

System description

The ACS (Acoustic Control System) is designed for acoustic control of BOP operation, and other subsea production units requiring a control system.

The ACS system may control up to 12 different functions with readback, and monitor up to seven analogue inputs. Two systems are available;

1. Emergency BOP control system
2. Primary surface BOP control system (*new*)!

A BOP system is divided in two parts, comprising:

- **Surface equipment**
- **Subsea equipment**

Both parts have transceivers that are connected to transducers. An advanced acoustic telemetry link is established between the surface and the subsea parts. The telemetry system is based on Spaced Frequency Shift Keying (SFSK), implying that the information is coded as a sequence of different frequencies. SFSK is the only reliable type of coding feasible in noisy and reverberant offshore environments.

The acoustic control function can also be operated from a standard Hydroacoustic positioning system like HiPAP or HPR 400.

Different transducers with different beamwidths are available for optimal performance in deep and noisy environments. Kongsberg Maritime can supply solenoid connector alternatives from leading suppliers and can also, on request, offer engineering in BOP stabbing solutions.

Now with functionality for Surface BOP applications



Features

- Acoustic BOP Control System and telemetry
- Acoustic control communication with spaced frequency shift keying (SFSK)
- Acoustic communication with high reliability in noisy and reverberant offshore environments
- Unique address for each subsea controller unit
- Two-way communication
- Operator override of two-way communication
- Off-line BOP status reading and command test
- Dual transceiver in the subsea unit
- Dual transducer in the subsea unit
- Long range option for production tree control
- System self-test diagnostics
- Off-line checking of full system without actually operating the valves
- Portable control unit with range measurement feature
- Integration of the Acoustic Control System with the HiPAP/ HPR systems, will simplify the daily check of the subsea control electronics.

Subsea BOP solution

Surface equipment

The surface equipment consists of a portable Acoustic Command and Control Unit, the ACC 401, and a dunking transducer with hand operable cable winch.

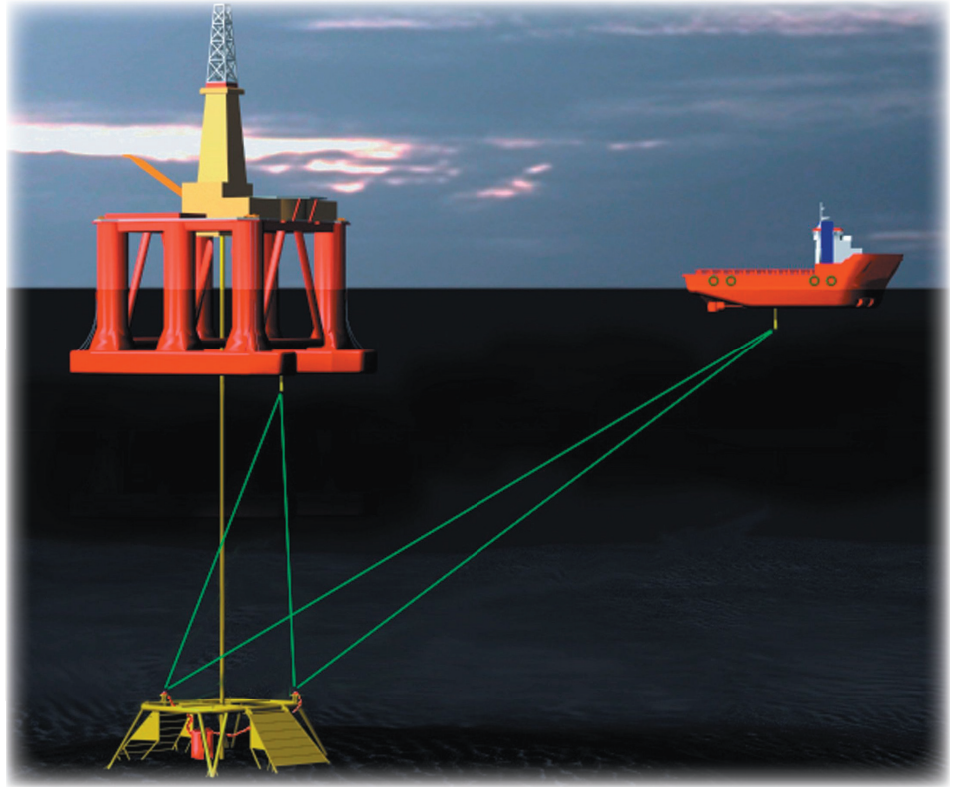
The ACC 401 unit is portable and it has an internal rechargeable battery with charger, which gives 10 hours normal operation.

The dunking transducer may be lowered into the sea from a rig, a stand-by vessel, a lifeboat, a helicopter and so on.

The ACC 401 is operated from the LCD display, using a cursor operated menu and dedicated push-buttons. The display has background lights for operations at night. To secure safe operation of critical subsea functions, the operator has to use both hands during activation of critical commands.

Subsea equipment

The subsea equipment consists of the Subsea Control Unit (SCU), two transducers with cables and waterproof connectors, and an interface cable for solenoid pack connection. The SCU holds the subsea electronics. It includes two transceivers with transducers, which makes the system 100% redundant. The SCU is powered from internal lithium batteries, and has one solenoid connector and two connectors for transducers.



Surface BOP solution

The ACS 433-S system is designed for acoustic control of the seabed POD in a Drilling package having a Surface BOP functionality.

Surface equipment

Same equipment as the Subsea BOP solution.

Subsea equipment

The SCU includes a serial line communication controller board (SIT), that enables flexible communication and protocols with the POD. Else; same ACS electronic container as the Subsea BOP solution.

BOP Simulator Unit

Each delivery is supplied with a BOP Simulator Unit with test cable.

Via the test cable, the simulator is connected to the end of the interface cable. The simulator is manufactured using the parameters for the actual BOP it will be simulating, and contains loads that correspond to the nominal loads of the solenoids which would normally be controlled.

- The simulator has a current sensor circuit that lights an LED if the solenoid current is too low.
- The simulator is marked with the names of the actual valves that should be controlled.

When a valve operation is performed, the LED corresponding to the valve function will light up for the specified period of time. If the system is equipped with feedback sensors, the sensors are simulated by switches for each valve.

Operational principles

When a two-hand operated command function is carried out, a two-way subsea communication is performed as follows:

- 1 The surface unit transmits address and command set-up information down to the subsea unit.
- 2 The subsea unit verifies the reception of address and command data.
- 3 An execute command is automatically transmitted down as a result of the received verification message. The operator may force the transmission of an execute command by a two-handed operation if the verification message fails to be received.
- 4 The subsea system confirms that the activation command has been correctly received and executed.

The principle of two-way communication provides the following advantages:

- Check of a transmitted address and command ensuring that erroneous messages are avoided.
 - Status readback of BOP functions is performed before and after a command has been carried out.
 - Allows routine checking of BOP status, and off-line testing of command functions at both surface and subsea levels.
 - Prevent unwanted operations.
- The acoustic control function can also be operated from a standard HiPAP / HPR 400 system.

System units



Technical specifications

System description	ACS 431 MF	ACS 433 MF	ACS 413 LF
Communication principle	SFSK	SFSK	SFSK
System depth rating (performance)	1500 m / 4500 ft	3000 m / 10.000 ft	3000 m / 10.000 ft
Portable Acoustic Command and Control Unit (ACC 401): Same unit for all systems			
Battery lifetime	Normal operation / continuous operation 50 hours / 10 hours		
Dimensions	HxLxW 228 x 383 x 320 mm	HxLxW 228 x 383 x 320 mm	HxLxW 228 x 383 x 320 mm
Weight	14 kg	14 kg	14 kg
Dunking transducer (TD): As standard all dunking transducers are delivered with a 70 m Kevlan armoured cable on a drum			
TD Name	TDD 303 MF	TDD 301 MF	TDD 103 LF
TD Opening angle	+30 degrees	+/-15 degrees	+/-30 degrees
TD Dimensions	Height / diameter 322 / 112 mm	Height / diameter 346 / 156 mm	Height / diameter 355 / 128 mm
Cable drum Dimensions	HxLxW 500 x 590 x 225 mm	HxLxW 500 x 590 x 225 mm	HxLxW 500 x 590 x 225 mm
Weight:			
- Cable drum with cable and TD	21.5 kg	26.6 kg	27.0 kg
- Separate TD	5.0 kg	10.0 kg	10.0 kg
Subsea Control Unit (SCU):			
Name	Subsea Control Unit, SCU 400 MF	Subsea Control Unit, SCU 400 MF	Subsea Control Unit, SCU 400 LF
Depth rating	1500 m	3000 m	3000 m
Dimensions	Height / diameter 1000 / 440 mm	Height / diameter 1000 / 440 mm	Height / diameter 1000 / 440 mm
Weight in air	300 kg	300 kg	300 kg
Subsea transducer (TD):			
TD name	TDA 324 MF	TDA 331 MF	TDA 133 LF
Opening angle	+/- 45 degrees	+/-15 degrees	+/- 30 degrees
Dimensions	Height / diameter 185 / 142 mm	Height / diameter 210 / 178 mm	Height / diameter 335 / 194 mm
Weight in air including cable	13 kg	9.6 kg	35 kg

ACC 401 Unit

- Transmitter and receiver frequency:
MF: 24 to 26.5 kHz
LF: 11.5 to 13 kHz
- Receiver bandwidth:
MF: 250 Hz
LF: 125 Hz
- Maximum power output: 500 W
- Supply voltage: 90 to 240 Vac
- Battery life,
normal operation: 50 hours
- Battery life,
continuous operation: 10 hours

SCU Unit

- Channels: Two fully redundant electronic control channels

Solenoid drivers:

- Standard / additional (option):
8 / 4 outputs
- Solenoid output:
48 Vdc or 24 Vdc
(other voltages on request)

- Electronic short circuit control
- Electronic solenoid current measurement
- Outputs are galvanically insulated

Solenoid feedback:

- Eight (8) external switch feedback inputs (standard)
- Seven (7) analogue:
4 to 20 mA sensors
- Operating temperature:
- 0° - 55° C

Internal battery (two units):

- Type: L 10/50
- Operation lifetime:
1.5 to 2 years
- Supply voltage: 48 Vdc nominal
- Housing: Steel, St 52 and corrosion proof alloy in flanges and connector bases

Receiver:

- Frequency, MF: 24 to 26.5 kHz
- Bandwidth, MF: 250 Hz

SCU 400 MF specific data

Transmitter:

- Reply frequency, MF:
24 to 26.5 kHz
- Maximum power output: 500 W

Receiver:

- Frequency, MF: 24 to 26.5 kHz
- Bandwidth, MF: 250 Hz

SCU 400 LF specific data

Transmitter:

- Reply frequency, LF:
11.5 to 13 kHz
- Maximum power output: 500 W

Receiver:

- Frequency, LF: 1.5 to 13 kHz
- Bandwidth, LF: 125 Hz

Simulator unit dimensions

- HxWxL (w/handles):
175 x 200 x 253 mm
- Weight: 1.5 kg

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