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Chapter 1 Instrument Hardware

1.1 Product Introduction



Nuclear Magnetic Resonance Oil Content Analyzer is a dedicated appliance used in oil content measurement for oil crops. This hi-tech product is based on NMR (Nuclear Magnetic Resonance) technology, developed under embedded platform, and fully applies DSP (Digital Signal Processing).

Easy Use, High Accuracy and **Rapid Measurement** are advantages of . Compare to other NMR based products, **Frequency Self-Locked** patent technology enables to operate without manual frequency tuning, hence reduces errors and greatly enhances measurement accuracy and stability.

measures a wide range of oil crops such as soybean, rapeseed, sesame, corn, cottonseed, peanut, sunflower seed, oil tea seed, tung seed, etc.

The following table is feature list of :

Hardware	● Applies Samsung high performance ARM9 processor with 400MHz core frequency. Software is developed under Microsoft WinCE operation system. ● Equips 7-inch true-color LCD, designed with concise operation interface, so popular, mouse + keyboard inputting mode which make like manipulating a PC. ● Applies up to date components conforming to industry standard. Machine has very low failure rate.
Function	● High accuracy and stability, it takes 30s each measurement after drying. ● Fewer manual intervention, software adjusts frequency automatically, user-friendly operation guide step by step, so intelligent and easy to use. Don't worry to cause any manual errors. ● Strong anti-interference, can be running under high EMI condition. ● Powerful printed function, results can be printed via embedded printer or saved to U-disk and then transferred to PC for post-handling. ● Easy maintenance, update software can be downloaded to U-disk from our website. Update will be done in 10 minutes by plugging the U-disk to USB port in the machine. ● Green product, the total power is 40W, no harm to human. ● Wide measurement range, including soybean, rapeseed, sesame, corn, cottonseed, peanut, sunflower seed, oil tea seed, tung seed, etc.

1.2 System Introduction

Nuclear Magnetic Resonance Oil Content Analyzer consists of two parts, one is **Host**, the other is **Magnet**. **Host** contains HF board, A/D sweep board, control board, power, etc; **Magnet** contains permanent magnet, sweep coil, probe, etc. The system structure is shown in figure 1.

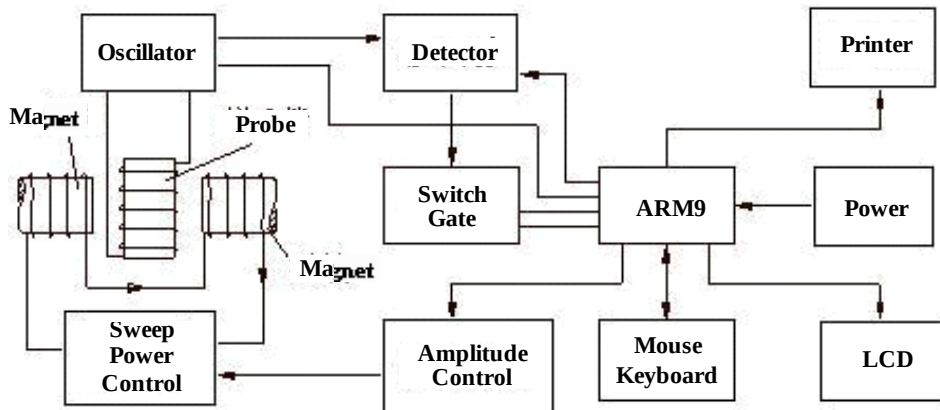


Figure 1 system structure

Nuclear Magnetic Resonance Oil Content Analyzer makes use of NMR (Nuclear Magnetic Resonance) technology, directly measuring the liquid H content to calculate oil content in samples. Under certain permanent magnetic field and RF(radio frequency) magnetic field interaction, energy level of H in material splits into two state: low level energy state and high level energy state. Low level energy state will transit to high energy state once it absorbs power from specific condition RF field, while it will go back to low energy state when condition doesn't satisfy. As long as we control the H transition condition, we control the occurring of transition. During transition, energy will be absorbed or released, we call it resonance. Measuring the amount of H transiting to high level energy state, we are able to calculate the content of H.

Usually the H in samples will be liquid, solid, or both. The required condition for liquid H and solid H resonance is different. All liquid H takes part in resonance in a small range of external magnetic field variation: about 10^{-5}T , while solid H is in the range about 10^{-3}T , this is shown in figure 2.

Making use of it, an electrical switch in instrument is going to cut the signal from solid H and save signal of liquid H, so the signal of resonance almost represents liquid H, it has direct ratio to oil in samples.

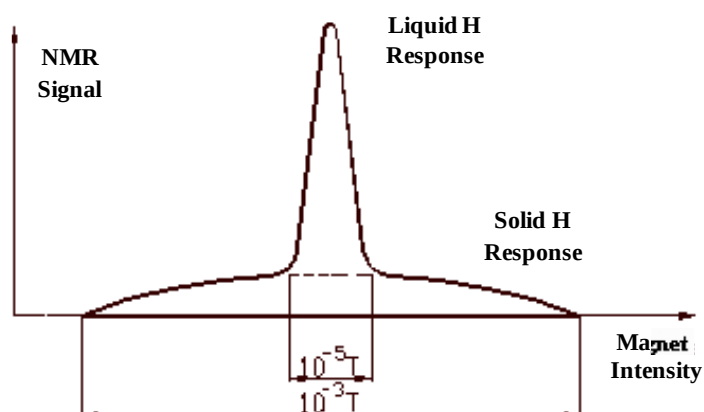


Figure 2 Relationship of NMR and Magnetic field intensity

Nuclear Magnetic Resonance Oil Content Analyzer is able to measure the oil content of the following material: soybean, rapeseed, sesame, corn, cottonseed, peanut, sunflower seed, oil tea seed, tung seed, etc. The process of measuring is fast, accurate, non-destroy. Test result will be displayed on LCD and can be save in U-disk or print out from the embedded printer.

consists of two parts:

① **Host**, contains control board, sweep board, LCD, power, etc. It is responsible for NMR signal receiving, processing and displaying.

② **Magnet**, contains permanent magnet, two sweep coils and probe. The uniformity of magnetic field is critical for any NMR process, because better uniformity yields better and stable SNR(signal to noise rate) of NMR signal.

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