

OCORA

Open CCS On-board Reference Architecture

Functional Vehicle Adapter

Standard Communication Interface Specification
Interface: SCI-FVA

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Document ID: OCORA-TWS04-012

Version: 2.00

Release: R1

Date: 03.12.2021

Revision history

Version	Change Description	Initial	Date of change
1.00	Official version for OCORA Delta Release.	CG	30.06.2021
2.00	Updated for the OCORA Release 1.0: <ul style="list-style-type: none"> ▪ Update of references. ▪ Modifications to be consistent with the OCORA System Architecture. ▪ Elaboration of chapter 5.2. Official version for OCORA R1.	CG	03.12.2021

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References

Reader's note: please be aware that the numbers in square brackets, e.g. [1], as per the list of referenced documents below, is 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.

- [1] OCORA-BWS01-010 – Release Notes
- [2] OCORA-BWS01-020 – Glossary
- [3] OCORA-BWS01-030 – Question and Answers
- [4] OCORA-BWS01-040 – Feedback Form
- [5] OCORA-BWS02-030 – Technical Slide Deck
- [6] OCORA-BWS03-010 – Introduction to OCORA
- [7] OCORA-BWS04-010 – Problem Statements
- [8] OCORA-TWS01-030 – System Architecture
- [9] OCORA-TWS04-010 – Functional Vehicle Adapter – Introduction
- [10] EN 50159:2010-09 – Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems
- [11] TSI CCS: 02016R0919 - EN - 16.06.2019 - 001.001 - 1: COMMISSION REGULATION (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union, amended by Commission Implementing Regulation (EU) 2019/776 of 16 May 2019 L 139I
- [12] SUBSET-139, version 0.0.13
- [13] SUBSET-139, version 0.0.17
- [14] OCORA-40-006-Gamma_CCS-TCMS-Interface-ETCS-Functionality
- [15] SUBSET-026 ERTMS/ETCS System Requirements Specification, version 3.6.0

1 Introduction

1.1 Purpose of the document

The purpose of the document is to specify the standard communication interface of the Functional Vehicle Adapter (SCI-FVA) with the aim to provide to the reader:

- The approach and methodology used for defining the interface between the functional vehicle adapter and the CCS on-board applications.
- The functional interface specification between the functional vehicle adapter and the CCS on-board applications.
- The definition of the variables used in the interface between the functional vehicle adapter and the CCS on-board applications.
- Non-functional requirements associated with the implementation of the interface between the functional vehicle adapter and the CCS on-board applications.

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 and can, therefore, engage in shaping OCORA. Feedback to this document and to any other OCORA documentation can be given by using the Feedback Form [\[4\]](#).

If you are a railway undertaking, you may find useful information to compile tenders for OCORA compliant CCS building blocks, for tendering complete on-board CCS system, or also for on-board CCS replacements for functional upgrades or for life-cycle reasons.

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

1.2 Applicability of the document

The document is currently considered informative but may become a standard at a later stage for OCORA compliant on-board CCS solutions. Subsequent releases of this document will be developed based on a modular and iterative approach, evolving within the progress of the OCORA collaboration.

1.3 Context of the document

This document is published as part of the OCORA Release R1, together with the documents listed in the Release Notes [\[1\]](#). Before reading this document, it is recommended to read the Release Notes [\[1\]](#). If you are interested in the context and the motivation that drives OCORA we recommend to read the Introduction to OCORA [\[6\]](#), and the Problem Statements [\[7\]](#). The reader should also be aware of the Glossary [\[2\]](#) and the Question and Answers [\[3\]](#).

The interface specification defined in this document is based on the OCORA approach for integrating the CCS on-board with the vehicle by means of a Functional Vehicle Adapter. Therefore, it is suggested to previously read the Functional Vehicle Adapter introduction document [\[9\]](#) that illustrates the context of the Functional Vehicle Adapter itself.

2 Approach and methodology of the interface definition

This chapter describes the approach and methodology for the definition of the interface between the functional vehicle adapter and the CCS on-board applications. This is the standardized interface between the different CCS on-board applications and the FVA, and that shall be applicable without modification independently from the vehicle type.

The envisaged approach and methodology consist of the following steps:

1. Identify the functions that involve a data exchange between the CCS on-board applications and the vehicle (TCMS).
2. For each function provide the rationale that triggers the required data exchange. This allows to better assess the details of the transferred data.
3. Based on the functions define the content that needs to be transferred via the interface as variables (including indication of safety relevance, need for confidence interval).
4. For each variable define the details (e.g. data type, value range, unit, cyclic time, refresh time, required freshness, etc.), so that the interface can be described in more detail.
5. Consolidate the different variables that have been defined based on the functions: possibly different functions need the same variable, or the same variable is needed with different resolutions, etc. All variables with the same content that have been identified multiple times shall be consolidated to one variable that is used for all involved functions.
6. Define how the variables shall be grouped in the interface (e.g. packet / telegram containing a specific set of variables). This allows to implement the interface.

3 Data format and structure

The intention was to describe in this chapter the data serialization format and the generic structure of the telegrams. It has however been decided that these topics are developed in the TWS02-CCN workstream of OCORA. In a subsequent release of this documentation this chapter contains a reference to a document from TWS02-CCN.

Furthermore, in a subsequent release of this documentation the content will be similar to chapters 7.3.2 and 7.3.3 of SUBSET-026. For instance, to include a naming convention for the variable names.

4 FVA functions in the context of CCS on-board applications

This chapter lists the FVA functions for the situations where the CCS on-board applications interact with the vehicle through the Functional Vehicle Adapter. Furthermore, it provides the rationale why each specific interaction is needed.

4.1 FVA functions in the context ETCS on-board application

The following table lists the Functional Vehicle Adapter functions for the situations where the ETCS on-board application is interacting with the vehicle:

Note: the table includes functions when a national train control (NTC) on-board is integrated with the ETCS on-board as an STM. The situation of an NTC running in the OCORA environment but not being integrated with the ETCS on-board as an STM is not considered reasonable or will have implemented its own integration into the vehicle and is therefore not reflected.

Note: for each specific function not all requirements / conditions from the SUBSETs will be listed in the table. The scope of the table is to identify the functions involving a data exchange between ETCS on-board and the vehicle.

ID	Title	Description	SUBSET Ref.	Rationale
Input to the ETCS on-board application				
F-ETCS-In-01	Cabin status	The FVA publishes the status of the vehicle cabin(s) information which indicates if the cabin(s) is / are either active or not active. The status of 1 or 2 cabins needs to be published, depending on the vehicle design. Note: only 1 cabin can be active at a time.	SS-026: 4.6.3 SS-026: 5.4.4 step 'S0' SS-034: 2.5.1 SS-119: 5.4.1 SS-035: 5.2.4.4	<ul style="list-style-type: none"> The cabin status input is used by ETCS on-board for various purposes, for instance as transition condition. The cabin status input is forwarded by ETCS on-board to NTC on-board for various purposes, for instance to start its operation.

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-In-02	Train data information	<p>The FVA publishes the vehicle values of the following items:</p> <ul style="list-style-type: none"> ▪ train category(ies) for cant deficiency ▪ train length ▪ traction / brake parameters <ul style="list-style-type: none"> ○ traction model ○ braking model or brake percentage ○ brake position ○ on-board correction factors ○ nominal rotating mass ▪ maximum train speed ▪ loading gauge ▪ axle load category ▪ traction system(s) accepted by engine ▪ train fitted with airtight system. ▪ axle number. 	SS-026: 3.18.3 / 5.17 SS-034: 2.6.2 SS-119: 5.5.1 / 5.5.3	<p>The train data information is an input that enables the ETCS on-board equipment to determine values for any of the indicated train data items. This information is used by the ETCS on-board to adapt the vehicle supervision for the characteristics of the vehicle.</p>
F-ETCS-In-03	Train composition	<p>The FVA publishes the train composition variable value(s) which has a project specific meaning.</p>	SS-119: 5.5.1.1.1 / 5.5.1.1.7	<p>The train composition input can be used by the ETCS on-board to deduce the values of the train data information: cant deficiency, traction model, maximum train speed, loading gauge, train length, train fitted with airtight system, and axle load category.</p> <p>Note: it has to be assessed in OCORA, if this function is in line with the OCORA design guidelines since its concept of use and value meaning(s) are not standardized. In a subsequent release of this documentation a concept is developed and published within OCORA.</p>
F-ETCS-In-04	Tilting health status	<p>The FVA publishes the tilting health status information which indicates if the tilting system is either operational or not operational.</p>	SS-119: 5.5.1.1.1 / 5.5.1.1.8	<p>In case of tilting trains, the tilting health status input can be used by the ETCS on-board to deduce the values of the train data information: cant deficiency, maximum train speed and loading gauge. How the values shall be deduced is project specific.</p> <p>Note: it has to be assessed in OCORA, if this function is in line with the OCORA design guidelines since only the value meanings is standardized but not its use.</p>

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-In-05	Train type	The FVA publishes the train type information which is an identifier for the type of train related to the actual vehicle. The number of values and their meaning is project specific.	SS-119: 5.5.1.1.1 / 5.5.1.1.9	This "identifier" input can be used by the ETCS on-board to select the appropriate train data set among the pre-configured ones. Note: it has to be assessed in OCORA, if this function is in line with the OCORA design guidelines since its concept of use and value meaning(s) are not standardized.
F-ETCS-In-06	Type of train data entry	The FVA publishes the type of train data entry information which indicates if the type of data entry is either fixed, or flexible or switchable.	SS-026: 3.18.3.2 SS-034: 2.6.1 SS-119: 5.5.2	The input value indicates the type of train data entry configuration to be applied on the DMI.
F-ETCS-In-07	Sleeping	The FVA publishes a vehicle command to ETCS on-board indicating if the sleeping is either requested or not requested.	SS-026: 4.4.6 / 4.6.3 SS-034: 2.2.1 SS-119: 5.1.1	The input value "sleeping requested" is used by ETCS on-board as one of the conditions for the transition to sleeping mode.
F-ETCS-In-08	Passive shunting	The FVA publishes a vehicle command to ETCS on-board indicating if the passive shunting is either permitted or not permitted.	SS-026: 4.4.20 / 4.6.3 SS-034: 2.2.2 SS-119: 5.1.2	The input value "passive shunting permitted" is used by ETCS on-board as one of the conditions for the transition to passive shunting mode.
F-ETCS-In-09	Non-leading	The FVA publishes a vehicle command to ETCS on-board indicating if the non-leading is either permitted or not permitted.	SS-026: 4.4.15 / 4.6.3 SS-034: 2.2.3 SS-119: 5.1.3	The input value "non-leading permitted" is used by ETCS on-board as one of the conditions for the transition to non-leading mode.
F-ETCS-In-10	Brake pressure	The FVA publishes the value of the vehicle brake pressure which represent either the pressure in the main brake pipe or in the brake cylinder.	SS-026: 3.13.2.2.7 / A.3.10 SS-034: 2.3.2 SS-119: 5.2.2	The brake pressure input is used by ETCS on-board in the service brake feedback model.
F-ETCS-In-11	Special brake status	The FVA publishes the vehicle special brake status information which indicates if the special brake is either active or not active.	SS-026: 3.13 SS-034: 2.3.6 SS-119: 5.2.6	The special brake status input is used by ETCS on-board to adapt the braking curve model for the characteristics of the service brake, the emergency brake, or both, according to the possible configurations of ETCS on-board.
F-ETCS-In-12	Additional brake status	The FVA publishes the additional vehicle brake status information which indicates if the additional brake is either active or not active.	SS-026: 3.13 SS-034: 2.3.7 SS-119: 5.2.7	The additional brake status input is used by ETCS on-board to adapt the braking curve model for the characteristics of the additional brakes which are independent of wheel/rail adhesion.
F-ETCS-In-13	Set speed	The FVA publishes a vehicle command to ETCS on-board indicating if the set speed information is either to be displayed or not to be displayed on the DMI. Furthermore, the FVA publishes the vehicle set speed value information.	SS-026: 4.7.2 SS-034: 2.5.5 SS-119: 5.4.5	The set speed input is used by ETCS on-board only for display of set speed on the DMI.

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-In-14	Direction controller	The FVA publishes the vehicle direction controller information which is given with the three states: forward, neutral, backward. Indication is relative to the active cabin.	SS-026: 3.14.2 / 5.13.1.4 SS-034: 2.5.2 SS-119: 5.4.2 SS-035: 5.2.4.4	<ul style="list-style-type: none"> The direction controller input is used by ETCS on-board to prevent train movement which conflicts with the current position of the direction controller in the active cab and to detect the driver's intention to reverse, which is one of the conditions for entering reversing mode. The direction controller input is forwarded by ETCS on-board to NTC on-board.
F-ETCS-In-15	Train integrity	The FVA publishes the result of the train integrity supervision which indicates if integrity has been lost or not lost.	SS-026: 3.6.5.2.1 SS-034: 2.5.3 SS-119: 5.4.3	Under ETCS Level 3, in case trackside track occupation/vacancy detection is no longer in operation (trackside Train Detection Devices are no longer used), this input is used by ETCS on-board as confirmation of train integrity meaning that the train length, stored as valid train data at the time the train was last known to be integer, can be used for reporting the train position to the trackside, which will allow the latter to safely use the information about the train rear end position. Note: the interface for this function will evolve according to the results of the on-going work of S2R.
F-ETCS-In-16	National system isolation	The FVA publishes the national system isolation status information which indicates if the national system is either isolated or not isolated.	SS-034: 2.7 SS-119: 5.6 SS-035: 10.3.3.5 / 10.3.3.6 e) / 10.14.1.2	The national system isolation input shall be used by the ETCS on-board in case it is interfaced to the national system through an STM and this national system requires isolation of the STM to be implemented.
F-ETCS-In-17	Traction status for NTC	The FVA publishes the vehicle traction status information which indicates if the traction is either on or off. Note: based on SS-119 §5.4.4.2.1 "traction off" refers to traction zero or negative (electro-dynamic brake) whereas "traction on" refers when traction is positive.	SS-034: 2.5.4 SS-119: 5.4.4 SS-035: 5.2.4.4	The traction status input is forwarded to NTC on-board that possibly uses it as a feedback loop - NTC on-board can supervise if traction is cut off in case NTC on-board orders traction cut off. Note: the purpose / rationale has to be further clarified.
F-ETCS-In-18	Emergency Brake feedback	This is the feedback loop which indicates if the Emergency Brake is commanded or not commanded.	SS-034: 2.3.3 SS-119: 5.2.3	The Emergency Brake feedback information is used by ETCS on-board to evaluate if Emergency Brake has been applied successfully (diagnostic) and for test purposes. The information is acquired by means of direct wired inputs to the ETCS on-board. Note: the use of this function is explicitly excluded in the FVA context as it is a direct wired connection involved in a SIL4 function.

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-In-19	Sensor variables	The FVA publishes the vehicle sensor information for some sensors which indicates the sensor values currently applied within the TCMS.		Note: the use of the packet 30 defined in document [14] is explicitly excluded in the OCORA environment as the rationale for its use is missing and the consistent concept needs to be developed before.
F-ETCS-In-20	Text messages	The FVA publishes the vehicle text messages to be displayed on the DMI.		Note: the use of the packets 31 and 32 defined in document [14] is explicitly excluded in the OCORA environment as the rationale for its use is missing and the consistent concept needs to be developed before.
F-ETCS-In-21	Mathematical braking curve model	The FVA publishes the mathematical braking curve model information from the vehicle which provides the braking curve for emergency brake and system brake.		Note: the use of the packet 33 defined in document [14] is explicitly excluded in the OCORA environment as the involved data is related to a SIL4 function and the rationale for its use is missing. A proper concept needs to be developed before.
F-ETCS-In-22	Brake test result	The FVA publishes the vehicle brake test result information which provides the result of the performed brake tests.		Note: the use of the packet 34 defined in document [14] is explicitly excluded in the OCORA environment as the rationale for its use is missing and the consistent concept needs to be developed before.
F-ETCS-In-23	Brake reason feedback	The FVA publishes the vehicle braking reason feedback information which provides the reason for having applied the service or emergency brake.		Note: the use of the packet 36 defined in document [14] is explicitly excluded in the OCORA environment as the rationale for its use is missing and the consistent concept needs to be developed before.
F-ETCS-In-24	Feedback variables	The FVA publishes the vehicle feedback information for some variables which indicates the values currently applied within the TCMS.		Note: the use of the packet 37 defined in document [14] is explicitly excluded in the OCORA environment as the rationale for its use is missing and the consistent concept needs to be developed before.
F-ETCS-In-25	FVA state	The FVA publishes the state of the FVA itself which indicates the state of the FVA (e.g. configuration, running, failure, etc.)		The FVA state information is used by the ETCS on-board to decide how to handle the data received by the FVA and behave accordingly.

Table 1 FVA functions in the context of ETCS on-board application: data from FVA to ETCS on-board

Note: in Table 1 the functions F-ETCS-In-19, F-ETCS-In-20, F-ETCS-In-21, F-ETCS-In-22 F-ETCS-In-23, and F-ETCS-In-24 are listed on purpose. This to have evidence that these functions are not forgotten (for the case where these would have been deleted) but are explicitly excluded.

ID	Title	Description	SUBSET Ref.	Rationale
Output from the ETCS on-board application				
F-ETCS-Out-01	<i>Emergency brake command</i>	The FVA receives the ETCS on-board order to the vehicle that the emergency brake is either commanded or not commanded. Originally the order might be triggered by ETCS on-board or NTC on-board. Note: when emergency brake is commanded the ETCS on-board in parallel also orders to cut off the traction.	SS-026: 3.13.10 / 3.14.1 / 4.4.14 / 4.4.4 / 4.4.5 / 4.4.13 / 5.11 SS-034: 2.3.3 SS-119: 5.2.3 SS-035: 5.2.5	Command used by ETCS on-board or NTC on-board to brake the vehicle. Also used to revoke the braking action. Note: if the emergency brake is only commanded through hard-wired signals, then the FVA is not involved. This command is only sent if emergency brake through serial connection is configured in ETCS on-board.
F-ETCS-Out-02	<i>Traction cut off</i>	The FVA receives the ETCS on-board order to the vehicle that the traction has either to be cut off or not to be cut off. Originally the order might be triggered by ETCS on-board or NTC on-board.	SS-026: 3.13.2.2.8 / 5.20 SS-034: 2.4.9 SS-119: 5.3.11 SS-035: 5.2.4.3	Command used by ETCS on-board or NTC on-board to brake the vehicle by removing the traction power. Also used to apply again the traction power.
F-ETCS-Out-03	<i>Service brake command</i>	The FVA receives the ETCS on-board order to the vehicle that the service brake is either commanded or not commanded. Originally the order might be triggered by ETCS on-board or NTC on-board. Note: when service brake is commanded the ETCS on-board in parallel also orders to cut off the traction.	SS-026: 3.13.2.2.7 / 3.13.10 / 3.14.1 SS-034: 2.3.1 SS-119: 5.2.1 SS-035: 5.2.5	Command used by ETCS on-board or NTC on-board to brake the vehicle. Also used to revoke the braking action.
F-ETCS-Out-04	<i>Isolation</i>	ETCS on-board isolation status information which indicates if the ETCS on-board is either isolated or not isolated. This information is only processed through hard-wired connection. The information is generated by the ETCS on-board isolation device and directly provided to the vehicle (e.g. TCMS).	SS-026: 4.4.3.1.1 SS-034: 2.2.4 SS-119: 5.1.4	The published information might be used by the vehicle to activate specific measures.
F-ETCS-Out-05	<i>Change of traction system</i>	The FVA receives from the ETCS on-board the remaining distance information from the max safe front end of the train to the location where the change of traction system occurs. Furthermore, it receives the identity of the new traction system.	SS-026: 3.12.1 / 5.20 SS-034: 2.4.1 SS-119: 5.3.2	The published information is used by the vehicle to change to the appropriate traction system at the given location.

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-Out-06	Pantograph to be lowered	The FVA receives from the ETCS on-board the distance information related to a powerless section with pantograph to be lowered, for instance the remaining distance information from the max safe front end of the train to the location where the powerless section starts.	SS-026: 3.12.1 / 5.20 SS-034: 2.4.2 SS-119: 5.3.3	<i>The published information is used by the vehicle to lower and raise the pantograph at the given locations.</i>
F-ETCS-Out-07	Main power switch to be switched off	The FVA receives from the ETCS on-board the distance information related to a powerless section with main power switch to be switched off, for instance the remaining distance information from the max safe front end of the train to the location where the powerless section starts.	SS-026: 3.12.1 / 5.20 SS-034: 2.4.7 SS-119: 5.3.8	<i>The published information is used by the vehicle to switch off and switch on the main power switch at the given locations.</i>
F-ETCS-Out-08	Special brake inhibition area	The FVA receives from the ETCS on-board the distance information related to a special brake inhibition area, for instance the remaining distance information from the max safe front end of the train to the location where the special brake inhibition area starts.	SS-026: 3.12.1 / 5.20 SS-034: 2.3.4 SS-119: 5.2.4	<i>The published information is used by the vehicle to not operate the different special brake types along the given location information.</i>
F-ETCS-Out-09	Air tightness area	The FVA receives from the ETCS on-board the distance information related to an air tightness area, for instance the remaining distance information from the max safe front end of the train to the location where the air tightness area starts.	SS-026: 3.12.1 / 5.20 SS-034: 2.4.4 SS-119: 5.3.5	<i>The published information is used by the vehicle to activate and release the air tightness at the given locations.</i>
F-ETCS-Out-10	Station platform	The FVA receives from the ETCS on-board the distance information related to the station platform, for instance the remaining distance information from the max safe front end of the train to the location where the station platform starts. Furthermore, it receives information about the station platform.	SS-026: 3.12.1 / 5.20 SS-034: 2.4.6 SS-119: 5.3.7	<i>The published information is used by the vehicle to enable passenger doors opening, side permission and opening with or without steps. The evaluation to consider the location.</i>
F-ETCS-Out-11	Change of allowed current consumption	The FVA receives from the ETCS on-board the remaining distance information from the max safe front end of the train to the location where the change of allowed current consumption occurs. Furthermore, it publishes the new allowed current consumption.	SS-026: 3.12.1 / 5.20 SS-034: 2.4.10 SS-119: 5.3.10	<i>The published information is used by the vehicle to respect the new allowed current consumption starting at the given location.</i>
F-ETCS-Out-12	NTC pantograph order	The FVA receives the ETCS on-board redirection about the NTC on-board order to the vehicle that the pantograph has either to be raised or lowered.	SS-035: 5.2.4.3 SS-034: 2.4.3 SS-119: 5.3.4	<i>Command used by NTC on-board to raise or lower the pantograph immediately based on knowledge about track conditions.</i>

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-Out-13	NTC main power switch order	The FVA receives the ETCS on-board redirection about the NTC on-board order to the vehicle that the main power switch has either to be opened or closed.	SS-035: 5.2.4.3 SS-034: 2.4.8 SS-119: 5.3.9	Command used by NTC on-board to open or close the main power switch immediately based on knowledge about track conditions.
F-ETCS-Out-14	NTC special brake inhibition	The FVA receives the ETCS on-board redirection about the NTC on-board order to the vehicle that the special brake has either to be inhibited or not inhibited.	SS-035: 5.2.4.3 SS-034: 2.3.5 SS-119: 5.2.5	Command used by NTC on-board to inhibit or allow the different special brake types use based on knowledge about track conditions.
F-ETCS-Out-15	NTC air tightness order	The FVA receives the ETCS on-board redirection about the NTC on-board order to the vehicle that the air tightness flap has either to be opened or closed.	SS-035: 5.2.4.3 SS-034: 2.4.5 SS-119: 5.3.6	Command used by NTC on-board to open or close the air tightness flap based on knowledge about track conditions.
F-ETCS-Out-16	Odometry data	The FVA receives from the ETCS on-board the odometry information.		The published information is used by the vehicle to consider it in the speed evaluation process and improve the speed accuracy. Furthermore, it may be used to evaluate the exact position for track conditions.
F-ETCS-Out-17	Track gradients	The FVA receives from the ETCS on-board the track gradients information.		The published information is used by the braking and traction systems of the vehicle to optimize the brake and traction control.
F-ETCS-Out-18	Packet 44	The FVA receives from the ETCS on-board the packet 44 information.		The published information is used by different systems in the vehicle depending on what information the track provides with packet 44.
F-ETCS-Out-19	ETCS on-board status	The FVA receives from the ETCS on-board the status information which indicates the status of the ETCS on-board.		The published information is used by the vehicle as diagnostic information that is centrally collected (and possibly displayed) for the whole vehicle. The information can then be used for specific operational processes.
F-ETCS-Out-20	Driver ID	The FVA receives from the ETCS on-board the driver-ID information which indicates the ID of the driver.		The published information is used by the TCMS for identification of the driver: drive permission, immobilizer, driver's logbook, seat adjustment, etc. Publishing this information from ETCS on-board to TCMS prevents the driver from having to enter his ID twice: in the TCMS and in the ETCS on-board.
F-ETCS-Out-21	Train running number	The FVA receives from the ETCS on-board the train running number which indicates the operated train number.		The published information is used by the TCMS that centrally collects this information for displaying it to the passengers and other processes. Publishing this information from ETCS on-board to TCMS prevents the driver from having to enter the train running number twice: in the TCMS and in the ETCS on-board.

ID	Title	Description	SUBSET Ref.	Rationale
F-ETCS-Out-22	Automatic driving	The FVA receives from the ETCS on-board the information if ETCS on-board is in automatic driving mode or not in automatic driving mode.	SS-119: 5.1.5	<i>The published information is used by the TCMS to confirm that commands from 'ATO Vehicle' shall be processed.</i>

Table 2 FVA functions in the context of ETCS on-board application: data from ETCS on-board to FVA

4.2 FVA functions in the context of ATO Vehicle application

The following table shows the FVA functions for the situations where the 'ATO Vehicle' (AV) application is interacting with the vehicle:

Note: the table is restricted to functions when 'ATO Vehicle' is running with GoA up to 2 (GoA 3 and 4 are excluded).

ID	Title	Description	SUBSET Ref.	Rationale
Input to the ATO vehicle application				
F-ATO-In-01	Engagement ready	The FVA publishes the engagement ready information which indicates if the vehicle conditions for engagement ready are either fulfilled or not fulfilled.	SS-139 6.2.3.1 / 7.3.4 [12]	<i>The published information is used by 'ATO Vehicle' to monitor if engagement of ATO operation is allowed. If engagement is not fulfilled, then 'ATO Vehicle' will disengage.</i>
F-ATO-In-02	Traction ready	The FVA publishes the traction ready information which indicates if the conditions for applying the traction are either fulfilled or not fulfilled.	SS-139 6.2.3.1 / 7.3.4 [12]	<i>The published information is used by 'ATO Vehicle' to monitor if traction can be applied. If 'traction ready' is not fulfilled 'ATO Vehicle' will order coasting (no traction).</i>
F-ATO-In-03	Dynamic brake ready	The FVA publishes the dynamic brake ready information which indicates if the conditions for applying the dynamic brake are either fulfilled or not fulfilled.	SS-139 6.2.3.1 / 7.3.4 [12]	<i>Only used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. Note: it has to be assessed in OCORA, if this function is in line with its principle.</i>
F-ATO-In-04	Traction status	The FVA publishes the traction status information which indicates if the traction is either applied or not applied.	SS-139 6.2.3.1 / 7.3.4 [12]	<i>The published information is used by 'ATO Vehicle' to monitor if traction is being applied when requested (feedback signal). It can be used by some 'ATO Vehicle' to make a forecast computation. Note: it has to be assessed in OCORA, if this function is in line with its principle.</i>

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-In-05	Dynamic brake status	The FVA publishes the dynamic brake status information which indicates if the dynamic brake is either applied or not applied.	SS-139 6.2.3.1 / 7.3.4 [12]	<p>Feedback signal only used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. It can be used by some 'ATO Vehicle' to make a forecast computation.</p> <p>Note: it has to be assessed in OCORA, if this function is in line with its principle.</p>
F-ATO-In-06	Standstill according TSI LOC & PAS	The FVA publishes the standstill status information (as defined in TSI LOC & PAS) which indicates if the vehicle is either at standstill or not at standstill.	SS-139 6.2.5.2 / 7.3.4 [12]	The published information is used by 'ATO Vehicle' to automatically open the doors when vehicle is at standstill according to the definition in TSI LOC & PAS.
F-ATO-In-07	Standstill according national rules (door opening permitted)	<p>The FVA publishes the standstill status information (as defined by national rules) which indicates if the vehicle is either at standstill or not at standstill.</p> <p>Content removed in SUBSET-139 between version 0.0.13 and 0.0.17.</p>	SS-139 6.2.5.2 / 7.3.4-32 [12]	<p>The published information is used by 'ATO Vehicle' to automatically open the doors when vehicle is at standstill according to the definition by the national rules.</p> <p>Note: the use of this function is explicitly excluded in the OCORA environment as it is project specific.</p>
F-ATO-In-08	Emergency brake released	The FVA publishes the emergency brake released information which indicates if the emergency brake is either released or not released.	SS-139 6.2.4.1 / 7.3.4 [12]	The published information is used by 'ATO Vehicle' to monitor if emergency brake is released or not. If emergency brake is not released 'ATO Vehicle' will order coasting (no traction).
F-ATO-In-09	Service brake status	The FVA publishes the service brake status information which indicates if the service brake is either applied or not applied.	SS-139 6.2.4.1 / 7.3.4 [12]	The published information is used by 'ATO Vehicle' to monitor if service brake is applied (feedback signal). If service brake is applied 'ATO Vehicle' will order coasting (no traction).
F-ATO-In-10	Holding brake status	The FVA publishes the holding brake status information which indicates if the holding brake is either applied or not applied.	SS-139 6.2.4.12 / 7.3.4 [12]	The published information is used by 'ATO Vehicle' to monitor if holding brake is being applied when requested (feedback signal). If the feedback is not consistent with the order the service brake application is ordered by 'ATO Vehicle'.

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-In-11	Direct brake status	The FVA publishes the direct brake status information which indicates if the direct brake is either applied or not applied.	SS-139 6.2.4.8 / 7.3.4 [12]	<p>Feedback signal mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the direct brake), for instance in case of cargo operations. The published information is used by 'ATO Vehicle' to monitor if direct brake is being applied when requested.</p> <p>Note: not clear what is the concept, what action is triggered if the feedback is not consistent with the expected behaviour.</p> <p>Note: it has to be assessed in OCORA, if this function is in line with its principle.</p>
F-ATO-In-12	Traction over brake status	The FVA publishes the traction over brake status information which indicates if the request is either enabled or not enabled to apply traction even while service brake is applied.	SS-139 6.2.4.1 / 7.3.4 [12]	<p>The published information is used by 'ATO Vehicle' for multiple purposes, for instance in case of brake cleaning mode or for a hill start (preventing roll-back).</p>
F-ATO-In-13	Actual speed	The FVA publishes the value of the vehicle speed which is evaluated / used outside of the CCS domain.	SS-139 6.2.5.2 / 7.3.4 [12]	<p>The published value can optionally be used by 'ATO Vehicle' (if it is of sufficient quality) to compute speed profiles and for train control.</p>
F-ATO-In-14	Actual acceleration	The FVA publishes the value of the vehicle acceleration which is evaluated / outside of the CCS domain.	SS-139 6.2.5.2 / 7.3.4 [12]	<p>The published value can optionally be used by 'ATO Vehicle' (if it is of sufficient quality) to compute speed profiles and for train control.</p>
F-ATO-In-15	Travelled distance	The FVA publishes a distance value counter being evaluated outside of the CCS domain.	SS-139 6.2.5.2 / 7.3.4 [12]	<p>The published value can optionally be used by 'ATO Vehicle' (if it is of sufficient quality) to compute speed profiles and for train control.</p>
F-ATO-In-16	Relative traction or brake set value	<p>The FVA publishes the degree of traction or brake performance set to the vehicle.</p> <p>Note: in SS-139 this information is transmitted by using one variable. From robustness perspective it is preferable to use two independent variables: one for traction degree and one for brake degree.</p>	SS-139 6.2.7.1 / 7.3.4 [12]	<p>The published information is used by 'ATO Vehicle' to monitor if the ordered degree of traction or brake has been properly processed in the vehicle (feedback signal) and as comfort function for smooth transition.</p> <p>Furthermore, it can be used by some 'ATO Vehicle' to make a forecast computation (possibly also from energy saving perspective).</p> <p>Note: not clear what is the concept, what action is triggered if the feedback is not consistent with the expected behaviour.</p> <p>Note: it has to be assessed in OCORA, if this function is in line with its principle.</p>

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-In-17	Brake pipe pressure	The FVA publishes the brake pipe pressure.	SS-139 6.2.4.8 / 7.3.4 [12]	Feedback signal mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. The published information is used by 'ATO Vehicle' when it controls the brake force splitting and/or brake blending. Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-In-18	Brake pipe pressure at brake distributor output	The FVA publishes the brake pipe pressure at brake distributor output.	SS-139 6.2.4.8 / 7.3.4 [12]	Feedback signal mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. The published information is used by 'ATO Vehicle' when it controls the brake force splitting and/or brake blending. Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-In-19	Relative traction / brake request limitation	The FVA publishes the relative traction / brake request limitation (for the whole train) in percentage. Content replaced in SUBSET-139 between version 0.0.13 and 0.0.17.	SS-139 6.2.7.1 / 7.3.4-22 [12] SS-139 6.2.7.5 / 6.2.7.6 / 7.3.3-12 [13]	The published information is used by 'ATO Vehicle' to compute speed profiles. The TCMS is in charge of maintaining the current value according to the track condition "allowed current consumption" and others.
F-ATO-In-20	Doors status	The FVA publishes the doors status.	SS-139 6.2.6.1 / 7.3.4 [12]	Even though doors status is used as an engagement condition by the TCMS (F-ATO-In-01), the published information is used by 'ATO Vehicle' to display the doors status on the DMI to the driver.
F-ATO-In-21	Traction / brake lever or generally the brake lever(s) position	The FVA publishes the traction / brake lever or generally the brake lever(s) position.	SS-139 6.2.7.1 / 7.3.4 [12]	The published information is used by 'ATO Vehicle' to monitor if the driver is intervening in the control of the train. If position of the lever changes to something different than zero position, then 'ATO Vehicle' should disengage as the driver has made an intervention.
F-ATO-In-22	Adhesion factor reduction	The FVA publishes the reduction of adhesion determined by the vehicle.	SS-139 6.2.7.1 / 7.3.4 [12]	The published information is used by 'ATO Vehicle' to inform the 'ATO trackside' about the determined limitation.
F-ATO-In-23	Maximum available tractive effort	The FVA publishes the maximum available tractive effort (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	The published information is used by 'ATO Vehicle' to compute speed profiles: this is the theoretical maximum available tractive effort.

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-In-24	Currently available tractive effort	The FVA publishes the maximum tractive effort at current speed (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	<i>The published information is used by 'ATO Vehicle' to compute speed profiles: this is the practical available tractive effort based on the current conditions.</i>
F-ATO-In-25	Maximum available tractive output power	The FVA publishes the maximum available tractive output power (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	<i>The published information is used by 'ATO Vehicle' to compute speed profiles. Power is needed to optimize energy consumption and smooth power peaks.</i>
F-ATO-In-26	Maximum available dynamic brake effort	The FVA publishes the maximum available dynamic brake effort (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	<i>Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. The published information is used by 'ATO Vehicle' to compute speed profiles. This is the theoretically maximum available dynamic brake effort.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-In-27	Currently available dynamic brake effort	The FVA publishes the available dynamic brake effort at current speed (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	<i>Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. The published information is used by 'ATO Vehicle' to compute speed profiles. This is the practically available dynamic brake effort based on the current conditions.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-In-28	Maximum available dynamic brake power	The FVA publishes the maximum available dynamic brake power (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	<i>Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually (including the dynamic brake), for instance in case of cargo operations. The published information is used by 'ATO Vehicle' to compute speed profiles. This is the maximum power from regenerative (electrical) brake.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-In-29	Current train mass	The FVA publishes the current train mass (for the whole train).	SS-139 6.2.7.1 / 7.3.5 [12]	<i>The published information is used by 'ATO Vehicle' to compute current speed profile.</i>
F-ATO-In-30	Brake mode	The FVA publishes the brake mode of the vehicle.	SS-139 6.2.7.1 / 7.3.5 [12]	<i>The published information is used by 'ATO Vehicle' to compute speed profiles. Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually, for instance in case of cargo operations.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-In-31	Current value of wheel diameters	<p>The FVA publishes the current value of the wheel diameters for the different axles.</p> <p>The FVA publishes the different TCMS speed sensor(s) pulses per km information.</p> <p>Content changed in SUBSET-139 between version 0.0.13 and 0.0.17. Assumption for this function is that the pulse generator speed sensors are directly connected to 'ATO Vehicle' via a wired connection.</p>	<p>SS-139 6.2.7.1 / 7.3.5 [12]</p> <p>SS-139 6.2.7.1 / 7.3.4-16 [13]</p>	<p>The published information is used by 'ATO Vehicle' to compute the current speed from raw sensor signals (limited to pulse generation sensors). This if 'ATO Vehicle' does not use an external speed source.</p> <p>Note: the use of this function is explicitly excluded in the OCORA environment as it is project specific and resource consuming.</p>
F-ATO-In-32	Speed sensor(s) status	<p>The FVA publishes the speed sensor(s) status.</p> <p>Content slightly changed in SUBSET-139 between version 0.0.13 and 0.0.17. Assumption for this function is that the pulse generator speed sensors are directly connected to 'ATO Vehicle' via a wired connection.</p>	<p>SS-139 7.3.4 [12]</p> <p>SS-139 6.2.5.2 / 7.3.3-22 / 7.3.3.1 [13]</p>	<p>The published information is used by 'ATO Vehicle' to compute the current speed from raw sensor signals (limited to pulse generation sensors). This if 'ATO Vehicle' does not use an external speed source.</p> <p>Note: not clear why 'ATO Vehicle' does not make its own sensor status evaluation for the directly connected speed sensors (pulse generator sensors).</p> <p>Note: the use of this function is explicitly excluded in the OCORA environment as it is project specific and resource consuming.</p>
F-ATO-In-33	Time synchronisation	<p>The FVA provides functionality for time synchronisation between 'ATO Vehicle' and vehicle.</p> <p>Note: the overall time synchronisation concept needs to be elaborated in OCORA also considering trackside and defining a standardised time master (for the whole vehicle but also considering CCS trackside). A different approach than currently defined in SUBSET-139 would be to introduce a time counter.</p> <p>Content removed in SUBSET-139 between version 0.0.13 and 0.0.17.</p>	<p>SS-139 6.2.8 / 7.3.4 [12]</p>	<p>Note: the use of this function is explicitly excluded in the OCORA environment as it is project specific.</p>
F-ATO-In-34	Cabin status	<p>The FVA publishes the status of the vehicle cabin(s) information which indicates if the cabin(s) is / are either active or not active.</p> <p>.</p>		<p>The published information is used by 'ATO Vehicle' to recognise in which direction the train moves: forward or backward.</p> <p>Note: this information seems to be missing in SUBSET-139 in order to ensure that 'ATO Vehicle' has all required information. Some information (direction, door side, etc.) is given in relation to the active cabin.</p>

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-In-35	Raw signals from speed sensors	The FVA publishes the number of pulses per time as a frequency signal. Content removed in SUBSET-139 between version 0.0.13 and 0.0.17.	SS-139 7.3.4.1 [12]	<i>The published information is used by 'ATO Vehicle' to compute the current speed from raw sensor signals (limited to pulse generation sensors). This if 'ATO Vehicle' does not use an external speed source.</i> Note: the use of this function is explicitly excluded in the OCORA environment as it is project specific and resource consuming.
Output from the ATO vehicle application				
F-ATO-Out-01	ATO state	The FVA receives from the 'ATO Vehicle' the state information which indicates the state of the 'ATO Vehicle'.	SS-139: 6.2.2.1 / 7.3.3 [12]	<i>From SUBSET-139: TCMS uses ATO state indication to decide which 'ATO Vehicle' output signals from the list of ATO active functions shall be followed and which 'ATO Vehicle' input signals shall be generated.</i> Note: this needs to be elaborated in more detail, currently not fully clear.
F-ATO-Out-02	ATO behaviour configuration	The FVA receives from the 'ATO Vehicle' the ATO behaviour configuration information which indicates how the relative traction or brake request shall be interpreted.	SS-139: 6.2.2.1 / 6.2.3.6 / 6.2.3.7 / 7.3.3 [12]	<i>TCMS uses ATO behaviour configuration indication to identify how to interpret the 'ATO Vehicle' output signal for relative traction or brake request - whether the option I or option II is used (see SUBSET-139 for details).</i>
F-ATO-Out-03	Relative traction or brake request	The FVA receives the 'ATO vehicle' order to the vehicle to apply a specific degree of traction or brake performance.	SS-139: 6.2.3.1 / 7.3.3 [12]	<i>The 'ATO Vehicle' needs to drive the vehicle for this it provides a value that is in the range from positive to negative. A positive value indicates traction order, a negative value indicates brake order, a neutral order indicates coasting (no traction, no brake applied).</i>
F-ATO-Out-04	Immediate indirect air brake request	The FVA receives the 'ATO vehicle' order to the vehicle to apply a certain degree of indirect air brake performance.	SS-139: 6.2.4.8 / 7.3.3 [12]	<i>Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually, for instance in case of cargo operations. The command is used by 'ATO Vehicle' to order a certain degree of indirect air brake performance.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-Out-05	Immediate direct air brake request	The FVA receives the 'ATO vehicle' order to the vehicle to apply a certain degree of direct air brake performance.	SS-139: 6.2.4.8 / 7.3.3 [12]	<i>Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually, for instance in case of cargo operations. The command is used by 'ATO Vehicle' to order a certain degree of direct air brake performance.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-Out-06	Traction request	The FVA receives the 'ATO Vehicle' order to the vehicle that the traction is either requested or not requested.	SS-139: 6.2.3.1 / 7.3.3-5 [12]	<i>The exchanged data corresponds to the binary information of the traction / brake lever position that is needed by the TCMS to drive the vehicle.</i>
F-ATO-Out-07	Dynamic brake request	The FVA receives the 'ATO Vehicle' order to the vehicle that the dynamic brake is either requested or not requested.	SS-139: 6.2.3.1 / 7.3.3 [12]	<i>Mainly used for locos in case the 'ATO Vehicle' needs to control each brake individually, for instance in case of cargo operations. The command is used by 'ATO Vehicle' to order the application of the dynamic brake.</i> Note: it has to be assessed in OCORA, if this function is in line with its principle.
F-ATO-Out-08	Holding brake request	The FVA receives the 'ATO Vehicle' order to the vehicle that the holding brake is either requested or not requested.	SS-139: 6.2.4.12 / 7.3.3 [12]	<i>The 'ATO Vehicle' requests to apply the holding brake to ensure that the vehicle is not rolling away after stopping at a station.</i> <i>Before departing the holding brake is released.</i>
F-ATO-Out-09	Quick brake release request	The FVA receives the 'ATO Vehicle' order to the vehicle that the quick release of the brake is either requested or not requested.	SS-139: 6.2.4.8 / 7.3.3 [12]	<i>The 'ATO Vehicle' requests to quickly release the brake in order to quickly be able to depart from a station. This is mainly applicable to the pneumatic brake of locos.</i>
F-ATO-Out-10	Doors command	The FVA receives the 'ATO vehicle' order to the vehicle that the doors shall either be opened or closed.	SS-139: 6.2.6.1 [12]	<i>The 'ATO Vehicle' can automatically open the doors when stopping at a station. Alternatively, it can automatically close the doors before departing from the station.</i> Note: the doors commands are supervised by a SIL2 TCMS.
F-ATO-Out-11	Doors command passengers	The FVA receives the 'ATO vehicle' order to the vehicle that the door opening by the passengers shall either be enabled or disabled.	SS-139: 6.2.6.1 [12]	<i>The 'ATO Vehicle' can automatically enable the passengers to open the doors when stopping at a station.</i>
F-ATO-Out-12	Doors command side	The FVA receives the 'ATO vehicle' order to the vehicle on which side the doors shall be operated: either left, or right, or both sides.	SS-139: 6.2.6.1 [12]	<i>The 'ATO Vehicle' can automatically indicate to the vehicle on which side the doors shall be opened when stopping at a station.</i> Note: the same information is already provided by ETCS on-board as a track condition. This means that the same function is provided by ETCS on-board and 'ATO Vehicle'. This needs to be aligned in order to have a streamlined concept.
F-ATO-Out-13	Requested traction direction	The FVA receives the 'ATO Vehicle' order to the vehicle that indicates in which direction traction is requested (forward or backward).		<i>Note: the information seems to be missing in SUBSET-139 what allows 'ATO Vehicle' to indicate in which direction traction shall be applied.</i>

ID	Title	Description	SUBSET Ref.	Rationale
F-ATO-Out-14	<i>Hitch command</i>	The FVA receives the 'ATO Vehicle' order to the vehicle that indicates if during train splitting / joining procedure the hitch shall be opened or closed. .		<i>Note: according to the Operational Requirements v 1.12 20/08/2020 for ATO GoA2 the automated joining and splitting of a train is foreseen (§ "ATO 5.7 Joining and splitting a train"). However, for the automated train splitting and joining operation it seems that some data exchange is missing in SUBSET-139. This line is listed here as reminder.</i>

Table 3 FVA functions in the context of ATO Vehicle application

5 Interface definition per CCS on-board application

5.1 Basic interface valid for all CCS on-board applications

Describes the basic interface between FVA and the CCS on-board applications. All variables that are of interest for more than one CCS on-board application are handled through this interface. Possibly signal values are just published to the CCS on-board side, not possible to write from CCS on-board side due to concurrent access right issues. Specification of the data exchange (variables and values) per system function / message / variable, to be analysed what is the best documentation solution.

Description to include: general behaviour, the definition of the trigger to exchange data between FVA and ETCS on-board application, timing behaviour, etc.

This chapter will be provided as part of a subsequent release of this documentation.

5.2 Interface between FVA and ETCS on-board application

Describes the interface between FVA and the ETCS on-board application (in the system architecture the latter is indicated with the interfaces SCI-FVA, SCI-VL). Specification of the data exchange (variables and values) per system function. Also, variables that are excluded on purpose shall be documented here with the relevant rationale. This allows to understand in future why the interface was defined this way.

5.2.1 FVA to ETCS on-board data

This chapter defines the signals related to each described function from chapter 4.1. More specifically it further defines the interface where the data source is the Functional Vehicle Adapter.

Function ID	Variable	Description	Max. Cycle Time	SUBSET Ref.	Remarks
F-ETCS-In-01	TR_OBU_CabStatusA	Indication if cab A is active or not active.	100 ms	SS-034: 2.5.1 SS-119: 5.4.1	It is undefined if component 'Vehicle Supervisor' or 'Vehicle Locator' or both are needing this information. See the System Architecture document [8] for details about these components.
	TR_OBU_CabStatusB	Indication if cab B is active or not active.	100 ms		
F-ETCS-In-02	TR_OBU_TrainCatCantDef	Train category for cant deficiency.	200 ms	SS-119: 5.5.3.2.1	SS-119 defines to evaluate this value either based on "train type", or based on "train composition" and "tilting health status", or by receiving directly the value.
	-	Train category	-	SS-026 3.18.3.2 SS-119 5.5.3.2	This variable is defined in SS-026 but the content for it seems to be missing in SS-119.
	TR_OBU_TrainLength	Length of the train.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.3	
	TR_OBU_T_Traction_cut_off (proposal, not defined in SS-119)	Brake parameters: traction model. (value of time delay T_traction_cut_off as per [15] 3.13.2.2.2.1)	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.4.2	In SS-119 the value is determined based on "train type" or "train composition". The value determination of SS-119 should be described in detail (currently it is not provided) and finally documented in SS-026.
	TR_OBU_T_brake_emergency (proposal, not defined in SS-119)	Brake parameters: brake build up time model value for emergency brake. (T_brake_emergency as per [15] 3.13.2.2.3.2)	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.4.3.1	SS-119 defines alternative proposals to evaluate this value either based on "train type" and the status of the special brakes, or based on "brake position" and "train length".
	TR_OBU_T_brake_service (proposal, not defined in SS-119)	Brake parameters: brake build up time model value for service brake. (T_brake_service as per [15] 3.13.2.2.3.2)	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.4.3.1	SS-119 defines alternative proposals to evaluate this value either based on "train type" and the status of the special brakes, or based on "brake position" and "train length".
	TR_OBU_BrakePercentage	Brake parameters: brake percentage.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.4.4	
	TR_OBU_BrakePosition1	Brake parameters: brake position.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.4.5	
	TR_OBU_BrakePosition1_Not				
	TR_OBU_BrakePosition2				
	TR_OBU_BrakePosition2_Not				

Function ID	Variable	Description	Max. Cycle Time	SUBSET Ref.	Remarks
	-	Brake parameters: on-board correction factors. (as described in [15] 3.13.2.2.9)	-	SS-026 3.18.3.2 SS-119 5.5.3.4.1.3 5.5.3.4.1.4	According to SS-119 the values are pre-configured in the ETCS on-board and not exchanged through the interface. Alternative proposal is that the correction factor values could be determined based on "train type" and / or "train composition". This would have to be elaborated and described in detail, finally to be documented in SS-026.
	TR_OBU_NomRotMass (proposal, not defined in SS-119)	Brake parameters: nominal rotating mass.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.4.6	In SS-119 the value is determined based on "train type" or "train composition". The value determination of SS-119 should be described in detail (currently it is not provided) and finally documented in SS-026.
	TR_OBU_MaxTrainSpeed (proposal, not defined in SS-119)	Maximum train speed.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.5	In SS-119 the value is determined based on "train type" or combination of "train composition" and "tilting health status". The value determination of SS-119 should be described in detail (currently it is not provided) and finally be documented in SS-026.
	TR_OBU_LoadingGauge	Loading gauge.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.6	
	TR_OBU_AxleLoadCat	Axle load category.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.7	
	TR_OBU_SupportedTractionSys	Indication with a list of the supported available traction systems.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.8	Supported traction systems are indicated based on a pre-configured project specific list containing 31 combinations of NID_CTRACTION and M_VOLTAGE. List is pre-configured in ETCS on-board and TCMS.
	TR_OBU_AirTightFitted	Indication if train is fitted or not fitted with airtight system.	200 ms	SS-026 3.18.3.2 SS-119 5.5.3.9	
	-	List of National Systems available on-board that are connected to ETCS on-board as an STM.	-	SS-026 3.18.3.2 SS-119 5.5.3.1.3	This list is pre-configured in ETCS on-board and TCMS for the specific project.
	- (not applicable, see SS-119)	Axle number.	-	SS-026 3.18.3.2 SS-119 5.5.3.1.3	Value is purely static data that is pre-configured in the ETCS on-board.

Function ID	Variable	Description	Max. Cycle Time	SUBSET Ref.	Remarks
F-ETCS-In-03	TR_OBU_TrainComposition	Train composition.	200 ms	SS-119: 5.5.1.1.1 / 5.5.1.1.7	In SS-119 it is not described in detail how this variable shall be used to determine specific values. Finally, this should be documented in SS-026.
F-ETCS-In-04	TR_OBU_TiltingHealthStatus	Indication if tilting system is operational or not operational.	200 ms	SS-119: 5.5.1.1.1 / 5.5.1.1.8	
	TR_OBU_TiltingHealthStatus_Not	Antivalent.			
F-ETCS-In-05	TR_OBU_TrainType	Train type	200 ms	SS-119: 5.5.1.1.1 / 5.5.1.1.9	In SS-119 it is not described in detail how this variable shall be used to determine specific values. Finally, this should be documented in SS-026.
F-ETCS-In-06	TR_OBU_TypeTrainData_S1	Indication if the data entry designating the 'train type' is either fixed, flexible or switchable.	200 ms	SS-026: 3.18.3.2 SS-034: 2.6.1 SS-119: 5.5.2	
	TR_OBU_TypeTrainData_S2				
F-ETCS-In-07	TR_OBU_TrainSleepReq (proposal, different than SS-119)	Indication if sleeping mode is requested or not requested.	100 ms	SS-026: 4.4.6 / 4.6.3 SS-034: 2.2.1 SS-119: 5.1.1	
	TR_OBU_TrainSleepReq_Not (proposal, different than SS-119)	Antivalent.			
F-ETCS-In-08	TR_OBU_PassiveShunting	Indication if passive shunting mode is permitted or not permitted.	100 ms	SS-026: 4.4.20 / 4.6.3 SS-034: 2.2.2 SS-119: 5.1.2	
F-ETCS-In-09	TR_OBU_NLEnabled	Indication if non-leading mode is enabled or not enabled.	100 ms	SS-026: 4.4.15 / 4.6.3 SS-034: 2.2.3 SS-119: 5.1.3	
F-ETCS-In-10	TR_OBU_BrakePressure	Indication of the brake pressure.	100 ms	SS-026: 3.13.2.2.7 / A.3.10 SS-034: 2.3.2 SS-119: 5.2.2	The value indicates the pressure in the main brake pipe or in the brake cylinder.
F-ETCS-In-11	TR_OBU_Brake_Status	Indication of the status of the different special brakes showing if each of these brakes is active or not active.	100 ms	SS-026: 3.13 SS-034: 2.3.6 SS-119: 5.2.6	100% indicates full braking power available, 0% indicates that no braking power is available. Note: this variable is not defined in SS-119.
	TR_OBU_Brake_Performance (proposal, not defined in SS-119)	Indication of the available brake performance for each specific special brake, value given in percentage.	100 ms		

Function ID	Variable	Description	Max. Cycle Time	SUBSET Ref.	Remarks
F-ETCS-In-12	-	Indication of the status of the different additional brakes showing if each of these brakes is active or not active.	-	SS-026: 3.13 SS-034: 2.3.7 SS-119: 5.2.7	Currently not used as no brakes are known that would qualify for "additional brakes".
F-ETCS-In-13	TR_OBU_SetSpeedDisplay	Command if the set speed information shall be displayed or not displayed.	100 ms	SS-026: 4.7.2 SS-034: 2.5.5 SS-119: 5.4.5	
	TR_OBU_SetSpeedValue	Indication of the set speed value.	100 ms		
F-ETCS-In-14	TR_OBU_DirectionFW	Indication of the vehicle direction controller position with the four states: forward, neutral, backward and invalid.	100 ms	SS-026: 3.14.2 / 5.13.1.4 SS-034: 2.5.2 SS-119: 5.4.2 SS-035: 5.2.4.4	Indication is relative to the active cabin.
	TR_OBU_DirectionBW				
F-ETCS-In-15	TR_OBU_TrainIntegrity_S1	Indication of the train integrity with the four states: confirmed, lost, unknown and invalid.	100 ms ¹	SS-026: 3.6.5.2.1 SS-034: 2.5.3 SS-119: 5.4.3	
	TR_OBU_TrainIntegrity_S1_Not				
	TR_OBU_TrainIntegrity_S2				
	TR_OBU_TrainIntegrity_S2_Not				
F-ETCS-In-16	TR_OBU_NTClolated	Indication of the isolation status of the different installed national systems showing if each of these systems is isolated or not isolated.	100 ms	SS-034: 2.7 SS-119: 5.6 SS-035: 10.3.3.5 / 10.3.3.6 e) / 10.14.1.2	The indication can be provided for up to 16 national systems. The available NTCs is a list that is pre-configured in ETCS on-board and TCMS for the specific project.
F-ETCS-In-17	TR_OBU_Traction_Status	Indication if the train traction is off or on.	100 ms	SS-034: 2.5.4 SS-119: 5.4.4 SS-035: 5.2.4.4	The indication is used by some national systems.
F-ETCS-In-18	-	Feedback indication about emergency brake application.	-	SS-034: 2.3.3 SS-119: 5.2.3	Not used in the context of the FVA. Processed internally in the ETCS on-board.
F-ETCS-In-19	-	Indications of some sensor values.	-		The use has explicitly been excluded.
F-ETCS-In-20	-	Indication of text messages to be displayed on the DMI.	-		The use has explicitly been excluded.
F-ETCS-In-21	-	Indication of the mathematical braking curve model to be used by ETCS on-board.	-		The use has explicitly been excluded.
F-ETCS-In-22	-	Indication of the results from the brake test.	-		The use has explicitly been excluded.

¹ In SS-119 version 1.2.4 this value is defined with 200 ms. OCORA has the feeling that this is somehow inconsistent with other variables like 'direction controller position' or 'brake status', especially under ETCS Level 3 in case trackside track occupation/vacancy detection is no longer in operation (trackside Train Detection Devices are no longer used).

Function ID	Variable	Description	Max. Cycle Time	SUBSET Ref.	Remarks
F-ETCS-In-23	-	Indication of the reason for having applied the brake.	-		The use has explicitly been excluded.
F-ETCS-In-24	-	Indication of the value for some variables used by the TCMS.	-		The use has explicitly been excluded.
F-ETCS-In-25	TR_OBU_FVAStatus (proposal, not defined in SS-119)	Indication of the FVA status.	200 ms		The status values will be defined in a subsequent OCORA release. And the expected behaviour of ETCS on-board also documented, ideally for SS-026 enhancement.

5.2.2 ETCS on-board to FVA data

This chapter defines the signals related to each described function from chapter 4.1. More specifically it further defines the interface where the data source is the ETCS on-board application.

Function ID	Variable	Description	Max. Cycle Time or Trigger Event	SUBSET Ref.	Remarks
F-ETCS-Out-01	OBU_TR_EB3_Cmd	Command of the emergency brake to the train.	100 ms	SS-026: 3.13.10 / 3.14.1 / 4.4.14 / 4.4.4 / 4.4.5 / 4.4.13 / 5.11 SS-034: 2.3.3 SS-119: 5.2.3 SS-035: 5.2.5	Note: if the emergency brake is only commanded through hard-wired signals, then the FVA is not involved. This command is only sent if emergency brake through serial connection is configured in ETCS on-board.
F-ETCS-Out-02	OBU_TR_TCO_Cmd	Command of the traction cut-off to the train.	100 ms	SS-026: 3.13.2.2.8 / 5.20 SS-034: 2.4.9 SS-119: 5.3.11 SS-035: 5.2.4.3	
F-ETCS-Out-03	OBU_TR_ServiceBrake	Command of the service brake to the train.	100 ms	SS-026: 3.13.2.2.7 / 3.13.10 / 3.14.1 SS-034: 2.3.1 SS-119: 5.2.1 SS-035: 5.2.5	
F-ETCS-Out-04	-	Indication of the ETCS on-board isolation.	-	SS-026: 4.4.3.1.1 SS-034: 2.2.4 SS-119: 5.1.4	The use of serial connection has explicitly been excluded, only handled through hard-wired connection.

Function ID	Variable	Description	Max. Cycle Time or Trigger Event	SUBSET Ref.	Remarks
F-ETCS-Out-05	OBU_TR_CTS_D_Change	Indication of the remaining distance from the max safe front end of the train to the location of the change of traction system.	100 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.4.1 SS-119: 5.3.2	
	OBU_TR_CTS_NewId	Indication of the country identifier for the new traction system.	100 ms		
	OBU_TR_CTS_New_Voltage	Indication of the voltage of the new traction system.	100 ms		
F-ETCS-Out-06	OBU_TR_PG_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the powerless section with pantograph to be lowered.	200 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.4.2 SS-119: 5.3.3	
	OBU_TR_PG_D_Exit	Indication of the remaining distance from the min safe front end of the train to the end location of the powerless section with pantograph to be lowered.	200 ms		
F-ETCS-Out-07	OBU_TR_MPS_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the powerless section with main power switch to be switched off.	200 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.4.7 SS-119: 5.3.8	
	OBU_TR_MPS_D_Exit	Indication of the remaining distance from the min safe front end of the train to the end location of the powerless section with main power switch to be switched off.	200 ms		
F-ETCS-Out-08	OBU_TR_RBI_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the regenerative brake inhibition area.	200 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.3.4 SS-119: 5.2.4	
	OBU_TR_RBI_D_Exit	Indication of the remaining distance from the min safe rear end of the train to the end location of the regenerative brake inhibition area.	200 ms		
	OBU_TR_MGI_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the magnetic shoe brake inhibition area.	200 ms		

Function ID	Variable	Description	Max. Cycle Time or Trigger Event	SUBSET Ref.	Remarks
	OBU_TR_MGI_D_Exit	Indication of the remaining distance from the min safe rear end of the train to the end location of the magnetic shoe brake inhibition area.	200 ms		
	OBU_TR_ECS_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the inhibition area of the eddy current brake for service brake.	200 ms		
	OBU_TR_ECS_D_Exit	Indication of the remaining distance from the min safe rear end of the train to the end location of the inhibition area of the eddy current brake for service brake.	200 ms		
	OBU_TR_ECE_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the inhibition area of the eddy current brake for emergency brake.	200 ms		
	OBU_TR_ECE_D_Exit	Indication of the remaining distance from the min safe rear end of the train to the end location of the inhibition area of the eddy current brake for emergency brake.	200 ms		
F-ETCS-Out-09	OBU_TR_AT_D_Entry	Indication of the remaining distance from the max safe front end of the train to the start location of the air tightness area.	200 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.4.4 SS-119: 5.3.5	
	OBU_TR_AT_D_Exit	Indication of the remaining distance from the min safe rear end of the train to the end location of the air tightness area	200 ms		
F-ETCS-Out-10	OBU_TR_SP_D_Entry(k)	Indication of the remaining distance from the max safe front end of the train to the start location of the platform (k).	200 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.4.6 SS-119: 5.3.7	Platform information can be provided for up to 5 platforms.
	OBU_TR_SP_D_Exit(k)	Indication of the remaining distance from the min safe front end of the train to the end location of the platform (k).	200 ms		
	OBU_TR_SP_Height(k)	Indication of the height of the platform (k).	200 ms		
	OBU_TR_SP_Right(k)	Indication of the side the platform (k)	200 ms		

Function ID	Variable	Description	Max. Cycle Time or Trigger Event	SUBSET Ref.	Remarks
	OBU_TR_SP_Left(k)	is on.	200 ms		
F-ETCS-Out-11	OBU_TR_ACC_D_Change	Indication of the remaining distance from the max safe front end of the train to the location of change of the allowed current consumption.	100 ms	SS-026: 3.12.1 / 5.20 SS-034: 2.4.10 SS-119: 5.3.10	
	OBU_TR_ACC_Limit	Indication of the new current consumption limitation.	100 ms		
F-ETCS-Out-12	OBU_TR_PG_Cmd	Command from the national system for the pantograph to be lowered or raised.	100 ms	SS-035: 5.2.4.3 SS-034: 2.4.3 SS-119: 5.3.4	
F-ETCS-Out-13	OBU_TR_MPS_Cmd	Command from the national system for the main power switch to be switched off or not to be switched off.	100 ms	SS-035: 5.2.4.3 SS-034: 2.4.8 SS-119: 5.3.9	
F-ETCS-Out-14	OBU_TR_RBInhibit_Cmd	Command from the national system for the regenerative brake to be inhibited or not to be inhibited.	100 ms	SS-035: 5.2.4.3 SS-034: 2.3.5 SS-119: 5.2.5	
	OBU_TR_MGInhibit_Cmd	Command from the national system for the magnetic shoe brake to be inhibited or not to be inhibited.	100 ms		
	OBU_TR_ECSInhibit_Cmd	Command from the national system for the eddy current brake for service brake to be inhibited or not to be inhibited.	100 ms		
	OBU_TR_ECEInhibit_Cmd	Command from the national system for the eddy current brake for emergency brake to be inhibited or not to be inhibited.	100 ms		
F-ETCS-Out-15	OBU_TR_AT_Cmd	Command from the national system for the air conditioning intake to be opened or closed.	100 ms	SS-035: 5.2.4.3 SS-034: 2.4.5 SS-119: 5.3.6	
F-ETCS-Out-16	OBU_TR_Speed (proposal, not defined in SS-119)	Indication of the current speed.	200 ms		
	OBU_TR_Speed_ConfMax (proposal, not defined in SS-119)	Indication of the maximum speed based on the current speed confidence interval.	200 ms		
	OBU_TR_Speed_ConfMin (proposal, not defined in SS-119)	Indication of the minimum speed based on the current speed confidence interval.	200 ms		

Function ID	Variable	Description	Max. Cycle Time or Trigger Event	SUBSET Ref.	Remarks
	OBU_TR_Direction (proposal, not defined in SS-119)	Indication of the current travel direction relative to the active cabin.	200 ms		Distance counter information can be used by the vehicle to make specific distance evaluations, for instance for track conditions, but also for specific packet 44 content. The value wraps around when the maximum value is reached.
	OBU_TR_Dist_Counter (proposal, not defined in SS-119)	Indication of a continuously incremented distance counter based on the distance information used by the ETCS on-board.	200 ms		
F-ETCS-Out-17	OBU_TR_Grad_Iter (proposal, not defined in SS-119)	Indication of the number of iterations for the following gradient information.	200 ms		Indication for the number of iterations (k) that provide the gradient information. Each iteration (k) corresponds to a gradient leg.
	OBU_TR_D_Gradient(k) (proposal, not defined in SS-119)	For k = 1: Indication of the remaining distance from the max safe front end of the train to the start location of the gradient profile leg with 'k = 1'. For k > 1: Indication of the incremental distance to next change of gradient (k).	200 ms		The relative distance information transformation concept for 'k = 1', when the starting point of the specific gradient profile leg has not been passed yet, is similar to the concept applied for track conditions. Once the starting location for the leg 'k = 1' has been passed, the distance for the leg 'k = 1' gets the value 0. Once the starting location of track gradient profile leg for 'k = 1' has been passed the distance is continuously evaluated for the start of the next gradient profile leg 'k = 2'. Once the track gradient profile leg for 'k = 1' has elapsed the next gradient profile leg gets then 'k = 1'.
	OBU_TR_Q_GDir(k) (proposal, not defined in SS-119)	Indication of the gradient (k) slope describing if it is downhill or uphill.	200 ms		
	OBU_TR_G_A(k) (proposal, not defined in SS-119)	Indication of the absolute value of the engineered gradient (k).	200 ms		

Function ID	Variable	Description	Max. Cycle Time or Trigger Event	SUBSET Ref.	Remarks
F-ETCS-Out-18	OBU_TR_P44 (proposal, not defined in SS-119)	Indication of the packet 44 content from a balise telegram.	Whenever a packet 44 with specific NID_XUSER is received. Latency ² to not be longer than 500 ms.		Only Packets 44 according a pre-configured list of NID_XUSER shall be forwarded from ETCS on-board to FVA. The list is defined project specific.
F-ETCS-Out-19	OBU_TR_ETCS_Status (proposal, not defined in SS-119)	Indication of the status of the ETCS on-board system with the severity indication.	400 ms		Severity status values must be defined, for instance: initialization / auto-test / info / running OK / warning / error / critical. The highest severity is indicated.
	OBU_TR_Event_Code (proposal, not defined in SS-119)	Indication of the event code as additional information to the status.	400 ms		The interface would allow to provide a numerical error code. The code itself is specific for each ETCS on-board system. The error code causing the highest severity is indicated.
F-ETCS-Out-20	OBU_TR_Driver_ID (proposal, not defined in SS-119)	Indication of the driver ID.	400 ms		
F-ETCS-Out-21	OBU_TR_NID_Operational (proposal, not defined in SS-119)	Indication of the train running number.	400 ms		
F-ETCS-Out-22	OBU_TR_AD_Status (defined in SS-119 v. 1.2.4)	Indication if the ETCS on-board is in automatic driving mode or not in automatic driving mode.	100 ms	SS-119: 5.1.5	This variable has been introduced in SS-119 version 1.2.4.

5.3 Interface between FVA and 'ATO Vehicle' application

Describes the interface SCI-FVA. Restricted to ATO with GoA up to 2 (GoA 3 & 4 are excluded). Specification of the data exchange (variables and values) per system function / message / variable, to be analysed what is the best documentation solution. Also, variables that are excluded on purpose shall be documented here with the relevant rationale. This allows to understand in future why the interface was defined this way.

Description to include: general behaviour, the definition of the trigger to exchange data between FVA and ATO Vehicle application, timing behaviour, link to SUBSET-139, -143 and other SUBSETs if applicable, etc.

This chapter will be provided as part of a subsequent release of this documentation.

² Latency between the time the packet 44 is forwarded by the component reading the balise messages (in SUBSET-026 chapter 2 indicated as BTM) and the time the information is forwarded on the SCI-FVA to the FVA.

5.3.1 FVA to ATO vehicle data

Describes the interface where the data source is the FVA.

This chapter will be provided as part of a subsequent release of this documentation.

Function ID	Variable	Description	Data exchange rate	SUBSET Ref.	Remarks
F-ATO-In-01					
F-ATO-In-02					
F-ATO-In-03					
F-ATO-In-04					
F-ATO-In-05					
F-ATO-In-06					
F-ATO-In-07					
F-ATO-In-08					
F-ATO-In-09					
F-ATO-In-10					

5.3.2 ATO vehicle to FVA data

Describes the interface where the data source is the 'ATO vehicle'.

This chapter will be provided as part of a subsequent release of this documentation.

Function ID	Variable	Description	Data exchange rate	SUBSET Ref.	Remarks
F-ATO-Out-01					
F-ATO-Out-02					
F-ATO-Out-03					
F-ATO-Out-04					
F-ATO-Out-05					
F-ATO-Out-06					
F-ATO-Out-07					
F-ATO-Out-08					
F-ATO-Out-09					
F-ATO-Out-10					

6 Definition and description of variables

General definition of a variable in the context of this specification.

Description of each single variable used in the interface, including characteristics like length of variable, value range, special values, default value, resolution, criteria to set / reset Boolean values, etc.

This chapter will be provided as part of a subsequent release of this documentation.