INTERFACE CONTROL DOCUMENT

FOR THE

SURFACE DISPLAY UNIT

TO

UNDERWATER UNIT

COMMUNICATIONS OF THE

MULTI-RETURN ALTIMETER

DWG. NO. DM00S0100/DOC

Rev 2.3 - 02/09/2011

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1. Scope

1.1 Identification

This document is the Interface control document for the Multi-Return Altimeter, Surface Display Unit (SDU) to Under Water Unit (UWU) Interface.

1.2 System Overview

The purpose of the system is to obtain a range to the sea-bed when presented with significant amounts of suspended sediments causing backscatter interference.

1.3 Document Overview

The purpose of this document is to provide the Interface specification for communications between the UWU and the SDU.

This section, section 1, provides an overview and general introduction.

Section 2 details the documents applicable to this document.

Section 3 details the interface specification.

2. Applicable Documents

None

3. Interface Specification

3.1 Definitions

This interface is defined using the Bachus Naur Form.

The Symbols used in this definition have the following meanings:

= defines equality of the item on the left to the expression on the right.

<x> defines an item. Each item consists of one or more elements.

"x" defines the element which is the ASCII character x.

| defines selection.

i.e. <x> = <a>|<b> means the item <x> is defined as being either the item <a> or the item <b>.

+ defines construction.

i.e. <x> = "a"+"b" means the item <x> is defined as being "ab".

[expression] defines an optional expression.

i.e. <x> = "a"[+"b"] means the item <x> is defined as being "a" or "ab".

{expression} defines a repeated expression. The no of repeats is 0 or more.

i.e. <x> = "a"{+"b"} means the item <x> is defined as being "a" or "ab" or "abb" or "abbb" or .... .

/nn defines the ASCII character with the hex value nn

i.e. /43 is the character C.
/02 is the control character STX.

3.2 Electrical Interface

The electrical interface consists of either a two wire RS232 link or a two wire RS485 link between the UWU and the SDU.

The characteristics of the communications link are as follows:

- Start bit: 1

- Data bits: 8

- Parity: None

- Stop bits: 2

- Data rate: 9600/38400 baud soft switching

- Hardware Handshaking: None

- Duplex: Half

3.3 Packet Protocol

The link will operate in a master slave mode. The SDU will be the master and the UWU's will be the slaves. The Master may send a packet at any time, and expect a packet to be returned from the corresponding slave.

The slave sends its reply packet of data starting within 100 milliseconds of receipt of a valid command for that slave unit.

If the master receives no response within 100 milliseconds, it will assume the slave is busy and may optionally repeat the command until it either gets a packet in return or reaches an internal timeout to flag to the user that the link is broken between the master and the slave.

Data will be passed between the SDU and UWU in packets.

A Packet is defined as follows:

<packet> = <STX> + <Unit ID> + <MSN> + <Message> + <EOT> + <ETX> + <LRC>

<Unit ID> = <Binary Data>

The Unit ID specifies which Unit the escape sequence or message is intended for, or came from. Unit ID's are in the range /20 to /FE. A unit ID of /FF indicates a general message, sent by the SDU, which is to be acted on by all UWU's, but not replied to.

<Binary Data> = /00 .. /FF

<STX> = /02

<ETX> = /03

<MSN> = <Binary Data>

This is the message sequence number, and is incremented by the sender. If the receiver receives a second valid packet with the same MSN, it will assume that it's reply was lost and will not act on the packet contents, although it will reply to the packet with a Pass Response message.

<LRC> = <Binary Data>

This is the Logical Redundancy Check. It consists of the exclusive or (XOR) of all the bytes in the packet, starting with the STX and ending with the ETX. Thus the XOR of the whole packet should be /00.

<Message> = {<Binary Data>}

The Binary Data may include an EOT character. To allow transmission of the EOT character without causing syntax conflicts, any EOT within the Message will be repeated on transmission. On reception, the second EOT will be discarded. The second EOT will not be used in the LRC calculation.

If the LRC on a packet received by the slave (UWU) is not correct, the slave will respond with a Fail Response message. If a break of more than 10 milliseconds occurs

within a packet the receiver will discard the packet and await the start of the next packet.

3.4 Message Protocol

The Message level of the protocol is used to define the information being passed at the application level. The messages are of two types, commands and responses. All commands originate from the DCU and all responses come from the UWU, in response to a command.

The Messages which may be transferred are defined as follows:

<Message> = <Command> | <Response>

<Command> = <Set Parameters> |
<Get Parameters> |
<Get Range> |
<Stop Pinging> |
<Start Pinging> |
<Set High Baud Rate > |
<Set Low Baud Rate> |
<Start NMEA Output> |
<Stop NMEA Output> |
<Transmit> |
<Unit Type Query> |
<Unit ID Request>

<Response> = <Pass Response> |
<Fail Response> |
<Unit Type Response> |
<Data Response> |
<Parameter Response> |
<Range Response>
<NMEA Message>

3.4.1 Set Parameters

The Set Parameters command is sent by the SDU to the UWU. The UWU writes the parameters to its internal non-volatile memory and will use these settings each time it is powered up until they are overwritten by repeating the command with different parameters. The reply to this command from the UWU will be a Pass Response message and then the UWU will write the parameters to its internal EEPROM and re-boot.

Because of the time taken to write the parameters into the EEPROM inside the altimeter the host software should wait for at least two seconds after receiving the Pass Response message before sending any other commands. The message is defined as follows:-

<Set Parameters> = “P” + <parameter block>

<parameter block> = <Velocity of Sound> +
<Start Range> +
<Stop Range> +
<Interval between Samples> +
<Gain> +
<Tx Pulse Width> +
<Number of Averages> +
<Repetition Rate> +
<Output Scale>

<Velocity of Sound> = /578 .. /640
(Value used to calculate range from time measurement in the range 1400m/s to 1600m/s – default value is 1500m/s)

<Start Range> = /014 .. /3E8
(Range before sampling starts in cm from 20cm to 1000cm – assumes 1500m/s for velocity of sound)

<Stop Range> = /032 .. /7D0
(Full scale range at which sampling stops in cm from 50cm to 2000cm – assumes 1500m/s for velocity of sound)

<Interval between Samples> = /01 .. /64
(In 1usec increments, covering the range 1usec to 100usec)

<Gain> = /00 .. /0F (Analogue receiver gain 0 to 15)

<Tx Pulse Width> = /01 .. /64
(In 10usec increments, covering the range 10usec to 1msec)

<Number of Averages> = /001 .. /3E8
(Averages between 1 and 1000 ranges before generating an output)

<Repetition Rate> = /01 .. /64
(Ping rate is from 0.1Hz to 10Hz)

<Output Scale> = <0> | <1> (0 = 0-5V, 1 = 0-10V full-scale output)

3.4.2 Get Parameters

The Get Parameters command is sent from the SDU to the UWU. The UWU responds with a Parameter Response message. The message is defined as follows:-

<Get Parameters> = “G”

3.4.3 Get Range

The Get Range command is sent from the SDU to the UWU. The UWU responds with a Range Response message. The message is defined as follows:-

<Get Range> = “B”

3.4.4 Stop Pinging

The Stop Pinging command is sent from the SDU to the UWU. The UWU responds with a Pass Response message. The UWU stops further acoustic transmissions until either the power is disconnected and reconnected or the Start Pinging command is sent from the SDU. The message is defined as follows:-

<Stop Pinging> = “S”

3.4.5 Start Pinging

The Start Pinging command is sent from the SDU to the UWU. The UWU responds with a Pass Response message. The UWU starts acoustic transmissions if it was currently stopped or just continues if already pinging. The message is defined as follows:-

<Start Pinging> = “R”

3.4.6 Set High Baud Rate

The Set High Baud Rate command is sent from the SDU to the UWU. The UWU responds with a Pass Response message at its current baud rate before switching to the high baud rate of 38400 baud. The message is defined as follows:-

<Set High Baud Rate> = “H”

3.4.7 Set Low Baud Rate

The Set Low Baud Rate command is sent from the SDU to the UWU. The UWU responds with a Pass Response message at its current baud rate before switching to the low baud rate of 9600 baud. The message is defined as follows:-

<Set Low Baud Rate> = “L”

3.4.8 Start NMEA Output

The Start NMEA Output command is sent from the SDU to the UWU. The UWU does not send a response message to this command. The UWU sends an NMEA style data string via RS232 and RS485 each time that the depth updates at the programmed repetition rate. The message is defined as follows:-

<Start NMEA Output> = “N”

3.4.9 Stop NMEA Output

The Stop NMEA Output command is sent from the SDU to the UWU. The UWU does not send a response message to this command.The UWU disables sending an

NMEA style data string via RS232 and RS485 each time that the depth updates. The message is defined as follows:-

<Stop NMEA Output> = “O”

NOTE:- When the Altimeter is powered on the system defaults to sending the NMEA data string at 9600 baud. If any character is sent to the Altimeter via the RS232 or RS485 communications ports then the unit will disable the NMEA output and will not restart until powered off and on again, unless the “Start NMEA Output” command is sent.

3.4.10 Transmit

The Transmit Command Message is sent by the SDU to the UWU. The UWU transmits a pulse and collects a set of data. The UWU then responds with a Data Response message.

The message is defined as follows:

<Transmit> = “A”

3.4.11 Unit Type Query

The Unit Type Query Command Message is sent by the SDU to the UWU. The UWU responds with a Unit Type Response message. The message is defined as follows:

<Unit Query> = "T"

3.4.12 Unit ID Request

The Unit ID Request Message is sent by the SDU to the UWU. The UWU responds by waiting a number of milliseconds, equivalent to its unit id, and then enabling the link to the surface, sending a single byte, which is its unit id, resetting the link to receive data, and then restarting. The message will normally be sent by the SDU as a general message, which all UWU's will respond to. This will enable the SDU to quickly identify all the UWU's connected to the system. The message is defined as follows:

<Unit ID Request> = "Z"

3.4.13 Pass Response

The Pass Response message is sent by the UWU to the SDU. The message is defined as follows:

<Pass Response> = "a"

3.4.14 Fail Response

The Fail Response message is sent by the UWU to the SDU. The message is defined as follows:

<Fail Response> = "b"

3.4.15 Unit Type Response

The Unit Type Response message is sent by the UWU to the SDU. The message is defined as follows:

<Unit Type Response> = "d" + <Unit Type>

<Unit Type> = <Marine Scan> | <Marine Echo> | <In Air Sonar> |
<Sediment Proflier>

N.B. additional unit types may be included in future versions.

<Marine Scan> = "A"

<Marine Echo> = "B"

<In Air Sonar> = "C"

<Sediment Profiler> = "E"

<Multi-Altimeter> = "F"

3.4.16 Data Response

The Data Response message is sent by the UWU to the SDU. The message is defined as follows:

<Data Response> = "e" + {<Data Byte>}

<Data Byte> = <Binary Data>

The number of data bytes is dictated by the start and stop ranges along with the sample interval, assuming a velocity of sound of 1500m/s. Note that the maximum number of samples is limited to 4095 by the UWU hardware.

3.4.17 Parameter Response

The Parameter Response message is sent by the UWU to the SDU. The message is defined as follows:

<Parameter Response> = "p"+ <parameter block>

3.4.18 Range Response

The Range Response message is sent by the UWU to the SDU. The message is defined as follows:

<Range Response> = "r" + <Data Byte>
+ <Data Byte>
+ <Data Byte>
+ <Data Byte>
+ <Data Byte>

<Data Byte> = <Binary Data>

Note: The 5 digits represent the BCD Altimeter range in mm with the MSB first.

3.4.19 NMEA Message

The NMEA output message is sent by the UWU to any listenening devices. This message is unique in that there are is no protocol wrapped around the message packet, the data is ASCII only for compatibility with third party systems. The message is defined as follows:

<NMEA Message> = “$MEALTnn.nnn*cc” and is followed by a carriage return character (0x0D)

<nn.nnn> = 5 ASCII decimal digits representing the range in metres with three decimal places and a fixed decimal point

<cc> = 2 ASCII HEX digits representing the modulo 256 sum of all characters between the dollar and asterisk in the above string