ČEZ DISTRIBUCE

Specific country setup requirements
for non-synchronous power-generating
modules in the Czech Republic:

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Obsah

This document is published as a guideline for manufactures and suppliers of non-synchronous power-generating modules and is issued by CEZ Distribuce, a.s. as a Distribution system operator (DSO) with the coordination of other DSOs in the Czech Republic (EG.D,a.s. and PREdistribuce, a.s.). The purpose of the document is to provide information needed for specific Czech country setup which must be implemented in non-synchronous power-generating modules (= power park modules according to EU 2016/631 definition – especially but not only PV inverters, power converters of wind parks etc.) which are connected to the distribution system in the Czech Republic.

1. Protection settings

Protection function		Settings	Tripping time [s]
overvoltage 3rd threshold	U >>>	1,2 Un	0,1
overvoltage 2nd threshold	U >>	1,15 Un	5
overvoltage 10-minute mean protection*	U >	1,11 Un	0
undervoltage 1st threshold	U <	0,7 Un	2,7
undervoltage 2nd threshold	U <<	0,45 Un	0,2
overfrequency	f >	51,5 Hz	0,1
underfrequency	f <	47,5 Hz	0,1

*When PV inverters doesn't support 10-minute mean protection, then the overvoltage 2nd threshold will be set to 1,11 Un with 60 s as a tripping time.

Nominal low voltage level in the Czech Republic = 230 V (phase to neutral = L–N).

2. Automatic reconnection after tripping

Automatic reconnection of non-synchronous power-generating modules after tripping is possible when following frequency range and voltage range are both fulfilled during the whole period of observation time:

Voltage range:	85 – 110% of nominal voltage
Frequency range:	47,5 - 50,05 Hz
Observation time (grid monitoring time):	300 s (5 minutes)

After reconnection, the active power generated by the non-synchronous power-generating modules shall not exceed a specific gradient 10% $P_{nominal}$/minute = 600 seconds from the reconnection (when actual P = 0%) to achieve 100% of P_{max} expressed as a percentage of the active nominal power of the module per minute. Non-synchronous power-generating modules for which it is not technically feasible to increase the power respecting the specified gradient over the full power range may connect after 20 minutes.

Nominal low voltage level in the Czech Republic = 230 V (phase to neutral = L–N).

3. Reactive power mode

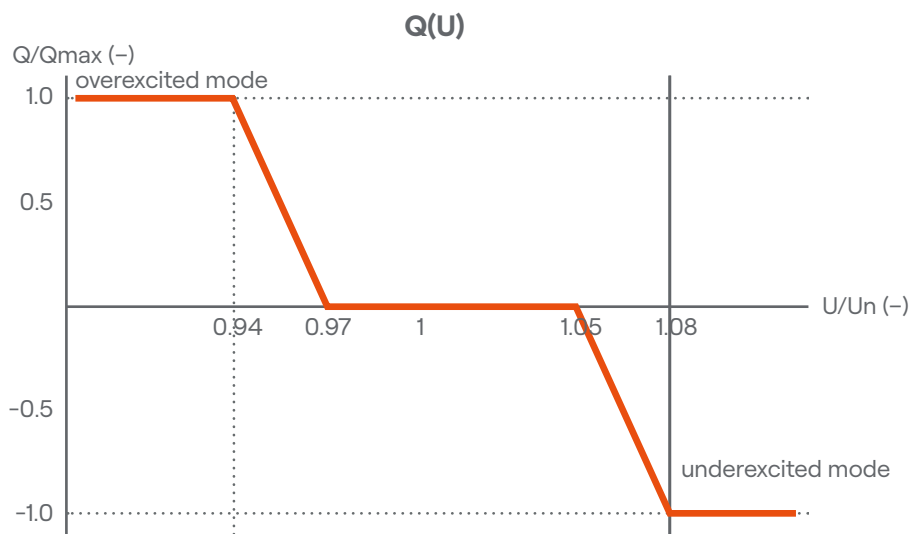**Voltage related control mode Q(U) must be active with the following settings:**

Figure 1: Voltage related control mode Q(U)

Voltage related control mode Q(U) set points:

$X_1 = 0,94 = 216,2$ V

$X_2 = 0,97 = 223,1$ V

$X_3 = 1,05 = 241,5$ V

$X_4 = 1,08 = 248,4$ V

Required time constant for voltage related control mode Q(U) = 20 s

Nominal low voltage level in the Czech Republic = 230 V (phase to neutral = L–N).

Non–synchronous power–generating modules must be capable to operate in voltage related control mode Q(U) with reactive power provision from active power factor = 0,90 underexcited to active power factor = 0,90 overexcited. As a value of Q_{max}, the amount of $Q = \pm43,6\%$ of P_{max} is considered, which corresponds to required range defined in Czech grid code (PPDS).

4. Voltage related active power reduction

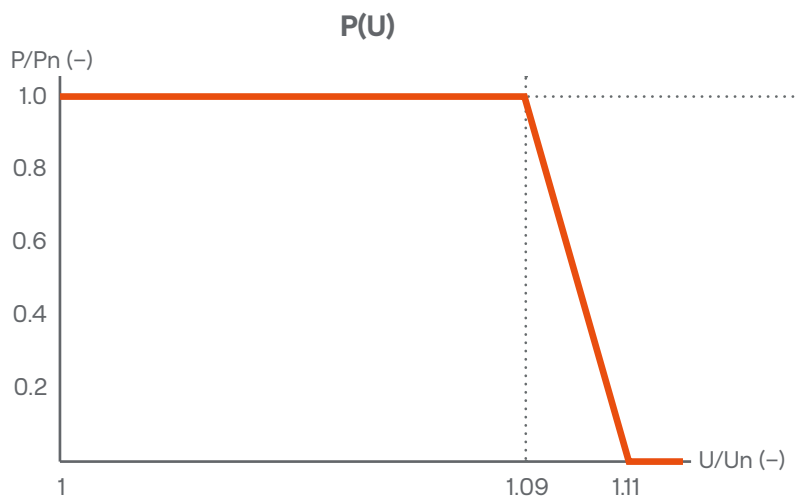**Autonomous P(U) characteristic must be active with the following settings:**

Figure 2: Autonomous P(U) characteristics

P(U) characteristic set points:

$U_1/Un = 1,09 = 250,7$ V

$U_2/Un = 1,11 = 255,3$ V

Recommended time constant for P(U) characteristics = 5 s.

Nominal low voltage level in the Czech Republic = 230 V (phase to neutral = L–N).

5. Active power response to overfrequency

Autonomous P(f) characteristic must be active with the following settings (according to requirements described in EN 50549-1 and EN 50549-2 – please see figure 3):

Rate limited power increase after deactivation of response

Active Power (% P_ref = % P_M)

100 % P_M

60 % P_M

$P_{ref} = P_M$
$f_1 = 50,2$ Hz
$s = 5$ %
f_{stop} = deactivated

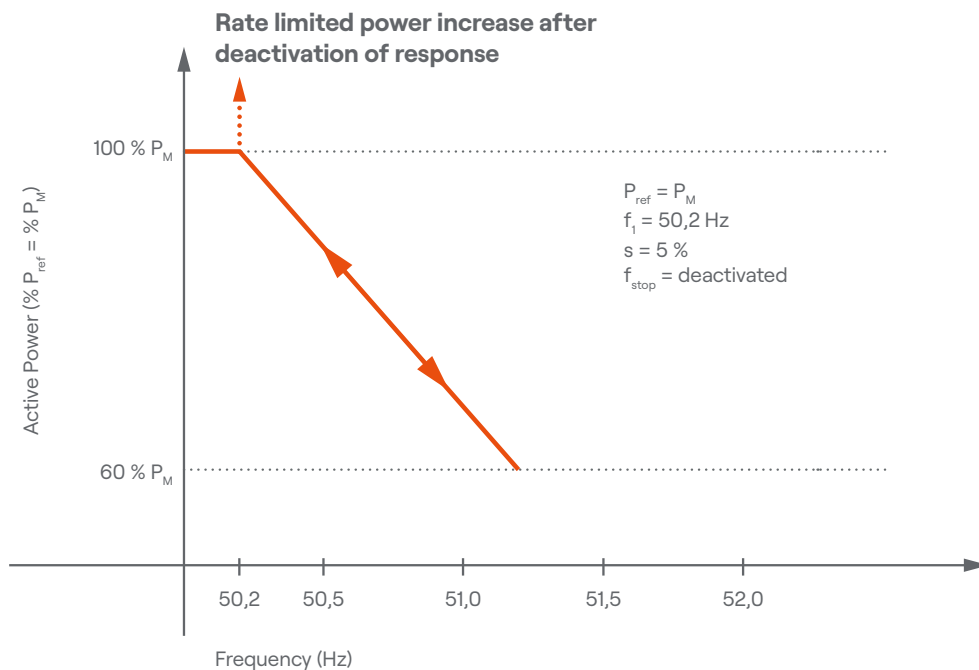50,2   50,5   51,0   51,5   52,0

Frequency (Hz)

Figure 3: Autonomous P(f) characteristics – example

The active power frequency response threshold for activation: 50,2 Hz

Rate limited power increase after deactivation of response: max. 10% $P_{nominal}$/minute

f_{stop}:   deactivated

The active power frequency derating gradient (or drop):   40% Pref/Hz (= statics of the function is set to 5%)

P_{ref} = the actual AC output power at the instant when the frequency reaches the threshold for activation of active power frequency response

P_M = actual AC active power output at a certain instant

6.   UVRT (under voltage ride through)

Non-synchronous power-generating modules must comply with fault-ride-through requirements as it is defined in COMMISSION REGULATION (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators.

U/Un

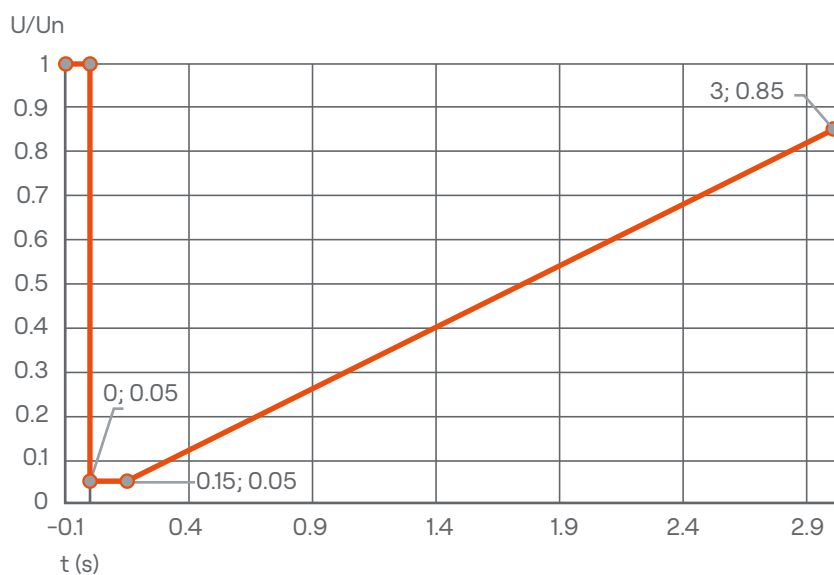3; 0.85

0; 0.05

0.15; 0.05

t (s)

Figure 4: under voltage ride through

The requirement for UVRT must be met not only by non-synchronous power-generating modules, but by the power-generating facility as a whole.

7. OVRT (over voltage ride through)

Non-synchronous power-generating modules must have a capability to withstand OVRT as it is defined in EN 50549-1 and 50549-2 with the following settings defined in Czech grid code (PPDS):
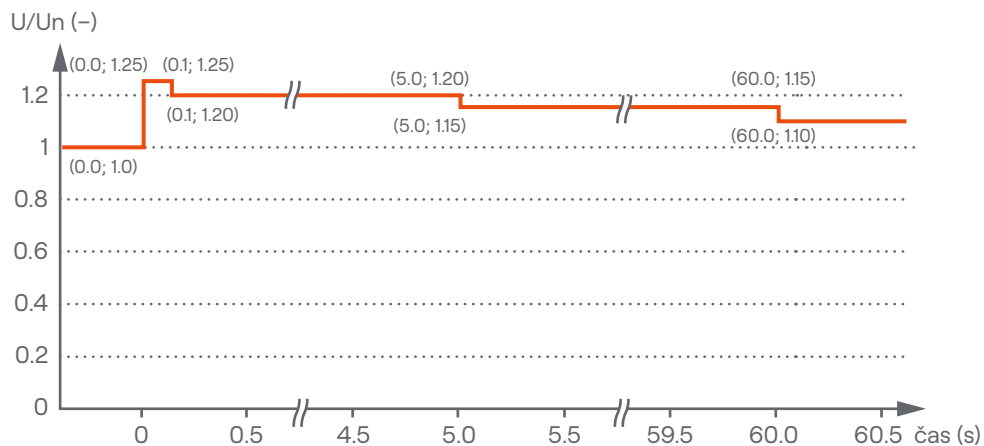
Nominal low voltage level in the Czech Republic = 230 V (phase to neutral = L-N).

The requirement for OVRT must be met not only by non-synchronous power-generating modules, but by the power-generating facility as a whole.

8. Voltage support during faults and voltage steps

Non-synchronous power-generating modules with nominal power 100 kW or higher must provide voltage support during faults and voltage steps with short circuit current with injection of reactive current according to requirements described in EN 50549-2 under 4.7.4.2.1.1 with gradient k = 3.

9. Rate of Change of Frequency immunity (ROCOF)

ROCOF immunity of a power generation plant means that the generating modules in this plant stay connected with the distribution network and are able to operate when the frequency on the distribution network changes with a specified ROCOF. The generating units and all elements in the generating plant that might cause their disconnection or impact their behaviour shall have this same level of immunity.

Non-synchronous power-generating modules must have ROCOF immunity at least +/- 2 Hz/s.

The ROCOF immunity is defined with a sliding measurement window of 500 ms.

10. Other requirements

Non-synchronous power-generating modules must also comply with other requirements specified under COMMISSION REGULATION (EU) 2016/631, Czech grid code and CEZ Distribuce's requirements for connection. These additional requirements are usually a feature or physical capability of non-synchronous power-generating modules which is not a subject of specific country setup that could be changed (for example operating frequency range, minimal requirement for active power delivery at underfrequency, continuous operating voltage, logic interface, reduction of active power on set point, remote information exchange, active power restoration after fault...) and all requirements of CEZ Distribuce are within the settings range defined by COMMISSION REGULATION (EU) 2016/631. For more information, please refer to Relevant documents section listed below.

Relevant documents:

COMMISSION REGULATION (EU) 2016/631 of 14 April 2016:

RfG

Czech grid code for distribution system:

Pravidla provozování distribuční soustavy 2023

Requirements for connection to CEZ Distribuce's distribution system:

Připojovací podmínky

EN standards:

Standard EN 50549-1

Standard EN 50549-2