Multifunction Calibrators

MC140 / MC140i
MC142 / MC142i

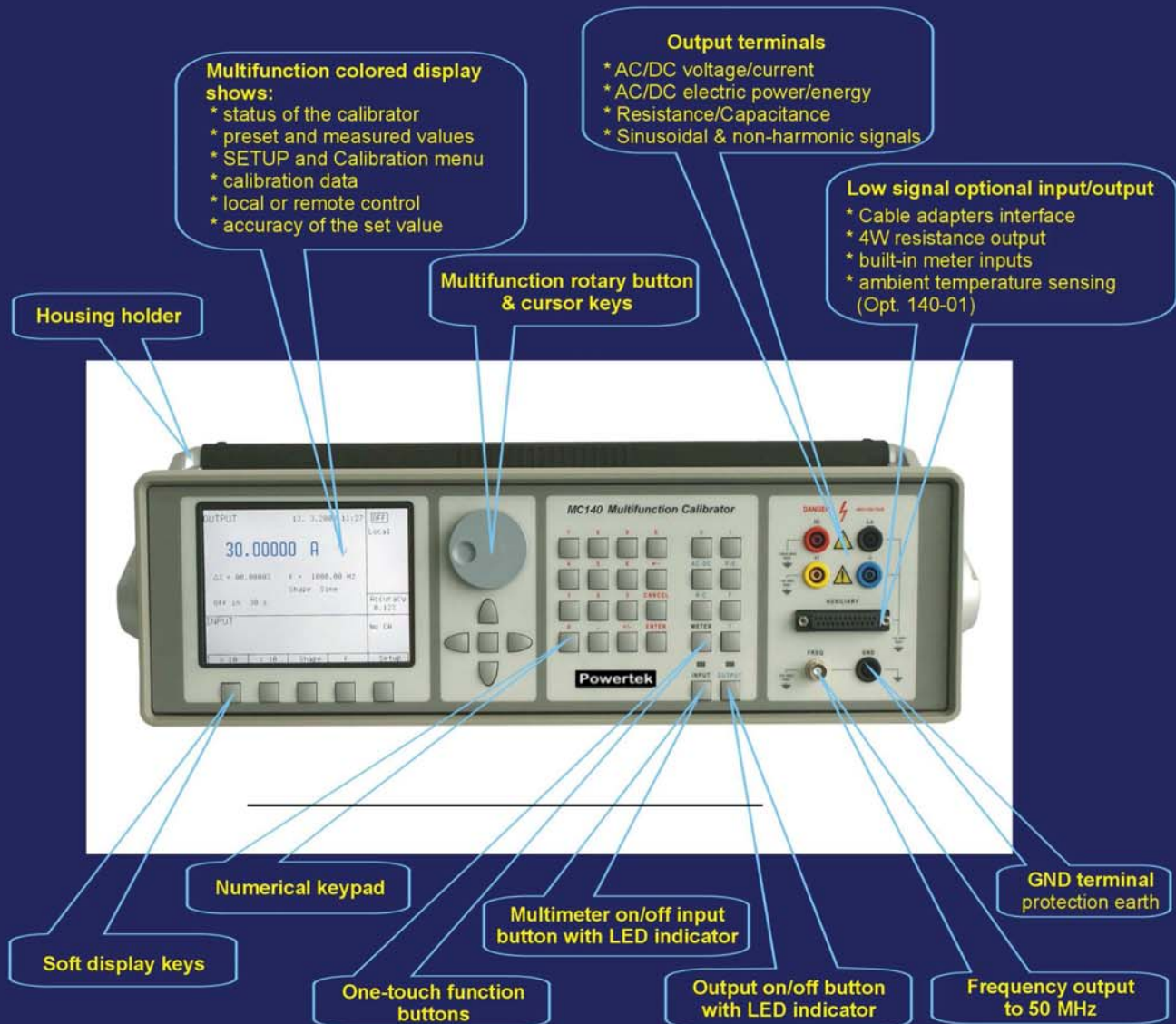# Front panel ergonomy

Series of MC140/MC140i & MC142/MC142i multifunction calibrators offers multiproduct calibrators of electric quantities up to 1000 V and 30 A

Basic application field are calibration laboratories, manufacturers of electric quantity meter.

Multifunction colored display shows:
* status of the calibrator
* preset and measured values
* SETUP and Calibration menu
* calibration data
* local or remote control
* accuracy of the set value

Output terminals
* AC/DC voltage/current
* AC/DC electric power/energy
* Resistance/Capacitance
* Sinusoidal & non-harmonic signals

Low signal optional input/output
* Cable adapters interface
* 4W resistance output
* built-in meter inputs
* ambient temperature sensing (Opt. 140-01)

Multifunction rotary button & cursor keys

Housing holder

Numerical keypad

Soft display keys

One-touch function buttons

Multimeter on/off input button with LED indicator

Output on/off button with LED indicator

Frequency output to 50 MHz

**GND terminal** protection earth

Front panel is splitted to logical areas :

* output terminals field
* numerical keypad with cursor keys and rotary button
* one-touch buttons for fast selection of requested function
* colored large-size TFT display with excelent contact and visibility from all directions

Rear panel with interface

Power line entry module with:

* 115V/230V line voltage selector
* main power line fuse
* power line switch

ventilation hole

RS 232

IEEE 488
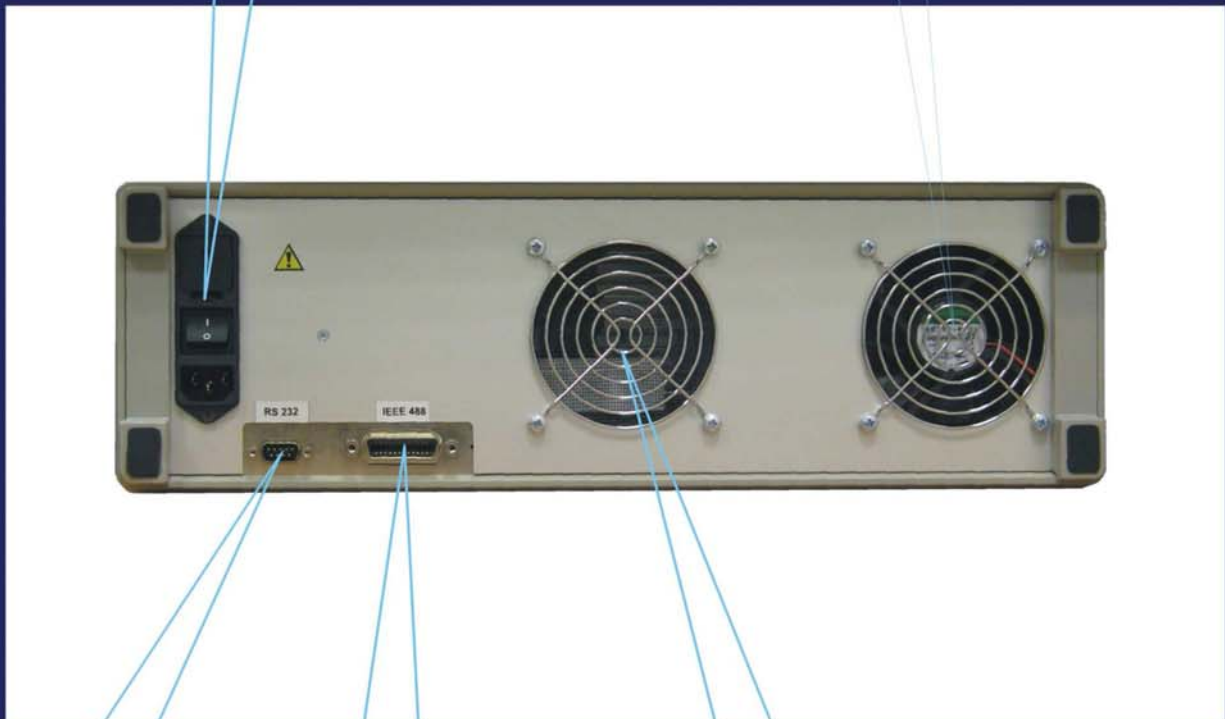
RS-232 interface

GPIB interface

ventilation hole

Series of MC140/MC140i & MC142/MC142i multifunction calibrators offers multiproduct calibrators of electric quantities up to 1000 V and 30 A
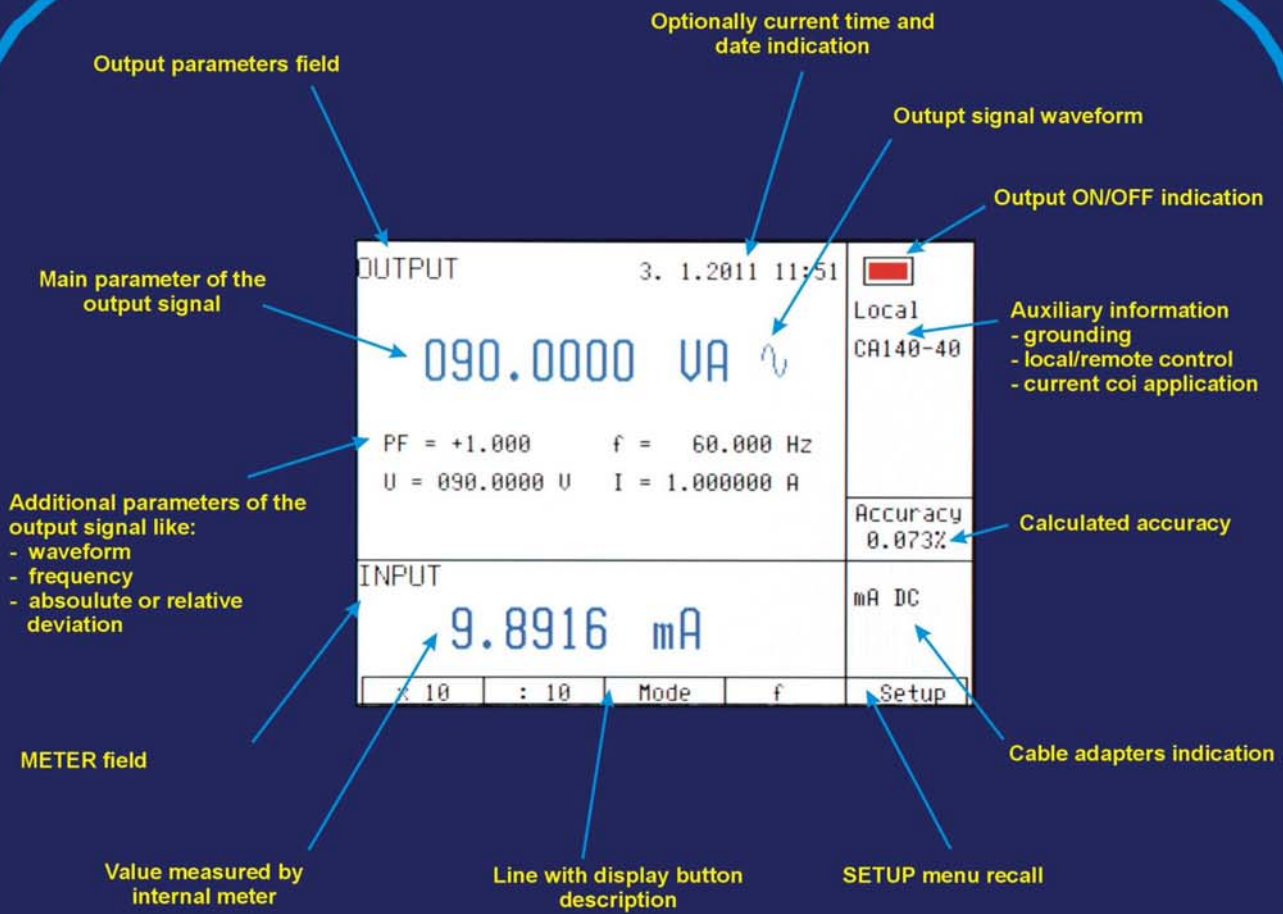
Basic application field are calibration laboratories, manufacturers of electric quantity meter.

LCD color display

Separated fields for:

- output signal parameters
- measured value
- auxiliary information
- soft button meaning

Optionally current time and date indication

Outupt signal waveform

Output parameters field

Output ON/OFF indication

Main parameter of the output signal

Auxiliary information
- grounding
- local/remote control
- current coi application

Additional parameters of the output signal like:
- waveform
- frequency
- absolute or relative deviation

Calculated accuracy

```
OUTPUT              3. 1.2011 11:51   [====]

                                      Local
     090.0000  VA  ∿                  CA140-40

 PF = +1.000        f =    60.000 Hz
 U = 090.0000 V    I = 1.000000 A
                                      Accuracy
                                      0.073%
INPUT
                                      mA DC
     9.8916  mA

   x 10  |  : 10  |  Mode  |    f    |  Setup
```

METER field

Cable adapters indication

Value measured by internal meter

Line with display button description

SETUP menu recall

Multifunction output/input terminals

Voltage output terminals H and L :

* DC output voltage 0 to 1000 V
* AC output voltage 100 uV to 1000 V
* Resistance in range 0 Ohmt to 50 MOhm (1000M in M-142)
* Capacitance in range 0.9nF to 50 uF (100 uF in M-142)
* AC/DC voltage in power/energy mode
* Non-harmonic waveforms (triangle, square, saw)
* Square waveform with setable duty cycle ratio from 1% to 99%

AUXILIARY connector

GND terminal
connected to protection earth

Current output terminals +I and -I :

* DC output current from 0 uV to 20 A (30 A for M-142)
* AC output current 100 uA to 20 A (30 A for M-142)
* AC/DC current in power/energy mode

Frequency output :

* PWM mode
AC squarewave voltage with calibrated amplitude
and duty cycle ratio from 1 mv to 10 V in frequency
range from 0.1 Hz to 100 kHz

* HF mode
squarewave signal with calibrated amplitude 4Vpk-pk
(0dB, -10dB, -20dB, -30dB) in frequency range from
0.1 Hz to 20 MHz

* **Output terminals are designed to withstand 1000V and 30 A load current**

* **Safe application using test cables from MC140 accessory**

* **Auxiliary connector extends MC140 Capability when applied with cable adapters**

* **Front panel additional grounding terminal for grounding UUTs.**

AC/DC voltage calibration
Resistance/Capacitance calibration

SETUP setting:
GND voltage ON
GND current ON
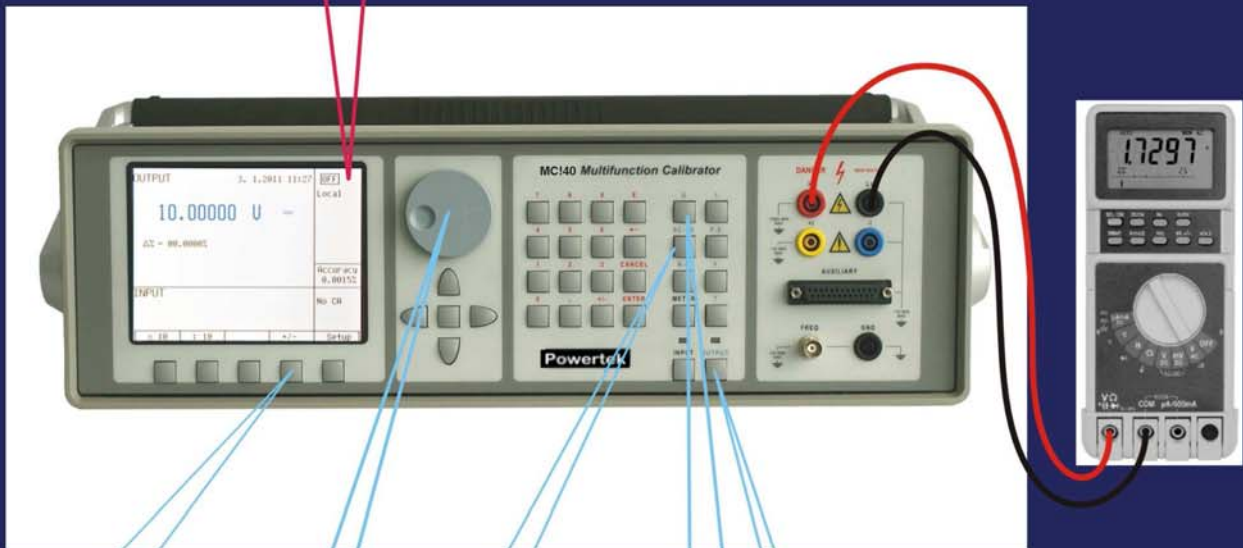
Set frequency
for AC voltage

1. Select function U or R - C

2. Select AC or DC voltage

3. Set requested value using:
rotary button or
cursor keys or
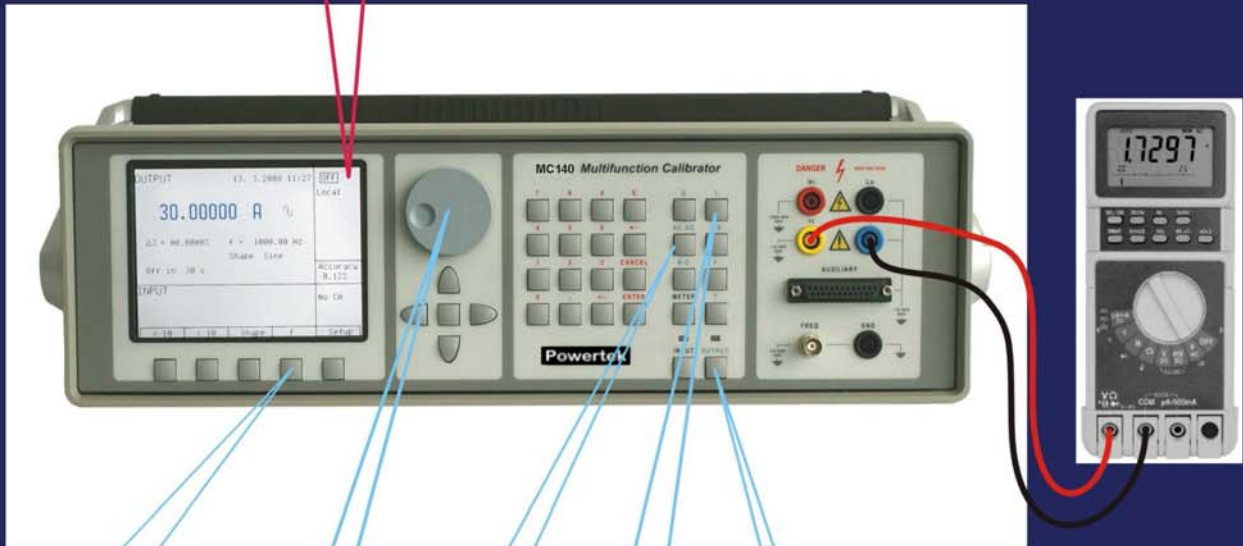numerical keypad

4. Switch output terminals ON

**Simple connection and one touch buttons simplifies
two-terminal calibration of UUTs:**
* Connect UUT input to the calibrator Hi - Lo
  output terminals
* Set desired function and requested value
* Switch on output terminals

**Display always show real relative
accuracy of the output signal**

AC/DC current calibration

SETUP setting:
GND voltage ON
GND current ON

Set frequency for AC voltage

1. Select function I

2. Select AC or DC current

3. Set requested value using:
rotary button or
cursor keys or
numerical keypad

4. Switch output terminals ON

Simple connection and one touch buttons simplifies
two-terminal calibration of UUTs:
* Connect UUT input to the calibrator +I and -I
  output terminals
* Set desired function and requested value
* Switch on output terminals

Display always show real relative
accuracy of the output signal

Auxiliary connector offers low signal outputs/inputs with enhanced features

Auxiliary connector expands capabilities of the MC140/142 calibrators :

* **using Option 140-40 Cable adapter (MC140&142)**
DC voltage to 12 V and DC current
to 25 mA with accuarcy 0.01% can be
measured.

* **using Option 140-60 Cable adapter (MC140&142)**
four-wire resistance in range up to
15 kOhm can be measured with
accuracy 0.0.2%

* **using Option 140-70 Cable adapter (MC140&142)**
four-wire resistance in range up to
15 kOhm can be sourced with full
accuracy 0.015 %

* **using Option 80 Cable adapter (MC142 only)**
temperature of external termocouple sensors
and mVDC to 2 V can be directly measured.

* **using Option 90 Cable adapter (M142 only)**
ambient temperature can be measured
with Pt100 sensor

MC140 multifunction terminal block with low signal outputs/inputs simplifies process calibrations

Simple connection of UUT like transducers, converters, temperature sensors with wide variety of I/O characteristic

RTD temperature sensor simulation output

20 mA current loop output

DC voltage output to 10 V
Thermocouple simulation output

DC mV-metr input, external thermocouple sensors connection

4-wire ohmemter, external RTD sensors connection

12V range DC voltmeter input
25mA DC ammeter input

strain gauge sensors

20 mA input fuse protection

* power supply source
* signal input

MC140/142 workplate extended capability

Metal worksheet simplifies connection of UUT to calibrator.

Under the metal plate fixed Pt100 temperature sensor offers direct measurement of ambient temperature displaying it on the display.

Optionally automatic compensation of cold junction of simulated thermocouple temperature sensor can be setup using the Pt100 sensor.
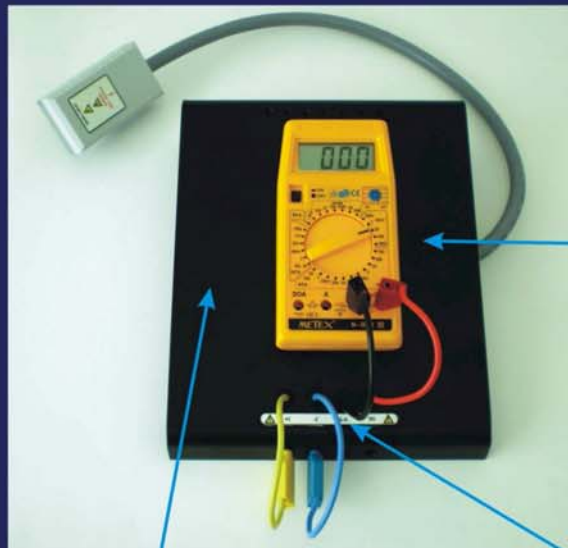
Aluminium worksheet serves as fixing plate for camera holder when camera module is applied for semiautomatic calibration of UUT.

Current and voltage test leads are connected directly to the calibrator front panel terminals.

AC/DC Electric power/energy calibration

Calibrator display in electric power/energy mode.

Calculated output power/energy

Frequency setting

Output current setting

Power factor setting

Output voltage setting

Calculated accuracy
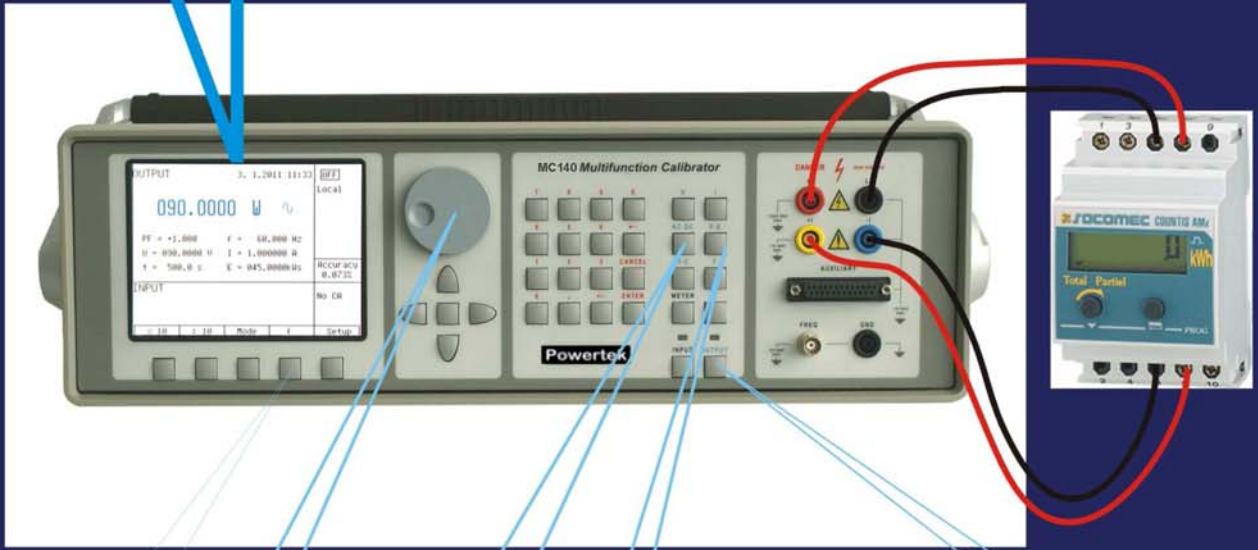
Time setting (Energy mode)

Calculated energy

```
OUTPUT              3. 1.2011 11:33  OFF
                                     Local

        090.0000  W   ⌁

   PF = +1.000        f =    60.000 Hz
   U = 090.0000 V     I = 1.000000 A
   t =   500.0 s      E = 045.0000kWs    Accuracy
                                         0.073%
INPUT
                                         No CA

   x 10   : 10   Mode     f        Setup
```

MC140 *Multifunction Calibrator*

Powertek

Set frequency for AC voltage

3. Set requested value using:
rotary button or
cursor keys or
numerical keypad

1. Select function P-E

4. Switch output terminals ON

2. Select AC or DC for voltage function

RTD and TC temperature sensor simulation

Calibrator display RTD mode.

```
OUTPUT          3. 1.2011 11:42   OFF
                                  Local
      0100.0 °C                   PTS68

ΔT = 0000.0°C    R0 =   100 Ω
Pt385

                                  Accuracy
                                  0.08°C
INPUT                             No CA


              RTD type            Setup
```

Calibrator display TC mode.

Selected temperature scale

Simulated temperature

```
OUTPUT          3. 1.2011 11:43   OFF
                                  Local
      0100.0 °C                   PTS68
                                  CA140-40

ΔT = 0000.0°C    RJ = 0023.0°C
TC type R

                                  Accuracy
                                  0.9°C
INPUT                             U DC


              TC type             Setup
```

Type of RTD sensor

R0 value

Absolute/relative deviation

Type of thermocouple sensor

3. Set requested value using:
rotary button or
cursor keys or
numerical keypad

1. Select function T

4. Switch output terminals ON

Frequency output

PWM frequency mode

```
OUTPUT            3. 1.2011 11:36   [OFF]
                                    Local
                                    Gnd
      1.000000 kHz  ⌐L

∆% = 00.0000%    U = 10.000 U
PWM= 50%         Shape  PWM POS
                 Mode :  PWM        Accuracy
                                    0.0050%
INPUT
                                    No CA

  x 10    :  0    Shape            Setup
```

Output frequency

Duty cycle ratio
0.01 to 0.99

Absolute/relative
amplitude deviation

Output voltage

Output voltage
shape

Range of setting

voltage:	1 mV to 10 V
duty cycle ratio:	0.01 to 0.99
frequency:	1 mHz to 100 kHz
shape:	square, triangle, truncated sin

HF mode

Range of setting

voltage:	4 Vpk-pk
output level:	0, -10, -20, -30 dB
frequency:	1 mHz to 20 MHz
shape:	square

Output voltage level

```
OUTPUT            3. 1.2011 11:37   [■]
                                    Local
                                    Gnd
      20.00000 MHz

∆% = 00.0000%    a = -30 dB

                 Mode :  HF         Accuracy
                                    0.0050%
INPUT
                                    No CA

  x 10    : 10                      Setup
```

1. Select function F
   PWM or HF mode

2. Set requested frequency using:
   rotary button or
   cursor keys or
   numerical keypad

3. Switch output terminals ON
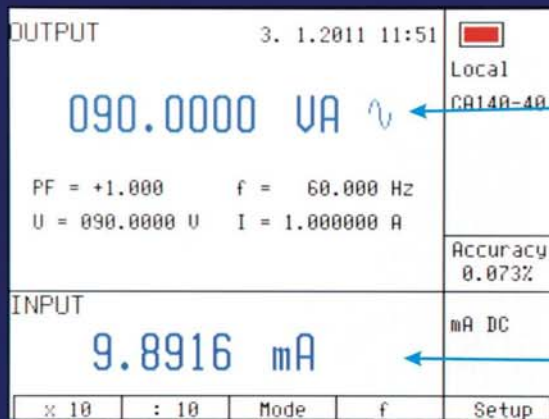
Process calibration

Various types of converters, sensing amplifiers and process meters can be calibrated using MC140/142 calibrators.

Calibrator can supply UUT with standard signal like:
- voltage, current electric power
- resistance, capacitance, frequency
- TC and RTD temperature sensor

Calibrator can measure response of UUT using internal meter simultanously. Following type of response can be measured:
- 20 mA current loop
- 10 VDC standardized output
- frequency, temperature

```
OUTPUT              3. 1.2011 11:51   ▬

                                      Local
     090.0000  VA  ⌁                  CA140-40


 PF = +1.000      f =   60.000 Hz
 U = 090.0000 V   I = 1.000000 A
                                      Accuracy
                                      0.073%
 INPUT
                                      mA DC
     9.8916   mA

   x 10  │  : 10  │  Mode  │   f   │  Setup
```

Output signal available at the output terminals

Calibrator internal METER reading

UUT is supplied with standard output signal

UUT output is measured using METER function

3. Set meter function: mADC

5. Set OUTPUT ON

2. Set requested value using:
rotary button or
cursor keys or
numerical keypad

1. Select output signal function DCV

4. Set INPUT ON

Recalibration procedure

Simple procedure of recalibration is accesible using calibrator CALIBRATION mode.

The procedure includes:
- **all functions and ranges of the output signals**
- **functions and ranges of the internal METER**

Calibration can be managed using calibrator front panel keypad.

Access to the CALIBRATION mode is protected with password.

List of readjustable functions is available when CALIBRATION mode is entered.

```
                              3. 1.2011 13:07  OFF
      CALIBRATION MENU                          Local
                                                CA140-40

      Voltage DC
      Voltage AC
      Current DC
      Current AC
      Power DC
      Power AC
      Resistance

      Select                                    Exit
```

```
                              3. 1.2011 13:08  OFF
      CALIBRATION MENU                          Local

      Voltage DC

      +0mV     -0mV    +19mV    -19mV
      +0mV     -0mV   +190mV   -190mV
      +0 V     -0 V    +1.9 V   -1.9 V
      +0 V     -0 V    +19 V    -19 V
      +0 V     -0 V   +190 V   -190 V
      +200 V  -200 V  +750 V   -750 V

      Select                                    Exit
```

List of ranges with recommended calibration point helps to readjust the calibrator.

Each line represents one range of function. Line contains recommended list of calibration points.

Philosophy of recalibration is based on "zero offset" and :slope" adjustment

Remote control & Automatic calibration

Calibrator enables full automatic operation using remote control mode.

Following interfaces are available for connecting the calibrator to PC:

- GPIB (IEEE-4888) interface. Connector is located on the rear panel.
  National instruments GPIB card is requested to be installed in the computer.

- serial line RS-232. Connector is located on the rear panel.

- USB interface using RS232-USB converter.

Calibrators can be applied in systems for automatic and semiautomatic calibration of UUTs:

- by user created application SW, using remote control commands

- using Powertek CALIBER application SW

CALIBER application software for automatic and semiautomatic calibration of meters of electric quantities.

CALIBER → Procedure ⟨ Standard unit / Unit under test ⟩ → Calibration certificate
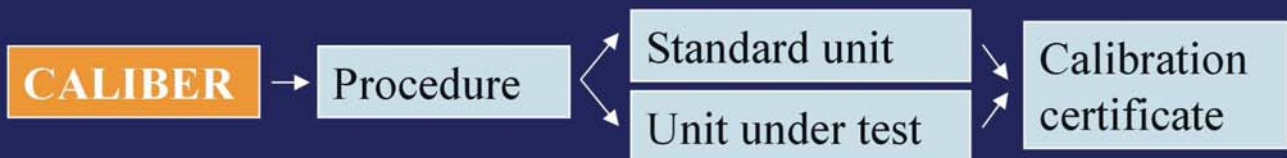
CALIBER application software is based on instrument cards. Basic instrument cards are delivered with the calibrator, however new card can be created by calibration laboratory.

Output from the CALIBER is list of calibration points with measured and evaluated results including uncertainty of calibration.

Calibration procedures can be easily created by calibration laboratory.

CALIBER Application SW for automatic calibration

Calibrator enables full automatic operation using remote control mode.

Calibration procedure can be easily created and modified. Procedure consists of list of calibration points.

Simple connection diagram including comment and information about terminal interconnection make it easy to understand the calibration process.

Optionally Powertek camera module can be integrated into the system. This option enabels semiatomatic calibrations of meters without any interface.

Measured values are evaluated and result of the calibration is displayed in the calibration report during calibration.