DIGISTANT®
Model 4423

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Valid from: 2011-02-15

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Präzisionsmessgeräte, Sensoren und Messsysteme
für elektrische, thermische und mechanische Größen

E G - K o n f o r m i t ä t s e r k l ä r u n g

EC- Declaration of Conformity according to EN ISO/IEC 17050-1:2004

Name des Herstellers: burster präzisionsmesstechnik gmbh & co kg
Manufacturer's Name:

Adresse des Herstellers: Talstr. 1-5
Manufacturer's Address: 76593 Gernsbach, Germany

erklärt unter alleiniger Verantwortung, dass das gelieferte Produkt
declares under sole responsibility that the product as originally delivered

Produktname: Dokumentierender Universal-Kalibrator DIGISTANT®
Product Name: *Documenting Universal Calibrator DIGISTANT®*

Modellnummer(n) (Typ): 4423
Models Number / Type:

Produktoptionen: Diese Erklärung beinhaltet obengenannte Produkte mit allen Optionen
Options *This declaration covers all options of the above product(s)*

mit den folgenden europäischen Richtlinien übereinstimmt und entsprechend das CE-Zeichen trägt:
complies with the requirements of the following applicable European Directives, and carries the CE marking accordingly:

2006/95/EC *Low Voltage*	Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen *Electrical Equipment designed for use within certain voltage limits*
2004/108/EC *EMC*	Elektromagnetische Verträglichkeit *Electromagnetic Compatibility*

Obengenannte Produkte entsprechen folgenden harmonisierten Normen:
Above named products conform with the following product standards:

Sicherheit: *Safety requirements:*	IEC 61010-1:2001 / EN 61010-1:2001 /EN 61010-2-031:1994 Messkategorie 1 / *CAT 1* * Stecker-Netzteil 4495-V001 *Power Pack*	Schutzklasse III* Safety class 3 Schutzklasse 2 *Safety class 2*
EMV Störaussendung: *EMC Generic emission:*	IEC/CISPR 11:2003 + A1:2004 + A2:2006 / EN 55011:2007 + A2:2007	
EMV Störfestigkeit: *EMC Generic immunity:*	IEC 61326-1:2005 / EN 61326-1:2006	Industrie Bereich *Industrial environment*

Ergänzende Informationen: */ Additional Information:*

Das Produkt wurde in einer typischen Konfiguration getestet. Um optimale Störfestigkeit zu erreichen ist das Gerät über geschirmte Leitungen anzuschließen.
The product was tested in a typical configuration. In order to reach optimal electromagnetic immunity the device has to be conducted with shielded line.

Diese Konformitätserklärung betrifft alle nach Ausstellungsdatum ausgelieferten Produkte:
This DoC applies to above-listed products placed on the EU market after:

Gernsbach 09.07.2008 i.V. Alfred Großmann
Datum */ date* *Quality Manager*

Dieses Dokument ist entsprechend EN ISO/IEC 17050-1:2004 Abs. 6.1g **ohne Unterschrift** gültig / *According EN ISO/IEC 17050 this document* ***is valid without a signature***.


VOLTS IN
10.000 V
TC OUT CJC ON
1000.0 °C
MENU | LIGHT | STEP
burster
DIGISTANT 4423
F1
F2
F3
HOME
CE
7
8
9
4
5
6
1
2
3
0
.
+/-
ENTER

Warning!

Regard the following advices to avoid electric shock or personal injury:

- ➔ Follow all equipment safety procedures.
- ➔ Do not apply more than the rated voltage. Refer to specifications for supported ranges.
- ➔ 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 using 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.
- ➔ 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 of 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.
- ➔ Disconnect test leads before changing to another measure or source function.
- ➔ 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.
- ➔ 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.
- ➔ When using a pressure module, make sure that the process pressure line is shut off and depressurized before you connect it or disconnect it from the pressure module.
- ➔ When servicing the calibrator, use only specified replacement parts.

Caution!

Regard the following advices to avoid damage to calibrator or to equipment under test:

- ➔ Use the proper terminal, function, and range for your measurement or sourcing application.
- ➔ To avoid mechanically damaging the pressure module, never apply more than 13.5 Nm of torque between the pressure module fittings, or between the fittings and the body of the module.
- ➔ 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.
- ➔ Use only power supply units of the model 4495-V001.

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1. Introduction

The burster 4423 is a Universal-Process-Calibrator, an accumulator-operated instrument that measures and sources electrical and physical parameters.

The calibrator has the following features and functions:

- Dual display
  - The upper display is used for the measurement of volts, current, and pressure.
  - The lower display is used to measure and source volts, current, pressure, resistance temperature detectors (RTDs), thermocouples, frequency, and resistance. It is also used to source pulse trains and to measure pressure.
- A thermocouple (TC) input/output terminal with internal reference-junction temperature compensation.
- 5 set points in each range for increasing/decreasing output.
- An interactive menu.
- An USB-interface for remote control.
- Isolated read back for transmitter calibration.
- Documenting capability for up to 50 tags and 21 test points at each tag.

1.1 Customer Service

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Talstraße 1 – 5
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Telephone: +49 – 7224 – 645 – 0
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e-mail: info@burster.de

1.2 Preparation

1.2.1 Unpacking the Device

The device has a weight of 1 kg and due to this it is packed shockproof.

Unpack it accurately and check the completeness of the delivery.

Standard scope of delivery:

- 1 Universal Process Calibrator model 4423
- 1 power supply unit model 4495-V001
- 1 USB-cable model 9900-K349
- 1 pair of measurement cables
- 1 Manual

➢ Verify accurately, that there is no damage on the calibrator. If there is a suspicion of damage, contact the manufacturer within 72 hours.

➢ Retain the packaging for examination by a representative of the manufacturer and / or the deliverer.

➢ Only ship the 4423 in the original packaging or in a container providing the same degree of protection.

1.2.2 Voltage Supply

The calibrator is supplied by an attached accumulator or by the delivered power supply unit (Connection at the CHARGE terminal).

Note:

The calibrator normally can be used, while charging. The calibrator can be used along with the power supply unit, although the accumulator is totally discharged. During this time the accumulator will be charged. The charge LED will light during the whole charge period. A normal charge period takes approx. 12 hours.

Operation time with one accumulator charge: >16 h at 10 mA at 1 kΩ burden.

The accumulator charge is displayed in percent (%), after the turn-on procedure.

Caution!

Damages at calibrator and accumulator occurred by using the wrong power supply unit!

Use only power supply units of the model 4495-V001.

Voltage supply of the power supply unit, model 4495-V001:

230 V AC +6 %, -10 %, 50/60 Hz

Secondary voltage: 12.6 V DC, 800 mA

2. Terminals and Interfaces of the Calibrator

"Figure 1" shows the input and output connections of the calibrator, Table 1 describes their use.

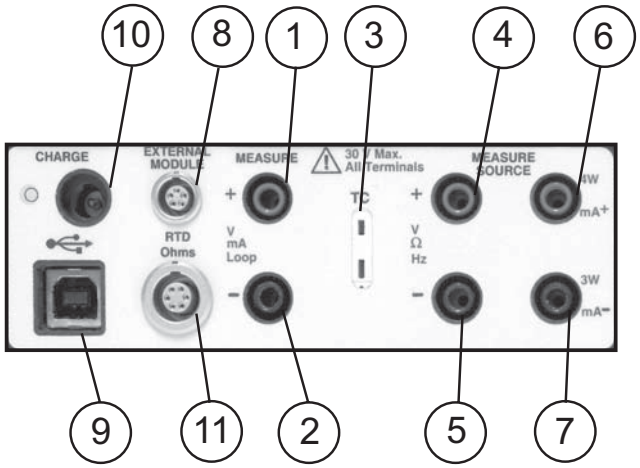


Figure 1. Input/Output Terminals

Table 1: Input and Output Terminals

No.	Name	Description
1, 2	Measure Isolated V and mA terminals	Input terminals for measuring current and voltage.
3	TC input/output	Terminal for measuring, or simulating thermocouples. Accepts miniature polarized thermocouple plugs with flat in-line blades spaced 7.9 mm (0.312 in) center to center.
4,5	Measure/Source V, RTD 2W, Hz	Terminals for measuring and sourcing voltage, frequency, pulse train, and RTDs
6,7	Measure/Source mA terminals, 3W and 4W	Terminals for measuring and sourcing current, and performing RTD measurements with 3-wire or 4-wire setups.
8	Pressure module connector	Connection to a pressure module for pressure measurements.
9	USB-port (model B)	Connects calibrator to a PC for uploading data or remote control.
10	CHARGE terminal	Connection to the power supply unit, model 4495-V001 for charging and mains-buffered operation.
11	RTD terminal	LEMO 1B terminal, for measuring RTDs.

"Figure 2" shows the location of the keys on the calibrator. Table 2 lists their function.

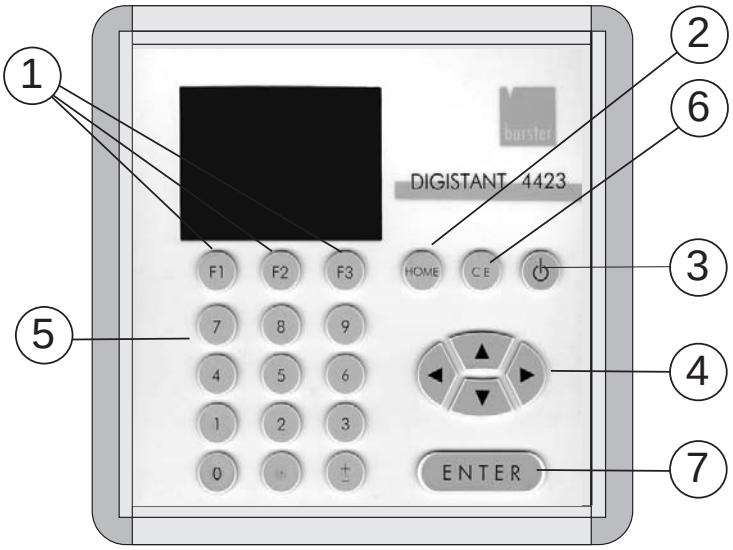


Figure 2. Keypad

Table 2. Key Functions

No.	Name	Function
1	Function Keys F1, F2, F3	Used to operate the menu bar at the bottom of the calibrator display. F1 is used for selecting options in the left box, F2 for the centre box, and F3 for the right box.
2	Home	Returns to home menu on the menu bar.
3	Power	Turns calibrator on and off.
4	Cursor Control Key	The arrow keys ◄ and ► are used to select which decade to be changed in output value. The arrow keys ▲ and ▼ are used to increase, decrease, or ramp output value.
5	Numeric Keypad	Allows user to enter Numeric values.
6	CE	Delete key
7	ENTER	Enter key

2.1 Main Display

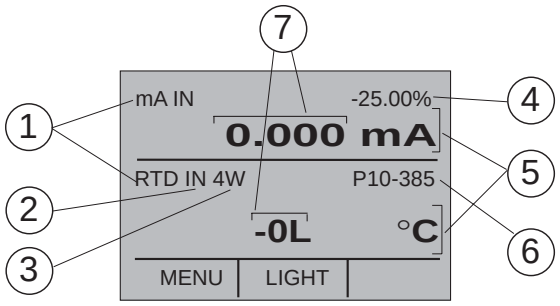


Figure 3. Display

The display of the calibrator, shown in “Figure 3”, is divided into three main sections:

- The upper display is used for measuring DC voltage, DC current (with and without loop power) and pressure.
- The lower display can be used for both measuring and sourcing.
- The menu bar is used to setup the upper and the lower display to perform the desired function.

Table 3: Display Functions

No.	Name	Description
1	Primary Parameters	Determine what parameter is going to be measured or sourced. The available options for the upper display are: VOLTS IN, PRESSURE, mA IN, and mA LOOP. The available options for the lower display are: VOLTS, TC (thermocouple), RTD, FREQ (frequency), PULSE, PRESSURE, mA, and mA 2W SIM.
2	Input/Output control	Switches the lower display between input mode (read), and output mode (source).
3	Additional Settings	Available only for TC (thermocouple), and RTD measurements. For TC this setting turns the CJC (Cold Junction Connection) on and off. For RTD measure [RTD IN], this setting sets the number of wires used in the measurement (2-wire, 3-wire, or 4-wire)
4	Span Indicator	Available only for mA and mA LOOP. Shows where in the preset span the measured value falls. Fixed for mA at 4 (0%) and 20 (100%).
5	Units	Shows what unit the measurement or source value is in. Available options are °C or °F for RTD and TC or CPM, Hz, or KHz for FREQ and PULSE.
6	Sensor Types	Shows the types of RTDs and TCs. Available types are shown in the Specifications. Also, displays the amplitude of the pulse and frequency source, and pressure units.
7	Numeric Displays	Display the numeric values of the signal being measured, or sourced. An "OL" reading indicates an out of range or overload condition.

2.2 Menu Bar

The menu bar, which is located at the bottom of the LCD, controls the parameters on the display.

Use the function keys (F1, F2, and F3) to navigate through all the levels and choices of the menu bar. Refer to the menu tree for a clarification on the layout of all the levels (shown at page 22)

The top level of the menu is the home menu. It can be accessed anytime by pressing the HOME key.

There are three variations of the home menu:

- input home menu
- output home menu
- pulse home menu

The used menu is dependent on the operation mode of the lower Display.

In the input home menu the only active options are [MENU] and [LIGHT]. Use the [MENU] option to enter the next level of the menu bar, the main menu. Press the corresponding function key (F1) to enter the main menu. The [LIGHT] option is used to turn on the LCD back light. Press the corresponding function key (F2) to turn on the back light.

The output home menu contains three active options, [MENU], [LIGHT] and [STEP] or [RAMP]. The first two options work the same as in the input home menu. The third option is selectable in the Auto Function Menu and is used to turn on and off the selected auto function. Leaving this menu or pressing the Home button will stop the auto functions.

The pulse home menu also has three active options: [MENU], [TRIG], and [COUNTS].

[TRIG] and [COUNTS] options are used for pulse simulation (see chapter 4.7: "Sourcing a pulse train").

The next level of the menu bar is the main menu. The levels under the main menu depend on what mode the calibrator is in.

The main menu has three active options [UPPER], [LOWER], and [MORE].

Choosing [UPPER] calls up the parameter selection menu for the upper display. Choosing [LOWER] calls up the parameter selection menu for the lower display. [MORE] enters the next menu level.

The next menu is the Document Mode selection menu. It contains the options [DOCUMENT], [NEXT], and [DONE]. Choosing [DOCUMENT] enters the document mode menu system (see chapter 8: ”Document Mode”). [NEXT] proceeds to the next menu level, and [DONE] returns to the home menu.

The Auto Function Menu is the next menu if you are in source mode. It contains the options [AUTO FUNC], [NEXT] and [DONE]. [AUTO FUNC] allows you to adjust the Automatic Output Function parameters. [NEXT] proceeds to the next menu level and [DONE] returns to the home menu (see chapter 4.2: “Using the Automatic Output Functions”).

The next menu level is the contrast menu. An exception are the settings RTD IN, FREQ OUT and PULSE in the lower display and the setting PRESSURE in the upper or lower display.

The options of the contrast menu are [CONTRAST], [NEXT], and [DONE]. The [CONTRAST] option is used to adjust contrast. [NEXT] proceeds to the auto off main menu, and [DONE] returns to home menu.

DIGISTANT shows the following menu after pushing [CONTRAST].

Use the arrow options to adjust the contrast, F2 means “darker”, F3 means “paler”. After the adjustment choose the [CONTRAST DONE] function key to confirm the new contrast (F1).

After pushing the F1 key you will be back in the home menu.

Note:

The DIGISTANT 4423 calibrator offers a wide contrast adjustment range to accommodate operation in extreme temperatures.

In certain cases making large changes in contrast may render the display difficult to read under normal conditions. If this occurs and the display is too pale or dark to read, proceed with the following process to set the contrast back to a default setting.

- Turn on the unit while holding down the "HOME" key.
- Hold the key down for a count of 10 seconds to restore contrast default settings.

If the display is so pale that you cannot tell if the unit is on or off, press the “HOME” key and then, use the backlight key.

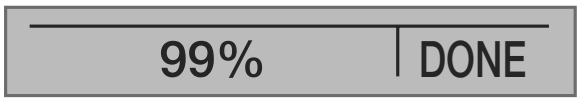
The auto off main menu contains the options [AUTO OFF], [NEXT], and [DONE]. The [AUTO OFF] option. It is used to activate and deactivate the automatic shutoff and to set the amount of time the calibrator needs to stay dormant before it shuts off. [NEXT] proceeds to the clock menu, and [DONE] returns to the home menu.

The Clock menu is the next menu displayed in the [MORE] menu sequence. It contains the options [CLOCK], [NEXT], and [DONE]. Choose [CLOCK] to set the calibrator date and time as described in chapter 8: "Document Mode", [NEXT] to proceed to the terminal emulation menu and [DONE] to the home menu.

The Terminal menu is the next menu displayed after choosing [MORE] in the main menu. Its options are [TERMINAL], [NEXT], and [DONE]. Choose [TERMINAL] to enter terminal emulation mode. Select [NEXT] to proceed to the light control menu or [DONE] to return to the home menu.

The light control menu is displayed if the [NEXT] function key is pressed in the Terminal menu. It is used to set the amount of time without activity after which the light is deactivated automatically. To activate this option, press the [LIGHT CTRL] and the [ON] function key. To deactivate the light control hit the [OFF] function key. [DONE] returns to the home menu. The shortest time, after which the light will be deactivated automatically, is one minute. The maximum time are 30 minutes.

The last menu in that sequence is the charge condition of the accumulator. The charge condition in Percent is already displayed at one of the start screens of the calibrator. During operation, the information is available in this menu. The calibrator will proceed with the home menu after one hit at a function keys (F1, F2, F3).



When the lower display is in the frequency or pulse mode, the frequency level menu is added after the main menu. The options available in this menu are [FREQ LEVEL], [NEXT], and [DONE]. The [FREQ LEVEL] option is used to adjust the amplitude of the wave. [NEXT] is used to access the contrast main menu, and [DONE] returns to the home menu.

When the calibrator is in RTD CUSTOM mode, the RTD custom setup menu is inserted after the main menu. Options [SET CUSTOM], [NEXT], and [DONE] are available. [SET CUSTOM] is used to enter a custom PRT into the calibrator (see chapter 4.9.1:"Custom RTD"). [NEXT] is used to enter the contrast main menu, and [DONE] to return to the home menu.

The pressure zeroing main menu is the final variation to choosing [MORE] in the main menu. It has the options [ZERO], used to zero pressure, [NEXT] and [DONE], which have the same function as above (see chapter 5.3: “Measuring Pressure”).

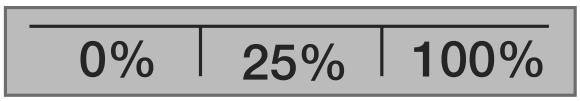
Once the 7160 is selected on the upper or lower display, a new item appears in the menu sequence following the [MORE] key: the 7160 menu. Pressing 7160 proceed to a separate menu sequence, providing 7160 zero and tare. The normal documentation mode is selectable by pressing the [NEXT] key.

The parameter selection menu is called up when [UPPER] or [LOWER] is selected from the main menu. It contains the following options: [SELECT], [NEXT], and [DONE]. When the display is selected, a parameter will start to flash. Use the [SELECT] option to change the parameter, and the [NEXT] option to switch to another variable. [DONE] returns to the home menu and enables the selected mode.

2.3 Cursor control / Set point control

The four cursor control arrows on the keypad can control the output value. By pressing one of the arrows a cursor will be added to the display under the last digit of the output value. The arrow keys ◄ and ► are used to select which decade to be changed in the output value. The arrow keys ▲ and ▼ are used to increase, decrease, or ramp the output value.

The menu bar will change to the set point menu with the touch of any one of the four arrow keys.



The three function keys are associated with 0, 25, and 100% values. 0 and 100% values can be stored by entering a value and then holding down the corresponding function key. The 25% key will then automatically step through the 25, 50, 75% value.

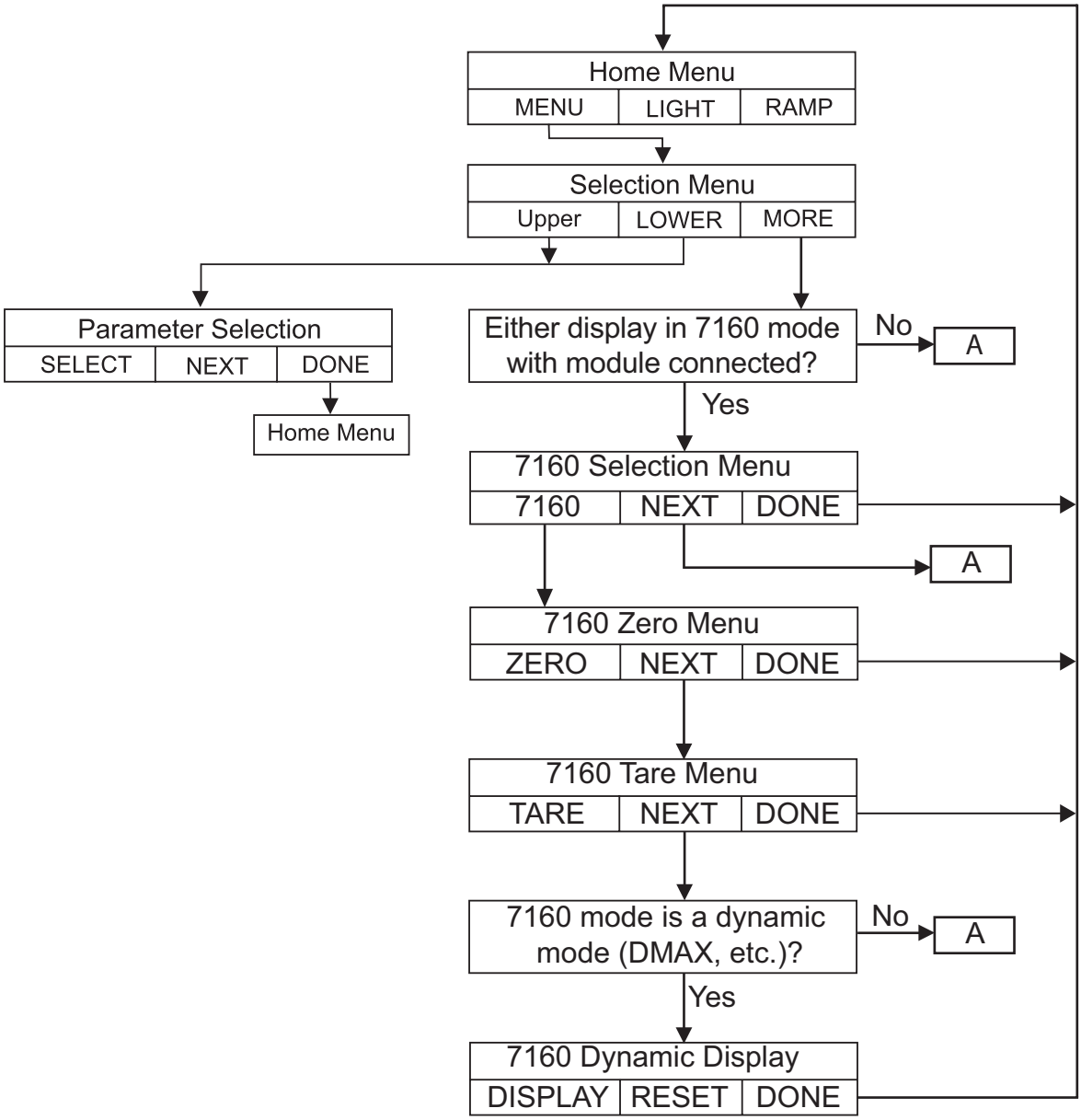


Figure 4: The Menu Tree (Part 1)

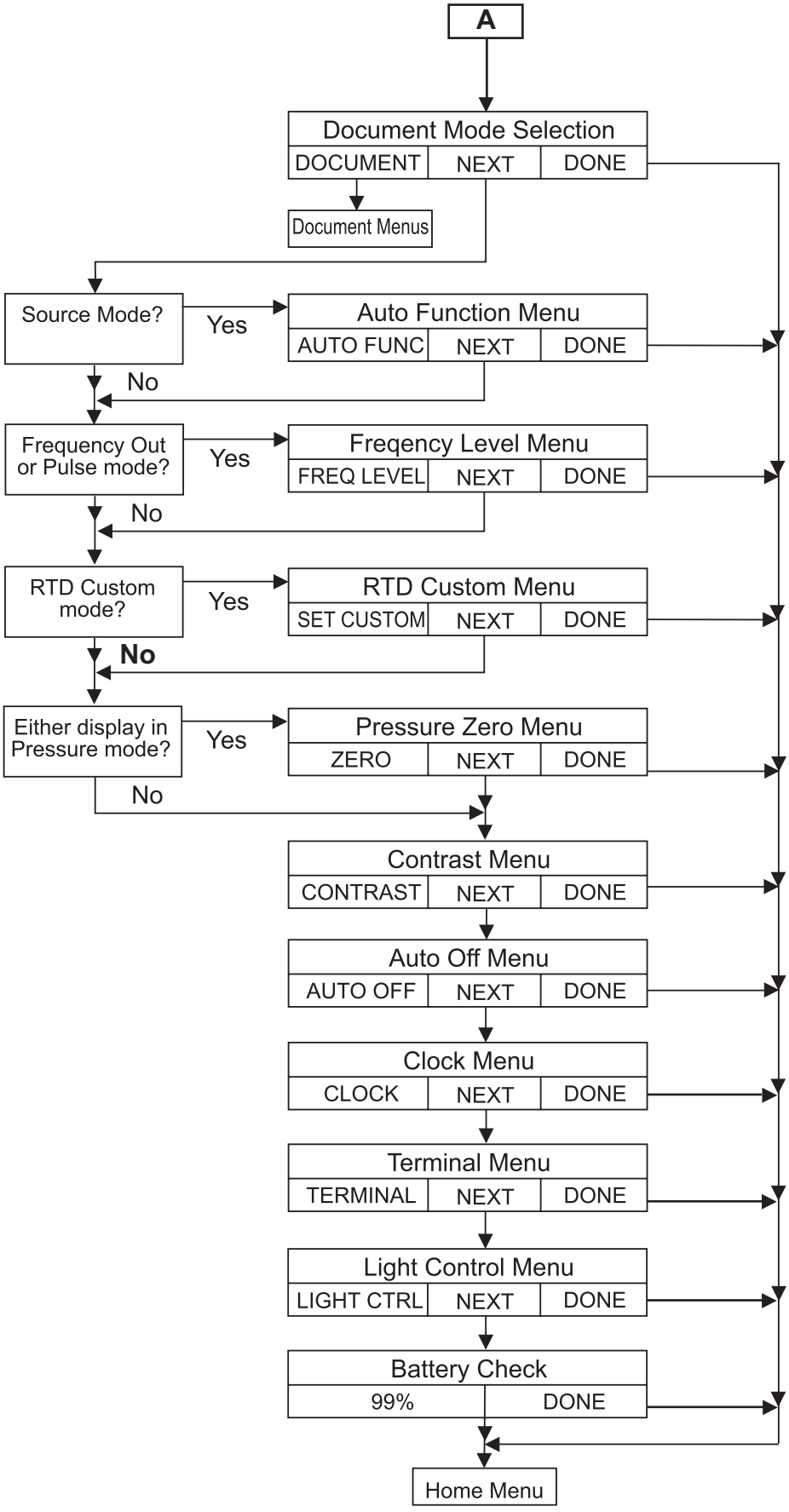


Figure 4a: The Menu Tree (Part 2)

3. Using Measure Modes (Lower Display)

3.1 Measuring Voltage and Frequency

Electrical parameters volts and frequency can be measured using the lower display.

To make the measurements, follow these steps:

- Switch to the lower display [LOWER] from Main Menu.
- Select the desired parameter for measurement.
- Connect leads as shown in Figure 5.

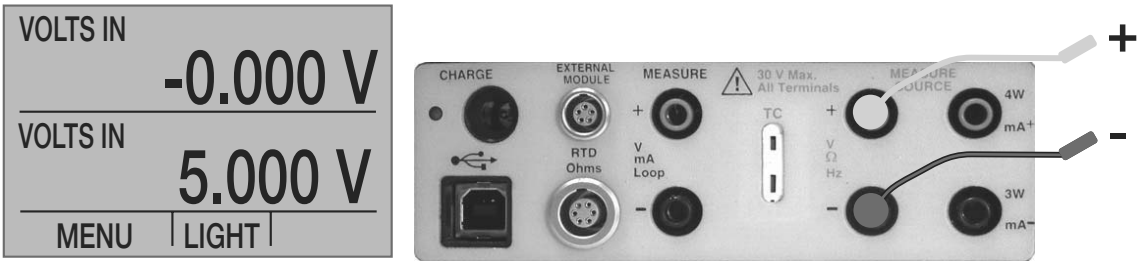


Figure 5. Measuring volts and frequency with Input/Output Terminals

3.2 Measuring Current (mA)

To measure mA, follow these steps:

- Switch to lower display [LOWER] form Main Menu.
- Select mA.
- Make sure the input/output control is set to “mA IN”.
- Connect leads as shown in Figure 6.

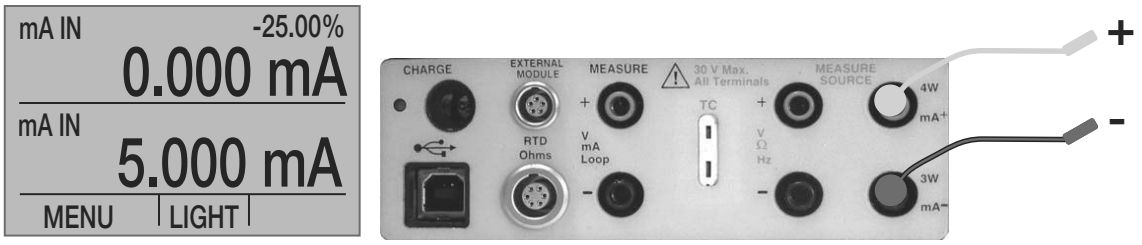


Figure 6. Measuring mA with Input/Output Terminals

3.3 Measuring Temperature

3.3.1 Using Thermocouples

The calibrator supports the following thermocouple types: B, C, E, J, K, L, N, R, S, T, U, BP and XK. The characteristics of all the types are described in chapter 9: "Specifications". The calibrator also has a Cold Junction Compensation (CJC) feature.

The CJC allows the following three versions of measurement:

1) TC IN CJC ON: Direct measurement of a thermocouple. The reference junction is formed electronically in the DIGISTANT. Connect the thermocouple with thermoelectric wires or compensation leads.
2) TC IN CJC OFF: The reference junction is switched off. The temperature of the reference junction will be refer to 0 °C. Connection with copper leads and copper miniplug.
3) TC IN CJC EXT: Use with external reference junction. The temperature is externally measured with a Pt100 at the hand-over point. Use the external reference junction model 4485-V001.

Note:

To improve the measurement of the temperature with the internal Pt100, identify the characteristics by calibrating. Enter these characteristics at the menu “RTD Custom”.

Normally this feature should be activated and the actual temperature of the thermocouple will be measured.

Note:

CJC OFF mode should only be used when calibration is being done using an external ice bath.

To use the thermocouple to measure temperature, follow these steps:

Note:

Use thermoelectric wires of the same type as the thermocouple, which is calibrated.

- Connect the thermocouple leads to the TC miniplug.
- Insert the plug into the thermocouple-socket on the calibrator (shown in Figure 7).

Note:

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

- Switch to lower display from Main Menu, [LOWER].
- Select “TC” from the primary parameters.
- Choose “IN” at the input/output control
- Than chose the thermocouple type from the sensor types.

  The temperature unit may also be changed from Celsius to Fahrenheit.

If the desired Thermocouple is not supported, measure the mV of the Thermocouple and use it along with a table.

To do so, proceed as above and choose mV from sensor types.

Figure 7: Measuring Temperature Using Thermocouple Terminals

3.3.2 Using Resistance-Temperature-Detectors (RTDs)

The supported types of RTDs are shown in chapter 9: “Specifications”.

RTDs are characterized by their 0 °C resistance (R_0).

You are able to connect the RTD with a 2, 3 or 4-wire connections at JACKS and with a 4-wire connection at LEMO. 4-wire allows the most precise measurement.

To use the RTD option, apply the following steps:

- Switch to lower display [LOWER] from Main Menu.
- Select “RTD” from the primary parameters.
- Select “IN” from input/output control.
- Confirm with [DONE].
- Press [MENU], [MORE], [NEXT] and [RTD INPUT].
- Now choose **JACKS** or **LEMO**.
- Confirm with [DONE].

If JACKS are selected:

- Switch to lower display [LOWER] from Main Menu.
- Select “RTD” from the primary parameters.
- Select “IN” from input/output control.
- Choose 2, 3, or 4-wire connection “2W”, “3W”, “4W”.

  4-wire allows the most precise measurement.
- Select RTD type from the sensor types.
- Use 4mm-JACKS to connect the RTD with the calibrator (Figure 8a).

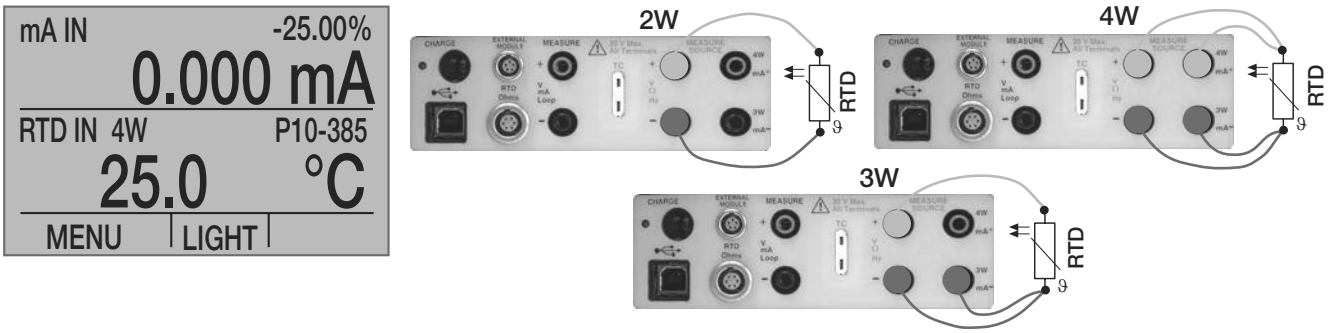
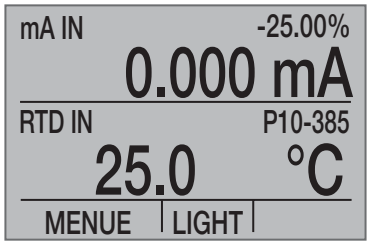


Figure 8. Measuring Temperature with RTD Connection

Resistance can also be measured using this function. To do so, use the procedure above and choose OHMS from the sensor types. This option can be used along with a table to measure an RTD, which is not programmed into the calibrator.

If LEMO is selected:

- Switch to lower display [LOWER] from Main Menu.
- Select “RTD” from the primary parameters.
- Select “IN” from input/output control.
- Choose 4-wire connection.
- Select RTD type from the sensor types.
- Use a LEMO 1B-plug (6 pins) to connect the RTD with the LEMO socket of the calibrator (Figure 8a).



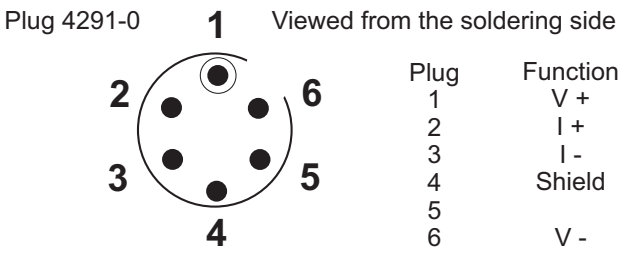


Figure 8a: Measuring temperature with RTD at the LEMO socket.

3.4 Measuring Pressure

Warning!

Damages occur upon violent release of pressure!

Before you attach the pressure module to the pressure line, shut off the valve and slowly bleed off the pressure.

Caution!

Mechanical damages at the pressure module!

Maximum torque between the fittings of the pressure module and between the fittings and the body of the module: 13.5 Nm.

Damages by overpressure!

The specified maximum pressure is printed on the pressure module. Never apply a higher pressure than specified.

Damages by corrosion!

Use the pressure module only with specified materials. Refer to the pressure module documentation for material compatibility.

Note:

The 4423 is compatible with the 7132 Calibrator Pressure Modules. Accessory 7132 is required for pressure measurement.

Note:

Pressure is not read from modules with frequency or pulse train mode enabled.

Note:

On high-pressure modules engineering units normally associated with low-pressure ranges are not valid selections (e.g. inH_2O or cmH_2O). Selecting one of these units with a high-pressure module attached will cause the display to read "----".

To measure pressure, follow these steps:

- Connect the pressure module and the pressure module adaptor 7130 to the calibrator as shown in Figure 9.

  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.

- Switch to either [UPPER] or [LOWER] display from the Main Menu.
- Select “PRESSURE” from the primary parameters.
- Select the desired measuring unit.
- Zero the pressure module.

  The zero function on the calibrator can be found in the pressure-zeroing menu.

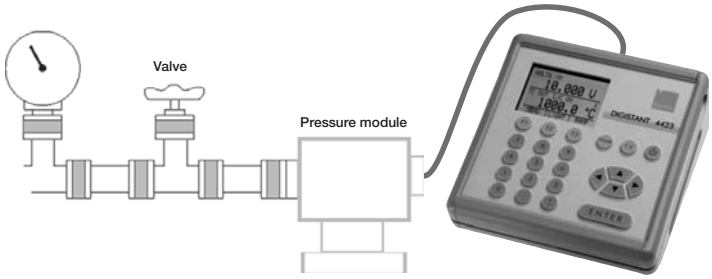


Figure 9: Connections for Measuring Pressure

3.4.1 Zeroing Pressure Modules

If you want to use the zero function, you first have to connect a pressure module and to choose the PRESSURE function on one Display of the 4423.

To adjust the calibrator, follow these steps:

- Enter the pressure-zeroing menu.

  To do this, at the home menu press the [MENU] key followed by [MORE], followed by [NEXT] at several times. Until the display shows the [ZERO] function.

- Select [ZERO].

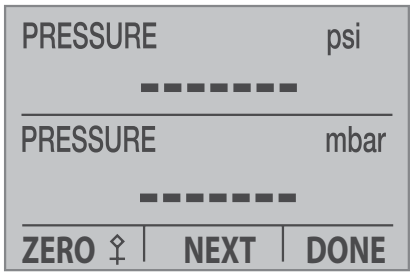
If you use an absolute pressure module, you have to insert the current barometric pressure as a reference. Because of this the 4423 shows the message:

"SET REFERENCE ABOVE"

➢ Enter the pressure using the keypad.

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.



3.5 Smart Sensor Interface

3.5.1 7160: Connecting the Smart Sensor Interface

Note:

Since only one module may be connected at a time, pressure and 7160 inputs can not be displayed at a time.

Note:

The allowed engineering units are dependent on the smart sensor interface connected. Because of this, you are only able to define a unit, if a smart sensor interface is connected to the 4423.

➢ Insert the smart sensor interface 7160 into the interface adaptor 7130.

➢ Connect the interface adaptor 7130 to 4423.

The 4423 needs a few seconds to establish the connection to the 7130. During this time the display shows "- -".

➢ Switch the lower display [LOWER] to 7160. (Upper display: refer to chapter 5.4.1)

At the upper display the access to the 7160 is disabled now.

Once the lower display is set to 7160, the top line of the display has changed.

It is now formatted as follows:

"7160 mmmm aaaa rrrrrr"

"mmmm" is the operating mode. These settings are possible:

STAT	static
DMAX	dynamic, displaying maximum peak
DMIN	dynamic, displaying minimum peak

DP-P	dynamic, displaying peak to peak
DRDG	dynamic, displaying present reading

"aaaa" is the averaging to be applied:

- X/1
- X/2
- X/4
- X/8
- X/16
- X/32

"rrrrrrr" is the sampling rate, possible is:

In static mode only fixed 3/s.

In dynamic mode:

- 3/s
- 10/s
- 50/s
- 100/s
- 500/s
- 1000/s

- Press the [SELECT] function key to cycle through the possible values for the presently highlighted field.
- Use the [NEXT] function key to change the presently highlighted field.
- Repeat this procedure for other fields.

Once the 7160 is selected on the upper or lower display, a new item appears in the menu sequence following the [MORE] key: the 7160 menu. Pressing 7160 proceed to a separate menu sequence, providing 7160 zero and tare. The normal documentation mode is selectable by pressing the [NEXT] key.

Note:

When a module is first plugged in, it should default to static mode (STAT). The averaging should be X/8, the sampling rate 3/s and zero and tare set to "0".

Using a dynamic mode for measurement, the 4423 generates all three peak values. But the display shows only one. The display will be set at the control menu for dynamic mode.

3.5.2 7160: Setting a zero offset

To set a zero offset a 7160 must be connected to the 4423 and 7160 must be selected on the lower display. (Upper display: refer to chapter 5.4.2)

The measurement system must be unloaded.

To set a zero offset:

Before starting the settings of the zero value the measurement system has to be unloaded and the tare value has to be “0”.

Otherwise there will be measurement errors!

- Press the [MENU] function key at the home menu.

  The menu bar now shows the main menu.

- Press the [MORE] function key.

  After pressing this function key the display shows the 7160 menu.

- Now press the [7160] function key.

  Doing this you have reached the zero offset menu for the 7160.

  Opening this menu the 4423 shows the current zero offset.

  There are two ways to define a new zero offset.

To set the zero offset to the present measured value:

- Press the [ZERO] function key.

  At the lower display, the 4423 now shows the present measured value with negated algebraic sing.

  Setting the new zero offset value, the 4423 ignores the former offset and tare value.

- Confirm the new zero offset value by pressing the [DONE] function key.

To set the zero offset to a fixed value:

- Enter the fixed value.

  To do this, use the numeric keypad of the 4423.

- Confirm the value by pressing the [ENTER] key.
- Confirm the new zero offset by pressing the [DONE] function key.

Note:

DIGISTANT® stores the **zero value** in a **non-volatile memory** of the 7160 module. Therefore you can further use the **zero value**, also after switch-off and switch-on again respectively after the 7160 module has been disconnected and then connected again.

3.5.3 7160: Tare

To set a new tare value a 7160 must be connected to the 4423 and 7160 must be selected on the lower display. (Upper display: refer to chapter 5.4.3)

The measurement system must be unloaded.

To set a tare value:

- First define a new zero offset value for the 7160.

  Refer to chapter 3.5.2 “7160: Setting a zero offset” for more information.

- Now apply the preload to the system.
- At home menu press the function keys [MENU], [MORE], [7160] and [NEXT].

  You have now reached the 7160 tare menu.

  Opening this menu the 4423 shows the current tare value.

To set the tare value to the present measured value:

- Press the [TARE] function key.

  At the lower display, the 4423 now shows the present measured value with negated algebraic sing.

  Setting the new tare value the 4423 ignores the former tare value.

- Confirm the new tare value by pressing the [DONE] function key.

To set the zero offset to a fixed value:

- Enter the fixed value.

  To do this, use the numeric keypad of the 44423.

- Confirm the value by pressing the [ENTER] key.
- Confirm your entry by pressing the [DONE] function key.

Note:

Opposite to its handling of the zero value DIGISTANT® stores the **tare value** in a **volatile memory**. This value is lost upon switching off DIGISTANT® or disconnecting 7160 from DIGISTANT®.

Example: Using the ZERO and TARE functions

Equipment: DIGISTANT 4423, adapter 7130, Smart-Sensor-Interface 7160 and load cell 8527-610 with a measuring range of 10 kN.

After switching on, the values for ZERO and TARE initially equal "0.000“. Simultaneously, a zero signal from the sensor of -0.0071 mV/V appears, which is the signal obtained without the influence of mounting parts. The test certificate states that this is equivalent to a zero offset of -0.047 kN. You can use the ZERO function of the DIGISTANT to set this zero offset to zero. This generates the **zero value**, which the DIGISTANT saves in a **non-volatile memory** inside the 7160. This means that you can use the zero value again, even after switching the device off and on, or after disconnecting the 7160 from the DIGISTANT and then reconnecting it.

The load cell is now mounted in a system. This subjects the sensor to an initial load of 0.300 kN. This initial load can be tared ("zeroed") using the TARE function. The DIGISTANT saves the resultant **tare value** in a **volatile memory**, however. Since this memory is volatile, the tare value is lost after switching off the DIGISTANT or after disconnecting the 7160 from the DIGISTANT. In these cases it is reset back to "0.000“.

Note:

Use the ZERO function only when the tare value equals "0". Otherwise incorrect measurements will be obtained!

3.5.4 Measurement in Static Mode

The home menu data display shows the present measured module reading, with the present zero and tare values applied in that order.

3.5.5 Measurement in Dynamic Mode

Using the 7160, in addition to static mode, you are able to measure in four dynamic modes:

- DMAX (displaying the maximum value since last reset)
- DMIN (displaying the minimum value since last reset)
- DP_P (displaying the peak to peak value since last reset)
- DRDG (displaying the present measured value)

The 4423 displays the measured values of a 7160 module in dynamic mode at the home menu data display, too. However the switching over to another dynamic mode is more complicated in this display. Because of this, please use the dynamic display for operations in dynamic mode.

To use a 7160 in dynamic mode:

➢ Connect the 7160 to the 4423.

➢ Switch the lower display [LOWER] to a dynamic mode. (Upper display: refer to chapter 5.4.5)

➢ Confirm your selection by pressing the [DONE] function key.

The 4423 now shows the home menu.

➢ Now press, one after another, the function keys [MENU], [MORE], [7160] and twice the [NEXT] function key.

Doing this, you have reached the dynamic display for dynamic mode measurement with 7160. The menu bar shows the following menu:

To change the active dynamic mode:

➢ Press the [DISPLAY] function key.

After pressing this function key the 4423 switches to the next dynamic mode (DMAX, DMIN, DP-P, DRDG)

To reset all peak values:

➢ Press the [RESET] function key.

Now you have reset all peak values.

To leave the dynamic display:

➢ Press the [DONE] function key.

The 4423 now shows the home menu.

4. Using Source Modes (Lower Display)

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

4.1 Setting 0 % and 100 % Output Parameters

To set the 0% and 100% points, following these steps:

- Select the lower display [LOWER] from Main Menu
- Choose the desired primary parameter.
- Select output “OUT” from the input/output control.
- Enter the desired value. For example select “VOLTS OUT”.
- Enter a voltage, for example 5 V, with the keypad and press Enter.
- Press any one of the cursor control arrows to display the set point control menu.
- Hold down the Function Key that corresponds to 0 % [F1].

  0 % will flash and the set point is stored.
- Repeat these steps for 100 %.

  For example enter 20 V and hold the Function Key that corresponds to 100 % [F3].
- Press the 25 % key.

  In our example you’ll cycle 5 V and 20 V in 25 % increments.

4.1.1 Stepping the current output

To use the 25 % function with mA output, follow these steps:

- Select the lower display from the Main Menu, and choose mA.
- Use the 25 % key to cycle between 4 mA and 20 mA in 25 % intervals.

4.2 Using the Automatic Output Functions

There are two automatic output functions, step and ramp. The selected function can be turned on and off using the Output Home Menu.

The Automatic Output Function parameters can be set in the Auto Function Menu.

The parameters are:

1) Which auto function will be available (Step or Ramp).
2) The Auto Function Time, time between steps for “step” and time to get from over one limit to the next for “ramp”.

The limits for the ramp and step functions are set to the 0 % and 100 % values (see Section 4.1: “Setting 0 % and 100 % Output Parameters”).

Steps are in 25 % increments from the 0 % value to the 100 % value.

4.3 Sourcing Current (mA)

To source a current, follow these steps:

- From the Main Menu select lower display [LOWER].
- Choose “mA” from the primary parameters.
- Switch to input/output control, and select output “OUT”.
- Connect the leads to the mA terminals (shown in Figure 10).
- Enter the desired current using the keypad.

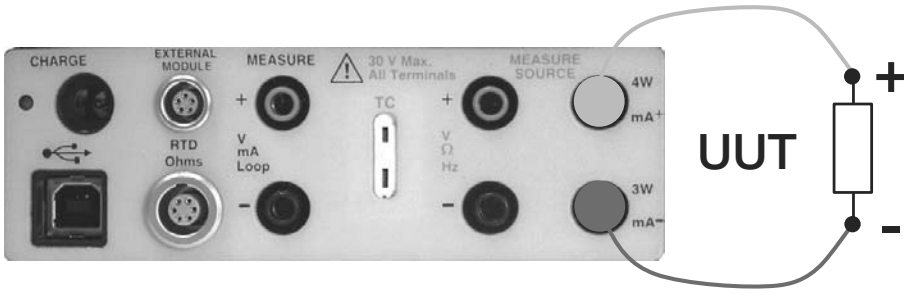
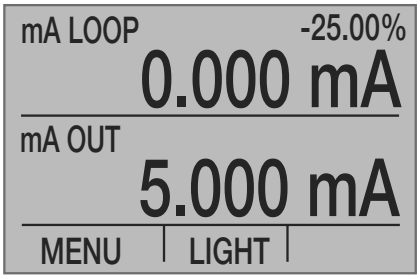


Figure 10: Connections for Sourcing Current



4.3.1 HART™ Resistor Selection

The 4423 has an internal 250-ohm resistor, which is required for HART™ devices. Enabling the 4423's internal 250-ohm resistor eliminates the need to manually add a series resistor during a HART™ calibration process.

Note:

When the 4423 internal 250-ohm resistor is activated, maximum load driving capability drops from 1000 ohms at 20 mA to 750 ohms at 2 0mA.

Note:

The HART™ resistor may be activated or deactivated only by skilled persons.

Caution!

Short-circuit at the accumulator!

Use insulated tools only.

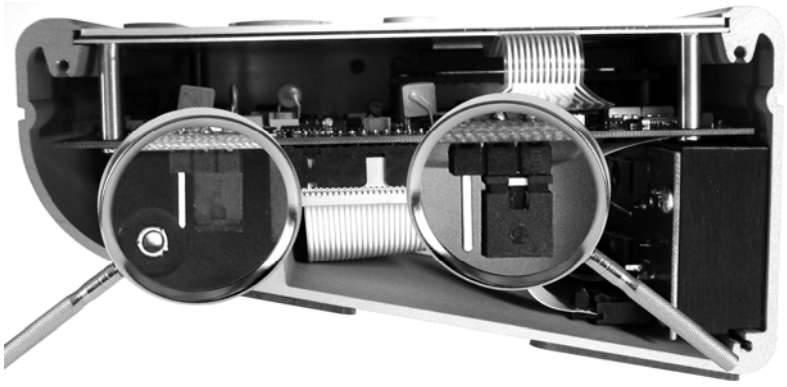
Enable/Disable Procedure

- Switch off the calibrator.
- Remove the two screws at the right plastic panel.
- Remove the 4 screws on the right metal side.
- Change HART™ jumpers on the multiway connector.

  Enable: Set both jumpers to left pins.

  Disable: Set both jumpers to the right pins.

  The status is printed on the topside of the board.



The opened side of the DIGISTANT, jumpers are disabled.

4.4 Simulating a Transmitter (Sink)

To have the calibrator supply a variable test current to a loop in place of a transmitter, follow these steps:

- Select [LOWER] from the Main Menu.
- Choose mA simulation from the primary parameters “mA 2W SIM”.
- Enter the desired current.
- Connect the 24V loop (shown in Figure 11).

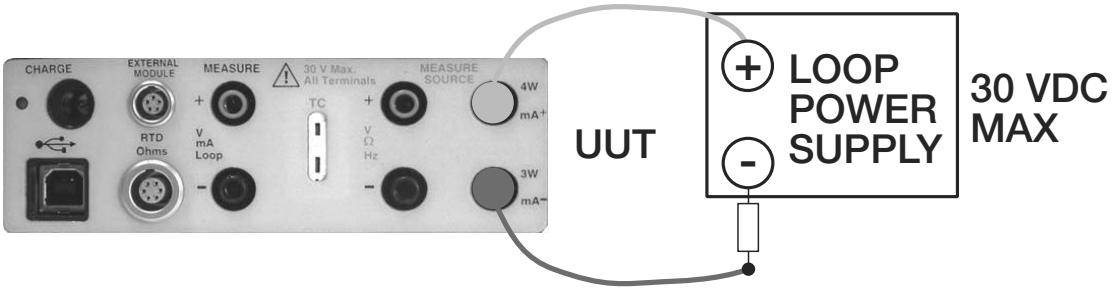


Figure 11: Connections for Simulating a Transmitter

4.5 Sourcing Voltage

To source volts follow these steps:

- Select lower display [LOWER] from the Main Menu.
- Choose “VOLTS” from the primary parameters.
- Switch to input/output control
- Select output “OUT”.
- Connect the leads at the voltage source terminals (shown in Figure 12).
- Enter the voltage using the keypad.

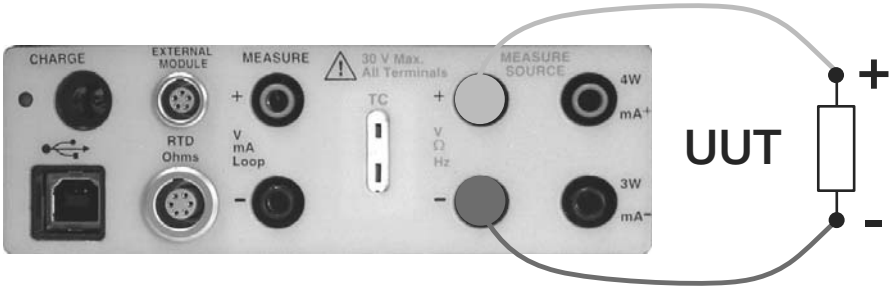
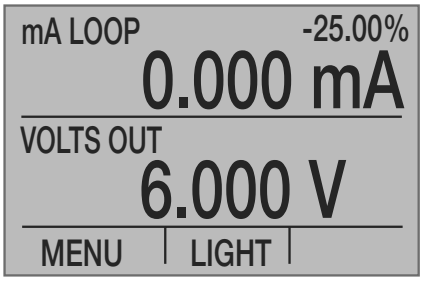


Figure 12: Connections for Sourcing Voltage and Frequency



4.6 Sourcing Frequency

To source a signal use these steps:

- Switch to the lower display [LOWER].
- Select “FREQ OUT” from the primary parameters.
- Switch to input/output control and select “OUT”, and than choose the frequency units.
- Connect the leads to the frequency output terminals (shown in Figure 12).
- Enter the desired frequency using the keypad.
- To change the amplitude, select [FREQ LEVEL] from frequency level menu.
- Enter the amplitude.

4.7 Sourcing a pulse train

The calibrator can produce a pulse train with an adjustable number of pulses at a desired frequency. For example, setting the frequency to 60Hz and the number of pulses to 60 would produce 60 pulses for a period of 1 second.

To source a pulse train, use the same connection as for frequency.

Proceed as follows:

- Switch to the lower display [LOWER].
- Select “PULSE” from the primary parameters.
- Choose the desired unit and enter the frequency using the keypad.
- Select the [COUNTS] function from the home menu.
- Enter the number of pulses.
- The amplitude of the pulses can be adjusted in the same manner as for frequency.
- Use [TRIG] to start and stop the signal.

4.8 Sourcing Thermocouples

To source a thermocouple use the following steps:

- Connect the thermocouple leads to the TC miniplug.
- Insert the plug into the thermocouple-socket on the calibrator (shown in Figure 13).

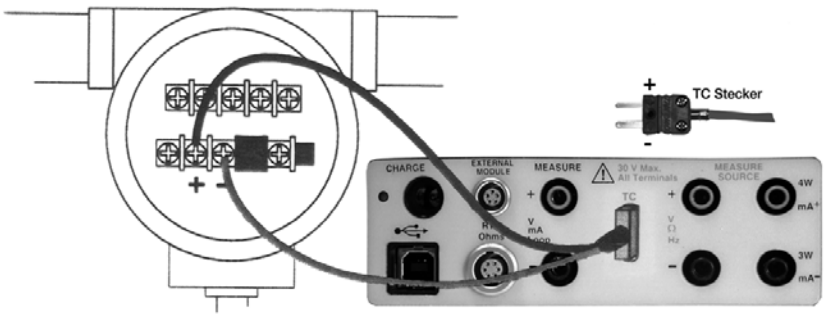


Figure 13: Connections for Outputting Thermocouples

- Select [LOWER] display from the Main Menu.
- Choose “TC” from the primary parameters.
- Choose output “OUT” from the input/output control.
- Select the CJC mode.

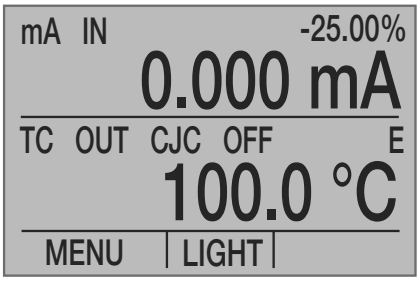
The CJC allows the following three versions of measurement:

1) TC IN CJC ON: Direct measurement of a thermocouple. The reference junction is formed electronically in the DIGISTANT. Connect the thermocouple with thermoelectric wires or compensation leads.
2) TC IN CJC OFF: The reference junction is switched off. The temperature of the reference junction will be refer to 0 °C. Connection with copper leads and copper miniplug.
3) TC IN CJC EXT: Use with external reference junction. The temperature is externally measured with a Pt100 at the hand-over point. Use the external reference junction model 4485-V001.

Note:

To improve the measurement of the temperature with the internal Pt100, identify the characteristics by calibrating. Enter these characteristics at the menu “RTD Custom”.

- Select the desired thermocouple type from the sensor types.
- Enter the temperature using the keypad.



4.9 Sourcing Resistance / RTDs

Note:

The calibrator simulates a 2-wire RTD. To connect 3- or 4-wire transmitter, use stacking cables, as shown in Figure 15.

To source an RTD, follow these steps:

- Select lower display from the Main Menu [LOWER].
- Choose “RTD” from the primary parameters.
- Choose output “OUT” from the input/output control.
- Select RTD type from the sensor types.
- Connect the calibrator to the instrument being tested (shown in Figure 14).
- Enter the temperature or resistance using the keypad.

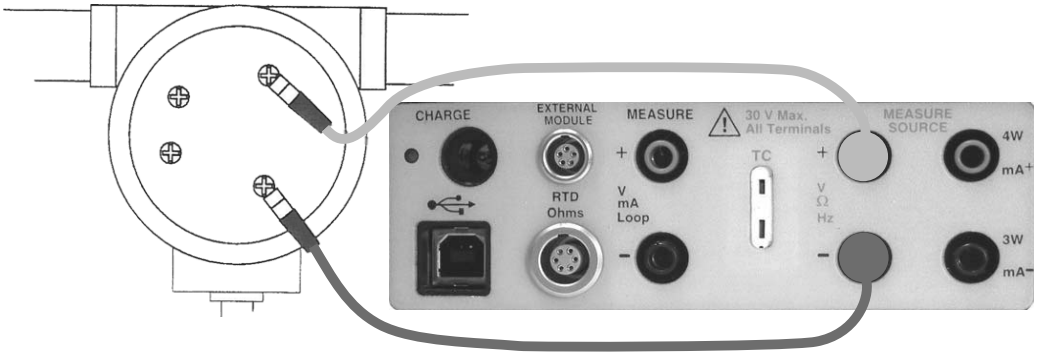


Figure 14: Connections for Outputting RTDs

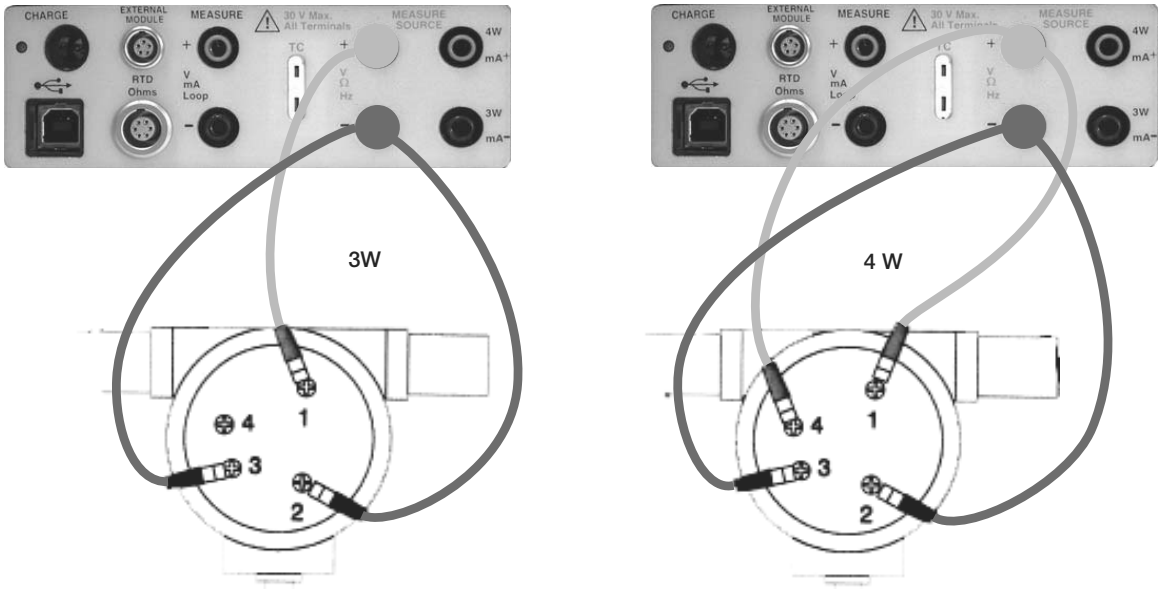


Figure 15: Using a 3- or 4-wire Connection for RTDs

4.9.1 Custom RTD

A custom curve-fit PRT may be entered into the calibrator for sourcing and measuring.

To do so, follow these steps:

- Switch to lower display [LOWER].
- Select “RTD” and set sensor type to “CUSTOM”.
- Enter the RTD custom setup main menu.
- Select [SET CUSTOM].
- Using the keypad, enter the values that the calibrator prompts for: minimum temperature, maximum temperature, R0 and the values for each of the temperature coefficients.

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. R_0 is the resistance of the probe at 0 °C. The coefficients for Pt385, Pt3926, and Pt3616 are shown in Table 4 below.

Table 4: RTD Coefficients

RTD	Range (°C)	R0	Coefficient A	Coefficient B	Coefficient C
PT385	-260 - 0	100	3.9083x10-3	-5.775x10-7	-4.183x10-12
PT385	0 - 630	100	3.9083x10-3	-5.775x10-7	---
PT3926	Below 0	100	3.9848x10-3	-5.87x10-7	-4x10-12
PT3926	Above 0	100	3.9848x10-3	-5.87x10-7	---
PT3916	Below 0	100	3.9692x10-3	-5.8495x10-7	-4.2325x10-12
PT3916	Above 0	100	3.9692x10-3	-5.8495x10-7	---

5. Using Isolated Measure Modes (Upper Display)

5.1 Measuring Voltage and Current

Warning!

Danger of an electric shock!

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

Never touch the probe to a voltage source when the test leads are plugged into the current terminals.

Use the following steps to measure the voltage or current output of a transmitter.

- Select the upper display from the Main Menu [UPPER].
- Select the desired primary parameter to be measured.
- Connect the leads to the isolated inputs of the calibrator (shown in Figure 16).

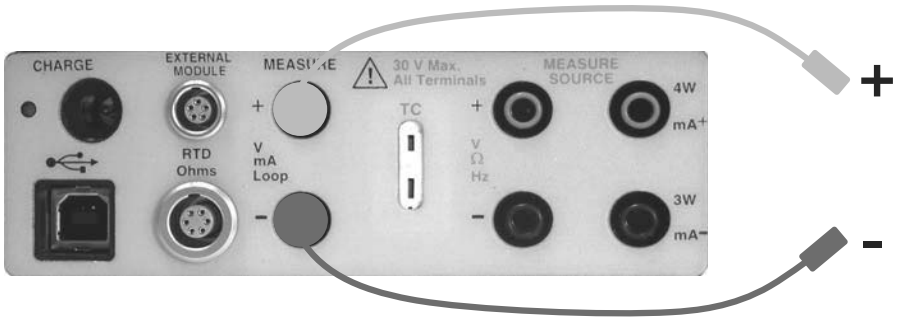


Figure 16: Isolated Input Connection

5.2 Measuring Current with Loop Power

To test a 2-wire, loop powered transmitter that is disconnected from wiring, use the loop power function. This function activates a 24 V supply in series with the current measuring circuit.

To use this option proceed as follows:

- Select “mA LOOP” as primary parameter in the upper display.
- Connect the calibrator to transmitter current loop terminals (shown in Figure 17).

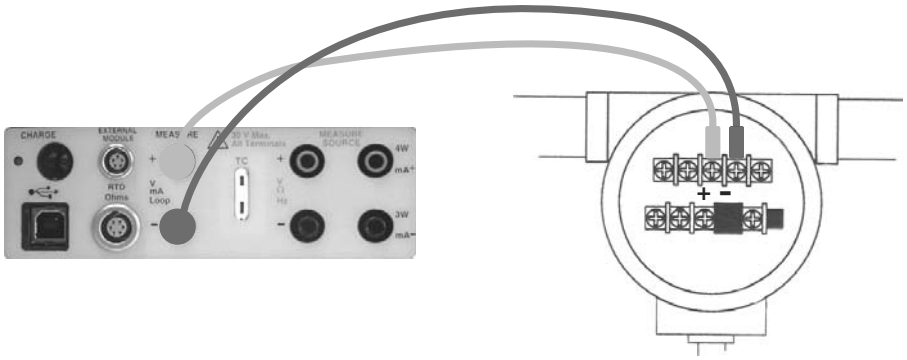


Figure 17: Connection Using Current Loop

5.2.1 HART™ Resistor Selection

The 4423 has an internal 250-ohm resistor, which is required for HART™ devices. Enabling the 4423's internal 250-ohm resistor eliminates the need to manually add a series resistor during a HART™ calibration process.

Note:

When the 4423 internal 250 resistor is activated, maximum load driving capability drops from 1000 ohms at 20 mA to 750 ohms at 20 mA.

Note:

The HART™ resistor may be activated or deactivated only by skilled persons.

Caution!

Short-circuit at the accumulator!

Use insulated tools only.

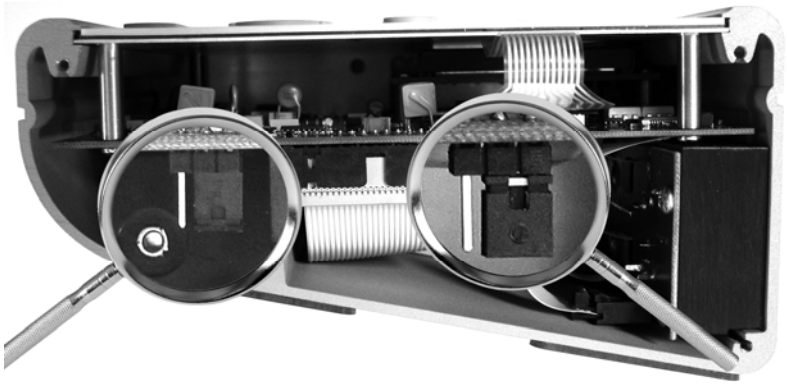
Enable/Disable Procedure

- Switch off the calibrator
- Remove 2 screws at the right plastic side.
- Remove the 4 screws on the right metal side.
- You can change the HART™ jumpers on the multiway connector.

  Enable: Set both jumpers to left pins.

  Disable: Set both jumpers to the right pins.

  The status is printed on the topside of the board.



The opened side of the DIGISTANT, jumpers are disabled.

5.3 Measuring Pressure

Warning!

Damages occur upon violent release of pressure!

Before you attach the pressure module to the pressure line, shut off the valve and slowly bleed off the pressure.

Caution!

Mechanical damages at the pressure module!

Maximum torque between the fittings of the pressure module and between the fittings and the body of the module: 13.5 Nm.

Damages by overpressure!

The specified maximum pressure is printed on the pressure module. Never apply a higher pressure than specified.

Damages by corrosion!

Use the pressure module only with specified materials. Refer to the pressure module documentation for material compatibility.

Note:

The 4423 is compatible with the 7132 Calibrator Pressure Modules. Accessory 7132 is required for pressure measurement.

Note:

Pressure is not read from modules with frequency or pulse train mode enabled.

Note:

On high-pressure modules engineering units normally associated with low-pressure ranges are not valid selections (e.g. inH_2O or cmH_2O). Selecting one of these units with a high-pressure module attached will cause the display to read "----".

To measure pressure, follow these steps:

- Connect the pressure module to the calibrator (shown in Figure 18).

  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.

- Switch to either [UPPER] or [LOWER] display from the Main Menu.
- Select “PRESSURE” from the primary parameters.
- Select the desired measuring unit.
- Zero the pressure module.

  The zero function on the calibrator can be found in the pressure-zeroing menu.

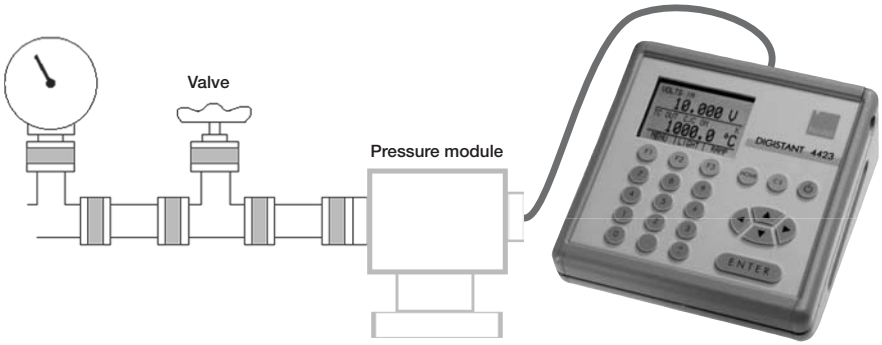


Figure 18: Measuring Pressure Transmitter

5.3.1 Zeroing Pressure Modules

If you want to use the zero function, you first have to connect a pressure module and to choose the PRESSURE function on one Display of the 4423.

To adjust the calibrator, follow these steps:

- Enter the pressure-zeroing menu.

  To do this, at the home menu press the [MENU] key followed by [MORE], followed by [NEXT] at several times. Until the display shows the [ZERO] function.

- Select [ZERO].

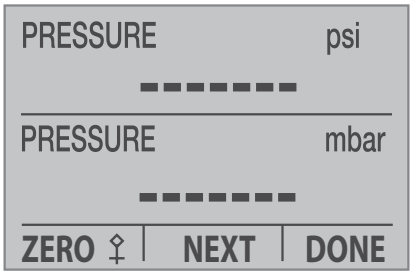
If you use an absolute pressure module, you have to insert the current barometric pressure as a reference. Because of this the 4423 shows the message:

“SET REFERENCE ABOVE”

- Enter the pressure using the keypad.

  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.



5.4 Smart Sensor Interface

5.4.1 7160: Connecting the Smart Sensor Interface

Note:

Since only one module may be connected at a time, pressure and 7160 inputs can not be displayed at a time.

Note:

The allowed engineering units are dependent on the smart sensor interface connected. Because of this, you are only able to define a unit, if a smart sensor interface is connected to the 4423.

- Insert the smart sensor interface 7160 into the interface adaptor 7130.
- Connect the interface adaptor 7130 to 4423.

  The 4423 needs a few seconds to establish the connection to the 7130. During this time the display shows "- -".
- Switch the upper display [UPPER] to 7160. (Lower display: refer to chapter 3.5.1)

  At the lower display the access to the 7160 is disabled now.

  Once the upper display is set to 7160, the top line of the display has changed.

  It is now formatted as follows:

  "7160 mmmm aaaa rrrrrr"

  "mmmm" is the operating mode. These settings are possible:

STAT	static
DMAX	dynamic, displaying maximum peak
DMIN	dynamic, displaying minimum peak
DP-P	dynamic, displaying peak to peak
DRDG	dynamic, displaying present reading

  "aaaa" is the averaging to be applied:

  - X/1
  - X/2
  - X/4
  - X/8
  - X/16
  - X/32

"rrrrrrr" is the sampling rate, possible is:

In static mode only fixed 3/s.

In dynamic mode:

- 3/s
- 10/s
- 50/s
- 100/s
- 500/s
- 1000/s

- Press the [SELECT] function key to cycle through the possible values for the presently highlighted field.
- Use the [NEXT] function key to change the presently highlighted field.
- Repeat this procedure for other fields.

Once the 7160 is selected on the upper or lower display, a new item appears in the menu sequence following the [MORE] key: the 7160 menu. Pressing 7160 proceed to a separate menu sequence, providing 7160 zero and tare. The normal documentation mode is selectable by pressing the [NEXT] key.

Note:

When a module is first plugged in, it should default to static mode (STAT). The averaging should be X/8, the sampling rate 3/s and zero and tare set to "0".

Using a dynamic mode for measurement, the 4423 generates all three extreme values. But the display shows only one. The display will be set at the control menu for dynamic mode.

5.4.2 7160: Setting a zero offset

To set a zero offset a 7160 must be connected to the 4423 and 7160 must be selected on the upper display. (Lower display: refer to chapter 3.5.2)

The measurement system must be unloaded.

To set a zero offset:

Before starting the settings of the zero value the measurement system has to be unloaded and the tare value has to be "0".

Otherwise there will be measurement errors!

- Press the [MENU] function key at the home menu.

  The menu bar now shows the main menu.

- Press the [MORE] function key.

  After pressing the [MORE] function key the display shows the 7160 menu.

- Now press the [7160] function key.

  Doing this you have reached the zero offset menu for the 7160.

  Opening this menu the 4423 shows the current zero offset.

  There are two ways to define a new zero offset.

To set the zero offset to the present measured value:

- Press the [ZERO] function key.

  At the upper display, the 4423 now shows the present measured value with negated algebraic sing.

  Setting the new zero offset value the 4423 ignores the former offset and tare value.

- Confirm the new zero offset value by pressing the [DONE] function key.

To set the zero offset to a fixed value:

- Enter the fixed value.

  To do this, use the numeric keypad of the 4423.

- Confirm the fixed value by pressing the [ENTER] key.

- Confirm the new zero offset by pressing the [DONE] function key.

Note:

DIGISTANT® stores the **zero value** in a **non-volatile memory** of the 7160 module. Therefore you can further use the **zero value**, also after switch-off and switch-on again respectively after the 7160 module has been disconnected and then connected again.

5.4.3 7160: Tare

To set a new tare value a 7160 must be connected to the 4423 and 7160 must be selected on the upper display. (Lower display: refer to chapter 3.5.3)

The measurement system must be unloaded.

To set a tare value:

- First define a new zero offset value for the 7160.

  Refer to chapter 3.5.2 “7160: Setting a zero offset” for more information.

- Now apply the preload to the system.

- At home menu press the function keys [MENU], [MORE], [7160] and [NEXT].

  You have now reached the 7160 tare menu.

  Opening this menu the 4423 shows the current tare value.

To set the tare value to the present measured value:

- Press the [TARE] function key.

  At the lower display, the 4423 now shows the present measured value with negated algebraic sing.

  Setting the new tare value the 4423 ignores the former tare value.

- Confirm the new tare value by pressing the [DONE] function key.

To set the zero offset to a fix value:

- Enter the fix value.

  To do this, use the numeric keypad of the 44423.

- Confirm the fixed value by pressing the [ENTER] key.

- Confirm your entry by pressing the [DONE] function key.

Note

Opposite to its handling of the zero value DIGISTANT® stores the **tare value** in a **volatile memory**. This value is lost upon switching off DIGISTANT® or disconnecting 7160 from DIGISTANT®.

Using the ZERO and TARE functions

Equipment: DIGISTANT 4423, adapter 7130, Smart-Sensor-Interface 7160 and load cell 8527-610 with a measuring range of 10 kN.

After switching on, the values for ZERO and TARE initially equal "0.000“. Simultaneously, a zero signal from the sensor of -0.0071 mV/V appears, which is the signal obtained without the influence of mounting parts. The test certificate states that this is equivalent to a zero offset of -0.047 kN. You can use the ZERO function of the DIGISTANT to set this zero offset to zero. This generates the **zero value**, which the DIGISTANT saves in a **non-volatile memory** inside the 7160. This means that you can use the zero value again, even after switching the device off and on, or after disconnecting the 7160 from the DIGISTANT and then reconnecting it.

The load cell is now mounted in a system. This subjects the sensor to an initial load of 0.300 kN. This initial load can be tared ("zeroed") using the TARE function. The DIGISTANT saves the resultant **tare value** in a **volatile memory**, however. Since this memory is volatile, the tare value is lost after switching off the DIGISTANT or after disconnecting the 7160 from the DIGISTANT. In these cases it is reset back to "0.000“.

Note:

Use the ZERO function only when the tare value equals "0". Otherwise incorrect measurements will be obtained!

5.4.4 Measurement in Static Mode

The home menu data display shows the present measured module reading, with the present zero and tare values applied in that order.

5.4.5 Measurement in Dynamic Mode

Using the 7160, in addition to static mode, you are able to measure in four dynamic modes:

- DMAX (displaying the maximum value since last reset)
- DMIN (displaying the minimum value since last reset)
- DP_P (displaying the peak to peak value since last reset)
- DRDG (displaying the present measured value)

The 4423 displays the measured values of a 7160 module in dynamic mode at the home menu data display, too. However the switching over to another dynamic mode is more complicated in this display. Because of this, please use the dynamic display for measurement in dynamic mode.

To use a 7160 in dynamic mode:

➢ Connect the 7160 to the 4423.

➢ Switch the upper display [UPPER] to a dynamic mode. (Lower display: refer to chapter 3.5.5)

➢ Confirm your selection by pressing the [DONE] function key.

The 4423 now shows the home menu.

➢ Now press, one after another, the function keys [MENU], [MORE], [7160] and twice the [NEXT] function key.

Doing this, you have reached the dynamic display for dynamic mode measurement with 7160. The menu bar shows the following menu:

To change the active dynamic mode:

➢ Press the [DISPLAY] function key.

After pressing this function key the 4423 switches to the next dynamic mode (DMAX, DMIN, DP-P, DRDG)

To reset all peak values:

➢ Press the [RESET] function key.

Now you have reset all peak values.

To leave the dynamic display:

➢ Press the [DONE] function key.

The 4423 now shows the home menu.

6. Using the Upper and the Lower Display for Calibration and Testing

6.1 Testing an Input or Indicating Device

To test and calibrate actuators, recording, and indicating devices using the source functions, follow these steps:

- Select the lower display [LOWER].
- Choose the correct primary parameter.
- Switch to “OUT” in the input/output control.
- Connect the leads to the instrument and the calibrator (shown in Figure 19).

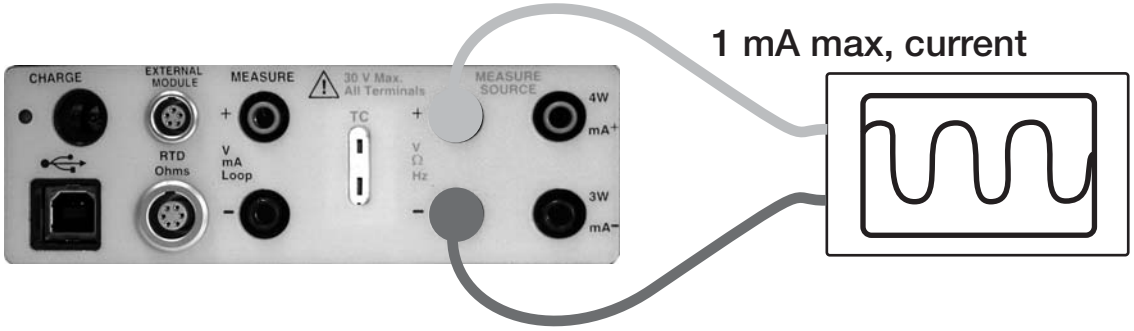


Figure 19: Connections for testing an Output Device

6.2 Calibration of an I/P Device

Follow these steps to calibrate a device that controls pressure using current as input signal:

- Select upper display from the Main Menu [UPPER].
- Select “PRESSURE” from the primary parameters.
- Switch to lower display from the Main Menu [LOWER].
- Select current source “mA out” from the primary parameters.
- Connect the calibrator to the device (shown in Figure 20).

  The calibrator will simulate the transmitter current and measure the output pressure.
- Enter a current using the keypad.

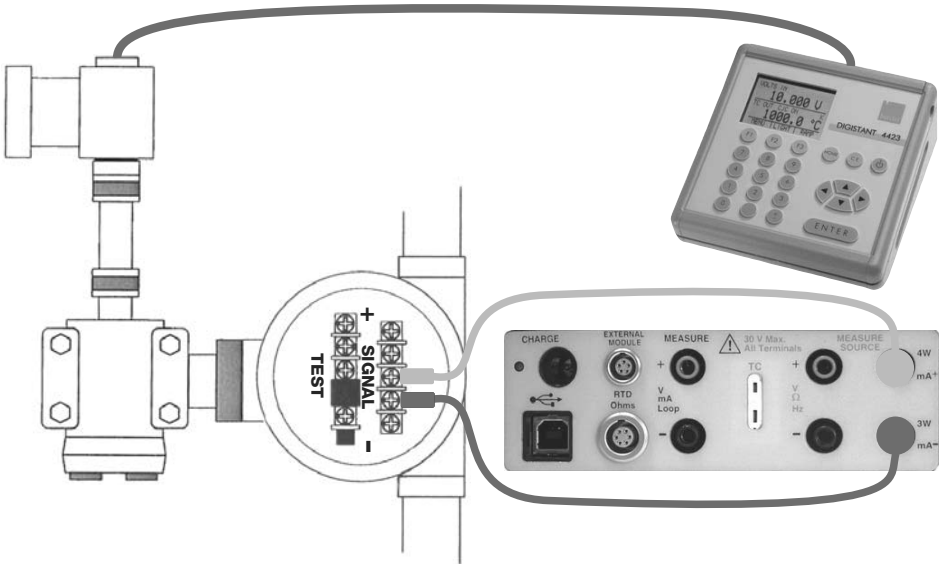


Figure 20: Calibrating an I/P Device

6.3 Calibration of a Transmitter

This section covers all but the pressure transmitters.

To calibrate a transmitter both the upper and the lower displays will be used, one for measuring and the other for source.

In this example a thermocouple temperature transmitter is used.

To calibrate a temperature transmitter, follow these steps:

- From the Main Menu select upper display [UPPER].
- Choose current loop “mA LOOP”.
- Switch to lower display from the Main Menu [LOWER].
- Select “TC” from the primary parameters.
- Choose output “OUT” from the input/output control.
- Select TC type.
- Set the 0 % and 100 % span points. To do this use the keypad and the [0 %] and [100 %] keys (refer to chapter 4.1: “Setting 0 % and 100 % Output Parameters”).
- Connect the calibrator to the transmitter (shown in Figure 21).
- Test transmitter at 0, 25, 50, 75 and 100 % using the 25 % step function (25 % key).
- Adjust the transmitter if necessary.

To calibrate a different transmitter:

- Follow the steps above with the exception of choosing TC on the lower display. Replace TC with the correct parameter for the transmitter.

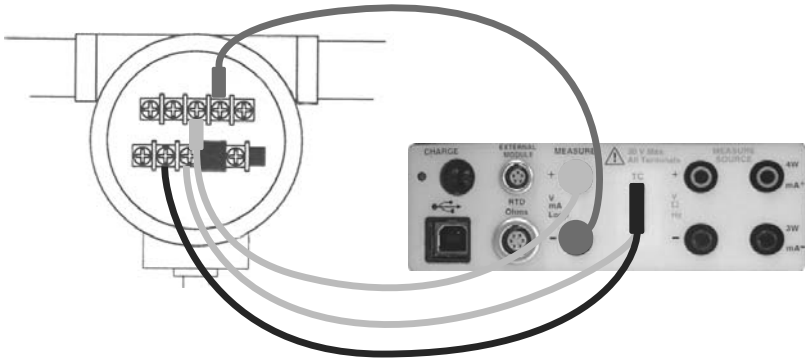


Figure 21: Calibrating a Transmitter

6.4 Calibration of a Pressure Transmitter

To calibrate a pressure transmitter, follow these steps:

- Select upper display from the Main Menu [UPPER].
- Choose “mA LOOP” from the primary parameters.
- Return to Main Menu.
- Select lower display [LOWER].
- Choose “PRESSURE” from the primary parameters.
- Connect the calibrator to the transmitter and the pressure module (shown in Figure 22).
- Zero the pressure module.
- Test the transmitter at 0 % and 100 % of the span.
- Adjust if necessary.

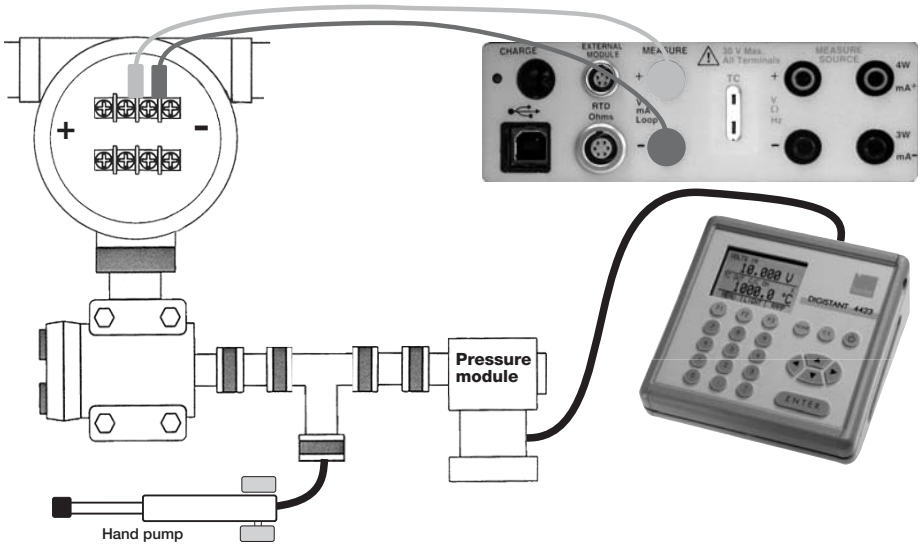


Figure 22: Calibrating a Pressure Transmitter

7. 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 USB port connection for remote operation (at calibrator: USB plug model B).

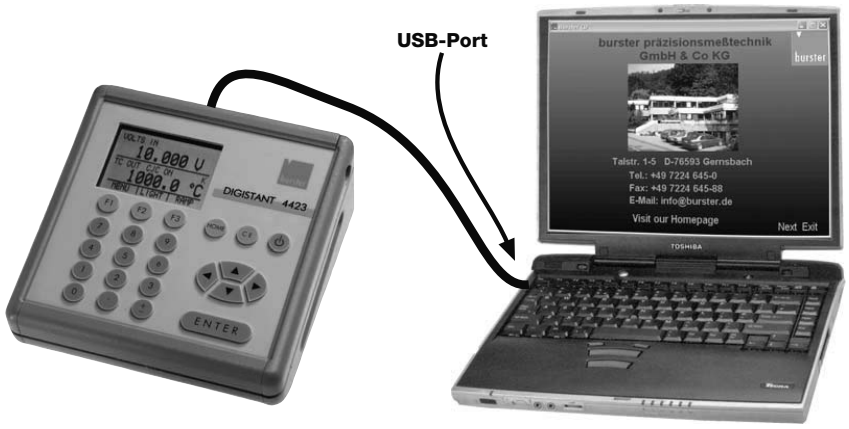


Figure 23: Calibrator-to-Computer Connection

7.1 Installation of the USB-interface Driver for Remote Control

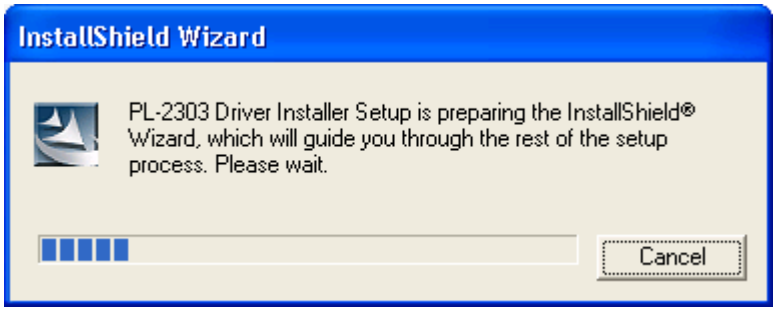
Before connecting the calibrator to the USB-interface of your PC, you have to install the USB-Interface driver.

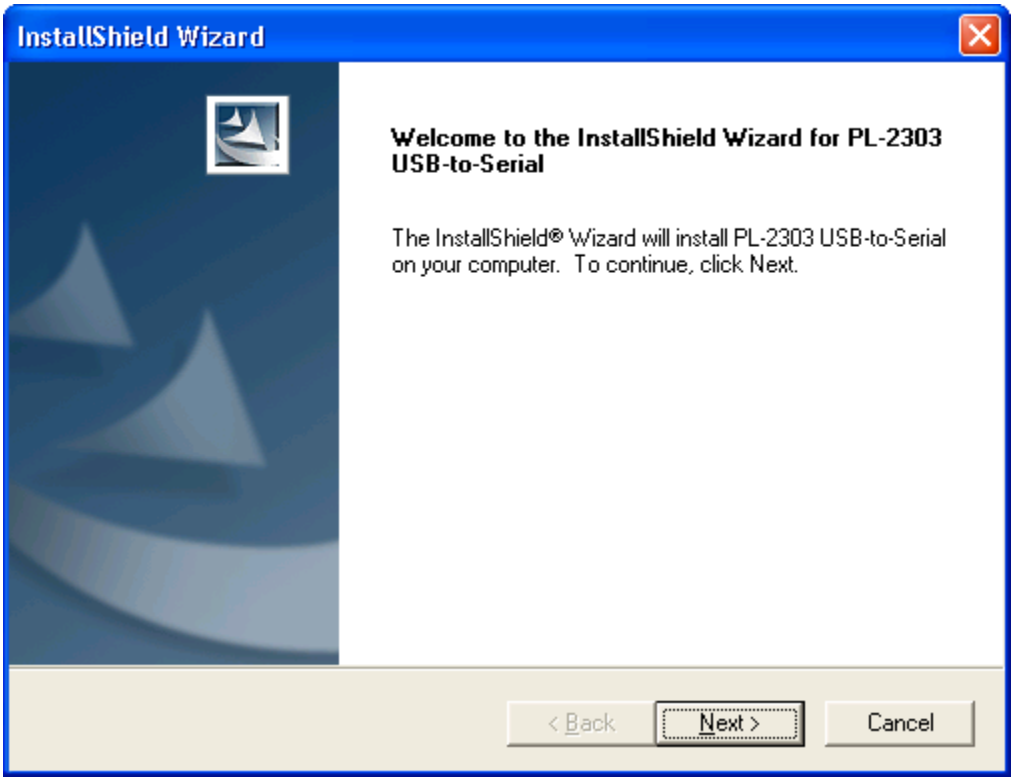
To install the interface driver you'll need an administrator-account!

If the following menu appeared not automatically:

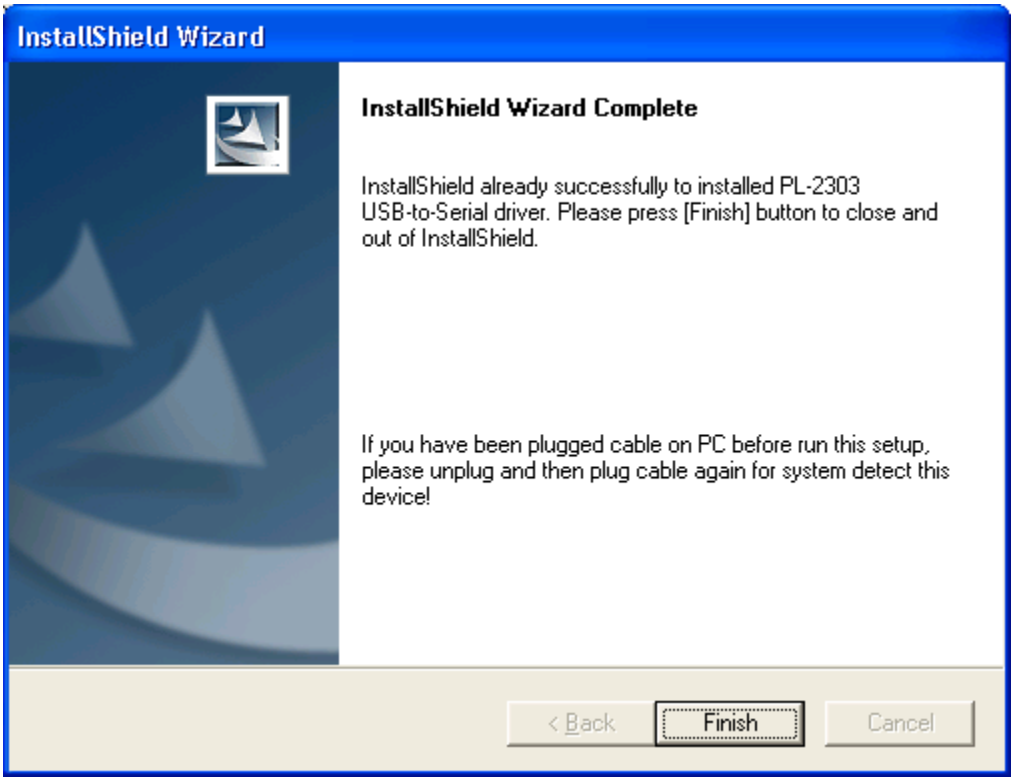
- Insert the burster Software CD into your CD/DVD-Drive.
- Run the file "autorun.exe" with a double-click at the left mouse-button.

- Go to section “Kalibratoren > 4423“
- Choose the link “Installation USB-Schnittstellentreiber“
- Follow the installation routine, which is shown below.





- Hit the button “Next>”, to proceed.



➢ To finish the installation, hit the button “Finish”.

Dependent on your operating system, you have to restart the PC after the installation of the USB-interface driver.

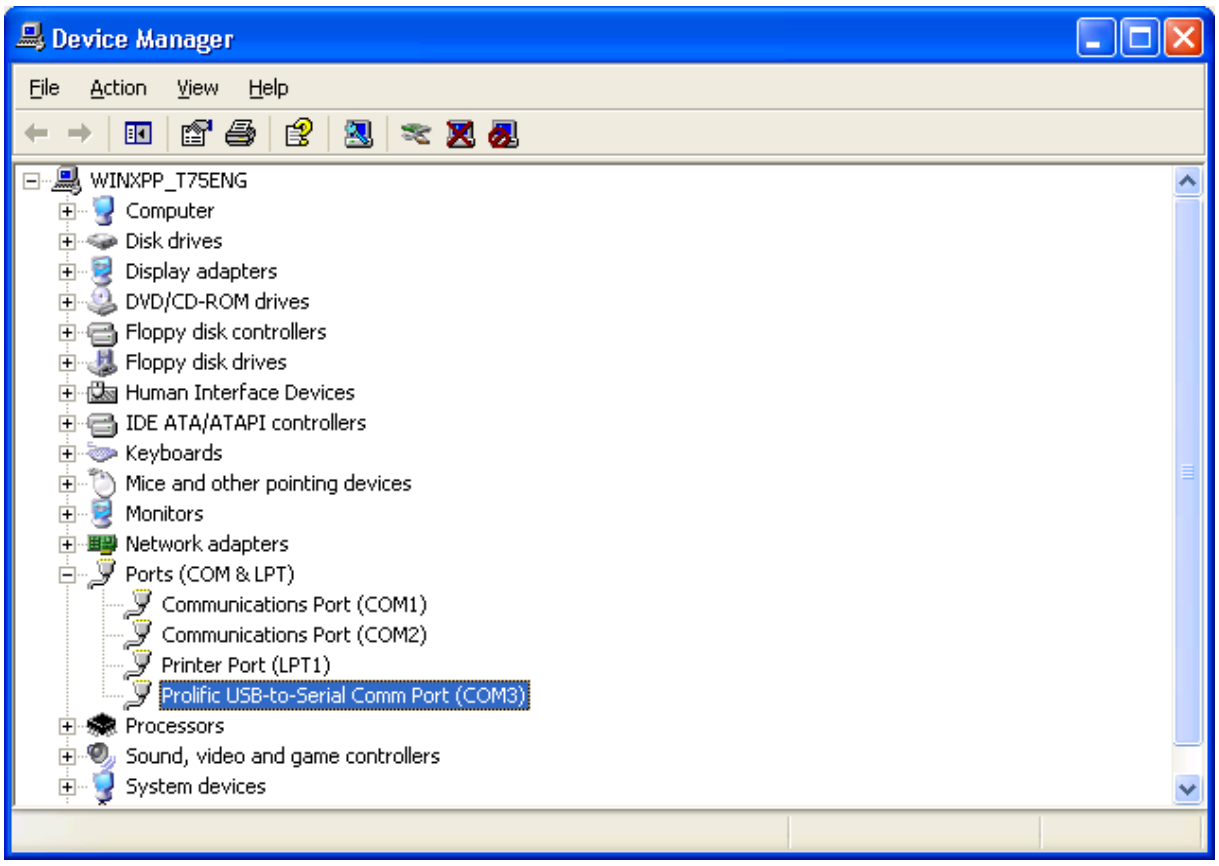
After the installation:

➢ Connect the USB-cable to an available USB-port of your PC.

Now the PC installs the identified calibrator on an available COM-port automatically.

To check, which COM-port is used, proceed the following steps:

Start > Settings > Control panel > System > Hardware > Device manager > ports (COM und LPT):



You'll find the calibrator at the entry "Prolific USB-to-Serial COM Port". Beyond this entry you'll see the assigned COM-port. You have to set up this COM-port at the software; you use to communicate with the calibrator.

7.2 Removing of the USB-interface driver

Follow this link to remove the driver of the USB-serial converter:

Start > Programs > PL-2303 USB-Serial Driver > Uninstaller

7.3 Interface Configuration

These are the interface parameters of the COM-port:

- 9600 Baud
- 8 Data bits
- 1 Stop bit
- No Parity
- Protocol: Xon/Xoff
- Terminator: EOL (End of Line), CR (Carriage Return) or both

7.4 Using Configuration Software

For comfortable configuration and control of the calibrator, use the burster software 4423-P001. You'll find this software at the burster software CD.

Note:

You'll find the specifications required by the configuration software in the file "readme.txt". The system opens this file during the installation process.

7.5 Using Windows Hyper Terminal

You are able to use Hyper Terminal for the remote control of the PC-connected calibrator (see Figure 23).

To do this use the following procedure:

- Start Hyper Terminal

  You'll find Windows Hyper Terminal at Accessories/Communications of the Windows Start menu.

- Select "File>New Connection".
- For Name enter "4423".
- Select the serial port (COM) that the unit is connected to.
- Enter the information for port settings, shown in chapter 7.3.
- Select ASCII setup from File/Properties/Settings and mark these choices:
  - "Echo typed characters locally"
  - "Wrap lines that exceed terminal width"
- Select "OK"
- Enter *IDN? to check the connection.

  This command will return information on the unit.

7.6 Changing Between Remote and Local Operation

The calibrator has three modes of operation:

- Local
- Remote
- Remote with Lockout

Local mode is the default mode.

Commands may be entered using the keypad on the unit or using a computer.

In Remote mode the keypad is disabled. Commands may only be entered using a computer. Choosing [GO TO LOCAL] from the menu on the calibrator display will restore keypad operation.

In Remote with Lockout, the keypad cannot be used at all.

To switch modes proceed as follows:

To enable Remote mode:

➢ Type in the serial command “REMOTE” at the computer terminal.

To enable Remote with Lockout:

➢ Type in “REMOTE” and “LOCKOUT” in either order.

To switch back to local operation:

➢ Enter “LOCAL” at the terminal.

This command also turns off “LOCKOUT” if it was on. For more information on commands refer chapter 7.8 “Remote Commands and Error Codes”.

7.7 Using Commands

7.7.1 Command types

You'll find a list of all available commands at chapter 7.8: "Remote Commands and Error Codes".

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 DCV

Tells the calibrator to measure voltage 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 current modes of the upper and lower displays.

Compound Commands

Commands that contain more than one command on one line.

For example:

LOWER_MEAS RTD; RTD_TYPE CU10

Sets the calibrator to measure RTD in the lower display and sets RTD type to "Cu 10".

Overlapped Commands

Commands that require more time to execute than normal. The command *WAI tells the calibrator to wait until the overlapped command is finished before executing the next command.

For example:

TRIG; *WAI

Triggers the pulse train. Once the pulse train has been triggered, the calibrator can proceed to the next command.

Sequential Commands

Commands that are executed immediately after they are entered. This type includes most of the commands.

7.7.2 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 lower case is acceptable.

7.7.3 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.

For example:

*ESE 140; *ESE?

Returns “140”.

Floating

Numbers that have up to 15 significant figures and exponents.

For example:

CPRT_COEFA?

Returns “3.908000E-03”.

Character Response Data (CRD)

Data returned as keywords.

For example:

RTD_TYPE?

Returns PT385_10.

Indefinite ASCII (IAD)

Any ASCII characters followed by a terminator.

For example:

*IDN?

Returns “burster, 4423, 250, 1.00”.

7.7.4 Calibrator Status

Status information is provided on the calibrator by status registers, enable registers, and queues. Each status register and queue has a summary bit in the Serial Poll Status Byte. Enable registers generate summary bits in the Serial Poll Status Byte.

The following is a list of registers and queues along with their function.

Serial Poll Status Byte (STB)

The STB is sent when the calibrator responds to the *STB? command. The Byte is cleared when power is reset. Figure 24 demonstrates how it works.

Service Request Enable Register (SRE)

Enables or disables the bits of the STB. Cleared when power is reset. Setting bits to “0” disables them in the STB. Setting the bits to “1” enables them.

7	6	5	4	3	2	1	0
0	MSS	ESB	0	EAV	0	0	0

Figure 24: Bit assignments for the SRE and the STB

MSS

Master Summary Status. Set to “1” when ESB or EAV are enabled (1). Read using the *STB? command.

ESB

Set to “1” when at least one bit in ESR is enabled (1).

EAV

Error Available. An error has been entered into the error queue, and may be read using the command FAULT?.

Event Status Register (ESR)

A two-byte register, in which the lower bits represent conditions of the Calibrator. Cleared when read and when power is reset.

Event Status Enable Register (ESE)

Enables and disables bits in the ESR.

Setting a bit to “1” enables the corresponding bit in the ESR. Setting it to “0” disables the corresponding bit.

The ESE is cleared at power reset.

Bit assignments for the ESR and the ESE respectively are shown below.

15	14	13	12	11	10	9	8
0	0	0	0	0	0	0	0

7	6	5	4	3	2	1	0
PON	0	CME	EXE	DDE	QYE	0	OPC

PON

Power On. The bit is enabled (1) if power was turned on and off before the Event Status Register was read.

CME

Command Error. The bit is enabled (1) when the calibrator receives an invalid command. For example, entering an unsupported RTD type may cause such an error.

EXE

Execution Error. The bit is enabled when the calibrator runs into an error while executing the last command. For example, a parameter that has too significant figures may cause such an error.

DDE

Device-dependent Error. This bit is enabled (1) when, for example, the output of the calibrator is overloaded.

QYE

Query Error.

OPC

Operation Complete. This Bit is enabled (1) when the calibrator has finished executing all commands before the command *OPC was entered.

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 and processes on a first in, first out basis.

7.8 Remote Commands and Error Codes

The following tables list all commands, and their descriptions, that are accepted by the calibrator.

Table 5: Common Commands

Command	Description
*CLS	*CLS (Clear status.) Clears the ESR, the error queue and the RQS bit in the status byte. Terminates pending Operation Complete commands
*ESE	Loads a byte into the Event Status Enable register.
*ESE?	Returns the contents of the Event Status Enable register.
*ESR?	Returns the contents of the Event Status register and clear the register.
*IDN?	Identification query. Returns the manufacturer, model number, and firmware revision level of the Calibrator.
*OPC	Enables setting of bit 0 (OPC for "Operation Complete") in the Event Status Register to “1” when all pending device operations are complete.
*OPC?	Returns a “1” after all pending operations are complete. This command causes program execution to pause until all operations are complete.
*RST	Resets the state of the instrument to the power-up state. This command holds off execution of subsequent commands until it is complete.
*SRE	Loads a byte into the Service Request Enable register.
*SRE?	Returns the byte from the Service Request Enable register.
*STB?	Returns the status byte.
*WAI	Prevents further remote commands from being executed until all previous remote commands have been executed.

Table 6: Calibrator Commands

Command	Description
CJC_STATE	Turns CJC on or off.
CJC_STATE?	Returns the state of the CJC.
CPRT_COEFA	Sets the custom RTD coefficient “A”.
CPRT_COEFA?	Returns the custom RTD coefficient “A”.
CPRT_COEFB	Sets the custom RTD coefficient “B”.
CPRT_COEFB?	Returns the custom RTD coefficient “B”.
CPRT_COEFC	Sets the custom RTD coefficient “C”.
CPRT_COEFC?	Returns the custom RTD coefficient “C”.
CPRT_MIN_T	Sets the custom RTD minimum temperature.
CPRT_MIN_T?	Returns the custom RTD minimum temperature.
CPRT_MAX_T	Sets the custom RTD maximum temperature.
CPRT_MAX_T?	Returns the custom RTD maximum temperature.
CPRT_R0	Sets the resistance (R0) of the custom RTD.
CPRT_R0?	Returns the resistance (R0) of the custom RTD.
FAULT?	Returns the error code of an error that has occurred.
FREQ_LEVEL	Sets the frequency and pulse amplitude.
FREQ_LEVEL?	Returns the frequency and pulse amplitude.
FREQ_TYPE	Set the frequency output to “continuous” (frequency) or “pulse”.
FREQ_TYPE?	Returns frequency output type, “continuous” or “pulse”.
FREQ_UNIT	Sets the unit for frequency and pulse.
FREQ_UNIT?	Returns the unit for frequency and pulse.
FUNC?	Returns the current mode of the upper and lower display.
GET_CLOCK	Returns the calibrator date and time setting.
GET_SN	Returns the calibrator serial number.
LOCAL	Puts the calibrator in local mode.
LOCKOUT	Locks out the keypad of the calibrator, and allows for remote operation only.
LOWER_MEAS	Sets the mode for measuring on the lower display.

Command	Description
L_PRES_UNIT	Sets the pressure unit on the lower display.
OUT	Sets the output of the calibrator.
OUT?	Returns the output of the calibrator.
PRES?	Returns the model and serial number of the attached pressure module.
PRES_UNIT?	Returns the pressure unit for the upper and lower display.
PULSE_CNT	Sets the number of pulses for the pulse train.
PULSE_CNT?	Returns the number of pulses in the pulse train.
REMOTE	Puts the calibrator in remote mode.
RTD_INPUT	JACKS or LEMO, with one space between the command, sets the connection mode by RTD input.
RTD_INPUT?	JACKS or LEMO, returns the connection mode.
RTD_TYPE	Sets the RTD type.
RTD_TYPE?	Returns the RTD type.
RTD_WIRE	Only JACKS selection, 2, 3 or 4, sets the number of wires used by the RTD mode.
RTD_WIRE?	Only JACKS selection, returns the wire number setting used in the RTD mode; 2, 3 or 4.
SET_CLOCK	Set calibrator clock.
SIM	Sets the output for mA simulation.
SIM?	Returns the output of the mA simulation.
TAG_CLEAR	Clear test data for a specified tag.
TAG_CLEAR_ALL	Clear test data for all tags.
TAG_DLND 0	Returns the number of unused tags available in the calibrator and the position of the first available tag for download.
TAG_DNLD	Download tag calibration test configuration data from PC to the 4423.
TAG_UPLD	Upload tag calibration test configuration results to a PC from the 4423.
TAGS?	Upload a list of all tag ID's to PC.
TC_TYPE	Sets the thermocouple type.
TC_TYPE?	Returns the thermocouple type.
TEMP_UNIT	Sets input/output temperature unit for RTD and TC.
TEMP_UNIT?	Returns the temperature unit for RTD and TC.

TRIG	Starts and stops the pulse train in pulse mode.
Command	**Description**
TRIG?	Returns “TRIGGERED” when a pulse train is on. Returns “UNTRIGGERED” when the pulse train is off.
TSENS_TYPE	Sets temperature sensor type.
TSENS_TYPE?	Returns temperature sensor type.
UPPER_MEAS	Sets the measuring mode for the upper display.
U_PRES_UNIT	Sets the upper pressure unit.
VAL?	Returns the measured values.
ZERO_MEAS	Zeros the pressure module.
ZERO_MEAS?	Returns the zero offset of the pressure module.

Table 7: Parameter units

Units	**Meaning**
MA	Milliamps of current
MV	Voltage in millivolts
V	Voltage in volts
CPM	Frequency in cycles per minute
Hz	Frequency in Hertz
KHz	Frequency in kilohertz
Ohms	Resistance in Ohms (Ω)
Cel	Temperature in Celsius
Far	Temperature in Fahrenheit
Psi	Pressure in pounds per square-inch
InH2O4C	Pressure in inches of water at 4°C
InH2O20C	Pressure in inches of water at 20°C
CmH2O4C	Pressure in centimeters of water at 4°C
CmH2O20C	Pressure in centimeters of water at 20°C
Bar	Pressure in bars
Mbar	Pressure in millibars
KPal	Pressure in kilopascals

Units	Meaning
InHg	Pressure in inches of mercury at 0°C
MmHg	Pressure in millimeters of mercury at 0°C
Kg/cm^2	Pressure in kilograms per square-centimeter

Table 8: Error codes

Error Number	Error Description
100	A non-numeric entry was received where it should be a numeric entry.
101	Too many significant digits entered.
102	Invalid units or parameter value received.
103	Entry is above the upper limit of the allowable range.
104	Entry is below the lower limit of the allowable range.
105	A required command parameter was missing.
106	An invalid pressure unit was received.
107	An invalid CJC_STATE was received.
108	An invalid TSENS_TYPE was received.
109	Pressure module not connected.
110	An unknown command was received.
111	An invalid RTD or TC parameter value was received
112	The serial input buffer overflowed.
113	Too many entries in the command line.
114	The serial output buffer overflowed.
115	Output is overloaded.
116	Calibrator not in pulse train mode when TRIG was received.
117	An invalid FREQ_TYPE was received.

7.9 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. Almost all commands for the calibrator are sequential.

This section will briefly explain each of the commands and describe their general use, which will include any parameters that may be entered with the command as well as what the output of the command is.

7.9.1 Common Commands

***CLS**

Clears the ESR, the error queue and the RQS bit. Also terminates all pending operations.

When writing programs, use before each procedure to avoid buffer overflow.

***ESE**

Loads a byte into the Event Status Enable register. The command is entered with a decimal number that, when converted to binary, enables the right bits in the Event Status Register.

For example:

*ESE 133

When “133” is converted to binary it is 10000101. Bits 7, 2, and 0 will be enabled.

***ESE?**

Returns the contents of the Event Status Enable register. The value returned is a decimal.

For example, if the register has the following settings:

“10000101” the value “133” will be return.

***ESR?**

Returns the contents of the Event Status Register in decimal form.

For example:

If the ESR contains “10111001”, *ESR? will return “185”.

***IDN?**

Returns the manufacturer, model number, and firmware revision of the Calibrator.

For example:

*IDN? will return “BURSTER,4423,0,1.20”

***OPC**

Enables the Operation Complete setting in the ESR. This setting makes it possible to check if an operation is complete after it has been initialized.

For example this operation could be used with the command TRIG.

***OPC?**

Returns “1” when all operations are complete, and causes program execution to pause until all the operations are complete.

For example:

TRIG; *OPC? will return a “1” when the pulse train initiated by TRIG is complete.

***RST**

Resets the state of calibrator to the power-up state. All subsequent commands are held off until the execution of the command is complete.

***SRE**

Loads a byte into the Service Request Enable register. A decimal number must be entered, which when converted to binary, corresponds to the correct settings.

For example:

*SRE 8 enters the binary number “00001000” to the SRE. This enables bit 3. Bit 6 is not used.

***SRE?**

Returns a byte from the SRE. The byte is returned in decimal format.

For example:

If “40” is returned, bits 5 and 3 are enabled.

***STB**

Returns the status byte in decimal form from the Serial Poll Status Byte.

For example:

If “72” is returned, bits 6 and 3 are enabled (001001000).

***WAI**

Prevents further remote commands from being executed until all previous commands are executed.

For example:

OUT 10 MA; *WAI; OUT 5 V will out put 10 mA and wait until output settles.

Than volts command will be processed.

7.9.2 Calibrator Commands

CJC_STATE

Turns Cold Junction Compensation (CJC) on or off, when the calibrator is in thermocouple (TC) mode.

The command is used by adding “ON”, “OFF” or “EXT” after it.

For example:

CJC_STATE OFF turns CJC off.

CJC_STATE?

Returns the state of the Cold Junction Compensation in thermocouple mode. The calibrator returns “OFF” if CJC is off, and “ON” if CJC is on.

CPRT_COEFA

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the first coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFA 3.908E-03 enters 3.908×10^{-3} as coefficient A.

CPRT_COEFA?

Returns the number, which was entered for the first coefficient of the polynomial used in the custom RTD.

Using the example above CPRT_COEFA? would return:

“3.908000E-03”

CPRT_COEFB

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the second coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFB -5.8019E-07 enters -5.8019×10^{-7} as coefficient B.

CPRT_COEFB?

Returns the number, which was entered for the first coefficient of the polynomial used in the custom RTD.

Using the example above, CPRT_COEFB? would return:

“-5.801900E-07”

CPRT_COEFC

This command is used for entering a custom RTD into the calibrator.

The numeric value entered after the command will be set as the third coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFC -5.8019E-12 enters -5.8019e^{-12} as coefficient C.

CPRT_COEFC?

Returns the number, which was entered for the third coefficient of the polynomial used in the custom RTD.

Using the example above CPRT_COEFC? would return:

"-5.801900E-12"

CPRT_MIN_T

Sets the minimum temperature of the custom RTD range. The temperature value must be entered with a degrees label, CEL for Celsius and FAR for Fahrenheit.

For example:

CPRT_MIN_T –260 CEL enters –260 °C as the minimum temperature.

CPRT_MIN_T?

Returns the value entered for minimum temperature in the range for a custom RTD.

The Calibrator always returns numbers in scientific notation.

The above example would return:

"-2.600000E+02, CEL"

CPRT_MAX_T

Sets the maximum temperature of the custom RTD range. The temperature value must be entered with a degrees label, CEL for Celsius and FAR for Fahrenheit.

For example:

CPRT_MAX_T 0.0 CEL enters 0.0°C as the maximum temperature.

CPRT_MAX_T?

Returns the value entered for maximum temperature in the range for a custom RTD.

The above example would return:

"0.000000E+00, CEL"

CPRT_R0

Sets the 0 °C resistance (R_0) in the custom RTD.

The value must be entered with a units label. Refer to Table 7.

For example:

CPRT_R0 100 OHM sets R0 to 100 Ω (ohms).

CPRT_R0?

Returns the value for the 0 °C resistance in custom RTD.

The above example would return:

"1.000000E+02, OHM"

FAULT?

Returns the error code number of an error that has occurred. The command may be entered when the previous command did not do what it was meant to do.

For example:

A value for current output is entered that is bigger than the supported range (0-24 mA).

FAULT? would return:

"103" which is the code number for an entry over range.

Refer to Table 8 for more information on error code numbers.

FREQ_LEVEL

Sets the amplitude of the wave used in the Frequency Out and Pulse modes. You'll find the valid range in chapter 9: "Specifications".

For example:

FREQ_LEVEL 5 V sets the amplitude at 5 Vpp.

FREQ_LEVEL?

Returns the amplitude of the wave used in Frequency Out and Pulse modes.

FREQ_LEVEL? with the above example would return:

"5.000000E+00, V"

FREQ_TYPE

When in frequency mode, sets the calibrator to output a continuous wave (Frequency Out), or a pulse train. To set the calibrator to continuous wave enter CONT after the command.

To set the calibrator to pulse enter PULSE after the command.

For example:

FREQ_TYPE CONT will set the calibrator to Frequency Output (FREQ OUT).

Note:

This command does not put the calibrator in frequency mode. Use the OUT command to put the calibrator in frequency mode.

FREQ_TYPE?

Tells whether calibrator is sourcing a pulse or a continuous wave. The command will return CONT if the calibrator is in FREQ OUT mode, and PULSE if the calibrator is in PULSE mode.

FREQ_UNIT

Sets the unit for frequency. There are three ranges of frequencies for frequency and pulse modes:

- CPM (cycles per minute)
- Hz
- kHz.

Use this command to select the right range.

For example:

FREQ_UNIT HZ sets the frequency to Hz range

FREQ_UNIT?

Returns the frequency unit currently being used by the frequency and pulse modes.

FUNC?

Returns the current mode of the upper and lower displays.

For example:

The calibrator is set to volts on the upper display, and pressure on the lower display

FUNC? would return:

DCV, PRESSURE

GET_CLOCK

Returns the current calibrator time and date as "yyyy/mm/dd hh:mm:ss",

For example:

“2006/03/25 19:02:56”

GET_SN

Returns the calibrator serial number (up to 10 digits).

For example:

"12345678"

LOCAL

Restores the calibrator to local operation, if it was in remote mode. Also clears LOCKOUT, if the unit was in lockout mode.

LOWER_MEAS

Sets the lower display to measure mode. Except for pulse and mA sim, which are source only, the command is followed by any of the following parameters:

- DCI for mA
- DCV for volts
- TC for thermocouple
- RTD for RTD
- FREQUENCY for frequency
- PRESSURE for pressure.

For example:

LOWER_MEAS DCV sets the lower display mode to VOLTS IN (measuring voltage).

L_PRES_UNIT

Sets the unit for measuring pressure on the lower display. Add the unit after the command.

The available pressure units and their syntax are shown in Table 7.

For example:

L_PRES_UNIT KPAL sets the pressure unit to kPa (kilopascals).

OUT

Sets the output of the calibrator. This command may be used to output mA, volts, frequency, temperature and ohms. Frequency output, which is set by the command FREQ_TYPE, is either continuous or pulse. The calibrator is automatically set to source mode when OUT is entered. A number and its unit must follow the command. See Table 7 for a list of available units.

For example:

OUT 10 MA sets the calibrator to mA OUT mode and sets the output to 10 mA.

OUT?

Returns the output of the calibrator.

Using the above example, OUT? would return:

"1.000000E-02, A"

PRES?

Returns the model and serial number of the attached pressure unit. Returns "NONE" if no pressure unit is attached.

For example:

PRES? Will return "BURSTER,001PNS,3,0"

PRES_UNIT?

Returns the pressure units of both the upper and the lower display.

For example:

The unit on the upper display is "bars", and on the lower it is "psi", the command will return:

"BAR, PSI"

PULSE_CNT

Sets the number of pulses the calibrator will produce when it is triggered while in pulse mode.

For example:

"PULSE_CNT 3000" will set the number of pulses to "3000".

PULSE_CNT?

Returns the number of pulses in the pulse train.

Using the above example, the returned value would be:

"3000"

REMOTE

Puts the calibrator in remote mode.

From the remote mode the user can still use the keypad to get back to local unless the command LOCKOUT was entered before REMOTE.

If the keypad is totally locked out, the user has to send the LOCAL command to get back to local operation.

RTD_INPUT

Sets the RTD input mode to JACKS or LEMO.

For example:

"RTD_INPUT LEMO" will set the RTD input mode to LEMO.

RTD_INPUT?

Returns the mode of the RTD input.

Using the above example, the returned mode would be:

"LEMO"

RTD_TYPE

Sets the RTD type.

The following is a list of RTD types the way they should be entered after the command:

- PT385_10
- PT385_50
- PT385_100
- PT385_200
- PT385_500
- PT385_1000
- PT392_100
- PTJIS_100
- Ni120
- Cu10
- Cu50
- Cu100
- YSI_400
- OHMS
- CUSTOM

For example:

"RTD_TYPE PT385_10" sets RTD type to "Pt385-10"

RTD_TYPE?

Returns the RTD type.

RTD_WIRE

Only JACKS selection. Sets the number of wires used for connection in measuring RTDs. The calibrator measures RTDs using 2-, 3-, and 4-wire connections.

To use a 2-wire connection:

➢ After the command, enter “2W”.

To use a 3-wire connection:

➢ After the command, enter “3W”

To use a 4-wire connection:

➢ After the command, enter “4W”

For example:

“RTD_WIRE 4W” sets the connection to 4-wire

RTD_WIRE?

Only JACKS selection. Returns the number of wires used in the RTD connection.

SET_CLOCK yyyy mm dd hh nn ss

Sets the calibrator date and time.

Note:

All two digit values must have a leading zero if they have a value less than “10”.

- “yyyy” is the year (2006 to 2100)
- “mm” is the month (01 to 12)
- “dd” is the day (01 to the number of days in the specified month)
- “hh” is the hour in 24 hour format (00 to 23)
- “nn” is the minute (00 to 59)
- “ss” is the second (00 to 59).

Returns <Complete> if successful, otherwise an error message enclosed in angle brackets is displayed.

For example:

“SET_CLOCK 2006 03 20 09 16 33”

SIM

Sets the output for current simulation.

This command also switches the calibrator into mA simulation mode.

➢ After the command, enter a number and a unit.

For example:

“SIM 5 MA” sets the current simulation at 5 mA

SIM?

Returns the output of the current simulation.

With the example above, the output would be:

"5.000000E-03, A"

TAG_CLEAR "tag"

This command erases the specified tag from the calibrator.

Note:

Once the data is erased, it cannot be recovered.

Returns <Complete> if successful, otherwise a self explanatory error message enclosed in angle brackets.

For example:

"TAG_CLEAR FT-8567"

TAG_CLEAR_ALL

This command erases all tags from the calibrator.

Note:

Once the data is erased, it cannot be recovered.

Returns <Complete> if successful, otherwise a self explanatory error message enclosed in angle brackets.

TAG_DNLD 0

The following command is used to determine the total number of unused tag locations available in the calibrator and the first location available for download.

Response:

Two integers separated by space:

1) Number of unused tag locations, an integer with the range "0" to "50"
2) First location available for download.
   "-1" if none available, else with the range "1" to "50"

Example of a response, if 48 tag locations are unused and the 3rd tag is available for download:

„48 3"

TAG_DNLD “field“ “tag“ “value“

This is the general format of the tag configuration download command.

The TAG_DNLD command is also used to download a tag test configuration to the calibrator. A complete configuration consists of 46 data fields, which are transmitted to the calibrator in a predefined sequence, one at a time, one per command.

The command name is followed by three parameters separated from each other by a single space. The first parameter is an integer identifying the data field contained in the command. The second parameter is the tag position in the calibrator that is being configured. The third parameter is the value for the data field.

For transmission obey to following rules:

- The commands must be sent in increasing numerical order, starting with TAG_DNLD 1 and ending with TAG_DNLD 46.
- All 46 fields for a single tag position must be sent together, in proper sequence, or all of the data is ignored and an error code is returned.
- The specified tag position must be unused or all of the data is ignored and an error code is returned.
- The command for each data field returns a success or error response enclosed in angle brackets.
- The response to one command must be received before the command for the next data field is sent.

Error responses are numeric codes, with each code value having the same meaning for all data fields.

Note:

An error on any command in the sequence causes all data downloaded to the tag location to be ignored, including that in previous and subsequent commands.

To correct an error, all commands for that tag position must be retransmitted starting with the first data field. The commands for any data fields not used by the specified instrument input and output configurations must be transmitted, but the data values may be left blank.

Parameters:

field:

Data field number, an integer with the range “1” to “46”

tag:

tag position in the calibrator, an integer with the range “1” to “50”, it must be unused

value:

data field value

Response:

<Complete> if successful, otherwise an error code enclosed in angle brackets <Error Code>.

The error codes and their meanings are as follows:

Error Code	Description
1	Invalid data field number, less than “1” or greater than “46”
2	The data field number is out of sequence, i.e. not one greater than the data field number in the previous command
3	Invalid tag position, less than “1” or greater than “50”
4	Tag position is in use
5	The tag position is not valid, i.e. it does not match the tag position in the previous command(s)
6	Data field value has too many characters, or contains characters not in the set allowed by the calibrator. Allowed are the characters in upper case “A” to “Z”, in lower case “a” to “z” (allowed but converted to upper case in the calibrator), digits “0” to “9”, space, and special characters (-+#%_.:,).
7	Tag identity value in data field 1 is already used in the calibrator, or is blank
8	Data field value is not a valid integer of length 20 characters or less. If not blank, it can only contain the digits 0 to 9
9	Number of test points in data field 25 is out of range, i.e. it must be “1” to “21”.
10	Data field value is not a valid floating point number with of length 20 characters or less. If not blank, it must be of the form “-d.d” where each “d" is a digit of the range 0 to 9, only one minus sign (may be omitted but if used it must come first), only one decimal point (may be omitted).
11	Numeric field value is out of range for the data field
12	String field value is not a valid value for the data field
13	Instrument input configuration specified in data fields 9 through 12, or instrument output configuration specified in data fields 16 through 19, is not valid. See field definitions below for valid configurations
14	The calibrator does not support the combination of instrument input and an output configuration, i.e. Pressure cannot be used simultaneously for input and output. Thermocouple, RTD, or frequency instrument output can not be used simultaneously with any type of instrument input Exception: Pressure or manual
17	Difference between instrument input range low and high, in data field 21 and 22 respectively, must be at least 0.0001.

The data fields are as follows.

Note:

Data fields between 2 and 8 are optional, that means they may stay blank. If you fill those fields, you can use a maximum of 16 characters. Only the characters, shown at error code 6, are allowed.

1) Tag identity

   Up to 16 characters.

   This identity must be unique within the calibrator.

   The characters must be from the set allowed by the calibrator as described at error code 6

2) Instrument manufacturer

   Only the characters, shown at error code 6, are allowed.

3) Instrument serial number

   Only the characters, shown at error code 6, are allowed.

4) Technician name

   Only the characters, shown at error code 6, are allowed.

5) Temperature

   Only the characters, shown at error code 6, are allowed.

6) Humidity

   Only the characters, shown at error code 6, are allowed.

7) Other data

   Only the characters, shown at error code 6, are allowed.

8) Instrument model number

   Only the characters, shown at error code 6, are allowed.

9) Instrument input type selection from the following list:
   - Milliamp
   - Milliamp 2W SIM
   - Volts
   - Thermocouple
   - RTD
   - Frequency
   - Pulse
   - Pressure
   - Manual

Note:

When the calibrator input type (instrument output type) is a 7160 in dynamic mode, the calibrator output is not used, but a valid output type and unit must still be specified; volts is recommended.

10) Instrument input units

Selection from the following list, based on the instrument input type selected in data field 9:

Input	Input unit
Milliamp	mA
Milliamp 2W SIM (mA, 2-wire-connection, simulation)	mA
Volts	V
Thermocouple	mV, DegC (°C), DegF (°F) (In conjunction with data field 11) Unit mV is only valid for curve mV, and is not valid for other curves
RTD	Ohms, DegC (°C), DegF (°F) (In conjunction with data field 11) Unit Ohms is only valid for curve Ohms, and is not valid for other curves
Frequency	CPM, Hz, kHz
Pulse	CPM, Hz, kHz
Pressure	psi, inH2O 4C, inH2O 20C, cmH2O 4C, cmH2O 20C, bar, mbar, kPa, inHg 0C, mmHg 0C, kg/cm2
Manual	User defined unit, blank or up to 5 characters from the set allowed by the calibrator as described under error code 6

Note:

When the calibrator input type (instrument output type) is a 7160 in dynamic mode, the calibrator output is not used, but a valid output type and unit must still be specified; “volts” is recommended.

11) Instrument input curve

Selection from the following list, based on the instrument input type selected in data field 9:

Input	Input curve
Thermocouple	B, C, E, J, K, L, N, R, S, T, U, BP, XK, mV (In conjunction with data field 10) Curve mV is valid only for unit mV, it is not valid for other units
RTD	P10-385, P50-385, P100-385, P200-385, P500-385, P1K-385, P100-392, P100-JIS, Ni 100, Ni 120, Cu 10, Cu 50, Cu 100, YSI-400, Ohms (In conjunction with data field 10) Curve Ohms is valid only for unit Ohms, it is not valid for other units

Blank for other instrument input types

12) Instrument input auxiliary data selection from the following list, based on the instrument input type selected in data field 9:

Input	Auxiliary data
Thermocouple	Cold junction selection from the following list: CJC ON, CJC OFF, CJC EXT (external)

Blank for other instrument input types

13) Instrument input frequency and input pulse amplitude voltage

A floating point number, range per the calibrator specifications.

Blank for other instrument input types

14) Instrument input pulse fixed parameter type

Selection from the following list:

- Counts
- Freq

Blank for other instrument input types

15) Instrument input pulse fixed parameter value

Based on the fixed parameter type selection in data field 14:

Parameter Type	Value
Counts	Number of counts in a complete pulse train, integer number, range per the calibrator specifications.
Freq	Frequency at which to generate the pulse train, expressed in the instrument input frequency unit specified in data field 10, floating point number, range per the calibrator specifications.

Blank for other instrument input types

16) Instrument output type

Selection from the following list:

- Milliamp
- Milliamp Loop
- Volts
- Thermocouple
- RTD
- Frequency
- Pressure
- Manual
- 7160 FORCE
- 7160 TORQUE
- 7160 PRESSURE
- 7160 DISPLACEMENT

17) Instrument output units

Selection from the following list, based on the instrument output type selected in data field 16:

Output	Output unit
Milliamp	mA
Milliamp Loop	mA
Volts	V
Thermocouple	mV, DegC (°C), DegF (°F) (In conjunction with data field 18) Units mV is valid only for curve mV, it is not valid for other curves
RTD	Ohms, DegC, DegF (In conjunction with data field 18) Units Ohms is valid only for curve Ohms, it is not valid for other curves
Frequency	CPM, Hz, kHz
Pressure	psi, inH2O 4C, inH2O 20C, cmH2O 4C, cmH2O 20C, bar, mbar, kPa, inHg 0C, mmHg 0C, kg/cm2
Manual	User defined units, blank or up to 5 characters from the set allowed by the calibrator as described at error code 6.
7160 FORCE	cN, N, kN, MN, lbs, klbs, SPECL
7160 TORQUE	Ncm, Nm, kNm, lbin, lbft, SPECL
7160 PRESSURE	Pa, kPa, MPa, mbar, bar, psi, inH2O 4C, inH2O 20C, cmH2O 4C, cmH2O 20C, mmHg, inHg, mWS, kg/cm2, SPECL
7160 DISPLACEMENT	mm, cm, m, in, ft, SPECL

The keyword SPECL used with 7160 selects the predefined special unit in the module witch is attached at the time of the test.

18) Instrument output curve

Selection from the following list, based on the instrument output type selected in data field 16:

Output	Output curve
Thermocouple	B, C, E, J, K, L, N, R, S, T, U, BP, XK, mV (In conjunction with data field 17) Curve mV is valid only for unit mV, it is not valid for other units
RTD	P10-385, P50-385, P100-385, P200-385, P500-385, P1K-385, P100-392, P100-JIS, Ni 100, Ni 120, Cu 10, Cu 50, Cu 100, YSI-400, Ohms (In conjunction with data field 17) Curve Ohms is valid only for unit Ohms, it is not valid for other units

Blank for other instrument output types

19) Instrument output auxiliary data

Selection from the following list, based on the instrument output type selected in data field 16:

Output	Auxiliary Data
Thermocouple	Cold Junction Compensation. Selection from the following list: • CJC ON • CJC OFF • CJC EXT
RTD	Connection type: Selection from the following list: • 2W • 3W • 4W • LEMO
7160 FORCE	Mode, average, and scan rate selection as described below.
7160 TORQUE	Mode, average, and scan rate selection as described below.
7160 PRESSURE	Mode, average, and scan rate selection as described below.
7160 DISPLACEMENT	Mode, average, and scan rate selection as described below.

Blank for other instrument output types.

7160 mode, average and scan rate selection are specified as follows:

Select at mode:

- o STAT
- o DMAX
- o DMIN
- o DP-P
- o DRDG

Select at average:

- o X/1
- o X/2
- o X/4
- o X/8
- o X/16
- o X/32

Select at scan rate:

- o 3/s
- o 10/s
- o 50/s
- o 100/s
- o 500/s
- o 1000/s

20) Test tolerance expressed as percent of span of the instrument input and output ranges.

Blank if no test is to be performed.

Else a floating point number, range “0.0” to “100.0”

Note:

When calibrator input (instrument output) is a 7160 in a dynamic mode, this must be blank.

21) Instrument input range low value

Blank if no tolerance test is to be performed.

A floating point number corresponding to the instrument output range low, expressed in the instrument input units specified in data field 10 if a tolerance test is to be performed.

No range validation

22) Instrument input range high value

Blank if no tolerance test is to be performed.

A floating point number corresponding to the instrument output range high, expressed in the instrument input units specified in data field 10 if a tolerance test is to be performed.

No range validation.

23) Instrument output range low value

Blank if no tolerance test is to be performed.

A floating point number corresponding to the instrument input range low, expressed in the instrument output units specified in data field 17 if a tolerance test is to be performed.

No range validation.

24) Instrument output range high value

Blank if no tolerance test is to be performed.

A floating point number corresponding to the instrument input range high, expressed in the instrument output units specified in data field 17 if a tolerance test is to be performed.

No range validation.

25) Number of test points used

Integer number, range “1” to “21”.

Note:

When calibrator input (instrument output) is a 7160 in a dynamic mode, this must be “1”.

26) to 46)

Instrument input test values “1” to “21”.

Blank if not used (per number of test points field 25)

Note:

When calibrator input (instrument output) is a 7160 in a dynamic mode, the first value should be “0.0” with remainder blank.

If used, a floating point number expressed in the instrument input units specified in data field 10.

Range per the calibrator specifications.

TAG_UPLD „field“ „tag“

This is the general format of the tag configuration upload command.

The TAG_UPLD command is used to upload tag calibration results from the calibrator to the PC.

A complete set of results consists of 128 data fields, which are requested from the calibrator one at a time, one per command.

The command name is followed by two parameters separated from each other by a single space. The first parameter is an integer identifying the data field requested and the second parameter is the tag position in the calibrator.

Except for the command TAG_UPLD 68 which requests the status of a tag position, the specified tag position must be in use or an error code is returned.

The command for each data field returns a one-line response. The response may be blank, i.e. no characters except a carriage return.

The response to one command must be received before the command for the next data field is sent.

Error responses are numeric codes, with each code value having the same meaning for all data fields.

The commands may be sent in any order, and any commands not required may be skipped (i.e. the commands for unused test points, etc).

Parameters:

field	Data field number, an integer with the range “1” to “128”
tag	Tag position in the calibrator, an integer with the range “1” to “50”; except for data field number 68, it must be in use

Response:

Data field value if successful, otherwise an error code in angle brackets, where “code is a number from the table below.

Note:

Unlike an error code, a data field cannot begin with a left angle bracket.

The error codes and their meanings are as follows:

3	Invalid tag position, less than “1” or greater than “50”
15	Invalid data field number, less than “1” or greater than “128”
16	Tag position is not in use

The data fields are as follows.

1) Tag identity

   It consists at minimum of one and at maximum of 16 characters.

   This identity must be unique within the calibrator; it is used only for one tag at a time.

2) Instrument manufacturer

   Blank or up to 16 characters

3) Instrument serial number

   Blank or up to 16 characters

4) Technician name

   Blank or up to 16 characters

5) Temperature

   Blank or up to 16 characters

6) Humidity

   Blank or up to 16 characters

7) Other data

   Blank or up to 16 characters

8) Instrument model number

   Blank or up to 16 characters

9) Calibrator output (instrument input) type

   Selection from the following list:

   - Milliamp
   - Milliamp 2W SIM
   - Volts
   - Thermocouple
   - RTD
   - Frequency
   - Pulse
   - Pressure
   - Manual
   - NONE when the calibrator input type (instrument output type) is a 7160 in a dynamic mode.

10) Calibrator output (instrument input) unit

Selection from the following list, based on the calibrator output (instrument input) type returned in data field 9:

Input	Unit
Milliamp	mA
Milliamp 2W SIM (mA, 2-wire-connection, simulation)	mA
Volts	V
Thermocouple	mV, DegC (C°), DegF (°F)
RTD	Ohms, DegC (C°), DegF (°F)
Frequency	CPM, Hz, kHz
Pulse	CPM, Hz, kHz
Pressure	psi, inH2O 4C, inH2O 20C, cmH2O 4C, cmH2O 20C, bar, mbar, kPa, inHg 0C, mmHg 0C, kg/cm2
Manual	User defined units, blank or 1 to 5 characters
NONE	when the calibrator input type (instrument output type) is a 7160 in a dynamic mode.

11) Instrument input curve

Selection from the following list, based on the instrument input type returned in data field 9:

Input	Input curve
Thermocouple	B, C, E, J, K, L, N, R, S, T, U, BP, XK, mV
RTD	P10-385, P50-385, P100-385, P200-385, P500-385, P1K-385, P100-392, P100-JIS, Ni 100, Ni 120, Cu 10, Cu 50, Cu 100, YSI-400, Ohms
Other types	NONE

NONE when the calibrator input type (instrument output type) is a 7160 in a dynamic mode.

12) Instrument input auxiliary data

Selection from the following list, based on the instrument input type returned in data field 9:

Input	Auxiliary data
Thermocouple	Cold junction: • CJC ON • CJC OFF • CJC EXT
Other types	NONE

NONE when the calibrator input type (instrument output type) is a 7160 in a dynamic mode.

13) Instrument input frequency and input pulse amplitude voltage

The instrument input frequency and the input pulse amplitude voltage are floating point numbers.

"0.0" for all other instrument input types.

14) Instrument input pulse fixed parameter type

Selection from the following list:

- o Counts
- o Freq
- o Other types: NONE

15) Instrument input pulse fixed parameter value

This value is based on the fixed parameter type returned in data field 14:

Parameter type	Value
Counts	Number of counts in a complete pulse train, integer number
Freq	Frequency at which the pulse train was generated, expressed in the instrument input frequency units returned in data field 10, floating point number
Other types	0

16) Instrument output type

Selection from the following list:

- Milliamp
- Milliamp Loop
- Volts
- Thermocouple
- RTD
- Frequency
- Pressure
- Manual
- 7160 FORCE
- 7160 TORQUE
- 7160 PRESSURE
- 7160 DISPLACEMENT

17) Instrument output units

Selection from the following list, based on the instrument output type returned in data field 16:

Output	Output unit
Milliamp	mA
Milliamp Loop	mA
Volts	V
Thermocouple	mV, DegC (C°), DegF (°F)
RTD	Ohms, DegC (C°), DegF (°F)
Frequency	CPM, Hz, kHz
Pressure	psi, inH2O 4C, inH2O 20C, cmH2O 4C, cmH2O 20C, bar, mbar, kPa, inHg 0C, mmHg 0C, kg/cm2
Manual	User defined units, blank or up to 5 characters
7160 FORCE	cN, N, kN, MN, lbs, klbs, SPECL
7160 TORQUE	Ncm, Nm, kNm, lbin, lbft, SPECL
7160 PRESSURE	Pa, kPa, MPa, mbar, bar, psi, inH2O 4C, inH2O 20C, cmH2O 4C, cmH2O 20C, mmHg, inHg, mWS, kg/cm2, SPECL
7160 DISPLACEMENT	mm, cm, m, in, ft, SPECL

The keyword SPECL used with 7160 selects the predefined special unit in the module witch is attached at the time of the test.

18) Instrument output curve

Selection from the following list, based on the instrument output type returned in data field 16:

Output	Output curve
Thermocouple	B, C, E, J, K, L, N, R, S, T, U, BP, XK, mV
RTD	P10-385, P50-385, P100-385, P200-385, P500-385, P1K-385, P100-392, P100-JIS, Ni 100, Ni 120, Cu 10, Cu 50, Cu 100, YSI-400, Ohms
Other types	NONE

19) Instrument output auxiliary data

Selection from the following list, based on the instrument output type returned in data field 16:

Output	Auxiliary data
Thermocouple	Cold junction selection from the following list: • CJC ON • CJC OFF • CJC EXT
RTD	Connection type from the following list: 2W, 3W, 4W, LEMO
7160 FORCE	Mode, average, and scan rate selection as describes below.
7160 TORQUE	Mode, average, and scan rate selection as describes below.
7160 PRESSURE	Mode, average, and scan rate selection as describes below.
7160 DISPLACEMENT	Mode, average, and scan rate selection as describes below.
Other types	NONE

7160 mode, average and scan rate selection are specified as follows:

Select at mode:

- o STAT
- o DMAX
- o DMIN
- o DP-P
- o DRDG

Select at average:

- o X/1
- o X/2
- o X/4
- o X/8
- o X/16
- o X/32

Select at scan rate:

- o 3/s
- o 10/s
- o 50/s
- o 100/s
- o 500/s
- o 1000/s

20) Test tolerance

The test tolerance is expressed as percent of span of the instrument input and output ranges.

“NONE” if no test was performed.

If a test was performed, a floating point number, range 20.0” to “100.0”,.

21) Instrument input range low value

“0.0” if no tolerance test was performed.

Floating point number corresponding to the instrument output range low, expressed in the instrument input units returned in data field 10, if a test was performed.

No range validation.

22) Instrument input range high value

“0.0” if no tolerance test was performed

Floating point number corresponding to the instrument output range high, expressed in the instrument input units returned in data field 10, if a test was performed.

No range validation.

23) Instrument output range low value

“0.0” if no tolerance test was performed.

Floating point number corresponding to the instrument input range low, expressed in the instrument output units returned in data field 17, if a test was performed.

No range validation.

24) Instrument output range high value

"0.0" if no tolerance test was performed.

Floating point number corresponding to the instrument input range high, expressed in the instrument output units returned in data field 17, if a test was performed.

No range validation.

25) Number of test points used

Integer number

26) to 46)

Instrument input As Found test results "1" through "21" as follows:

NONE	If not used
UNDER	If calibrator output was under range
OVER	If calibrator output was over range
else	Floating point number expressed in the instrument input units returned in data field 10

47) to 67)

Instrument output As Found test results "1" through "21" as follows:

NONE	If not used
UNDER	If calibrator input was under range
OVER	If calibrator input was over range
else	Floating point number expressed in the instrument output units returned in data field 17

When the calibrator input type (instrument output type) is a 7160 in a dynamic mode, the first four values are used and the rest are set to NONE.

These four values are:

- the final reading at the time the data was saved
- the maximum reading over the test period
- the minimum reading over the test period
- the peak to peak reading over the test period

68) Tag position state as follows:

0	Not in use
1	Uncalibrated downloaded tag
2	Tag completed As Found calibration
3+	Tag completed As Left calibration passes equivalent to state value less 2

69) Pressure module or 7160 module serial number, up to 16 characters.

70) Pressure module type single character as follows:

G	gauge, or not pressure
A	absolute
V	vacuum
C	compound
D	differential

71) Pressure module range in psi, 1.0 if not pressure.

72) Pressure module or 7160 module calibration year (four digit format, integer number).

73) Pressure module or 7160 module calibration month (integer number).

74) Pressure module or 7160 module calibration day (integer number).

75) Instrument input range and test value decimal places (integer number).

76) Instrument output range and test result decimal places (integer number).

77) to 97)

Instrument input As Left test values “1” through “21”, last pass only, as follows:

NONE	If not used
UNDER	If calibrator output was under range
OVER	If calibrator output was over range
else	Floating point number expressed in the instrument input units returned in data field 10

98) to 118)

Instrument output As Left test results.

“1” through “21”, last pass only, as follows:

NONE	If not used
UNDER	If calibrator input was under range
OVER	If calibrator input was over range
else	Floating point number expressed in the instrument output units returned in data field 17

When the calibrator input type (instrument output type) is a 7160 in a dynamic mode, the first four values are used and the rest are set to NONE.

These four values are:

- the final reading at the time the data was saved
- the maximum reading over the test period
- the minimum reading over the test period
- the peak to peak reading over the test period

119) Year of instrument calibration, last pass.

The year is given as a four-digit format, integer number.

120)Month of instrument calibration, last pass.

The month is given as an integer number, range “1” to “12”.

121)Day of instrument calibration, last pass.

The Day is given as an integer number, range “12 to maximum for month.

122)Hour of instrument calibration, last pass.

The hour is given as an integer number, range “0” to “23”.

123)Minute of instrument calibration, last pass.

The minute is given as an integer number, range “0” to “59”.

124)Second of instrument calibration, last pass.

The second is given as an integer number, range “0” to “59”.

125)Year of last calibrator certification.

The year is given as a four-digit format, integer number.

126)Month of last calibrator certification.

The month is given as an integer number, range “1” to “12”.

127)Day of last calibrator certification.

The day is given as an integer number, range “1” to maximum for month.

128)Tag set up source as follows:

0	Manual in calibrator
1	Downloaded

TAGS?

This command is a stand alone command, i.e. it doesn’t need any parameters.

If there are no tags stored, the calibrator displays the message “<No tags available>”.

If tags are available, the calibrator displays a list of all stored tags, one per line. Each Line contains the following parameters:

- The Position of the tag in the calibrator, an integer with the range 1 to 50.
- The status of the tag, a single character ‘U’ means uncalibrated, ‘C’ means calibrated.
- The tag identification, a string with maximum length of 16 characters.

These parameters are separated by a single space. Each line are terminated by cararriage return character, hex 0D.

TC_TYPE

Sets the type of the thermocouple.

All available types are shown in the TC Types table in chapter 9.2: “Types of Thermocouples”.

For example:

TC_TYPE B sets thermocouple type to “B”

TC_TYPE?

Returns the type of thermocouple the calibrator is set to.

TEMP_UNIT

Sets the temperature unit for sourcing and measuring RTD and TC.

➢ Add CEL after the command for Celsius, and FAR for Fahrenheit.

For example:

TEMP_UNIT CEL sets the temperature to be measured or sourced to Celsius.

TEMP_UNIT?

Returns the temperature unit that is currently used for measuring and sourcing RTD and TC.

TRIG

Starts and stops the pulse train when the calibrator is in pulse mode.

The parameters of the pulse train are set by commands PULSE_CNT, and FREQ_LEVEL.

Entering TRIG initializes the train.

Entering the command while the pulse train is running stops it.

TRIG?

Returns “TRIGGERED” if the pulse train is running.

Otherwise it returns “UNTRIGGERED”.

Returns “NONE” when the calibrator is not in pulse mode.

TSENS_TYPE

Sets the temperature sensor type to thermocouple or to RTD for temperature measurement.

- After the command add TC for thermocouple, or RTD for RTDs.

For example:

TSENS_TYPE TC sets the sensor type to thermocouple

TSENS_TYPE?

Returns the type of sensor that is currently set to measure temperature, either TC or RTD.

UPPER_MEAS

Sets the measuring mode for the upper display.

- After the command enter DCI for mA, DCI_LOOP for mA with loop power, DCV for volts, and PRESSURE for pressure.

For example:

UPPER_MEAS DCV sets the upper display to measure volts

U_PRES_UNIT

Sets the unit for measuring pressure on the upper display.

- Add the unit after the command.

The available pressure units and their syntax are shown in Table 7.

For example:

U_PRES_UNIT MMHG sets the pressure unit to millimeters of mercury at 0°C

VAL?

Returns the value of any measurement taking place on the upper and lower display.

For example:

The upper display is measuring 5 mA, and the lower display is measuring 10 V. VAL? Will return:

“5.000000E-03, A, 1.000000E+01, V“

ZERO_MEAS

Zeroes the attached pressure module.

- Enter the zeroing value in PSI after the command when zeroing an absolute pressure module.

ZERO_MEAS?

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

8. Document Mode

8.1 Introduction

Document mode allows creating repeatable calibration tests for up to 50 tags while in the field. The predefinition of the test can be formed on calibrator or by software on PC with a following download to the calibrator.

At minimum one and at maximum 21 user selectable test points create a test. This test may be repeated as many times as necessary to complete adjustment and calibration of the tag. For each tag two sets of test results are stored. An initial set stores the “As Found” state and a final set stores the “As Left” state.

If tag's calibration is only tested, both sets of test results will be the same.

When creating a test in the field, you have to select the calibrator input and output to be used for the test before the As Found test is started. These include the standard measure and source types of the 4423, plus two special types, “manual input” and “manual output”. Manual input and output extend the versatility of the calibrator by entering data from auxiliary measurement or source equipment, or from field devices that can not be physically connected to the calibrator, such as the dial position of a panel meter.

The calibrator output points are entered one at a time for the As Found test. The point values may be entered in any order. Usually this is done as a sequence of ascending or descending values. After each output is generated, wait until the input has settled. Once settled, press a function key to prompt for manual entries if any, to save both the output and input values, and finally to step to the next point.

Once all required test points have been entered, press a different function key to end the As Found test by prompting for the tag identification data and the test validation limit. The real time clock adds automatically the date and time of the test. If test validation was selected, there is the option of displaying the As Found test results.

To perform a downloaded test, select the tag to be tested from a list of As Found tests, which is displayed by the 4423. The calibrator cycles through the test points one at a time automatically generating the As Found output value in the case of a calibrator source type. In case of manual output type it displays the As Found value.

Once the input has settled, press a function key to prompt for manual input entry, to save both the As Found output and input values. Finally you’ll step to the next point. Once the last point has been tested, the As Found test automatically ends, the real time clock time stamp is saved, and then you will be prompted for changes to the tag identification data (any field but tag number which can not be changed). If test validation was selected, you have the option of displaying the As Found test results.

After the As Found test is ended, you have the option of saving the As Found results into the As Left storage and ending the tag calibration, of entering an adjustment mode to monitor physical adjustments to the tag prior to starting an As Left test, or of directly entering the As Left test.

Note:

The adjustment causes differences between the “As Found” and the “As Left Test”.

During adjustment mode, you can step up and down the list of test points. The 4423 automatically generates the corresponding output in the case of a calibrator source type, or displays the value of a manual output type. In this way any changes to the original test points resulting from physical adjustments to the instrument may be evaluated.

Alternatively, you may enter output values different from the test points and monitor corresponding input values. When the adjustment is complete, press a function key to enter the As Left test.

During the As Left test the calibrator cycles through the test points one at a time automatically generating the As Found output value in the case of a calibrator source type, or displaying the As Found value of a manual output type. Once the input has settled, press a function key to save both the As Left output and input values. Finally you'll proceed to the next point.

Once the last point has been tested, the As Left test automatically ends. If test validation was selected, you have has the option of displaying the As Left test results. Finally, you have the option of ending the tag calibration, of entering an adjustment mode to monitor physical adjustments to the tag prior to starting a further As Left test, or of directly entering a further As Left test.

Additional As Left tests may be performed after tag calibration has ended as long as the original tag data has not been cleared from storage. A menu item is available for selecting any tag and starting another As Left test.

Review functions are available to view test results on the 4423 display.

Individual or all tag test results may be cleared from storage using menu functions.

8.1.1 Smart Sensor Interface

New Ad Hoc Tag Setup

The operating mode, averaging, sampling rate and units are set during the display ([UPPER / LOWER]) configuration step.

An error is displayed if a 7160 module is not plugged in during this step.

Immediately following this, menus are presented for zero and tare of the input. This zero and tare apply for the duration of the test sequence, including any Adjustments and As Left tests that follow the As Found test.

If a separate repeat As Left test is requested at a later time, the zero and tare menus are presented before the test to provide updated values.

Downloaded Tag Setup

The module type (force, torque, displacement, or pressure), operating mode, averaging, sampling rate, and units are downloaded with the tag configuration, and can not be changed.

When the tag is selected, an error is displayed if no 7160 module is plugged in, or if the module plugged in does not match the device type downloaded.

Otherwise, before the As Found calibration, the 4423 presents menus for zero and tare of the input. This zero and tare apply for the duration of the test sequence, including any Adjustments and As Left tests that follow the As Found test.

If a separate repeat As Left test is requested at a later time, the zero and tare menus are presented before the test to provide updated values.

As Found and As Left Testing

For both modes, the calibrator output type selected at the UPPER or LOWER display selection is most likely to be MANUAL OUT, specifying the force, torque, displacement, or pressure being applied at each test point. This does not rule out using an electrical calibrator output like V or mA, but this seems most unlikely considering physical weights or a manual force balance is usually used to apply force to the instrument under test.

Static mode tests operate the same as for other simple instrument outputs, such as VOLTS.

Dynamic mode tests have only one test point where three values are recorded: maximum, minimum, and peak to peak.

Before pressing [SAVE]:

- First press the [◀] key.

  The test point may be repeated to reset the minimum and maximum peak values to the present module reading, and the peak-to-peak value to zero.

- Now press the [SAVE] function key.

  Doing this, all three values are saved and the tag identification data is requested.

Test Results Display, Storage, and PC Upload

Static mode test results are displayed and stored the same as for other simple instrument outputs, such as VOLTS.

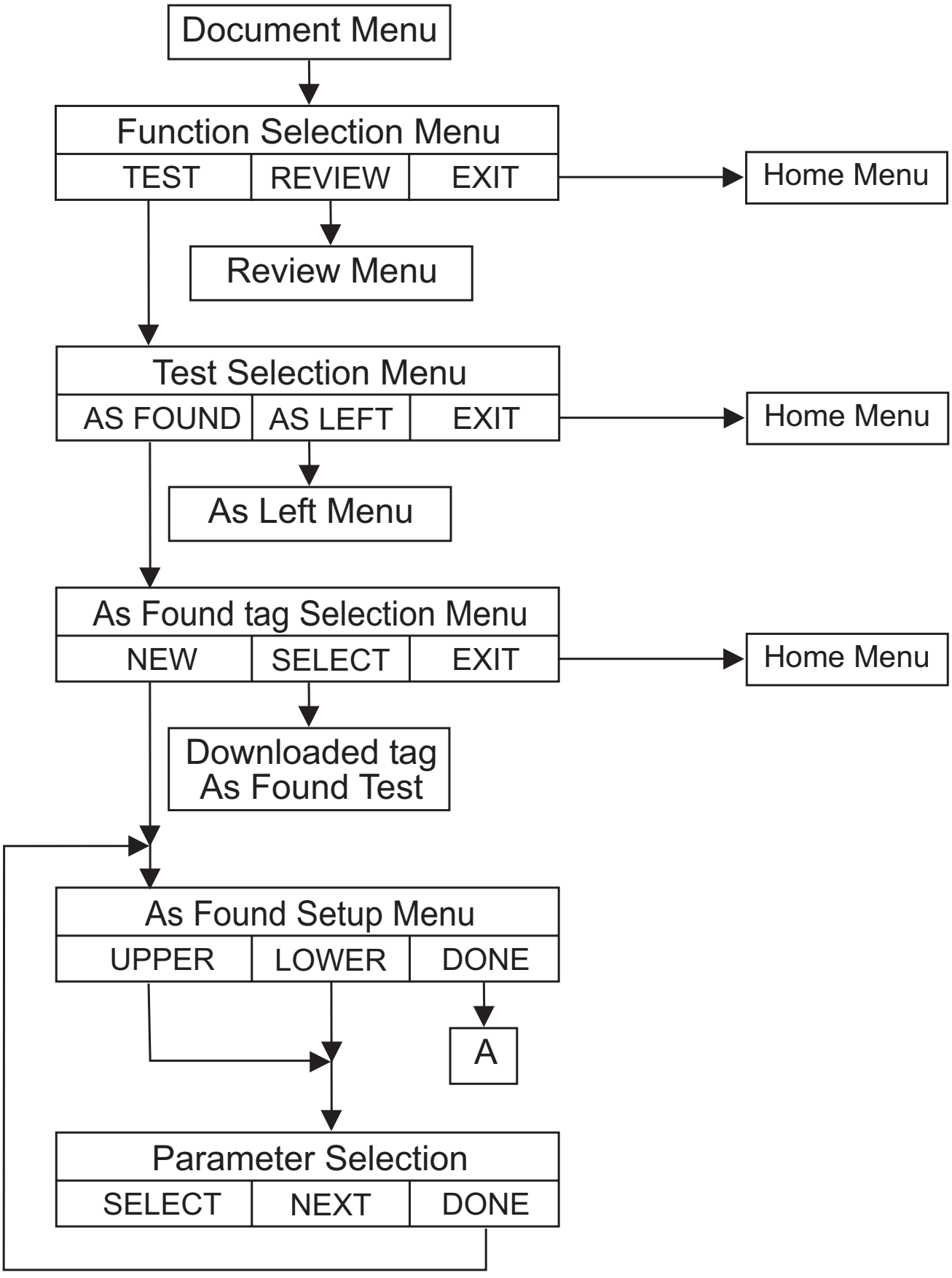
Unlike this, dynamic mode tests results are displayed, stored, and uploaded as if there were 3 standard test points.

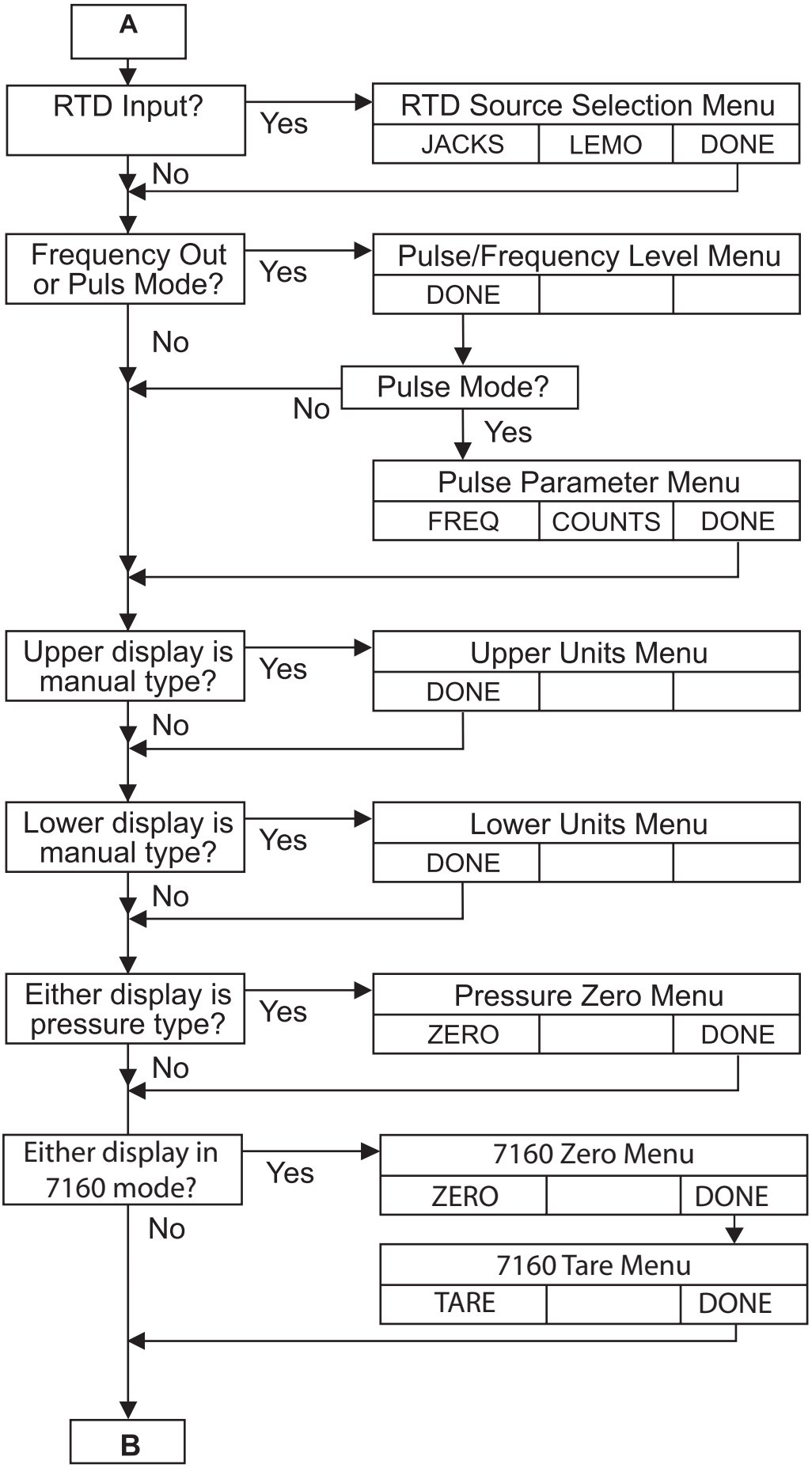
The first point is the maximum peak value, the second point is the minimum peak value, and the third point is the peak-to-peak value.

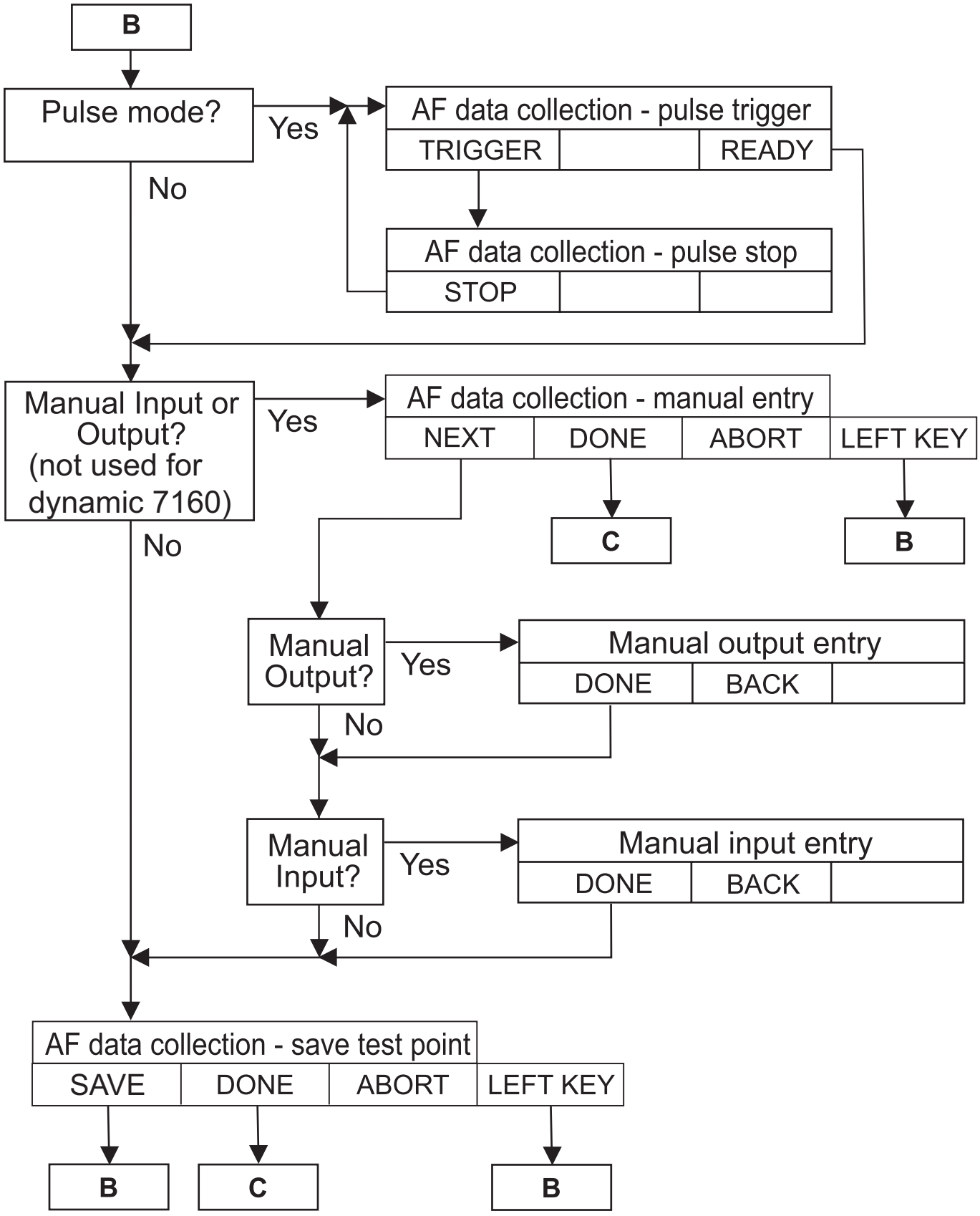
Unfortunately, flash memory constraints in the 4423 prevent implementation of special displays and upload commands for this mode. So the three points are identified numerically:

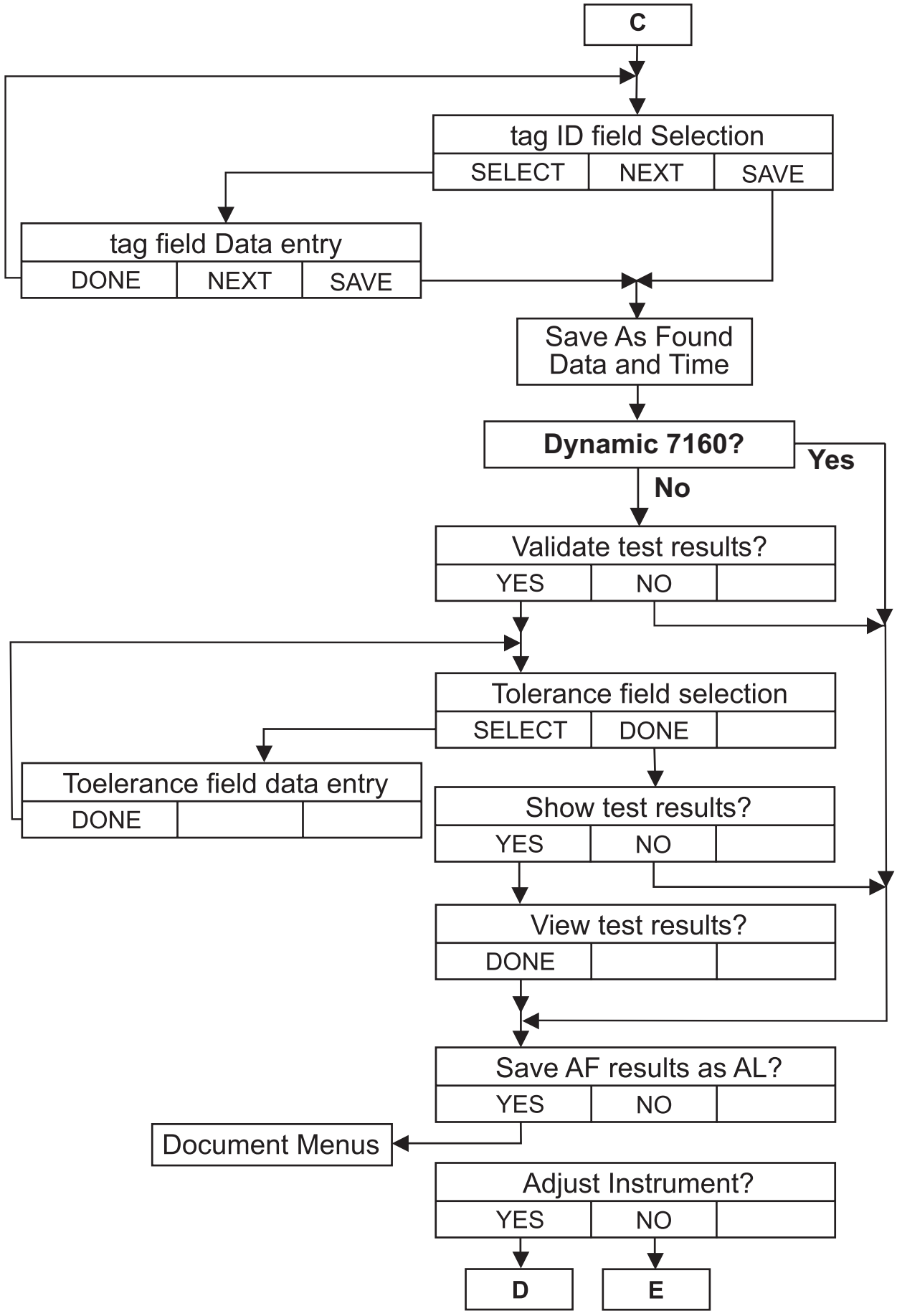
1) max
2) min
3) peak to peak

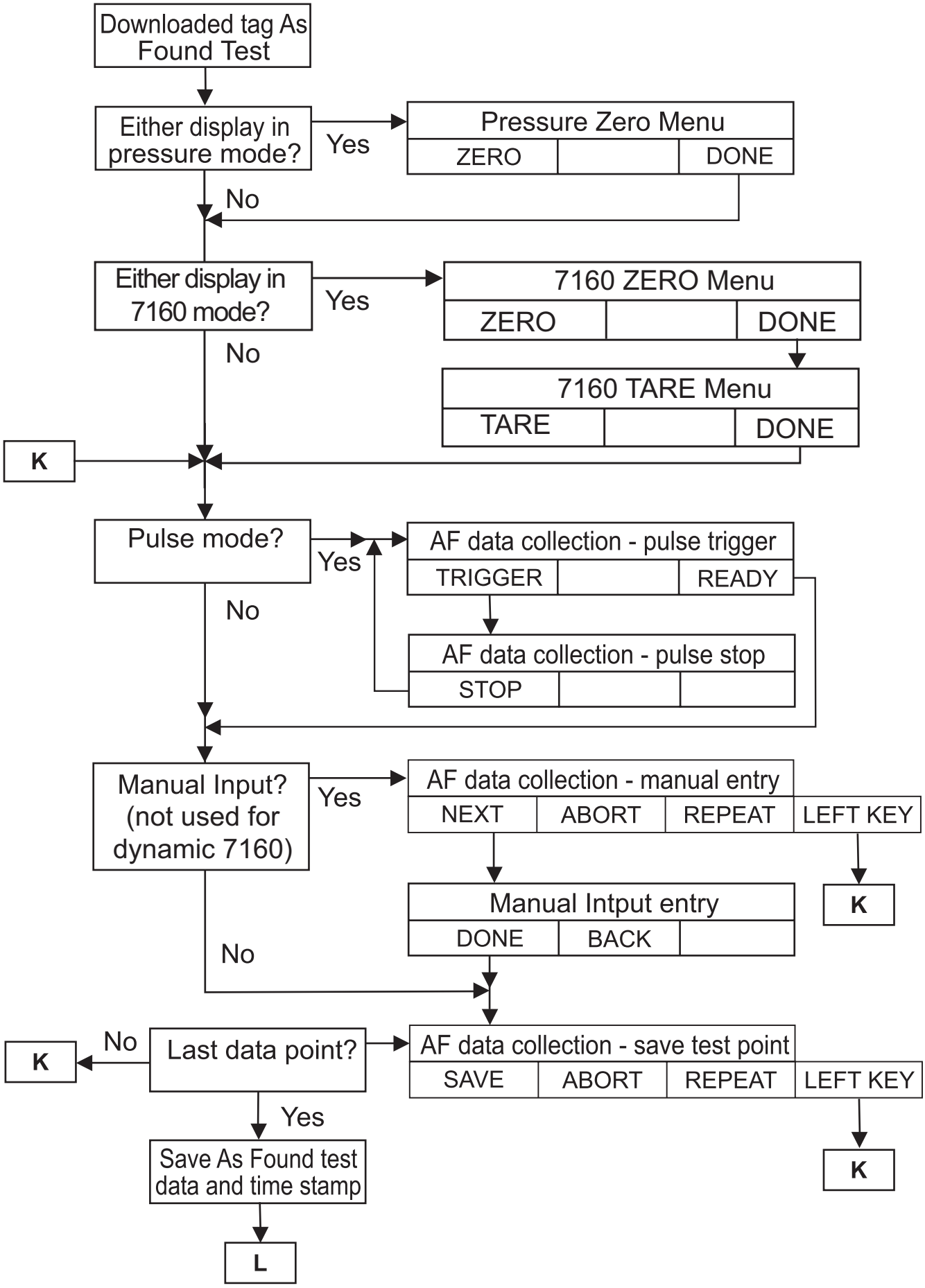
8.1.2 Document Mode Menu Tree

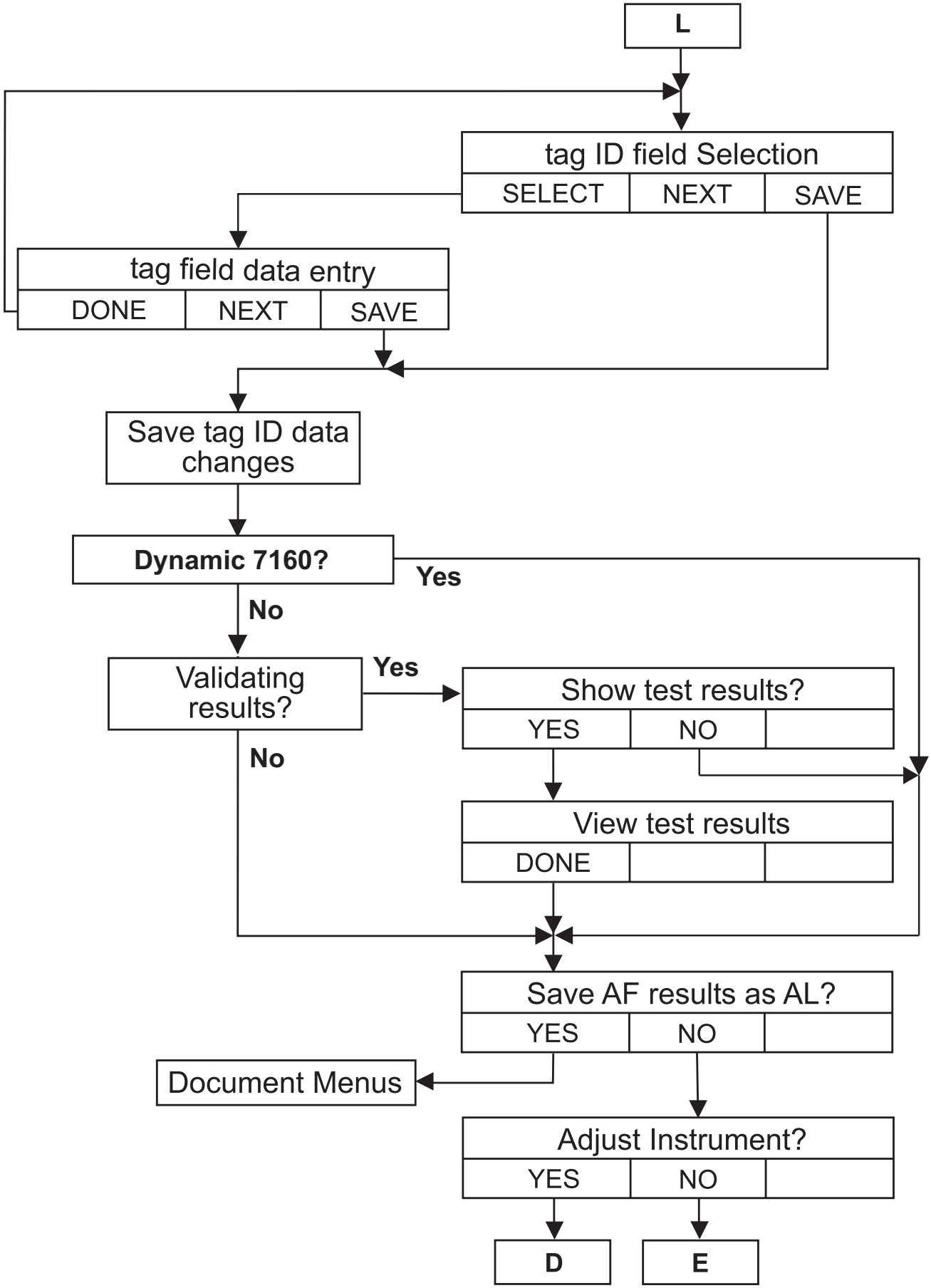


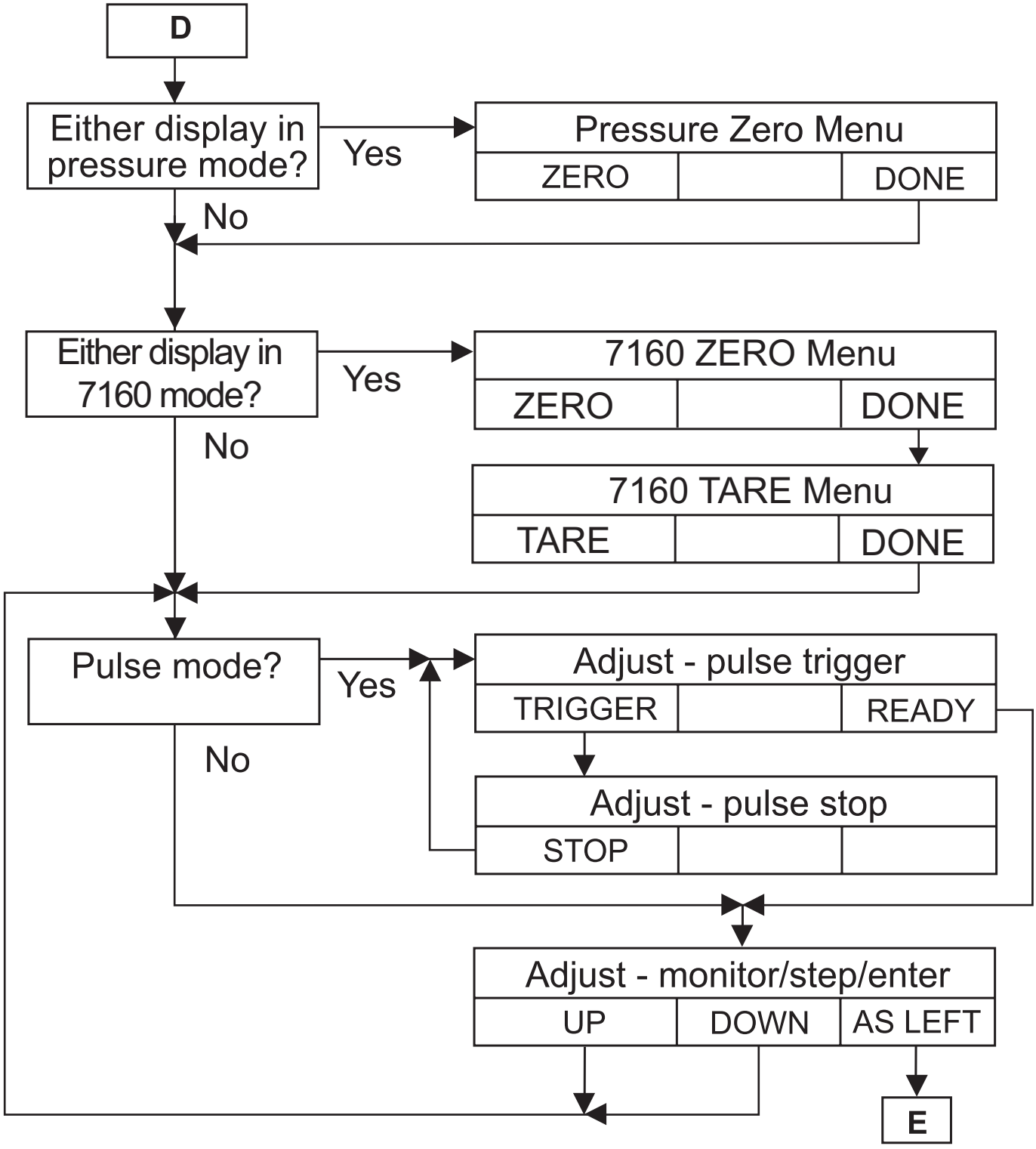

A
RTD Input?
Yes
RTD Source Selection Menu
JACKS
LEMO
DONE
No
Frequency Out or Puls Mode?
Yes
Pulse/Frequency Level Menu
DONE
No
Pulse Mode?
No
Yes
Pulse Parameter Menu
FREQ
COUNTS
DONE
Upper display is manual type?
Yes
Upper Units Menu
DONE
No
Lower display is manual type?
Yes
Lower Units Menu
DONE
No
Either display is pressure type?
Yes
Pressure Zero Menu
ZERO
DONE
No
Either display in 7160 mode?
Yes
7160 Zero Menu
ZERO
DONE
No
7160 Tare Menu
TARE
DONE
B

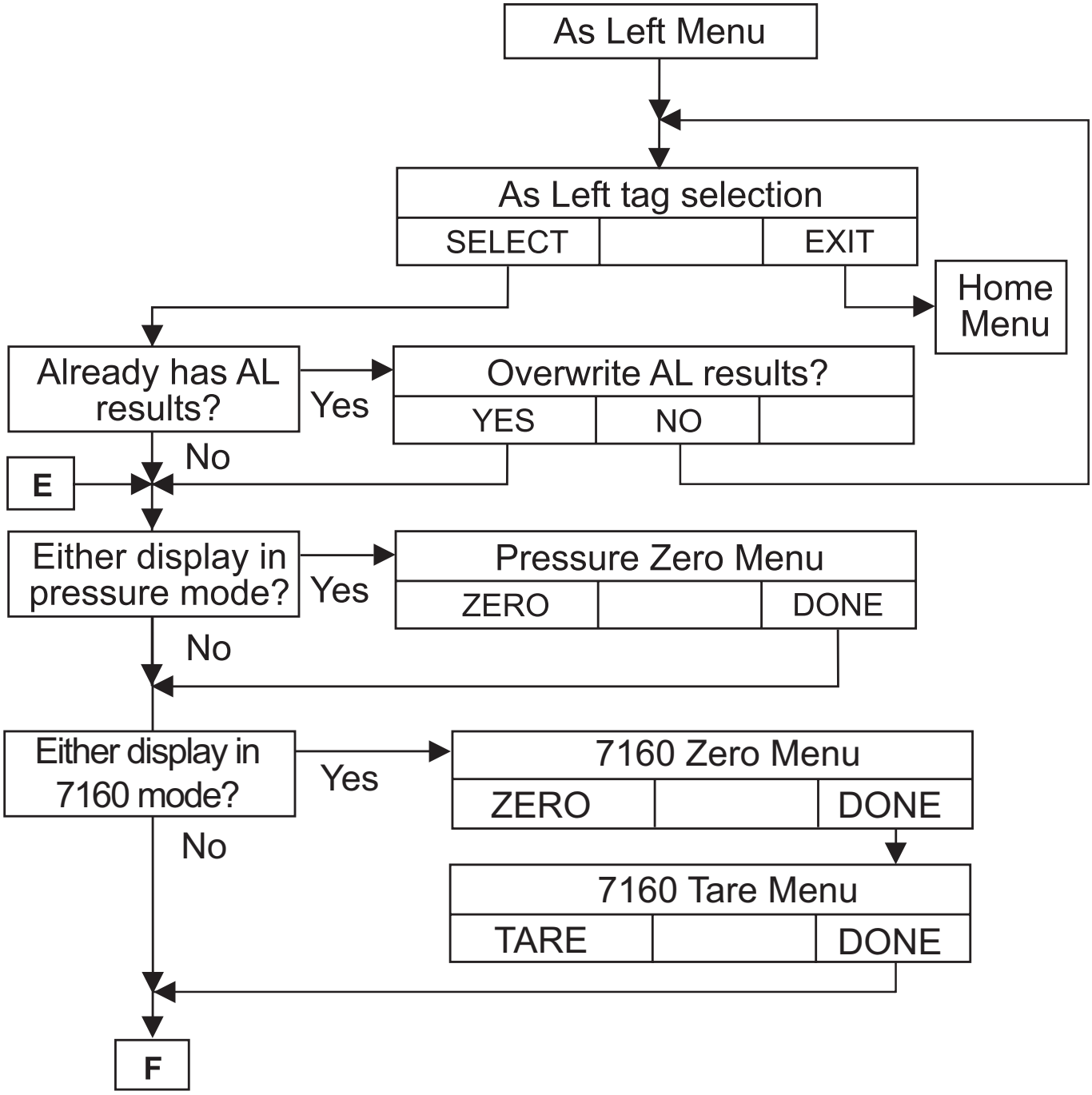

B
Pulse mode?
Yes
No
AF data collection - pulse trigger
TRIGGER
READY
AF data collection - pulse stop
STOP
Manual Input or Output? (not used for dynamic 7160)
Yes
No
AF data collection - manual entry
NEXT
DONE
ABORT
LEFT KEY
C
B
Manual Output?
Yes
No
Manual output entry
DONE
BACK
Manual Input?
Yes
No
Manual input entry
DONE
BACK
AF data collection - save test point
SAVE
DONE
ABORT
LEFT KEY
B
C
B

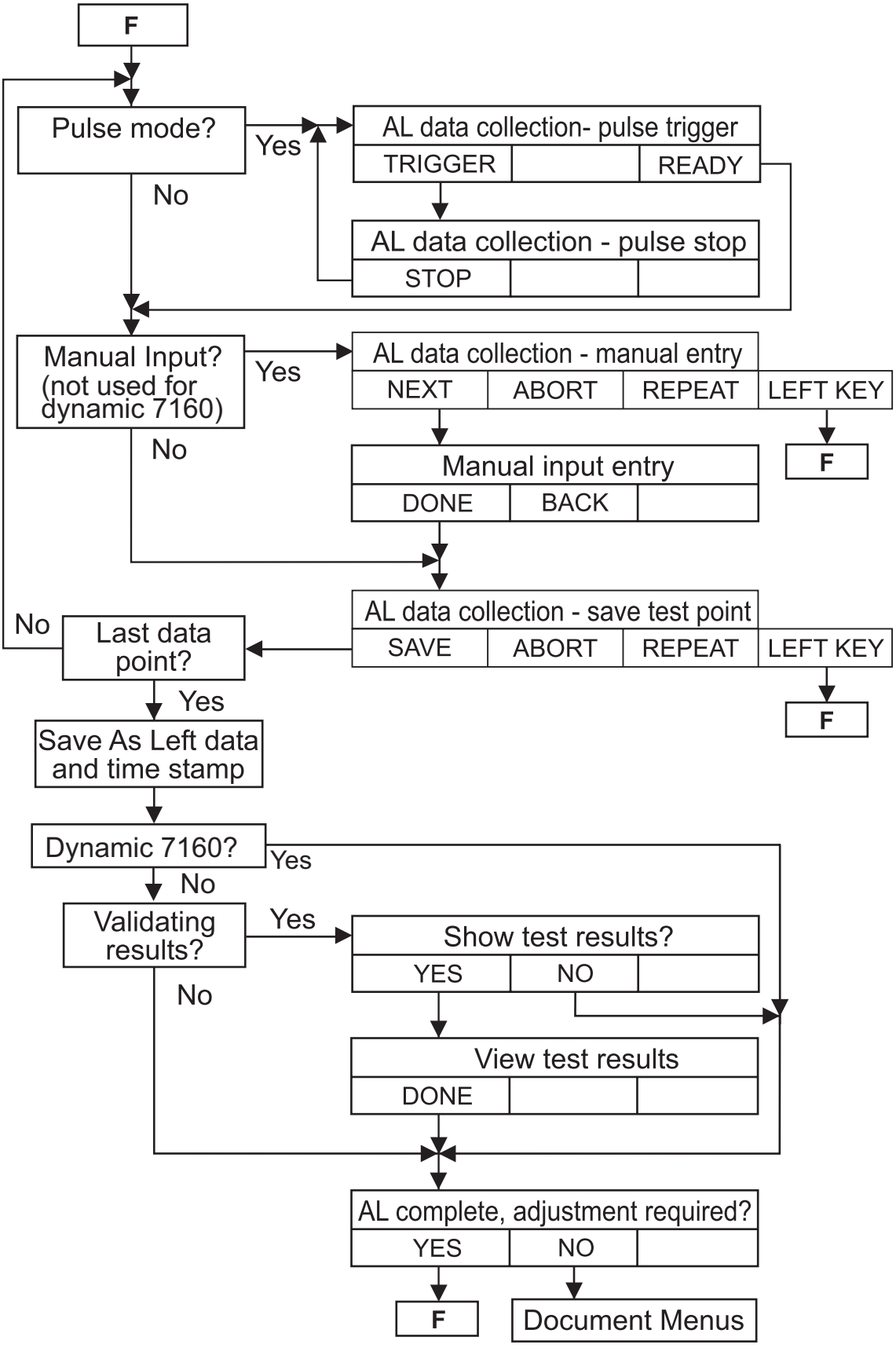

C
tag ID field Selection
SELECT
NEXT
SAVE
tag field Data entry
DONE
NEXT
SAVE
Save As Found Data and Time
Dynamic 7160?
Yes
No
Validate test results?
YES
NO
Tolerance field selection
SELECT
DONE
Toelerance field data entry
DONE
Show test results?
YES
NO
View test results?
DONE
Save AF results as AL?
YES
NO
Document Menus
Adjust Instrument?
YES
NO
D
E

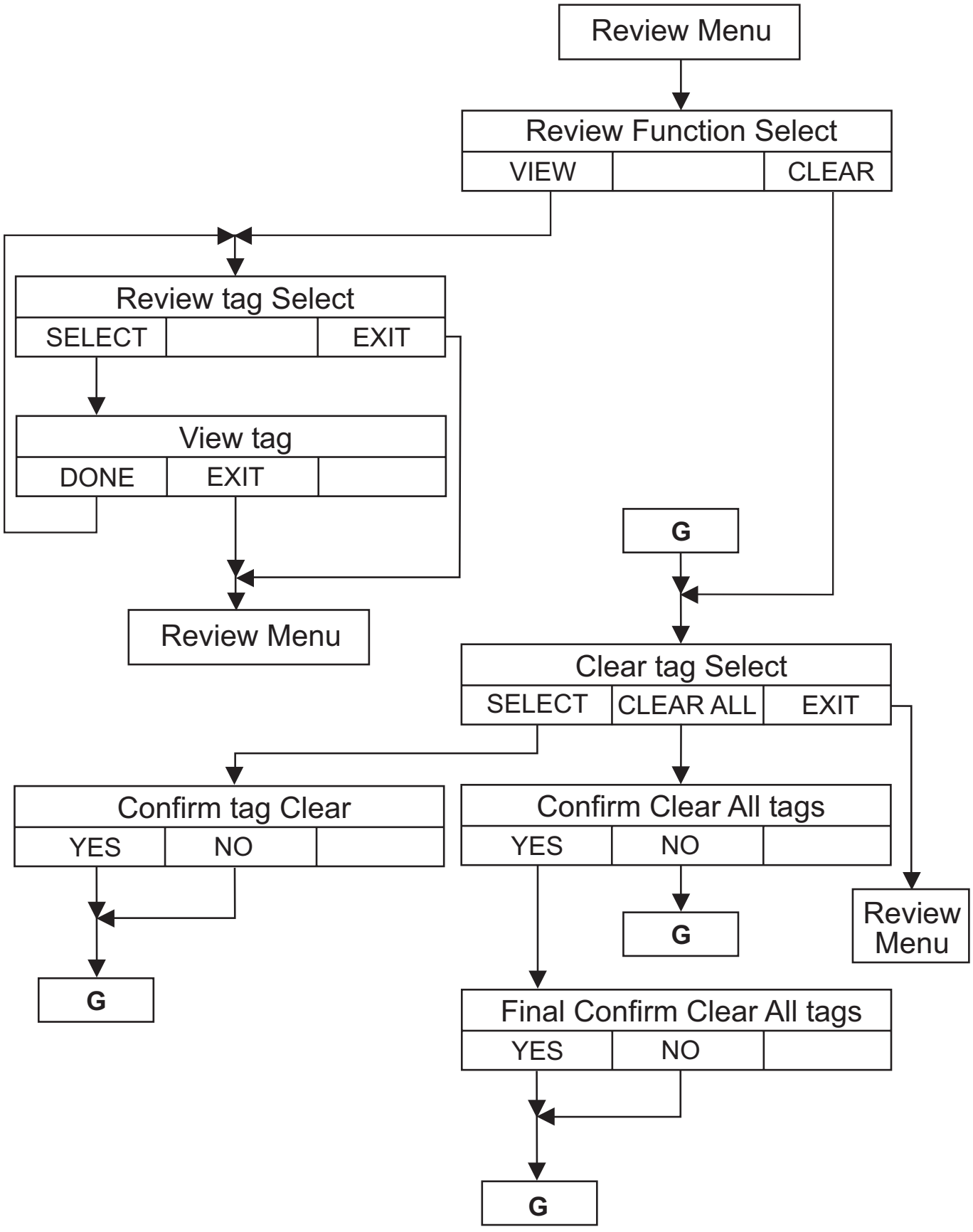

Downloaded tag As Found Test
Either display in pressure mode?
Yes
Pressure Zero Menu
ZERO
DONE
No
Either display in 7160 mode?
Yes
7160 ZERO Menu
ZERO
DONE
No
7160 TARE Menu
TARE
DONE
K
Pulse mode?
Yes
AF data collection - pulse trigger
TRIGGER
READY
No
AF data collection - pulse stop
STOP
Manual Input? (not used for dynamic 7160)
Yes
AF data collection - manual entry
NEXT
ABORT
REPEAT
LEFT KEY
Manual Intput entry
DONE
BACK
K
No
No
Last data point?
AF data collection - save test point
SAVE
ABORT
REPEAT
LEFT KEY
K
Yes
K
Save As Found test data and time stamp
L

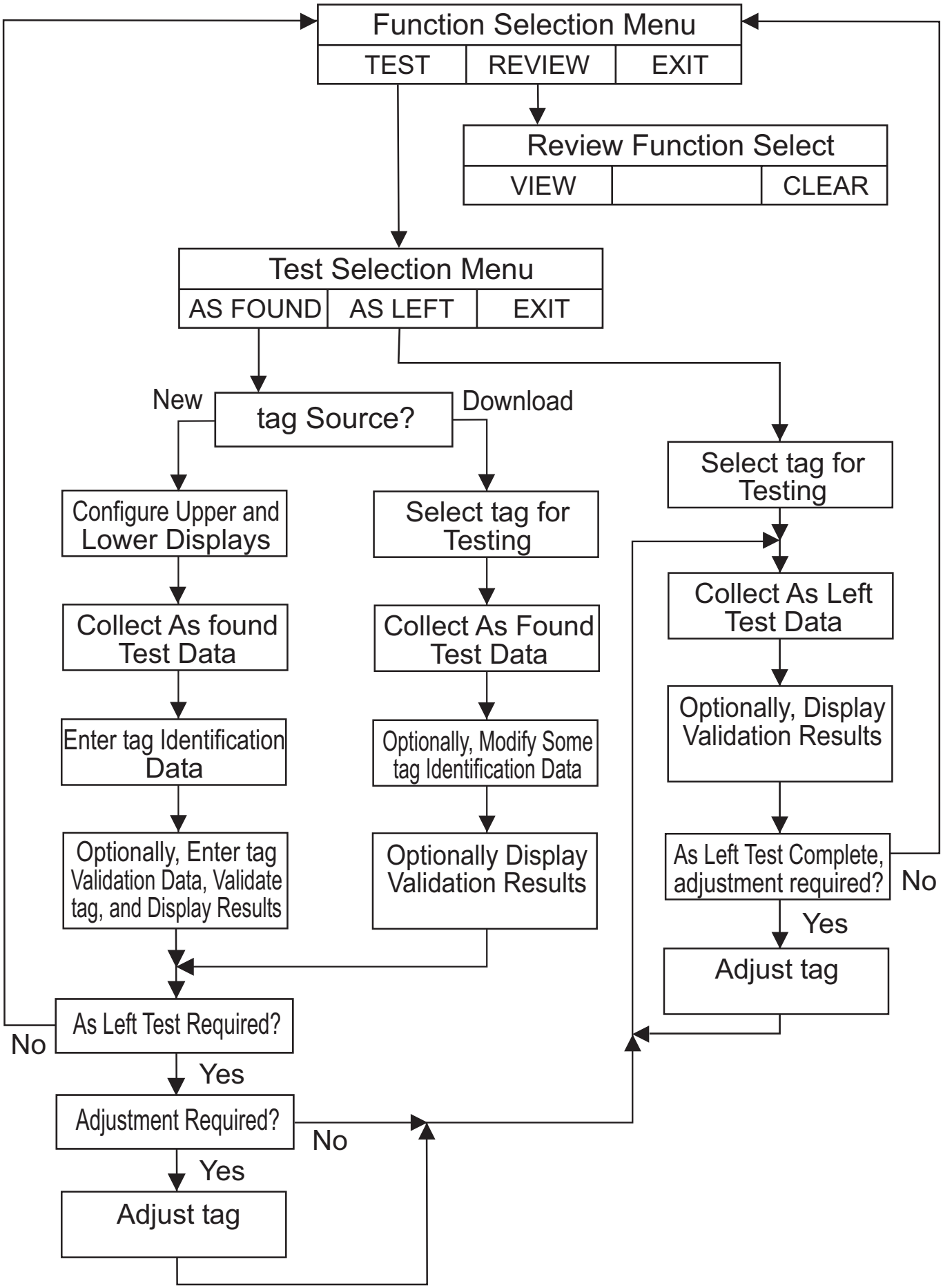

L
tag ID field Selection
SELECT
NEXT
SAVE
tag field data entry
DONE
NEXT
SAVE
Save tag ID data changes
Dynamic 7160?
Yes
No
Validating results?
Yes
No
Show test results?
YES
NO
View test results
DONE
Save AF results as AL?
YES
NO
Document Menus
Adjust Instrument?
YES
NO
D
E


D
Either display in pressure mode?
Yes
No
Pressure Zero Menu
ZERO
DONE
Either display in 7160 mode?
Yes
No
7160 ZERO Menu
ZERO
DONE
7160 TARE Menu
TARE
DONE
Pulse mode?
Yes
No
Adjust - pulse trigger
TRIGGER
READY
Adjust - pulse stop
STOP
Adjust - monitor/step/enter
UP
DOWN
AS LEFT
E


As Left Menu
As Left tag selection
SELECT
EXIT
Home Menu
Already has AL results?
Yes
Overwrite AL results?
YES
NO
No
E
Either display in pressure mode?
Yes
Pressure Zero Menu
ZERO
DONE
No
Either display in 7160 mode?
Yes
7160 Zero Menu
ZERO
DONE
No
7160 Tare Menu
TARE
DONE
F


F
Pulse mode?
Yes
No
AL data collection- pulse trigger
TRIGGER
READY
AL data collection - pulse stop
STOP
Manual Input? (not used for dynamic 7160)
Yes
No
AL data collection - manual entry
NEXT
ABORT
REPEAT
LEFT KEY
F
Manual input entry
DONE
BACK
AL data collection - save test point
SAVE
ABORT
REPEAT
LEFT KEY
F
No
Last data point?
Yes
Save As Left data and time stamp
Dynamic 7160?
Yes
No
Validating results?
Yes
No
Show test results?
YES
NO
View test results
DONE
AL complete, adjustment required?
YES
NO
F
Document Menus


Review Menu
Review Function Select
VIEW
CLEAR
Review tag Select
SELECT
EXIT
View tag
DONE
EXIT
Review Menu
G
Clear tag Select
SELECT
CLEAR ALL
EXIT
Confirm tag Clear
YES
NO
G
Confirm Clear All tags
YES
NO
G
Review Menu
Final Confirm Clear All tags
YES
NO
G


Function Selection Menu
TEST
REVIEW
EXIT
Review Function Select
VIEW
CLEAR
Test Selection Menu
AS FOUND
AS LEFT
EXIT
New
tag Source?
Download
Configure Upper and Lower Displays
Collect As found Test Data
Enter tag Identification Data
Optionally, Enter tag Validation Data, Validate tag, and Display Results
Select tag for Testing
Collect As Found Test Data
Optionally, Modify Some tag Identification Data
Optionally Display Validation Results
Select tag for Testing
Collect As Left Test Data
Optionally, Display Validation Results
As Left Test Complete, adjustment required?
No
Yes
Adjust tag
No
As Left Test Required?
Yes
Adjustment Required?
No
Yes
Adjust tag

8.2 New Tag As Found Test

8.2.1 Setup

- At the main menu, press the [MENU] function key, followed by [MORE].
- If a 7160 is selected, you have to press the [NEXT] function key.
- Press the [DOCUMENT] function key.

  The display shows the first level document mode menu.

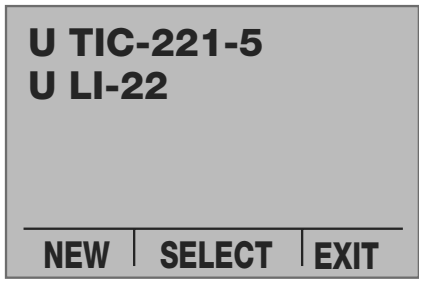
- Press the [TEST] function key

  The menu bar displays the test selection menu.

- Press the [AS FOUND] function key.

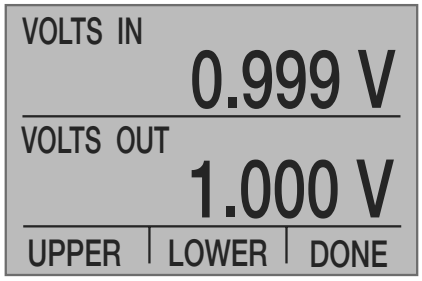
  The As Found Tag Selection menu is displayed.

  This menu shows all uncalibrated downloaded tags.



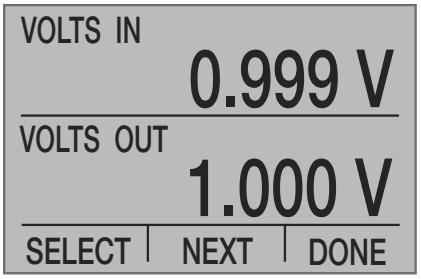
  The letter “U” indicates an uncalibrated downloaded tag.

- Display the As Found Tag setup menu for configuring a new tag; To do this press the [NEW] function key.



- Press the [UPPER] or the [LOWER] function key.

  The 4423 displays the respective type and parameter selection menu.



These two menus operate the same as the normal upper and lower type and parameter selection menus. For further information see chapter 3, 4 and 5.

These two menus here have two extra type selections, [MANUAL IN] and [MANUAL OUT].

The currently selected parameter field blinks.

- Press the [SELECT] function key.

  In this way you'll cycle through the possible selections for that field.

- Press the [NEXT] function key

  You'll move to the next parameter field.

When all parameters are set for the selected display:

- Press the [DONE] function key.

  You'll return to the As Found setup menu.

One display must be selected as a calibrator input type, and the other must be selected as a calibrator output type.

Pressure cannot be selected simultaneously on both displays, as the 4423 is only capable of handling one pressure at a time.

Once both the upper and lower displays are properly selected.

- Press the [DONE] function key on the As Found setup menu to proceed with the setup.

At this point some display type selections, as described below, require optional setup data to be entered.

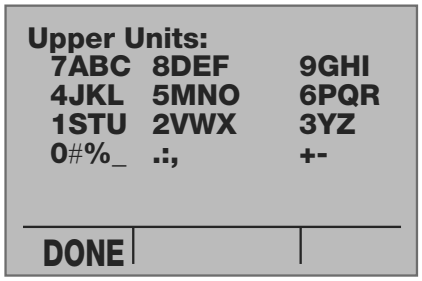
Otherwise:

- Press [DONE].

  This proceeds directly to the As Found data collection prompt.

Optional Setup - Manual Input or Output on Upper Display

If either manual type is selected on the upper display, the upper manual unit description prompt is displayed.



Up to 5 characters may be entered for a unit description using a mobile phone style entry method. The four lower lines provide a mapping of the allowed alphanumeric characters to the numeric keypad keys.

To enter a character

- Press the corresponding numeric key multiple times until the desired character is displayed.

  For example, to enter E, press the 8 key at three times.

If the next character is on a different numeric key:

- Simply press that key

  This advances the cursor and displays the first mapped character.

If the next character is on the same key:

- Press ENTER.

  This will advance the cursor.

- Press the numeric key.

To insert a space

- Press ENTER twice.

To erase characters

- Press CE.

To confirm the entry

If the unit description is completed:

- Press the [DONE] function key.

Optional Setup - Manual Input or Output on Lower Display

If either manual type is selected on the lower display, the lower manual unit description prompt is displayed. Except for the title on the first line, it looks and operates like the upper display version described in the previous paragraph.

Optional Setup – Strain Gauge 7160 on Upper or Lower Display

If strain gauge type is selected on the upper or lower display, the 4423 displays the zero and tare prompts.

Except for the omitted [NEXT] selection, these displays are formatted the same as the basic mode displays, and operate the same.

If you have finished the setup:

- Press the [DONE] function key on the zero menu.

  The 4423 will proceed to the tare menu

To proceed to the test:

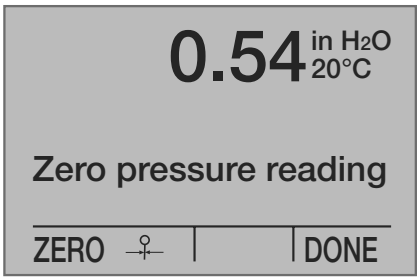
- Press the [DONE] function key on the tare menu.

Optional Setup - Pressure on Upper or Lower Display

If pressure is selected on the upper or lower display, a pressure zero prompt is displayed.

This prompt is displayed before each adjustment or subsequent test.

If the installed module is not an absolute pressure module, the following prompt is displayed.



The value displayed on the top line is the current pressure reading adjusted with the current zero value.

To set a new pressure zero

- Press the [ZERO] function key.

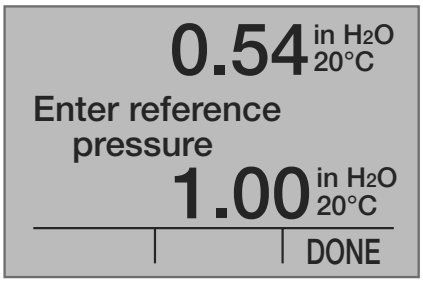
When the pressure zero is correct:

- Press the [DONE] function key to continue.

To skip changing the zero

- Press the [DONE] function key.

If the installed module is an absolute pressure module, the following prompt is displayed.



The value displayed on the top line is the current pressure reading adjusted with the current reference pressure.

To set a new reference value

- Enter the new reference pressure using the numeric keys.
- Press the ENTER key.

When satisfied with the pressure reference:

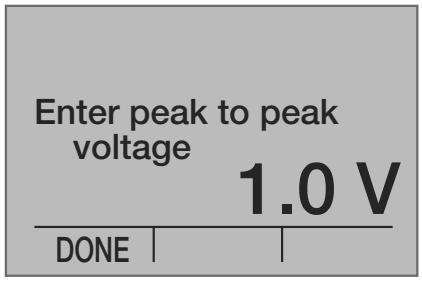
- Press the [DONE] function key to continue.

To skip changing the reference value

- Press the [DONE] function key.

Optional Setup - Frequency Output on Lower Display

If frequency output is selected on the lower display, a prompt for peak-to-peak voltage (Vpp) is displayed.



- Enter the new peak-to-peak voltage using the numeric keys.
- Press the ENTER key.

When satisfied with the voltage value.

- Press the [DONE] function key to continue.

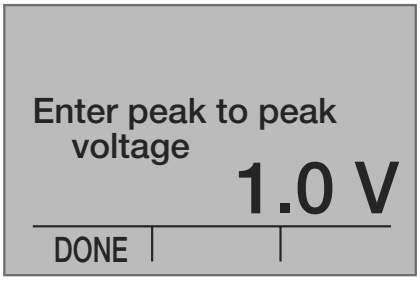
To skip changing the current voltage

- Press the [DONE] function key.

Optional Setup - Pulse Train Output on Lower Display

If pulse train output is selected on the lower display, a prompt for peak-to-peak voltage is displayed, followed by a prompt for a fixed frequency or a fixed number of pulse counts.

The peak-to-peak voltage prompt is used as follows:



To change the voltage

- Enter the new peak-to-peak voltage using the numeric keys
- Press the ENTER key.

When satisfied with the voltage value.

- Press the [DONE] function key to continue.

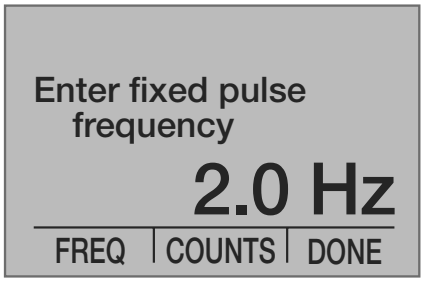
To skip changing current voltage

- Press the [DONE] function key.

Pulse train has two variable parameters, frequency and pulse count. Since the 4423 can only store one variable parameter per test, one of these must be set to a fixed value for all test points, while the other is changed.

A second prompt allows the fixed parameter to be selected, and a value to be entered for it.

In the sample below, frequency is currently selected as the fixed parameter with a value of 2.0 Hz.



To select the fixed parameter

- Press the [FREQ] function key or the [COUNTS] function key.

  The upper display will change to reflect the current value for that parameter

- Enter the new parameter value using the numeric keys followed.
- Press the ENTER key.

When satisfied with the parameter selection and value:

- Press the [DONE] function key to continue.

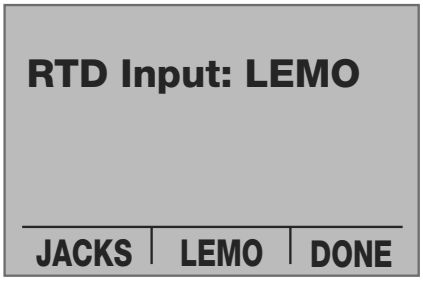
To skip changing current parameter selection and value

- Press the [DONE] function key.

Optional Configuration – RTD Input with 4 mm JACKS or LEMO 1B (6 pins)

If RTD input is selected on the lower display [LOWER], there is an option to select 6-pin LEMO socket or 4 mm JACKS. To do so press the function keys [MENU], [MORE], [NEXT] followed by the [RTD INPUT] function key.

A prompt for input source is displayed:



- Press the function key F1 or F2 to select 4 mm JACKS or LEMO socket.

  The display will change to reflect the current selection.

When satisfied with the input terminal.

- Press the [DONE] function key to continue.

8.2.2 Data Collection

The prompt displayed during the test depends on the input and output types selected. Any combination, which includes “pulse train output”, “manual input” or “manual output” has its own unique prompt sequence. All other combinations are covered by a generic prompt.

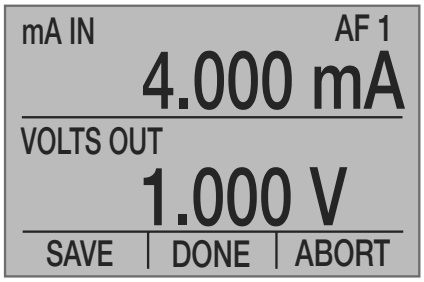
The test for each point consists of “setting the output value”, “waiting for the input to settle”, and “saving the data”. This process is repeated until the desired number of test points is recorded. For ease of analysis, it is suggested that the test points be evenly spaced across the test range and that they be entered in one of this orders:

- ascending
- descending
- ascending followed by descending
- descending followed by ascending

Generic Type Prompt

A prompt similar to the following is displayed for each test point.

Except the input/output combination includes “pulse train output”, “manual input” or “manual output”.



The current test type, “AF” for As Found, and point number are shown in the upper right corner of the display.

Note:

The calibration point number shows the next calibration point to be tested while the corresponding data are not saved yet.

If the calibrator output is pressure:

➢ Adjust the external pressure source until the displayed output value matches the desired test value.

For all other output types:

➢ Enter the output value to be generated using the numeric keys.

➢ Press ENTER.

Once the displayed calibrator input value has settled:

➢ Press the [SAVE] function key.

The point number in the upper right increases to show that the test data is saved.

That means that the data is saved.

You may step to the next point.

Once the desired number of points has been tested:

- Press the [DONE] function key to end the data collection stage.
- Proceed to the entry of test identification data.

To terminate data collection without saving any data

- Press either the HOME key or the [ABORT] function key.

  A prompt is displayed requesting confirmation that the test data accumulated so far is to be abandoned ("**Abandon test data?**").

To return to the data collection process at the point where it was interrupted:

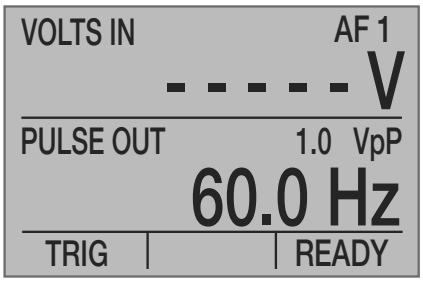
- Press the [NO] function key.

To abandon the data collected:

- Press the [YES] function key.

Pulse Train Type Prompt

When the input/output combination includes a pulse train output, the following is displayed for each test point.



The current test type, "AF" for As Found, and point number are shown in the upper right corner of the display.

Note:

The calibration point number shows the next calibration point to be tested while the corresponding data are not saved yet.

- Enter the output value to be generated using the numeric keys.
- Press ENTER.
- Press the [TRIG] function key to generate the pulse train.

  The lower line change to the following while the pulse train is being generated.

To abort the pulse train before it is finished:

➢ Press the [STOP] function key.

When the pulse train is complete, or is aborted, the lower line changes back to its original state.

Once the calibrator input value has settled, and the results are acceptable:

➢ Press the [READY] function key.

You'll proceed to the prompts for saving the data.

If the calibrator input is manual, the lower line changes to the following prompts.

➢ Press the [NEXT] function key.

You'll enter the manual input value.

Further Information about manual data entry could be found in the subsection "Manual Input/Output Type Prompt".

See the following paragraphs for a description of the [DONE] and [ABORT] function keys.

If the calibrator is not manual, or after manual data has been entered, the lower line changes to the following prompts.

If the data displayed is correct:

➢ Press the [SAVE] function key.

The data is saved and you'll step to the next point.

The point number in the upper right increases to show that the test data is saved.

If the pulse train or manual data must be corrected before saving:

➢ Press the ◄ key.

You'll change back to the [TRIG/READY] prompts and repeat the test.

Once the desired number of points has been tested:

➢ Press the [DONE] function key.

The data collection is finished and you'll proceed to the entry of test identification data.

To terminate the data collection without saving any data.

- Press either the HOME key or the [ABORT] function key.

  A prompt is displayed requesting confirmation that the test data accumulated so far is to be abandoned ("**Abandon test data?**").

To return to the data collection process at the point where it was interrupted:

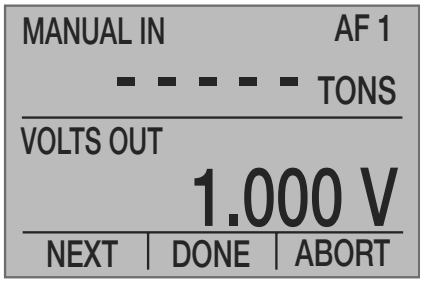
- Press the [NO] function key.

To abandon the data collected:

- Press the [YES] function key.

Manual Input/Output Type Prompt

When the input/output combination includes a manual input or manual output, a prompt similar to the following is displayed for each test point.



The current test type, "AF" for As Found, and point number are shown in the upper right corner of the display.

Note:

The point number is the next point to be tested and data has not been saved for it yet.

If the calibrator output is pressure:

- Adjust the external pressure source until the displayed output value matches the desired test value.

If the calibrator output is manual:

- Adjust the external source to the desired test value.

For all other output types:

- Enter the output value to be generated using the numeric keys.
- Press ENTER.

If the calibrator input is not manual:

- Wait for the displayed calibrator input value to settle.
- Press the [NEXT] function key.

  The manual entry(s) are prompted now.

  Refer to the following subsection for further information.

If the calibrator input is manual:

- Wait for the external device reading to settle.
- Press the [NEXT] function key.

  The manual entry(s) are prompted now.

  Refer to the following subsection for further information.

Upon return from the manual entry prompts(s), the [NEXT] function key label changes to [SAVE].

If the manual data must be corrected before saving it:

- Press the ◄ key.

  The [SAVE] function key changes back to [NEXT].

- Press [NEXT].
- Repeat the manual entry(s).

If the data displayed is correct:

- Press the [SAVE] function key.

  The point number in the upper right increases to show that the test data is saved.

  The data is saved and you'll step to the next point.

Once the desired number of points has been tested:

- Press the [DONE] function key.

  The data collection is finished and you'll proceed to the entry of test identification data.

To terminate the data collection without saving any data.

- Press either the HOME key or the [ABORT] function key.

  A prompt is displayed requesting confirmation that the test data accumulated so far is to be abandoned ("**Abandon test data?**").

To return to the data collection process at the point where it was interrupted:

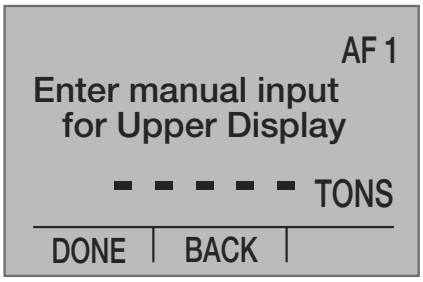
- Press the [NO] function key.

To abandon the data collected:

- Press the [YES] function key.

Manual Data Entry Prompt

A prompt similar to the following is displayed for entry of manual inputs and outputs. When both input and output is manual, the output prompt is displayed first.



- Enter the manual value using the numeric keys.
- Press ENTER.

If the value is correct:

- Press the [DONE] function key

  You may continue now.

To adjust correct the value:

- Press the [BACK] function key.

  You'll return to the previous prompt display.

Strain Gauge 7160 Dynamic Mode

This mode operates differently than the other modes.

When the [SAVE] function key is pressed, the 4423 automatically stores these values:

- present reading
- maximum since test start
- minimum since test start
- peak to peak since test start.

The test is considered complete and only the [DONE] and [ABORT] function keys, and the [◄] key, are active.

To repeat the test:

➢ Reset the device under test

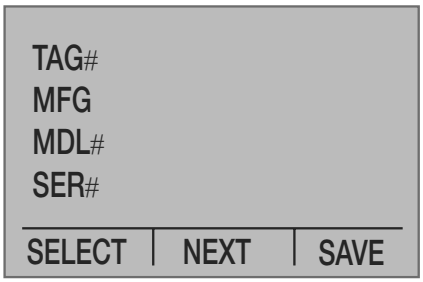
➢ Press the [◄] key.

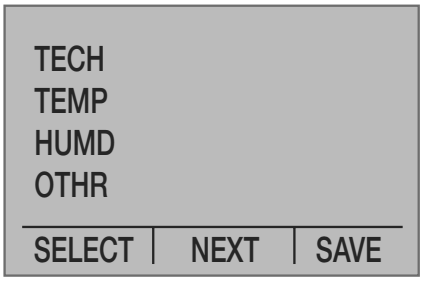
This will reactivate the [SAVE] function key and resets the maximum, minimum and peak to peak values.

8.2.3 Identification Data Entry

When you press the [DONE] function key at the end of the data collection, the first page of a two-page identification data display is shown.

Initially all data fields are blank, but after data is entered the current value of each field is shown to the right of its description.





These two pages provide space to enter eight phrases of up to 16 characters each to describe the test that has been performed. The first seven phrases are predefined to be:

- Tag ID
- Instrument Manufacturer
- Model Number
- Instrument Serial Number
- Technician Name or ID number
- Temperature
- Humidity.

The last phrase is for client use.

Note:

There is no restriction on the data that may be entered except for Tag Number, which must have a non-blank first character and must be unique among all tags currently stored in the calibrator.

To switch between the two pages

➢ Press the [NEXT] function key.

To save the data and proceed to the results validation step

- Press the [SAVE] function key.

  The Data is saved now and you'll proceed to the result validation step.

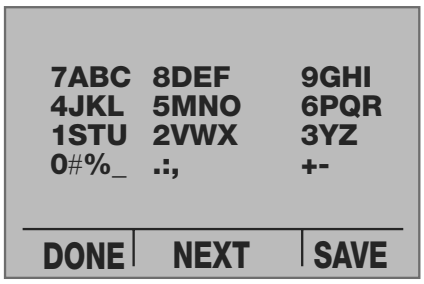
To switch from one field to the next

- Press the ▲ and ▼ keys.

To enter data into the highlighted field

- Press the [SELECT] function key.

  A prompt similar to the following is displayed showing the field name and current value on the top line.



Up to 16 characters may be entered for the field using a mobile phone style entry method. The four lower lines provide a mapping of the allowed characters to the numeric keypad.

To enter a character

- Press the corresponding numeric key multiple times until the desired character is displayed.

  For example, to enter E, press the 8 key at three times.

If the next character is on a different numeric key

- Simply press that key.

  The first mapped character is displayed at the next cursor position.

If the next character is on the same key

- Press ENTER

  The cursor is now advanced to the next position.

- Press the same key.

To insert a space

- Press ENTER twice.

To erase characters

- Press CE.

To return to the two-page identification data display

- Press the [DONE] function key.

To display and edit the next data field in sequence

- Press the [NEXT] function key.

To save the data and proceed to the results validation step

- Press the [SAVE] function key.

8.2.4 Results Validation

After the identification data has been saved, a prompt is displayed asking whether test results are to be validated or not.

If validation is selected, each test point is assigned a pass or fail status on the test results displays and reports.

Validation is automatically performed at the end of each As Left test.

If validation is not selected, no status is displayed on the test results displays and reports, and no validation is performed.

Note:

Results validation is not available for strain gauge dynamic mode tests.

Validation is based on a linear relationship between calibrator output and input. For input and output, zero and span values are entered, along with a % span error tolerance.

Zero and span are used to calculate expected calibrator input values corresponding to the actual calibrator output values. The expected input values are then compared to the actual input values and pass/fail status determined by the % span error tolerance.

Note:

Use the test results validation only, if the instrument's output/input relationship is linear.

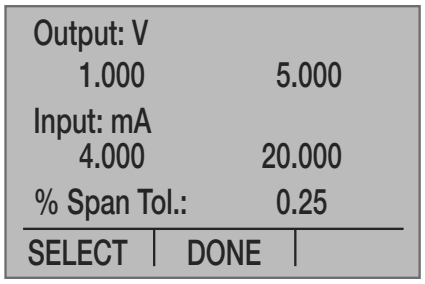
To validate the results

- Press the [YES] function key.

To skip validation and proceed to the test conclusion stage

- Press the [NO] function key.

When validation is selected, the following prompt is displayed showing the current settings for output zero and span, input zero and span, and the % span error tolerance.

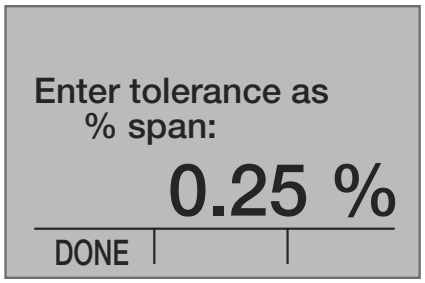


At the sample the span tolerance is initially set to 0.25%, and the input and output values are set to the corresponding minimum and maximum test results values. As the test results values will only approximate the actual instrument range, they will need to be modified to exact range values for the validation.

To modify range values

- Select a value to be modified. To do this use the ▲, ▼, ◄, and ► keys.
- Press [SELECT] function key.

When a value is selected for modification, a prompt similar to the following one for error tolerance is displayed.



The upper part of the display indicates the value being modified, and the lower part indicates the current value.

- Enter the new value using the numeric keys.
- Press ENTER.
- Press the [DONE] function key.

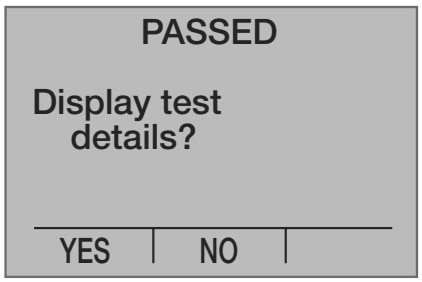
  You'll return to the current settings display.

Once all values have been modified

- Press [DONE].

  You'll continue on to the overall test status display.

  The overall test status display provides the option of displaying details for each test point.



The overall test status is displayed on the top line. If all points passed, "PASSED" is displayed. If one or more points have failed, "FAILED" is displayed.

To skip detail results display and proceed to the test conclusion stage

- Press the [NO] function key.

To display the test details

- Press the [YES] function key.

The content and operation of this display is identical to that described in the chapter 8.6: "Viewing Test Results".

When viewing is complete:

- Press the [DONE] function key.

  You'll proceed to the test conclusion stage.

8.2.5 Test Conclusion

A prompt is displayed asking whether the As Found test results are to be saved for the As Left test results, and the testing for this tag is to be ended ("**AS FOUND test complete. Accept AS FOUND data for AS LEFT?**").

If the test has been successful and no further testing is required:

- Press the [YES] function key.

  You'll return to the first level document mode menu.

If further testing is required:

- Press the [NO] function key.

  A prompt is displayed asking whether an adjustment step is required before proceeding to the first As Left test ("**Adjustment required?**").

If an adjustment is required:

- Press the [YES] function key.

If no adjustment is required, proceed directly to As Left data collection.

- Press the [NO] function key.

8.3 Adjustment

During the adjustment process, the output values entered in the As Found test can be generated by stepping up or down through the test points.

If the output type is generated by the calibrator (i.e. not pressure or manual) a user-entered value, which may be different from the test points, may be generated.

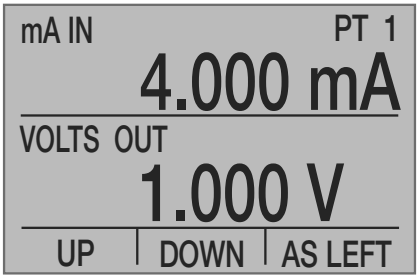
If pressure is selected on the upper or lower display, the pressure zero prompt is displayed and operates as described under As Found Setup.

If strain gauge is selected on the upper or lower display, the 4423 first displays the zero and tare prompts and operate as described under As Found Setup.

The prompt displayed during the test depends on the input and output types selected. Any combination, which includes pulse train output, has its own unique prompt sequence. All other combinations are covered by a generic prompt.

Generic Type Prompt

When the output is not pulse train, a prompt similar to the following is displayed for each test point.



The “PT” in the upper right corner of the display indicates that this is the adjustment display. If an As Found data point is being generated, its number is displayed. If a user-entered value is being generated, two dashes are displayed.

To cycle through the As Found test points:

- Press the [UP] or [DOWN] function key.

If the output type is not pressure or manual, the calibrator will generate it.

If the output type is pressure or manual, the output value is displayed so that it can be set on the external source.

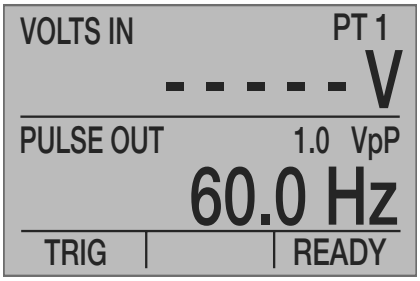
If the output type is not pressure or manual, any value different from the test points can be entered using the numeric keys:

- Enter the values using the numeric keys.
- Press ENTER.
- Press the [AS LEFT] function key.

  You’ll proceed directly to the As Left data collection.

Pulse Train Type Prompt

When the output is pulse train, the following is displayed for each test point.



The “PT” in the upper right corner of the display indicates that this is the adjustment display. If an As Found data point is selected, its number is displayed. If a user-entered value is selected, two dashes are displayed.

To enter a user value for generation:

- Use the numeric keys.
- Press ENTER.

To proceed to the next menu:

- Press the [READY] function key.

There the [UP] and [DOWN] function keys can be used to scroll through the As Found data points.

To generate the pulse train:

- Press the [TRIG] function key.

  The lower line changes to the following while the pulse train is generated.

To abort the pulse train before it is finished:

- Press the [STOP] function key

When the pulse train is complete, or is aborted, the lower line changes back to its original state.

To change the lower line to the prompts for scrolling through the As Found test points, or proceeding to As Left data collection:

- Press the [READY] function key.

To cycle through the As Found test points:

- Press the [UP] or [DOWN] function key.

To proceed directly to As Left data collection:

- Press the [AS LEFT] function key.

To return to the trigger menu and generate a new pulse train:

- Press the ◄ key.

8.4 Downloaded Tag As Found Test

8.4.1 Tag Selection

- At the main menu, press the [MENU] function key, followed by the [MORE] function key,
- If a 7160 is selected, you have to press the [NEXT] function key.
- Press the [DOCUMENT] function key.

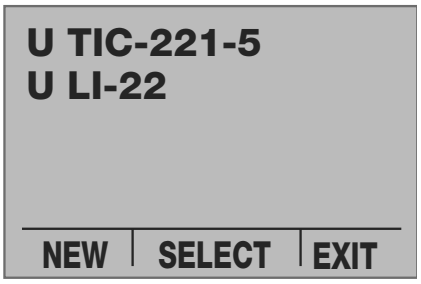
  The display shows the first level document mode menu.

- Press the [TEST] function key.

  The menu bar displays the test selection menu.

- Press the [AS FOUND] function key.

Now the As Found Tag Selection menu is displayed, which lists all uncalibrated downloaded tags.



Tag numbers are displayed on multiple pages, six tags to a page.

The letter “U” indicates an uncalibrated downloaded tag.

To scroll to the next or previous tag:

- Press the ▲ and ▼ keys.

To scroll to an other page:

- Use the ◄ and ► keys.

When the desired tag number is highlighted:

- Press the [SELECT] function key.

  You’ll proceed to data collection.

To return to the main menu without selecting a tag:

- Press the [EXIT] function key.

8.4.2 Data Collection (As Found)

If “pressure” is selected on the upper or lower display, the pressure zero prompt is displayed first, and operates as described under “New Tag As Found Setup”.

If strain gauge is selected on the upper or lower display, the 4423 first displays the zero and tare prompts and operates as described under As Found Setup.

Downloaded Tag As Found data collection is identical to New Tag As Found data collection except for three minor differences.

1) The test outputs cannot be changed; they will be the predefined values that were downloaded. For pressure and manual output types, the downloaded value is displayed for you to set it on the external source. For all other output types, the calibrator automatically generates the As Found value.
2) Once the [SAVE] function key is pressed for the last test point, the process automatically proceeds to the identification data entry stage.
3) A [REPEAT] function key is available for restarting the test at the first point.

8.4.3 Identification Data Entry

At this step the technician is given the opportunity to update any of the downloaded tag identification fields, except for the tag number which must remain the same in order for the PC program to synchronize the test results with its database during upload.

Otherwise this process is identical to that described under “New Tag As Found identification data entry”.

When the [SAVE] function key is pressed, the process automatically proceeds to the test conclusion stage.

8.4.4 Test Conclusion

If test validation was selected, a display showing the overall “pass/fail” status of the test is displayed with a prompt asking whether details should be displayed.

To display the details:

- Press the [YES] function key.

To skip the details

- Press the [NO] function key.

In either case the adjustment prompt is displayed next. A prompt is displayed asking whether further adjustment and testing is required.

To proceed to the adjustment menu:

- Press the [YES] function key.

To proceed to the first level document mode menu:

- Press the [NO] function key.

8.5 As Left Test

An As Left test can immediately follow an As Found test or a previous As Left test, or it can be initiated at a later time for any tag stored in memory.

If it immediately follows another test, no tag selection step is required and data collection starts right away.

If it is initiated at a later time, the tag must be selected first.

8.5.1 Tag Selection

To open the selection:

- At the main menu, press the [MENU] function key, followed by [MORE].

  If a 7160 is selected, you have to press the [NEXT] function key.

- Press the [DOCUMENT] function key.

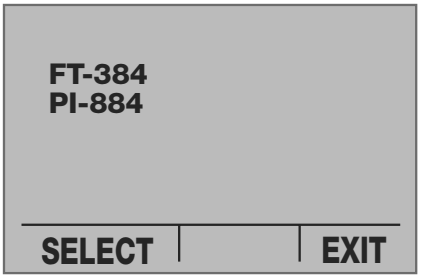
  The menu bar displays the first level document mode menu.

- Press the [TEST] function key.

  The menu bar displays the test selection menu.

- Press the [AS LEFT] function key.

  The display shows all calibrated tags available for recalibration.



Tag numbers are displayed on multiple pages, six tags to a page.

To return to main menu, without selection:

- Press the [EXIT] function key.

To scroll to an other page:

- Use the ◄ and ► keys.

To scroll to the next or previous tag:

- Press the ▲ and ▼ keys.

When the desired tag number is highlighted:

- Press the [SELECT] function key.

  You'll now proceed to data collection.

If the there has been no previous As Left test proceed directly to data collection.

If there has been at least one previous As Left test, a prompt requesting confirmation to overwrite existing As Left data is displayed.

To overwrite existing data:

- Press [YES] function key to continue to data collection.

Don't overwrite existing data:

- Press the [NO] function key to return to tag selection.

8.5.2 Data Collection (As Left)

If pressure is selected on the upper or lower display, the pressure zero prompt is displayed first. The pressure zero prompt is described under "As Found" Setup.

If strain gauge is selected on the upper or lower display, the 4423 first displays the zero and tare prompts and operates as described under New Tag As Found Setup.

As Left data collection is identical to As Found data collection except for four minor differences.

1) The "AF" in the upper right corner of the display is changed to "AL" during the collection.
2) The test outputs cannot be changed; they will be the same as the As Found values. This ensures that the As Found and As Left test results line up when being compared later. For "pressure" and "manual output" types, the As Found value is displayed for you to set it on the external source. For all other output types, the calibrator automatically generates the As Found value.
3) Once the [SAVE] function key is pressed for the last test point, the process automatically proceeds to the next stage.
4) A REPEAT function key is available for restarting the As Left test at the first point.

8.5.3 Test Conclusion (As Left)

If test validation was selected, a display showing „P“ (pass) or „F“ (fail) is displayed after the values.

To display the details:

- Press the [YES] function key.

To skip the details:

- Press the [NO] function key.

In either case the adjustment prompt is displayed next.

A prompt is displayed asking whether further adjustment and testing is required.

If further adjustment is required:

- Press the [YES] function key.

  You'll proceed to adjustment menu.

If no further adjustment is required:

- Press the [NO] function key.

  You'll proceed to first level document mode menu.

8.6 Viewing Test Results

To open the results:

- At the main menu, press the [MENU] function key, followed by the [MORE], followed by [DOCUMENT]

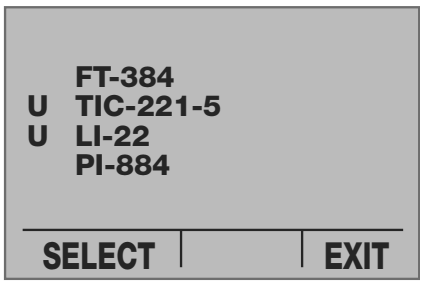
  The menu bar displays the first level document mode menu.

- Press the [REVIEW] function key.

  The menu bar displays the review selection menu.

- Press the [VIEW] function key.

  The tag selection prompt is displayed.



Tag numbers are displayed on multiple pages, six tags to a page.

The letter “U” indicates an uncalibrated downloaded tag the remainder has been calibrated.

To scroll to the next or previous tag:

- Press the ▲ and ▼ keys.

To scroll to an other page:

- Use the ◄ and ► keys.

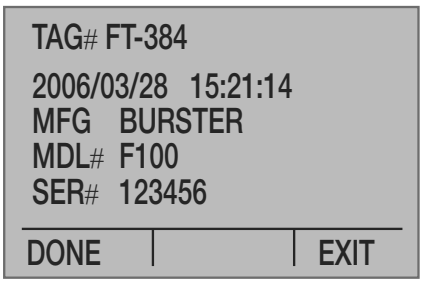
To return to the main menu without selecting a tag:

Press the [EXIT] function key.

When the desired tag number is highlighted:

➢ Press the [SELECT] function key.

The first part of the data is displayed showing the tag number, calibration date and time, and the first few identification fields.



➢ Press the ▲ and ▼ keys.

You'll scroll through the remaining pages of data, cycling from the last page to the first page and vice versa.

The second page contains the remaining identification fields and the validation error tolerance.

The third page contains the instrument input setup.

The fourth page contains the instrument output setup.

The fifth and subsequent pages display the test results.

Only on pages displaying test results, use the ◄ and ► keys to switch between the As Found results and the As Left results.

Note:

Unlike the input during the tests, these data is measured.

If the test was strain gauge dynamic mode, only four data values are shown in the right, instrument output, column and the left column is blank.

These values are:

- present reading at the time the data was saved
- maximum since test start
- minimum since test start
- peak to peak since test start

To return to the tag selection menu:

➢ Press the [DONE] function key.

To return to the review selection menu:

➢ Press the [EXIT] function key.

8.7 Clearing Test Results

- At the main menu, press the [MENU] function key, followed by [MORE], followed by [DOCUMENT].

  The menu bar displays the first level document mode menu.

- Press the [REVIEW] function key.
- The review selection menu is displayed.

- Press the [CLEAR] function key.

  The display shows the tag selection prompt and clear menu.

To erase all tags from the calibrator memory:

- Press the [CLEAR ALL] function key.

  You have to confirm the request (**"Clear data for ALL tags?"**).

- Press the [YES] function key in response to every prompt.

  All tags will be cleared

To abort the clear request:

- Press the [NO] function key in response to any prompt.

To erase a single tag from the calibrator memory:

- Highlight the desired tag as described under viewing test results.
- Press the [SELECT] function key.

  You have to confirm the request (**"Clear data for XXXXX?"**).

To abort the request:

- Press the [NO] function key.

To erase the tag:

- Press the [YES] function key.

To erase additional tags:

- Highlight each in turn.
- Press the [SELECT] function key.

When all desired tags have been erased:

- Press the [EXIT] function key

  You'll return to the review selection menu.

8.8 Setting the Date and Time

- At the main menu, press the [MENU] function key, followed by the [MORE].
- Press the [NEXT] function key multiple times.

  The menu bar shows the clock selection menu.

- Press the [CLOCK] function key.
- The clock data entry screen is displayed.

Initially the date and time values displayed on the top line are the precise clock setting when the screen was displayed.

After that they are static values representing any data changes made. The clock is not updated until the [SAVE] function key is pressed.

Note:

For the most accurate setting it is recommended that all values but the seconds be entered first, enter a time slightly ahead of the current, then enter a second's value of zero, and finally press the [SAVE] function key exactly when the entered time is reached.

Switch Between the individual data and time fields

- Press the [NEXT] and [BACK] function keys.

  The upper part of the display will change to reflect the current value for that field.

Set data and time

- Use the numeric keys to change the value.

  Enter the data as follows:

  - The year must be 2006 to 2100.
  - The month 1 to 12.
  - The day 1 to the number of days in the specified month.
  - The hour 0 to 23.
  - The minute 0 to 59.
  - The second 0 to 59.

- Press ENTER after every entry.

Note:

If the day is made invalid by changing to a month with fewer days, the day value will automatically be changed to the maximum number of days valid for the new month.

To save the settings:

- Press the [SAVE] function key.

  The clock settings are saved.

  You'll return to the home menu.

To exit the data entry screen without changing the clock

- Press the HOME key.

8.9 Error codes at documentation mode

OL, -OL,OVER, UNDER

The signal or input, on which the Display (UPPER / LOWER) is related, is out of range.

On the review display and the test results upload, these are changed to "OVER" and "UNDER" respectively.

"-----", NONE

During testing, a line of dashes is shown on the upper and/or lower display.

Unavailable pressure reading, or a requested manual input or output has not been entered yet.

On the review display and the test results upload, this is changed to "NONE".

"Tag storage is full

All 50 tag storage locations are in use. Before providing a new one, you have to delete an unnecessary tag.

"Tag storage is empty"

No tags are available in storage, for selection or displaying.

"Select one input, and one output"

During the set up of a new tag 'As Found' test, the upper and lower display selections are either both inputs or both outputs.

"Maximum number of test points saved"

For this new tag ‘As Found’ test the maximum of 21 test points has already been saved.

"Tag# must be unique with non-blank first character"

An attempt is made to save a tag number, which is not unique within the calibrator, or has a space as its first character.

“At least one test point is required"

During a new tag 'As Found' test the [DONE] key is pressed and no test points have been saved.

"Value entered is out of range"

The numerical entered value (pulse frequency level, pulse fixed parameter, barometric pressure zero, manual input, manual output, date and time, error tolerance percent and ranges) is out of range.

"Warning - changed value not saved"

During a new tag 'As Found' test, the [DONE] key is pressed and the manual input or output value just entered has not been saved.

"External EEPROM fault. See manual"

The access to the external EEPROM used for tag data storage fails.

"Output span is too small"

An attempt is made to save tolerance data where the output span is less than 0.00001. This minimum span is required to avoid divide by zero problems during the test point pass/fail calculations later.

"No calibrated tags are available"

An “As Left” test is selected but there are no previously calibrated tags.

"No downloaded tags are available"

An “As Found” test is selected but there are no uncalibrated downloaded tags available. Either nothing has been downloaded, or all downloaded tags have already been through their 'As Found' test.

Numerically coded error messages

The numerically coded error messages returned by the serial commands for downloading tag test configurations and uploading tag test. Results are described in section 7.9.2: “Calibrator Commands”, command: “TAG_DNLD” (page 90).

9. Specifications

Only values that include tolerances or limits are data covered by the warranty. Values that do not include tolerances are provided for information and do not come under the warranty.

The measuring precision is based on the use of 4-wire technology. If 3-wire technology is used, ± 0.05 Ω must be added. All values are applicable at 23 °C ± 5 °C.
Outside this temperature range, the measurement is accurate to ± 50 ppm/K.

Operating temperature range: -10 °C to 50 °C

Storage temperature: -20 °C to 70 °C

Auxiliary supply:
a) Ni-MH inbuilt battery, operating time > 16 h (10 mA into 1 kΩ)
b) 230 V AC mains adapter, mains-buffered operation is possible

Interface: USB version 1.1

Housing: Aluminum console with plastic side pieces

Dimensions (W x H x D): 160 x 85 x 175 mm

Weight: approx. 1 kg

Protection category: IP 30

Protection class: III

9.1 Electrical Characteristics and Frequencies

Electrical data

Range	Resolution	Tolerance from measured or set value
Voltage source		
0.000 to 20.000 VDC	0.001 V	± 0.015 % ± 2 digits
Voltage measurement		
isolated - 0.100 to + 30.000 VDC	0.001 V	± 0.015 % ± 2 digits
not isolated - 0.100 to + 20.000 VDC	0.001 V	± 0.015 % ± 2 digits
Thermocouple mV		
Source -10.000 to + 75.000 mV	0.001 mV	± 0.02 % ± 10 µV
Measure -10.000 to + 75.000 mV	0.001 mV	± 0.02 % ± 10 µV
Current source		
0.000 to 24.000 mA / 1kΩ Load @ 20 mA	0.001 mA	± 0.015 % ± 2 digits
Current measurement		
isolated - 0.100 ... 24.000 mA	0.001 mA	± 0.015 % ± 2 digits
not isolated - 0.100 ... 24.000 mA	0.001 mA	± 0.015 % ± 2 digits
Resistance simulation *(works with all pulsed instrumentation transducers ≥ 5 ms)*		
5.0 to 400 Ω/Imeas 0.1 -0.5 mA	0.1 Ω	± 0.015 % ± 0.1 Ω
5.0 to 400 Ω/Imeas 0.5 -3.0 mA	0.1 Ω	± 0.015 % ± 0.03 Ω
400 to 1500 Ω/Imeas 0.05-0.8 mA	1 Ω	± 0.015 % ± 0.3 Ω
1500 to 4000 Ω/Imeas 0.05-0.4 mA	1 Ω	± 0.015 % ± 0.3 Ω
Resistance measurement		
0.00 to 400.00 Ω	0.01 Ω	± 0.015 % ± 0.03 Ω
400.1 to 4000.0 Ω	0.1 Ω	± 0.015 % ± 0.3 Ω

Frequency

Range	Tolerance
Resistance simulation *(Amplitude adjustable 1 ... 20 V) rectangular*	
CPM source 2.0 to 600.0 CPM	± 0.05 %
Hz source 1.0 to 1000.0 Hz	± 0.05 %
kHz source 1.0 to 10.0 kHz	± 0.125 %
Measure 2.0 to 600.0 CPM	± 0.05 % ± 0.1 CPM
Hz measure 1.0 to 1000.0 Hz	± 0.05 % ± 0.1 Hz
kHz measure 1.00 to 10.0 kHz	± 0.05 % ± 0.01kHz
Pulse *(Amplitude adjustable 1 ... 20V) source only*	
Pulse 1 to 30.00	
2 CPM to 10.0 kHz	

9.2 Types of Thermocouples

Thermocouple models

Thermocouples		Range		Tolerance
Source/measure				
J	EN 60584-1/ITS90	-200.0 to	0.0 °C	0.4 °C
		0.0 to	800.0 °C	0.2 °C
		800.1 to	1200.0 °C	0.3 °C
K	EN 60584-1/ITS90	-200.0 to	0.0 °C	0.6 °C
		0.0 to	1000.0 °C	0.3 °C
		1000.1 to	1372.0 °C	0.5 °C
T	EN 60584-1/ITS90	-200.0 to	0.0 °C	0.6 °C
		0.0 to	400.0 °C	0.2 °C
E	EN 60584-1/ITS90	-200.0 to	- 100.0 °C	0.6 °C
		-100.0 to	950.0 °C	0. °C
R	EN 60584-1/ITS90	0.0 to	1750 °C	1.2 °C
S	EN 60584-1/ITS90	0.0 to	1750 °C	1.2 °C
B	EN 60584-1/ITS90	600 to	800 °C	1.2 °C
		800 to	1000 °C	1.3 °C
		1000 to	1820 °C	1.5 °C
C	Hoskins E 988	0.0 to	1000.0 °C	0.6 °C
		1000.1 to	2316.0 °C	2.3 °C
XK	GOST	-200.0 to	800.0 °C	0.2 °C
BP	NIST	0.0 to	2500 °C	0.9 °C
L	DIN 43710/IPTS68	-200.0 to	0.0 °C	0.25°C
		0.0 to	900.0 °C	0.2 °C
U	DIN 43710/IPTS68	-200.0 to	0.0 °C	0.5 °C
		0.0 to	400.0 °C	0.25°C
N	EN 60584-1/ITS90	-200.0 to	0.0 °C	0.8 °C
		0.0 to	1300.0 °C	0.4 °C

All tolerances are quoted without error at the reference junction.
The reference junction error outside 23 °C ± 5 °C is 0.05 °C / °C.
Additional reference junction error 0.2 °C.

9.3 Measuring Temperature / simulate Temperature RTD

Temperature measurement / temperature simulation RTD

Designation	Range	Tolerance from measured or set value	
		Measure	Source
Ni120 (672) Minco	- 80.0 to 260,0 °C	± 0.08 °C	± 0.06 °C
Ni100 (618)			
DIN 43760/IPTS68	- 60.0 to 250.0 °C	± 0.08 °C	± 0.15 °C
Cu10 (427)	- 100.0 to 260,0 °C	± 0.82 °C	± 0.82 °C
Cu50 GOST	- 180.0 to 200.0 °C	± 0.18 °C	± 0.2 °C
Cui100 GOST	- 180.0 to 200.0 °C	± 0.11 °C	± 0.13 °C
YSI 400	15.0 to 50.0 °C	± 0.02 °C	± 0.05 °C
Pt 100 (385)			
DIN EN 60751:1996	- 200.0 to 200.0 °C	± 0.13 °C	-
	200.0 to 800.0 °C	± 0.23 °C	-
	- 200.0 to 400.0 °C	-	± 0.2 °C
	400.0 to 800.0 °C	-	± 0.29 °C
Pt 200 (385)			
DIN EN 60751:1996	- 200.0 to 100.0 °C	-	± 0.45 °C
	100.0 to 300.0 °C	-	± 0.52 °C
	300.0 to 630.0 °C	-	± 0.66 °C
	- 200.0 to 630.0 °C	± 0.61 °C	-
Pt 500 (385)			
DIN EN 60751:1996	- 200.0 to 100.0 °C	-	± 0.21 °C
	100.0 to 300.0 °C	-	± 0.26 °C
	300.0 to 630.0 °C	-	± 0.34 °C
	- 200.0 to 630.0 °C	± 0.31 °C	-
Pt 1000 (385)			
DIN EN 60751:1996	- 200.0 to 100.0 °C	-	± 0.14 °C
	100.0 to 300.0 °C	-	± 0.18 °C
	300.0 to 630.0 °C	-	± 0.25 °C
	- 200.0 to 630.0 °C	± 0.21 °C	-
Pt 10 (385)	- 200.0 to 100.0 °C	-	± 0.84 °C
DIN EN 60751:1996	100.0 to 300.0 °C	-	± 0.95 °C
	300.0 to 630.0 °C	-	± 1.09 °C
	630.0 to 800.0 °C	-	± 1.2 °C
	- 200.0 to 800.0 °C	± 1.13 °C	-
Pt 50 (385)	- 200.0 to 100.0 °C	-	± 0,25 °C
DIN EN 60751:1996	100.0 to 300.0 °C	-	± 0,26 °C
	300.0 to 630.0 °C	-	± 0.34 °C
	630.0 to 800.0 °C	-	± 0.4 °C
	- 200.0 to 800.0 °C	± 0.33 °C	-
Pt 100(3926) + Pt 100 (3916)	- 200.0 to 100.0 °C	-	± 0.13 °C
	100.0 to 300.0 °C	-	± 0.17 °C
	300.0 to 630.0 °C	-	± 0.25 °C
	- 200.0 to 200.0 °C	± 1.13 °C	-
	200.0 to 630.0 °C	± 0.2 °C	-

RTD: works with all pulsed instrumentation transducers ≥ 5 ms.

9.4 Specifications for pressure modules

Pressure modules

Range	Tolerance	Over-Pressure	Model
Against atmospheric pressure			
0 to 20 mbar	± 0.1 %	400 %	7132-4020
0 to 67 mbar	± 0.05 %	400 %	7132-4067
0 to 350 mbar	± 0.025 %	400 %	7132-4350
0 to 500 mbar	± 0.035 %	300 %	7132-4500
0 to 700 mbar	± 0.025 %	300 %	7132-4700
0 to 2 bar	± 0.025 %	300 %	7132-5002
0 to 3.5 bar	± 0.03 %	300 %	7132-50035
0 to 7 bar	± 0.025 %	300 %	7132-5007
0 to 10 bar	± 0.035 %	200 %	7132-5010
0 to 20 bar	± 0.025 %	200 %	7132-5020
0 to 34 bar	± 0.025 %	200 %	7132-5034
0 to 70 bar	± 0.025 %	200 %	7132-5070
0 to 100 bar	± 0.035 %	200 %	7132-5100
0 to 200 bar	± 0.05 %	200 %	7132-5200
0 to 340 bar	± 0.05 %	200 %	7132-5340
0 to 700 bar	± 0.1 %	120 %	7132-5700
Vacuum			
0 to -350 mbar	± 0.025 %	400 %	7132-4350-V001
0 to -1 bar	± 0.025 %	300 %	7132-5001-V001
Absolute			
0 to 1 bar	± 0.025 %	300 %	7132-5001-V002
0 to 2 bar	± 0.025 %	300 %	7132-5002-V002
0 to 3.5 bar	± 0.03 %	300 %	7132-50035-V002
0 to 7 bar	± 0.025 %	300 %	7132-5007-V002
0 to 20 bar	± 0.025 %	200 %	7132-5020-V002
Dual pressure / Compound			
-1 to 1 bar	± 0.025 %	300 %	7132-5001-V003
-1 to 2 bar	± 0.025 %	300 %	7132-5002-V003
Difference			
0 to 350 mbar	± 0.025 %	400 %	7132-4350-V004
0 to 2 bar	± 0.025 %	300 %	7132-5002-V004
0 to 3.5 bar	± 0.03 %	300 %	7132-50035-V004

For further, comprehensive information, please see data sheet 7132 in product group 7.