

KOSTAL

KOSTAL INDUSTRIE ELEKTRIK
GmbH & Co. KG
58099
HAGEN

Technical notice

Inverter compliance with article 12 of guide UTE 15-712-1

KOSTALINDUSTRIE ELEKTRIK
GmbH&Co.KG 58099 HAGEN

Mission completed on 24/05/2024
Avis Technique :
(Details of examinations are given in the report)

CASE NO.: 2403STC00000012
JOB NO.: 984Q0240500000000939
REPORT DATE: 22/08/2024

REPORT REFERENCE: 984Q0/24/8002

5 Place des Frères Montgolfier
78182 Saint-Quentin-En-Yvelines
Tel.: 01.55.47.27.10
Email : oswaldo.quiros@socotec.com

Auditor: QUIROS Oswaldo
Signature :
Number of pages : 11


SOCOTEC
5, place des Frères Montgolfier - CS 20732 - Guyancourt
CS 20732 - Guyancourt
78182 St-Quentin-en-Yvelines Cedex
Tél. : 01 30 12 80 00 - www.socotec.fr

TABLE OF CONTENTS

TABLE OF CONTENTS

PURPOSE OF THE SERVICE	3
NATURE OF THE ASSIGNMENT	3
BENEFIT LIMIT.....	3
REFERENCE STANDARDS	3
REFERENCE DOCUMENTS	4
ELEMENTS VERIFIED.....	4
TECHNICAL ADVICE	5
APPENDIX A: INVERTER CHARACTERISTICS	6
Appendix B: DC-side switch identification.....	7
Appendix C: CE marking identification.....	8
Appendix D: Details of Technical Specifications and Decoupling Protective Devices in accordance with DIN VDE 0126-1	9
Appendix E: Functional diagram.....	11

PURPOSE OF THE SERVICE

The purpose of this report is to document the results of our detailed technical assessment, with a view to issuing an opinion on the conformity of KOSTAL's PLENTICORE G3 inverter with the requirements specified in paragraph §12 of standard UTE C15-712-1. Furthermore, in the context of the installation of this inverter in France, our mission includes the validation of its system and DC operation, in accordance with the applicable standards.

NATURE OF THE ASSIGNMENT

The current mission aims to analyze the documents provided by the client, with the purpose of confirming the compatibility of the PLENTICORE G3 inverter with the specifications required for its deployment within an electrical installation in France. This analysis falls within the scope of intervention established by our contractual agreement, following the acceptance of our technical and financial proposal.

BENEFIT LIMIT

The scope of this report includes a thorough review of the documentation provided by the customer. It is important to note that this document does not represent a certificate of conformity for the equipment. Furthermore, our technical opinion is not intended to guide the design of the final installation where the inverter will be integrated. A verification in compliance with current standards, in particular with Consuel, must be carried out to ensure full compliance of the installation.

REFERENCE STANDARDS

- UTE C 15-712-1: "Photovoltaic installations connected to the public distribution network" July 2013.
- NF EN 62109-1: "Safety of power converters used in photovoltaic systems - Part 1: general requirements" July 2010
- NF EN 62109-2: "Safety of power converters used in photovoltaic systems - Part 2: Particular requirements for inverters" October 2011
- DIN VDE 0126-1-1 "Automatic disconnecting device between a generator and the public low-voltage network" August 2013
- NF C 15-100: "Low-voltage electrical installations" December 2002

REFERENCE DOCUMENTS

- Certificate of conformity IEC/EN 20109-1:2010 and IEC/EN 62109-2:2011 by KIWA .
Date of issue: 18.04.2024.
- EU Declaration of Conformity - PLENTICORE G3- Date : 22.03.2024
- Technical data : Solar Inverter PLENTICORE G3. - Ref: EN - DOC03090475 - Date: March 2024
- Product test report - IEC/EN 62103-1 :2010, IEC/EN 20109-2 :2011. KIWA . Date 05 march 2024
- Operating manual- PLENTICORE G3 Hybrid inverter

VERIFIED ELEMENTS

- **Document review:** In-depth analysis of user manuals, certificates, test reports and declarations of conformity.
- **DC switch inspection:** Rigorous inspection of the DC switch to ensure correct operation.
- **CE Marking check:** Verification of the presence and conformity of the CE marking, attesting to compliance with European standards.
- **Evaluation of decoupling protection devices:** Confirmation of the existence and effectiveness of decoupling protection mechanisms.

TECHNICAL ADVICE

After a thorough examination of the technical specifications of the PLENTICORE G3 inverter, both on the AC and DC sides, and taking into account the previously mentioned standards, the equipment meets the required conditions for use in France.

This validation is contingent upon the entire electrical installation's compliance with current standards. It is imperative that the suitability of the entire installation be subject to detailed studies to ensure proper implementation, in accordance with the manufacturer's recommendations and the requirements of the electrical network operator.

This specifically includes the verification of compatibility of voltages, currents, frequencies, and load capacities, to ensure the optimal and safe operation of the overall electrical system, in conformity with current European standards.

In accordance with Article 12 of the UTE C15-712-1 (2013) guide, it is required to provide a disconnection device and an emergency shutdown mechanism, on both the AC and DC sides. For high-power inverters, these devices can be integrated within the same enclosure. In the case of inverters with multiple DC inputs, it is acceptable to perform the emergency shutdown via separate direct control devices. These devices can be switches, circuit breakers, or contactors. To meet these requirements, the concerned inverters are equipped with disconnect switches compliant with the IEC 60947-3 standard. The inverters with multiple DC inputs also meet the criteria for high power, allowing these devices to be integrated within their enclosure. Moreover, the presence of integrated connectors, accessible without opening the inverter, facilitates the connection of DC cables without exposure to direct contact with internal components. Consequently, the integrated DC switches meet the requirements for disconnection and emergency shutdown on the DC side, as defined by Article 12 of the UTE C15-712-1 (2013) guide. Additional measures must be considered to comply with the AC disconnection needs near the inverter, and other provisions may be required to adhere to the directives of Article 12.4, concerning Public Access Buildings (ERP) or Classified Installations for Environmental Protection (ICPE).

APPENDIX

APPENDIX A: INVERTER CHARACTERISTICS

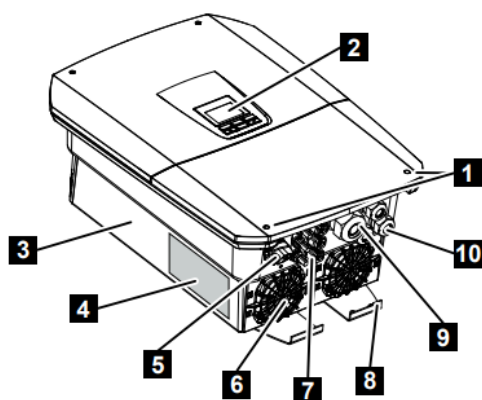
PLENTICORE

Hybrid inverter - G3 4.0-20 kW



PLENTICORE G3		S			M			L		
Input side (DC)	Basic power	kW	4.0			8.5		15		
	Optional power upgrade level 1 ¹⁾	kW		5.5		10		17.5		
	Optional power upgrade level 2 ¹⁾	kW			7.0		12.5		20	
	Max. PV power (cos φ = 1)	kWp	6	8.25	10.25	12.75	15	18.75	22.5	30
	Max. PV power per DC input	kW	8.25	8.25	8.25	10.5	10.5	10.5	18	18
	Nominal DC power	kW	4.08	5.61	7.14	8.67	10.2	12.75	15.3	17.85
	Rated input voltage (U _{DC,r})	V					680			
	Start-up input voltage (U _{DC,start})	V					95			
	Max. system voltage (U _{DC,max})	V					1000			
	MPP range at rated output (U _{MPP,min}) ³⁾	V	80	110	140	170	200	250	170	198
	MPP range at rated output (U _{MPP,max}) ³⁾	V	800	800	800	800	800	800	800	800
	Working voltage range (U _{DCwork,min} - U _{DCwork,max}) ⁴⁾	V					75...900			
	Max. input current (I _{DC,max}) DC1/DC2 input	A		17			17		30	
	Max. input current (I _{DC,max}) DC3 input	A		17			30		30	
	Max. PV short-circuit current (I _{SC,PV}) DC1/DC2 input	A		23.8			23.8		42.0	
	Max. PV short-circuit current (I _{SC,PV}) DC3 input	A		23.8			42.0		42.0	
	Number of DC inputs						3			
	Number of combined DC inputs (PV or battery)						1			
	Number of independent MPP trackers						3			
	DC 3 – battery input optional									
Output side (AC)	Min. working voltage for battery input (U _{DCwork,bat,min})	V					95			
	Max. working voltage for battery input (U _{DCwork,bat,max})	V					650			
	Max. charging/discharging current at battery input	A		17/17			30/30		30/30	
	Max. BAT power per DC input	kW	8.25	8.25	8.25	10.5	10.5	10.5	18	18
	Rated power, cos φ = 1 (P _{AC,r})	kW	4.0	5.5	7.0	8.5	10	12.5	15	17.5
	Apparent output power (S _{AC,Nom} , S _{AC,max})	kVA	4.0/4.0	5.5/5.5	7.0/7.0	8.5/8.5	10/10	12.5/12.5	15/15	17.5/17.5
	Min. output voltage (U _{AC,min})	V					320			
	Max. output voltage (U _{AC,max})	V					460			
	Rated AC current (I _{AC,r})	A	5.8	7.9	10.1	12.3	14.4	18	21.7	25.3
	Max. output current (I _{AC,max})	A		11.2			20.0		32.0	
	Short-circuit current (peak/RMS)	A	9.1/6.4	12.4/8.8	15.9/11.3	19.2/13.6	22.6/16.0	28.2/20.0	34.1/24.1	39.6/28.1
	Grid connection						3N-, 230/400 V, 50 Hz			
	Rated frequency (f _i)	Hz					50			
	Min/max grid frequency (f _{min} /f _{max})	Hz					47/52.5			
	Setting range of the power factor (cos φ _{AC,r})						0.8 ... 1 (ind./cap.)			
	Power factor for rated power (cos φ _{AC,r})						1			
	Max. THD	%					3			
	Standby	W					3.5			

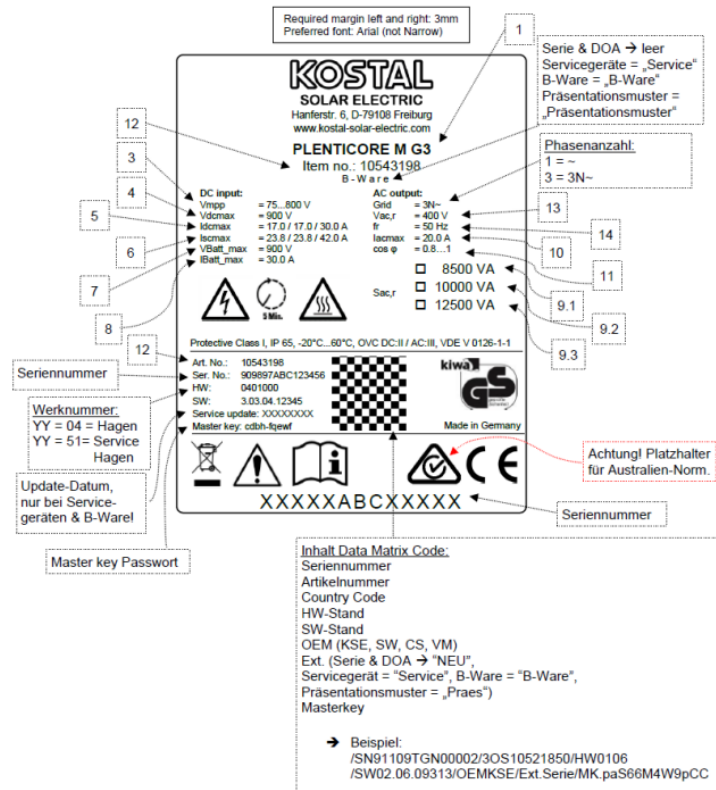
APPENDIX B: DC-SIDE SWITCH IDENTIFICATION



- 1 Cover screws
- 2 Display
- 3 Housing
- 4 Type plate
- 5 DC switch
- 6 Fan
- 7 Plug connector for connecting the PV generators and a battery system (battery connection optional)
- 8 Additional PE connection, outside
- 9 Cable opening for AC mains cable
- 10 Cable openings for communication

APPENDIX C: CE MARKING IDENTIFICATION

Copy of marking plate:



Appendix D: Details of Technical Specifications and Decoupling Protective Devices in accordance with DIN VDE 0126-1

Power class

PLENTICORE G3	Unit	S			M			L		
Basic power	kW	4.0	-	-	8.5	-	-	15	-	-
Optional power extension level 1	kW	-	5.5	-	-	10	-	-	17.5	-
Optional power extension level 2	kW	-	-	7.0	-	-	12.5	-	-	20

Input side (DC)

PLENTICORE G3	Unit	S				M			L			
Max. PV power (cos φ = 1)	kWp	6	8.25	10.25	12.75	15	18.75	22.5	26.5	30		
Max. PV power per DC input	kWp	8.25			10.5			18				
Nominal DC power	kW	4.08	5.61	7.14	8.67	10.2	12.75	15.3	17.85	20.4		
Rated input voltage (Udc,r)	V	680										
Start input voltage (Udc,start)	V	95										
Max. system voltage (Udc,max)	V	1000										
MPP range at rated output (Umpp,min)	V	80	110	140	170	200	250	170	198	227		
MPP range at rated output (Umpp,max)	V	800										
Operating voltage range (Udc,workmin)	V	75										
Operating voltage range (Udc,workmax)	V	900										
Max. input current (Idc,max) DC1/DC2 input	A	17						30				
Max. input current (Idc,max) DC3 input	A	17			30							
Max. PV short-circuit current (ISC_PV) DC1/DC2 input	A	23.8						42				
Max. PV short-circuit current (ISC_PV) DC3 input	A	23.8			42							
Number of DC inputs		3										
Number of combined DC inputs (PV or battery)		1										
Number of independent MPP trackers		3										

Input side (DC3 battery input)

PLENTICORE G3	Unit	S		M	L
Battery input min. working voltage range (Udc,workbatmin)	V			95	
Battery input max. working voltage range (Udc,workbatmax)	V			650	
Battery input max. charge/discharge current	A	17/17		30/30	

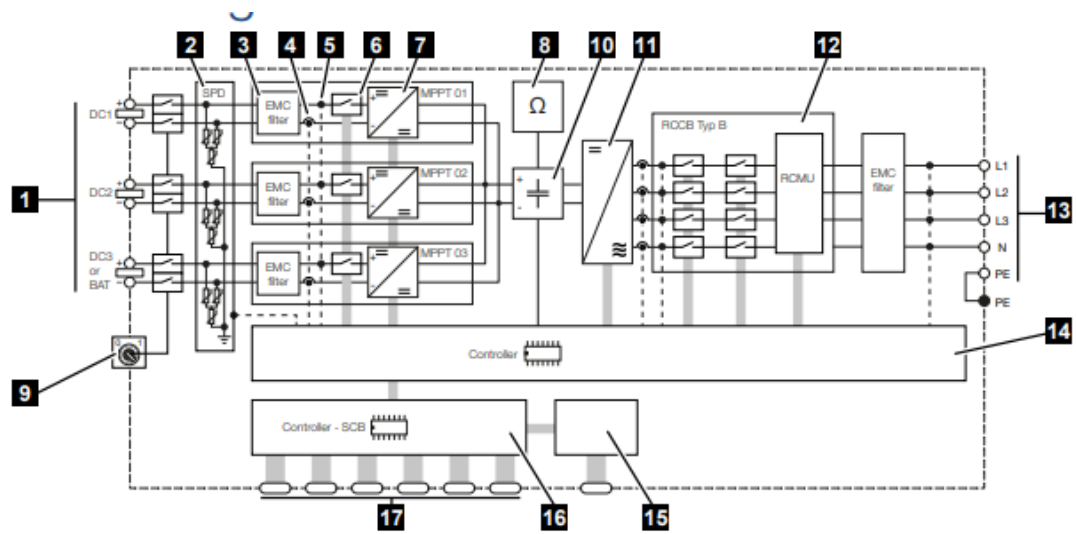
Output side (AC)

PLENTICORE G3	Unit	S				M				L	
Rated power, $\cos \phi = 1$ ($P_{ac,r}$)	kW	4.0	5.5	7.0	8.5	10	12.5	15	17.5	20	
Output apparent power ($S_{ac,nom}$, $S_{ac,max}$)	kVA	4.0/4.0	5.5/5.5	7.0/7.0	8.5/8.5	10/10	12.5/12.5	15/15	17.5/17.5	20/20	
Min. output voltage ($U_{ac,min}$)	V	320									
Max. output voltage ($U_{ac,max}$)	V	460									
Rated alternating current ($I_{ac,r}$)	A	5.8	7.9	10.1	12.3	14.4	18.0	21.7	25.3	28.9	
Max. output current ($I_{ac,max}$)	A	11.2				20		32			
Short-circuit current (peak/RMS)	A	9.1/6.4	12.4/8.8	15.9/11.3	19.2/13.6	22.6/16.0	28.2/20.0	34.1/24.1	39.6/28.1	45.4/32.1	
Grid connection		3N~, 230/400 V, 50 Hz									
Rated frequency (f_r)	Hz	50									
Grid frequency ($f_{min} - f_{max}$)	Hz	47/52.5									
Setting range for the power factor ($\cos \phi_{AC,r}$)		0.8...1 (ind./cap.)									
Power factor at rated power ($\cos \phi_{AC,r}$)		1									
THD	%	3									
Standby	W	3.5									

System data

PLENTICORE G3	Unit	S	M	L
Topology: Without galvanic isolation – transformerless			Yes	
Protection class in accordance with IEC 60529			IP65	
Protective class according to IEC 62103			I	
Overvoltage category according to IEC 60664-1 on input side (PV generator)			II	
Overvoltage category according to IEC 60664-1 on output side (grid connection)			III	
DC overvoltage protection module type 2 – can be retrofitted			Yes	
Pollution degree			4	
Environmental category (outdoor installation)			Yes	
Environmental category (indoor installation)			Yes	
UV resistance			Yes	
AC cable diameter (min-max)	mm		10...28	
AC cable cross-section (min-max)	mm ²	2.5...10	4...10	6...10
DC cable cross-section (PV/BAT) (min-max)	mm ²	2,5...6 / 4...6	2,5...6 / 6	4...6 / 6
Max. fuse protection on output side (AC) IEC 60898-1	A	B16/C16	B25/C25	B32/C32
Internal operator protection in accordance with EN 62109-2			Yes	
Independent disconnection device according to VDE V 0126-1-1			Yes	
Mechanical DC circuit switch as per IEC 60947-3			ja	
Height/width/depth	mm		561/409/237	
Weight	kg	21.8	22.3	24.3
Cooling principle – regulated fans			Yes	
Max. air throughput	m ³ /h		184	
Noise emission (typical)	dB(A)		39	
Ambient temperature	°C		-20...60	
Max. operating altitude above sea level	m		2000	
Relative humidity	%		4...100	
Connection technology, DC side			SUNCLIX plug	
Connection technology, AC side			Spring-type terminal strip	
Connection technology, COM			Push-in terminals	

APPENDIX E: FUNCTIONAL DIAGRAM



- 1 DC circuit switch
- 2 DC input
- 3 SPD module with monitoring (optional/changeable)
- 4 Electromagnetic compatibility (EMC) filter
- 5 Current measuring point
- 6 Voltage measuring point
- 7 Electronic DC disconnection device
- 8 DC regulator
- 9 Insulation monitoring
- 10 Intermediate circuit
- 11 Inverter bridge
- 12 Grid monitoring and shutdown
- 13 3-phase AC output
- 14 System control with MPP trackers
- 15 Display
- 16 Smart Communication Board (SCB)
- 17 Interfaces (e.g. Ethernet, USB, energy meter)