

Appendix 1.A

Generic signal list for generation facilities - requirements for real-time information

RfG article 14(5)(d)(ii)

Final version approved by the Danish Utility Regulator - 17.11.2018

This is a translation. In case of inconsistencies, the Danish version applies.

Date: 5.10.2018

B2: facilities between 1 MW and 3 MW
 Please note that if you want to provide ancillary services (e.g. FCR, RR, FRR) from a facility, this may require more signals than those listed below and there may be further/other requirements from balance responsible parties, etc. You should therefore look into the rules and requirements, as appropriate.

Facility categories					Generic signal description	Description	Purpose	Basis for requirement
A	B1	B2	C	D				
		X	X	X	Grid connection switch / switch gear status in the facility's point of connection	Indicates whether the facility is electrically connected to the public electricity supply grid. The value must reflect the actual status, not only the expected setting. Signal relates to the facility's grid connection switches.	State estimation of the electricity system, including short-circuit power	TSO: Signal is required in order to perform a correct state assessment of the electricity system, including calculating the facility's contribution to short-circuit power in the system. DSO: Signal is required in order to check whether a facility is connected or not. In addition, switch status is used for state assessment, including short-circuit calculations.
		(X)	X	X	Generator circuit-breaker/switch gear status in the generator point of connection (the grid enterprise decides whether to request the signal for B2-systems)	Indicates whether the individual generator is electrically connected to the public electricity supply grid. The value must reflect the actual status, not only the expected setting. The TSO does not require this signal from individual generators and connecting radials under 10 MW.	State estimation of the electricity system, including short-circuit power	TSO: Signal is required in order to perform a correct state assessment of the electricity system, including calculating the facility's contributions to short-circuit power in the system.
		X	X	X	Active power kW – measured in the point of connection	Measurement of active power. Net power supplied in the POC.	State assessment of the electricity system	TSO: Signal is required in order to perform a correct state assessment of the electricity system and check whether dynamic stability limits in the electricity system are observed. DSO: Measurement is required and used to perform state assessment and evaluation of load in the distribution grid.
			X	X	Scheduled active power (shows the present set point)	Transfer of scheduled active power. This is an RfG requirement.		Requirement is made in RfG article 15(2)(g)(ii).
				X	Possible active power control properties	Absolute value of the facility's active power properties in relation to its nominal properties.		TSO: KCEl must know a facility's real-time active power properties in relation to its nominal properties.
				X	Possible reactive power control properties	Absolute value of the facility's reactive power properties in relation to its nominal properties.		TSO: KCEl must know a facility's real-time reactive power properties in relation to its nominal properties.
		X	X	X	Active power control - absolute constraint	Activation of temporary reduction of the maximum permitted active power generation of the facility.	Electricity grid protection (e.g. in case of faults or rerouting in the grid)	TSO: Signal is required in order to ensure that the dynamic stability thresholds of the electricity system can be complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. Active power limits may owe to, for example. thermal constraints in circuit breakers, transformers, lines, etc. DSO: Signal is required in order to be able to constrain active power in connection with congestion caused by faults or maintenance in the distribution grids, so that the thermal limitations in the distribution grids are not exceeded.
		X	X	X	Active power control – required maximum active power	Set point for temporary reduction of the maximum permitted active power generation of the facility.	Electricity grid protection (e.g. in case of faults or rerouting in the grid)	TSO: Signal is required in order to ensure that the dynamic stability thresholds of the electricity system can be complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. Active power limits may owe to, for example. thermal constraints in circuit breakers, transformers, lines, etc. DSO: Signal is required in order to be able to constrain active power in connection with congestion caused by faults or maintenance in the distribution grids, so that the thermal limitations in the distribution grids are not exceeded.
		X	X	X	Active power control - current measured in the point of connection	Measurement of RMS current.	State assessment of the electricity system	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Measurement is required in order to manage the distribution grids and assess the thermal capacity of components in the grids in case of rerouting and in normal operation. Current measurements are also used to perform state assessments..
		X	X	X	Reactive power control - MVAR measured in the point of connection	Measurement of reactive power.	State assessment of the electricity system	TSO: Signal is required in order to measure whether the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Measurement is required in order to check that the requisite reactive power is actually supplied. In addition, the measurement is used for state assessments.
		X	X	X	Reactive power control – activated/deactivated		Q control	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required to be able to activate or deactivate Q control.
		X	X	X	Reactive power control - requisite MVAR in the point of connection	Set point	Q control	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required in order to regulate reactive power as grid enterprises are obligated to comply with a requirement for the exchange of reactive power between the distribution and transmission grids. In addition, it also helps to ensure the stability of the distribution grids.
		X	X	X	Power factor control - cos (phi) measured in the point of connection	Measurement of Cos (phi). Deviations between the set point and measurements may occur temporarily when the set point is changed.	Measurement	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Measurement is required in order to check whether power factor control works correctly (this may be a calculated value).
		X	X	X	Power factor control - activated/deactivated		Power Factor control	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required in order to activate or deactivate power factor control.

Facility categories					Generic signal description	Description	Purpose	Basis for requirement
A	B1	B2	C	D				
		X	X	X	Power factor control - required cos (phi) in the point of connection		Power Factor control	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required in order to control a facility's reactive power. Control is primarily used to offset the facility's impact on the grid - for example voltage impact in the point of connection or reactive power losses originating from the facility.
		X	X	X	Voltage measured in the point of connection	Measurement of RMS voltage	State assessment of the electricity system	TSO: Signal is required in order to measure whether the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Measurement is required in order to check whether the facility is energised and to ensure voltage stability in the distribution grids. In addition, the measurement will be used to perform state assessments and voltage control monitoring.
			X	X	Voltage control – activated/deactivated		Voltage control	TSO: Signal is required in order to run the voltage control function in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required to be able to activate or deactivate voltage control.
			X	X	Droop for voltage control		Voltage control Reactive power control	TSO: Signal is required in order to run the voltage control function in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required in order to ensure that voltage remains within the normal voltage range and to maintain voltage stability.
			X	X	Required voltage in the voltage reference point	Set point to be delivered via the production telegraph.	Voltage control	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: Signal is required in order to ensure that voltage remains within the normal voltage range and to maintain voltage stability.
			X	X	Wind power: Activation/deactivation of the downward regulation function for active power at high wind speeds	Reduces active power at high wind speeds in a controlled manner so that no momentary outages of active power happen when wind speeds exceed the wind power facility's cut-out wind speed constraint.	Downward regulation function designed to create a controlled downward regulation at high wind speeds	TSO: Signal is required in order to operate the electricity system in a way that ensures that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration at high wind speeds.
			X:PPM (Possible signal for SGM)	X:PPM (Possible signal for SGM)	System protection		Activation/deactivation of system protection function	TSO: Signal is required in order to activate/deactivate the function designed to ensure that the dynamic stability thresholds of the electricity system can be complied with in difficult operating situations, including alert state and emergency state as well as system restoration. The reason for a momentary limitation of active power may be that the system operator is trying to avoid system failure by preventing overload of circuit breakers, transformers, lines, etc.
			X:PPM (Possible signal for SGM)	X:PPM (Possible signal for SGM)	System protection		Sets steps for system protection function	TSO: Signal is required in order to ensure, stepwise, that the dynamic stability thresholds of the electricity system can be complied with in difficult operating situations, including alert state and emergency state as well as system restoration. The reason for a momentary limitation of active power may be that the system operator is trying to avoid system failure by preventing overload of circuit breakers, transformers, lines, etc.
X	X	X			Stop signal	Forces facility to shut down (time may vary according to facility category).	Option to shut down facility to ensure personal and facility safety (Activation/deactivation of stop signal)	TSO: Signal is required in order to ensure that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: The signal must be available in order to shut down a facility in connection with faults or maintenance (RfG requirement)
X	X	X			Holding signal	Prevents (re-)connection of the facility.	Option to prevent reconnection of facility to ensure personal and facility safety (Activation/deactivation of reconnection)	TSO: Signal is required in order to ensure that the dynamic stability thresholds of the electricity system are complied with in all operating situations, including normal operation, alert state and emergency state as well as system restoration. DSO: The signal must be available in order to stop a facility from automatically connecting to the grid.