

Standardisation Newsletter

Standardisation Efforts on Industrial and Service Robots

In order to bring a robotic product on the market, manufacturers have to fulfil safety regulations. Apart from existing general (type A and type B) safety standards, product specific (type C) safety standards are of significant value to manufacturers as they ease hazard analysis and also reduce the legal risk for research facilities and companies. To satisfy this demand, the international standardisation organisation (ISO) has been developing safety standards in the domain of industrial robots for many years.

About 8 years ago, the importance of the emerging sector of service robots has been realised and first working groups were established to deal with these new robots types. As a result, the first safety standard for “personal care robots” – service robots in direct interaction with a human – has been published in February 2014.

While safety standards form the basis to establish a robotic product on the market, other standards can help to reduce trade barriers and to foster market growth. Standards on terminology and coordinate systems improve communication between manufacturers, suppliers and end users and are a first step towards exchangeable robot components. In a few years, more standards on robot modularity can be expected that will help to make robot systems modular and highly interchangeable. Further initiatives have started to create standards for benchmarking robot performance, making complex robots’ abilities measurable with the goal to increase market transparency.

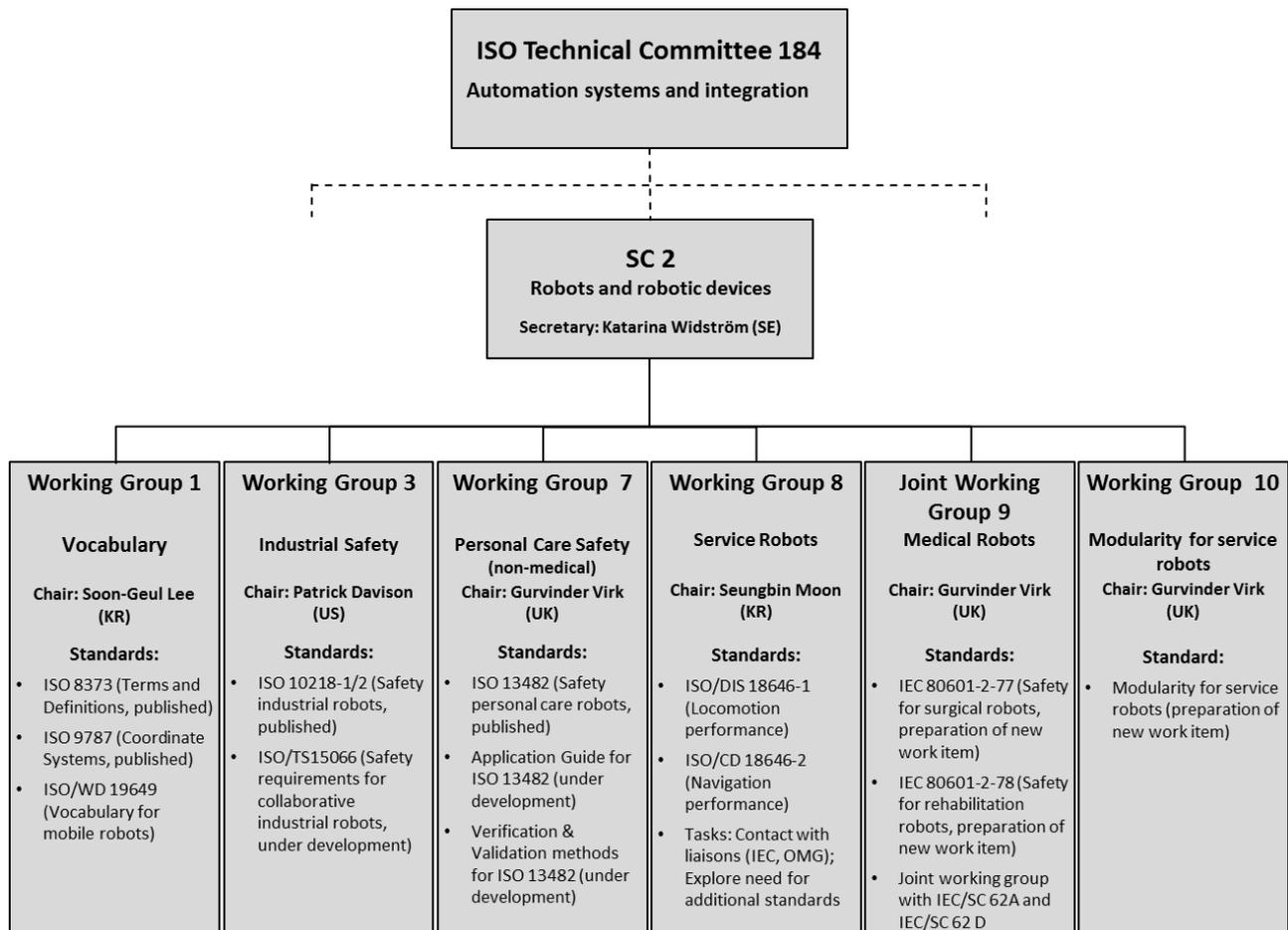


Fig. 1 Current structure of ISO TC184/SC 2

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All ISO standardisation related to robots takes place in committee TC 184/SC 2 (robots and robotic devices), which is currently organised in six working groups (see Fig. 1). Standards are developed through the instrument of “commenting”: During balloting periods, each national standardisation organisation has the possibility to submit comments proposing to change, delete or add text to the respective standard. In the international meetings, these comments are resolved in discussions and agreed changes are applied to the document.

Nations that are currently actively participating in developing these standards are Canada, China, Denmark, France, Germany, the Netherlands, Japan, South Korea, United Kingdom and the United States. The working groups usually meet three times a year, in turns in North America, Europe and Asia. Meetings of the SC 2 committee are held every one and a half years. Working groups are open for all motivated contributors. Experts are explicitly encouraged to participate.¹

Further information is available on the ISO website² and the committee website³.

The latest standardisation meeting took place in Stuttgart (Germany) from 9th to 17th June. Working groups 1, 3, 7 (Fig. 2), 8 and 10 met together with the superordinate committee SC 2.



Fig. 2 Participants of the meeting of WG 7 at Fraunhofer IPA in Stuttgart

¹ For more information regarding possible participation in TC 184/SC 2, please contact: theo.jacobs@ipa.fraunhofer.de

² http://www.iso.org/iso/standards_development/technical_committees/other_bodies/iso_technical_committee.htm?commid=54138

³ www.robotstandardisation.org

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Progress in WG 1 – Vocabulary and coordinate systems

Chair: Soon-Geul Lee (Korea)

- Standards:
- ISO 8373 – Robots and robotic devices – Vocabulary (published)
 - ISO 9787 – Robots and robotic devices – Coordinate systems and motion nomenclatures (published)
 - ISO/CD 19649 – Robots and robotic devices – Vocabulary for mobile robots (committee draft)

WG 1 is maintaining basic definitions and terminology like “robot” or “autonomy” that are standardised in ISO 8373 (published in 2012). As especially the market for service robots is still emerging, these definitions are not considered to be final, but will be adjusted from time to time as necessary. An example is the definition of “autonomy” which is currently being discussed with respect to the area of medical applications. Future editions of ISO 8373 will therefore most likely contain updated definitions.

Apart from basic terminology, WG 1 is dealing with other vocabulary for certain domains such as navigation or perception. Currently ISO 19649 is under preparation and will soon reach the status of a “draft international standard” which is one of the last balloting stages before publication. The standard defines terminology for mobile robots such as the definitions of wheel types and undercarriage structures.

In Stuttgart, the group discussed and resolved comments prepared by the member countries. It is expected by the end of 2015, the DIS ballot – the last balloting procedure before publication – can be started.

Progress in WG 3 – Industrial safety

Chair: Patrick Davison (USA)

- Standards:
- ISO 10218-1 – Robots for industrial environments – Safety requirements – Part 1: Robot (published in 2011)
 - ISO 10218-2 – Robots for industrial environments – Safety requirements – Part 2: Industrial robot system and integration (published in 2011)
 - ISO/TS 15066 – Robots and robotic devices – Safety requirements for industrial robots – Collaborative operation (close to publication)

WG 3 has continued its work on the technical specification ISO/TS 15066 with the goal to publish the document by the end of 2015. The technical specification contains limits for impact forces and pressures which might lead to an injury in case of collisions. Values are taken from medical literature/forensics as well as from practical tests on pain tolerance levels. In the future, the data might also be included in the standards ISO 10218-1 and -2.

When the work on TS 15066 is finished, WG 3 will start two new work items. One will be a technical report on the safety of manual load stations, i.e. stations where a worker hands over a part directly to a robot end effector (e.g. a gripper). In addition, a guidance document will be developed on the safety of “robotic devices”, machines that are similar to robots, but are lacking either the number of programmable axes or the degree of autonomy.

Progress in WG 7 – Personal Care Safety

Chair: Gurvinder Virk (UK)

- Standards:
- ISO 13482 – Robots and robotic devices – Safety requirements for personal care robots (published in February 2014)
 - Application guide for ISO 13482 to be published as a technical report (new work item)
 - Validation criteria for personal care robots (new work item)

After five years development time, ISO 13482, the first safety standard for “personal care robots” has finally been published in February 2014. With the publication of ISO 13482, manufacturers can for the first time rely on a specialised type C safety standard when designing their products. As some concepts presented in the standard are rather new, the working group has decided to develop two guidance documents which will help manufacturers to apply the standard and to verify compliance of their products.

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In a technical report that is currently under preparation, verification and validation measures are described which can be used by robot manufacturers for safety testing. Tests include stability tests for different travel patterns (e.g. on ramps or while accelerating or stopping), but also impact tests with crash test dummies.

A second technical report that is developed by the group provides guidance on how to perform risk assessment and risk reduction for personal care robots. Currently, the group is discussing detailed examples for a risk assessment for different robot types which will be included in the document.

Progress in WG 8 – Service robots

Chair: Seungbin Moon (Korea)
Task: Determining need for additional standards for service robots
Standards:

- ISO/DIS 18646-1 – Robots and robotic devices – Performance criteria and related test methods for service robot – Part 1: Locomotion for wheeled robot
- ISO/CD 18646-2 – Robots and robotic devices – Performance criteria and related test methods for service robot – Part 2: Navigation

WG 8 has the special task to monitor the development on the service robot market and the preparation of robot-related standards in other working groups. In the last years, several liaisons have been established with IEC, because the development of standards for autonomous vacuum cleaners and lawn-movers has been initiated there.

Apart from the coordination work, WG 8 is developing standards on robot performance. In order to compare the performance of functions like path-finding, object recognition or the ability to move on difficult terrain, standardised test methods are necessary. Two years ago, WG 8 started the development of ISO 18646-1, a standard for measuring locomotion performance. The current draft will soon enter the final balloting stage and then be published. A second part on navigation performance is currently under preparation and will include e.g. test setups for measuring path repeatability of the turning width of a mobile robot.

Progress in JWG 9 – Medical robot safety

Chair: Gurvinder Virk (UK)
Standards:

- IEC 60601-2-77 – Safety for medical robots in surgery (new work item)
- IEC 60601-2-78 – Safety for medical robots in rehabilitation (new work item)

JWG 9 is a Joint Working Group in cooperation with IEC/SC 62A and IEC/SC 62D. After the working group has spent several years with collecting material and discussing possible work items, two subgroups have been founded recently. The first subgroup will focus on medical robots for surgery and will soon start to develop a standard for basic safety and essential performance for such applications. The second subgroup will do the same for medical robots used for rehabilitation.

JWG 9 is also finalising a technical report on autonomy in the context of medical robots. The report will e.g. discuss the influence of autonomy on the risk.

Progress in WG 10 – Modularity

Chair: Gurvinder Virk (UK)
Standard:

- Modularity for industrial and service robots (new work item)

Although the number of service robot installations is constantly growing, reusability of software and hardware components as well as interchangeability of parts is considered as relatively low. A significant challenge for standardisation in the next years will be to establish a common base for compatibility between hard- and software components from different manufacturers and the seamless exchange of parts or modules. This can only be reached, if mechanical, electrical and software interfaces are suitably taken into account.

Since its formation in 2014, WG 10 is discussing initial concepts for modularity standardisation. A possible way could be to develop a general standard first and to focus on more specific aspects in later standards.

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During the meeting in Stuttgart, initial definitions, e.g. for “modules” and “components”, were discussed. Another topic was the question how safety aspects (“modular safety”) should be included in future standards.

Recent developments in SC 2

Chair: Henrik Jerregård (SE)
Secretary: Katarina Widström (SE)

In the meeting of the superordinate committee SC 2, the progress in the working groups was presented by the convenors and the necessity of future adjustment in working group structures and work items was discussed.

As standardisation in robotics is getting more and more important and several new working groups have been established in the last years, the committee agreed that this development should also be reflected in the position of robotics in the ISO organisational structure. It was therefore decided to apply for promotion from an SC (“sub-committee”) under the TC (“technical committee”) “Automation systems and integration” to a separate TC “Robotics”. This step would also allow the committee to open itself to new robot applications (such as agriculture robotics) that do not really fit in the current TC’s scope. The matter will be discussed with the ISO technical management board in the next months.

Possibilities to get involved in standardisation work

For the European academia/research and industry, it is crucial to participate in all standardisation working groups with a sufficient number of technical experts. Only by doing so, innovations and products will be considered during the standardisation process and latest research results can be incorporated in the standard. So we kindly ask you to consider participating in the standardisation process!

Encouragement to attend international meetings

Technical experts, who attend international meetings, vote in international balloting procedures and submit comments to propose changes in the documents are appointed by the national standardisation organisation of their respective country. In order to get nominated, interested persons from industry or research institutes should contact their national standardisation body to ask for details.

Apart from formal contribution as a technical expert, it is also possible to visit a meeting as an observer. Observers are also formally appointed by national standardisation organisations, but do not have the right to participate in official balloting.

The next international meetings are planned as follows:

- October 14-23, 2015: Meetings of WG 1, 7, 8, 9 and 10 in Hangzhou, China
- December 7-9, 2015: Meeting of WG 3 in Yokohama, Japan
- February 18-26, 2016: Meetings of WG 1, 7, 8, 9 and 10 in New Delhi, India (to be confirmed)
- March 7-9, 2016: Meeting of WG 3 in Quebec City, Canada
- June 2016: Meetings of WG 1, 7, 8 and 10 in Oxford, England
- June 2016: Meeting of WG 3 in Gothenburg, Sweden

Contributing to national mirror committees

When several experts from one country participate in standardisation, a national mirror committee may be formed. In these national committees, homework and comments for the international meetings are coordinated and results from the international meetings are disseminated to the national community. Even if

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no mirror committee has been formed yet, it is possible for interested technical experts to contribute to standardisation on a national level without attending the international meetings, for example by making comments for an international balloting.

Benefit from travel cost subvention

The EU-funded coordination action RockEU offers the possibility to reimburse travel costs to meetings for interested first-time visitors from a European country. If you are interested to join an international meeting, please contact Theo Jacobs (theo.jacobs@ipa.fraunhofer.de). It is obvious that only a long term engagement in these standardisation efforts is beneficial for the WG or the participants.

European Topic Group on Standardisation

With the euRobotics aisbl, “Topic Groups” is a community-driven instrument to coordinate the activities in specific sub-domains of robotics. The objective of a Topic Group is to support the launch of tangible “project proposals” by members of the European robotics community (be the member of euRobotics AISBL or not), but, first and foremost, to prepare the roadmap and project calls that precede such proposals.⁴

In 2014, a topic group on standardisation was created which deals with standardisation activities in ISO, IEC and other standardisation organisations. A focus lies on research activities to support standardisation, e.g. to provide experimental data which can be included in standards or can be used to validate the requirements in standards. The standardisation topic group is headed by Gurvinder Virk and Paolo Barattini.⁵

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⁴ Topic Groups: <http://www.eu-robotics.net/ppp/objectives-of-our-topic-groups/>

⁵ List of euRobotics Topic Groups (as of 23 July 2014): http://www.eu-robotics.net/cms/upload/List_of_Topic_Groups_23072014.pdf