

# INTERNATIONAL STANDARD



**Printed electronics –  
Part 403-1: Printability – Requirements for reproducibility – Basic patterns for  
evaluation of printing machine**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).



IEC 62899-403-1

Edition 1.0 2018-06

# INTERNATIONAL STANDARD



---

**Printed electronics –  
Part 403-1: Printability – Requirements for reproducibility – Basic patterns for  
evaluation of printing machine**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 31.180; 37.100.10

ISBN 978-2-8322-5806-4

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Abbreviated terms .....	8
5 General description of basic pattern .....	8
6 Basic pattern for evaluation .....	8
6.1 General.....	8
6.2 PMVT .....	9
6.3 PMHZ .....	9
6.4 PMAG.....	10
6.5 PMAR .....	11
6.6 PMCR.....	12
7 Register marks .....	13
7.1 General.....	13
7.2 Design of register mark.....	14
7.2.1 Square register mark .....	14
7.2.2 Circle register mark .....	14
7.2.3 Doughnut register mark .....	14
7.2.4 Triangle register mark.....	15
7.2.5 Diamond register mark.....	15
7.2.6 Cross register mark .....	15
7.2.7 Double cross register mark .....	16
7.2.8 X cross register mark.....	16
8 Requirements for evaluation .....	17
8.1 Evaluation items .....	17
8.2 Measurement methods and instruments .....	17
9 Evaluation pattern information .....	17
9.1 General.....	17
9.2 PMVT .....	17
9.3 PMHZ .....	17
9.4 PMAG.....	17
9.5 PMAR .....	18
9.6 PMCR.....	18
Annex A (informative) Examples of basic pattern layouts .....	19
A.1 Example 1.....	19
A.2 Example 2.....	19
Annex B (informative) Use case of basic pattern .....	20
B.1 General.....	20
B.2 Large variation of cylinder rotation speed with a normal plate .....	20
B.3 Out-of-roundness of cylinder with a normal plate.....	21
Annex C (informative) Other evaluation patterns .....	23
C.1 General.....	23
C.2 Example.....	23

Bibliography.....	24
Figure 1 – PMVT.....	9
Figure 2 – PMHZ.....	10
Figure 3 – PMAG .....	11
Figure 4 – PMAR .....	12
Figure 5 – PMCR .....	13
Figure 6 – Register marks.....	14
Figure 7 – Square register mark.....	14
Figure 8 – Circle register mark.....	14
Figure 9 – Doughnut register mark.....	15
Figure 10 – Triangle register mark .....	15
Figure 11 – Diamond register mark .....	15
Figure 12 – Cross register mark.....	16
Figure 13 – Double cross register mark.....	16
Figure 14 – X cross register mark .....	16
Figure A.1 – Example of basic pattern layout in a printing area and a margin area.....	19
Figure A.2 – Example of basic pattern layout in a margin area .....	19
Figure B.1 – Example of use case for PMVT .....	21
Figure B.2 – Example of use case for PMAR.....	22
Figure C.1 – Semi-arcs and circular doughnuts.....	23

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## PRINTED ELECTRONICS –

**Part 403-1: Printability – Requirements for reproducibility –  
Basic patterns for evaluation of printing machine**

## 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62899-403-1 has been prepared by IEC technical committee 119: Printed Electronics.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
119/214/FDIS	119/223/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

A list of all parts in the IEC 62899 series, published under the general title *Printed electronics*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

The IEC 62899-403 series contains basic patterns to evaluate the printability of a printing machine, plating, and applications for printed electronics. The printability is defined as both the quality of printed patterns and the reproducibility of printing designs as the result of the interaction of printing media, inks, and substrates. The documents from the IEC 62899-403 series provide commonly-utilized design patterns for evaluating printability. The quality of printed patterns is satisfied by accurate measuring, with a mechanical, physical, or optical apparatus, the patterns being two-dimensional or three-dimensional. On the other hand, the reproducibility of printing designs is achieved by estimating the reproducibility of replica.

The IEC 62899-402 series assumes a large role in the standardization of measuring methods for these printed patterns, and the IEC 62899-403 series has a key role in standardizing the estimation of the patterns' reproducibility.

In the business field, requests from industry to apply the printing technology to electronics manufacturing have been guarantees for both the quality and reproducibility that have helped facilitate international trade and enhanced user value in the field of printed electronics.