User Manual

EN

CST-122

Charging Station Tester

SPEKTER

CST-122

Charging Station Tester

User Manual

Table of Contents:

Safety Information, Warnings

Testing of Charging Stations should only be carried out by properly trained and competent persons!
Carefully read this safety information before using the Tester.

Symbols used on the instrument or in this User Manual:

	**Warning of a potential danger, comply with this User Manual.**
☞	**Reference, please pay utmost attention.**
	**Earth (ground) terminal**
	**Do not touch, hazardous voltage, risk of electric shock.**
	**Read this User Manual.**
	**Symbol for marking of electrical and electronic equipment (WEEE Directive).**
	**Conformity symbol, confirms compliance with the applicable European directives. The requirements of the Low Voltage Directive with the relevant regulations Standards are also fulfilled.**
	**Safety assured with double insulation.**

 **WARNINGS**

☞ **This User Manual contains information and references, necessary for safe operation and maintenance of the Tester. Prior to using the Tester, the user is kindly requested to thoroughly read the User Manual and comply with it in all sections.**

☞ **If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

☞ **Failure to read this User Manual or to comply with the warnings and references contained herein can result in serious bodily injury or equipment damage.**

Introduction

You have acquired a high-quality Tester manufactured by MI SPEKTER, which will enable you to perform repeatable measurements for a very long period of time.

The Tester is designed to test functionality and safety of Charging Stations mode 3 for AC charging. This Tester allows you to conduct tests in combination with appropriate test instrument like Installation Tester and Oscilloscope or Multimeter. With this Tester the Charging Stations could be tested in accordance with EN/IEC 61851-1 standard.

Available measurements, product description

- PE Test (potential presence of dangerous voltage at PE terminal) – touch electrode and LED indicator.
- Phase indicator (presence of all three phase voltages measured to N) – three LED lamps.
- PP State simulation (Open, 13 A, 20 A, 32 A, 63 A, Error) – rotary switch.
- CP State simulation (A, B, C, D, "E") – rotary switch.
- CP Error simulation (CP signal short-circuited to PE) – push button.
- PE Error simulation (interruption of PE conductor) – push button.
- Diode Error simulation (diode short-circuited) – push button.
- Measurements on L1, L2, L3, N and PE conductors – five 4-mm safety sockets for connection to Installation Tester.
- Measurements of CP signal – two 4-mm safety sockets for connection to oscilloscope or multimeter.

Scope of Supply

1 pc CST-122 Charging Station Tester with fixed cable and Type 2 connector for connection to charging station with panel mounted socket or with fixed cable
1 pc User Manual
1 pc Warranty card
1 pc Soft carrying bag

Transport and Storage

The Tester must be stored in dry and closed areas. In case of the Tester being transported in extreme temperatures, a recovery time of minimum 2 hours is required prior to any operation.

Safety Measures

The Tester has been built and tested in compliance with valid safety regulations and left the factory in safe and perfect condition. In order to maintain this condition and to ensure safe Tester operation, the user must pay attention to the references and warnings contained within this User Manual.

WARNINGS, DANGER OF ELECTRICAL SHOCK

- In order to avoid electrical shock, the valid safety and national regulations regarding excessive contact voltages must receive utmost attention when working with voltages exceeding 70 V DC or 33 V RMS AC.
- The respective accident prevention regulations established by the national health & safety board for electrical systems and equipment must be strictly met at all times.
- Prior to any operation, ensure that the Tester including cable and connector is in perfect condition.
- The Tester may only be connected to Charging Station as indicated in the technical specification section.
- The Tester may only be used within the operating ranges as specified in the technical specification section.
- The Tester may only be used in dry and clean environments. Dirt and humidity reduce insulation resistance and may lead to electrical shocks, in particular for high voltages.
- Never use the Tester in precipitation such as dew or rain. In case of condensation due to temperature jumps, the Tester may not be used.
- A perfect tests and measurements may only be ensured within the temperature range of -20 °C to +40 °C.
- Prior to opening the Tester ensure that it is disconnected from all current circuits.
- If the operator's safety is no longer guaranteed, the Tester is to be put out of service and protected against use. The safety can no longer be guaranteed if the Tester including cable and connector:
  – shows obvious damage
  – does not carry out the desired tests or measurements
  – has been stored for too long under unfavorable conditions
  – has been subjected to mechanical stress during transport

Appropriate Usage

WARNINGS

- The Tester may only be used under conditions and for the purposes for which it was conceived. For this reason and particularly for safety reason, the technical data including environmental conditions must be followed.
- When modifying the Tester, the operational safety is no longer ensured.
- The Tester may only be opened by an authorized service technician. Before opening the Tester, it must be disconnected from any electrical circuitry.

Description of Warning Marks on Front Panel

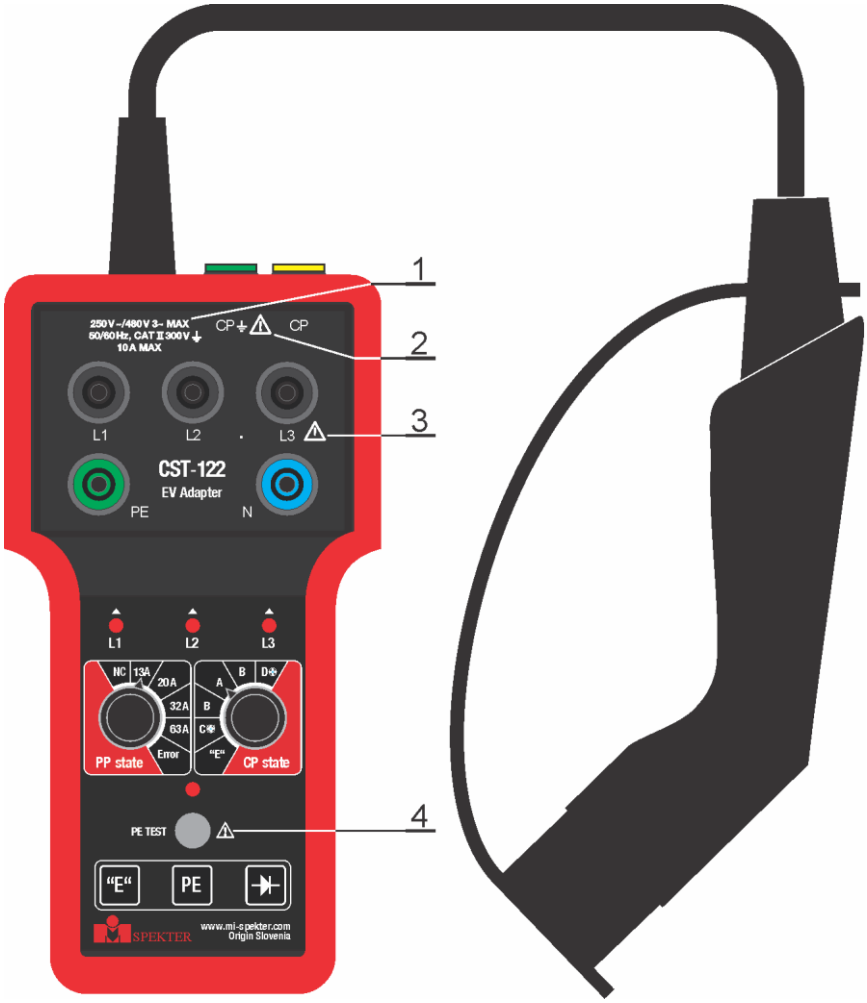

Figure 1: Explanation of warning marks and measurement category (CAT) rating of input / output terminals

Warning 1:
Rating of input voltage and current.

Warning 2:
Terminals CP⏚ and CP with low-voltage output (approx. +/- 12V) powered by Charging Station.
Terminal marked with ⏚ is connected to PE!
Use the test sockets for test purpose only!
In case of wrong wiring or error of the Charging Station these terminals may become hazard.

Warning 3:
Dangerous voltages may be present at L1, L2, L3, N and PE terminals while the Tester is plugged in to a Charging Station.
Use the test sockets for test purpose only, **max. allowed loading 1 A**!
In case of wrong wiring or error of the Charging Station also terminals N and PE may be hazard.

Warning 4:
High danger of electric shock is present when PE Test indicator lights while performing PE Test, see test instructions on page 14. In this case further testing must be stopped immediately!
Ensure to ground your body sufficiently while performing this test!

Operation Elements and Connectors

Front panel of the CST-122 Charging Station Tester

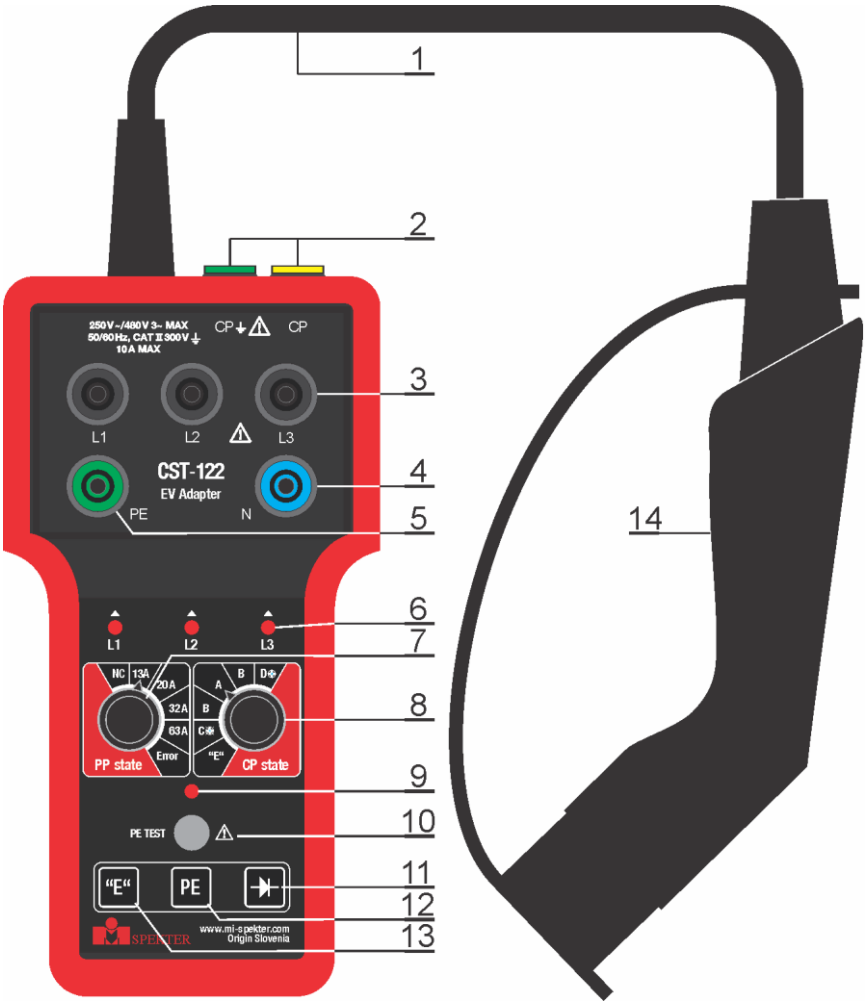

Figure 2: Operational elements and connectors on the CST-122 Charging Station Tester

1 ..... 7-pole fixed cable
2 ..... CP output terminals – green terminal (marked with ⏚) is connected to PE
3 ..... Measuring terminals L1, L2 and L3
4 ..... Measuring terminal N
5 ..... Measuring terminal PE
6 ..... Phase indicators of L1, L2, L3 inputs measured against N
7 ..... PP (Proximity Pilot) state rotary switch selector (Open, 13A, 20A, 32A, 63A and Error)
8 ..... CP (Control Pilot) state rotary switch selector (A, B, C, D and Error)
9 ..... PE Test warning lamp
10 ..... PE Test touch probe
11 ..... Diode Error button
12 ..... PE Error button
13 ..... “E” Error button
14 ..... EV connector for Charging Stations Type 2

Back side of the CST-122 Charging Station Tester

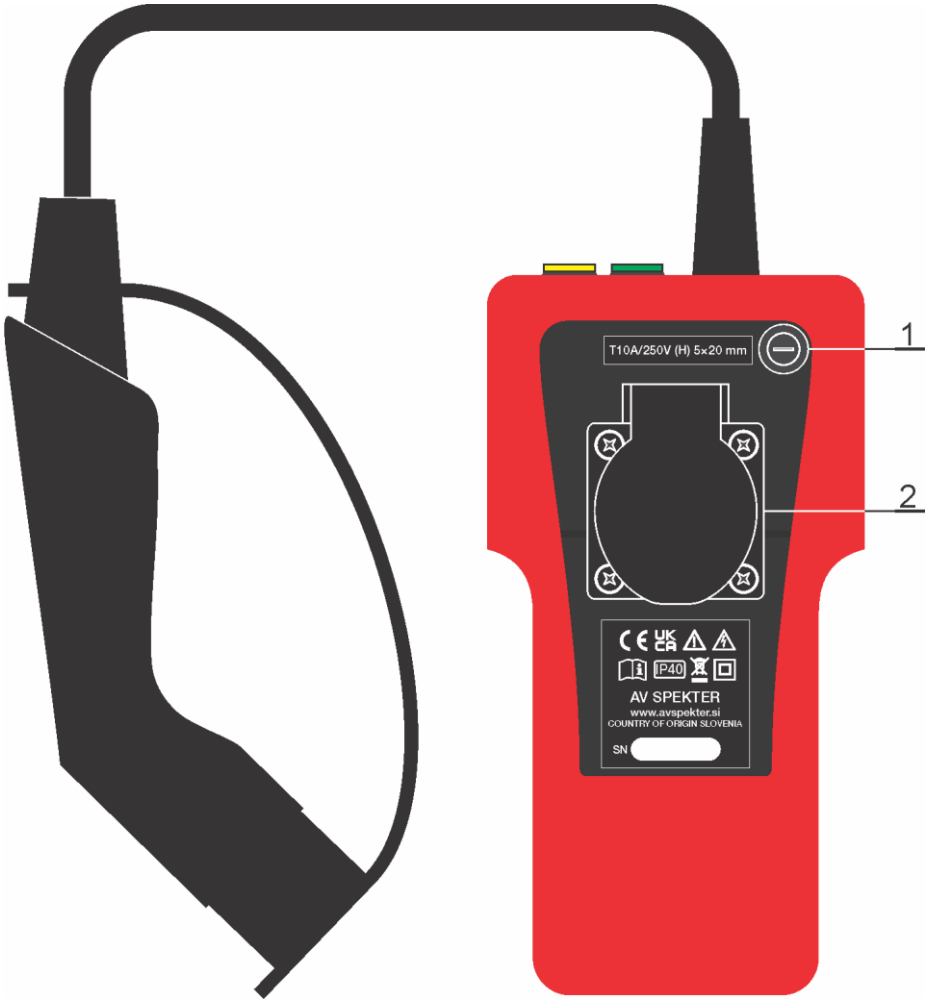

Figure 3: Back side of the CST-122 Charging Station Tester

1 .... Fuse T10A/250V 5×20 mm. It protects schuko socket against overload
2 .... Schuko socket. Use for test purpose only! Max allowed current 10A!

Testing Charging Stations

Warnings

WARNINGS

- Before starting the tests, you must familiarize yourself with the EN/IEC 61851-1 standard "Electric vehicle conductive charging system - Part 1: General requirements" and with the documentation of the Charging Station.
- Before commencing the tests, you are strongly advised to make reference to the local regulations and standards for safety at works regulations and any relevant publications from the Health and Safety Executive.
- The tests should only be performed by competent persons who are familiar with the requirements of the type of tests suitable for installations.
- It is potentially hazardous for both user and the DUT (Device Under Test) if the wrong type of tests is undertaken or if testing is carried out in an incorrect sequence.

- It is important that you fully understand the various tests required and how they should be performed.
- The appliance must have passed the PE Test prior to any other test. If this test fails further testing must be stopped and the fault must be removed. In case of error, all metal parts of the Charging Station including output terminals and PE may carry hazard voltage. In this case there is a high risk of electric shock to the operator and other persons nearby.

Purpose of the CST-122 Charging Station Tester

There are two main purposes of the Tester:

1) To simulate connection of an electrical vehicle (EV) to tested Charging Station (Tester simulates electrical vehicle in this case). Connection of the Tester and appropriate setting of the Tester triggers the charging process in Charging Station. Various cable charging capabilities can be simulated (open, 13 A, 20 A, 32 A, 63 A and Error) and all possible car modes as well (A, B, C, D and Error "E").
2) To provide easy access to charging terminals L1, L2, L3, N, PE and to CP signal terminals to which an additional measuring equipment can be connected for further testing.

Charging Stations should be tested after installation and as repeating test after a certain time. Please refer to the manufacturer's recommendation and national standards like DIN VDE 0100-600 for initial test or DIN VDE 0105-100.

Tester offers the following functional tests:
- PE Test (presence of hazardous voltage at PE terminal)
- Vehicle states (CP) A, B, C, D and "E"
- Cable capacities (PP) (Open, 13 A, 20 A, 32 A, 63 A and Error)
- Error simulations (CP error "E", PE error, Diode error)

By using an appropriate Installation Tester, the following tests are possible:
- Visual inspection
- Phase-neutral and phase-phase voltages
- Mains frequency
- Phase sequence
- Resistance of PE conductor
- Insulation resistance in all combinations between live terminals L1, L2, L3, N
- Insulation resistance in all combinations between live terminals L1, L2, L3, N against PE
- Loop / Line impedance
- RCD test
- RDC-DD 6 mA test

By using an appropriate Oscilloscope or Multimeter, the following tests are possible:
- CP signal analysis (PWM)

Note: The list above is only an example! This Tester will help you to conduct the tests mentioned above.

Connection of the CST-122 Charging Station Tester to Charging Station

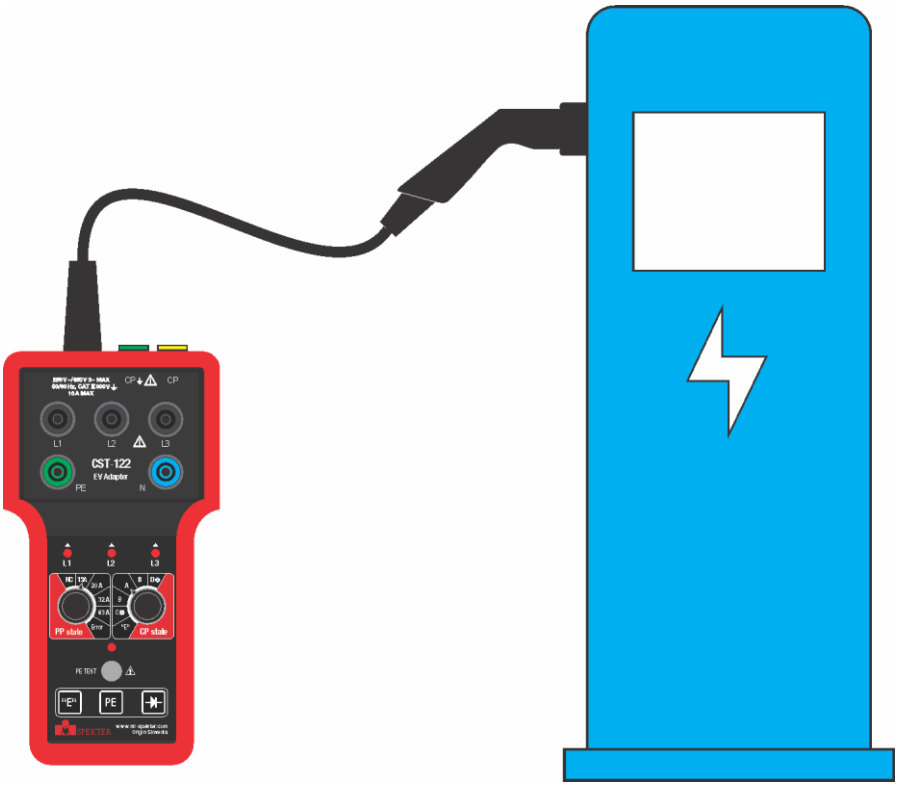

Figure 4: Connection of CST-122 Charging Station Tester to a Charging Station Type 2 with panel mount socket

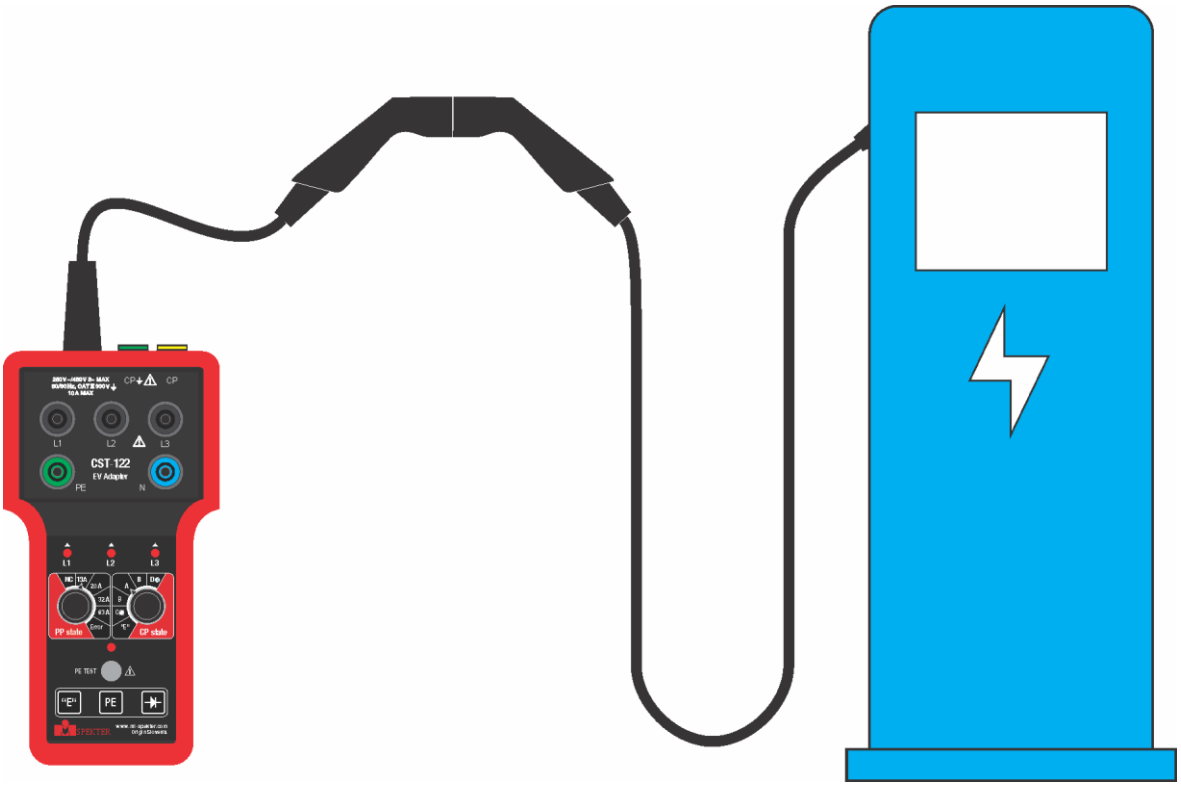

Figure 5: Connection of CST-122 Charging Station Tester to a Charging Station Type 2 with fixed cable

Basic information on how to test Charging Stations

PE Test

PE Test is a safety feature of the Tester. With this feature operator can test PE conductor for possible presence of dangerous voltage against ground.
In normal circumstances PE conductor is grounded and therefore has no voltage against ground. But in case the PE conductor is not grounded (for example connected to phase by mistake or PE interrupted) it presents most dangerous situation.

Test procedure: After the Tester is connected to a Charging Station, touch the touching probe (see position 10 in figure 2) with bare finger, see the figure below. If light indicator glows (see position 9 in figure 2), then dangerous voltage is present at PE conductor. Stop further testing immediately and check for possible wiring fault of tested PE conductor!

Note: Repeat the PE Test also when tested Charging Station applies mains voltage to the Tester (at least one phase indicator is ON, see position 6 in figure 2).

⚠ In case of this error, PE terminal carries hazardous voltage. There is a high risk of electric shock to the operator and other persons nearby!
Possible errors are:
- PE interrupted / not connected.
- PE carries hazardous voltage (for example connected to phase)

⚠ Do not wear gloves while performing this test and ensure a proper connection to ground. Do not touch any metal parts while performing this test!

⚠ In case of improper grounding of your body (i.e. isolated location of your body), you cannot rely on this result!

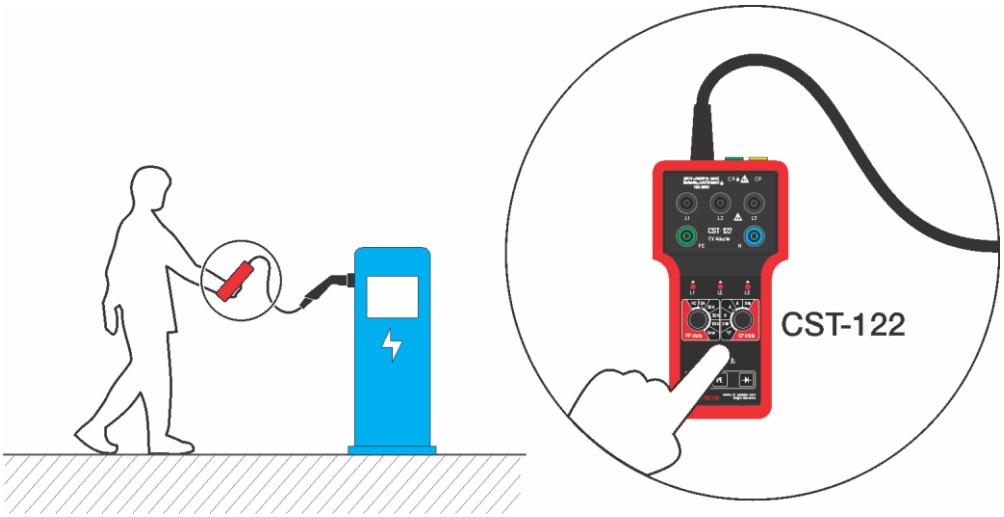

Figure 6: PE Test

PP State (Cable Simulation)

PP = Proximity Pilot

With PP state rotary switch (see position 7 in figure 2) various current capabilities of charging cable can be simulated. Current capabilities are simulated with different resistances connected between PP and PE terminals. Correlation between resistance and current capability of charging cable is shown in the Table 1 below.

Marking of cable current capability	Resistance between PP and PE
No cable	Open (∞)
13 A	1,5 kΩ
20 A	680 Ω
32 A	220 Ω
63 A	100 Ω
Error	0 Ω

Table 1: Correlation between resistance and current capability of charging cable

CP State (Vehicle Simulation)

CP = Control Pilot

With CP State rotary switch selector (see position 8 in figure 2) various vehicle states can be simulated when the Tester is connected to Charging Station. Vehicle states are simulated with different resistances connected between CP and PE terminals. Correlation between resistance and vehicle state is shown in the Table 2 below.

Marking of Vehicle State	Vehicle State	Resistance between CP and PE	Voltage at CP terminal
A	Electric vehicle (EV) not connected	Open (∞)	±12 V 1 kHz
B	Electric vehicle (EV) connected, not ready to charge	2,74 kΩ	+9 V / -12 V 1 kHz
C	Electric vehicle (EV) connected, ventilation not required, ready to charge	882 Ω	+6 V / -12 V 1 kHz
D	Electric vehicle (EV) connected, ventilation required, ready to charge	246 Ω	+3 V / -12 V 1 kHz
“E”	Electric vehicle (EV) connected, CP signal short-circuited, charging station must turn to OFF state	0 Ω	0 V

Table 2: Correlation between resistance and vehicle state

CP Signal output terminals
CP output terminals (see position 2 in figure 2) are connected to CP and PE conductors of tested Charging Station via the Tester.
Green socket is connected to PE! This output is intended for connection of an Oscilloscope or Multimeter in order to check the waveform, amplitude, duty cycle and frequency of the CP signal.

Control Pilot function is using PWM (Pulse Width Modulation):
Purpose of the Control Pilot function is communication between vehicle and Charging Station. The duty cycle of this PWM signal is generated by Charging Station and defines available charging current depending on Charging Station capacity, connection cable capacity and potential other limitations like for example overloaded mains system.
Amplitude of the signal is defined by the car (by the Tester in this case) and it shows the state of the car.

For details of communication protocol please refer to EN/IEC 61851-1 and the documentation of the manufacturer of the Charging Station.

CP Error "E" Simulation
With "E" button or "E" position at CP state selector (see positions 8 and 13 in figure 2) CP Error can be simulated acc. to EN/IEC 61851-1 standard. When "E" button is pushed or when CP state selector is in "E" position, a short circuit between CP and PE through internal diode is made. A pending charging process must be aborted as a result, and a new charging process must be prevented.

Note! Position "E" at CP state rotary switch is equal to pressed "E" error button.

PE Error Simulation
With "PE" button (see position 12 in figure 2) interruption of PE conductor is simulated.
When "PE" error button is pushed, a pending charging process must be aborted as a result, and a new charging process must be prevented.

Phase indicator
Phase indicator consists of three LED lamps, one for each phase (see position 6 in figure 2).
When the Tester is connected to Charging Station and phase voltages are present at charging connector, the three LED indicators (three-phase system) are ON.

Notes!

- In case neutral (N) conductor is not present or it is interrupted, LED indicators do not indicate possible voltage presence at L1, L2 and L3 conductors! The LED indicators cannot be used for phase sequence testing.
- In case the Charging Station has only a single-phase output then only one LED is ON.

Schuko socket
The Schuko socket (see position 2 in figure 3) is connected to L1, N and PE conductors of Charging Station via the Tester. This output is intended for measuring purpose only. It offers the possibility to connect an Installation Tester or an external load. External load enables to check if the electric power meter counts in the right manner or in some Charging Stations it simulates connected car.

Note: In case of connected external load, respect intermittent use according to technical specification listed in this User Manual. Max. current is limited to 10 A and it is fused with fuse T10A/250V, 5×20 mm (see position 1 in figure 3).

Measuring terminals L1, L2, L3, N and PE

Measuring terminals (see positions 3, 4 and 5 in figure 2) are directly connected to the terminals of the Charging Station via the Tester. These terminals may be used for measuring purposes only! Max allowed current is 1 A. It is not allowed to draw current over a longer period or supply anything else.

Appropriate Installation Tester is needed to carry out further measurements.

Maintenance

When using the Tester in compliance with the User Manual, no special maintenance is required. However, should functional errors occur during normal operation our after sales service will repair your Tester without delay.

Cleaning

If the instrument is needed to be cleaned after daily usage, it is advisable to use a wet cloth and a mild household detergent.
Prior to cleaning, disconnect the Tester from all measurement circuits and charging connector must be disconnected from Charging Station.
Never use acid-based detergents or dissolvent liquids for cleaning.
After cleaning it, do not use the Tester until it is completely dried up.

Fuse Replacement

If, due to overload or improper operation, a fuse blows, it is necessary to obey the following notes for replacement:

⚠WARNING

Prior to replacement of blown fuse, the Tester must be disconnected from all measuring circuits and charging connector must be disconnected from Charging Station.

- Use only fuse specified and rated in technical specifications.
- Use of unspecified fuses and in particular shorting fuse-holders is prohibited.
- Spare fuses can be obtained in electric supply wholesale shops or in our factory service.

Fuse replacement:
The fuse T10A/250V, 5 x 20 mm (see position 1 in figure 3) may be blown if no voltage is present at schuko socket when charging connector is connected to Charging Station and Charging Station is in “charging” mode.

To replace the blown fuse, proceed as follows:

1) Unscrew fuse holder cap by using an appropriate flat screwdriver.
2) Remove the defective fuse and replace it with a new one.
3) Replace the fuse holder cap.

☞ If the fuse blows several times (for example in case of operating error) the Tester must be sent in to the service department in order to be checked.

☞ Use only fuses as defined in technical specification. Using alternative fuses may cause a safety risk!

Technical Specifications

General Features

Input voltage	Up to 250V (single phase system) or up to 480 V (three phase system), 50/60 Hz, max 10 A
Internal power consumption	1 W max.
EV Connector	IEC 62196-2 plug, 16 A (type 2, 7P three-phase), cable length 0.5 m
Housing	Plastic handheld with rubber protection
Dimensions (width × length × height)	110 × 210 × 70 mm (without cable and connector)
Weight	0.92 kg
Ingress protection class	IP40 (4-mm sockets IP20)
CE directive	Low Voltage Directive LVD 2014/35/EU
Safety	EN/IEC 61010-1:2010+A1:2019 (Safety requirements for electrical equipment for measurement, control and laboratory use - General requirements) EN / IEC 61010-2-030:2021 (Safety requirements for electrical equipment for measurement, control and laboratory use - Particular requirements for equipment having testing or measuring circuits)
EMC	Not applicable
Working temperature range	-5 ... +40 °C
Storage temperature range	-20 ... +50 °C
Working humidity range	10 ... 85 % relative humidity w/o condensation
Storage humidity range	Up to 85 % relative humidity w/o condensation
Pollution degree	2
Protection class	II (double insulation)
Measurement category	CAT II 300 V
Altitude above sea level	3000 m max.

Functions

L1, L2 and L3 indicators	Yes (presence of all three phase voltages measured to N) - three LEDs
PE Test	Yes (potential presence of dangerous voltage at PE terminal) - touch electrode and red LED
PP state simulation	Open, 13 A, 20 A, 32 A, 63 A and Error - rotary switch
CP state simulation	A, B, C, D ◉, D ◉, and CP error “E” - rotary switch
CP Error “E”	Yes (CP signal short-circuited) - push button
PE Error	Yes (PE interrupted) - push button
Diode Error	Yes (diode short-circuited) - push button

Outputs (for test purposes only)

L1, L2, L3, N and PE output terminals	4-mm sockets, max. 250/480 V, CAT II 300 V, max. 1 A
CP signal output terminals	4-mm sockets, approx. +/-12 V under normal conditions (in case of wrong wiring or error of the charging station, these terminals may become hazardous => up to max. CAT II 300 V against PE)

Schuko socket (for connection of an Installation Tester or external load)	Max. 250 V, CAT II 300 V, allowed current max. 10 A **Warning!** ☞ **Intermittent use should be respected. Max. ratio (current on time) / (current off time) = 1 / 3, max. current on time = 0.5 h.**
Schuko socket protection	Fuse T10A/250V, 5×20 mm, type 179021.10 Siba

Limited Warranty and Limitation of Liability

It is guaranteed that this MI SPEKTER product is free of material and manufacturing damages for the time period of 24 months starting from the date of purchase. This warranty does not include fuse malfunctions, as well as damages caused by accidents, negligence, misusage, unauthorized modifications, abnormal operating conditions or improper handling. The sales offices do not have the right to extend the warranty on behalf of MI SPEKTER.

Service

All products that are sent in for repair or calibration within or beyond the warranty period must contain the following data: Name of the client, name of the company, address, contact telephone number and a proof of purchase. Please enclose also a short description (or a service form) of the problem detected or of desired maintenance.

Service address:
MI SPEKTER d.o.o.
Podpeška cesta 67
SI-1351 Brezovica pri Ljubljani
Slovenia

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List of Abbreviations

CAT II..... Overvoltage Category II
CP..... Control Pilot
PP..... Proximity Pilot
DUT..... Device Under Test
EVSE..... Electric Vehicle Supply Equipment
EV ..... Electric Vehicle
PC II..... Protection class II (appliances with double/reinforced insulation)

Subject to technical changes without notice!
09/2024 Version 1.4