

PCA2 - On-Load Protection Condition Analyser



- Tests entire system (Relay, Breaker, Tripping Supply, Wiring etc.) simultaneously
- Records full protection operation sequence (before, during and after fault/trip/reclose)
- Captures critical 'first trip'
- On or Off-Load Injection Test Set/Timer
- On or Off-Load Breaker Analyser
- General Purpose Oscillographic/Event Recorder with COMTRADE export
- Quick PC data transfer via USB drive

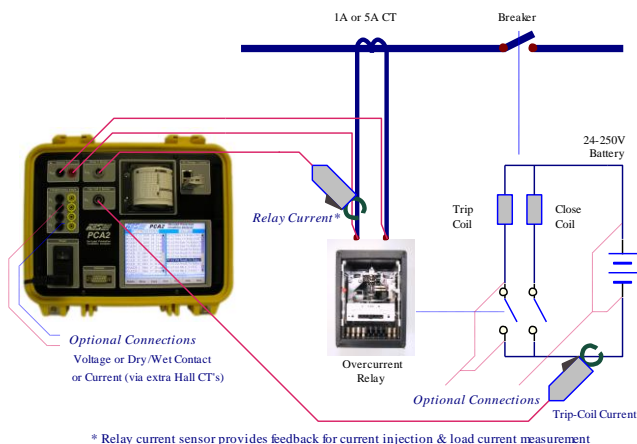
Overview

Developed in conjunction with EDF Energy UK, the PCA2 is a complete substation protection performance evaluation and recording system. It tests several elements of the protection system. Its advanced software-controlled current source can inject a precise current into the relay even whilst the system is on-load. The critical 'first-trip' of both relay and breaker can then be captured and automatically analysed.

It is well known that some relays and breakers can become sluggish after a long period of inactivity. The ideal way to test any protection system is to simulate the precise conditions that occur during a fault on a previously undisturbed system whilst simultaneously recording its performance. Performing such a test on a system that has not operated for a long time then yields very useful data as to how the system would perform given a real fault.

Traditionally the different protection system parts (relay, breaker, tripping supply, etc.) have been tested individually with the circuit first being taken off-line manually. Modern maintenance strategies call for efficient and minimally-intrusive methods that can provide a computerised record of the performance of the entire protection as a *complete system* and with the least outage time.

The PCA2 also records the tripping supply and trip-coil current profile and additional voltages/contacts/currents as desired. The unit automatically analyses this information to extract data on many aspects of breaker and overall protection system condition. As well as performing a complete system test, the PCA2 can be used for testing overcurrent relays and breakers individually and for many other investigative studies on protection systems, both on and off-load. The PCA2 is a key tool that enables a truly cost-effective Reliability Centred Maintenance Program (RCM) for substation protection.



Basic & Optional Connections for ON-LOAD testing

System Concept

The PCA2 incorporates an advanced current injection unit together with a deep-memory high-resolution multichannel current/voltage/contact-event recorder. Both injection and recording functions can be used together or *totally independently*.

All instrument control is via a bright high-resolution colour touch-screen. The built-in printer provides an instant hard-copy printout. The USB port enables quick and convenient results transfer to a PC via 'pen drives' as well as the use of a Bar Code Reader for quick site data entry.

On-Load Current Injection

The advanced current output of the PCA2 can function in one of two modes: as a general purpose precision injection unit for off-line relay testing or as a special ON-LOAD injection unit. When used for on-load injection, an external clip-on hall-effect CT is used, to record the load current & establish main contact time, and as a feedback element so that a precise and stable current can be injected into the relay, compensating for any load current present.

Current Output

The current output of the PCA2 employs fully digital waveform generation & low-noise switching amplifier technology. The processor generates high precision waveforms to the required amplitude, frequency and phase angle. The output is continuously monitored and tightly regulated, maintaining an accurate, ultra-low distortion waveform independent of the supply input or load. This guarantees clean sinusoidal waveforms are produced, even into difficult saturating magnetic loads (i.e. electromagnetic relays). If the output deviates from its programmed setting for any reason (open circuit, overburden, etc.) then the operator is warned via a message on the display.

Multichannel current/voltage/contact-event recorder

The PCA2 is also a fully fledged high speed oscillographic recorder with 80Mb of memory dedicated to high-speed/high-resolution recording of the various current/voltage/contact input channels. Several start/stop external triggering and event capture modes are available.

As well as providing instant hard-copy printout of measurements of waveforms and relay/breaker timing data, the PCA2 can save the raw recorded oscillographic data to internal memory or the supplied USB memory stick for transfer to a PC. The industry standard COMTRADE file format (IEEE Standard Common Format for Transient Data Exchange for Power Systems) is used.

The standard PCA2 configuration provides for 2x Current & 4x Voltage/Contact channels. Each Voltage/Contact input can also be used with transducers/low-level signals or for recording extra currents (using additional clip-on current probes). The Voltage/Contact channels can also connect directly across offline breaker main contacts for additional timing measurements (pole-slip, etc.)

Specifications – Current Output

Current Output

Fully software controlled and regulated
0-25A Range / 0.001A Resolution
±45V peak Compliance Voltage
Duty cycle: 250VA/10A (continuous), 500VA/25A for 30sec.
<0.5% Error Typ., 1% Max, <0.2% Distortion
DC-1kHz / 0.001 Hz Resolution
< ± 0.005% Freq Error
Injection start synchronised with zero crossing and data recording.
During **ON-LOAD injections** automatically phase-locks (45-65Hz) and instantly corrects for any load current variation during injection.

Protection & Power Management

Processor continually monitors output for accuracy and waveform quality – any deviation from the programmed value is immediately reported to the user. Fault conditions like over-burden/over-power/over-temperature and open-circuit result in tests being aborted and a warning displayed.

Specifications – Inputs/Data Acquisition

Current Inputs

2x dedicated Current inputs (via supplied clip-on 'Hall' sensors)
Trip Coil Current Sensing & Relay Current Sensing/Feedback
+/-35Apk (25A RMS) Range / 0.001A Resolution
+pk, -pk, instantaneous & RMS measurements displayed
<0.5% Error Typ., 1% Max
Resolution: 16-bits (15+sign)
Bandwidth: DC to 4kHz

Voltage/Contact Inputs

4x Ultra-flexible **Galvanically-Isolated** inputs
Selectable as Voltage or Wet/Dry Contact recording
+/-300Vpk & +/-10V pk range (for transducers/sensors etc.)
+pk, -pk, instantaneous & true-RMS measurements displayed
<0.2% Error Typ., 0.4% Max
Resolution: 16-bits (15+sign)
Bandwidth: DC to 4kHz
(Voltage/contact inputs can also be used to measure current via additional **CT-HE2A** clip-on Hall probes)
Can be used to measure & record any arbitrary voltage or contact (e.g. battery voltage, relay trip contacts, breaker auxiliary contacts on-line or main breaker contacts during off-line testing)

Contact Mode

Software selectable as wet/dry, contact/2.5-300V
Records actual contact voltage over time (not just on/off status)

Protected against incorrect wet/dry selection

Time Resolution/Sampling Rate

10,000 samples/sec (±0.1msec resolution)

Memory

80Mb memory dedicated to waveform/event acquisition
(40 seconds recording for all channels at 10kHz)

Trigger Events

Programmable start & stop recording on any or multiple Voltage/Contact/Current inputs or injection start/stop
Programmable pre-trigger and post-trigger recording times

Specifications – Computer/Screen

Screen VGA (640x480) TFT LCD 256K colours with touch control
Memory 128Mb RAM, 1Gb Flash (512 Mb available for user storage)
Time/Date Real-time clock with 1 year battery backup
Interfaces 10/100Mbps Ethernet
2x USB (for Flash Drive / Ext. Hard Disk / Barcode-reader etc.)
USB Memory Stick: 1Gb supplied as standard

Specifications – Miscellaneous

Isolation

Current output, Voltage/Contact inputs & contact outputs are all individually **galvanically-isolated** from each other and chassis to 1500V

Interface I/O

15way connector for add-on accessories/expansion

Input Power

95-260VAC input / 45-65Hz AC
40W no load, 600W continuous max

Physical / Environmental

274x247Wx180m / 9.5kg Weight
0-50°C Operating Temperature
5-95% Relative humidity (non-condensing)
IP65 Protected Enclosure (when closed), airtight, watertight.
CE Marked, Tested to EN50081-2 & EN50082-2

Our policy of continuous product improvement may mean that equipment supplied differs slightly from specifications in this publication – check at time of ordering.

Software

Manual Test Mode:

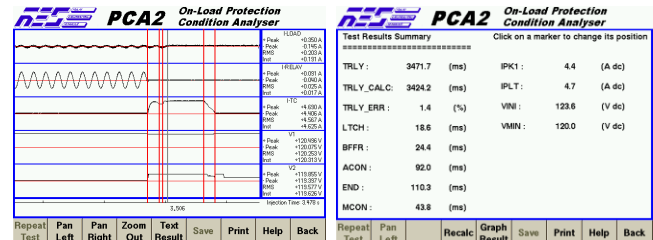
Real-time oscilloscope display with Current/Voltage/Contact Measurements
General purpose current source & timer
Quick On-Load or Off-Load Injections
Overcurrent Relay Testing/Timing

Auto Test Mode:

On-Load & Off-Load testing with recoding
Timing/Voltage/Current measurements on rec. data
Auto Relay/Breaker/Trip Supply results analyses
OCB, VCB & SF6 breaker types Trip-Coil analysis

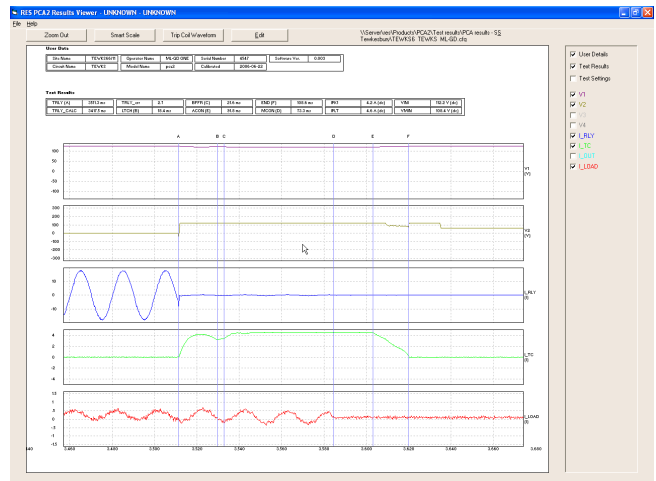
Utilities:

Results Saving/Transfer to USB drive
Software updates via USB drive
Online operating manual



Supplied PC Viewer:



Advanced Results Reporting/Archiving package for Win98/XP/Vista.
User defined cursors/markers/analytical functions



The Company

Relay Engineering Services Limited (RES) develops and markets equipment exclusively for testing power systems protection and switchgear. The company is the UK market leader in automatic protection relay test equipment. RES has a long record as an approved supplier to every main Electricity Generation, Transmission, Distribution and Railway Maintenance Company in the UK as well as to over 30 countries worldwide. All RES products are rugged, field-proven instruments designed to provide superior long-term service and reliability. The company also supplies dedicated protection relay set sets, battery discharge testers, HV circuit-breaker testers & custom testing & fault simulation hardware and software.

Ordering Information

code: PC2A	code: CT-HE2A
 <p>PCA2 Protection Condition Analyser + Padded protective case Set of power & test cables 2x CT-HE2A clip-on Hall probes 4Gb USB Flash Drive Operating manual Calibration certificate PCA Viewer Software for PC</p>	 <p>Additional clip-on Hall-effect CT – enables Voltage/Contact inputs to measure/record currents Specs as for std Current Inputs (extra CT's can also be used to record all 3-ph secondary currents)</p>