

# TECHNICAL SPECIFICATION

---

**Pilot function through a control pilot circuit using PWM (pulse width modulation) and a control pilot wire**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE



---

ICS 43.120

ISBN 978-2-8322-1281-3

**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 Control pilot circuit.....	7
3.1 General.....	7
3.2 Typical pilot electric equivalent circuit .....	8
3.3 Simplified pilot electric equivalent circuit.....	9
3.4 Other requirements .....	9
4 Requirements for parameters .....	10
5 Test procedures for immunity of EV supply equipment to wide tolerances on the pilot wire and the presence of high frequency data signals on the pilot wire.....	25
5.1 General.....	25
5.2 Constructional requirements of the EV simulator.....	25
5.3 Test procedure.....	25
5.4 Test list – Oscillator frequency and generator voltage test .....	26
5.5 Duty cycle test .....	27
5.6 Pulse wave shape test .....	27
5.7 Sequences diagnostic – normal charge cycle .....	27
5.8 Open earth wire test.....	29
5.9 Test of short circuit values of the voltage.....	29
5.10 Example of a test simulator of the vehicle (informative).....	29
5.11 Optional hysteresis test.....	31
5.11.1 General .....	31
5.11.2 Test sequence for hysteresis between states B and C .....	32
5.11.3 Test sequence for hysteresis between states C-E, D-E .....	32
5.11.4 Test sequence for hysteresis between states C-D.....	32
Figure 1 – Typical control pilot electric equivalent circuit.....	8
Figure 2 – Simplified control pilot electric equivalent circuit .....	9
Figure 3 – State machine diagram for typical control pilot .....	15
Figure 4 – State machine diagram for simplified control pilot.....	15
Figure 5 – Normal operation cycle.....	27
Figure 6 – Simplified control pilot cycle .....	28
Figure 7 – Optional charge cycle test.....	29
Figure 8 – Example of a test circuit (EV simulator).....	30
Table 1 – Maximum allowable carrier signal voltages on pilot wire .....	10
Table 2 – Control pilot circuit parameters (see Figures 1 and 2).....	10
Table 3 – Vehicle control pilot circuit values and parameters .....	11
Table 4 – System states detected by the EV supply equipment.....	12
Table 5 – State behavior .....	14
Table 6 – List of sequences .....	16

Table 7 – Pilot duty cycle provided by EV supply equipment .....	24
Table 8 – Maximum current to be drawn by vehicle .....	24
Table 9 – Test resistance values .....	25
Table 10 – Parameters of control pilot voltages .....	26
Table 11 – Test parameters of control pilot signals at the measure point according to Figure 8 .....	27
Table 12 – Normal charge cycle test .....	28
Table 13 – Position of switches .....	31
Table 14 – Initial settings of the potentiometer at the beginning of each test .....	31

Withdrawn

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### PILOT FUNCTION THROUGH A CONTROL PILOT CIRCUIT USING PWM (PULSE WIDTH MODULATION) AND A CONTROL PILOT WIRE

#### 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 62763, which is a technical specification, has been prepared by IEC technical committee 69: Electric road vehicles and electric industrial trucks.

Edition 2 of IEC 61851-1, published in 2010 is presently undergoing revision. This Technical Specification will be valid until the publication of Edition 3 of IEC 61851-1.

In this document, the numbers in square brackets at the beginning of a sentence, help to identify requirements.

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

Enquiry draft	Report on voting
69/242/DTS	69/254/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.

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.

Withdrawn

## INTRODUCTION

The pilot wire function described in this document has been designed as a control mechanism for the supply of electrical energy to electric vehicles, principally for the charging of the traction batteries of the vehicle. It concerns all charging systems that ensure the pilot function with a pilot wire circuit with PWM for mode 2, mode 3 and mode 4 charging as described in the IEC 61851 series. As indicated in the foreword, Edition 2 of IEC 61851-1, published in 2010 is presently undergoing revision. This Technical Specification will be valid until the publication of Edition 3 of IEC 61851-1.

Withdrawn

## PILOT FUNCTION THROUGH A CONTROL PILOT CIRCUIT USING PWM MODULATION AND A CONTROL PILOT WIRE

### 1 Scope

This Technical Specification describes the pilot wire function designed as a control mechanism for the supply of electrical energy to electric vehicles, principally for the charging of the traction batteries of the vehicle. It concerns all charging systems that ensure the pilot function with a pilot wire circuit with PWM for mode 2, mode 3 and mode 4 charging as described in the IEC 61851 series.

This document describes the functions and sequencing of events for this circuit based on the recommended typical implementation circuit parameters. The parameters indicated also ensure the interoperability of control pilot wire systems designed according to SAE J1772.

This document is not applicable to vehicles using pilot functions that are not based on a PWM signal and a pilot wire.

NOTE 1 In the context of this document the words "EV supply equipment" designate any one of the following: the AC EV supply equipment in mode 3, the in cable control box in mode 2 and/or the DC EV supply equipment in mode 4.

NOTE 2 The control pilot wire is a supplementary conductor, in addition to the power lines linking the vehicle to EV supply equipment via the vehicle coupler.

### 2 Normative references

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.

IEC 61851-1:2010, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-23<sup>1</sup>, *Electric vehicle conductive charging system – Part 23: D.C. electric vehicle charging station*

ISO/IEC 15118<sup>1</sup> (all parts), *Road vehicles – Vehicle to grid communication interface*

---

<sup>1</sup> To be published.