GPS LTD.

GPS-925

Multifunction Process Calibrator

0.02% source and measure · thermocouples and RTDs · 24 V loop supply · IP67

Operating Manual

Issue 1

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1 Safety

Read this manual before first use, and use the GPS-925 only as this manual describes.

> **Warning: the GPS-925 sources and measures voltage and current on live circuits. Follow all safety procedures, and select the correct function and range before connecting.**

- Before use, check that the calibrator works normally, for example by sourcing from the lower display and reading the value on the upper display.
- Close the battery door before use. Remove the test leads before opening it.
- Inspect the test leads before use. Replace any lead with damaged insulation or exposed metal.
- Do not touch the metal contacts of the probes while they are connected.
- Connect the common lead first and the live lead second. When disconnecting, remove the live lead first.
- Remove the test leads before changing the measuring or source function.
- If the calibrator behaves abnormally, stop using it and have it repaired.
- Do not use the calibrator near explosive gas.
- Use only six LR03 alkaline or R03 nickel-metal hydride (or nickel-cadmium) cells, fitted inside the case. Charge or replace them when the low-battery symbol appears.

Every signal terminal is protected automatically against an accidental connection to 220 V, and the case is sealed to IP67.

2 Introduction

The GPS-925 is a handheld process calibrator that sources and measures DC voltage, millivolts, current, resistance, frequency, thermocouples and RTDs to 0.02% of reading. On a site visit it replaces a current source, a voltage source, a resistance box, an electronic potentiometer and a frequency meter.

It has two displays. The upper display measures DC voltage, millivolts, current (with or without the 24 V loop supply), resistance and continuity. The lower display measures or sources voltage, millivolts, current, resistance, frequency, thermocouples and RTDs. The two work independently, on isolated terminals, so the calibrator can drive a transmitter input from the lower display and read its output on the upper display at the same time (section 11).

- Thermocouple cold-junction compensation, automatic or manual
- Transmitter simulation in an externally powered 4 to 20 mA loop
- 0%, 100% and 25% steps, and three automatic ramps
- Stored setups, and PC communication over RS232

3 Specification

Item	Specification
Measure, DC voltage	0 to 60 V (upper display ±30 V) · ±(0.02% of reading + 2 counts)
Measure, DC mV	−15 to 125 mV · ±(0.02% of reading + 2 counts)
Measure, DC current	0 to 24 mA · ±(0.02% of reading + 2 counts) · input resistance below 100 Ω
Measure, resistance	0 to 440 Ω: ±0.15 Ω (2/3-wire), ±0.1 Ω (4-wire) · 400 to 3200 Ω: ±1.0 Ω (2/3-wire), ±0.5 Ω (4-wire)
Measure, frequency	1 Hz to 99.999 kHz · ±(0.01% of reading + 1 count) · square wave, ≥1 Vp-p from 10 Hz to 10 kHz

Item	Specification
Source, DC voltage	0 to 10 V · ±(0.02% of reading + 2 counts) · maximum load 1 mA
Source, DC mV	−15 to 125 mV · ±(0.02% of reading + 2 counts)
Source, DC current	0 to 24 mA, active or passive (SIM) · ±(0.02% of reading + 2 counts) · 20 mA into 1000 Ω
Source, resistance	10 to 440 Ω: ±0.15 Ω · 400 to 3200 Ω: ±1.0 Ω
Source, frequency	0.2 Hz to 20 kHz · ±(0.01% of reading + 1 count) · square wave ≥4.5 Vp-p
Thermocouples	J, K, T, E, R, S, B, N · measure and source · 0.1 °C resolution
Cold junction	Automatic or manual · ±1.5 °C, not included in the thermocouple accuracy
RTDs	Pt100, Pt1000, Cu50, Cu100 · measure and source · 0.1 °C resolution
Loop supply	24 V DC in series with the mA measurement
Output modes	Manual step, 25% step, 0%/100%, slow and fast ramp, stair ramp
Interface	RS232 for PC communication, on the communication and charging connector
Power	6 × AAA (LR03 alkaline or R03 NiMH/NiCd), up to 50 h on alkaline · 12 V / 1 A adapter
Reference conditions	18 °C to 28 °C after a 10-minute warm-up · ±0.005% of full scale per °C from −10 to 18 °C and 28 to 55 °C
Protection	IP67 · every signal terminal protected against misconnection to 220 V
Dimensions, weight	200 × 96 × 47 mm · 650 g

Accuracy applies for one year after calibration, at 18 °C to 28 °C after a 10-minute warm-up.

4 The instrument



Figure 1 The GPS-925 front panel

	Item	Description
1	Display	Upper display (MEASURE) and lower display (MEASURE or SOURCE), each with its own function (section 4)
2	Power	Hold for more than 2 seconds to switch on or off
3	V mV	Upper display: DC voltage or DC millivolts
4	mA LOOP	Upper display: DC current, or current with the 24 V loop supply
5	Ω •)))	Upper display: resistance or continuity
6	Backlight	Backlight on or off. Held at switch-on, enters contrast adjustment. With the power key, sets the brightness
7	MEAS / SOURCE	Lower display: switch between measure and source
8	mA	Lower display: DC current, or transmitter simulation (SIM)
9	V Hz	Lower display: DC voltage or frequency
10	mV Ω	Lower display: DC millivolts or resistance
11	TC	Lower display: thermocouple. Each press selects the next type

	Item	Description
12	RTD	Lower display: RTD. Each press selects the next type
13	RANGE	Lower display: selects the source range
14	100%	Sets the output to 100% of span. Hold to store the present value as 100%
15	▲ 25%	Raises the output by 25% of span
16	▼ 25%	Lowers the output by 25% of span
17	0%	Sets the output to 0% of span. Hold to store the present value as 0%
18	Arrow keys	◀ and ▶ select the digit to change; ▲ and ▼ raise or lower it, with automatic carry
19	STORE SETUP	Stores the present setup. Also saves the backlight, contrast and power-off settings
20	RECALL	Recalls a stored setup
21	Ramp	Starts automatic ramping. Each press selects the next ramp; any key stops it
22	SOURCE/MEASURE terminals	Lower display, isolated from the MEASURE pair (section 8)
23	MEASURE terminals	Upper display: V/mV, Ω, mA and LOOP, with COM (section 7)

Terminals

Terminal	Use
V/mV/Ω/Hz TC/RTD and COM	Lower display: voltage, millivolts, frequency, resistance (2-wire), thermocouple and RTD, measure and source
mA out (+ and −)	Lower display: mA source, and mA measurement. The + terminal is also 4W, the − terminal also 3W
SIM mA in	The − mA out terminal with COM: transmitter simulation in an externally powered loop
3W, 4W	Extra sense terminals for 3- and 4-wire resistance and RTD measurement
MEASURE: V/mV Ω mA LOOP and COM	Upper display. Electrically isolated from the SOURCE/MEASURE terminals
Communication and charging	Adapter input, and PC connection with the optional RS232 cable

Display

The upper display is always a measurement. The lower display shows MEASURE or SOURCE, and in source mode the output as a percentage of the span (Figure 2).



Figure 2 Upper display reading loop current, lower display sourcing 12 mA (50%)

Indication	Meaning
Battery symbol	Shown when about 20% or less charge remains. Flashes while charging, steady when charging ends
Charging symbol	Shown, with the backlight on, while the adapter is connected
Over-range	In resistance measurement, the connection is open
Flashing lower value	The mA source cannot drive the set current into the load: an overload symbol is also shown
Buzzer	Confirms a stored 0% or 100% value and a factory reset; sounds below 50 Ω in continuity

5 Power

Batteries

The calibrator takes six AAA cells: LR03 alkaline, or R03 nickel-metal hydride or nickel-cadmium. Alkaline cells last up to about 50 hours. Remove the test leads before opening the battery door, and close the door before use.

Charging and the adapter

The 12 V / 1 A adapter plugs into the communication and charging connector. It runs the calibrator and charges rechargeable cells. The battery symbol flashes while charging and stops when charging ends. Charging stops automatically when the cells are full, or when alkaline cells are fitted.

Automatic power-off

The calibrator switches off 30 minutes after the last key press. The setting is shown for about 2 seconds at switch-on.

- To turn automatic power-off off, press the power key and ◀ together. To turn it on, press the power key and ▶ together.
- To change the time, press the power key and ▶ together, set 1 to 30 minutes with ▲ and ▼, and press STORE SETUP. The setting closes by itself after 5 seconds without a key press.

Backlight

The backlight key turns the backlight on and off. To set the brightness, press the power key and the backlight key together until BRIGHT appears, adjust with ▲ and ▼, and press STORE SETUP. The setting closes by itself after 5 seconds without a key press.

6 Getting started

Hold the power key for more than 2 seconds. All segments show for 1 second, then the model and power-off time for 2 seconds. The calibrator starts with DC voltage on both displays.

First check: voltage to voltage

This short test checks the calibrator and shows how sourcing and stepping work.

1. Connect V/mV/Ω/Hz on the lower display to V/mV on the MEASURE pair, and COM to COM.
2. Press MEAS / SOURCE so the lower display shows SOURCE.
3. Set 1 V with the arrow keys: ◀ and ▶ select the digit, ▲ and ▼ change it.
4. Hold 0% until the buzzer sounds. 1 V is now 0% of the span.
5. Set 5 V and hold 100% until the buzzer sounds. 5 V is now 100%.
6. Press ▲ 25% and ▼ 25% to step between 1 V and 5 V. The upper display reads each step.

7 Upper display: measuring

The upper display uses the MEASURE terminals, which are isolated from the rest. It is not affected by anything set on the lower display (Figure 3).

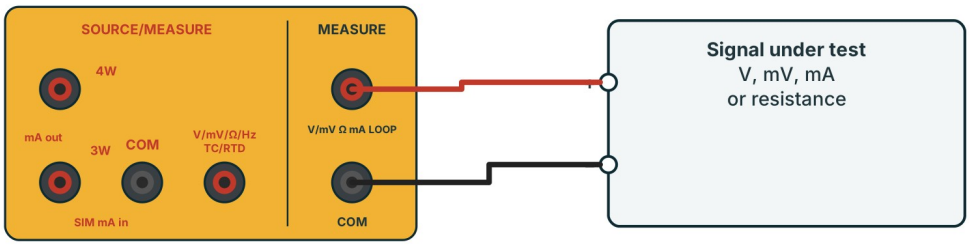


Figure 3 Upper display measurement

- DC voltage: the default at switch-on. Press V mV to change between DC V and DC mV.
- DC current: press mA LOOP until mA is shown.
- Resistance and continuity: press Ω •))) to change between them. In continuity the buzzer sounds below 50 Ω.

Current with the loop supply

Press mA LOOP until LOOP and mA show together. The calibrator then puts 24 V in series with its mA measurement, so it can power and read a two-wire transmitter that is disconnected from the plant wiring (Figure 4).

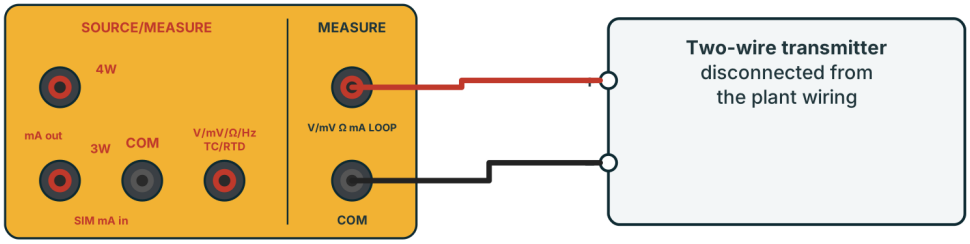


Figure 4 Powering and reading a two-wire transmitter

8 Lower display: measuring and sourcing

The lower display works independently of the upper display. MEAS / SOURCE changes between measure and source; RANGE selects the source range.

Voltage, millivolts and frequency

Connect to V/mV/Ω/Hz and COM (Figure 5). Press V Hz for DC voltage or frequency, or mV Ω for millivolts. Select measure or source with MEAS / SOURCE. In frequency source, RANGE selects the 200 Hz, 2000 Hz or 20 kHz range.

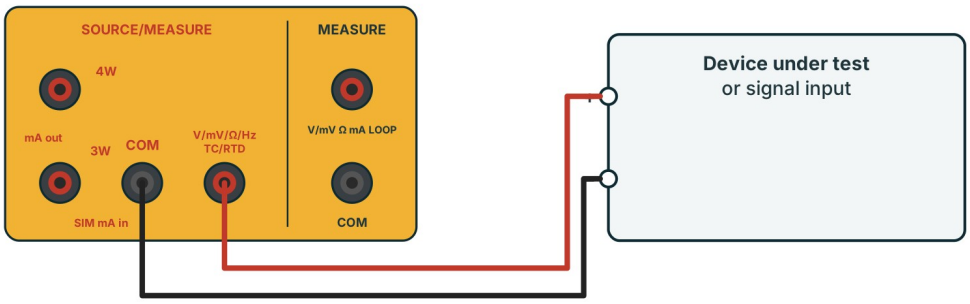


Figure 5 Lower display: voltage, millivolts, frequency and 2-wire connections

Measuring current

Select measure and press mA. Connect the circuit to the mA terminals.

Sourcing current

Select source and press mA. The calibrator drives the set current out of mA out + and back into mA out − (Figure 6). It drives 20 mA into up to 1000 Ω. If the load is too high, the overload symbol appears and the lower value flashes: check the connections and the load.

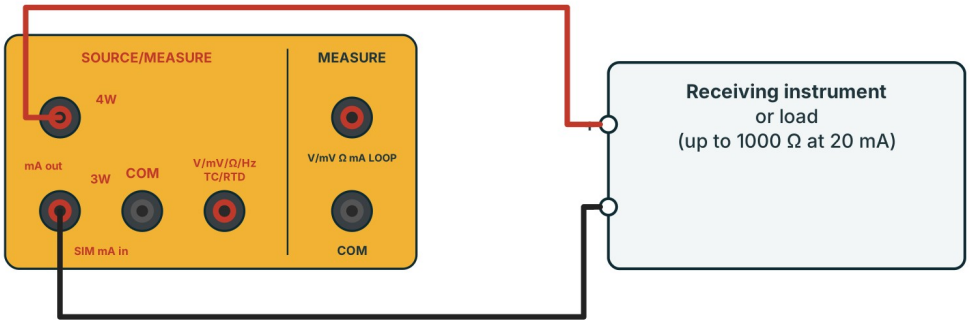


Figure 6 Sourcing current into a receiving instrument

Simulating a transmitter

In place of a two-wire transmitter, the calibrator sets the current in a loop powered by an external 24 V supply. Connect the loop supply + to the − mA out terminal and COM towards the rest of the loop, as the SIM mA in marking shows (Figure 7), select source and press mA until SIM is shown. Set the current with the arrow keys or the percentage keys.

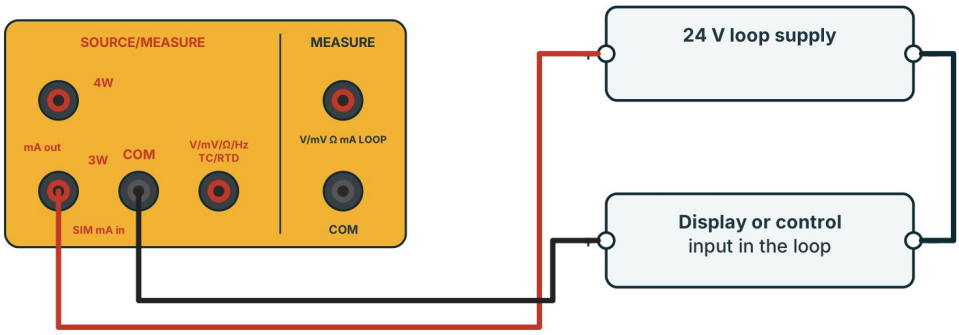
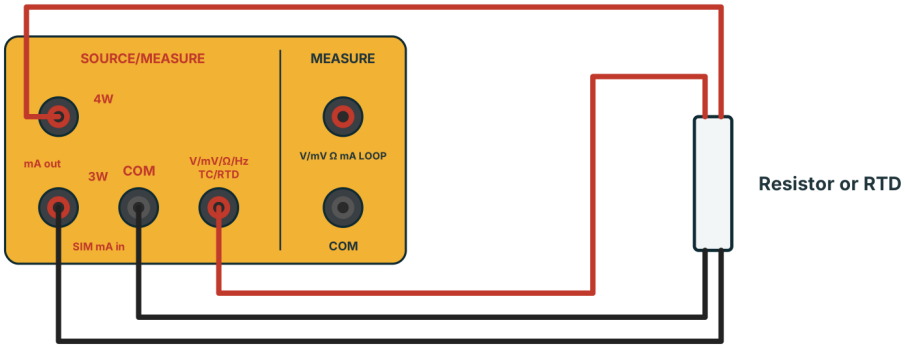


Figure 7 Simulating a transmitter in an externally powered loop

Resistance

To measure, select measure and press mV Ω for Ω. Choose 2-, 3- or 4-wire with the arrow keys (Figure 8): 2-wire uses V/mV/Ω/Hz and COM, 3-wire adds 3W, and 4-wire adds 4W. The wiring is not detected again until you leave resistance and return. An over-range indication means the connection is open.



3-wire: leave 4W unconnected · 2-wire: V/mV/Ω/Hz and COM only

Figure 8 3- and 4-wire resistance and RTD measurement

To source resistance, select source and press mV Ω for Ω. Connect as for voltage, and press RANGE for the 400 Ω or 3200 Ω range. The device under test must supply an excitation current of 0.4 to 3.3 mA on the 400 Ω range, or 0.1 to 0.6 mA on the 3200 Ω range.

9 Temperature

Measuring a thermocouple

1. Connect the thermocouple to V/mV/Ω/Hz TC/RTD and COM. If the plug and the calibrator are at different temperatures, wait at least one minute for the connection to settle.
2. Select measure and press TC. Each press selects the next type.
3. To see the thermocouple voltage in mV, press RANGE. It shows for 3 seconds.

Cold-junction compensation

Automatic compensation, using the calibrator's own terminal temperature, is the default, and the display shows Auto. Press RECALL to see the compensation temperature in use: it shows for 2 seconds. Compensation adds ±1.5 °C to the thermocouple accuracy.

1. For manual compensation, press STORE SETUP. STORE appears, with the manual compensation temperature as the small value.
2. Set the temperature with the arrow keys.
3. Press STORE SETUP to save it and leave the setting.
4. To return to automatic compensation, press RECALL.

Measuring an RTD

Select measure and press RTD. Each press selects the next type. The calibrator detects 2-, 3- or 4-wire connection, or you can set it with the arrow keys (Figure 8). 3-wire is the most common connection, 4-wire the most accurate, and 2-wire the least accurate.

Simulating a thermocouple or RTD

1. Connect the device under test to V/mV/Ω/Hz TC/RTD and COM.
2. Select source, and press TC or RTD until the type is shown.
3. Set the temperature with the arrow keys.

RTD simulation is 2-wire only: the 3W and 4W terminals are for measurement. To drive a 3- or 4-wire input, link the extra wires at the device under test. An over-limit indication means the excitation current from the device is outside the limit.

10 Spans, stepping and ramping

The 0% and 100% values set the span for stepping, ramping and the percentage shown on the lower display. To change them, set the value and hold 0% or 100% until the buzzer sounds. They are kept when the calibrator is switched off.

Function	0%	100%
DC V	0 V	10 V
DC mV	0 mV	100 mV
DC mA	4 mA	20 mA
Resistance, 400 Ω range	0 Ω	400 Ω
Resistance, 3200 Ω range	0 Ω	3200 Ω
Frequency	0 Hz	200 Hz, 2000 Hz or 20 kHz, by range
Thermocouple K	0 °C	1000 °C
RTD Pt100	0 °C	500 °C

Factory spans shown for the functions the maker lists. Other thermocouple and RTD types have their own factory spans.

Stepping

Press ▲ 25% or ▼ 25% to step the output by a quarter of the span. Press 0% or 100% briefly to go straight to that end.

Ramping

Press the ramp key to start a ramp. Each press selects the next one, and any other key stops it.

Ramp	Output
Slow ramp	0% to 100% and back in 40 seconds, repeated
Fast ramp	0% to 100% and back in 15 seconds, repeated
Stair ramp	0% to 100% and back in 25% steps, holding each step for 5 seconds, repeated

11 Calibrating a transmitter

The two displays together calibrate a transmitter in one setup: the lower display drives its input and the upper display powers its loop and reads the output (Figure 9).

1. Set the upper display to mA with LOOP.
2. Set the lower display to source, and select the input the transmitter expects: thermocouple type, RTD type, mV or V.
3. Set the transmitter's zero and span as the 0% and 100% values.
4. Step through 0, 25, 50, 75 and 100% with the percentage keys, reading the output current at each point. Adjust the transmitter as needed.

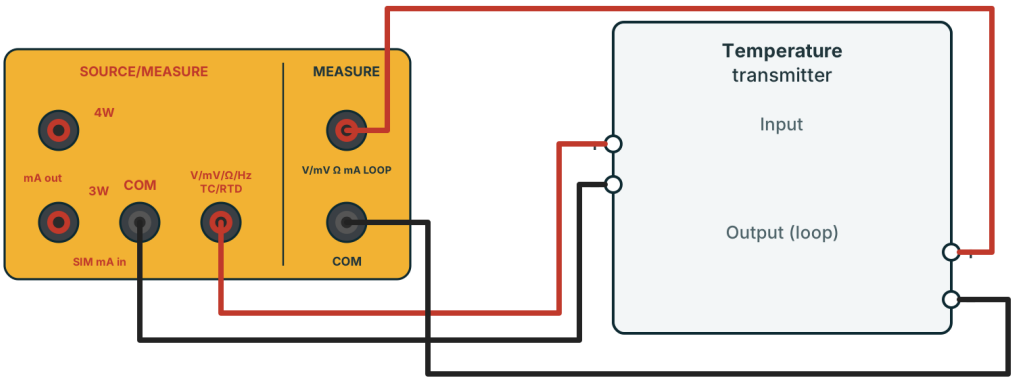


Figure 9 Calibrating a temperature transmitter

12 Setups, reset and PC connection

Stored setups

STORE SETUP stores the present setup, and RECALL brings it back.

Factory reset

Press the power key and RECALL together until the buzzer sounds. Both displays return to DC voltage, automatic power-off to 30 minutes, the backlight to 60% and the spans to their factory values.

PC connection

With the optional RS232 cable on the communication and charging connector, the calibrator communicates with a PC. For software, contact GPS.

13 Care and calibration

- Check the test leads before every use, and replace any that are damaged.
- Charge or replace the cells when the low-battery symbol appears. Use only the cell types listed in this manual.
- If the calibrator behaves abnormally, stop using it and return it for repair.

To keep the specified accuracy, we recommend recalibration by GPS or an authorised GPS agent every year.

14 Supplied with the instrument

- GPS-925 calibrator and aluminium carry case
- Test probe leads, red and black
- Stackable 4 mm test leads, red and black
- Insulated test clips (4)
- 12 V / 1 A power adapter
- This manual

Optional: six R03 rechargeable cells, and the RS232 communication cable.

Model	Description	Part number
GPS-925	Multifunction process calibrator, 0.02%, source and measure, IP67	800600

15 Warranty and service

One year from the date of purchase, subject to product registration with GPS at www.gpslimited.com/register-product. Service and technical support are available for the life of the instrument.

For service, calibration or technical support contact GPS at sales@gpslimited.com or +44 (0) 203 093 0914, quoting the model, part number and serial number.