

signal

**Sources and measures current**

Allows for calibration of transmitters in a two-wire loop

**Stable source**

Internal 24 VDC supply for consistent loop power

**High resolution**

Read to 0.001 mA in the measurement mode

**% of full scale reading**

Displays a percentage to provide for easy analysis of results

**Fixed step function**

Allows you to easily calibrate linear or flow transmitters and valve positioners

**Manual or automatic stepping function**

You can choose to use either method and have 10 to 30 seconds between steps

**Timesaving features**

Fast one-key-one-function access to the features such as the step function or loop supply power

**Large display**

Includes large numbers for unit reading, a percentage display, and dedicated icons for calibrator status including a low battery indicator

**Traceable calibration**

For your confidence, the unit is supplied with a calibration certificate that is fully traceable to a national standards lab such as NIST or NPL

ISO 9001 Manufacturer

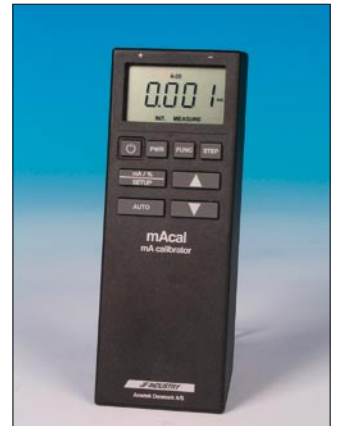
# JOFRA™ mAcal

## milliAmp calibrator

### Compact loop calibrator ideal for field use

The mAcal Milliamp Calibrator is an economical and easy-to-use calibration device for sourcing and measuring mA signals.

The instrument is designed specifically for 2-wire transmitter loops with 4 to 20 mA signals and it is delivered with traceable certification.



### PRODUCT DESCRIPTION

The JOFRA mAcal keypad is easy-to-use and provides positive tactile feedback to the user. Each key is labeled for easy operation. A large, high-contrast, 5-digit LCD display indicates numeric values in mA, %, V or sec. The resolution is 0.001 mA in measurement mode. The user can change the display to read in % of Full Scale and flow readings are shown in % of Flow.

The display also indicates error codes. Visual warnings are displayed for loop mismatch, reverse polarity and over range. Plus, the unit is equipped with a user adjustable automatic shut-off feature that prevents accidental battery discharge when the unit is not in use. A built-in, permanent fuse eliminates the need to replace the fuse in the case of overloads: no need to return the unit to the factory to reset or replace the fuse.

The mAcal Loop Calibrator provides loop power in the range of 0 to 45 VDC and the instrument is designed to generate a stable 24 VDC supply for the loop. The mAcal Loop Calibrator also reduces the time and complexity often associated with loop calibration. The instrument features special fixed steps for performing linear and flow transmitter or valve positioner calibrations. The instrument has seven different built-in current values and the user may choose between manual or automatic steps with 10 or 30 seconds between steps. You can perform an entire test by placing the mAcal in the process loop and take readings from the control room.

**AMETEK®**  
CALIBRATION INSTRUMENTS

## JOFRA mA<sub>CAL</sub> CALIBRATOR

### PWR

Switch between external and internal loop power supply EXT. (the +24 VDC of the current loop is generated by an external power supply) and INT. (the +24 VDC of the current loop is generated by the mA<sub>Cal</sub> itself).

### Mains adapter

Connection to mains adapter. 6 VDC, 230 mA.  
Note : The mains adapter does not charge rechargeable batteries.

### ON/OFF

Switching instrument on/off. Auto shut-off to extend battery life (user programmable).

### mA/% / setup

Alternating between readout in mA and %. If the key is held down for more than 2 sec., a change to SETUP takes place. Under SETUP this key is used to select next parameter.

### Auto

AUTO ramp or AUTO-STEP function is started or stopped.

### Connection

Connection of + test lead

### Connection

Connection of - test lead

### Display

Shows numerical value in mA, %, V or sec., and for readout of error codes etc.

### FUNC

This key allows for changing functions between SOURCE mA, MEASURE mA and MEASURE Volt function.

### Step

The STEP function is activated or de-activated.

### Up arrow

Functions to increase entered values or to scroll up.

### Down arrow

Functions to decrease entered values or to scroll down.



### JOFRA mA<sub>Cal</sub> in softcase

The mA<sub>Cal</sub> calibrator is available separately and are supplied in a handy softcase that allows for complete operation of the unit while in the case. The convenient internal arrangement offers you the space to store test leads.

**FUNCTIONAL SPECIFICATIONS**

**PHYSICAL SPECIFICATIONS**

**Current source**

Range:.....0 to 24 mA  
 Resolution:.....0.01 mA  
 Accuracy (k=2): ..... ±0.05% of F.S.  
 Maximum load: ..... 900 ohm  
 Temperature coefficient: ..... 0.005% per °C (-10 to 40°C)  
 ..... 0.003% per °F (-14 to 104°F)

**Current measurement**

Range:.....0 to 24 mA  
 Resolution:.....0.001 mA  
 Accuracy (k=2):..... ± 0.05% of F.S.  
 Input impedance: ..... 10 ohm  
 Temperature coefficient: ..... 0.003% per °C (-10 to 40°C)  
 ..... 0.002% per °F (-14 to 104°F)

**Voltage measurement**

Range:..... -45V to +45 VDC  
 Resolution:.....0.1 VDC  
 Accuracy: ..... ± 0.5 VDC  
 Input impedance: ..... 10M ohm

**Instrument weight (incl. batteries, leads and case)**

Weight .....0.8 lbs /355g

**Instrument dimensions (incl. batteries, leads and case)**

Size: L x W x H..... 6.85 x 2.6 x 1.0 in / 174 x 66 x 26 mm

**Miscellaneous**

Operating (ambient) temperature ....-14 to 104°F (-10 to 40°C)  
 Storage (ambient) temperature.....-4 to 122°F (-20 to 50°C)  
 CE Conformity..... 89/336/EEC, EN50081-1, EN50081-2,  
 EN50082-1, EN50082-2, (91/157/EEC)

**OTHER SPECIFICATIONS**

**Power supply**

120 VDC Mains Adapters: ..... 103964, 6 VDC / 240 mA US/  
 Japan- 1.3mm DC female connector  
 Batteries ..... 4 Type LR6, AA, 1.5 VDC Alkaline  
 Battery life .....200 hours with external loop power  
 20 hours with 12 mA output/internal loop power  
 Warranty: .....2-year Factory Warranty



Fig. 1

**Adjusting the instrument**

Connect the mAcal to an external reference instrument as shown in Fig. 1. The mAcal now carries out a self-calibration and adapts its circuits to that measured. Switch on the mAcal. It is now adjusted and ready for use.

Note: The mAcal can only be adjusted in mA. Adjustment of the VDC function is not possible.

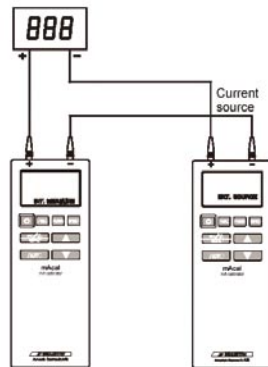


Fig. 2

**Calibrating the instrument (measure mA)**

Connect the mAcal to an external reference instrument and a current source as shown in Fig. 2.

Calibration is carried out in the following points: 0 mA, 4 mA, 8 mA, 12 mA, 16 mA, 20 mA and 24 mA. If the mAcal displays EEEEE when measuring the 24 mA, you must turn down the current until the EEEEE disappears.

Calibration must subsequently be carried out at a lower value (e.g. 23.995 mA).

The deviation between the read value of the mAcal and the read value of the reference instrument must be 8 µA at a maximum.



Fig. 3

**Calibrating the instrument (source mA)**

Connect the mAcal to an external reference instrument as shown in Fig. 3.

Calibration is carried out in the following points: 0 mA, 4 mA, 8 mA, 12 mA, 16 mA, 20 mA and 24 mA. The deviation between the adjusted value of the mAcal and the read value of the reference instrument must be 8 µA at a maximum.

## ORDERING INFORMATION

Part No.	Description
75-MACAL	mAcal Calibrator with standard accessories

## STANDARD DELIVERY

### mAcal Calibrator:

- mAcal
- Soft carrying case
- 2 test leads with crocodile clip
- 4 batteries, type LR6, AA
- User manual

## ACCESSORIES

Part no.	Description
103964	120 VAC Adapter (US / Japan)
103950	230 VAC Adapter (Euro)
103957	230 VAC Adapter (UK)
124716	4 x 1,5 Volt rechargeable batteries
124718	Charger for 124716 batteries - 115/230 VAC



**AMETEK Calibration Instruments** offers a complete range of calibration equipment for temperature, pressure, and signal - including calibration software.

**JOFRA Temperature standards**  
Portable precision thermometer. Dry-block and liquid bath calibrators: 4 series, with more than 20 models - featuring speed, portability, accuracy and advanced documenting functions with JOFRACAL temperature calibration software.

**JOFRA Pressure standards**  
Convenient electronic systems ranging from -1 to 700 bar (25 inHg to 10,000 psi) - multiple choices of pressure ranges, pumps and accuracies, fully temperature-compensated for problem-free and accurate field use.

**JOFRA Signal calibration**  
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**JOFRA / JF Marine Instruments**  
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*...because calibration is  
a matter of confidence*

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CALIBRATION INSTRUMENTS

AMETEK Calibration Instruments is one of the world's leading manufacturers and developers of calibration instruments for temperature, pressure and process signals as well as for temperature sensors both from a commercial and a technological point of view.

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Pub code SS-CP-2320-US Issue 0605

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