

Low Voltage Automatic Thyristor-Switched Capacitor & Filter Bank

1. Product Overview

True**PHASE IQ™** is True**PHASE POWER**'s low voltage automatic capacitor and filter banks, specifically engineered for facilities with high harmonic environments and rapidly fluctuating dynamic loads. Where standard contactor-based banks cannot respond quickly enough, the True**PHASE IQ™** uses thyristor-based switching to deliver sub-cycle compensation that eliminates transient current peaks and providing continuous, precise reactive power correction.

Typical applications include:

- Welding operations and arc furnaces
- Press and stamping equipment
- Variable frequency drive (VFD) heavy environments
- Semiconductor fabrication facilities
- Data centers with rapidly varying IT loads
- Any facility where load changes faster than contactor-based banks can respond

2. Switching Technology & Cycle Times

The True**PHASE IQ**'s core differentiator is its bidirectional thyristor switching architecture. This is the only approach capable of responding to load changes within a single electrical cycle.

Switching Parameter	TruePhase IQ Specification
Switching technology	Bidirectional thyristor valves (zero-voltage switching)
Switching speed	Less than 1 full electrical cycle
Maximum switching rate	Over 60 times per second (>60 Hz equivalent)
Real-world duty cycle	Over 10,000 switches per stage per day (field verified — welding application)
Switching method	Zero-voltage crossing detection — thyristors fire precisely when voltage across the module equals zero, eliminating transient current peaks
vs. contactor-based banks	Contactors respond in seconds; thyristors respond in <1 cycle — orders of magnitude faster

Zero-Voltage Switching Explained:

The controller continuously monitors the voltage across each thyristor module and gates the thyristors to switch precisely at the voltage zero crossing. This eliminates inrush transient current peaks that would otherwise stress capacitors, upstream equipment, and the grid connection. The result is extremely low mechanical wear (no moving parts), virtually no electrical stress per switching event, and the ability to sustain over 10,000 switch operations per stage per day indefinitely.

3. System Capacity & Configuration

Parameter	Specification
Total kVAR range	75 kVAR to 1,200 kVAR per enclosure
Maximum stages	Up to 12 steps / stages
Stage protection	Each stage individually fuse-protected
Stage rotation	Controller automatically rotates switching sequence to equalize wear across all stages
Voltage options	208 / 240 / 480 / 600 Vac, 60 Hz
Phase configuration	Three-phase balanced network topology

4. Harmonic Filtering Specifications

Parameter	Specification
Filter type	Detuned harmonic filter (passive)
Tuning frequency	3.78th harmonic of nominal frequency (standard)
Tuning rationale	Detuning to 3.78th harmonic prevents resonance under varying loads, temperatures, and component aging — safer than tuning to a specific harmonic order
Reactor tolerance	-3% / +3% (tight tolerance for accurate tuning)
Filter reactor insulation	Class H insulation — highest standard rating
Over-temperature protection	Each filter stage includes an over-temperature sensor; overheating stages auto-deactivate
Capacitor cells	High-temperature, harmonic-rated (same spec as PowerVar Filter Bank Series)

5. Capacitor Cell Technical Specifications

TruePHASE IQ™ comes standard with high-temperature, harmonic-rated capacitor cells.

Parameter	Specification
Design life	20 years continuous duty
Construction	Self-healing, low-loss metallized polypropylene dielectric film
Losses	Less than 0.2 W per kVAR
Discharge resistors	Residual voltage reduced to less than 50V within 1 minute of de-energization
Overvoltage/overcurrent rating	Higher than standard cells — rated for three-phase balanced network topology of thyristor-switched systems
Safety listing	UL-listed pressure-activated circuit interrupter rated for 10,000 AFC

6. Fold Capacitor Safety System

- Self-healing polypropylene film automatically isolates any puncture developing over time from charge/discharge cycles
- Solder-free contact ring eliminating winding damage risk during fabrication
- Three-phase overpressure disconnect that removes power in the event of excessive internal pressure build-up
- Segmented metallization supplementing self-healing protection under extreme operating conditions

7. Current Ratings

Parameter	Specification
Continuous current rating (low harmonics site)	1.3x rated current
Continuous current rating (moderate harmonics site)	1.65x rated current
Continuous current rating (high harmonics site)	Up to 2.7x rated current
Filter reactor rated current	Minimum 135% of rated capacitor current (detuned applications); minimum 150% for filter applications
Reactor temperature rise	Less than 110°C rise at 135% of rated current
Reactor construction	Three-phase copper-wound gapped iron core

8. Smart Controller Specifications

Parameter	Specification
Measurement	Single-phase (standard) or three-phase power factor and THD monitoring
Local display	Backlit LCD for local access and diagnostics
Stages — standard	8 stages (front panel)
Stages — maximum	Expandable to 12 stages
Power factor correction range	0.5 inductive to 1.0 (unity power factor)
Stage sequencing	Automatic rotation to equalize capacitor and thyristor wear
Remote communication ports	USB, RS-232, RS-485, TCP/IP Ethernet
Communication protocols	Modbus (native), Profibus (native)
Control algorithm	Continuously calculates optimal reactive power compensation level and switches stages accordingly in real-time

9. Enclosure & Environmental Specifications

Parameter	Specification
Standard enclosure rating	NEMA 1 (12-gauge steel)
Optional enclosure ratings	NEMA 3R, NEMA 12
Enclosure construction	Welded 11-gauge zinc-plated steel with ventilation covers
Cooling	Passive and/or forced air (model dependent); ball-bearing fans with removable, vacuumable dust filters
Operating temperature	-30°C (-22°F) to +46°C (115°F) — NEMA 3R required for below 5°C installations
Storage temperature	-5°C (23°F) to +70°C (158°F)
Maximum altitude (no derating)	2,000 m (6,562 ft)
Agency certifications	UL Listed, CSA Listed
Enclosure size range	64H x 20W x 16D inches (smallest) to 94H x 84W x 36D inches (largest)
Optional configurations	Shipping splits, special paint, bus duct entry, back-to-back construction

10. At-a-Glance Summary

Specification	TruePhase IQ Value
Target environment	High harmonics + dynamic / rapidly fluctuating loads
Switching technology	Bidirectional thyristors — NO mechanical contactors
Switching speed	< 1 electrical cycle
Max switching rate	> 60 times per second
Field duty cycle (verified)	> 10,000 switches / stage / day
Capacitor type	High-temperature, harmonic-rated self-healing cells
Capacity range	75 – 1,200 kVAR per enclosure
Maximum stages	12
Voltage options	208 / 240 / 480 / 600 Vac, 60 Hz
Filter tuning	Detuned at 3.78th harmonic
Reactor tolerance	±3%
Reactor insulation	Class H
Max continuous current	Up to 2.7x rated current
PF correction range	0.5 inductive → 1.0 unity
Communications	USB / RS-232 / RS-485 / TCP/IP Ethernet
Protocols	Modbus (native), Profibus (native)
Enclosure (standard)	NEMA 1 (3R and 12 optional)
Operating temperature	-30°C to +46°C
Max altitude	2,000 m
Certifications	UL Listed, CSA Listed