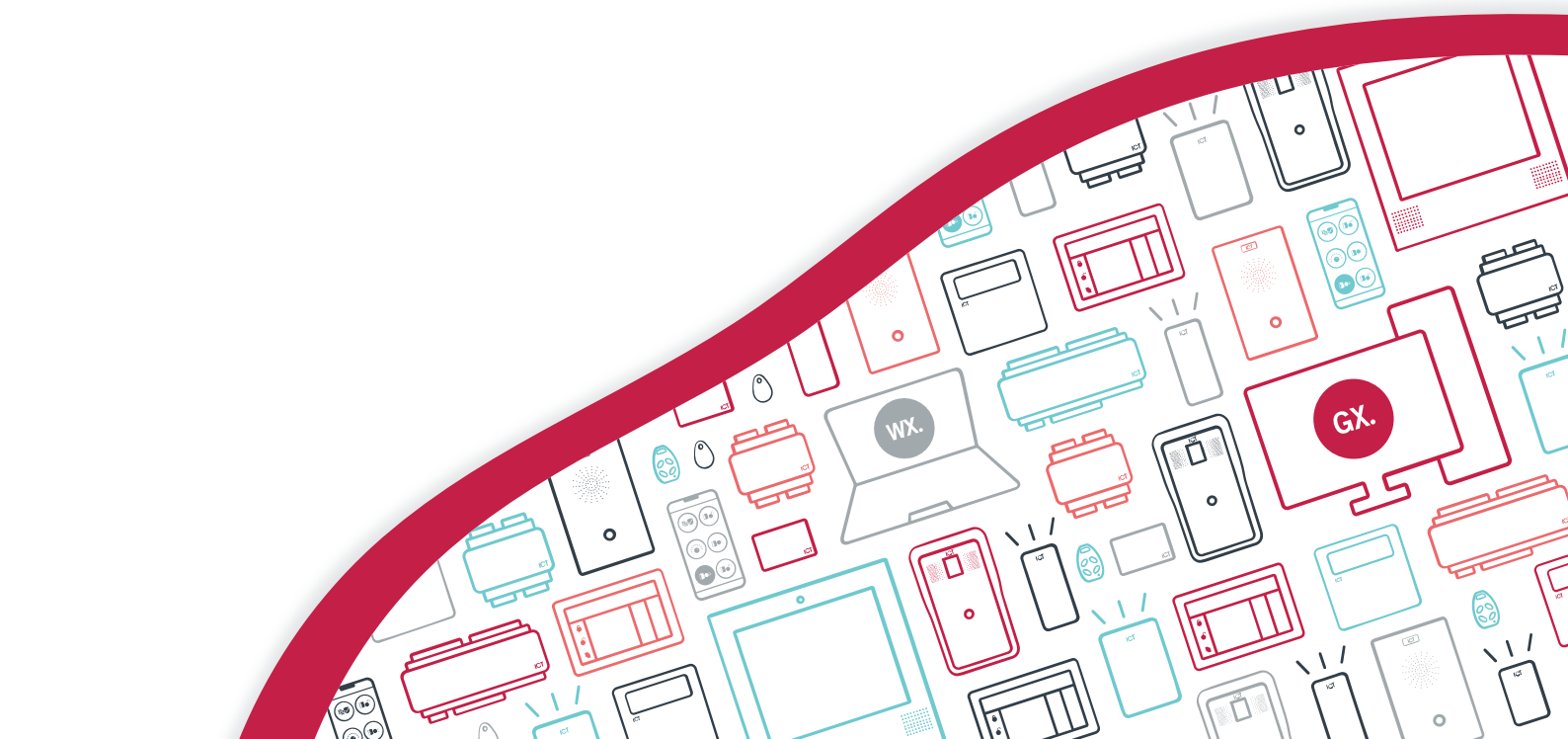
AN-248

Low Level Elevator Control in Protege GX and Protege WX

Application Note



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Contents

Introduction

Access control systems are not limited to controlling access to doors. Buildings that have elevators often require access to floors to be controlled as well.

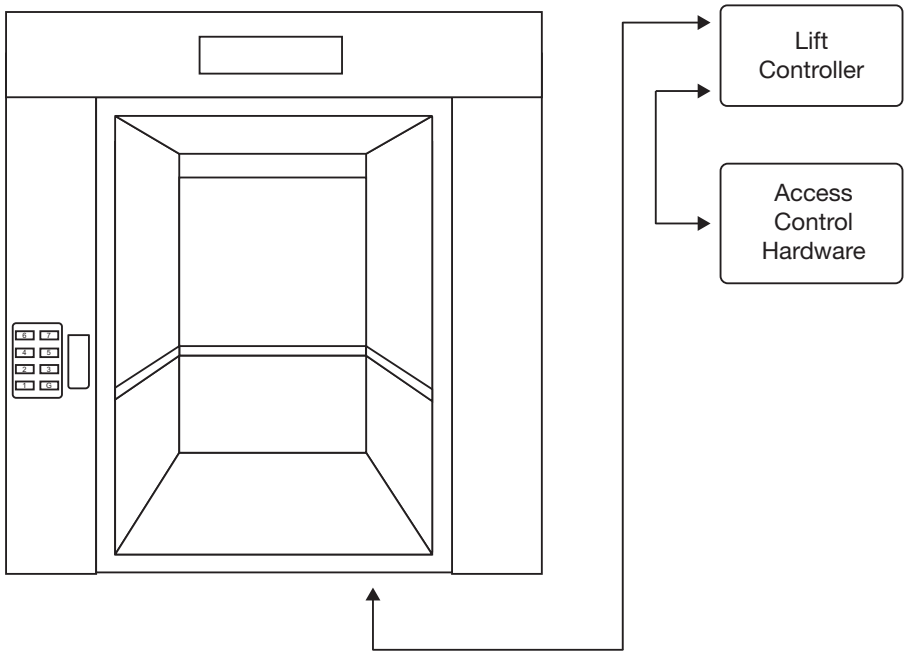
Low level elevator integration with Protege GX and Protege WX enables cost effective access control of almost any elevator system, regardless of age or capability. Basic integration is achieved by wiring Protege outputs directly to elevator floor relays, allowing the Protege system to control the locking and unlocking of floors. In addition, elevator buttons can be connected to Protege inputs, enabling Protege to record which floor a user has selected when they gain access at the elevator (destination reporting).

This application note covers the hardware requirements and configuration required for low level elevator control. It also demonstrates how to program an elevator system in Protege GX or Protege WX with two distinct programming scenarios.

Protege GX can also achieve high level interface (HLI) integration with some elevator systems, where the controller communicates with an elevator server or controller over the TCP/IP network rather than physical outputs and inputs. For more information, see the relevant application note for each system.

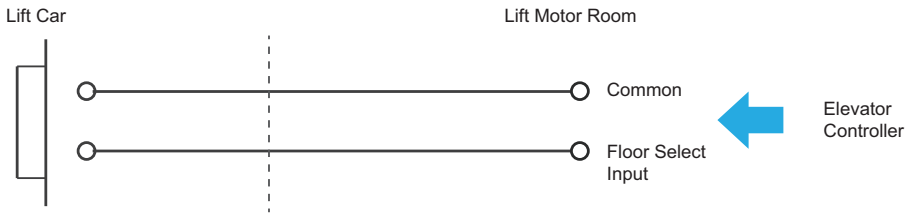
Basic Elevator Control

Basic elevator control is commonly achieved by installing a card reader in each elevator car. When a user badges their card at the card reader, the floors that they have access to are unlocked for a short period of time. During this time, the user is able to select a floor.

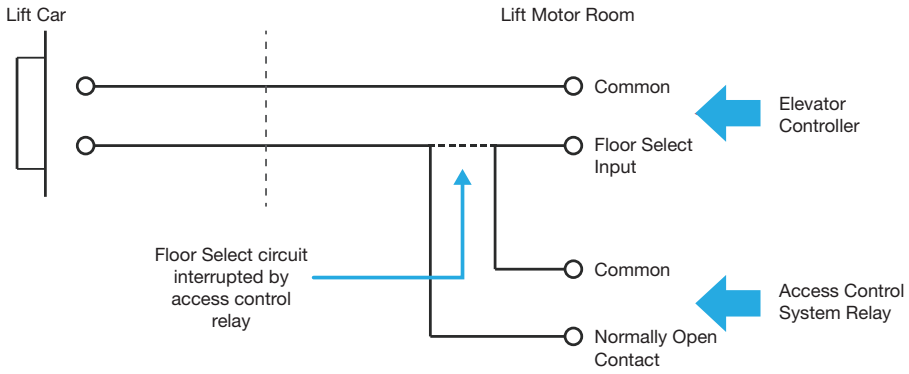


In older elevator systems, elevator control was achieved by modifying the elevator system wiring to prevent a button press being received by the elevator controller.

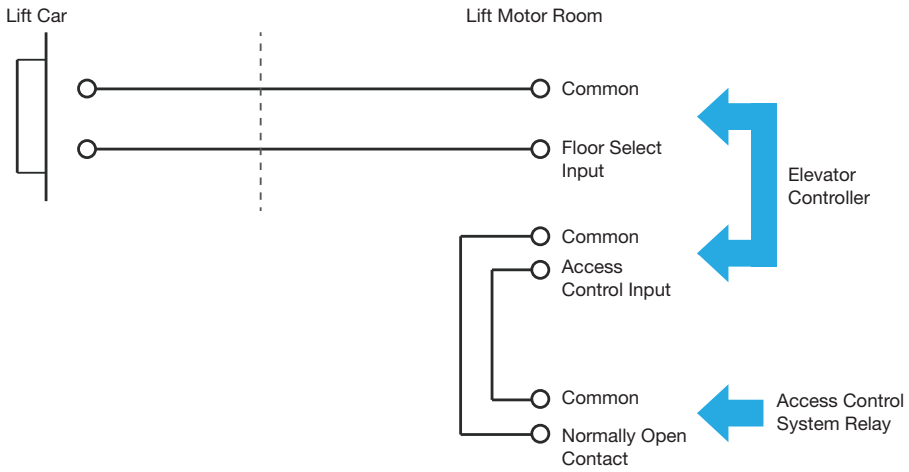
Floor select wiring without **access control**



Floor select wiring with **access control**



Modern elevator control systems are microcontroller based. Access control is achieved by wiring inputs and outputs between the elevator control system and the access control system:



Warning: Elevator system wiring can carry high voltages. You should always use caution when interfacing with elevator control wiring.

Destination Reporting

Although basic elevator control suits most installations, some require further security. Basic elevator control does not prevent multiple floors from being selected once the floors are unlocked. This can result in a user gaining unauthorized access to a floor. When basic elevator control is used, there is no record of which floor (or floors) a user has selected. If a situation arises that needs investigation, the event log can only show when access was granted to a user, but not which floor the user selected.

Where this level of security is insufficient, destination reporting can be implemented. This involves providing a set of isolated inputs to the elevator control system which receive feedback on which floor buttons are pressed. When a user badges their card, none of the relays are energized. When a floor is selected, the system sees the button press and in response pulses the appropriate floor relay and logs an event showing which floor the user selected.

As well as controlling access to floors, elevator control allows the scheduled unlocking of a floor. When used in conjunction with destination reporting, this also allows:

- Prevention of scheduled unlocking until the first person arrives (late to open).
- Unlocking when the floor area is disarmed.
- Preventing access if the floor area is armed.

Programming Overview

The following steps are required to program low level elevator control in Protege GX or Protege WX.

To program elevator cars and floors in Protege WX, the controller must have advanced mode unlocked.

1. Program the floor relay outputs for each elevator.
2. Destination reporting only: Program the floor button inputs for each elevator.
3. Create the floor records.
4. Create any schedules or areas which will be used to control floor locking/unlocking.
5. Program the elevator cars, which connect the floors, outputs and inputs.

   Some features in the elevator car programming are not available without destination reporting enabled.
6. Configure the reader expanders to support elevator cars.
7. Assign access to elevator groups and floor groups to users.
8. Test the elevator operation.

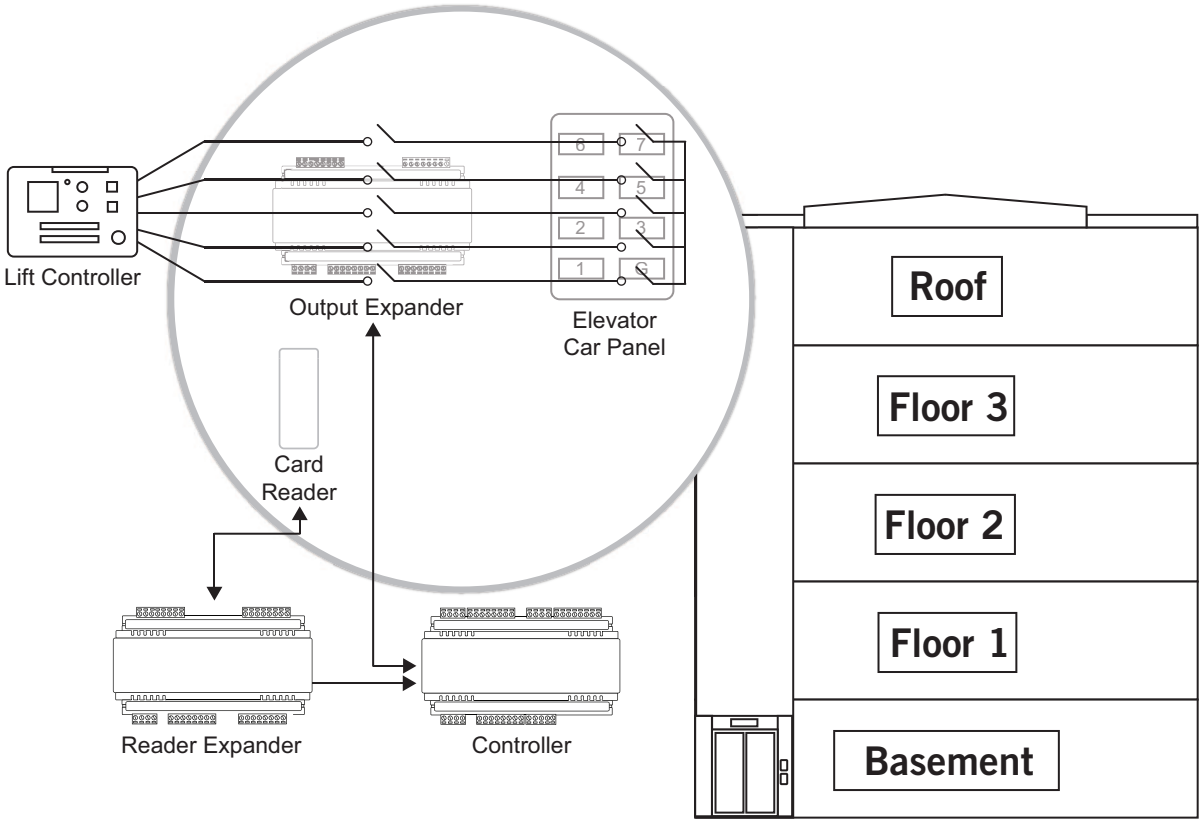
This application note includes two programming scenarios: one basic elevator control setup (see page 18), and one advanced scenario with destination reporting (see page 23).

Hardware Setup

Basic Elevator Control Requirements

To implement a basic elevator control system using DIN rail modules, you will need a controller and:

- One card reader and reader port for each elevator car.
  You can use the controller's onboard reader ports, or use a reader expander.
- One Form C relay output for each controlled floor, per elevator car.
  This means a building with 4 floors and 2 elevator cars requires 8 relays. You can use the controller's onboard relays, a reader expander, an output expander, or an input/output expander.

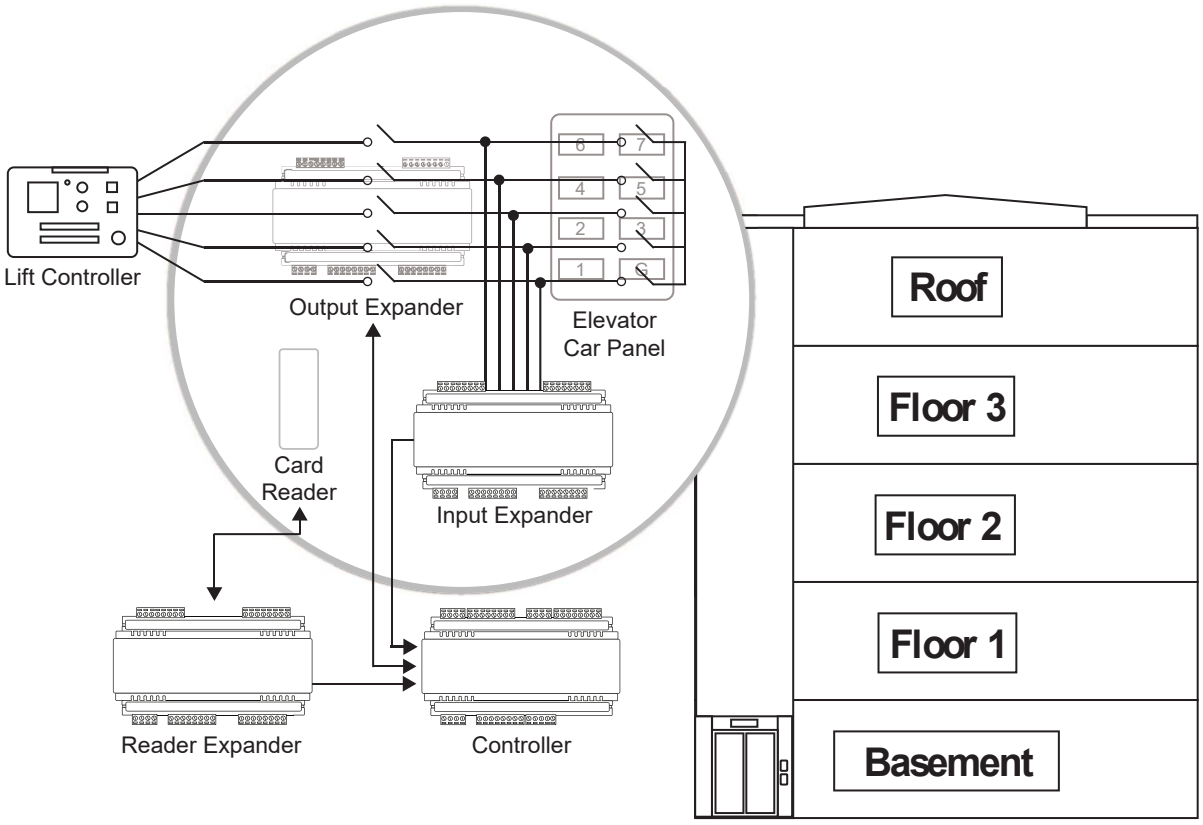


Relays are only required for **controlled** floors. Open access floors (such as a ground level or unsecured car park), do not need relays.

Destination Reporting Requirements

To implement elevator control with destination reporting, you will need a controller and:

- One card reader and reader port for each elevator car.
  You can use the controller's onboard reader ports, or use a reader expander.
- One Form C relay output for each controlled floor, per elevator car.
  You can use the controller's onboard relays, a reader expander, an output expander, or an input/output expander.
- One input for each controlled floor, per elevator car.



Any system input can be used for destination reporting. However, the Protege DIN Rail 16 Input Opto-Isolated Expander module has been specifically designed for this purpose. Each input is optically isolated and looks for a voltage between 12V and 230V AC or DC rather than an EOL resistor.

Caution: Ensure that clean (voltage-free) contacts are supplied by the elevator control system if you are using standard inputs.

Examples of Hardware Requirements

To connect Protege with an elevator system, you will need the following hardware:

- One available **reader port** and **card reader**, per elevator car
- One Form C relay **output** for each controlled floor, per elevator car
- One **input** for each controlled floor, per elevator car (if implementing destination reporting)

The following examples are just some of the scenarios and hardware that can be used. Remember that you can use any combination of modules to provide the required reader ports, relay outputs, and inputs.

Expander modules are not dedicated to elevator control, so any unused inputs or outputs can be used for other purposes. Controllers and reader expanders can be used to provide elevator control and door access control simultaneously.

1 Car, 4 Floors

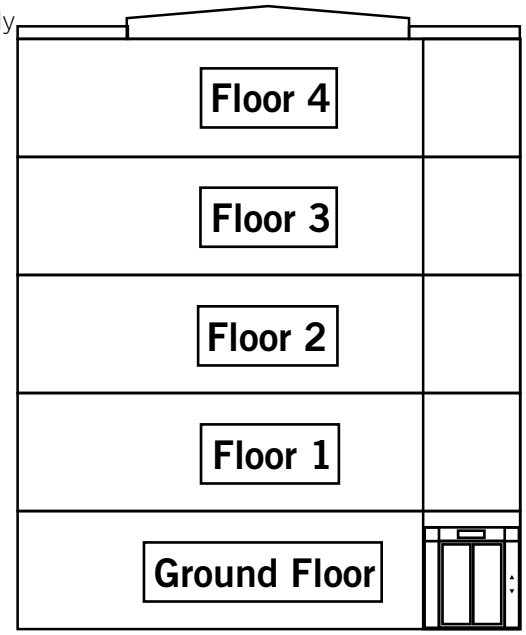
In this example we could use a single door controller, as we need only 1 reader port for the card reader in the elevator.

We also need to provide 4 floor control outputs, so could use either:

- a PRT-PX8-DIN and use the remaining 4 outputs for other purposes such as lighting control or sirens.

  -or-

- a PRT-IO84-DIN and use the remaining 8 inputs for other purposes such as intruder detection.



1 Car, 4 Floors, Door Control

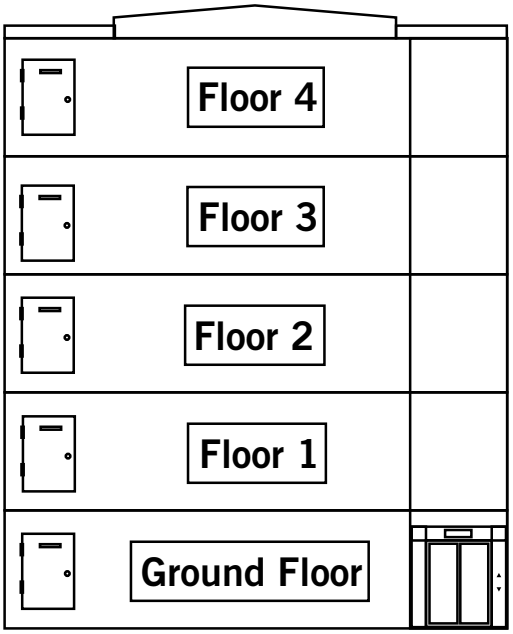
In this example we need 6 reader ports - one for the elevator car reader, and 5 to provide standard door access control on each floor - so we would need a standard controller and 2 PRT-RDM2-DIN-485s.

We also need to provide 4 floor control outputs, so could use either:

- a PRT-PX8-DIN and use the remaining 4 outputs for other purposes such as lighting control or sirens.

  -or-

- a PRT-IO84-DIN and use the remaining 8 inputs for other purposes such as intruder detection.

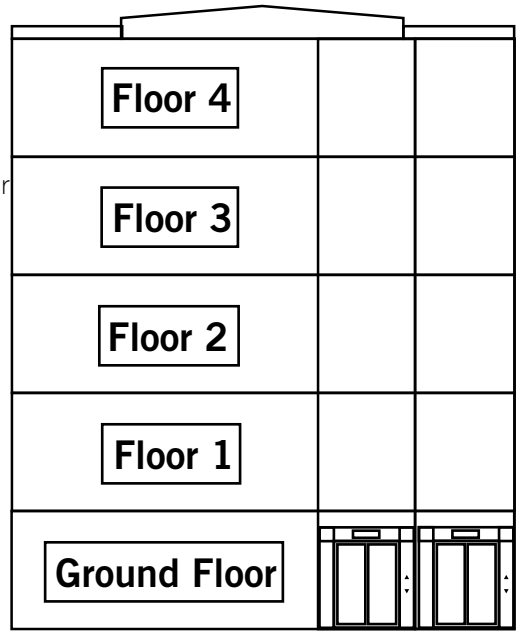


2 Cars, 4 Floors

In this example we need 2 reader ports - one for each elevator car reader - so would use a standard two door controller.

We would also need a PRT-PX8-DIN to provide the 8 floor control outputs.

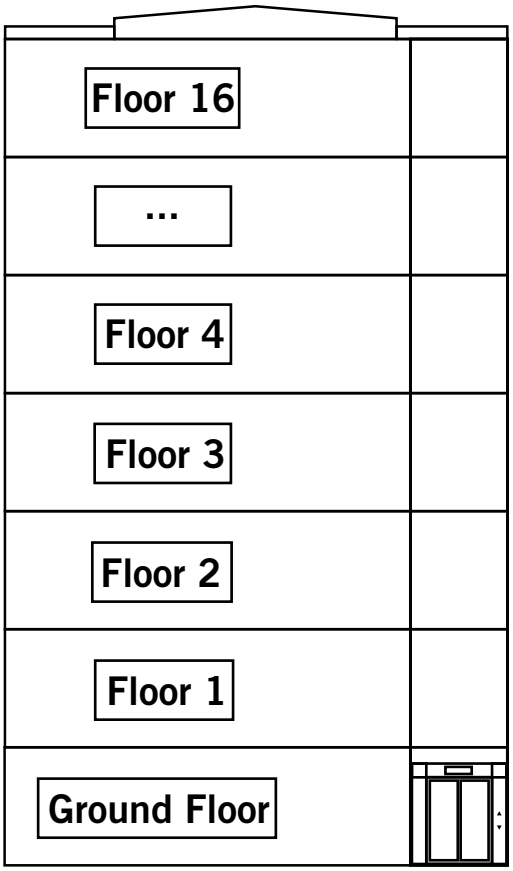
While we are providing access control for 4 floors, we have 2 elevator cars, so need 8 relay outputs to control floor access.



1 Car, 16 Floors

In this example we would only need a single door controller as we need only 1 reader port.

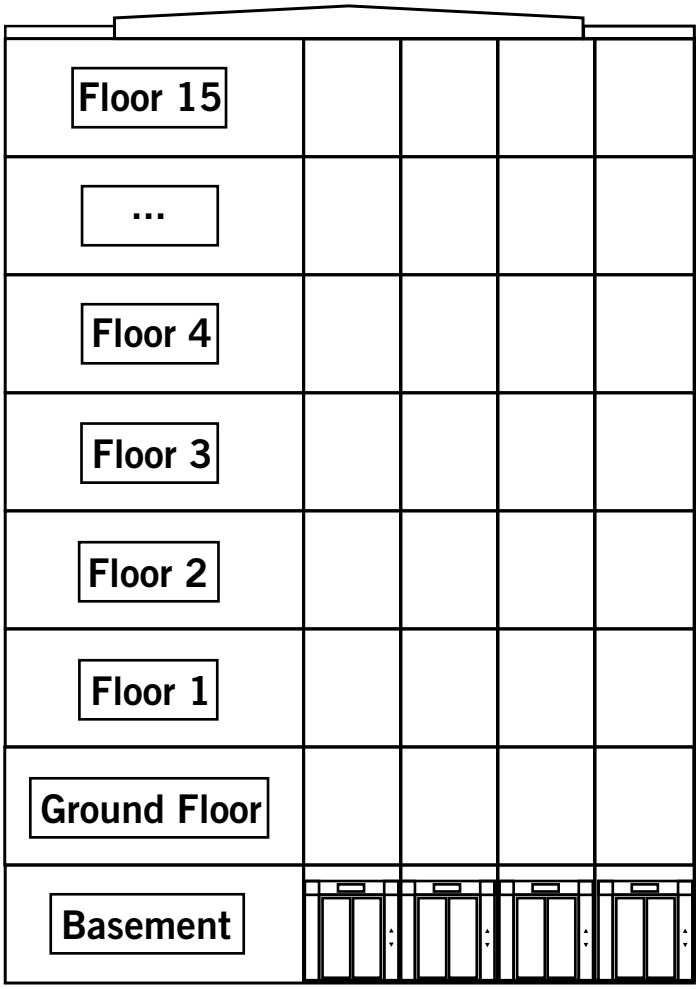
We would need two PRT-PX8-DIN modules to provide the 16 floor control outputs.



4 Cars, 16 Floors

In this example we need 4 reader ports - one for each elevator car reader - so are using a standard controller and a PRT-RDM2-DIN-485 module.

We have 16 controlled floors and 4 elevator cars, making a total of 64 relay outputs that are required so would also need 8 PRT-PX8-DIN modules.

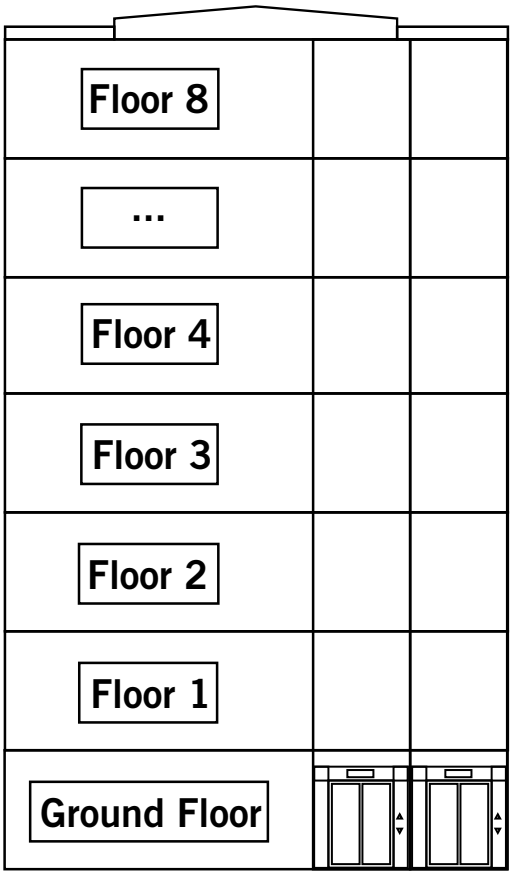


Destination Reporting

In this example we need 2 reader ports - one for each elevator car reader - so would use a standard controller.

With 8 controlled floors and 2 elevator cars, we need 16 outputs to control the floor relays so would use two PRT-PX8-DIN modules.

We want to include destination reporting, so would also use a PRT-ISO16-DIN or PRT-ZX16-DIN module to provide the 16 inputs required for button feedback.



Elevator Floor Relay Connections

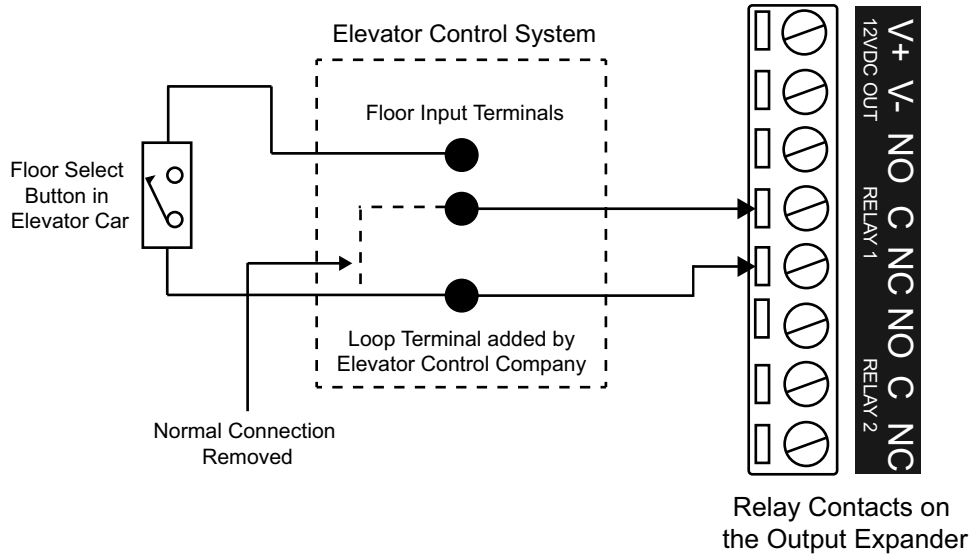
Control relays can be wired in either a normally open connection (fail secure) or a normally closed connection (fail safe).

- **Fail Safe**: When power is interrupted (fails), the electronic locking device is released (unlocked).
- **Fail Secure**: When power is interrupted (fails), the electronic locking device is secured (locked).

It is recommended that the relays be connected in fail safe configuration. This is mandatory if the installation is to comply with UL specifications.

Fail Safe Wiring

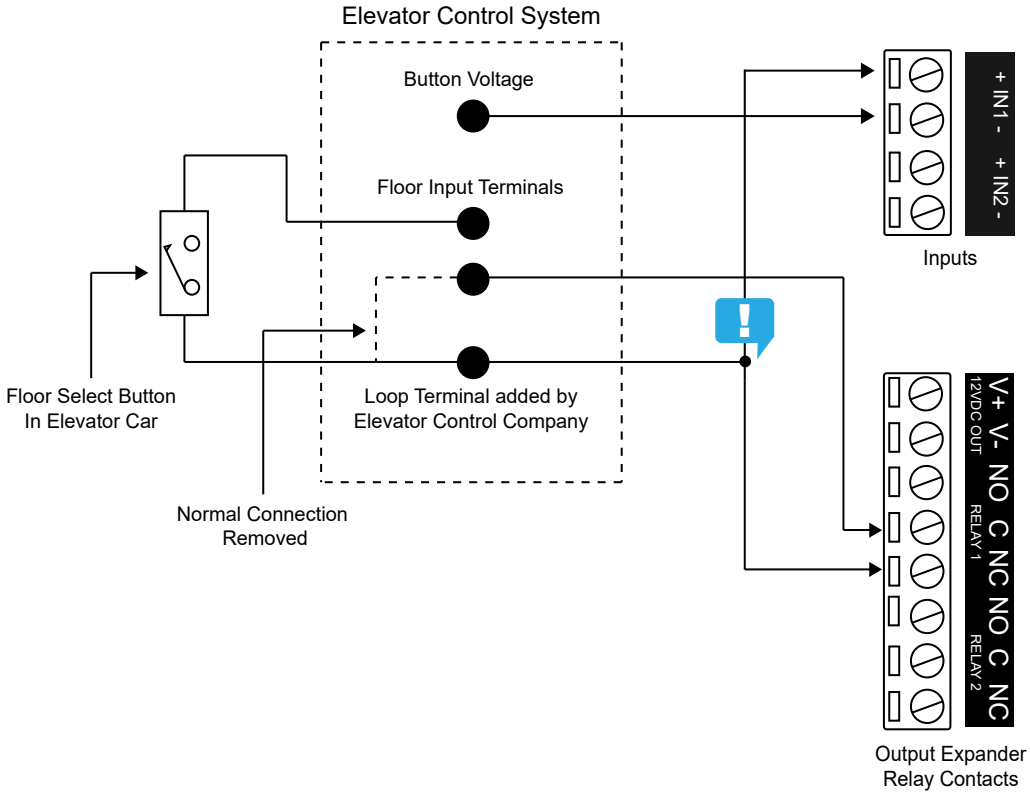
By interfacing the floors that require security to the normally closed connection of the relay, the elevator controller operates in a fail safe mode. Connection is achieved by breaking the button input from the elevator system and connecting either end to the C and NC connection for the appropriate floor relay. Although you can break either side of the button wiring to provide the same functionality, we recommend the elevator company break the control signal and not the common for the button. This method allows a very simple migration to the destination reporting option if required in the future.



Fail safe wiring requires the relays to be inverted in programming.

Fail Safe Wiring with Destination Reporting

The difference between standard fail safe operation and destination reporting operation is that the floor relay only changes state when a user selects a floor, preventing more than one floor from being selected. Fail safe destination reporting requires an additional wire from the contacts of the relay to the input terminal on the input expander. A button voltage common wire is also required from the elevator control system.

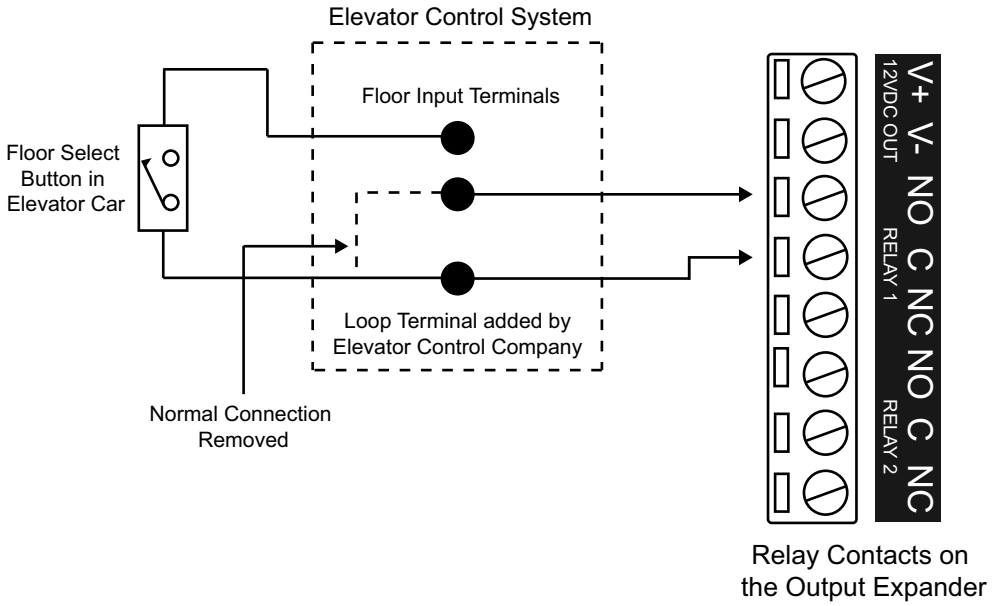


Note: It is important that the active input to the input expander is linked from the side of the relay that is **not** switched.

Fail Secure Wiring

The fail secure mode of operation provides a high level of security to installations that require floor access to be secured in the case of any failure.

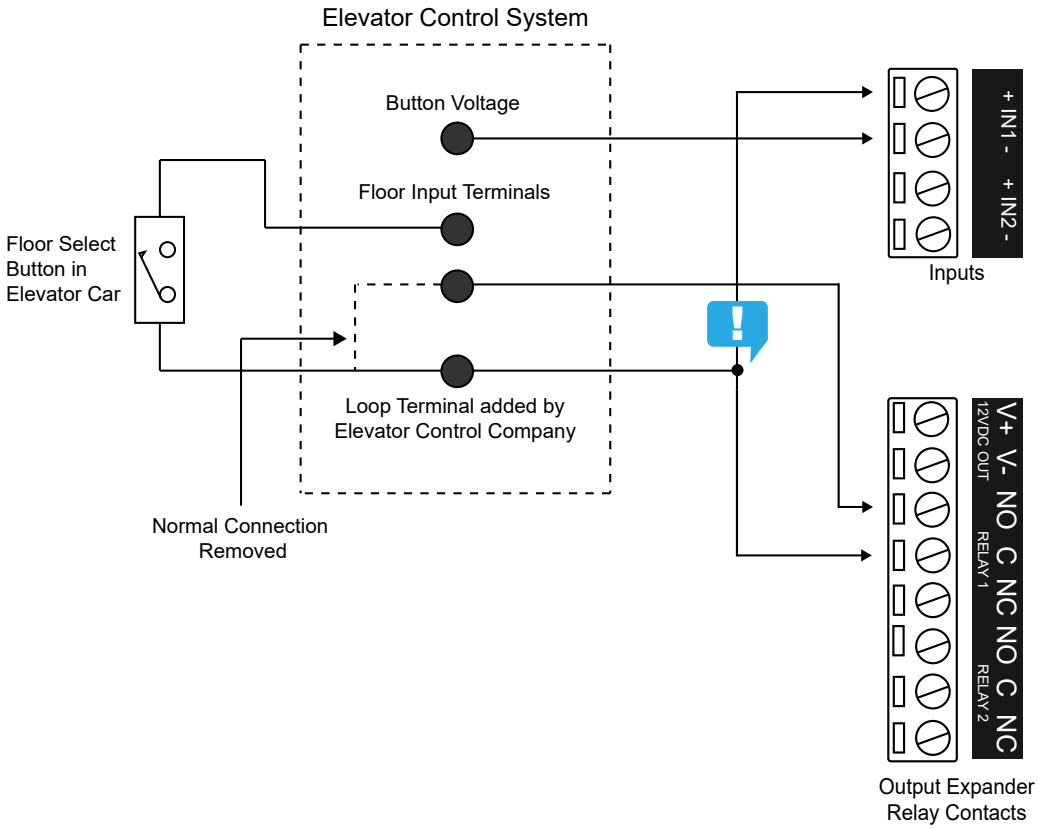
Fail secure wiring is not recommended for use in modern installations.



The floor control relays must be wired using the NO and C relay contacts. This only allows access to a floor if the relay is activated. Deactivation of the relay or a complete power failure prevents any access to the floor.

Fail Secure Wiring with Destination Reporting

Fail secure destination reporting requires an additional wire from the contacts of the relay to the input terminal on the input expander. A button voltage common wire is also required from the elevator control system.



Note: It is important that the active input to the input expander is linked from the side of the relay that is **not** switched.

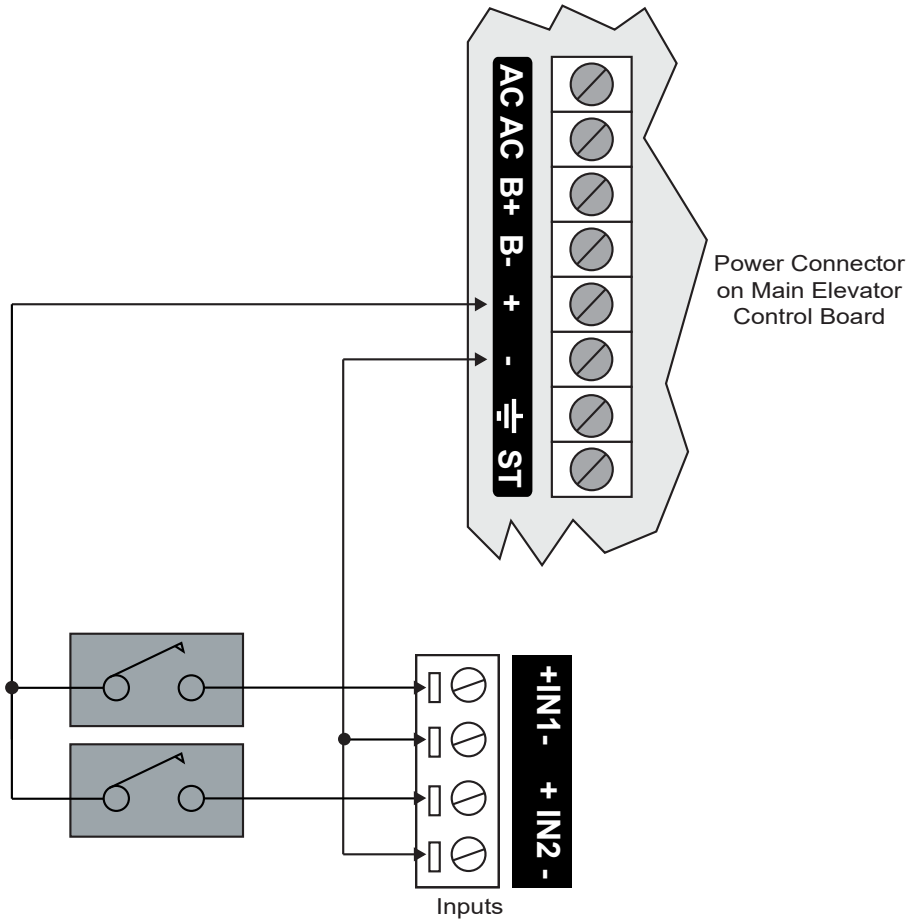
Communication Failure

When an expander loses contact with the controller it results in a communication failure. Protege programming allows you to choose whether to automatically allow or prevent access to a floor in this situation.

When programming the output records (see the programming scenarios below), you can determine whether an elevator floor relay is turned on or off when the expander module loses contact. In the **Options** tab of the output programming, enable the **Preset module offline** option, then either enable or disable **Output turns on when module offline**.

Testing Destination Reporting

Installations that use destination reporting can be complicated and require careful planning. We recommend consulting the elevator company well in advance of providing a solution to your client, and that you also configure and set up a unit with destination reporting enabled using the simple test circuit shown below. This allows you to understand the principles and operation of the unit prior to installation taking place.



1. Use two standard normally open switches as shown, and wire these to the AUX output.
2. Connect the common to the negative terminal of each input.
3. When pressing the switch, you should see an LED on the face of the expander module illuminate, corresponding to the input used.

   The LED indicators illuminate regardless of the destination reporting mode that is configured in the elevator settings (see the programming scenarios below).

Programming Scenario 1: Basic Elevator Control

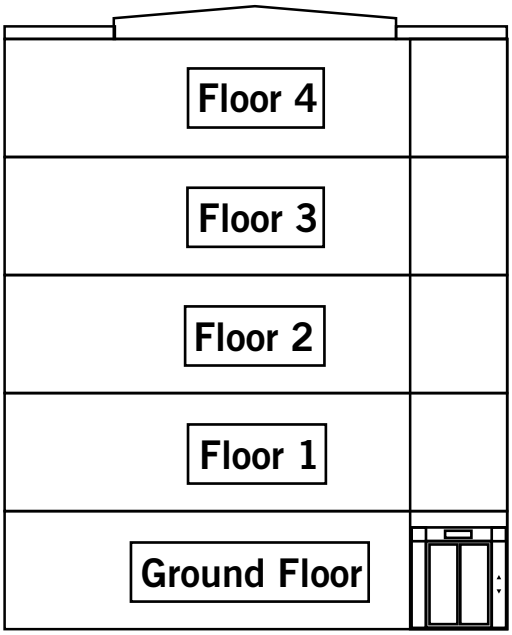
In this scenario, we have a five story building that requires basic low level elevator control for a single elevator. The floor relays will be configured for fail safe operation, so that all floors unlock on a power failure.

The ground floor of the building is uncontrolled (accessible at all times without credentials). Therefore, the hardware requirements are:

- 4 floor relay outputs
- 1 reader port with card reader

It is assumed that the relevant expander modules have been programmed in the system. If physical output hardware is not available, you can use virtual outputs to complete the programming. Add an output expander and enable the **Virtual Module** option to create the virtual outputs.

The requirements for each floor are as follows:



Floor	Requirements
Ground Floor	Uncontrolled, accessible at all times without credentials
Floor 1	Controlled, unlocked during office hours (9am - 5pm)
Floor 2	Controlled
Floor 3	Controlled
Floor 4	Controlled

Programming the Outputs

For this programming scenario, four outputs will be required to unlock the four controlled floors.

1. Navigate to **Programming | Outputs**.
2. Select each output that will be used for elevator control and give it a relevant **Name** and **Keypad display name** (limited to 16 characters). These should include at least the floor number and physical output address. The table below shows a useful naming convention:

Floor	Name	Keypad Display Name
Floor 1	Elevator Floor 1 Relay	PX1.1 Elv Flr1
Floor 2	Elevator Floor 2 Relay	PX1.2 Elv Flr2
Floor 3	Elevator Floor 3 Relay	PX1.3 Elv Flr3
Floor 4	Elevator Floor 4 Relay	PX1.4 Elv Flr4

3. Because the outputs are wired in a fail safe (normally closed) configuration, they must be inverted in the programming. Use Shift + Click to highlight the four outputs, then open the **Options** tab and enable **Invert output**.

4. Similarly, we want all floors to unlock if there is a communications failure with the controller. To achieve this, enable both **Preset module offline** and **Output turns on when module offline**.

   If there is a loss of communications, the expander module will automatically turn the output on, unlocking the floor. To prevent floor access during a communications failure, disable **Output turns on when module offline**.

5. Click **Save**.

Programming the Floors

Each controlled floor must have a corresponding floor record. There is no need to program a record for the ground floor, as it is not controlled by Protege.

1. Navigate to **Programming | Floors**.
2. Add the four controlled floors and set the **Floor relay** as outlined in the table below. Floor relay numbers must be unique, programmed in numerical order, and start at the lowest accessible floor.

   In this case, the lowest accessible (controlled) floor is Floor 1, so that floor will have a **Floor relay** of 1.

Floor Name	Floor Relay
Floor 1	1
Floor 2	2
Floor 3	3
Floor 4	4

3. Click **Save** to complete each record.

Creating the Schedule

We will create a schedule to allow Floor 1 to be unlocked during office hours.

1. Navigate to **Sites | Schedules** (Protege GX) or **Scheduling | Schedules** (Protege WX) and add a new schedule called Office Hours.
2. Under **Time periods and groups**, create a period that covers 9:00 AM - 5:00 PM, Monday to Friday.
3. Configure any necessary holiday groups and holiday modes.
4. Click **Save**.

Programming the Elevator Car

The building has a single elevator car that must be programmed with the floors and outputs added above.

1. Navigate to **Programming | Elevator cars** and add a new elevator car with the name Elevator 1.
2. Set the **Reader expander** and **Reader port** that will be used to control access to this elevator car.
3. Set the **Unlock access time** to 5 seconds.

   This is the length of time that the relay outputs will be activated. When destination reporting is not enabled, the user has this long to press a floor button after they gain access.

4. Set the **Authentication mode** to Card, Card and PIN, Card or PIN, or PIN only. For this scenario, we will set it to Card.

   This option may not be available in your system. To determine whether elevator car authentication modes are supported, see the Appendix (see page 32).

5. In the **Schedules and areas** tab, click **Add** to add the four controlled floors to the elevator car.

6. Set the following options for Floor 1:
   - **Schedule**: The unlock schedule for the floor. Set to Office Hours.
   - **Schedule verify** / **Verify** (depending on your system): Enable this option to allow the floor to unlock and relock on schedule. If the floor is locked while the schedule is valid or latch unlocked while the schedule is invalid, it will be returned to the correct state within one minute.
   - **Output**: Elevator Floor 1 Relay
7. For the other three floors, set the corresponding **Output** as programmed above.
8. Click **Save**.

Configuring the Reader Expander

The reader expander port must be configured to provide elevator control instead of door control.

1. Navigate to **Expanders | Reader expanders** and select the reader expander that is being used for access in the elevator car.
2. Open the **Reader 1** or **Reader 2** tab, depending on the reader port that is being used for access.
3. Ensure that the **Reader 1/2 door** is not set.
4. Set the **Reader 1/2 mode** to Elevator.
5. Set the **Reader 1/2 elevator** to the Elevator 1 record created above.
6. Click **Save**.
7. Wait for the changes to be downloaded to the controller, then right click on the expander record and click **Update module**.

Assigning Access to Users

To gain access to a floor, a user must have both the elevator car and the floor assigned in their access level. You will need to create any elevator groups and floor groups that are necessary to grant the required access.

For this scenario, we will grant access to two users: Mike Tory (manager), who has access to all floors at all times, and Kevin Simon (employee), who only has access to Floor 2.

1. Navigate to **Groups | Elevator groups** and add a new elevator group called Building 1 elevator group.
2. Add Elevator 1 to the group, and click **Save**.
3. Navigate to **Groups | Floor groups** and create the Managers floor group.
4. Add Floors 1-4 to the group, and click **Save**.

   It is possible to set a **Schedule** on each individual floor to limit access to particular times.
5. Navigate to **Users | Access levels** and create the Managers access level.
6. In the **Floor groups** tab, add the Managers floor group.
7. In the **Elevator groups** tab, add the Building 1 elevator group. Click **Save**.

   The **Include all floors** and **Include all elevators** options should be used with caution, as these will automatically grant users access to any new floors or elevators created in the site.
8. Create the Floor 2 Employees access level.
9. In the **Floors** tab, add Floor 2.
10. In the **Elevator groups** tab, add the Building 1 elevator group. Click **Save**.
11. In **Users | Users**, create the users Mike Tory (with the Managers access level) and Kevin Simon (with the Floor 2 Employees access level). Assign each user a credential for use in testing.

Testing the Elevator

Finally, we can use our two users to test the programming.

In Protege GX, it is recommended that you set up a status page or floor plan that includes the Elevator 1 record, as well as an event window. This will allow you to view and control the status of each individual floor that can be accessed from the elevator.

Events in Protege WX can be viewed on the **Monitoring | All Events** page. You can view and control floor status on the **Monitoring | Elevators** page.

1. To test the unlock schedule, set the controller time to 8:59:00 AM:
   - **Protege GX**: Navigate to **Sites | Controllers** and right click on the controller. Enter the new time and select **Set controller date time**.
   - **Protege WX**: Navigate to **Scheduling | Time**. Enter the new **Time** and click **Save**, then press F5 to refresh the page.

   Elevator 1, Floor 1 should be secured.
2. Wait until the controller field time reaches 9:00 AM. Floor 1 should unlock within 1 minute of the schedule becoming valid.

   ```
   Schedule Office Hours Is Valid
   Elevator Elevator 1 Floor Floor 1 Unlocked By Schedule Office Hours
   Output Elevator Floor 1 Relay On By Floor Floor 1
   ```
3. Badge the card belonging to Kevin Simon. Access should be granted and Floor 2 unlocked for 5 seconds.

   ```
   User Kevin Simon Granted Access To Elevator 1 Using Access Level Floor 2
   Employees
   Output Elevator Floor 2 Relay On By Floor Floor 2
   ...
   Output Elevator Floor 2 Relay Off By Floor Floor 2
   ```
4. Badge the card belonging to Mike Tory. Access should be granted and all floors unlocked for 5 seconds (except for Floor 1, which is already unlocked).

   ```
   User Mike Tory Granted Access To Elevator 1 Using Access Level Managers
   Output Floor 2 Relay On By Floor Floor 2
   Output Floor 3 Relay On By Floor Floor 3
   Output Floor 4 Relay On By Floor Floor 4
   ...
   Output Floor 2 Relay Off By Floor Floor 2
   Output Floor 3 Relay Off By Floor Floor 3
   Output Floor 4 Relay Off By Floor Floor 4
   ```
5. Right click on Floor 1 and click **Deactivate** to lock the floor. The floor should unlock again within 1 minute.

   ```
   Operator Admin Locked Floor Floor 1 On Elevator 1
   Output Elevator Floor 1 Relay Off By Floor Floor 1
   ...
   Elevator Elevator 1  Floor Floor 1 Unlocked By Schedule Office Hours
   Output Elevator Floor 1 Relay On By Floor Floor 1
   ```
6. Set the controller time to 4:59:00 PM.
   - **Protege GX**: Navigate to **Sites | Controllers** and right click on the controller. Enter the new time and select **Set controller date time**.
   - **Protege WX**: Navigate to **Scheduling | Time**. Enter the new **Time** and click **Save**, then press F5 to refresh the page.
7. Wait until the controller field time reaches 5:00 PM. Floor 1 should be locked within 1 minute of the schedule becoming invalid.

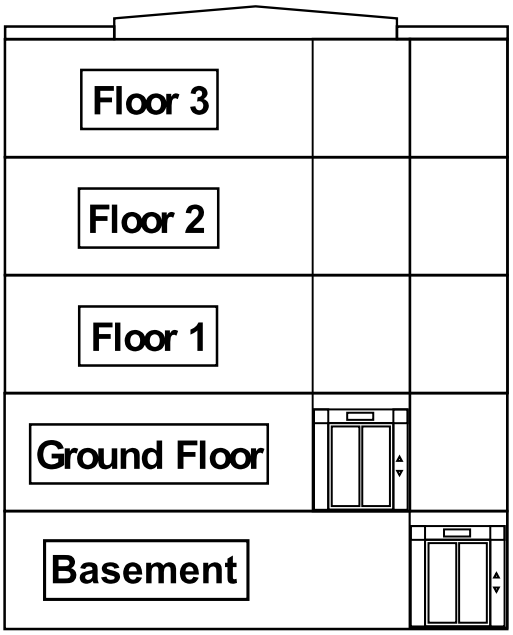
   ```
   Schedule Office Hours Is Invalid
   Elevator Elevator 1 Floor Floor 1 Locked By Schedule Office Hours
   Output Elevator Floor 1 Relay Off By Floor Floor 1
   ```

8. Right click on Floor 1 and click **Activate** to unlock the floor. The floor should relock within 1 minute.

```
Operator Admin Unlocked Floor Floor 1 On Elevator 1
Output Elevator Floor 1 Relay On By Floor Floor 1
...
Elevator Elevator 1 Floor Floor 1 Locked By Schedule Office Hours
Output Elevator Floor 1 Relay Off By Floor Floor 1
```

Programming Scenario 2: Destination Reporting

In this scenario, we will configure a four story building with a single basement floor. The building has two elevator cars: one public elevator which can only access the above ground floors, and one service elevator which can travel to all floors. The installation requires destination reporting and fail safe operation.



For this installation, one output and one input is needed for each controlled floor button in an elevator car. The ground floor of the building is uncontrolled and accessible at all times without credentials. Therefore, the following hardware is required to cover both elevator cars:

- 7 floor relay outputs
- 7 inputs for destination reporting
- 2 reader ports with card readers

It is assumed that the relevant expander modules have been programmed in the system. If physical output hardware is not available, you can use virtual outputs to complete the programming. Add an output expander and enable the **Virtual Module** option to create the virtual outputs.

Some of the upper floors unlock in certain situations to allow free access from the public elevator. However, to discourage general usage, the floors do not unlock from the service elevator. The requirements for each floor are as follows:

Floor	Requirements
Basement	Controlled, accessible only by service elevator
Ground Floor	Uncontrolled, accessible at all times without credentials
Floor 1	Controlled, unlocked during office hours (9am - 5pm), only from public elevator, operates late to open
Floor 2	Controlled, unlocked during office hours (9am - 5pm), only from public elevator, only when the lobby area is disarmed
Floor 3	Controlled

If you have completed Scenario 1, you may wish to use a fresh database for this scenario, or add 'Scenario 2' to the floor record names to prevent confusion.

Programming the Outputs

Seven output records are required: three for the floors accessible from the public elevator, and four for those accessible from the service elevator.

1. Navigate to **Programming | Outputs**.
2. Select each output that will be used for elevator control and give them a relevant **Name** and **Keypad display name** (limited to 16 characters). These should include at least the elevator name, floor number and physical output address. The table below shows a useful naming convention:

Floor	Name	Keypad Display Name
Basement	Service Elevator Basement Relay	PX1.1 Svc B1
Floor 1	Public Elevator Floor 1 Relay	PX1.2 Pbl Flr1
	Service Elevator Floor 1 Relay	PX1.3 Svc Flr1
Floor 2	Public Elevator Floor 2 Relay	PX1.4 Pbl Flr2
	Service Elevator Floor 2 Relay	PX1.5 Svc Flr2
Floor 3	Public Elevator Floor 3 Relay	PX1.6 Pbl Flr3
	Service Elevator Floor 3 Relay	PX1.7 Svc Flr3

3. Because the outputs are wired in a fail safe (normally closed) configuration, they must be inverted in the programming. Use Shift + Click to highlight the seven outputs, then open the **Options** tab and enable **Invert output**.
4. Similarly, we want all floors to unlock if there is a communications failure with the controller. To achieve this, enable both **Preset module offline** and **Output turns on when module offline**.

   If there is a loss of communications, the expander module will automatically turn the output on, unlocking the floor. To prevent floor access during a communications failure, disable **Output turns on when module offline**.
5. Click **Save**.

Programming the Inputs

Seven input records are required: three for the floors accessible from the public elevator, and four for those accessible from the service elevator. These represent the elevator buttons, allowing Protege to record which floor each user selects when they gain access in the elevator car.

1. Navigate to **Programming | Inputs**.
2. Select each input that will be used for elevator control and give them a relevant **Name** and **Keypad display name** (limited to 16 characters). These should include at least the elevator name, floor number and physical input address. The table below shows a useful naming convention:

Floor	Name	Keypad Display Name
Basement	Service Elevator Basement Button	ZX1.1 Svc B1
Floor 1	Public Elevator Floor 1 Button	ZX1.2 Pbl Flr1
	Service Elevator Floor 1 Button	ZX1.3 Svc Flr1
Floor 2	Public Elevator Floor 2 Button	ZX1.4 Pbl Flr2
	Service Elevator Floor 2 Button	ZX1.5 Svc Flr2
Floor 3	Public Elevator Floor 3 Button	ZX1.6 Pbl Flr3
	Service Elevator Floor 3 Button	ZX1.7 Svc Flr3

3. For destination reporting it is preferable to have a fast input response time, as the button must be pressed and the relay energized before the elevator controller can receive the floor request.

   Use Shift + Click to highlight the seven inputs, then set the **Alarm input speed** and **Restore input speed** to 10 msec.
4. Click **Save**.

Programming the Floors

Each controlled floor must be programmed. However, even if a floor can be accessed from two elevator cars it only needs to be programmed once. There is no need to program a record for the ground floor, as it is not controlled by Protege.

1. Navigate to **Programming | Floors**.
2. Add the four controlled floors and set the **Floor relay** as outlined in the table below. Floor relay numbers must be unique, programmed in numerical order, and start at the lowest accessible floor.
   In this case, the lowest accessible (controlled) floor is the Basement, so that floor will have a **Floor relay** of 1.

Floor Name	Floor Relay
Basement	1
Floor 1	2
Floor 2	3
Floor 3	4

3. Click **Save** to complete each record.

Creating the Schedules

For this scenario we will use two schedules: one to control unlocking of Floors 1 and 2, and another to grant access to after hours maintenance staff.

1. Navigate to **Sites | Schedules** (Protege GX) or **Scheduling | Schedules** (Protege WX) and add a new schedule called Office Hours.
2. Under **Time periods and groups**, create a period that covers 9:00 AM- 5:00 PM, Monday to Friday.
3. Configure any necessary holiday groups and holiday modes.
4. Click **Save**.
5. Create a second schedule with the name After Hours.
6. Under **Time periods and groups**, create a period that covers 5:00 PM - 9:00 PM, Monday to Friday.
7. Configure any necessary holiday groups and holiday modes.
8. Click **Save**.

Creating the Area

An area will be used to control the unlocking of Floor 2.

1. Navigate to **Programming | Areas**.
2. Create a new area with the name Floor 2 Lobby.
3. (Protege GX only) Assign at least one output to the area to ensure that it will be downloaded to the controller.
4. Click **Save**.

Programming the Elevator Cars

Both elevator cars must be created and programmed with the specific floors that they are able to access. They must also be configured to use destination reporting.

Programming the Service Elevator Car

The service elevator travels to all floors in the building. However, it is always necessary to enter credentials - i.e. the floors do not unlock.

1. Navigate to **Programming | Elevator cars** and add a new record with the name Service Elevator.
2. Set the **Reader expander** and **Reader port** that will be used to control access to this elevator car.
3. Set the **Unlock access time** to 1 second.
   When destination reporting is enabled, this is the length of time that the relay output will be energized to send the floor request to the elevator controller.
4. Set the **Floor select time** to 5 seconds.
   When destination reporting is enabled, the user has this time (in seconds) to press a floor button after they are granted access.
5. Check **Destination reporting enable**.
6. Set the **Authentication mode** to Card, Card and PIN, Card or PIN, or PIN only. For this scenario, we will set it to Card.

   This option may not be available in your system. To determine whether elevator car authentication modes are supported, see the Appendix (see page 32).
7. In the **Schedules and areas** tab, click **Add** to add all four floors to the elevator.
8. Set the following options for each floor:
   - **Schedule**: Never
   - **Input**: Service Elevator Floor X Button
   - **Output**: Service Elevator Floor X Relay
9. Click **Save**.

Programming the Public Elevator Car

The public elevator car only travels to the upper three floors. Some floors have specific unlocking requirements to allow access without credentials.

1. In **Programming | Elevator cars**, add a new record with the name Public Elevator.
2. Set the **Reader expander** and **Reader port** that will be used to control access to this elevator car.
3. Set the **Unlock access time** to 1 second.
4. Set the **Floor select time** to 5 seconds.
5. Check **Destination reporting enable**.
6. Set the **Authentication mode** to Card, Card and PIN, Card or PIN, or PIN only.

   This option may not be available in your system. To determine whether elevator car authentication modes are supported, see the Appendix (see page 32).
7. In the **Schedules and areas** tab, click **Add** to add Floors 1, 2 and 3.
8. Set the following options for Floor 1:
   - **Schedule**: The unlock schedule for the floor. Set to Office Hours.
   - **Late to open**: Enable this option to ensure that the door will not unlock on schedule until the first user has gained access.
   - **Schedule verify** / **Verify** (depending on your system): Enable this option to allow the floor to unlock and relock on schedule. If the floor is locked while the schedule is valid or latch unlocked while the schedule is invalid, it will be returned to the correct state within one minute.
   - **Input**: Public Elevator Floor 1 Button
   - **Output**: Public Elevator Floor 1 Relay

9. Set the following options for Floor 2:
   - **Schedule**: Office Hours
   - **Area**: The 'inside area' for the floor. Set to Floor 2 Lobby.
   - **Schedule verify** / **Verify** (depending on your system): Enable this option to allow the floor to unlock during working hours.
   - **Follow area status**: Enable this option so that the floor will unlock when the inside area is disarmed, and lock when the area is armed.
   - **Input**: Public Elevator Floor 2 Button
   - **Output**: Public Elevator Floor 2 Relay
   - **Enable area control** / **Disarm area** (depending on your system): Enable this option so that the floor is automatically disarmed when a user with sufficient permissions gains access. Users will be denied access if they do not have permission to disarm the area.
10. For Floor 3, set the **Input** and **Output** to the corresponding records.
11. Click **Save**.

Configuring the Reader Expander

The reader expander ports must be configured to provide elevator control instead of door control.

1. Navigate to **Expanders | Reader expanders** and select the reader expander that is being used for access to the service elevator car.
2. Open the **Reader 1** or **Reader 2** tab, depending on the reader port that is being used for access.
3. Ensure that the **Reader 1/2 door** is not set.
4. Set the **Reader 1/2 mode** to Elevator.
5. Set the **Reader 1/2 elevator** to the Service Elevator.
6. Click **Save**.
7. Repeat the above steps for the Public Elevator.
8. Wait for the changes to be downloaded to the controller, then right click on the expander record and click **Update module**.

Assigning Access to Users

To gain access to a floor, a user must have both the elevator car and the floor assigned in their access level. You will need to create any elevator groups and floor groups that are necessary to grant the required access.

For this scenario, we will grant access to two users: Ursula Tenant (employee) who has access to Floor 1 via the public elevator during working hours (9am - 5pm), and Angie Fitzroy (maintenance staff) who has access to all floors via either elevator after hours (5pm - 9pm). Angie has access to disarm the Floor 2 Lobby area, but Ursula does not.

1. In the **Groups** menu, create the various groups that are needed to grant user access. These are outlined below:

Type of Group	Name	Records in Group
Area Group	Floor Lobbies	• Floor 2 Lobby
Elevator Group	Public	• Public Elevator
Elevator Group	Maintenance	• Public Elevator • Service Elevator
Floor Group	Maintenance	• Basement • Floor 1 • Floor 2 • Floor 3

2. Navigate to **Users | Access levels** and create the Maintenance access level. Grant the following access:
   - **Floor groups**: Maintenance
   - **Elevator groups**: Maintenance, set the **Schedule** to After Hours.
   - **Disarming area groups**: Floor Lobbies

   Click **Save**.
3. Create the Floor 1 Employees access level. Grant the following access:
   - **Floors**: Floor 1, Floor 2
   - **Elevator groups**: Public, set the **Schedule** to Office Hours.

   Click **Save**.
4. In **Users | Users**, create the users Angie Fitzroy (assign the Maintenance access level) and Ursula Tenant (assign the Floor 1 Employees access level). Assign each user a credential for use in testing.

Testing the Elevators

Finally, we can use our two users to test the programming.

In Protege GX, it is recommended that you set up a status page or floor plan that includes both the Public Elevator and Service Elevator records, as well as an event window and the Floor 2 Lobby area. This will allow you to view and control the status of each individual floor that can be accessed from the elevator.

Events in Protege WX can be viewed on the **Monitoring | All Events** page. You can view and control floor status on the **Monitoring | Elevators** page.

When a single floor is assigned to two different elevators, the locking and unlocking of the floor can be controlled independently for each elevator.

1. Ensure that the Floor 2 Lobby area is armed.
2. To test the unlock schedule, set the controller time to 8:59:00 AM:
   - **Protege GX**: Navigate to **Sites | Controllers** and right click on the controller. Enter the new time and select **Set controller date time**.
   - **Protege WX**: Navigate to **Scheduling | Time**. Enter the new **Time** and click **Save**, then press F5 to refresh the page.

   Elevator 1, Floor 1 should be secured.
3. Wait until the controller field time reaches 9:00 AM. Neither floor should unlock on schedule.

```
Schedule Office Hours is Valid
Elevator Public Elevator Floor Floor 2 Denied Unlock By Area Status Floor
2 Lobby
```

4. Badge the card assigned to Ursula Tenant at the public elevator's card reader. Press and release the Public Elevator Floor 1 Button to request access to Floor 1.

   Ursula should be granted access to Floor 1 and the floor relay should be activated. Since the first user has gained access to this floor, the floor unlocks by schedule (late to open).

   ```
   User Ursula Tenant Waiting For Floor Selection Public Elevator Using
   Access Level Floor 1 Employees
   Input Public Elevator Floor 1 Button Opened
   Input Public Elevator Floor 1 Button Closed
   ...
   Elevator Public Elevator Floor Floor 1 Unlocked Late To Open By Schedule
   Office Hours
   Output Public Elevator Floor 2 Relay On By Floor Floor 2
   User Ursula Tenant Floor Unlocked Floor 1 On Public Elevator Using Access
   Level Floor 1 Employees
   ```

   Note that while Public Elevator : Floor 1 is unlocked, Service Elevator : Floor 1 remains locked. Credentials are still required to access Floor 1 via the Service Elevator.

5. Badge Ursula's card at the public elevator's card reader again. Press and release the Public Elevator Floor 2 Button to request access to Floor 2.

   Ursula should be granted access to the elevator, but denied access to Floor 2. This is because she does not have permission to disarm the Floor 2 Lobby area.

   ```
   User Ursula Tenant Waiting For Floor Selection Public Elevator Using
   Access Level Floor 1 Employees
   Input Public Elevator Floor 2 Button Opened
   Input Public Elevator Floor 2 Button Closed
   Elevator Public Elevator Floor Floor 2 Denied Unlock By Area Status Floor
   2 Lobby
   ```

6. Right click on the Floor 2 Lobby and click **Disarm**. Within one minute Floor 2 should unlock.

   ```
   Area Floor 2 Lobby Disarmed By Admin
   ...
   Elevator Public Elevator Floor Floor 2 Unlocked By Area Floor 2 Lobby
   Output Public Elevator Floor 2 Relay On By Floor Floor 2
   ```

7. Badge Ursula's card at the service elevator's card reader. Access should be denied, as she does not have access to this elevator.

   ```
   User Ursula Tenant Denied Access By Elevator Group At Service Elevator
   Using Access Level Floor 1 Employees
   ```

8. Badge the card assigned to Angie Fitzroy at the service elevator's card reader. Access should be denied, as the schedule is invalid.

   ```
   User Angie Fitzroy Denied Access By Elevator Group At Service Elevator
   Using Access Level Maintenance
   ```

9. Arm the Floor 2 Lobby area. Within one minute, Floor 2 should lock.

   ```
   Area Floor 2 Lobby Armed By Admin
   ...
   Elevator Public Elevator Floor Floor 2 Locked By Area Floor 2 Lobby
   Output Public Elevator Floor 2 Relay On By Floor Floor 2
   ```

10. Set the controller time to 4:59:00 PM.
    - **Protege GX**: Navigate to **Sites | Controllers** and right click on the controller. Enter the new time and select **Set controller date time**.
    - **Protege WX**: Navigate to **Scheduling | Time**. Enter the new **Time** and click **Save**, then press F5 to refresh the page.

11. Wait until the controller field time reaches 5:00 PM. Floor 1 should be locked within 1 minute of the schedule becoming invalid.

```
Schedule Office Hours Is Invalid
Elevator Public Elevator Floor Floor 1 Locked By Schedule Office Hours
Output Elevator Floor 1 Relay Off By Floor Floor 1
```

12. Badge Angie's card at the service elevator's card reader. Press the Service Elevator Basement Button to select the basement. Access should be granted.

```
User Angie Fitzroy Waiting For Floor Selection Service Elevator Using
Access Level Maintenance
Input Service Elevator Basement Button Opened
Input Service Elevator Basement Button Closed
User Angie Fitzroy Floor Unlocked Basement On Service Elevator Using
Access Level Maintenance
Output Service Elevator Basement Relay On By Floor Basement
Output Service Elevator Basement Relay Off By Floor Basement
```

13. Badge Angie's card again at the public elevator's reader. Press the Public Elevator Floor 2 Button to select Floor 2.

    Access should be granted and the Floor 2 Lobby should be disarmed automatically. The floor will not latch unlock, because the relevant schedule is invalid.

```
User Angie Fitzroy Waiting For Floor Selection Public Elevator Using
Access Level Maintenance
Input Public Elevator Floor 2 Button Opened
Input Public Elevator Floor 2 Button Closed
User Angie Fitzroy Floor Unlocked Floor 2 On Public Elevator Using Access
Level Maintenance
Output Public Elevator Floor 2 Relay On By Floor Basement
Area Floor 2 Lobby Disarmed By Angie Fitzroy Using Reader RD X on Port
Port Y
Output Public Elevator Floor 2 Relay Off By Floor Basement
```

Programming Commands

Supported programming commands provide additional functionality options to low level elevator control.

DRI Activates Relay

Add the command **`DRIActivatesRelay = true`** to enable the 'Destination Reporting Interface Activates Relay' function.

In destination reporting integrations, normally when a user badges a card the system waits for an input activation before activating only the floor relay that was selected.

With this command enabled, when a user gains access to the elevator car all of the floor relays that they have access to are activated for the **Unlock access time**. If a floor is selected, all relays turn off except for the selected one, which remains on for another **Unlock access time** period.

This is required by the security interfaces of some elevator systems.

Exclude Open Floors

Add the command **`DRMExcludeOpenFloors = true`** to enable the 'Exclude Open Floors' function.

In destination reporting integrations, normally when a user selects a floor that is already open the system records access events and status as if the user had unlocked the floor.

With this command enabled, no access events or status are recorded for floors that are latched open.

Audible Feedback

Add the command **`DRMAudibleFeedback = true`** to enable the 'Audible Feedback' function.

With this command enabled, the reader beeper will sound when access is granted or denied after the user selects a floor in a destination reporting integration.

This feature is only supported for Wiegand readers.

Appendix: Authentication Modes

By default, elevator cars use card only authentication. The ability to set the authentication mode for an elevator car (e.g. PIN, Card and PIN) is only supported in some versions.

If you have Protege GX version 4.3.308 or higher and Protege GX controller firmware version 2.08.865 or higher, you can configure the **Authentication mode** using the option in the Protege GX user interface.

If the **Authentication mode** is not set, the elevator will default to card only operation.

If you have Protege GX controller firmware version 2.08.865 or higher or Protege WX version 4.00.452 or higher, you can configure the authentication mode using commands. In the **Commands** section of the elevator car programming, enter `EntryMode = #`, where **#** defines the authentication mode as follows:

#	Authentication Mode
0	Card only
1	PIN only
2	Card and PIN
3	Card or PIN

If you do not have the versions outlined above, the authentication mode cannot be configured. Only card operation is supported for elevator cars in earlier versions.

Dual Credential Pending Time

When the authentication mode above is set to Card and PIN you can define how long (in seconds) the elevator will wait for the second credential.

Add the command `DualCredPendingTime = #` to the elevator car, where **#** is the pending time in seconds. The default time is 10 seconds.

Using Credential Types

Elevator cars support custom card formats using credential types, but there are some specific configuration requirements:

1. In **Programming | Elevator cars**, set the **Authentication mode** to <not set>.
   If this option is not available in the user interface, remove the `EntryMode` command.

   Credential types will not work when the **Authentication mode** is set to Card only.

2. In **Expanders | Reader expanders | Reader 1/2**, select the appropriate reader port and set the **Reader 1/2 format** to Custom credential. This instructs the reader port to check the programmed credential types.
3. In **Sites | Credential types**, program the required credential type.

   When the reader receives card data, it will check each credential type format in order until it finds a match. It will match the card data against the first credential type that has the correct bit length. For example, if there are two different 32-bit formats used on the site, ensure that the format used by elevator car readers is programmed first in the list. Otherwise the card data may be interpreted incorrectly.

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