INTERNATIONAL STANDARD

ISO 11783-7

First edition
2002-09-01

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

Part 7: Implement messages application layer

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

Partie 7: Couche d'application de base

Reference number
ISO 11783-7:2002(E)

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Printed in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 11783-7 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

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: Data dictionary*

Annexes A and B form a normative part of this part of ISO 11783. Annex C is for information only.

Introduction

Parts 1 to 11 of ISO 11783 specify a communications system for agricultural equipment based on the CAN 2.0 B [1] protocol. SAE J 1939 [2] 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 J 1939 specifications to be used by agricultural and forestry equipment with minimal changes. General information on ISO 11783 is found in ISO 11783-1.

The purpose of ISO 11783 is to provide an open interconnected system for on-board electronic systems. It is intended to enable electronic units 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 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 assured ISO that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. For this purpose, the statement of the holder of this patent 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 patents other than that 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 7: Implement messages application layer

SAFETY PRECAUTIONS — Caution is to be taken with any automatic control of implements carried out using a message defined in this part of ISO 11783. See ISO 11783-9 for safe-mode operations.

1 Scope

This part of ISO 11783 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 sensor, 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 implement messages application layer of the network, specifying the message set and defining the messages used for communication with and between tractors and connected implements.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 11783. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 11783 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 639 (all parts), *Codes for the representation of names of languages*

ISO 11783-1:—[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 11783-6:—[1)], *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 6: Virtual terminal*

ISO 11783-9, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 9: Tractor ECU*

ISO 11783-10:—[1)], *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 10: Task controller and management information system data interchange*

1) To be published.

ISO 11783-11:—[1)], *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 11: Data dictionary*

IEC 61162-3:—[1)] *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 3: Serial data instrument network*

3 General requirements and recommendations

3.1 General

The message set specified by this part of ISO 11783 is designed to support the basic needs of an implement for information from a tractor, as well as limited controls enabling coordination between implement and tractor. The message set supports messages containing information on

— time,

— ground speed,

— distance,

— navigation,

— PTO parameters,

— three-point hitch,

— general process data, and

— lighting function parameters.

Messages are regularly repeated at fixed intervals.

The message parameters are defined in annex A; the parameter groups are specified in annex B.

See annex C for examples of tractor control messages.

3.2 Signal characterization

The ISO 11783 network has been designed with the intent of providing current data from an electronic control unit (ECU) to and for use by other ECUs on the network.

It is recommended that the time between physical data acquisition of a signal and the transmission of the data not exceed twice the repetition rate defined for the data.

3.3 Message format

3.3.1 General

The ISO 11783 network message format uses the parameter group number as the label for a group of parameters. Each parameter within the group can be expressed as characters, as scaled data defined by the ranges given in 3.3.3, or as function states consisting of one or more bits. Characters are transmitted with the left-most character first.

Numerical parameters consisting of two or more data bytes shall be transmitted least significant byte first.

3.3.2 Data type

Each parameter is identified as being of either the command or measured data type.

— Command data specifies the desired state of a multi-state parameter, function or numerical value of a set point as requested by a transmitting ECU. Specific confirmation of a command is not necessarily assured. For example, the command may request that a solenoid be activated, yet no measurement be taken to ensure the solenoid has accomplished its function.

EXAMPLE 1 Engage power take-off (PTO), extend auxiliary valve state, activate headlight high-beam, rear hitch position set point.

— Measured data conveys the current value of a parameter, as measured or observed by the transmitting ECU, determining the condition of the defined parameter.

EXAMPLE 2 Ground-based speed, hitch position, PTO engagement, implement position.

3.3.3 Parameter ranges

Table 1 defines the ranges used to determine the validity of a transmitted signal, Table 2 those ranges used to denote the state of a discrete parameter, and Table 3 those used to denote the state of a control mode command. The values in the range “error indicator” provide the means for an ECU to immediately indicate that valid parametric data are not currently available due to some type of error in the sensor, subsystem or ECU.

If an ECU failure prevents transmission of valid data for a parameter, the appropriate error indicator given in Table 1 or 2 should be used in place of that parameter's data. However, if the measured or calculated data has yielded a value that is valid, yet which exceeds the defined parameter range, the error indicator should not be used. The data should be transmitted using the appropriate minimum or maximum parameter value. If the sensor cannot determine if the measured or calculated data is valid, it shall send the error indicator.

3.3.4 Adding to parameter groups

Several of the parameter groups contain bytes that are undefined and which may be replaced with new parameters defined by ISO at a future date. If existing parameter group definitions do not permit the inclusion of new parameters, then a new parameter group may be defined.

See ISO 11783-1 for additional definitions and the abbreviations of instructions for requesting that parameters be added to parameter groups and new parameter group numbers be created.

Table 1 — Transmitted signal ranges

Range name	1 byte	2 bytes	4 bytes	ASCII
Valid signal	0 to 250 00_{16} to FA_{16}	0 to 64 255 0000_{16} to $FAFF_{16}$	0 to 4 211 081 215 00000000_{16} to $FAFFFFFF_{16}$	1 to 254 01_{16} to FE_{16}
Reserved range for future indicator bits	251 to 253 FB_{16} to FD_{16}	64 256 to 65 023 $FB00_{16}$ to $FDFF_{16}$	4 211 081 216 to 4 261 412 863 $FB000000_{16}$ to $FDFFFFFF_{16}$	none
Error indicator	254 FE_{16}	65 024 to 65 279 $FExx_{16}$	4 261 412 864 to 4 278 190 079 $FExxxxxx_{16}$	0 00_{16}
Not available, not installed or not requested	255 FF_{16}	65 280 to 65 535 $FFxx_{16}$	4 278 190 080 to 4 294 967 294 $FFxxxxxx_{16}$	255 FF_{16}

Table 2 — Transmitted values for discrete parameters (measured)

Range name	Transmitted value
Disabled (Off, passive, etc.)	00
Enabled (On, active, etc.)	01
Error indicator	10
Not available or not installed	11

Table 3 — Transmitted values for control commands

Range name	Transmitted value
Command to disable function (turn Off, etc.)	00
Command to enable function (turn On, etc.)	01
Reserved	10
Don't care/take no action (leave function as is)	11

3.4 Implement configuration offsets

The configuration of a tractor–implement connection, and the offset to and from the tractor and implement reference points, are used in the navigational parameters and in the implement configuration of process data messages. See ISO 11783-10.

Annex A
(normative)

Parameter definitions

A.1 Time (UTC)

Data length:	3 bytes
Resolution:	Byte 1 = 0,25 s/bit, 0 s offset
	Byte 2 = 1 min/bit, 0 min offset
	Byte 3 = 1 h/bit, 0 h offset
Operating range:	Byte 1 = 0 to 59,75 s
	Byte 2 = 0 min to 59 min
	Byte 3 = 0 h to 23 h
Type:	Measured

A.2 Date

Data length:	3 bytes
Resolution:	Byte 1 = 1 month/bit, 0 month offset
	Byte 2 = 0,25 d/bit, 0 day offset
	Byte 3 = 1 y[2)]/bit, + 1985 year offset
Operating range:	Byte 1 = 1 month to 12 months
	Byte 2 = 0,25 d to 31,75 d
	Byte 3 = + 1985 (year) to + 2 235 (year)
Type:	Measured

NOTE A value of 0 for the month (byte 1) is null. The value 1 identifies January, 2 identifies February, etc. A value of 0 for the day (byte 2) is null. The values 1, 2, 3 and 4 are used to identify the first day of the month; 5, 6, 7 and 8 identify the second day of the month etc. A value of 0 for the year (byte 3) identifies the year 1985; a value of 1 identifies 1986, etc.

2) The SI unit for “year” (annum) is a.

A.3 Local minute offset

Local time offset in minutes from a reference time (UTC).

Data length:	1 byte
Resolution:	1 min/bit, 0 min offset
Operating range:	0 min to 59 min
Type:	Measured

A.4 Local hour offset

Local time offset in hours from a reference time (UTC).

Data length:	1 byte
Resolution:	1 h/bit, – 24 h offset
Operating range:	– 24 h to 23 h
Type:	Measured

A.5 Ground-based speed

Actual groundspeed of a machine, measured by a sensor such as radar.

Data length:	2 bytes
Resolution:	0,001 m/s/bit, 0 m/s offset; upper byte resolution = 0,256 m/s/bit
Data range:	0 m/s to 64,255 m/s
Type:	Measured

A.6 Ground-based distance

Actual distance travelled by a machine based on measurements from a sensor such as radar.

When distance exceeds 4 211 081,215 m, the value should be reset to zero and incremented as additional distance accrues.

Data length:	4 bytes
Resolution:	0,001 m/bit
Data range:	0 m to 4 211 081,215 m
Type:	Measured

A.7 Ground-based direction

Measured signal indicating either forward or reverse as the direction of travel.

When speed is zero, indicate the last travel direction until a different direction is detected.

Data length: 2 bits

Value	Meaning
00	Reverse
01	Forward
10	Error indication
11	Not available

Type: Measured

A.8 Wheel-based speed

Value of the speed of a machine as calculated from the measured wheel or tail shaft speed.

Data length: 2 bytes

Resolution: 0,001 m/s/bit, 0 m/s offset

upper byte resolution = 0,256 m/s/bit

Data range: 0 m/s to 64,255 m/s

Type: Measured

A.9 Wheel-based distance

Distance travelled by a machine as calculated from wheel or tail-shaft speed.

When distance exceeds 4 211 081,215 m, the value should be reset to zero and incremented as additional distance accrues.

Data length: 4 bytes

Resolution: 0,001 m/bit

Data range: 0 m to 4 211 081,215 m

Type: Measured

A.10 Wheel-based direction

Measured signal indicating either forward or reverse as the direction of travel.

When speed is zero, indicate the last travel direction until a different direction is detected or selected and engaged.

Data length: 2 bits

Value	Meaning
00	Reverse
01	Forward
10	Error indication
11	Not available

Type: Measured

A.11 Key switch state

Indicates the key switch state of the tractor or power unit.

This does not indicate unforeseen power interruptions such as those caused by starting the engine.

Data length: 2 bits

Value	Meaning
00	Key switch Off
01	Key switch not Off
10	Error indication
11	Not available

Type: Measured

A.12 Maximum time of tractor power

Maximum time of remaining tractor or power unit supplied electrical power at the current load.

This parameter may be estimated rather than being a measured value.

Data length: 1 byte

Resolution: 1 min/bit, 0 offset

Data range: 0 to 250

Type: Measured

A.13 Maintain ECU power

Request to the Tractor ECU to maintain ECU_PWR power for the next 2 s.

Data length: 2 bits

Value	Meaning
00	No further requirement for ECU_PW
01	Requirement for 2 s more of ECU_PWR
10	Reserved
11	Don’t care

Type: Command

A.14 Maintain actuator power

Request to the Tractor ECU to maintain PWR power for the next 2 s.

Data length: 2 bits

Value	Meaning
00	No further requirement for PWR
01	Requirement for 2 s more for PWR
10	Reserved
11	Don't care

Type: Command

A.15 Implement transport state

Indicates the transport state of an implement connected to a tractor or power unit.

Data length: 2 bits

Value	Meaning
00	Implement may not be transported
01	Implement may be transported
10	Error indication
11	Not available

Type: Measured

A.16 Implement park state

Indicates the state of an implement where it may be disconnected from a tractor or power unit.

Data length: 2 bits

Value	Meaning
00	Implement may not be disconnected
01	Implement may be disconnected
10	Error indication
11	Not available

Type: Measured

A.17 Implement work state

Indicates that an implement is connected to a tractor or power unit and is ready for work.

Data length: 2 bits

Value	Meaning
00	Implement is not ready for field work
01	Implement is ready for field work
10	Error indication
11	Not available

Type: Measured

A.18 Navigation parameters

ISO 11783 networks shall use the navigation parameters specified in IEC 61162-3 (NMEA 2000[3)]). Messages requiring multiple data frames shall use the ISO transport protocol specified in IEC 61162-3, rather than the NMEA fast packet protocol.

NOTE The navigational receiver antenna is located at the navigational receiver point on the tractor/implement.

A.19 Hitch parameters

A.19.1 Front hitch position

Measured position of the front three-point hitch, it is expressed as a percentage of full travel: 0 % indicates the full down position; 100 %, the full up position.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 % offset

Data range: 0 % to + 100 %

Type: Measured

A.19.2 Rear hitch position

Measured position of the rear three-point hitch, it is expressed as a percentage of full travel: 0 % indicates the full down position; 100 %, the full up position.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 % offset

Data range: 0 % to + 100 %

Type: Measured

3) National Marine Electronics Association network standard.

A.19.3 Front hitch position command

Command for allowing the position of the front three-point hitch to be set, it is expressed as a percentage of full travel: 0 % indicates the full down position; 100 %, the full up position.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 % offset

Data range: 0 % to + 100 %

Type: Command

A.19.4 Rear hitch position command

Command for allowing the position of the rear three-point hitch to be set, it is expressed as a percentage of full travel: 0 % indicates the full down position; 100 %, the full up position.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 % offset

Data range: 0 % to + 100 %

Type: Command

A.19.5 Front hitch in-work indication

Measured signal indicating that the front hitch is positioned below (in-work) or above (out-of-work) an adjustable switching threshold.

Data length: 2 bits

Value	Meaning
00	Hitch position is out-of-work
01	Hitch position is in-work
10	Error indication
11	Not available

Type: Measured

A.19.6 Rear hitch in-work indication

Measured signal indicating that the rear hitch is positioned below (in-work) or above (out-of-work) an adjustable switching threshold.

The method of determining switching threshold is not standardized and is to be determined by the machine designer.

Data length: 2 bits

Value	Meaning
00	Hitch position is out-of-work
01	Hitch position is in-work
10	Error indication
11	Not available

Type: Measured

A.19.7 Front draft

Apparent horizontal force applied to the front hitch by an implement.

A positive value indicates force applied to the tractor opposed to heading.

Data length:	2 bytes
Resolution:	10 N/bit, – 320 000 N offset
Data range:	– 320 000 N to 322 550 N
Type:	Measured

A.19.8 Rear draft

Apparent horizontal force applied to the rear hitch by an implement.

A positive value indicates force applied to the tractor opposed to heading.

Data length:	2 bytes
Resolution:	10 N/bit, – 320 000 N offset
Data range:	– 320 000 N to 322 550 N
Type:	Measured

A.19.9 Front nominal lower link force

Measurement providing an indication of draft at the lower links of the front three-point hitch.

Nominal lower link force may be expected to be approximately linear with respect to draft and may be proportional to draft for a single hitch position. This measurement is typically obtained from a transducer on the lower hitch links and typically used as raw data in draft control. A positive value indicates force applied to the tractor opposed to heading.

Data length:	1 byte
Resolution:	0,8 %/bit, – 100 % offset
Data range:	– 100 % to + 100 %
Type:	Measured

A.19.10 Rear nominal lower link force

Measurement providing an indication of draft at the lower links of the rear three-point hitch.

Nominal lower link force may be expected to be approximately linear with respect to draft and may be proportional to draft for a single hitch position. This measurement is typically obtained from a transducer on the lower hitch links and typically used as raw data in draft control. A positive value indicates force applied to the tractor opposed to heading.

Data length: 1 byte

Resolution: 0,8 %/bit, – 100 % offset

Data range: – 100 % to + 100 %

Type: Measured

A.20 PTO parameters

A.20.1 Front PTO output shaft speed

Measured rotational speed of the front power take-off (PTO) output shaft.

For existing tractors that monitor PTO speed prior to the engagement clutch, the PTO speed will only be valid when PTO is engaged, and will be unavailable when disengaged.

Data length: 2 bytes

Resolution: 0,125 1/min/bit, 0 1/min offset

Data range: 0 1/min to + 8 031,875 1/min

Type: Measured

A.20.2 Rear PTO output shaft speed

Measured rotational speed of the rear power take-off (PTO) output shaft.

For existing tractors that monitor PTO speed prior to the engagement clutch, the PTO speed will only be valid when PTO is engaged, and will be unavailable when disengaged.

Data length: 2 bytes

Resolution: 0,125 1/min/bit, 0 1/min offset

Data range: 0 1/min to + 8 031,875 1/min

Type: Measured

A.20.3 Front PTO output shaft speed set point

Measured value of the set point of the rotational speed of the front power take-off (PTO) output shaft.

Data length: 2 bytes

Resolution: 0,125 1/min/bit, 0 1/min offset

Data range: 0 1/min to + 8 031,875 1/min

Type: Measured

A.20.4 Rear PTO output shaft speed set point

Measured value of the set point of the rotational speed of the rear power take-off (PTO) output shaft.

Data length: 2 bytes

Resolution: 0,125 1/min/bit, 0 1/min offset

Data range: 0 1/min to + 8 031,875 1/min

Type: Measured

A.20.5 Front PTO output shaft speed set point command

Command for setting the rotational speed of the front power take-off (PTO) output shaft.

Data length: 2 bytes

Resolution: 0,125 1/min/bit, 0 1/min offset

Data range: 0 1/min to + 8 031,875 1/min

Type: Command

A.20.6 Rear PTO output shaft speed set point command

Command for setting the rotational speed of the rear power take-off (PTO) output shaft.

Data length: 2 bytes

Resolution: 0,125 1/min/bit, 0 1/min offset

Data range: 0 1/min to + 8 031,875 1/min

Type: Command

A.20.7 Front PTO engagement

Measured signal indicating that the front power take-off (PTO) is engaged or disengaged.

Data length: 2 bits

Value	Meaning
00	PTO disengaged
01	PTO engaged
10	Error indication
11	Not available

Type: Measured

A.20.8 Rear PTO engagement

Measured signal indicating that the rear power take-off (PTO) controller has engaged or disengaged the rear PTO.

Data length: 2 bits

Value	Meaning
00	PTO disengaged
01	PTO engaged
10	Error indication
11	Not available

Type: Measured

A.20.9 Front PTO mode

Measured signal indicating that the front power take-off (PTO) mode is either 540 rpm or 1 000 r/min.

Data length: 2 bits

Value	Meaning
00	PTO mode is 540
01	PTO mode is 1 000
10	Error indication
11	Not available

Type: Measured

A.20.10 Rear PTO mode

Measured signal indicating that the rear power take-off mode (PTO) is either 540 r/min or 1 000 r/min.

Data length: 2 bits

Value	Meaning
00	PTO mode is 540
01	PTO mode is 1 000
10	Error indication
11	Not available

Type: Measured

A.20.11 Front PTO economy mode

Measured signal indicating that the front power take-off (PTO) economy mode is engaged or disengaged.

Economy mode PTO operates at 540 r/min or 1 000 r/min at lower engine revolutions.

Data length: 2 bits

Value	Meaning
00	PTO economy mode is disengaged
01	PTO economy mode is engaged
10	Error indication
11	Not available

Type: Measured

A.20.12 Rear PTO economy mode

Measured signal indicating that the rear power take-off (PTO) economy mode is engaged or disengaged.

Economy mode PTO operates at 540 r/min or 1 000 r/min at lower engine revolutions.

Data length: 2 bits

Value	Meaning
00	PTO economy mode is disengaged
01	PTO economy mode is engaged
10	Error indication
11	Not available

Type: Measured

A.20.13 Front PTO engagement command

Command for engaging or disengaging the front power take-off (PTO).

Data length: 2 bits

Value	Meaning
00	Disengage PTO
01	Engage PTO
10	Reserved
11	Don't care

Type: Command

A.20.14 Rear PTO engagement command

Command for engaging or disengaging the rear power take-off (PTO).

Data length: 2 bits

Value	Meaning
00	Disengage PTO
01	Engage PTO
10	Reserved
11	Don't care

Type: Command

A.20.15 Front PTO mode command

Command for selecting the mode of the front power take-off (PTO).

Data length: 2 bits

Value	Meaning
00	Select 540 r/min mode
01	Select 1 000 r/min mode
10	Reserved
11	Don't care

Type: Command

A.20.16 Rear PTO mode command

Command for selecting the mode of the rear power take-off (PTO).

Data length: 2 bits

Value	Meaning
00	Select 540 rpm mode
01	Select 1 000 rpm mode
10	Reserved
11	Don't care

Type: Command

A.20.17 Front PTO economy mode command

Command for engaging and disengaging the front power take-off (PTO) economy mode.

Data length: 2 bits

Value	Meaning
00	Disengage PTO economy mode
01	Engage PTO economy mode
10	Reserved
11	Don't care

Type: Command

A.20.18 Rear PTO economy mode command

Command for engaging and disengaging the rear power take-off (PTO) economy mode.

Data length: 2 bits

Value	Meaning
00	Disengage PTO economy mode
01	Engage PTO economy mode
10	Reserved
11	Don't care

Type: Command

A.21 Auxiliary valve parameters

A.21.1 Auxiliary valve number

Numeric identification of auxiliary hydraulic valve instance within a device identified by a NAME.

Auxiliary valves are numbered beginning with 0 and increase in sequence to the maximum number of auxiliary hydraulic valves in the device. The tractor's auxiliary valves shall be labelled with valve numbers corresponding to these auxiliary valve numbers. In a connected system where auxiliary valve messages are broadcast, the transmitted valve number shall correspond to the number label of the auxiliary valve which an implement or equipment is connected. The auxiliary valve numbers do not reference any location or mounting of the auxiliary valves.

In systems using “power beyond” technology, valve number 0 shall be used to identify the power beyond control valve.

Data length: 8 bits

Resolution: 1

Data range: 0 to 15

Type: Measured

A.21.2 Auxiliary valve number 0 extend port measured flow

Measured flow through the extend port of auxiliary valve number 0 of a tractor, expressed as a percentage of full flow.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100 % indicates maximum flow returning to the tractor through this port.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 % to 125 %

Type: Measured

A.21.3 Auxiliary valve number 0 retract port measured flow

Measured flow through the retract port of auxiliary valve 0 of a tractor, expressed as a percentage of full flow.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100% indicates maximum flow returning to the tractor through this port.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 % to 125 %

Type: Measured

A.21.4 Auxiliary valve number 0 extend port estimated flow

Value reported by the controller of flow through the extend port of auxiliary valve 0 of a tractor which could be based on the commanded position of the valve.

Zero percent indicates no flow, 100 %, maximum flow, – 100 % maximum flow returning to the tractor through this port. Caution should be exercised when using this parameter in feed back control systems because this parameter is estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 % to 125 %

Type: Estimated

A.21.5 Auxiliary valve number 0 retract port estimated flow

Value reported by the controller of flow through the retract port of auxiliary valve 0 of a tractor which could be based on the commanded position of the valve.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100 % indicates maximum flow returning to the tractor through this port. Caution should be exercised when using this parameter in feedback control systems owing to this parameter being estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 % to 125 %

Type: Estimated

A.21.6 Auxiliary valve number 0 valve state

Measured state of the auxiliary valve number 0.

A blocked state means the valve is closed and there is no flow from or to the valve and the fluid may be under pressure. A floating state means that there is no control flow from or to the valve and that the valves ports are connected directly to the hydraulic fluid's tank. This means that the hydraulic fluid may flow to or from the valve as driven by the actuator. Extend state means that flow is controlled from the valve's extend port and the fluid returns into the retract port. Retract state means that flow is controlled from the valve's retract port and the fluid returns into the extend port.

Data length: 4 bits

Value	Meaning
0000	Blocked
0001	Extend
0010	Retract
0011	Floating
0100 to 1101	Reserved
1110	Error indication
1111	Not available

Type: Measured

A.21.7 Auxiliary valve number 0 extend port pressure

Measured nominal pressure at the extend port of auxiliary valve of a tractor 0.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

A.21.8 Auxiliary valve number 0 retract port pressure

Measured nominal pressure at the retract port of auxiliary valve 0 of a tractor.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

A.21.9 Auxiliary valve number 0 return port pressure

Measured nominal pressure at the return port of auxiliary valve 0 of a tractor.

Data length: 1 byte

Resolution: 16 kPa/bit, 0 offset

Data range: 0 kPa to 4 000 kPa

Type: Measured

A.21.10 Auxiliary valve number 0 port flow

Command for setting the flow through the extend or retract port of auxiliary valve 0 of a tractor, expressed as a percentage of full flow.

Zero percent indicates no flow, 100 % indicates maximum flow; the flow returns to the tractor through the opposite port.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 % offset

Data range: 0 % to 100 %

Type: Command

A.21.11 Auxiliary valve number 0 state

Command for setting the auxiliary valve number 0 state.

With float enabled, hydraulic fluid may flow to or from the tractor as driven by the implement.

Data length: 4 bits

Value	Meaning
0000	Block
0001	Extend
0010	Retract
0011	Float
0100 to 1110	Reserved
1111	Don't care

Type: Command

A.21.12 Auxiliary valve number 0 fail safe mode — Command

Command for setting the fail safe mode of auxiliary valve number 0.

Data length: 2 bits

Value	Meaning
00	Block
01	Float
10	Reserved
11	Don't care

Type: Command

A.21.13 Auxiliary valve number 0 fail safe mode — Measured

Measured state of the fail safe mode of auxiliary valve number 0.

Data length: 2 bits

Value	Meaning
00	Block
01	Float
10	Error indication
11	Not available

Type: Measured

A.21.14 Parameters for auxiliary valves number 1 to 14

This part of ISO 11783 specifies the parameters only for auxiliary valves number 0 and 15. However, the data structures for valves 1 to 14 are to be identical. The data are also identical, except for the valve number.

A.21.15 Auxiliary valve number 15 extend port measured flow

Measured flow through the extend port of auxiliary valve number 15 of a tractor, expressed as a percentage of full flow.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100 % indicates maximum flow returning to the tractor through this port.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 to 125 %

Type: Measured

A.21.16 Auxiliary valve number 15 retract port measured flow

Measured flow through the retract port of auxiliary valve 15 of a tractor, expressed as a percentage of full flow.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100 % indicates maximum flow returning to the tractor through this port.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 % to 125 %

Type: Measured

A.21.17 Auxiliary valve number 15 extend port estimated flow

Value reported by the flow controller through the extend port of auxiliary valve 15 of a tractor, which could be based on the commanded position of the valve.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100 % indicates maximum flow returning to the tractor through this port. Caution should be exercised when using this parameter in feedback control systems owing to this parameter being estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 % to 125 %

Type: Estimated

A.21.18 Auxiliary valve number 15 retract port estimated flow

Value reported by the flow controller through the retract port of auxiliary valve 15 of a tractor, which could be based on the commanded position of the valve.

Zero percent indicates no flow, 100 % indicates maximum flow, – 100 % indicates maximum flow returning to the tractor through this port. Caution should be exercised when using this parameter in feed back control systems owing to this parameter being estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, – 125 % offset

Data range: – 125 to 125 %

Type: Estimated

A.21.19 Auxiliary valve number 15 valve state

Measured state of the auxiliary valve number 15.

A blocked state means the valve is closed and there is no flow from or to the valve and the fluid may be under pressure. A floating state means that there is no control flow from or to the valve and that the valves ports are connected directly to the hydraulic fluid's tank. This means that the hydraulic fluid may flow to or from the valve as driven by the actuator. Extend state means that flow is controlled from the valve's extend port and the fluid returns into the retract port. Retract state means that flow is controlled from the valve's retract port and the fluid returns into the extend port.

Data length: 4 bits

Value	Meaning
0000	Blocked
0001	Extend
0010	Retract
0011	Floating
0100 to 1101	Reserved
1110	Error indication
1111	Not available

Type: Measured

A.21.20 Auxiliary valve number 15 extend port pressure

Measured nominal pressure at the extend port of auxiliary valve of 15 a tractor.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

A.21.21 Auxiliary valve number 15 retract port pressure

Measured nominal pressure at the retract port of auxiliary valve 15 of a tractor.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

A.21.22 Auxiliary valve number 15 return port pressure

Measured nominal pressure at the return port of auxiliary valve 15 of a tractor.

Data length: 1 byte

Resolution: 16 kPa/bit, 0 offset

Data range: 0 kPa to 4 000 kPa

Type: Measured

A.21.23 Auxiliary valve number 15 port flow

Command for setting the flow through the extend or retract port of auxiliary valve 15 of a tractor, expressed as a percentage of full flow.

Zero percent indicates no flow, 100 % indicates maximum flow; the flow returns to the tractor through the opposite port.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 % offset

Data range: 0 % to 100 %

Type: Command

A.21.24 Auxiliary valve number 15 state

Command for setting the auxiliary valve number 15 state.

With float enabled, hydraulic fluid may flow to or from the tractor as driven by the implement.

Data length: 4 bits

Value	Meaning
0000	Block
0001	Extend
0010	Retract
0011	Float
0100 to 1101	Reserved
1111	Don't care

Type: Command

A.21.25 Auxiliary valve number 15 fail safe mode — Command

Command for setting the fail safe mode of auxiliary valve number 15.

Data length: 2 bits

Value	Meaning
00	Block
01	Float
10	Reserved
11	Don't care

Type: Command

A.21.26 Auxiliary valve number 15 fail safe mode — Measured

Measured state of the fail safe mode of auxiliary valve number 15.

Data length: 2 bits

Value	Meaning
00	Blocked
01	Floating
10	Error indication
11	Not available

Type: Measured

A.22 Lighting parameters

A.22.1 Head light high-beam

Command for activating or deactivating the “tractor’s” high-beam head lamps.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don’t care

Type: Command

A.22.2 Head light-high beam data

Parameter providing measured data from the tractor’s high-beam head lamps.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.3 Low beam head light

Command to activate or either deactivate the tractor’s low-beam head lamps.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don’t care

Type: Command

A.22.4 Low-beam head light data

Parameter providing measured data from the tractor's low-beam head lamps.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.5 Alternate head lights

Command for activating or deactivating the tractor's alternate head lamps (only low-beam is available on alternate head lamps). The alternate position lamps are intended for use with loader and snow ploughs where the primary head lamps might be blocked.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.6 Alternate head light data

Parameter providing measured data from the alternate head lamps.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.7 Tractor front low-mounted work lights — Command

Command for activating or deactivating the tractor's front low-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.8 Tractor front low-mounted work lights — Measured

Parameter providing measured data from the tractor's front low-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.9 Tractor front high-mounted work lights — Command

Command for activating or deactivating the tractor's front high-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.10 Tractor front high-mounted work lights — Measured

Parameter providing measured data from the tractor's front high-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.11 Tractor underside-mounted work lights — Command

Command for activating or deactivating the tractor's underside-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.12 Tractor underside-mounted work lights — Measured

Parameter providing measured data from the tractor's underside-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.13 Tractor rear low-mounted work lights — Command

Command for activating or deactivating the tractor's rear low-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.14 Tractor rear low-mounted work lights — Measured

Parameter providing measured data from the tractor's rear low-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.15 Tractor rear high-mounted work lights — Command

Command for activating or deactivating the tractor's rear high-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.16 Tractor rear high-mounted work lights — Measured

Parameter providing measured data from the tractor's rear high-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.17 Tractor side low-mounted work lights — Command

Command for activating or deactivating the tractor's side low-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.18 Tractor side low mounted work lights — Measured

Parameter providing measured data from the tractor's side low-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.19 Tractor side high-mounted work lights — Command

Command for activating or deactivating the tractor's side high-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.20 Tractor side high-mounted work lights — Measured

Parameter providing measured data from the tractor's side high-mounted work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.21 Left-turn signal Lights — Command

Command for activating or deactivating left-turn signal lights on the tractor and all connected implements.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.22 Left-turn signal lights — Measured

Parameter providing measured data from the tractor and attached implement left-turn signal lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.23 Right-turn signal lights — Command

Command for activating or deactivating right-turn signal lights on the tractor and all connected implements.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.24 Right-turn signal lights — Measured

Parameter providing measured data from the tractor's and attached implement's right-turn signal lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.25 Left stop lights — Command

Command for activating or deactivating the tractor's and implement's left stop lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.26 Left stop lights — Measured

Parameter providing measured data from the tractor's and attached implement's left stop lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.27 Right stop lights — Command

Command for activating or deactivating the tractor's and implement's right stop lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.28 Right stop lights — Measured

Parameter providing measured data from the tractor's and attached implement's right stop lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.29 Centre stop lights — Command

Command for activating or deactivating the tractor's and implement's centre stop lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.30 Centre stop lights — Measured

Parameter providing measured data from the tractor's and attached implement's centre stop lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.31 Tractor marker lights — Command

Command for activating or deactivating the tractor's front position lights, rear red tail lights, side amber running lights, license-plate lights, and instrument and switch back lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.32 Tractor marker lights — Measured

Parameter providing measured data from the tractor's marker lights, including front-position lights, rear tail lights, side running lights, license-plate lights, and instrument and switch back lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.33 Implement marker lights — Command

Command for activating or deactivating, implement, front position lights, rear red tail lights, side amber running lights, license-plate lights, and instrument and switch back lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.34 Implement marker lights — Measured

Parameter providing measured data from an attached implement, marker lights, including front position lights, rear tail lights, side running lights, license plate lights, and instrument and switch back lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.35 Tractor clearance lights — Command

Command for activating or deactivating the tractor's high-mounted clearance and centre ID lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.36 Tractor clearance lights — Measured

Parameter providing measured data from the tractor's high-mounted clearance and centre ID lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.37 Implement clearance lights — Command

Command for activating or deactivating the implement's high-mounted clearance lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.38 Implement clearance lights — Measured

Parameter providing measured data from an attached implement's high-mounted clearance lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.39 Rotating beacon light — Command

Command for activating or deactivating slow-moving vehicle indicator lights on the tractor, implements or both.

Activation of the slow moving vehicle lights implies that the controller should manipulate the lighting as appropriate to provide the slow moving vehicle lighting function.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.40 Rotating beacon light — Measured

Parameter providing measured data from the beacon light on the tractor or attached implements.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.41 Tractor front fog lights — Command

Command for activating or deactivating the tractor's front fog lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.42 Tractor front fog lights — Measured

Parameter providing measured data from the tractor's front fog lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.43 Rear fog lights — Command

Command for activating or deactivating the tractor's or implement's rear fog lights, or both.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.44 Rear fog lights — Measured

Parameter providing measured data from the tractor's or implement's rear fog lights, or both.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.45 Implement rear work lights — Command

Command for activating or deactivating implement's the rear work lights.

NOTE This is the same as reversing lights for truck applications.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.46 Implement rear work lights — Measured

Parameter providing measured data from the implement's rear work lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.47 Implement OEM option 1 light — Command

Command for activating or deactivating an implement's OEM option 1 light, which is provided to meet special needs on implements, such as tank inspection or filling lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.48 Implement OEM option 1 light — Measured

Parameter providing measured data from the implement's OEM option 1 light.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.49 Implement OEM option 2 light — Command

Command for activating or deactivating an implement's OEM option 2 light, which is provided to meet special needs on implements, such as tank inspection or filling lights.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.50 Implement OEM option 2 light — Measured

Parameter providing measured data from the implement's OEM option 2 light.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.51 Back-up lights and alarm horn — Command

Command for activating or deactivating the back-up lights and/ or associated alarm if required.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.52 Back-up lights and alarm horn — Measured

Parameter providing measured data from the back-up lights, associated alarm or both.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.53 Implement left forward work lights — Command

Command for activating or deactivating the forward-facing work lights towards the left end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.54 Implement left forward work light — Measured

Parameter providing measured data from the forward-facing work lights towards the left end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.55 Implement right forward work lights — Command

Command for activating or deactivating the forward-facing work lights towards the right end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don't care

Type: Command

A.22.56 Implement right forward work lights — Measured

Parameter providing measured data from the forward-facing work lights towards the right end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.57 Implement left-facing work lights — Command

Command for activating or deactivating work lights mounted on an implement for illuminating beyond the left end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don’t care

Type: Command

A.22.58 Implement left-facing work lights — Measured

Parameter providing measured data from the work lights mounted on an implement for illuminating beyond the left end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.59 Implement right-facing work lights — Command

Command for activating or deactivating work lights mounted on an implement for illuminating beyond the right end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don’t care

Type: Command

A.22.60 Implement right-facing work lights — Measured

Parameter providing measured data from the work lights mounted on an implement for illuminating beyond the right end of the implement.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.61 Daytime running lights

Command for activating or deactivating the tractor's or powered vehicle's running lights.

NOTE Usually only used for on road vehicles.

Data length: 2 bits

Value	Meaning
00	Deactivate
01	Activate
10	Reserved
11	Don’t care

Type: Command

A.22.62 Running light data

Parameter providing measured data from the tractor's or powered vehicle’s running lights.

Data length: 2 bits

Value	Meaning
00	Deactivated
01	Activated
10	Fault detected
11	Not available

Type: Measured

A.22.63 Lighting data message request

Command for requesting the lighting data message from all lighting controllers, providing the state of all lights.

Data length: 2 bits

Value	Meaning
00	No data requested
01	Data requested
10	Reserved
11	Don't care

Type: Command

A.22.64 Background illumination level

Command for setting the instrument and control illumination level.

Data length: 1 byte

Resolution: 0,4 %/bit, 0 offset

Data range: 0 % to 100 %

Type: Command

A.23 Language-specific parameters

A.23.1 Language code

Command sent to all ECUs specifying the operator's desired language of information.

ISO 11783 networks shall use the two-character string country codes in accordance with ISO 639.

EXAMPLE Dutch: nl; French: fr; English: en; German: de.

Data length: 2 bytes

Resolution: 7 bit ISO Latin 1 characters

Type: Command

A.23.2 Decimal symbol

Command sent to all ECUs that a point or comma be displayed for the decimal symbol.

Data length: 2 bits

Value	Meaning
00	Comma is used
01	Point is used
10	Reserved
11	No action

Type: Command

A.23.3 Date

Command sent to all ECUs specifying the displayed order of the date.

Data length: 8 bits

Value	Meaning
0	ddmmyyyy
1	ddyyyymm
2	mmyyyydd
3	mmddyyyy
4	yyyymmdd
5	yyyyddmm

Type: Command

A.23.4 Time

Command sent to all ECUs specifying the displayed format of the time.

Data length: 2 bits

Value	Meaning
00	24 h
01	12 h (am/pm)
10	Reserved
11	No action

Type: Command

A.23.5 Units of measure parameter

A.23.5.1 General

Commands sent to all ECUs specifying the units of measure to be used for the display of information.

A.23.5.2 Distance units

Command specifying the distance units.

Data length: 2 bits

Value	Meaning
00	Metric (kilometres, metres, etc.)
01	Imperial (miles, feet, etc.)
10	Reserved
11	No action

Type: Command

A.23.5.3 Area unit

Command specifying the area units.

Data length: 2 bits

Value	Meaning
00	Metric (hectares or square metres)
01	Imperial (acres or square feet)
10	Reserved
11	No action

Type: Command

A.23.5.4 Volume units

Command specifying the volume units.

Data length: 2 bits

Value	Meaning
00	Metric (litre)
01	Imperial (gallon)
10	US (gallon)
11	No action

Type: Command

A.23.5.5 Mass units

Command specifying the mass units.

Data length: 2 bits

Value	Meaning
00	Metric (tonne, kilograme)
01	Imperial [long tons (UK), pounds, etc.]
10	Tons/pounds [short tons (US), pounds, etc.]
11	No action

Type: Command

A.23.5.6 Temperature units

Command specifying the temperature units.

Data length: 2 bits

Value	Meaning
00	Metric (degrees Celsius, kelvin, etc.)
01	Imperial (degrees Fahrenheit, etc.)
10	Reserved
11	No action

Type: Command

A.23.5.7 Pressure units

Command specifying the pressure units.

Data length: 2 bits

Value	Meaning
00	Metric (kilopascals, pascals, etc.)
01	Imperial (pounds per square inch, etc.)
10	Reserved
11	No action

Type: Command

A.23.5.8 Force units

Command specifying the force units.

Data length: 2 bits

Value	Meaning
00	Metric (newtons, etc.)
01	Imperial (pounds-force, etc.)
10	Reserved
11	No action

Type: Command

A.23.5.9 Units system

Command specifying the system to be used for the display of any units, or units other than those specified in A.23.5.2 to A.23.5.8.

Data length: 2 bits

Value	Meaning
00	Metric
01	Imperial
10	US
11	No action

Type: Command

A.23.6 Repetition rate

Parameter defining the repetition rate of the transmission of the message with the associated PGN: the value of 0 implies the default rate is desired, while a value of 65535 implies no change is requested.

Data length: 2 bytes

Resolution: 1 ms

Data range: 0 to 64 255

Type: Command

A.24 Number of members in working set

A particular working set is identified by the NAME of the working set master, which is associated with the source address (SA) of the message containing this parameter. No member (as identified by a specific NAME, not by ECU) may belong to more than one working set at a time. See ISO 11783-1 and ISO 11783-6.

Data length: 8 bits

Resolution: 1

Data range: 1 to 250

A.25 Process data parameters

A.25.1 General

Messages used for the transmission of reference data, measured data or set point commands or both to one or more controllers.

Process variable data messages are composed of the fields given in Table A.1. The first 4 bytes of the message identify the data format, the type of data, and the controller or controllers required to act on or provide the data. The identity of the data is determined by a data dictionary entry derived from a 16 × 16 matrix table. There are 16 pages of these matrices based on implement type (see ISO 11783-1). Because more than one implement of the same type can be connected to the system, 4 bits are used to identify the location of implements with respect to one another. The count byte is used to identify the ECU, sensor, actuator or product that is to process or utilize the data. See ISO 11783-11 for data dictionary entries.

The initialization process for determining the implement position and the count byte shall be in accordance with ISO 11783-1.

Table A.1 — Process data fields

Reserved	Data format	Data type	Data modifier	Count number	Implement type	Implement position	DD row	DD column	Process variable value			
Bits												
1	2	2	3	8	4	4	4	4	32			
Byte 1				Byte 2	Byte 3		Byte 4		Byte 5	Byte 6	Byte 7	Byte 8

The byte ordering of the process variable fields is given as follows, arranged to allow the process variable value to be treated as a number in a manner consistent with 3.3.1.

Byte 1:

Bit 8 Reserved

Bits 7, 6 Data format/Error condition

Bits 5, 4 Process data type

Bits 3 to 1 Process data modifier

(Bit 8 is the bit sent closest to the DLC bits of the message.)

Byte 2:

Bit 8 to 1 Count number (most significant at Bit 8)

Byte 3:

Bits 8 to 5 Implement type (most significant at Bit 8)

Bits 4 to 1 Implement position (most significant at Bit 4)

Byte 4:

Bits 8 to 5 Data dictionary entity row number (most significant at Bit 8)

Bits 4 to 1 Data dictionary entity column number (most significant at Bit 4)

Byte 5:

Bits 8 to 1 Least significant byte of process variable value (most significant at Bit 8)

Byte 6:

Bits 8 to 1 Second byte of process variable value (most significant at Bit 8)

Byte 7:

Bits 8 to 1 Third byte of process variable value (most significant at Bit 8)

Byte 8:

Bits 8 to 1 Most significant byte of process variable value (most significant at Bit 8)

(Bit 1 is the last of the data bits sent and is closest to the CRC in the message.)

A.25.2 Data format/Error condition

Two-bit parameter indicating the format or availability of the data in the following process data parameter.

Data length: 2 bits

Value	Meaning
00	Data format is long integer
01	Data format is floating
10	Data format is unsigned long integer
11	Not available or error

“Data format long is integer” indicates that the 4 data bytes of the process data parameter will be signed long Integer.

“Data format is floating” indicates that the 4 data bytes of the process data parameter will be in floating point format as defined by IEEE 754 [3].

“Error” indicates that the 4 data bytes of the process data parameter is in an error condition.

“Not available” indicates that the value of the process data parameter in the process variable value field can not be provided by the ECU because it is not installed, has failed or can not obtain a measurement.

A.25.3 Process data type

Two-bit parameter indicating the purpose for which the data in the following process data parameters is to be used. See Table A.2.

Data length: 2 bits

Value	Meaning
00	Data is set point
01	Data is actual values
10	Message is set point request
11	Message is actual value request

Type: Command

“Data is set point” indicates that the 4 data bytes of the process data parameter will contain a set point.

“Data is actual values” indicates that the 4 data bytes of the process data parameter will contain an actual value.

“Message is a set point request” indicates that the addressed controller must return the set point in the 4 data bytes of the process data parameter as defined in implement type, data dictionary and fields.

“Message is actual value request” indicates that the addressed controller must return the present measured value in the 4 data bytes of the process data parameter as defined in implement type, data dictionary and fields.

A.25.4 Process data modifier

Three-bit parameter indicating how the data in the following process data parameters is to be used when combined with the process data type parameter. See Table A.2.

Data length: 3 bits

NOTE Process data type is included since data modifier is a function of data type

A.25.5 Count number parameters (see Table A.3)

A.25.5.1 General

Parameters indicating the member of the set of possible entities being referenced.

The means of generating this count number is explained in A.25.5.2 to A.25.5.3. See ISO 11783-10.

Data length: 1 byte

A.25.5.2 Group number

Parameter used by software within the management computer, in combination with the element number, to produce a unique count number for each member of a particular set of entities on an implement.

A.25.5.3 Element number

Parameter used by software within the management computer, in combination with group number, to produce a unique count number for each member of a particular set of entities on an implement.

Table A.2 — Process data modifier parameter

Data type	Data modifier	Meaning
X0	000	Requested set point
X0	001	Percentage value: Start = 100 %; Stop = 0 %
X0	010	Lower limit value
X0	011	Upper limit value
X0	100	Measuring increment for integrated and average values: — positive values in the data field have to be considered as distance increment (in cm) for a distance proportional measurement; — negative values in the data field have to be considered as time increment (in ms) for a time proportional measurement.
X0	101	Measuring increment for data collection: — positive values in the data field have to be considered as distance increments (in cm) for a distance proportional data collection or as thresholds (‰) for a data collection according to modification thresholds; — negative values in the data field have to be considered as time increments (in ms) for a time proportional data collection; — at a measuring increment 0 no data are collected.
00	110	The content of the least significant byte in the data field has the following meaning: — measuring program stop: XXXX 0000 — measuring program start: XXXX 0001 (for distance proportional measurement) XXXX 0010 (modification threshold) XXXX 0100 (for time proportional measurement) — reset: XXXX 1 000
X0	111	Actuator calibration
X1	000	Momentary value
X1	001	Minimum value
X1	010	Maximum value
X1	011	Integral value
X1	100	Average value
X1	101	Parameter value quality (TBD)
X1	110	Conversion factor
X1	111	Sensor calibration
NOTE For specific applications, the bit group MOD can also have further meanings for certain data identifiers beside this standard allocation. These are specified at appropriate place in the description of the data identifier.		

Table A.3 — Count number parameters

Count number	Meaning of data field content / Calculation rule
00000000	256 × group number + (element number + 1)[a]
00000001 to 11111110	Process value for element respectively group[b]: — Group = 1 + (count – 1) DIV (element number + 1) — Element = (count – 1) – (element number + 1) × (group – 1)
11111111	Process value for all groups and elements[c]

NOTE For certain data identifiers, the bit group count number can have further meanings besides this standard allocation. These are specified at appropriate place in the description of the data identifier.

[a] The characteristic values for the number of the groups (i.e. injectors) of elements (i.e. section width) and the number of elements in the higher group for a process value (i.e. application rate) raised by 1 are transferred in the 4 bytes data field. This gives a scheme by which single but also groups of elements can be actuated.

[b] By the number of the single element, it is possible to determine the group number and the number of the single element according to the calculation rule. In the data field, it is mentioned the appropriate process value. At element = 0 the complete group is actuated. DIV is the integer part of the division.

[c] Hereby all groups and elements are actuated. In the data field, it is mentioned the appropriate process value (i.e. work height of sprayer boom).

A.25.6 Implement type

Four-bit parameter indicating the data dictionary page to be used for locating the identity of the following data.

Data length: 4 bits

Data range: 0 to 15

A.25.7 Implement position

Four-bit parameter indicating the implement referenced within a set of identical implements.

The numbering is to start with 1 at the leftmost, foremost, bottommost implement. The numbering will then increment from left to right, followed by front to rear, followed by bottom to top (left being defined as to a person's left when looking toward the front of the vehicle from behind the vehicle). Special case 15 is for signifying all positions of implements of this implement type.

Data length: 4 bits

Data range: 0 to 15

EXAMPLE 1 The front implement is 0 and the rear implement 1 when two implements of identical type are towed one behind the other.

EXAMPLE 2 The left implement is 0 and the right 1 when two implements of identical type are towed side by side.

The subdivision of group and element is

a) geometric arrangement

— group = contiguous number of elements,

b) masses

— group = mass, and

— element = geometric arrangement of distributing elements, and

c) volume

— group = volume, and

— element = geometric arrangement of distributing elements.

For the manner of counting of the group and element number, the following determination applies at the geometric arrangements.

a) Width — increasing numbers from the left to the right.

b) Length — increasing numbers from the front to the rear.

c) Height — increasing numbers from the bottom to top.

d) Circle — clockwise increasing numbers:

1) horizontal arrangement — 0° in direction of travel;

2) vertical arrangement in direction of travel — 0° in direction of travel;

3) vertical arrangement transverse to direction of travel — 0° leftwards.

A.25.8 Data dictionary row

Four-bit parameter indicating the row to be used within the specific data dictionary table identified by implement type.

NOTE This is the group (GRUP) in LBS documents.

Data length: 4 bits

Data range: 0 to 15

A.25.9 Data dictionary column

Four-bit parameter indicating the column to be used within the specific data dictionary table identified by implement type.

NOTE This is the instance (INST) in LBS documents.

Data length: 4 bits

Data range: 0 to 15

A.25.10 Process variable value

Four-byte parameter containing the actual data for the process data message.

Data length: 4 bytes

Resolution: Per data dictionary

Data range: Per data dictionary

A.26 Tractor control parameters

A.26.1 General

These parameters are used by connected implements or a task controller for controlling the operation of a towing tractor and to the optimise performance of the connected system. The tractor is required to determine the constraints of each control mode and acknowledge the commands only as appropriate. These parameters are to be used in control loops and are not absolute set points.

A.26.2 Tractor control

A.26.2.1 General

Commands from a connected implement, the task controller or the operator, using the tractor ECU interface on a virtual terminal (VT), used for setting the optional function control modes of a tractor ECU.

These modes accomplish various combinations of optimization goals, focused on optimizing power, speed and slip, and controlling travel direction. Each control mode is described in, respectively, in A.26.2.2 to A.26.2.11.

Data length: 5 bits

Value	Meaning
00000	Disable remote control
00001	Enable cruise control
00010	Enable front hitch slip control
00011	Enable rear hitch slip control
00100	Enable front PTO slip control
00101	Enable rear PTO slip control
00110	Enable reduce speed slip control
00111	Enable auxiliary valve slip control
01000	Enable maximum draft power control
01001	Enable constant PTO speed control
01010	Enable combined constant PTO speed, cruise control
01011	Enable minimum engine speed control
01100	Enable combined engine economy, cruise control
01101	Enable front PTO torque control
01110	Enable rear PTO torque control
01111	Enable front draft force control
10000	Enable rear draft force control
10001	Enable guidance control
10010 to11110	Reserved
11111	Don't care

Type: Command

A.26.2.2 Cruise control

Commands the tractor to maintain a fixed ground speed.

This speed may be calculated from wheel speed, ground speed, or navigational system speed. It is the responsibility of the tractor to determine which measurement currently available in the tractor provides the most accurate measurement for the current operating conditions, and use that measurement in the control. See ISO 11783-9.

Value	Meaning
00001	Enable cruise control

A.26.2.3 Slip control

Commands that limit the slip of the traction device to reduce power loss at the tractor/soil interface.

Each of the following modes limits slip using different control strategies, with different advantages and disadvantages.

— Rear hitch slip control adjusts the working depth of a hitch mounted implement, to reduce the draft force and transfer weight to the rear of the tractor. In 2WD and MFWD tractors the weight transfer increases the load on the rear driving wheels to improve traction. In 4WD and track type tractors, this weight transfer has little or no benefit. This mode results in inconsistent working depth as a result of the depth adjustments.

— Front hitch slip control adjusts the working depth of the front-mounted implement to reduce draft force, but does not produce a useful weight transfer in the tractor. This mode results in inconsistent working depth as a result of the depth adjustments.

— Auxiliary valve slip control adjusts the working depth of the trailed implement to reduce draft force, but does not produce a useful weight transfer in the tractor. This mode results in inconsistent working depth as a result of the depth adjustments.

— Front or rear PTO slip control adjusts the PTO speed to reduce draft force in implements that can decrease draft requirement with varying PTO speed (e.g. power harrows). This mode can produce consistent working depth and maximize the overall power output (the sum of PTO and drawbar power), but requires the ability to adjust PTO speed independent of engine speed to avoid running the engine at non-optimal speeds.

— Reduce speed slip control adjusts the ground speed of the vehicle to reduce draft requirements. This mode produces consistent working depth, but results in operation at less than maximum power output.

Value	Meaning
00010	Enable front hitch slip control
00011	Enable rear hitch slip control
00100	Enable front PTO slip control
00101	Enable rear PTO slip control
00110	Enable reduce speed slip control
00111	Enable auxiliary valve slip control

A.26.2.4 Maximum draft power mode

Command for setting the power train performance strategy to maximise draft power through alternating transmission ratio (i.e. to slow down at certain engine revolution-per-minute decrease and speed up with engine revolution-per-minute recovering or exceeding above the point of maximum power).

Value	Meaning
01000	Enable maximum draft power control

A.26.2.5 Constant PTO speed mode

Command for setting the constant PTO speed control mode based on its cruise control mode.

Value	Meaning
01001	Enable constant PTO speed control
01010	Enable combined constant PTO speed, cruise control

A.26.2.6 Minimum engine speed mode

Command for setting the minimum engine speed control mode for the tractor to alter its engine speed, throttle position and gear ratio in order to reduce noise emission and fuel consumption.

Value	Meaning
01011	Enable minimum engine speed control

A.26.2.7 Economy engine control mode

Command for setting the economy engine control mode for the tractor to alter its engine speed, throttle position and gear ratio in order to achieve minimum fuel consumption.

Value	Meaning
01100	Enable combined engine economy, cruise control

A.26.2.8 Front PTO torque control mode

Command for setting the front PTO torque control mode that is used to protect a PTO driven implement from overload.

Value	Meaning
01101	Enable front PTO torque control

A.26.2.9 Rear PTO torque control mode

Command for setting the rear PTO torque control mode used to protect a PTO driven implement from overload.

Value	Meaning
01110	Enable rear PTO torque control

A.26.2.10 Draft control mode commands

A.26.2.10.1 Rear draft force control

Command for adjusting the working depth of a hitch mounted implement, to reduces the draft force and transfer weight to the rear of the tractor.

In 2WD and MFWD tractors the weight transfer increases the load on the rear driving wheels to improve traction. In 4WD and track type tractors, this weight transfer has little or no benefit. This mode results in inconsistent working depth as a result of the depth adjustments.

Value	Meaning
01111	Enable front draft force control

A.26.2.10.2 Front draft force control

Command for adjusting the working depth of the front mounted implement to reduce draft force, but which does not produce a useful weight transfer in the tractor.

This mode results in inconsistent working depth as a result of the depth adjustments.

Value	Meaning
10000	Enable rear draft force control

A.26.2.11 Guidance control mode command

Command for controlling the steering of a tractor from the implement or implement bus-mounted guidance ECU

Value	Meaning
10001	Enable guidance control

A.26.3 Control action command

Closed loop control command the tractor ECU's commanded mode must complete.

Data length: 2 bits

Value	Meaning
00	Hold current value
01	Decrement/ lower by value
10	Increment/ raise by value
11	Don't care

Type: Command

A.26.4 Commanded control value parameters

A.26.4.1 General

Parameters providing the commanded set point value or commanded change in set point value to be completed by the implement command to the Tractor ECU.

A.26.4.2 Commanded vehicle speed

Commanded set point value or commanded change in set point value of the wheel-, ground- or navigation-based tractor speed.

Data length:	2 bytes
Default value:	0
Resolution:	0,001 m/s/bit, upper byte 0,256 m/s/bit
Offset:	0 m/s
Range:	0 to 64,255
Units:	Metres per second
Type:	Command

A.26.4.3 Commanded PTO speed

Commanded set point value or commanded change in set point value of the front or rear PTO speed.

Data length:	2 bytes
Default value:	850
Resolution:	0,125 1/min/bit
Offset:	0 1/min
Range:	0,0 1/min to 8,031 875 1/min
Unit:	Reciprocal minutes[4)]
Type:	Command

A.26.4.4 Commanded hitch position

Commanded set point value or commanded change in set point value of the front or rear hitch position.

Data length:	1 byte
Default value:	0
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Command

4) The SI unit is expressed as 2 min^{-1}.

A.26.4.5 Commanded PTO torque

Commanded set point value or commanded change in set point value of the front or rear PTO torque.

Data length:	1 byte
Default value:	0
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Command

A.26.4.6 Commanded auxiliary valve flow

Commanded set point value or commanded change in set point value within the slip control function of the flow from the tractor auxiliary valve number given in A.26.4.7.

Data length:	1 byte
Default value:	0
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Command

A.26.4.7 Commanded auxiliary valve number

Number of the auxiliary valve indicating the flow set point or change in flow set point valve within the slip control function.

NOTE This valve number is also used by the limit value.

Data length:	1 byte
Default value:	0
Resolution:	1/bit
Offset:	0
Range:	1 to 15
Unit:	Valve number
Type:	Command

A.26.4.8 Commanded draft force

Commanded set point value or commanded change in set point value of the front or rear lower link draft force.

Data length:	1 byte
Default value:	0
Resolution:	1 000 N/bit
Offset:	– 100 000 N
Range:	– 100 000 N to 150 000 N
Unit:	Newton
Type:	Command

A.26.4.9 Commanded guidance angle

The commanded set point value or commanded change in set point value of the vehicle direction which is the deviation from the navigational x-axis. See 3.4.

Data length:	2 bytes
Default value	0
Resolution	1/256°/bit; upper byte resolution = 1°/bit
Offset:	– 125°
Range:	– 125° to 125°
Unit:	Degree
Type:	Command

A.26.5 Control limits parameters

A.26.5.1 General

These parameters provide the limit value of the commanded set point to be completed by tractor controllers as commanded by the implement to the tractor ECU message.

A.26.5.2 Draft force limit

Value of the limit of the commanded front or rear lower link draft force.

Data length:	1 byte
Resolution:	1 000 N/bit
Offset:	– 100 kN
Range:	– 100 kN to 150 kN
Unit:	Newton
Type:	Command

A.26.5.3 PTO torque limit

Value of the limit of the commanded front or rear PTO torque.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Command

A.26.5.4 Absolute maximum PTO torque limit 540 rpm

Value of the limit of the commanded absolute front or rear PTO torque at 540 rpm.

Data length:	1 byte
Resolution:	30 N·m/bit
Offset:	0 N·m
Range:	0,0 N·m to 7 500 N·m
Unit:	Newton metre
Type:	Command

A.26.5.5 Auxiliary valve flow limit

Parameter used for setting a maximum flow limit on an auxiliary valve within slip control function.

The selected valve is indicated by the valve number and the port selection is made within the auxiliary valve slip control mode command.

NOTE The limit refers to the valve specified in control value parameter.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
range:	0,0 to 100 %
Unit:	Percent
Type:	Command

A.26.6 Tractor control parameters

A.26.6.1 General

Measured parameter from a Tractor ECU of the optional function control modes settings.

Each of the measured control modes is specified, respectively, in A.26.6.2 to A.26.6.11.

Data length: 5 bits

Value	Meaning
00000	Disable remote control
00001	Enable ground speed cruise control
00010	Enable wheel speed cruise control
00011	Enable navigation speed cruise control
00100	Enable front hitch slip control
00101	Enable rear hitch slip control
00110	Enable front PTO slip control
00111	Enable rear PTO slip control
01000	Enable reduce speed slip control
01001	Enable auxiliary valve slip control
01010	Enable maximum draft power control
01011	Enable constant PTO speed control
01100	Enable constant PTO speed ground speed cruise control
01101	Enable constant PTO speed wheel speed cruise control
01110	Enable constant PTO speed navigation speed cruise control
01111	Enable minimum engine speed control
10000	Enable engine economy ground speed cruise control
10001	Enable engine economy speed wheel speed cruise control
10010	Enable engine economy speed navigation speed cruise control
10011	Enable front PTO torque control
10100	Enable rear PTO torque control
10101	Enable front draft force control
10110	Enable rear draft force control
10111	Enable guidance control
11000 to11110	Reserved
11111	Not available

Type: Measured

A.26.6.2 Cruise control

Parameter that reports the optional function Cruise Control mode setting of a Tractor ECU.

Value	Meaning
00001	Enable ground speed cruise control
00010	Enable wheel speed cruise control
00011	Enable navigation speed cruise control

A.26.6.3 Slip control

Parameter that reports the slip control mode setting of a Tractor ECU.

Value	Meaning
00100	Enable front hitch slip control
00101	Enable rear hitch slip control
00110	Enable front PTO slip control
00111	Enable rear PTO slip control
01000	Enable reduce speed slip control
01001	Enable auxiliary valve slip control

A.26.6.4 Maximum draft power

Parameter that reports the setting of the power train performance strategy for maximizing draft power through alternating transmission ratio.

Value	Meaning
01010	Enable maximum draft power control

A.26.6.5 Constant PTO speed

Parameter that reports the setting of the constant PTO speed control mode setting of a Tractor ECU.

Value	Meaning
01011	Enable constant PTO speed control
01100	Enable constant PTO speed ground speed cruise control
01101	Enable constant PTO speed wheel speed cruise control
01110	Enable constant PTO speed navigation speed cruise control

A.26.6.6 Minimum engine speed

Parameter that reports the minimum engine speed control mode for the tractor alter its engine speed, throttle position and gear ratio in order to reduce noise emission and fuel consumption.

Value	Meaning
01111	Enable minimum engine speed control

A.26.6.7 Economy engine control

Parameter that reports the economy engine control mode for the tractor to alter its engine speed, throttle position and gear ratio in order to achieve minimum fuel consumption.

Value	Meaning
10000	Enable engine economy ground speed cruise control
10001	Enable engine economy speed wheel speed cruise control
10010	Enable engine economy speed navigation speed cruise control

A.26.6.8 Front PTO torque control

Parameter that reports the Front PTO torque control mode, used to protect a PTO driven implement from overload.

Value	Meaning
10011	Enable front PTO torque control

A.26.6.9 Rear PTO torque control

Parameter that reports the Rear PTO torque control mode, used to protect a PTO driven implement from overload.

Value	Meaning
10100	Enable rear PTO torque control

A.26.6.10 Draft control status

Parameter that reports the draft control mode setting of the tractor.

Value	Meaning
10101	Enable front draft force control
10110	Enable rear draft force control

A.26.6.11 Guidance control

Parameter that reports the steering control mode setting of the tractor.

Value	Meaning
10111	Enable guidance control

A.26.7 Control action

Parameter that reports the closed loop control command of the tractor ECU's commanded control mode.

Data length: 2 bits

Value	Meaning
00	Hold current value
01	Decrement/lower by value
10	Increment/raise by value
11	Not available

Type: Measured

A.26.8 Control mode

Parameter that reports the tractor ECU's commanded control mode.

Data length: 2 bits

Value	Meaning
00	Driver mode
01	Remote control mode
10	Error, driver/system interrupt
11	Not available

Type: Measured

A.26.9 Control value

A.26.9.1 General

These parameters report the commanded set point value of tractor's commanded control mode.

A.26.9.2 Vehicle speed set point

Parameter that reports the commanded set point value of the wheel-, ground- or navigation-based tractor speed control mode.

Data length: 2 bytes

Resolution: 0,001 m/s/bit, upper byte 0,256 m/s/bit

Offset: 0 m/s

Range: 0 to 64,255

Units: Metres per second

Type: Measured

A.26.9.3 PTO speed set point

Parameter that reports the commanded set point value of the front or rear PTO speed.

Data length: 2 bytes

Resolution: 0,125 1/min

Offset: 0 1/min

Range: 0,0 1/min to 8,031 875 1/min

Unit: Reciprocal minute

Type: Measured

A.26.9.4 Hitch position set point

Parameter that reports the commanded set point value of the front or rear hitch position.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Measured

A.26.9.5 PTO torque set point

Parameter that reports the commanded set point value of the front or rear PTO torque.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Measured

A.26.9.6 Maximum slip set point

Parameter that reports the settled maximum flow of an auxiliary valve within slip control function.

NOTE The selected valve is indicated through valve number and the port selection is made within the auxiliary valve slip control mode command.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Measured/Estimated

A.26.9.7 Auxiliary valve number

Parameter that reports the number of the auxiliary valve selected for the control of the flow within slip control function.

NOTE This valve number is also used by the limit value.

Data length:	1 byte
Resolution:	1 /bit
Offset:	0
Range:	1 to 15
Unit:	Valve number
Type:	Measured

A.26.9.8 Draft force set point

Parameter that reports the commanded set point value of the front or rear lower link draft force.

Data length:	2 bytes
Resolution:	10 N/bit
Offset:	– 320 000 N
Range:	– 320 000 N to 322 550 N
Unit:	Newton
Type:	Measured

A.26.9.9 Guidance angle set point

Parameter that reports the commanded set point value of the vehicle direction. See 3.4.

Data length:	2 bytes
Resolution:	1/256°/bit; upper byte resolution = 1°/bit
Offset:	– 125°
Range:	– 125° to 125°
Unit:	Degree
Type:	Measured

A.26.10 Control limit parameters

A.26.10.1 General

These parameters report the settings of the limit value of the commanded set point to be controlled by tractor controllers as commanded by the implement to the Tractor ECU message.

A.26.10.2 Draft force limit set point

Parameter that reports the value of the limit of the commanded front or rear lower link draft force.

Data length:	1 byte
Resolution:	1 000 N/bit
Offset:	– 100 kN
Range:	– 100 kN to 150 kN
Unit:	Newton
Type:	Measured

A.26.10.3 PTO torque limit set point

Parameter that reports the value of the limit of the commanded front or rear PTO torque.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Measured

A.26.10.4 Absolute maximum PTO torque limit set point 540 rpm

Parameter that reports the value of the limit of the commanded absolute front or rear PTO torque at 540 rpm.

Data length:	1 byte
Resolution:	30 N·m/bit
Offset:	0 N·m
Range:	0 N·m to 7 500 N·m
Unit:	Newton metre
Type:	Measured

A.26.10.5 Auxiliary valve flow limit set point

Parameter that reports the settled limit of flow from an auxiliary valve within slip control function.

NOTE The auxiliary valve number is defined by the auxiliary valve flow command.

Data length:	1 byte
Resolution:	0,4 %/bit
Offset:	0 %
Range:	0,0 % to 100 %
Unit:	Percent
Type:	Measured/Estimated

A.27 Tractor Facility parameters

A.27.1 General

Parameters used to request and report tractor ECU facilities.

A.27.2 Tractor ECU class request

Parameter used to request the class of a tractor ECU.

Data length: 2 bits

Value	Meaning
00	TECU class 1
01	TECU class 2
10	TECU class 3
11	Not requested

Type: Command

A.27.3 Tractor facility request

Parameter used to request a facility of a tractor ECU.

Data length: 1 bit

Value	Meaning
0	Facility not required
1	Facility required

Type: Command

A.27.4 Tractor ECU class response

Parameter used to respond to a request of the class of a tractor ECU.

Data length: 2 bits

Value	Meaning
00	TECU class 1
01	TECU class 2
10	TECU class 3
11	Not available

Type: Measured

A.27.5 Tractor facility response

Parameter used to respond to a request of a facility of a tractor ECU.

Data length: 1 bit

Value	Meaning
0	Facility not available
1	Facility available

Type: Measured

Annex B
(normative)

Parameter groups

B.1 Time/Date

Transmission repetition rate:	On request
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	230
Default priority:	6
Parameter group number:	65254 ($00FEE6_{16}$)
Bytes 1 to 3:	Time (UTC) (see clause A.1)
Bytes 4 to 6:	Date (see A.2)
Byte 7:	Local minute offset (see clause A.3)
Byte 8:	Local hour offset (see clause A.4)

B.2 Ground-based speed and distance

Message normally sent by the tractor ECU on the implement bus on construction and agricultural implements providing to connected systems the current measured ground speed (also includes a free running distance counter and an indication of the direction of travel).

NOTE Accuracies of both wheel-based and ground-based sources may be speed-dependent and may degrade at low speeds. Wheel-based information may not be updated at the 100 ms rate at low speeds.

Transmission repetition rate:	100 ms
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	73
Default priority:	3
Parameter group number:	65097 ($00FE49_{16}$)
Bytes 1, 2:	Ground-based implement speed (See clause A.5)

Bytes 3 to 6:	Ground-based distance (see clause A.6)	
Byte 7:	Reserved	
Byte 8:	Bits 8 to 3:	Reserved
	Bits 2, 1:	Ground-based direction (see clause A.7)

B.3 Wheel-based speed and distance

Message sent by the tractor ECU on the implement bus on construction and agricultural implements providing to connected systems the current measured wheel-based speed (also includes a free running distance counter and an indication of the direction of travel).

When the ignition key switch is turned off, both the ECU_PWR and PWR have to be maintained to send this message plus 2 s. This is not required when the engine is cranking (starting).

NOTE Accuracies of both wheel-based and ground-based sources can be speed-dependent and degrade at low speeds. Wheel-based information might not be updated at the 100 ms rate at low speeds.

Transmission repetition rate:	100 ms	
Data length:	8 bytes	
Data page:	0	
PDU format:	254	
PDU specific:	72	
Default priority:	3	
Parameter group number:	65096 ($00FE48_{16}$)	
Bytes 1, 2:	Wheel-based implement speed (see clause A.8)	
Bytes 3 to 6:	Wheel-based distance (see clause A.9)	
Byte 7:	Maximum time of tractor power (see clause A.12)	
Byte 8:	Bits 8 to 5:	Reserved
	Bits 4, 3:	Key switch state (see clause A.11)
	Bits 2, 1:	Wheel-based direction(see clause A.10)

B.4 Maintain power

Message sent by any ECU connected to the implement bus requesting that the tractor ECU not switch off the power for 2 s after it has received the wheel-based speed and distance message indicating the ignition has been switched off.

Transmission repetition rate:	As required after receiving the message indicating that the ignition switch has changed from the ON state to the OFF state, or on change of state of parameters.

Data length:	8 bytes	
Data page:	0	
PDU format:	254	
PDU specific:	71	
Default priority:	6	
Parameter group number:	65095 ($00FE47_{16}$)	
Byte 1:	Bits 8, 7:	Maintain ECU power (see clause A.13)
	Bits 6, 5:	Maintain actuator power (see clause A.14)
	Bits 4 to 1:	Reserved
Byte 2:	Bits 8, 7:	Implement transport state (see clause A.15)
	Bits 6, 5:	Implement park state (see clause A.16)
	Bits 4, 3:	Implement work state (see clause A.17)
	Bits 2, 1:	Reserved
Bytes 3 to 8:	Reserved	

B.5 Navigation system messages

ISO 11783 networks shall use the navigation messages specified in IEC 61162-3 (NMEA 2000). The preferred (minimum) messages for ISO 11783 are GNSS position data, GNSS high output position and GNSS pseudorange noise statistics. Messages requiring multiple data frames shall use the ISO transport protocol specified in IEC 61162-3, rather than the NMEA fast packet protocol.

B.6 Secondary or front hitch status

Message providing the measurement of the current front hitch parameters.

Transmission repetition rate:	100 ms	
Data length:	8 bytes	
Data page:	0	
PDU format:	254	
PDU specific:	70	
Default priority:	3	
Parameter group number:	65094 ($00FE46_{16}$)	
Byte 1:	Front hitch position (see A.19.1)	
Byte 2:	Bits 8 to 7:	Front hitch in-work indication (see A.19.5)

	Bits 6 to 1: Reserved
Byte 3:	Front nominal lower link force (see A.19.9)
Bytes 4, 5:	Front draft (see A.19.7)
Bytes 6 to 8:	Reserved

B.7 Primary or rear hitch status

Message that provides the measurement of the current rear-hitch parameters.

Transmission repetition rate:	100 ms
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	69
Default priority:	3
Parameter group number:	65093 ($00FE45_{16}$)
Byte 1:	Rear hitch position (see A.19.2)
Byte 2:	Bits 8, 7: Rear hitch in-work indication (see A.19.6)
	Bits 6 to 1: Reserved
Byte 3:	Rear nominal lower link force (see A.19.10)
Bytes 4, 5:	Rear draft (see A.19.8)
Bytes 6 to 8:	Reserved

B.8 Secondary or front PTO output shaft

Message that provides the measurement of the current secondary or front power take-off (PTO) output shaft parameters.

Transmission repetition rate:	100 ms when engaged, otherwise on request
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	68
Default priority:	3
Parameter group number:	65092 ($00FE44_{16}$)

Bytes 1, 2:	Front PTO output shaft speed (see A.20.1)
Bytes 3, 4:	Front PTO output shaft speed set point (see A.20.3)
Byte 5:	Front PTO output shaft state
	Bits 8, 7: Front PTO engagement (see A.20.7)
	Bits 6, 5: Front PTO mode (see A.20.9)
	Bits 4, 3: Front PTO economy mode (see A.20.11)
	Bits 2, 1: Reserved
Bytes 6 to 8:	Reserved

B.9 Primary or rear PTO output shaft

Message that provides the measurement of the current primary or rear power take-off (PTO) output shaft parameters.

Transmission repetition rate:	100 ms when engaged, otherwise on request
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	67
Default priority:	3
Parameter group number:	65091 ($00FE43_{16}$)
Bytes 1, 2:	Rear PTO output shaft speed (see A.20.2)
Bytes 3, 4:	Rear PTO output shaft speed set point (see A.20.4)
Byte 5:	Rear PTO output shaft state
	Bits 8, 7: Rear PTO engagement (see A.20.8)
	Bits 6, 5: Rear PTO mode (see A.20.10)
	Bits 4, 3: Rear PTO economy mode (see A.20.12)
	Bits 2, 1: Reserved
Bytes 6 to 8:	Reserved

B.10 Hitch and PTO commands

Message that provides control of the hitch position, PTO shaft set point speed and PTO engagement.

Transmission repetition rate:	Minimum rate of 1 second between messages or when a parameter is required to change state.
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	66
Default priority:	3
Parameter group number:	65090 ($00FE42_{16}$)
Byte 1:	Front hitch position command (see A.19.3)
Byte 2:	Rear hitch position command (see A.19.4)
Bytes 3, 4:	Front PTO output shaft speed set point (see A.20.5)
Bytes 5 to 6:	Rear PTO output shaft speed set point (see A.20.6)
Byte: 7:	PTO output shaft engagement
	Bits 8, 7: Front PTO engagement (see A.20.13)
	Bits 6, 5: Rear PTO engagement (see A.20.14)
	Bits 4 to 1: Reserved
Byte 8:	Bits 8, 7: Front PTO mode (see A.20.15)
	Bits 6, 5: Rear PTO mode (see A.20.16)
	Bits 4, 3: Front PTO economy mode (see A.20.17)
	Bits 2, 1: Rear PTO economy mode (see A.20.18)

B.11 Auxiliary valve 0 estimated flow

Message that provides the estimated flow of auxiliary valve number 0.

NOTE This valve is used for power beyond control.

Transmission repetition rate:	100 ms
Data length:	8 bytes
Data page:	0
PDU format:	254

PDU specific:	16	
Default priority:	3	
Parameter group number:	65040 ($00FE10_{16}$)	
Byte 1:	Valve 0 extend port estimated flow (see A.21.4)	
Byte 2:	Valve 0 retract port estimated flow (see A.21.5)	
Byte 3:	Bits 8, 7:	Valve 0 fail safe mode (see A.21.13)
	Bits 6, 5	Reserved
	Bits 4, 1:	Valve 0 valve state (see A.21.6)
Bytes 4 to 8	Reserved	

B.12 Auxiliary valve 0 measured flow

Message that provides the measurements of auxiliary valve number 0.

NOTE This valve is used for power beyond control.

Transmission repetition rate:	100 ms
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	32
Default priority:	3
Parameter group number:	65056 ($00FE20_{16}$)
Byte 1:	Valve 0 extend port measured flow (see A.21.2)
Byte 2:	Valve 0 retract port measured flow (see A.21.3)
Bytes 3 to 4:	Valve 0 extend port pressure (see A.21.7)
Bytes 5 to 6:	Valve 0 retract port pressure (see A.21.8)
Byte 7:	Valve 0 return port pressure (see A.21.9)
Byte 8:	Reserved

B.13 Auxiliary valve 0 command

Message that provides control of the flow through the auxiliary valve number 0.

NOTE This valve is used for power beyond control.

Transmission repetition rate:	Minimum rate of 1 s between messages for each valve or when a parameter is required to change state.
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU specific:	48
Default priority:	3
Parameter group number:	65072 ($00FE30_{16}$)
Byte 1:	Valve 0 port flow (see A.21.10)
Byte 2:	Reserved
Byte 3:	bits 8, 7: Valve 0 fail safe mode (see A.21.12)
	Bits 6, 5: Reserved
	Bits 4, 1: Valve 0 valve state (see A.21.11)
Bytes 4 to 8:	Reserved

B.14 Auxiliary valve 1 to 14 messages

This part of ISO 11783 sives definitions for auxiliary valve number 0 and auxiliary valve number 15 messages only. Message definitions for valves 1 to 14 are the same as those given for valve 15 in clauses B.15, B.16 and B.17. The data are identical except for the valve number. The parameter group numbers for each of these valve messages are as follows.

See A.21.14.

Auxiliary valve 1 estimated flow	65041 ($00FE11_{16}$)
Auxiliary valve 1 measured flow	65057 ($00FE21_{16}$)
Auxiliary valve 1 command	65073 ($00FE31_{16}$)
Auxiliary valve 2 estimated flow	65042 ($00FE12_{16}$)
Auxiliary valve 2 measured flow	65058 ($00FE22_{16}$)
Auxiliary valve 2 command	65074 ($00FE32_{16}$)
Auxiliary valve 3 estimated flow	65043 ($00FE13_{16}$)
Auxiliary valve 3 measured flow	65059 ($00FE23_{16}$)
Auxiliary valve 3 command	65075 ($00FE33_{16}$)
Auxiliary valve 4 estimated flow	65044 ($00FE14_{16}$)
Auxiliary valve 4 measured flow	65060 ($00FE24_{16}$)

Auxiliary valve 4 command	65076 ($00FE34_{16}$)
Auxiliary valve 5 estimated flow	65045 ($00FE15_{16}$)
Auxiliary valve 5 measured flow	65061 ($00FE25_{16}$)
Auxiliary valve 5 command	65077 ($00FE35_{16}$)
Auxiliary valve 6 estimated flow	65046 ($00FE16_{16}$)
Auxiliary valve 6 measured flow	65062 ($00FE26_{16}$)
Auxiliary valve 6 command	65078 ($00FE36_{16}$)
Auxiliary valve 7 estimated flow	65047 ($00FE17_{16}$)
Auxiliary valve 7 measured flow	65063 ($00FE27_{16}$)
Auxiliary valve 7 command	65079 ($00FE37_{16}$)
Auxiliary valve 8 estimated flow	65048 ($00FE18_{16}$)
Auxiliary valve 8 measured flow	65064 ($00FE28_{16}$)
Auxiliary valve 8 command	65080 ($00FE38_{16}$)
Auxiliary valve 9 estimated flow	65049 ($00FE19_{16}$)
Auxiliary valve 9 measured flow	65065 ($00FE29_{16}$)
Auxiliary valve 9 command	65081 ($00FE39_{16}$)
Auxiliary valve 10 estimated flow	65050 ($00FE1A_{16}$)
Auxiliary valve 10 measured flow	65066 ($00FE2A_{16}$)
Auxiliary valve 10 command	65082 ($00FE3A_{16}$)
Auxiliary valve 11 estimated flow	65051 ($00FE1B_{16}$)
Auxiliary valve 11 measured flow	65067 ($00FE2B_{16}$)
Auxiliary valve 11 command	65083 ($00FE3B_{16}$)
Auxiliary valve 12 estimated flow	65052 ($00FE1C_{16}$)
Auxiliary valve 12 measured flow	65068 ($00FE2C_{16}$)
Auxiliary valve 12 command	65084 ($00FE3C_{16}$)
Auxiliary valve 13 estimated flow	65053 ($00FE1D_{16}$)
Auxiliary valve 13 measured flow	65069 ($00FE2D_{16}$)
Auxiliary valve 13 command	65085 (00 $FE3D_{16}$)
Auxiliary valve 14 estimated flow	65054 ($00FE1E_{16}$)
Auxiliary valve 14 measured flow	65070 ($00FE2E_{16}$)
Auxiliary valve 14 command	65086 ($00FE3E_{16}$)

B.15 Auxiliary valve 15 estimated flow

Message that provides the estimated flow of auxiliary valve number 15.

Transmission repetition rate:	100 ms	
Data length:	8 bytes	
Data page:	0	
PDU format:	254	
PDU-specific:	31	
Default priority:	3	
Parameter group number:	65055 ($00FE1F_{16}$)	
Byte 1:	Valve 15 extend port estimated flow (see A.21.17)	
Byte 2:	Valve 15 retract port estimated flow (see A.21.18)	
Byte 3:	Bits 8, 7:	Valve 15 fail safe mode (see A.21.13)
	Bits 6, 5	Reserved
	Bits 4, 1:	Valve 15 valve state (see A.21.26)
Bytes 4 to 8	Reserved	

B.16 Auxiliary valve 15 measured flow

Message that provides the measurement of auxiliary valve number 15.

Transmission repetition rate:	100 ms
Data length:	8 bytes
Data page:	0
PDU format:	254
PDU-specific:	47
Default priority:	3
Parameter group number:	65071 ($00FE2F_{16}$)
Byte 1:	Valve 15 extend port measured flow (see A.21.15)
Byte 2:	Valve 15 retract port measured flow (see A.21.16)
Bytes 3 to 4:	Valve 15 extend port pressure (see A.21.20)
Bytes 5 to 6:	Valve 15 retract port pressure (see A.21.21)
Byte 7:	Valve 15 return port pressure (see A.21.22)
Byte 8:	Reserved