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Fulfilling ANSI A17.1-2019 / CSA B44-19 requirements in wider elevator door applications

Background information

The Elevator Safety Code ["Code"] for North America, ANSI / ASME A17.1-2019 / CSA B44-19, introduced new prescriptive requirements for the reopening device used to detect persons or objects between the elevator doors or approaching the elevator cab entrance and subsequently generating a reopen signal.

When CEDES became aware that new requirements for elevator door protection were going to be introduced, we reviewed various technologies to find the best-in-class solution. CEDES used several criteria for our technology evaluation, including:

- no requirement for a minimum separation distance between sensor and human / object,
- have sufficient resolution to detect persons and objects reliably,
- fulfill the detection criteria defined by the Code,
- be able to tell the difference between stationary person(s) or object(s) versus those moving in the detection field,
- work with application variations, e.g., when landing doors lead cab doors,
- fulfill the self-monitoring requirements defined in the Code,
- be in a robust housing, and
- have strong light immunity.

Based on these details and our customer's input, a transom-mounted, a TOF-based solution was viewed as the best technology for the application. This led to the development of CEDES CabSafe system, consisting of a CabSafe controller, a CabSafe 2D (cegard/Pro) light curtain and a Time-of-Flight (TOF) CabSafe 3D sensor.

CEDES introduced our CabSafe™ system just prior to the release of the Code in late 2019. The Code defines both design and application requirements. A third-party certified our product to ensure that the design requirements defined in the Code were indeed fulfilled. When the CabSafe system is installed according to the operating instructions, LiftInstituut attests that it fulfills ANSI / ASME A17.1-2019 / CSA B44-19.

For 2.44 m (8 ft) mounting heights and less, the standard CabSafe systems fulfills Code requirements for door openings up to 1.37 m (4.5 ft) wide. For taller doors, a tall door variant (TD) is available for our CabSafe 3D Sensor to accommodate the optical changes that occur based on the geometrical requirements.

This paper describes how the CabSafe system can be used to fulfill Code requirements in elevators having door widths greater than 1.37 m (4.5 ft) using multiple CabSafe controllers and CabSafe 3D sensors. The following examples are representative of what is possible. Please contact your local CEDES representative if you require assistance with your specific application.

Some basic rules for using multiple sensors and controllers as a single system

Before we describe the details in three example applications, it is important to establish some basic rules for implementation. As mentioned, the CEDES CabSafe system typically consists of a light curtain that detects persons or objects in the door path, a CabSafe 3D sensor that detects persons or objects approaching the elevator cab entrance and a controller that provides a single output representative of the signals from the light curtain and CabSafe 3D sensor, and monitors both devices to fulfill the self-monitoring requirements of the Code.

The following basic rules provide some guidelines for fulfilling the Code requirements:

1. When multiple CabSafe 3D Sensor are used to widen the overall detection field of approaching objects, a controller is required for each CabSafe 3D Sensor used.
2. The light curtain receiver output signal must be paralleled to all controllers in the system so that the signal from each controller takes the light curtain into account so that the timing requirements defined by the Code cab be fulfilled.
3. In some cases, the light curtain can be used to indicate that the doors have reached a position where the CabSafe 3D sensor can be rendered inoperative. The light curtain output changes frequency at a point less than 450 mm (18 in) from full close as prescribed by the Code. This render inoperative function is ideal for single CabSafe 3D sensors in dynamic installations (i.e., when the light curtain is mounted on the moving door[s]).
4. A retentive (bipolar) switch is necessary when a CabSafe 3D sensor must be rendered inoperative prior to the light curtain indicating that the doors have reach a point that is less than 450 mm (18 in) from full close. This render inoperative function is ideal for static installations when the light curtain is mounted in a fixed manner (does not move with the doors) and when multiple sensors are used.
5. Ensure that the power available to the system is sufficient. Plan for 24 VDC, 0.5 Amps for each CabSafe 3D sensor used and ensure that the same 0 VDC Common signal is used for the 0 VDC common for all controllers.
6. The monitored portion of the CabSafe 3D sensor field is 970 mm (38.2 in) wide from the centerline of the sensor in center-opening applications. For side-opening applications, the CabSafe 3D sensor field is -50 mm to +920 mm (-1.97 in to 36.22 in) from the centerline of the sensor.
7. When considering the number of sensors needed to fulfill your application requirements, ensure there are no gaps in the detection area required by the Code.
8. DIP switch settings for the configurations shown are indicated in the controller (gray boxes) in the connection diagram(s) that accompany each example.

Example 1: Side-opening application with two (2) CabSafe 3D sensors – for openings up to 2.305 m (7.56 ft) wide

In this side-opening elevator door system application, wider door openings to 2.285 m (7.49 ft) can be fulfilled using two (2) CabSafe 3D sensors to fulfill the prescriptive requirements for the door reopening device defined in Section 2.13.5 of the Code. In this case:

- CabSafe 3D **Sensor 1** should be mounted 240 mm from the strike jamb.
- CabSafe 3D **Sensor 1** is set to left-side mounting.
- CabSafe 3D **Sensor 2** is also set to left-side mounting.
- CabSafe 3D **Sensor 1** is set to Frequency Group A.
- CabSafe 3D **Sensor 2** is set to Frequency Group B.
- A magnetic switch is needed to render the CabSafe 3D **Sensor 2** inoperative.
- A second magnetic switch will also be needed for CabSafe 3D **Sensor 1** for static-mounted light curtain applications.

The system, in this example, consists of: (2) CabSafe 100 controllers, (2) CabSafe 3D sensors, (1) CabSafe 2D (cegard/Pro) light curtain, and (1 or 2) magnetic switch(es) / actuator(s), depending on light curtain mounting, and associated mounting accessories.

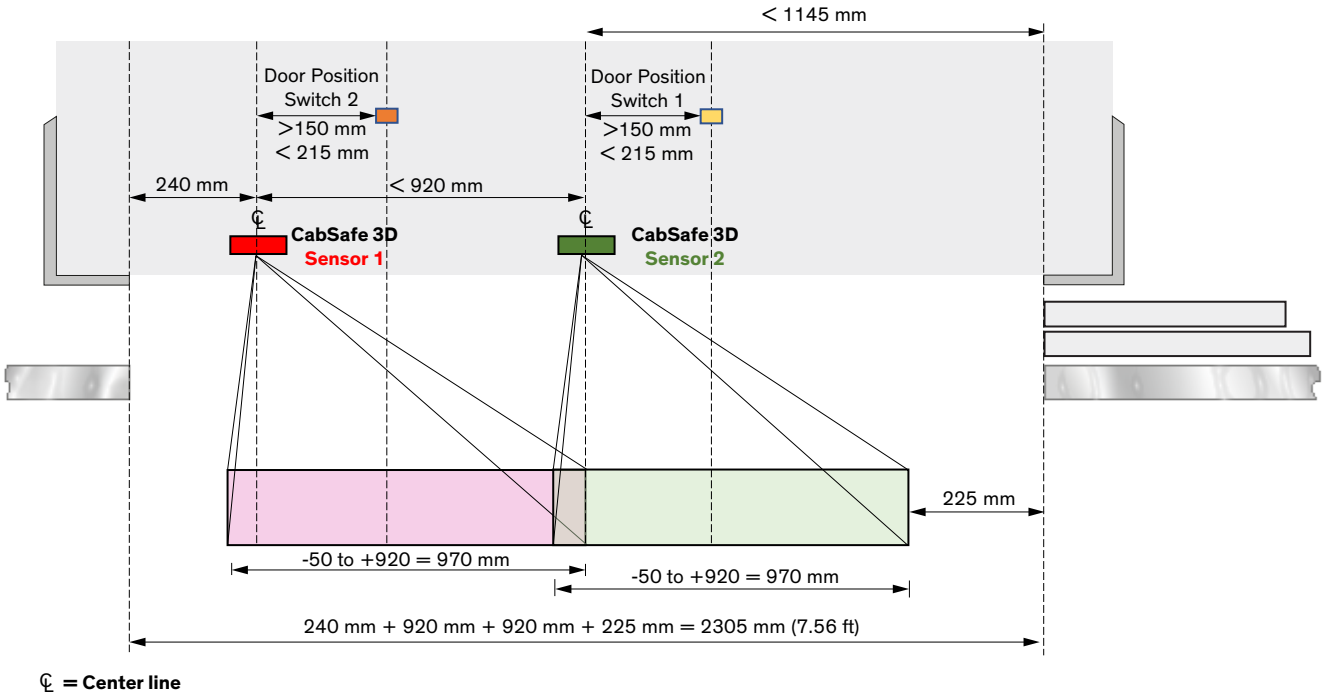


Figure 1

When the light curtain is used for the render inoperative function of CabSafe 3D **Sensor 1** (i.e. the light curtain is mounted on the elevator doors) and a Door Position Switch 1 is used for the render inoperative function of CabSafe 3D **Sensor 2**, the system is electrically connected as shown in Figure 2.

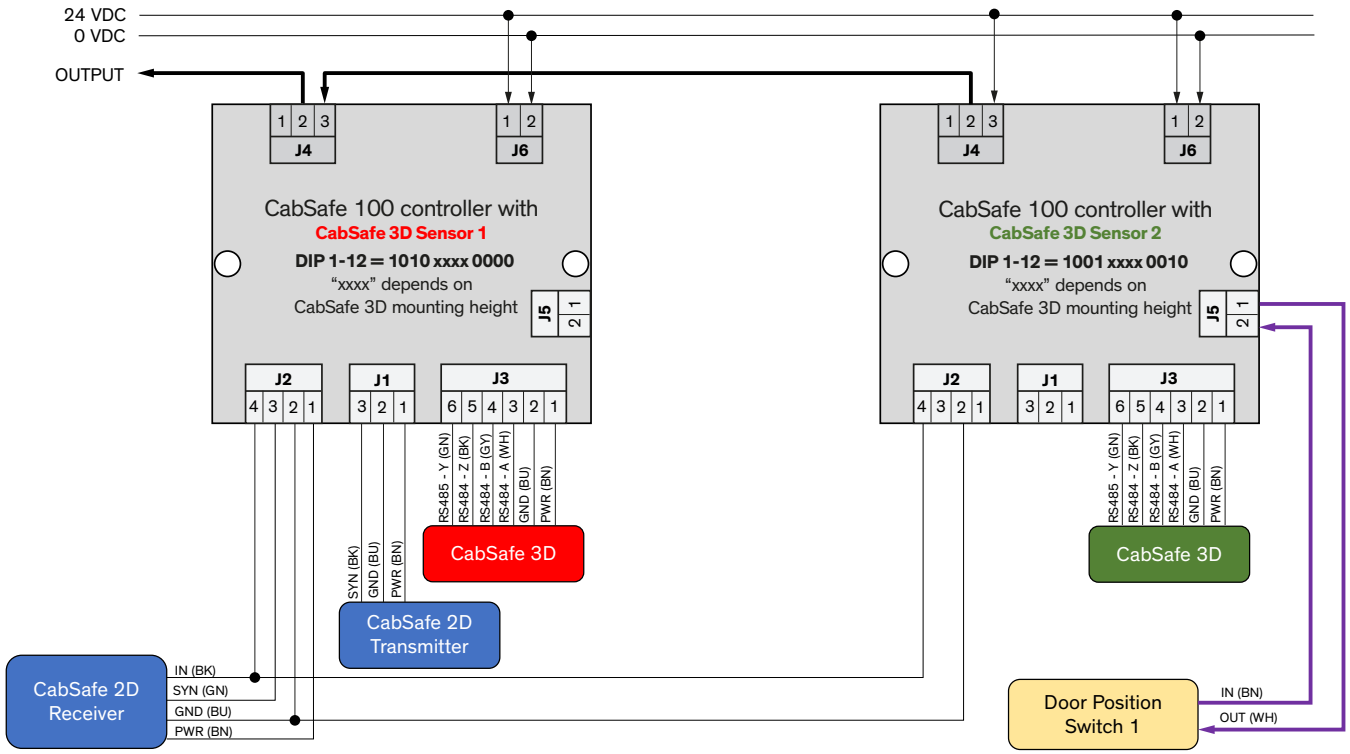


Figure 2

When the light curtain is static mounted (i.e., does not move with the door[s]), Door Position Switch 1 is used for the render inoperative function of CabSafe 3D **Sensor 2** and Door Position Switch 2 is used for the render inoperative function of CabSafe 3D **Sensor 1**, which leads to a system that is electrically connected as shown in Figure 3.

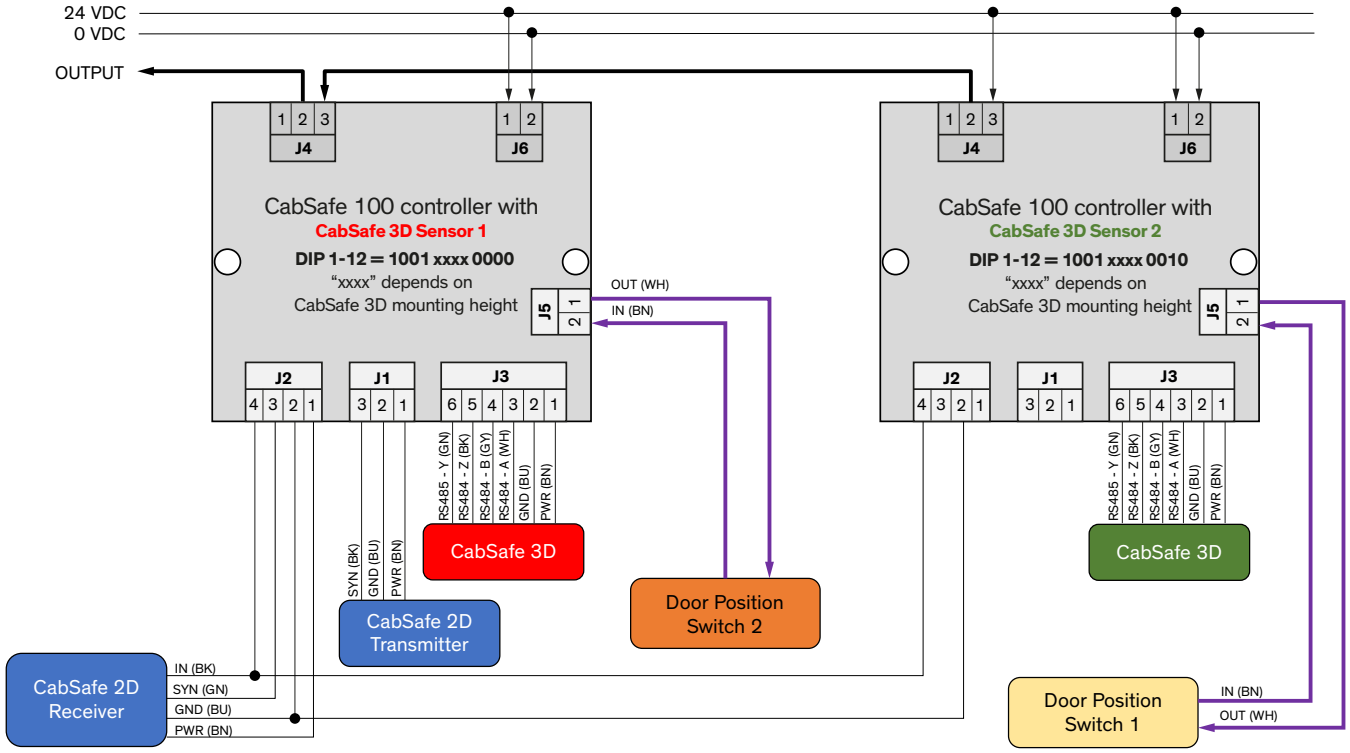


Figure 3

Example 2: Center-opening application with two (2) CabSafe 3D sensors – for openings up to 2.14 m (7 ft) wide

In a center-opening elevator door system application, wider door openings to 2.14 m (7 feet) can use two (2) CabSafe 3D sensors to fulfill the prescriptive requirements for the door reopening device defined in Section 2.13.5 of the Code. In this case:

- The CabSafe 3D sensors are both flush-mounted with 150 mm between them centerline to centerline. The sensors should be symmetrically positioned relative to the entrance centerline as shown in the figure that follows.
- CabSafe 3D **Sensor 1** is set to left-side mounting.
- CabSafe 3D **Sensor 2** is set to right-side mounting.
- CabSafe 3D **Sensor 1** is set to Frequency Group A.
- CabSafe 3D **Sensor 2** is set to Frequency Group B.
- A magnetic switch is used to render both CabSafe 3D **Sensor 1** and CabSafe 3D **Sensor 2** inoperative.

The system would consist of: (2) CabSafe 100 controllers, (2) CabSafe 3D sensors, (1) light curtain, (1) Door Position Switch, and associated mounting accessories.

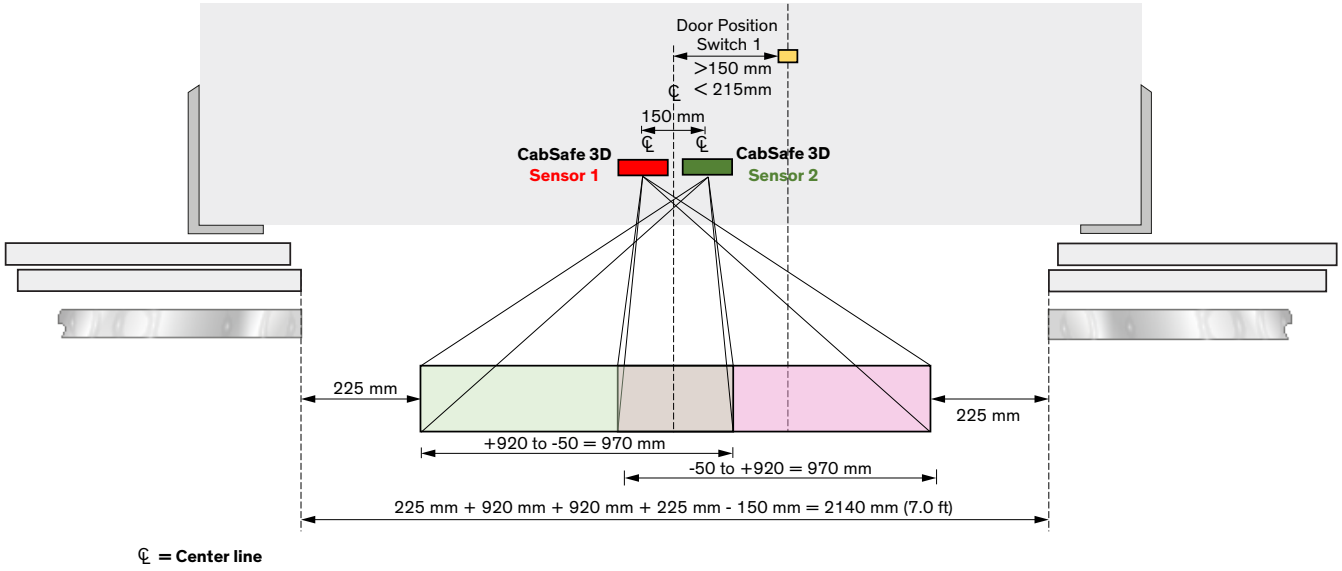


Figure 4

The system shown above is electrically connected as shown in Figure 5.

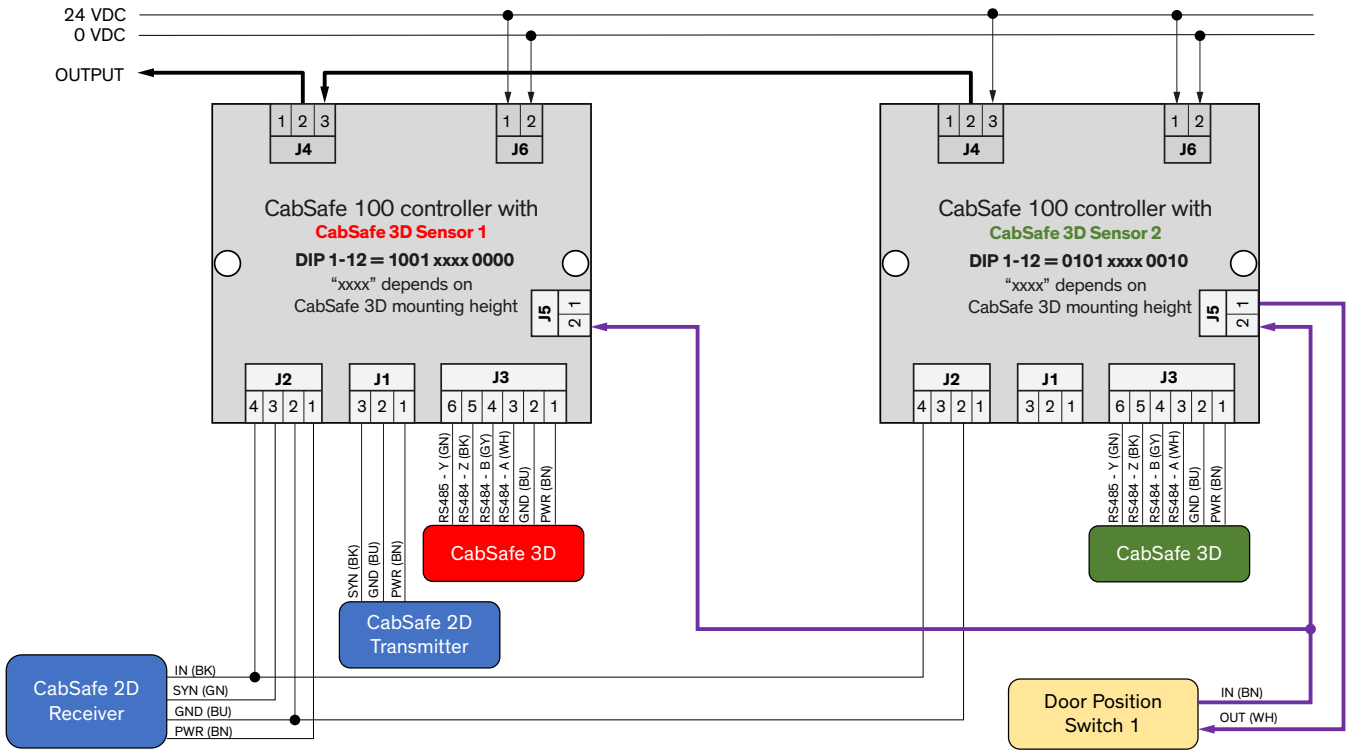


Figure 5

Example 3: Center-opening application with three (3) CabSafe 3D sensors - for openings up to 3.2 m (10.5 ft) wide

In a center-opening elevator door system application, wider door openings to 3.2 m (10.5 ft) could use three (3) CabSafe 3D sensors to fulfill the prescriptive requirements for the door reopening device defined in Section 2.13.5 of the Code. In this case:

- CabSafe 3D **Sensor 1** and CabSafe 3D **Sensor 3** should be located an equal distance from CabSafe 3D **Sensor 2** so that the Door Position Switch 1 applies correctly to both sensors.
- CabSafe 3D **Sensor 2** should be centered on the entrance centerline
- CabSafe 3D **Sensor 1** should be located less than 460 mm (18.1 in) from CabSafe **Sensor 2** as shown
- CabSafe 3D **Sensor 3** should be located less than 460 mm (18.1 in) from CabSafe **Sensor 2** as shown
- CabSafe 3D **Sensor 1** is set to right-side mounting.
- CabSafe 3D **Sensor 2** is set to center-opening.
- CabSafe 3D **Sensor 3** is set to left-side mounting.
- Door Position Switch 1 is used to render the CabSafe 3D **Sensor 1** and CabSafe 3D **Sensor 3** inoperative.
- Door Position Switch 2 may be used to render the CabSafe **Sensor 2** inoperative e.g., when the light curtain is static mounted.

The system, in this example, consists of: (3) CabSafe 100 controllers, (3) CabSafe 3D sensors, (1) light curtain, and (1 or 2) magnetic switch(es) / actuator(s), and associated mounting accessories.

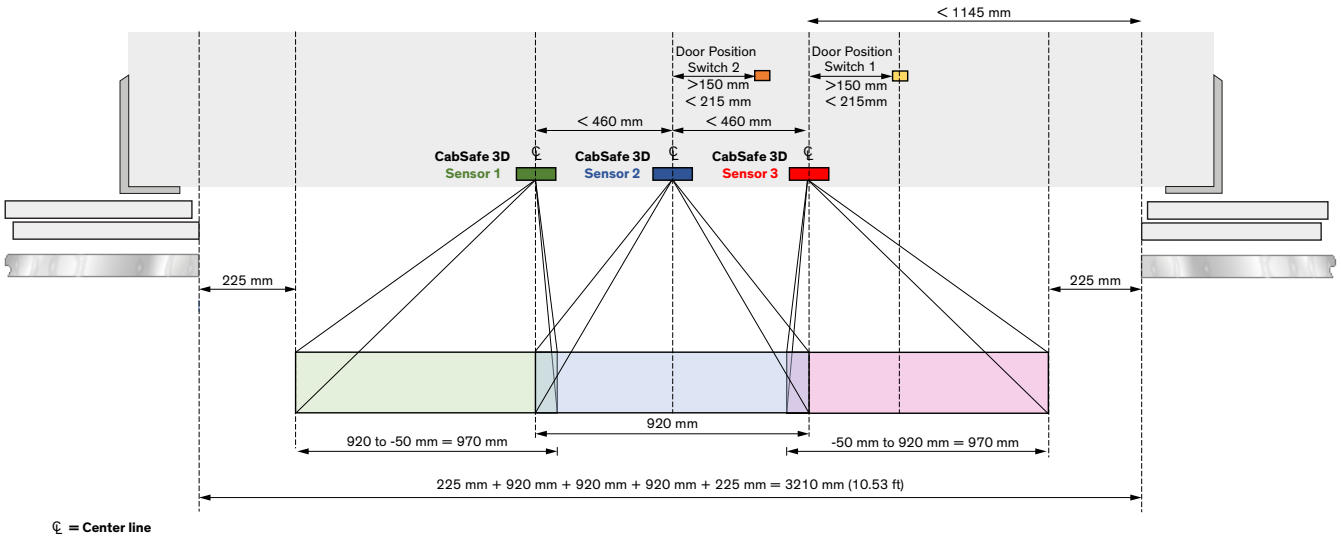


Figure 6

- When the light curtain is used to render CabSafe 3D **Sensor 2** inoperative, and Door Position Switch 1 is used to render CabSafe 3D **Sensor 1** and CabSafe 3D **Sensor 3** inoperative, the system is electrically connected as shown in Figure 7.

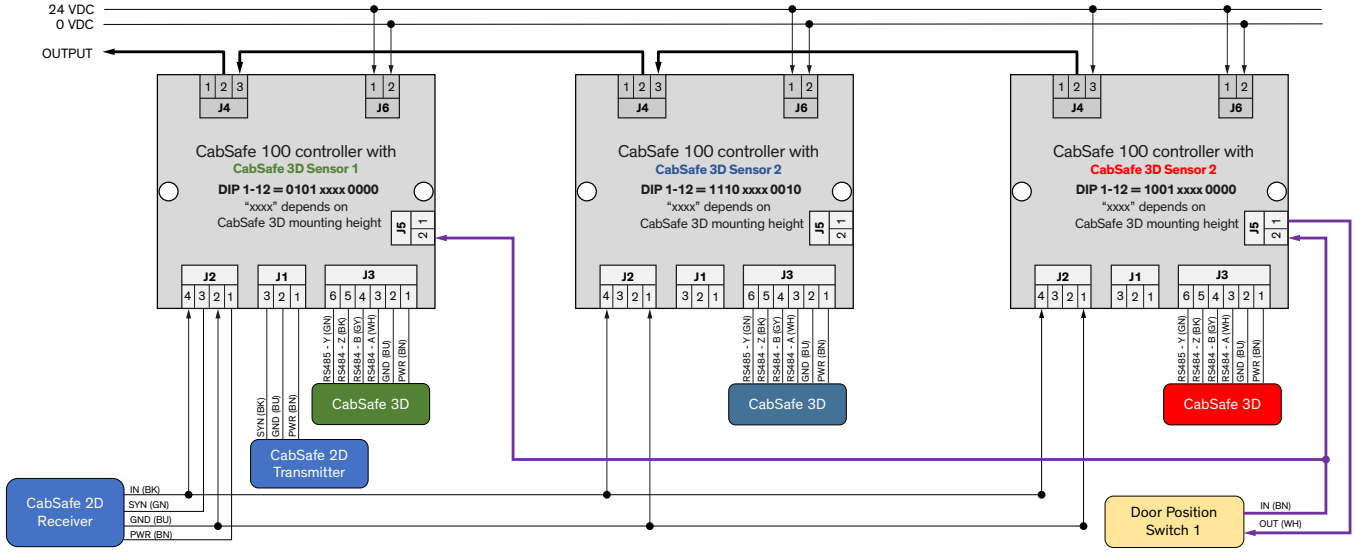


Figure 7

Alternatively, when Door Position Switch 2 is used for to render CabSafe 3D **Sensor 2** inoperative (e.g. in static-mounted light curtain applications), and Door Position Switch 1 is used to render CabSafe 3D **Sensor 1** and CabSafe 3D **Sensor 3** inoperative, the system could be electrically connected as shown in Figure 8.

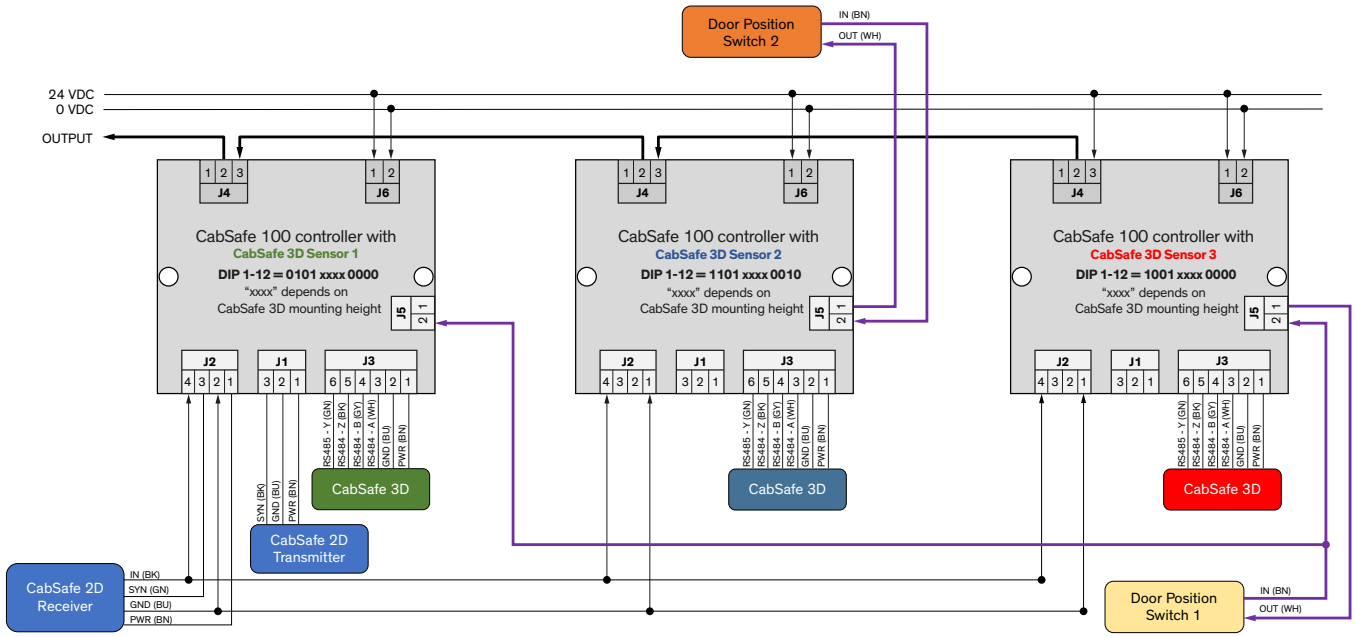


Figure 8

The CabSafe 200 controller is available when 85 … 264 VAC power is used. Wiring is similar and the DIP switch settings use the same configuration as the CabSafe 100 controller. The wiring for Example 3 using CabSafe 200 controllers is shown in Figure 9 below.

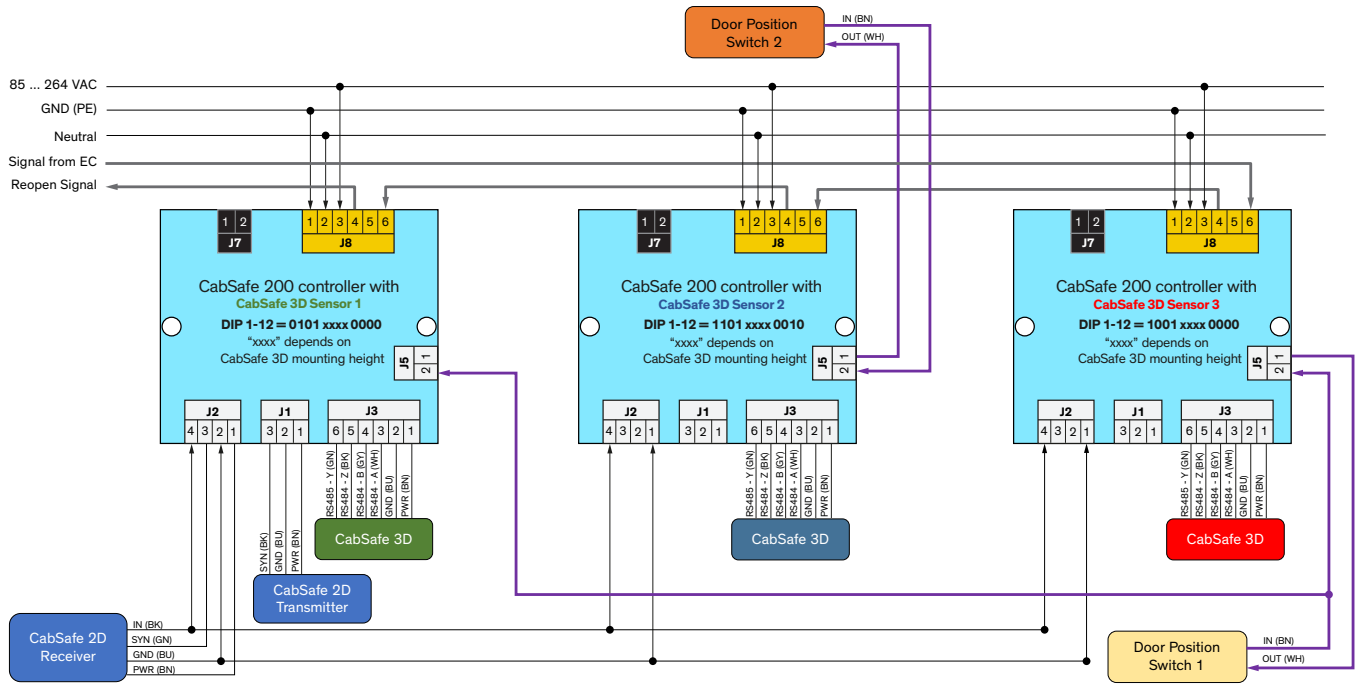


Figure 9

Summary

By following some basic design rules, it is possible to use multiple CabSafe 3D sensors (with CabSafe controllers) to fulfill the reopening device requirements defined in Section 2.13.5 in ANSI A17.1-2019 / CSA B44-19.

Ensure that there are no gaps between CabSafe 3D detection fields in your configuration, and the overall field created using multiple CabSafe 3D sensors fulfills the moving line of detection requirements as defined by the Elevator Safety Code.

These examples have been evaluated by CEDES in accordance with the requirements defined by the North American 2019 Elevator Safety Code – ANSI A17.1-2019 / CSA B44-19 and ANSI A17.5-2019 CSA B44.1-19.

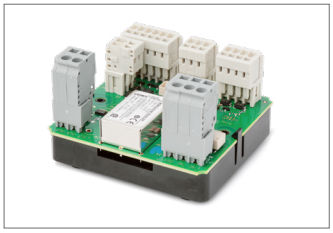
The information contained in this white paper is based on the use of CabSafe controllers with SW 1.11 or later.

For additional information on the CabSafe system, including operating instructions, test certificates, and troubleshooting tools, please visit our website at: https://www.cedes.com/en/products/cabsafe/.

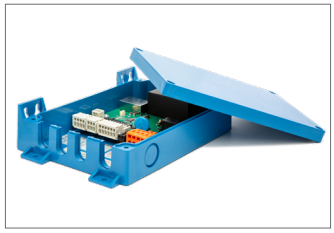
Components of the CEDES CabSafe system

CabSafe™ 3D

CabSafe™ 2D



CabSafe™ 100 controller



CabSafe™ 200 controller