



Metrology Made Simple



ADT761A Calibration Manual

ADT761A Calibration Manual

1.0 – Scope

The Additel ADT761A series are portable automated pressure calibrators designed for both field and laboratory use. These calibrators have multiple standard models (LLP, D, 500, 1K, 1.5K, BP) with a variety of ranges and accuracy to choose from. The ADT761A's innovative design contains a built-in pump, interchangeable precision pressure sensors, internal controller, and large touchscreen color display. Additional features include multiple forms of communications, data logging, and task management. Please read this document carefully before attempting to perform any type of verification or adjustment. Also ensure that the operator has the metrological expertise and equipment to perform the work.

2.0 – References

- Additel 761A User Manual
- Additel 773, 783, and 793 User Manual
- Additel 151 Digital Pressure Module Datasheet
- Additel 161 Intelligent Digital Pressure Modules Datasheet
- Additel 286 Multifunction Reference Thermometer Readout User Manual

3.0 – Recommended Equipment and Specifications

Equipment	Specifications	Recommended Model/ Item Number/Description
Pressure Controller	Applicable to the ADT761A pressure ranges	ADT773, ADT783, ADT793
Reference Standard Modules	Applicable to the ADT761A pressure ranges	ADT151, ADT161
Hoses	Applicable to the ADT761A pressure ranges	ADT100-HTK's, silicone tube, Festo tube, etc.
Connection Cables	USB cable type A to type B	1210200243
Multifunction Calibrator	Applicable to the ADT761A electrical ranges	-
Readout Device / Multimeter	Applicable to the ADT761A electrical ranges	ADT286

4.0 – Environmental Conditions

- Ideal Temperature and Humidity Conditions:
 - $23 \pm 5^{\circ}\text{C}$ with less than 80% relative humidity

5.0 – General Diagrams and Descriptions

Diagram 5.1
(Basic Structure)

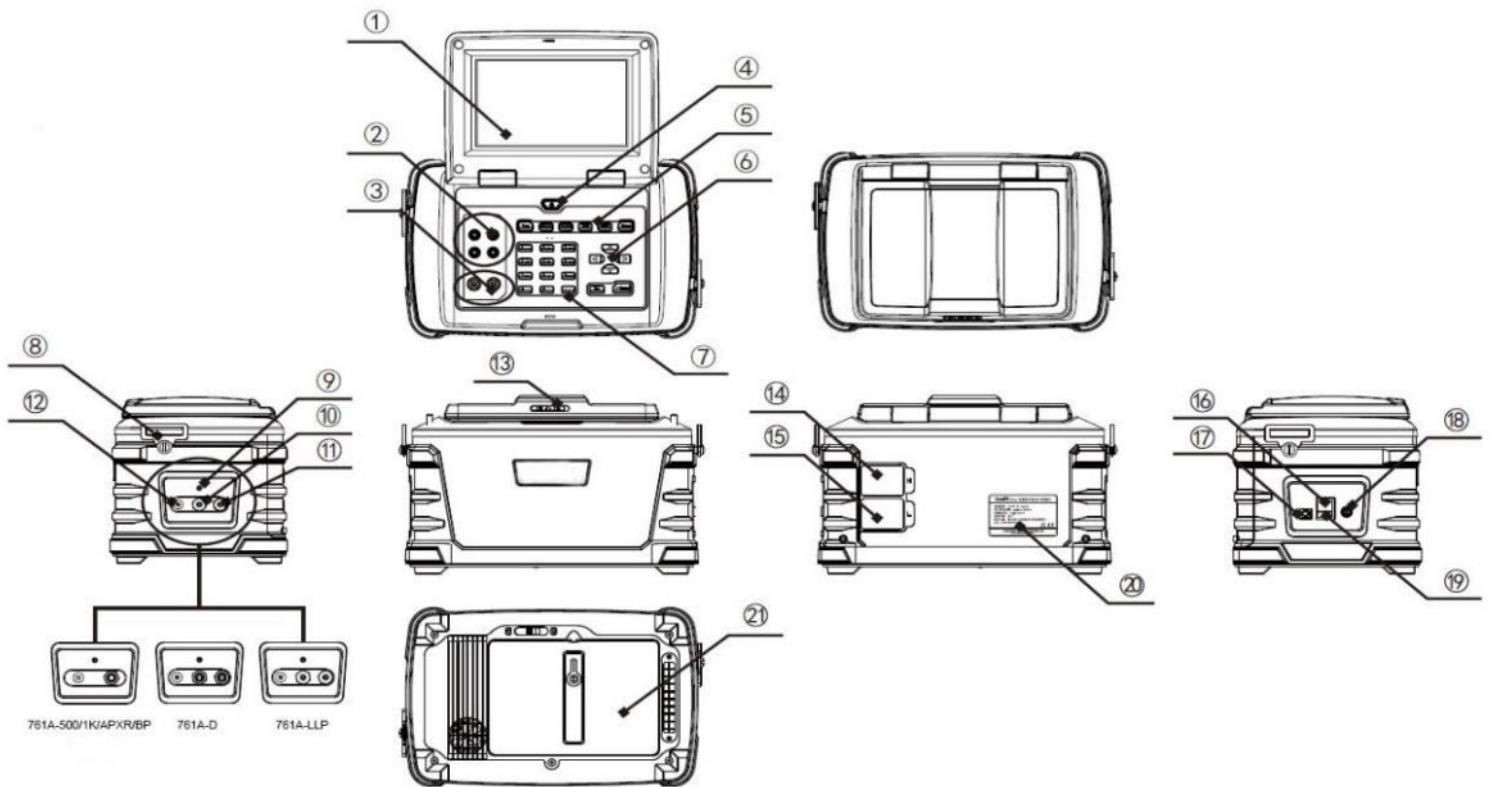


Table 5.1
(Basic Structure)

Item	Name
①	Screen
②	PC Board
③	Connector Interface
④	On/Off
⑤	Shortcut keys
⑥	Function keys
⑦	Numeric Keypad
⑧	Strap connections
⑨	Atmosphere port
⑩	REF/FLT Port
⑪	Output Port
⑫	Vent Port
⑬	Lock
⑭	High Pressure Module
⑮	Low Pressure Module
⑯	LAN Interface
⑰⑲	USB port
⑱	Power supply input
⑳	Label
㉑	Battery

Table 5.2
(5 – Shortcut Keys Description)










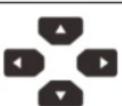

Item	Keypad	Description
1		On/Off Key: Power
2		Shortcut Key: Pressure vent
3		Shortcut Key: Pressure measurement mode
4		Shortcut Key: Pressure Controlling mode
5		Shortcut Key: Snapshot
6		Shortcut Key: Setup interface
7		Shortcut Key: Return home
8		Shortcut Key: Cancellation or Return function
9		Shortcut Key: Fulfillment or confirmation function
10		Navigate key: Up, down, left, right key
11		Numeric Key

Diagram 5.2
(Electrical & Signal Ports)

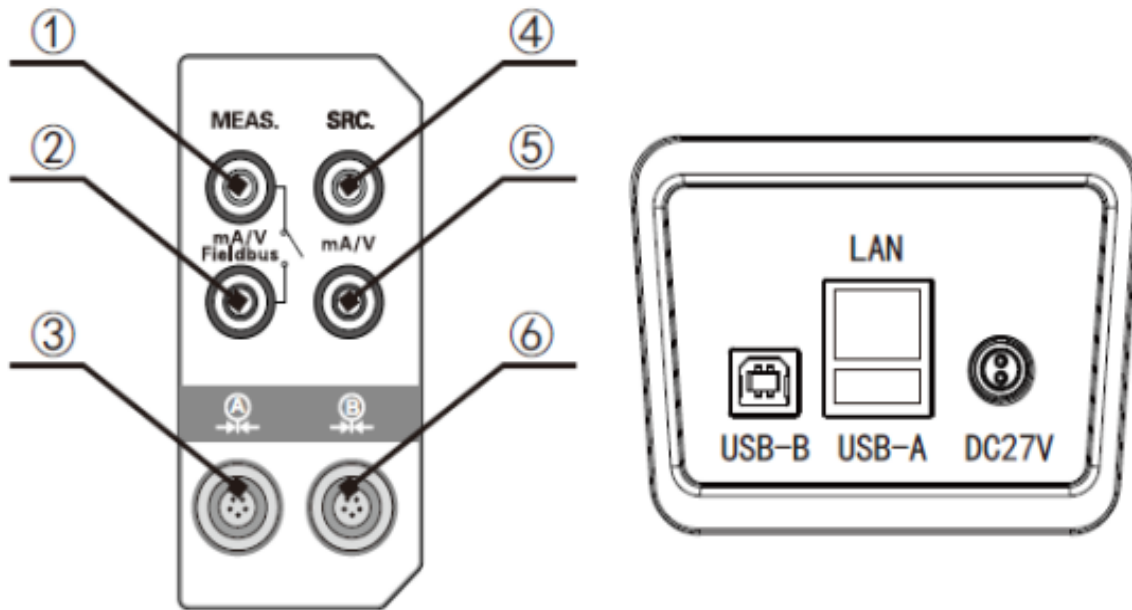


Table 5.3
(Electrical & Signal Ports)

Port	Description
①②	Current, Voltage, Switch measurement and HART, Profibus PA bus communication, Red is positive , Black is negative
④⑤	Current, Voltage and power output, Red is positive , Black is negative
③	Jack A for connecting external pressure module
⑥	Jack B for connecting external pressure module
DC27V	Power adapter connection port
LAN	Ethernet port
USB-A	USB master, for flash drive connection
USB-B	USB slave, for computer connection

6.0 – Calibration Procedure

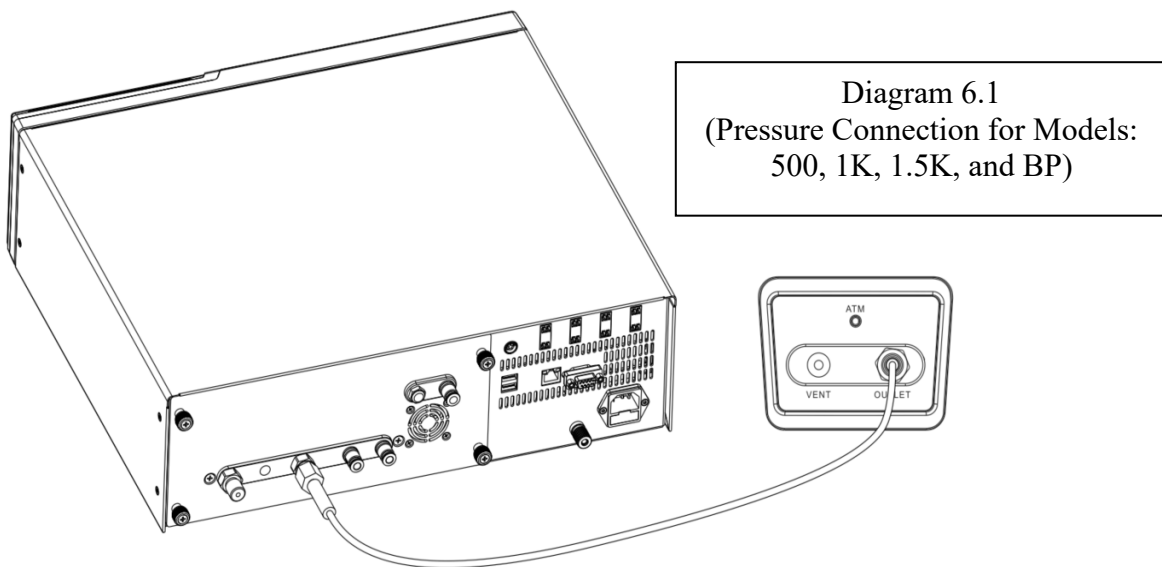
6.1 – Date & Time

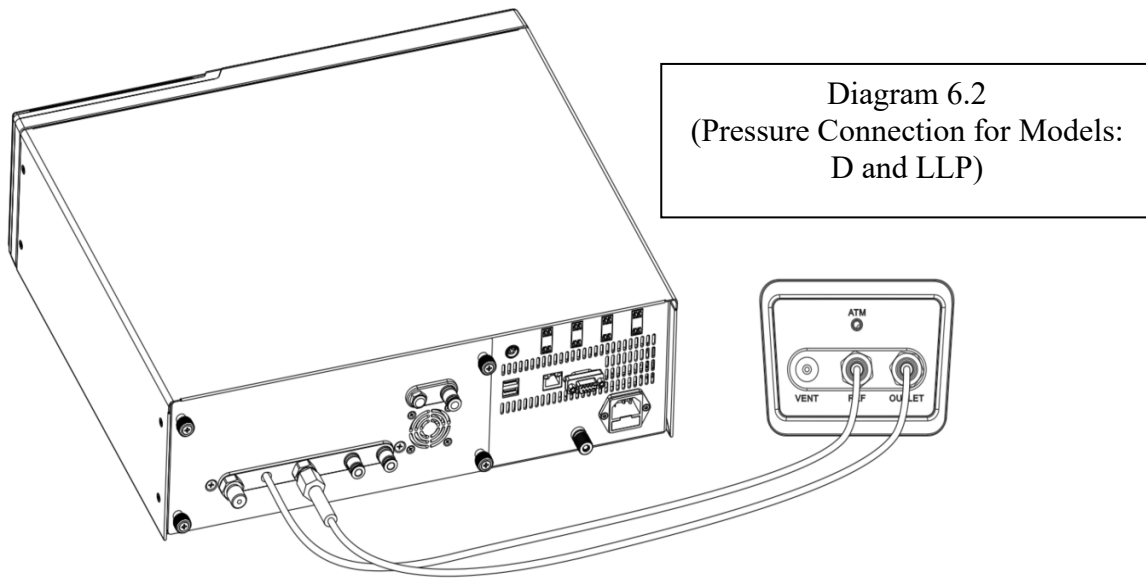
- 1) Press the **Power button** to turn the unit on.
- 2) Press the **Setup button** (shortcut keys) to enter the system settings interface.
- 3) Press **Personalization** on the touch screen display to customize certain features.
- 4) Press **Date & Time** to view the following parameters: Time, Date, Date Format, Date Separator, 24 Hour Time, and Time Zone.
- 5) If necessary, use the touch screen display to adjust any of the Date & Time parameters.
- 6) Press the **Home button** (shortcut keys) to return to the main display.

6.2 – Exercise & Zero

6.2.1 – Exercise

- 1) Connect the unit to the appropriate pressure system and ensure that all connections are sealed to prevent any pressure leakage. Refer to the following diagrams for the Pressure Connection Ports of different models.





- NOTE: Please ensure that all equipment is rated to handle the maximum pressure of the unit under test.
- 2) Ensure that the unit is set to measure pressure. If not, press **Measure** on the display or shortcut keys.
 - 3) Pressurize the system to the lower limit range of the unit and allow it to stabilize for a sufficient amount of time. Additel typically allows 60 seconds of stabilization time.
 - 4) Pressurize the system to the upper limit range of the unit and allow it to stabilize for a sufficient amount of time.
 - 5) Repeat the lower and upper limit exercise for an additional two cycles then vent the system when done.
 - 6) If the unit is unstable when controlling pressure or is slow to achieve the target pressure, try running the Auto Tune function under the Calibration options. To access Auto Tune proceed to the Setup button > Calibration > Input 123456 password > Auto Tune. Repeat the lower and upper limit exercise cycles after the Auto Tune is complete.

6.2.2 – Zero

- 1) Vent the system for a sufficient amount of time to allow any trapped gas to escape. Ensure that the unit is set to **Vent** using the touch screen display or the shortcut key.
- 2) Press the **••• icon** at the right of the main pressure display. Press the **Zero icon** from the options to manually zero the unit before pressure verification.
 - The unit should not be zeroed when in absolute pressure mode; doing so will add an offset to the test values.

6.3 – Pressure Verification

- 1) Connect the Unit Under Test - UUT (ADT761A) to the appropriate pressure system. Refer to Diagrams 6.1 and 6.2 for the pressure connections of different models.
- 2) Ensure that the correct reference standards are being used for an acceptable Test Uncertainty Ratio (TUR) and the system is sealed properly in order to prevent any leakage.
- 3) Ensure that the unit is set to **Measure** using the display or shortcut key.
- 4) Determine the test points for the appropriate range. Additel uses the following:
 - **Compound Pressure – CP** typically has 11 test points:
(-13psi, -7.25psi, 0%, 25%, 50%, 75%, 100%, 75%, 50%, 25%, 0%) max range,
Example: CP100 test points are (-13, -7.25, 0, 25, 50, 75, 100, 75, 50, 25, 0) psi
 - **Differential Pressure – DP** typically has 9 test points:
(-100%, -75%, -50%, -25%, 0%, 25%, 50%, 75%, 100%) max range
Example: DP100 test points are (-100, -75, -50, -25, 0, 25, 50, 75, 100) inH2O

- **Absolute Pressure – AP** typically has 11 test points:

(1.5psi.a, 14.5psi.a, 25%, 50%, 75% 100%, 75%, 50%, 25%, 14.5psi.a, 1.5psi.a) max range.

Example: AP100 test points are (1.5, 14.5, 25, 50, 75, 100, 75, 50, 25, 14.5, 1.5) psi.a

- **Barometric Pressure – BP** typically has 9 test points:

(60, 75, 90, 105, 110, 105, 90, 75, 60) kPa.a

- 5) Source the correct amount of pressure for each test point.
- 6) Allow appropriate time for each test point to stabilize and record each measured value.
- 7) Compare the reference and UUT test values for the pressure verification. Additel recommends maintaining less than 50% of the tolerance limit.

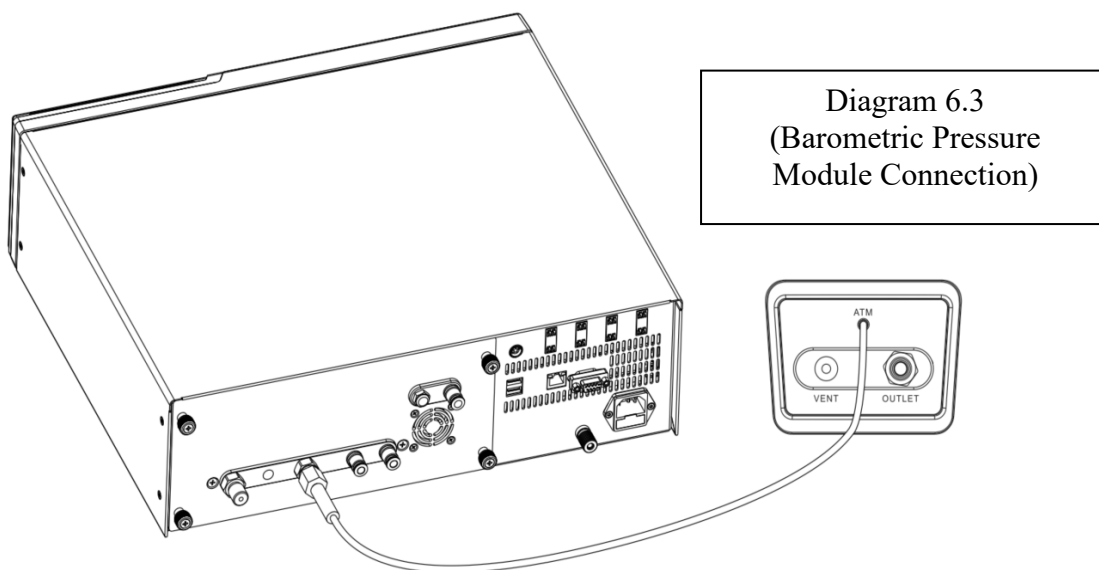
6.4 – Pressure Calibration


- 1) Press the **Setup button** (shortcut key) to enter the system settings interface.
- 2) Press **Calibration** on the touch screen display and input the Calibration Password as 123456. Press the **Check icon** (bottom right) to confirm.
- 3) Press **Pressure Modules** to select which module to calibrate.
- 4) Select the **High Pressure Range** to calibrate the high pressure sensor.
- 5) Press **Pressure Source** (top left) and select **External Pressurizing** from the drop down options.
- 6) Determine the calibration points for the appropriate range. CP and DP ranges typically have 3 calibration points: lower limit, zero, and upper limit. AP and BP ranges typically have 2 calibration points: lower limit and upper limit.
- 7) The display will show a column of the calibration points. If necessary, edit the calibration points using the touch screen display.

- 8) Press the **Play icon** (bottom right) to begin the high pressure calibration.
- 9) The display will now show three columns: Calibration Points, References, and Measured Pressure.
- 10) The lower limit row will be highlighted. Source the lower limit pressure and allow enough time to stabilize. If necessary, adjust the Reference for the lower limit using the touch screen display. Press the **Next icon** (bottom right) to confirm the lower limit calibration. Repeat this step for the zero and upper limit calibration points.
- 11) Press **OK** to save the high pressure calibration data.
- 12) The display will return to the pressure modules. Select the **Low Pressure Range** to calibrate the low pressure module.
- 13) Press **Pressure Source** and select **External Pressurizing** from the drop down options.
- 14) Determine and edit the calibration points, if necessary, using the touch screen display.
- 15) Press the **Play icon** to begin the low pressure calibration.
- 16) The lower limit row will be highlighted. Source the lower limit pressure and allow enough time to stabilize. If necessary, adjust the Reference for the lower limit using the touch screen display. Press the **Next icon** to confirm the lower limit calibration. Repeat this step for the zero and upper limit calibration points.
- 17) Press **OK** to save the low pressure calibration data.
- 18) Press the **Home button** (shortcut key) to return to the main pressure display.
- 19) Repeat the Zero procedure (6.2.2) and Pressure Verification (6.3).

6.5 – Barometer Verification

- 1) Connect the unit's Barometer (BP) – ATM port to the appropriate barometer pressure system using a blue Festo hose (4mm). Refer to the following diagram for the BP Module Connection.



- 2) Press the **unit of measurement** on the main pressure display and select **kPa** to change it.
- 3) To view the unit's BP reading, press  at the top of the display to access the Control Center. The Barometric reading is found under the ATM icon, measured in kPa.a.
- 4) Determine the test points for barometric pressure. Additel typically uses 4 test points for BP testing: (60, 80, 100, 110) kPa.a
- 5) Source the correct amount of pressure for each test point.
- 6) Allow appropriate time for each test point to stabilize and record each measured value.
Additel sets the barometric test tolerance at $\pm 55\text{Pa}$.
- 7) Compare the reference and UUT test values for barometer verification. Additel recommends maintaining less than 50% of the tolerance limit.

6.6 – Barometer Calibration

- 1) Press the **Setup button** to enter the system settings interface.
- 2) Press **Calibration** on the touch screen display and input the Calibration Password as 123456. Press the **Check icon** to confirm.
- 3) Press **Pressure Modules** to select which module to calibrate.
- 4) Select **Barometer** to calibrate the internal barometric sensor.
- 5) Select **Dual Point Calibration**. BP typically has 2 calibration points: 60kPa.a for the lower limit and 110kPa.a for the upper limit.
- 6) The display will show three columns: Calibration Points, References, and Measured Pressures. If necessary, adjust the calibration points using the touch screen display.
- 7) Press the **Play icon** to begin the BP calibration procedure.
- 8) The lower limit row will be highlighted. Source the lower limit pressure and allow enough time to stabilize. If necessary, adjust the Reference for the lower limit using the touch screen display. Press the **Next icon** to confirm the lower limit calibration. Repeat this step for the upper limit calibration.
- 9) Press **OK** to save the barometer calibration data.
- 10) Press the **Home button** to return to the main pressure display.
- 11) Vent the system and repeat the Barometer Verification (6.5).

6.7 – Electrical Verification

- 1) To show the electrical functions on the main display, ensure that the **input (measure)**



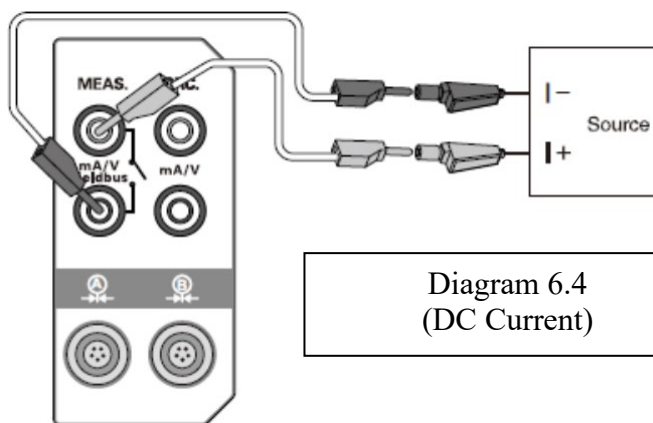
icon and **output (source)**



icon located at the top of the screen are

highlighted. Press these icons to toggle their display ON and OFF.

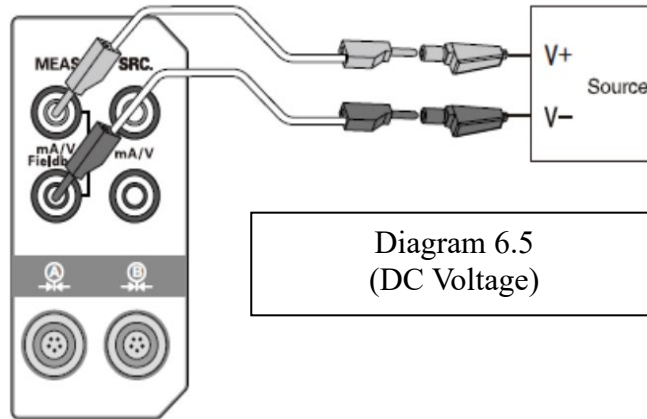
- 2) Press the **input icon** on the left side of the display and select **(-50~50) mA** to measure the DC Current. Ensure that the unit is wired correctly to measure current as shown in the following diagram.



- 3) Before testing DC Current, press the **Zero icon** at the right of the input section. Press the **Zero icon** to manually zero the unit before electrical verification.
- 4) DC Current typically has 8 test points as shown in the table below. Source the correct amount of current for each point. Allow appropriate time for each test point to stabilize and record each measured value.

DC Current (-50~50)mA	
Test Point (mA)	Specification (mA)
-50	± 0.0060
-25	± 0.0030
-10	± 0.0018
0	± 0.0010
4	± 0.0013
10	± 0.0018
25	± 0.0030
50	± 0.0060

- 5) Compare the reference and UUT test values of DC Current. Additel recommends maintaining less than 50% of the tolerance limit.
- 6) Press the **input icon** and select **(-30~30) V** to measure the DC Voltage (V). Ensure that the unit is wired correctly to measure voltage as shown in the following diagram.



- 7) Before testing DC Voltage, press the **••• icon** at the right of the input section. Press the **Zero icon** to manually zero the unit before electrical verification.
- 8) DC Voltage (V) typically has 8 test points as shown in the table below. Source the correct amount of voltage for each point. Allow appropriate time for each test point to stabilize and record each measured value.

DC Voltage (-30~30)V	
Test Point (V)	Specification (V)
-30	± 0.0024
-12	± 0.0012
-5	± 0.0005
0	± 0.0001
1	± 0.0002
5	± 0.0005
12	± 0.0012
30	± 0.0024

- 9) Compare the reference and UUT test values of DC Voltage (V). Additel recommends maintaining less than 50% of the tolerance limit.

10) Press the **input icon** and select **(-300~300) mV** to measure the DC Voltage (mV).

Ensure that the unit is wired correctly to measure voltage. Refer to Diagram 6.5.

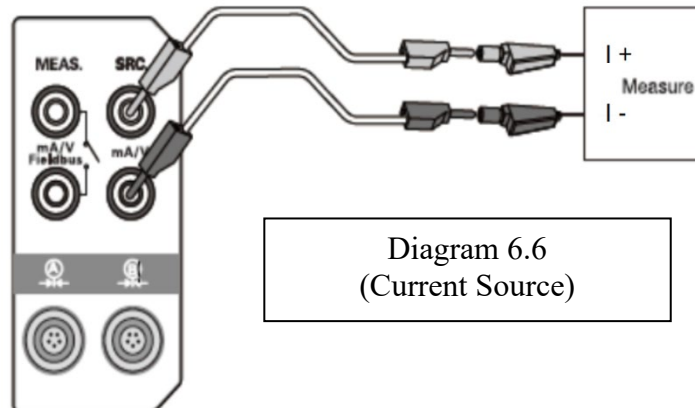
11) Before testing DC Voltage, press the **••• icon** at the right of the input section. Press the **Zero icon** to manually zero the unit before electrical verification.

12) DC Voltage (mV) typically has 5 test points as shown in the table below. Source the correct amount of voltage for each point. Allow appropriate time for each test point to stabilize and record each measured value.

DC Voltage (-300~300)mV	
Test Point (mV)	Specification (mV)
-300	± 0.0300
-150	± 0.0180
0	± 0.0060
150	± 0.0180
300	± 0.0300

13) Compare the reference and UUT test values of DC Voltage (mV). Additel recommends maintaining less than 50% of the tolerance limit.

14) Press the **output icon** on the left side of the display and select **(0~25) mA** to output the Current Source. Ensure that the unit is wired correctly to output current.

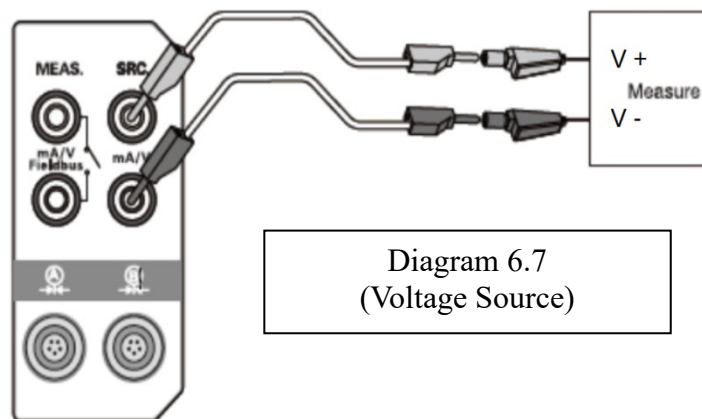


15) Current Source typically has 7 test points as shown in the table below. Source the correct amount of current for each point. Allow appropriate time for each test point to stabilize and record each measured value.

Current Source (0~25)mA	
Test Point (mA)	Specification (mA)
0.1	± 0.0002
1.0	± 0.0003
2.5	± 0.0004
4.0	± 0.0013
12.0	± 0.0020
20.0	± 0.0026
25.0	± 0.0030

16) Compare the reference and UUT test values of Current Source. Additel recommends maintaining less than 50% of the tolerance limit.

17) Press the **output icon** on the left side of the display and select **(0~16) V** to output the Voltage Source. Ensure that the unit is wired correctly to output voltage as shown in the following diagram.



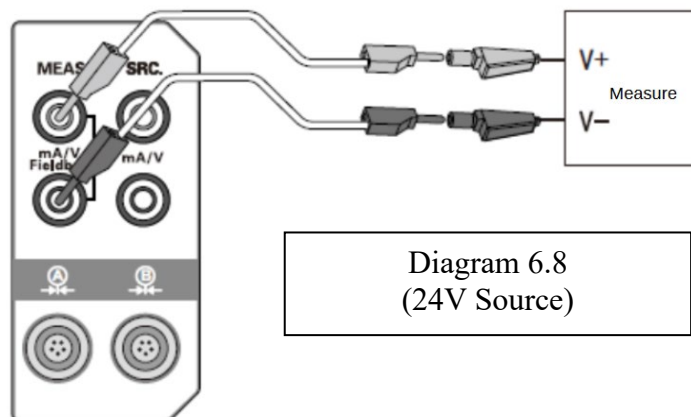
18) Voltage Source typically has 5 test points as shown in the table below. Source the correct amount of voltage for each point. Allow appropriate time for each test point to stabilize and record each measured value.

Voltage Source (0~16)V	
Test Point (V)	Specification (V)
0.1	± 0.0005
1.0	± 0.0006
5.0	± 0.0009
10.0	± 0.0013
16.0	± 0.0018

- 19) Compare the reference and UUT test values of Voltage Source. Additel recommends maintaining less than 50% of the tolerance limit.
- 20) Press the **output icon** on the left side of the display and select **(16~30) V** to output the Power Supply Source. Ensure that the unit is wired correctly to output voltage. Refer to Diagram 6.7.
- 21) Power Supply Source typically has 4 test points as shown in the table below. Source the correct amount of voltage for each point. Allow appropriate time for each test point to stabilize and record each measured value.

Power Supply Source (16~30)V	
Test Point (V)	Specification (V)
16	± 1
24	± 1
28	± 1
30	± 1

- 22) Compare the reference and UUT test values of Power Supply Source. Additel recommends maintaining less than 50% of the tolerance limit.
- 23) Press the **input icon** on the left side of the display and select **(-50~50) mA** to measure the 24V Source. Ensure that the unit is wired correctly to measure loop power as shown in the following diagram.



24) 24V Source only has 1 test point as shown in the table below. 24V Source can be toggled ON by pressing the **••• icon** at the right of the input section and selecting **Enable Loop Power**. Allow appropriate time for the test point to stabilize and record the measured value.

24V Source	
Test Point (V)	Specification (V)
24	± 1

25) Compare the reference and UUT test values for 24V Source. Additel recommends maintaining less than 50% of the tolerance limit.

6.8 – Electrical Calibration

- 1) Press the **Setup button** to enter the system settings interface.
- 2) Press **Calibration** on the touch screen display and input the Calibration Password as 123456. Press the **Check icon** to confirm.
- 3) Press **Electrical** to view the electrical calibration options. Note: Power Supply Source and 24V Source are unable to undergo electrical calibration.
- 4) Press **(-50~50) mA** to calibrate DC Current. Ensure that the electrical system is wired to measure current. Refer to Diagram 6.4.
- 5) The display will show three columns: Calibration Ranges, Calibration Points, and Actual Values. DC Current typically has 10 calibration points total: 5 for the range (-25~25) mA and 5 for the range (-50~50) mA. Adjust the calibration points, if necessary, using the touch screen display.
- 6) Press the **Play icon** to begin the DC Current calibration.
- 7) A calibration point will be highlighted. Source the correct amount of current for that point and allow enough time to stabilize. Press the **Next icon** to proceed. Repeat this step for each of the calibration points as they are highlighted.
- 8) Press the **Save icon** (bottom right) and **OK** to save the DC Current calibration data.
Press the **Back icon** (top right) to return to the Electrical calibration options.
- 9) Press **(-30~30) V** to calibrate DC Voltage (V). Ensure that the electrical system is wired to measure voltage. Refer to Diagram 6.5.
- 10) The display will show three columns: Calibration Ranges, Calibration Points, and Actual Values. DC Voltage (V) typically has 15 calibration points total: 5 for the range (-30~30) V, 5 for the range (-12~12) V, and 5 for the range (-5~5) V. Adjust the calibration points, if necessary.

- 11) Press the **Play icon** to begin the DC Voltage (V) calibration.
- 12) A calibration point will be highlighted. Source the correct amount of voltage for that point and allow enough time to stabilize. Press the **Next icon** to proceed. Repeat this step for each of the calibration points as they are highlighted.
- 13) Press the **Save icon** and **OK** to save the DC Voltage (V) calibration data. Press the **Back icon** to return to the Electrical calibration options.
- 14) Press **(-300~300) mV** to calibrate DC Voltage (mV). Ensure that the electrical system is wired to measure voltage. Refer to Diagram 6.5.
- 15) The display will show three columns: Calibration Range, Calibration Points, and Actual Values. DC Voltage (mV) typically has 5 calibration points. Adjust the calibration points, if necessary.
- 16) Press the **Play icon** to begin the DC Voltage (mV) calibration.
- 17) A calibration point will be highlighted. Source the correct amount of voltage for that point and allow enough time to stabilize. Press the **Next icon** to proceed. Repeat this step for each of the calibration points as they are highlighted.
- 18) Press the **Save icon** and **OK** to save the DC Voltage (mV) calibration data. Press the **Back icon** to return to the Electrical calibration options.
- 19) Press **(0~16) V** to calibrate Voltage Source. Ensure that the electrical system is wired to source voltage. Refer to Diagram 6.7.
- 20) The display will show three columns: Calibration Range, Calibration Points, Actual Value. Voltage Source typically has 5 calibration points. If necessary, adjust the calibration points.
- 21) Press the **Play icon** to begin the Voltage Source calibration.
- 22) The unit will source the amount of voltage based on the highlighted calibration point. Allow enough time to stabilize. Using the touch screen display, adjust the Actual Value

on the unit to match the reading of the readout device. Press the **Next icon** to proceed.

Repeat this step for each of the calibration points as they are highlighted.

- 23) Press the **Save icon** and **OK** to save the Voltage Source calibration data. Press the **Back icon** to return to the Electrical calibration option.
- 24) Press **(0~25) mA** to calibrate Current Source. Ensure that the electrical system is wired to source current. Refer to Diagram 6.6.
- 25) The display will show three columns: Calibration Ranges, Calibration Points, and Actual Values. Current Source typically has 8 calibration points total: 3 for the range (0~2.5) mA and 5 for the range (0~25) mA. If necessary, adjust the calibration points.
- 26) Press the **Play icon** to begin the Current Source calibration.
- 27) The unit will source the amount of current based on the highlighted calibration point.
Allow enough time to stabilize. Using the touch screen display, adjust the Actual Value on the unit to match the reading of the readout device. Press the **Next icon** to proceed.
Repeat this step for each of the calibration points as they are highlighted.
- 28) Press the **Save icon** and **OK** to save the Current Source calibration data. Press the **Home button** to return main electrical display.
- 29) Repeat the Electrical Verification (6.7).