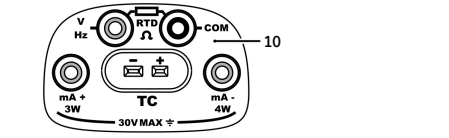
GE
Sensing

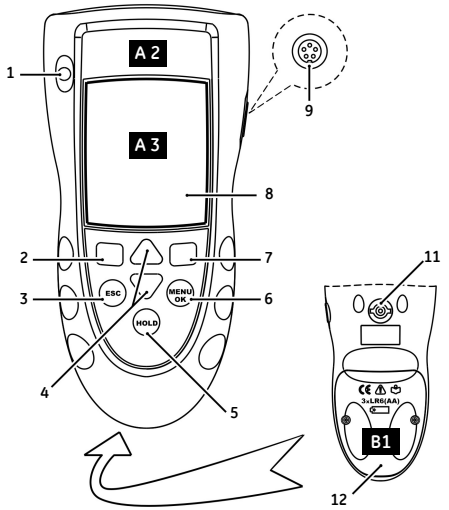
Druck DPI 880

Multi-function calibrator

User manual - K405

A1





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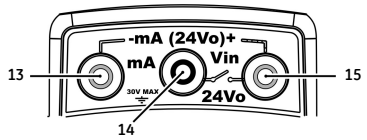
A2



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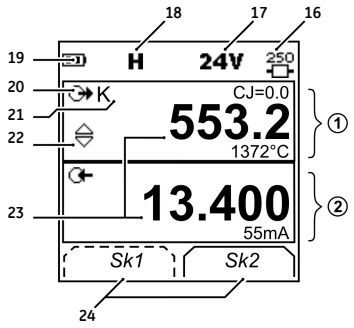
A3



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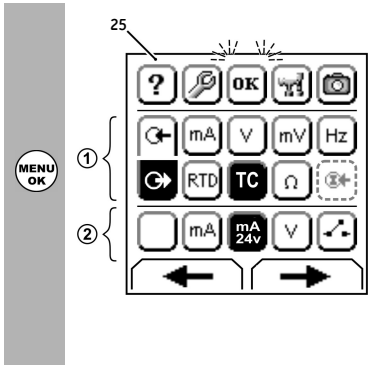


25

B1

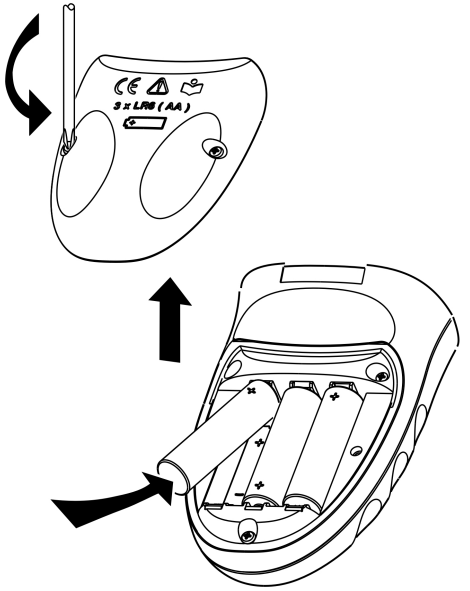


Table of Contents

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
* Measure mA, Volts/mV, Hz/pulse count
* Supply mA, Volts/mV, Hz/pulse count
* Measure/simulate: - a Resistance Temperature Detector (RTD): Ω or °C/°F - a thermocouple (TC): mV or °C/°F - 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

* *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.

Safety - 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

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. Leaves a menu option. Cancels the changes to a value.
4. ▲ ▼	Increases or decreases a value. 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). Selects or accepts an item or value. 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". **COM** Common connector **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". **Vin**, ⊶ Volts input or switch **24Vo** 24V loop power supply

To start - Key to figure A3 (Display)

Item	Description
16. ⊶	Task indication for the switch test. ⊶ = 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
17. **24V**	The loop power supply is on. *Refer to: Table 2/3*
18. **H**	The data on the display is on hold. To continue, press the **HOLD** button again.
19.	Shows the battery level: 0 to 100%.
20.	Identifies the type of data. = Input = Output = IDOS input *Refer to: Table 2/3*
21. to 22.	The settings applied to the input or output:
21. **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).
22.	, ... , = Output operation (Table 5)
23. **13.400** 55mA	The measured values applicable to the task selections in item 25, area ① and ② + the measurement range and units.
24. *Sk1/2*	A soft-key function. To select an available function, press the soft-key below it. Example: = Move left = Move right
25.	The task selection menu. One task selection is permitted in each area (① and ②).
	= 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. *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: Accepts the selections on the menu. *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 - K397: DPI 800 series data logging upgrade kit.

To start - 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.

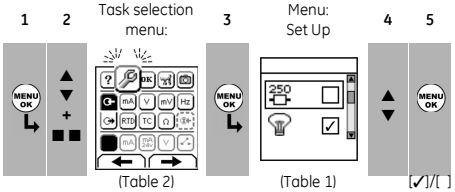
To start - Power on or off

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".

To start - Set up the basic operation

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



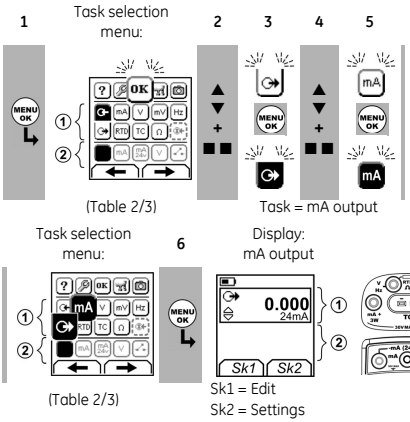
If there is additional data for a menu option, select *Settings* (■ ■) to see the values that are set up. If necessary, adjust the values.

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. *Additional data: Select Settings* (■ ■)
O/I	To select and set up the power off facility + timer. *Additional data: Select Settings* (■ ■)
	To show the battery level (%).
	To set the display contrast (%). ▲ 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. *Additional data: Refer to "Calibration".*
	To select and show the applicable status data. (Software Build, Calibration Due date, Serial Number, IDOS Information).

To start - 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)*

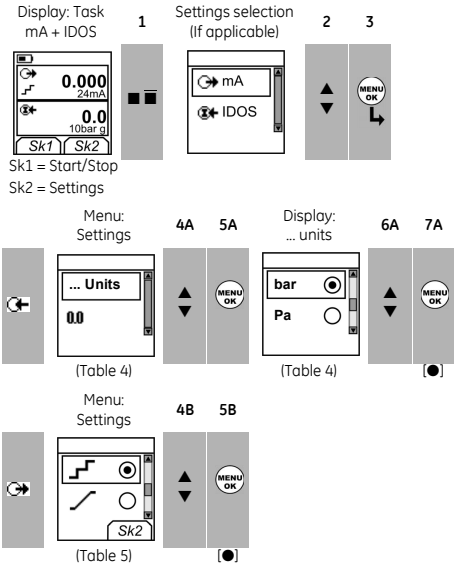
Options (If applicable)	Description
	Input measurement tasks:
mA	Measure ±55 mA
V	Measure ±30V
mV	Measure ±120mV
Hz	Measure the frequency (Units: Table 4)
RTD	Measure RTD temperature
Ω	Measure RTD resistance or Ω
TC	Measure thermocouple temperature OR mV
	Only when an IDOS UMM is attached. An IDOS measurement 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. Black button = *Dual Function*, area ② is set to off.
▢ mA V mA/24V	Input measurement tasks: Measure ±55 mA Measure ±30V Measure ±55 mA (24V loop power is on)
	A switch test
	Only when an IDOS UMM is attached. An IDOS measurement task.

To start - 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.



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: Hz: Range < 1000Hz kHz: Range 0 to 50kHz counts/minute (cpm) counts/hour (cph)
...	(TC only). Change the measurement operation: *Temperature* to *mV* OR *mV* to *Temperature*
CJ ...	(TC only). To select the type of cold junction (CJ) compensation. *Automatic*: The instrument monitors the CJ temperature and applies the necessary CJ compensation. *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. *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: Hz: Range < 1000Hz kHz: Range 0 to 50kHz pulses/minute (ppm) pulses/hour (pph)
...	(TC only). Change the output operation: *Temperature* to *mV* OR *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. *Additional data: Select Settings* (■ ■)

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

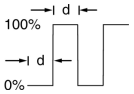
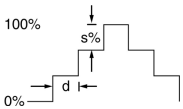
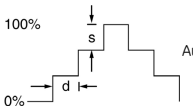
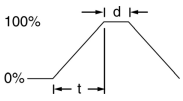
Options (If applicable)	**Description**
100 0	To select and set up values for the "Span Check" output. Example output cycle:  This cycle repeats automatically. *Additional data* (Table 6)*: Select Settings* (■ ■)
% Step	To select and set up values for the "% Step" output. Example output cycle:  Auto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

Operation - 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.

Operation - 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).

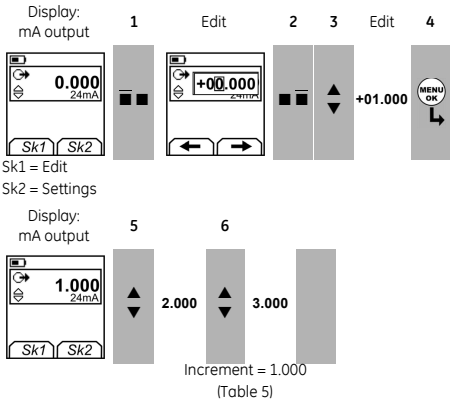
Operation - Change the output values

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):



Operation - 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).

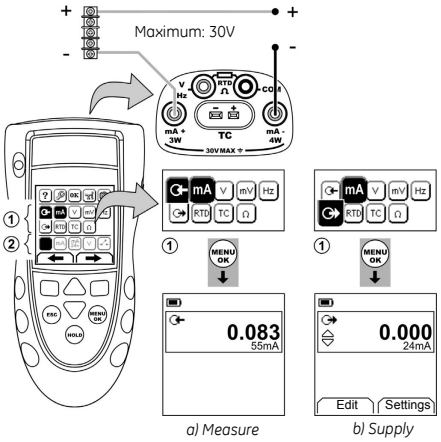


Figure 1: *Example configuration - To measure/supply mA with external loop power (Area ①)*

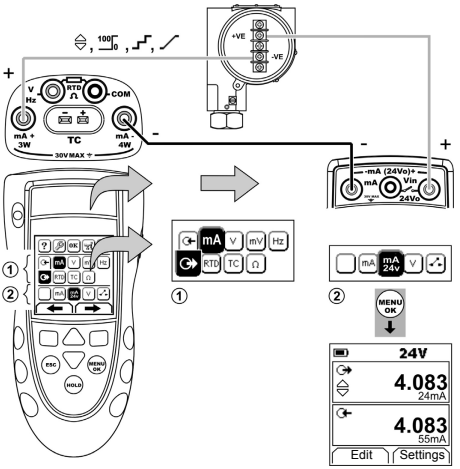


Figure 2: *Example configuration - To supply mA with internal loop power (Area ①)*

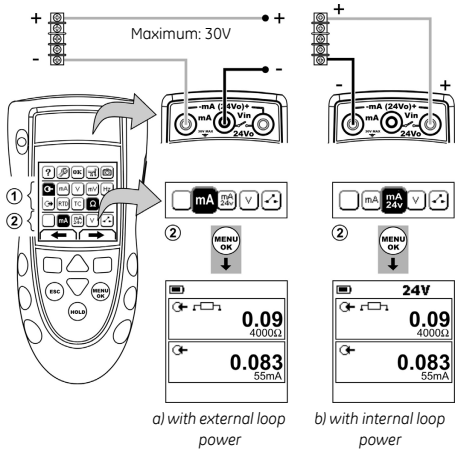


Figure 3: *Example configuration - To measure mA (Dual Function, area ②)*

Operation - 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).

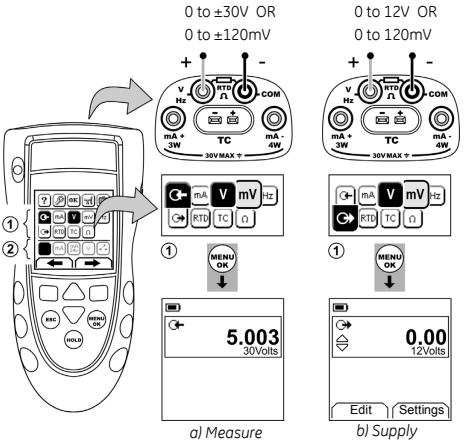


Figure 4: *Example configuration - To measure/supply Volts or mV (Area ①)*

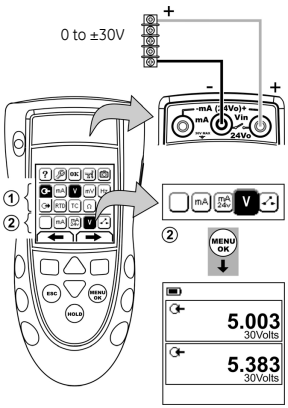


Figure 5: *Example configuration - To measure Volts (Dual Function, area ②)*

Operation - 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).

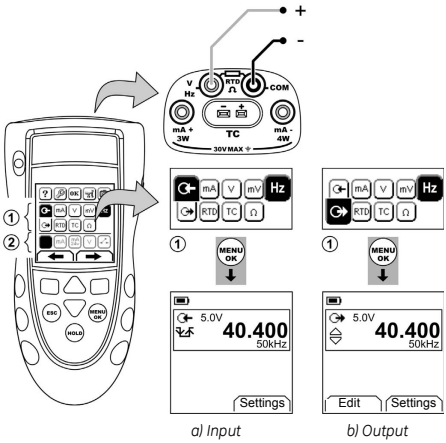


Figure 6: *Example configuration - To measure/supply Hz or Pulses*

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

Operation - 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.

Operation - 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).

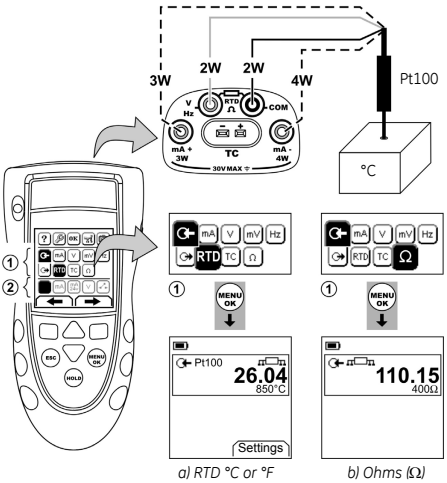


Figure 7: *Example configuration - To measure the temperature or resistance*

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.

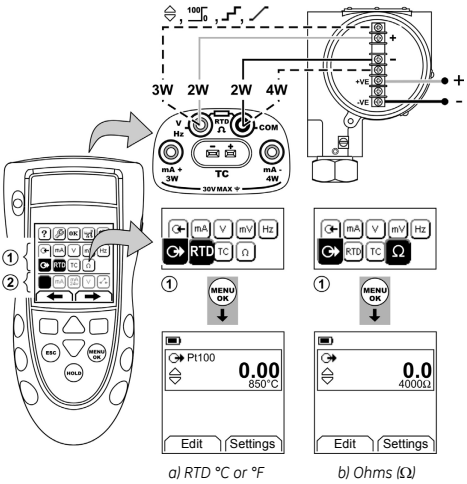


Figure 8: *Example configuration - To simulate the temperature or resistance*

Operation - 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.

Operation - 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).

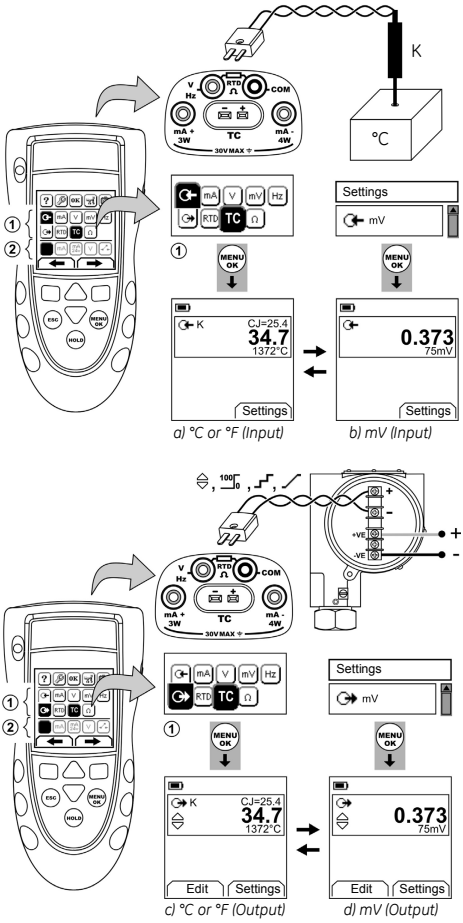


Figure 9: *Example configuration - To measure/simulate the temperature (°C/°F) or mV values of a TC*

Operation - 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).

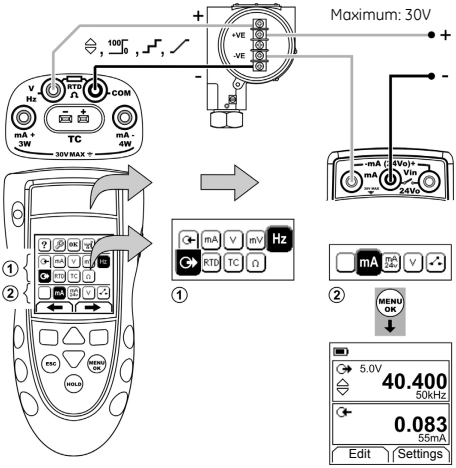


Figure 10: *Example configuration - Transmitter calibration with external loop power*

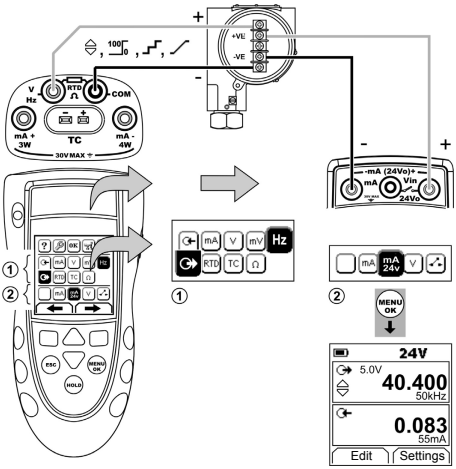


Figure 11: *Example configuration - Transmitter calibration with internal loop power*

Operation - 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.

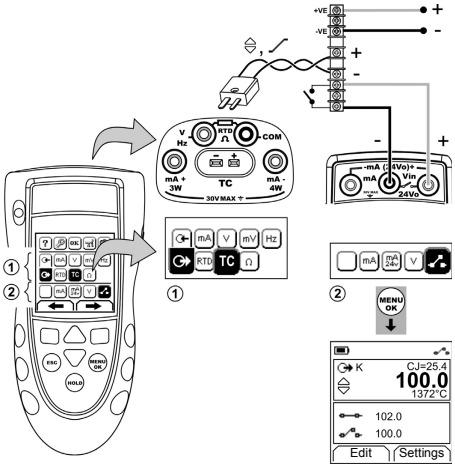
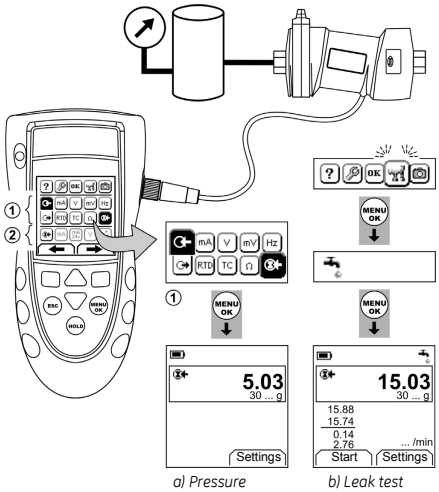


Figure 12: *Example configuration - Switch test*

Operation - 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.

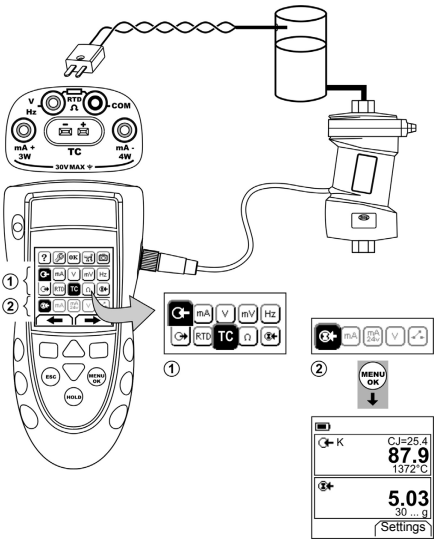


Figure 14: *Example configuration - To measure pressure and temperature*

Operation - 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 www.gesensing.com)
- your local government office.

Maintenance - Clean the unit

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

Maintenance - 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: GE 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.

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

* *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* ➤

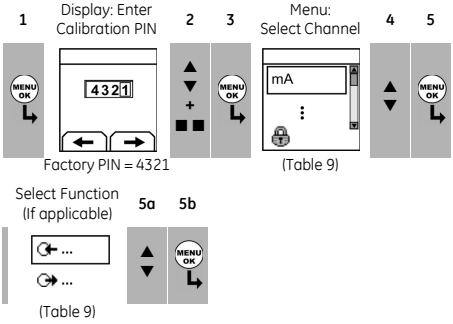


Table 9: *Calibration options*

Options	Description
... ➤	To calibrate the specified input/output: ... = mA, mV, Volts, Hz, RTD (Ohms), TC (mV)
IDOS	UMM only. To calibrate the specified IDOS UMM. 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. 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.

Calibration - 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

Calibration - 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

Calibration - 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

Calibration - 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

Calibration - 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 Hz	Calibrator error (Hz)	Permitted DPI 880 error (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 kHz	Calibrator error (kHz)	Permitted DPI 880 error (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

Calibration - 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).

Calibration - 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 Resistor* (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

* *Or an equivalent resistance simulator*

Calibration - 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)*	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

* *Refer to "Specification"*

Calibration - 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

Calibration - 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.

Specification - 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 (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 (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 Dual Function, mA measure (area ②): ≈ 7 hours (24 V Source at 12 mA)

Specification - Electrical (A1 - Item 10)

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

* *Refer to "Specification - Resistance ranges (Ohms/RTD)"*

Specification - Electrical connectors (A2)

Range (Measure)	0 to ±55 mA 0 to ±30 V
Accuracy: Measure mA	0.02% of reading + 3 counts
Accuracy: Measure V	0.03% of reading + 2 counts
Temperature coefficient 14 to 50°F, 86 to 122°F (-10 to 10°C, 30 to 50°C)	 0.0017% FS / °F (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

Specification - 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)

Specification - 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)

Specification - Frequency

cpm = counts/minute, cph = counts/hour

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

ppm = pulses/minute, pph = pulses/hour

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

Temperature coefficient 14 to 50°F, 86 to 122°F (-10 to 10°C, 30 to 50°C)	 0.0017% FS / °F (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 ac* ± 5% (≤ 10 mA)

* *Peak to Peak*

Specification - 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 1 832	-150 to 1 000	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

***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)

Specification - mV (TC) range

Range (mV)	Impedance	Accuracy (Measure/Supply)
-10 to 75	< 0.2 Ω	0.02% of reading + 7 counts

Customer service

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