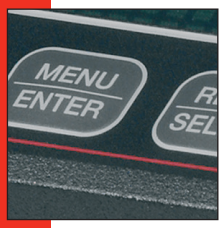
AMETEK®
TEST & CALIBRATION INSTRUMENTS

Reference Manual
Advanced Signal Calibrator

ASC-400





Reference Manual
Advanced Signal Calibrator
JOFRA ASC-400

About this manual….

- **The structure of the manual**
  This reference manual is aimed at users who are familiar with AMETEK signal calibrators, as well as those who are not. The manual is divided into 12 chapters, which describe how to set up, operate, service and maintain the signal calibrator. The technical specifications are described and accessories may be ordered from the list of accessories.

- **Safety symbols**
  This manual contains a number of safety symbols designed to draw your attention to instructions, which must be followed when using the instrument, as well as any risks involved.

Warning
Conditions and actions that may compromise the safe use of the instrument and result in considerable personal or material damage.

Caution…
Conditions and actions that may compromise the safe use of the instrument and result in slight personal or material damage.

Note…
Special situations, which demand the user's attention.

List of contents

1.0 Introduction

Congratulations on your new AMETEK JOFRA Advanced Signal Calibrator!

With the AMETEK JOFRA Advanced Signal Calibrator, you have chosen an extremely effective instrument, which we are sure will perform according to your expectations. This ASC-400 signal calibrator is a handheld, battery or DC adaptor powered instrument that measures and sources electrical and physical parameters.

During the past several years, we have acquired extensive knowledge of industrial signal calibration. This expertise is reflected in our products, which are all designed for daily use in an industrial environment. Please note that we would be very interested in hearing from you if you have any ideas or suggestions for changes to our products.

This reference manual applies to the following instrument:

- **JOFRA ASC-400**

The calibrator has the following features and functions:

- A dual colour display.
  The upper display is used for the measurement of volts, current, pressure, %error, scaling and switch test

  The lower display can be used to measure and source volts, millivolts, current, pressure, resistance, resistance temperature detectors (RTDs), thermocouples, frequency, and resistance, and to source pulse trains.
- A thermocouple (TC) input/output terminal with automatic and manual reference-junction (cold junction) temperature compensation.
- An interactive and intuitive user interface
- USB interface for remote control
- Isolated read back for transmitter calibration.
- A BARO option turning any gauge measuring APM into an absolute measuring device.
- Extended and comprehensive pressure measurement capabilities with JOFRA advanced pressure modules (APM)

ISO-9001 certified

AMETEK Denmark A/S was ISO-9001 certified in September 1994 by Bureau Veritas Certification Denmark.

CE-label

CE Your new signal calibrator bears the CE label and conforms to the EMC Directive.

Technical assistance

Please contact the dealer from whom you acquired the instrument if you require technical assistance.

1.1 Warranty

This instrument is warranted against defects in workmanship, material and design for two (2) years from date of delivery to the extent that AMETEK will, at its sole option, repair or replace the instrument or any part thereof which is defective, provided, however, that this warranty shall not apply to instruments subjected to tampering or, abuse, or exposed to highly corrosive conditions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED AND AMETEK HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. AMETEK SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, ANY ANTICIPATED OR LOST PROFITS.

This warranty is voidable if the purchaser fails to follow any and all instructions, warnings or cautions in the instrument's User Manual.

If a manufacturing defect is found, AMETEK will replace or repair the instrument or replace any defective part thereof without charge; however, AMETEK's obligation hereunder does not include the cost of transportation, which must be borne by the customer. AMETEK assumes no responsibility for damage in transit, and any claims for such damage should be presented to the carrier by the purchaser.

1.2 Receiving the Advanced Signal Calibrator

When you receive the instrument…

1) Unpack and check the signal calibrator and the accessories carefully.
2) Check the parts according to the list shown below.

   If any of the parts are missing or damaged, please contact the dealer who sold you the signal calibrator.

You should receive:

- 1 ASC-400 Calibrator
- 1 electronic Reference manual on USB memory stick
- 2 sets of test leads and test clips (black and red)
- 1 carrying soft bag
- 1 USB cable
- 6 x AA batteries
- 1 Calibration certificate (International traceable)

When reordering, please specify the part numbers according to the list of accessories, section 12.0

1.3 Dimensioning drawing

2.0 Safety instructions

Read this manual carefully before using the instrument!

Please follow the instructions and procedures described in this manual. They are aimed at allowing you to make the best of your signal calibrator and avoid any personal injuries and/or damage to the instrument.

Disposal – WEEE Directive

The signal calibrator contains Electrical and Electronic circuits and must be properly recycled or disposed of (in accordance with the WEEE Directive 2002/96/EC).

Warning

The signal calibrator is designed to calibrate and measure low voltage process signals. To ensure the safety of the operator and the instrument, **DO NOT** connect the signal calibrator to input voltages above 30 Volts.

To avoid possible electric shock or personal injury:

- Do not apply more than the rated voltage. See specifications for supported ranges.
- 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, vapour, 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 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 a violent release of pressure in a pressurized system, shut off the valve and slowly bleed off the pressure before you attach the pressure module to the pressure line.
- 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 the signal calibrator or to the equipment under test:

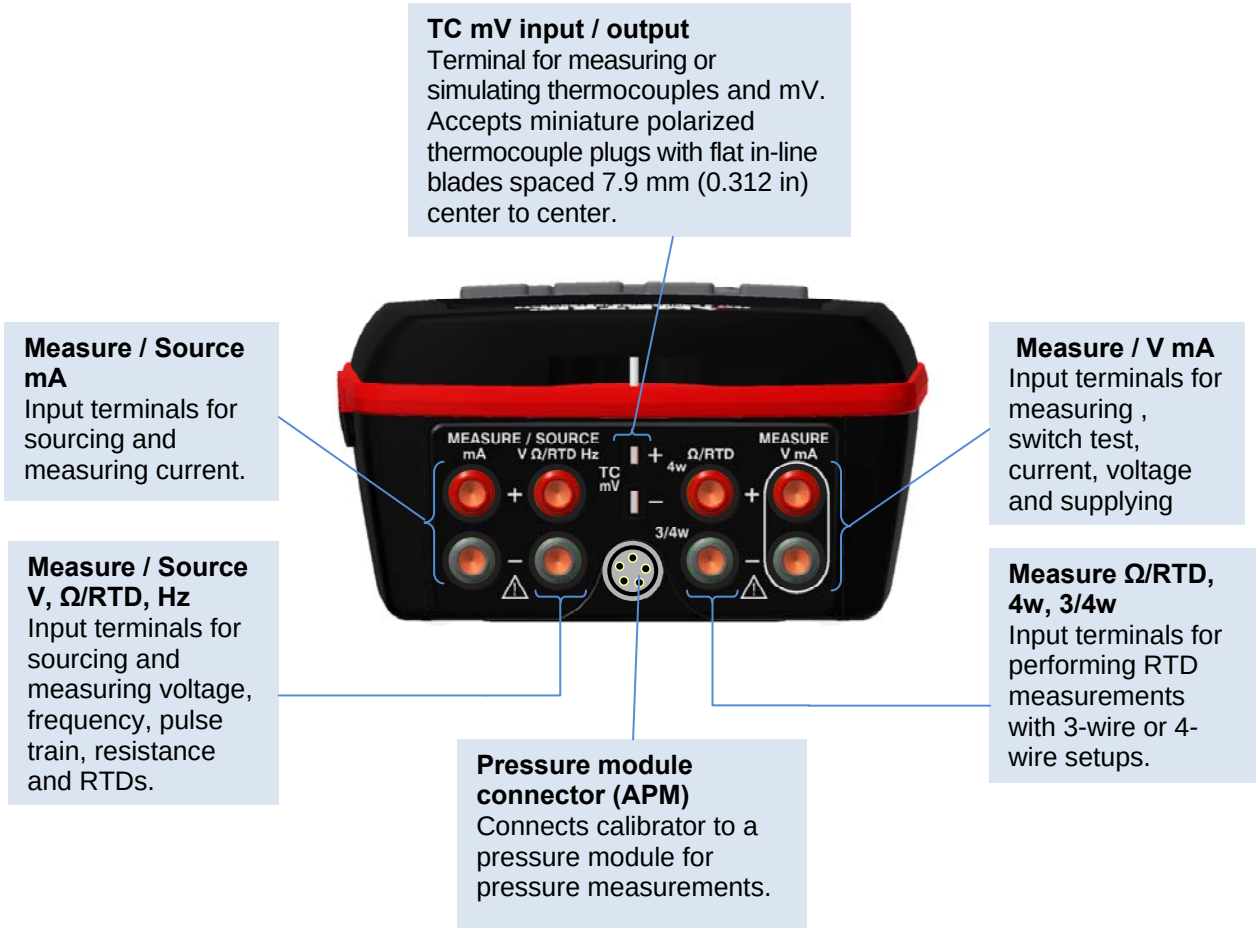
- Disconnect the power and discharge all high-voltage capacitors before testing resistance or continuity.
- Use the proper jacks, function, and range for your measurement or sourcing application.
- If the message changes to "OL" the range limit is exceeded and the pressure source must immediately be removed from the APM to prevent damage to the pressure transducer inside.
- To avoid damaging the pressure module from overpressure, never apply pressure above the rated maximum printed on the module.
- To avoid damaging the plastic lens and case, do not use solvents or abrasive cleansers.
- When using the switch test function, make sure that no other equipment, such as heavy loads or sources, is connected in the test loop.

Note…

The product liability **only** applies if the instrument is subject to a manufacturing defect. This liability becomes void if the user fails to follow the maintenance instructions described in this manual or uses unauthorized spare parts.

3.0 Calibrator Interface

3.1 Input/Output Connections



TC mV input / output
Terminal for measuring or simulating thermocouples and mV. Accepts miniature polarized thermocouple plugs with flat in-line blades spaced 7.9 mm (0.312 in) center to center.

Measure / Source mA
Input terminals for sourcing and measuring current.

Measure / V mA
Input terminals for measuring , switch test, current, voltage and supplying

Measure / Source V, Ω/RTD, Hz
Input terminals for sourcing and measuring voltage, frequency, pulse train, resistance and RTDs.

Measure Ω/RTD, 4w, 3/4w
Input terminals for performing RTD measurements with 3-wire or 4-wire setups.

Pressure module connector (APM)
Connects calibrator to a pressure module for pressure measurements.

USB connection
Connects calibrator to a PC for remote control.

Charger Connector
Connects to optional power supply / battery charger.

3.2 Keypad - Functions

Power key/ Backlight key
Turn the calibrator on and off. Press the button for five seconds to turn it off. Adjust the backlight intensity.

Arrow Keys
Have different functions depending on the mode of operation. In navigation mode, they move the cursor in the desired direction.
In edit mode, they roll in the list of options or if entering a number, the arrow left and arrow right move the cursor one character in the desired direction.

Zero key
Zero Pressure Module reading.

Numeric Keypad
Allows user to enter Numeric values in both upper and lower display.

Function keys F1, F2, F3, F4
To operate the menu bar at the bottom of the calibrator display, use the F-keys.

Back key
Cancel a selection / edit or return to previous menu.

Action key / Enter key
Action function: Open and close edit fields or a menu button. The action key also accepts the selected option or entered value.

Enter function: Accept selected options or entered values. When a value is entered with the Enter Key the cursor selects the next value field in the list.

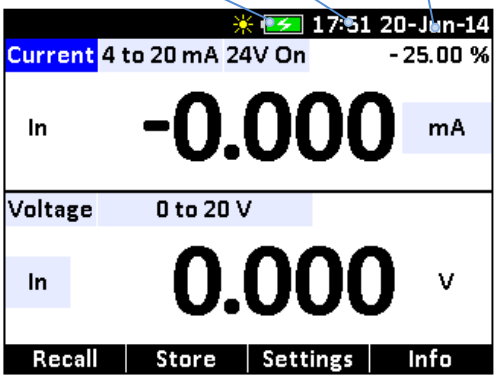
Configuration key
Opens and closes configuration mode.

3.3 Main display - Functions

Battery icon.
Remaining power and attached power adapter

Real Time Clock display

Date display

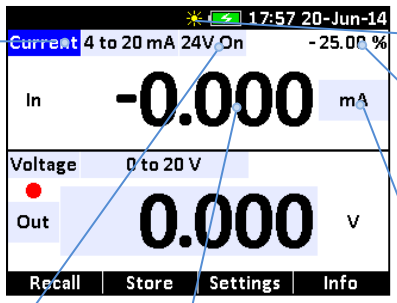


Upper display
The upper display is used for measuring DC voltage, DC current with and without loop power, pressure, percent, error, scaled value, switch test.

Lower display
The lower display can be used for both measuring and sourcing.

Horizontal menu bar
The menu bar is used to setup both the upper and the lower display to perform the desired function. The function keys (F1, F2, F3 and F4) are used to navigate through all the levels and choices of the menu bar.

3.4 Upper display (Read-back display) - Functions



Primary Parameters
Determine what parameter is going to be measured.

The available options for the upper display are: CURRENT, VOLTAGE, SWITCH TEST, PRESSURE and LEAK TEST.

Backlight Intensity
Indicates Low, Medium or High intensity on backlight

Secondary upper display
Shows where in the preset span the measured value falls. Fixed for mA at 4 (0%) and 20 (100%). Also shows mA value for percent error, mA or Volts value for scaling and leak rate for pressure.

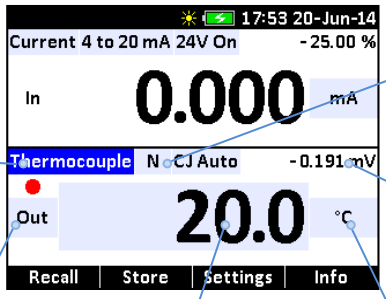
Numeric display
Displays the numeric values of the signal being measured.

An “OL” reading indicates an out of range or overload condition.

Units
Shows what unit the measurement value is in. Available options are : mA, SCALING, %ERROR, VOLT and PRESSURE UNITS.

Additional parameters
Selection and selection of parameters relevant to the choice of primary parameter

3.5 Lower display (Primary display) – Functions



Primary Parameters
Determine what parameter is going to be measured or sourced.

The available options for the upper display are: CURRENT, VOLTAGE, THERMO-COUPLE, RTD, OHMS, FREQUENCY, PULSE, PRESSURE and BARO (opt.)

Additional parameters
Selection and selection of parameters relevant to the choice of primary parameter.

Native Value
0 to 100 % in mA out mode and leak rate for pressure.

Numeric display
Displays the numeric values of the signal being measured, or sourced.

An “OL” reading indicates an out of range or overload condition.

Units
Shows what unit the measurement or source value is in.

Input / Output
Switches / indicates lower display input mode (read), and output mode (source).

4.0 Operating the calibrator

Warning

Please inspect the Safety Instructions in section 2.0 before using the instrument.

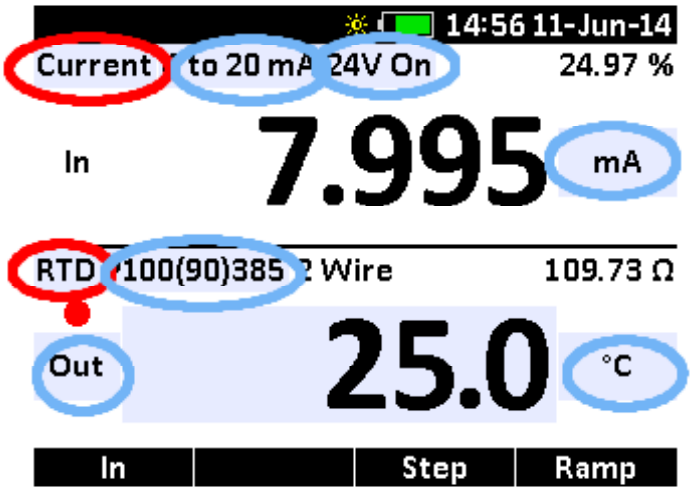
Caution…

Please inspect the Safety Instructions in section 2.0 before using the instrument.

Connect USB cable and APM before switching on the instrument, or before applying DC power.

4.1 Basic operation (Setup)

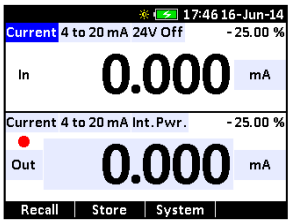
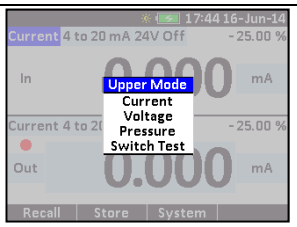
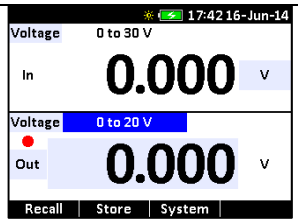
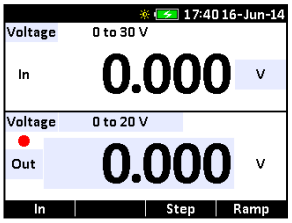
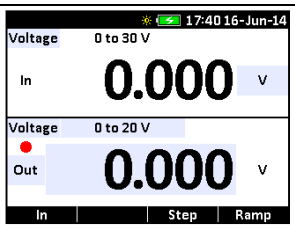
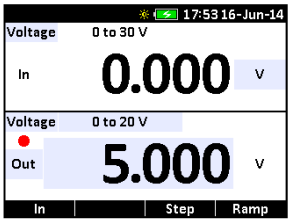
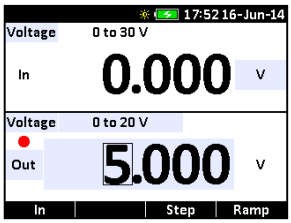
1. Select mode for upper and lower display **(RED markers).**
2. Select the related options and functions for the selected modes **(BLUE markers)**



Note…

the light blue fields; they indicate a parameter / function that can be selected or altered in edit mode. This works like a build in user manual, indicating the changeable parameters for the selected mode at all times.

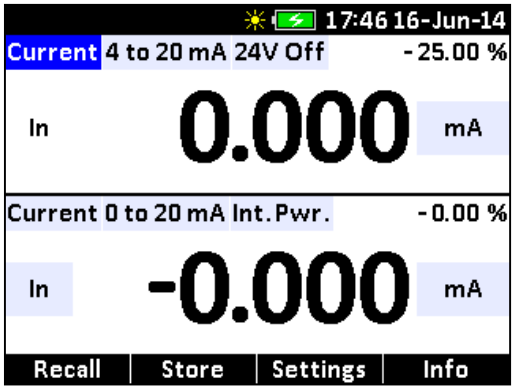
4.2 The principle of navigating through a Setup

ACTION	SCREEN DISPLAYED
1. Press  to access edit mode. 2. Use the  (ARROW) keys to move between the parameter fields.	
3. Press  to access the various Parameter lists to choose from. 4. Start by selecting upper or lower display.	
5. Use the  (ARROW) keys to move between the parameter fields and make more changes…	
6. Press  to accept the selections and leave the edit mode.	
7. Use the numeric keys to enter an output value (if output if chosen).	
8. Press  to accept the value.	
9. Or use the  (ARROW) keys to enter “fine adjust” mode. Move the value-frame to the right or left using the ◀ or ▶ keys. Modify the digits using the ▲ or ▼ keys.	

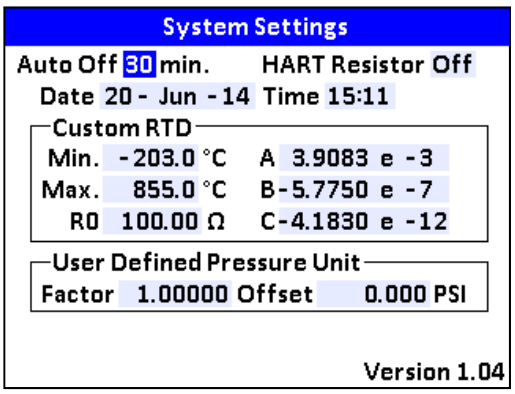
4.3 System Settings

The System Settings setup can be accessed at any stage of operation:

1. Press  to display the Horizontal menu bar.

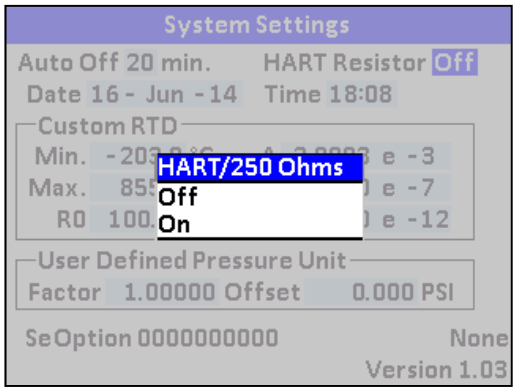


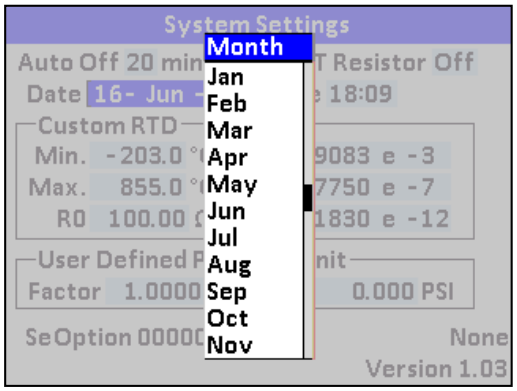
2. Press F3 (System) to access the System Settings.



3. Use the  (ARROW) keys to move between the setting fields.
4. Press  to open a setting field for editing.
5. Use the numeric keys to enter the desired value and press  to accept the value.

   When entering the HART Resistor ON/OFF field and Date field horizontal lists appear.





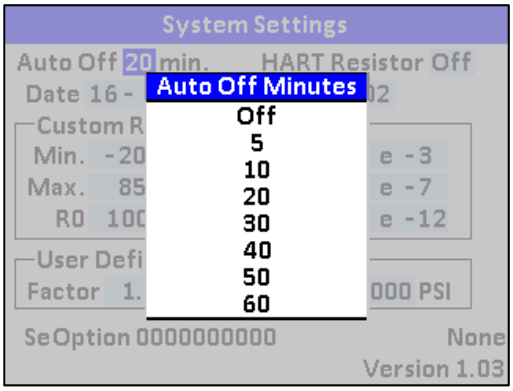
6. Use the  and  keys to scroll in the lists and select from the lists by pressing  .
7. Press either  or  to exit the System Settings.

8. The calibrator resumes normal operation after a few seconds. It will return to the setup last used.

4.3.1 Power Saver (Auto off)

The ASC-400 calibrator automatically turns off 5 to 60 minutes after the last keystroke. To reduce or increase this time or to disable this feature, do as follows:

1. In the System Settings setup enter the “Auto Off” setting field and press ◯ to access the Auto Off Minutes list.

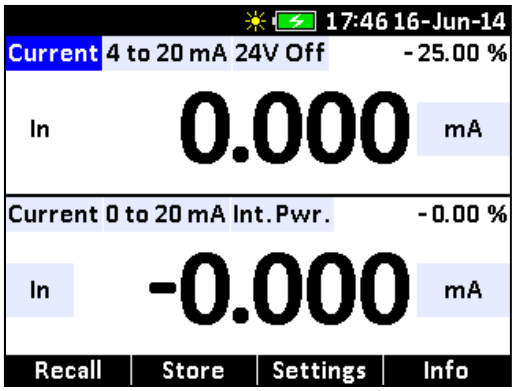


2. The list displays the turn-off time in minutes.
   Off disables the power saver and the calibrator will be permanently off.
3. Select the turn-off time by pressing ◯ .
4. Press ⚙ to exit the System Settings.

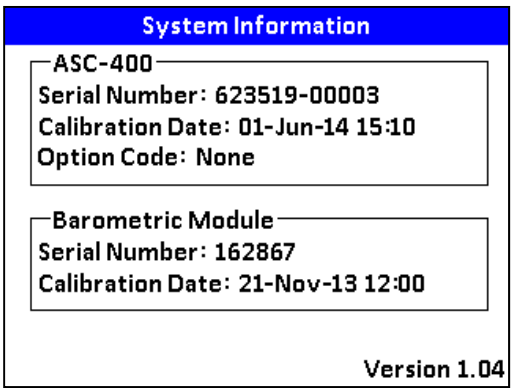
4.4 System Information

The System Information can be accessed at any stage of operation:

1. Press  to display the Horizontal menu bar.



2. Press F4 (Info) to access the System Information.

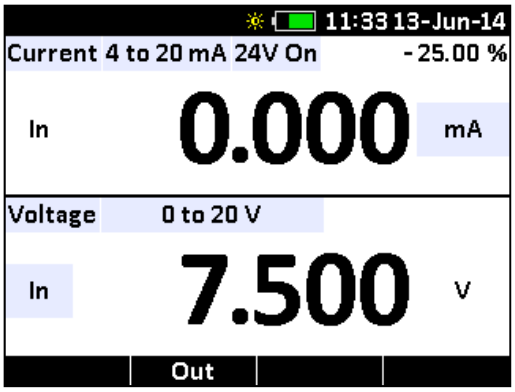


5.0 Using measure modes (lower display)

5.1 Measuring volts

The electrical parameter volts can be measured using the lower display.
To make the desired measurements, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Voltage” from the Lower Mode list.
2. Select the desired Range from the Range list.
3. Select the desired Test Mode (in) from the Test Mode list.
4. Accept the selections and leave the edit mode.



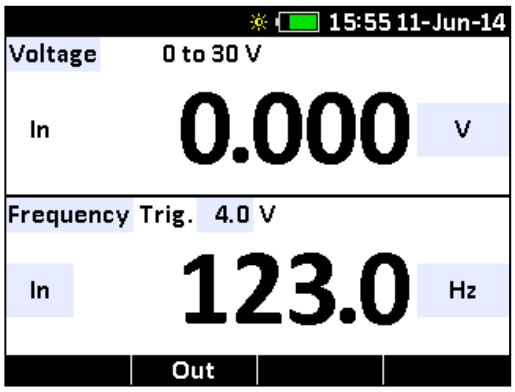
5. Connect the leads, as shown in Figure 1.

Figure 1
Measuring Volts

5.2 Measuring frequency

The electrical parameter frequency can be measured using the lower display.
To make the desired measurements, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Enter edit mode.
2. Select “Frequency” from the Lower Mode list.
3. Select the desired Test Mode (In) from the Test Mode list.
4. Enter the desired trigger level (Trig. V) value using either the ARROW keys or the numeric keys.
5. Select the desired unit from the Units list.
6. Accept the selections and leave edit mode.



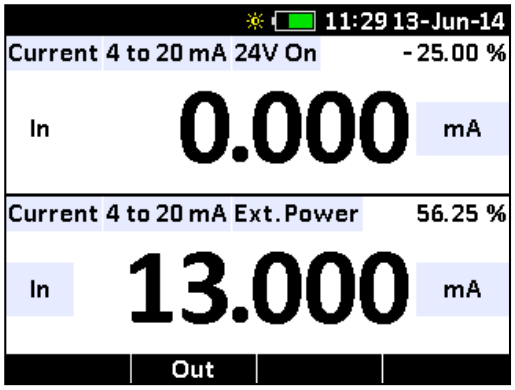
7. Connect the leads, as shown in Figure 2.

Figure 2
Measuring Frequency

5.3 Measuring mA

The electrical parameter mA can be measured using the lower display.
Follow the principle of navigating through the functions as described in the guidelines in section 4.2 to make the desired mA measurements:

1. Enter edit mode.
2. Select “Current” from the Lower Mode list.
3. Select the desired Test Mode (In) from the Test Mode list.
4. Select the desired Range from the Range list.
5. Select the desired power source from the Power Source list.
6. Select mA or % from the Units list.



7. Accept the selections and leave edit mode.
8. Connect the leads, as shown in Figure 3.

Figure 3
Measuring mA

5.4 Measuring Temperature

5.4.1 Using Thermocouples (TC)

The ASC-400 supports the following thermocouple types:

B, BP, C, E, J, K, L, N, R, S, T, U, XK

The characteristics of all the types are described in section 11 – Technical Specifications.

The ASC-400 has 3 cold junction Modes to choose from:

- **CJ Auto** Automatic CJ compensation, CJ temperature inside the connector is measured by a high accuracy RTD.
- **CJ Off** With CJ in OFF Mode, the calibrator will measure the difference between the thermocouple at the junction and at its TC input terminal (equivalent to 0ºC CJ).
- **CJ Manual** With CJ in Manual Mode it is possible to set the desired CJ temperature to be used for temperature calculation.

Note…

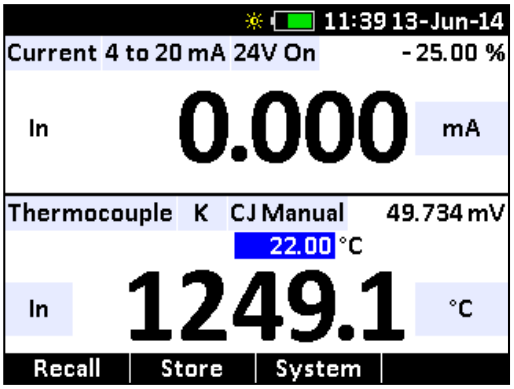
CJ Off Mode should only be used when calibration is being done using an external ice bath.

CJ Manual mode should be used when the cold junction temperature is known, but different from 0 ºC.

To use the thermocouple to measure temperature, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Attach the thermocouple leads to the TC mini plug, and insert the plug into the input/output of the ASC-400 calibrator, as shown in Figure 4.

2. Enter edit mode.
3. Select “Thermocouple” from the Lower Mode list.
4. Select the desired Test Mode (In) from the Test Mode list.
5. Select TC function from the TC Type list.
6. Select CJ Mode from the list.
7. If CJ Manual is selected a CJ temperature value must be entered using either the ARROW keys or the numeric keys.



8. Select the temperature unit from the Units list.

9. Accept the selections and leave edit mode.

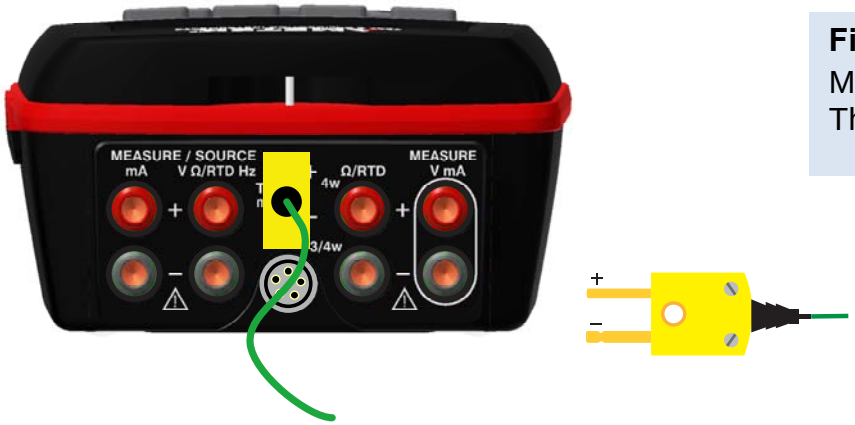


Figure 4
Measuring Temperature using Thermocouple Terminals

Note…

For best accuracy wait minimum 2 to 5 minutes for the temperature between the mini plug and the calibrator to stabilize before any measurements are taken.

Use the appropriate type of TC connector, using a wrong type of mini TC connector will cause additional CJ error.

The ASC-400 calibrator can also measure the mV of a Thermocouple, which can be used along with a table in case the corresponding TC type is not supported by the calibrator.

To select mV do as follows:

1. Select “Voltage” from the Lower Mode list.
2. Select “-10 to 75 mV” from the Range list.

In this mode the CJ compensation is turned off.

Note…

The TC wire used must match the thermocouple type being calibrated.

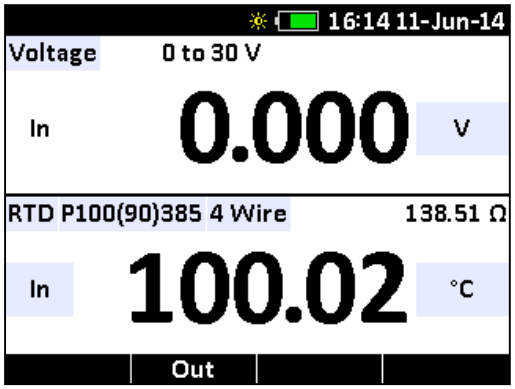
5.4.2 Using Resistance-Temperature-Detectors (RTDs)

The supported types of RTDs are shown in Section 11 - Specifications.

RTDs are characterized by their 0°C resistance, R0. The ASC-400 calibrator accepts two, three, and four wire inputs, with four wire input being the most accurate.

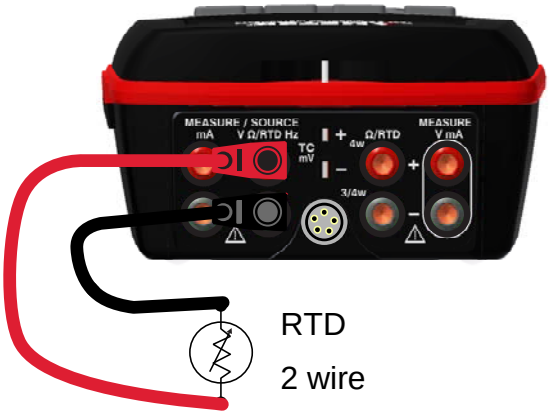
To use the RTD option, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

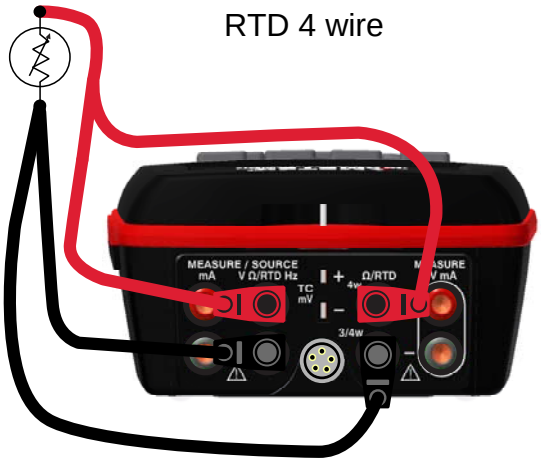
1. Enter edit mode.
2. Select “RTD” from the Lower Mode list.
3. Select “In” from the Test Mode list.
4. Select RTD type from the RTD Type list.
5. Select a wire connection from the Num. Wires list. 4-wire allows for the most precise measurement.
6. Accept the selections and leave edit mode.



7. Attach RTD leads, as shown in Figure 5

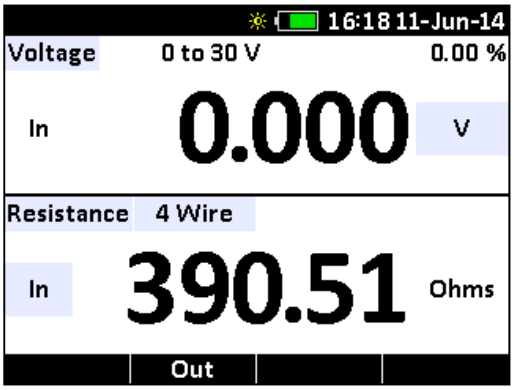
Figure 5
Measuring RTD temperature
2, 3 or 4 wire connections





Resistance can also be measured using this function:

1. Select “Resistance” from the Lower Mode list.
2. Proceed as in the above guidelines.



This option can be used to measure ohms or a type resistive temperature sensor, which is not programmed into the ASC-400 calibrator.

5.5 Measuring Pressure

Warning

To avoid a violent release of pressure in a pressurized system, shut off the valve and slowly bleed off the pressure before you attach the pressure module to the pressure line.

Caution…

- To avoid damaging the pressure module from overpressure, never apply pressure above the rated maximum printed on the module.
- To avoid damaging the pressure module from corrosion, use it only with specified materials. Refer to the pressure module documentation for material compatibility.

To measure pressure, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

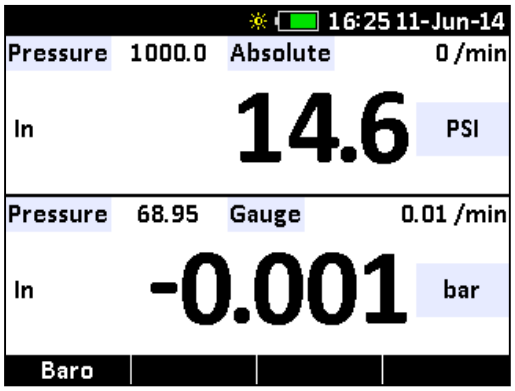
1. Connect the pressure module to the ASC-400 calibrator, as shown below in Figure 6.

Note…

The APM might take a while to start up. The module is a complete pressure measuring system with a microcontroller system inside.

The calibrator can measure pressure on both the upper and the lower display. This makes it possible to measure pressure in two different units at the same time.

2. Select either the upper or lower display to work from.
3. Select “Pressure” from the Upper or Lower Mode list.
4. Select type of pressure, Gauge or Absolute (If barometer is mounted in ASC-400).
5. Select the desired measuring unit from the Units list.
6. Zero the pressure module (see section 5.5.1 for using the zeroing function).
7. Leak rate is automatically calculated in the selected pressure unit / minute.



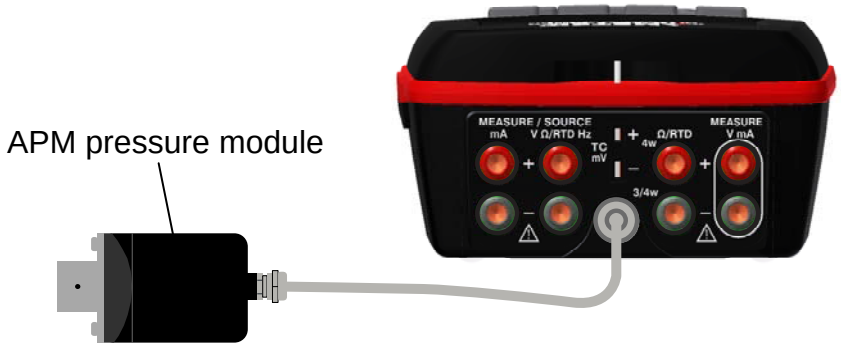


Figure 6
Connections for Measuring Pressure

5.5.1 Zeroing with Absolute Pressure Modules (APM S, H and Mk.II)

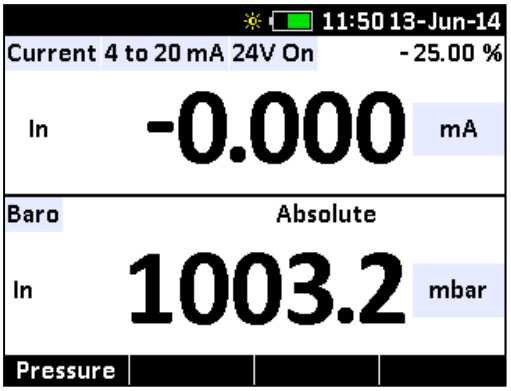
To zero, adjust the calibrator to read a known pressure, such as barometric pressure.

To adjust the calibrator, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select either the upper or lower display to work from.
2. Select “Pressure” from the Upper or Lower Mode list.
3. Press ZERO to activate the Zeroing.
4. The calibrator stores the Barometric zero offset in non-volatile memory.
   The zero offset is stored for one absolute pressure module at a time. If a new absolute module is connected this process must be repeated.

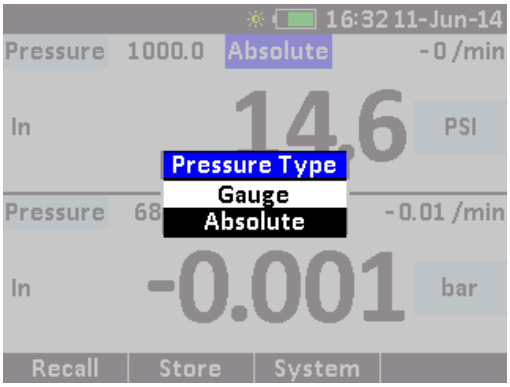
5.5.2 Using the BARO Module (optional)

1. The BARO barometer option in the ASC-400 calibrator has 2 functions.
   - Working as a high accuracy barometer



   - Applying the barometric pressure value to the measurement of a pressure module (APM) allowing any gauge APM to be used for absolute measurements. This system is superior to ordinary absolute sensors, as the working sensor is gauge and can be zeroed at any time, compensating for potential drift.

2. If the BARO option is mounted, the pressure type field becomes active and pressure type can be selected.



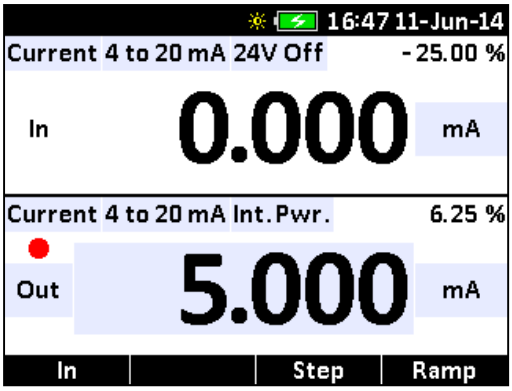
6.0 Using Source modes (Lower Display)

The ASC-400 calibrator can generate calibrated signals for testing and calibrating process instruments. The calibrator can source voltages, currents, resistances, frequencies, pulses, and the electrical output of RTD and thermocouple temperature sensors.

6.1 Sourcing mA (internal loop power supply)

To source a current, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Current” from the Lower Mode list.
2. Select “Int. Pwr.” from the Power Source list.
3. Select “Out” from the Test Mode list.
4. Connect leads to the mA terminals, as shown in Figure 7.
5. Enter the desired current using either the ARROW keys or the numeric keys.



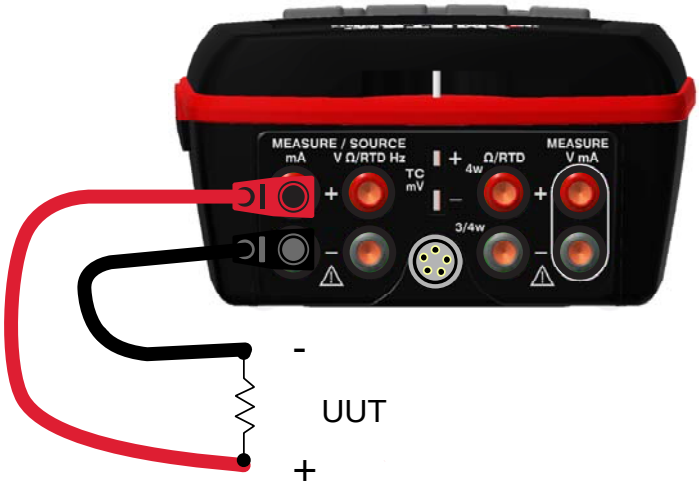


Figure 7
Connections for Sourcing Current

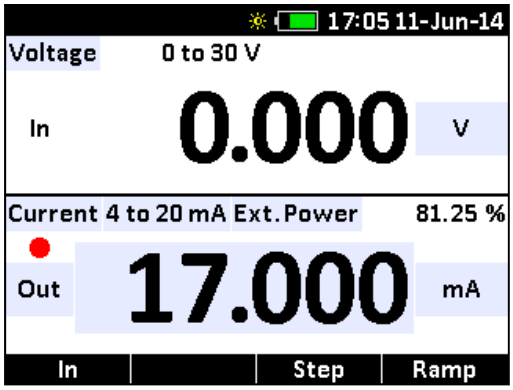
UUT 900 ohms max. (650 ohms with HART resistor turned on)

6.2 mA Sink (external loop power supply)

The ASC-400 calibrator can supply a variable test current into a mA loop to calibrate or debug installed mA loops

Follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Current” from the Lower Mode list.
2. Select “Ext. Pwr.” from the Power Source list.
3. Connect the loop, as shown in Figure 8.



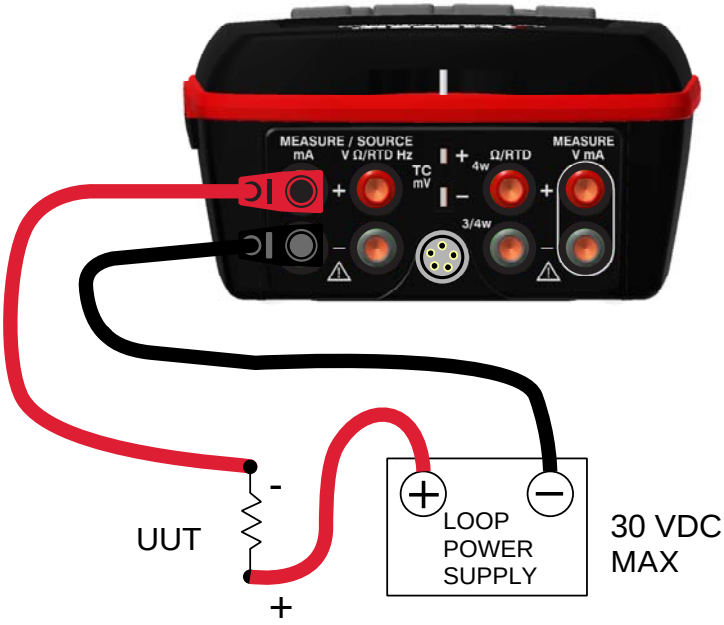


Figure 8
Connections for mA loop calibration/debug

6.3 Sourcing Voltage

To source voltage, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Voltage” from the Lower Mode list.
2. Select “0 to 20 V” from the Range list.
3. Select “Out” from the Test Mode list.
4. Connect leads to the voltage source terminals, as shown in Figure 9.
5. Enter the desired voltage using either the ARROW keys or the numeric keys.

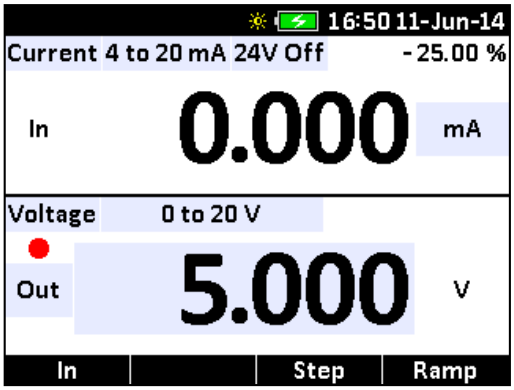
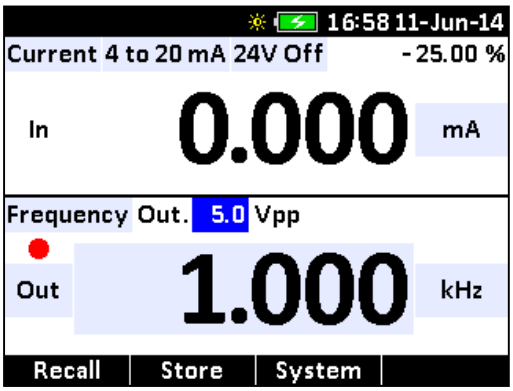


Figure 9
Connections for Sourcing Voltage and Frequency

6.4 Sourcing Frequency

To source a signal, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Frequency” from the Lower Mode list.
1. Select “Out” from the Test Mode list.
2. Select the desired frequency unit from the Units list.
3. Connect leads to the frequency output terminals, as shown in Figure 9.
4. Enter the desired frequency using either the ARROW keys or the numeric keys.
5. The amplitude can be changed by entering the Output Volt peak to peak (Out. Vpp) setup field. Use either the ARROW keys or the numeric keys to change the amplitude.

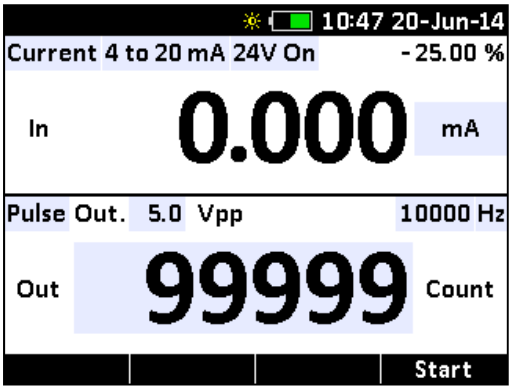


6.5 Sourcing a Pulse Train

The ASC-400 calibrator can generate a pulse train with a selectable number of pulses at a desired frequency and output level.
For example, setting the frequency to 10Hz and the number of pulses to 99999 would produce 99999 pulses for a period of 10 seconds.

To source a pulse, use the same connection as for frequency, and follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

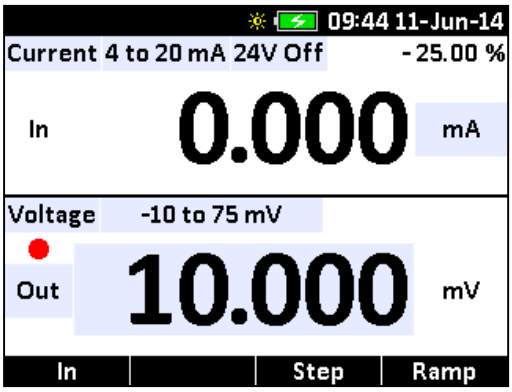
1. Select “Pulse” from the Lower Mode list.
2. Select the desired frequency unit from the Units list.
3. The amplitude of the pulse can be changed by entering the Output (Out. Vpp) setup field. Use either the ARROW keys or the numeric keys to change the amplitude.
4. Enter the desired number of pulses (Count) using either the ARROW keys or the numeric keys.
5. Press F4 (Start) to start and stop the signal.



6.6 Sourcing mV

To source an mV, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Connect the thermocouple leads to the appropriate polarized TC mini plug, and insert the plug into the TC terminals on the calibrator, as shown in Figure 10.
2. Select “Voltage” from the Lower Mode list.
3. Select “-10 to 75 mV” from the Range list.
4. Select “Out” from the Test Mode list.
5. Enter the desired mV using either the ARROW keys or the numeric keys.

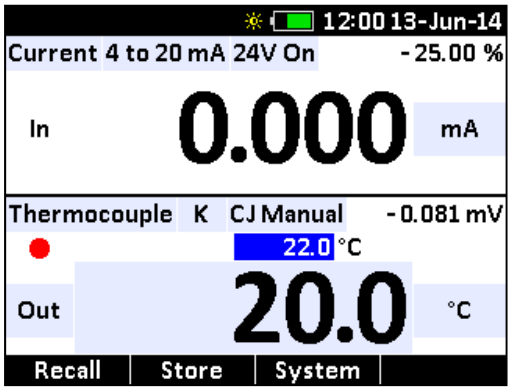


Note…
CJ compensation is not active in this mode.

6.7 Sourcing Thermocouples

To source a thermocouple, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Connect the thermocouple leads to the appropriate polarized TC mini plug, and insert the plug into the TC terminals on the calibrator, as shown in Figure 10.
2. Select “Thermocouple” from the Lower Mode list.
3. Select the desired thermocouple type from the TC Type list.
4. Select the desired CJ mode from the CJ Mode list.
   If CJ Manual is selected, enter CJ temperature.



5. Select the desired temperature unit from the Units list.
6. Select “Out” from the Test Mode list.
7. Enter the temperature using either the ARROW keys or the numeric keys.

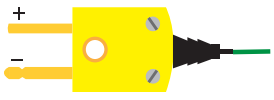


Figure 10
Connections for Thermocouple temperature and mV output. (showing additional mA loop from TTX / signal converter)

Note…
The TC wire and connector used must match the TTX / signal converter input

6.8 Sourcing Ohms/RTDs

To source an RTD, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “RTD” or “Resistance” from the Lower Mode list.
2. Select the desired RTD type from the RTD Type list (only when selecting “RTD” from the Lower Mode list).
3. Select the desired temperature unit from the Units list (only when selecting “RTD” from the Lower Mode list).
4. Select “Out” from the Test Mode list.
5. Connect the calibrator to the instrument being tested, as shown in Figure 11.
6. Enter the temperature or the resistance using either the ARROW keys or the numeric keys.

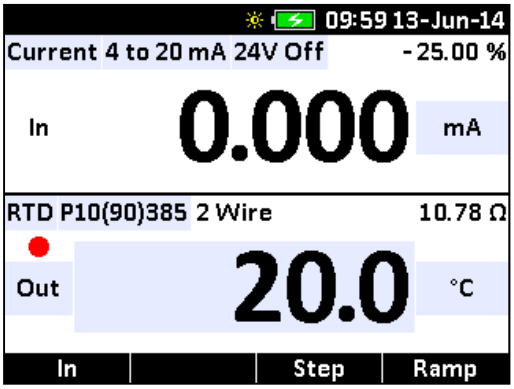
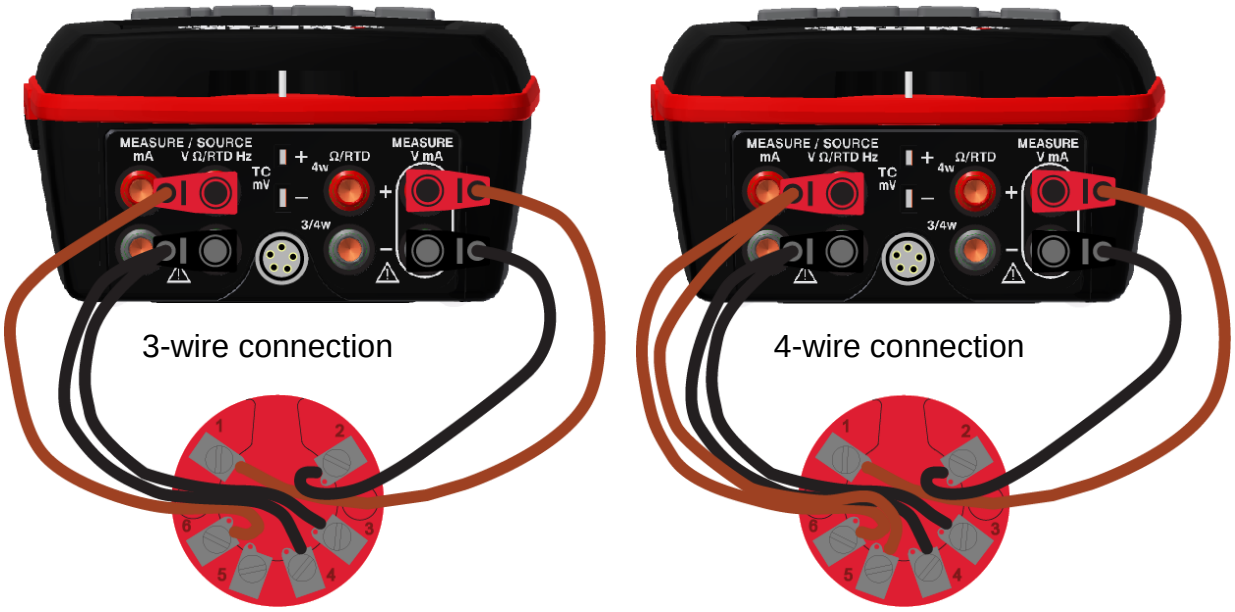


Figure 11
Connections for Outputting RTDs (always 2-wire)
(showing additional mA loop from TTX / signal converter)

Note…

The ASC-400 calibrator simulates a 2-wire RTD. To connect 3- or 4-wire transmitter, use stacked test leads, as shown in Figure 12.

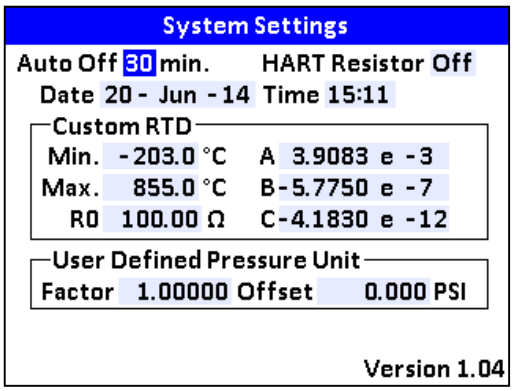
Figure 12
Using a 3- or 4-wire Connection for RTDs



6.9 Custom RTD

The ASC-400 offers the possibility of entering a custom curve-fit PRT into the calibrator for sourcing and measuring.
Follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Custom” from the RTD Type list. The option is found at the bottom of the list.
2. Press F3 (System) to access the System Settings.



3. Enter the desired values in the Custom RTD setting fields using either the ARROW keys or the numeric keys and accept the values.
4. Leave the System Settings setup.
5. Attach the custom RTD leads as shown in Figures 11 or 12.

The custom function uses the Calendar-Van Dusen equation for outputting and measuring custom RTDs.

The coefficient C is only used for temperatures below 0°C. Only A and B coefficients are needed for the range above 0°C, so coefficient C should be set to 0.

The R0 is the resistance of the probe at 0°C.
The ITS 90 coefficients for PT385, PT3926, and PT3616 are shown in Table 1.

Table 1
RTD Coefficients

RTD	Range (°C)	R0	Coefficient A	Coefficient B	Coefficient C
PT385	-200 to 0	100	3.9083 x 10-3	-5.775 x 10-7	-4.183 x 10-12
PT385	0 to 850	100	3.9083 x 10-3	-5.775 x 10-7	-
PT3926	Below 0	100	3.9848 x 10-3	-5.87 x 10-7	-4 x 10-12
PT3926	Above 0	100	3.9848 x 10-3	-5.87 x 10-7	-
PT3916	Below 0	100	3.9692 x 10-3	-5.8495 x 10-7	-4.2325 x 10-12
PT3916	Above 0	100	3.9692 x 10-3	-5.8495 x 10-7	-

6.10 Using Auto Output functions

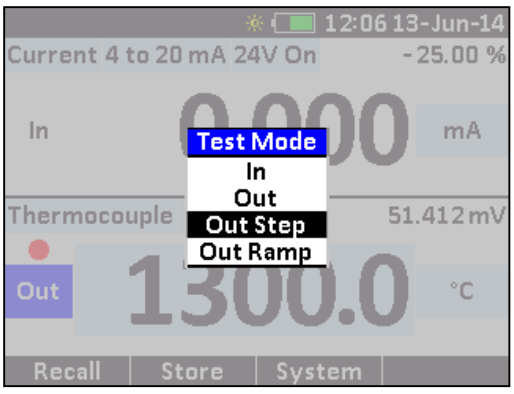
The ASC-400 calibrator has two Auto Output functions:

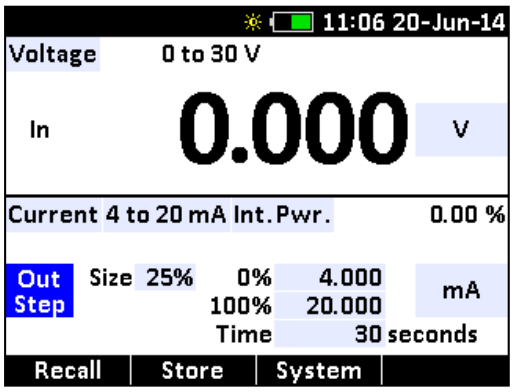
- Step
- Ramp

6.10.1 Using the Step function

To use the Step function, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

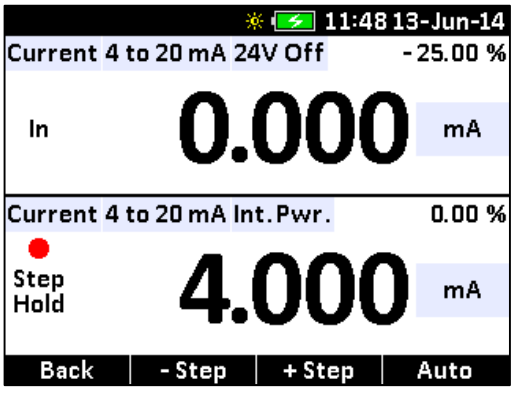
1. Select the desired lower mode from the Lower Mode list. Auto Output options are not available for Pulse, Pressure and Baro modes.
2. Select “Out Step” from the Test Mode list.





3. If TC or RTD is selected, choose the type and temperature units first, to get proper step values.
4. Selection of Step is also possible using the F3 function key (Step) for quick, menu free access.
5. Select the desired step size from the Step Size list. The ASC-400 will step from the 0% set source value to the 100% set source value in 10%, 20% or 25%increments. The step time is adjustable from 1 to 999 seconds.
6. Exit the edit mode menu when all the selections have been made.
7. Press F3 (Step) to access the MANUAL Step menu.

   or
8. Press F4 (Auto) to start auto stepping, using the selected step time.

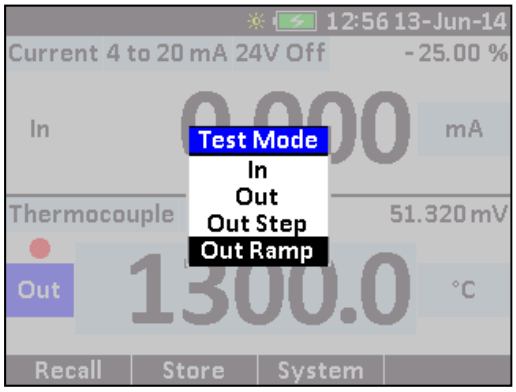


9. Pres either F2 (–Step) or F3 (+Step) to Step up- or downwards.
10. In AUTO step, press F4 (Stop) to stop the auto stepping.
11. To cancel Step or Auto step mode, press F1 (Back).

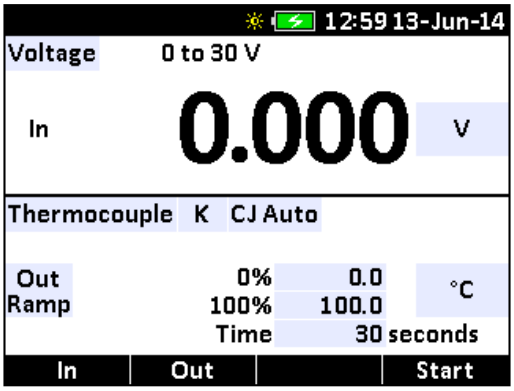
6.10.2 Using the Ramp function

To use the Ramp function, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

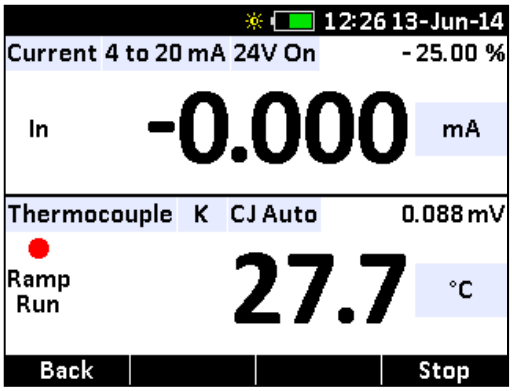
1. Select the desired lower mode from the Lower Mode list. Auto Output options are not available for Pulse, Pressure and Baro modes.
2. Select “Out Ramp” from the Test Mode list.



3. If TC or RTD is selected, choose the type and temperature units first, to get proper ramp values.
4. Selection of Ramp is also possible using the F4 function key (Ramp) for quick, menu free access.
5. Select the desired 0% and 100% values. The ASC-400 will ramp from the 0% set source value to the 100% set source value in the selected time (5 to 999 seconds).
6. Exit the edit mode menu when all the selections have been made.



7. Press F4 (Start) to begin auto rapping.



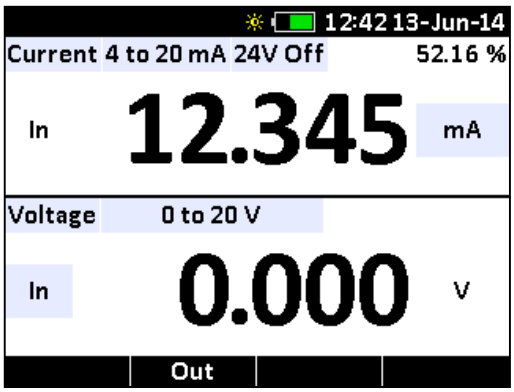
8. When ramping, press F4 (Stop) to stop ramping.
9. To cancel Ramp mode, press F1 (Back).

7.0 Using Isolated Measure Modes (Upper Display)

7.1 Measuring mA (external loop supply)

The current output of a transmitter, or any other 0 to 24 mA current, can be measured using the upper display.
To make the desired measurements, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Current” from the Upper Mode list.
2. Select the primary parameters to be measured and accept the selections.



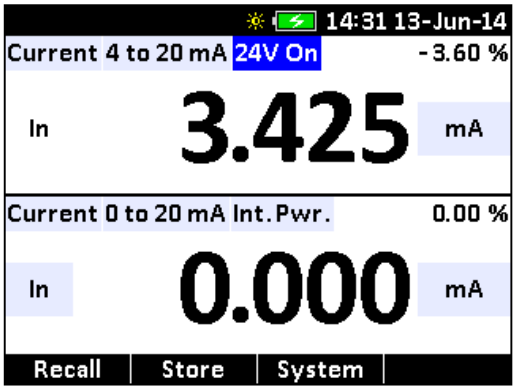
3. Connect the leads to the isolated inputs of the calibrator, as shown in Figure 13.

Figure 13
mA current measurement connection (upper window)

7.2 Measuring current with internal loop power

To test/calibrate a 2-wire, loop powered transmitter, as stand alone, use the loop power function. This function activates a 24V supply in series with the current measuring circuit. To use this option, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Current” from the Upper Mode list.
2. Select “24V On” from the 24V Power list.



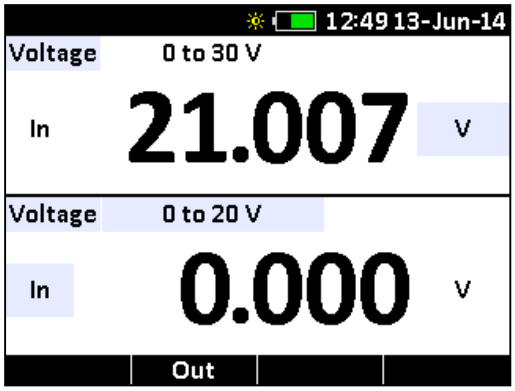
3. Connect the ASC-400 calibrator to transmitter current loop terminals, as shown in Figure 14.

Figure 14
Connection using build in loop supply in ASC-400

7.3 Measuring Voltage

The voltage output of a transmitter can be measured using the upper display.
To make the desired measurements, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select “Voltage” from the Upper Mode list.
2. Select the primary parameters to be measured and accept the selections.



3. Connect the leads to the isolated inputs of the calibrator, as shown in Figure 13.

7.4 Measuring Pressure

Warning

To avoid a violent release of pressure in a pressurized system, shut off the valve and slowly bleed off the pressure before you attach the pressure module to the pressure line.

Caution…

- To avoid damaging the pressure module from overpressure, never apply pressure above the rated maximum printed on the module.
- To avoid damaging the pressure module from corrosion, use it only with specified materials. Refer to the pressure module documentation for material compatibility.

To measure pressure, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

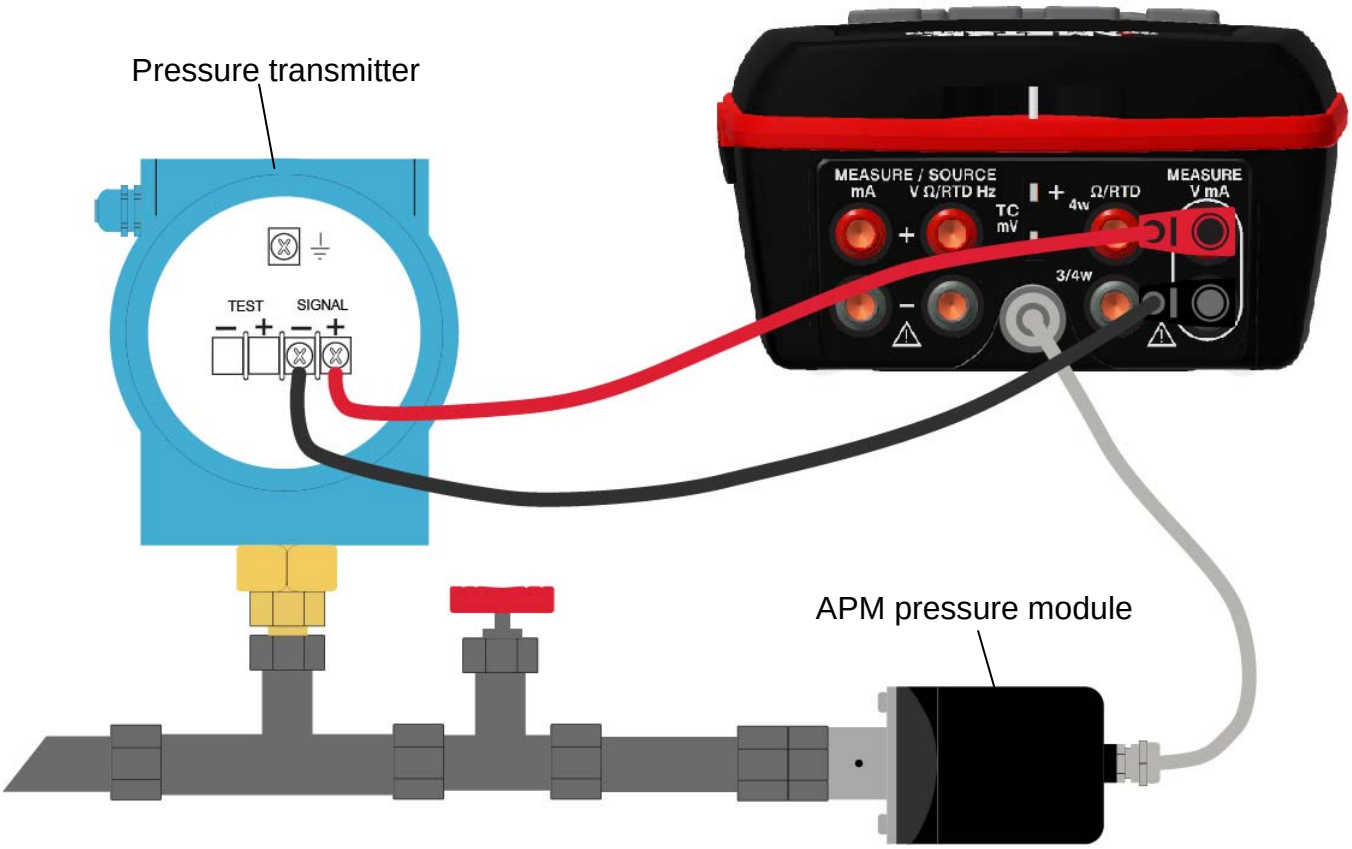
1. Connect the pressure module (JOFRA APM) to the ASC-400 calibrator, as shown in Figure 15.

   The calibrator can measure pressure on both the upper and the lower display. This makes it possible to display the pressure value in two different pressure units at the same time.

2. Select either the upper or lower display to work from.
3. Select “Pressure” from the Upper or Lower Mode list.
4. Select the desired measuring unit from the Units list

5. Zero the pressure module (see section 5.5.1 for using the zeroing function).

Figure 15
Measuring on a Pressure Transmitter (PTX)



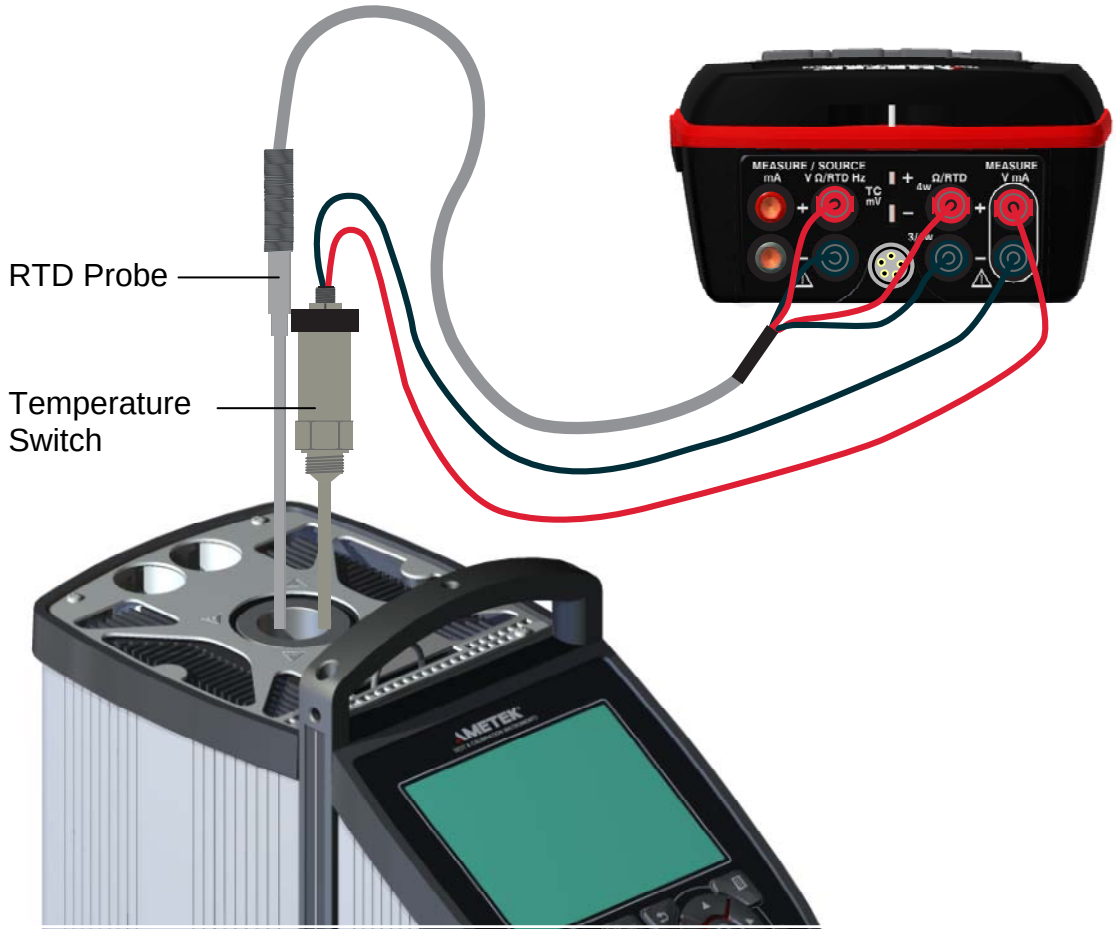
8.0 Using the Upper and Lower Display for Calibration and Testing

8.1 Performing a Temperature Switch Test

The ASC-400 calibrator can detect switch state changes and link the results in any source/simulate mode (except pulse), performing an automatic or semi automatic switch calibration, on a great variety of pressure, temperature and electrical level switches.

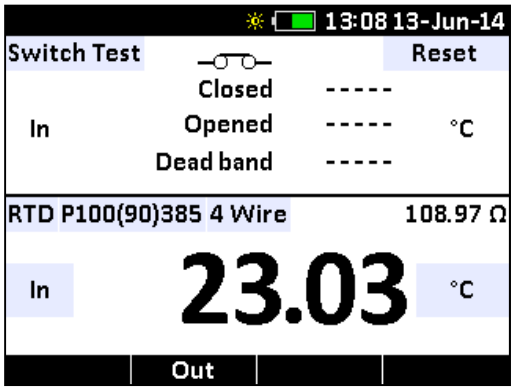
An example is given below for calibrating a temperature switch, measuring the temperature with an external RTD sensor, using an external temperature source.

Figure 16
Temperature Switch Test

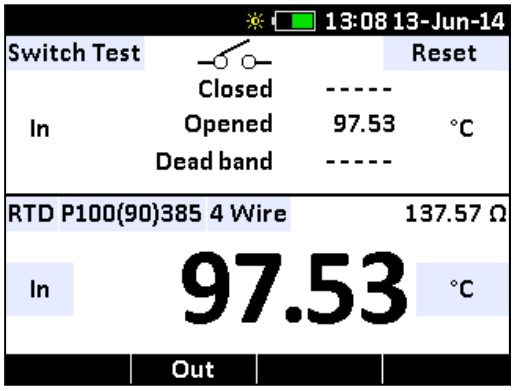


To perform a switch test, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

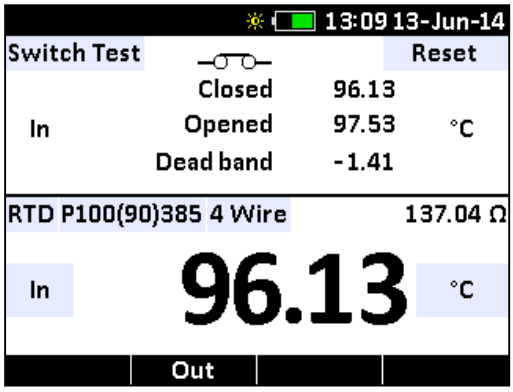
1. Select the upper display and select “Switch Test” from the Upper Mode list.
2. Connect the ASC-400 calibrator to the switch using the switch terminals. The polarity of the terminals does not matter.
3. The upper display shows no read outs at neither “Closed”, “Opened” nor “Dead band”



4. Raise the temperature slowly until the switch opens.



5. Lower the temperature slowly until the switch closes.
6. The upper display will now show :
   - the temperature when the switch closed
   - the temperature that the switch opened at
   - the dead band between the temperatures readings.



7. To perform another test clear the data by selecting “Reset” using the edit mode.

8.2 Performing a Pressure Switch Test

The ASC-400 calibrator can detect contact state changes and capture the results in any source/simulate mode (except pulse). The calibrator records switch state and pressure measurement, at the time of switch change, after the test, the result is displayed in a convenient and easy to use format.

An example is given below for a pressure switch test.

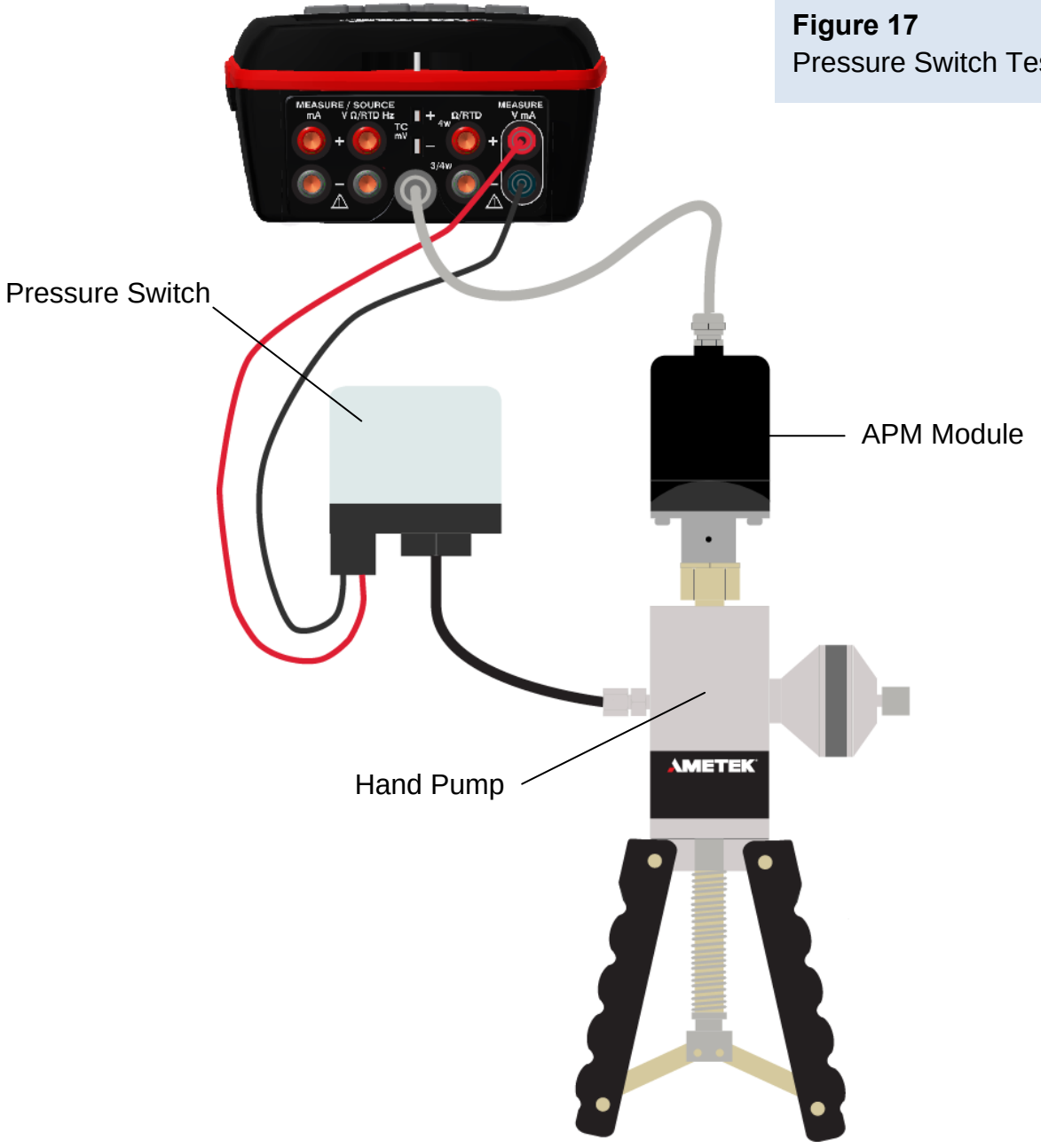


Figure 17
Pressure Switch Test

To perform a switch test, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select the upper display and select “Switch Test” from the Upper Mode list.
2. Connect the ASC-400 calibrator to the switch using the pressure switch terminals. The polarity of the terminals does not matter.

3. Connect the pump to the ASC-400 calibrator and the pressure switch.
4. Make sure the vent on the pump is open. Zero the pump if necessary.

Note…

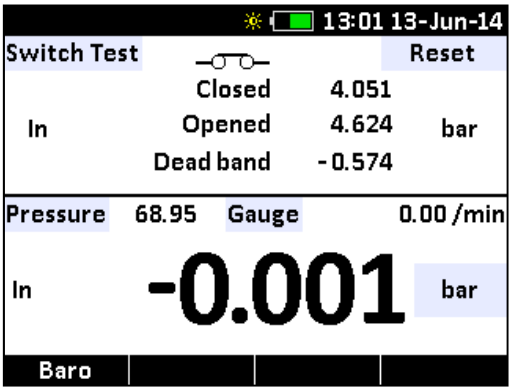
Zero the APM if necessary. Close the vent after zeroing the calibrator.

5. The upper display shows no read outs at neither “Closed”, “Opened” nor “Dead band”
6. Apply pressure with the pump slowly until the switch opens.

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 device under test should be done slowly to ensure accurate readings.

7. Vent the pump slowly until the pressure switch closes.
8. The upper display will now show :
   - the pressure when the switch closed
   - the pressure that the switch opened at
   - the dead band between the pressure readings.



8.3 Testing an Input or Indicating Device

To test and calibrate actuators, recording, and indicating devices using the source functions, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

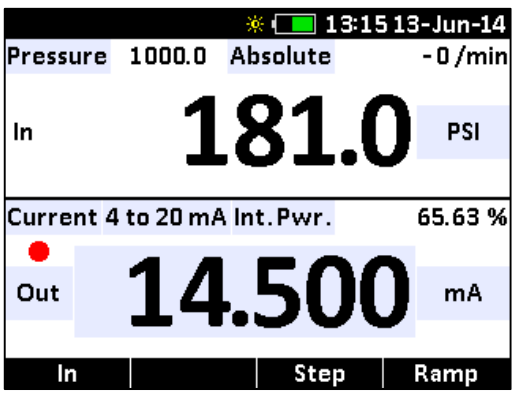
1. Select the lower display and select the desired primary parameter from the Lower Mode list.
2. Select “Out” from the Test Mode list (input/output control).
3. Connect the leads to the device and the ASC-400 calibrator as shown in Figure 18.

Figure 18
Connections for Testing an Output Device

8.4 Calibrating an I/P Device

To calibrate a device that controls pressure, follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select the upper display and select “Pressure” from the Upper Mode list.
2. Select the lower display and select “Current” from the Lower Mode list.
3. Connect the ASC-400 calibrator to the device as shown in Figure 19.
   The calibrator will simulate the transmitter current and measure the output pressure.
4. Enter a current using either the ARROW keys or the numeric keys.



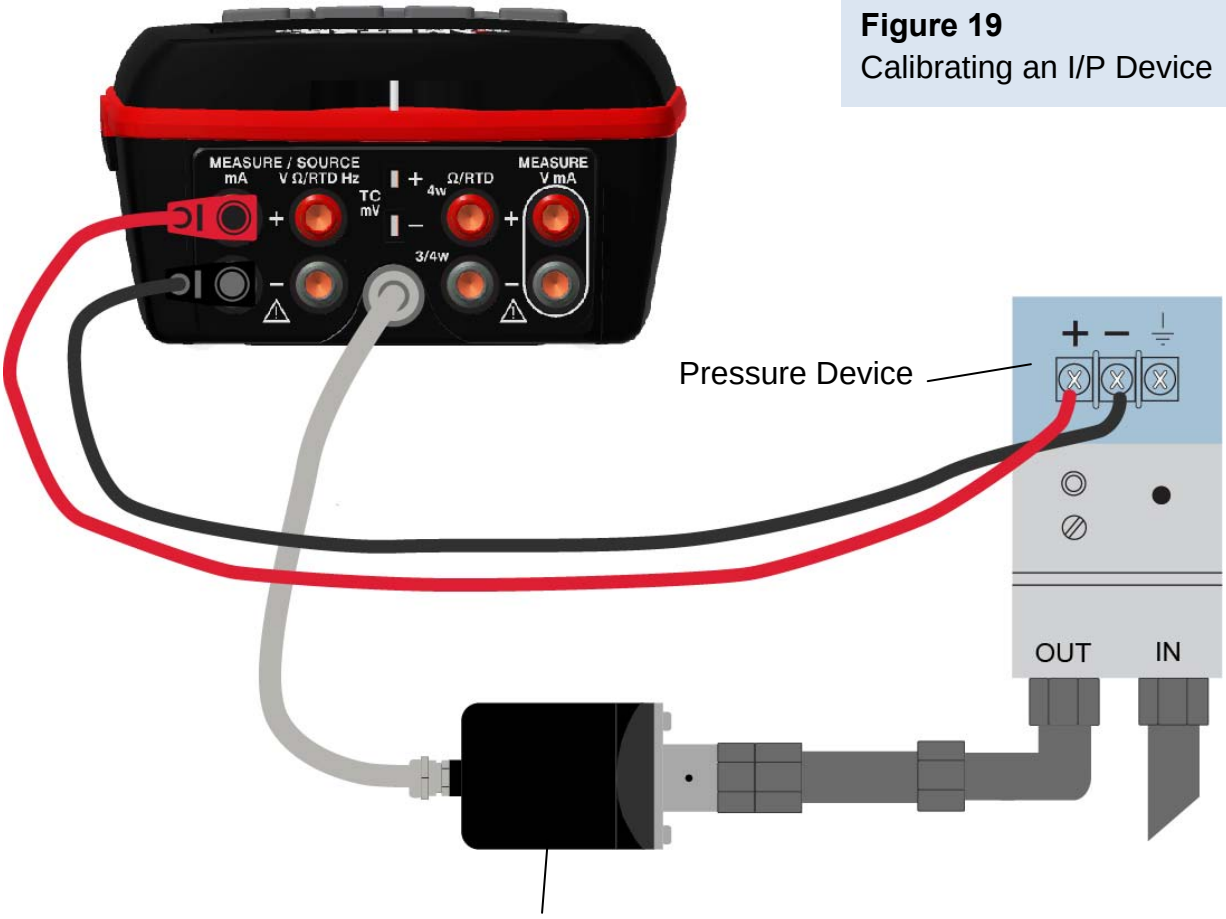


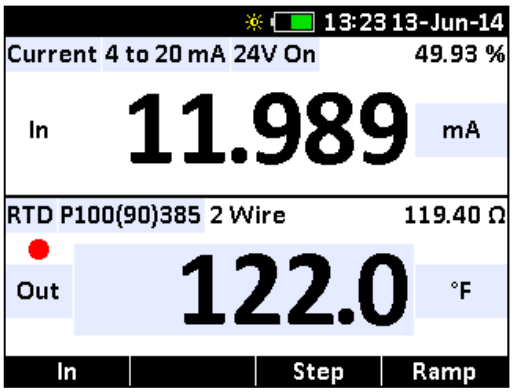
Figure 19
Calibrating an I/P Device

8.5 Calibrating a Transmitter (Signal Converter)

To calibrate a transmitter both the upper and the lower displays will be used; one for measuring the output, and one for sourcing the input. This section covers all but the pressure transmitters. A RTD temperature transmitter is used in this example.

Follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select the lower display and select “RTD” from the Lower Mode list.
2. Select “Out” from the Test Mode list (input/output control).
3. Select “RTD” from the RTD Type list.
4. Select the upper display and select “Current” from the Upper Mode list.
5. Select “4 to 20mA” from the Range list.
6. To turn the loop power on, select “24V On” from the 24V Power list (loop power).
7. Connect the ASC-400 calibrator to the transmitter as shown in Figure 20.
8. Enter output values using the numeric keys or fine adjust using the ARROW keys.



9. Adjust the transmitter as necessary.

To calibrate different transmitter types, follow the above steps with the exception of selecting the appropriate input type on the lower display.

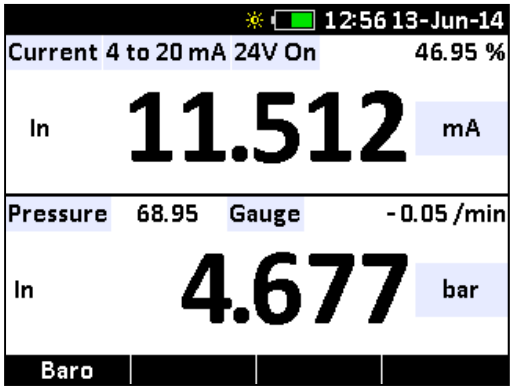
Figure 20
Calibrating a Transmitter

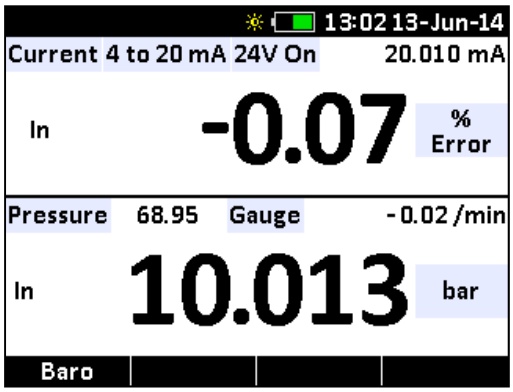
8.6 Calibrating a Pressure Transmitter (loop powered 4-20 mA)

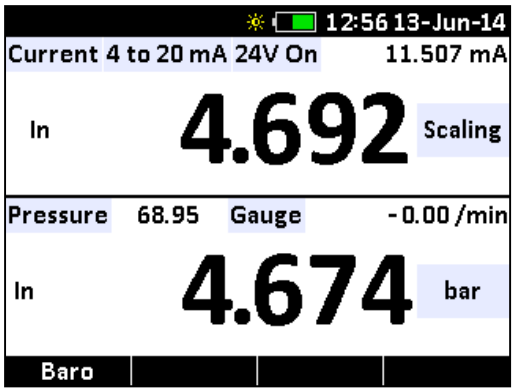
To calibrate a pressure transmitter both the upper and the lower displays will be used; upper for measuring the output, and lower for pressure measurement.

Follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select the lower display and select “Pressure” from the Lower Mode list.
2. Select the upper display and select “Current” from the Upper Mode list.
3. Select “4 to 20mA” from the Range list.
4. To turn the loop power on, select “24V On” from the 24V Power list.
5. Connect the ASC-400 calibrator to the transmitter and the pressure module as shown in Figure 21.
6. Zero the pressure module.

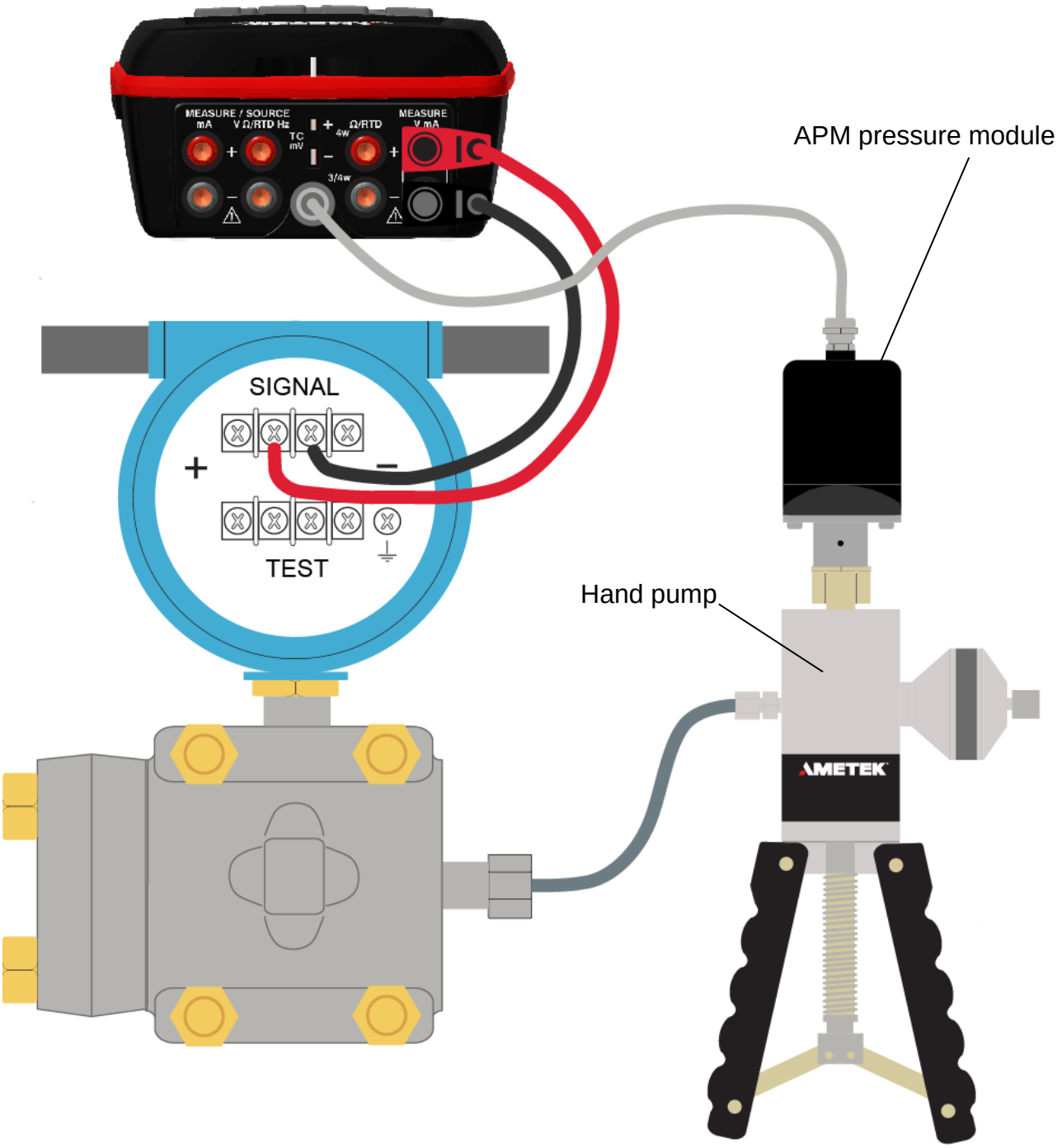






7. Test the transmitter at 3 or more points of the span to prove hysteresis.
8. Adjust the transmitter as necessary.

Figure 21
Calibrating a Pressure Transmitter

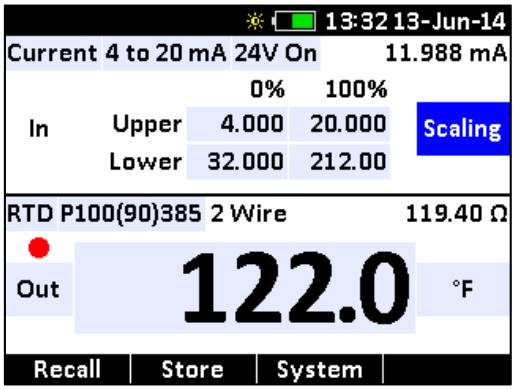


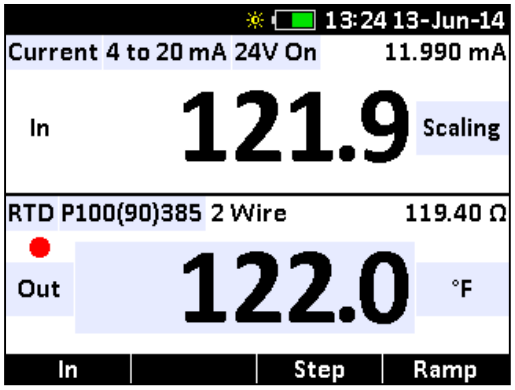
8.7 Using Scaled Current or Voltage when testing or calibrating a T/I Transmitter

The ASC-400 calibrator has the ability to read current or voltage on the upper display that is scaled to and displayed in the same units of the lower display.

Follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select the lower display and select “RTD” from the Lower Mode list.
2. Select “Out step” from the Test Mode list (input/output control).
3. Select “RTD” from the RTD Type list.
4. Set the 0%, the 100% span points and the time using either the ARROW keys or the numeric keys
5. Select the upper display and select either “Current” or “Voltage” from the Upper Mode list.
6. Select power mode, internal or external power. (Current only)
7. Select “Scaling” from the Units list.
8. From the Scaling Menu set the 0% and 100% point for the upper and lower displays using either the ARROW keys or the numeric keys.



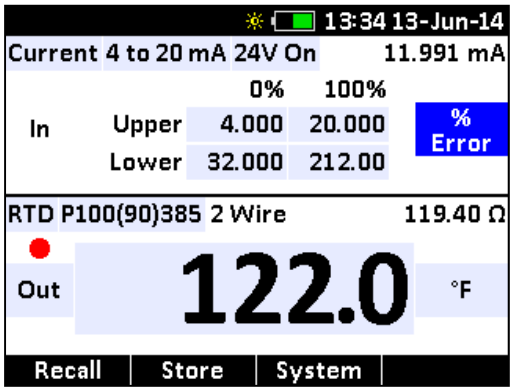


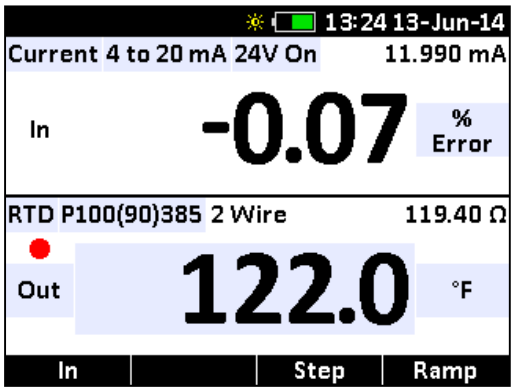
8.8 Using Percent Error when testing or calibrating a T/I Transmitter

The ASC-400 calibrator features a function which can calculate signal or pressure vs. milliamp error as a percentage of the 4 to 20 mA loop span.

Follow the principle of navigating through the functions described in the guidelines in section 4.2 and proceed as follows:

1. Select the lower display and select “RTD” from the Lower Mode list.
2. Select “Out step” from the Test Mode list (input/output control).
3. Select “RTD” from the RTD Type list.
4. Set the 0%, the 100% span points and the time using either the ARROW keys or the numeric keys
5. Select the upper display and select either “Current” or “Voltage” from the Upper Mode list.
6. Select power mode, internal or external power. (Current only)
7. Select “%Error” from the Units list.
8. From the %Error Menu set the 0% and 100% point for the upper and lower displays using either the ARROW keys or the numeric keys.





9.0 Maintenance

Warning

To avoid possible electric shock, personal injury or sudden release of pressure, review “Safety Instructions” Section 2.0 before proceeding.

Only qualified service personnel should perform calibration, repairs, or service not covered by this manual.

For maintenance procedures not described in this manual, or if the ASC-400 calibrator needs repair, please contact AMETEK Denmark Service Department as described below in section 9.1 “Returning the calibrator to service”.

9.1 Returning the calibrator to service

If the calibrator continuously malfunctions, verify that the instrument is being operated as described in this manual and return it to the manufacturer for repair/service.

If the calibrator needs repair and is under warranty, see the warranty statement section 1.1 for terms. If the warranty has lapsed, the calibrator can be repaired and returned for a fixed fee.

When returning the instrument please enclose a fully completed service information form. Simply copy the “Service info” form from the following page and fill in the required information. The calibrator should be returned in the original packing.

Note…

AMETEK Denmark’s liability ceases if:

- parts are replaced/repaired using spare parts, which are not identical to those recommended by the manufacturer.
- non-original parts are used in any way when operating the instrument.

AMETEK Denmark’s liability is restricted to errors originated from the factory.

Service info

Customer data: **Date:**

Customer name and address:_____

Attention and dept.:_____

Fax no./phone no.:_____

Your order no.:_____

Delivery address:_____

Distributor name:_____

Instrument data:

Model and serial no.:_____

Warranty claimed Yes:_____ No:_____ Original invoice no.:_____

Temp. calibration	Sensor input	**Service request:**	**This instrument is sent for (please check off):**
☐	☐	___ Calibration as left	___ Check
☐	☐	___ Calibration as found and as left	___ Service
☐	☐	___ Accredited calibration as left	___ Repair
☐	☐	___ Accredited calibration as found and as left.	

Diagnosis data/cause for return:

Diagnosis/fault description:_____

_____

_____

_____

_____

Special requests:_____

_____

_____

_____

_____

Safety precautions: if the product has been exposed to any hazardous substances, it must be thoroughly decontaminated before it is returned to AMETEK Denmark A/S. Details of the hazardous substances and any precautions to be taken must be enclosed.

9.2 Replacing batteries

The battery icon  indicates how much power is remaining.

If the batteries discharge too deeply the calibrator will automatically shut down to avoid battery leakage and false measurements.

All stored data will be preserved.

Caution…

Always set the charger switch in “Alkaline” position when alkaline batteries are installed (factory setting).

The ASC-400 calibrator uses six AA batteries.

1. Unscrew the captive screw (knurled head) to gain access to the battery compartment.

Figure 22
Replacing batteries

2. Replace the batteries taking care to note polarity for their proper installation. Use **ONLY** AA size Alkaline batteries or optional NiMH rechargeable batteries. Ensure the battery type switch is in the right position (Alkaline or rechargeable).
3. Remount battery cover and the captive screw.

9.3 Storing

It is not necessary to store away the ASC-400 calibrator after use.
The calibrator can be part of a continuous set-up, as long as it is kept in a dry, clean place.

Alternatively the calibrator can be stored in the soft bag delivered with the instrument.

9.4 Cleaning

Caution…

Before cleaning the calibrator, you **must** switch it off.

Periodically wipe the case of the calibrator with a damp soft cloth. A mild detergent can be used with the water.

Caution…

- The soft cloth must be firmly wrung to avoid any water penetrating the calibrator and causing damage.
- **Do not** use solvents or abrasive cleansers. They might damage the display and case.

10.0 Errors

Warning

During set-up, make sure that there is correlation between the software set-up, and the actual distribution of the sensors connected to the calibrator. The software cannot detect misplacements of sensors.

If the power is lost to the entire test set-up or part of it, it is highly recommended to restart the calibration.

GENERAL ERRORS	
Error description	Solution
ASC-400 does not turn on :	• Check the batteries • Check the power supply • If the error still occurs, return the ASC-400 to the manufacturer for service
Faulty readout :	• Check that the connected sensors are correctly connected and that they are properly polarised • Check that the ASC-400 is set up correctly • Switch the ASC-400 off and on again • If the error still occurs, return the ASC-400 to the manufacturer for service
No contact with the ASC-400 :	• Check the power supply • Check the USB connection. Use only the supplied cable • Switch the ASC-400 off and on again - and set up the software again • If the error still occurs, return the ASC-400 to the manufacturer for service
	When using Hyper Terminal or similar terminal programs, and communications fails, check that the program has been set up correctly.
Faulty readout from thermocouples:	• Check that the correct type has been selected during setup • Check that the sensors have been correctly polarised and connected • Check that the correct type of cold junction has been selected manually/automatically/off • Check that the ASC-400 is not subjected to direct or indirect heat sources

11.0 Technical specifications

All specifications are given with an ambient temperature of 23 ±5°C / 73 ±9°F

Mechanical specifications

Description	Value
Operating temperature :	-10 to 50°C / 14 to 122°F
Storage temperature :	-20 to 60°C / -4 to 140°F
Dimension LxWxH :	220x96x55 mm / 8.66x3.78x2.17 in
Case protection:	IP40
Humidity:	0% to 80% R.H. non-condensing
Display:	2.8" 320*240 TFT colour display
Weight incl. Batteries :	584 g / 20.6 oz
Unit in soft case :	235x95x115 mm / 9.25x3.74x4.53 in
Weight incl. Test leas and test chips :	933 g / 32.91 oz
Shipping size :	275x100x175 mm / 10.83x3.94x6.89 in
Shipping weight :	1233 g /43.49 oz

Electrical specifications

Description	Value
Mains adapter:	(option) 9VDC/500mA - 230VAC/115VAC
Batteries :	6 x AA batteries 1.5V AA… Alkaline (non rechargeable) or AA NiMh (rechargeable)
Battery lifetime, Alkaline, backlight low: **Battery lifetime, Alkaline, backlight high, 12 mA: loop power:**	30 hours 13 hours
Battery charge current. Use only NiMH cells with capacity larger than 1700 mAh.:	85 mA
RS232 communication interface : Connector : Communication type :	 Mini USB female (B) USB 2.0 / ASCII
Display update rate:	2.5/second (mA, V, resistance, RTD, TC) 10/second (pressure, switch-test)
Temperature coefficient: **-10°C to 18°C and 28°C to 50°C:**	0.003%FS/°C / 0.0017%FS/°F (mA, V, resistance) 0.001%rdg/°C / 0.0006%rdg/°F (frequency)

Thermocouple mV	Range		Accuracy ±
	Min	Max	12 months
TC mV read	-10.000 mV	75.000 mV	0.015% rdg +10µV
TC mV source	-10.000 mV	75.000 mV	0.015% rdg +10µV

Maximum output current is 3 mA Output impedance 0.010 ohm. Input impedance 10 Mohm.

Thermocouple Cold junction	Range		Accuracy ±
	Min	Max	12 months
CJC compensation	18°C / 64°F	28°C / 83°F	0.2°C / 0.36°F
CJC outside above			0.05°C/°C 0.05°F/°F

Volt V	Range		Accuracy ±
	Min	Max	12 months
Read (Isolated)	0.000 V	30.000 V	0.01% rdg +2mV
Read (non-isolated)	0.000 V	20.000 V	0.01% rdg +2mV
Source	0.000 V	20.000 V	0.01% rdg +2mV

Maximum output current in voltage ranges is 3 mA Output impedance <1 ohm . Input resistance 1 Mohm.

Frequency Pulse	Range		Accuracy ±
	Min	Max	12 months
CPM read	2.0	600.0	0.05% rdg + 0.1CPM
Hz read	0.050	10.000	0.05% rdg + 0.001Hz
	10.000	100.00	0.05% rdg + 0.01Hz
	100.00	1000.0	0.05% rdg + 0.1Hz
	1000.0	10000	0.05% rdg + 1Hz
KHz read	1.000	10.000	0.05% rdg +0.001KHz
CPM source	2.0	600.0	0.05% rdg
Hz source	0.050	1000.0	0.05% rdg
	1000.0	10000	0.06% rdg
KHz source	1.000	10.000	0.06% rdg
Pulse (source only) **Rate : 1 Hz to 10KHz**	1	99999	

Input voltage amplitude range on frequency is 1 to 20 V, Trigger level 0.2 to 10 volt. Minimum pulse width 10 µS.
Output amplitude is adjustable from 1 to 20 V and is a square wave with a 50% duty cycle.
For output frequency, a slight negative offset of approximately -0.1 V is present to assure zero crossing.

Ohm	Range		Accuracy ±
	Min	Max	12 months
Ohm read (low)	0.00	400.00	0.015% rdg + 0.03 ohm
Ohm read (high)	400.0	4000.0	0.015% rdg + 0.3 ohm
Ohm source (low)			
@ 0.1 to 0.2 mA	5.0	400.00	0.015% rdg +0.10 ohm
@ 0.2 to 0.5 mA	5.0	400.00	0.015% rdg +0.05 ohm
@ 0.5 to IE max	5.0	400.00	0.015% rdg +0.03 ohm
Ohm source (high)			
@ 0.05 to 0.1 mA	400.0	4000.0	0.015% rdg +0.5 ohm
@ 0.1 to IE max	400.0	4000.0	0.015% rdg +0.3 ohm

True Ohm Measurement current (pulsed) 0.25 mA.
3W measurement current match 1% Source exitation current IEXI(max) = 2.0 V / R, IEXI must never exceed 3 mA.
Pulsed current (source) Unit is compatible with smart transmitters and PLCs with pulse > 5 ms.

Current – mA and loop

Description	Value
Range mA:	0 to 24 mA
Loop power for transmitter:	Yes, 24 VDC / ±10%
Isolated input:	Yes

Current mA	Range		Accuracy ±
	Min	Max	12 months
Read (Isolated)	0.000 mA	24.000 mA	0.010% rdg +2µA
Read (non-isolated)	0.000 mA	24.000 mA	0.010% rdg +2µA
Source	0.000 mA	24.000 mA	0.010% rdg +2µA

Hart resistor 250 ohm (On/Off in software). Maximum loop resistance source @ 24 mA (Hart on/ Hart off) 650 ohm / 900 ohm.
mA source voltage input range (external power/HART resistor off) 1V - 30V.

Thermocouple - TC

Description	Value
TC types:	B, BP, C, E, J, K, L, N, R, S, T, U, XK
Cold junction compensation ON/OFF Control:	Yes

TC Type	Temperature resolution		Temperature range				12 month accuracy	
			°C		°F		°C	°F
	Source	Measure	Min.	Max.	Min.	Max.		
B	0,1	0,1	200	200	392	392	5,02	9,04
			300	400	572	752	3,36	6,05
			400	600	752	1112	2,47	4,45
			600	800	1112	1472	1,60	2,88
			800	1000	1472	1832	1,39	2,51
			1000	1820	1832	3308	1,07	1,93
BP	0,1	0,1	0	1200	32	2192	0,89	1,61
			1200	2000	2192	3632	1,39	2,51
			2000	2500	3632	4532	1,96	3,53
C	0,1	0,1	0	200	32	392	0,75	1,35
			200	800	392	1472	0,64	1,16
			800	1200	1472	2192	0,78	1,41
			1200	1600	2192	2912	0,97	1,75
			1600	2000	2912	3632	1,24	2,24
			2000	2316	3632	4200,8	1,70	3,06
E	0,1	0,01	-200	-100	-328	-148	0,46	0,83
			-100	0	-148	32	0,26	0,47
			0	400	32	752	0,20	0,36
			400	1000	752	1832	0,30	0,54
J	0,1	0,01	-210	-150	-346	-238	0,59	1,07
			-150	0	-238	32	0,34	0,62
			0	660	32	1220	0,26	0,47
			660	1200	1220	2192	0,36	0,65
K	0,1	0,01	-200	-100	-328	-148	0,72	1,30
			-100	0	-148	32	0,35	0,63
			0	400	32	752	0,30	0,54
			400	800	752	1472	0,37	0,67
			800	1000	1472	1832	0,42	0,76
			1000	1372	1832	2501,6	0,53	0,96
L	0,1	0,01	-200	-100	-328	-148	0,37	0,67
			-100	900	-148	1652	0,26	0,47
N	0,1	0,01	-200	-100	-328	-148	1,08	1,95
			-100	0	-148	32	0,50	0,90
			0	1000	32	1832	0,41	0,74
			1000	1300	1832	2372	0,49	0,89
R	0,1	0,1	-50	0	-58	32	2,72	4,90
			0	200	32	392	1,89	3,41
			200	660	392	1220	1,17	2,11
			660	1600	1220	2912	0,95	1,71
			1600	1768,1	2912	3214,58	1,07	1,93
S	0,1	0,1	-50	0	-58	32	2,51	4,52
			0	200	32	392	1,86	3,35
			200	400	392	752	1,21	2,18
			400	1600	752	2912	1,10	1,98
			1600	1768,1	2912	3214,58	1,23	2,22
T	0,1	0,01	-200	-100	-328	-148	0,70	1,26
			-100	0	-148	32	0,38	0,69
			0	200	32	392	0,26	0,47

			200	400	392	752	0,22	0,40
U	0,1	0,01	-200	0	-328	32	0,54	0,98
			0	600	32	1112	0,26	0,47
XK	0,1	0,01	-200	-100	-328	-148	0,43	0,78
			-100	0	-148	32	0,23	0,42
			0	400	32	752	0,18	0,33
			400	800	752	1472	0,24	0,44

Does not include thermocouple wire error and CJC.

Resistance - RTD

Description	Value
RTD types:	Pt10/50/100/200/400/500/1000, Cu10/50/100, Ni120, YSI400
Response time:	Less than 5 mSec
Connection:	2, 3 and 4-wire

4-wire RTD Type	Temperature resolution		Temperature range				12 month accuracy	
	Source	Measure	°C		°F		°C	°F
			Min.	Max.	Min.	Max.		
Pt10(90)385	0,1	0,1	-200	100	-328	212	0,85	1,53
			100	400	212	752	0,98	1,77
			400	660	752	1220	1,12	2,02
			660	850	1220	1562	1,23	2,22
Pt50(90)385	0,1	0,01	-200	100	-328	212	0,22	0,4
			100	400	212	752	0,29	0,53
			400	660	752	1220	0,35	0,63
			660	850	1220	1562	0,41	0,74
Pt100(90)385	0,1	0,01	-200	100	-328	212	0,12	0,22
			100	400	212	752	0,2	0,36
			400	660	752	1220	0,26	0,47
			660	850	1220	1562	0,31	0,56
Pt200(90)385	0,1	0,01	-200	265	-328	509	0,14	0,26
			265	400	509	752	0,55	0,99
			400	660	752	1220	0,64	1,16
			660	850	1220	1562	0,72	1,3
Pt400(90)385	0,1	0,01	-200	0	-328	32	0,09	0,17
			0	400	32	752	0,34	0,62
			400	660	752	1220	0,41	0,74
			660	850	1220	1562	0,47	0,85
Pt500(90)385	0,1	0,01	-200	100	-328	212	0,22	0,4
			100	400	212	752	0,29	0,53
			400	660	752	1220	0,35	0,63
			660	850	1220	1562	0,41	0,74
Pt1K(90)385	0,1	0,01	-200	100	-328	212	0,14	0,26
			100	400	212	752	0,2	0,36
			400	660	752	1220	0,26	0,47
			660	850	1220	1562	0,31	0,56
P50(90)391	0,1	0,01	-200	100	-328	212	0,21	0,38
			100	400	212	752	0,28	0,51
			400	660	752	1220	0,35	0,63
			660	850	1220	1562	0,4	0,72
			850	1100	1562	2012	0,49	0,89
P100(90)391	0,1	0,01	-200	100	-328	212	0,15	0,27
			100	400	212	752	0,2	0,36
			400	660	752	1220	0,26	0,47
			660	850	1220	1562	0,31	0,56
			850	1100	1562	2012	1,38	2,49
P100(90)392	0,1	0,01	-260	100	-436	212	0,13	0,24
			100	400	212	752	0,19	0,35
			400	630	752	1166	0,25	0,45
M10(90)427	0,1	0,1	-200	260	-328	500	0,85	1,53
M50(90)428	0,1	0,01	-200	200	-328	392	0,21	0,38
M100(90)428	0,1	0,01	-200	200	-328	392	0,14	0,26
M100(90)617	0,1	0,01	-60	180	-76	356	0,11	0,2

H120(90)672	0,1	0,01	-80	260	-112	500	0,1	0,18
P100(90)JIS	0,1	0,01	-200	100	-328	212	0,14	0,26
			100	500	212	932	0,22	0,4
YSI(90)400	0,1	0,01	15	150	59	302	0,02	0,04

Read accuracy is based on 4 wire input.
Source accuracy in terminals 2 wire source.

Pressure modules, Barometric option (BARO) and APM CPF

APM CPF Type (s)	Gauge						12 month Accuracy ± 0 to 30 % range	12 month Accuracy ± 30 to 110% range	12 month Accuracy ± Vacuum % FS
	Bar		MPa		psi				
3 bar 300 kPa 30 psi	-1	3	-0.099	0.300	-14.5	30	0.0075% FS	0.025% RDG	0.06% FS
10 bar 1 MPa 100 psi	-1	10	-0.099	1.0	-14.5	100	0.0075% FS	0.025% RDG	0.06% FS
30 bar 3 MPa 300 psi	-1	30	-0.099	3.0	-14.5	300	0.0075% FS	0.025% RDG	0.06% FS
100 bar 10 MPa 300 psi	0	100	0	10.0	0	1 000	0.015% FS	0.05% RDG	N/A
300bar 30 MPa 3 kpsi	0	300	0	30.0	0	3 000	0.015% FS	0.05% RDG	N/A
700 bar 70 MPa 10 kpsi	0	700	0	70.0	0	10 000	0.03% FS	0.1% RDG	N/A
1000 bar 100 MPa 15 kpsi	0	1000	0	100.0	0	15 000	0.03% FS	0.1% RDG	N/A

Absolute pressure	**APM CPF with ASC-400 BARO option / 12 month Accuracy ±**				
3 bar APM CPF	Accuracy ±	300 kpA APM CPF	Accuracy ±	30 psi APM CPF	Accuracy ±
0.0138 to 1 barA	0.0008 barA	1.38 to 100 kPaA	0.08 kPaA	0.2 to 14.5 psiA	0.011 psiA
1 to 4 barA	0.025% RDG + 0.0003 barA	100 to 400 kPaA	0.025% RDG +	14.5 to 44.5 psiA	0.025% RDG + 0.003 psiA
10 bar APM CPF	Accuracy ±	1 MPa APM CPF	Accuracy ±	100 psi APM CPF	Accuracy ±
0.0138 to 1 barA	0.0008 barA	0.00138 to 0.1 MPaA	0.00008 MPaA	0.2 to 14.5 psiA	0.011 psiA
1 to 4 barA	0.001 barA	0.1 to 0.4 MPaA	0.0001 MPaA	14.5 to 44.5 psiA	0.011 psiA
4 barA to 11 barA	0.025% RDG	0.4 MPaA to 1.1 MPaA	0.025% RDG	44.5 to 114.5 psiA	0.025% RDG
30 bar APM CPF	Accuracy ±	3 MPa APM CPF	Accuracy ±	100 psi APM CPF	Accuracy ±
0.014 to 1 barA	0.001 barA	0.0014 to 0.1 MPaA	0.001 MPaA	0.2 to 14.5 psiA	0.01 psiA
1 to 10 barA	0.003 barA	0.1 to 1.0 MPaA	0.003 MPaA	14.5 to 104.5 psiA	0.03 psiA
10 barA to 31 barA	0.025% RDG	1.0 MPaA to 3.1 MPaA	0.025% RDG	104.5 to 314.5 psiA	0.025% RDG

Specified temperature range -10 to 50°C / 14 to 122°F (APM CPF & BARO option) Vacuum FS, 1 bar / 100 kPA / 14.5 psi. F.S. (full scale) is the numerical value of the positive pressure range. Accuracy includes hysteresis, nonlinearity, repeatability and reference standard uncertainty, 1 Year typical longterm stability, operated inside the rated temperature span and pressure range. Requiring frequently zeroing.

Additional specifications - directives observed

Standards		Description	
2004/108/EC	:	EMC Directive	
EN61326-1: 2012	:	Electrical equipment for measurement, control and laboratory use – EMC-requirements: Class B equipment.	
		Emmision : CISPR 11, Class B	
		Immunity :	
		IEC 61000-4-2 ESD	4 kV contact / 8 kV air
		IEC 61000-4-3 Electromagnetic field	3 V/m 80 MHz to 1 GHz 3 V/m 1.4 GHz to 2 GHz 1 V/m 2 GHz to 2.7 GHz
		IEC 61000-4-3 Voltage dip	0% during half cycle 0% during 1 cycle 40% during 10/12 cycles 70% during 25/30 cycles
		IEC 61000-4-11 Short interruptions	0% during 250/300 cycles
		IEC 61000-4-4 Burst	1 kV
		IEC 61000-4-5 Surge	½ kV
		IEC 61000-3-6 Conducted RF	3V (150 kHz to 80 MHz)

12.0 List of accessories

All parts listed in the list of accessories is available from the factory through our dealers.
Please contact your dealer for assistance if you require parts, which do not appear in the list.

List of accessories

Accessories	Part no.
Large padded soft case	127415
Soft bag incl. strap	128848
6 x 1.5V AA Ni-MH rechargeable batteries	128859
External Power Supply/Charger 9VDC/200mA-230VAC/115VAC	124720
Thermocouple male plug type K - Yellow	120517
Thermocouple male plug type N - Orange	120514
Thermocouple male plug type T - Blue	120515
Thermocouple male plug type J - Black	120516
Thermocouple male plug type R/S – Green	120518
Thermocouple male plug type Cu-Cu - White	120519
Extension cable for type K – 5 meter	121983
Extension cable for type N – 5 meter	122523
Cable 2 m (6.6ft.) with LEMO/Banana connectors	65-PT100-LB-CABLE
APM Pressure Modules	Contact your local dealer for various options or visit our website : www.ametekcalibration.com

AMETEK Test & Calibration Instruments
A business unit of AMETEK Measurement & Calibration Technologies Division offering the following industry leading brands for test and calibration instrumentation.

JOFRA Calibration Instruments
Temperature Calibrators
Portable dry-block calibrators, precision thermometers and liquid baths. Temperature sensors for industrial and marine use.
Pressure Calibrators
Convenient electronic systems ranging from -25 mbar to 1000 bar - fully temperature-compensated for problem-free and accurate field use.
Signal Instruments
Process signal measurement and simulation for easy control loop calibration and measurement tasks.

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Pneumatic floating-ball or hydraulic piston dead weight testers with accuracies to 0.015% of reading. Pressure generators delivering up to 1,000 bar.

Crystal Pressure
Digital pressure gauges and calibrators that are accurate, easy-to-use and reliable. Designed for use in the harshest environments; most products carry an IS, IP67 and DNV rating.

Lloyd Materials Testing
Materials testing machines and software that guarantees expert materials testing solutions. Also covering Texture Analysers to perform rapid, general food testing and detailed texture analysis on a diverse range of foods and cosmetics.

Davenport Polymer Test Equipment
Allows measurement and characterization of moisture-sensitive PET polymers and polymer density.

Chatillon Force Measurement
The hand held force gauges and motorized testers have earned their reputation for quality, reliability and accuracy and they represent the de facto standard for force measurement.

Newage Hardness Testing
Hardness testers, durometers, optical systems and software for data acquisition and analysis.

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