NEOMETRIX

Automated Inverter Test Rig On Labview Environment

Product Catalog

www.neometrixgroup.com

About us:

Neometrix Defence Celebrating 20 Years of Excellence! For the past two decades, Neometrix Defence has maintained its position as a premier provider of advanced test benches and rigs.

Our accreditation by the Directorate General of Aeronautical Quality Assurance, India (DGAQA) and Defence Research & Development Organization, India (DRDO) underscores our commitment to upholding the highest international defence industry standards.

Counting the Indian Air Force/Army/Navy, Ministry of Defence, Hindustan Aeronautical Limited, and DRDO among our esteemed clientele, we are recognized for delivering state-of-the-art solutions and unwavering performance reliability.

Strengths & Capabilities:

Neometrix Defence is a powerhouse of engineering brilliance, proudly serving every Indian Air Force station and partnering with the Indian Army, Navy, Railways, BARC, NPCIL, and ISRO. With a team of over 100 elite engineers and visionary founders from IIT Kanpur and IIT Delhi, we harness cutting-edge technology to set the gold standard in mechanical engineering.

We Don't Just Meet Industry Demands – We Define Them!

- We have established our presence in all Air Force stations across India. With the Indian Air Force as our leading customer, we are dedicated to upholding the highest standards of excellence in the aerospace industry.
- Our extensive clientele extends beyond the defence industry, including projects with the Indian Army, Navy, Railways, BARC, NPCIL, ISRO, and more. In essence, we excel in all aspects of mechanical engineering!
- Our team comprises over 100 graduate engineers, supported by a cutting-edge manufacturing site equipped with state-of the-art machinery, enabling us to meet the highest Engineering standards.
- The founders of our company are distinguished graduates from IIT Kanpur and IIT Delhi, bringing extensive expertise and a wealth of engineering knowledge to Neometrix Defence.

Table of contents

Introduction:

The Automated Inverter Test Bench by Neometrix Defence is a cutting-edge, fully automated validation platform built to meet the most stringent requirements of modern power electronics. At its core is a LabVIEW®-driven environment running on an industrial PC, which orchestrates over 140 distinct test sequences spanning DC input/output characterization, AC performance, protection threshold verification, and dynamic transfer-time analysis. This modular approach ensures that every inverter—whether for UPS systems, solar installations, or electric vehicles—is evaluated under precisely controlled conditions, eliminating variability and human error.

Underpinning the bench's capabilities is a flexible PXI-based hardware suite that integrates programmable DC power supplies, high-speed data acquisition modules, and a multi-channel power analyzer. These instruments communicate seamlessly via NI drivers, allowing rapid transitions between test modes—such as resistive, inductive, and capacitive loading—without manual rewiring. All measurement data are captured at up to 1 MS/s, then time-stamped and archived in an SQL database, providing full traceability and enabling deep post-test analysis of efficiency curves, THD waveforms, and protection trip characteristics.

Beyond raw performance testing, the system emphasizes compliance and usability. Role-based user management and encrypted credentials safeguard access, while an automated calibration-alert engine—aligned with ISO 17025 guidelines—locks out tests when instrumentation calibration is overdue. The intuitive HMI presents real-time graphs and pass/fail indicators, and upon completion generates standardized PDF or CSV reports, complete with trend plots and raw data attachments. As a result, manufacturers, R&D teams, service technicians, and certification labs all benefit from a unified, error-resistant workflow that dramatically reduces test cycle times and ensures consistency with international standards.

Purpose & Applications:

- The Automated Inverter Test Bench from Neometrix Defence is a turnkey, LabVIEW®-powered platform engineered to streamline the full spectrum of inverter validation workflows. At its heart, an industrial PC hosts a modular state-machine sequencer that executes over 140 distinct test routines—ranging from DC-input characterization and AC-output performance to protection-threshold verification and sub-millisecond transfer-time analysis. Integrated PXI instrumentation (power supplies, DAQ modules, digital I/O) and a high-precision power analyzer enable rapid mode transitions (resistive, inductive, capacitive loading) without manual rewiring, while real-time prompts guide operators through each step, ensuring repeatability and data integrity.

- All test readings—captured at up to 1 MS/s and time-stamped—are automatically archived in an SQL database, granting complete traceability for post-test analysis of efficiency curves, THD waveforms, and trip characteristics. Role-based user management with encrypted credentials, combined with an ISO 17025-aligned calibration-alert engine, enforces rigorous quality controls and locks out any test when instrument certification is overdue. The intuitive HMI displays live graphs and pass/fail status, and upon test completion generates standardized PDF or CSV reports complete with trend plots, raw data attachments, and digital signatures for audit trails.

- Designed for diverse applications—from end-of-line QA/QC in UPS, solar, and EV inverter manufacturing to prototype characterization in R&D labs, on-site maintenance checks, and compliance testing against IEC 61000, UL 1741, and IEEE 1547 standards—the bench delivers consistent, error-resistant results that dramatically reduce cycle times. With DGAQA and DRDO certifications, an ISO 17025-compliant calibration lab, and a track record of deployments across the Indian Air Force, DRDO, HAL, and major industrial clients, Neometrix's Automated Inverter Test Bench represents a proven investment in productivity, precision, and regulatory compliance.

Key Features:

- Modular LabVIEW State-Machine Sequencing of 146 Parameter Tests
  At the core of the bench is a LabVIEW® application organized as a state-machine: each of the 146 test steps—covering everything from input/output voltage and current measurements to transfer-time analysis and protection trip validation—is encapsulated in its own "state." This architecture allows you to reorder, insert, or skip entire test sequences without rewriting code, simply by modifying the state transition table. The result is a highly maintainable system that can be rapidly reconfigured for new inverter models or special customer protocols.

- High-Speed NI PXI Data Acquisition (Up to 1 MS/s)
  Precision matters when you're characterizing fast transients, surge events, or minute waveform distortions. The PXI-6229 DAQ module samples voltages and currents at up to 1 mega-sample per second per channel, capturing every overshoot, undershoot, and ripple cycle. Combined with the NI PXI-4071 digital multimeters for high-accuracy DC readings, this hardware suite ensures both fast-event fidelity and DC precision in a single, tightly integrated rack.

- Adaptive Electronic Load Control Without Hardware Swaps
  Switching between resistive, inductive, and capacitive loading has traditionally meant physically rewiring banks or manually reconfiguring loads. Here, solid-state relays and PLC-driven load banks accept 4–20 mA control signals from LabVIEW, dynamically adjusting load type and magnitude on-the-fly. With a single click in the HMI, you can sweep from no-load to full-load conditions or emulate complex mixed loads—no cable changes, no downtime.

- Role-Based User Management with Audit Trails
  Every operator, engineer, and administrator logs in with unique credentials. Permissions control access to test configuration, limit editing, report generation, and calibration overrides. Behind the scenes, an encrypted audit log records who did what and when—every test run, every limit change, every calibration reset—meeting the strict traceability demands of Defense and aerospace customers.

- Automated ISO 17025 Calibration Tracking and Alerts
  Instrument drift undermines test integrity—so the bench enforces ISO 17025 compliance by tracking each device's last calibration date versus its due date. Seven days before expiry, pop-up warnings appear; at expiry, the system locks out any critical tests until a new certificate is logged. Calibration certificates (PDF/JPG) can be uploaded directly into the instrument registry, streamlining your lab audit process.

Technical Specifications:

Parameter	Specification
DC Input Voltage	0–50 V programmable; ±0.01 V accuracy
AC Output Voltage & Frequency	0–300 VAC, 45–65 Hz; ±0.1% accuracy
Load Control	0–100% various P.F.; switching <10 ms
Current Measurement	Up to 30 A/ch; isolated transducers
Efficiency & THD	IEC 61000-3-2; 2–50 kHz range
Protection Tests	OV/UV, OF/UF, short-circuit, overload
Transfer Time	<1 ms at 25% load
Data Logging	SQL Server; 1 M samples/s
Interfaces	Ethernet, RS-232, USB, OPC UA
Software	LabVIEW 2024 Q3; Windows 10/11

System Components & Architecture:

Industrial PC & HMI: Touchscreen LabVIEW interface

PXI Chassis & Modules: NI PXI-4110, 4071, 6229, 8536

Power Analyzer: IEEE 488/LXI-enabled unit for THD and power metrics

Electronic Load Bank: Resistive, inductive, capacitive modes

I/O & Switching: Solid-state relays, contactors, E-stop integration

Network & Storage: Gigabit Ethernet to SQL server

Installation & Maintenance

Site Requirements:

- Power: 230 VAC, 15 A
- Environment: 10 °C–40 °C, indoor, dust-free

Maintenance Schedule:

- Daily: Visual inspection
- Monthly: Reference standard checks
- Quarterly: Safety-interlock tests
- Annually: Full calibration of PXI & analyser

Operational Workflow

Login & Authentication:

- Users begin by entering their unique credentials on the intuitive HMI login screen. The system verifies roles (Operator, Engineer, Administrator) against its encrypted database, then directs each user to a customized dashboard showing only the functions they're authorized to access—minimizing clutter and preventing unauthorized changes.

Test Profile Selection & Configuration:

- From the dashboard, the user can choose a predefined test profile (e.g., "Solar Inverter Final Test") or import a custom CSV file containing new limit sets and sequence parameters. A live preview displays key steps, expected durations, and pass/fail criteria, allowing last-minute adjustments before execution.

Pre-Check & Instrument Health Verification:

- Before any measurements begin, the bench automatically pings all connected PXI modules, power analyzer, and load banks to confirm communication integrity. It then cross-checks each device's calibration status against its due date—locking out critical tests or flagging devices that require attention—and runs quick self-tests (voltage sanity checks, I/O loop tests) to ensure hardware readiness.

Automated Test Execution with Operator Prompts:

- The state-machine controller steps through each test node in sequence, setting instrument parameters, applying loads, and capturing data at up to 1 MS/s. Whenever a manual action is required—such as switching the inverter mode or confirming load connections—a clear on-screen prompt appears with a countdown timer. Once the operator clicks "ACK," the bench resumes automatically.

Real-Time Data Validation & Review:

- As measurements stream in, embedded pass/fail logic instantly compares readings against configured limits. Any out-of-range value triggers a warning banner, allowing the operator to pause or rerun the test. Throughout execution, live graphs plot voltage, current, efficiency, and THD, giving immediate visual feedback.

Review, Digital Sign-Off & Archival:

- After the final test step, the system presents a summary screen showing overall status, individual parameter outcomes, and any flagged anomalies. An engineer or supervisor then provides a digital signature (password-protected), which the bench embeds into the PDF/CSV report. The signed report—complete with raw data files—is automatically saved to the SQL archive and mirrored to network storage for redundancy.

Automated Notification & Follow-Up:

- Within seconds of archival, the bench's notification engine emails a summary report link to the QA manager, test engineer, and any designated stakeholders. If any critical failures occurred or a calibration due date is imminent, the email subject line and body explicitly highlight these issues, ensuring rapid corrective action without manual oversight.