## **Real time telemetry of measured values for units and groups providing FFR**

For the 2024 procurement year, no real-time communication with Svenska kraftnät is required. Until further notice, the provider shall instead continuously log measured values ​​and send logged data to Svenska kraftnät for verification on a monthly basis. This document describes the requirements on the format and sampling time of submitted data.

The provider may store data in any format suitable during operation, but when is to be delivered to Svenska kraftnät, it must be in the units and in the format specified in this document.

### **Measurement values to be logged**

The supplier shall, for each unit or group supplying FFR, log and save the data listed below at the specified resolution or better.

• Date and time (preferably UTC, otherwise clearly marked).

• Available capacity FFR [MW] (resolution ≤ 0.01 MW).

Available capacity refers to the actual delivery that will take place in the event of a disruption, normally the sum of the intended delivery and any additional delivery.

• Measured active power [MW] (resolution ≤ 0.01 MW).

• Measure grid frequency [Hz] (resolution ≤ 10 mHz).

• Activated FFR capability (0 or 1, where 1 indicates activated FFR).

• Measured charge level (State of charge) [%] (resolution ≤ 0.01)

### **Calculation of the available capacity**

Available capacity shall be calculated in a manner that is representative of the actual delivery that will occur in the event of a disturbance, normally the sum of the intended delivery and any additional delivery. Any restrictions must be taken into account. Below is a proposal to start from:

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|  |  |
| --- | --- |
|  | Current setting for FFR contribution for Unit or Group in (MW) |
|  | Maximum up-regulation capacity for Unit or Group in (MW) where up-regulation capacity is the ability to increase production or reduce consumption. Consideration must be given to the capacity for other reserve deliveries and the operating situation. |

### **Sampling time**

Regarding the registration interval of logged data, there are two options for the FFR providing entity to choose from:

1. Keep the sampling time constant at a maximum of 100 ms throughout the entire measurement series.
2. Use a sampling time of 1 s during normal operation and 100 ms in the event of a disturbance. The time interval that must be logged in the event of a disturbance is from and including 10 seconds before activation of the FFR up to and including 15 minutes from the moment of activation. As these results in two different sampling times, the measurement data must be separated into two files before they are sent to Svenska kraftnät. One file must contain logged data for normal operation (sampling time 1 s), while the other file contains logged data during disturbances (sampling time max 100 ms)

### **Data format**

In order for Svenska kraftnät to be able to review submitted data as smoothly and objectively as possible, the process for this is partially automated. Formatting and file names must therefore follow the specifications described below.

Data is delivered in csv format (character encoding UTF-8), values ​​separated by comma (,) and decimals indicated by decimal point (.). Lines are separated by line breaks (↵ ASCII/CRLF=0x0D 0x0A). File names must be in the format [Resource]\_[Service]\_[Area]\_[Interval]\_[Sampling\_rate]\_[Date].csv, where the sub-elements are specified as follows:

* Resource = Designation for the resource according to agreement with Svenska Kraftnät.
* Service = Support service that the log file covers, in this case FFR.
* Area = Bid ​​area for the unit/group. The bid range can be either SE1, SE2, SE3 or SE4.
* Interval = Time interval that the log file covers, specified in the format YYYYMMDDThhmm-YYYYMMDDThhmm.
* Sampling rate = Nominal time difference between samples specified in milliseconds.
* Date = Date when the log file was compiled to be sent to Svenska kraftnät, specified in the format YYYYMMDD.

Example file names:

UnitG1\_FFR\_SE3\_20200515T0000-20200601T2359\_100ms\_20200602.csv

Data points in the csv file are formatted as follows:

DateTime,FfrCap,InsAcPow, …

[DateTime1],[record1\_1],[record1\_2], … ,[record1\_X]

[DateTime2],[record2\_1],[record2\_2], … ,[record2\_X]

etc.

Columns to be included are specified below, including header row and data type.

Columns that are not applicable should be left blank.

* DateTime = Date and time in the format YYYYMMDDThhmmss.nnn, where n are decimals of a second, e.g. 20200601T093702.012
* FfrCap = Available capacity FFR in [MW], specified as a double with at least two decimal places, e.g. 20.10. Available capacity refers to the actual delivery that will take place in the event of a disturbance, normally the sum of the intended delivery and any additional delivery.
* InsAcPow = Instantaneous measured active power in [MW], specified as a double with at least two decimal places, e.g. 120.53
* GridFreq = Measured grid frequency in [Hz], specified as a double with at least two decimal places, e.g. 49.32
* ContOutSig = control signal for activation (i.e. trigger condition met and delivery profile in progress), boolean indicator [1/0] with activated (=1) or not activated (=0), ex 1.
* SoC = measured charge level ("State of charge") stated as a percentage [%] with at least two decimal places in the format double, e.g. 30.00.

The following columns are optional for the 2023-2024 season. If included, they should follow the format below:

* ContSetP = The regulator's setpoint for active power before delivery of FFR in [MW], specified as a double with at least two decimal places, e.g. 67.50
* ContMode = alphanumeric designation for used control mode, e.g. FFR4

An example of how a csv file should be structured is shown in *Figure* *1*.

DateTime, FfrCap, InsAcPow, GridFreq, ContOutSig, ContSetP, SoC

20200601T093702.012, 20.10, 120.53, 49.91, 0, 67.50, 99.05

20200601T093702.112, 20.10, 120.53, 49.49, 1, 67.50, 99.05

20200601T093702.212, 20.10, 110.33, 49.48, 1, 67.50, 98.90

20200601T093702.312, 20.10, 101.04, 49.49, 1, 67.50, 98.58

*Figur 1. Example of how the logged data should be reported. The example does not include ContMode as this column is optional.*