GRID® - Gauging Run Integrity Data System
OPERATING MANUAL

Onlines' GRID® system, when fitted to a pig and run through a pipeline, detects the presence and location of defects along the pipeline and transmits the information in the form of coded acoustic pulses

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PINGER CONFIGURATION INFORMATION	
PINGER MODEL:	
PINGER SERIAL NUMBER:	
PINGER FREQUENCY:	
PINGER ACOUSTIC POWER:	
PINGER PULSE LENGTH:	
PASS PING RATE (PPR):	
PASS DATA RATE (PDR):	
PASS BATTERY LIFE AT +5°C:	
FAIL PING RATE (FPR):	
FAIL DATA RATE (FDR):	
FAIL BATTERY LIFE AT +5°C:	
SPECIFIED ON PRESSURE:	
SPECIFIED OFF PRESSURE	
TEST CONNECTION LOCATION:	

GRID_5001

Checked	(IF APPLICABLE)	**Date**	(IF APPLICABLE)
Approved	APPROVED ca , 16:46:47, 11/10/2017	**Date**	

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COMMENTS:

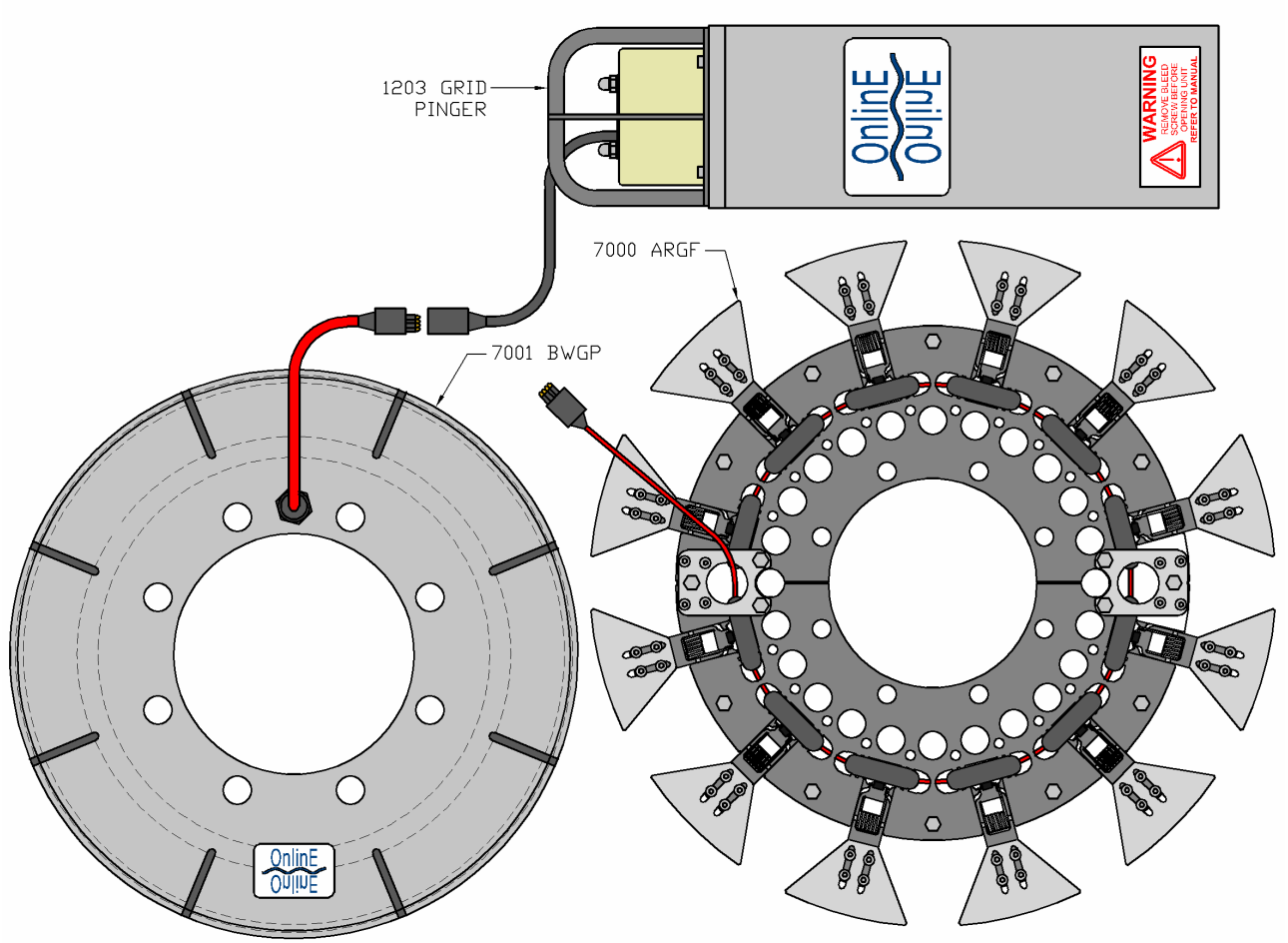
CONTENTS **Page**

1. GENERAL DESCRIPTION

Refer to the Page 2 for the specific configuration of the GRID® System supplied with this manual.

OEL's GRID® Systems consist of an acoustic GRID® Pinger connected to a 7001 Break Wire Gauge Plate (BWGP) and/or a 7000 Auto Resetting Gauging Fingers Ring (ARGF). When fitted to a PIG and run through a pipeline, the system detects the presence and location of multiple* defects along the pipeline and transmits the information in the form of coded acoustic pulses at ranges up to 1km subsea. The transmissions can be monitored using an acoustic receiver and the data can be decoded using OEL's dedicated AUDIOSCOPE software, or after some practice, by simply listening to the signal and counting pulses using the AUDIOSCOPE software as a visual aid.

The major advantage of this system is that the operator does not need to recover the pig to visually inspect the gauge plate, or run an intelligent pig - both of which are very time consuming and expensive procedures, particularly if the pig is being received subsea.



The current system can be manufactured to specific project specifications and supplied with either an 800 or 1200 sized GRID® Pinger. These are based on OEL's proven 800 and 1200 Series acoustic pinger designs. The 7000 ARGF Ring is typically suitable for 10" pipelines or larger.

* A 7000 ARGF ring must be fitted in order to detect multiple events.

2. SYSTEM OPERATION

In the standard configuration, the 7001 BWGP and/or ARGF are fitted to the disc packet on the front of a PIG and connected to a GRID® Pinger that is mounted inside the PIG body.

Once activated, the GRID® Pinger will transmit the RTC time (in the format HH:MM:SS), and log the start time into memory.

The GRID® Pinger will monitor the status of the 7001 BWGP and providing it is undamaged, will enter into its PASS state.

When the GRID® Pinger is in the PASS state, it will transmit a single pulse at the Pass Ping Rate (PPR), and will transmit the Time Since Start (TSS, in days, hours and minutes) at intervals determined by the Pass Data Rate (PDR).

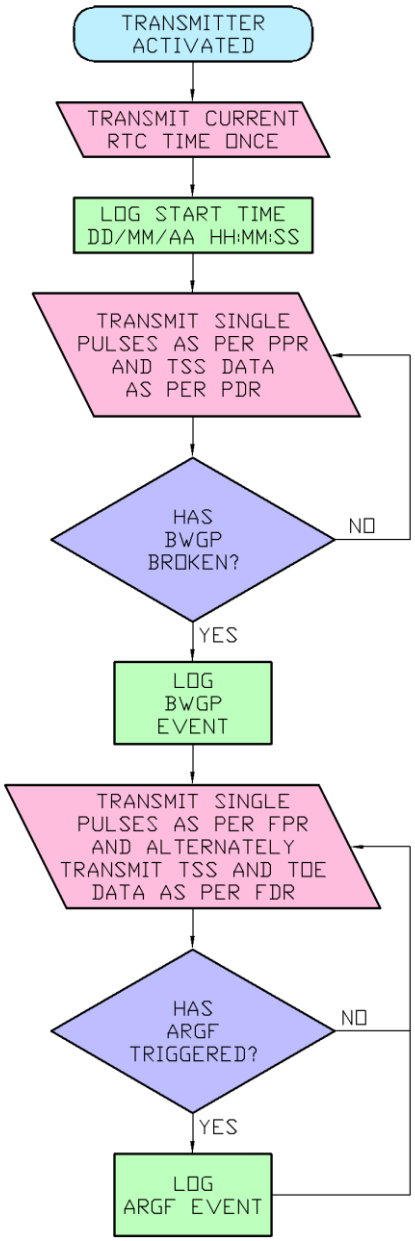
The GRID® Pinger will remain in the PASS state until it detects that the BWGP has broken, at which point the GRID® Pinger will log the Time of Event (TOE, The time after the point of activation at which the event occurred in the format DD:HH:MM) in memory, transmit a double pulse, and then enter into the FAIL state.

When the GRID® Pinger is in the FAIL state, it will transmit a single pulse at the Fail Ping Rate (FPR), and will alternately transmit the Time Since Start (TSS) and Time of Event (TOE) at intervals determined by the Fail Data Rate (FDR). Using the TSS and TOE data, the user can calculate the approximate time and position of the pipeline defect.

Only the first event will be detected by the BWGP. Any subsequent events will be detected by the ARGF ring (if fitted) and logged by the system.

Up to 80 event time stamps can be logged by the GRID® Pinger and can be downloaded to a laptop using our dedicated software once the pig has been recovered.

The PPR, PDR, FPR and FDR rates, along with the acoustic power and pulse lengths all affect the battery life of the GRID® system and can be tailored to meet the project requirements.



The system can be easily customised to transmit the desired data at the desired time and over the desired duration, according to client specifications.

Online Electronics work closely with clients and PIG manufacturers and aim to provide a transparent interface at all stages of the specification, design and testing of the system to ensure the desired performance is achieved during operation. Please contact Online Electronics Ltd for further details.

3. SYSTEM SPECIFICATIONS

3.1. STANDARD 800 SERIES GRID® PINGER

GENERAL:

Battery Type ..... 24V DC, 16 x Alkaline AA Cells

Acoustic Output Power ..... 20W ±3dB Typical (Configurable 5W to 60W)

Beam Pattern ..... Omni-directional ±3dB

Frequency ..... Pre-Configured within 24-30kHz (9-18kHz and 30-40kHz options available)

Operating Temperature Range .....-2°C to +60°C

External Pressure Rating ..... 4500m / 450bar

Weight in Air 4.1kg

MATERIALS:

Housing Material .....2205 DUPLEX STAINLESS STEEL

Endcap Material..... 316 STAINLESS STEEL

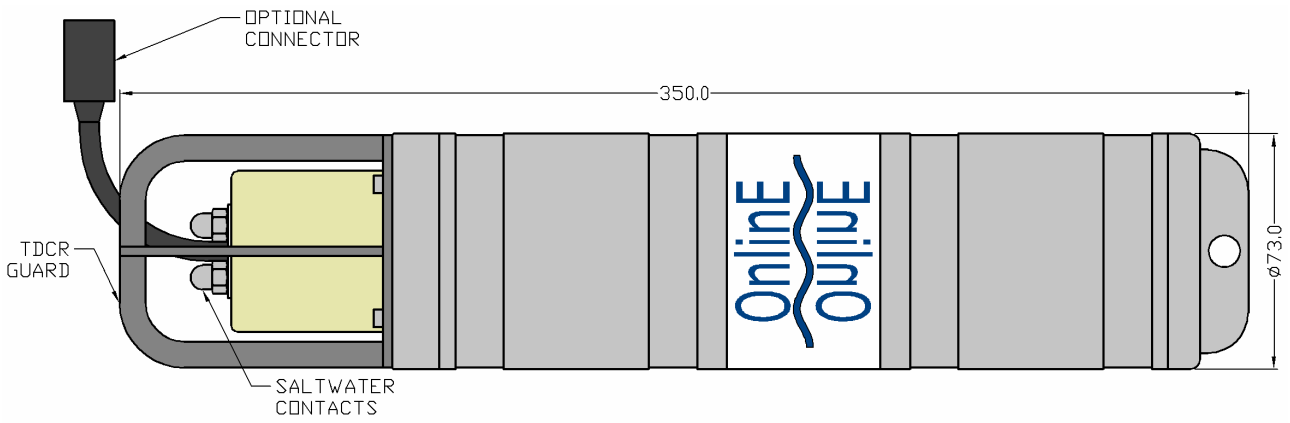
Transducer Housing Material ..... PEEK / PU

O-Ring Material NBR70

BATTERY LIFE:

The following table shows typical battery lifetimes for a 20W 800 GRID® Pinger with a standard 4 msec pulse length at +5°C. Please note that the Acoustic Power, Pulse Length, Ping Rate and Data Rate all affect the battery life and can be configured by OEL to meet specific project requirements. Please contact Online Electronics for more information.

PING RATE (Seconds)	**DATA RATE** (Minutes)	**TYPICAL BATTERY LIFETIME** (Days)
2	2	16
2	5	18
2	10	19
5	2	27
5	5	36
5	10	41



3.2. STANDARD 1200 SERIES GRID® PINGER

GENERAL:

Battery Type ..... Custom 31.5V Alkaline Battery Pack, BATT-11200

Standard Acoustic Output Power .....20W ±3dB (Configurable 5W to 60W)

Beam Pattern ..... Omni-directional ±3dB

Frequency ..... Pre-Configured within 9-18kHz (24-30kHz and 30-40kHz Options Available)

Operating Temperature Range .....-2°C to +60°C

External Pressure Rating ..... 3000m / 300bar

Weight in air 11.5kg

MATERIALS:

Housing material .....2205 DUPLEX STAINLESS STEEL

Endcap material .....2205 DUPLEX STAINLESS STEEL

Bleedscrew material..... 316 STAINLESS STEEL

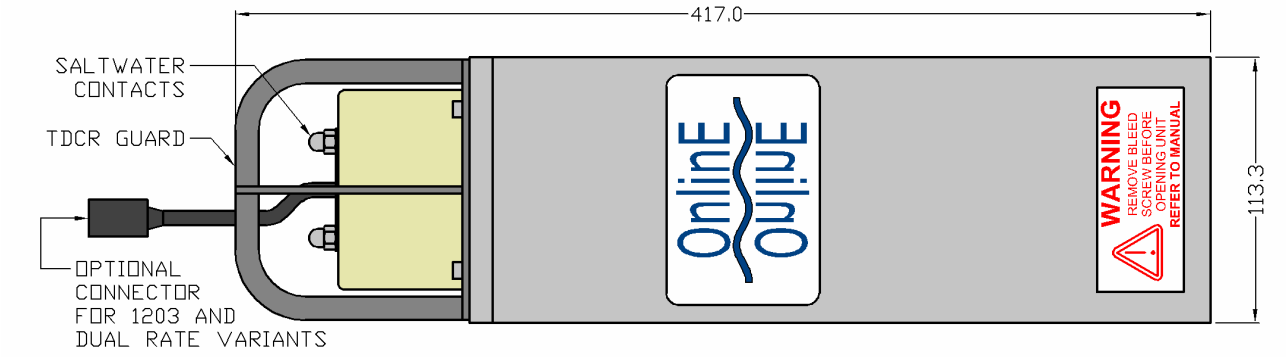
Transducer Housing material..... PEEK / PU

O-ring material NBR70

BATTERY LIFE:

The following table shows typical battery lifetimes for a 20W 1200 GRID® Pinger with a standard 10 msec pulse length at +5°C. Please note that the Acoustic Power, Pulse Length, Ping Rate and Data Rate all affect the battery life and can be configured by OEL to meet specific project requirements. Please contact Online Electronics for more information.

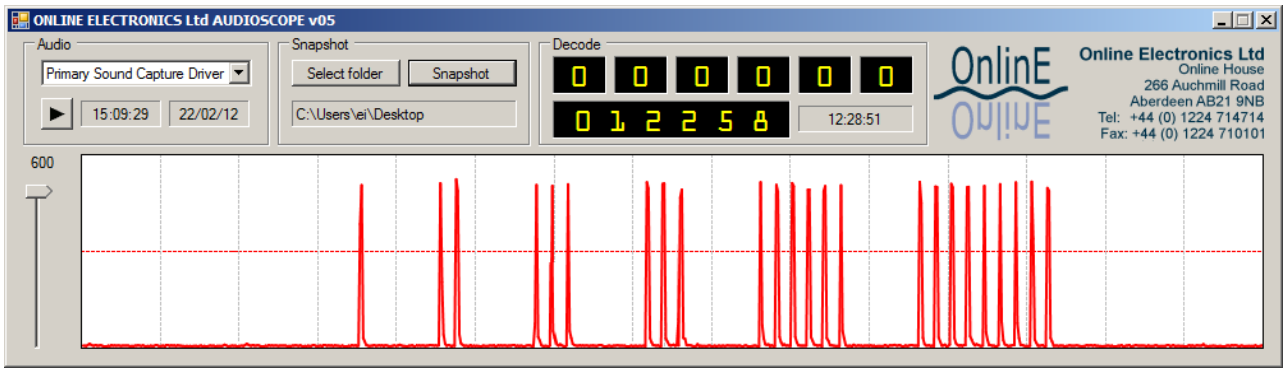
PING RATE (Seconds)	**DATA RATE** (Minutes)	**TYPICAL BATTERY LIFETIME** (Days)
2	2	59
2	5	70
2	10	74
5	2	102
5	5	140
5	10	159



4. AUDIOSCOPE SOFTWARE

Online Electronics' AUDIOSCOPE software plots the amplitude of audio signals against time allowing visual monitoring and interpretation of the audio signals generated by Acoustic or EM receivers connected to the Line In or Microphone input of a laptop or PC. This is particularly useful when the signal being received consists of an amplitude modulated coded transmission.

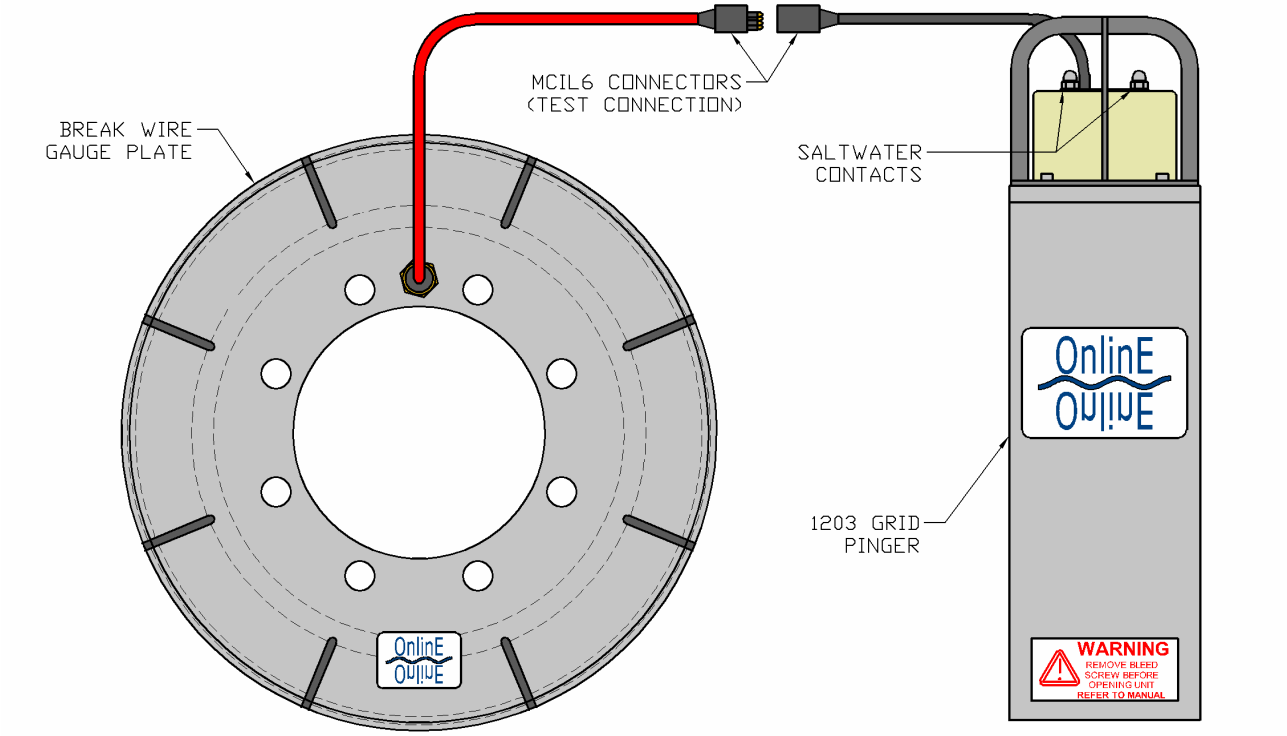
The software has several intuitive and useful features such as a live 15 second buffered display, Y-Scale Adjustment, Pause/Play function, Screen Snapshot function, Audio Snapshot function and OEL Acoustic Data Transmitter decoding function. Refer to the latest AUDIOSCOPE MANUAL for further information.



5. SYSTEM TEST

5.1. EXAMPLE SETUP

The illustration below shows a typical configuration for the GRID® system without an ARGF ring. In this configuration, the 7001 BWGP is fitted to the Disc Packet at the front of the PIG, the GRID® Pinger is mounted inside the PIG body, and the two are be connected together by cables terminated by MCIL6 connectors. Note: In some cases different connector configurations may be required depending on the layout of the PIG.



If the connection between the BWGP and GRID® Pinger is broken while the system is activated, the GRID® Pinger will respond as if the gauge plate has been damaged. This simple behaviour can be used to test the system. Note: If testing the GRID® System in air, the acoustic hydrophone should be placed within 10cm of the transducer head on the GRID® Pinger. If using a GRID® Pinger with frequency below ~15kHz, the acoustic transmissions should be audible without using a receiver.

Most GRID® systems are designed with a TEST CONNECTION point where the BWGP can be easily disconnected in order to test the BWGP functionality. The location of the TEST CONNECTION is detailed on Page 2 of the manual. Due to constraints of the PIG design, some GRID® systems don't have a TEST CONNECTION point and the location is defined as NA. In these cases, disconnecting the BWGP is not recommended if the operator is not familiar with the 7001 BWGP cable design and installation. If this test is required before deployment, then partial disassembly of the Disc Packet on the 7001 BWGP end of the pig may be required in order to gain access to the cable connection on the BWGP itself.

Please refer to Page 2 of this manual to confirm the configuration of the current GRID® System being used.

Below are typical repetition rates for a GRID® Pinger that will be used as an example to help illustrate the test procedure:

Pass Ping Rate, PPR:	5 Seconds	Pass Data Rate, PDR:	5 Minutes
Fail Ping Rate, FPR:	2 Seconds	Fail Data Rate, FDR:	5 Minutes

5.2. TEST PROCEDURE

1. Close the mechanical link between the Saltwater Contacts to activate the GRID® Pinger. Take a note of the Time of Activation, TOA (in this example, we'll assume the TOA to be 13:28:15, in HH:MM:SS format).

2. Approximately 10 seconds after activation, confirm that the unit transmits a series of pulses that when decoded correspond to the time of activation. For information regarding the decoding of the acoustic transmissions, please see Section 4 of this manual.

3. Confirm that the GRID® Pinger continually transmits a single acoustic pulse at the PPR (every 5 seconds in the example system).

4. In addition to the single acoustic pulse, the GRID® Pinger will transmit the Time Since Start data, TSS, at intervals determined by the Pass Data Rate, PDR. In our example, the first TSS transmission would be at 13:30:00, and would consist of a 6 groups of pulses. The number of pulses in each group would be [1 1 1 1 1 3], which when decoded corresponds to the time 00:00:02 (in DD:HH:MM format).

5. If left in this state, the GRID® Pinger would continue transmitting the TSS at 5 minute intervals (00:00:07 at 13:35:00, 00:00:12 at 13:40:00, 00:00:17 at 13:45:00, 00:00:22 at 13:50:00 etc.) while continuing to transmit single pulses at the PPR in-between the data transmissions.

6. Once the PASS state behaviour above has been confirmed, disconnect the gauge plate by opening the TEST CONNECTION between the GRID® Pinger and the BWGP (refer to Page 2 of this manual for the location of the TEST CONNECTION of the accompanying GRID® System). In the example system, the location of the TEST CONNECTION is the interface between the two MCIL6 connectors as shown in Section 5.1.

7. Confirm that the GRID® Pinger transmits a double pulse just after the BWGP is disconnected and record the time when this occurred. The Time of the Event data (time of event after activation), TOE, will be transmitted within 1 minute of the BWGP event. If the event occurred at 15:05:30, then at 15:06:00 the GRID® Pinger would transmit the TOE, 00:01:38, indicating that the BWGP event occurred 00 days, 01 Hours and 38 Minutes after the Time of Activation.

8. Confirm that the GRID® Pinger now transmits single pulses at the Fail Ping Rate, FPR (every 2 seconds in our example) and that the Pinger alternately transmits the TSS and TOE at intervals determined by the Fail Data Rate, FDR (every 5 minutes in the example system).

9. Confirm that the TSS and TOE values being transmitted agree with the recorded time of activation and the time of BWGP event.

10. Once the above functionality has been confirmed, open the mechanical link to deactivate the GRID® Pinger. Re-make the TEST CONNECTION and wait for 1 minute to allow the GRID® Pinger to fully deactivate and reset.

11. Repeat steps 1 to 4 and confirm that the GRID® Pinger resumes transmitting single pulses at the PPR, transmits the TSS at the PDR and the TSS data corresponds to the new TOA.
    Note: No TOE will be transmitted providing the test connection has been mated properly.
12. Re-open the mechanical link to deactivate the GRID® Pinger. The system is now ready for deployment.

6. OPERATIONAL PROCEDURES

6.1. PRE-DEPLOYMENT

Prior to deployment, a system test should be carried out to ensure that the system is functioning and the relevant personnel are familiar with its operation. For details of the system test, see section 5 of this manual.

The system test requires the use of a PC running OEL's AUDIOSCOPE software connected to an acoustic receiver, in order to monitor the acoustic transmissions from the GRID® Pinger. A laptop with the AUDIOSCOPE software pre-installed is supplied with the GRID® System as standard. For information regarding setting up the laptop and using the AUDIOSCOPE software, please see section 4 of this manual.

6.2. GRID® GAUGING PIG DEPLOYMENT

Ensure that all cable connections are properly mated and that all cables are routed in such a way that they will not be exposed to damage during the pig run.

The GRID® Pinger can be activated in 2 ways:

1. **Using the mechanical link** will activate the GRID® Pinger and guarantee that the unit will remain activated until the batteries are depleted. This is the recommended method of activation.

2. **Using the saltwater links** means that the GRID® Pinger will activate when the line is flooded with conducting fluid e.g. water (not oils). If it can be guaranteed that the GRID® Pinger will be dry until flooding occurs, the GRID® system can be deployed several months before it is to be used. Once the GRID® Pinger has been flooded and activated, it must be guaranteed that it will remain submerged for the duration of the pig run. **If the GRID® Pinger becomes "air-locked" for longer than a few seconds there is a risk that the unit will deactivate, resetting the internal timers and TOA, causing incorrect TSS and TOE data to be transmitted. Logged data will be unaffected and can be downloaded on recovery of the unit. In cases where this could occur, the mechanical link must be used instead**.

Take a note of the time and date at the moment of activation (Time of Activation, TOA). If the GRID® system detects a fault in the pipeline then this information is required to locate the fault.

At the moment of activation confirm that the GRID® Pinger transmits a series of pulses that represent the current time. Confirm that that this time is correct. Between bursts of data, confirm that the GRID® Pinger transmits single pulses at the Pass Ping Rate, PPR (see Page 2). Confirm that the unit transmits bursts of data at the Pass Data Rate, PDR (see Page 2), representing the Time Since Start, TSS, which should correspond to the TOA.

The gauging pig can now be run. If the gauge plate becomes damaged at any point during the run, the GRID® Pinger will begin to transmit single acoustic pulses at the Fail Ping Rate, FPR, and also transmit data at intervals determined by the Fail Data Rate, FDR (the data being sent will alternate between TSS and Time of Event, TOE). This will continue until the batteries are depleted. Refer to Page 2 of this manual for the FPR and FDR of the GRID® System accompanying this manual.

7. DISPOSAL OF UNIT

Online Electronics Ltd takes its responsibilities under the WEEE Regulations extremely seriously and has taken steps to be compliant in line with our corporate and social responsibilities. In the UK, OEL has joined a registered compliance scheme WeeeCare (registration number **WEE/MP3538PZ/SCH**).

Electrical and electronic equipment should never be disposed of with general waste but must be separately collected for the proper treatment and recovery.

The crossed out bin symbol, placed on the product, reminds you of the need to dispose of it correctly at the end of its life.

When buying a new product you will have the possibility to return, free of charge, another end of life product of equivalent type that has fulfilled the same functions as the supplied equipment. These items may be deposited at:

Online Electronics Ltd
Online House
Woodburn Road
Blackburn Business Park
Blackburn
Aberdeen
AB21 0PS
UK

Alternatively, to arrange a collection of any waste electrical equipment obligated to OEL, please telephone WeeeCare on **0844 800 2004**.

8. WARRANTY

Online products are guaranteed for one year from the date of purchase. Goods should be returned transportation prepaid to Online Electronics Limited.

There is no charge for parts or labour should any product require repair due to a manufacturing deficiency during the guarantee period.

In the event of a manufacturing deficiency the inward transportation costs will be repaid to the client.