



Overview of the Central Command and Control System

For

TuDEM

The automatic fire extinguishing system for tunnel protection with
remote controlled monitors



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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.

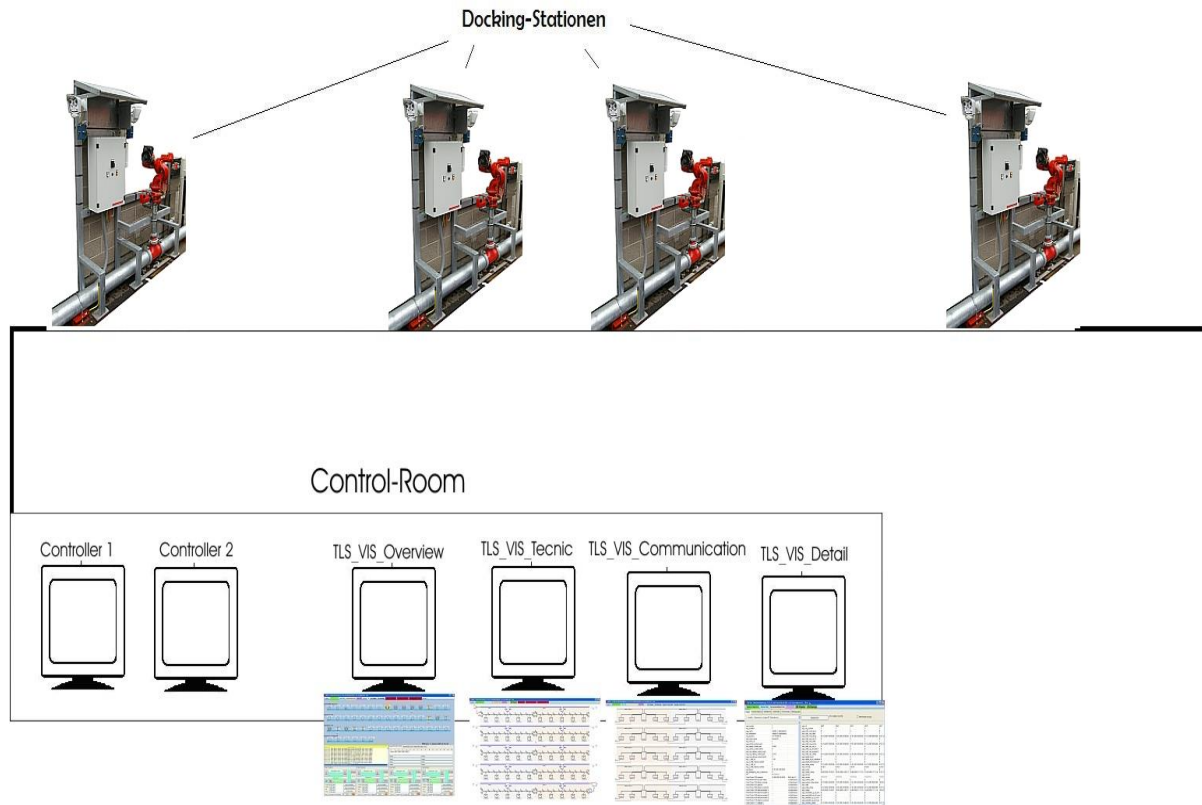
The fire extinguishing system for tunnel protection with remote controlled monitors consists in a fixed structure, installed at the ceiling along the tunnel without mobile units.

The **fixed structure** is equipped with:

- the electric remote controlled fire fighting monitor for each docking station with flow rate 1.000 lt./min.,
- main water (or foam premix) supply pipe (working pressure ~10 bar),
- main electric power supply line,
- 2 IP / TV cameras for each docking station for visible and infrared light
- serial bus for data transmission,
- the electric panel with command and control devices,
- 1 flammable gas detector and 1 toxic gas detector for monitoring dangerous situations (optional).
- 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**. On each docking station a remote controlled monitor is installed. The main purpose of this docking station is to guarantee the communication among the monitor, the detectors and the control system.



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.

Eintritte	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus	Aus
101: IR-Melder 1 auf CP #10 => [Aus], [0 mA], [0 mV]															
102: Thermo-Melder 2 auf CP #10 => [Aus], [0 mA], [0 mV]															
103: Thermo-Melder 3 auf CP #10 => [Aus], [0 mA], [0 mV]															
104: Thermo-Melder 4 auf CP #10 => [Aus], [0 mA], [0 mV]															
105: Thermo-Melder 5 auf CP #10 => [Aus], [0 mA], [0 mV]															
106: IR-Melder 6 auf CP #10 => [Aus], [0 mA], [0 mV]															
107: Temperatur-Melder 7 auf CP #10 => [Aus], [0 mA], [0 mV]															
108: Temperatur-Melder 8 auf CP #10 => [Aus], [0 mA], [0 mV]															

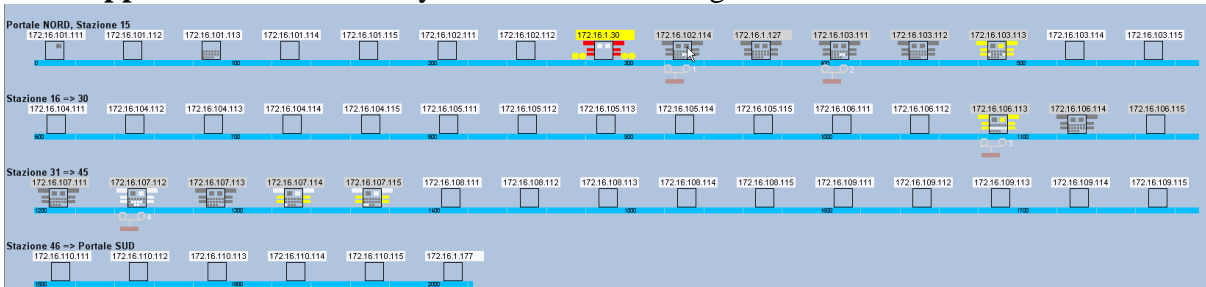
In the upper area you can see the states of the main database,



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

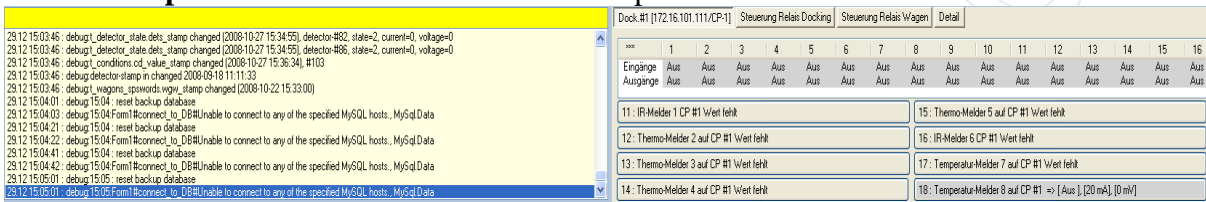


In the upper half of the screen you can see the docking stations.



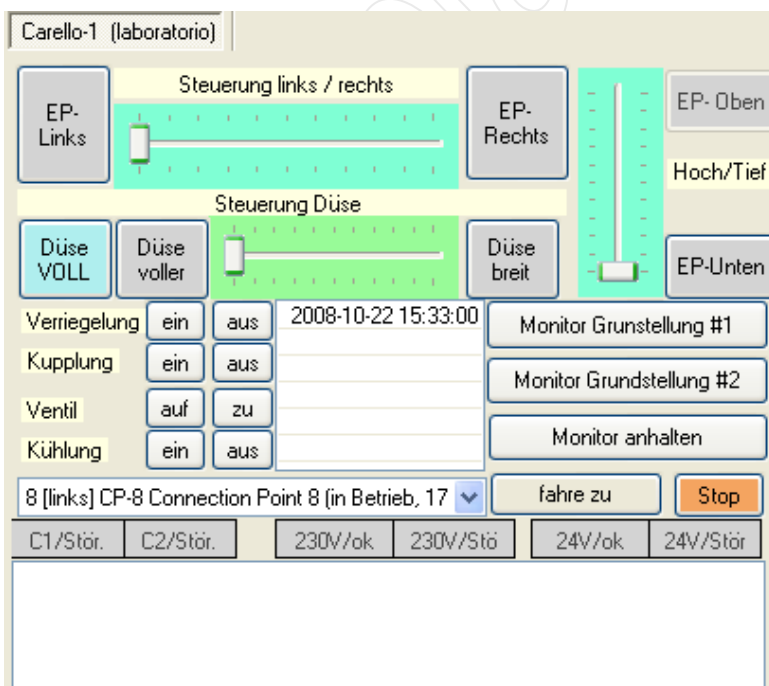
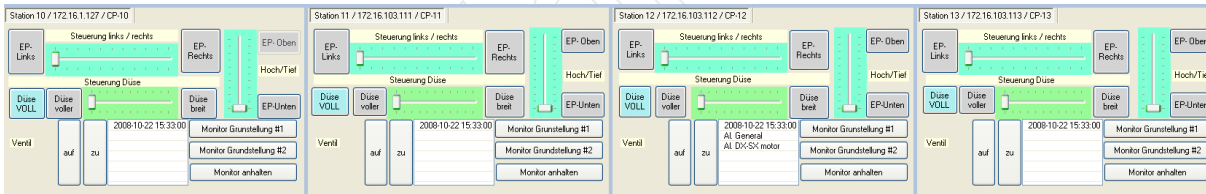
Near each docking station are shown the conditions of the detectors in appropriate colours.

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. Furthermore in this area it is possible to control the selected docking station.

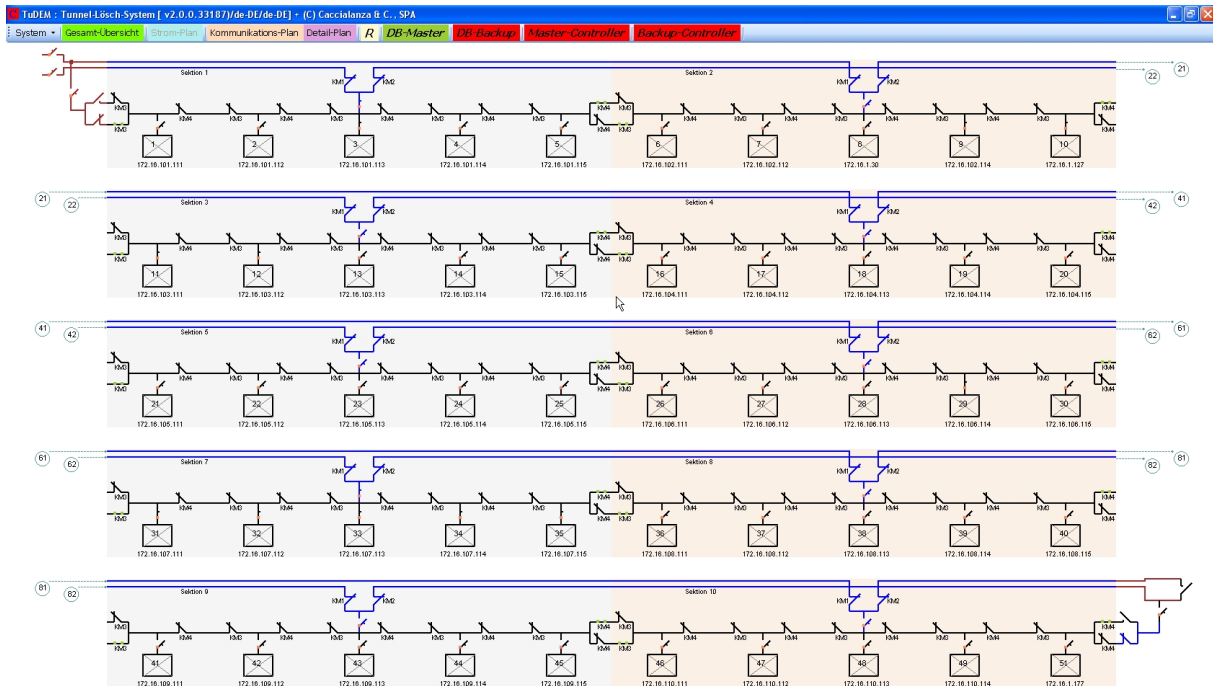
The lower part of the screen is reserved to the 4 monitors, which are nearest to the selected docking station. In 4 side by side arranged dialog boxes are shown in a glance the states of the 4 monitors. By pressing the buttons or the sliders it is possible to control the single units.



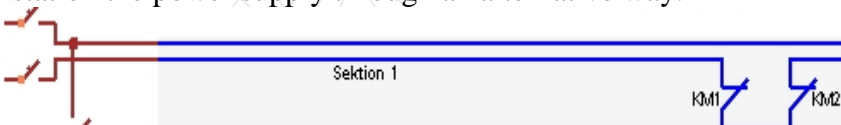


The program *TLS_VIS_Technic*

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



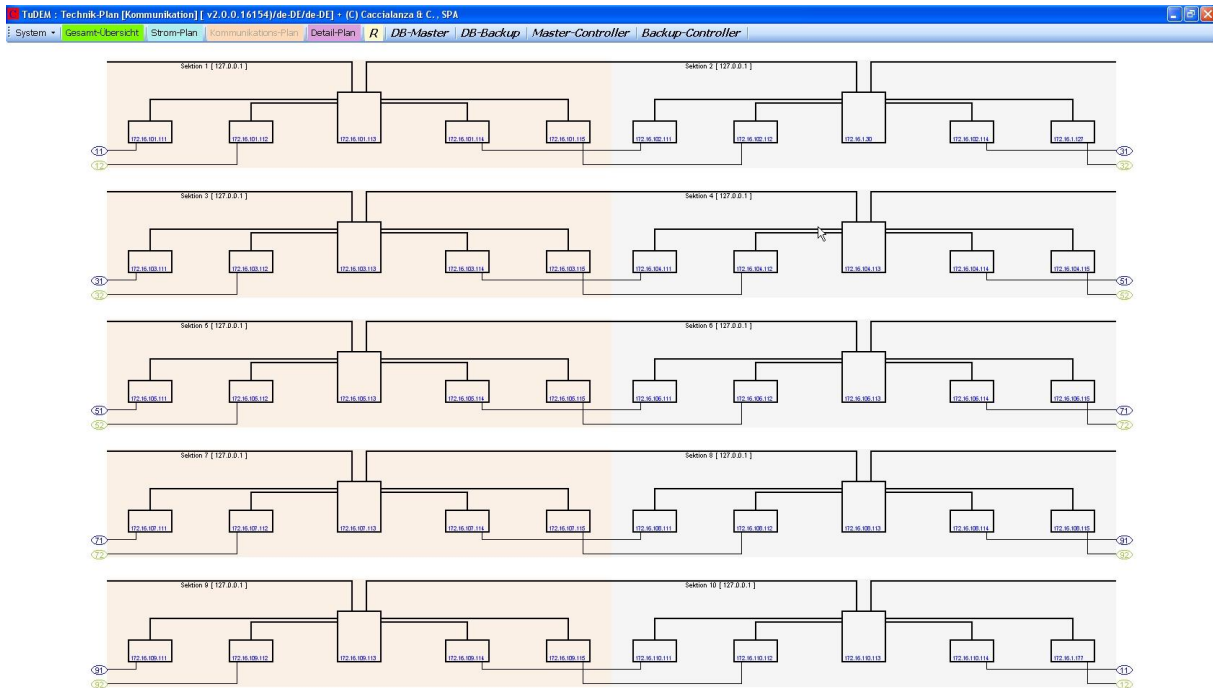
This program allows the maintenance personnel in the Control Room to check at a glance, whether the electric power of the system is okay or, if not, in which sector there are problems. Also the electric current supply is constructed in a redundant way; this guarantees in case of failure of one station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

The screenshot shows the 'DB-Master' tab of the software. The main window displays a list of parameters for 'Wagon #1 (laboratorio)'. The parameters are organized into two columns. The left column lists various control and monitoring parameters, while the right column lists status and identification parameters. The status of each parameter is indicated by a value (0 or 1) and a timestamp.

Parameter	Value	Timestamp
wg_number	1	
wg_enabled	1	
wg_name	Carello-1 (laboratorio)	
wg_description	Wagon #1 (laboratorio)	
wg_ipaddress	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	0	
wg_stamp	01.01.2001 00:00:00	
wg_emergency_stop_supervision	0	
Word %rnmw1100 (monitor)	24.09.2008 15:09:29	0x8 (dez. 8)
Word %rnmw1101 (nozzle / valve)	.....	no date found
Word %rnmw1102 (block / cooling)	.....	no date found
Word %rnmw1103 (gancio)	.....	no date found
Word %rnmw1104 (allarmi monitore)	.....	no date found
Word %rnmw1106 (valore encoder 1)	.....	no date found
Word %rnmw1107 (valore encoder 2)	.....	no date found
Word %rnmw1108 (valore encoder 2)	.....	no date found
Word %rnmw1109 (valore encoder 2)	.....	no date found
Word %rnmw1110 (allarmi monitore)	.....	no date found
Word %rnmw1111 (inverter 1)	.....	no date found
Word %rnmw1112 (inverter 2)	.....	no date 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 docking stations

The screenshot shows the 'Andockstationen' tab of the software. The main window displays a list of docking stations with columns for ID, Name, Description, and IP address. The status of each station is indicated by a value (0 or 1) and a timestamp. The right side of the window shows a detailed view of the selected station (CP-8).

#	Name	Beschreibung	IP-Adr.
1	CP-1	Connection Point 1	172
2	CP-2	Connection Point 2	172
3	CP-3	Connection Point 3	172
4	CP-4	Connection Point 4	172
5	CP-5	Connection Point 5	172
6	CP-6	Connection Point 6	172
7	CP-7	Connection Point 7	172
8	CP-8	Connection Point 8 (in Betrieb, 172.16.102.113)	172
9	CP-9	Connection Point 9 (in Betrieb)	172
10	CP-10	Connection Point 10 (in Betrieb, mit 88, 172.16.102.115)	172
11	CP-11	Connection Point 11 (in Betrieb)	172
12	CP-12	Connection Point 12 (in Betrieb)	172
13	CP-13	Connection Point 13 (in Betrieb, mit 88)	172
14	CP-14	Connection Point	172
15	CP-15	Connection Point	172
16	CP-16	Connection Point	172

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	pnnnnnnn	0	01
online	18.09.2008 14:49:41	0	?????????	0	01
online	18.09.2008 14:23:59	2.0	nnnnnnnn	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

#	Beschreibung	Typ	Board88	Status	Strom	Spannung	Zeit
86	IR-Melder 6 CP #8	IR-Melder (1,6)	8 / Board 88, i	0	0	0	29.09.2
87	Temperatur-Melder 7 auf CP #8	Temperatur-Melder (7,8)	8 / Board 88, i	1	20	44	24.09.2
88	Temperatur-Melder 8 auf CP #8	Temperatur-Melder (7,8)	8 / Board 88, i	0	0	0	24.09.2
91	IR-Melder 1 CP #9	IR-Melder (1,6)	9 / Board 88, i				
92	Thermo-Melder 2 auf CP #9	Thermo-Melder (2,3,4,5)	9 / Board 88, i				
93	Thermo-Melder 3 auf CP #9	Thermo-Melder (2,3,4,5)	9 / Board 88, i				
94	Thermo-Melder 4 auf CP #9	Thermo-Melder (2,3,4,5)	9 / Board 88, i				
95	Thermo-Melder 5 auf CP #9	Thermo-Melder (2,3,4,5)	9 / Board 88, i				
96	IR-Melder 6 CP #9	IR-Melder (1,6)	9 / Board 88, i				
97	Temperatur-Melder 7 auf CP #9	Temperatur-Melder (7,8)	9 / Board 88, i				
98	Temperatur-Melder 8 auf CP #9	Temperatur-Melder (7,8)	9 / Board 88, i				
101	IR-Melder 1 CP #10	IR-Melder (1,6)	10 / Board 88				
102	Thermo-Melder 2 auf CP #10	Thermo-Melder (2,3,4,5)	10 / Board 88				

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

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

Wagen			Andockstationen			Detektoren			LOG-Daten			Kommandos			Bedingungen					
Kommandos der letzten 6 Monate anzeigen												<input type="checkbox"/> zeige zugehörige LOG-Angaben			aktualisieren			08.01.2009 17:14:28		
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;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

Wagen			Andockstationen			Detektoren			LOG-Daten			Kommandos			Bedingungen		
<input type="checkbox"/> zeige zugehörige LOG-Angaben												aktualisieren			08.01.2009 17:15:58		
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_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.