Calculator Overview

VIC Matrix Calculator Overview

The VIC Matrix Calculator is a comprehensive design tool that integrates all the concepts covered in this educational series. It allows you to design, simulate, and optimize complete VIC circuits by calculating component values, resonant frequencies, Q factors, and system behavior.

> Calculator URL: https://matrix.stanslegacy.com

What the Calculator Does

The calculator brings together multiple design domains:

1. Choke Design Module

Calculate inductance, DCR, parasitic capacitance, and SRF for custom wound chokes.

- Core selection (ferrite, iron powder, air core)
- Wire gauge and material selection
- Bifilar winding support
- Multi-layer winding calculations

2. Water Profile Module

Model the WFC as an electrical component with all relevant parameters.

- Electrode geometry (plates, tubes, arrays)
- Water conductivity effects
- Temperature compensation
- EDL and solution resistance

3. Circuit Profile Module

Combine chokes and WFC into complete VIC circuits for analysis.

- Primary and secondary resonance
- Q factor and bandwidth
- Voltage magnification
- Ring-down characteristics

4. Simulation Module

Visualize circuit behavior and optimize performance.

- Frequency response plots
- Time-domain waveforms
- Impedance analysis
- Sensitivity analysis

Design Workflow

The recommended workflow for using the calculator:

1. **Define Requirements:** Target frequency, available components, constraints
2. **Design/Select Chokes:** Use Choke Design module or enter measured values
3. **Configure Water Profile:** Enter WFC geometry and water properties
4. **Create Circuit Profile:** Combine components and select topology
5. **Run Simulation:** Analyze resonance, Q, and system behavior
6. **Optimize:** Adjust parameters to improve performance
7. **Build & Verify:** Construct circuit and compare to predictions

Key Features

Feature	Description	Benefit
Real-time Calculations	Results update instantly as you change parameters	Rapid design iteration
Warning System	Alerts for out-of-range values or design issues	Avoid common mistakes
Saved Profiles	Store and recall choke, water, and circuit configurations	Compare designs easily
Interconnected Models	Changes propagate through entire system	See full system impact
Educational Notes	Tooltips and explanations throughout	Learn while designing

Input vs. Output Parameters

You Provide (Inputs):

- Core dimensions and material properties
- Wire gauge, material, and turn count
- Electrode geometry and spacing

- Water conductivity and temperature
- Operating frequency or frequency range

Calculator Provides (Outputs):

- Inductance (L), DCR, parasitic capacitance
- Self-resonant frequency (SRF)
- WFC capacitance and ESR
- Resonant frequency (f_0)
- Q factor, bandwidth, ring-down time
- Voltage magnification ratio
- Impedance characteristics
- Frequency response curves

Accuracy and Limitations

Parameter	Typical Accuracy	Notes
Inductance	±10-20%	Core properties vary; always verify
DCR	±5%	Depends on wire tables accuracy
WFC Capacitance	±15%	Fringe effects, water purity affect results
Q Factor	±20-30%	Multiple loss mechanisms; use as estimate
Resonant Frequency	±10-15%	Depends on L and C accuracy

Important: The calculator provides design estimates. Always verify critical parameters with measurements on actual components. Real-world results may vary due to manufacturing tolerances, stray inductance/capacitance, and environmental factors.

Getting Started

To begin using the VIC Matrix Calculator:

1. Navigate to the application dashboard
2. Start with the module that matches your first design decision:
   - If you have specific chokes → Start with Choke Design
   - If you have a specific WFC → Start with Water Profile
   - If you have target frequency → Work backwards from Circuit Profile
3. Follow the guided workflow to complete your design

Tip: The following pages in this chapter provide detailed guidance on each module. Work through them in order for the best understanding of the calculator's capabilities.

Next: Component Input Parameters →

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