Overview of the

Central Command and Control System

for

TuDEM

The automatic fire extinguishing system for tunnel protection with mobile remote controlled monitors on overhead rail

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A brief description of the system

Innovating fire extinguishing system for tunnel fires, for fully automatic intervention or for remote operation from a remote Control Room.
The system is based on the proven technology of fire fighting remote controlled foam/water monitors, worldwide utilized and appreciated for the fire protection in heavy risk plants.
The fire extinguishing system for tunnel protection with mobile remote controlled monitors on overhead trailer consists in a fixed structure (overhead rail), installed at the ceiling along the tunnel, and in a number of mobile units (trailers) equipped with foam/water monitors moving along the fixed structure.

The mobile unit

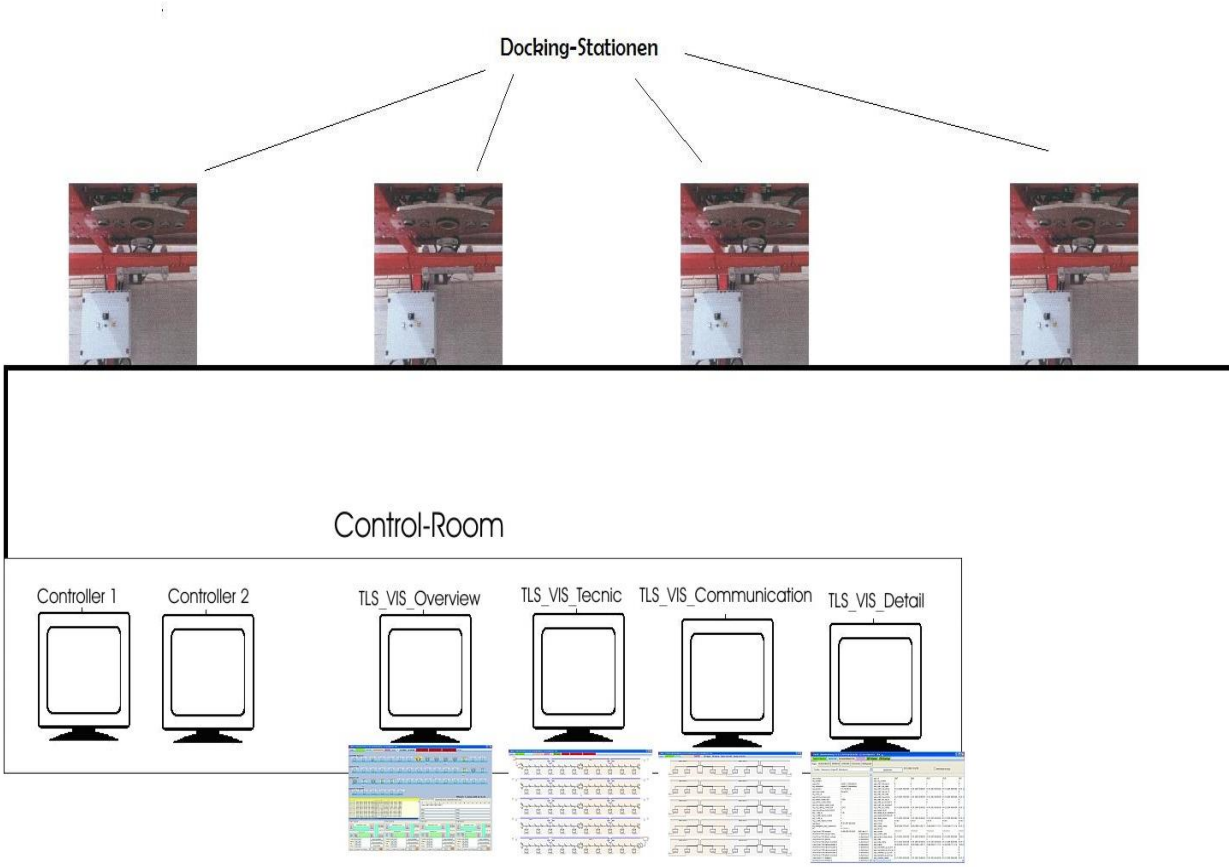
Each mobile unit (trailer) is equipped with:
- the electric remote controlled fire fighting monitor with flow rate 1.000 lt./min.,
- the motors for the linear movement of the trailer along the overhead rail,
- the battery for power supply of the unit during the movement along the overhead rail (buffer batteries which are automatically charged when the unit is connected "in stand-by" to a docking and control station),
- 2 IP / TV cameras for visible and infrared light,
- the electric panel with command and control devices,
- 1 flammable gas detector and 1 toxic gas detector for monitoring dangerous situations (optional).

The fixed structure

The fixed structure is equipped with:
- main water (or foam premix) supply pipe (working pressure ~10 bar),
- main electric power supply line,
- serial bus for data transmission,
- heat sensing cable and infrared flame detectors for fire detection.

The docking stations and the Control Room

At regular intervals along the tunnel are installed the **docking stations**. These stations are used to supply the mobile units with water, foam and electric power. For this reason, they are equipped with a power supply and a special coupling, which performs the docking function for the mobile unit.



The **Control Room** is the central point, where any kind of information, such as alarm messages, status messages or the pictures from the IP cameras are administrated. The intelligent controllers and the database systems are designed in a redundant way, like the entire communication. So the functionality of the system is always guaranteed, even in case of a computer failure.
Both intelligent controllers (**Controller 1** and **Controller 2**) are equipped with the Linux operation system which guarantees security and reliability.

The system is designed for a multiuser environment. Through the redundant construction of the local network and a wireless LAN (WLA) it is possible to maintain the visualisations of the system in separate rooms.

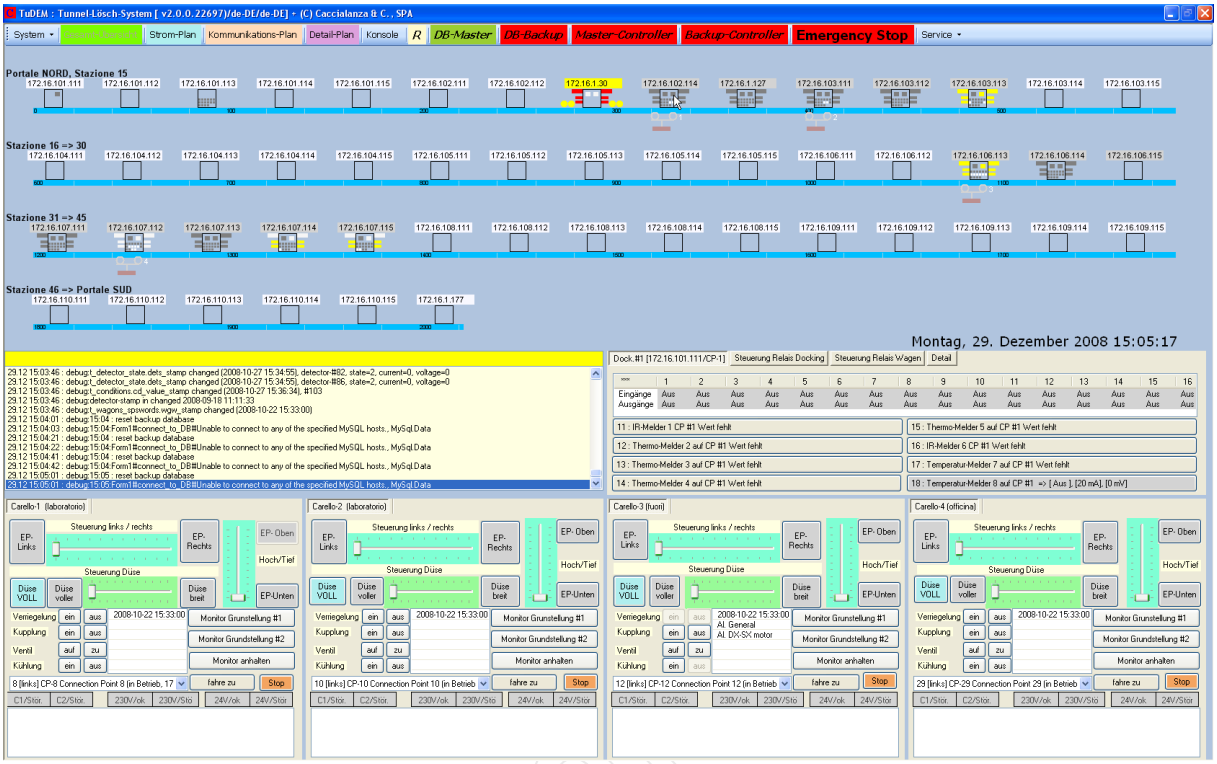
The visualisation programs

The visualisation of the system is performed by 4 different programs. These programs are running under the windows operation system

1. ***TLS_VIS_Overview***: overview over the entire system
2. ***TLS_ VIS_Technic***: technical overview (power / electricity)
3. ***TLS_ VIS_Communication***: technical overview (communication)
4. ***TLS_ VIS_Detail***: administration of the database

The program TLS_VIS_Overview

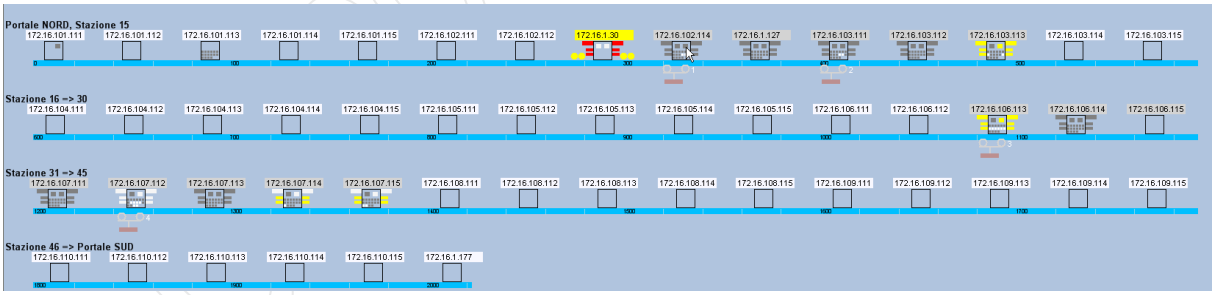
TLS_VIS_Overview shows at a glance the state of the entire system.



In the upper area you can see the states of the main database,

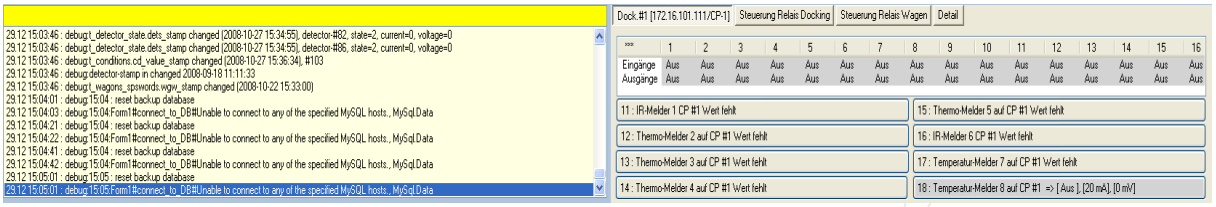
the backup database, the master controller and the backup controller. A green colour signalises the OKAY state, a red colour shows an ERROR condition.

In the **upper half of the screen** you can see the docking stations and the mobile units.



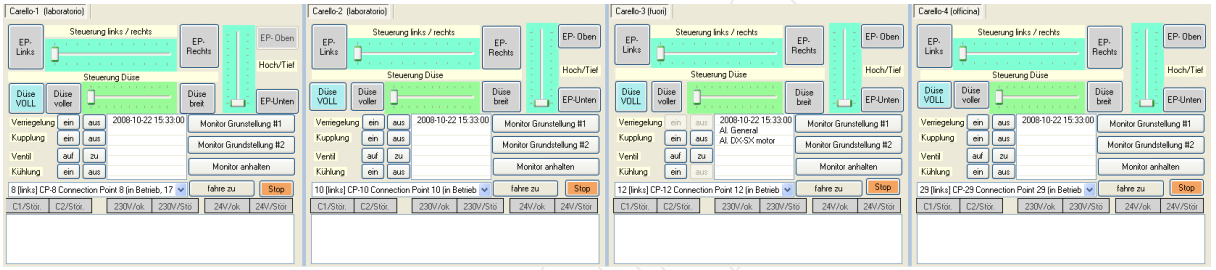
Near each docking station are shown the conditions of the detectors in appropriate colours.

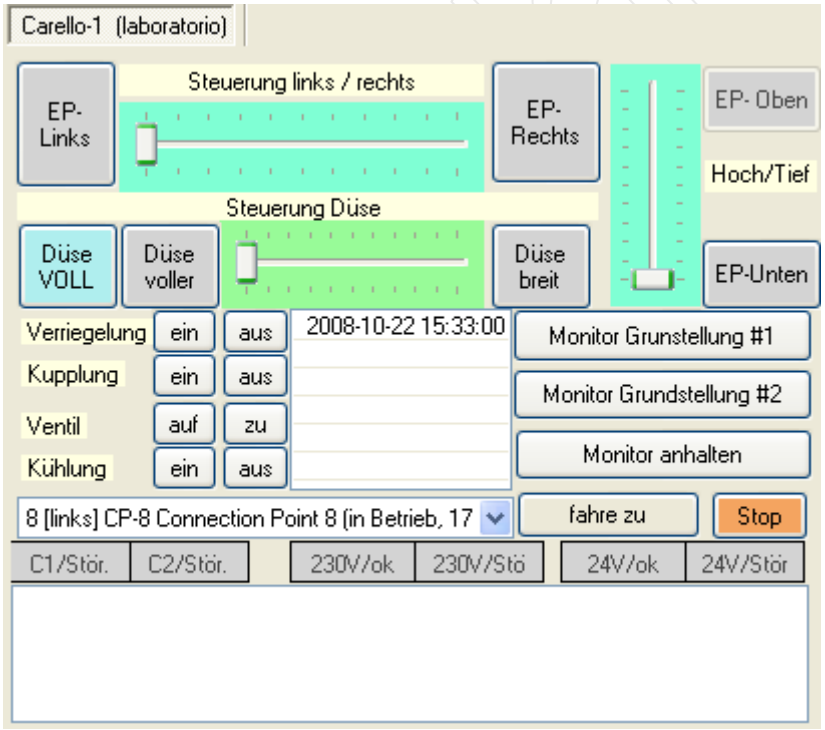
The **middle part of the screen** is divided in two parts.



In the left part some status information is shown. The right part is reserved to the detail view of the selected docking station or the selected mobile unit. Furthermore, in this area it is possible to control the selected docking station or the selected mobile unit.

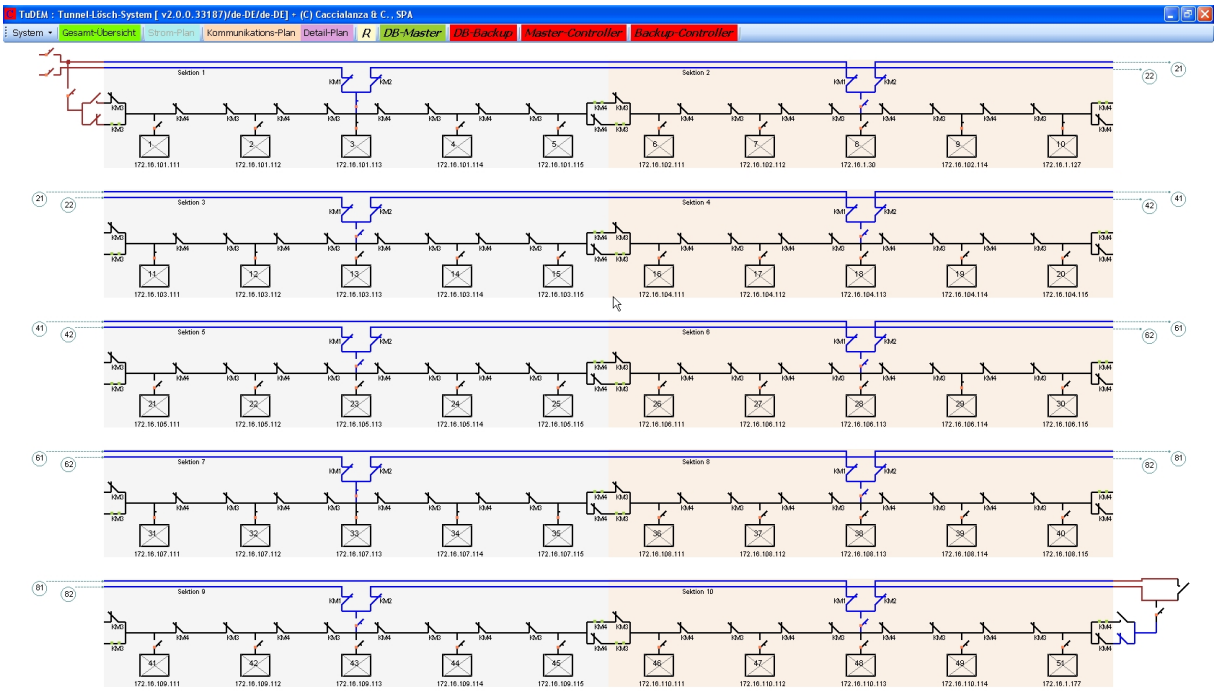
The **lower part of the screen** is reserved to the mobile units. In 4 side by side arranged dialog boxes are shown in a glance the states of the 4 mobile units. By pressing the buttons or the sliders it is possible to control the single units.



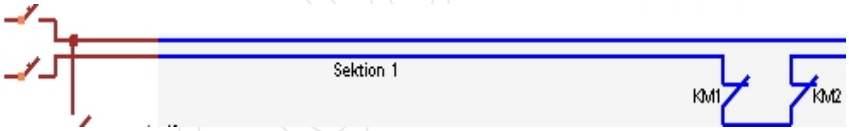


The program TLS_VIS_Technic

TLS_VIS_Technic is used to control in a glance the entire electric current and voltage of the system.



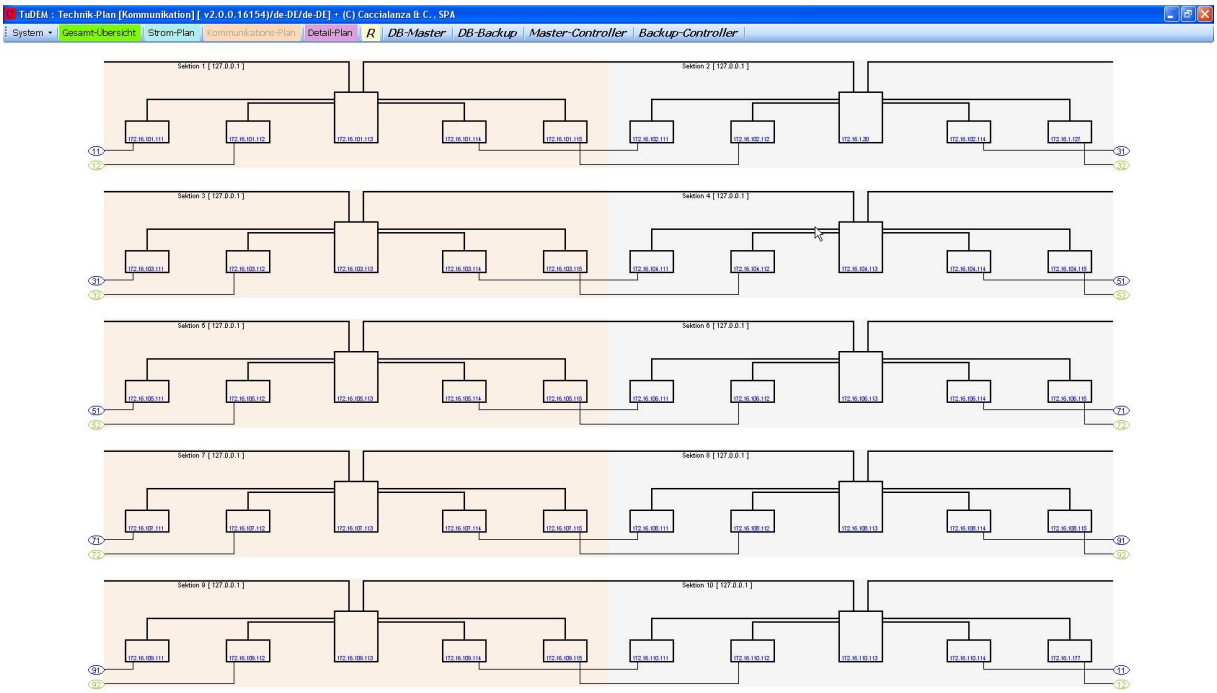
This program allows the maintenance personnel in the Control Room to check at a glance, whether the electric power of the system is okay or, if not, in which sector there are problems. Also the electric current supply is constructed in a redundant way; this guarantees in case of failure of one station the power supply through an alternative way.



A blue line marks a line under current. KM1 to KM4 shows the actual state of the relays.

The program TLS_VIS_Communication

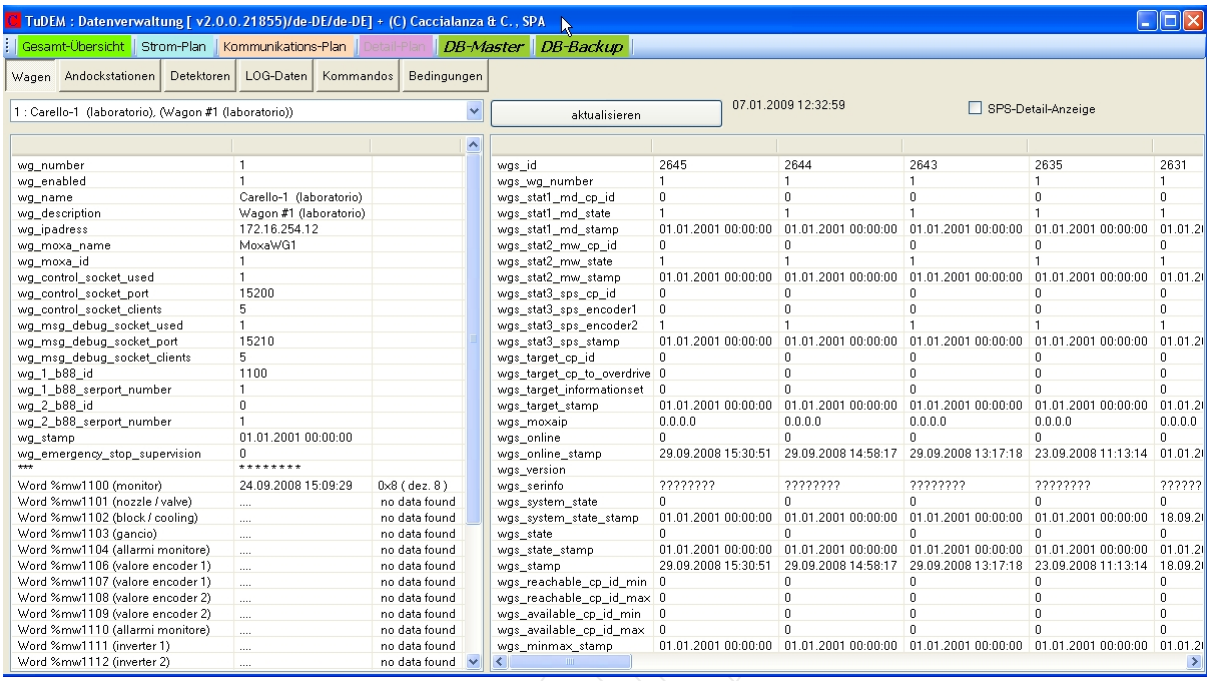
TLS_VIS_Communcation is used like *TLS_VIS_Technic* for the entire control of the serial communication.



This program allows the maintenance personnel in the Control Room to check at a glance, whether the electric power of the system is okay or, if not, in which sector there are problems. Also the electric current supply is constructed in a redundant way; this guarantees in case of failure of one station the power supply through an alternative way.

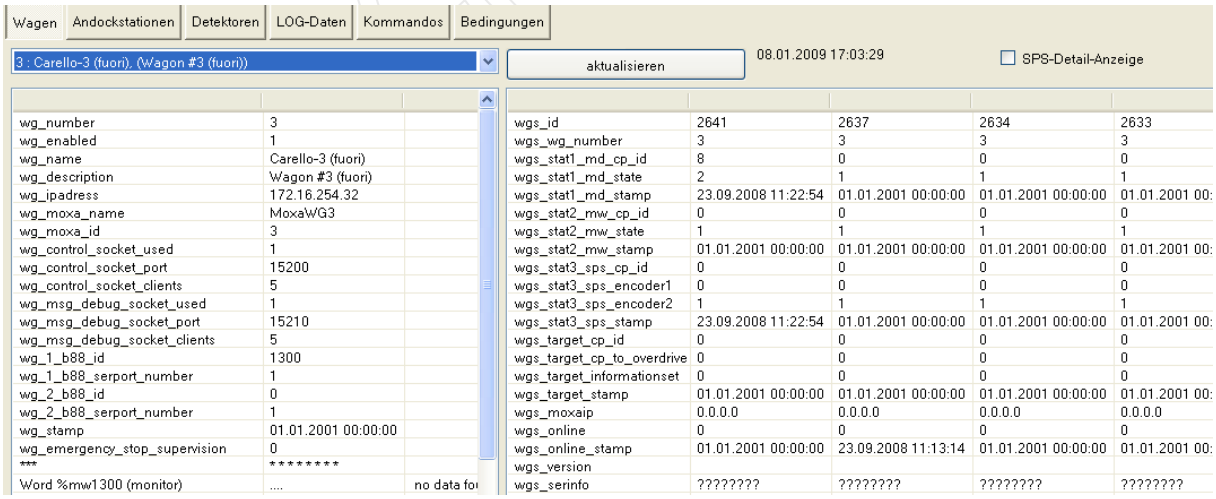
The program TLS_VIS_Detail

TLS_VIS_Detail can be used by the maintenance personnel to view and evaluate the database entries.



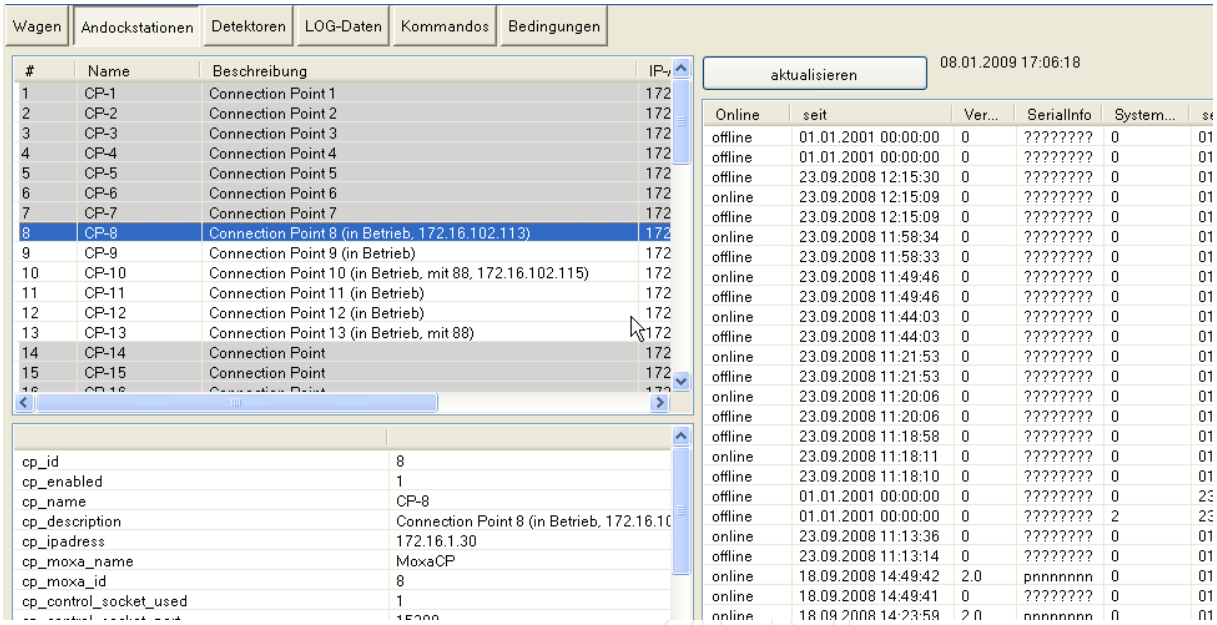
Information for the database is generated by the controllers (Controller 1 and Controller 2) when the system is in operation. The program *TLS_VIS_Detail* edits these data for the maintenance personnel is an appropriate way.

TLS_VIS_Detail: the trailers



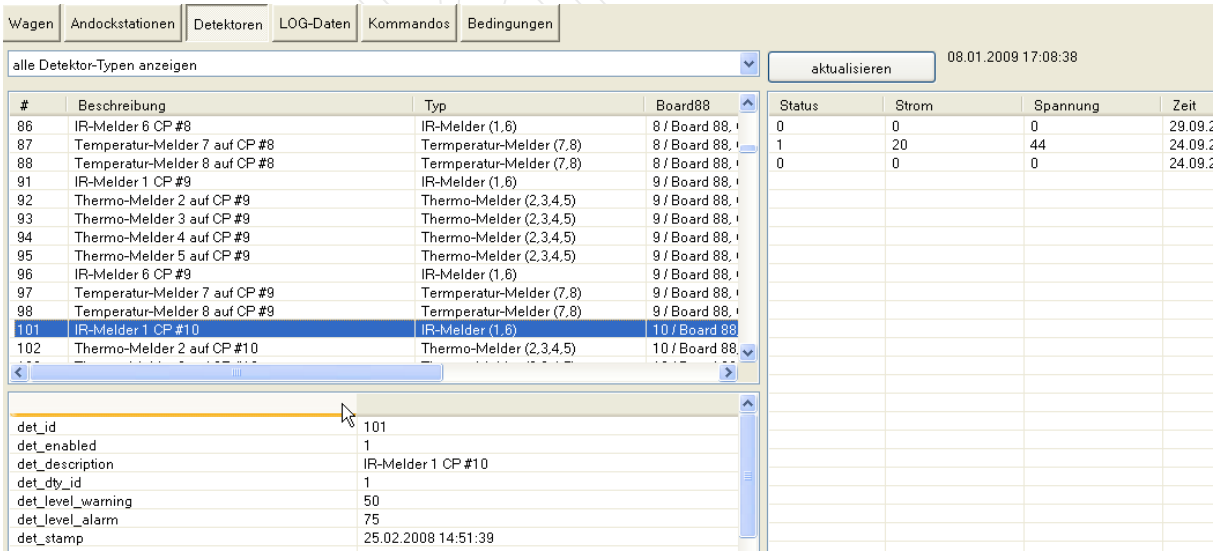
In the left area the configuration data of the selected trailer are shown; in the right area there are the data and information continuously created by the intelligent controllers.

TLS_VIS_Detail: the docking stations



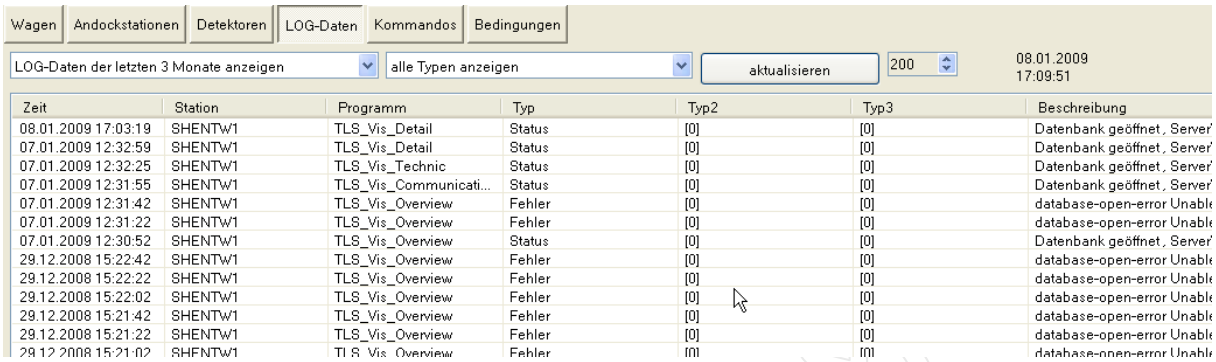
In the left area all docking stations are listed. After selection of one station the configuration data are shown in the lower area and on the right side you can see all log data for this docking station.

TLS_VIS_Detail: the detectors



In the left area all available detectors are listed. After selection of one detector the configuration data are shown in the lower area and on the right side you can see all log data for this detector.

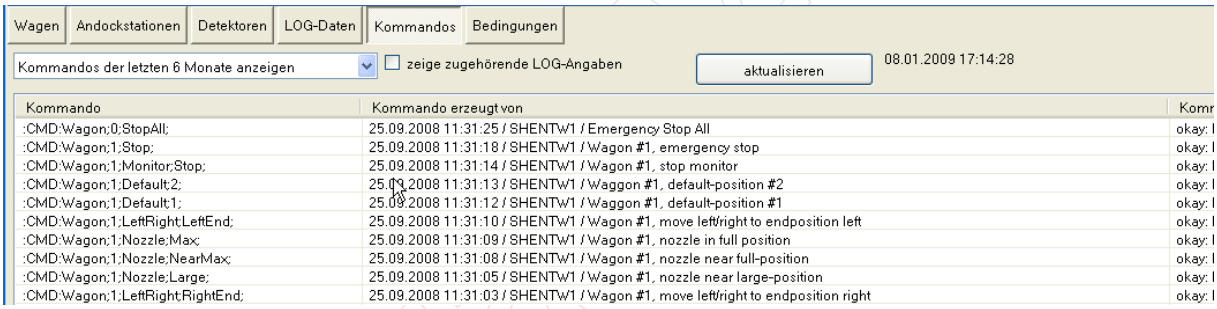
TLS_VIS_Detail: the LOG data



Zeit	Station	Programm	Typ	Typ2	Typ3	Beschreibung
08.01.2009 17:03:19	SHENTW1	TLS_Vis_Detail	Status	[0]	[0]	Datenbank geöffnet, Server'
07.01.2009 12:32:59	SHENTW1	TLS_Vis_Detail	Status	[0]	[0]	Datenbank geöffnet, Server'
07.01.2009 12:32:25	SHENTW1	TLS_Vis_Technic	Status	[0]	[0]	Datenbank geöffnet, Server'
07.01.2009 12:31:55	SHENTW1	TLS_Vis_Communicati...	Status	[0]	[0]	Datenbank geöffnet, Server'
07.01.2009 12:31:42	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
07.01.2009 12:31:22	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
07.01.2009 12:30:52	SHENTW1	TLS_Vis_Overview	Status	[0]	[0]	Datenbank geöffnet, Server'
29.12.2008 15:22:42	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
29.12.2008 15:22:22	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
29.12.2008 15:22:02	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
29.12.2008 15:21:42	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
29.12.2008 15:21:22	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable
29.12.2008 15:21:02	SHENTW1	TLS_Vis_Overview	Fehler	[0]	[0]	database-open-error Unable

The LOG data are produced by the intelligent controllers during the normal operation of the system. This information can be used to check the state and the behaviour of the system.

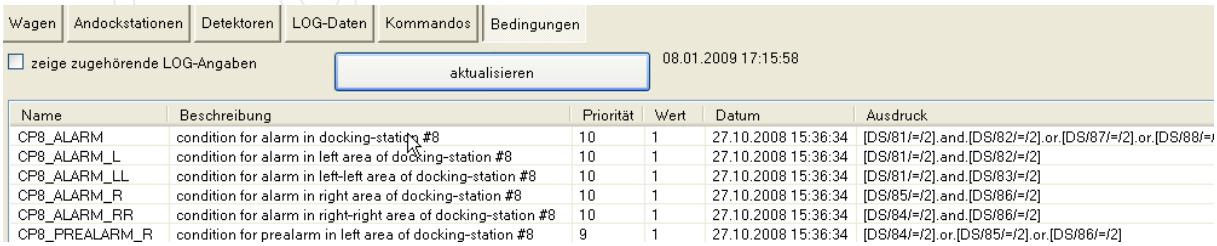
TLS_VIS_Detail: the commands



Kommando	Kommando erzeugt von	Komr
:CMD:Wagon;0;StopAll;	25.09.2008 11:31:25 / SHENTW1 / Emergency Stop All	okay: I
:CMD:Wagon;1;Stop;	25.09.2008 11:31:18 / SHENTW1 / Wagon #1, emergency stop	okay: I
:CMD:Wagon;1;Monitor;Stop;	25.09.2008 11:31:14 / SHENTW1 / Wagon #1, stop monitor	okay: I
:CMD:Wagon;1;Default;2;	25.09.2008 11:31:13 / SHENTW1 / Waggon #1, default-position #2	okay: I
:CMD:Wagon;1;Default;1;	25.09.2008 11:31:12 / SHENTW1 / Waggon #1, default-position #1	okay: I
:CMD:Wagon;1;LeftRight;LeftEnd;	25.09.2008 11:31:10 / SHENTW1 / Wagon #1, move left/right to endposition left	okay: I
:CMD:Wagon;1;Nozzle;Max;	25.09.2008 11:31:09 / SHENTW1 / Wagon #1, nozzle in full position	okay: I
:CMD:Wagon;1;Nozzle;NearMax;	25.09.2008 11:31:08 / SHENTW1 / Wagon #1, nozzle near full-position	okay: I
:CMD:Wagon;1;Nozzle;Large;	25.09.2008 11:31:05 / SHENTW1 / Wagon #1, nozzle near large-position	okay: I
:CMD:Wagon;1;LeftRight;RightEnd;	25.09.2008 11:31:03 / SHENTW1 / Wagon #1, move left/right to endposition right	okay: I

Commands are used only internally; they were created by the system and were executed by the intelligent controller. The information on the screen shows the command and its execution state.

TLS_VIS_Detail: the conditions



Name	Beschreibung	Priorität	Wert	Datum	Ausdruck
CP8_ALARM	condition for alarm in docking-station #8	10	1	27.10.2008 15:36:34	[DS/81/=/2].and.[DS/82/=/2].or.[DS/87/=/2].or.[DS/88/=
CP8_ALARM_L	condition for alarm in left area of docking-station #8	10	1	27.10.2008 15:36:34	[DS/81/=/2].and.[DS/82/=/2]
CP8_ALARM_LL	condition for alarm in left-left area of docking-station #8	10	1	27.10.2008 15:36:34	[DS/81/=/2].and.[DS/83/=/2]
CP8_ALARM_R	condition for alarm in right area of docking-station #8	10	1	27.10.2008 15:36:34	[DS/85/=/2].and.[DS/86/=/2]
CP8_ALARM_RR	condition for alarm in right-right area of docking-station #8	10	1	27.10.2008 15:36:34	[DS/84/=/2].and.[DS/86/=/2]
CP8_PREALARM_R	condition for prealarm in left area of docking-station #8	9	1	27.10.2008 15:36:34	[DS/84/=/2].or.[DS/85/=/2].or.[DS/86/=/2]

Conditions are created by the system producer and are used only internally.