

# **GRID® - Gauging Run Integrity Data System Operating Manual**

**Online Electronics' 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**



**Online Electronics Limited**  
**+ 44 (0) 1224 714714**  
**OEL-Sales@ik-worldwide.com**

**[online-electronics.com](http://online-electronics.com)**

<b>CONFIGURATION INFORMATION</b>	
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:	



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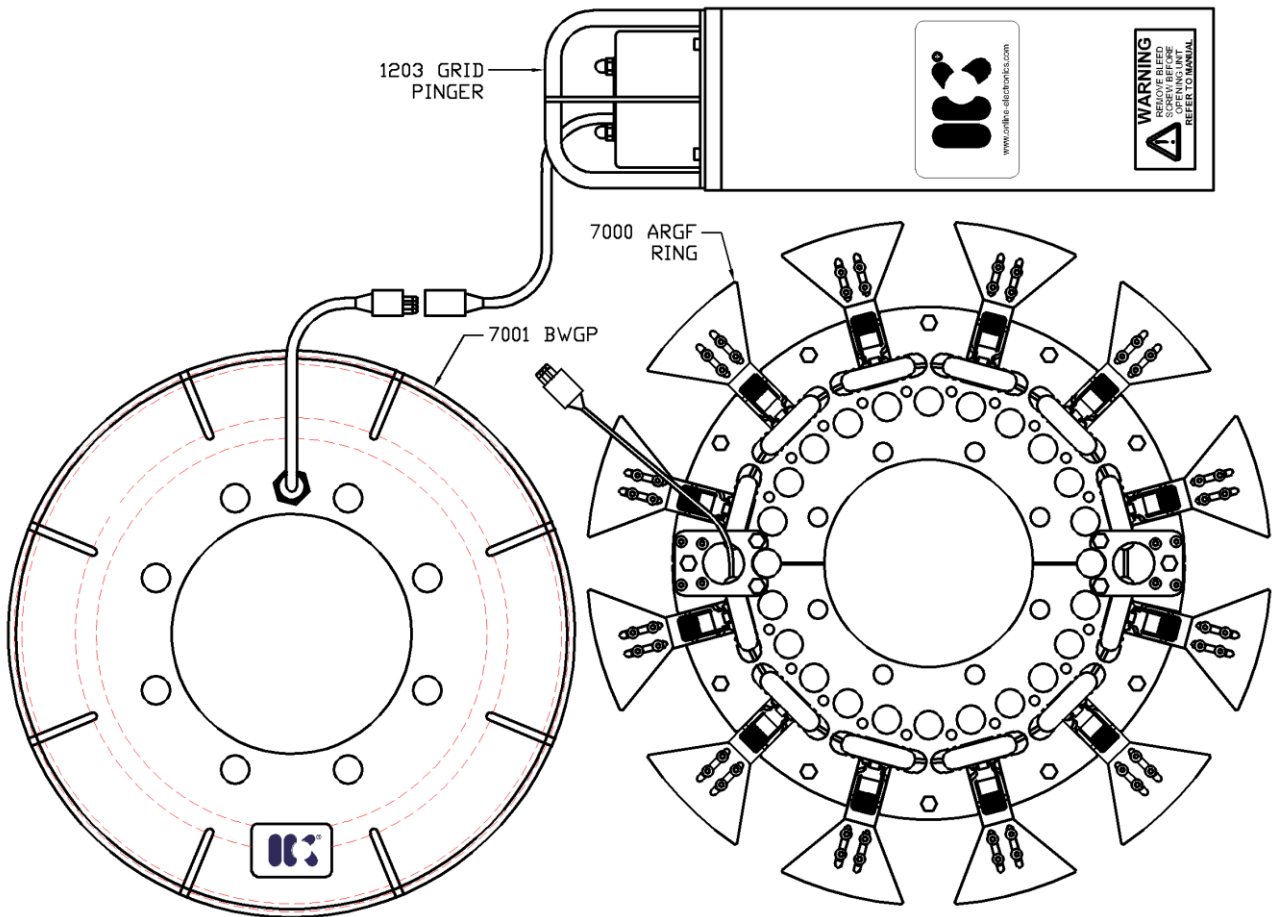
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# 1. DESCRIPTION

Refer to the Page 1 for the specific configuration of the GRID® System supplied with this manual.

Online'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 Online'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 a 600, 800 or 1200 sized GRID® Pinger. These are based on Online's proven 600, 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 SPECIFICATIONS

### 2.1. 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 +54°C  
 External Pressure Rating ..... 4500m / 450bar  
 Weight in Air..... 4.1kg

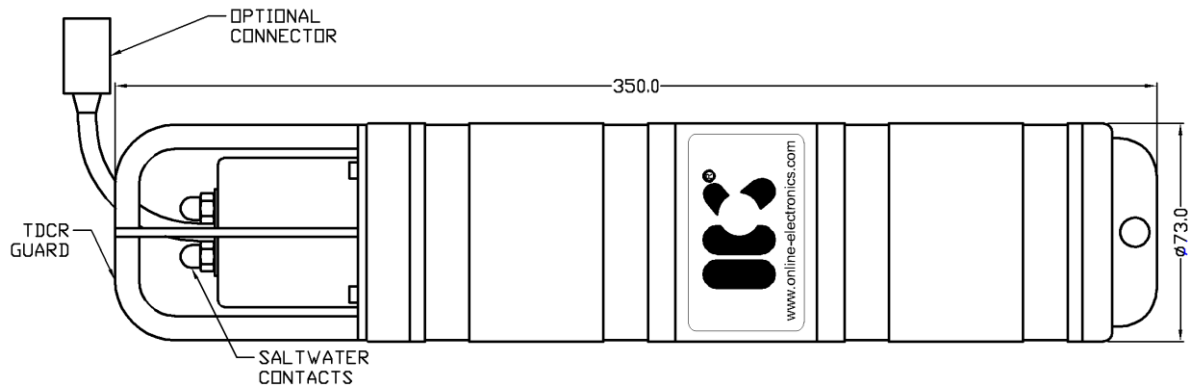
**MATERIALS:**

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



## 2.2. 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 +54°C  
 External Pressure Rating ..... 3000m / 300bar  
 Weight in air ..... 11.5kg

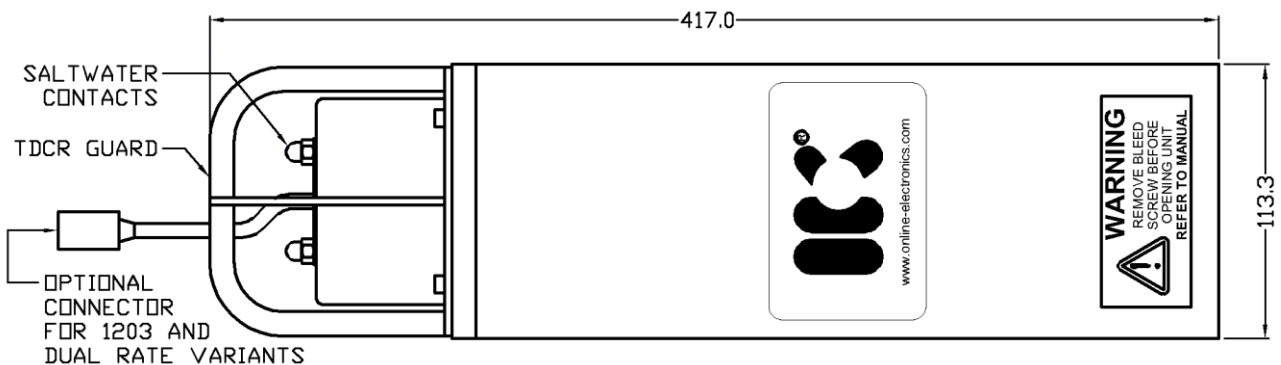
### MATERIALS:

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



### 2.3. STANDARD 600 SERIES GRID® PINGER

**GENERAL:**

Battery Life at +5°C from 3x Duracell ID1400 Alkaline C Cells ..... 16.5 Days (2s Ping Rate)\*  
 Battery Life at +5°C from 3x SAFT LS26500 Lithium C Cells ..... 26 Days (2s Ping Rate)\*  
 Acoustic Output Power ..... 10W ±3dB  
 Beam Pattern ..... Omni-directional ±3dB  
 Operating Frequency ..... Pre-Configured within 26-42 kHz  
 Operating Temperature Range ..... -2°C to +54°C  
 External Pressure Rating ..... 3000m / 300bar  
 Weight in Air ..... 1.1kg

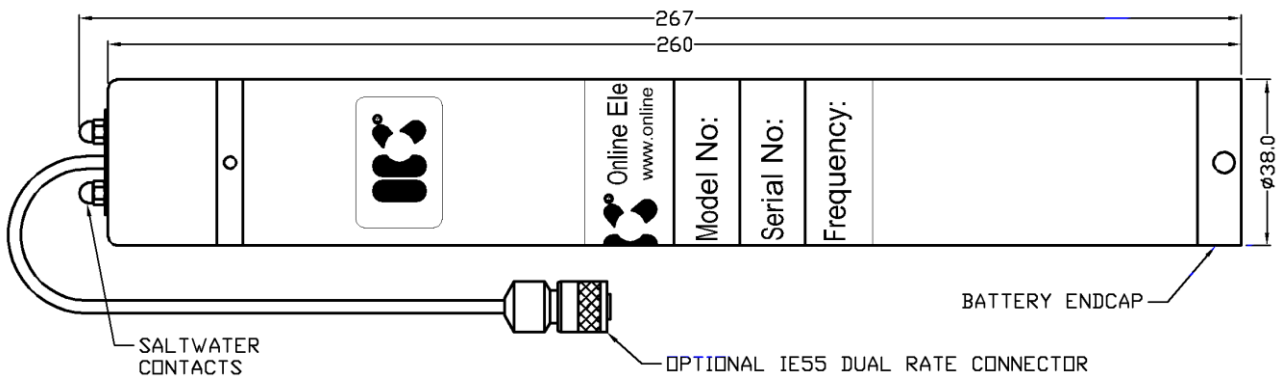
**MATERIALS:**

Housing Material ..... 316 STAINLESS STEEL  
 Endcap Material ..... ALLOY BRONZE  
 Transducer Material ..... PEEK / PU  
 O-Ring Material ..... NBR70

**BATTERY LIFE:**

The following table shows typical battery lifetimes for a 10W 600 GRID® Pinger with a standard 5 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)	BATTERY LIFETIME - ALKALINE CELLS (Days)	BATTERY LIFETIME - LITHIUM CELLS (Days)
2	2	13	20.5
2	5	15	23.5
2	10	16	24.5
5	2	22.5	34
5	5	31	47
5	10	35.5	54





### 3. RULES FOR SAFE OPERATION

⚠ **WARNING:** Any operation involving pressure is potentially hazardous. No person should use this equipment unless they are fully aware of the potential hazards of working with pressurised vessels. The purchaser of this equipment is responsible for the training and competence of operators and the manner in which it is used. This manual should be read through and understood before installation and commissioning so that the operator is familiar with the equipment. Contact Online Electronics Ltd immediately should any difficulty arise in the use of this equipment.

⚠ **WARNING:** Always loosen the bleedscrew on the rear of the 1200 pinger or the 800 battery endcap to relieve any internal pressure prior to opening.

⚠ **WARNING:** Always use caution when opening equipment which has been in a pressurised environment. It is possible for pressure to leak into the equipment and remain there even after external pressure has been removed. ALWAYS point the end to be opened towards a safe area and away from yourself or others. Contact Online Electronics immediately if there is a suspicion that the equipment has become pressurised.

⚠ **CAUTION:** Do not expose the unit to aggressive solvents or chemicals which could be harmful to the Housing, PU Transducer, Nitrile Rubber O-Rings or Connectors.

⚠ **CAUTION:** All subsea connections must be terminated or blanked prior to deployment.

⚠ **CAUTION:** Equipment should only be opened in a clean laboratory environment.

⚠ **CAUTION:** To prevent the formation of condensation within the unit, allow the unit temperature to stabilise within the laboratory environment for a minimum of 6 hours prior to opening.

⚠ **CAUTION:** It is possible for liquids to become trapped in threads and/or gaps around openings. ALWAYS point the end to be opened downwards to allow any trapped liquid to drain out of and not into the equipment.

⚠ **CAUTION:** If the unit is to be placed in storage, always ensure that it is turned OFF and the batteries are removed and stored separately.

## 4. 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.

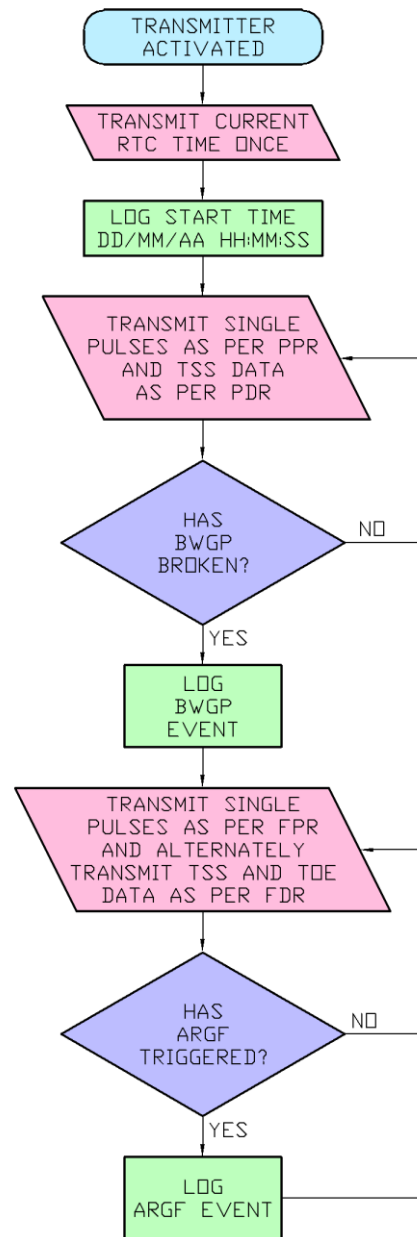
Only the first event will be detected by the BWGP. Any subsequent events will be detected by the ARGF ring (if fitted) and logged by the system.

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.

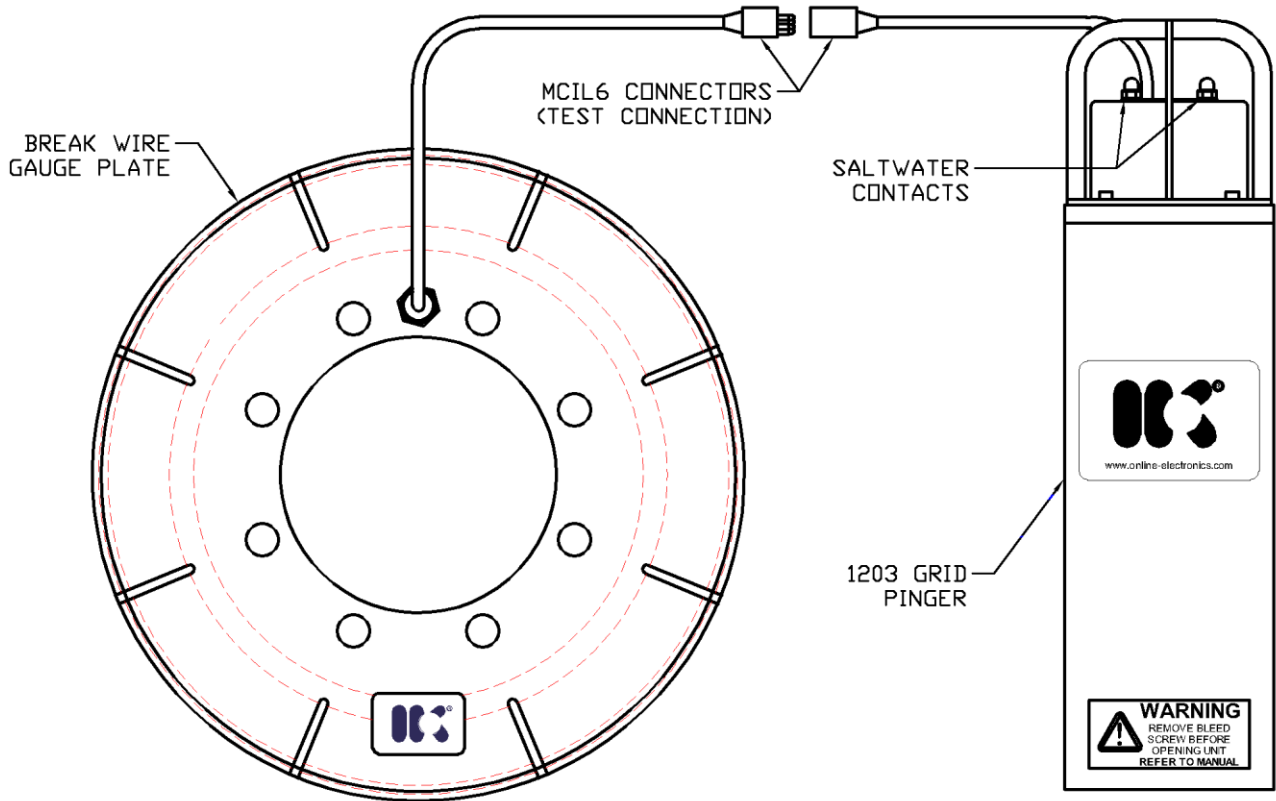
The system can be easily customised to transmit the desired data at the desired time and over the desired duration, according to client specifications.

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.



### 4.1. EXAMPLE SETUP

The illustration below shows a typical configuration for the GRID<sup>®</sup> system without a 7000 ARGF ring. In this configuration, the 7001 BWGP is fitted to the Disc Packet at the front of the PIG, the GRID<sup>®</sup> 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<sup>®</sup> Pinger is broken while the system is activated, the GRID<sup>®</sup> 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<sup>®</sup> System in air, the acoustic hydrophone should be placed within 10cm of the transducer head on the GRID<sup>®</sup> Pinger. If using a GRID<sup>®</sup> Pinger with frequency below ~15kHz, the acoustic transmissions should be audible without using a receiver.

Most GRID<sup>®</sup> 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 1 of the manual. Due to constraints of the PIG design, some GRID<sup>®</sup> 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.

Refer to Page 1 of this manual to confirm the configuration of the current GRID<sup>®</sup> System being used.

Below are typical repetition rates for a GRID<sup>®</sup> 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

## 4.2. FUNCTION TEST

1. Familiarise yourself with all the rules for safe operation of this equipment as described in Section 3 RULES FOR SAFE OPERATION.
2. 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).
3. 800/1200 only - 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 refer to Section 4 OPERATION.
4. Confirm that the GRID® Pinger continually transmits a single acoustic pulse at the PPR (e.g. every 5 seconds in the example system).
5. 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).
6. 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.
7. 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 1 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.
8. Confirm that the GRID® Pinger transmits a double pulse just after the BWGP is disconnected (800/1200 only) and record the time when this occurred. Confirm that the next transmitted data value corresponds with the TOE (Time of Event after activation).
9. 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).
10. Confirm that the TSS and TOE values being transmitted agree with the recorded time of activation and the time of BWGP event.
11. 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.
12. 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. Re-open the mechanical link to deactivate the GRID® Pinger. The system is now ready for deployment.

13. The function 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, refer to the latest AUDIOSCOPE USER MANUAL.

### 4.3. INSTALLATION

⚠ **WARNING:** The pinger must be mounted in such a way that no movement or vibration is possible whatsoever (e.g. clamped). If the unit is allowed to rattle and/or vibrate within the pig, then the resultant hammering effect can exceed the bump rating of the unit, leading to damage and/or failure. Wedging blocks of PU should be used as required to reduce any movement or vibration of the pinger within the pig. Note: The wedging blocks should only be in contact with the pinger body, not the transducer.

⚠ **WARNING:** The pinger transducer must be left protruding from the PIG body to minimise attenuation of the acoustic transmission.

⚠ **CAUTION:** Ensure that the bleedscrew on the rear of the pinger is fitted, do not overtighten.

⚠ **CAUTION:** The transducer head must be protected against physical impact.

⚠ **CAUTION:** Ensure that there is adequate access for water to flood the saltwater links if the mechanical link is not going to be used.

⚠ **CAUTION:** If the pinger is fitted with an external connector then it MUST be terminated or blanked.

### 4.4. PRE-DEPLOYMENT

1. Familiarise yourself with all the rules for safe operation of this equipment as described in Section 3 RULES FOR SAFE OPERATION.
2. Confirm a Section 4.2 FUNCTION TEST has been completed.
3. Confirm the pinger has been installed correctly as described in Section 4.3 INSTALLATION.

### 4.5. GRID® GAUGING PIG DEPLOYMENT

1. Confirm the pinger has been installed correctly as described in Section 4.3 INSTALLATION.
2. Confirm by which one of the 2x methods shown below the pinger should turn on using and ensure the pinger has been set to this method.
  - **Mechanical Link:** When the mechanical link is used to bridge the saltwater contacts the GRID® Pinger will activate and will remain activated until the batteries are depleted. This is the recommended method of activation. Ensure the non-conductive sleeve is removed from the mechanical link before use, otherwise the unit will not activate.
  - **Saltwater Links:** When using the saltwater links to activate the GRID® Pinger, the unit will only 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.

3. 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. It is important that this time is recorded accurately, so it is recommended that you record the reading against UTC time using an internet connected computer.
4. 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.
5. Between bursts of data, confirm that the GRID® Pinger transmits single pulses at the Pass Ping Rate, PPR (see Page 1).
6. Confirm that the unit transmits bursts of data at the Pass Data Rate, PDR (see Page 1), representing the Time Since Start, TSS, which should correspond to the TOA. Take a note of one of the TSS Readings along with the exact time and date it was received. This data can be used as one of the Drift Compensation synchronisation points (see SECTION 7). It is important that this time is recorded accurately, so it is recommended that you record the reading against UTC time using an internet connected computer.
7. The gauging pig can now be run.
8. 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 1 of this manual for the FPR and FDR of the GRID® System accompanying this manual.

## **5. SOFTWARE INSTALLATION**

The following software is required for interrogation / unload of data from the GRID® System. If a fully programmed laptop was not supplied with the GRID® System or the required software has not been installed, install the 1203 software and AUDIOSCOPE software which has been supplied on a USB Pen Drive by Online Electronics by following the instructions below.

### **5.1. 1203 SOFTWARE INSTALLATION**

1. Log into the host PC as an administrator with full administrator rights.
2. Execute the setup.exe file found in the 1203 UNLOAD folder on the USB Pen Drive.
3. Follow all instructions provided on the screen to complete the installation.
4. The software will now be available in the Start menu.

### **5.2. AUDIOSCOPE SOFTWARE INSTALLATION**

Refer to the latest AUDIOSCOPE Manual for instruction on installation and use.

### **5.3. USB CABLE DRIVER INSTALLATION**

The 1200 download cable includes a USB convertor which requires VCP (Virtual Com Port) drivers to be installed on the host PC. For further information, or to download the latest version, visit [www.ftdchip.com/FTDrivers.htm](http://www.ftdchip.com/FTDrivers.htm). The latest driver version can be found on the USB Pen Drive supplied by Online Electronics. This can be installed by following the instructions below.

1. Log onto the host PC as an administrator with full administrator rights.
2. Connect the USB Cable to an available USB port on the host PC. Ensure the cable is not connected to the pinger at this time. If windows does not already have suitable drivers it will automatically detect the device and prepare to install the drivers.
3. When prompted to, point towards the Drivers folder on the supplied USB Pen Drive.
4. If automatic installation does not work then follow the instructions below.
5. Unplug the USB Cable from the PC, wait a few seconds then re-connect to a different USB port.
6. Refer to [www.ftdichip.com/Support/Documents/InstallGuides.htm](http://www.ftdichip.com/Support/Documents/InstallGuides.htm) for install guides for the installation of drivers.

### **6. PINGER DATA UNLOAD**

To unload data from the GRID® Pinger at the end of an operation, connect the USB end of the download cable to the PC and wait approximately 10 seconds for the cable to be detected by the PC then follow the instructions below.

1. Open the 1203/603 CONFIG software as appropriate.
2. Select the correct USB from the COM Ports list (usually the last one if the drivers are newly installed).
3. Ensure that the pinger is turned OFF and the Download cable is not connected to the pinger.
4. Press CONNECT.
5. Turn the Pinger ON and confirm it starts pinging.
6. Connect the Download Cable to the Pinger. Always ensure the Pinger is on before connecting the cable.
7. Press SHOW STATUS on the software. Confirm communication has been established and data is received.
8. Press START CAPTURE. Choose a filename and location to save the unloaded data to.
9. Press UNLOAD LOG to unload all data from the Pinger. You should see data scrolling down the Data window on the software.
10. Press STOP CAPTURE to save and close the unload file.

## **7. CLOCK DRIFT COMPENSATION**

The 600, 800 and 1200 series of pingers use an MH32768L Euroquartz crystal for their clock timings. The crystal has a rated accuracy of 20ppm which means that it could drift as much as 1.73s per day. If a long time passes between when the unit is activated and when a gauge plate event is triggered, the error in the TOE could be significant.

The AUDIOSCOPE software includes a drift compensation calculator which automatically calculates the Drift Rate and Adjusted Time of Event based on two synchronisation points (TSS readings taken at known times) and the TOE reading. See the AUDIOSCOPE manual for more information.

The drift compensation works best when you have a synchronisation point before and after the event occurred (the closer to the TOE the better), however it can still be calculated using two synchronisation points taken after the TOE, although they should be a number of days apart if possible.

It is important that the time of each of the TSS readings is recorded accurately. As such, it is recommended that you record the readings against UTC time using an internet connected computer.



## 8. 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  
Blackburn Business Park  
Woodburn Road  
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**.

## 9. 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.