Power & Energy calibrators

M133 / M133i
Single phase

Features
- Voltage 1 … 280V
- Current 8mA … 30A
- Frequency DC, 15 … 1000Hz
- Phase 0 … 360°
- Power 0 … 18kW
- Energy function as standard
- Built in process multimeter

M133 only
- Harmonic distortion (50 harmonic components)
- Interharmonic distortion
- Modulation and flicker
- Dip/Swell

Power & Energy calibrators

M133C / M133Ci
Three phase

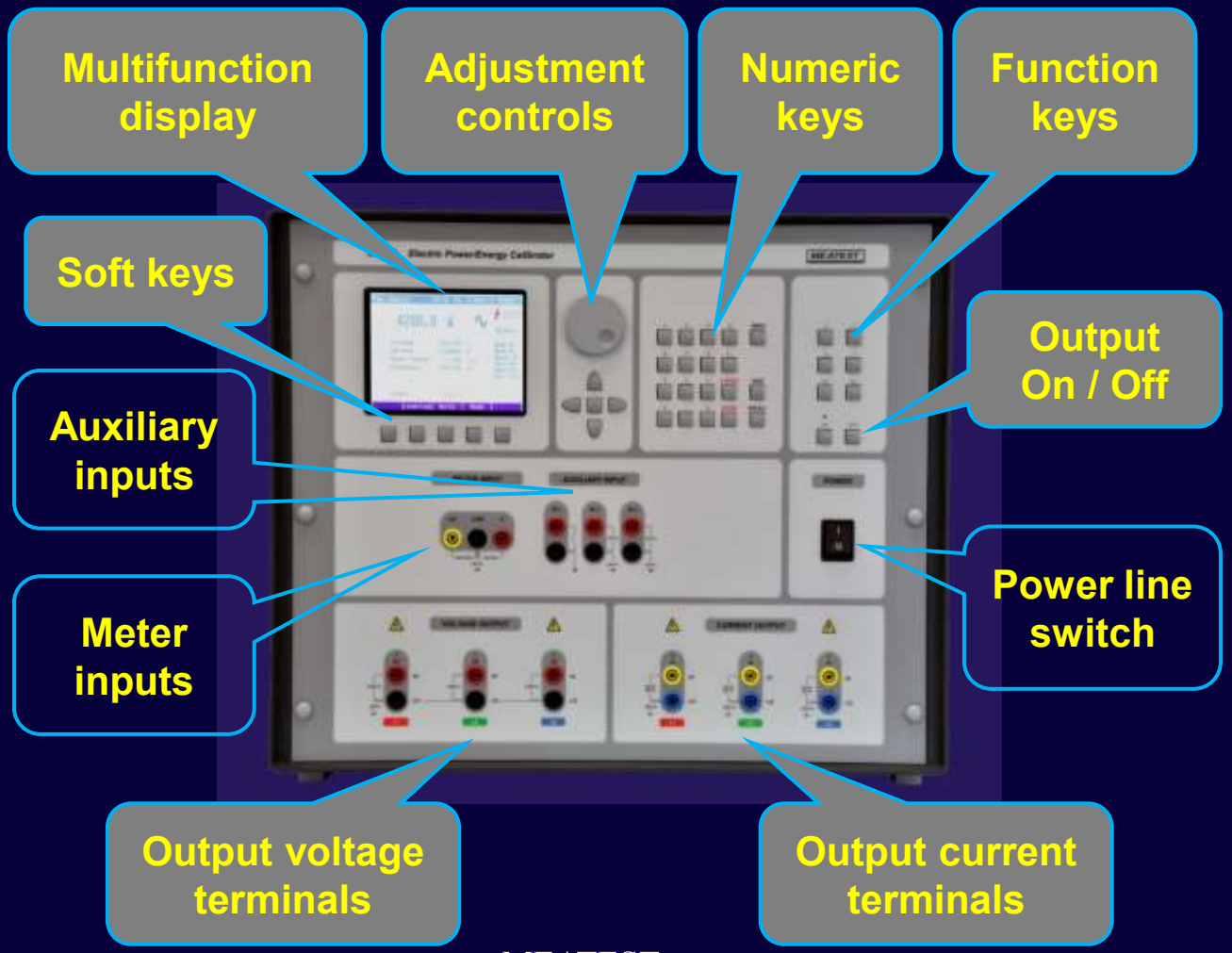
Features

- Voltage 1 … 600Vac, 1 ... 280Vdc
- Current 8mA … 30A (90A single phase)
- Frequency DC, 15 … 1000Hz
- Phase 0 … 360°
- Power 0 … 54kVA
- Energy function as standard
- Built in process multimeter

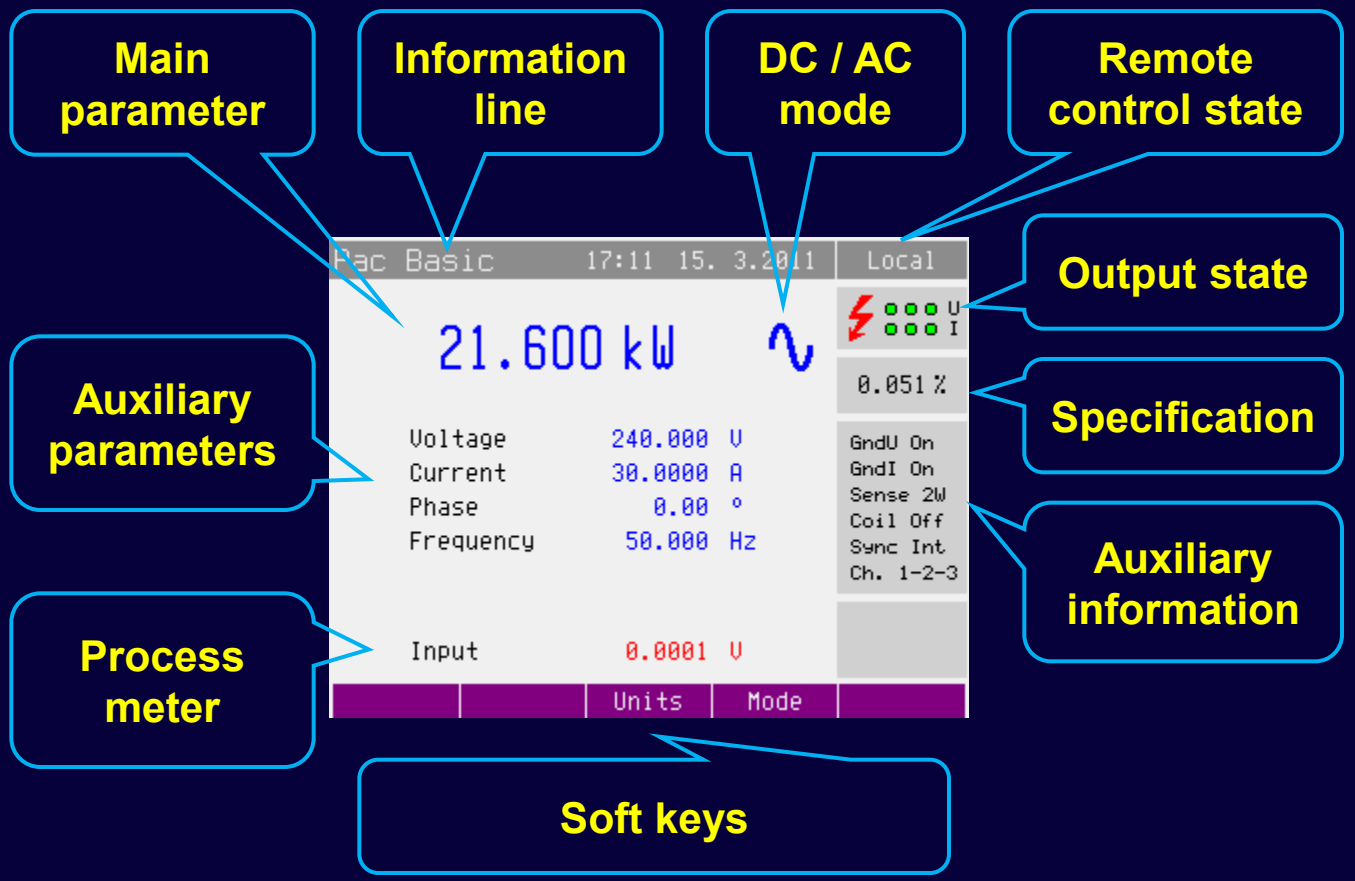
M133C only

- Harmonic distortion
  (50 harmonic components)
- Interharmonic distortion
- Modulation and flicker
- Dip/Swell

M133C – Front panel



M133/M133C - Display



COLORS

RED
measured values

BLUE
editable parameters

BLACK
names, fixed parameters

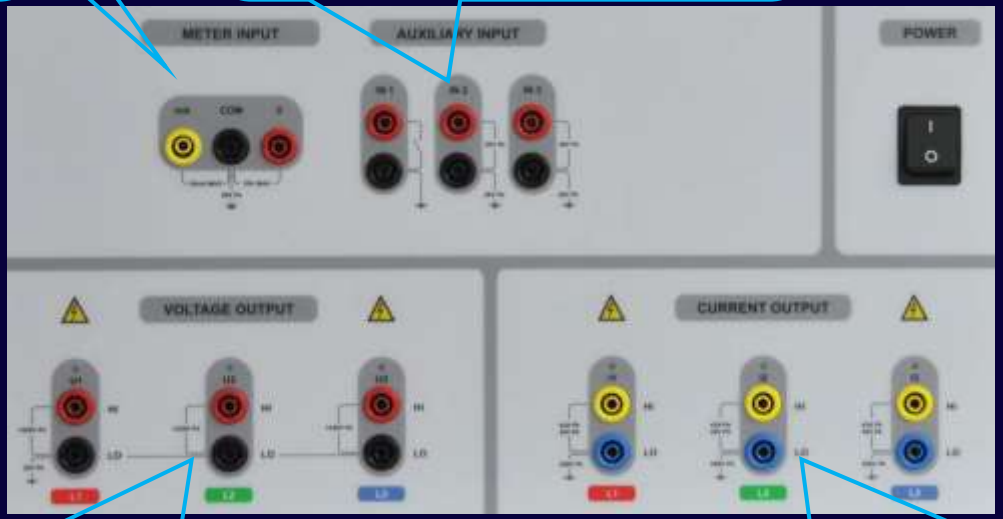
M133C - Terminals

Meter input

+/- 10V
+/- 20mA
0 … 10kHz

Auxiliary input

Energy pulses counting
Dip / Swell triggering
External synchronization



Voltage outputs

L1, L2, L3 phases
Common Lo terminals
Floating up to 20Vpk

Current outputs

L1, L2, L3 phases
Independent Lo terminals
Floating up to 450Vpk

M133/M133C – Functions

Direct selection via Function keys

Function	Description
Power	One / three phase, AC/DC power generation Range 0.008 VA … 18 kVA (each phase) Best accuracy 0.044%
Energy	One / three phase, AC/DC energy generation (counting) Best accuracy 0.044%
Voltage	One phase, AC/DC voltage generation Range 1 V … 280 V (600 V in AC mode – M133C) Best accuracy 0.025%
Current	One phase, AC/DC current generation Range 8 mA … 30 A (90A in high current mode – M133C) Best accuracy 0.035%

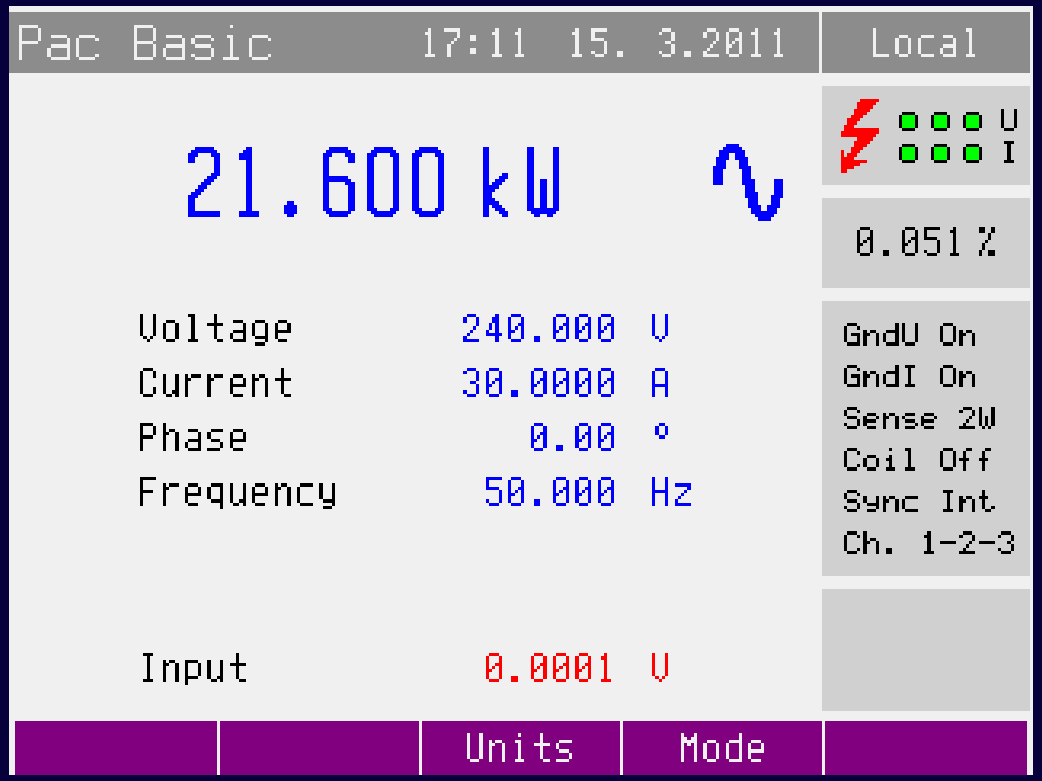
M133/M133C – Power function

Power modes – selection via „Mode“ soft key

	Mode	Description
M133i / M133Ci	**Basic**	Common setting for all phases (1-3).
	High current	All current outputs connected together. Output current up to 90A in one phase.
	Extended	Independent setting of amplitude and phase shift for each output (3x voltage, 3x current).
	Harmonic	Fundamental harmonic + 50 harmonic components generation. Modulation by square or harmonic signal.
	Interharmonic	Fundamental harmonic + one interharmonic component generation.
	Dip/Swell	Dips and Swells generation on the fundamental harmonic.

M133/M133C – Power function

Basic mode (AC and DC)



- ✓ **Common setting for all selected phases.**
- ✓ **Easy setting of power value.**
- ✓ **Fixed phase shift between voltage channels (120°).**

Basic mode – M133C application

Calibration of watt meters and multi meters

FUNCTIONS

power
voltage
current
phase
frequency

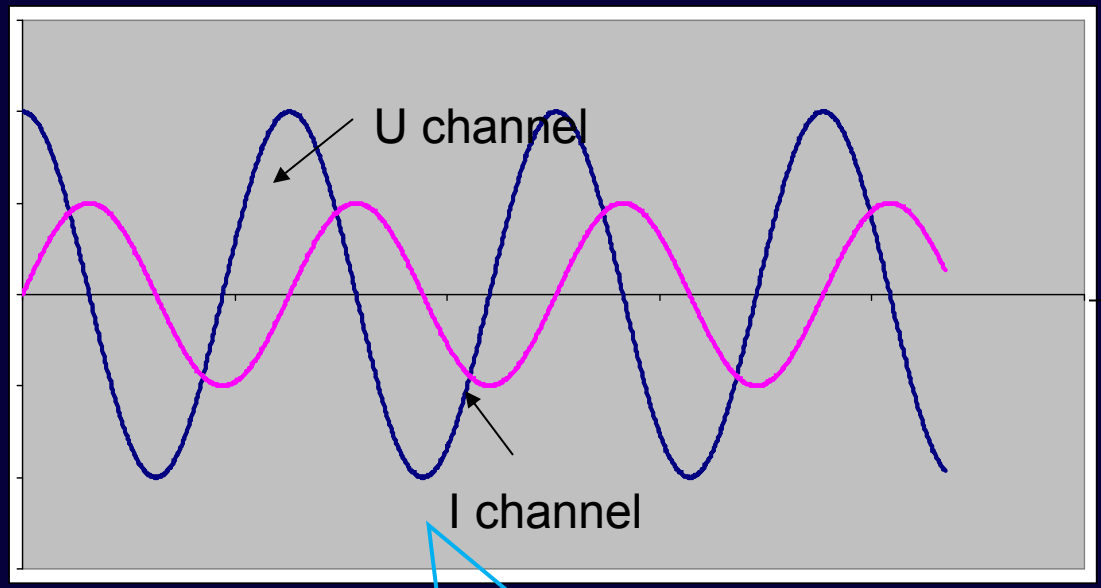
Basic mode – M133 application

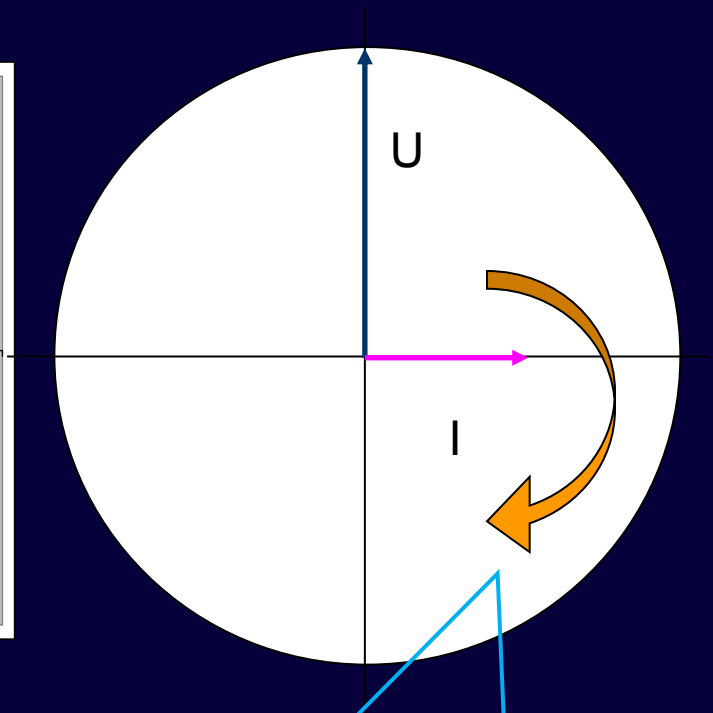
Calibration of watt meters and multi meters

FUNCTIONS

power
voltage
current
phase
frequency

Basic mode - signal vectors





Time diagram

Power Basic mode, single phase
Harmonic output signal

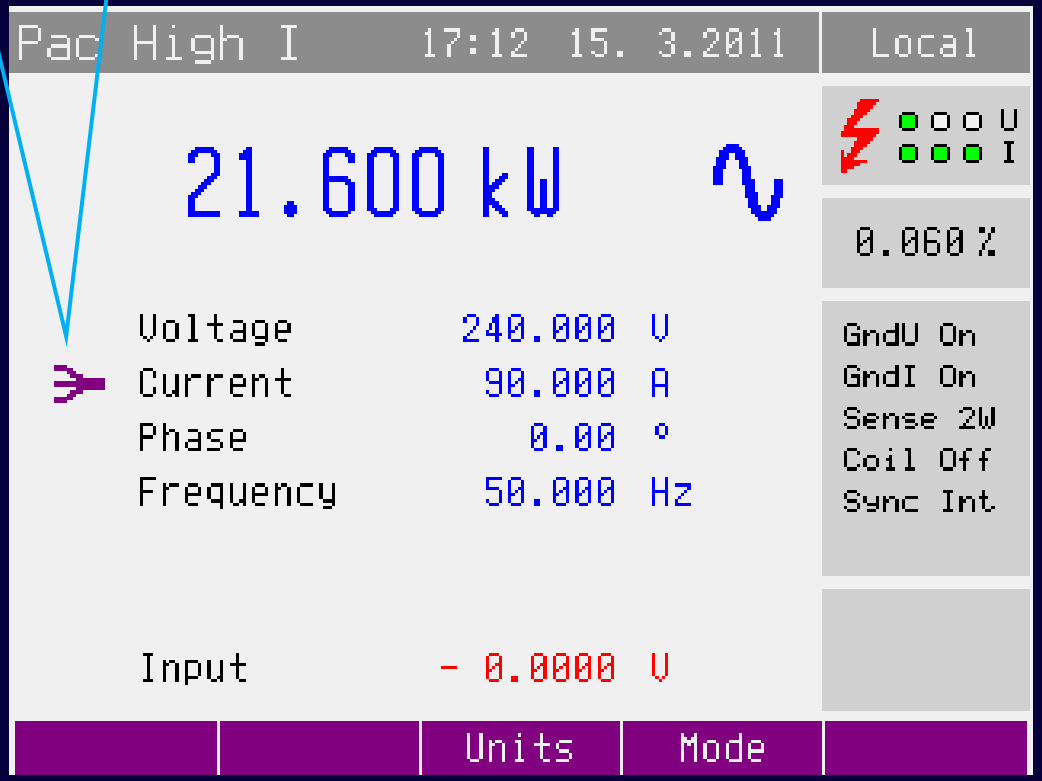
Phase diagram

Current vector can rotate 0…360°

M133/M133C – Power function

High current mode sign

High current mode (AC and DC)



- ✓ **Only for three phase configuration**
- ✓ **Direct current in one phase up to 90A.**
- ✓ **Option 133-01 high current adapter required.**

M133C – High current adapter

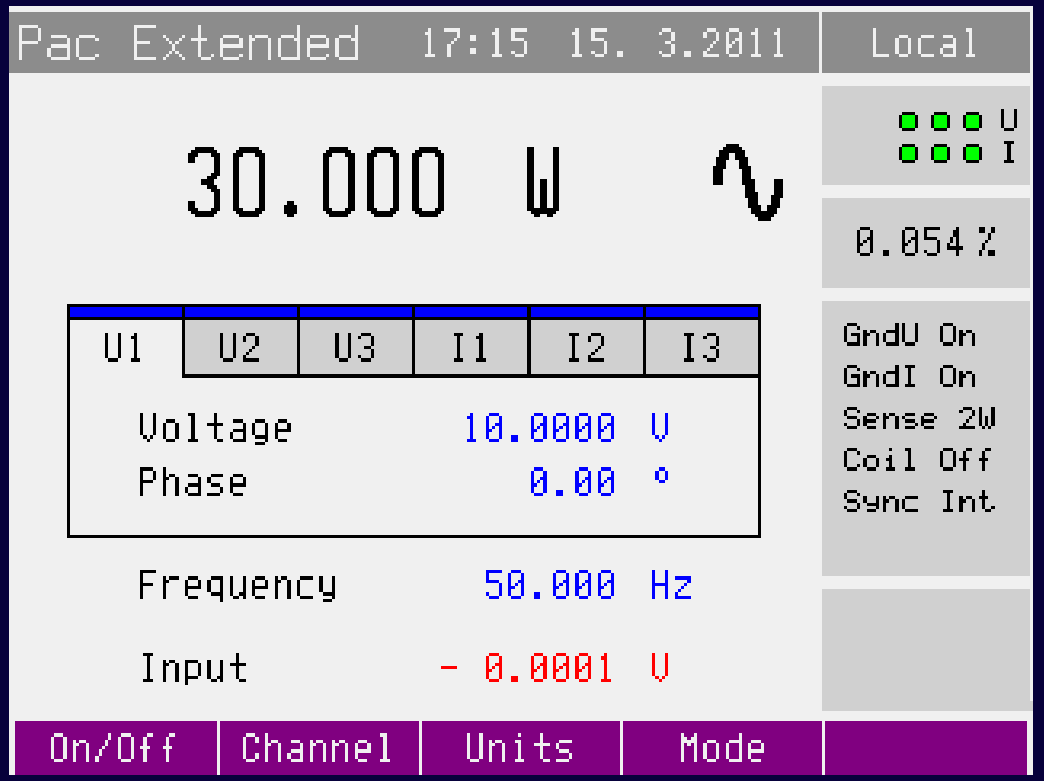
Up to 90A direct current in one-phase applications

Option 133-01 High current adapter

200A gold plated output terminals

M133/M133C – Power function

Extended mode (AC and DC)



- ✓ **Independent setting of amplitude and phase for all six channels.**
- ✓ **Individual channels can be switched ON / OFF.**
- ✓ **Testing of phase meters.**
- ✓ **Testing of watt meters with non standard input signals.**

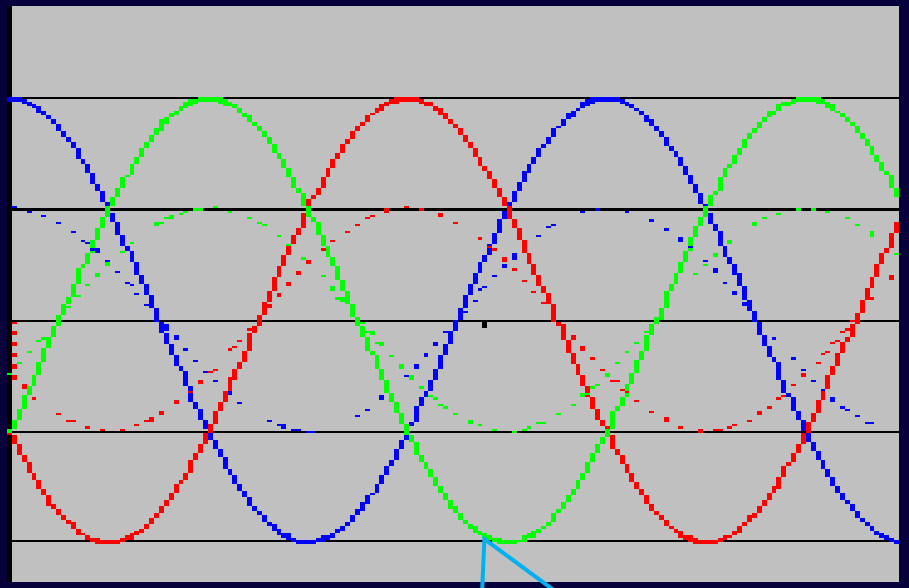
Extended mode - application

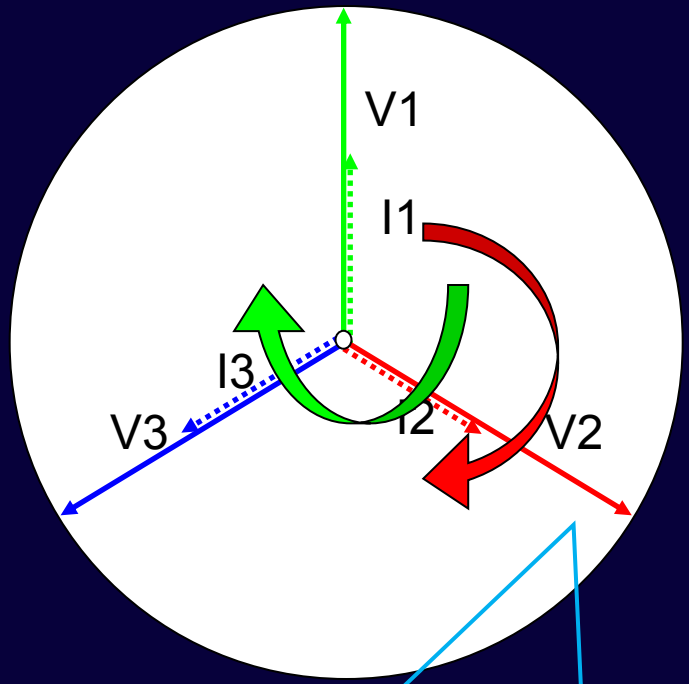
Calibration of different transducers

INPUT
power
voltage
current
phase
frequency

OUTPUT
+/- 10V
+/- 20mA
0…10 kHz

Extended mode - signal vectors





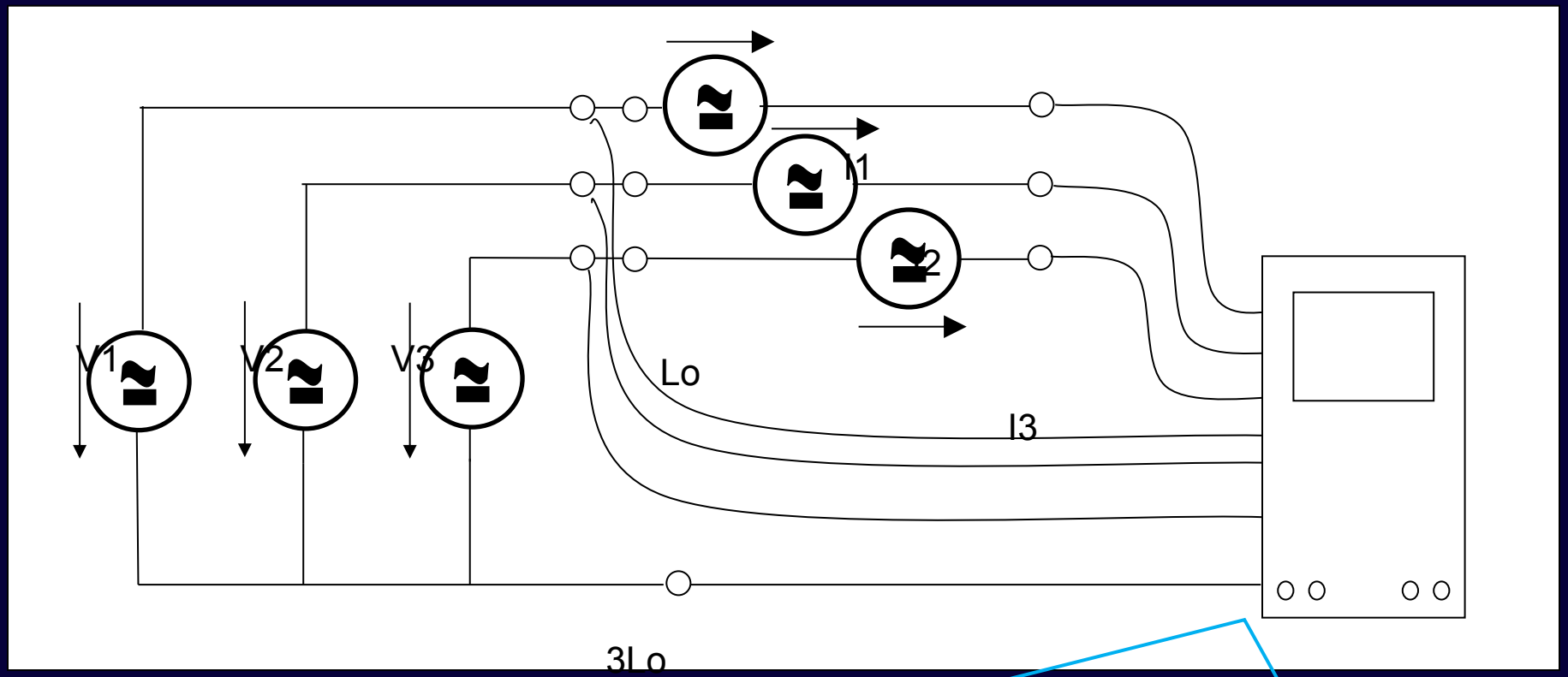
Time diagram

Power Extended mode, three phase
Harmonic output signal

Phase diagram

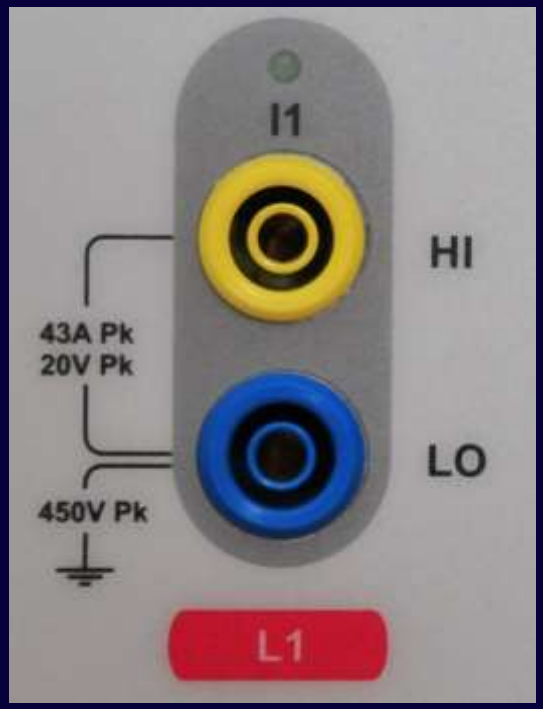
Current vectors can rotate 0…360°
Voltage vectors can rotate 0…360°

Floating current outputs (M133C only)



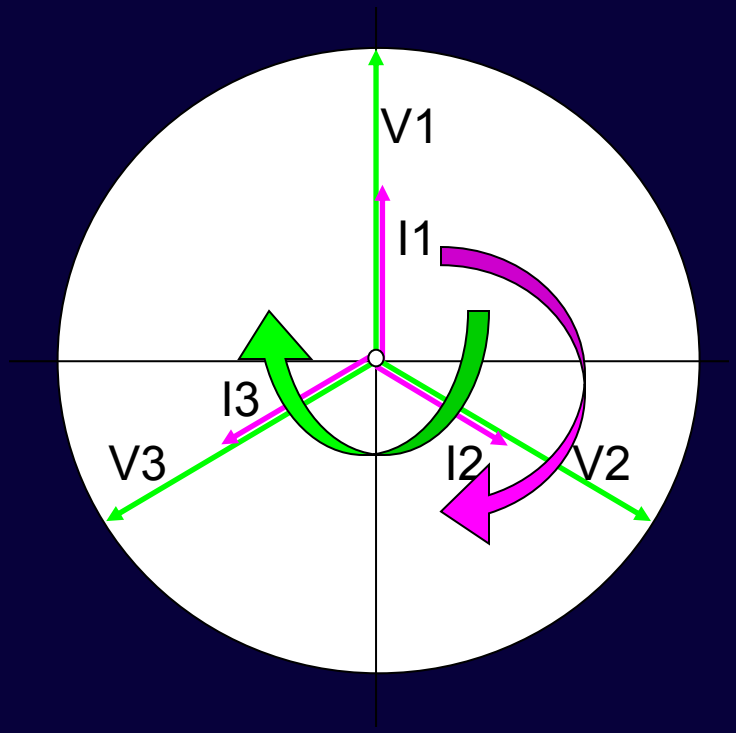
Meters with common voltage and current terminals need floating current outputs.

Floating current outputs (M133C only)

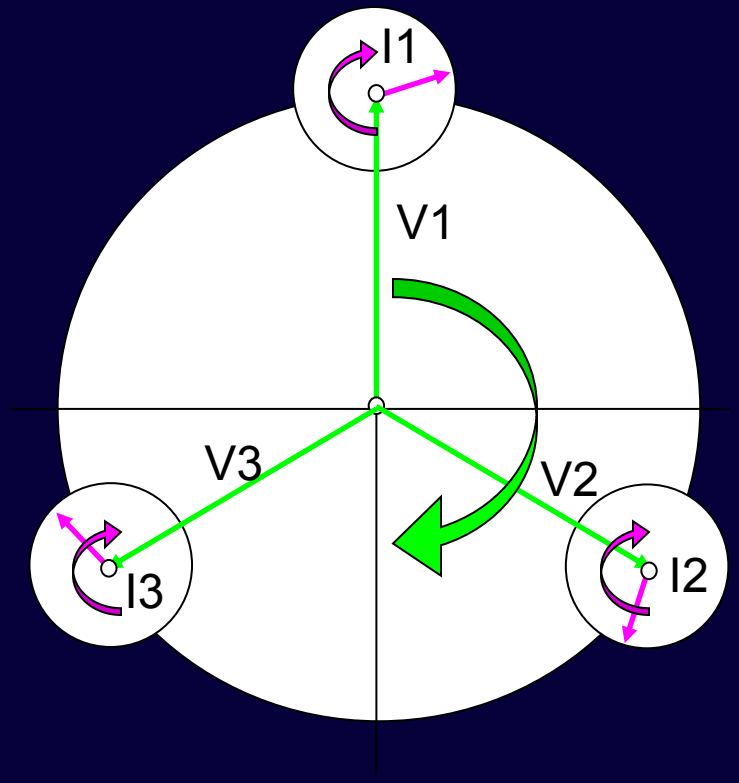


- ✓ **M133C current terminals can float up to 450Vpk.**
- ✓ **Current terminals can be connected direct to the voltage terminals (HI output).**
- ✓ **For voltages above 280 V (RMS) are current terminals internally grounded.**

Floating current outputs (M133C only)



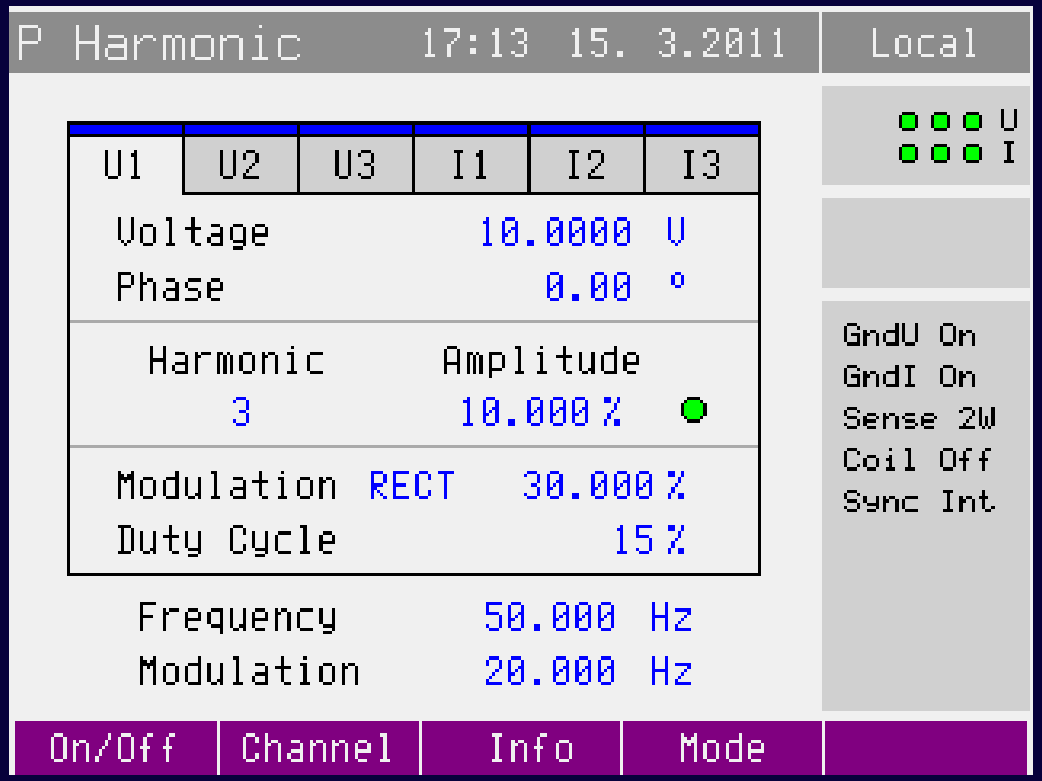
Common current Lo system



Floating current system

M133/M133C – Power function

Harmonic mode (AC only)



Independent setting for each channel:

Fundamental harmonic
- **amplitude**
- **phase**

50 harmonic components
- **amplitude**

Modulation
- **SIN or RECT**
- **duty cycle**

Harmonic mode - application

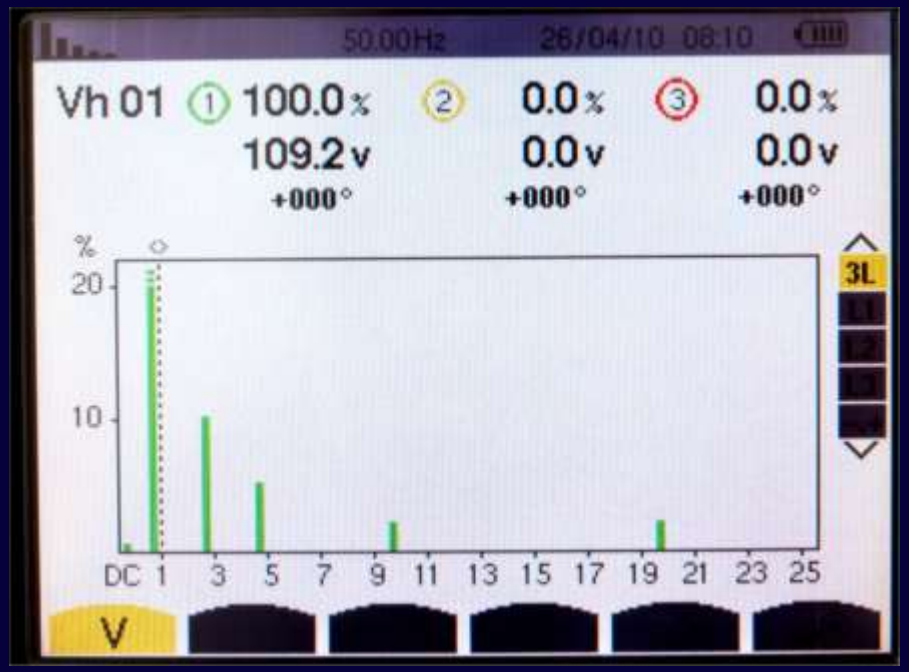
Calibration of power quality meters

FUNCTIONS

power
voltage
current
phase
frequency
harmonic 1…50
interharmonic
modulation
flicker
dip/swell

Harmonic mode

Phase spectrum of harmonic signal (single phase)



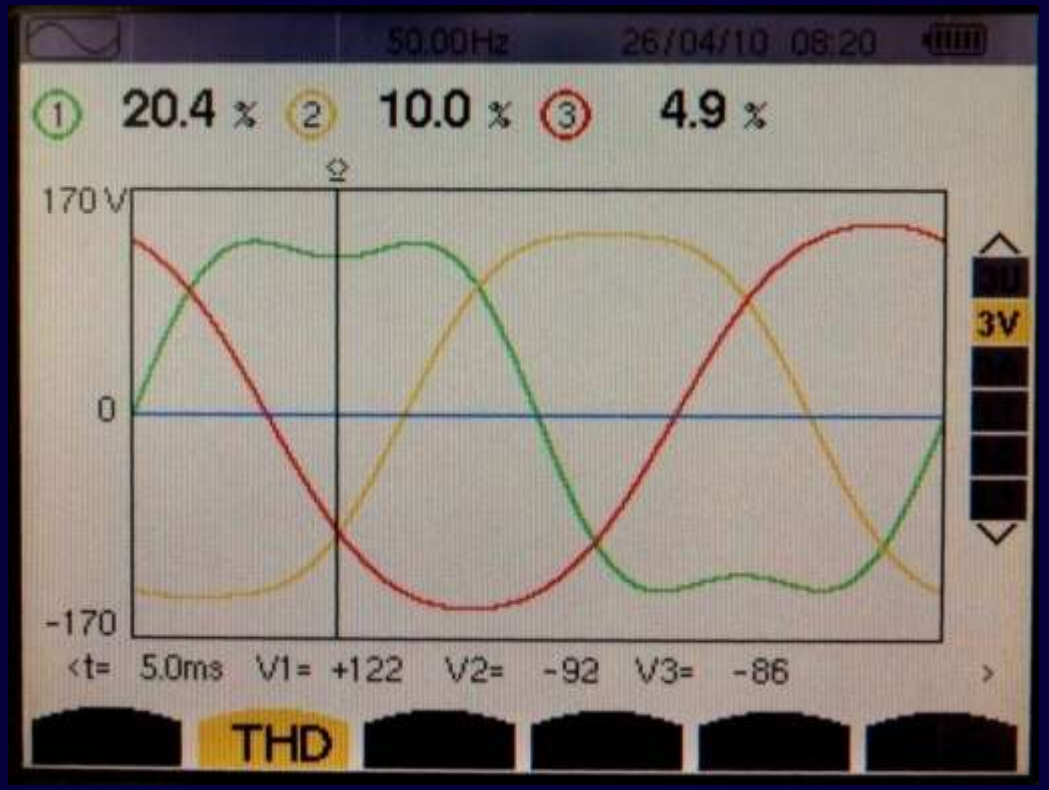
Setting:

One-phase output (L1)

1. **Harmonic 110V (100%)**
3. **Harmonic 10 %**
5. **Harmonic 5 %**
10. **Harmonic 2 %**
20. **Harmonic 2 %**

Harmonic mode

Signal with harmonic distortion (three phases)



Three – phase voltage output:

V1 phase

1H = 100 % **3H = 20 %**

5H = 5 % **10H = 2 %**

V2 phase

1H = 100 % **3H = 8 %**

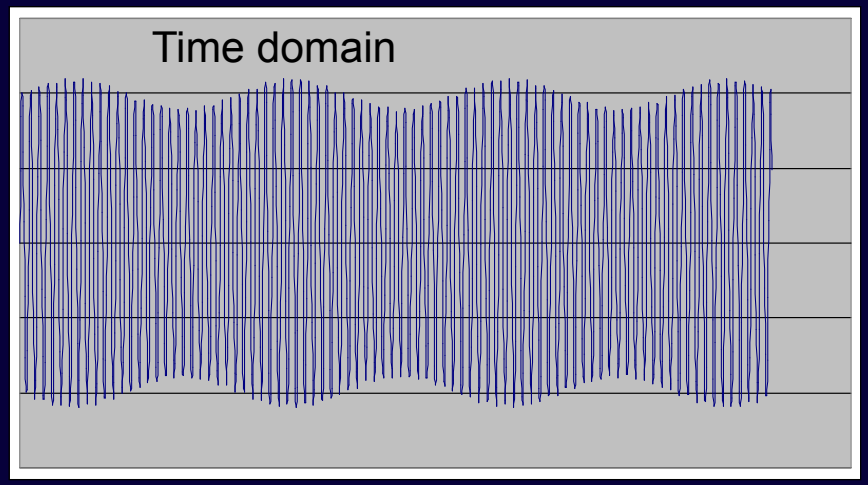
5H = 2 % **10H = 2 %**

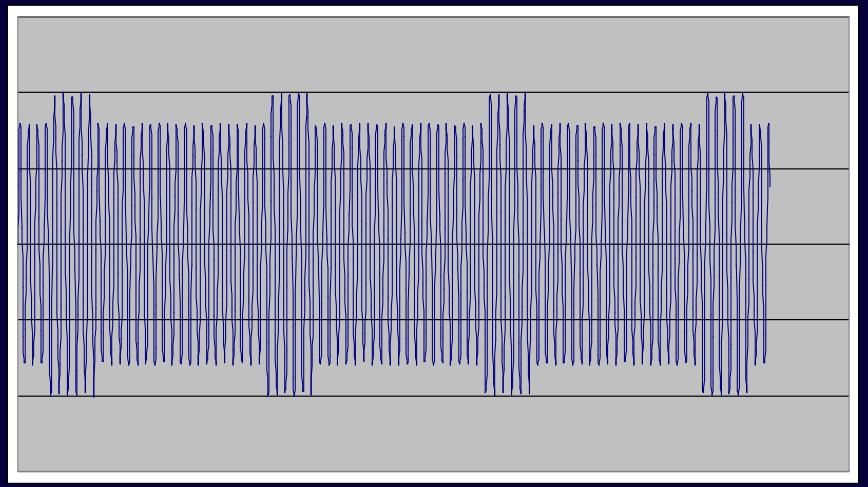
V3 phase

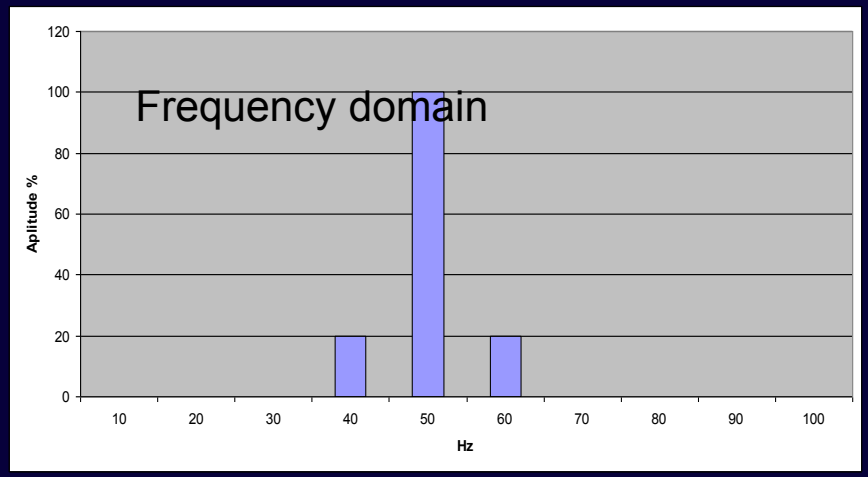
1H = 100 % **3H = 5 %**

5H = 1 % **10H = 1 %**

Harmonic mode - modulation



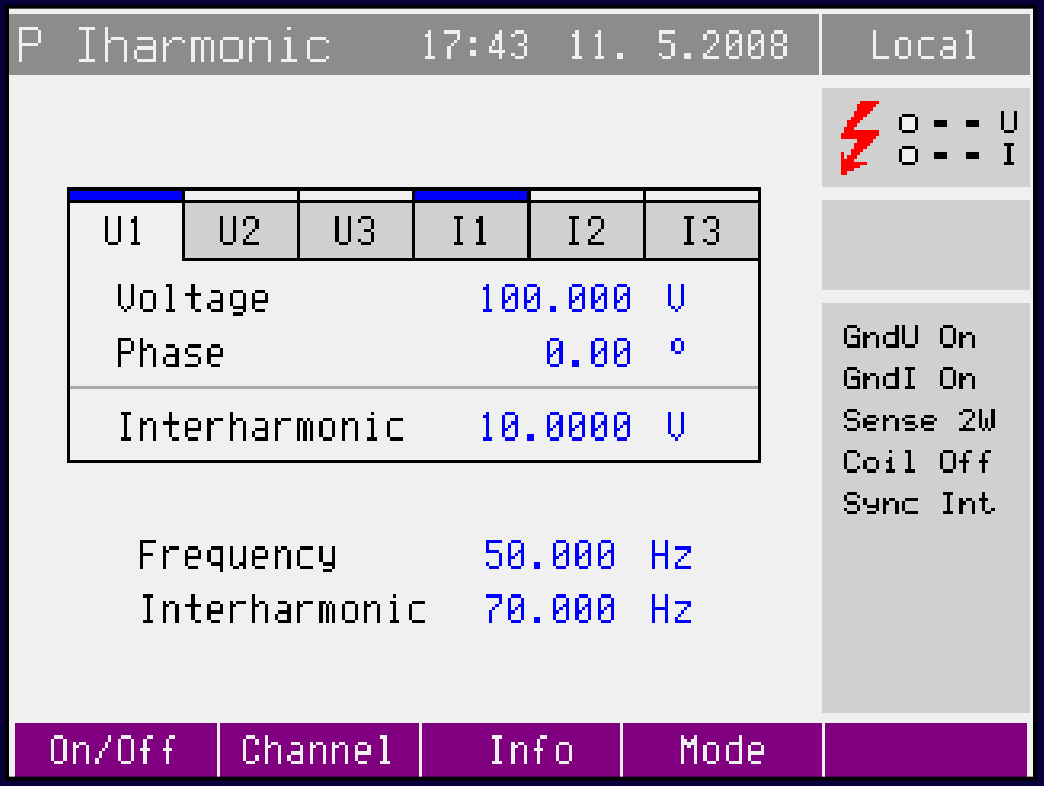




- ✓ **Modulation with sine or rectangular signal (floating harmonics or flicker).**

M133/M133C – Power function

Interharmonic mode (AC only)

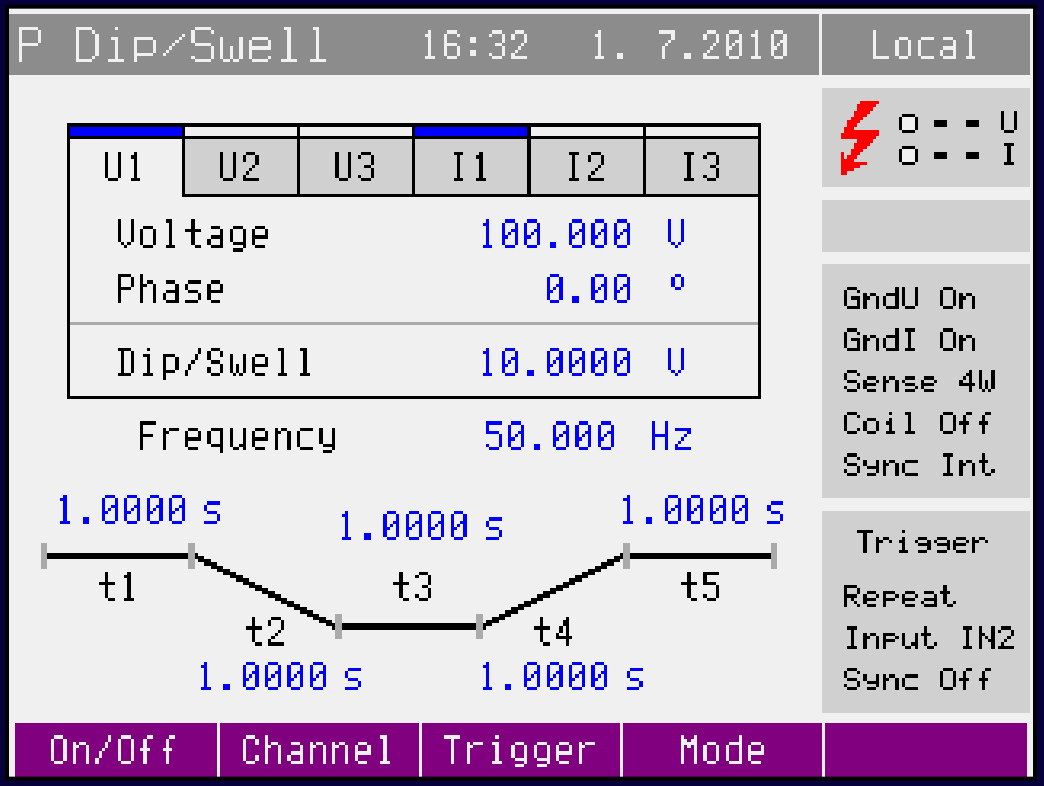


Independent setting for each channel:

Fundamental harmonic
- amplitude
- phase
Interharmonic component
- amplitude of one interharmonic component

M133/M133C – Power function

Dip / Swell mode (AC only)



Independent setting for each channel:

Fundamental harmonic
- amplitude
- phase
Dip or Swell
- amplitude of Dip (Swell)

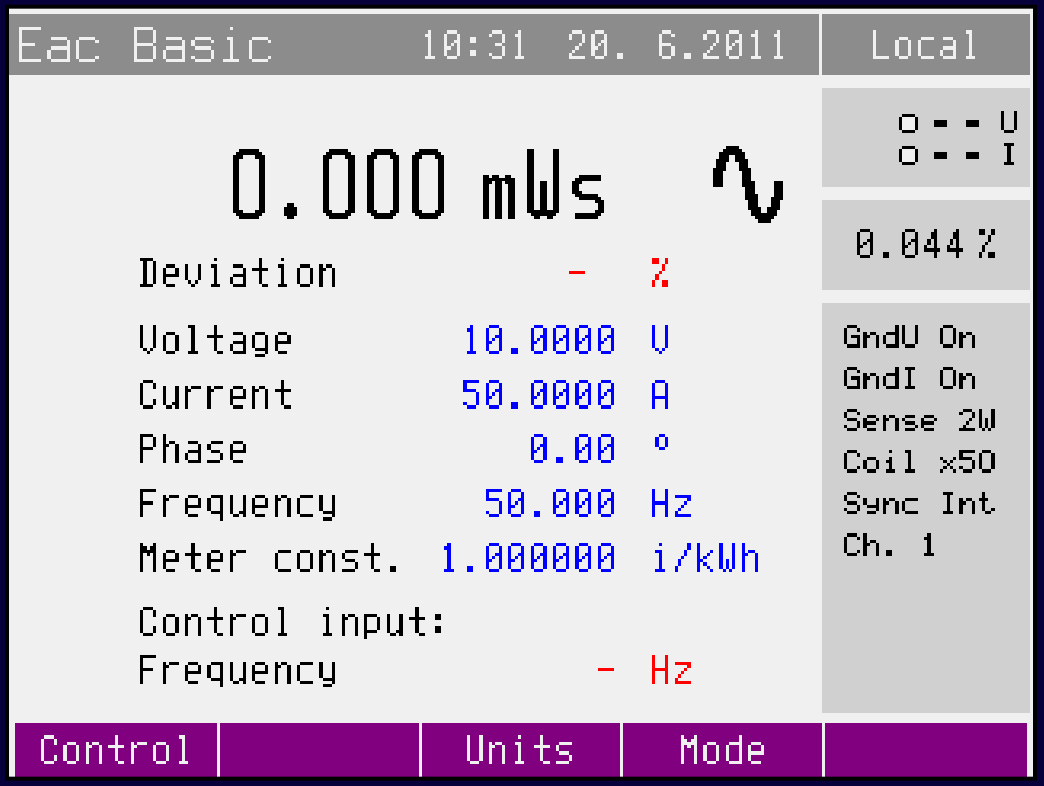
M133/M133C – Energy function

Energy modes – selection via „Mode“ soft key

Mode	Description
Basic	Common setting for all phases (1-3).
High current	All current outputs connected together. Output current up to 90A in one phase.

M133/M133C – Energy function

Basic mode (AC and DC)

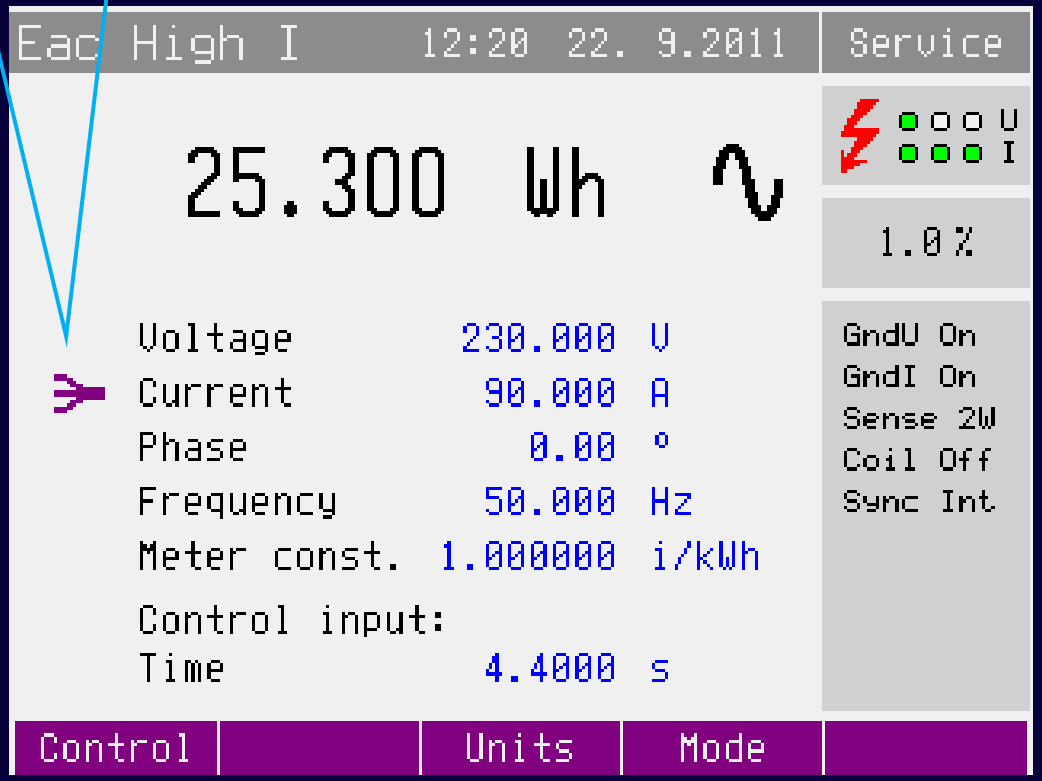


- ✓ **Common setting for all selected phases.**
- ✓ **Fixed phase shift between voltage channels (120°).**

M133/M133C – Energy function

High current mode sign

High current mode (AC and DC)



- ✓ **Only for three phase configuration**
- ✓ **Direct current in one phase up to 90A.**
- ✓ **Option 133-01 high current adapter required.**

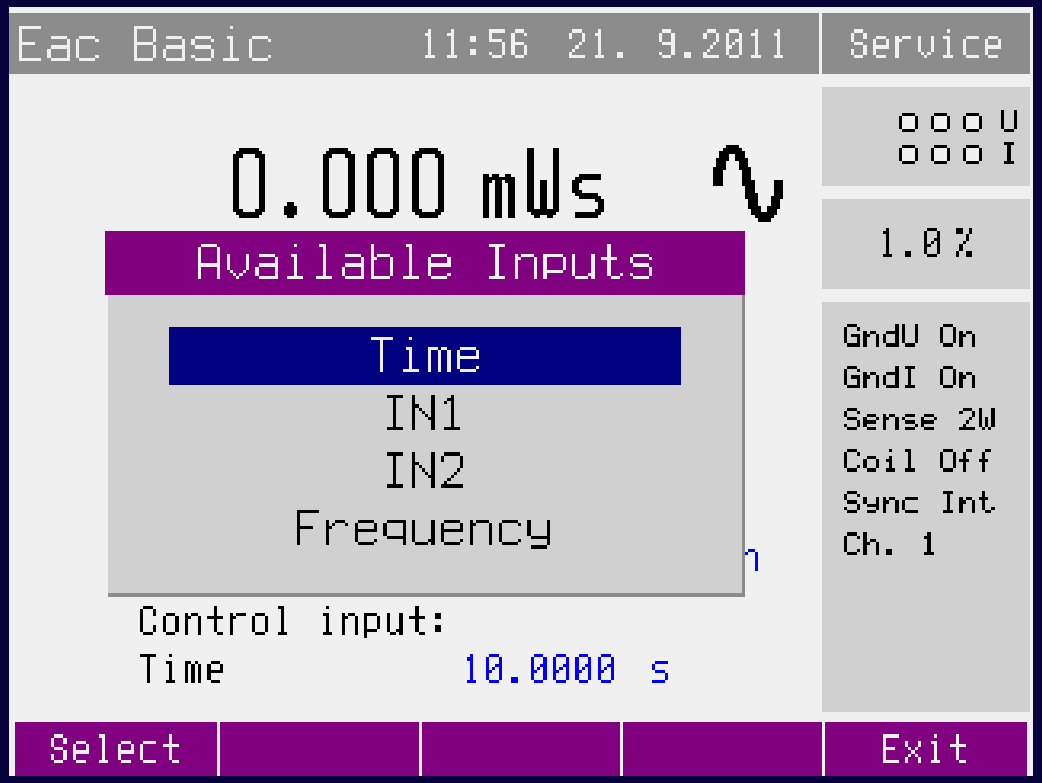
Energy function - application

Calibration of electrometers

- ✓ **Calibrator can read pulses from tested electrometer and evaluate deviation of the electrometer.**

M133/M133C – Energy counting

Methods of energy counting (Control input)



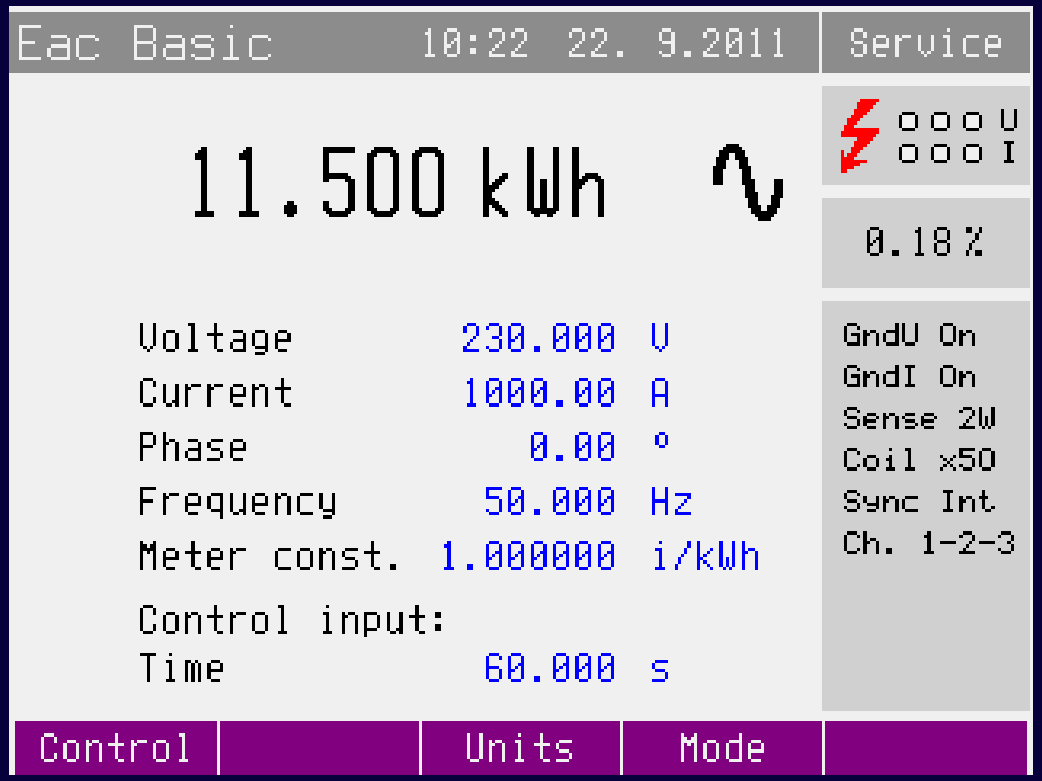
✓ **Time**
Energy is delivered for defined time.

✓ **IN1, IN2**
Defined number of pulses on inputs IN1 (IN2) is counted.

✓ **Frequency**
Compares frequency generated by energy meter with standard frequency (calibrator).

M133/M133C – Energy counting

Timed Mode (Control input: Time)

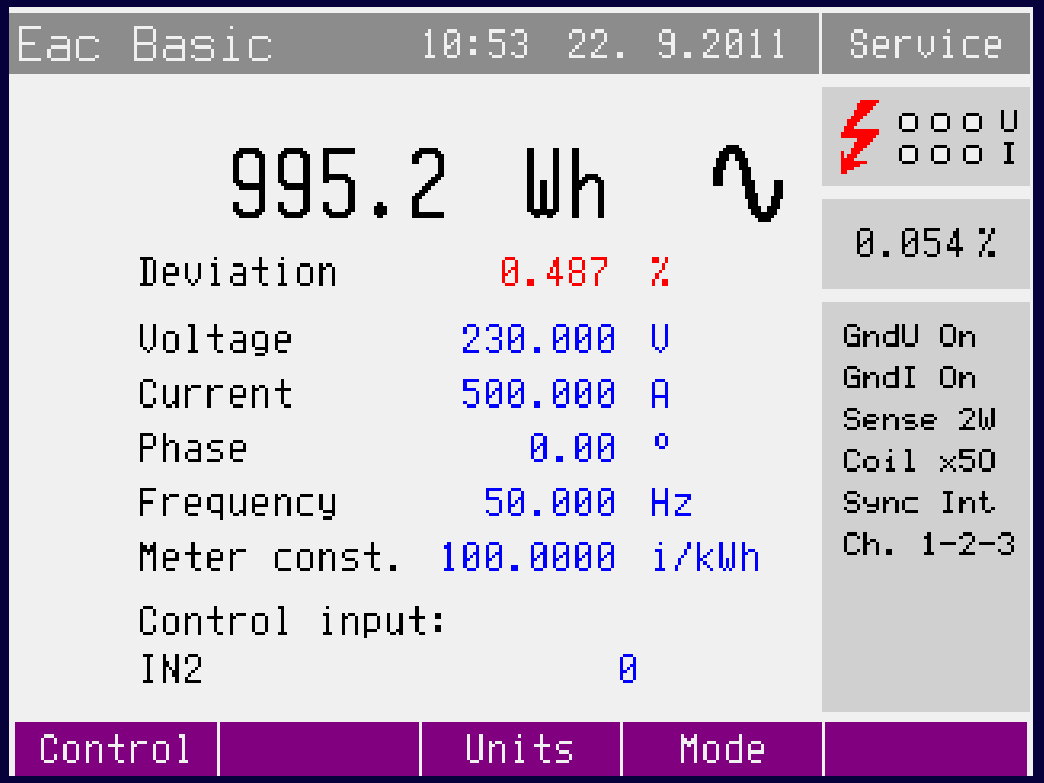


✓ **Time**
Calibrator delivers energy for defined time period after pressing ON key. Than disconnects all outputs and displays counted energy.

Easy energy mode with lower accuracy.

M133/M133C – Energy counting

Counted Mode (Control input: IN1, IN2)



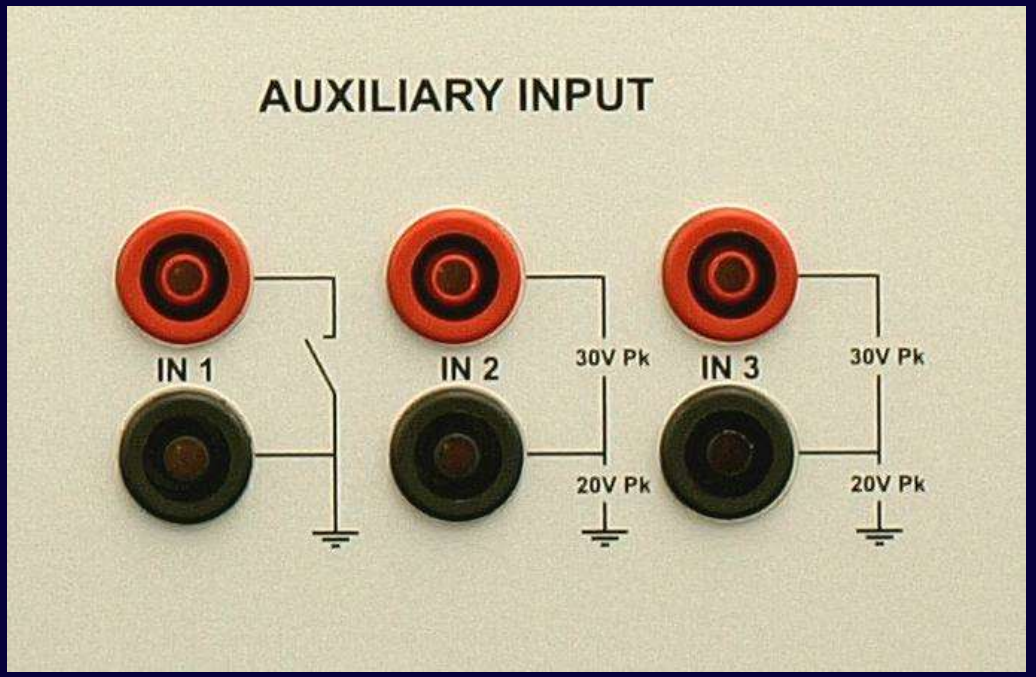
✓ **IN1, IN2**

Calibrator starts counting energy after receiving third pulse (floating start) from the selected input. Than counts defined number of pulses, disconnects all outputs, displays counted energy and deviation of the meter.

Best accuracy and repeatability.

M133/M133C – Energy counting

Difference between inputs IN1 and IN2.



- ✓ **IN1**

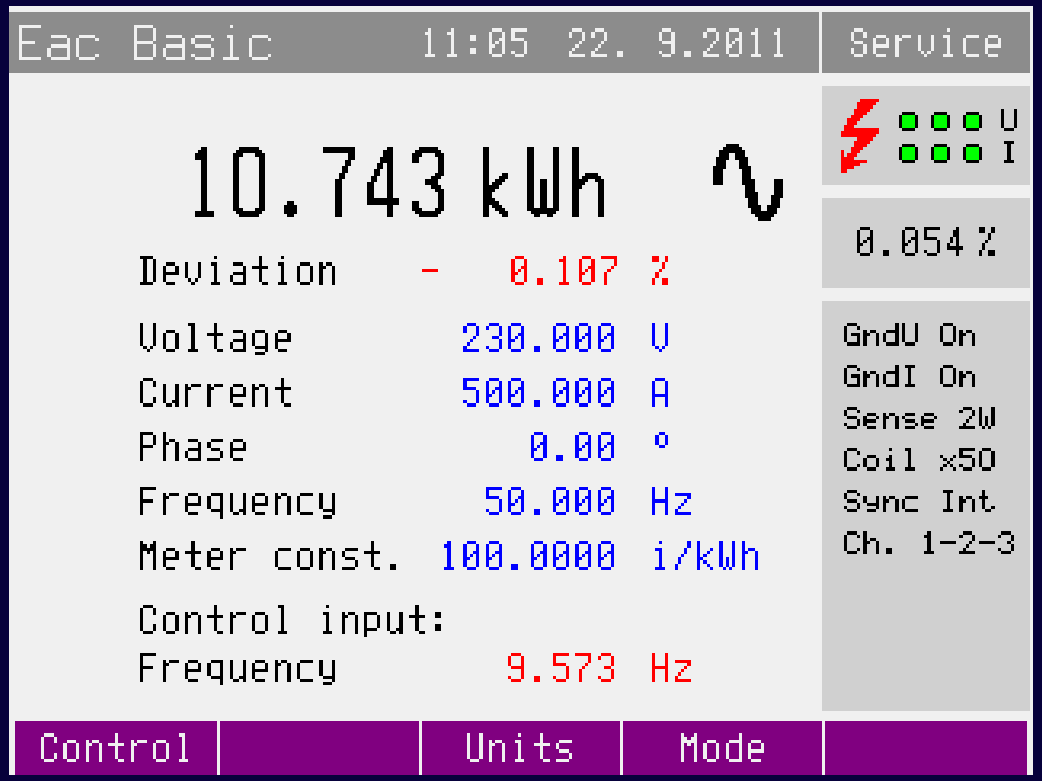
For counting pulses from passive contacts (relay, open collector). IN1 is grounded to protective earth.

- ✓ **IN2**

For counting active (voltage) pulses. IN2 is floating up to 20Vpk.

M133/M133C – Energy counting

Free run Mode (Control input: Frequency)

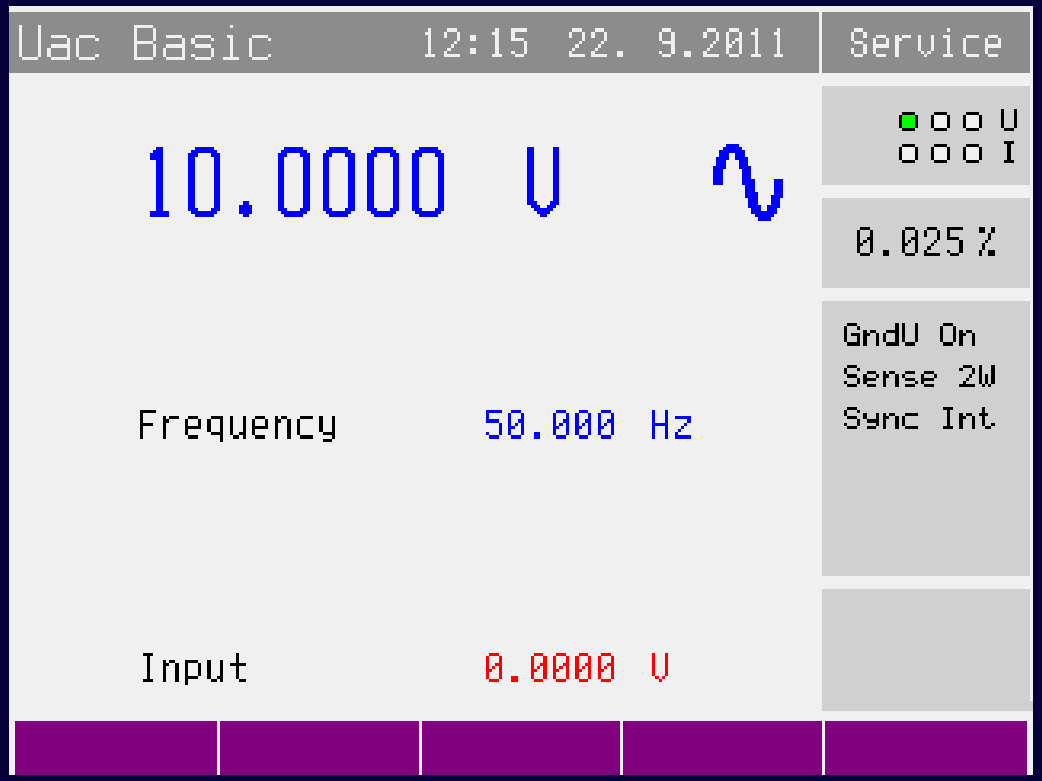


✓ **Frequency**
Calibrator starts counting energy after pressing ON key. Calibrator continuously measures frequency of pulses from measured meter and displays its deviation.

Fast method, suitable for manufactures for adjusting of meters.

M133/M133C – Voltage function

Basic mode (AC and DC)



- ✓ **Generation of one phase voltage.**
- ✓ **Calibration of voltmeters.**

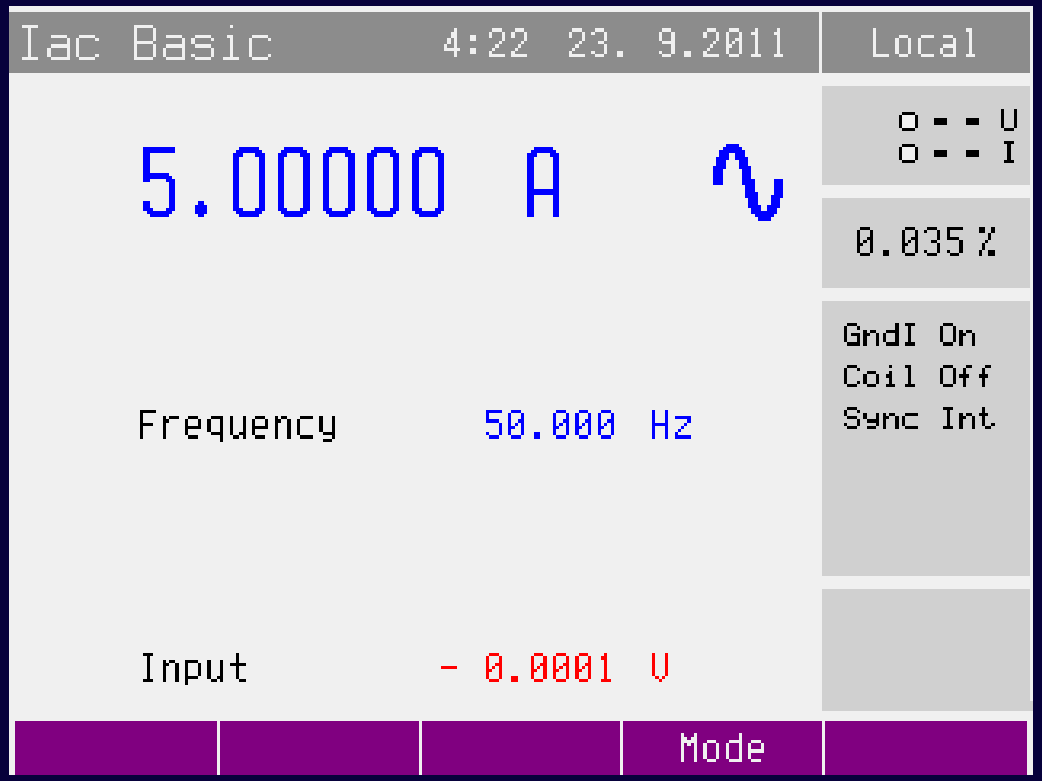
M133/M133C – Current function

Current modes – selection via „Mode“ soft key

Mode	Description
Basic	Common setting for all phases (1-3).
High current	All current outputs connected together. Output current up to 90A in one phase.

M133/M133C – Current function

Basic mode (AC and DC)



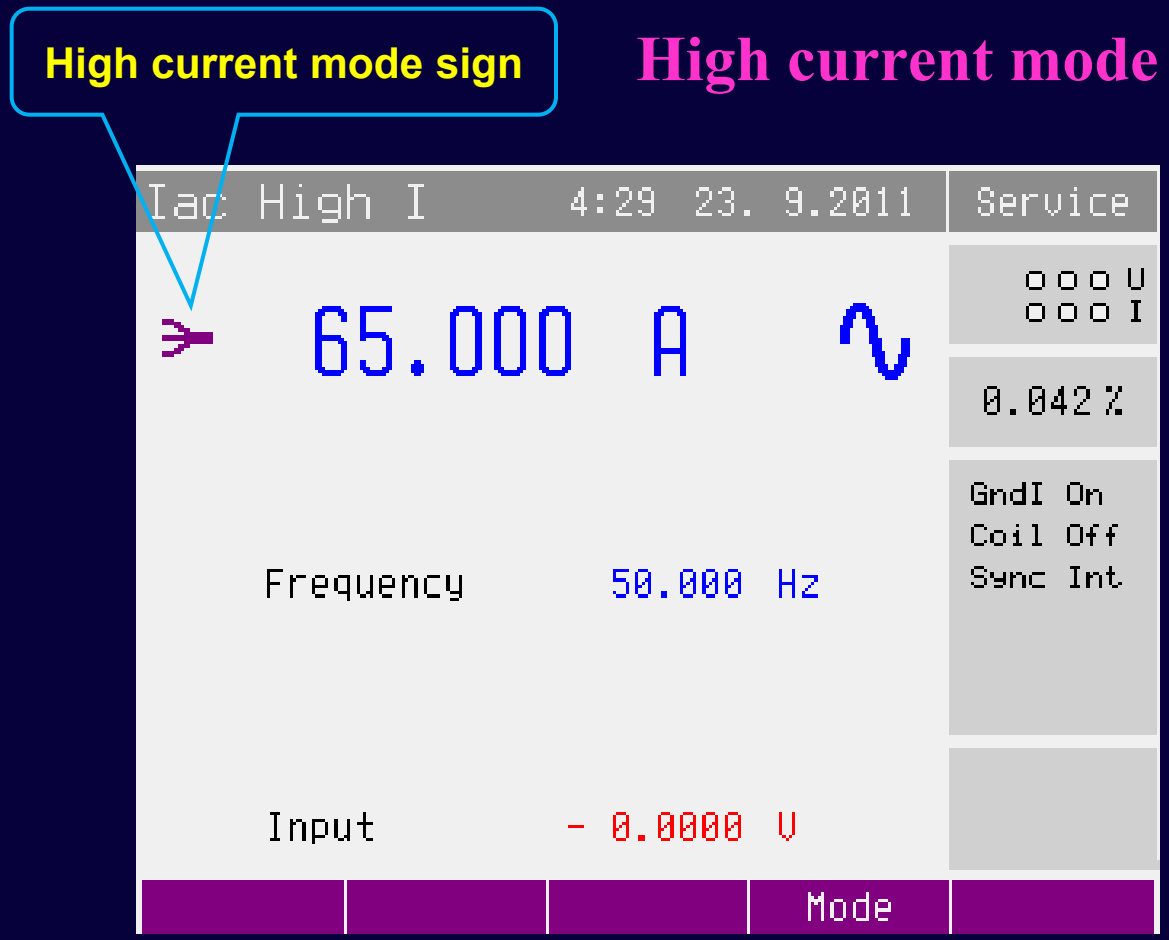
- ✓ **Generation of one current.**
- ✓ **Calibration of current meters.**

Current function – application

Calibration of clamp meters

FUNCTIONS
current

M133/M133C – Current function

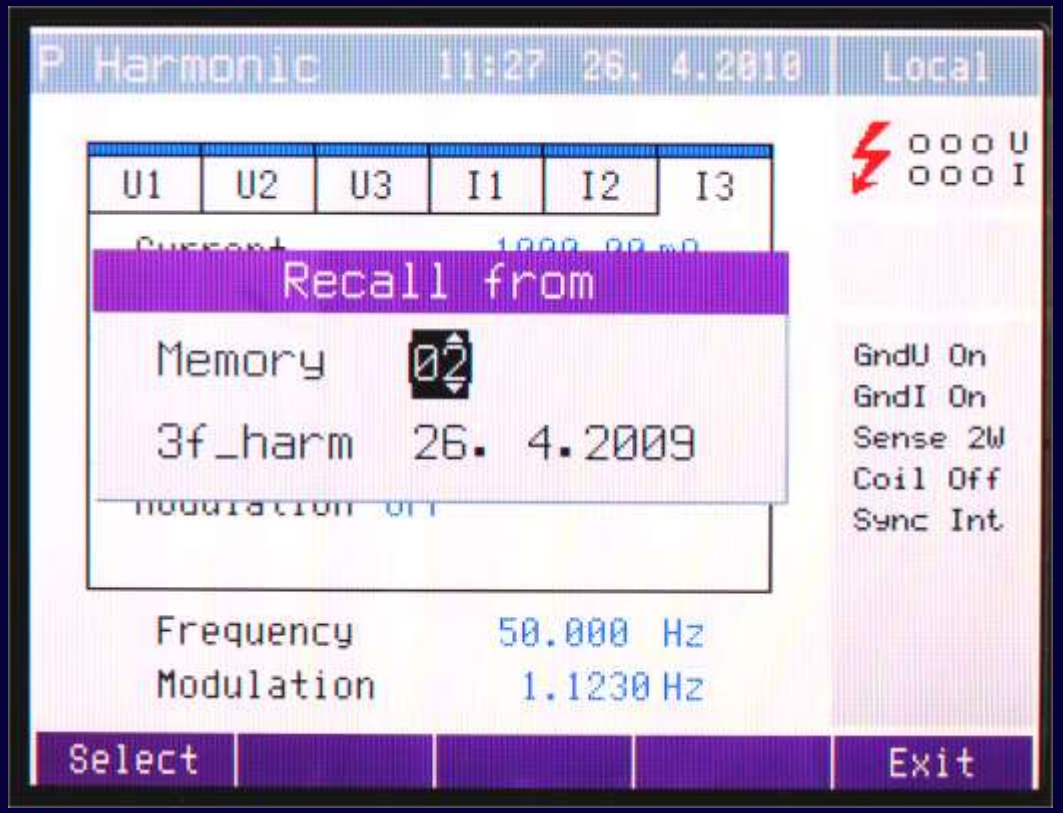


High current mode (AC and DC)

- ✓ **Only for three phase configuration**
- ✓ **Direct current in one phase up to 90A.**
- ✓ **Option 133-01 high current adapter required.**

M133/133C – Other features

Saving current settings



- ✓ **Actual instrument setting can be stored into internal memory.**
- ✓ **100 memories.**
- ✓ **Each setting can be followed by the name.**

M133/133C – Other features

Recalibration

- ✓ **Access to calibration data protected with password.**
- ✓ **Simple system of calibration data saving.**

M133/133C – Other features

Remote control

Standard interfaces

IEEE488
RS232
Ethernet

Optional USB interface

Interface converts RS232 to USB port

Optional

USB

M133/M133C - software

Programs available for M133 calibrators

Power

Specialized software for electric power transducers calibration. Easy to use.

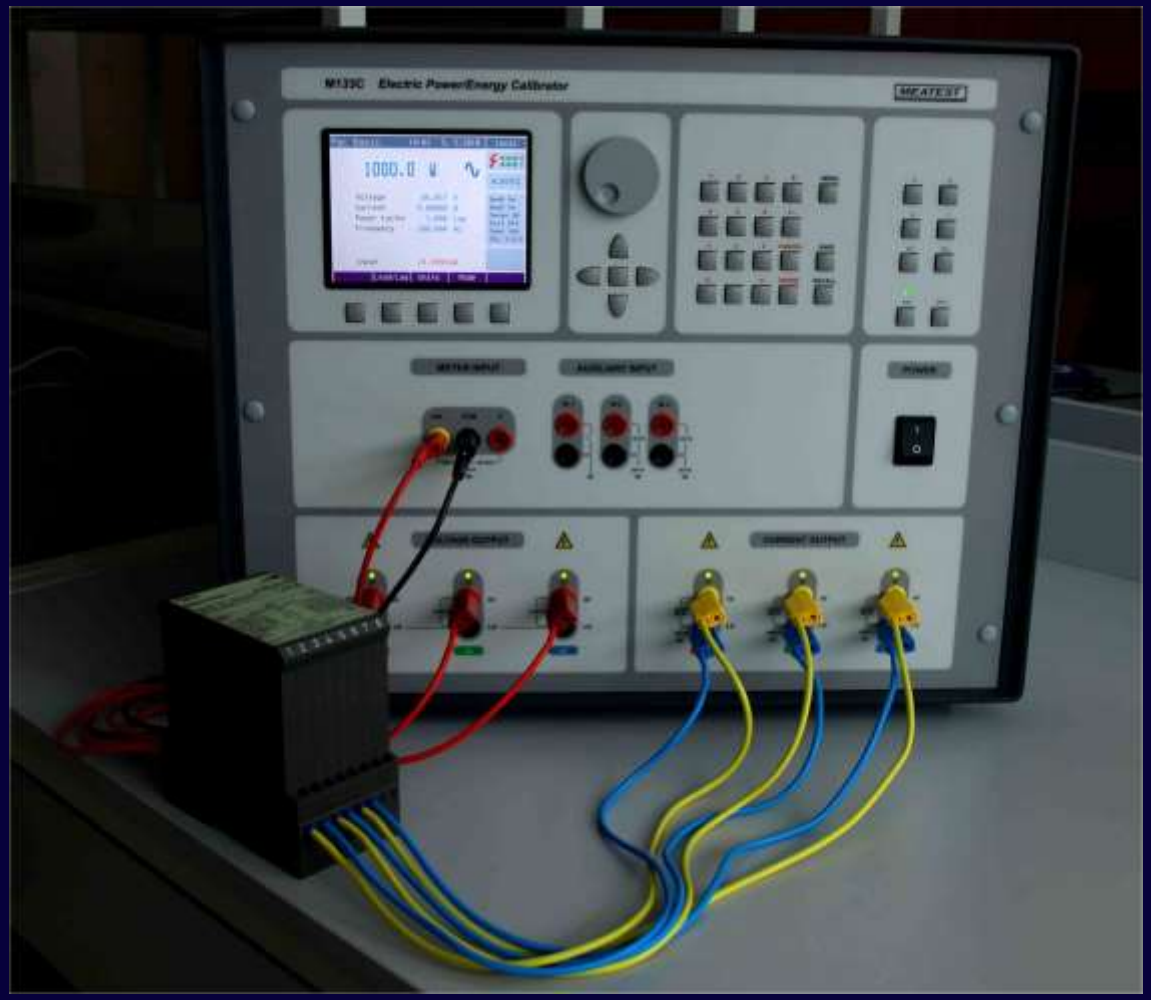
Caliber

Software for computer controlled calibration. Universal use.

Control Panel

Software for M133 easy setting. Freeware.

Power



Power

Features

Software for (power) transducers testing and calibration.

Full automatic calibration.

Deviation and uncertainty calculation.

Printing calibration certificate and labels for transducers.

Database of calibrated instruments and calibration certificates.

Easy to use.

Power

Requirements

Standard unit

Electrical power calibrator (M103, M133)

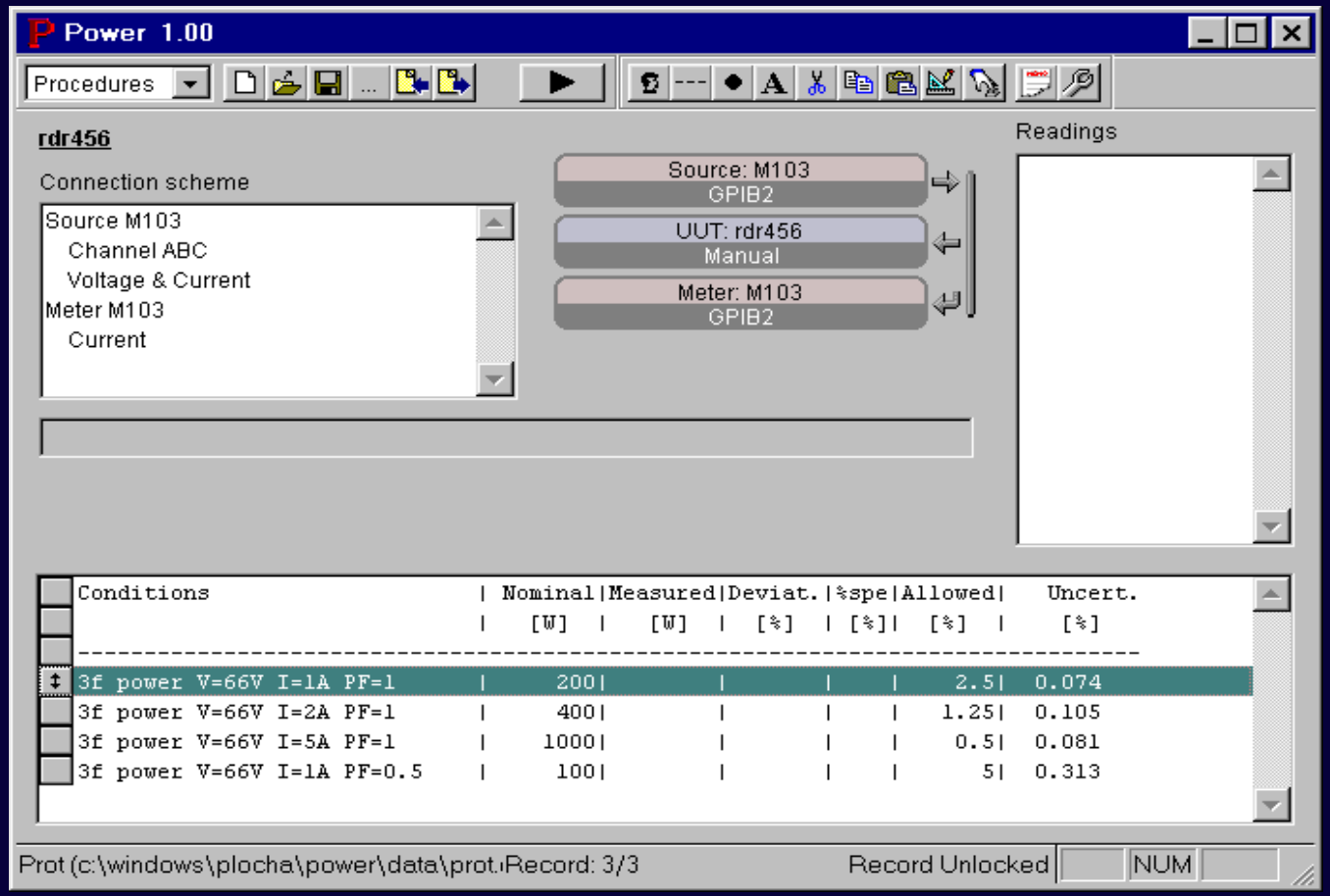
Computer

OS Windows 2000 or higher

RS232 , IEEE488 or USB interface

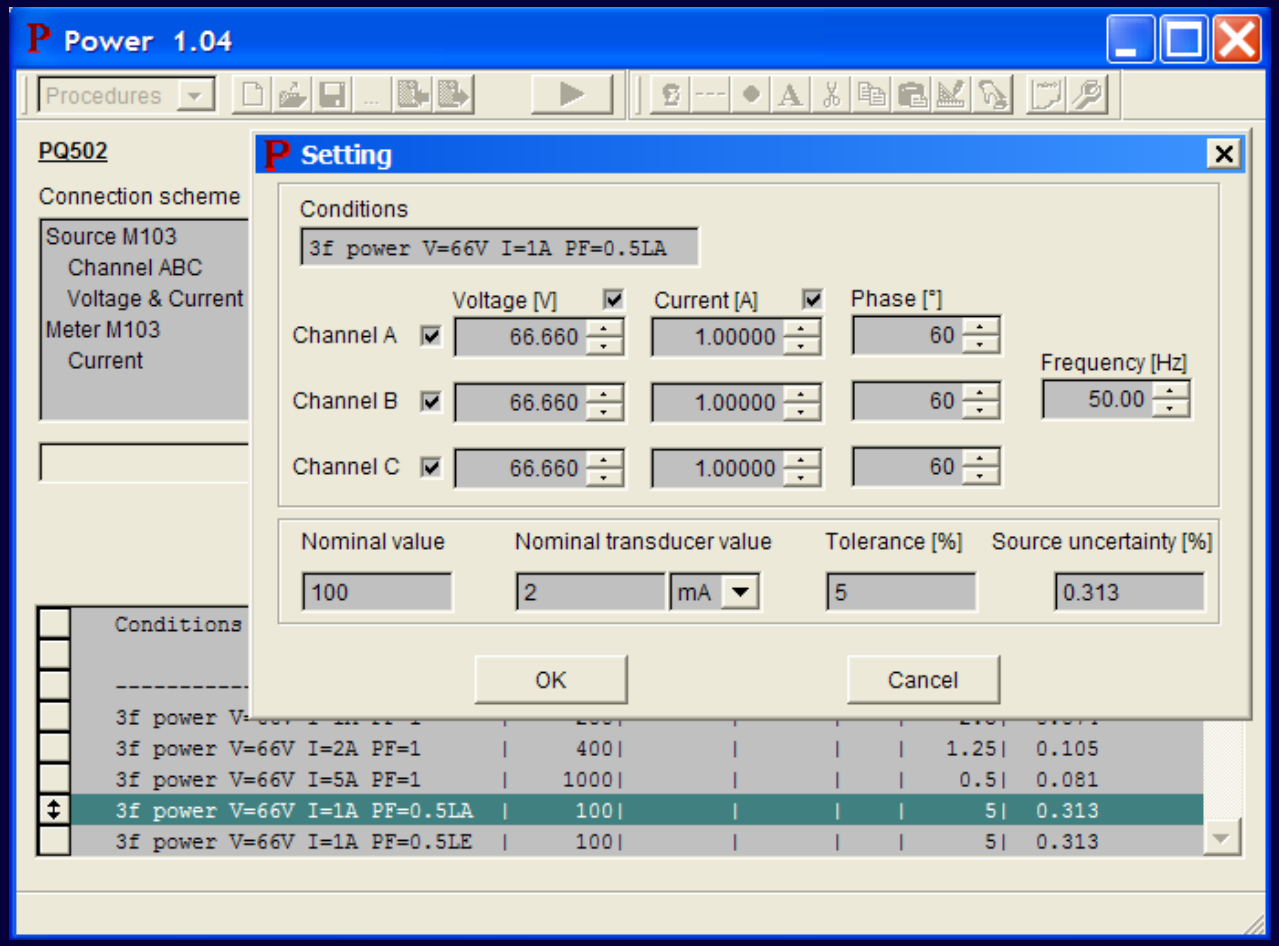
Power

Calibration procedure



Power

Calibration point - setup



Power

Typical application - transducers

Transducer's input:

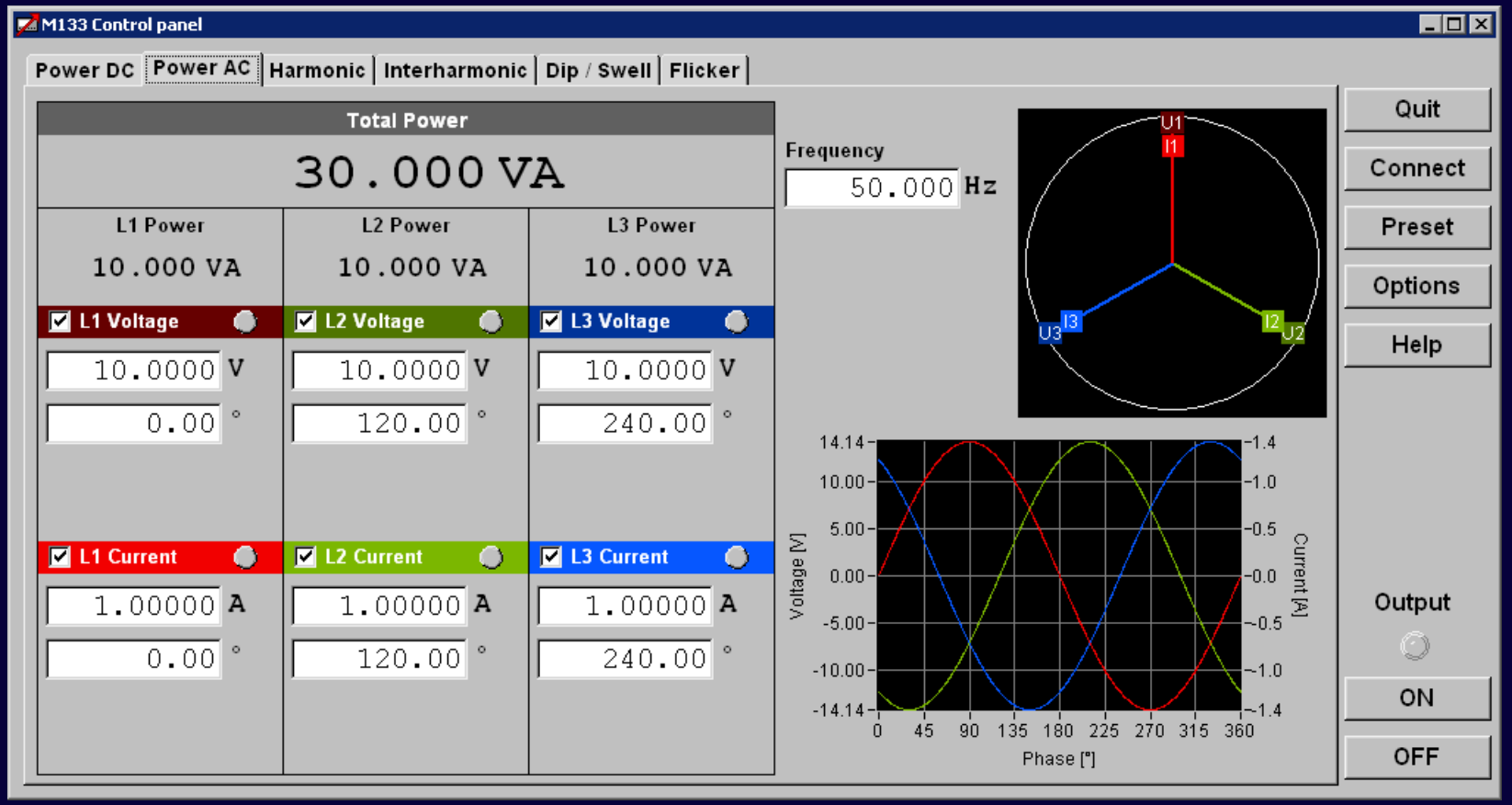
- **Power [W, VA, VAr]**
- **Voltage**
- **Current**
- **Phase**
- **Frequency**

Transducer's output:

- **Voltage 0-10V**
- **Current 0(4)-20mA**
- **Frequency 0-15kHz**

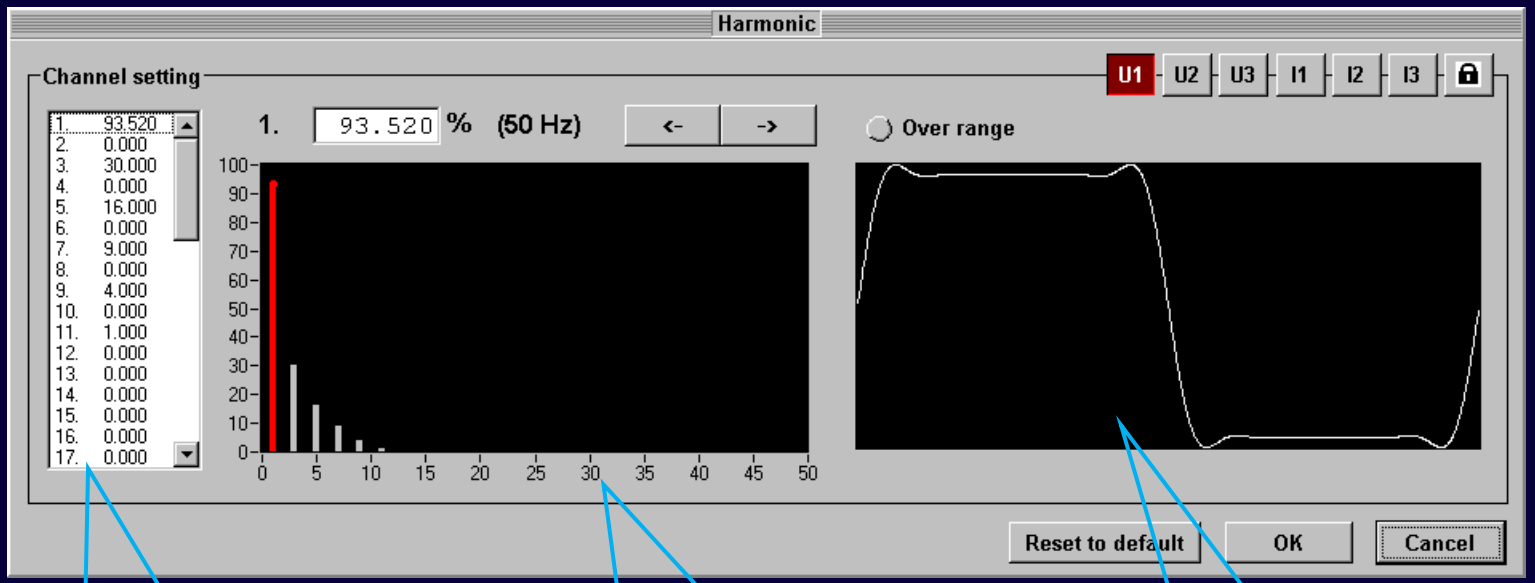
M133 – Control Panel

M133 easy setting (freeware)



M133 – Control Panel

Harmonic distortion setting



List of harmonic components

Harmonic components in frequency domain

Output signal shape