

Z300 HE

Data Sheet and technical Specification



PV String Analyzer for High-Efficiency Solar Modules

1500 VDC · 0 - 40 A DC

Designed for TOPCon, HJT, IBC and other high-capacitance PV modules.

emazys ApS

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1. Overview

The Z300 HE is the high-efficiency PV string analyzer of the emazys Z300 family, designed for utility-scale 1500 VDC solar farms. Its test method enables safe and accurate measurement of high-efficiency PV modules (TOPCon, HJT, IBC, n-PERT), whose elevated diffusion capacitance produces inrush currents often exceeding 100 A.

The instrument covers I_{sc} , I_{peak} , V_{oc} , polarity, Riso, ground fault localization, series resistance R_s via impedance spectroscopy, a continuous voltmeter, and an integrated tone generator with a handheld pickup included in the kit. The Z300 HE actively discharges the string and measures its capacitance, and uses this to estimate the maximum power point (V_{mpp} , I_{mpp} , P_{max} and fill factor FF).

Instrument Overview	Z300 PHE
Instrument type	Portable PV string analyzer for high-efficiency module farms.
Family	Z300 HE, the high-efficiency analyzer of the Z300 family.
Rated system voltage	1500 VDC, CAT III
Rated current	0 - 40 A DC
Designed for	TOPCon, HJT, IBC, n-PERT and other high-efficiency PV modules. Utility-scale 1500 VDC solar farms.
Connectivity	Bluetooth (active) via ESP32 MCU UART (wired debug/service).
Host platforms	iOS app, Android app, emazys cloud platform
Cloud tiers	Free, Premium, Team

2. Mechanical, Environmental & Power

Mechanical	Z300 HE
Enclosure	Peli 1400 Protector case, custom-modified
External dimensions (L × W × D)	347 × 295 × 146 mm
Internal dimensions (L × W × D)	301 × 228 × 131 mm
Internal volume	approx. 9 L
Weight (instrument only)	approx. 4.5 kg
Enclosure materials	Body: Polypropylene Latches: ABS O-ring: Polymer

	Pins: Stainless steel
Connectors for DUT	3 × case-side mounted shrouded 4 mm banana sockets Rated: 1500 V DC / 1 kV CAT III
Ingress protection	IP65 (enclosure closed, formally verified). Dust-tight, protected against water jets from any direction.
Environmental	
Storage temperature	-10 °C to +55 °C (limited by battery)
Operating temperature	0 °C to +35 °C (limited by battery)
Enclosure temperature range (case only)	-40 °C to +88 °C
Operating altitude	up to 2000 m
Operating humidity	5 - 95 % RH, non-condensing
Pollution degree	2 (per EN 61010-1)
Power and Battery	
Battery model	RRC2054 smart battery pack
Technology	Li-Ion, DC 15 V, 3200 mAh, 48.0 Wh
Operating time	8 - 10 hours typical
Standby/Sleep time	max. 150 hours in sleep mode
Recharge time	1 - 2 hours
External charger	RRC AC adapter, 100-240 VAC input
Replacement battery	Only emazys-supplied RRC2054 packs permitted

3. Measurement Specifications

All measurement accuracies apply under stable light conditions and within the declared operating temperature range. Precision is stated as $\pm$ (percentage of reading) $\pm$ (absolute offset) unless otherwise noted.

Open-circuit voltage Voc	Z300 HE
Range	0 - 1500 V
Precision	± 0.5 % of reading ± 1 V
Analysis	Checks polarity and voltage in-range
Continuous voltmeter	
Function	Live voltage monitoring during cable connection and pre-test verification.

Channels	PV+ to PV- (string voltage) PV+ to ground PV- to ground
Range	0 - 1500 V (each channel)
Sample time	approx. 25 ms per sample (24-bit ADC, oversampled with global-chop)
Use case	Confirms instrument is correctly attached before initiating measurements. Detects ground potential anomalies (string-to-earth voltage).
Polarity check	
Result	OK or Reverse
Action on Reverse	Measurement is blocked until polarity is corrected.
Short-circuit current I_{sc}	
DC current range	0 - 40 A
Measurement method	Captures the module discharge profile and the steady-state I_{sc} .
Precision	$\pm 1\%$ of reading ± 50 mA
Prerequisites verified before measurement	Correct polarity V_{oc} within rated range
Output	Steady-state short-circuit current Module discharge profile. PV+ and PV- monitored during short for verification.
Suitable for	TOPCon, HJT, IBC and other high-capacitance HE modules
Module discharge profile	
Source	Captured during I_{sc} test.
Information conveyed	Module capacitance behavior. Provides the data set used by the MPP estimation function (see below).
Use case	Diagnostic insight into module health Comparison between strings
MPP estimation based on controlled discharge	
Source	Derived from the Z300 HE measurement sequence.
Coverage	Operating region from open-circuit voltage down through and around the maximum current point I_{sc} .

Reported parameters	Vmpp, Impp, Pmpp, Fill factor FF
Method	emazys MPP method (proprietary). STC correction available when used with the Tempirra environmental sensor
Use case	String-level performance verification against module datasheet values. Identification of underperforming or mismatched strings Direct comparison of FF and MPP between strings.
Insulation resistance to ground Riso	
Range	0 Ω - 99 M Ω
Measurement time	approx. 20 s
Conditions	Irradiation > 100 W/m ² , and String Voc > 100 V
Precision (stable light conditions)	± 50 k Ω ± 10 %
Analysis	Above 99 M Ω : reported as Riso > 99 M Ω Below 100 k Ω : reported as Riso < 100 k Ω
Ground fault detection and localization	
Threshold for fault indication	1 M Ω
Threshold for localization trigger	3 M Ω
Localization precision (stable light conditions)	± 0.5 PV module
Localization resolution	0.1 PV modules
Conditions	Irradiation > 100 W/m ² String Voc > 100 V
Fault indication	Fault reported in user interface if Riso < 1 M Ω
Series resistance Rs (impedance spectroscopy)	
Range	0 Ω - 1 M Ω
Measurement time	approx. 10 s
Conditions	Irradiation > 100 W/m ²
Precision (stable light conditions)	± 10 % of reading ± 50 m Ω
Method	Multi-frequency impedance sweep (100 Hz - 100 kHz). Rs extracted from high-frequency asymptote of impedance spectrum.
Output	Rs reported per string.
Tone generator and pickup	

Tone generator	App-level feature: instrument emits an audio-frequency signal onto the connected PV cables for tracing.
Handheld tone pickup	Included in the Z300 HE kit.
Use case	Locating cables along a run. Identifying which cable connects to which inverter input.

4. Optional Accessories

Optional accessory	Z300 HE
Tempirra environmental sensor	Wireless irradiance and temperature reference sensor. Enables STC correction of measurement results. Sold separately as an accessory.

5. Safety & Compliance

The Z300 HE has CE conformity. It was designed and tested to the harmonized standards listed below; the Z300 HE is based on design principles, with clearance, creepage, and insulation dimensioned for CAT III 1500 VDC operation in accordance with EN 61010-1 Table K.2. Declarations and supporting test documentation can be provided on request.

Safety	Standard / Value
Design standard	EN 61010-1 (engineered to comply)
Overvoltage category	CAT III at 1500 VDC
Pollution degree	2
Insulation, live side to user side	Reinforced insulation
Isolation transformer factory test voltage	9 kV DC (routine production test)
Clearance and creepage distances	Dimensioned per EN 61010-1 Table K.2 for CAT III 1500 V.
Protection class	Class II (double/reinforced insulation)
EMC compliance	
EMC standards applied	EN 61326-1: EMC for measurement equipment (general). EN 61326-2-2: portable test/measurement equipment. CISPR 11 / EN 55011: radiated and conducted emissions (Class B).
Radio standards applied	EN 301 489-1: common EMC requirements for radio equipment.

	EN 301 489-17: broadband data transmission (Bluetooth via ESP32).
Immunity tests covered	IEC 61000-4-2: Electrostatic discharge IEC 61000-4-3: Radiated RF field IEC 61000-4-4: Fast transient burst IEC 61000-4-5: Surge IEC 61000-4-6: Conducted RF
CE marking and directives	
CE marking basis	Z300 HE is designed to the same harmonized standards and design rules as Z200PVA and Z300 PVT with clearance, creepage, and isolation dimensioned for 1500 VDC CAT III operation.
Low Voltage Directive (LVD)	2014/35/EU
EMC Directive	2014/30/EU
Radio Equipment Directive (RED)	2014/53/EU (Bluetooth via ESP32)
RoHS Directive	2011/65/EU (restriction of hazardous substances)
WEEE Directive	2012/19/EU (electrical waste)
Declaration of Conformity	Available on request from emazys ApS
Service and support	
Warranty period	12 months from date of shipment
Recommended calibration interval	12 months
Calibration service	Available via emazys or authorized partners

6. Product Labeling

Each Z300 HE instrument carries a safety and identification label mounted inside the enclosure lid. The label conforms to EN 61010-1 clause 5 marking requirements and displays the key ratings, hazard symbols, and regulatory markings relevant to the instrument.



Model	emazys Z300 PVT
DC power rating	0-1500 V / 0-30 A DC
Measurement category	CAT III 1500V DC
Insulation	Double insulation
Country of origin	Denmark

High voltage - risk of electrical shock.
 High voltage sources and stored charges.
 Disconnect input when the instrument is not in use.
 Read instructions before connecting any sources.

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Figure 1. Internal safety and identification label (template; HE label shows the HE model designation and 0 - 40 A DC rating).

7. Notes and Disclaimers

MPP estimation: The Z300 HE delivers the string-level electrical commissioning tests required by IEC 62446-1 (Voc, Isc, polarity and Riso), and adds ground fault localization and series resistance Rs as diagnostic features beyond the standard. The instrument estimates the maximum power point characteristics (Vmpp, Impp, Pmpp and FF) of the string using the emazys MPP method (proprietary). The MPP characteristics are estimated and are intended for string-level performance verification, comparison against module datasheet values and identification of underperforming or mismatched strings.

Voltage abort threshold: The hardware includes a safety margin and will abort the Isc measurement if the open-circuit voltage exceeds an internal abort threshold of approximately 1600 V. Operation above the rated 1500 VDC is not supported.

Ground fault localization accuracy: The ± 0.5 PV module localization precision assumes low string series resistance and stable measurement conditions. On strings with elevated series resistance (e.g. long cable runs, partial soiling, or weak connections), the reported fault position may shift; the indication remains useful as a starting point for inspection.

Ingress protection: IP65 rating applies when the enclosure is fully closed. The base enclosure is a Peli 1400 Protector case, modified with sealed feed-throughs for instrument connectors. Formal IP-test documentation is available on request.

Tone generator and pickup: The Z300 HE app-level tone generator drives an audio-frequency signal onto the connected PV cables. The Z300 HE kit includes a matched handheld tone pickup for tracing the signal along the cable run.

Specifications are subject to change without notice. All values are typical unless otherwise specified. For the most current data sheet, contact emazys or visit emazys.com.