ANNUAL REPORT 2025

NSAI TECHNICAL COMMITTEE NSAI/TC 49/SC 03 - ROBOTICS

Contents

1 Chairman's Statement

In 2020 NSAI offered the position of Chairman to Mr Tom Meany, who accepted the role and has been a great asset to the committee, providing presentations on standards at committee meetings and providing reports on international meetings.

Mr Meany is a functional safety technical specialist on the Industrial and Instrumentation Group working at Analog Devices (Limerick) for over 7 years, with extensive experience in the area of Functional Safety. Mr Meany is a member of NSAI/TC 48/SC 14, NSAI/TC 48/SC 10, NSAI TC 128 and NSAI/ETC/TC 100/SC 1.

After five years of dedicated leadership, Mr. Tom Meanty has stepped down as Chair of NSAI/TC 49/SC 023 in 2025. Throughout his term, Tom's contributions were marked by innovative ideas, strategic thinking, and, most significantly, his tireless efforts to enhance the credibility and visibility of the committee. These efforts fostered a vibrant and productive environment, earning recognition that has become a valuable asset for us. The strong relationships Tom cultivated with partners and stakeholders will ensure the committee continues to prosper in the years ahead.

In 2025, Mr. Declan Staunton assumed the role of Chair. Declan brings a wealth of experience and a forward-looking approach that will build on the solid foundation established under Tom's leadership. His commitment to collaboration and technical excellence positions the committee to maintain its momentum and further strengthen its role within the standards community.

2 Introduction

This Standards Committee was created as a Working Group to feed into the National Steering Committee on Collaborative Robotics by following the activities of ISO/TC 299 *Robotics*. The National Steering Committee on Collaborative Robotics was created by the IDA with the purpose of assisting the Irish manufacturing industry with the introduction of industrial robots into collaborative operations and applications with human workers.

The global industrial robots market is projected to grow from $16.78 billion in 2022 to $35.68 billion by 2029

The primary focus of the Standards Committee is on Industrial Robotics at an ISO level and the development of safety requirements through Standards, that will enable the introduction of humans into the workspace of an industrial robot. The workspace of an industrial robot has traditionally been a restricted space. In collaborative application, this workspace will be redefined as a shared space. The safety of the human worker is the ultimate concern.

3 Scope of TC

Standardisation in the field of robotics, excluding toys and military applications.

This committee will not produce indigenous Irish Standards. The national committee will participate in the development of International Standards at an ISO level.

The International Standards published by ISO will be adopted as European Standards and harmonised to the Machinery Directive where applicable. NSAI will then adopt these European Standards as Irish Standards.

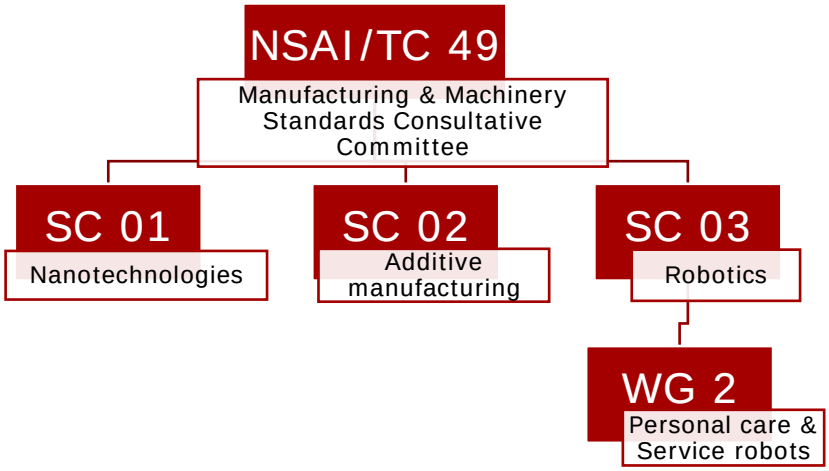
The committee mirrors the following international committees:

Committee Name	Committee Title
ISO / TC 299	Robotics
ISO / TC 299 / WG 2	Service robot safety
ISO / TC 299 / WG 3	Industrial safety
ISO / TC 299 / WG 4	Service robot performance
ISO / TC 299 / WG 6	Modularity of service robots

4 Structure and Membership

4.1 Structure

The Figure below illustrates the structure of the National Committee:



4.2 Members

The list below are the members for the year 2025:

Organisation	Role
ABB Robotics	Committee member
Analog Devices	Chairman
ATU	Committee Member
Boston Scientific	Committee member
DCU	Committee member
Digital Manufacturing Ireland	Committee member
Eiratech	Committee member
Essilor	Committee member
Future Mobility Ireland	Committee member
Health & Safety Authority	Committee member
IDA	Committee member
Iamus Technologies	Committee member
IMR	Committee member
ITS Ltd	Committee member
KUKA Robotics	Committee member
MTU	Committee member
NSAI	Secretary
Pilz	Committee member
Reliance Automation	Committee member
Rockwell	Committee member
Schivo Group	Committee member
SETU	Committee member
Somex Automation	Committee member
Trinity College Dublin	Committee member
Technological University Dublin	Committee member
University College Dublin	Committee member
University Limerick	Committee member

5 Summary of 2025 Activities

5.1 National

5.1.1 Meetings

The meetings were conducted via web-conferencing to reduce the burden and environmental impact of travel for members. Committee members attended the following national meetings:

Meeting No.	Date	Minutes Reference ** optional**
1	07th February 2025	N 308
2	22nd May 2025	N 321
3	25th September 2025	N 329
4	03rd December 2025	N 332

5.1.2 National Work

The Standards Committee will not draft any National Standards. All of the ISO/TC 299 Standards that are adopted as European Standards, will be published as Irish Standards.

5.2 International/Regional

5.2.1 Meetings

Committee members attended international meetings as follows:

Committee Name	Location	Date	No. of Attendees
ISO/TC 299/WG 3	USA	14th-17th February 2025	1
ISO/TC 299/WG 3	Virtual	12th-21st March 2025	0
ISO/TC 299/WG 3	Denmark	10th–13th June 2025	1
ISO/TC 299/WG 3	Austria	08th–10th September 2025	0

5.2.2 International/Regional Work

Ireland is committed to following and inputting into the revision of the International Standards for the Safety Functionality of Industrial Robotics (ISO 10218). Since 2017 to 2022 Ireland has been represented at each of the meetings held in Europe and internationally.

In 2023, there were no national position ballots for the ISO 10218 series. However, in 2024, two Final Draft International Standard (FDIS) ballots were reviewed and voted on by the committee. The international working group was committed to ensuring the document would proceed with

the harmonisation process with the Current Machinery Directive. International meetings took place to discuss the Harmonised Standards Consultant's comments and ensure that their resolutions brought about minimal technical changes.

In February 2025, ISO published updated editions of both standards:

- ISO 10218-1:2025 – *Robotics — Safety requirements — Part 1: Industrial robots*.
- ISO 10218-2:2025 – *Robotics — Safety requirements — Part 2: Industrial robot applications and robot cells*.

They have since been incorporated as EN ISO standards (via CEN, DIN, ÖNORM), positioning them for formal recognition under EU regulation.

The focus of the work is on the requirements around the collaborative applications for robotics and humans.

5.2.3 International/Regional Standards Reviewed

ISO/NP 25874*; Safety requirements common to industrial and service robotics*

ISO/NP 26058-1; *Safety requirements for industrial mobile robots — Part 1:*

ISO/NP 26305-1 (Ed 2); *Robotics — Performance test method for service robots — Part 1: Shock absorption type contact-detective outer cover*

ISO/NP 26264-1; *Humanoid robot datasets — Part 1: General requirements*

ISO 9787:2013 (Ed 3, vers 2); *Robots and robotic devices — Coordinate systems*

5.2.4 International/Regional Voting Results

The committee voted on seventeen out of the twenty-eight international votes in 2025.

5.3 Regulatory Development/Update

Wednesday 21st April 2021, the European Commission presented its proposal for a new Regulation on machinery products. The main legal changes are the transformation of the legislation into a Regulation, with alignment to the New Legislative Framework. The regulation will facilitate the homogenous application throughout the EU. and an alignment with the horizontal rules on the responsibilities of economic operators, market surveillance, accreditation, as well as the role of notified bodies and conformity assessment procedure.

On 29th June 2023 the Machinery Regulation (Regulation (EU) 2023/1230) was published.

This text replaces Machinery Directive 2006/42/EC. The Machinery Regulation intends to better cover new technologies such as autonomous mobile machinery (robots), internet of things with connected equipment, or artificial intelligence (AI), where specific modules of AI using learning techniques ensure safety functions.

The new text will enter into force 42 months after its publication, which means **20th January 2027**. Exceptions pertain some rules applying to Member States, such as the notification of conformity assessment bodies, definitions of penalties from each EU, etc. There are no transitional provisions between the Machinery Directive and the Machinery Regulation. This means that manufacturers will have to comply with the Machinery Directive until 19th January 2027 and with the new Machinery Regulation as of the following day.

Main changes:

The Machinery Regulation introduces relevant changes, among which:

- Legal status: as a Regulation, the Machinery Regulation provides more harmonisation as well as direct application throughout the EU. Manufacturers will not need to wait for each country's transposition in national law, which may introduce stronger national requirements.
- New Legislative Framework: the Machinery Regulation follows the principles of the New Legislative Framework, which sets out the main rules for the accreditation of conformity assessment bodies and for the market surveillance framework.
- Paperless: manufacturers can provide product instructions in digital format. If the machine is intended for non-professional users, a paper document containing the main safety information needs to be provided.
- Common specifications: the Machinery Regulation gives rules for the development of common specifications, in case there are issues to develop a harmonised standard for a specific machine.
- Substantial modification: the notion of 'substantial modification' is introduced, targeting evolutions/modifications brought out by the final user, and which generate a change of the significant hazards associated with the modified machine.
- Conformity Assessment: the general principle for the conformity assessment of the machinery is self-compliance. Machinery indicated in a list included in the Regulation must undergo validation through notified bodies (external accredited centres). Under the Machinery Directive there was the possibility to apply for self-compliance when an

existing harmonised standard covers all its relevant hazards; under the Machinery Regulation this possibility was revoked for some specific machinery or components. In particular, power take-off (PTO) drive shafts and their guards or simply guards to PTOs, when they are placed alone on the market, will need to be validated by a notified body.

- Machine learning: systems containing 'fully or partially self-evolving behaviour containing machine learning approaches' are now in the list of machinery requiring the validation by a notified body. The upcoming AI Regulation, when published, will consider these systems as high-risk Artificial Intelligence and impose additional requirements.
- Partly completed machinery will need to comply with the requirements of the Machinery Regulation before they are incorporated in the whole machinery.

Technical Requirements:

The technical requirements are gathered in a specific annex to the Machinery Regulation. Compared to the Machinery Directive, the numbering remains unchanged. Here below is an overview of the main changes.

Protection against corruption/Safety and reliability of control systems: The Machinery Regulation extends the protection against external influences, when they would result in a dangerous behaviour of the machine. This impacts both the protection of the machinery and the behaviour of control systems (cybersecurity). The manufacturer is required to identify key data or key software, the versions of the software installed, the proof of interventions. The upcoming publication of the Cyber-Resilience Act should cover this in detail. On remote controls, a communication or a connection failure must not lead to a dangerous situation either.

Manufacturers of **mobile machinery** will need to:

- Provide a filtered cab for machines with ride-on driver, when the main use of the machine is the application of hazardous substances. This is typically the case for self-propelled sprayers.
- Provide an audible and visual warning when the seat belt is not fastened on machines presenting a risk of overturning. Additionally, where there is a significant risk of roll or tip over and its restraint system is not used it shall not be possible for the machinery to move.
- Take into account the possibility of contact with overhead power lines. Manufacturers will need to do this firstly with measures to avoid the contact or the creation of an electric arc, and secondly through solutions to prevent electrical hazards in case the contact occurs.

For **autonomous mobile machinery**, a set of new requirements was introduced:

- The possibility to have a supervisor and a related supervisory function. This role intends to monitor the actions of the robot when it is in autonomous mode. The robot must send information and alerts to the supervisor who has the possibility to stop, re-start the machine in autonomous mode, or to bring it to a safe position.
- The robot must travel safely in a defined working area (also for the automatic charging of the batteries), using either a physical borders or obstacle detection.

Finally, for **machines fitted with fully or partially self-evolving logic or behaviour**, the risk assessment will need to take into account the behaviour of the machine after it is placed on the market. This measure targets in particular the movement space and the tasks it will perform. The manufacturer will need to ensure good connection between the operator and the machinery, when it comes to communication and to forces used to carry out a task. Finally, the data related

to a software of a safety function taking decision will have to be stored each time a decision is taken.

Next steps:

Now that the text of the Machinery Regulation has been published there are two important steps that will follow:

- Development of the Application Guide of the Machinery Regulation, in order to avoid diverging interpretations of the text
- Update of the harmonised standards. Each standard will need at least the addition of an annex making the link between the requirements of the Regulation and the requirements of the standards. The European Commission is working with standardisation instances on a Standardisation Request to officially allow this work.

The full text of the Machinery Regulation can be read in all the official languages of the EU at this link:

EUR-Lex - 32023R1230 - EN - EUR-Lex (europa.eu)

Products designed and manufactured in accordance with the Machinery Directive 2006/42/EC can circulate freely throughout the internal market and Member States may not introduce additional and/or diverging requirements regarding the manufacturing and placement on the market of such products.

The new Regulation will apply from 42 months after entry force, thus giving companies time to adjust to the new requirements.

Moreover, the requirements in the AI Act address the safety risks presented by AI systems used in control safety functions in machinery, complementing certain specific requirements in the Machinery Directive with the AI Act will ensure that an AI system is integrated in a safe way into the whole machine, ensuring that the safety of the machine as a whole is not compromised. In order to define obligations and provide a uniform legal framework for the development, marketing and use of AI systems in safety systems through a risk-based approach, in combination with the Machinery Regulation.

Once high-risk AI system for products covered by the AI Act are placed on the market or put into service, with the product manufactured in accordance with the AI Act, the manufacturer of the product shall assume responsibility for the conformity of the AI system and shall be subject to obligations in relation to the AI system as a supplier under the AI Act.

Harmonised Standards

Currently, over 800 harmonised standards are listed in the Official Journal of the European Union under the Machinery Directive. CEN/CENELEC Technical Committees are reviewing these standards to identify those that do not meet the new requirements of the Machinery Regulation. Any "gaps" identified by the committees could then be noted as restrictions in the Official Journal before January 20, 2027.

Additionally, on July 4, 2024, the European Commission published a draft standardisation request to the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) regarding machinery and related products. This request supports Regulation (EU) 2023/1230 of the European Parliament and of the Council, aiming to draft new harmonised standards and European standardisation deliverables. Furthermore, it specifies requirements for revising existing harmonised standards and European standardisation deliverables. The Draft Standardisation request can be view at the following LINK.

As of April 2025, the CEN/CENELEC Machinery Coordination Group reported significant progress and challenges related to the implementation of the new Machinery Regulation and harmonised standards. Key updates include:

- **926 harmonised standards cited** under the Machinery Directive.
- **299 active revision projects** addressing both the existing directive and the new regulation framework.
- **91 projects** specifically focused on updates required by the new Machinery Regulation.
- A draft of a new type-B standard for EHSR 1.1.9 ("protection against corruption") progressing through the enquiry stage.

Additionally, under Regulation 1025/2012, Article 10(5), harmonised standards must undergo a HAS (Harmonised Standards) review before publication in the Official Journal. Between March 2024 and March 2025, 243 HAS requests were processed, with the following outcomes:

1. 31 compliant
2. 14 conditional
3. 198 non-compliant, resulting in delays to standardisation updates.

6 Irish Publications/Reviews

6.1 Publications

National standards will not be produced by this committee. The International Standards may be published as European Standards and then adopted as Irish Standards.

6.2 Reviews

The Committee reports to the Manufacturing & Machinery Standards Consultative Committee and the Chairman participates in the work of this group.

7 Work programme for 2026 onwards

ISO/DIS 8373; *Robotics — Vocabulary*

ISO/FDIS 13482*; Robotics — Safety requirements for service robots*

ISO/AWI 15066-1; *Collaborative safety — Physical contact — Part 1: Biomechanical thresholds and data*

ISO/FDIS 18646-6; *Robotics — Performance criteria and related test methods for service robots — Part 6: Lower-limb wearable robots*

ISO/CD 18646-7; *Robotics — Robotics — Performance criteria and related test methods for service robots — Part 7: Travelling around humans*

ISO/CD 18646-8; *Robotics — Robotics — Performance criteria and related test methods for service robots — Part 8: Electric vehicle charging robots*

ISO/WD TR 20218-3; *Robotics — Safety design for industrial robot systems — Part 3: Guidance for the use of ISO 10218-2 (ed 2)*

ISO/DIS 21423; *Robotics — Autonomous mobile robots for industrial environments — Communications and interoperability*

ISO/AWI 24112; *Robotics — Electrical interfaces — Connectivity and interoperability for end-effectors*

ISO/CD TS 25213; *Robotics — Test methods for measuring the energy consumption of robots — 6-Axis articulated industrial robots*

ISO/WD 25785-1; *Robotics — Part 1: Safety requirements for dynamically stable industrial mobile robots (legged, wheeled, or other forms of locomotion) – Part 1: Robots*

ISO/WD 25874; *Robotics — Safety requirements — Industrial and service robotics*

ISO/WD 26058-1; *Safety requirements for industrial mobile robots — Part 1: Industrial mobile robots*

ISO/AWI 26159-1; *Robotics — Infrastructure for robot applications — Part 1: Framework*

8 Additional Information

The Chairman, Mr Tom Meany, was presented with a "1997 Award" on the 14th of October 2020. The "1997 Award" is presented to members of NSAI Committees in recognition of the significant contribution to the standards work of NSAI.

Irish experts have attended the ISO/TC 299/WG 3 Industrial Safety of Robots meetings over the past number of years and made significant contributions to the revision of ISO 10218-1 and ISO 10218-2. In January 2021 an Irish comment submitted as part of the public enquiry stage for ISO 10218-1, was accepted as a means to avoiding having solely a Performance Level d, Category 3 architecture requirement, which was a major discussion point over three previous meetings of ISO/TC 299/WG 3.

Dr Nikolas Papakostas a committee member from UCD was involved in the Horizon 2020 project SHERLOCK - Seamless and safe human centred robotic applications for novel collaborative workplaces, that concluded in September 2022. Dr Papakostas co-authored multiple peer reviewed articles as part of the deliverables of this project.

Dr Dorel Picovici a committee member from SETU and course Director, announced the new 4-year programme to produce an adaptable graduate capable of working across industries where robotic and automated systems are employed.

Dr Ken Horan, Director of Robotics and Automation at the Irish Manufacturing Research Centre (IMR) and a committee member was involved in MAAS – Measurement Aided Assembly of Large-scale structure project. MAAS was a 2-year project funded by Smart Eureka and supported by Enterprise Ireland (EI) and the Centre for the Development of Industrial Technology (CDTI). The major goal of the MAAS project was to develop an efficient automated solution for the manufacturing of aircraft sub-assemblies. The project evaluated the use of collaborative robots and related automated activities within manufacturing, assembly, and inspection operations. A mobile robotics solution was designed, developed, and integrated into a prototype assembly line in IMR. Irish SME's were central to this project and worked closely with IMR to identify, develop and deliver a full wing and panel 3D scanning and measurement solution.

Mr Tom Meany the Former committee Chairman presented at the International Robot Safety Conference 2024. His presentation focused on the latest advancements in robotic safety standards and the importance of integrating functional safety into industrial robotics. Mr Meany emphasised the need for rigorous testing to ensure the safety of robotic systems, including addressing fire and shock risks, energy and battery system hazards, and injury prevention. His insights were well-received, highlighting the critical role of safety in the rapidly evolving field of robotics. His impactful work was recognised by the Chair of ISO/TC 299/WG 3 Ms Roberta Shea, while she was on stage presenting. Ms Shea highlighted Tom's significant contributions to the ISO 10218:202X series, particularly in the communications and security sections, which are crucial under the new machinery regulations.

Declan Staunton, Principal Applications Engineer at Analog Devices and Chair of NSAI/TC 49/SC 03 (Robots, Cobots, and Robotics), presented at the 2025 International Robot Safety Conference in Houston, Texas. His presentation, titled "The Role of Functional Safety in Robotics," explored how evolving safety standards are adapting to the rapid growth of intelligent and collaborative robotic systems. He highlighted the integration of functional safety into modern robotics environments and the need for comprehensive standards that address AI, human–robot interaction, and system reliability, reinforcing global efforts to establish robust and harmonized safety frameworks.