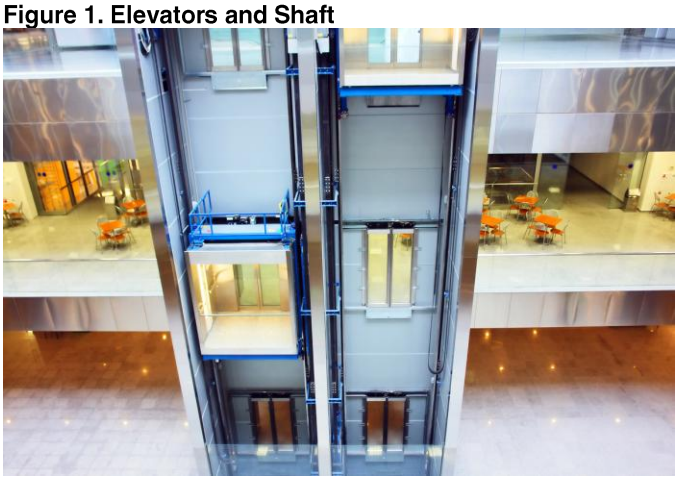
Sensors and Switches in Elevator Applications

BACKGROUND

People-moving elevators are classified as commercial (Fig. 1) or residential and have different codes and safety requirements. Generally powered by electric motors, elevators/lifts are vertical transport vehicles that move people or goods between floors of a building. There are four primary types of elevator movement mechanisms: traction, hydraulic, pneumatic/vacuum and climbing. Geared traction elevators use worm gears to control mechanical movement of the elevator cars by "rolling" steel hoist ropes over a drive shaft which is attached to a gearbox drive by a high speed motor. Gearless traction elevators are low speed, high torque electric where the drive shaft is directly attached to the end of the motor. Hydraulic elevators operate on hydraulic systems rather than direct traction. Vacuum elevators do not have cables and are often installed in spaces that are narrower than traditional elevator shafts. Climbing elevators are self-ascending, through the use of a combustion or electric engine. This application note refers primarily to commercial traction elevators. (See Figure 1.)

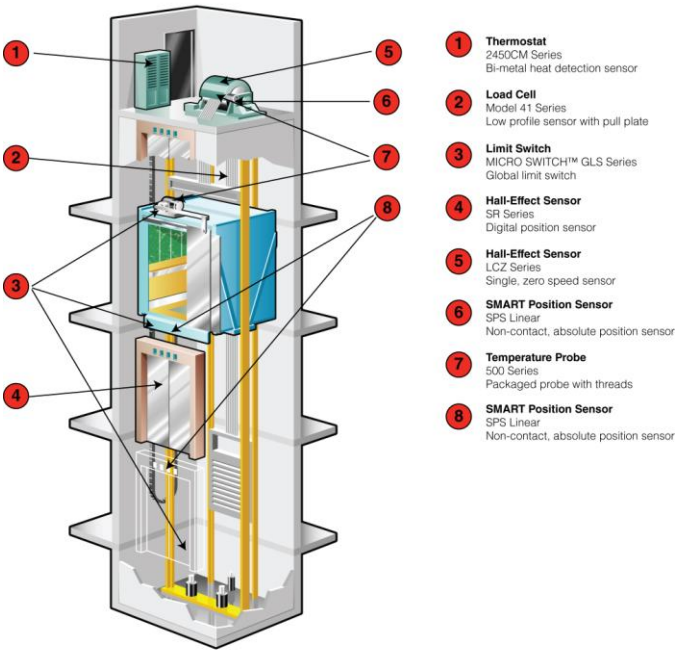
Figure 1. Elevators and Shaft



SOLUTIONS

Honeywell manufactures many products that may be used in commercial elevator applications. They are designed to help control temperature, safety, direction, position, load, and more. (See Figure 2.)

Figure 2. Potential Honeywell Products Used in Elevators



Thermostats

2450CM Series bi-metal heat detection sensor: In elevators, thermostats are used in the system control box as an over-temperature switch to help prevent the system from overheating.

Honeywell's commercial and precision snap-action thermostats include automatic and manual reset options, phenolic or ceramic housings and a variety of mounting brackets and terminal options. Each thermostat's design is configured from a base unit, and can be customized for temperature tolerance and mechanical configurations. (See Table 1).

Load Cells

Model 41 Series low-profile sensor with pull plate: In elevators, load cells are designed to determine the weight of the load on the elevator so it won't move if it is overloaded.

Low profile "pancake" type, bonded foil, strain gage load cells are engineered to measure loads from 5 to 500,000 pounds. The tension/compression Model 41 is designed with the threaded hole running completely through the center of the cell. Model 41 utilizes two stabilizing diaphragms, which are welded to the sensing load button which is fixed as an integral part of the load cell and cannot be removed or changed. (See Table 2).

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Table 1. Thermostats Used in Elevator Applications

2450CM Series Bi-Metal Heat Detection Sensor	Features and Benefits
	• Cost effective • Small size allows enhanced response to temperature changes • 4-posted “H” construction for application mounting bracket • Wide variety of mounting brackets and terminals allow application flexibility

Table 2. Load Cells Used in Elevator Applications

Model 41 Series Low Profile Sensor With Pull Plate	Features and Benefits
	• Low profile “pancake” type • Engineered to measure loads from 5 lb to 500,000 lb • Two stabilizing diaphragms which are welded to the sensing member reduce off-center and side-loading effects • Non-linearity, hysteresis and repeatability specifications provide high performance • Welded construction and ability to be hermetically sealed enhance durability

Table 3. MICRO SWITCH™ Global Limit Switches Used in Elevator Applications

GLS Series Global Limit Switch	Features and Benefits
	• Reliable switch performance • Designed to IEC standard for world-wide applications • Global agency approvals and availability • International conduit sizes • Direct PLC interface compatible (two circuit) • Modular construction reduces maintenance parts costs • Designed for ease of installation • Global package size with compact housing • Maximizes electrical life

Limit Switches

MICRO SWITCH™ GLS Series global limit switch: Limit switches are used in commercial elevators, in addition to wheelchair lifts, to detect the position of the elevator or lift floor. Commercial elevators also employ limit switches in the buffer system.

GLS Series switches offer a complete range of approved products and are suitable for most industrial applications. The standard product EN50041 features switch mounting centers as 30 mm x 60 mm. The miniature EN50047 offers users the choice of plastic, metal, and three conduit versions – all are mounting (20 mm x 22 mm) compatible with each other.

GLS actuators include side rotary, top pin plunger, top roller plunger, side rotary adjustable, side rotary adjustable rod, top roller lever, wobble, coil head wobble, and cat whisker wobble. (See Table 3).

Position Sensors

Hall-Effect Sensors

SR Series digital position sensor: Hall-effect sensors are used to monitor the position (open, shut) of the elevator door. When the doors open completely, the sensor resets the timer that determines when the doors should close. When the doors are closed, the sensor will sense when the door is closed, indicating that the elevator can be moved.

SR Series sensors are constructed from a thin sheet of conductive material with output connections perpendicular to the direction of current flow. Rugged, epoxy-filled plastic housing allows for use in potential corrosive applications. (See Table 4.)

SMART Position Sensor

SPS Linear non-contact, absolute position sensor: Honeywell’s SMART position sensor is used in elevator applications for accurate floor position control. When the elevator is approaching the floor, it slows and then levels to the floor it has reached.

This product uses a combination of ASIC (Application-Specific Integrated Circuit) technology and an array of MR (magnetoresistive) sensors to determine the position of a magnet attached to a moving object. The array measures the output of the sensors mounted along the magnet’s direction of travel.

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Table 4. Position Sensors Used in Elevator Applications Used in Elevator Applications

Hall-effect Position Sensor SR Series (SR3F-A1/SR4P2-A1) Digital Position Sensor	SMART Position Sensor (Linear Configuration) SPS Linear Series Non-Contact, Absolute Position Sensor
	
Features and Benefits	
• Enables total system cost reduction • Improves durability and reduces repair and maintenance costs • Stable magnetic solution with 30+ years of safety functionality • Easily interfaces and wires with many designs	• Indicates floor location even without power • Reduces overall system cost • Flexible mounting locations • Reliability minimizes down time • Enhanced durability for 10-25 years • Self-diagnostics feature reduces equipment downtime • Programmability increases flexibility, allowing the user to adjust the parameters without having to develop new equipment • Small size, which takes up 50% less space than most competitive technologies, for use where space is at a premium

Table 5. Speed Sensors Used in Elevator Applications

LCZ Series Single, Zero Speed Sensor	Features and Benefits
	• Available in several diameters and lengths for application flexibility • Stainless steel package is simple to install and adjust, and does not require rotational orientation • Small size allows application flexibility • Cost effective • Low power consumption allows energy efficiency • Durable

Table 6. Temperature Probe Used in Elevator Applications

500 Series Packaged Temperature Probe with Threads	Features and Benefits
	• Wide selection of housing materials ranging from all plastic to all metal, resistance and termination options allow application flexibility • Wide operating temperature range (-40 °C to 300 °C [-40 °F to 572 °F]) allow operation under a wide range of environmental conditions • Wide variety of connectors and lead types allow application flexibility

SMART Position Sensor, continued

The output and the sensor sequence determine the nearest pair of sensors to the center of the magnet location. The output of these two sensors is used to determine the position of the magnet between them. In this application, the SMART position sensor linear configuration would be attached to the floor; the magnet would be affixed to the elevator so that when it senses the linear array it would slow down and stop. (See Table 4.)

Speed Sensors

LCZ Series single, zero speed sensor: Speed sensors are used to control the elevator motor speed.

Honeywell's speed sensors use multiple technologies to detect a change in magnetic field to create an electronic signal for control system interface. These technologies offer the ability to detect speed, direction, or position of a moving ferrous metal or magnetic target. Sensing is accomplished without contacting the target, and there are no moving parts, minimizing mechanical wear of the sensor or target. (See Table 5.)

Temperature Probes

500 Series packaged probe with threads: Temperature probes are used in the motor windings and bearings to help prevent the motor from overheating. Probes are used in both the main drive motor as well as the elevator door motor.

Honeywell's temperature sensors are designed to maximize component and product performance with enhanced reliability, repeatability, precision and responsiveness. A wide selection of housing, resistance and termination options allow application flexibility. (See Table 6.)

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⚠ WARNING

PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

⚠ WARNING

MISUSE OF DOCUMENTATION

- The information presented in this application note is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

SALES AND SERVICE

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

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000695-1-EN IL50 GLO Printed in USA
May 2009