(12) UK Patent Application (19) GB (11) 2 451 258 (13) A

(43) Date of A Publication 28.01.2009

(21) Application No: 0714471.0

(22) Date of Filing: 25.07.2007

(71) Applicant(s):
**Vetco Gray Controls Limited**
**(Incorporated in the United Kingdom)**
**2 High Street, Nailsea, BRISTOL,**
**BS48 1BS, United Kingdom**

(72) Inventor(s):
**Julian R Davis**
**Ian Kent**
**Robert Dalziel**

(74) Agent and/or Address for Service:
**Page Hargrave**
**Southgate, Whitefriars, Lewins Mead,**
**BRISTOL, BS1 2NT, United Kingdom**

(51) INT CL:
***E21B 33/035*** (2006.01) ***E21B 34/16*** (2006.01)
***E21B 47/12*** (2006.01)

(56) Documents Cited:
**GB 2427227 A** **GB 2421524 A**
**GB 2417742 A** **GB 2396086 A**
**GB 2377131 A** **US 6018501 A**

(58) Field of Search:
INT CL **E21B**
Other: **WPI, EPODOC**

(54) Abstract Title: **A wireless subsea electronic control module for a well installation**

(57) Software is loaded from, and data is loaded to, a subsea electronic control module (SEM) including a transceiver 5 connected to a port on processing means 2. The transceiver 5 has a radio frequency input/output coupled to a modem interface A. The wiring of modem interface A functions as an antenna for the transceiver. The modem communicates with internal processing means 2, which implements received commands in the form of ouputs to driver circuits 3. These in turn output to external devices such as control valves through interfaces B. The data from external inputs, such as pressure and temperature measurements, positions of valves etc from a multiplicity of interfaces C is routed through conditioning circuits 4 before entering the processor and subsequent transmission via the transceiver 5 to external transceiver 6 and processor in computer 7. The carrier frequency is in the GHz region and may include Bluetooth™ and wi-fi communication systems.

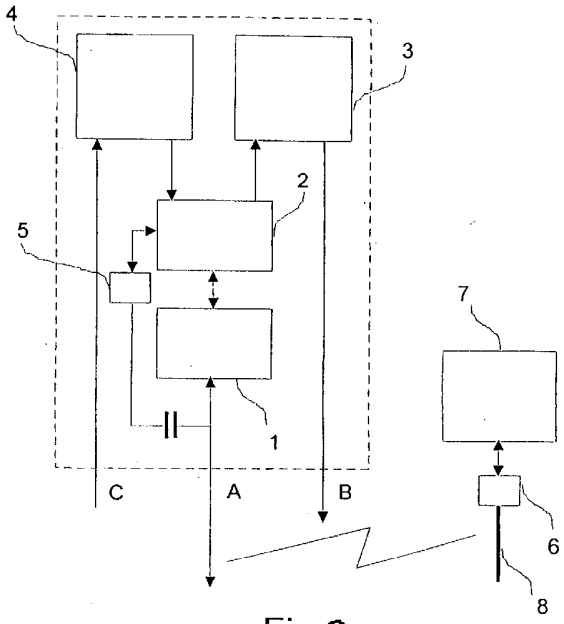


Fig. 2

GB 2 451 258 A

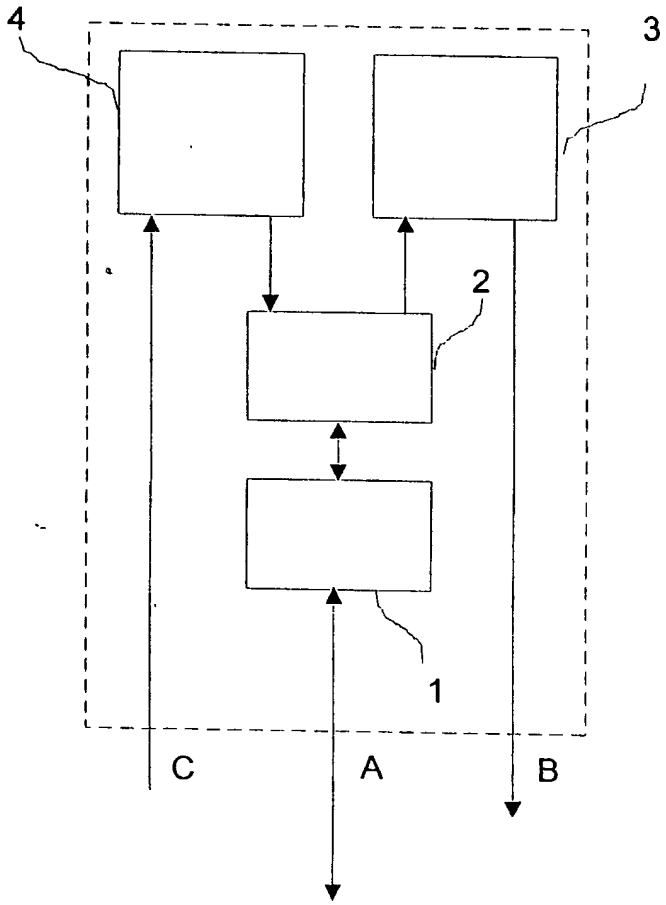


Fig. 1 - Prior Art

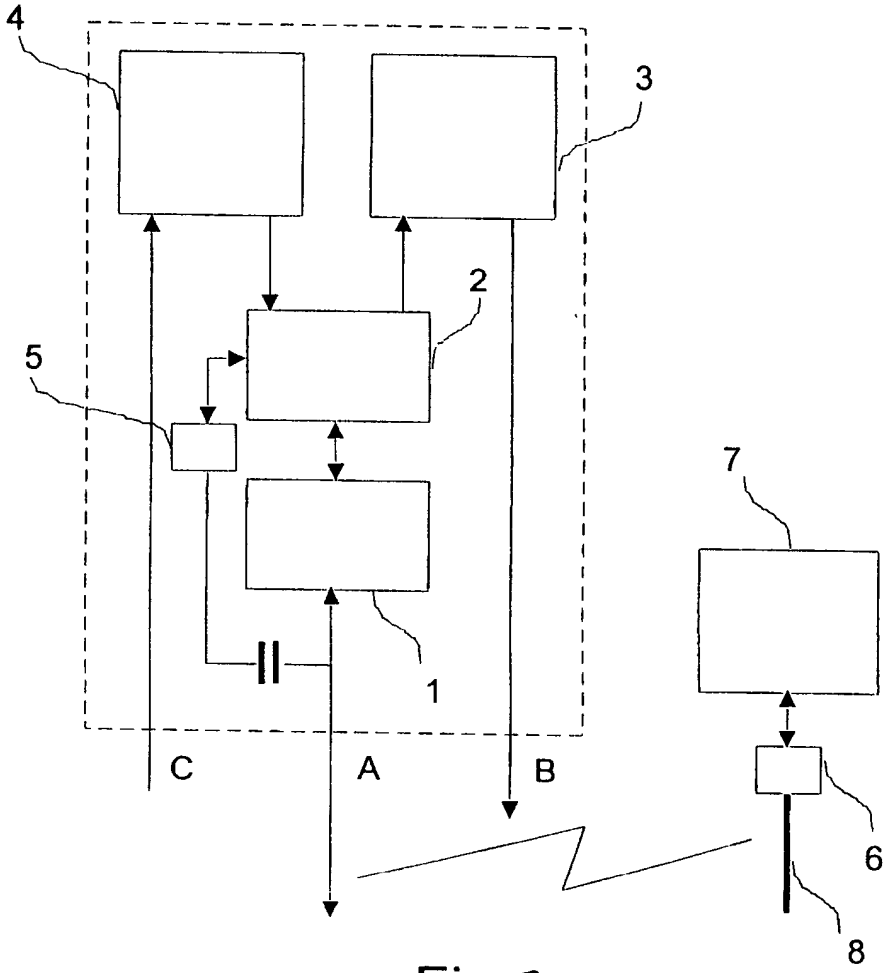


Fig. 2

2451258

# Electronics module

This invention relates to an electronics module for a well installation, and a method of loading software and / or data to such a module.

The control of a subsea fluid extraction well is normally effected by a subsea electronic control module (SEM) housed within, or located close to, a subsea control module (SCM) mounted on a well tree, situated on the sea bed at the well head. The SEM is provided with electric power and communications via an umbilical line to a control platform, which may be on a vessel or located on land. Typically, the SEM receives commands via the umbilical communication line to its internal electronics. These are then processed by the SEM, and the resulting electrical outputs are sent to electrically-operated production fluid control valves and / or directional control valves (DCVs) housed in the SCM, which control hydraulic power to hydraulically-operated valves. The SEM also feeds data relating to such operations back to the control platform. Additionally, the SEM electronics handles many other functions, which include the collection and interpretation of data from sensors distributed throughout the production system, such as pressure, temperature, fluid flow, microseismic, oil / water quality and, on more recent systems, compressed video and transmits them back to the control platform. The SEM also houses the electronics required to operate a High Integrity Pipeline Protection System (HIPPS) and the electronics for the communication system, such as modems and routers, or in more modern systems, Ethernet interfaces, as well as communication redundancy.

Fig. 1 shows a block diagram of a typical existing SEM. A modem 1 effects external communication, e.g. to the control platform, through an interface A. The modem 1 communicates internally to an SEM processing means 2, which implements commands from the control platform in the form of outputs to driver circuits 3. These in turn output a multiplicity of drives to external devices such as DCVs through interfaces B. External inputs from a multiplicity of interfaces C connect to signal conditioning electronic circuits 4. These external inputs include for example signals from the SCM such as monitoring functions, e.g. pressure and temperature measurements, positions of valves

etc which can have a variety of electrical interfaces. The circuits 4 convert these electrical inputs into a suitable interface for processing means 2. The processing means 2 then processes the inputs and either effects control of the well via the interfaces B and / or outputs data via the modem 1 back to the control platform through the interface A. For the processing means 2 to operate, it is necessary to load data and software to it. This is carried out during factory testing and installation, and is achieved relatively slowly via the modem 1 through the interface A.

Typically, modern SEMs employ processors / microcontrollers to implement the functions described above which has resulted in very large software packages and data having to be loaded in. It takes typically seven hours to load the software / data on a current SEM, via its communication modem, due to the relatively slow speed of the modem. This has a major effect on both testing times and cost. Furthermore, the costs involved in having to take this length of time on the installation vessel at the point of installation are highly significant. One possible solution to this problem could be to add a high-speed data link to the SEM, but this would mean that an additional connector has to be added to the SCM electronic interface plate. However, with the prevailing trend to provide smaller and lighter well control systems containing SCMs, the surface area of the SCM connector end plate has become minimal and there is typically not enough room to add another connector. Furthermore, such a connector may be an expensive device.

It is an aim of the present invention to overcome these problems, namely to provide a system which enables rapid loading of software or data to a SEM, without requiring an additional connector.

This aim is achieved by incorporating a short range, high frequency, wireless transceiver, such as Bluetooth (RTM), to the internal electronics of a SEM. The existing wires connecting to the internal modem may be utilised as an antenna, and software / data loaded via this link. Thus no additional connector is required at the SCM end plate and if the carrier frequency of the transceiver is in the GHz region and thus wide band, data and software can be loaded rapidly. Since the electronics of the SEM, including the

transceiver, is housed in a metal-screened container, spurious radiation from the transceiver is contained. The current cost of small transceivers such as Bluetooth (RTM) are insignificant compared with the costs involved with the long software / data loading times of existing systems.

Using the invention, the extensive quantity of software and data required by the processor in a modern SEM can be loaded in a fraction of the time that it takes to load via the normal modem interface, thus making major savings in time and cost in both the manufacturing and test of the product and its installation.

In accordance with a first aspect of the present invention there is provided an electronics module for a well installation as set out in the accompanying claims.

In accordance with a second aspect of the present invention there is provided a method for loading software and /. or data to an electronics module for a well installation as set out in the accompanying claims.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 schematically shows a known SEM arrangement; and
Fig. 2 schematically shows a SEM and loading means in accordance with the present invention.

Fig. 2 schematically shows an SEM in accordance with the invention, together with means for loading software and / or data to the SEM. Components in common with the known SEM shown in Fig. 1 retain the same reference numerals. A transceiver 5 is located within the SEM, and connected to a port on the processing means 2 for communication therewith. The transceiver 5 has an RF input / output coupled, for example capacitively, to the existing modem external interface A. The modem interface A wiring functions as an antenna or aerial for the transceiver 5 in use. Firmware is stored

in the processing means 2, typically in ROM, at manufacture. This enables communication between the transceiver 5 and the processing means 2.

In order to load the required software and / or data to processing means 2, an external processor 7 is used, which is connected to a wireless transceiver 6. The processor 7 may for example be a laptop computer, which carries the software / data required by the SEM. Transceiver 6 includes an antenna 8 to effect wireless communication with transceiver 5 via the wiring of modem interface A. In this way, data and / or software can be transmitted at high speed through the wireless interface.

Although the efficiency, as an antenna, of the existing modem wiring is relatively poor, it is adequate to permit successful communication, since the antenna 8 of the external transceiver 6 can be placed very close to the interface A during loading.

In an alternative embodiment of the present invention, not shown, an external processor 7 that has wi-fi capability is employed, together with a wi-fi compatible transceiver 5 in the SEM. With this arrangement, the need for a separate transceiver 6 is eliminated.

The above-described embodiments are exemplary only, and various alternatives are possible within the scope of the claims.

Although Bluetooth (RTM) and wi-fi have been specifically mentioned, any other wireless communication systems and protocols may be used provided that they are capable of handling the necessary volume of data at the required rate for satisfactory operation of the electronics module.

It is envisages that the present invention may either be used to effect loading of the software and / or data in the first instance, or may be used as a back-up arrangement to current methods if necessary.

**CLAIMS**

1. An electronics module for a well installation, comprising a wireless receiver for receiving data and / or software from an external source.

2. A module according to claim 1, comprising a modem and associated wiring.

3. A module according to claim 2, wherein the modem wiring is connected to the wireless receiver for functioning as an antenna of the wireless receiver.

4. A module according to any preceding claim, further comprising processing means, and wherein the wireless receiver is connected to the processing means for communication therewith.

5. A module according to any preceding claim, wherein the receiver functions as a transceiver.

6. A module according to any preceding claim, wherein the receiver is Bluetooth (RTM) configured.

7. A module according to any preceding claim, wherein the wireless receiver has a carrier frequency in the order of GHz.

8. A module according to any preceding claim, wherein the wireless receiver is wi-fi compatible.

9. A module according to any preceding claim, adapted for underwater installation.

10. A method of loading software and / or data to an electronics module for a well installation, comprising the steps of:

a) providing an electronics module comprising a wireless receiver;

b) providing a processor, external to the module, connected to wireless transmission means;

c) loading software and / or data from the processor to the module via the wireless transmission means and receiver.

11. A method according to claim 10, wherein the electronics module comprises a modem and associated wiring.

12. A method according to claim 11, wherein the modem wiring functions as an antenna for the wireless receiver.

13. A method according to any of claims 10 to 12, wherein the loading step is carried out prior to deployment of the module.

14. An electronics module for a well installation substantially as herein described with reference to Fig. 2.

15. A method of loading software and / or data to an electronics module, substantially as herein described with reference to Fig. 2.

Intellectual Property Office

For Creativity and Innovation

7

**Application No:** GB0714471.0 **Examiner:** D. P. Harness

**Claims searched:** 1-15 **Date of search:** 16 November 2007

## Patents Act 1977: Search Report under Section 17

**Documents considered to be relevant:**

| Category | Relevant to claims | Identity of document and passage or figure of particular relevance |
|---|---|---|
| X | 1-13 | GB2377131 A (SCHLUMBERGER) Figure 9; page 3, line 3 to page 4 line 8; page 7, lines 21 to 38; note bi-directional modems 200 & 202. |
| X | 1, 2, 4-11 & 13 | GB2417742 A (VETCO GRAY INC) Figure 6; Paragraphs [0035] to [0037]. |
| X | 1,2, 4-11, & 13. | GB2427227 A (FMC KONGSBERG SUBSEA AS) Figure1; page 6 lines 5 to 36. Particularly note control and telemetry signals 19 and control module 14. |
| X | 1 & 10 at least. | US6018501 A (SMITH ET AL) Figure 1 and abstract. |
| A | 1 & 10 | GB2396086 A (ABB OFFSHORE SYSTEMS LTD) Figure 2 and abstract. |
| A | 1 & 10 | GB2421524 A (VETCO GRAY) Figure 3 and abstract. |

Categories:

| | | | |
|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category | P | Document published on or after the declared priority date but before the filing date of this invention |
| & | Member of the same patent family | E | Patent document published on or after, but with priority date earlier than, the filing date of this application |

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC$^{X}$ :

Worldwide search of patent documents classified in the following areas of the IPC

E21B

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

**International Classification:**

| Subclass | Subgroup | Valid From |
|---|---|---|
| E21B | 0033/035 | 01/01/2006 |
| E21B | 0034/16 | 01/01/2006 |
| E21B | 0047/12 | 01/01/2006 |