INTERNATIONAL STANDARD

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Tractors and machinery for agriculture and forestry — Serial control and communications data network —

Part 10: Task controller and management information system data interchange

Tracteurs et matériels agricoles et forestiers — Réseaux de commande et de communication de données en série —

Partie 10: Contrôleur de tâches et échange de données des systèmes d'information de gestion

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

This second edition cancels and replaces the first edition (ISO 11783-10:2009) which has been technically revised.

ISO 11783 consists of the following parts, under the general title *Tractors and machinery for agriculture and forestry — Serial control and communications data network*:

— *Part 1: General standard for mobile data communication*

— *Part 2: Physical layer*

— *Part 3: Data link layer*

— *Part 4: Network layer*

— *Part 5: Network management*

— *Part 6: Virtual terminal*

— *Part 7: Implement messages application layer*

— *Part 8: Power train messages*

— *Part 9: Tractor ECU*

— *Part 10: Task controller and management information system data interchange*

— *Part 11: Mobile data element dictionary*

— *Part 12: Diagnostics services*

— *Part 13: File server*

— *Part 14: Sequence control*

Introduction

This International Standard specifies a communications system for agricultural equipment based on the ISO 11898-1 protocol. SAE J1939[1] documents, on which parts of ISO 11783 are based, were developed jointly for use in truck and bus applications and for construction and agriculture applications. Joint documents were completed to allow electronic units that meet the truck and bus SAE J1939[1] specifications to be used by agricultural and forestry equipment with minimal changes.

General information on this International Stamdard is to be found in ISO 11783-1. The purpose of this International Standard is to provide an open, interconnected system for on-board electronic systems. It is intended to enable electronic control units (ECUs) to communicate with each other, providing a standardized system.

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this part of ISO 11783 may involve the use of a patent concerning the controller area network (CAN) protocol referred to throughout the document.

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

The holder of this patent has ensured ISO that he 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:

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Attention is drawn to the possibility that some of the elements of this part of ISO 11783 may be the subject of patent rights other than those identified above. ISO shall not be held responsible for identifying any or all such patent rights.

Tractors and machinery for agriculture and forestry — Serial control and communications data network —

Part 10: Task controller and management information system data interchange

1 Scope

This International Standard as a whole specifies a serial data network for control and communications on forestry or agricultural tractors and mounted, semi-mounted, towed, or self-propelled implements. Its purpose is to standardize the method and format of transfer of data between sensors, actuators, control elements, and information storage and display units, whether mounted on, or part of, the tractor or implement. This part of ISO 11783 describes the task controller applications layer, which defines the requirements and services needed for communicating between the task controller (TC) and electronic control units. The data format to communicate with the farm-management computer, the calculations required for control, and the message format sent to the control function are defined in this part of ISO 11783.

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.

ISO 11783-1, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 1: General standard for mobile data communication*

ISO 11783-3, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 3: Data link layer*

ISO 11783-5, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 5: Network management*

ISO 11783-6, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 6: Virtual terminal*

ISO 11783-7, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 7: Implement messages application layer*

ISO 11783-11, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 11: Mobile data element dictionary*

ISO 11783-12, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 12: Diagnostics services*

ISO 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO/IEC 10646, *Information technology — Universal Coded Character Set (UCS)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11783-1 apply.

3.1
client
control function (CF) that establishes a connection with a task controller (TC) or a data logger (DL) and provides data for data logging by the DL or TC and/or accepts control commands from the TC

Note 1 to entry: This term has been introduced in version 4 to replace the term working set for the CF that connects to a TC or DL. The multi member working set concept is not applied to TC or DL clients. The communication between a TC or DL and their clients is limited to transmission of messages between TC or DL and the working set master

3.2
coding data
data that changes infrequently, such as machine or chemical data, or data which is referenced in a task for the purpose of allocating tasks administratively

3.3
data dictionary entity
description of the data dictionary identifier, definition, value range, value resolution, and units specifications used by process data variables

3.4
data logger
DL
control function (CF) defined specifically to perform data logging functionality

3.5
data logger (DL) client
CF that establishes a connection with a data logger (DL) and provides data for data logging by the DL

3.6
data transfer file set
collection of files in the extensible markup language format and binary formats, which are used for the data transfer between the farm management information system and the task controller of an ISO 11783 network

3.7
device descriptor object pool
DDOP
collection of device-related objects and their relationships which together describe the functionality and structure of a device for the purposes of task control and data logging

3.8
device element
any addressable item on a device

EXAMPLE Nozzle on sprayer boom where the nozzle has individually addressable process data variables.

3.9
field
area of land managed by a farmer, represented by either a single partfield or a collection of more than one partfield

Note 1 to entry: The field is only of importance within the farm management information system for business management considerations and is not necessarily related to a single crop.

3.10
grid cell
rectangular areas defined by overlaying a grid on a partfield

3.11
management computer gateway
CF that interfaces to the management computer system and to the ISO 11783 network

Note 1 to entry: A management computer gateway can store data for transmission at a later time.

3.12
partfield
area characterized by the cultivation of only one agricultural crop

Note 1 to entry: Partfield is the XML element to which tasks are allocated to obtain smallest granularity.

3.13
polygon
planar surface defined by one exterior boundary and by zero or more interior boundaries

Note 1 to entry: Each interior boundary describes a hole in the surface.

Note 2 to entry: A single or group of polygons can be used to define a treatment zone.

3.14
process data variable
element of information that has a value that describes the state of a process

Note 1 to entry: Process data variables consist of the attributes range, resolution, and units, as defined in the data dictionary.

3.15
setpoint value source
CF that can determine a setpoint value during a task for use by another CF and contains one or more Device Process Data object(s) with the property attribute set to the “control source” value

3.16
setpoint value user
CF that accepts a setpoint value from either the TC or another source to modify its real-time performance such as rate control and contains one or more Device Process Data object(s) with the property attribute set to the “settable” value

3.17
task controller (TC) client
CF that establishes a connection with a task controller (TC) and provides data for data logging and/or accepts control commands from the TC

3.18
task controller (TC) number
identification number that is derived from the function instance of the task controller (TC)

3.19
XML element
representation of the data of a domain object and consists at least of an opening tag, a number of attributes, and a closing tag

4 Abbreviations

For the purposes of this document, the abbreviations given in ISO 11783-1 apply.

5 General description

5.1 Task management

There are two main purposes of task management in the mobile implement control system.

The first is the management of the farm resources, including tractors, implements, sensor systems, workers, and the products used. It is possible for the farmer to plan and evaluate the use of the resources. He is then able to automatically control the use of his inventory of products and can keep track of the status and conditions of his machinery. Resource designators are globally transferred as coding data and are part of the data transfer file set as detailed in Clause 7.

The second purpose is the management of the farm activities carried out in the fields. These activities are described by tasks to distinguish all the work that is planned, is in execution, or has been done by the farmer or by a contractor for one customer in one partfield.

The data transfer is possible in two directions. The planned tasks are sent to the task controller (TC) on the mobile implement control system (MICS) and the results of the work are sent back to the farm-management information system (FMIS). Tasks can be generated both on the FMIS and on the MICS.

Task management has the following workflow.

a) Planning field tasks and maintaining coding data using the software of an FMIS computer operated by the farmers or contractors, as detailed in 5.2.

b) Converting the task data into XML format.

c) Assigning the task data produced by the planning software to the data required for the implements or sensor systems to be used to complete the planned tasks. This step is optional.

d) Transferring the task data from the FMIS system to the TC of the MICS, as detailed in 5.4.

e) The TC uses the task data to transmit process data messages to the ECUs on the implement.

f) The TC collects data according to the DataLogTriggers specified in the task data.

g) Transferring the collected data to the FMIS. Collected data can be in the XML format or in a proprietary format. When a proprietary format is used, this step involves converting the proprietary format into the XML format.

h) Reading the XML files and converting into the FMIS format for storage and evaluation of the data.

Figure 1 illustrates the interfaces between the software on the FMIS computer and the ECUs mounted on an ISO 11783-configured implement.

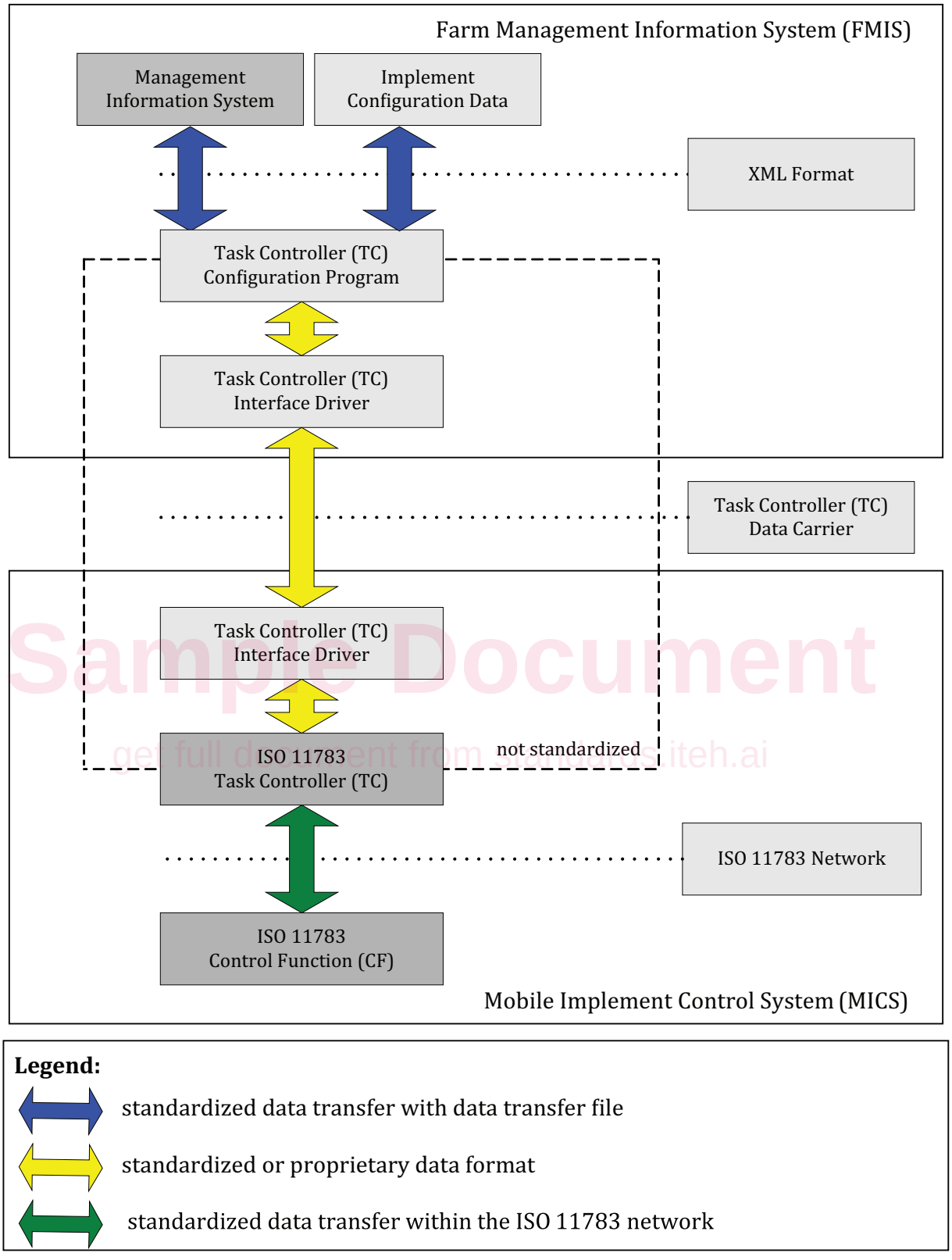

Figure 1 — Task management entities and interfaces

5.2 Task management on FMIS computer

Task management is defined as a part of an FMIS, responsible for planning and evaluation of field work. Tasks specify what, where, how, by whom, and when work is planned to be carried out.

The amount of data transferred between the FMIS and the MICS is dictated by the administrative requirements of a farming enterprise. For the recording of field activities only, the task management can be used to file the data in a working journal. For this purpose, only the coding data need be transferred from FMIS to MICS, and the tasks are created on the MICS by selection of the involved resources. In this case, only the data transfer file set from MICS to FMIS contain tasks. In enterprises where tasks are planned on the FMIS, these will be included, together with the coding data, in the data transfer file set from FMIS to MICS. These planned tasks can range from mere planned allocations of resources to geographical information for site-specific field operations.

5.3 Preselection and assignment of Devices

Any client device in the mobile system can only be identified uniquely by its CF NAME. For FMIS purposes, the client CF NAME needs to be unique worldwide. This implies that the device manufacturer has the responsibility to ensure that the Identity Number in combination with the other fields in the NAME uniquely identifies the device.

At the FMIS, the preselection of devices depends on the planned task. It can be necessary to assign a type of device or function, a specific device, or even the device of a particular manufacturer. The DeviceAllocation XML elements may include planned assignments about the devices to be used. This information ranges between specific and indistinct.

The XML attribute ClientNAMEValue contains the eight-byte NAME of a control function as it is defined in ISO 11783-5. Not all parts of a NAME need be specified and only certain elements of a NAME need to be defined to determine a device on the mobile network. Those parts of ClientNAMEValue containing information to be used on the mobile system to select a proper device are masked by a bitset structure stored in the XML attribute, ClientNAMEMask. All different combinations of elements of the NAME structure can be marked as valid for device selection (logical AND). On the FMIS, these masks could be coded as symbols. Once the preselection information is set in a task on the FMIS, it is not overwritten on the mobile system because the device that is used during task processing on the mobile system is stored as the XML attribute DeviceIdRef.

5.4 Task controller interface driver

After generating the interface files, the TC driver of the manufacturer of the TC is activated on the farm computer. This driver is responsible for the data transfer to the TC, which is part of the MICS using its proprietary data format or the ISO 11783-10 XML format and data carrier, such as any type of memory card or radio link. The translation of the data from the data transfer file set in messages on the ISO 11783 network, as well as the kind of transfer between the mobile system and the FMIS, is not subject to a standardized procedure as part of this International Standard. To make implement-specific set point data, this driver can add and use device descriptor data supplied by the manufacturers.

5.5 Task controller user interface

A TC can provide a means for the user to interact with the TC. User interaction can be through a virtual terminal (VT) or other interface. Operator interfaces can range from very simple to elaborate, depending on the designer's intent. For example, a simple TC that only supports single tasks that run automatically might not require any user interaction. More advanced TCs can offer additional operator interface capabilities, such as

— select a task from a list,

— start/stop/resume/complete a task,

— modify a task,

— create a task, and

— add new coding data.

Through the user interface, an operator can react to special circumstances or events in order to execute tasks in a reasonable way. The operator can also be informed about the status and results of the tasks and their components. For example, the operator could print a work confirmation for a farmer.

5.6 Data logger function

A separate data logger (DL) can be installed on a network, e.g. to function as a telemetry data logger. The task controller protocol is used by such a telemetry data logger which enables this data logging only control function to use device descriptors and process data messages for collecting data in addition to logging data from any other parameter groups that are broadcast or can be requested on the ISO 11783 network.

This DL CF is identified on the network by a specific data logger function, as specificied in ISO 11783-1. The DL functionality is a subset of the TC functionality and uses the same connection mechanism as the TC control function. Reusing the TC to TC client communication protocol makes the data logging functionality and the process data definitions of the TC available for use with the DL CF, without interfering with the TC client controlling functionalities of the TC.

The data logger function can be used for general non-task-related data logging. The use of the data logger function is not restricted to a telemetry environment.

The data logger function is introduced in ISO 11783-10 version 4. The ISO 11783-10 version is communicated on the network in the Version message (B.5.3) and in the data transfer file set in the VersionMajor attribute of the ISO11783_TaskData XML element (D.32).

6 Task controller requirements

6.1 Task selection and execution

The TC can provide a mechanism for the selection and shall provide a mechanism for the execution of a task contained in the data transfer file set. Selection of an individual task can be done either by the operator through an operator interface or automatically by the TC. The means of task selection is not specified by this part of ISO 11783. The TC designer is free to decide how task selection is implemented. The method provided for starting and stopping a task is not subject to standardization. This functionality is also to be determined by the TC designer.

On a MICS, a task may or may not be selected. If a task has not been selected by the operator, then the TC may prompt the operator for a task selection or may select a task automatically.

The status of a task is defined in Table 1.

Table 1 — Task status

Planned	Task is prepared at FMIS or MICS but not yet processed on MICS.
Running	Task is currently being processed on MICS. Only one task can be active per TC at the same time.
Paused	Task was previously running, is not currently running, and is not yet completed. This state can be a task final state from a TC perspective. Tasks with this state in data transfer file set with a MICS origin are required to be processed by the FMIS.
Completed[a]	Task is finished. This status can only be set by the operator and cannot be set automatically by the MICS. Tasks with this state in data transfer file set with a MICS origin are required to be processed by the FMIS.
Template[b]	Task is a template task. When a template task is started, a copy of the template is made and the copy is started as a new task. Template tasks that are defined by the FMIS shall not be modified by the MICS. Template tasks that are created on the MICS shall be identified as new tasks in the data transfer file set. Once a template task that is created on the MICS is instantiated in a non-template task, then the template task shall not be modified.