

### I-V400w

Rel. 1.09 - 09/10/15

I-V curve tracer and IVCK tester up to 15A

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### **1. GENERAL SPECIFICATIONS OF I-V400w MODEL**

HT ITALIA enlarges its range of products for photovoltaic system introducing the new I-V400w

The instrument allows to measure I-V curve as well as main parameters of both single-module and strings in a photovoltaic system **up to a maximum of 1000V and 15A** 

The acquired data are then worked out and transferred to the reference conditions (STC) in order to compare them with the rated data declared by modules' manufacturer. The comparison between the detected and the rated data permits to immediately determine whether the string or the module respect the parameters declared by the manufacturer.

The instrument allows to perform quick tests (IVCK) to measure open circuit voltage Voc and short circuit current Isc on PV module/strings output even without irradiation conditions.

I-V400w manages an internal database of the most common photovoltaic modules. Such a database can be updated at any time by the user both through the management software and directly through the instrument's interface. **The saved data can be downloaded to PC also through WiFi connection.** 



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#### **ELECTRICAL SPECIFICATIONS** 2.

Accuracy is calculated as  $\pm$  [% reading + (number of dgts) x resolution] at 23°C  $\pm$  5°C, <80%HR

VDC Voltage @ OPC		
Range (V) (***)	Resolution (V)	Accuracy
5.0 ÷ 999.9	0.1	±(1.0%rdg+2dgt)

(\*\*\*) The I-V curve and Rs measurements start for VDC > 15V and the accuracy is defined for VDC > 20V

IDC Current @ OPC		
Range (A)	Resolution (A)	Accuracy
0.10 ÷ 15.00	0.01	±(1.0%rdg+2dgt)

Max Power @ OPC (Vmpp >30V, Impp >2A)		
Range (W) (*, **)	Resolution (W)	Accuracy
50 ÷ 9999	1	±(1.0%rdg+6dgt)

Vmpp = Maximum power voltage, Impp = Maximum Power Current

(\*) Max measurable value of Power must include FF value( $\sim 0.7$ )  $\rightarrow$  Pmax = 1000V x 10A x 0.7 = 7000W (\*\*) Test is stopped and the message "Thermal instability" occurs if the instrument detects Voltage > 700V and Current I >3A, I > -0.038\*V + 37.24 - 0.5

VDC Voltage (@ STC and OPC), IVCK		
Range (V) (***)	Resolution (V)	Accuracy (*,**)
5.0 ÷ 999.9	0.1	±(4.0%rdg+2dgt)

IDC Current (@ STC and OPC), IVCK		
Range (A)	Resolution (A)	Accuracy (**)
0.10 ÷ 15.00	0.01	±(4.0%rdg+2dgt)

Max Power @ STC (Vmpp >30V, Impp >2A)		
Range (W) (*, **)	Resolution (W)	Global accuracy (**)
50 ÷ 9999	1	$\pm$ (5.0%rdg+1dgt)

Vmpp = Maximum power voltage, Impp = Maximum Power Current

(\*) Measurements start for VDC > 15V and the accuracy is defined for VDC > 20V (\*\*) Test conditions:

Test cond.: Steady Irrad.≥700W/m<sup>2</sup>, spectrum AM 1.5,solar incidence vs perpendicular. ≤ ± 25°, Cells Temp. [15..65°C]

> Global accuracy include contribute of solar sensor and its measuring circuit

Irradiance (with reference cell)		
Range (mV)	Resolution (mV)	Accuracy
1.0 ÷ 100.0	0.1	±(1.0%rdg+5dgt)

Temperature of module (with auxiliary PT1000 probe)		
Range (°C)	Resolution (°C)	Accuracy
-20.0 ÷ 100.0	0.1	±(1.0%rdg+1°C)

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## **3. GENERAL SPECIFICATIONS**

Features:128x128pxl custom LCD with backlight 256kbytesMemory capacity:256kbytesSaved data:249 curves (I-V curve test), 999 IVCKPOWER SUPPLY:SOLAR I-V internal power supply: $6x1.5V$ alkaline batteries type LR6, AA, AM3, MN 1500 > 249 curve (I-V curve test), 999 IVCK test approx 120 hours (yield test)SOLAR-02 power supply: $4x1.5V$ alkaline batteries type AAA LR03 approx 1.5hOUTPUT INTERFACE PC communication port:optical/USB and WiFi wireless RF comunication (max distance 1m)MECHANICAL FEATURES Dimensions (L x W x H):235 x 165 x 75mm 1.2kgPMIRONMENTAL CONDITIONS: Reference temperature: $0^\circ + 40^\circ C$ <80%HRStorage humidity: $x80\%$ HRStorage humidity: $x80\%$ HRGENERAL REFERENCE STANDARDS: Safety:IEC/EN61010-1 IEC/EN61010-03 IEC/EN60891 (I-V curve test) IEC/EN60891 (I-V curve test) IEC/EN60891 (I-V curve test) IEC/EN60891 (I-V curve test) IEC/EN60895/E (CHNOPPER CURVE) CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2 Max altitude of use:This instrument complies with the requirements of the European Low Voltage Directives 2006/95/E	DISPLAY AND MEMORY:	
Saved data:  249 curves (I-V curve test), 999 IVCK    POWER SUPPLY:  6x1.5V alkaline batteries type LR6, AA, AM3, MN 1500    SOLAR I-V internal power supply:  5249 curve (I-V curve test), 999 IVCK test    Autonomy of SOLAR I-V:  5249 curve (I-V curve test), 999 IVCK test    SOLAR-02 power supply:  4x1.5V alkaline batteries type AAA LR03    SOLAR-02 max recording time (@ IP=5s):  approx 120 hours (yield test)    Autonomy of SOLAR -02 max recording time (@ IP=5s):  approx 120 hours (yield test)    OUTPUT INTERFACE  optical/USB and WiFi    PC communication port:  optical/USB and WiFi    Interface with SOLAR-02 :  wireless RF comunication (max distance 1m)    MECHANICAL FEATURES  0    Dimensions (L x W x H):  235 x 165 x 75mm    Weight (batteries included):  1.2kg    ENVIRONMENTAL CONDITIONS:  Reference temperature:    Reference temperature:  0° ÷ 40°C    vorking temperature (batt. not included):  -10 ÷ 60°C    storage humidity:  -80%HR    Safety of measurement accessories:  IEC/EN61010-1    IEC/EN60891 (I-V curve test)  IEC/EN60891 (I-V curve test)    I-V curve measurement:  IEC/EN60891 (I-V curve test)	Features:	128x128pxl custom LCD with backlight
POWER SUPPLY:  SQLAR I-V internal power supply:  SXLAR I-V:  SXLAR I-V:  SQLAR I-V: <td>Memory capacity:</td> <td>256kbytes</td>	Memory capacity:	256kbytes
SOLAR I-V internal power supply: $6x1.5V$ alkaline batteries type LR6, AA, AM3, MN 1500Autonomy of SOLAR I-V:> 249 curve (I-V curve test), 999 IVCK test approx 120 hours (yield test)SOLAR-02 power supply: $4x1.5V$ alkaline batteries type AAA LR03SOLAR-02 max recording time (@ IP=5s):approx 1.5hOUTPUT INTERFACEPC communication port:optical/USB and WiFiInterface with SOLAR-02 :wireless RF comunication (max distance 1m)MECHANICAL FEATURESDimensions (L x W x H): $235 \times 165 \times 75 mm$ Weight (batteries included):1.2kgENVIRONMENTAL CONDITIONS:Reference temperature: $0^{\circ} \div 40^{\circ}C$ Working temperature: $0^{\circ} \div 40^{\circ}C$ Working temperature $0^{\circ} \div 40^{\circ}C$ Storage temperature (batt. not included): $-10 \div 60^{\circ}C$ Safety:IEC/EN61010-1EMC:IEC/EN61010-031I-V curve measurement accessories:IEC/EN60891 (I-V curve test)I-V curve measurement:IEC/EN60904-5 (Temperature measurement)Hould degree:2Overvoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max alitude of use:2000m	Saved data:	249 curves (I-V curve test), 999 IVCK
Autonomy of SOLAR I-V: approx 120 hours (yield test)> 249 curve (I-V curve test), 999 IVCK test approx 120 hours (yield test)SOLAR-02 power supply: SOLAR-02 max recording time (@ IP=5s): approx 1.5h $4x1.5V$ alkaline batteries type AAA LR03 approx 1.5hOUTPUT INTERFACE PC communication port: Interface with SOLAR-02 :PC communication port: Interface with SOLAR-02 :optical/USB and WiFi wireless RF comunication (max distance 1m)MECHANICAL FEATURES Dimensions (L x W x H): Weight (batteries included):235 x 165 x 75mm 1.2kgBeference temperature: Working temperature: Storage temperature (batt. not included): Storage humidity: x e80%HREC/EN61010-1 EC/EN61326-1GENERAL REFERENCE STANDARDS: EMETY Safety of measurement accessories: I-V curve measurement: L C/EN60304-5 (Temperature measurement) double insulation Pollution degree: Quervoltage category: A double insulation Pollution degree: Quervoltage category: A at litude of use:249 curve (I-V curve test), II 000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max altitude of use:2000m		
approx 120 hours (yield test)SOLAR-02 power supply:4x1.5V alkaline batteries type AAA LR03SOLAR-02 max recording time (@ IP=5s):approx 1.5hOUTPUT INTERFACEPC communication port:optical/USB and WiFiInterface with SOLAR-02 :wireless RF comunication (max distance 1m)MECHANICAL FEATURESDimensions (L x W x H):235 x 165 x 75mmWeight (batteries included):1.2kgENVIRONMENTAL CONDITIONS:Reference temperature:0° ÷ 40°CWorking temperature:0° ÷ 40°CWorking temperature (batt. not included):-10 ÷ 60°CStorage humidity:<80%HR		
SOLAR-02 max recording time (@ IP=5s):  approx 1.5h    OUTPUT INTERFACE  optical/USB and WiFi    PC communication port:  iwireless RF comunication (max distance 1m)    Interface with SOLAR-02 :  wireless RF comunication (max distance 1m)    MECHANICAL FEATURES  Dimensions (L x W x H):  235 x 165 x 75mm    Dimensions (L x W x H):  235 x 165 x 75mm  Weight (batteries included):  1.2kg    ENVIRONMENTAL CONDITIONS:  E    Reference temperature:  0° ÷ 40°C    Working temperature:  0° ÷ 40°C    Working temperature  0° ÷ 40°C    Working temperature (batt. not included):  -10 ÷ 60°C    Storage temperature (batt. not included):  IEC/EN61010-1    EMC:  IEC/EN61010-031    I-V curve measurement accessories:  IEC/EN60891 (I-V curve test)    I-V curve measurement:  IEC/EN60904-5 (Temperature measurement)    Insulation:  double insulation    Pollution degree:  2    Qvervoltage category:  CAT	Autonomy of SOLAR I-V:	
OUTPUT INTERFACE  optical/USB and WiFi    PC communication port:  interface with SOLAR-02 :    Interface with SOLAR-02 :  wireless RF comunication (max distance 1m)    MECHANICAL FEATURES  Dimensions (L x W x H):  235 x 165 x 75mm    Dimensions (L x W x H):  235 x 165 x 75mm    Weight (batteries included):  1.2kg    ENVIRONMENTAL CONDITIONS:  Reference temperature:  0° ÷ 40°C    Working temperature:  0° ÷ 40°C    Vorking humidity:  <80%HR	SOLAR-02 power supply:	4x1.5V alkaline batteries type AAA LR03
PC communication port:  optical/USB and WiFi    Interface with SOLAR-02 :  wireless RF comunication (max distance 1m)    MECHANICAL FEATURES	SOLAR-02 max recording time (@ IP=5s):	approx 1.5h
Interface with SOLAR-02 : wireless RF comunication (max distance 1m)     MECHANICAL FEATURES    Dimensions (L x W x H):  235 x 165 x 75mm    Weight (batteries included):  1.2kg    ENVIRONMENTAL CONDITIONS:  23°C ± 5°C    Working temperature:  0° ÷ 40°C    Working temperature (batt. not included):  -10 ÷ 60°C    Storage temperature (batt. not included):  -10 ÷ 60°C    Storage humidity:  <80%HR		
MECHANICAL FEATURESDimensions (L x W x H): $235 \times 165 \times 75 \text{mm}$ Weight (batteries included): $1.2 \text{kg}$ ENVIRONMENTAL CONDITIONS:Reference temperature: $0^\circ + 40^\circ\text{C}$ Working temperature: $0^\circ + 40^\circ\text{C}$ Working humidity: $80\%$ HRStorage temperature (batt. not included): $-10 \div 60^\circ\text{C}$ Storage humidity: $<80\%$ HRGENERAL REFERENCE STANDARDS:Safety:IEC/EN61010-1EMC:IEC/EN6126-1Safety of measurement accessories:I-V curve measurement:I-V curve measurement:I-V curve test)Insulation:Pollution degree:Qvervoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max altitude of use:		
Dimensions (L x W x H): $235 \times 165 \times 75 \text{mm}$ Weight (batteries included): $1.2 \text{kg}$ ENVIRONMENTAL CONDITIONS:Reference temperature: $0^{\circ} \pm 40^{\circ}\text{C}$ Working temperature: $0^{\circ} \pm 40^{\circ}\text{C}$ Working humidity: $< 80\%$ HRStorage temperature (batt. not included): $-10 \pm 60^{\circ}\text{C}$ Storage humidity: $< 80\%$ HRGENERAL REFERENCE STANDARDS:Safety:IEC/EN61010-1EMC:IEC/EN6110-031I-V curve measurement accessories:IEC/EN60891 (I-V curve test)I-V curve measurement:UEC/EN60904-5 (Temperature measurement)Insulation: $2$ Pollution degree: $2$ Overvoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max altitude of use: $2000m$	Interface with SOLAR-02 :	wireless RF comunication (max distance 1m)
Weight (batteries included):  1.2kg    ENVIRONMENTAL CONDITIONS:  23°C ± 5°C    Reference temperature:  0° ÷ 40°C    Working temperature:  0° ÷ 40°C    Working humidity:  <80%HR		
ENVIRONMENTAL CONDITIONS:Reference temperature: $23^{\circ}C \pm 5^{\circ}C$ Working temperature: $0^{\circ} \div 40^{\circ}C$ Working humidity: $80\%$ HRStorage temperature (batt. not included): $-10 \div 60^{\circ}C$ Storage humidity: $-10 \div 60^{\circ}C$ Storage humidity: $80\%$ HRGENERAL REFERENCE STANDARDS:IEC/EN61010-1EMC:IEC/EN61326-1EMC:IEC/EN61010-031I-V curve measurement accessories:IEC/EN60891 (I-V curve test)I-V curve measurement:IEC/EN60904-5 (Temperature measurement)Insulation:double insulationPollution degree:2Overvoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max altitude of use:2000m		
Reference temperature: $23^{\circ}C \pm 5^{\circ}C$ Working temperature: $0^{\circ} \div 40^{\circ}C$ Working humidity:<80%HR	Weight (batteries included):	1.2kg
Working temperature: $0^\circ \div 40^\circ C$ Working humidity:<80%HR	ENVIRONMENTAL CONDITIONS:	
Working humidity:<80%HRStorage temperature (batt. not included):-10 ÷ 60°CStorage humidity:<80%HR	•	$23^{\circ}C \pm 5^{\circ}C$
Storage temperature (batt. not included):-10 ÷ 60°C <80%HRStorage humidity:-10 ÷ 60°C <80%HRGENERAL REFERENCE STANDARDS:IEC/EN61010-1 IEC/EN61326-1Safety:IEC/EN61010-31 IEC/EN61010-031I-V curve measurement accessories:IEC/EN60891 (I-V curve test) IEC/EN60904-5 (Temperature measurement)Insulation:double insulationPollution degree:2Overvoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max altitude of use:2000m		
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Safety of measurement accessories:IEC/EN61010-031I-V curve measurement:IEC/EN60891 (I-V curve test)Insulation:IEC/EN60904-5 (Temperature measurement)Pollution degree:2Overvoltage category:CAT II 1000V DC, CAT III 300V AC to groundMax altitude of use:2000m		
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Insulation:double insulationPollution degree:2Overvoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2Max altitude of use:2000m	I-V curve measurement:	
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Overvoltage category:CAT II 1000V DC, CAT III 300V AC to ground Max 1000V among inputs P1, P2, C1, c2 2000mMax altitude of use:2000m		
Max 1000V among inputs P1, P2, C1, c2 Max altitude of use: 2000m		
Max altitude of use: 2000m	Overvollage calegory.	
	Max altitude of use:	
This instrument complies with the requirements of the European Low Vellage Directives 2000/05/5		200011
This instrument complies with the requirements of the European Low Voltage Directives "Junk/uk/E	This instrument complies with the requ	irements of the European Low Voltage Directives 2006/05/EC

ies with the requirements of the European Low Voltage Directives 2006/95/EC This instrumen (LVD) and EMC 2004/108/EC This instrument satisfies the requirements of 2011/65/EU (RoHS) directive and 2012/19/EU (WEEE) directive





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