



# Magnetic and Optical Encoders for Use in Passenger Elevator Systems

## Application Note



Model EMS2



Model EN

### INTRODUCTION

Directive 95/16/EC established European legal requirements for the design, installation and placement of new elevators on the market. The Directive makes provisions for a number of standards. The first was EN81 Elevator Safety Regulations, introduced in July 1999 which defined the development and type approval of new passenger and goods elevators. Extensions of the original standard have been implemented to deal with new requirements as they have arisen. Examples include EN81-70 for disabled access to elevators or EN81-21 for new elevators in existing buildings. In the United States, ASME A17.1 defines a similar safety code for elevators and escalators.

### PROBLEM TO BE SOLVED

EN81-1 defines safety rules for the construction and installation of electric elevators while EN81-2 establishes safety rules for the construction and installation of hydraulic lifts. In both cases, the standards apply to new elevators. In 2003 it was determined that there were three million elevators in use in Europe, and 50 % of these lifts were installed more than 20 years ago. As a result, it was necessary to introduce EN81-80 to cover requirements for the improvement of existing passenger and goods elevator safety. EN81-80 categorizes various hazards and hazardous situations, analyzed by a risk assessment, covering 74 scenarios.

### SOLUTION

Encoders with non-contacting technology can be used to provide the reliable position feedback necessary to fulfill the requirements of EN81 Elevator Safety Regulations. The encoder works to measure speed and direction in an elevator via a signal response to the elevator controller. The controller monitors the A and B channel output of the encoder to determine which channel arrives first. The controller then verifies whether the encoder is turning clockwise or counterclockwise. Speed is determined by the rate at which the A and B channels are switched. An electronic controller will have been pre-programmed with parameters determining safe elevator operation during the design and installation phase. If the encoder output produces a signal that defines a speed higher than the safety limit prescribed for a specific load in either direction, then the controller will apply the brakes to the elevator car and either bring the car to a full stop or slow the elevator as necessary.



## Magnetic and Optical Encoders for Use in Passenger Elevator Systems



Model EMS22



Model EN

### **SOLUTION (Continued)**

The high resolution of the encoder helps to ensure that the application of brakes by the electronic controller is smooth, preventing discomfort to passengers that could result from a sudden or rapid deceleration. Encoders can be mounted using several different methods. Examples include connection directly to the electric motor of the elevator, attachment to a pulley on which the traction rope runs (the encoder rotates as the rope moves), or in a draw-wire configuration. The Bourns® EN Encoder can be used, for example, as part of a system for compliance with Section 3.2 of Annex I of the Lift Directive. This section requires that a device be fitted to the elevator to prevent the car from falling or encountering uncontrolled upward movements, in the event of a power failure or failure of other components.

Non-contacting encoders can also be used to ensure accurate lands of the elevator car at each floor. Distance is measured by assigning each pulse interval a distance value, which is memorized by the elevator controller based on the exact output of the encoder at a specific position. During the service life of the elevator this initial set-up ensures that the car will be directed to stop within a few millimeters of each floor, independent of the actual load. As an additional feature, the output can be monitored continuously by the controller for improper counting sequences. This input may be used to determine scheduling of maintenance. Non-contacting encoders eliminate the need for a set of reed switches for each floor, improving reliability and reducing maintenance costs of the elevator.

Bourns offers encoders with magnetic or optical technology that provide a reliable solution to the functional safety requirements established in EN81-80. The Model EMS22 magnetic and EN optical rotary encoders offer a two-channel quadrature output necessary for detecting both the speed and direction of either a hydraulic or traction elevator. The encoder output may also be used to determine the position of the elevator, if necessary. Model EMS22 is capable of 50 million to 100 million revolutions and Model EN is capable of 10 million to 200 million revolutions while maintaining a high level of reliability and good resolution. For harsh environments, such as in an elevator shaft, the encoders can be sealed to IP 65 requirements. Both models have an optional cable and connector option, and can be retrofitted with locking connectors as an added value to safety requirements. The optional index channel in the Model EMS22 provides a zero-position signal allowing the device to be used for tracking absolute position of the elevator.



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Model EMS22



Model EN

### **SOLUTION (Continued)**

Bourns offers customers the option of Model EMS22 and Model EN, with a servo mount that facilitates the direct coupling of the encoder to the motor. This feature creates the possibility of using the encoder for determination of the elevator door position. Typically, the encoder is mounted in a motor shaft. Based on the quadrature output, a signal is generated that provides information on the position of the door, stall protection and confirms the direction in which the door is travelling. The rotational life characteristics of Model EMS22 and EN with ball bearing option and a servo mount bushing helps to ensure that the service life of the door position detection mechanism outlasts many of the mechanical components used in an elevator door assembly.

### **ADDITIONAL RESOURCES**

For more information on Bourns® Sensors and Controls, visit Bourns online at:

**[www.bourns.com](http://www.bourns.com)**

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