



Door Interlocking

Overview

This technical note details how to configure the Inner Range Inception controller to support door interlocking functionality.

Introduction

Door interlocking involves restricting access through doors, when other conditions have not been met. A common example is an airlock scenario, where two doors open into a separate space. Only one door is allowed to be open at any time, preventing air at one end of the airlock from directly passing through to the other end. This means to open a door, the other door must be locked and closed. Note that there may be more than two doors leading in to the airlock.

Similarly, interlocking can be used for safety environments, preventing access to a room if machinery is running. In this case, the machinery must be stopped before access to the door is allowed. Access to doors can also be restricted if hazardous substances are detected on the other side of a door.

Interlocking in Inception

As the applications of interlocking can be quite varied, there is no “Interlocking” structure in Inception. Instead, the flexible user permissions structures and automated actions can be used to easily implement any interlocking scenario.

Three key components are used to implement the interlocking scenario:

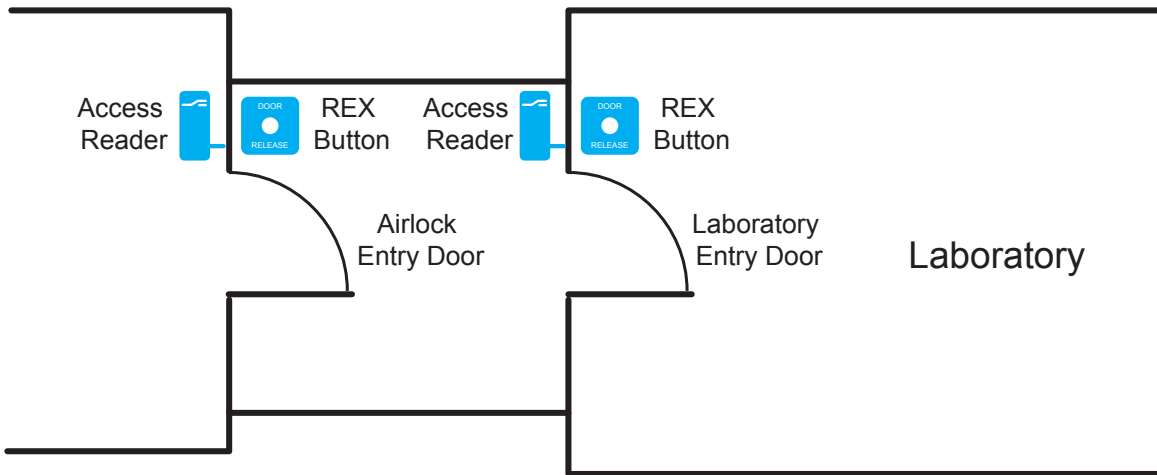
- 1. Custom Output** – A custom output is created that represents whether access to the interlocked doors is allowed. If the output is off, no doors in the interlock group should be allowed to unlock.
- 2. User Permissions** – For sites where the interlocked doors are controlled with access readers, a user’s permission to these doors should only be allowed if the custom output described above is turned on.
- 3. Automated Actions** – An automated action is used to control when the interlock custom output is activated. Similarly, additional automated actions can be used to restrict any ingress/egress (REX/REN) buttons for the interlock doors.

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Scenario – Airlock Doors to a Laboratory

To illustrate how to implement door interlocking in Inception, the following scenario will be used:

A clean room exists between two interlocked doors, separating a laboratory from the rest of the building. Only authorized personnel are allowed into the lab and due to the clean room, only one door is allowed to be open at a time. User access cards are required to enter the airlock and enter the lab, while egress (REX) buttons are used to exit.



Scenario Configuration – Custom Output

A single custom output is used as a state-holder, representing whether access to the interlocked doors is allowed. If the output is on, then the doors involved in the interlock should be allowed to unlock. As soon as a door is unlocked in the interlock, the output is turned off to restrict further access. Once all doors are both locked and closed, the output will be turned on again.

Custom outputs can be configured on the [**Configuration > Outputs > Custom Outputs**] page. For the above example, a custom output is created with the name *Airlock Access Allowed*.



Scenario Configuration – User Permissions

As access to the interlock is controlled by access control readers, user permissions can be used to implement the interlock to enter the lab. In this case, the users who are allowed access to the lab are assigned permission to the two doors, however, those permissions are only allowed when the above custom output is on.

Permissions	Allowed	What	When
	Allow	Door Lab Entry Door Access	Airlock Access Allowed Is On
	Allow	Door Airlock Entry Door Access	Airlock Access Allowed Is On

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Scenario Configuration – Automated Action

The automated actions are used to implement the actual interlocking logic. The first automated action required controls the *Airlock Access Allowed* custom output. This custom output should be on if access to the interlocked doors is allowed. So, an automated action is created with the following settings:

Trigger Condition

True when ALL of the following are true

- Airlock Entry Door Is Locked
- Airlock Entry Door Is Closed
- Lab Entry Door Is Locked
- Lab Entry Door Is Closed

Actions When True

Action Type	Item	Action
Control Output	Airlock Access Allowed	Turn On Output

Actions When False

Action Type	Item	Action
Control Output	Airlock Access Allowed	Turn Off Output

This action ensures that all doors involved in the interlock are both locked and closed, before turning on the custom output. This custom output can then be used throughout the system to indicate the state of the interlock. If more doors were included in the scenario, they can all be added to the same trigger condition.

In this scenario, two egress buttons are used to exit the lab and airlock. Note that when configuring the hardware, these buttons must be “Generic Switch” inputs instead of REX/REN buttons linked to the door. These would instead be implemented with automated actions, with one action per door. The lab egress button is instead configured by an automated action with the following settings:

Trigger Condition

True when ALL of the following are true

- Airlock Access Allowed Is On
- Lab Egress Button Is Active

Actions When True

Action Type	Item	Action
Control Door	Lab Entry Door	Grant Access

This action will grant access to the *Lab Entry Door* (unlock for the default unlock time) when the *Lab Egress Button* is pressed, but only if the *Airlock Access Allowed* custom output is on. A similar automated action can be made for the other egress button to leave the airlock.

With this, the entire interlocking scenario has been configured. Below are more examples that show how to extend this interlocking scenario or explain how to implement other interlocking types.

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Advanced – Emergency/Maintenance Override

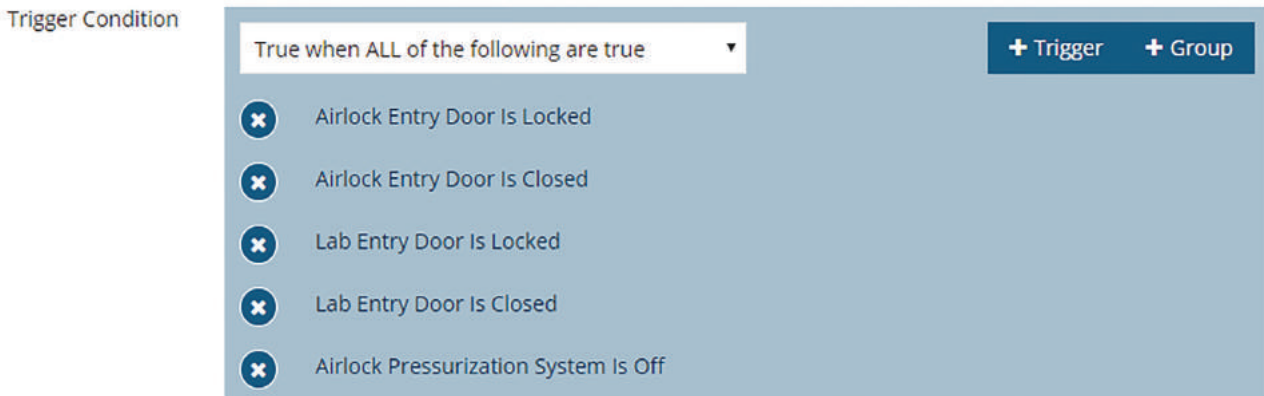
If an emergency or maintenance override function is required, this can be added to the automated action that controls the custom output. For this, the trigger is updated to include the emergency override or maintenance input, as shown below:



If the emergency override input is active, then the *Airlock Access Allowed* custom output will always be on, ignoring the states of the doors. This lets all of the other logic using this custom output to remain unchanged.

Advanced – Pressurization/Ventilation System

One extension to the scenario may be that a pressurization or ventilation process must run for a period of time after a door opens and then closes. This requirement can also be added to the same trigger that controls the *Airlock Access Allowed* custom output. For example, there could be an output that when turned on, will run the pressurization or ventilation system. Access to the doors should only be allowed when both doors are locked and closed and the pressurization system is not running, so the trigger can be updated to:



The pressurization system can then be controlled by another automated action where when both doors are closed, the system is run for 5 seconds.

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Advanced – Pressurization/Ventilation System (cont.)

Trigger Condition

True when ALL of the following are true

- Airlock Entry Door Is Closed
- Lab Entry Door Is Closed

Actions When True

Action Type	Item	Action
Control Output	Airlock Pressurization System	Turn On Output for 5 seconds

As the triggers are edge based, the output will only turn on when both doors are closed, after one was opened.

Advanced – Quarantine/Alarm Lockdown

One addition to the scenario could be to lock down or quarantine the lab in case of an emergency. If access in should not be restricted, but access out should, then the automated actions used to control the egress (REX) buttons that exit the area could be further qualified to ensure there are no alarms within the lab. Similarly, user access to the airlock could be restricted, preventing a user from walking in to a hazardous environment by extending the automated action that controls the *Airlock Access Allowed* custom output.

Summary

With the flexibility of the automated actions, many different interlocking scenarios can be implemented. The scenario explained was an airlock system; however the same techniques can be used to implement man traps and any other interlock styles. Many doors can be included in the one interlock set with any business rules also managed by the Inception system. Or a single door can be interlocked to prevent access unless a set of steps is followed like shutting down machinery on the other side of the door.



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