

INTERNATIONAL STANDARD

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





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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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SEMICONDUCTOR DEVICES –

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

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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.

A list of all parts in the IEC 60747 series, published under the general title *Semiconductor devices*, 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
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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: 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.

¹ Under development.

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.

SEMICONDUCTOR DEVICES –

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

1 Scope

This part of IEC 60747 specifies the control scheme of a sensor which is a device or a module which achieves a sensing function, data processing function and data output function, by employing a digital processing unit and a means of bidirectional communication between the sensor and an external terminal module.

2 Normative references

There are no normative references in this document.

3 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

smart sensor

sensor device or sensor module which integrates analog-to-digital conversion and digital processing of the captured sensor signal(s)

3.2

smart sensing unit

unit comprising a smart sensor, a terminal module, and a power supply, which can send output data of the smart sensor to the outside

3.3

terminal module

integrated circuit device or module which is a component of a smart sensing unit, and which controls the smart sensor, receives the output data of the smart sensor, and sends the output data to the outside

3.4

digital processing circuit

integrated circuit device or a module performing digital arithmetic and(or) logic operations on digital data

3.5

register

local storage area on a digital processing circuit, which holds digital data that is being processed by the digital processing circuit