LKS6

LKS6 Fire Monitor System

The LKS6 system has been developed for optimum control of fire prevention systems using electrical remote-controlled fire monitors. Monitors of this kind are usually installed to protect crude oil ports, loading and unloading wharfs for oil products, oil terminals, high-risk industrial plants, refineries, off-shore rigs, airport hangars, etc.

Apart from actuating the monitors, the system can also control the configured valves and pumps. Where required by particular environmental conditions, instead of electrical monitors, the system can be used on hydraulic units equipped with electro-hydraulic command actuators and electrical feedback.

The LKS6 system involves the installation of microprocessor control units (called UZM for the monitors and UZA for the motor operated valves) allocated to the individual users, which are connected to the main control panel by means of a special single electrical power and control cable loop. Auxiliary control units, called UZK, are normally connected to the same loop. A closed-circuit TV system (CCTV) may also be incorporated into the system, consisting of a colour (or black and white) video camera directly mounted either on the revolving frame of each monitor or on fixed posts and display monitors located at the main control panel and at any peripheral sub-panels.

The LKS6 is particularly useful for remote-controlled fire monitor systems employing a large number of monitors and for systems in which the individual users (monitors, valves, pumps, etc.) and the main and auxiliary control panels are positioned some distance apart. In cases of this kind, conventional systems require many control and power cables to connect each actuator of each user to the main control panel, as well as numerous cables for interconnection with auxiliary control panels.

Apart from the high installation costs involved in using so many cables, traditional systems also require expensive protection of the large cable trunks against mechanical damage and fire.

With the LKS6 system, however, a special single cable can be used (flame-resistant for 180 minutes) which is able to link up all of the users and any auxiliary control panels, regardless of the number of units included in the system and the type of performance required. In this case, apart from obviously reducing installation costs, protection of the cable against mechanical damage and fire also becomes much easier and more secure.

The LKS6 system also allows perfect supervision, in real time, of every function performed by the system and the status of its components, and increases reliability thanks to the electrical power supply loop and the microprocessors installed in the control units which reset electrical connections between the units if there is damage or a break at any point of the connecting cable.

With the LKS6 system, the requirement (by legal standards and in the interests of safety) for installation of a clearly visible main switch in the vicinity of each remote-controlled unit can be easily met as the UZM unit is mounted directly on the monitor and the UZA unit is installed in the immediate vicinity of the controlled valves. The status of the knife switches is automatically monitored by the system.

Lastly, by adding a host computer, the LKS6 system can synchronize movement of a number of monitors, directing their jets onto the same target and displaying the position of the monitors and the trajectory of their jets (performing automatic adjustments to compensate for wind direction and strength) on the VDU. The host also enables the system to display and print-out the conditions and statuses of the system when it is on standby or during intervention. All of the above information can also be obtained on auxiliary host computers, from which it is possible to send commands to the system, which are then hierarchically filtered by the main computer.

The main advantages of the LKS6 system can be summarized as follows:

- very low installation costs in terms of both material and labour (only one special cable needs to be installed for all of the system's functions, including the CCTV system).
- lower maintenance costs, compared not only to hydraulic systems but also to traditional electrically controlled systems (the status of each unit is continuously monitored so there is no need for inspections or movement tests to assess operativity; each alarm condition is automatically indicated and recorded)
- possibility to receive feedback (limit-switch signals and analog position values) at both the main control panel and any sub-panels by means of the single cable mentioned above, with separate signals indicating intervention of the torque limiters, thermistors and any other protective equipment
- complete efficiency of the system even in the event of the first fault on the main cable, with automatic reconfiguration of the loop
- possibility to subsequently add other UZM monitor control units and UZA valve control units to the main line if the system is extended at a later date, without any need for modifications to the existing system
- possibility to subsequently add sub-control panels at any point on the loop, providing control and status information for all of the system's units
- possibility for synchronized operation of a number of monitors with automatic aiming of the extinguishing jets onto the same target and automatic adjustment to compensate for meteorological conditions (direction and strength of wind)
- possibility to apply a colour CCTV system linked to each monitor and connected not only to the main control panel, but also to any auxiliary panels, using the same single system cable.

System Structure

The structure of the system can be freely chosen, simply taking into account the type of performance required in extinguishing operations. The monitors can therefore be positioned wherever required, without restriction. All Caccialanza & C´s fire monitors available in the LKS6 version can be used, and may be of any type and with any delivery rating. More specifically, the A3 fire monitor is predisposed for operation with water or water-foam with a delivery rating of 1000 to 3000 l/min. The A4 monitor can be equipped to operate with water or water-foam, or can be fitted with a double circuit for water and foam with a switching valve. This version can be supplied with a delivery rating of from 3000 to 6000 l/min. It is also available in a double-acting version. The A6 monitor can be supplied with water or water-foam operation and delivery ratings of 6000 to 20000 l/min. Lastly, the A8 fire monitor, which can again be equipped to operate with either water or water-foam, can be used with delivery ratings of up to 30000 l/min. For all of the above fire monitors, the following special features should be highlighted: each monitor is protected by built-in thermistors - the limit switches can be directly set after installation, selecting the positions from the whole available operating range and simply setting them with a screwdriver - maximum torque sensors protect the fire monitor and operator from danger and damage in the event of accidental collision with obstacles during movement - two limit-switches and maximum-torque contacts are installed for each direction, providing a double, independent check of each function - built-in potentiometers allow real-time detection of monitor position, for both lifting and rotation. Similarly, the type of water and/or water-foam distribution can be chosen so that the specific hydraulic characteristics of the system are optimized. Lastly, it is possible to use distribution systems with centralized foam production or with production divided into various areas or performed locally on the individual fire monitors. Each monitor is linked to a UZM type unit of the LKS6 system, consisting of two boxes, respectively positioned at the bottom of the pole and directly on the fixed turret of the fire monitor. Each UZM unit can control the monitor movements of lifting/lowering and turning to the right/left, and can also be equipped to control deflectors, if fitted, for a full or blade-type jet of foam, or alternatively to control the water nozzle for a full jet or partial jet. If the monitor has a double gun, the unit can also control the water/foam switching valve. To perform the above functions, from 2 to 4 power control boards are used (specifications given below). If the fire monitor does not feature a nozzle, deflector or switching valve, the boards that are not dedicated to these functions can be used to control one or two monitor feed valves. A microprocessor board supervises logical control of all of the digital inputs and outputs and analog inputs (feedback of actuator position) included in the system. The same board autonomously controls loop reconfiguration functions in the event of a fault on the interconnecting cable. Lastly, there is a power supply board to generate all of the voltages necessary for operation of the control equipment and to charge the back-up battery which ensures logical operation of the unit even in the event of mains power failure. The power board necessary for reconfiguration of the loop power supply circuit and the signal board which supervises reconfiguration of the serial interface of the control circuit and the CCTV system if fitted, are housed in the box at the bottom of the pole. This box is also equipped with a multi-pole socket for connection of local portable control units. To control and monitor valves and pumps located outside the immediate vicinity of the fire monitor (or when there are more monitors than can be directly controlled by the UZM unit), UZA units are installed. The basic structure of these units are similar to that described above; they are available in two versions for directly powering valves or for simply interfacing valves and pumps

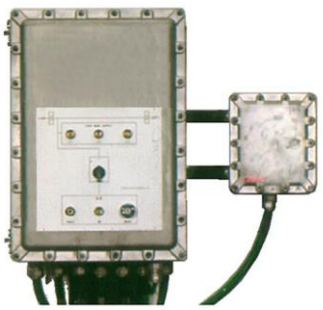
which can be powered separately using conventional electrical panels (even existing panels). In the typical structure, there is one box containing the circuit reconfiguration equipment, identical to the one described in the UZM unit, and another containing a microprocessor board (with a similar performance to that described for the UZM unit), direct valve-actuation boards (in the version with powering of the valves) or auxiliary relay boards to control the remote power switches (outside the panel) of pumps and valves, and an optoisolated input board to connect lines carrying signals from the actuators (outside the panel).

The main control panel can be located at any point in the loop and is the only point of the system that has to be directly powered by the existing mains electricity network. If an emergency power supply is provided at this power point, it is automatically made available to the whole system.

The main control panel is always equipped with power devices to manage automatic loop reconfiguration, and with control devices to manage serial connection in the same automatic reconfiguration procedure.

It can also be equipped with boards for direct on-panel display of the status of each unit and direct control by means of manipulators. In this way, a pseudo-conventional panel section can be created, from which the operator can directly control each unit by moving the relative manipulators and see the result of his operations by means of the relative indicators. Even when this system is provided, however, all of the control and monitoring operations for each system unit can still be performed by means of the keyboard and display.

The main control panel is also interfaced to the host computer, equipped with a graphic colour monitor, from which all of the control and monitoring operations can be performed for each unit either individually or using the group-control function.



To execute this function, the groups of monitors and relative valves/pumps are defined beforehand, taking into consideration the various operating circumstances in which the system may find itself, depending on the variable fire risk and the particular event underway. For each group, the main fire monitor and auxiliary monitors are defined. Once this has been done, when operating the group, commands only have to be sent to the main monitor as the auxiliary monitors will automatically perform the operations necessary in order to help extinguish the fire in the set point. Wind factors are also taken into consideration in calculation of the trajectories and actuation of the monitors: if the system detects that one or more monitors are unable to reach the set point, it will automatically disable them and only automatically reactuate them when a change in the environmental conditions or movement of the extinguishing target makes it possible for them to reach the area.

The host computer also gives a permanent display of system efficiency, monitoring each power and serial connection of every unit, the status of the sectioning devices and fuses on each unit, and intervention of any safety or protective device.

By simply checking the technological alarm display table it is consequently possible to immediately note any system malfunction when it is on standby or in operation.

All data regarding operations performed and system and alarm status is automatically logged and can subsequently be accessed and stored on external magnetic media. Auxiliary control panels can

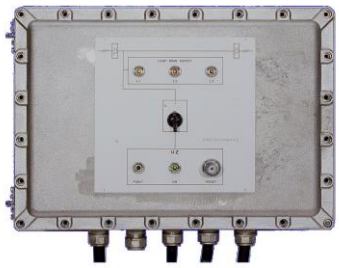
be constructed with a technical system and structure similar to either the main control panel, described above, or the main host computer. In addition to the stationary auxiliary control panels, portable versions are also available which can be directly interfaced to the connector on each UZM and UZA unit. This makes it possible to directly operate each component from any point of the system, particularly for maintenance, with free selection directly in the field.

For electrical connections between the system's components, special cables have been created which can resist fire for 120 minutes at 700°C.

The CMT2 or CMT21 cables are designed to form the main loop connecting all the units, while the CMT3 cable is designed for interconnection of the two UZM and UZA boxes and for connection of the actuators linked to them.

Lastly, the CMT1 cable is of particularly flexible design (although with a lower degree of fire resistance) and is used specifically for connection of the monitor on the revolving turret and the top UZM box, positioned on the fixed turret.

All of the cables are armoured and shielded, so they can be directly used in the construction of systems in areas with a risk of explosion.



The CMT 2 cable is used for the loop connection in case the serial connection is performed by means of wires, while the CMT 21 cable is required for the same loop connection in case of serial transmission by optical fibres. In this solution the required optical fibres are built in the central part of the loop cable.

The UZM and UZA units can be supplied in a normal version or in an Eex-d version for installation in dangerous areas.

The UZK unit is available in both a Eex-d version and a mixed version, which is part Eex-d and part Eex-i with intrinsic safety.

Boards

The system uses various arrangements of modular boards, either plugged directly one into the other or interconnected via flat cables.

The following types of boards may be installed:

- motherboards into which individual function boards are plugged
- function boards which perform the individual system functions
- power supply boards and interface and auxiliary boards

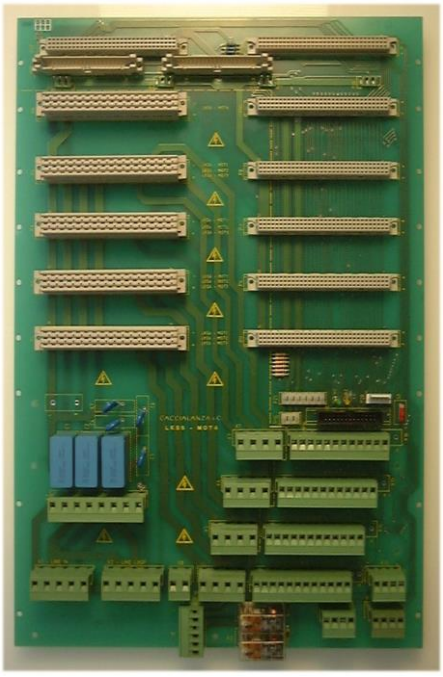
Motherboards

Various types of motherboard are produced for use in both sub-panels and the main control panel. In the units with directly powered components, a special structure makes it possible for the same motherboard to receive boards with a power bus at 400/230V 50Hz, alongside a signal bus, maintaining the necessary distances and electrical protection and providing adequate shielding for correct operation of the logic signal. The boards are designed to be housed in a dedicated box or for mounting in standard 19" modular racks.

The actual list of the available boards is as follows:

Part Number	Description	Layout Nr..	View Nr
4640010409	LKS6/MOT4	46190407	BL604000
4640012409	LKS6/MOT24	46192406	BL624000
4640014009	LKS6/MOT40	46194006	BL640000
4640014809	LKS6/MOT48	46194806	BL648000
4640018009	LKS6/MOT80	46198006	BL680000
4640019909	LKS6/MOT99	/	/

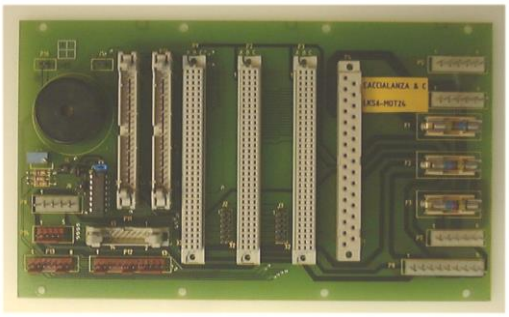
MOT4 board



Motherboard for UZM (monitor control) and UZA (valve control, in version with direct power supply) units. They are divided into two distinct sectors, related to two distinct buses. In the section dedicated to the power boards and supply board, there are two connectors for direct simultaneous connection of both buses; the processor board, on the other hand, is only connected to the control bus. In the power section, there is an RC filtering group between the three phases and the neutral. There is also a connector for plugging in the omnipolar main switch/knife switch. All field connections, for both the power lines and control lines, are made by means of plug-in type printed circuit terminals. In the power section, the pitch is 7.62 mm with 500V insulation. The clamps can receive cables with a cross-section of up to 2.5 mm. Signal carrying cables, on the other hand, are interfaced by means of multi-pole connectors. The

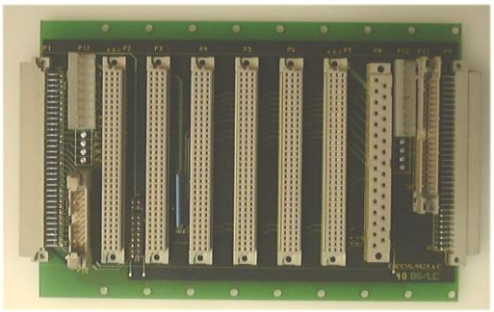
motherboard can receive up to four power boards, such as the MOT1, MOT2 or MOT3, as well as the MOT6 supply board , the MOT49 stand-by phases control board and MOT5 processor board.

MOT24 board



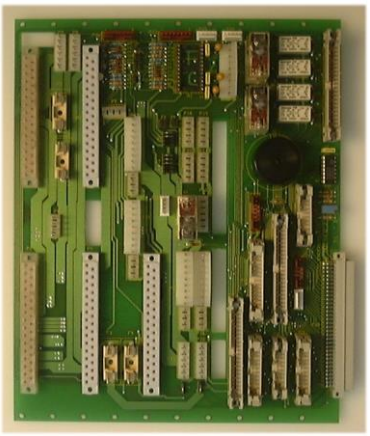
A smaller sized motherboard and system bus board for UZA type sub control panels (valves and pumps without direct power supply), UZK units (auxiliary command and control unit) and the auxiliary bus of the HZ main control panel. It is designed to receive the MOT6 local processor card, the MOT67 supply card and, in the only version for HZ, the MOT20 serial management board and MOT19 interface. The board can be connected, by means of multi-pole connectors, to other identical boards or to the MOT40 complete bus board if an extension to the sub-panel's bus is required.

MOT40 board



Motherboard and system bus board for the HZ main control panel. It is designed to receive the MOT31 main processor board, the MOT41 analog input management board and the MOT22 digital input and output management board. The number of MOT22 boards may vary from 1, in the minimum configuration, to 4 when there is a fully equipped local repeater. It also has slots for MOT/D converter boards. The MOT40 can be directly connected to other identical boards of connected to an MOT24 board by means of connectors in order to extend the control unit's bus.

MOT48 board



This type of motherboard is designed to house the main MOT/BA4 power supply board in the HZ main control panel and to interconnect with displays and keyboards. In the main control panel, there is a single MOT48 board.

MOT80 board

This type of motherboard is designed to house the CCTV sub-system in the UZM sub-panel, HZ main control panel and UZK command and control sub-panel. It can directly receive CCD solid-state boards to power video cameras, MOT67 boards to power interface units and for MOT85 video conversion, as well as MOT85 boards. Video connections to the video cameras are made by means of BNC connectors. The other connections are made by means of plug-in type printed circuit clamps.

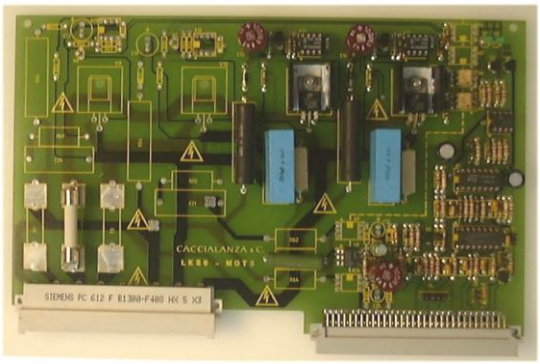
Function boards

The function boards are the "brain" of each unit, and directly manage individual functions or coordinate the functioning of other boards. Function boards can be broadly divided into actuation boards (including power) of the field units, field signal acquisition/sending boards and signal processing and monitoring boards.

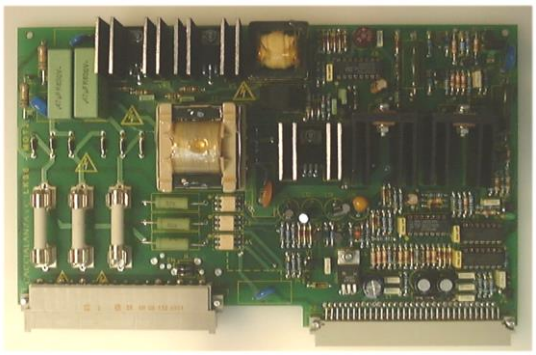
This is the list of the different boards :

Part Number	Description	Layout Nr..	View Nr
4640010109	LKS6/MOT1	46190106	BL601000
4640010209	LKS6/MOT2	46190206	BL602000
4640010309	LKS6/MOT3	46190306	BL603000
4640010509	LKS6/MOT5	46190507	BL605000
4640010709	LKS6/MOT7	46190710	BL607000
4640010769	LKS6/MOT7AB	46190709	BL607AB0
4640010809	LKS6/MOT8	46190806	BL608000
4640010819	LKS6/MOT8F	46190810	BL608F00
4640010839	LKS6/MOT8FO	46190808	BL608FO0
4640010859	LKS6/MOT8FL	46190807	BL608FL0
4640010879	LKS6/MOT8FU	46190816	BL608FU0
4640011209	LKS6/MOT12	46191206	BL612000
4640011909	LKS6/MOT19	46191906	BL619000
4640012009	LKS6/MOT20	46192006	BL620000
4640012209	LKS6/MOT22	46192206	BL622000
4640013109	LKS6/MOT31	46193106	BL631000
4640014109	LKS6/MOT41	46194106	BL641000
4640018509	LKS6/MOT85	/	BL685000
4640019709	LKS6/MOTS3	46190976	BL697000
4640019769	LKS6/MOTSF	46190996	BL697060
4640019809	LKS6/MOTST	46190986	BL698000

MOT1 board



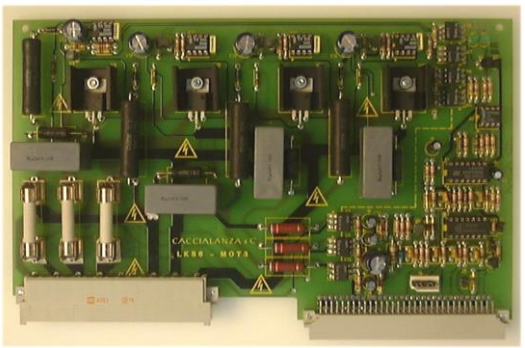
This function board is designed to directly supply power to a single-phase actuator with a mains voltage of 230V/50Hz. The board can control power of 0.5 KVA. In the power section, the board is equipped with fuses and fuse carriers and with thyristors to command the actuator, with the possibility of inverting the motor's direction of rotation. In the control section, there is an interface for the main local processor and the feedback signals from the actuator. For the limit-switch, maximum torque and motor thermistor intervention signals, there is a direct input on the board logic to block movement. A similar parallel input is then sent by the actuator directly to the main processor which, in turn, sends a second control signal by bus to the board with redundancy operation. Monitoring of the status of the power supply voltages and fuses is also provided. Connection between the control section and power section with mains voltage is only made by means of optoisolators. The board is equipped with two connectors with direct insertion - a power version and a signal version - for the respective buses of the motherboard.



MOT2 board

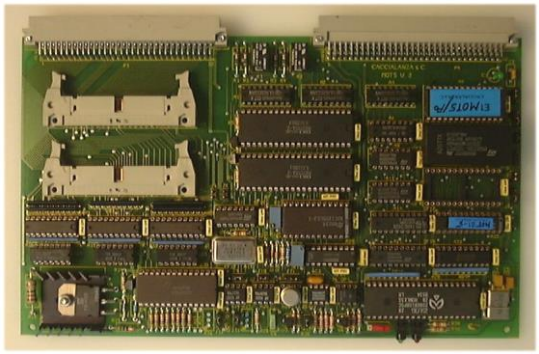
This board is designed to directly supply power to a single-phase actuator in direct current at 24V. The board can control power of 0.4 KVA. To perform its function, the three-phase power supply at 400V/50Kz is directly converted into direct current on the board. In the power section, the board is equipped with fuses with fuse carriers and thyristors to command the actuator, with the possibility of inverting the direction of rotation of the motor. In the control section, there is an interface for the main local processor and the feedback signals from the actuator. For the limit-switch, maximum torque and motor thermistor intervention signals, there is a direct input on the board logic to block movement. A similar parallel input is then sent by the actuator directly to the main processor which, in turn, sends a second control signal by bus to the board with redundancy operation. Monitoring of the status of the power supply voltages and fuses is also provided. Connection between the control section and power section with mains voltage is only made by means of optoisolators. The board is equipped with two connectors with direct insertion - a power version and a signal version - for the respective buses of the motherboard.

MOT3 board



This function board is designed to directly supply power to a three-phase actuator at 400V/50Hz. The board can control power of 0.6 KVA. In the power section, the board is equipped with fuses and fuse carriers and with thyristors to command the actuator, with the possibility of inverting the motor's direction of rotation. In the control section, there is an interface for the main local processor and the feedback signals from

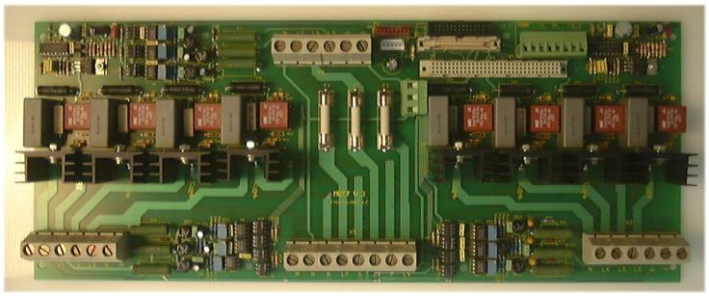
the actuator. For the limit-switch, maximum torque and motor thermistor intervention signals, there is a direct input on the board logic to block movement. A similar parallel input is then sent by the actuator directly to the main processor which, in turn, sends a second control signal by bus to the board with redundancy operation. Monitoring of the status of the power supply voltages and fuses is also provided. Connection between the control section and power section with mains voltage is only made by means of optoisolators. The board is equipped with two connectors with direct insertion - a power version and a signal version - for the respective buses of the motherboard.



MOT5 board

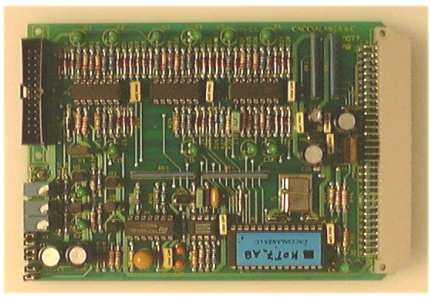
This is a logic board for management of the UZM and UZA sub-control panel. The board is equipped with a Z8 processor and three types of memory: RAM, EPROM and non-volatile RAM. It is also equipped with a current-loop serial line for connection to the main loop by means of the MOT8 board. It is equipped with digital inputs and outputs for the acquisition of signals from the actuators and for their command by means of the MOT1, MOT2 or MOT3 board, and also for direct control of the MOT7 (power-section loop control) and MOT8 (signal- section loop control) boards.

MOT7 board



This board is designed to control the power section of the loop. It can be equipped for operation in the sub-panels or main control panel (in this case, there are two MOT7 boards, each linked to an MOT12 board). The unit is equipped with two groups of four thyristor, one for each phase and the neutral. It is consequently possible to section the loop, with logic commands from the processor board, at the input, output or on the power supply branch of the control panel. On the same board, there is also a plug-in printed circuit terminal board for connection of the omnipolar main remote switch/knife switch. The board is also equipped with a set of three fuses to protect the branch line. Each of the thyristor groups has a functional check on each phase and the neutral. The interface with the control section is made by means of optoisolators.

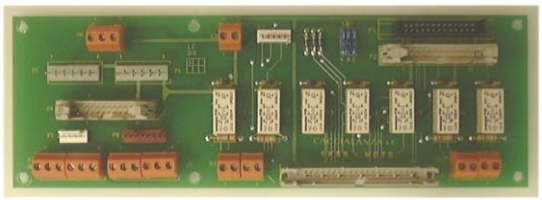
On the board a multipole connector for the insertion of the MOT 7 AB control board is provided



MOT7AB board

This is a logic board designed to control the operatinal functions of the MOT 7 board, both automatically and by means of commands performed by the MOT 5 local main processor board.

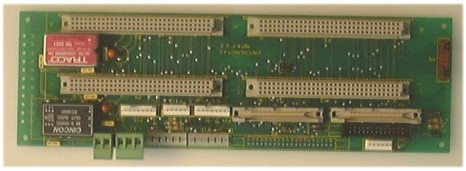
It is equipped with a single chip microprocessor of type SGS 6225.



MOT8 board

This board is designed to control the signal section of the loop (serial line or CCTV line) in the all wire version of the serial loop. The board allows sectioning at the input or output of the serial line, with reclosing of the resulting loop, keeping the branch to the controlled sub-panel inserted. Loop management commands are received directly from the processor board. The board is also equipped with a multi-pole connector, interfaced with the sub-panel service connector, which allows connection of a portable control unit. A diagnostic board to check the status of the serial line can also be connected. The board also features dip switches that can be used for direct configuration of the loop (for testing or operation in test conditions).

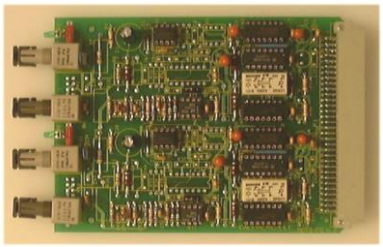
MOT8F board



The board is designed to control the signal section of the loop (serial line or CCTV lne) in the optical fibres version of the system.

The board itself is basically a motherboard with the parallel identical sections, for the main serial loop and for the auxiliary (UZK) serial loop.

Each section of the card is equipped with two multipole connectors, to host the optical interface card (type MOT 8 FO or MOT 8 FL) and the serial and loop control interface card.

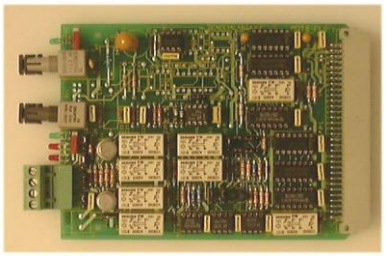


MOT8FO board

This board is equipped with two pairs of optoelectric transducers to perform the receive and transmit function of the optical fibre of each side of the loop.

The unit is also equipped with the sectioning devices which are required to insulate a portion of the communication loop (both transmit and receive fibres)

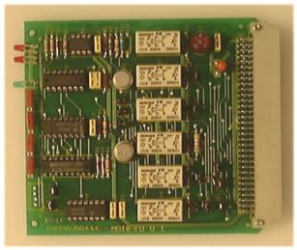
MOT8FL board



This board represents the interface between an optical fibre and a wire (current loop) section of the serial communication loop.

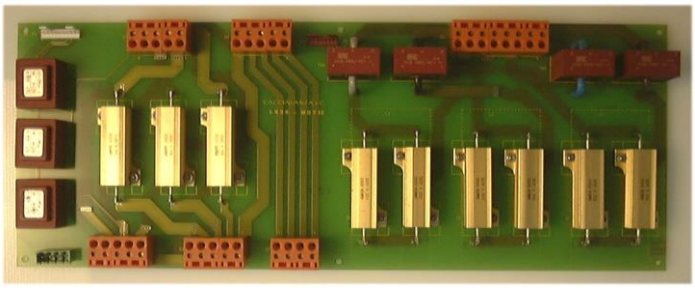
Is equipped with a pair of optoelectric transducers to perform the receive and transmit function of the optical fibre at one side of the loop and with a pair of current loop transducers to perform the same functions at the other wire equipped side of the loop. The card can be set in order to fit the required transformation (fibre to wire or wire to fibre) in the loop.

MOT8FU board



The boards manages all the controls in the serial loop communication performed by optical fibres and is equipped with all the interfaces to the current loop serial interface of the MOT 5 main processor local board ads well as at the auxiliary plug for mobile connected external UZK.

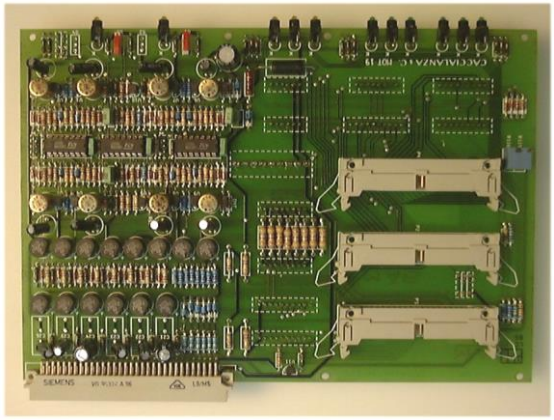
The card controls according to the information flow direction detected on the loop the connection of the transducers to the right corrent loop and RS232 interfaces on the board itself.



MOT12 board

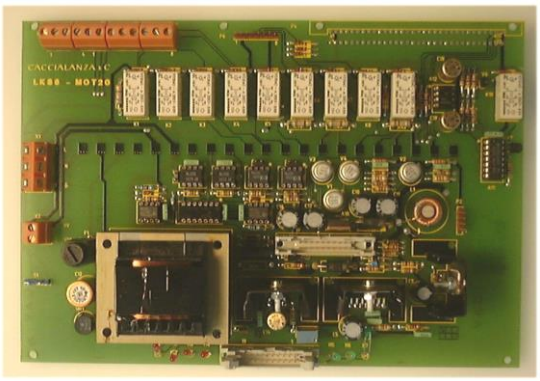
This is an auxiliary power board, designed to be directly interfaced with the MOT7 board in the main HZ control panel. Two pairs of MOT7/MOT12 boards are always used - one for the primary power supply of the loop and the other to supply power to the loop-reclosing branch. The board is equipped with power resistances which are automatically enabled by the main control panel processor during the loop-efficiency test phase. It is also equipped with TA current transformers and TV voltage transformers, with appropriate interfaces, which are used by means of the MOT19 board to monitor the operating conditions of the power section of the system.

MOT19 board

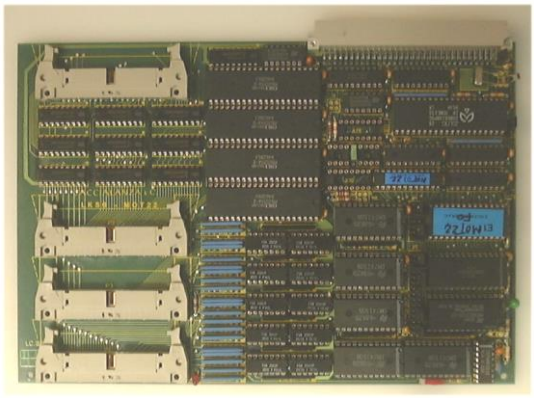


This auxiliary board is plugged into the main HZ control panel in order to interface the analog and digital lines and to manage the primary functions of the system. The interfaced analog lines are then sent to the MOT41 board; the digital lines (both inputs and outputs) are sent to the MOT22 board. Voltage and current monitoring is performed using the transducers mounted on the MOT12 board. The board itself also generates the alarm signals that are sent concurrently to both the main processor and directly to the MOT7 power board. Management of the MOT7 and MOT20 boards is also controlled by this board, and the transducer for transmitting wind direction and speed data, measured by an anemometer, is also connected to it. The MOT19 board is also equipped with test switches to simulate loop functioning and test the efficiency of the reconfiguration circuit, and pushbuttons to manually reset the power lines (operating parallel to the automatic reset controlled by the panel). The board lastly detects the status of the loop-safety thermomagnetic switches and the correct phase sequence in the control panel power supply.

MOT20 board



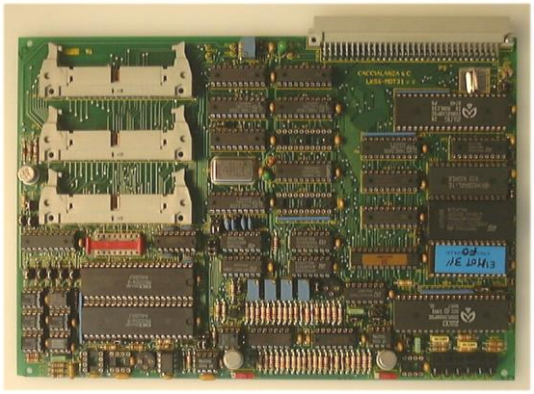
This board manages the serial lines on both sides of the loop in the main control panel in the all wire version of the serial loop. By means of commands from the main processor board, the loop can be configured for single operation or operation in two separate sections. This configuration is chosen if a communication fault is detected. In this case, a special program reconfigures the loop, step by step, on both sides until the faulty area has been isolated between two sub-panels, still maintaining the connection with all the sub-panels.



MOT22 board

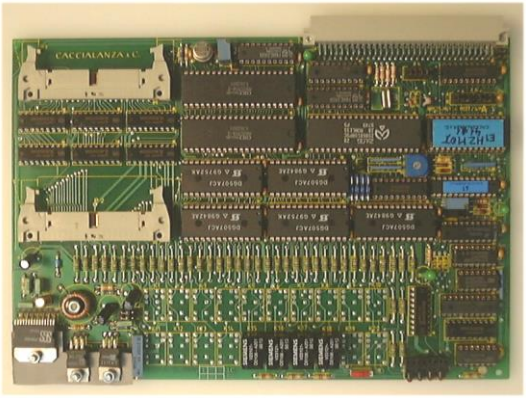
This board is equipped with RAM, EPROM and non-volatile RAM memories and can manage 80 digital input lines and 80 digital output lines. The board is equipped with its own local Z8 processor, which handles functional line management. A number of boards can be linked on the control panel bus. In the typical configuration, one MOT22 board is always included to manage the main system-actuation inputs/outputs, while up to three more can be added to interface MOT14 and MOT15 boards for command and direct display, by means of keyboard, manipulators and LEDs, of the field units.

MOT31 board



This is the main processor board for management of the HZ main control panel and UZK sub-panels. The board is equipped with a Z8 processor and three types of memory: RAM, EPROM and non-volatile RAM. It is also equipped with an RS232 serial port for connection to a host computer, plus a current-loop serial line which is interfaced with the MOT20 board for management of the main system-control loop. The MOT31 board also controls the local bus, to which all the other boards in the control panel are connected, and in particular the boards for I/O control and parallel command by means of the MOT14 and MOT15 boards. This card is also interfaced to the display, in order to show the statuses of all the system components, and to the alphameric keyboard in order to enter commands.

MOT41 board



This board has the specific function of managing the analog lines of the system. It is equipped with its own Z8 processor and has EPROM and non-volatile RAM memories. In the standard version, the analog lines are in voltage with a range of 0-10V; but it is also possible to manage the lines in current with a range of 1-0.20 mA. A DC/DC converter is installed on the board for generation of the voltages required by the controlled lines. By means of a digital analog converter and a series of multiplexers, the board transforms field data and processes it locally. The relative information is then sent, by means of the local bus, to the main control panel. Line safety operations, on the other hand, are managed locally if abnormal voltage or current values are detected.

MOT85 board

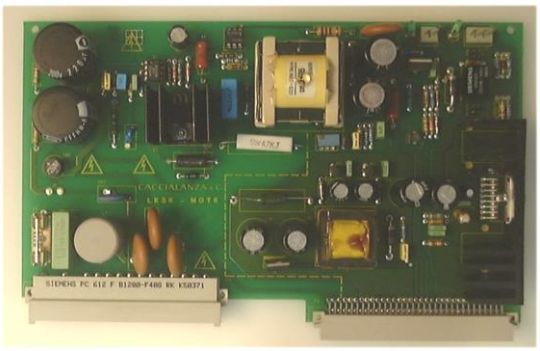
This is a video board for insertion in the 80 bus on UZM sub-panels and the main control panel. The board allows interfacing of a CCD colour video camera or colour monitor to the two-wire transmission line inserted into the main loop. In each board, the signal received from the previous section is decompressed and equalized and the signal to be transmitted to the next section is reconditioned and compressed. A trimmer makes it possible to set the system according to the length and characteristics of each section. The board is also equipped with a mini test connector which can be connected to the video equipment during setting operations.

Power supply boards

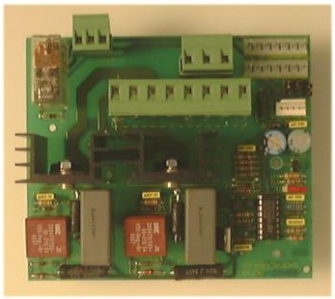
For the different power supply functions performed in the system following cards are provided:

Part Number	Description	Layout Nr..	View Nr
4640010609	LKS6/MOT6	46190606	BL606000
4640014909	LKS6/MOT49	46194906	BL649000
4640016509	LKS6/MOT65	39044651	BL665000
4640016709	LKS6/MOT67	46196706	BL667000
3195005509	LKS6/BA4-12	39043266	BF5BA410
3195002009	LKS6/D-5±15	39043197	BF5D5150

MOT6 board



This is the power supply board inserted in UZM and UZA sub-panels (version with direct power supply). It is powered directly from the mains and, by means of a switching feeder, supplies the auxiliary voltages at 12V to power the function boards, 5V for the logic boards, and at +15V and -15V to power the analog/digital converters. It also charges the emergency back-up battery of the sub-control panel and warns of power supply failure.

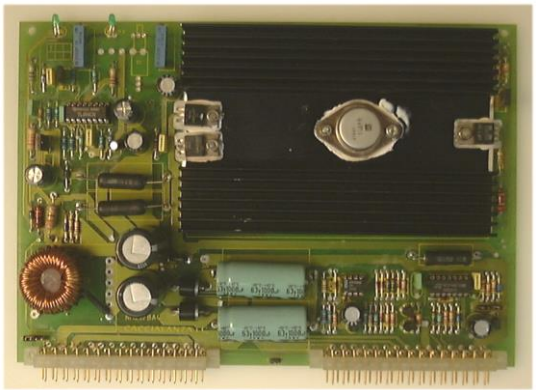


MOT49 board

This auxiliary board is used to switch off the power supply to the motors during the stand-by periods of the local unit operations.

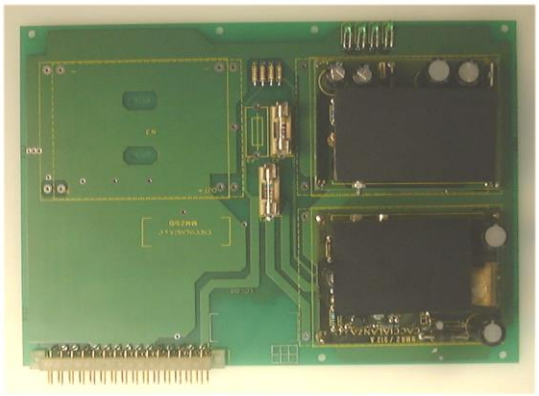
The switch on /switch off operations are automatically controlled by the MOT5 card; in this way the heath production in the local panels is kept to a minimum.

MOT/BA4 board



This is the power supply board for the main control panel and is powered directly from the mains via a transformer. At 12V it can supply a maximum current of 8A. It also charges the system's back-up batteries and warns of power supply failure.

MOT/D board

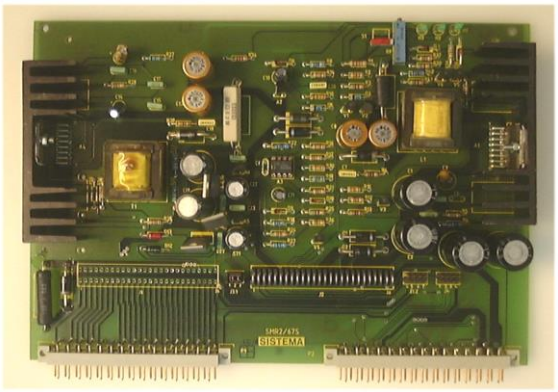


This board is designed to support the FMZ5/911 and FMZ5/912 DC/DC converter boards. It is directly installed on the MOT40 bus board of the main control panel and supplies the required voltages to the group of function boards installed on the same motherboard. The FMZ5/911 board uses an input voltage of 12V and supplies an output voltage of 5V, adjusted and stabilized to power the panel's microprocessors and other digital users. The FMZ5/912 converter board with a primary input voltage of 12V supplies +15 and -15V output voltages to power the analog digital converters of the function boards and supplies the voltage necessary for operation of the RS232 serial lines.

MOT65 board

Power supply board for the CCTV system. It is used in all of the control panels to directly generate a voltage of 24V d.c. from the mains to power the video interface.

MOT67 board



This is a power supply board for the UZA panel (version without power supply) and the UZK panel. It is equipped with a switching device powered from the mains via a transformer, which generates a primary voltage of 12V for the control panel functions and for charging the emergency back-up battery. It also generates voltages of +5V for logic operation of the processor board, and of +15V and -15V to power the analog/digital converters. It also sends power supply failure signals to the main processor board.

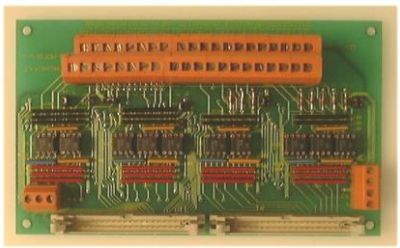
Interface and auxiliary boards

The various interface and auxiliary functions are performed by the following boards :

Part Number	Description	Layout Nr..	View Nr
4640010909	LKS6/MOT9	46190906	BL609000
4640011009	LKS6/MOT10	46191006	BL610000
4640011409	LKS6/MOT14v.HZ	46191406	BL614000
4640011429	LKS6/MOT14v.UZK	46191406	BL614020
4640011509	LKS6/MOT15v.1MC	46191506	BL615000
4640011519	LKS6/MOT15v.5PS	46191506	BL615000
4640011529	LKS6/MOT15v.2MO	46191506	BL615000
4640011549	LKS6/MOT15v.5PL	46191506	BL615000
4640011559	LKS6/MOT15v.1MO	46191506	BL615000
4640011569	LKS6/MOT15v.2MC	46191506	BL615000
4640011579	LKS6/MOT15v.1M3	46191506	BL615000
4640011709	LKS6/MOT17	46191706	BL617000
4640011809	LKS6/MOT18	39044180	BL618000
4640011819	LKS6/MOT18F	46191806	BL618F00
3195005109	LKS6/N1	39043216	BF5N1000
3195005209	LKS6/N4	39043246	BF5N4000

MOT9 board

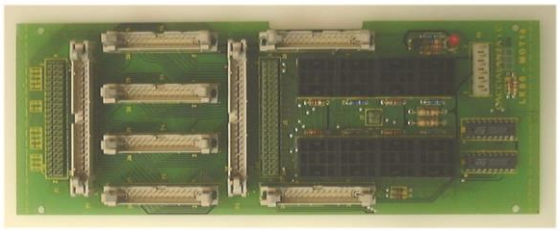
This is a relay power board, with the possibility of direct power supply. It is equipped with 6 relays with 1 exchange contact, with a capacity of up to 4A/max 230V. Each contact is protected by a fuse and it is possible directly power up to 6 users, with voltage setting by the user (max 230V).



MOT10 board

A terminal board, complete with optoisolators, to connect signals and feedback from the actuators. It is equipped with a local DC/DC converter for the generation of auxiliary voltage to send to the field.

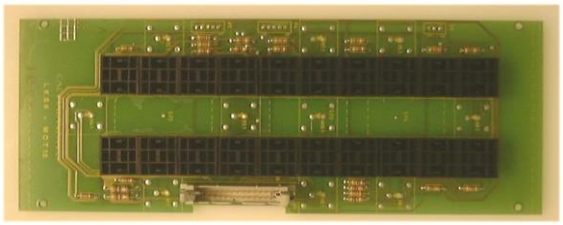
MOT14 board



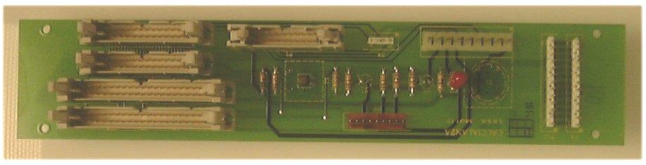
Display and command board for the HZ main control panel and for UZK auxiliary command and control panels. The board is interconnected, by means of multi-pole flat cables, to the MOT22 board and can, itself, connect up to 4 MOT15 boards. Printed-circuit sockets are installed directly on the board so that pushbuttons and LED indicators can be directly plugged in on the panel version. This creates a pseudo-conventional

operator interface, in addition to the possibility to communicate by means of the display unit and keyboard.

MOT15 board



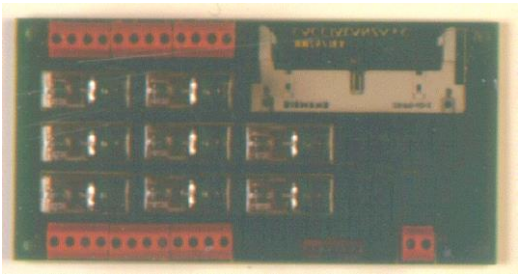
This board is interconnected to the MOT14 board, through which it is connected to the digital inputs and outputs of the MOT22. The board can be equipped with various printed-circuit socket arrangements to receive control-panel pushbuttons, indicator lights and joystick-type manipulators. By means of these command devices, the operator can perform pseudo-conventional operation of the individual monitor units and system valves, as well as receiving status information. Like the MOT14, is used in both the HZ main control panel and UZK sub-panels.



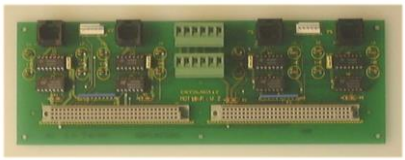
MOT17 board

Auxiliary display and command board for the UZA control panel, in the version without power command, and the UZK panel. It is equipped with LED status indicators and key-operated pushbuttons for system reset.

MOT18 board



Interface board for serial lines, used in the HZ main control panel. Depending on programming, it can be used to manage two current loops (interconnected to the main loop) or two RS232 loops (connected to the host computer and auxiliary host computer if used). It has one connector for direct connection to the MOT20 board and another for connection of the diagnostics board to check serial line operation.



MOT18F board

The board is designed to control the signal section of the loop (serial line or CCTV line) in the main panel HZ for the optical fibres version of the system. The board is designed to house two MOT 8FO optical interface cards, one for the main loop and one for the auxiliary (UZK) serial loop.

For each section a transformation of the incoming and outgoing signals is foreseen into the RS 232 standard, with a total capability of 4 independent COMs connectable.

MOT/N1 board

This board is designed for interconnection of a 230V/50Hz (max 2A) user to the mains. It is equipped with a mains filter and safety fuse. Its terminals can receive cables with a cross-section of up to 2.5 sq.mm.

MOT/N4 board

This is the same as the MOT/N1 board, except that it is designed for 4 users at 230V/50Hz. The maximum total current that can be supplied is 4A.

The Host Computer

The host computer is the "brain" of the entire system, and controls all the connected service and security devices. The main functions of the host computer are: -Command of each monitor by means of a keyboard or mouse, with the following commands: turning, lifting, opening/closing of water and foam valves and, where available on the monitor, full/partial (or blade-type) jet control and switching from water to foam - Performance of the above operations for a group of monitors after defining the main monitor and associated monitors - Selection of the video camera to be displayed on the colour monitor - Supply in real-time of all information regarding technological system operating status, and in particular, indication of faulty components, or components not keeping to nominal values - Automatic logging of all events and operations performed on the computer, and of all abnormal conditions. The computer used as host needs a hard disk and a high resolution graphic colour monitor. A printer can be added to the configuration if required. The software can be customized during installation to display maps of the system, showing the monitors and other associated control components. The individual units can be manually selected and controlled by simply keying in the number of the chosen monitor on the keyboard and operating the assigned keys, or by selecting the highlighted areas on the colour display with the mouse. When controlling a group of monitors, on the other hand, the system has to be programmed beforehand, selecting five possible basic video pages that will correspond to five different sections of the system. Five different monitor groups can be defined for each video page. Each group consists of one main monitor and auxiliary monitors which can be freely selected from among those in that particular section of the system. For example, if protecting a crude oil port, starting from the basic video page showing the whole port, it is possible to have up to five different video pages for the same number of wharfs, and, for each of these, to have five different conditions stored in the memory to cater for the same number of ship types that may dock at the same wharf.

The grouping operations performed by the operator for the monitors are obviously automatically extended to all of the water and foam valves and all of the water and foam pumps (main and reserve types) included in the system.

At this stage it is possible to obtain synchronized control of all of the monitors in the selected group in two different ways: by moving the main monitor in the desired directions with the allocated keys or mouse (the other monitors will automatically follow the selected trajectory) or by selecting the desired target of the fire monitors' extinguishing jets by means of the mouse, leaving the computer to make all of the other calculations. It is possible to make real-time adjustments to the set target if the jets need to be adjusted, although when calculating the trajectory the computer automatically takes into account environmental factors, and wind direction and speed in particular, which can be directly displayed on the screen. By making use of the possibility to select each video camera installed on each monitor (where included in the system) it is also possible to directly view the extinguishing operation underway on the colour video. There is also the possibility to simultaneously operate a second group. To do this, after setting the desired conditions for one group, the operate can select the storage function and then assume control of a second group, for which all of the functions described above can be performed while the first group will continue to operate as programmed.

A technological map is available, showing all of the units in the system with the relative connecting, signal and power lines incorporated into the main cable. For each unit, there is indication of the statuses of the loop control components, for both the signal and power sections,

and of the status of each group within the unit itself. Warning is therefore immediately given of any malfunction, particularly regarding opening of the knife switches or tripping of the fuses. The average voltage and current values present on the loop at that moment are also displayed, as is the status of every component of the main control panel. This map consequently provides an immediate picture of all of the information regarding system status when on standby or in operation. As already mentioned, all alarm conditions detected by the system and all operations performed by it are automatically stored on hard disk with the possibility of subsequent processing and transfer of the data onto floppy disks for filing. In addition to the host computer described above, the LKS6 system can also be equipped with one or more back-up hosts. These computers receive all the system-status and monitor-position data which are then displayed as on the main computer. It is also possible to give commands to all the system components from the back-up hosts, with a preset order of hierarchy between the various units. The trajectory calculations and commands, however, are sent to the system sub-panels by the main host computer, so that it also acts as an interface, receiving commands from the back-up hosts. Lastly, as a special case, it is possible to have a portable back-up host connected to the system by radio: this makes it possible, for example, to even control fire extinguishing operations from a helicopter flying overhead.

Portable control unit

The UZKp portable control unit has been specially designed for direct on-site control and analysis of system conditions. The ZM (fire monitor) and UZA (valve) units are equipped with a multi-pole connector into which the portable unit can be directly plugged. The unit consists of a sturdy, easy-to-carry case, which opens out into two sections for use: one section is placed on the floor and plugged into the UZK or UZA connector while the other section is carried on a strap. The section carried by the operator contains all of the display and control units, while the ground unit contains the power supply unit, interface for connection to the system loop and an emergency back-up battery. In normal operating conditions, the unit is directly powered by the loop, and the battery is kept on charge as a back up. The emergency battery can, however, also be separately charged from a standard 230V/50Hz mains socket. The UZKp displays a video page showing both the status and position of all the fire monitors installed in the system. It is also possible to select a specific monitor and send movement commands to it, with simultaneous indication of the analog position and any limit-switch signal or malfunction/alarm condition. Alternatively, any group of valves or pumps in the system can be selected, again with simultaneous status-display and command-transmission. A technological video page, giving all the information about each unit in the system, can also be selected from the portable unit. By means of another test program, it is also possible to directly examine the messages sent along the serial loop on the display, in order to analyze any transmission problems. The unit can finally be used as an emergency aid for any stationary UZM, UZA or UZK unit with a flat back-up battery after a long period of disuse. From the above it is clear that the UZKp unit can be used as both a maintenance and training instrument and as an operative instrument in extinguishing operations where on-site control is desired instead of operation from the main control panel or from other fixed panels.

How a system is designed

Before an LKS6-controlled fire monitor system can be designed in detail, it is essential to know exactly what zones of the premises have to be protected, what kind of monitor is required and the number and type of associated valves and pumps needed to ensure that protection. Then, on the basis of the layout and technical specifications of the building, the system designer can proceed to define the number and position of the UZA units for controlling the valves and pumps, considering that, as the UZM units have to coincide with the position of each monitor in the system, they are already positioned with the first step of selection and that, if a monitor is not equipped with a nozzle or deflector and switching valve, one or two valves associated with the monitor can be inserted into the same UZM unit. The position of the main control panel and any UZK auxiliary panels can then be defined. The main control panel is usually located in a protected area, and the 400/230V 50Hz power supply needed for operation of the whole system must be carried to it (this is the only point that has to be powered, so it is very easy to provide an emergency back-up or dual power supply). The optimum loop cable path is then defined, with the only obligation being that all units should be connected to it. Particular care is taken, however, in checking the areas crossed by the cable and their relative risks. Loop lengths of up to 500 m do not require intermediate amplification units, providing that no more than 8 units are connected. If this is not the case, amplification is necessary, and can be provided in any UZ, or independently. For longer loop lengths, amplifier units can be used. The maximum number of monitors that can be connected to the loop is 16; the maximum number of valve and pump units is 64. The main control panel can also be linked to a UZA unit for pump and valve control, and the valves can be powered from the loop or separately: the choice will be made considering the environmental conditions and whether there are already electrical control components installed. The pumps are usually equipped with a separate power supply. Obviously, a mixed system is also possible. Any video cameras (colour or black and white) can be linked to each UZM unit and, in particular cases, also to the UZA. The display monitor can be installed not only on the main control panel, but on any UZK sub-panel. Where extra light is needed for operation of the video cameras due to environmental conditions, normal or infrared lighting can be derived from the system loop: the lights will be controlled by the computer to come on automatically at set times or as commanded by the operator. Customization of the software to match the specific system layout and grouping of the valves and pumps with the monitors, is directly performed by Caccialanza & C., while customization and formation of the groups can be entirely performed by the operator, and directly modified on the host computer at any moment.