

AUTOMATED DRILL CORE SCANNING SYSTEM TYPE : DCS1040

Technical Data

Automated drill core scanning system Type DCS1040 is an advanced state of art NaI detector based, data acquisition unit including two axis motion controller. System software built-in gives core assay of atomic minerals such as U, Th, K at different locations of the core under scan apart from providing programmability for motion control system.

The data obtained is interpreted in terms of PPM or percentage ore grade. System facilitates initial calibration using a 'calibrated drill core standard'

Automated drill core scanning system essentially consists of the following constituent units

- Object manipulator (two axis – Z & θ) with stepper motor drive system.
- Multi-channel analyzer.
- 3"x3" NaI scintillation detector with associated electronics, detector bias & amplifier.
- Personnel computer system.
- Core scanning, data acquisition & control software.



Two axis (Z & θ) object manipulator with stepper motor drive system – consisting of the large vertical platform, which can hold drill core(s) of different standard sizes.

These include 3", 4" & 5" sizes.

core is loaded into

PVC tubular holder, which is anchored vertically into the motion control system.

This motion control system, has been designed for vertical scanning of the core in Z-axis specifically to conserve floor space. System while facilitating full scanning of 100 cm length of core requires little space on the floor.

On the Z-axis there are two IR slotted sensors at the extreme ends which are defined as 'HOME 1' & 'HOME 2'. System software is designed to always start scanning from 'HOME 1' position. 'HOME 1' & 'HOME 2' IR switches, work as soft limit switches for defining scan length of the core.

Apart from this, additional mechanical switches have been provided which are located just beyond these IR switches these are basically micro switches. In case of failure of the IR switches these mechanical switches arrest the movement further, & prevent the drive system getting jammed at the extreme position.

A stepper motor mounted at the top coupled through a threaded rod drives the core holder vertically by about one metre. Core holder is essentially a **PVC tube**, into which 'drill core' is loaded for scanning.

Another stepping motor mounted on the moving platform near to top end of the core holder facilitates, θ - rotation for the core holder. There is an IR switch provided for this which defines 'HOME' position in θ - direction Figure above shows the complete system picture of the 'Automated drill core scanner'.

On the right side of the object manipulator, a separate cabin with door arrangement, houses stepper motor drive electronic system consisting of SMPS power supply, θ & Z drive systems & USB stepper motor controller.

Object manipulator has arrangement for fixing the 3"x3" NaI detector into the detector housing with slit arrangement facing the core / core holder. Detector front is covered by adequate shielding to minimize background counting.

DETECTOR – AMPLIFIER – MULTI CHANNEL ANALYSER

This part of the system has the following constituent units. Detailed specifications & other functional features are described in the following paragraphs.

1. SPECIFICATIONS OF NIM INSTRUMENTATION BIN

Interchangeability	:	Mechanical Tolerance are in accordance with TID 20893 (Rev)
Panel dimensions	:	Standard rack 8 3/4 inches high and 11 3/4 inches wide (without flanges)
Depth	:	12 3/4 including heatsinks
Module connectors	:	8 NIM connectors per bin at the panel as specified by TID 20893 (Rev) or 24 pin of Amphenol connectors (for use in INDIA)
Installed wiring	:	All connectors of MINI BIN are wired in parallel for +12V, -12V,+24V and -24V, high quality GND and power return GND
Construction	:	Bin is constructed with two side aluminium flanges with casted handles, top and bottom S.S. Rod spot welded mesh supported with two aluminium bars at top and bottom, module guides with S.S. rods and connector plate at the back. All these parts are anodised/painted completely. The channels are milled, spot welded S.S.Rod guides provide precisely smooth and easy movement of modules into the bin.
Minibin enclosure dimension	:	14" wide X 10" height x 11.5" depth without accounting handles and heatsinks

2. SPECIFICATIONS OF POWER SUPPLY MB 403

Input		
Voltage	:	220V +/- 10% AC
Frequency	:	50Hz
Current	:	1.2A (Approx.) at 90W
DC output	:	+12V DC at 1: -12V at 1A +24V DC at 0.5A : -24V at 0.5A Total output load not to exceed 90W
Regulation	:	for +/- 12V & +/- 24V +/- 0.05%
Stability	:	for +/- 12V & +/- 24V, +/- 0.3% over any 24 hours period at constant ambient temperature. Over the combined range of no load to full load and specified mains variation after 60 min. warm-up.
Temperature range	:	0 to 50° C ambient
Temperature coefficient	:	0.02% per o C over 0 to 50° C ambient.
Noise and ripple	:	for +/- 12V & +/- 24V, 3mV rms
Voltage adjustments	:	+/- 2% minimum range. Resetability +/- 0.5% of supply voltage
Recovery time	:	+/- 12V & +/- 24V outputs will recover within +/- 0.1% of steady state values with in 100 micro seconds following any change in specified line voltage or between 10 to 100% full load.
Circuit protection	:	a. Input of the supply is protected by two fuses b. Output of the power supply is short circuit and overload protected by means of foldback electronic circuit. c. Recovery is automatic when overload or short circuit is removed. d. Continuous short circuit will not damage the power supply unit.

3. HIGH VOLTAGE UNIT TYPE : HV 502

- a. Output voltage variable continuously from 0 to 2000 volts.
- b. Output current (maximum) 1mA.
- c. Load and Line Regulations : better than 0.005% of full scale
- d. Indefinite overload and short circuit protections and self recovery.
- e. Output ripple less than 20 mV.
- f. Dimensions : Two bit Module.
- g. HV is adjustable by ten turn helipot with knob.
- h. HV indication is provided on a 3 1/2 LED DPM.

4. SPECTROSCOPY AMPLIFIER TYPE : SA 524**A. PERFORMANCE**

- Gain Range : Continuously variable from X4 to X1500.
- Pulse Shaping : quasi-gaussian and quasi-triangular.
- Shaping time : 0.5, 1, 2, 3, 6 and 10 ms
- Input Noise : 5 mv r.m.s with 3 ms shaping time
- Overload : Recovers to within 2% of baseline in 15x shaping time from x200 overload.
- Integral Non-Linearity : < 0.05% from 0 to 10V.
- Crossover Walk : Bipolar zero cross over walk is < ± 3 ns in 50:1 dynamic range.

B. CONTROLS

- Fine gain : Front panel 10 turns precision potentiometer provides a continuously adjustable, gain factor from 0.5 to 1.5.
- Coarse gain : Front panel six-position switch selects gain factors of X20, X50, X100, X200, X500 and X1000.
- PZ : Screwdriver adjustment of the PZ cancellation using 20-turn potentiometer on the front panel.
- Pos/Neg : Front panel toggle switch for selecting either positive or negative input signals.
- Atn : A front panel toggle switch selects an input attenuation factor of X1 or X2.5
- Shaping : Front panel six position switch for selecting shaping times of 0.5, 1, 2, 3, 6 and 10 ms.
- Tri/gauss : Front panel toggle switch for selecting quasi-gaussian or quasi-triangular unipolar output shape.
- Bal : Screwdriver adjustment to match the gains of normal and differential reference inputs for maximum common mode noise rejection in DIFF mode using 20 turn potentiometer on the front panel
- Lim : A push-button switch on the front panel to prevent oscilloscope input from overloading and thus enabling observation of the baseline in sensitive ranges of the scope.

5. NaI SCINTILLATION DETECTOR

- Transducer : Flat type Integral assembly
- Phosphor : NaI (TI), 3x3 inches crystal
- Photomultiplier : 3" Bialkali phototube with mu metal magnetic/light shielding.
- Operating Voltage : 750 - 900V
- Resolution : Better than 8.5% with Cs-137
- Pre-amplifier : Built-in
- Gain (Approx) : 25
- Noise : (rms referred to input) Less than 50 micro volts
- Output : Positive tail pulse
- Output Impedance : 90 Ohms
- Power Requirement : (Typical) -12V @12mA

SOFTWARE FEATURES

Software in the integrated environment, facilitates the user with variety of programmable features required for automatic drill core scanning.

The moment core scanner system software is invoked, the following screen appears, from this screen one can notice that onto the extreme left side of the screen there is a vertical soft scale, defined, with a pointer. This pointer indicates the position of the core in the Z-axis with respect to the detector slit & 'HOME 1' position. One can know the physical position while scanning, by looking at the pointer.

On the top left side Z & θ status with buttons is indicates. This essentially indicates position in mm & Theta axis position in degree.

There are additional indicators for selection of 'HOME 1' & 'HOME 2'. Additionally there are two indicator windows (in RED) to show up Z position extreme i.e., upper limit & lower limit (extreme).

There are other command buttons as described below.

SCAN
SETTINGS

This opens up a window which facilitates the user to program for scan settings

START SCAN

This button is enabled at the end of programming & saving of scan settings, which initiates core scanning.

START SCAN

This button stops scanning.

EXIT

This button facilitates one to exit from this window.

OFF-TIME

This button is provided for off-line viewing of saved scanned data files.

On the top right side of this window we find MCA – PHA spectrum acquisition plot-out area where in counts Vs channel no. is plotted. Below this window, to the left MCA parameters can be configured. These include LLD, ULD, Base line Dwell time, Time scale, ROI settings etc.,

MULTICHANNEL ANALYSER FEATURES :

MCA resolution : 1024 (by default) that is selection of no. of channels for acquisition i.e. ADC resolution.

LLD : Lower level disc can be selected to cut-off any noise.

ULD : By default it is 10.0V if one likes to cut-off one can set it accordingly.

Time mode : By default it is 'CLOCK TIME'. One can choose 'LIVE TIME' mode of acquisition for MCA, to correct for dead time losses.

Base line : It is off-set at Zero level.

Dwell time : By default is 100 m.sec change is as desired.
In sec mode, one can choose from 1 sec to 9999 sec

Time Scale : sec or m.sec
By default 100 m.sec

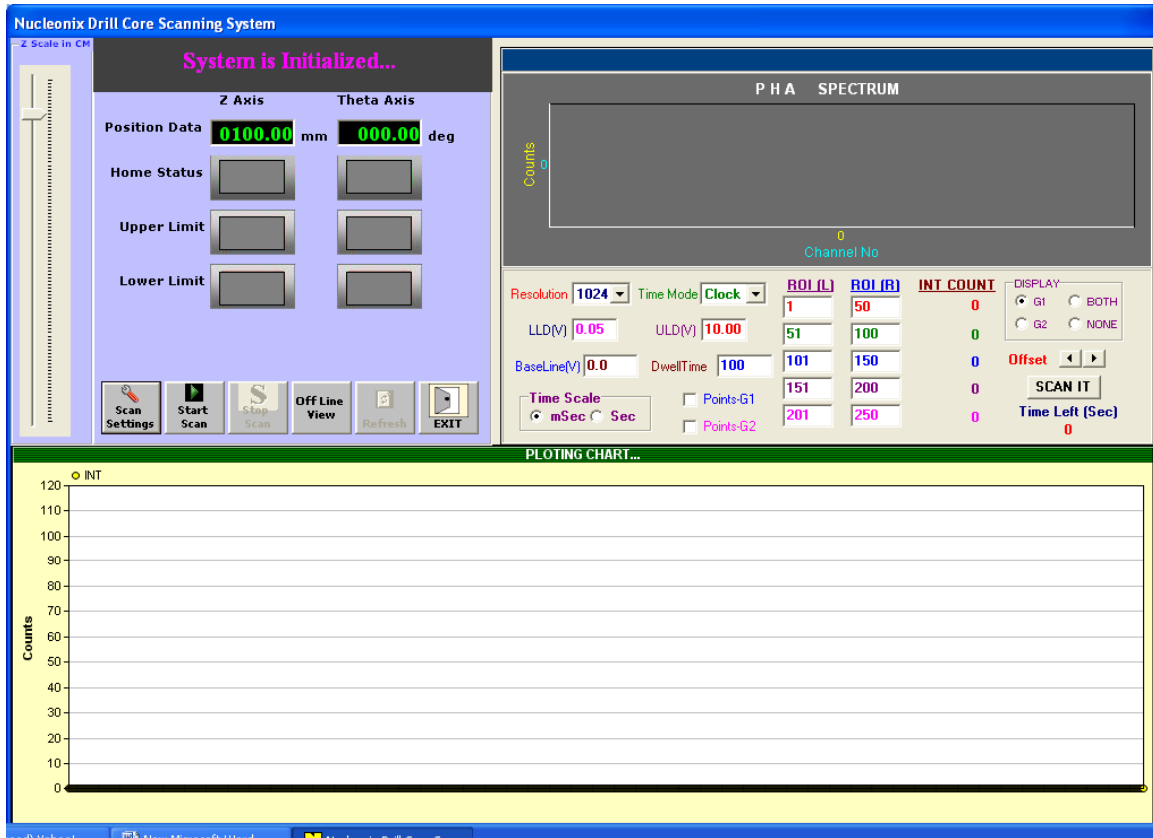


Fig : Data acquisition screen

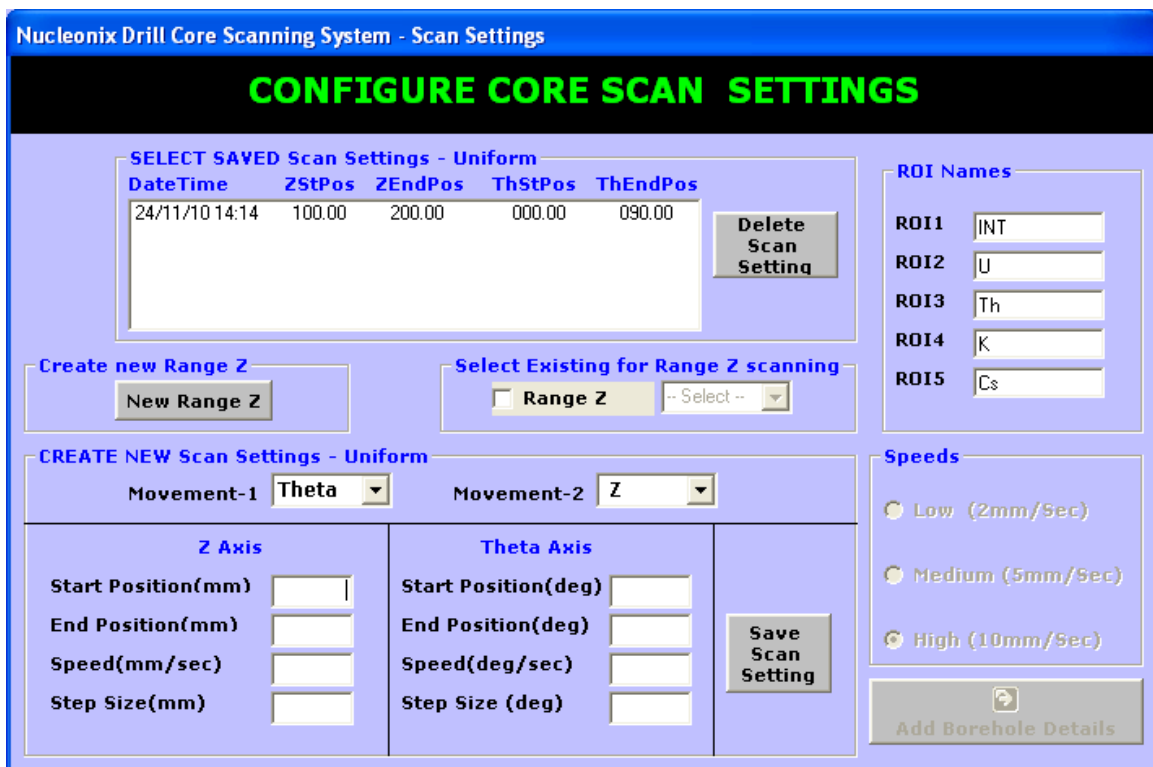


Fig : Configuration window