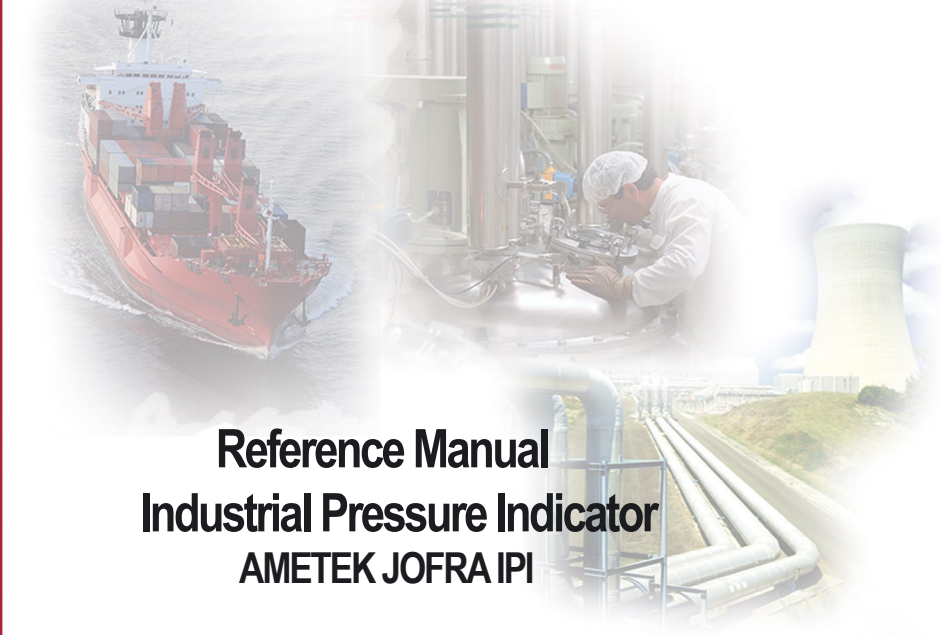




Reference Manual Industrial Pressure Indicator AMETEK JOFRA IPI

© Copyright 2005 AMETEK Denmark A/S



*temperature
pressure
signal
software*



Introduction

The IPI combines the high accuracy of digital electronics with the convenience and ease of use of an analog test gauge. Accurate to $\pm 0.05\%$ FS, the IPI can be used as a calibration reference, or in any application where high accuracy pressure measurement is required.

Many user configurable functions have been designed into the IPI including sampling rate, TARE, damping, auto shut off, and min-max. Once the gauge is configured, settings can be locked and password protected to prevent unauthorized changes to configuration.

1.1 Contacting Ametek

US, Canada, Latin America
Europe, Africa, Middle East

Asia

AMETEK TCI at **1-800-527-9999**
AMETEK Denmark A/S at
+ 45 4816 8000
AMETEK Singapore Pte. Ltd. at
+ 65 (64) 842 388

1.2 Standard Equipment

Check to see that your IPI has arrived intact. Batteries are factory installed unless you have purchased the optional 24V powered version, in which case batteries are not supplied or installed. Save the packing materials at least until you have verified that there is no concealed damage.

1.3 Safety information

A Warning identifies conditions and actions that pose hazard(s) to the user; a Caution identifies conditions and actions that may damage the Calibrator or the equipment under test.

Symbols Used

The following table lists the International Electrical Symbols. Some or all of these symbols may be used on the instrument or in this manual.

Symbol	Description
	Power OFF
	Power ON
	Earth ground
	Risk of Danger. Important information. Refer to manual.
	Battery
	Hazardous Voltage
	Conforms to ATEX requirements
	Certified by CSA as conforming to relevant Canadian and USA standards
	Conforms to relevant European Union directives.
	Wheeled bin, conforms to EC directive 2002/96/EC

Hazard Location Information

Ex Hazardous Areas

An Ex-hazardous area as used in this manual refers to an area made hazardous by the potential presence of flammable or explosive vapors. These areas are also referred to as hazardous locations, see NFPA 70 Article 500 or CSA C22.1 Section 18.

Certification

This product is certified by CSA with the following rating:
Class I, Div. 2, Groups A-D



Misuse

Should the BetaGauge be exposed to overpressure or sudden physical shock (i.e. being dropped) it should be examined for any damage that may

cause a safety concern. If in doubt please return the unit for evaluation to Ametek. Please refer to the Customer Service Section for contact information.

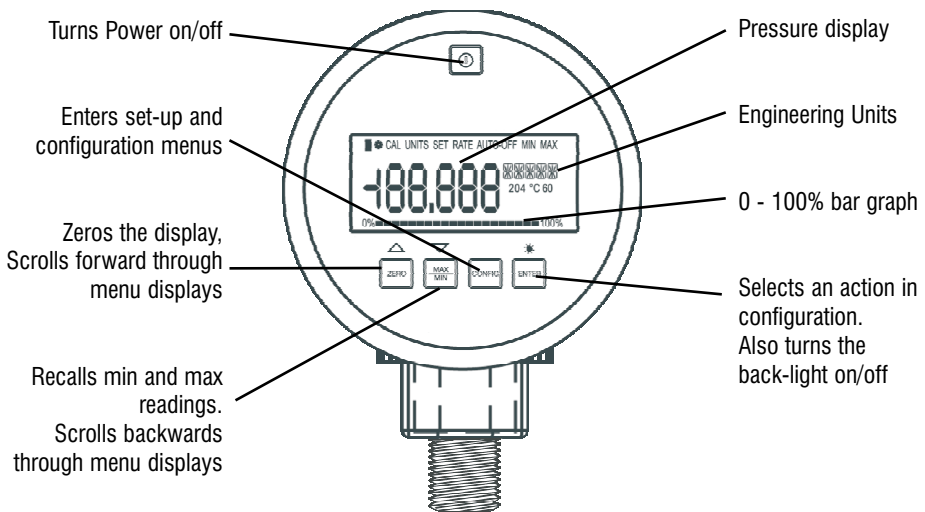


Caution

To avoid possible damage to calibrator or to equipment under test:

- If the message changes to "OL" the range limit is exceeded and the pressure source must immediately be removed from the IPI to prevent damage to the pressure transducer inside.
- Maximum torque allowed is 13,5 Nm = 10 ftlbs. NEVER exceed the torque allowed.

IPI Display and Controls



Operation

Power: The standard IPI is supplied with 3 AA batteries installed. If you purchased the optional 24Volt powered version, batteries are not installed. Connect a 24V power supply to the terminal block on the rear of the gauge, noting proper polarity.

Do not install batteries when external power will be used.

Push the power button momentarily to turn the unit on. Push it again to turn it off.

Set-up and configuration:

Push the CONFIG button to access the user-settable functions on the gauge. Each time the CONFIG button is pressed; the display advances to the next

function. Once a function has been set, press ENTER to exit the configuration menu, or CONFIG to continue with further configuration. In order, the configuration menu and operation is as follows:

1. **Engineering Units set.** The unit is shipped configured to display PSI. By pressing the ▲ and ▼ (ZERO and MAX/MIN) keys you can scroll forward and backwards through the 18 standard engineering units plus a one custom unit/scale. When the desired unit is displayed, press ENTER or CONFIG. Pressure will now be displayed in the chosen engineering units.

See the Specifications section of this manual for a list of available engineering units. See the Supervisory Mode section for details on setting up custom units.

2. **Set Auto Off.** The auto-shut off can be set in 1 minute increments from 1 to 30 minutes or “off” (continuous operation). The unit is shipped set for 30 minutes. Use the ▲ and ▼ keys to set the desired interval. The “off” setting is at the low end of the choices, below 1 minute.
3. **Display battery voltage.** Actual voltage and a percent of life bargraph indicate battery condition
4. **Display actual temperature.** The IPI is temperature compensated, this displays the temperature measured by the internal sensor. The value can be set to degrees F or degrees C using the arrow keys.
5. **Set damping.** Choices are “on” and “off” set with the ▲ and ▼ keys. Turning damping on will smooth readings from pulsating pressure sources.
6. **Set sample rate:** This determines how often pressure is sampled and the display is updated. Choices are 0.5, 1, 3, and 10 samples/second. Note that 10/sec provides the fastest response time.
7. **Set TARE.** This allows you to set a constant offset value, which is then subtracted from the measured pressure. For example if a TARE is set at 30 PSI, and the measured pressure is 37 PSI, the displayed value will be 7 PSI.
A pressure of 27 PSI would be displayed as -3 PSI.

The tare value is set manually with the ▲ and ▼ keys, and is based on the engineering units and resolution selected for display. TARE value can be set to the maximum range of the gauge.

The bar graph will always display the actual pressure based on the full range of the gauge regardless of the tare setting. This is done for safety to insure that even with a “0” reading that pressure is being applied to the gauge.

8. **Function Lock:** Access to each of the settable parameters above can be turned “off” once set, to prevent unauthorized changes to configuration. This is accomplished through a password protected “supervisory mode”. Press ENTER to access the supervisory mode, or CONFIG to return to normal operation.

Supervisory Mode

Push the CONFIG button to access the user-settable functions on the indicator. Each time the CONFIG button is pressed; the display advances to the next function. Press CONFIG repeatedly until “FUnC LOCK” is displayed.

Press ENTER when “FUnC LOCK” is displayed, 0^{PWRD} will be displayed on the gauge. The password to enter supervisory mode is 101, set using the ▲ and ▼ keys. Holding a key continuously will cause the display to advance more quickly for faster setting. The password is factory set and cannot be changed.

1. Your IPI is shipped from the factory with all setting access “unlocked” or available to be changed.
2. In supervisory mode each of the parameters can be locked or unlocked using the ▲ and ▼ keys. Select LOC (lock) for those parameters you do not want to be accessible, and UnLOC (unlock) for those can be accessed.
3. In order, the functions that can be unlocked, locked or accessed are:
 - Zero function (enable/disable)
 - Set pressure units (enable/disable)
 - Auto shutdown adjustment (enable/disable)
 - Damping settings (enable/disable)
 - Sample rate setting (enable/disable)
 - Tare setting (enable/disable)
 - Custom engineering units (set scale factor)
4. Use the CONFIG key to scroll through the above choices, and the ▲ and ▼ keys to lock and unlock features. Press CONFIG to continue scrolling through the parameters, pressing ENTER at any point saves your settings and returns the gauge to normal operation.

When a function is “locked”, it cannot be accessed or changed from its current state. To change a locked function, enter the supervisory mode, and unlock the function. Once it is changed, you may enter supervisory mode to lock access again.

5. Setting a custom engineering unit or scale: The last menu choice in supervisory mode is SET FACTR. This allows you to set a multiplier

factor from 0.001 to 100, creating a custom scale. The set factor will be multiplied by the PSI measured, the result will be displayed.

For example: 40 PSI is the equivalent of 1000 lbs of product in a tank. You want to display the product weight, using a 100 PSI gauge. By setting a factor of 25, a 40 PSI pressure would display as 1000 (40 x 25). The engineering unit displayed on the IPI will be "Cust".

Normal Operation

Turning the backlight on and off: Press the ENTER button.

Zeroing the display: Press and hold the ZERO button.

MAX/MIN: The IPI stores minimum and maximum pressure values in memory. Pressing the MAX/MIN button once will display the minimum pressure from memory. Pressing the MAX/MIN button again will display the maximum pressure from memory. After about 2 seconds, the gauge returns to normal (live display) operation. To clear the MAX/MIN memory registers, press and hold the MAX/MIN button for 2 or more seconds until "CLr" is displayed.

The analog bar graph at the bottom of the display indicates the applied pressure level relative to the full range of the gauge. Keep in mind that if a TARE value has been programmed into the gauge, the displayed pressure will not reflect the true pressure applied.

Changing the Batteries



Explosion hazard

Batteries must only be changed in an area known to be non-hazardous.

Grasp the face ring on the IPI, turn it approximately ¼ turn counterclockwise and remove. The face of the gauge can now be lifted to expose the battery holder. Take off the battery hold clip and remove the batteries. Install three AA batteries noting proper polarity. Note: Use **ONLY** AA size batteries and be sure to reinstall the battery holder retaining clip. Reassemble the case making certain that the face is properly oriented.

If you purchased the optional 24 Volt powered version, the terminals for power input are located on the rear of the gauge. To apply power simply connect 24 volts to the rear terminal block taking care to observe proper polarity.

WARNING

Gauges ordered with the external power option will not come with batteries installed. Batteries **MUST NOT** be installed when operating on external power. External power option gauges are not approved for hazardous location use.

Battery life

Battery life is about 1500 hours (60 days) of continuous use with the backlight off. With intermittent use, batteries could last a year or more. There is a low battery icon in the upper left of the display. It will appear when battery level is low. Replace batteries per recommendations found in the specifications section of this manual.

RS-232 Interface

An RS-232 interface is standard on the IPI. Serial communication can be used for configuration, calibration, and to transfer measurement data from the gauge. For detailed specifications on the interface and software communication, contact the factory at 603-434-1433 and request a copy of our interface manual.

WARNING

The RS-232 interface must not be used in hazardous areas.

CLEANING

To clean the BetaGauge use a cloth with a mild cleaning solution.

Specifications

All specifications cover the temperature range from 0°C to +50°C, unless otherwise noted.

Available Input Ranges

See page 14 for a table of available ranges in PSI plus equivalent ranges and resolution for all engineering units

Accuracy

Positive Pressure: $\pm 0.05\%$ FS

Vacuum: $\pm 0.25\%$ FS (500 PSI gauge ranges and below)

0.1% FS for 15/30 PSI compound/vacuum versions

For gauges with full scale ranges equal to, or less than 30 psi (2 BAR), vacuum operation is limited to -5psi (-350 mBAR). The exception is the 30 PSI compound/vacuum model which will operate to -14.7 PSI.

Over Pressure Protection:

Ranges from 15 PSI to 500 PSI/1 to 35 bar: 3X input pressure range

1,000, 3,000, and 5,000 PSI/70 to 350 bar ranges: 2X input pressure range

10,000 PSI/700 bar: 1.5X input pressure range

Overload Alarm (indicate OL on display): 1.2X input pressure range

Temperature Compensation

0 °C to +50 °C (32 °F to +122 °F) to rated accuracy

Note: For temperatures from -10 °C to 0 °C and 50 °C to 55 °C add .005% F.S./°C

Standard Engineering Units

PSI, Bar, kg/cm², inH₂O (4 °C, 20 °C or 60 °F),

ftH₂O (4 °C, 20 °C or 60 °F), cmH₂O (4 °C and 20 °C), mH₂O (4 °C and 20 °C),

KPa, mBAR, inHg, mmHg, Torr

One custom unit (user programmable)

Media Compatibility

Liquids and gases compatible with 316 stainless steel

Environmental

Operating Temperature -10 °C to +55 °C

Storage -20 °C to +70 °C (-4 °F to +158 °F)

Humidity 10% to 95% RH Non-condensing

Pollution Degree II

Mechanical

Dimensions 4.5" (diameter) x 2.2" (depth) x 5" (height)

Pressure Connection: 1/4" NPT Male

Housing: Stainless steel, meets NEMA 4/IP65

Display

5-1/2 Digits, 0.65" (16.53 mm) high

20-Segment bar graph, 0 to 100%

Power

Battery three (3), size AA alkaline batteries, optional 24 VDC power.

Battery Life 1,500 hours without backlight, 2,000 hours at slow sample rate

Low Battery Indicator icon is displayed near the end of battery life

Approvals



Class I, Div. 2, Groups A-D CE approved

Appendix 1: IPI Calibration Procedure

Overview

Calibration adjustment of the IPI is performed electronically via internal software with the case closed. There are no mechanical adjustments; all calibration commands and adjustments are done via the keypad, using the display to guide the user through the calibration process.

Eight calibration points are used in the adjustment program, working from full scale to zero at pressures equaling 100%, 87.5%, 75%, 62.5%, 50%, 37.5%, 25%, 12.5%, and 0% of full scale plus vacuum.

Note: This is an ambient temperature calibration, and should be performed at an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ ($72\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$). Calibration outside this temperature range will invalidate the temperature compensation program in the IPI.

Calibration Interval

You should check performance of the PI at the interval required by your calibration program. We recommend adjustment when measurement deviates by more than 75% of the specified accuracy, or 0.04%

Test Equipment

Verification and calibration of the IPI requires pressure and/or vacuum standards able to produce and indicate pressures from vacuum to the full-scale range of the unit under test. In order to maintain the specified accuracy of the IPI, standards should have a TUR of 4:1 or better.

Connections:

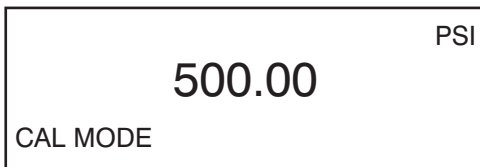
The PI uses a 1/4 NPT male connection in the pressure input port. Various adapters may or may not be needed to connect to the pressure standard. Always make sure the hose, tubing, and fittings etc have a rated working pressure at or above the pressure of the unit. Also it is important that there be no leaks when performing calibration; use Teflon tape where appropriate.

Entering Calibration Mode:

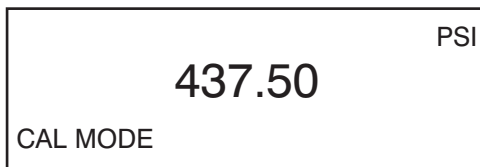
After you have made your connections, turn the power on while holding the CONFIG key. Use the arrow keys to enter the password. The password is 101. If you have entered calibration mode correctly the display should look as shown below. The pressure value displayed will be the full-scale value of the gauge.

Procedure:

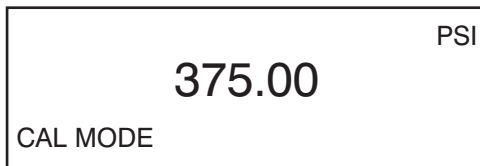
Screens shown in this manual represent the displays shown with a 500 psi Gauge. The IPI will prompt the technician for the appropriate pressure at each calibration point.



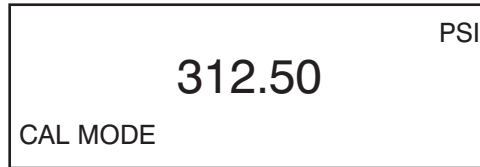
Use the Pressure Standard to output 500.00 psi (100%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ———. When the readings are complete the screen should look as shown in the illustration that follows.



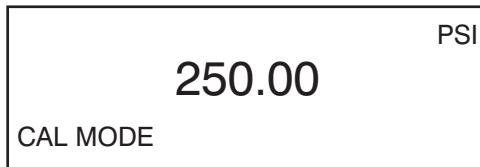
Use the Pressure Standard to output 437.50 psi (87.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ———. When the readings are complete the screen should look as shown below.



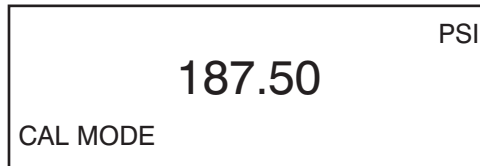
Use the Pressure Standard to output 375.00 psi (75%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the screen should look as shown below.



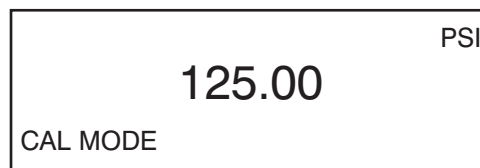
Use the Pressure Standard to output 312.50 psi (62.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the screen should look as shown below.



Use the Pressure Standard to output 250.00 psi (50%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the screen should look as shown below.

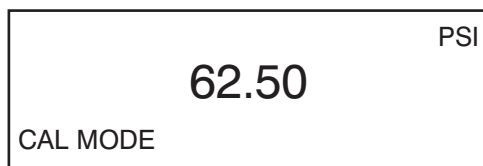


Use the Pressure Standard to output 187.50 psi (37.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the screen should look as shown below.

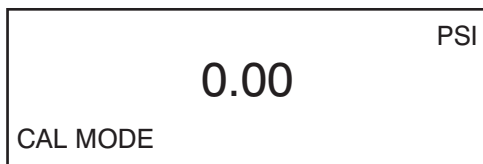


Use the Pressure Standard to output 125.00 psi (25%). After the output has stabilized, press the ENTER key to continue. As the unit takes

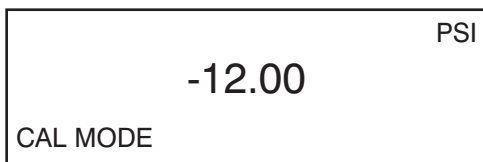
readings, the screen will show _____. When the readings are complete the screen should look as shown below.



Use the Pressure Standard to output 62.50 psi (12.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the screen should look as shown below.



Use the Pressure Standard to output 0.00 psi. After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the screen should look as shown below.



Note: Only some ranges use vacuum calibration. If your gauge is not one, than this step will be automatically skipped and calibration will be complete.

Use the Pressure Standard to output -12.00 psi. After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show _____. When the readings are complete the unit will reset and power up in normal mode.

Service Center Calibration or Repair

Only qualified service personnel should perform calibration, repairs, or servicing not covered in this manual. If the calibrator fails, check the batteries first, and replace them if needed.

Verify that the calibrator is being operated as explained in this manual. If the calibrator is faulty, send a description of the failure with the calibrator. Be sure to pack the calibrator securely, using the original shipping container if it is available.

Available Ranges and Resolution by Engineering Unit

Eng. Units	PSI Ranges									
	15	30	100	300	500	1000	2000	3000	5000	10000
psi	15.000	30.000	100.00	300.00	500.00	1000.0	2000.0	3000.0	5000.0	10000
bar	1.0342	2.0684	6.8947	20.684	34.474	68.947	137.89	206.84	344.74	689.47
mbar	1034.2	2068.4	6894.8	20684	34474	68948	NA	NA	NA	NA
kPa	103.42	206.84	689.48	2068.4	3447.4	6894.8	13790	20684	34474	68948
kg/cm²	1.0546	2.1092	7.0307	21.092	35.153	70.307	140.61	210.92	351.53	703.07
cmH ₂ O@4°C	1054.6	2109.3	7030.9	21093	35154	70309	NA	NA	NA	NA
cmH ₂ O@20°C	1056.5	2113.0	7043.4	21130	35217	70434	NA	NA	NA	NA
mH ₂ O@4°C	10.546	21.093	70.309	210.93	351.54	703.09	1406.2	2109.3	3515.4	7030.9
mH ₂ O@20°C	10.565	21.130	70.434	211.30	352.17	704.34	1408.7	2113.0	3521.7	7043.4
inH ₂ O@4°C	415.21	830.42	2768.1	8304.2	13840	27681	55361	83042	NA	NA
inH ₂ O@20°C	415.95	831.89	2773.0	8318.9	13865	27730	55460	83189	NA	NA
inH ₂ O@60°F	415.61	831.23	2770.8	8312.3	13854	27708	55415	83123	NA	NA
mmHg@0°C	775.73	1551.5	5171.5	15515	25858	51715	NA	NA	NA	NA
inHg@0°C	30.540	61.081	203.60	610.81	1018.0	2036.0	4072.0	6108.1	10180	20360
ftH ₂ O@4°C	34.601	69.202	230.67	692.02	1153.4	2306.7	4613.5	6920.2	11534	23067
ftH ₂ O@20°C	34.662	69.324	231.08	693.24	1155.4	2310.8	4621.6	6932.4	11554	23108
ftH ₂ O@60°F	34.634	69.269	230.90	692.69	1154.5	2309.0	4617.9	6926.9	11545	23090
Torr	775.73	1551.5	5171.5	15515	25858	51715	NA	NA	NA	NA



*..because calibration is
a matter of confidence*

AMETEK

Calibration Instruments

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

JOFRA Temperature standards

*Portable precision thermometer. Dry-block calibrators:
4 series, more than 20 models - featuring speed,
portability, accuracy, and advanced documenting functions.*

M&G Primary pressure standards

*Pneumatic floating-ball or hydraulic piston deadweight testers
- easy-to-use with accuracies up to 0.015% of reading.*

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

*Process signal measurement and simulation
for easy control loop calibration and measurement tasks -
from handheld field instruments for multi or single
signals to laboratory reference level bench top instruments.*

AMETEK is a leading global manufacturer of electrical and electromechanical products for niche markets. Listed on the New York Stock Exchange (AME) since 1930, AMETEK's annual sales exceed \$1 billion. Operations are in North America, Europe, and Asia, with about one third of sales to markets outside the United States.

AMETEK®
CALIBRATION INSTRUMENTS

AMETEK Test & Calibration Instruments • Florida, USA (Western Hemisphere)

Tel: +1 727-536-7831 • Tel: +1 800-527-9999 • calinfo.us@ametek.com

AMETEK Denmark A/S • Denmark (Europe and the Middle East)

Tel: +45 4816 8000 • ametek@ametek.dk

AMETEK Precision Instruments Europe GmbH • Germany (Germany only)

Tel: +49 2159 91360 • info@ametek.de

AMETEK Singapore Pte. Ltd. • Singapore (Asia)

Tel: +65 6 484 2388 • aspl@ametek.com.sg

www.ametekcalibration.com
www.jofra.com

Information within this document is
subject to change without notice.
All rights reserved.