Power One Aurora String Inverter:
energy absorption

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PURPOSE:

This document specifies the energy absorption of the inverter when it is not outputting energy to the grid, in various operating conditions.

APPLICATION AREA:

The following table lists the inverters to which this document refers:

Single-phase transformerless inverters	Three-phase transformerless inverters
PVI-2000	PVI-10.0-OUTD-400(-S)
PVI-3600	PVI-12.5-OUTD-400(-S)
PVI-3.0-OUTD(-S)	TRIO-20.0-TL-OUTD-S2X
PVI-3.6-OUTD(-S)	TRIO-27.6-TL-OUTD-S2X
PVI-4.2-OUTD(-S)	
PVI-5000-OUTD(-S)	
PVI-6000-OUTD(-S)	
Single-phase inverters with high-frequency isolating transformer	**Three-phase inverters with high-frequency isolating transformer**
UNO-2.0-I-OUTD(-S)	PVI-10.0-I-OUTD-400(-S)
UNO-2.5-I-OUTD(-S)	PVI-12.0-I-OUTD-400(-S)
PVI-3.8-I-OUTD(-S)	
PVI-4.6-I-OUTD(-S)	

Table 1: List of inverters to which this document refers.

INVERTER ENERGY ABSORPTION

The main energy source for Power-One string inverters is the solar array: this means that when functioning normally the inverters power-up and are capable of converting energy only when there is sufficient voltage/power from the solar array. Part of the energy generated by the solar array is used by the inverter to power the auxiliary and logic circuits which enable it to function.

When the inverters are not outputting energy to the grid, but are powered up and connected to it (typically in the powering-down phase, when an inverter has detected an undervoltage condition because of which the inverter can no longer convert energy), the inverter absorbs energy from the grid. The period during which the inverter takes power from the grid can be set using the display (*TprotUV* parameter, which has a default value of 60 sec).

The following tables indicate the energy absorption of the different inverter models, in several typical operating conditions and taking into account the nominal voltage of the grid. The values have a tolerance of +/- 15%.

Energy is absorbed from the solar array if it exceeds the input threshold required to power-up the logic circuits.

From the AC grid the inverter can absorb active power (P) and reactive (capacitive) power (Q). The following tables indicate these two values separately, together with the apparent power value (S) and the cosφ value.

The following graph indicates, in the interests of clarity, the phasorial representation of the values in the tables:

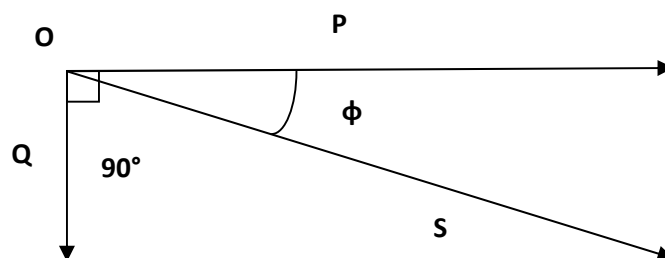P = active power

Q = reactive (capacitive) power (produced by the current with a lead of 90° with respect to the voltage)

S = apparent power (vectorial sum of P and Q)

φ = phase difference angle between the Active power and the Apparent power (P and S), equal to the phase difference between the phase voltage and the absorbed phase current

cos φ = power factor

Fig. 1: Phasorial power diagram

Model	SINGLE-PHASE TRANSFORMERLESS INVERTER		
	DC side absorption before connecting to the grid Conditions: Vin present; Vgrid absent Inverter status: "Waiting sun"; "Vac absent"	**AC side "nighttime" absorption after disconnection from the grid** Conditions: Vin absent; Vgrid present Inverter status: Inverter off	**Average AC absorption with no DC input after connection, for a time period which can be set between 1 and 3600 seconds (default 60 sec) without disconnection from the grid** Conditions: Vin absent; Vgrid present Inverter status: Inverter connected to the grid without outputting power
PVI-2000-OUTD	Vin=340Vdc ; P=8.1 W Vin=180Vdc ; P=8.9 W	P=0.3 W Q=5.6 VAR S=5.7 VA cosϕ= - 0.05	P=19 W Q=46 VAR S=50 VA cosϕ= - 0.38
PVI-3600 (indoor)	Vin=340Vdc ; P=8 W Vin=180Vdc ; P=6.6 W	P=0.3 W Q=5.7 VAR S=5.8 VA cosϕ= - 0.05	Functionality not available
PVI-3.0-TL-OUTD(-S)	Vin=340Vdc ; P=7.1 W Vin=180Vdc ; P=5.8 W	P=0.9 W Q=8.8 VAR S=8.9 V cosϕ= - 0.1	P=15 W Q=83 VAR S=84 VA cosϕ= - 0.15
PVI-3.6-TL-OUTD(-S)	Vin=340Vdc ; P=7.2 W Vin=180Vdc ; P=5.5 W	P=0.8 W Q=51.8 VAR S=52 VA cosϕ= - 0.015	P=22 W Q=91 VAR S=93 VA cosϕ= - 0.23
PVI-4.2-TL-OUTD(-S)	Vin=340Vdc ; P=7.2 W Vin=180Vdc ; P=5.5 W	P=0.8 W Q=51.8 VAR S=52 V cosϕ= - 0.015	P=22 W Q=91 VAR S=93 VA cosϕ= - 0.23
PVI-5000-TL-OUTD(-S) PVI-6000-TL-OUTD(-S)	Vin=340Vdc ; P=8.1 W Vin=180Vdc ; P=6.38 W	P=1.1 W Q=16.3 VAR S=16.4 V cosϕ= - 0.07	P=28 W Q=99 VAR S=102 VA cosϕ= - 0.28

THREE-PHASE TRANSFORMERLESS INVERTER			
Model	DC side absorption before connecting to the grid Conditions: Vin present; Vgrid absent Inverter status: "Waiting sun"; "Vac absent"	AC side "nighttime" absorption after disconnection from the grid Conditions: Vin absent; Vgrid present Inverter status: Inverter off	Average AC absorption with no DC input after connection, for a time period which can be set between 1 and 3600 seconds (default 60 sec) without disconnection from the grid Conditions: Vin absent; Vgrid present Inverter status: Inverter connected to the grid without outputting power
PVI-10.0-TL-OUTD-400(-S)(-FS)	Vin=340Vdc ; P=9 W Vin=700Vdc ; P=12 W	P=1 W Q=109 VAR S=109 VA cosφ= - 0.002	P=48 W Q=20 VAR S=56 VA cosφ= - 0.85
PVI-12.5-TL-OUTD-400(-S)(-FS)	Vin=340Vdc ; P=9 W Vin=700Vdc ; P=12 W	P=1W Q=109 VAR S=109 VA cosφ= - 0.002	P=48 W Q=20 VAR S=56 VA cosφ= - 0.85
TRIO-20.0-OUTD-S2X (*)	Vin=340Vdc ; P=9 W Vin=700Vdc ; P=17 W	P=0.4 W Q=96 VAR S=96 VA cosφ= - 0.003	P=55 W Q=50 VAR S=70 VA cosφ= - 0.78
TRIO-27.6-OUTD-S2X (*)	Vin=340Vdc ; P=10 W Vin=700Vdc ; P=18 W	P=0.4 W Q=96 VAR S=96 VA cosφ= - 0.003	P=57 W Q=50 VAR S=70 VA cosφ= - 0.75

(*) The basic, -S2 and -S2F versions of the TRIO-20.0/27.6-TL-OUTD inverter have a slightly lower absorption than the –S2X version.

	SINGLE-PHASE AND THREE-PHASE INVERTERS WITH HIGH-FREQUENCY ISOLATING TRANSFORMER			
Model	**DC side absorption before connecting to the grid** Conditions: Vin present; Vgrid absent Inverter status: "Waiting sun"; "Vac absent"	**AC side "nighttime" absorption after disconnection from the grid** Conditions: Vin absent; Vgrid present Inverter status: Inverter off	**Average AC absorption with no DC input after connection, for a time period which can be set between 1 and 3600 seconds (default 60 sec) without disconnection from the grid** Conditions: Vin absent; Vgrid present Inverter status: Inverter connected to the grid without outputting power	**DC side temporary absorption (duration 10 min) following use of the "Power-up from grid" button** Conditions: Vin absent; Vgrid present Inverter status: Inverter connected to the grid without outputting power
PVI-3.8-I-OUTD(-S)	Vin=340Vdc ; P=8.2 W Vin=180Vdc ; P=7.4 W	P=0.9 W Q=35 VAR S=35.1 VA cosφ= - 0.03	P=30 W Q=105 VAR S=110 VA cosφ= - 0.25	P=10.4 W Q=43.5 VAR S=44.8 VA cosφ= - 0.23
PVI-4.6-I-OUTD(-S)	Vin=340Vdc ; P=8.2 W Vin=180Vdc ; P=7.4 W	P=0.9 W Q=35 VAR S=35.1 VA cosφ= - 0.03	P=30 W Q=105 VAR S=110 VA cosφ= - 0.25	P=10.4 W Q=43.5 VAR S=44.8 VA cosφ= - 0.23
PVI-10.0-I-OUTD-400(-S)	Vin=340Vdc ; P=10.5 W Vin=180Vdc ; P=9 W	P=0 W Q=110 VAR S=110 VA cosφ= - 0.02	P=38 W Q= n/a S=40 W	P=10 W Q=105 VAR S=106 VA cosφ= - 0.26
PVI-12.0-I-OUTD-400(-S)	Vin=340Vdc ; P=10.5 W Vin=180Vdc ; P=9 W	P=0 W Q=110 VAR S=110 VA cosφ= - 0.02	P=38 W Q= n/a S=40 W	P=10 W Q=105 VAR S=106 VA cosφ= - 0.26

SINGLE-PHASE INVERTER WITH HIGH-FREQUENCY ISOLATING TRANSFORMER: "UNO" series			
Model	**DC side absorption before connecting to the grid** Conditions: Vin present; Vgrid absent Inverter status: "Waiting sun"; "Vac absent"	**AC side "nighttime" absorption after disconnection from the grid** Conditions: Vin absent; Vgrid present; display on; RS485 ON Inverter status: Display and communication line can be used	**AC side "nighttime" absorption after disconnection from the grid** Conditions: Vin absent; Vgrid present; display off; RS485 OFF Inverter status: Inverter off
UNO-2.0-I-OUTD(-S)	Vin=340Vdc ; P=8 W	P=6.8 W Q=18.7 VAR S=20.1 VA $\cos\phi$= - 0.341	P=0.5 W Q=15.2 VAR S=15.3 VA $\cos\phi$= - 0.03
UNO-2.5-I-OUTD(-S)	Vin=340Vdc ; P=8 W	P=6.8 W Q=18.7 VAR S=20.1 VA $\cos\phi$= - 0.341	P=0.5 W Q=15.2 VAR S=15.3 VA $\cos\phi$= - 0.03