

MC6

Advanced field calibrator and communicator



Beamex® MC6
More than a calibrator.

beamex
WORLD-CLASS CALIBRATION SOLUTIONS™



The impossible made possible: combining advanced functionality with ease-of-use.

Beamex® MC6 is an advanced, high-accuracy field calibrator and communicator. It offers calibration capabilities for pressure, temperature and various electrical signals. The MC6 also contains a full fieldbus communicator for HART, FOUNDATION Fieldbus and Profibus PA instruments.

The usability and ease-of-use are among the main features of the MC6. It has a large 5.7" color touch-screen with a multilingual user interface. The robust IP65-rated dust- and water-proof casing, ergonomic design and light weight make it an ideal measurement device for field use in various industries, such as the pharmaceutical, energy, oil and gas, food and beverage, service as well as the petrochemical and chemical industries.

The MC6 is one device with five different operational modes, which means that it is fast and easy to use, and you can carry less equipment in the field. The operation modes are: Meter, Calibrator, Documenting Calibrator, Data Logger and Fieldbus Communicator. In addition, the MC6 communicates with Beamex® CMX Calibration Software, enabling fully automated and paperless calibration and documentation.

In conclusion, the MC6 is more than a calibrator.



MC6 Main Features

Accuracy

High-accuracy, advanced field calibrator and communicator.

Usability

Combines advanced functionality with ease-of-use.

Versatility

Versatile functionality beyond traditional calibration applications.

Communicator

Full multi-bus communicator for HART, FOUNDATION Fieldbus and Profibus PA instruments.

Integration

Automates calibration procedures for paperless calibration management.



Accuracy



High-accuracy, advanced field calibrator and communicator

Unmatched accuracy

Today's process instrumentation is becoming more and more accurate. Therefore, calibration equipment must also have improved accuracy. When Beamex develops new measurement equipment, it makes no compromises in terms of accuracy – it must be best-in-class. The MC6 makes no exceptions. Accuracy is one of the main features of the MC6. It is among the most accurate, advanced field calibrators available on the market.

Accuracy that tolerates demanding conditions

Field calibrators and communicators must tolerate demanding environmental conditions, such as cold or warm weather, moisture and dust. The MC6 is designed to handle demanding and variable environmental conditions. All of the pressure, electrical and temperature ranges are temperature compensated, and therefore the accuracy of the calibrator is not jeopardized when used in given types of extreme environments.

Accredited calibration certificate as standard

Every MC6 calibrator is calibrated in the Beamex accredited laboratory before delivery. As proof of how accurate it is, each MC6 is delivered with a traceable, accredited calibration certificate as standard. The certificate includes calibration and uncertainty data from the calibration laboratory. The calibration laboratory's Scope of Accreditation can be found on Beamex's website (www.beamex.com).

Summary of accuracy figures

The MC6 has specifications for short-term accuracy and for 1-year total uncertainty.

Brief summary of the Accuracy figures:

- Pressure accuracy starting from $\pm(0.005\% \text{ FS} + 0.00125\% \text{ of reading})$.
- Temperature - RTD temperature measurement accuracy starting from $\pm 0.011^\circ\text{C}$.
- Electric - Current measurement accuracy starting from $\pm(0.75 \mu\text{A} + 0.0075\% \text{ of reading})$.



Usability



Designed for field use

User-friendly interface

The MC6 has a large 5.7" color touch-screen with high resolution and an effective adjustable backlight. The buttons on the touch-screen have been designed large enough to use with bare fingers, so there is no need for a stylus – it can even be used with gloved hands! In addition, the MC6 has a membrane keypad. The multi-lingual user interface has been divided into different operational modes. A soft number keypad and alphabetical QWERTY text keypad will appear whenever necessary for easy number/text entries.

Automated procedures

Whenever a certain measurement or generation is selected, the user interface shows where to make the connections, which allows you to use a device with several connections. The MC6 is also a documenting calibrator and it communicates with the Beamex® CMX Calibration Software enabling fully automated and paperless calibration data management. This makes the calibration and documenting of calibration results automatic and much easier. Since the MC6 is a measurement device that replaces several individual devices, there's no need to carry several units in the field. What's more, the MC6 is also a fieldbus communicator, and therefore there is no need to carry an additional communicator.

Robust, lightweight and ergonomic design

The MC6 has the latest, rechargeable lithium-ion polymer batteries, which are durable and charge up quickly. The user interface keeps you up to date on the remaining operation time in hours and minutes, making it easy to follow how long the battery will last. Once the unit is switched on, it is ready to use in just a few seconds. The case is ergonomic and water-/dust-proof (IP65). There are two types of cases available: a slim case when internal pressure modules are not needed and an extended version, which provides room for the internal pressure modules. The wrist strap makes it easy to hold the device in your hand, while the neck strap makes it easy to carry and use the device.

User-interface modes

The MC6 is a unique measurement device, as it combines advanced functionality with ease-of-use. How is it possible to combine these two features? The solution is that the MC6 contains various operational modes all in one device, each of which is optimized for different uses. The operational modes are Meter, Calibrator, Documenting Calibrator, Communicator and Data Logger.



User-interface modes

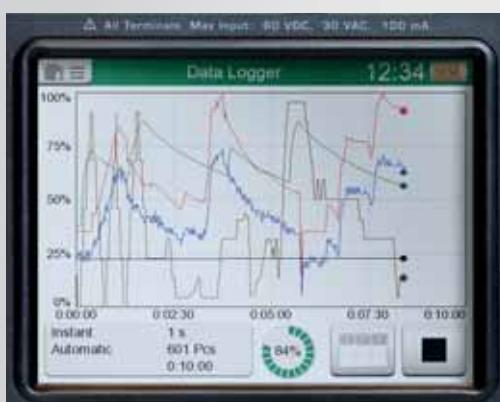
Meter

The Meter mode is designed for simple and easy measurement of signals. Oftentimes, you may need to measure something quickly and easily. Often a simple multi-meter is used for this purpose, as it is easy to use. Some multifunctional calibrators may be too slow and difficult to use, so it is easier to just choose the simpler meter. The Meter mode in MC6 is optimized for this type of simple and easy metering.



Data Logger

The Data Logger is designed for logging various measurement results. Often in industry, there is a need to measure signals for shorter or longer periods and to save the results in a memory for later analysis. This may be related to trouble-shooting, surveillance or calibration. The Data Logger mode in MC6 is optimized for this type of use.



Calibrator

The Calibrator mode is designed for calibrating various process instruments. Oftentimes, you need to check and calibrate a certain process instrument/transmitter. Transmitters typically have an input and an output. So you either need to have two devices, or a device capable of doing two things simultaneously. The Calibrator mode in MC6 is optimized for this type of use.





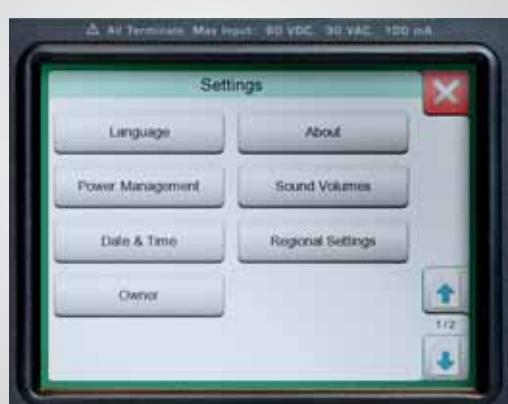
Communicator

The Communicator mode is designed to communicate with Fieldbus instruments. In today's process plants, smart instrumentation is being used to an increasing degree. Therefore, engineers need to use communicators or configuration software. Most of this instrumentation is HART, FOUNDATION Fieldbus or Profibus PA. The Communicator mode in MC6 is optimized for communicator use.



Documenting calibrator

The Documenting Calibrator mode is designed for the process instrument calibration and documenting of the calibration results. In today's process plant, calibrations often have to be documented. Without a Documenting Calibrator, documentation must be done manually, which takes a lot of precious time and is prone to error. The Documenting Calibrator mode in MC6 is optimized for use as a documenting process calibrator.



Settings

The Settings mode allows you to edit the calibrator's various settings.

Versatility



Versatile functionality beyond traditional calibration applications

The MC6 is an advanced field calibrator and communicator, which replaces several measurement devices. It offers extremely versatile and multifunctional calibration capability for pressure, temperature and various electrical signals. It also includes a full Fieldbus communicator for HART, FOUNDATION Fieldbus and Profibus PA instruments.

MC6 measurement, generation and simulation functions

- Pressure measurement
- Voltage measurement and generation
- Current measurement and generation
- Resistance measurement and simulation
- RTD measurement and simulation
- TC measurement and simulation
- Frequency measurement and generation
- Pulse counting and generation
- Switch state sensing
- Built-in 24 VDC Loop Supply
- Field communicator for HART, FOUNDATION Fieldbus and Profibus PA

MC6 as a pressure calibrator

The MC6 can come with as many as 4 internal pressure modules (3 standard modules + a barometric module). There is also a connection for external pressure modules. All of the internal and external pressure modules up to 6 bar (90 psi) come with an internal returning relief valve that protects the module from accidental overpressure. Most of the pressure modules have a compound range, and therefore they can measure from full vacuum up to the module range. When a unit is equipped with the barometric module, all other modules can be used for measuring absolute pressure. This means that there is no need to purchase separate absolute and gauge pressure modules. This makes it more practical to use and saves money. The MC6 can communicate with BeameX® Automatic Pressure Controller POC6 enabling fully automatic calibration of pressure instruments.

MC6 as a temperature calibrator

The MC6 has two RTD channels, and therefore it is able to measure two RTD sensors simultaneously with great accuracy. You can program sensor correction coefficients into the MC6 if you need to compensate sensor error. It also has two thermocouple channels, so it can accurately measure two thermocouples simultaneously, and it has automatic internal compensation of the reference (cold) junction. Using external or manual reference junction compensation is also possible. One thermocouple channel has a unique and very versatile connection block supporting the use of plain thermocouple wires, or any type of thermocouple connector. The MC6 supports a large number RTD and thermocouple sensors as standard, and there are several additional sensors available as optional sensors. The MC6 can communicate with temperature controllers (Dry Blocks) enabling fully automatic calibration of temperature sensors or temperature instruments with temperature sensor.



Field Communicator



Full multi-bus field communicator for HART, FOUNDATION Fieldbus and Profibus PA instruments

Smart instrumentation is becoming more and more common in today's process plants. The most widely used smart instrument protocols are HART, FOUNDATION Fieldbus and Profibus PA. Therefore, in addition to a calibrator, an engineer often needs to use a field communicator. The MC6 combines these two; it's a calibrator and a communicator.

Communicator

The Communicator mode is a full multi-bus communicator for HART, FOUNDATION Fieldbus and Profibus PA instruments. Therefore, it eliminates the need to carry a separate communicator with you. All of the communicator electronics for all protocols are built into the MC6, including internal loop power supply with various required impedances for different buses, which means there is no need to use any external loop supply or resistors. The connections are extremely easy to make - just connect two leads from the MC6 to the instrument.

Multi-bus Communicator

The MC6 communicator can be used with all types of Fieldbus instruments, not only pressure and temperature transmitters. All 3 protocols can be simultaneously installed into an MC6, and therefore the very same device can be used as a HART, FOUNDATION Fieldbus and Profibus PA communicator. With the MC6, you can access all parameters in all blocks of a Fieldbus instrument. Its memory stores device descriptions for the Fieldbus instruments. When new instruments are introduced on the market, new device description files will be made available and can be easily downloaded into the memory. For example, the MC6 DD library supports approximately 1,000 different Device Descriptions for the HART protocol.

Communicator and Calibrator

The MC6 is not only a communicator; it is also a multifunctional calibrator, which allows you to make traceable metrological calibration and trimming for Fieldbus instruments. What's more, the Fieldbus parameters can be configured, the variables logged into the Data Logger mode or measured in the Calibrator mode and calibrated and documented in the Documenting Calibrator mode.



Seamless Integration.

Automate calibration procedures for paperless calibration management

According to some studies, instrument technicians use up to 50 % of their time doing paperwork, i.e. preparing calibration instructions, making notes of calibration results in the field and documenting and archiving calibration results.

All of the above tasks are extremely important and necessary, but doing them in the “Beamex way”, with seamlessly communicating documenting calibrators and calibration software, remarkably improves the quality, efficiency and accuracy of the entire calibration process and saves costs compared to traditional pen and paper systems or “do-it-yourself” computer databases. The Beamex® MC6 communicates with Beamex® CMX Calibration Software enabling fully automated and paperless calibration and documentation! Beamex calibrators, workstations, calibration software and professional services form the most integrated, automated calibration system available.

Benefits of an automated calibration system with seamlessly communicating documenting calibrators and calibration software:

- Preparing calibration schedules and documentation is fast and efficient.
- No more typing errors related to calibration documentation.
- Planning optimal interval for performing calibrations is easy.
- Quality and accuracy of calibration records are dramatically improved.
- Calibration data is easily accessible for audits.
- System integration with maintenance management systems is possible.



BEAMEX® INTEGRATED CALIBRATION SOLUTION, STEP-BY-STEP

The Beamex® CMX Calibration Software indicates what needs to be calibrated and when.



- Easy, fast and efficient
- No need to search archived paper files

Download calibration procedures and instructions from the software to the MC6.



- Fast procedure
- No pen, paper or notepads needed

Perform instrument calibration and data collection with the MC6.



- The MC6 replaces many individual measurement devices and calibrators
- Automated calibration is fast

Upload calibration results to the software.



- Automatically download calibration results back to software
- Data transfer is fast and efficient, writing mistakes are eliminated

Create, store and manage calibration information safely and efficiently with the software.



- All calibration data is stored and managed in the CMX database
- Calibration certificates, reports and labels in electronic format, on paper or both
- All documentation in the CMX is in auditable and traceable (e.g. ISO17025, cGMP, 21 CFR Part 11)

Integration to a maintenance management system.



- Plant hierarchy and work orders are stored in MMS (e.g. SAP®, Maximo®) and from there transferred to the CMX, which stores all calibration procedures, standards and results
- When calibration work has been performed, the CMX sends acknowledgement of the calibration back to MMS.

Additional Features

Feature	Specification
Scaling	A versatile programmable scaling function allows user to scale any measurement or generation unit into any other unit. Supports also rooting transfer function for flow applications. Also, custom units and custom transfer functions are supported.
Alarm	An alarm that can be programmed with high or low limit, as well as slow rate or fast rate limit.
Leak test	A dedicated function that can be used to analyse a change in any measurement. Can be used for pressure leak testing as well as any stability testing.
Damping	A programmable damping allows user to filter any measurement.
Resolution	Possibility to change the resolution of any measurement by reducing or adding decimals.
Step	A programmable step function for any generation or simulation.
Ramp	A programmable ramp function for any generation or simulation.
Quick access	Possibility to set four (4) quick access buttons in generation to easily generate the programmed values.
Spinner	Possibility to easily step any digit in the generation value up or down.
Additional info	Allow user to see additional information in the screen such as: Min, Max, Rate, Average, Internal temperature, RTD sensor's resistance, thermocouple's thermovoltage, range min/max, etc.
Function info	Displays more information on the selected function.
Connection diagrams	Displays a picture showing where to connect the test leads with the selected function.
Calibration references	Allows you to document the additional references that were used during the calibration and passes on the information to Beamex CMX calibration software.
Users	Possibility to create a list of persons in the documenting calibrator in order to easily select who did the calibration.
Custom pressure unit	Large number of custom pressure units can be created.
Custom RTD sensor	Unlimited number of custom RTD sensors can be created using the Callendar van Dusen coefficients.
Custom point sets	Unlimited number of custom point sets can be created in calibration of an instrument, or step generation.
Custom transfer function	Unlimited number of custom transfer functions can be created in calibration of an instrument or in scaling function.

Note; All functions are not available in all user interface modes.



Specifications

General Specifications

Feature	Value
Display	5.7" Diagonal 640 x 480 TFT LCD Module
Touch Panel	5-wire resistive touch screen
Keyboard	Membrane keyboard
Backlight	LED backlight, adjustable brightness
Weight	Extended case: 1.5 ... 2.0 kg (3.3 ... 4.4 lb) Flat case: 1.5 kg (3.3 lb)
Dimensions	Extended case: 200 mm x 230 mm x 70 mm (D x W x H) (7.87 in x 9.06 in x 2.76 in) Flat case: 200 mm x 230 mm x 57 mm (D x W x H) (7.87 in x 9.06 in x 2.24 in)
Battery type	Rechargeable lithium-ion polymer, 4200 mAh, 11.1V
Charging time	Approximately 4 hours
Charger supply	100 ... 240 VAC, 50-60 Hz
Battery operation	10 ... 16 hours
Operating temperature	-10 ... 45 °C (14 ... 113 °F)
Operating temperature while charging batteries	0 ... 30 °C (32 ... 86 °F)
Storage temperature	-20 ... 60 °C (-4 ... 113 °F)
Specifications valid	0 ... 45 °C, unless other mentioned
Humidity	0 ... 80% R.H. non condensing
Warmup time	Specifications valid after a 5 minute warmup period.
Max. input voltage	30 V AC, 60 V DC
Display update rate	3 readings/second
Safety	Directive 2006/95/EC, EN 61010-1:2001
EMC	Directive 2004/108/EC, EN 61326-1:2006
Ingress protection	IP65
Drop	IEC 60068-2-32. 1 meter (3.28 ft)
Vibration	IEC 60068-2-64. Random, 2 g, 5 ... 500Hz.
Max altitude	3000 m (9842 ft)
Warranty	Warranty 3 Years. 1 year for battery pack. Warranty extension programs are also available.

Measurement, generation and simulation functions

- Pressure measurement (internal/external pressure modules)
- Voltage measurement (± 1 V and -1 ... 60 VDC)
- Current measurement (± 100 mA) (internal or external supply)
- Frequency measurement (0 ... 50 kHz)
- Pulse counting (0 ... 10 Mpulse)
- Switch state sensing (dry/wet switch)
- Built-in 24 VDC Loop Supply (low impedance, HART impedance or FF/PA impedance)
- Voltage generation (± 1 V and -3 ... 24 VDC)
- Current generation (0 ... 55 mA) (active/passive, i.e. Internal or external supply)
- Resistance measurement, two simultaneous channels (0 ... 4 k Ω)
- Resistance simulation (0 ... 4 k Ω)
- RTD measurement, two simultaneous channels
- RTD simulation
- TC measurement, two simultaneous channels (universal connector/mini-plug)
- TC simulation
- Frequency generation (0 ... 50 kHz)
- Pulse queue generation (0 ... 10 Mpulse)
- HART Communicator
- FOUNDATION Fieldbus Communicator
- Profibus PA Communicator

(Some of the above functions are optional)

Pressure measurement

Internal Modules	External Modules	Unit	Range ⁽³⁾	Resolution	Accuracy ^{(1) (±)}	1 Year Uncertainty ^{(2) (±)}
P B	EXT B	kPa a mbar a psi a	70 to 120 700 to 1200 10.15 to 17.4	0.01 0.1 0.001	0.3 mbar	0.05 kPa 0.5 mbar 0.0073 psi
P10mD	EXT10mD	KPa diff mbar diff iwc diff	± 1 ± 10 ± 4	0.0001 0.001 0.0001	0.05 % Span	0.05 % Span + 0.1 % RDG
P100m	EXT100m	kPa mbar iwc	0 to 10 0 to 100 0 to 40	0.0001 0.001 0.001	0.015 % FS + 0.0125 % RDG	0.025 % FS + 0.025% RDG
P400mC	EXT400mC	kPa mbar iwc	± 40 ± 400 ± 160	0.001 0.01 0.001	0.01 % FS + 0.0125 % RDG	0.02 % FS + 0.025% RDG
P1C	EXT1C	kPa bar psi	± 100 ± 1 -14.5 to 15	0.001 0.00001 0.0001	0.007 % FS + 0.0125 % RDG	0.015 % FS + 0.025% RDG
P2C	EXT2C	kPa bar psi	-100 to 200 -1 to 2 -14.5 to 30	0.001 0.00001 0.0001	0.005 % FS + 0.01 % RDG	0.01 % FS + 0.025% RDG
P6C	EXT6C	kPa bar psi	-100 to 600 -1 to 6 -14.5 to 90	0.01 0.0001 0.001	0.005 % FS + 0.01 % RDG	0.01 % FS + 0.025% RDG
P20C	EXT20C	kPa bar psi	-100 to 2000 -1 to 20 -14.5 to 300	0.01 0.0001 0.001	0.005 % FS + 0.01 % RDG	0.01 % FS + 0.025% RDG
P60	EXT60	kPa bar psi	0 to 6000 0 to 60 0 to 900	0.1 0.001 0.01	0.005 % FS + 0.0125 % RDG	0.01 % FS + 0.025% RDG
P100	EXT100	MPa bar psi	0 to 10 0 to 100 0 to 1500	0.0001 0.001 0.01	0.005 % FS + 0.0125 % RDG	0.01 % FS + 0.025% RDG
P160	EXT160	MPa bar psi	0 to 16 0 to 160 0 to 2400	0.0001 0.001 0.01	0.005 % FS + 0.0125 % RDG	0.01 % FS + 0.025% RDG
-	EXT250	MPa bar psi	0 to 25 0 to 250 0 to 3700	0.001 0.01 0.1	0.007 % FS + 0.0125 % RDG	0.015 % FS + 0.025% RDG
-	EXT600	MPa bar psi	0 to 60 0 to 600 0 to 9000	0.001 0.01 0.1	0.007 % FS + 0.01 % RDG	0.015 % FS + 0.025% RDG
-	EXT1000	MPa bar psi	0 to 100 0 to 1000 0 to 15000	0.001 0.01 0.1	0.007 % FS + 0.01 % RDG	0.015 % FS + 0.025% RDG

¹⁾ Accuracy includes hysteresis, nonlinearity and repeatability (k=2).

²⁾ Uncertainty includes reference standard uncertainty, hysteresis, nonlinearity, repeatability and typical long term stability for mentioned period. (k=2)

³⁾ Every internal/external gauge pressure module's range may be displayed also in absolute pressure if the Barometric Module (PB or EXT B) is installed/connected.

Maximum number of internal pressure modules is 3 gauge/differential pressure modules and one Barometric (PB) module in the extended case. The flat case has room for internal Barometric module only. Both cases have connection for external pressure modules.

External pressure modules are also compatible with Beamex MC2, MC4 and MC5 family calibrators.

Supported pressure units:

Pa, kPa, hPa, MPa, mbar, bar, gf/cm², kgf/cm², kgf/m², kp/cm², lbf/ft², psi, at, torr, atm, ozf/in², iwc, inH2O, ftH2O, mmH2O, cmH20, mH20, mmHg, cmHg, mHg, inHg, mmHg(0°C), inHg(0°C), mmH20(60°F), mmH20(68°F), mmH20(4°C), cmH20(60°F), cmH20(68°F), cmH20(4°C), inH20(60°F), inH20(68°F), inH20(4°C), ftH20(60°F), ftH20(68°F), ftH20(4°C).

Large number of user pressure units can be created.

Temperature coefficient:

<±0.001% RDG/°C outside 15 - 35 °C (59 - 95 °F).

P10mD / EXT10mD: < ±0.002% Span/°C outside 15 - 35 °C (59 - 95 °F)

Max overpressure:

2 times the nominal pressure. Except following modules;

PB/EXTB: 1200 mbar abs (35.4 inHg abs). P10mD/EXT10mD: 200 mbar (80 iwc).

EXT600: 900 bar (13000 psi). EXT1000: 1000 bar (15000 Psi).

Pressure Media:

Modules up to P6C/EXT6C: Dry clean air or other clean, inert, non-toxic, non-corrosive gases. Modules P20C/EXT20C and higher: Clean, inert, non-toxic, non-corrosive gases or liquids

Wetted Parts:

AISI316 stainless steel, Hastelloy, Nitrile rubber

Pressure connection:

PB/EXTB: M5 (10/32") female.

P10mD/EXT10mD: Two M5 (10/32") female threads with hose nipples included.

P100m/EXT100m to P20C/EXT20C: G1/8" (ISO228/1) female. A conical 1/8" BSP male with 60° internal cone adapter included for Beamex hose set.

P60, P100, P160: G1/8" (ISO228/1) female.

EXT60 to EXT1000: G 1/4" (ISO228/1) male

TC measurement & simulation

TC1 measurement & simulation / TC2 measurement

Type	Range (°C)	Range (°C)	Accuracy ⁽¹⁾	1 Year Uncertainty ^{(2) (±)}
B ⁽³⁾	0 ... 1820	0 ... 200	⁽⁸⁾	⁽⁴⁾
		200 ... 500	1.5 °C	2.0 °C
		500 ... 800	0.6 °C	0.8 °C
		800 ... 1820	0.4 °C	0.5 °C
R ⁽³⁾	-50 ... 1768	-50 ... 0	0.8 °C	1.0 °C
		0 ... 150	0.6 °C	0.7 °C
		150 ... 400	0.35 °C	0.45 °C
		400 ... 1768	0.3 °C	0.4 °C
S ⁽³⁾	-50 ... 1768	-50 ... 0	0.7 °C	0.9 °C
		0 ... 100	0.6 °C	0.7 °C
		100 ... 300	0.4 °C	0.55 °C
		300 ... 1768	0.35 °C	0.45 °C
E ⁽³⁾	-270 ... 1000	-270 ... -200	⁽⁸⁾	⁽⁴⁾
		-200 ... 0	0.05 °C + 0.04% RDG	0.07 °C + 0.06% RDG
		0 ... 1000	0.05 °C + 0.003% RDG	0.07 °C + 0.005% RDG
J ⁽³⁾	-210 ... 1200	-210 ... -200	⁽⁸⁾	⁽⁴⁾
		-200 ... 0	0.06 °C + 0.05% RDG	0.08 °C + 0.06% RDG
		0 ... 1200	0.06 °C + 0.003% RDG	0.08 °C + 0.006% RDG
K ⁽³⁾	-270 ... 1372	-270 ... -200	⁽⁸⁾	⁽⁴⁾
		-200 ... 0	0.08 °C + 0.07% RDG	0.1 °C + 0.1% RDG
		0 ... 1000	0.08 °C + 0.004% RDG	0.1 °C + 0.007% RDG
		1000 ... 1372	0.012% RDG	0.017% RDG
N ⁽³⁾	-270 ... 1300	-270 ... -200	⁽⁸⁾	⁽⁴⁾
		-200 ... -100	0.15% RDG	0.2% RDG
		-100 ... 0	0.11 °C + 0.04% RDG	0.15 °C + 0.05% RDG
		0 ... 800	0.11 °C	0.15 °C
T ⁽³⁾	-270 ... 400	-270 ... -200	⁽⁸⁾	⁽⁴⁾
		-200 ... 0	0.07 °C + 0.07% RDG	0.1 °C + 0.1% RDG
		0 ... 400	0.07 °C	0.1 °C
U ⁽⁵⁾	-200 ... 600	-200 ... 0	0.07 °C + 0.05% RDG	0.1 °C + 0.07% RDG
L ⁽⁵⁾	-200 ... 900	-200 ... 0	0.06 °C + 0.025% RDG	0.08 °C + 0.04% RDG
		0 ... 900	0.06 °C + 0.002% RDG	0.08 °C + 0.005% RDG
C ⁽⁶⁾	0 ... 2315	0 ... 1000	0.22 °C	0.3 °C
		1000 ... 2315	0.018% RDG	0.027% RDG
G ⁽⁷⁾	0 ... 2315	0 ... 60	⁽⁸⁾	⁽⁴⁾
		60 ... 200	0.9 °C	1.0 °C
		200 ... 400	0.4 °C	0.5 °C
		400 ... 1500	0.2 °C	0.3 °C
		1500 ... 2315	0.014% RDG	0.02% RDG
D ⁽⁶⁾	0 ... 2315	0 ... 140	0.3 °C	0.4 °C
		140 ... 1200	0.2 °C	0.3 °C
		1200 ... 2100	0.016% RDG	0.024% RDG
		2100 ... 2315	0.45 °C	0.65 °C

Resolution 0.01 °C.

With internal reference junction please see separate specification.

Also other thermocouple types available as option, please contact Beamex.

¹⁾ Accuracy includes hysteresis, nonlinearity and repeatability (k=2).

²⁾ Uncertainty includes reference standard uncertainty, hysteresis, nonlinearity, repeatability and typical long term stability for mentioned period. (k=2)

³⁾ IEC 584, NIST MN 175, BS 4937, ANSI MC96.1

⁴⁾ ±0.007% of thermovoltage + 4 µV

⁵⁾ DIN 43710

⁶⁾ ASTM E 988 - 96

⁷⁾ ASTM E 1751 - 95e1

⁸⁾ ±0.004% of thermovoltage + 3 µV

Measurement input impedance	> 10 MΩ
Simulation maximum load current	5 mA
Simulation load effect	< 5 µV/mA
Supported units	°C, °F, Kelvin, °Ré, °Ra
Connector	TC1: Universal TC connector , TC2: TC Miniplug

RTD measurement & simulation

R1 & R2 measurement

Sensor Type	Range (°C)	Range (°C)	Accuracy ⁽¹⁾	1 Year Uncertainty ^{(2) (±)}
Pt50(385)	-200 ... 850	-200 ... 270 270 ... 850	0.025 °C 0.009% RDG	0.03 °C 0.012% RDG
Pt100(375)				
Pt100(385)				
Pt100(389)	-200 ... 850	-200 ... 0 0 ... 850	0.011 °C 0.011 °C + 0.009% RDG	0.015 °C 0.015 °C + 0.012% RDG
Pt100(391)				
Pt100(3926)				
Pt100(3923)	-200 ... 600	-200 ... 0 0 ... 600	0.011 °C 0.011 °C + 0.009% RDG	0.015 °C 0.015 °C + 0.012% RDG
		-200 ... -80 -80 ... 0 0 ... 260 260 ... 850	0.007 °C 0.016 °C 0.016 °C + 0.009% RDG 0.03 °C + 0.011% RDG	0.01 °C 0.02 °C 0.02 °C + 0.012% RDG 0.045 °C + 0.02% RDG
Pt200(385)	-200 ... 850			
Pt400(385)	-200 ... 850	-200 ... -100 -100 ... 0 0 ... 850	0.007 °C 0.015 °C 0.026 °C + 0.01% RDG	0.01 °C 0.02 °C 0.045 °C + 0.019% RDG
Pt500(385)	-200 ... 850	-200 ... -120 -120 ... -50 -50 ... 0 0 ... 850	0.008 °C 0.013 °C 0.025 °C 0.025 °C + 0.01% RDG	0.01 °C 0.02 °C 0.045 °C 0.045 °C + 0.019% RDG
Pt1000(385)	-200 ... 850	-200 ... -150 -150 ... -50 -50 ... 0 0 ... 850	0.007 °C 0.018 °C 0.022 °C 0.022 °C + 0.01% RDG	0.008 °C 0.03 °C 0.04 °C 0.04 °C + 0.019% RDG
Ni100(618)	-60 ... 180	-60 ... 0 0 ... 180	0.009 °C 0.009 °C + 0.005% RDG	0.012 °C 0.012 °C + 0.006% RDG
Ni120(672)	-80 ... 260	-80 ... 0 0 ... 260	0.009 °C 0.009 °C + 0.005% RDG	0.012 °C 0.012 °C + 0.006% RDG
Cu10(427)	-200 ... 260	-200 ... 260	0.012 °C	0.16 °C

R1 Simulation

Sensor Type	Range (°C)	Range (°C)	Accuracy ⁽¹⁾	1 Year Uncertainty ^{(2) (±)}
Pt50(385)	-200 ... 850	-200 ... 270 270 ... 850	0.055 °C 0.035 °C + 0.008% RDG	0.11 °C 0.11 °C + 0.015% RDG
Pt100(375)				
Pt100(385)				
Pt100(389)	-200 ... 850	-200 ... 0 0 ... 850	0.025 °C 0.025 °C + 0.007% RDG	0.05 °C 0.05 °C + 0.014% RDG
Pt100(391)				
Pt100(3926)				
Pt100(3923)	-200 ... 600	-200 ... 0 0 ... 600	0.025 °C 0.025 °C + 0.007% RDG	0.05 °C 0.05 °C + 0.014% RDG
		-200 ... -80 -80 ... 0 0 ... 260 260 ... 850	0.012 °C 0.02 °C 0.02 °C + 0.006% RDG 0.03 °C + 0.011% RDG	0.025 °C 0.035 °C 0.04 °C + 0.011% RDG 0.06 °C + 0.02% RDG
Pt200(385)	-200 ... 850			
Pt400(385)	-200 ... 850	-200 ... -100 -100 ... 0 0 ... 850	0.01 °C 0.015 °C 0.027 °C + 0.01% RDG	0.015 °C 0.03 °C 0.05 °C + 0.019% RDG
Pt500(385)	-200 ... 850	-200 ... -120 -120 ... -50 -50 ... 0 0 ... 850	0.008 °C 0.012 °C 0.026 °C 0.026 °C + 0.01% RDG	0.015 °C 0.025 °C 0.05 °C 0.05 °C + 0.019% RDG
Pt1000(385)	-200 ... 850	-200 ... -150 -150 ... -50 -50 ... 0 0 ... 850	0.006 °C 0.017 °C 0.023 °C 0.023 °C + 0.01% RDG	0.011 °C 0.03 °C 0.043 °C 0.043 °C + 0.019% RDG
Ni100(618)	-60 ... 180	-60 ... 0 0 ... 180	0.021 °C 0.019 °C	0.042 °C 0.037 °C + 0.001% RDG
Ni120(672)	-80 ... 260	-80 ... 0 0 ... 260	0.021 °C 0.019 °C	0.042 °C 0.037 °C + 0.001% RDG
Cu10(427)	-200 ... 260	-200 ... 260	0.26 °C	0.52 °C

For Platinum sensors Callendar van Dusen coefficients can be programmed. Also other RTD types available as option, please contact Beamex.

RTD Measurement current	Pulsed, bi-directional 1 mA (0..500 Ω), 0.2 mA (>500 Ω).
4-wire connection	Measurement specifications valid
3-wire measurement	Add 10 m Ω
Max resistance excitation current	5 mA (0...650 Ω). $I_{exc} * R_{sim} < 3.25$ V (650...4000 Ω).
Min resistance excitation current	> 0.2 mA (0...400 Ω). >0.1 mA (400...4000 Ω).
Simulation settling time with pulsed excitation current	< 1 ms
Supported units	$^{\circ}$ C, $^{\circ}$ F, Kelvin, $^{\circ}$ Ré, $^{\circ}$ Ra

Internal Reference Junction TC1 & TC2

Range ($^{\circ}$ C)	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-10 ... 45 $^{\circ}$ C	± 0.10 $^{\circ}$ C	± 0.15 $^{\circ}$ C

Specifications valid in temperature range: 15 ... 35 $^{\circ}$ C.

Temperature coefficient outside of 15 ... 35 $^{\circ}$ C: ± 0.005 $^{\circ}$ C/ $^{\circ}$ C.

Specifications assumes that calibrator has stabilized in environmental condition, being switched on, for minimum of 90 minutes. For a measurement or simulation done sooner than that, please add uncertainty of 0.15 $^{\circ}$ C.

In order to calculate the total uncertainty of thermocouple measurement or simulation with internal reference junction used, please add the relevant thermocouple uncertainty and the Internal Reference Junction uncertainty together as a root sum of the squares.

Voltage measurement

IN (-1 ... 60 V)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-1.01 ... 1 V	0.001 mV	3 μ V + 0.003% RDG	5 μ V + 0.006% RDG
1 ... 60.6 V	0.01 mV	0.125 mV + 0.003% RDG	0.25 mV + 0.006% RDG
Input impedance			> 2 M Ω
Supported units			V, mV, μ V

TC1 & TC2 (-1 ... 1 V)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-1.01 ... 1.01 V	0.001 mV	3 μ V + 0.004% RDG	4 μ V + 0.007% RDG
Input impedance			> 10 M Ω
Supported units			V, mV, μ V
Connector			TC1: Universal TC connector , TC2: TC Miniplug

⁽¹⁾ Accuracy includes hysteresis, nonlinearity and repeatability (k=2).

⁽²⁾ Uncertainty includes reference standard uncertainty, hysteresis, nonlinearity, repeatability and typical long term stability for mentioned period. (k=2)

Voltage generation

OUT (-3 ... 24 V)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-3 ... 10 V	0.00001	0.05 mV + 0.004% RDG	0.1 mV + 0.007% RDG
10 ... 24 V	0.0001 V	0.05 mV + 0.004% RDG	0.1 mV + 0.007% RDG
Maximum load current			10 mA
Short circuit current			>100 mA
Load effect			< 50 μ V/mA
Supported units			V, mV, μ V

TC1 (-1 ... 1 V)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-1 ... 1 V	0.001 mV	3 μ V + 0.004% RDG	4 μ V + 0.007% RDG
Maximum load current			5 mA
Load effect			< 5 μ V/mA
Supported units			V, mV, μ V

Current measurement

IN (-100 ... 100 mA)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-25 ... 25 mA	0.0001 mA	0.75 μ A + 0.0075% RDG	1 μ A + 0.01% RDG
\pm (25 ... 101 mA)	0.001 mA	0.75 μ A + 0.0075% RDG	1 μ A + 0.01% RDG
Input impedance			< 10 Ω
Supported units			mA, μ A
Loop supply			Internal 24 V \pm 10% (max 55 mA), or external max 60 VDC.

Current generation

OUT (0 ... 55 mA)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
0 ... 25 mA	0.0001 mA	0.75 μ A + 0.0075% RDG	1 μ A + 0.01% RDG
25 ... 55 mA	0.001 mA	1.5 μ A + 0.0075% RDG	2 μ A + 0.01% RDG
Internal loop supply			24 V \pm 5%. Max 55 mA.
Max load impedance w. internal supply			24 V / (generated current). 1140 Ω @ 20 mA, 450 Ω @ 50 mA
Max external loop supply			60 VDC
Supported units			mA, μ A

⁽¹⁾ Accuracy includes hysteresis, nonlinearity and repeatability (k=2).

⁽²⁾ Uncertainty includes reference standard uncertainty, hysteresis, nonlinearity, repeatability and typical long term stability for mentioned period. (k=2)

Frequency measurement

IN (0.0027 ... 51000 Hz)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
0.0027 ... 0.5 Hz	0.000001 Hz	0.000002 Hz + 0.001% RDG	0.000002 Hz + 0.002% RDG
0.5 ... 5 Hz	0.00001 Hz	0.00002 Hz + 0.001% RDG	0.00002 Hz + 0.002% RDG
5 ... 50 Hz	0.0001 Hz	0.0002 Hz + 0.001% RDG	0.0002 Hz + 0.002% RDG
50 ... 500 Hz	0.001 Hz	0.002 Hz + 0.001% RDG	0.002 Hz + 0.002% RDG
500 ... 5000 Hz	0.01 Hz	0.02 Hz + 0.001% RDG	0.02 Hz + 0.002% RDG
5000 ... 51000 Hz	0.1 Hz	0.2 Hz + 0.001% RDG	0.2 Hz + 0.002% RDG
Input impedance		> 1 MΩ	
Supported units		Hz, kHz, cph, cpm, 1/Hz(s), 1/kHz(ms), 1/MHz(μs)	
Trigger level		Dry contact, wet contact -1 ... 14 V	
Minimum signal amplitude		1.0 Vpp (<10kHz), 1.2 Vpp (10 ... 50 kHz)	

Frequency generation

OUT (0.0005 ... 50000 Hz)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
0.0005 ... 0.5 Hz	0.000001 Hz	0.000002 Hz + 0.001 % RDG	0.000002 Hz + 0.002% RDG
0.5 ... 5 Hz	0.00001 Hz	0.00002 Hz + 0.001 % RDG	0.00002 Hz + 0.002% RDG
5 ... 50 Hz	0.0001 Hz	0.0002 Hz + 0.001 % RDG	0.0002 Hz + 0.002% RDG
50 ... 500 Hz	0.001 Hz	0.002 Hz + 0.001 % RDG	0.002 Hz + 0.002% RDG
500 ... 5000 Hz	0.01 Hz	0.02 Hz + 0.001 % RDG	0.02 Hz + 0.002% RDG
5000 ... 50000 Hz	0.1 Hz	0.2 Hz + 0.001 % RDG	0.2 Hz + 0.002% RDG
Maximum load current		10 mA	
Wave forms		Positive square, symmetric square	
Output amplitude positive square wave		0 ... 24 Vpp	
Output amplitude symmetric square wave		0 ... 6 Vpp	
Duty Cycle		1 ... 99%	
Amplitude accuracy		< 5% of amplitude	
Supported units		Hz, kHz, cph, cpm, 1/Hz(s), 1/kHz(ms), 1/MHz(μs)	

Pulse counting

IN (0 ... 9 999 999 pulses)

Input impedance	> 1 MΩ
Trigger level	Dry contact, wet contact -1 ... 14 V
Minimum signal amplitude	1 Vpp (< 10 kHz), 1.2 Vpp (10 ... 50 kHz)
Max frequency	50 kHz
Trigger edge	Rising, falling

⁽¹⁾ Accuracy includes hysteresis, nonlinearity and repeatability (k=2).

⁽²⁾ Uncertainty includes reference standard uncertainty, hysteresis, nonlinearity, repeatability and typical long term stability for mentioned period. (k=2)

Pulse generation

OUT (0 ... 9 999 999 pulses)

Resolution	1 pulse
Maximum load current	10 mA
Output amplitude positive pulse	0 ... 24 Vpp
Output amplitude symmetric pulse	0 ... 6 Vpp
Pulse frequency range	0.0005 ... 10000 Hz
Duty Cycle	1 ... 99%

Resistance measurement

R1 & R2 (0 ... 4000 Ω)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
-1 ... 100 Ω	0.001 Ω	4.5 m Ω	6 m Ω
100 ... 110 Ω	0.001 Ω	0.0045% RDG	0.006% RDG
110 ... 150 Ω	0.001 Ω	0.005% RDG	0.007% RDG
150 ... 300 Ω	0.001 Ω	0.006% RDG	0.008% RDG
300 ... 400 Ω	0.001 Ω	0.007% RDG	0.009% RDG
400 ... 4040 Ω	0.01 Ω	9 m Ω + 0.008% RDG	12 m Ω + 0.015% RDG
Measurement current		Pulsed, bi-directional 1 mA (0..500 Ω), 0.2 mA (>500 Ω).	
Supported units		Ω , k Ω	
4-wire connection		Measurement specifications valid	
3-wire measurement		Add 10 m Ω	

Resistance simulation

R1 (0 ... 4000 Ω)

Range	Resolution	Accuracy ⁽¹⁾	1 Year Uncertainty ⁽²⁾
0 ... 100 Ω	0.001 Ω	10 m Ω	20 m Ω
100 ... 400 Ω	0.001 Ω	5 m Ω + 0.005% RDG	10 m Ω + 0.01% RDG
400 ... 4000 Ω	0.01 Ω	10 m Ω + 0.008% RDG	20 m Ω + 0.015% RDG
Max resistance excitation current	5 mA (0 ... 650 Ω). Iexc * Rsim < 3.25 V (650 ... 4000 Ω).		
Min resistance excitation current	> 0.2 mA (0 ... 400 Ω). >0.1 mA (400 ... 4000 Ω).		
Settling time with pulsed excitation current	< 1ms		
Supported units	Ω , k Ω		

⁽¹⁾ Accuracy includes hysteresis, nonlinearity and repeatability (k=2).

⁽²⁾ Uncertainty includes reference standard uncertainty, hysteresis, nonlinearity, repeatability and typical long term stability for mentioned period. (k=2)

Modularity, options and accessories

Modularity and options

- All electrical / temperature functions are included as standard
- Two case bottom choices:
 - flat (no room for internal pressure modules, only Barometer)
 - extended (room for internal pressure modules)
- Optional internal pressure modules (up to four internal pressure modules; three standard and one barometric)
- Optional user-interface modes:
 - Documenting Calibrator
 - Data Logger
 - HART Communicator
 - FOUNDATION Fieldbus Communicator
 - Profibus PA Communicator
- Pressure / Temperature Controller Communications



Standard Accessories

- Accredited calibration certificate
- User guide
- Computer cable (USB)
- Battery charger / eliminator
- Internal LiPO battery pack
- Test leads and clips
- Appropriate pressure T-hose with internal low pressure modules
- CD-ROM with user manual, software tools and product information



Optional Accessories

- Soft Carrying Case
- Soft Accessory Case
- Hard Carrying Case
- Spare battery pack
- Adapter cables for the second RTD channel
- Cable for pressure and temperature controllers



Related products and services

Portable calibrators

Beamex's range of portable MC-calibrators for field calibration is known for their accuracy, versatility and also for meeting both high and uncompromised quality standards.

Workstations

A workstation can be considered ideal when most of the maintenance and calibration tasks are performed in the workshop. Beamex's workstation is a modular testing and calibration system designed for use in workshops and laboratories.

Temperature dry blocks

Beamex offers two different dry block series: the Beamex® FB Series Field Temperature Blocks and the Beamex® MB Series Metrology Temperature Blocks. The dry blocks in the FB Series are lightweight, high-accuracy temperature dry blocks for industrial use. The dry blocks in the MB Series deliver bath-level accuracy for industrial applications as well.

Calibration software

Beamex® CMX Calibration Management Software

The Beamex® CMX is calibration management software that assists in documenting, planning, analyzing and, finally, optimizing calibration work. The CMX's scalable technology and user configuration allows you to integrate it easily into other systems for a one-of-kind calibration system that fits your specific needs completely. The CMX also helps to meet the regulatory requirements, whether your plant's calibration system needs to comply with ISO 17025, cGMP or 21 CFR Part 11. By using the CMX, you will have all your calibration results in a traceable and auditable form, either printed on paper or stored in electronic format in a database.

Professional services

Recalibration and service

There are many benefits from using the services provided by Beamex's accredited calibration laboratory on a regular basis. It ensures that the calibration equipment remains in excellent condition and you are also able to provide, if needed, up-to-date proof of the calibrator's measurement accuracy. The Beamex Calibration Laboratory provides traceable calibration services in pressure, temperature, DC current, DC voltage, resistance and frequency.

Training and installation

Beamex provides worldwide services for installation and training. This way you are able to have your new calibration system up and running in no time. You also learn about the capabilities of Beamex calibration equipment, how to use it and how your organization will benefit the most from it.

Accessories

PG series of calibration pumps

The PG series includes hand-held, lightweight pressure and vacuum sources for field use. The PG series of hand pumps are ideal pressure/vacuum generators to be used as accessories for pressure and vacuum calibration.

External pressure modules

The external pressure modules introduce new configuration possibilities and add flexibility, as it is possible to calibrate even more pressure ranges with the same calibrator. This way, the Beamex calibration equipment meets your needs even better.

PORTABLE CALIBRATORS



WORKSTATIONS



PROFESSIONAL SERVICES



CALIBRATION SOFTWARE



beamex
WORLD-CLASS CALIBRATION SOLUTIONS®