PD CLC/TS 62603-1:2014

BSI Standards Publication

Industrial process control systems — Guidelines for evaluating process control systems

Part 1: Specifications

bsi.

...making excellence a habit.™

National foreword

This Published Document is the UK implementation of CLC/TS 62603-1:2014. It supersedes PD IEC/TS 62603-1:2014, which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/65, Measurement and control, to Subcommittee GEL/65/2, Elements of systems.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2014

ISBN 978 0 580 88260 9

ICS 25.040.40

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 June 2014.

Amendments/corrigenda issued since publication

Date	Text affected
30 November 2014	This corrigendum renumbers PD IEC/TS 62603-1:2014 as PD CLC/TS 62603-1:2014. Annex ZA inserted

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CLC/TS 62603-1

September 2014

ICS 25.040.40

English Version

Industrial process control systems - Guideline for evaluating process control systems - Part 1: Specifications (IEC/TS 62603-1:2014)

Systèmes de commande des processus industriels - Lignes directrices pour l'évaluation des systèmes de commande de processus - Partie 1: Spécifications
(CEI/TS 62603-1:2014)

Industrielle Prozessleitsysteme - Richtlinie für die Beurteilung der Leistung von Prozessleitsystemen - Teil 1: Festlegungen
(IEC/TS 62603-1:2014)

This Technical Specification was approved by CENELEC on 2013-06-26.

CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

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.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. CLC/TS 62603-1:2014 E

Foreword

The text of document 65B/875/DTS, future edition 1 of IEC/TS 62603-1, prepared by SC 65B "Measurement and control devices" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as CLC/TS 62603-1:2014.

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 Technical Specification IEC/TS 62603-1:2014 was approved by CENELEC as a Technical Specification without any modification.

Annex ZA
(normative)
Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60038 (mod)	2009	IEC standard voltages	EN 60038	2011
IEC 60050	series	International Electrotechnical Vocabulary	-	series
IEC 60079-10	-	Electrical apparatus for explosive gas atmospheres -- Part 10: Classification of hazardous areas	EN 60079-10	-
IEC 60079-10-1	-	Explosive atmospheres -- Part 10-1: Classification of areas - Explosive gas atmospheres	EN 60079-10-1	-
IEC 60079-10-2	-	Explosive atmospheres -- Part 10-2: Classification of areas - Combustible dust atmospheres	EN 60079-10-2	-
IEC 60079-11	-	Electrical apparatus for explosive gas atmospheres -- Part 11: Intrinsic safety	EN 60079-11	-
IEC 60079-14	-	Explosive atmospheres -- Part 14: Electrical installations design, selection and erection	EN 60079-14	-
IEC 60300-3-4	-	Dependability management -- Part 3-4: Application guide - Guide to the specification of dependability requirements	EN 60300-3-4	-
IEC 60654-1	-	Industrial-process measurement and control equipment - Operating conditions -- Part 1: Climatic conditions	EN 60654-1	-
IEC 60654-2	-	Operating conditions for industrial-process measurement and control equipment -- Part 2: Power	EN 60654-2	-
IEC 60654-3	-	Operating conditions for industrial-process measurement and control equipment -- Part 3: Mechanical influences	EN 60654-3	-
IEC 60654-4	-	Operating conditions for industrial-process measurement and control equipment -- Part 4: Corrosive and erosive influences	EN 60654-4	-
IEC 60721-3-1	-	Classification of environmental conditions - - Part 3: Classification of groups of environmental parameters and their severities -- Section 1: Storage	EN 60721-3-1	-
IEC 60721-3-2	-	Classification of environmental conditions - - Part 3: Classification of groups of environmental parameters and their severities -- Section 2: Transportation	EN 60721-3-2	-
IEC 60721-3-3	-	Classification of environmental conditions - - Part 3: Classification of groups of environmental parameters and their severities -- Section 3: Stationary use at weatherprotected locations	EN 60721-3-3	-

IEC 60721-3-4	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities -- Section 4: Stationary use at non-weatherprotected locations	EN 60721-3-4	-
IEC 60848	-	GRAFCET specification language for sequential function charts	EN 60848	-
IEC 60870-4	-	Telecontrol equipment and systems -- Part 4: Performance requirements	HD 546.4 S1	-
IEC 61000-4-2	-	Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	-
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	-
IEC 61000-4-4	-	Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	-
IEC 61000-4-5	-	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	FprEN 61000-4-5	-
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	-
IEC 61000-4-8	-	Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8	-
IEC 61000-4-9	-	Electromagnetic compatibility (EMC) -- Part 4-9: Testing and measurement techniques - Pulse magnetic field immunity test	EN 61000-4-9	-
			+prA1	
			+AB	
IEC 61000-4-10	-	Electromagnetic compatibility (EMC) -- Part 4-10: Testing and measurement techniques - Damped oscillatory magnetic field immunity test	EN 61000-4-10	-
			+prA1	
			+AB	
IEC 61000-4-11	-	Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	-
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards - Emission standard for industrial environments	EN 61000-6-4	-
IEC 61025	-	Fault Tree Analysis (FTA)	EN 61025	-
IEC 61069-1	-	Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment -- Part 1: General considerations and methodology	EN 61069-1	-
			+EN 61069-1:1993/corrigendum Nov. 1993	1993

IEC 61069-4	-	Industrial process measurement and control - Evaluation of system properties for the purpose of system assessment -- Part 4: Assessment of system performance	EN 61069-4	-
IEC 61069-5	-	Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment -- Part 5: Assessment of system dependability	EN 61069-5	-
IEC 61069-6	-	Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment -- Part 6: Assessment of system operability	EN 61069-6	-
IEC 61069-7	-	Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment -- Part 7: Assessment of system safety	EN 61069-7	-
IEC 61069-8	-	Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment -- Part 8: Assessment of non-task-related system properties	EN 61069-8	-
IEC 61078	-	Analysis techniques for dependability - Reliability block diagram and Boolean methods	EN 61078	-
IEC 61131-2	-	Programmable controllers -- Part 2: Equipment requirements and tests	EN 61131-2	-
IEC 61131-3	-	Programmable controllers -- Part 3: Programming languages	EN 61131-3	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 61158	series	Industrial communication networks - Fieldbus specifications	FprEN 61158	series
IEC 61326-1	-	Electrical equipment for measurement, control and laboratory use - EMC requirements -- Part 1: General requirements	EN 61326-1	-
IEC 61508	series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	series
IEC 61511	series		EN 61511	series
IEC 61512	series	Batch control	EN 61512	series
IEC 61784	series	Industrial communication networks - Profiles	EN 61784	series
IEC 62305-1 (mod)	-	Protection against lightning -- Part 1: General principles	EN 62305-1	-
			+AA	201X
IEC 62347	-	Guidance on system dependability specifications	EN 62347	-
IEC 62381	-	Automation systems in the process industry - Factory acceptance test (FAT), site acceptance test (SAT) and site integration test (SIT)	EN 62381	-
IEC 62443-2-1	-	Industrial communication networks - Network and system security -- Part 2-1: Establishing an industrial automation and control system security program	-	-

IEC 62443-3-3	-	Industrial communication networks - Network and system security - Part 3-3: System security requirements and security levels	-	-
IEC/TR 62380	-	Reliability data handbook - Universal model for reliability prediction of electronics components, PCBs and equipment	-	-
ISO/IEC 14764	2006	Software Engineering - Software Life Cycle Processes - Maintenance	-	-
IEEE 802.11	-	IEEE Standard for Information technology- Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	-	-
ISA 18.1-1979(R1992)	-	annunciator sequences and specifications	-	-
ISA 18.2-2009	-	Management of alarm systems for the process industries	-	-
ISA 37.1-1975 (R1982)	-	Electrical Transducer Nomenclature & Terminology	-	-
ISA S88	-	Batch control	-	-

CONTENTS

FOREWORD 6
INTRODUCTION 8
1 Scope 9
2 Normative references 12
3 Symbols and abbreviated terms 15
4 Technical specifications of a PCS 16
4.1 System architecture 19
4.1.1 General 19
4.1.2 Technology and scope of the PCS 20
4.1.3 Basic architecture 20
4.1.4 Total number of I/Os 21
4.1.5 Number of tags 21
4.1.6 Number of control loops 22
4.1.7 Reference standards and marking 22
4.2 Installation environment 22
4.2.1 General 22
4.2.2 Climatic conditions 22
4.2.3 Power supply 24
4.2.4 EMC requirements 26
4.2.5 Mechanical vibrations 38
4.2.6 Corrosive and erosive influences 39
4.2.7 Lightning protection 41
4.2.8 Hazardous area 41
4.2.9 Earth connection 43
4.3 System characteristics 43
4.3.1 General 43
4.3.2 System scalability 43
4.3.3 System expandability 44
4.3.4 Integration of sub-systems 44
4.3.5 System configuration 44
4.3.6 Automatic documentation 45
4.3.7 Programming languages for control 45
4.3.8 PCS localisation 47
4.4 System dependability 48
4.4.1 General 48
4.4.2 Reliability 48
4.4.3 Availability 49
4.4.4 Functional redundancy criteria 50
4.4.5 Maintainability 51
4.4.6 Spare capacity of the system 51
4.4.7 Safety 52
4.5 Input/Output specifications 54
4.5.1 General 54
4.5.2 Conventional Input/Output 54
4.5.3 Input/Output from/to Smart Devices 55
4.5.4 Serial connection to Remote I/O 56
4.5.5 Hot-swap 56

4.5.6 Module diagnostic 56
4.5.7 Input validation 56
4.5.8 Read-back function 56
4.5.9 Forced output 56
4.5.10 Special inputs 56
4.5.11 Intrinsically safe I/Os 56
4.5.12 Monitoring functions 56
4.6 Software requirements 57
4.6.1 General 57
4.6.2 Cyber security 57
4.6.3 Software simulator 58
4.6.4 Remote supervisory functions 59
4.6.5 On-line documentation 59
4.7 Human Machine Interface (HMI) 59
4.7.1 General 59
4.7.2 Control room HMI hardware – architecture 59
4.7.3 Control room HMI hardware – operator stations 60
4.7.4 Control room HMI hardware – monitors 60
4.7.5 Control room HMI hardware – special displays 60
4.7.6 Control room HMI software 60
4.7.7 Requirements for Local Operator Interface 61
4.7.8 Alarm management 61
4.7.9 Events management 64
4.7.10 Historical archiving 65
4.7.11 Trend and statistics management 65
4.8 Communication requirements 66
4.8.1 General 66
4.8.2 Field equipment serial communication 67
4.8.3 Controller network 68
4.8.4 Control room network 68
4.8.5 External link 68
4.8.6 Communication interfaces 68
4.8.7 Communication with ERP system 69
4.8.8 Communication with Manufacturing Execution System (MES) 69
4.9 Required performances 70
4.9.1 General 70
4.9.2 Time performances of the PCS 70
4.9.3 Controller performances 71
4.9.4 HMI performances 72
4.9.5 Plant Asset Management 72
4.10 Life cycle support 73
4.10.1 General 73
4.10.2 Training of the personnel 73
4.10.3 Technical support for operation 74
4.10.4 Warranty 74
4.10.5 Software upgrade 74
4.10.6 References of the supplier 74
4.11 FAT specification 75
4.11.1 General 75

4.11.2 FAT for Hardware Supply 75
4.11.3 FAT for Application Software 76
Annex A (informative) Table for “System Architecture” 79
Annex B (informative) Table for “Installation Environment” 81
Annex C (informative) Table for “System characteristics” 86
Annex D (informative) Table for “System dependability” 88
Annex E (informative) Table for “Input/Output specification” 90
Annex F (informative) Table for “Software requirements” 93
Annex G (informative) Table for “Human Machine Interface (HMI)” 95
Annex H (informative) Table for “Communication requirements” 99
Annex I (informative) Table for “Required performances” 102
Annex J (informative) Table for “Life Cycle Support” 104
Annex K (informative) Table for “FAT specifications” 106

Figure 1 – Procedure for specifying and testing a PCS 10
Figure 2 – The process of PCS evaluation 11
Figure 3 – Content of the PCS technical specifications 17
Figure 4 – Example of a layout drawing 21
Figure 5 – The dependability concept 48
Figure 6 – Architectures of BPCS and ESD 53
Figure 7 – Communication networks in a PCS 67
Figure 8 – FAT levels of depth 77

Table 1 – Summary table for proposal evaluation 18
Table 2 – Example of proposal global vote calculation 19
Table 3 – Climatic condition parameters and severities for classes of location 23
Table 4 – Base immunity requirements 27
Table 5 – Immunity requirements for industrial applications 28
Table 6 – ED classed 29
Table 7 – Test levels for ED 29
Table 8 – Test levels for RF fields 30
Table 9 – Test levels for Electrical Fast Transient/Burst 31
Table 10 – Test levels for surge protection 33
Table 11 – Test levels for RF induced disturbances 34
Table 12 – Test levels for power frequency magnetic fields 35
Table 13 – Test levels for pulse magnetic field 36
Table 14 – Test levels for damped oscillatory magnetic field 36
Table 15 – Test levels for voltage dips 37
Table 16 – Test levels for short interruptions 37
Table 17 – Table for emission limits 38
Table 18 – Concentration of gas and vapour contaminants (in cm^3/m^3) 40
Table 19 – Aerosol contaminants 40
Table 20 – PFD and PFH related to SIL 54

Table 21 – Time resolution and discrimination capacity 71
Table 22 – Example of FAT Specification 78

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL PROCESS CONTROL SYSTEMS – GUIDELINE FOR EVALUATING PROCESS CONTROL SYSTEMS –

Part 1: Specifications

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.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62603-1, which is a technical specification, has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
65B/875/DTS	65B/905/RVC

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

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

A list of all parts in the IEC 62603 series, published under the general title *Industrial process control systems – Guideline for evaluating process control systems*, can be found on the IEC website.

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

- transformed into an International standard,
- 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

This International Technical Specification defines a procedure for verifying if a given Process Control System (PCS) satisfies the technical requirements specified by the end-user or by an engineering company for a specific application. The basic concept of this document is that “you can test what you have specified”. A testing procedure is meaningless if it does not include a procedure for specifying the technical requirements to be tested.

This Technical Specification was developed in the framework of the existing standards that define the general concepts of PCS design and testing, that is:

IEC 61069 Industrial process measurement and control – Evaluation of system properties for the purpose of system assessment – Parts 1,2,3,4,5,6,7,8

IEC 62381 Automation systems in the process industry – Factory acceptance test (FAT), site acceptance test (SAT), and site integration test (SIT)

The group of standards 61069 defines the general methodology, definitions, and procedures for assessing the functional characteristics of a PCS (Part 1 and 2) in terms of functionalities (Part 3), performances (Part 4), dependability (Part 5), operability (Part 6), safety (Part 7), and non-task-related properties (Part 8). IEC 62381 gives additional details about the general procedures for testing a PCS in factory, on site, and after the general integration of the complete system.

The IEC 62603 fully complies with these standards and gives a detailed guidance for specifying a PCS and for testing the specified functions. IEC 61069 and 62381 create a framework that is valid for any PCS as a system, while 62603, inside this framework, gives the users guidance for specifying the PCS he needs for carrying out the required functions.

INDUSTRIAL PROCESS CONTROL SYSTEMS – GUIDELINE FOR EVALUATING PROCESS CONTROL SYSTEMS –

Part 1: Specifications

1 Scope

This International Technical Specification describes methods and provides guidance for the evaluation of Process Control Systems (PCS) during the phase of selection between different proposals.

The methods of evaluation proposed in this technical specification are intended for use mainly by users, engineering companies, or independent test laboratories, to verify manufacturers' proposals during the tender (as described in IEC 62603-1) or the provided Process Control System during the FAT procedure.

The specification and test procedures specified in this technical specification apply to a large variety of automation systems, both based on conventional technology (e.g. 4 mA to 20 mA field devices) and based on Intelligent Field Devices (IFD) with serial communication of any kind. For this reason, the tests specified in this technical specification are not necessarily sufficient for automation systems specifically designed for special duties. In such cases, user and manufacturer should define additional tests for assessing specific functions or performances.

The procedure for specifying the PCS technical requirements, evaluating the different offers, and carrying out the tests on the chosen PCS differs from one company to another and from one project to another, but some common steps exist, as Figure 1 shows. The IEC 62603 considers this process divided into two steps: definition of the PCS technical requirements (in the scope of IEC 62603-1) and test of the chosen PCS.