
VDV-Schrift

301-2-12
01/2023

**IBIS-IP Beschreibung der Dienste /
Service description**

VideoRecordingService - V2.4

Gesamtbearbeitung

Ausschuss für Telematik und Informationssysteme (ATI)

Gefördert durch:



Bundesministerium
für Wirtschaft
und Technologie

aufgrund eines Beschlusses
des Deutschen Bundestages

IBIS-IP Beschreibung der Dienste / Service description

VideoRecordingService - V2.4

Gesamtbearbeitung

Unterausschuss für Telematik (UA-Telematik)

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Vorwort

Diese VDV-Schrift wurde aus der VDV-301-2 separiert, um Anpassungen an einzelnen IBIS-IP-Diensten unabhängig von anderen IBIS-IP-Diensten vornehmen zu können.

In der VDV-301-2 werden die technischen Grundlagen wie auch die Basisdienste, welche die Grundlagen eines IBIS-IP-Systems bilden, beschrieben. Die VDV-Schrift 301-2-12 beschreibt den Video Aufzeichnungsdienst. Für eine allgemeine Einführung in die Videodienste sei auf VDV301-2-11 verwiesen.

Dieser Dienst VDV301-2-12 ist kompatibel zu VDV301 Version 1.0 und 2.x.

Foreword

This VDV-requirement document has been separated from the VDV-301-2 in order to make adjustments to individual IBIS IP services independent from other IBIS IP services.

The technical basics as well as the basic services of the IBIS-IP systems are described in the VDV-301-2. The VDV 301-2-12 describes the video recording services. For a general description of video services please refer to VDV301-2-11.

This service VDV301-2-12 is compliant to VDV301 version 1.0 as well as 2.x.

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Abkürzungen / Abbreviations

CCTV	Closed Circuit Television (video system)
CVCU	Central Video Control Unit
ERM	Event Recording Mode (alarm/emergency recordings)
GPI	General Purpose Input (digital input)
HTTP	Hyper Text Transfer Protocol
H26x	Naming of several types of video codecs
IBIS	Integriertes Bordinformationssystem/Integrated on-board information system (on-board communication protocol)
IP	Internet Protocol
RRM	Ring Recording Mode (normal ring buffer recordings)
RTP	Real Time Protocol
RTSP	Real Time Streaming Protocol
SOA	Server Oriented Architecture
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
VDV	Verband Deutscher Verkehrsunternehmen e. V./Association of German Transport Companies
VDV301	IBIS-IP (also IBIS over IP or IBIS-IP) specification
VDV300	IBIS (analogue) specification
VS	Video stream

1 VideoRecording Service

1.1 Funktionen und Aufgaben des Dienstes *VideoRecordingService*

Der **VideoRecordingService** ist einer von mehreren IBIS-IP Videodiensten:



Figure 3: IBIS-IP Videofunktionsgruppen und Dienste

Bei Fahrzeugen für den öffentlichen Verkehr ist die Anzeige der Bilddaten von Innen- und Außenkameras erforderlich. Eine korrekte Darstellung und Aufzeichnung von Videobildern und / oder Bildern erfordern Informationen über die Formate, in denen die Videodaten von den verfügbaren Bildquellen im IBIS-IP-System bereitgestellt werden. Das Format umfasst Parameter wie Dimensionen (Höhe, Breite), die Videocodierung (z.B. H.264, Motion JPEG), das unterstützte Protokoll (z.B. RTSP / RTP) und Informationen zur Adressierung.

Aufgaben des **VideoRecordingService** sind:

- Steuerung der Aufnahme von mehreren Bildquellen zur Speichereinheit
- Umschalten des Aufnahmemodus von "RingRecording Mode (RRM)" auf "Event Recording Mode (ERM)" und zurück
- Pausieren / Neustarten der Aufnahmen von einer oder mehreren Bildquellen

Der **VideoRecordingService** bietet folgende Funktionen:

- Bereitstellung von Operationen für die Start / Stopp-Aufnahme von Video- / Bilddaten aus Bildquellen (Kameras)
- Bei Bedarf kann der Service Bilddaten aus Bildquellen digitalisieren und codieren
- Bei Bedarf kann der Dienst zusätzliche Daten und Informationen aufzeichnen, die sich auf die Videoaufzeichnungen beziehen (z. B. GNSS-Navigationsdaten, Fahrzeugstau und Diagnoseinformationen, Temperatur, Beschleunigungsdaten des Fahrzeugs, Diagnosedaten von S.M.A.R.T. aus Speichereinheiten und vieles mehr)

Der Dienst kann in einer separaten CVCU implementiert werden, die eine Anwendung hostet und andere Dienste als VideoRecordingService (z. B. den Touchscreen-Monitor als Datensinke oder Videoaufzeichnungseinheit) verwendet.

1 VideoRecording Service

1.1 Functions and Tasks of the Service *VideoRecordingService*

The **VideoRecordingService** is one of several IBIS-IP video services:



Figure 1: IBIS-IP video functional groups and services

In vehicles for public transport, the display of the image data from interior and exterior cameras is required. A correct representation and recording of video images and/or pictures require information about the formats in which the video data are provided by the available image sources within the IBIS-IP system. The format includes parameters such as dimensions (height, width), the video encoding (eg, H.264, Motion JPEG), the supported protocol (eg, RTSP / RTP) and information for addressing.

The tasks of the service **VideoRecordingService** are:

- Control the recording from several picture sources to storage unit
- Switching recording mode from “**RingRecording Mode (RRM)**” to “**Event Recording Mode (ERM)**” and back
- Pausing/restarting the recordings from one or more picture sources

The service **VideoRecordingService** provides the following functions:

- Provision of operations for start/stop recording of video/image data from picture sources (cameras)
- If required, the service can digitize and encode image data from picture sources
- If required, the service can record additional data and information which are related to the video recordings (e.g. GNSS navigation data, vehicle status and diagnostic information, temperature, acceleration data of the vehicle, S.M.A.R.T. diagnostic data from storage units and much more)

The service can be implemented in a separate CVCU, which hosts an application and uses other services as **VideoRecordingService** (e.g. touch screen monitor as data sink or a Video Recording Unit).

2 Specification

2.1 Overview

The **VideoRecordingService** has no information regarding the picture sources (cameras) which are available in IBIS-IP system. Furthermore it neither has information about the type of cameras nor the video parameters (e.g. video codec, frame rate, dimension of the picture) of the video streams. These parameters are provided by the **VideoLiveService** which will provide information regarding:

- Current available picture sources in the vehicle/IBIS-IP structure
- Belonging technical information (camera type, frame rate, URL (IP network cameras), stream ID, camera name and other)

The **VideoRecordingService** will be started by the **SystemManagementService** by use of the service-start operation of **DeviceManagementService** (of the specific video device) and name of the service.

Note: Some IP network cameras provide password protection feature. To get access to the video stream/pictures of such a camera the correct login data must be available and must be used. If the login data does not match, the camera declines the access and the pictures/video streams can not be obtained.

2.1.1 Identification of **VideoRecordingService**

According to VDV 301 v1.0 each of video service is identifiable within the IBIS-IP structure:

Subject identification:

- Service Name
- IBIS-IP version
- Device Type
- Device ID

Technical identification:

- system-wide unique IP address or system-wide unique DNS name
- device on which the service runs
- Service name,
- Ports and Path (optional), under which the service is accessible

Each device connected to the IBIS-IP network is configured with an IPv4 address and can be addressed by this address in the IBIS-IP network. The announcement of individual video services (by service name) will be realized as defined in accordance to VDV301 via DNS-SD.

For data transmission protocols TCP, UDP, HTTP will be used. Beyond these protocols the Real Time Protocol (RTP) and Real Time Streaming Protocol (RTSP) are used for transmission of video data in realtime (refer to *VideoLiveService* specification).

Note: IP network cameras can provide one or more streams in parallel – these streams can have several and different profiles (parameters as resolution, frame rate etc.). This depends on the configuration, model and manufacturer of the IP-network camera.

2.2 Architecture

Within a vehicle several systems may exist which offer and/or use the video services for several purposes:

VideoRecordingService

... for recording video images from picture sources and/or request stored video images.

VideoDisplayService

... for display of video images from specific sources and/or a combination of several image sources from more than one image source and/or combination of image sources and additional information on one screen (OSD). The information can be: camera names, date/time information, navigation system information or other data.

VideoLiveService

... for request of real time video streams from picture sources.

The ***VideoRecordingService*** may be implemented in an on-board system on demand. But it is recommended to implement it in a CVCU unit which can control/preprocess the video data from the picture sources (cameras) and manage video archives and start/stop behavior of the recording unit.

2.3 Configuration of video system components

The configuration of video devices and/or video applications is not part of the IBIS-IP video services. The configuration of sources will be realized either by the image source itselfs (e.g. configuration of network camera) or by a CVCU.

2.4 Common Services

2.4.1 *DeviceManagementService* and Error Handling

The video services will be started and monitored by ***SystemManagementService*** and ***DeviceManagementService***. Any device that hosts a video application, implements the service ***DeviceManagementService***, including its operations. Refer to Section 9.3.1 operations of the device management service from VDV301-2 [2].

Each unit announces the device type, device ID and the available services to the the ***DeviceManagementService***, so that these information can be provided within IBIS-IP architecture.

Errors on the video device will be signaled with by ***GetDeviceStatus*** and associated ***SubscribeDeviceStatus***. By ***DeactivateDevice*** the video services can be terminated so that a voltage shutdown may not damage the disks and storage media (only for ***VideoRecordingService***).

2.4.2 System start/stop procedure and power management

This service provides operations for recording control. The system behavior for all services at the start of the IBIS-IP system is identical and follows this sequence:

- On any device on which a video service will be implemented the ***DeviceManagementService*** must be implemented (only once) and must be started automatically while startup of the unit.
- After start of ***DeviceManagementService*** the video service publicates itself via DNS SD to known in the IBIS-IP system.
- To start the display of images on a screen/monitor automatically after the start of the IBIS-IP system the operations for services of ***DeviceManagementService*** will be used (StartService, StopService)
- The operations of the ***VideoRecordingService*** can now be used as required
- To stop and/or restart the ***VideoRecordingService*** the operations of ***DeviceManagementService***.

The behavior of *VideoRecordingService* differs in comparison to other services in one point:

As described above this service can be started by the IBIS-IP ***SystemManagementService*** via calling of service-start operation of the ***DeviceManagementService*** of the video unit which implements the ***VideoRecordingService***.

In comparison to other on-board systems there are situations where the CCTV system must stay/be in operation even if other on-board units and/or the complete IBIS-IP system are not in operation. The reason is that a CCTV system – depending on the specific needs of the customer– shall record images/pictures from cameras even if the vehicle is switched off. That means the ignition/boot up signal is OFF and other on-board systems are (or will) shut down [refer to use cases UC_005, UC_006].

2.4.2.1 Power management of vehicle

The CCTV system of the vehicle is connected directly to the battery of the vehicle and is controlled via the ignition signal (road vehicles)/ start up/shut down signal (rail) of the vehicle. The power management of the vehicle is independent from IBIS-IP system. This constellation ensures that video images can be recorded even in situations where ignition/start up signal is switched off but the customer wants to record video data.

Most important aspect is that the CCTV system must keep recording in mode “**Event Recording Mode ERM**” even if the driver switches off the vehicle and pulls out the control key. In this case usually the IBIS-IP gets the trigger information to shut down – in the end this will lead to the situation that the VideoRecording Service will be stopped. In order to prevent the CCTV system from stopping the event recording in such critical situation it is necessary to keep the CCTV system in recording mode **ERM**.

Note: Hence the video system needs to be controlled (start up/shut down) by use of two separate modes which shall be implemented as configuration parameter in the configuration of the CVCU:

StartStopMode = “CVCU” – Primary controlling by CVCU and its configuration settings

If this parameter is set in the CVCU configuration the CVCU starts the recording automatically and without any dependency from IBIS-IP system components (CVCU settings control the CVCU behavior primary, IBIS-IP VideoRecordingService operations/commands are considered secondary). Because other on-board may need more time than the CVCU to boot up it is recommended to start the recording of video pictures automatically without explicit calling of the start operation of *VideoRecordingService*. This “AUTO-START” behaviour shall be part of the CVCU application. This mechanism ensures that video pictures from the cameras are recorded even if other IBIS-IP units take longer time for initialization or an IBIS-IP system component fails.

The *VideoRecordingService* can and will be started anyway. If the IBIS-IP system tries to call the start recording function of the service the service will respond a message/indication that the recording has started yet. The records can be stopped by operation StopRecordings.

StartStopMode = “IBIS-IP” Primary controlling via IBIS-IP system

If this option is used the recording function of the CVCU is controlled by the IBIS-IP system (primary) and its services/units (SystemManagementService). The CVCU starts up the recording functionality automatically (via internal business logic) and without explicit calling of an operation of service ***VideoRecordingService***. The recordings will stop immediately after calling of the stop operation of the VideoRecordingService.

The CVCU starts normally (and automatically) in mode **RRM**. If the recording function is not activated automatically (due to a system fault or another problem) the operation ***StartRingRecording*** must be executed explicitly for start of the recording in recording mode **RRM**.



The primary controller ***StartStopMode*** option shall be configurable via CVCU. It is highly recommended to implement this parameter and function into the CVCU configuration/application/firmware.



If the CVCU **shall be integrated and controlled primary by the IBIS-IP system** the default Start/Stop Mode in the CVCU configuration shall be set ***StartStopMode* = *StartStopMode* = "IBIS-IP"** – refer also to use case UC_008.

If the CVCU **shall be integrated into the IBIS-IP system and the customer must consider specific rules/regulations of data safety/security** the default Start/Stop Mode in the CVCU configuration shall be set to ***StartStopMode* = "CVCU"**.

To get these values back as response to calling of an operation it shall be implemented into the business logic of the CVCU.

2.4.2.2 Stop of recordings and shutdown behaviour

By execution of the operation **StopRecording** the IBIS-IP system sends the command to stop all current recordings. The physically shutdown of the CVCU can not be controlled via IBIS-IP (in this version) and will be managed via ignition/boot up/shut down signal of the vehicle.

As described in chapter 2.4.2 there can be a critical situation where a stop of recordings in **ERM** or **RRM** must be avoided. Depending of the CVCU configuration (**StartStopMode = "CVCU"** or **StartStopMode = "IBIS-IP"**) the CVCU will react in different ways:

StartStopMode = "CVCU"

The CVBS recognizes the stop command and will consider the current status/recording mode as well as the CVCU internal configuration parameters and settings for the recordings. In both recording modes **RRM/ERM** the CVCU considers configured settings/parameters (e.g. follow-up time for event/alarm recordings or normal recordings and keeps recording until a specified follow-up time has been elapsed.

The CVCU responds according to the description of the operation as described in the tables below. After the follow-up time has been elapsed the CVCU stops the records and indicates the change of current state. If the service has been subscribed the state change will be recognized within the IBIS-IP system.

In this mode the CCTV system will only stop the recordings if:

- Ignition bootup/shut down signal is switched OFF, and
- a configured follow-up time is elapsed, and

StartStopMode = "IBIS-IP"

The behavior of the CVCU is completely controlled by the IBIS-IP system. The CVCU recognizes the stop command and will not consider any CVCU internal configuration parameters, neither the current status/recording mode nor settings for follow-up times for normal ring recording or event/alarm recordings. The CVCU stops immediately all recordings (even current alarm recordings), replies the related response structure (refer to description in tables below) and indicates the change of state in the IBIS-IP system.



If the operation *StopRecordings* is executed and the CVCU records in mode ERM the CVUC shall stop the alarm recordings and switch to recording mode RRM automatically to ensure that the recordings are not completely stopped.

2.4.2.3 Behaviour at call of operation ForceStopRecordings:

In some situations the stop of the recordings must be forced due to specific regulations/guide lines/procedures at customers. Especially in the field of maintenance and or commissioning it is expressly desired to stop recordings. To fulfill such requirements [refer also to Uses Case UC_010] the recordings can be stopped immediately by the operation **ForceStopRecordings**.



The operation *ForceStopRecordings* shall only be used in specific situations (maintenance/commissioning/testing). Avoid the use of this operation for normal operation! This operation forces the CVCU to stop all recordings without consideration of configured StartStopMode and/or any other settings in the business logic of the unit.

Please note that all recordings are stopped after successful execution of this operation. The CVCU does not start the recordings in mode RRM automatically!

2.4.2.4 Shut down behavior of the CVCU

The CVCU will (physically) shut down if the trigger signal is not present anymore and any configured follow-up times are elapsed. A forced shutdown of the unit via IBIS-IP command is not possible and must be triggered by switching OFF the battery power of the vehicle.

2.5 Operations of VideoRecordingService

Before describing the operations in detail some explanations regarding the recording modes and storage archives must be given:

The organization, configuration and structure of the video archives on the storage device (CVCU or an external storage device (e.g. a Network Attached Storage NAS)) is not in scope of the *VideoRecordingService*. This must be managed by the business logic/application of the video unit itself. For further explanations it is assumed that the CVCU provides an internal storage device (Hard Disc Drive HDD and/or Solid State Disc SSD) and an appropriate file structure with archives for recording in two separate modes:

Ring Recording Mode (RRM):

By use of this recording mode the video data will be stored into ring buffers/archives which will be overwritten continuously and automatically. The time frame for overwriting can be configured in demand in the CVCU application/configuration according to the customer needs. For every image source (camera) a specific ring archive is organized and provided by the CVCU. This type of recording is also known as "Black-box recording".

Event Recording Mode, alarms/alerts (ERM):

By use of this recording mode the video data will be also stored into buffers/archives which will not be overwritten automatically. These data are protected against overwriting because they are interesting for further analysis (investigations of crimes). The time for overwriting can be configured manually in demand in the CVCU application/configuration according to the customer needs.



Note: The handling/management of overwriting, erasing, and/or further processing of the recorded video data is not part of this video service and shall be provided by the Business logic/firmware/application/configuration of the CVCU.

A CCTV system for on-board applications operates in full automatic mode. The management of archives is task of the CVCU application and its internal business logic. A monitoring of fill levels of the ring buffers/archives is not necessary because these archives are naturally always full (100%). The archives for alarm/event recordings shall be protected against automatical overwriting – in the end these archives could be full which prevents the CVCU from recording of further video material in mode ERM. To check the fill level of alarm archives the Service offers a possibility to check this.

Pre-alarm and post-alarm recordings shall be part of the business logic and the archive management of the CVCU and are not in scope of this service. The configuration of recording profiles are also part of the business logic and configuration/application of the CVCU (e.g. in mode **RRM** recording with frame rate of 6 frames per second (fps), in mode **ERM** recording with framerate of 12 or more fps).

The following table lists all available operations of **VideoRecordingService** :

Operation	Req./Resp.	Beschreibung
StartRecordingRRM (Ring Recording Mode)	Req.	-
	Resp.	VideoRecordingService.VideoRecordingStateResponseStructure
StartRecordingERM (Event Recording Mode, alarm)	Req.	-
	Resp.	VideoRecordingService.VideoRecordingStateResponseStructure
PauseRecordingRRM (Pauses recordings in RRM)	Req.	VideoRecordingService.PauseRecordingRRMRequestStruture
	Resp.	VideoRecordingService.VideoRecordingStateResponseStructure
StopRecording (Stop recording in dependence of the StartStopMode which is configured in the CVCU)	Req.	-
	Resp.	VideoRecordingService.VideoRecordingStateResponseStructure
ForceStopRecording (Force to stop all recordings)	Req.	-
	Resp.	VideoRecordingService.VideoRecordingStateResponseStructure
GetVideoRecordingState	Req.	-
	Resp.	VideoRecordingService.VideoRecordingStateResponseStructure
SubscribeVideoRecordingState	Req.	SubscribeRequestStructure
	Resp.	SubscribeResponseStructure
UnsubscribeVideoRecordingState	Req.	UnsubscribeRequestStructure
	Resp.	UnsubscribeResponseStructure

Table 1: Operations of IBIS-IP VideoRecordingService

In the next chapter the operations including their data structures are described. For a quick and easy implementation of the service this proposal considers only one data structure for responses.

2.5.1 Data structure of operation *StartRecordingRRM*

By execution of this operation the recordings from all configured (CVCU configuration) image sources will be started, the unit starts in record mode **RRM**. If the CVCU is in mode **ERM**, the CVCU will react depending on the configured parameter for **Start/Stop mode** (“IBIS-IP” or “CVCU”) in the following way:

Start/Stop mode “CVCU”:

The CVCU will consider the parameters of own configuration set. If any follow-up time for alarm recording is configured the CVCU will stay in alarm/record mode until the follow-up time has been elapsed. After this time the CVCU will stop the alarm recordings and change recording mode from **ERM** into **RRM**. If more than one command has been sent to the CVCU the commands will be managed in LIFO (Last In First Out) order. Only the last command will be executed by the CVCU and all other commands will be discarded and ignored.

Start/Stop “IBIS-IP”:

The CVCU will not consider the parameters of own configuration set and will change the recording mode immediately from **ERM** to mode **RRM**.

2.5.1.1 Request

No additional data must be given by execution of operation *StartRecordingRRM*.

2.5.1.2 Response

The response of this operation is a data structure which provides state information, fill level details and error information (the responded state shall be “RRM”):

<i>VideoRecordingService.VideoRecordingStateResponse</i>				+Structure	Response data structure for operation <i>StartRecordingRRM</i>
	a	VideoRecordingState	-1:1	+VideoRecordingState	Structure for describing a video recording state)
	b	OperationErrorMessage		IBIS-IP.string	Error messages as provided by the CVCU and/or other storage device.

Table 2: Description of response structure *VideoRecordingService.VideoRecordingStateResponse*

<i>VideoRecordingStateStructure</i>				+Structure	Request data structure for operation <i>PauseRecordingRRM</i>
		State	1:1	+VideoRecordingStateEnumeration	Current states of recording system: RRM – Ring Recording Mode ERM – Event Recording Mode (alarms, alerts) RRMFUT – Follow Up Time in mode RRM ERMFUT – Follow Up Time in mode ERM OFF – Recordings stopped PAUSE – pause mode of recordings (Ring, RRM)

		AlarmArchiveFillLevel	0:1	<i>IBIS-IP.int</i>	Current level of archives for event/alarm recordings (recordings in mode ERM) in percent (%)
		StartStopMode	0:1	<i>+RecordingSystemStartStopModeEnumeration</i>	The current configuration value for start/stop behavior of the CVCU in IBIS-IP system.

Table 3: Description of VideoRecordingStateStructure

Indication of state of video recording

The current status of video recording (CVCU) is provided by **VideoRecordingStateEnumeration**:

Enumeration	Values	Description
VideoRecordingStateEnumeration	RRM	RingRecordingMode : The CVCU records the video material into the ring buffer archives which will be overwritten continuously and automatically. This is the normal Black-Box recording procedure.
	ERM	EventRecordingMode : The CVCU records the video material into the alarm buffer archives which will be not be overwritten continuously and automatically. This is a specific Black-Box recording procedure.
	RRMFUT	RingRecordingModeFollowUpTime : The CVCU is still in mode RRM, records the video material into ring buffer archives. A follow-up time is configured and active. The CVCU will record until this time is elapsed and stop the recording after this time automatically.
	ERMFUT	EventRecordingModeFollowUpTime : The CVCU is still in mode ERM, records the video material into alarm buffer archives. A follow-up time for event recordings is configured and active. The CVCU will record until this time is elapsed and stop the recording after this time automatically.
	OFF	All recordings are stopped, Recordings will NOT start automatically again
	PAUSE	All recordings are paused, Recordings will start automatically after specified time interval

Table 4: Description of VideoRecordingStateEnumeration

Indication of start/stop mode behavior configured in the CVCU

The start/stop mode behavior which is configured in the CVCU is provided by **RecordingSystemStartStopModeEnumeration**:

Enumeration	Values	Description
RecordingSystemStartStopModeEnumeration	IBIS-IP	The CVCU starts automatically in the IBIS-IP system. If the StopRecording operation is executed the CVCU will not consider own parameters and will stop all recording immediately.
	CVCU	The CVCU starts automatically in the IBIS-IP system. If the StopRecording operation is executed the CVCU will consider own parameters for controlling of video material into the archives. If any follow up times are configured, the CVCU stays in current

		recording mode and ignores the command until the configured time is elapsed.
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Table 5: Description of *RecordingSystemStartStopModeEnumeration*

2.5.2 Data structure of operation *StartRecordingERM*

The execution of this operation will either start the recording of video data in mode ERM (if the CVCU is not in mode RRM) or change the recording state from RRM to ERM. By execution of this command the CVCU will record video data which to alarm archives.

2.5.2.1 Request

No additional data must be given by execution of operation *StartRecordingERM*.

2.5.2.2 Response

The response to the operation call is the structure *VideoRecordingStateResponse* (refer to decription of the response structure in chapter 2.5.1.2). The responded state shall be "ERM".

2.5.3 Data structure of operation *PauseRecordingRRM*

2.5.3.1 Request

This operation is intended to set the CVCU in mode PAUSE. In this mode the recordings in mode RRM will be stopped for a specific time interval which is given by the request structures. After the specified times has elapsed the CVCU will restart the recordings in RRM automatically. No additional manual interaction is required.

<i>VideoRecordingService.PauseRecordingRRMRequest</i>				+Structure	Request data structure for operation <i>PauseRecordingRRM</i>
		PauseInterval	1:1	+IBIS-IP.int	Time in seconds for PAUSE mode.

Table 6: Description of response structure *VideoRecordingService.PauseRecordingRequest*

2.5.3.2 Response

The response to the operation call is the structure *VideoRecordingStateResponse* (refer to decription of the response structure in chapter 2.5.1.2). The responded state shall be "PAUSE".

2.5.4 Data structure of operation *StopRecording*

The execution of this operation will stop the recording in mode ERM and RRM if the start/stop of mode of CVCU is configured as "IBIS-IP".

If the start/stop mode of CVCU is configured as "CVCU" the unit will consider specific configurations for recording. Any configured follow-up times will be considered and the unit will stop the recordings after this time is elapsed (Parameter "CVCU" has higher precedence than Parameter "IBIS-IP"). For detailed description refer to chapter 2.4.2.

2.5.4.1 Request

No additional data must be given by execution of operation ***StopRecordingERM***.

2.5.4.2 Response

The response to the operation call is the structure ***VideoRecordingStateResponse*** (refer to description of the response structure in chapter 2.5.1.2). The responded state shall be "OFF".

2.5.5 Data structure of operation *ForceStopRecording*

The execution of this operation will stop the recording in mode ERM and RRM without consideration of the configured start/stop mode in the CVCU business logic/configuration/application. For detailed description refer to chapter 2.4.2.

2.5.5.1 Request

No additional data must be given by execution of operation ***ForceStopRecording***.

2.5.5.2 Response

The response to the operation call is the structure ***VideoRecordingStateResponse*** (refer to description of the response structure in chapter 2.5.1.2). The response state shall be "OFF".

2.5.6 Data structure of operation *GetVideoRecordingState*

By execution of this operation the CVCU replies the current state of video recording without any changes of the recording mode. This operation is just for information purposes.

2.5.6.1 Request

No additional data must be given by execution of operation ***GetVideoRecordingState***.

2.5.6.2 Response

The response to the operation call is the structure ***VideoRecordingStateResponse*** (refer to description of the response structure in chapter 2.5.1.2).

2.5.7 Data structure of operation *SubscribeVideoRecordingState*

For subscription of abonements the data structures ***SubscribeRequest*** & ***SubscribeResponse*** are used.

2.5.8 Data structure of operation *UnsubscribeVideoRecordingState*

For unsubscription of abonements the data structures ***UnsubscribeRequest*** & ***UnsubscribeResponse*** are used.

3 Test / Testing

3.1 Testing Environments

The test of the service requires following items and environment and must consider following pre conditions:

- Ensure that at the correct components are available for the test.
- 1 x Central Video Control Unit (CVCU)
- At least 1 x video data source (camera, either analogue or IP network)
- Hard & Software tools for analysis of recorded video material
- Implementation of IBIS-IP **VideoRecordingService** in the CVCU. All services must be started in a correct way (consider that this requires an onboard unit which provides the base services as **SystemManagementService** and **DeviceManagementService**)
- All equipment must be connected via Ethernet (IBIS IP) and supplied with power
- Ignition/boot-up signal must be connected in a correct way to the CVCU
- An “Emergency/Event/Alarm” push button must be connected to the CVCU via GPI
- A “Maintenance” push button must be connected to the CVCU via GPI

The type of the data source which will be used for testing depends on the requirement of the specific project and the type and functionality of the Central Video Control Unit.

3.2 Test Cases

Test Case 1 - Test of startup mechanism of CVCU and the auto-start of service operation StartRecordingRRM:

The CVCU will be started by ignition/bootup signal of vehicle and shall start the Service itselfs and the recording in Mode RRM automatically.

Test Case 2 - Test of operation StartRecordingERM:

The command will be executed by CVCU triggered by the operation StartRecordingERM. The CVCU shall switch the recording mode from RRM to ERM. If current mode is ERM the CVCU keeps recording in this mode. If mode is OFF the CVCU switches starts the recording in mode RRM.

Test Case 3 - Test of operation StartRecordingRRM:

The command will be executed by CVCU triggered by the operation StartRecordingRRM. The CVCU shall switch the recording mode from ERM to RRM. If current mode is RRM the CVCU keeps recording in this mode. If mode is OFF the CVCU switches starts the recording in mode RRM.

Test Case 4 - Test of operation StopRecording in mode RRM

The CVCU starts recording in mode RRM (t1) – follow up times are configured in the CVCU configuration:

- for normal recordings (mode RRM) → 120 seconds

After 180 seconds of recording in mode RRM the recordings shall be stopped via execution of operation **StopRecording** (refer to test result including information regarding the dependencies as parameter StartStopMode, State, recording mode etc).

Test Case 5 - Test of operation StopRecording in mode ERM

The CVCU starts recording in mode RRM (t1) – follow up times are configured in the CVCU configuration:

- for event recordings (mode ERM) → 300 seconds

After t2 = 120 seconds of recording in mode RRM the operation **StartRecordingERM** will be executed. At t3= 240 seconds the recordings shall be stopped via execution of operation **StopRecording** (refer to test result including information regarding the dependencies as parameter StartStopMode, State, recording mode etc).

Test Case 6 - Test of operation ForceStopRecording in Mode RRM

The CVCU records in mode RRM – a follow up time for mode RRM is configured (120 seconds). Via operation **ForceStopRecording** the recordings shall be stopped immediately for maintenance purposes.

Expected: Stop of recordings after 300 s (120 s video material mode RRM, 180 s video material ERM).

Test Case 7 - Test of operation ForceStopRecording in Mode ERM

The CVCU records in mode RRM – a follow up time for mode ERM is configured in the CVCU (300 seconds). After execution of **StartRecordingERM** (@ t2 = 120 s) the CVCU records 120 second of event video material. @t3 = 300 s) the recordings shall be stopped immediately for maintenance purposes by execution of **ForceStopRecording**.

Test Case 8 - Test of operation PauseRecordingRRM

The CVCU records in mode RRM – by calling operation PauseRecordingRRM with time interval of 120 seconds.

3.3 Expected Test Results

Test Case	Result
1	DeviceManagementService and SystemManagementService are running. The CVCU shall start the recording in Mode RRM automatically after boot-up by self-calling the operation VideRecordingService and starts automatically the recordings. The Service shall be known in the IBIS-IP system.
2	All required IBIS-IP services are running. The CVCU operates in recording mode RRM. After execution of the StartRecordingERM operation the CVCU shall change into mode ERM. The state "ERM" shall be replied in the response structure.
3	All required IBIS-IP services are running. The CVCU operates in recording mode ERM. After execution of the StartRecordingRRM operation the CVCU shall change from mode ERM into mode RRM. The state "RRM" shall be replied in the response structure.
4	Mode RRM – All required IBIS-IP services are running. The CVCU operates in recording mode RRM. Dependend of parameter "StartStopMode" and configured follow-up times (ERM = 300) the expected results are as follows: StartStopMode = "IBIS-IP": The CVCU will stop recordings. The final state is OFF. StartStopMode = "CVCU": The records will be stopped after the configured follow-up time of 300 s. In the end the final state is OFF.
5	Mode ERM - All required IBIS-IP services are running. The CVCU operates in recording mode RRM and changes into mode ERM. The state "ERM" shall be replied in the response structure. Dependend of parameter "StartStopMode" and configured follow-up times (ERM = 300) the expected results are as follows: StartStopMode = "IBIS-IP": If the CVCU records in mode ERM the CVCU will stop event recordings and changes back the record mode RRM. The final state is RRM. StartStopMode = "CVCU": If the CVCU records in mode RRM the records will be stopped after the configured follow-up time of 300 s. In the end the final state is OFF.
6	The CVCU stops all recording in mode ERM or RRM independed of configuration parameters State, StartStopMode, follow-up times (ERM/RRM).
7	The CVCU stops all recording in mode ERM or RRM independed of configuration parameters State, StartStopMode, follow-up times (ERM/RRM).
8	The CVCU shall pause the recordings in RRM mode for 120 seconds an restart the recording in mode RRM automatically again. If the CVCU record in mode ERM the recordings shall not be paused.

Table 7: Table of test results

4 Versionshistorie / Version History

4.1 Version 2.4

4.1.1 Funktionale Erweiterungen – Functional Upgrade

— Keine / None

4.1.2 Technische Ergänzungen/Korrekturen – Technical Upgrade/Corrections

- Copy/Paste-Fehler bei den Subscribe-Methoden behoben / Fixed Copy/Paste-Error at Subscribe-methods
- Unklarheiten bei der Antwort des GetVideoRecordingState bereinigt / clarified issues at GetVideoRecordingState

Regelwerke – Normen und Empfehlungen / References

- (1) CEN/TS 13149-7 Öffentlicher Verkehr - Planungs- und Steuerungssysteme für
Straßenfahrzeuge - Teil 7: System- und Netzwerkarchitektur; Englische
Fassung CEN/TS 13149-7:2015 /

Public transport - Road vehicle scheduling and control systems - Part
7: System and Network Architecture
- (2) CEN/TS 13149-8 Öffentlicher Verkehr - Planungs- und Steuerungssysteme für
Straßenfahrzeuge - Teil 8: Physikalische Schicht für IP-Kommunikation;
Englische Fassung CEN/TS 13149-8:2013 /

Public transport - Road vehicle scheduling and control systems - Part
8: Physical layer for IP communication
- (3) VDV 301-1 Internetprotokoll basiertes integriertes Bordinformationssystem IBIS-
IP - Teil 1: Systemarchitektur /

VDV 301-1: IBIS-IP, Part 1: System architecture
- (4) /VDV 301-2 Internetprotokoll basiertes integriertes Bordinformationssystem IBIS-
IP - Teil 2: Schnittstellenspezifikation /

VDV 301-2: IBIS-IP, Part 2: Interface Specification V1.0
- (5) VDV 301-2-1 IBIS-IP Beschreibung der Dienste - Gemeinsame Datenstrukturen und
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IBIS-IP Description of Services – Common Data Structures and
Enumerations
- (6) VDV 301-2-11 IBIS-IP Dienst VideoLiveService v1.0, 1.0, 05/2017 /

IBIS-IP Service VideoLiveService v1.1 1.0, 05/2017
- (7) VDV 301-2-13 IBIS-IP Dienst VideoDisplayService v1.1 1.0, 05/2017 /

IBIS-IP Service VideoDisplayService v1.11.0, 05/2017

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