



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).



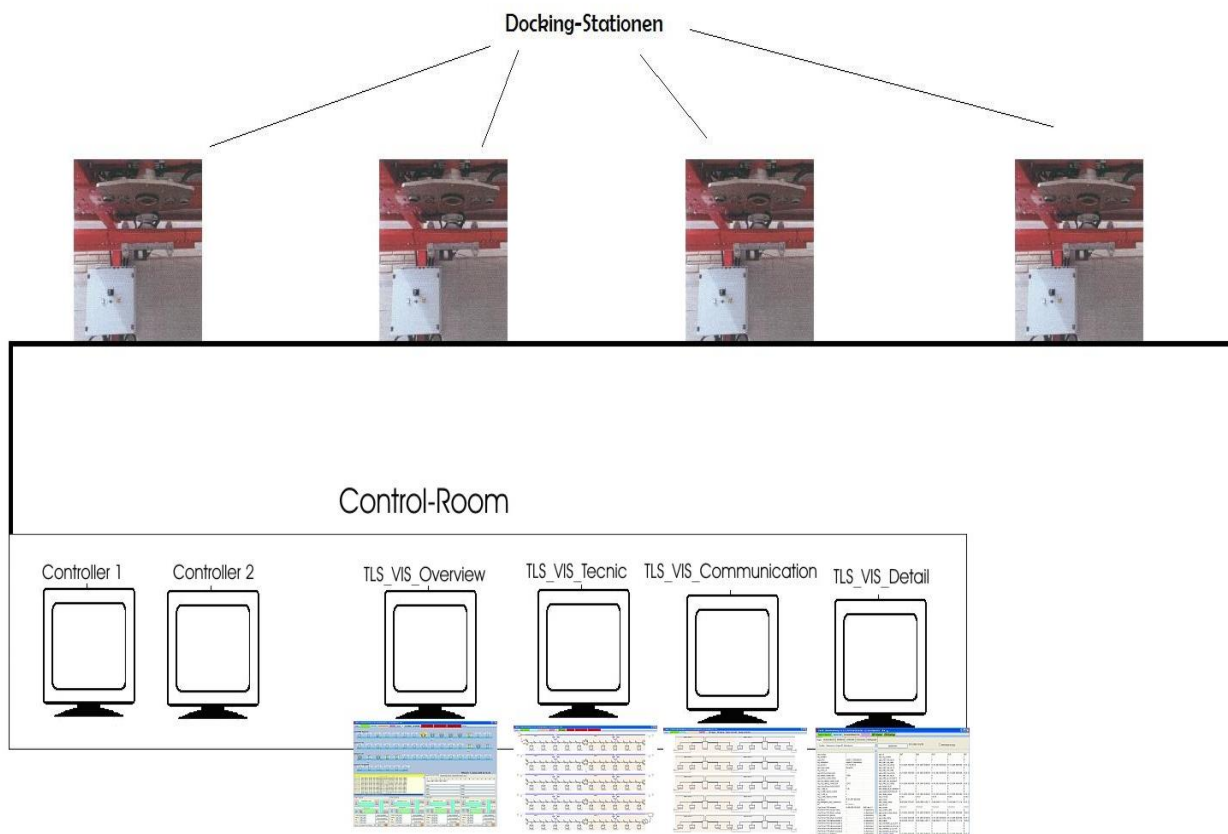
The fixed structure

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.

Montag, 29. Dezember 2008 15:05:17

21 12 15 03 46: debug: _detector_state_det_stamp changed (2008-10-27 15:34:55), detector=#02, state=2, current=0, voltage=0
 21 12 15 03 46: debug: _detector_state_det_stamp changed (2008-10-27 15:34:55), detector=#06, state=2, current=0, voltage=0
 21 12 15 03 46: debug: _conditions_cil_value_stamp changed (2008-10-27 15:30:30), #100
 21 12 15 03 46: debug: _detector_stamp_in_changed 2008-05-18 11:11:33
 21 12 15 03 46: debug: _wagon_towards_vgw_stamp changed (2008-10-22 15:33:00)
 21 12 15 04 01: debug: 15:04: reset backup database
 21 12 15 04 03: debug: 15:04 FormlReconnect_to_DB: Unable to connect to any of the specified MySQL hosts.: MySQL Data
 21 12 15 04 01: debug: 15:04: reset backup database
 21 12 15 04 22: debug: 15:04 FormlReconnect_to_DB: Unable to connect to any of the specified MySQL hosts.: MySQL Data
 21 12 15 04 41: debug: 15:04: reset backup database
 21 12 15 04 42: debug: 15:04 FormlReconnect_to_DB: Unable to connect to any of the specified MySQL hosts.: MySQL Data
 21 12 15 05 01: debug: 15:05: reset backup database
 21 12 15 05 01: debug: 15:05 FormlReconnect_to_DB: Unable to connect to any of the specified MySQL hosts.: MySQL Data

Engänge	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus
11: IR-Melder 1 auf CP #1	Wert fehlt																	
12: Thermo-Melder 2 auf CP #1	Wert fehlt																	
13: Thermo-Melder 3 auf CP #1	Wert fehlt																	
14: Thermo-Melder 4 auf CP #1	Wert fehlt																	
15: Thermo-Melder 5 auf CP #1	Wert fehlt																	
16: IR-Melder 6 auf CP #1	Wert fehlt																	
17: Thermo-Melder 7 auf CP #1	Wert fehlt																	
18: Thermo-Melder 8 auf CP #1	Wert fehlt																	

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



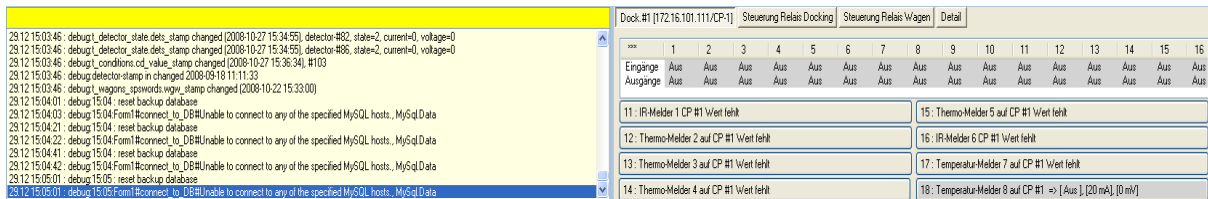
the backup database, the master controller and the backup controller. A green colour signals the OKAY state, a red colour shows an ERROR condition.

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.

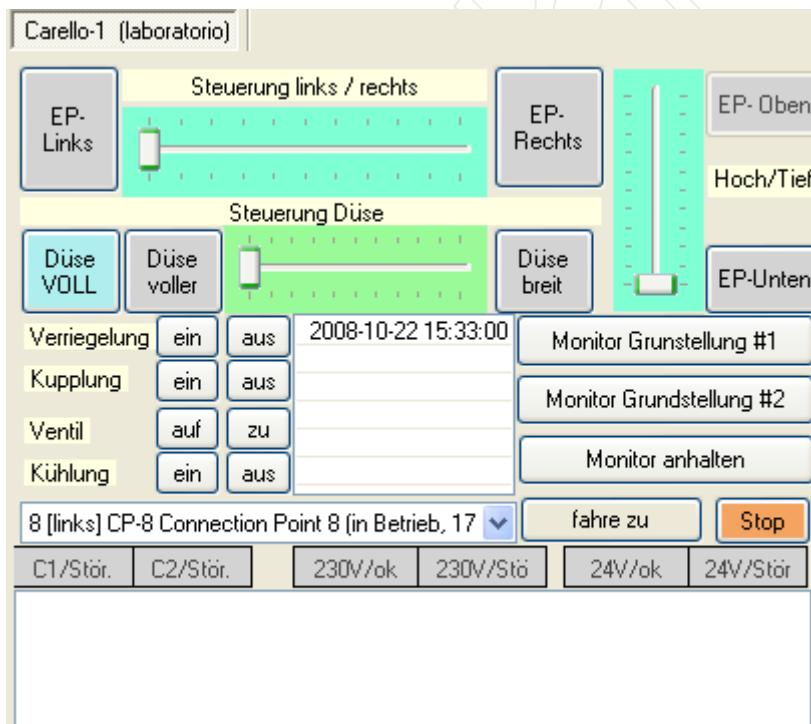
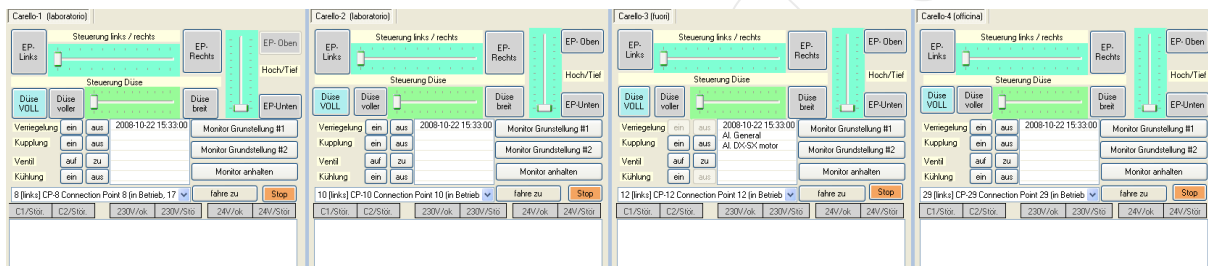


The **middle part of the screen** is divided in two parts.



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.

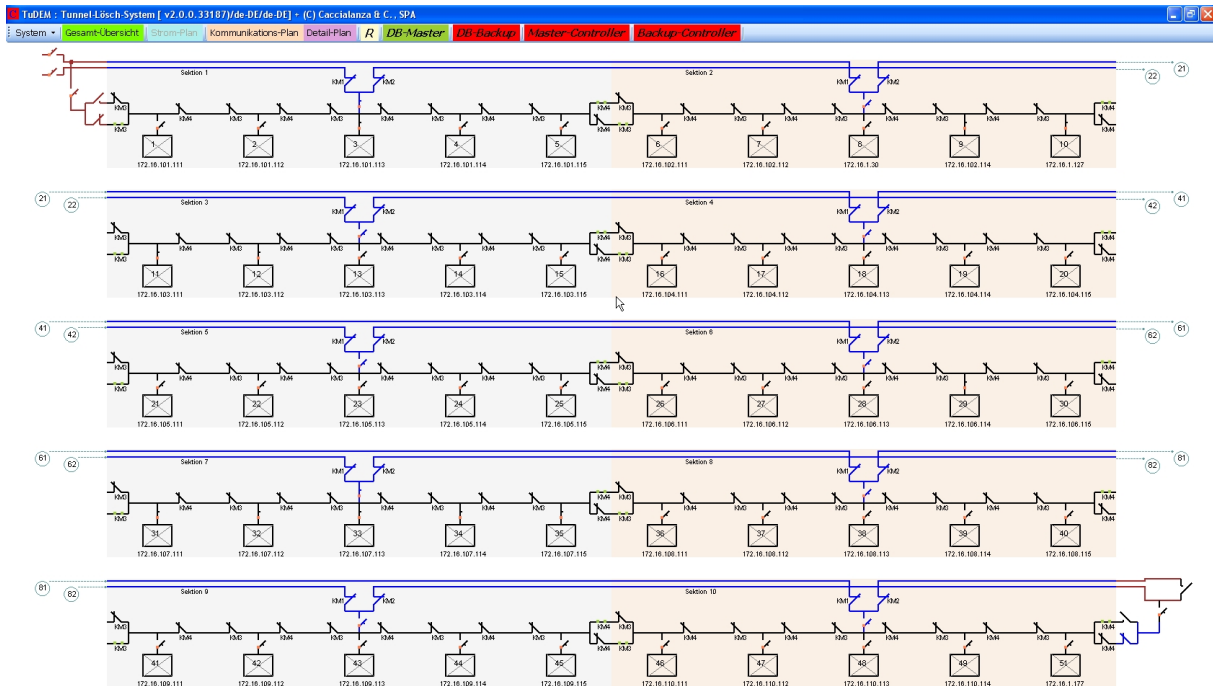
The **lower part of the screen** is reserved to the mobile units. In 4 side by side arranged dialog boxes are shown in a glance the states of the 4 mobile units. By pressing the buttons or the sliders it is possible to control the single units.



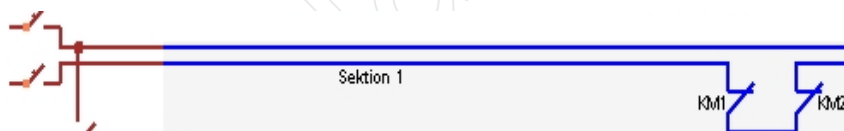


The program *TLS_VIS_Technic*

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.

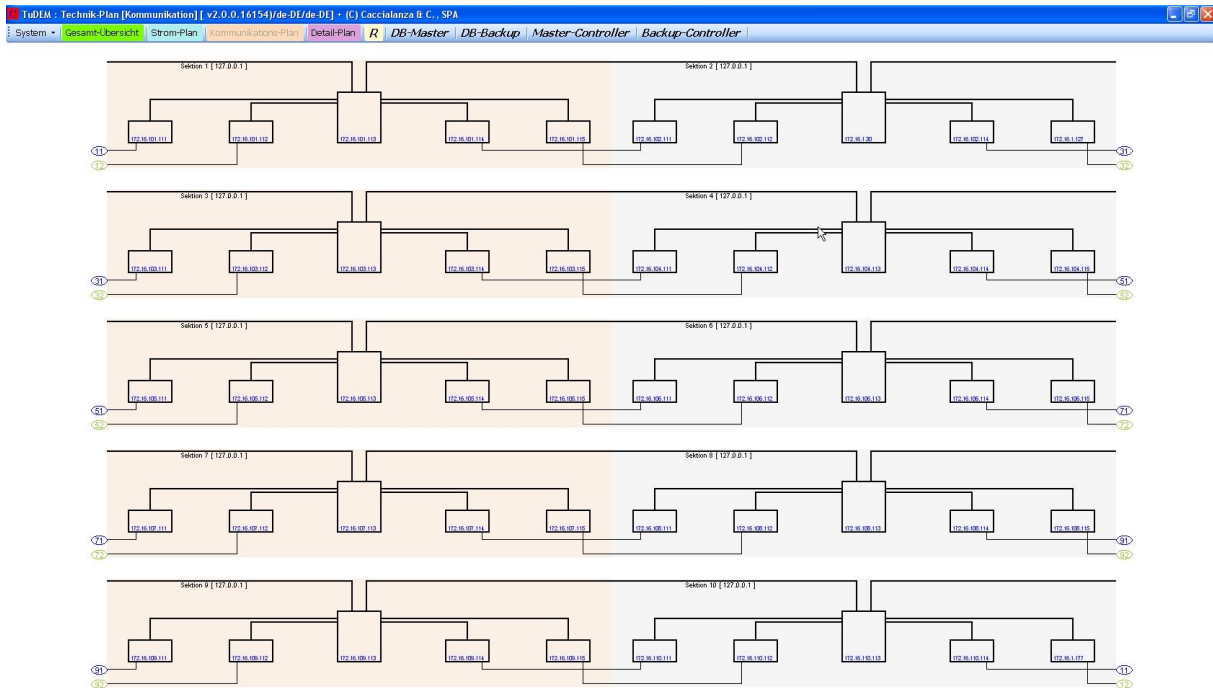


A blue line marks a line under current. KM1 to KM4 shows the actual state of the relays.



The program *TLS_VIS_Communication*

TLS_VIS_Communication is used like *TLS_VIS_Technik* 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.

The screenshot shows the software interface for Wagon #1 (laboratorio). The left pane displays configuration data for various components, and the right pane shows a table of system parameters.

Parameter	Value	Value	Value	Value	Value
wg_number	1	2645	2644	2643	2635
wg_enabled	1	1	1	1	1
wg_name	Carello-1 (laboratorio)				
wg_description	Wagon #1 (laboratorio)				
wg_ipadress	172.16.254.12				
wg_moxa_name	MoxaWG1				
wg_moxa_id	1				
wg_control_socket_used	1				
wg_control_socket_port	15200				
wg_control_socket_clients	5				
wg_msg_debug_socket_used	1				
wg_msg_debug_socket_port	15210				
wg_msg_debug_socket_clients	5				
wg_1_b88_id	1100				
wg_1_b88_serport_number	1				
wg_2_b88_id	0				
wg_2_b88_serport_number	1				
wg_stamp	01.01.2001 00:00:00				
wg_emergency_stop_supervision	0				
***	*****				
Word %mw1100 (monitor)	24.09.2008 15:09:29	0x8 (dez. 8)			
Word %mw1101 (nozzle / valve)	....	no data found			
Word %mw1102 (block / cooling)	....	no data found			
Word %mw1103 (gancio)	....	no data found			
Word %mw1104 (allarmi monitore)	....	no data found			
Word %mw1106 (valore encoder 1)	....	no data found			
Word %mw1107 (valore encoder 2)	....	no data found			
Word %mw1108 (valore encoder 2)	....	no data found			
Word %mw1109 (valore encoder 2)	....	no data found			
Word %mw1110 (allarmi monitore)	....	no data found			
Word %mw1111 (inverter 1)	....	no data found			
Word %mw1112 (inverter 2)	....	no data found			

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 in an appropriate way.

TLS_VIS_Detail: the trailers

The screenshot shows the software interface for Wagon #3 (fuori). The left pane displays configuration data for various components, and the right pane shows a table of system parameters.

Parameter	Value	Value	Value	Value	Value
wg_number	3	2641	2637	2634	2633
wg_enabled	1	1	1	1	1
wg_name	Carello-3 (fuori)				
wg_description	Wagon #3 (fuori)				
wg_ipadress	172.16.254.32				
wg_moxa_name	MoxaWG3				
wg_moxa_id	3				
wg_control_socket_used	1				
wg_control_socket_port	15200				
wg_control_socket_clients	5				
wg_msg_debug_socket_used	1				
wg_msg_debug_socket_port	15210				
wg_msg_debug_socket_clients	5				
wg_1_b88_id	1300				
wg_1_b88_serport_number	1				
wg_2_b88_id	0				
wg_2_b88_serport_number	1				
wg_stamp	01.01.2001 00:00:00				
wg_emergency_stop_supervision	0				
***	*****				
Word %mw1300 (monitor)	....	no data found			

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

The screenshot shows the 'Andockstationen' (Docking Stations) tab selected. The main table lists 16 docking stations (CP-1 to CP-16). CP-8 is selected, and its configuration details are shown in the lower-left pane:

cp_id	8
cp_enabled	1
cp_name	CP-8
cp_description	Connection Point 8 (in Betrieb, 172.16.102.113)
cp_ipaddress	172.16.1.30
cp_moxa_name	MoxaCP
cp_moxa_id	8
cp_control_socket_used	1

The right pane shows a log table for CP-8:

Online	seit	Ver...	SerialInfo	System...	st
offline	01.01.2001 00:00:00	0	?????????	0	01
offline	01.01.2001 00:00:00	0	?????????	0	01
offline	23.09.2008 12:15:30	0	?????????	0	01
online	23.09.2008 12:15:09	0	?????????	0	01
offline	23.09.2008 12:15:09	0	?????????	0	01
online	23.09.2008 11:58:34	0	?????????	0	01
offline	23.09.2008 11:58:33	0	?????????	0	01
online	23.09.2008 11:49:46	0	?????????	0	01
offline	23.09.2008 11:49:46	0	?????????	0	01
online	23.09.2008 11:44:03	0	?????????	0	01
offline	23.09.2008 11:44:03	0	?????????	0	01
online	23.09.2008 11:21:53	0	?????????	0	01
offline	23.09.2008 11:21:53	0	?????????	0	01
online	23.09.2008 11:20:06	0	?????????	0	01
offline	23.09.2008 11:20:06	0	?????????	0	01
offline	23.09.2008 11:18:58	0	?????????	0	01
online	23.09.2008 11:18:11	0	?????????	0	01
offline	23.09.2008 11:18:10	0	?????????	0	01
offline	01.01.2001 00:00:00	0	?????????	0	23
offline	01.01.2001 00:00:00	0	?????????	2	23
online	23.09.2008 11:13:36	0	?????????	0	01
offline	23.09.2008 11:13:14	0	?????????	0	01
online	18.09.2008 14:49:42	2.0	pnrrrrrrrr	0	01
online	18.09.2008 14:49:41	0	?????????	0	01
online	18.09.2008 14:23:59	2.0	nnrrrrrrrr	0	01

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

The screenshot shows the 'Detektoren' (Detectors) tab selected. The main table lists various detectors. IR-Melder 1 CP #10 is selected, and its configuration details are shown in the lower-left pane:

det_id	101
det_enabled	1
det_description	IR-Melder 1 CP #10
det_dty_id	1
det_level_warning	50
det_level_alarm	75
det_stamp	25.02.2008 14:51:39

The right pane shows a log table for detector 101:

Status	Strom	Spannung	Zeit
0	0	0	29.09.2008 14:51:39
1	20	44	24.09.2008 14:51:39
0	0	0	24.09.2008 14:51:39

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 / Wagon #1, default-position #2	okay: I
:CMD:Wagon;1:Default;1;	25.09.2008 11:31:12 / SHENTW1 / Wagon #1, default-position #1	okay: I
:CMD:Wagon;1:LeftRightLeftEnd;	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:LeftRightRightEnd;	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/=2]
CP8_ALARM_LL	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.