Production Control Systems

No one offers you more field-proven production

EXPERIENCE
Since the early days of subsea production, Cameron has been supplying production control systems designed to meet the exacting demands of the marketplace. With more than 550 subsea control module (SCM) installations as of the start of 2011, Cameron understands that control systems require an extra measure of precision and expertise. We have continued to invest to ensure that the facilities and people that produce our control systems are the best in the business.

Cameron’s success with production controls systems is a direct result of a long history of supplying sophisticated controls systems for both drilling and production. This experience has enabled Cameron to bring deepwater controls experience to production systems. Cameron began with direct hydraulic production controls systems and moved to piloted and sequential systems followed by electro-hydraulic multiplexed control systems. Then, in 1988, Cameron introduced its modular CAMTROL® Electro-Hydraulic Multiplex Control System, which has evolved to become highly successful and popular with customers around the world. Today, Cameron has taken the lead in advancing controls technology by being the first to install and operate an all-electric control system as well as the first to install and operate a broadband control system. In addition, Cameron leads the industry in providing state-of-the-art communications options including modem, direct DSL, direct fiber optic, distributed fiber optic/DSL and distributed DSL/DSL.

In today’s market, Cameron offers the flexibility to select a production control system to suit field specifications.

INNOVATION
CAMTROL Electro-Hydraulic Multiplex Control System
CAMTROL control systems have been installed in subsea operating regions around the world. This success is due to several factors. First is the system configuration flexibility which allows the use of universal and interchangeable equipment to enhance safety and minimize non-productive time. Plus, the system offers interchangeability and easy retrievability of key components for lower operating costs. In addition, CAMTROL offers outstanding reliability and availability.
CameronDC All-Electric Control System
In 2008, Cameron installed and commissioned the world’s first DC all-electric subsea production system – CameronDC™. The CameronDC system has no hydraulics and no accumulators. Much of the conventional electro-hydraulic equipment had been either simplified or eliminated. Benefits of the all-electric system include high availability, improved operability, environmental benefits, elimination of deepwater/long stepout limitations, efficient field startup, continuous operation with real-time feedback, extended monitoring and trending possibilities and umbilical/fluid savings.

As a result of the success of the initial CameronDC installation, Cameron has introduced the second generation of CameronDC, which offers increased functionality, lower cost and improved communications in addition to all of the other benefits of all-electric control.

CAMLAN Broadband Control System  Cameron’s CAMLAN™ control system and its unique communications distribution unit (CDU) enable secure, high-bandwidth communication, providing real-time data on a fully open architecture. The CAMLAN system has been installed and operating successfully for a major operator since 2008 and has broken the barrier for use of a fully functional TCP/IP Ethernet local area network (LAN) for control of a subsea system from the surface production facility.

High-Integrity Pressure Protection System (HIPPS)
Cameron’s HIPPS protects flowlines against overpressure. Equipped with intelligent safety and control systems, it meets stringent integrity levels and ensures safe operation. In addition, HIPPS offers the flexibility to expand field layouts and to branch off new lines from existing systems even when the pressure ratings of the two systems are different. Cameron’s HIPPS technology is field-proven and meets stringent industry standards.

AVAILABILITY
In short, Cameron has the experience to deliver control system solutions for real-world challenges, whether conventional hydraulic or game-changing all-electric or broadband systems.
No matter what the subsea scenario, Cameron will work with clients to configure our system to meet the field requirements.
Cameron’s Production Controls in the Field

Cameron’s range of modular production control solutions provides the flexibility to design to real-world challenges. Long stepouts. Deepwater. Greenfield developments. Brownfield developments. No matter what the subsea scenario, Cameron will work with clients to configure our system to meet the field requirements.

This illustration demonstrates just one solution for a field utilizing Cameron’s CAMTROL production control system. The field could just have easily been developed using CameronDC all-electric technology or CAMLAN broadband solutions. In this example, the CAMTROL components used include the following:

**TOPSIDES**

1. **Master Control Station (MCS)** The MCS controls and monitors the entire subsea control system, both topsides and subsea. The system displays data such as pressures and temperatures, and subsea valve status via the human machine interface (HMI). The MCS is a fully redundant PC- or PLC-based system.

2. **Electric Power Unit (EPU)** The EPU is the power conditioning unit for the topsides and subsea system. The unit normally consists of three cabinets – one for the topsides output and dual redundant cabinets for the subsea output.

3. **Topsides Umbilical Termination Unit (TUTU)** The TUTU is the interface between the surface and subsea equipment. It is the common termination point for the electrical, hydraulic, chemical and communication lines.

4. **Hydraulic Power Unit (HPU)** The HPU supplies clean, filtered, pressurized hydraulic fluid for the system. The unit typically generates two redundant pressure levels each for low-pressure and high-pressure functions.

**SUBSEA**

5. **Umbilical Termination Assembly (UTA)** The UTA is the termination point for the subsea umbilical and integrates with the SDU to distribute the hydraulic and electrical lines in the umbilical. The UTA can be mounted on the SDU or installed separately.

6. **Subsea Distribution Unit (SDU)** The SDU distributes hydraulic fluid, electrical signals and chemicals from the umbilical to the trees and manifolds. These are received from the UTA which can be built into the SDU or stabbed into place.

7. **Flying Leads** For relatively short distances, electrical flying leads (EFLs) and hydraulic flying leads (HFLs) are used to supply electrical power, hydraulic power and chemicals from the UTA to the SDU and from the SDU to the trees.

8. **Subsea Control Module (SCM)** The SCM communicates with the MCS, executes MCS commands and monitors subsea data. SCMs can be mounted on trees and/or manifolds. To facilitate retrieval, it is installed on a subsea control module mounting base (SCMMB). The subsea accumulator module (SAM) provides local pressurized hydraulic fluid to speed up actuation time. The SAM can be integrated with the SCM or installed on the tree, manifold or SDU.

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**S U B S E A  C O M M U N I C A T I O N  O P T I O N S**

A vital part of any control system is its distribution and transmission of communication. Cameron offers several different methods to suit varying field requirements, including:

**Traditional Copper Line Communication** In this system, communication between the MCS and the SCMs is achieved via modems. Data speed is 9.6 kbits/s, and maximum step-out distance is 40 miles (65 km).

**Direct Digital Subscriber Line (DSL)** In direct DSL, the communication between the MCS and the SCM is achieved via DSL modems. Data speed is 192 kbits/s and step-out distance is 22 miles (36 km).

**Direct Fiber Optic** In direct fiber optic, the communication between the MCS and the SCM is achieved via fiber optic lines inside the umbilical. Data speed is 100 Mbits/s and maximum step-out distance is 100 miles (160 km), which can be extended by using repeaters.

**Distributed Fiber Optic/DSL** In distributed fiber optic/DSL, a CDU is added to the system and the communication between the MCS and the CDU is achieved via fiber optic lines in the umbilical. The communication between the CDU and the SCMs is achieved by copper DSL connections. Data speed is 100 Mbits/s and step-out distances are 100 miles (160 km), which can be extended by using repeaters. And, because the distribution is copper-based DSL, the possibilities for field layout are virtually limitless.

**Distributed DSL/DSL** In distributed DSL/DSL, the communication between the MCS and the SCM is realized using a pair of DSL lines in the umbilical that end in a CDU. The CDU distributes DSL communication lines to individual wells. Data speed is 192 kbits/s and maximum step-out distance is 22 miles (36 km).
Cameron’s world-class manufacturing facility in Celle, Germany, is our Center of Excellence for the engineering, manufacturing, testing and assembly of production controls systems. Here, hundreds of highly specialized experts focus on innovative process and control solutions in a facility that houses some of the most sophisticated equipment to ensure the high level of quality and cleanliness that today’s controls systems demand.

Cameron is the only controls system supplier to hold both API Q1 and API 17F licenses, in addition to being fully compliant with emerging API 17N, IWIS and SIIS standards.

Dedicated support structures allow for safe and ergonomic work practices. This is an example of support structures to assemble SDUs.

An onsite hyperbaric chamber rated to 13,123 ft (4000 m) water depth provides testing capabilities to verify if the equipment works under submerged conditions.

Control of critical components ensures high quality throughout the production process.

Final check of fully assembled and tested products ensures all items are delivered to specification.
CAMTROL Subsea Control Module (SCM)

The SCM is the heart of the CAMTROL production control system. It provides electro-hydraulic control and monitoring for a wide variety of field functions, including tree valves and chokes, manifold valves, pressure/temperature monitoring, downhole intelligence control and monitoring, sand detection, corrosion monitoring and multiphase flow measurement.

With up to 32 control functions, 16 external electrical connections that allow numerous sensor interface configurations and multidrop intelligent completion capability, the SCM sets the industry standard in functionality and potential. The SCM can handle AC or DC power supply, an enhanced feature for large step-out distances where DC can provide huge benefits on copper cross sections. Cameron’s SCM is one of the lightest, most compact control modules in the industry. Installation and intervention are performed by standard work-class ROVs. It is rated for water depths up to 10,000 ft (3000 m).

All SCM components are fully qualified to meet the harsh service requirements. In fact, Cameron has the capability in-house to design, build and test the SCM-mounted control valves, providing superior control over performance and quality of critical SCM components.
CAMLAN Communication Distribution Unit (CDU)

Cameron’s CAMLAN communication distribution unit (CDU) supports an open and modular communication network which connects all important nodes in the field to efficiently process information and to supply electric power to the SCMs.

Fiber optic cables are used to connect the topside MCS with the subsea CDU, which typically is in a central location in the field where it communicates with tree-mounted SCMs via copper cables. The combination of fiber optics and copper allows this system to achieve large bandwidths and a step-out distance of 100+ miles as well as a faster exchange of data. In addition, using Ethernet via fiber optics and DSL via copper increases the possible variations in field layout. And the open architecture of this configuration allows any subsea equipment with an Ethernet interface to be connected directly to the CDU using its own unique IP address.

Field-proven.
System flexibility.
- Large bandwidth (100 Mbits/s)
- Fast distribution of data and response times
- Flexible Ethernet network
- TCP/IP compatible

CAMLAN Communication
Subsea Distribution Systems

Subsea distribution systems for Cameron’s control systems include all components required for hydraulic, chemical, electrical and fiber optic distribution from topside to subsea and can vary from simple one-well solutions to complex multi-well cluster scenarios.

As a systems provider, Cameron has successfully proven the capability to design, build, test and commission many types of distribution components such as distribution units, umbilical terminations and hydraulic, electrical and fiber optic flying leads. Major components such as subsea distribution units (SDUs) and umbilical termination assemblies (UTAs) are fully assembled at Cameron’s Celle, Germany, facility, including all critical welding activities on hydraulic and chemical tubing. These components can be designed in a number of configurations and combinations such as individual skid-mounted components and combination units in which the SDU, UTA and other components are designed in one package.

Modular. Flexible.
• Covers many field scenarios
• In-house assembly and welding
• Expandable
• Used for hydraulic, chemical, electrical and fiber optic solutions
Master Control Station (MCS)

Cameron’s topside control system is a combination of an MCS, an electrical power unit (EPU) and a hydraulic power unit (HPU). These components provide all of the necessary features to support any possible field layout.

The MCS provides the control and monitoring for various interface connections. The MCS comprises dual redundant processing systems to eliminate single mode failure points and features bumpless transfers from the faulty to the healthy channel system. The MCS can communicate subsea via modems (signal on power or separate power and communications) and fiber optic/DSL channels. One single MCS cabinet can handle a large field with more than 100 wells and can process more than 20,000 events per second. The MCS software is open and flexible and is continuously maintained.

Highly specialized IT engineers support the MCS during all phases of development, installation, commissioning and production. Software support is provided for the life of the MCS.
CameronDC All-Electric Control System

The CameronDC All-Electric Production Control System is an industry first. The pilot CameronDC system has been operational in the North Sea since September 2008. With zero hydraulics, CameronDC solves key environmental challenges while delivering its powerful value proposition – unprecedented reliability, availability and maintainability.

Building on input regarding the pilot system, the second generation DC system represents state-of-the-art technology. It is a full-capability control system that can be scaled up or down for different applications and is a true enabler for production, subsea processing and water injection systems. The new features include simplified system architecture, fiber optic communication technology, and increased functionality. In addition, response time is fast and accuracy and precision are enhanced over conventional systems. CameronDC feedback is a digital, real-time actual performance. In addition to high-speed communication and real-time condition monitoring, CameronDC provides the ability to track performance over time, reducing unplanned maintenance. Project savings come in several areas including cheaper umbilicals, savings in host facility space and weight, and the elimination of the purchase, maintenance and disposal of hydraulic fluid.

One-of-a-kind performance.
- No hydraulics
- Virtually unlimited stepouts and water depths
- Low power
- Increased reliability
- Improved operability
High-Integrity Pressure Protection System (HIPPS)

Cameron’s experience in subsea production control systems carries over into HIPPS technology. HIPPS is a safety instrumented system used to isolate downstream components from over-pressure. These systems are used primarily to protect downstream flowlines, flowline jumpers and equipment. The system works via pressure transmitters which sense pressure increases above the preset number. If an increase is detected, the system signals flowline isolation valves to close to protect the lower-rated downstream infrastructure.

Because safety and availability are paramount for HIPPS, the system uses a series of transmitters that react in a pre-defined voting logic to ensure that the system operates reliably. Cameron’s HIPPS meets the stringent requirements of Safety Integrity Level (SIL) 3 and feature full redundancy to ensure operational integrity.

HIPPS allows operators to reduce the length of high-pressure flowline infrastructure and equipment, thus reducing installation costs. They also permit the tie-in of new high-pressure wells into existing subsea systems.
HSE Policy Statement
At Cameron, we are committed ethically, financially and personally to a working environment where no one gets hurt, nothing gets harmed.