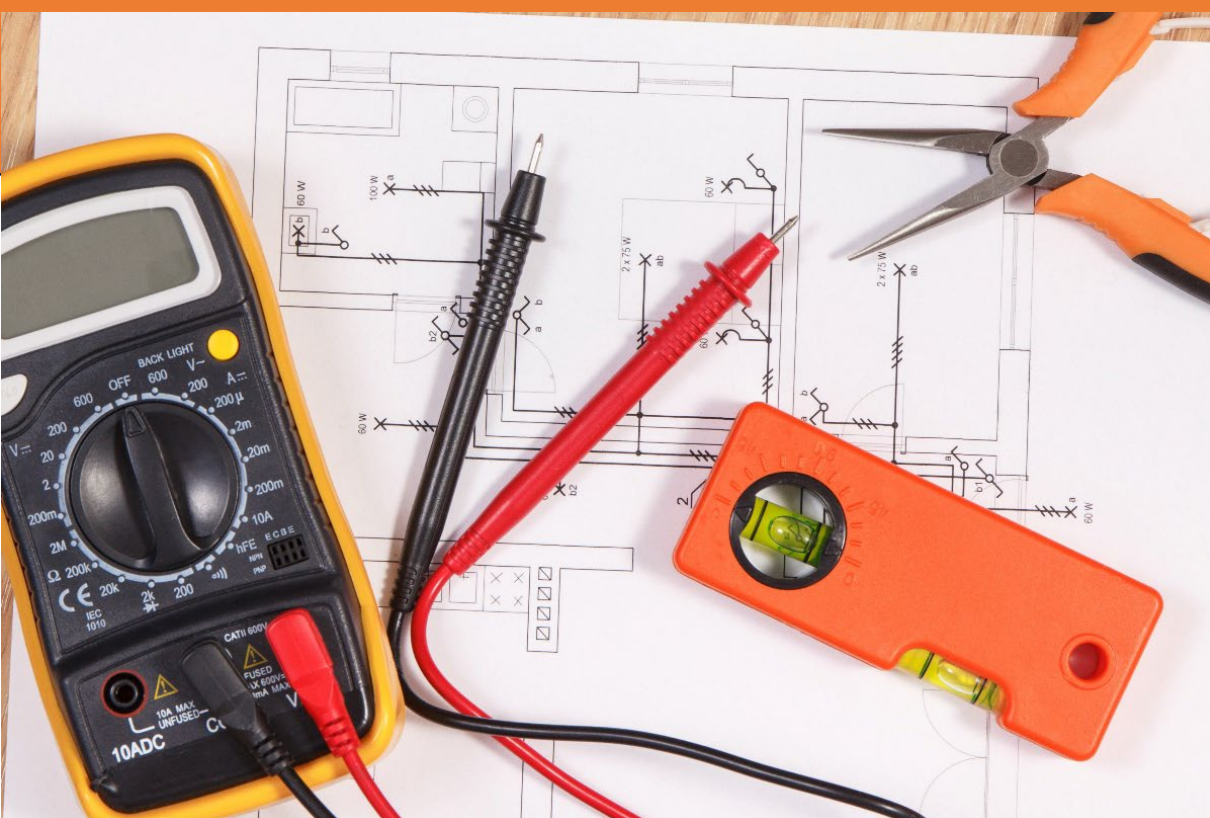


# Electrical installation guide for the North American region v3.2

Edition date: 2023-09-21



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## 1. Preamble

This document was created for electricians and constructors for pre-cabling and installation of UpHome smart home systems. Hereinafter, we shall present the key concepts and instruments of the UpHome system, the central control box, which includes the rail mountable control units, followed by the cabling of the smart home network, and finally, the connection of the modules. Completing the checklist at the end of the document means that the system is ready to be programmed.

### 1.1. UpHome devices

The UpHome smart home solution is a wirelink system connected to sensors and actuators (and the internet) in households, and is capable of carrying out complex smart-home functions via the communication between these devices.

UpHome devices belong to 3 main groups:

#### 1. Central unit or controller

The controller is the heart of the smart home system, which is absolutely vital. Here is where the mini computer is, which is responsible for carrying out more complex functions. Connecting the central unit to the internet allows the user to control the home remotely, using a mobile app.

Furthermore, the controller (hardware version 1.1.5) includes:

- Analogue and digital inputs
- Relays
- Wiegand ports

which may be sufficient to carry out the functions in the smallest homes. In most cases however, the system needs to be extended.



1. 1 - UpHome central unit (controller)

## 2. DIN Rail Extension Module

Extension units are **mountable onto DIN rails**, which connect to the controller via **CAN bus**. Their objective is **extending the number of connection options**, which are limited on the controller.



2. 2 - UpHome Extension module

Several types available:

Name	Function	Number of extended connections
NONC Extension	Digital port extension	24
Relay 10 Extension	Relay port extension	10

## 3. Wall or LS modules (behind switches)

Small, wall mountable (in mounting box, behind switches) modules. Usually, these make up the largest part of the smart home system.

They connect to the controller (or the aforementioned DIN rail LS extension) via so-called **LS** ("Low Speed") **bus**.

There is one type of external encasing which is 19 mm. The contacts are located on them separately: low-current spring contacts on one side. On their bottom, there is a small red status indicator LED, which aids in troubleshooting.

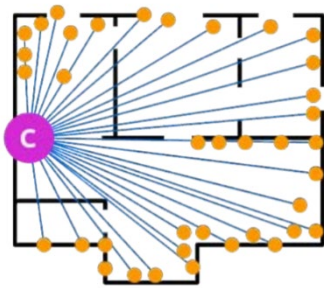


3. 3 – UpHome wall (LS) module

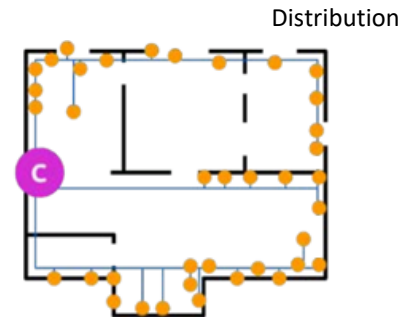
Name	Function	Number of extended connections
Ls Alternative 8 Module	Digital port extension	8

## Cabling of the smart home system

### 1.2. Topology



*Point-to-point topology*



*Cabling in Tree topology*

4. 4 – Comparison of point-to-point and tree topology cabling used for LS modules

It is recommended to install the power supply unit, the controller, the DIN rail modules into the traditional, masked home distributor developed for the circuit breakers.

We recommend taking the following into consideration when selecting the size:

- we recommend having a reserve of at least 20%,
- a space of a few modules is left at the end of each row, where an entire device cannot fit,
- room must be provided for the cabling as well

There is usually no space in the distribution box to separate high-current and low-current energy cables for each row, but when doing vertical cabling, it is recommended to route high-current cables on one side, and low-current cables on the other. For terminal strips, low and high-current strips must be separated and labelled.

### 1.3. Bus cable

#### 1.3.1. Type

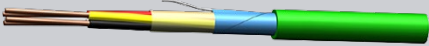
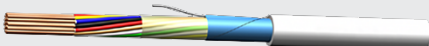




5. 6 - 4-kV KNX bus cable

As a rule, cables with different voltage levels (extra low and low voltage) cannot be routed in the same conduit, with the exception of 4-kV insulation strength cables, like bus cables.

For this reason, in the UpHome system, **J-y(st)y 2x2x0,8** cables with a 4-kV insulation strength must be used. The most commonly known cables of this type are **green KNX/EIB cables**. This way, high and low-current cables do not require separate conduits.

Bus cables, alarm cables must be labelled (e.g., with a thin sharpie), otherwise, troubleshooting will be very hard.

	Image	Type	Comment
✓		J-y(st)y 2x2x0,8 KNX/EIB	green, Insulation strength: 4 kV
✗		J-y(st)y	grey, Insulation strength: usually 1-2 kV (must not be routed in same conduit as high-current)
✗		0.22 alarm cable	not suitable
✗		Ethernet cable	limited suitability (for fewer modules, shorter distances and routed in separate conduit – not recommended!)

1 1 – Suitable bus cables

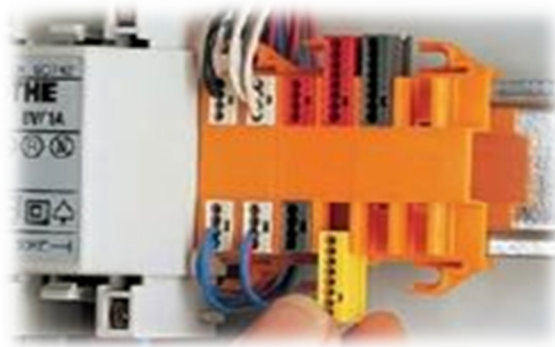
### 1.3.2. Connection

The four strands of the bus cable are recommended to be connected with the microWAGO (243 series) manufactured for KNX/EIB cables.



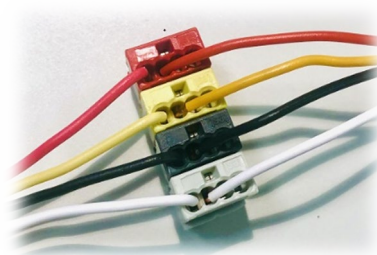
6. 7 – WAGO 243 series (micro)

Micro WAGO's can be connected to one another, with rail mountable supporting elements available for them, and they are also available in the colours of the bus cables.



SEQ ábra \\* ARABIC Fig. 8 – DIN rail mountable WAGO support

The use of appropriate colouring, as per the figure below, is recommended.



7. 9 - Connection of bus cable with microWAGO



If these are unavailable, then WAGO's made for simple, solid cables may also be used, but these are harder to work with, since their springs are strong and it's harder to insert cable strands into them.



8. 10 - WAGO 2273 series

The uninsulated strand routed next to the bus cable's shielding is thinner, so this cannot be connected with a WAGO 243, but it *can* be connected with WAGO 221 with locking lever.



9. 11 - WAGO 221 series

#### 1.4. CAN bus

The CAN bus connects DIN extension modules with the UpHome controller.

##### 1.4.1. Topology

It is a strictly straight bus; there may be no branches, so DIN devices must be fastened. If, for some reason, the topology would nevertheless be a point-to-point one, then two bus cables must be routed to a device (e.g., distributor-collector) so that the physically straight bus topology can still be configured.



10. 12 - CAN bus, incorrect branch and solution with two cables

The controller does not necessarily have to be at the end of the bus.

##### 1.4.2. Limitations

The CAN bus can have a maximum length of up to 1 km, however, more devices require more input power, which may cause major supply voltages at large distances. If the supply voltage of the bus falls below 20V, the situation must be resolved, for example, via local power supply.

### 1.4.3. Colour coding

Recommended colour coding: on the CAN connectors, in this order from left to right

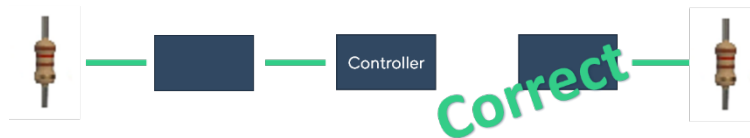
Colour	Role
Red	+24 V Supply Voltage
Black	GND
Yellow	CAN H data line +
White	CAN L data line –
uninsulated thin strand	shield

2.2 – CAN bus colour coding

### 1.4.4. Connection

**The 120-ohm termination resistor is required at both ends of the CAN bus.** These are not integrated into the controller either, but we provide them as standard for each of our controllers. It is easiest to place the resistors in the CAN screw terminals of the modules at the two ends of the bus, between the yellow and the white wires, by wrapping the legs of the resistor around the 0.8 solid copper core, otherwise the connector will not fasten it properly.

(The resistors can only be omitted for very short distances; we recommend always using them in practice.)



11. 13 – CAN bus with termination resistors

The simplest way to continue the strip terminals of the modules.



bus cable's routing is using the

12. 14 - Typical CAN connection

The shields must also be connected together and they must be connected precisely at a single point into the house's EPH network, preferably next to the controller or inside the main distribution panel.

## 1.5. LS bus

The LS bus connects the wall modules (placed in the mounting boxes) with the controller (or the LS extension module).

### 1.5.1. Topology

Unlike the electrical installation of traditional sensors, the cabling of the LS modules is not point-to-point, so the baffling jungle of cables around the central unit can be avoided.

LS module cabling is bus-based, meaning that **it allows for tree-like branching**. In certain modules, incoming and outgoing bus cables have separate configurations.

### 1.5.2. Limitations

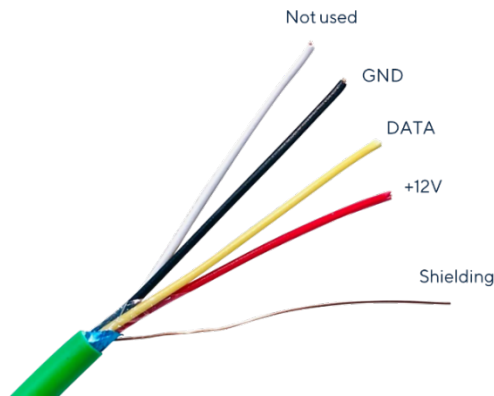
- The maximum length of an LS bus is 100 m.
- **An LS bus can hold a maximum of 16 modules.** We recommend not using all of it for future extendibility, and connecting just 12 to 13 devices to a single bus.
- **The maximum current is 1A at 12VDC!** It can be used to power safety technology devices; however, it cannot be burdened too much! (Magnetic gate locks must not be connected to it!)

### 1.5.3. Colour coding

Colour coding of the 4 strands of the J-y(st)y 2x2x0,8 KNX/EIB cable for LS bus:

Colour	Role
Red	+12 VDC Supply Voltage
Yellow	Data line
Black	GND
White	Not in use (backup)
uninsulated thin strand	shield

3 3 – LS bus colour coding



13. – LS bus colour coding

In case of bifurcations, splicing, **all four strands and shielding must be connected**, even if according to the current plans, the LS bus will only be using three strands.

### 1.5.4. Connection

As we've previously mentioned, the LS bus can also follow a tree structure, meaning that it can have junctions.

- In case of bifurcations, splicing, all four strands and shielding must be connected, even if according to the current plans, the LS bus will only be using three strands. (For what could the fourth strand be used? E.g., a second LS bus, separate supply voltage, backup in case of failure, etc.)
- The shields must also be connected together and they must be connected precisely at a single point into the house's EPH network, preferably next to the controller/LS Tree extension or inside the main distribution panel.
- Distribution and further routing of the LS bus may be done in the following ways:
  - it is difficult to connect two cables/strands into a single connection point of an LS module, but it can be done with a little finesse,
  - They can be divided into many routes with WAGOs. In this way, only one bus cable needs to be connected into one module, which is the recommended solution, however, enough room must be provided for the WAGO's division.

### 1.5.5. Cabling - tubing

It is worthwhile routing them to every switch, as this way, you will have the option to add plus circuits to the system in the future, e.g., when changing the furniture arrangement, the connector's controller can be moved together with the floor lamp.

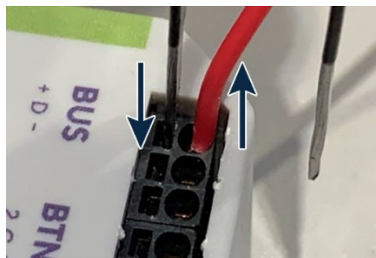
We recommend to include conduits one size larger in the plan, due to the additional space required for the bus cable.

Distribution of lighting circuits follows bus distribution, so the bus cable (from the controller or LS Extension), as well as the high-current power supply (from the high-current distributor) can be routed to a switch module within the same conduit.

Example of typical tubing, cabling topology: The common supply cables of several lighting circuits are started from the distribution board. For the first switch, the bus and high-current cables can be branched off towards the local LS module and circuit, or the next switch/LS module/circuit. As such, switches on a single bus cable, which are practically on the same distribution branch are connected in succession, and the local consumer(s) is/are supplied from the LS modules behind each switch.

### 1.5.6. Connection

A shorter 4-5 mm blanking length is required for connection on the low-current side. This is especially important when using devices without the option for additional bus connection, so 2 strands must be forced into each connection point of the LS bus (no supported, but permitted solution). The cables from the low-current connectors of the LS modules can be pulled out either via rotation or by using a thin tool (e.g., one end of a pair of tweezers) to go into the rectangular hole next to the cable.



14. 20 - Pulling out a cable from an LS module

The easiest way to connect an LS module with a switch is by using the small pieces cut out from the bus cable's strands. All switches are button switches, simple or double switches.

### 1.5.7. Placement

An LS module needs to be installed so the red status indicator LED (1-mm hole) on its bottom faces outward, which makes troubleshooting much easier. Order going outward from the inside: connection-module-switch fixture.

If the LS modules are not installed behind the fixture, but into a connection box, it is still recommended that their cover be removable, so they can be accessible in case of troubleshooting or failure.

### 1.6. Comparison of the two buses

Although the same KNX/EIB J-y(st)y 2x2x0.8 cable is used for both buses, there are serious differences between the two, shown in the following summarising table:

	CAN bus	LS bus
Where is it used?	Between DIN rail extension devices	Between wall, LS devices
Topology	Straight, no branching allowed	Tree-structure
Does it require termination resistors?	Yes, 120Ω on both ends	No
How many strands are used	All four	Usually only three
Supply Voltage	24 VDC	12V DC
Maximum length	1 km	100 m
Maximum number of devices	30	16 per channel*
Maximum power		1A

\*: Maximum recommended number of devices should not be used; a reserve must be provided for possible future extensions.

## 2. Implementation of features

In the following, we will present the implementation of smart home features using UpHome devices.

### 2.1. Lighting control

Simple connection of lighting can be done with UpHome **DIN Relay 10 extension** modules, which contain 10 controllable relays respectively.

#### 2.1.1. Alternative switching

We use **LS alternative 8 modules** since control is done entirely through software, LS alternative modules can give commands to **DIN Relay 10 extensions**, therefore a remote control feature is presented.

## 3. Integration

### 3.1. Small gate, pedestrian entrance

Intercoms are power via PoE (Power over Ethernet), so a single Cat5e or Cat6 Ethernet cable will be enough for them. The use of shielded cables, such as SFTP, is recommended. Cannot be routed in the same conduit as high-current cables!

Doorbird D101S devices can be mounted onto the wall, with the possibility of recessed/wall mounting larger Doorbirds and Akuvoxes. Connection behind the device is required for pre-wall mounting as well, which can be done in a 65-mm mounting box. Doorbird D101S devices cannot hide larger mounting boxes. In-wall mounted devices have their own boxes.

There are two connection options:

- standard PoE (preferred):
  - Doorbird:
    - only support ModeA PoE, so it cannot be supplied by all PoE devices (e.g., supply with TP-Link TL-PoE150S is possible),
    - connection is possible either via RJ45 or via its own connection cable, which needs to be connected via the Ethernet cable
  - Akuvox: simple RJ45 connection
- passive PoE
  - Doorbird: 15VDC (power supply provided)
  - Akuvox: 12VDC (power supply not provided)
  - usual colour coding:
    - blue+white and blue is the positive cable (!), this is connected to the red,
    - brown+brown and white is the GND, this is connected to the black,
  - there are passive PoE injectors which can also be used both outside and inside

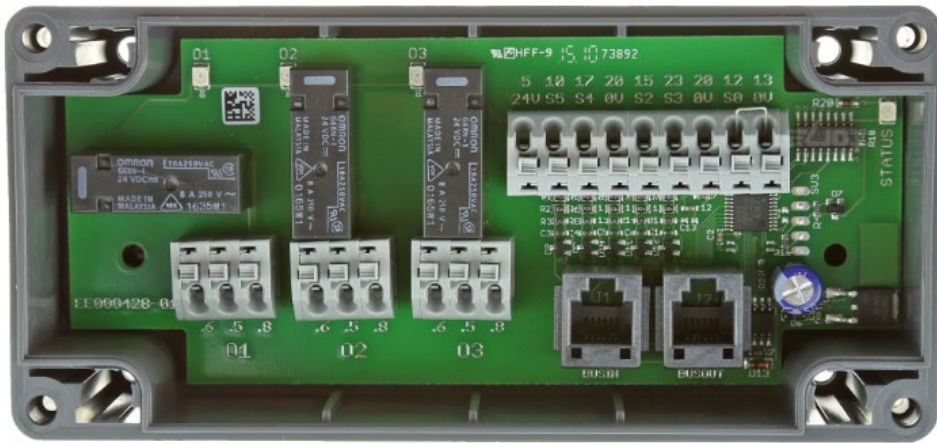
However, opening the gate lock must be handled separately. The opening voltage of buzz-in magnetic locks will also need to be provided, which will require a separate 2x1, or for longer distances, a 2x1.5 cable. **12V power supply must not be provided from the LS bus**, because the high power consumption of the magnetic lock may cause disturbances in the modules' power supply.

Conduits must be routed to the box behind the intercom, so that the opening voltage may be provided from the intercom's relay as well. If there is an EXIT (gate open) button, then that must also be routed under the intercom.

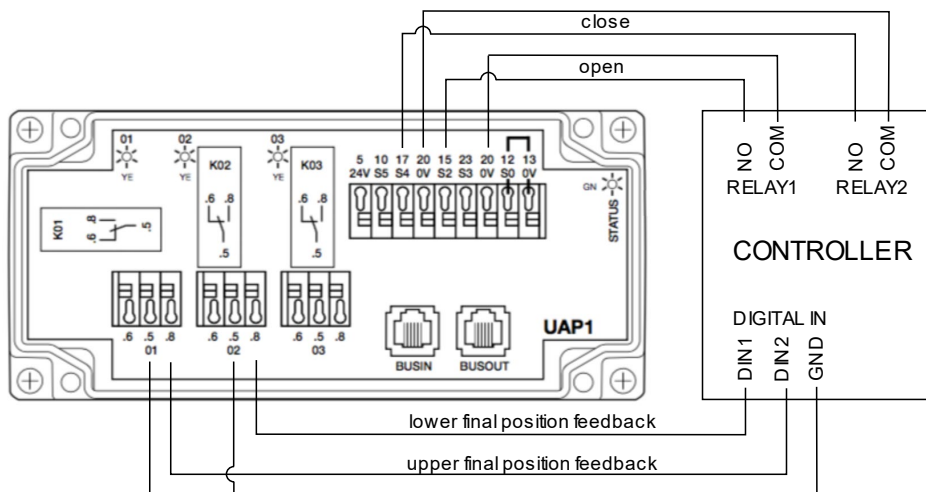
Opening detectors are not compulsory, but they can be integrated as additional features for controlling small gates, which can be signalled by the application on the interface, for example.

### 3.2. Large gates, vehicle entrances

The best solution is **using an integration module**, which is able to receive opening and closing orders, as well as transmit opening sensor condition on a single point. A suitable module is, for example, the Hörmann UAP1. In this case, the bus cabling of gate automation must be done separately, and you must connect to the integration module, which must be connected to the UpHome system, with an 8-strand alarm cable.



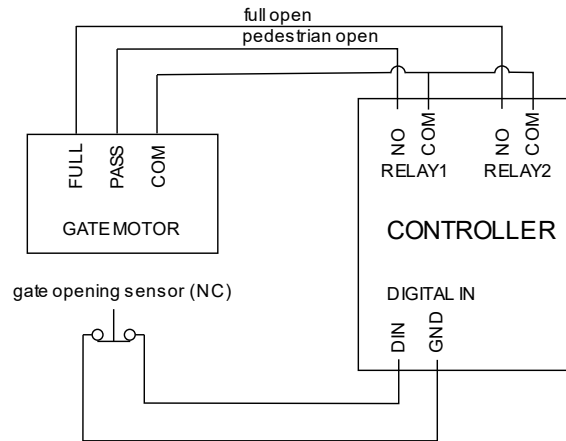
15. 31 - Hörmann UAP1 universal adapter panel



16. 32 - Connection of Hörmann UAP1 into the UpHome controller

If the module is not available, then the opening order, as well as the opening sensor must be cabled separately, all the way to the gate, which requires a 6-strand alarm cable for each gate.





17. 33 - General connection of gate control to the controller

In addition to control, the 110V supply voltage must also be routed to the fence, the gate, because the gate motors, as well as lighting will be powered from this supply.

### 3.3. Cabling of safety technology devices

These are low-current devices, cabled via 0.22 alarm cables, or Ethernet cables. Routing them in a single conduit with high-current cables is **prohibited**.

Cabling of devices:

Device	Cable requirement
opening sensor	2x0.22 or 4x0.22
motion sensor	4x0.22
siren	2x0.5 + 6x0.22
code keyboard, card and fingerprint reader	2x0.5 + 6x0.22
wind sensor	4x0.22
through-flow sensor	4x0.22
water leak sensor	4x0.22

4 6 – Cabling requirements of safety technology devices

**All cables must be labelled.** Programming may only be carried out if a list is made regarding which sensor is connected to which digital input.

The contact of safety technology devices is usually closed (NC) in the baseline, so for example, motion sensors must be connected in line in a stairway, if you want to connect several to a single output.

#### 3.3.1. Integration of alarm system

We recommend connecting safety technology devices to the alarm. Their signals are received from it via integration. Currently, we have experience with the Paradox Digiplex EVO product range, but in theory, we can communicate with any alarm sending-receiving ASCII characters via RS232. On the Paradox alarm side, an APR-PRT3 printer module is required, which can be connected to the controller’s serial port via a D-SUB connector.



18. 34 - Paradox APR-PRT3 integration and printer module

A 4x0.22 cable will be needed between the controller and the alarm port, which can be used to connect the RS-232's 3 cables (TX, RX, GND) to the controller from the DB9 connector. We recommend carrying out connection with a DB9 male - serial port converter.



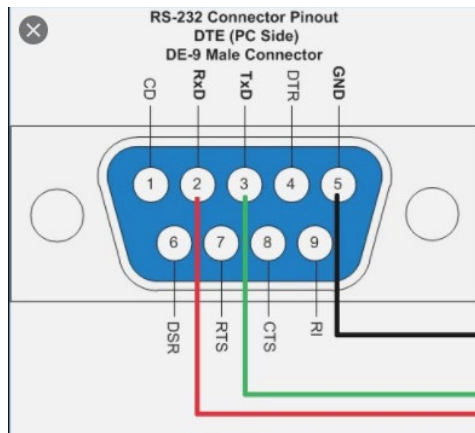
19. 35 – DB9 (male) – screw terminal strip converters

The connectors in the first two pictures need to have the nuts used for fastening removed, as these are already on the PRT3, so you wouldn't be able to plug them in. The third image shows a version that can be used without dismantling.

When connecting the DB9 connector, pay attention to connect one side's Tx to the other side's Rx, so the Tx and Rx need to be "cross" connected.

### RS232 Wiring





20. 36 – Connection of DB9 male connector

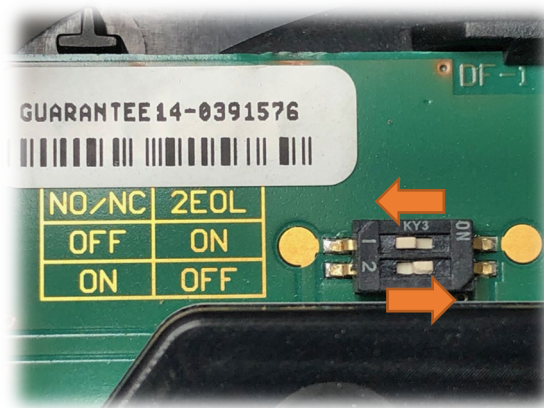
The DB9 connector’s connection diagram is wrong in the PRT3 module’s own documentation, as the descriptions of pins 2-3 are switched. That diagram must show Tx-Rx connection from the device’s point of view.

### 3.3.2. Connection of Wiegand

Devices using the Wiegand protocol can be connected to the designated Wiegand ports of the controller (2 devices, connection: chapter 4.1), or the NO/NC digital input extension module (3 devices, connection: chapter 4.2.2). These devices typically use a power supply of 12V DC (usually red and black) and they communicate via D0/W0 (usually green) and D1/W1 (usually white) strands. Such devices often have a pushbutton, an audible or visible warning device, connected separately, which require additional strands, pairs of strands.

### 3.3.3. Satel TSD-1 combined optical smoke and thermal velocity sensor

Sensors that can save lives or protect you from major economic damages are recommended to be connected to a specialised system: the alarm. There is nothing to be lost, as these can be obtained via integration: for example, the water sensor’s signal can be used to stop the water.



21. 37 - Appropriate setup of Satel TSD-1

Appropriate setup of DIP switches:

- 1: OFF
- 2: ON

Connection:

- 1: GND
- 2: relay (to NC input)
- 3: relay (in our case, this is also a GND, but should be cabled separately)
- 4: +12V

### 3.3.4. Connection of Satel FD-1

Requires a supply voltage of 12 VDC (red-black) and returns contact (yellow-white).

We recommend carrying out jumper connection to NC.

### 3.3.5. Connection of motion sensors

Simple motion sensors can also be placed here, like Paradox DG 460 infrared sensors, as they are flat and easily mountable either to the underside of the bed, or on the floor.

The 12-V supply voltage can be supplied from the LS bus as well, with two options for connecting the motion signal:

- a. the device is left in the default NC(Normally Closed), in which case the two PIRs are connected in line,
- b. the J2 jumper is removed, and the NO(Normally Open) is used, in which case the correct connection type is parallel connection.

The only NC/NO-compatible modules are the Alt8 and DI24/NONC.



22. 38 – Paradox DG 460

### 3.4. Internet connection

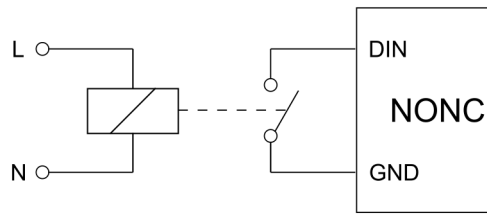
Connecting the UpHome to the local network requires two strands of Cat5e or Cat6 Ethernet cables to the switch or router serving as the LAN's central unit.

### 3.5. Connection of uninterruptible power supply (UPS)

Since the output of an uninterruptible power supply is a traditional socket, the connector plug can also be inserted rotated 180 degrees, thus switching the zero-phase. Therefore, **it is PROHIBITED to connect the plug connector cable to the zero rail of the small distributor**, because in case of an unlucky connection, the phase will be the one connected to this uninsulated metal part!

Only our own devices, as well as the LED power supplies can be connected to the uninterruptible power supply, if:

- It can support the maximum power, and
- there is a voltage monitor relay, which provides information for automatic light dimming in case of a power outage. This is a simple AC relay connected to any digital (contact) input.

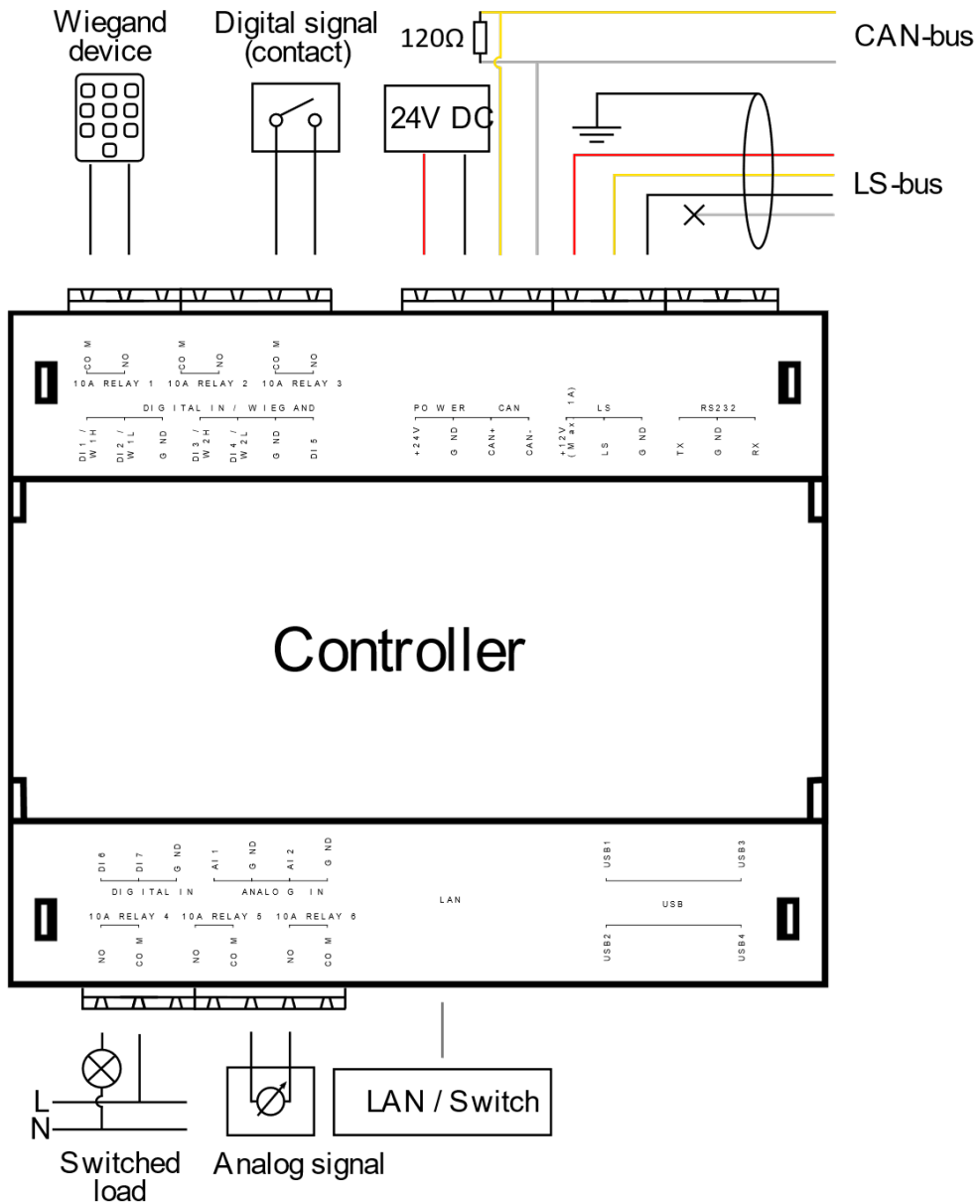


23. 39 - Connection of the voltage monitor relay to a general digital (contact) input

## 4. Connection of UpHome modules

### 4.1. UpHome controller

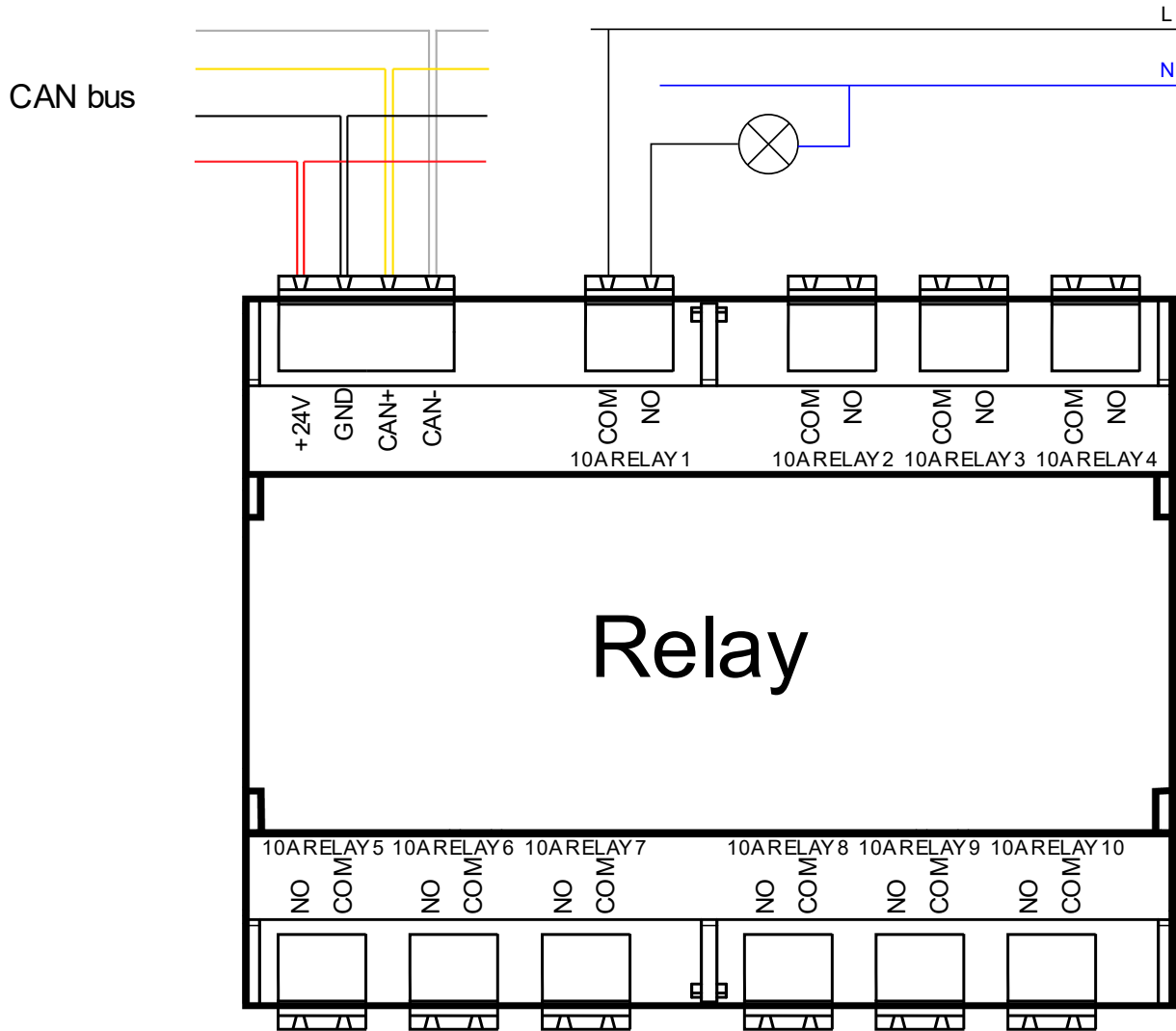
Item no.: UP-CDN-CTP-150, Version: v1.5.0



**4.2. Extension modules**

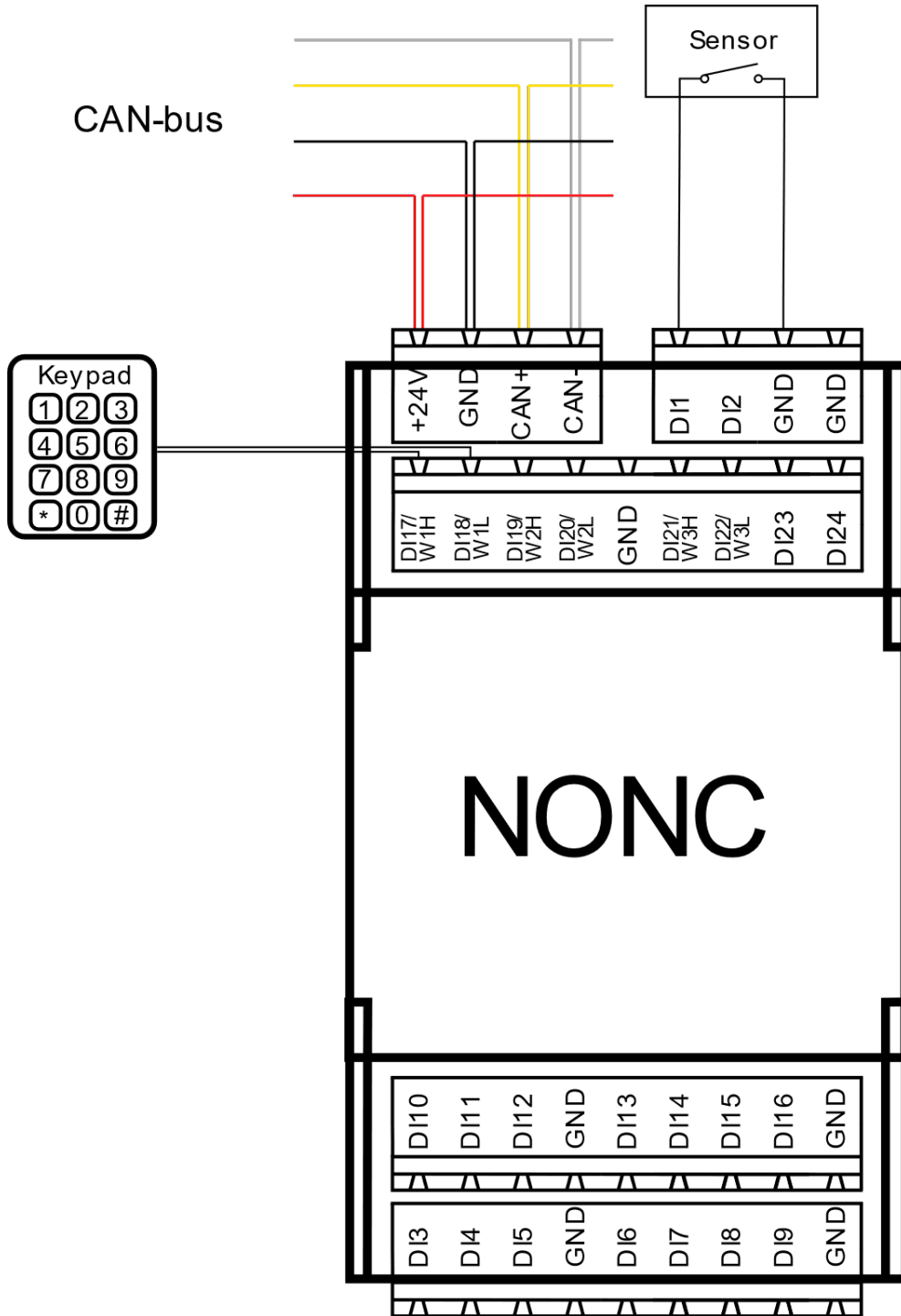
**4.2.1. Relay 10 extension**

Item no.: UP-CDN-R10-113, Version: v1.1.3



**4.2.2. Digital IN 24 extension (NO/NC)**

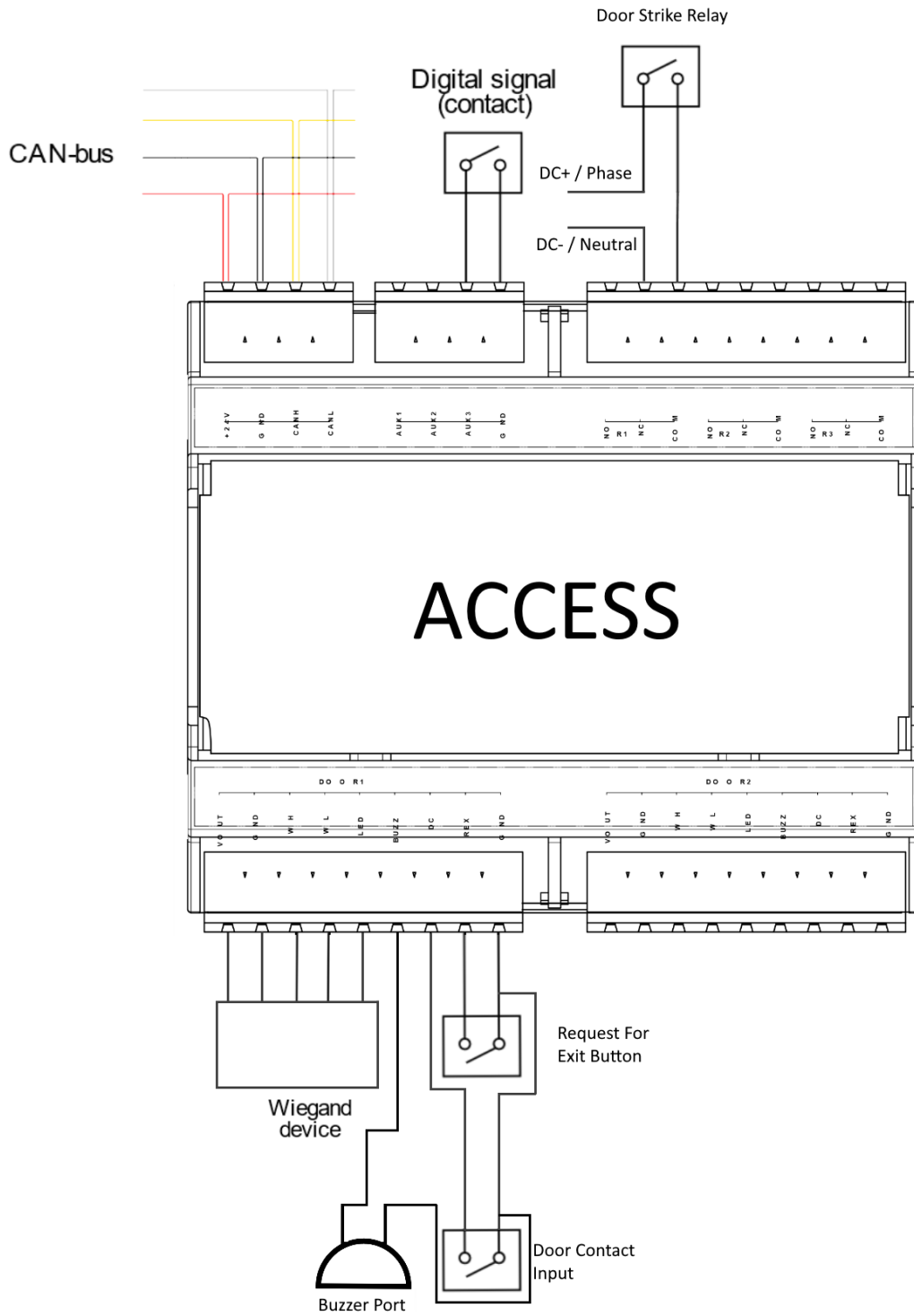
Item no.: UP-CDN-D24-113, Version: v1.1.3





**4.2.3. Access Extension**

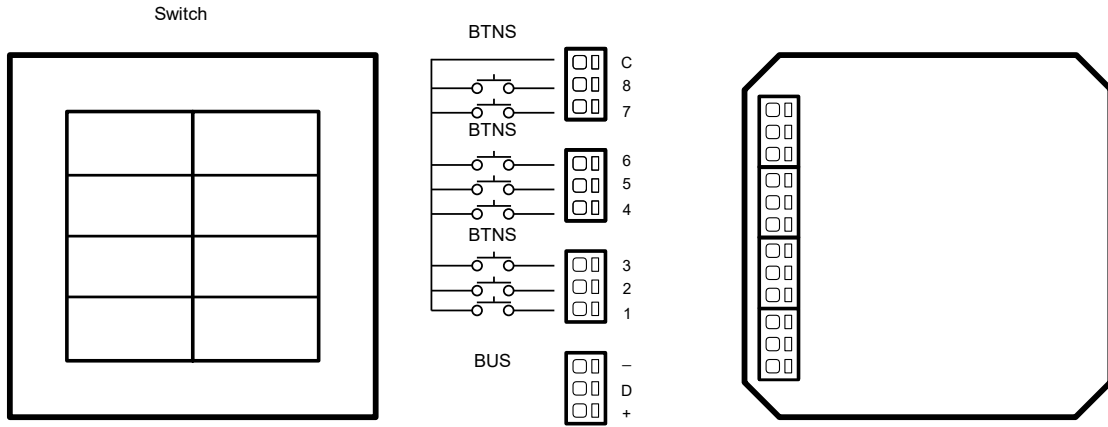
Item no.:UP-CDN-AC2-100, Version: v1.0.0



**4.3. LS wall module**

**4.3.1. 8-port digital IN (ALTERNATIVE 8) module**

Item no.:UP-CLS-AL8-102, Version: v1.0.2



## 5. Notes

## 6. Checklist for handover for programming

With this checklist, the Client and their electrician acknowledge that they have carried out all installation works of the system, as per the contractual provisions, and the system is ready to be programmed.

Placing a check next to the following lines means that substantive testing of the given point has been carried out and the task is completed/the test was successful. Unsuccessful tests shall be marked with X, and points not applicable on the given system shall be marked with N/A.

Inspection	
	All DIN and LS devices are installed physically in position, and are connected
	All high-current connections have been carried
	All low-current connections have been carried out (Wiegand, opening and motion sensors, etc.)
	CAN bus connected, with 120-ohm terminations at both ends
	There is no short-circuit between any two strands of the CAN bus
	LS bus(es) are connected, with a maximum number of 16 devices per bus
	There is no short-circuit between any two strands of the LS bus
	Power supplied to devices
	CAN bus measures 24V
	LS bus measures 12V

Client name:	Electrician name:
Client signature:	Electrician signature:

**Technical assistance:**

**+36 1 770 7730**

**M - F: 9:00 AM - 5:30 PM (UTC+2)**

