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Vorgesehen als Ersatz für
DIN EN 62264-3:2008-01**Integration von Unternehmensführungs- und Leitsystemen –
Teil 3: Aktivitätsmodelle für das operative Produktionsmanagement
(IEC 65E/456/CDV:2015);
Englische Fassung FprEN 62264-3:2015**

Enterprise-control system integration –
Part 3: Activity models of manufacturing operations management
(IEC 65E/456/CDV:2015);
English version FprEN 62264-3:2015

Intégration du système de commande d'entreprise –
Partie 3: Modèles d'activités pour la gestion des opérations de fabrication
(IEC 65E/456/CDV:2015);
Version anglaise FprEN 62264-3:2015

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2016-09-16 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

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Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 84 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE

Nationales Vorwort

Die Englische Fassung des europäischen Dokuments FprEN 62264-3:2015 „Integration von Unternehmensführungs- und Leitsystemen – Teil 3: Aktivitätsmodelle für das operative Produktionsmanagement“ (Entwurf in der Umfrage) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 65E/456/CDV:2015 „Enterprise-control system integration – Part 3: Activity models of manufacturing operations management“ unverändert in den Entwurf FprEN 62264-3:2015 übernommen worden.

Das internationale Dokument wurde vom SC 65E „Devices and integration in enterprise systems“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet.

Bei der Abstimmung zu dem Europäischen Schluss-Entwurf bei CENELEC und dem Internationalen Schluss-Entwurf bei IEC [Final Draft International Standard (FDIS)] sind jeweils nur „JA/NEIN“-Entscheidungen möglich, wobei „NEIN“-Entscheidungen fundiert begründet werden müssen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

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Da sich die Benutzer des vorliegenden Normentwurfs der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der FprEN 62264-3 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt und deren Abschnitt 3, der die Begriffe und Abkürzungen festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA des vorliegenden Normentwurfs hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Dieser Normentwurf steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

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Änderungen

Gegenüber DIN EN 62264-3:2008-01 wurden folgende Änderungen vorgenommen:

- a) den Inhalt der Unterabschnitte 4.1, 4.2, 4.4, 4.5, 4.6, 5.3 und die Anhänge A und F in DIN 62264-1:2013 verbracht;
- b) Unterabschnitt 5.4 und Anhang F gestrichen;
- c) die deutsche Fassung wurde im Unterabschnitt 3.1 an den aktuellen Standardtext angepasst.

Nationaler Anhang NA^{N1)} (informativ)

Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

1 Anwendungsbereich

Dieser Teil von IEC 62264 legt Aktivitätsmodelle für das Produktionsmanagement fest, mithilfe derer Unternehmenssysteme die Systemintegration steuern können. Die in dieser Norm definierten Aktivitäten stimmen mit den in IEC 62264-1 enthaltenen Definitionen von Objektmodellen überein. Die modellierten Aktivitäten reichen von Geschäftsplanungs- und Logistikfunktionen, welche als Funktionen der Ebene 4 definiert sind, bis Prozesssteuerungsfunktionen, die in IEC 62264-1 in Form der Funktionen der Ebene 2 abgebildet sind. Der Anwendungsbereich dieser Norm ist beschränkt auf:

- ein Modell der Aktivitäten im Zusammenhang mit dem Produktionsmanagement, Funktionen der Ebene 3;
- eine Bestimmung einiger zwischen Aktivitäten der Ebene 3 ausgetauschten Daten.

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1.1

Kapazitätsterminierung

(en: finite capacity scheduling)

Planungsmethode, bei der die Arbeit für die Produktionsausrüstung geplant wird, ohne dass die verfügbare Kapazität der Produktionsausrüstung durch eine der Kapazitätsanforderungen an die Produktionsausrüstung überschritten wird

3.1.2

Lager- und Bestandsmanagement

(en: inventory operations management)

Aktivitäten der Ebene 3 einer Produktionsstätte, die Materialbestand und -transport koordinieren, anweisen, verwalten und verfolgen als Teil des Betriebsmanagements

^{N1)} Nationale Fußnote: Die Nummerierung aus IEC 65E/456/CDV:2015 wurde beibehalten.

3.1.3**Arbeitsliste**

(en: job list)

Sammlung von Arbeitsaufträgen für einen Betrieb/eine Ressource oder mehrere Betriebe/Ressourcen in einem festgelegten Zeitraum

Anmerkung 1 zum Begriff Dabei kann es sich um Arbeitsaufträge in Form von Anweisungen zur Einrichtung von Maschinen, Betriebsbedingungen für kontinuierliche Prozesse, Anweisungen für den Materialtransport oder zu beginnende Aufgaben in einem Batch-System handeln.

Anmerkung 2 zum Begriff Arbeitslisten sind auf alle Managementbereiche anwendbar, z. B. Instandhaltung, Qualitätsprüfung und Lager und Bestand.

3.1.4**Arbeitsauftrag**

(en: job order)

Zusammenstellung terminierter Arbeiten, die zur Ausführung übertragen werden

3.1.5**Leistungskennzahl****KPI**

(en: key performance indicator)

quantifizierbarer Grad des Erreichens eines kritischen Ziels

[QUELLE: ISO 22400-1-2014, 2.1.5]

3.1.6**Instandhaltungsmanagement**

(en: maintenance operations management)

Aktivitäten innerhalb der Ebene 3 einer Produktions-/Fertigungsstätte, die die Funktionen zur Instandhaltung von Einrichtungen, Werkzeugen und Assets koordinieren, anweisen, steuern und verfolgen, um die Verfügbarkeit für die Produktion und die Planung reaktiver, periodischer, vorbeugender und proaktiver Wartungsmaßnahmen sicherzustellen

3.1.7**Produktions-/Fertigungsstätte**

(en: manufacturing facility)

ein Werk oder ein Betriebskomplex innerhalb eines Werks, das bzw. der die Ressourcen und die Aktivitäten zur Nutzung der Ressourcen beinhaltet

3.1.8**Betriebsmanagement**

(en: manufacturing operations management)

Aktivitäten der Ebene 3 einer Produktions- oder Fertigungsstätte, die das Personal, die Einrichtungen und das Material innerhalb der Produktion/Fertigung koordinieren, anweisen, steuern und verfolgen

Anmerkung 1 zum Begriff Diese Norm gliedert das Betriebsmanagement in vier Kategorien (Produktionsmanagement, Instandhaltungsmanagement, Qualitätsmanagement und Lager- und Bestandsmanagement) und verweist auf andere Unternehmensaktivitäten, die das Betriebsmanagement beeinflussen.

3.1.9**Produktionsmanagement**

(en: production operations management)

Aktivitäten innerhalb der Ebene 3 einer Produktions-/Fertigungsstätte welche die Funktionen koordinieren, steuern und verfolgen, die Rohmaterialien, Energie, Ausrüstung, Personal und Information nutzen, um Produkte innerhalb der festgelegten Kosten, Qualität, Mengen, Sicherheit und Terminvorgaben herzustellen

3.1.10

Qualitätsmanagement

(en: quality operations management)

Aktivitäten innerhalb der Ebene 3 einer Produktions-/Fertigungsstätte, die die Funktionen zur Qualitätsmessung und Berichterstattung koordiniert, anweist, steuert und verfolgt

3.1.11

Nachverfolgung

(en: tracing)

Aktivität, mit der unter Verwendung von Verfolgungsinformationen ein organisierter Bericht über die Nutzung einer Ressource oder eines Produkts ab einem beliebigen Zeitpunkt, vorwärts oder rückwärts, abgerufen werden kann

3.1.12

Verfolgung

(en: tracking)

Aktivität der Aufzeichnung von Attributen von Ressourcen und Produkten über alle Schritte der Instanziierung, Nutzung, Änderung und Verteilung hinweg

3.1.13

Betrieb

(en: work center)

Anlage, Produktionseinheit, Produktionslinie, Lager oder ein anderes Ausstattungselement derselben Ebene, die/das als Erweiterung des Ausstattungshierarchiemodells definiert ist

Anmerkung 1 zum Begriff: Um die Konformität mit vorhandenen Schema-Implementierungen zu wahren, wird die festgelegte englische Benennung „work center“ anstelle der GB-englischen Benennung „work centre“ verwendet.

3.1.1^{N2)}

Betriebsplan

(en: work schedule)

Plan, der die Aktivitäten des Produktions-, Instandhaltungs-, Lager- und Bestands- oder Qualitätsmanagements oder eine Kombination dieser Aktivitäten im Detail festlegt

^{N2)} Nationale Fußnote: Fehler in IEC 65E/456/CDV:2015, korrekt ist 3.1.14.

– Leerseite –

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 3: Activity models of manufacturing operations management

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- International Standard IEC 62264-1 has been prepared by subcommittee 65E: System aspects, of IEC technical committee 65: Industrial-process measurement and control and ISO SC5, JWG 15, of ISO technical committee 184: Enterprise-control system integration.
- It is published as a double logo standard.
- The text of this standard is based on the following documents:

CDV	Report on voting

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 10 P-members out of 10 having cast a vote.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

54 The list of all the parts of the IEC 62264 series, under the general title *Enterprise-control*
55 *system integration*, can be found on the IEC website.

56 The committee has decided that the contents of this publication will remain unchanged until
57 the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in
58 the data related to the specific publication. At this date, the publication will be

- 59 • reconfirmed,
60 • withdrawn,
61 • replaced by a revised edition, or
62 • amended.

63

64

65

INTRODUCTION

66 This part of IEC 62264 shows activity models and data flows for manufacturing information
67 that enables enterprise-control system integration. The modelled activities operate between
68 Level 4 logistics and planning functions and Level 2 manual and automated process control
69 functions. The models are consistent with the object models given in IEC 62264-2 and the
70 Level 3 (manufacturing operations and control) definitions.

71 The goal of the standard is to reduce the risk, cost and errors associated with implementing
72 enterprise systems and manufacturing operations systems in such a way that they inter-
73 operate and easily integrate. The standard may also be used to reduce the effort associated
74 with implementing new product offerings.

75 This standard provides models and terminology for defining the activities of manufacturing
76 operations management. The models and terminology defined in this standard are:

- 77 – to emphasize the good practices of manufacturing operations;
- 78 – to be used to improve existing manufacturing operations systems;
- 79 – to be applied regardless of the degree of automation.

80 Some potential benefits produced when applying the standard may include:

- 81 – reducing the time to reach full production levels for new products;
- 82 – enabling vendors to supply appropriate tools for manufacturing operations;
- 83 – enabling more uniform and consistent identification of manufacturing needs;
- 84 – reducing the cost of automating manufacturing processes;
- 85 – optimizing supply chains;
- 86 – improving efficiency in life-cycle engineering efforts.

87 It is not the intent of this part of the standard to:

- 88 – suggest that there is only one way of implementing manufacturing operations;
- 89 – force users to abandon their current way of handling manufacturing operations;
- 90 – restrict development in the area of manufacturing operations;
- 91 – restrict use only to manufacturing industries.

92 Changes from IEC 62264-3 ed1 to this version are:

- 93 1. Clause 4.1 *Manufacturing Operations Management* was moved to Part 1 and therefore was
94 removed from Part 3
- 95 2. Clause 4.2 *Functional hierarchy* was moved to Part 1 and therefore was removed from Part 3
- 96 3. Clause 4.4 *Criterion for defining activities below Level 4* was moved to Part 1 and therefore
97 was removed from Part 3
- 98 4. Clause 4.5 *Categories of production information* was moved to Part 1 and therefore was
99 removed from Part 3
- 100 5. Clause 4.6 *Manufacturing operations information* was moved to Part 1 and therefore was
101 removed from Part 3
- 102 6. Clause 5.3 *Expanded equipment hierarchy model* was moved to Part 1 and therefore was
103 removed from Part 3
- 104 7. Clause 5.4 *Expanded decision hierarchy model* was removed from Part 3. The corresponding
105 section was removed from Part 1 and replaced with a reference to ISO-15704 Industrial
106 automation systems.
- 107 8. *Annex A (informative) Other enterprise activities affecting manufacturing operations* was
108 moved to Part 1 and therefore was removed from Part 3
- 109 9. *Annex D (informative) Associated standards* was moved to Part 1 and therefore was removed
110 from Part 3
- 111 10. *Annex F (informative) Applying the decision hierarchy model to manufacturing operations*
112 *management* was removed from Part 3. The corresponding section was removed from Part 1
113 and replaced with a reference to ISO-15704 Industrial automation systems.

11. *Annex G (informative) Mapping PSLX ontology to manufacturing operations management* was removed from Part 3. The committee felt that this section is more appropriate as a PSLX white paper or TR.
12. The names for data were changed to match the Part 4 standard names. These name changes were made in all figures and in the text. The following data names were changed or added:
- a. *Detailed Production Schedule* changed to *Work Schedule*
 - b. *Production Dispatch List* changed to *Job list*
 - c. *Production Work Order* changed to *Job Order*
 - d. *Work Order* changed to *Job Order*
 - e. *Detailed Maintenance Schedule* changed to *Work Schedule*
 - f. *Detailed Inventory Schedule* changed to *Work Schedule*
 - g. The addition of *Work Masters* as objects that define how work is to be done.
 - h. The addition of the management of *Work Calendars* as a task in resource management
 - i. The addition of the creation of *Work Records* as a task in tracing

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 3: Activity models of manufacturing operations management

1 Scope

This part of IEC 62264 defines activity models of manufacturing operations management that enable enterprise system to control system integration. The activities defined in this standard are consistent with the object models definitions given in IEC 62264-1. The modelled activities operate between business planning and logistics functions, defined as the Level 4 functions and the process control functions, defined as the Level 2 functions of IEC 62264-1. The scope of this standard is limited to:

- a model of the activities associated with manufacturing operations management, Level 3 functions;
- an identification of some of the data exchanged between Level 3 activities.

2 Normative references

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

IEC 61512-1:2010, *Batch control – Part 1: Models and terminology*

IEC 61512-2:2001, *Batch control - Part 2: Data structures and guidelines for languages*

IEC 62264-1 ed2, *Enterprise-control system integration – Part 1: Models and terminology*

IEC 62264-2 ed2, *Enterprise-control system integration – Part 2: Object model attributes*

IEC 62264-4 ed1, *Enterprise-control system integration – Part 4: Objects and attributes for manufacturing operations management integration*

ISO 15704:2000, *Industrial automation systems – Requirements for enterprise-reference architecture and methodologies*

ISO 22400-1, *Automation systems and integration – Key performance indicators (KPIs) for manufacturing operations management – Part 1: Overview, concepts and terminology*

ISO 22400-2, *Automation systems and integration — Key performance indicators for manufacturing operations management — Part 2: Definitions and descriptions*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1

finite capacity scheduling

scheduling methodology where work is scheduled for production equipment, in such a way that no production equipment capacity requirement exceeds the capacity available to the production equipment

3.1.2

inventory operations management

activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track inventory and material movement within manufacturing operations

176 **3.1.3**
177 **job list**
178 collection of job orders for one or more work centers and/or resources for a specific time
179 frame

180 NOTE 1 to entry This may take the form of job orders for the set-up instructions for machines, operating
181 conditions for continuous processes, material movement instructions, or batches to be started in a
182 batch system.

183 NOTE 2 to entry Job lists are applicable to all operations management areas, such as maintenance, quality test
184 and inventory.

185 **3.1.4**
186 **job order**
187 unit of scheduled work that is dispatched for execution at

188 **3.1.5**
189 **key performance indicator**
190 **KPI**
191 Quantifiable level of achieving a critical objective

192 [SOURCE: ISO 22400-1-2014, 2.1.5]

193 **3.1.6**
194 **maintenance operations management**
195 activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track
196 the functions that maintain the equipment, tools and related assets to ensure their availability
197 for manufacturing and ensure scheduling for reactive, periodic, preventive, or proactive
198 maintenance

199 **3.1.7**
200 **manufacturing facility**
201 site, or area within a site, that includes the resources within the site or area and includes the
202 activities associated with the use of the resources

203 **3.1.8**
204 **manufacturing operations management**
205 activities within Level 3 of a manufacturing facility that coordinate, direct, manage and track
206 the personnel, equipment and materials in manufacturing

207 NOTE to entry This standard details manufacturing operations management in terms of four categories
208 (production operations management, maintenance operations management, quality operations
209 management and inventory operations management) and provides references for other enterprise
210 activities affecting manufacturing operations.

211 **3.1.9**
212 **production operations management**
213 activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track
214 the functions that use raw materials, energy, equipment, personnel and information to
215 produce products, with the required costs, qualities, quantities, safety and timeliness

216 **3.1.10**
217 **quality operations management**
218 activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track
219 the functions that measure and report on quality

220 **3.1.11**
221 **tracing**
222 activity that provides an organized record of resource and product use from any point, forward
223 or backward, using tracking information

224 **3.1.12**
225 **tracking**
226 activity of recording attributes of resources and products through all steps of instantiation, use,
227 change and disposition

228 **3.1.13**
229 **work center**
230 process cell, production unit, production line, storage zone, or any other equivalent level
231 equipment element defined as an extension to the equipment hierarchy model

232 NOTE For compatibility with existing schema implementations the defined term “work center” is used in place of
233 the UK English spelling “work centre”.

234 **3.1.1**
235 **work schedule**
236 detailed schedule that defines production, maintenance, inventory or quality operations
237 activities, or any combination of the activities

238 **3.2 Abbreviations**

239 For the purposes of this standard, the following abbreviations apply.

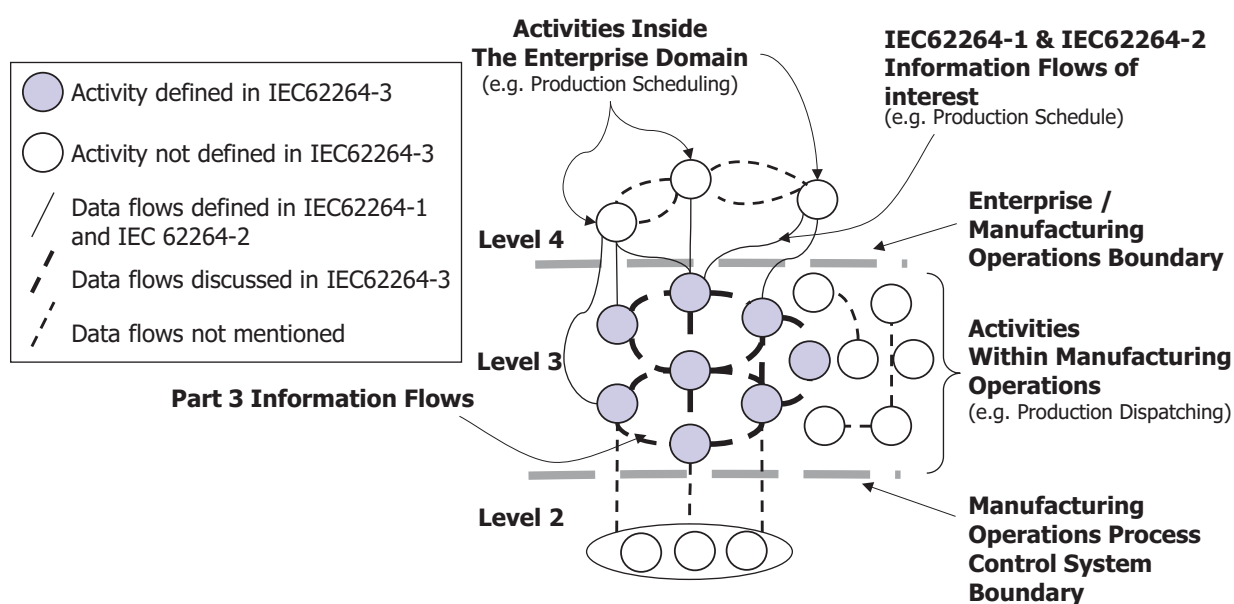
240	AGV	Automated guided vehicles
241	AMS	Asset management system
242	ASRS	Automated storage and retrieval system
243	CAPE	Computer-aided process engineering
244	CAD	Computer-aided design
245	CAE	Computer-aided engineering
246	CASE	Computer-aided software engineering
247	CIM	Computer integrated manufacturing
248	CNC	Computerized numerical control
249	DCS	Distributed control system
250	ERP	Enterprise resource planning
251	EWI	Electronic work instructions
252	HR	Human resources
253	KPI	Key performance indicator
254	LIMS	Laboratory information management system
255	MOM	Manufacturing Operations Management
256	MES	Manufacturing execution system
257	MPS	Master production schedule
258	MRP	Material resource planning
259	OEE	Overall equipment effectiveness
260	PAT	Process analytical technology
261	PERA	Purdue enterprise reference architecture
262	PDM	Product data management
263	PLC	Programmable logic controller
264	PLM	Product life-cycle management
265	PRM	Purdue reference model for computer-integrated manufacturing
266	QA	Quality assurance
267	R&D	Research and development
268	RFQ	Request for quote
269	ROA	Return on assets
270	SCADA	Supervisory control and data acquisition
271	SOC	Standard operating conditions
272	SOP	Standard operating procedure

273	SQC	Statistical quality control
274	SPC	Statistical process control
275	WIP	Work in process
276	WMS	Warehouse management system

277 4 Structuring concepts

278 4.1 Activity models

279 Figure 1 illustrates the activity models of this standard in relationship to Part 1 and Part 2.
 280 The activities in this standard exchange information with activities defined as Level 4 and
 281 Level 2 activities. The grey circles indicate the activities detailed in this standard. The
 282 information flows between the activities of this standard, indicated as heavy dashed lines, are
 283 described in general in this standard. In addition, the information flows between the activities
 284 of this standard and dependent Level 2 activities are identified.
 285



286
287 **Figure 1 – Activity relationships**

288 4.2 Manufacturing operations management elements

289 The shaded areas in the Manufacturing Operations Management Model in Part 1 represent
 290 the manufacturing operations management activities modelled in this standard. Manufacturing
 291 operations management is the collection of production operations management, maintenance
 292 operations management, quality operations management, inventory operations management
 293 and other activities of a manufacturing facility.

294 This standard defines four formal models: production operations management, maintenance
 295 operations management, quality operations management and inventory operations
 296 management. These are detailed in Clauses 6, 7, 8 and 9 and are listed below.

- 297 a) The production operations management model, which shall include the activities of
 298 production control (3.0) that operate as Level 3 functions and the subset of the production
 299 scheduling (2.0) that operate as Level 3 functions and as defined in Part 1.
- 300 b) The maintenance operations management model, which shall include the activities of
 301 maintenance management (10.0) that operate as Level 3 functions.
- 302 c) The quality operations management model, which shall include the activities of quality
 303 assurance (6.0) that operate as Level 3 functions.
- 304 d) The inventory operations management model, which shall include the activities of
 305 management of inventory and material including product inventory control (7.0) and

306 material and energy control activities (4.0) defined as operating as Level 3 functions and
307 as shown in the Manufacturing Operations Management Model in Part 1.

308 NOTE 1 The numbers in parenthesis “()” refer to the functional model depicted in Part 1.

309 NOTE 2 Other categories of operations management may exist depending on company policy or
310 organization. They are not formally modelled in this standard but they can make use of the generic
311 standard model.

312 5 Structuring models

313 5.1 Generic template for categories of manufacturing operations management

314 5.1.1 Template for management of operations

315 A generic model for management of operations shall be used as a template to define the
316 production operations management, maintenance operations management, quality operations
317 management and inventory operations management models. This model is shown in Figure 2.
318 This generic model is extended for each specific area in later clauses.

319 NOTE The fine details of the generic model are different for each of the manufacturing operations management
320 areas.

321 5.1.2 Use of the generic model

322 The generic model is instantiated for the four categories listed in 5.1.1. However, this same
323 template may be instantiated for other possible manufacturing operations categories or for
324 other operations areas within the enterprise.

325 EXAMPLE 1 A company could apply the model to receiving operations management and shipping operations
326 management where these are separately managed.

327 EXAMPLE 2 A company could apply the model to cleaning and sterilization operations management, where
328 these are separately managed.

329 EXAMPLE 3 A company could apply the model to independent logistics operations management categories for
330 inbound logistics, outbound logistics, internal transfer and inventory control.

331 NOTE This clause is normative so that companies that apply the generic model to areas other than the
332 four detailed in this standard can determine and document their degree of conformance to the
333 model.

334 When the generic model is instantiated for a new category, the activities within a category
335 shall include the definitions of resource management, definition management, dispatching,
336 tracking, data collection, analysis, detailed scheduling, and execution management.

337 5.1.3 Generic activity model

338 There shall be a hierarchy used in this standard that starts at a category of operations
339 management. Each category is composed of a collection of activities and each activity is
340 composed of a set of tasks. The generic model applies to the sets of activities.

341 The generic activity model defines a general request-response cycle that starts with requests
342 or schedules, converts them into a detailed schedule, dispatches work according to the
343 detailed schedule, manages the execution of work, collects data and converts the collected
344 data back into responses. This request-response cycle is supported with:

- 345 – analysis of the work performed for improvements or corrections;
- 346 – management of the resources used in execution of the performed work;
- 347 – management of the definitions of the performed work.

348 The generic activity model and the detailed models are not intended to represent an actual
349 implementation of a manufacturing information system. However, they do provide a consistent
350 framework for such systems. Actual systems may use different structures supporting other
351 task arrangements. The purpose of these models is to identify possible data flows within
352 manufacturing operations. The ovals in the model indicate collections of tasks, identified as
353 the main activities. Lines with arrowheads indicate a set of important information flows
354 between the activities. The terms without ovals indicate data objects defined in Part 2 or
355 other parts of the standard.

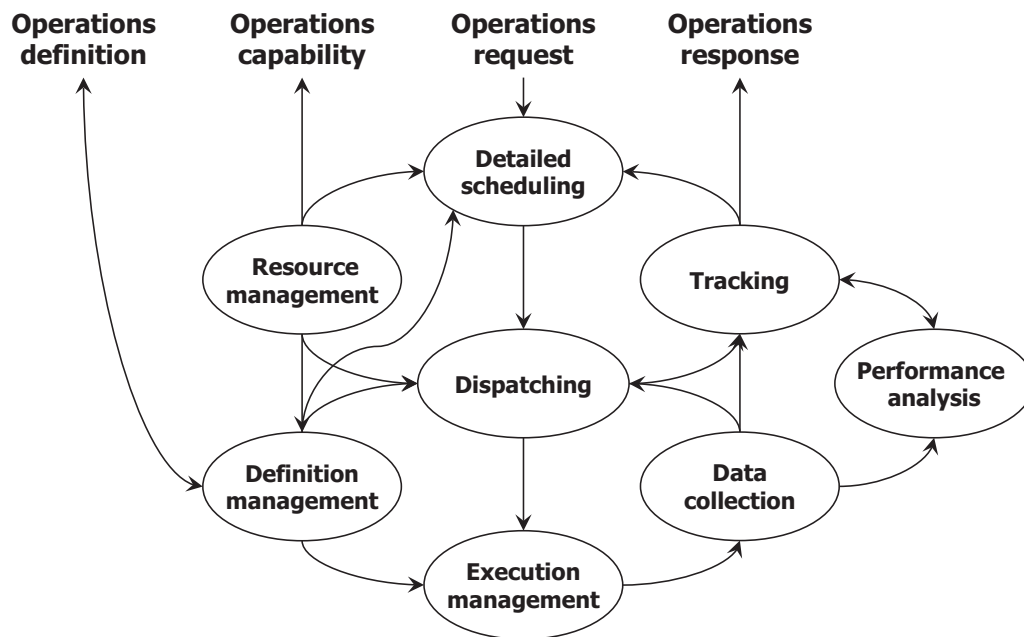


Figure 2 – Generic activity model of manufacturing operations management

NOTE Not all information flows are depicted in Figure 2. In any specific implementation, information from any activity may be required by any other activity. Where the model is expanded for specific activities, the lines indicating information flows are not intended to be exclusive lists of information exchanged.

5.2 Interaction among generic activity models

5.2.1 Information flows between generic activity models

In addition to the information flows within the activities of specific operations categories, there are also information flows between the different categories. Some of this information is defined in the following clauses, but not all information flows are explicitly defined in this standard.

NOTE Specific implementations of activity models may give prominence to one specific activity model over others.

EXAMPLE 1 In pharmaceutical industries, quality operations may provide the direction for other operations.

EXAMPLE 2 In distribution centres, inventory operations may provide the direction for other operations.

EXAMPLE 3 In consumer packaged goods, production operations may provide the direction for other operations.

EXAMPLE 4 In refining, inventory operations may provide the direction for production operations.

5.2.2 Handling resources within the generic activity models

Information about resources (materials, personnel, physical assets, and equipment) may be handled within any one of the four activity models of manufacturing operations (production, quality, maintenance and inventory) presented in this standard.

Although data for different resources may be found in different models, there are primary reporting paths through which information should be obtained.

a) Personnel information specific to each activity model may be obtained from the specific activity model.

b) Equipment information specific to each activity model may be obtained from the specific activity model.

c) Material information specific to each activity model may be obtained from the specific activity model. However, material inventory information, including finished goods and raw materials, may be obtained from the inventory activity model. Material movement operations may be managed by activities in the production, quality, maintenance, or inventory activity models. A specific material movement instance only exists within one activity model at any given point in time.

- 391 d) Physical asset information specific to each activity model may be obtained from the
392 specific activity model.

393 5.2.3 Scheduling interactions

394 An activity in a detailed activity model has interactions with other activities in the same model
395 and interactions with equivalent activities in other activity models. Interactions within each
396 activity model are described in Clauses 6, 7, 8 and 9.

397 There are many interactions associated with detailed scheduling between activity models
398 because of the need to coordinate between many work tasks assigned to a same resource on
399 a given time interval. Also, the definitions of work tasks in the different types of operations
400 management are closely related.

401 Clear definition of interactions between detailed production scheduling, detailed inventory
402 scheduling, detailed maintenance scheduling and detailed quality-test scheduling should be
403 specified. For interactions with production the following three interactions shall be defined, as
404 illustrated in Figure 3.

- 405 1) Interaction between detailed production scheduling and detailed inventory scheduling.
406 This is defined as coordination of information, at the start or completion of production, of
407 the quantity of materials that is consumed or produced during production and stored or
408 moved by inventory operations.

409 NOTE Scheduling of transportation can be defined in either detailed production scheduling or detailed
410 inventory scheduling.

411 EXAMPLE 1 Production not scheduled to start before the scheduled issuing of the corresponding inventory of
412 materials.

413 EXAMPLE 2 Completion of scheduled production triggers a scheduled inventory operation.

- 414 2) Interaction between detailed production scheduling and detailed maintenance scheduling.
415 This is defined as coordination of information about equipment that provides capability and
416 capacity during production and needs to be reserved for maintenance depending on the
417 equipment condition.

418 EXAMPLE 3 Not scheduling corrective maintenance and production on equipment simultaneously.

419 EXAMPLE 4 Scheduling maintenance based on scheduled use of equipment for production.

- 420 3) Interaction between detailed production scheduling and detailed quality-test scheduling.
421 This is defined as coordination of information about the quality of produced and consumed
422 materials, which need to be quality-tested depending on the required level of quality and
423 the latest production performance.

424 EXAMPLE 5 Detailed inspection schedule embedded in the work schedule.

425 EXAMPLE 6 Inspection operations requests production operations to schedule rework of the product.

426 Figure 3 shows an integrated scheduling framework across Level 3.

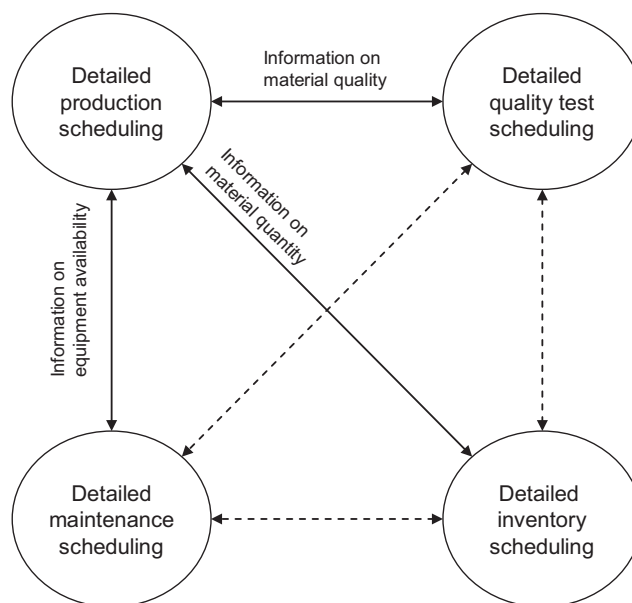


Figure 3 – Detailed scheduling interactions

5.3 Hierarchy of planning and scheduling

In this subclause, planning is defined as an activity for clarifying actions or operations to achieve a given goal and reserving enough amount of resource capacity to hit minimum targets. Scheduling is defined as an activity for allocating actions and operations to particular resources at particular times, taking into account various actual constraints and optimization of several evaluation parameters.

Figure 4 illustrates that in terms of the hierarchy, planning ranks higher than scheduling because a schedule is made using the results of a plan. Planning determines the goals for scheduling. Some constraints and sub-goals for objective functions in scheduling problems are determined in advance by planning activities. The results of scheduling show whether or not the result of planning is feasible and efficient. If it is not feasible, planning usually generates another result for scheduling. Feasibility and efficiency of scheduling are types of constraints of planning.

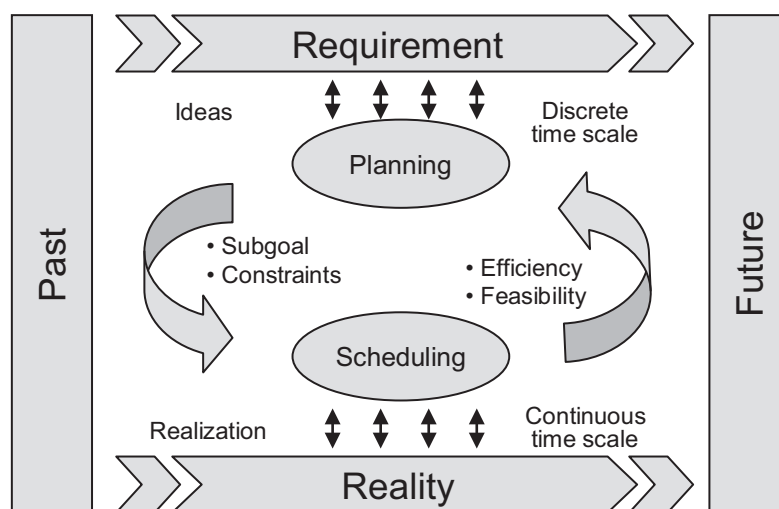


Figure 4 – Schematic relationship of planning and scheduling

444 The differences between planning and scheduling are the kinds of results which are related to
445 different aspects of time concepts. Figure 4 also illustrates these two concepts.

446 In planning, the main results will be target quantities that apply over certain periods of time.
447 The results of planning are represented on a discrete time scale as periodic times.

448 EXAMPLE 1 Results of planning might be “50,000 widgets this month”, “divisional sales of \$480,000 next
449 month”, “summary of overtime hours for next week”, etc.

450 Results in scheduling represent the specific timing of actions, for example, start time and
451 completion time of operation, inventory issue time, shipping time, etc. The results of sequence
452 information for operations are represented on a continuous time scale as relative or absolute
453 times.

454 EXAMPLE 2 Results of scheduling might be “9:00 Monday run Job order 2345 for 6 shifts at 100 % utilization”,
455 “9:00 Wednesday perform preventative maintenance on E887e”.

456 5.4 Resource definition for scheduling activities

457 5.4.1 Consumed resources and non-consumed resources

458 A resource is defined in IEC 62264-1 as personnel, equipment and/or material. In this
459 standard, particularly from the viewpoint of detailed scheduling activities, resources can be
460 divided into two different groups: consumed resources generally corresponding to personnel
461 hours worked, materials (including energy) and non-consumed resources generally
462 corresponding to personnel skills and equipment use. Consumed resources and non-
463 consumed resources are typically handled differently in scheduling activities.

464 A consumed resource quantity is changed by operations processes. This type of resource
465 usually includes raw materials (including energy), WIP inventories and final products and may
466 also include personnel hours worked or equipment time. The quantity of the resource typically
467 changes before or after operations.

468 A non-consumed resource is not used up by operations processes but is scheduled on the
469 basis of capacity. The quantity of the resource typically does not change before or after
470 operations.

471 5.4.2 Resource capacity and availability

472 In IEC 62264-1 and IEC 62264-2, operations scheduling depends on the availability of both
473 consumed and non-consumed resources. Available capacity in this standard is a portion of
474 operations capacity that can be attained but is not committed to current or future operations
475 processes and may be defined as a rate.

476 Example 1 As shown in Figure 5 for a bicycle factory, the available capacity for production is 30 bicycle seats
477 per hour for four hours of operation, during first shift, Monday and Tuesday, in the grey bars.

478 Example 2 For a bicycle factory, the available capacity for consumption is 15 bicycle seats per hour of
479 operation, during second and third shift, Tuesday, in the green bar.

480 Example 3 Projected inventory for bicycle seats within a bicycle factory is 80 seats at the start of the first shift
481 on Monday and 200 seats at the end of the first shift and 320 seats at the end of Tuesday first shift.
482 At the end of Tuesday third shift 240 seats would be consumed, and inventory is 80.

483

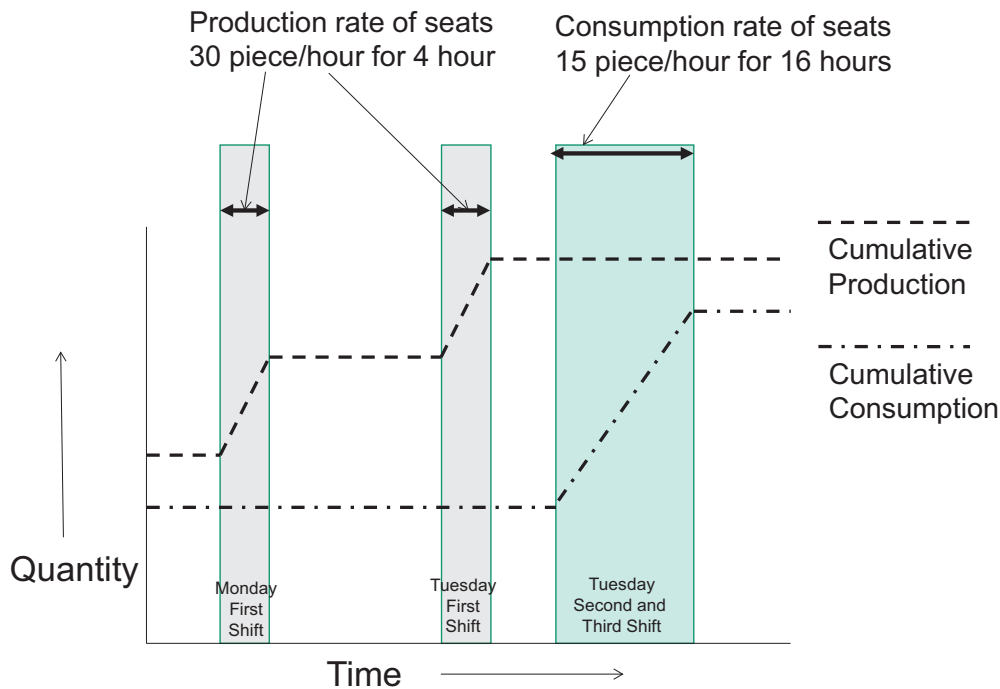


Figure 5 –Inventory for a consumable resource

NOTE Consumed resources and non-consumed resources are typically handled differently in scheduling activities. In IEC 62264-1 and IEC 62264-2, production scheduling depends on the availability of both consumed and non-consumed resources. Production capacity is determined by both the availability of consumed resources (inputs such as raw material, components) and the availability and capacity of non-consumed resources (the physical system such as equipment, facilities and people).

6 Production operations management

6.1 General activities in production operations management

Production operations management shall be defined as the collection of activities that coordinate, direct, manage and track the functions that use raw materials, energy, equipment, personnel and information to produce products, with the required costs, qualities, quantities, safety and timeliness. The general activities in production operations management are listed in IEC 62264-1 and include

- reporting on production including variable manufacturing costs;
 - collecting and maintaining data on production, inventory, manpower, raw materials, spare parts and energy usage;
 - performing data collection and off-line analysis as required by engineering functions;
- NOTE This may include statistical quality analysis and related control functions.
- performing needed personnel functions, such as work period statistics (for example, time, task), vacation schedule, work force schedules, union line of progression and in-house training and personnel qualification;
 - establishing the immediate work schedule for its own area accounting for maintenance, transportation and other production-related requests;
 - locally optimizing the costs for individual production areas while carrying out the production schedule established by the Level 4 functions;
 - modifying production schedules to compensate for plant production interruptions that may occur in its area of responsibility.

6.2 Production operations management activity model

The production operations management model in the Manufacturing Operations Management Model in Part 1 is expanded to a more detailed activity model of production operations shown

in Figure 6. The four elements of information (product definition, production capability, production schedule, and production performance) correspond to the exchanged information defined in IEC 62264-1 and illustrated in Figure 6. The oval-labelled production Level 1-2 functions represent the Level 1 and Level 2 sensing and control functions.

520 The activities defined here are not intended to imply an organizational structure of systems,
521 software, or personnel. The model is provided to help in the identification of activities that
522 may be performed and in the identification of roles associated with the activities. It defines
523 what is done, not how it should be organized. Different organizations may have a different
524 arrangement of roles and assignment of roles to personnel or systems.

525

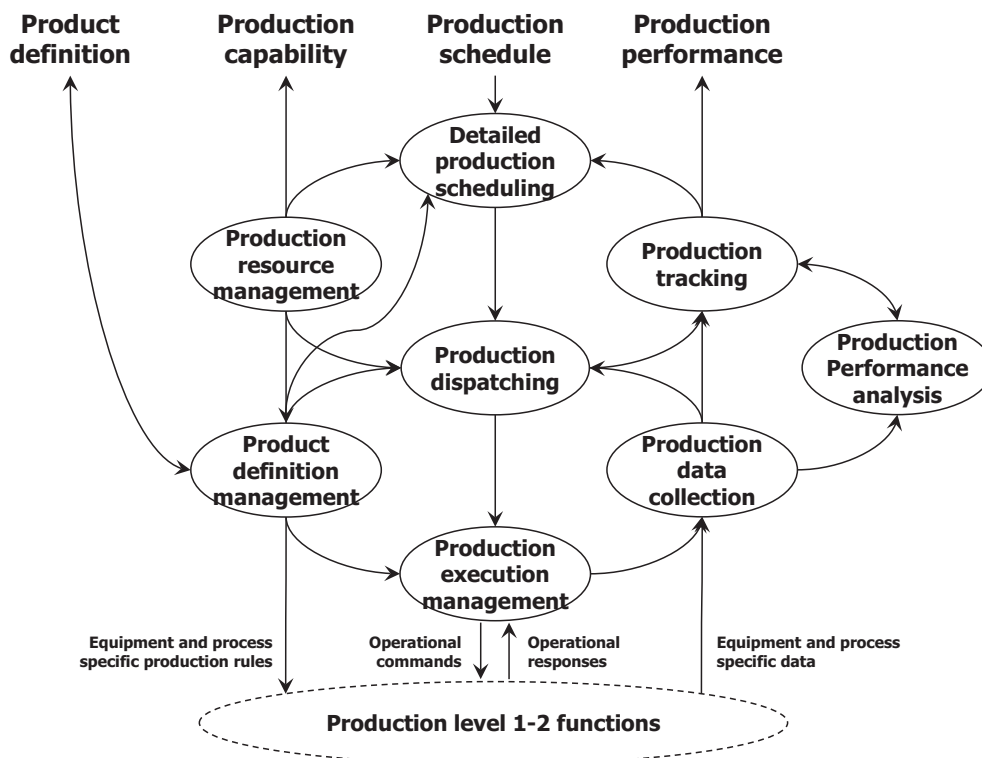


Figure 6 – Activity model of production operations management

528 Not all production requests and production responses cross the boundary to the Level 4
529 functions. While production operations may be driven by production schedules, there can be
530 production requests and production responses used internally within manufacturing
531 operations management to handle situations such as rework, local intermediates, or
532 consumable production.

533 Not all information flows within production operations management are depicted in Figure 6.
534 In any specific implementation, information from any activity may be required by any other
535 activity. Where activities in the production operations management model are defined in detail
536 in this clause, some additional information flows are identified. Not all data sources and data
537 sinks are identified in the detailed models.

6.3 Information exchange in production operations management

6.3.1 Equipment and process specific production rules

Equipment and process specific production rules shall be defined as the specific instructions sent to Level 2 based on the specific assigned tasks.

EXAMPLE	Programmes for CNC machines for a specific product type, PLC programmes that change on the basis of the process under control, or unit recipes where these are executed in Level 2 or Level 1 equipment.
---------	--

NOTE See IEC 61131-3 for examples of this type of data.