TR 93 : 2021
(ICS 25.040.30)

TECHNICAL REFERENCE

Data exchange between robots, lifts and automated doorways to enable autonomous operations

Singapore Standards Council

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The Technical Committee set up the Working Group on Data Interchange Between Robots, Lifts and Automated Doorways to prepare this standard. The Working Group consists of the following experts who contributed in their *individual capacity*:

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The organisations in which the experts of the Working Group are involved are:

Advanced Remanufacturing and Technology
Advanced Robotics Centre – NUS
Beckhoff Automation Pte Ltd
Centre for Healthcare Assistive and Robotics Technologies
Continental Automotive
HOPE Technik Pte Ltd
Infocomm Media Development Authority
KONE Pte Ltd
Marina Bay Sands Pte Ltd
ROS-Industrial Consortium Asia Pacific
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Foreword

This Technical Reference (TR) was prepared by the Working Group on Data Exchange Between Robots, Lifts and Automated Doors set up by the Technical Committee on Robotics and Automation under the purview of MSC.

This TR aims to provide information for system integrators and facility owners in regards to robot-lift and robot-automatic doorway integration design and best practices specifically on the data exchanges to achieve interoperability of multiple fleets of robots with the infrastructures. Information provided within this document would offer guidelines on what and how to sequence the messages that are to be exchanged, thus ensuring the safe operation between robots, lifts and automatic doorways. Specific message protocol and solutions are not prescribed in this document.

This TR is a provisional standard made available for application over a period of three years. The aim is to use the experience gained to update the TR so that it can be adopted as a Singapore Standard. Users of the TR are invited to provide feedback on its technical content, clarity and ease of use. Feedback can be submitted using the form provided in the TR. At the end of the three years, the TR will be reviewed, taking into account any feedback or other considerations, to further its development into a Singapore Standard if found suitable.

Attention is drawn to the possibility that some of the elements of this TR may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "Mature Standards". Mature Standards will not be subject to further review, unless there are requests to review such standards.*

2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*

3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

Data exchange between robots, lifts and automated doors to enable autonomous operations

0 Introduction

The installation of lifts in government and commercial multi-storied or 'flatted' building is common in Singapore. Increasingly, Automatic Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs) – generally termed as robots -- are deployed within such buildings for autonomous material transportation and deliveries. Such deliveries can be scheduled or ad-hoc. For the effective deployment of robots in such buildings with lift(s), the capability of the robots to ride the lift as part of their route will be critical, without which the implementation of robotic transportation/deliveries will not be complete. This is in addition to the robots' capability to traverse through automated doors which will be installed for security and sanitisation reasons.

This Technical Reference (TR) sets the standard for the architecture and communications/data exchanges between robot and lift and between robot and automatic doorways, regardless of make/model of the automated door system, lift and robot. Compliance with this TR will facilitate the smooth implementation of robotic solutions in smart multi-storey buildings.

1 Scope

This TR specifies the compliance requirements when integrating robots with lifts and robots with automated doors. This TR defines the minimum set of data exchanges, as well as the hardware requirements for robot-lift integration of both digital and discrete lift control systems.

The types of lifts that building owners can integrate with the robots may vary. The most common parameters are as follows:

- Designate or mixed usage – passenger, cargo or mixed-used lift;
- Number of doors – single door or dual door (front and back door); and
- Site of digital lift controller – within the building it serves or in Internet cloud.

For robot-automated door systems, the types of power operated doors suitable for integration include both swing and sliding doors, as long as they are able to be opened or closed by an automatic door operator. Low-voltage power-assisted doors are not part of the scope for this TR.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 61000-6-2	Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
ISO 22201-1:2017	Lifts (elevators), escalators and moving walks – Programmable electronic systems in safety-related applications – Part 1: Lifts (elevators) (PESSRAL)
SS 550:2009 +A3:2017	Code of practice for installation, operation and maintenance of electric passenger and goods lifts