Advanced Manufacturing Roadmap

NEMA

National Electrical Manufacturers Association

Agenda

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Request for input and feedback

Background

Market Development Cooperator Program

- Establishes a partnership between International Trade Administration (ITA) of the U.S. Department of Commerce and non-profit industry groups like NEMA

- NEMA was awarded an MDCP in October 2021

- The award is focused on expanding U.S. participation on technical standards related to advanced manufacturing systems and increasing U.S. exports of advanced manufacturing systems

Why Advanced Manufacturing?

INCREASE PRODUCTIVITY AND QUALITY

REDUCE ENERGY USE

ENABLE MANUFACTURERS TO IMPROVE MANUFACTURING AND SUPPLY CHAIN RESILIENCY

Advanced Manufacturing Roadmap

- Identify gaps in standardization as well as key priority areas for participation
- Requires input from a variety of relevant stakeholders:
  - Manufacturers
  - Industry associations
  - Standards-related government agencies

Why an Advanced Manufacturing Roadmap?

Technical and trade challenges to implementing advanced manufacturing systems

Interoperability and standardization can reduce barriers to implementation

A consensus-based standards roadmap will help drive action

Organizations Addressing Advanced Manufacturing Standards

National Electrical Manufacturers Association

Association for Advancing Manufacturing

International Society of Automation

UL Standards and Engagement

International Electrotechnical Committee

International Organization for Standardization

National Electrical Manufacturers Association

- ANSI-accredited SDO representing the US Electro Industry representing over 325 US Manufactures .

- Administers 70+ US TAGs to the IEC including:

- SC22G Adjustable Speed Drives

- TC 65 Industrial Automation

- SyC SM – Systems Committee Smart Manufacturing

Developer of Safety Standards for:

- Industrial Controls
- Industrial Control Panels
- Adjustable Speed Drives
- Industrial Machinery
- Motors
- PLCs

ISA — International Society of Automation
Setting the Standard for Automation™

UL Standards & Engagement®

Standards Development for:

- Automation
- Cybersecurity
- Industrial Process Control
- Manufacturing Measurement

- Association for Advancing Automation (A3)
- Robotics Standards
  - Developer of ANSI Robotic Safety Standards
  - Administers US TAG to ISO 299 Robotics
- Vision and Imaging Standards
- Robotics, Vision and Motion Control Certification Programs

International Electrotechnial Commission

- 173 countries
- International standards for electrical, electronic and related technologies
- IEC Technical Committees/Subcommittees developing standards impacting Advanced Manufacturing Technology:
  - TC 44 Safety of Rotating Machinery
  - TC 65 Industrial-Process Measurement, Control, and Automation
  - SC65A Systems Aspects
  - SC65B Measurement and Control Devices
  - SC65C Industrial Networks
  - SC65E Devices and Integration in Enterprise Systems

International Organization for Standardization

- Membership of168 national standards bodies
- 816 Technical Committees and Subcommittees
- 24,748 International Standards covering almost all aspects of technology, management, and manufacturing
- 11 ISO Technical Committees/Subcommittees developing standards impacting Smart Manufacturing Technology including:
  - ISO/TC 39 Machine Tools
  - ISO/TC 184 Automation Systems and Integration
  - ISO/TC 184 SC 1: Physical Device Control
  - ISO/TC 184 SC 4: Industrial Data
  - ISO/TC 184 SC 5: Interoperability for Enterprise Systems
  - ISO/TC 261 Additive Manufacturing
  - ISO/TC 299 Robotics
  - ISO/IEC JTC1 Information Technology
  - ISO/IEC JTC1SC27 Information Security/Cyber Security and Privacy Protection
  - ISO/IEC JTCSC41 Internet of Things and Digital Twin
  - ISO/IEC JTCSC42 Artificial Intelligence

Overview of Roadmap

Aspects of Advanced Manufacturing

- Devices included in advanced manufacturing systems, such as robotics and sensors

- Device Control and management and the interoperability of devices

- Communication protocols used in advanced manufacturing systems

- Data analytics used in advanced manufacturing systems

- Application integration of advanced manufacturing systems

Advanced Manufacturing Roadmap

- Devices
- Device Management & Interoperability
- Communication
- Data Analytics
- Application & Integration

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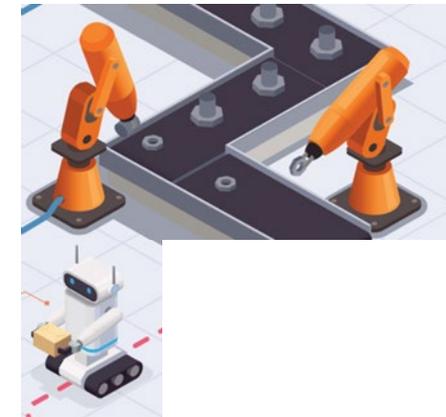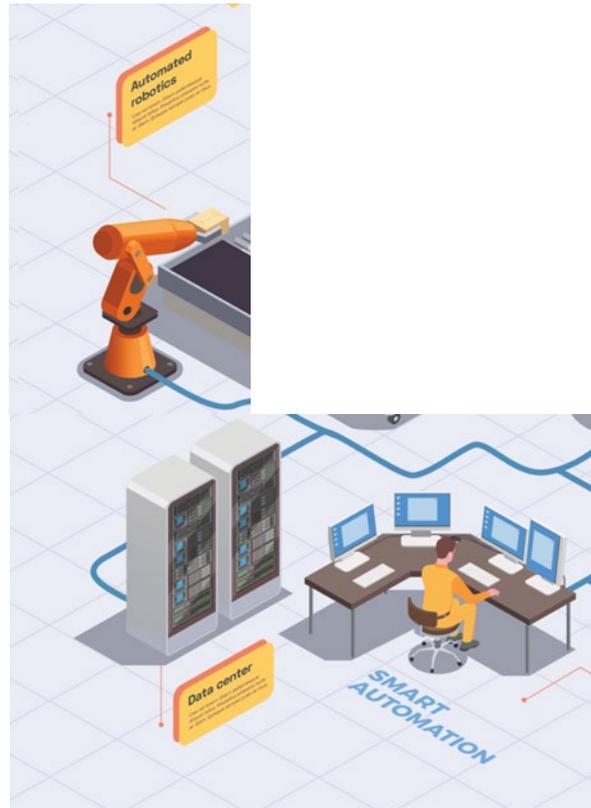
Advanced Manufacturing Roadmap

Devices

Device Management & Interoperability

Communication

Data Analytics

Application & Integration

Advanced Manufacturing Roadmap

- Devices
- Device Management & Interoperability
- Communication
- Data Analytics
- Application & Integration

Devices

- PLCs
- Motor Drives
- Sensors
- Industrial PCs
- Robotics
- Process Actuators

Device Management and Interoperability

- Human Machine Interface (HMI)
- Machine Interconnection
- Process Control Software

Communication

- Industrial Networks
- Network Communications Protocols
- Internet of Things

Data Analytics

- Big Data
- Quality Control
- Business Applications
- Manufacturing Applications

Application and Integration

- Supervisory Control and Data Acquisition (CADA) Systems
- Artificial Intelligence (AI)
- Cyber Security

Example from Devices Aspect

Section	Title	Abstract
IEC TC3	IEC 60445:2021 Edition 7.0 (2021-07-16) Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors	IEC 60445:2021 applies to the identification and marking of terminals of electrical equipment such as resistors, fuses, relays, contactors, transformers, rotating machines and, wherever applicable, to combinations of such equipment (e.g. assemblies), and also applies to the identification of terminations of certain designated conductors. It also provides general rules for the use of certain colours or alphanumeric notations to identify conductors with the aim of avoiding ambiguity and ensuring safe operation. These conductor colours or alphanumeric notations are intended to be applied in cables or cores, busbars, electrical equipment and installations. This basic safety publication is primarily intended for use by technical committees in the preparation of standards in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51. It has the status of a basic safety publication in accordance with IEC Guide 104. IEC 60445:2021 cancels and replaces the sixth edition published in 2017. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition: a) the definitions have been aligned with IEC 60050-195:2021 and IEC 60050-826; b) the provisions for colour to be used for identification of certain designated conductors are made requirements and not only recommendations; c) introduction of a new subclause on marking of protective terminals for multiple power supply inputs on equipment.

Gap analysis of standards and specifications

In-depth description of key issues related to standardization in advanced manufacturing

Relevant published standards and specifications in development

Recommendations for additional research and development (R&D)

Recommendations for standards and specifications needed

Gap Analysis

Gaps assigned a priority based on:

Value: What is the magnitude and frequency of a gap?

Effort: What are the resources are required to resolve a Gap.

Impact: What is the Return on Investment for resolving a gap

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A total of 14 Gaps have been Identified to Date

3 of the Gaps Identified to date are considered high priority

Largest number of Gaps in Devices

More Gaps are being identified as the work continues

Universe of Gaps

Lack of US Participation in many US Technical Advisory Groups

Existing Standards in need of revision
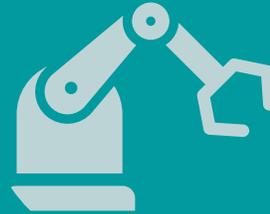
New Standards needed for emerging technologies
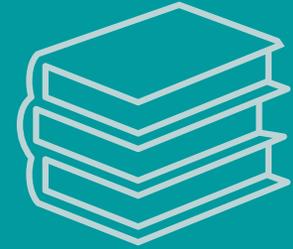
Guidance Documents needed to assist medium and small companies adopt Advanced Manufacturing Technologies

High Priority Gaps

GAP D1:
Missing Robotics Application Guidance

Recommendation: Identify existing Industrial Robotics Guidance Documents from ISO and A3 other SDOs for inclusion in the roadmap.

Priority: High

Status of Progress: Need to identify lead and participants

Relevant Organizations : A3 - Association for Advancing Automation

GAP D2.1: Missing IOT Guidance

Recommendation: Identify existing Sensor and Internet of Things Standards from IEC, ISO, and other SDOs for inclusion in the roadmap.

Priority: High

Status of Progress: Project Lead Needed.

Relevant Organizations: NEMA and ISA

GAP CyB3.1:
Identify Cybersecurity Standards as they apply to Smart Manufacturing

Recommendation: Identify Cybersecurity Standards applicable to the manufacturing space

Priority: High

Status of Progress: Need to identify lead and participants

Relevant Organizations: NEMA, NIST, and ISO

INFORMATION NEEDED

Are there additional areas of focus that should be included? What standards need to be added?

What other organizations are active in this space?

What gaps are missing? What gaps have work underway?

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