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# DPI 880

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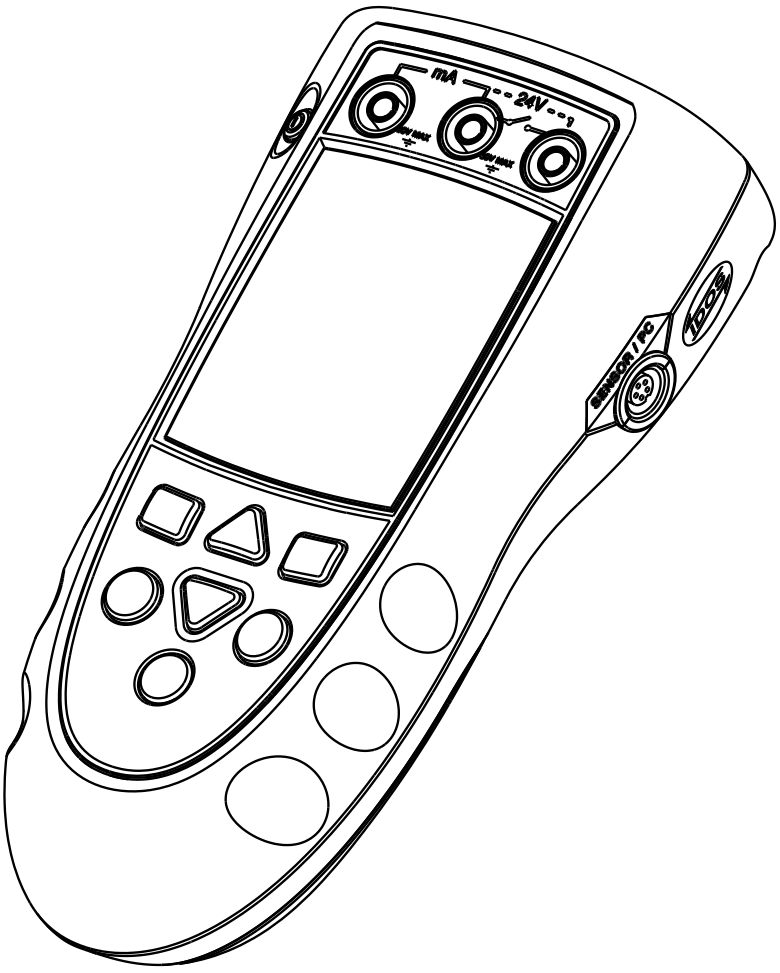
## Multi-function Calibrator
Instruction Manual

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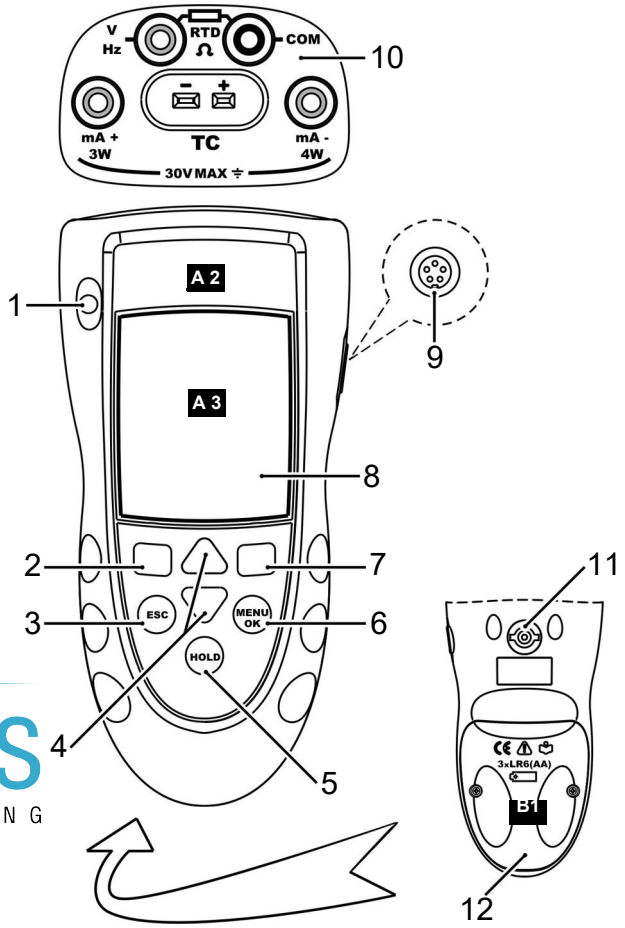
## A1



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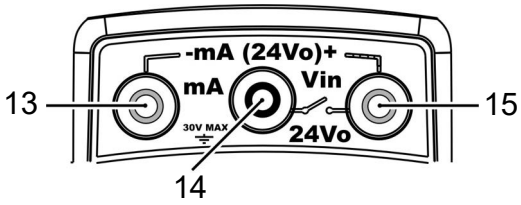
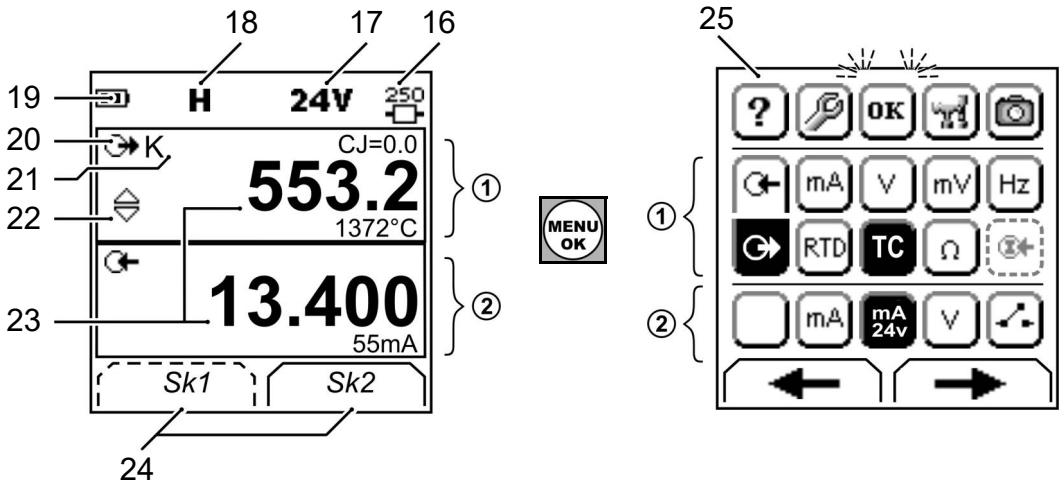
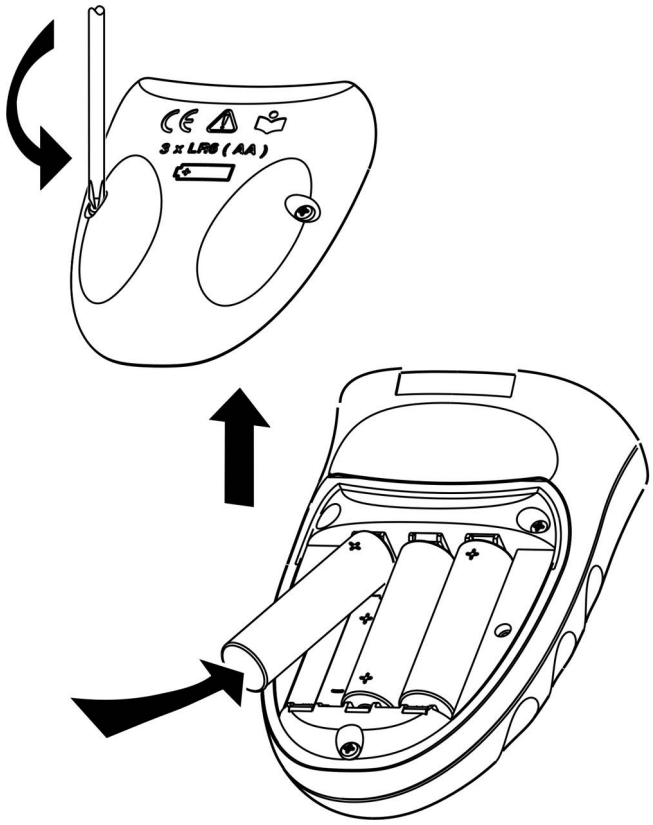



## A3



B1

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# Druck DPI 880

## Multi-function calibrator

**User manual - K0405**


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## Table of Contents



## Introduction

The DPI 880 Multi-function Calibrator is part of the Druck DPI 8xx series of hand held instruments.
This series of instruments uses Intelligent Digital Output Sensor (IDOS) technology to give instant plug and play functionality with a range of Universal Measurement Modules (UMM). Example: the Universal Pressure Module (UPM).
The DPI 880 includes these functions:

| Function |
|---|
| a Measure mA, Volts/mV, Hz/pulse count |
| * Supply mA, Volts/mV, Hz/pulse count |
| * Measure/simulate:<br>- a Resistance Temperature Detector (RTD): Ω or °C/°F<br>- a thermocouple (TC): mV or °C/°F<br>- a resistor (Ω) |
| Cold Junction (CJ) compensation: Automatic/Manual |
| Step/Ramp functions: Automatic/Manual |
| Communications port: IDOS or RS232 |
| Language selection (Refer to Table 1) |
| ** Measure pressure/Leak test: External IDOS UPM |
| ** Snapshot: Up to 1000 displays with a date/time stamp |
| 250Ω series resistor. Use this instrument together with a HART® communicator to set up and calibrate HART® devices. |
| Switch test |
| Other functions: Hold, Backlight |

*a Refer to "Specification".*
*** Optional item***

## Safety

Before you use the instrument, make sure that you read and understand all the related data. This includes: all local safety procedures, the instructions for the UMM (if applicable), and this publication.

**WARNING**

- **It is dangerous to ignore the specified limits for the instrument or to use the instrument when it is not in its normal condition. Use the applicable protection and obey all safety precautions.**
- **Do not use the instrument in locations with explosive gas, vapor or dust. There is a risk of an explosion.**
- **To prevent electrical shocks or damage to the instrument, do not connect more than 30V between the terminals, or between the terminals and the ground (earth).**
- **UPM only. To prevent a dangerous release of pressure, isolate and bleed the system before you disconnect a pressure connection.**

Before you start an operation or procedure in this publication, make sure that you have the necessary skills (if necessary, with qualifications from an approved training establishment). Follow good engineering practice at all times.

***Marks and symbols on the instrument***

| | | | |
|---|---|---|---|
| CE | Complies with European Union directives | | Warning - refer to the manual |
| | Read the manual | | Battery |
| | Ground (Earth) | | ON/OFF |
| | Do not dispose of this product as household waste. Refer to “Maintenance”. | | |
| More marks and symbols are specified in “To start”. | | | |

## To start

***Key to figure* A1/A2 *(Instrument)***

| Item | | Description |
|---|---|---|
| 1. | ❍ | On or off button. |
| 2. | ■■ | Left-hand soft-key. Selects the function above it on the display (Item 24). Example: Edit |
| 3. | **ESC** | Moves back one menu level.<br>Leaves a menu option.<br>Cancels the changes to a value. |
| 4. | ▲<br>▼ | Increases or decreases a value.<br>Highlights a different item. |
| 5. | **HOLD** | Holds the data on the display. To continue, press the **HOLD** button again. |
| 6. | **MENU OK** | Shows the task selection menu (Item 25).<br>Selects or accepts an item or value.<br>Selects [✓] or cancels [ ] a selection. |
| 7. | ■■ | Right-hand soft-key. Selects the function above it on the display (Item 24). Example: Settings |
| 8. | | Display. Refer to A3 |
| 9. | SENSOR/ PC | Communications port. Use to connect a Universal Measurement Module (UMM) or a RS232 cable. |
| 10. | | Connectors to measure or supply the specified values. Refer to “Operation”.<br>**COM** Common connector<br>**3W, 4W** 3-wire, 4-wire RTD input |
| 11. | | Connection point for some of the optional accessories. Refer to the datasheet. |
| 12. | | Battery compartment. Refer to B1. |
| 13. 14. 15 | | (*Dual Function*) Connectors to measure or supply the specified values. Refer to “Operation”.<br>**Vin**, Volts input or switch<br>**24Vo** 24V loop power supply |

### *Key to figure A3 (Display)*

| Item | Description |
|---|---|
| **1.** | Task indication for the switch test.<br>= switch closed = switch open |
| | UPM only. Task indication for the leak test. |
| 250 | There is a 250Ω series resistor in the mA circuit. |
| | Refer to: Table 2/3 |
| **2.** 24V | The loop power supply is on.<br>Refer to: Table 2/3 |
| **3.** H | The data on the display is on hold. To continue, press the **HOLD** button again. |
| **4.** | Shows the battery level: 0 to 100%. |
| **5.** | Identifies the type of data.<br>= Input = Output<br>= IDOS input<br>Refer to: Table 2/3 |
| **21. to 22.** | The settings applied to the input or output: |
| **6.** **K** | The thermocouple type (K, J, T ... ) - (Table 4/*5*). |
| **CJ= ...** | The cold junction temperature (Table 1) |
| **Pt...** | The RTD type (Pt50, ...) - (Table 4/*5*). |
| | RTD input connections: 2, 3, or 4 (Figure 7) |
| **5.0V** | ...V The input trigger level (Table 4) or the output amplitude (Table 5). |
| **7.** | , ... , = Output operation (Table 5) |
| **8.** **13.400** 55mA | The measured values applicable to the task selections in item 25, area ① and ②<br>+ the measurement range and units. |
| **9.** *Sk1/2* | A soft-key function. To select an available function, press the soft-key below it. Example:<br>= Move left = Move right |
| **10.** | The task selection menu. One task selection is permitted in each area (① and ②). |
| OK | = cursor position (flashes on/off) |
| TC | = a button or task selection is set in area ① or ②. |
| | Sets the *Dual Function*, area ② selections to off. This saves the battery power.<br>Refer to: Table 2/3 |
| ? | *Help*: Shows a connection diagram for the task selections you have set. |
| | *Set Up*: Shows the *Set Up* menu to set up the basic operation. Refer to Table 1. |
| OK | OK: Accepts the selections on the menu.<br>*Note: MENU/OK also does this.* |
| | *Utilities*: *Leak Test*. Use this function with a UPM. Refer to Figure 13. |
| | *Snapshot*: Optional item - To use this facility, install the data logging upgrade kit. Refer to the user manual - K0397: DPI 800 series data logging upgrade kit. |

### *Prepare the instrument*

Before you use the instrument for the first time:

- Make sure that there is no damage to the instrument, and that there are no missing items.
- Remove the plastic film that protects the display. Use the tag (◗ ) in the top right-hand corner.
- Install the batteries (refer to B1). Then re-attach the cover.

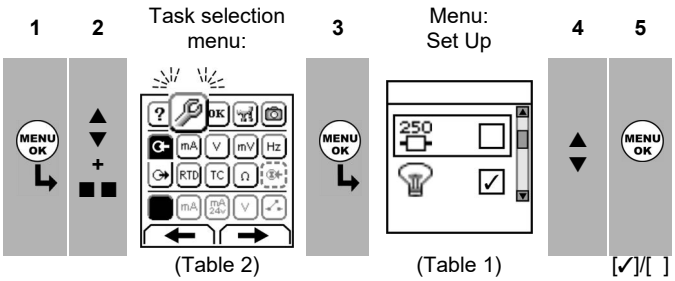
### *Power on or off*

To set the power on or off, press ❍ (A1 - item 1). The instrument does a self test and then shows the applicable data.

When the power is off, the last set of configuration options stays in memory. Refer to “Maintenance”.

### *Set up the basic operation*

Use the *Set Up* menu to set up the basic operation of the instrument.



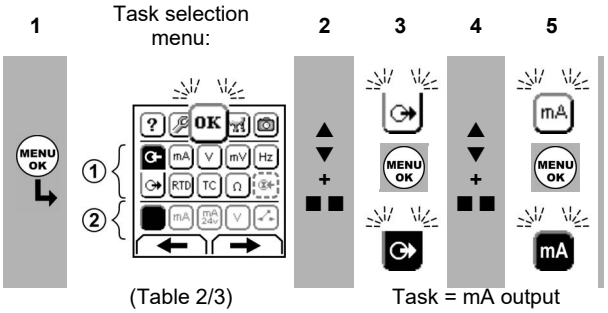

If there is additional data for a menu option, select *Settings* (■ ■) to see the values that are set up. If necessary, adjust the values.

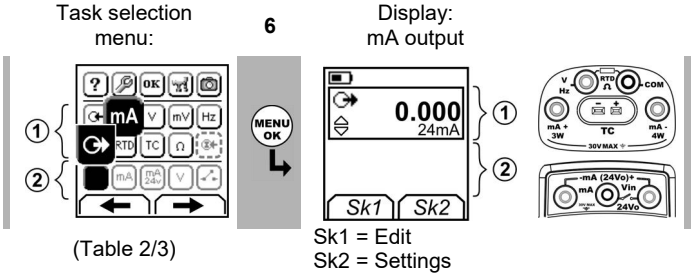
***Table 1:*** *Menu options - Set Up*

| Options | Description |
|---|---|
| ... Scale | To select the applicable international temperature scale: IPTS 68 or ITS 90. |
| 250 | To add a 250Ω series resistor into the mA circuit. You can then use this instrument together with a HART® communicator to set up and calibrate HART® devices. |
| | To select and set up the backlight facility + timer.<br>*Additional data:* Select *Settings* (■ ■) |
| O/I | To select and set up the power off facility + timer.<br>*Additional data:* Select *Settings* (■ ■) |
| | To show the battery level (%). |
| | To set the display contrast (%).<br>▲ Increases %, ▼ decreases % |
| | To set the time + date. The calibration facility uses the date to give service and calibration messages. |
| | To set the language option. |
| | To calibrate the instrument.<br>*Additional data:* Refer to “Calibration”. |
| | To select and show the applicable status data. (Software Build, Calibration Due date, Serial Number, IDOS Information). |

### *Select a task (Measure and/or supply)*

When the instrument is set up (Table 1), use the task selection menu to select the applicable task.




If you attach a Universal Measurement Module (UMM) to the communications port (A1 - item 9), the task selection menu shows the applicable IDOS options.

Make the necessary selections from each area (① and ②). One task is permitted in each area.

*Note: Use the Dual Function area (②) to do two operations at the same time. If the area ② selection is not necessary, set this area to off (■). This saves the battery power.*

***Table 2:** Menu options - Task selections (Area ①)*

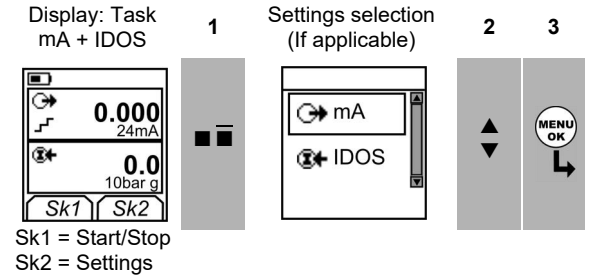
| Options (If applicable) | Description |
|---|---|
| | Input measurement tasks: |
| mA | Measure ±55 mA |
| V | Measure ±30V |
| mV | Measure ±120mV |
| Hz | Measure the frequency (Units: Table 4) |
| RTD | Measure RTD temperature |
| Ω | Measure RTD resistance or Ω |
| TC | Measure thermocouple temperature OR mV |
| | Only when an IDOS UMM is attached. An IDOS measurement task. |
| | Output tasks: |
| mA | Supply 0 to 24 mA |
| V | Supply 0 to 12V |
| mV | Supply 0 to 120mV |
| Hz | Supply an output frequency (Units: Table 4) |
| RTD | Simulate RTD temperature |
| Ω | Simulate RTD resistance or Ω |
| TC | Simulate thermocouple temperature OR mV |

***Table 3:** Menu options - Task selections (Dual Function, area ②)*

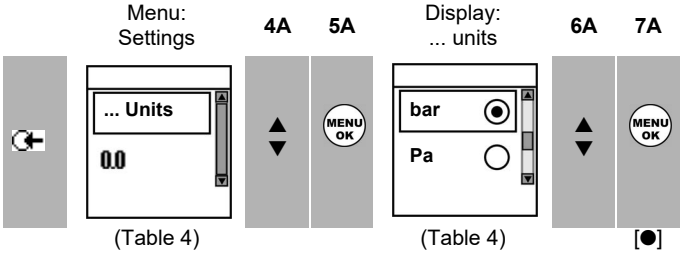
| Options (If applicable) | Description |
|---|---|
| | White button = A *Dual Function* is set.<br>Black button = *Dual Function*, area ② is set to off. |
| | Input measurement tasks: |
| mA | Measure ±55 mA |
| V | Measure ±30V |
| mA/24V | Measure ±55 mA (24V loop power is on) |
| | A switch test |
| | Only when an IDOS UMM is attached. An IDOS measurement task. |

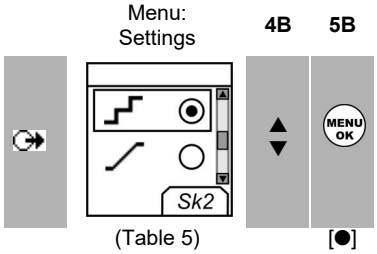
***Set up the settings***

When the task is set up (Table 2/3), use the *Settings* menu to adjust the input and/or output operation.




Sk1 = Start/Stop
Sk2 = Settings




If there is additional data for a menu option, select *Settings* (■ ■) to see the values that are set up. If necessary, adjust the values.

***Table 4:** Menu options - Settings (Input)*

| Options (If applicable) | Description |
|---|---|
| ... Units | *Pressure Units* (UPM only). If you select an IDOS task (Table 2/3). Select one of the fixed units of measurement (psi, mbar ... ). |
| | *Temperature Units* (RTD or TC only). To select the temperature units (°C or °F). |
| | *Frequency Units* (Hz only). To select one of these units:<br>Hz: Range < 1000Hz kHz: Range 0 to 50kHz<br>counts/minute (cpm) counts/hour (cph) |
| ... | (TC only). Change the measurement operation:<br>*Temperature* to *mV* OR<br>*mV* to *Temperature* |
| CJ ... | (TC only). To select the type of cold junction (CJ) compensation.<br>*Automatic*: The instrument monitors the CJ temperature and applies the necessary CJ compensation.<br>*Manual*: Measure the CJ temperature and set the applicable value. The instrument uses this value to apply the necessary CJ compensation. |
| ... type | *Select RTD Type* (RTD only). To select an applicable RTD type (Pt50, Pt100 ... ) |
| | *Select TC Type* (TC only). To select an applicable thermocouple type (K, J, T ... ) |
| Trigger level | (Hz only). To set the amplitude at which the instrument senses a frequency signal. Default = 5V.<br>*Auto Detect* [✓]/[ ]: Set this option to make the instrument calculate the value from the available signal. |
| 0.0 | (UPM only). Gage sensors or sensors with differential operation. A zero correction that makes the instrument read zero at local pressure. |
| | (Leak Test only). To set an applicable period for the leak test (Hours:Minutes:Seconds). |

***Table 5:** (Part of table) Menu options - Settings (Output)*

| **Options** (If applicable) | Description |
|---|---|
| ... Units | Pressure/Temperature: Refer to Table 4. |
| | *Frequency Units* (Hz only). To select one of these units:<br>Hz: Range < 1000Hz kHz: Range 0 to 50kHz<br>pulses/minute (ppm) pulses/hour (pph) |
| ... | (TC only). Change the output operation:<br>*Temperature* to *mV* OR<br>*mV* to *Temperature* |
| CJ ... | (TC only). Refer to Table 4. |
| ... type | Refer to Table 4. |
| Amplitude | (Hz only). To set the amplitude of the output signal. Amplitude = 5V (Default). |
| | To select and set up a value for the "Nudge" output. Example: 1.000 mA increments.<br>*Additional data: Select Settings* (■ ■) |

***Table 5:*** *(Part of table) Menu options - Settings (Output)*

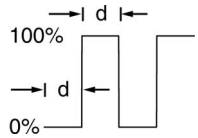
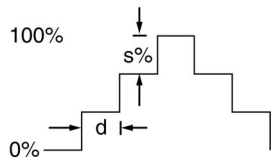
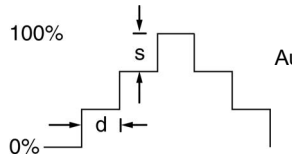
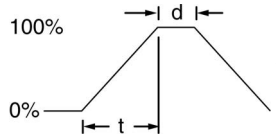
| Options (If applicable) | Description |
|---|---|
| 100 0 | To select and set up values for the "Span Check" output. Example output cycle:<br>  <br>This cycle repeats automatically.<br>*Additional data (*Table 6*): Select Settings* (■ ■) |
| % Step | To select and set up values for the "% Step" output. Example output cycle:<br>  <br>Auto Repeat - Optional<br>*Additional data (*Table 6*): Select Settings* (■ ■) |
| ... Step | To select and set up values for the "Defined Step" output. Example output cycle:<br>  <br>Auto Repeat - Optional<br>*Additional data (*Table 6*): Select Settings* (■ ■) |
| | To select and set up values for the "Ramp" output. Example output cycle:<br>  <br>Auto Repeat - Optional<br>*Additional data (*Table 6*): Select Settings* (■ ■) |

***Table 6:*** *Additional data for Settings (Output):*

| Item | Value |
|---|---|
| **Span Check** | |
| Low (0%) | Set the 0% value. |
| High (100%) | Set the 100% value. |
| Dwell (d) | Set the period (Hours:Minutes:Seconds) between each change in value. |
| **% Step** | Low (0%), High (100%), Dwell (d): As above. |
| Step Size (s) ... % | Set the change in value for each step as a percentage of the full-scale range (High - Low). |
| **Defined Step** | Low (0%), High (100%), Dwell (d): As above. |
| Step Size (s) | Set the change in value for each step. Example: 1.000 mA steps. |
| **Ramp** | Low (0%), High (100%), Dwell (d): As above. |
| Travel (t) | Set the period (Hours:Minutes:Seconds) to go from the Low (0%) value to the High (100%) value. |
| Auto Repeat | If applicable, select this item to repeat a cycle continuously. |

## Operation

This section gives examples of how to connect and use the instrument. Before you start:

- Read and understand the "Safety" section.
- Do not use a damaged instrument.

### *Electrical connections*

To prevent instrument errors, make sure that the electrical connections (A1-item 10 and/or A2) are correct.

The Help button (A3 - Item 25) shows a connection diagram for the task selections you have set.

### *Communications port connections*

Use the communications port (A1 - item 9) to attach an IDOS Universal Measurement Module (UMM).

When you attach the cable from a UMM (Figure 13/14), the instrument automatically changes the menus to give you all the applicable options (Table 2/3).

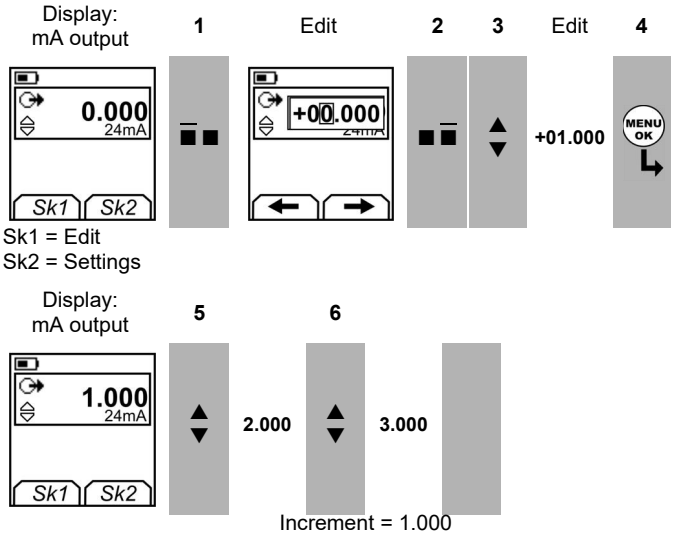
### *Change the output values*

When the output operation is set up (Table 5), use one of these procedures to change the output values:

***Table 7:*** *Procedures to change the output*

| Output | Procedure |
|---|---|
| | Select *Edit* (■ ■) and/or use the ▲ ▼ buttons. See the example below. |
| 100 0, | Select *Start/Stop* (■ ■) or use the ▲ ▼ buttons to make the step changes manually. |
| | Select *Start/Stop* (■ ■). |

Example procedure ("Nudge" output):




### *Measure/supply mA*

To measure/supply a current:

1. Connect the instrument (Figure 1, 2 or 3) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the task from the task selection menu (Table 2/3).

*Note: Use the Dual Function area (②) to do two operations at the same time. If the area ② selection is not necessary, set this area to off* (■)*. This saves the battery power.*

3. If necessary, adjust the *Settings* (Table 4/5) and/or the

output values to the system (Table 7).

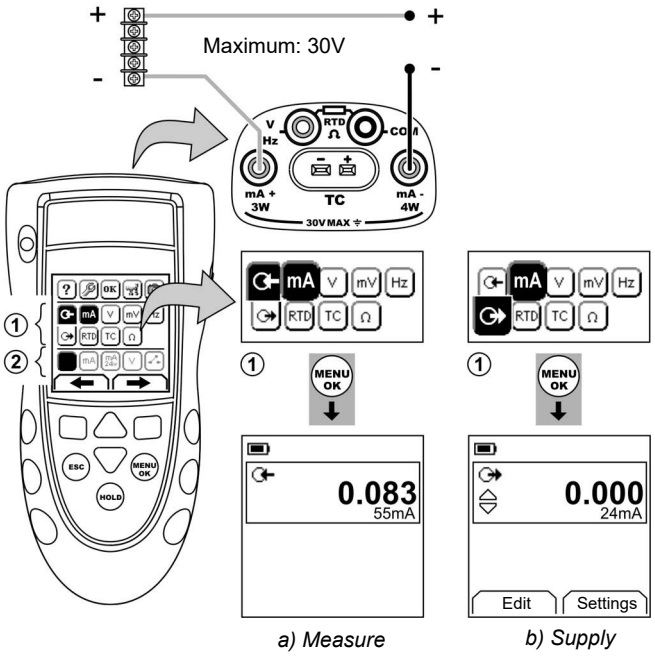



***Figure 1:*** *Example configuration - To measure/supply mA with external loop power (Area ①)*

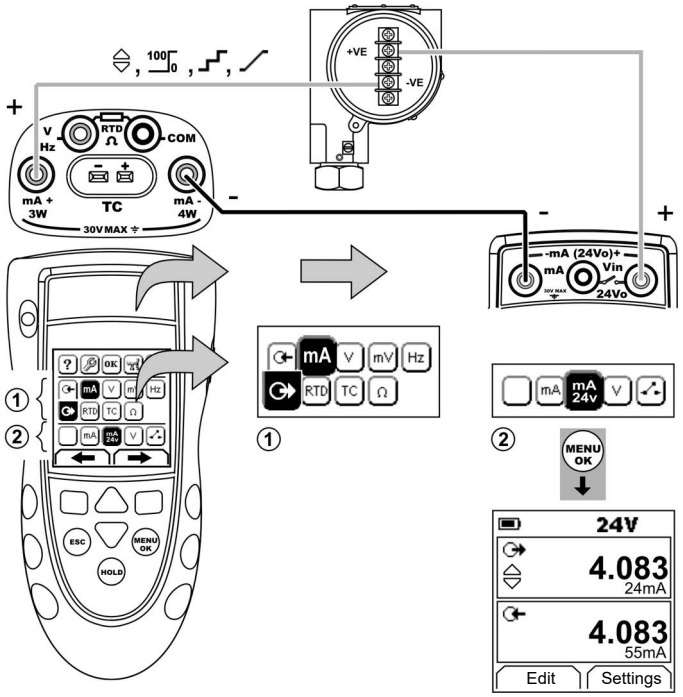



***Figure 2:*** *Example configuration - To supply mA with internal loop power (Area ①)*

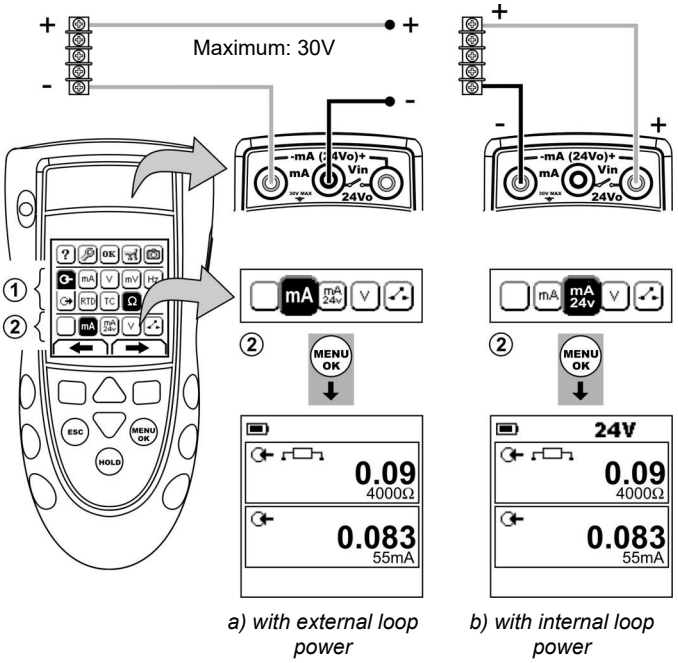



***Figure 3:*** *Example configuration - To measure mA (Dual Function, area ②)*

### *Measure/supply Volts or mV*

To measure/supply Volts or mV:

1. Connect the instrument (Figure 4/5) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the task from the task selection menu (Table 2/3).

*Note: Use the Dual Function area (②) to do two operations at the same time. If the area ② selection is not necessary, set this area to off (■). This saves the battery power.*

3. If necessary, adjust the *Settings* (Table 4/5) and/or the output values to the system (Table 7).

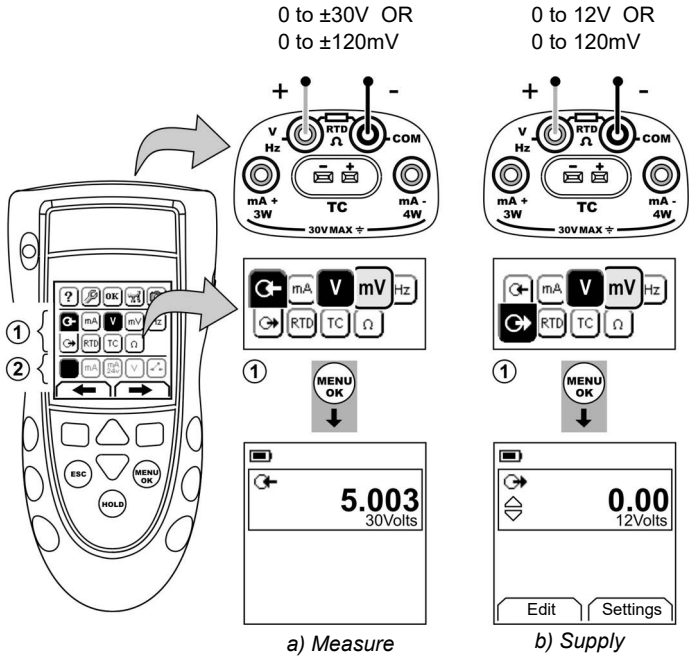



***Figure 4:*** *Example configuration - To measure/supply Volts or mV (Area ①)*

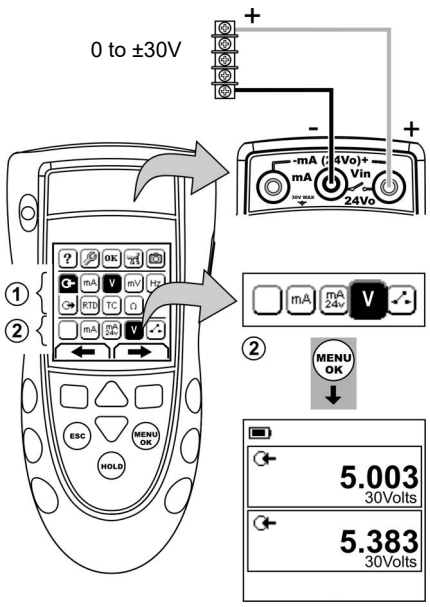
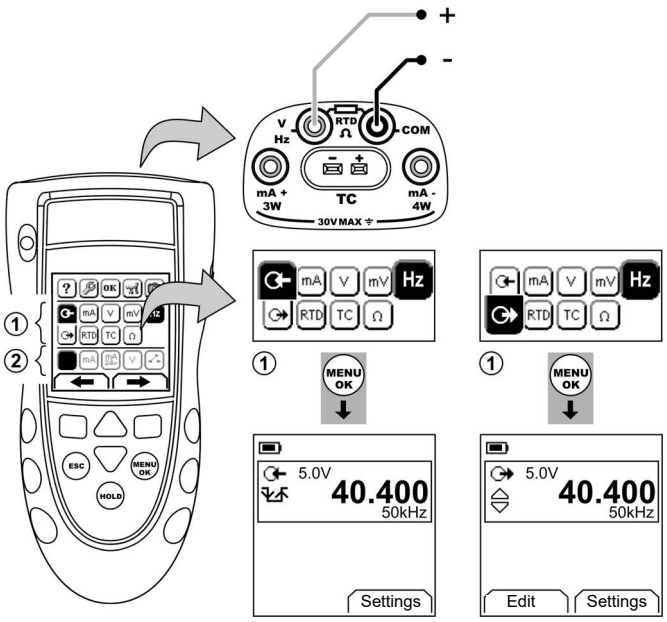



***Figure 5:*** *Example configuration - To measure Volts (Dual Function, area ②)*

***Measure/supply Hz or pulses***

To measure/supply Hz or pulses:

1. Connect the instrument (Figure 6) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the task from the task selection menu (Table 2):
3. If necessary, adjust the *Settings* (Table 4/5) and/or the output values to the system (Table 7).




*a) Input* *b) Output*

***Figure 6:*** *Example configuration - To measure/supply Hz or Pulses*

For an input, the display shows the condition of the frequency gate:

= Gate open (measurement starts)
= Gate closed (measurement is waiting for the next rising edge of the cycle)
= Fast cycle

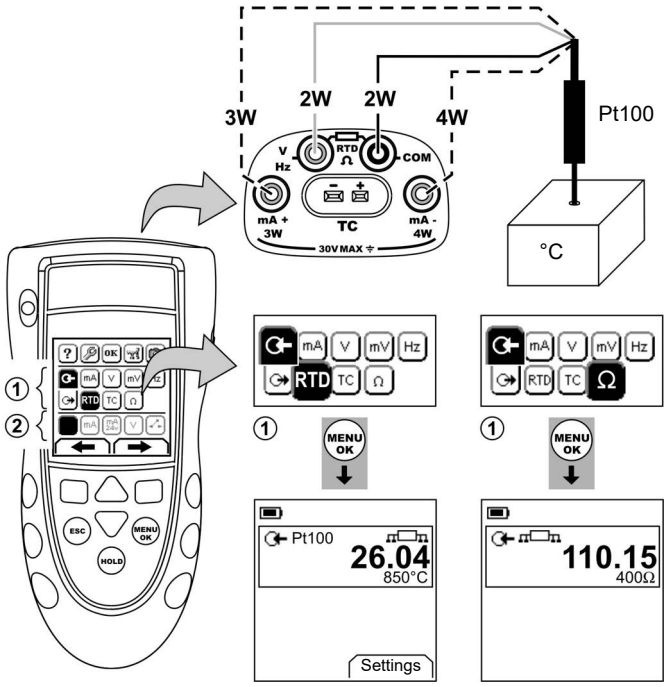
***RTD/Ohms connections***

In the examples that follow 2W, 3W, and 4W identify the 2, 3, and 4-wire connections for a RTD or resistance.

***Measure/simulate an RTD or Ohms***

To measure/simulate RTD values or Ohms:

1. Connect the instrument (Figure 7/8) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the task from the task selection menu (Table 2):
3. If necessary, adjust the *Settings* (Table 4/5) and/or the output values to the system (Table 7).




*a) RTD °C or °F* *b) Ohms (Ω)*

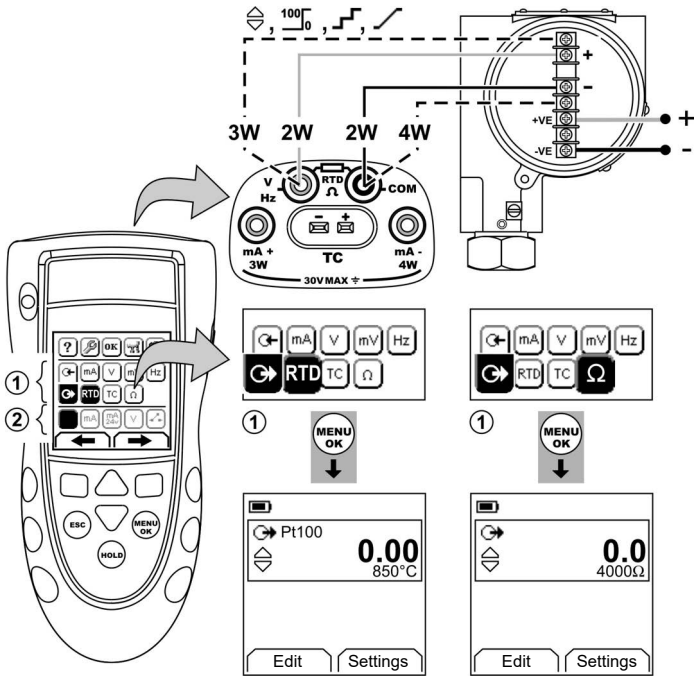
***Figure 7:*** *Example configuration - To measure the temperature or resistance*

For an input, the display shows the number of RTD or resistance connections.

= Four-wire RTD attached.

If this symbol does not agree with the number of connections:

- Make sure that the connections are correct.
- Make sure that the wires and the sensor are serviceable.




*a) RTD °C or °F* *b) Ohms (Ω)*

***Figure 8:*** *Example configuration - To simulate the temperature or resistance*

***Thermocouple (TC) connections***

Attach the TC wires to the applicable TC mini-connector (Figure 9). The wider blade is the negative. Then attach the connector to the instrument.

***Measure/simulate a Thermocouple***

To measure/simulate the TC values:

1. Connect the instrument (Figure 9) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the task from the task selection menu (Table 2).
3. Select *Settings* (■ ■) to change the operation from *Temperature* to *mV* or *mV* to *Temperature*.
4. If necessary, adjust the *Settings* (Table 4/5) and/or the output values to the system (Table 7).

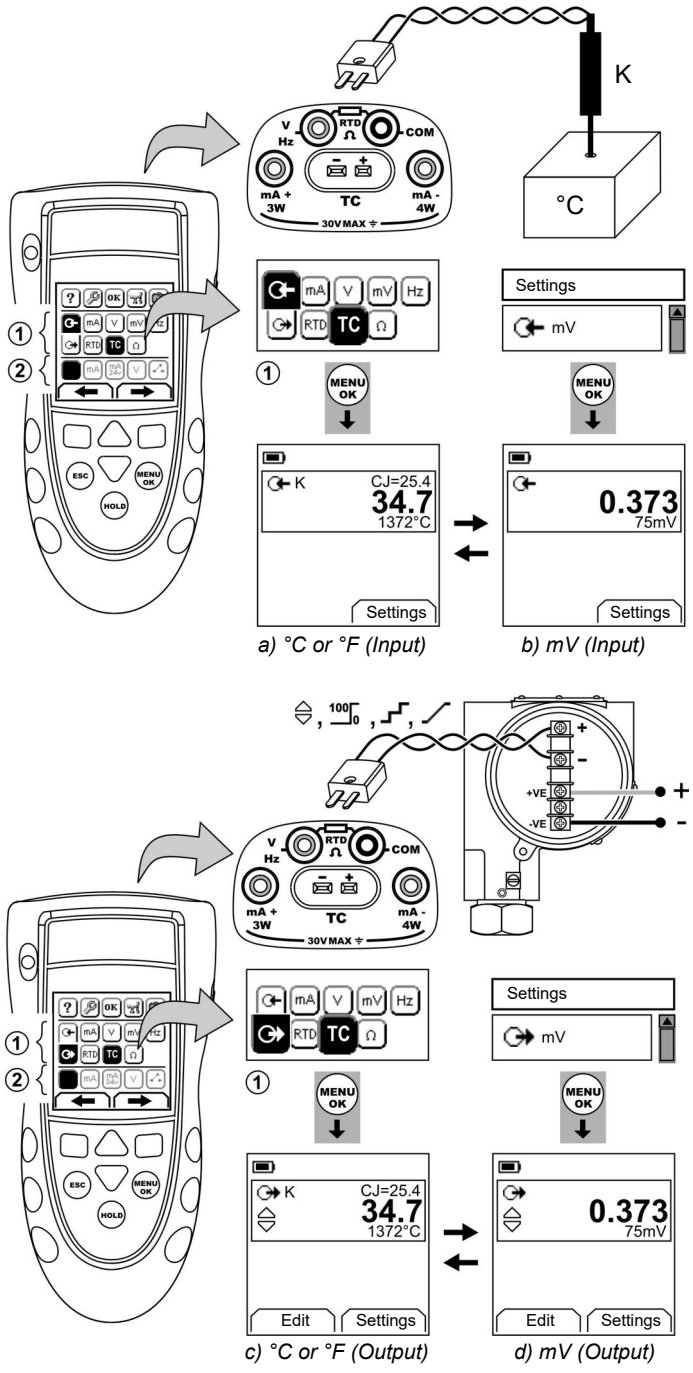



***Figure 9:*** *Example configuration - To measure/simulate the temperature (°C/°F) or mV values of a TC*

***Transmitter calibration***

To calibrate a transmitter:

1. Connect the instrument (Figure 10/11) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the applicable calibration task from the task selection menu (Table 2/3) and, if necessary, adjust the *Settings* (Table 4/5).
3. Supply the output values to the system (Table 7).

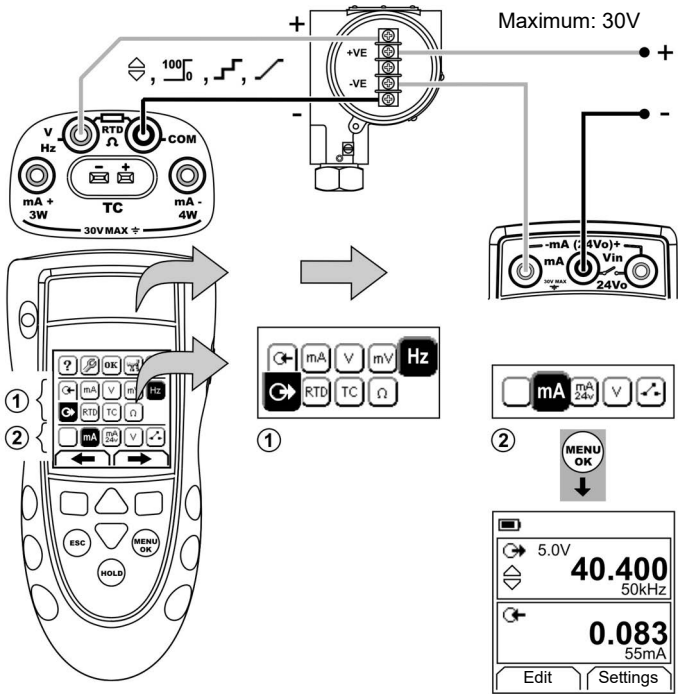



***Figure 10:*** *Example configuration - Transmitter calibration with external loop power*

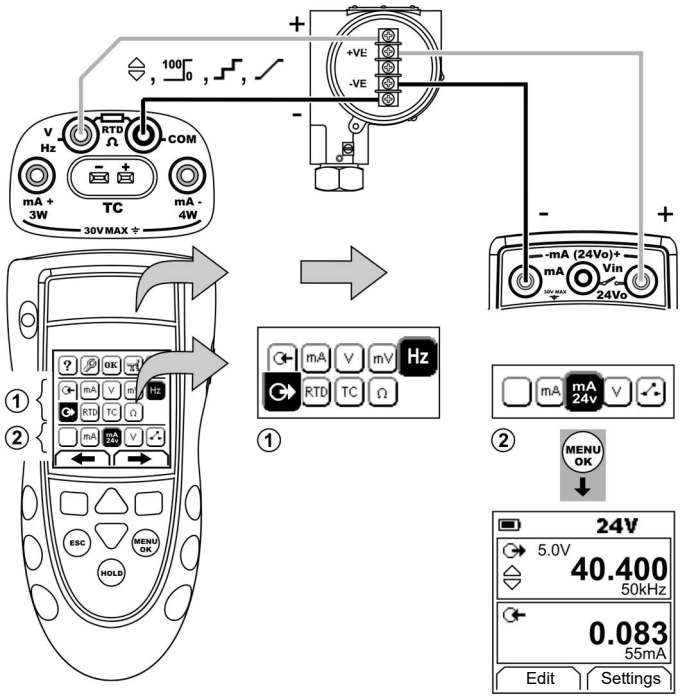



***Figure 11:*** *Example configuration - Transmitter calibration with internal loop power*

***Switch test***

To do tests on a switch:

1. Connect the instrument (Figure 12) and, if necessary, adjust the *Set Up* (Table 1).
2. Select the applicable switch test from the task selection menu (Table 2/3) and, if necessary, adjust the *Settings* (Table 5). The display shows the switch condition (open or closed) in the top right-hand corner.
3. Supply the output values to the system (Table 7).

- Example - “Nudge” output.

a. Use *Edit* (■ ■) to set a value less than the switch value.
b. Use the ▲ ▼ buttons to change the value in small increments.

- Example - “Ramp” output.
  a. Set “High” and “Low” values that are applicable to the switch value (Table 6). Then, to get an accurate switch value, set a long “Travel” period.
  b. Use *Start/Stop* (■ ■) to start and stop the “Ramp” cycle.

4. If necessary, supply the output values in the opposite direction until the switch changes condition again.

   The display shows the applicable values to open and close the switch.

5. To do the test again, press **ESC** to reset the values.

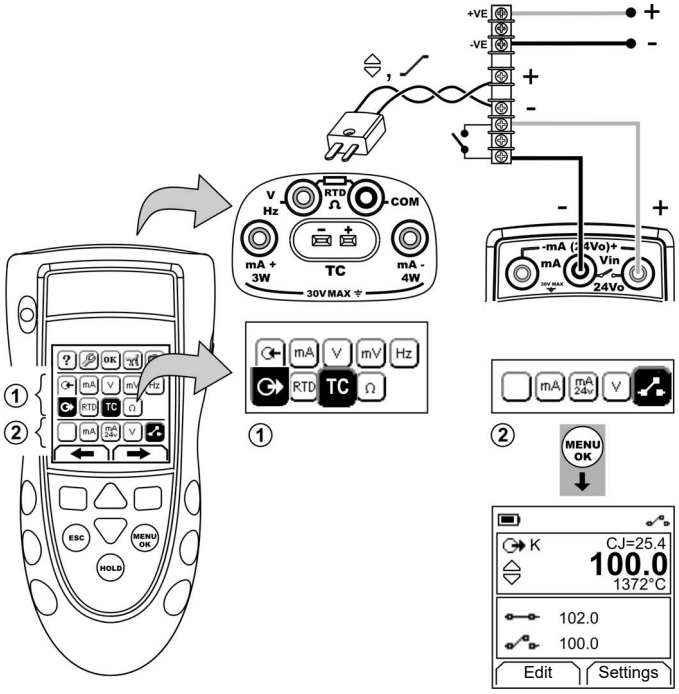
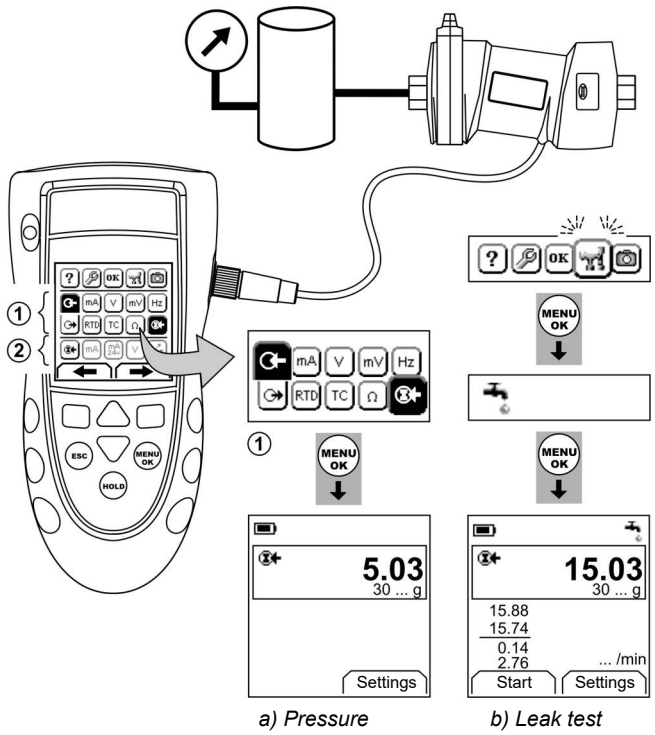



***Figure 12:*** *Example configuration - Switch test*

***UPM Pressure measurements***

Read all the instructions supplied with the UPM and then use the specified procedures to connect it (Figure 13/14).




*a) Pressure* *b) Leak test*

***Figure 13:*** *Example configuration - Pressure measurement with a UPM*

When the connections are complete, make the necessary IDOS selections (Table 2/3).

Each time you use a different UPM, the DPI 880 records its measurement units (capacity: the last 10 different UPM). When you re-attach one of the last 10 UPM, the DPI 880 automatically uses the applicable units (psi, mbar ... ).

*UPM - Measure the pressure/leak test*

To measure the pressure with or without a leak test (Figure 13):

1. Select the applicable pressure task from the task selection menu (Table 2/3) and, if necessary, adjust the *Set Up* (Table 1), and the *Settings* (Table 4/5).

   *Utilities* function: Use this function to include the *Leak Test* option.

2. If applicable, set the period for the leak test (Table 4).
3. If necessary, do a zero correction (Table 4).
4. To start the leak test, select Start (■ ■). When the test is finished, the instrument calculates the leak rate in the applicable units/minute.

To measure pressure with another operation (Figure 14), use the same procedure.

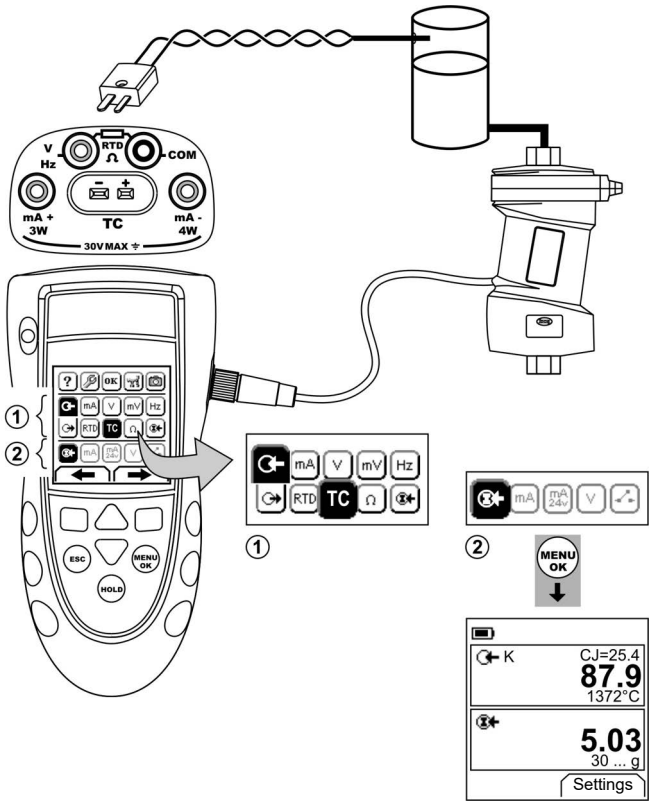



***Figure 14:*** *Example configuration - To measure pressure and temperature*

### *Error indications*

If the display shows <<<< or >>>> :

- Make sure that the range is correct.
- Make sure that all the related equipment and connections are serviceable.

## Maintenance

This section gives procedures to maintain the unit in a good condition. Return the instrument to the manufacturer or an approved service agent for all repairs.

Do not dispose of this product as household waste. Use an approved organisation that collects and/or recycles waste electrical and electronic equipment.

For more information, contact one of these:

- our customer service department: (Contact us at Druck.com)
- your local government office.

### *Clean the unit*

Clean the case with a moist, lint-free cloth and a weak detergent. Do not use solvents or abrasive materials.

### *Replace the batteries* B1

To replace the batteries, refer to B1. Then re-attach the cover.

Make sure that the time and date are correct. The calibration facility uses the date to give service and calibration messages.

All the other configuration options stay in memory.

## Calibration

*Note: Druck can provide a calibration service that is traceable to international standards.*

We recommend that you return the instrument to the manufacturer or an approved service agent for calibration. If you use an alternative calibration facility, make sure that it uses these standards.

***Before you start***

To do an accurate calibration, you must have:

- the calibration equipment specified in Table 8.
- a stable temperature environment: 70 ± 2°F (21 ± 1°C)

***Table 8:*** *Calibration equipment*

| **Function** | **Calibration equipment** (ppm = parts per million) |
|---|---|
| mA OR mA (Dual ... ) | mA calibrator.<br>Accuracy - mA input/output: Table 10/11<br>Accuracy - mA (Dual Function): Table 10 |
| mV OR TC (mV) | mV calibrator.<br>Accuracy - mV input/output: Table 12/14<br>Accuracy - TC (mV): Table 20 |
| Volts OR Volts (Dual ... ) | Volts calibrator.<br>Accuracy - Volts input/output: Table 13/ 15.<br>Accuracy - Volts (Dual Function): Table 13 |
| Hz | 1) Frequency meter<br>Total error: 7 ppm or better<br>Resolution: 8 digits (minimum)<br>2) Signal generator |
| IDOS | UMM only. Refer to the user manual for the IDOS UMM. |
| CJ | - Standard RTD probe<br>Accuracy: 50 mK for 23 to 82.4°F (-5 to 28°C)<br>- Digital thermometer<br>Accuracy: 10 mK |
| RTD Ohms | - Standard 0Ω resistor<br>- aStandard resistor (Ω): 100, 200, 300<br>Tolerance: 50 ppm + 0.6 ppm/°C + 5 ppm/year<br>- *Standard resistor (Ω): 400, 1k, 2k, 4k<br>Tolerance: 10 ppm + 0.6 ppm/°C + 5 ppm/year |
| RTD Ohms | An ohmmeter or an RTD measurement system with the specified excitation currents (Table 19). |

*a Or an equivalent resistance simulator*

Before you start the calibration, make sure that the time and date on the instrument are correct (Table 1).

*Selection sequence:*

➤ *Task selection menu* ➤ *Set Up* (Table 1) ➤ *Calibration* ➤

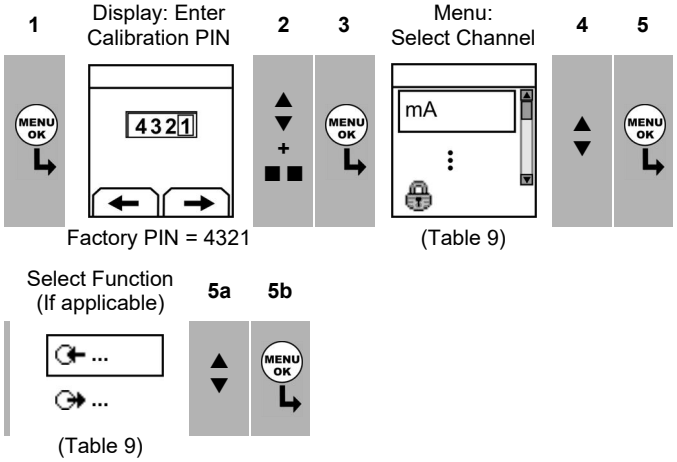



***Table 9:*** *Calibration options*

| Options | Description |
|---|---|
| ... ➤ ... ... | To calibrate the specified input/output:<br>... = mA, mV, Volts, Hz, RTD (Ohms), TC (mV) |
| IDOS | UMM only. To calibrate the specified IDOS UMM.<br>Refer to the user manual for the IDOS UMM. |
| CJ | To calibrate the cold junction channel. |
| mA (Dual ... ) | To calibrate the *mA (Dual Function)* input. |
| Volts (Dual ... ) | To calibrate the *Volts (Dual Function)* input. |
| | *Calibration Due:* To set the date of the next calibration for the instrument.<br>After the specified calibration date, there is a warning message. There is a selection box to stop the warning. |
| | To change the calibration PIN (Personal Identification Number). |

When you select a channel/function, the display shows the applicable instructions to complete the calibration.

When the calibration is complete, select *Calibration Due* and set the new calibration date for the instrument.

***Procedures: mA input***

1. Connect the instrument to the calibration equipment (Figure 3).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do a three-point calibration (-FS, Zero and +FS)*. The display shows the applicable instructions to complete the calibration.
4. To make sure that the calibration is correct, select the applicable mA input task (Table 2) and apply these values:

- mA: -55, -40, -24, -18, -12, -6, 0 (open circuit)
  Then mA: 0, 6, 12, 18, 24, 40, 55.

5. Make sure that the error is in the specified limits (Table 10).

***Table 10:*** *mA input error limits*

| **Applied mA** | **Calibrator error (mA)** | **Permitted DPI 880 error (mA)** |
|---|---|---|
| ±55 | 0.002 2 | 0.005 |
| ±40 | 0.001 8 | 0.004 |
| ±24 | 0.001 4 | 0.003 |
| ±18 | 0.000 4 | 0.003 |
| ±12 | 0.000 3 | 0.002 |
| ±6 | 0.000 2 | 0.002 |
| 0 (open circuit) | - | 0.001 |

***Procedures: mA output***

1. Connect the instrument to the calibration equipment (Figure 1).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do a two-point calibration (Zero and +FS). The display shows the applicable instructions to complete the calibration.
4. To make sure that the calibration is correct, select the applicable mA output task (Table 2) and set these output values:

- mA: 0.1, 4, 12, 20, 24

5. Make sure that the error is in the specified limits (Table 11).

***Table 11:*** *mA output error limits*

| **Output mA** | **Calibrator error (mA)** | **Permitted DPI 880 error (mA)** |
|---|---|---|
| 0.1 | 0.000 006 | 0.001 |
| 4 | 0.000 20 | 0.001 |
| 12 | 0.001 4 | 0.001 |
| 20 | 0.002 | 0.002 |
| 24 | 0.002 3 | 0.002 |

* *FS = Full scale*

***Procedures: mV/Volts input***

1. Connect the instrument to the calibration equipment (Figure 4).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do a three-point calibration (-FS, Zero and +FS). The display shows the applicable instructions to complete the calibration.
4. To make sure that the calibration is correct, select the applicable mV or Volts input task (Table 2).
5. Then apply the input values that are applicable to the calibration:

- mV: -120, -60, -30, 0 (short circuit)
  Then mV: 0, 30, 60, 120

OR

- Volts (V): -30, -15, -5, 0 (short circuit)
  Then volts (V): 0, 5, 15, 30

6. Make sure that the error is in the specified limits (Table 12 or Table 13).

***Table 12:*** *mV input error limits*

| Applied mV | Calibrator error (mV) | Permitted DPI 880 error (mV) |
|---|---|---|
| ±120 | 0.001 3 | 0.03 |
| ±60 | 0.000 8 | 0.02 |
| ±30 | 0.000 6 | 0.02 |
| 0 (Short circuit) | - | 0.01 |

***Table 13:*** *Volts (V) input error limits*

| Applied V | Calibrator error (V) | Permitted DPI 880 error (V) |
|---|---|---|
| ±30 | 0.000 58 | 0.004 |
| ±15 | 0.000 11 | 0.002 |
| ±5 | 0.000 06 | 0.001 |
| 0 (Short circuit) | - | 0.001 |

***Procedures: mV/Volts output***

1. Connect the instrument to the calibration equipment (Figure 4).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do a two-point calibration (Zero and +FS). The display shows the applicable instructions to complete the calibration.
4. To make sure that the calibration is correct, select the applicable mV or Volts output task (Table 2).
5. Then set the output values that are applicable to the calibration:

- mV: 0, 30, 60, 90, 120

OR

- Volts (V): 0, 3, 6, 9, 12

6. Make sure that the error is in the specified limits (Table 14 or Table 15).

***Table 14:*** *mV output error limits*

| Output mV | Calibrator error (mV) | Permitted DPI 880 error (mV) |
|---|---|---|
| 0 | 0.000 05 | 0.01 |
| 30 | 0.000 425 | 0.02 |
| 60 | 0.000 8 | 0.03 |
| 90 | 0.001 175 | 0.03 |
| 120 | 0.000 98 | 0.04 |

***Table 15:*** *Volts (V) output error limits*

| Output V | Calibrator error (V) | Permitted DPI 880 error (V) |
|---|---|---|
| 0 | 0.000 000 05 | 0.001 |
| 3 | 0.000 017 5 | 0.002 |
| 6 | 0.000 03 | 0.002 |
| 9 | 0.000 05 | 0.002 |
| 12 | 0.000 134 | 0.002 |

***Procedures: Hz input/output***

1. Connect the instrument to the calibration equipment (Figure 6).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Set up the equipment with these conditions:

   Frequency meter: Gate time = one second
   Signal generator: Output = 10V, unipolar, square wave
   Frequency = 990 Hz
   DPI 880: Input units = Hz (Table 4)
   Input trigger level = 5V (Table 4)

4. Use the calibration menu (Table 9) to do the calibration. The display shows the applicable instructions to complete the calibration.
5. To make sure that the calibration is correct, set up the equipment to do one of these calibration checks:

- Hz input calibration check (Figure 6):

  Frequency meter: Gate time = one second
  Signal generator: Output = 10V, unipolar, square wave
  DPI 880: Input trigger level = 5V (Table 4)
  Units (Table 4): Hz or kHz as specified in Table 16/17.

- Hz output calibration check (Figure 6):

  Frequency meter: Gate time = one second
  DPI 880: Units (Table 5): Hz or kHz as specified in Table 16/17.

6. Measure or supply the specified values (Table 16/17): Hz then kHz. Make sure that the error is in the specified limits.

***Table 16:*** *Hz error limits (Measure/Supply)*

| Measure/ Supply | Calibrator error (Hz) | Permitted DPI 880 error (Hz) | |
|---|---|---|---|
| Hz | | ⟵ | ⟶ |
| 25 | 0.000 175 | 0.002 | 0.001 4 |
| 100 | 0.000 7 | 0.002 | 0.002 1 |
| 250 | 0.001 75 | 0.004 | 0.003 5 |
| 500 | 0.003 5 | 0.006 | 0.005 8 |
| 990 | 0.006 93 | 0.011 | 0.010 4 |

***Table 17:*** *kHz error limits (Measure/Supply)*

| Measure/ Supply | Calibrator error (kHz) | Permitted DPI 880 error (kHz) | |
|---|---|---|---|
| kHz | | ⟵ | ⟶ |
| 2.500 0 | 0.017 5 | 0.000 2 | 0.000 042 |
| 10.000 0 | 0.07 | 0.000 2 | 0.000 112 |
| 20.000 0 | 0.14 | 0.000 3 | 0.000 205 |
| 30.000 0 | 0.21 | 0.000 4 | 0.000 298 |
| 50.000 0 | 0.35 | 0.000 6 | 0.000 483 |

***Procedures: CJ input***

1. Connect the instrument to the calibration equipment (Figure 9).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do a one-point

calibration (+FS). The display shows the applicable instructions to complete the calibration.

4. To make sure that the calibration is correct, select the applicable T1 input task (Table 2).
5. Make sure that the DPI 880 gives a probe temperature that agrees with the temperature on the digital thermometer ±0.2°F (0.1°C).

***Procedures: RTD (Ohms) input***

1. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
2. Use the calibration menu (Table 9) to do a two-point calibration for each range.

- Range: 0-399.9Ω
  a. Nominal zero ohms: Make a 4 wire connection to the 0Ω resistor (Figure 7).
  b. Nominal positive full-scale ohms: Make a 4 wire connection to the 400Ω resistor (Figure 7).
- Range: 400Ω-4kΩ
  a. Nominal zero ohms: Make a 4 wire connection to the 400Ω resistor (Figure 7).
  b. Nominal positive full-scale ohms: Make a 4 wire connection to the 4kΩ resistor (Figure 7).

The display shows the applicable instructions to calibrate each range.

3. To make sure that the calibration is correct, select the applicable ohms input task (Table 2).
4. Make a 4 wire connection to the applicable standard resistor (Table 18) and measure the value (Figure 7).
5. Make sure that the error is in the specified limits (Table 18).

***Table 18:*** *RTD (Ohms) input error limits*

| Standard Resistora (Ω) | Resistor error (Ω) | Permitted DPI 880 error (Ω) |
|---|---|---|
| 0 (Short circuit) | - | 0.05 |
| 100 | 0.008 | 0.05 |
| 200 | 0.013 | 0.05 |
| 300 | 0.018 | 0.05 |
| 400 | 0.007 | 0.05 |
| 1k | 0.042 | 0.25 |
| 2k | 0.052 | 0.25 |
| 4k | 0.072 | 0.50 |

*a Or an equivalent resistance simulator*

***Procedures: RTD (Ohms) output***

1. Connect the instrument to the calibration equipment (Figure 8).
2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do a two-point calibration for each range.

- Range: 0-399.9Ω
- Range: 400Ω-1999.9Ω
- Range: 2kΩ-4kΩ

The display shows the applicable instructions to calibrate each range.

4. To make sure that the calibration is correct, select the applicable ohms output task (Table 2).
5. Supply the specified values (Table 19). Make sure that the error is in the specified limits.

***Table 19:*** *RTD (Ohms) output error limits*

| Ohms (Ω) | Excitation (mA)a | Calibrator error (Ω) | Permitted DPI 880 error (Ω) |
|---|---|---|---|
| 0 | 0.50 to 3.0 | 0.003 | 0.05 |
| 100 | 0.50 to 3.0 | 0.004 | 0.06 |
| 200 | 0.50 to 3.0 | 0.005 | 0.06 |
| 300 | 0.50 to 3.0 | 0.007 | 0.07 |
| 400 | 0.50 to 3.0 | 0.008 | 0.07 |
| 1000 | 0.05 to 0.8 | 0.015 | 0.30 |
| 2000 | 0.05 to 0.4 | 0.026 | 0.40 |
| 4000 | 0.05 to 0.3 | 0.049 | 0.80 |

*a Refer to "Specification"*

***Procedures: TC (mV) input/output***

1. Connect the instrument to the calibration equipment:

- TC (mV) input = Figure 9b
- TC (mV) output = Figure 9d

2. Let the equipment get to a stable temperature (minimum: 5 minutes since the last power on).
3. Use the calibration menu (Table 9) to do the calibration:

- TC (mV) input = three-point calibration (-FS, Zero and +FS).
- TC (mV) output = two-point calibration (Zero and +FS). The display shows the applicable instructions to complete the calibration.

4. To make sure that the calibration is correct, select the applicable TC (mV) input or output task (Table 2) and apply the necessary values:

- TC (mV) input: -10, 0 (short circuit) Then TC (mV): 25, 50, 75
- TC (mV) output: -10, 0, 25, 50, 75

5. Make sure that the error is in the specified limits (Table 20).

***Table 20:*** *TC (mV) input/output error limits*

| Input or output TC (mV) | Calibrator error TC (mV) | | Permitted DPI 880 error TC (mV) | |
|---|---|---|---|---|
| | mV | mV | mV | mV |
| -10 | 0.000 5 | 0.000 18 | 0.008 | 0.008 |
| 0 | - | 0.000 05 | 0.006 | 0.006 |
| 25 | 0.000 6 | 0.000 36 | 0.010 | 0.010 |
| 50 | 0.000 8 | 0.000 68 | 0.014 | 0.014 |
| 75 | 0.001 0 | 0.000 99 | 0.018 | 0.018 |

***Procedures: IDOS UMM***

Refer to the user manual for the IDOS UMM.
When the calibration is complete, the instrument automatically sets a new calibration date in the UMM.

## Specification

All accuracy statements include one year stability.

### *General*

| | |
|---|---|
| Languages | English [Default] |
| Operating temperature | 14 to 122°F (-10 to 50°C) |
| Storage temperature | -4 to 158°F (-20 to 70°C) |
| Humidity | 0 to 90% without condensation<br>(Def Stan 66-31, 8.6 cat III) |
| Shock/Vibration | BS EN 61010:2001; Def Stan 66-31, 8.4 cat III |
| EMC | BS EN 61326-1:1998 + A2:2001 |
| Safety | Electrical - BS EN 61010:2001; CE Marked |
| Size (L: W: H) | 7.1 x 3.3 x 2.0 in<br>(180 x 85 x 50 mm) |
| Weight | 15 oz (425 g) |
| Power supply | 3 x AA alkaline batteries |
| Duration | Measure functions (area ①): ≈ 60 hours<br>Dual Function, mA measure (area ②):<br>≈ 7 hours (24 V Source at 12 mA) |

### *Electrical (A1 - Item 10)*

| | | |
|---|---|---|
| Range (Measure): | 0 to ±55 mA<br>0 to 4000Ωa | 0 to ±120 mV<br>0 to ±30 V |
| Accuracy: Measure mA | 0.02% of reading + 3 counts | |
| Accuracy: Measure mV | 0.02% of reading + 2 counts | |
| Accuracy: Measure V | 0.03% of reading + 2 counts | |
| Range (Supply): | 0 to 24 mA<br>0 to 4000Ω* | 0 to 120 mV<br>0 to 12 V |
| Accuracy (Supply):<br>mA, mV, V | 0.02% of reading + 2 counts | |
| Temperature coefficient<br>(Measure or supply)<br>14 to 50°F, 86 to 122°F<br>(-10 to 10°C, 30 to 50°C) | 0.0017% FS / °F<br>(0.003% FS / °C) | |
| Connectors (A1 - Item 10) | Four 0.16 in (4 mm) sockets<br>One TC mini-connector socket | |

*a Refer to "Resistance ranges (Ohms/RTD)"*

### *Electrical connectors (A2)*

| | |
|---|---|
| Range (Measure) | 0 to ±55 mA<br>0 to ±30 V |
| Accuracy: Measure mA | 0.02% of reading + 3 counts |
| Accuracy: Measure V | 0.03% of reading + 2 counts |
| Temperature coefficient<br>14 to 50°F, 86 to 122°F<br>(-10 to 10°C, 30 to 50°C) | 0.0017% FS / °F<br>(0.003% FS / °C) |
| Switch detection | Open and closed. 2 mA current. |
| Loop power output | 24 V ± 10% (Maximum: 35 mA) |
| HART® resistor | 250 Ω |
| Connectors (A2) | Three 0.16 in (4 mm) sockets |

### *Temperature ranges (RTD)*

| RTD type | Standard | Range °F | Range °C | Accuracy °F * | Accuracy °C * |
|---|---|---|---|---|---|
| Pt50 (385) | IEC 751 | -328 to 1 562 | -200 to 850 | 0.90 | 0.50 |
| Pt100 (385) | IEC 751 | -328 to 1 562 | -200 to 850 | 0.45 | 0.25 |
| Pt200 (385) | IEC 751 | -328 to 1 562 | -200 to 850 | 1.08 | 0.60 |
| Pt500 (385) | IEC 751 | -328 to 1 562 | -200 to 850 | 0.72 | 0.40 |
| Pt1000 (385) | IEC 751 | -328 to 752 | -200 to 400 | 0.36 | 0.20 |
| D 100 (392) | JIS 1604-1989 | -328 to 1 202 | -200 to 650 | 0.45 | 0.25 |
| Ni 100 | DIN 43760 | -76 to 482 | -60 to 250 | 0.36 | 0.20 |
| Ni 120 | MINCO 7-120 | -112 to 500 | -80 to 260 | 0.36 | 0.20 |

*Temperature coefficient:
14 to 50°F, 86 to 122°F = 0.0028% FS / °F
(-10 to 10°C, 30 to 50°C = 0.005% FS / °C)

### *Resistance ranges (Ohms/RTD)*

| Range (Ω) | Excitation (mA) | Accuracy (Ω)* | |
|---|---|---|---|
| | | Measure | Supply |
| 0 to 400 | 0.10 to 0.5 | - | 0.15 |
| 0 to 400 | 0.50 to 3.0 | 0.10 | 0.10 |
| 400 to 1 500 | 0.10 to 0.8 | 0.50 | 0.50 |
| 1 500 to 3 200 | 0.05 to 0.4 | 1.00 | 1.00 |
| 3 200 to 4 000 | 0.05 to 0.3 | 1.30 | 1.30 |

*Temperature coefficient:
14 to 50°F, 86 to 122°F = 0.0028% FS / °F
(-10 to 10°C, 30 to 50°C = 0.005% FS / °C)

### *Frequency*

cpm = counts/minute, cph = counts/hour

| Range (Measure): | Accuracy: |
|---|---|
| 0 to 999.999 Hz<br>0 to 50.0000 kHz<br>cpm: 0 to 999 999<br>cph: 0 to 999 999 | For all the ranges:<br>0.003% of reading + 2 counts |

ppm = pulses/minute, pph = pulses/hour

| Range (Supply): | Accuracy: |
|---|---|
| 0 to 999.99 Hz<br>0 to 50.000 kHz<br>ppm: 0 to 59 999<br>pph: 0 to 99 999 | 0.003% of reading + 0.0023 Hz<br>0.003% of reading + 0.0336 Hz<br>0.003% of reading + 0.138 cpm<br>0.003% of reading + 0.5 cph |

| | |
|---|---|
| Temperature coefficient<br>14 to 50°F, 86 to 122°F<br>(-10 to 10°C, 30 to 50°C) | <br>0.0017% FS / °F<br>(0.003% FS / °C) |
| Output waveform | Square, bipolar |
| Voltage input | 0 to 30 V |
| Trigger level | 0 to 12 V, Resolution: 0.1 V |
| Output amplitude | 0.1 to 12 V dc ± 1% (≤ 10 mA) |
| | 0.1 to 12 V aca ± 5% (≤ 10 mA) |

*a Peak to Peak*

### *Temperature ranges (TC)*

| Thermocouple type | Standard | Range °F | | | Range °C | | | Accuracy °F * | Accuracy °C * |
|---|---|---|---|---|---|---|---|---|---|
| K | IEC 584 | -454 | to | -328 | -270 | to | -200 | 3.6 | 2.0 |
| K | IEC 584 | -328 | to | 2 502 | -200 | to | 1 372 | 1.1 | 0.6 |
| J | IEC 584 | -346 | to | 2 192 | -210 | to | 1 200 | 0.9 | 0.5 |
| T | IEC 584 | -454 | to | -292 | -270 | to | -180 | 2.5 | 1.4 |
| T | IEC 584 | -292 | to | -94 | -180 | to | -70 | 0.9 | 0.5 |
| T | IEC 584 | -94 | to | 752 | -70 | to | 400 | 0.6 | 0.3 |
| B | IEC 584 | 32 | to | 932 | 0 | to | 500 | 7.2 | 4.0 |
| B | IEC 584 | 932 | to | 2 192 | 500 | to | 1 200 | 3.6 | 2.0 |
| B | IEC 584 | 2 192 | to | 3 308 | 1 200 | to | 1 820 | 1.8 | 1.0 |
| R | IEC 584 | -58 | to | 32 | -50 | to | 0 | 5.4 | 3.0 |
| R | IEC 584 | 32 | to | 572 | 0 | to | 300 | 3.6 | 2.0 |
| R | IEC 584 | 572 | to | 3 214 | 300 | to | 1 768 | 1.8 | 1.0 |
| S | IEC 584 | -58 | to | 32 | -50 | to | 0 | 4.5 | 2.5 |
| S | IEC 584 | 32 | to | 212 | 0 | to | 100 | 3.4 | 1.9 |
| S | IEC 584 | 212 | to | 3 214 | 100 | to | 1 768 | 2.5 | 1.4 |
| E | IEC 584 | -454 | to | -238 | -270 | to | -150 | 1.6 | 0.9 |
| E | IEC 584 | -238 | to | 1 796 | -150 | to | 980 | 0.7 | 0.4 |
| N | IEC 584 | -454 | to | -4 | -270 | to | -20 | 1.8 | 1.0 |
| N | IEC 584 | -4 | to | 2 372 | -20 | to | 1 300 | 1.1 | 0.6 |
| L | DIN 43710 | -328 | to | 1 652 | -200 | to | 900 | 0.6 | 0.3 |
| U | DIN 43710 | -328 | to | 212 | -200 | to | 100 | 0.9 | 0.5 |
| U | DIN 43710 | 212 | to | 1 112 | 100 | to | 600 | 0.6 | 0.3 |
| C | | 32 | to | 2 732 | 0 | to | 1 500 | 1.8 | 1.0 |
| C | | 2 732 | to | 3 632 | 1 500 | to | 2 000 | 2.5 | 1.4 |
| C | | 3 632 | to | 4 199 | 2 000 | to | 2 315 | 3.4 | 1.9 |
| D | | 32 | to | 3 092 | 0 | to | 1 700 | 1.8 | 1.0 |
| D | | 3 092 | to | 3 992 | 1 700 | to | 2 200 | 2.9 | 1.6 |
| D | | 3 992 | to | 4 514 | 2 200 | to | 2 490 | 6.5 | 3.6 |
| ХА (K) ** | | -454 | to | 2 502 | -270 | to | 1 372 | - | 0.6 *** |
| ЖК (J) ** | | -346 | to | 2 192 | -210 | to | 1 200 | - | 0.5 *** |
| МК (T) ** | | -454 | to | 752 | -270 | to | 400 | - | 0.3 *** |
| ПР (B) ** | | 32 | to | 3 308 | 0 | to | 1 820 | - | 1.0 *** |
| ПП (S) ** | | -58 | to | 3 214 | -50 | to | 1 768 | - | 1.4 *** |
| ХК (E) ** | | -454 | to | 1 796 | -270 | to | 980 | - | 0.4 *** |
| ВР-1 ** | ГОСТ 50431-92 | 32 | to | 4 532 | 0 | to | 2 500 | - | 2.5 *** |
| ХК(r) / ХК(рус) ** | ГОСТ 50431 | -328 | to | 1 472 | -200 | to | 800 | - | 0.25 *** |

* Mid-point value for the specified range. To calculate the actual error at a specified temperature, use the mV (TC) specification.
** Only available with Russian versions of the DPI 880. *** Best accuracy for the range.

**Cold Junction (CJ) error (Maximum):**

Range 50° to 86°F (10 to 30°C) = 0.4°F (0.2°C)

Add 0.01° CJ error / ° ambient temperature change for ranges: 14 to 50°F, 86 to 122°F (-10 to 10°C, 30 to 50°C)

### *mV (TC) range*

| Range (mV) | Impedance | Accuracy (Measure/Supply) |
|---|---|---|
| -10 to 75 | < 0.2 Ω | 0.02% of reading + 0.01% FS |

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