



Metrology Made Simple



ADT226Ex / ADT227Ex Calibration Manual

ADT226Ex & ADT227Ex Calibration Manual

Table of Contents

1.0 - Scope.....	2
2.0 - References.....	2
3.0 - Environmental Conditions.....	2
4.0 - General Diagram and Description.....	2
5.0 - Recommended Equipment and Specifications.....	3
6.0 - Date & Time.....	4
7.0 - Zero Procedure.....	4
8.0 - Electrical Verification.....	4
8.1 - DC Voltage Verification.....	4
8.2 - Loop Power Output Verification.....	6
8.3 - DC Current Verification.....	6
8.4 - Resistance Verification.....	7
8.5 - Frequency Verification.....	9
8.6 - TC Verification.....	10
9.0 - Barometer Verification.....	13
10.0 - Electrical Calibration.....	14
10.1 - DC Voltage Measure Calibration.....	14
10.2 - DC Current Measure Calibration.....	15
10.3 - Frequency Measure Calibration.....	15
10.4 - DC Current Source Calibration.....	16
10.5 - DC Voltage Source Calibration.....	16
10.6 - Frequency Source Calibration.....	17
10.7 - TC Measure Calibration.....	17
10.8 - Resistance Measure Calibration.....	18
10.9 - TC Source Calibration.....	18
10.10 - Resistance Source Calibration.....	19
10.11 - CJC Calibration.....	20
11.0 - Barometer Calibration.....	21

1.0 - Scope

The Additel ADT226Ex and ADT227Ex are a series of multifunctional process calibrators. These calibrators have the capability of sourcing, simulating and measuring pressure, temperature, and electrical signals. Other features include a built in Barometer, USB type C and Bluetooth communications, dual channel pressure module ports, and a touch screen color display. The ADT227Ex also has the option of enabling full HART communication. These devices ATEX certified and intrinsically safe, allowing operators to perform calibrations in the harshest of environments. 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

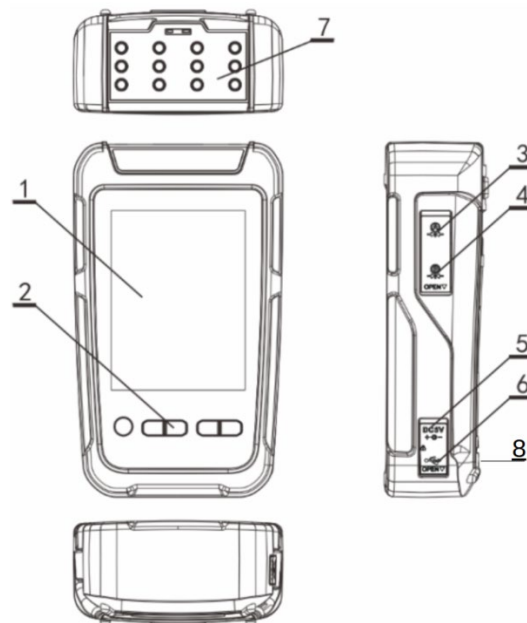
- Additel 286 Multifunction Reference Thermometer Readout User Manual
- Additel 875 Dry Well Calibrator User Manual
- Additel 761A User Manual

3.0 - Environmental Conditions

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

4.0 - General Diagram and Description

No.	Part Name	Function
1	Touch Screen Display	Navigate the display area by touch screen.
2	Keys	Power, Home, Status and Navigation buttons.
3	LEMO Type Connection A	Connects to an external pressure module.
4	LEMO Type Connection B	Connects to an external pressure module.
5	Power Adapter Port	Connects to the power supply.
6	USB Type C Port	Connects to the USB communication.
7	Electrical Measurement Plugs	Connects to cables for electrical measurements.
8	Barometer (ATM) Port	Connects to Festo hose for Barometer testing.



5.0 - Recommended Equipment and Specifications

Equipment	Specification/ Description	Recommended Model/ Item Number
Electrical Calibrator	Applicable to the ADT226/227 electrical ranges/accuracy	Fluke 5720A or equivalent
Electrical Readout	Applicable to the ADT226/227 electrical ranges/accuracy	ADT286
Resistance Decade Box	Applicable to ADT226/227 resistance ranges/accuracy	-
Waveform Generator	Applicable to the ADT226/227 frequency ranges/accuracy	Keysight 33512B or equivalent
Frequency Counter	Applicable to the ADT226/227 frequency ranges/accuracy	Keysight 53220A or equivalent
Temperature Source	Applicable to the ADT226/227 temperature ranges/accuracy	ADT875PC-155
Temperature Reference	Applicable to the ADT226/227 temperature ranges/accuracy	AM1710-12-ADT
Thermocouple	Characterized Type E	-
Pressure Calibrator	Applicable to ADT226/227 barometer specification	ADT761A-BP
Electrical Cable Connection	Red and black banana jack test leads	9022
Special TC Cable Connection	Banana jack to copper TC mini connector	-
Temperature Cable Connection	Bare wire to copper TC mini connector (Type E)	9080
Temperature Insert	Low temperature insert, insulation piece and plugs	ADT110-875-L-INSERT-C
Pressure Hose Connection	Festo hose (4mm)	-

6.0 - Date & Time

- 1) Hold the **Power Button** (bottom keys) to turn the unit ON.
- 2) Press the **Home Icon** (top left) on the display or the **Home Button** (bottom keys) to display the main interface options.
- 3) Press **Setup** (bottom right) then press **Personalization**.
- 4) Press **Date & Time** to view the following parameters: Date, Time, Date Format, Separator, and 24-Hour Time. If necessary, use the touch screen display to adjust any of these parameters.
- 5) Press the **Home Button** to return to the main interface. Press **Calibrator** (bottom left) to display the main calibration functions.

7.0 - Zero Procedure

On the Calibrator display, a Zero Icon is shown on the right side of the Measurement section for certain functions. If necessary, press the **Zero Icon** prior to starting electrical measurements to remove any offset.

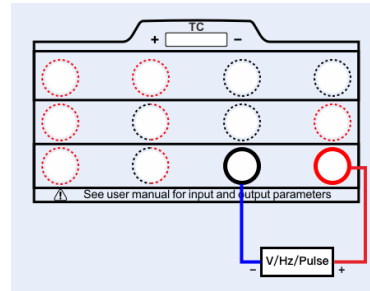
8.0 - Electrical Verification

The top half of the Calibrator screen displays the Measurement (input) functions while the bottom half displays the Source (output) functions. The Measure and Source icons (left) can be pressed to change functionality between voltage, current, frequency, TC, RTD, etc.

8.1 - DC Voltage Verification

1) Press the **Source Icon** and select **(0~10.5)V** to source DC Voltage. Connect the unit according to the diagram.

Diagram 8.0
(DC Voltage Source)

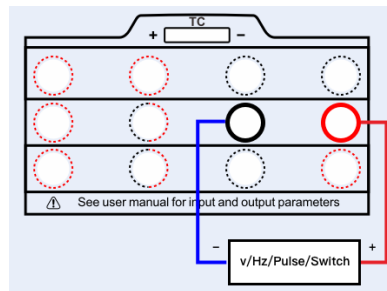


2) Verify the values in the table.

DC Voltage Source (0~10.5)V		
Test Point (V)	Spec - 226Ex (V)	Spec - 227Ex (V)
0.1	± 0.0008	± 0.0008
5	± 0.0018	± 0.0013
10	± 0.0028	± 0.0018

3) Press the **Measure Icon** and select **(-30~30)V** to measure DC Voltage. Connect the unit according to the diagram. Press the **Zero Icon** (right) prior to taking measurements.

Diagram 8.1
(DC Voltage Measure)



4) Verify the values in the table.

DC Voltage Measure (-30~30)V		
Test Point (V)	Spec - 226Ex (V)	Spec - 227Ex (V)
-30	± 0.0075	± 0.0045
0	± 0.0015	± 0.0015
30	± 0.0075	± 0.0045

5) Press the **Measure Icon** and select **(-300~300)mV** to measure DC Voltage. Press the **Zero Icon** prior to taking measurements.

6) Verify the values in the table.

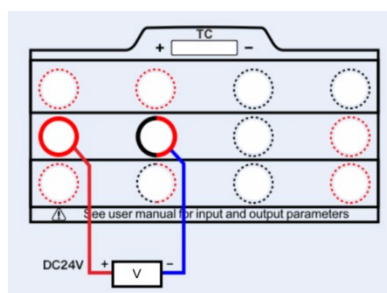
DC Voltage Measure (-300~300)mV		
Test Point (mV)	Spec - 226Ex (mV)	Spec - 227Ex (mV)
-300	± 0.075	± 0.045
0	± 0.015	± 0.015
300	± 0.075	± 0.045

8.2 - Loop Power Output Verification

1) Press the **Status Button** (keys) next to the Home Button. Press the **24V Icon** to enable loop power.

Connect the unit according to the diagram.

Diagram 8.2
(Loop Power Output)



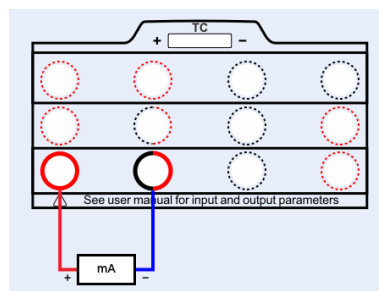
2) Verify the values in the table.

Loop Power Output		
Test Point (V)	Spec - 226Ex (V)	Spec - 227Ex (V)
20	± 2.20	± 2.20

8.3 - DC Current Verification

1) Press the **Source Icon** and select **(0~25)mA** to source DC Current. Connect the unit according to the diagram.

Diagram 8.3
(DC Current Source)

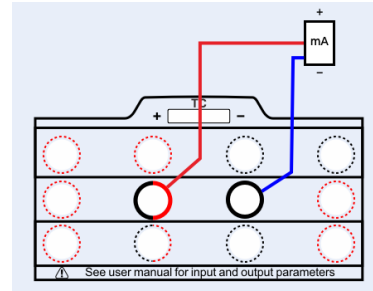


2) Verify the values in the table.

DC Current Source (0~25)mA		
Test Point (mA)	Spec - 226Ex (mA)	Spec - 227Ex (mA)
0	± 0.0013	± 0.0013
10	± 0.0033	± 0.0023
25	± 0.0063	± 0.0038

3) Press the **Measure Icon** and select **(-30~30)mA** to measure DC Current. Connect the unit according to the diagram. Press the **Zero Icon** prior to taking measurements.

Diagram 8.4
(DC Current Measure)



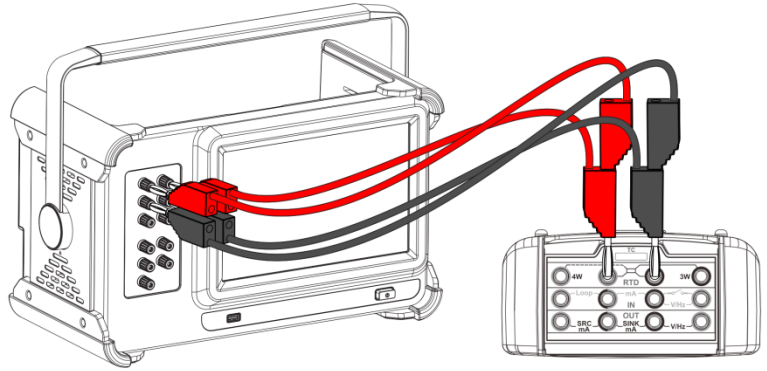
4) Verify the values in the table.

DC Current Measure (-30~30)mA		
Test Point (mA)	Spec - 226Ex (mA)	Spec - 227Ex (mA)
-30	± 0.0075	± 0.0045
0	± 0.0015	± 0.0015
30	± 0.0075	± 0.0045

8.4 - Resistance Verification

1) Press the **Source Icon** and select **RTD** to source Resistance. Press the **Setup Icon** on the right and press **Settings**. Select Ω as the Sensor type and **400 Ω** for the Range then press the **Check Icon** to confirm. Connect the unit according to the diagram. Note: A 2 wire setup from the unit is connected to a 4 wire setup from the readout device.

Diagram 8.5
(Resistance Source)



2) Verify the values in the table.

Resistance Source (0~400) Ω		
Test Point (Ω)	Spec - 226Ex (Ω)	Spec - 227Ex (Ω)
25	± 0.025	± 0.023
100	± 0.040	± 0.030
200	± 0.060	± 0.040
400	± 0.100	± 0.060

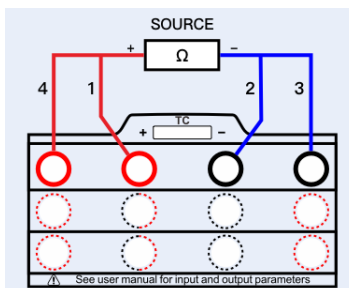
3) Press the **Setup Icon** on the right and press **Settings**. Select **Ω** as the Sensor type and **4000 Ω** for the Range then press the **Check Icon** to confirm.

4) Verify the values in the table.

Resistance Source (0~4000) Ω		
Test Point (Ω)	Spec - 226Ex (Ω)	Spec - 227Ex (Ω)
25	± 0.21	± 0.20
400	± 0.28	± 0.24
1000	± 0.40	± 0.30
2000	± 0.60	± 0.40
4000	± 1.00	± 0.60

5) Press the **Measure Icon** and select **RTD** to measure Resistance. Press the **Setup Icon** on the right and press **Settings**. Select **Ω** as the Sensor type, **4** for the Wires, and **400 Ω** as the Range. Press the **Check Icon** to confirm. Connect the unit according to the diagram.

Diagram 8.6
(Resistance Measure)



6) Verify the values in the table.

Resistance (4 Wire) Measure (1~400) Ω		
Test Point (Ω)	Spec - 226Ex (Ω)	Spec - 227Ex (Ω)
25	± 0.025	± 0.023
100	± 0.040	± 0.030
200	± 0.060	± 0.040
400	± 0.100	± 0.060

7) Press the **Measure Icon** and select **RTD** to measure Resistance. Press the **Setup Icon** on the right and press **Settings**. Select **Ω** as the Sensor type, **4** for the Wires, and **4000 Ω** as the Range. Press the **Check Icon** to confirm.

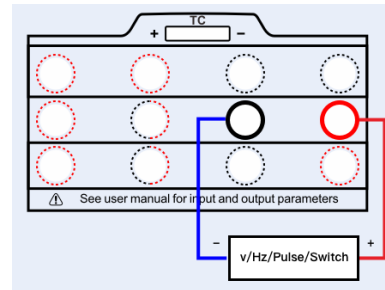
8) Verify the values in the table.

Resistance (4 Wire) Measure (1~4000) Ω		
Test Point (Ω)	Spec - 226Ex (Ω)	Spec - 227Ex (Ω)
25	± 0.21	± 0.20
400	± 0.28	± 0.24
1000	± 0.40	± 0.30
2000	± 0.60	± 0.40
4000	± 1.00	± 0.60

8.5 - Frequency Verification

1) Press the **Measure Icon** and select **(0.01~50K)Hz** to measure Frequency. Connect the unit according to the diagram.

Diagram 8.7
(Frequency Measure)

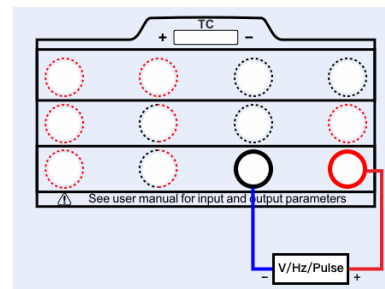


2) Verify the values in the table.

Frequency Measure (0.01~50,000)Hz		
Test Point (Hz)	Spec - 226Ex (Hz)	Spec - 227Ex (Hz)
100	± 0.007	± 0.004
1,000	± 0.070	± 0.040
50,000	± 2.700	± 1.200

3) Press the **Source Icon** and select **(0.01~50K)Hz** to source Frequency. Using the **Setup Icon** on the right, press **Scaling** to set the Transfer function as Square then press the **Check Icon** to confirm. Using the **Setup Icon** again, press **Settings** to set the Amplitude as 5V then press the **Check Icon**. Connect the unit according to the diagram.

Diagram 8.8
(Frequency Source)



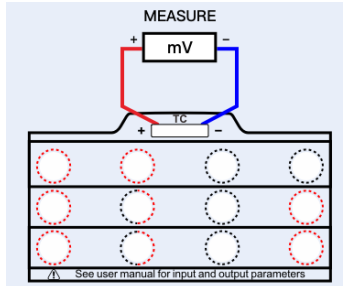
4) Verify the values in the table.

Frequency Source Square (0.1~50,000)Hz		
Test Point (Hz)	Spec -226Ex (Hz)	Spec -227Ex (Hz)
100	± 0.007	± 0.004
1,000	± 0.070	± 0.040
50,000	± 2.700	± 1.200

8.6 - TC Verification

1) Press the **Source Icon** and select **TC** to source Thermocouple. Press **Setup Icon** on the right and press **Settings**. Select **mV** as the Sensor type then press the **Check Icon** to confirm. Connect the unit to the electrical readout device using the banana jack to copper TC mini connector wire.

Diagram 8.9
(TC Source)

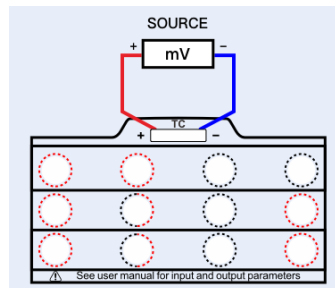


2) Verify the values in the table.

TC Voltage Source (-10~75)mV		
Test Point (mV)	Spec - 226Ex (mV)	Spec - 227Ex (mV)
-10	± 0.0058	± 0.0040
0	± 0.0038	± 0.0030
75	± 0.0188	± 0.0105

3) Press the **Measure Icon** and select **TC** to measure Thermocouple. Press the **Setup Icon** on the right and press **Settings**. Select **mV** as the Sensor type then press the **Check Icon** to confirm. Connect the unit to the electrical source device using the banana jack to copper TC mini connector wire.

Diagram 8.10
(TC Measure)

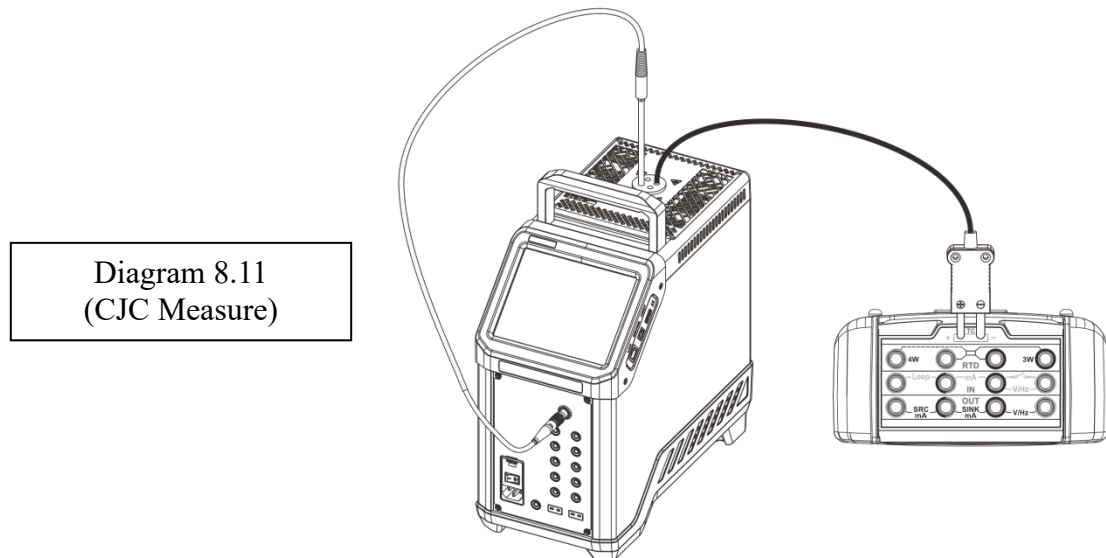


4) Verify the values in the table.

TC Voltage Measure (-10~75)mV		
Test Point (mV)	Spec - 226Ex (mV)	Spec - 227Ex (mV)
-10	± 0.0058	± 0.0040
0	± 0.0038	± 0.0030
75	± 0.0188	± 0.0105

5) Press the **Measure Icon** and select **TC** to measure Thermocouple. Press **Setup Icon** on the right and press **Settings**. Select **K** as the Sensor type, **Auto** as the Reference Junction, **°C** as the Temperature unit, and **0.001** as the Resolution. Press the **Check Icon** to confirm. Additel uses a temperature source (ADT875PC-155), reference probe (AM1710-12-ADT), and a characterized Type E Thermocouple for Cool Junction Compensation (CJC).

6) Connect the unit according to the diagram. Insert and plug in the reference probe into the temperature source to get an external (EXT) readout value. Insert one end of the Type E cable (bare wire) into the temperature source and set the internal (INT) temperature of the drywell to 20.0°C. Connect the other end of the Type E cable (TC connection) into the 226Ex/227Ex and allow enough time for the temperature to stabilize.



7) Verify the values in the table.

CJC Measure (Type E)		
Test Point (°C)	Spec - 226 (°C)	Spec - 227 (°C)
20.0	± 0.15	± 0.15

9.0 - Barometer Verification

- 1) Press the **Status Button** from the front display keys. This button will display information such as the date, barometric pressure, temperature, battery life, etc. The Barometer pressure (BP) is indicated by the kPa value.
- 2) Lift the rubber ATM (atmosphere) flap on the back of the unit to reveal the hose connection. Using a blue Festo hose (4mm), connect the barometer pressure system to the unit's ATM port.
- 3) Verify the values in the table.

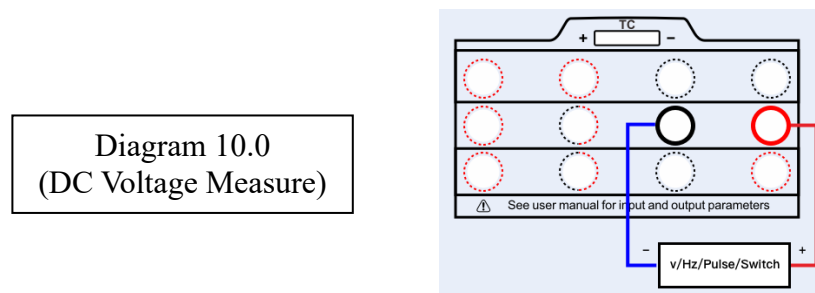
Barometric Pressure Sensor (60~110)kPa.a		
Test Point (kPa.a)	Spec - 226Ex (kPa.a)	Spec - 227Ex (kPa.a)
60	± 0.055	± 0.055
80	± 0.055	± 0.055
100	± 0.055	± 0.055
110	± 0.055	± 0.055

10.0 - Electrical Calibration

- 1) Press the **Home Icon/Button** > **Setup** > **Calibration**.
- 2) Input the Password as **123456** then press the **Check Icon** to confirm.
- 3) Icons on the left side are indicated with a left arrow for input/measure or a right arrow for output/source.

10.1 - DC Voltage Measure Calibration

- 1) Press **Input (-30~30)V** to calibrate DC Voltage Measure. Connect the unit according to the diagram.

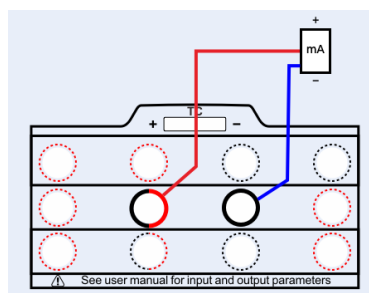


- 2) Press **Start** to begin the calibration for DC Voltage Measure.
- 3) Source the voltage for the first calibration point. If necessary, press the Reference number to edit the value. Press **Next** to record an Indication Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 4) Press **Yes** to save the calibration data for DC Voltage Measure ($\pm 30V$).
- 5) Press **Input (-300~300)mV** to calibrate DC Voltage Measure.
- 6) Press **Start** to begin the calibration for DC Voltage Measure.
- 7) Source the voltage for the first calibration point. If necessary, press the Reference number to edit the value. Press **Next** to record an Indication Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 8) Press **Yes** to save the calibration data for DC Voltage Measure ($\pm 300mV$).

10.2 - DC Current Measure Calibration

1) Press **Input (-30~30)mA** to calibrate DC Current Measure. Connect the unit according to the diagram.

Diagram 10.1
(DC Current Measure)

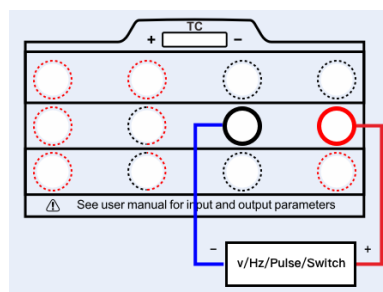


- 2) Press **Start** to begin the calibration for DC Current Measure.
- 3) Source the current for the first calibration point. If necessary, press the Reference number to edit the value. Press **Next** to record an Indication Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 4) Press **Yes** to save the calibration data for DC Current Measure ($\pm 30\text{mA}$).

10.3 - Frequency Measure Calibration

1) Press **Input (0.01~50k)Hz** to calibrate Frequency Measure. Connect the unit according to the diagram.

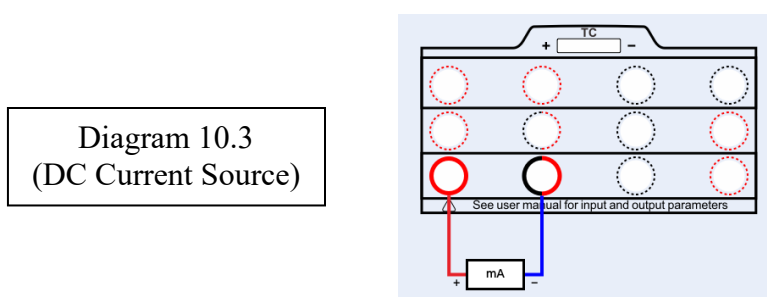
Diagram 10.2
(Frequency Measure)



- 2) Press **Start** to begin the calibration for Frequency Measure.
- 3) Source the frequency for the calibration point. If necessary, press the Reference number to edit the value. Press **Finish** after the calibration point has been recorded.
- 4) Press **Yes** to save the calibration data for Frequency Measure (0.01~50k)Hz.

10.4 - DC Current Source Calibration

1) Press **Output (0~25)mA** to calibrate DC Current Source. Connect the unit according to the diagram.



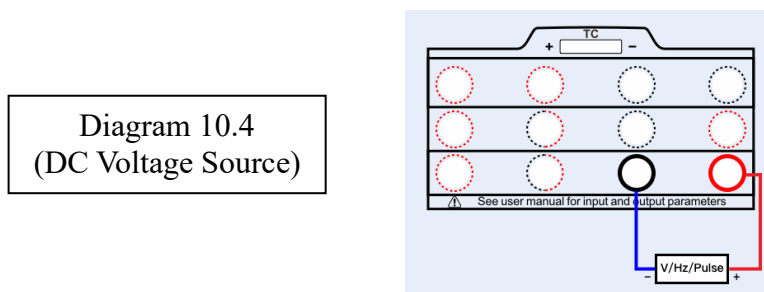
2) Press **Start** to begin the calibration for DC Current Source.

3) The unit will source for the first calibration point. Press the Reference number and edit the value to match that of the readout device. Press **Next** to record a Reference Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.

4) Press **Yes** to save the calibration data for DC Current Source (0~25)mA.

10.5 - DC Voltage Source Calibration

1) Press **Output (0~10.5)V** to calibrate DC Voltage Source. Connect the unit according to the diagram.



2) Press **Start** to begin the calibration for DC Voltage Source.

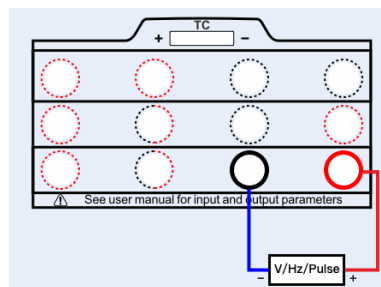
3) The unit will source for the first calibration point. Press the Reference number and edit the value to match that of the readout device. Press **Next** to record a Reference Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.

4) Press **Yes** to save the calibration data for DC Voltage Source (0~10.5)V.

10.6 - Frequency Source Calibration

- 1) Press the **Right Arrow Button** (keys) to navigate to the next page of calibration functions.
- 2) Press **Output (0.01~50k)Hz** to calibrate Frequency Source. Connect the unit according to the diagram.

Diagram 10.5
(Frequency Source)

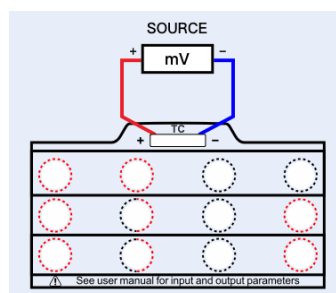


- 3) Press **Start** to begin the calibration for Frequency Source.
- 4) The unit will source for the calibration point. Press the Reference number and edit the value to match that of the readout device. Press **Finish** after the calibration point has been recorded.
- 5) Press **Yes** to save the calibration data for Frequency Source (0.01~50k)Hz.

10.7 - TC Measure Calibration

- 1) Press **Input (-10~75)mV** to calibrate TC Measure. Connect the unit according to the diagram.

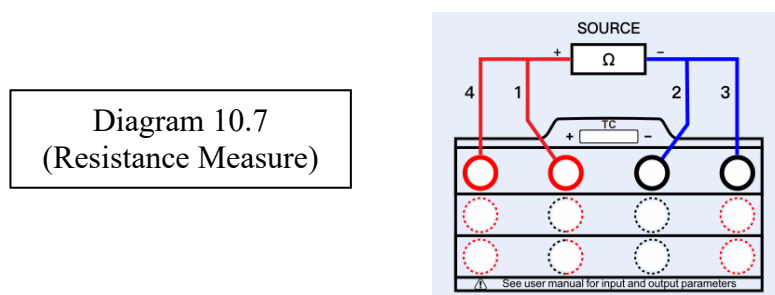
Diagram 10.6
(TC Measure)



- 2) Press **Start** to begin the calibration for TC Measure.
- 3) Source the voltage for the first calibration point. If necessary, press the Reference number to edit the value. Press **Next** to record an Indication Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 4) Press **Yes** to save the calibration data for TC Measure mV.

10.8 - Resistance Measure Calibration

1) Press **Input (0~400) Ω** to calibrate Resistance Measure. Connect the unit according to the diagram.



2) Press **Start** to begin the calibration for Resistance Measure.

3) Source the resistance for the first calibration point. Press the Reference number to edit the value.

Press **Next** to record an Indication Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.

4) Press **Yes** to save the calibration data for Resistance Measure (400 Ω).

5) Press **Input (0~4000) Ω** to calibrate Resistance Measure.

6) Press **Start** to begin the calibration for Resistance Measure.

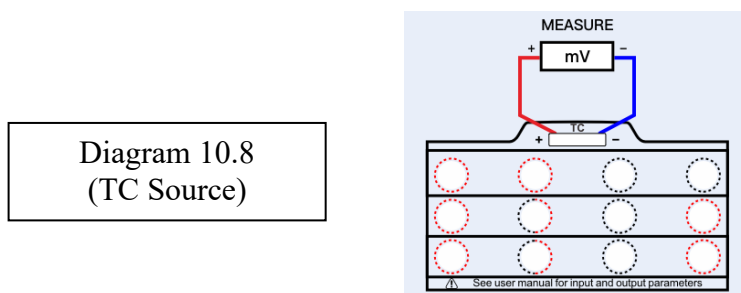
7) Source the resistance for the first calibration point. Press the Reference number to edit the value.

Press **Next** to record an Indication Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.

8) Press **Yes** to save the calibration data for Resistance Measure (4000 Ω).

10.9 - TC Source Calibration

1) Press **Output (-10~75)mV** to calibrate TC Source. Connect the unit according to the diagram.



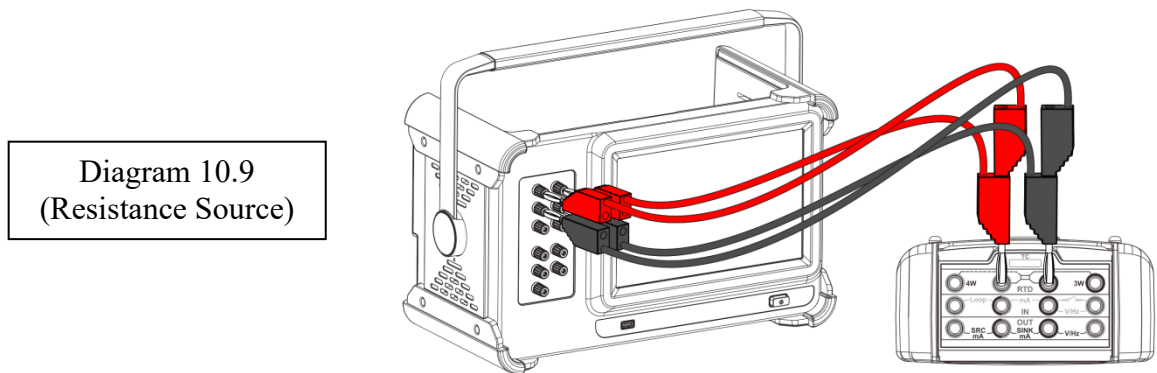
2) Press **Start** to begin the calibration for TC Source.

- 3) The unit will source for the first calibration point. Press the Reference number and edit the value to match that of the readout device. Press **Next** to record the Reference Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 4) Press **Yes** to save the calibration data for TC Source mV.

10.10 - Resistance Source Calibration

- 1) Press **Output (0~400) Ω** to calibrate Resistance Source. Connect the unit according to the diagram.

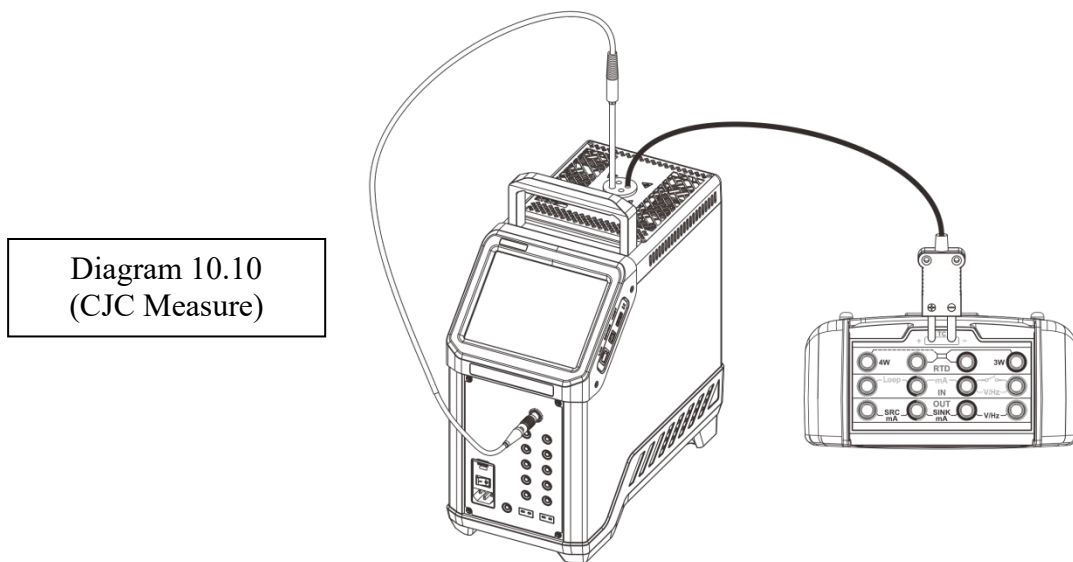
Note: A 2 wire setup from the unit is connected to a 4 wire setup from the readout device.



- 2) Press **Start** to begin the calibration for Resistance Source.
- 3) The unit will source for the first calibration point. Press the Reference number and edit the value to match that of the readout device. Press **Next** to record the Reference Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 4) Press **Yes** to save the calibration data for Resistance Source (400 Ω).
- 5) Press the **Right Arrow Button** to navigate to the next page of calibration functions.
- 6) Press **Output (0~4000) Ω** to calibrate Resistance Source.
- 7) Press **Start** to begin the calibration for Resistance Source.
- 8) The unit will source for the first calibration point. Press the Reference number and edit the value to match that of the readout device. Press **Next** to record the Reference Value. Repeat this step for each of the calibration points. Press **Finish** after the last calibration point has been recorded.
- 9) Press **Yes** to save the calibration data for Resistance Source (4000 Ω).

10.11 - CJC Calibration

- 1) Press **Input CJC** to calibrate TC Measure CJC. Additel uses a temperature source (ADT875PC-155), reference probe (AM1710-12-ADT), and a characterized Type E Thermocouple.
- 2) Connect the unit according to the diagram. Insert and plug in the reference probe into the temperature source to get an external (EXT) readout value. Insert one end of the Type E cable (bare wire) into the temperature source and set the internal (INT) temperature of the drywell to 20.0°C. Connect the other end of the Type E cable (TC connection) into the 226Ex/227Ex and allow enough time for the temperature to stabilize.



- 3) Press **Start** to begin the calibration for TC Measure.
- 4) Press **Reference** and input the readout value as stated by the external reference probe. Press **Sensor Type** and select E. Allow enough time for the calibration point to stabilize. Press **Finish** to record the calibration point.
- 5) Press **Yes** to save the calibration data for TC Measure CJC.
- 6) Press the **Home Button** to return to the main interface. Press **Calibrator** to display the main calibration functions.
- 7) Repeat the Electrical Verification (8.0).

11.0 - Barometer Calibration

- 1) Press the **Home Icon/Button** > **Setup** > **Calibration**.
- 2) Input the Password as **123456** then press the **Check Icon** to confirm.
- 3) Press the **Right Button** (keys) to navigate to the last page of the calibration options.
- 4) Press **ATM** to calibrate the barometric pressure sensor of the unit. Ensure that the barometric pressure system is connected to the ATM port on the back of the unit using a blue Festo hose (4mm).
- 4) Press **Two Point**.
- 5) Press **Start** to begin BP calibration.
- 6) Source the pressure for the first calibration point. Allow enough time for it to stabilize. If necessary, adjust the Reference value. Press the **Next** to record the Indication Value. Repeat this step for the other calibration point. Press **Finish** after the last calibration point has been recorded.
- 7) Press **OK** to save the BP calibration.
- 8) Repeat the Barometer Verification (9.0).