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TECHNICAL SPECIFICATION

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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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- withdrawn,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.

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.

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[1], *Electric vehicle conductive charging system – Part 23: D.C. electric vehicle charging station*

ISO/IEC 15118[1] (all parts), *Road vehicles – Vehicle to grid communication interface*

3 Control pilot circuit

3.1 General

Two types of pilot functions are possible: simplified and typical.

- Simplified pilot function fulfils the basic requirements that are described in 6.4.1 of IEC 61851-1:2010.
- Typical pilot function fulfils the basic requirements that are described in 6.4.1 of IEC 61851-1:2010 and also allows the selection of charging rate as described in 6.4.2. of IEC 61851-1:2010.

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1 To be published.

Additional requirements for implementation in mode 4 system are described in IEC 61851-23.

Figures 1 and 2 show examples of the principle of operation of the control pilot circuit.

The EV (electric vehicle) supply equipment may cut off the power after at least 5 s in case the EV will use more current than the duty cycle indicates.

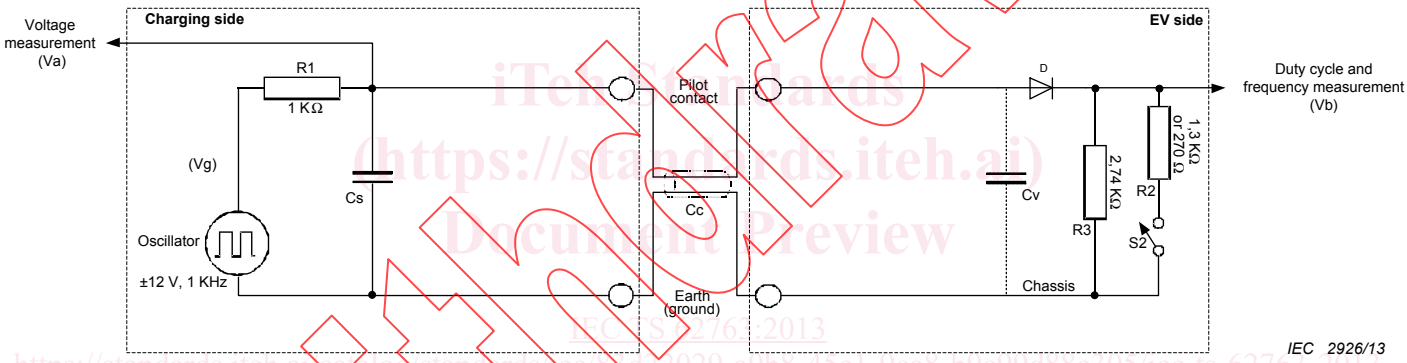
It is recommended to de-energize the system, if the measured current exceeds the current signalled by duty cycle with a tolerance of 10 %.

[RA03-010**]** The circuit parameters shall be designed in accordance with Table 2, Table 3 and 3.4.

[RA03-020**]** The functionality of the pilot line shall follow the requirements defined in Table 2, Table 6, Table 7, and Table 8.

This information may be provided to the pilot function controller by an energy management system.

3.2 Typical pilot electric equivalent circuit



NOTE Inductive components can be included, but are not shown here.

Figure 1 – Typical control pilot electric equivalent circuit

The EV supply equipment communicates by setting the duty cycle of a PWM signal or a steady-state DC voltage of the pilot signal, (Table 7 and Table 8).

The EV supply equipment may change the duty cycle of the PWM at any time.

The EV communicates by loading the positive half-wave of the pilot signal.

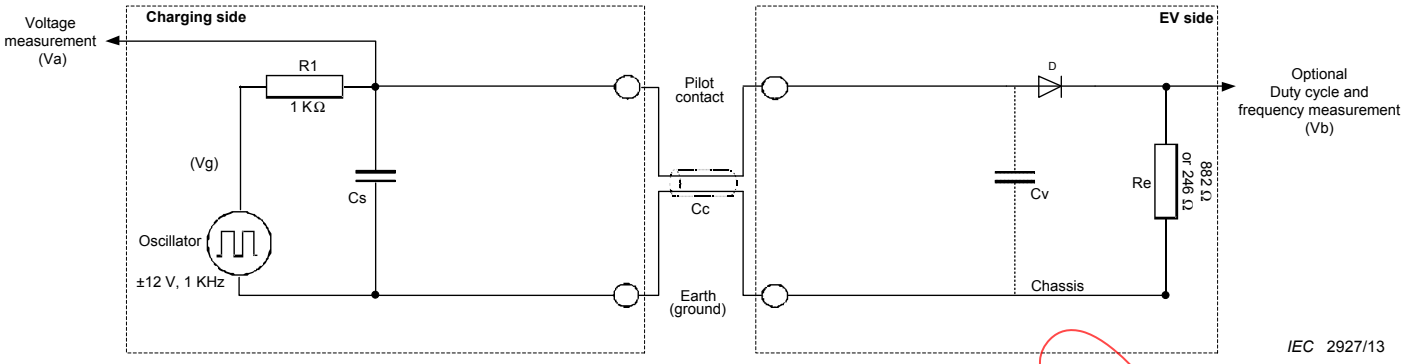
For further information see also Table 3 and Table 4.

[RA03-030] Typical control pilot (Figure 1) shall support state B.

[RA03-040] Using a typical control pilot, the EV shall follow the PWM, Table 8.

NOTE The designations of R2 and R3 have been exchanged with respect to IEC 61851-1:2010..

3.3 Simplified pilot electric equivalent circuit



NOTE Inductive components can be included, but are not shown here.

Figure 2 – Simplified control pilot electric equivalent circuit

[RA03-050] EVs, designed with simplified circuit, shall be limited to single phase charging and not exceeding 10 A.

[RA03-060] For a system using the simplified control pilot, the EV supply equipment side shall modulate the PWM in the same manner as done for a system using a typical control pilot.

The simplified control pilot circuit gives an equivalent result to the circuit shown in Figure 1 as if the switch S2 is closed.

[RA03-070] In a simplified pilot circuit, state B does not exist.

[RA03-080] An EV using the simplified control pilot circuit, may measure the duty cycle.

[RA03-090] The EV supply equipment may cut off the power after at least 5 s in case the EV will use more current than the duty cycle indicates.

It is not recommended to use simplified pilot for new design.

For the EV in new design, it is recommended to follow the PWM.

NOTE In some countries simplified pilot is not allowed: US.

3.4 Other requirements

[RA03-100] Additional components required for signal coupling shall not cause the control pilot duty cycle signal, to get deformed beyond the limits defined in Table 7 and tested as in 5.5.

[RA03-110] Any impedance inserted in series with the pilot wire, at the EV supply equipment shall not have a total inductance of more than 1 mH (Lse).

[RA03-120] Any impedance inserted in series with the pilot wire, at the EV shall not have a total inductance of more than 1 mH (Lsv).

[RA03-130] Any inductive impedance inserted in series with the pilot wire shall be resistively damped to avoid high frequency oscillation of the PWM signal.