


KONGSBERG

SSS
Basic Operator Course

F&G Drilling

THE FULL PICTURE


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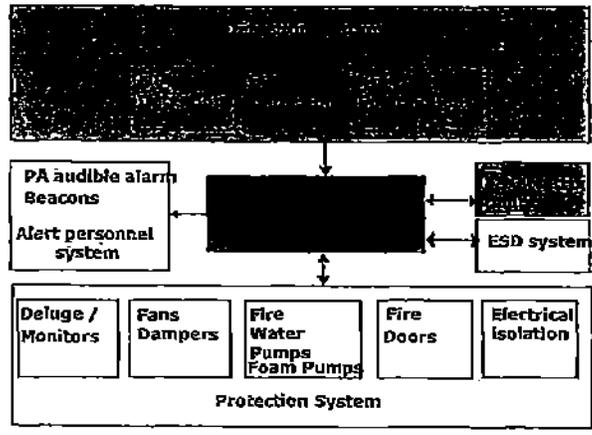
F&G Purpose

- The main objectives of the Fire & Gas are:
 - Monitoring and alarm display of the F&G status, and interface for operator Intervention.
 - Early and reliable detection of fire and gas hazards, wherever such events are likely to occur. Main types of detection: gas, flame, heat, smoke detection, manual fire alarm, CO2- and sprinkler released.
 - Alert personnel and initiate protective actions automatically or manually upon operator's activation. Examples of protective actions: activate fire fighting systems (deluge, CO2, sprinkler), shutdown of ventilation, closing of fire doors and dampers, start of fire/foam pumps.

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EXHIBIT #	1123
WIT:	

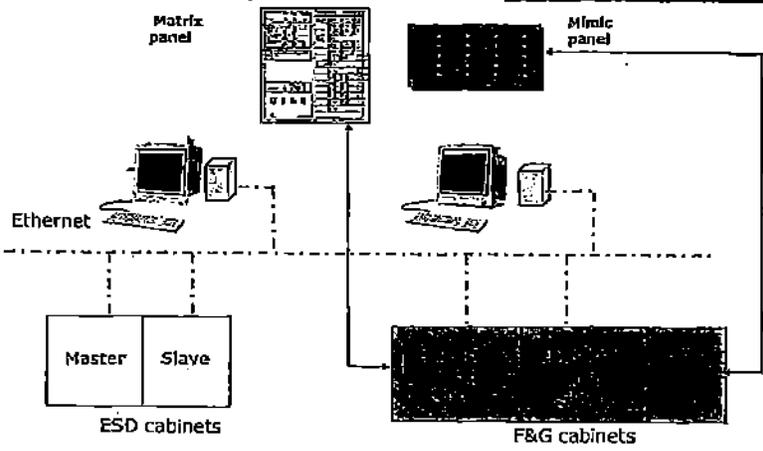
F&G system interfaces



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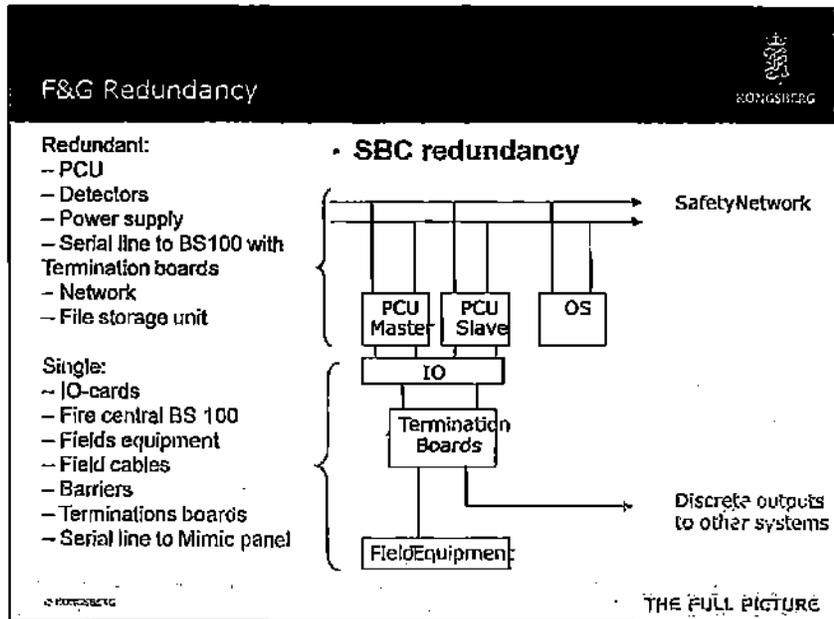
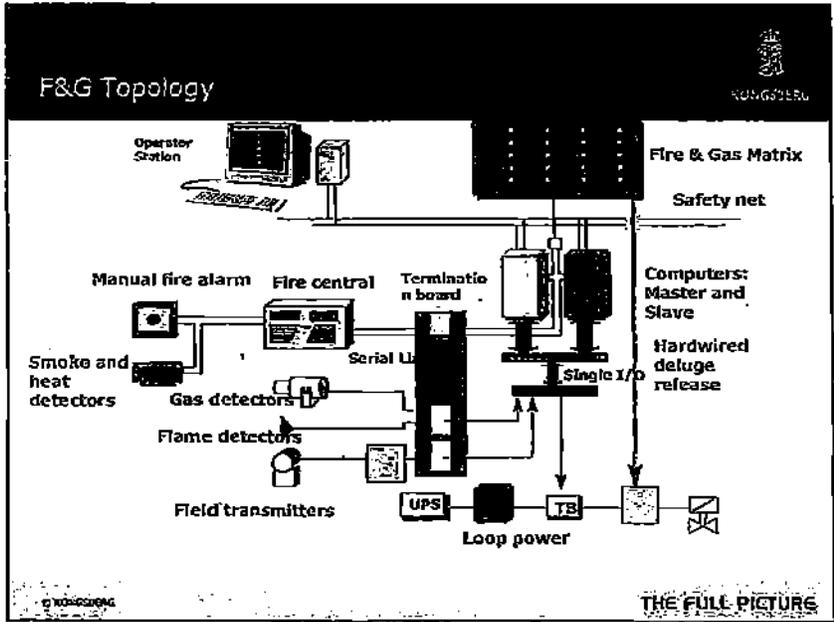
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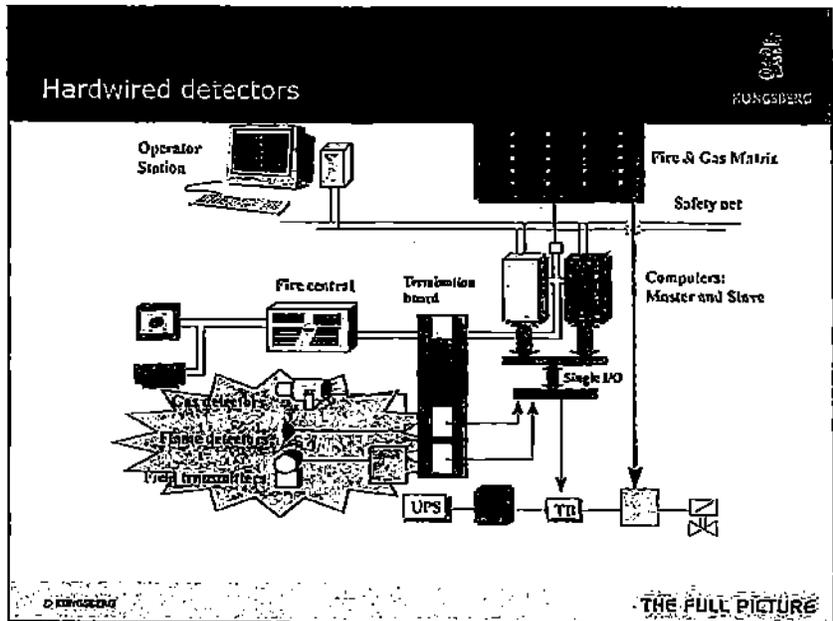
F&G Topology



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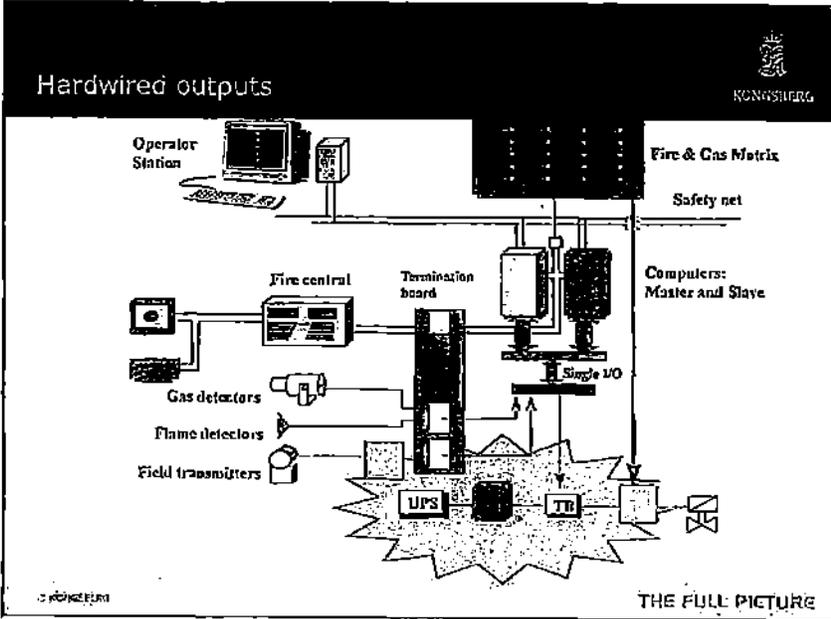
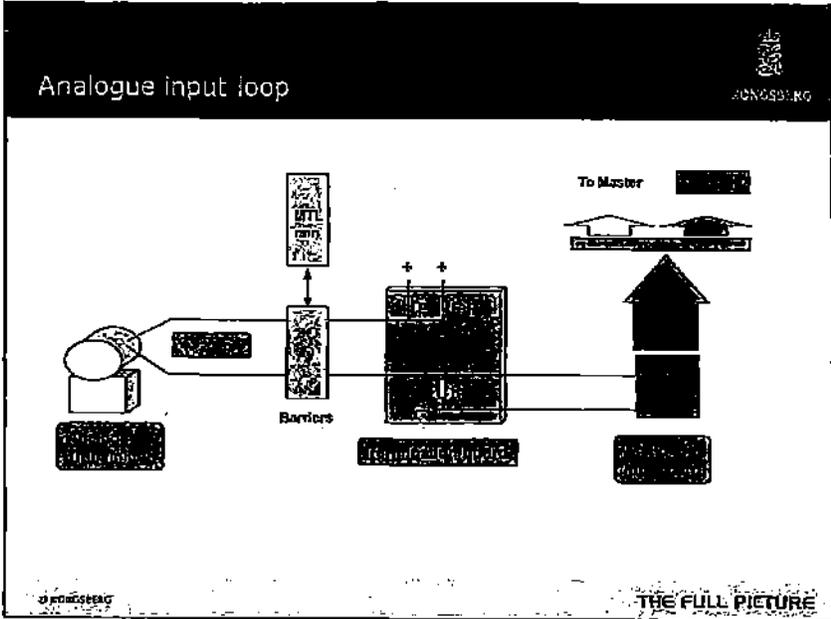


Input loop

- Analogue input signals to F&G system:
 - Gas and flame detectors
 - Pressure transmitters (i.g. Pressure in Fire Water system)
 - Level transmitters (i.g. Sprinkler tank)
 - Matrix switches (i.g. Start Fire Water Pump and Start/Stop Foam Pump)
- These detectors, transmitters and switches are giving a signal of 4-20mA and are connected to the F&G using I/O cards.
- Digital input signals to F&G system:
 - Limit switches

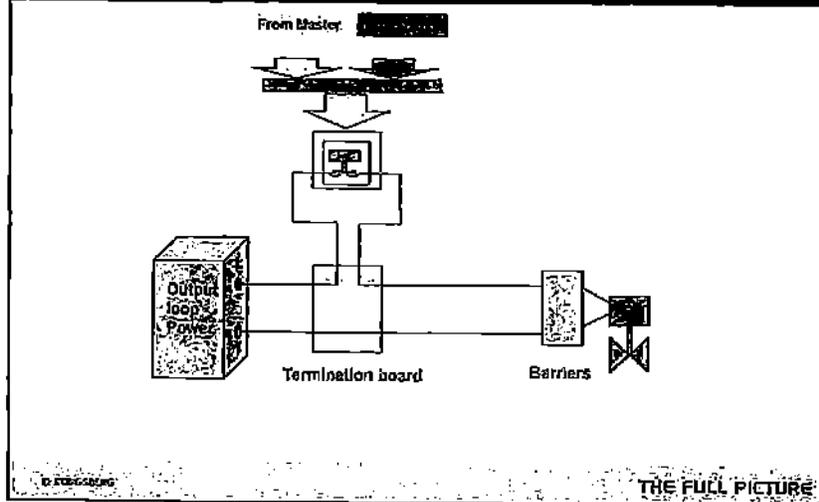
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Output loop NE

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Output signals

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The output loops can be of NE and NDE type. On Deepwater Kongsberg only NDE are applied, this includes the internode signals to the ESD.

- Shutdown signals: close fire dampers and door release. Note: DP3 MODU will not close the intake/dampers of machine room in case of gas detection in combustion air intake and ventilation air intake for engine room. The engine should have manoeuvre possibilities as long as possible.
- Activation of active protection systems: Start fire pump, start and stop foam pump, release foam valves.
- Automatic alarm: general alarm, fire alarm, gas alarm, toxic gas alarm, status light
- Matrix panels:
 - status lamps (for fire, gas, toxic, fault, override)
 - alarm buzzer

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Outputs signals activation



• Outputs due to fire detection are activated from the F&G or the ESD System. The C&E will show which outputs that will be activated in the different situations:

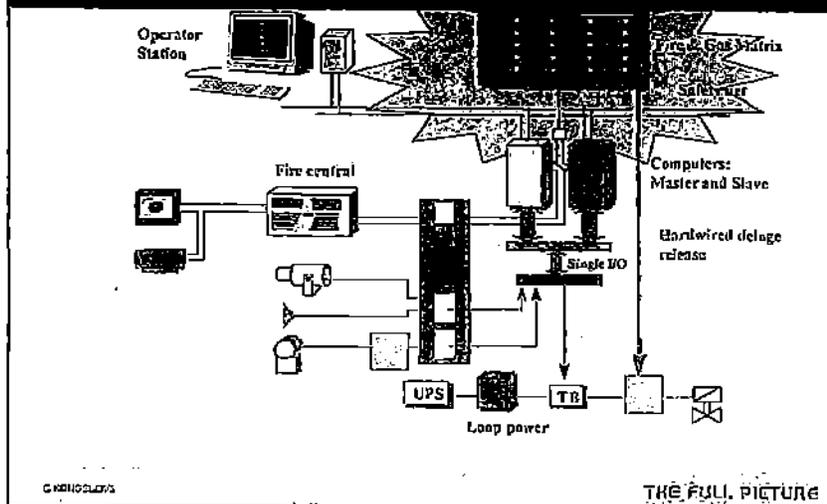
- Confirmed fire e.g. manual fire alarm, flame detection, 2 out of any smoke/heat detectors within a fire area, or an unacknowledged alarm after 2 minutes.
- Gas detection e.g. CGD, TGD and beacons will be activated according to these combinations (example):

H2S High Alarm	10ppm
H2S HighHigh Alarm	20ppm
HC High Alarm	20%LEL
HC HighHigh Alarm	60%LEL

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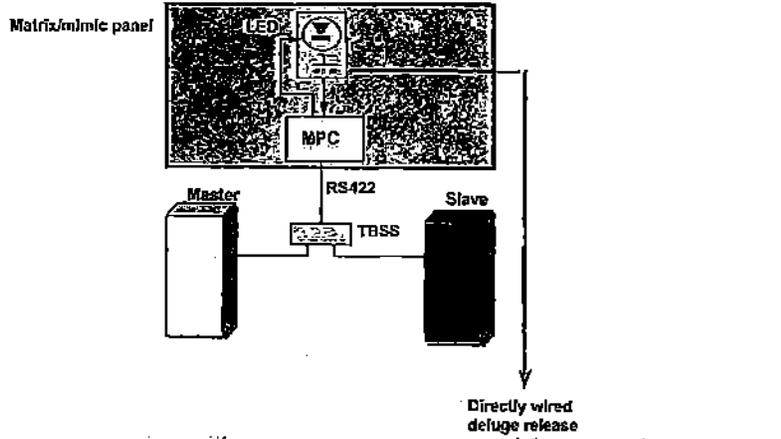
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F&G panel



Interface to matrix/mimic panel

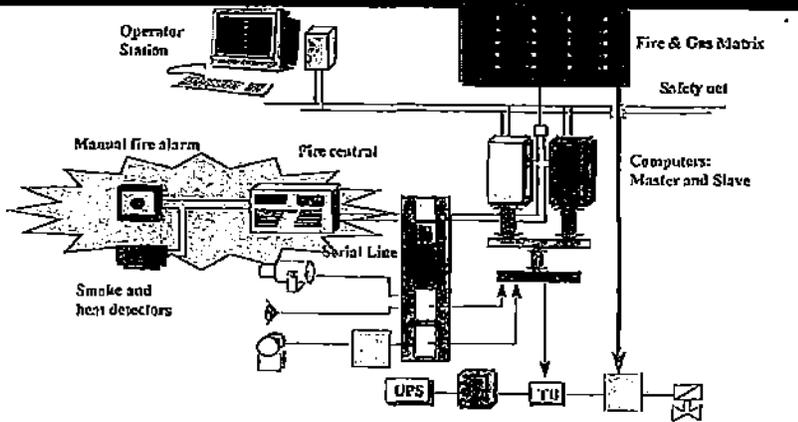
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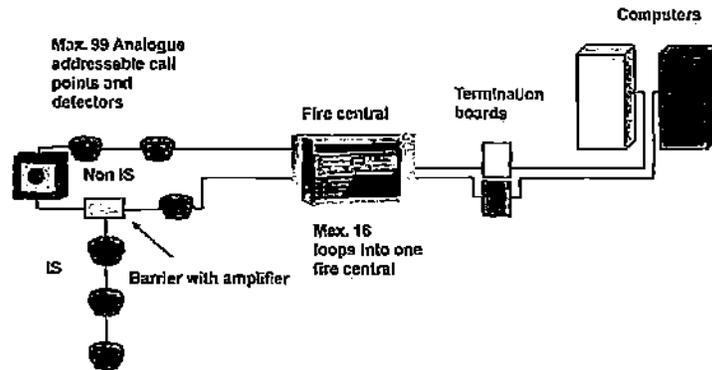
Fire central interface

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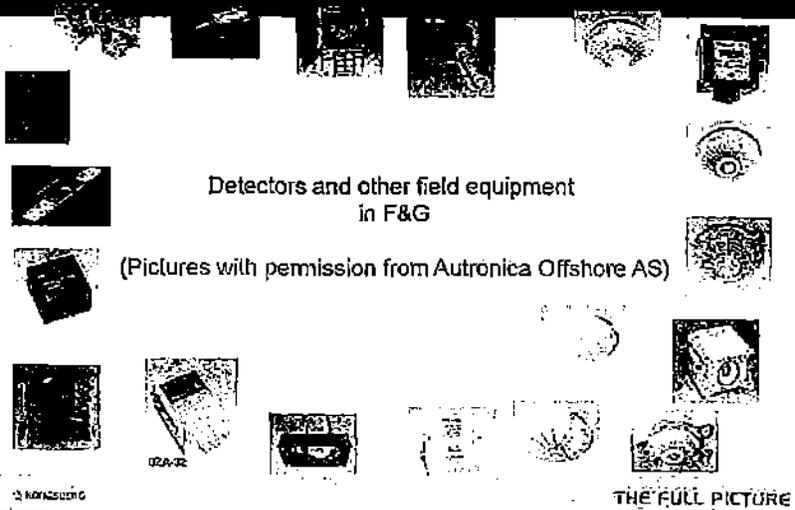
Fire central BS100



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Detectors



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Fire detection



- A fire can be automatically detected in three ways:
 - By heat detection
 - By flame detection
 - By smoke detection

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Smoke detectors



- Smoke detectors used in safety system:
 - Ionic type used to detect high energy fire,
 - Optical type used to detect fire of low energy, used in electrical rooms and living rooms.
 - Early warning smoke detector, used in electrical equipment / instrument rooms, HVAC rooms and cable trunks.
- Smoke detectors are of an individual addressable type. They are arranged in loops connected to the Fire central BS 100.
- Examples:
 - Autronica Optical detector BH-31H
 - Autronica BH-31A/Ex optical detector, IS
 - Autronica BH-31A+BWP-40B
- Used in accommodation areas, areas with mechanical ventilation and in ventilation duct.

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Heat detectors



• The heat detectors will be addressable and connected to a fire detection central communicating with the F&G.

• Examples of Heat detectors used in safety systems:

– Autronica BE-34 with Thermistor element, max. temp. of surroundings 40 degC.



BE-34

– Autronica BE-34/EX, IS

– Fenwall 27212-xxx uses in areas with a high surroundings temperature



Fenwall 27212

• Used in areas where smoke detectors can not be used (i.g. galley)

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Flame detectors



• Flame detector IR3 used in safety systems:

• Triple infrared (IR) spectrum flame detector.

• 90 ° horizontal and vertical cone of vision,

• Maximum detection range of 60 m

• Ultra high immunity to false alarms.

• 3 sec response time for a "Standard Fire" (0,3m x 0,3m gasoline pan fire), range 15 m

• Important to control field of vision. Can get problems because of vibrations and sunlight.

• The detector is giving a signal of 4-20mA for a given range and are connected to the F&G using IO cards.

• Used in machine spaces (near to engines, oilfired boilers and generators) in addition to a smoke detector,



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Extra equipment



- Address/interface unit BN-35. Gives possibility of addressing detectors in BS100 loops.



- Short Circuit unit BKH-30. Reduces among of disappeared detectors in case of fault in BS100 loop.



- Zenerbarrier unit (1 spur) BZ-32/1. Barrier for detectors located in zone 1.

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Gas detectors



- The gas detection system consist of:

Combustible gas detection (hydrocarbon HC, acetylene leakage, hydrogen accumulation). Detectors located high.

Toxic gas detection (hydrogen sulfide H₂S). Detectors located low (H₂S is heavier than air).

- Types of gas detectors:

- Gas Point detector, ex hydrocarbon gas HC, units %LEL
- Gas Point detector, ex hydro sulphide gas H₂S, units: parts per millions (ppm)
- Gas Open path detector, units: LELm.

- Gas detectors are installed using individual 4-20 mA analogue current loop.

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Gas detectors

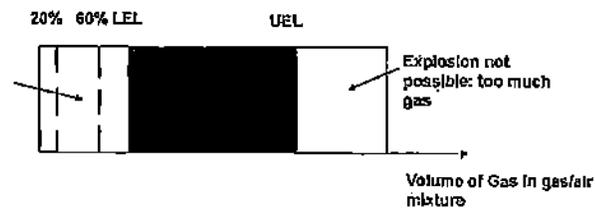


- Gas detectors are installed in:
 - ventilation intakes for the accommodation
 - external intakes for combustion air
 - hazardous areas where gases may occur (along the drilling mud path: drill floor, mud pump room)
 - ventilation outlets from zone 1 and 2
 - welding shop (an acetylene type)
 - battery lockers (a hydrogen type)

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LEL definition



- The volume of combustible gas in the gas/air mixture will define the Lower Explosion Level (LEL) and the Upper Explosion Level (UEL).
- Explosion will not be possible :
 - In area with not enough combustible gas in gas/oxygen mixture (to the left of LEL). (E.g. 60% LEL means that we are close to the limit of possible explosion.)
 - In area with too much combustible gas in gas/oxygen mixture (to the right of UEL).

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Gas detectors

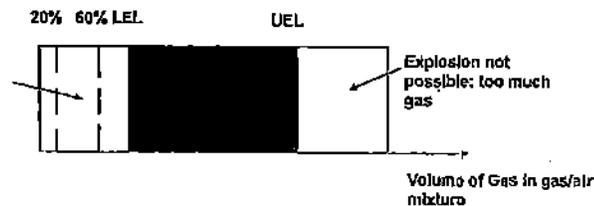


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Gas detectors



- Crowcon Cirrus IR
- HC Gas Detector, Fixed Point flammable gas detector
- Dual wavelength infrared absorption detection technique.
- Immune to sunlight and all catalyst poisons.
- Fault diagnosis, dirty optics and beam block.
- Measuring range 0-100% LEL

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Gas detectors



- Crowcon Txgard
- H₂S Gas Detector, Gas Point detector, flameproof, 0-25 parts per million (ppm)
- Detcon
- H₂S Gas Detector, Diffusion adsorption gas point detector, flameproof, 0-25 parts per million (ppm)
- Detcon
- HC Gas Detector, Gas point detector, 0-100% LEL



Detcon H₂S

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Gas detectors

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- An Open Path gas detector measures the accumulated amount of gas over a defined distance divided by the distance (LELm).
- PLMS GD4014:
 - Open path flammable gas detector with sender and receiver
 - Dual wavelength Infrared absorption detection technique
 - Detection distance between 4 and 30m
 - Measurement range 0-5 LELm



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Manual Call Point

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- Autronica BF-35, Dry rooms and general indoor use, break glass type
- Autronica BF-35/EX, IS indoor
- Autronica BF-52/0100, Weatherproof, break glass type, for use where higher IP rating is required.
- Autronica BF-53/EX/0100, IS weatherproof, lift flap and push type, to be used in external working areas, heavy traffic areas and Zone 1 area
- Manual call points will be addressable and connected to fire detection central.



BF-35

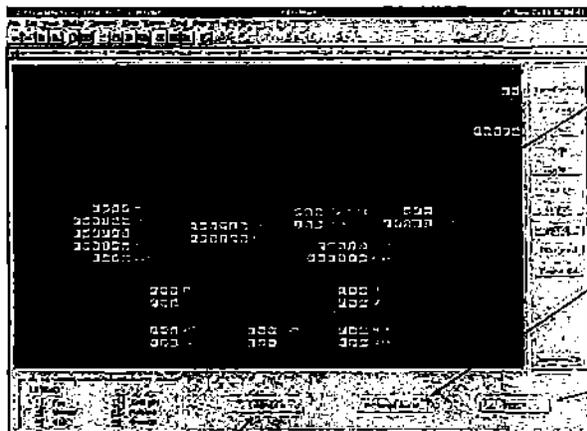


BF-53

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F&G main display



Hot-spots to Level 2

Acknowledge alarms within F&G system and reset the fire central

Reset of F&G output sequences

Turn off the audible alarm from the BS100 fire central and from the matrix

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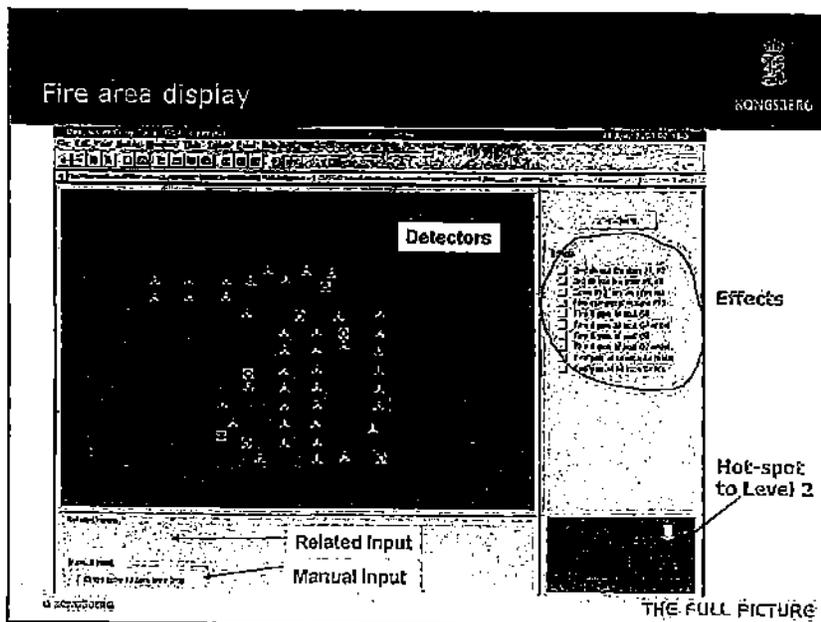
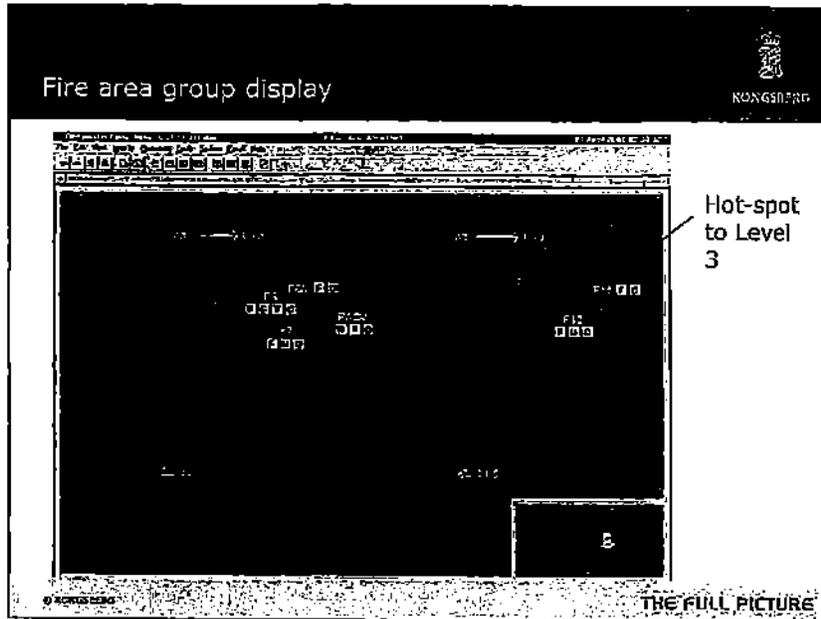
Status and colours on monitor



LEGEND	
F	Fire
M	Manual
G	Gas
T	Toxic gas
R	Release
O	Override

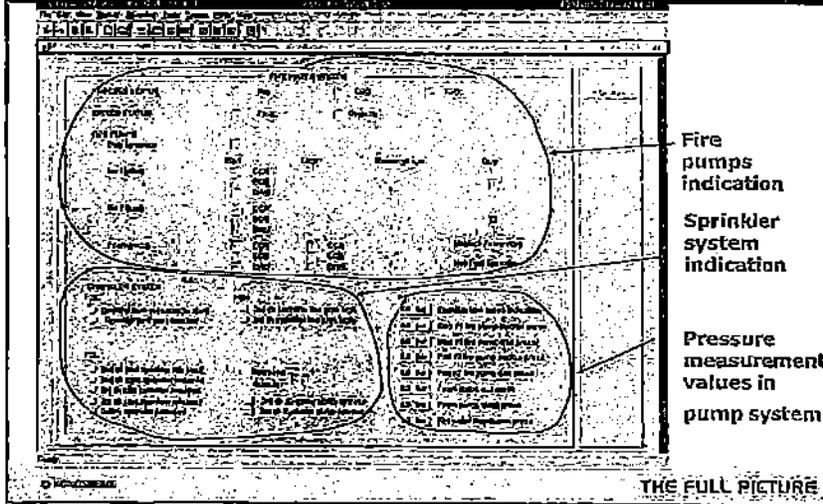
- F** Fire detected. Magenta flashing states indicates that a fire detector (smoke, heat or flame) is in the alarm state.
- T** Gas detected, T when H2S, G when HC. Magenta flashing state indicates that at a gas detector has reached minimum low level alarm.
- M** Manual fire alarm. Magenta flashing state indicates that a manual fire alarm has been activated (using Manual Call Points).
- R** Released. Magenta flashing state indicates that a CO2 release is in alarm state
- O** Inhibit/Override. Cyan coloured element with the letter O inside. Indicates that at least one input is inhibited or that an output is overridden.

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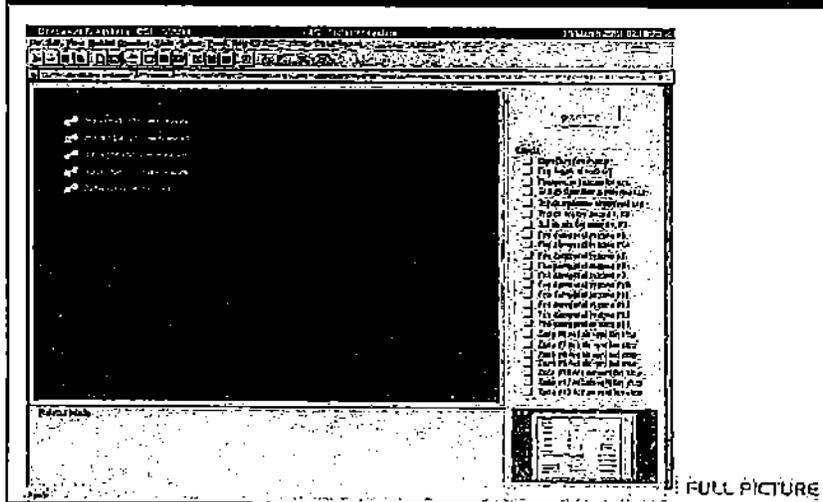
Fire water system display

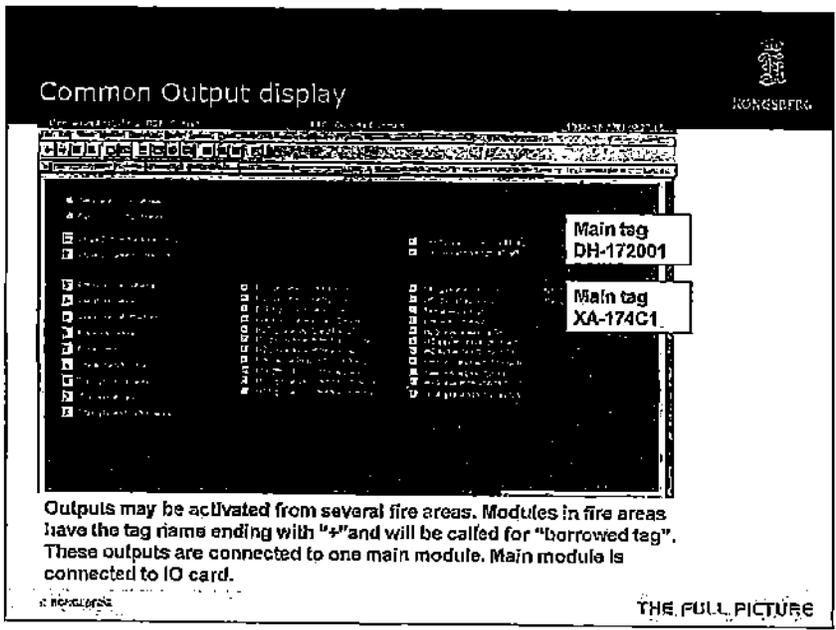
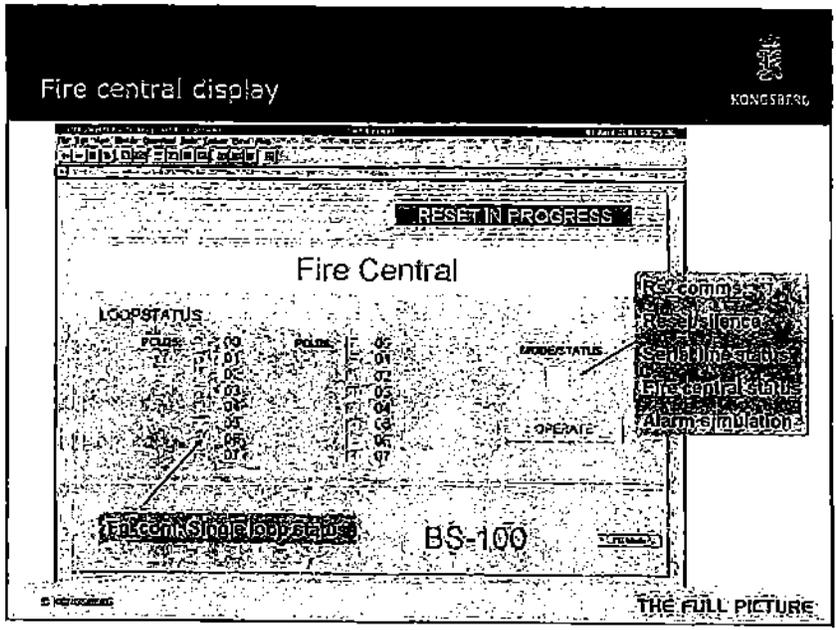
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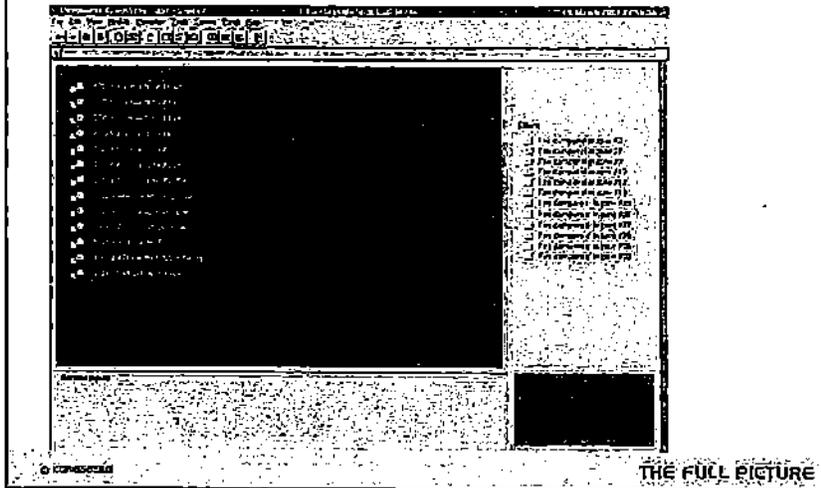
Sprinkler release display

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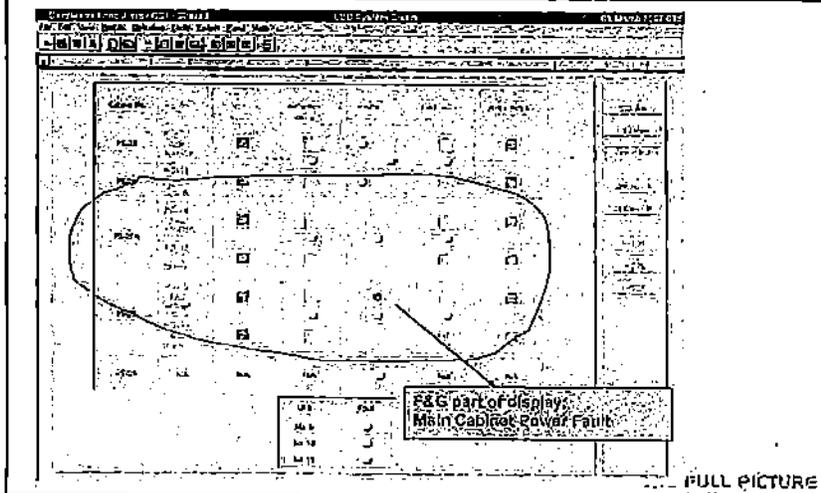




Internode display



System status



Detector symbols KONGSBERG

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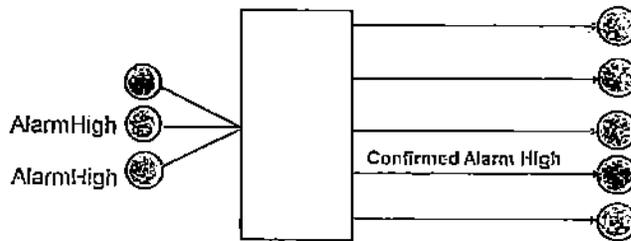
Alarm colours KONGSBERG

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Voting



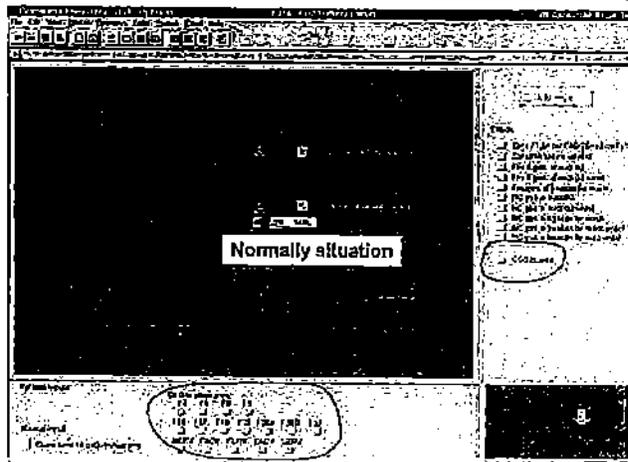
- Fire alarms go through a voting system. The voting system is used to reduce the consequences of a detector/signal fault or false alarms. The C&E will show which outputs that will be activated in the different situations.
- Gas alarms do not use the voting principle. One gas alarm will activate the outputs according to the C&E.



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Gas detection

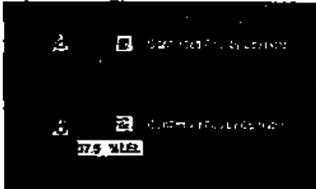
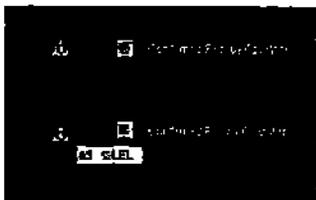


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Gas detection


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OVERVIEW

EPZ 1A

- Zone 1: 1A top PAC-20K 02 in (slip)
- Zone 1A Batrn. 01 Vent.
- Fire & gen. al 02 (02)
- Fire & gen. al 02 (02) wood
- Fire & gen. al beacon for hatch
- HC gas al 02 (02)
- HC gas al beacon 01 water
- HC gas al beacon for hatch
- HC gas al beacon for hatch wood
- HC gas al beacon for 02 wood

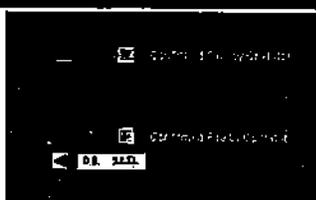
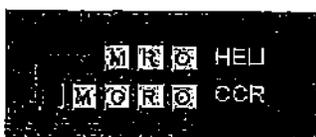
CO2 in area



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Fire detection


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OVERVIEW

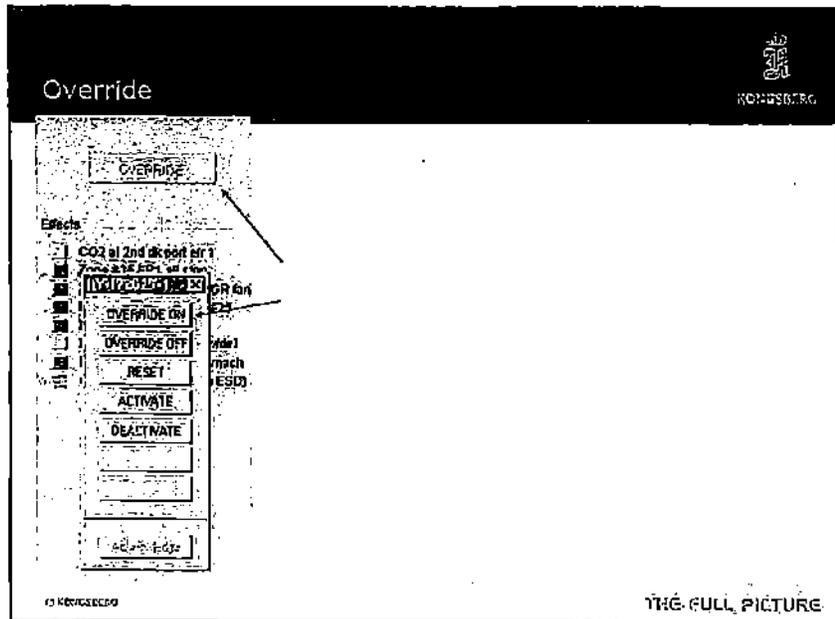
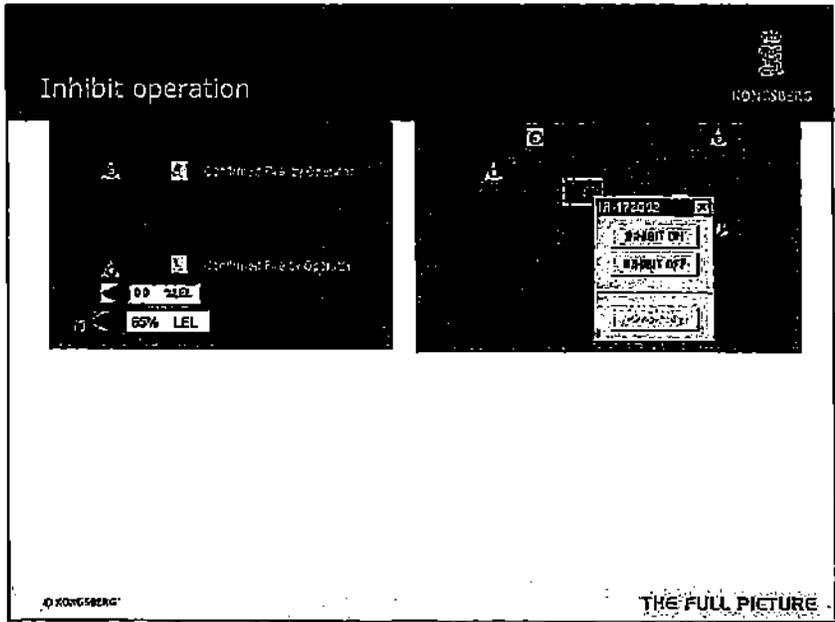
EPZ 1A

- Zone 1: 1A top PAC-20K 02 in (slip)
- Zone 1A Batrn. 01 Vent.
- Fire & gen. al 02 (02)
- Fire & gen. al 02 (02) wood
- Fire & gen. al beacon for hatch
- HC gas al 02 (02)
- HC gas al beacon 01 water
- HC gas al beacon for hatch
- HC gas al beacon for hatch wood
- HC gas al beacon for 02 wood

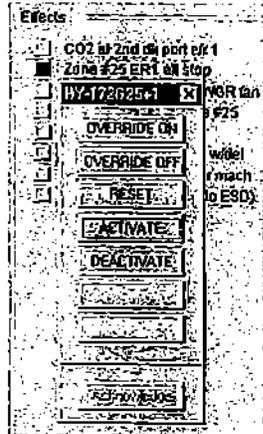
CO2 in area



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Activate on



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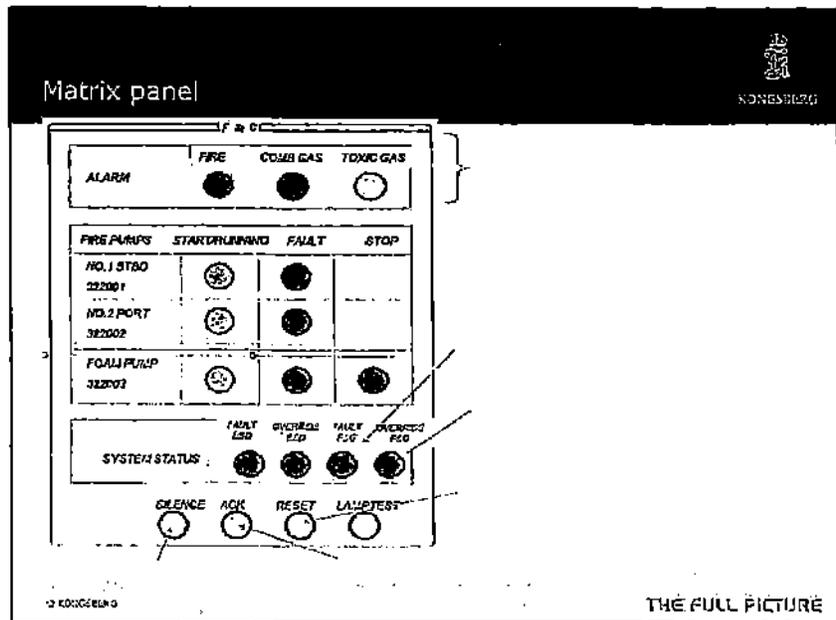
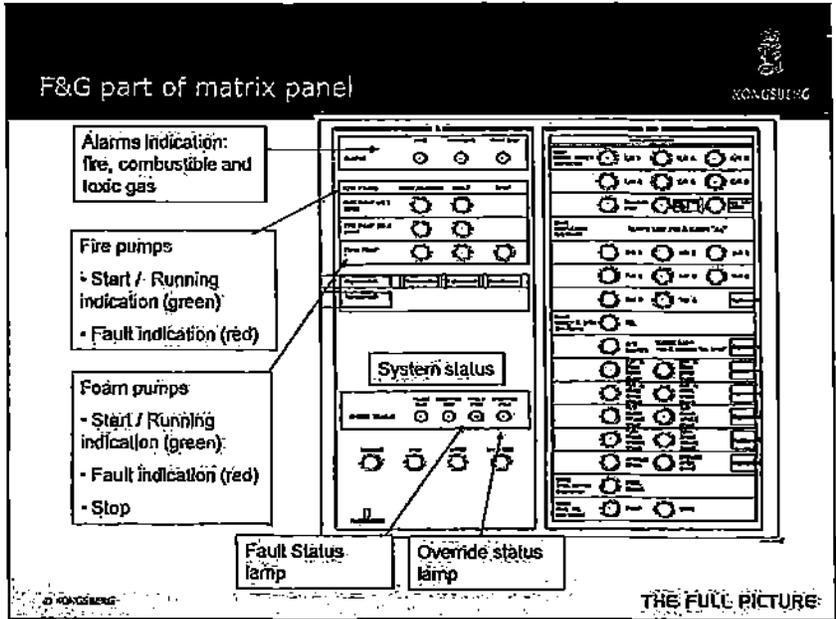
Borrowed tag



- Tag name of output modules (e.g. XA-174AF2+16) on a fire area display indicates "borrowed tag" when +n is added to tagname.
- Borrowed tag can be override, but no other modules in family will be overridden.
- To override the whole family of modules with borrowed tag the main module has to be override (e.g. XA-174AF2 on F&G Outputs Common display).

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Operation on Fire pumps



FIRE PUMPS	START/RUNNING	FAULT	STOP
NO.1 STBD 322001			
NO.2 PORT 322002			
FOAM PUMP 322003			

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Fire pump logic



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SSS

Basic operator course

ESD Purpose

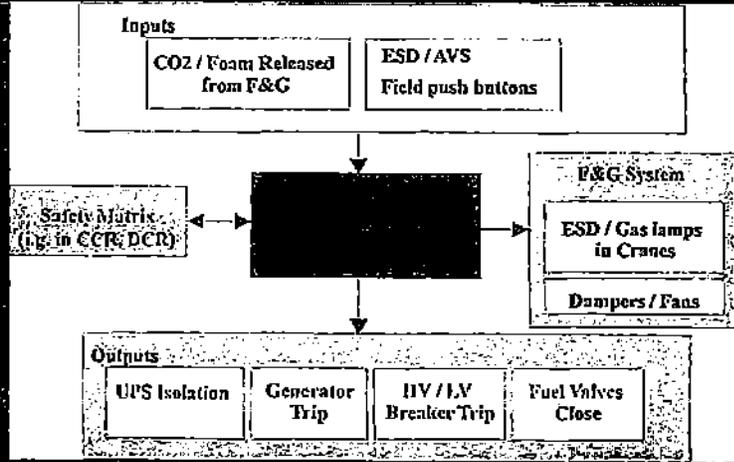
The main objective of the ESD System is to minimise the consequences of an emergency situation related to uncontrolled release of hydrocarbons or outbreak of fire.

ESD system will maintain an adequate level of safety for personnel, protect the installation and its equipment and the environment against pollution.

An ESD level is activated either from manual call points located throughout the installation or automatically from the Fire&Gas system.

Typical actions for the ESD system is to stop the engines of vessels power plants and electrical isolation.

ESD typical interactions

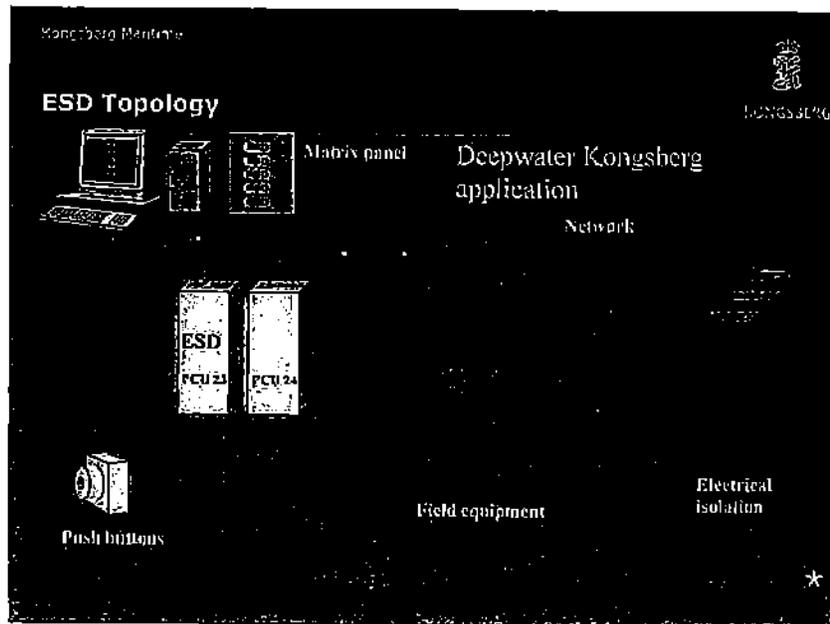
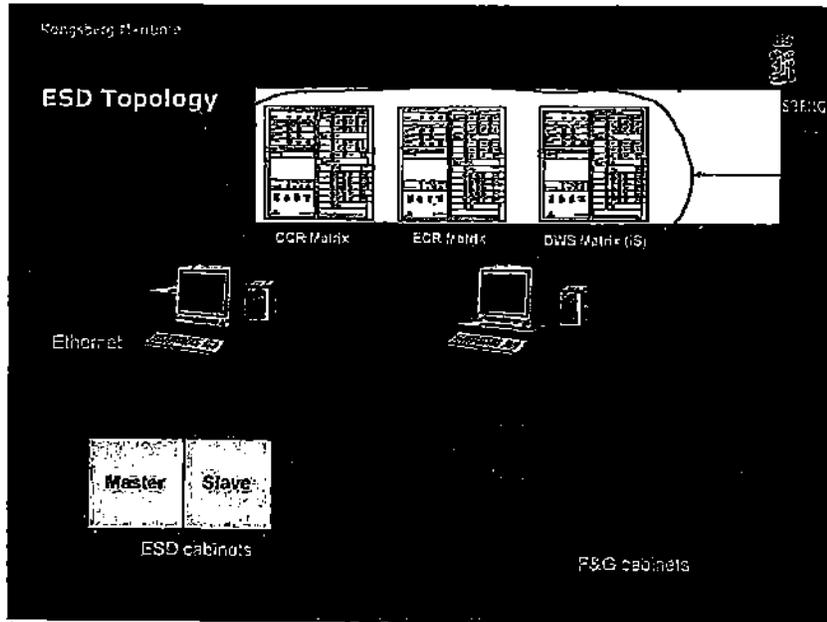


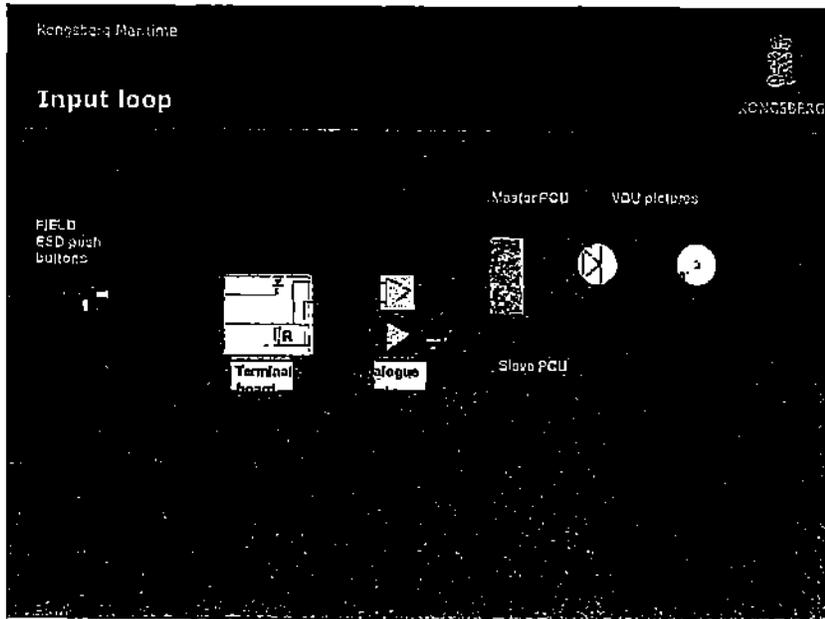
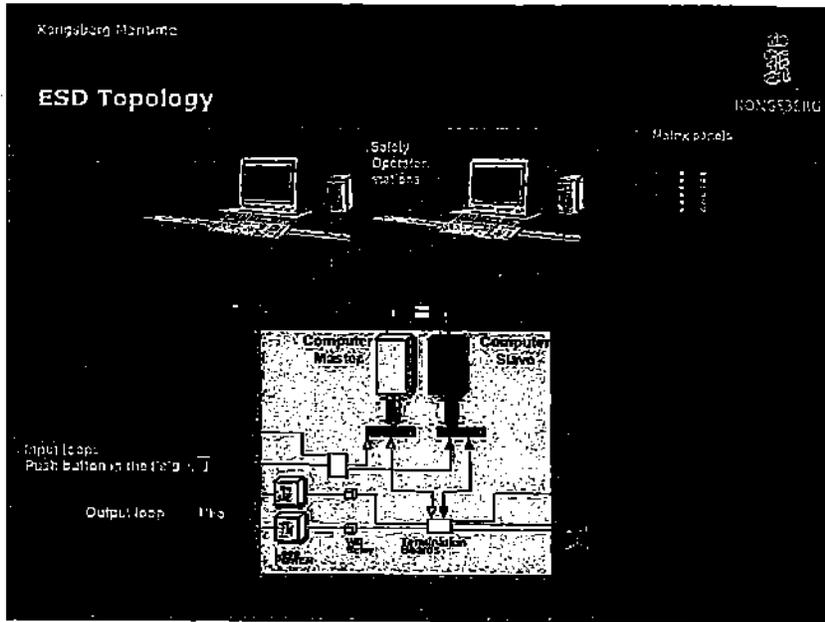
ESD level in SSS, ABS solution

The ESD system is the top level safety system

The system is divided into levels of operation to form the shutdown hierarchy representing a staged response to increasing levels of hazard.

ESD 1-1 to 1-9	Engine rooms/Oil Xfer shutdown Isolation of ignition sources
ESD 2-1 to 2-8	Propulsion shutdown
ESD 3	HVAC shutdown
ESD 4	Drill floor shutdown





ESD Redundancy

1oo2 redundancy

Redundant:

- PCU
- IO-cards
- Power supply
- Network
- File storage unit

Switch

Single:

- fields equipment
- field cables
- barriers
- terminations cards

ESD signals

Manual Call Points
in field

ESD

Field devices to be tripped

ESD matrix
• Matrix indication
• Matrix located switches

F&G works as an alarm and monitoring system.

F&G perform low level shut-down like low voltage system and ventilation. ESD handles electrical power production (high voltage system) ESD valves and UPS shutdown.



ESD Redundancy

1oo2 redundancy

Redundant:

- PCU
- IO-cards
- Power supply
- Network
- File storage unit

Switch

Single:

- fields equipment
- field cables
- barriers
- terminations cards



ESD signals

Manual Call Points
in field

ESD

Field devices to be tripped

ESD matrix

- Matrix Indication
- Matrix located switches

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F&G perform low level shut-down like low voltage system and ventilation. ESD handles electrical power production (high voltage system), ESD valves and UPS shutdown.



Interaction between ESD and F&G cabinets

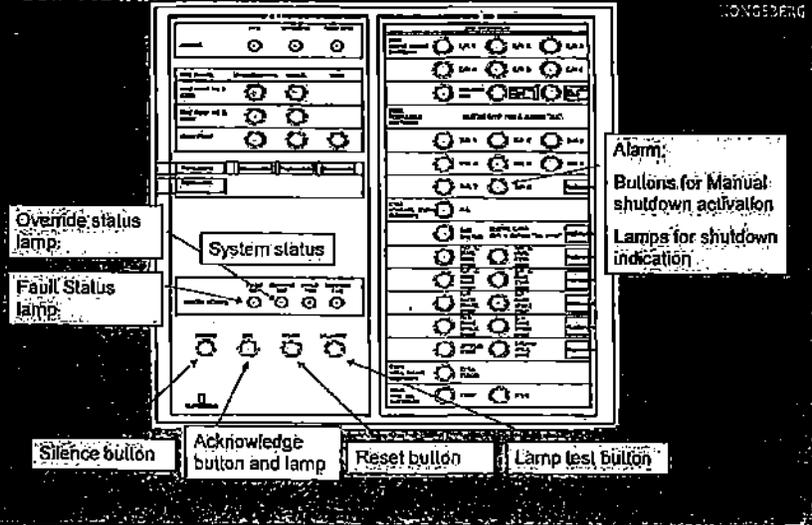
Example:
Deepwater
Kongsberg

From ESD to F&G:
Fire dampers close (SD...)

ESD



ESD Matrix



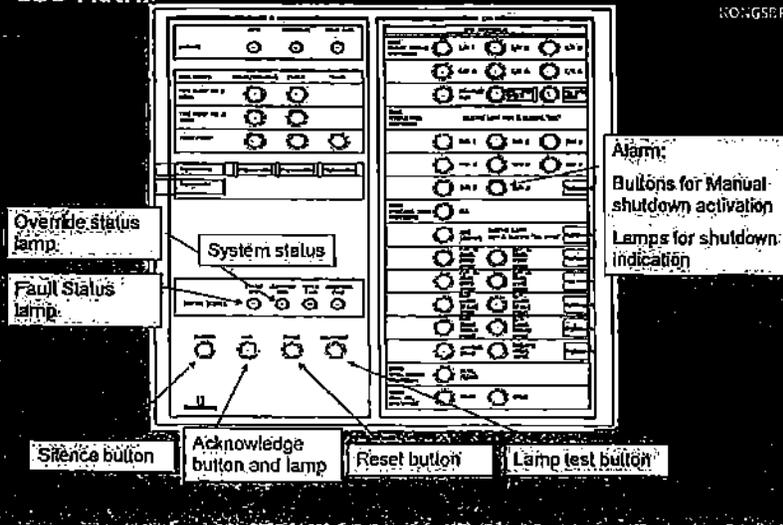
Interaction between ESD and F&G cabinets

Example:
Deepwater
Kongsberg

From ESD to F&G:
Fire dampers close (SD...)

ESD

ESD Matrix



Kongsberg Maritime

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ESD Level One (Main)

Input alarm indication

Hot-spot to the specific ESD levels

Inhibit, override and signal fault status

Acknowledge-button
Reset-button
Silence-button

Kongsberg Maritime

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ESD Level Two

Input signals XS..
sd-meas modules

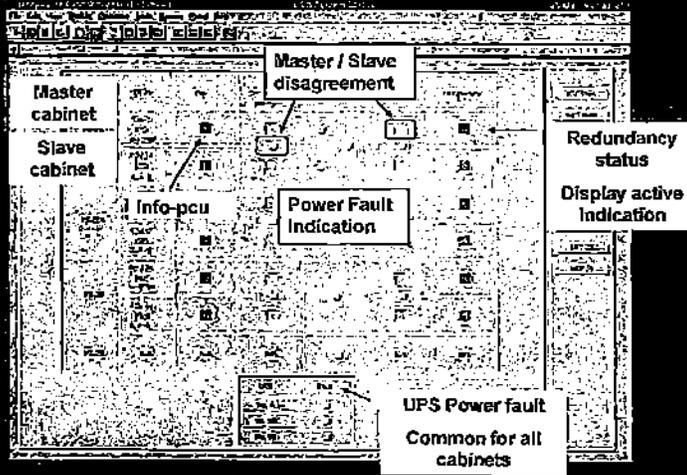
Internode signals from F&G
sd-in modules

CAUSES	EFFECTS
ESD 11 (Emergency Stop)	Emergency stop signal
ESD 12 (Emergency Stop)	Emergency stop signal
ESD 13 (Emergency Stop)	Emergency stop signal
ESD 14 (Emergency Stop)	Emergency stop signal
ESD 15 (Emergency Stop)	Emergency stop signal
ESD 16 (Emergency Stop)	Emergency stop signal
ESD 17 (Emergency Stop)	Emergency stop signal
ESD 18 (Emergency Stop)	Emergency stop signal
ESD 19 (Emergency Stop)	Emergency stop signal
ESD 20 (Emergency Stop)	Emergency stop signal
ESD 21 (Emergency Stop)	Emergency stop signal
ESD 22 (Emergency Stop)	Emergency stop signal
ESD 23 (Emergency Stop)	Emergency stop signal
ESD 24 (Emergency Stop)	Emergency stop signal
ESD 25 (Emergency Stop)	Emergency stop signal
ESD 26 (Emergency Stop)	Emergency stop signal
ESD 27 (Emergency Stop)	Emergency stop signal
ESD 28 (Emergency Stop)	Emergency stop signal
ESD 29 (Emergency Stop)	Emergency stop signal
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ESD 97 (Emergency Stop)	Emergency stop signal
ESD 98 (Emergency Stop)	Emergency stop signal
ESD 99 (Emergency Stop)	Emergency stop signal
ESD 100 (Emergency Stop)	Emergency stop signal

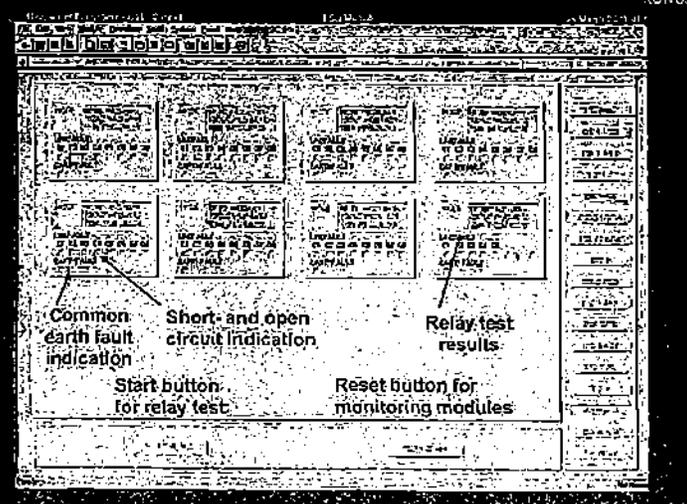
sd-out modules SD..



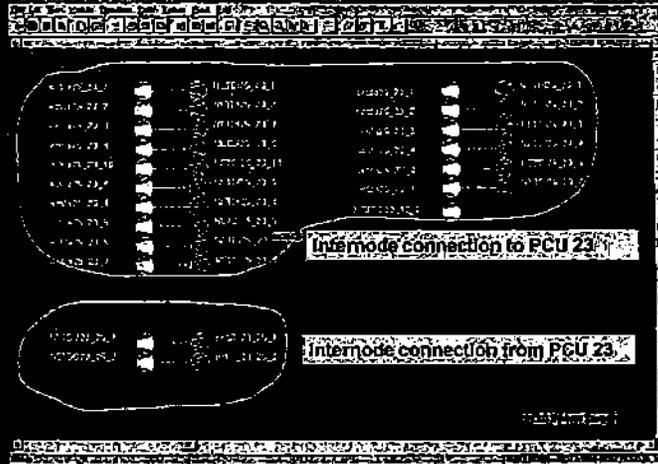
ESD System status



ESD Monitoring of output loops



Internode networks modules



Internode networks modules

Fail-safe internode connections via the network:

Netmodule (netdo) on exporting PCU will pack signals.

Netmodule (netdi) on receiving PCU - will unpack signals and in case of missing updating of data (on both of networks), it will generate fail-safe values of signals.

The fail-safe values can be configured individually to either stay on the last received value (freeze) or to go to a predefined value (0 or 1).



Alarm colours (project dependent)

Upon alarm the **symbol** for the input module changes to alarm colour and the **tag** will change to flashing alarm colour. Which output modules to activate are defined in the Cause module (sd_in).

White Normal state, no alarms or action.

Yellow Low priority alarm, alarms that do not require immediate actions. System alarms, like open/short circuit, line fault, earth fault

High priority alarm - alarms that require action. Alarms like Prewarning, AlarmH and AlarmL. Manually activated shutdown on output module.

Emergency priority alarm - alarms that require immediate action. All emergency alarms like AlarmHH and AlarmLL. All shutdown actions

Module mode is Inhibit, override, blocked input/output.

Module mode is passive.



Operations from OS

Module operation menu

- inhibit inputs
- override outputs
- alarm acknowledge
- reset
- manual activation
- test of C&E



Input module sd-ameas



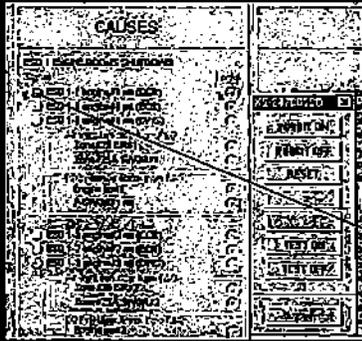
Input module sd-in



Output module sd-in



Inhibit input module



Used on sd-In modules

Operator menu: INHIBIT ON

Indications on logic module:

- cyan spot
- tag mark "I"
- cyan symbol colour

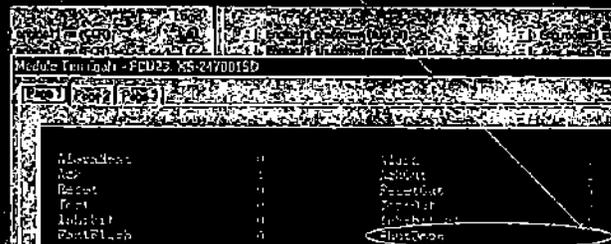
The same indication on the signal module



Inhibit input module

Results:

Shutdown terminal set to 0.



This module will not cause any shutdown action in the ESD system in case of alarm situation.

Alarm reporting as normally.



Inhibit input module

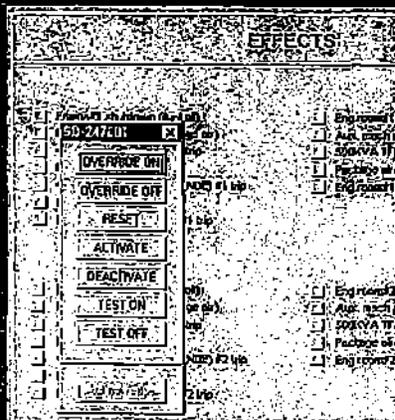


Alarm indications: magenta colour on symbols, alarm line

- INHIBIT ON when module in alarm mode will not cause shutdown on effect modules.
- Alarm is latched: Shutdown will be activated if inhibit is removed with INHIBIT OFF.



Override output module



Used on sd-out modules

Operator menu: OVERRIDE ON

Indication on module

- cyan symbol colour
- tag mark "o"

Override output module

Results:

Shutdown terminals will be set to 0 and field equipment will be not activated



Alarm reporting as normally
Removing OVERRIDE from an active module will give shutdown of field equipment.

Alarm acknowledge

Alarm can be acknowledge:
From main ESD display or ESD Matrix panel.
From module's operator menu
From alarm page for one alarm or a section of alarms



Override output module

Results:

Shutdown terminals will be set to 0 and field equipment will be not activated



Alarm reporting as normally
Removing OVERRIDE from an active module will give shutdown of field equipment.



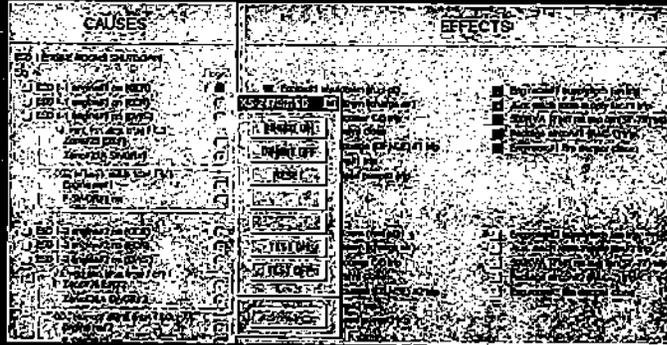
Alarm acknowledge



Alarm can be acknowledge:
From main ESD display or ESD Matrix panel.
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From alarm page for one alarm or a section of alarms



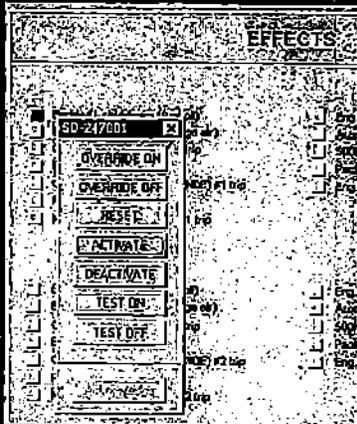
Reset



Reset procedure:
 Acknowledge alarm
 Reset module. Reset deactivate shutdown terminals.



Manual activation



Used on sd-out modules
 Operator menu: ACTIVATE
 Indication: red symbol colour
 Operation can be performed from ESD Matrix panel or ESD main display, by pressing the wanted ESD level button.

Kongsberg Maritime

KONGSBERG

Manual activation

The screenshot shows a control interface with two main panels: 'CAUSES' on the left and 'EFFECTS' on the right. Below these panels is a control area with several buttons, including 'STOP', 'START', 'STOP', 'START', 'STOP', 'START', 'STOP', 'START'. A red circle highlights the 'STOP' button in the 'EFFECTS' section.

Result:
Activation of shutdown terminals on module causing shutdown of field equipment

Kongsberg Maritime

KONGSBERG

Test of Cause & Effect

The screenshot shows a control interface with two main panels: 'CAUSE' on the left and 'EFFECTS' on the right. The 'CAUSE' panel contains a list of items with checkboxes and status indicators. The 'EFFECTS' panel contains a list of items with checkboxes and status indicators. A central control area contains buttons for 'STOP', 'START', 'STOP', 'START', 'STOP', 'START', 'STOP', 'START'.



Operation upon a shutdown situation

In the alarm situation the status lamp on the main display and on the matrix panel will be activated. Open display of the affected shutdown level to get information about input in alarm and activated output.

Operating procedure:

- Silent the audible alarms by using the silent-button
- Acknowledge the alarm
- Why did the shutdown occur? Take actions.
- When the alarm situation is over, start the reset procedure
 - Operate the acknowledge-button
 - Reset field equipment that tripped
 - Operate the reset-button



Start-up of both PCUs

After a black-out and during major system changes

Start-up procedure:

- Work permission
- Check power system and fuses
- Check network
- Start both PCUs at the same time
- Check the PCU status page on the operator stations
- Check the PCU redundancy page: Check that both master and slave are OK, and that master is active
- Both PCUs are OK
 - Check alarm inputs
 - Check alarm page, and acknowledge all system alarms
 - Operate the acknowledge-button
 - Check outputs
 - No NDE-output will be activated, because of the stop
 - All NE-output will be activated, because of the stop
 - Operate the reset-button.



Start-up of one of the PCUs

After a black-out and during major system changes

Start-up procedure:

- Work permission
- Check alarm input and activated outputs
- Check network
- Start PCU
- Check the PCU status page on the operator stations
- Check the PCU redundancy page. Check that both master and slave are OK, and that master is active
- Both PCU's are OK
 - Check alarm page, and acknowledge all system alarms
 - Check alarm inputs
 - Check outputs: no outputs will be activated because of a single PCU stop / start
- PCU not OK
 - Report the failure.
 - Take the necessary precaution, because of a single ESD system.