SPARQ

**Table 1: Comparison of key CTQs between IQ8H (leading single-channel microinverter from Enphase) and Q2000-4102**

| Critical to Quality (CTQ) | Enphase (IQ8H-240-72-2-US) | SPARQ (Q2000-4102) |
|---|---|---|
| **DC Power (Panel)** | 540+ (clipping at 390) | 540+ (clipping at 450) |
| **AC Power** | 380 | 2000 |
| **Power Density (W/in$^3$)** | 5.63 | 19.57 |
| **Weight Density (W/kg)** | 351.8 | 606.1 |
| **Power Clipping** | 390 per channel | 450 per channel |
| **MPPT** | Highly fluctuating (3.5% Average) | Single point (~0% fluctuations) |
| **MPPT Efficiency** | Not Specified | Static: 99.85%<br>Dynamic: 99.8% |
| **Total Harmonic Distortion (THD)** | <5% | <2% |
| **Power Factor (PF)** | Limited 0.85 leading – 0.85 lagging | Full-Range 1.0 leading – 1.0 lagging |
| **Efficiency (Peak/CEC)** | 97.6/97.0 | 97.5/97.0 |
| **Continuous AC Power** | No, Burst-Mode below 30% load | Yes |
| **Modes of Operation** | Grid-Connected | Grid-Connected<br>Off-Grid<br>Dual-Mode |

Sparq was the first to introduce Quad Architecture for microinverters with below industry disruptive performance characteristics:

1. Integrated four isolated ultra-high-frequency, ZVS, DC/DC converters, one energy-combiner and one high-power DC-AC inverter in one enclosure (eliminated three DC/AC converters),
2. Eliminated low reliability electrolytic capacitors by eliminating inherent double-frequency ripple at PV-panels
3. Implemented independent MPPT for every PV-panel,
4. Reduced THD by novel ripple-steering among four DC/DC converters,
5. Enabled dual-mode operation or motor control without power clipping at high-temperature,
6. Reduced cost by implementing all digital controls through one shared FPGA,
7. Resolved longstanding partial shading and major safety concerns due to HVDC arcing and electric shock in string inverters
8. Eliminated need for Rapid Shut-Down. This feature is inherent and comes at no extra cost
9. Developed SparqLinq (wireless supervisory Gateway/Controller for parallel microinverters), and SparqVu (cloud-based PHM to access real-time-data and historical records) development

As compared to IQ8H (Enphase single-channel microinverter), a rigorous study concluded that Q2000-4102 help:

- eliminates low reliability electrolytic capacitors resulting in longer life,
- reduce DC-link by 99.64%,
- reduce THD from 5% to 2%,
- increase gravimetric power density by 73%
- increase volumetric power density by 248%

**References:**

[1] Enphase IQ8H datasheet

[2] Sparq Q2000-4102 datasheet