

Application Note

Setting Grid Parameters for coolcept fleX and coolcept³ fleX Inverters

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1. Introduction

During the initial commissioning of inverters of the Brand Steca coolcept flex and coolcept³ flex the inverter and the interface protection and automatic disconnection device are being configured with the default settings requested by relevant standards based on the Country code chosen.

Due to local grid conditions at the point of connection the grid operator may demand changing those parameters.

Parameters can be changed

- after the initial commissioning and before the DC disconnecter is switched into the ON position: under "Settings"->"Service"->"All Parameters" (protected by password)

by a qualified specialist.

This document provides a list of changeable settings and their corresponding parameter for each country code.

Please be aware:

The installation and commissioning instructions in the manual of Steca inverters are not being replaced by the information in this document.

Changing settings without explicit specification by the grid operator may affect conformity with relevant standards and regulations.

For changes in the password protected settings menu the qualified specialist is asked to contact the technical support of Steca/KATEK (customerservice@katek-group.com) or one of the local service partners.



Legally required parameters can be changed in the service menus. Any change may have a negative effect on the performance of the inverter and possibly even break a law.

- Only specialists that can ensure that changes do not violate any applicable regulations and standards are allowed to perform any changes on the parameters of the service menus.

2. Germany – Country Code 4901 – D AR4105:2019

2.1 Configuration of the automatic disconnection device

Tripping thresholds of the automatic disconnection device can be configured with the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|------------------------------|---------------|------|
| 7 | U UpAve | Voltage rise protection U> | 110 | % |

2.2 Response to a change in frequency/ P(f) characteristics

The response to a change in frequency (P(f)) can be adjusted with the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|------------------------------|---------------|------|
| 20 | F Derate | P(f) overfrequency threshold | 50,2 | Hz |
| 26 | F GradReduc | Gradient of P(f) | 40 | %/Hz |

2.3 Response to a change in voltage/ P(U) characteristics

Overvoltage based reduction in active power production can be activated with the following parameter.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|---|---------------|------|
| 65 | P(U) type | P(U) Enabling: 0 = disabled 1 = enabled | 0 | |

2.4 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power".

2.5 Additional settings

The maximum power produced by the inverter – e.g. for the 70% limitation – can be limited by the following parameter.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|------------------------------|---------------|------|
| 39 | P UserLimit | Power Limit of the inverter | Nominal Power | W |

3. Austria – Country Code 4302 – TOR ERZEUGER

3.1 Configuration of the automatic disconnection device

Voltage and frequency tripping thresholds of the automatic disconnection device can be configured with the following parameters. Ueff> is implemented as a 10 minute average, therefor the tripping delay is not applicable

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|------------|------------------------------------|---------------|------|
| 3 | U 1UpLimit | Overvoltage Ueff>> | 115 | % |
| 4 | U 1UpTime | Overvoltage Ueff>> tripping delay | 0,1 | s |
| 7 | U UpAve | Overvoltage Ueff> | 111 | % |
| | n/a | Overvoltage Ueff> tripping delay | | s |
| 88 | U UpperRR | Overvoltage relapse ratio | 95 | % |
| 51 | U 2LoLimit | Undervoltage Ueff<< | 25 | % |
| 52 | U 2LoTime | Undervoltage Ueff<< tripping delay | 0,5 | s |
| 1 | U 1LoLimit | Undervoltage Ueff< | 80 | % |
| 2 | U 1LoTime | Undervoltage Ueff< tripping delay | 1,5 | s |
| 89 | U LowerRR | Undervoltage relapse ratio | 105 | % |
| 12 | F 1LoLimit | Underfrequency | 47,5 | Hz |
| 13 | F 1LoTime | Underfrequency tripping delay | 0,1 | s |
| 14 | F 1UpLimit | Overfrequency | 51,5 | Hz |
| 15 | F 1UpTime | Overfrequency tripping delay | 0,1 | s |

3.2 Response to a change in frequency/ P(f) characteristics / LFSM-O

The droop of the LFSM-O mode is adjusted as a gradient. The gradient can be calculated with the following formula. Percentages have to be converted, e.g. a droop of 5 % has to be written as 0,05. The gradient has to be converted as well, e.g. 0,4 1/Hz is equivalent to 40 %/Hz

$$gradient = \frac{1}{50 \text{ Hz} \cdot droop}$$

The delay can be deactivated by setting a negative value

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|-----------------------------------|---------------|------|
| 20 | F Derate | Frequency threshold of the LFSM-O | 50,2 | Hz |
| 26 | F GradReduc | Droop of the LFSM-O | 40 | %/Hz |
| 64 | F ActDelay | Activation delay | -10 | ms |

3.3 Response to a change in voltage/ P(U) characteristics

The response of the inverter to a change in voltage can be configured with the following parameters. No artificial delay is implemented.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|---|---------------|------|
| 65 | P(U) type | Method of power reduction 0 = disabled 1 = method a) 2 = method b) | 1 | |
| 66 | P(U)+Uentry | Breakpoint of P(U) curve UKnick (setpoint a) | 110 | % |
| 67 | P(U)+Uend | UGrenz of P(U) curve (setpoint b) | 112 | % |
| 76 | P(U) CRTime | Dynamic of the P(U)-control | 5 | s |

3.4 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power".

3.5 Additional settings

Waiting time and gradient of the soft ramp up of the inverter after starting or reconnecting can be set by the following parameters

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|------------|---|---------------|-------|
| 24 | Recon Time | Waiting time after reconnecting | 300 | s |
| 25 | Recon Grad | Gradient of power increase after reconnecting | 10 | %/min |
| 92 | T Standard | Waiting time after starting | 60 | s |

Disconnection because of a rate of change in frequency may be required by the grid operator. It can be configured with the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|----------------------------------|---------------|------|
| 31 | F Rocof | Change of frequency per interval | 0 | Hz |
| 32 | T Rocof | Interval length | 1 | s |

4. Country Code 50549 – EN 50549:2019

4.1 Configuration of the automatic disconnection device

Voltage and frequency tripping thresholds of the automatic disconnection device can be configured with the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|------------|---|---------------|------|
| 1 | U 1LoLimit | Undervoltage threshold stage 1 [27<] | 85 | % |
| 2 | U 1LoTime | Undervoltage operate time stage 1 [27<] | 1,5 | s |
| 51 | U 2LoLimit | Undervoltage threshold stage 2 [27<<] | 0 | % |
| 52 | U 2LoTime | Undervoltage operate time stage 2 [27<<] | 0 | s |
| 3 | U 1UpLimit | Overvoltage threshold stage 1 [59>] | 115 | % |
| 4 | U 1UpTime | Overvoltage operate time stage 1 [59>] | 5 | s |
| 49 | U 2UpLimit | Overvoltage threshold stage 2 [59>>] | 120 | % |
| 50 | U 2UpTime | Overvoltage operate time stage 2 [59>>] | 0,2 | s |
| 7 | U UpAve | Threshold overvoltage 10 min mean protection | 110 | % |
| 12 | F 1LoLimit | Underfrequency threshold stage 1 [81<] | 47,5 | Hz |
| 13 | F 1LoTime | Underfrequency operate time stage 1 [81<] | 0,5 | s |
| 55 | F 2LoLimit | Underfrequency threshold stage 2 [81<<] | 0 | Hz |
| 56 | F 2LoTime | Underfrequency operate time stage 2 [81<<] | 0 | s |
| 16 | F PLoLimit | Underfrequency threshold narrow frequency band | 0 | Hz |
| 17 | F PLoTime | Underfrequency operate time narrow frequency band | 0 | s |
| 14 | F 1UpLimit | Overfrequency threshold stage 1 [81>] | 52 | Hz |
| 15 | F 1UpTime | Overfrequency operate time stage 1 [81>] | 0,5 | s |
| 53 | F 2UpLimit | Overfrequency threshold stage 2 [81>>] | 0 | Hz |
| 54 | F 2UpTime | Overfrequency operate time stage 2 [81>>] | 0 | s |
| 18 | F PUpLimit | Overfrequency threshold narrow frequency band | 0 | Hz |
| 19 | F PUpTime | Overfrequency operate time narrow frequency band | 0 | s |

4.2 Response to a change in frequency/ P(f) characteristics

The droop of the LFSM-O mode is adjusted as a gradient. The gradient can be calculated with the following formula. Percentages have to be converted, e.g. a droop of 5 % has to be written as 0,05. The gradient has to be converted as well, e.g. 0,4 1/Hz is equivalent to 40 %/Hz

$$gradient = \frac{1}{50 \text{ Hz} \cdot droop}$$

The delay can be deactivated by setting a negative value.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|--|---------------|------|
| 20 | F Derate | Overfrequency Threshold frequency f_1 | 50,2 | Hz |
| 26 | F GradReduc | Overfrequency droop | 40 | %/Hz |
| 64 | F ActDelay | Overfrequency Intentional Delay Underfrequency Intentional Delay | -10 | ms |
| 62 | F ExitRecon | Overfrequency Deactivation threshold f_stop | 50,2 | Hz |
| 28 | F ExitDelay | Overfrequency deactivation time t_stop | 30 | s |
| 27 | F BackGrad | Overfrequency mode: 0: Deactivation Threshold disabled 1: Deactivation Threshold enabled | 0 | |
| 70 | P(F)-Limit | Underfrequency Threshold frequency f_1 | 49,8 | Hz |
| 86 | P(f)-Grad | Underfrequency droop | 40 | %/Hz |

4.3 Response to a change in voltage/ P(U) characteristics

Overvoltage based reduction in active power production can be activated with the following parameter.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|---|---------------|------|
| 65 | P(U) type | P(U) Enabling: 0 = disabled 1 = enabled | 0 | |

4.4 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power". Additionally the following parameters can be configured under "All Parameters"

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|------------------------------|---------------|------|
| 87 | CosPhiLimit | Minimal cos Phi for Q(U) | 0,35 | |
| 45 | Q P_LockIn | Lock in power for Q(U) | 0 | % |
| 46 | Q P_LockOut | Lock out power for Q(U) | 0 | % |

4.5 Additional settings

“Highvoltage Fault Ride Through” and “Lowvoltage Fault Ride Through” can be configured with the following parameters

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|-----------------------------------|---------------|------|
| 84 | U Hvfrt | Static voltage range overvoltage | 120 | % |
| 85 | U Lvfrt | Static voltage range undervoltage | 50 | % |

Waiting time and gradient of the soft ramp up of the inverter after starting or reconnecting can be set by the following parameters. If parameters are used for both situations they have to be set to the stricter requirement.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|--|---------------|-------|
| 21 | F LoRecon | Reconnecting – Lower frequency Starting – Lower frequency | 49,5 | Hz |
| 22 | F UpRecon | Reconnecting – Upper frequency Starting – Upper frequency | 50,1 | Hz |
| 9 | U LoRecon | Reconnecting – Lower voltage Starting – Lower voltage | 85 | % |
| 10 | U UpRecon | Reconnecting – Upper voltage Starting – Upper voltage | 110 | % |
| 24 | Recon Time | Reconnecting – observation time | 60 | s |
| 25 | Recon Grad | Reconnecting – Active power increase gradient | 10 | %/min |
| 92 | T Standard | Starting – observation time | 60 | s |
| 83 | StartupGrad | Starting – Active power increase gradient | 100 | %/min |

5. Italy – Country Code 3911 – Italia locale und 3912 – Italia esterno

5.1 Response to a change in frequency/ P(f) characteristics

The droop of the LFSM-O mode is adjusted as a gradient. The gradient can be calculated with the following formula. Percentages have to be converted, e.g. a droop of 2,6 % has to be written as 0,026. The gradient has to be converted as well, e.g. 0,77 1/Hz is equivalent to 77 %/Hz

$$gradient = \frac{1}{50 \text{ Hz} \cdot droop}$$

The delay can be deactivated by setting a negative value

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|---------------------------------|---------------|------|
| 26 | F GradReduc | Overfrequency droop | 77 | %/Hz |
| 64 | F ActDelay | Overfrequency Intentional Delay | -10 | ms |

5.2 Response to a change in voltage/ P(U) characteristics

Voltage based active power reduction is activated by default.

5.3 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power". Additionally the following parameters can be configured under "All Parameters"

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|------------------------------|---------------|------|
| 42 | Q U_LockIn | Lock In Voltage Q(P) | 105 | % |
| 43 | Q U_LockOut | Lock Out Voltage Q(P) | 100 | % |
| 45 | Q P_LockIn | Lock in power for Q(U) | 20 | % |
| 96 | QU actDelay | Q(U) activation delay | 0 | s |

5.4 Additional settings

Waiting time and gradient of the soft ramp up of the inverter after starting or reconnecting can be set by the following parameters. If parameters are used for both situations they have to be set to the more strict requirement

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|------------|--|---------------|------|
| 21 | F LoRecon | Reconnecting – Lower frequency Starting – Lower frequency | 49,9 | Hz |
| 22 | F UpRecon | Reconnecting – Upper frequency Starting – Upper frequency | 50,1 | Hz |
| 24 | Recon Time | Reconnecting – observation time | 300 | s |
| 92 | T Standard | Starting – observation time | 30 | s |

6. Belgium – Country Code 3204 – Belgique C10/11 ed2.1

6.1 Configuration of the automatic disconnection device

Voltage and frequency tripping thresholds of the automatic disconnection device can be configured with the following parameters. Tripping delay do include the intrinsic delay of the disconnection device.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|------------|--------------------------------------|---------------|------|
| 1 | U 1LoLimit | Undervoltage trip setting | 80 | % |
| 2 | U 1LoTime | Undervoltage trip delay | 0,2 | s |
| 3 | U 1UpLimit | Overvoltage trip setting | 115 | % |
| 4 | U 1UpTime | Overvoltage trip delay | 0,2 | s |
| 7 | U UpAve | Overvoltage 10 min mean trip setting | 110 | % |
| 12 | F 1LoLimit | Underfrequency trip setting | 47,5 | Hz |
| 13 | F 1LoTime | Underfrequency trip delay | 0,2 | s |
| 14 | F 1UpLimit | Overfrequency trip setting | 51,5 | Hz |
| 15 | F 1UpTime | Overfrequency trip delay | 0,2 | s |

6.2 Response to a change in frequency/ P(f) characteristics

The droop of the LFSM-O mode is adjusted as a gradient. The gradient can be calculated with the following formula. Percentages have to be converted, e.g. a droop of 5 % has to be written as 0,05. The gradient has to be converted as well, e.g. 0,4 1/Hz is equivalent to 40 %/Hz

$$gradient = \frac{1}{50 \text{ Hz} \cdot droop}$$

The delay can be deactivated by setting a negative value

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|--|---------------|------|
| 20 | F Derate | Overfrequency Threshold frequency f_1 | 50,2 | Hz |
| 26 | F GradReduc | Overfrequency droop | 40 | %/Hz |
| 64 | F ActDelay | Overfrequency Intentional Delay Underfrequency Intentional Delay | -10 | ms |
| 62 | F ExitRecon | Overfrequency Deactivation threshold f_stop | 50,2 | Hz |
| 28 | F ExitDelay | Overfrequency deactivation time t_stop | 30 | s |
| 27 | F BackGrad | Overfrequency mode: 0: Deactivation Threshold disabled 1: Deactivation Threshold enabled | 0 | |
| 70 | P(F)-Limit | Underfrequency Threshold frequency f_1 | 49,8 | Hz |
| 86 | P(f)-Grad | Underfrequency droop | 0 | %/Hz |

6.3 Response to a change in voltage/ P(U) characteristics

Overvoltage based reduction in active power production can be activated with the following parameter.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|--|---------------|------|
| 65 | P(U) type | P(U) Enabling: 0 = deactivated 1 = activated | 0 | |

6.4 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power". Additionally the following parameters can be configured under "All Parameters"

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|------------------------------|---------------|------|
| 87 | CosPhiLimit | Minimal cos Phi for Q(U) | 0,35 | |
| 45 | Q P_LockIn | Lock in power for Q(U) | 0 | % |
| 46 | Q P_LockOut | Lock out power for Q(U) | 0 | % |

6.5 Additional settings

Waiting time and gradient of the soft ramp up of the inverter after starting or reconnecting can be set by the following parameters. If parameters are used for both situations they have to be set to the more strict requirement

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|--|---------------|-------|
| 21 | F LoRecon | Reconnecting – Lower frequency Starting – Lower frequency | 49,5 | Hz |
| 22 | F UpRecon | Reconnecting – Upper frequency Starting – Upper frequency | 50,1 | Hz |
| 9 | U LoRecon | Reconnecting – Lower voltage Starting – Lower voltage | 85 | % |
| 10 | U UpRecon | Reconnecting – Upper voltage Starting – Upper voltage | 110 | % |
| 24 | Recon Time | Reconnecting – observation time | 60 | s |
| 25 | Recon Grad | Reconnecting – Active power increase gradient | 10 | %/min |
| 92 | T Standard | Starting – observation time | 60 | s |
| 83 | StartupGrad | Starting – Active power increase gradient | 20 | %/min |

7. Denmark – Country Code 4500 – Danmark DK1 TR V1.2 und 4501 – Danmark DK2 TR V1.2

7.1 Configuration of the automatic disconnection device

Voltage and frequency tripping thresholds of the automatic disconnection device can be configured with the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|------------|-------------------------------------|---------------|------|
| 1 | U 1LoLimit | Undervoltage step 1 U< - Setting | 85 | % |
| 2 | U 1LoTime | Undervoltage step 1 U< - Trip Time | 50 | s |
| 51 | U 2LoLimit | Undervoltage step 2 U<< - Setting | 80 | % |
| 52 | U 2LoTime | Undervoltage step 2 U<< - Trip Time | 0,2 | s |
| 3 | U 1UpLimit | Overvoltage step 1 U> - Setting | 110 | % |
| 4 | U 1UpTime | Overvoltage step 1 U> - Trip Time | 60 | s |
| 49 | U 2UpLimit | Overvoltage step 2 U>> - Setting | 115 | % |
| 50 | U 2UpTime | Overvoltage step 2 U>> - Trip Time | 0,2 | s |
| 12 | F 1LoLimit | Underfrequency f< - Setting | 47,5 | Hz |
| 13 | F 1LoTime | Underfrequency f< - Trip Time | 0,2 | s |
| 14 | F 1UpLimit | Overfrequency f> - Setting | 51,5 | Hz |
| 15 | F 1UpTime | Overfrequency f> - Trip Time | 0,2 | s |

7.2 Response to a change in frequency/ P(f) characteristics

The droop of the LFSM-O mode is adjusted as a gradient. The gradient can be calculated with the following formula. Percentages have to be converted, e.g. a droop of 5 % has to be written as 0,05. The gradient has to be converted as well, e.g. 0,4 1/Hz is equivalent to 40 %/Hz

$$gradient = \frac{1}{50 \text{ Hz} \cdot droop}$$

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|--|------------------------|------|
| 20 | F Derate | frequency threshold f _{RO} LFSM-O | DK1: 50,2 DK2: 50,5 | Hz |
| 26 | F GradReduc | droop of active power reduction LFSM-O | DK1: 40 DK2: 50 | %/Hz |

7.3 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power".

7.4 Additional settings

Disconnection because of a rate of change in frequency can be configured with the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|--|---------------|------|
| 31 | F Rocof | Rate of change of frequency per second | 2,5 | Hz |

8. Australia – Country Code 6101 – Australia

8.1 Voltage Disconnection Limits

The automatic disconnection of the inverter based on average voltage for a 10 minute period can be configured with the parameter

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|--|---------------|------|
| 7 | U UpAve | Average voltage Vnom_max over 10 minute period | 106,2 | % |

8.2 Response to an increase in frequency

The response to an overfrequency can be configured with the following parameter

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|------------------------------|---------------|------|
| 91 | P(f)+F-Stop | f stop | 52 | Hz |

8.3 Power derating for voltage variation / Volt-Watt response mode

The Volt-Watt response mode is enabled by default. The reference values can be set by the following parameters.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|--|---------------|------|
| 66 | P(U)+Uentry | Volt-watt response V3 | 110 | % |
| 67 | P(U)+Uend | Voltage where P=0W. Calculated with V_3 and V_4 and their corresponding power levels p_{V3} and p_{V4} $V_{0W} = \frac{p_{V4}V_3 - p_{V3}V_4}{p_{V4} - p_{V3}}$ | 112 | % |

8.4 Additional reactive power settings

The configuration of reactive power characteristics is done during the initial commissioning or in the service menu in the submenu "Reactive power". Reactive power regulation for voltage variation (Volt-VAr mode) can be set by choosing "Q(U) lin".

8.5 Additional settings

The soft ramp up of the inverter after connecting or reconnecting can be set by the following parameters

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-------------|---|---------------|-------|
| 25 | Recon Grad | Gradient of power rate limit W_{Gra} reconnecting after tripping the disconnection device | 16,67 | %/min |
| 83 | StartupGrad | Gradient of power rate limit W_{Gra} after connecting | 16,67 | %/min |

The Demand Response Mode can be enabled with the following parameter. For details regarding the required electrical connection please consider the corresponding document.

| ID | Parameter | Nomenclature in the standard | Default Value | Unit |
|----|-----------|---|---------------|------|
| 48 | RapidShut | Shutdown enabling 0 = disabled 2 = DRMO activated | 0 | |