

# DranEST III+

Automated Electrical Safety Testers



- Menu Driven Test Sequences in fully automatic or manual mode
- Automatic Polarity Reversal of Mains Connection
- Automatic Recognition of Connection Errors and Protection Categories (Cat I – II)
- Multiple Connection Capabilities – with Graphic Connection Diagrams
- Backlit LCD shows schematic diagrams for test connections, online help, instructions and error messages beside selection menus and test results
- Protective Conductor Testing – Equipment Current: 200mA, 10A or 25A
- Insulation Resistance: 0.05 to 310 M $\Omega$
- Leakage Current Measurements: 0.000 .... 120 mA
- High Voltage Testing up to 6 kV
- Function Test with Power Analysis: Volt, Amp, Watt, VA, PF, Wh
- Maximum Safety for the operator provided by a built-in protective circuit breaker
- Data Memory for up to 125 tests included
- Menu Languages English, German, French are standard
- Optional: Data Logger with key pad for data entry, Report Generator with Software
- Compact – Rugged – Light Weight - Portable



## Applications

DranEST III+ Electrical Safety Analyzer tests Laboratory and Hospital Equipment to both North American and International Standards. Also T & M, Electrical Appliances and IT Equipment are tested to IEC Standards.

## Operating Modes

- Manual
- Auto-Sequence
- Function Testing

## Tests

- Ground Bond Testing
- Protective Conductor Resistance
- Insulation Resistance Tests
- Leakage Current Tests
- High Voltage Tests
- Function Tests, including power

## Features

The DranEST III+ has unique capabilities for testing the electrical safety of:

- Electrical Medical Devices according to IEC 60601, UL 60601, UL 544, UL 187, and NFPA 99
- Recurring Testing of ME Equipment according to IEC 62353
- Electrical Measuring, Control and Laboratory Devices according to IEC 61010 & UL 61010)
- Safety of Household Appliances according to IEC 60335
- Data Processing Equipment according to IEC 60950 and UL 1950
- High Voltage Testing as per IEC 60950, IEC 61010, IEC 60335 and IEC 60601

## Electrical Safety

Safety Class	I per IEC 61010-1/EN 61010-1/VDE 0411-1
Nominal Voltage	115/230 V
Test Voltage	3.7 kV, 50 Hz
Measuring Category	250 V CAT II
Contamination	Level 2
Safety Shutdown	for residual current at device under test > 25 mA, disconnecting time < 100 ms probe current > 10 mA, < 1 ms

## Electromagnetic Compatibility EMC

Product Standard	DIN EN 61326:2002
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### Interference Emission

		Class
EN 55022		B
Interference Immunity	Test value	Feature
EN 61000-4-2	Contact/atmosphe. – 4 kV/8 kV	A
EN 61000-4-3	10 V/M	C
EN 61000-4-4	Mains connection - 2 kV	B
EN 61000-4-5	Mains connection - 1 kV	A
EN 61000-4-6	Mains connection - 3 V	A
EN 61000-4-11	0.5 period / 100%	A

## Mechanical Design

Display	multiple dot matrix display, 128 x 128 pixels
Dimensions	test instruments without high-voltage module: LxWxH: 292 mm x 138 mm x 243 mm test instruments with high-voltage module: LxWxH: 292 mm x 138 mm x 300 mm
Weight	instrument: approx. 4.5 kg instrument w/ HV test: approx. 5.24 kg instrument w/ 25 A PE test: approx. 5.5 kg instr. w/ 25 A PE & HV test: approx. 5.9 kg
Protection housing	IP 40
Terminals	IP 20 per DIN VDE 0470, part 1/EN 60529

## Ambient Conditions

Storage Temperature	– 20 °C ... + 60 °C
Operating Temperature	– 10 °C ... + 50 °C
Accuracy Range	0 °C ... + 50 °C
Relative Humidity	max. 75%, no condensation
Elevation	max. 2000 m
Deployment	indoors, outdoors: only under specified ambient conditions

## RS 232 Data Interface

Type	RS 232C, serial, per DIN 19241
Format	9600, N, 8, 1
Connector	9-pin subminiature socket connector

## Power Supply

Line Voltage	103.5 V ... 126.5 V or 207 V ... 253 V
Line Frequency	50 Hz or 60 Hz
Power Consumption	approx. 30 VA for 10 A test current approx. 95 VA, test duration max. 70 s for 25 A test current approx. 180 VA, test duration max. 70 s

## Warranty

2 years for workmanship.

## Calibration

The DranEST III+ comes with a Factory Calibration DKD Certificate recognized by NIST, ANSI, ISO 9001 certified

# Specifications

Measured Quantity	Measuring Range/ Nominal Range of Use	Resolution	Nominal Voltage $U_N$	Open- Circuit Voltage $U_0$	Nominal Current $I_N$	Short- Circuit Current $I_k$	Internal Resis- tance $R_i$	Refer- ence Resis- tance $R_{REF}$	Measuring Error	Intrinsic Error	Overload Capacity	
											Value	Time
Device Protective Conductor Resis- tance $R_{PE}$	0.000 ... 2.100 $\Omega$	1 m $\Omega$	—	4.5 ... 9 V DC	—	> 200 mA DC	—	—	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$ > 10 d	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont.
	2.11 ... 31.00 $\Omega$	10 m $\Omega$	—	< 6 V AC	—	> 10 A AC <sup>4)</sup> > 5 s	—	—			no protection <sup>5)</sup>	
Insulation Resistance $R_{INS}$	0.050 ... 1.500 M $\Omega$	1 k $\Omega$	50 ... 500 V DC	1.0 • $U_N$ ... 1.5 • $U_N$	> 1 mA	< 10 mA	—	—	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont.
	1.01 ... 10.00 M $\Omega$	10 k $\Omega$										
	10.1 ... 310.0 M $\Omega$	100 k $\Omega$							$\pm(10\% \text{ rdg.} + 10 \text{ digits})$	$\pm(1\% \text{ rdg.} + 10 \text{ digits})$		
Equivalent Leakage Current $I_{EL}$	0.00 ... 21.00 mA	10 $\mu$ A	—	230 V ~ -20/ +10 %	—	< 3.5 mA	> 72 k $\Omega$	2 k $\Omega$	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont.
	20.1 ... 120.0 mA	100 $\mu$ A										
Contact Current (Absence of Voltage) $I_{probe}$	0 ... 3.500 mA	1 $\mu$ A	—	—	—	—	2 k $\Omega$	—	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont. <sup>2)</sup>
Residual Current $I_{RC}$ between L and N	0.000 ... 3.100 mA ~ 3.00 ... 31.00 mA ~	1 $\mu$ A 10 $\mu$ A	—	—	—	—	—	—	$\pm(10\% \text{ rdg.} + 10 \text{ digits})$ > 10 digits	$\pm(5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	1)	1)
Equivalent Device and/or Patient Leakage Current EDL and/or EPL	0.0 ... 310.0 $\mu$ A	0.1 $\mu$ A	—	230 V ~ -20/ +10 %	—	< 3.5 mA	> 72 k $\Omega$	1 k $\Omega$ $\pm 50 \Omega$	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont. <sup>1) 3)</sup>
	0.000 ... 2.100 mA	1 $\mu$ A										
	2.101 ... 21.00 mA	10 $\mu$ A										
	20.1 ... 120.0 mA	100 $\mu$ A										
Leakage Current $I_{L2}$	0.0 ... 310.0 $\mu$ A	100 nA	110 % of highest line voltage <sup>6)</sup>	—	—	—	1 k $\Omega$	—	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{ rdg.} + 5 \text{ digit})$ > 10 digit	253 V	cont. <sup>1) 3)</sup>
All Leakage Current $I_L$	0.210 ... 3.600 mA	1 $\mu$ A	—	—	—	—	1 k $\Omega$	—	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{ rdg.} + 5 \text{ digit})$ > 10 digit	253 V	cont. <sup>1) 3)</sup>
	3.10 ... > 15.00 mA	10 $\mu$ A										

1) As of 25 mA: shutdown by residual current measurement within 100 ms

2) Exception earth leakage current: only 0.000 ... 3.100 mA

3) Measuring circuit is highly resistive, indication at display

4) Measurement with AC test current (Feature G00 or G01) is not possible at the sockets (1 through 3).

Feature G01: > 25 A: Short-circuit current is less than 25 A if the SC5 special cable is used.

5) Test duration max. 40 s, protection against overheating: measurement cannot be restarted until a waiting period of 1 minute has elapsed.

6) Calculated value

7) AC and DC are measured for patient leakage current and patient auxiliary current.

Key: of rdg. = of reading (measured value), D = digit

Function	Measured Quantity	Measuring Range / Nominal Range of Use	Resolu- tion	Open- Circuit Voltage $U_0$	Short- Circuit Current $I_k$	Internal Resis- tance $R_i$	Measuring Error	Intrinsic Error	Overload Capacity		
									Value	Duration	
Functions Test	Nominal Voltage $U_{LN}$	103.5 V ... 126.5 V 207.0 ... 253.0 V ~	0.1 V	—	—	—	—	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$	253 V	cont.	
	Load Current $I_a$	0 ... 16.00 A RMS	10 mA	—	—	—	—	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$	20 A	10 min	
	Active Power P	0 ... 3700 W <sup>8)</sup>	1 W	—	—	—	—	$\pm(5\% \text{ rdg.} + 10 \text{ digits})$ > 20 digits	253 V	cont.	
	Apparent Power AP	0 ... 4000 VA	1 VA	Calculated Value $U_{LN} \cdot I_a$					$\pm(5\% \text{ rdg.} + 10 \text{ digits})$ > 20 digits	20 A	10 min
	Power Factor PF, sinusoidal: $\cos \phi$	0.00 ... 1.00	0.01	Calculated Value P / AP, Display > 10 W					$\pm(10\% \text{ rdg.} + 5 \text{ digits})$		
	Residual Current $\Delta I$ between L and N	0.00 ... 31.00 mA ~	10 $\mu$ A	—	—	—	—	$\pm(10\% \text{ rdg.} + 10 \text{ d})$ > 10 digits	$\pm(5\% \text{ rdg.} + 5 \text{ digits})$	1)	1)
$U_{Ac/dc}$	Voltage	0 ... 253.0 V —, ~ and ~	0.1 V	—	—	—	—	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont.	
	Low-Voltage SC III	—, ~ and ~	—	—	—	—	$\pm(5\% \text{ rdg.} + 10 \text{ d})$				
$U_{Probe}$	Probe Voltage	0 ... 253.0 V —, ~ and ~	0.1 V	—	—	—	—	$\pm(2.5\% \text{ rdg.} + 5 \text{ digits})$ > 10 digits	253 V	cont.	
R	Resistance	0 ... 150.0 k $\Omega$	100 $\Omega$	< 20 V -	—	1.1 mA	—	$\pm(1\% \text{ rdg.} + 3 \text{ digits})$	253 V	cont.	
$I_C$	Current via Clip-On Current- Voltage Converter WZ12C	0.000 ... 10.00 A ~ 0 ... 100 A ~	1 mA 1 A	—	—	1.5 M $\Omega$ 1.5 M $\Omega$	—	$\pm(3\% \text{ rdg.} + 10 \text{ digits})$ > 10 digits without clip	253 V	cont.	
	Temperature with Pt100 / Pt1000 Sensor	-200 ... -50 °C -50.1 ... +300.0 °C +300 ... +850 °C	1 °C 0.1 °C 1 °C	< 20 V -	—	1.1 mA	—	$\pm(2\% \text{ rdg.} + 1 \text{ } ^\circ\text{C})$ $\pm(1\% \text{ rdg.} + 1 \text{ } ^\circ\text{C})$ $\pm(2\% \text{ rdg.} + 1 \text{ } ^\circ\text{C})$	10 V	cont.	

8) Measured value P and calculated value S are compared, and the smaller value is displayed.

## Reference Ranges

Line Voltage 115 / 230 V  $\pm 0.2\%$   
 Line Frequency 50/60 Hz  $\pm 0.1\%$   
 Waveshape sine (deviation between effective and rectified value < 0.5%)  
 Ambient Temperature +23 °C  $\pm 2$  K  
 Atmospheric Humidity 50% relative  $\pm 5\%$   
 Load Resistors linear

## Nominal Ranges of Use

Line Voltage 103.5 V ... 126.5 V or 207 V ... 253 V  
 Line Frequency 50 Hz or 60 Hz  
 Line Voltage Waveshape sine  
 Temperature 0 °C ... + 50 °C

Table: Individual Measurements and Regulations

Individual Measurements per Regulation	Test current [A]	DIN VDE 0701 Part 1	DIN VDE 0701 Part 240	DIN VDE 0702	DIN EN 60950	DIN EN 61010	DIN EN 60335	DIN VDE 0751	IEC 601/EN 60601
Protective Conductor Resistance	0,2	•	•	•				•	
	10							•	
	25				•	•	•	•	•
Insulation Resistance		•		•					
Equivalent Leakage Current		•	•	•					
Equivalent (Device) Leakage Current							•	•	
Equivalent Patient Leakage Current								•	
Residual Current		•		•					
Device Leakage Current								•	
Earth Leakage Current									•
Contact Current		•		•					
Absence of Voltage (exposed conductive parts)			•						
Housing Leakage Current					•	•			•
Patient Leakage Current									•
Patient Auxiliary Current									•
High-Voltage Test					•	•	•		AC
Single Fault Conditions N PC						•	•		•
Mains at Application Part									•

Key

- Required test

Table: Leakage Current Types

DIN VDE 0701-1	DIN VDE 0702-1	DIN VDE 0751-1 (2001)	DIN EN 60601-1	The following is measured:
Equivalent Leakage Current	Equivalent Leakage Current			PROBE (connected to protective conductor) to L & N
		Equivalent Device Leakage Current	I <sub>Δ</sub> interrupted from N	PROBE (connected to protective conductor) to L & N
		Equivalent Patient Leakage Current		L & N & PE to Patient Jacks
Contact Current/ Measurement for Absence of Voltage	Contact Current/ Measurement for Absence of Voltage		Housing Leakage Current NC	Probe to PE
		Patient Leakage Current NC	Patient Leakage Current NC	Patient Jack to PE
			Patient Auxiliary Current NC	Patient Jack to Patient Jack
			Earth Leakage Current NC	Protective Conductor to PE
		Device Leakage Current during Operation, Direct Measurement		Protective Conductor Interrupted, Probe + PAP to PE
Protective Conductor Current with Residual Current Measurement	Protective Conductor Current with Residual Current Measurement	Device Leakage Current during Operation, with residual Current Measurement		See chapter 11.5

Key

- NC = normal condition
- PAP = patient application part
- PE = Potential earthing  $\triangle$ , system protective conductor
- PC = Protective conductor of the DUT

**DranEst III+H**

Test Current +/-200mA DC or 10A AC, High Voltage up to 6 kV DC, Memory for 125 Tests, Test Procedures IEC 61010, 60335, 60950, IEC 62353, Adapter Set for International Sockets

**DranEst III +M**

Test Current +/-200mA DC or 10A AC, 10+2 Patient Ports IEC60601 Memory for 125 Tests, Test Procedures IEC 61010, 60335, 60950, IEC 62353, IEC 60601, Adapter Set for International Sockets

**DranEst III + MH**

Test Current +/-200mA DC or 25A AC, High Voltage up to 6 kV DC, 10+2 Patient Ports IEC60601 Memory for 125 Tests, Test Procedures IEC 61010, 60335, 60950, IEC 62353, IEC 60601, Adapter Set for International Sockets

**Options:**

- SI-Module Storage Interface Module with keyboard for data entry M702F
- F2000 Carrying Case for Tester & Accessories Z700D
- RTD Pt100 Temperature Sensor -40...+ 600°C Z3409
- WZ12C Clamp-on Current Sensor 1mA – 120 A Z219C
- Report Generator with PC.doc-Word/Excel Software Z714A



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CAT IV



DKD Calibration Certificate