SmarT-Ping

Hull Mounted Pinger Control System

Operation Handbook

(Version 2:02 April 2004)

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SmarT-Ping Firmware Revision 2:02 April 2004

SmarT-Ping   **(Firmware Revision 2:02 April 2004)**

Introduction.

The Smart-Ping system is a single channel trigger system with a navigation serial interface receiving water depth information in order to automatically set both the ping rate and delay periods ,while keeping the ping rate as fast as the current water depth will allow , while also keeping the seabed positioned on the record according to user requirements.

The Smart-Ping system is controlled by a simple keypad with just four function keys together with four Arrow keys. The display is a small 2 line by 16 character LCD unit housed within the desktop controller unit.
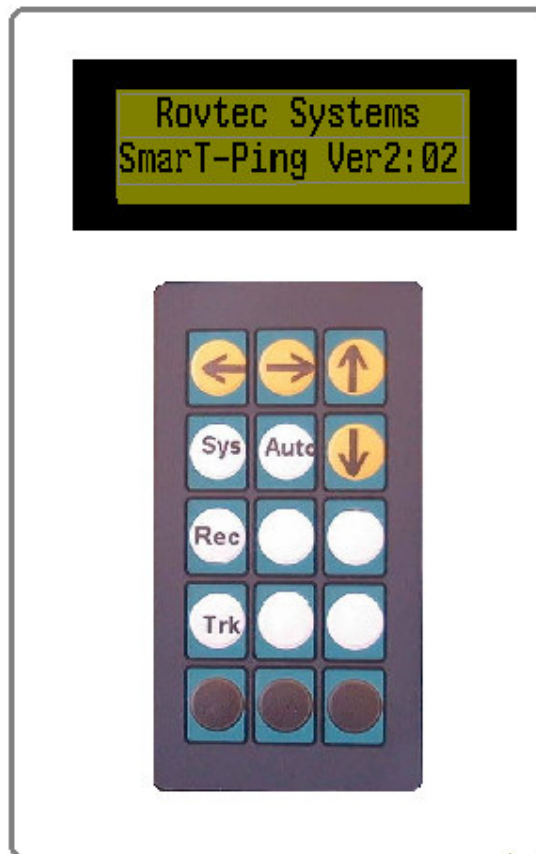
Function Key 1 System Set up

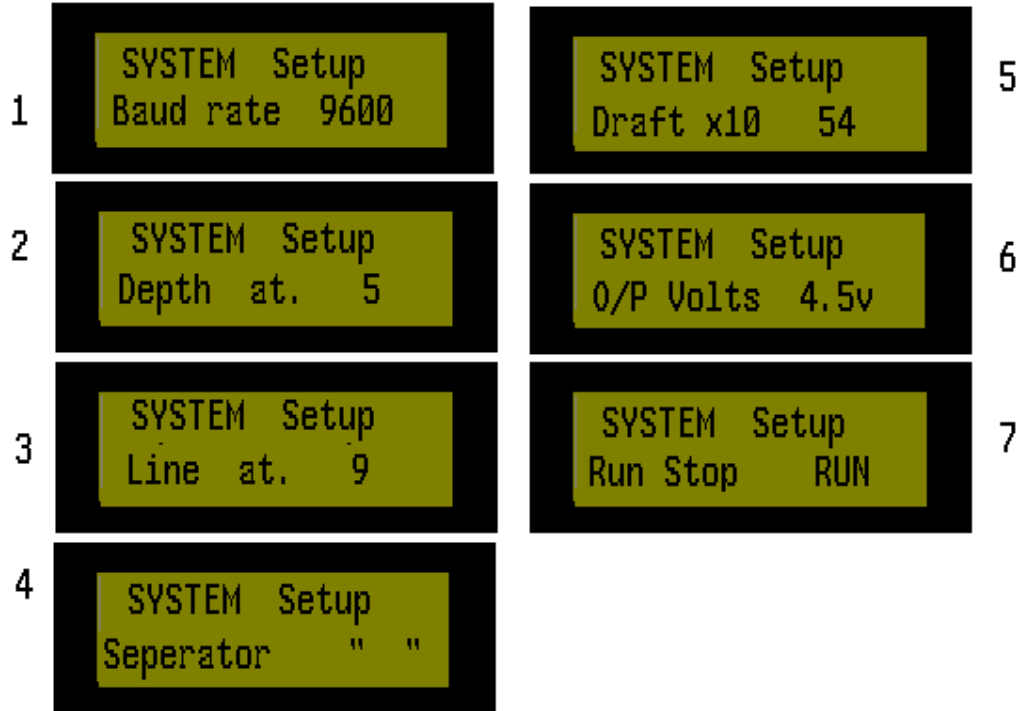Function Key 2 Recorder Set up

Function Key 3 Tracking Set up

Function Key 4 Mode   Auto Manual selection

Smart-ping Control Menu:

SYSTEM MENU

The SYSTEM SETUP MENU
The SYSTEM SETUP Menu is entered by pressing the function key marked "SYS".
The majority of the following seven parameters do not need to be changed often.

1	SYSTEM Setup Baud rate 9600	
2	SYSTEM Setup Depth at. 5	
3	SYSTEM Setup Line at. 9	
4	SYSTEM Setup Seperator " "	

SYSTEM Setup Draft x10 54	5	
SYSTEM Setup O/P Volts 4.5v	6	
SYSTEM Setup Run Stop RUN	7	

Once inside this menu the user may scroll through the seven sub menu items by
simply using the UP DOWN Arrow keys. To enter any of the sub menu items the user
must press the RIGHT ARROW key , to return to the main display the LEFT ARROW
Key must be pressed.

System Set up Baud Rate Baud Rate for Navigation Serial Link (Default 9600
Baud) also supports 1200baud to 34.8Kbaud (setting saved)
System Set up Depth at. Depth at. Position   0-255   (Default Setting =5)
The position of the Depth parameter in the String from Navigation. (setting saved)
System Set up Line at. Line at.   Position   0-255 (Default Setting =9) The
position of the LINE NAME parameter in the String from Navigation. (setting saved)
System Set up Separator. Character value (Default setting = Space Char) The
value of the "ASCII" character that separates the groups of parameters within the
navigation string. (setting saved) the value is displayed between quotation marks.

System Set up Draft. Vessel Draft   multiplied by 10   2.0 - 6.9mtrs (20-69) The
Draft setting in Meters x10 (setting saved)

System Set Up O/P Volts   4.5v or 9-12v   default 4.5v

System Set Up Run-Stop   stops or runs the trigger unit , the system default
condition is "run",
(Menu 6 and 7 O/P Volts and RUN Stop are not saved and default conditions will apply on power up.)

Smart-ping Control Menu:

SYSTEM MENU

Auto Mode Control Function Key

The System has several modes of operation Manual, Full Auto ,and Auto Delay only. The "Auto Mode" may be changed more frequently and is accessed from within the SYSTEM MENU.
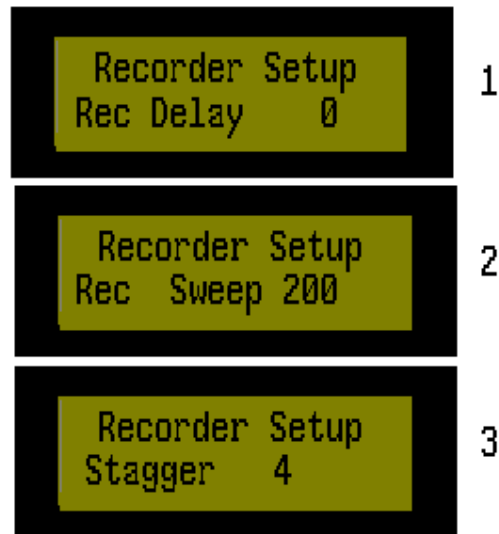
System Set up Auto Key. By pressing the AUTO KEY while in the SYSTEM menu its possible to toggle the system between FULL AUTO and AUTO DELAY ONLY mode, the LCD will show the selected setting for two seconds. The setting toggles between the two possible modes "FULL AUTO" and "AUTO DELAY ONLY".

While the system is showing the main display , pressing the AUTO KEY turns auto mode off (MANUAL MODE) or Auto mode on and into whatever mode AUTO Mode is currently set.
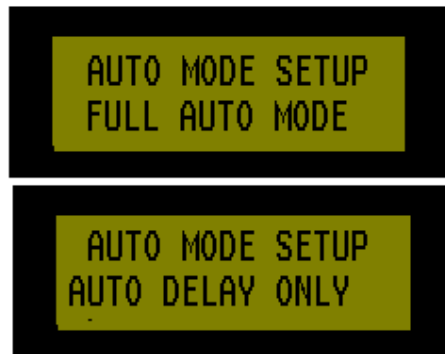
Each mode is identified by its own special character displayed after the delay value at the far right hand side of the display .The auto mode setting is saved and will be restored on power up , except in the case where no water depth information is present , and manual mode will be set.

In the main display ,when no water depth information is present , the AUTO MODE key has no affect. The system will remain in manual mode while no water depth information is being received on the navigation serial link..

Smart-ping Control Menu:

RECORDER MENU

The RECORDER SETUP MENU

The RECODER SETUP menu is entered by pressing the function key marked "REC". The following settings will only need changing when associated changes are made on the recording system.

Using the UP DOWN Arrow keys it possible to simply scroll through the entire list of three sub menu items. Once again pressing the RIGHT ARROW Key enters the sub menu for editing while the LEFT ARROW key returns the system to the main display.

Recorder Set up Recorder Delay
The value of internal delay in mSec's applied within the Recording system
 (Default = 0mSec)
Recorder Set up Recorder Sweep
The value of the total digitise window on the recorder (Default =160mSEc)

NOTE This setting is nothing to do with paper record sweep and is in fact total recording time in the recording system

Note: if changes are made to either of the above recording system parameters, the, changes must be reflected here enabling Smart-Ping system to correctly place the seabed on the record.

Recorder Set up Stagger
Sets the amount of the delay jump performed by the trigger unit on a delay change, this value should be set to less than half the "LIMIT VALUE" (Coda Recorder) on the seabed tracking gate on the recording system. (04 - 64mSec)
Requested delay changes that are less than the stagger value, will be effected in one single ping, and requested delay changes greater than the stagger value, will be effected in jumps of the stagger value on each successive ping, until the entire delay change has been executed in total.

Smart-ping Control Menu:

<div align="center">

TRACKING MENU

</div>

The TRACKING SETUP MENU

The TRACKING SETUP MENU as seen on the LCD Display
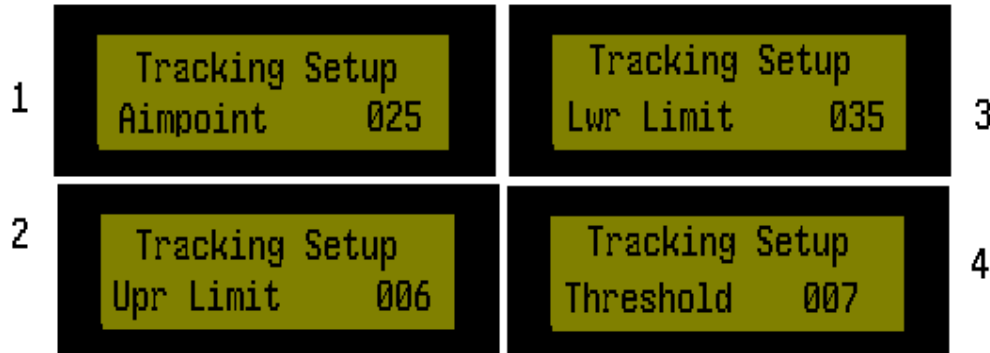
The following settings may need updating as changing seabed conditions dictate. Using the UP DOWN Arrow keys it possible to simply scroll through the entire list of four sub menu items. As with all the other menus on Smart Ping, the RIGHT ARROW Key is pressed to Enter and edit the sub menu item and the LEFT ARROW KEY to return to the main display.

Tracking Set up. Seabed Aim point
Seabed Aim point   1-100   (Default =15mSEc)
The position in mSec on the record where the seabed is to be placed
When Auto Mode is switched on.

Tracking Set up. Upr Limit
Upper Limit   1- 100   (Default= 5mSEc)
The value in mSec, above which, the seabed must not go on the record.

Tracking Set up. Lwr Limit
Lower Limit   1- 100   (Default =35mSec)
The value in mSec, below which, the seabed must not go on the record.

Tracking Set up. Threshold
Threshold   1-10   (no default setting)
Threshold is simply a counter for the number of times the depth must go out of limits before the auto delay changes are applied in auto mode (Default=1)
The Threshold Count relates to time 1 = 6 seconds of seabed position being out of limits and a count of 10= 33 seconds of seabed position being out of limits .

(All of the above four setting values are saved and restored on power up.)

As various types of known seabed slopes are encountered, it may be necessary to change the aim-point higher or lower on the record, in order to achieve less overall delay changes on a given line. *(See Operation Section of handbook)*

Smart-Ping Auto Manual Mode Operation
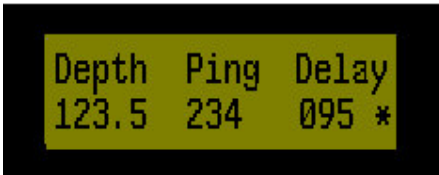
Auto Mode Operation.
This AUTO MODE key is simply used to toggle the systems operating mode from
Auto to Manual mode. However the function key has another function under the
System menu, it toggles the system between FULL AUTO MODE and
AUTO DELAY ONLY mode, when the key is pressed the system will display the
Selected mode setting for approx 2 seconds duration before returning the display to
the current system menu item once more.
The key is also used inside the TRACKING Menu for selecting the DEBUG mode of
operation. *(See Debug section of manual*)

In Full Auto mode, the system will change the ping rate and the delay period each
time the seabed moves outside the upper or lower limit on the record. The change
will take place after a number of counts have taken place
(see threshold setting under the tracking menu.)

In Auto Delay only the delay period is changed in order to position the seabed at the
desired aim point on the record, the ping rate is not adjusted. The change will take
place after a number of counts have taken place
(see threshold setting under the tracking menu.)

A small star character is visible on the far right hand side Of the display to the right of
the delay value, this indicates the system will monitor water depth and adjust delays
and Ping rate according to the depth and the current seabed position on the record.
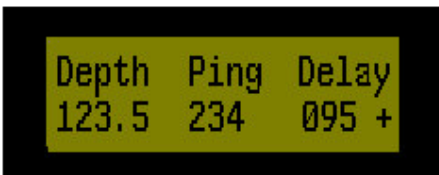
(Full Auto Mode display)

A small "Plus" Symbol visible on the far right hand side of the display indicates the
system will adjust the delay period only, leaving the ping rate as set, when ever user
set limits are exceeded in the detected seabed position on the record sweep.

(Auto Delay Only Display)

In manual mode the "Star" or "Plus" characters will disappear and the user then has
full control over the Ping Rate and delay values being applied by the system.

(Manual Mode display)

Smart-Ping   Auto Manual Mode Operation

Manual Mode operation

The Arrow Keys are used in a logical arrangement where LEFT ARROW
Means move cursor to the LEFT and Right Arrow means move the cursor to the
RIGHT. When no cursor is flashing but the system is in manual mode as indicated by
the display As seen above *(no "+" PLUS or "*" STAR symbol on display)*

By first pressing the RIGHT Arrow Key the cursor will first flash On the TENS unit of
the Ping
By first pressing the LEFT Arrow Key the cursor will first flash On the TENS unit of
the Delay

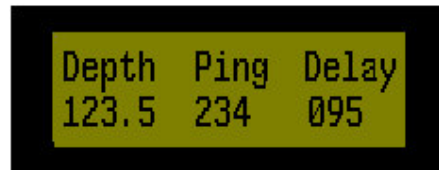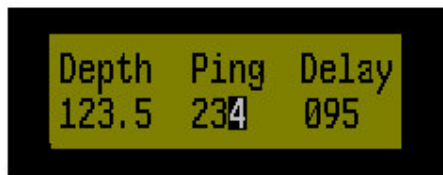Manual mode cursor on TENS of PING rate.

Pressing right arrow key will bring the cursor to the ones unit of ping rate as shown
above
Once the cursor is flashing on any parameter, then that value may be increased or
decreased by use of the UP DOWN arrow keys.

Simple Rules for Manual changes
The Rules of manual changes are as follows , The Ping Rate can not be the same or
less than the Delay value.
The Delay value can not be greater than or equal to the Ping Rate.
Decrement of 10's value will only occur when the value being decreased is greater
than or equal to 10, Delays of Zero are allowed and in this condition Delay and Ping
outputs are coincident.

General System Operation:
In Auto or Manual mode, Pressing any of the three Set up Function Keys will bring
the system into a menu display for setting of the various groups of set up parameters
as previously described. While the system is placed in any of these menu pages, the
system will be able to perform all its auto tracking functions as the system is
receiving water depth from Navigation every second. The systems full functionality is
preserved no matter what the user is doing with the menus.

Note: that water depth is not constantly updated on the display while manual
changes are being made to the Ping or Delay values, however once the cursor is
moved to the left and the flashing cursor is switched off, the displayed water depth
will be updated once more.

Smart-Ping   GeneraL System Operation

Annotation output:
In Auto or manual mode the serial string to the recording system is annotated with an appended Line number in the format   " L_0999_T278D124

This feature is ON by default and cannot be turned off.
There is however one important requirement for this system to annotate the recording system correctly. In order for this feature to work correctly, The line number group must be placed as the very last item in the navigation string, this situation is forced in firmware by copying out the line name parameter from where ever it resides in the incoming string, and appending it as a new parameter together with the annotation information as the last item in the string. The Recording system set-up for navigation needs to reflect this fact as no matter where the line name is within the string it will always be placed to the rear of the string when transmitted to the recording system by the SmarT-Ping System.

A suitable Navigation set up string must be selected together with a suitable Recorder system Navigation set-up, to cope with this change in the change of the Line number position within the outgoing string from SmarT-Ping.

The SmarT-Ping processor simply passes characters on to the recording system as soon as they are received, with only microseconds delay, and the output string is simply appended with the copied line information together with the current ping and delay annotation information.

The formatting of the Line number is critical to the correct operation and the characters must be terminated by either a carriage return or line feed character. The smart ping processor appends the annotation string in place of the navigation termination character and appends the termination character after the annotation string has been output to the recording system.

E.g. navigation input   ….   *"3456.90 L_0999CR LF"*
Output to Recording system would be ... *"3456.90 L_0999_T280D056CR LF"*
 (Where "T" stands for trigger or ping rate, and "D" is for delay period)

HIGH VOLTS Output Level
In order to change the pulse output levels to a higher voltage required by some source units, the user must press the RIGHT arrow key in the O/P Volts sub menu In the SYSTEM Menu, and then press either the UP arrow key to turn on the high volts ,Or the DOWN arrow key to turn off the HIGH VOLTS.
When turning on the High Volts the user is presented with a "YES NO" "are you sure" screen as shown below.

Left arrow key cancels the operation , Right arrow key turns on the High Volts
The output level will be at the unregulated DC input voltage.
The default setting is 4.5volts which is restored at power up.
(Closure outputs are not affected by this feature.)

Smart-Ping   System Hardware

Hardware: Trigger Unit
The trigger and navigation interface unit is a small 9-12v DC powered box, which has the serial connections to the Navigation and the Recording systems along with trigger connections to the Pinger Source and the recording system.
It has a single RJ45 (Cat5 standard network Cable) connection to the Display and keypad unit.

Front Panel

The picture above shows the version 2:02 April 2004 version of Smart Ping front panel.

Rear Panel
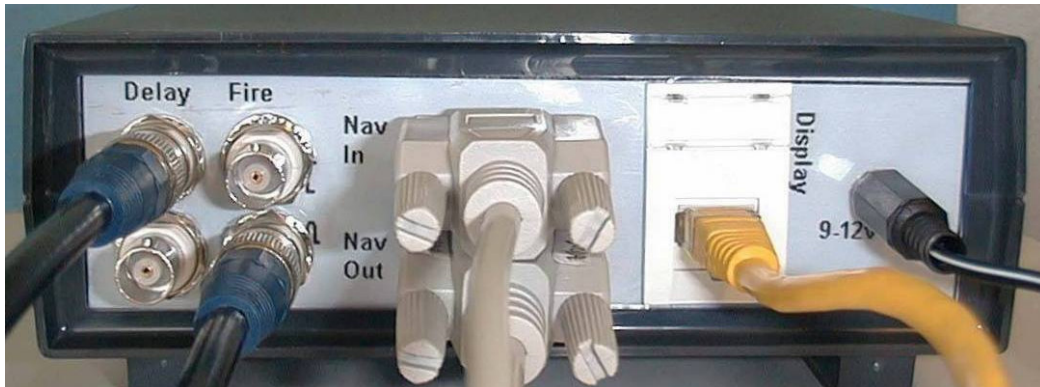
The picture above shows the version 2:02 April 2004 version of Smart Ping rear panel with wiring.

The Trigger unit control box is separate from the Keypad and Display unit, and has a single LED on its front panel to indicate trigger operation, On the rear panel (see picture above) the FIRE OUTPUT should be connected to the PINGER SOURCE trigger input and the DELAY OUTPUT should be connected to the recording system (CODA) input trigger.

The user should first determine if the particular equipment requires a closure or a pulse, as both forms of trigger output are available from the SmarT-Ping rear panel. Looking at the rear panel the Pulse outputs are available on the bottom two BNC Connectors and the CLOSURE outputs on the TOP two connectors.

Smart-Ping   System Hardware

Hardware: Display Unit

The display unit comprises of a hard wearing membrane keypad and LCD display panel housed in a light weight but robust desk top housing with a single RJ45 connector mounted on the sloped rear panel of the unit.

There are just four FUNCTION keys plus four ARROW KEYS
(there are also four spare keys for future system enhancements)

The display unit receives its power from the Trigger unit on the CAT5 type network cable, together with the display signals.

If the display unit becomes disconnected from the main unit, the system will continue to operate as normal, as soon as the display unit is reconnected the display will be returned as normal.

A standard (one to one RJ45 Patch lead) Network Patch lead can be used to connect the display to the trigger unit, the lead can be up to 20 meters in length.

Alarms:
The Display /Keypad unit has a buzzer and this will sound a short lightly audible beep when ever a key is pressed, The unit in Auto mode will however, begin to beep LOUDLY for several seconds when ever the user set upper and lower seabed limits on the current record have been exceeded by the water depth, the system only beeps if it is about to issue auto delays.
After the unit beeps two to three times and then stops, the Auto Delays will have been changed. The received water depths are averaged over three successive updates and will only trigger an auto delay change when the limits are exceeded by a "threshold count" times in succession.

This feature avoids the delays being changed for erratic depth information coming from navigation in rough weather and also allows the user to set a faster or slower acting systematic delay changes as a function of differing type of seabed slopes.

Smart-Ping   System Logic

Menu Logic:
Pressing a Function Key brings the unit to the associated menu group
Pressing the up or down arrow will scroll through the menus
(The menu lists have been kept to a minimum to avoid confusion.)
The value of the particular parameter will be shown on each menu line.
Pressing the RIGHT arrow key will select the menu for editing and the cursor will flash on the current value.
Pressing the UP or DOWN arrow will move the value through its limits,
These limits will vary for each parameter.
Pressing the LEFT ARROW will bring the system back to the menu page allowing further parameters to be changed within the same menu list.

Pressing the RIGHT ARROW will accept the current value and bring the system straight back to the main screen, where the water depth will be updated once more together with the current PING and DELAY values, The Auto mode char will be visible if the unit is in auto mode.

The parameters will be saved each time they are changed to the systems internal NON-VOLATILE RAM, ensuring the unit will power up with the current settings if the power is removed for any reason.

Power Down Power UP:
There is no power "ON OFF" SWITCH on the Smart Ping interface unit, it is assumed that once powered up, the system will be more or less in constant use, it is only possible to temporarily suspend the output of trigger pulses and closures, but apart from this feature all power resets are achieved by simply removing and reconnecting the input power.

If the unit is powered down, the system will return to its full operating mode in less than three seconds on power up. Restoring the correct ping for the water depth and the appropriate delay to position the seabed at the Aim point and restore Navigation strings with annotation to the recording system.
On power up there is an intentional delay to see if there is any Serial Data present, during this time the current firmware version is displayed , if water depth information is present ,the water depth will be set and if the unit is set to Auto mode ,Then auto delays will be calculated and applied from start up and the display will reflect these ping and delay periods.

If however the unit is set to Auto mode and if for whatever reason there is no serial data present , the unit will revert to MANUAL MODE with DEPTH set to zero and PING AND DELAY will be set to the previously saved values that were selected in manual mode. It is now up to the user to set the PING and delay periods manually, until such a time as serial navigation data can be restored.

If the unit is set to manual mode, the last PING and delay period that was used, will be set in the system, and the system will power up with these settings regardless of the presence of water depth information or not.

Smart-Ping   System Logic

Navigation link Time out:
A beep alarm is sounded continuously when the system is in AUTO mode
(Either full auto or delay only) if a three second period elapses with no navigation
strings coming into the system, the display will show the letters "NAV" in place of the
normal water depth, and a continuous beeping alarm will sound.
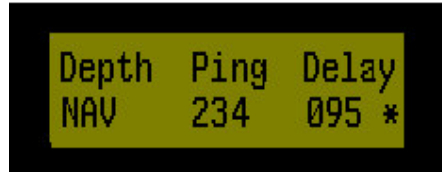
This alarm is different from the auto delay adjustment alarm, in that it doesn't stop,
until the navigation strings are restored or the Smart-Ping system is placed in manual
mode, there is no "Nav time out" alarm in manual mode.
This feature is useful for detecting short navigation data "drop outs" which may occur
on line from time to time.
The water depth value is set to zero in this condition so none of the auto modes can
be selected until water depth is restored, to cancel the alarm , the user must press
the auto mode button once, this clears the alarm sets the water depth to zero and
places the unit in manual mode.

Debug Mode
On selection of the Tracking menu, the AUTO MODE key has the ability to toggle a
special debug mode on or off.On entry to Debug mode the system will test all input
output features of the system
PULSE AND CLOSURE outputs will toggle on for a full second duration then off for
a second and then on again. This allows for easy AVO meter testing of the pulse and
closure outputs.
When checking the closure output place the positive terminal of the ohm meter on
the centre pin on the BNC connector,
The reading should toggle LOW to HI ohms every two seconds.
FIRE LED will flash on and off every two seconds.

Navigation OUTPUT will transmit a debug string approximately every second
as follows ….
                    "SMART PING 001" CR LF
                    "SMART PING 002" CR LF
                    "SMART PING 003" CR LF

The string is followed by a carriage return and line feed , and is transmitted at the
current navigation link baud rate settings , this simple debug string can be checked
on any standard PC terminal program at the Navigation end of the connection.

Smart-Ping   System Logic

Debug Mode contd.

On entry to the Debug mode the display will shown as below.

Navigation Input Debug Terminal
Will receive and display characters on the bottom line of the display , initially only the first 16 chars received will be displayed, if the user wishes to see the remainder of the string from the navigation system , simply pressing the RIGHT ARROW key will cause the system to display the string from the 14th character in the string , and pressing the key again will jump to the 28th character and so on , pressing the left key will return the display towards the first character in the string.

As soon as characters are received on the Navigation Input, the display will show the data received on the bottom line, with the total number of characters received on the top line as shown below.

This serial terminal feature is very useful for checking all serial connections.
Pressing the AUTO MODE key will turn off debug mode and return the system to normal operation immediately.
NOTE: Prior to selecting Debug mode, the user should remove the trigger connections.
(no harm will occur except that the Pinger and recorder system will be triggered every 2 seconds)

STOPPING THE TRIGGER UNIT
It is possible to suspend output triggers from the unit via the RUN STOP sub menu within the System menu. On entry to this sub menu, pressing the UP arrow key runs the unit and the DOWN arrow key stops the unit.
When the unit is stopped the FIRE Led will stop flashing and the ping and delay values will be blanked out on the display as shown below. All trigger outputs will stop.

The user must RUN the unit once more before any changes can be made to PING or DELAY values , On Entry to the System menu press the UP arrow key to go directly to the RUN STOP sub menu. Serial link activity is not affected by this feature. The default condition is RUN and this status will be restored on system power up.

Smart-Ping   Using the System
Using the System:
(A user guide to operating the SmarT-Ping System)
Once the system is set up for a particular seabed slope, it will move the seabed
position each time the user set limits are exceeded by the current seabed position,
this however may result in many delay changes being made over a short period of
time, if the aim point and the upper and lower limits are not set far enough apart to
cope with various types of seabed slopes.

So as a rule one must decide (after consultation with the GEO) how far down the
record you are happy to place the seabed in the knowledge that its going to rise
quickly towards the top of record as a function of a rising sea bed type slope.

The plan would be to place the aim point just a few milliseconds above the lower
threshold position and each time the delay is adjusted the seabed position will move
as far down the record as its currently possible to place it without losing valuable
penetration data below, and by setting the upper threshold to a low value of 3 or 4
milliseconds this will ensure the seabed has as much scope for movement before
delays are recalculated and the seabed re positioned again, for downward slopes the
plan would operate in reverse where the aim point would be set just below the upper
threshold and the lower threshold dropped to as far down the record as was possible.

Where large delay changes are likely to be effected by SmarT-Ping, the Stagger
value becomes more important, the stagger value should be set to a value of
approximately just less than half of the width of the seabed tracking search window
on the recording system, so when large delay changes are made, the recording
system will be able to keep a track on the seabed and hopefully not lose lock as a
function of automated delay changes made by SmarT-Ping.

For gentle undulating seabed's where the overall water depth is not varying by very
much along the line, (such as when rigid contour following with an MBES System)
Then a narrow window of operation (near the upper portion of the record) can be set
And the system will effect delay changes from time to time to keep the seabed at or
near the desired aim point in the upper portion of the display.
One final point to consider when using stagger is that if any smoothing of the seabed
returns is being used on the recording system, such as the setting that can be found
on the seabed tracking set-up window on the coda recording system, the staggered
delay will not work correctly with "smoothing ON" and the recorder seabed lock will
be lost each time large delay changes are made.

Smart-Ping   Using the system

Using the System:

What Mode to USE?
There are three modes of operation, which one should you use? As with most things, it depends on conditions, if for example you are working out into deeper than 60mtrs, the system can be safely left in **full auto mode** ensuring the fastest ping will be issued for any given depth, however the user should be aware that when the system is used in shallow water (less than 55mtrs) the system will generate ping rates that will quickly fill the "PING BUFFER" on the recording system.
On Coda this can be viewed by pressing the small "mode" button on the time and position display on the main recording window, as shown below….

Mode 2 display on coda recording system

SHALLOW WATER
In these sort of shallow water depths, the user should set a sensible rate of say 200mSec-210mSec and then switch the mode to "**Auto Delay Only**" where the system will continue to correctly position the sea bed using only the delay period and not adjust the ping rate, this way its quite safe to carry on into even shallower water and the system will only issue a fixed ping rate and the recording system will be able to cope with the fixed ping rate.

Factors affecting the ping buffer count for a given ping rate are…
Record length
Sample rate number of samples per ping
Number of times the output is being repeated to the plotter
(to improve annotation size on paper records normally)

Shallow Water Operation
In water depths of 30mtrs and below the auto delay functions of the SmarT-Ping system become redundant, and so the system should always be used in "manual mode" in these very shallow water depths.

In very shallow water when the system determines that there is not enough water column time to place the seabed at the user selected AIMPOINT, and calculate an accurate delay value according to the current water depth , the "SHOAL" feature is automatically turned on , (assuming that the system was in one of the auto modes)

When "SHOAL" is switched on the letters "SHOAL" are written over the water depth every second navigation string update, every other update the shallow water depth is displayed, in effect the word "SHOAL" flashes on and off, and the system remains in the selected auto mode but automatically sets the Delay value to 001mSec in an attempt to keep the seabed some where high up on the record,

Smart-Ping   Using the system

Shallow Water contd.

In this instance, the system will continue to monitor the water depth until the depth increases to a point where the auto delay calculation can produce a valid delay figure once more and the "SHOAL" feature will be automatically switched off.

The user should consider placing the seabed aim point further up the record (e.g. a lower value in mSec) when working in very shallow water, this action will extend the range into shallow water, in which the smart ping can operate , but generally in water depths of less than 30mtrs the user should switch to manual mode and track the seabed by adjusting delays manually etc.

Normal Operation (50-200mtrs)
At Some times it may be useful to move the ping rate for reasons of what's called the "wrap round" or "Ghost" where a second or third "seabed /sea surface ghost" image appears near the seabed on the current record, this can happen quite often especially in shallow water depending on weather and seabed conditions,

In order to remove the offending ghost image, which more than likely will affect the seabed tracking of the recording system, its normally only necessary to slow the ping rate by 10 or 20 mSec to move the ghost out of the critical seabed tracking window. Slowing the ping rate will take it up into the water column or speeding up the ping rate will bring it over the data
There are other times when small delay changes are in order, if for example a flat seabed is coming in more or less on top of a timing line on the recorder, the GEO will thank you for moving the seabed just below the timing line making for a much clearer image on screen and paper, this can also be avoided by setting aim-points mid way between the 10mSec timing lines and not leaving any thing set where the seabed will always be positioned on-top of a timing line.

System Settings
A complete guide to the system settings aboard Celtic Explorer
If for some reason the system should lose its settings or they are changed for whatever reason or saved as the wrong settings, here follows a list of what the main parameters should be set to on the Celtic Explorer.

System Set-up   The Baud Rate
This should be 9600 for the current link set up as defined in coda port settings for the Navigation link used on board , The current "Fugro I/O" settings are also the same.

Smart-Ping   Using the system

System Settings (Celtic Explorer)

There is a new navigation set up created in the coda and the settings are as follows
The Setup is called "SMARTPING"

Ident	**"SmarT-Ping"**			
"Time Basis"	**GMT**			
"Nav Basis"	**METRES**			
"Update Warning"	**30**			
separator	**"ASCII TEXT"**	**" "**		
key	**"ASCII TEXT"**	**"CODA"**		
easting	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
northing	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
kp	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
dcc	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
depth	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
altitude	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
smg	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
heading	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
junk	**"ASCII TEXT"**	**"variable"**	**0**	**1**
"Fix Number"	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
"Speed of Sound"	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
"Data Age"	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
"Nav Time"	**"ASCII NUMBER"**	**"variable"**	**0**	**1**
"Line Name"	**"ASCII TEXT"**	**"variable"**	**0**	**1**
"Nav Termination"	**"binary Integer"**	**1**	**10**	
endnav				

The SmarT-Ping firmware copies the line name, from where ever its currently defined to be in the system set-up, "Line At" setting, and assuming its not at the end of the string, the smart ping copies the line name and appends it to the end of the "Nav string", inserting it as a new parameter, together with the timing information. This means that the user must define the group where the line number is in the original string from Navigation as a JUNK parameter and add an extra "Line Name" parameter at the end of the list as can be seen in the "SmarT-Ping" Nav script set-up shown above, If however the line name parameter is actually the last parameter in the string, then the coda "Nav set-up" script would remain the same, i.e. one parameter for line name and the smart ping would still require the user to count the group number where the line name appears in the string , but when the system find's it is positioned at the end of the string, it will simply append the line name as it exists in the string with the timing information, this set-up allows for complete flexibility for any type of navigation set up possible, with coda and its "Nav string" arrangement.

Using the System:
A complete guide to the system settings aboard Celtic Explorer
System settings
The DEPTH AT should be set to 5 for the set-up shown on the previous page.
The LINE AT should be set to   9 for the set-up shown on the previous page.
The SEPARATOR should be set to a SPACE character   shown as " " on the LCD

The last parameter in the system settings may be changed from time to time and this is the DRAFT setting, the vessel draft may be found to vary by up to 0.4 of a meter over a period of a 28day trip.
A point to mention here is that draft is calculated each time the parameter is changed and is thereafter used as a fixed delay within the firmware in SmarT-Ping
The system uses a very simple look up table of delays versus draft and the table is fairly crude.

Using the System:

A complete guide to the system settings aboard Celtic Explorer
System settings
Draft setting contd
One may find that the actual delay applied, may not change for each
decimetre added or subtracted on the draft setting, any very small errors in
positioning of the seabed on the record can be attributed to incorrect draft setting and
the draft setting should be used as a means of fine tuning the delay positioning of the
seabed to exactly 10msec when the aim point is set to 10msec, if the seabed is
slightly above or below , then the draft setting should be adjusted to get the seabed
in exactly the right position. This has no affect on the delay figure being applied to the
recorder and the figure currently being annotated on the record, this just 'tweaks' the
calculations within SmarT-Ping to give the desired effect with the seabed position on
a given sweep. The delay figure that SmarT-Ping comes up with is the figure we
apply to the recording system and this figure is correct in time and is the figure that is
annotated to the record.
(*See formula appendix B   DRAFT has some small effect on delay calculations,*)

RECORDER SET-UP
The Recorder Delay is normally set to zero unless any internal delay is actually
added by the operator within the recorder set-up, this figure must match what is set in
the recorder otherwise the delays applied by the system will be incorrect for seabed
positioning on the record.

The Recorder Sweep is the setting that must match the "TOTAL RECORD TIME" on
the recorder; it has nothing to do with the paper or screen sweep time,
It must match the **recorder total record time**, other wise the ping rates calculated by
the system may have a ping occurring somewhere in the lower part of the current
record sweep time, if the record sweep is set shorter in SmarT-Ping than is actually
set in the recording system.
(*See formula appendix B   Rec_Sweep has a large affect on trigger calculations,*)

The Stagger figure is normally set to 4, however if the width of the seabed tracking
search window on the recorder system is set to be wider than 12 or 15 msec then the
stagger figure may be increased to approx half the width of the window on the
recording system. Delay changes larger than stagger will be affected over a series of
two pings each at a new staggered delay value until the new delay value has been
Reached, Setting "Stagger" to a higher value than the maximum expected delay
change will effectively turn the feature off.

Using the System:

A complete guide to the system settings aboard Celtic Explorer
TRACKING SET UP
The Seabed Aim point is set according to the seabed slope as described earlier in
the handbook. Normal setting would be in the order of 10-20mSec where there is not
a large change in water depth along a given line.

The Upper threshold is normally set to 3-8mSec bearing in mind if the slope comes
up very quickly, the system takes at least 7 successive exceptions to the limit before
the new auto delay will be issued, so care must be taken not to set the upper limit too
close to the top of the record or the system may allow the seabed to run off the top of
the record for a short time.

Using the System:

A complete guide to the system settings aboard Celtic Explorer
TRACKING SET UP contd.

The Lower threshold should be set to the point on the record where one does not want the seabed to appear below on the record. Normally set to 30-40mSec depending on conditions and "GEO" requirements.

As seabed rises, the limits set by Upper limit will eventually be exceeded, the system looks at water depth over a series of three updates and averages these depths
And also counts the number of times that the limit has been exceeded , once the system exceeds the **THRESHOLD** count the auto delays are re calculated.

The "threshold" setting has the effect of delaying or speeding up the changing of delays as a function of varying water depth, at Threshold =1 the seabed position must exceed limits for over 5 –6 seconds.
At a setting of 10 the seabed must exceed limits for over 33 seconds.
In rough weather, the "threshold" should be increased, to avoid invalid changes due to bogus depths from echo sounder, and with quickly rising or falling slopes the threshold figure should be decreased to speed up system reaction time and avoid the seabed going off the top of the record with rising slopes and going to far down the record with falling slopes.

SAVING SETTINGS
After each setting in any of the thee system menus are adjusted, the changes will be written and saved to the systems internal NON VOLATILE RAM after the next navigation string water depth has been written to the LCD Display, while the system is in the main window showing "DEPTH PING DELAY".
The are only two exceptions to this , as described earlier in the manual , Menu 6 and 7 in the System set-up menu, are not saved , the O/p Volts level menu and the Run Stop menu , which both default to Low volts and run mode respectively on power up.

If the user wishes to change the operating mode the user must first enter the SYSTEM menu and then press the AUTO Key where the system will toggle between "FULL AUTO" and "DELAY ONLY" mode, This mode is saved and will be restored on power up, assuming water depth information is present while the system is booting up, the boot up process takes approx three seconds.

Smart Ping:

Upgrading the system firmware:

Rovtec supply a program to re-program the SmarT-Ping main processor firmware.
This program is used with any Rovtec supplied field firmware upgrade File.
The operation is simple and fast. The small upgrade file can be emailed to any
vessel. (16Kbyte attachment)
The upgrade file and "Boot-loader" program are loaded onto a Floppy
The unit can be re-programmed without removing the cover, via the NAVIGATION
INPUT connector. A standard One to One 9 Way serial lead is used to connect a
standard com port on any laptop or PC which holds the upgrade file and
"Boot-loader" program.

The user places the floppy into the laptop and runs the program and simply resets
the power to the smart ping unit and then uploads the firmware upgrade via the serial
lead connected to the navigation input connector. The Operation takes only 20
seconds. There is a help file for using the Boot-Loader on the firmware upgrade
floppy disk.

Firmware UPGRADE requires a Floppy disk, Laptop, Serial cable, Smart ping unit

Smart Ping Maintenance

Servicing SmarT-Ping
There are **only two** serviceable parts inside the SmarT-Ping unit and these are the trigger output OPTO ISOLATOR CHIP, and the Clock Generator chip.

The Output Chip is a Radionics (RS) Part Number 307-064 "quad opto-isolator Transistor unit" supplied in the Spares kit.
The Clock generator chip is a small 8pin micro, also supplied in the spares kit

If any of the Pulse or closure outputs fail for any reason the Trigger Output Chip must be replaced. These outputs can be fully checked quickly and simply with an AVO meter by entering the special DEBUG MODE by pressing the AUTO MODE key within the TRACKING MENU.
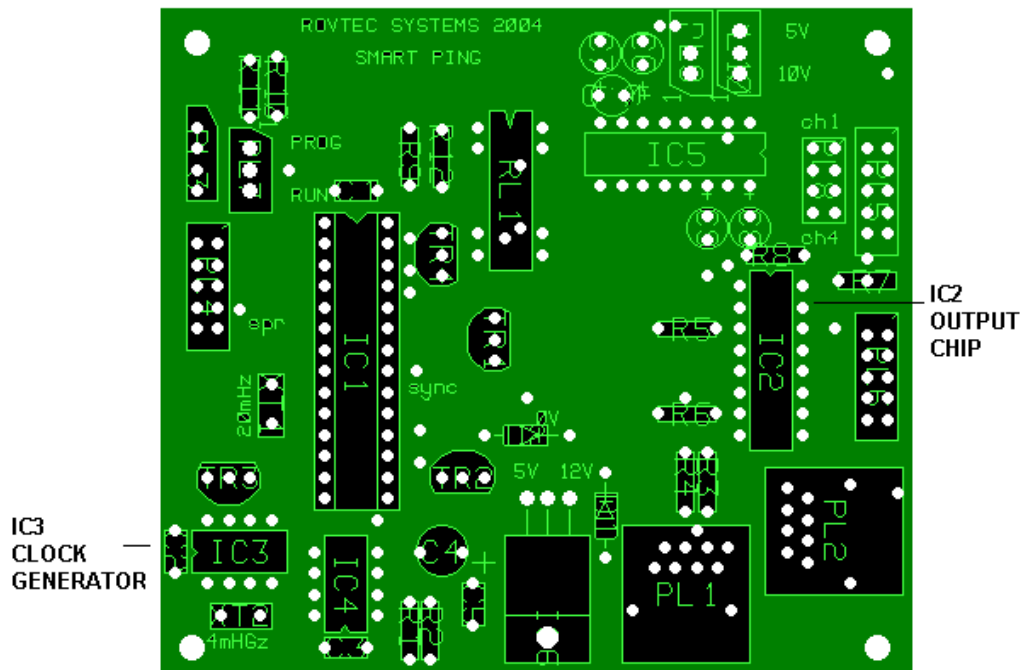
Instructions for replacing output chip:

Power down the unit remove the four base cross head screws and remove the top cover and locate the Output Chip as per the drawing above, It will be necessary to remove the top processor board, remove two nylon screws and lift off the top board after removing the various board connectors.
Locate remove and replace the chip, replace the top board and associated connectors and replace the two nylon screws to secure the board back onto the top of the trigger board. Replace lid and secure the four base screws.

Smart Ping Maintenance

SYSTEM CLOCK FAILURE
The second serviceable part is the clock generator microprocessor
The Highly accurate quarter millisecond system timing clock is generated by a highly reliable small 8pin microprocessor as shown in the picture of the trigger card above. It is labelled with the letters "CLK" on the top side of the chip.

If for any reason an error occurs with the system clock the system displays a major error screen as follows
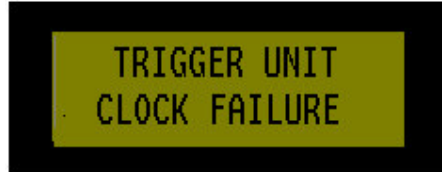
The system checks the clock is functioning correctly every four seconds.
Should the above error message appear, the unit should first be powered down and then powered up again to see if the clock fails again or starts up correctly.

However, If this message continues to be displayed each time the system is powered up (or at least within four seconds of power up) then the CLOCK generator processor should be changed. The same instructions apply as for replacing the output chip in terms of removing screws and cover etc..

System Spares Kit
Contains
One   16 pin OPTO ISOLATOR Chip
One   8 pin Clock Generator Microprocessor chip
One   Floppy Disk with Tiny Boot-loader program plus help document for using the
           boot loader program for field upgrading firmware.

The "re programming lead" is any standard serial cable , the Laptop or PC can be simply plugged into the Navigation output end of the navigation link cable.
Only Transmit and receive and ground are used.
(ensure that pins 2 3 and 5 are used for this operation)

To test any serial lead, simply connect the lead to the NAVIGATION INPUT Connector, and run a terminal program on the PC end and run the special DEBUG Mode on Smart Ping.
On the PC terminal you should see SMART PING 001 SMART PING 002 etc
and any characters typed on the terminal that are followed by the enter key
will appear on the Smart Ping display. This proves that the lead is ok and will work with the "Boot-loader " program.

Smart Ping General Information

What does SmarT-Ping System Do??

The Sub Bottom profiler system on the Celtic Explorer is a 4x4 hull mounted 3-4kHz profiling system connected to an "SES Probe 5000" Power source from which data is recorded to a "CODA DA200" recording system.

Because the transducers are hull mounted, this naturally means there will be a varying water column between the energy source and the seabed as a function of changing water depth, The SmarT-Ping system removes this water column time (By applying a timed delay) and triggers the source and the recording system so as to arrange that the returned seabed data always appears at the optimum position for viewing on the paper (and tape) record.   i.e. at the top most portion of the record, affording the maximum period of potential penetration recorded below.
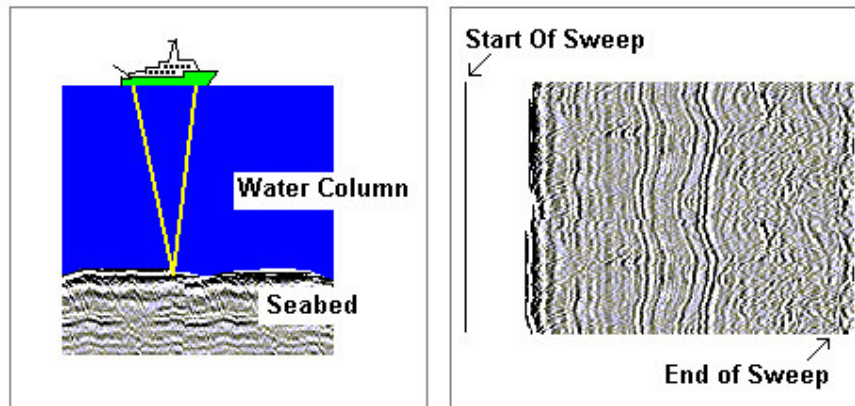
The Water Column is defined as the time it takes energy to travel from the source (ships hull) to the seabed, the "Seabed time delay" is defined as the time it takes energy to travel from the hull mounted source (transmitter) to the seabed and back to the receiver on the ships hull.

This time is calculated as (Water Depth) x 2 /1.5 in milliseconds

(Using 1500mtr / second as the standard figure for speed of sound in water)

The main task of the system is to take into account the record sweep period of the recording system and the current water depth, and to calculate the fastest possible ping for the given water depth and apply the most appropriate delay keeping the seabed at the upper most portion of the record sweep.

Also in the execution of these delay changes to avoid the user having to constantly adjust the seabed tracking thresholds on the recording system by staggering all delay changes to occur inside the seabed tracking "GATE WINDOW thereby avoiding loss of seabed tracking by the recording system and keep the TVG triggering from the correct position on the record sweep.

Smart Ping Handbook Glossary
Terms and descriptions used in this manual
Ping
The trigger to the energy source that fires the "Pinger" or sub bottom profiler system, generally used to describe the rate of these triggers in milliseconds .
Delay
The time period in milliseconds required to position the seabed in the uppermost portion of the record sweep in milliseconds. Generally refers to the
Term "seabed delay time".
Sweep
The time period of the recording system start to end of record in milliseconds.
Depth
Refers to the current water depth received from the navigation serial string being sent by the navigation system to the recording system.
Sea Bed Aim Point
The position in milliseconds where the SmarT-Ping System operator requires the seabed to appear on the record sweep. (measured from top of sweep = 0mSec)
Upper Threshold   (Upr Limit)
The position in milliseconds on the record sweep, above which the seabed must not move in real time, if the seabed moves above this position, the system will move the seabed by changing the delay periods applied to the recording system to move the seabed back to the desired aim point. The Ping Rate will also be recalculated if full auto mode is selected.
Lower Threshold (Lwr Limit)
The position in milliseconds on the record sweep, below which the seabed must not move in real time, if the seabed moves below this position, the system will move the seabed by changing the Delay periods applied to the recording system to move the seabed back to the desired aim point. The Ping rate will also be recalculated if full auto mode is selected.

Threshold   count for the amount of time seabed is out of limits before auto changes are executed. (1= 6 seconds 10 = 33 seconds)

Auto /Manual Mode Function Key
The operation mode of the Smart-Ping system, in "auto" the system will move the seabed automatically as a function of water depth and current threshold settings, in manual mode the system does not move delays automatically and the user must change delays manually to position the seabed within the record sweep.
Tracking Function key
A function key, which allows the user, set the "seabed aim point" "Upper" and "lower Threshold" settings in the system and refers to water depth tracking with a view to keeping the seabed at a desired point on the record sweep.
Stagger
The amount by which delays are moved in small jumps to stagger the application of new delay changes in order to avoid losing "Seabed Lock" on the recording system.
Seabed Lock
Describes the software algorithm in recording system to automatically detect the seabed and trigger the start point for the time varied gain (TVG) ramp within the recording system.
**TVG**
Describes the time varied gain function of the recording system where by the gain is swept over time from a low gain to a higher gain across the time of the record, the recorder usually arranges the start of the TVG ramp to occur in a position as close to the seabed as possible by automatically detecting the actual seabed signal and starting the ramp at this point.

"SHOAL" alarm condition that exists when the water depth is too shallow to place the seabed at the desired position on the record.

APPENDIX   A

SYSTEM LAYOUT DIAGRAM (Celtic Explorer)
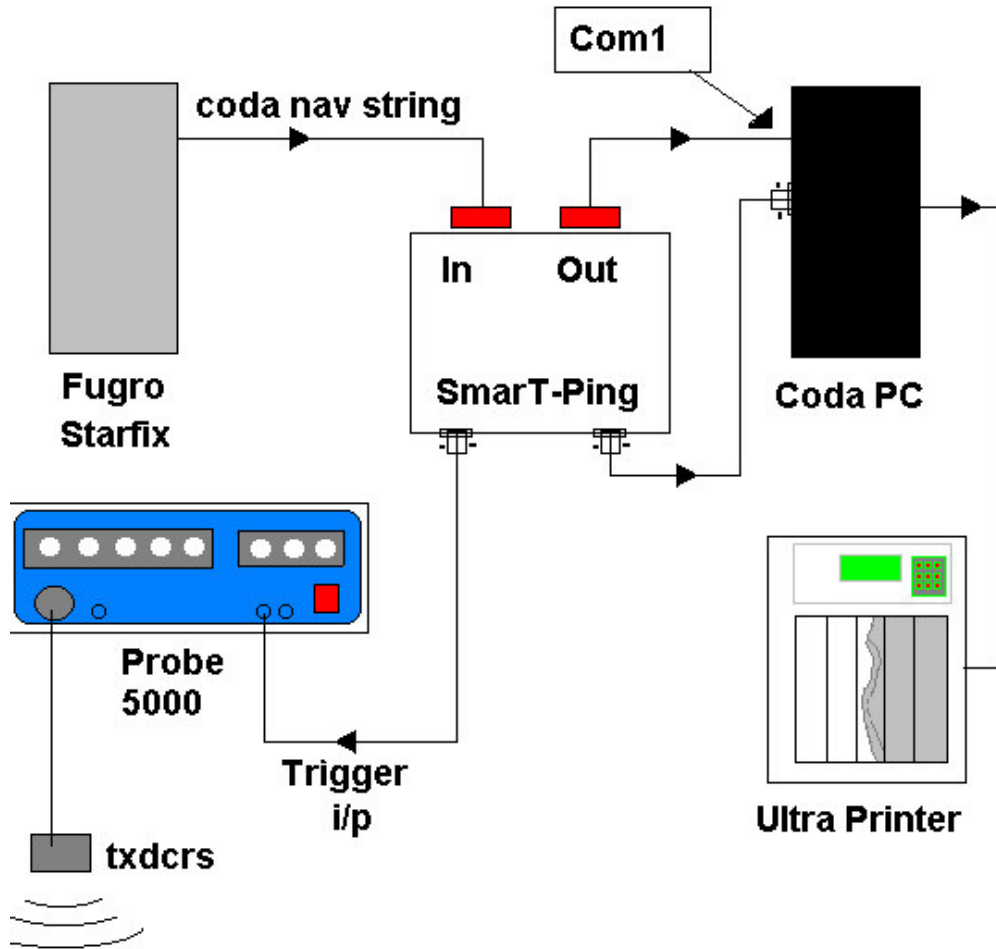
APPENDIX   B

SYSTEM FORMULA
Listed here are the basic formula used to calculate the various system parameters used in the system to effect delay change and seabed position tracking.

"Start of window" is calculated as follows
(Top of Recorder record window or current "Top of Sweep")

Terms used to calculate start of window
Auto_delay = current delay applied to recorder trigger
Rec_delay = any internal recorder delay applied (normally set to zero)
Draft_delay = is a fixed delay set by vessel   draft*2/1.5 in msec

start_window = (auto_delay + rec_delay+draft_delay);

From start of window its possible to find where the seabed is on the current record
Knowing the current depth
Seabed = water depth *2 /1.5 and with the subtraction of "start window" from "seabed" we can find how far down or up the record, the seabed is at present.

One further parameter is required to set the auto delay
SeaBed_AimPoint = desired seabed aim point on current record

If the system "upper" or "lower limits" are exceeded, a new auto delay can be calculated from the following …..
Seabed = water depth *2/1.5
auto_delay = Seabed - (SeaBed_AimPoint+Rec_Delay+draft_delay)

The new ping rate is then simply set from the following formula
Using the new auto delay and the recorders sweep time and adding a small number of milliseconds for system redundancy between pings.

New_Ping_Rate =   (Rec_sweep+auto_delay) + 3

3mSec are added to avoid a second ping within its record sweep period.

APPENDIX   C

SYSTEM WIRING   (April 2004 Rev 2:04)
Important information regarding the rear panel connections on Smart-ping.!

Rear panel of smart ping April 2004 Ver 2:02

Coda Trigger Input normally set to CLOSURE   (use "Delay" Top Connector)
Pulse 5000 Trigger Input normally set to PULSE   (use "Fire" Bottom Connector)

Nav In (female 9 Way)   **Pin 5   Ground**
                                 Pin 4   NC --
                                 Pin 3   Receive From Navigation
                                 Pin 2 Transmit *
                                 Pin 1   NC --

Nav Out (male 9 Way)   **Pin 5   Ground**
                                 Pin 4   NC --
                                 Pin 3   NC --
                                 Pin 2   Transmit to Recording System
                                 Pin 1 NC --

*NB: Do not connect the transmit line from the Smart-Ping at the Navigation end of
the "Nav In" lead as this will at best, heavily load the serial transmit signal and at
worst stop the recording system from seeing the output navigation string from the
Smart Ping unit on the "Nav Out" connector Pin 2.

"Field Re programming" is the only reason that Transmit and Receive lines are both
wired on the "Nav in" Connector.
For re-programming in the field use a lead with both Pin 2 and Pin 3 connected to the
PC or laptop. A "one to one" serial patch lead will work fine.

The Smart-Ping unit transmits data to both the "Nav In" and "Nav out" connectors but
only the output to the recording system should be connected for normal day to day
operation in the field.
The Display Lead is standard (one to one) network patch lead (max 20mtrs)
The DC power input socket is (+ve) **POSITIVE** to the centre pin max 17v Dc input.