GRAFCET specification language for sequential function charts (IEC 60848:2013)

This document is a preview generated by EVS

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 60848:2013 sisaldab Euroopa standardi EN 60848:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 60848:2013 consists of the English text of the European standard EN 60848:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 07.06.2013.	Date of Availability of the European standard is 07.06.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

This document is a preview generated by EVS

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 29.020

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60848

June 2013

ICS 29.020

Supersedes EN 60848:2002

English version

GRAFCET specification language for sequential function charts
(IEC 60848:2013)

Langage de spécification GRAFCET pour diagrammes fonctionnels en séquence
(CEI 60848:2013)

GRAFCET, Spezifikationssprache für Funktionspläne der Ablaufsteuerung
(IEC 60848:2013)

This European Standard was approved by CENELEC on 2013-04-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

© 2013 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Ref. No. EN 60848:2013 E

This document is a preview generated by EVS

Foreword

The text of document 3/1135/FDIS, future edition 3 of IEC 60848, prepared by SC 3B “Documentation” of IEC/TC 3 “Information structures, documentation and graphical symbols" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60848:2013.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-01-03
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-04-03

This document supersedes EN 60848:2002.

EN 60848:2013 includes the following significant technical changes with respect to EN 60848:2002:

This edition constitutes a global technical revision with the extended definition of the concept of variables introducing: internal variable, input variable and output variable.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60848:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61131-3:2003	NOTE	Harmonised as EN 61131-3:2003 (not modified).

This document is a preview generated by EVS

CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
2 Normative references 8
3 Terms and definitions 8
3.1 Terms in the GRAFCET 8
3.2 Terms, general purpose 10
4 General principles 10
4.1 Context 10
4.2 GRAFCET, a behaviour specification language 11
4.3 GRAFCET, short presentation 12
4.3.1 General 12
4.3.2 Structure 12
4.3.3 Elements for interpretation 12
4.4 Syntax rule 13
4.5 Evolution rules 14
4.5.1 General 14
4.5.2 Initial situation 14
4.5.3 Clearing of a transition 14
4.5.4 Evolution of active steps 14
4.5.5 Simultaneous evolutions 14
4.5.6 Simultaneous activation and deactivation of a step 14
4.6 Input events 14
4.6.1 General 14
4.6.2 Input events specification 15
4.7 Internal events 15
4.7.1 General 15
4.7.2 Internal events described by the step activation 15
4.7.3 Internal events described by the deactivation of a step 15
4.7.4 Internal events described by the clearing of a transition 15
4.8 Output modes 16
4.8.1 General 16
4.8.2 Continuous mode (assignation on state) 16
4.8.3 Stored mode (allocation on event) 16
4.9 Application of the evolution rules 16
4.9.1 General 16
4.9.2 Non transient evolution 17
4.9.3 Transient evolution 17
4.9.4 Consequence of a transient evolution on the assignations 17
4.9.5 Consequence of a transient evolution on the allocations 18
4.10 Comparison between the two output modes 18
4.10.1 General 18
4.10.2 Determination of the value of the outputs 19
4.10.3 Analysis of the value of the outputs for a grafcet chart at a defined instant 19
4.10.4 Actions relative to transient evolution 19
4.10.5 Possible conflict on the value of the outputs 19

This document is a preview generated by EVS

5 Graphical representation of the elements 19
6 Graphical representation of sequential structures 32
6.1 General 32
6.2 Basic structures 32
6.2.1 Sequence 32
6.2.2 Cycle of a single sequence 32
6.2.3 Selection of sequences 33
6.2.4 Step skip 33
6.2.5 Backward sequence skip 34
6.2.6 Activation of parallel sequences 34
6.2.7 Synchronization of sequences 34
6.2.8 Synchronization and activation of parallel sequences 35
6.3 Particular structures 36
6.3.1 Starting of a sequence by a source step 36
6.3.2 End of a sequence by a pit step 36
6.3.3 Starting of a sequence with a source transition 37
6.3.4 End of a sequence by a pit transition 38
7 Structuring 38
7.1 General 38
7.2 Partition of a grafcet chart 38
7.2.1 Connected grafcet chart 38
7.2.2 Partial grafcet 39
7.3 Structuring using the forcing of a partial grafcet chart 40
7.4 Structuring using the enclosure 41
7.5 Structuring using the macro-steps 43
Annex A (informative) Example of the control of a press 45
Annex B (informative) Example: Automatic weighing-mixing 46
Annex C (informative) Relations between GRAFCET of IEC 60848 and the SFC of IEC 61131-3 52
Bibliography 54

Figure 1 – Graphical representation of the sequential part of a system 11
Figure 2 – Structure and interpretation elements used in a grafcet chart to describe the behaviour of a sequential part of the system defined by its input and output variables 13
Figure 3 – Example of grafcet with enclosures (including description) 43
Figure A.1 – Representation of the working press using a grafcet 45
Figure B.1 – Overview diagram of weighing-mixing system 46
Figure B.2 – Grafcet of a weighing-mixing involving only continuous actions 47
Figure B.3 – Grafcet of the weighing-mixing, involving continuous and stored actions 48
Figure B.4 – Grafcet of the weighing-mixing, divided into a global description using macro-steps and a description detailed by the macro-step expansions 49
Figure B.5 – Structuring with operating modes using forcing orders 50
Figure B.6 – Structuring with operating modes using enclosing step 51

Table 1 – Steps 20
Table 2 – Transitions 21
Table 3 – Directed links 22

This document is a preview generated by EVS

Table 4 – Associated transition-conditions 23
Table 5 – Continuous actions 27
Table 6 – Stored actions 30
Table 7 – Comments associated with elements of a grafcet chart 31
Table 8 – Partial grafcet chart 39
Table 9 – Forcing of a partial grafcet chart 40
Table 10 – Enclosing steps 41
Table 11 – Macro-steps 44

This document is a preview generated by EVS

INTRODUCTION

This International Standard is mainly aimed at people such as design engineers, maintenance engineers, etc., who need to specify the behaviour of a system, e.g. the control and command of an automation system, safety component, etc. This specification language should also serve as a communication means between designers and users of automated systems.

This document is a preview generated by EVS

GRAFCET SPECIFICATION LANGUAGE FOR SEQUENTIAL FUNCTION CHARTS

This document is a preview generated by EVS

1 Scope

This International Standard defines the GRAFCET[1] specification language for the functional description of the behaviour of the sequential part of a control system.

This standard specifies the symbols and rules for the graphical representation of this language, as well as for its interpretation.

This standard has been prepared for automated production systems of industrial applications. However, no particular area of application is excluded.

Methods of development of a specification that makes use of GRAFCET are beyond the scope of this standard. One method is for example the "SFC language" specified in IEC 61131-3, which defines a set of programming languages for programmable controllers.

NOTE See Annex C for further information on the relations between IEC 60848 and implementation languages such as the SFC of IEC 61131-3.

2 Normative references

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

(void)

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE The definitions of the terms in 3.1 apply only in the context of the GRAFCET specification language.

3.1 Terms in the GRAFCET

3.1.1
action
GRAFCET language element associated with a step, indicating an activity to be performed on output or internal variables

3.1.2
directed link
GRAFCET language element indicating the evolution paths between steps by connecting steps to transitions and transitions to steps

3.1.3
grafcet chart
function chart using the GRAFCET specification language

---

1 GRAFCET: GRAphe Fonctionnel de Commande Etape Transition.