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WHITE PAPER
THE MOVING PARTS OF HOMES

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1. INTRODUCTION

This white paper is one of a series of thematic white papers covering various aspects of electrical installations in houses, flats and residential units. They are aimed at architects, designers, specification writers, decision makers and students.

In this white paper we focus on the moving parts within the home that affect safety, security, privacy, comfort and responsible energy consumption. This naturally includes a wide variety of electrically controllable moving parts, both stand-alone and those incorporated in an integrated home system (IHS). We discuss roll-down shutters, solar shading, curtains, garage doors and ordinary doors, in that order.

2. ROLL-DOWN SHUTTERS AND SOLAR SHADING

2.1. ROLL-DOWN SHUTTERS

Roll-down shutters give residents and homes better protection against break-ins and that is why they are often fitted on ground-floor windows. However, it is also advisable to install roll-down shutters on upper-floor windows if they can be reached from outside, for example from a flat roof.

A disadvantage of manually operated roll-down shutters is that, every morning and evening, someone has to go through the entire home and raise or lower each shutter. This physical effort can be difficult for older people, making it necessary to ask the neighbours or other family members to carry out this task every day.

Automatic motorised roll-down shutters do not have this drawback, and they have other advantages as well. Some systems now available support both local and group operation. In the latter case, all roll-down shutters in the dwelling can be raised or lowered at the same time with a separate push-button, switch or smartphone app. Using a timer with the Astro function, it is even possible to have the roll-down shutters raised at dawn and lowered at dusk. In that case, the user can of course set the earliest time for raising the shutters and the latest time for closing them.

When the occupants are out for the evening, or away for a while, the automated roll-down shutters can also give the appearance that the property is occupied by being automatically raised and lowered at chosen times. The advantage is that outside observers will get the impression that someone is at home, reducing the risk of a break-in when the occupants are away.

As well as enhancing security and comfort, roll-down shutters help cut energy costs. When they are lowered they provide an additional barrier against cold night air, which means the heating system does not have to run as much at night. What's more, in the summer they help keep the home cool by blocking solar radiation. That reduces the load on the air conditioning system, which in turn yields energy savings. According to several studies, the total energy savings can be as much as 10 to 15%. In addition, lower CO_2 emissions are also a nice benefit. We will have more to say about this in the section on awnings and sun blinds.

2.1.1. AVOIDING TECHNICAL PITFALLS

As you know, with lighting you can simply connect several light fittings in parallel if you want to switch them on or off at the same time. With roll-down shutters, and in fact with all motors that can run in two directions (which includes awnings and sun blinds), you can never connect two or more motors in parallel. It's always tempting to do this when you want to be able to open and close several roll-down shutters in the same room as a group.

However, if you connect the motors of several roll-down shutters in parallel, you get a sort of yo-yo effect. If one of the shutters reaches the fully closed position just a bit earlier than the others, a reverse voltage is

generated, sending the shutter back upwards. To avoid this, you need to provide each motor with its own cable to the distribution panel. There you can always choose to control specific motors as a group by connecting them to a common switch and with the addition of an isolation relay.

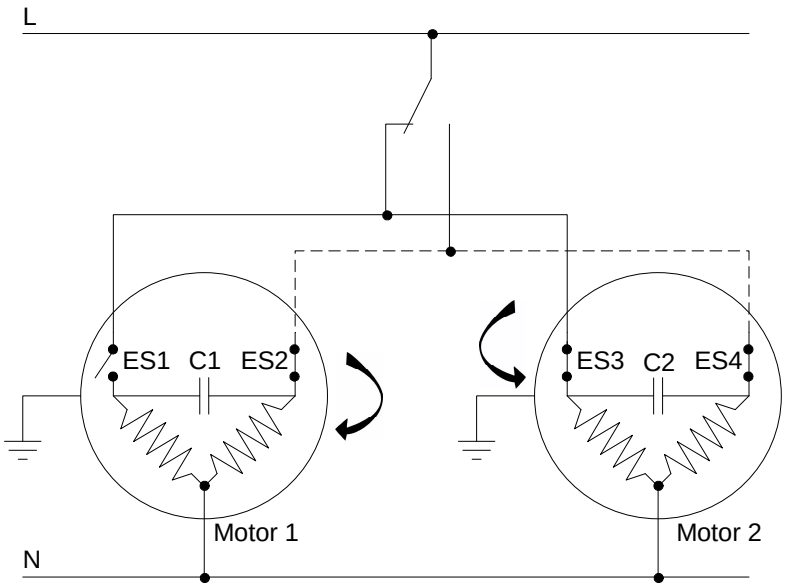

Figure 1: When one of the motors stops earlier, that motor starts to turn the other way through the action of the other motor. (Illustration source: E&D Systems)

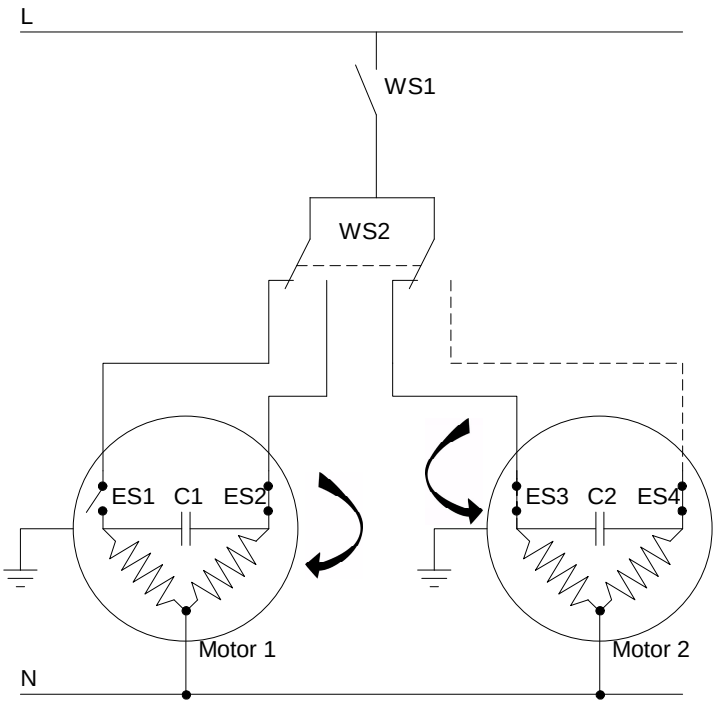

Figure 2: By using an isolating relay (WS2), the shutters will always perform the same movement and will not hinder one another. (Illustration source: E&D Systems)

2.1.2. SAFETY FIRST

If all the windows on a floor are equipped with electrical roll-down shutters (and possibly the doors as well), the safety aspect needs to be addressed when writing specifications or designing the layout. If there is a power outage, for example due to fire, the occupants in every room where the shutters are closed must be able to open at least one shutter manually in order to leave the dwelling via that exit.

For this purpose, short hexagonal shafts can be inserted into the motor. An eye is then mounted on the end of the shaft at the outside of the shutter box and a crank rod can be inserted in this eye to roll up the shutter. This can be done by hand if necessary.

Figure 3: A mechanical emergency handle for an automated roll-down shutter might not be pretty, but the safety of the occupiers takes precedence. (Illustration source: E&D Systems)

2.1.3. WHAT ABOUT EXISTING MANUALLY OPERATED ROLL-DOWN SHUTTERS?

Existing manually operated roll-down shutters can also be automated. Strap winders with a wide range of features, including timer functions and group control, are commercially available for this purpose. The strap winder can be powered from a nearby socket-outlet.

Figure 4: The buttons and display enable all kinds of functions. A traditional manually controlled shutter ribbon winder can easily and quickly be replaced by an automated model. (Photo source: Rademacher)

2.2. SOLAR SHADING

When the sun is shining fiercely, occupants prefer to keep the sun outside to avoid excessive heat accumulation indoors, or to sit in the shade on the patio to enjoy the splendid summer weather. For this they need solar shading. As with roll-down shutters, you can choose either manually operated or automatic systems. The latter have distinct advantages with regard to convenience, as well as energy savings.

2.2.1. TYPES OF SOLAR SHADING

There are many types of solar shading. First you have awning systems (also called horizontal solar shading), which are similar to the solar shading systems used on the patios of cafés and restaurants. They are an excellent choice for blocking the heat of the sun on a patio or the glass roof of a veranda. There are also many forms of sun blinds (also called vertical solar shading). They slide in two rails on the outside of the window and let through only a fraction of the sunlight. Those are the two most commonly used systems.

Figure 5: An awning (left) and a sun blind (right). (Illustration source: Winsol)

There are also sun blinds that are installed indoors next to the window. Obviously, this results in more heat building up in the room than with exterior sun blinds, because the sunlight (and the associated heat) is already inside the home before it is blocked by the blind. Exterior sun blinds are therefore the preferred choice.

2.2.2. SAVINGS

As well as increasing the comfort of the occupants, solar shading helps cut energy costs. A room that stays relatively cool — even when the sun is shining brightly — is not only more pleasant for the occupants, but also reduces the need for cooling from the air conditioning system.

But that's not all: in the spring and autumn, as well as the winter, solar radiation can help keep room temperatures at the right level. For that, it is naturally necessary to link the solar shading to a smart IHS that controls the solar shading and manages the indoor temperature. When the indoor temperature is too low, the IHS will avoid deploying the solar shading when heat is available from the sun. Users can override this automatic operation when they are at home and prefer not to sit in direct sunlight.

2.2.3. SENSORS

An automated system is much better at responding to the needs of occupants. For example, on a working day when it is raining at 8 a.m. and the sun comes out at 9 a.m. and shines brightly for the rest of the day, an automated system can respond to this by deploying the solar shading. That is not possible with manual operation because the occupants will probably have already left for work before the sun comes out. The result is then an overheated home when they return in the evening.

In order to respond to external conditions, several sensors are needed. The first is a light sensor, which measures the intensity of daylight. Here, the solar shading is deployed when there is too much daylight and withdrawn when it gets darker. A wind sensor is also always needed, because most awnings or sun blinds have fabrics that can be damaged by high wind. Finally, it can be useful to have a rain sensor so that the fabric can be rolled up when it starts to rain.

Figure 6: A module with integrated light and wind sensors. (Illustration source: Somfy)

2.2.4. THE CONTROLLER

A large variety of stand-alone systems are available. They receive signals from the sensors and automatically control deployment and withdrawal of the solar shading, even when nobody is at home. However, these systems cannot take the indoor temperature into account. To make that possible, the sensors must be connected to an IHS. In either case, the system can be controlled automatically or with the aid of push-buttons or a smartphone app. Remote operation (from anywhere outside the home) is also possible with an IHS.

3. MOTORISED CURTAINS

Our behaviour of wanting to see, but not be seen, is probably a throwback to behaviour inherited from our forefathers. We had to be able to see a long way in order to detect possible dangers, such as other tribes or predators. On the other hand, we wanted to be seen as little as possible so as not to fall victim to some form of danger. In this modern age we still exhibit this behaviour, albeit usually for other reasons. For example, from our home we like looking outside in the daytime to see what is going on in the neighbourhood, and that is a result of our inquisitiveness. However, in the evening and at night we are more visible to the outside world due to the use of indoor lighting. In that case, things are reversed and we are exposed. We hang curtains to deal with that and they give us a cosy, sheltered and safe feeling as well. People cannot look in from the outside, and our privacy is guaranteed.

3.1. WHAT ARE THE ADVANTAGES OF MOTORISED CURTAINS?

First of all, greater convenience. You can open and close individual curtains at the press of a button. Group controllers are also available, which allow you to control all the curtains in a room — or even all the curtains in the entire dwelling — at the same time. In some cases actions can also be performed automatically at previously chosen times, or under the control of a timer with the Astro function.

Sometimes access to a window is blocked by the position of a sofa, making manual operation difficult or impossible. Manual operation of curtains on skylights can also be difficult due to the height.

Figure 7: The remote control for the motorised curtains (right) makes it easy for users to open and close the curtains situated behind the sofa and behind the floor lamp. (Illustration source: Goelst)

Older people with mobility problems have the same need for privacy and, if they are no longer able to manually operate the curtains themselves, the question arises as to whether it is time for them to move to an expensive care flat or a rest home. Electronically-operated curtains can therefore be a solution for enabling continued independent living at home.

3.2. TYPES OF CURTAIN SYSTEM

Besides the traditional, free-hanging, rail-mounted curtains, there are numerous other curtain systems such as roller blinds, vertical or horizontal slats, plissé curtains, skylight curtains, etc. An electrical control can be supplied for each type of curtain.

For traditional curtains, a special rail is placed above the window. A silent motor is then mounted on the rail, either on the left- or right-hand side. The power supply consists of a 24V or 230V connection, usually combined with a switch or a remote control. As well as individual curtain operation, many brands also offer the convenience of carrying out group or general operations. With this approach, occupants do not have to walk through the entire dwelling to manually open and close the curtains. Linking the curtain controllers to an IHS allows them to be included in mood button configurations.

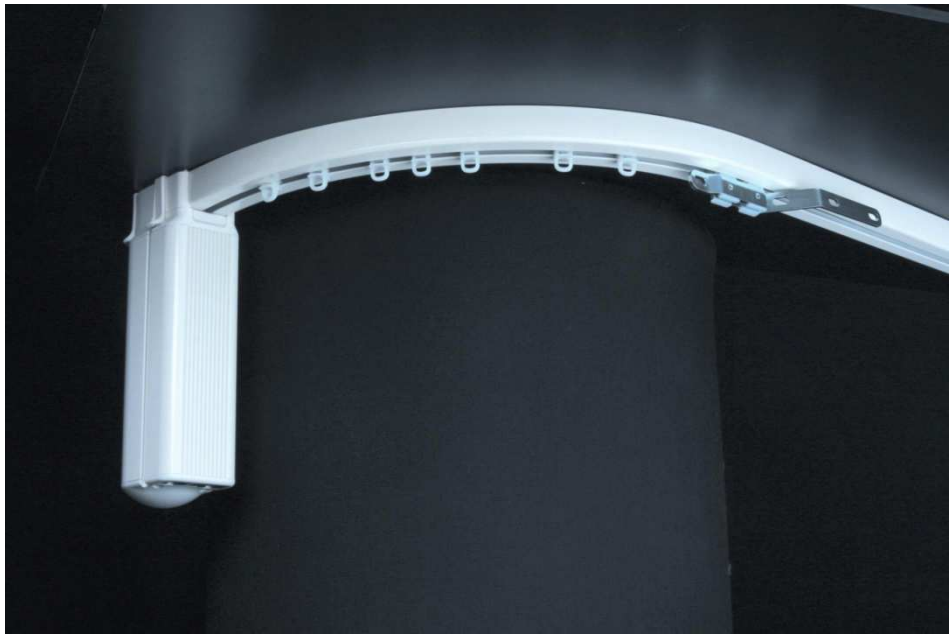

Figure 8: A curved motorised curtain rail and motor. (Illustration source: Goelst)

4. GARAGE DOOR

Most modern homes with a garage have a garage door equipped with a motorised drive. These are usually stand-alone systems, and you can only operate the garage door with them, and nothing else.

However, if an IHS is installed in the home it is possible to integrate other home sub-systems into the IHS, such as the lighting, heating and/or air conditioning systems. As an example, when the occupant comes home and opens the garage door with the remote control in the vehicle, the garage light goes on at the same time and a path to the kitchen or the living room is lit up. In addition, the heating can automatically be set to a comfortable level.

When the occupant leaves home through the garage, he or she presses the “All Off” button. This switches off the lighting in the home, except in the garage, and puts the heating in economy mode. The garage door is also opened, and the outdoor lighting is switched on for a few minutes. The vehicle passes a sensor when it drives away, causing the garage door to be closed and the garage light to go out.

4.1. STAND-ALONE SYSTEMS

Various types of garage doors and controllers are available. For example, you can choose from inward pivoting, outward pivoting or sectional garage doors. The motor unit is usually mounted on the ceiling of the garage, but there are also motors that mount directly on the door.

Conventional systems are operated by a remote control in the vehicle and a push-button in the garage. Each time the button is pressed, the door moves in the opposite direction from the last time it was pressed. Pressing the button while the door is moving stops the door.

Figure 9: A typical garage door motor for ceiling mounting. (Illustration source: Somfy)

4.2. IHS CONTROLLER

If users want to be able to control the garage door with their IHS system, a different motor must be fitted. This is because the motor must have at least two input contacts: one for opening the door and another for closing it. That way, the user knows exactly what the garage door will do when a control button is pushed, even if they cannot see the door at that moment.

A magnetic contact at the bottom of the door is also required to provide feedback about the position of the garage door (open or closed). If the door encounters an obstacle while closing, it will automatically stop for safety reasons, so this position feedback is necessary. If the user cannot see the door while it is closing, they might think it is closed when it is actually partially open. To avoid this situation, the magnetic contact must be closed after the usual door closing time. If it is not, the IHS will send a message to the user's mobile phone or cause one or more lights to flash in the home. This tells the user that there is something in the way of the door — for example, one of the kids has left their bike in the door opening.

5. WHAT ABOUT THE FRONT DOOR?

A normal electrical door lock works fine during the day, but it only closes the door at one point. That makes things easier for burglars because they only have to force the door at that one point. However, there are better systems available that provide greater security.

Some systems have electrically operated three-point or four-point closure. They are mounted in a routed recess in the lock stile. A standard door handle is fitted on the inside face of the door. The electrical lock is connected to a module on the distribution panel, which controls lock opening and closing. When the door handle is operated, it mechanically unlocks the door. This allows users to open the door whenever desired, even when no power is available. When the door is closed, the lock automatically returns to the secure night position.

There are two ways to open the door from the outside. The simplest option is a conventional key. It unlocks the door and, after the door is closed, the lock automatically returns to the night position. The other option for opening the door from the outside is to use an access control system, such as a keypad or a proximity card reader. The signal from the access control device is sent to the module on the distribution panel, which in turn opens the lock. When the door is closed, the result is the same as in the previously described situations.

6. USEFUL LINKS

Automate your manual shutters
http://pitchbook.copperwire.org/automate-your-manual-shutters#

The “I can see you, you can’t see me” game
http://pitchbook.copperwire.org/the-i-can-see-you-you-cant-see-me-game#

Controlling your garage door with your IHS
http://pitchbook.copperwire.org/controlling-your-garage-door-with-your-ihs#

Does your home look occupied when you are not around?
http://pitchbook.copperwire.org/does-your-home-look-occupied-when-you-are-not-around#

Save energy using automatic shutters and sunscreens
http://pitchbook.copperwire.org/save-energy-using-automatic-shutters-and-sunscreens#

Window sun screens, blinds and shutters
http://www.leonardo-energy.org/white-paper/window-sun-screens-blinds-and-shutters