I-V400
MULTIFUNCTION INSTRUMENT FOR VERIFICATION OF I-V CHARACTERISTIC OF PHOTOVOLTAIC STRINGS AND MODULES

I-V 400 is the ideal solution for the ordinary and scheduled maintenance of photovoltaic systems. With I-V 400, searching for possible failures and problems in systems is extremely rapid, efficient and intuitive. I-V 400 carries out the field measurement of the I-V characteristic and of the main characteristic parameters both of a single module and of module strings. The instrument measures, together with the I-V characteristic of the device being tested, also the values of its temperature and incident irradiation. The acquired data are then processed to extrapolate the I-V characteristic at standard test conditions (STC) in order to proceed with the comparison with the nominal data declared by the modules' manufacturer, thus immediately determining whether or not the string or the module being tested respects the characteristics declared by the manufacturer. In some PV installations, such as roof-top installations, it may be difficult to access the module output cables. An access to the cables at the combiner box or at the inverter's inputs may be the only chance. In this case the measurement of I-V characteristics can be achieved by measuring the environmental parameters (irradiation and temperature) through the remote optional unit SOLAR-02. The remote unit is positioned next to the photovoltaic modules and it is connected to the probes for measuring environmental parameters. The synchronization between the two units guarantees the necessary contemporaneity of measurements making possible the extrapolation of the I-V curve at STC without using long extension cords cable.
Output current or voltage from the module or string is measured with the 4-terminal method, which allows extending the measurement cables without requiring any compensation for their resistance, thus always providing accurate and precise measurements. In its internal memory, I-V 400 manages a database of photovoltaic modules, which can be updated at any time both via the management software and directly on the instrument. Together with the measurement of the I-V characteristic and the extrapolation of the characteristic at standard test conditions, I-V 400 compares the obtained values with the values declared by the manufacturer, immediately providing the OK / NO result of the test. The operator must not do any calculation, nor any difficult operation. The instrument carries out the comparison rapidly and automatically.

FUNCTIONS

- Measurement of output voltage from module/string up to 1000V DC
- Measurement of output current from module/string up to 10A DC
- Measurement of solar irradiation [W/m^2] with reference cell
- Measurement of module temperature, automatic or by means of external probe
- Measurement of output DC and nominal power of module/string
- Synchronization with remote unit SOLAR-02
- Numerical and graphical display of I-V characteristic
- Quick test mode
- Measurement of the resistance of photovoltaic module series
- Mechanical inclinometer for the detection of the incidence angle of solar irradiation
- 4-terminal measuring method
- Extrapolation to standard test conditions (STC)
- Evaluation of testing result: OK / NO
- Management of up to 30 types of photovoltaic modules in the internal database
- Internal memory for data saving
- Recalling results on the display
- Optical/USB port for PC connection
- Help on line on the display

ACCESSORIES

ACCESSORIES	Code
Standard	
Kit of 4 cables with 4mm banana plugs + 4 alligator clips	KITGSC4
Kit of 2 adapters with MC3 compatible connectors	KITPVMC3
Kit of 2 adapters with MC4 compatible connectors	KITPVMC4
Reference cell for irradiation measurement	HT304N
Mechanical inclinometer	M304
Windows software + optical/USB cable C2006	TOPVIEW2006
Rigid transport suitcase	VA500
User manual	
Calibration certificate ISO9000	
Optional	
Probe PT1000 for cell temperature measurement	PT300N
Kit of belts for slinging the instrument over one's shoulder	SP-0400
Remote unit to record irradiation and temperature	SOLAR-02
Kit of 2 cables banana 4mm, green/black, 25m	KITPVEXT25M
Rigid transport suitcase	VA400

GENERAL CHARACTERISTICS
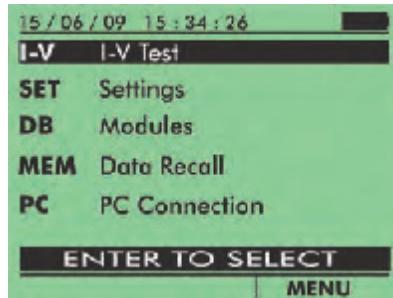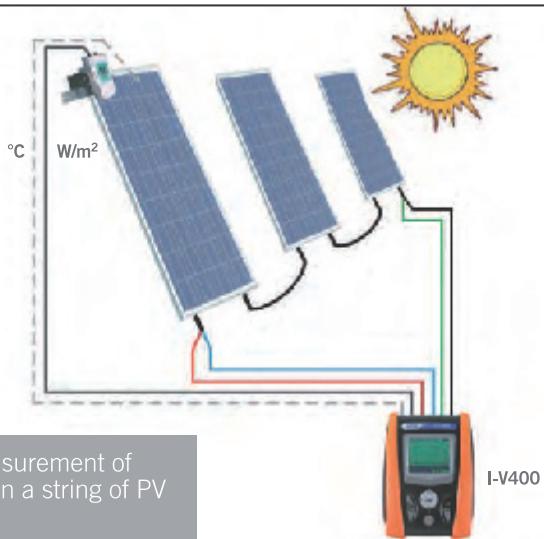
Display:	LCD Custom, 128x128pxl, backlit
Power supply:	6x1.5V alkaline bat. type AA LR06
Auto power off:	after 5 minutes in stand-by
Internal memory:	256kBytes
Curves which can saved:	> 200
PC interface:	optoisolated optical/USB port
Safety:	IEC/EN61010-1
Meas. accessory safety:	IEC/EN61010-031, IEC/EN10-032
Measures:	IEC/EN 60891, IEC/EN 62446
Insulation:	double insulation
Pollution degree:	2
Measurement category:	CAT II 1000V, CAT III 300V (to earth) Max 1000V between inputs
Dimensions:	235x165x75mm
Weight (batteries included):	1.2kg

Some standard accessories
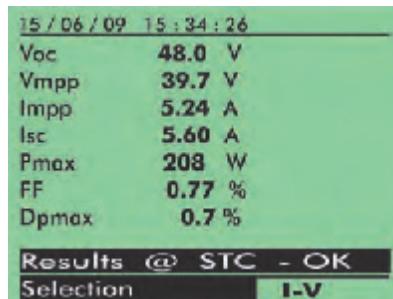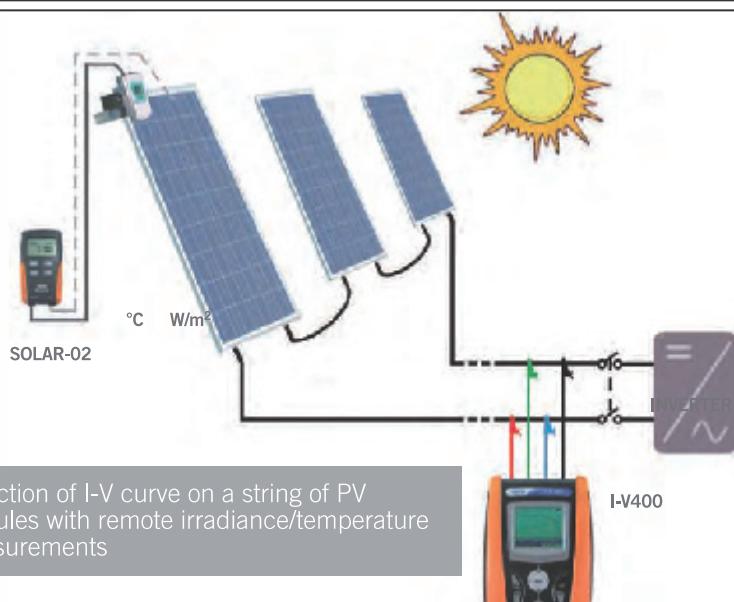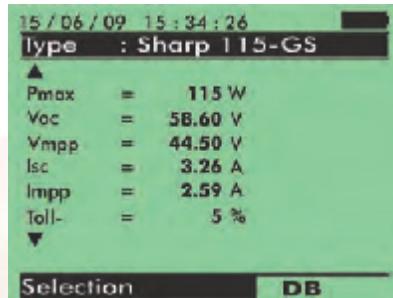
HT304N   *M304*

Direct measurement of I-V curve on a string of PV modules

°C   W/m²

I-V400

SOLAR-02

°C   W/m²

INVERTER

I-V400

Detection of I-V curve on a string of PV modules with remote irradiance/temperature measurements

You Tube™
www.youtube.com/user/HTinstruments1
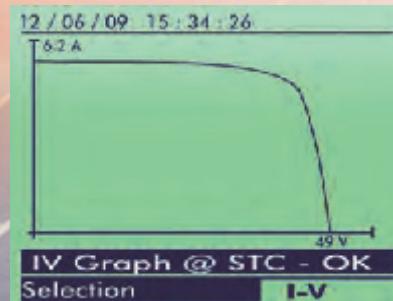
I-V400
AN INSTRUMENT WITH UNIQUE FEATURES

I-V400
HV00400V

Simple and intuitive user interface

Numerical measurement with OK result

Addition of a PV module to the database

Graph of a NOT-OK curve

Graph of an I-V curve with OK result

1. GENERAL SPECIFICATIONS OF I-V 400 METER

HT ITALIA enlarges its range of products for photovoltaic system introducing the new **I-V 400**

The instrument allows the on field measurement of I-V curve as well as of the main parameters of a single module and of a whole photovoltaic system up to a maximum of 1000V and 10A

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 the manufacturer of those modules. 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 the open voltage Voc and short circuit current Isc on PV module/strings output also without irradiation conditions

I-V 400 manages an internal database of the most common photovoltaic modules. Such a database can be updates at any time by the user both through the management software and directly through the instrument's interface

2. ELECTRICAL SPECIFICATIONS

Accuracy is calculated as ± [% reading + (number of dgts) x resolution] at 23°C ± 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 ÷ 10.00	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(~ 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 ÷ 10.00	0.01	±(4.0%rdg+2dgt)

Max Power @ STC (Vmpp >30V, Impp >2A)

Range (W) (*, **)	Resolution (W)	Global accuracy (**)
50 ÷ 9999	1	±(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^2 , 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)

3. GENERAL SPECIFICATIONS

DISPLAY AND MEMORY:

Features: 128x128pxl custom LCD with backlight
Memory capacity: 256kbytes
Saved data: 249 curves (I-V curve test), 999 IVCK

POWER SUPPLY:

SOLAR I-V internal power supply: 6x1.5V alkaline batteries type LR6, AA, AM3, MN 1500
Autonomy 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 LR03
SOLAR-02 max recording time (@ IP=5s): approx 1.5h

OUTPUT INTERFACE

PC communication port: optical/USB
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:

Reference temperature: $23°C \pm 5°C$
Working temperature: $0° \div 40°C$
Working humidity: <80%HR
Storage temperature (batt. not included): $-10 \div 60°C$
Storage humidity: <80%HR

GENERAL REFERENCE STANDARDS:

Safety: IEC/EN61010-1
Safety of measurement accessories: IEC/EN61010-031
I-V curve measurement: IEC/EN60891 (I-V curve test)
IEC/EN60904-5 (Temperature measurement)
Insulation: double insulation
Pollution degree: 2
Overvoltage category: CAT II 1000V DC, CAT III 300V AC to ground
Max 1000V among inputs P1, P2, C1, c2
Max altitude of use: 2000m

This instrument complies with the requirements of the European Low Voltage Directives 2006/95/EEC (LVD) and EMC 2004/108/EEC