Smart Manufacturing Standards Map

by

Joseph Briant (Schneider Electric)
2- SM2 project
Big Picture: an initiative

- **ISO/TC184/SC4/JWG 8** Manufacturing related standards
- **ISO/TC184/SC4** Integrated Manufacturing Task Force (IMTF)
- **ISO/TC184** Decision to manage the Big Picture (Busan)

**Timeline:**
- **1999:**
  - ISO/TC184 & IEC/TC65 Joint Advisory Group (Frankfurt)
- **2000:**
- **2001:**
  - ISO/TC184 Big Picture Technical Report [tc184n1565]
- **2002:**
- **2003:**
  - ISO/TC184 & IEC/TC65 Joint Advisory Group (Berlin)
- **2004:**
- **2005:**
- **2006:**
- **2007:**
- **2008:**
- **2009:**
  - AFNOR Set of documents [CP 18MM 14764]
- **2010:**
  - Collaborative study EDF & Ecole Centrale de Lille IG2I
  - ISO/TC 184 resolution 563 to push Big Picture as ISO project (TMB) (Nara)
- **2011:**
  - ISO/TC184 Technical Report
- **2012:**
- **2013:**
- **2014:**
- **2015:**
- **2016:**
Several mapping initiatives

ISO/SAG I4.0-SM  |  ISO/TC 184  |  SGAM  |  Germany  |  USA

France  |  Japan  |  Japan  |  China

Figure 1: Three Views of Smart Manufacturing Unit

Layers

- Business
- Functional
- Information
- Communication
- Integration

Life Cycle Value Network

Product

DFSCM

CPI

DFMA

Production

USA

Innovation

Business

Sustainability

Technology

System

Intelligent

Characteristics

Intelligence

Design

Acceptance

Operation

Retirement

Maintenance

Management

Environment

Delivery

Quality

Coal

Plant

Product

Process

Personnel

Plan

Check

Action

Do
Creation of ISO-IEC/SM2TF

ISO/TC resolution Berlin September 2017

ToR

Phase 1: Create an initial compilation of terms and definitions for Smart Manufacturing, generate and organize a definitive list of Smart Manufacturing-relevant standards from committees participating in SMCC and IEC, taking into consideration the work done to date (e.g., ISO/SA on Industry 4.0, Smart Manufacturing output, ISO/TC 184 “Big Picture”, IEC TC 65 AHC3, IEC SC 65), identify additional relevant Smart Manufacturing standards from other Standards Developing Organizations (SDOs), including consortia and national initiatives; provide an initial classification to facilitate navigation and understanding of the content; publish the output of Phase 1 as an ISO/IEC Technical Report, and issue periodic updates.

Phase 2: Classify the contents of the standards map according to existing reference models and the unified reference model resulting from ISO/TC 184 – IEC/TC 65 JWG 21; Republish the resulting output in a maintained database format.

Phase 3: In collaboration with the IEC/SMG work to maintain the smart energy standards map, and with bodies developing other standards mapping tools (for example the standard mapping tool referred to in TC 184 resolution 565), develop a concept to represent the content of the Standards Map in a smart, graphically supported way to meet the needs of market users and standards developers;

Define a business case to publish the content of the Standards Map according to this concept

Provide a recommendation to ISO/TMB and IEC/SMB to support the realization and maintenance of the Standards Map project.
# ISO/IEC SM2 Framework

<table>
<thead>
<tr>
<th>Semantics</th>
<th>Information</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Define the characteristics of standards</td>
<td>2-Give value to the characteristics of relevant standards</td>
<td>3- Produce representations for different viewpoints</td>
</tr>
<tr>
<td><img src="image1" alt="SM2 Vocabulary" /></td>
<td><img src="image2" alt="SM2 Catalogue" /></td>
<td>- Choose template</td>
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<tr>
<td></td>
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<td>- Generate</td>
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<td></td>
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<td><img src="image3" alt="SM2 Representation type 2D-1" /></td>
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<tr>
<td></td>
<td></td>
<td><img src="image4" alt="SM2 Representation type 3D-1" /></td>
</tr>
<tr>
<td>4- Feedback process: Characteristics are adapted from the analysis needs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- SM2 Representation type 2D-1
- SM2 Representation type 3D-1
Project schedule

Kick off

Berlin meeting #1
March 7~8
(attendance = 18)

Frankfurt meeting #2
July 12~13
(attendance = 17)

Chicago meeting #3
November 15~16
(attendance = 14)

Paris meeting #4
May 20~21
(attendance = 23)

2nd circulation to TCs/SCs
Jan 30

ISO: Apr 4
IEC: Apr 1

ISO/IEC TR 63306-1
SM2 Framework

ISO/IEC TR 63306-2
SM2 Catalogue

Draft implementation in IEC Mapping Platform
Dec 16

49 ISO TCs/SCs
35 IEC TCs/SCs
15 JTC 1 SCs

1st circulation to TCs/SCs

Web meeting #6
January 14
(attendance = 16)

Web meeting #7
April 23~24
(attendance = 26)

Web meeting #8
July 6
(attendance = 15)

Web meeting #9
July 29
(attendance = 16)

Web meeting #10
November 6
(attendance = 20)

Web meeting #11
January 20
(attendance = 14)

Web meeting #12
March 24

Berlin meeting #1
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(attendance = 18)

Frankfurt meeting #2
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(attendance = 20)

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January 20
(attendance = 14)

Web meeting #12
March 24
3- Publications
• DTR: IEC 100%, ISO only one negative vote
• Published on 2020-12-16

• DTR: 100% positive in ISO and IEC
• Few comments.
• Should be published soon.
Table 17 – Characteristics of "Functional hierarchy"

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected world</td>
<td>It reflects the horizontal market operations in value added networks. EXAMPLE: Network of factories</td>
</tr>
<tr>
<td>Business (L4)</td>
<td>Business planning, operation and logistics</td>
</tr>
<tr>
<td></td>
<td>Level 4 functions involved in the business-related activities needed to manage a manufacturing organization</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], 3.1.16]</td>
</tr>
<tr>
<td></td>
<td>Establishing and executing the basic plant schedule for production, material use, delivery, shipping, determining inventory levels, operational management, etc.</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], Figure 3]</td>
</tr>
<tr>
<td>Operations management (L3)</td>
<td>Operations management</td>
</tr>
<tr>
<td></td>
<td>manufacturing operations management MOM activities within Level 3 of a manufacturing facility that coordinate the personnel, equipment and material in manufacturing</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], 3.1.22]</td>
</tr>
<tr>
<td></td>
<td>Level 3 functions involved in managing the work flows to produce the desired end-products</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], 3.1.17]</td>
</tr>
<tr>
<td></td>
<td>Work flow / recipe control to produce the desired end products. Maintaining records and optimizing the production process, dispatching production, detailed production scheduling, reliability assurance, etc.</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], Figure 3]</td>
</tr>
<tr>
<td>Control (L2)</td>
<td>Level 2 functions involved in monitoring and controlling of the physical process</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], 3.1.17]</td>
</tr>
<tr>
<td></td>
<td>Monitoring, supervisory control and automated control of the production process</td>
</tr>
<tr>
<td></td>
<td>[SOURCE: IEC 62264-1:2013 [1], Figure 3]</td>
</tr>
<tr>
<td>Sensor and actuator (L1)</td>
<td>Level 1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ISO/IEC 63306-1 SM2 Framework
ISO/IEC 63306-2 URLs to the SM2 Catalogue Excel file

https://standards.iso.org/iso/


Part 2: SM2 Catalogue
## ISO/IEC 63306-2 SM2 Catalogue

| Status | Standard number | Edition | Publication date | Reference | Publication | Equipment hierarchy | Functional hierarchy | Life cycle | Hierarchy | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle | Life cycle |
|--------|-----------------|---------|-----------------|-----------|-------------|---------------------|----------------------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
|        | ISO 10303-1xx   |         |                 |           |             |                      |                      |            |           |            |            |            |            |            |            |            |            |            |            |            |            |
|        | ISO 10303-2xx   |         |                 |           |             |                      |                      |            |           |            |            |            |            |            |            |            |            |            |            |            |            |
|        | ISO 10303-239   | 2012-11 |                 |           |             |                      |                      |            |           |            |            |            |            |            |            |            |            |            |            |            |            |
|        | ISO 13584-x     | various |                 |           |             |                      |                      |            |           |            |            |            |            |            |            |            |            |            |            |            |            |            |
4- Graphical mapping tool
IEC Mapping Platform

ISO-IEC SM2 test 000
Smart manufacturing Standards Map (SM2) / Top map

IEC 61850

Smart grid map

Norway - Standards relevant on road construction in Norway
This map gives overview on standards specially relevant for road constructions in Norway

Norway - Standarder for cybersikkerhet i kraftsystemet
Dette er en oversikt over standarder relevante for kraftsystemet, som beskrevet i teknisk rapport NEK IEC TR 62357, Referansearkitektur.

Norway - NEK Cybersikkerhetskart
Dette kartet gir en oversikt over områder hvor det er identifisert mulig relevante standarder innen cybersikkerhet, fra en rekke forskjellige standardiseringsorganer.

Norway - Standards relevant to electrotechnical consultants
This map gives an overview of legislation and standards relevant to companies that perform electrotechnical consulting.

Sustainable Development Goals

TC 5 Standards Inventory

Cybersecurity Publications Inventory
This map has been prepared by ACSEC.

TC 125
Personal e-Transporters (PeTs)
Smart Grid map (1)

https://mapping.iec.ch/#/maps/1
Smart Grid map (2)  
https://mapping.iec.ch/#/maps/1
SM2 map: main page

ISO/IEC 63306 Smart Manufacturing Standards Map (SM2)

https://mapping.iec.ch/#/maps/48

Click on this area to open the 2D map "Production system life cycle - Functional hierarchy".

Implement/Control

Resources  Communication  Information  Function  Business

IEC 61131-3  Programmable controllers - Part 2: Programming languages
IEC 61512 (series)  Batch control
ISO 16100 (series)  Industrial automation systems and integration - Manufacturing software capability profiling for interoperability
6 publications
ISO 16100-3:2009  Part 3: Interface services, protocols and capability templates
ISO 16100-4:2006  Part 4: Conformance test methods, criteria and reports
ISO 16100-5:2002  Part 5: Methodology for profile matching using multiple capability class structures
ISO 16100-6:2018  Part 6: Interface services and protocols for matching profiles based on multiple capability class structures
ISO TS 8000-1
SM2 map: Link to ISO & IEC catalogues

ISO 16100-1:2009
Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 1: Framework

Abstract

IEC 61131-3:2013 specifies the syntax and semantics of a unified suite of programming languages for programmable controllers (PCs). This suite consists of two textual languages, Instruction List (IL) and Structured Text (ST), and two graphical languages, Ladder Diagram (LD) and Function Block Diagram (FBD). This third edition cancels and replaces the second edition, published in 2003 and constitutes a technical revision. It includes the following significant technical changes:

1. A compatible extension of the second edition. The main extensions are new data types and conversion functions, references, name spaces and the object oriented features.

Additional information

- Publication type: International Standard
- Publication date: 2013-02-20
- Edition: 3.0
- Available language(s): English/French
- TC/SC: TC 65/SC 65B - Measurement and control devices
Questions & Answers

1st and 2nd June

http://standardsdays.afnet.fr