

An Introduction to uDSProbe

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Version History

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1. Introduction

1. About LNETEC

We are a team with over 30 years of technical expertise, specializing in End-to-End Product Development, software design, electronics design and IOT solutions. With three decades of experience and a passion for all things technology, we **guarantee** the success and high quality in all our solutions.

Keeping in line with our company vision, we have successfully developed the **uDSProbe** - a level and density measurement probe based on magnetostriction effect.

2. About uDSProbe

The uDSProbe is a level and density measurement probe and associated safety barrier system. It works on magnetostriction principle. The uDSProbe can measure level, density, and temperature of liquids in real time.

Common liquid examples where uDSProbe can be used are petrol, diesel and water.

uDSProbe will monitor and gather data in unison with the Automatic Tank Gauging systems (ATGs), commonly used to monitor fuel tanks at petrol stations.

Design of the uDSProbe meets all the safety standards, thanks to the specially designed electronics circuits, leak proof enclosure assembly and free moving level and density floats.

The uDSProbe extensively uses Digital Signal Processing (DSP), which justifies the name uDSProbe.

3. Working Principal

Magnetostrictive probe works on principle of magnetostriction effect. Magnetostriction effect is the property of a ferromagnetic materials (iron, nickel) that causes them to change their shape and dimensions when they are kept in a magnetic and electric field simultaneously. A magnetostrictive level probe is built by suspending a ferromagnetic metal wire inside a long stainless-steel shaft/pipe.

The electronic components, mounted safely at the top of the stainless-steel pipe, generates an electrical pulse that travels down the wire, at regular intervals. This creates an electric field. The density float, containing the ferromagnetic compounds are installed around the shaft (as illustrated in *diag. 2*). The buoyancy of the float allows it to move freely around the shaft with variable changes in the liquid level. This, in turn results in a magnetic field, created by the magnets inside the float.

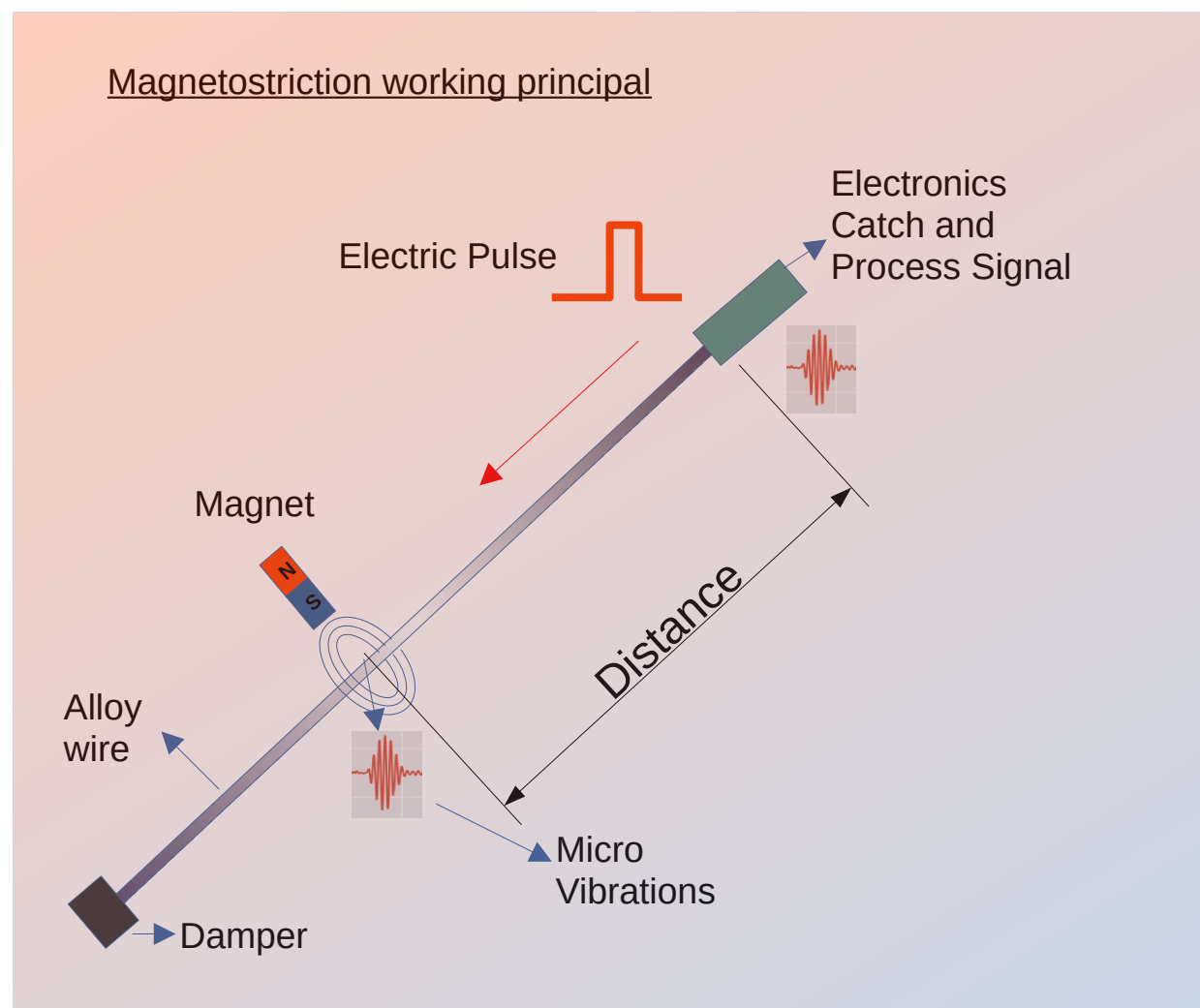
A micro vibration is produced at the location of float, this vibration is the key to determine the accurate level. Vibrations travels at a known speed, and therefore can be timed to accurately measure the distance by the electronics in the probe housing.

Probe can have multiple floats to measure required parameters of multiple liquids. This is achieved by tuning density of float for the liquid.

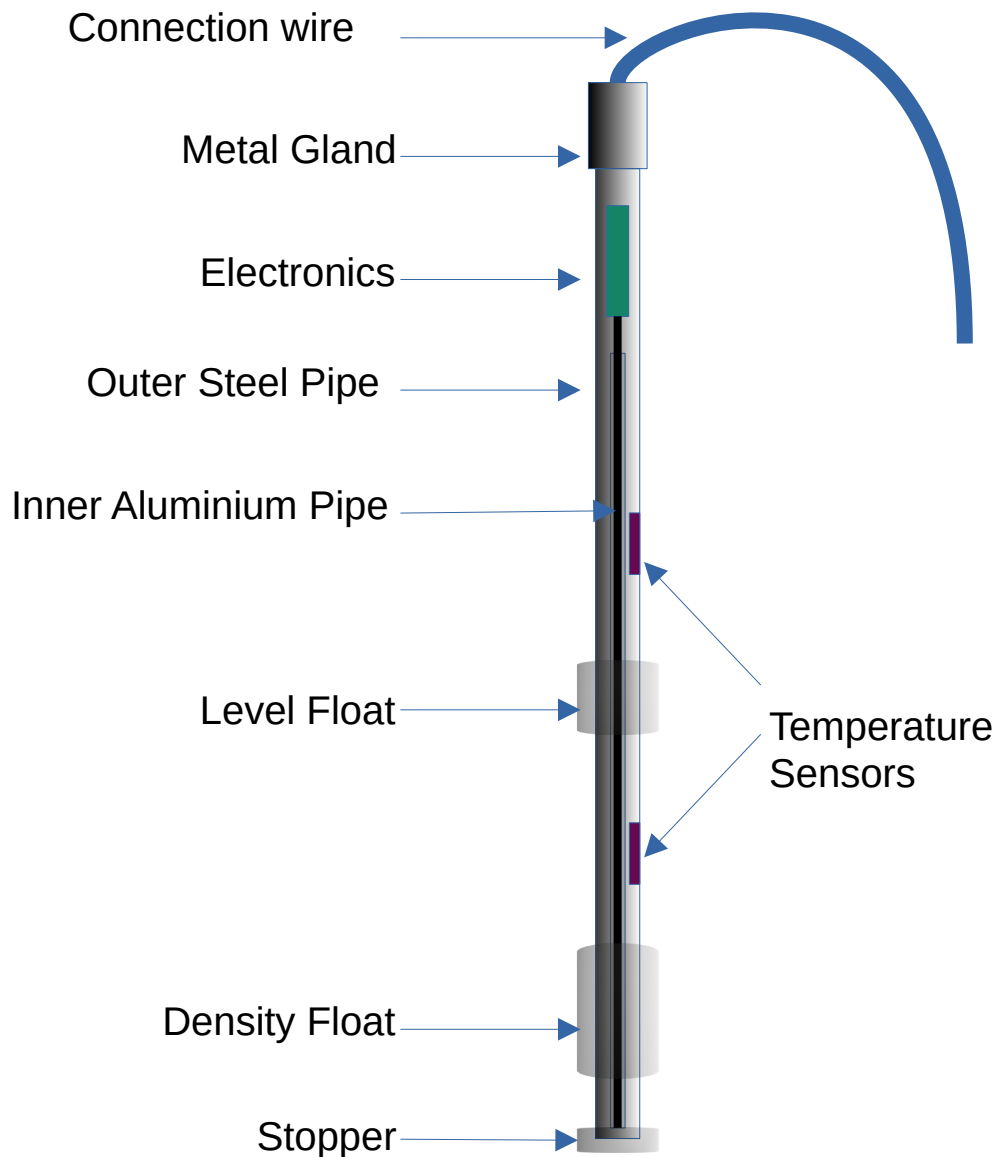
Probe also contains temperature sensors which measure temperature of fuel at different locations.

The uDSProbe can also be used to measure the density of the liquid. A density float is fully immersed in the liquid and electronics inside probe is programmed to calculate density in real-time.

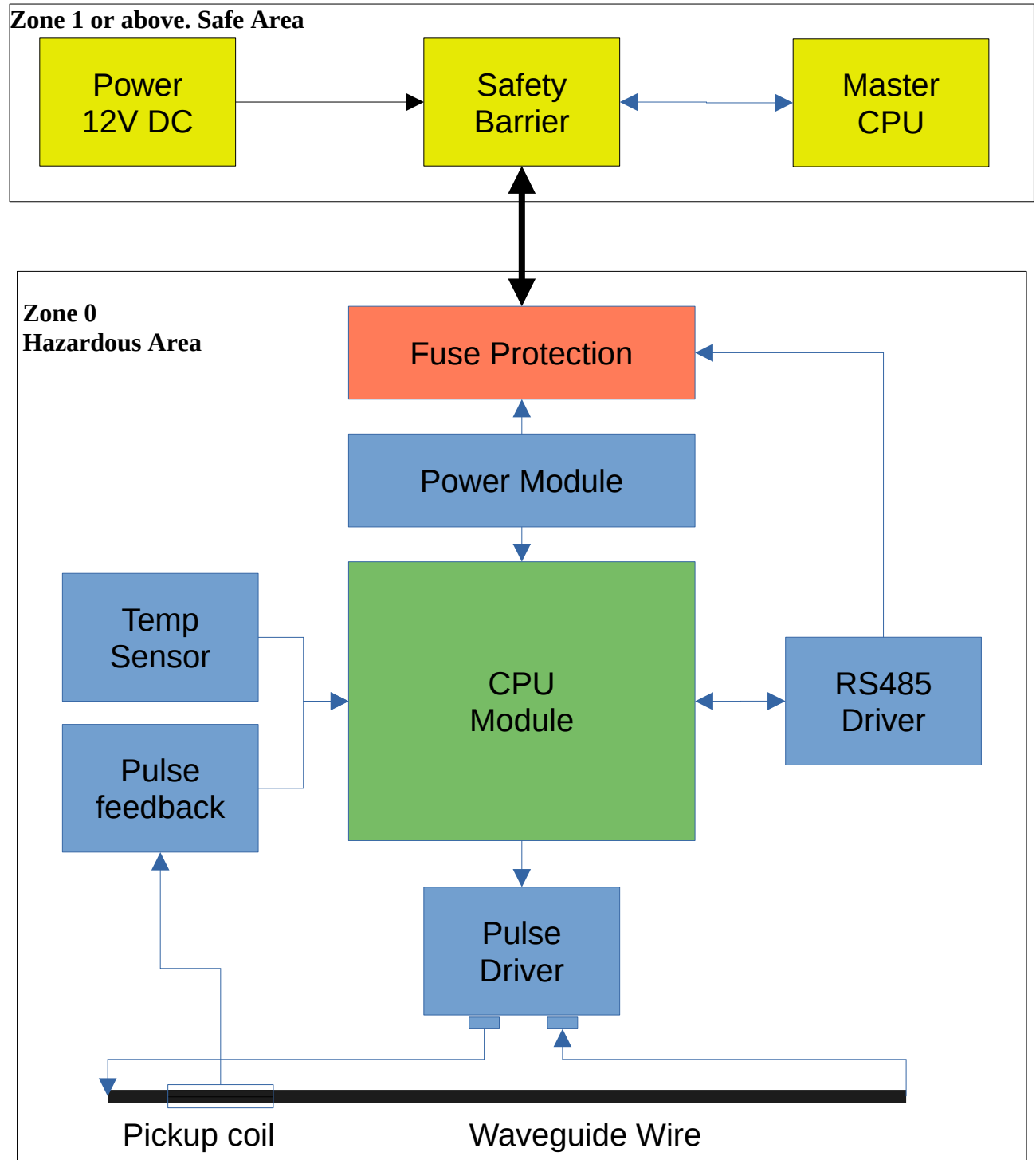
The main application uDSProbe is to measure level and density of liquids in Petrol/Diesel tanks, in-line with the safety guidelines and norms of the Petroleum and Explosive Safety Organisation (PESO).



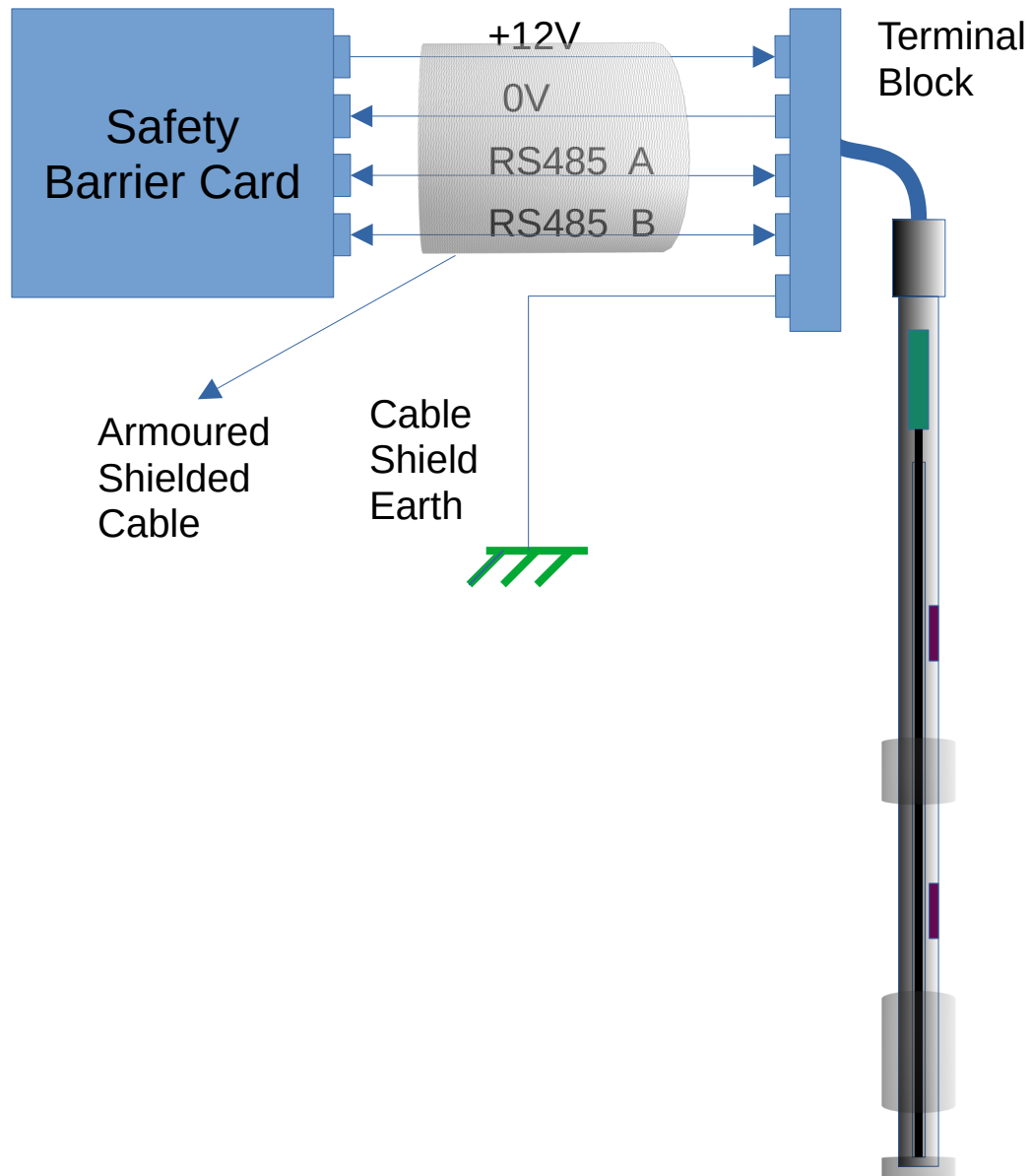
2. The uDSProbe Structure Diagram



3. The uDSProbe Block Diagram



4. The uDSProbe wiring diagram



5. The uDSProbe specifications

Main Specifications

Sr	Parameter	Description
1	Operating Temperature	-10C to 60C
2	Input Power	12V / 100mA
3	Communication Interface	RS485
4	Humidity	0 – 90% non condensing
5	Ingress Protection	IP68
6	Probe body Material	ASTM304 Seamless steel tube
7	Level Float Material	ESD Safe Plastic Body Ferrite magnet/Neodymium magnet
8	Density Float Material	ESD Safe Plastic Body Ferrite magnet/Neodymium magnet Stainless Steel Spring
9	Gland for cable	IP68 LAPP make (or equivalent) Brass, nickel-plated Lead free Brass, nickel-plated
10	Connection wire	Fire-retardent Armoured Cable LAPP make (or equivalent)

Connection Specifications

Sr	Connection Name	Description
1	+12V	+12 V input terminal of power supply
2	0 V	0 V input of power supply
3	RS485 A	RS485 A terminal for communication
4	RS485 B	RS485 B terminal for communication

6. Main Components

1. Outer Steel Pipe

1. ASTM 304 / 316 /316L Stainless Steel Pipe
2. Exhibit excellent corrosion resistance to a wide range of corrosive environments
3. Length : 0.5 meter to 5 meter
4. Outer Diameter : 21.3 mm
5. Thickness : 1.65 mm or 2.11 mm
6. ASTM A312 TP304 Seamless Pipe

2. Inner Aluminium Pipe

1. Exhibit excellent corrosion resistance to a wide range of corrosive environments
2. Length : 1 meter to 3.5 meter
3. Outer Diameter : 10 mm
4. Thickness: 1mm

3. Wave guide wire

1. Magnetostriction : 6-8ppm
2. Density 8.05/cm³
3. Linear Expansion coefficient: $8.1 \mu A) = 5.0 \mu A/m-^{\circ}C$
4. Tensile strength >686MPa
5. Curie point 120°C
6. Working temperature -40°C~80°C
7. Diameter 0.50mm to 1.5mm
8. Metal Cable Gland

4. Level Float

1. Available in ESD safe plastic and steel
2. Available in various sizes and densities to match different liquids
3. Long life

5. Density Float

1. Available in ESD safe plastic and steel
2. Available in various sizes and densities to match different liquids
3. Long life

6. Cable Gland

1. Connecting thread
2. Protection class / Standard(s) for Safety
3. Strain relief
4. Temperature range
5. Design
6. Corrosion protection
7. Other characteristics:

8. Approvals:
9. Norm references:
10. M12x1.5 up to M110x2 acc. to DIN EN 60423
11. IP 68 – 10bar / 30min for M12x1,5 to M50x1,5 acc. to DIN EN 60529
12. IP 68 – 5bar / 30min for M63x1,5 acc. to DIN EN 60529
13. IP 68 – 1bar / 30min for M63x1,5plus & M75x1,5 acc. to DIN EN 60529
14. IP 69 for M12x1,5 up to M63x1,5 acc. to DIN EN 60529
15. Liquid tight cord grip acc. to UL514B, CSA C22.2 No. 18.3-12
16. Type 1, Type 4x, Type 6 and Type 12 acc to UL 50E, CSA C22.2 No. 94.2-15
17. Category A according to DIN EN 62444
18. Dynamic
19. Static
20. MS-M
21. MSR-M
22. -25°C up to +100°C
23. -40°C up to +100°C
24. standard
25. with reducing sealing ring (for smaller cable diameters)
26. Salt spray test (168 H. / 35°C) acc. to DIN EN ISO 9227

7. **The uDSProbe PCB specification**

1. Material: FR4
2. Board Thickness: 1.60 MM
3. Surface Finish: HAL (Sn-Pb)
4. Solder Mask: Bottom Green
5. Solder Mask: Top Green
6. Legend Bottom: White
7. Peel Off No
8. Carbon Contacts No
9. Electrical Testing Yes
10. Layers 4 L
11. TG Std. Tg (130-140 °)
12. Finish Cu Thickness 35.00
13. Inner Cu Thickness 0.00
14. Legend Top White
15. Blind & Buried Via No
16. Countersunk No
17. Hard Gold (Gold tabs) 0.00
18. Via Fill No
19. Special Buildup No
20. Beveling No

8. **PCB Coating**

1. Appearance : Clear And Transparent And Smooth & Glossy
2. Specific Gravity (Density@25 degree C) : 0.916
3. Viscosity @25 degree C : 60 Sec (Zans G1 Cup)
4. Comparative Tracking Index (CTI Value) : 600
5. Coating Thickness (Single Coat) : 15 to 35 Microns
6. Dielectric Strength : 15 KV/mm
7. Thermal Cycling (MIL-I-46058-C-AR) : As Per Mil Std
8. Withstand Temperature (Film) : 130 Degree Celsius
9. Film Traceable : Under UV Lamp
10. Curing Time : 24 Hours
11. Pre & Post Heating of PCB For coating : 10 min
12. Hard Dry : 2 hours
13. AR30, ALQ30, ALQ60, ALQ100, SKR70