

OCORA

Open CCS On-board Reference Architecture

Addendum to SUBSET-139

ATO On-Board to Rolling Stock Interface

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References

Reader's note: please be aware that the document ids in square brackets, e.g. [OCORA-BWS01-010], as per the list of referenced documents below, are used throughout this document to indicate the references to external documents. Wherever a reference to a TSI-CCS SUBSET is used, the SUBSET is referenced directly (e.g. SUBSET-026). OCORA always references to the latest available official version of the SUBSET, unless indicated differently.

[\[OCORA-BWS01-010\] – Release Notes](#)

[\[OCORA-BWS01-020\] – Glossary](#)

[\[OCORA-BWS01-040\] – Feedback Form](#)

[\[OCORA-BWS02-030\] - Technical Slide Deck](#)

[\[OCORA-TWS01-030\] – System Architecture](#)

[\[OCORA-TWS01-035\] – CCS-On-Board Architecture](#)

[\[OCORA-TWS02-030\] – OCORA Addendum to SUBSET-147](#)

[\[OCORA-TWS04-010\] - Functional Vehicle Adapter – Introduction](#)

[\[OCORA-TWS04-012\] - TCMS - Standard Communication Interface Specification](#)

[\[SUBSET-026\] – ERTMS/ETCS – System Requirements Specification](#)

[\[SUBSET-125\] - ERTMS/ATO – System Requirements Specification](#)

[\[SUBSET-126\] – ERTMS/ATO - ATO-OB / ATO-TS FFFIS Application Layer](#)

[\[SUBSET-139\] - ERTMS/ATO - ATO-OB / ROLLING STOCK FFFIS APPLICATION LAYER](#)

[\[SUBSET-147\] – ERTMS Data Applications – FFFIS part: CCS Consist Network Communication Layers](#)

1 Introduction

1.1 Purpose of the document

The purpose of this document is to define requirements that have not been considered in [\[SUBSET-139\]](#), this with the intention to get a standardised and unambiguous implementation of the integration between ATO on-board and the rollingstock. The document is based on content elaborated in former phases of the OCORA collaboration, most content originates from the "TCMS - Standard Communication Interface Specification" [\[OCORA-TWS04-012\]](#) document. The [\[SUBSET-139\]](#) is a mandatory specification of the TSI-CCS 2023 release which aims at defining the standardised interface between the ATO on-board and the rollingstock.

This OCORA Addendum is intended to be used in tenders for CCS on-board systems or one of its building blocks, either as part of a new rollingstock or as enhancement or replacement in existing legacy rollingstocks. This document is based on the architecture described in the System Requirements Specification [\[SUBSET-026\]](#).

If you are an organisation interested in developing CCS on-board building blocks according to OCORA design principles, the information provided in this document can be used as input for your development.

This document is addressed to experts in the CCS domain and to any other person, interested in the OCORA concepts for on-board CCS. The reader is invited to provide feedback to the OCORA collaboration. Feedback to this document and to any other OCORA documentation can be given by using the feedback form [\[OCORA-BWS01-040\]](#).

1.2 Applicability of the document

This document is applicable for integrations of ATO on-board into rollingstocks with a [\[SUBSET-139\]](#) compliant TCMS but also for legacy rollingstocks that do not contain a [\[SUBSET-139\]](#) compliant TCMS. In the latter case, the rollingstock (TCMS) shall communicate through a Functional Vehicle Adapter (FVA) with the ATO on-board to comply with the [\[SUBSET-139\]](#) compliant ATO on-board system. In this case, refer also to the document "Functional Vehicle Adapter – Introduction" [\[OCORA-TWS04-010\]](#).

1.3 Context of the document

This document is published as part of an OCORA Release, together with the documents listed in the Release Notes [\[OCORA-BWS01-010\]](#). All abbreviations and terms used are defined in the Glossary [\[OCORA-BWS01-020\]](#).

2 Additional requirements to SUBSET-139

2.1 Definition of the lower layers of the interface

OCORA-10430 - The interface between the ATO on-board and the rollingstock shall be implemented including the definitions of the document "Addendum to SUBSET-147" [\[OCORA-TWS02-030\]](#).

2.2 Additional variables to be transmitted

This chapter defines variables that have not been considered in [\[SUBSET-139\]](#).

2.2.1 ATO on-board diagnostic information

This chapter defines variables in terms of ATO on-board diagnostic information. The intention is to define a generic set of variables that can be implemented by all different suppliers.

Rationale for the data: The published diagnostic information is used by the rollingstock as diagnostic information that is centrally collected (and eventually displayed) for the whole rollingstock. The information can then be logged and / or used for specific operational processes.

Note: this chapter 2.2.1 is related to the function ID "F-ATO-Out-15" of the document [\[OCORA-TWS04-012\]](#).

2.2.1.1 ATO on-board Operational Condition

OCORA-10436 - The ATO on-board shall provide the operational condition information of the ATO on-board indicating the severity of an active event or the currently executed process.

The ATO on-board operational condition to be provided as variable Q_ATO_OPCondition. The variable shall be encoded as follows:

| Variable Name | Size | Meaning | |
|-------------------|--------|---------|---|
| Q_ATO_OPCondition | 4 bits | 0 | Unknown <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board could be the state NP.</i> |
| | | 1 | Initialising <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board could be in a state between NP and CO.</i> |
| | | 2 | Auto test <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board could be in a state between NP and CO.</i> |
| | | 3 | Updating <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board there is no specific state.</i> |
| | | 4 | Maintenance mode <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board there is no specific state.</i> |
| | | 5 | Running (OK) <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board is in one of the states CO, NA, AV, RE, EG, DE. Excluded are the states NP and FA.</i> |
| | | 6 | Warning issue <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board is in one of the states CO, NA, AV, RE, EG, DE. Excluded are the states NP and FA.</i> |
| | | 7 | Error issue <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board is in the state FA.</i> |
| | | 8 | Critical issue <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board is in the state FA.</i> |
| | | 9 | Shutting down <i>Note: Based on the State Machine described in chapter 9 of SUBSET-125 the ATO on-board there is no specific state.</i> |
| | | 10..15 | Spare values |

Table 1 Definition for variable "ATO on-board operational condition"

The variable Q_ATO_OPCondition is used for diagnostic purposes. This variable is different from the

variable M_ATO_STATE which represents the standardised ATO on-board state machine introduced in [SUBSET-125] and transmitted to trackside according to [SUBSET-126].

The “ATO on-board Operational Condition” value is indicated according to the event or process with the highest severity.

Note I: the ATO on-board of the different suppliers might not provide all the “ATO on-board Operational Condition” variable values as defined here. Each specific ATO on-board shall only provide the operational condition values that are available by default from the product. The supplier to provide a description of the implemented operational condition values.

Note II: the “ATO on-board Operational Condition” variable is not intended for use in safety relevant functions.

Definition of the different component operational conditions:

| Operational Condition information | Definition |
|-----------------------------------|---|
| Unknown | On-board component operational condition is not known, or the on-board component is in an operational condition that has not been defined in this table. |
| Initialising | On-board component is starting up, initialising, possibly performing some internal tests, and will soon come into operation (if no issue persists). The on-board component is not operational yet and has only reduced communication capability. |
| Auto test | On-board component is performing some automated tests and will soon come into operation (if no issue persists). The on-board component is not operational but has the full communication capability available. |
| Updating | On-board component is busy while installing one or more new configuration item The on-board component is not operational and might only have a reduced communication capability. |
| Maintenance mode | On-board component is in maintenance mode, it will come into operation once it exits the maintenance mode. The on-board component is not operational and might only have a reduced communication capability. |
| Running (OK) | On-board component works normally, no misbehaviour or anomaly has been detected. |

| Operational Condition information | Definition |
|-----------------------------------|---|
| Warning issue | <p>On-board component has detected an abnormal operation of a component within itself. The on-board component continues to function but there is a medium-to-low impact on operations (non-critical). This includes that for the on-board component to function it may include the use of a procedural workaround.</p> <p>Service measures should be initiated. If no action is taken, an operation might fail in the future.</p> |
| Error issue | <p>On-board component has detected the failure of a component within itself. The on-board component continues to function but there is a high impact to at least portions of operations (on-board component use is severely reduced) and no procedural workaround exists.</p> <p>Service measures must be initiated.</p> |
| Critical issue | <p>On-board component has detected the catastrophic failure of a component within itself. The on-board component does no longer function and halts operations, no procedural workaround exists.</p> <p>Substitution of a line replaceable unit (LRU) and its repair in the workshop is required.</p> |
| Shutting down | <p>On-board component is shutting down.</p> <p>The on-board component is no longer operational and has only a reduced communication capability.</p> |

Table 2 Definition of the different component operational conditions

2.2.1.2 ATO on-board Event Code

OCORA-10440 - The ATO on-board shall provide a numerical value that corresponds to an event code for the whole ATO on-board subsystem. The meaning of the event code (each value) is specific to the installed equipment. The supplier of the equipment has the freedom to make use of the 8 variables in the way that best suits to him (technically the one variable of size 256 bits has been split into 8 smaller variables). The supplier shall provide the documentation describing the specific meaning of each event code.

The ATO on-board event code to be provided as variable M_ATO_Event_Code_n. The variable shall be encoded as follows:

| Variable Name | Size | Meaning | |
|--------------------|---------|-------------------|------------------|
| M_ATO_Event_Code_1 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_2 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_3 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_4 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_5 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_6 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_7 | 32 bits | 0.. 4'294'967'295 | Project specific |
| M_ATO_Event_Code_8 | 32 bits | 0.. 4'294'967'295 | Project specific |

Table 3 Definition of variable "ATO on-board event code"

The "ATO on-board Event Code" variables can be used in different manners:

- Each numerical value has a specific meaning.
Each value of each variable has a dedicated meaning that could be a specific error code or an event, examples:
 - Error: value 5 = no connection available to a specific external component (e.g. ETCS on-board).
 - Error: value 52 = real time clock battery is flat.
 - Error: value 186 = received journey profile is not valid.
 - Event: value 24 = temperature exceeds the limit.
 - Event: value 379 = technician logged in the device.
- The variable can be regarded as a bit field where each bit is specific for a component or a status.
Each bit of each variable provides the boolean information of a specific component or of a specific status, examples:
 - Component --> bit 7: DC / DC converter 2 - value 0 = OK, value 1 = defect.
 - Component --> bit 16: cubicle fan - value 0 = OK, value 1 = defect.
 - Specific status --> bit 12: cabin 1 status - value 0 = inactive, value 1 = active.
 - Specific status --> bit 25: watchdog monitoring - value 0 = watchdog not started, value 1 = watchdog active.
 - Specific status --> bit 31: NTP time server - value 0 = server not available, value 1 = server available.
- The variable can be regarded as a bit field, where a specific number of bits are grouped for a specific component. This group of bits has then a specific meaning for the particular component.

A group of bits provides the status for a specific component, examples:

- The four bits 3 to 6: state of ATO-OB - value 0 = NP, value 1 = CO, value 2 = NA, values 3 = AV, value 4 = RE, value 5 = EG, value 6 = DE, value 7 = FA, value 8..15 = spare.
- The four bits 22 to 25: board in slot 2 - binary 1000 = OK, binary 0100 = Warning, binary 0010 = Defect, binary 0001 = Unknown.
- A combination of the above variants is thinkable, where the assignment is distributed over the different variables.
- Other possible use of the available variables.

2.2.1.3 ATO on-board Hardware version

OCORA-10442 - The ATO on-board shall provide the version(s) of the hardware for the different Line Replaceable Unit (LRU) components running within the ATO on-board. The supplier of the equipment must provide the description how his LRU component discloses the hardware version by means of this variable. Furthermore, the supplier must document the version of each supplied LRU hardware component.

The ATO on-board hardware version to be provided as variable M_ATO_HW_Version_n. The variable shall be encoded as follows:

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_1 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 4 Definition for variable "ATO on-board Hardware Version - 1"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_2 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 5 Definition for variable "ATO on-board Hardware Version - 2"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_3 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 6 Definition for variable "ATO on-board Hardware Version - 3"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_4 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 7 Definition for variable "ATO on-board Hardware Version - 4"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_5 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 8 Definition for variable "ATO on-board Hardware Version - 5"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_6 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 9 Definition for variable "ATO on-board Hardware Version - 6"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_7 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 10 Definition for variable "ATO on-board Hardware Version - 7"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_HW_Version_8 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> “-“ (decimal=45, hex=2D), if the ASCII character is not used. |

Table 11 Definition for variable “ATO on-board Hardware Version - 8”

The definition allows to disclose the hardware version for up to 8 different line replaceable unit components within the ATO on-board. The numerical values and the ASCII character of each “ATO on-board Hardware Version” variable (variables 1 to 8) can be compiled into the following format: “xxx.yyy.zzz/A”.

Example of one compiled ATO on-board LRU component hardware version variable: 34.8.25/F

2.2.1.4 ATO on-board Software version

OCORA-10444 - The ATO on-board shall provide the version(s) of the software for the different Line Replaceable Unit (LRU) components running within the ATO on-board. The supplier of the equipment must provide the description how his LRU component discloses the software version by means of this variable. Furthermore, the supplier must document the version of each released LRU component software.

The ATO on-board software version to be provided as variable M_ATO_SW_Version_n. The variable shall be encoded as follows:

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_1 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 12 Definition for variable "ATO on-board Software Version - 1"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_2 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 13 Definition for variable "ATO on-board Software Version - 2"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_3 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 14 Definition for variable "ATO on-board Software Version - 3"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_4 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 15 Definition for variable "ATO on-board Software Version - 4"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_5 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 16 Definition for variable "ATO on-board Software Version - 5"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_6 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 17 Definition for variable "ATO on-board Software Version - 6"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_7 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 18 Definition for variable "ATO on-board Software Version - 7"

| Variable Name | Size | Meaning | |
|--------------------|---------|---------|---|
| M_ATO_SW_Version_8 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 19 Definition for variable "ATO on-board Software Version - 8"

The definition allows to disclose the software version for up to 8 different line replaceable unit components within the ATO on-board. The numerical values and the ASCII character of each "ATO on-board Software Version" variable (variables 1 to 8) can be compiled into the following format: "xxx.yyy.zzz/A".

Example of one compiled ATO on-board LRU component software version variable: 2.23.16/B

2.2.1.5 ATO on-board Parametrisation file version

OCORA-10446 - The ATO on-board shall provide the version(s) of the parametrisation file (configuration) for the different Line Replaceable Unit (LRU) components running within the ATO on-board. The parametrisation file (configuration) version information exposes the version of the parametrisation file that is currently being applied by the software of the different LRU components of the ATO on-board. The parametrisation file defines all configurable parameters of the specific component. The supplier of the equipment must provide the description how his component discloses the parametrisation file version by means of this variable. Furthermore, the supplier must document the version of each released LRU component parametrisation file (configuration).

The ATO on-board parametrisation file version to be provided as variable M_ATO_Cfg_Version_n.

The variable shall be encoded as follows:

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_1 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 20 Definition for variable "ATO on-board Parametrisation File Version - 1"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_2 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 21 Definition for variable "ATO on-board Parametrisation File Version - 2"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_3 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 22 Definition for variable "ATO on-board Parametrisation File Version - 3"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_4 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 23 Definition for variable "ATO on-board Parametrisation File Version - 4"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_5 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 24 Definition for variable "ATO on-board Parametrisation File Version - 5"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_6 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 25 Definition for variable "ATO on-board Parametrisation File Version - 6"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_7 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 26 Definition for variable "ATO on-board Parametrisation File Version - 7"

| Variable Name | Size | Meaning | |
|---------------------|---------|---------|---|
| M_ATO_Cfg_Version_8 | 32 bits | 0..7 | xxx major version <i>Reserved value:</i> 127, if the major version is not used. |
| | | 8..15 | yyy minor version <i>Reserved value:</i> 127, if the minor version is not used. |
| | | 16..23 | zzz patch version <i>Reserved value:</i> 127, if the patch version is not used. |
| | | 24..31 | 1 ASCII character <i>Reserved value:</i> "-" (decimal=45, hex=2D), if the ASCII character is not used. |

Table 27 Definition for variable "ATO on-board Parametrisation File Version - 8"

The definition allows to disclose the parametrisation file (configuration) version for up to 8 different line replaceable unit components within the ATO on-board. The numerical values and the ASCII character of each “ATO on-board Parametrisation File Version” variable (variables 1 to 8) can be compiled into the following format: “xxx.yyy.zzz/A”.

Example of one compiled ATO on-board LRU component parametrisation file version variable:
15.48.3/H

Note: not all equipment from the different suppliers makes use of a parametrisation file (configuration). In case no parametrisation file (configuration) is used, then the version of the parametrisation inserted by other means into the component shall be provided. In case no parametrisation version is managed, then in all sections the reserved values for “not used” shall be applied.

2.3 Interface and packets definition

The interface of ATO on-board to the Rolling stock is defined in [\[SUBSET-139\]](#).

Accordingly, the packets are structured with the header, the user data, and the checksum.

The header used in the packets of this document is the same as defined in [\[SUBSET-139\]](#).

The checksum for error detection used in the packets of this document is the same as defined in [\[SUBSET-139\]](#): CRC32.

2.3.1 User data – List of packets

OCORA-10447 - The following user data packets are used for communication between ATO on-board and the Rolling stock (RST):

| Packet Name | Packet ID | Source | Sink | Transmitting cycle [ms] (max) | Data Class [SUBSET-147] | Timeout [ms] |
|---------------------------------|-----------|--------|------|-------------------------------|---|--------------|
| ATO_RST_Condition_and_Event | 41 | ATO | RST | 500 | Process Data | 2500 |
| ATO_RST_Hardware_Version | 42 | ATO | RST | 500 | Process Data | 2500 |
| ATO_RST_Software_Version | 43 | ATO | RST | 500 | Process Data | 2500 |
| ATO_RST_Parametrisation_Version | 44 | ATO | RST | 500 | Process Data | 2500 |

Table 28 User data packet overview

2.3.2 User data – Packet description

2.3.3 User data – ATO to RST packet 41: Condition and Event

OCORA-10453 - The definition of the ATO_RST_Condition_and_Event packet is as follows:










| Byte Offset | Bit Offset | Variable Name | Variable / Description | Data Type | Reference |
|-------------|------------|--------------------|---|-----------|---|
| 0 | 0 | Q_ATO_OPCondition | ATO on-board operational condition information. | ENUM4 |  OCORA-10436 |
| 0 | 3 | Padding | | 4 bits | |
| 1 | 0 | M_ATO_Event_Code_1 | ATO on-board event code 1. | UINT32 |  OCORA-10440 |
| 5 | 0 | M_ATO_Event_Code_2 | ATO on-board event code 2. | UINT32 |  OCORA-10440 |
| 9 | 0 | M_ATO_Event_Code_3 | ATO on-board event code 3. | UINT32 |  OCORA-10440 |
| 13 | 0 | M_ATO_Event_Code_4 | ATO on-board event code 4. | UINT32 |  OCORA-10440 |
| 17 | 0 | M_ATO_Event_Code_5 | ATO on-board event code 5. | UINT32 |  OCORA-10440 |
| 21 | 0 | M_ATO_Event_Code_6 | ATO on-board event code 6. | UINT32 |  OCORA-10440 |
| 25 | 0 | M_ATO_Event_Code_7 | ATO on-board event code 7. | UINT32 |  OCORA-10440 |
| 29 | 0 | M_ATO_Event_Code_8 | ATO on-board event code 8. | UINT32 |  OCORA-10440 |

Table 29 ATO to RST packet 41: Condition and Event

2.3.3.1 User data – ATO to RST packet 42: Hardware version

OCORA-10455 - The definition of the ATO_RST_Hardware_Version packet is as follows:









| Byte Offset | Bit Offset | Variable Name | Variable / Description | Data Type | Reference |
|-------------|------------|--------------------|---|-----------|---|
| 0 | 0 | M_ATO_HW_Version_1 | ATO on-board Hardware version of LRU 1. | UINT32 |  OCORA-10442 |
| 4 | 0 | M_ATO_HW_Version_2 | ATO on-board Hardware version of LRU 2. | UINT32 |  OCORA-10442 |
| 8 | 0 | M_ATO_HW_Version_3 | ATO on-board Hardware version of LRU 3. | UINT32 |  OCORA-10442 |
| 12 | 0 | M_ATO_HW_Version_4 | ATO on-board Hardware version of LRU 4. | UINT32 |  OCORA-10442 |
| 16 | 0 | M_ATO_HW_Version_5 | ATO on-board Hardware version of LRU 5. | UINT32 |  OCORA-10442 |
| 20 | 0 | M_ATO_HW_Version_6 | ATO on-board Hardware version of LRU 6. | UINT32 |  OCORA-10442 |
| 24 | 0 | M_ATO_HW_Version_7 | ATO on-board Hardware version of LRU 7. | UINT32 |  OCORA-10442 |
| 28 | 0 | M_ATO_HW_Version_8 | ATO on-board Hardware version of LRU 8. | UINT32 |  OCORA-10442 |

Table 30 ATO to RST packet 42: Hardware Version

2.3.3.2 User data – ATO to RST packet 43: Software version

OCORA-10457 - The definition of the ATO_RST_Software_Version packet is as follows:









| Byte Offset | Bit Offset | Variable Name | Variable / Description | Data Type | Reference |
|-------------|------------|--------------------|---|-----------|---|
| 0 | 0 | M_ATO_SW_Version_1 | ATO no-board Software version of LRU 1. | UINT32 |  OCORA-10444 |
| 4 | 0 | M_ATO_SW_Version_2 | ATO no-board Software version of LRU 2. | UINT32 |  OCORA-10444 |
| 8 | 0 | M_ATO_SW_Version_3 | ATO no-board Software version of LRU 3. | UINT32 |  OCORA-10444 |
| 12 | 0 | M_ATO_SW_Version_4 | ATO no-board Software version of LRU 4. | UINT32 |  OCORA-10444 |
| 16 | 0 | M_ATO_SW_Version_5 | ATO no-board Software version of LRU 5. | UINT32 |  OCORA-10444 |
| 20 | 0 | M_ATO_SW_Version_6 | ATO no-board Software version of LRU 6. | UINT32 |  OCORA-10444 |
| 24 | 0 | M_ATO_SW_Version_7 | ATO no-board Software version of LRU 7. | UINT32 |  OCORA-10444 |
| 28 | 0 | M_ATO_SW_Version_8 | ATO no-board Software version of LRU 8. | UINT32 |  OCORA-10444 |

Table 31 ATO to RST packet 43: Software Version

2.3.3.3 User data – ATO to RST packet 44: Parametrisation version

OCORA-10459 - The definition of the ATO_RST_Parametrisation_Version packet is as follows:









| Byte Offset | Bit Offset | Variable Name | Variable / Description | Data Type | Reference |
|-------------|------------|---------------------|--|-----------|---|
| 0 | 0 | M_ATO_Cfg_Version_1 | ATO on-board Parametrisation version of LRU 1. | UINT32 |  OCORA-10446 |
| 4 | 0 | M_ATO_Cfg_Version_2 | ATO on-board Parametrisation version of LRU 2. | UINT32 |  OCORA-10446 |
| 8 | 0 | M_ATO_Cfg_Version_3 | ATO on-board Parametrisation version of LRU 3. | UINT32 |  OCORA-10446 |
| 12 | 0 | M_ATO_Cfg_Version_4 | ATO on-board Parametrisation version of LRU 4. | UINT32 |  OCORA-10446 |
| 16 | 0 | M_ATO_Cfg_Version_5 | ATO on-board Parametrisation version of LRU 5. | UINT32 |  OCORA-10446 |
| 20 | 0 | M_ATO_Cfg_Version_6 | ATO on-board Parametrisation version of LRU 6. | UINT32 |  OCORA-10446 |
| 24 | 0 | M_ATO_Cfg_Version_7 | ATO on-board Parametrisation version of LRU 7. | UINT32 |  OCORA-10446 |
| 28 | 0 | M_ATO_Cfg_Version_8 | ATO on-board Parametrisation version of LRU 8. | UINT32 |  OCORA-10446 |

Table 32 ATO to RST packet 44: Parametrisation Version