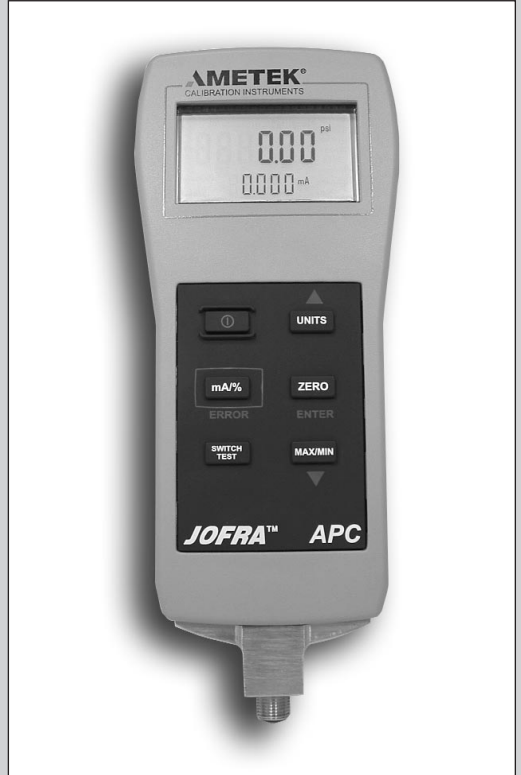


# **AMETEK JOFRA APC**

## **Advanced Pressure Calibrator**



## **Reference Manual**



# 1. Introduction

The Ametek APC is a high accuracy, full function pressure calibrator. The calibrator includes the following features and functions:

- Dual display. The upper portion of the display is used to read pressure in various units. The lower portion of the display is primarily used to read current (up to 24 mA).
- Pressure can be read from an internal sensor or an external module (APM).
- Switch test functionality uses an higher speed pressure update rate for superior performance.
- Current can be read with or without loop power.
- An RS232 interface allows complete “hands off” remote control monitoring.

The Ametek APC is well suited for various applications including calibration of gauges, pressure switches, safety valves, and P/I transmitters.

The APC is available in the following ranges:

10 psi / 0.7 bar	1,000 psi / 70 bar
30 psi / 2 bar	3,000 psi / 200 bar
200 psi / 15 bar	5,000 psi / 350 bar
500 psi / 35 bar	10,000 psi / 700 bar

Vacuum is supported in all units up to 500 psi / 35 bar.

External pressure modules (APMs) can be added to support additional pressure ranges.

**Read this manual carefully before using the instrument and make sure that all safety instructions and warnings are observed.**

## 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

Inspect the unit carefully upon receipt. Save packing carton in case re-shipment is necessary. If there appears to be any damage, equipment missing or if there are any questions about the unit, contact AMETEK.









Check to see if your calibrator is complete. It should include:

- APC Calibrator
- Instruction Manual
- Test Leads
- Carrying Case
- (2) Pressure Fittings
- Calibration Certificate

## 1.3 Safety information

### ***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
	AC (Alternating Current)
	AC-DC
	Battery
	CE Complies with European Union Directives
	DC
	Double Insulated
	Electric Shock
	Fuse
	PE Ground
	Hot Surface (Burn Hazard)
	Read the User's Manual (Important Information)
	Off
	On
	Canadian Standards Association
	Crossed out wheeled bin (comprehended by the directive 2002/95/EC)

The following definitions apply to the terms “Warning” and “Caution”.

- “Warning” identifies conditions and actions that may pose hazards to the user.
- “Caution” identifies conditions and actions that may damage the instrument being used.

Use the calibrator only as specified in this manual, otherwise injury and damage to the calibrator may occur.



## **Warning**

### **To avoid possible electric shock or personal injury:**

- Do not apply more than the rated voltage. See specifications for supported ranges.
- Thermostats must **not** be connected to any other voltage source during a test
- Follow all equipment safety procedures.
- Never touch the probe to a voltage source when the test leads are plugged into the current terminals.
- Do not use the calibrator if it is damaged. Before you use the calibrator, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.
- Select the proper function and range for your measurement.
- Make sure the battery cover is closed and latched before you operate the calibrator.
- Remove test leads from the calibrator before you open the battery door.
- Inspect the test leads for damaged insulation or exposed metal. Check test leads continuity. Replace damaged test leads before you use the calibrator.
- When using the probes, keep your fingers away from the probe contacts. Keep your fingers behind the finger guards on the probes.
- Connect the common test lead before you connect the live test lead. When you disconnect test leads, disconnect the live test lead first.
- Do not use the calibrator if it operates abnormally. Protection may be impaired. When in doubt, have the calibrator serviced.
- Do not operate the calibrator around explosive gas, vapor, or dust.
- When using a pressure module, make sure the process pressure line is shut off and depressurized before you connect it or disconnect it from the APC or pressure module.
- Disconnect test leads before changing to another measure or source function.

- When servicing the calibrator, use only specified replacement parts.
- To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.
- To avoid personal injury or damage to the calibrator, use only the specified replacement parts and do not allow water into the case

 **Caution**

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

- Disconnect the power and discharge all high-voltage capacitors before testing resistance or continuity.
- Use the proper jacks, function, and range for your measurement or sourcing application.
- If the message changes to "OL" the range limit is exceeded and the pressure source must immediately be removed from the APC to prevent damage to the pressure transducer inside.
- Maximum torque allowed is 15Nm/10 ftlbs. NEVER exceed the torque allowed.
- To avoid damaging the plastic lens and case, do not use solvents or abrasive cleansers.

Clean the calibrator with a soft cloth dampened with water or water and mild soap.

# 2. Calibrator Interface

## 2.1 Display and Inputs

The calibrator display has two numeric character lines. The large line shows the measured pressure, and the small line shows the measured current. The measured current may be displayed in mA, in percentage of mA range (4mA - 20mA), where 0% corresponds to 4mA and 100% to 20mA, or percent error (see section 4.3). Pressure units are located on the right side of the display. For a listing of all the units supported refer to the table in the Specifications section.

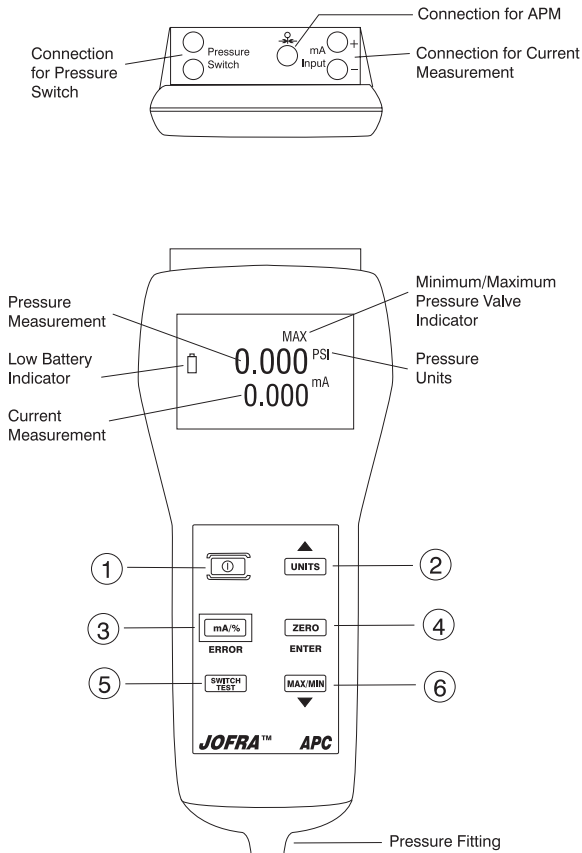
The calibrator has two sets of input terminals located on top of the unit and a pressure fitting located on the bottom of the unit. The input terminals on the right are used for measuring current. The terminals on the left are used for pressure switch connection.

## 2.2 Key Functions

Figure 1 shows the layout of the calibrator keypad while Table 1 lists the individual keys and their functions.

**Table 1: Key Functions**

Key	Function
1	Turns the unit on and off
2	Select different pressure units. Press and hold while unit is powering up to change the power saver setting. Also used for % error data entry.
3	Switches the lower numeric display between mA, percentage of range and % error function. This key also enables loop power when held during power up.
4	Zeroes the pressure sensor. Also acts as enter key in the % error mode.
5	Used in Switch Test mode (see section 5)
6	Displays the minimum and maximum pressure and current measured since power up. Also used for % Error data entry



**Figure 1**

### 2.3 Power Saver

The calibrator has an adjustable power saver option that allows it to shut down after being idle (no keys pressed) for a period of 1 to 30 minutes. To set the shutoff time:


1. Press and hold the (UNITS) key while powering up the unit.
2. A number from 1 to 30 or OFF will appear on the bottom of the display.
3. Use the (UNITS) key to increase the number, and the (MAX/MIN) key to decrease the number.
4. To disable power saver mode decrease the number until OFF is displayed on the screen.
5. Press the (ZERO) key to save the settings and return to normal operation.



### 3. Measuring Pressure and Current

 **Warning**

Make sure the process pressure line is shut off and depressurized before you connect it or disconnect it from the APC or pressure module.

 **Caution**

- If the message changes to "OL" the range limit is exceeded and the pressure source must immediately be removed from the APC to prevent damage to the pressure transducer inside.
- Maximum torque allowed is 15Nm/xx ftlbs. NEVER exceed the torque allowed.

To measure pressure, connect the calibrator using an appropriate fitting. Choose a pressure unit for measurement with the (UNITS) key. Pressure will be displayed on the large numeric display. Use the (ZERO) key to zero the pressure sensor when vented to atmospheric pressure

**Important NOTE:** To ensure accuracy of the calibrator it is critical to zero the APC before a device is calibrated.

To measure current use the mA input terminals on the top of the calibrator. Current can be measured in mA or percentage of range. The range on the calibrator is set to 0% at 4 mA and 100% at 20 mA. For for example if the current measured is displayed as 75% then the mA value is 16 mA.

#### 3.1 Media Compatibility

The APC calibrator utilizes a media isolated sensor to prevent sensor contamination. Whenever possible clean, dry air is the media of choice. If that is not always possible, make sure that the media is compatible with the following wetted parts:

Low Pressure - Unit range up to 200 PSI      High Pressure - Unit range 500 PSI and up

- |                        |                        |
|------------------------|------------------------|
| 1) Nickel plated brass | 1) 316 Stainless Steel |
| 2) Glass               |                        |
| 3) RTV (silicone)      |                        |
| 4) BUNA-N              |                        |

#### 3.2 Measuring Pressure with External Modules (APMs)

The APC provides a digital interface to External Pressure Modules (APMs). These modules are available in various ranges and types including gauge, vacuum, differential and absolute. The modules work seamlessly with the calibrator. Simply plug them in to the interface and the reading from the internal sensor will be replaced by that of the APM. Since the interface

between the APC and the APM is digital all the accuracy and display resolution is derived from the APM.

### 3.3 Zeroing of External Modules (APMs)

The zeroing of the APM is stored separately from that of the internal sensor. Use the (ZERO) key to zero the APM. For zeroing of absolute APMs, use the (▲), (▼) and (ENTER) keys to enter the barometric reference pressure. The APC stores barometric reference pressure for one absolute module at a time.

### 3.4 Minimum and Maximum Measurements

The calibrator automatically records the maximum and minimum values for pressure that were read by the calibrator since it has been turned on or reset. The current or mA reading is also stored for the corresponding pressure value. To recall the recorded values from memory press the (MAX/MIN) key. To clear the memory press and hold the (MAX/MIN) key until "CLR" is displayed.

## 4. Calibrating Transmitters

### **Warning**

- Do not apply more than the rated voltage. See specifications for supported ranges.
- Thermostats must not be connected to any other voltage source during a test

### **Caution**

- Disconnect the power and discharge all high-voltage capacitors before testing resistance or continuity.

### 4.1 Using the mA Input Function

The mA input function allows the user to read back the 4 to 20 mA output from the device being calibrated. This can be done in one of two ways:

1. Passively – Where the device under test directly generates a 4 to 20 mA and can be read by the APC
2. Actively – Where the APC supplies 24 VDC loop power to the device under test to power the device while reading the resulting 4 to 20 mA signal.

When the APC is first powered up it always defaults to the passive mA input mode. To activate loop power do the following steps:

1. Before turning on the APC press and hold down the (% mA) key.

2. Press the Power key while continuing to hold down the (% mA) key.
3. Allow the unit to go through the initial power-up sequence (about 5 seconds) then release the (% mA) key.
4. Note that the LCD will display LOOP PWR. Loop power will remain on until the APC is turned off. **Remember** loop power is only activated when this sequence is followed. Unless this sequence is performed during power up the APC will always default to the passive input mode.

## 4.2 Calibrating a Pressure-to-Current Transmitter

To calibrate a pressure-to-current transmitter (P/I), perform the following steps:

1. Connect the calibrator and the pump to the transmitter as shown in the setup in Figure 2.
2. Apply pressure with the pump.
3. Measure the current output of the transmitter.
4. Ensure the output is correct. If not, adjust the transmitter as necessary.

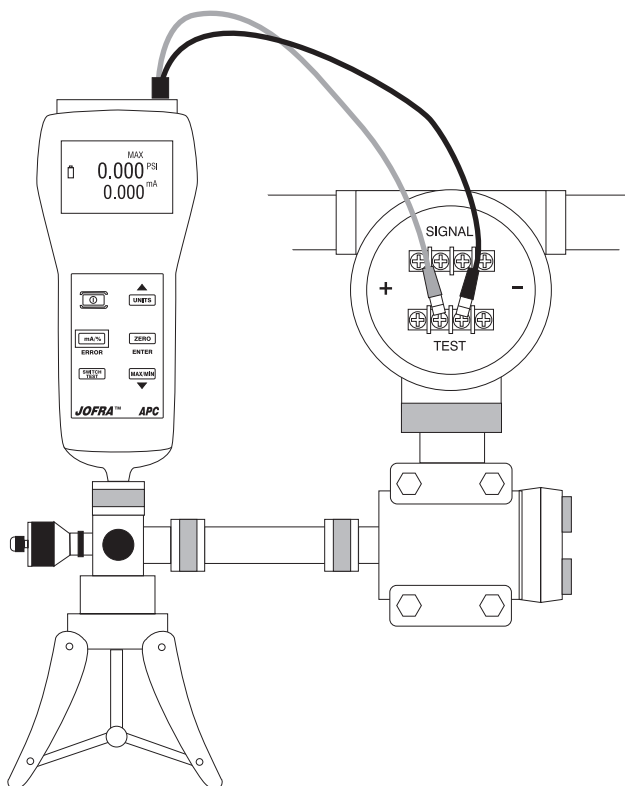


Figure 2

### 4.3 Percent Error Function

The APC features a unique function which can calculate pressure vs. milliamp error as a percentage of the 4 to 20 mA loop span.

**Example:**

Suppose a pressure transmitter under test is 30 psi (2 Bar) Full Scale and outputs a corresponding 4 to 20 mA signal. The user can program in a 0 to 30 psi pressure span into the APC and the APC will calculate and display the deviation or % Error from the expected 4 to 20 mA output. This eliminates the need for manual calculations and also helps if it becomes difficult to set an exact pressure with an external pump.

To use the %Error function proceed as follows:

- 1) With the APC turned on and operating press and hold the (mA/%) key for approximately 3 to 5 seconds until the word "HI" appears in the lower portion of the LCD
- 2) Using the units (▲) key and the max/min (▼) adjust the display for the desired full scale value. Then press the (ENTER) key.
3. The word "LO" will appear on the lower half of the LCD. Again using the arrow keys set the display to read the low point of the desired pressure range.
4. Press the (ENTER) again and the APC will be in the % ERROR mode ready for use.
5. The LO and HI points will remain in non-volatile memory until they are changed again by the user.

## 5. Performing a Pressure Switch Test

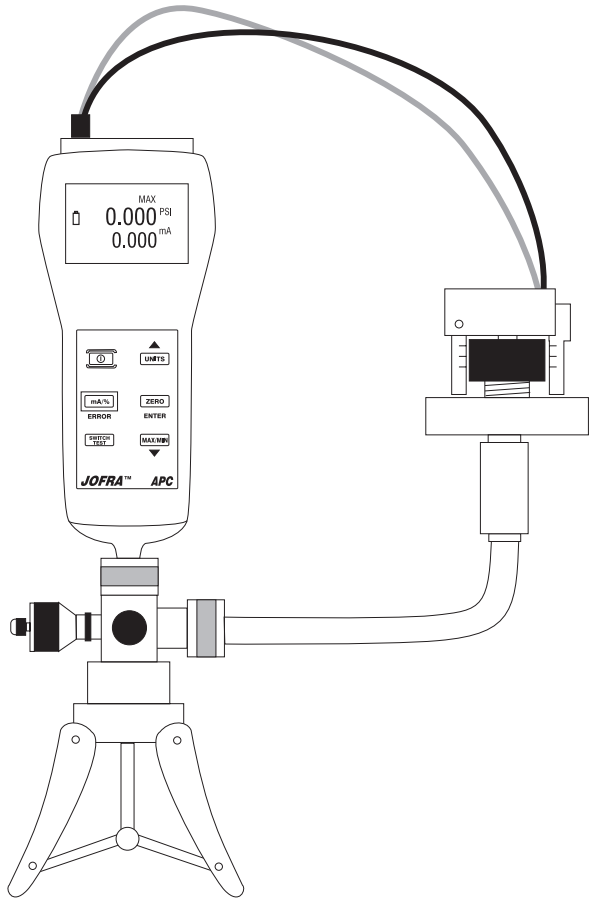


- Do not apply more than the rated voltage. See specifications for supported ranges.

To perform a switch test, follow these steps:

1. Connect the calibrator to the switch using the pressure switch terminals. Then connect the pump to the calibrator and the pressure switch. The polarity of the terminals does not matter. This set up is shown in Figure 3.
2. Make sure the vent on the pump is open. Zero the calibrator if necessary. Close the vent after zeroing the calibrator.
3. Press the (SWITCH TEST) key to enter pressure switch test mode. The calibrator will display CLOSE instead of a mA measurement.
4. Apply pressure with the pump slowly until the switch opens.  
**Important Note:** In the switch test mode the display update rate is increased to help capture changing pressure inputs. Even with this enhanced sample rate pressurizing the device under test should be done slowly to ensure accurate readings.
5. Once the switch is open, OPEN will be displayed, bleed the pump slowly until the pressure switch closes. RECALL will appear on the display.
6. Press the (SWITCH TEST) key to read the pressure values for when the switch opened, for when it closed, and for the dead band.
7. Hold the (SWITCH TEST) key to clear the data and perform another test.
8. Press the (mA/%) key to cancel the test.

**Important NOTE:** The above example uses a normally closed switch. The basic procedure is still the same for a normally open switch, the display will just read OPEN instead of CLOSE.



**Figure 3**

## 6. Remote Operation

The calibrator can be remotely controlled using a PC terminal, or by a computer program running the calibrator in an automated system. It uses an RS232 serial port connection for remote operation. With this connection the user can write programs on the PC, with Windows languages like Visual Basic to operate the calibrator, or use a Windows program such as Hyper Terminal, to enter single commands. Typical RS232 remote configurations are shown in Figure 4.

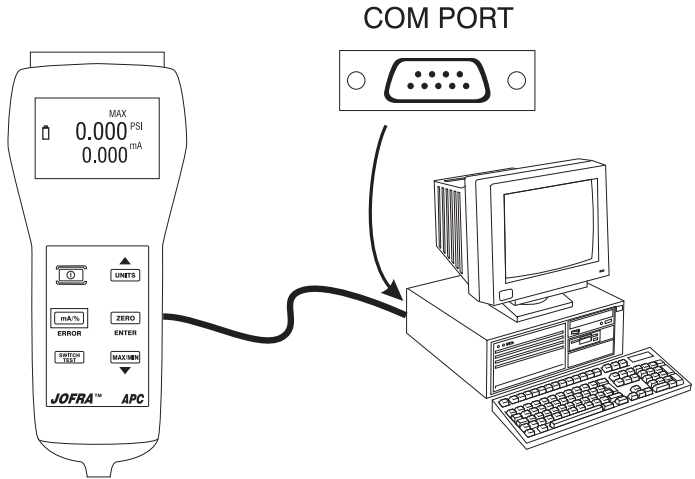


Figure 4

### 6.1 Setting up the RS232 Port for Remote Control

**Note:** The RS232 connection cable should not exceed 15m unless the load capacitance measured at connection points is less than 2500pF.

Serial parameter values:

- 9600 baud
- 8 data bits
- 1 stop bit
- no parity
- Xon/Xoff
- EOL (End of Line) character or CR (Carriage Return) or both

To set up remote operation of the calibrator on the Windows Hyper Terminal, connected to a COM port on the PC as in Figure 4, use the following procedure:

1. Start Hyper Terminal (located in Accessories/Communications of the Windows Start menu)

2. Select New Connection.
3. For Name enter APC. Select the com port to which the unit is connected.
4. Enter the above information for port settings.
5. Select ASCII setup from File/Properties/Settings and mark these choices:
  - Echo typed characters locally
  - Wrap lines that exceed terminal width
6. Select OK
7. To see if the port works enter `"*IDN?"`. This command will return information on the unit.

## 6.2 Using Commands

### 6.2-1 Command types

Refer to the Section on Remote Commands for all available commands. The calibrator may be controlled using commands and queries. All commands may be entered using upper or lower case. The commands are divided into the following categories:

#### Calibrator Commands

Only the calibrator uses these commands. For example  
`LOWER_MEAS DCI`  
tells the calibrator to measure current in mA on the lower display.

#### Common Commands

Standard commands used by most devices. These commands always begin with an `"*"`. For example  
`*IDN?`  
tells the calibrator to return its identification.

#### Query Commands

Commands that ask for information. They always end with a `"?"`.  
For example:  
`FUNC?`  
Returns the selected modes of the upper and lower displays.

#### Compound Commands

Commands that contain more than one command on one line.  
For example:  
`LOWER_MEAS DCI; PRES_UNIT PSI`  
Sets the calibrator to measure current in mA on the lower display and sets pressure unit to psi.



### **6.2-2 Character Processing**

The data entered into the calibrator is processed as follows:

- ASCII characters are discarded if their decimal equivalent is less than 32 (space), except 10 (LF) and 13 (CR).
- Data is taken as 7-bit ASCII.
- The most significant data bit is ignored.
- Upper or lowercase is acceptable.

### **6.2-3 Response Data Types**

The data returned by the calibrator can be divided into four types:

#### **Integer**

For most computers and controllers they are decimal numbers ranging from -32768 to 32768.

#### **Floating**

Numbers that have up to 15 significant figures and exponents.

#### **Character Response Data (CRD)**

Data returned as keywords. For example:  
PRES\_UNIT? returns PSI

#### **Indefinite ASCII (IAD)**

Any ASCII characters followed by EOM. For example:  
\*IDN? returns AMETEK, APC, 0, 1.00

### **6.2-4 Calibrator Status**

#### **Error Queue**

If an error occurs due to invalid input or buffer overflow, its error code is sent to the error queue. The error code can be read from the queue with the command FAULT?. The error queue holds 15 error codes. When it is empty, FAULT? returns 0. The error queue is cleared when power is reset or when the clear command \*CLS is entered.

#### **Input Buffer**

Calibrator stores all received data in the input buffer. The buffer holds 250 characters. The characters are processed on a first in, first out basis.

### 6.3 Remote Commands and Error Codes

The following tables list all commands that are accepted by the calibrator.

**Table 2: Common Commands**

Command	Description
*CLS	*CLS (Clear status.) Clears the error queue.
*IDN?	Identification query. Returns the manufacturer, model number, and firmware revision level of the Calibrator.

**Table 3: Calibrator Commands**

Command	Description
CAL_START	Puts the calibrator in calibration mode
FUNC?	Returns the functions that the upper and lower displays are in.
FAULT?	Returns an error code from the error queue.
PRES?	Returns the model and serial number of the attached pressure module.
LOWER_MEAS	Sets the mode for measuring on the lower display.
PRES_UNIT	Sets the pressure unit for the upper display.
PRES_UNIT?	Returns the pressure unit for the upper display.
VAL?	Returns the measured values.
ZERO_MEAS	Zeros pressure for either the calibrator or the attached module.
ZERO_MEAS?	Returns the current zero offset value.
MINMAX_RST	Resets the min and max value.
MIN?	Returns the min pressure since the last time it was reset, also returns the mA read at that value.
MAX?	Returns the max pressure since the last time it was reset, also returns the mA read at that value.
ST_START	Begins a switch test.
ST_OPEN?	Returns pressure at which the switch opened (switch test mode).
ST_CLOSE?	Returns pressure at which the switch closed (switch test mode).
ST_DEAD?	Returns deadband pressure of the switch (switch test mode).
HI_ERR	Sets the upper limit pressure for the % error calculation.
HI_ERR?	Returns the upper limit pressure used for the % error calculation.
LO_ERR	Sets the lower limit pressure for the % error calculation.
LO_ERR?	Returns the lower limit pressure used for the % error calculation.

**Table 4: Parameter units**

<b>Units</b>	<b>Meaning</b>
A	Amps of current
mA	milliamps of current
PERCENT	Current measured as a percentage of a 4-20 mA loop.
PERCENT_ERROR	Current measured as a percentage of deviation from a 4-20 mA loop, relative to pressure measured, and user selectable pressure limits.
Psi	Pressure in pounds per square-inch
Bar	Pressure in bars
mBar	Pressure in millibars
Kg/cm2	Pressure in kilograms per centimeter squared
InH2O4C	Pressure in inches of water at 4°C
InH2O20C	Pressure in inches of water at 20°C
InH2O60F	Pressure in inches of water at 60°F
mH2O4C	Pressure in meters of water at 4°C
mH2O20C	Pressure in meters of water at 20°C
cmH2O4C	Pressure in centimeters of water at 4°C
cmH2O4C	Pressure in centimeters of water at 20°C
ftH2O4C	Pressure in feet of water at 4°C
ftH2O20C	Pressure in feet of water at 20°C
ftH2O60F	Pressure in feet of water at 60°F
Inhg0C	Pressure in inches of mercury at 0°C
mmhg0C	Pressure in millimeters of mercury at 0°C
kpal	Pressure in kiloPascals

**Table 5: Error codes**

<b>Error Number</b>	<b>Error Description</b>
101	A non-numeric entry was received where it should be a numeric entry
102	Too many significant digits entered
103	Invalid units or parameter value received
105	Entry is above the upper limit of the allowable range
106	Entry is below the lower limit of the allowable range
108	A required command parameter was missing
109	An invalid pressure unit was received

116	Pressure module not connected
117	An unknown command was received
120	The serial input buffer overflowed
121	Too many entries in the command line
122	The serial output buffer overflowed

## 6.4 Entering Commands

Commands for the calibrator may be entered in upper or lower case. There is at least one space required between the command and parameter, all other spaces are optional. This section will briefly explain each of the commands and describe their general use. This will include parameters that may be entered with the command as well as the response(s) of a query command.

### 6.4-1 Common Commands

#### **\*CLS**

Clears error queue. When writing programs, use before each procedure to avoid an error buffer overflow.

#### **\*IDN?**

Returns the manufacturer, model number, and firmware revision of the calibrator. For example:

\*IDN? will return AMETEK, APC, 0, 1.00

### 6.4-2 Calibrator Commands

#### **CAL\_START**

Puts the calibrator in calibration mode. The main display will read CAL MODE and a calibration menu will be displayed on the terminal if the correct password is entered.

#### **FUNC?**

Returns the mode of the upper and lower displays.

Upper responses are PRESSURE, and RECALL (switch test mode).

Lower responses are DCI, DCI\_PERCENT, DCI\_ERR, and SWITCH\_TEST.

For example, if the calibrator is set to read pressure on the upper display, and current in mA on the lower display, FUNC? Would return:

PRESSURE,DCI

## **FAULT?**

Returns the error code from the error queue . The command may be entered when the previous command did not do what it was expected to do.

For example, if an entered pressure unit is invalid, FAULT? Would return:

109 which is the code number for an invalid pressure unit.

Refer to the Error Codes table for more information on error code numbers.

## **PRES?**

Returns the model and serial number of the attached pressure module. Returns NONE if no pressure module is attached. For example:

PRES? Could return AMETEK,001PNS,3,0

## **LOWER\_MEAS**

Sets the lower display measure mode. The command is followed by any of the following parameters. Enter DCI for current in mA, DCI\_PERCENT for current displayed as a percentage of 4-20 mA, DCI\_ERR for current displayed as a percentage of error from 4-20 mA based on the current pressure reading and user definable pressure limits. For example:

LOWER\_MEAS DCI\_PERCENT sets the lower display mode to current displayed as a percentage of 4-20 mA

## **PRES\_UNIT**

Sets the pressure units of the upper display. Valid pressure units are as follows:

Psi  
Bar  
Mbar  
Kg/cm2  
InH2O4C  
InH2O20C  
InH2O60F  
mH2O4C  
mH2O20C  
cmH2O4C  
cmH2O4C  
ftH2O4C  
ftH2O20C  
ftH2O60F  
Inhg0C

Mmhg0C  
Kpal

For example to set the unit on the upper display to bar:  
PRES\_UNIT Bar

### **PRES\_UNIT?**

Returns the pressure units of the upper display. For example, if the unit on the upper display is bar the command will return:  
BAR

### **VAL?**

Returns the value of any measurement taking place on the upper and lower display. For example, if the upper display is measuring 5 psi, and the lower display is measuring 5%ERR, then VAL? will return:

5.000000E-00, PSI, 5.000000E+00, PERCENT\_ERROR

### **ZERO\_MEAS**

Zeros the pressure reading of the calibrator or zeroes the attached pressure module. Enter the zeroing value after the command when zeroing an absolute pressure module.

### **ZERO\_MEAS?**

Returns the zero offset or the reference value for absolute pressure modules.

### **MINMAX\_RST**

Resets the min and max values.

### **MIN?**

Returns the minimum pressure value and mA value at that pressure since the last time it was reset.

### **MAX?**

Returns the maximum pressure value and mA value at that pressure since the last time it was reset.

### **ST\_START**

Puts the unit in switch test mode.

### **ST\_OPEN?**

Returns the pressure at which the pressure switch opened. This is only available in switch test recall mode (after the test has been completed).

**ST\_CLOSE?**

Returns the pressure at which the pressure switch closed. This is only available in switch test recall mode (after the test has been completed).

**ST\_DEAD?**

Returns the deadband of the pressure switch. This is only available in switch test recall mode (after the test has been completed).

**HI\_ERR**

Sets the upper limit pressure for the percent error calculation.

**HI\_ERR?**

Returns the upper limit pressure for the percent error calculation.

**LO\_ERR**

Sets the lower limit pressure for the percent error calculation.

**LO\_ERR?**

Returns the lower limit pressure for the percent error calculation.

## 7. Specifications

**Table 6: Pressure**

Pressure range in bar	0.7, 2, 15, 35, 70, 200, 350, 700 bar
Pressure range in psi	10, 30, 200, 500, 1000, 3000, 5000, 10,000 psi
Supported pressure units	psi, bar, mbar, kg/cm <sup>2</sup> , inH <sub>2</sub> O @ 4°C, inH <sub>2</sub> O @20°C, inH <sub>2</sub> O @60°C, mH <sub>2</sub> O @4°C, mH <sub>2</sub> O @20°C, cmH <sub>2</sub> O @4°C, cmH <sub>2</sub> O @20°C, ftH <sub>2</sub> O @4°C, ftH <sub>2</sub> O @20°C, ftH <sub>2</sub> O @60°C, inHg @0°C, mmHg @0°C, kPa
Overload maximum	+50% F.S. (10000/700 Bar is 20%)
Overload alarm	Activates at approximately +20% F.S.
Connection	1/8in NPT female for ranges 200 psi and under / 1/8in NPT male for ranges over 200 psi
Positive accuracy	± 0.04% of reading ± 0.01% F.S. (All ranges except 10 psi) .05% F.S. (0°C to 50°C) (10 psi)
Vacuum accuracy	± 0.05% F.S. (10, 30, 200, 500 psi units only) (10°C to 45°C) 0.1% F.S. (10 psi)
Operating temperature	-10°C to 50°C / 14°F to 122°F (Temp. comp. 0 to 50°C)
Storage temperature	-20°C to 60°C / -4°F to 140°F
Temperature Compensation for electrical	± 0.005% F.S./ °C outside 18 to 28°C ± 0.003% F.S./ °F outside 64 to 82°F

**Table 7: General Specifications**

LCD	Dual information LCD plus icon indicators
Display resolution	5 digits
Display update	Approximately 4 times per second (faster during switch test)
Switch test capture	50 milliseconds
mA input (0-24mA)	Accuracy: ± 0.015% of reading ± 2μA
Switch test	Supply max 9V
Batteries	1 x 9 VDC Alkaline
Low battery indicator	7 VDC
Size	188mm x 84mm x 52mm / 7.37in x 3.31in x 2.05in
Weight	400g / 14.1oz

All above specifications are specified at 23°C ± 5°C / 74.3°F ± 9°F unless otherwise noted.



# 8. Maintenance

## 8.1 Replacing Batteries

Replace batteries as soon as the battery indicator turns on to avoid false measurements.

**Note:** Use only 9 Volt alkaline battery.

## 8.2 Cleaning the Unit



To avoid personal injury or damage to the calibrator, use only the specified replacement parts and do not allow water into the case.



To avoid damaging the plastic lens and case, do not use solvents or abrasive cleansers.

Clean the calibrator with a soft cloth dampened with water or water and mild soap.

## 8.3 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.

## 8.4 Replacement Parts & Accessories

<u>Order Number</u>	<u>Description</u>
SPK-APC-001	Operating Manual
SPK-HHC-002	Soft carrying case
104203	Test Lead Set
11-90110	Fitting - 1/8 NPT Female x 1/4 BSP Female
11-90111	Fitting - 1/8 NPT Female x 1/4 NPT Female
601104	Teflon Tape
123958	RS232 - Stereo to Serial connection
124004	Shoulder strap with snap hooks
T-870	Fitting - 1/8 NPT Male x 1/4 BSP Female
11-90067	Fitting - 1/8 NPT Male x 1/4 NPT Female





**AMETEK**

Test & Calibration Instruments Division  
8600 Somerset Drive  
Largo, FL 33773 USA  
**TEL** 727-536-7831  
**TOLL-FREE** 800-527-9999  
**FAX** 727-539-6882  
**E-mail:** calinfo.fl-lar@ametek.com

**AMETEK Denmark A/S** Gydevang 32-34  
Post Office Box 30  
DK-3450 Allerod  
Denmark  
**Tel** +45 4816 8000  
**Fax** +45 4816 8080  
**E-mail** ametek@ametek.dk

**AMETEK Precision Instruments Europe GmbH**  
Postfach 2165  
D-40644, Meerbusch  
Germany  
Tel +49 2159 9136 0  
Fax +49 2159 9136 39  
E-mail info@ametek.de

**AMETEK Singapore Pte. Ltd.**  
10 Ang Mo Kio Street 65  
#05-12 TECHPOINT  
Singapore 569059  
Tel +65 6484 2388  
Fax +65 6481 6588  
E-mail aspl@ametek.com.sg