

# QR-10 Series *R-Can*:

## General-Purpose Pocket Programmable Resistance Substitution Box

### *Datasheet*





QR-100/101 is an electronically controlled, portable, programmable resistance substitution box (can) specially designed for technicians, engineers and students. It provides up to 8.4 MΩ “true” resistance with 0.1 Ω steps and 1 mΩ (or 6 digits) resolution.

### What You Set Is What You Get

Thanks to the compact keypad and 0.54” OLED, user can set the desired values in the field directly; While the USB-COM port allows it to be controlled by a PC, laptop or other USB host device for automatic test.

Furthermore, with the tolerance as tight as  $\pm 0.05\%$  (T class) or  $\pm 0.01\%$  (A class), rated power of 1.0 W and of modest price for all fans, QR-100/101 is supposed to be the ideal candidate to replace/upgrade the cumbersome conventional resistance substitution box.

### Highlights

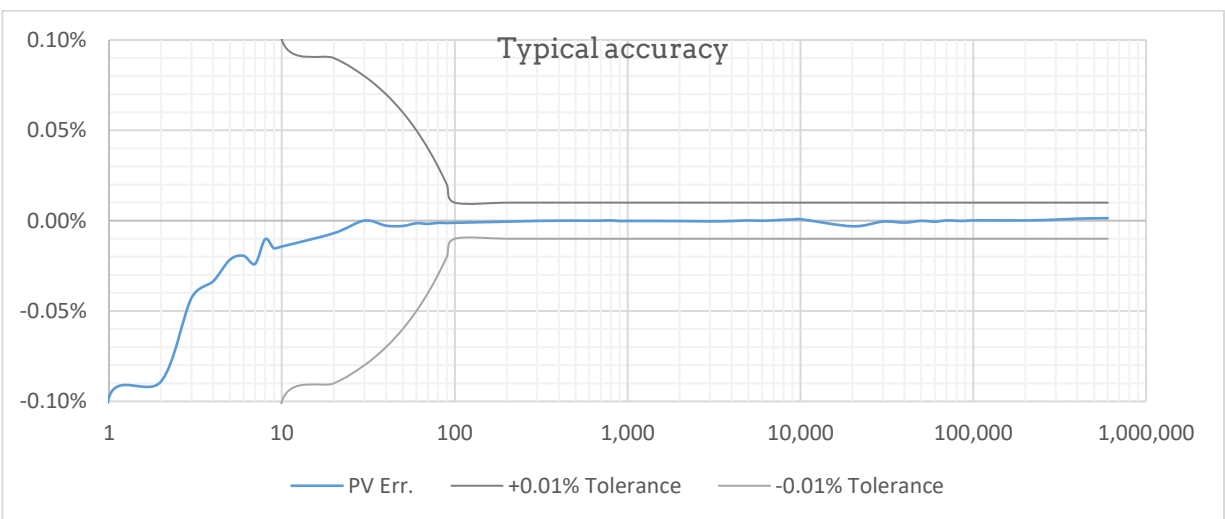
- Easy-to-use keypad
- USB-COM port interface with user-friendly AT commands style protocol
- Real resistance output generated by relay-resistor array
- High accuracy:  
Of  $\pm 0.05\%$  ( $>100 \Omega$ , T class);  
Of  $\pm 0.01\%$  ( $>100 \Omega$ , A class)
- Wide range:  
Of  $1 \Omega \sim 630 \text{ K}\Omega$  (QR-101, 0.1  $\Omega$  steps);  
Of  $1 \Omega \sim 8.4 \text{ M}\Omega$  (QR-101, 1.0  $\Omega$  steps)
- 1.0 W high power rating
- Safety output limit
- Latched output with ZERO power consumption
- Enabled user calibration
- Rechargeable battery
- Portable with small dimensions and solid housing

### Designed for

- Labs
- Schools
- ...

### Applications

- Sensor simulation
- Sensor & multimeter calibration
- Precise op. amplifier gain control
- Wheatstone Bridge tuning
- Circuits on-line adjustment
- Resistive load
- Auto-test
- Physical law verification



## Device type

Type	Class <sup>1</sup>	Best Accuracy	TCR <sup>2</sup>	Power Rating	Output Range <sup>3</sup>	Step	Order Code
QR100	A	0.01%	<25 ppm	1 W	1 Ω ~870 Ω	0.1 Ω	QR100A-1K-R1
					1 Ω ~11.5 KΩ	1 Ω	QR100A-AK-1R
	T	0.05%	<50 ppm		1 Ω ~870 Ω	0.1 Ω	QR100T-1K-R1
					1 Ω ~11.5 KΩ	1 Ω	QR100T-AK-1R
QR101	A	0.01%	<25 ppm		1 Ω ~630 KΩ	0.1 Ω	QR101A-1M-R1
					1 Ω ~8.4 MΩ	1 Ω	QR101A-AM-1R
	T	0.05%	<50 ppm		1 Ω ~630 KΩ	0.1 Ω	QR101T-1M-R1
					1 Ω ~8.4 MΩ	1 Ω	QR101T-AM-1R

- 1 Class A: standard version  
Class T: economical version or test samples
- 2 Defined by base resistors which > 2 Ω.
- 3 Output range may vary with each unit. In general, for the max output, the difference is within 1% of the given value; the minimum output is around 1.0 Ω.

## Specifications

Key features	QR100	QR101	Definitions
<b>Output</b>			
Initial accuracy		A class @Cali. Temp. ±2 °C	T class @Cali. Temp. ±5 °C
	<=100 Ω:	±0.1 Ω	±0.5 Ω
	>100 Ω:	±0.01%	±0.05%
Step	0.1 Ω or 1.0 Ω		Operation times <5,000 for each relay
Difference of SP and PV	<1 step		SP: Set Point PV: Process Value
Rated power	1.0 W or 200 Vdc max.		
TCR <sup>1</sup>	A class: 25 ppm typical T class: 50 ppm typical		
Thermoelectric potential (EMF)	<50 μV	<80 μV	Estimated base on relay's specification
Relay type	Bi-stable signal relay		
Relay durability	Electrical: 1 x 10 <sup>5</sup> min. Mechanical: 5 x 10 <sup>7</sup> min.		
Relay settle time	55 ms max.	95 ms max.	
Output terminal	φ2.0 mm female banana connectors		
<b>User interface (UI)</b>			
Keypad	Mechanical buttons with silicone rubber caps		non-waterproof
Display	0.54" OLED, monochrome		

## Specifications (continued)

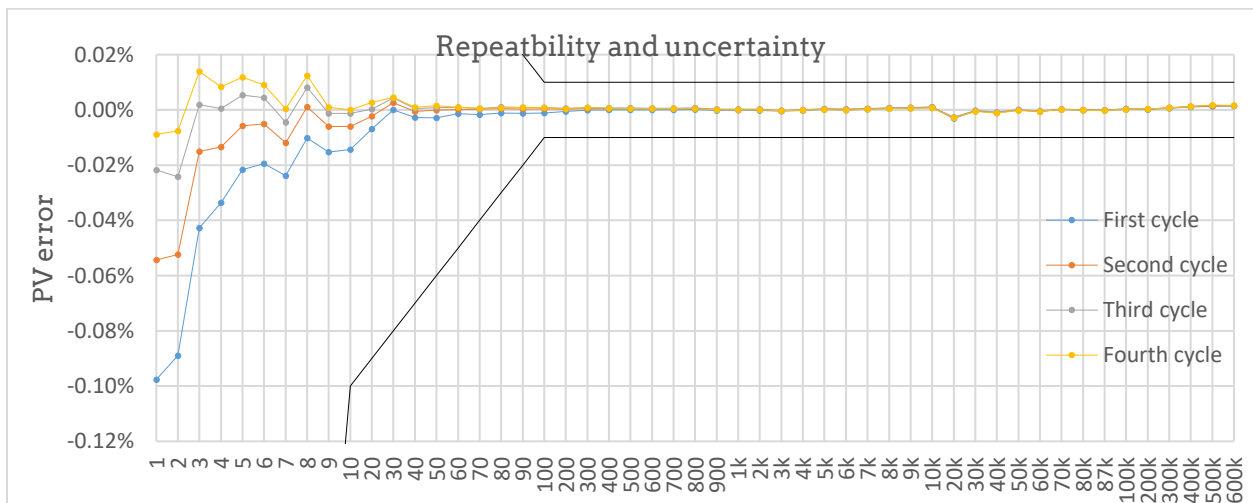
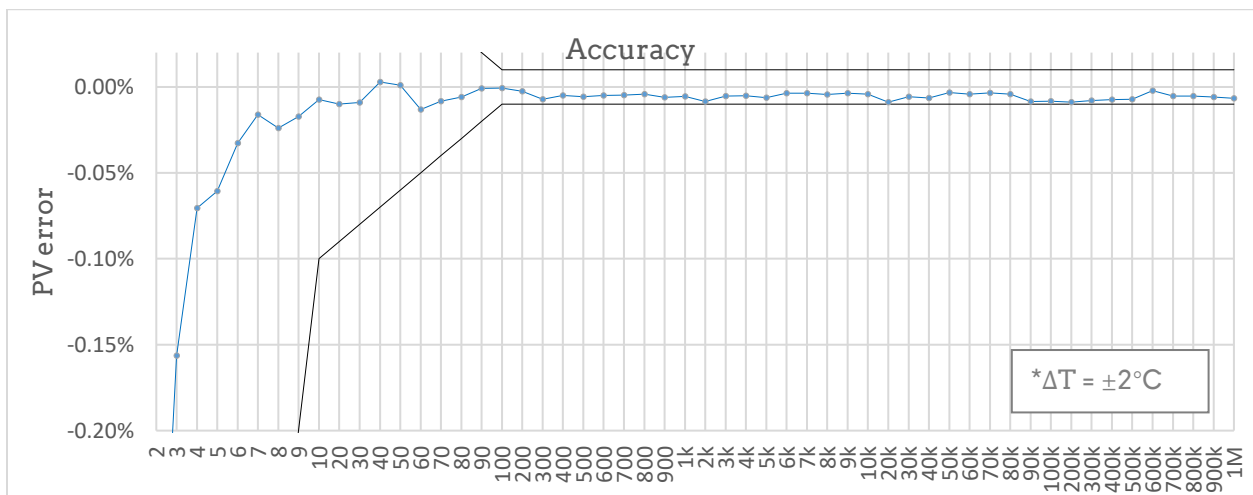
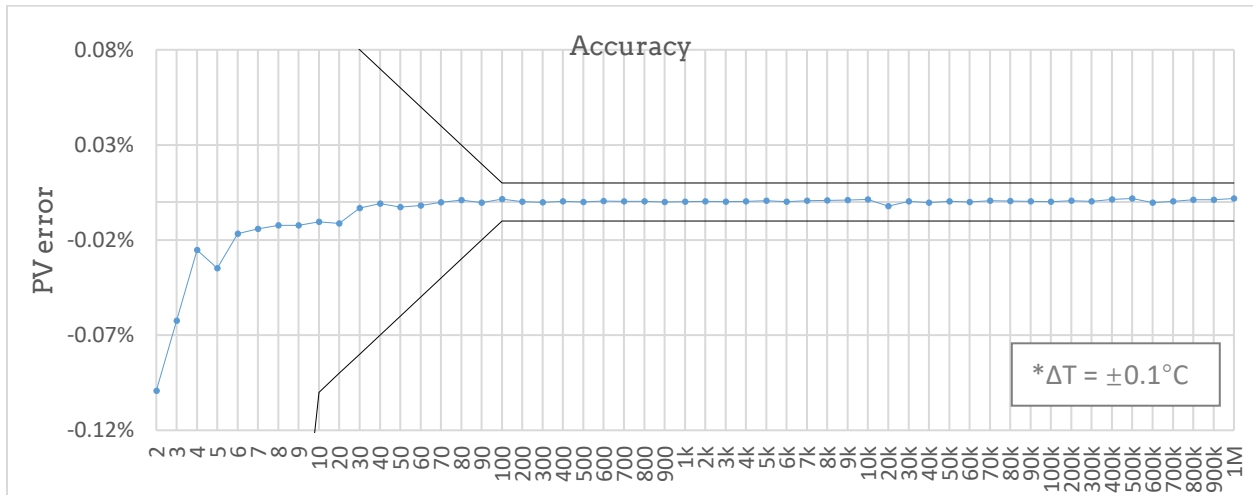
<b>Main display items</b>	Set Point (SP), Process Value (PV), Rated voltage of PV (U<), Output low limit (R>), Battery voltage (VB) and Device info.	
<b>Resolution</b>	SP: 0.1 Ω or 6 digits PV: 1 mΩ or 6 digits	
<b>Power saving</b>	Turn off display after 1 min of inactivity; Shut down after 1 h of inactivity	
<b>Communication interface</b>		
<b>Interface</b>	USB-to-serial COM port	
<b>Driver IC</b>	WCH CH340	<a href="#">WIN driver link</a> <a href="#">MAC driver link</a>
<b>Baud rate</b>	115,200 bps	
<b>Protocol</b>	Proprietary AT commands, user calibration is allowed	Please refer to <a href="#">User Manual</a>
<b>Connector<sup>2</sup></b>	USB type-C	
<b>Battery</b>		
<b>Battery</b>	Rechargeable Li-Polymer, 500+ charge/discharge cycles	
<b>Battery life</b>	About 12 hours @ 1Hz frequency operation	
<b>Charging power supply</b>	5 V ± 5%, 100 mA min.	Via USB type-C port
<b>Charging time</b>	3 hours	
<b>Shelf life</b>	10 month, Re-charge the battery every 8 month is recommended	
<b>General Specifications</b>		
<b>Operating temperature</b>	-10 °C to 40 °C	
<b>Relative humidity</b>	10 % to 95 % non-condensing	
<b>Storage temperature</b>	-20 °C to 35 °C	
<b>Housing material</b>	Brass (cup), Dioxide aluminum alloy (lid)	
<b>Dimensions</b>	5.5 cm (OD) x 4.6 cm (H)	5.5 cm (OD) x 6.1 cm (H)
<b>Weight</b>	About 190 g	About 225 g
<b>Accessories</b>	2 x ultra-stable 2 mm banana plug cable (0.5 m), 2 x alligator clip with 2 mm banana connector	
<b>Warranty</b>	A class: 2 year T class: 1 year	Indoor use only

- For the base resistors >2Ω. Actual TCR may slightly higher especially for the low range values (<100Ω). However, on the other hand, since base resistors that with opposite TCRs can cancel each other out, actual TCR of some points may be very much lower.
- A common USB type-C cable for Android smart phones probably also works well on this device.

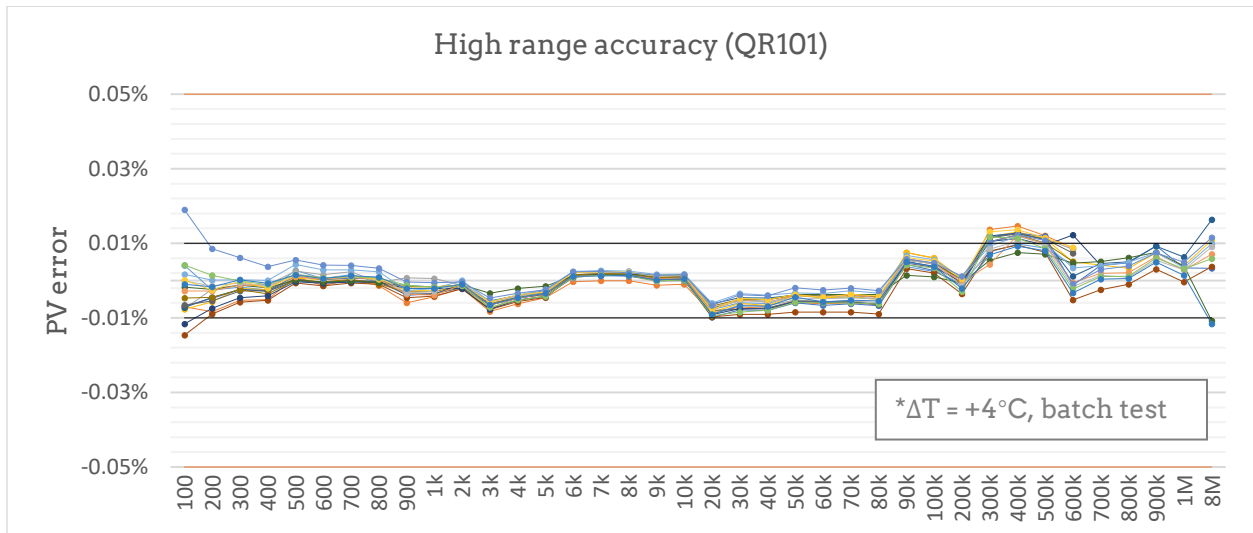
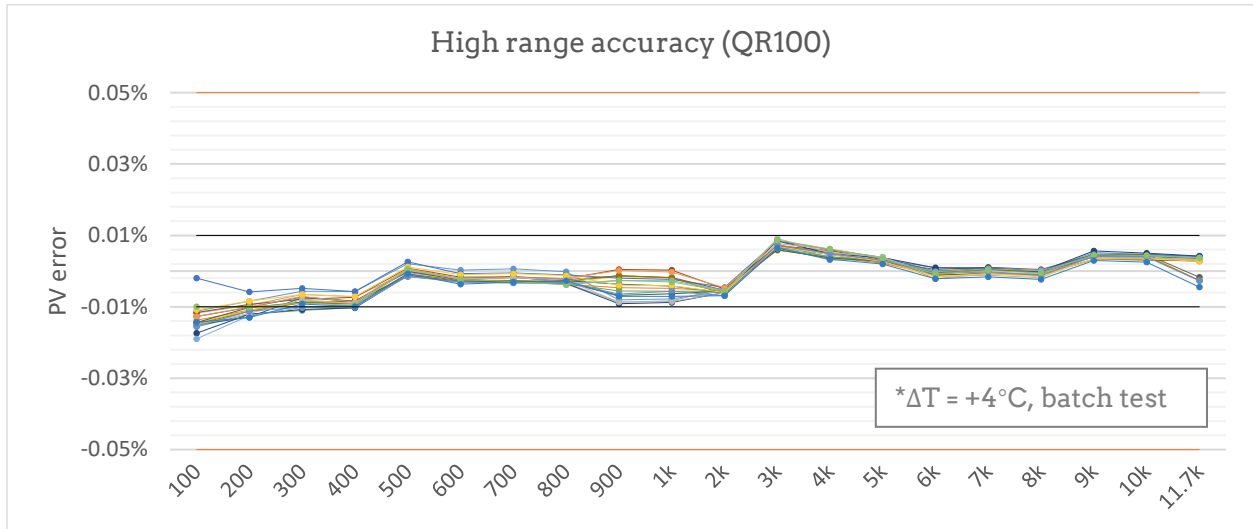
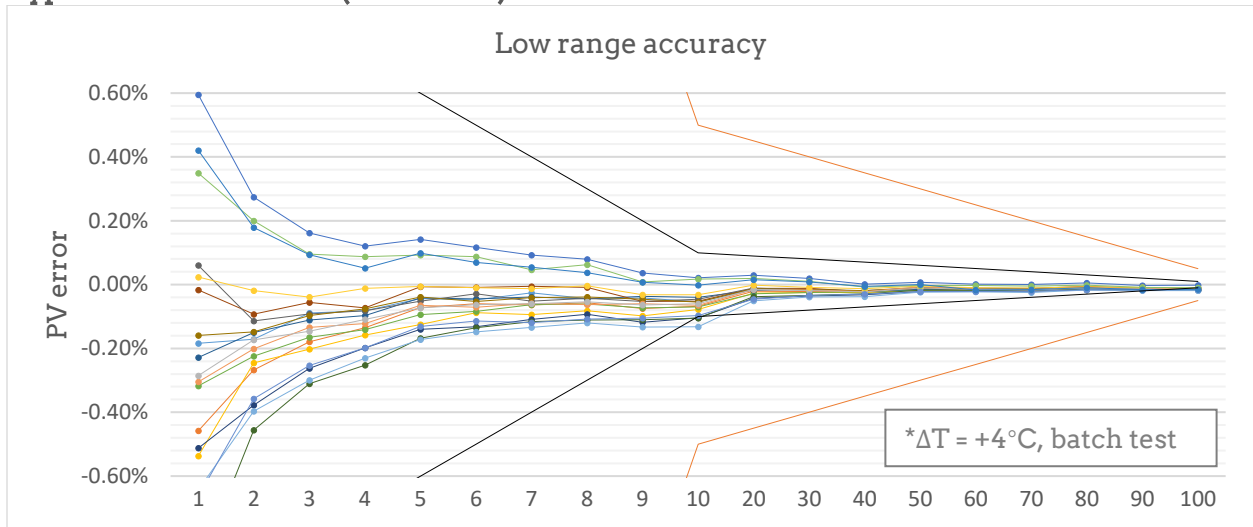
### Typical characteristics\*

\*All tests based on T class samples (unless otherwise noted)

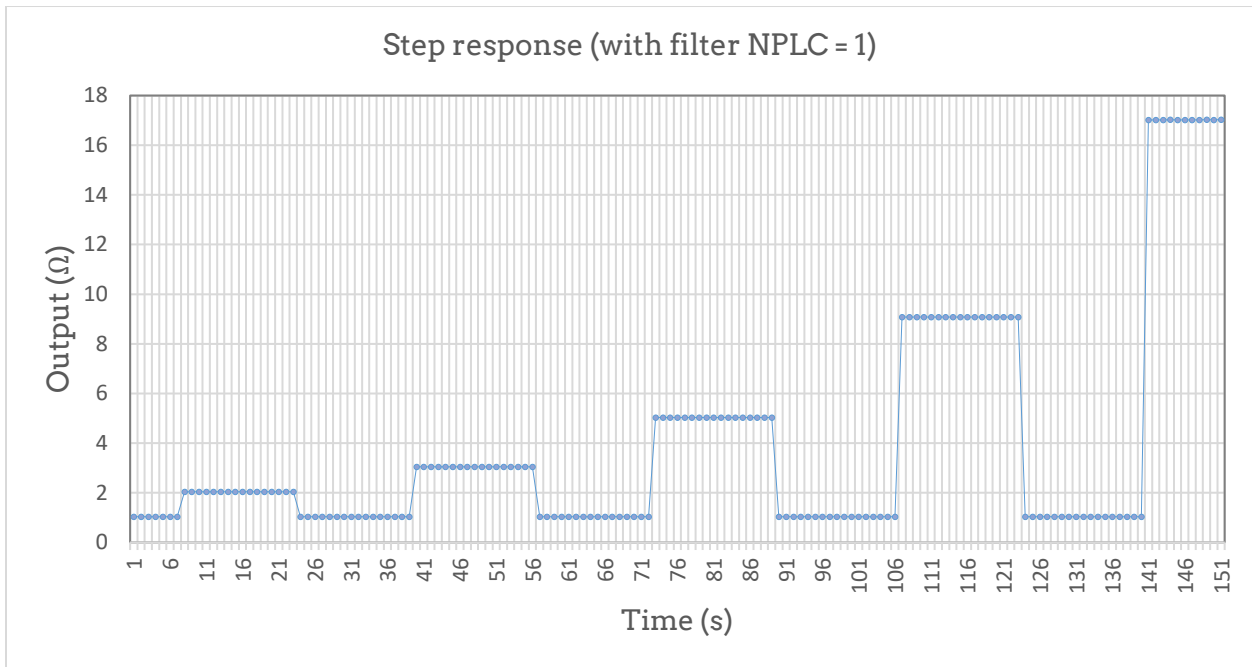
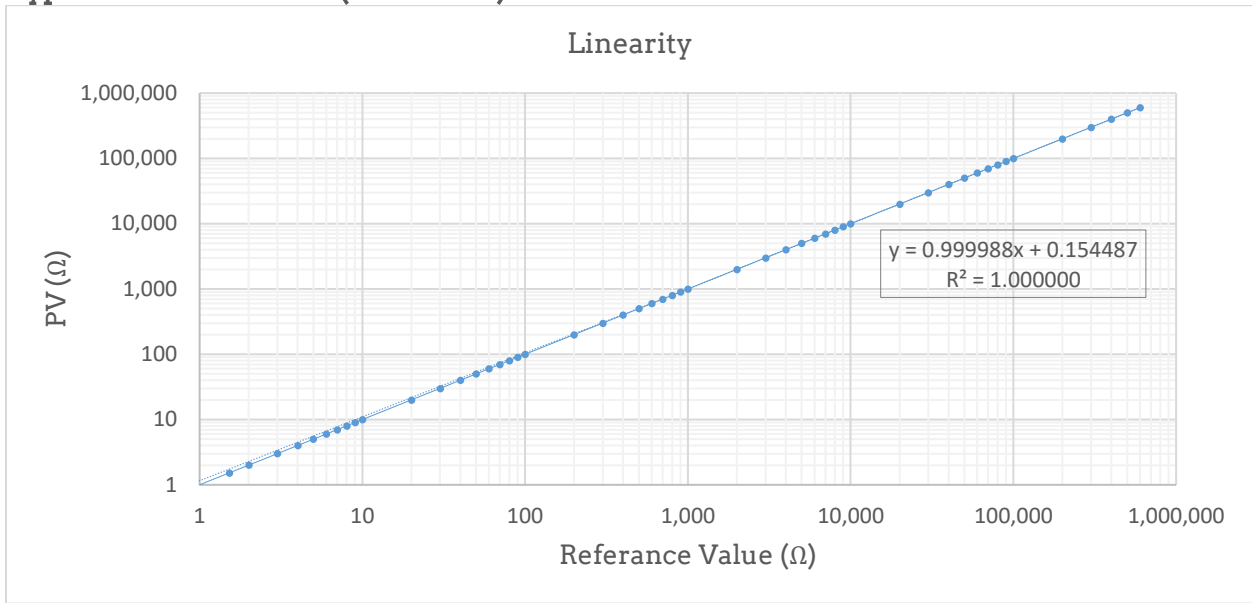
Definition:  $\Delta T$  = test temperature - calibration temperature.



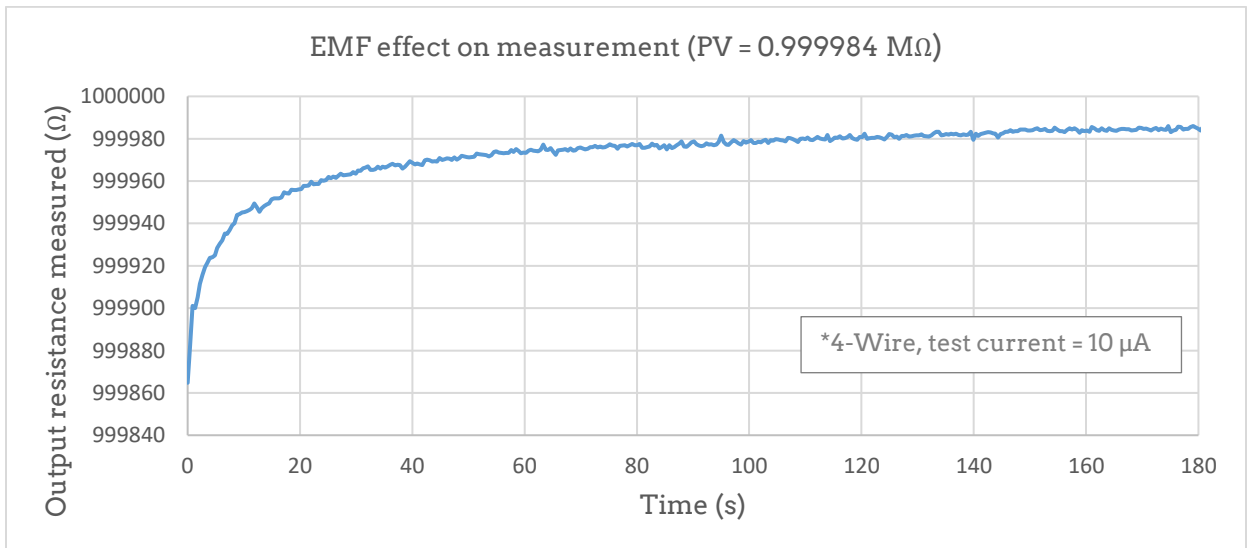
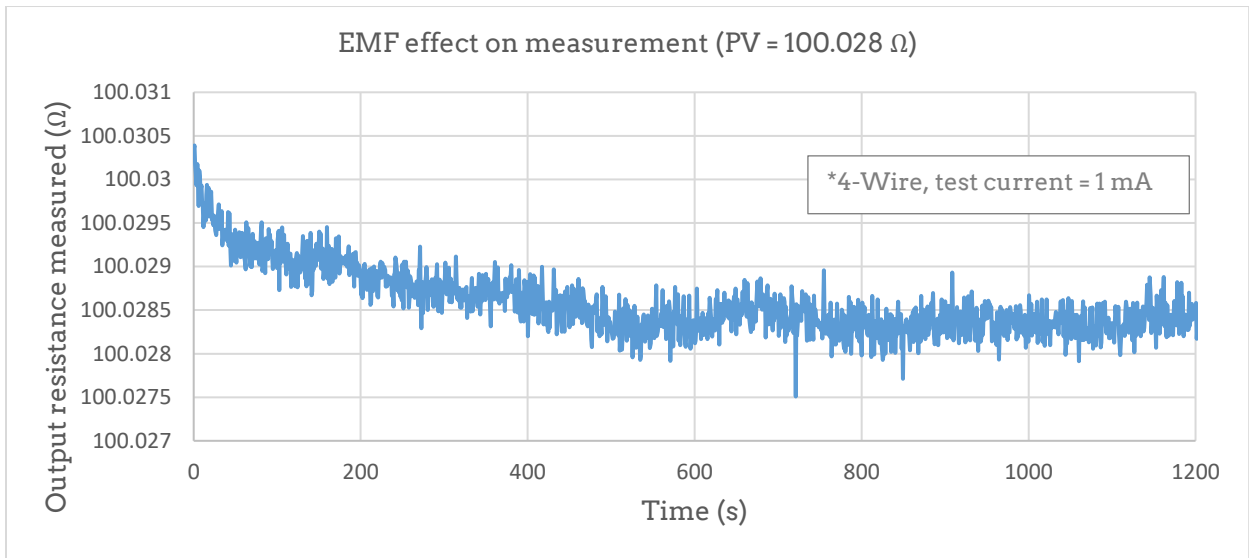
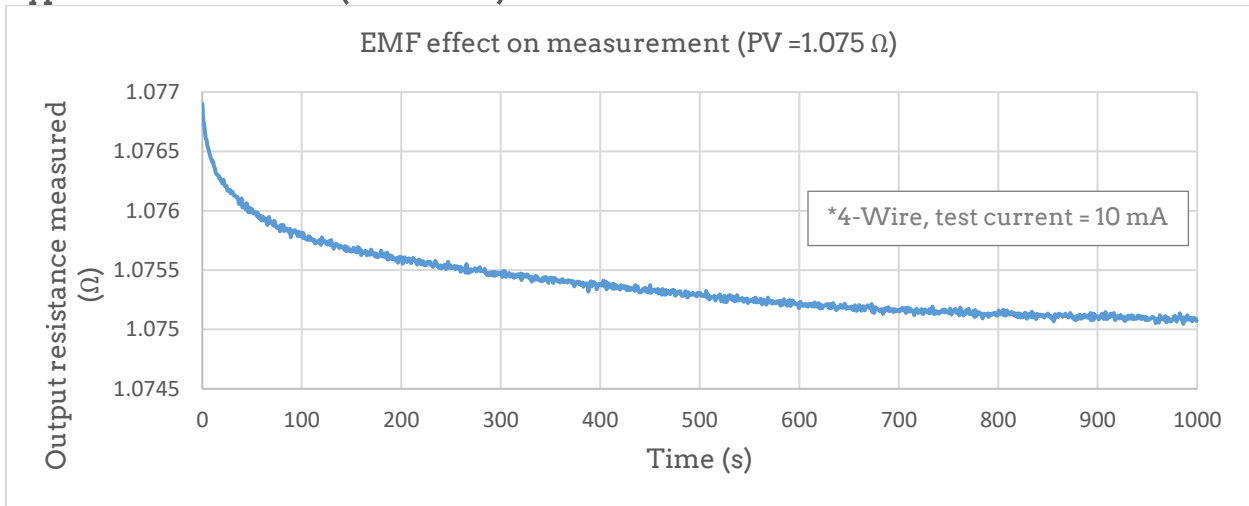
Typical characteristics (continued)



### Typical characteristics (continued)

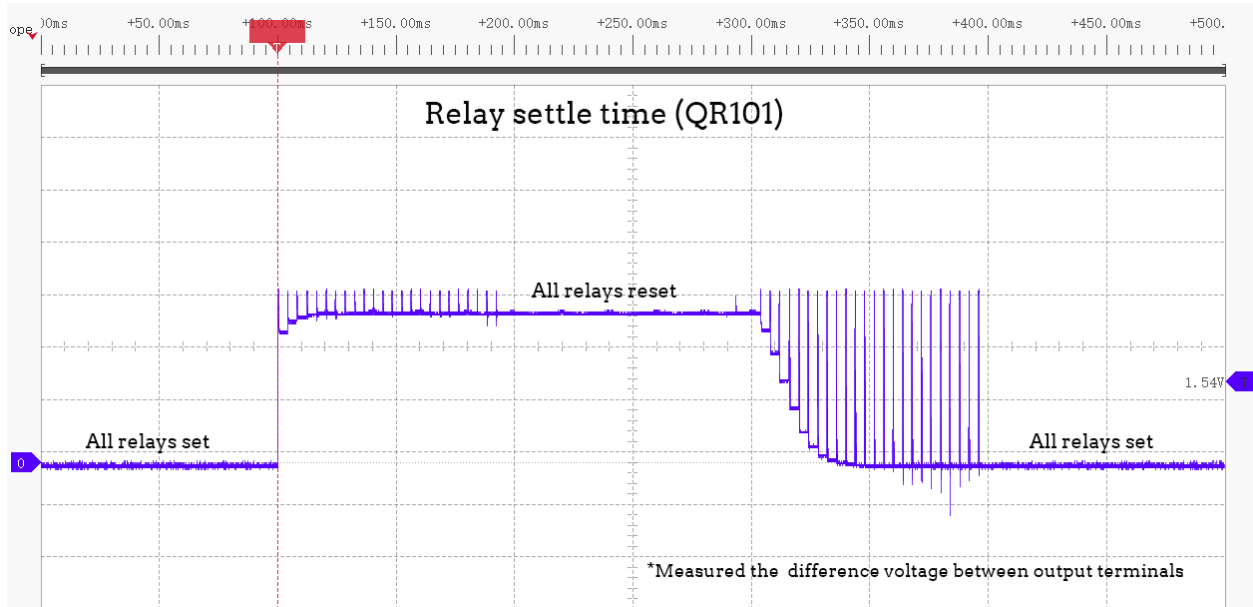
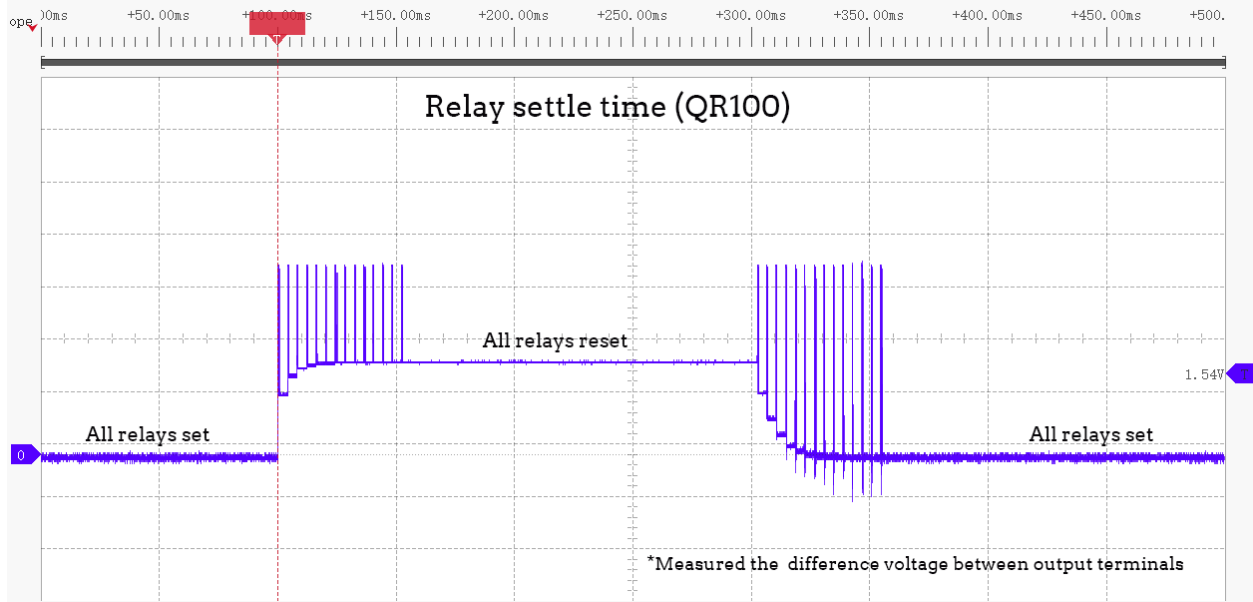


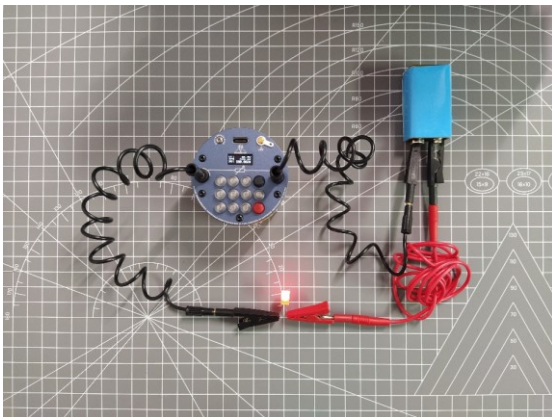
### Typical characteristics (continued)





## Typical characteristics (continued)





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