ZERA

PPCS

Primary Standard PPCS

Precision Power Calibration System

General

The Precision Power Calibration System (PPCS) is designed for high precision, traceable calibration of measuring devices (e.g. comparators) for active, reactive and apparent power. It is of particular importance for the national metrological institutes in order to maintain the traceability within country and internationally.

The single-phase Precision Power Calibration System produces sinus-type voltages and currents with adjustable phase shifts from 0° to ±180° and frequencies from 40 Hz to 70 Hz.
The steady generation and highly accurate measurement of active, reactive and apparent power is possible at the specified power factors with a standard measurement uncertainty of < 10 x 10^{-6} related to apparent power at frequencies from 40 Hz to 70 Hz.
The PPCS is based on the research work carried out by the team of scientists from PTB Braunschweig, Germany and tested for several years to ensure technical claims.

Features

- Highly accurate current, voltage and power calibration
- High measuring stability due to ZERA components that have been proven for many years
- High repeat accuracy of the measuring values
- Lowest measuring uncertainty from < 10 x 10^{-6} (relative to the nominal value of the apparent power)
- Simple traceability to SI unit “DC voltage” and “AC resistor” to national reference standards
- Wide range of Harmonic generation and accurate measurement

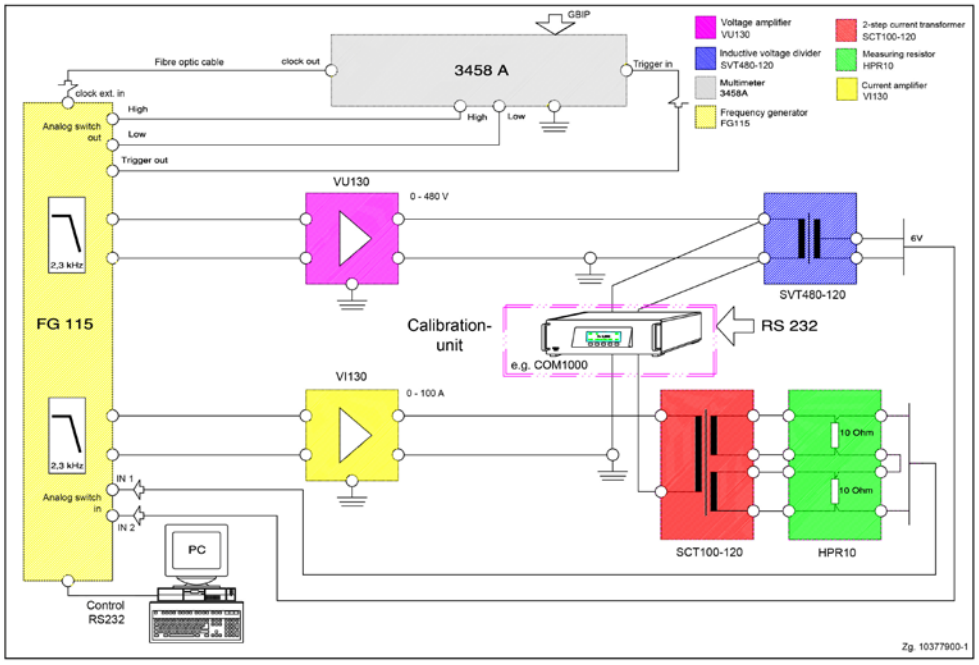
Recommended calibration periods:

- Transformers (SVT480-120, SCT100-120) every 5 years
- Resistors (HPR10) every two years
- Multi-meter 3458A* every 90 days (for highest accuracy every 24 hours)

* A DC device (e. g. Fluke) is required for re-calibration of the multi-meter

The inherent errors of the individual components determined during the re-calibration can be used for fault compensation in the operating program.

Measuring Principle



Measuring Principle

The measuring principle is based on synthesized AC voltage and current generation using single sampling voltmeter for synchronization and computerized evaluation by means of **D**iscrete **F**ourier **T**ransform (DFT).
PC software communicates with the frequency generator (FG115) which consists of a dual voltage programmable amplifier. Signals pass on to voltage and current amplifiers (based on linear amplifier technology) through antialiasing filter FES101. The feedback measurement of the voltage output is performed via inductive divider (SVT480-120); current output is measured by precision current transformer (SCT100-120) and high precision resistor (HPR10). Both values are detected by FG115 for corrective action.
Values measured by the device under test are read out via interface. The user software compares the generated values and the values, received from the device under test and shows the errors.
Further traceability to the SI units "DC voltage" and "DC resistor" are achieved by using RMS voltmeter and AC precision resistor with small and known frequency responses. The use of single clock signal for generation and measurement synchronization ensures the great reduction in measurement uncertainty. This clock signal f_{clock} is taken from the sampling voltmeter.
These measurements lead to a significant reduction of
1. Synchronization errors with sampling method and
2. Unavoidable differences between sampling voltmeters.

Individual Components

Digital Oscilloscope

RM2000B/TDS2014B – Digital oscilloscope is used to see the output waveform quality.

Multi-meter

3458A – $8^1/_2$ digit multi-meter for synchronization and recording of the measured values.

Frequency Meter

5313A – Frequency meter for counting pulses to carry out calibration based on power proportional pulse output.

Double Alternating Voltage Source

FG115 - The programmable double alternating voltage source is the basic component for the sequential, alternating, synchronous scanning method (Salisa) and provides the PPCS power reference standard together with the modified multi-meter 3458A.

Current Amplifier

VI130 - Analogue current amplifier for generating output currents from 0.01 A up to 100 A for frequencies of 40 ...70 Hz. The amplifier consists of an output converter (TTS4161), a push-pull converter (VE5484) and a power supply (UR5532).

Precision Current Transformer

SCT100-120 - **S**tandard **C**urrent **T**ransformer for transforming a primary current of 0.1 A ... 100 A into a secondary current of 0.1 A.

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High Precision Resistor

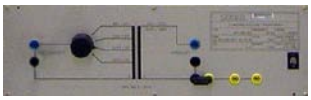
HPR10 – High Precision Resistor with a nominal value of 10 Ω. The HPR10 will be loaded with 0.1 A from SCT100-120 and generates a suitable voltage of 1 V for sampling process in FG115 (feedback measurement).

Voltage Amplifier

VU130 – Analogue voltage amplifier for generating output voltages from 0 V up to 480 V for frequencies of 40 ... 70 Hz. The amplifier consists of an output converter (TVS4160), a push-pull converter (VE5484) and a power supply (UR5532).

Inductive Divider

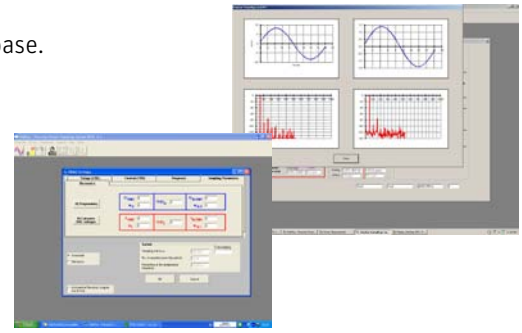
SVT480-120 – The voltage divider SVT480-120 generates a suitable voltage of 6 V for sampling process in FG115 (feedback measurement) from the primary ranges : 480 V / 240 V / 120 V / 60 V.



Control

PPSS – The especially developed Precision Power Sampling System is a Windows based software and controls the PPCS. The software is able to control the device under calibration (e.g. C12, K2005, K2006, KOM100.1, KOM200.3, COM100x, COM300x, COM303-3, RMM300x, EPZ303, ILM03, LMG95) and calculates the error and measurement uncertainty (standard deviation).

The result will be stored in the data base.



Technical Data

PPCS	
Voltage range	0 ... 480 V
Current range	10 mA ... 100 A
Fundamental frequency	40 ... 70 Hz
Harmonic generation and measurement	Up to 40th Harmonic (related to 50 Hz fundamental frequency)
Phase shifting	± 180°
Measurement uncertainty, power measurement	< 10 x 10^{-6} (@ 47,5 ... 62,5 Hz) [1] [2]
Power supply	Single-phase 230 V ± 10 %, 50/60 Hz (mains side fused with 16 A)
Dimensions	~ 600 x 800 x 1900 cm

[1] related to apparent power
[2] related to the ranges from 30 ... 240 V and 0,05 ... 10 A

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Subjects to alteration.