
**Tractors and machinery for
agriculture and forestry — Electrical
high-power interface 700 V DC / 480 V
AC —**

**Part 1:
General**

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ISO 23316-1:2022

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

A list of all parts in the ISO 23316 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

Due to the requirements of modern agriculture, the precise control of implement functions is a key issue in agricultural technology. The required precision is difficult to achieve with mechanical or hydraulic devices; it is more efficient to provide control with electric and electronic means, i.e. electric power and ISOBUS. The use of electric power allows implement manufacturers to offer farmers improved implements that provide a higher degree of automation and navigation, resulting in greater precision, better power distribution, and better controllability.

The purpose of the ISO 23316 series is to provide a design and application standard covering implementation of electrical high-power interfaces operating at up to 700 V DC/480 V AC for manufacturers of agricultural machinery.

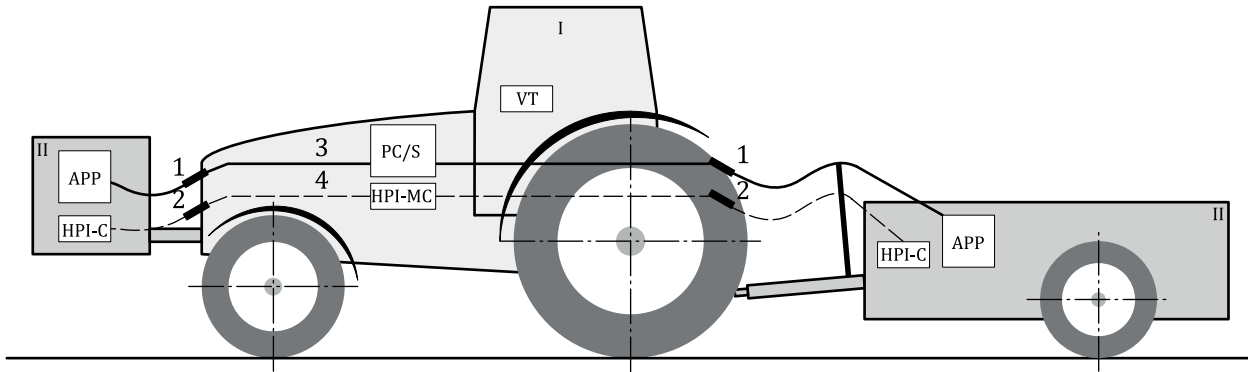
The ISO 23316 series specifies the physical and logical interface requirements that provide interoperability and cross compatibility for systems and equipment.

Conformance to the ISO23316 series means all applicable requirements from ISO 23316-1 to ISO 23316-7 are met.

It is permitted for partial systems or components to conform to the ISO 23316 series by applying all applicable requirements, for example, for the plug, receptacle or inverters, on a tractor or implement.

NOTE If a DC-mode only HPI is provided, it is not necessary to conform with ISO 23316-4 which describes AC-mode, as it is not applicable. If an AC-mode only HPI is provided, it is not necessary to conform with ISO 23316-5 which describes DC-mode, as it is not applicable.

The ISO 23316 series defines an interface between a power providing device (supply system) and a power consuming device (consumer system), used within an automated electrified system in the agricultural industry. This series deals with electrical, mechanical and bus communication objectives and is used in conjunction with the relevant part of ISO 11783, which defines the ISOBUS. [Figure 1](#) portrays the elements of typical equipment that involve the high-power interface.



Key

- | | | | |
|---------|----------------------|--------|---------------------------------------|
| 1 | high-power interface | APP | application |
| 2 | ISOBUS connector | PC/S | power converter / switch |
| 3 | power lines | HPI-C | high-power interface - control |
| 4 | ISOBUS | HPI-MC | high-power interface - master control |
| — | power connection | VT | virtual terminal (user interface) |
| - - - - | signal connection | | |
| I | supply system | | |
| II | consumer system | | |

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Figure 1 — Typical elements of system incorporating a high-power interface

0.2 Patent

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from the patent database available at www.iso.org/patents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. ISO shall not be held responsible for identifying any or all such patent rights.

Tractors and machinery for agriculture and forestry — Electrical high-power interface 700 V DC / 480 V AC —

Part 1: General

1 Scope

This document describes the general purpose and structure of the ISO 23316 series and common elements of the ISO 23316 series.

The following topics are not within the scope of this document:

- service, maintenance, and related diagnostics;
- functional safety;
- control strategies for high-power supplies and loads;
- application-specific strategies and operational modes;
- component design;
- energy storage systems, e. g. supercapacitors or batteries;
- multiple electrical power supplies to a common DC-link.

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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 terminology databases for use in standardization at the following addresses:

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

3.1

alternating current

AC

alternating electric quantities such as voltage or current, to devices operated with these, or to quantities associated with these devices

[SOURCE: IEC 60050-151:2001, 151-15-01]

3.2

application

APP

system of load and optional load logical box located on a consumer system

3.3
controller area network
CAN

protocol originally defined for use as a communication network for control application in vehicles

[SOURCE: ISO 17356-1:2005, 2.17]

3.4
connector

receptacle or plug assembly containing socket, plug, pins or contact sockets

3.5
consumer system
CS

physical unit consisting of one or more applications and its control instances (e.g. implement) to be connected via HPI to a supply system

3.6
electric energy converter
CNV

device for changing one or more characteristics associated with electric energy

Note 1 to entry: Characteristics associated with energy are for example voltage, number of phases and frequency including zero frequency.

[SOURCE: IEC 60050-151-13-36]

3.7
direct current
DC

time-independent electric quantities such as voltage or current, to devices operated with direct voltage and current, or to quantities associated with these devices

[SOURCE: IEC 60050-151:2001, 151-15]

3.8
DC link
DCLNK

DC connection between devices (e.g. power converter) to distribute electric power

Note 1 to entry: Refers to tractors, implements, or both.

3.9
electronic control unit
ECU

electronic item consisting of a combination of basic parts, subassemblies and assemblies packaged together as a physically independent entity (e.g. ISOBUS job controller)

3.10
electrical high-power interface
HPI

logical and power gateway between a power providing supply system and a power consumer system used within an electrified system in the agricultural industry

3.11
electromagnetic compatibility
EMC

ability of equipment or a system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[SOURCE: IEC 60050-161-01-07/-01-06]

3.12**fieldbus**

industrial computer network protocol used for real-time distributed control (e.g. EtherCAT™¹⁾ using Ethernet – combined with optimized communication functions between a main fieldbus controller and a segment of fieldbus sub devices)

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.1593]

3.13**HPI control****HPI-C**

control instance of a consumer system, unambiguously assigned to one HPI connected to a PS of the VC-B2 network providing communication client function to a supply system and, optionally, communication server function, if it is possible to connect another consumer system

3.14**HPI master control****HPI-MC**

control instance, assigned to at least one but not more than 15 HPIs of the VC-B2 network of one supply system, providing communication server functionality for the communication to the related HPIs, managing the interlock loop, and providing the network management functions (e.g. topology determination) to all consumer systems connected to the supply system

3.15**interlock loop****IL**

means to detect the status of each socket/plug-combination

3.16**inverter/switch control****PC/SC**

control for AC mode, a power converter; for DC mode, a switch such as a contactor or solid-state switch, typically an integral part of the PC/SC

3.17**inverter****INV**

electric energy converter that changes direct electric current to single-phase or polyphase *alternating currents* (3.1)

[SOURCE: IEC 60050-151-13-46]

3.18**ISOBUS**

CAN bus system according to ISO 11783

Note 1 to entry: ISOBUS is a SAE J1939 based CAN communication bus system, usually used in agriculture and forestry between, such as a tractor, as power supply and at least one implement as load. The communication bus system consists at least of one tractor ECU and one implement ECU. One tractor ECU shall fulfil the functions of a master controller. The tractor ECU (TECU) is a gateway between the ISOBUS and tractor internal bus(es) including the attached controls; thus it exchanges communication objects between both buses, but fulfils also further functions. On-board the implement at least one ECU (also known as Job Controller or Task Controller) interconnects the ISOBUS with the implement application specific controls, optionally via implement internal bus(es); thus, it exchanges communication objects between both buses, but fulfils also further functions.

Note 2 to entry: For details, see the ISO 11783 series.

1) EtherCAT™ is a Tradename of Beckhoff, used as an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

3.19
load logical box
LLB

collects and transfers sensor data and specific parameters from the load to the PC/S via fieldbus

Note 1 to entry: electrical device connected to the fieldbus as slave controller and optionally topic electrical load internal communication bus; intended use as memory of load specific data (e.g. electric machine specific data) and load sensor electronics (e.g. for processing of temperature, speed, or position sensor signal)

3.20
load

electrical load that is resistive, capacitive or inductive or any combination

Note 1 to entry: Electrical loads are not restricted to drives, either in AC or DC mode

3.21
maximum working voltage

highest value of AC voltage (rms) or of DC voltage that can occur under any normal operating conditions according to the manufacturer's specifications, disregarding transients and ripple

3.22
overvoltage
OV

voltage higher than the rated operating voltage range

3.23
plug

connector attached to the consumer system cable

Note 1 to entry: Within this standard the plug contains the male power pins

3.24
power converter
PC

device that converts electric energy from DC to AC or from AC to DC

[SOURCE: ISO 21782-1:2019, 3.18]

3.25
power converter/switch
PC/S

Device controlling the power outlet

Note 1 to entry: for AC mode, a power converter; for DC mode, a switch such as a contactor or solid-state switch

3.26
power supply
power supply system
PS

provision of electric energy from a source

[SOURCE: IEC 60050-151]

Note 1 to entry: If implements are connected in series, the predecessor implement can also provide the PS

3.27
pulse width modulation
PWM

pulse time modulation in which the pulse duration varies in accordance with a given function of the value of the modulating signal

[SOURCE: IEC 60050-702]