Guidelines on signal list

Technical regulation 3.2.2
for PV power plants with a power output above 11 kW

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Table of contents

Reading instructions

These guidelines have been prepared as an aid for understanding a few more details concerning the required signals for all *photovoltaic (PV) power plant categories* with which the *plants* must be able to exchange on the *PCOM* interface in order to be connected to the grid in Denmark.

In the document, references are made to the *plant* requirements and section 7 in TR 3.2.2.

These guidelines have been prepared by Energinet.dk and are available at www.energinet.dk.

1. Terminology and definitions

General terms and definitions which are referred to in TR 3.2.2, section 1, are used in this document.

2. Signal list

Information, metering signals and activation possibilities are specified in TR 3.2.2, section 7. In the chart below, a few more details and explanations regarding the individual signals have been described with respect to the use of the information. The information must be available at the *PCOM* interface for the *plant*.

Activation of the individual functions in the *plants* and the configuration of the specific parameters must comply with the requirements specified in TR 5.8.1.

The signal list has been prepared in Excel file format and is available at www.energinet.dk.

3. The signal names of SUNSPEC Alliance

In the chart below, the individual signals have been mentioned with reference to the signal names of SUNSPEC Alliance wherever it has been possible.

Signal list for PV Power Plants - TF 3.2.2																	
Revision: 11.0			date:	19.11.2014			Specifications for sunspec profiles are available for download at: www.sunspec.org/download. The specifications can be downloaded free of charge by entering name and affiliation. Subsequently, the documentation can seen in the zip file at the following website address: \Protocol-Information-Conformance-Statements.zip\Protocol Information Conformance Statements\									
Category															Sunspec ID		
A	B	C	D	Signal description	Comments	Possible interval	Typical value	Unit	Data types	Purpose of the signal	Responsible for signal availability in PCOM	Ancillary services	Energinet.dk reference	Model Prefix Abbrevations	Start Offset	Label	
	X	X	X	Swich gear status in POC		Open/closed	-	-	Status	Monitor coupling state network for netPOC	Network owner		TR 5.8.1	IC123	5	Conn	
	X	X	X	Active power kW - metered in POC	Active power metering	0 - P_{max}	-	kW	Metering	Input for settlement	Meter operator		TR 5.8.1	M203	19	Watts	
		X	X	Active power control - ramp rate constraint	Active power control	Active/Inactive	-	-	Control	Activation/deactivation function	Plant owner	Mandatory ancillary services	TR 5.9.1	Always active			
		X	X	Active power control - gradient for upward active power control	Active power control	10 - 300 kW/WTGS/s	50 kW/WTGS/s	kW/second	Set point	Speed control for upward regulation of active power	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	9	WMaxLimPct_RmpTms	
		X	X	Active power control - ramp rate for downward active power control	Active power control	10 - 300 kW/WTGS/s	50 kW/WTGS/s	kW/second	Set point	Control the speed for downward regulation of active power	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	9	WMaxLimPct_RmpTms	
		X	X	Active power control - absolut power constraint	Active power control	Active/Inactive	-	-	Control	Activation/deactivation function	Plant owner	Mandatory ancillary services	TR 5.9.1	Always active			
		X	X	Active power control - desired maximum active power	Active power regulation	0 - P_{max}	-	kW	Set point	Input for controlling active power supplied from a PV power plant	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	6	WMaxLimPct	
		X	X	Active power control - delta power constraint	Active power regulation	Active/Inactive	-		Control	Activation/deactivation function	Plant owner	Mandatory ancillary services	TR 5.8.1 + tender documents	N.A.			
		X	X	Active power control - desired regulating reserve - Pdelta	Frequency control	0 - P_{max}	-	kW	Set point	Input for creating reserves of active power in a PV power plant	Plant owner	Mandatory ancillary services	TR 5.8.1 + tender documents	N.A.			
	X	X	X	Reactiv power Mvar - metered in POC	Reactive power control	Q_{min} til Q_{max}	-	kvar	Metering	Input for active power controlling	Meter operator		TR 5.8.1	M203	29	VAR	
		X	X	Power factor - metered in POC	Reactive power control	0 - 1	-	-	Metering	Input for reactive power controlling	Plant owner	Mandatory ancillary services	TR 5.9.1	M203	34	PF	
		X	X	Power factor - desired PF in POC	Reactive power control	0 - 1	1	-	Set point	Set points for desired power factor	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	11	OutPFSet	
		X	X	Reactive power control - active/not active	Reactive power control	Active/Inactive	-	-	Control	Activation/deactivation function	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	23	VArPct_Ena	
		X	X	Reactive power control - desired reactive power in POC	Reactive power control	Q_{min} to Q_{max}	0	kvar	Set point	Set point for desired Mvar	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	17	VArMaxPct	
		X	X	Voltage - voltage metered in the voltage reference point	Voltage control	V_{refmin} - V_{refmax}	-	V	Metering	Input for voltage control in POC	Meter operator	Optional ancillary services	TR 5.8.1 + tender documents	M203	12	Voltage LL	
		X	X	Voltage control - activated/not activated	Voltage control	Active/Inactive	-	-	Control	Activation/deactivation function	Plant owner	Optional ancillary services	TR 3.2.2 + tender documents	IC126	4	ModEna	
		X	X	Voltage control - voltage metered in POC	Voltage control	U_{min} to U_{max}	-	V	Metering	Monitor voltage condition in a PV power plant	Plant owner	Optional ancillary services	TR 3.2.2 + tender documents	M203	12	Voltage LL	
		X	X	Voltage control - droop for voltage control	Voltage control	2 - 6%	4%	% of Un	Set point	Droops for voltage stabilisation in POC	Plant owner	Optional ancillary services	TR 3.2.2 + tender documents	N.A.			
		X	X	Voltage control - desired voltage in voltage reference point	Voltage control	U_{ref} ± 10%	-	V	Set point	Input for voltage stabilisation in POC	Plant owner	Optional ancillary services	TR 3.2.2 + tender documents	N.A.			
		X	X	Frequency response - activated/not activated	Frequency response	Active/Inactive	-	Hz	Set point	Activation/deactivation function	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	IC134	4	ModEna	
		X	X	Frequency response - start frequency for frequency response - fR	Frequency response	50.00 - 50.50	50.2	Hz	Set point	Input for frequency stabilisation	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	IC134	14-53	Hz, W	
		X	X	Frequency control - frequency metered in POC	Frequency control	47.00 - 52.00	-	-	Status	Input for frequency stabilisation in POC	Meter operator		TR 5.8.1	M203	17	Hz, W	
		X	X	Frequency control - activated/not activated	Frequency control	Active/Inactive	-	-	Status	Activation/deactivation function	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	Reference frequency - desired frequency in POC - f_{ref}	Frequency control	50.00	50.00	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - control limit - low - fmin	Frequency control	46.50 - 47.50	47.00	Hz	Set point	Lower control limit value for frequency control	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - control limit - high - fmax	Frequency control	51.00 - 52.50	52.00	Hz	Set point	Upper control limit value for frequency control	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - start frequency for regulation band and frequency respons- f1	Frequency control	49.50 - 50.00	49.80 or 50.20	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	N.A.			
		X	X	Frequency control - start frequency for dead band - f2	Frequency control	49.80 - 50.00	49.88	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	N.A.			
		X	X	Frequency control - end frequency for dead band - f3	Frequency control	50.00 - 50.20	50.02	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	N.A.			
		X	X	Frequency control - end frequency for regulation band - f4	Frequency control	50.00 - 50.50	50.2	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	N.A.			
		X	X	Frequency control - end frequency for regulation up to f5	Frequency control	51.00 - 52.00	51.25	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - end frequency for regulation up to f6	Frequency control	51.00 - 52.00	51.75	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - droop 1 for regulation from f1 to f2	Frequency control	2 -8%	4%	% of Pn	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR5 .8.1 + tender documents	N.A.			
		X	X	Frequency control - droop 2 for regulation from f3 to f4	Frequency control	2 - 8%	6%	% of Pn	Set point	Input for frequency stabilisation in POC	Plant owner	Optional ancillary services	TR 5.8.1 + tender documents	N.A.			
		X	X	Frequency control - droop 3 for regulation from f4 to f5	Frequency control	2 - 10%	8%	% af Pn	Set point	Input for frequency stabilisation in POC	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - droop 4 for downward regulation from f5 to f6	Frequency control	5 - 20%	10%	% of Pn	Set point	Input for frequency stabilisation in POC	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	Frequency control - frequency limit for reclosure, if active power has been reduced to below Pmin - f7	Frequency control	50.00 - 50.10	50.05	Hz	Set point	Input for frequency stabilisation in POC	Plant owner	Mandatory ancillary services	TR 5.9.1	N.A.			
		X	X	System protection	System protection	Active/Inactive	-	-	Control	Activation/deactivation function	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	6	WMaxLimPct	
X	X	X	X	Stop signal	System protection	Active/Inactive	-	-	Control	Activation/deactivation of plant	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	5	Conn = 0	
X	X	X	X	On-hold signal - "Released for start"	System protection	Active/Inactive	-	-	Control	Activation/deactivation of start of plant	Plant owner	Mandatory ancillary services	TR 5.9.1	IC123	5	Conn = 1	