

Firmware for 3-phase Vienna rectifier with low cost mixed-signal control for power factor correction

User interfaces and utilities	ST-LINK programmer / debugger	UART / Windows terminal	
Applications	PFC Control	Output Voltage Control	Protections
Middleware			
Hardware Abstraction	STNRG device library source package	SMED Configurator	
Hardware	STNRG388A, SCTW35N65G2V, STPSC20H12, STGAP2SM, VIPER26HD		
	STDES-VIENNARECT		



Features

- Power factor control based on mixed-signal architecture
- Configurable DC bus voltage control based on [STNRG388A](#) digital controller
- Programmable start-up procedure
- Up to 6 programmable PWM generators State Machine Event Driven (SMED)
- Fast digital input (DIGIN), with configurable pull-up
- Max. 1.3 ns PWM resolution
- Serial debug/monitor
- Overcurrent and overvoltage protection
- STNRG SMED Configurator support

Description

This firmware provides control for high power three-phase AC/DC rectifier applications based on Vienna topology featuring mixed-signal control. It runs on the [STNRG388A](#) controller providing digital output voltage regulation, while analog circuitry manages CCM current regulation to provide high power quality, with low THD and high PF.

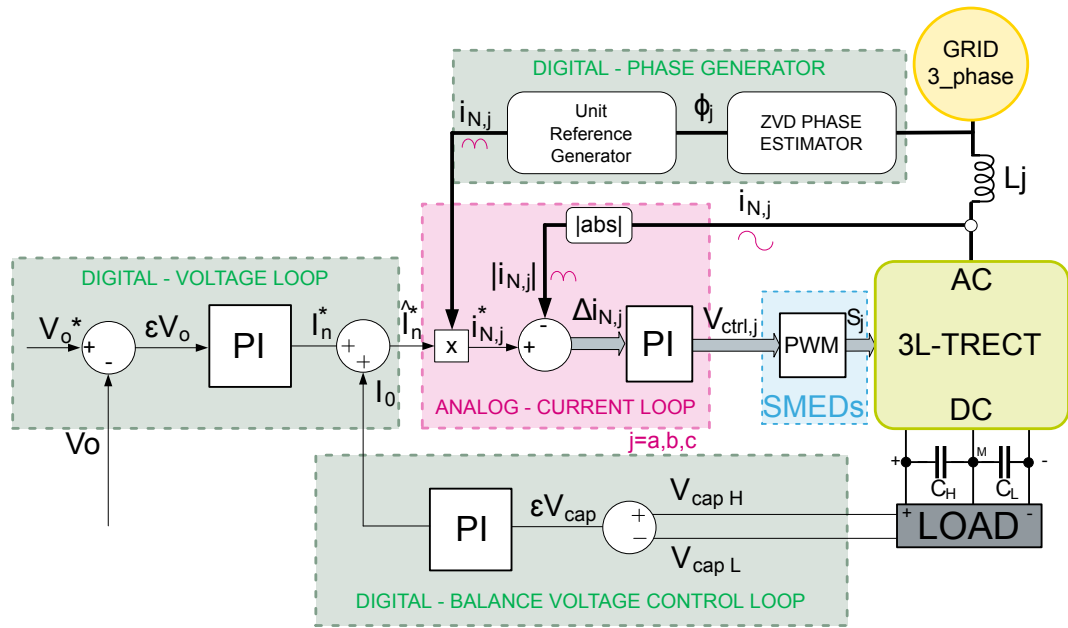
The firmware provides an environment to configure output voltage, control parameters and protection thresholds. The digital controller uses the operating parameters to determine appropriate reference signals for the analog circuitry and event-driven state machine (SMED) to generate modulation signals for PFC output control.

Product summary	
Firmware for 15 kW, 3-phase Vienna rectifier	STSW-VIENNARECT
15 kW, 3-phase Vienna rectifier for PFC	STDES-VIENNARECT
Firmware runs on:	STNRG388A digital controller for power conversion with up to 6 prog. PWM generators, 96 MHz PLL
Firmware download method:	ST-LINK/V2
Firmware IDE:	IAR Embedded Workbench
Tools and libraries	STSW-STLUXSMED02 STSW-STLUXLIB02
Applications	PFC Converter - Three Phase Input DC Fast Charging Station

1 Mixed signal mode control in active rectifier applications

The mixed-signal control logic in this application consists of a digital section to control the bus voltage with a current request applied to the analog current regulator. Digital output balancing control is implemented by means of an offset in the current reference to ensure the voltage rating on the output capacitors is not exceeded. The analog current control uses the input voltage reference waveform to ensure that the input current waveform is in phase with the voltage, thus guaranteeing a very near unity power factor. The SMEDs are managed by the voltage control signal (V_{ctrl}) generated by the analog current loop.

Figure 1. Digital and analog control loops in active rectifier



Revision history

Table 1. Document revision history

Date	Version	Changes
11-Dec-2019	1	Initial release.

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