameters:

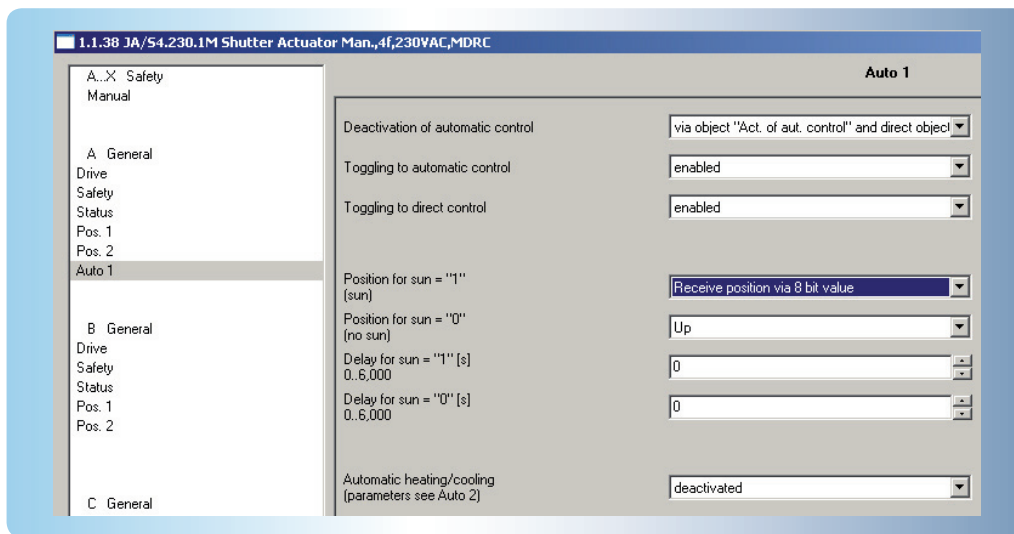


Fig. 38: Parameter function Automatic shutter actuator

After automatic control is enabled in the parameter windows *X General* ($X = A \dots X$), the actions for sun position-controlled blind control are set in the parameter window *Auto 1*. It is important to select the option *Receive position via 8 bit values* in the parameter *Position if sun = 1*.

The parameter *Position if sun = 0* is generally parameterised with *UP*, but other positions can be selected.

In the following figure, the communication objects of the blind actuator and blind actuator modules are shown, as well as the assignment of the group addresses of the three communication objects already mentioned:

Control functions

Communication object No. 4 *Sensor no. 1* represents the connection to the brightness sensor. Up to 4 communication objects for sensors can be activated.

1.1.38 JA/54...	11	Output A		Move blinds Up-Down	1 bit
	12	Output A		Louvre adj./ Stop Up-Down	1 bit
	22	Output A		Activation of aut. control	1 bit
	23	Output A	8/2/1	Sun	1 bit
	24	Output A	8/2/3	Move to pos. for sun 0..255	1 Byte
	25	Output A	8/2/2	Adjust louvres for sun 0..255	1 Byte
	41	Output B		Move blinds Up-Down	1 bit
	42	Output B		Louvre adj./ Stop Up-Down	1 bit
	71	Output C		Move blinds Up-Down	1 bit
	72	Output C		Louvre adj./ Stop Up-Down	1 bit
	101	Output D		Move blinds Up-Down	1 bit
	102	Output D		Louvre adj./ Stop Up-Down	1 bit
1.1.37 JSB/S...	0	Input date		Input date	3 Byte
	1	Input time		Input time	3 Byte
	4	Sensor no. 1	8/3/1	Brightness Level 1	1 bit
	12	Façade A	8/2/3	Move to position 0..255	1 Byte
	13	Façade A	8/2/2	Move louvres 0..255	1 Byte
	14	Façade A	8/2/1	Sun	1 bit

Fig. 39: Assignment of the group addresses shutter actuator and shutter modules



After parameterization of the basic functions in the JSB/S 1.1 (see above) and the settings stated in the blind actuator, the function of the sun position-dependent control is guaranteed in principle. Without shadow casters, a detailed examination of the facade or windows is not necessary, as all facade surfaces are subject to the same degree of sunshine. Afterwards, the function is optimised further, e.g. the brightness threshold or blind height during sunshine are adjusted.



The setup is more comprehensive, should the facade be subject to shadow-casters. The shadow caster data such as the size and distance from the facade must be determined. Detailed information such as the window size and distances to the window are required. The corresponding set-up times should be considered.



A complete planning checklist intended especially for sun position-dependent blind control can be found in the product manual of the JSB/S 1.1.

Notes

Checklist

Roller Blind/Shutter Control

Building: _____

Level: _____

Room: _____

Smallest common controlled unit no.: _____

Function: _____

Intended shutter/blinds:

- ☐ Internal shutter vertical
 - ☐ Number _____
 - ☐ Drive
 - ☐ 230 V AC
 - ☐ 24 V DC
 - ☐ 12 V DC
 - ☐ SMI
 - ☐ Other _____
 - ☐ Current consumption _____
 - ☐ Reversal time _____
 - ☐ Travel time _____
 - ☐ Mechanical end limit switches
 - ☐ Switch off via increased current
 - ☐ No switch off via end switch or increased current
 - ☐ Installation location _____
- ☐ Internal shading
 - ☐ Number _____
 - ☐ Drive
 - ☐ 230 V AC
 - ☐ 24 V DC
 - ☐ 12 V DC
 - ☐ SMI
 - ☐ Other _____
 - ☐ Current consumption _____
 - ☐ Reversal time _____
 - ☐ Travel time _____
 - ☐ Mechanical end limit switches
 - ☐ Switch off via increased current
 - ☐ No switch off via end switch or increased current
 - ☐ Installation location _____

Checklist

- ☐ External shutter _____
 - ☐ Number _____
 - ☐ Drive
 - ☐ 230 V AC
 - ☐ 24 V DC
 - ☐ 12 V DC
 - ☐ SMI
 - ☐ Other _____
 - ☐ Current consumption _____
 - ☐ Reversal time _____
 - ☐ Travel time _____
 - ☐ Mechanical end limit switches
 - ☐ Switch off via increased current
 - ☐ No switch off via end switch or increased current
- ☐ Installation location _____

Manual on-site operation

- ☐ Conventional push button/switch with flush mounted interface
 - ☐ 1 push button (short = lamella, long = moving)
 - ☐ 1 push button (short = Move, long = Lamella)
 - ☐ 1 push button, move only
 - ☐ 1 switch operation, move only
 - ☐ 2 push button, standard
 - ☐ 2 switch operation, move only (roller blinds)
 - ☐ 2 push button operation, move only (roller blinds)
 - ☐ 2 push buttons (only Lamella)
 - ☐ Push buttons: Additional functions: _____
 - ☐ Other free rocker used for _____
 - ☐ Status feedback via LED
 - ☐ Orientation light
- ☐ Bus push button
 - Make: _____
 - Design: _____
 - ☐ Other free rocker used for _____
 - ☐ Additional functions: _____
 - ☐ Status feedback via LED
 - ☐ Orientation light
- ☐ Number of assigned push buttons _____
- ☐ Installation locations _____

Checklist

Superior manual operation

- ☐ Central operation
 - ☐ Central UP
 - ☐ Central DOWN
- ☐ Superior group circuit
 - ☐ Number of groups _____
 - ☐ Function _____
- ☐ Integration into manually controlled scenes
 - ☐ Number of scenes _____
 - ☐ Behaviour with scene call _____

Automatic control on-site

- ☐ Controlled with other events on-site
 - ☐ _____
 - ☐ _____

Superior automatic control

- ☐ Automatic shading – with sun
 - ☐ No reaction
 - ☐ DOWN
 - ☐ UP
 - ☐ STOP
 - ☐ Predefined position
 - ☐ Position setting via superior control
- ☐ Automatic shading – no sun
 - ☐ No reaction
 - ☐ DOWN
 - ☐ UP
 - ☐ STOP
 - ☐ Predefined position
- ☐ HEATING/COOLING automatic
 - ☐ HEATING + sun
 - ☐ no reaction
 - ☐ DOWN
 - ☐ UP
 - ☐ STOP
 - ☐ Predefined position
 - ☐ HEATING + no sun
 - ☐ no reaction
 - ☐ DOWN
 - ☐ UP
 - ☐ STOP
 - ☐ Predefined position

Checklist

- ☐ COOLING + sun
 - ☐ No reaction
 - ☐ DOWN
 - ☐ UP
 - ☐ STOP
 - ☐ Predefined position
- ☐ COOLING + no sun
 - ☐ No reaction
 - ☐ DOWN
 - ☐ UP
 - ☐ STOP
 - ☐ Predefined position
- ☐ Timer
 - ☐ Weekly timer program
 - ☐ Yearly timer program
 - ☐ Number of daily sequences _____
 - ☐ Number of special days _____
- ☐ Twilight switch
 - ☐ Move UP at _____ I_x
 - ☐ Move DOWN at _____ I_x
- ☐ Integration into automatically controlled scenes
 - ☐ Number of scenes _____
 - ☐ Behaviour with scene call _____
- ☐ Controlled with other superior events
 - ☐ _____
 - ☐ _____

Checklist

Safety functions

- ☐ Behaviour on wind alarm
 - ☐ Deactivated (does not react to wind alarm)
 - ☐ Activated – no reaction (movement is ended and then blocked)
 - ☐ Activated – UP
 - ☐ Activated – DOWN
 - ☐ Activated – STOP
- ☐ Behaviour on frost alarm
 - ☐ Deactivated (does not react to frost alarm)
 - ☐ Activated – no reaction (movement is ended and then blocked)
 - ☐ Activated – UP
 - ☐ Activated – DOWN
 - ☐ Activated – STOP
- ☐ Behaviour on rain alarm
 - ☐ Deactivated (does not react to rain alarm)
 - ☐ Activated – no reaction (movement is ended and then blocked)
 - ☐ Activated – UP
 - ☐ Activated – DOWN
 - ☐ Activated – STOP
- ☐ Priorities of weather alarms
 - Wind alarm _____
 - Rain alarm _____
 - Frost alarm _____
- ☐ Behaviour when blocked (e.g. for cleaning)
 - ☐ Deactivated (does not react to block)
 - ☐ Activated – no reaction (movement is ended and then blocked)
 - ☐ Activated – UP
 - ☐ Activated – DOWN
 - ☐ Activated – STOP
 - ☐ Activated – move to position (blind-shutter height/louvre setting)
- ☐ Enable forced operation
- ☐ Priorities of the functions Safety
 - Weather alarm _____
 - Block _____
 - Forced operation _____

Checklist

Operation/display at a remote location

- ☐ Remote controlled
 - ☐ Via telephone
 - ☐ Via LAN
 - ☐ Via Internet
- ☐ Status message
 - ☐ On visualisation system
 - ☐ Query via telephone
 - ☐ Query via LAN
 - ☐ Query via Internet

Special functions

- ☐ Integration in occupancy simulation
- ☐ Inhibit on-site operation at certain times
 - ☐ Times: _____
 - ☐ Behaviour on inhibit removal
 - ☐ UP
 - ☐ DOWN
 - ☐ State as beforehand
 - ☐ As last “attempted” manual on-site operation
- ☐ Inhibit on-site operation for certain events/states
 - ☐ Events: _____
- ☐ Allow only UP movement at certain times
- ☐ Allow only DOWN movement at certain times
- ☐ Switch from certain points with higher priority (forced operation)
 - Behaviour on priority removal
 - ☐ UP
 - ☐ DOWN
 - ☐ State as beforehand
 - ☐ As last “attempted” manual on-site operation
- ☐ Partition function
 - ☐ As an open partition common control with

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