BS ISO 11783-7:2015

BSI Standards Publication

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

## Part 7: Implement messages application layer

bsi.

...making excellence a habit.™

**National foreword**

This British Standard is the UK implementation of ISO 11783-7:2015. It supersedes BS ISO 11783-7:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AGE/6, Agricultural tractors and forestry machinery.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.



ISBN 978 0 580 75624 5

ICS 35.100.70; 35.240.99; 65.060.01

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2015.

**Amendments issued since publication**

| Date | Text affected |
|---|---|

BS ISO 11783-7:2015

INTERNATIONAL STANDARD

**ISO 11783-7**

Third edition
2015-03-15

# 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 11783-7:2015(E)

**COPYRIGHT PROTECTED DOCUMENT**



ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

# Contents

Page

**Foreword** ... **iv**
**Introduction** ... **vi**
**1 Scope** ... **1**
**2 Normative references** ... **1**
**3 General requirements and recommendations** ... **2**
3.1 General ... 2
3.2 Signal characterization ... 2
3.3 Message format ... 2
3.4 Implement configuration offsets ... 5
**Annex A** (normative) **Parameter definitions** ... **6**
**Annex B** (normative) **Parameter groups** ... **121**
**Annex C** (informative) **Tractor control messages — Examples** ... **175**
**Annex D** (informative) **Implement control of tractor facilities — Control implementation** ... **184**
**Bibliography** ... **185**

# Foreword

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

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

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

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

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

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

This third edition cancels and replaces the second edition (ISO 11783-7:2009) which has been technically revised.

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

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

— *Part 2: Physical layer*

— *Part 3: Data link layer*

— *Part 4: Network layer*

— *Part 5: Network management*

— *Part 6: Virtual terminal*

— *Part 7: Implement messages application layer*

— *Part 8: Power train messages*

— *Part 9: Tractor ECU*

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

— *Part 11: Mobile data element dictionary*

— *Part 12: Diagnostics services*

— *Part 13: File server*

— *Part 14: Sequence control*

# Introduction

ISO 11783 specifies a communications system for agricultural equipment based on the ISO 11898-1[1] protocol. SAE J1939[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 J1939 specifications to be used by agricultural and forestry equipment with minimal changes.

General information on ISO 11783 is to be 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 control units (ECUs) to communicate with each other, providing a standardized system.

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

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

The holder of this patent has ensured ISO that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from:

Robert Bosch GmbH

Wernerstrasse 51

Postfach 30 02 20

D-70442 Stuttgart-Feuerbach

Germany

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

**INTERNATIONAL STANDARD** **ISO 11783-7:2015(E)**

# 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

ISO 11783 as a whole specifies a serial data network for control and communications on forestry or agricultural tractors and mounted, semi-mounted, towed or self-propelled implements. Its purpose is to standardize the method and format of transfer of data between sensors, actuators, control elements and information storage and display units, whether mounted on, or part of, the tractor or implement. This part of ISO 11783 describes the 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 11783-1:2007, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 1: General standard for mobile data communication*

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

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

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

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

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

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

IEC 61162-3, *Maritime navigation and radio communication 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 (power take-off) parameters,

— three-point hitch,

— general process data, and

— lighting function parameters.

Some of the messages are regularly repeated at fixed intervals and others are transmitted upon request only. The specific transmission requirements for each message are defined in Annex B.

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 a control function (CF) that is located in an electronic control unit (ECU) to, and for use by, other CFs that are located in the same or in other ECUs on the network. ISO 11783-1 lists the definitions of the CF and ECU terms.

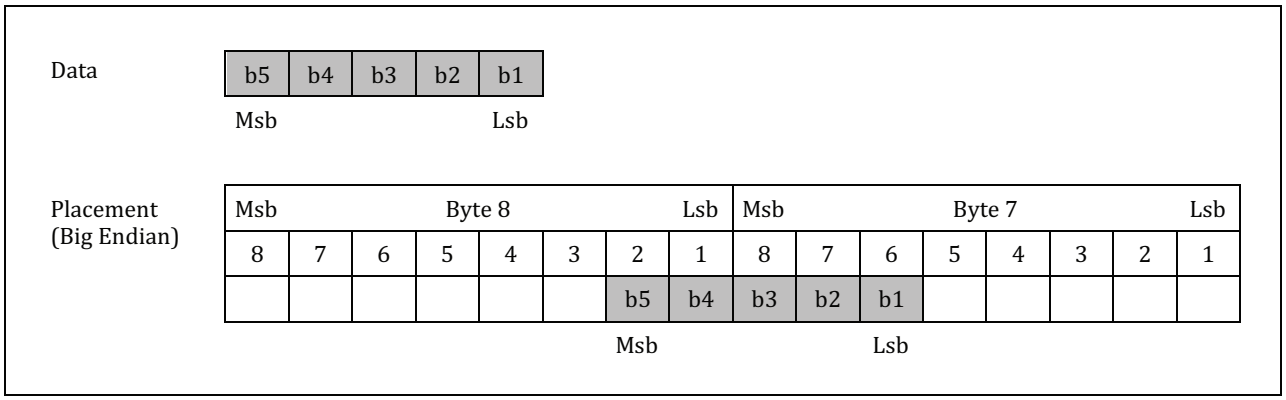
It is recommended that the time between physical data acquisition of a signal and the transmission of the data not exceed twice the repetition rate defined for the data.

## 3.3 Message format

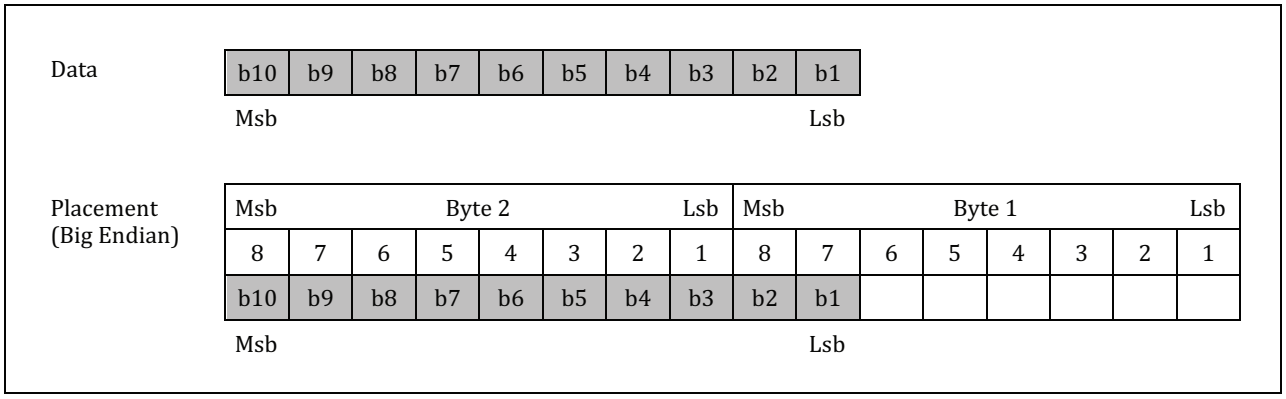
### 3.3.1 General

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.

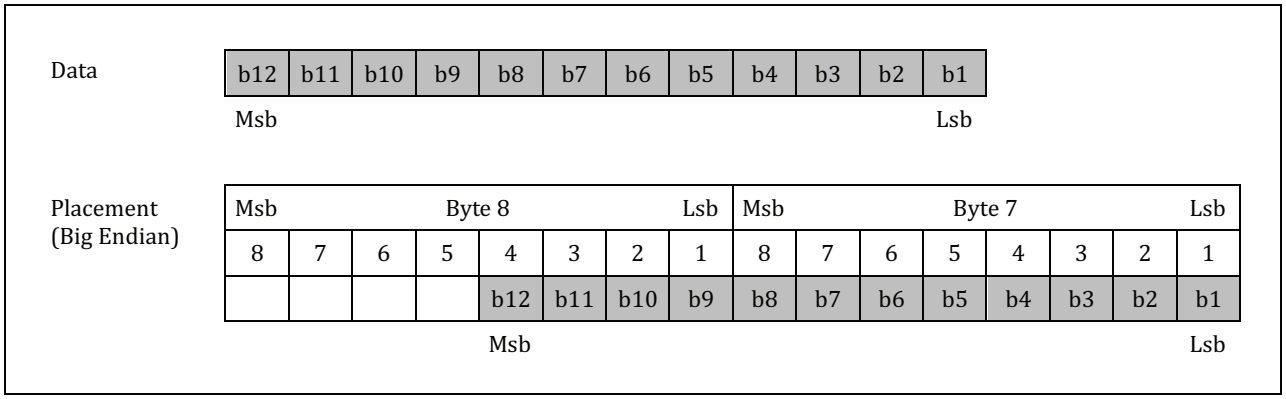
Numerical parameters consisting of two or more data bytes shall be transmitted least significant byte first. When a parameter is placed in more than one byte because of its location in the data field, the least significant bits (Lsb) of the parameter are placed in the least significant byte with the remaining most significant bits (Msb) placed in the next higher byte starting at the first bit. See Figure 1.




**a) Data parameter of less than one byte crossing a byte boundary**




**b) Data parameter larger than one byte ending on a byte boundary**




**c) Data parameter larger than one byte starting on a byte boundary**

**Figure 1 — Placement of data parameters in more than one byte**

### 3.3.2 Data types

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

— **Command**

Command data specifies the desired state of a multistate parameter, function or numerical value of a set point as requested by a transmitting CF. Specific confirmation of a command is not necessarily

ensured. For example, the command may request that a solenoid be activated, yet no measurement be taken to ensure the solenoid has accomplished its function.

The tractor is not expected to automatically execute any given command. Commands for control affect the change or introduction of motion or power into the system, and may be issued in parallel with other commands from within various tractor systems. Each command must be considered with other tractor controls and operating conditions, and only executed if the tractor control system considers it to be appropriate.

EXAMPLE 1 Engage PTO, extend auxiliary valve state, activate headlight high-beam, move rear hitch.

— **Measured**

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

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

### 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 a CF to immediately indicate that valid parametric data are not currently available due to some type of error in the sensor, subsystem or CF.

If a CF failure prevents transmission of valid data for a parameter, the appropriate error indicator given in Tables 1 or 2 shall 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 shall not be used. The data shall be transmitted using the appropriate minimum or maximum parameter value. If the sensor cannot determine if the measured or calculated data are 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 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<br>$00_{16}$ to $FA_{16}$ | 0 to 64 255<br>$0000_{16}$ to $FAFF_{16}$ | 0 to 4 211 081 215<br>$00000000_{16}$ to $FAFFFFFF_{16}$ | 1 to 254<br>$01_{16}$ to $FE_{16}$ |
| Parameter-specific indicator | 251<br>$FB_{16}$ | 64 256 to 64 511<br>$FBxx_{16}$ | 4 211 081 216 to 4 227 858 431<br>$FBxxxxxx_{16}$ | None |
| Reserved range for future indicator bits | 252 to 253<br>$FC_{16}$ to $FD_{16}$ | 64 512 to 65 023<br>$FC00_{16}$ to $FDFF_{16}$ | 4 227 858 432 to 4 261 412 863<br>$FC000000_{16}$ to $FDFFFFFF_{16}$ | None |
| Error indicator | 254<br>$FE_{16}$ | 65 024 to 65 279<br>$FExx_{16}$ | 4 261 412 864 to 4 278 190 079<br>$FExxxxxx_{16}$ | 0<br>$00_{16}$ |
| Not available, not installed, not requested or take no action (leave function as is) | 255<br>$FF_{16}$ | 65 280 to 65 535<br>$FFxx_{16}$ | 4 278 190 080 to 4 294 967 294<br>$FFxxxxxx_{16}$ | 255<br>$FF_{16}$ |

**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 |

For future compatibility, except where noted in the particular message definition, reserved bits within a message are to be set to "all 1's" to indicate "Not Available".

Unique to Part 7 are several messages which utilize single-bit parameters such as availability of individual features. Portions of these messages may be reserved and additional single-bit indicators. It is important to note the expected value of these reserved parameters in the message definitions as they may differ from the rules defined above. In some cases, the default value is zero ("0") for forward compatibility. The value of zero indicates "not supported" in these messages.

## 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)

The following three parameters provide the current time at the Universal Time Coordinate (UTC). If the local hour offset parameter (A.4) is equal to 125 ($FA_{16}$), then the time parameter is the local time instead of UTC.

| | |
|---|---|
| Data length: | 3 bytes |
| Resolution: | Byte 1 = 0,25 s/bit, 0 s offset - SPN 959 |
| | Byte 2 = 1 min/bit, 0 min offset - SPN 960 |
| | Byte 3 = 1 h/bit, 0 h offset - SPN 961 |
| Operating range: | Byte 1 = 0 s to 59,75 s; Byte 2 = 0 min to 59 min; Byte 3 = 0 h to 23 h |
| Type: | Measured |

## A.2 Date

The following three parameters provide the current date at the Universal Time Coordinate (UTC). If the local hour offset parameter (A.4) is equal to 125 ($FA_{16}$), then the date parameter is the local date instead of UTC date.

| | |
|---|---|
| Data length: | 3 bytes |
| Resolution: | Byte 1 = 1 month/bit, 0 month offset - SPN 963 |
| | Byte 2 = 0,25 d/bit, 0 day offset - SPN 962 |
| | Byte 3 = 1 y/bit, 1985 year offset - SPN 964 |
| Operating range: | Byte 1 = 1 month to 12 months |
| | Byte 2 = 0,25 d to 31,75 d |
| | Byte 3 = 1985 (year) to 2235 (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.

## A.3 Local minute offset

Local minute offset is the number of minutes between the Universal Time Coordinate (UTC) time and date and a local time and date. This value is added to UTC time and date to determine the local time and date. The local offset is a positive value for times east of the Prime Meridian to the International Date Line. The local offset is a negative value for times west of the Prime Meridian to the International Date Line. The local minute offset is only applicable when the time and date parameters are reported as UTC time and date.

Data length: 1 byte

Resolution: 1 min/bit, –125 min offset

Operating range: –59 min to 59 min

Type: Measured

SPN: 1601

Note: This parameter was harmonized with SAE in a technical corrigenda published 2004-10-15. Prior to that Technical Corrigenda the parameter was defined as follows:

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 hour offset is the number of hours between the Universal Time Coordinate (UTC) time and date and a local time and date. This value is added to UTC time and date to determine the local time and date. The local offset is a positive value for times east of the Prime Meridian to the International Date Line. The local offset is a negative value for times west of the Prime Meridian to the International Date Line.

Data length: 1 byte

Resolution: 1 h/bit, –125 h offset

Operating range: –23 h to 23 h

Type: Measured

SPN: 1602

The time and date parameters shall be Universal Time Coordinate (UTC) time, to be used with the local hour offset value for determining the local time. See Table A.1 for interpretations of time and date parameters for local hour offset non-operating ranges.

**Table A.1 — Local hour offset interpretations**

| Local hour offset value | Interpretation of received parameters | |
|---|---|---|
| | Time and date | Local offsets |
| –125 to –24 ($00_{16}$ to $65_{16}$) | Time standard unknown | Unknown |
| –23 to 23 ($66_{16}$ to $94_{16}$) | UTC time and date | Local time offsets |
| 24 to 123 ($95_{16}$ to $F8_{16}$) | Time standard unknown | Unknown |
| 124 ($F9_{16}$) | UTC time and date | No offset provided |
| 125 ($FA_{16}$) | Local time and date | No offset provided |
| 126 to 130 ($FB_{16}$ to $FF_{16}$) | Time standard unknown | Unknown |

NOTE This parameter was harmonized with SAE in a technical corrigenda published 2004–10–15. Prior to that Technical Corrigenda the parameter was defined as follows:

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 machine speed

Actual ground speed 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

SPN: 1859

## A.6 Ground-based machine distance

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

When the distance exceeds 4 211 081,215 m, the value shall 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

SPN: 1860

## A.7 Ground-based machine direction

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

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

NOTE Forward and reverse refer to the normal directions of travel of the tractor or implement chassis. The direction does not change when the operator's perspective is changed (i.e. when operator station is reversed).

EXAMPLE Operator station reversed.

Data length: 2 bits

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

Type: Measured

SPN: 1861

## A.8 Wheel-based machine speed

The 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

SPN: 1862

## A.9 Wheel-based machine distance

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

When the distance exceeds 4 211 081,215 m, the value shall 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

SPN: 1863

## A.10 Wheel-based machine direction

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

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

NOTE Forward and reverse refer to the normal directions of travel of the tractor or implement chassis. The direction does not change when the operator's perspective is changed (i.e. when operator station is reversed).

EXAMPLE Operator station reversed.

Data length: 2 bits

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

Type: Measured

SPN: 1864

## 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

SPN: 1865

## 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

SPN: 1866

## 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_PWR |
| 01 | Requirement for 2 s more of ECU_PWR |
| 10 | Reserved |
| 11 | Don't care |

Type: Command

SPN: 1867

## 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

SPN: 1868

## 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

SPN: 1869

## 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

SPN: 1870

## A.17 Implement ready-to-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

SPN: 1871

## A.18 Navigation location parameters

ISO 11783 networks shall use the navigation location parameters specified in IEC 61162-3 [NMEA 2000[1)]].

NOTE The actual location in the navigation parameters shall be reported for the Navigation Reference Point (NRP) on the tractor/implement. The definition of the Navigation Reference Point and the tractor/implement coordinate system are specified in ISO 11783-10. The NRP may be the antenna location in case only a GNSS receiver is available but it may also be the location of a reference point projected on the ground surface below the tractor/implement in case the GNSS location data are corrected for the roll and pitch of 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

SPN: 1872

### 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

SPN: 1873

### 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

SPN: 1874

1) National Marine Electronics Association network standard.

### 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

SPN: 1875

### 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.

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

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

SPN: 1876

### 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 the switching threshold is not standardized and is to be determined by the manufacturer.

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

SPN: 1877

### A.19.7 Front draft

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

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

Data length: 2 bytes

Resolution: 10 N/bit, –320 000 N offset

Data range: –320 000 N to 322 550 N

Type: Measured

SPN: 1878

### A.19.8 Rear draft

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

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

Data length: 2 bytes

Resolution: 10 N/bit, –320 000 N offset

Data range: –320 000 N to 322 550 N

Type: Measured

SPN: 1879

### 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 the force applied to the tractor opposed to its heading.

Data length: 1 byte

Resolution: 0,8 %/bit, –100 % offset

Data range: –100 % to 100 %

Type: Measured

SPN: 1880

### 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 the force applied to the tractor opposed to its heading.

Data length: 1 byte

Resolution: 0,8 %/bit, –100 % offset

Data range: –100 % to 100 %

Type: Measured

SPN: 1881

### A.19.11 Front hitch position limit status

This parameter is used to report the Tractor ECU's present limit status associated with front hitch position commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited High (only lower command values result in a change) |
| 011 | Limited Low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5150

### A.19.12 Rear hitch position limit status

This parameter is used to report the Tractor ECU's present limit status associated with the rear hitch position commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited High (only lower command values result in a change) |
| 011 | Limited Low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5151

### A.19.13 Front hitch exit/reason code

This parameter is used to indicate why the front hitch cannot accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010011 | Reserved |
| 010100 | Hydraulic oil level too low |
| 010101 | Hitch locked out |
| 010110 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN: 5816

### A.19.14 Rear hitch exit/reason code

This parameter is used to indicate why the rear hitch cannot accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010011 | Reserved |
| 010100 | Hydraulic oil level too low |
| 010101 | Hitch locked out |
| 010110 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN : 5819

## 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 |
| SPN: | 1882 |

### 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 |
| SPN: | 1883 |

### 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 |
| SPN: | 1884 |

### 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

SPN: 1885

### 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

SPN: 1886

### 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

SPN: 1887

### 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

SPN: 1888

### A.20.8 Rear PTO engagement

Measured signal indicating that the rear 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

SPN: 2408

### A.20.9 Front PTO mode

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

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | PTO mode is 540 r/min |
| 01 | PTO mode is 1 000 r/min |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 1889

### A.20.10 Rear PTO mode

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

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | PTO mode is 540 r/min |
| 01 | PTO mode is 1 000 r/min |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 1890

### 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

SPN: 1891

### 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

SPN: 1892

### 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

SPN: 1893

### 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

SPN: 1894

### 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

SPN: 1895

### 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 r/min mode |
| 01 | Select 1 000 r/min mode |
| 10 | Reserved |
| 11 | Don't care |

Type: Command

SPN: 1896

### 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

SPN: 1897

### 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

SPN: 1898

### A.20.19 Front PTO engagement request status

This parameter is used to report the Tractor ECU's status associated with front PTO engagement requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External request accepted. No subsequent operator intervention. |
| 01 | Control override (most recent external request ignored because of operator or tractor system override) |
| 10 | Error |
| 11 | Not available (parameter not supported) |

Type: Measured

SPN: 5152

### A.20.20 Front PTO mode request status

This parameter is used to report the Tractor ECU's status associated with front PTO mode requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External request accepted. No subsequent operator intervention. |
| 01 | Control override (most recent external request ignored because of operator or tractor system override) |
| 10 | Error |
| 11 | Not available (parameter not supported) |

Type: Measured

SPN: 5153

### A.20.21 Front PTO economy mode request status

This parameter is used to report the Tractor ECU's status associated with front PTO economy mode requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External request accepted. No subsequent operator intervention. |
| 01 | Control override (most recent external request ignored because of operator or tractor system override) |
| 10 | Error |
| 11 | Not available (parameter not supported) |

Type: Measured

SPN: 5154

### A.20.22 Front PTO shaft speed limit status

This parameter is used to report the Tractor ECU's present limit status associated with front PTO shaft speed commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5155

### A.20.23 Rear PTO engagement request status

This parameter is used to report the Tractor ECU's status associated with rear PTO engagement requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External request accepted. No subsequent operator intervention. |
| 01 | Control override (most recent external request ignored because of operator or tractor system override) |
| 10 | Error |
| 11 | Not available (parameter not supported) |

Type: Measured

SPN: 5156

### A.20.24 Rear PTO mode request status

This parameter is used to report the Tractor ECU's status associated with rear PTO mode requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External request accepted. No subsequent operator intervention. |
| 01 | Control override (most recent external request ignored because of operator or tractor system override) |
| 10 | Error |
| 11 | Not available (parameter not supported) |

Type: Measured

SPN: 5157

### A.20.25 Rear PTO economy mode request status

This parameter is used to report the Tractor ECU's status associated with rear PTO economy mode requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External request accepted. No subsequent operator intervention. |
| 01 | Control override (most recent external request ignored because of operator or tractor system override) |
| 10 | Error |
| 11 | Not available (parameter not supported) |

Type: Measured

SPN: 5158

### A.20.26 Rear PTO shaft speed limit status

This parameter is used to report the Tractor ECU's present limit status associated with rear PTO shaft speed commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5159

### A.20.27 Front PTO exit/reason code

This parameter is used to indicate why the front PTO cannot accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 0010011 | Reserved |
| 010100 | Invalid PTO gear |
| 010101 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN 5817

### A.20.28 Rear PTO exit/reason code

This parameter is used to indicate why the rear hitch cannot accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 0010011 | Reserved |
| 010100 | Invalid PTO gear |
| 010101 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN 5820

## A.21 Auxiliary valve parameters

### A.21.1 Auxiliary valve number

Auxiliary hydraulic 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 to 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.

### 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

SPN: 1899

### A.21.3 Auxiliary valve number 0 retract port measured flow

Measured flow through the retract 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

SPN: 1900

### 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 % 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 because this parameter is estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, –125 % offset

Data range: –125 % to 125 %

Type: Estimated

SPN: 1901

### 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 because this parameter is estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, –125 % offset

Data range: –125 % to 125 %

Type: Estimated

SPN: 1902

### A.21.6 Auxiliary valve number 0 valve state

Measured state of the auxiliary valve number 0.

A blocked state means that the valve is closed and there is no flow from or to the valve and that the fluid may be under pressure. A floating state means that there is no control flow from or to the valve and that the valve 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

SPN: 1903

### A.21.7 Auxiliary valve number 0 extend port pressure

Measured nominal pressure at the extend 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

SPN: 1904

### 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

SPN: 1905

### 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

SPN: 1906

### A.21.10 Auxiliary valve number 0 port flow — Command

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

SPN: 1907

### A.21.11 Auxiliary valve number 0 state — Command

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

SPN: 1908

### 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

SPN: 1909

### A.21.13 Auxiliary valve number 0 fail safe mode

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

SPN: 1910

### A.21.14 Auxiliary valve number 0 measured flow limit status

This parameter is used to report the Tractor ECU's present measured flow limit status associated with valve number 0 flow commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5160

### A.21.15 Auxiliary valve number 0 estimated flow limit status

This parameter is used to report the Tractor ECU's present estimated flow limit status associated with valve number 0 flow commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5161

### A.21.16 Auxiliary valve number 0 exit/reason code

This parameter is used to indicate why the auxiliary valve 0 cannot accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010011 | Reserved |
| 010100 | Hydraulic oil level too low |
| 010101 | Valve locked out |
| 010110 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN 5800

### A.21.17 Parameters for auxiliary valves numbers 1 to 14

This part of ISO 11783 only specifies the parameters 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 and SPNs.

### A.21.18 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

SPN: 2335

### A.21.19 Auxiliary valve number 15 retract port measured flow

Measured flow through the retract 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

SPN: 2336

### A.21.20 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 because this parameter is estimated and not measured.

Data length: 1 byte

Resolution: 1 %/bit, –125 % offset

Data range: –125 % to 125 %

Type: Estimated

SPN: 2337

### A.21.21 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 feedback 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

SPN: 2338

### A.21.22 Auxiliary valve number 15 valve state

Measured state of the auxiliary valve number 15.

A blocked state means that the valve is closed and there is no flow from or to the valve and that the fluid may be under pressure. A floating state means that there is no control flow from or to the valve and that the valve ports are connected directly to the hydraulic fluid 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

SPN: 2339

### A.21.23 Auxiliary valve number 15 extend port pressure

Measured nominal pressure at the extend 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

SPN: 2340

### A.21.24 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

SPN: 2341

### A.21.25 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

SPN: 2342

### A.21.26 Auxiliary valve number 15 port flow — Command

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

SPN: 2343

### A.21.27 Auxiliary valve number 15 state — Command

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

SPN: 2344

### A.21.28 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

SPN: 2345

### A.21.29 Auxiliary valve number 15 fail safe mode

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

Data length: 2 bits

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

Type: Measured

SPN: 2346

### A.21.30 Auxiliary valve number 15 measured flow limit status

This parameter is used to report the Tractor ECU's present measured flow limit status associated with valve number 15 flow commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5190

### A.21.31 Auxiliary valve number 15 estimated flow limit status

This parameter is used to report the Tractor ECU's present estimated flow limit status associated with valve number 15 flow commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5191

### A.21.32 Auxiliary valve 15 exit/reason code

This parameter is used to indicate why the auxiliary valve 15 cannot accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010011 | Reserved |
| 010100 | Hydraulic oil level too low |
| 010101 | Valve locked out |
| 010110 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN 5815

### A.21.33 General-purpose valve extend port measured flow

Measured flow through the extend port of a general-purpose valve, expressed as a percentage of full flow.

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

Data length: 1 byte

Resolution: 1 %/bit, –125 % offset

Data range: –125 % to 125 %

Type: Measured

SPN: 2937

### A.21.34 General-purpose valve retract port measured flow

Measured flow through the retract port of a general-purpose valve, expressed as a percentage of full flow.

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

Data length: 1 byte

Resolution: 1 %/bit, –125 % offset

Data range: –125 % to 125 %

Type: Measured

SPN: 2938

### A.21.35 General-purpose valve extend port estimated flow

The value reported by the controller of flow through the extend port of a general-purpose valve, 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 valve through this port. Caution should be exercised when using this parameter in feedback 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: Measured

SPN: 2939

### A.21.36 General-purpose valve retract port estimated flow

The value reported by the controller of flow through the retract port of a general-purpose valve, 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 valve through this port. Caution should be exercised when using this parameter in feedback 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: Measured

SPN: 2940

### A.21.37 General-purpose valve state

The measured state of a general-purpose valve.

A blocked state means that the valve is closed and there is no flow from or to the valve and the that fluid may be under pressure. A floating state means that there is no control flow from or to the valve and that the valve ports are connected directly to the hydraulic fluid 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 | Block |
| 0001 | Extend |
| 0010 | Retract |
| 0011 | Float |
| 0100 to 1101 | Reserved |
| 1110 | Error indication |
| 1111 | Don't care |

Type: Measured

SPN: 2932

### A.21.38 General-purpose valve extend port pressure

The measured nominal pressure at the extend port of a general-purpose valve.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

SPN: 2941

### A.21.39 General-purpose valve retract port pressure

The measured nominal pressure at the retract port of a general-purpose valve.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

SPN: 2942

### A.21.40 General-purpose valve return port pressure

The measured nominal pressure at the return port of a general-purpose valve.

Data length: 1 byte

Resolution: 16 kPa/bit, 0 offset

Data range: 0 kPa to 4 000 kPa

Type: Measured

SPN: 2943

### A.21.41 General-purpose valve port flow — Command

Command for setting the flow through the extend or retract port of a general-purpose valve, expressed as a percentage of full flow.

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

Data length: 1 byte

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

Data range: 0 % to 100 %

Type: Command

SPN: 2944

### A.21.42 General-purpose valve state — Command

Command for setting a general-purpose valve state.

With float enabled, hydraulic fluid may flow to or from the valve 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

SPN: 2933

### A.21.43 General-purpose valve fail safe mode — Command

Command for setting the fail safe mode of a general-purpose valve.

Data length: 2 bits

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

Type: Command

SPN: 2935

### A.21.44 General-purpose valve fail safe mode

The measured state of the fail safe mode of a general-purpose valve.

Data length: 2 bits

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

Type: Measured

SPN: 2934

### A.21.45 General-purpose valve load sense pressure

The maximum of the currently measured pressures of a general-purpose valve's work port A and work port B.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

SPN: 4086

### A.21.46 General-purpose valve pilot pressure

The measured pressure of a general-purpose valve's pilot supply port.

Data length: 1 byte

Resolution: 16 kPa/bit, 0 offset

Data range: 0 kPa to 4 000 kPa

Type: Measured

SPN: 4087

### A.21.47 General-purpose valve assembly load sense pressure

The maximum measured pressure of a general-purpose valve assembly's current collective load sense pressures where a valve assembly can consist of two or more valves.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data Range: 0 kPa to 321 275 kPa

Type: Measured

SPN: 4088

### A.21.48 General-purpose valve assembly supply pressure

The measured pressure of the hydraulic supply port to a valve assembly.

Data length: 2 bytes

Resolution: 5 kPa/bit, 0 offset

Data range: 0 kPa to 321 275 kPa

Type: Measured

SPN: 4089

### A.21.49 General-purpose valve measured limit status

This parameter is used to report the Tractor ECU's present measured flow limit status associated with general-purpose valve flow commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5192

### A.21.50 General-purpose valve estimated limit status

This parameter is used to report the Tractor ECU's present estimated flow limit status associated with general-purpose valve flow commands that are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5193

## A.22 Lighting parameters

### A.22.1 High-beam headlights — Command

Command for activating or deactivating the machine's high-beam headlights[2)].

Data length: 2 bits

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

Type: Command

SPN: 2347

### A.22.2 High-beam headlights

Parameter providing measured data from the machine's high-beam headlights[3)].

Data length: 2 bits

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

Type: Measured

SPN: 2348

### A.22.3 Low-beam headlights — Command

Command to activate or deactivate the machine's low-beam headlights [3)].

Data length: 2 bits

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

Type: Command

SPN: 2349

2) "Head lamps" is a synonym.

3) "Head lamps" is a synonym.

### A.22.4 Low-beam headlights

Parameter providing measured data from the machine's low-beam headlights [4].

Data length: 2 bits

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

Type: Measured

SPN: 2350

### A.22.5 Alternate headlights — Command

Command for activating or deactivating the machine's alternate headlights [4] [4] (on which only low-beam is available). The alternate position lamps are intended for use with loader and snow ploughs where the primary headlights could be blocked.

Data length: 2 bits

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

Type: Command

SPN: 2351

### A.22.6 Alternate headlights

Parameter providing measured data from the alternate headlights [5][6].

Data length: 2 bits

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

Type: Measured

SPN: 2352

---

4) "Alternate" is here used as the synonym of "alternative".

5) "Alternate" is here used as the synonym of "alternative".

6) "Head lamps" and "headlights" are terms with the same meaning used in the different English-speaking countries.

### 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

SPN: 2353

### A.22.8 Tractor front low-mounted work lights

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

SPN: 2354

### 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

SPN: 2355

### A.22.10 Tractor front high-mounted work lights

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

SPN: 2356

### 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

SPN: 2357

### A.22.12 Tractor underside-mounted work lights

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

SPN: 2358

### 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

SPN: 2359

### A.22.14 Tractor rear low-mounted work lights

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

SPN: 2360

### 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

SPN: 2361

### A.22.16 Tractor rear high-mounted work lights

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

SPN: 2362

### 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

SPN: 2363

### A.22.18 Tractor side low-mounted work lights

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

SPN: 2364

### 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

SPN: 2365

### A.22.20 Tractor side high-mounted work lights

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

SPN: 2366

### 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

SPN: 2367

### A.22.22 Left-turn signal lights

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

Data length: 2 bits

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

Type: Measured

SPN: 2368

### 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

SPN: 2369

### A.22.24 Right-turn signal lights

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

SPN: 2370

### 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

SPN: 2371

### A.22.26 Left stop lights

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

SPN: 2372

### 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

SPN: 2373

### A.22.28 Right stop lights

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

SPN: 2374

### 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

SPN: 2375

### A.22.30 Centre stop lights

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

SPN: 2376

### A.22.31 Tractor marker (position) lights — Command

Command for activating or deactivating the tractor's front position lights, rear red tail lights, side amber running lights, license-plate (number-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

SPN: 2377

### A.22.32 Tractor marker (position) lights

Parameter providing measured data from the tractor's marker lights, including front-position lights, rear tail lights, side running lights, license-plate (number-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

SPN: 2378

### A.22.33 Implement marker (position) lights — Command

Command for activating or deactivating the implement's, front position lights, rear red tail lights, side amber running lights, license-plate (number-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

SPN: 2379

### A.22.34 Implement marker (position) lights

Parameter providing measured data from an attached implement, marker lights, including front position lights, rear tail lights, side running lights, license-plate (number-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

SPN: 2380

### 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

SPN: 2381

### A.22.36 Tractor clearance lights

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

SPN: 2382

### 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

SPN: 2383

### A.22.38 Implement clearance lights

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

SPN: 2384

### A.22.39 Rotating beacon light — Command

Command for activating or deactivating slow-moving vehicle indicator lights on the tractor or implement 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

SPN: 2385

### A.22.40 Rotating beacon light

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

Data length: 2 bits

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

Type: Measured

SPN: 2386

### 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

SPN: 2387

### A.22.42 Tractor front fog lights

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

SPN: 2388

### 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

SPN: 2389

### A.22.44 Rear fog lights

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

SPN: 2390

### A.22.45 Implement rear work lights — Command

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

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

Data length: 2 bits

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

Type: Command

SPN: 2405

### A.22.46 Implement rear work lights

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

SPN: 2394

### A.22.47 Implement OEM option 1 light — Command

Command for activating or deactivating an implement's OEM (original equipment manufacturer) 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

SPN: 2395

### A.22.48 Implement OEM option 1 light

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

SPN: 2396

### 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

SPN: 2397

### A.22.50 Implement OEM option 2 light

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

SPN: 2398

### 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

SPN: 2391

### A.22.52 Back-up lights and alarm horn

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

SPN: 2392

### 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

SPN: 2597

### A.22.54 Implement left forward work lights

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

SPN: 2598

### 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

SPN: 2406

### A.22.56 Implement right forward work lights

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

SPN: 2407

### 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

SPN: 2399

### A.22.58 Implement left-facing work lights

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

SPN: 2400

### 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

SPN: 2401

### A.22.60 Implement right-facing work lights

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

SPN: 2402

### A.22.61 Daytime running lights — Command

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

SPN: 2403

### A.22.62 Daytime running lights

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

SPN: 2404

### A.22.63 Lighting data message request — Command

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

SPN: 2393

### A.22.64 Background illumination level — Command

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

SPN: 1487

## A.23 Language-specific parameters

### A.23.1 Language code

Command sent to all CFs 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

SPN: 2410

### A.23.2 Decimal symbol

Command sent to all CFs that determines whether a point or a comma will be displayed as the decimal symbol.

Data length: 2 bits

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

Type: Command

SPN: 2411

### A.23.3 Date format

Command sent to all CFs specifying the displayed format of the date.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0 | ddmmyyyy |
| 1 | ddyyyymm |
| 2 | mmyyyydd |
| 3 | mmddyyyy |
| 4 | yyyymmdd |
| 5 | yyyyddmm |
| 6–250 | Reserved |

Type: Command

SPN: 2412

### A.23.4 Time format

Command sent to all CFs 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

SPN: 2413

### A.23.5 Units of measure parameters

#### A.23.5.1 General

These are sent to all CFs to specify the units of measure to be used for the display of information.

#### A.23.5.2 Distance units

Command specifying a distance unit.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Metric (kilometres, metres, …) |
| 01 | Imperial/US (miles, feet, …) |
| 10 | Reserved |
| 11 | No action |

Type: Command

SPN: 2414

#### A.23.5.3 Area units

Command specifying an area unit.

Data length: 2 bits

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

Type: Command

SPN: 2415

#### A.23.5.4 Volume units

Command specifying a volume unit.

Data length: 2 bits

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

Type: Command

SPN: 2416

#### A.23.5.5 Mass units

Command specifying a mass unit.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Metric (tonnes, kilograms, ...) |
| 01 | Imperial (long tons, pounds, ...) |
| 10 | US (short tons, pounds, ...) |
| 11 | No action |

Type: Command

SPN: 2417

#### A.23.5.6 Temperature units

Command specifying a temperature unit.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Metric (degrees Celsius, degrees Kelvin, ...) |
| 01 | Imperial/US (degrees Fahrenheit, ...) |
| 10 | Reserved |
| 11 | No action |

Type: Command

SPN: 5194

#### A.23.5.7 Pressure units

Command specifying a pressure unit.

Data length: 2 bits

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

Type: Command

SPN: 5195

#### A.23.5.8 Force units

Command specifying a force unit.

Data length: 2 bits

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

Type: Command

SPN: 5196

#### A.23.5.9 Units system

Command specifying the system to be used for the display of any unit, or a unit 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

SPN: 5197

### A.23.6 Repetition rate — Command

Parameter defining the commanded repetition rate of the transmission of the message with the associated PGN. The value of 0 implies that the default rate is desired, while a value of 65 535 implies no change is requested.

Data length: 2 bytes

Resolution: 1 ms

Data range: 0 to 64 255

Type: Command

SPN: 2418

### A.23.7 Repetition rate

The actual value of the transmission rate of the message with the associated PGN.

Data length: 2 bytes

Resolution: 1 ms

Data range: 0 to 64 255

Type: Measured

SPN: 5198

## A.24 Working set parameters

### A.24.1 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 CF) 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

SPN: 2409

### A.24.2 NAME of working set member

This parameter is a NAME with the format specified in ISO 11783-5 that identifies a member of a working set. This NAME is the same at that which was used by the member when it claimed its associated source address.

Data length: 8 bytes

Resolution: 1 count/bit

Data range: 0 to (2^64 – 1)

Type: Measured

SPN: 2845

## A.25 Implement operating state parameters

### A.25.1 Implement operating state — Command

Command for setting the operating state of a connected implement system.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Set implement to field working state |
| 01 | Set implement to transport state |
| 10 | Set implement to park state |
| 11 | Take no action |

Type: Command

SPN: 5139

### A.25.2 Implement Start/Stop operations

State of a switch or other operator input to start or enable implement operations. The start or enabled state can be the result of the implement being positioned in an operating position. It can be generated by an operator placing a switch to an ON state. Also called “Master ON/OFF” switch.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Stop or disable implement operations |
| 01 | Start or enable implement operations |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 5203

### A.25.3 Stop all implement operations

State of a switch or other operator input to immediately stop operation of all functions that were activated by operator controls or message commands from a VT, auxiliary control input, TECU, task controller or sequence control master. This switch shall be available to the operator at all times. When the activation of this switch has caused all implement operations to stop, a "permit all implement operations state" does not directly restart an implement. Implement operations shall only be restarted by the use of a start/stop ("Master ON/OFF") switch or other such means.

This operator input is independent of any other type of input and is located in each operator location that can be used during implement operations. This input shall meet the requirements of ISO 15077 for its location and operation by an operator to activate stop implement operations.

The implement shall not rely solely on this stop all implement operations operator input to stop the implement. An implement shall provide another means by which to stop normal implement operation such as a dedicated start/stop switch, a soft key or button on a VT or an auxiliary input assigned to the operations stop function.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Stop implement operations |
| 01 | Permit all implements to operation ON |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 5140

### A.25.4 Stop all implement operations transition number

This parameter indicates the number of transitions from Permit (01) to Stop (00) since power up of the Stop all implement operations parameter. The parameter resets to zero on the next transition after reporting the maximum value.

| | |
|---|---|
| Data length: | 1 byte |
| Resolution: | 1 / bit |
| Data range: | 0 to 255 |
| Type: | Measured |
| SPN: | 7443 |

## 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 optimize the performance of the connected system. The tractor is required to determine the constraints of each control mode and acknowledge the commands only as appropriate.

### A.26.2 Tractor control mode commands

As of the third edition, the tractor control mode commands described in section A.26.2 are deprecated and shall not be used for new designs.

#### 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. The individual control mode commands are described in A.26.2.2 to A.26.2.10.

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 to 11110 | Reserved |
| 11111 | Don't care |

Type: Command

SPN: 5204

### 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. The tractor determines which measurement currently available in the tractor provides the most accurate measurement for the current operating conditions, and uses 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 in order to reduce power loss at the tractor/soil interface.

Each of the following modes limits slip using a different control strategy, each with its own 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. On 2WD and MFWD tractors, the weight transfer

increases the load on the rear driving wheels to improve traction. On 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 maximize draft power through alternating transmission ratio (i.e. to slow down at a 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 reduce the draft force and transfer weight to the rear of the tractor.

On 2WD and MFWD tractors, the weight transfer increases the load on the rear driving wheels to improve traction. On 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 |
|---|---|
| 10000 | 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 |
|---|---|
| 01111 | Enable rear draft force control |

## A.26.3 Tractor control command value parameters

### A.26.3.1 General

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

### A.26.3.2 Commanded vehicle speed

Commanded 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

Data range: 0 to 64,255

Units: Metres per second

Type: Command

SPN: 5205

### A.26.3.3 Commanded PTO speed

Commanded 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

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

Unit: Reciprocal minutes

Type: Command

SPN: 5206

#### A.26.3.4 Commanded hitch position

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

| | |
|---|---|
| Data length: | 1 byte |
| Default value: | 0 |
| Resolution: | 0,4 %/bit |
| Offset: | 0 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Command |
| SPN: | 5207 |

#### A.26.3.5 Commanded PTO torque

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

| | |
|---|---|
| Data length: | 1 byte |
| Default value: | 0 |
| Resolution: | 0,4 %/bit |
| Offset: | 0 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Command |
| SPN: | 5208 |

#### A.26.3.6 Commanded auxiliary valve slip control

##### A.26.3.6.1 General

Commanded auxiliary valve slip control uses the three parameters listed below, specified in the following subclauses.

| | | |
|---|---|---|
| Data length: | | 2 bytes |
| Byte 1: | | Auxiliary valve flow (see A.26.3.6.2) |
| Byte 2: | Bits 8 to 5: | Auxiliary valve state (see A.26.3.6.3) |
| | Bits 4 to 1: | Auxiliary valve number (see A.26.3.6.4) |
| Type: | | Command |

#### A.26.3.6.2 Commanded auxiliary valve flow

Command for the set point value within the slip control function of the flow from the tractor auxiliary valve number given in A.26.3.6.4.

Data length: 1 byte

Default value: 0

Resolution: 0,4 %/bit

Offset: 0 %

Data range: 0 % to 100 %

Unit: Percent

Type: Command

SPN: 5209

#### A.26.3.6.3 Commanded auxiliary valve state

Command for setting of the state of the auxiliary valve number given in A.26.3.6.4.

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

SPN: 5210

#### A.26.3.6.4 Commanded auxiliary valve number

The number of the auxiliary valve selected for the commanded flow set point value within the slip control function.

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

| | |
|---|---|
| Data length: | 4 bits |
| Default value: | 0 |
| Resolution: | 1/bit |
| Offset: | 0 |
| Data range: | 0 to 15 |
| Unit: | Valve number |
| Type: | Command |
| SPN: | 5211 |

#### A.26.3.7 Commanded draft force

Commanded 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 |
| Data range: | –100 000 N to 150 000 N |
| Unit: | Newton |
| Type: | Command |
| SPN: | 5212 |

### A.26.4 Tractor control mode command response parameters

#### A.26.4.1 General

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

The measured control modes are specified in A.26.4.2 to A.26.4.10.

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 to 11110 | Reserved |
| 11111 | Not available |

Type: Measured

SPN: 5213

### A.26.4.2 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.26.4.3 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.26.4.4 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.26.4.5 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.26.4.6 Minimum engine speed

Parameter that reports 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 |
|---|---|
| 01111 | Enable minimum engine speed control |

### A.26.4.7 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.26.4.8 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.26.4.9 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.26.4.10 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.26.5 Tractor control value response parameters

#### A.26.5.1 General

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

#### A.26.5.2 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

Data range: 0 to 64,255

Units: Metres per second

Type: Measured

SPN: 5214

### A.26.5.3 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 |
| Data range: | 0 1/min to 8 031,875 1/min |
| Unit: | Reciprocal minutes |
| Type: | Measured |
| SPN: | 5215 |

### A.26.5.4 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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Measured |
| SPN: | 5216 |

### A.26.5.5 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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Measured |
| SPN: | 5217 |

### A.26.5.6 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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Measured/Estimated |
| SPN: | 5218 |

### A.26.5.7 Auxiliary valve slip control

Number of the auxiliary valve indicating the flow set point within the slip control function. This parameter also contains the flow direction.

| | | |
|---|---|---|
| Data length: | | 2 bytes |
| Byte 1: | | Auxiliary valve flow (see A.26.5.7.1) |
| Byte 2: | Bits 8 to 5: | Auxiliary valve state (see A.26.5.7.2) |
| | Bits 4 to 1: | Auxiliary valve number (see A.26.5.7.3) |
| Type: | | Measured |

#### A.26.5.7.1 Auxiliary valve flow

Parameter that reports the set point value within the slip control function of the flow from the tractor auxiliary valve number given in A.26.5.7.3.

| | |
|---|---|
| Data length: | 1 byte |
| Default value: | 0 |
| Resolution: | 0,4 %/bit |
| Offset: | 0 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Measured/Estimated |
| SPN: | 5219 |

#### A.26.5.7.2 Auxiliary valve state

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

Data length: 4 bits

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

Type: Measured

SPN: 5220

#### A.26.5.7.3 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: 4 bits

Resolution: 1/bit

Offset: 0

Data range: 0 to 15

Unit: Valve number

Type: Measured

SPN: 5221

#### A.26.5.8 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 |
| Data range: | –320 000 N to 322 550 N |
| Unit: | Newton |
| Type: | Measured |
| SPN: | 5222 |

### A.26.6 Tractor control limit parameters

#### A.26.6.1 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.26.6.2 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 kN/bit |
| Offset: | –100 kN |
| Data range: | –100 kN to 150 kN |
| Unit: | Newton |
| Type: | Measured |
| SPN: | 5223 |

### A.26.6.3 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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Measured |
| SPN: | 5224 |

### A.26.6.4 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 r/min.

| | |
|---|---|
| Data length: | 1 byte |
| Resolution: | 30 N·m/bit |
| Offset: | 0 N·m |
| Data range: | 0 N·m to 7 500 N·m |
| Unit: | Newton metre |
| Type: | Measured |
| SPN: | 5225 |

### A.26.6.5 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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Measured/Estimated |
| SPN: | 5226 |

### A.26.7 Tractor control limit status

This parameter is used to report the Tractor ECU's present limit status associated with a parameter whose commands are persistent.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5227

### A.26.8 Tractor control limit command parameters

#### A.26.8.1 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.26.8.2 Draft force limit set point command

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

Data length: 1 byte

Resolution: 1 kN/bit

Offset: –100 kN

Data range: –100 kN to 150 kN

Unit: Newton

Type: Command

SPN: 5228

### A.26.8.3 PTO torque limit set point command

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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Command |
| SPN: | 5229 |

### A.26.8.4 Absolute maximum PTO torque limit set point 540 r/min command

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

| | |
|---|---|
| Data length: | 1 byte |
| Resolution: | 30 N·m/bit |
| Offset: | 0 N·m |
| Data range: | 0 N·m to 7 500 N·m |
| Unit: | Newton metre |
| Type: | Command |
| SPN: | 5230 |

### A.26.8.5 Auxiliary valve flow limit set point command

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 % |
| Data range: | 0 % to 100 % |
| Unit: | Percent |
| Type: | Command |
| SPN: | 5231 |

## 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

This parameter is 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

SPN: 5232

### A.27.3 Tractor facility request

This parameter is used to request a facility of a Tractor ECU.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Facility not required |
| 1 | Facility required |

Type: Command

SPN: 5233

### A.27.4 Tractor ECU class response

This parameter is 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

SPN: 5234

### A.27.5 Tractor facility response

This parameter is used to respond to a request for a facility of a Tractor ECU.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Facility not available |
| 1 | Facility available |

Type: Measured

SPN: 5235

### A.27.6 Tractor facility reserved bit indicator

This parameter indicates whether the reserved bits in the message are set to 0 or 1.

NOTE This parameter is necessary for backward compatibility because standard compliance is to set reserved bits to 1, and because previous versions of the standard did not state an exception for reserved tractor facility bits.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 0 | Reserved bits are set to 0 |
| 1 | Reserved bits are set to 1 |

Type: Measured

SPN: 5236

### A.27.7 Tractor facility request - Limit/request status reporting

This parameter indicates whether the requester requires reporting of the limit status and request status parameters in the tractor's supported status messages. See A.19.11 and A.20.19 for an example of one of these parameters.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Limit/request status reporting not required |
| 1 | Limit/request status reporting required |

Type: Measured

SPN: 7445

### A.27.8 Tractor facility response - Limit/request status reporting

This parameter indicates whether the vehicle supports reporting of the limit status and request status parameters in the tractor's supported status messages. See A.19.11 and A.20.19 for an example of one of these parameters.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Limit/request status reporting not available |
| 1 | Limit/request status reporting available |

Type: Measured

SPN: 7444

## A.28 Guidance commands

### A.28.1 Curvature command

Desired course curvature over ground that a machine's steering system is required to achieve. The desired path is determined by the automatic guidance system expressed as the inverse of the instantaneous radius of curvature of the turn. Curvature is positive when the vehicle is moving forward and turning to the driver's right.

Data length: 2 bytes

Resolution: 0,25 $km^{-1}$/bit, –8 032 $km^{-1}$ offset

Data range: –8 032 to 8 031,75 $km^{-1}$

Type: Command

SPN 5237

### A.28.2 Estimated curvature

Machine steering system's estimate of the curvature of the current turn. Curvature is positive when the vehicle is moving forward and turning to the driver's right.

Data length: 2 bytes

Resolution: 0,25 $km^{-1}$/bit, –8 032 $km^{-1}$ offset

Data range: –8 032 to 8 031,75 $km^{-1}$

Type: Measured

SPN 5238

### A.28.3 Curvature command status

This parameter indicates whether the guidance system is attempting to control steering with this command.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Not intended to steer |
| 01 | Intended to steer |
| 10 | Reserved |
| 11 | Not available |

Type: Command

SPN: 5239

### A.28.4 Request reset command status

Machine steering system request to the automatic guidance system to change Curvature Command Status state from “Intended to steer” to “Not intended to steer”.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Reset not required |
| 01 | Reset required |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN : 5240

### A.28.5 Steering input position status

Machine steering system indicates whether manual steering is in the correct position for guidance to function (i.e. may be neutral steering).

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Not the correct position |
| 01 | Correct position |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN : 5241

### A.28.6 Steering system readiness

Machine steering system indicates that it is free from faults that would preclude guidance system operation.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | System is not ready |
| 01 | System is ready |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 5242

### A.28.7 Mechanical system lockout

State of a lockout switch that allows operators to disable automatic steering system functions.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Not active |
| 01 | Active |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 5243

### A.28.8 Guidance Limit Status

This parameter is used to report the steering system's present limit status associated with guidance commands that are persistent (i.e. not transient/temporary/one-shot).

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

NOTE The limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 5726

### A.28.9 Guidance system command exit/reason code

This parameter is used to indicate why the guidance system cannot currently accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010011 | Reserved |
| 010100 | Hydraulic oil level too low |
| 010101 | Hydraulic oil temperature too low |
| 010110 | Vehicle transmission gear does not allow remote commands (park, etc.) |
| 010111 | Vehicle speed too low |
| 011000 | Vehicle speed too high |
| 011001 | Alternate guidance system active |
| 011010 | Control unit in diagnostic mode |
| 011011 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN: 5725

## A.29 ISOBUS compliance certification parameters

### A.29.1 ISOBUS compliance test protocol publication year

The publication year of the compliance test protocol to which the certification test was performed.

| | |
|---|---|
| Data length: | 6 bits |
| Resolution: | 1 year, 2000 year offset |
| Data range: | 2000–2061 |
| Type: | Measured |
| SPN | 4313 |

### A.29.2 ISOBUS compliance test protocol revision

Revision of the compliance test performed.

NOTE As of the third edition of this document, the definition of this parameter has been changed to support more revisions of the test protocol.

When the ISOBUS Compliance Certification message revision parameter (see A.29.19) is set to "1" (third edition and later), the following definition applies:

In years where there are multiple revisions of the test protocol, a revision number suffix is used in addition to the certification year (A.29.1).

| | |
|---|---|
| Data length: | 5 bits |
| Resolution: | 1/bit |
| Data Range: | 0–30 |
| Type: | Measured |
| SPN | 4314 |

When the ISOBUS Compliance Certification message revision parameter (see A.29.19) is set to "0" (second edition), the following definition applies:

In years where there are multiple revisions of the test protocol, an alphabetic suffix is used in addition to the certification year (A.29.1).

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | First revision (no suffix) |
| 001 | Second revision (suffix A) |
| 010 | Third revision (suffix B) |
| 011 | Fourth revision (suffix C) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Reserved |
| 111 | Not available |

Type: Measured

SPN 4314

### A.29.3 ISOBUS compliance certification laboratory type

Approving body for the certification laboratory.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Non-certified laboratory/self-certification |
| 01 | AEF certified laboratory |
| 10 | Reserved |
| 11 | Not available (not certified) |

Type: Measured

SPN: 4315

Note: Prior to the third edition, this parameter had the following definition.

Approving body for the certification laboratory.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Non-certified laboratory/self-test |
| 001 | EU certified laboratory |
| 010 | NA certified laboratory |
| 011 | Reserved |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Reserved |
| 111 | Not available (not certified) |

Type: Measured

SPN: 4315

### A.29.4 Compliance certification laboratory ID

Manufacturer code of the laboratory that performed the compliance test. In the case of a self-certified CF, this matches the manufacturer code contained in the address claim PGN. The value of this parameter is assigned by committee (see ISO 11783-1:2007, Table B.6).

Data length: 11 bits

Resolution: 1/bit

Data range: In accordance with ISO 11783-1:2007, Table B.6

Type: Measured

SPN 4316

### A.29.5 Compliance certification type — Minimum CF

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN : 4317

### A.29.6 Compliance certification type — TECU Class 1

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4318

### A.29.7 Compliance certification type — TECU Class 2

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4319

### A.29.8 Compliance certification type — TECU Class 3

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4320

### A.29.9 Compliance certification type — Class 3 ECU

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4321

### A.29.10 Compliance certification type — Virtual terminal

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4322

### A.29.11 Compliance certification type — VT working set master

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4323

### A.29.12 Compliance certification type — VT working set member

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4324

### A.29.13 Compliance certification type — Task controller

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4325

### A.29.14 Compliance certification type — TC working set master

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4326

### A.29.15 Compliance certification type — TC working set member

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4327

### A.29.16 Compliance certification type — File server

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4328

### A.29.17 Compliance certification type — GPS receiver

As of the third edition of this document, this parameter has been deprecated due to a change in the definition and communication of functionalities. See ISO 11783-12 for more detail on functionalities.

This parameter is used to indicate the type of compliance test performed.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Not certified |
| 1 | Certification test performed |

Type: Measured

SPN: 4329

### A.29.18 Compliance certification reference number

Certification reference number assigned by a certification laboratory. This value can be used together with the Certification Lab ID and CF Manufacturer ID to uniquely identify the test file of the certification laboratory.

Data length: 16 bits

Resolution: 1/bit

Data range: 0 to 64 255

Type: Measured

SPN 4330

### A.29.19 ISOBUS Compliance Certification message revision

This parameter distinguishes the format of the ISOBUS Compliance Certification message in the second edition from the format in the third and later editions.

Data length: 1 bit

| Value | Meaning |
|---|---|
| 0 | Format of message in second edition. |
| 1 | Third and later edition message revision |

Type: Measured

SPN: 7446

## A.30 Selected speed control parameters

### A.30.1 Machine selected speed

Current value of the speed as determined from a number of sources by the machine. This parameter reports the value of one of the currently available machine speeds (wheel-, ground-, or navigational-based), which the machine has determined to best represent the machine's 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 |
| Data range: | 0 to 64 255 |
| Units: | Metres per second |
| Type: | Measured |
| SPN | 4305 |

### A.30.2 Machine selected distance

Actual distance travelled by the machine based on the value of selected machine speed (see A.30.1).

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

| | |
|---|---|
| Data length: | 4 bytes |
| Resolution: | 0,001 m/bit |
| Offset: | 0 m |
| Data range: | 0 m to 4 211 081,215 m |
| Units: | Metres |
| Type: | Measured |
| SPN | 4306 |

### A.30.3 Machine selected direction

Indicates the current direction of travel of the machine.

NOTE Forward and reverse refer to the normal directions of travel of the chassis. The direction does not change when the operator's perspective is changed (i.e. when operator station is reversed).

Data length: 2 bits

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

Type: Measured

SPN : 4309

### A.30.4 Machine selected speed source

An indication of the speed source that is currently being reported in the machine speed parameter (see A.30.1). Simulated speed is a system-generated speed message to permit implement operations when the machine is not actually moving. Blended speed is a speed message that uses a combination of the actual speed sources based on the operator's or the manufacturer's selected logic, i.e. when a ground-based speed source is less than 0,5 m/s, the speed message will then send the wheel speed source.

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Wheel-based speed |
| 001 | Ground-based speed |
| 010 | Navigation-based speed |
| 011 | Blended speed |
| 100 | Simulated speed |
| 101 | Reserved |
| 110 | Reserved |
| 111 | Not available |

Type: Measured

SPN: 4308

### A.30.5 Machine selected speed set point command

Commanded set point value of the machine speed as measured by the selected source.

Data length: 2 bytes

Default value: 0

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

Offset: 0 m/s

Data range: 0 to 64 255

Units: Metres per second

Type: Command

SPN 4310

### A.30.6 Machine selected direction command

Commanded direction of the machine.

NOTE Forward and reverse refer to the normal directions of travel of the chassis. The direction does not change when the operator's perspective is changed (i.e. when operator station is reversed).

Data length: 2 bits

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

Type: Command

SPN: 4312

### A.30.7 Machine selected speed set point limit

This parameter is used by a machine to communicate its maximum allowed speed to the tractor.

Data length: 2 bytes

Default value: 0

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

Offset: 0 m/s

Data range: 0 to 64 255

Units: Metres per second

Type: Command

SPN 4311

### A.30.8 Machine selected speed limit status

This parameter is used to report the Tractor ECU's present limit status associated with a parameter whose commands are persistent (i.e. not transient/temporary/one-shot).

Data length: 3 bits

| Value | Meaning |
|---|---|
| 000 | Not limited |
| 001 | Operator limited/controlled (request cannot be implemented) |
| 010 | Limited high (only lower command values result in a change) |
| 011 | Limited low (only higher command values result in a change) |
| 100 | Reserved |
| 101 | Reserved |
| 110 | Non-recoverable fault |
| 111 | Not available (parameter not supported) |

Note that the limited conditions (limited high and low) could be temporary, for example when a large set point change is limited by a ramp rate. This bit can be set until the ramp is complete to prevent windup (and subsequent overshoot) due to the response of the controlled value.

A non-recoverable fault is non-recoverable from the viewpoint of the implement. Operator action within the tractor may resolve the issue and result in a change to "Operator Limited/Controlled" status.

Type: Measured

SPN: 4307

### A.30.9 Machine selected speed exit/reason code

This parameter is used to indicate why the vehicle speed control unit cannot currently accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010101 | Reserved |
| 010110 | Vehicle transmission gear does not allow remote commands (park, etc.) |
| 010111 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN : 5818

## A.31 Operator direction reversed

This parameter indicates whether the reported direction is reversed from the perspective of the operator (e.g. the operator station has been reversed such that forward direction actually moves the operator backwards).

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Not reversed |
| 01 | Reversed |
| 10 | Error indication |
| 11 | Not available |

Type: Command

SPN 5244

## A.32 Drive strategy parameters

### A.32.1 Drive strategy priority 1

This parameter indicates the current tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the highest priority.

Manufacturer specific modes are intended to allow a tractor to report a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable wheel speed/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Requested mode not supported |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don’t care |

Type: Measured

SPN 5727

### A.32.2 Drive strategy priority 2

This parameter indicates the current tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the second highest priority.

Manufacturer specific modes are intended to allow a tractor to report a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable wheel speed/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Requested mode not supported |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don't care |

Type: Measured

SPN 5728

### A.32.3 Drive strategy priority 3

This parameter indicates the current tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the third highest priority.

Manufacturer specific modes are intended to allow a tractor to report a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable wheel speed/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Requested mode not supported |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don't care |

Type: Measured

SPN: 5729

### A.32.4 Drive strategy priority 4

This parameter indicates the current tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates lowest priority.

Manufacturer specific modes are intended to allow a tractor to report a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable wheel speed/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Requested mode not supported |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don't care |

Type: Measured

SPN: 5730

### A.32.5 Drive strategy request state

This parameter reports the tractor's state associated with Drive Strategy requests that are transient/temporary/one-shot.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | External Request Accepted. No subsequent operator intervention |
| 01 | Control override (most recent external request ignored) |
| 10 | Error indication |
| 11 | Not available/Not Installed |

Type: Command

SPN : 5731

### A.32.6 Drive strategy exit/reason code

This parameter is used to indicate why the drive strategy subsystem cannot currently accept remote commands or has most recently stopped accepting remote commands.

Data length: 6 bits

| Value | Meaning |
|---|---|
| 000000 | No reason/all clear |
| 000001 | Required level of operator presence/awareness not detected |
| 000010 | Implement released control of function |
| 000011 | Operator override of function |
| 000100 | Operator control not in valid position |
| 000101 | Remote command timeout |
| 000110 | Remote command out of range/invalid |
| 000111 | Function not calibrated |
| 001000 | Operator control fault |
| 001001 | Function fault |
| 001010 to 010101 | Reserved |
| 010110 | Vehicle transmission gear does not allow remote commands (park, etc.) |
| 010111 to 110000 | Reserved |
| 110001 to 111101 | Manufacturer specific |
| 111110 | Error |
| 111111 | Not available (parameter not supported) |

Type: Measured

SPN : 5732

### A.32.7 Drive strategy priority 1 request

This parameter is used to request an alteration to the tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the highest priority request.

Manufacturer specific modes are intended to allow a request of a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable combined wheel/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Reserved |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don't care |

Type: Command

SPN: 5733

### A.32.8 Drive strategy priority 2 request

This parameter is used to request an alteration to the tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the second highest priority request.

Manufacturer specific modes are intended to allow a request of a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable combined wheel/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Reserved |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don't care |

Type: Command

SPN: 5734

### A.32.9 Drive strategy priority 3 request

This parameter is used to request an alteration to the tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the third highest priority request.

Manufacturer specific modes are intended to allow a request of a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable combined wheel/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Reserved |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don’t care |

Type: Command

SPN: 5735

### A.32.10 Drive strategy priority 4 request

This parameter is used to request an alteration to the tractor drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine. This parameter indicates the lowest priority request.

Manufacturer specific modes are intended to allow a request of a mode that is not mapped and allow an implement to synchronize to that mode.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0x00 | Enable maximum draft power control |
| 0x01 | Enable constant PTO speed control |
| 0x02 | Enable combined wheel/PTO speed ratio control |
| 0x03 | Enable minimum engine speed control |
| 0x04 | Enable engine economy control |
| 0x05 | Enable maximum hydraulic power control |
| 0x06 | Enable maximum electric power control |
| 0x07–0xEC | Reserved |
| 0xED - 0xFC | Manufacturer specific modes |
| 0xFD | Reserved |
| 0xFE | Error or reserved |
| 0xFF | Not available/Don't care |

Type: Command

SPN: 5736

### A.32.11 Restore operator drive strategy setting request

This parameter requests the drive strategy subsystem to restore the settings for drive strategy to the state before automation was ended.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | No Request (sent when implement does not want setting restored) |
| 01 | Restore Operator Drive Strategy Setting |
| 10 | Error indication |
| 11 | Not available |

Type: Command

SPN: 5737

## A.33 Implement in-work state

Indicates that an implement is connected to a tractor or power unit and is in work state.

Data length: 2 bits

| Value | Meaning |
|---|---|
| 00 | Implement is not in work state |
| 01 | Implement is in work state |
| 10 | Error indication |
| 11 | Not available |

Type: Measured

SPN: 7447

## A.34 Heartbeat sequence number

This parameter indicates the sequence number of the heartbeat message. The heartbeat message is used to determine the integrity of the communication of messages and parameters transmitted by a CF.

Data length: 8 bits

| Value | Meaning |
|---|---|
| 0 - 250 | Valid incrementing counter values |
| 251 | Counter initial value |
| 252, 253 | Reserved for future definition. Receiving CFs shall ignore heartbeat messages that contain these values. |
| 254 | Error indication |
| 255 | Not available |

Type: Current Value

SPN: 7345

The validation of the heartbeat sequence number value and the required actions by the heartbeat message transmitter and receiver CFs are specified in B.33 Heartbeat message.

The following FMI's are valid for diagnosing the Heartbeat sequence number SPN:

| FMI Value | Meaning |
|---|---|
| 10 | Abnormal Rate of Change |
| 11 | Root Cause not Known |
| 12 | Bad Intelligent Device or Component |
| 19 | Received Network Data in Error |

Both the transmitter and the recipient of the SPN can use these FMI's to indicate the reason for an error state or for the occurrence of reduced functionality due to an error in the Heartbeat sequence number value processing.

# 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 A.1) |
| Bytes 4 to 6: | Date (see A.2) |
| Byte 7: | Local minute offset (see A.3) |
| Byte 8: | Local hour offset (see 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 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: | | 73 |
| Default priority: | | 3 |
| Parameter group number: | | 65097 ($00FE49_{16}$) |
| Bytes 1, 2: | | Ground-based machine speed (see A.5) |
| Bytes 3 to 6: | | Ground-based machine distance (see A.6) |
| Byte 7: | | Reserved |
| Byte 8: | Bits 8 to 3: | Reserved |
| | Bits 2, 1: | Ground-based machine direction (see 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. The message also includes a free-running distance counter, an indication of the direction of travel and the state of the start/stop switch or input.

When the ignition key switch is turned off, both the ECU_PWR and PWR have to be maintained to send this message for an additional 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 machine speed (see A.8) |
| Bytes 3 to 6: | | Wheel-based machine distance (see A.9) |
| Byte 7: | | Maximum time of tractor power (see A.12) |
| Byte 8: | Bits 8, 7: | Operator direction reversed (see A.31) |
| | Bits 6, 5: | Start/stop state (see A.25.2) |
| | Bits 4, 3: | Key switch state (see A.11) |
| | Bits 2, 1: | Wheel-based machine direction (see A.10) |

## B.4 Maintain power

Message sent by any CF 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 that the ignition has been switched off. The message also includes the connected implement(s) operating state.

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 A.13) |
| | Bits 6, 5: | Maintain actuator power (see A.14) |
| | Bits 4 to 1: | Reserved |
| Byte 2: | Bits 8, 7: | Implement transport state (see A.15) |
| | Bits 6, 5: | Implement park state (see A.16) |
| | Bits 4, 3: | Implement ready-to-work state (see A.17) |
| | Bits 2, 1: | Implement in-work state (see A.33) |
| Bytes 3 to 8: | | Reserved |

## B.5 Navigation location system messages

ISO 11783 networks shall use the navigation location messages specified in IEC 61162-3 (NMEA 2000). The preferred (minimum) messages for ISO 11783 are "GNSS position data", "Position delta, high precision rapid update", "COG & SOG, Rapid Update", and "GNSS pseudo-range noise statistics". Messages requiring multiple data frames shall use the NMEA fast packet protocol instead of the transport protocol specified in ISO 11783-3.

## 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 4: | Front hitch position limit status (see A.19.11) |
| | Bits 3 to 1: | Reserved |
| Byte 3: | | Front nominal lower link force (see A.19.9) |
| Bytes 4, 5: | | Front draft (see A.19.7) |
| Byte 6: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Front hitch exit/reason code (see A.19.13) |
| Bytes 7, 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 4: | Rear hitch position limit status (see A.19.12) |
| | Bits 3 to 1: | Reserved |
| Byte 3: | | Rear nominal lower link force (see A.19.10) |
| Bytes 4, 5: | | Rear draft (see A.19.8) |
| Byte 6: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Rear hitch exit/reason code (see A.19.14) |
| Bytes 7, 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: | Front PTO engagement request status (see A.20.19) |
| Byte 6: | Bits 8, 7: | Front PTO mode request status (see A.20.20) |
| | Bits 6, 5: | Front PTO economy mode request status (see A.20.21) |
| | Bits 4 to 2: | Front PTO shaft speed limit status (see A.20.22) |
| | Bit 1: | Reserved |
| Byte 7: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Front PTO exit/reason code (see A.20.27) |
| Byte 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: | Rear PTO engagement request status (see A.20.23) |
| Byte 6: | Bits 8, 7: | Rear PTO mode request status (see A.20.24) |
| | Bits 6, 5: | Rear PTO economy mode request status (see A.20.25) |
| | Bits 4 to 2: | Rear PTO shaft speed limit status (see A.20.26) |
| | Bit 1: | Reserved |
| Byte 7: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Rear PTO exit/reason code (see A.20.28) |
| Byte 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: | | 100 ms when active |
| 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 command (see A.20.5) |
| Bytes 5 to 6: | | Rear PTO output shaft speed set point command (see A.20.6) |
| Byte: 7: | | PTO output shaft engagement command |
| | 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 command (see A.20.15) |
| | Bits 6, 5: | Rear PTO mode command (see A.20.16) |
| | Bits 4, 3: | Front PTO economy mode command (see A.20.17) |
| | Bits 2, 1: | Rear PTO economy mode command (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: | | Auxiliary valve 0 extend port estimated flow (see A.21.4) |
| Byte 2: | | Auxiliary valve 0 retract port estimated flow (see A.21.5) |
| Byte 3: | Bits 8, 7: | Auxiliary valve 0 fail safe mode (see A.21.13) |
| | Bits 6, 5: | Reserved |
| | Bits 4, 1: | Auxiliary valve 0 valve state (see A.21.6) |
| Byte 4: | Bits 8 to 6: | Auxiliary valve 0 limit status (see A.21.15) |
| | Bits 5 to 1: | Reserved |
| Byte 5: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Auxiliary valve 0 exit/reason code (see A.21.16) |
| Bytes 6 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: | | Auxiliary valve 0 extend port measured flow (see A.21.2) |
| Byte 2: | | Auxiliary valve 0 retract port measured flow (see A.21.3) |
| Bytes 3 to 4: | | Auxiliary valve 0 extend port pressure (see A.21.7) |
| Bytes 5 to 6: | | Auxiliary valve 0 retract port pressure (see A.21.8) |
| Byte 7: | | Auxiliary valve 0 return port pressure (see A.21.9) |
| Byte 8: | Bits 8 to 6: | Auxiliary valve 0 limit status (see A.21.14) |
| | Bits 5 to 1: | 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: | | 100 ms when active |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 48 |
| Default priority: | | 3 |
| Parameter group number: | | 65072 ($00FE30_{16}$) |
| Byte 1: | | Auxiliary valve 0 port flow command (see A.21.10) |
| Byte 2: | | Reserved |
| Byte 3: | Bits 8, 7: | Auxiliary valve 0 fail safe mode command (see A.21.12) |
| | Bits 6, 5: | Reserved |
| | Bits 4, 1: | Auxiliary valve 0 state command (see A.21.11) |
| Bytes 4 to 8: | | Reserved |

## B.14 Auxiliary valve 1 to 14 messages

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

See A.21.17.

| | |
|---|---|
| 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 ($00FE3D_{16}$) |
| 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: | | Auxiliary valve 15 extend port estimated flow (see A.21.20) |
| Byte 2: | | Auxiliary valve 15 retract port estimated flow (see A.21.21) |
| Byte 3: | Bits 8, 7: | Auxiliary valve 15 fail safe mode (see A.21.29) |
| | Bits 6, 5: | Reserved |
| | Bits 4, 1: | Auxiliary valve 15 valve state (see A.21.22) |
| Byte 4: | Bits 8 to 6: | Auxiliary valve 15 estimated limit status (see A.21.49) |
| | Bits 5 to 1: | Reserved |
| Byte 5: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Auxiliary valve 15 exit/reason code (see A.21.32) |
| Bytes 6 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: | | Auxiliary valve 15 extend port measured flow (see A.21.18) |
| Byte 2: | | Auxiliary valve 15 retract port measured flow (see A.21.19) |
| Bytes 3 to 4: | | Auxiliary valve 15 extend port pressure (see A.21.23) |
| Bytes 5 to 6: | | Auxiliary valve 15 retract port pressure (see A.21.24) |
| Byte 7: | | Auxiliary valve 15 return port pressure (see A.21.25) |
| Byte 8: | Bits 8 to 6: | Auxiliary valve 15 limit status (see A.21.30) |
| | Bits 5 to 1: | Reserved |

## B.17 Auxiliary valve 15 command

Message that provides control of the flow through auxiliary valve number 15.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms when active |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 63 |
| Default priority: | | 3 |
| Parameter group number: | | 65087 ($00FE3F_{16}$) |
| Byte 1: | | Auxiliary valve 15 port flow command (see A.21.26) |
| Byte 2: | | Reserved |
| Byte 3: | Bits 8, 7: | Auxiliary valve 15 fail safe mode command (see A.21.28) |
| | Bits 6, 5: | Reserved |
| | Bits 4, 1: | Auxiliary valve 15 state command (see A.21.27) |
| Bytes 4 to 8: | | Reserved |

## B.18 Lighting command

Global message from the tractor to all lighting controllers on the tractor and attached implements.

Separate parameters are provided for tractor and implement work and driving lights. Additional commands are provided for three optional lights on implements to meet the needs of speciality equipment. Common marking and signalling parameters are provided.

This message is used to control the state of all lighting functions. It shall be sent on each change of state of a lamp, or at a periodic rate to provide synchronization of turn signal and hazard flashers. The state values indicate that the light is to be turned ON or OFF. Flashing is accomplished by sending the lighting message with the state alternately ON or OFF. A lighting command message shall be sent at least once per second. It is the responsibility of the tractor designer to provide the correct combination of lamp commands to meet local legislative directives.

| | | |
|---|---|---|
| Transmission repetition rate: | | On change of lamp ON/OFF state. Maximum period of 1 s between messages. No greater than 10 messages per second for all lights. |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 65 |
| Default priority: | | 3 |
| Parameter group number: | | 65089 ($00FE41_{16}$) |
| Byte 1: | Bits 8, 7: | High-beam headlights command (see A.22.1) |
| | Bits 6, 5: | Low-beam headlights command (see A.22.3) |
| | Bits 4, 3: | Alternate headlights command (see A.22.5) |
| | Bits 2, 1: | Daytime running lights command (see A.22.61) |
| Byte 2: | Bits 8, 7: | Left-turn signal lights command (see A.22.21) |
| | Bits 6, 5: | Right-turn signal lights command (see A.22.23) |
| | Bits 4, 3: | Rotating beacon lights command (see A.22.39) |
| | Bits 2, 1: | Tractor front fog lights command (see A.22.41) |
| Byte 3: | Bits 8, 7: | Left stop lights command (see A.22.25) |
| | Bits 6, 5: | Right stop lights command (see A.22.27) |
| | Bits 4, 3: | Centre stop lights command (see A.22.29) |
| | Bits 2, 1: | Back-up lights and alarm horn command (see A.22.51) |

| | | |
|---|---|---|
| Byte 4: | Bits 8, 7: | Tractor marker (position) lights command (see A.22.31) |
| | Bits 6, 5: | Implement marker (position) lights command (see A.22.33) |
| | Bits 4, 3: | Tractor clearance lights command (see A.22.35) |
| | Bits 2, 1: | Implement clearance lights command (see A.22.37) |
| Byte 5: | Bits 8, 7: | Tractor rear high-mounted work lights command (see A.22.15) |
| | Bits 6, 5: | Tractor rear low-mounted work lights (command see A.22.13) |
| | Bits 4, 3: | Tractor underside-mounted work lights command (see A.22.11) |
| | Bits 2, 1: | Rear fog lights command (see A.22.43) |
| Byte 6: | Bits 8, 7: | Tractor front high-mounted work lights command (see A.22.9) |
| | Bits 6, 5: | Tractor front low-mounted work lights command (see A.22.7) |
| | Bits 4, 3: | Tractor side high-mounted work lights command (see A.22.19) |
| | Bits 2, 1: | Tractor side low-mounted work lights command (see A.22.17) |
| Byte 7: | Bits 8, 7: | Implement left forward work lights command (see A.22.53) |
| | Bits 6, 5: | Implement right forward work lights command (see A.22.55) |
| | Bits 4, 3: | Implement OEM option 1 light command (see A.22.47) |
| | Bits 2, 1: | Implement OEM option 2 light command (see A.22.49) |
| Byte 8: | Bits 8, 7: | Implement rear work lights command (see A.22.45) |
| | Bits 6, 5: | Implement left-facing work lights command (see A.22.57) |
| | Bits 4, 3: | Implement right-facing work lights command (see A.22.59) |
| | Bits 2, 1: | Lighting data message request command (see A.22.63) |

## B.19 Lighting data

Response to the request for lighting data in the lighting command message.

Each lighting controller on the tractor and attached implements shall transmit this message to the Tractor ECU when requested. The tractor will then use this information to determine which lighting systems are functioning. Lighting controllers that have a lamp-sensing capability shall also report failed light bulbs.

NOTE This is a legal requirement in many areas.

| | | |
|---|---|---|
| Transmission repetition rate: | | As requested. |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 64 |
| Default priority: | | 6 |
| Parameter group number: | | 65088 ($00FE40_{16}$) |
| Byte 1: | Bits 8, 7: | High-beam headlights (see A.22.2) |
| | Bits 6, 5: | Low-beam headlights (see A.22.4) |
| | Bits 4, 3: | Alternate headlights (see A.22.6) |
| | Bits 2, 1: | Daytime running lights (see A.22.62) |
| Byte 2: | Bits 8, 7: | Left turn lights (see A.22.22) |
| | Bits 6, 5: | Right turn lights (see A.22.24) |
| | Bits 4, 3: | Rotating beacon lights (see A.22.40) |
| | Bits 2, 1: | Tractor front fog lights (see A.22.42) |

| | | |
|---|---|---|
| Byte 3: | Bits 8, 7: | Left stop lights (see A.22.26) |
| | Bits 6, 5: | Right stop lights (see A.22.28) |
| | Bits 4, 3: | Centre stop lights (see A.22.30) |
| | Bits 2, 1: | Back-up lights and alarm horn (see A.22.52) |
| Byte 4: | Bits 8, 7: | Tractor marker (position) lights (see A.22.32) |
| | Bits 6, 5: | Implement marker (position) lights (see A.22.34) |
| | Bits 4, 3: | Tractor clearance lights (see A.22.36) |
| | Bits 2, 1: | Implement clearance lights (see A.22.38) |
| Byte 5: | Bits 8, 7: | Tractor rear high-mounted work lights (see A.22.16) |
| | Bits 6, 5: | Tractor rear low-mounted work lights (see A.22.14) |
| | Bits 4, 3: | Tractor underside-mounted work lights (see A.22.12) |
| | Bits 2, 1: | Rear fog lights (see A.22.44) |
| Byte 6: | Bits 8, 7: | Tractor front high-mounted work lights (see A.22.10) |
| | Bits 6, 5: | Tractor front low-mounted work lights (see A.22.8) |
| | Bits 4, 3: | Tractor side high-mounted work lights (see A.22.20) |
| | Bits 2, 1: | Tractor side low-mounted work lights (see A.22.18) |
| Byte 7: | Bits 8, 7: | Implement left forward work lights (see A.22.54) |
| | Bits 6, 5: | Implement right forward work lights (see A.22.56) |
| | Bits 4, 3: | Implement OEM option 1 light (see A.22.48) |
| | Bits 2, 1: | Implement OEM option 2 light (see A.22.50) |
| Byte 8: | Bits 8, 7: | Implement rear work lights (see A.22.46) |
| | Bits 6, 5: | Implement left-facing work lights (see A.22.58) |
| | Bits 4, 3: | Implement right-facing work lights (see A.22.60) |
| | Bits 2, 1: | Reserved |

## B.20 Background lighting level command

Message used to control the state of all background lighting functions such as instruments and switches.

It shall be sent at each change of the background lighting level, with a maximum period of 5 s between messages.

| | |
|---|---|
| Transmission repetition rate: | On change of background lighting level. A maximum period of 5 s between messages. |
| Data length: | 8 bytes |
| Data page: | 0 |
| PDU format: | 208 |
| PDU specific: | DA |
| Default priority: | 3 |
| Parameter group number: | 53248 (00D00016) |
| Byte 1: | Background illumination level (see A.22.64) |
| Bytes 2 to 8: | Reserved |

## B.21 Language command

A global message sent to inform all CFs on the ISO 11783 bus of the language, date, time format and units of measurement to be used by the connected system.

After the system has completed its power-on and address claims, the VT (virtual terminal) shall send this message. A default language shall be stored in the Tractor ECU and the installed VT to be used by the connected system if the desired language is not supported by the implement CFs. The VT shall provide a method for the operator to view the supported language list of a connected implement or implement pool and to select a language from this list. If no language has been selected by the operator, as would be the case in a factory-new VT, the VT requests this default language from the Tractor ECU and stores it as the VT's default language. Once the operator has set the language, the VT's language message always takes priority over the Tractor ECU's default language. The operator's selected language shall then be stored in the Tractor ECU, the installed VT or both, to be used at the next power-up of the connected system.

| | | |
|---|---|---|
| Transmission repetition rate: | | On system initialization and on request. |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 15 |
| Default priority: | | 6 |
| Parameter group number: | | 65039 ($00FE0F_{16}$) |
| Bytes 1 to 2: | | Language code (see A.23.1) |
| Byte 3: | | Number format |
| | Bits 8, 7: | Decimal symbol (see A.23.2) |
| | Bits 6, 5: | Time format (see A.23.4) |
| | Bits 4 to 1: | Reserved |
| Byte 4: | | Date format (see A.23.3) |
| Byte 5: | | Units of measure |
| | Bits 8, 7: | Distance units (see A.23.5.2) |
| | Bits 6, 5: | Area units (see A.23.5.3) |
| | Bits 4, 3: | Volume units (see A.23.5.4) |
| | Bits 2, 1: | Mass units (see A.23.5.5) |
| Byte 6: | | Units of measure |
| | Bits 8, 7: | Temperature units (see A.23.5.6) |
| | Bits 6, 5: | Pressure units (see A.23.5.7) |
| | Bits 4, 3: | Force units (see A.23.5.8) |
| | Bits 2, 1: | Units system (see A.23.5.9) |
| Bytes 7 to 8: | | Reserved |

## B.22 Flexible repetition rates

### B.22.1 Request for repetition rate

Message allowing the system to adapt the bus bandwidth to the needs of the user of the message.

The user of a message with a particular PGN can request a specific, desired repetition rate. This includes the default rate that can be requested with a value of $0000_{16}$. If it is possible for the source of the message with the requested PGN to deliver the message with the desired repetition rate, it will honour the request.

CFs are not required to monitor the bus for this message. If another CF cannot or does not want to use the requested repetition rate, which is necessary for systems with fixed timing control loops, it may ignore this message. The requester of a varied rate shall wait 250 ms after transmission of this request message and, if no response for repetition rate has been received, the requester shall assume that the request was not accepted. Any source of the requested PGN that honours a new rate, shall send the response for repetition rate and wait 250 ms before switching to the new rate. If the source of the requested PGN has also received a request with the repetition rate of $0000_{16}$, within the 250 ms of receiving a request for a different rate, it shall use the default rate.

| | |
|---|---|
| Transmission repetition rate: | On request. |
| Data length: | 8 bytes |
| Data page: | 0 |
| PDU format: | 204 |
| PDU specific: | DA |
| Default priority: | 6 |
| Parameter group number: | 52224 ($00CC00_{16}$) |
| Bytes 1 to 3: | PGN, that the repetition rate is requested for (see ISO 11783-3) |
| Bytes 4, 5: | Repetition rate command (see A.23.6) |
| Bytes 6 to 8: | Reserved |

### B.22.2 Response for repetition rate

Global message that is the response to the request of a specific user to change the repetition rate.

NOTE The data field is the same as the request, but the repetition rate is the actual value of the sender.

| | |
|---|---|
| Transmission repetition rate: | On request. |
| Data length: | 8 bytes |
| Data page: | 0 |
| PDU format: | 254 |
| PDU specific: | 14 |
| Default priority: | 6 |
| Parameter group number: | 65038 ($00FE0E_{16}$) |
| Bytes 1 to 3: | PGN of the request |
| Bytes 4, 5: | Repetition rate (see A.23.7) |
| Bytes 6 to 8: | Same as request |

## B.23 Working set messages

### B.23.1 General

A working set supports communications between CFs on the ISO 11783 network where several control functions are acting as distributed processes providing a single application. These several control functions, each with a distinct NAME, can be in either in a single ECU or in different ECUs connected to the network. Working sets are used in ISO 11783 where several dissimilar NAMEs are intended to function as a single implement.

One CF shall be designated as the working set master for each working set. The working set master uses its address as a subset of the "global" destination for one-to-many communications, and to permit a receiving CF (service provider) of many-to-one communications to associate each of the several control functions with all the others that form a particular working set. The format for the communications becomes one-to-one in each case, with the service provider sending most of the data for the working set to the address of the network control function that has identified itself as the working-set master.

Messages, such as displayed data, may be sent by individual members of the working set. The response to a request by a member of a working set shall be sent by the receiving CF (service provider) to the requesting working set member. This message process allows response messages to be sent by using transport protocol to working set members. Working set members have no obligation to monitor destination specific messages directed to other members of the working set.

Any other CF on the network can interact with the working set by sending messages to the working set master or by sending messages directly to any of the working set members if required.

Messages received by other CFs from working set members are known to be associated with the particular working set and shall be interpreted accordingly.

EXAMPLE 1 A planter has a Working Set Master and one Working Set Member for each row. A connected VT accepts commands from the master and from each of the members of that set. Each member updates the presentation for their individual row.

Task controller commands are sent only to the working set master. The method the master uses to communicate the command(s) to the members is proprietary to the design of that working set.

Two message types are required to define the working set. The first message defines the working set's size and the second identifies the members of the set. The master transmits both of these messages.

The Working Set Messages are defined in ISO 11783-7. Please see the individual application layer sections (e.g. ISO 11783-6 and ISO 11783-10) for the actual application of these messages as the usage may be different and/or limited by the individual application layers.

### B.23.2 Working Set Master message

Message sent by the master of a working set to identify how many members are in the set.

The master is included as a member in the total. The source address (SA) of this message is associated with the master's NAME. Also, particular working sets may be identified by their master's NAME.

| | |
|---|---|
| Transmission repetition rate: | As required. |
| Data length: | 8 bytes |
| Data page: | 0 |
| PDU format: | 254 |
| PDU specific: | 13 |
| Default priority: | 7 |
| Parameter group number: | 65037 ($00FE0D_{16}$) |
| Byte 1: | Number of members in working set (see A.24.1) |
| Bytes 2 to 8: | Reserved |

### B.23.3 Working Set Member message

Message sent by the master of a working set to identify an individual member of a specific working set (master's SA identifies the particular working set).

There will be a number of these messages sent by any particular working set master. The number of messages will be one less than the number of members in the working set. No message is required to identify the master's NAME. This may be obtained from the master's address claim. This message structure requires that CFs communicating with a working set verify that they have received the appropriate number of working set member messages so that they can identify all of the members of the particular working set.

| | |
|---|---|
| Transmission repetition rate: | As required. |
| Data length: | 8 bytes |
| Data page: | 0 |
| PDU format: | 254 |
| PDU specific: | 12 |
| Default priority: | 7 |
| Parameter group number: | 65036 ($00FE0C_{16}$) |
| Bytes 1 to 8: | NAME of this specific member of the working set is identified by the member's claimed SA (see A.24.2). |

### **B.23.4** Working Set application rules

The term "service provider" is a network control function — whether in a single ECU or one control function of many within an ECU — that works and communicates with a working set as a separate entity. It is not a member of the working set being described, but can be a member or master of another working set.

The working-set application rules are the following.

a) A working-set-master message shall always be followed by the appropriate number of working-set-member messages. The number of working-set-member messages is one less than the working-set size. A service provider of the working set that does not receive the correct number of member definitions shall request the working-set-master PGN from the master of the set. On receipt of this request, the master shall completely define the set by sending the working-set-master message followed by the appropriate number of working-set-member messages. Applications that do not work with working sets can ignore the working-set messages and communicate directly with all other network control functions.

   Unless otherwise stated in the specific application layer document (e.g. ISO 11783 Part 6), the service provider may ignore a working set after a minimum of three failed attempts to get the complete set of members from the working set master.

b) Working sets shall be defined by the NAMEs of the working-set members. Working-set-member messages are sent at an interval of 100 ms. If more than 350 ms has elapsed after a working-set-member message, the receiver shall assume that the working-set master has completed sending all the NAMEs of the working-set members.

c) Working-set members are also individual control functions on the network, and therefore communicate as individual control functions. Fault messages are sent from the control function's SA, and any commands to clear fault tables, program parameters, and others shall be addressed to the individual SA of the intended control function. Working-set members shall be programmed to allow for such individual communications to the working-set master without having all the working-set members accepting programming not intended for them.

   NOTE 1 Member control functions may behave as a group and allow programming of common data into all members. This requires that the member control functions have application software to allow this to happen. Control functions that do not work with working sets can ignore working-set messages and communicate directly with all other network control functions.

d) Each control function on the network shall not be a member of more than one working set. If an existing working-set master issues a new working-set-master message, service providers of working sets on the network shall replace the old working-set definition with the new definition. A working-set master shall be responsible for re-defining their working set if changes are needed, and it shall send a working-set-master message with the Number of members parameter set to zero if the working set's purpose is no longer required.

e) The working-set master shall create a new working set when it changes its NAME. The old working set no longer exists, but its definition can remain in the memory of the service provider control function until a clean-up is performed using the method specified in d) by sending a working-set-master message with the Number of members parameter set to zero. The service provider for the working set has the responsibility for detecting and correcting duplication of members of a set.

   NOTE 2 Service providers for working sets are responsible for managing their resources by, for example, periodically checking for duplications and for unused working sets in order to recover the internal memory used for those sets that are no longer active.

f) A change in the SA of the working-set master does not change the definition of the set. The service providers shall update the association of SA to NAME when the new address claim is received, and the working-set members shall change the address that they use to receive working-set communications.

g) The service providers of working sets shall associate a new SA with the appropriate working set when a working-set member changes its SA. Since the working-set members are defined by NAME, the SA change, assuming that the NAME is unchanged, can be handled by the working-set service providers as they receive new address claim messages.

h) It is the responsibility of the working-set master to account for all of the NAMEs of members of the working set. The master shall revise the working-set definition when new members join or leave the network. Service providers shall create the working set with the total number of members as specified in the working-set-member messages, and then add the SA of members as they claim addresses. This process is similar to the above process of changing the SA of a member that is active but which has changed its SA because of a later address claim by another control function.

## B.24 Tractor control messages

### B.24.1 Tractor control mode command

As of the third edition of ISO 11783-7, the Tractor control mode command message described in this section is deprecated and shall not be used for new designs.

Task controller or implement to Tractor ECU message.

Two commands are grouped within this single message. Many of the command modes are mutually exclusive and are grouped accordingly.

| | | |
|---|---|---|
| Transmission repetition rate: | | Default is 100 ms, maximum is 10 ms for doing closed-loop cruise control. For setting slip control functions, a repetition rate of 1 s in 10 s and on a change of state is required. If there is no update after 15 s, the Tractor ECU will default to no-slip control. |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 11 |
| Default priority: | | 3 |
| Parameter group number: | | 65035 ($00FE0B_{16}$) |
| Byte 1: | Bits 8 to 4: | Tractor control mode command number 1 (see A.26.2.1) |
| | Bits 3 to 1: | Reserved |
| Byte 2: | Bits 8 to 4: | Tractor control mode command number 2 (see A.26.2.1) |
| | Bits 3 to 1: | Reserved |
| Bytes 3, 4: | | Tractor control command value number 1 (see A.26.3) |
| Byte 5: | | Tractor control limit command number 1 (see A.26.8) |
| Bytes 6, 7: | | Tractor control command value number 2 (see A.26.3) |
| Byte 8: | | Tractor control limit command number 2 (see A.26.8) |

### B.24.2 Tractor control command tractor response

As of the third edition of ISO 11783-7, the Tractor control command tractor response message described in this section is deprecated and shall not be used for new designs.

| | | |
|---|---|---|
| Transmission repetition rate: | | On every command. |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 10 |
| Default priority: | | 3 |
| Parameter group number: | | 65034 ($00FE0A_{16}$) |
| Byte 1: | Bits 8 to 4: | Tractor control mode response number 1 (see A.26.4) |
| | Bits 3 to 1: | Tractor control limit status number 1 (see A.26.7) |
| Byte 2: | Bits 8 to 4: | Tractor control mode response number 2 (see A.26.4) |
| | Bits 3 to 1: | Tractor control limit status number 2 (see A.26.7) |
| Bytes 3, 4: | | Tractor control value response number 1 (see A.26.5) |
| Byte 5: | | Tractor control limit number 1 (see A.26.6) |
| Bytes 6, 7: | | Tractor control value response number 2 (see A.26.5) |
| Byte 8: | | Tractor control limit number 2 (see A.26.6) |

### B.24.3 Tractor facility response message

Tractor response to an implement CF or a task controller request for tractor classification and facilities.

Transmission repetition rate: On power-up and then on request.

Data length: 8 bytes

Data page: 0

PDU format: 254

PDU specific: 9

Default priority: 3

Parameter group number: 65033 ($00FE09_{16}$)

Byte 1: Tractor class

- Bits 8, 7: Tractor class (see A.27.4)
- Classification 1 facilities
- Bit 6: Power management — key switch (see A.27.5)
- Bit 5: Power management — maximum time tractor power (see A.27.5)
- Bit 4: Power management — maintain power (see A.27.5)
- Bit 3: Speed information — wheel-based speed (see A.27.5)
- Bit 2: Speed information — ground-based speed (see A.27.5)
- Bit 1: Speed information — engine speed (see A.27.5)

Byte 2:

- Bit 8: Hitch information — rear position (see A.27.5)
- Bit 7: Hitch information — rear in work (see A.27.5)
- Bit 6: PTO information — rear shaft speed (see A.27.5)
- Bit 5: PTO information — rear shaft engagement (see A.27.5)
- Bit 4: Lighting — minimal set as existing trailer connector (see A.27.5)

NOTE As of the third edition of this document, this minimal lighting set is no longer a requirement of Classification 1. It is part of the Classification 2 requirements.

| | | |
|---|---|---|
| Byte 2 (continued): | Bit 3: | Language command storage in Tractor ECU (see A.27.5) |
| | Bit 2: | Reserved — set to zero (0) |
| | Bit 1: | Reserved — set to zero (0) |
| | Classification 2 facilities | |
| Byte 3: | Bit 8: | Time date (see A.27.5) |
| | Bit 7: | Speed and distance — ground-based distance (see A.27.5) |
| | Bit 6: | Speed and distance — ground-based direction (see A.27.5) |
| | Bit 5: | Speed and distance — wheel-based distance (see A.27.5) |
| | Bit 4: | Speed and distance — wheel-based direction (see A.27.5) |
| | Bit 3: | Additional hitch parameters — rear draft (see A.27.5) |
| | Bit 2: | Lighting — full implement lighting message set (see A.27.5) |
| | Bit 1: | Estimated or measured auxiliary valve status (see A.27.5) |
| | Classification 3 facilities | |
| Byte 4: | Bit 8: | Hitch commands — rear hitch position (see A.27.5) |
| | Bit 7: | PTO commands — rear PTO speed command (see A.27.5) |
| | Bit 6: | PTO commands — rear PTO engagement command (see A.27.5) |
| | Bit 5: | Auxiliary valve commands (see A.27.5) |
| | Bit 4: | Limit/request status reporting (see A.27.8) |
| | Bit 3: | PTO commands — rear PTO mode/gear command (see A.27.5) |
| | Bits 2 to 1: | Reserved — set to zero (0) |
| | Addendum N | |

| | | |
|---|---|---|
| Byte 5: | Bit 8: | Navigational system high-output position (see A.27.5) |
| | Bit 7: | Navigational system position data (see A.27.5) |
| | Bit 6: | Navigational pseudo-range noise statistics (see A.27.5) |
| | Bit 5: | Reserved — set to zero (0) |
| | Bit 4: | Operator external light controls (see A.27.5) |
| | Bit 3: | Machine selected speed (see A.27.5) |
| | Bit 2: | Machine selected speed control (see A.27.5) |
| | Bit 1: | Direction control (see A.27.5) |
| | Addendum F | |
| Byte 6: | Bit 8: | Hitch information — front position (see A.27.5) |
| | Bit 7: | Hitch information — front in work (see A.27.5) |
| | Bit 6: | PTO information — front shaft speed (see A.27.5) |
| | Bit 5: | PTO information — front shaft engagement (see A.27.5) |
| | Bit 4: | Additional hitch parameters — front draft (see A.27.5) |
| | Bit 3: | Hitch commands — front hitch position (see A.27.5) |
| | Bit 2: | PTO commands — front PTO speed command (see A.27.5) |
| | Bit 1: | PTO commands — front PTO engagement command (see A.27.5) |
| Byte 7: | Bit 8: | PTO commands — front PTO mode/gear command (see A.27.5) |
| | Bits 7 to 3: | Reserved — set to zero (0) |
| | Bit 2: | External Guidance Status and Commands (see A.27.5) |
| | Bit 1: | Drive Strategy Status and Commands (see A.27.5) |
| Byte 8: | Bits 8 to 2: | Reserved — set to zero (0) |
| | Bit 1: | Reserved bit indicator — set to zero (0) to indicate reserved bits are set to 0. (see A.27.6) |

If Byte 8/Bit 1 is set to “1”, the following bits need to be considered “Reserved”:

Byte 2, Bits 1, 2

Byte 4, Bits 1 to 4

Byte 5, Bits 1 to 5

Byte 7, Bits 1 to 8

Byte 8, Bits 2 to 8

Reserved bits must be set to “0” to allow “1” to indicate that newer facilities are supported. Since previous versions of the standard did not mention this, they were set to “1” as is customary for reserved bits.

### B.24.4 Required tractor facilities message

Implement CF or task controller request to the Tractor ECU for a desired tractor classification and tractor facilities.

| | | |
|---|---|---|
| Transmission repetition rate: | | On request. |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 254 |
| PDU specific: | | 8 |
| Default priority: | | 3 |
| Parameter group number: | | 65032 ($00FE08_{16}$) |
| | | Tractor class |
| Byte 1: | Bits 8, 7: | Tractor ECU class request (see A.27.2) |
| | Classification 1 facilities | |
| | Bit 6: | Power management — key switch (see A.27.3) |
| | Bit 5: | Power management — maximum time tractor power (see A.27.3) |
| | Bit 4: | Power management — maintain power (see A.27.3) |
| | Bit 3: | Speed information — wheel-based speed (see A.27.3) |
| | Bit 2: | Speed information — ground-based speed (see A.27.3) |
| | Bit 1: | Speed information — engine speed (see A.27.3) |
| Byte 2: | Bit 8: | Hitch information — rear position (see A.27.3) |
| | Bit 7: | Hitch information — rear in work (see A.27.3) |
| | Bit 6: | PTO information — rear shaft speed (see A.27.3) |
| | Bit 5: | PTO information — rear shaft engagement (see A.27.3) |
| | Bit 4: | Lighting — minimal set as existing trailer connector (see A.27.3) |
| | Bit 3: | Language command storage in Tractor ECU (see A.27.3) |
| | Bit 2: | Reserved — set to zero (0) |
| | Bit 1: | Reserved — set to zero (0) |
| | Classification 2 facilities | |

| | | |
|---|---|---|
| Byte 3: | Bit 8: | Time date (see A.27.3) |
| | Bit 7: | Speed and distance — ground-based distance (see A.27.3) |
| | Bit 6: | Speed and distance — ground-based direction (see A.27.3) |
| | Bit 5: | Speed and distance — wheel-based distance (see A.27.3) |
| | Bit 4: | Speed and distance — wheel-based direction (see A.27.3) |
| | Bit 3: | Additional hitch parameters — rear draft (see A.27.3) |
| | Bit 2: | Lighting — full implement lighting message set (see A.27.3) |
| | Bit 1: | Estimated or measured auxiliary valve status (see A.27.3) |
| | Classification 3 facilities | |
| Byte 4: | Bit 8: | Hitch commands — rear hitch position (see A.27.3) |
| | Bit 7: | PTO commands — rear PTO speed command (see A.27.3) |
| | Bit 6: | PTO commands — rear PTO engagement command (see A.27.3) |
| | Bit 5: | Auxiliary valve commands (see A.27.3) |
| | Bit 4: | Limit/request status reporting (see A.27.7) |
| | Bit 3: | PTO commands — rear PTO mode/gear command (see A.27.3) |
| | Bits 2 to 1: | Reserved — set to zero (0) |
| | Addendum N | |
| Byte 5: | Bit 8: | Navigational system high-output position (see A.27.3) |
| | Bit 7: | Navigational system position data (see A.27.3) |
| | Bit 6: | Navigational pseudo-range noise statistics (see A.27.3) |
| | Bit 5: | Reserved — set to zero (0) |
| | Bit 4: | Operator external light controls (see A.27.3) |
| | Bit 3: | Selected machine speed (see A.27.3) |
| | Bit 2: | Selected machine speed control (see A.27.3) |
| | Bit 1: | Direction control (see A.27.3) |
| | Addendum F | |

| | | |
|---|---|---|
| Byte 7: | Bit 8: | PTO commands — front PTO mode/gear command (see A.27.5) |
| | Bits 7 to 3: | Reserved — set to zero (0) |
| | Bit 2: | External Guidance Status and Commands (see A.27.5) |
| | Bit 1: | Drive Strategy Status and Commands (see A.27.5) |
| Byte 8: | Bits 8 to 2: | Reserved — set to zero (0) |
| | Bit 1: | Reserved bit indicator — set to zero (0) to indicate reserved bits are set to 0. (see A.27.6) |

NOTE 1 If Byte 8/Bit 1 is set to "1", the following bits need to be considered "Reserved":

Byte 2, Bits 1, 2

Byte 4, Bits 1 to 4

Byte 5, Bits 1 to 5

Byte 7, Bits 1 to 8

Byte 8, Bits 2 to 8

NOTE 2 Reserved bits must be set to "0" to allow "1" to indicate that newer facilities are supported. Since previous versions of the standard did not mention this, they were set to "1" as is customary for reserved bits.

## B.25 General-purpose valve messages

### B.25.1 General

The general-purpose valve messages are for hydraulic valves with built-in controllers connected to ISO 11783 network. They are to be used on closed systems that interface to the controllers on the implement bus either through the TECU or Working Set with the TECU as master or through a closed system communicating on the implement bus.

### B.25.2 General-purpose valve estimated flow

This message provides the estimated flow of a general-purpose valve.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 198 |
| PDU specific: | | DA |
| Default priority: | | 3 |
| Parameter group number: | | 50688($00C600_{16}$) |
| Byte 1: | | General-purpose valve extend port estimated flow (see A.21.35) |
| Byte 2: | | General-purpose valve retract port estimated flow (see A.21.36) |
| Byte 3: | Bits 8,7: | General-purpose valve fail safe mode (see A.21.44) |
| | Bits 6,5: | Reserved |
| | Bits 4,1: | General-purpose valve state (see A.21.37) |
| Byte 4: | Bits 8 to 6: | General-purpose valve limit status (see A.21.50) |
| | Bits 5 to 1: | Reserved |
| Bytes 5 to 8: | | Reserved |

### B.25.3 General-purpose valve measured flow

This message provides the measured flow of a general-purpose valve.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 197 |
| PDU specific: | | DA |
| Default priority: | | 3 |
| Parameter group number: | | 50432($00C500_{16}$) |
| Byte 1: | | General-purpose valve extend port measured flow (see A.21.18) |
| Byte 2: | | General-purpose valve retract port measured flow (see A.21.34) |
| Bytes 3–4: | | General-purpose valve extend port pressure (see A.21.38) |
| Bytes 5–6: | | General-purpose valve retract port pressure (see A.21.39) |
| Byte 7: | | General-purpose valve return port pressure (see A.21.40) |
| Byte 8: | Bits 8 to 6: | General-purpose valve limit status (see A.21.49) |
| | Bits 5 to 1: | Reserved |

### B.25.4 General-purpose valve command

This message provides control of the flow through a general purpose valve.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms when active |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 196 |
| PDU specific: | | DA |
| Default priority: | | 3 |
| Parameter group number: | | 50176($00C400_{16}$) |
| Byte 1: | | General-purpose valve port flow command (see A.21.41) |
| Byte 2: | | Reserved |
| Byte 3: | Bits 8,7: | General-purpose valve fail safe mode (see A.21.44) |
| | Bits 6,5: | Reserved |
| | Bits 4,1: | General-purpose valve state (see A.21.37) |
| Bytes 4 to 8: | | Reserved |

### B.25.5 General-purpose valve load sense pressure

This message provides the measured load sense pressure and pilot pressure of a valve. If the valve assembly has the capability, the message can also provide the assembly's measured load sense and supply pressure.

| | |
|---|---|
| Transmission repetition rate: | 100 ms when active |
| Data length: | 8 bytes |
| Data page: | 0 |
| PDU format: | 07 |
| PDU specific: | DA |
| Default priority: | 6 |
| Parameter group number: | 1792 ($000700_{16}$) |
| Bytes 1 to 2: | General-purpose valve load sense pressure (see A.21.45) |
| Byte 3: | General-purpose valve pilot pressure (see A.21.46) |
| Bytes 4 to 5: | General-purpose valve assembly load sense pressure (see A.21.47) |
| Bytes 6 to 7: | General-purpose valve assembly supply pressure (see A.21.48) |
| Byte 8: | Reserved |

## B.26 Guidance system messages

### B.26.1 Guidance system command

This message is sent by an automatic guidance control system to the machine steering system (represented by the TECU). It provides steering commands and serves as heartbeat between guidance system and steering control system.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 173 |
| PDU specific: | | DA |
| Default priority: | | 3 |
| Parameter group number: | | 44288($00AD00_{16}$) |
| Byte 1 to 2: | | Curvature command (see A.28.1) |
| Byte 3: | | Command state |
| | Bits 8 to 3: | Reserved |
| | Bits 2,1: | Curvature command status (see A.28.3) |
| Bytes 4 to 8: | | Reserved |

### B.26.2 Guidance machine status

This message provides feedback to interface automatic guidance control systems from machine steering systems. It provides information and status from the steering control system to the guidance system.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 172 |
| PDU specific: | | DA |
| Default priority: | | 3 |
| Parameter group number: | | 44032($00AC00_{16}$) |
| Byte 1 to 2: | | Estimated curvature (see A.28.2) |
| Byte 3: | | Readiness state |
| | Bits 8 to 7: | Request reset command status (see A.28.4) |
| | Bits 6 to 5: | Steering input position status (see A.28.5) |
| | Bits 2 to 1: | Mechanical system lockout (see A.28.7) |
| Byte 4: | Bits 8 to 6: | Guidance limit status (see A.28.8) |
| | Bits 5 to 1: | Reserved |
| Byte 5: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Guidance system command exit/reason code (see A.28.9) |
| Bytes 6 to 8: | | Reserved |

## B.27 ISOBUS compliance certification message

This message reports the compliance certification status of a specific electronic control unit.

| | | |
|---|---|---|
| Transmission repetition rate: | | On request |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 253 |
| PDU specific: | | 66 |
| Default priority: | | 6 |
| Parameter group number: | | 64834($00FD42_{16}$) |
| Byte 1: | Bits 8 to 7: | LSBits (2–1) of ISOBUS compliance test protocol revision (see A.29.2) |
| | Bits 6 to 1: | ISOBUS compliance test protocol publication year (see A.29.1) |
| Byte 2: | Bits 8 to 6: | Least significant bits of certification lab ID (see A.29.4) |
| | Bit 5, 4: | MSBits (5–4) of ISOBUS compliance test protocol revision (see A.29.2) |
| | Bits 3, 2: | ISOBUS compliance certification laboratory type (see A.29.3) |
| | Bit 1: | Bit 3 of ISOBUS compliance test protocol revision (see A.29.2) |
| Byte 3: | Bits 8 to 1: | Most significant bits of certification lab ID (see A.29.4) |
| | | Compliance certification type |
| Byte 4: | Bits 8 to 1: | Reserved for future use – set to 0 |
| Byte 5: | Bits 8 to 1: | Reserved for future use – set to 0 |
| Byte 6: | Bit 8: | ISOBUS Compliance Certification message revision (A.29.19) |
| | Bits 7 to 1: | Reserved for future use – set to 0 |
| Bytes 7 to 8: | | Compliance certification reference number (see A.29.18) |

As of the third edition of this document, the organization and communication of functionalities has changed. See ISO 11783-12 for more detail. Prior to the third edition, this message was defined as follows:

| | | |
|---|---|---|
| Transmission repetition rate: | | On request |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 253 |
| PDU specific: | | 66 |
| Default priority: | | 6 |
| Parameter group number: | | 64834($00FD42_{16}$) |
| Byte 1: | Bits 8 to 7: | LSBits of ISOBUS compliance test protocol revision (see A.29.2) |
| | Bits 6 to 1: | ISOBUS compliance test protocol publication year (see A.29.1) |
| Byte 2: | Bits 8 to 6: | Least significant bits of certification lab ID (see A.29.4) |
| | Bit 5, 4: | Reserved |
| | Bits 3, 2: | ISOBUS compliance certification laboratory type (see A.29.3) |
| | Bit 1: | MSBit of ISOBUS compliance certification revision (see A.29.2) |
| Byte 3: | Bits 8 to 1: | Most significant bits of certification lab ID (see A.29.4) |
| | | Compliance certification type |
| Byte 4: | Bit 8: | Minimum CF (see A.29.5) |
| | Bit 7: | TECU Class 1 (see A.29.6) |
| | Bit 6: | TECU Class 2 (see A.29.7) |
| | Bit 5: | TECU Class 3 (see A.29.8) |
| | Bit 4: | Class 3 ECU (see A.29.9) |
| | Bit 3: | Virtual terminal (see A.29.10) |
| | Bit 2: | VT working set master (see A.29.11) |
| | Bit 1: | VT working set member (see A.29.12) |

| | | |
|---|---|---|
| Byte 5: | Bit 8: | Task controller (see A.29.13) |
| | Bit 7: | TC working set master (see A.29.14) |
| | Bit 6: | TC working set member (see A.29.15) |
| | Bit 5: | File server (see A.29.16) |
| | Bit 4: | GPS receiver (see A.29.17) |
| | Bit 3: | Reserved for future use – set to 0 |
| | Bit 2: | Reserved for future use – set to 0 |
| | Bit 1: | Reserved for future use – set to 0 |
| Byte 6: | Bit 8: | Reserved for future use – set to 0 |
| | Bit 7: | Reserved for future use – set to 0 |
| | Bit 6: | Reserved for future use – set to 0 |
| | Bit 5: | Reserved for future use – set to 0 |
| | Bit 4: | Reserved for future use – set to 0 |
| | Bit 3: | Reserved for future use – set to 0 |
| | Bit 2: | Reserved for future use – set to 0 |
| | Bit 1: | Reserved for future use – set to 0 |
| Bytes 7 to 8: | | Compliance certification reference number (see A.29.18) |

## B.28 Machine selected speed messages

### B.28.1 Machine selected speed

Message that provides the current machine selected speed, direction and source parameters.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 240 |
| PDU specific: | | 34 |
| Default priority: | | 3 |
| Parameter group number: | | 61474 ($00F022_{16}$) |
| Bytes 1, 2: | | Machine selected speed (see A.30.1) |
| Bytes 3 to 6: | | Machine selected distance (see A.30.2) |
| Byte 7: | Bits 8 to 7: | Reserved |
| | Bits 6 to 1: | Machine selected speed exit/reason code (see A.30.9) |
| Byte 8: | Bits 8 to 6: | Machine selected speed limit status (see A.30.8) |
| | Bits 5 to 3: | Machine selected speed source (see A.30.4) |
| | Bits 2, 1: | Machine selected direction (see A.30.3) |

### B.28.2 Machine selected speed command

Message that provides the control of the machine speed and direction.

| | | |
|---|---|---|
| Transmission repetition rate: | | 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 253 |
| PDU specific: | | 67 |
| Default priority: | | 3 |
| Parameter group number: | | 64835 ($00FD43_{16}$) |
| Bytes 1, 2: | | Machine selected speed set point command (see A.30.5) |
| Bytes 3, 4: | | Machine selected speed set point limit (see A.30.7) |
| Bytes 5 to 7: | | Reserved |
| Byte 8: | Bits 8 to 3: | Reserved |
| | Bits 2, 1: | Machine selected direction command (see A.30.6) |

## B.29 Implement operating state command

Message sent by the Tractor ECU on the implement bus on forestry or agriculture implements providing to connected systems the current commanded implement operating state.

| | | |
|---|---|---|
| Transmission repetition rate: | | 1 s and on change of state |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 253 |
| PDU specific: | | 03 |
| Default priority: | | 3 |
| Parameter group number: | | 64771 ($00FD03_{16}$) |
| Bytes 1 to 7: | | Reserved |
| Byte 8: | Bits 8 to 3: | Reserved |
| | Bits 2, 1: | Implement operating state command (see A.25.1) |

## B.30 All implements stop operations switch state

This message may be sent by any control function (CF) connected to the implement bus on forestry or agriculture implements providing to connected systems the current state of the all implement stop operations switch.

At least one of these switches shall be in each operator location of the connected system.

All implements shall start a process to stop all operations when this broadcast message is received from any CF with a value of "Stop implement operations" (see A.25.3).. Before an implement turns off all implement operations, it shall assume a failsafe condition. If an implement is operating in an automation mode, it may enter a failsafe condition before requesting the tractor ECU to exit the automation mode, e.g. PTO, Auxiliary valve, and/or tractor movement.

The working set master for the implement shall then inform the operator that the implement has stopped all operations due to the activation of the Stop All Implement Operations switch.

Implement working set masters shall include, on their home screen, an indication, e.g. icon or a function name, if it supports Stop All Implement Operations.

The Working Set shall monitor the number of transitions for each ISB server upon receiving first the message from a given ISB server. A Working Set shall consider an increase in the transitions without detecting a corresponding transition of the Stop all implement operations state as an error and react accordingly.

| | | |
|---|---|---|
| Transmission repetition rate: | | 1 s and on change of state |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 253 |
| PDU specific: | | 02 |
| Default priority: | | 3 |
| Parameter group number: | | 64770 ($00FD02_{16}$) |
| Bytes 1 to 6: | | Reserved |
| Byte 7: | | Stop all implement operations transition number (see A.25.4). |
| Byte 8: | Bits 8 to 3: | Reserved |
| | Bits 2, 1: | All implement stop operations switch state (see A.25.3) |

## B.31 Drive strategy status

Message sent from the tractor to the implement to indicate the current status, of the drive strategy priority structure, which indicates the priority of the multiple powertrain functions.

| | | |
|---|---|---|
| Transmission repetition rate: | | 500 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 252 |
| PDU specific: | | 205 |
| Default priority: | | 6 |
| Parameter group number: | | 64717 (0x00FCCD16) |
| Byte 1 | | Drive strategy priority 1 (see A.32.1) |
| Byte 2 | | Drive strategy priority 2 (see A.32.2) |
| Byte 3 | | Drive strategy priority 3 (see A.32.3) |
| Byte 4 | | Drive strategy priority 4 (see A.32.4) |
| Byte 5 to 6: | | Reserved |
| Byte 7: | Bits 8, 7: | Drive strategy request state (see A.32.5) |
| | Bits 6 to 1: | Reserved |
| Byte 8: | Bits 8, 7: | Reserved |
| | Bits 6 to 1: | Drive strategy exit/reason code (see A.32.6) |

## B.32 Drive strategy command

Message sent to the tractor that is used to alter the powertrain drive strategy priority structure, which determines the balance between fuel economy/consumption and the torque reserve of the engine.

| | | |
|---|---|---|
| Transmission repetition rate: | | Every 500 ms and on change of data in the PGN but no faster than 100 ms |
| Data length: | | 8 bytes |
| Data page: | | 0 |
| PDU format: | | 252 |
| PDU specific: | | 206 |
| Default priority: | | 3 |
| Parameter group number: | | 64718 ($00FCCE_{16}$) |
| Byte 1 | | Drive strategy priority 1 request (see A.32.7) |
| Byte 2 | | Drive strategy priority 2 request (see A.32.8) |
| Byte 3 | | Drive strategy priority 3 request (see A.32.9) |
| Byte 4 | | Drive strategy priority 4 request (see A.32.10) |
| Byte 5 to 7: | | Reserved |
| Byte 8: | Bits 8 to 3: | Reserved |
| | Bits 2, 1: | Restore Operator drive strategy setting request (see A.32.11) |

## B.33 Heartbeat message

The heartbeat message has been defined to support the implementation of ISO 25119 compliant systems using the ISO 11783 protocol definition. This message provides a sequence number parameter and meets requirements of a medium diagnostic coverage on a hardware category 2 system by:

a) Providing end-to-end validation of the data from the data source to the data consumer regardless of whether there are other controllers involved in the communication path.

b) Enabling a single heartbeat message to be used by multiple data consuming CFs to validate the communication from a single data source CF.

### B.33.1 Heartbeat message implementation requirements

To fulfil the required diagnostic coverage (DC medium) in a hardware category 2 system, the ISO 11783 CAN protocol shall contain the following control measures/methods:

a) Each subsystem in the safety critical path shall transmit messages, required for safety related functions, which enables the receiving systems to execute a watchdog function (timeout observation in relation with message repetition)

b) On request each subsystem in the safety critical path shall transmit a Heartbeat message, which contains a sequence number and which enables the receiving systems to execute a watchdog function (timeout observation in relation with message repetition)

c) Each receiving system in the safety critical path shall check the Heartbeat message from the relevant data source system

d) If the check of the Heartbeat message fails, the receiving system shall achieve a safe state

e) The sample rate of the Heartbeat message shall be equal or more than the sample rate of the safety relevant CAN message

Every message transmitted by a CF can be made part of a safety critical path. To secure the communication every CF on the network shall be able to transmit the heartbeat message on request. The determination of a safety critical path in a system using the ISO 11783 protocol is defined in AEF.[3]

The content of all messages transmitted by a CF shall be internally validated to be correct before transmission on the network. In addition to these messages, the heartbeat message is added to secure the communication on the network. As long as the heartbeat message is transmitted at the regular time interval and the sequence number increases through the valid range, then the heartbeat message indicates that the data source CF is operational and provides correct data in all its messages.

### B.33.2 Heartbeat message definition

The heartbeat message is used to determine the integrity of the communication of messages and parameters being transmitted by a CF. There may be multiple instances of the heartbeat message on the network. Upon request, each CF shall transmit this message with the appropriate sequence number value.

| | |
|---|---|
| Transmission repetition rate: | 100 ms |
| Data length: | 1 byte |
| Data page: | 0 |
| PDU format: | 240 |
| PDU specific: | 228 |
| Default priority: | 3 |
| Parameter group number: | 61668 |
| Byte 1 | Heartbeat sequence number (see A.34) |

### B.33.3 Heartbeat message handling

#### B.33.3.1 Requesting the heartbeat message

By default a CF wouldn't transmit the heartbeat message to reduce the total bandwidth. If a CF uses information (messages) from another CF for its critical path it shall request the heartbeat message from that CF. The consuming CF(A) shall send a Request for Repetition rate for the heart beat message with a repetition rate of 100 ms. The providing CF(B) shall start the transmission of the heartbeat message and CF(A) shall start the validation of the heartbeat message. If the providing CF(B) is not able to honour this request, it shall not respond to this request. If no response for the repetition rate has been received after 250 ms, the requester CF(A) shall assume that the request was not accepted by CF(B). CF(A) shall take appropriate action according to the risk assessment.

If a CF is already providing the heart beat message the consuming CF shall not make a request for repetition rate for the heartbeat message from that CF.

### B.33.3.2 Sequence Number

The heartbeat sequence number value shall be set to 251 once upon initialization of a CF (e.g. after a controller power up, a controller reset or the start of the transmission of the VT-status message). After this initialization, the heartbeat sequence number shall be incremented by 1 from 0 to 250 each time the heartbeat message is transmitted. When the heartbeat sequence number exceeds 250 the value shall be reset to 0 and incremented by 1 from 0 to 250 again.

Each CF shall update the sequence number each time the message is transmitted.

### B.33.3.3 Validation of the Sequence Number

Every CF which uses information (messages) from another CF shall validate the heartbeat message of that CF. The consuming CF stores the previous sequence number of that CF and will compare if the sequence number of the current heartbeat message is incremented by 1. In case where the previous sequence number is 250 or 251 (initialization) the sequence number of the current heartbeat message shall be 0. Otherwise an error in the communication is detected.

Sequence Number value 254 indicates an error condition. An error condition at the sender side means that the receiver shall treat the Heartbeat message system as being in an error state and that the CF shall take appropriate action according to it's risk assessment (same case as above with the difference in that it is induced by the sender of the heartbeat message).

Sequence Number value 255 indicates that this parameter is not available. This value shall be used when the transmitted CF is in a shutdown status and is gracefully disconnecting from the network. A receiving CF can inform an operator accordingly and enter a safe state.

The following rules shall be used by each CF that uses the Heartbeat PGN to evaluate the Heartbeat Sequence Number values:

1. If the currently received and the previously received Heartbeat messages contain the same Heartbeat Sequence Number values, but are unequal to 255, then the recipient shall treat the currently received message as in a Heartbeat Sequence Error State.

2. If the currently received Heartbeat message Heartbeat Sequence Number value is in the range of 252 to 253, then the recipient shall ignore the message. Future definitions may require processing but as long as these Sequence Number values are reserved they shall be ignored.

3. If the currently received Heartbeat message Heartbeat Sequence Number value is 254, then the recipient shall treat the message as in Heartbeat Transmission Error State.

4. If the currently received Heartbeat message Heartbeat Sequence Number value is 251, then the recipient shall recognize that the transmitting CF has reset. This reset state triggers the receiving Control Function to synchronize it's message number to the value transmitted by the transmitting Control Function.

5. If the current received Heartbeat message Heartbeat Sequence Number value is 255, but the previously received value is not equal to 255, the recipient shall treat the message as in Heartbeat Graceful Shutdown Initialization State.

6. If the currently received Heartbeat message Heartbeat Sequence Number value is incremented by more than 3, taking into account the roll-over at 250, from the previously received Heartbeat message Heartbeat Sequence Number value, then the Receiver shall treat the message as in Heartbeat Sequence Error State. This rule allows for missing up to 3 Heartbeat messages before the recipient enters a Heartbeat Sequence Error State.

7. If the Heartbeat PGN recipient has detected and entered the Heartbeat Sequence Error State, it shall listen for 8 correct, sequential Heartbeat messages in a row before returning to Heartbeat Sequence Operational State.

#### B.33.3.4 Validation of message timing

Every CF which uses information (messages) from another CF shall validate the timing of the heartbeat message of that CF. If the repetition rate exceeds 300 ms an error in the communication is detected.

#### B.33.3.5 Error detected in communication

In case where an error in the communication is detected the CF shall take appropriate action according to the risk assessment. The appropriate action could be to enter the safe state and inform the operator.

# Annex C
(informative)

# Tractor control messages — Examples

As of the third edition of this document, the Tractor Remote Control messages are deprecated. Absent those message definitions, this Annex is no longer applicable.

## C.1 Initialization, error recovery and background

This annex provides recommendations for establishing a control loop between implement controllers or task controllers and the tractor via the TECU, to maximize interoperability and minimize unexpected results from operation of the system. As recommendations, they are not required for conformity with this part of ISO 11783, and tractors may still supply services even if the recommendations are not followed. Nevertheless, they offer a higher probability of success, as they have been applied by tractor systems designers for TECU implementations.

In order to initiate acceptance of remote commands by the tractor, the implement controller will have to match its command value to the current value being transmitted by the tractor. Once this is accomplished, the tractor changes the limit status appropriately and begins to accept change commands from the implement controller. This ensures that the implement is "up to date" with any operator actions, and allows for a smooth transition to the implement's requested value.

If the operator performs an action that prevents the implement request from proceeding, such as manually raising a hitch and thereby overriding an auxiliary depth control request, the tractor notifies the implement that its request is not accepted and the status is operator limited/controlled. The implement can accept the limit and wait for it to be removed before accomplishing further control, or it can interact with the operator, via its operator interface, to request that the limit be removed (i.e. the implement to now command the hitch to move down).

If the tractor detects a communications failure, it should either switch to operator limited/controlled status or signal a non-recoverable error. Which state the tractor switches to depends on the action necessary to recover from the given failure conditions. If the tractor requires operator intervention (on the tractor network) before a return to remote mode is allowed, then it should report a non-recoverable fault. The required operator intervention, if any, is at the discretion of the tractor system designer.

If the tractor reverts to the operator limited/controlled status, then the implement should match the current tractor setting to re-initiate the external commands. The implement can still require an operator intervention via its interface on the VT depending on the nature of the implement.

Since the tractor only sends its current command value(s) in response to a command from the implement bus, the implement needs to initiate communications after start-up to obtain the current tractor command. This is accomplished by sending a command value of "Not Requested" ("ALL ONES"). The tractor does not act on this command, but responds with its current command value(s). The implement can then match the current tractor command to initiate acceptance of the remote commands.

If a particular command is not supported by the tractor, the response contains "Not Available" in the limit status for the particular command. If any of the commands contained in an implement's request are unsupported, the tractor does not initiate acceptance of any of the remote command values in the request.

The tractor or the implement can decide that a transition to remote mode is not acceptable and either prevent the return or not request the mode change.

The limit high and limit low control modes are sent by the tractor when a physical or operator-determined limit (e.g. upper hitch limit) has been reached. The implement then knows that movement is restricted and requests that additional set point changes in the indicated direction be ignored by the tractor. This can be a transient condition if, for example, the tractor limits the rate of change on the set point changes. Once the ramp reaches the requested set point, the limit status should return to "Not limited".

## C.2 Cruise control

Control mode providing the single control of vehicle velocity.

The following illustrates the messages exchanged to initiate remote command acceptance.

The command uses only parameters, control mode command number 1 and control value number 1. The remaining parameters control mode command number 2, control value number 2 and control limits number 2 are all set to the not requested condition of "ALL ONES". For this command, the no-control-limit value is required to be set and the parameter control limit 1 is set to "ALL ONES".

**Message 1 — Implement requests current tractor command value of cruise control**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 11 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65035 ($00FE0B_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode command # 1 | $00001_2$ | Cruise control |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Byte 2: | Bits 8 to 4: | Tractor control mode command # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Bytes 3, 4: | | Tractor control command value # 1 | $FFFF_{16}$ | Not Requested |
| Byte 5: | | Tractor control limit command | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control command value # 2 | $FFFF_{16}$ | Not Requested |
| Byte 8: | | Tractor control limit command | $FF_{16}$ | Not Requested |

**Message 2 — Tractor responds without going into remote control mode**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 10 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65034 (00FE0A16) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode response # 1 | 000012 | Cruise control |
| | Bits 3 to 1: | Tractor control limit status # 1 | 0012 | Operator Limited/Controlled |
| Byte 2: | Bits 8 to 4: | Tractor control mode response # 2 | 111112 | Not Requested |
| | Bits 3 to 1: | Tractor control limit status # 2 | 1112 | Not Requested |
| Bytes 3, 4: | | Tractor control value response # 1 | 600 | Actual speed of 0,6 m/s |
| Byte 5: | | Tractor control limit # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control value response # 2 | $FFFF_{16}$ | Not Requested |
| Byte 8: | | Tractor control limit # 2 | $FF_{16}$ | Not Requested |

**Message 3 — Implement requests the adjustment of set point for cruise control**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 11 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65035 ($00FE0B_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode command # 1 | $00001_2$ | Cruise control |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Byte 2: | Bits 8 to 4: | Tractor control mode command # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Bytes 3, 4: | | Tractor control command value # 1 | 600 | Current speed of 0,6 m/s |
| Byte 5: | | Tractor control limit command | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control command value # 2 | $FFFF_{16}$ | Not Requested |
| Byte 8: | | Tractor control limit command | $FF_{16}$ | Not Requested |

**Message 4 — Tractor response after accepting implement adjustment of set point for control mode**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 10 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65034 ($00FE0A_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode response # 1 | $00001_2$ | Cruise control |
| | Bits 3 to 1: | Tractor control limit status # 1 | $000_2$ | Not Limited |
| Byte 2: | Bits 8 to 4: | Tractor control mode response # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Tractor control limit status # 2 | $111_2$ | Not Requested |
| Bytes 3, 4: | | Tractor control value response # 1 | 600 | Actual speed of 0,6 m/s |
| Byte 5: | | Tractor control limit # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control value response # 2 | $FFFF_{16}$ | Not Requested |
| Byte 8: | | Tractor control limit # 2 | $FF_{16}$ | Not Requested |

**Message 5 — Implement requests change in speed**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 11 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65035 ($00FE0B_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode command # 1 | $00001_2$ | Cruise control |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Byte 2: | Bits 8 to 4: | Tractor control mode command # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Bytes 3, 4: | | Tractor control command value # 1 | 500 | Decrease speed to 0,5 m/s |
| Byte 5: | | Tractor control limit command # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control command value # 2 | $FFFF_{16}$ | Not Requested |
| Byte 8: | | Tractor control limit command # 2 | $FF_{16}$ | Not Requested |

**Message 6 — Tractor accepts requested change in speed**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 10 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65034 ($00FE0A_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode response # 1 | $00001_2$ | Cruise control |
| | Bits 3 to 1: | Tractor control limit status # 1 | $000_2$ | Remote mode |
| Byte 2: | Bits 8 to 4: | Tractor control mode response # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Tractor control limit status # 2 | $111_2$ | Not Available |
| Bytes 3, 4: | | Tractor control value response # 1 | 500 | 0,5 m/s |
| Byte 5: | | Tractor control limit # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control value response # 2 | $FFFF_{16}$ | Not Requested |
| Byte 8: | | Tractor control limit # 2 | $FF_{16}$ | Not Requested |

## C.3 Combined constant PTO speed and cruise control

Control mode that is a combined control of constant PTO speed and control of vehicle velocity.

The command uses parameters, control mode command number 1, control value number 1 and control value number 2. The remaining parameter, control mode command number 2, is set to the "Not Requested" condition of "ALL ONES". This command is in fact two commands in one with control value number 1 referring to the PTO section, and control value number 2 referring to the cruise control section. The following exchange does not show the initial entry into remote control mode, but does illustrate a condition in which the operator has set a maximum speed (5 km/h) that the implement is trying to exceed.

**Implement request**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 11 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65035 ($00FE0B_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode command # 1 | $01010_2$ | Combined PTO & cruise |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Byte 2: | Bits 8 to 4: | Tractor control mode command # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Bytes 3, 4: | | Tractor control command value # 1 | 4320 | 540/min |
| Byte 5: | | Tractor control limit command # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control command value # 2 | 2000 | 2 m/s (7,2 km/h) |
| Byte 8: | | Tractor control limit command # 2 | $FF_{16}$ | Not Requested |

**Tractor response**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 10 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65034 ($00FE0A_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode response # 1 | $01010_2$ | Combined PTO & cruise |
| | Bits 3 to 1: | Tractor control limit status # 1 | $000_2$ | Not Limited |
| Byte 2: | Bits 8 to 4: | Tractor control mode response # 2 | $11111_2$ | Not Requested |
| | Bits 3 to 1: | Tractor control limit status # 2 | $010_2$ | Limited High |
| Bytes 3, 4: | | Tractor control value response # 1 | 4320 | 540/min |
| Byte 5: | | Tractor control limit # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control value response # 2 | 1389 | 1,389 m/s (5 km/h) |
| Byte 8: | | Tractor control limit # 2 | $FF_{16}$ | Not Requested |

## C.4 Auxiliary valve slip control with cruise control

Control mode providing the multiple control of vehicle slip by varying the flow of the auxiliary valve and control of the speed. This example illustrates the message sent by an implement bus device once the initial connection has been completed.

The auxiliary valve slip control command uses only parameters, control mode command number 1, and control value number 1. The remaining parameters, control mode command number 2 and control value number 2, are used for the cruise control. Control value number 1 consists of parts: auxiliary valve flow (Byte 3), auxiliary valve state and auxiliary valve number (Byte 4). No implied priority exists between these two commands, and the command parameters number 1 and number 2 may be reversed, provided the parameters remain a set.

**Message from implement**

| | | | | |
|---|---|---|---|---|
| Data length: | | 8 bytes | | |
| Data page: | | 0 | | |
| PDU format: | | 254 | | |
| PDU specific: | | 11 | | |
| Default priority: | | 3 | | |
| Parameter group number: | | 65035 ($00FE0B_{16}$) | | |
| Byte 1: | Bits 8 to 4: | Tractor control mode command # 1 | $00111_2$ | Valve slip control |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Byte 2: | Bits 8 to 4: | Tractor control mode command # 2 | $00001_2$ | Cruise control |
| | Bits 3 to 1: | Reserved | $111_2$ | Not Requested |
| Bytes 3, 4: | | Tractor control command value # 1 | | |
| | Bits 16 to 9: | Commanded auxiliary valve flow value | 25 | 10 % flow |
| | Bits 8 to 5: | Commanded auxiliary valve state | $0001_2$ | Extend |
| | Bits 4 to 1: | Commanded auxiliary valve number | $0010_2$ | Valve 2 |
| Byte 5: | | Tractor control limit command # 1 | $FF_{16}$ | Not Requested |
| Bytes 6, 7: | | Tractor control command value # 2 | 1389 | 1,389 m/s |
| Byte 8: | | Tractor control limit command # 2 | $FF_{16}$ | Not Requested |

# Annex D
(informative)

# Implement control of tractor facilities — Control implementation

The intent of the implement command and remote control messages is not to transfer control from the operator to the implement but rather to provide a mechanism for the tractor to include the implement controller capabilities in its overall control scheme. It is recommended that these parameters not be adjusted in a high-speed control loop by the implement controller. Response time to any set point change is subject to several variables, including CAN bus latency and filtering and/or latency within the tractor, which differ from system to system.

A hitch position command from an implement is a request that the tractor must reconcile with any limits set or actions taken by the operator before initiating the implement's request. The operator controls and settings define an "operating envelope" within which the tractor can allow the implement to make changes.

The hitch is a good example for illustrating this concept. The hitch has operator settings for position, upper limit and lower limit. In addition, most systems have some type of "draft-mix" setting which continuously adjusts the hitch position and/or lower limit based on the present draft. The upper and lower limits define one "envelope". The draft-mix logic can further limit the range of hitch movement. Any of these settings limits the hitch position commands from the implement.

The hitch commands from an implement are considered "persistent commands", since the hitch continues to move toward the desired position if the limit condition clears. For example, the operator adjusts the draft-mix to allow a greater range of movement.

Commands such as PTO engagement are considered "transient commands". They are temporary in nature and, if they cannot be satisfied immediately, the command is ignored by the tractor. For example, if the PTO is disabled via in-cab controls, a command to engage the PTO is ignored. Even if the in-cab controls are changed to allow the implement to engage the PTO, the PTO does not engage until the implement sends a new "engage" command.

To initiate external control of "persistent command" functions such as the rear hitch, the implement controller shall first send a hitch and PTO command PGN containing the same value for the hitch command as the hitch position parameter in the rear hitch status PGN. If the tractor accepts this command, it responds with the value of "Not Limited" (000) in the rear hitch position limit status parameter.

When an implement controller is not requesting control or is relinquishing control of a function, it shall send a value of "Not Requested" ("ALL ONES") in the command to the tractor.

Initialization of a "transient command" function (e.g. PTO) is similar to this. The implement shall send the current value of the tractor parameter in the command PGN. When the tractor responds with "External Request Accepted" in the corresponding request status, subsequent commands from the implement are accepted and acted upon accordingly. If, at any time, the operator takes an action or a condition exists which inhibits the external command capability, the tractor should report "Driver control" or "Error" in the corresponding request status parameter.

# Bibliography

[1] ISO 11898-1:2003, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

[2] SAE J1939, *Recommended Practice for a Serial Control and Communications Vehicle Network*

[3] AEF (Ag Industry Electronics Foundation, http://www.aef-online.org), *guideline for the alignment of ISOBUS systems with ISO 25119*

**ICS 65.060.01;35.240.99**

Price based on 185 pages

*This page deliberately left blank*

# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

**BSI Group Headquarters**

389 Chiswick High Road London W4 4AL UK

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Copyright



## Useful Contacts:

**Customer Services**
**Tel:** +44 845 086 9001
**Email (orders):** orders@bsigroup.com
**Email (enquiries):** cservices@bsigroup.com

**Subscriptions**
**Tel:** +44 845 086 9001
**Email:** subscriptions@bsigroup.com

**Knowledge Centre**
**Tel:** +44 20 8996 7004
**Email:** knowledgecentre@bsigroup.com

**Copyright & Licensing**
**Tel:** +44 20 8996 7070
**Email:** copyright@bsigroup.com

bsi.

...making excellence a habit.™