

PCA2

On-Load Protection Condition Analyser



- **Tests entire system (relay, breaker, tripping supply, CT, 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**

Description

The PCA2 is a complete substation protection performance evaluation and recording system. It tests a number of elements of the protection system. Its advanced software-controlled current source can inject a precise current into the relay whilst the system is on-load. The critical 'first-trip' of the relay and circuit breaker can then be captured and automatically analyzed.

It is well known that relays and circuit breakers can become sluggish after long time 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, first trip, 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 over-current relays and circuit breakers individually. It can also be used for analytical studies on many other 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.

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

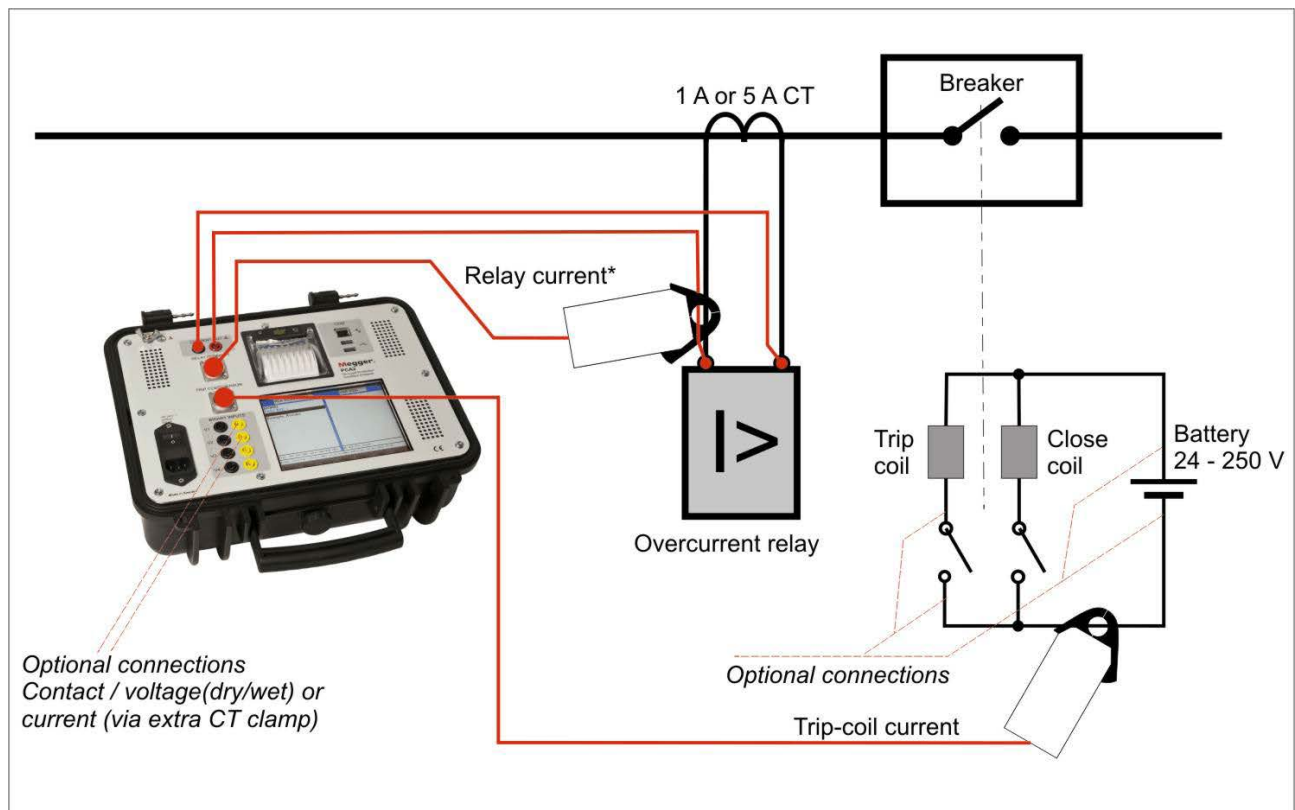
The advanced current output of the PCA2 can function in one of two modes: as a general purpose precision injection unit for off-line relay testing or as a special On-Load injection unit. When used for on-load injection, an external clip-on hall-effect CT is used, to record the load current & establish 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 32 MB 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.



Basic and optional connections for On-Load testing

* Relay current sensor provides feedback for current injection & load current measurement

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 2 x current and 4 x 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 PCA2

Specifications are subject to change without notice.

Environment

Application field The instrument is intended for use in high-voltage substations and industrial environments.

Temperature

Operating 0°C to +50°C (32°F to +122°F)
Storage & transport -25°C to +70°C (-13°F to +158°F)

Humidity 5% – 95% RH, non-condensing

CE-marking

LVD 2006/95/IEC in accordance with: EN/IEC 61010-1: 2010 EN/IEC 61010-2-030: 2010

EMC 2006/95/EC in accordance with: EN 61326 : 2006

General

Mains voltage 100-240 V AC, 45-65 Hz
Power consumption 40 W no load, 600 W continuous max
Dimensions 274 x 247 x 180 mm (10.8" x 9.7" x 7.1")
Weight 7 kg (15 lbs)
Isolation Current output, Voltage/Contact inputs & contact outputs are all individually galvanically-isolated from each other and chassis to 1500 V
Interface I/O 15way connector for add-on accessories/expansion
Interfaces 10/100 Mbs Ethernet
 2x USB (for Flash Drive / Ext. Hard Disk / Barcode-reader etc.)
 USB Memory Stick: 1Gb supplied as standard

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

Screen VGA (640x480) tft lcd 256k colours with touch control

Memory 256 Mb RAM, 1Gb flash (512 mb available for user storage) time/date real-time clock with 1 year battery backup

Current output

Fully software controlled and regulated. Injection start synchronised with zero crossing and data recording. During ON-LOAD injections automatically phase-locks (45-65 Hz) and instantly corrects for any load current variation during injection.

Range 0 to 17 A continuous
 17 to 25 A max 20 s.

Resolution 0.001 A

Compliance voltage ±45 Vpeak

Duty cycle 250 VA/10 A (continuous), 500 VA/25 A for 30 s.

Error <0.5% Typ., 1% Max

Distortion <0.2% (DC-1 kHz)

Resolution 0.001 Hz

Frequency error < ±0.005%

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.

Inputs/Data acquisition

(Voltage/contact inputs can also be used to measure current via additional CT 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)

Current inputs

No. of inputs 2 x dedicated current inputs (via supplied clip-on 'Hall' sensors) trip coil current sensing & relay current sensing/feedback

Range ±35 Apeak (25 Arms)

Resolution 0.001 A

Measurement +pk, -pk, instantaneous & ROMS measurements displayed

Error <0.5% Typ., 1% Max

Resolution 16-bits (15+sign)

Bandwidth DC to 4 kHz

Current probe CP35

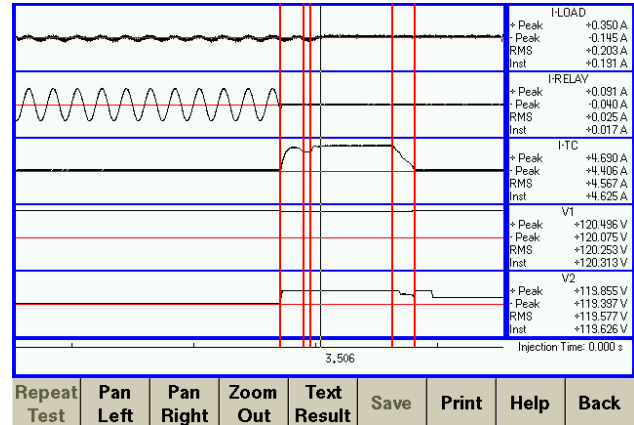
- Current range 30 A
- Output sensitivity 100 mV/A
- Frequency range DC to 100 kHz (-0.5 dB)
- Resolution ±1 mA
- Basic inaccuracy ±1% of reading ±2 mA
- Conductor position sensitivity < ±1% relative to centre reading
- Phase shift (up to 1 kHz) < 2 degrees
- Load impedance > 100 kΩ
- Output connection Safety BNC connector

Voltage/Contact inputs

- No. of inputs 4 x ultra-flexible galvanically-isolated inputs selectable as voltage or wet/dry contact recording.
- Range ±300 Vpeak and ±10 V peak (for transducers/sensors etc.)
- Measurement +pk, -pk, Instantaneous & true-RMS measurements displayed
- Error <0.2% Typ., 0.4% Max
- Resolution 16-bits (15+sign)
- Bandwidth DC to 4 kHz

Contact mode

- Software selectable as wet/dry, contact/2.5-300 V Records actual contact voltage over time (not just on/off status). Programmable pre-trigger and post-trigger recording times Protected against incorrect wet/dry selection
- Time resolution/sampling rate 10,000 samples/sec (±0.1msec resolution)
- Memory 32 Mb memory dedicated to waveform/event acquisition (40 seconds recording for all channels at 10 kHz)
- Trigger events Programmable; start & stop recording on any or multiple voltage/contact/current inputs or injection start/stop



Auto test results with auto analysis markers shown



The rugged enclosure for PCA2 has a detachable pocket for cables and accessories.

Ordering information

Item	Art. No.
PCA2	CQ-19090

Included accessories

- Set of power & test cables
- 2x CT clip-on hall probes
- 8 GB USB flash drive
- PCA viewer software for PC

Optional accessories

CT clamp

- Additional clip-on hall-effect CT with 4 mm banana contacts. Enables voltage/contact inputs to measure/record currents

XA-30010

Postal address
 Megger Sweden AB
 Box 724
 SE-182 17 DANDERYD
 SWEDEN
 T +46 8 510 195 00
 F +46 8 510 195 95

Visiting address
 Megger Sweden AB
 Rinkebyvägen 19
 SE-182 36 DANDERYD
 SWEDEN
 seinfo@megger.com
 www.megger.com

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