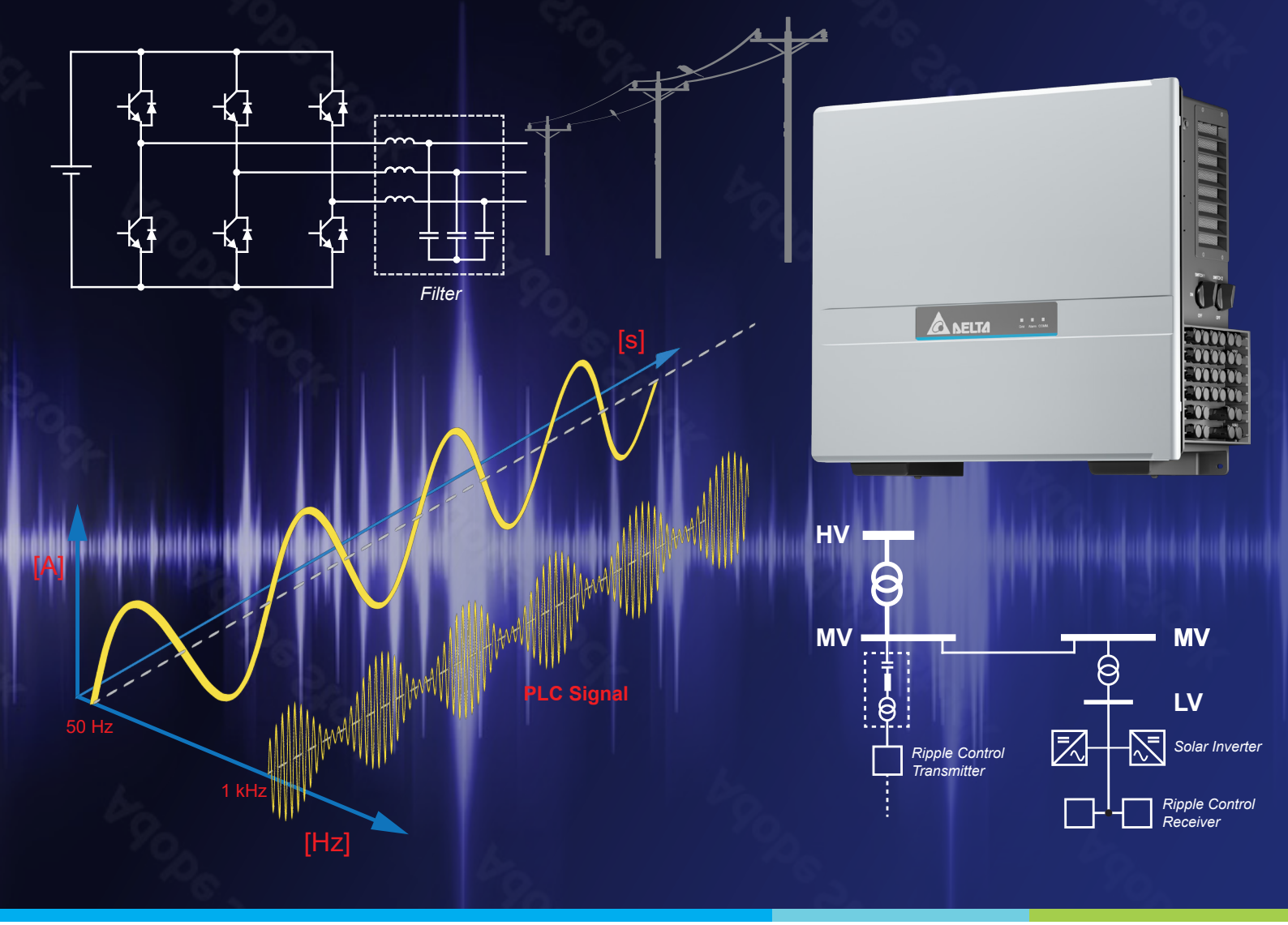


The Impact of Solar Inverters on the Ripple Control Signal in the Swiss Grid

Technical and regulatory background information.
Delta's approach for compliancy with the requirements.
Practical recommendations for PV plants with Delta solar inverters.

Use of the Ripple Control Signal in Switzerland

Some grid operators in Switzerland use audio frequency ripple control systems to control consumers on the grid, such as street lighting or heat pumps.

A ripple control signal is sent over the power line. It is a carrier signal in the frequency range of 100 to 1600 Hz.

Grid operators use ripple control signals to stabilize the power grid when electricity demand is high or low. They can turn loads on or off to regulate the amount of power going into the grid.

Electrical equipment on the grid must not affect the ripple control signal. The device must be made safe for the grid otherwise the grid operator may stop it working.

Effects of a Solar Inverter on the Grid

Grid-connected solar inverters feed electricity into the public grid and are designed to deliver a sinusoidal current at 50 Hz.

However, ther are always harmonics in the grid. These are unwanted currents whose frequency is a multiple of the fundamental frequency of 50 Hz. Harmonics are caused by non-linear loads such as electronic devices, LED lights, inverters or switching power supplies that do not consume electricity evenly. The harmonics interfere with the fundamental current, distorting the sinusoidal waveform, which degrades power quality and can eventually cause problems in the grid.

Solar inverters therefore have filters with often passive elements to remove harmonics on the output stages. These filters can also attenuate signals that are intentionally routed over the distribution line.

Swiss energy suppliers that use the ripple control signal therefore require solar inverters to be redesigned. They should continue to filter out harmonics, but should not negatively affect the frequency ranges of the ripple control signal and thus its signal strength.

Delta‘s solution

Delta has modified its digital control system for the M15A to M100A Flex inverters so that they meet the requirements of the respective energy supplier. The settings of the digital control unit can be adjusted during the measurement appointment.

Get Ready for the Measurement Date

To ensure that the measurement date goes smoothly for plant operators and installers, we recommend the following preparations

The table shows the minimum firmware version for the different Delta solar inverters. If necessary, update the firmware by using the DeltaSolar app or the Delta Service Software (DSS) for Windows PC. The DSS is available on partnerportal.delta-emea.com.

The software settings for the ripple control signal can only be made with the DSS. To connect the Windows PC to the RS485 bus, you also need a standard USB-RS485 adapter.

Test the RS485 connection between the PC and inverters:

Connect your PC to the RS485 bus via the USB-RS485 adapter.

Familiarize yourself with the DSS. Are all the inverters found on the RS485 bus and displayed correctly?

The required software settings are made in the “Config” tab, “Ripple Control” subsection. Take a look at this section so that you can quickly find the settings at the appointment.

Delta Model Name	Minimum Firmware Version	
	DSP1	COMM
M15A_220 / M20A_220 Flex / M30A_230 Flex	1.20	1.25
M50A_260 Flex	1.42	1.22
M70A_260 Flex	1.42	1.33
M100A_280 Flex	1.23	1.17

Measurement Procedure

The utility inspector measures the quality of the ripple control signal twice: once with all inverters switched off and once with all inverters switched on. This way, the inspector can determine the effect of the inverters on signal strength and quality.

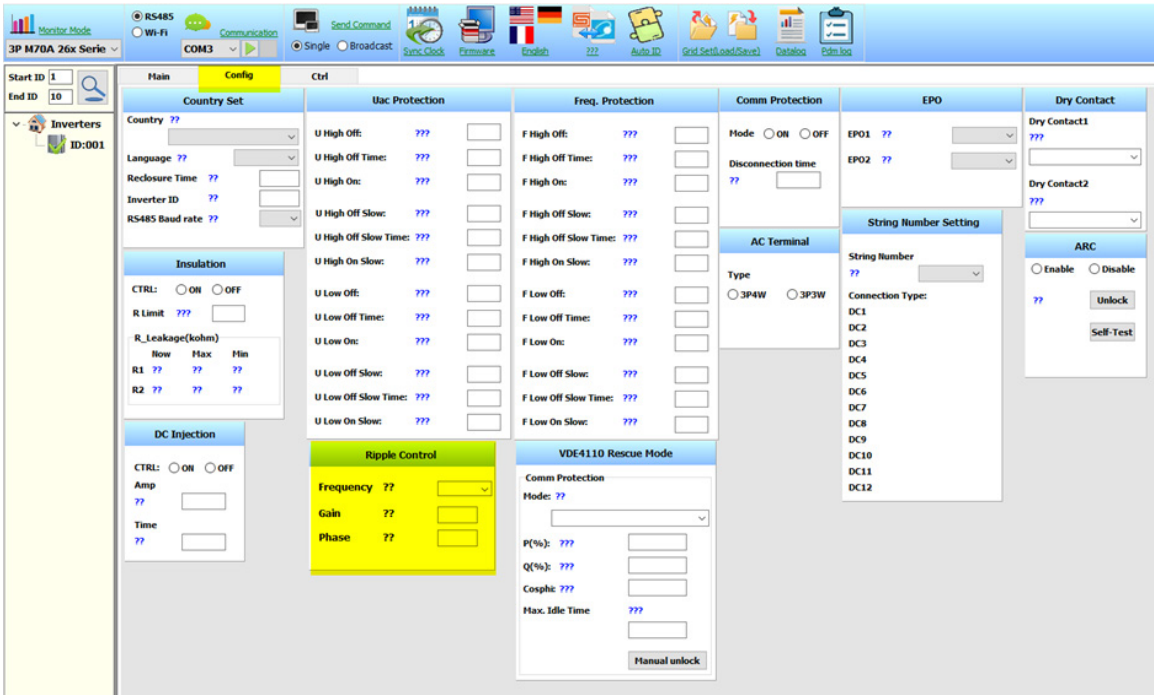
To activate the function, in the DSS select the frequency range that most closely matches that of the ripple control signal.

If the frequency settings are insufficient, you can adjust the “Gain” parameter in ±1 steps.

If you get stuck during the measurement appointment, contact Delta Customer Service. You will find the phone number and email address below.

Once the inspector has approved the system’s inverters, it is best to attach a label with the settings to each inverter. You should also record the settings in the system documentation. This will ensure that you can set the same values again if an inverter needs to be replaced.

Grid operators may have specific requirements or recommendations regarding the compatibility of inverters and the handling of ripple control signals. It is advisable to regularly review this information and to contact the grid operator if anything is unclear.



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Ripple_control_signal_in_Switzerland_V1_EN_2024-09-12