Vienna, Aarau, Prague in May 2021

A-CH-CZ Association Guideline

The DSOs' associations

- Oesterreichs E-Wirtschaft, Brahmsplatz 3, 1040 Wien, www.oesterreichsenergie.at
- Verband Schweizerischer Elektrizitätsunternehmen VSE,
  Hintere Bahnhofstrasse 10, 5000 Aarau, Schweiz, www.strom.ch
- ČEZ Distribuce, a. s., Vyskočilova 1461/2A, 140 00 Prague, Czech Republic, www.cezdistribuce.cz

have agreed to promote

Requirements for the controllability of electromobility charging points by means of a grid operator switch contact (valid from 01-01-2022)

to be introduced in their national regulations.

1 Introduction

The dynamic increase in electro mobility especially in high load periods exacts interventions by the distribution system operator (DSO) to reduce power demand in the electric grids.

The requirements described below are specified for the establishment of a standardised controllability of charging points for electro mobility (CD charging device) by means of a grid operator switch contact.

2 Functional description

This document describes a standardised controllability of electric-mobility charging points by means over a wire guided communication link to a signal source of the DSO.

3 Scope of application

The requirements apply to fixed and mobile AC and DC charging device with an apparent power rating $S_r \geq 3{,}68$kVA drawn from the mains.

The requirements for AC CD related to the current (e.g. rated current Ir) in this document also refer to the resulting power – this also applies to DC CD.

4 Control circuit and supply voltage

The control of the CD during the charging process is implemented by means of a switching contact supplied with protective extra low voltage (PELV) for the DSO

The interrogation of the DSO dry contact S1 is carried out via the CD. The signal transmission has to be possible over at least a 50m long cable line CAT.7 AWG 23 without coupling relay via one pair of wires. In certain cases e.g. due to local DSO control unit technology the installation of a coupling relay may be necessary on the part of the customer.

The reason for using CAT.7 control cable is to ensure electromagnetic compatibility (EMC) and to prepare the communication path for a later suitability with a network-capable digital interface.

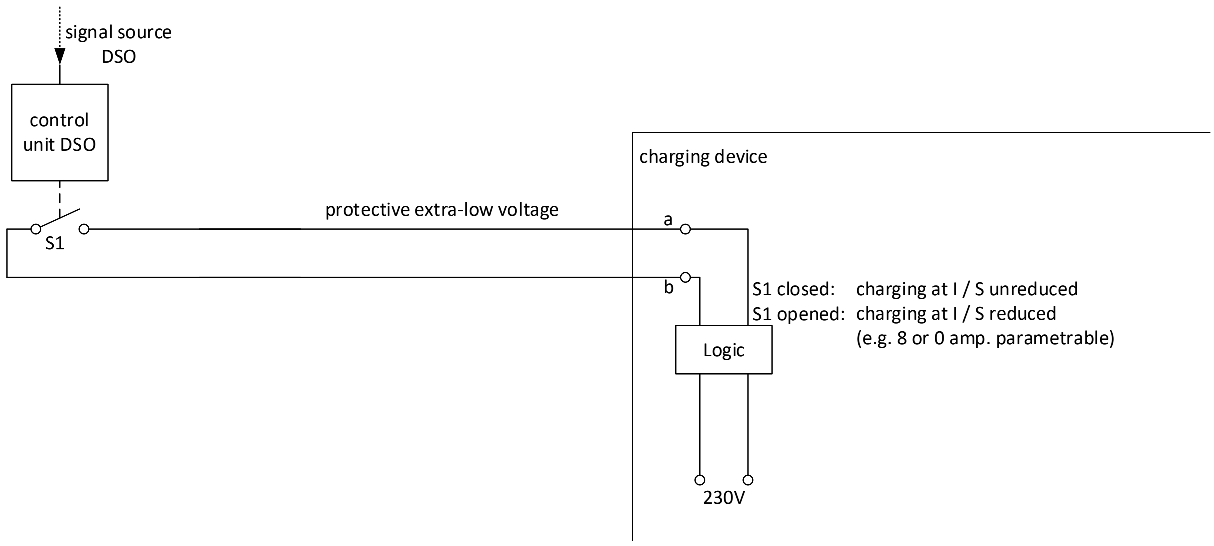

Figure 1: Control circuit

5 Charging current influence

The DSO influences the charging current consumption of the CD with the switch position of its control unit.

This requires the definition of a reduced charging current I_{red} and a maximum set (and then unreduced) charging current I_{unred} by the DSO.

I_{red} (or analogue P_{red}) .... reduced current set in CD (0 A or ≤ 8 A, e.g. 6 A)

I_{unred} (or analogue P_{unred}) .... in CD – value acc. to DSO commitment – at least I_{unred} = 8A and 16A must be adjustable, also for a stronger CD with I_r = 32 A.

Example 1	Example 2	Example 3	Example 4
S1 on: 16 A	S1 on: 16 A	S1 on: 8 A	S1 on: 32 A
S1 off: 8 A	S1 off: 0 A	S1 off: 0 A	S1 off: 8 A

Table 1: Examples of charging current influence

6 Number of DSO switching contacts

The minimum requirement is one contact. This is sufficient for the current standard case of usual charging device. In Switzerland, for example, there were specifications with 2 contacts in some cases. Two contacts are recommended.

Note: With regard to current requirements such as vehicle to grid (V2G), more contacts are already required. With the current state of the art, DC charging points are a prerequisite for feeding back power from the vehicle. For this V2G operation, the regulations of the countries for generation plants apply. Here, the switching contact requirement is already described in the regulations (up to 4 contacts required).

Alternatively, many grid operators see a digital interface (e.g. EEBUS) as the next sensible stage of development.

7 Time response

7.1 Step response of the AC CD with setting $I_{red} \geq 6$ A:

Increase $I_{red} \rightarrow I_{unred}$ in ideal case as linear ramp (when converted into steps, a tolerance band of ± 5% P_r applies, starting from the linear ideal course) with 100 % ΔI / min with $\Delta I = I_{unred} - I_{red}$

Drop $I_{unred} \rightarrow I_{red}$ at 100 % ΔI / min analogous.

Reaction time: ramp starts immediately – max. time delay 5 s.

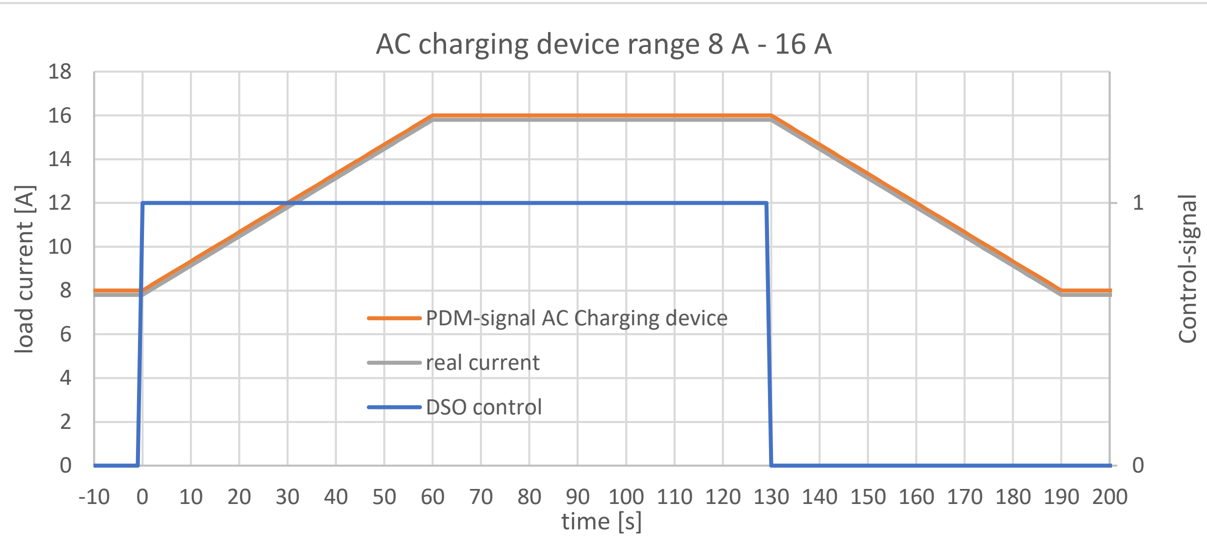

Diagram 1: Behaviour AC CD in the range between 8A and 16A

7.2 Step response of the AC CD with setting I_{red} = 0 A

Sequence I_{red} → I_{unred}: Start value 6 A after 10 s. After charging process has started (charging current > 4 A or status C (CP-PE = 880 Ω)) – current increase ramp of 100 % ΔI / min with ΔI = I_{unred} - 6 A as linear ramp (or in steps with a tolerance band ± 5% I_r from the ideal linear course).

If the e-vehicle (EV) has not started the charging process 300 s after release, the CD may start the process without ramp.

Drop I_{unred} → I_{red} at 100 % ΔI / min analogue.

Reaction time: Ramp starts immediately – max. time delay 5 s.

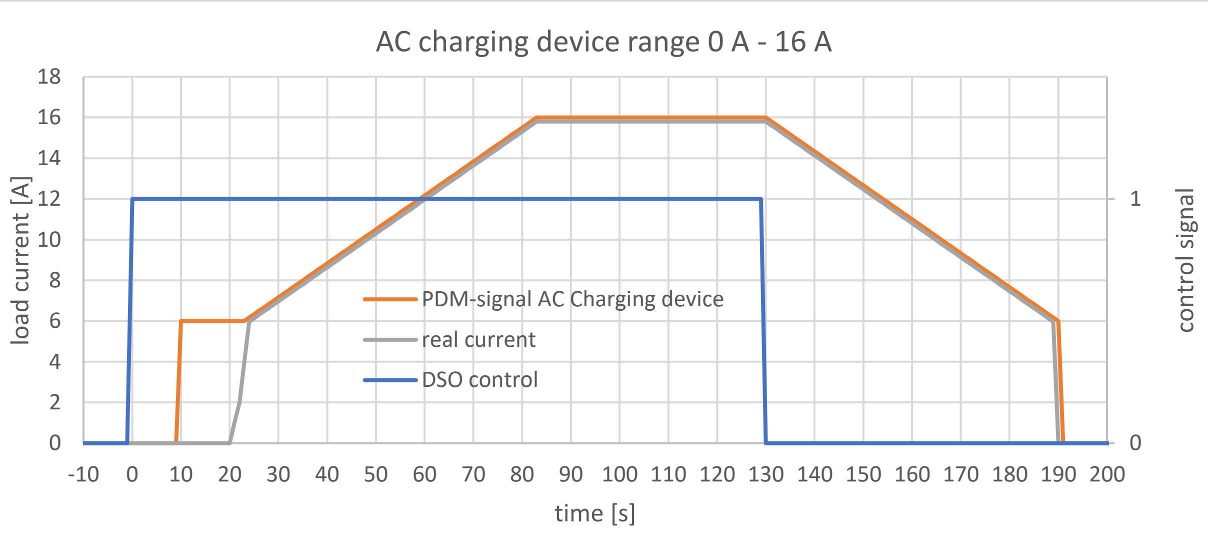

Diagram 2: Behaviour AC CD in the range between 0A and 16A

7.3 Tolerance bands for AC charging current changes

Both when increasing and reducing charging power, ± 5% I_r are permissible in relation to the rated current. The inclusion of a time delay of 5s additionally extends the tolerance range during the power change. The tolerance band refers to the PDM-signal and not to the vehicle-dependent real current.

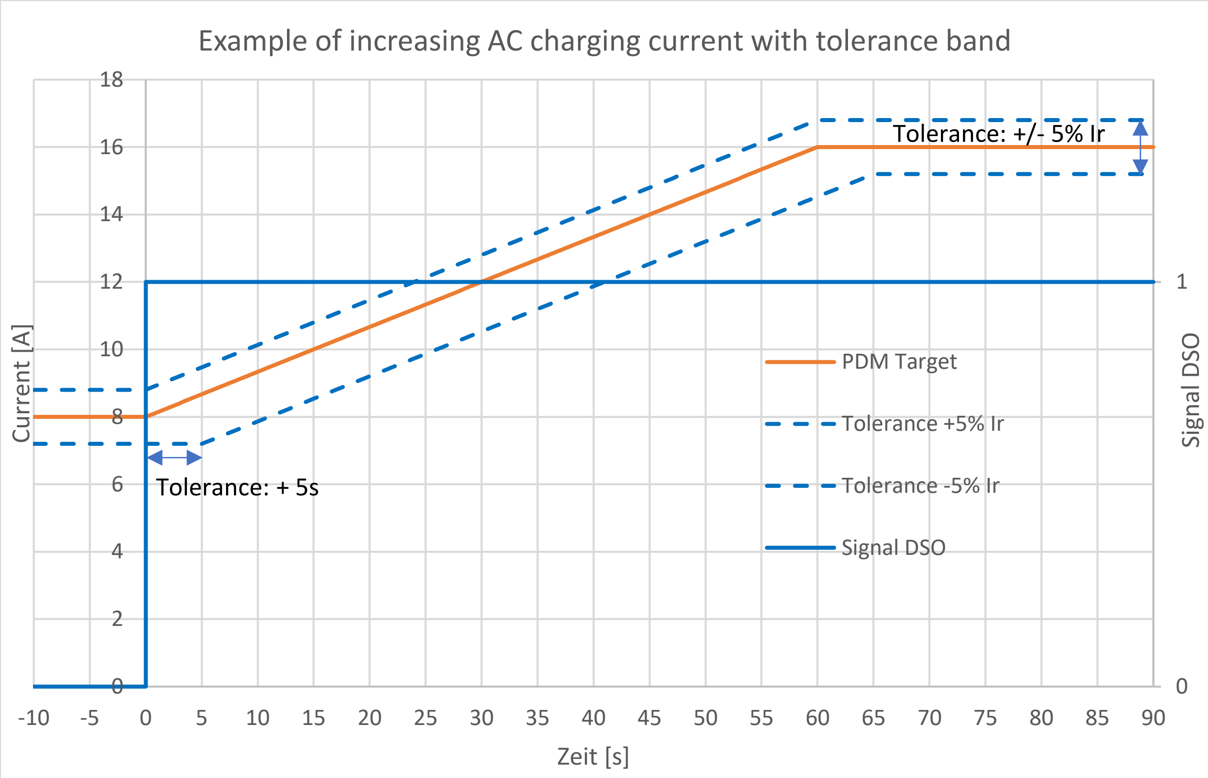

Diagram 3: Tolerance bands for AC charging current changes (example)

7.4 Step response of the DC Charging Device with setting P_{red} = 0 % P_{unred}

Increase P_{red} → P_{unred} as a linear ramp with a tolerance band ± 5% S_r with 100 % ΔP / min with ΔP = P_{unred} – P_{red}

Drop P_{unred} → P_{red} at 100 % ΔP / min analogue

Reaction time: Ramp starts immediately – max. time delay 5 s.

Power measurement both AC and DC side permissible

P_{red} adjustable to at least 0 % Pr, 50 % P_r or infinitely variable

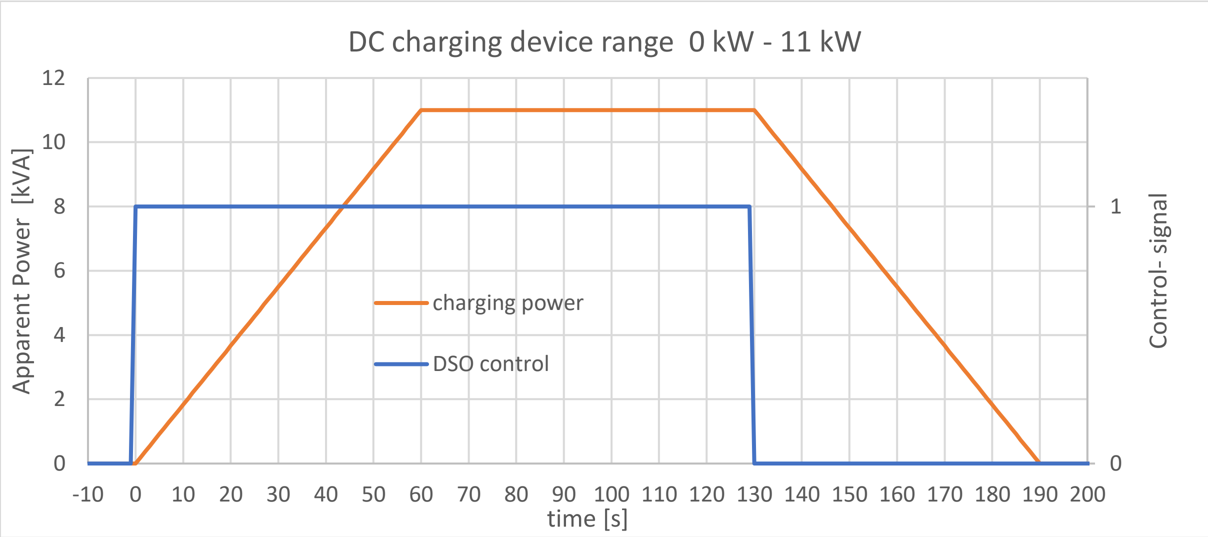

Diagram 4: Behaviour DC CD in the range between 0 kW and 11kW

7.5 Tolerance band for DC charging power changes

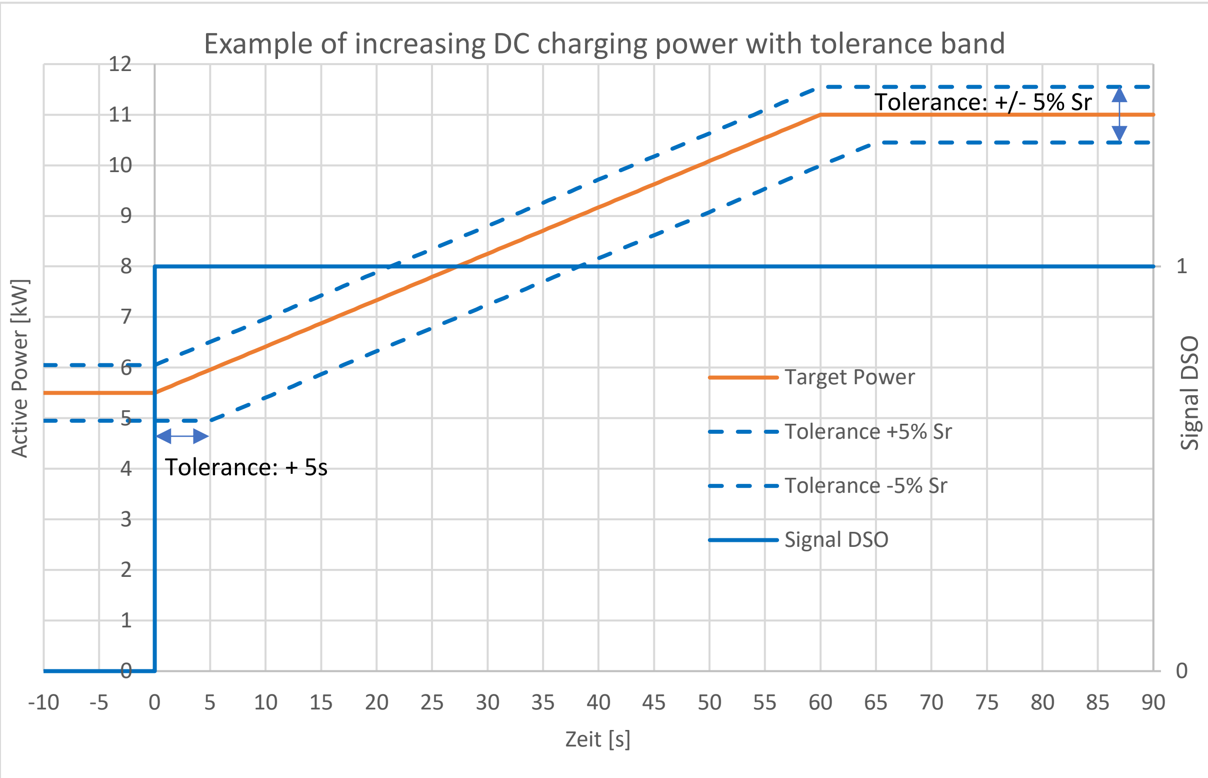

Diagram 5: Tolerance bands for DC charging power changes (example)

Both when increasing and reducing the charging power, ± 5% S_r is permissible in relation to the rated apparent power. The inclusion of a time delay of 5s further extends the tolerance range during the power change.

8 Further requirements

In line with the developments in PV inverters, grid-serving functions are being introduced also for charging device. Technical solutions for these PV devices can also be exemplary for CD.

8.1 Status display of the operating status of the charging point

For the operator of the CD, an easily understandable status display are to be implemented as to whether the mode I_{red} / S_{red} is active. A signal by LED or a display (without further auxiliary functions) directly on the device would be ideal. For example, a green LED display should preferably show the unreduced operating mode. Alternatively, a smart phone app provided by the CD manufacturer or an interface to the Home Energy Management System (HEMS) is also possible.

8.2 Symmetry requirements

The unbalance (asymmetry) has to be monitored with 3-phase detection. In the case of non-3-phase symmetrical operation, a current limitation of the feeding conductor(s) to 16 A takes place.

8.3 Undervoltage release (pause)

If at the connection terminal of the CD the voltage drops below u (t) < 0.85 * 230 V = 195.5 V (t > 3 s)
→ charging shall be interrupted (paused) using the following hysteresis:
u (t) > 0.9 * 230 V = 207 V (t > 300 sec = 5 min).

The reconnection condition must not be violated during this mains monitoring time. Otherwise the counter restarts again.
Note: For some systems, a voltage quality that deviates from EN 50160 is agreed between the relevant DSO and the customer (e.g. at week grid branches, in remote areas). For this a parameterisation of voltage (from 160 V - 230 V) and time (from 0 s - 600 s) should be possible in coordination with the DSO.

8.4 Start-up ramp after power failure (supply interruption) or undervoltage release

After reconnection, charging starts up with a ramp of 10% S_r / min linearly or in steps of 10% S_r observing a tolerance band of ±10% S_r based on the ideal ramp form. For AC CD with current control, the start-up ramp is 10% I_r / min. A single step from zero to a technical minimum power (current) is permissible (e.g. 6 A as start value).

8.5 Parameter setting of the CD

When delivered, the CD is idealy set to the standard country setting of the country concerned, e.g. A or CH or CZ. Alternatively, country setting can be selected directly on the device in accordance with the manufacturer's parameterisation instructions. A standard country setting with appropriate options is published by the DSO associations for A-CH-CZ.

8.6 Manipulation security

The DSO-relevant settings must not be changed in any user interface (e.g. via smartphone app, web browser). Changes (only by qualified electricians) via software are only feasible under sufficient password protection.

If the settings are made by using, for example, so-called dip switches, those must be protected by covers that can only be removed with tools (e.g. screwdrivers).

8.7 Documentation of the setting parameters (organizational)

Qualified electricians must be able to document the settings and transmit them to the relevant DSO on request.

8.8 Charging management systems

Functionally analogous, the requirements are also to be implemented in central charging management systems. The local load control system must be able to limit the available power, which is then distributed to the individual charging stations.

The upper and lower current / power values are agreed with the relevant DSO in advance.