GOSSEN METRAWATT

METRALINE PRO-TYP EM I/II/III

Single and 3-phase Test Adapter for Testing Electric Charging Stations with PROFITEST MTECH+ and MXTRA

3-447-060-03
1/11.19

Opening of Equipment / Repair

The equipment may be opened only by authorized service personnel to ensure the safe and correct operation of the equipment and to keep the warranty valid.

Even original spare parts may be installed only by authorized service personnel.

In case the equipment was opened by unauthorized personnel, no warranty regarding personal safety, measurement accuracy, conformity with applicable safety measures or any consequential damage is granted by the manufacturer.

Device Return and Environmentally Compatible Disposal

The instrument is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German Electrical and Electronic Device Law). This device is subject to the RoHS directive. Furthermore, we make reference to the fact that the current status in this regard can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE.

We identify our electrical and electronic devices in accordance with WEEE 2012/19/EU and ElektroG with the symbol shown to the right per DIN EN 50419.

These devices may not be disposed of with the trash.
Please contact our service department regarding the return of old devices.

If you use **batteries** or **rechargeable batteries** in your instrument or accessories which no longer function properly, they must be duly disposed of in compliance with the applicable national regulations.
Batteries or rechargeable batteries may contain harmful substances or heavy metal such as lead (PB), cadmium (CD) or mercury (Hg).

They symbol shown to the right indicates that batteries or rechargeable batteries may not be disposed of with the trash, but must be delivered to collection points specially provided for this purpose.

Table of Contents

General Notes

Read the operating instructions thoroughly and carefully before using your instrument. Follow all instructions contained therein. Make sure that the operating instructions are available to all users of the instrument.

Explanation of Symbols

CE This product fulfills guidelines in accordance with 89/336/EEC.

 Warning regarding property damage. Safety precautions must be adhered to.

 Warning regarding personal injury. Safety precautions must be adhered to.

Basic Safety Precautions

Guarantee

No guarantee is made with regard to function and safety unless the warnings and safety precautions included in these operating instructions are observed.
GMC-I Messtechnik GmbH assumes no liability for personal injury or property damage which occurs due to non-observance of the warnings and safety precautions.

Use for Intended Purpose

The METRALINE PRO-TYP EM I/II/III test adapter is intended exclusively for performing tests in accordance with DIN VDE 0100-600/DIN VDE 0105-100 for the effectiveness of protective measures at charging stations for electric vehicles with type 2 connector socket (mode 3 charging). The METRALINE PRO-TYP EM I/II/III test adapter establishes a connection between the charging station and PROFITEST MASTER (PROFITEST MTECH+ and MXTRA) to this end. Use for other purposes is prohibited.
In particular, the test sockets and the earthing contact socket may not be used in order to connect electric loads to the charging station.

Testing Conducted by a Qualified Electrician in Accordance with German Occupational Safety Law and TRBS1203

Only trained, qualified electricians may use the METRALINE PRO-TYP EM I/II/III test adapter.
Trained, qualified electricians fulfill the following requirements:

- Knowledge of general and specific accident prevention regulations
- Knowledge of applicable electrotechnical regulations
- Training in use and care of appropriate safety equipment
- Ability to recognize hazards associated with electricity

Warning!

Danger!

The METRALINE PRO-TYP EM I/II/III test adapter may only be used to conduct tests at charging stations for electric vehicles with type 2 connector socket (mode 3 charging) in accordance with DIN VDE 0100-600/DIN VDE 0105-100.
The device may only be used in combination with the PROFITEST test instruments (DIN VDE 0413)!
The adapter is not intended for operation of electric loads at the test sockets or the earthing contact socket, which may result in severe property damage and personal injury!

Product Overview

Scope of Delivery

- METRALINE PRO-TYP EM I/II/III test adapter
- Operating instructions

Device Layout of METRALINE PRO-TYP EM I (Z525F)

Key

1 Rotary switch, vehicle state (CP) and CP Socket for PWM Signal evaluation
2 Rotary switch, cable (PP)
3 Test sockets (PE, N, L1, L2, L3)
4 Phase sequence indicator LEDs
5 Type II plug for charging stations
6 Additional type I plug or Chinese plug for METRALINE PRO-TYP EM III (Z525H)

In addition, an earthing contact (Schuko) socket for METRALINE PRO-TYP EM II (Z525G)

Initial Start-Up

General

Warning!

Danger!

The METRALINE PRO-TYP EM I/II/III test adapter should be checked to assure that it's in good condition before initial start-up. The device may not be used if it's damaged.
The device may only be used by trained personnel.

Connecting a PROFITEST MASTER (PROFITEST MTECH+ and MXTRA)

The test adapter is equipped with test sockets (3) (METRALINE PRO-TYP EM I) or an earthing contact socket (7) (METRALINE PRO-TYP EM II) to which a PROFITEST MASTER can be connected. Maximum permissible load for the connections may not be exceeded when testing a charging station (230 V, max. 13 A).
Observe the manufacturer's instructions when connecting the PROFITEST MASTER.

Connecting the METRALINE PRO-TYP EM I/II/III Test Adapter to a Charging Station

The device is equipped with a type 2 plug (5) (METRALINE PRO-TYP EM I/II) or an additionally exchangeable test plug (6) (METRALINE PRO-TYP EM III) for connection to the charging station. This can be plugged into the charging station. If applicable, authorization at the charging station is required to this end.

VDE Testing at Charging Stations with the Help of the METRALINE PRO-TYP EM I/II/III Test Adapter

VDE tests can be conducted at charging stations in accordance with IEC 61851 with the help of the METRALINE PRO-TYP EM I/II/III test adapter in combination with a PROFITEST MTECH+ and PROFITEST MXTRA.
The test adapter triggers the charging process by simulating an electric vehicle. Only by means of simulation is the charging station's outlet energized so that it can be tested with the PROFITEST MTECH+ and PROFITEST MXTRA test instruments.
The test adapter makes the following functions available:

Vehicle Simulation (CP)

States A, B, C and E can be simulated in accordance with IEC 61851. The various vehicle states are selected by means of a rotary switch (1).

State A: No vehicle connected
State B: Vehicle connected, but not ready for charging
State C: Vehicle connected and ready for charging without venting
State E: Error – short circuit between CP and PE via internal diode

Cable Simulation (PP)
The various codings for charging cables with 13, 20, 32 and 63 A can be simulated. It's also possible to simulate the "no cable" state.
The various charging cables are simulated by connecting different resistances between PP and PE with the help of a rotary switch (2). The following values are possible in accordance with IEC 61851:

No cable:	0 Ω
13 A cable:	1.5 kΩ
20 A cable:	680 Ω
32 A cable:	220 Ω
63 A cable:	100 Ω

Fault Simulation
The test adapter's rotary switch (1) can be turned to "E" in order to simulate a short-circuit between CP and PE via an internal diode.
A pending charging process must be aborted as a result, and a new charging process must be prevented.

Phase Sequence Indicator
The METRALINE PRO-TYP EM I/II/III test adapter is equipped with LEDs (4) which indicate phase sequence. As soon as the phase conductors are energized, the LEDs light up red. Depending on the layout of the charging station, either one or three phases can be active.
An active charging process and at least one voltage conducting phase are prerequisites for VDE testing.

Maintenance

Due to the device's characteristics, no maintenance should be carried out by the user. If repairs should become necessary, please contact us.
Outside surfaces may only be cleaned with a dry, lint-free cloth.

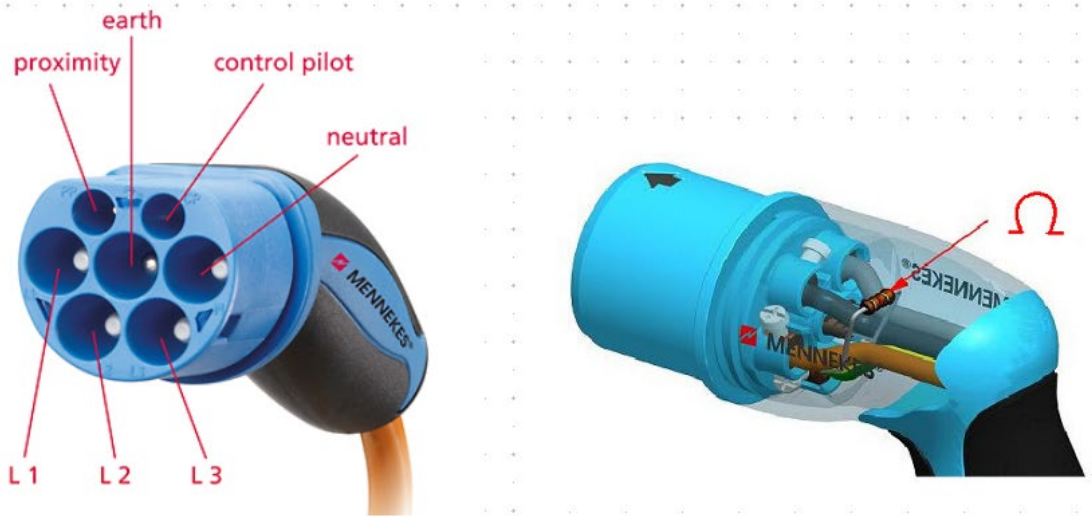
Danger!
No liquids may be permitted to penetrate into the device's interior or the plug connectors.

Technical Data

Input voltage:	400 V (3-phase)
Frequency:	50 Hz
Test consumer power:	Max. 2.9 kVA (no continuous operation!)
Protection:	IP 20
Operating temperature:	-10 to 45 °C
Storage temperature:	-25 to 60 °C
Relative humidity:	Up to 80% (no condensation)

Appendix: Practical Information on Testing Charging Stations

Type II Plug for Mode 3 Charging



Source: Mennekes

Resistance Coding for Charging Cables (PP)

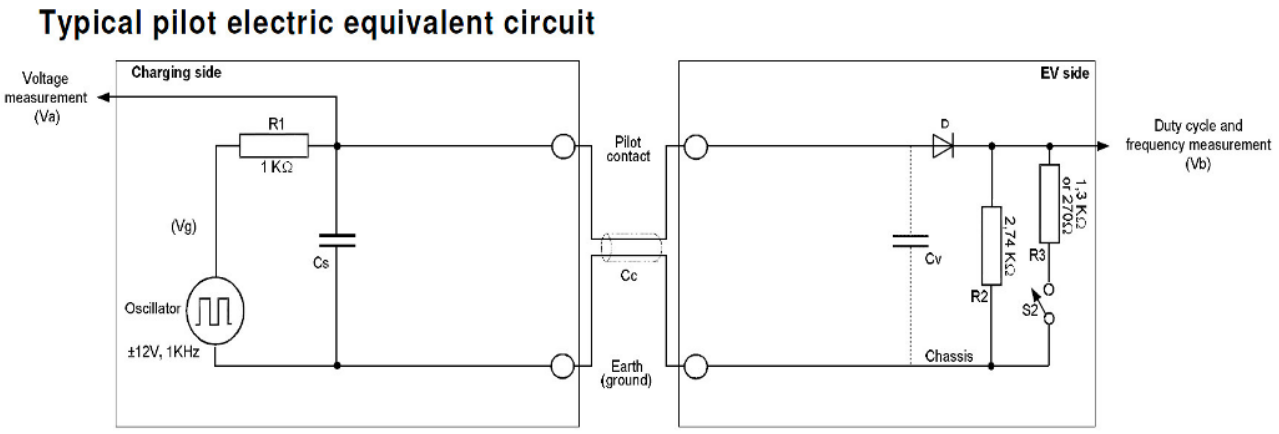
Table B.101 - Resistor coding for plugs

Current capability of the cable assembly	Nominal resistance of Rc Tolerance +/- 3% (3)	Recommended interpretation range by the EVSE
13 A	1.5 kΩ 0,5 W(1,2)	> 1 kΩ - 2.7kΩ
20 A	680 Ω 0,5 W(1,2)	330 Ω – 1 kΩ)
32 A	220 Ω 0,5 W(1,2)	150 Ω - 330 Ω
63 A (3-phase) / 70 A (1phase)	100 Ω 0,5 W(1,2)	75 Ω - 150 Ω
Interrupt power supply		< 75 Ω

1 The power dissipation of the resistor caused by the detection circuit shall not exceed the value given above. The value of the pull-up resistor shall be chosen accordingly.
2 Resistors used should preferably fail open circuit failure mode. Metal film resistors commonly show acceptable properties for this application.
3 Tolerances to be maintained over the full useful life and under environmental conditions as specified by the manufacturer.

Source: DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Typical Pilot Circuit for Mode 3 Charging



Source: DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Typical Pilot Circuit for Mode 3 Charging

Table A.2 – Vehicle control pilot circuit values and parameters (see Figures A.1, A.2)

Parameter	Symbol	Value	Value Range	Units
Permanent resistor value	R2	2,740	2658 - 2822	Ω
Switched resistor value for vehicles not requiring ventilation	R3	1,300	1261 – 1339	Ω
Switched resistor value for vehicles requiring ventilation	R3	270	261.9 – 278.1	Ω
Equivalent total resistor value no ventilation (Figure A.2)	Re	882	856 - 908	Ω
Equivalent total resistor ventilation required (Figure A.2)	Re	246	239 - 253	Ω
Diode voltage drop (2,75 – 10 mA, -40 °C to + 85 °C)	Vd	0,7	0.55 – 0.85	V
Maximum total equivalent input capacity	Cv	2 400	N/A	pF

Value ranges are to be maintained over full useful life and under design environmental conditions.

Note: 1% resistors commonly recommend for this application

Source: DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

System States — PWM Voltage

Table A.3 – System states

System state	EV connected to the EVSE	S2	EV ready to receive energy	EVSE ready to supply energy	EVSE supply energy	Va [a]			Remark
						High level	Low level		
A1	no	N/A	no	Not Ready	Off	12 V [d]	N/A	Steady voltage	Vb = 0 V
A2			no	Ready	Off	12 V [d]	-12v [e]	PWM	
B1	yes	open	no	Not Ready	Off	9 V [b]	N/A	Steady voltage	R2 detected
B2			no	Ready	Off	9 V [b]	-12v [e]	PWM	
C1	yes	closed	yes	Not Ready	Off	6 V [c]	N/A	Steady voltage	R3 = 1,3 kΩ ± 3 % Charging area ventilation not required
C2			yes	Ready	On	6 V [c]	-12v [e]	PWM	
D1			yes	Not Ready	Off	3 V [c]	N/A	Steady voltage	R3 = 270 Ω ± 3 % Charging area ventilation required
D2			yes	Ready	On	3 V [c]	-12v [e]	PWM	
E	yes	N/A	no	Not Ready	Off	0 V		Steady voltage	Vb = 0: EVSE or utility problem or utility power not available or pilot short to earth
F	yes	N/A	no	Not Ready	Off	N/A	-12v	Steady voltage	EVSE not available

[a] All voltages are measured after stabilization period.

[b] The EVSE generator may apply a steady state DC voltage or a +12 V square wave during this period. The duty cycle indicates the available current as in Table A.5.

[c] The voltage measured is function of the value of R3 in Figure A.1 (indicated as Re in Figure A.2).

[d] 12 V static voltage

[e] The EVSE shall check pilot line low state of -12V, diode presence, at least at the transition between B1 and B2.(or at least once before the closing of the supply switch on the EVSE).

The state changes between A, B, C and D are caused by the EV
the state changes between 1 and 2 are created by the EVSE.

Source: DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

System States — PWM Voltage

Table A.201 – Pilot voltage range

The following table details the pilot voltage range as a result of tables A.1 and A.2 components values. These voltage ranges applies to the EVSE (Va).

	Nominal voltage range imposed by the system			Acceptable voltage range recognized to detect the states [a]		
State / Range	Minimum [V]	Nominal [V]	Maximum [V]	Minimum [V]	Nominal [V]	Maximum [V]
States A1, A2 / positive	11.4	12	12.6	11	12	13
States B1, B2 / positive	8.37	9	9.59	8	9	10
States C1, C2 / positive	5.47	6	6.53	5	6	7
States D1, D2 / positive	2.59	3	3.28	2	3	4
State E	0	0	1	-1	0	1
States A2,B2,C2, D2 / negative State F [a]	-12.6	-12	-11.4	-13	-12	-11

[a] Applicable to Va only

Note : the EVSE may also be designed to use the voltage of the internal generator (Vg) as a reference. The valid voltage ranges are then to be calculated as given in the following table. These ranges are idebtical to the values in the above table for Vg=12V

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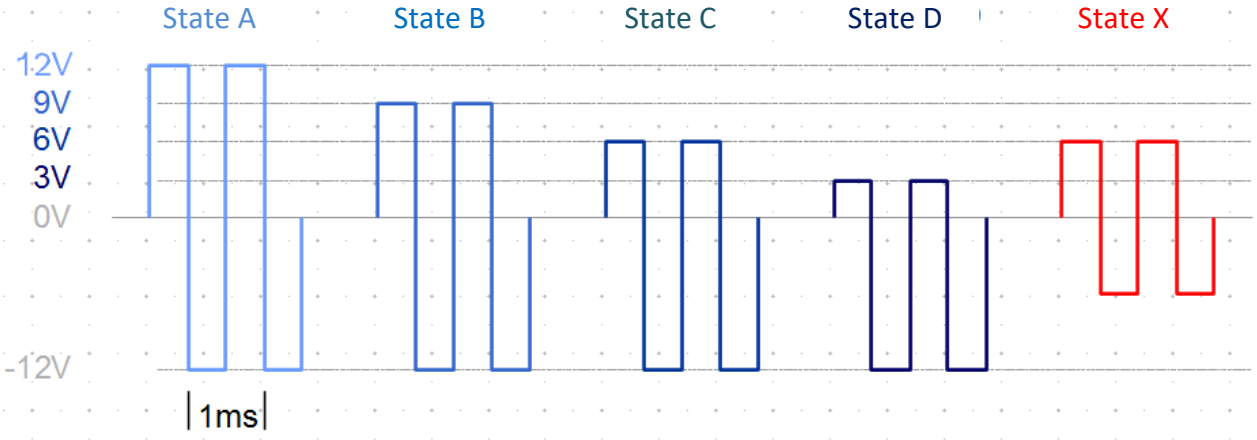
System States — PWM Voltage



State A: No vehicle connected
State B: Vehicle connected, but not ready for charging
State C: Vehicle connected and ready for charging without venting
State D: Vehicle connected and ready for charging with venting
State X: Error

System States — Duty Cycle

Table A.6 – Maximum current to be drawn by vehicle

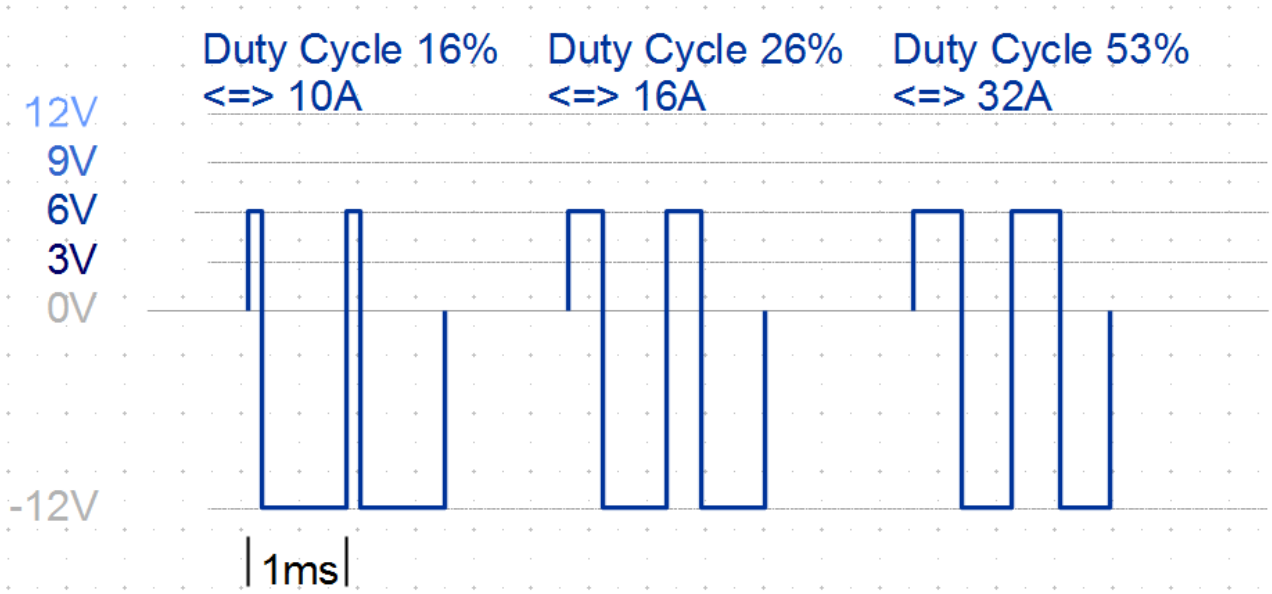
Nominal duty cycle interpretation by vehicle	Maximum current to be drawn by vehicle
Duty cycle < 3 %	Charging not allowed
3 % ≤ duty cycle ≤ 7 %	A duty cycle of 5% indicates that digital communication is required and must be established between the EVSE and EV before charging. Charging is not allowed without digital communication. Digital communication may also be used with other duty cycles.
7 % < duty cycle < 8 %	Charging not allowed
8 % ≤ duty cycle < 10 %	6 A
10 % ≤ duty cycle ≤ 85 %	Available current = (% duty cycle) × 0,6 A
85 % < duty cycle ≤ 96 %	Available current = (% duty cycle - 64) × 2,5 A
96 % < duty cycle ≤ 97 %	80 A
Duty cycle > 97 %	charging not allowed
If the PWM signal is between 8 % and 97 %, the maximum current may not exceed the values indicated by the PWM even if the digital signal indicates a higher current. In 3-phase systems, the duty cycle value indicates the current limit per each phase. The current indicated by the PWM signal shall not exceed the current cable capability and the EVSE capability, the lower between them apply.	

Note: the EV should respect 6A as lower value of the PWM

Note : the indication "no maximum implies that the delay time has no constraints and may depend on external influences and the conditions existing on the EVSE or the EV.

Source: DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

System States — Duty Cycle



Repair and Replacement Parts Service
Calibration Center * and Rental Instrument Service

When you need service, please contact:

GMC-I Service GmbH
Service Center
Beuthener Straße 41
90471 Nürnberg • Germany
Phone +49 911 817718-0
Fax +49 911 817718-253
E-Mail service@gossenmetrawatt.com
www.gmci-service.com

This address is only valid in Germany.
Please contact our representatives or subsidiaries for service in other countries.

*** DAkkS Calibration Laboratory for Electrical Quantities D-K-15080-01-01 accredited per DIN EN ISO/IEC 17025**

Accredited measured quantities: direct voltage, direct current values, DC resistance, alternating voltage, alternating current values, AC active power, AC apparent power, DC power, capacitance, frequency and temperature

Product Support

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