

ERTMS/ATO

**ATO-OB / ETCS-OB FFFIS
Application Layer**

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1. MODIFICATION HISTORY

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2. TABLE OF CONTENTS

1. MODIFICATION HISTORY	2
2. TABLE OF CONTENTS.....	5
3. LIST OF TABLES.....	6
4. INTRODUCTION.....	7
4.1 Scope and purpose of the document.....	7
4.2 Reference documents	7
4.3 Abbreviations	8
4.4 Definitions	8
5. PRINCIPLES.....	9
5.1 Definition of the Variables	9
5.2 Definition of the Packets	9
6. PACKET DESCRIPTION	10
6.1 List of Packets.....	10
6.2 User Data.....	11
6.2.1 Packets: ATO-OB to ETCS-OB.....	11
6.2.2 Packets: ETCS-OB to ATO-OB.....	15

3. LIST OF TABLES

Table 1 Reference Documents.....	7
Table 2 Packet summary.....	10
Table 3 Packet Number 0: ATO_ETCS_Status	11
Table 4 Packet Number 1: ATO_ETCS_DMI.....	12
Table 5 Packet Number 2: ATO_ETCS_Data_Entry_Need	13
Table 6 Packet Number 3: ATO_ETCS_Data_Entry_Request	13
Table 7 Packet Number 4: ATO_ETCS_Data_View_Values	14
Table 8 Packet Number 5: ETCS_ATO_Static	16
Table 9 Packet Number 6: ETCS_ATO_Dynamic	22
Table 10 Packet Number 7: ETCS_ATO_Driver_Inputs	22
Table 11 Packet Number 8: ETCS_ATO_Data_Entry_Values.....	23
Table 12 Packet Number 9: ETCS_ATO_Data_Entry_Flag.....	24
Table 13 Packet Number 11: ETCS_ATO_BRAKE_DECELERATIONS.....	25

4. INTRODUCTION

4.1 Scope and purpose of the document

- 4.1.1.1 The purpose of this document is to define the Application Layer of the ATO-OB / ETCS-OB FFFIS to support ERTMS/ATO. The lower layers of communication details are specified in [Ref 10].
- 4.1.1.2 The scope of this document is the definition of the standardised set of data to transmit between the ATO-OB and the ETCS-OB to support ERTMS/ATO.
- 4.1.1.3 The requirements associated to this interface are included in [Ref 1] (ERTMS/ATO System Requirement Specification SUBSET-125) and [Ref 4] (System Requirement Specification SUBSET-026).

4.2 Reference documents

Ref. N°	Title	Reference
[Ref 1]	ERTMS/ATO System Requirements Specification	SUBSET-125
[Ref 2]	ATO-OB / ATO-TS FFFIS Application Layer	SUBSET-126
[Ref 3]	ERTMS/ATO Glossary	13E154
[Ref 4]	ERTMS/ETCS System Requirements Specification	SUBSET-026
[Ref 5]	FIS Juridical Recording	SUBSET-027
[Ref 6]	Dimensioning and Engineering rules	SUBSET-040
[Ref 7]	IEEE 802.3 Ethernet Standard	NA
[Ref 8]	FFFIS STM Application Layer	SUBSET-058
[Ref 9]	Glossary of Terms and Abbreviations	SUBSET-023
[Ref 10]	Interface Specification Communication Layers for On-board Communication	SUBSET-143

Table 1 Reference Documents

4.3 Abbreviations

4.3.1.1 For ATO related abbreviations see ERTMS/ATO Glossary [Ref 3].

4.3.1.2 For ETCS related abbreviations see SUBSET-023 [Ref 9].

4.4 Definitions

4.4.1.1 For ATO related definitions see ERTMS/ATO Glossary [Ref 3].

4.4.1.2 For ETCS related definitions see SUBSET-023 [Ref 9].

5. PRINCIPLES

5.1 Definition of the Variables

- 5.1.1.1 All variables defined within this document shall comply with [Ref 10].
- 5.1.1.2 The variables already defined in ETCS are used in this interface by using the same name and giving the corresponding reference in its description and resolution/formula.
- 5.1.1.3 In the case that the length of an ETCS variable is not aligned with any of the data types defined in [Ref 10] and is not part of a BITSET, the needed amount of "0" values will be added in the most significant bits of the variable, to align it with the data type defined in the corresponding column of the packet description table.

5.2 Definition of the Packets

- 5.2.1.1 The following chapters will describe the user data only. All details on the way how User Data are transformed to packets can be found in [Ref 10]. Packets are multiple variables grouped into a single unit, with a defined internal structure.

6. PACKET DESCRIPTION

6.1 List of Packets

Packet Number	Packet Name	Source	Sink	Transmitting cycle [ms]	Data Class [Ref 10]	Timeout [ms]
0	ATO_ETCS_Status	ATO	ETCS	100	Process Data	1000
1	ATO_ETCS_DMI	ATO	ETCS	100	Process Data	1000
2	ATO_ETCS_Data_Entry_Need	ATO	ETCS	NA	Message Data	-
3	ATO_ETCS_Data_Entry_Request	ATO	ETCS	NA	Message Data	-
4	ATO_ETCS_Data_View_Values	ATO	ETCS	NA	Message Data	-
5	ETCS_ATO_Static	ETCS	ATO	1000	Process Data	3000
6	ETCS_ATO_Dynamic	ETCS	ATO	200	Process Data	1000
7	ETCS_ATO_Driver_Inputs	ETCS	ATO	100..200	Process Data	1000
8	ETCS_ATO_Data_Entry_Values	ETCS	ATO	NA	Message Data	-
9	ETCS_ATO_Data_Entry_Flag	ETCS	ATO	NA	Message Data	-
10	ETCS_ATO_Data_View_Values_Request	ETCS	ATO	NA	Message Data	-
11	ETCS_ATO_BRAKE_DECELERATIONS	ETCS	ATO	200	Process Data	1000

Table 2 Packet summary

- 6.1.1.1 The packets for which no transmitting cycle is defined in Table 2 are sent event-based.
- 6.1.1.2 The packet numbers defined in Table 2 correspond to NID_PACKET definition given in [Ref 10]. This interface uses Slot 1 (see [Ref 10]).

6.2 User Data

6.2.1 Packets: ATO-OB to ETCS-OB

6.2.1.1 Packet Number 0: ATO_ETCS_Status

Packet Number		0			
Item	Variable Name		Description	Data Type	Resolution/Formula
	Bit	ATO_INFO_SET	ATO information BITSET	BITSET8	
1	0	Q_AD_MODE_REQUEST	Qualifier to request the ETCS AD Mode.		Values: 0 = AD Mode not requested 1 = AD Mode requested
2	1..7	Spare			

Table 3 Packet Number 0: ATO_ETCS_Status

6.2.1.2 Packet Number 1: ATO_ETCS_DMI

Packet Number		1			
Item	Variable Name		Description	Data Type	Resolution/Formula
	Bit	ATO_DMI_INFO	DMI Indicators BITSET	BITSET16	
1	0..2	M_ATOSTATUS	ATO status to be displayed.		Values: 0 = ATO Selected 1 = ATO ready for engagement 2 = ATO Engaged 3 = ATO Disengaging 4 = ATO Failure 5 - 7 = spare
2	3..4	Q_STOPACCURACY	Stopping accuracy information to be displayed.		Values: 0 = No stopping accuracy indication 1 = Accurate stop 2 = Undershoot 3 = Overshoot
3	5..6	Q_DWELLTIME_INFO	Dwell Time information to be displayed.		Values: 0 = No Dwell Time indication 1 = Remaining Dwell Time 2 = Train Hold 3 = Spare
4	7..9	Q_DOORINFO	Train door information to be displayed.		Values: 0 = No information 1 = Request driver to close doors 2 = Request driver to open doors on both sides 3 = Request driver to open right doors 4 = Request driver to open left doors 5 = Doors are open 6 = Doors are closed 7 = Doors are being closed by ATO
5	10..11	Q_SKIPSTP	Skip Stopping Point information to be displayed.		Values: 0 = No information 1 = Skip Stopping Point requested by the driver 2 = Skip Stopping Point requested by the ATO-TS 3 = Skip Stopping Point Inactive

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Packet Number		1			
Item	Variable Name		Description	Data Type	Resolution/Formula
6	12	Q_COASTING	Coasting indication to be displayed.		Values: 0 = No information 1 = Coasting advice
7	13	Q_WARNINGSOUND	Qualifier indicating if the ATO-OB is requesting the ETCS-OB to produce a warning sound.		Values: 0 = Warning sound not requested 1 = Warning sound requested
8	14..15	Spare			
9	T_DWELLTIME		Remaining Dwell Time to be displayed.	UINT16	Resolution: 1 s Special value: 65535 = no remaining Dwell Time indication
10	V_TAS		Target Advice Speed to be displayed.	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = No Target Advice Speed indication
11	D_NEXTADVICE		Distance to next advice change to be displayed.	UINT32	Resolution: 1 cm Special value: (2 ³² -1) = No information
12	T_NEXT_STP_ARRIVAL_TIME		Arrival time to the next Stopping Point or Stopping Points to be skipped to be displayed It is the number of seconds from the reference time 00:00:00 in local time.	UINT32	Resolution: 1 s Special value: 86400 ... interpreted by ECTS-OB (DMI) as "24:00:00" 86401 - (2 ³² -2) = spare (2 ³² -1) = No information
13	L_TEXT_STP		Length of text string in bytes for the name of the next Stopping Point or Stopping Points to be skipped.	UINT8	Special values: 0 = No information to display
(L_TEXT_STP) - times	14	X_TEXT_STP (k)	Name of the next Stopping Point or Stopping Points to be skipped to be displayed.	UINT8	See [Ref 8], Section §8.1.120.
15	N_STPDISTANCE_ITER		Number of "distance to the next Stopping Point or Stopping Point to be skipped" elements.	UINT8	Special values: 0 = No information to display
(N_STPDISTANCE_ITER) - times	16	D_STPDISTANCE (l)	Distance to the Stopping Point or Stopping Point to be skipped to be displayed.	UINT32	Resolution: 1 cm

Table 4 Packet Number 1: ATO_ETCS_DMI

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6.2.1.3 Packet Number 2: ATO_ETCS_Data_Entry_Need

Packet Number		2			
Item	Variable Name		Description	Data Type	Resolution/Formula
	Bit	ATO_Data_Entry_Need		BITSET8	
1	0	Q_ATO_DATAENTRY	Qualifier indicating if the ATO-OB needs Specific ATO Data or not.		Values: 0 = No Specific ATO Data needed. 1 = Specific ATO Data needed.
2	1..7	Spare			

Table 5 Packet Number 2: ATO_ETCS_Data_Entry_Need

6.2.1.4 Packet Number 3: ATO_ETCS_Data_Entry_Request

Packet Number		3			
Item	Variable Name		Description	Data Type	Resolution/Formula
1	N_DER_ITER		Number of Specific ATO Data requested.	UINT8	Special values: 0 = "End of Specific ATO Data Entry" 16 - 255 = spare
(N_DER_ITER) - times (L_CAPTURE(k)) - times (L_VALUE(k)) - times (N_DKV_ITER) - times (L_VALUE(k,n)) - times	2	NID_DATA_ATO (k)	Identifier of the Specific ATO Data.	UINT8	Numbers
	3	L_CAPTURE (k)	See [Ref 8] §8.1.8	UINT8	See [Ref 8] §8.1.8
	4	X_CAPTURE (k, l)	See [Ref 8] §8.1.119	UINT8	See [Ref 8] §8.1.119
	5	L_VALUE (k)	See [Ref 8] §8.1.12	UINT8	See [Ref 8] §8.1.12
	6	X_VALUE (k, m)	See [Ref 8] §8.1.121	UINT8	See [Ref 8] §8.1.121
	7	N_DKV_ITER (k)	Number of dedicated keyboard values.	UINT8	Special values: 0 = there is no dedicated keyboard
	8	L_VALUE (k, n)	See [Ref 8] §8.1.12	UINT8	See [Ref 8] §8.1.12
	9	X_VALUE (k, n, o)	See [Ref 8] §8.1.121	UINT8	See [Ref 8] §8.1.121

Table 6 Packet Number 3: ATO_ETCS_Data_Entry_Request

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6.2.1.5 Packet Number 4: ATO_ETCS_Data_View_Values

Packet Number		4			
Item	Variable Name	Description	Data Type	Resolution/Formula	
1	N_DVV_ITER	Number of Data View values.	UINT8	Special values: 0 = "No Specific ATO Data values" 16 - 255 = spare	
(N_DVV_ITER) - times (L_CAPTION (k)) - times (L_VALUE (k)) - times	2	NID_DATA_ATO (k)	Identifier of the Specific ATO Data.	UINT8	Numbers
	3	L_CAPTION (k)	See [Ref 8] §8.1.8	UINT8	See [Ref 8] §8.1.8
	4	X_CAPTION (k, l)	See [Ref 8] §8.1.119	UINT8	See [Ref 8] §8.1.119
	5	L_VALUE (k)	See [Ref 8] §8.1.12	UINT8	See [Ref 8] §8.1.12
	6	X_VALUE (k, m)	See [Ref 8] §8.1.121	UINT8	See [Ref 8] §8.1.121

Table 7 Packet Number 4: ATO_ETCS_Data_View_Values

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6.2.2 Packets: ETCS-OB to ATO-OB

6.2.2.1 Packet Number 5: ETCS_ATO_Static

Packet Number		5			
Item	Variable Name		Description	Data Type	Resolution/Formula
	Bit	ETCS_DATA	ETCS valid data qualifiers set	BITSET8	
1	0	Q_TRAIN_DATA_VALID	Qualifier indicating if the ETCS Train Data are valid.		Values: 0 = ETCS Train Data not valid 1 = ETCS Train Data valid
2	1	Q_OPERATIONAL_DATA_VALID	Qualifier indicating if the ETCS Operational Data (NID_OPERATIONAL and DRIVER_ID) are valid.		Values: 0 = ETCS Operational Data not valid 1 = ETCS Operational Data valid
3	2..7	Spare			
4	NID_ENGINE		See [Ref 4] §7.5.1.88	UINT32	See [Ref 4] §7.5.1.88
5	NID_ANTENNA		Identification of the antenna.	UINT8	Values: 0 = antenna 1 1 = antenna 2 2 = antenna 3 3 = antenna 4 Special Values: 4 .. 255
6	D_ANTENNA		Distance from antenna to the train front end.	UINT16	Resolution: 1 cm
7	N_ANTENNA_ITER		Number of additional antennas installed on-board	UINT8	Values: 0 .. 3 Special Values: 4 .. 255
N_ANTENNA_ITER - times	8	NID_ANTENNA(i)	Identification of the additional antenna	UINT8	Values: 0 = antenna 1 1 = antenna 2 2 = antenna 3 3 = antenna 4 Special Values: 4 .. 255
	9	D_ANTENNA(i)	Distance from additional antenna to the train front end.	UINT16	Resolution: 1 cm
10	L_TRAIN		[If Q_TRAIN_DATA_VALID = 1] See [Ref 4] §7.5.1.56	UINT16	See [Ref 4] §7.5.1.56
11	V_MAXTRAIN		[If Q_TRAIN_DATA_VALID = 1] See [Ref 4] §7.5.1.160	UINT8	See [Ref 4] §7.5.1.160
12	NC_CDTRAIN		[If Q_TRAIN_DATA_VALID = 1] See [Ref 4] §7.5.1.82.2	UINT8	See [Ref 4] §7.5.1.82.2
13	NC_TRAIN		[If Q_TRAIN_DATA_VALID = 1] See [Ref 4] §7.5.1.84	BITSET16	See [Ref 4] §7.5.1.84
14	M_AXLELOADCAT		[If Q_TRAIN_DATA_VALID = 1] See [Ref 4] §7.5.1.62	UINT8	See [Ref 4] §7.5.1.62
15	M_NOM_ROT_MASS		[If Q_TRAIN_DATA_VALID = 1] See [Ref 5] §4.2.4.2	UINT8	See [Ref 5] §4.2.4.2
16	M_BRAKE_PERCENTAGE_ATO		[If Q_TRAIN_DATA_VALID = 1] Brake percentage from ETCS Train Data.	UINT8	Resolution: 1 % Special Values: 251 - 254 = spare 255 = Not relevant for trains on which the braking models are captured as Train Data

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<i>Packet Number</i>		5		
Item	Variable Name	Description	Data Type	Resolution/Formula
17	M_BRAKE_POSITION_ATO	[If Q_TRAIN_DATA_VALID = 1] Brake position from ETCS Train Data.	UINT8	Values: 0 = Passenger train in P 1 = Freight train in P 2 = Freight train in G Special Values: 3 - 255 = spare
18	Q_INDEX_GAMMA_CONF	[If Q_TRAIN_DATA_VALID = 1] Qualifier indicating the set of full service braking models preconfigured in the ETCS-OB, which are currently applicable according to the capture of the ETCS Train Data.	UINT8	Special Values: 255 = Not relevant for trains on which the brake percentage is acquired as part of Train Data and the conversion model is applicable
19	NID_OPERATIONAL	[If Q_OPERATIONAL_DATA_VALID = 1] See [Ref 4] §7.5.1.92	BCD32	See [Ref 4] §7.5.1.92
20	DRIVER_ID	[If Q_OPERATIONAL_DATA_VALID = 1] See [Ref 5] §4.2.3.7 and [Ref 4] §A.3.11	STRING16	See [Ref 5] §4.2.3.7 See [Ref 4] §A.3.11

Table 8 Packet Number 5: ETCS_ATO_Static

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6.2.2.2 Packet Number 6: ETCS_ATO_Dynamic

Packet Number		6			
Item	Variable Name		Description	Data Type	Resolution/Formula
	Bit	ETCS_ATO_INFO_SET	ETCS Information BITSET	BITSET8	
1	0	M_ADHESION_DRIVER	Adhesion factor set by the driver.		Values: 0 = slippery rail is set by the driver 1 = slippery rail is not set by the driver
2	1	Q_APPCOND	Qualifier indicating if the ETCS applicable conditions for ATO Operational are fulfilled.		Values: 0 = ETCS applicable conditions for ATO Operational are not fulfilled 1 = ETCS applicable conditions for ATO Operational are fulfilled
3	2..3	Q_RC	Factor to indicate whether a movement in the direction of the train orientation corresponds to an increase or a decrease of the position counter.		Values: 0 = unknown (no train orientation) 1 = Increase (factor = 1) 2 = Decrease (factor = -1)
4	4..7	Spare			
Positioning Information					
	Bit	POSITION_REPORT_SET	Position Report BITSET	BITSET8	
5	0..1	Q_DIRSOLR	See [Ref 5] §4.2.3.5		See [Ref 5] §4.2.3.5
6	2..3	Q_DSOLR	See [Ref 5] §4.2.3.5		See [Ref 5] §4.2.3.5
7	4..7	Spare			
8	N_LOC_REF		Value of the position counter at the moment the data of the packet is determined.	INT32	Resolution: 1 cm Special value: ($2^{31}-1$) = spare Note: the "spare" value is used as a special value in other variables which depend on this counter (e.g. N_LOC_REFBALISE).
9	T_LOC_REF		Time at which the position counter is determined.	UINT32	Resolution: 1 ms Special value: ($2^{32}-1$) = unknown
10	N_LOC_REFBALISE		Value of the position counter at the center of balise used as location reference by the ETCS on-board, i.e. the reference balise of the ETCS SOLR or the balise duplicating this one, see [Ref 4] §3.16.2.3.3.	INT32	Resolution: 1 cm Special value: ($2^{31}-1$) = unknown
11	NID_ACTIVE_ANTENNA_SOLR		Identification of the antenna active when the reference balise of the ETCS SOLR was passed	UINT8	Values: 0 = antenna 1 1 = antenna 2 2 = antenna 3 3 = antenna 4 Special Values: 4 - 255 = spare

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Packet Number		6		
Item	Variable Name	Description	Data Type	Resolution/Formula
12	NID_REFBALISE	Identification of the balise used as location reference by the ETCS on-board, i.e. the reference balise of the ETCS SOLR or the balise duplicating this one, see [Ref 4] §3.16.2.3.3.	BITSET32	Values: Bit00 to bit02 = N_PIG as defined in [Ref 4] § 7.5.1.81 Bit03 to bit16 = NID_BG as defined in [Ref 4] § 7.5.1.85 Bit17 to bit26 = NID_C as defined in [Ref 4] § 7.5.1.86 Bit27 to bit31 = not relevant Special values: (2 ³² -1) = unknown
13	T_LOC_REFBALISE	Time at which the position counter was equal to N_LOC_REFBALISE.	UINT32	Resolution: 1 ms Special value: (2 ³² -1) = unknown
14	N_LOC_BALISERUNOVER1	Value of the position counter at the last balise passed.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = unknown
15	NID_ACTIVE_ANTENNA_BRO1	Identification of the antenna active when the last balise was passed	UINT8	Values: 0 = antenna 1 1 = antenna 2 2 = antenna 3 3 = antenna 4 Special Values: 4 - 255 = spare
16	NID_BALISERUNOVER1	Identification of the last balise passed.	BITSET32	Values: Bit00 to bit02 = N_PIG as defined in [Ref 4] § 7.5.1.81 Bit03 to bit16 = NID_BG as defined in [Ref 4] § 7.5.1.85 Bit17 to bit26 = NID_C as defined in [Ref 4] § 7.5.1.86 Bit27 to bit31 = not relevant Special values: (2 ³² -1) = unknown
17	T_LOC_BALISERUNOVER1	Time at which the position counter was equal to N_LOC_BALISERUNOVER1.	UINT32	Resolution: 1 ms Special value: (2 ³² -1) = unknown
18	N_LOC_BALISERUNOVER2	Value of the position counter at the balise passed before NID_BALISERUNOVER1.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = unknown
19	NID_ACTIVE_ANTENNA_BRO2	Identification of the antenna active when the last balise before NID_BALISERUNOVER1 was passed	UINT8	Values: 0 = antenna 1 1 = antenna 2 2 = antenna 3 3 = antenna 4 Special Values: 4 - 255 = spare
20	NID_BALISERUNOVER2	Identification of the balise passed before NID_BALISERUNOVER1.	BITSET32	Values: Bit00 to bit02 = N_PIG as defined in [Ref 4] § 7.5.1.81 Bit03 to bit16 = NID_BG as defined in [Ref 4] § 7.5.1.85 Bit17 to bit26 = NID_C as defined in [Ref 4] § 7.5.1.86 Bit27 to bit31 = not relevant Special values: (2 ³² -1) = unknown

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Packet Number		6			
Item	Variable Name	Description	Data Type	Resolution/Formula	
21	T_LOC_BALISERUNOVER2	Time at which the position counter was equal to N_LOC_BALISERUNOVER2.	UINT32	Resolution: 1 ms Special value: (2 ³² -1) = unknown	
22	L_UNCERTAINTY_OVERREADING	Over-reading amount of the confidence interval to the train position referred to the SOLR.	UINT32	Resolution: 1 cm Special values: (2 ³² -1) = unknown	
23	L_UNCERTAINTY_UNDERREADING	Under-reading amount of the confidence interval to the train position referred to the SOLR.	UINT32	Resolution: 1 cm Special values: (2 ³² -1) = unknown	
Supervision Information					
24	M_MODE	See [Ref 4] §7.5.1.72	UINT8	See [Ref 4] §7.5.1.72	
25	N_LOC_EBI	[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the closest Emergency Brake supervision limit for the current speed of the train.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = No EBI supervised by the ETCS-OB.	
26	A_GRADIENT	[If M_MODE is equal to FS, AD or OS] Applicable value of acceleration/deceleration due to the gradient from the maximum safe front end of the train.	INT16	Resolution: 1 mm/s ² Values: -2500 ... +2500 = Acceleration (negative, declining section) /Deceleration (positive, inclining section) due to gradient Special Values: -32768 ... -2501 = spare 2501 ... 32766 = spare 32767 = unknown	
27	N_GRAD_ITER	[If M_MODE is equal to FS, AD or OS] Number of gradient changes.	UINT8	Special values: 0 = no gradient information available 52 - 255 = spare	
(N_GRAD_ITER) - times	28	N_LOC_GRADCHANGE (k)	[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the A_GRADIENT change.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = not allowed
	29	A_GRADIENT (k)	[If M_MODE is equal to FS, AD or OS] Applicable value of acceleration/deceleration due to the gradient from the estimated value of the position counter at the A_GRADIENT change.	INT16	Resolution: 1 mm/s ² Values: -2500 ... +2500 = Acceleration (negative, declining section) /Deceleration (positive, inclining section) due to gradient Special values: -32768 ... -2501 = spare 2501 – 32766 = spare 32767 = close the gradient profile
30	A_MAXREDADH	[If M_MODE is equal to FS, AD or OS] Maximum deceleration due to reduced adhesion conditions from the maximum safe front end of the train.	UINT16	Resolution: 1 mm/s ² Special value: 65535 = no maximum deceleration	

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Packet Number		6			
Item	Variable Name	Description	Data Type	Resolution/Formula	
31	N_ADHE_ITER	[If M_MODE is equal to FS, AD or OS] Number of A_MAXREDADH changes.	UINT8	Special values: 0 = no reduced adhesion conditions announced 22 - 255 = spare	
(N_ADHE_ITER) - times	32	N_LOC_ADHCHANGE (l)	[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the A_MAXREDADH change.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = not allowed
	33	A_MAXREDADH (l)	[If M_MODE is equal to FS, AD or OS] Maximum deceleration due to reduced adhesion conditions from the estimated value of the position counter at the A_MAXREDADH change..	UINT16	Resolution: 1 mm/s ² Special value: 65534 = close the adhesion profile 65535 = no maximum deceleration
34	V_MRSP	[If M_MODE is equal to FS, AD or OS] Speed from the minimum safe front end of the train.	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = unknown	
35	N_MRSP_ITER	[If M_MODE is equal to FS, AD or OS] Number of MRSP iterations. See [Ref 4] §3.13.7.2	UINT8	Special values: 51 - 255 = spare	
(N_MRSP_ITER) - times	36	N_LOC_MRSP (p)	[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the MRSP change including train length compensation.	INT32	Resolution: 1 cm Special values: (2 ³¹ -1) = not allowed
	37	V_MRSP (p)	[If M_MODE is equal to FS, AD or OS] Speed from the estimated value of the position counter at the MRSP change.	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = Non numerical value telling that the MRSP ends at N_LOC_MRSP(n).
38	N_LOC_EOALOA	[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the EOA or LOA (including temporary EoAs) currently supervised by the ETCS-OB.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = no EOA nor LOA supervised by ETCS	
39	V_EOALOA	[If M_MODE is equal to FS, AD or OS] Permitted speed at the EOA or LOA currently supervised by the ETCS-OB	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = no EOA nor LOA supervised by ETCS	
40	N_LOC_SVL	[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the supervised location (SvL).	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = No SvL supervised by ETCS	
41	T_TRACTION	[If M_MODE is equal to FS, AD or OS] Time during which the traction effort is still present after the Emergency brake intervention. If conversion model is used, this variable is to be used only when braking to standstill. See [Ref 4] §3.13.9.3.2.2 a) but without the expected brake build up time reduction as per A.3.12 of [Ref 4].	UINT16	Resolution: 10 ms	

ERA * UNISIG * EEIG ERTMS USERS GROUP

Packet Number		6		
Item	Variable Name	Description	Data Type	Resolution/Formula
42	T_TRACTION_SPEED	[[If M_MODE is equal to FS, AD or OS] Time during which the traction effort is still present after the Emergency brake intervention when braking to a target speed > 0 km/h if conversion model is used. See [Ref 4] §3.13.9.3.2.2 a) but without the expected brake build up time reduction as per A.3.12 of [Ref 4].	UINT16	Resolution: 10 ms Special value: 65535 = Not relevant in case conversion model is not used
43	T_BE_REACT	[[If M_MODE is equal to FS, AD or OS] Safe brake reaction time during which the braking effort is not yet present after the Emergency brake intervention. It is the interval between the command of the brake by the on-board and the moment the brake force starts to build up. See [Ref 4] §3.13.6.2.2.3.	UINT16	Resolution: 10 ms
44	T_BEREM	[[If M_MODE is equal to FS, AD or OS] Remaining time during which the traction effort is not present until the full application of the braking effort is reached. If conversion model is used, this variable is to be used only when braking to standstill. See [Ref 4] §3.13.9.3.2.2 b) but without the safe brake build up reduction as per A.3.12 of [Ref 4].	UINT16	Resolution: 10 ms
45	T_BEREM_SPEED	[[If M_MODE is equal to FS, AD or OS] Remaining time during which the traction effort is not present until the full application of the braking effort is reached when braking to a target speed > 0 km/h if conversion model is used. See [Ref 4] §3.13.9.3.2.2 b) but without the safe brake build up reduction as per A.3.12 of [Ref 4].	UINT16	Resolution: 10 ms Special value: 65535 = Not relevant in case conversion model is not used
46	V_PERMITTED	[[If M_MODE is equal to FS, AD or OS] Permitted speed at the current location (P).	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = unknown
47	V_RELEASE_ATO	[[If M_MODE is equal to FS, AD or OS] Current release speed of the ETCS-OB.	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = no release speed available
48	N_LOC_RSM	[[If M_MODE is equal to FS, AD or OS] Estimated value of the position counter at the RSM start location.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = no release speed available
Speed and Acceleration Information				
49	V_EST	Current estimated train speed calculated by ETCS Odometry.	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = unknown
50	V_DELTA0	Compensation of the inaccuracy of the speed measurement. See [Ref 4] §3.13.9.3.2.10.	UINT16	Resolution: 1 cm/s Special values: 16668 - 65534 = spare 65535 = unknown

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Packet Number		6		
Item	Variable Name	Description	Data Type	Resolution/Formula
51	A_EST	Current estimated train acceleration calculated by ETCS-OB.	INT16	Resolution: 1 mm/s ² Values: -5000 ... +5000 = Deceleration (negative)/Acceleration (positive) Special Values: -32768 ... -5001 = spare 5001 ... 32766 = spare Special values: 32767 = unknown
Linking Information				
52	N_LINK_ITER	Number of next linked Balise Groups announced.	UINT8	Special values: 31 - 255 = spare (See [Ref 6] §4.3.2.1.1 i)).
N_LINK_ITER - times	53	N_LOC_LINKNBG (q)	Estimated value of the position counter at the linked Balise Group. The position is referenced to the balise with the N_PIG = 0.	INT32 Resolution: 1 cm Special values: (2 ³¹ -1) = spare
	54	NID_LINKNBG (q)	Identification of the linked Balise Group. N_PIG is always 0.	BITSET32 Values: Bit00 to bit02 = N_PIG as defined in [Ref 4] § 7.5.1.81 Bit03 to bit16 = NID_BG as defined in [Ref 4] § 7.5.1.85 Bit17 to bit26 = NID_C as defined in [Ref 4] § 7.5.1.86 Bit27 to bit31 = not relevant Special values: (2 ³² -1) = unknown

Table 9 Packet Number 6: ETCS_ATO_Dynamic

6.2.2.3 Packet Number 7: ETCS_ATO_Driver_Inputs

Packet Number		7		
Item	Variable Name	Description	Data Type	Resolution/Formula
1	N_ATOENGAGE_SELECTION	ATO Engage selection counter.	UINT8	
2	N_SKIPSTPREQ_SELECTION	Skip Stopping Point Request selection counter.	UINT8	
3	N_SKIPSTPREV_SELECTION	Skip Stopping Point Revocation selection counter.	UINT8	

Table 10 Packet Number 7: ETCS_ATO_Driver_Inputs

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6.2.2.4 Packet Number 8: ETCS_ATO_Data_Entry_Values

Packet Number		8			
Item	Variable Name	Description	Data Type	Resolution/Formula	
1	N_DEV_ITER	Number of data entry values.	UINT8	Special values: 16 - 255 = spare	
(N_DEV_ITER) - times (L_VALUE (k)) - times	2	NID_DATA_ATO (k)	One value of this variable represents a Specific ATO Data required by the ATO-OB.	UINT8	Numbers
	3	L_VALUE (k)	See [Ref 8] §8.1.12	UINT8	See [Ref 8] §8.1.12
	4	X_VALUE (k, l)	See [Ref 8] §8.1.121	UINT8	See [Ref 8] §8.1.121

Table 11 Packet Number 8: ETCS_ATO_Data_Entry_Values

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6.2.2.5 Packet Number 9: ETCS_ATO_Data_Entry_Flag

Packet Number		9			
Item	Variable Name		Description	Data Type	Resolution/Formula
	Bit	ATO_DATA_ENTRY_FLAG		BITSET8	
1	0	M_ATO_DATAENTRYFLAG	Indicate the beginning or the end of the Specific ATO Data Entry procedure.		Values: 0 = Stop 1 = Start
2	1..7	Spare			

Table 12 Packet Number 9: ETCS_ATO_Data_Entry_Flag

6.2.2.6 Packet Number 10: ETCS_ATO_Data_View_Values_Request

6.2.2.6.1 This packet does not contain user data.

6.2.2.7 Packet Number 11: ETCS_ATO_BRAKE_DECELERATIONS

Packet Number		11			
Item	Variable Name		Description	Data Type	Resolution/Formula
1	N_LOC_REF		Value of the position counter at the moment the data of the packet is determined.	INT32	Resolution: 1 cm Special value: (2 ³¹ -1) = spare Note: the "spare" value is used as a special value in other variables which depend on this counter (e.g. N_LOC_REFBALISE).
2	T_LOC_REF		Time at which the position counter of this packet is determined.	UINT32	Resolution: 1 ms Special value: (2 ³² -1) = unknown
3	A_BRAKE_SAFE		A_BRAKE_SAFE value applicable from zero speed, related to the brake model applicable from the maximum safe front end of the train	UINT16	Resolution: 1 mm/s ² Special value: 65535 = unknown
4	N_BRAKE_SAFE_ITER		Number of A_BRAKE_SAFE changes related to the brake model applicable from the maximum safe front end of the train.	UINT8	Special values: 0 = no A_BRAKE_SAFE changes available 10 - 255 = spare
N_BRAKE_SAFE_ITER - times	5	V_CHANGE_BRAKE (m)	Value of the speed from which (and excluding) the value of A_BRAKE_SAFE (m) is applicable.	UINT16	Resolution: 1 cm/s Special values: 16668 – 65535 = spare
	6	A_BRAKE_SAFE (m)	Applicable value of A_BRAKE_SAFE.	UINT16	Resolution: 1 mm/s ²

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Packet Number		11		
Item	Variable Name	Description	Data Type	Resolution/Formula
7	N_SEBDM_ITER	Number of location changes of safe emergency brake deceleration models (e.g. inhibition of special brakes).	UINT8	Special values: 0 = no changes in brake model 41 - 255 = spare
(N_SEBDM_ITER) - times (N_BRAKE_SAFE_ITER) - times	8	N_LOC_SEBDM_CHANGE (n)	Estimated value of the position counter from which the safe emergency brake deceleration model is applicable.	INT32 Resolution: 1 cm Special value: ($2^{31}-1$) = not allowed
	9	A_BRAKE_SAFE (n)	A_BRAKE_SAFE value applicable from zero speed, related to the brake model applicable from N_LOC_SEBDM_CHANGE (n)	UINT16 Resolution: 1 mm/s ²
	10	N_BRAKE_SAFE_ITER (n)	Number of A_BRAKE_SAFE changes for the brake model applicable from N_LOC_SEBDM_CHANGE (n).	UINT8 Special values: 0 = no A_BRAKE_SAFE changes available 10 - 255 = spare
	11	V_CHANGE_BRAKE (n, o)	Value of the speed from which (and excluding) the value of A_BRAKE_SAFE (n,o) is applicable.	UINT16 Resolution: 1 cm/s Special values: 16668 – 65535 = spare
	12	A_BRAKE_SAFE (n, o)	Applicable value of A_BRAKE_SAFE.	UINT16 Resolution: 1 mm/s ²

Table 13 Packet Number 11: ETCS_ATO_BRAKE_DECELERATIONS