Open Communication Interface for Road Traffic Control Systems
Offene Schnittstellen für die Straßenverkehrstechnik

OCIT Outstations

Function mirror
OCIT-O Version 3.0
for Traffic Signal Controllers

OCIT-O_Function mirror_V3.0_A01

Unrestricted ODG – OCIT-Developer Group

OCIT® is a registered trademark of the companies AVT STOYE, Siemens, Stührenberg and SWARCO

Function mirror

OCIT Outstations Version 3.0 for Traffic Signal Controllers

Issue: OCIT-O_Function mirror_V3.0_A01

Issued by: OCIT Developer Group (ODG)

Contact: www.ocit.org

Copyright © 2018 ODG. All rights reserved. Documents with a more recent version or revision level replace all contents of the previous versions.

Contents

Document history

Version Issue	Distribution	Date	Comment:
V3.0 A01	PUBLIC	2018-03-15	OCIT-O V3.0

Specifications

The **OCIT outstations configuration document OCIT-O CD V3.0** contains an overview of all of the specifications having a copyright administered by ODG and assigns versions and issue statuses according to:

- associated specifications of the interface "OCIT outstations for traffic signal controllers" with reference to the corresponding OCIT-C specifications,
- gives information on the use of the transmission profiles and
- provides an overview of packages of specifications for interfaces for the use of which a nominal fee is required by ODG

The current issue of the document is published on www.ocit.org.

1 Introduction

An important part of the investment and future-proofing of road traffic control systems is the ability to network all of its components without any hassles. The OCIT-O V3 interface supports traffic control on the basis of the data from a roadside unit.

The standardized interfaces will be documented under the brand designation OCIT. OCIT stands for:

> **O**pen **C**ommunication **I**nterface for Road **T**raffic Control Systems

The latest information, documentation of the OCIT interfaces of the field levels as well as further links to groups associated to the OCIT process with links to documents for central level interfaces can be found on the website of the ODG (www.ocit.org). A glossary with explanations of the abbreviations and terms used in the function mirror can be found in the document "OCIT-O Glossary version 3.0".

Traffic signal controllers and central units are connected via OCIT to a system-wide network based on Internet technology. OCIT-C interfaces are interfaces for the central areas and tools.

OCIT Outstations are interfaces between field devices[1] for road traffic control systems and the associated central units. "OCIT Outstations for Traffic Signal Controllers" is a specialization for traffic signal controllers. These interfaces are dealt with here together with the associated system interfaces and functions.

The function mirror should help planners and operators to use the strengths of OCIT Outstations to make it easier for them to create tenders. It describes the functions of a traffic signal control system determined by OCIT-O, made of up central devices, data transmission and traffic signal controllers.

1.1 Scope of application

The function mirror is based on the Documentation chapter listed in OCIT Specifications and includes the previous versions. The description of the "OCIT Outstations for Traffic Signal Controllers" interface functions form the main part of the function mirror.

Furthermore it includes:

An introduction to OCIT-Center-to-Center interfaces, how they interact with OCIT Outstations, and additional information regarding system planning at suitable places, as OCIT Outstations have an extensive range of configuration possibilities.

The following graphic shows the interfaces of an OCIT based traffic signal control system.

OCIT-LED is an electric interface for LED signal heads with 40 V technology with a performance rating of under 10 Watts. OCIT-LED is not dealt with in the function mirror.

[1] Devices which are located on the road such as traffic signal controls, traffic measuring points or display controls are referred to generally in OCIT Standardization as field devices.

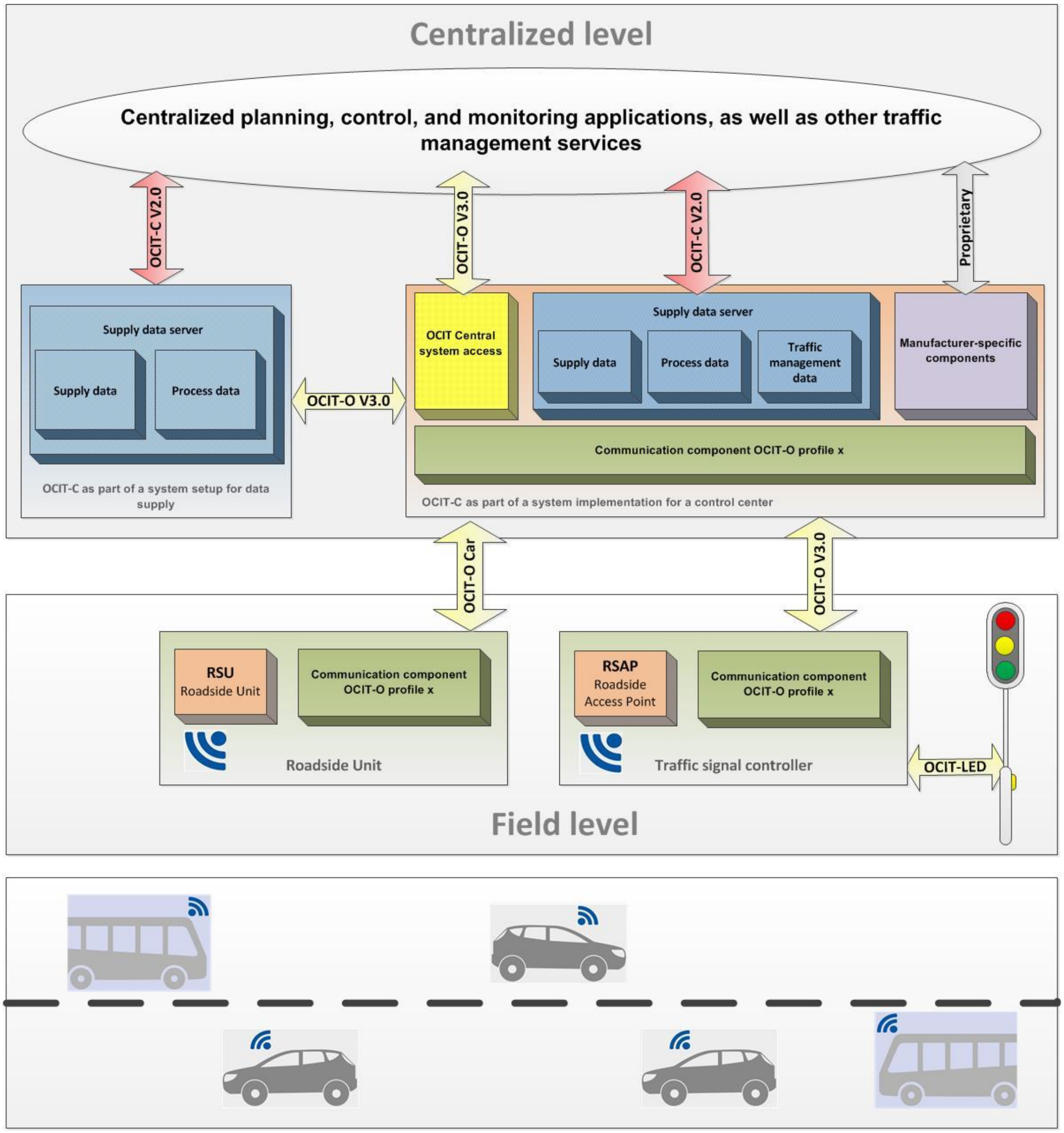

Fig. 1: OCIT interfaces for cooperative city infrastructure

2 Properties of the OCIT interfaces

2.1 OCIT-Center-to-Center (OCIT-C)

OCIT-C are standardized interfaces between central components and systems. Characteristic for these interfaces is the importing of data sets (archive data, archived measurement values, supply data etc.) into the connected system and their asynchronous processing. Conversely, the result of the processing is also a data set, e.g. a supply of the devices.

The traffic signal controllers from OCIT-O Version 2 onwards provide standardized data and functions that are based on the definitions in the OCIT-C specifications for TSSs.

The following OCIT-C interfaces are supported:

OCIT-C supply data (OCIT-C VD)
The prominent feature of OCIT-C is the standardized remote data supply to the traffic signal controllers from a planning station. For this, these supply data that must be modified frequently for traffic-related reasons have been standardized in ("User supply"). The specifications for this can be found as standard in both the OCIT-C and OCIT-O TSC documentation. The Instations component OCIT-C VD server assumes the task of format conversion from OCIT-O to OCIT-C (Supply data server).

OCIT-C process data acquisition (OCIT-C PD)
Process data are data and measurements that are recorded by the traffic signal controller. The acquisition and delivery of the process data in the format OCIT-O was already in place with the first OCIT-O version. New OCIT-O functions make it easier to manage process data in the traffic signal controller. The OCIT-C component PD server assumes the task of format conversion from OCIT-O to OCIT-C (Process data server).

Note: OCIT-C Version 1 corresponds to the standard DIN V VDE V 0832 - Road Traffic Signal Systems - Part 601 and Part 602: Interface between centralized devices for the exchange of traffic-related data.

2.2 OCIT Outstations

The typical task of OCIT Outstations is the secure remote operation and monitoring of field devices, for which immediate acknowledgment, reaction and troubleshooting takes place. OCIT systems with the OCIT Outstations interface only transmit commands, data and messages when certain events occur. A rigid cycle [2] is not required here. This enables the use of Internet technology and thus the connection of field devices into networks. In such systems, the transmission time of the data fluctuates depending on the network load. The components of an OCIT system are designed in such a way that the transmission times do not disturb the user / observer.

System-wide, accurately timed actions are carried out in a time-controlled fashion. For this there is a time-standardization service present in the control center with which all the controller-internal clocks can be set so that all the controllers in the entire system have a single basis of time. All of the messages and commands are marked with a “time stamp” that arranges them chronologically. In traffic signal controllers, the synchronization of "green waves" also takes place using the exact system time and not via synchronization commands from the central device.

2.2.1 Designation of the OCIT Outstations interface

An OCIT Outstations interface is characterized by its purpose of use (until now traffic signal controllers and LED signal heads). Through the selection of a suitable transmission profile, the interface receives a certain characteristic. For this reason, OCIT interfaces are labeled using the name of the field device and the transmission profile.

[2] The rigid 1 second cycle for transmitting commands, data and messages used in older traffic control systems, requires means of communication and transfer which have to be selected in such a way that the transmission times for all conditions remain under 1 second. Longer transmission times can cause serious malfunctions.

To give an example of this, an OCIT-O interface for traffic signal controllers with transmission profile 3 (Ethernet with DHCP) is named as follows:

OCIT-O Version 3.0 for Traffic Signal Controllers with OCIT-O Profile 3 V1.0

The interface is documented in OCIT-Outstations Specifications (see chapter Documents).

2.2.2 Traffic Signal Controllers

OCIT capable traffic signal controllers are Single Master devices. From a logical standpoint its counterpart (central device) is always unique, even if it is composed of multiple system parts or components. Incoming commands from the control center are therefore always carried out in the same way by the controllers without distinguishing from which component they originate.

Due to the time behavior of the OCIT outstations protocol, OCIT traffic signal controllers are designed specifically for use in systems with a decentralized structure. They control complex local traffic actuations and can acquire and process traffic measurement values ("intelligent controllers"). They have the following characteristic properties:

They have powerful microprocessors that locally control complex traffic actuations and perform processing of measurement values.

They have accurate clocks that control synchronization actions and whose time is used for labeling events.

Switching actions are controlled by signal programs where the following specifications are made:

Predefined signal plans that are either stored in the device and/or can be supplied with data via the control center while in operation are selected via the switching commands of the control center or via internal switching tables.

If a local traffic-actuated logic is used, selected signal programs are varied according to the traffic situation.

The traffic-actuated logic for its part is to be set up by parameters for various situations.

The following traffic signal controllers are not designed for operation on the OCIT-O interface:

- so-called switching devices, whose characteristic is that switching actions prompted by the control center are given preference and are executed within one second and in the event of failure of the control center guarantee emergency operation only.
- group controllers, that is devices that assume central control tasks and control smaller device groups via their own interfaces.

2.2.3 Central devices for OCIT traffic signal controllers

A central device[3] is a device for controlling and monitoring road traffic composed of one or more components. The components of the central level can be found at different locations (distributed system). From the perspective of the OCIT process the centralized level includes at least one traffic signal central device and the traffic signal systems attached to it with their traffic signal controllers. The subsystems such as traffic engineer's workstation, supply data server, system for quality assurance, adaptive network control and others, if applicable, are extensions.

Each defined and applied OCIT function of the traffic signal controller also requires a corresponding function in the central device.

The central devices have the so-called central system access (Fig. 1). This enables OCIT-C components and manufacturer specific tools which are not integrated into the central device to access functions of the traffic signal controller.

As OCIT-capable traffic signal controllers are Single Master devices, the central devices must be designed in such a way that central users are informed of the current system function at all times and do not or are unable to disturb the system through contradictory commands. This applies in particular for the operation via the central system access.

2.2.4 Data transmission and protocol

The transmission technology in OCIT outstations is based on standard transport protocol TCP/IP, which can be used independent of the physical data transmission and guarantees secure data connections. Common services on the Internet such as HTTP or e-mail, use this standard for example.

OCIT has its own definition for the transmission protocol of the user level that can coexist with the Internet standards, the "Basic Transport Packet Protocol Layer" (BTPPL). BTPPL was developed with reference to cable connections sometimes present in urban control networks with limited transmission capacity. It works with a small data overhead and this allows it to use these routes as well.

BTPPL offers 2 channels for data transport. A channel with a high priority is used for switching commands and messages; remote data supply can be performed on the channel with low priority. The method is asynchronous. A transmitter can continually send telegrams and after dispatching telegrams does not need to wait for corresponding feedback messages but can rather arrange these in terms of time after their arrival. An integral part of the protocol is the SHA-1 algorithm, which has 24-byte password protection ensuring that hackers cannot tamper with the field devices.

BTPPL can communicate using TCP/IP via various transmission paths. For many of these types of communication there exist standards and therefore also standard communication devices. Examples: DSL, Ethernet, GSM, analog public telephone network, ISDN (digital public telephone network) and dedicated-line mode in private networks via analog modems.

In the OCIT system some of these standard processes are suitable for communication between field devices and control centers. The corresponding definitions in the

[3] The term central device is used in the OCIT-O documents as an abbreviation for a traffic signal central device to which traffic signal controllers are connected, (see document OCIT-O Glossary).

OCIT standard are designated as OCIT transmission profiles. They consist of definitions for system features, type of transmission media and devices, minimum requirements for transmission capacity, line properties, etc.

With OCIT transmission profiles, different traffic signal controllers from different manufacturers can be operated without additional agreements.

Defined so far are:

- Transmission profile "Profile 1 – Transmission profile for point-to-point connections on permanently switched transmission paths". The transmission takes places here using equivalent CCITT V.35 modems.
- Transmission profile "Profile 2 – Transmission profile for dial-up connections in the fixed-line network and GSM mobile telecommunication network".

  Note: Profile 2 is no longer sold by ODG and should not be used in new projects.

- Transmission profile "Profile 3 - Ethernet with DHCP". Connection with Ethernet is a standardized, wired data network technology for local data networks, via which a simple connection to a wide variety of communication networks is possible.
- Transmission profile "Profile 4 - VPN" standardizes the transmission via a secured virtual private network (VPN).

Transmission profiles not standardized in OCIT can be implemented on a project-specific basis, but they require hardware and software changes to controllers and central devices.

2.2.5 Standard and manufacturer objects

OCIT Outstations differentiates between the following as organizational features:

OCIT Outstations objects
represent the standard. All OCIT Outstations compliant devices can execute the functions associated with this.

Manufacturer objects
objects are not standardized objects. They can be defined by owners of rights of use to OCIT outstations. Depending on the situation, the specification takes place without further consultation or together with the manufacturers taking part in the project. The objective of this definition is to create technical possibilities for functions required in OCIT outstations which are not foreseen, still missing, proprietary or project specific. To ensure uninterrupted operation in the mixed manufacturer system, the specification and realization of the manufacturer objects must take place in accordance with the OCIT standards and guidelines. Each user of manufacturer objects receives an OCIT Member number after registering with the ODG. This is used to identify the data telegrams of the respective manufacturer objects. This way, they can be distinguished in the system from the standard OCIT Outstations Objects and are clearly identifiable. Through the acquisition of a system with OCIT interfaces, the operator receives limited rights of use from the system manufacturer to the respective road traffic control system. This also applies for project specific objects that a manufacturer realizes for an operator. A use above and beyond this can be specially agreed upon between the partners. Administration of the member numbers is the responsibility of the ODG. The current list of member numbers is published on the homepage www.ocit.org.

3 OCIT Outstations V3.0 for Traffic Signal Controllers

The specifications of the OCIT outstations interface version 3.0 for traffic signal controllers are backward compatible with control centers with OCIT-O versions 2.0 1.x.

The specifications of the OCIT Outstations version 3.0 interface contains functions that are required for integrating cooperating vehicles into a traffic infrastructure system. This makes it possible in the OCIT system.

- Decentralized Environmental Notification Message (DENM) [Ref]

  For risk messages (DENM) on the one hand, it is possible to transmit these from the control center to the vehicles. On the other hand, risk messages from the road are collected, filtered, and effectively transmitted to the control center. This provides the user with a necessary overview of the current situation.

- Quality assurance, statistics and messages from floating car data
- Prioritization of public transport and special vehicles based on the cooperative messages
- Cooperative Awareness Message (CAM) [Ref]

  Flowing traffic can be captured using CAMs. These data are transmitted to the central system in a processed and compressed form.

- Signal Phase and Timing (Spat) [Ref]

  The CAM messages (sign-on and Spat (acknowledgment) are used to prioritize public transport.

- Topography information (MAP) [Ref]

to integrate into the traffic management.

A new component is defined in the infrastructure, the so-called Roadside Unit (RSU). For the RSU, the OCIT-O Car interface is a license-free option to integrate this RSU into a traffic management system. OCIT-O Car offers the necessary functionalities for this.

3.1 New functions in OCIT-O V3.0

The new functions in OCIT-O V3.0 are broken down into 3 groups. For a start, there are functionalities which are linked to the functionality of a traffic signal controller (such as the transmission of signal phase and timing). These new functions can be found in the document OCIT-O TSC V3.0.

Functions which can also be found in a generic roadside unit (RSU), can be found in the document OCIT-O Car V1.0. These functionalities of course are also provided by a traffic signal controller (TSC).

The table below displays the new functions and upgrades in detail.

Functional overview of OCIT-O for traffic signal controllers		V1.1	V2.0	V3.0	Car
OCIT Center	Support for the **OCIT-C VD-TSS** interface for the remote user supply. Support for the **OCIT-C PD-TSS** interface for recording process data.		X	X	
Supplying data	**Remote user supply:** Traffic basic data (switch on / off programs, signal programs, offset, intergreen and minimum times). Master control clock (local 12 month automatic routine). TA control procedure and parameters. Extensive functions for managing supply versions (versioning of user and manufacturer supply, data backup, reading the user supply). Block-based writing of complex structured user program values (user parameter values). Data relevant to security can only be supplied by means of the manufacturer.		X	X	
Switching	Individual switching of: Intersections or partial intersections on and off / flashing, signal programs, special interventions, local control procedures, PT prioritization, modifications of the behavior of the local TA procedures. No switching on or changing of a program, if a signal program is not supplied.	X	X	X	
	Switching of all of the switching options given above with only command ("Switch Intersections" method).		X	X	
Measured values	Vehicles per hour and occupancy in %. Detector raw data with high resolution (sampling intervals up to 10 ms). Sampling and aggregation intervals can be set.	X	X	X	
	Task element for detectors with additional information: Recording measurement values from vehicle detectors with additional information: such as speed, length, type (8 vehicle classes as per TLS) counted values and average speed per vehicle class. Task element for extended aggregated detector values: As well as the count and occupancy rate, the speed and type of vehicles are also recorded in an aggregated form, sorted in accordance with the eight vehicle classes as per TLS and from this the average speed and counted value are determined.		X	X	

Data detection	Detection and archiving of operating states, messages, signaling, traffic measurement values, PT telegrams, detector raw data. Reading and writing of user program values.	X	X	X	
	Data for the process data interface OCIT-I PD-TSL. Archive for process data, of which the selection is frequently changed. Naming conventions for user program values. Quick access to complex data structures or arrays of user program values (user parameter values). Quick recording of the signaling for online visualization. Recording of the OCIT-O telegram traffic for testing purposes (tracing).		X	X	
Reporting	Operating states, operations, faults with information about time, source, impact, number / name of the affected component, freely compatible texts. Door on the device, EVU, control element Collective fault Rapid message in the event of a network failure / wire breakage. Messages when the reception of PT telegrams is faulty. Messages for the supply operation.	X	X	X	
	Definitions of message parts, formats and names, digital in and outputs, signal groups, signal heads, signal head chambers, acknowledgments, actual status and process identification. Comprehensive and convenient functions for reading device information and references upon instances, e.g. reading all orders in a list.		X	X	
Traffic control system	All local traffic system control procedures can be integrated in compliance with OCIT- Parameters and results (AP values) can be changed, recorded or archived. R09 standard telegrams R09 Extended telegrams 3 standard back calculations for the synchronization of devices. Central / local time as the priority time source.	X	X	X	
Information about the field devices	Information about the field device: OCIT version, manufacturer, device type, time source, time zone, Instances of all objects, central device and field device numbers of the communication partner implemented in the field device.	X	X	X	

	Up to 65535 return function values, filter functions		X	X	
Improve-ments	Definitions of device behavior: central system access, central switch requests, operating mode, back calculation procedure, partial intersections, synchronization, time count, R09 telegram units, network off, fault cleared, reset, timeout, passwords, format for checksums, frequency of NTP queries. Data type for dynamic parameters, e.g. for network control or other procedures. Possibility for changing the User-Domain-names from the central device.		X	X	
Transmis-sion system	Transmission profile “Profile 1 - Transmission profile for point-to-point connections on permanently switched transmission paths”. The transmission takes places here using equivalent CCITT V.35 modems.	X	X	X	X
	Transmission profile “Profile 2 – Transmission profile for dial-up connections in the fixed-line network and GSM mobile telecommunication network”.	X	X		
	Transmission profile “Profile 3 - Ethernet”	*)	X	X	X
Risk mes-sages	Transmission of risk messages from the control center to the roadside and sending as a DENM. The following message types can be transmitted: • Roadworks • Accidents • Critical sections			X	X
	Archiving risk messages (sent and received)			X	X
	Current status of the risk messages: • Which are active / passive • with validity period • Geographical area			X	X
Capturing flowing traffic	Recording vehicle data • Date, time • Position, speed, direction • Vehicle types			X	X
	Aggregation of traffic data • Average speed • Waiting time • Number of stops			X	X
	Connection-related data			X	

Prioritization of public transport systems	Transmission of prioritization requests from the control center to the field device.			**X**	**X**
	Offset RSUs for detecting vehicles not at an intersection				**X**
Topology data supply	Supplying topology data using the standardized supply mechanism.			**X**	
Signal plan recorded	Upgraded to include the Spat contents.			**X**	

*) Whether field devices which support Profile 1 or 2 can be upgraded to Profile 3 depends on the type and scope of the installed operating system and the associated connected hardware.

4 Agreements regarding the function mirror

The function mirror describes the functions, specification compliant traffic signal controllers, transmission procedures and central devices which are able to perform as standard in accordance with the Specifications (see Documentation chapter) in a concentrated form, as well as the optional supplements and the options for project specific adjustments.

4.1 Traffic signal controller equipment

In the function mirror, the OCIT traffic signal controller functions are broken down into **basic configuration**, **optional**, and **project-specific configuration** (hardware and software). The basic configuration is offered on all devices. Optional configurations are specified, but are not configured as standard or implemented in all controller configurations. If additional hardware is required for this, this is performed extra. Additionally, further project specific required functions which are not contained within the specifications can be realized in compliance with the technical basis of OCIT Outstations.

When using functions which go beyond the basic configuration, the system planner must take the entire system into consideration, i.e. the properties of the traffic signal controllers, the transmission system and the central device. The performance features concerning this must be named in the tenders, so that the tenderers are able to estimate and calculate the influences on the entire system. To do this, the function mirror provides information which describes the configuration variations and their performance properties, as well as the use with the project-specific functions and their position in the overall system.

The number of signal programs, signal groups or detectors required in the traffic signal controllers depends on the type of application. These configuration variations are requested individually for each device / system or as a minimum configuration level, so that the manufacturer is able to select and provide suitable device types. Information regarding the configuration levels are provided by the manufacturer's data sheets. To keep the function mirror clearly structured, requirements which are always necessary project specifically are not referred to in the tables.

4.2 Basic Configuration (G)

The basic configuration is a selection based on current practical experience of the functions and components specified in OCIT Outstations. A **minimum configuration** level (storage space among other things) and the associated performance capability are described. For the customer, this means that this "Packet" does not need to be designated extra in tenders. Expansions which go beyond the basic configuration are possible with manufacturer specific boundaries.

Should some of these required configuration features of specialized device types not be required for the intended application from the manufacturer's point of view, such as small devices for pedestrian protection and for that reason not implemented from the outset, the manufacturer will indicated this in tenders and in their data sheets.

4.3 Optional Configurations (O)

The optional configurations supplement the basic configurations. They are specified in OCIT Outstations, a **minimum configuration** level (storage space among other things) and the associated performance capability are described. Optional configurations must be required on top. They result from the technical requirements of the respective project and possibly involve additional costs. A detailed description may be waived in the tenders. Expansions which go beyond the minimum configuration level of the optional configurations are possible with manufacturer specific boundaries.

4.4 Project-specific Configurations (P)

This is used to refer to configuration level variations which are foreseen in OCIT Outstations, but are highly project dependent in their design. These must be described in detail.

4.5 Value ranges

The maximum values **which can be addressed** are specified in the function mirror. These are set so high for the software that their boundaries cannot practically be reached. For instance, according to the definitions up to 255 partial intersections can be addressed, however the practical boundary lies far below this.

4.6 Display of the functions

The functions of the interface are described in the definitions in the form of **object types** and **methods**. This form of representation is based on a software implementation with object-based programming languages. Each object type has properties and methods. The properties describe the states which this object type can accept. The methods of an object type describe and control its behavior. For certain types of objects, such as archives, there are a number of them in the device. They are labeled as instances.

This type of portrayal is not clearly structured enough for overviews or planning resources. For this reason, the function mirror renders the software oriented specifications into a representation which can be understood by the planner. Additionally, it is important to also take into consideration other basic conditions for device and system properties which are defined in the Specifications, such as timing, synchronization etc, as well as designating additional function-related hardware configurations. The terms for the functions selected in the function mirror for this reason do not always have a 1:1 relationship with the terms in the Specifications and not with the object numbers which identify the objects in the Specifications.

4.7 Definition of terms

The abbreviations and terms used can be found in the document "OCIT-O Glossary version 3.0".

5 Scheduling and selection of functions

The OCIT Outstations V3.0 for Traffic Signal Controllers interface possesses diverse options for parameterization and expansion. Therefore, it can be used for various control and traffic-system tasks and system concepts. These tables in the following chapters list the functions of interfaces and their expansion options. They provide information regarding the important considerations and definitions for the system set up, traffic related functions and transmitting data, as well as for the selection and parameterization of the interface functions themselves.

Legend of the tables in Chapter 5.1 and 5.2:

Table column "Configuration":

This specifies which functions are included in which configuration of the traffic signal controllers (see also Chapter 3).

- **G** Basic configuration with specified minimum performance, storage space or other features.
- **O** Optional configuration with specified minimum performance, storage space or other features.
- **P** Project specific configuration

Table column "System reference":

Individual functions are identified here whose selection or parameterization are based on the planned function of the overall system. In this process, specifications which must be met in the planning process and as part of the commissioning and properties which can be changed during the operation are distinguished between.

System Specifications that determine the properties of the entire system and the can be met already during the planning stage. Examples: Considerations for the use of radio controlled clocks or the selection of the archive variables in the traffic signal controllers based on the intended purpose of the system.

Parameters Definition of parameters or settings with which OCIT devices are integrated into the system, e.g. IP addresses. Parameters are usually defined as part of the commissioning by the suppliers in collaboration with the customers.

Operation Settings which can be changed during the operation such as tasks for the recording of data in the archives. Using these settings, the system properties can be changed during the runtime.

Identification in the text:

V2 Identification of new functions or definitions from OCIT-O version 2 onwards.

V3 Identification of new functions or definitions from OCIT-O version 3 onwards.

CAR Identification of new functions or definitions contained in the “OCIT-O Car” license.

5.1 System definitions

This table shows the use of the OCIT Outstations version 3.0 interface for traffic signal controller necessary considerations and specifications for the system set up, the traffic system functions and for the transmission of data.

No.	Function	Equipment	System reference
1	**System**		
1.1.	**Addresses**		
	Device name Each OCIT-O field device requires a unique name (host name). This is made up of the user identification (domain), a field device number and a central device number. A real Internet domain address or a similar address of an isolated network can be used as an operator identification, such as stadtname.de for example. Example of a central device host name: fg0.z3.stadtname.de Example of a field device host name: fg12.z3.stadtname.de The modification of the domain name from field devices of the user domain, which usually concerns all traffic signal controllers / field devices of a control area can be performed automatically. The resupply of the domain names of all the field devices affected to be performed proprietarily is therefore not necessary. **Numbers of field devices and central devices** Field device number (FNr): 1 to 65535 Central device number (ZNR): 0 to 65535) The field device number of the central device is always = 0. Note: No leading zeros may be used when assigning numbers. **IP addresses** Field devices and central devices communicate with one another via IP addresses. Each device in an operator network must therefore possess a unique IP address. The assigning of the IP addresses takes place via the central device which assigns an IP address to each device with a host name. Host names and associated IP addresses are managed in the central device by a domain name server (DNS) which itself can be invoked via a preset IP address.	**G**	**Parameter**: Define domain, ZNr, FNr (host name) and IP addresses or IP address range.

No.	Function	Equipment	System reference
	First and foremost here, self-administered addresses come into consideration as IP addresses. The paid use of real Internet addresses is rather unrealistic due to the high number of required Internet addresses. It is to be determined, whether OCIT outstations and addresses of the central components are located within a common IP network. If necessary, a firewall is to be used. **V2:** It is possible that during operation the IP address of the field device is changed (function DNS cache invalidation). The host name must not be changed.		
1.2	**Passwords**		
	Passwords, which are used by the relevant recipients for identification and verification of the sender and for SHA-1 transmission protection (see number 4.2), are used for transmission protection. **V2:** The use of this process has the benefit, that system access ways and other connections do not have to be protected by a firewall. Field devices know at least the following OCIT-O passwords: Password for the field device itself (pre-programmed with "OCITPASSWORD" upon delivery) Password for the central device (pre-programmed with "OCITPASSWORD" upon delivery) Password of the replacement central device Password of the central system access password for unknown IP addresses (default) Each password may be up to 12 characters in length. The passwords can be changed from the central device. **V2:** Note: Preferably all field devices within a central system should use the same field device password.	G	**Operation:** Set passwords.
1.3	**System time**		
1.3.1	The system requests a matching system time in the control center and all field devices with an accuracy of ± **500 ms**. For this the control center already provides	G	**System:** Define type of clocks (DCF 77 or other) as a reference

No.	Function	Equipment	System reference
	the **time-standardization service NTP version 4 (RFC 591 1305)**, which can be used by the OCIT traffic signal controllers for synchronizing the controller time with the control center time. The synchronization process compensates for the transmission times in the network. The time-standardization service provides an unchanging basis of time that does not acknowledge any skipping for daylight savings time and back and no time zones (UTC time). The UTC time is the system's internal basis of time. For conversion to the local time, local information (time zone) and the switching points for daylight savings time/standard time are needed. The conversion from the UTC times—delivered by OCIT devices in their messages—to local time takes place in the central device. **V2:** Generally considered to be the NTP server is FNr. 0 (fg0) in the central device. A manual configuration of NTP servers is a project-specific solution.		for the time-standardization service of the central device. **Parameter:** Information for converting the UTC to local time.
1.3.2	**Traffic signal controllers with permanent data connections to the central device** If no explicit request by the operator is indicated, then the control center time-standardization service has the highest priority for time synchronization of the controller time with the control center time. Clocks in the field devices, in the simplest case an integrated clock from the local computer, provide the controller time only after being switched on or if the control center time-standardization service cannot be reached during a time specified by the manufacturer. **V2:** For permanent connections such as OCIT-O Profile 1 the control center time-standardization service NTP is requested by the field device at least every 15 minutes and immediately after the connection is established.	**G**	**System:** Define type of clocks (DCF 77 or other) as a local time reference in the traffic signal controllers.
1.3.3	Optionally, the controller can be configured in such a way by the manufacturer that a local clock takes priority as a time reference for the controller time. The control center time-standardization service is only used in the event of failure of the local clock. The required uniform system time is only guaranteed if the accuracy of the local clock corresponds to the control center clock. In practical terms, this means that an integrated clock of the local computer cannot be used as a prioritized time reference.	**O**	**System:** Define type of clocks (DCF 77 or clocks of similar value) as a local time reference in the traffic signal controllers.

No.	Function	Equipment	System reference
1.3.4	**Traffic signal controllers with temporary data connections to the central device** A configuration with prioritized control center time-standardization service is not practical here because it would require permanent connections. Therefore, local clocks in the field devices (DCF 77 or other systems) provide the prioritized time reference for the controller time. The required uniform system time is only guaranteed if the accuracy of the local clock corresponds to the control center clock.	**P**	**System:** Define type of clocks (DCF 77 or other) as a local time reference in the traffic signal controllers.
1.5.	**Synchronizing traffic signal controllers in green waves.**		
1.5.1	The synchronization into green waves is clock controlled. The back calculation process needed for this is to be determined on a project-specific basis because the back calculation method in the system (field state and traffic signal controllers with OCIT-O) must be the same. **V2:** OCIT traffic signal controllers must command at least the following back calculation methods: Reference time 1.1. 0:00:00 Local time, current year Reference time 1980-01-01 0:00:00 Local time Reference time 0:00:00 Local time of the current day Reference time 1970-01-01 0:00:00 Universal Time Coordinated **V2:** The synchronization is suspended when starting a signal plan switch and only continued after the switch to the new signal plan has been performed.	**G**	**System:** Select one of the intended back calculations. Other back calculations must be realized in the devices and the central device on a project-specific basis.
1.5	**Relative intersections**		

No.	Function	Equipment	System reference
	The addressing scheme of OCIT outstations provides for the possibility that a traffic signal controller may logically contain intersections (theoretically up to 256) which are independent of each other (relative intersections). Any relative intersection can in turn contain up to 4 partial intersections. Not all manufacturers can offer such sophisticated devices.	**O**	**System:** Specify where and when relative intersections should come into use (traffic system planning).
1.6	**Partial intersections**		
	Partial intersections are signal groups of one total intersection (relative intersection) aggregated into individual signal areas that do not conflict with one another. All partial intersections work with the same signal program at a particular time. Partial intersections can be switched on and off from the central device. **V2:** An OCIT-O traffic signal controller of version 2.0 or higher always has at least one partial intersection. The total intersection (or relative intersection) can be composed of 1 to a maximum of 4 partial intersections.	**O**	**System:** Specify where and when relative intersections should be used (traffic system planning).
1.7	**Traffic-actuation logics**		
	OCIT traffic signal controllers can be equipped and operated with diverse logics. The manufacturers offer various logics with their devices. However, one can not assume that each manufacturer offers all conceivable products. For this reason, the type of logic must be requested explicitly. Alternatively, it is possible to only describe the tasks to be initiated and to leave the type of logic empty.	**P**	**System:** Specify a system wide procedure.
1.7.1	**AP values** User program values (AP values) are internal variables which can be used by user programs. The data of the AP values can: be saved in the archive in the field device using the available methods, be read from the central device, be changed from the central device (if it makes sense in the context of the property of the values). **V2:** To govern access to the AP values in the customer system for multiple manufacturers, it must be possible	**P**	**System:** Define AP values and reading functions.

No.	Function	Equipment	System reference
	to clearly reference the AP values inside a device by using a name: The following standard AP values are already defined in the standard: Cycle seconds TX, running stage PH and requested stage UE. Project specific AP values: Names of the AP values with system-wide meaning are to be agreed upon on a project-specific basis. **V2: AP values of the OCIT-I process data**: The names of the AP values that are used for the transmission of process data in accordance with the OCIT-I definitions for process data (document OCIT-I PD-DM) are formed as OCIT-I PD Member.OType strings. **V2: Formats**: AP values can be defined with 2, 4 byte or as a block (BLOB) with a maximum length of 1 Mbyte (e.g. for dynamic parameters for network control or other procedures). AP values can be grouped to be able to depict complex data structures or arrays as well. **V2: Block by block reading:** This function is used when large volumes of AP values should be transferred to the central device efficiently. To do this, the values of the AP values are written into a list which is read by the central device. **V2: Groups of AP values:** These functions can be used when complex data structures or also arrays of AP values are to be handled. To arrange the AP values into groups, the period (.) is used in the name which enables a clearly arranged presentation. **V2:** The names of the AP values present in the traffic signal controller can be read using SOFeldgeraet.InstanceInfo (SOFieldDevice.InstanceInfo), (up to 65535 return values).		
1.8	**Project specific functions of the OCIT outstations interface**		
1.8.1	OCIT Outstations offers the option of functions which are not contained within the specifications to be realized in compliance with the technical basis of OCIT Outstations in the form of "Manufacturer objects". Such functions can be offered by the manufacturer as a special configuration features (manufacturer specific) or required in projects (project specific). They must then	**P**	**System:** Define functions in consultation with the manufacturers.

No.	Function	Equipment	System reference
	be realized by all manufacturers concerned. The system planner / customer must explicitly require and describe these project specific "manufacturer objects"		

No.	Function	Equipment	System reference
2	**OCIT Center-to-Center**		
	V2: Traffic signal controllers with OCIT-O TSC Version 2 provide standardized data and functions that are based on the definitions in the OCIT-C specifications for TSSs. The following interfaces are supported:		
2.1	**OCIT-C VD-TSS interface for the remote user supply:** OCIT-O TSC V2.0 and onwards provides a standardized remote data supply to the traffic signal controllers from a planning station. For this, these supply data that must be modified frequently for traffic-related reasons have been standardized in ("User supply"). The central component OCIT-C VD server assumes the task of format conversion from OCIT-O to OCIT-C (Supply data server). Overview: Traffic basic data (switch on / off programs, signal programs, offset, intergreen and minimum times). Master control clock (local 12 month automatic routine). TA control procedure and parameters. Extensive functions for managing supply versions (versioning of user and manufacturer supply, data backup, reading the user supply). Block-based writing of complex structured user program values (user parameter values). Data relevant to security can only be supplied by means of the manufacturer.		
2.2	**OCIT-C PD-TSS interface for recording process data:** Process data are data and measurements that	P	**System:** Integration of the server into the

No.	Function	Equipment	System reference
	are recorded by the traffic signal controller. The acquisition and delivery of the process data in the format OCIT-O was already in place with the first OCIT-O version. The "expanded detector values" are added as detectable data from OCIT-O TSC V2.0 onwards. New OCIT-O functions make it easier to manage process data in the traffic signal controller. The central component OCIT-C PD server assumes the task of format conversion from OCIT-O to OCIT-C (Process data server).		central system following consultation with the manufacturers.
3	**C2X specific components**		
3.1	C2X modem **Car/V3:** To ensure participation in the cooperative wireless network, the OCIT-O components must be equipped with a wireless device based on 802.11p.	**O**	
3.2	Risk message		
	Car/V3: Risk messages are used to increase the safety of traffic participants, to reduce CO2 emissions, and for statistical purposes. In OCIT-O, they are based on Decentralized Environmental Notification Messages (DENMs).	**O**	
3.2.1	Recording risk messages/transmitting risk messages to the control center Risk messages are recorded in archives. The object MwAuftragDenm provides the framework for this. The risk messages are also transmitted to the control center using the standard mechanism defined for the archives.	**O**	
3.2.2	Distributing risk messages To distribute risk messages at the field level, the object was defined in the DENM pool. Through this, the control center is able to initiate the distribution of risk messages.		
3.2.3	Status of risk messages If risk messages are received from the field, their status can be queried from the DENM pool. Important data, such as the initiator of the message and its validity.	**O**	
3.3	Status information		

No.	Function	Equipment	System reference
	In a C2X system, the vehicles send the data from several sensors to the infrastructure using a Cooperative Awareness Message (CM). These data should be used for carrying out a quality analysis and quality assurance of the traffic.	**O**	
3.3.1	Car: Basic status information **CAR:** For this, the following data of interest for the traffic engineers are collected: The following data are recorded by an OCIT-O Car capable RSU (or an OCIT-O V3 TSC): • Time and date • Position • Speed • Vehicle direction • Vehicle type	**O**	
3.3.2	Locally assessed status information **V3:** The positions of the vehicles in a lane or even a signal group can be assigned using the intersection topology from the MAP message. The following values are provided for central analysis of the vehicle data (each in the area of the RSU): Average speed Waiting time Number of stops connection-related average values	**O**	
3.4	Public transport prioritization		
3.4.1	CAM telegram Public transport vehicles and special response vehicles are able to request a prioritization using the C2X communication CAM telegrams. Offset RSUs enable the reception of cooperative telegrams for prioritization even outside the reach of the radio on the TSC. Using OCIT-O V3.0, these request telegrams can be recorded and requests can be initiated from the RSU via the control center on the TSC.	**O**	
3.4.2	Reading out public transport reporting points		

No.	Function	Equipment	System reference
	V3: Using OCIT V3, the reporting points can be read out from the TSC (Oepnv.GetMeldepunkte). This is how the control center finds out which reporting points are supplied for in the control of the TSC. Telegrams at this reporting point can then be transmitted to the TSC, even if they are received by an offset RSU.		
3.4.3	Recording public transport telegrams **Car:** OCIT-O Car provides a new variant of R09 telegrams for CAM based public transport telegrams (MwAuftragCamPrio). In addition to the well-established R09.16 information, it also includes information from the Cooperative Awareness Message (CAM): • Station ID and type • Position of the vehicle • Embarkation status	**O**	
3.4.4	Setting requests in the TSC **V3:** The control center is able to set a request for a reporting point, which was triggered by an offset RSU via OCIT V3 in the TSC.	**O**	
3.5	Forecast		
3.5.1	Spat recording **V3:** The Signal Phase and Timing (Spat) telegram is able to send the TSC’s current signal status and a prediction of the signals to the vehicles from within the cooperative infrastructure. There is the possibility to request the current status (Spat object) and record the data (task elements AeSpatEsg and AeSpat) for documenting the information sent.	**O**	
3.6	Topology		
3.6.1	MAP supply **V3:** Topography information is transmitted from within the cooperative communication network of the traffic infrastructure to the vehicles using the MAP notification. OCIT V3.0 gives you the possibility to use the supply infrastructure from OCIT V2.0, to supply these topographical data to an OCIT V3.0 capable field device.	**O**	
3.7	Standalone RSU	**O/P**	

No.	Function	Equipment	System reference
	A new OCIT field device has been defined within the cooperative infrastructure. On the one hand, this RSU without TSC functionality can be made available to the services defined in OCIT-O Car. On the other hand, other functions can also be integrated (such as MAP supply).		
3.7.1	**Car:** Device information Similar to the TSC device status, an upgraded device information has been defined for the RSU.	**O**	
3.7.2	Equipment The functionality required in the RSU depends on the application. You must define which from the functions specified above (risk messages, status information, public transport prioritization, MAP supply), are required in the RSU.	**P**	
4	**Central system access**		
	Central system access enables supply or service tools to communicate with the traffic signal controllers from the central device. To do this, the existing connections and communication units from the central device are used. Access of the tools to the traffic signal controllers takes place practically in parallel to the access of the central device. The traffic signal controllers therefore carry out all commands that arrive via the central system access point. The "last come - first serve" principle applies. This can lead to conflicts when commands are transmitted from different sources, e.g. from the central control clock and a service tool. The status change of the field device is visible in the central device via the actual vector and the initiator can be detected via the SysJobId. The connection of the service tools to the central device takes place via the central LAN (10/100 Base T Ethernet, RJ-45 connector). Logically taken into consideration is the system access of a OCIT outstations interface. The number of LAN accesses depends on the number of manufacturers who operate tools in the central device. **V2:** In the past, the central system access point was meant for the device suppliers' experts, who with it run the supply on their own traffic signal controllers from the central device or from remote locations, or test device functions. As of OCIT-O version 2.0 the central system access point is also used for the user supply with supply tools of any manufacturer. To show clearly how much	**G**	**System:** Define number of LAN accesses, remote connections via telephone, WAN etc. **Parameter:** IP address, password

No.	Function	Equipment	System reference
	responsibility is associated with the use of the central system access point for the overall functions of the system, the following rule is set in OCIT-O TSC V2.0: Upon delivery of the traffic signal controllers, the password entered for commands via the central system access point is not the default OCIT-O password, but instead a password that only the manufacturer knows. From the central system access point, if this password is not known, the user can only transmit objects via the central system access point that are not protected with the SHA-1 algorithm and that do not affect the system functions. However, data supplies and control commands are protected with SHA-1 and cannot be transmitted. If the customer (operator) needs all of the functions of the central system access point, this must be ordered separately. This clearly shows the operator's responsibility for the use of the central system access point. Upon receipt of this separate request, the traffic signal controller supplier is then either to configure the traffic signal controllers with the standard OCIT-O password or with one specified by the customer. If this password is known, it will be possible to supply the traffic signal controllers via the central system access point and to set the switching requests. The operator / central device manufacturer provides the following information for each central system access: IP address of the system access computer to be connected IP address of the gateway computer (if necessary) IP address of the name server (DNS) OCIT central device numbers to be used by the system access point and OCIT field device numbers.	O	
5	**Data transmission**		
5.1	**OCIT Protocol BTPPL (Basis Transport Packet ProtocoL).**		
	OCIT uses the ISO-OSI layers model. BTPPL is located in layers 7 to 5. In layers 4 and 3 it is supplemented by the UDP, TCP and IP standard protocols. Layers 2 and	G	

No.	Function	Equipment	System reference
	1 are occupied in accordance with the respective transmission profiles. If project-specific transmission procedures are selected, these may have to be adjusted. Transmission security: SHA-1 algorithm against unauthorized access Generating checksums (Fletcher) TCP/IP transport layer security devices Security devices and error correction in the transmission units. **V2:** From version A03 btppl telegram sizes of up to 2 megabyte can be transmitted.		
5.2	**Data network protection**		
	An integral part of the BTPPL protocol is the SHA-1 algorithm, which has 24-bit password protection ensuring that hackers cannot tamper with the field devices. This algorithm protects the field device, which ignores unsecured commands. If hackers electronically tap the connections between the field devices and the central device, intrusion into the central system components and further into the administrative network would nevertheless be possible. This attack can occur due to improper use of the network protocols of layers 3 and 4. In their central communication equipment the manufacturers of control centers generally offer a sufficiently high level of protection against these intrusion attempts. Administrative networks are usually protected through the use of firewalls at different system levels.	**P**	**System:** Test attack scenario, potentially install firewall.
5.3	**Detecting faults in the transmission path**		

No.	Function	Equipment	System reference
	A "fault in the transmission path" is understood here as a complete failure in the transmission path for several seconds, such as one that might occur if the connection is interrupted ("communication fault") or if there is a power supply failure ("power outage"). Transmission faults can be detected in the field devices and central devices through the lack of telegrams. Detection possibilities based on the functions of the transmission device such as carrier monitoring are not planned in OCIT Outstations as they would be subject to regulations with regards to the selection of the transmission devices. Transmission faults detected by the field device generates the “Communication Fault” message and make their way to the control center via the query of the default message archive. This message includes the cause of the error "power outage". There is also the option of differentiating the "power outage" cause of error from other types of causes as a power outage is also detected on the field device by the hardware (see row 4.3.1 in this table). Note: Due to relevant technology selected to detect a transmission fault or the amount of time between telegrams, the times of origin of the "Communication Fault" messages in the field device and in the central device may differ significantly! It is recommended to specify in the system whether, and how fast the field device, only the central device, or both must detect a transmission fault.	**G**	**System:** **V2:** Specify in the system whether, and how fast the field device, only the central device, or both must detect a transmission fault.
5.3.1	A detected transmission fault includes the cause "power outage". An immediate differentiation of the fault cases is not possible without further measures. The cause can only be reconstructed following the elimination of the fault from the messages saved in the device archives. To be able to detect a causal power outage shortly after the occurrence of a transmission fault, the supply voltage in the field device must remain available long enough for the central device to be able to access the corresponding device messages (in the archives). To do this, a buffering of the supply voltage over at least 30 seconds is required (short term UPS). Most manufacturers offer additional hardware for this purpose. To keep the buffer time as short as possible, the power outage can also be reported to the central device in the shortest time possible through the "EvList::OnPowerOFF()" event.	**O**	**System:** Short term UPS Quick message (event)

No.	Function	Equipment	System reference
5.3.2	**V2: Managing messages in a central device:** To prevent an incorrect interpretation of the time of the power outage, the power outage message archived in the central device should only be derived from the message "Power OFF" from the standard message archive. To get information immediately, the EvList::OnPowerOFF() can be displayed as the status.	**P**	**System:** Define message management
5.4	**Transmission profiles**		
	Transmission profiles are definitions for the data transmission system and the device functions required for this purpose. Up to now, three transmission profiles have been defined in OCIT-O: Profile 1 – Transmission profile for point-to-point connections on permanently switched transmission paths Profile 2 - Transmission profile for dial-up connections in the fixed-line network and GSM mobile telecommunication network Profile 3 - Ethernet with DHCP Transmission profiles not standardized in OCIT can be implemented on a project-specific basis, but they require hardware and software changes to controllers and central devices.	**P**	**System:** Define transmission system.
5.4.1	**Transmission profile 1**		
	Data transmission system corresponding to the specifications of "Profile 1 - Transmission profile for point-to-point connections on permanently switched transmission paths, version 1.1"	**G**	Configuration corresponding with the selection of transmission profile.
	Transmission installations Various modems corresponding with CCITT V.35. LOGEM®LGx28.8D1 series modems meet all the technical requirements for the secure communication of devices from various manufacturers to a central device. For this reason, they are used as the reference modem when troubleshooting in the event of ambiguous malfunctions of the transmission path. If other modems are integrated into the devices, these must exhibit a similar level of functionality as the reference modems and meet their benchmark figures: Operating types V.34,V.32bis, V32, V.22bis	**G**	Configuration corresponding with the selection of transmission profile.

<table>
<tr><th>No.</th><th>Function</th><th>Equipment</th><th>System reference</th></tr>
<tr><td></td><td>Error protection V42
Data compression V42bis
Transmission speed 2400 up to 28800 bit/sec
Impedance 600 Ohm
Receive level area - 6 ...- 43 dBm
Transmission level (at 600 Ohm) - 6 ... - 12 dBm
Symmetry > 55 dB
Return loss > 14 dB

Temperature range for using in the traffic signal controller: -25 to +70 °C

Selection, integration and connection system of the modem are given by the manufacturer.</td><td></td><td></td></tr>
<tr><td></td><td>Transmission paths

Cu two wire line (private networks) or analog Telekom transmission paths.

Manufacturer details and empirical values:
<table>
<tr><th></th><th>Wire diameter 0.8 mm</th><th>Wire diameter 0.6 mm</th></tr>
<tr><td>Point to point connections</td><td>Up to 12 km. In individual cases, up to 15 km can be reached with better quality cables.</td><td>Up to 6.7 km. This value is calculated by a computer, is not guaranteed but has been confirmed in practice.</td></tr>
<tr><td>2 modems back to back</td><td>Up to 25 km.</td><td>Up to 13.4 km with the restrictions as above.</td></tr>
</table>
With very bad transmission paths, it may occur that the minimum transmission speed of 2400 bit/s is selected or set automatically. Transmission ranges can not be specified for these transmission paths, they are to be determined through trials. At 2400 bit/s, only operating and reporting is still possible for traffic signal controllers with OCIT-O. Should measurement values or signaling data be transmitted, a transmission speed of 9600 bit/s and higher should be sought.</td><td>-</td><td>System: Implement network planning.</td></tr>
<tr><td>5.4.2</td><td>Transmission profile 2</td><td></td><td></td></tr>
</table>

No.	Function	Equipment	System reference
	Data transmission system corresponding with the specifications of "Profile 2 – Transmission profile for dial-up connections in the fixed-line network and GSM mobile telecommunication network". The connections between field device and central device are set up as required through dial up procedures by the field device and central device.	G	Configuration corresponding with the selection of transmission profile.
	Transmission installations Standardized GSM modules or ISDN installations without further preference. Selection, integration and connection system of the modem are given by the manufacturer.	G	Configuration corresponding with the selection of transmission profile.
	Transmission paths Transmission paths are the digital distribution networks, GSM (GSM 900 in the German network or GSM 1800 in the European network) or ISDN (also as a user owned network). The dial up networks must support the following properties: Bit rate adaption for adjusting line based transmissions of various transmission speeds to the digital network. Both transmission installations and the participating networks must support the CLIP functions (call number transmission). This is generally offered in GSM networks, GSM modems and in ISDN networks, however the provider's defaults are to be observed. Analog connections (POTS network) are not supported due to the often lacking CLIP function and the slow connection establishment in profile 2. In exceptional cases, these can be drafted and configured on a project specific basis and following detailed consultation with all participants.	P	Configuration corresponding with the selection of the transmission profile and the transmission path
5.4.3	**Transmission profile 3**		
	Data transmission system corresponding with the specifications of "Profile 3 - Transmission profile for Ethernet with DHCP". Connection with Ethernet is a standardized, wired data network technology for local data networks,	G	Configuration corresponding with the selection of transmission profile.

No.	Function	Equipment	System reference
	via which a simple connection to a wide variety of communication networks is possible. Whether field devices which support Profile 1 or 2 can be upgraded to Profile 3 depends on the type and scope of the installed operating system and the associated connected hardware.		

5.2 Interface functions

This table lists the functions of the OCIT Outstations for traffic signal controllers interface in version 3.0. Each interface function requires a corresponding user or device function in the central device and in the traffic signal controllers. The central device must support all functions used in the system, the individual traffic signal controllers only need to support the basic functions and the additional (optional or project-specific) functions selected for their intended purpose.

The OCIT traffic signal controllers from various manufacturers to some extent produce various reactions for the same results. This is due to the history of the systems present for the users. OCIT-O deliberately refrains from making provisions here. Typical differences can be found in the following functions:

Switching on in the GPS or synchronous

Reporting of the switch on / off programs

Text for fault messages

Switching back on after fault elimination

Operating cycle controls and switching back on

The device manufacturers can adjust these functions to the user requirements.

No.	Function	Equipment	System reference
6	**Interface functions**		
6.1	**Control center switch requests**		
6.1.1	**Operating model** A central user can manually or automatically initiate the following switching actions depending on the configuration of the central device. Switch total intersection on / off Enable switching local total intersections on/off. The off status can be: Off-dark or off-flashing (RiLSA and special flashing) Select control center signal program (max. 255); enable local signal program selection Or switch partial intersections 1 to n off like total intersections (in off status) Enable local activation of the partial intersections. The actual status of a partial intersection can be on or off (in off status). The main intersection cannot be activated via this mechanism. The off status can be: Off-dark or off-flashing (RiLSA and special flashing) Switch traffic actuation on/off, enable local enabling of traffic actuation. Switch special intervention x on/off, enable local special intervention. **V2:** Switching the signal program, intersection, partial intersection, special intervention and modifications with only a single call. The user model assumes that each object of the control center switch request can be set independently of the others. For example, if the central device switches a partial intersection on or off, this does not affect the state of the special intervention. Manual switching requests (via the local user device) have priority in respect to the switching requests from the central device. The priority of switching requests from the central device in respect to the switching requests originating from the device (from the local traffic actuated program selection) can be selected. If the central device enables the local selection, the field device selects the switchings based on other local criteria (control clock or local plan).	G	**Operating:** Select priority of the switching requests of the central device as opposed to the local switching requests.

No.	Function	Equipment	System reference
	V2: Note: With these possible settings and the diverse associated lengths of validity, this results in a very large number of configurations. In order to achieve clear controller behavior, OCIT-compliant configurations are listed in a table in the document OCIT-O_TSC_V2.0.		
6.1.2	**Operation identifier** Throughout the system, operations are performed from different sources (local or control center, manually or automatically). These sources for example are a central user, a central automatic time function or a local traffic actuated logic. Their actions are marked with an operation identifier. Field device messages caused by operations of use or change operations adopt the operation identifier of the triggering action. This way, the operation and response can be documented in the central device. The operation identifier consists of origin identifier and task number. The task number is always issued by the system component determined by the origin identifier. **V2:** Origin identifier: Central device / system access / field device with further breakdowns into types (switching clock, supply data server), process data server, etc.), subtypes (user device, special intervention, etc.) and instances thereof. Task number of the central device: 0 to 65535 for origin identifier Task number of the field devices: 0 to 63 for origin identifier	G	
6.1.3	**Start and end time** Switching requests have a validity period which is given in the form of a start and an end time. (Resolution: one second). The **start time** makes it possible to offset different transmission times for synchronous switching of multiple traffic signal controllers. Switch requests only go into effect when the start time is reached; until then the new request remains in waiting position and the old one remains current. A switch request in the future always overwrites the switch request in waiting position. The **end time** essentially makes it possible to revert to local operation at the defined time without any further connection to the control center. Every control center switch request accepted by the controller remains valid	G	

No.	Function	Equipment	System reference
	in the controller until its end time regardless of any faults in the transmission path.		
6.1.4	**V2: Switch intersections** Signal program, intersections, partial intersections, special intervention and modifications are switched with only a single call. Using this method, the influence of temporal behavior of the transmission route is ruled out for the switching request. If an attempt is started to switch to a non-supplied program from the controller status Off, then the device remains off. Note: It is recommended with OCIT-O TSC Version 2.0, Release 02 or higher that method "SwitchIntersection" be used in order to ensure that the time-related behavior of the transmission route does not affect the switch requests.	G	
6.1.5	**Signal program selection** Central signal program selection of the signal program No. 1-255. **V2:** If an attempt is started to switch to a non-supplied program from the controller status Off, then the device remains off.	G	
6.1.6	**Switch intersections on and off** Switching on and off entire intersections including the partial intersections. Possible settings: Enabling / locking of the local intersection state selection for signal program, on and off Switching on into the signal program Switching off into the default state (normally flashing in the secondary direction as per RilSA). Switching off to Off-Flashing-Secondary direction Switching off to Off-Dark Switching off to Off-Flashing-All	G	**System:** Specify switching procedure (see foreword to this table, Chap5.2 and table 5.1)
6.1.7	**Switching partial intersections on and off**	G	**System:** Specify switching procedure (see foreword to this table,

No.	Function	Equipment	System reference
	Partial intersections can be switched on and off from the central device. Up to 4 partial stations can be realized in one intersection. Possible settings: Enabling / locking of the local partial intersection state selection for signal program, on and off Switch the partial intersections to the state of the intersection (on, signal program) Switching off into the default state (normally flashing in the secondary direction as per RilSA). Switching off to Off-Flashing-Secondary direction Switching off to Off-Dark Switching off to Off-Flashing-All		Chap 5.2 and table 5.1)
6.1.8	**Select the effect of the special intervention** If a control center signal program switch request is present and a special intervention switch request is present for the same time, then the controller activates the special intervention but only if the intersection is switched on. Switch special intervention: Local special intervention enabled Select temporarily valid signal program, e.g. fire brigade plan route 1 - n. Special intervention off, block of local special interventions	**G**	**System:** Traffic and system planning of special interventions.
6.1.9	**Select higher level state of the local TA** Local TA status selection enabled The local TA logic does not work, i.e. fixed-time mode The local TA logic works.	**G**	**System:** Traffic and system planning of the TA
6.1.10	**Select state of the influence of the local TA by individual traffic** TA control through individual traffic enabled. Individual traffic does not influence the TA logic Individual traffic influences the TA logic	**O**	**System:** Traffic system planning of the individual traffic prioritization.
6.1.11	**Select higher level state of the public transport prioritization.**	**O**	**System:** Traffic system planning of the public

No.	Function	Equipment	System reference
	Local PT prioritization enabled The local PT prioritization does not work The local PT prioritization works		transport prioritization. Equip devices to do this.
6.1.12	**Project-specific modifications** Generally, the implementation of modifications can take place in two different ways: 1. OCIT compliant through "project specific modifications" while maintaining the signal program. To do this, the following stipulations can be selected from the central device: No stipulations (local selection) Modification on Modification off 2. On a project specific basis through signal program switching, e.g. program 1 = fixed time, program 11 = traffic actuated.	**P**	**System:** Traffic system planning of the modifications.
6.2	**Querying the operating state of the field device**		
	The field device returns the current state at the time of the query and the operation identifier of the triggering task to the central device.		
6.2.1	**Running signal program** The traffic signal controller returns the number of the signal program running at the time of the query and the operation identifier of the triggering task.	**G**	
6.2.2	**SwitchOn/OffStatus of an intersection** The traffic signal controller returns the OnOffStatus of the intersection set at the time of query along and the operation identifier of the triggering task.	**G**	
6.2.3	**SwitchOn/OffStatus of a partial intersection** The traffic signal controller returns the status of the partial intersection set at the time of query along and the operation identifier of the triggering task.	**G**	
6.2.4	**Special intervention status** The traffic signal controller returns the status of the effect of the special interventions set at the time of query along and the operation identifier of the triggering task.	**G**	

No.	Function	Equipment	System reference
6.2.5	**Status of the local TA logic** The traffic signal controller returns the higher level status of taking into account the traffic system results on the control procedures set at the time of query along and the operation identifier of the triggering task.	**G**	
6.2.6	**Status of the influence of the local TA logic by individual traffic** The traffic signal controller returns the status of the effect of the individual traffic on the local TA logic active at the time of query along with the operation identifier of the corresponding task.	**O**	
6.2.7	**Status of the public transport prioritization** The traffic signal controller returns the higher level status of taking into account the results of the public transport prioritization set at the time of query along and the operation identifier of the triggering task.	**O**	
6.2.8	**Status of project specific modifications** The traffic signal controller returns the status of the effect of project specific modifications set at the time of query along and the operation identifier of the triggering task. So that the central device can display the meaning of this modification to the operator, an explanatory text is also transmitted.	**P**	
6.2.9	**Operating mode** The traffic signal controller returns the operating mode set locally at the time of query along and the operation identifier of the triggering task.	**G**	
6.2.10	**Operating status (actual vector)** The traffic signal controller returns the operating mode set at the time of query along, a collective fault message, operating statuses and the operation identifier of the triggering task. In the event of a change of the actual vector, a message (event) can be issued by the traffic signal controller (can be configured from the central device) which is able to cause the central device to read the operating status. Actual vector information: Time since the last change of the actual vector Collective fault:	**G**	**Operation:** Configure event.

No.	Function	Equipment	System reference
	Priority is given where there are a number of types of error present at the same time. An error with a higher priority overrides an error with a lower priority: • no fault • Internal fault without shutoff (priority 1): e.g. communication faults • Fault without shutoff (priority 2): secondary lamp faults or other signal monitoring alarm without shutoff • Fault with partial shutoff of the system (priority 3): e.g. shutoff of partial intersections by SiMo, but at least one partial intersection is still running. • Fault with shutoff of the entire system (priority 4): e.g. all signal monitoring fault shutoffs (e.g. primary lamp faults) Operating mode + operation identifier Signal program + operation identifier Intersection on or off + operation identifier Partial intersection on or off + operation identifier Current special intervention + operation identifier Current modifications + operation identifier • TA logic • PT prioritization • project-specific modification		
6.3	**Query device status**		
6.3.1	In addition to the actual vector there is a controller status for each traffic signal controller. This can be queried, but is not written into the operating state archive. The controller status contains the following entries: Current time source Emergency off (short term UPS required) Door open (collective message via all door contacts) List of the faulty detectors Network voltage in order Network voltage faulty (short term UPS required) List of faulty lamps Indication whether the permanent memory is consistent (checksum).	**G**	**System:** Select option short term UPS.
6.4	**Recording and transmitting operating data (Archives and archive functions)**		

No.	Function	Equipment	System reference
6.4.1	**Archives** Selected operating data are collected in the archives of the traffic signal controllers. There are several archives in each controller. What data are to be stored in which archive is determined by tasks of the control center. Up to 256 different tasks are possible for each archive. The data from the archives can be read out by the control center or at the system access. Additionally, the control center can request data archived by the controller that are in certain positions or data that were recorded at particular times. The archived data are collected by the central device upon the occurrence of particular events. In the case of occurrence of such an event the controller sends an event telegram (does not contain the data) to the control center, which in turn can request individual or multiple data from the archives. Event telegrams can be triggered: when a set fill level of the archive has been reached, when entering certain variable values, when changing the target address for the event telegrams. The archives of the controllers can be parameterized by the control center during operation. The following can be defined: size, type of tasks, events that lead to event telegrams, stop and enable collection of data, reset. The following procedures are available for recording data: Cyclical recording, entry when values change, entry following a comparison (<, >, =, unequal, leap), recording of a quick change (e.g. detect signals from loop detectors in a compressed form), record R09 telegrams, record signaling, record binary inputs, record AP values. The following listed archives can be applied in each traffic signal controller:	G	**System:** Specify the type of archives. **Operating:** Create tasks (data that should be recorded and archived).
6.4.2	**Operating state archive (list number 0)** The operating state archive is used for saving the operating state. The operating states are recorded for each operating state change. The tasks for this are pre-defined and cannot be changed. The archive is contained	G	**System:** Establish a larger archive.

No.	Function	Equipment	System reference
	in the basic configuration and is configured to the minimum level. The data stored in the archive are preserved after switching off the power supply. Minimum number of entries: 400 Typ. Fill time: 80 days (5 signal plan changes per day)		
6.4.3	**Standard message archive (list number 1)** Contains messages from signal monitoring, faults and other messages: OCIT main message + secondary message + message degree. The tasks for this are pre-defined and cannot be changed. The archive is contained in the basic configuration and is configured to the minimum level. The data stored in the archive are preserved after switching off the power supply. Minimum number of entries: 1200 Typ. Fill time: 600 days (2 entries per day)	**G**	**System:** Establish a larger archive.
6.4.4	**Syslog archive (list number 2)** Archive for tasks and data which are kept permanently. The archive is available even in the basic configuration. The archive size is adjusted by the manufacturer to the other archives available in the controller. The data stored in the archive are preserved after switching off the power supply.	**G**	
6.4.5	**Archive service - system access (list number 3)** Archive in the controller for tasks that manage the central system access.	Configuration, archive size and tasks are specified by the device suppliers.	
6.4.6	**Supply archive (list number 4)** The supply archive contains all messages which may occur during the supply operation. In the standard message archive each supply operation is marked only with the messages "Supply start" and "Supply end".	**G**	
6.4.7	**Dynamic archive (list number 31)** This archive is provided for process data whose instructions are frequently changed. The number of entries into the signaling archive and measurement value archive can serve as an orientation	**G**	**System:** Specify archive variables. **Operation:** Create tasks.

No.	Function	Equipment	System reference
	for selecting the size of the archive (12,000 each as a minimum). However, it must be ensured that the transmission of process data via the transmission route between traffic signal controller and central device (PD server) is limited. In the case of typical usage of the traffic signal controller with profile 1 at a transmission rate of 19200 Baud and the transmission of the data from 20 signal groups and 32 detectors, for this reason no more than 20 AP values should be additionally transmitted every second.		
6.4.8	**Signaling archive (list number 32)** Contains the signaling states, recorded at each state change. Possible additions: Cycle seconds TX, detector signals, stages, among others Minimum number of entries (12 signal groups for example): 1200 Typ. Fill time: 20 minutes (one change per second)	**G**	**System:** Establish a larger archive. **Operation:** Create tasks for selected signal groups and supplementing values.
6.4.9	**PT archive (list number 33)** R09 standard telegrams (time created, reporting point, line, trip, route, priority, vehicle length, manual direction, schedule deviation) or advanced R09 telegrams. All the R09 telegrams relevant for this traffic signal controller are stored in the archive. Received but irrelevant telegrams are not stored. Minimum number of entries: 1200 Typ. Fill time: approx. 10 days (1 bus ever 10 minutes, 1 message)	**O**	**System:** Establish a larger archive.
6.4.10	**Measurement value archive (list number 34)** Contains expanded and aggregated detector values as well as project specific measurement values (as AP values). Minimum number of entries (aggregated over of 15 minutes for example): 1200 Typ. Fill time: 12 days	**O**	**System:** Establish a larger archive. **Operation:** Create tasks for selected measurement values.
6.4.11	**Online archive (list number 35)** Raw detector values (changes of the detector output) and the AP values. The sampling interval in which the	**O**	**System:** Specify archive variables.

No.	Function	Equipment	System reference
	changes are detected (resolution) can be adjusted from the control center. The maximum resolution that can be set is 10 ms. If a sampling interval is selected that the controller cannot provide, an error message is dispatched that also contains the interval supported by the controller. Benchmarks (byte every time a loop is passed): 20		**Operation:** Create tasks for selected measurement values.
6.4.12	**Offline archive (list number 36)** This archive is planned for OCIT-O Profile 2 to be able to specify which messages may lead to a callback request at the central device on a project-specific basis.	**P**	**System:** Specify archive variables. **Operation:** Create tasks.
6.4.13	**Free archives** Archives are established on a project specific basis.	**P**	**System:** Specify archive variables. **Operation:** Create tasks.
6.5	**Messages**		
6.5.1	Messages are all entries into the archives that represent operating faults, processes or states. Each message is made up of the following parts: Time of the entry into the archive, main message and additional message (message parts). Each message part has an identifier, operation identifier and its own parameters. The central device assesses the messages and adds them as a message degree (see further below) message category (see further below) and possibly text. Using the additional message parts, manufacturer specific expansions of the main messages are possible. With OCIT, it is possible to expand the standard by manufacturer-specific objects and methods. **V2:** To also make these expansions available to different manufacturers when using systems from a variety of manufacturers, these objects must be described entirely as an xml file (<manufacturer>AddOns.xml). When doing so, the nomenclature defined in OCIT-Standard must be used. In order to have them automatically parsed from the central device to be displayed and to be able to process them, making it possible to show these messages on the screen in clear text, the	**G**	**System:** Specify whether the manufacturer specific additional messages should be issued as text. Specify messages (see foreword to this table, Chap 5.2)

No.	Function	Equipment	System reference
	format must be maintained exactly. Only a short characterized text is defined for the message. The possible values and meanings of the parameters included in the message must be described in an XML format.		
6.5.2	**Message degree and message category** The message degree and message category only refer to the main message part. Message degree: 0 Information 1 Warning 2 Error 3 Critical Error Message category: 0 Other 1 Controller hardware 2 Target signal pattern error 3 Actual pattern error 4 TA logic 5 Communication system 6 Operating system / firmware 7 User software 8 Supply 9 Clock 10 Detectors 11 Operating state	**G**	**System:** Change the assignment to the messages on a project-specific basis (software adjustment of the controllers is necessary)
6.5.3	**Main messages** Fault cleared This message is created when a fault is cleared and with this the previous fault message should be removed. **V2:** Faults which have been cleared can be listed as manufacturer specific secondary messages. Power off This message shows the time when the power supply was switched off. **V2:** The message can be expanded with a manufacturer-specific secondary message, to return a distinct reason for the power outage. Option: Report power outage to the central device through an event (quick message) as soon as possible. Power ON System error	**G** **O**	**System:** Specify project-specific messages, select "quick message" option.

No.	Function	Equipment	System reference
	Target pattern fault		**System:** Select type of "door open messages". Note: The option for the expanded "Door open messages" may require adjustments to the hardware of the field devices.
	Actual pattern error (severe)	O	
	Conflict		
	Intergreen time		
	Minimum green time		
	Minimum red time		
	Red lamp error		
	actual pattern error (secondary)	O	
	Communications fault		
	Clock faulty / ok		
	Service on / off		
	Door open / closed Option: Difference between "Door on controller part", "Door on EVU part" and "Door on control element" (the expanded messages are realized as additional message parts of the "Door open / closed" message).		
	Supply beginning		
	Supply end		
	Cycle check		
	Change of operating mode		
	Messages when the reception of PT telegrams is faulty.		
	Time skip		
	Archive operation messages		
	System messages		
	Project specific messages (1 to 32)		
	Parameters of the main messages can be the names of the following components: Intersections, partial intersection, signal group, signal head, signal head chamber, incoming signal group, clearing signal group, detector.		
	Recommendation for message management in a central device: Message forwarding for the purpose of troubleshooting / maintenance should as a rule not be done based on error messages, but instead after checking the current status of the device by querying the objects ActualVector and DeviceStatus.		

No.	Function	Equipment	System reference
6.6	**Detecting measurement values**		
6.6.1	**Detection of the signaling for visualizing in the central device** **V2:** The signaling is recorded to do this depending on the count value of the cycle time counter TX (cycle seconds). In the earlier versions of OCIT-O, to do this all signal groups and the TX value had to be ordered individually (TESignalPattern). To simplify this, it is now possible to order the cycle seconds TX and all states of the signal groups together using the **TESiplOnline** function. For a cyclical requested task with an interval of typically 1 second every entry is created with the TX and all signal groups. For a task which is only requested in the event of a change, an entry is generated for every change of the TX that either only the TX contains (particularly if the signal remains constant) or the TX is followed by all signal groups as soon as only one signal group has changed. With Version 2.0 it is recommended that this task element (**TESiplOnline**) be used instead of TESignalPattern. The measurement values for the "Signaling" reference the target signal patterns, not the measurement values of the signal monitoring. The following are recorded for each signal (green / yellow / red): Dark Flashing starting with dark Flashing starting with light Frequency: 1 Hz / 2 Hz on **V3:** The prediction sent is recorded.	**G**	
6.6.2	**Detector measurement values** **Raw values:** Detection of binary detector signals **V2:** Measurement values of detectors with additional information:	**O**	**System:**

<table>
<tr><th>No.</th><th>Function</th><th>Equipment</th><th>System reference</th></tr>
<tr><td></td><td>
<table>
<tr><td>Occupancy</td><td>Occupancy duration of the measurement site in 10ms:
0 - 655.34 s</td></tr>
<tr><td>Gap</td><td>Last gap in 10 ms:
0 - 655.34 s</td></tr>
<tr><td>Journey time</td><td>Journey time from point 1 to point 2 Measurement site in ms: 1 ms - 32766 ms</td></tr>
<tr><td>Speed</td><td>Measured speed in km/h:
0 - 254 km/h</td></tr>
<tr><td>Vehicle length</td><td>Length of the vehicle in 0.1m:
0.1 - 25.4 m</td></tr>
<tr><td>Vehicle type</td><td>Type of vehicle (class) corresponding with the TLS,.Technical Delivery Terms for Route Stations, German Federal Highway Research Institute, 2006》
Class 0: Car
Class 1 Car + trailer
Class 2 Truck
Class 3 Truck + trailer
Class 4 Bus
class 5 Other
class 6 Motorbike
class 7 Delivery truck
class 8 Semi trailer truck
Class > 8 undefined</td></tr>
</table>
Aggregated detector measurement values
<table>
<tr><td>Counter value in vehicles/h</td><td>0 to 65534
All vehicles in the aggregation interval</td></tr>
<tr><td>Occupancy level in %</td><td>0 to 100%
All vehicles in the aggregation interval</td></tr>
</table>
</td><td></td><td>Specify detectors, names, and contents of the AP values.
Operating: Select sampling and aggregation.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Function</th><th>Equipment</th><th>System reference</th></tr>
<tr><td></td><td>
<table>
<tr><td>Average speed;
divided for each class between 1 and 8 in km/h</td><td>0 to 254
255 no valid value</td></tr>
<tr><td>Counted value,
divided for each class between 1 and 8</td><td>0 - 65534
65535 no valid value</td></tr>
</table>
The specified value ranges designate the information capable of being transmitted with OCIT-O. Real transmitted values and their accuracy depend on the detector type used that is not specified in OCIT-O. Speed detectors often only work at or above a minimum speed of several km/h, for example.
Sampling and aggregate intervals can be set from 10 ms up to (theoretically) 497 days.
The highest resolution is achieved using the smallest sampling interval which can be set of 10 ms.
If a device does not support a requested sampling interval, an error message ensues with details of the intervals supported by the device.
C2X data
</td><td></td><td></td></tr>
<tr><td>6.6.3</td><td>
R09 standard telegrams
Time created, reporting point, line, trip, route, priority, vehicle length, manual direction, schedule deviation.
Extended R09 telegrams
Standard telegram + relative intersection number, status of PT modification, TX upon reporting, signal plan, running stage, requested stage, travel time at sign on / sign off, green end of the PT signal group.
V3: C2X based telegrams
</td><td>O</td><td>System: Specify type of R09 telegrams.</td></tr>
<tr><td>6.7</td><td>Query field device information
(system object field device)</td><td></td><td></td></tr>
<tr><td>6.7.1</td><td>
The purpose of this object is to provide general information via the field device and register the communication partner for the field device:
Manufacturer (MemberID)
</td><td>G</td><td></td></tr>
</table>

No.	Function	Equipment	System reference
	Device type (central device, system access or field device) OCIT version / subversion SW version of the user program Current local or central time Time zone: Deviation from GMT in seconds (Greenwich Mean Time) Time sources: unknown / network / quartz / DCF / GPS Query of the instances of the object type implemented in the field device: Returns all instances which match the specified object (e.g. detector 1 ...n). This method may also be used, for example, to read out all tasks for a list. Central and field device numbers of the communication partner **V2**: max. 65535 return values		
6.8	**Standard AP values**		
6.8.1	Standard AP values are used frequently and for that reason are predefined AP values which can be handled, such as project specific AP values (read only however, cannot be edited). Cycle second TX: The cycle second of the signal program running is counted beginning with 0 in 100 ms increments. Running stage PH: not defined / current stage number Desired stage UE: Stage transition active / inactive	**G**	**System:** Use corresponding with the traffic system planning.
6.9	**Detectors and signals**		
6.9.1	**V2: Querying names and / or states** Note: The supply of the names takes place in the traffic signal controllers and can only be carried out by the device manufacturer. Digital input (**DigInput**) for querying the name of the binary, digital inputs such as detector message inputs and request signals. On a project-specific basis DigInput can be used to query freely selectable input signals.	**G**	

No.	Function	Equipment	System reference
	Signal group (**SignalGroup**) is used for querying the name of the signal group. The object cannot be activated or queried regarding its binary statuses with OCIT-O methods. Signal head (**SignalHead**) is used for querying the name of the signal head. The object cannot be activated or queried regarding its binary statuses with OCIT-O methods. Signal head chamber (**SignalHeadChamber**) is used for querying the name of the signal head chamber (lamps). The object cannot be activated or queried regarding its binary statuses with OCIT-O methods.		
6.10	**Change passwords** (System object remote device)		
6.10.1	Using this object, passwords can be changed safely from the central device. A password may be up to 12 characters in length.	**G**	
6.11	**Service operation display** (System object remote service)		
6.11.1	This objects indicates to the central device and the system access whether, until when, and why this device is in service operation. The service operation can take place via the local service access or via the central service access. In local system operation, a similarly usable piece of information is returned through the message "Door open". The information from this optional function can be useful for the user when carrying out service via the central system access.	**O**	**System:** Select option depending on the project specific specifications.
6.12	**Trace options**		
6.12.1	For testing purposes, the detection of the btppl telegram correspondence is designated "tracing". There is provision for 2 recording options: The btppl telegram correspondence is detected in the traffic signal controller or in a control center unit and is saved. The trace files present in binary format can be converted into a readable format using the OCIT-O type tool which is included in the scope of supply. The btppl telegram correspondence is detected and saved through an external detection device (trace tool)	**G**	

No.	Function	Equipment	System reference
	on the traffic signal controller or a control center unit. The ports (not the physical) for connecting the trace tool and its basic functions are specified in OCIT-O. The trace tool is not currently contained in the scope of supply of the OCIT-O Specifications.		

A1 New functions in OCIT Outstations V3.0 for Traffic Signal Controllers (details)

Compared with V2.0, the specifications of the OCIT Outstations version 3.0 interface for Traffic Signal Controllers contain a series of new functions which focus on the Car-2-X communication. The scope of function has been expanded for some of the functions already existing in version 2.0. Functions which have remained unchanged have often been specified in further detail or supplemented with information regarding their application.

The present overview concentrates on the **application related description of new or expanded** functions, whose in-depth description is divided across a number of documents. The description of the functionally unchanged functions which has been improved in many places can however only be found in the individual documents of the specification. An overview of the changes can be found in the document

The specifications of the OCIT-O interface version 3.0 for traffic signal controllers are backward compatible with version 2.x. They include the unchanged or expanded functions from version 2.x and the new functions. Some of the new functions may replace the old ones. It is recommended to use them when communicating with the corresponding devices.

It was necessary for the standardized remote data supply and the expanded recording of process data to mutually coordinate the specifications from OCIT Outstations and OCIT Center to Center.

A1.1 Functional overview

OCIT-O Car_V1.0:	
0	Status information
A1.3	Public transport prioritization
A1.4	Risk message
A1.5	Requesting signal plan data
A1.6	Spat object
OCIT-O TSC_V3.0:	
A1.7	MAP object
A1.8	Archives of the traffic signal controllers
A1.9	AP value object

OCIT-O Basis V3.0:	
A1.10	Operation identifier
OCIT-O Rules and protocols V3.0:	
A1.11	Data transmission and protocol
A1.12	System time

A1.2 Status information

The vehicles send their status information from several sensors to the RSU via the CAM messages. This makes them available for the traffic control in the central device or the TSS.

The data of interest to the traffic engineers are time and date, position, speed, direction of the vehicle and vehicle type.

The positions of the vehicles in a lane or even a signal group can be assigned using the intersection topology from the MAP message. The average speed, waiting time, number of stops and connection-related average values are provided for a central analysis of the vehicle data. These values are each related to the RSU's reception reach.

The data from the C2X – communication should be used for a quality analysis and quality assurance of the intersections.

A1.3 Public transport prioritization

Public transport vehicles and special response vehicles are able to request a prioritization using the Car2X communication CAM telegrams. These request telegrams can be recorded. The CAM messages with R09 container is the same in terms of selection for the task for R09 telegrams and only returns an advanced data set.

The public transport configuration of a traffic signal system can be queried by the central device. The central device is able to send public transport request telegrams (R09 telegrams) to the traffic signal system. Using these functions, it is possible to implement a public transport prioritization for telegrams which are guided via the control center.

A1.4 Risk messages

Risk messages can be triggered at the control center level, as well as at the field level, and can be distributed across the entire system. The information of a traffic participant with a risk message leads to an increased safety of the traffic participant or a reduction of the environmental pollution (CO2 emission). Simultaneously, there is the option of statistical evaluation.

The risk messages inform about roadworks areas, incident and incident messages, traffic situation, road conditions and meteorological data (wind, rain, visibility).

A1.5 Requesting signal plan data

There is an option of requesting information about the current signal status of the traffic signal controllers and the time remaining until the next status change. These predicted traffic-light-stage information can be transmitted to vehicles. An evaluation of the deviation of the predicted signal times and the actual deviations can be generated.

A1.6 Spat object

The Spat object offers the option of requesting the predicted duration for the current status of a signal group or to also transmit this to the traffic signal controller. This way, predictions that were created on the basis of historical data can be provided to traffic participants. If the central computer or an externally running prediction algorithm generates the prediction data and transmits it to the traffic signal controller, these do not have an effect on the actual switching behavior in the field device. Additionally, if predicted data are also generated in the field device, it is up to the field device which predicted data are passed onto the RSU. (project-specific solution)

A1.7 MAP object

The MAP object offers the possibility to transmit the topology information for an intersection to the controller or to request the MAP data saved in it. The MAP data are defined for use in motor vehicles and tailored to their requirements. To transmit the MAP data, the OCIT supply data mechanism is used. This uses the mechanisms for versioning and checksums

A1.8 Archives of the traffic signal controllers

New archives have been defined for storing C2X data.

- Archive 37 – for the status information of the vehicles
- Archive 38 – for the risk messages
- Archive 39 – for the predicted signal status of a signal group

The archives 37, 38, and 39 can be configured from the control center whilst running.

A1.9 AP value object

The object type AP value (1:505) was expanded with GetGescription. This returns a description or a clear text name of the AP value.

A1.10 Operation identifier

The operation identifier is edited by text and types of causes have been added

- 6 = Supply data server
- 7 = Processor data server
- 8 = C2X

.

A1.11 Data transmission and protocol

The OCIT-O transmission profile 2 is not suitable for OCIT-O version 3.0.

A1.12 System time

The OCIT system was upgraded to the time service NPT version 4 (RFC 591305).

For this the control center provides the time service NPT, which can be used by the OCIT traffic signal controllers for synchronizing controller time with control center time.

A2 Glossary

The explanations of the technical terms and abbreviations used in this document can be found in “OCIT – O Glossary V3.0”.

A3 Figure

TOC

A4 References

ETSI, 1. 5.-1. (08 2013). ETSI TS 101 539-1: "Road Hazard Signalling (RHS) application requirements specification".

ETSI, 1. 6. (01. 06 2009). ETSI TR 102 638: "Basic Set of Applications; Definitions". Europe.

ETSI, 1. 6.-3. (1. 09 2010). ETSI TS 102 637-3: "Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service". Europe.

ETSI, 1. 8. (01. 06 2011). ETSI TR 102 863: "Basic Set of Applications; Local Dynamic Map (LDM);". Europe.

ETSI, 1.-2. (08 2013). ETSI TS 102 894-2: "Users and applications requirements; Part 2: Application and facilities layer common data dictionary".

ETSI, 3.-0. (08 2013). ETSI EN 302 637-03: "Specifications of Decentralized Environmental Notification Basic Service (DENM)". Europe.

Copyright © 2018 ODG