

IP FA2 Cluster: Enabling Digital Technologies

Track Train Communication Sessions FFFIS Application Layer for I-DRTA-DROB

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Reviewed: Y

Document status		
Revision	Date	Description
01	13/10/24	First draft for Annex 2 to D27.3
02	22/01/2026	Clean version after implementing JU comments

Project funded from the European Union's Horizon Europe research and innovation programme		
Dissemination Level		
PU	Public	x
CO	Confidential, restricted under conditions set out in Model Grant Agreement	

Start date: 01/12/2022

Duration: 42 months

ACKNOWLEDGEMENTS



Union.

This project has received funding from the Europe's Rail Joint Undertaking (ERJU) under the Grant Agreement no. 101102001. The JU receives support from the European Union's Horizon Europe research and innovation programme and the Europe's Rail JU members other than the

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1 INTRODUCTION

1.1 SCOPE AND PURPOSE OF THE DOCUMENT

1.1.1.1 The purpose of this document is to present the interoperable interface between the two subsystems of the Digital Register Transactor and the Digital Register On-Board.

1.1.1.2 The Communication session requirements are defined in [1].

1.2 REFERENCE AND APPLICABLE DOCUMENTS

1.2.1.1 This section presents the reference and applicable documents.

Ref. N°	Title	Reference
[1].	Track to Train Communication Session Management Principles	R2DATO-TTC
[2].	ERTMS/ETCS System Requirements Specification	SUBSET-026

Table 1: List of references

2 DETAILED DESCRIPTION OF THE I-DRTA-DROB APPLICATION LAYER

2.1 LIST OF TRACK-TRAIN PACKETS

2.1.1.1 This section details the application level of the Track/Train interfaces.

Packet Number (NID_PACKET_TT)	Packet Name	Source	Sink
1	Digital Register Handshake Request	DR-OB	DR-TA
2	Digital Register Handshake Acknowledgement	DR-TA	DR-OB
3	Digital Register Handshake Reject	DR-TA	DR-OB
4	Map Area Request	DR-OB	DR-TA
5	Map Area	DR-TA	DR-OB
6	Segment Profile Request	DR-OB	DR-TA
7	Segment Profile	DR-TA	DR-OB
8	Digital Register Session Termination Request	DR-OB	DR-TA
9	Digital Register Session Termination	DR-TA	DR-OB

Table 2 Packet summary

2.2 TRACK-TRAIN HEADER PACKET

2.2.1.1 This section details the Track-Train header of a packet exchanged between the DR-OB and the Digital Register Transactor / Train Data Transactor.

2.2.1.2 The information in the header allows each packet to be uniquely identified.

2.2.1.3 Track-Train Header composition:

<i>Track-Train Header</i>				
Item	Variable Name	Description	Length	Resolution/Formula
001	NID_PACKET_TT	Packet number, used in the header for each packet, allowing the receiving equipment to identify the data which follows.	8 bits	Numbers Special Values: 19 - 255 = spare
002	NID_ENGINE	ETCS Identity, see [Ref 2], Section 7.5.1.88.	24 bits	See [Ref 2], Section 7.5.1.88.
003	T_Timestamp_Date	Date of timestamp of the packet.	15 bits	Date of a timestamp in UTC. The variable represents the number of days from the 1st January 2010. Values from 0 (01/01/2010) to 32767 (18/09/2099)
004	T_Timestamp_Seconds	Seconds of timestamp of the packet in UTC.	17 bits	Seconds of a timestamp in UTC. The variable represents the number of seconds from the beginning of the day. Values from 0 (00:00:00) to 86399 (23:59:59)
005	N_Packet_Counter	Packet counter sent from the sending subsystem. This value is a circulating counter. In case of an overflow the value might jump from the maximum value to the minimum value. The value is maintained by the sender for each NID_PACKET_TT separately during the entire session.	8 bits	Binary to numeric

2.3 DIGITAL REGISTER TRANSACTOR AND DIGITAL REGISTER ONBOARD FFFIS

2.3.1 Digital Register Handshake Request Packet (DR_HSReq)

2.3.1.1 This section details the structure of a DR_HSReq Packet sent by DR-OB to DR-TA.

2.3.1.2 Digital Register Handshake Request Packet composition:

Packet Number		1			
Item	Variable Name	Description	Length	Resolution/Formula	
001	Track-Train Header	see chapter 8.3		-	
Digital Register Handshake Request Details					
002	N_ITER	Number of iterations of DR-OB supported versions.	5 bits	See [Ref 2], Section 7.5.1.80	

Packet Number		1			
Item	Variable Name		Description	Length	Resolution/Formula
003		M_TT_Version (k)	Track Train Communication system version supported.	16 bits	1st byte for the major Version 2nd byte for the minor Version Applicable values: 0x0100 = TT version 1.0 0x0101 = TT version 1.1
004	Q_Absolute_Train_Position		Qualifier to indicate the availability of the absolute train position data.	1 bit	0 = No Absolute Train Position data 1 = Absolute Train Position data available
005	N_Latitude		If [Q_ABSOLUTE_TRAIN_POSITION == Absolute Train Position data available] Latitude value in degrees for the position of the geometry point (as per ETRS89 standard).	32 bits	Binary to numeric (in degrees) with a resolution of 10 ⁻⁷ . For example, the value 50.1234567° will be represented as 501234567.
006	N_Longitude		If [Q_ABSOLUTE_TRAIN_POSITION == Absolute Train Position data available] Longitude value in degrees for the position of the geometry point (as per ETRS89 standard).	32 bits	Binary to numeric (in degrees) with a resolution of 10 ⁻⁷ . For example, the value 50.1234567° will be represented as 501234567.
007	N_Altitude		If [Q_ABSOLUTE_TRAIN_POSITION == Absolute Train Position data available] Altitude value in centimetres for the position of the geometry point (as per ETRS89 standard).	20 bits	Binary to numeric (in centimetres)
008	Q_Relative_Train_Position		Qualifier to indicate the availability of the relative train position data.	1 bit	0 = No Relative Train Position data 1 = Relative Train Position data available
009	NID_C		If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
010	NID_SP		If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] SP identity.	32 bits	Binary to numeric
011	M_SP_Version		If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] Identifier of the segment profile version.	16 bits	1 byte for the major version and 1 byte for the minor one.
012	D_SP_Position		If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] Position of the estimated front end of the train at the moment the Map Area Request is sent (relatively from the beginning of the given SP).	24 bits	Binary to numeric (in centimetres)
013	Q_DR_TA_Handling_Over		This attribute allows the DR-TA to know if the handshake request is due to a handing over DR-TA.	1 bit	0 = No handing over 1 = Handing over

Table 3 Digital Register Handshake Request Packet structure

2.3.2 Digital Register Handshake Acknowledgement Packet (DR_HSAck)

2.3.2.1 This section details the structure of the DR_HSAck Packet sent by DR-TA to DR-OB.

2.3.2.2 Digital Register Handshake Acknowledgement Packet composition:

Packet Number		2			
Item	Variable Name	Description	Length	Resolution/Formula	
001	Track-Train Header	see chapter 8.3		-	
Digital Register Handshake Acknowledgement Details					
002	NID_C	Identity of the DR-TA's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.	
003	NID_DR_TA	Identifier of the Digital Register Transactor.	14 bits	Binary to numeric	
004	M_TT_Version	Track Train Communication system version to be used.	16 bits	1st byte for the major Version 2nd byte for the minor Version Applicable values: 0x0100 = TT version 1.0 0x0101 = TT version 1.1	
005	T_Timeout_DR_TA_Response	Maximum time after which the DR-OB must consider that a request has not been answered.	8 bits	Binary to numeric (in seconds)	

Table 4 Digital Register Handshake Acknowledgement Packet structure

2.3.3 Digital Register Handshake Reject Packet (DR_HSRej)

2.3.3.1 This section details the structure of the DR_HSRej Packet sent by DR-TA to DR-OB.

2.3.3.2 Digital Register Handshake Reject Packet composition:

Packet Number		3			
Item	Variable Name	Description	Length	Resolution/Formula	
001	Track-Train Header	see chapter 8.3		-	
Digital Register Handshake Reject Details					
002	Q_Reject_Reason	Qualifier indicating the reason for the rejection.	2 bits	0 = TT system version incompatible 1 = Another DR_TA in charge 2 = DR_TA in charge unknown 3 = Spare	
DR_TA Contact Information - If [Q_Reject_Reason == Another DR_TA in charge]					
003	NID_C	If [Q_Reject_Reason == Another DR_TA in charge] Identity of the DR_TA's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.	
004	NID_DR_TA	If [Q_Reject_Reason == Another DR_TA in charge] Identifier of the DR_TA.	14 bits	Binary to numeric	

Table 5 Digital Register Handshake Reject Packet structure

2.3.4 Map Area Request Packet (MAPAReq)

2.3.4.1 This section details the structure of the MAPAReq Packet sent by DR-OB to DR_TA.

2.3.4.2 Map Area Request Packet composition:

Packet Number		4			
Item	Variable Name	Description	Length	Resolution/Formula	
001	Track-Train Header	see chapter 8.3		-	
Map Area Request					
002	N_Map_Area_Radius	Value of the radius covering the requested map area.	8 bits	Binary to numeric (in meters) with a resolution of 10m. [0..256] x10m <=> [0..2560]m	
003	Q_Absolute_Train_Position	Qualifier to indicate the availability of the absolute train position data.	1 bit	0 = No Absolute Train Position data 1 = Absolute Train Position data available	
004	N_Latitude	If [Q_ABSOLUTE_TRAIN_POSITION == Absolute Train Position data available] Latitude value in degrees for the position of the geometry point (as per ETRS89 standard).	32 bits	Binary to numeric (in degrees) with a resolution of 10^-7. For example, the value 50.1234567° will be represented as 501234567.	
005	N_Longitude	If [Q_ABSOLUTE_TRAIN_POSITION == Absolute Train Position data available] Longitude value in degrees for the position of the geometry point (as per ETRS89 standard).	32 bits	Binary to numeric (in degrees) with a resolution of 10^-7. For example, the value 50.1234567° will be represented as 501234567.	
006	N_Altitude	If [Q_ABSOLUTE_TRAIN_POSITION == Absolute Train Position data available] Altitude value in centimetres for the position of the geometry point (as per ETRS89 standard).	20 bits	Binary to numeric (in centimetres)	
007	Q_Relative_Train_Position	Qualifier to indicate the availability of the relative train position data.	1 bit	0 = No Relative Train Position data 1 = Relative Train Position data available	
008	NID_C	If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.	
009	NID_SP	If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] SP identity.	32 bits	Binary to numeric	
010	M_SP_Version	If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] Identifier of the segment profile version.	16 bits	1 byte for the major version and 1 byte for the minor one.	
011	D_SP_Position	If [Q_RELATIVE_TRAIN_POSITION == Relative Train Position data available] Position of the estimated front end of the train at the moment the Map Area Request is sent (relatively from the beginning of the given SP).	24 bits	Binary to numeric (in centimetres)	

Table 6 Map Area Request Packet structure

2.3.5 Map Area Packet (MAPArea)

2.3.5.1 This section details the structure of the MAPArea Packet sent by DR-TA to DR-OB.

2.3.5.2 Map Area Packet composition:

Packet Number		5			
Item	Variable Name		Description	Length	Resolution/Formula
001	Track-Train Header		see chapter 8.3		-
Map Area					
002	Q_Map_Area_Status		Status of the Map Area: 'Valid': Map Area containing the data requested. 'Update': specifies that the Map Area has been updated within the current visibility of the DR-OB.	3 bits	0 = Valid 1 = Update [2-7] = Spare
003	N_ITER (k)		Number of iterations of Segment Profiles. If N_ITER is 0 then no data set is following.	24 bits	Binary to numeric (in centimetres)
004	NID_C (k)		Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
005	NID_SP (k)		SP identity.	32 bits	Binary to numeric
006	M_SP_Version (k)		Identifier of the segment profile version. See section Segment Profile Packet (SP).	16 bits	1 byte for the major version and 1 byte for the minor one.

Table 7 Map Area Packet extension structure

2.3.6 Segment Profile Request Packet (SPReq)

2.3.6.1 The details of the Segment Profile Request packet are defined in section 7.3.8.

2.3.6.2 DR-OB sends the Segment Profile Request packet to DR-TA, which differs from the GoA2 architecture, where ATO-OB was responsible for sending this packet to ATO-TS.

2.3.6.3 Segment Profile Request Packet composition:

Packet Number		6			
Item	Variable Name		Description	Length	Resolution/Formula
001	ATO Header		see chapter 7.2		-
Segment Profile Request Details					
002	N_ITER		Number of iterations of SPs requested. The minimum value for the variable in this packet is 1.	5 bits	See [Ref 2], Section 7.5.1.80
003	NID_C (k)		Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
004	NID_SP (k)		Identity of the requested Segment Profile.	32 bits	Binary to numeric

Table 8: Segment Profile request structure

2.3.7 Segment Profile (SP)

2.3.7.1 This section details the structure of the extension of GoA2 Segment Profile Packet

2.3.7.2 The Segment Profile packet is built up of the based GoA2 Segment Profile Packet and additional attributes required for GoA3/4 and localisation needs.

2.3.7.3 GoA2 Segment Profile Packet composition

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
001	ATO Header		see chapter 7.2		-
Segment Profile Status					
002	N_ITER		Number of iterations of SPs in the packet.	5 bits	See [Ref 2], Section 7.5.1.80
003		NID_C (k)	Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
004		NID_SP (k)	SP identity.	32 bits	Binary to numeric
005		Q_SP_Status (k)	Status of the Segment Profile: "Valid": SP requested. "Invalid": SP not found in ATO-TS database.	1 bits	0 = Invalid 1 = Valid
Segment Profile Details - If [Q_SP_Status <> Invalid]					
006		M_SP_Version (k)	If [Q_SP_Status <> Invalid] Identifier of the segment profile version.	16 bits	1 byte for the major version and 1 byte for the minor one.
007		L_SP (k)	If [Q_SP_Status <> Invalid] Length of the segment of railway covered by the SP.	24 bits	Binary to numeric (in centimetres) Minimum Value: 1
008		D_EoA_Offset (k)	If [Q_SP_Status <> Invalid] Distance to stop the train in rear of the EoA.	24 bits	Binary to numeric (in centimetres)
009		Q_UTC_Offset (k)	If [Q_SP_Status <> Invalid] Offset to add to the UTC time in order to calculate the local time.	7 bits	Binary to numeric Unsigned value Resolution: 15 min 0 = UTC - 14:00 56 = UTC ± 0 112 = UTC + 14:00 113 - 127 = Spare
010		M_SP_Altitude (k)	If [Q_SP_Status <> Invalid] Altitude at the beginning of the SP. Considering ETRS89 as reference. Note: ETRS89 is the EU -recommended frame of reference for geodata for Europe	20 bits	Binary to numeric (in centimetres) starting at -1000m
011		Q_ATOTS_Contact_Info_Dir (k)	If [Q_SP_Status <> Invalid] Qualifier indicating whether contact information of another ATO-TS valid for nominal travelling direction of the SP, valid for reverse travelling direction of the SP or no contact information follows.	2 bits	0 = No Contact info follows 1 = ATO-TS contact info for nominal direction follows 2 = ATO-TS contact info for reverse direction follows 3 = Spare
ATO-TS Contact Information - If [Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for nominal direction follows or Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for reverse direction follows]					

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
012		NID_C (k)	If [Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for nominal direction follows or Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for reverse direction follows] Identity of the ATO-TS's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
013		NID_ATOTS (k)	If [Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for nominal direction follows or Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for reverse direction follows] Identifier of the adjacent ATO-TS. The value of this variable is assigned to be unique, see clause 6.2.1.10	14 bits	Binary to numeric
014		NID_C (k)	If [Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for nominal direction follows or Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for reverse direction follows] Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
015		NID_SP (k)	If [Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for nominal direction follows or Q_ATOTS_Contact_Info_Dir == ATO-TS contact info for reverse direction follows] SP identity of the first segment in the adjacent ATO-TS area.	32 bits	Binary to numeric
Static Speed Profile Start					
016		V_STATIC (k)	Basic Static Speed Profile speed at the beginning of the Segment Profile. The variable used is comparable to V_STATIC, as defined in [Ref 2], Section 7.5.1.171.	7 bits	[0..120] x 5 km/h <=> [0..600] km/h; [121-127] = Spare
017		Q_FRONT (k)	see [Ref 2], Section 7.5.1.109 This is applicable only for step up.	1 bits	see [Ref 2], Section 7.5.1.109
Specific SSP					
018		N_ITER (k)	Number of iterations of Specific Static Speed Profiles. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
019		Q_DIFF (k,l)	See [Ref 2], Section 7.5.1.102.1.	2 bits	See [Ref 2], Section 7.5.1.102.1.
Cant Deficiency - If [Q_DIFF == Cant Deficiency specific category]					
020		NC_CDDIFF (k,l)	If [Q_DIFF == Cant Deficiency specific category] See [Ref 2], Section 7.5.1.82.1	4 bits	See [Ref 2], Section 7.5.1.82.1
Other Specific SSP - If [Q_DIFF == Other specific category, replaces the Cant Deficiency SSP or Q_DIFF == Other specific category, does not replace the Cant Deficiency SSP]					
021		NC_DIFF (k,l)	If [Q_DIFF == Other specific category, replaces the Cant Deficiency SSP or Q_DIFF == Other specific category, does not replace the Cant Deficiency SSP] See [Ref 2], Section 7.5.1.83.	4 bits	See [Ref 2], Section 7.5.1.83.
022		V_DIFF (k,l)	See [Ref 2], Section 7.5.1.156	7 bits	See [Ref 2], Section 7.5.1.156
Static Speed Profile Change					

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
023		N_ITER (k)	Number of iterations of Static Speed Profiles changes. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
024		D_Location (k,l)	Location of the Static Speed Profile change relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
025		V_STATIC (k,l)	Basic Static Speed Profile speed. The variable used is comparable to V_STATIC, as defined in [Ref 2], Section 7.5.1.171.	7 bits	[0..120] x 5 km/h <=> [0..600] km/h; [121-127] = Spare
026		Q_FRONT (k,l)	See [Ref 2], Section 7.5.1.109 This is applicable only for step up.	1 bits	see [Ref 2], Section 7.5.1.109
Specific SSP Change					
027		N_ITER (k,l)	Number of iterations of Specific Static Speed Profiles. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
028		Q_DIFF (k,l,m)	See [Ref 2], Section 7.5.1.102.1.	2 bits	See [Ref 2], Section 7.5.1.102.1.
Cant Deficiency Change - If [Q_DIFF == Cant Deficiency specific category]					
029		NC_CDDIFF (k,l,m)	If [Q_DIFF == Cant Deficiency specific category] See [Ref 2], Section 7.5.1.82.1	4 bits	See [Ref 2], Section 7.5.1.82.1
Other Specific SSP Change - If [Q_DIFF == Other specific category, replaces the Cant Deficiency SSP or Q_DIFF == Other specific category, does not replace the Cant Deficiency SSP]					
030		NC_DIFF (k,l,m)	If [Q_DIFF == Other specific category, replaces the Cant Deficiency SSP or Q_DIFF == Other specific category, does not replace the Cant Deficiency SSP] See [Ref 2], Section 7.5.1.83.	4 bits	See [Ref 2], Section 7.5.1.83.
031		V_DIFF (k,l,m)	See [Ref 2], Section 7.5.1.156	7 bits	See [Ref 2], Section 7.5.1.156
Gradient Start					
032		G_New_Gradient (k)	Value of the new gradient at the beginning of the Segment Profile. The variable used is comparable to G_A, as defined in [Ref 2], Section 7.4.2.6.	10 bits	Binary to numeric (0-1023) with resolution 0.1‰
033		Q_GDIR (k)	see [Ref 2], Section 7.5.1.110	1 bits	see [Ref 2], Section 7.5.1.110
Gradients Change					
034		N_ITER (k)	Number of iterations of gradient changes. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
035		D_Location (k,l)	Location of the gradient change relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
036		G_New_Gradient (k,l)	Value of the new gradient. The variable used is comparable to G_A, as defined in [Ref 2], Section 7.4.2.6.	10 bits	Binary to numeric (0-1023) with resolution 0.1‰
037		Q_GDIR (k,l)	see [Ref 2], Section 7.5.1.110	1 bits	see [Ref 2], Section 7.5.1.110
Curve Start					

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
038		Q_Radius_Category (k)	Curve category at the beginning of the Segment Profile.	5 bits	0 = R>7000m 1 = 7000m≥R>4500m 2 = 4500m≥R>2800m 3 = 2800m≥R>2000m 4 = 2000m≥R>1500m 5 = 1500m≥R>1250m 6 = 1250m≥R>1075m 7 = 1075m≥R>925m 8 = 925m≥R>825m 9 = 825m≥R>725m 10 = 725m≥R>625m 11 = 625m≥R>525m 12 = 525m≥R>475m 13 = 475m≥R>425m 14 = 425m≥R>375m 15 = 375m≥R>325m 16 = 325m≥R>300m 17 = 300m≥R>275m 18 = 275m≥R>250m 19 = 250m≥R>225m 20 = 225m≥R>200m 21 = 200m≥R>175m 22 = 175≥R>150m 23 = = R≤150m [24-31] = Spare
Curves Change					
039		N_ITER (k)	Number of iterations of curve changes. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
040		D_Location (k,l)	Location of the curve change relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
041		Q_Radius_Catego ry (k,l)	Curve category.	5 bits	0 = R>7000m 1 = 7000m≥R>4500m 2 = 4500m≥R>2800m 3 = 2800m≥R>2000m 4 = 2000m≥R>1500m 5 = 1500m≥R>1250m 6 = 1250m≥R>1075m 7 = 1075m≥R>925m 8 = 925m≥R>825m 9 = 825m≥R>725m 10 = 725m≥R>625m 11 = 625m≥R>525m 12 = 525m≥R>475m 13 = 475m≥R>425m 14 = 425m≥R>375m 15 = 375m≥R>325m 16 = 325m≥R>300m 17 = 300m≥R>275m 18 = 275m≥R>250m 19 = 250m≥R>225m 20 = 225m≥R>200m 21 = 200m≥R>175m 22 = 175≥R>150m 23 = = R≤150m [24-31] = Spare
Power Voltage Start					
042		M_VOLTAGE (k)	See [Ref 2], Section 7.5.1.78	4 bits	See [Ref 2], Section 7.5.1.78
043		NID_CTRACTION (k)	If [M_VOLTAGE <> Line not fitted with any traction system] See [Ref 2], Section 7.5.1.86.1	10 bits	See [Ref 2], Section 7.5.1.86.1
Power Voltage Change					

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
044		N_ITER (k)	Number of iterations of voltage changes. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
045		D_Location (k,l)	Location of the voltage change relatively to the beginning of the SP	24 bits	Binary to numeric (in centimetres)
046		M_VOLTAGE (k,l)	See [Ref 2], Section 7.5.1.78	4 bits	See [Ref 2], Section 7.5.1.78
047		NID_CTRACTION (k,l)	If [M_VOLTAGE <> Line not fitted with any traction system] See [Ref 2], Section 7.5.1.86.1	10 bits	See [Ref 2], Section 7.5.1.86.1
Current Limitation Start					
048		M_CURRENT (k)	See [Ref 2], Section 7.5.1.62.1 Note: a powerless section is indicated as a current limit "0" (zero)	10 bits	See [Ref 2], Section 7.5.1.62.1
Current Limitation Change					
049		N_ITER (k)	Number of iterations of allowed current consumption changes. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
050		D_Location (k,l)	Location of the allowed current consumption change relatively to the beginning of the SP	24 bits	Binary to numeric (in centimetres)
051		M_CURRENT (k,l)	Current Consumption Limit See [Ref 2], Section 7.5.1.62.1 Note: a powerless section is indicated as a current limit "0" (zero)	10 bits	See [Ref 2], Section 7.5.1.62.1
Balise Group					
052		N_ITER (k)	Number of iterations of balise groups. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
053		Q_NEWNID_C (k,l)	Qualifier to indicate if NID_C of this balise group is following or the NID_C of the SP is valid for this balise group.	1 bits	0 = Use NID_C of SP 1 = NID_C to be used follows
054		NID_C (k,l)	If [T_Q_NEWNID_C == NID_C to be used follows] Identity of the BG's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
055		NID_BG (k,l)	See [Ref 2], Section 7.5.1.85.	14 bits	See [Ref 2], Section 7.5.1.85.
Balises					
056		N_ITER_BG (k,l)	Number of iterations of balises in the balise group, which are located on the k th SP Note: the number of balises belonging to a balise group and located on an SP may be lower than the total number of balises of the balise group, in case this latter is split over two SPs.	4 bits	Binary to numeric
057		N_PIG (k,l,m)	See [Ref 2], Section 7, 5.1.81	3 bits	See [Ref 2], Section 7, 5.1.81
058		D_Location (k,l,m)	Location of the balise relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Timing Points					
059		N_ITER (k)	Number of iterations of Timing Points. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
060		NID_TP (k,l)	TP identity. The NID_TP is unique within a NID_C.	32 bits	Binary to numeric.
061		D_Location (k,l)	Location of the Timing Point relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
062		Q_Stop_Location_Tolerance (k,l)	Required stopping tolerance to use when the TP is a Stopping Point.	5 bits	0 = 10cm 1 = 20cm 2 = 30cm 3 = 40cm 4 = 50cm 5 = 1m 6 = 1,5m 7 = 2m 8 = 2,5m 9 = 3m 10 = 5m 11 = 7,5m 12 = 10m 13 = 15m 14 = 20m 15 = 25m 16 = 30m 17 = 50m 18 = 75m 19 = 100m [20-30] = Spare 31 = No requirement
063		Q_STP_Reached (k,l)	Distance from a Stopping Point to consider it as reached.	5 bits	0 = 10cm 1 = 20cm 2 = 30cm 3 = 40cm 4 = 50cm 5 = 1m 6 = 1,5m 7 = 2m 8 = 2,5m 9 = 3m 10 = 5m 11 = 7,5m 12 = 10m 13 = 15m 14 = 20m 15 = 25m 16 = 30m 17 = 50m 18 = 75m 19 = 100m [20-30] = Spare 31 = No requirement
Timing Point Name					
064		L_TEXT (k,l)	See [Ref 2], Section 8.1.11.	8 bits	See [Ref 2], Section 8.1.11.
065		X_TEXT (k,l,m)	Name of the TP.	8 bits	See [Ref 2], Section 8.1.120.
Platform Area					
066		N_ITER (k)	Number of iterations of Platform Areas. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
067		Q_Range (k,l)	Specifies if the Platform Area starts, ends, starts and ends or covers the whole concerning Segment Profile	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
068		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the platform start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
069		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the platform end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Tunnel					
070		N_ITER (k)	Number of iterations of tunnels. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
071		Q_Range (k,l)	Specifies if the Tunnel starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
072		Q_Tunnel_Category (k,l)	Category of the Tunnel.	2 bits	0 = Single track tunnel 1 = Double track tunnel 2 = Wide-cross section tunnel 3 = Spare
073		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the tunnel start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
074		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the tunnel end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Axle Load Speed Profile					
075		N_ITER (k)	Number of iterations of Axle Load Speed Profiles. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
076		Q_Range (k,l)	Specifies if the Axle Load Speed Profile starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
077		M_AXLELOADCAT (k,l)	See [Ref 2], Section 7.5.1.62	7 bits	See [Ref 2], Section 7.5.1.62
078		V_New_Speed_Level (k,l)	Speed restriction to be applied if the axle load of the train $\geq$ M_AXLELOADCAT (k,v)	7 bits	[0..120] x 5 km/h $\Leftrightarrow$ [0..600] km/h; [121-127] = Spare
079		Q_FRONT (k,l)	See [Ref 2], Section 7.5.1.109 This is applicable only for step up.	1 bits	see [Ref 2], Section 7.5.1.109
080		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Axle Load Speed Profile start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
081		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Axle Load Speed Profile end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Unprotected Level Crossing Stop					
082		N_ITER (k)	Number of iterations of stopping locations for unprotected level crossings. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
083		D_UnprotectedLx_Stop_Nominal (k,l)	Location of the stop in rear of an unprotected level crossing if the valid travelling direction of the SP is nominal. Undefined if for this travelling direction the location is not inside this SP.	24 bits	Binary to numeric (in centimetres) 16777215 = Undefined Location

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
084		D_UnprotectedLx_Stop_Reverse (k,l)	Location of the stop in rear of an unprotected level crossing if the valid travelling direction of the SP is reverse. Undefined if for this travelling direction the location is not inside this SP.	24 bits	Binary to numeric (in centimetres) 16777215 = Undefined Location
Permitted Braking Distance					
085		N_ITER (k)	Number of iterations of Permitted Braking Distance areas. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
086		Q_Range (k,l)	Specifies if the Permitted Braking Distance area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
087		D_Permitted_Braking_Distance (k,l)	Permitted Braking Distance value.	24 bits	Binary to numeric (in centimetres)
088		Q_PBD_SBEB (k,l)	Whether the permitted braking distance is to be achieved with the Service Brake or Emergency Brake.	1 bits	0 = Service Brake 1 = Emergency Brake
089		G_PBD (k,l)	A single gradient value applicable for the calculation	8 bits	Binary to numeric (0-255) with resolution 1‰
090		Q_GDIR_PBD (k,l)	Direction of the gradient.	1 bits	0 = Downhill 1 = Uphill
091		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Permitted Braking Distance area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
092		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Permitted Braking Distance area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Switch Off Regenerative Brake					
093		N_ITER (k)	Number of iterations of Switch off Regenerative Brake areas. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
094		Q_Range (k,l)	Specifies if the Switch off Regenerative Brake area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
095		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Switch off Regenerative Brake area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
096		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Switch off Regenerative Brake area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Switch Off Eddy Current Brake					
097		N_ITER (k)	Number of iterations of Switch off eddy current brake for service brake areas. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
098		Q_Range (k,l)	Specifies if the Switch off eddy current brake for service brake area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
099		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Switch off eddy current brake for service brake area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
100		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Switch off eddy current brake for service brake area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Switch Off Eddy Current Emergency Brake					
101		N_ITER (k)	Number of iterations of Switch off eddy current brake for emergency brake areas. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
102		Q_Range (k,l)	Specifies if the Switch off eddy current brake for emergency brake area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
103		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Switch off eddy current brake for emergency brake area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
104		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Switch off eddy current brake for emergency brake area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Switch Off Magnetic Shoe Brake					
105		N_ITER (k)	Number of iterations of Switch off Magnetic Shoe Brake areas. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
106		Q_Range (k,l)	Specifies if the Switch off Magnetic Shoe Brake area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = StartsEnds 3 = WholeSP
107		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Switch off Magnetic Shoe Brake area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
108		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Switch off Magnetic Shoe Brake area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Area with Dynamic Brake force Inhibition					
109		N_ITER (k)	Number of iterations of areas with Dynamic Brake force inhibition. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
110		Q_Range (k,l)	Specifies if the Dynamic Brake Inhibition Area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = forceStartsEnds 3 = WholeSP
111		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Dynamic Brake Force Inhibition Area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
112		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Dynamic Brake Force Inhibition Area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
Area with limited Dynamic Brake force					
113		N_ITER (k)	Number of iterations of areas with limited Dynamic Brake force. If N_ITER is 0 then no data set is following.	5 bits	See [Ref 2], Section 7.5.1.80
114		Q_Range (k,l)	Specifies if the Dynamic Brake Limitation Area starts, ends, starts and ends or covers the whole concerning Segment Profile.	2 bits	0 = Starts 1 = Ends 2 = forceStartsEnds 3 = WholeSP
115		M_Dynamic_Brake_Force_Limit (k,l)	Maximum Brake Force [kN] to be applied by the Dynamic Brake	16 bits	Range: 0 ... 3000 kN, resolution 1 kN, Special values: 3001 ... MAXNUM - 1: spare MAXNUM: Unknown
116		D_Start_Location (k,l)	If [Q_Range == Starts or Q_Range == StartsEnds] Location of the Dynamic Brake Force Limit Area start relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)
117		D_End_Location (k,l)	If [Q_Range == Ends or Q_Range == StartsEnds] Location of the Dynamic Brake Force Limit Area end relatively to the beginning of the SP.	24 bits	Binary to numeric (in centimetres)

Table 9 GoA 2 Segment Profile Packet structure

2.3.7.4 Segment Profile Packet extension composition:

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
Geometry Layer					
118		N_ITER (k)	Number of iterations of geometry point. If N_ITER is 0 then no data set is following.	24 bits	Binary to numeric
119		N_Latitude (k,l)	Latitude value in degrees for the position of the geometry point (as per ETRS89 standard).	32 bits	Binary to numeric (in degrees) with a resolution of 10 ⁻⁷ . For example, the value 50.1234567 will be represented as 501234567.
120		N_Longitude (k,l)	Longitude in degrees for the position of the geometry point (as per ETRS89 standard).	32 bits	Binary to numeric (in degrees) with a resolution of 10 ⁻⁷ .

Packet Number		7			
Item	Variable Name		Description	Length	Resolution/Formula
					For example, the value 50.1234567 will be represented as 501234567.
121		N_Altitude (k,l)	Altitude value in centimetres for the position of the geometry point (as per ETRS89 standard).	20 bits	Binary to numeric (in centimetres)
122		D_position	Position of the geometric point (relatively from the beginning of the given SP).	24 bits	Binary to numeric (in centimetres)
Adjacent Segment Profiles					
123		N_ITER (k)	Number of iterations of adjacent Segment Profiles. If N_ITER is 0 then no data set is following.	3 bits	Binary to numeric Specific Values: [5-8] = Spare
124		NID_C (k,l)	Identity of the SP's country or region.	10 bits	See [Ref 2], Section 7.5.1.86.
125		NID_SP (k,l)	SP identity.	32 bits	Binary to numeric
126		M_SP_Version (k)	Identifier of the segment profile version.	16 bits	1 byte for the major version and 1 byte for the minor one.
127		Q_Adjacent_Type	Specifies if the Adjacent Segment Profile is adjacent from the start or the end of the segment profile. The nominal travelling direction of the SP is used as reference.	1 bit	0 = From the start 1 = From the end

Table 10 Segment Profile Packet extension structure

2.3.8 Digital Register Session Termination Request Packet (DR_SESSTermReq)

2.3.8.1 The section details the structure of a DR_SESSTermReq sent by the DR_TA to the DR-OB.

2.3.8.2 Digital Register Session Termination Request Packet composition:

Packet Number		8			
Item	Variable Name		Description	Length	Resolution/Formula
001	Track-Train Header		see chapter 8.3		-

Table 11 Digital Register Session Termination Request Packet structure

2.3.9 Digital Register Session Termination Packet (DR_SESSTerm)

2.3.9.1 The section details the structure of a DR_SESSTerm Packet sent by the DR-OB to the DR_TA.

2.3.9.2 Digital Register Session Termination Packet composition:

Packet Number		9			
Item	Variable Name	Description	Length	Resolution/Formula	
001	Track-Train Header	see chapter 8.3		-	
Session Termination Details					

Packet Number		9		
Item	Variable Name	Description	Length	Resolution/Formula
002	Q_Termination_Reason	Qualifier indicating the reason for the communication session termination.	4bits	0 = DR-TA Termination Request 1 = Last SP left 2 = DR-TA Handover cancelled 3 - 15 = Spare

Table 12 Digital Register Session Termination Packet structure