CiA Draft Standard Proposal 407

CANopen

Application Profile for Passenger Information

- not recommend for implementaion, may be changed without notification -

Version 1.0
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Contents

1 Scope

This application profile specifies the application objects as well as the PDO default mapping for devices used in passenger information systems. The specified application objects are based on the VDV-IBIS data model. This specification contains definition of the usual appliance profiles. It defines a minimum configuration, too.
All devices compliant to this application profile use communication techniques, which are conforming to those described in the CANopen application layer and communication profile /1/. In addition, programmable devices may use communication techniques, which conform to those described in the framework for programmable CANopen devices /3/. If you like to use transparent data, you may implement dynamic objects as defined in EDS specification /12/. These specifications should be consulted in parallel to this application profile specification.

2 References

/1/	CiA DS 301:2002	CANopen application layer and communication profile (version 4.02)
/2/	CiA DR 303-1:2002	Cabling and connector pin assignment (version 1.1)
/3/	CiA DSP 302:2002	Framework for programmable CANopen devices (version 3.11)
/4/	CiA DS 401:2002	Device profile for generic I/O devices (version 2.1)
/5/	ENV 13149-4:2000	Public transport – Road vehicle scheduling and control systems – On board data transmission between equipment inside a vehicle – Part 4: General application rules for CANopen transmission busses
/6/	ENV 13149-5:2000	Public transport – Road vehicle scheduling and control systems – On board data transmission between equipment inside a vehicle – Part 5: CANopen cabling specifications
/7/	ISO 11992:2000	Road vehicles – Interchange of digital information on electrical connections between towing and towed vehicles – Part 2: Application layer for braking and running gear equipment
/8/	ISO 11992:2000	Road vehicles – Interchange of digital information on electrical connections between towing and towed vehicles – Part 3: Application layer for equipment other than braking and running gear
/9/	ISO 11992:2000	Road vehicles – Interchange of digital information on electrical connections between towing and towed vehicles – Part 4: Diagnostic communication
/10/	ISO 16844:2000	Road vehicles – Tachograph systems – Part 7: Definitions
/11/	SAE J1939/71	Surface vehicle recommended practice – Vehicle application layer
/12/	CiA DS 306:2002	EDS (electronic data sheet) specification (version 1.1)
/13/	ISO/IEC 646:1991	ISO 7-bit coded character set for information interchange
/14/	ISO/IEC 8859-1:1998	8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1
/15/	ISO/IEC 8859-2:1999	8-bit single-byte coded graphic character sets - Part 2: Latin alphabet No. 2
/16/	ISO/IEC 8859-3:1999	8-bit single-byte coded graphic character sets - Part 3: Latin alphabet No. 3
/17/	ISO/IEC 8859-4:1998	8-bit single-byte coded graphic character sets - Part 4: Latin alphabet No. 4
/18/	ISO/IEC 8859-5:1999	8-bit single-byte coded graphic character sets - Part 5: Latin/Cyrillic alphabet
/19/	ISO/IEC 8859-6:1999	8-bit single-byte coded graphic character sets - Part 6: Latin/Arabic alphabet
/20/	ISO/IEC 8859-7:1987	8-bit single-byte coded graphic character sets - Part 7: Latin/Greek alphabet
/21/	ISO/IEC 8859-8:1999	8-bit single-byte coded graphic character sets - Part 8: Latin/Hebrew alphabet
/22/	ISO/IEC 8859-9:1999	8-bit single-byte coded graphic character sets - Part 9: Latin alphabet No. 5
/23/	ISO/IEC 8859-10:1998	8-bit single-byte coded graphic character sets - Part 10: Latin alphabet No. 6
/24/	ISO/IEC 8859-13:1998	8-bit single-byte coded graphic character sets - Part 13: Latin alphabet No. 7
/25/	ISO/IEC 8859-14:1998	8-bit single-byte coded graphic character sets - Part 14: Latin alphabet No. 8
/26/	ISO/IEC 8859-15:1999	8-bit single-byte coded graphic character sets - Part 15: Latin alphabet No. 9
/27/	ISO 11898-1:2002	Road vehicles – Controller area network – Part 1: Data link layer
/28/	ISO 10918-1:1994	Digital compression and coding of continuous-tone still images: Requirements and guidelines

3 Definitions, acronyms and abbreviations

3.1 Identifiers and numbers

3.1.1 Vehicle related identifiers and numbers

The vehicle ID is assigned uniquely by the system designer to the vehicle. Usually it refers to the vehicle ID text object ($611C_h$) containing the number given inside of the main computer or the number is coded by a fixed connector at the main computer (see figure 1: xxxx).
The body ID assigned by the system designer refers to the body ID text object ($611D_h$) containing the readable identification on the vehicle body. Usual this text is printed on the vehicle body (see figure 1: yyyy).
The radio ID assigned by the system designer refers to the radio ID text object ($611E_h$) containing the textual radio address of the bus. This address is necessary for selective calls to this bus (see figure 1: zzzz).

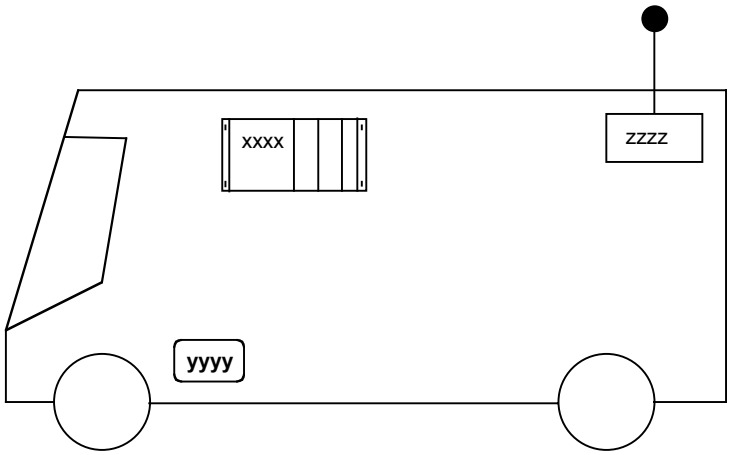


Figure 1: Vehicle related identifiers and numbers

3.1.2 Vehicle operation identifiers and numbers

The garage ID assigned by the system designer refers to the garage ID text object ($611F_h$) containing the textual description of the depot or garage, where a vehicle is going to be parked during the night (see figure 2).
The block ID assigned by the system designer indicates the work of a vehicle from the time it leaves a parking point (depot, garage) after parking until its next return to park at a parking point. Any subsequent departure from a parking point after parking marks the start of a new block. A block may consist of one or several lines (see figure 2). The block ID refers to the block ID text object (6197_h) containing the textual description of the block.
The line ID assigned by the system designer refers to the line ID text object (6196_h) containing the textual or numerical name of the line, which is known from the public by. A line may consist of a single route or a group of routes.

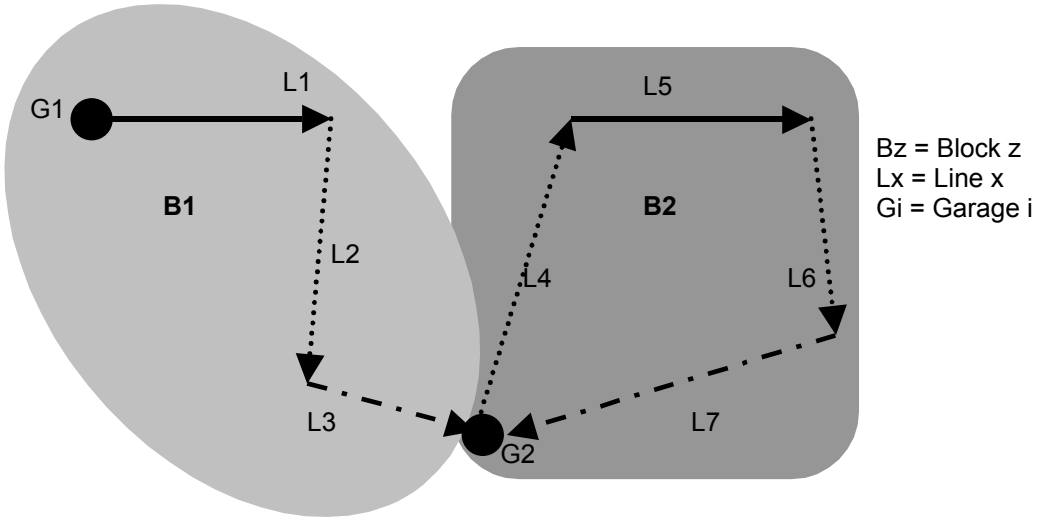
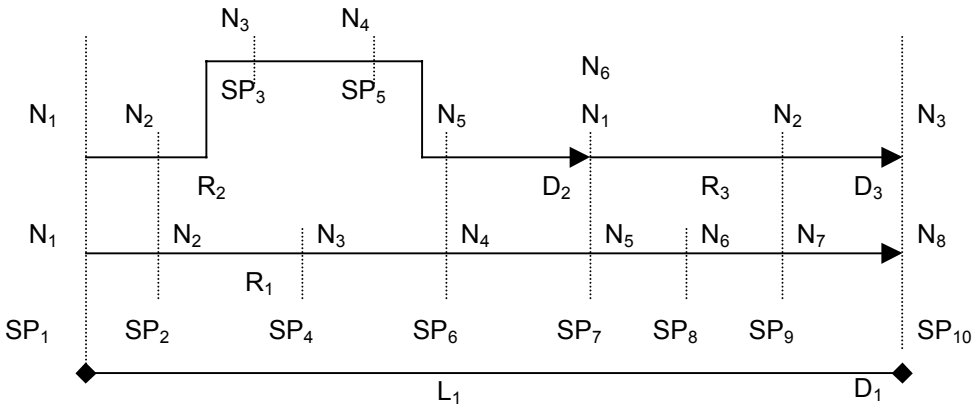


Figure 2: Non-closed and closed block

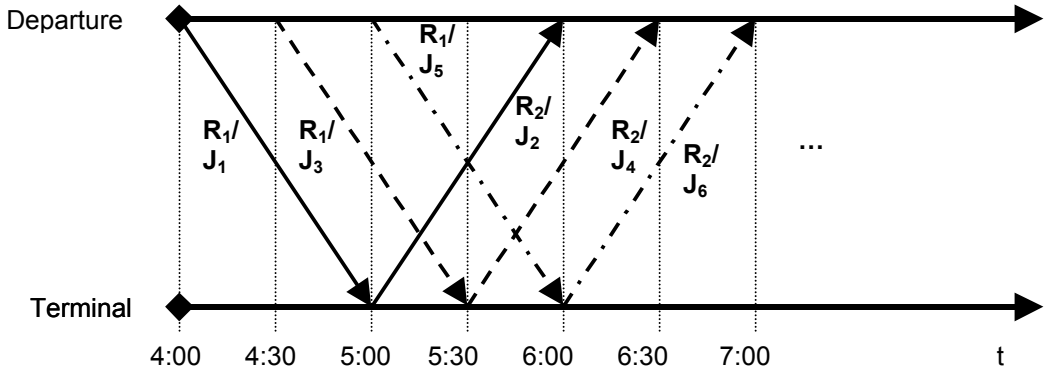
A route is an ordered list of points defining one single path through the road (or rail) network. Stop points, timing points and points of other types may be used to define this path uniquely. The route number is related to a line (see figure 3).
The stop point ID assigned by the system designer refers to the stop point ID text object (6120_h) representing uniquely a stop point within a transportation network (see figure 3).
The destination number is the reference to the route destination. The number can differ from stop point ID (see figure 3).
The number of running in route representation is the running stop point number within a route (see figure 3).



L_i = Line i
D_n = Destination number n
R_x = Route number x in Line i
SP_y = Stop Point Identifier y
N_z = running Stop Point Number z in the route

Figure 3: Definition of a line

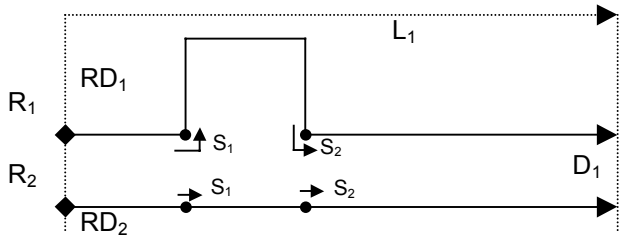
The journey number refers to a journey (between one terminal to another terminal) related to a given time or time table (see figure 4).



R_i = route number
J_i = Journey number
t = time

Figure 4: Definition of a journey

The route destination ID identifies a unique route and line. With this identifier the path and the rail track of this line/route is defined for a vehicle. For example, this is used for the controlling of rail switches in the track (see figure 5).

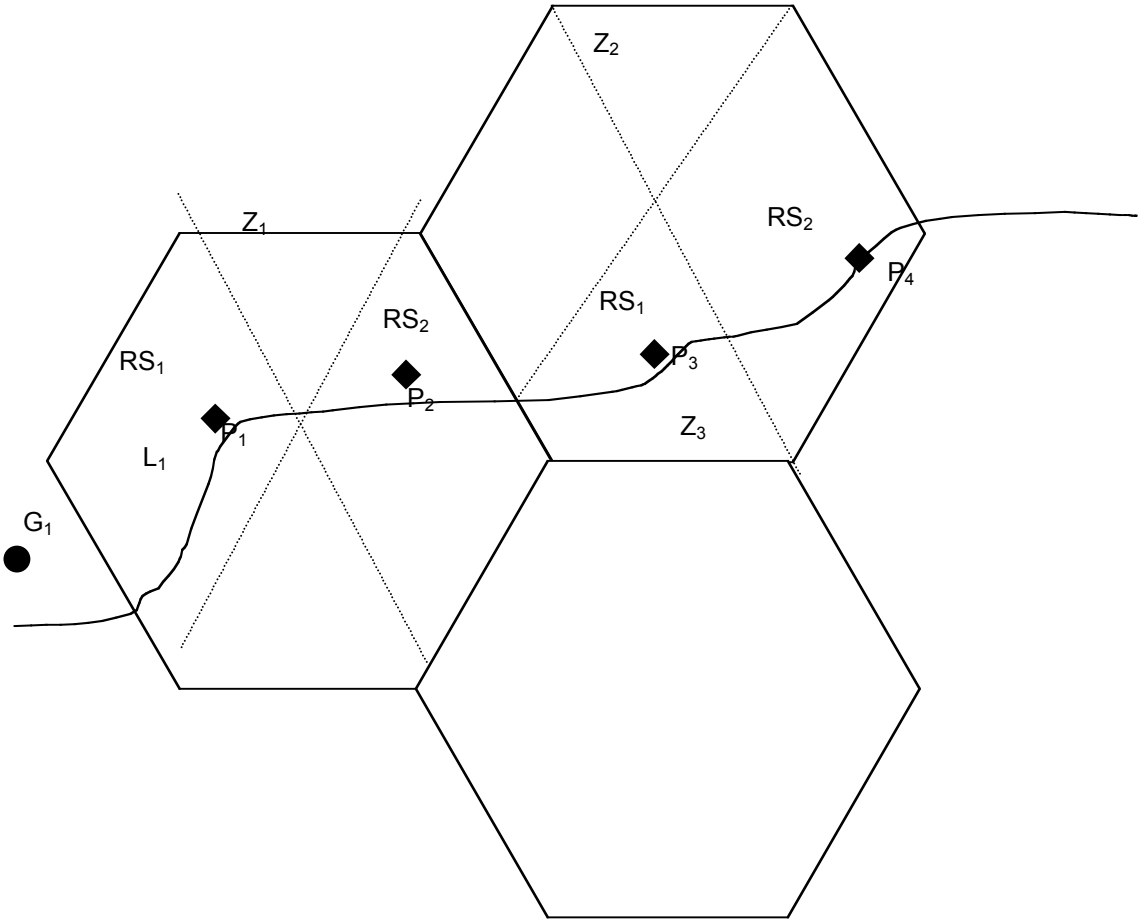


L_x = Line ID x
R_i = Route number i
D_j = Destination number
RD_n = Route destination ID

Figure 5: Description of the use of Route Destination ID

3.1.3 Fare terms and related identifiers and numbers

The route segment number indicates a set of consecutive links on a given route and is unique for a fare zone (see figure 6).
The fare zone indicates the current fare zone number (see figure 6).
The previous fare zone indicates the number of the last/previous crossed fare zone (see table 1).
The previous route segment number is the number of the last/previous crossed route segment (see table 1).



G_i = Garage i
L_j = Line j
Z_n = Fare zone n
RS_x = Route segment x
P_z = Vehicle position z

Figure 6: Fare terms and related identifiers and numbers

Table 1 Contents of the objects at the different vehicle positions p_x

Positions	P_1	P_2	P_3	P_4
Fare zone	Z_1	Z_1	Z_2	Z_2
Route segment	RS_1	RS_2	RS_1	RS_2
Previous fare zone	-	-	Z_1	Z_1
Previous route segment	-	RS_1	RS_2	RS_1

3.2 Abbreviations

AAS
Acoustic Announcement System
System that controls the acoustic announcements within a vehicle.

CAN
Controller Area Network
Data link layer protocol for serial communication as specified in ISO 11898-1.

CiA
CAN in Automation
International users and manufacturers group promoting CAN.

COB
Communication Object
Data transportation unit in a CAN network mapped to one or more CAN frames.

COD-ID
COB Identifier
Identifies a COB uniquely in a network and determines the priory of that COB in the network.

DRCC
Data Radio Communication Control
Controls data radio transmission between vehicle and central station.

DSRC
Dedicated Short Range Communication
Controls radio or infrared shot distance communicator.

GIF
Graphics Interchange Format
The data stream-oriented file format maintained by CompuServe, defines the transmission protocol of bitmap data.

HMI
Human Machine Interface
Device providing input and/or output capability for human users.

IAM
IBIS Application Manager
Main on-board computer controlling the IBIS system.

IBIS
Integriertes Bordinformationssystem
Integrated on-vehicle information system for passengers and drivers.

JPEG
Joint Photographic Experts Group
The best known standard from JPEG is ISO 10918-1, which is the first of the multi-part set of standards for still image compression.

PDO
Process Data Object
Unconfirmed COB containing process data and mapped to one CAN data frame.

RPDO
Receive PDO
PDO received by one node or several nodes depending on the configuration.

SDO
Service Data Object (SDO)
Confirmed and optionally segmented COB providing peer-to-peer communication with access to the Object Dictionary of a device.

TPDO
Transmit PDO

PDO transmitted by one node.

UTC

Universal Time Coordinated (UTC)
International time base previously known as GMT.

VRCC

Voice Radio Communication Control
Controls voice radio transmission between vehicle and central station.

XML

Extensible Markup Language
Formatting language for text (http://www.w3.org/TR/2000/WD-xml-2e-20000814).

4 Hardware preferences

4.1 Physical layer

The definitions given in prEN 13149-4 and prEN 13149-5 shall be used in CANopen networks for devices compliant to this application profile.

4.1.1 Bit rates

See prEN 13149-4.

4.1.2 Bus connector

See prEN 13149-5 and /2/.

4.1.3 Bus cable

See prEN 13149-5 and /2/.

5 Data modelling

5.1 General

Application objects may use a standardized structure. Different application objects use the following data definitions. Most of the data can be transmitted within a single PDO. In case of an object with a length of more than 8 byte, SDO communication is used.

5.2 Large data

The transfer of texts and other data (e.g. bitmaps) longer than 8 byte requires a segmented transfer performed by SDO. As the transporting of the SDOs is done through a peer-to-peer connection, it is not possible to supply all devices with the text simultaneously.
The following procedure is determined:

- Texts and other data to be stored can be sent to the equipment at any time using SDO service.
- Each text or data has a system-wide, definite reference number, which is sent within the SDO.
- Devices can also request text and data (by SDO).
- The texts and data can be clearly addressed via the reference number.
- Using a PDO, which contains a reference number the devices (respective indicators) may requested to display a text.

5.3 Text structure

5.3.1 General

Texts can be stored (and transferred) in two different formats: plain text and XML formatted text.

5.3.2 Plain text

This format will be used to store and transfer plain text without any specific control characters. It is usual to control old style displays or to store the names of stations.

5.3.3 XML formatted text

to be specified

5.3.3.1 Referenced text

to be specified

5.3.3.2 Referenced CANopen objects

to be specified

5.3.3.3 Call-up parameter

to be specified

6 Virtual device profiles

6.1 Introduction

The main approach of this application profile specification is the definition of virtual devices and their application objects. A physical device consists of one or more virtual devices. A virtual device shall not be distributed to several physical devices. Each virtual device supports a set of mandatory objects and may implement additionally a variable set of optional objects. Physical devices will not be defined, because they may implement multiple functions.
The virtual device implements different application objects, some shall be supported (**M**andatory) and some may be supported (**O**ptional). In the virtual device description, there is defined the access attribute indicating if an application object is read only (ro), read/write (rw) or write only (wo). Read only indicates that this shall not be written via the bus; read/write allows to read and to write this object; and write only means that this application object shall be not read via the bus.

6.2 Main on-board computer

Main on-board computer controls and supervises the on-vehicle information system application.

class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6001_h	events_from_virtal_devices	M	wo
6002_h	events_for_virtual_devices	M	ro
6100_h	vehicle_ID	O	ro
6101_h	body_ID	O	ro
6102_h	garage_ID	O	ro
6103_h	radio_ID	O	ro
6104_h	vehicle_class	O	ro
6105_h	number_of_vehicle_units	O	ro
6106_h	driver_schedule_number	O	ro
6107_h	route_destination_ID	O	ro
6108_h	journey_direction	M	ro
6109_h	stop_point_ID	M	ro
$610A_h$	number_of_running_in_route_direction	O	ro
$610B_h$	line_short_representation	O	ro
$610C_h$	text_line/route_description	O	ro
$610D_h$	text_of_destination	O	ro
$610E_h$	local_time_and_date	M	ro
$610F_h$	time_standby	O	ro
6110_h	route_segment_number	M	ro
6111_h	fare_zone	M	ro
6112_h	text_of_stop_point	O	ro
6113_h	previous_route_segment	O	ro
6114_h	previous_fare_zone	O	ro

Index	Name	M/O	Access
6115_h	scheduled_time_and_date	O	ro
6116_h	blocking_of_ticket_canceller	O	ro
6117_h	traffic_light_priortiy_request	O	ro
6118_h	stop_point_short_representation	O	ro
6119_h	inside_temperature	O	ro
$611A_h$	car_mileage	O	ro
$611B_h$	car_mileage_calibration_information	O	ro
$611C_h$	vehicle_ID_text	O	ro
$611D_h$	body_ID_text	O	ro
$611E_h$	garage_ID_text	O	ro
$611F_h$	radio_ID_text	O	ro
6120_h	stop_point_ID_text	O	ro
6121_h	route_destination_ID_text	O	ro
6122_h	driver_schedule_number_text	O	ro
6123_h	vehicle_speed	O	ro
6190_h	driver_ID	M	wo
6191_h	destination_number	M	wo
6192_h	line_ID	M	wo
6193_h	route_number	M	wo
6194_h	block_ID	M	wo
6195_h	journey_number	M	wo
6196_h	line_ID_text	O	ro[1]
6197_h	block_ID_text	O	ro[1]
6198_h	driver_ID_text	O	ro[1]
6204_h	bus_stop_request	M	ro
6481_h	wheel_based_vehicle_speed	O	wo
6482_h	vehicle_mileage	O	wo
6483_h	vehicle_mileage_precision	O	wo
6484_h	drive_flag_and_direction_flag	O	wo
6486_h	compass_bearing	O	wo
6487_h	compass_bearing_precision	O	wo
6488_h	state_of_doors	O	wo
6489_h	ambient_air_temperature	O	wo
6520_h	tachograph_speed	O	wo
6552_h	high_resolution_vehicle_distance	O	wo
6660_h	position	O	wo
6661_h	position_precision	O	wo

Index	Name	M/O	Access
6662_h	GPS_based_speed	O	wo
6663_h	GPS_based_heading	O	wo
6664_h	GPS_mileage	O	wo
6665_h	GPS_mileage_precision	O	wo
6680_h	time_universal_reference	O	wo
6720_h	passenger_counting_manager_data	O	wo
6721_h	total_in/out_passenger_counting_value	O	wo
6722_h	counter_passenger_sum	O	wo
6723_h	passenger_capacity_use	O	wo
6740_h	short_diagnostic_error_field	M	wo
6741_h	extended_diagnostic_message_file	O	wo
6742_h	error_class_1	O	wo
6743_h	error_class_2	O	wo
6744_h	error_class_3	O	wo

[1] In some cases the identification device may have the access type ‚ro' and the main on-board computer ‚wo' and ‚rw'

6.3 Identification

The identification device provides daily identification and numbering objects.

Class	0	not used
Subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6190_h	driver_ID	M	ro
6191_h	destination_number	M	ro
6192_h	line_ID	M	ro
6193_h	route_number	O	ro
6194_h	block_ID	M	ro
6195_h	journey_number	M	ro
6196_h	line_ID_text	O	wo[1]
6197_h	block_ID_text	O	wo[1]
6198_h	driver_ID_text	O	wo[1]

[1] In some cases the identification device may have the access type ‚ro' and the main on-board computer ‚wo' and ‚rw'

6.4 Passenger information

Passenger information device displays data.

Class	1	destination indicator
	2	next stop indicator
	3	information indicator
Subclass	1	simple
	2	text
	3	graphics
	4	extended

Assignment of objects to classes and subclasses:

Index	**Name**	**class**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**Access**
		subclass	1	2	3	4	1	2	3	4	1	2	3	4	
6001_h	events_from_virtual_devices		O	O	O	O	O	O	O	O	O	O	O	O	ro
6002_h	events_for_virtual_devices		O	O	O	O	O	O	O	O	O	O	O	O	wo
6101_h	body_ID		-	O	O	O	-	O	O	O	-	O	O	O	wo
6109_h	stop_point_ID		-	-	-	O	M	M	M	M	M	M	M	M	wo
$610B_h$	line_short_representation		-	O	M	M	M	M	M	M	M	M	M	M	wo
$610C_h$	text_line/route_description		O	O	O	O	-	-	-	-	O	M	O	O	wo
$610D_h$	text_of_destination		-	M	O	O	-	O	O	O	-	M	O	O	wo
$610E_h$	local_time_and_date		-	-	-	O	-	-	-	O	-	-	-	O	wo
6110_h	route_segment_number		M	M	M	M	-	-	-	-	M	M	M	M	wo
6112_h	text_of_stop_point		-	O	O	O	-	M	O	O	-	M	O	O	wo
6119_h	inside_temperature		-	-	-	O	-	-	-	O	-	O	O	O	wo
$611D_h$	body_ID_text		-	O	O	O	-	O	O	O	-	O	O	O	wo
6120_h	stop_point_ID_text		-	-	-	O	M	M	M	M	M	M	M	M	wo
6121_h	route_destination_ID_text		O	O	O	O	O	O	O	O	O	O	O	O	wo
6123_h	vehicle_speed		-	-	-	O	-	-	-	O	-	O	O	O	wo
6191_h	destination_number		M	M	M	M	M	M	M	M	M	M	M	M	wo
6192_h	line_ID		O	M	M	M	O	M	M	M	M	M	M	M	wo
6193_h	route_number		M	M	M	M	M	M	M	M	M	M	M	M	wo
6196_h	line_ID_text		O	M	M	M	O	M	M	M	M	M	M	M	wo
6200_h	XML_text		O	O	O	O	O	O	O	O	O	O	M	O	rw
6201_h	special_character_files		-	O	O	O	O	O	O	O	O	O	O	O	rw
6202_h	referenced_files_for_XML_files		O	O	O	O	O	O	O	O	O	O	M	O	rw
6203_h	display_mapping		M	M	M	M	M	M	M	M	M	M	M	M	rw
6204_h	bus_stop_request		-	-	-	-	-	O	O	O	O	O	O	O	wo
6205_h	character_set		-	-	-	-	-	O	O	O	O	O	O	O	wo
6481_h	wheel_based_vehicle_speed		-	-	-	O	-	-	-	O	-	O	O	O	wo

6488_h	state_of_doors	-	-	-	O	-	-	-	O	-	O	O	O	wo
6489_h	ambient_air_temperature	-	-	-	O	-	-	-	O	-	O	O	O	wo
6520_h	tachograph_speed	-	-	-	O	-	-	-	O	-	O	O	O	wo
6662_h	GPS_based_speed	-	-	-	O	-	-	-	O	-	O	O	O	wo
6740_h	Short_diagnostic_message_field	-	-	-	-	-	-	-	-	O	O	O	O	wo
6741_h	extended_diagnostic_message_file	-	-	-	-	-	-	-	-	O	O	O	O	wo
6742_h	error_class_1	-	-	-	-	-	-	-	-	O	O	O	O	wo
6743_h	error_class_2	-	-	-	-	-	-	-	-	O	O	O	O	wo
6743_h	error_class_3	-	-	-	-	-	-	-	-	O	O	O	O	wo

6.5 Ticket canceller

Ticket canceller device cancels tickets.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6001_h	events_from_virtal_devices	O	ro
6002_h	events_for_virtual_devices	O	wo
6100_h	vehicle_ID	O	wo
6105_h	number_of_vehicle_units	O	wo
6108_h	journey_direction	M	wo
6109_h	stop_point_ID	M	wo
$610A_h$	number_of_running_in_line_representation	O	wo
$610B_h$	line_short_representation	O	wo
$610E_h$	local_time_and_date	M	wo
6110_h	route_segment_number	M	wo
6111_h	fare_zone	M	wo
6112_h	text_of_stop_point	O	wo
6116_h	blocking_of_ticket_canceller	O	wo
6118_h	stop_point_short_representation	O	wo
$611C_h$	vehicle_ID_text	O	wo
6120_h	stop_point_ID_text	M	wo
6191_h	destination_number	M	wo
6192_h	line_ID	M	wo
6193_h	route_number	O	wo
6194_h	block_ID	M	wo

6.6 Ticket printer

Ticket printer device prints tickets.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6100_h	vehicle_ID	O	wo
6108_h	journey_direction	M	wo
6109_h	stop_point_ID	M	wo
$610A_h$	number_of_running_in_route_representation	O	wo
$610B_h$	line_short_representation	O	wo
$610C_h$	text_line/route_description	O	wo
$610E_h$	local_time_and_date	M	wo
6110_h	route_segment_number	M	wo
6111_h	fare_zone	M	wo
6112_h	text_of_stop_point	M	wo
6116_h	blocking_of_ticket_canceller	O	wo
6118_h	stop_point_short_representation	O	wo
$611C_h$	vehicle_ID_text	O	wo
6120_h	stop_point_ID_text	M	wo
6191_h	destination_number	M	wo
6192_h	line_ID	M	wo
6193_h	route_number	M	wo
6194_h	block_ID	M	wo
6196_h	line_ID_text	M	wo
6197_h	block_ID_text	O	wo
6740_h	short_diagnostic_message_field	M	wo
6741_h	extended_diagnostic_message_file	O	wo
6742_h	error_class_1	O	wo
6743_h	error_class_2	O	wo
6744_h	error_class_3	O	wo

6.7 Ticket/card reader/validator

Ticket/card reader/validator device reads and/or validates the ticket.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows

Index	Name	M/O	Access
tbd	tbd	tbd	tbd

6.8 Acoustic announcer

Acoustic announcers provide information for passengers (e.g. “Next stop is ...”). They may be indoor and outdoor load-speakers.
Object 6109_h shall be used to trigger the announcement.

Classes	0	not used
subclasses	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6109_h	stop_point_ID	M	wo
6120_h	stop_point_ID_text	O	wo

6.9 Acoustic control manager

Acoustic control manager controls the AAS/Intercom sub-system.

Simple acoustic passenger information system consists only of a digital accoustic announcer and a power amplifier. The main on-board computer triggers an announcement with writing to object 6109_h of the acoustic announcement virtual device. All other functions are realised in hardware.
In more powerful systems, the main on-board computer is able to control the AAS sub-system with object 6001_h. For example, the driver wants to make a manual announcement to passengers via microphone and loudspeakers. He pushes the related button on the panel (driver's console keyboard). The driver's console display device sends a corresponding event to the main on-board computer. The main on-board computer translates this request in a command for the acoustic control manager to realise a manual announcement (that means to switch the audio paths in the hardware).
Complex systems provide passenger driver intercommunication additionally to manual and digital announcements. Such systems consist of more than one device, distributed over a train or a bus. One device (acoustic control manager") controls the other devices (acoustic control units). The interaction between Acoustic Control Manager and Acoustic Control Units is manufacturer-specific. That is why this standard defines only the interface between the main on-board computer and the acoustic control manager. The communication between Acoustic Control Manager and Acoustic Control Units may be established with objects in the area 2000_h – $5FFF_h$ (Manufacturer Specific Profile Area).
The object 6001_h can be used to switch audio paths in an AAS sub-system on or off by an main on-board computer.

Classes	0	not used
subclasses	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6001_h	events_from_virtual_device	O	ro
6002_h	events_for_virtual_device	O	wo

6.10 Train bus gateway

Train bus gateway is used to communicate with other vehicles in the train.

Classes	0	not used
subclasses	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6100_h	vehicle_ID	O	wo[1]
6101_h	body_ID	O	wo[1]
6102_h	garage_ID	O	wo[1]
6103_h	radio_ID	O	wo[1]
6104_h	vehicle_class	O	wo[1]
6105_h	number_of_vehicle_units	O	wo[1]
6106_h	driver_schedule_number	O	wo[1]
6107_h	route_destination_ID	O	wo[1]
6108_h	journey_direction	M	wo[1]
6109_h	stop_point_ID	M	wo[1]
$610A_h$	number_of_running_in_route_direction	O	wo[1]
$610B_h$	line_short_representation	O	wo[1]
$610C_h$	text_line/route_description	O	wo[1]
$610D_h$	text_of_destination	O	wo[1]
$610E_h$	local_time_and_date	M	wo[1]
$610F_h$	time_standby	O	wo[1]
6110_h	route_segment_number	M	wo[1]
6111_h	fare_zone	M	wo[1]
6112_h	text_of_stop_point	O	wo[1]
6113_h	previous_route_segment	O	wo[1]
6114_h	previous_fare_zone	O	wo[1]
6115_h	scheduled_time_and_date	O	wo[1]
6116_h	blocking_of_ticket_canceller	O	wo[1]
6117_h	traffic_light_priortiy_request	O	wo[1]
6118_h	stop_point_short_representation	O	wo[1]
$611C_h$	vehicle_ID_text	O	wo[1]
$611D_h$	body_ID_text	O	wo[1]
$611E_h$	radio_ID_text	O	wo[1]
$611F_h$	garage_ID_text	O	wo[1]
6120_h	stop_point_ID_text	O	wo[1]
6121_h	route_destination_ID_text	O	wo[1]
6123_h	vehicle_speed	O	wo[1]

Index	Name	M/O	Access
6190_h	driver_ID	M	wo[1]
6191_h	destination_number	M	wo[1]
6192_h	line_ID	M	wo[1]
6193_h	route_number	M	wo[1]
6194_h	block_ID	M	wo[1]
6195_h	journey_number	M	wo[1]
6196_h	line_ID_text	O	wo[1]
6197_h	block_ID_text	O	wo[1]
6204_h	bus_stop_request	O	rw[1]
6481_h	wheel_based_vehicle_speed	O	wo[1]
6484_h	drive_flag_and_direction_flag	O	wo[1]
6488_h	state_of_doors	O	wo[1]
6489_h	ambient_air_temperature	O	wo[1]
6660_h	position	O	wo[1]
6680_h	time_universal_reference	O	wo[1]
6700_h	passenger_counting_in_and_out_per_door	O	wo
6720_h	passenger_counting_manager_data	O	wo[1]
6740_h	short_diagnostic_message_field	O	wo[2]
6741_h	extended_diagnostic_message_file	O	wo[2]
6742_h	error_class_1	O	wo[2]
6743_h	error_class_2	O	wo[2]
6744_h	error_class_3	O	wo[2]

[1] ro, if there is no main on-board computer and identification device in this CANopen segment

[2] ro, if there is no diagnostics device in this CANopen segment

6.11 Vehicle gateway

Vehicle gateway device is used for interaction to other in-vehicle networks. Mainly it performs the logical information exchange between the driver's working place (vehicle driver indicator virtual device), drivetrain (e.g. engine, brake and gearbox), bodytrain (e.g. door control units), and multiplex-train (e.g. sensors, lamps and switches). The tachograph virtual device will be very often implemented together with the vehicle gateway in one physical device.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
$610E_h$	local_time_date	O	ro
6481_h	wheel_based_vehicle_speed	O	ro
6482_h	vehicle_mileage	O	ro
6483_h	vehicle_mileage_precision	O	ro
6484_h	drive_flag_and_direction_flag	O	ro
6486_h	compass_bearing	O	ro
6487_h	compass_bearing_precision	O	ro
6488_h	state_of_doors	O	ro
6489_h	ambient_air_temperature	O	ro
$648A_h$	fuel_economy	O	ro
$648B_h$	brake_switch	O	ro
$648C_h$	engine_coolant_temperature	O	ro
$648D_h$	operation_times	O	ro

6.12 Vehicle driver indicator

Vehicle driver indicator device is used for interaction to the vehicle driver.

Class	1	Display only
	2	Display with keyboard
subclass	0	not used

Assignment of objects to classes and subclasses:

Index	Name	Class 1	Class 2	Access
$610E_h$	local_time_and_date	O	M	wo
6488_h	state_of_doors	O	O	wo
6489_h	ambient_air_temperature	O	O	wo
$648A_h$	fuel_economy	O	O	wo
$648B_h$	brake_switch	O	O	wo
$648C_h$	engine_coolant_temperature	O	O	wo
$648C_h$	operation_times	O	O	wo
6740_h	short_diagnostic_error_field	O	O	wo

6.13 Tachograph

Tachograph device provides data as specified in ISO 16844. The Tachograph itself may be a Modular Tachograph chart unit (MTCO), a Tachograph Simulation Unit (TSU) or a Digital Tachograph (DTCO). The Tachograph virtual device will usually be implemented together with the vehicle gateway virtual device.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6190_h	driver_ID	M	wo
6520_h	tachograph_speed	M	ro
6521_h	drive_recognition_and_direction_indication	M	ro
6522_h	high_resolution_vehicle_distance	M	ro
6523_h	tachograph_time_and_date	O	ro
6524_h	tachograph_driver_ID	M	ro
6525_h	continuous_driving_time	M	ro

6.14 Data radio communication controller (DRCC)

DRCC device controls data radio communication between vehicle and central station.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
tbd	tbd	tbd	tbd

6.15 Voice radio communication controller (VRCC)

VRCC device controls voice radio communication between vehicle and central station.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
tbd	tbd	tbd	tbd

6.16 Dedicated Short Range Communication (DSRC) device

A radio, or infrared short distance communication link. DSRC device receives and transmits wireless data between vehicle and the non-vehicle unit located e.g. at a depot refueling station, at a depot entrance, or at a specific location at the roadside.

Classes	1	not used
subclasses	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
tbd	tbd	tbd	tbd

6.17 Geographical positioning device

Geographical positioning device provides accurate geographical position derived from the Global Positioning System (GPS).

class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6660_h	position	M	ro
6661_h	position_precision	O	ro
6662_h	GPS_based_speed	O	ro
6663_h	GPS_based_heading	O	ro
6664_h	GPS_mileage	M	ro
6665_h	GPS_mileage_precision	O	ro

6.18 Time fixing device

Time fixing device provides accurate time (UTC).

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6660_h	position	M	wo
6680_h	time_universal_reference	M	ro

6.19 Driver's console display

Driver's console display device is used for displaying information.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
tbd	tbd	tbd	tbd

6.20 Driver's console keyboard

Driver's console keyboard provides push button, keyboard and other digital input capability.

Classes	1	not used
subclasses	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
$66C0_h$	Flag direction forward selection	O	ro
6700_h	digital input	M	ro

6.21 Passenger counter

Passenger counter is used for the counting process of the door area by an open door request.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6001_h	events_from_virtual_device	O	ro
6002_h	events_for_virtual_device	O	wo
6488_h	state_of_doors	O	wo
6700_h	passenger_counting_in_and_out_per_door	M	ro

6.22 Passenger counting manager

Passenger counting manager device is used for data collection processing. Once the counting process has been completed at a stopping point, the counting values from all doors will be transferred to the managing unit where they are summarized and concatenated with the line information and be stored afterwards:

class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6001_h	events_from_virtal_devices	M	ro
6002_h	events_for_virtual_devices	M	wo
6100_h	vehicle_ID	O	wo
6108_h	journey_direction	M	wo
6109_h	stop_point_ID	M	wo
$610E_h$	local_time_and_date	M	wo
6191_h	destination_number	M	wo
6192_h	line_ID	M	wo
6193_h	route_number	M	wo
6488_h	state_of_doors	O	wo
6700_h	passenger_counting_in_and_out_per_door	M	wo
6720_h	passenger_counting_manager_data	O	ro
6721_h	total_in/out_passenger_counting_value	M	ro
6722_h	counter_passenger_sum	M	ro
6723_h	passenger_capacity_usage	O	ro

6.23 Diagnostics device

Diagnostics device manages and provides diagnostic information.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
$610E_h$	local_time_and_date	M	wo
6660_h	position	O	wo
6740_h	short_diagnostic_error_field	M	ro
6741_h	extended_diagnostic_message_file	O	ro
6742_h	error_class_1	O	ro
6743_h	error_class_2	O	ro
6744_h	error_class_3	O	ro

6.24 Generic I/O device

Generic I/O device provides simple digital and analogue I/O functionality in accordance with /4/.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
6760_h	digital_input	O	ro
6761_h	digital_output	O	rw
6762_h	analogue_input	O	ro
6763_h	analogue_output	O	rw

6.25 Power supply

Power supply device supplies power for the passenger information modules.

Class	0	not used
subclass	0	not used

All objects used by this virtual device are listed as follows:

Index	Name	M/O	Access
tbd	tbd	tbd	tbd

7 Error handling

7.1 Principle

Emergency messages shall be triggered by internal errors in the device and they are assigned the highest possible priority to ensure that they get access to the bus without latency. By default, the Emergency Messages shall contain the error field with pre-defined numbers and additional information.

7.2 Error behaviour

If a serious device failure is detected the module shall enter by default autonomously the pre-operational state. If object 1029h is implemented, the device can be configured to enter alternatively the stopped state or remain in the current state in case of a device failure. Device failures shall include the following communication errors:

- Bus-off conditions of the CAN interface
- Life guarding event with the state ‘occurred’
- Heartbeat event with state ‘occurred’

Serious device errors also can be caused by device internal failures.

7.3 Additional error codes

In addition to the Emergency message error codes specified in /1/, the following error codes may be used for this application profile.

Error code	Meaning
2110_h	Short circuit
2310_h	Current at outputs too high (overload)
2320_h	Short circuit at outputs
2330_h	Load dump at outputs
3110_h	Supply voltage too high
3120_h	Supply voltage too low
3210_h	Internal voltage too high
3220_h	Internal voltage too low
3310_h	Output voltage too high
3320_h	Output voltage too low
3330_h	Output voltage missing
$FF01_h$	Out of paper (ticket printer)
$FF02_h$	No signal (GPS, time fixing)
$FF03_h$	No radio connection (DRCC, VRCC, and DSRC)
$FF04_h$	Requested display mapping format not supported (display and ticket printer)
$FF05_h$	No announcements available (Acoustic announcement)

8 Predefinitions

8.1 Predefined communication objects

8.1.1 Object 1000_h: Device type

The object at index 1000h describes the type of device and its functionality.

31 24	23 20	19 16	15 0
Device code	**Class**	**Sub-class**	**Number of device profile: 407_d**
MSB			LSB

If the device implements only one virtual device, the additional information contains the virtual device code (8 bit), the device class code (4 bit), and the device subclass code (4 bit).

If the device codes is '0', the physical device is supporting more than only one virtual device. In this case, the object 6000h contains the codes of the all supported virtual devices.

Codes of virtual device:

code	function	class/subclass
00_h	Multiple virtual device	-
01_h	Main on-board computer	No
02_h	Identification	No
03_h	Passenger information	Yes
04_h	Ticket canceller	No
05_h	Ticket printer	No
06_h	Ticket/card reader/validators	No
07_h	Acoustic announcement	No
08_h	Acoustic control manager	No
09_h	Train bus gateway	No
$0A_h$	Vehicle gateway	No
$0B_h$	Vehicle driver information	No
$0C_h$	Tachograph	No
$0D_h$	Data radio communication control (DRCC)	No
$0E_h$	Voice radio communication control (VRCC)	No
$0F_h$	Data short range communication (DSRC)	No
10_h	Geographical positioning	No
11_h	Time fixing	No
12_h	Driver's console display	Yes
13_h	Driver's console keyboard	No
14_h	Passenger counting	Yes
15_h	Passenger counting manager	Yes
16_h	Diagnostics device	No
17_h	Generic I/O device	No
18_h	Power supply	No
$19_h..FF_h$	reserved	-

8.1.2 Object 1001_h: Error register

The device profile specific bit in the error register is reserved for future use.

8.1.3 Object 1029_h: Error behavior

This object specifies to which state the device shall be set, when a communication error or an in-vehicle network error is detected. Besides the specification given in /1/ the following sub-indexes may be implemented optionally. If the object is not implemented the device shall behave as the default values define.

0 = pre-operational (only if current state is operational)

1 = no state change

2 = stopped

Entry Description

Sub-Index	2h
Description	Internal_Device_Error
Access	rw
Entry Category	Optional
PDO Mapping	No
Value Range	0h to 2h
Default Value	0h

8.1.4 Pre-defined configurations

8.1.4.1 Minimum configuration

The minimum configuration includes following devices:

- Main on-board computer (virtual device code 01_h)
- Identification device (virtual device code 02_h)
- Passenger information (virtual device code 03_h)
  class 1: Destination indicator
  subclass 2: text
- Ticket canceller (virtual device code 04_h)

8.1.4.2 Typical configuration

The typical configuration includes following devices:

- Main on-board computer (virtual device code 01_h)
- Identification device (virtual device code 02_h)
- Passenger information (virtual device code 03_h)
  class 1: Destination indicator
  subclass 2: text
- Passenger information (virtual device code 03_h)
  class 2: Next stop indicator
  subclass 2: text
- Ticket canceller (virtual device code 04_h)
- Ticket printer (virtual device code 05_h)

8.1.4.3 Pre-defined PDOs

The following table shows the PDOs for minimum configuration (shaded areas) and for typical configuration (all areas). The PDOs shall be transmitted once after reaching the operational state and after that each change of value shall cause transmission. Event timer and inhibit timer of all TPDOs are 0 except the event timer of TPDO_1 of the main on-board computer device (defeualt value = 1 min). The transmission type of all TPDOs and RPDOs is 255. Main on-board computer and identification device shall reside on different physical devices; they are not required to reside on the same node as the NMT master.

Message No.	Main on-board comp. (01_h)	COB-ID	Identification (02_h)	Destination indicator (03_h:01_h:02_h)	Next stop indicator (03_h:02_h:02_h)	Ticket canceller (04_h)	Ticket printer (05_h)
1	**TPDO1**	181_h	-	-	-	RPDO1	RPDO1
2	**TPDO2**	381_h	-	RPDO2	-	RPDO2	RPDO2
3	**TPDO3**	401_h	-	-	RPDO4	-	RPDO4
4	**TPDO4**	481_h	-	-	-	-	RPDO5
5	**TPDO5**	501_h	-	-	-	-	RPDO6
6	RPDO2	201_h	**TPDO1**	-	-	-	-
7	RPDO3	281_h	**TPDO2**	RPDO3		RPDO3	RPDO3
8	RPDO1	301_h	**TPDO3**	RPDO1	-	-	-

The PDO mapping of the messages shall be as follows:

Message No.	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
1	610E:01_h year	610E:02_h day	610E:03_h month	610E:04_h hour	610E:05_h minute	610E:06_h second	not transmitted	
2	6110:00_h route_segment_ number		6111:00_h fare_zone	6116:00_h blocking_ of_ticket_ canceller	6108:00_h journey_ direction	610A:00h number_ of_ running_ in_route	not transmitted	
3	6109:00_h stop_point_ID				6001:01_h events_from_virtual_device			
6	610B:01-08_h line_short_representation							
7	6118:01-08_h stop_point_representation							
8	6190:00_h driver_ID				NOT TRANSMITTED			
9	6194:00_h block_ID				6192:00_h line_ID		6195:00_h journey_number	
10	6191:00_h destination_number				6193:00_h route_number		not transmitted	

8.1.5 Application-specific configuration

Application-specific configuration may include any virtual device specified in this application profile as well as any generic CANopen devices. (*Note:* The NMT master shall configure generic CANopen devices before they are switched into OPERATIONAL state in order to avoid inconsistencies regarding PDO communication and mapping parameters; alternatively the user may integrate off-line pre-configured devices).

9 Object dictionary

9.1 Overview on object dictionary entries

Each physical device compliant with this application profile specification shall share the object dictionary entries from 6000_h to $67FF_h$. These entries are common to all modules and each module only implements those objects relevant to its functions (virtual device).

The application objects are grouped so that index ranges are belonging to virtual devices. Not all objects have to be implemented in any devices to be compliant with this specification.

Index range	Object providing devices
6000_h – $60FF_h$	Physical device
6100_h – $618F_h$	Main on-board computer
6190_h – $61FF_h$	Identification
6200_h – $62FF_h$	Passenger information
6300_h – $631F_h$	Ticketing canceller
6320_h – $633F_h$	Ticket printer
6340_h – $635F_h$	Ticket/card reader/validators
6380_h – $63AF_h$	Acoustic announcer
$63B0_h$ – $63CF_h$	Acoustic control manager
6400_h – $647F_h$	Train bus gateway
6480_h – $64FF_h$	Vehicle gateway
6500_h – $651F_h$	Vehicle driver indicator
6520_h – $657F_h$	Tachograph
6600_h – $661F_h$	DRCC
6620_h – $663F_h$	VRCC
6640_h – $665F_h$	DSRC
6660_h – $667F_h$	Geographical positioning
6680_h – $669F_h$	Time fixing
$66A0_h$ – $66BF_h$	Driver’s console display
$66C0_h$ – $66DF_h$	Driver’s console keyboard
6700_h – $671F_h$	Passenger counting
6720_h – $673F_h$	Passenger counting manager
6740_h – $675F_h$	Diagnostics device
6760_h – $677F_h$	Generic I/O device
6780_h – $679F_h$	Power supply
$67FF_h$	Device type object
7000_h – $9FFF_h$	reserved for future, consult CiA

9.2 Detailed specification of object entries

9.2.1 Introduction

Object description and Entry description attributes are specified in /1/.

The CATEGORY and ENTRY CATEGORY attributes of objects indicate, if the object shall be implemented (Mandatory) or may be implemented (Optional); for detailed specifications see ***Virtual device profiles***.
The ACCESS attribute for an object is different for a device, which provides this objects by means of producer functionality (ro) or for devices which consume this object via PDO or SDO (rw). For detailed specifications see ***Virtual device profiles***.

In some entry descriptions, the VALUE RANGE definition derives from other standards. In such case, there are given references as well as the value (in brackets) for convenient reasons.

The DEFAULT VALUE attribute defines the value of an object with ACCESS attribute of the value 'ro' after power-on.

9.2.2 Complex data type definition

9.2.2.1 Record 0080_h: Fuel consumption

Index	Sub-index	fuel_consumption_record	Data type
0080_h	0_h	number_of_entries	Unsigned8
	1_h	fuel_rate	Unsigned16
	2_h	instantaneous_fuel_economy	Unsigned16
	3_h	average_fuel_economy	Unsigned16
	4_h	total_fuel_used	Unsigned32
	5_h	trip_fuel	Unsigned32
	6_h	total_idle_fuel_used	Unsigned32

9.2.2.2 Record 0081_h: Time and date

Index	Sub-index	time_and_date_record	Data type
0081_h	0_h	number_of_entries	Unsigned8
	1_h	local_hour	Signed8
	2_h	local_minute	Signed8
	3_h	year	Unsigned8
	4_h	day	Unsigned8
	5_h	month	Unsigned8
	6_h	hour	Unsigned8
	7_h	minute	Unsigned8
	8_h	second	Unsigned8

9.2.3 Objects related to the physical device

9.2.3.1 Object 6000_h: Supported virtual device types

This object indicates which virtual devices are implemented in the physical device (multiple virtual devices). The 16-bit virtual device type description is compliant to the additional information field in object 1000_h.

Object description

Index	**6000_h**
Name	supported_virtual_device_types
Object Code	ARRAY
Data Type	Unsigned16
Category	Mandatory for all multiple virtual devices

Entry description

Sub-Index	0_h
Description	number_of_supported_virtual_devices
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	virtual_device_type_1
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	Unsigned16
Default Value	No

Sub-Index	2_h
Description	virtual_device_type_2
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	Unsigned16
Default Value	No

Sub-Index	3_h
Description	virtual_device_type_3
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	Unsigned16
Default Value	No

to

Sub-Index	FE_h
Description	virtual_device_type_254
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	Unsigned16
Default Value	No

9.2.4 Object 6001_h: Events from virtual devices

This object contains state information or information on occurrence of special events from a virtual device. The capability of this object allows one physical device to include up to 32 virtual devices.

Sub Index 1 “event_at_sub” indicates every available Sub Index between 2_h and 21_h, which is not zero.

The 32-bit field format (Sub Index 1) shall be as follows:

31 ... 24	23 ... 16	15 ... 8	7 ... 0
Sub 33 ... Sub 26	Sub 25 ... Sub 18	Sub 17 ... Sub 10	Sub 9 ... Sub 2
MSB			LSB

Event flag value definition:

0 = Sub x is zero (no event)

1 = Sub x is **not** zero (at least one event)

Every available Sub Index between 2_h and 21_h provides a 4 Byte event structure for a virtual device.

The 32-bit field format shall be as follows:

31 ... 24	23 ... 8	7 ... 0
Code of virtual device	Manufacturer-specific information	Event flags
MSB		LSB

The code of virtual device corresponds directly to the additional information in object 1000_h (except code 00_h) and means the code of the event producing virtual device. Unused bits in the manufacturer specific information field shall be filled with 0. The Event flag bit field allows coding of eight independent events. Each bit represents a single event. The event definitions are given in the following tables.

Event flag value definition:

0 = event not present

1 = event pending

Passenger information device event codes

Event flag	Definition
0	State information (manufacturer-specific)
1	Display in test mode
2	Mapped information cannot be displayed
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Acoustic control manager event codes

Event flag	Definition
0	reserved
1	Driver microphone to indoor loudspeakers
2	Driver microphone to outdoor loudspeakers
3	Driver microphone to VRCC
4	Travel attendant microphone to indoor loudspeakers
5	VRCC to indoor loudspeakers
6	state information (manufacturer specific)
7	reserved

Ticket canceller event codes

Event flag	Definition
0	state information (manufacturer specific)
1	reserved
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Passenger counting event codes

Event flag	Definition
0	number of incoming or outgoing passengers more than 200
1	reserved
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Passenger counting manager event codes

Event flag	Definition
0	Close to passenger capacity limit
1	Passenger capacity warning limit
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Diagnostic event codes

Event flag	Definition
0	More than 200 entries in object 6340_h
1	Object 6340_h close to capacity limit
2	More than 200 entries in object 6342_h
3	More than 200 entries in object 6343_h
4	More than 200 entries in object 6344_h
5	reserved
6	reserved
7	reserved

Object description

Index	**6001_h**
Name	events_from_virtual_devices
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	2_h to 21_h
Default Value	No

Sub-Index	1_h
Description	event_at_sub
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned32
Default Value	0

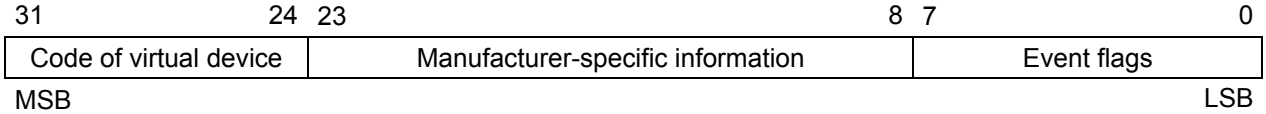
Sub-Index	2_h
Description	events_from_1st_virtual_device
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	0

to

Sub-Index	21_h
Description	Events_from_32nd_virtual_device
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	0

9.2.5 Object 6002_h: Events for virtual device

This object contains commands, state information or information on occurrence of special events for virtual devices.
The 32-bit field format shall be as follows:



The code of virtual device corresponds directly to the additional information in object 1000_h (except code 00_h) and means the code of the event consuming virtual device. Unused bits in the manufacturer-specific information shall be filled with 0. The Event flag bit field allows coding of eight independent events. Each bit represents a single event. The event definitions are given in the following tables:

Event flag value definition:

0 = event not present

1 = event pending

Tachograph event codes

Event flag	Definition
0	Reset tachograph trip distance
1	Adjust local hour offset
2	Adjust local minute offset
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Passenger Information event codes

Event flag	Definition
0	send state information
1	enter testmode
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Acoustic announcement event codes

Event flag	Definition
0	send state information
1	reserved
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Ticket canceller event codes

Event flag	Definition
0	send state information
1	reserved
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

Object description

Index	**6002_h**
Name	events_for_virtual_devices
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	no
Value Range	1_h to 20_h
Default Value	No

Sub-Index	1_h
Description	events_for_1st_virtual_device
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	No

to

Sub-Index	20_h
Description	events_for_32nd_virtual_device
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	No

9.2.6 Objects provided by main on-board computer

9.2.6.1 Object 6100_h: Vehicle ID

The vehicle ID assigned by the system designer identifies uniquely the vehicle. The ID value is application-specific and refers to the vehicle ID text object ($611C_h$).

Object description

Index	**6100_h**
Name	vehicle_ID
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned32
Default Value	0_h

9.2.6.2 Object 6101_h: Body ID

The body ID assigned by the system designer identifies uniquely the vehicle body. The ID value is application-specific and refers to the body ID text object ($611D_h$).

Object description

Index	**6101_h**
Name	body_ID
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned16
Default Value	0_h

9.2.6.3 Object 6102_h: Garage ID

The garage ID assigned by the system designed identifies uniquely the garage. The ID value is application-specific and refers to the garage ID text object ($611E_h$).

Object description

Index	**6102_h**
Name	garage_ID
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.4 Object 6103_h: Radio ID

The radio ID assigned by the system designer identifies uniquely the radio unit. It is used for selective calls (e.g. technical vehicle address, operational vehicle address, line/vehicle journey number). The ID value is application-specific and refers to the radio ID text object ($611F_h$).

Object description

Index	**6103_h**
Name	radio_ID
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned32
Default Value	0_h

9.2.6.5 Object 6104_h: Vehicle class

This object defines the class of vehicle.

0 = not used
1 = bus
2 = tram
3 = light railway
4 = trolley bus
5 to FE = application-specific

Object description

Index	**6104_h**
Name	vehicle_class
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	ro
PDO Mapping	No
Value Range	Unsigned8
Default Value	No

9.2.6.6 Object 6105_h: Number of vehicle units

This object indicates the total number of coaches including the engine vehicle.

Object description

Index	**6105_h**
Name	number_of_vehicle_units
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned8
Default Value	1_h

9.2.6.7 Object 6106_h: Driver schedule number

This object contains a number for the driver to know his operation for this day. The number is application-specific and refers to the driver schedule number text object (6122_h). The value of 0 means no driver schedule is assigned.

Object description

Index	**6106_h**
Name	driver_schedule_number
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned32
Default Value	0_h

9.2.6.8 Object 6107_h: Route destination ID

The route destination ID assigned by the system designer identifies uniquely the route destination. The ID value is application-specific and refers to the route destination ID text object (6121_h). An ID value of 0 means no route destination is assigned.

Object description

Index	**6107_h**
Name	route_destination_ID
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned32
Default Value	0_h

9.2.6.9 Object 6108_h: Journey direction

This is the direction of a journey. The following values shall apply:
0_h = no direction specified
1_h = forward
2_h = backward
3_h to $7F_h$ = reserved for future use
80_h to FF_h = manufacturer-specific

Object description

Index	**6108_h**
Name	journey_direction
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	1_h

9.2.6.10 Object 6109_h: Stop point ID

The stop point ID assigned by the system designer identifies uniquely a stop point. The ID value is application-specific and refers the stop point ID text object (6120_h).

Object description

Index	**6109_h**
Name	stop_point_ID
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned32
Default Value	0_h

9.2.6.11 Object $610A_h$: Number of running in route representation

This is the running stop point number within a route. The number value is application-specific.

Object description

Index	**$610A_h$**
Name	number_of_running_in_route_representation
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	1 to 255
Default Value	1_h

9.2.6.12 Object $610B_h$: Line short representation

This object is a unique, short textual description of a line (e.g. *U8*, *S34*, *MITRY*, etc.) Each 8-bit field contains one 8-bit coded ASCII character. Unused characters shall be of the value 0. This object may be indicated to the driver and/or the passengers. The driver can choose the line by using this textual description.

Object description

Index	**$610B_h$**
Name	line_short_representation
Object Code	ARRAY
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_characters
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 8_h
Default Value	No

Sub-Index	1_h
Description	character_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0

Sub-Index	2_h
Description	character_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0

to

Sub-Index	8_h
Description	character_8
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0

9.2.6.13 Object $610C_h$: Text line/route description

This object contains detailed plain textual descriptions of a line or route; for example: "<Station 1> – <Station n>" or "<Station abbreviation 1> - <Station abbreviation 2> - <Station abbreviation 3> - <Station abbreviation n>". Writing a text into this object will not effect directly a change on any passenger information device. The display mapping object (6203_h) is used to control the passenger information update.

Object description

Index	**$610C_h$**
Name	text_line/route_description
Object Code	ARRAY
Data Type	Octet_String128
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	text_line/route_description_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

Sub-Index	2_h
Description	text_line/route_description_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

to

Sub-Index	FE_h
Description	text_line/route_description_FE
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

9.2.6.14 Object $610D_h$: Text of destination

This object contains plain textual descriptions of destinations. Writing a text into this object will not effect directly a change on any passenger information device. The display mapping object (6203_h) is used to control the passenger information update.

Object description

Index	**$610D_h$**
Name	text_of_destination
Object Code	ARRAY
Data Type	Octet_String128
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	text_of_destination_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

Sub-Index	2_h
Description	text_of_destination_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

to

Sub-Index	FE_h
Description	text_of_destination_255
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

9.2.6.15 Object $610E_h$: Local time and date

This object provides the local time and date. The value ranges for the different objects are specified as follows (FF_h means, local time and date values are invalid):

Object name	Lower value limit	Upper value limit	Value/bit
Year	1985	2235	1 year (offset 0)
Day	0,25	31,75	0,25 days (offset 0)
Month	1	12	1 month (offset 0)
Hour	0	23	1 hour (offset 0)
Minute	0	59	1 minute (offset 0)
Second	0	59,75	0,25 second (offset 0)

Object description

Index	**$610E_h$**
Name	local_time_and_date
Object Code	ARRAY
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	6_h
Default Value	6_h

Sub-Index	1_h
Description	year
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	see above
Default Value	FF_h

Sub-Index	2_h
Description	day
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	see above
Default Value	FF_h

Sub-Index	3_h
Description	month
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	see above
Default Value	FF_h

Sub-Index	4_h
Description	hour
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	see above
Default Value	FF_h

Sub-Index	5_h
Description	minute
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	see above
Default Value	FF_h

Sub-Index	6_h
Description	second
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	see above
Default Value	No

9.2.6.16 Object $610F_h$: Time standby

This object defines the device's "power off" delay in minutes. The timer starts by detecting "ignition off" and is stopped by "ignition on". If the timer expires, the device's power is automatically switched off.

Object description

Index	**610F$_h$**
Name	time_standby
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	0 to 15_d
Default Value	10_d

9.2.6.17 Object 6110$_h$: Route segment number

The route segment number indicates a set of consecutive links on a given route. The value is application-specific and it is mostly used for fare collection purposes.

Object description

Index	**6110$_h$**
Name	route_segment_number
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned16
Default Value	0_h

9.2.6.18 Object 6111$_h$: Fare zone

This object indicates the current number of fare zone.

Object description

Index	**6111$_h$**
Name	fare_zone
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0_h

9.2.6.19 Object 6112$_h$: Text of stop point

This object contains plain textual description of the name of current or next stop point. Writing a text into this Object will not effect directly a change on any passenger information device.

The display mapping object (6203_h) is used to control the passenger information update.

Object description

Index	**6112_h**
Name	text_of_stop_point_x
Object Code	ARRAY
Data Type	Octet_String128
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	text_of_stop_point_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

Sub-Index	2_h
Description	text_of_destination_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

to

Sub-Index	FE_h
Description	text_of_destination_255
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String128
Default Value	No

9.2.6.20 Object 6113_h: Previous route segment

This object indicates the number of previous route segment (see object 6110_h), The value is application-specific.

Object description

Index	**6113_h**
Name	previous_route_segment
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned16
Default Value	No

9.2.6.21 Object 6114_h: Previous fare zone

The number indicates the previous fare zone after changing to the current fare zone.

Object description

Index	**6114_h**
Name	previous_fare_zone
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned8
Default Value	0_h

9.2.6.22 Object 6115_h: Scheduled time and date

This object indicates the scheduled local time and date for the current vehicle position. The value ranges for the different fields are specified in the following table

Field name	**Lower value limit**	**Upper value limit**	**Value/bit**
Year	1985	2235	1 year (offset 0)
Day	0,25	31,75	0,25 days (offset 0)
Month	1	12	1 month (offset 0)
Hour	0	23	1 hour (offset 0)
Minute	0	59	1 minute (offset 0)
Second	0	59,75	0,25 second (offset 0)

(1) local time offset to GMT (2) local minute offset

Object description

Index	**6115_h**
Name	scheduled_time_and_date
Object Code	ARRAY
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	6_h
Default Value	6_h

Sub-Index	1_h
Description	year
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

Sub-Index	2_h
Description	day
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

Sub-Index	3_h
Description	month
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

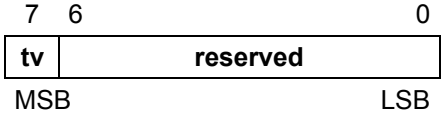
Sub-Index	4_h
Description	hour
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

Sub-Index	5_h
Description	minute
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

Sub-Index	6_h
Description	second
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

9.2.6.23 Object 6116_h: Blocking of ticket canceller

With this object ticket canceller may be temporarily blocked.



tv = 0: ticket validator in operation
tv = 1: ticket validator blocked

Object description

Index0	**6116_h**
Name	blocking_of_ticket_canceller
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0_h

9.2.6.24 Object 6117_h: Traffic light priority request

This object indicates a request for traffic light priority.
0 to FE_h = application-specific priority levels
FF_h = no or lowest priority level

Object description

Index	**6117_h**
Name	traffic_light_priority_request
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	FF_h

9.2.6.25 Object 6118_h: Stop point short representation

This object is an alphanumeric token as a stop point description. Each 8-bit field contains one 8-bit coded ASCII character. Unused characters shall be of the value 0.

Object description

Index	**6118_h**
Name	stop_point_short_representation
Object Code	ARRAY
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_characters
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 8_h
Default Value	No

Sub-Index	1_h
Description	character_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0

Sub-Index	2_h
Description	character_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0

to

Sub-Index	8_h
Description	character_8
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned8
Default Value	0

9.2.6.26 Object 6119_h: Inside temperature

This object contains the cabin temperature in 0.1 degrees Celsius/bit.

Object description

Index	**6119_h**
Name	inside_temperature
Object Code	VAR
Data Type	Signed16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	-1000 .. 1000
Default Value	No

9.2.6.27 Object $611A_h$: Car mileage

This object provides the accumulated distance traveled. The value is given in 5 m per bit with an offset of 0 meter.

Object description

Index	**$611A_h$**
Name	car_mileage
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See ISO 16844-7
Default Value	See ISO 16844-7

(1) 0 to 21,055,406 km; (2) 0 km

9.2.6.28 Object $611B_h$: Car mileage calibration information

This object contains the precision of the mileage measurement in 5 m per bit, mandatory if object $611A_h$ is implemented. The value of $FFFF_h$ means precision is unknown.

Object description

Index	**$611B_h$**
Name	car_mileage_calibration_information
Object Code	VAR
Data Type	Unsigned16
Category	Conditional: If object $611A_h$ is implemented

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned16
Default Value	$FFFF_h$

9.2.6.29 Object 611C$_h$: Vehicle ID text

This object contains the textual description of the vehicle identification (see object 6100$_h$).

Object description

Index	**611C$_h$**
Name	vehicle_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0$_h$
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.30 Object 611D$_h$: Body ID text

This object contains the textual description of the body identification (see object 6101$_h$).

Object description

Index	**611D$_h$**
Name	body_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0$_h$
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.31 Object 611E$_h$: Garage ID text

This object contains the textual description of the garage identification (see object 6102$_h$).

Object description

Index	**611E$_h$**
Name	garage_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0$_h$
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.32 Object 611F$_h$: Radio ID text

This object contains the textual description of the radio identification (see object 6103$_h$).

Object description

Index	**611F$_h$**
Name	radio_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0$_h$
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.33 Object 6120$_h$: Stop point ID text

This object contains the textual description of the stop point identification (see object 6109$_h$).

Object description

Index	**6120$_h$**
Name	stop_point_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0$_h$
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.34 Object 6121$_h$: Route destination ID text

This object contains the textual description of the route destination identification (see object 6107$_h$).

Object description

Index	**6121$_h$**
Name	route_destination_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0$_h$
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.35 Object 6122_h: Driver schedule number text

This object contains the textual description of the driver schedule number (see object 6106_h).

Object description

Index	**6122_h**
Name	driver_schedule_number_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.6.36 Object 6123_h: Vehicle speed

This object provides the vehicle speed in 1/256 km/h per bit (positive value for forward as well as backward speed). The value derived from one or more vehicle speed sources (object 6481_h: wheel-based vehicle speed, object 6520_h: tachograph speed, or object 6662: GPS speed). If more than one speed source is available, some data fusion mechanism may be used (e.g. average) in order to get one single speed value.

Object description

Index	**6123_h**
Name	vehicle_speed
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	0 to $FFFF_h$ (1)
Default Value	No

(1) 0 to 255.996 km/h

9.2.7 Objects provided by identification device

9.2.7.1 Object 6190_h: Driver ID

This object contains the identification of the current driver. The ID value is application-specific and shall refer to the tachograph driver identification (object 6524_h) and may refer to driver ID text (object 6198_h).

Object description

Index	**6190_h**
Name	driver_ID
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	Unsigned32
Default Value	0_h

9.2.7.2 Object 6191_h: Destination number

This number is reference to the line destination. The number value is application-specific.

Object description

Index	**6191_h**
Name	destination_number
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned32
Default Value	0_h

9.2.7.3 Object 6192_h: Line ID

The line ID assigned by the system designer identifies uniquely a line. The ID value is application-specific and refers to the line ID text object (6196_h).

Object description

Index	**6192_h**
Name	line_ID
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	Unsigned16
Default Value	0_h

9.2.7.4 Object 6193_h: Route number

The route with a certain number defines the sequence of stops from a line. The number value is application-specific.

Object description

Index	**6193_h**
Name	route_number
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default for typical configuration
Value Range	Unsigned16
Default Value	0_h

9.2.7.5 Object 6194_h: Block ID

The block ID assigned uniquely by the system designer identifies uniquely the block. The ID value is application-specific and refers to the block ID text object (6197_h).

Object description

Index	**6194_h**
Name	block_ID
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	Unsigned32
Default Value	0_h

9.2.7.6 Object 6195_h: Journey number

This number refers to a journey (between one terminal to another terminal) related to given time or time-table. The number value is application-specific; the value of ‘0’ indicates a non-service journey.

Object description

Index	**6195_h**
Name	journey_number
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Default
Value Range	Unsigned16
Default Value	0_h

9.2.7.7 Object 6196_h: Line ID text

This object contains the textual description of the line identification.

Object description

Index	**6196_h**
Name	line_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.7.8 Object 6197_h: Block ID text

This object contains the textual description of the block identification.

Object description

Index	**6197_h**
Name	block_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.7.9 Object 6198_h: Driver ID text

This object contains the textual description of the driver ID.

Object description

Index	**6198_h**
Name	driver_ID_text
Object Code	VAR
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.8 Objects provided to passenger information device

9.2.8.1 Object 6200_h: XML text

This object contains 1 to 254 XML files or segments usually for complex displays. Writing a file or a segment into this object will not currently effect a change on any passenger information device. The display mapping object (6203_h) is used to control the passenger information update.
The size of every supported Sub-Index (except Sub-Index 0) depends on the display capabilities.
In order to reduce the quantity of data transmissions, it is possible to split up XML files into segments. Each segment of a XML file shall use a separate sub-index.

Object description

Index	**6200_h**
Name	XML_text
Object Code	ARRAY
Data Type	Visible_String
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1h to FE_h
Default Value	No

Sub-Index	1_h
Description	XML_file_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	no
Value Range	Visible_String
Default Value	No

Sub-Index	2_h
Description	XML_file_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Visible_String
Default Value	No

to

Sub-Index	FE_h
Description	XML_file_254
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Visible_String
Default Value	No

9.2.8.2 Object 6201_h: Special character files

This object contains 1 to 254 files, each file of them describes a special character. This object allows changing or modifying the set of special characters.
The size of each supported Sub-Index (except Sub-Index 0) depends on the display capabilities.

Object description

Index	**6201_h**
Name	special_character_files
Object Code	ARRAY
Data Type	Domain
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	special_character_file_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Domain
Default Value	No

Sub-Index	2_h
Description	special_character_file_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Domain
Default Value	No

to

Sub-Index	FE_h
Description	special_character_file_254
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Domain
Default Value	No

9.2.8.3 Object 6202_h: Referenced files for XML files

This object contains 1 to 254 reference files e.g. JPEG or GIF files for XML files. Writing a reference file into this object will not lead to an immediate change on any passenger information device. The display mapping object (6203_h) is used to control the passenger information update.

Object description

Index	**6202_h**
Name	referenced_files_for_XML_files
Object Code	ARRAY
Data Type	Domain
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	reference_file_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Domain
Default Value	No

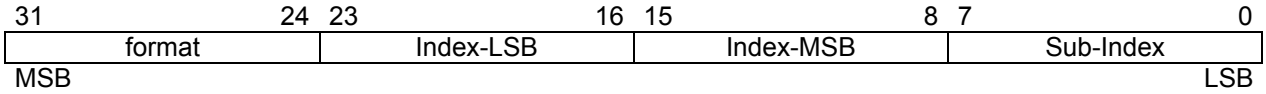
Sub-Index	2_h
Description	reference_file_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Domain
Default Value	No

to

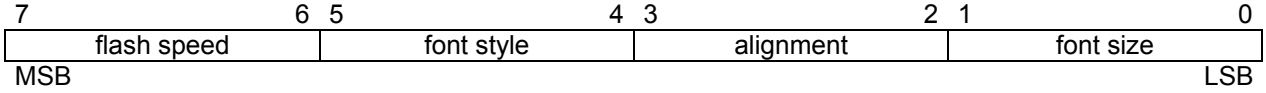
Sub-Index	FE_h
Description	reference_file_254
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Domain
Default Value	No

9.2.8.4 Object 6203_h: Display mapping

This object is used to assemble display information. A display information will be described by their complete object address.
The 32-bit field format shall be as follows:



The entries Index-LSB, Index-MSB and Sub-Index corresponds directly to the multiplexor ”m”, known from the SDO Protocol.
The Byte ”format” allows modifying the display mode. In case the text itself includes formatting tags, the „format“ shall be set to zero.



Value definitions:

flash speed	**font style**	**alignment**	**font size**
0 = no flash mode	0 = no mode	0 = no mode	0 = no mode
1 = slow	1 = regular	1 = align left	1 = small
2 = medium	2 = bold	2 = center	2 = regular
3 = fast	3 = scrolling from left	3 = align right	3 = large

The display layout depends on the sequence of entries in the mapping object. Sub-index 2 will be displayed at the upper left position of the display. Following display information will be displayed more right and/or in the next line.
The display device is responsible for a correct display layout. That is why the display device is allowed to ignore a format statement or the sequence rule.
Writing the index/sub-index of a text object into this object will not effect a change on any passenger information device
In order to cause an update of the display device actualize sub index 1. The value of the least significant byte of sub index 1 incates the number of mapped objects to be displayed. (Starting at sub index 2 and the following without gaps). The function of the other 3 bytes of sub index 1 are manufacturer-specific.

Object description

Index	**6203_h**
Name	display_mapping
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

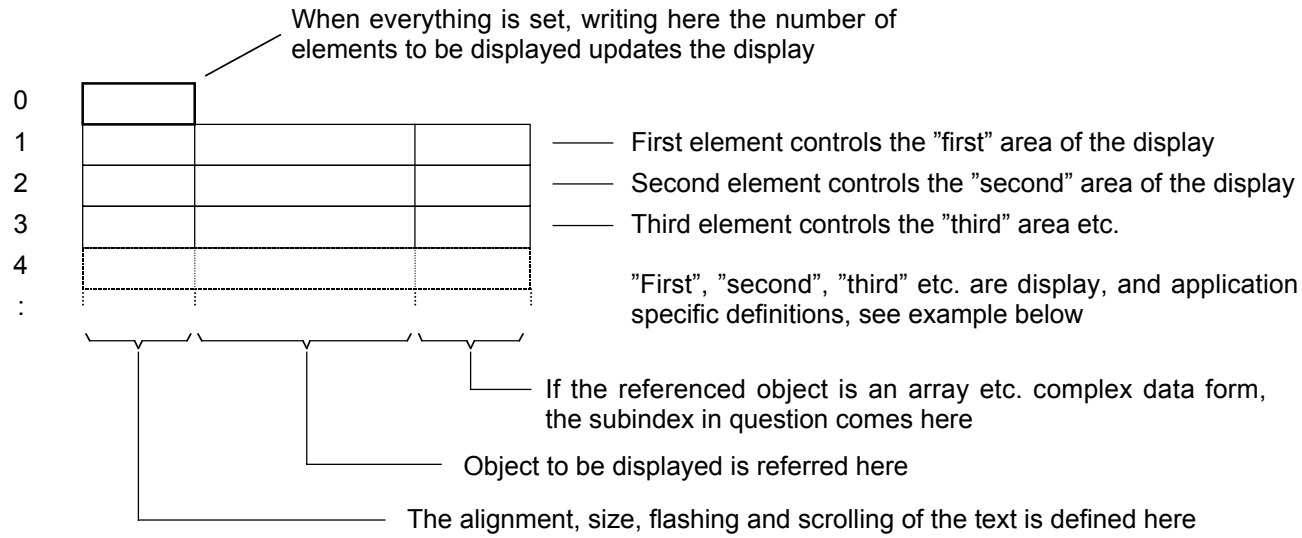
Sub-Index	1_h
Description	display_update
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	see below

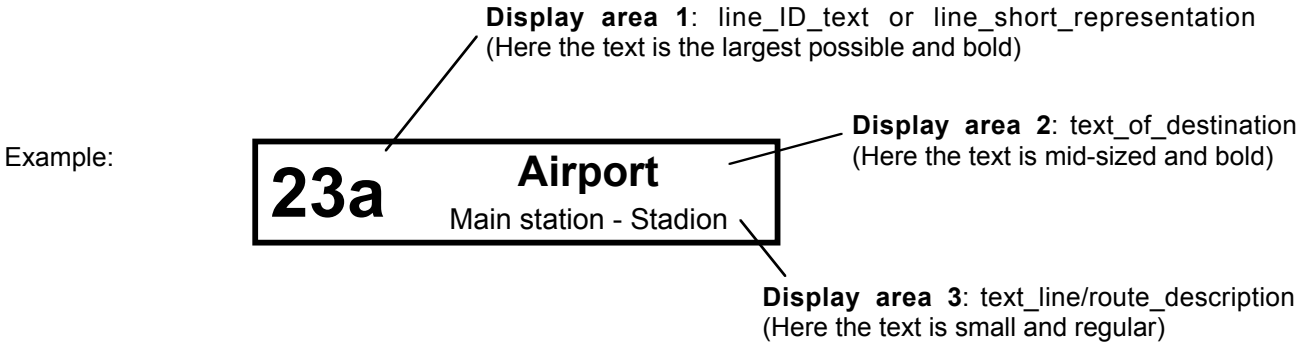
Sub-Index	2_h
Description	mapped_object_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	see below

Sub-Index	3_h
Description	mapped_object_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	see below

to

Sub-Index	FE_h
Description	mapped_object_253
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned32
Default Value	No





Note: In the typical configuration sub-index 1 defines the format for the text_line/route_description object ($610C_h$); sub-index 2 defines the format for the text_of_stop_point object (6112_h).

9.2.8.5 Object 6204_h: Bus stop request

This object indicates that there is a request to stop the vehicle at next station. The driver or a passenger may activate the request. The following shall be applied:

TRUE = bus stop requested
FALSE = bus stop not requested

Object description

Index	**6204_h**
Name	bus_stop_request
Object Code	VAR
Data Type	Boolean
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Boolean
Default Value	FALSE

9.2.8.6 Object 6205h: Character Set

This object is used to select a character set at a display device. The default character set is the 7 Bit ASCII-Code. Additional character sets are listed from Sub Index 2. Sub Index 1 contains the selected character set. This object relates to the information of the objects 610Ch, 610Dh and 6112h (plain text objects).

Object description

Index	**6205_h**
Name	character_set
Object Code	ARRAY
Data Type	Unsigned16
Category	Mandatory

Entry description

Sub-Index	0h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1h to FEh
Default Value	No

Sub-Index	1h
Description	selected_ character_set
Entry Category	Mandatory
Access	rw
PDO Mapping	No
Value Range	see table
Default Value	0

Sub-Index	2h
Description	1st additional available character set
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	see table
Default Value	No

to

Sub-Index	FEh
Description	253rd additional available character set
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	see table
Default Value	No

Predefined character sets

Value	character set	Comment
0	ISO 646-US (7-bit US-ASCII, /13/)	default
1	ISO 8859-1 (/14/)	optional
2	ISO 8859-2 (/15/)	optional
:	:	optional
Fh	ISO 8859-15 (/26/)	optional
10h to 7FFFh	reserved	
8000h to FFFFh	manufacturer specific character sets	optional

9.2.9 Objects provided by ticket canceller

No application objects provided.

9.2.10 Objects provided by ticket printer

No application objects provided.

9.2.11 Objects provided by ticket/card reader/validator

No application objects provided.

9.2.12 Objects provided by acoustic announcer

No application objects provided.

9.2.13 Objects provided by acoustic control manager

No application objects provided.

9.2.14 Objects provided by train bus gateway

No application objects provided.

9.2.15 Objects provided by vehicle gateway

9.2.15.1 Object 6481_h: Wheel based vehicle speed

This object provides the speed of motion in 1/256 km/h per bit (positive value for forward as well as backward speed). It is compliant to ISO 11992-3 and ISO 16844-7.

Object description

Index	**6481_h**
Name	wheel_based_vehicle_speed
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See ISO 16844-7 (1)
Default Value	No

(1) 0 to 250.996 km/h

9.2.15.2 Object 6482_h: Vehicle mileage

This object contains the sum of moved meters. The value is given in 5 m per bit. This object is compliant to ISO 16844-7.

Object description

Index	**6482_h**
Name	vehicle_mileage
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See ISO 16844-7 (1)
Default Value	0

(1) 0 to 21,055,406 km

9.2.15.3 Object 6483_h: Vehicle mileage precision

This object contains the precision of the mileage measurement in 5 m per bit. The value of $FFFF_h$ means precision is unknown.

Object description

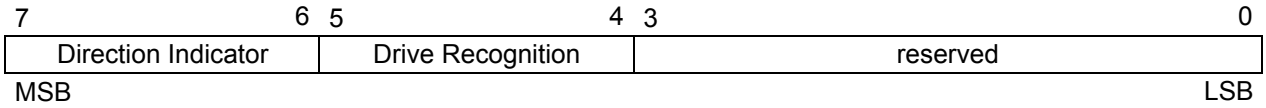
Index	**6483_h**
Name	vehicle_mileage_precision
Object Code	VAR
Data Type	Unsigned16
Category	Conditional: If object 6482_h is implemented

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	optional
Value Range	Unsigned16
Default Value	$FFFF_h$

9.2.15.4 Object 6484_h: Drive flag and direction flag

This object provides drive recognition and direction indication. Motion is recognized when more than 1 plus per second is detected from the motion sensor for at least 5 seconds. The following definitions shall apply:



Direction indicator:
00 = forward
01 = reverse
10 = error
11 = not available

Drive recognition:
00 = no motion detected
01 = motion detected
10 = error
11 = not available

Object description

Index	**6484_h**
Name	drive_flag_and_direction_flag
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See above
Default Value	No

9.2.15.5 Object 6486_h: Compass bearing

This object contains the measured (e.g. by a compass) heading of the vehicle in 1/128 degrees per bit. It is compliant to SAE J1939/71.

Object description

Index	**6486_h**
Name	compass_bearing
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71 (1)
Default Value	No

(1) 0 to $64{,}256_d$ (equivalent to 502 degrees)

9.2.15.6 Object 6487_h: Compass bearing precision

This object contains the precision of direction measurement. One bit corresponds to 1/128 degrees. The value of $FFFF_h$ means the precision is unknown.

Object description

Index	**6487_h**
Name	compass_bearing_precision
Object Code	VAR
Data Type	Unsigned16
Category	Conditional: If object 6486_h is implemented

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	$FFFF_h$

9.2.15.7 Object 6488_h: State of doors

This object indicates the current state of cabin doors. The 8-bit fields are structured as follows:

general_state

7 0

Bit 7	Bit6	Bit5	reserved

MSB LSB

Bit 7: 0 = all valid doors closed 1 = at least one door open
Bit 6: 0 = left side doors blocked 1 = left side doors released
Bit 5: 0 = right side doors blocked 1 = right side doors released

specific_state

7 0

Bit 7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

MSB LSB

Bit 7: 0 = door N closed 1 = door N open
Bit 6: 0 = door N invalid 1 = door N valid
Bit 5: 0 = door N+1 closed 1 = door N+1 open
Bit 4: 0 = door N+1 invalid 1 = door N+1 valid
Bit 3: 0 = door N+2 closed 1 = door N+2 open
Bit 2: 0 = door N+2 invalid 1 = door N+2 valid
Bit 1: 0 = door N+3 closed 1 = door N+3 open
Bit 0: 0 = door N+3 invalid 1 = door N+3 valid

Object description

Index	**$6488F_h$**
Name	state_of_door
Object Code	ARRAY
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	Number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	general_state
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	2_h
Description	specific_state_1_to_4
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	3_h
Description	specific_state_5_to_8
Entry Categroy	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

to

Sub-Index	FE_h
Description	specific_state_1009_to_1012
Entry Categroy	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

9.2.15.8 Object 6489_h: Ambient air temperature

This object contains the ambient air temperature with a resolution of 0.03125 degrees Celsius per bit. The object is compliant to SAE J1939/71.

Object description

Index	**6489_h**
Name	ambient_air_temperature
Object Code	VAR
Data Type	Signed16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See SAE J1939/71 (1)
Default Value	No

(1) -273 to 1735.0

9.2.15.9 Object $648A_h$: Fuel economy

Fuel consumption of the vehicle engine measured in different ways:

- *Sub-index 1_h:* Amount of fuel consumed by engine per unit of time (fuel_rate) measured in 0.05 l/h per bit with a value range of 0 to 32.12.75 l/h
- *Sub-index 2_h:* Current fuel economy at current vehicle (instantaneous_fuel_economy) measured in 1/512 km/l per bit with a value range of 0 to 125.5 km/l
- *Sub-index 3_h:* Average of instantaneous fuel economy for that segment of vehicle operation of interest (average_fuel_economy) measured in 1/512 km/l per bit with a value range of 0 to 125,5 km/l
- *Sub-index 4_h:* Accumulated amount of fuel used during vehicle operation (total_fuel_used) measured in 0.5 l per bit with a value range of 0 to 2,105,540,607.5 l
- *Sub-index 5_h:* Fuel consumed during all or part of a journey (trip_fuel) measured in 0.5 l per bit with a value range of 0 to 2,105,540,607.5 l
- *Sub-index 6_h:* Accumulated amount of fuel used during vehicle operation while under idle conditions (total_idle_fuel_used) measured in 0.5 l per bit with a value range of 0 to 2,105,540,607.5 l
- *Sub-index 7_h:* Accumulated amount of fuel used during vehicle operation (total_fuel_used) measured in 0.5 l per bit with a value range of 0 to 2,105,540,608 l

Object description

Index	**$648A_h$**
Name	fuel_economy
Object Code	Record
Data Type	fuel_consumption (80_h)
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 7_h
Default Value	No

Sub-Index	1_h
Description	fuel_rate
Data Type	Unsigned16
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71
Default Value	No

Sub-Index	2_h
Description	instantaneous_fuel_economy
Data Type	Unsigned16
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71
Default Value	No

Sub-Index	3_h
Description	average _fuel_economy
Data Type	Unsigned16
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71
Default Value	No

Sub-Index	4_h
Description	total_fuel_used
Data Type	Unsigned32
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71
Default Value	No

Sub-Index	5_h
Description	trip_fuel
Data Type	Unsigned32
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71
Default Value	No

Sub-Index	6_h
Description	total_idle_fuel_used
Data Type	Unsigned32
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see SAE J1939/71
Default Value	No

9.2.15.10 Object $648B_h$: Brake switch

Switch signal, which indicates that the brake pedal is being pressed.

Bit 7	Bit 6	Bit 5 to Bit 0 (reserved)

Value definition

Bit 7	Bit 6	Function
0	0	Brake pedal released
0	1	Brake pedal depressed
1	0	Error
1	1	Information not available

Object description

Index	**$648B_h$**
Name	brake_switch
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see above
Default Value	No

9.2.15.11 Object $648C_h$: Engine coolant temperature

This object provides temperature of liquid found in engine cooling system in 1°C per bit with a value range of -40 to +210°C. Offset shall be -40°C. The object is compliant to SAE J1939/71.

Object description

Index	**$648C_h$**
Name	engine_coolant_temperature
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See SAE J1939/71
Default Value	No

9.2.15.12 Object $648D_h$: Operation times

This object provides several operation times:

- *Sub-index 1_h:* Accumulated time of operation of engine while under idle conditions (total_idle_hours) measured in 0.05 h per bit with a value range of 0 to 210,554,060.75h
- *Sub-index 2_h:* Accumulated time of operation of vehicle (total_vehicle_hours) measured in 0.05 h per bit with a value range of 0 to 210,554,060.75h
- *Sub-index 3_h:* Accumulated time of operation of engine (total_engine_hours) measured in 0.05 h per bit with a value range of 0 to 210,554,060.75h
- *Sub-index 4_h:* Accumulated time of operation of power takeoff device (total_power_takeoff_hours) measured in 0.05 h per bit with a value range of 0 to 210,554,060.75h

Object description

Index	**$648D_h$**
Name	operation_times
Object Code	ARRAY
Data Type	Unsinged32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 4_h
Default Value	No

Sub-Index	1_h
Description	total_idle_hours
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See SAE J1939/71
Default Value	No

Sub-Index	2_h
Description	total_vehicle_hours
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See SAE J1939/71
Default Value	No

Sub-Index	3_h
Description	total_engine_hours
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See SAE J1939/71
Default Value	No

Sub-Index	4_h
Description	total_power_takeoff_hours
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See SAE J1939/71
Default Value	No

9.2.16 Objects provided by vehicle driver information

No application objects provided.

9.2.17 Objects provided by tachograph

9.2.17.1 Object 6520_h: Tachograph speed

This object provides the speed of motion in 1/256 km/h per bit (positive value for forward as well as backward speed). It is compliant to ISO 16844-7. The precision of the value is ±1 km/h (0.277 m/s).

Object description

Index	**6520_h**
Name	tachograph_speed
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

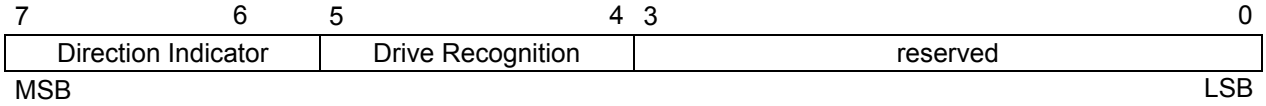
Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See ISO 16844-7 (1)
Default Value	No

(1) 0 to 64000_d (250,996 km/h)

9.2.17.2 Object 6521_h: Drive recognition and direction indication

This object provides drive recognition and direction indication. Motion is recognized when more than 1 pulse per second is detected from the motion sensor for at least 5 seconds. The following definitions shall apply and are compliant to ISO 16844-7:



Direction indicator: 00 = forward
01 = reverse

Drive recognition: 00 = no motion detected
01 = motion detected

Object description

Index	**6521_h**
Name	drive_recognition_and_direction_indication
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See above
Default Value	No

9.2.17.3 Object 6522_h: High resolution vehicle distance

This object provides the accumulated distance traveled by the vehicle during its operation (total vehicle distance), and the distance traveled during all or a part of a journey (trip distance). Both values are given in 5 meter per bit; precision is 1% of 1 km (10 m). They are compliant to ISO 16844.

Object description

Index	**6522_h**
Name	high_resolution_vehicle_distance
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 2_h
Default Value	No

Sub-Index	1_h
Description	total_vehicle_distance
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See ISO 16844-7 (1)
Default Value	No

Sub-Index	2_h
Description	trip_distance
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See ISO 16844-7 (1)
Default Value	No

(1) 0 to 21,055,406 km

9.2.17.4 Object 6523_h: Tachograph time and date

This object provides time and date in UTC format. The value ranges for the different sub-objects are specified in the following table, they are compliant to ISO 16844-7:

Object name	Lower value limit	Upper value limit	Value/bit
Local Hour (1)	-23	+23	1 hour (offset –125)
Local Minute (2)	-59	+59	1 minute (offset –125)
Year	1985	2235	1 year (offset 0)
Day	0,25	31,75	0,25 days (offset 0)
Month	1	12	1 month (offset 0)
Hour	0	23	1 hour (offset 0)
Minute	0	59	1 minute (offset 0)
Second	0	59,75	0,25 second (offset 0)

(1) local time offset to GMT (2) local minute offset

Object description

Index	**6523_h**
Name	tachograph_time_and_date
Object Code	RECORD
Data Type	time_and_date (81_h)
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	8_h
Default Value	8_h

Sub-Index	1_h
Description	local_hour
Data Type	Signed8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	0_h

Sub-Index	2_h
Description	local_minute
Data Type	Signed8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	0_h

Sub-Index	3_h
Description	year
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	4_h
Description	day
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	5_h
Description	month
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	6_h
Description	hour
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	7_h
Description	minute
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	8_h
Description	minute
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

9.2.17.5 Object 6524_h: Tachograph driver ID

This object identifies driver 1 and driver 2. Each identifier is made of 3 byte indicating the issuing member state of the driver card and 16 byte containing the card number according to the EU tachograph regulation. This is compliant to ISO 16844. There are two slots where the driver card shall be inserted.

Object description

Index	**6524_h**
Name	tachograph_driver_ID
Object Code	ARRAY
Data Type	Visible_String19
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	Mandatory
Value Range	2_h
Default Value	2_h

Sub-Index	1_h
Description	driver_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	See ISO 16844-7
Default Value	No

Sub-Index	2_h
Description	driver_2
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	See ISO 16844-7
Default Value	No

9.2.17.6 Object 6525_h: Continuous driving time

This object provides the continuous driving time for driver 1 and driver 2. These times are computed as current accumulated driving times. The resolution is 1 min per bit. This is compliant to ISO 16844.

Object description

Index	**6525_h**
Name	continuous_driving_time
Object Code	ARRAY
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	Mandatory
Value Range	2_h
Default Value	2_h

Sub-Index	1_h
Description	driver_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	No

Sub-Index	2_h
Description	driver_2
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	No

9.2.18 Objects provided by DRCC

No application objects are provided.

9.2.19 Objects provided by VRCC

No application objects are provided.

9.2.20 Objects provided by DSRC

No application objects are provided.

9.2.21 Objects provided by geographical positioning device

9.2.21.1 Object 6660_h: Position

This object contains the current position of the vehicle. Longitude and latitude angel are specified as follows and are compliant to SAE J1939/71:

Byte 3	Byte 2	Byte 1	Byte 0
longitude angel *Resolution:* 10^{-7} degree/bit *Offset:* -210 degrees *Range:* -210 degrees (WEST) to +211.108122 degrees (EAST)			
MSB			LSB

Byte 3	Byte 2	Byte 1	Byte 0
latitude angel *Resolution:* 10^{-7} degree/bit *Offset:* -210 degrees *Range:* -210 degrees (SOUTH) to +211.108122 degrees (NORTH)			
MSB			LSB

Object description

Index	**6660_h**
Name	position
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Description	Mandatory
Access	ro
PDO Mapping	No
Value Range	2_h
Default Value	2_h

Sub-Index	1_h
Description	latitude
Entry Description	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See above
Default Value	No

Sub-Index	2_h
Description	longitude
Entry Description	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See above
Default Value	No

9.2.21.2 Object 6661_h: Position precision

This object contains the precision of position measurement in 1 m per bit. The value of FF_h means precision is unknown.

Object description

Index	**$631F_h$**
Name	position_precision
Object Code	VAR
Data Type	Unsigned8
Category	Conditional: if object 6660_h is implemented

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned8
Default Value	FF_h

9.2.21.3 Object 6662_h: GPS based speed

This object provides the speed of motion in 0.1 m/s per bit produced from GPS data.

Object description

Index	**6662_h**
Name	GPS_based_speed
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	No

9.2.21.4 Object 6663_h: GPS based heading

This object contains the heading of the vehicle derived from GPS data. This format is the same as in SAE J1939/71. The value is given in 1/128 degrees per bit.

Object description

Index	**6663_h**
Name	GPS_based_heading
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	See SAE J1939 (1)
Default Value	No

(1) 64,256 to 65,535 (corresponding to 0 .. 502 degrees)

9.2.21.5 Object 6664_h: GPS mileage

This object contains the sum of moved meters. The value is given in 5 m per bit.

Object description

Index	**6664_h**
Name	GPS_mileage
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	see ISO 16844 (1)
Default Value	0_h

(1) 0 to 21,055,406 km

9.2.21.6 Object 6665_h: GPS mileage precision

This object contains the precision of the Mileage measurement in meters, mandatory if object 6329_h is implemented. The value of $FFFF_h$ means precision is unknown.

Object description

Index	**6665_h**
Name	GPS_mileage_precision
Object Code	VAR
Data Type	Unsigned16
Category	Conditional: If object 6329_h is implemented

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned16
Default Value	$FFFF_h$

9.2.22 Objects provided by time fixing device

9.2.22.1 Object 6680_h: Time universal reference

This object provides time and date in UTC format. It shall be used in conjunction with the actual measured geographical position, speed (over ground) and direction (of movement). The value ranges for the different sub-objects are specified in the following table:

Object name	Lower value limit	Upper value limit	Value/Bit
Local hour (1)	-23	+23	1 hour (offset –125)
Local minute (2)	-59	+59	1 minute (offset –125)
Year	1985	2235	1 year (offset 0)
Day	0,25	31,75	0,25 days (offset 0)
Month	1	12	1 month (offset 0)
Hour	0	23	1 hour (offset 0)
Minute	0	59	1 minute (offset 0)
Second	0	59,75	0,25 second (offset 0)

(1) local time offset to GMT (2) local minute offset

Object description

Index	**6680_h**
Name	time_universal_reference
Object Code	RECORD
Data Type	time_and_date (81_h)
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	8_h
Default Value	8_h

Sub-Index	1_h
Description	local_hour
Data Type	Signed8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	0_h

Sub-Index	2_h
Description	local_minute
Data Type	Signed8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	0_h

Sub-Index	3_h
Description	year
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	4_h
Description	day
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	5_h
Description	month
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	6_h
Description	hour
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	7_h
Description	minute
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

Sub-Index	8_h
Description	minute
Data Type	Unsigned8
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	See table
Default Value	No

9.2.23 Objects provided by driver's console display

No application objects are provided.

9.2.24 Objects provided by driver's console keyboard

9.2.24.1 Object $66C0_h$: Flag direction forward selection

This object indicates the driver's selection of vehicle motion direction.

Value definition

TRUE = reverse gear not engaged
FALSE = reverse gear engaged

Object description

Index	**$66C0_h$**
Name	flag_direction_forward_selection
Object Code	VAR
Data Type	Boolean
Category	see ***Virtual device profiles***

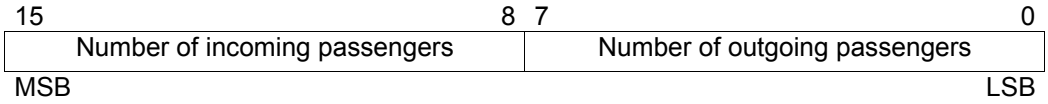
Entry description

Sub-Index	0h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Boolean
Default Value	TRUE

9.2.25 Objects provided by passenger counter

9.2.25.1 Object 6700_h: Passenger counting in and out per door

This object contains the counting result of incoming and outgoing passengers of a door area. The structure of the 16-bit field shall be as follows:



Object description

Index	**6700_h**
Name	passenger_counting_in_and_out_per_door
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub_Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	0_h

9.2.26 Objects provided by passenger counting manager

9.2.26.1 Object 6720_h: Passenger counting manager data

This object provides transparent data.

Object description

Index	**6720_h**
Name	passenger_counting_manager_data
Object Code	VAR
Data Type	Domain
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.26.2 Object 6721_h: Total in/out passenger counting value

This object contains the counting result of incoming and outgoing passengers per car. The number of incoming and outgoing passengers is given as 16-bit value.

Object description

Index	**6721_h**
Name	total_in_out_passenger_counting_value
Object Code	ARRAY
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_entries
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	2_h
Default Value	2_h

Sub-Index	1_h
Description	number_incoming_passengers
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned16
Default Value	0_h

Sub-Index	2_h
Description	number_outgoing_passengers
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Unsigned16
Default Value	0_h

9.2.26.3 Object 6722_h: Counter passenger sum

This object contains the number of current on-board passengers in one car.

Object description

Index	**6722_h**
Name	counter_passenger_sum
Object Code	VAR
Data Type	Unsigned16
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned16
Default Value	0_h

9.2.26.4 Object 6723_h: Passenger capacity usage

This object indicates the percent of used capacity in 1% steps.

Object description

Index	**6723_h**
Name	passenger_capacity_usage
Object Code	VAR
Data Type	Unsigned8
Category	see ***Virtual device profiles***

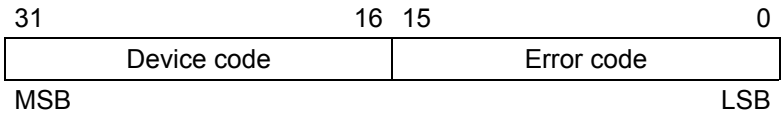
Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned8
Default Value	0_h

9.2.27 Objects provided by diagnostics device

9.2.27.1 Object 6740_h: Short diagnostic error field

This object contains the history of device errors and of error input information. The diagnostic device gets the error messages from external sensors, error input lines and in some cases via external bus systems. An error message transmission will be the exception. In this case, it is necessary to perform a peer-to-peer PDO or SDO communication between the diagnostic device and each reproting device. Transmitted error messages shall be written to sub index 1.
The following procedure describes the handling of this object:
1. The entry at sub-index 0 contains the number of actual errors that are recorded in the Array starting at sub-index 1.
2. Every new error shall be stored at sub-Index 1, the older ones shall move down the list.
3. Writing a „0“ to sub-index 0 deletes the entire error history. Values higher than 0 are not allowed to write. This shall lead to an abort message (error code: 0609 0030_h).
The 32-bit field format shall be as follows:



The 16-bit device code includes all necessary information for the device identification. The 16-bit error code allows distinguishing 65,535 errors. The device codes and the error code may differ between systems. That is why it should be able at least for the manufacturer to configure the codes.
In case of serious error, an Emergency message should be transmitted.

Object description

Index	**6740_h**
Name	short_diagnostic_error_field
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_errors
Entry Category	Mandatory
Access	rw
PDO Mapping	optional
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	short_error_field_1
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	Unsigned32
Default Value	No

Sub-Index	2_h
Description	short_error_field_2
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	Unsigned32
Default Value	No

to

Sub-Index	FE_h
Description	short_error_field_254
Entry Category	Optional
Access	ro
PDO Mapping	No
Value Range	Unsigned32
Default Value	No

9.2.27.2 Object 6741_h: Extended diagnostic message file

This file contains all diagnostic messages that have occurred since the last erasure. The diagnostic device gets the error messages from external sensors, error input lines and in some cases via external bus systems. This file shall not be transmitted by PDO communication. The admissible values of data are the range of the 7-bit coded ASCII characters. The extended diagnostic message file should be line oriented. Every line should be closed with „line feed – carriage return".
Writing a „0" to sub-index 0 deletes the extended diagnostic message file. Values higher than 0 are not allowed to write. This shall lead to an abort message (error code: 0609 0030_h).

Object description

Index	**6741_h**
Name	extended_diagnostic_message_file
Object Code	VAR
Data Type	Domain
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	No
Default Value	No

9.2.27.3 Object 6742_h: Extended diagnostic message: Error class 1

This object contains all error class 1 diagnostic messages. The diagnostic device gets the error messages from external sensors, error input lines and in some cases via external bus systems. An error message transmission will be the exception. In this case, it is necessary to perform a peer-to-peer PDO or SDO communication between the diagnostic device and each reproting device. Transmitted error messages shall be written to sub index 1. The admissible values of data are the range of the 7-bit coded ASCII characters. Messages shorter than 64 characters shall be filled with zeros.
The entry at sub-index 0 contains the number of actual errors that are recorded in the Array starting at sub-index 1. Every new error is stored after the last valid entry.
Writing a '0' to sub-index 0 deletes all read entries, gaps are closed. Writing a '1' to sub-index 0 deletes all entries. Values higher than 1 are not allowed to write. This shall lead to an abort message (error code: 0609 0030_h).

Object description

Index	**6742_h**
Name	error_class_1_messages
Object Code	ARRAY
Data Type	Octet_String64
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_messages
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	message_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

Sub-Index	2_h
Description	message_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

to

Sub-Index	FE_h
Description	message_254
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

9.2.27.4 Object 6743_h: Extended diagnostic message: Error class 2

This object contains all error class 2 diagnostic messages. The diagnostic device gets the error messages from external sensors, error input lines and in some cases via external bus systems. An error message transmission will be the exception. In this case, it is necessary to perform a peer-to-peer PDO or SDO communication between the diagnostic device and each reproting device. Transmitted error messages shall be written to sub index 1. The admissible values of data are the range of the 7-bit coded ASCII characters. Messages shorter than 64 characters shall be filled with zeros.
The entry at sub-index 0 contains the number of actual errors that are recorded in the Array starting at sub-index 1. Every new error is stored after the last valid entry.
Writing a ‘0’ to sub-index 0 deletes all read entries, gaps are closed. Writing a ‘1’ to sub-index 0 deletes all entries. Values higher than 1 are not allowed to write. This shall lead to an abort message (error code: 0609 0030_h).

Object description

Index	**6743_h**
Name	error_class_2_messages
Object Code	ARRAY
Data Type	Octet_String64
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_messages
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	message_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

Sub-Index	2_h
Description	message_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

to

Sub-Index	FE_h
Description	message_254
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

9.2.27.5 Object 6744_h: Extended diagnostic message: Error class 3

This object contains all error class 3 diagnostic messages. The diagnostic device gets the error messages from external sensors, error input lines and in some cases via external bus systems. An error message transmission will be the exception. In this case, it is necessary to perform a peer-to-peer PDO or SDO communication between the diagnostic device and each reproting device. Transmitted error messages shall be written to sub index 1. The admissible values of data are the range of the 7-bit coded ASCII characters. Messages shorter than 64 characters shall be filled with zeros.
The entry at sub-index 0 contains the number of actual errors that are recorded in the Array starting at sub-index 1. Every new error is stored after the last valid entry.
Writing a ‘0’ to sub-index 0 deletes all read entries, gaps are closed. Writing a ‘1’ to sub-index 0 deletes all entries. Values higher than 1 are not allowed to write. This shall lead to an abort message (error code: 0609 0030_h).

Object description

Index	**6744_h**
Name	error_class_3_messages
Object Code	ARRAY
Data Type	Octet_String64
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_messages
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to FE_h
Default Value	No

Sub-Index	1_h
Description	message_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

Sub-Index	2_h
Description	message_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

to

Sub-Index	FE_h
Description	message_254
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	No
Value Range	Octet_String64
Default Value	No

9.2.28 Objects provided by generic I/O device

9.2.28.1 Object 6760_h: Digital input

This object reads a group of up to 32 simple digital inputs.

Object description

Index	**6760_h**
Name	digital_input
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	ro
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	No

9.2.28.2 Object 6761_h: Digital output

This object writes a group of up to 32 simple digital outputs.

Object description

Index	**6761_h**
Name	digital_output
Object Code	VAR
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Access	rw
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	0_h

9.2.28.3 Object 6762_h: Analogue input

This object reads up to 4 groups of up to 2 simple analogue inputs. The following structure shall be applied:

31 16	15 0
Channel 1 (Bit 31 is sign)	Channel 2 (Bit 15 is sign)
MSB	LSB

Object description

Index	**6762_h**
Name	analogue_input
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_input_groups
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 4_h
Default Value	No

Sub-Index	1_h
Description	input_group_1
Entry Category	Mandatory
Access	ro
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	No

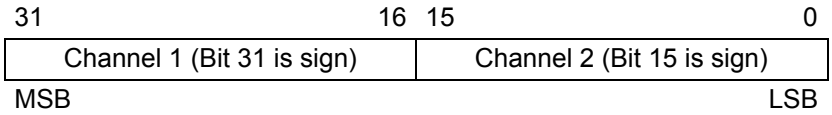
Sub-Index	2_h
Description	input_group_2
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	No

to

Sub-Index	4_h
Description	input_group_4
Entry Category	Optional
Access	ro
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	No

9.2.28.4 Object 6763_h: Analogue output

This object writes up to 4 groups of up to 2 simple analogue outputs. The following structure shall be applied:



Object description

Index	**6763_h**
Name	analogue_output
Object Code	ARRAY
Data Type	Unsigned32
Category	see ***Virtual device profiles***

Entry description

Sub-Index	0_h
Description	number_of_output_groups
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	1_h to 4_h
Default Value	No

Sub-Index	1_h
Description	output_group_1
Entry Category	Mandatory
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	0_h

Sub-Index	2_h
Description	output_group_2
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	0_h

to

Sub-Index	4_h
Description	output_group_4
Entry Category	Optional
Access	see ***Virtual device profiles***
PDO Mapping	Optional
Value Range	Unsigned32
Default Value	0_h

9.2.29 Objects provided by power supply

No application objects provided.

9.2.30 General objects

9.2.30.1 Object $67FF_h$: Device type

This object shall describe the first device in a multiple device module according to /1/.