MC4

Documenting Process Calibrator

beamex MC4

0.271   8.2829
T1   Err: -0.31

Menu   Numeric   Accept

F1   F2   F3

Temperature / Generate   Measure

T/C mV   R, RTD V, I   R meas sense   V, I

Max 60 V ~, 30 V ~, 100 mA

beamex
WORLD-CLASS CALIBRATION SOLUTIONS™

Document as you go

Calibration is an important part of any instrumentation maintenance program, but planning and executing the calibration program using manual tools and pen and paper is an error-prone, time consuming and expensive exercise.

With the help of a computerized calibration management system and documenting process calibrators communicating with each others, you can achieve better results and remarkable savings.

The Beamex® MC4 is a documenting process calibrator. Instrument data can be sent from a computer to the MC4, and calibration results can be uploaded from the MC4 to a computer using the Beamex® CMX calibration software.

Being a multifunctional calibrator, MC4 is suitable for calibrating various process parameters, such as pressure, temperature and electrical signals.

High accuracy is one of the important features of the MC4. A standard feature of the MC4 includes an accredited calibration certificate as proof of its accuracy. The correction coefficients of a PRT probe can be programmed into MC4 to further improve the temperature accuracy.

The large graphical display, menu-based multilingual user interface, and full numerical keyboard make it easy to learn and use the MC4.

A rechargeable internal battery pack and charger are standard accessories that support the effective use of the MC4. The membrane keyboard and integrated impact protectors make the MC4 a weatherproof and robust calibrator. The MC4 can have both internal and external pressure modules, making it extremely versatile.

With the MC4, it is easy and fast to make automated and documented calibrations of process instruments.

The high quality and functionality, combined with an affordable price, makes MC4 a great calibration tool.

Beamex® MC4 Documenting Process Calibrator

Beamex® MC4 Documenting Process Calibrator and Beamex® CMX Calibration Management Software make an efficient paperless computerized calibration system.

MC4 Measurement and Generation/Simulation Functionality

Features
Internal pressure module (optional)
Connection for external pressure modules
Current measurement (with internal and external supply)
Voltage measurement
Frequency measurement
Pulse counting
Switch sensing
Internal HART® compatible 24 VDC loop supply
Current generation (with internal and external supply)
Voltage generation
Frequency generation
Pulse generation
mV measurement / simulation
Resistance measurement / simulation
RTD measurement / simulation, supports Callendar van Dusen sensor coefficients for PRT sensors
Thermocouple measurement / simulation

Features of the MC4 Calibrator

1. **Versatile Calibration Mode**
The MC4 includes a versatile Calibration Mode, making it easy and effective to calibrate process instruments.

2. **All-in-one functionality**
The MC4 is a versatile calibrator with many different functions. There's no need to take several different measurement devices to the field, MC4 does the job.

3. **Accuracy guaranteed**
The MC4 is a highly accurate process calibrator. As a proof of this, each calibrator is delivered with a traceable, accredited calibration certificate.

4. **Calibration is fast and easy**
The large graphical display, menu-based multilingual user interface, and full numerical keyboard make the MC4 quick and easy to use.

Advanced features of MC4

Feature	Specification
Calibration Mode	MC4 includes a versatile Calibration Mode making it easy and effective to create and calibrate process instruments.
PRT sensor coefficients	Possibility to enter PRT sensor's correction coefficients into the MC4 enabling it to compensate sensor errors.
Error % display	When calibrating a transmitter, the transmitter's output may be displayed in an error % unit rather than in an engineering unit.
Error display in input or output units	When calibrating a transmitter, the transmitter's output may be displayed as error in input or output engineering units.
%-display	Any measurement or generation may be presented as a percent within the user-programmable range.
Scaling	A versatile, programmable scaling function allows the user to scale any measured or generated unit into any custom unit. Scaling also includes a rooting transfer function for flow applications, as well as custom transfer functions.
User setups	The unit has a large number of user-configurable setups that make it easy to save and quickly recall the desired configuration.
Leak testing	The leak test function indicates the pressure drop and leak rate during the user-programmable period.
Step and Ramp	The unit includes versatile and programmable automatic step and ramp generation function, as well as manual step function.
Programmable alarms	Any measurement can be programmed to have an alarm based on the measurement value or on its rate of change.
Damping	Programmable damping allows the user to select different filterings for the measurements.
Bar graph	The bar graph allows the user to display the measurement or generation as an analogue bar, including programmable starting and ending points.
Difference	Difference measurement allows the user to measure the difference between two pressure modules.
Deviation	The deviation function allows the user to display a deviation between a given reference value and the actual measurement.
Redundancy	Redundancy measurement allows the user to measure the same pressure using two pressure modules (internal and external) simultaneously. The unit's alarm sounds if the readings excessively differ from each other.
Additional information	The unit also allows the user to view various pieces of additional information such as Min / Max / Rate / Internal temperature / Thermocouple's thermovoltage / RTD sensor's resistance /, etc.

MC4 – General specifications for all models

General Specifications

Feature	Specification
Display	60 mm x 60 mm (2.36" x 2.36"), 160 x 160 pixels, back lit LCD
Weight	720…830 g (1.59…1.83 lbs)
Dimensions	215 mm (8.5") x 102 mm (4") x 49 mm (1.9") (d/w/h)
Keyboard	Membrane keyboard
Battery type	Rechargeable NiMH pack, 4000 mAh, 3.6V DC
Charging time	5 hours
Charger supply	100…240 VAC, 50–60 Hz
Battery operation	13…24 hours in measurement mode, back light off. 8…12 hours when sourcing an average of 12 mA to loop, with back light on.
Battery operation with optional dry battery cartridge and 4 alkaline AA cells	4…8 hours in measurement mode, back light off. 3…4 hours when sourcing an average of 12 mA to loop, with back light on.
Operating temperature	−10…50°C (14…122°F)
Operating temp. while charging batteries	0…35°C (32…95°F)
Storage temperature	−20…60°C (−4…140°F)
Humidity	0 to 80% R.H. non-condensing
Warm-up time	Specifications valid after a 5-minute warm-up period.
Max. input voltage	30 V AC, 60 V DC
Safety	Directive 73/23/EEC, EN 61010-1
EMC	Directive 89/336/EEC, EN 61326

Voltage measurement −1…60 V DC

Range	Resolution	1 Year Uncertainty(±) [1]
±0.25 V	0.001mV	0.02% RDG + 5 µV
±(0.25…1 V)	0.01 mV	0.02% RDG + 5 µV
1…25 V	0.1 mV	0.02% RDG + 0.25 mV
25…60 V	1 mV	0.02% RDG + 0.25 mV

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Input impedance	>1 MΩ
Supported units	V, mV, µV
Display update rate	3 / second

mA measurement ±100 mA

Range	Resolution	1 Year Uncertainty(±) [1]
±25mA	0.0001 mA	0.02% RDG + 1.5 µA
±(25…100 mA)	0.001 mA	0.02% RDG + 1.5 µA

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Input impedance	< 7.5 Ω
Supported units	mA, µA
Display update rate	3 / second

Loop supply

Feature	Specification
Maximum output current	> 25 mA, short circuit protected
Output voltage	24 V ± 10%
Output impedance in HART® compatible mode	300 Ω ± 20%

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2).

Electrical measurements

Frequency measurement 0.0027…50 000 Hz

Range	Resolution	1 Year Uncertainty(±)[1]
0.0027…0.5 Hz	0.000001 Hz	0.01% RDG
0.5…5 Hz	0.00001 Hz	0.01% RDG
5…50 Hz	0.0001 Hz	0.01% RDG
50…500 Hz	0.001 Hz	0.01% RDG
500…5000 Hz	0.01 Hz	0.01% RDG
5000…50000 Hz	0.1 Hz	0.01% RDG

Feature	Specification
Temperature coefficient	Specification valid from −10 to 50°C (14…122°F)
Input impedance	> 1 MΩ
Trigger level	−1…14 V in 1 V steps and open collector inputs
Minimum signal amplitude	2 Vpp (< 10 kHz), 3 Vpp (10…50 kHz)
Supported units	Hz, kHz, cph, cpm, 1/Hz (s), 1/kHz (ms), 1/MHz (µs)
Gate period	267 ms + 1 signal period

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2)

Pulse counting 0…9 999 999 pulses

Feature	Specification
Range	0 to 9 999 999 pulses
Input impedance	> 1 MΩ
Trigger level	−1…14 V in 1 V steps and open collector inputs
Minimum signal amplitude	2 Vpp (pulse length > 50 µs), 3 Vpp (pulse length 10…50 µs)

Switch test

Feature	Specification	
Potential free contacts	Test voltage (Trigger level)	3 V, 0.13 mA (1 V) or 24 V, 35 mA (2 V)
Voltage level detection	Trigger level Input impedance	−1…14 V in 1 V steps > 1 MΩ

Pressure Measurements

Internal Pressure Modules (NPM)

Internal Module [3]	Unit	Range [2]	Resolution	1 Year Uncertainty($\pm$) [1]
NPM200mC	kPa mbar iwc	$\pm$20 $\pm$200 $\pm$80	0.001 0.01 0.001	0.035% FS + 0.05% RDG
NPM2C	kPa bar psi	−100 to 200 −1 to 2 −14.5 to 30	0.001 0.00001 0.001	0.015% FS + 0.035% RDG
NPM20C	kPa bar psi	−100 to 2000 −1 to 20 −14.5 to 300	0.01 0.0001 0.01	0.015% FS + 0.035% RDG
NPM160	MPa bar psi	0…16 0…160 0…2400	0.0001 0.001 0.01	0.015% FS + 0.035% RDG
Barometric option	Also enables absolute pressure measurement for the above pressure inputs. When using the barometric option, add 0.1 kPa (0.0146 psi) uncertainty for absolute pressure measurement.			

Feature	Specification
Temperature coefficient	< $\pm$0.001% RDG /°C outside 15…35°C. < $\pm$0.0006% RDG /°F outside 59…95°F
Maximum overpressure	2 × Range
Pressure port	G 1/8" female (G 1/8 (ISO 228/1) 60° internal cone adaptor, except IPM160)
Media compatibility	Wetted parts: AISI316 stainless steel, Nitrile rubber.
Supported pressure units	Pa, hPa, kPa, MPa, mbar, bar, lbf/ft^2, psi, ozf/in^2, gf/cm^2, kgf/cm^2, kgf/m^2, kp/cm^2, at, mmH$_2$O, cmH$_2$O, mH$_2$O, iwc, ftH$_2$O, mmHg, cmHg, mHg, inHg, mmHg(0°C), inHg(0°C), mmH$_2$O(4°C; 60°F; 68°F/20°C), cmH$_2$O(4°C; 60°F; 68°F/20°C), inH$_2$O(4°C; 60°F; 68°F/20°C), ftH$_2$O(4°C; 60°F; 68°F/20°C), torr, atm, + **four (4) user-configurable units**
Display update rate	2.5 / second

External Pressure Modules (EXT) Standard Accuracy

External Module	Range [2]		Resolution	1 Year Uncertainty($\pm$) [1]
EXT200mC-s	$\pm$200 mbar	$\pm$80 iwc	0.01 mbar 0.01 iwc	0.05% RDG + 0.05% FS
EXT2C-s	−1…2 bar	−14.5…30 psi	0.0001 bar 0.001 psi	0.05% FS
EXT20C-s	−1…20 bar	−14.5…300 psi	0.001 bar 0.01 psi	0.05% FS
EXT160-s	0…160 bar	0…2400 psi	0.01 bar 0.1 psi	0.05% FS

External Pressure Modules (EXT) High Accuracy

Module	Range [2]		1 Year Uncertainty($\pm$) [1]
Barometric	800…1200 mbar abs	23.6…35.4 inHg a	0.5 mbar (0.015 inHg)
EXT10mD	$\pm$10 mbar differential	$\pm$4 iwc differential	0.05% Span + 0.1% RDG
EXT100m	0…100 mbar gauge	0…40 iwc	0.025% FS + 0.025% RDG
EXT400mC	$\pm$400 mbar	$\pm$160 iwc	0.02% FS + 0.025% RDG
EXT1C	$\pm$1 bar	−14.5…15 psi	0.015% FS + 0.025% RDG
EXT2C	−1…2 bar	−14.5…30 psi	0.01% FS + 0.025% RDG
EXT6C	−1…6 bar	−14.5…90 psi	0.01% FS + 0.025% RDG
EXT20C	−1…20 bar	−14.5…300 psi	0.01% FS + 0.025% RDG
EXT60	0…60 bar	0…900 psi	0.01% FS + 0.025% RDG
EXT100	0…100 bar	0…1500 psi	0.01% FS + 0.025% RDG
EXT160	0…160 bar	0…2400 psi	0.01% FS + 0.025% RDG
EXT250	0…250 bar	0…3700 psi	0.015% FS + 0.025% RDG
EXT600	0…600 bar	0…9000 psi	0.015% FS + 0.025% RDG
EXT1000	0…1000 bar	0…15000 psi	0.015% FS + 0.025% RDG

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2)
2) The internal pressure module's range may also be displayed in absolute pressure if a Barometric Module is used.
3) The MC4 Calibrator can hold one internal pressure module and the barometric option.
All external pressure modules (EXT) are also compatible with Beamex MC2, MC5 and MC5P Calibrators.

Electrical generation, measurement and simulation

mV measurement (T/C-terminals) –25…150 mV

Range	Resolution	1 Year Uncertainty(±) [1]
–25…150 mV	0.001 mV	0.02% RDG + 4 µV

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Input impedance	> 10 MΩ
Supported units	V, mV, µV
Display update rate	3 / second

mV generation (T/C-terminals) –25…150 mV

Range	Resolution	1 Year Uncertainty(±) [1]
–25…150 mV	0.001 mV	0.02% RDG + 4 µV

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Maximum load current	5 mA
Load effect	< 5µV/mA
Supported units	V, mV, µV

Voltage generation –3…12 V

Range	Resolution	1 Year Uncertainty(±) [1]
±0.25 V	0.01 mV	0.02% RDG + 0.1 mV
–3…–0.25 V	0.1 mV	0.02% RDG + 0.1 mV
0.25…12 V	0.1 mV	0.02% RDG + 0.1 mV

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Maximum load current	5 mA
Load effect	< 50 µV/mA
Supported units	V, mV, µV

mA generation (source/sink) 0…25 mA

Range	Resolution	1 Year Uncertainty(±) [1]
0…25 mA	0.0001 mA	0.02% RDG + 1.5 µA

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Max load impedance (source)	750 Ω (0…20 mA), 600 Ω (20…25 mA)
Max loop voltage (sink)	60 V
Supported units	mA, µA

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2).

Electrical generation, measurement and simulation

Resistance measurement 0…4000 Ω

Range	Resolution	1 Year Uncertainty(±) [1]
0…250 Ω	1 mΩ	4-wire connection:
250…2650 Ω	10 mΩ	0.02% RDG + 3.5 mΩ
2650…4000 Ω	100 mΩ	3-wire connection:
		0.02% RDG + 13.5 mΩ

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Measurement current	Pulsed, bi-directional 1 mA (0…500 Ω), 0.2 mA (>500 Ω).
Supported units	Ω, kΩ
Display update rate	3 / second

Resistance simulation 0…4000 Ω

Range	Resolution	1 Year Uncertainty(±) [1]
0…400 Ω	10 mΩ	0.04% RDG or 30 mΩ (Whichever is greater)
400…4000 Ω	100 mΩ	0.04% RDG or 30 mΩ (Whichever is greater)

Feature	Specification
Temperature coefficient	< ±0.0015% RDG / °C outside of 18…28°C < ±0.0008% RDG / °F outside of 64.4…82.4°F
Maximum Resistance excitation current	5 mA (0…650 Ω) Iexc × Rsim < 3.25 V (650…4000 Ω)
Settling time (pulsed currents)	1 ms
Supported units	Ω, kΩ

Specification valid with an exitation current >0.2 mA (0...400 ohm), >0.1 mA (400...4000 ohm)

Frequency generation 0.0005…10 000 Hz

Range	Resolution	1 Year Uncertainty(±) [1]
0.0005…0.5 Hz	0.000001 Hz	0.01% RDG
0.5…5 Hz	0.00001 Hz	0.01% RDG
5…50 Hz	0.0001 Hz	0.01% RDG
50…500 Hz	0.001 Hz	0.01% RDG
500…5000 Hz	0.01 Hz	0.01% RDG
5000…10000 Hz	0.1 Hz	0.01% RDG

Feature	Specification
Temperature coefficient	Specification valid from –10 to 50°C (14…122°F)
Maximum load current	5 mA
Output amplitude positive square wave	0…12 Vpp ±(0.2 V+5%)
Output amplitude symmetric square wave	0…6 Vpp ±(0.2 V+5%)
Duty cycle	1…99% (0.0009…500 Hz), high / low time: min 25µs, max 1165 s
Supported units	Hz, kHz, cph, cpm, 1/Hz (s), 1/kHz (ms), 1/MHz (µs)
Jitter	< 0.28 µs

Pulse generation 0…9 999 999 pulses

Feature	Specification
Range	0 to 9 999 999 pulses
Resolution	1 pulse
Maximum load current	5 mA
Output amplitude positive pulse	0…12 Vpp ±(0.2 V+5%)
Output amplitude symmetric pulse	0…6 Vpp ±(0.2 V+5%)
Pulse frequency	0.0005…10 000 Hz
Duty cycle	1…99% (0.0009…500 Hz), high / low time: min 25µs, max 1165 s

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2).

Temperature measurement and simulation

Thermocouple measurement and simulation

Thermocouple types available as standard			
Type	Range (°C)	Range (°C)	1 Year Uncertainty (±) [1]
B [2]	0…1820	0…200 200…500 500…800 800…1820	[3] 2.0°C 0.8°C 0.6°C
R [2]	–50…1768	–50...0 0…50 50…1400 1400…1768	1.0°C 0.7°C 0.5°C 0.6°C
S [2]	–50…1768	–50…0 0…50 50…1500 1500...1768	1.0°C 0.7°C 0.6°C 0.7°C
E [2]	–270…1000	–270…–200 –200…0 0…600 600…1000	[3] 0.07°C + 0.08% RDG 0.07°C + 0.015% RDG 0.026% RDG
J [2]	–210…1200	–210…–200 –200…0 0…1200	[3] 0.08°C + 0.07% RDG 0.08°C + 0.02% RDG
K [2]	–270…1372	–270…–200 –200…0 0…1000 1000…1372	[3] 0.1°C + 0.1% RDG 0.1°C + 0.02% RDG 0.03% RDG
N [2]	–270…1300	–270…–200 –200…–100 –100…0 0…750 750…1300	[3] 0.02% RDG 0.15°C + 0.05% RDG 0.15°C + 0.01% RDG 0.03% RDG
T [2]	–270…400	–270…–250 –250…–200 –200…0 0…400	[3] 0.7°C 0.1°C + 0.1% RDG 0.1°C + 0.01% RDG
U [4]	–200…600	–200…0 0…600	0.15°C + 0.1% RDG 0.15°C + 0.01% RDG
L [4]	–200…900	–200…0 0…900	0.13°C + 0.07% RDG 0.13°C + 0.02% RDG
C [5]	0…2315	0…900 900…2000 2000…2315	0.4°C 0.045% RDG 1.2°C
G [6]	0…2315	0…70 70…200 200…1600 1600…2000 2000…2315	[3] 1.0°C 0.5°C 0.7°C 1.0°C
D [5]	0…2315	0…1000 1000…2000 2000…2315	0.4°C 0.04% RDG 1.2°C

Feature	Measurement	Simulation
Resolution	0.01°C	0.01°C
Temperature coefficient	< ±0.0015% of thermovoltage / °C outside of 18…28°C < ±0.0008% of thermovoltage / °F outside of 64.4…82.4°F	< ±0.0015% of thermovoltage / °C outside of 18…28°C < ±0.0008% of thermovoltage / °F outside of 64.4…82.4°F
Input impedance	>10 MΩ	–
Supported units	°C, °F, K	°C, °F, K
Display update rate	3 / second	–
Maximum load current	–	5 mA
Load effect	–	< 5 µV/mA

Temperature measurement and simulation

Internal Reference Junction

Range (°C)	1 Year Uncertainty
−10…50°C	±0.25°C

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2).
    Uncertainty does not include reference junction uncertainty.
2) IEC 584, NIST MN 175, BS 4937, ANSI MC96.1
3) ±0.02% of thermovoltage + 4 µV
4) DIN 43710
5) ASTM E 988 - 96
6) ASTM E 1751 - 95e1

RTD measurement and simulation

Sensor Type	Range	Resolution	Measurement 1 Year Uncertainty (±) [1]	Simulation 1 Year Uncertainty (±) [1] [2]
Pt 50…1000	−200…0°C 0…850°C	0.01°C	0.06°C 0.06°C + 0.025% RDG	0.10°C 0.10°C + 0.025% RDG
Ni 100	−60…180°C	0.01°C	0.06°C	0.12°C
Ni 120	−80…260°C	0.01°C	0.06°C	0.12°C
Cu10	−200…260°C	0.01°C	0.2°C	0.8°C

Feature	Measurement	Simulation

Temperature coefficient	< ±0.0015%
	   of resistance / °C outside of 18…28°C
	< ±0.0008%
	   of resistance / °F outside of 64.4…82.4°F
		< ±0.0015%
		   of resistance / °C outside of 18…28°C
		< ±0.0008%
		   of resistance / °F outside of 64.4…82.4°F

Measurement current	Pulsed, 1 mA (0..500 Ω), 0.2 mA (>500 Ω).	–
Maximum Resistance excitation current	–	5 mA (0…650 Ω) Iexc × Rsim < 3.25 V (650…4000 Ω)
Supported units	°C, °F, K	°C, °F, K
Display update rate	3 / second	–
Settling time (pulsed currents)	1 ms	–

RTD types available as standard				
Pt50 (385)	Pt400 (385)	Pt100 (3926)	Pt100 (3923)	Cu10 (427)
Pt100 (385)	Pt500 (385)	Pt100 (391)	Ni100 (618)	
Pt200 (385)	Pt1000 (385)	Pt100 (375)	Ni120 (672)	

1) Uncertainty includes reference standard uncertainty, hysteresis, non-linearity, repeatability and typical long-term stability for the mentioned period. (k=2).
2) Specification valid with an excitation current >0.2 mA (0...400 Ω), >0.1 mA (400…4000 Ω)

MC4 supports Callendar van Dusen correction coefficients for PRT sensors to compensate sensor error.

Standard Accessories

- User guide
- Calibration certificate
- Internal rechargeable NiMH battery pack + battery charger
- Test leads and clips
- USB cable
- Adapter pressure connector – from G1/8" female to G 1/8" male
  with 60° internal cone (included in models with internal pressure module)

Optional Accessories

- Pressure T-hose
- Soft carrying case
- Connection cable for external pressure modules
- Dry battery cartridge
- Calibration handpumps

All specifications are subject to change without prior notice.
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Portable calibrators

Workstations

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