BS IEC 60747-19-1:2019

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Semiconductor devices

Part 19-1: Smart sensors – Control scheme of smart sensors

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The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

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

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Published by BSI Standards Limited 2019

ISBN 978 0 539 01704 5

ICS 31.080; 31.080.01; 31.080.99

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2019.

Amendments/corrigenda issued since publication

Date	Text affected

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Full document details: BS IEC 60747-19-1:2019

IEC 60747-19-1

Edition 1.0 2019-11

INTERNATIONAL STANDARD

Semiconductor devices –
Part 19-1: Smart sensors – Control scheme of smart sensors

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.080.99

ISBN 978-2-8322-7606-8

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CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
4 Construction of smart sensor's control scheme 8
4.1 General 8
4.2 Assignment of the smart sensor's registers in the control scheme 8
4.3 Operation procedure of control scheme 9
4.4 Physical connection between smart sensor and terminal module 11
4.5 Optional configuration 12
4.6 Optional function 14
Annex A (informative) Practical example of smart sensor's control scheme 15
Annex B (informative) Smart sensor with multiple sensors – Practical example 18

Figure 1 – Block diagram of hardware configuration regarding the smart sensor's control scheme from the terminal module in the smart sensing unit 10
Figure 2 – Example of block diagram of connection lines between smart sensor and terminal module 12
Figure 3 – Example of block diagram of connection lines with optional interrupt input and output lines between smart sensor and terminal module 13
Figure A.1 – Block diagram of hardware configuration of smart accelerometer as an example of smart sensors 15
Figure B.1 – Block diagram of hardware configuration in the case of a smart sensor with multiple sensors 19
Figure B.2 – Block diagram of hardware configuration of a smart sensor with a temperature sensor and a humidity sensor as an example of a smart sensor with multiple sensors 20

Table 1 – Assignment of the smart sensor's registers in the smart sensor's control scheme 11
Table 2 – Example of connection lines between smart sensor and terminal module 12
Table 3 – Recommended optional configuration of connection lines between the smart sensor and terminal module 13
Table 4 – Recommended optional function of smart sensor's control scheme 14
Table A.1 – Practical example of assignment of smart sensor's registers in smart sensor's control scheme 16
Table B.1 – Practical example of assignment of registers of the smart sensor with a temperature sensor and a humidity sensor 21

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Full document details: BS IEC 60747-19-1:2019

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SEMICONDUCTOR DEVICES –

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International Standard IEC 60747 has been prepared by subcommittee SC47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

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

CDV	Report on voting
47E/642/CDV	47E/668/RVC

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.

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INTRODUCTION

The development of smart sensors which integrate analog-to-digital conversion and digital processing of the captured sensor signal(s) is in progress. A smart sensing unit, which comprises a smart sensor; a terminal module, to control the smart sensor and perform wireless communication; and a power supply for the smart sensor and the terminal module, can send the output data of the smart sensor wirelessly to the outside. Here, the power supply can be a plug-in power supply, a battery, an energy harvester, or their combination. A smart sensing network where a large number of smart sensing units are located in manufacturing factories, offices, and stores has been examined. With this network, environmental monitoring, sensing of operational situations of manufacturing equipment and sensing of other various events contribute to the realization of the following outcomes by analyzing the collected sensing data. Namely, energy saving, improvement in factory productivity such as operation rate, shortening of production lead time, preventive equipment maintenance, and product quality improvement can be achieved.

However, considering the three components of the smart sensing unit, namely, the smart sensor, terminal module, and power supply, standardization regarding control schemes to connect the components to each other and regarding the indication of specifications of the components has not been sufficiently established yet. This issue leads to the present situation, where the development of each component in the smart sensing unit has not proceeded efficiently.

The IEC 60747-19 series aims to address this issue. The IEC 60747-19 series comprises two parts and its structure is currently conceived as follows:

Part 19-1: Smart sensors – Control scheme of smart sensors

Part 19-2[1]: Smart sensors – Indication of specifications of smart sensors and power supplies to drive smart sensors

Part 19-1 specifies a control scheme of the smart sensor from the terminal module in the smart sensing unit. Generally, the manufacturers of sensors have incorporated into the sensors various parameters and conditions for sensing operations to fulfil various requests and needs of the users. Therefore, it has been quite difficult for the users to understand how to set the parameters and conditions adequately and master the use of sensors. This issue has been a considerable obstacle in designing the smart sensing unit and smart sensing system. The main objective of this part is to solve this obstacle for future expansion of the smart sensors and smart sensing network systems.

Part 19-2 aims to provide guidelines to specify information that is required when the smart sensing unit is newly designed. When the smart sensing unit is newly designed especially to use an autonomous power supply, the designers have to appropriately arrange the selection of the components of the unit and their usage conditions to satisfy that the power capability of the power supply successfully exceeds the total power budget to be consumed in the unit as a whole. First, information about the detailed power consumption characteristics of the smart sensors is indispensable for this achievement. Namely, information about time-axis power profiles which is not necessarily described in the datasheet of sensors is essential when intermittent sensing operations are often adopted and a careful lower power design including time-axis characteristics to allow adoption of an autonomous power supply is needed in IoT (Internet of Things) applications. Therefore, Part 19-2 discusses an indication of smart sensors' electrical characteristics of time-axis power profiles. Second, information about total power capability of the power supply to drive the unit and the smart sensor(s) is essential. This power supply as a module comprises (a) primary battery(batteries), and(or) (a) secondary battery(batteries), and(or) (an) energy harvester(s), or their combinations.

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Considering the not-so-simple configuration including power management circuits as a power supply, Part 19-2 also discusses the indication of specifications of the power supply. With the establishment of appropriate indications, the three components of the smart sensing unit can be easily selected and combined from a point of view of a low-power design, when the smart sensing unit is newly designed and the overall design of the smart sensing unit itself can be facilitated.

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