FOUR-QUADRANT AC SOURCE

Four-Quadrant AC (**4QAC**) is an advanced AC test-bench framework application for COMPISO System Units (**CSUs**) in all configurations. This time-based digital arbitrary waveform generator supports all operation modes of the CSU and allows the user to generate waveforms like **sine** with optional **harmonics**, **rectangle** and **triangle** waves. In addition, complex test sequences and scenarios such as HVRT, LVRT and frequency sweeps can be programmed, which makes the application suitable for laboratory operation and power electronic device certification testing. The core of the application is the scripter mode, an environment utilizing **EGSTON Power Script** (**EPS**), a C-based scripting language that allows the user to program complex sequences and define waveforms to change their behavior during test execution.

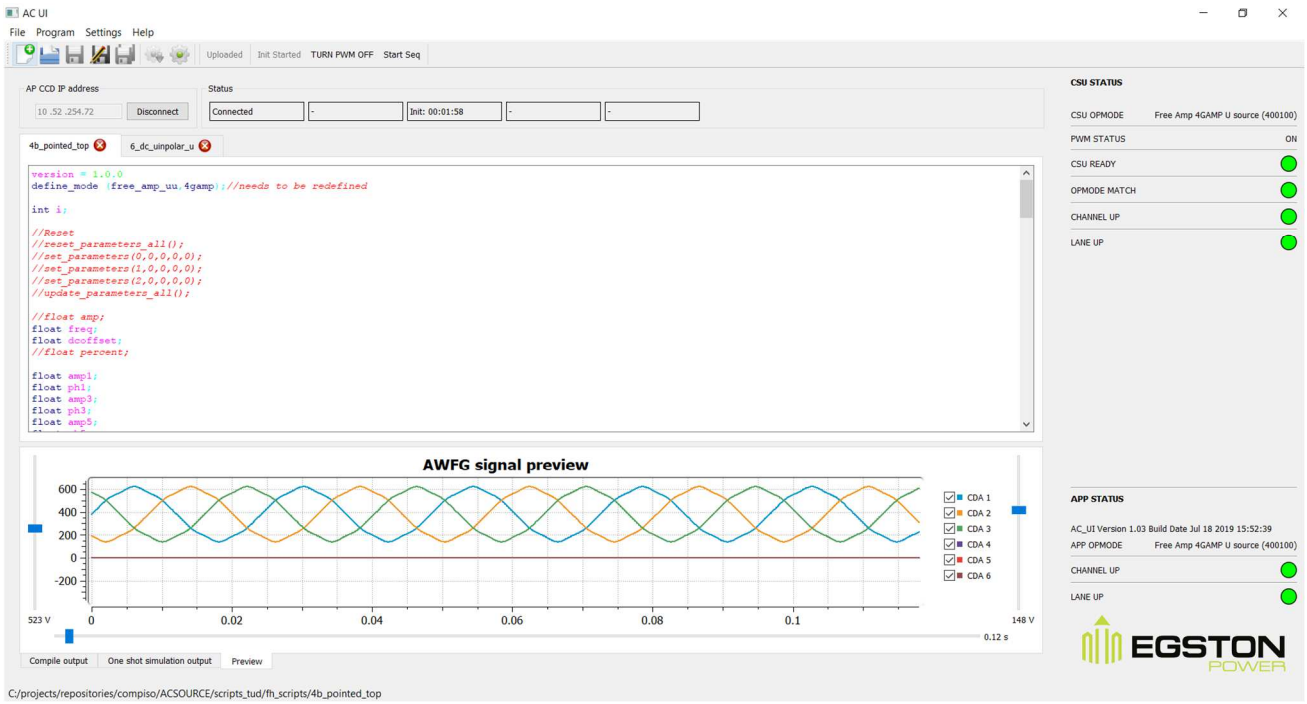

Figure 1. Screenshot of 4QAC running in scripter mode.

Features
CSU operation mode support
User friendly and powerful user interface
Designed respecting power electronics industry tests and certification
Bidirectional power flow as AC source and sink
Full four-quadrant operation
Multi-channel time-based arbitrary waveform generation
Supports sine waveforms with optional harmonics, rectangle and triangle waves
Programming output in EPS in scripter mode
Three-phase phase-locked loop mode
Small form-factor pluggable (**SFP**) optic-fiber interface to send setpoints and receive measurements
Frequency, amplitude, DC offset and phase signal parameter 1 ms real-time update rate
Setpoint generation for up to six independent or synchronized channels
Graphical editor to easily define and generate waveforms; e.g., sine, rectangle and triangle

Control modes
Voltage source, a programmable signal generation scenario
Current source, a programmable signal generation scenario
Voltage/current mixed mode, a programmable signal generation scenario
Three-phase phase-locked loop I mode as a current source/load
Three-phase phase-locked loop S mode as a power source/sink
Waveform types
Sine wave
Sine wave with harmonics: • Harmonics up to the 100th order • Interharmonics • Subharmonics
Square wave (adjustable duty cycle (0–100%); can be used to acquire system step and impulse response)
Triangle wave (sawtooth waves also supported)
EPS
Developed by EGSTON for the generation of script-based signal sequences of arbitrary duration
C-based scripting language
Basic concepts: • Easy definition of all basic functions with a simple function call • Global variable definition for frequency, amplitude, phase angle and DC offset • User-defined variables • Basic operators, e.g., +, -, *, /, AND, OR, NOT, Modulo, Shift, Comparators • Block statements, e.g., if, if-else, while
I/O commands: print
Readily available example EPS scripts for standard industry tests and certification signal sequences: • LVRT/HVRT • Frequency drift • Frequency sweep • Interharmonic and subharmonic test • Islanding tests
Script development workflow: • Write script or load from file • Syntax check • Compile • Upload to the real-time processor • Execute test sequence

Visualization
EPS integrated development environment with text editor and control flow buttons
Signal preview window
Compilation status window
CSU status indicators: • CSU operation mode • CSU pulse-width modulation enabled • CSU ready • CSU and application operation mode match • Channel up and lane up
Application status: • Connection status between host PC and real-time processor • Channel up and lane up indicators for SFP connection
Numerical and time-related aspects
4 µs setpoint timestep
6 channels
1 ms parameter update rate for frequency, amplitude, phase and DC offset
IEEE 754 single-precision floating-point
Internal free-running or phase-locked time base
EPS-controlled manual triggers for dynamic tests
Scope of delivery
4QAC software
Real-time processor
Host PC
Interfaces
TCP/IP-based configuration between the host PC and real-time processor
SFP-based optical link between the CSU and real-time processor for reliable real-time setpoint and measurement data exchange

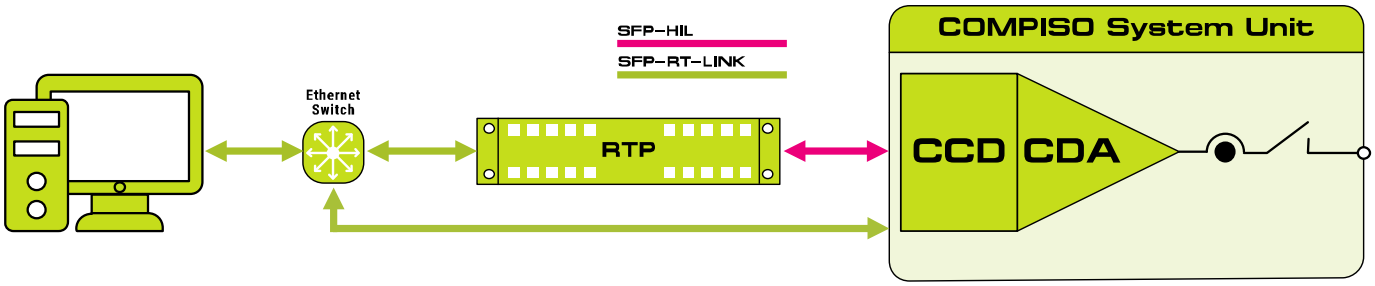

Figure 2. Communication architecture