IEC TR 63238-1

Edition 1.0 2019-07

TECHNICAL REPORT

colour inside

Process management for avionics – Electronics design – Part 1: Electrical signal properties, naming conventions and interface control document (ICD)

IEC TR 63238-1:2019-07(en)

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

Tel.: +41 22 919 02 11
info@iec.ch
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 corrigendum or an amendment might have been published.

IEC publications search - 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 It also gives information on projects, replaced and withdrawn publications.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
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - 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.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries 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
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 TR 63238-1

Edition 1.0 2019-07

TECHNICAL REPORT

colour inside

Process management for avionics – Electronics design – Part 1: Electrical signal properties, naming conventions and interface control document (ICD)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 03.100.50; 31.020; 49.060

ISBN 978-2-8322-7187-2

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

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROCESS MANAGEMENT FOR AVIONICS – ELECTRONICS DESIGN –

Part 1: Electrical signal properties, naming conventions and interface control document (ICD)

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. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 63238-1, which is a Technical Report, has been prepared by IEC technical committee 107: Process management for avionics.

The text of this Technical Report is based on the following documents:

Draft TR	Report on voting
107/351/DTR	107/356/RVDTR

Full information on the voting for the approval of this Technical Report 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 63238 series, published under the general title *Process management for avionics – Electronics design*, 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.

PROCESS MANAGEMENT FOR AVIONICS – ELECTRONICS DESIGN –

Part 1: Electrical signal properties, naming conventions and interface control document (ICD)

1 Scope

This part of IEC 63238 provides information and a template to create an interface control document (ICD) for any project which includes electronic assemblies, such as electronic circuit card assemblies (CCAs) or electronic devices, connected together. This document proposes electrical signal naming conventions when interfacing electronic assemblies, and an example containing seven signal naming conventions is included. This document supports original equipment manufacturers (OEMs) in the preparation and maintenance of their electronic assemblies interfaces and integration specifications to avoid misunderstanding of signals which can cause unnecessary design and/or integration errors, and testing complications.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
interface control document
ICD
document which defines for each electronic signal its electrical properties value and naming

Note 1 to entry Typical electronic signal examples include DC voltage, 5 V, 3,3 V.

Note 2 to entry Typical electrical property values include sine wave, rectangular wave.

3.1.2
electronic assembly
electrical or electronic device that is not subject to disassembly without destruction or impairment of design use

EXAMPLE Electronic circuit cards or modules, displays, storage devices, printers, laptop computer, electro/optical devices, etc.

[SOURCE: IEC TS 62239-2:2017, 3.1.20]

3.1.3
circuit card assembly
CCA
functional electronic product based on a printed circuit board (PCB) which supports and connects electronic or electrical components

Note 1 to entry: Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

Note 2 to entry A circuit card assembly can also be called printed circuit assembly (PCA) or printed circuit board assembly (PCBA).

3.1.4
electrical interface
item which allows exchanges and interactions outside of an electronic assembly

Note 1 to entry: A connector can be used to implement an electrical interface.

3.1.5
net-list
list of connections between two or several points

Note 1 to entry: The connection points are usually called "terminals" or "pins" in electronics; for example, a connector of an electric circuit card assembly (CCA) is composed of pins, also named outputs.

Note 2 to entry: An electrical connection is usually named “net” and allows the propagation of an electrical signal.

3.2 Abbreviated terms

AC	alternating current
CCA	circuit card assembly
DC	direct current
HF	high frequency
ICD	interface control document
ECMP	electronic component management plan
L	load
OEM	original equipment manufacturer
S	source

4 ICD description

4.1 General

The ICD contains, based on electrical signal or net naming conventions, the electrical parameters for connector pins or outputs of an electronic assembly (electronic CCA or electronic device for example).

Each pin can be connected to a source (S) or a load (L). Thus, the ICD defines sources and loads for each pin. Each source supplies voltage or current with a specified signal shape. Each load can be a resistor, inductor, capacitor, or impedance.

It is common for designers to use certain rules to name the net-lists, so that the signal type lies inside it. See Table 1 for examples.

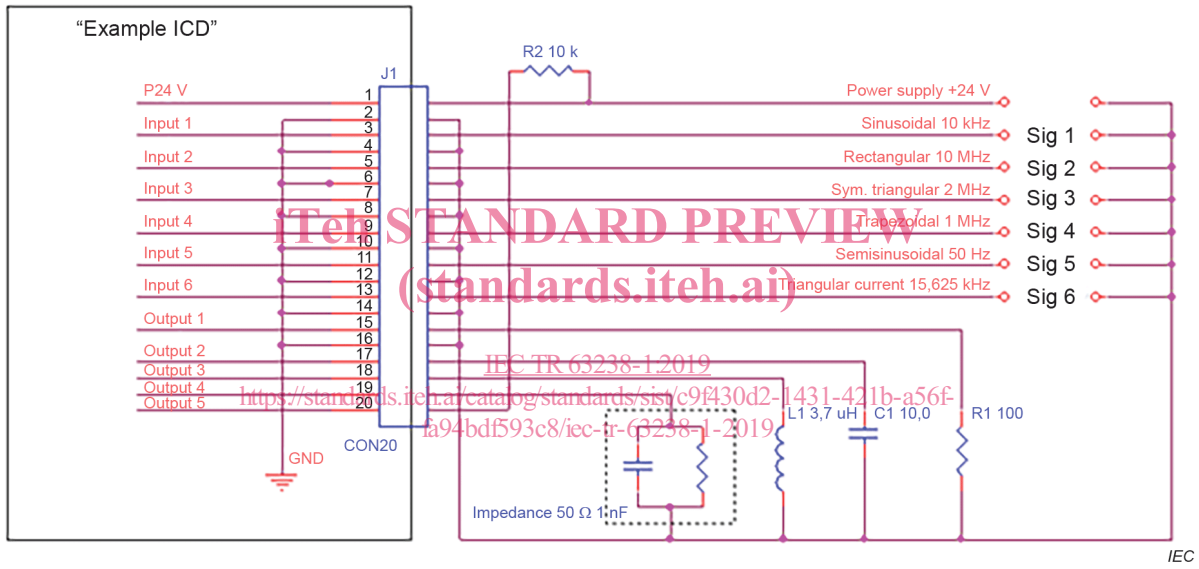
Table 1 – Examples for sources and loads

Sources	Power supply for a CCA – DC (battery) or AC; any input signal of a CCA (digital or analog).
Loads	Any output signal of a CCA (digital or analog); any module connected to a CCA that uses the CCA as a power source (for example speaker, motor, etc.)

Annex A includes an example of an ICD for the circuit described in Figure 1.

4.2 Electrical interface

For the purposes of this document and the ICD definition, Figure 1 proposes an example of a user's electronic schematic which includes an electrical interface with electrical signals.



Process management for avionics – Electronics design – Part 1: Electrical signal properties, naming conventions and interface control document (ICD)

Figure 1 – Example of an electronic schematic including an electrical interface

In Figure 1, "Sig1" to "Sig6" are signals which are defined in 4.3.3, respectively, at "Figure 2" to "Figure 7" level, and loads such as inductance "L1", capacitor "C1" and resistor "R1" are presented in Table 4.

4.3 ICD specification format

4.3.1 General

The ICD specification is typically described as explained in 4.3.2

An example of a typical user's ICD specification is shown in Table A.1.

4.3.2 Format of the ICD specification

The ICD specification tables have the typical header shown in Table 2:

Table 2 – Typical ICD specification table header

#	Param	Syntax	Units	Default	Comments

where:

- # is the order of the parameters. The parameters should be extracted in the same order that they are written, starting from the first row. This table should be used as a list of instructions.
- Param: the name of the ICD parameter that needs to be extracted;
- Syntax: this is the syntax of the field and can be one of the following:

  L – selected from a drop-down list;

  F – floating point number (for example "0,3" or "56"). Orders of magnitude can be used when entering "F" fields: p (pico), n (nano), u (micro), m (milli), k (kilo), M (mega), G (giga),T (terra) (for example "22 m" is equivalent to "0,022");

  S – string (text), set of any characters (for example "A1" or "1" or "B");
- Units: the default units of this parameter (for parameters of type F). The number that is entered in this field is interpreted in these units;
- Default: indicates if this field has a default value. A user can use the default value by entering "-" in the library:

  "D" means that if the parameter is entered as "-", this parameter will not be used for the calculation;

  a value written in this column indicates that if the parameter is entered as "-", that value is used;

  blank – no default value for this parameter, the field in mandatory;
- Comments: this column contains an explanation of the field.

4.3.3 ICD content

The typical content of an ICD file is as shown in Table 3 based on the circuit shown in Figure 1.

Table 3 – Typical ICD file

	Parameter	Syntax	Units	Default	Comment
1	Description	S			Description
	Connector type				
2	RefDes of connector	L			Reference designator of the connector. Use the drop-down menu.
3	Pin number	L			List of pins of the connector in the drop-down menu. In addition to the pins one can select “common load/source”. One should not change the pin numbers in a normal usage, because the program already populates all the connector pins into the ICD table. The usage of “common load/source” is needed when a single load or source is connected to all the pins having the same “NET-IN/NET-OUT” in a connector so that the current is divided between all the common pins. If a source is connected to many pins in a connector, all the pins can be defined with the source, or alternatively there can be one line with a “common load/source” and the rest of the lines can stay unconnected.
4	NET-IN/NET-OUT	L			Select the needed net name in the pop-up menu. This is the name of the net that is connected to the selected pin.

	Parameter	Syntax	Units	Default	Comment
5	Reference_NET	L			Select the needed net name in the drop-down menu. The source/load is connected between the nets “NET-IN/NET-OUT” and “Reference_NET”. Ground pins do not have reference nets usually, they can be omitted from the ICD or marked as “not connected”.
6	Signal type	L			Select from "-" (the connector pin is connected, the rest of the parameters need to be set) / "not connected" (the connector pin is not connected), or select signals defined in the “sources and loads definition”.
7	Polarity	L			Polarity of the signal offset. It indicates the sign of “Voffset”. Select from +/- (positive/negative). The polarity indicates the polarity of the “NET-IN/NET-OUT” (relative to the “Reference_NET”.
8	Source or load type	L1			See Table 4. Select the source or load type. The source/load is inserted between the nets “NET-IN/NET-OUT” and “Reference_NET”.
9	Shape of signal	L2			See Table 5. Select the needed shape of the signal in the drop-down menu. If a shape is selected, a graph is plotted below to specify the signal parameters. This is used only for the following "Source or load type" values: "Voltage", "Current" and "HF power".
10	Voffset [V]	F	[V]	0	Voltage offset of the signal. See for example Figure 5.
11	V~peak-to-peak [V]	F	[V]		Peak-to-peak voltage of the signal. See for example Figure 5.
12	Ioffset [A]	F	[A]	0	Current offset of the signal. See for example Figure 5.
13	I~peak-to-peak [A]	F	[A]		Peak-to-peak current value of the signal. See for example Figure 5.
14	P [dbm]	F	[dBm]		Input power. As sinusoidal voltage with Offset = 0 and A_0 = √(20 x ((P - 30)/10) x R_{load}). See for example Figure 2.
15	Freq [MHz]	F	[MHz]		Frequency of the signal. See for example Figure 5.
16	Pulse width: T0 [µs]	F	[µs]	1/(2 x Freq [MHz])	Pulse width of the signal. See for example Figure 5.
17	Initial delay time [µS]	F	[µs]	0	Initial delay of pulse referenced to the beginning of a signal period. See for example Figure 5.
18	Front width: T1 [µs]	F	[µs]	0	Front (rise) width of the pulse. See for example Figure 5.
19	R [Ohm]	F	[Ohm]		Resistive value of the load. Use only for "Source or load type": "Resistor" and "Impedance"; see “L1” at Table 4 level.
20	L [uH]	F	[uH]		Inductive value of the load. Use only for "Source or load type": "Inductive" and "Impedance"; see “L1” at Table 4 level.
21	C [uF]	F	[uF]		Capacitive value of the load. Use only for "Source or load type": "Capacitor" and "Impedance"; see “L1” at Table 4 level.

The source or load type “L1” is described in Table 4 and the shape of signal “L2” in Table 5.