ADACS

control and Supervision System

Your business technologists. **Powering progress**

Aims of the control system

The increasing complexity of industrial processes, their high degree of automation and the size of corresponding investments require a proportional amount of attention to be paid to the control and supervision of such installations. The technological means available to design control and instrumentation systems are also of increasing importance. A modern control system must therefore be built on this progress and contribute as much as possible to the efficient operation of the installation.

Controlling installations with a high degree of safety

For installations to be controlled with a high degree of safety, operators must benefit from a high degree of comfort. They must be guided in their control activities, benefit from better conditions of supervision and online documentation. Simple and ordered access to data is of prime importance.

Assistance with failure management is also essential. Means for identifying the causes of incidents, classification of failures to be dealt with in order of gravity and a procedure to be followed to repair and/or minimize consequences, must be provided.

Improving the profitability of the installation

In order to ensure high installation availability, the control system must provide assistance with preventive and corrective maintenance.

The control system can also contribute to improving knowledge of the process by providing engineers with all the historical information required about the operation of the process.

Reliability and availability

Because numerous essential tasks need to be assigned to control systems, such systems have to be increasingly reliable. The control system becomes an essential element of the installation. Any prolonged non-availability of the system means that processes have to cease. Any doubt about the data provided makes the systems unusable.

This is why such a computerized process control system must ensure irreproachable reliability and availability. When operating, the system must clearly provide highly reliable data.

The system must perform with full function over its entire operating lifespan, and processes to ensure this must be in place.

Control with ADACS

Atos Worldgrid has developed specific know-how for control and supervision since the 1980s. This has become, in the end, the customizable technological platform ADACS.

ADACS (Advanced Data processing And Control System) is the business application designed to completely manage Level 2 operating systems

This document describes all necessary functions for a computerized control-room and the constraints and specific requirements for the remote control domain. It shows how our experience acquired on more than 300 industrial systems all over the world in countries including France, Great Britain, China and Russia can bring benefits in terms of technological evolution, and how those benefits can help you strictly comply with quality and safety requirements of our customers in conformance with the standards and recommendations of Safety Authorities.

Positioning control system in a command control

ADACS is the principal system in the control rooms of many critical infrastructure units. Because of this, it must be positioned within the overall architecture of a command control system. The overall design of command control and its equipment meets the specifications imposed by the process, safety and operating conditions, leading to a multi-leveled architecture.

Level O – Instrumentation

The process interfaces with sensors, actuators and protection devices. They perform measurements (pressure, temperature, flow) and transform the physical data into electrical signals, to be used by PLCs (Programmable Logic Controllers).

Level 1-PLCs

The PLCs of the reactor protection, the turbo· alternator, of the monitoring and control of the plant process signals from the sensors and drive actuators. These systems develop, based on a number of input data, orders for machines so that process parameters remain within the limits allowed by the safety, or to trigger protection actions such as an emergency stop of the reactor.

This command control architecture is more apparent on new plants than on refurbished plants. For new plants, driving is most often in a sitting mode in a highly computerized control room with ADACS, the conventional panels acting as an emergency fallback. As part of the refurbished historical plants, driving remains effectively in a ·stand-up mode', ADACS provides the convenience of supervision and operator assistance, in addition to existing conventional panels.

Level 2-Control Room

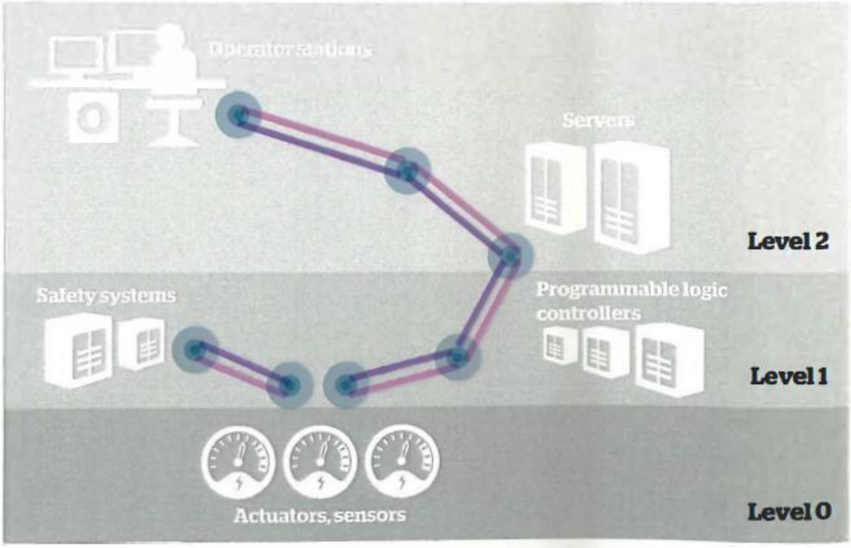
Supervision and management of the plant including all means available to operators in the control room (control panels, alarms). This room holds centralized, relevant information for the control of facilities as well as the means of remote control of various organs. The set consists of HMI, workstations and desks, backup panel, and provides the interface with PLCs from Level 1.

Level 3-External systems

Systems external to the remote control unit are related to the command control for requirements relating to maintenance, interventions management, delivery of information to experts in a crisis, the long-term archiving of system data. These external systems, fed by the computers on Level 2, are isolated for safety reasons to compliance IEC, ISO standards.

Atos Worldgrid, as a provider of computerized Level 2 ADACS, can also be supplier and system integrator of the entire safety unclassified command control system.

In such architecture ADACS is clearly positioned at Level 2 as the main computerized process control system in a control room, interfaced with Level 1 PLCs and Level 3 external systems. The ADACS computerized system is complemented by safety hardwired I&C panels directly linked to Level 1.



The performance of the ADACS solution

A solution specifically designed for critical infrastructure

The ADACS solution was initially designed to control power plants. It has therefore inherited adequate and uniform consideration for safety, reliability, availability, sizing and performance requirements. It has also inherited a wealth of functions allowing optimum control.

From the start, Atos Worldgrid developed generic ADACS components to address large industrial systems for the markets of generation, transmission and distribution of energy.

ADACS is the business application integrating these components, designed to manage the Level 2 systems controlling the generation units. It not only integrates all necessary functions for a control room, but also natively all the constraints and requirements specific to remote control domain.

An advanced control

Process control is performed from computerized operator stations. Mimic displays show the status of equipment and information acquired or calculated.

The mode of displays sequence is natural. The operator can choose the level of detail the most appropriate to his needs, from the whole process view to the detailed view of equipment by a technical sheet.

Equipment control and management functions are accessible by menu on simple selection of this equipment in a display.

The operator can view the history of the process in the form of logbooks. trends or tables of values.

In addition to these standard functions of a supervisor (SCADA). ADACS is designed for controlling large industrial plants and offers particular features to command control of critical infrastructure facilities.

Features dedicated to remote control

Centralized calculations allow the presentation of summary information. These are validated and consistent for the entire process data set.

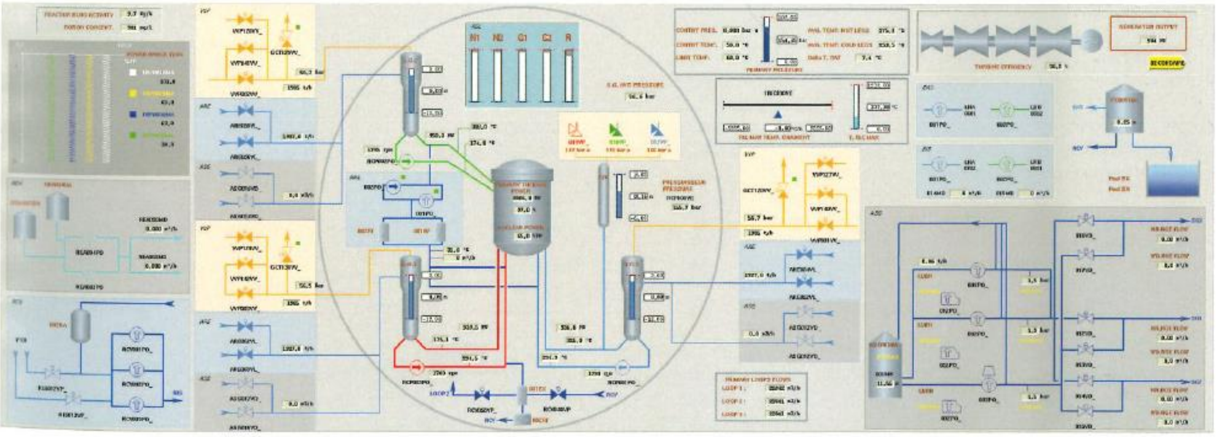
Alarm treatment: acknowledgement, storage in lists according to severity, aggregated presentation or inhibition, depending on the process state.

Presentation of calculations results as a flowchart showing dynamic calculation of synthetic data.

Operator definition of new online calculations (calculator).

Orientation for decision and control by computerized operating modes.

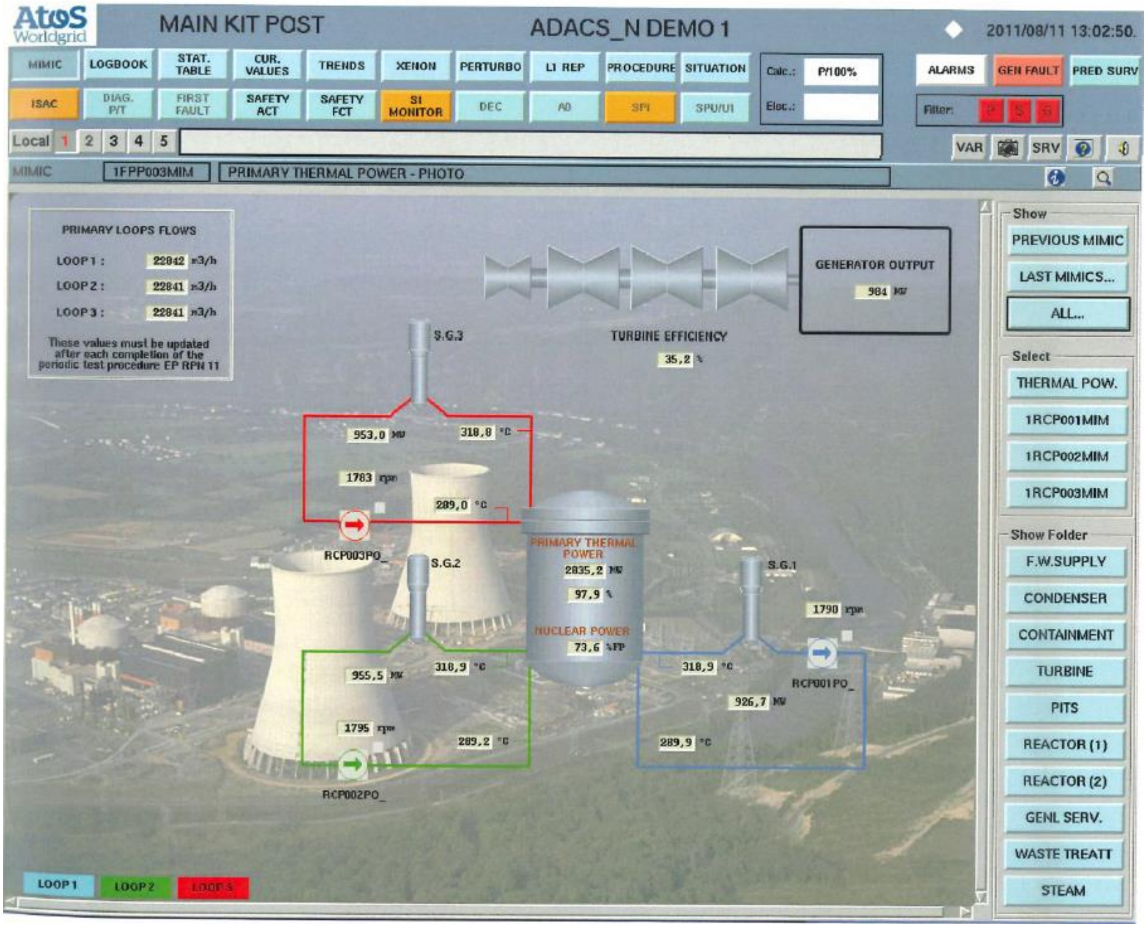
All these characteristics are essential to help the operator in the analysis of information to take the best decision based on the process state.



The operator workstation

A homogeneous HMI allows the operator to control and supervise the process efficiently. It results from the experience and know-how in command control, and particularly in the critical infrastructure field. The set of hardware used by the operator (high resolution color graphic screens, keyboard, mouse or trackball) is called an operator workstation. An ADACS system can have several local or remote operator workstations, each of them allowing all or part of the process to be supervised. The mouse (or trackball) is the main device to access to the various functions and data. The keyboard is used as an auxiliary device to capture text or numerical values. The operating functions are accessible via display menus or buttons.

The screens are used to display the synoptic representations of the installation. The displays appear in static or moveable windows and are accessible by pointing.



MAIN KIT POST

ADACS_N DEMO 1

2011/08/11 13:02:50.

Calc.: P/100%

Elec.:

MIMIC 1FPP003MIM PRIMARY THERMAL POWER - PHOTO

PRIMARY LOOPS FLOWS

LOOP 1 : 22842 m3/h

LOOP 2 : 22841 m3/h

LOOP 3 : 22841 m3/h

These values must be updated after each completion of the periodic test procedure EP RPN 11

GENERATOR OUTPUT 984 MW

TURBINE EFFICIENCY 35,2 %

PRIMARY THERMAL POWER 2835,2 MW

97,9 %

NUCLEAR POWER 73,6 %FP

Screen Layout

The organization of a graphic screen of the operator workstation is such that the operator can follow up operator functions naturally and effectively. Three areas cover the entire surface of the screen.

Function selection area

On top of screen, this area includes a tool bar and general information.

The tool bar is made of buttons giving access to the functions of the Operator Interface.

General information gives the name of the installation, date, time, etc.

Dialog function panel

Each function has its panel of vertical dialog, combining all possible actions on the presentation of information or the behavior of the function itself.

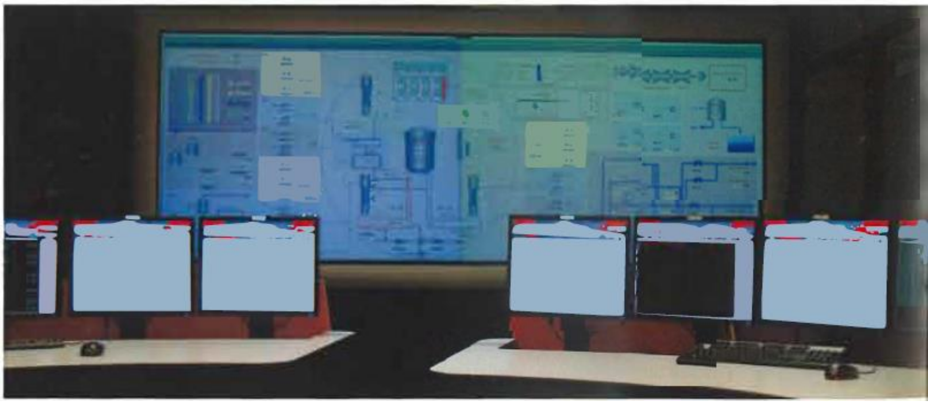
Viewing of the function

On the viewing area. process information are displayed and refreshed in real-time. This area is specific to each function described in the following pages.

Operator workstations organization

The modularity of ADACS can satisfy the need for a control room of an industrial control system unit, namely 4 operator workstations, each consisting of five graphic screens, allowing the display of all functions necessary to the control, on which the operator navigates and performs most actions with a mouse or trackball.

Smaller operator workstations, adapted to local information, can be composed of 1-4 screens, and also an operator workstation will be dedicated to showing the general surveillance mimic on a large screen. On all these workstations, all functions are available or can be restricted.



Login to operator workstations

Login to the operator workstation is through access profile (login) either by physical workstation or by user, configurable according to the practice of the operator.

All users have the right to consult all functions. Only the executing rights differ. There are three levels of user rights:

- Super User has all the rights including sending orders
- Standard User has the rights to acknowledge elements such as alarms and to change settings
- The Observer can only consult. For a specific profile it is possible to require the compulsory presence of the alarms display. It is also possible to associate the automatic display of a function with a profile according to the context.

Mouse and keyboard

The items on the screen selected with the mouse are also available using the keyboard keys, by combining the function and control keys.

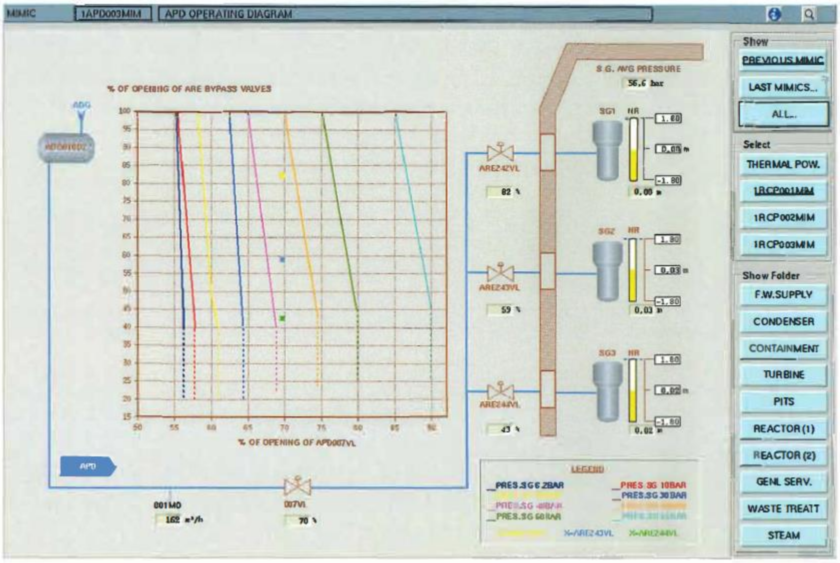
This whole mechanism allows an approach to the process control by use of rugged industrial keyboards, or remote touch screens.

Control and supervision mimic displays

Mimic displays

The mimic displays show the process state graphically and textually. The fast selection of a mimic is an important aspect of this function. In order to do this, the access to a mimic can be accomplished in several ways:

- From the menu of the mimic function: button for direct access to a display, selecting a display in lists of folders, last displays displayed
- From the displays tree menu
- On selection of an icon in a mimic giving access to another display (display link)
- From other interactive functions (e.g. selection of the mimic associated with an alarm).



Animated graphics

An image is made of a static part called background and of animated graphics.

Many graphics are available to represent the entire critical infrastructure process:

- Substantive elements of the plant including pipes. tanks
- Equipment, sensors, actuators
- Graphic or digital representations of variables, value tables. bar charts. graphs. XY charts.

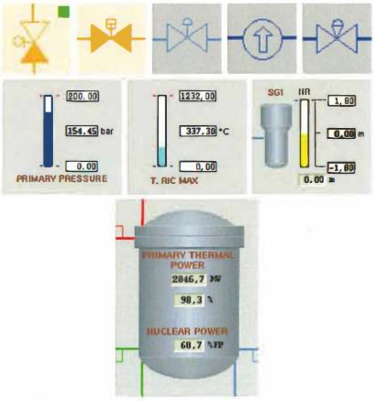
These graphics belong to a library that can be easily extended to meet additional requirements.

When information is changed, following a process state change, the graphic is animated accordingly.

The ADACS concept of graphics objects can bring together all the animation properties of the variables graphically represented.

An animated graphics consists of several elements, for example:

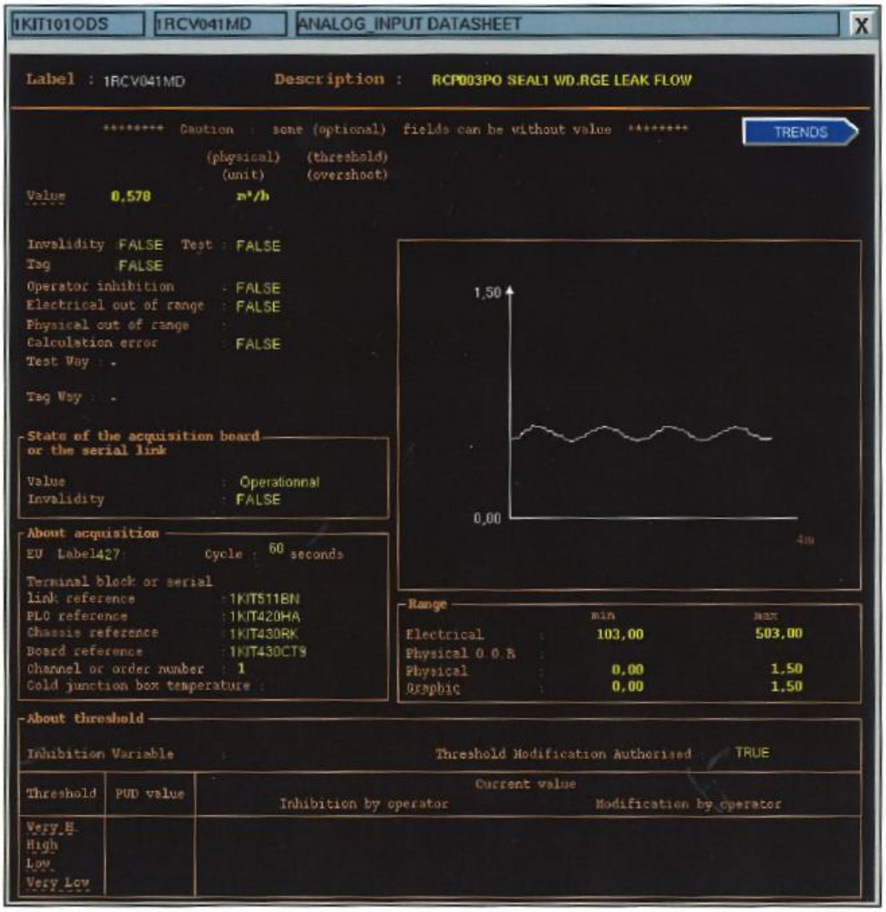
- Diagram showing the equipment, valve, pump
- Open state, closed, on, off
- Value, represented either by graphics or text
- Control mode, manual or automatic
- Name of the equipment textually displayed
- Fault indication, threshold indication.



To facilitate the understanding of the operator, displaying a particular state is homogeneous for all equipment. For example, the invalidity of a variable is displayed using the same color. It is the same for the representation of states of equipment in test, locked, forced state.

For the best view of the operator it is possible either to set the displays size or to allow zoom effects and display movement with scrollbars, for example the same display can be viewed on a large screen or an operator workstation screen.

The designation of equipment graphics allows access to additional displays, technical datasheets and operating menus.



Label : 1RCV041MD   Description : RCP003PO SEAL1 WD.RGE LEAK FLOW

******** Caution : some (optional) fields can be without value ********

(physical) (unit)   (threshold) (overshoot)

Value 0,578 m³/h

Invalidity FALSE Test : FALSE
Tag FALSE
Operator inhibition : FALSE
Electrical out of range : FALSE
Physical out of range :
Calculation error : FALSE
Test Way : -

Tag Way : -

State of the acquisition board or the serial link

Value : Operationnal
Invalidity : FALSE

About acquisition

EU Label427 : Cycle : 60 seconds

Terminal block or serial link reference : 1KIT511BN
PLC reference : 1KIT420HA
Chassis reference : 1KIT430RK
Board reference : 1KIT430CT9
Channel or order number : 1
Cold junction box temperature :

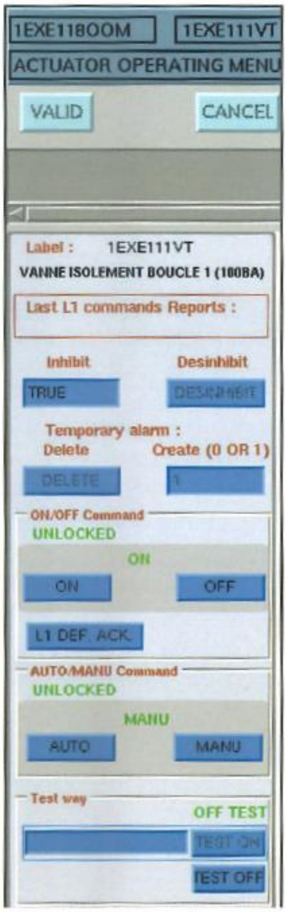
Range

	min	max
Electrical :	103,00	503,00
Physical O.O.R :		
Physical :	0,00	1,50
Graphic :	0,00	1,50

About threshold

Inhibition Variable :   Threshold Modification Authorised TRUE

Threshold	PUD value	Current value Inhibition by operator	 Modification by operator
Very H. High Low Very Low			



Label : 1EXE111VT

VANNE ISOLEMENT BOUCLE 1 (100BA)

Last L1 commands Reports :

Inhibit: TRUE   Desinhibit

Temporary alarm :
Delete   Create (0 OR 1): 1

ON/OFF Command
UNLOCKED
ON

AUTO/MANU Command
UNLOCKED
MANU

Test way
OFF TEST

Technical datasheets

A technical datasheet is a display associated with a particular type of equipment, e.g. tank, pump, switch, measuring station, signaling, etc. Its format is generic for all the facilities of a given type.

The access to a technical datasheet is done naturally by selecting the graphics of the concerned equipment in a mimic. A technical datasheet is a window that can be shifted or closed.

A technical datasheet presents all the information on the equipment allowing basically its animated and detailed documentation. For example, the following information can be presented:

- Equipment name and location
- Current state (open/closed. on/off)
- Calculated data (number of handling, action duration, estimated values)
- Equipment driving mode (automatic, manual)
- Parameters values (alarms threshold)
- History of associated measurement. etc.

Operating menus

An operating menu allows the operator to control or configure equipment. It is accessible by designating corresponding graphics in a display.

The operating menu appears in a window, giving every means to send a command and to control its acknowledgement, visualizing the equipment state by index showing the evolution of the regulated value and the setting point.

The control menu can also manage the equipment, setting in test mode, tagging, forcing, setting surveillance thresholds and involving alarms.

Alarms presentation and processing

An alarm is a functioning default within the plant. This anomaly can have serious consequences if it is not detected early and if operators are not immediately notified. It requires immediate or deferred action by the operators.

ADACS classifies alarms in several groups:

- The functional alarms indicating an abnormal situation for the process. This can be activated by the outcome of an internal calculation (e.g. temperature too high and too low pressure)
- Generic faults related to equipment technological defects not justifying treatment as specific and urgent as for functional alarm. (sensor error, technological defect, power loss)
- Predefined surveillances are groupings of defects (input, internal variable, threshold) monitored with respect to a specific value.

An alarm is associated with a severity indicating its importance and therefore the urgency of the intervention defined by a color display There are five possible severity levels: red, yellow, white, green and blue for functional alarms, colors can be set.

The operator is notified of incoming alarms by flashing indicators permanently present on any screen and is orientated to alarm lists to consult by the flashing of other indicators.

Many alarms lists are configurable, according to variables such as by type, severity, default, in storage, inhibited, in test, as shown on the figure below. In these lists the alarms are presented in the form of alphanumeric time-stamped messages containing labels and statements; they can be filtered by various criteria available in the panels.

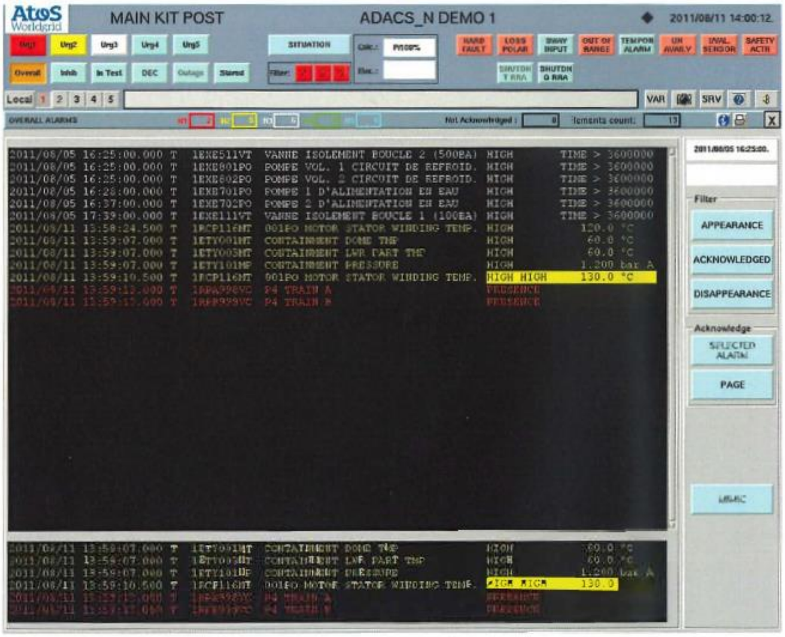
From these lists, the operator can access displays related to alarms for quick access to information appropriate to diagnosis. The operator can acknowledge or store the alarms once diagnosed.

Alarms are often a consequence of initial alarms, causing a flood of information. This can cause a dangerous delay in diagnosis of the initial failure. ADACS offers alarms reducing mechanisms by inhibition and situation.

ADACS makes a calculation of situations to determine the process state. Alarms can then be inhibited according to these situations.

A functional alarm can be inhibited by information from other objects too. Thus the presence of an 'inhibitory· alarm called inhibitory masks the display of inhibitory alarms called inhibited.

An alarm in addition for alarm handling with data availability and state of the art knowledge control room for operator.



```
2011/08/05 16:25:00.000 T  1EXE511VT  VANNE ISOLEMENT BOUCLE 2 (500BA) HIGH        TIME > 3600000
2011/08/05 16:25:00.000 T  1EXE801PO  POMPE VOL. 1 CIRCUIT DE REFROID. HIGH        TIME > 3600000
2011/08/05 16:25:00.000 T  1EXE802PO  POMPE VOL. 2 CIRCUIT DE REFROID. HIGH        TIME > 3600000
2011/08/05 16:28:00.000 T  1EXE701PO  POMPE 1 D'ALIMENTATION EN EAU    HIGH        TIME > 3600000
2011/08/05 16:37:00.000 T  1EXE702PO  POMPE 2 D'ALIMENTATION EN EAU    HIGH        TIME > 3600000
2011/08/05 17:39:00.000 T  1EXE111VT  VANNE ISOLEMENT BOUCLE 1 (100BA) HIGH        TIME > 3600000
2011/08/11 13:58:24.500 T  1RCP116MT  001PO MOTOR STATOR WINDING TEMP. HIGH           120.0 °C
2011/08/11 13:59:07.000 T  1ETY001MT  CONTAINMENT DOME THP             HIGH            60.0 °C
2011/08/11 13:59:07.000 T  1ETY003MT  CONTAINMENT LWR PART THP         HIGH            60.0 °C
2011/08/11 13:59:07.000 T  1ETY101MP  CONTAINMENT PRESSURE             HIGH           1.200 bar A
2011/08/11 13:59:10.500 T  1RCP116MT  001PO MOTOR STATOR WINDING TEMP. HIGH HIGH      130.0 °C
2011/08/11 13:59:12.000 T  1RPA998VC  P4 TRAIN A                       PRESENCE
2011/08/11 13:59:12.000 T  1RPB999VC  P4 TRAIN B                       PRESENCE
```

```
2011/08/11 13:59:07.000 T  1ETY001MT  CONTAINMENT DOME THP             HIGH            60.0 °C
2011/08/11 13:59:07.000 T  1ETY003MT  CONTAINMENT LWR PART THP         HIGH            60.0 °C
2011/08/11 13:59:07.000 T  1ETY101MP  CONTAINMENT PRESSURE             HIGH           1.200 bar A
2011/08/11 13:59:10.500 T  1RCP116MT  001PO MOTOR STATOR WINDING TEMP. HIGH HIGH      130.0
2011/08/11 13:59:12.000 T  1RPA998VC  P4 TRAIN A                       PRESENCE
2011/08/11 13:59:12.000 T  1RPB999VC  P4 TRAIN B                       PRESENCE
```

Control procedures

Computerized procedures are part of the functions of control assistance available to plant operators. Through the ADACS system functions in general and with the procedures in particular, operators have reliable and appropriate information. They can access to all relevant factors of each situation and its evolution. They are guided in an incident or accident, by procedures tolerating misdiagnosis (EPA surveillance, Approach By State) and designed to bring in the best possible conditions on a point of safe operating of the plant.

Computerized procedures guide and facilitate the tasks of the operator for the control of the plant, in both normal and emergency situations, by assisting in the progress of instructions or instruction sequences adapted to each situation, following directives, orders and instructions to be performed by control operators.

To access procedures, ADACS provides the operator with a set of descriptive displays of their organization and information necessary to guide the operator to the correct procedure. The presentation of these displays, trees, folders, links included in animated graphics, is freely designed during the engineering phase of the application data. These orientation displays can be accessed from an alarm suggesting to be treated with a procedure thus selected.

A procedure is made of a set of operating modes and sheets, all organized into chapters and subchapters.

When an operator wants to execute a procedure, they must lock it to prohibit management by other operators, using the dialog panel that also offers all the dialog necessary for navigation in procedures.

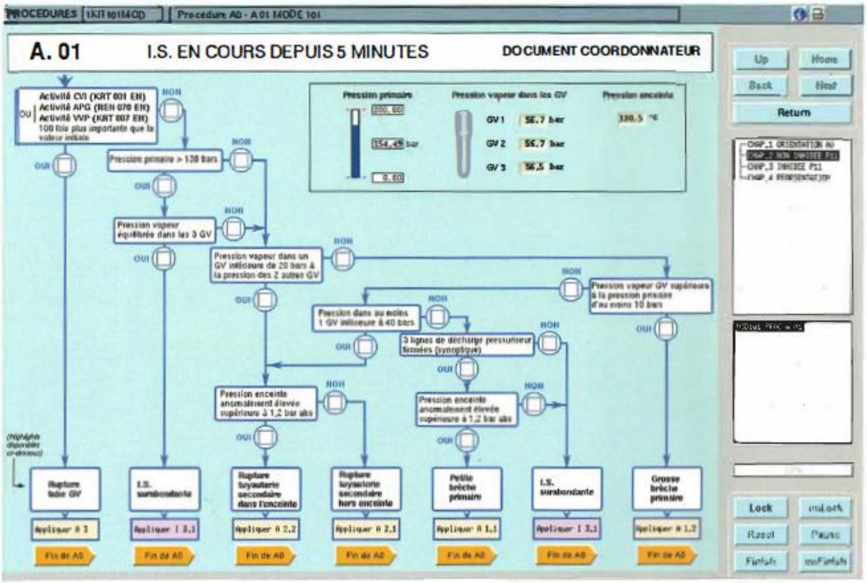
An operating mode is a collection of ·steps' presented on one or more pages; each page is a graphics display.

These graphics displays created in engineering with the ADAGE editor can contain all standard graphic objects (diagrams, displays, graphs, references) as well as the three following prototypes dedicated to procedures:

- A checkbox to save the considered order
- A highlight to set a step identified
- An annotation to allow the operator to enter free comments on a step.

This information is stored by the system until the operator clears the procedure; it is available and updated on all operator stations.

In terms of procedures, ADACS provides a host structure enabling engineering to define a powerful diagnosis and decision support for the control operator, providing guidance in a book of structured, dynamic instructions in the most appropriate form (texts, pictures, checklist, flowchart).


PROCEDURES
1KIT101MOD
Procedure A0 - A01 MODE 101
A. 01
I.S. EN COURS DEPUIS 5 MINUTES
DOCUMENT COORDONNATEUR
Activité CVI (KRT 001 EN)
OU
Activité APG (REN 070 EN)
Activité VVP (KRT 007 EN)
100 fois plus importante que la valeur initiale
NON
OUI
Pression primaire > 138 bars
Pression vapeur équilibrée dans les 3 GV
Pression vapeur dans un GV inférieure de 20 bars à la pression des 2 autres GV
Pression vapeur GV supérieure à la pression primaire d'au moins 10 bars
Pression dans au moins 1 GV inférieure à 40 bars
3 lignes de décharge pressuriseur fermées (synoptique)
Pression enceinte anormalement élevée supérieure à 1,2 bar abs
Pression enceinte anormalement élevée supérieure à 1,2 bar abs
Pression primaire
200,00
154,49 bar
0,00
Pression vapeur dans les GV
GV 1 56,7 bar
GV 2 56,7 bar
GV 3 56,5 bar
Pression enceinte
100,5 °C
Rupture tube GV
I.S. surabondante
Rupture tuyauterie secondaire dans l'enceinte
Rupture tuyauterie secondaire hors enceinte
Petite brèche primaire
I.S. surabondante
Grosse brèche primaire
Appliquer A 3
Appliquer I 3,1
Appliquer A 2,2
Appliquer A 2,1
Appliquer A 1,1
Appliquer I 3,1
Appliquer A 1,2
Fin de A0
Up
Home
Back
Next
Return
Lock
unLock
Reset
Pause
Finish
unFinish

Data engineering

The DGS (Data Generation System) provides the means for creating and maintaining a database describing the industrial process and its implementation on the ADACS system. It is a true engineering tool, to manage large sets of data for critical processes.

The DGS is used to define real-time system data to generate and publish them for the direct use by the real-time system. It provides:

- Maximum consistency of data distributed throughout the system
- Minimal disturbance of the real-time system. Indeed, all the configuration operations are done offline, the only system disturbances occur during the consideration of files corresponding to a new version of data.

The DGS uses the ORACLE relational database, ensuring consistency and data integrity in all cases.

Several users can enter on the DGS, edit. view data, multiple accesses to data being regulated. DGS provides the ability to assign each of its users with an access level to secure and prioritize operations on different entities of a project.

ADACS system configuration

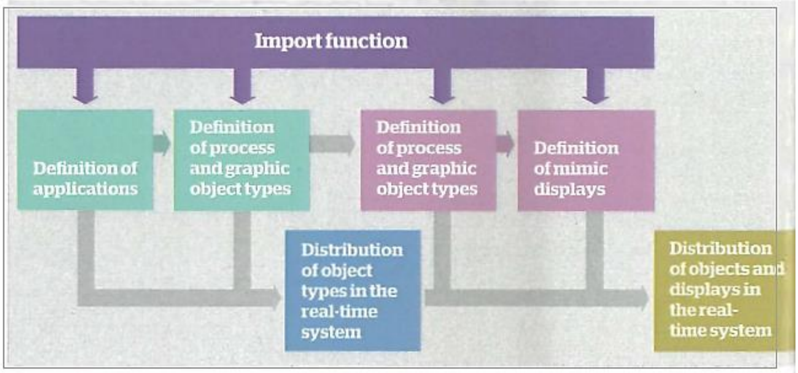
There are several stages to the configuration of an ADACS system.

Operations defining configuration data can be done either interactively via the human-machine interface of DGS, or using an import function (interpretation of ASCII files respecting a predefined grammar).

Mimic displays are defined using the graphical editor ADAGE, realizing the integration of graphics and variables.

The data structured as object are edited using masks and lists made available by the DGS.

The DGS engineering cycle separates phases of structuring data (object type), feeding data (object), and distribution of consolidated data in the real-time system. The definition of objects and displays can be done in parallel. In all cases the DGS ensures the overall consistency by strong consistency checks of data and rigorous version management.


Import function
Definition of applications
Definition of process and graphic object types
Definition of process and graphic object types
Definition of mimic displays
Distribution of object types in the real-time system
Distribution of objects and displays in the real-time system

The import function performs the loading of data describing the process, for example in the case of a renovation, or to interface to Level 1 configuration tools or to the customer engineering database.

Distributed hardware architecture

The architecture based on the ADACS software bus allows to easily build the most appropriate hardware architecture. The hardware architecture can be adapted, based on:

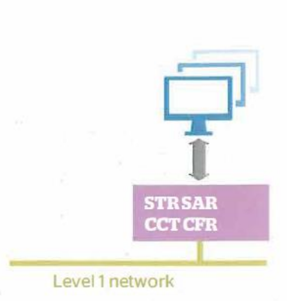
- The number of operator workstations, the nature of each of them (screens, data entry means and designation)
- Geographical constraints (location of Level 1 equipment, information systems and operator stations)
- The computing power required
- Availability required, and thus the need for redundancy
- The number and type of Level 1 equipment.

Each ADACS functional module can be implemented on a dedicated computer or share a computer with other modules. Here are three typical examples of architecture:

Minimum architecture

The smallest hardware architecture is a workstation, or a laptop, on which the treatment modules are installed, process interface, servers, operator station, and data generator.

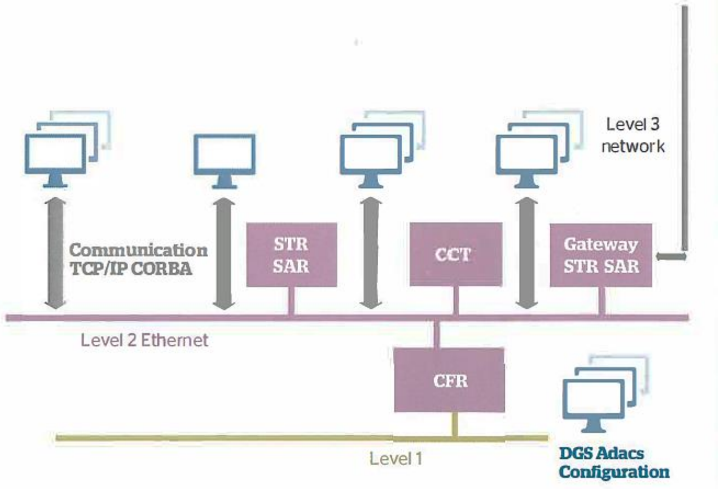
This configuration with 1 or 2 screens can be used alternatively as a configuration tool for engineering, operator workstation for operating and control, or demonstrator with the inclusion of an I/0 data simulator.



Medium scale architecture

A typical architecture of a supervision application:

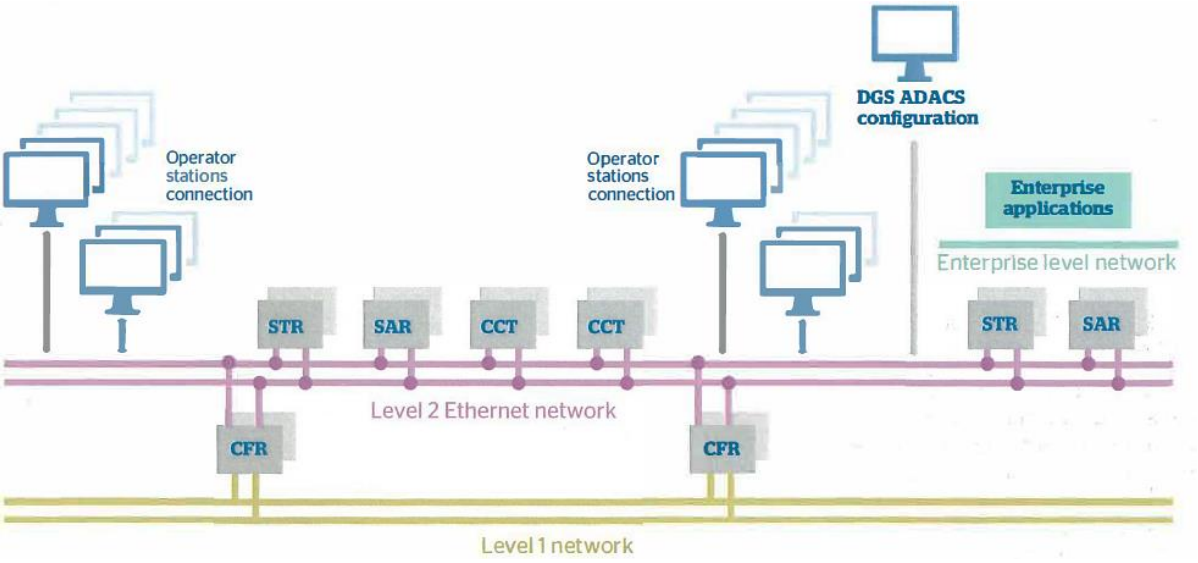
- A server for process interface (CFR)
- A server for data processing (CCT)
- A real-time and archive server (STR. SAR)
- Several operator workstations (four in this example)
- A gateway to a Level 3 network
- A workstation for the data generator (DGS)
- A local network. possibly redundant.



Extended high performance and redundant hardware architecture

For a main system in control room, with high performance and availability requirements, the ADACS solution is based on the following typical architecture:

- Two servers in active redundancy implement the data processing module (CCT)
- Four servers implement the process interface module (CFR), and work in redundancy out of sync (two servers cover half of the facility and the two others provide redundancy)
- A server implements the archiving function (SAR): a second SAR can be added to provide necessary archive redundancy. The SAR can also be integrated into the same servers as the STR
- Four real-time data servers for the operator stations (STR)
- Four multi-screen operator workstations (five screens) are used in the control room
- Four reduced operator workstations (three screens), available when needed for the work of commissioning the plant unit
- Two remote operator workstations (crisis situation room)
- A workstation for the data generation module
- An external applications server that ensures interface with Level 3 (archive and real-time data server).



High availability

ADACS provides high availability, even in the case of complex applications. Besides the intrinsic quality of the software, ADACS can be installed on redundant hardware architecture. In the event of a hardware failure, the ADACS redundancy ensures that full continuity of service can be maintained (no down time, no loss of data, control or processing).

Active redundancy, network and software bus

The network component used by ADACS,
has been developed by Atos Worldgrid to fully satisfy the requirements of distributed control and instrumentation systems.

Reliable protocol

This component provides two main communication protocols (Transport Layer 4) suited to the transmission requirements of distributed control systems.

Reliable point-to-point protocol. This protocol ensures the exchange and control of information between two distant points and offers the following:

- Reliability: it ensures the transmission of messages exchanged, which means no loss, no duplication, and an order of messages which is identical on arrival as it was at departure
- Multiplexing: authorizes several connections between distant points
- Flow control: the transmitter retains the message until the receiver is ready to receive it
- Fragmentation and reassembly: it allows messages of up to 64 Kbytes to be sent, offering a message of fragmentation and reassembly service to adapt to ETHERNET.

Reliable distribution protocol. A transmitter can send the same message to several receivers by making just one send request. The component takes responsibility for distributing the message to all receivers without duplicating it.

Standard protocol

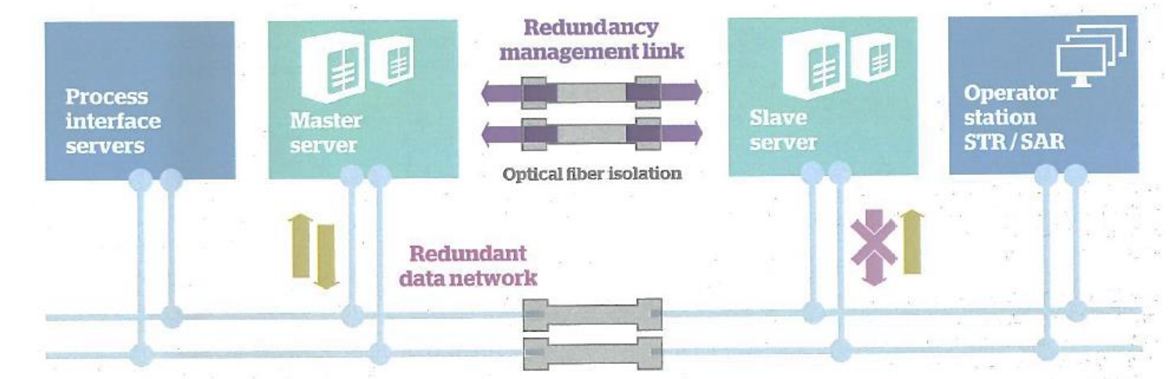
The network component can share the ETHERNET media with other communication software, such as TCP/IP.\, CORSA. FTP, IEC, ISO etc.

New computers can be added to the network or moved very easily. All that is required, is to add an adaptor to the cable which doesn't disturb the network. This means that future extensions do not need to be anticipated.

The network component conforms to the ISO 802.3 (ETHERNET): error detection and correction (32 bits CRC) standard. Research has demonstrated that with a media load of less than 30% of the nominal flow, the risk of losing a message is null, and the delay caused by management of collisions is minimal.

Computers in active redundancy

This redundancy is managed by the ADS component of the ADACS product.


Process interface servers
Master server
Redundancy management link
Optical fiber isolation
Slave server
Operator station STR / SAR
Redundant data network

The principle of active redundancy

Two computers working in active redundancy run the same software. When the system is started up, one of the two computers is master and the other is the slave.

Both receive the same messages from the network and the master plays the leading part towards the slave. To be more precise, the master tells the slave which is the message it must process from among the ones it has received and which kind of processing it has to carry out at any given time.

At the same time, the master carries out exactly the same processing. When this is complete, if the results need to be transmitted on the network, the master sends them and asks the slave not to transmit its results.

Therefore, both the master and the slave process the same message and their status is always identical.

Furthermore, the two computers monitor each other. If the slave fails, the master continues to operate undisturbed. If the master fails, the slave becomes master, i.e. .. it chooses the messages to be processed itself and the types of processing to be carried out, subsequently sending the messages via the network.

Perfect continuity of service

This way of managing redundancy means that in the event of a failure on one of the two computers, there is perfect continuity of service in the performance of the various operations. None of the messages received or processing carried out by the computers is lost.

The delay caused by failures is virtually null because the status of the two computers is permanently identical.

Following a failure, the repaired computer can be reinserted without stopping the system and almost without disturbance. All the information needed and contained in the master's memory (such as real-time database, messages) is transmitted to the slave and the active redundancy process starts up again.

Communication between the master and slave computers is by high flow rate parallel link, which also works in active redundancy. This communication does not therefore place any further load on the network component. The link can be a fibreoptic link and therefore ensure electric insulation between the two computers as well as geographical isolation (for protection in the event of a fire).

Messages received by the computers working in active redundancy are sent, via the transmitter, by means of the network component distribution protocol. There is therefore no duplication of messages in the network and the redundancy places no extra load on the network.

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