Modular Active Power Filter
ESD34
New Generation

- Enersine ESD34
- Modular Design
**Power Range**

- **Control Module**
  - Each controller can manipulate 4 Power Modules.
  - 440mm x 710mm x 85mm (w x d x h)

- **Power Module**
  - 400V 35A for 3 Phase 3 Wires and 4 Wires
  - 480V 35A for 3 Phase 3 Wires
  - 440mm x 710mm x 131mm (w x d x h)

- **Capacity**
  - 400V 35A, 60A, 90A, 120A
  - 400V 35A, 60A, 90A, 120A
  - Up to 960A in parallel

Easy to install in standard 19” rack cabinet.

http://www.ablerex.com.tw
Effects of Harmonics

- Over voltage/current in the distribution network
- Over heated power cables, transformers & generators
- Overheating in all types of electronics systems causing component failures
- Nuisance tripping in circuit breakers and protection relays
Effects of Harmonics

- Malfunction of automatic control system
- Damage to capacitors due to resonance
- Inaccuracy of instrument measurement
- Interference in telecommunication systems
- Voltage distortion and lagging in power factor
APF Working Principle

Cancel the loads harmonic current and then obtain a sinusoidal current in the utility
Measure the harmonics current generated from the non-linear load
Generate opposite phase shifted harmonics current of the same amplitude

Perfect Sinusoidal source current
Applications

- Utilities Industry
- Steel, Chemical, Automotive Industry
- Printing, Pulp and Paper Industry
- Office, Building and Data Center
- UPS and MCC (Motor Control Centers)
- Elevator and HVAC System

HVAC: Heating, Ventilation and Air Conditioning
Feature

- Modular and easy to extend
- Apply to 3 Phase 3 Wires/4 Wires System
- Advanced DSP technology, programmable
- Close/Open Loop Control
- Compensate up to 51st harmonics
- Compensate up to 12 different harmonics simultaneously
- Power Factor Correction
- Correct unbalance three phase utility
- No problem of overload
- Shunt connection, easy for maintenance
- User-friendly control panel
- Operate in parallel up to 8 control units
Advantages of ESD 34

- Eliminate harmonic current
- Improve power factor
- Correct unbalance three Phase Utility
- Eliminate Neutral Line Current
- Significantly reduce the voltage waveform distortion
- Reduce voltages drop on transformers & cables
- Reduce temperatures rise on transformers & cables
- Reduce Voltage Difference between Neutral and Grounding
- Save Money
Overall view

2 Models …
- Rack type
Overall view

- Wall Mount type
1. Main Fuse
2. Soft-start Electromagnetic Contactor Module
3. Link Inductor
4. Ripple Current Filter Module
5. High Frequency Inductor
6. IGBT Power Converter Module
7. DC Capacitor Module
- Different current rating can operate in parallel
- Up to 8 control modules in parallel
- Maximum rating
- Up to 960A

120A \times 8 = 960A
User Friendly

- LED Control Panel

1. ON/OFF Keypad
2. Reset ( & Alarm Silence) Keypad
3. Power On Indicator
4. Filtering Indicator
5. Full Correcting Indicator
6. Error Indicator
7. Power Module Status Indicators
8. Alarm Indicators
User Friendly

- LCD Control & Display Panel (Optional)

1. Display Screen
2. ON/OFF Keypad
3. Reset ( & Alarm Silence) Keypad
4. Power On Indicator
5. Filtering Indicator
6. Full Correcting Indicator
7. Error Indicator
8. Confirmation/Enter Key
9. Directional Scrolling Key
10. Escape/Cancel Key

http://www.ablerex.com.tw
User Friendly

- LCD Control & Display Panel (Optional)
- Meter Parameter
- Waveform Spectrum (Up to 51st order)
- Configuration
- Event Log (Up to 300 records)
- Multiple Languages (Up to 10 Languages)
**User Friendly**

- LCD Control & Display Panel (Optional)

Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KVA</td>
<td>89.3</td>
</tr>
<tr>
<td>Freq</td>
<td>50.1Hz</td>
</tr>
<tr>
<td>PF</td>
<td>0.76</td>
</tr>
<tr>
<td>Vab</td>
<td>401 V</td>
</tr>
<tr>
<td>Vbc</td>
<td>400 V</td>
</tr>
<tr>
<td>Vca</td>
<td>403 V</td>
</tr>
<tr>
<td>THDv</td>
<td>1.3%</td>
</tr>
<tr>
<td>THDv</td>
<td>1.6%</td>
</tr>
<tr>
<td>THDv</td>
<td>1.8%</td>
</tr>
<tr>
<td>Ia</td>
<td>128 A</td>
</tr>
<tr>
<td>Ib</td>
<td>125 A</td>
</tr>
<tr>
<td>Ic</td>
<td>128 A</td>
</tr>
<tr>
<td>THDi</td>
<td>82.1%</td>
</tr>
<tr>
<td>THDi</td>
<td>84.2%</td>
</tr>
<tr>
<td>THDi</td>
<td>81.7%</td>
</tr>
<tr>
<td>In</td>
<td>216 A</td>
</tr>
</tbody>
</table>
User Friendly

- LCD Control & Display Panel (Optional)
  Waveform -

![Waveform View](http://www.ablerex.com.tw)

WINDOW 1 = Ia(S)
rms = 99 A
THDi = 6.3%

WINDOW 2 = Ia(L)
rms = 128 A
THDi = 82.1%
User Friendly

- LCD Control & Display Panel (Optional)
- Spectrum -

SPECTRUM_VIEW

VIEW=Ia(L)

H05 = 39.2%
THD = 82.1%
Freq = 50.1Hz
Communication

- 2 Communication Slots
  - Standard –
  - RS232 and USB in slot 1
  - 5 Output Dry Contacts
  - 1 Input Dry Contact
  - EPO
2 Communication Slots
Optional in slot 2
- RS485/422 (JBUS/MOD BUS)
- Ethernet Card
Before Enersine turn on

The system voltage has serious distortion due to harmonic current.
Eliminate Harmonic

- After Enersine turn on
- Enersine APF not only eliminate harmonic current but also improve voltage distortion.

V & Ir while Enersine on
THDV=3.1%, THDlr=30.0%

V & Is while Enersine on
THDIs=2.5%
**Improve Power Factor**

- Single-phase Rectifier Application

Enersine ESD34 not only eliminate harmonic current but also improve power factor.

**Before Enersine on**

![Graph showing voltage vs load current with THDi=51.89% and PF=0.77](http://www.ablerex.com.tw)
Improve Power Factor

- Single-phase Rectifier Application

Enersine ESD34 not only eliminate harmonic current but also improve power factor.

After Enersine on

Voltage vs Source Current

THDi=4.31%
Pf=1.0
Balance 3 phase

- Three Phase Unbalance System Before Enersine Turn On

Utility Voltage

Phase R Current

Phase S Current

Phase T Current

rms(1) 230.0 V
rms(2) 38.2 V
rms(3) 13.6 V
rms(4) 24.3 V
Three Phase Unbalance System
After Enersine Turn On, three phase current is balanced.

Utility Voltage

Phase R Current

Phase S Current

Phase T Current

rms(1) 230.9 V
rms(2) 20.9 V
rms(3) 20.2 V
rms(4) 21.1 V
Eliminate N – line Current

- Three Phase Unbalance System
  After Enersine Turn On, Neutral Line Current is canceled.

![Graph showing Utility Voltage, Load Neutral Current, APF Neutral Current, and Source Neutral Current.](http://www.ablerex.com.tw)
### General Characteristics

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment Storage Temperature</strong></td>
<td>-20°C to +70°C</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>+0°C to +40°C</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>&lt;95%</td>
</tr>
<tr>
<td><strong>Operating Altitude</strong></td>
<td>&lt;1000 m</td>
</tr>
<tr>
<td><strong>Reference Harmonic Standard</strong></td>
<td>EN61000-3-4, IEEE 519-1992</td>
</tr>
<tr>
<td><strong>Reference Design Standard</strong></td>
<td>EN60146</td>
</tr>
<tr>
<td><strong>Safety Standard</strong></td>
<td>EN50178; UL508</td>
</tr>
<tr>
<td><strong>Electromagnetic Compatibility</strong></td>
<td>IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6</td>
</tr>
</tbody>
</table>
## Specifications

### Power Module

<table>
<thead>
<tr>
<th>Specification</th>
<th>400V +15%, -20%</th>
<th>480V +10%, -20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>400V +15%, -20%</td>
<td>480V +10%, -20%</td>
</tr>
<tr>
<td>Phase/Wires</td>
<td>3 phase 4 wires/3 wires</td>
<td>3 phase 3 wires</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 ± 3 Hz</td>
<td></td>
</tr>
<tr>
<td>Maximum Compensation Current/Phase</td>
<td>35 Arms</td>
<td></td>
</tr>
<tr>
<td>De-rating Compensation Current/Phase (1)</td>
<td>30 Arms</td>
<td></td>
</tr>
<tr>
<td>Maximum Compensation Current of Neutral</td>
<td>105 Arms</td>
<td>N/A</td>
</tr>
<tr>
<td>Inrush Current</td>
<td>Less than rated current</td>
<td></td>
</tr>
<tr>
<td>Current Limitation</td>
<td>Yes, at full correcting</td>
<td></td>
</tr>
<tr>
<td>Maximum Heat losses</td>
<td>650 Watt</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>RAL9011(PANTONE Process Black C)</td>
<td></td>
</tr>
<tr>
<td>Protection Index</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Dimensions (WxDxH)</td>
<td>440 x 710 x 131mm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>31 Kg</td>
<td></td>
</tr>
</tbody>
</table>

(1) When 2 and above Power Modules work in power scalable configuration, the power module will downgrade automatically from 35A to 30A. It means 60A/90A/120A, while 2/3/4 power modules connecting in parallel.
## Specifications

### Control Module

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Voltage</strong></td>
<td>400V ±15%, -20%</td>
</tr>
<tr>
<td></td>
<td>480V ±10%, -20%</td>
</tr>
<tr>
<td><strong>Phase/Wires</strong></td>
<td>3 phase 4 wires/3 wires</td>
</tr>
<tr>
<td></td>
<td>3 phase 3 wires</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>50/60±3 Hz (Auto Sensing)</td>
</tr>
<tr>
<td><strong>Compensated Harmonic Orders</strong></td>
<td>From 2nd to 51st order. Up to 12 orders active simultaneously (2nd <del>31st). Higher Order Compensation (32nd</del>51st) Disable/Enable operation.</td>
</tr>
<tr>
<td><strong>Power Factor Correction</strong></td>
<td>Compensate both lagging and leading reactive power.</td>
</tr>
<tr>
<td></td>
<td>Power factor can be programmed from 0.7 lagging to 0.7 leading.</td>
</tr>
<tr>
<td><strong>CT Ratio</strong></td>
<td>Can be set.</td>
</tr>
<tr>
<td></td>
<td>Primary Current: 100A~10000A</td>
</tr>
<tr>
<td></td>
<td>Secondary Current: 1A(Standard)/5A (Optional)</td>
</tr>
<tr>
<td><strong>CT Location</strong></td>
<td>Source Side: Close Loop Control</td>
</tr>
<tr>
<td></td>
<td>Load Side: Open Loop Control</td>
</tr>
<tr>
<td><strong>Response Time</strong></td>
<td>&lt; 20 ms</td>
</tr>
<tr>
<td><strong>Number of controllable Power Module</strong></td>
<td>Up to 4 Power Modules.</td>
</tr>
<tr>
<td><strong>Parallel</strong></td>
<td>Up to 8 Control Modules.</td>
</tr>
<tr>
<td><strong>Maximum Heat losses</strong></td>
<td>50 Watt</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>RAL9011 (PANTONE Process Black C)</td>
</tr>
<tr>
<td><strong>Protection Index</strong></td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Dimensions (WxDxH)</strong></td>
<td>440 x 710 x 86mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>14 Kg</td>
</tr>
</tbody>
</table>
## Specifications

### Communication

| Dry Contact (Standard) | 5 Output Dry Contacts  
| 1 Input Dry Contact  
| 1 EPO |
| Communication | Standards: RS232/USB  
| Options: RS485/422  
| Ethernet Card |
| Programming | Setting by LCD Panel, Software |
| Software | **ESD-Link34 Monitoring Software (Option)**  
| **Enersine ESD34 Expert Service Program** |
| Communication Protocol | J-Bus / Mod Bus |
Let’s Create a Powerful Future