ZERA

PPCS

Primary Standard PPCS

Precision Power Calibration System

General

The **P**recision **P**ower **C**alibration **S**ystem (PPCS) is designed for high precision, traceable calibration of measuring devices (e.g. comparator) 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 stable provision and highly accurate measurement of active, reactive and apparent power is possible at any power factor with a standard measuring error of < 10 x 10^{-6} w.r.t apparent at frequencies from 40 Hz to 70 Hz (at a frequency from 100 Hz to 400 Hz < 30 x 10^{-6}).
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

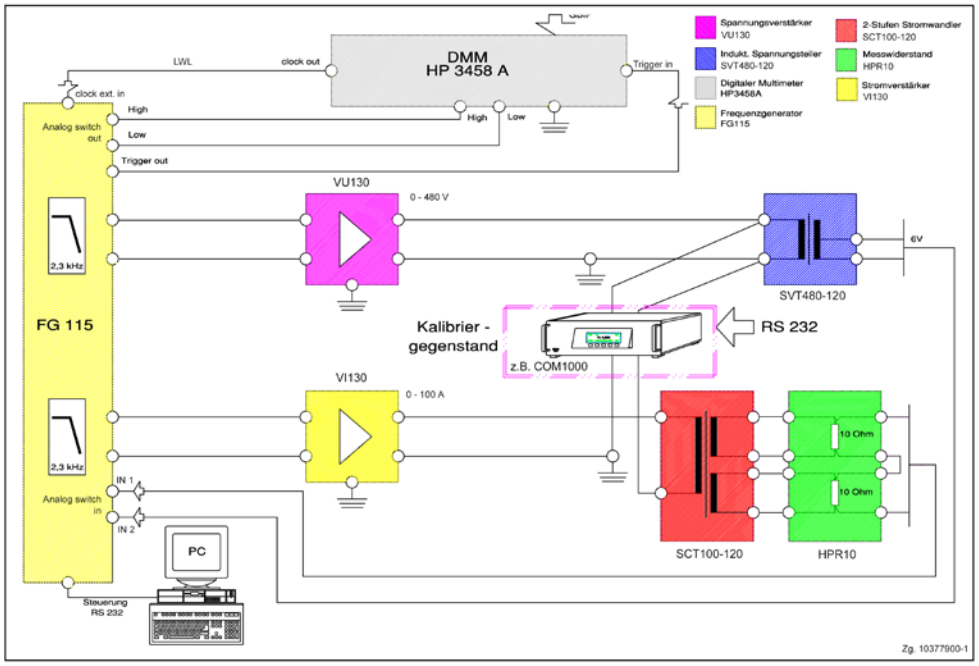
- Highly accurate current, voltage and power calibration
- High measuring stability due to ZERA components that have been proven for many years
- High repeat accuracy of the measuring values
- Lowest measuring uncertainty from von < 10 x 10^{-6} (relative to the nominal value of the apparent power)
-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

Calibration periods required:

- Converter every 5 years
- Resistors every year
- Multi-meter every 90 days (for highest accuracy every 24 hours)

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 discrete Fourier transform (DFT).
PC software communicates with the frequency generator (FG115) which consists 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 value and the values received from the device under test and shows the errors.
Further traceability to the SI units "DC voltage" and "DC resistance" 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 measures lead to a significant reduction of
1. synchronization errors with sampling method and
2. unavoidable difference between sampling voltmeters.

Individual Components

Digital Oscilloscope

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

Digital Multi-meter

HP3458A – $8^1/_2$ digit digital-multi-meter HP3458A is used for synchronization and to acquire the measured values.

Frequency Meter

HP5313A – Frequency meter is used for counting the 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 scanning voltmeter Agilent HP3458A.

Current Amplifier

V130 - Analogue current amplifier for generating output currents from 0.1 A up to 100 A for frequencies of 40 - 70 Hz (optional 400 Hz). The amplifier consists of an output converter (TTS4161), a push-pull converter (VE5484) and a power supply (UR5532).

Precision Current Transformer

SCT100-120 - Standard Current Transformer

High Precision Resistor

HPR10 – High Precision Resistor

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Voltage Amplifier

VU130 – Analogue voltage amplifier for generating output voltages from 60 V up to 480 V for frequencies of 40-70 Hz (optional 400 Hz).

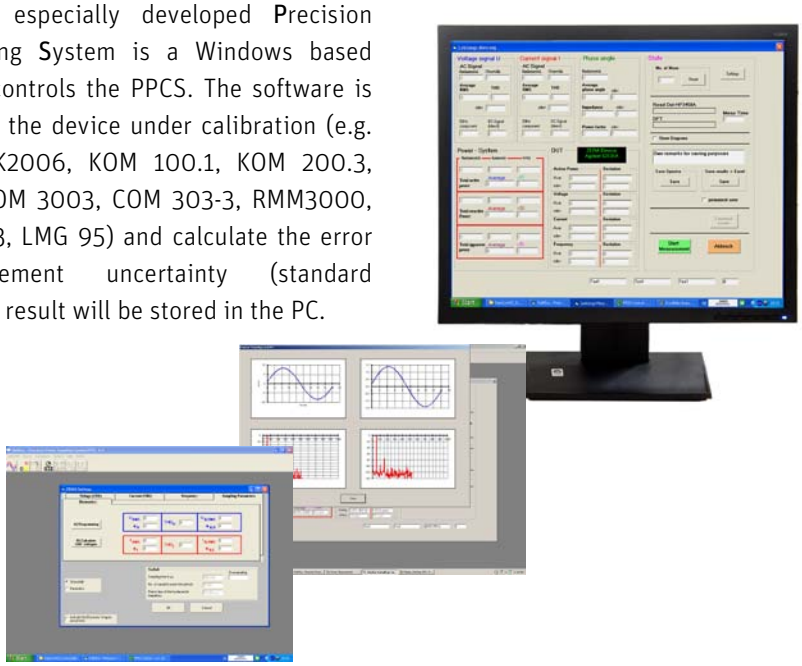
The amplifier consists of an output converter (TVS4160), a push-pull converter (VE5484) and a power supply (UR5532).

Inductive Divider

SVT480-120 – The voltage divider SVT480-120 generates the measuring value (6 V) from the primary ranges : 480 V / 240 V / 120 V / 60 V.

Control

PPSS – The especially developed **P**recision **P**ower **S**ampling **S**ystem is a Windows based software and controls the PPCS. The software is able to control the device under calibration (e.g. C12, K2005, K2006, KOM 100.1, KOM 200.3, COM 3000, COM 3003, COM 303-3, RMM3000, EPZ303, ILM03, LMG 95) and calculate the error and measurement uncertainty (standard deviation). The result will be stored in the PC.



Technical Data

PPCS	
Initial voltage	60 V - 480 V
Initial current	0,1 A - 100 A
Frequency	40 Hz - 70 Hz (optional 400 Hz)
Power factor	0 - 1 - 0 - (-1)
Power uncertainty *	< 10 x 10^{-6} (at 40 Hz - 70 Hz) < 30 x 10^{-6} (at 400 Hz)
Harmonic generation & Measurement	Upto 40th Harmonic (related to 50 Hz fundamental)
Supply	single-phase 230 V ± 10 %, 50 ... 60 Hz (mains side fused with 20 A)
Design type	19“ switch cabinet

* related to apparent

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Subjects to alteration.