



FLYZ-8101

Battery Impedance Spectrum Analyzer

Precision EIS testing for single cells

USER MANUAL

Version 1.0 · February 2026



1. Preface

Thank you for choosing the AI-EIS FLYZ-8101 Battery Impedance Spectrum Analyzer. Please keep this user manual for reference so that you can use the product fully and for a long time.

Latest version of this manual

The content of this manual may change due to revisions or specification changes. The latest version can be downloaded from our website:

<http://www.ai-eis.com/flyz-8101.html>

Product registration

To make sure you receive important product information, please register your product:

<https://www.ai-eis.com/register>

Latest AnalyZis software

Instrument control and data analysis are performed with the AnalyZis software. The latest version can be downloaded from our website:

https://www.ai-eis.com/AnalyZis_software.html

2. Package Contents

When the instrument is delivered, please check for transport damage or anomalies before use. Pay particular attention to the accessories, switches and terminals on the panel surface. If anything is damaged or the instrument does not operate according to specification, please contact us.

Table 1 — Package contents

Item	Qty	Picture
FLYZ-8101 Battery Impedance Spectrum Analyzer	1	
Warranty card	1	



Item	Qty	Picture
Power adapter (24 V 1 A, 1.5 m)	1	
RS-232 data cable (1 m)	1	
Measurement cable set (1.5 m)	1	
Induction-canceling lead extension (0.5 m)	1	
Test probes	4	
Alligator clips	4	

Note: the accessory pictures are indicative; actual items may vary slightly.

3. Safety Precautions

To use the instrument safely and make full use of its functions, please observe the following precautions. Use the instrument within its specifications, and within the specifications of accessories and optional parts.

!! WARNING

During measurement, the maximum excitation current applied to the object under test can reach 2 A (FLYZ-8101C) or 90 mA (FLYZ-8101E). Measuring primary (non-rechargeable) batteries may damage them — **do not measure primary batteries.**

!! WARNING

Batteries may catch fire or be damaged by over-discharge. Manage the battery voltage properly during measurement.

!! WARNING

To prevent electric shock, never remove the instrument enclosure. High voltage and



high-temperature parts are inside.

Checks before use

- Before use, check the measurement probes for damaged insulation or exposed metal. Such damage can cause electric shock — replace with the models specified by us.
- Confirm that no fault has been caused by storage or transport, and verify operation before use. If a fault is found, contact us.
- The instrument has ventilation holes on the side for heat dissipation; keep the specified clearance to surroundings when placing it.
- Before switching on, verify that the supply voltage marked on the power connection matches your power adapter. Using a voltage outside the specified range may damage the instrument or cause an electrical accident.
- Always connect/disconnect power while the power switch on the rear panel is OFF (O).

Do not place the instrument in the following locations

- Direct sunlight or high-temperature locations
- Locations with corrosive or explosive gases
- Locations exposed to water, oil, chemicals or solvents
- Humid or condensing locations
- Locations with strong electromagnetic waves or near charged objects
- Dusty locations
- Near induction heating equipment (high-frequency induction heaters, IH cooktops, etc.)
- Locations subject to frequent mechanical vibration
- Unstable or inclined surfaces



4. Overview

4.1 Features

The FLYZ-8101 is used for AC impedance spectrum measurement and analysis of full cells in commercial or experimental settings. With high-precision voltage measurement, it is the ideal instrument for battery quality management. Its noise-resistant circuit design maintains reliable measurement performance even in complex industrial production environments.

Precision hardware

- **True wide-band precision measurement:** frequency range 7.8 kHz – 0.015 Hz, covering the full band from ohmic impedance to Warburg diffusion impedance.
- **High accuracy and interference immunity:** Kelvin four-wire method with specially designed induction-canceling excitation terminals eliminates the inductive error introduced by long cables, ensuring accurate measurement of resistances down to 0.6 mΩ, independent of battery size and measurement distance.
- **Wide compatibility:** 1.45 – 4.5 V cell voltage range; 1.5 m leads plus alligator-clip/probe accessories cover every scenario from coin cells, cylindrical, pouch and prismatic cells to large blade cells and packs.

Easy operation

- Battery reverse-connection and mis-connection protection safeguards both instrument and battery.
- Tri-color status LED (acquisition / fault / power) gives an at-a-glance status; RS-232 and CAN dual interfaces fit various industrial environments.

Powerful software

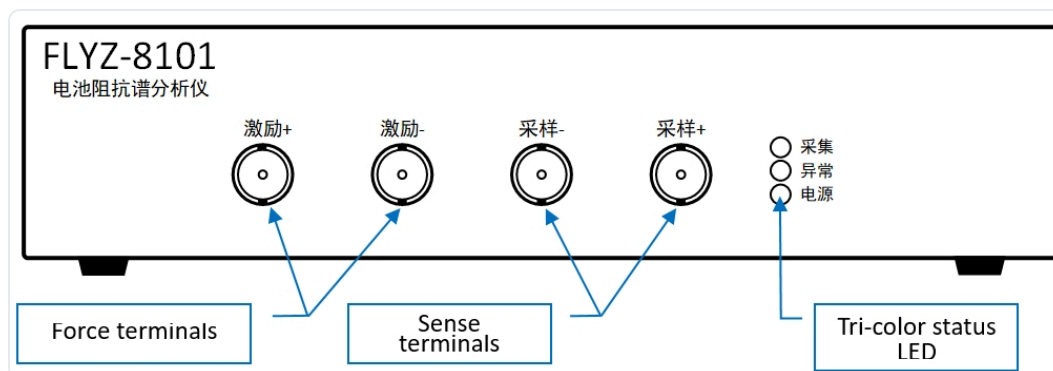
- The comprehensive host software integrates professional functions such as KKR validation, DRT analysis and ECM fitting — testing and analysis in one seamless workflow.
- Data can be saved to a cloud server, supporting team collaboration, data traceability and a full lifecycle health record for every battery.

Professional analysis

- Fully automated analysis workflow: KKR validation (data reliability check) → DRT analysis (distribution of relaxation times, identifying the dominant processes) → ECM equivalent-circuit fitting, linked in one intelligent chain. One click generates a professional analysis report, compressing hours of expert work.

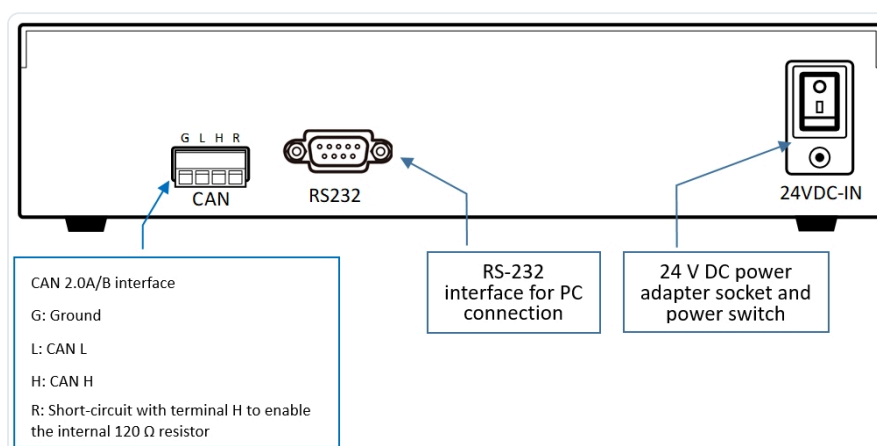
4.2 Panel description

Front panel



Front panel: tri-color status LED · voltage sense terminals (SENSE+ / SENSE-) · excitation current terminals (FORCE+ / FORCE-)

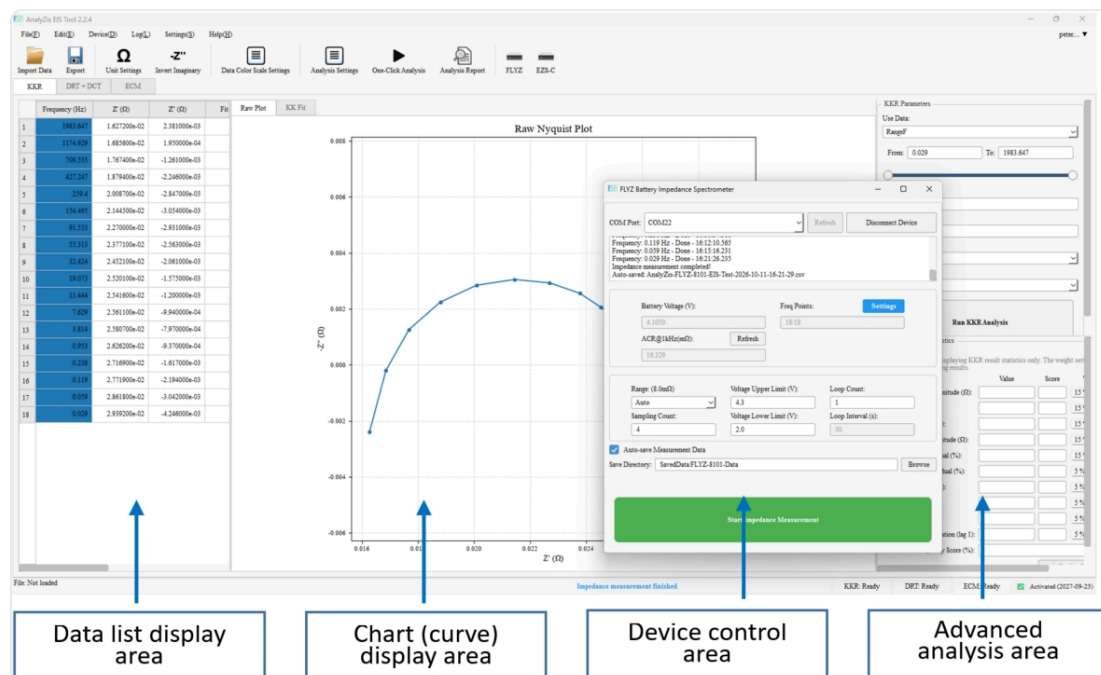
Rear panel



Rear panel: 24 V DC power adapter socket and power switch · RS-232 interface for PC connection · CAN 2.0 A/B interface (G: ground, L: CAN-low, H: CAN-high)



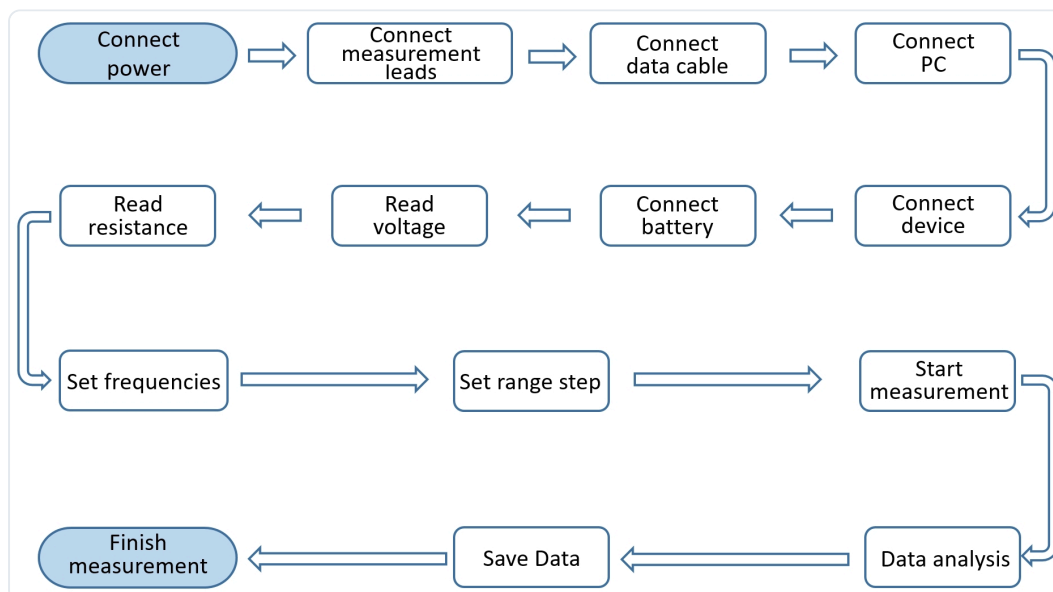
4.3 Software interface



AnalyZis main window: device control area · advanced analysis area · chart display area · data list area
(UI switchable between English and Chinese)

For software operation refer to the **AnalyZis-EIS Analysis Software User Manual**, available on the software page of our website: https://www.ai-eis.com/AnalyZis_software.html

4.4 Measurement workflow

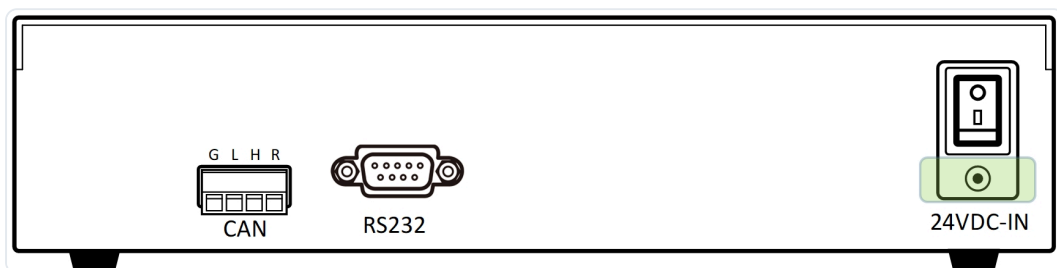


Measurement workflow

5. Preparation

5.1 Connecting the power adapter

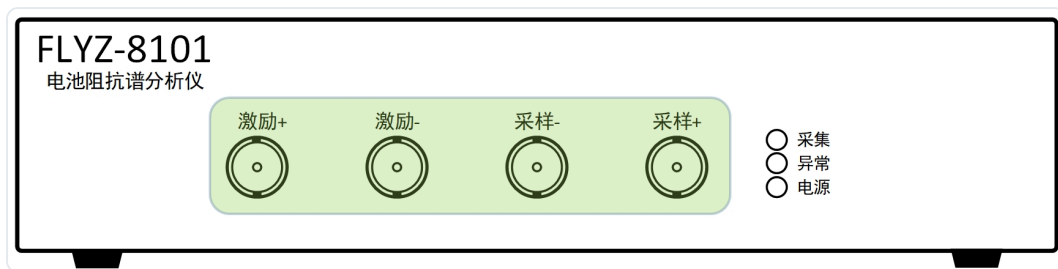
- The FLYZ-8101 supply voltage is 24 V. Make sure the adapter voltage is neither higher nor lower.
- Make sure the adapter can supply at least 1 A.
- Before connecting the adapter, confirm the power switch on the rear panel is OFF (O).
- First plug the adapter into mains, then insert the 24 V DC plug into the power socket on the rear panel.



Connecting the power adapter: 24 V DC socket and power switch on the rear panel

5.2 Connecting the measurement leads

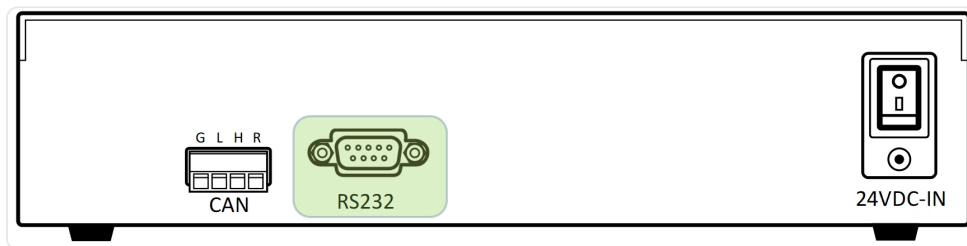
- The FLYZ-8101 measurement leads are special Kelvin four-wire cables with induction-canceling leads. Other cables will not work.
- The BNC connectors of the measurement leads connect to the BNC sockets on the front panel. Match the label on each cable to the label on the panel, one by one:
FORCE+ (cable) → FORCE+ (instrument) · FORCE- (cable) → FORCE- (instrument)
SENSE+ (cable) → SENSE+ (instrument) · SENSE- (cable) → SENSE- (instrument)
- The banana plugs of the measurement leads accept either the alligator clips or the test probes, depending on your test scenario.
- Connect the clips or probes to the tabs/terminals of the battery under test: red to positive, black to negative.
- Make sure the induction-canceling leads on the FORCE+/FORCE- terminals are connected to each other. If the positive and negative terminals are far apart, use the supplied extension lead to extend the induction-canceling lead, and keep the extension parallel to the battery under test.



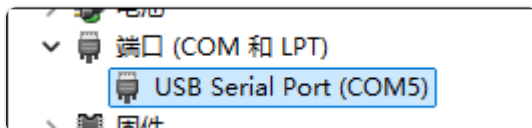
Connecting the measurement leads: the four BNC connectors match the front-panel labels one to one

5.3 Connecting the data cable

- The FLYZ-8101 connects to a PC via its RS-232 interface (standard DB9).
- Use the supplied RS-232-to-USB cable. If you use another RS-232 cable, make sure it is based on an FTDI chip; cables with other chips (CH340, PL2303, etc.) may not work reliably.
- Connect the USB end to the PC and confirm the driver is installed correctly. When "COMx" appears in the Windows Device Manager, the driver is ready (see figure).



RS-232 data cable: DB9 port on the rear panel to a USB port of the PC



Windows Device Manager showing the COM port

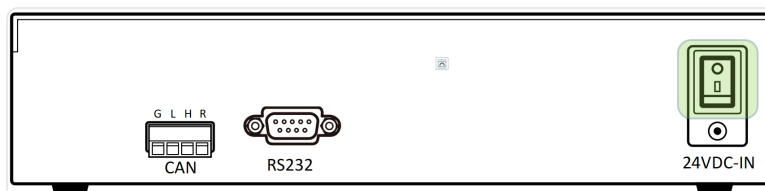
5.4 Downloading the AnalyZis software

The FLYZ-8101 is controlled through the AnalyZis software. Download the latest version before first use:

https://www.ai-eis.com/AnalyZis_software.html

5.5 Powering on / off

A power switch next to the power socket on the rear panel turns the instrument on and off. When powered on, the power indicator LED on the front panel lights up.



Power indicator on the front panel

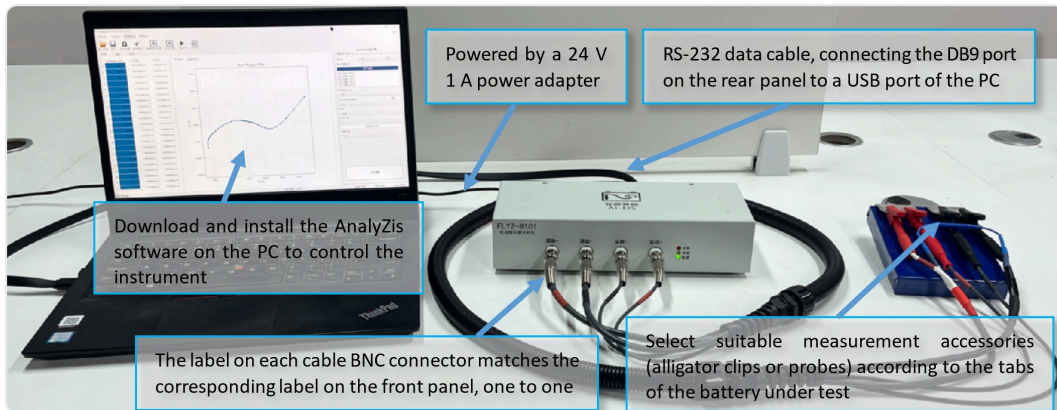
5.6 Pre-measurement check

Before use, confirm that no fault has been caused by storage or transport, and verify operation before measuring. If a fault is found, contact us.

6. Basic Measurement

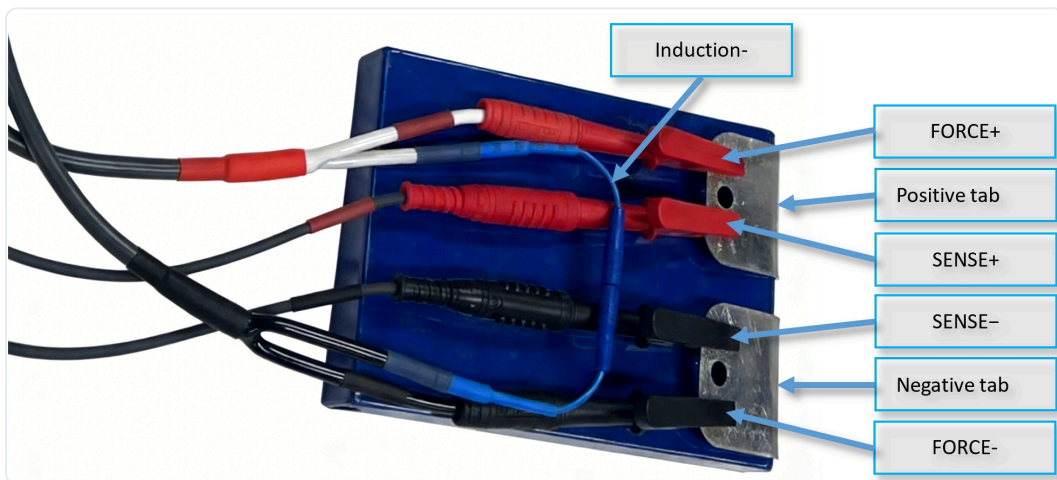
6.1 Connection overview

Overall connection:



Overall connection: 24 V adapter · RS-232 to PC · AnalyZis on the PC · measurement leads matched to the front-panel labels

Battery-side connection (alligator clips or needle probes, depending on the battery):



Battery-side connection: FORCE+ and FORCE- on the battery tabs; SENSE+ / SENSE- alongside; induction-canceling lead bridged between FORCE+ and FORCE- and kept parallel to the battery

6.2 Starting the software

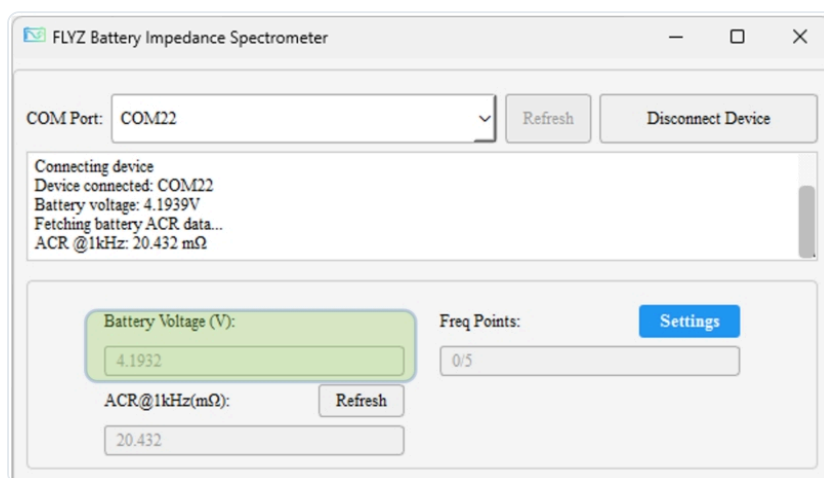
Run AnalyZis on the PC. Click the **FLYZ** button on the toolbar to open the device control window of the FLYZ-8101 Battery Impedance Spectrometer.



Toolbar FLYZ button — click to open the device control window

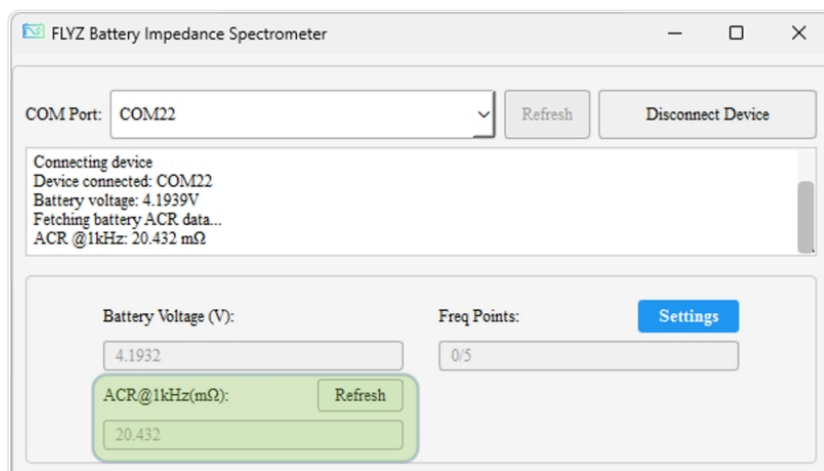
6.3 Measuring voltage

If the battery is correctly connected through the sense leads and its voltage is between 1.45 V and 4.5 V, click **Connect Device** in the device control window. After a successful connection the software automatically reads the battery voltage at 1-second intervals.



6.4 Measuring ACR (1 kHz)

After **Connect Device** succeeds and a valid voltage is measured, AnalyZis automatically measures the ACR (1 kHz AC internal resistance). The result is shown in the device control window; the refresh button next to it re-runs the ACR measurement manually.





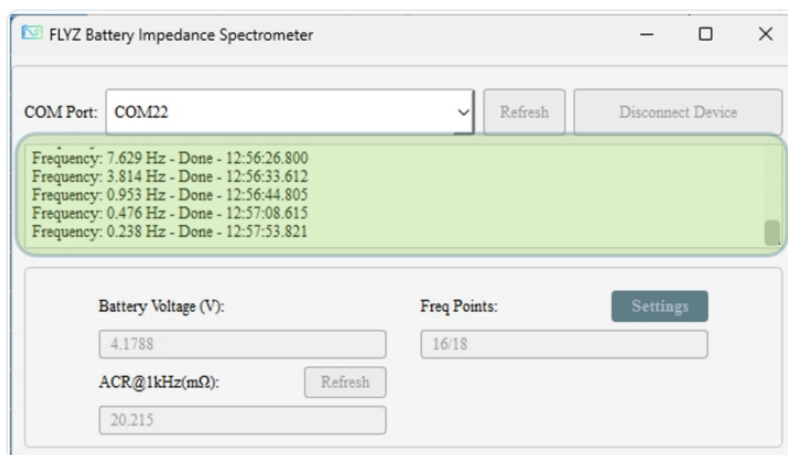
6.5 Measuring the impedance spectrum (EIS)

Before measuring EIS, set three parameters: **range step**, **sampling count** and **frequency list** — see Chapter 8. With the parameters set, click **Start Impedance Measurement** to begin the EIS sweep.

6.6 Checking the EIS result

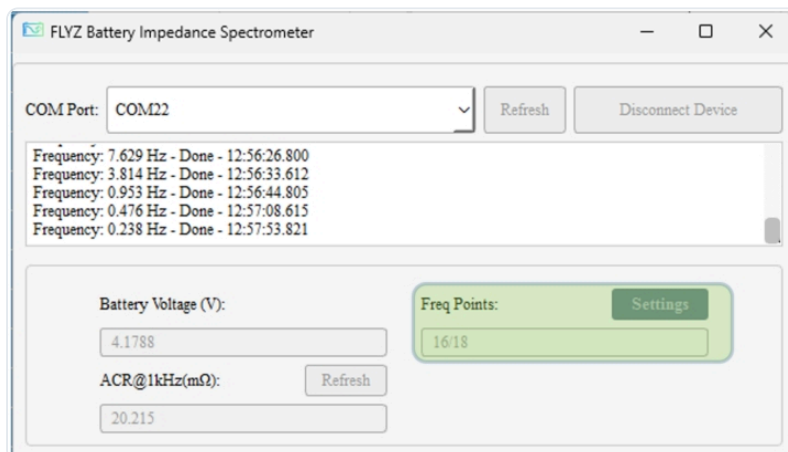
Progress monitoring:

- The information bar updates the completed frequency points.



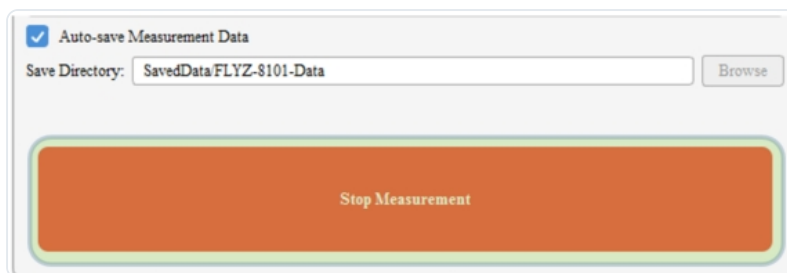
Information bar updating the completed frequency points

- The sweep counter shows "completed points / total points".



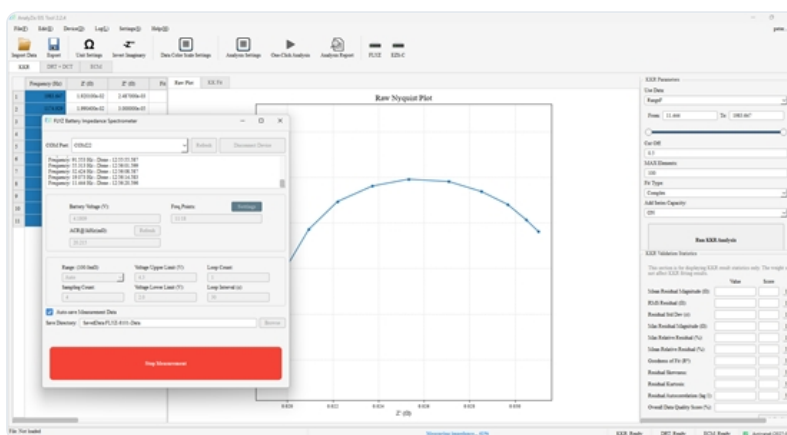
Sweep counter: completed / total frequency points

- During the sweep, the button shows "Stop Measurement" — the sweep can be interrupted at any time.



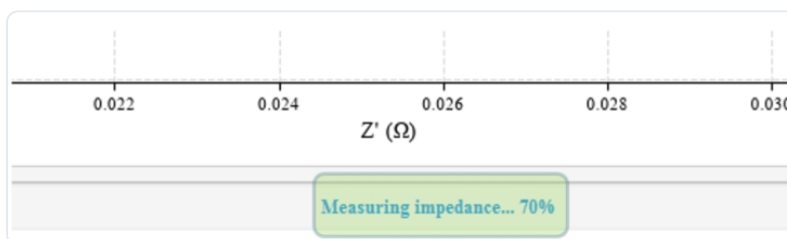
Button shows "Stop Measurement" during the sweep

- Measured points are plotted live (Nyquist plot).



Live Nyquist plot of measured points during the sweep

- The status bar shows "Measuring... xx%".



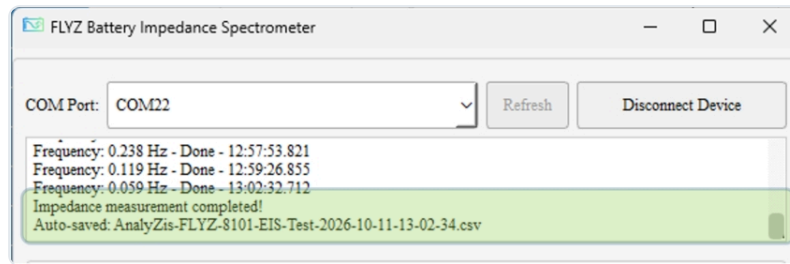
Status bar: "Measuring... xx%"

Error handling:

- On an error, click "Stop Measurement" to interrupt.
- Check the error dialog or the log file for details.

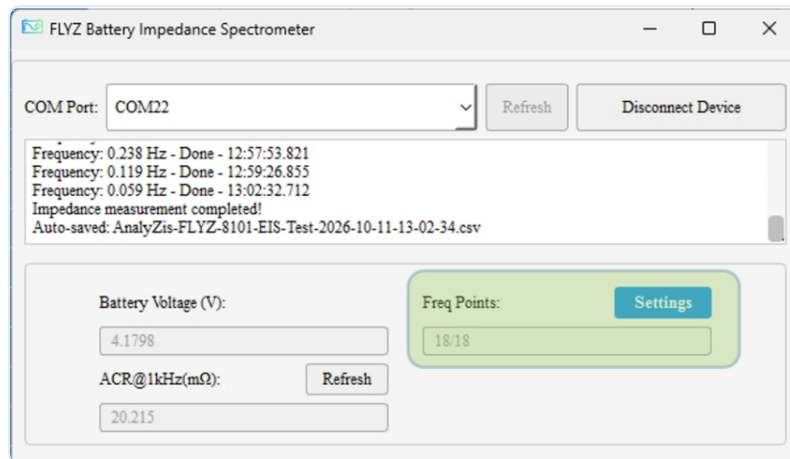
Completion:

- The information bar shows "Impedance measurement completed".



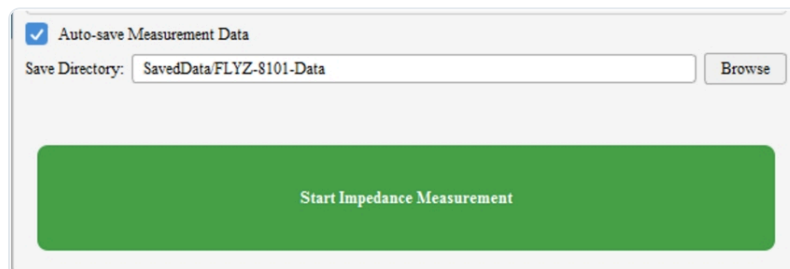
Information bar: "Impedance measurement completed"

- Completed points equal total points.



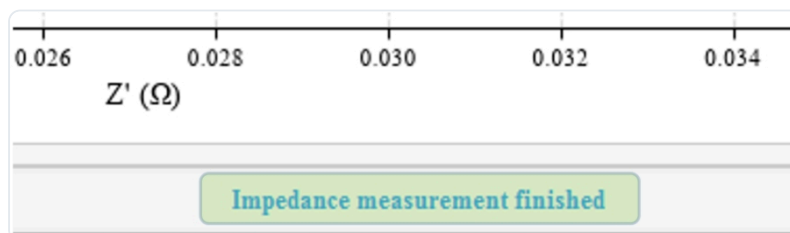
Completed points equal total points

- The button returns to "Start Measurement".



Button returns to "Start Measurement"

- The status bar shows "Measurement finished".



Status bar: "Measurement finished"



7. Customizing Measurement Conditions

Preventing over-charge / over-discharge with the voltage limit function

The screenshot shows a settings window with several input fields. The 'Voltage Upper Limit (V):' and 'Voltage Lower Limit (V):' fields are highlighted with a green border. The 'Range: (100.0mΩ)' is set to 'Auto'. The 'Sampling Count:' is set to '4'. The 'Loop Count:' is set to '1'. The 'Loop Interval (s):' is set to '30'.

Parameter	Value
Range: (100.0mΩ)	Auto
Sampling Count:	4
Voltage Upper Limit (V):	4.3
Voltage Lower Limit (V):	2.0
Loop Count:	1
Loop Interval (s):	30

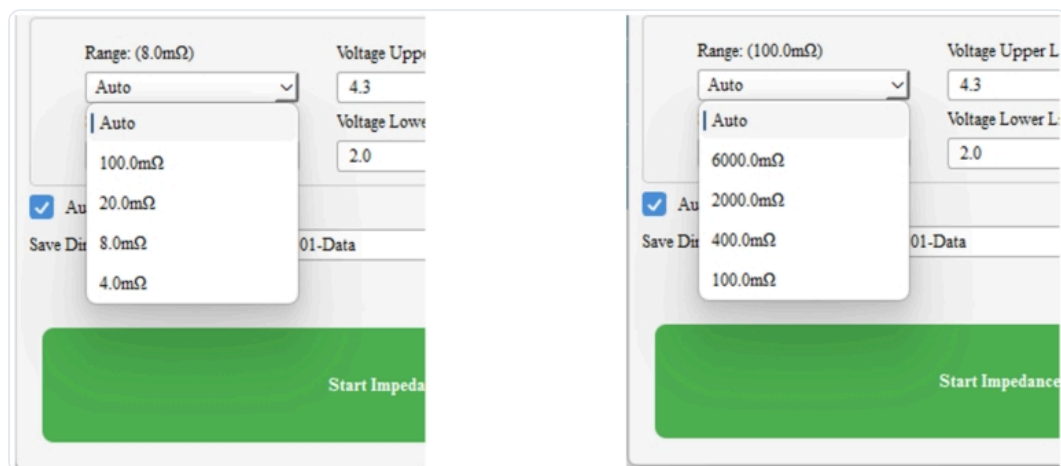
If the voltage of the object under test rises above the upper limit or falls below the lower limit, impedance measurement is suspended and the information bar shows **Voltage Abnormal**.



8. Parameter Settings

8.1 Range step

Choose a range step matching the internal resistance of the battery. For example, if the measured ACR is 10 mΩ, select the 20 mΩ step (FLYZ-8101C). The smaller the step value, the larger the excitation current applied to the battery. Selecting an appropriate step improves accuracy and signal quality.

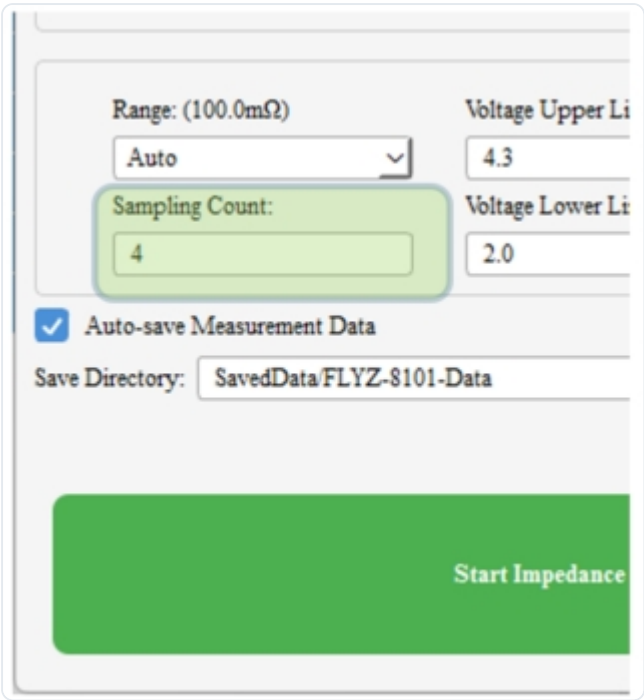


Range steps: FLYZ-8101C (left) · FLYZ-8101E (right)

8.2 Sampling count

If the sampled data is noisy, increase the sampling count to improve the signal-to-noise ratio. The instrument samples each frequency point multiple times and outputs the average. Higher counts improve accuracy but increase the total measurement time.

- Range: 1 – 128 samples per frequency point (balance speed vs. accuracy)



8.3 Frequency list

The FLYZ-8101 frequency range is 7.8 kHz – 0.015 Hz, with up to 254 frequency points per measurement. Selectable frequency values are listed in Table 2 (with acquisition update times); they can also be configured by:

- Table selection: tick the desired frequency points directly in the frequency table
- Bulk operations: "Select All" / "Clear Selection" for quick setup
- Import /export: import or export the frequency list as CSV files
- Enter the start frequency, stop frequency and number of points
- Click "Select Frequencies" to generate a logarithmically uniform sequence automatically
- After configuration, click OK to write the frequency list to the instrument

Frequency Settings

Select	Frequency (Hz)
☐	2807.624
☐	2716.071
☐	2624.518
☐	2532.965
☐	2441.412
☐	2349.859
☐	2258.306
☐	2166.753
☐	2075.200
☒	1983.647
☐	1892.094

Select All

Show Selected Only

Clear Checked

Import

Export

Frequency Range Settings

From:

Start Frequency (Hz)

To:

End Frequency (Hz)

Count:

Number of frequency points

Select Frequencies

Selected freq=18

OK

Cancel

- **Table check:** tick the desired frequency points directly in the frequency table.
- **Bulk operations:** "Select All" / "Clear" for quick selection; import/export the frequency list as CSV.
- **Logarithmic generation:** enter start frequency, stop frequency and number of points, then click "Select Frequencies" to generate a log-uniform sequence.
- After configuration, click **OK** to write the frequency list to the instrument.



The selectable frequency values and their acquisition update times are listed in **Table 2** in Section 9.4.1.



9. Specifications

9.1 General

Operating temperature / humidity	0 – 40°C, ≤ 80% RH (non-condensing)
Storage temperature / humidity	–10 – 50°C, ≤ 80% RH (non-condensing)
Warranty period	3 years
Location of use	Indoor, altitude ≤ 2000 m, pollution degree 2
Rated supply voltage	24 V DC
Rated supply current	200 mA
Max. rated power	12 VA
Battery voltage under test	1.45 – 4.5 V
Max. voltage at measurement terminals	6.0 V
Communication interfaces	RS-232, CAN 2.0 A/B
Measurement functions	Voltage, AC internal resistance (ACR @ 1 kHz), impedance spectrum (EIS)
Measurement leads	Kelvin four-wire (with induction-canceling leads)
Safety design	Battery reverse-connection and mis-connection protection

9.2 Voltage measurement

Measurement range	1.45 – 4.5 V
Channels	SENSE+ and SENSE– terminals
Resolution	0.1 mV
Accuracy	±4 mV (0 – 40°C)
Measurement time	1.0 s
Over-range indication	Voltage abnormal alert; impedance measurement disabled



9.3 ACR measurement (1 kHz)

	FLYZ-8101C	FLYZ-8101E
Measurement range	0.6 mΩ – 350 mΩ	12 mΩ – 27 Ω
Accuracy	±0.05 mΩ (0 – 40°C)	±0.5 mΩ (0 – 40°C)
Resolution	1 μΩ	1 μΩ
Measurement time	10 s	10 s
Frequency	1 kHz	1 kHz
Channels	SENSE+/SENSE– and FORCE+/FORCE– terminals	

9.4 EIS measurement

9.4.1 Frequency parameters

Frequency range	7.8 kHz – 0.015 Hz
Frequency accuracy	±1%

Table 2 — Selectable frequencies (Hz) and acquisition update times (s)

Single [1]	Consecutive [2]	Selectable frequencies (Hz)				
3.0s	1.0s	7812.52	7324.237	6896.99	6469.743	6042.496
3.0s	1.0s	5615.249	5188.001	4333.507	3906.26	3662.118
3.0s	1.0s	3417.977	3204.354	2990.73	2899.177	2807.624
3.0s	1.0s	2716.071	2624.518	2532.965	2441.412	2349.859
3.0s	1.0s	2258.306	2166.753	2075.2	1983.647	1922.612
3.0s	1.0s	1861.577	1815.8	1770.024	1724.247	1678.471
3.0s	1.0s	1632.694	1586.918	1541.141	1495.365	1449.588
3.0s	1.0s	1403.812	1358.035	1312.259	1266.482	1220.706
3.0s	1.0s	1174.929	1129.153	1083.376	1007.082	991.823
3.0s	1.0s	976.565	961.306	946.047	938.418	930.788
3.0s	1.0s	915.529	907.9	900.27	877.382	869.753
3.0s	1.0s	862.123	846.865	839.235	831.606	816.347



Single [1]	Consecutive [2]	Selectable frequencies (Hz)				
3.0s	1.0s	808.717	801.088	785.829	778.2	770.57
3.0s	1.0s	755.312	747.682	740.053	724.794	717.165
3.0s	1.0s	709.535	694.276	686.647	679.017	663.759
3.0s	1.0s	656.129	648.5	633.241	625.612	617.982
3.0s	1.0s	602.723	595.094	587.464	572.206	564.576
3.0s	1.0s	556.947	541.688	534.059	526.429	511.17
3.0s	1.0s	503.541	495.911	484.467	480.653	476.838
3.0s	1.0s	465.394	461.579	457.764	450.135	446.32
3.0s	1.0s	442.506	434.876	431.061	427.247	419.617
3.0s	1.0s	415.803	411.988	404.359	400.544	396.729
3.0s	1.0s	389.1	385.285	381.47	373.841	370.026
3.0s	1.0s	366.211	358.582	354.767	350.953	343.323
3.0s	1.0s	339.508	335.694	328.064	324.25	320.435
3.0s	1.0s	312.806	308.991	305.176	297.547	293.732
3.0s	1.0s	289.917	282.288	278.473	274.658	267.029
3.0s	1.0s	263.214	259.4	251.77	247.956	244.141
3.0s	1.0s	240.326	238.419	236.511	232.697	230.789
3.0s	1.0s	228.882	223.16	221.253	219.345	215.531
3.0s	1.0s	213.623	211.716	207.901	205.994	204.086
3.0s	1.0s	200.272	198.364	196.457	192.642	190.735
3.0s	1.0s	188.828	185.013	183.105	181.198	177.383
3.0s	1.0s	175.476	173.569	169.754	167.847	165.939
3.0s	1.0s	162.125	160.217	158.31	154.495	152.588
3.0s	1.0s	150.68	146.866	144.958	143.051	139.236
3.0s	1.0s	137.329	135.422	131.607	129.699	127.792
3.0s	1.0s	123.978	122.07	120.163	116.348	114.441
3.0s	1.0s	112.533	108.719	106.811	104.904	101.089



Single [1]	Consecutive [2]	Selectable frequencies (Hz)				
3.0s	1.0s	99.182	97.275	95.367	93.46	91.553
3.0s	1.0s	89.645	87.738	85.83	83.923	82.016
3.0s	1.0s	80.108	78.201	76.294	74.386	72.479
3.0s	1.0s	70.572	68.664	66.757	64.849	62.942
3.0s	1.0s	61.035	59.128	57.22	55.313	53.405
3.0s	1.0s	51.498	49.591	47.683	45.776	43.869
3.0s	1.0s	41.961	40.054	38.147	36.239	34.332
3.0s	1.0s	32.424	30.517	28.61	26.703	24.795
3.0s	1.0s	22.888	20.98	19.073	17.166	15.258
3.0 s	1.0 s	13.351	11.444	9.536	7.629	5.722
3.0 s	1.0 s	3.814	1.907			
5.5 s	2.0 s	0.953	0.953	0.953	0.953	0.953
10.5 s	4.5 s	0.476	0.476	0.476	0.476	0.476
20.6 s	8.4 s	0.238	0.238	0.238	0.238	0.238
42.4 s	16.8 s	0.119	0.119	0.119	0.119	0.119
85.0 s	33.4 s	0.059	0.059	0.059	0.059	0.059
168.5 s	67.0 s	0.029	0.029	0.029	0.029	0.029
336.4 s	134.7	0.015	0.015	0.015	0.015	0.015

[1] "Single" is the acquisition update time of the first sample at that frequency. When the sampling count is 1, this is the update time of that point.

[2] "Consecutive" is the update time of each subsequent sample. With sampling count $n > 1$, the point update time = single time + $(n - 1) \times$ consecutive time.

9.4.2 Measurement parameters

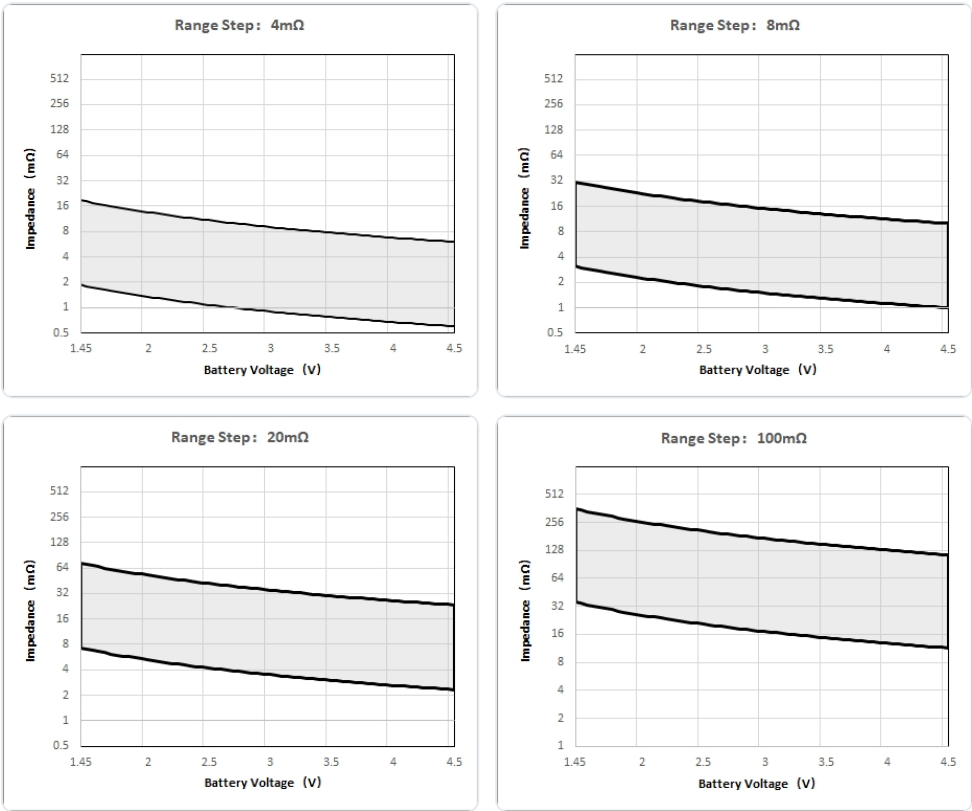
	FLYZ-8101C	FLYZ-8101E
Measurement range	0.6 mΩ – 350 mΩ	12 mΩ – 27 Ω
Range steps	4 / 8 / 20 / 100 mΩ	100 / 400 / 2000 / 6000 mΩ
Accuracy	±0.05 mΩ (0 – 40°C)	±0.5 mΩ (0 – 40°C)



	FLYZ-8101C	FLYZ-8101E
Resolution	1 $\mu\Omega$	1 $\mu\Omega$
Measured quantities	Impedance real part (Z') and imaginary part (Z'')	
Channels	SENSE+/SENSE- and FORCE+/FORCE- terminals	

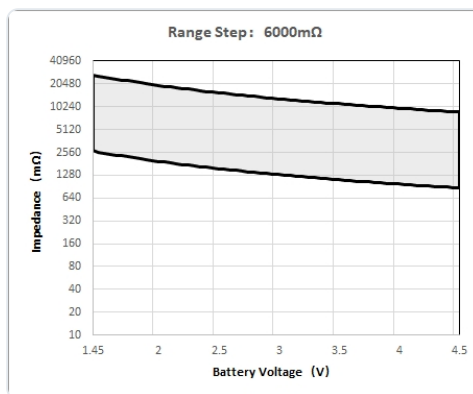
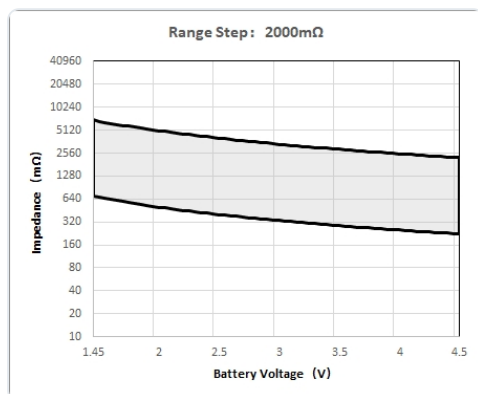
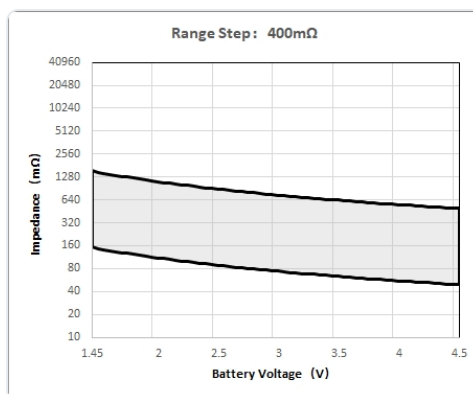
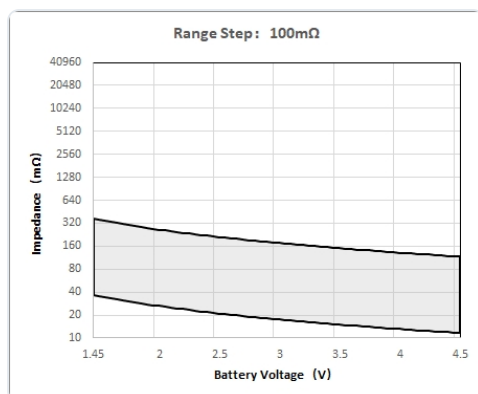
9.4.3 Battery internal-resistance ranges

FLYZ-8101C



FLYZ-8101C range steps: 4 mΩ · 8 mΩ · 20 mΩ · 100 mΩ

FLYZ-8101E

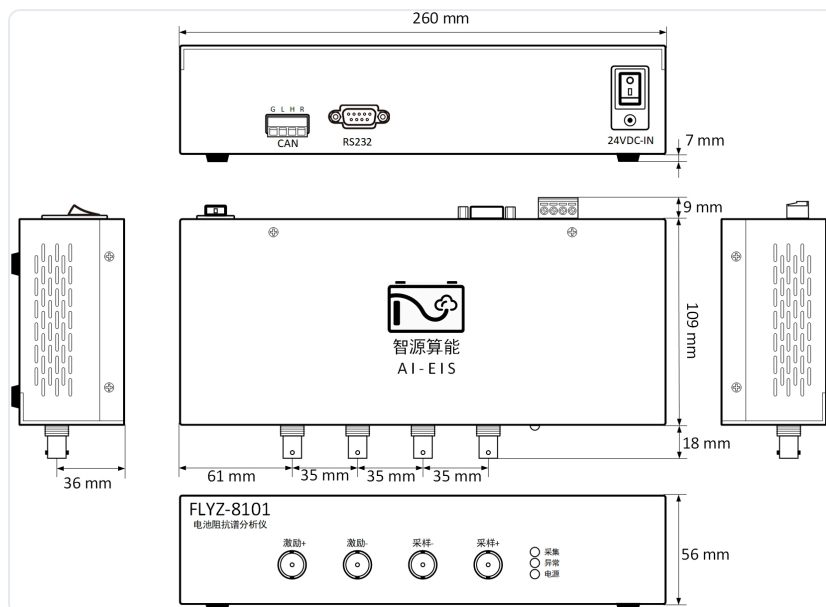


FLYZ-8101E range steps: 100 m Ω · 400 m Ω · 2000 m Ω · 6000 m Ω



10. Appendix

10.1 Appearance



10.2 Latest version of this manual

The content of this manual may change due to revisions or specification changes. The latest version can be downloaded from our website:

<http://www.ai-eis.com/flyz-8101.html>

10.3 User account registration

Create a free account to download the AnalyZis software and receive product updates:

<https://www.ai-eis.com/register>

10.4 Latest version of the AnalyZis software

Instrument control and data analysis are performed with the AnalyZis software. The latest version can be downloaded from our website:

https://www.ai-eis.com/AnalyZis_software.html



WeChat official account



Website



FLYZ-8101 product page



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