GE Oil & Gas
Drilling & Surface

Sondex* Wireline

Addressable Downhole Switch

ADS003 for $2^{1}/_{8}$" Tools (SX Ends)

Operation & Maintenance Manual

CE

Tool Code: ADS003
Document: MN-ADS003
Revision: E
Date: 7 January 2013

GE imagination at work

* Denotes a trademark of the General Electric Company

Contents

0 ABOUT THIS MANUAL

0.1 Manual History

Date	Issue	Description	Auth	Chk	App
29/08/12	A	First Issue	CW	NH/ PW/ PR	PR
29/08/12	D	Changed to Revision D to align with SAP	CW	NH/ PW/ PR	PR
04/01/13	E	Changed specification for Withstand Voltage (Max)	CW	AM/ PR	PR

0.2 Technical Help

For further technical help contact GE Technical Services as follows:

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Web: www.geoilandgas.com/downholetechnology

0.3 Feedback

Please help us to improve future issues of this manual by adding your comments or corrections to www.geoilandgas.com/downholetechnology, referencing the document number.

Thank you.

Photographs and sketches are for illustration purposes only. Depending on the tool model that you have, certain features or dimensions may differ from those shown.

Documents from external sources (i.e.: MSDS) either supplied with or referenced to in this manual, are considered the latest version at the time the manual was issued. However, the document may be altered by the external source without prior notice to Sondex Wireline Ltd.

1 OVERVIEW

The Addressable Downhole Switch (ADS) tool is an electro-mechanical down-hole switch mechanism, which allows an operator to electrically isolate and reconnect the lower head on command from the surface. The tool is only active when the voltage at its upper head is between certain negative DC voltage limits. Outside of these limits, the tool electronics go into a high impedance state. The switch mechanism itself is mechanical and will remain in the same state when the electronics are in the high impedance state. When activated by the surface control panel (ADSP), the tool provides a constant indication of its present status.

Figure 1-1 ADS003

1.1 Purpose

The ADS tool is intended for use between well tractors and payloads or similar scenarios where the payload tools may be sensitive to the tractor supply voltages. In use, the tool allows the operator to electrically connect or disconnect the payload below it on command from a surface control panel (ADSP). Furthermore, the control panel can enable/connect or disable/ disconnect other surface equipment, depending on the state of the ADS tool.

A typical scenario would be the placement of the ADS tool below a well tractor and above a perforating gun. While tractoring, the ADS would be in the '**SAFE (Open)**' condition. Once the correct depth is reached, the ADS would be set to the '**FIRE (Closed)**' state to allow the guns to be operated. While the ADS is in the '**SAFE (Open)**' state, the tractor supply would be enabled and the shooting supply disabled, when in the '**CLOSED**' state the opposite would apply.

1.2 Applications

- Perforating while Tractoring.
- Use of tools with widely differing operating voltages within a toolstring.

1.3 Specification

The specifications for the ADS003 are shown in ***Table 1-1***.

Table 1-1 ADS003 Tool Specification

Parameter	Specification	Remarks
Operating Temperature (Max)	177°C (350°F)	
Operating Pressure (Max)	15,000psi (103.4MPa)	
Tool Diameter	$2^1/_8$" (54mm)	
Make-up Length	25.69" (653mm)	
Shipping Length	29.49" (749mm)	Including Thread Protectors
Tool Weight	22lb (10kg)	
Operating Voltage:		
Nominal	-50 to -80V DC	
Maximum	-90V DC	
Minimum	-40V DC	
Withstand Voltage (Max)	-1000V DC to +1500V DC 600V AC	For one minute
Through Voltage (Max)	±1000V DC, 500V AC	
Through Current (Max)	5A AC/DC	
Tool Current:		
Motor OFF	20mA nominal	
Motor ON	60mA nominal	
Communication Rate:		
Surface to Tool	600 baud	
Tool to Surface	600 baud	
Downlink Modulation	±10V AMI	AMI = Alternate Mark Inversion
Uplink Modulation	±10mA AMI	
Communication Protocol	WLINK	
End Connections	Sondex	
Vibration Qualification	5g (15 to 500Hz), 20 Sweeps	
Shock Qualification	1000g 0.5ms half sine	

1.4 Detonators and Initiators

The ADS may only be used with electric detonators and initiators that incorporate at least one of the following features:

1 A high-voltage Exploding Bridge Wire (EBW) design.

2 A high-voltage Exploding Foil Initiator (EFI) design.

3 Features providing protection substantially equivalent to that afforded by the features described in items (1) and (2) above, and which have been validated by an independent, recognized testing agency.

2 SAFETY

In normal use, there are some specific safety instructions to safely handle GE Oil & Gas equipment. The information in this section must be followed in addition to your specific Company and Local Rules & Regulations (Directives).

Personnel must be qualified to operate or service this equipment. When the equipment is not installed, commissioned and used in accordance with the specifications of GE Oil & Gas, protection will likely be impaired.

2.1 Hazardous Areas and 'Hot Work'

WARNING!

HAZARDOUS AREAS AND 'HOT WORK'!

Under certain circumstances or failure modes this equipment can become a potential source of ignition.

It can be used only in Safe Areas and cannot be used in classified Hazardous Areas ('Zoned' areas) unless a approved system of work is in place (for example, Hot Work Permit) and applicable precautionary measures have been followed (for example, monitoring for gas leaks, site inspection, fire fighting equipment, work procedures).

This must be done in accordance with local and national legislation with regard to the use of electrical equipment in potentially explosive atmospheres.

2.2 Electrical Hazard

WARNING!

ELECTRICAL HAZARD!

To protect operators, make sure the Tool Safety Clamp *P/N: KITB-Earth Clip* (for non-Ultrawire™ tools) is attached to the toolstring and correctly grounded. Refer to the Tool Safety Clamp manual (*MN-TSC001*).

WARNING!

ELECTRICAL HAZARD!

There are hazardous voltages in the equipment. Do not touch the exposed electrical connections, wires or metal as they can be at a dangerous potential.

2.3 Stored Energy

WARNING!

STORED ENERGY!

The tool has components/areas that can store energy. This energy can be released without warning.

Refer to *the applicable section of the related manual* for instructions to safely release this stored energy.

2.3.1 TRAPPED PRESSURE SAFETY PRECAUTIONS

WARNING!

TRAPPED PRESSURE!

Spaces in the tool can retain trapped pressure after a down hole leakage. As this pressure can be released without warning, always:

- **Contact *GE Oil & Gas Technical Services* IMMEDIATELY for advice before maintenance is attempted.**
- **Make sure all trapped pressure has been removed from the tool before it is transported.**

Wear a protective face shield.

Wear a protective apron.

Logging tools are subjected to harsh conditions downhole. High hydrostatic-pressure, high-temperature, shock, vibration and contact with corrosive substances can all contribute to causing possible leaks into sealed housings. Leak paths include but are not limited to:

- Permeation through the seals.
- Seal failures.
- Hairline cracks in welds.

During the deployment of a tool down hole, one or more of the above failure conditions can lead to a quantity of fluid/gas leaking into the cavities of the tool. The leakage paths are rarely completely reversible and so a proportion of the fluid/gas is likely to be retained (trapped) inside the tool as it is recovered from the well. In some cases the quantity, composition and pressure of the trapped fluid/gas will present a significant safety hazard in terms of stored potential energy.

Trapped pressure in a tool represents a significant hazard as the tool is handled immediately after it is removed from a well. The hazard continues to exist during the subsequent transportation, storage, repair and servicing operations. In extreme conditions, the tool could explode! Therefore all precautions must be taken to mitigate injury to the operator and nearby personnel.

Listed below are some signs that indicate the tool could contain trapped pressure:

- Telemetry failures downhole.
- Signs of mechanical damage.
- Unusual seepage of fluid out of the tool or bubbling/hissing noises.
- Tools that have been fished.
- Tools that have been downhole for extended periods.
- Hard to undo housings or housing split nuts.

When there are signs of trapped pressure, read first ***Section 4.3, Post Logging Checks*** and then ***Section 5.1, Trapped Pressure - Tool Disassembly*** in the order shown to mitigate hazards.

2.3.1.1 REMEMBER

1 **DO NOT** point parts of the tool (that can become projectiles) at either yourself or others.

2 **DO NOT** release the pressure by removing filler plugs or other small plug items, unless the tool manual shows different instructions (refer to ***Section 5.1, Trapped Pressure - Tool Disassembly***) that this is the correct method to release the trapped pressure.

3 **DO NOT** ignore the risk of trapped pressure and return the tool to its transportation packaging. The tool can explode at any time due to sudden mechanical shock or changes in atmospheric pressure. This could be dangerous with some methods of transport. For example, when the tool is being transported in an aircraft.

4 **DO NOT** open the tool in a confined space or building. There is a possibility of toxic chemicals being released.

5 **DO NOT** install the Thread Protectors to the ends of the tool.

2.3.1.2 Recommended Precautions to Follow

1 **Always** wear Personal Protective Equipment (PPE) - hard toe boots, safety glasses and fluid resistant gloves are a minimum.

2 **Always** let the tool stand in a cordoned-off safe area (outdoors is recommended) with hazard signs indication, for a minimum of 24hrs (where possible, let the stand for a longer period). Pressure can leak out slowly and (with a sufficient period) the tool pressure will decrease to a less dangerous and more manageable level.

3 **Always** put (in a prominent position) a noticeable warning indicator on the tool (marker pen, sticky label, etc.) to tell others that the tool could contain trapped pressure. It is recommended also to display (at a safe distance from the tool) large signs that can be read clearly and convey the same warning.

4 **Always** make all colleagues and other operators in the area know that the tool could contain trapped pressure.

5 **Always** give a sufficient period for the tool to cool down to the ambient temperature. Fluids (especially gases) have more stored potential energy at a high temperature than at ambient temperature. When the tool is allowed to cool down, it will decrease this potential energy.

6 **Always** know that the well fluid in the tool could be hazardous or toxic. For example, it could contain Hydrogen Sulphide (H_2S). Take all necessary precautions to prevent harm to operators. Thus do disassemble the tool outdoors and use toxic-chemical monitoring equipment.

7 **Always** know that the well fluid in the tool could be a flammable gas or mist. Disassemble the tool away from sources of ignition or sparking.

8 **Always** make sure the suspect tool is disassembled until all inner volumes have been made safe and free of pressure.

9 Refer to ***Section 4.3, Post Logging Checks***.

2.4 Irritants

The necessary precautions to use, store or discard an irritant are:

- **ALWAYS** refer to the applicable Material Safety Data Sheet (MSDS) for the irritant.
- **DO NOT** touch either your skin or your eyes whilst protective gloves are worn.
- **DO NOT** let the irritant to either contact the mouth or to be ingested.

When the disposal of an irritant is necessary, it **MUST** be in accordance with all Local Rules & Regulations (Directives) for the country where the disposal is to occur. If not available, then International Rules & Regulations (Directives) **MUST** be followed.

2.4.1 *Liquid-O-Ring® type 101 Lubricant*

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Liquid-O-Ring® type 101.

2.4.2 *Loctite® 243 Thread Locker*

IRRITANT!

LOCTITE® 243 THREAD LOCKER

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Loctite® 243.

2.4.3 *Dow Corning® 3140 RTV Coating*

IRRITANT!

DOW CORNING® 3140 RTV COATING

Wear protective gloves.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Dow Corning® 3140 RTV Coating.

2.4.4 *Dow Corning® 3145 RTV Coating*

IRRITANT!

DOW CORNING® 3145 RTV COATING

Wear protective gloves.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Dow Corning® 3145 RTV Coating.

2.5 Tool Integrity

2.5.1 Greases and Sealants

CAUTION!

GREASES AND SEALANTS!

Electrical failure can occur when some greases and sealants are used. Those that contain a volatile content can produce gasses in the tool when heated.

GE Oil & Gas recommend to use **ONLY** the greases and sealants specified for the Tool.

GE Oil & Gas recommends, in this tool manual, the use of Liquid-O-Ring®, type 101 (***P/N: LOR101***) to grease lightly:

- The pressure seals.
- All threads for the tool joints and the pressure housings.
- All seals.

The correct greases and lubricants **MUST** be used in the maintenance of all GE Oil & Gas downhole equipment. Some threads are internal and do not stop grease entering the tool. **DO NOT** use too much grease. **DO NOT** use copper loaded greases unless specified in the related tool manual.

2.5.2 Seal Maintenance

CAUTION!

SEAL INTEGRITY!

Tool function relies on seal integrity. Replace worn or damaged seals.

ALWAYS check **ALL** seals for damage. Remove, discard and replace, when damaged and at recommended service intervals.

2.5.3 Fluid/Gas Ingress

CAUTION!

FLUID/GAS INGRESS!

The Split Nuts/Tool Joints **MUST** be tightened correctly and fully to prevent fluid ingress.

The tool is designed to be used in a hostile environment. This is only possible when:

- All seals are installed correctly.
- All Split Nuts/Tool Joints have been tightened correctly and fully.

Failure to complete the above can result in the ingress of fluids or corrosive gases that could damage the tool. Where there is fluid/gas ingress the tool could contain trapped pressure. This trapped pressure can be dangerous when not released in a procedure approved for the tool. Refer to the applicable Section in the related equipment manual for the correct procedure to release trapped pressure and to ***Section 2.3.1, Trapped Pressure Safety Precautions***.

2.6 Connection to the Toolstring

2.6.1 Bending and Rig Up of the Tool

CAUTION!

BENDING STRESSES!

When the tool is not supported correctly, it can be subjected to bending stresses that exceed its design limit.

To prevent damage to the tool/toolstring:

- GE Oil & Gas recommend the tool/toolstring is assembled using a riser or lubricator. If not applicable, make up the toolstring vertically.
- **DO NOT** move an assembled long or heavy tool/toolstring from horizontal to vertical positions.
- **DO NOT** lift long or heavy tools/toolstring by the cable head for manoeuvring or transportation purposes.
- Make sure the tool is sufficiently supported when servicing.

2.7 Electrostatic Discharge (ESD)

CAUTION!

ELECTROSTATIC DISCHARGE!

The tool contains electronic circuits and devices that can suffer permanent damage if exposed to electrostatic discharge (ESD).

ALL ESD precautions must be taken to prevent electrostatic discharge damage to the electronics during tool maintenance.

2.8 Hot Surfaces

WARNING!

HOT SURFACES!

In some circumstances or failure modes, the tool can become hot.

Wear protective gloves.

2.9 WEEE Disposal Information

CAUTION!

ELECTRICAL EQUIPMENT DISPOSAL!

Disposal of electrical equipment must be in accordance with Local/International Rules and Regulations. They will recommend the collection framework available to return, recycle and treatment of electrical wire and components.

For more information refer to: ***http://www.weeerohsinfo.com/***.

2.10 EMC Classification

CAUTION!

EMC CLASSIFICATION

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

2.11 Transportation and Storage

Where the equipment is supplied in a carry tube and/or flight case, GE Oil & Gas recommend that the equipment is stored and transported in that carry tube and/or flight case for protection.

The tool should be stored and transported with the threads and O-Rings lightly greased with Liquid-O-Ring (***P/N: LOR101***) and thread protectors fitted.

3 THEORY OF OPERATION

This section gives a description of how the ADS003 tool operates on a mechanical and electrical level.

3.1 Block Diagrams

Below is the block diagram for ADS003.

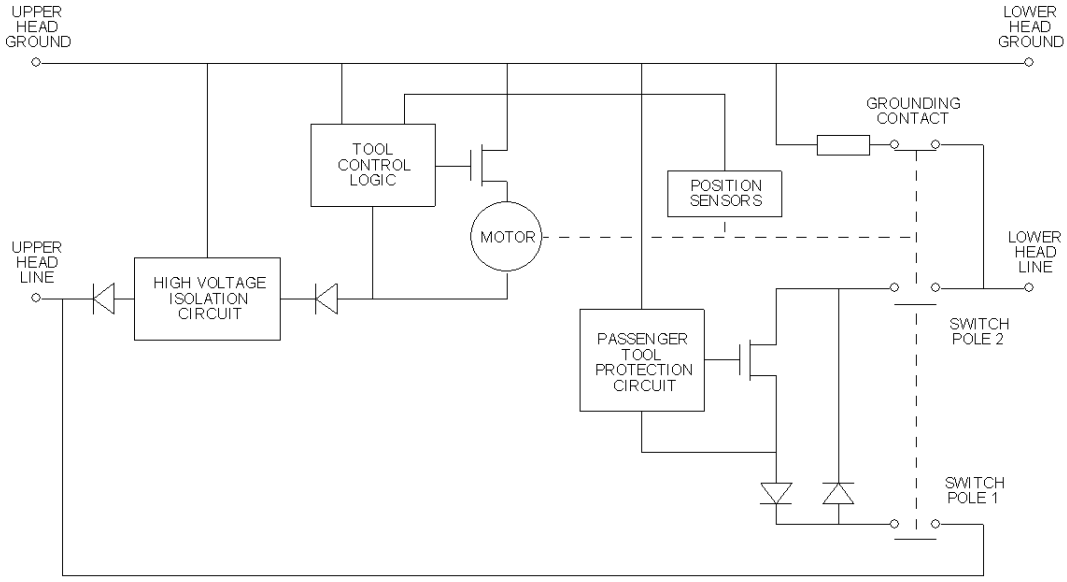


Figure 3-1 ADS Tool Block Diagram

3.2 Mechanical Description

The switch element consists of a Sliding Block, carrying two pins that mate with sockets in a Fixed Block thus creating a 2-pole connector. The Sliding Block is actuated by a lead screw, driven by a DC gear-motor. The Blocks are arranged such that when fully apart (switch element is fully open), the pins are approximately 5 to 6 mm away from the sockets thus minimising the possibility of arcing even if one contact is at extremely high potential. A third pin on the Sliding Block engages in a hole in the Electronics Chassis when in the fully **SAFE (Open)** position, thus providing an earth path for lower head connection when in this state.

The Electronics Chassis consists of an aluminium fabrication, which is trapped between Wave Springs when installed in the Pressure Housing. This allows a small amount of longitudinal movement to provide a degree of shock absorption during perforating or similar operations in which the tool will experience significant longitudinal percussive shocks. Lateral (radial) movement of the Electronics Chassis within the Pressure Housing is controlled by O-Rings fitted to the chassis, such as to be under slight compression when installed. Furthermore these O-Rings provide longitudinal damping, such as to prevent the Electronics Chassis from moving excessively against the Wave Springs. The Wave Springs also provide a reliable earth contact between chassis and housing.

3.3 Electrical Description

The ADS tool is powered by a negative voltage between zero and -80VDC. Outside of this voltage range, the tool goes to a high impedance state and presents no appreciable load or impedance to the line. The tool will draw current at low voltages, but needs at least -40VDC to work correctly. At lower voltages the motor may have insufficient power.

When powered, the tool constantly scans the position of the moveable switch element and indicates this at the surface panel. The position is detected by an array of Hall Effect Sensors actuated by magnets, mounted in the sliding block. In normal operation there is no point where the position of the sliding block is not known.

The process to change the state of the switch requires a precise pattern of commands between tool and surface panel with confirmations from the engineer. Should at any time a bad or missing command be detected, the tool is shut down and the panel reports the fault.

When the switch element is in the **FIRE (Closed)** position the upper and lower heads are connected via the passenger protection circuit. This prevents voltages between 0 (zero) and -100VDC from reaching the lower head under any circumstances. In the open position, the upper and lower heads are disconnected and, since the passenger protection circuit is connected between the sliding pins, it is completely out of the circuit. Also, a third pin provides a ground path through a resistor for the lower head.

The status of the tool and the surface system is reported on an LCD on the ADSP. Operation of the system is accomplished with two push buttons and a single selector switch. The surface system is powered from 110V or 230VAC, 50 to 60Hz, selected by a switch on the rear panel.

The panel includes the line power supply, needed to operate the tool, and relays, capable of switching the tractor and shooting voltages onto the line. The relays are interlocked, such as to prevent more than one system ever being connected to the line. The Tractor relay is specified to prevent welding of the contacts in the event that the relay changes state while the Tractor is taking power.

4 OPERATING PROCEDURE

4.1 Pre-Logging Checks

WARNING! **LIQUID-O-RING® TYPE 101 LUBRICANT**

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant* more information.

4.1.1 ELECTRICAL

The following electrical checks should be carried out to make sure that the ADS003 is operating correctly.

Note: The readings will differ as indicated according to the position of the switch. When the switch is in an intermediate position, the results will be unpredictable. Therefore it is important to make sure that the tool is in the correct position before performing these checks.

When the ADS003 is **NOT** in the **SAFE (Open)** position it must be motored to that position before continuing, to make the tool safe to handle. To achieve this follow the instructions below and refer to the ADSP001 manual (*MN-ADSP001*).

1 Connect the tool to the panel, via a logging cable or a Dummy Logging Cable (DLC), and motor to the **SAFE (Open)** position.

2 Switch off the power to the ADS003 and disconnect the tool from the toolstring.

3 Using a multimeter check the continuity and insulation as follows and make sure they are as stated below:

Note: The readings given below are for guidance only and are very much dependant on the meter used as some measurements are through diode junctions. It is recommended that you record your own readings for a known good tool for each meter available to you and use these readings when validating the tool prior to logging.

Tool in OPEN (SAFE) Mode

Upper Connector (+ve probe) to Lower Connector (-ve probe)	>10MΩ
Upper Connector (+ve probe) to Housing (-ve probe)	>10MΩ
Lower Connector (+ve probe) to Upper Connector (-ve probe)	>3MΩ
Lower Connector (+ve probe) to Housing (-ve probe)	100Ω ±10%
Housing (+ve probe) to Upper Connector (-ve probe)	~3MΩ
Housing (+ve probe) to Lower Connector (-ve probe)	100Ω ±10%

4 Reconnect the ADS003 to the system as shown in *Figure 4-2* and motor the tool to the **FIRE (Closed)** position.

5 Switch off the power to the ADS003 and disconnect the tool from the toolstring.

6 Using a multimeter check the continuity and insulation as follows:

Tool in CLOSED (FIRE) Mode

Upper Connector (+ve probe) to Lower Connector (-ve probe)	~1MΩ (Series Diode)
Upper Connector (+ve probe) to Housing (-ve probe)	>10MΩ
Lower Connector (+ve probe) to Upper Connector (-ve probe)	>20MΩ (Series Diode +FET)
Lower Connector (+ve probe) to Housing (-ve probe)	>20MΩ
Housing (+ve probe) to Upper Connector (-ve probe)	~2MΩ
Housing (+ve probe) to Lower Connector (-ve probe)	~2MΩ

4.1.2 MECHANICAL

Reference:	General Assembly	*AD-09737*
	Electronics Assembly	*AD-85971*

To complete the pre-logging mechanical checks it is first necessary to set the ADS003 to the **SAFE (Open)** position and then gain access to the Electronics Chassis to perform a visual and O-Ring check. To achieve this follow the instructions below and refer to the ADSP001 manual (*MN-ADSP001*).

1 Check, clean with Liquid-O-Ring® type 101 (*P/N: LOR101*) and when necessary, replace the Primary O-Rings (*items 3 & 4*, 09737). Refer to *Section 7.1.3, Seal Replacement Recommendations*.

2 When operating an ADS with explosive devices, refer to the checklist in *Appendix C*.

3 Connect the ADS003 to the ADSP via a logging cable or Dummy Logging Cable (DLC) as shown in *Figure 4-1* and motor the ADS003 to the **SAFE (Open)** position before connecting the ADS into a toolstring.

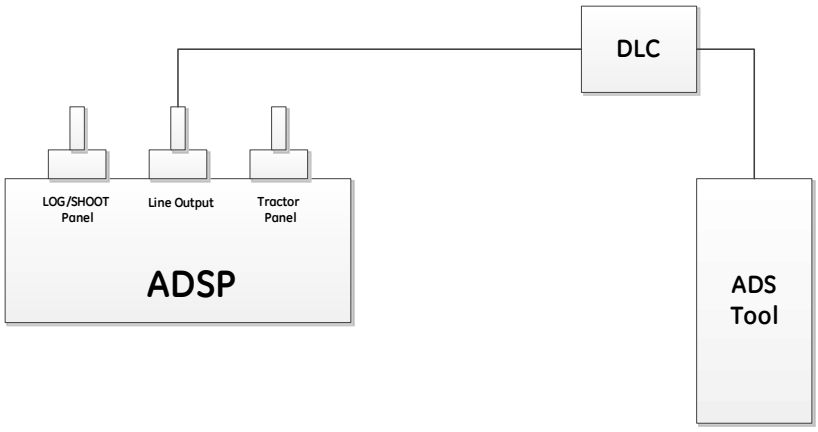


Figure 4-1 ADS003 Basic Connections

4.1.3 OPERATIONAL

Refer to *MN-ADSP001* for a complete description of operation procedures.

4.2 Connecting to Toolstring & Logging Panel

4.2.1 ADS Tool

The tool should be positioned in the string just above the tool(s) which require electrical isolation, e.g. between a well tractor and perforating guns. A Shock Sub should always be deployed between the ADS tool and the Ballistic (Explosive) Device, as shown in ***Figure 4-2***. For details about the recommended Shock Sub, refer to ***Appendix A.2, Ancillary Equipment***.

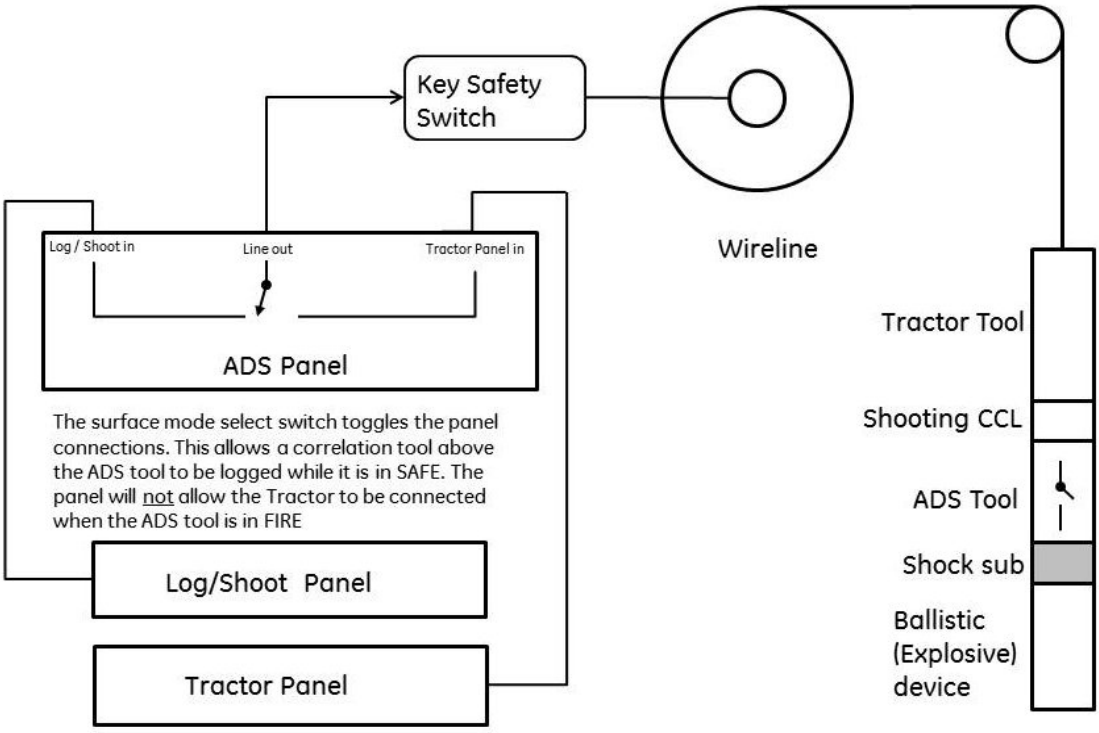


Figure 4-2 Typical Connection with the Tractor and Shooting Panels

The ADS should never be connected directly to the panel. A logging cable or Dummy Logging Cable (DLC) should always be used. While the tool or panel will not be damaged if connected directly, correct operation cannot be guaranteed.

4.2.2 ADS Surface Panel

It is important to understand that the ADS and ADSP form a complete system and cannot be considered independently. The behaviour of the ADSP and hence the remainder of the surface system will depend on the state of the ADS itself.

The specific details of the connection of the ADSP to the surface logging system will depend upon the application and the type of equipment elsewhere in the system. For the purposes of the description, a basic scenario consisting of a tractor panel, a shooting panel and the ADSP and its connections are shown below in ***Figure 4-2***.

4.3 Post Logging Checks

4.3.1 Relief of Trapped Pressure at the Tool Joint

WARNING!

TRAPPED PRESSURE!

Refer to *Section 2.3.1, Trapped Pressure Safety Precautions*.

When any of the circumstances that follow are encountered or it is suspected that the tools may have leaked, then you must proceed as if the tools contain trapped, pressurised fluid/gas until otherwise determined. The characteristics of trapped pressure are:

- Telemetry failures downhole.
- Signs of mechanical damage.
- Unusual seepage of fluid out of the tool or bubbling/hissing noises.
- Tools that have been fished.
- Tools that have been downhole for extended periods.
- Hard to undo housings or housing split-nuts.

To relieve the trapped pressure at the tool joint, complete these steps:

1 Place a rag over the tool joint. This will diffuse any jet of gas or fluid that may emerge from the tool joint.

2 Unscrew **SLOWLY** the tool joint. Should there be trapped pressure inside the tool joint, the tool joint may well be tighter than usual and require more torque than normal to undo.

3 At some point, well before the threads of the tool joint disengage, fluid or gas release will occur. As soon as any hissing or fluid appearance is noted, cease **IMMEDIATELY** to unscrew the tool joint and allow the pressure to dissipate before unscrewing further. This way, the pressure load on the tool joint can be retained safely by the threads that remain engaged.

4 Once the operator is satisfied that no more fluid or gas is escaping, resume to unscrew **SLOWLY** the tool joint. When further hissing or signs of fluid escape are evident, cease **IMMEDIATELY** the unscrewing and allow the pressure to dissipate.

5 Repeat these steps until all trapped pressure within the tool joint is released and there is no pressure loading.

6 The above procedure **DOES NOT** relieve any pressure that may be trapped within the ADS003. To relieve any pressure trapped within the ADS003, refer to ***Section 5.1, Trapped Pressure - Tool Disassembly*** **BEFORE** proceeding with either Post Logging Disassembly or Transportation.

7 For other tools, refer to the relevant Section of their Operation & Maintenance Manual.

4.3.2 TOOLSTRING DISASSEMBLY

Reference: General Assembly *AD-09737*

Below are instructions for disassembling the tool after use:

1 The tool should ideally be left in the **SAFE (Open)** position after last use, so it is in a safe state prior to the next job.

2 The toolstring should be thoroughly cleaned before disassembly. Make sure:

- Well fluid does not reach the electrical connectors.
- The thread protectors are fitted to the tool as soon as possible after removal from the toolstring.

3 Should the tool have been exposed to high levels of vibration or mechanical shock, the Pressure Housing (*item 1*) should be removed and the chassis and switch assembly inspected for signs of damage or movement. Refer to *Section 7.2, Extraordinary Maintenance*.

4 Should the tool need more than one operation to move to a required position, the cause of this should be investigated before it is next used. Refer to *Section 7, Extended Checks*.

4.4 Transport, Handling & Storage

WARNING!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

Store with end threads lightly greased with Liquid-O-Ring® (*P/N: LOR101*) and with water tight thread protectors fitted.

The tool should be transported to site in the transport case provided.

Do not subject the tool to extreme shock, such as dropping or hitting with a hard object.

5 MECHANICAL DESCRIPTION

The main chassis carries the PCBs and motor. The switch elements are secured to the chassis via guide rails, which also serve to locate the lower chassis cap. A similar cap is mounted at the top of the chassis assembly. These caps carry electrical feedthrough connections. The chassis is centralised in the Pressure Housing by a number of O-Rings, which act as shock absorbers.

The Upper and Lower Subs locate the Chassis Assembly longitudinally within the Pressure Housing. Wave springs centralise the Chassis Assembly and provide an earth connection between the Chassis Assembly and the Upper & Lower Subs. Both the Upper and Lower Subs contain pressure isolated electrical feedthrough assemblies with Sondex fittings. The chassis should be able to move longitudinally within the Pressure Housing, limited by the wave springs, to enable it to absorb large physical shocks, such as during perforating operations or similar.

5.1 Trapped Pressure - Tool Disassembly

Reference: General Assembly ***AD-09737***

WARNING!

TRAPPED PRESSURE!

Refer to *Section 2.3.1, Trapped Pressure Safety Precautions.*

Due to the open spaces within the tool, the method below will make sure all pressure is removed from the entire tool in the safest way:

1 When the ADS003 has other tools fitted above/below it or when it has thread protectors fitted then refer to ***Section 4.3.1, Relief of Trapped Pressure at the Tool Joint*** for the safe removal of these before proceeding.

2 Retain the tool by clamping the Pressure Housing (***item 1***) within a suitable vice, using soft jaws where possible to protect the tool. Make sure that access to the Lower Sub (***item 11***) is possible.

3 Place a rag over the lower end of the Pressure Housing (***item 1***) and the joint between the Pressure Housing (***item 1***) and the Lower Sub (***item 11***) of the ADS003. This will diffuse any jet of gas or fluid/gas that may emerge from the joint and the lower end of the Pressure Housing (***item 1***).

4 Unscrew **SLOWLY** the Lower Sub (***item 11***) from the Pressure Housing (***item 1***) of the ADS003. Should there be trapped pressure inside the Pressure Housing (***item 1***) the tool joint may well be tighter than usual and require more torque than normal to undo.

5 At some point, well before the threads of the joint have become disengaged, fluid or gas release will occur. As soon as any hissing or fluid appearance is noted, the disconnection process should cease **IMMEDIATELY** and the pressure inside the Pressure Housing (***item 1***) allowed to escape before the joint is unscrewed further. This way, the pressure load on the tool joint can be retained safely by the threads that remain engaged.

6 Once the operator is satisfied that no more fluid or gas is escaping, resume to unscrew **SLOWLY** the joint. When further hissing or signs of fluid escape are evident, cease **IMMEDIATELY** the unscrewing and allow the pressure to dissipate.

7 Repeat these steps until all trapped pressure is released and there is no pressure loading on the tool joint.

5.2 Disassembly

Reference:	General Assembly	*AD-09737*
	Electronics Assembly	*AD-85971*

The main chassis carries the PCBs and Motor Assemblies (***items 5, 6 & 3***, 85971). The switch elements are secured to the Electronics Chassis (***item 12***, 85971) via guide rails (***items 11 & 13***, 85971), which also serve to locate the Lower End Cap (***item 31***, 85971). A similar End Cap (***item 10***, 85971) is mounted at the top of the Electronics Assembly (***item 2***, 09746). These caps carry electrical Feedthrough Connections (***items 17, 15, 16 & 7***, 85971). The Electronic Assembly (***item 2***, 09737) is centralised radially within the Pressure Housing (***item 14***, 09746) by three O-Rings (***item 30***, 85971), mounted around the Motor area of the Electronics Chassis (***item 2***, 85971), which act as shock absorbers.

The Upper and Lower Subs (***items 7 & 11***, 09737) locate the Electronics Assembly (***item 2***, 09737) longitudinally within the Pressure Housing (***item 1***, 09737). Two Wave Springs (***item 6***, 09737) centralise the Electronics Assembly axially and provide an earth connection between the Electronics Assembly and the Upper and Lower End Sub. Both the Upper and Lower End Subs contain pressure isolated electrical Feedthrough Assemblies (***item 3***, 09737) with Sondex end connections. The Electronics Assembly should be able to move longitudinally within the Pressure Housing, limited by the wave springs, to enable it to absorb large physical shocks, such as during perforating operations or similar.

5.2.1 Positioning the ADS Before Disassembly

Reference:	Electronics Assembly	*AD-85971*
	Motor Assembly	*AD-40279*

Before disassembling the tool and using the ADSP (Surface Panel), make sure the tool is motored to the **FIRE (Closed)** position and then disconnect the tool from the ADSP and remove the mains power. For instructions about how to motor the tool using the ADSP, refer to ***MN-ADSP001***.

Note: The tool must be in the **FIRE (Closed)** position to enable access to later allow the Sliding Contact Block Assembly (***item 1***, 85971) to be removed from the Motor Leadscrew (***item 3***, 40279) on the Sliding Contact Block, should it need to be changed or the Contact Blocks need servicing. Refer to ***Section 5.2.3.5, Servicing the Sliding Contact Block***.

Should the tool be in the **SAFE (Open)** position and it can not be motored to the **FIRE (Closed)** position, then it has incurred damage from well operations and it will not be possible to access the lower end of the tool. Contact ***GE Oil & Gas Technical Services*** to return the tool, as this kind of maintenance lies outside the scope of this manual.

5.2.2 Servicing Upper & Lower Subs

Reference:	General Assembly	*AD-09737*
	Electronics Assembly	*AD-85971*

The Upper and Lower End Subs (***items 7 & 11***, 09737) retain the Electronics Assembly (***item 2***, 09737) inside the Pressure Housing (***item 1***, 09737); once the End Subs are removed the Electronics Assembly will only be retained by the frictional effect of the O-Ring buffers (***item 30***, 85971).

Below are instructions to remove the End Subs from the Pressure Housing and extract the Electronics Assembly:

1 Using two spanners, unscrew the End Subs (***items 7 & 11***, 09737) and remove them from the Pressure Housing (***item 1***, 09737).

2 Making sure the Electronics Assembly (***item 2***, 85971) does not slide out, carefully tilt the Pressure Housing (***item 1***, 09737) slightly one way until the Wave Spring (***item 6***, 09737) falls out. Repeat and tilt slightly the other way to remove the second Wave Spring. Retain both Wave Springs for later use, however, should they be damaged or worn, replace.

Should it not be possible to remove the two Wave Springs (***item 6***, 09737), they can be accessed by pushing carefully the Electronics Assembly (***item 2***, 85971) from one end to remove it from the Pressure Housing (***item 1***, 09737).

Note: The tool has now been disassembled and the Primary O-Ring seals can be changed; alternatively, it is also prepared for more detailed maintenance. See ***Figure 5-1***.

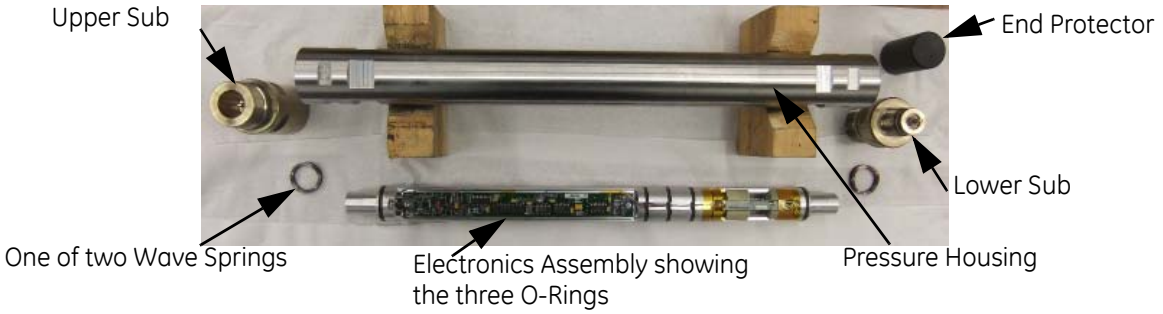


Figure 5-1 The ADS with End Subs and Housing removed

3 Discard all primary O-Rings (***items 3 & 4***, 09737). The O-Rings are located on the lower end of the Upper Sub (***item 7***, 09737) and on both ends of the Lower Sub (***item 11***, 09737). Refer to ***Section 7.1.3, Seal Replacement Recommendations***.

4 Should no further disassembly be required, fit new Primary O-Rings and lubricate the O-Rings on the End Subs with a small amount of Liquid-O-Ring® type 101 (***P/N: LOR101***). Then reassemble the tool. Refer to ***Section 5.3, Reassembly***.

5.2.2.1 Upper Sub

WARNING!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

The Upper Sub (***item 7***, 09737) contains the Connector (***item 8***, 09737) and O-Ring (***item 10***, 09737) which should to be checked after each run and replaced when necessary. Refer to ***Figure 5-2*** and the instructions below to complete this task:

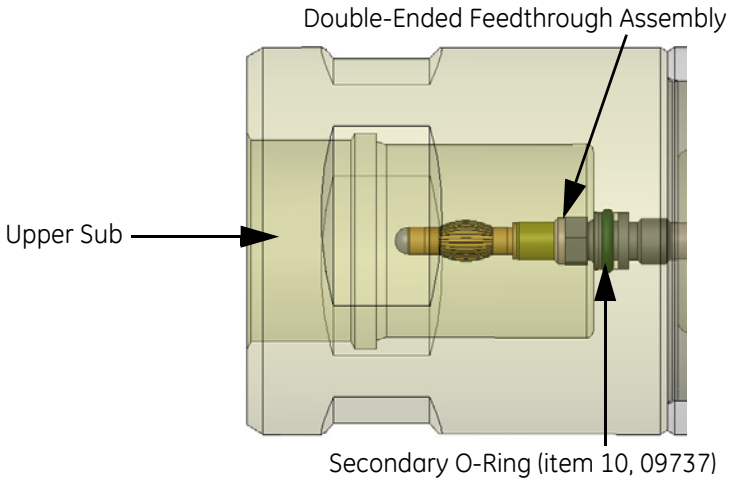


Figure 5-2 Upper Sub Assembly

1 Should it be fitted, remove the Upper Thread Protector (***item 9***, 09737) from the Upper Sub (***item 7***, 09737).

2 Remove the Upper Double-ended Feedthrough Assembly (***item 8***, 09737) and discard the O-Ring (***item 10***, 09737) and replace with new.

However, should there be signs of damage or wear/tear, then inspect the Feedthrough Assembly and replace it, together with the O-Ring, as required.

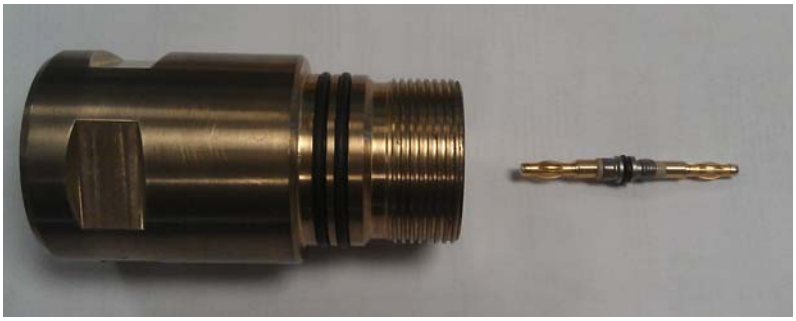


Figure 5-3 Upper Double-ended Feedthrough Assembly

3 Refit the Upper Double-ended Feedthrough Assembly and O-Ring (***items 8 & 10***, 09737) into the Upper Sub (***item 15***, 09746) and check it is seated correctly.

4 Should no further disassembly be required, refer to ***Section 5.3.3, Refitting the Upper & Lower Subs***.

5.2.2.2 Lower Sub

WARNING!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

The Lower Sub (***item 11***, 09737) contains the Connector and Feedthrough Assemblies (***items 8 & 12***, 09737) which need to be checked after each run and replaced when necessary. See ***Figure 5-4*** and instructions below to complete this task:

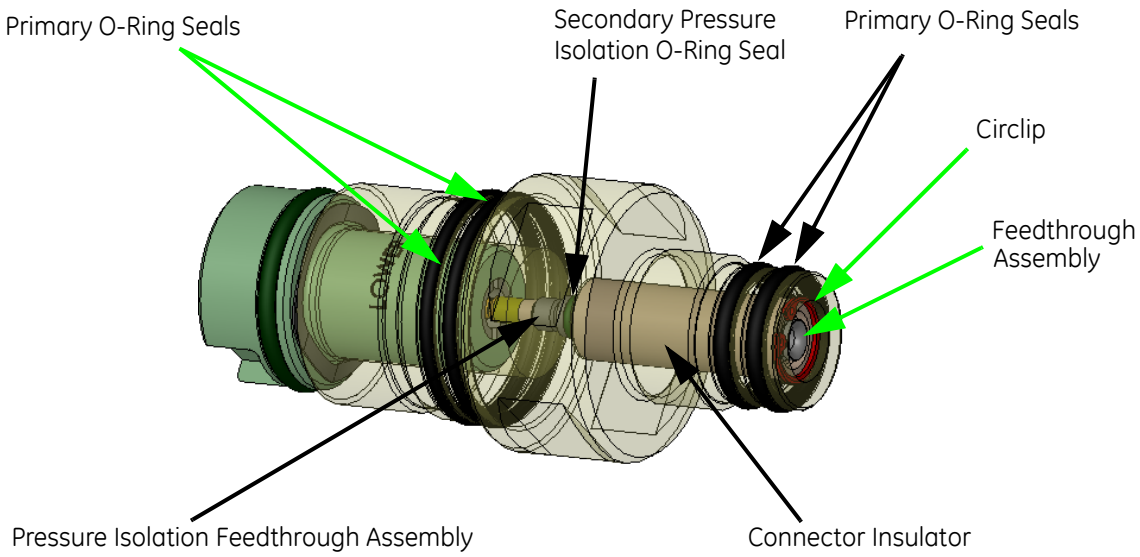


Figure 5-4 Lower Sub Assembly

1 Remove the End Thread Protector (***item 5***, 09737).

2 Remove the Circlip (***item 14***, 09737). This holds the Insulator (***item 13***, 09737) and Female GO Socket (***item 12***, 09737) in place.

3 Although shown separately on the drawing (***AD-09737***), the Female GO Socket (***item 12***, 09737) is a light interference fit with the Insulator (***item 13***, 09737). Pull together, the Female GO Socket & Insulator (***items 12 & 13***, 09737) to free them from the Assembly.

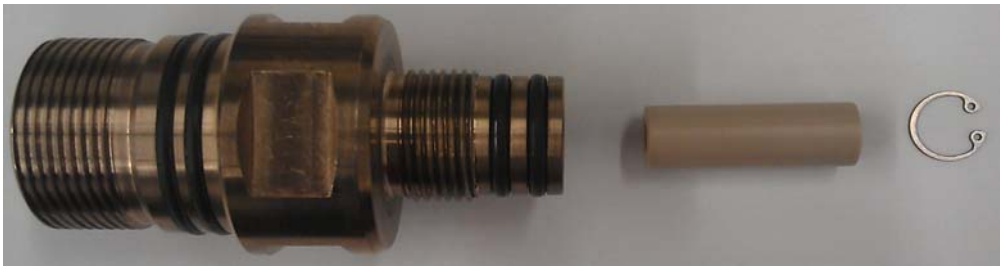


Figure 5-5 Female GO Socket & Insulator

4 Should either the Female GO Socket (***item 12***, 09737) or the Insulator (***item 13***, 09737) need replacing, it is recommended that both parts are replaced as to separate the components will render both parts damaged.

5 Using a Nut Spinner (***P/N: 10051, KITT-ADS002/03***) remove the Double-ended Feedthrough Assembly (***item 8***, 09737).

6 Inspect the Double-ended Feedthrough Assembly and should it be necessary, replace the O-Ring (*item 10*, 09737). However, should the Kemlon™ Pin be damaged, replace the Assembly (complete with O-Ring) with new.

7 Lubricate the O-Ring (*item 10*, 09737) with Liquid-O-Ring® type 101 (*P/N: LOR101*) and using the Nut Spinner (*P/N: 10051, KITT-ADS002/03*), refit the Double-ended Feedthrough Assembly (*item 8*, 09737) inside the Lower Sub (*item 17*, 09746).

8 Insert the Insulator and Female GO Socket (*items 13 & 12*, 09737).

9 Refit the Circlip (*item 14*, 09737).

10 Should no further disassembly be required, refer to *Section 5.3.3, Refitting the Upper & Lower Subs*.

5.2.3 SERVICING ELECTRONICS ASSEMBLY

Reference:	Electronics Assembly	*AD-85971*
	Sliding Contact Block Assembly	*AD-40118*
	Fixed Connector Block Assembly	*AD-40150*

5.2.3.1 Removing the End Caps

The Upper and Lower End Caps (*item 10 & 31*, 85971) are held respectively to the Electronics Chassis (*item 12*, 85971) and Side Rails (*items 11 & 13*, 85971) by means of four countersunk screws (*item 27*, 85971) and various electrical wired connections.

Complete these instructions to remove the End Caps (*items 10 & 31*, 85971)with a view to servicing both ends of the Electronics Assembly:

1 Remove the Pressure Housing, Upper and Lower Subs, (refer to the instructions in *Section 5.2.3*).

2 Remove and discard the five O-Rings (*item 30*, 85971) on both End Caps and the Electronics Assembly (*item 12*, 85971). Replace with new but do not lubricate.

The O-Rings fitted to the Chassis and both End Caps are for shock absorption only and should only be replaced if there is evidence of excessive damage or wear or after five exposures to temperatures above 100°C (212°F). **DO NOT** apply grease to the buffer O-Rings. For more information about checks for O-Rings, refer to *Section 7.1.3, Seal Replacement Recommendations*.

5.2.3.2 Upper End Cap Disassembly

Complete these instructions for servicing the Upper End Cap Assembly:

1 Remove the Cap Hd Screw, three Serrated Washers and two Solder Tags (*items 25, 32 & 23*, 85971) complete with the black ground wire attached.

2 Unscrew and remove the Retaining Nut (*item 16*, 85971) from the Upper End Cap (*item 10*, 85971).

3 Unscrew the two Csk Hd Skt Screws (*item 27*, 85971), then pull the End Cap and the Connector Assembly away from the Electronics Chassis.

Note: The orientation of the Insulator Disc should be noted. The slots align with the slots on the Upper End Cap (*item 10*, 85971), which in turn line up and engage with the flat surface of the Electrical Chassis (*item 12*, 85971). See *Figure 5-6*.

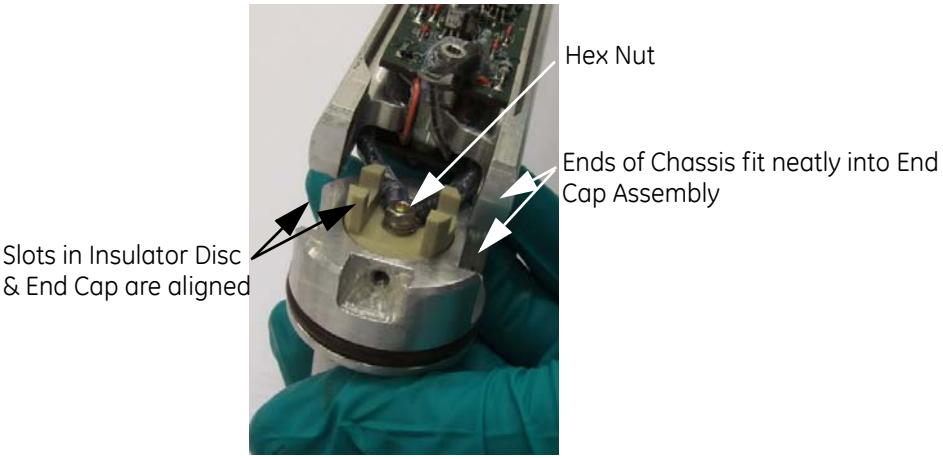


Figure 5-6 The Upper End Cap removed from Electronics Chassis

4 Using pliers to steady the Connector Assembly (***item 15***, 85971)from the top-end of the Upper End Cap (***item 10***, 85971), and a socket, unscrew the Hex Nut (***item 18***, 85971) and remove the three Serrated Washers (***item 32***, 85971) and the two Solder Tags (***item 23***, 85971) complete with wires.

Figure 5-7 Removing the Hex Nut

5 Remove, check and clean the Insulator Disc (***item 14***, 85971).

6 The Connector Assembly (***item 15***, 85971) and its Insulating Sleeve (***item 17***, 85971) can now be removed (separately or together) from the Upper End Cap (***item 10***, 85971).

7 Unscrew the second Retaining Nut (***item 16***, 85971) from the back of the Upper End Cap (***item 10***, 85971).

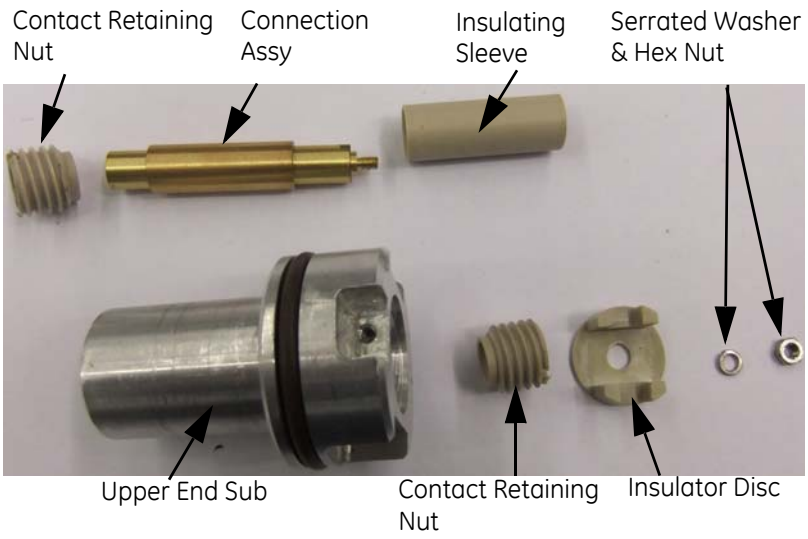


Figure 5-8 The Upper End Cap with Connector Assembly & Insulators

8 Check the Insulator Disc and Insulating Sleeve (***items 14 & 17***, 85971) for damage and replace as required.

9 Check the Retaining Nuts (***item 16***, 85971) for damage and replace as required.

10 Check both the ground and line wiring to the Solder Tags (***item 23***, 85971) for damage and repair or replace these wires as required.

11 Should the PCBs need replacing (***Section 5.2.3.7***), it is recommended these are done here, otherwise reassemble the Upper End Cap Assembly. Refer to ***Section 5.2.3.3, Upper End Cap Reassembly***.

5.2.3.3 Upper End Cap Reassembly

IRRITANT!

LOCTITE® 243 THREAD LOCKER

Refer to *Section 2.4.2, Loctite® 243 Thread Locker*.

Reference: Electronics Assembly ***AD-85971***

1 Reassemble the Connector Assembly by completing the steps below:

i. Insert the Retaining Nut (***item 16***, 85971) into the rear of the End Cap (***item 10***, 85971) that has the large shallow counter bore, then tighten.
ii. The Connector Assembly and Insulating Sleeve (***items 15 & 17***, 85971) can be fitted together. Insert them both into the End Cap (***item 10***, 85971) from the front end.
iii. At the back of the End Cap and over the protruding thread of the Connector Assembly (***item 15***, 85971), position the Insulating Disc (***item 14***, 85971) then refit the assembly with the sequence of Serrated Washers, Solder Tags and the Hex Nut (***items 32, 23 & 18***, 85971).

Note: Make sure each solder tag is inter-spaced by a washer, so that the wires are not damaged and then screw on the nut, but **DO NOT** fully tighten at this stage.

iv. Then, using pliers, hold and retain the front-end of the Connector Assembly (***item 15***, 85971) to stop it from turning.

v. Apply a small amount of Loctite® Threadlocker 243 (***P/N: 91064***) and tighten the Hex Nut (***item 18***, 85971). Be sparing with the threadlocker, as too much will impair the electrical conductivity of the Connector. **Make sure the threadlocker is only applied to the threads!**

Note: The Hex Nut (***item 18***, 85971) should tighten to the Central Contact (***item 15***, 85971) but it should not tighten completely the Insulator Disc (***item 14***, 85971) to the face of the counter bore in the Upper End Cap (***item 10***, 85971). There should still be some freedom to rotate the Insulator Disc with respect to the Upper End Cap.

Figure 5-9 Refitting the Hex Nut, Washers & Solder Tags

vi. Then rotate the End Cap Assembly through 90° to fit it to the Electronics Chassis (***item 12***, 85971). Position the Isolating Disc (***item 14***, 85971) so that it fits onto the end of the Electronics Chassis (***item 12***, 85971) but does not trap any wires. The black wires should be located, on the underside of the Electronics Chassis, in the wiring channels on the Electronics Chassis. See ***Figure 5-6*** and ***Figure 5-10***.

Figure 5-10 Positioning the Insulator Disc with the Electronics Chassis

vii. Refit the two Csk Hd Skt Screws (***item 27***, 85971) and then tighten.
viii. Refit the Serrated Washers, Solder Tags and Cap Hd Screw (***items 32, 23 & 25***, 85971). Apply a small amount of Loctite® Threadlocker 243 (***P/N: 91064***) and tighten. Be sparing with the threadlocker, as too much will impair the electrical conductivity of the Connector. **Make sure the threadlocker is only applied to the threads!**
ix. Refit the other Retaining Nut (***item 16***, 85971) at the front of the Upper End Cap (***item 10***, 85971) and tighten.

2 Should one not already be fitted, fit a replacement O-Ring (***item 30***, 85971) to the Upper End Cap (***item 10***, 85971).

The O-Rings fitted to the Chassis End Caps are for shock absorption only and should only be replaced if there is evidence of excessive damage or wear, or after five exposures to temperatures above 100°C (212°F). **DO NOT** apply grease to the buffer O-Rings. For more information about checks for O-Rings, refer to ***Section 7.1.3, Seal Replacement Recommendations***.

5.2.3.4 Lower End Cap Disassembly

Complete these instructions for servicing the Lower End Cap Assembly:

1 Remove any Kapton™ tape (***P/N: T004-00092***) from the Electronics Assembly to gain access to the Hall Effect PCB (***item 4***, 85971) and various wires.

2 Remove the other Retaining Nut (***item 16***, 85971) from the rear of the Lower End Cap (***item 31***, 85971).

3 Refer to ***Step 5*** of ***Section 5.2.3.7, Servicing the PCBs*** for instructions to remove the Hall Effect Sensor PCB (***item 4***, 85971) from the Motor Retainer Plate (***item 9***, 85971) and the Lower End Cap (***item 31***, 85971). Then lay out the Hall Effect Sensor PCB (out of the way) alongside the Electronics Chassis (***item 12***, 85971).

Should the Hall Effect Sensor PCB (***item 4***, 85971) not be serviced then the Board may remain connected, via its remaining wiring loom. It should still be moved out of the way and protected from any damage whilst work continues.

4 Refer to ***Step 1*** of ***Section 5.2.3.7, Servicing the PCBs*** for instructions to remove the three white wires from the Sliding Contact Block (***item 1***, 85971) and one black wire from the Fixed Contact Block (***item 2***, 85971).

5 Unscrew and retain the two Csk Screws (***item 27***, 85971) on the bottom-end of the Chassis Side Rails (***item 11 & 13***, 85971). The Fixed Contact Block (***item 2***, 85971) and Lower End Cap (***item 31***, 85971) are no longer secured to the Electronics Chassis but they are still connected to each other.

6 Slide the Fixed Contact Block (***item 2***, 85971) and Lower End Cap (***item 31***, 85971) out from between the Chassis Side Rails (***item 11 & 13***, 85971) and replace with new as required.

7 Hold the Fixed Contact Block (***item 2***, 85971) and using appropriate tooling, grasp the exposed end of the Central Contact (***item 15***, 85971) and unscrew both together, separating the remaining Lower End Cap (***item 31***, 85971) from the Fixed Contact Block (***item 2***, 85971).

8 Remove the large Insulator Disc (***item 7***, 85971), inspect and replace as required.

9 The Connector Assembly (***item 15***) and its Insulating Sleeve (***item 17***) can now be removed from the Lower End Cap (***item 31***, 85971). These may be removed separately or together.

10 There are no field serviceable parts in the Fixed Contact Block (***item 2***, 85971), so clean, check and replace with new as required.

The socket located within the Fixed Contact Block will now be free to come out from the Fixed Contact Block (***item 1***, 40150).

5.2.3.5 Servicing the Sliding Contact Block

Reference:	Electronics Assembly	***AD-85971***
	Sliding Contact Block Assembly	***AD-40118***
	Modified Motor Assembly	***AD-40279***

The Sliding Contact Block (***item 1***, 85971) runs in and out on the Motor Leadscrew and makes or breaks the Line contact to the Lower Connector by means of the two contacts (***item 5***, 40118). When the Sliding Contact Block is in the break position it is grounded by means of the Grounding Pin (***item 8***, 40118). The Sliding Contact Block also has three small Magnets (***item 2***, 40118) fitted that are used in conjunction with the Hall Effect Sensor Board (***item 4***, 85971) to ascertain the position of the Sliding Contact Block.

Note: The Magnets (***item 2***, 40118) are not field serviceable. Should the Magnets be damaged the Sliding Contact Block Assembly (***item 1***, 85971) should be replaced in its entirety.

To remove the Sliding Contact Block complete these steps:

1 Disassemble the Lower End Cap Assembly and remove the Fixed Contact Block (***item 2***, 85971), refer to ***Section 5.2.3.4, Lower End Cap Disassembly***.

2 Remove the Fixed Contact Block, refer to ***Step 10*** of ***Section 5.2.3.4, Lower End Cap Disassembly***.

3 Should it not already have been done, unsolder (using ***SN100C***) the three white and one black wire(s) from the HV Isolation Board and the Hall Effect Sensor Board (***items 4 & 6***, 85971. Refer to ***Step 4*** above.

4 Unscrew the two Csk Hd Skt Screws (***item 28***, 85971) from the top-end of the Chassis End Rails (***items 11 & 13***, 85971) and lift off the Side Rails.

Note: The other Csk Hd Screws (***item 27***, 85971) holding the Chassis Side Rails should already be removed when the Lower End Cap was disassembled.

5 Unscrew the Sliding Contact Block (***item 1***, 85971) from the Motor Leadscrew (***item 3***, 40279).

6 Check and inspect the Sliding Contact Block once free from the assembly. Should it be damaged or worn, or the magnets be damaged, replace with new, then check the Sliding Contact Block Grounding Pin and Contact Pins (***items 8 & 5***, 40118). Should they be damaged or worn, replace, otherwise complete the instructions in ***Steps 8 and 9***, after servicing the Leadscrew Nut.

7 To service or replace the Leadscrew Nut (***item 10***, 40118):

i. Remove the PTFE sleeving to separate the two white wires.
ii. Unscrew the four Skt Cap Hd Screws (***item 13***, 40118) and remove the four Spring Washers (***item 12***, 40118) and Leadscrew Nut Retainer Block (***item 11***, 40118).
iii. Slide out the Leadscrew Nut (***item 10***, 40118) from the Sliding Contact Block (***item 1***, 40118).
iv. Clean or replace the Leadscrew Nut (***item 10***, 40118) and refit into the Sliding Contact Block (***item 1***, 40118). **DO NOT** apply any grease to the Leadscrew Nut.
v. With the Leadscrew Nut (***item 10***, 40118) in place within the Sliding Contact Block (***item 1***, 40118), place one of the four M3 Spring Washers (***item 12***, 40118) onto each of the four M3

Skt Cap HD Screws (*item 13*, 40118) and use these to secure the Leadscrew Nut Retainer Block (*item 11*, 40118) onto the Sliding Contact Block (*item 1*, 40118).

vi. Tighten fully the four M3 Skt Cap HD Screws (*item 13*, 40118).

vii. Resleeve the two white wires with new PTFE sleeving.

8 To check and replace the Sliding Contact Block Grounding Pin (*item 8*, 40118):

i. Loosen the M2.5 Brass Nut (*item 9*, 40118) and unscrew and withdraw the Pin from the Sliding Contact Block (*item 1*, 40118), taking care not to damage the wire that feeds through the Sliding Contact Block and is soldered into the back of the Pin.

ii. Inspect the Sliding Contact Block Grounding Pin and when damaged or worn, replace with new.

iii. Should the Sliding Contact Block Grounding Pin (*item 8*, 40118) have been replaced, re-solder (using *SN100C*) the black ground wire into the new Pin (*item 8*, 40118) and clean off any flux residue. This connects the Hall Effect Sensor (*item 4*, 85971) to the Sliding Contact Block (*item 1*, 85971).

iv. To refit the Sliding Contact Grounding Pin (*item 8*, 40118) screw the M2.5 Brass Nut (*item 9*, 40118) fully onto the Pin (*item 8*, 40118) but do not tighten down. Place the M2.5 Spring Washer (*item 7*, 40118) and M2.5 Plain Washer onto the end of the Pin in that order.

v. Feed the black ground wire through the hole in the Sliding Contact Block (*item 1*, 40118) and screw the Pin (*item 8*, 40118) into the Sliding Contact Block. Make sure that the Pin is screwed in fully and then tighten the Brass Nut (*item 9*, 40118) against the Sliding Contact Block (*item 1*, 40118).

9 To replace the two Sliding Contact Block Contact Pins (*item 5*, 40118):

i. Unscrew and withdraw the Pins, one at a time, from the Sliding Contact Block (*item 1*, 40118) taking care not to damage the wire that feeds through the Sliding Contact Block and is soldered into the back of each of the Pins.

ii. Inspect the Sliding Contact Block Pins and when damaged or worn, replace with new.

iii. Should the Sliding Contact Block Pins (*item 5*, 40118) have been replaced, re-solder (using *SN100C*) the white Line wire into the pin (*item 5*, 40118) and clean off any flux residue. These connect the HV Isolation PCB (*item 6*, 85971) to the Sliding Contact Block (*item 1*, 85971).

iv. To refit the Sliding Contact Block Contact Pins (*item 5*, 40118) place a M3 Crinkle Washer (*item 3*, 40118) over the wire onto the Pin (*item 5*, 40118) and feed the wire through the hole in the Sliding Contact Block (*item 1*, 40118). Screw the Pin into the Sliding Contact Block and tighten fully the Pin (*item 5*, 40118).

10 The Electronics Assembly should not need to be disassembled any further. However, should the motor need servicing, it is recommended that it is done here. Refer to *Section 5.2.4, Servicing the Motor*. Otherwise reassemble the tool starting with refitting the Sliding Contact Block.

5.2.3.6 Refitting the Sliding Contact Block

Reference:		
	General Assembly	*AD-09737*
	Electronics Assembly	*AD-85971*
	Wiring Diagram	*WD-85971*

1 Inspect the wiring to the Sliding Contact Block (*item 1*, 85971) for damage and repair or replace as required. Otherwise, refer to the Wiring Diagram (*WD-85971*) to reconnect it.

2 Screw the Sliding Contact Block (*item 1*, 85971) onto the end of the Motor Leadscrew. Continue to screw the Sliding Contact Block on until it is positioned about half way down the Leadscrew. There should be a sleeved wire each side of the Pin (*item 8*, 40118) and in the wiring channel as shown below:

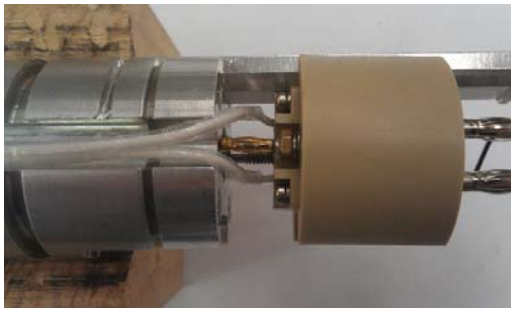


Figure 5-11 Wire Positioning around Sliding Contact Block

3 Make sure that the Sliding Contact Block is oriented correctly with the Magnets facing towards the underside of the Electronics Chassis (***item 12***, 85971) where the Hall Effect Sensor Board (***item 4***, 85971) will be mounted and refit the Chassis Side Rails (***item 11 & 13***, 85971) to the Motor Retainer Plate (***item 9***, 85971) using the two M3 Skt Cap Hd Screws (***item 28***, 85971) with the Sliding Contact Block (***item 1***, 85971) mounted between the Chassis Side Rails.

4 Use Kapton™ tape (***P/N: T004-0002***) to tape the white wires within the wiring channels in the Chassis Side Rails (***items 11 & 13***, 85971) and just over the Fixed Contact Block (***item 2***, 85971).

5 The movement and function of the Sliding Contact Block needs to be checked. This has to be carried out before the Wave Springs (***item 6***, 09737) and Pressure Housing (***item 1***, 09737) are refitted and before the tool is deployed. Refer to ***Section 5.3.1, Sliding Contact Block Movement & Function***.

5.2.3.7 Servicing the PCBs

IRRITANT!

DOW CORNING® 3140 RTV COATING

Refer to *Section 2.4.3, Dow Corning® 3140 RTV Coating*.

Reference:		
	Electronics Assembly	***AD-85971***
	Electronics Wiring Diagram	***WD-85971***

1 The HV (High Voltage) Isolation Board (***item 6***, 85971) is attached to the Electronics Chassis by means of six cap head screws; two of these just secure the board whilst the other four also secure the (FETs) mounted on the board. Complete the instructions below to service the HV Isolation Board:

i. Remove carefully, the Kapton™ Tape (***P/N: T004-00092***) that holds the wiring in place.
ii. On the HV Isolation PCB (***item 6***, 85971) remove the four Cap Hd Screws (***item 22***, 85971) and Spring Washers (***item 19***, 85971) that secure the four FETs in place.
iii. Then remove and retain the two Cap Hd Screws (***item 22***, 85971) and Spring Washers (***item 19***, 85971) that secure the board to the chassis.
iv. Unsolder (using ***SN100C***) the relevant wires from the PCB.

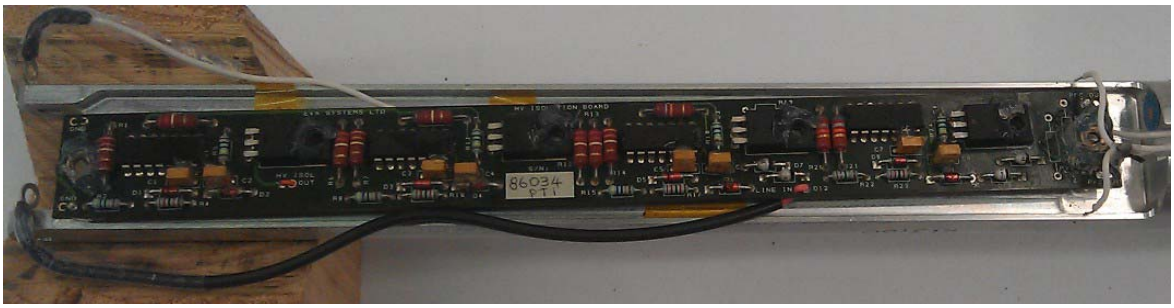


Figure 5-12 HV Isolation Board with wires unsoldered

v. Lift carefully the HV Isolation PCB (***item 6***, 85971), away from the Electronics Chassis (***item 12***, 85971).
vi. Replace the HV Isolation PCB (***item 6***, 85971) when necessary, referring to the wiring diagram (***WD-85971***).
vii. Inspect the wires for serviceability and replace any wires where necessary, then solder (using ***SN100C***) the wires back onto the PCB and remove any flux residue.

2 To refit the HV Isolation board:

i. Fit loosely the two Cap Hd Screws (***item 22***, 85971), with Spring Washers (***item 19***, 85971) fitted, in the two PCB fixing locations (one at either end of the board).
ii. Fit the four Cap Hd Screws (***item 22***, 85971), with Spring Washers (***item 19***, 85971) fitted, in the four FETs locations.
iii. Make sure that all wiring is clear of the Electronics Chassis.
iv. Tighten fully and carefully the six Cap Hd Screws (***item 22***, 85971). These should be tightened to no more than 1Nm. Refer to ***Section 7.2.4, Transistor Mounting on PCB 86034***.
v. Replace the Kapton™ Tape (***P/N: T004-00092***) to secure wires in place.

3 The ADS Logic Board (***item 5***, 85971) is attached to the Electronics Chassis by means of three cap head screws. Follow the instructions below to service the ADS Logic Board:

i. Remove carefully, the Kapton™ Tape (***P/N: T004-00092***) that holds the wiring in place.
ii. Remove and retain the three Cap Hd Screws (***item 22***, 85971) and Spring Washers (***item 19***, 85971) from the ADS Logic Board (***item 5***, 85971).
iii. Unsolder (using ***SN100C***) the relevant wires from the PCB.
iv. Replace the ADS Logic Board (***item 5***, 85971) when necessary, referring to the wiring diagram (***WD-85971***).
v. Inspect the wires for serviceability and replace any wires where necessary, then solder (using ***SN100C***) the wires back onto the PCB and remove any flux residue.

4 To refit the ADS Logic Board:

i. Fit loosely the three Cap Hd Screws (***item 22***, 85971), with Spring Washers (***item 19***, 85971) fitted, in the PCB fixing locations.
ii. Make sure that all wiring is clear of the Electronics Chassis.
iii. Tighten fully and carefully the three Cap Hd Screws (***item 22***, 85971).
iv. Replace the Kapton™ Tape (***P/N: T004-00092***) to secure wires in place.

5 The Hall Effect Sensor Board (***item 4***, 85971) is attached across the motorised connector block and monitors the position of the Sliding Contact Block (***items 1***, 85971) as it is motored back and forth. The board is secured by means of two Slotted Pan Hd Screws (***items 20***, 85971), one at each end. Follow the instructions below to service the Hall Effect Sensor Board:

i. Remove any Kapton™ Tape (***P/N: T004-00092***) keeping the wiring in place. Make a note of the position of the tape.

ii. Remove any Dow Corning® RTV 3140 Coating (***P/N: T006-03140***) to gain access to the fasteners on the Board.
iii. Unscrew and retain the two Slotted Pan Hd screws (***item 20***, 85971) and Crinkle Washers (***item 21***, 85971). There will also be some Insulator Standoffs (***item 8***, 85971) to remove. These are located underneath the Board.
iv. Lift the Hall Effect Sensor PCB (***item 4***, 85971) away from the Motor Retaining Plate (***item 9***, 85971), Sliding Contact Block Assembly (***item 1***, 85971) and Fixed Connector Block Assembly (***item 2***, 85971).

Note: When servicing the Contact Blocks (***items 1 & 2***, 85971), unsolder (using ***SN100C***) the two black wires adjacent to the Fixed Contact Block (***item 2***, 85971), that are on the Hall Effect Sensor Board. The Board can then be removed from its loom and moved to one side as shown below:

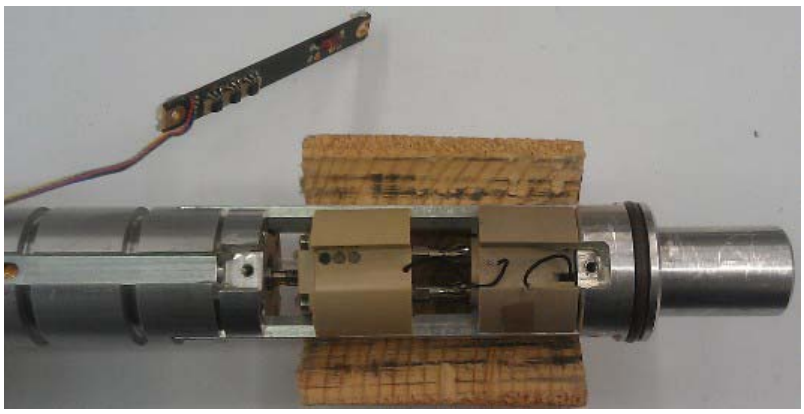


Figure 5-13 Hall Effect Sensor Board with unsoldered wires

v. Should it be necessary to replace the Hall Effect Sensor Board Assembly (***item 4***, 85971), unsolder (using ***SN100C***) the five wires from the ADS Logic Board (***item 5***, 85971) that connect to the Hall Effect Sensor Board, then on the Board itself, unsolder the two black wires that connect to the Contact Blocks (***items 1 & 2***, 85971).

6 To refit the Hall Effect Sensor Board (***item 4***, 85971):

i. Fit loosely the two Pan Hd Screws (***item 20***, 85971), with Crinkle Washers (***item 21***, 85971) fitted, through the PCB fixing Holes and then through the Insulator Standoffs (***item 8***, 85971) to the Motor Retaining Plate (***item 9***, 85971) and the Fixed Connector Block Assembly (***item 2***, 85971).
ii. Make sure that the PCB is fitted with the Hall Effect Sensors on the inner side facing towards the Sliding Contact Block (***item 1***, 85971).
iii. Make sure all wiring is clear of the Electronics Chassis (***item 12***, 85971) then tighten fully the two Pan Hd Screws (***item 20***, 85971).
iv. Reconnect and solder the wires, refer to ***WD-85971*** for connection details. Make sure that the wires are routed correctly through their strain relief holes and soldered in place using ***SN100C*** solder. Remove all flux residue after soldering.

5.2.3.8 Fixed Contact Block & Lower End Cap Reassembly

IRRITANT!

LOCTITE® 243 THREAD LOCKER

Refer to *Section 2.4.2, Loctite® 243 Thread Locker*.

Reference: Electronics Assembly ***AD-85971***

1 Check the insulators (***items 7, 17 & 16***, 85971) and the Central Contact (***item 15***, 85971), replace when necessary.

2 When the Central Contact (***item 15***, 85971) has been removed from the Fixed Contact Block (***item 2***, 85971), reassemble the Connector Assembly by completing the steps below (otherwise refer to ***Step 3***):

i. Refit one of the Retaining Nuts (***item 16***, 85971) to the back of the Lower End Cap (***item 31***, 85971).
ii. Insert the Insulating Sleeve and the Central Contact (***items 17 & 15***, 85971) together, into the Lower End Cap (***item 31***, 85971).
iii. Place the Insulator Disc (***item 7***, 85971) over the threaded end of the Central Contact Assembly (***items 17 & 15***, 85971).
iv. Screw together, carefully, the Lower End Cap (***item 31***, 85971) and the Connector Assembly (***items 16, 7, 17 & 15***, 85971) with the Fixed Contact Block (***item 2***, 85971).

3 To refit the Fixed Contact Block (***item 2***, 85971), Lower End Cap (***item 31***, 85971) and the associated Connector Assembly (***item 7, 16, 15 & 17***, 85971):

i. Slide the Fixed Contact Block (***item 2***, 85971) between the Chassis Side Rails (***item 11 & 13***, 85971), until the slots in the Lower End Cap also engage with the Chassis Side Rails.
ii. Make sure the third and smaller slot (located in the Lower End Cap (***item 31***, 85971) is orientated correctly with respect to the Motor Retainer Plate (***item 9***, 85971), so the Hall Effect Sensor PCB (***item 4***, 85971) can be fitted at a later stage.
iii. Using small pliers, grasp the end of the Central Contact (***item 15***, 85971) and tighten with respect to the Fixed Contact Block (***item 2***, 85971).
iv. Apply a small amount of Loctite® Threadlocker 243 (***P/N: 91064***) and tighten the Csk Hd Skt Screws (***item 27***, 85971). Be sparing with the threadlocker, as too much will impair the electrical conductivity of the Connector. **Make sure the threadlocker is only applied to the threads!**
v. Fit one of the Retaining Nuts (***item 16***, 85971) to the Lower End Cap (***item 31***, 85971) and tighten.

4 Inspect the wiring to the Fixed Contact Block (***item 2***, 85971) for damage and repair, replace or reconnect as required. Refer to the Wiring Diagram (***WD-85971***) for information.

5 Before resoldering any wires, refer to the Wiring Diagram (***WD-85971***) for information and make sure the wires are routed through the strain relief holes correctly. Then (using ***SN100C***), resolder any wires to the Boards and remove any flux residue after soldering. The relevant wires to reattach are:

- the two white wires from the Sliding Contact Block and the one white wire from the Fixed Contact Block (***items 1 & 2***, 85971) to the HV Isolation PCB (***item 6***, 85971).
- the two wires to the Hall Effect Sensor PCB (***item 4***, 85971), one is from the Sliding Contact Block (***item 1***, 85971) and the other from the Fixed Contact Block (***item 2***, 85971).

6 Refit the HV Isolation Board and the Hall Effect Sensor PCB (items 6 & 4, 85971). Refer to ***Section 5.2.3.7, Servicing the PCBs***.

7 Apply Kapton™ tape (***P/N: T004-00092***) to retain the wires correctly within their respective wiring channel grooves on the Fixed Contact Block (***item 2***, 85971), the Chassis Side Rail (***item 13***, 85971) and over the end of the slot in the main Electronics Chassis (***item 12***, 85971).

8 Apply, carefully, a small amount of Dow Corning® RTV 3145 (***P/N: T006-03145***) to the joint seam between each outer Retaining Nut (***item 16***, 85971) and their respective End Caps (***items 10 & 31***, 85971). Make sure no RTV is allowed to ingress into the open end of the two Central Contact Assemblies (***items 15 & 17***, 85971).

9 Fit new Buffer O-Rings (***item 30***, 85971) to the centre of the Electronics Chassis and, should one not already be fitted, fit an O-Ring to the Lower End Cap (***item 31***, 85971).

The O-Rings fitted to the Electronics Chassis and End Caps are for shock absorption only and should only be replaced if there is evidence of excessive damage or wear, or after five accumulated exposures to temperatures above 100°C (212°F) to avoid temperature set. **DO NOT** apply grease to the buffer O-Rings. For more information about checks for O-Rings, refer to ***Section 7.1.3, Seal Replacement Recommendations***.

10 The tool is now in a state to reassemble. Then perform all necessary checks before the tool is deployed. Refer to ***Section 5.3, Reassembly***.

5.2.4 Servicing the Motor

Reference:	Electronics Assembly	***AD-85971***
	Modified Motor Assembly	***AD-40279***

The Motor (***item 3***, 85971) drives the Sliding Contact Block (***item 1***, 85971) in and out to make or break the contacts with the Fixed Contact Block (***item 2***, 85971). Complete the instructions below to service the Motor:

1 Remove the Lower End Cap and the Fixed Contact Block Assemblies, refer to ***Section 5.2.3.4, Lower End Cap Disassembly*** for instructions about how to do this.

2 Remove the Sliding Contact Block, refer to ***Section 5.2.3.5, Servicing the Sliding Contact Block*** for instructions about how to do this.

3 Remove any Kapton™ tape (***P/N: T004-00092***) and unsolder (using ***SN100C***) the two (red and black) Motor wires from the ADS Logic Board (***item 5***, 85971).

4 Should it not already have been done when servicing the Sliding Contact Block (***Step 5*** of ***Section 5.2.3.5***), then unscrew the four M3 Skt Cap Screws (***item 26***, 85971) and lift off the Motor Retainer Plate (***item 9***, 85971). Carefully slide the Motor (***item 3***, 85971) out of its recess in the lower end of the Electronics Chassis (***item 12***, 85971) feeding the two Motor wires through the slot in the Electronics Chassis whilst taking care not to damage the wires.

5 Seated at the bottom of the Motor recess in the Electronics Chassis is a Buffer O-Ring (***item 29***, 85971). This O-Ring is for shock absorption only and should only be replaced if there is evidence of excessive damage or wear, or after five exposures to temperatures above 100°C (212°F), to avoid accumulated temperature set. **DO NOT** apply grease to the Buffer O-Rings. Refer to ***Section 7.1.3, Seal Replacement Recommendations***.

6 To replace the Leadscrew (***item 3***, 40279) knock out the Spirol™ Pin (***item 4***, 40279) and pull the Leadscrew off the Motor Output Shaft. Fit a new Leadscrew, line up the holes and fit a new Spirol™ Pin.

5.2.4.1 Refitting the Motor

Reference: Electronics Assembly *AD-85971*

There are no user servicable parts in the Motor (*item 1*, 40279). To replace the Motor:

1 Clean and refit or replace the O-Ring (*item 29*, 85971) in the bottom of the Motor recess in the Electronics Chassis (*item 12*, 85971). **DO NOT** apply grease to the O-Ring.

2 Feed the two (red & black) Motor wires into the Motor recess in the Electronics Chassis (*item 12*, 85971) and out through the slot towards the bottom end of the recess. Pull gently these wires through whilst sliding the Motor (*item 3*, 85971) into the recess. Take care not to trap or otherwise damage the wires.

3 Align the Motor Assembly (*item 3*, 85971) so that the slots in the Motor end plate are aligned with the cut-outs in the end of the Electronics Chassis (*item 12*, 85971) and the two motor wires are not twisted around the motor inside the motor recess. Place the Motor Retainer Plate (*item 9*, 85971) over the Motor output shaft and align the slots with the Motor end plate and in the end of the Electronics Chassis. Place the four M3 Spring Washers (*item 19*, 85971) onto the four M3 Skt Cap Screws (*item 26*, 85971) and refit the screws into the end of the Electronics Chassis to hold the Motor in place. Tighten fully the four screws.

4 Route the two (red & black) Motor wires through to the ADS Logic Board (*item 5*, 85971) and resolder them to the PCB (using *SN100C*) solder. (Make sure that the wires pass underneath the three buffer O-Rings (*item 30*, 85971) on the Electronics Chassis (*item 12*, 85971). Refer to *WD-85971* for wire connections. Make sure that the wires are routed correctly through the strain relief holes and remove any flux residue after soldering.

5 Use Kapton™ tape (*P/N: T004-00092*) to secure the wires in place so that they do not get damaged when the tool is reassembled.

5.3 Reassembly

Reference: Assembly Drawing *AD-09737*
Electronics Assembly *AD-85971*

WARNING! **LIQUID-O-RING® TYPE 101 LUBRICANT**

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

Make sure the wiring is not damaged. Pay special attention to the white wires, running from the HV Isolation PCB (*item 6*, 85971) to the Contact Block (*item 1*, 85971) and make sure the wiring is not trapped during reassembly and that when reassembled, all wiring lies freely with no excessive strain.

Finally, check the wiring running along the Electronics Chassis (*item 12*, 85971) is secured at regular intervals with Kapton™ tape (*P/N: T004-00092*) and refer to *Section 7.1.3, Seal Replacement Recommendations* for information about the lubrication and location of the O-Rings.

5.3.1 Sliding Contact Block Movement & Function

WARNING!

ELECTRICAL SAFETY WARNING!

DO NOT touch the tool when it is powered up or connected to the ADSP!

Reference:		
	Assembly Drawing	***AD-09737***
	Electronics Assembly	***AD-85971***
	Sliding Contact Block Assembly	***AD-40118***

Once fitted, the movement and function of the Sliding Contact Block (***item 1***, 85971) needs to be tested. To do these checks, access to a multimeter and ADSP panel are required. During these tests, should the Sliding Contact Block not move freely up and/or down the Connection Pins (***item 5***, 40118), then the bottom end of the tool will need disassembling. Refer to ***Section 5.2.3.5, Servicing the Sliding Contact Block***.

1 Fit an adaptor to the tool whilst the Pressure Housing (***item 1***, 09737) is off and run a line out cable (via Dummy Logging Cable (DLC)) to the top of the Electronics Assembly (***item 2***, 09746).

2 Switch the mains power and ADSP on and motor the tool to the **SAFE (Open)** position. Then disconnect the tool from the panel, DLC and line out cable.

3 Using a multimeter, check the continuity and insulation of the tool. Refer to ***Section 7.1.1, Electrical***. These readings should be the same with the Pressure Housing (***item 1***, 09737) off and on. The readings should be measured as insulation to Electronics Chassis and the continuity (resistor to Chassis), refer to ***Section 7.1.1, Electrical***, ***Step 1***.

4 Reconnect the tool to the panel and motor the tool to the **FIRE (Closed)** position, then disconnect the tool from the panel, DLC and lineout cable.

5 Using a multimeter, check the continuity. It should be an open circuit to infinite reading, making the tool safe to connect a perforating gun below it.

6 Check the Sliding Contact Block motors to each position before it times out (at 30 seconds). Should the tool current rise significantly above the average and/or the motor labour, this is a good indication there may be a problem and the Sliding Contact Block will need rechecking. Refer to ***Section 5.2.3.5, Servicing the Sliding Contact Block***.

   Monitor the electrical wires visually during the movement phases of the Sliding Contact Block (***item 1***, 85971), to make sure that they don't get pinched or become trapped by that movement.

7 When all tests are finished and the Sliding Contact Block is verified as working, the Pressure Housing can be fitted.

5.3.2 Refitting the Pressure Housing

Reference:		
	Assembly Drawing	***AD-09737***

To reassemble the tool, push the Electronics Assembly (***item 2***) into the Pressure Housing (***item 1***), making sure the Upper and Lower ends of the Electronics Assembly are correctly orientated with respect to the markings on the Pressure Housing (when reading the text in its correct orientation, then the Lower End of the Electronics Assembly should be at the bottom of the Pressure Housing).

5.3.3 REFITTING THE UPPER & LOWER SUBS

Reference:	Assembly Drawing	***AD-09737***
	Electronics Assembly	***AD-85971***

1 Should it not already have been done, fit new Primary O-Rings (***items 3 & 4***, 09737) to each End Sub (***items 7 & 11***, 09737) and lubricate with a small amount of Liquid-O-Ring® type 101 (***P/N: LOR101***).

2 Check the condition of the Wave Springs (***item 6***, 09737), should this not already have been done. Then, locate and make sure the Wave Springs are seated correctly over the End Caps (***items 10 & 31***, 85971) at each end of the Electronics Assembly (***item 2***, 09737), so that they fit inside the Pressure Housing (***item 1***, 09737), when it is fitted. This is important so that they can move correctly, with the axial load, when the ADS is used with perforating guns.

3 Making sure the Wave Springs (***item 6***, 09737) are still present at each end, position the relevant End Sub (***items 7 & 11***, 09737) in place and start to screw together the End Subs and Pressure Housing (***item 1***, 09737). See ***Figure 5-14***. It is best to start engaging one End Sub and then once the resistance is felt from the Wave Spring, stop and engage the other End Sub (partially) also.

Once both End Subs have been partially engaged, continue to screw them together (alternately) within the Pressure Housing, until both are fully tight.

Figure 5-14 End Subs removed

4 Check the Thread Protectors (***items 9 & 5***, 09737) and change the environmental O-Ring on the Male Thread Protector (***item 9***, 09737) when required but **DO NOT** grease it. Then should it be necessary, fit the End Protectors onto the ends of the End Subs (***items 7 & 11***, 09737).

5 The tool is now fully reassembled. Complete the necessary electrical checks before the tool leaves the workshop. Refer to ***Section 7.1.1, Electrical***.

6 Connect the ADSP to the ADS using a Dummy Logging Cable and Line Out cable and switch on the mains power. Refer to the ADSP Manual (***MN-ADSP001***) for instructions.

7 Check that the tool can motor to the **SAFE (Open)** and **FIRE (Closed)** positions. Once this is achieved, disconnect the tool from the ADSP and switch off the mains power.

6 ELECTRICAL DESCRIPTION

6.1 ADS Tool

Reference:	ADS003 Wiring Diagram	*WD-09737*
	Electronic Chassis Wiring Diagram	*WD-85971*

The tool contains three PCB assemblies and the motor switch mechanism. Isolation from high or positive wireline voltages is provided by the HV Isolation PCB 86032. Control and monitoring of the tool is performed by the Processor PCB assembly 86032 (410462 when programmed). The position of the switch mechanism is detected by Hall effect sensors mounted on the Hall sensor PCB assembly 86030. The switch is operated by the DC Gearmotor assembly 40279.

6.1.1 HV Isolation Circuit Board

Reference:	HV Isolation Board	*CD-86034*

6.1.1.1 Line Isolation Circuit

The Line Isolation Circuit is intended to isolate the ADS electronics from the wireline when the voltage on the line is outside the range 0 (zero) to -80V DC. It has to be able to withstand up to +1500V DC and -1000V DC or 600V AC for short periods at full rated temperature, and allow a through voltage of ±1000V DC or 500V AC at 5A, while maintaining that isolation sufficiently to prevent the ADS from powering up in any way. The circuit consists of three similar cascaded modules. Each module has a threshold detector, based around a CMOS inverter IC (U1, U2 & U3). When the line voltage is sufficiently high, the voltage across the resistor (R4, R10, R17) the gate) is turned on. The result is that the MOSFET pass transistor (Q1, Q2 & Q3) is turned off, thus isolating the ADS circuit from the line. The resistor and diode (R1/D2, R7/D4 & R14/D6) provide local power for the CMOS Inverter ICs (U1, U2 & U2), while zener diode (D1 , D2 & D3) prevent excessively high voltages from reaching the logic IC inputs. The resistor chain R3, R9 and R16 bias the transistor cascade, such that they share the line voltage equally. Resistors R6, R12, R13 provide extra resistance in the voltage dividing chains, according to the level of the module in the cascade. Diodes D12 and D7 and resistors R25 and R26 prevent reverse voltage operation.

6.1.1.2 Passenger Protection Circuit

The passenger protection circuit is intended to isolate all tools below the ADS, while the ADS is powered up at -35 to -95VDC nominal line voltage. The circuit is identical in operation to the line isolation circuit module, described in ***Section 6.1.1.1***, except that it works in the opposite sense; i.e the MOSFET (Q4) is turned off when CMOS inverter (U4) detects a voltage in the range 0 (zero) to -100VDC. This prevents the ADS power from reaching the tools below the ADS under all circumstances, when the ADS is powered up. The circuit is tolerant of short circuits to ground in either or both polarities over the full temperature range.

6.1.2 Processor Circuit Board

Reference:	Processor Circuit Board	*CD-86032*

6.1.2.1 Power Supply

Power regulation for the tool logic is provided by zener diode (D5) via the current source around transistors (Q1 & Q2). The current source is set at 10mA. Positive voltages are blocked by diode (D6) and fuse (F1) provides protection in the event of catastrophic failure.

6.1.2.2 Downlink Receiver

Downlink voltage pulses are detected on the wireline by capacitors (C1 & C2). Two of the inverters (U1F & U1B) are configured as comparators with the threshold set by resistors (R4 to R7). The resultant logic level pulses are decoded by U3 & U5 and the data-stream passed to the PIC processor. (U2)

6.1.2.3 Uplink Driver

Current pulses are placed on the wireline by connecting resistors (R19 & R18) between wireline and armour using Q11 & Q12 as switches. Note that in normal operation transistor (Q12) is normally on and is turned off to generate a negative current pulse.

6.1.2.4 Motor Control Bridge

The motor is controlled bi-directionally via a conventional H-bridge configured around MOSFETs (Q3 to Q6) with appropriate level shifting. In addition a separate MOSFET (Q10) is used to isolate the bridge. In operation a hardware watchdog circuit based around MOSFTET (Q14) has to be continually triggered by the PIC processor (U2) in order to keep the logic level signals to the bridge active. If the processor stops running for any reason the bridge will fail fully off.

6.1.2.5 Hall Effect Sensor Interface

The Hall Effect Sensors are open collector devices and pull-up resistors (R21 to R23) are provided for all sensors followed by Schmitt trigger buffers (U1). In addition since the Hall Effect Sensors have a high quiescent current, they are only turned on for short periods (approximately 10µs) by the processor (U2) when they are required to be read. This is accomplished by MOSFET (Q13).

6.1.2.6 PIC Processor.

All control and monitoring functions are performed by a PIC 16F819 microcontroller (U2) clocked at 4MHz. In-circuit re-programming is implemented. In the event that the PIC detects a fault condition it goes to a low current state and remains in an infinite wait loop waiting for power-on-reset.

6.1.3 HALL EFFECT SENSOR PCB

Reference: Hall Sensor Board *CD-86030*

The three Hall Effect Sensors are mounted on the underside of the PCB to align with the magnets on the sliding switch block. In addition the PCB carries the resistor circuitry (R1 & R2) used to short the lower head to chassis when the switch mechanism is in the **SAFE (Open)** position.

7 EXTENDED CHECKS

7.1 Preventative Maintenance

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

CAUTION!

SEAL INTEGRITY

Refer to ***Section 2.5.2, Seal Maintenance***.

7.1.1 ELECTRICAL

1 Using a multimeter check the continuity and insulation as follows:

Note: The readings given below are for guidance only and are very much dependant on the meter used as some measurements are through diode junctions. It is recommended that you record your own readings for a known good tool for each meter available to you and use these readings when validating the tool prior to logging.

Tool in OPEN (SAFE) Mode

Upper Connector (+ve probe) to Lower Connector (-ve probe)	>10MΩ
Upper Connector (+ve probe) to Housing (-ve probe)	>10MΩ
Lower Connector (+ve probe) to Upper Connector (-ve probe)	>3MΩ
Lower Connector (+ve probe) to Housing (-ve probe)	100Ω ±10%
Housing (+ve probe) to Upper Connector (-ve probe)	~3MΩ
Housing (+ve probe) to Lower Connector (-ve probe)	100Ω ±10%

Tool in CLOSED (FIRE) Mode

Upper Connector (+ve probe) to Lower Connector (-ve probe)	~1MΩ (Series Diode)
Upper Connector (+ve probe) to Housing (-ve probe)	>10MΩ
Lower Connector (+ve probe) to Upper Connector (-ve probe)	>20MΩ (Series Diode + FET)
Lower Connector (+ve probe) to Housing (-ve probe)	>20MΩ
Housing (+ve probe) to Upper Connector (-ve probe)	~2MΩ
Housing (+ve probe) to Lower Connector (-ve probe)	~2MΩ

2 Make sure any Kapton™ tape (***P/N: T004-00092***) used to secure wiring within wire channels is in good condition and will not become trapped between the Electronics Chassis (***item 12***, 85971) and Pressure Housing (***item 1***, 09737).

3 Check tool current.

4 Perform a visual inspection of the electronics for debris, damaged components and wires. This should include an inspection of the wiring around the Switch Assembly (***items 1 & 2***, 85971). which is subject to movement as the Sliding Contact Block (***item 1***, 85971) itself moves.

This inspection should include making sure the wires are not trapped at any time during the full range of movement of the Sliding Contact Block (***item 1***, 85971). Wires which run in channels or holes within the Electronics Chassis (***item 12***, 85971), should be correctly located and not have incurred chafing or other damage.

7.1.2 MECHANICAL

Reference: Electronics Assembly *AD-85971*

1 Remove dirt and old grease from pressure housing threads and seals. Apply fresh grease.

2 Inspect seals for damage or ageing/hardening and replace where required.

3 Check for:

- Damaged wires
- Wires that are loose or likely to be damaged during reassembly
- Damaged components
- Electrical components shorting to chassis
- Heat or chemical damage (discoloured components)
- Incorrect thread grease or excessive quantity, see *Section 2.4*
- Cleanliness of connectors and loose/bent pins before replacing
- Loose screws/nuts/components/connectors.

Note: When RTV3140 (*P/N: T006-03140*) or RTV3145 (*P/N: T006-03145*) is used to secure loose components, it must be fully cured before housing is replaced.

4 Check all fasteners for tightness, particularly after use in which the tool has been subjected to extreme mechanical shock or vibration.

5 Check the tightness of the connector pins in the Sliding Contact Block (*items 1*) and tighten if necessary.

DO NOT overtighten. Excessive torque will strip the threaded inserts from within the Sliding Contact Block.

7.1.3 SEAL REPLACEMENT RECOMMENDATIONS

Reference: Assembly Drawing *AD-09746*
Electronics Assembly *AD-85971*

Refer also: *Section 4.3, Post Logging Checks*.

WARNING! **LIQUID-O-RING® TYPE 101 LUBRICANT**

Refer to for *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

GE Oil & Gas recommend that all the primary seals are replaced after every run or six months when the tool is not in use.

Secondary seals should be replaced under these situations:

- 25 runs or sooner when damaged.
- one year when not in use.
- when the tool is run in a well with temperatures >150°C (302°F).
- when exposed to H_2S or CO^2.

Anti-Extrusion Rings (Back-up Rings) should be cleaned and checked every time the seals are replaced. It is recommended that they are replaced every 25 runs or sooner when damaged. Refer to *Appendix C* for the correct fitting of the Anti-Extrusion Rings.

Note: The O-Rings fitted to the chassis assembly are not pressure isolating seals. They act as shock absorbers and spacers between the chassis and housing. Therefore their physical condition is less critical than those in pressure isolating locations. However, should they exhibit signs of significant wear or damage

they must be replaced, or after every five runs, because they are used as shock absorbers to buffer the electronics during perforating for example. These O-Rings are made of a softer material to the pressure seal O-Rings - **DO NOT** mix them up.

Primary Seals:

- Four O-Rings (***item 3***, 09737)
- Two O-Rings (***item 4***, 09737)
- One O-Ring (***item 29***, 85971)

Secondary Seals:

- Two O-Rings (***item 10***, 09737)
- Five O-Ring Seals (***item 30***, 85971) that act as shock absorbers.

There is also one environmental O-Ring Seal on the Upper Thread Protector (***item 9***, 09737).

7.1.4 Ageing of Electronics

At 150°C (302°F), significant electronic ageing failures are expected after 4000hrs typical use, hence PCB replacement should be considered at this point. Every additional 10°C (18°F) halves the time. Life of the electronics is also accelerated by vibration and corrosive gas inside the chassis. Visual inspection and logging previous history is recommended, but is unlikely to predict premature failure. Tools that may be suspected of reliability problems due to age or unusual log response may be heated to 120°C (248°F), which would not normally age the electronics, and afterwards subjected to moderate vibration. A moderately hard blow from a wooden hammer is recommended.

DO NOT USE METAL HAMMERS.

7.1.5 Heat Testing above 120°C (248°F)

This is not generally recommended since it shortens tool life expectancy. Heat testing may be required for contractual reasons, tool out of use for a long period, or job with unusually high well temperature. The test should be carried out slightly above expected well temperature only and the tool should not be kept at temperature for more than 1 hour. Do not exceed the maximum rated temperature for the tool.

7.2 Extraordinary Maintenance

Reference:	ADS003 General Assembly	***AD-09737***
	Electronics Assembly	***AD-85971***
	Sliding Contact Block Assembly	***AD-40118***
	Motor Assembly	***AD-40279***

Faults are likely to be confined to:

- The Motor Assembly
- Sliding Contact Block Assembly
- The Wave Springs on the Electronics Assembly
- Transistor Mountings on the HV Isolation PCB; and
- Communication between the tool and ADSP

Therefore complete these maintenance checks, as part of fault finding when servicing the tool:

7.2.1 Servicing the Leadscrew Nut

Should excessive current be noted during switch actuation, the Leadscrew Nut (***item 10***, 40118) should be inspected for signs of damage or contamination with dust; the cleanliness of the rails on which the Sliding Contact Block (***item 1***, 85971) slides should also be checked. The block should not be tight on the

rails, a small amount of play should be evident, equivalent to 0.01 to 0.02″ clearance should be evident between block and rails. Refer to ***Section 5.2.3.5, Servicing the Sliding Contact Block***.

7.2.2 Motor Assembly

The Gearmotor uses a planetary gearbox assembly and this may become worn or damaged in the event of significant use or excessive shock. This will be revealed by excessive gear noise and/or high current while the motor is running. Refer to ***Section 5.2.3.6, Refitting the Sliding Contact Block***.

Should the gear noise significantly vary in pitch with each revolution of the Motor Leadscrew (***item 3***, 40279), then the Motor Leadscrew itself may be damaged and should be carefully inspected.

7.2.3 Wave Springs

If the wave springs (***item 6***, 09737) located at the ends of the Electronics Assembly (***item 2***, 09737), show signs of damage or loss of tension they should be replaced. The free height of the spring should be between 4 and 6mm. Refer to ***Section 5.2.2, Servicing Upper & Lower Subs***.

7.2.4 Transistor Mounting on PCB 86034

The screws (***item 22***, 85971) securing Q1 to Q4 to the Electronics Chassis (***item 12***, 85971) on PCB 86034 should not be over-tightened or there is a significant risk of damaging the transistor housings. The maximum applied torque should be 1.0Nm. No insulation parts are required but a spring washer (***item 19***, 85971) should be fitted between bolt head and transistor body. Refer to ***Section 5.2.3.7, Servicing the PCBs*** (***Step 1***).

7.2.5 Communication with the ADSP

In the event of a failure causing a loss of communication between the tool and panel, the panel will time out and indicate a fault condition which results in the tool being turned off. In order to facilitate basic fault finding of the tool, it is permissible to power the tool in isolation by connecting it to a DC power supply. The positive output of the power supply should be connected to the tool chassis and the negative output to the line input, at the upper head of the tool. Voltages in the range -50 to -60VDC will be suitable. This will enable basic tests on supply rails to be carried out. Refer to ***MN-ADSP001*** for instructions about how to operate the panel with the ADS tool.

7.3 Troubleshooting

An oscilloscope, digital multi-meter, soldering iron and hand tools will be required to perform electrical checks. Also, refer to ***Section 5, Mechanical Description*** and ***Appendix B, Drawings & Parts lists*** for any instructions and drawings required to perform these checks.

In order to facilitate basic fault finding of the tool, it is permissible to power the tool in isolation by connecting it to a DC power supply. The positive output of the power supply should be connected to the tool chassis and the negative output to the line input, at the upper head of the tool. Voltages in the range -50 to -60VDC will be suitable. This will enable basic tests on supply rails to be carried out.

Below are a list of extended electrical checks to be performed on the ADS Tool:

Table 7-2 ADS Tool Extended Electrical Checks

Symptom	Check
Initial Inspection	Check for: • Damaged wires • Damaged components • Electrical components shorting to chassis • Heat or chemical damage (discoloured components) • Incorrect thread grease or excessive quantity, refer to *Section 2.5*. Also check all fixings are tight.
Excessive Tool Current	Check for trapped or shorted wires. Disconnect line connection to Processor Board to isolate fault to Processor Board or HV Isolation Board. Replace or fault find faulty PCB.
Little or no tool current	Check for broken wiring or feed-throughs at both ends of the tool. Check that the HV Isolation Board is operating correctly, the line out voltage should be present with a head voltage of between 0 and -95V DC nominal. Check for the presence of 4.6 to 5.2VDC on the Control PCB by measuring the voltage across D5.
Excessive Motor Current	Check alignment and condition of the connector pins and sockets within the switch element. Clean or replace as necessary. Check the motor's condition. If the motor/gearbox is noisy it may be excessively worn. Check the freedom of movement of the sliding switch element within the chassis. Make sure that the guide rails are free of contamination. Do not apply lubricant, it is not necessary and could lead to contamination of the switch connectors. Remove the motor and connect it to a bench PSU. Replace it if motor current is in excess of 100mA with no load at 50VDC
Motor Does Not Run	Check for broken or damaged wires to the motor. Check the motor drive MOSFETs on the Control PCB (Q3 to Q6) by measuring the voltage between Red and Black motor terminations - it should be approximately equal to tool head voltage during motor run period. Remove the motor and connect it to a bench PSU. The output shaft should turn at 1 to 2rps at 50V DC and should continue to turn even at low voltages.
No communication between tool and panel	Check the wiring to the upper head. Isolate the HV Isolation PCB and apply the line connection directly to the Control PCB. Should this be successful, fault find or replace the HV Isolation PCB.

APPENDIX A EQUIPMENT & RECOMMENDED SPARES

A.1 Main Equipment

Part No	Description	Qty	Remarks
ADS003	Addressable Downhole Switch $2^1/_8$"	1	Sondex Ends
ADSP001	ADS Surface Panel	1	Refer to ***MN-ADSP001***

A.2 Ancillary Equipment

Part No	Description	Qty	Remarks
AS90065	$2^1/_8$" Shock Tool Assembly	1	
KIT-90065CPLT	Kit Shock Sub 21/8" Complete W O Rings	1	

A.3 Maintenance Equipment

A.3.1 CONSUMABLES

Part No	Description	Qty	Remarks
LOR101	Liquid-O-Ring® type 101 Lubricant for greasing O-Ring seals	1	5oz pot
LOR101L	Liquid-O-Ring® type 101 Lubricant for greasing O-Ring seals	1	16oz pot
91064	Loctite® Threadlocker 243	1	10ml bottle
T006-03140	Dow Corning® 3140 RTV	1	90ml tube
T006-03145	Dow Corning® 3145 RTV	1	90ml tube
T004-00092	Kapton Tape (25mm Width)	1	Roll (length 33m)
N/A	SN100C Flux Cored Solder Wire	N/A	Not available from GE Oil & Gas

A.3.1 SERVICE/HANDLING TOOLS

Part No	Description	Qty	Remarks
KITT-ADS002/03	Hand Tool Kit for ADS002/03	1	
KITB-Earth Clip	Tool Safety Clamp (Earthing kit)	1	Refer to Tools Safety Clamp manual (***P/N: MN-TSC001***)

A.4 Recommended Spares

Part No	Description	Qty	Remarks
KITB-ADS003	Basic Spares Kit (supplied with tool)	1	To support one run in hole
KITR-ADS003	Recommended Spares Kit	1	Supports 25 runs in hole
KITO-ADS003	O-Ring Spares Kit	1	

A.5 Kit Details

PARTS LISTING

Part	*Issue*
KITT-ADS002/03	A

Description

Kit Hand Tools ADS (002 & 003)

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	91105	Toolroll With SX Badge Large Black	1	EA	
0002	91005	Spanner Open Ended 42mmx38mm	2	EA	
0003	91130	Pin C Spanner 35-50mm	1	EA	
0004	10051	Kemlon tool Sondex - 4BA Hex Socket	1	EA	
0005	91103	Pliers Circlip 812 Chrome/Van	1	EA	
0006	10038	Spanner Box 3/8 x 5/16 Modified	1	EA	
0007	10037	Bar Tommy	1	EA	
0008	91029	Key, Hex Metric (Set)	2	EA	
0009	91102	Pliers Mini Flat Nose 5 Inch	1	EA	
0010	91822	Medium Flat Blade Screwdriver, 5mm	1	EA	
0011	415088	Assy Tooling Nut Connector ADS	1	EA	

PARTS LISTING	
Part	*Issue*
KITB-ADS003	B
Description	
Kit, Spares, Basic, ADS003	

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	KITO-ADS003	Kit, Spares, O-Rings, ADS003	1	EA	
0002	91744	Spring Wavy Single Wave 0137 SS	2	EA	
0003	01047	Circlip Internal 5/8 SS N1300	1	EA	

PARTS LISTING	
Part	*Issue*
KITB-ADS003	B
Description	
Kit, Spares, Basic, ADS003	

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	KITO-ADS003	Kit, Spares, O-Rings, ADS003	1	EA	
0002	91744	Spring Wavy Single Wave 0137 SS	2	EA	
0003	01047	Circlip Internal 5/8 SS N1300	1	EA	

PARTS LISTING

Part	*Issue*
KITO-ADS003	A

Description

Kit, Spares, O-Rings, ADS003

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	99129	O-ring 129 Viton 90	0	20	
0002	99211	O-ring 211 Viton 90	0	10	
0003	95218	O-ring 218 Viton 75	0	5	
0004	95008	O-ring 008 Viton 75	0	2	

PARTS LISTING

Part	*Issue*
KITB-Earth Clip	A

Description

EARTH CLIP ASSY

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	20272	EARTH CLIP ASSY	2	EA	
0002	20279	G CLAMP 4" MODIFIED FOR EARTHING	1	EA	
0003	91676	LARGE EARTH BONDING CLIP - 140mm LONG	1	EA	
0005	W029-0GNYW	Wire PVC,Flexible Type BK,84/0.3,Gn/Y	1	M	
0006	J089-00001	Yellow Crimp Terminal, M6 Ring	6	EA	
0007	93158	Scr Pan Hd Sltd M6x12mmLG SS-A2 (DIN 85)	1	EA	
0008	93060	Washer Plain M6 SS-A2 DIN125 Form A	2	EA	
0009	91675	WASHER SHAKEPROOF M6 -SS	2	EA	

APPENDIX B DRAWINGS & PARTS LISTS

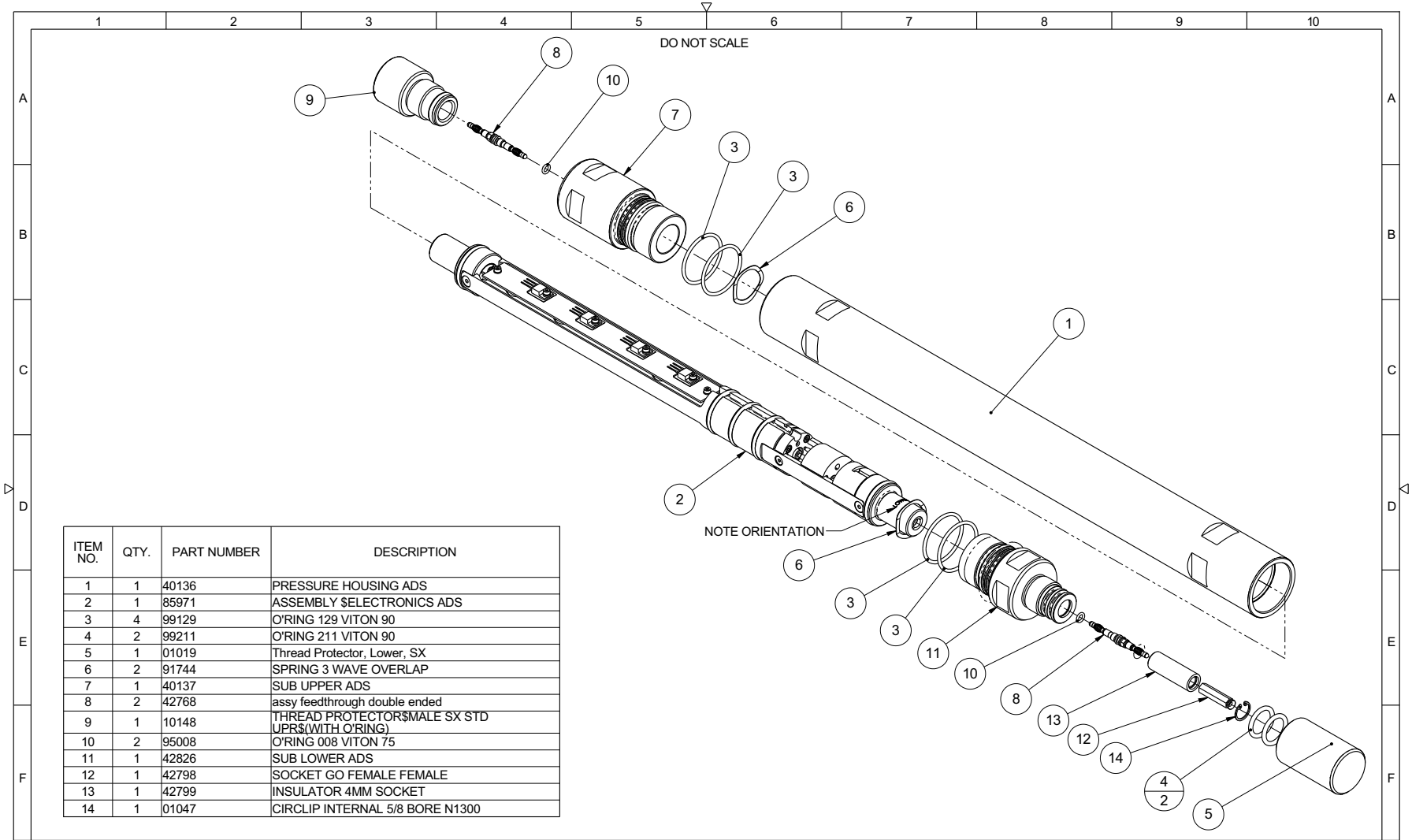
B.1 Mechanical drawings

Description	Drawing	Remarks
ADS003 General Assembly	AD-09737-C	See drawing
Electronics Assembly	AD-85971-E	See drawing
Sliding Contact Block Assembly	AD-40118-PT1	See drawing
Fixed Block Connector Assembly	AD-40150-PT1	See drawing
Modified Motor Assembly	AD-40279-PT1	See drawing

B.2 Electrical drawings

B.2.1 ADDRESSABLE DOWNHOLE SWITCH - TOOL

Description	Type	Drawing
ADS003 General Assembly	Wiring Diagram	WD-09737-C
Electronics Assembly	Wiring Diagram	WD-85971-C
Hall Sensor PCB	Circuit Diagram	CD-86030-C
Processor PCB	Circuit Diagram	CD-86032-C
HV Isolation PCB	Circuit Diagram	CD-86034-D
Hall Sensor PCB	Wiring Diagram	WD-86030-A



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	40136	PRESSURE HOUSING ADS
2	1	85971	ASSEMBLY $ELECTRONICS ADS
3	4	99129	O'RING 129 VITON 90
4	2	99211	O'RING 211 VITON 90
5	1	01019	Thread Protector, Lower, SX
6	2	91744	SPRING 3 WAVE OVERLAP
7	1	40137	SUB UPPER ADS
8	2	42768	assy feedthrough double ended
9	1	10148	THREAD PROTECTOR$MALE SX STD UPR$(WITH O'RING)
10	2	95008	O'RING 008 VITON 75
11	1	42826	SUB LOWER ADS
12	1	42798	SOCKET GO FEMALE FEMALE
13	1	42799	INSULATOR 4MM SOCKET
14	1	01047	CIRCLIP INTERNAL 5/8 BORE N1300

DRAWN:	CHECKED:	APP'D:
NGH	GC	PW
DATE: 16/03/06	DATE: 16/03/06	DATE: 16/03/06

DIM IN: INCHES
MATL: SEE DETAIL DRAWINGS
SCALE: 1:2 A2
HEAT TREATMENT/CONDITION: NOT APPLICABLE

SONDEX F/M No: F0022

ISS	DESCRIPTION	APPD	DATE
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B	ECR 5-59575 REFERS	NPB	05/11/10
A		TG	18/05/09
NC			
PT1	INITIAL PROTOTYPE RELEASE	PW	16/03/06

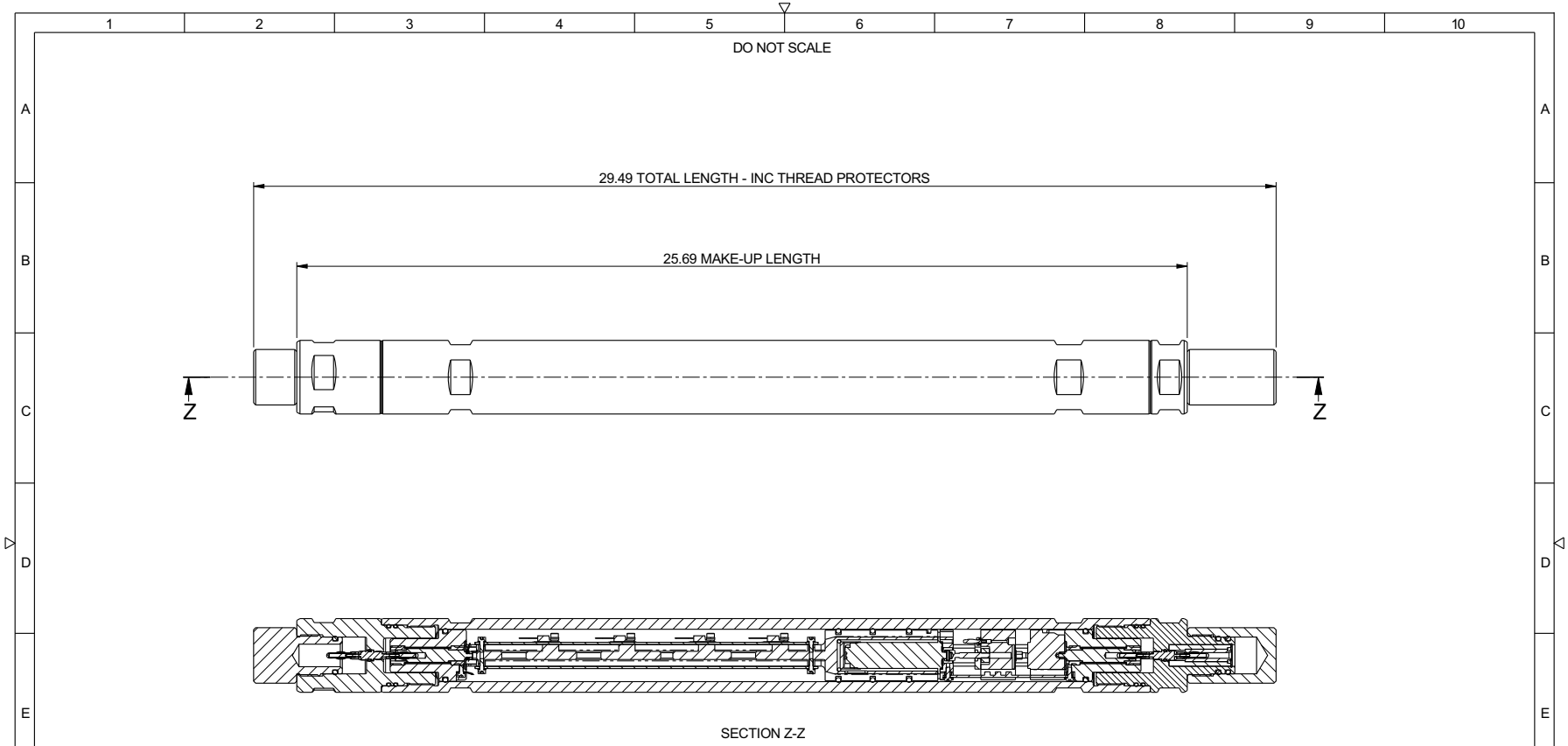
Sondex
Tel. 0118 932 6755

THIRD ANGLE PROJECTION

MACHINE FINISH 64
USED ON: ADS003
GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

TITLE: ASSY Ø2-1/8" ADDRESSABLE DOWNHOLE SWITCH SONDEX

SHEET 1/2
DRAWING No. AD 09737
ISSUE C
S W



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DIM IN: INCHES	MATL: SEE DETAIL DRAWINGS		
SCALE: 1:2	A2	HEAT TREATMENT/CONDITION: NOT APPLICABLE	

ISS	DESCRIPTION	APPD	DATE
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B	REF. ECR59575	NPB	05/11/10
A		TG	18/05/09
NC			
PT1	INITIAL PROTOTYPE RELEASE	PW	16/03/06

Sondex
Tel. 0118 932 6755

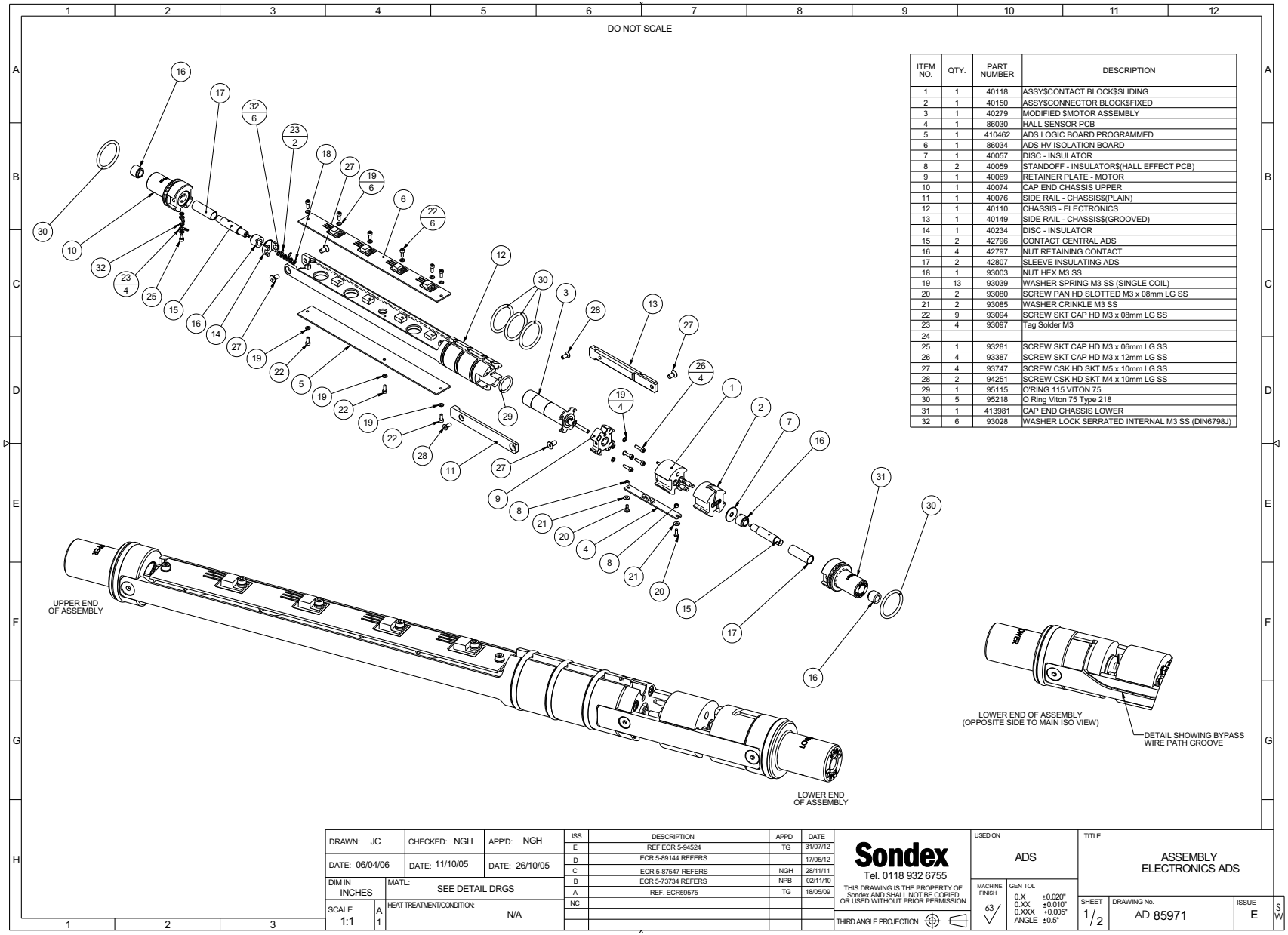
THIRD ANGLE PROJECTION

MACHINE FINISH 64
USED ON: ADS003
GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

TITLE: ASSY Ø2-1/8" ADDRESSABLE DOWNHOLE SWITCH SONDEX

SHEET 2/2 | DRAWING No. AD 09737 | ISSUE C | S W

SONDEX F/M No: F0022



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	40118	ASSY$CONTACT BLOCK$SLIDING
2	1	40150	ASSY$CONNECTOR BLOCK$FIXED
3	1	40279	MODIFIED $MOTOR ASSEMBLY
4	1	86030	HALL SENSOR PCB
5	1	410462	ADS LOGIC BOARD PROGRAMMED
6	1	86034	ADS HV ISOLATION BOARD
7	1	40057	DISC - INSULATOR
8	2	40059	STANDOFF - INSULATOR$(HALL EFFECT PCB)
9	1	40069	RETAINER PLATE - MOTOR
10	1	40074	CAP END CHASSIS UPPER
11	1	40076	SIDE RAIL - CHASSIS$(PLAIN)
12	1	40110	CHASSIS - ELECTRONICS
13	1	40149	SIDE RAIL - CHASSIS$(GROOVED)
14	1	40234	DISC - INSULATOR
15	2	42796	CONTACT CENTRAL ADS
16	4	42797	NUT RETAINING CONTACT
17	2	42807	SLEEVE INSULATING ADS
18	1	93003	NUT HEX M3 SS
19	13	93039	WASHER SPRING M3 SS (SINGLE COIL)
20	2	93080	SCREW PAN HD SLOTTED M3 x 08mm LG SS
21	2	93085	WASHER CRINKLE M3 SS
22	9	93094	SCREW SKT CAP HD M3 x 08mm LG SS
23	4	93097	Tag Solder M3
24			
25	1	93281	SCREW SKT CAP HD M3 x 06mm LG SS
26	4	93387	SCREW SKT CAP HD M3 x 12mm LG SS
27	4	93747	SCREW CSK HD SKT M5 x 10mm LG SS
28	2	94251	SCREW CSK HD SKT M4 x 10mm LG SS
29	1	95115	O'RING 115 VITON 75
30	5	95218	O Ring Viton 75 Type 218
31	1	413981	CAP END CHASSIS LOWER
32	6	93028	WASHER LOCK SERRATED INTERNAL M3 SS (DIN6798J)

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SCALE: 1:1	A1	HEAT TREATMENT/CONDITION: N/A

ISS	DESCRIPTION	APP'D	DATE
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D	ECR 5-89144 REFERS		17/05/12
C	ECR 5-87547 REFERS	NGH	28/11/11
B	ECR 5-73734 REFERS	NPB	02/11/10
A	REF. ECR59575	TG	18/05/09
NC			

Sondex
Tel. 0118 932 6755

THIRD ANGLE PROJECTION

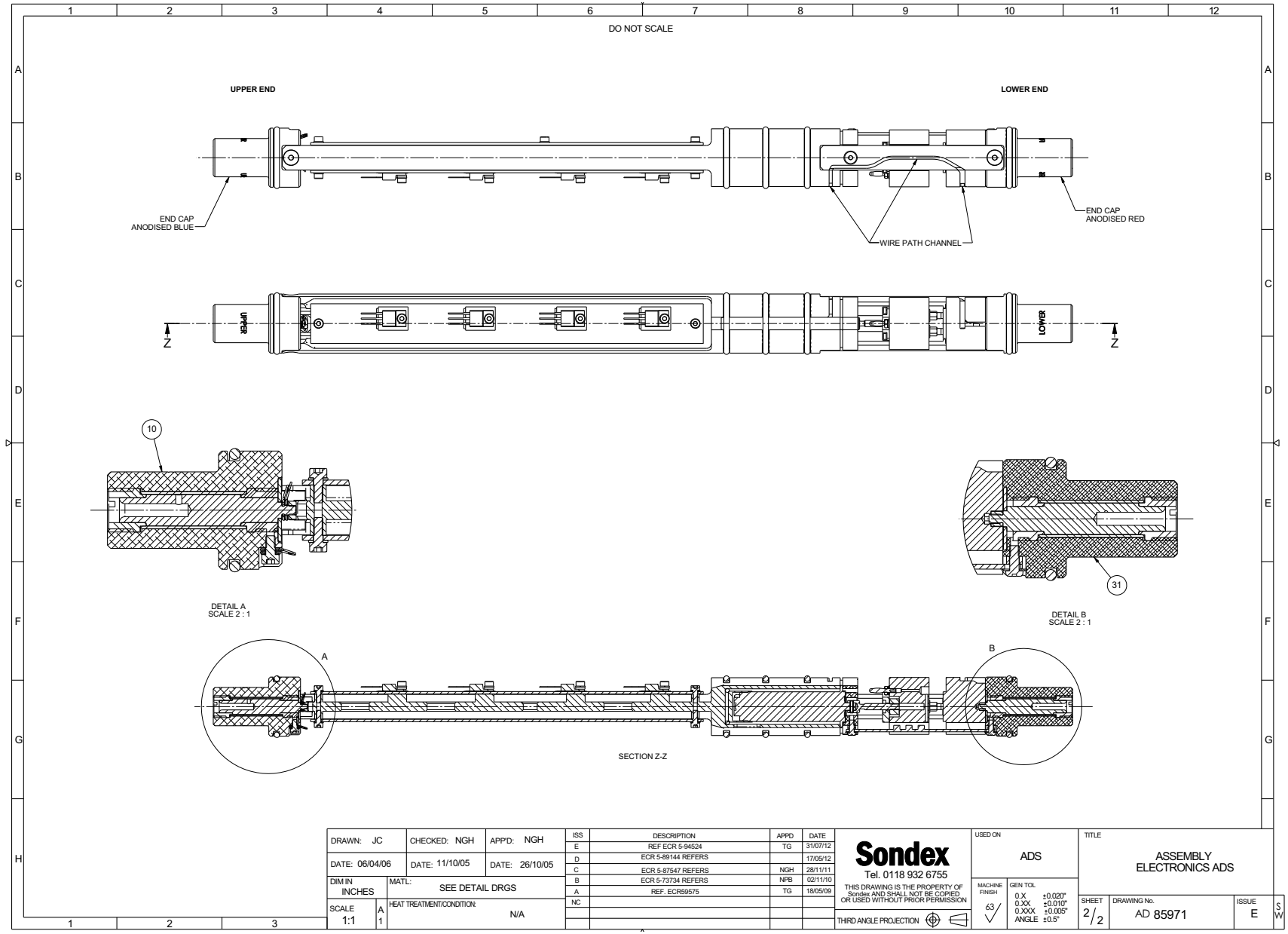
USED ON: ADS

MACHINE FINISH: 63

GEN TOL: 0.X ±0.020" 0.XX ±0.010" 0.XXX ±0.005" ANGLE ±0.5°

TITLE: ASSEMBLY ELECTRONICS ADS

SHEET 1/2 | DRAWING No. AD 85971 | ISSUE E | S W



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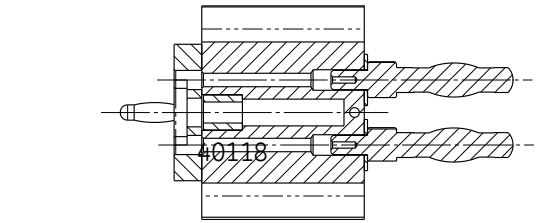

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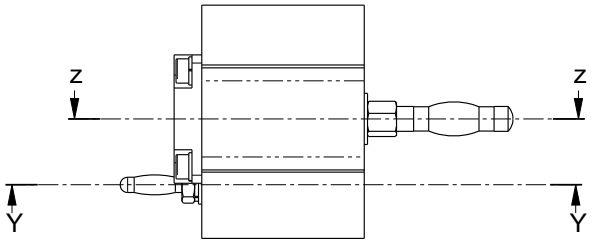

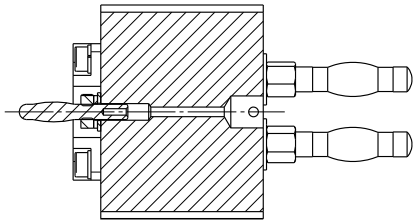

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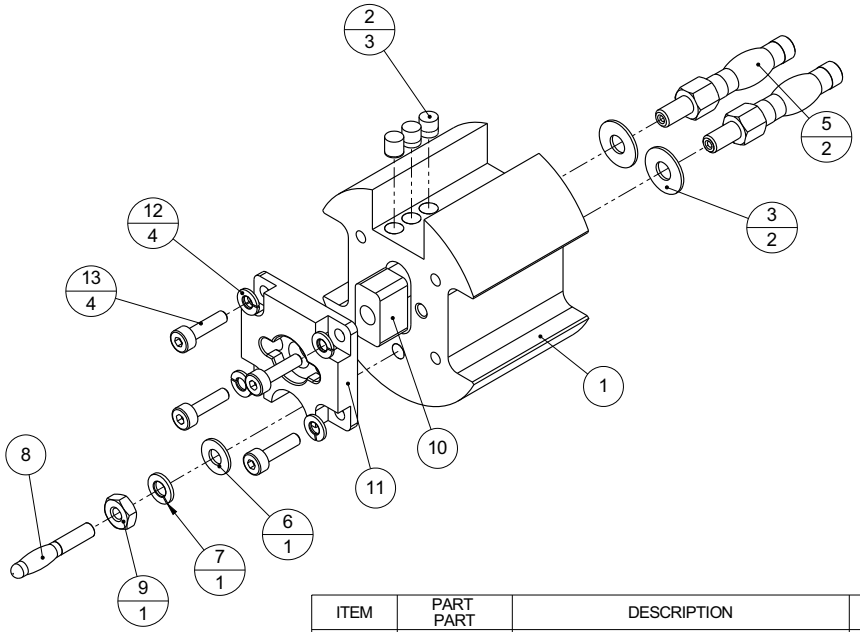


ITEM	PART PART	DESCRIPTION	QTY.
1	40053	BLOCK CONTACTS - SLIDING	1
2	91740	MAGNET 3x3	3
3	93085	WASHER CRINKLE M3 SS	2
4			
5	40111	PIN 4mm - MODIFIED	2
6	91742	Waher DIN 125 - A 2.7	1
7	93410	WASHER SPRING M2.5 SS (SINGLE COIL)	1
8	40114	PIN 2.5mm - MODIFIED	1
9	94243	M2.5 BRASS NUT	1
10	40131	NUT LEADSCREW	1
11	40065	RETAINER BLOCK$LEADSCREW NUT	1
12	93258	WASHER SPRING M2 SS (SINGLE COIL)	4
13	93730	SCREW SKT CAP HD M2 x 08mm LG SS	4
14			
15			

DRAWN: JC	CHECKED: NGH	APP'D: PW	
DATE: 04/10/05	DATE: 06/10/05	DATE: 26/10/05	
DIM IN: INCHES	MATL: SEE DETAIL DRAWINGS		
SCALE: 2:1	A2	HEAT TREATMENT/CONDITION: NOT APPLICABLE	

ISS	DESCRIPTION	APPD	DATE
PT1	INITIAL PROTOTYPE RELEASE	PW	10/05/06

Sondex
Tel. 0118 932 6755

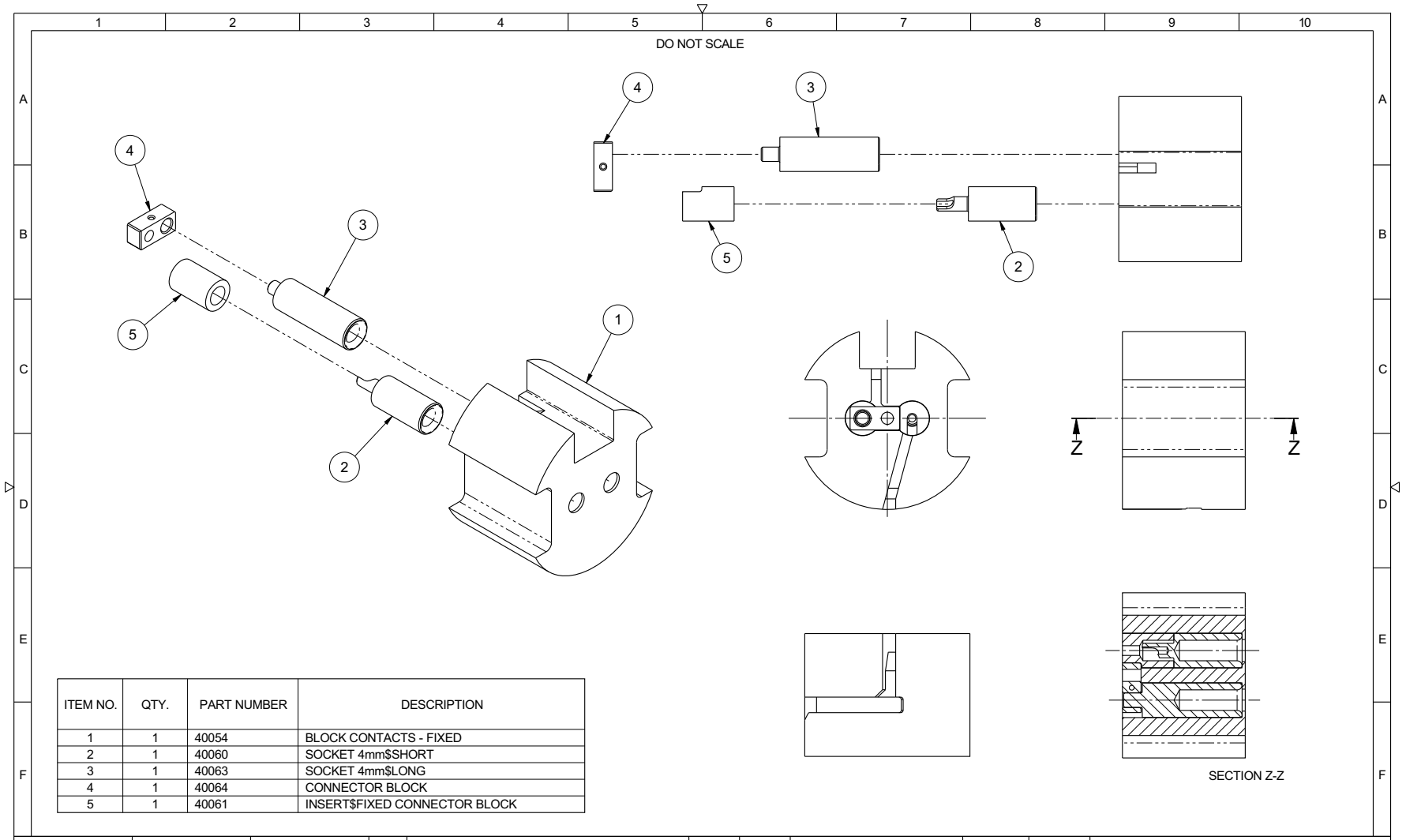
THIRD ANGLE PROJECTION

MACHINE FINISH 64 | USED ON: ADS

GEN TOL
0.X 0.020"
0.XX 0.010"
0.XXX 0.005"
ANGLE ±0.5°

TITLE: ASSY CONTACT BLOCK SLIDING

SHEET 1/1 | DRAWING No. AD 40118 | ISSUE PT1 | S W



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	40054	BLOCK CONTACTS - FIXED
2	1	40060	SOCKET 4mm$SHORT
3	1	40063	SOCKET 4mm$LONG
4	1	40064	CONNECTOR BLOCK
5	1	40061	INSERT$FIXED CONNECTOR BLOCK

DRAWN: NGH	CHECKED: GC	APP'D: PW	
DATE: 06/10/05	DATE: 26/10/05	DATE: 26/10/05	
DIM IN: INCHES	MATL: SEE DETAIL DRAWINGS		
SCALE: 2:1	A2	HEAT TREATMENT/CONDITION: NOT APPLICABLE	

SONDEX FM No: F0022

ISS	DESCRIPTION	APPD	DATE
PT1	INITIAL PROTOTYPE RELEASE	PW	26/10/05

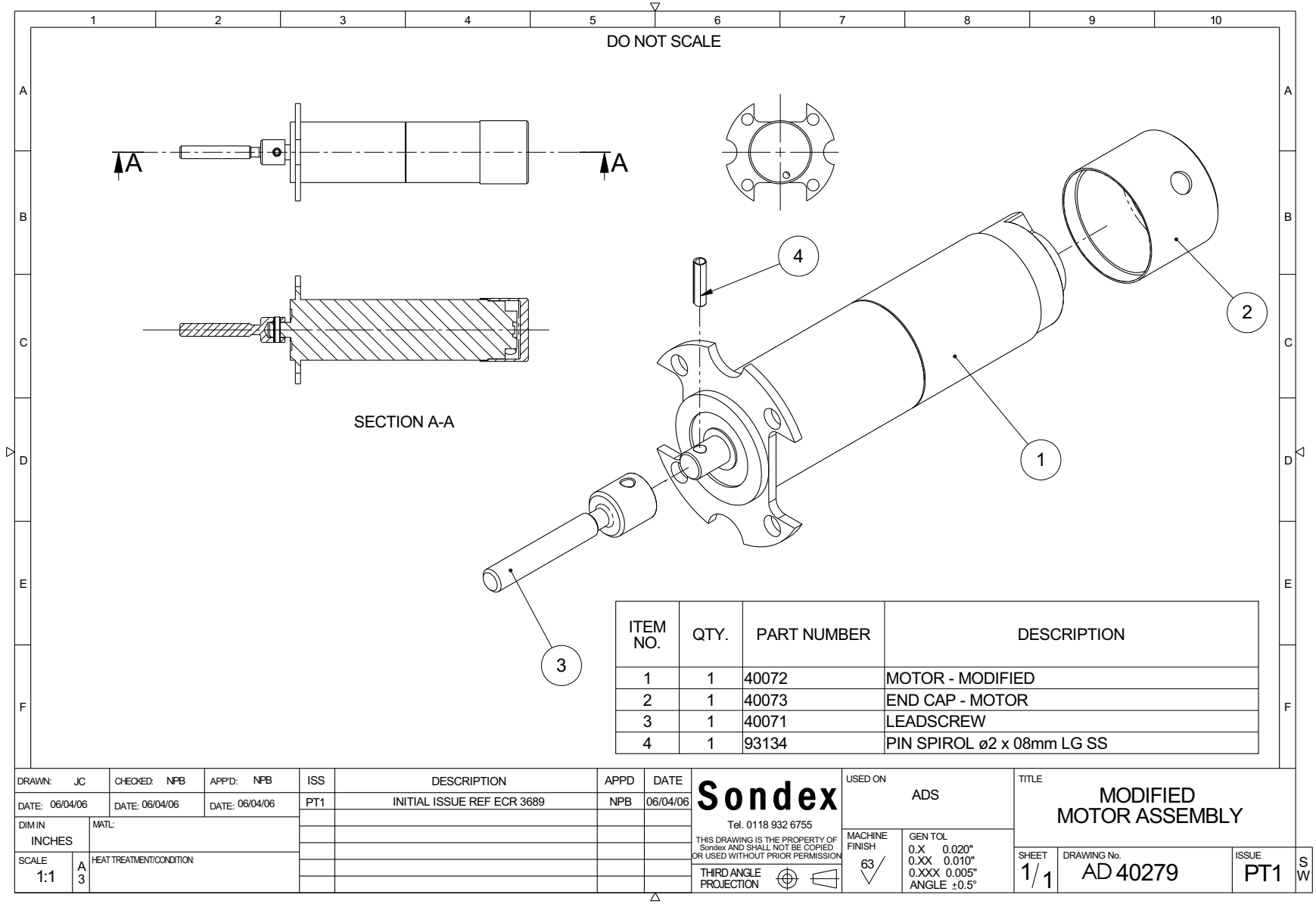
Sondex
Tel. 0118 932 6755

THIRD ANGLE PROJECTION

MACHINE FINISH 64
USED ON: ADS
GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

TITLE: ASSY CONNECTOR BLOCK FIXED

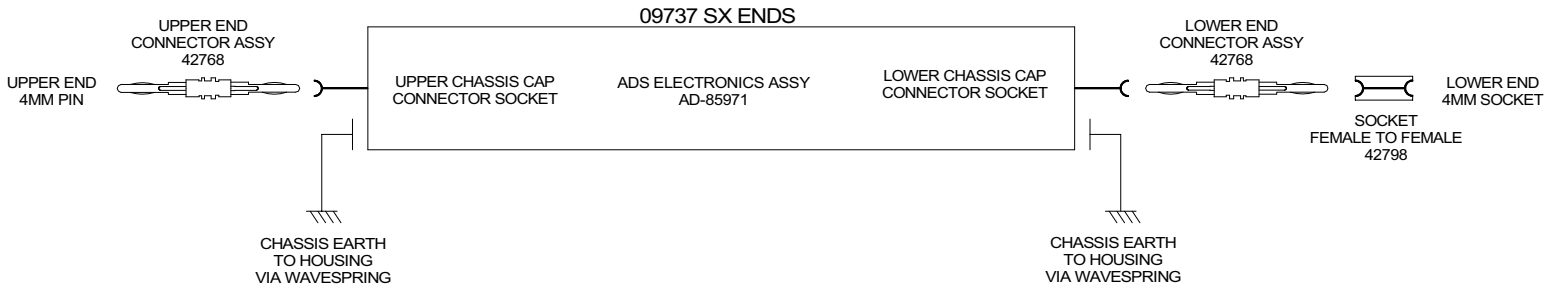
SHEET	DRAWING No.	ISSUE	
1/1	AD 40150	PT1	S W



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	40072	MOTOR - MODIFIED
2	1	40073	END CAP - MOTOR
3	1	40071	LEADSCREW
4	1	93134	PIN SPIROL ø2 x 08mm LG SS

DRAWN: JC	CHECKED: NPB	APP'D: NPB	ISS	DESCRIPTION	APPD	DATE	Sondex
DATE: 06/04/06	DATE: 06/04/06	DATE: 06/04/06	PT1	INITIAL ISSUE REF ECR 3689	NPB	06/04/06	Tel. 0118 932 6755
DIM IN INCHES	MATL:						THIS DRAWING IS THE PROPERTY OF Sondex AND SHALL NOT BE COPIED OR USED WITHOUT PRIOR PERMISSION
SCALE 1:1	A3	HEAT TREATMENT/CONDITION:					THIRD ANGLE PROJECTION

USED ON ADS	TITLE MODIFIED MOTOR ASSEMBLY		
MACHINE FINISH 63	GEN TOL 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°	SHEET 1/1	DRAWING No. AD 40279
		ISSUE PT1	S W



REV	CHANGES	CHKD	DATE	APPD	DATE
B	CM 5-73732 This dwg incorrectly labelled Rev A	PS	2/8/10	PW	2/8/10
C	CM 5-76982 Correct dwg orientation	(PS)	10/11/10	(PW)	10/11/10

GE Oil & Gas

TITLE:

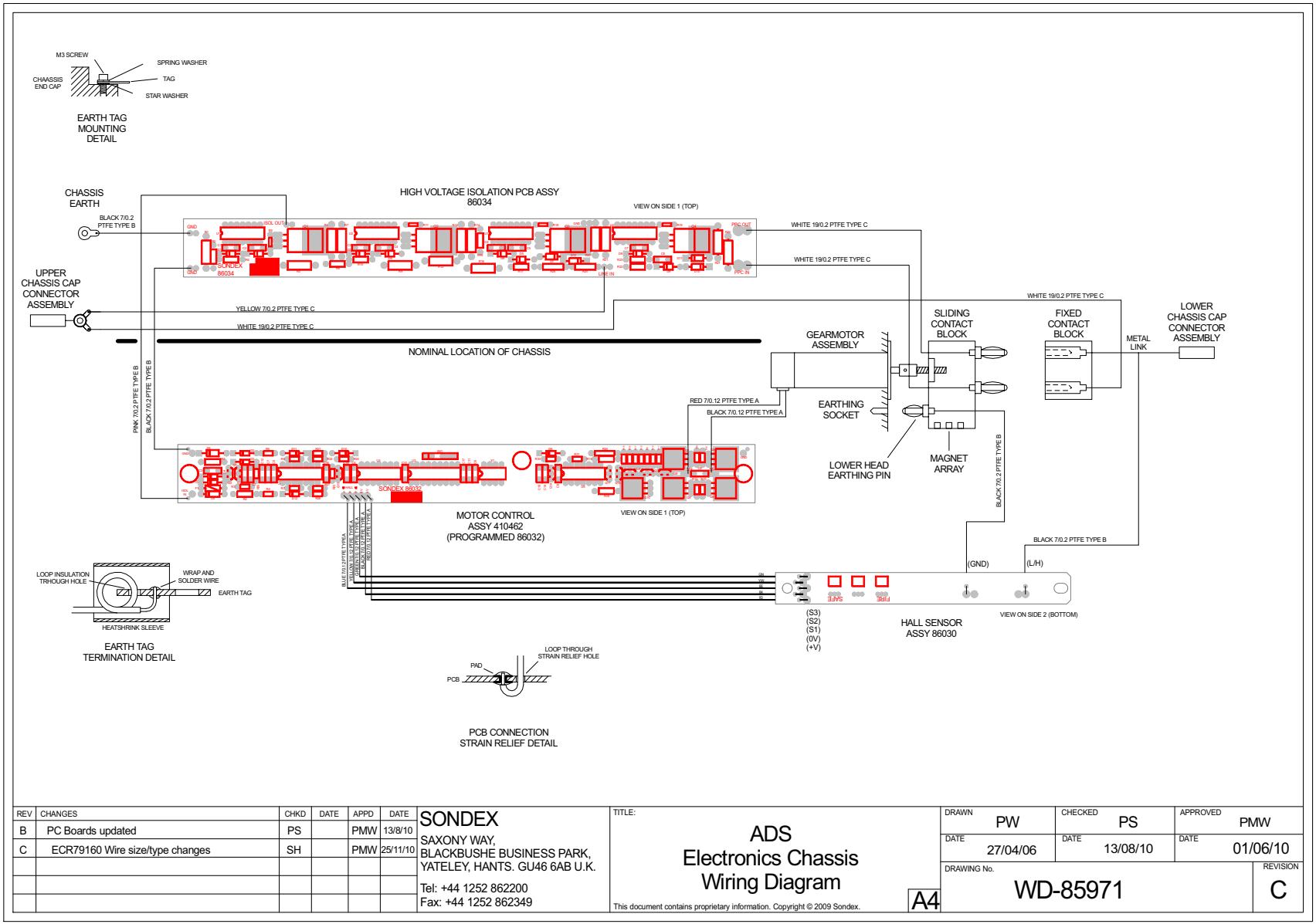
ADS (SX ENDS)
MAIN ASSEMBLY
WIRING DIAGRAM

A4

DRAWN	CHECKED	APPROVED
MP	PS	PW
DATE 10/2/10	DATE 2/8/10	DATE 2/8/10

DRAWING No. WD-09737

REVISION C



REV	CHANGES	CHKD	DATE	APPD	DATE
B	PC Boards updated	PS		PMW	13/8/10
C	ECR79160 Wire size/type changes	SH		PMW	25/11/10

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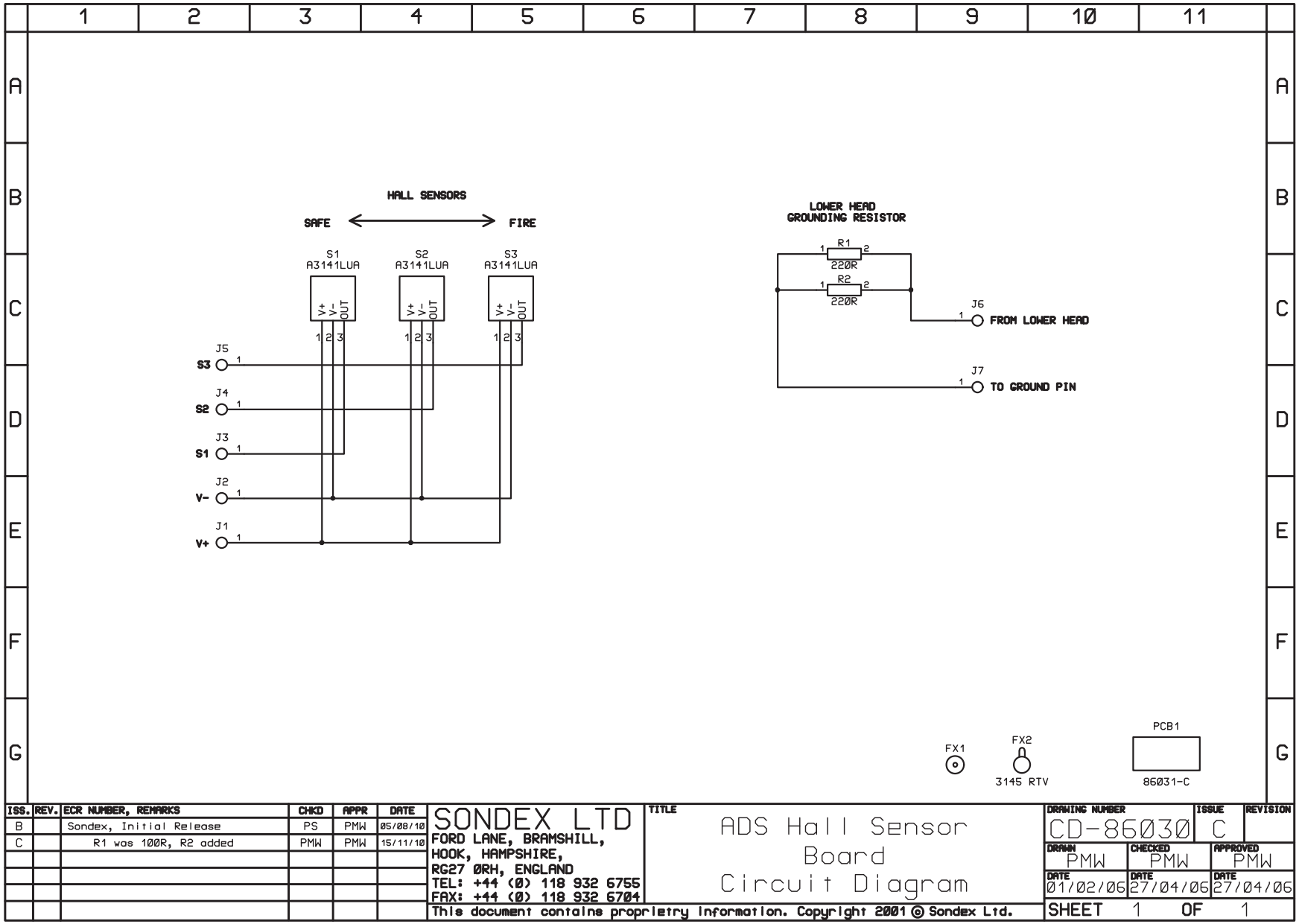
TITLE:
ADS
Electronics Chassis
Wiring Diagram

A4

DRAWN	CHECKED	APPROVED
PW	PS	PMW
DATE 27/04/06	DATE 13/08/10	DATE 01/06/10

DRAWING No. WD-85971

REVISION C



ISS.	REV.	ECR NUMBER, REMARKS	CHKD	APPR	DATE
B		Sondex, Initial Release	PS	PMW	05/08/10
C		R1 was 100R, R2 added	PMW	PMW	15/11/10

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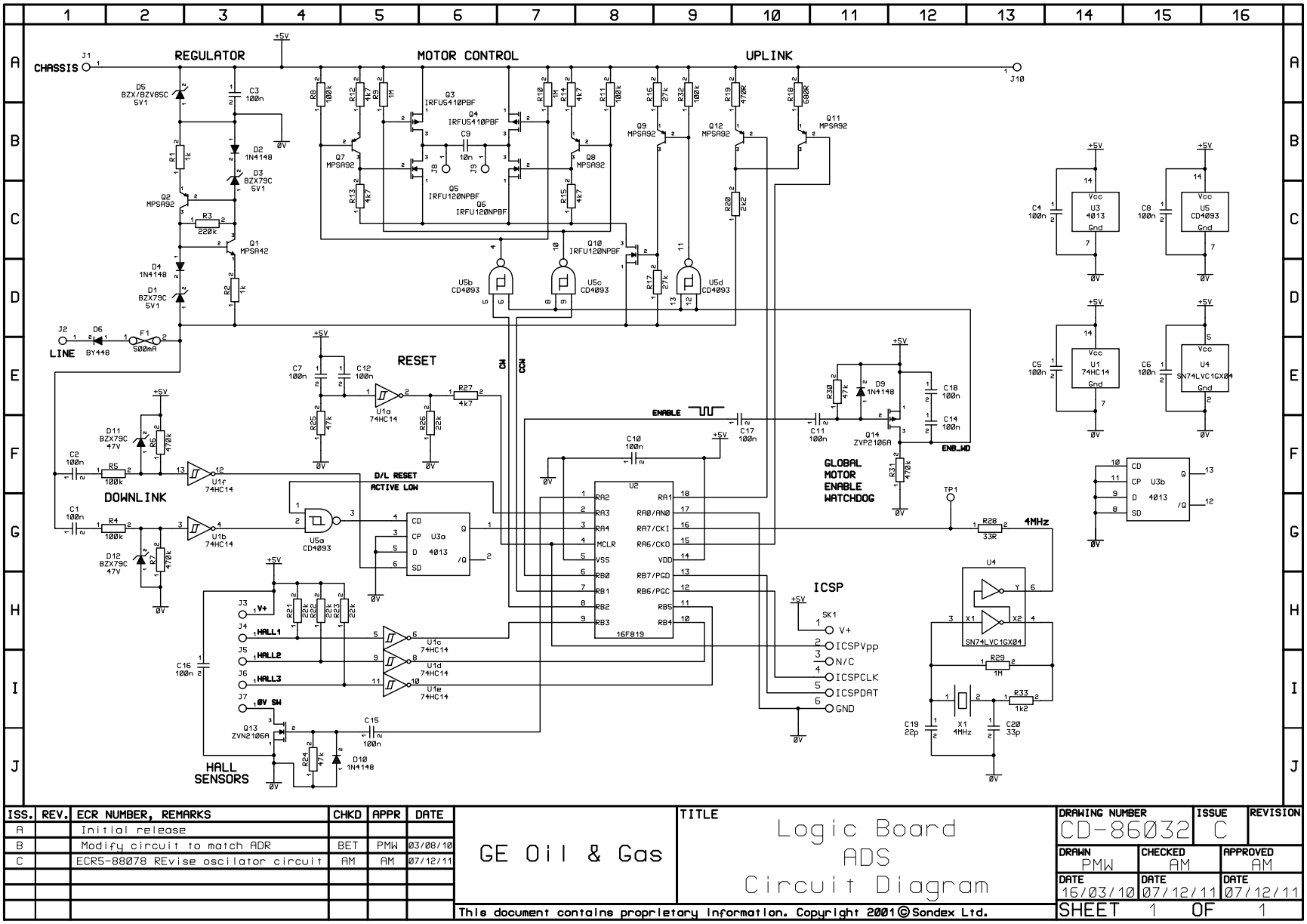
TITLE: ADS Hall Sensor Board Circuit Diagram

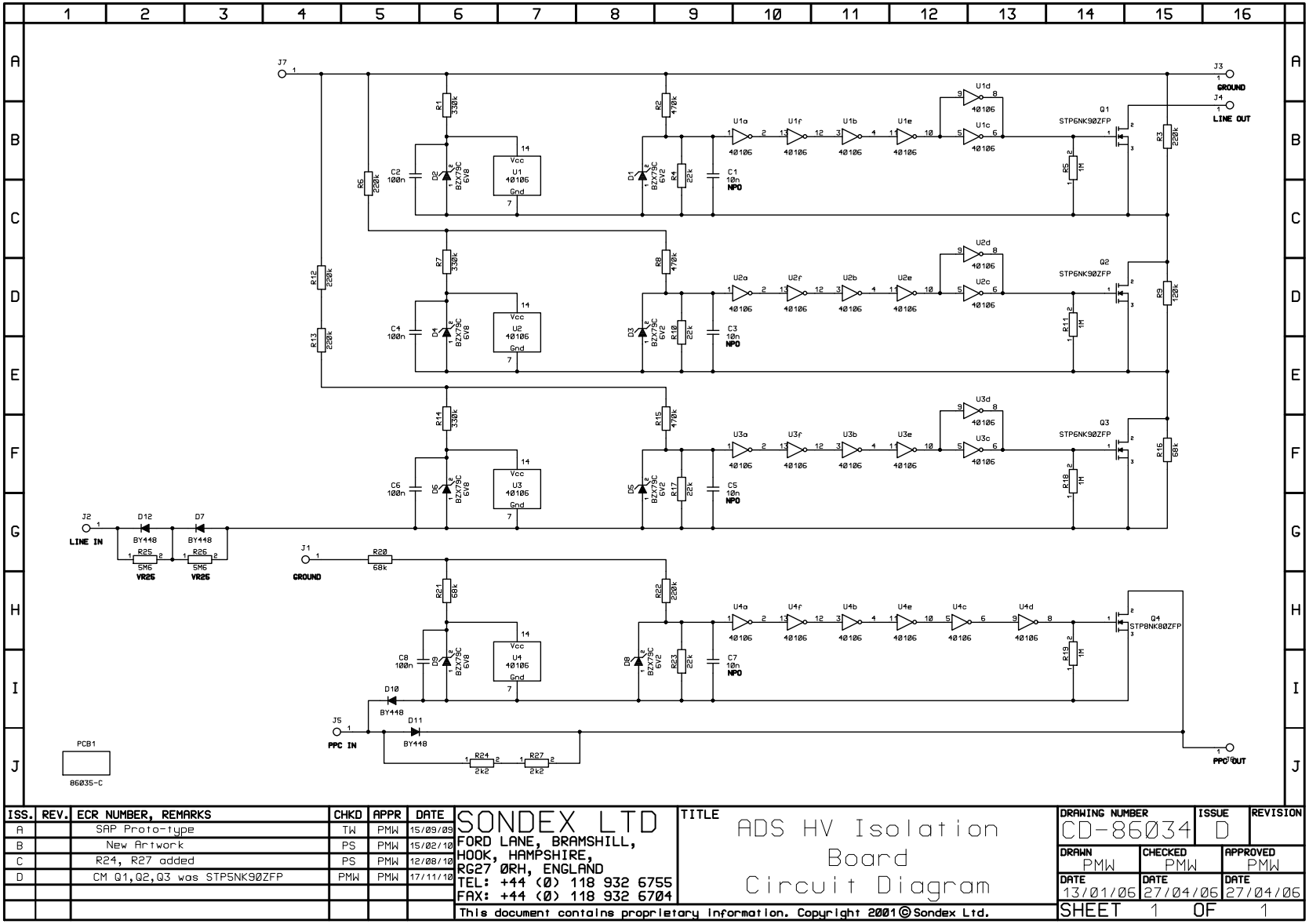
DRAWING NUMBER: CD-86030 | ISSUE: C | REVISION:

DRAWN	CHECKED	APPROVED
PMW	PMW	PMW
DATE 01/02/06	DATE 27/04/06	DATE 27/04/06

SHEET 1 OF 1



ISS.	REV.	ECR NUMBER, REMARKS	CHKD	APPR	DATE
A		Initial release			
B		Modify circuit to match ADR	BET	PMW	03/08/10
C		ECR5-88078 REvise oscillator circuit	AM	AM	07/12/11



ISS.	REV.	ECR NUMBER, REMARKS	CHKD	APPR	DATE
A		SAP Proto-type	TW	PMW	15/09/09
B		New Artwork	PS	PMW	15/02/10
C		R24, R27 added	PS	PMW	12/08/10
D		CM Q1,Q2,Q3 was STP5NK90ZFP	PMW	PMW	17/11/10

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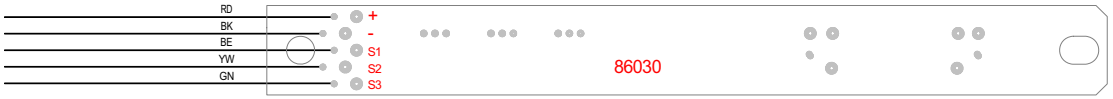
TITLE
ADS HV Isolation Board Circuit Diagram

DRAWING NUMBER	ISSUE	REVISION
CD-86034	D	

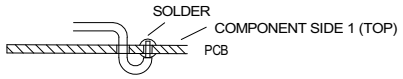
DRAWN	CHECKED	APPROVED
PMW	PMW	PMW
DATE 13/01/06	DATE 27/04/06	DATE 27/04/06

SHEET 1 OF 1

WIRES ARE 7/0.12 PTFE TYPE A
320MM LONG



VIEW ON SIDE 1 (TOP)



PCB CONNECTION
STRAIN RELIEF METHOD
SEE NOTE 1.

VIEW ON SIDE 2 (BOTTOM)

NOTES:- 1. FOR SOLDERING REFER TO PROCESS SPEC. PS118
2. PASS WIRES THROUGH STRAIN RELIEF HOLES FROM SIDE 1 TO SIDE 2 OF BOARD THEN BACK THROUGH PADS FROM SIDE 2 TO SIDE 1 OF BOARD IN POSN'S +, -, S1, S2, S3.

REV	CHANGES	CHKD	DATE	APPD	DATE

GE Oil & Gas

TITLE:

ADS Hall Sensor
Circuit Board
Wiring Diagram

A3

DRAWN	CHECKED	APPROVED
D.McEwen	MP	PEJR
DATE 21/02/12	DATE 21/02/12	DATE 21/02/12

DRAWING No. WD-86030

REVISION A

APPENDIX C ADS OPERATION CHECKLIST

GE Checklist for operating ADS tool with Explosive devices v 1.9

This checklist only refers to the operation of the GE/Sondex ADS tool.
All safety precautions relating to the client's explosive device must also be observed in addition to the steps outlined below.

If in any doubt as to the safety of an operation do not continue!

	A	**Before start of Explosive Operations** Note: At this point no explosives should be within the working area
		Conduct a Risk Assessment & Pre-job Safety meeting with all relevant people e.g. Wireline crew, Wellsite Representative
		Make sure Wireline Engineer has checked Wireline for electrical Continuity & Insulation before explosives removed from storage
		Check cabling of ADS, Shooting & Tractor panels are connected as per ***Figure 4.2 (Chapter 4)***
		Connect the ADS tool below Tractor & CCL (**WITHOUT Perforating Guns**)
		Turn on ADS Panel power,
		Motor tool to **SAFE** (A current increase of between 35 to 95mA should be noted whilst motoring ADS tool - typically 52mA)
		Check Status display reads **"SAFE"** with "T" flashing & LCD display current reads ≈ 18mA
		Switch Surface Mode Select switch to **TRACTOR** mode
		Check Tractor for correct operation
		During Tractor motoring check voltage at bottom of ADS tool <25mV DC or AC
		Motor tool to **FIRE** and ensure the panel display reads **"TOOL : FIRE"**
		Switch Surface Mode Select switch to **LOG/SHOOT** mode
		Firing Check: check shooting voltage/current is present at bottom of ADS tool when shooting voltage applied from Shooting panel (observe all safety precautions). Ensure ADS tool is visible by Engineer during this check.
		Motor tool to **SAFE** and ensure the panel display reads **"TOOL : SAFE"**
		Switch Surface Mode Select switch to **LOG/SHOOT** mode
		Check Shooting CCL for correct operation
		Switch Surface Mode Select switch to **ADS Comms** mode and check panel display reads **"TOOL : SAFE"**
		Turn off the ADS & Tractor Panels.
		Using a multimeter on resistance range (not diode check) check ADS tool resistance between bottom connector & housing = 110Ω +/- 10% . This indicates that the tool is in **SAFE** position.
	B	**Electrical check before arming Explosive device**
		Using a multimeter on resistance range (not diode check) check ADS tool resistance between bottom connector & housing = 110Ω +/- 10% . This indicates that the tool is in **SAFE** position
		Check with Multimeter for <25 mV AC & DC on bottom connector of ADS tool to housing
		Wireline Safety key switch in SAFE position and key held by employee nearest the explosive device
		All Logging unit Panels in SAFE postion & switched off.
		All non essential Logging unit power turned OFF at power supplies/circuit breakers

The following should be performed by the Service Company Wireline Engineer and may vary depending on company procedures.

Run1	Run2	C	**Explosive Device Arming** *GE personnel should vacate the arming area*
			All non-essential personnel cleared from restricted area, and radio silence established if required
			Recheck Wireline Safety key Switch is in SAFE position and key with employee nearest explosive device
			Detonator placed in Safety tube before electric arming
			Detonator electrically checked in safety tube using safety meter
			Check <25mV AC or DC voltage on hot wire
			Ground hot wire to gun body and then Electrically arm detonator. Follow EBBA (Electric before Ballistic Arming) sequence
			All personnel out of the line of fire
			Ballistically arm device and prepare to run in hole
			Safety key remains with employee nearest device until 250' (75m) below ground level or seabed
			If device needs to be returned to surface for any reason then go to Section E

	D	**Operating Tractor/Firing device**
		Only Power up toolstring when below 250' (75m) from surface or below the seabed (in the case of offshore operations)
		When operating Tractor or tools above ADS ensure ADS panel is powered & ADS tool is in **SAFE** position
		Only switch ADS tool to **FIRE** position when ready to operate Explosive device
		Immediately after firing Explosive device switch ADS tool to **SAFE.** Check the panel display reads **"TOOL : SAFE"**
	E	**Return to surface**
		Stop at 250' (75m) below seabed or ground level and check radio silence granted & received (if applicable)
		Electrical Switches off as per steps B3, B4 & B5
		Recheck Wireline Key Safety Switch is in SAFE position and key held by employee nearest the explosive device
		If Explosive device status is uncertain (e.g. misfired) then treat as live gun and disarm ballistically before electrically. Disconnect immediately from GE/Sondex equipment. Do not fault find until Explosive device has been disarmed and made safe.
		Wireline Service company to check Explosive device for trapped pressure, take appropriate precautions & bleed off as necessary

Please sign below to confirm that steps above were taken **during** logging operation

Wireline Engineer's signature	Print name
GE / Sondex Engineer's signature	Print name
Customer Representative signature	Print name

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Drilling & Surface

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