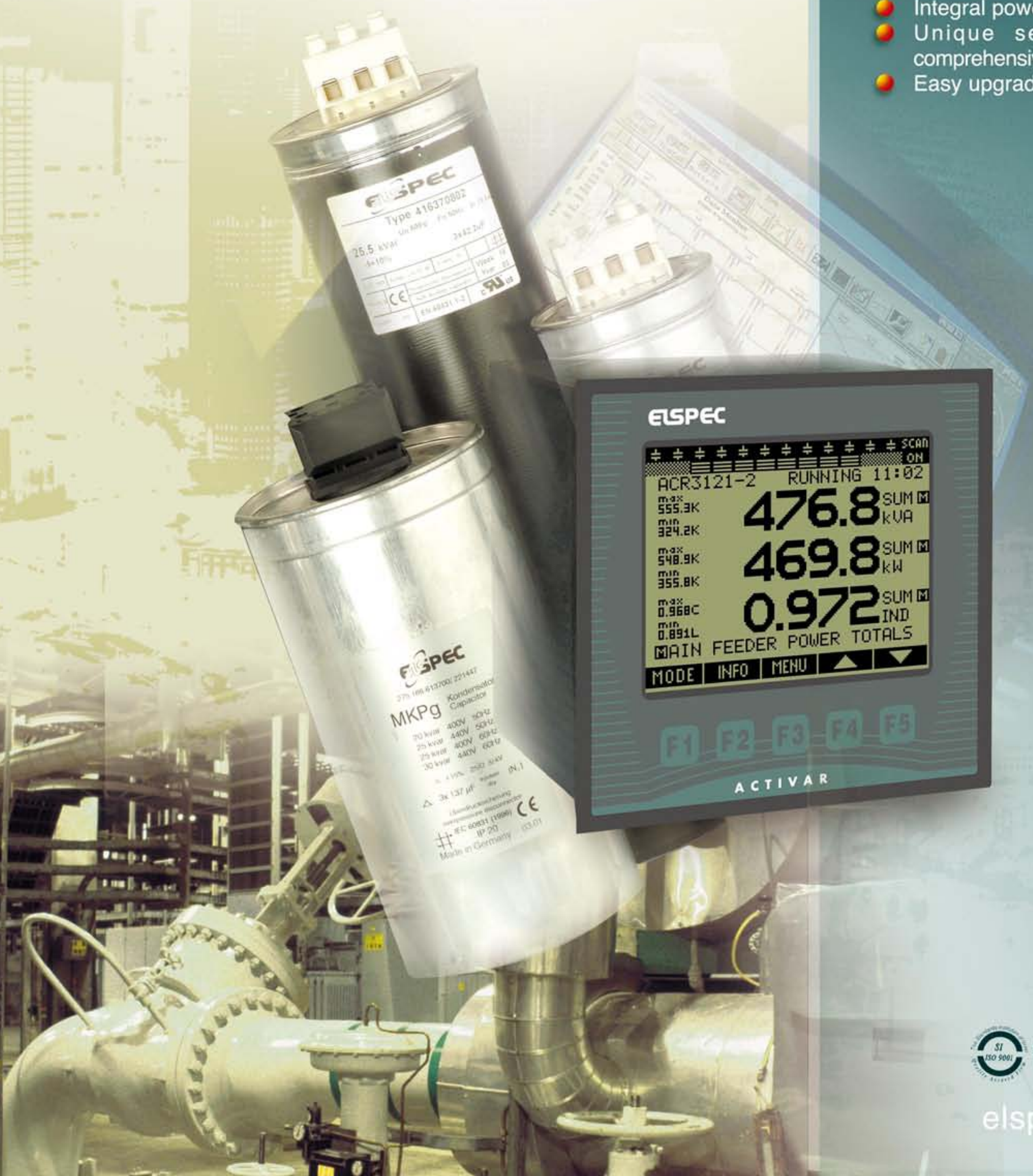
ACTIVAR

Fast compensation (1 second typical, 3-4 seconds maximum), unlimited number of transient-free operations.
Low-cost state-of-the-art alternative for replacing electro-mechanical power factor solutions

Power Quality Solutions

ELSPEC

- Transient-Free switching
- Prevents damage to sensitive electronic equipment
- Saves energy
- Harmonic filtration
- Accurate power factor control, even with harmonics present
- Extremely long life expectancy
- Considerably low temperature rise, due to unique SCAN mode
- Integral power quality analyzer
- Unique self-testing and comprehensive reporting feature
- Easy upgrade to the Equalizer



elspec-ltd.com

Comparison Between Elspec ACTIVAR and Electromechanically-Switched Capacitors

Fast and Accurate Compensation
The ACTIVAR achieves full compensation in 1 second typical (3-4 seconds maximum). The compensation is based on averaging the FFT analysis of each cycle, resulting in more accurate compensation, even with the presence of harmonics.

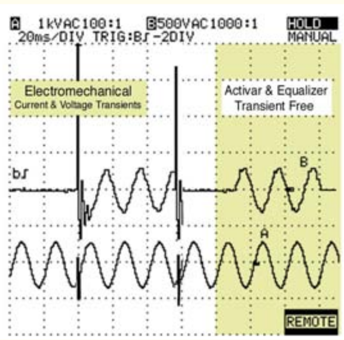
Slow Compensation Time
Due to technology limitations, electromechanical switching has slow compensation time. Connecting 1 step in 10 - 30 seconds, and complete compensation can take several minutes.

Simultaneous Group Connection
When load changes require connection or disconnection of more than one step, the ACTIVAR controls the switching of as many steps as required at precisely the same time. Simultaneous connection or disconnection provides the following benefits:
- Faster full compensation
- For example, a 1:2:2 system configuration and groups 1&2 are connected. When 1 more step is required, group 3 will be connected simultaneously while group 1 is disconnected.
- Real binary sizing – 1:2:2 is exactly the same as 1:1:1:1:1

Single-Step Connection
A significant time period elapses between connection or disconnection of a step. As a result, the performance of the compensation system is reduced due to the following:
- Slower compensation, especially when more than one step is required
- For example, a 1:2:2 system configuration and groups 1&2 are connected. When 1 more step is required, group 3 will be connected long after group 1 is disconnected.
- Binary sizing affects performance

Transient-free Switching
Electronic switching technology prevents any transients typically associated with conventional capacitor switching. This is extremely important in sites with sensitive electronic equipment, such as hospitals, data centers and facilities.

Fixed Capacity and Filter Characteristics
The capacity of the ACTIVAR capacitors is virtually permanent over the years, which prevents the need to replace capacitors. Moreover, the tuning frequency remains constant over time, which allows system performance to remain at the highest possible level.

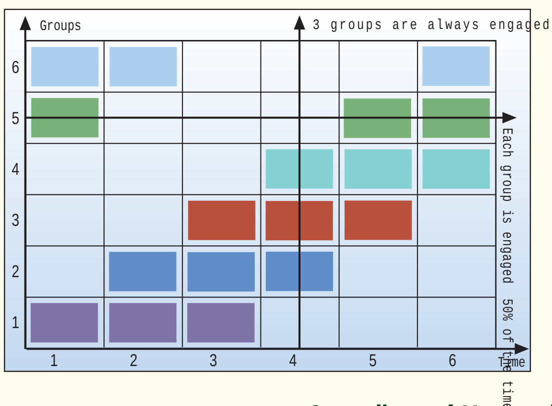


Transients
Contactor-based switching causes significant current and voltage transients. These spikes can cause severe electrical damage, and is one of the leading causes of power supply failure.

Capacity Drop and Filter Variance
The capacity degrades over time and may require replacement of capacitors. Further, the (de-)tuned filters dependent on capacitor-to-inductor ratings. As the capacitors degrades over time, the (de-)tuning frequency will change, and may create a resonance condition, even though the original system included harmonic inductors.

Long Life and Reduced Maintenance Costs
Elspec ACTIVAR reduces site maintenance costs by increasing the lifetime of:
- Switching elements
- Capacitors
- Sensitive electronic equipment

Capacitor Duty Cycle - SCAN Mode
The unique SCAN feature protects the ACTIVAR's capacitors, reduces their average current and temperature and extends their life. Simultaneous connection and disconnection of steps in FIFO (First In First Out) manner is shown on the right.



Limited Life and High Maintenance Costs
Contactors have a finite and limited life, and therefore need to be replaced frequently. Transients caused by contactor switching and capacity degradation over time requires repetitive equipment failures and expensive replacements.

Unequal Duty Cycle
Groups in most conventional systems are engaged dependent on the actual load, but are not equally utilized. The first step generally gets the most usage and is the first to fail due to its high duty cycle compared to the other steps.

Easy to Use and Maintain
The advanced DSP and microprocessor-based controller, with its large full graphic LCD display, provides easy-to-use operation. The controller includes a complete electrical measurement system, which can replace a facilities' main monitoring meter. The controller operates the BIT (Built In Test), which reports system or network conditions. The optional PowerIQ software can remotely control all ACTIVAR operation and display additional system power information.

Complicated Use and Maintenance
Electromechanical controllers normally require dip-switch programming and/or hard-to-follow programming manuals. Small display monitoring (or none at all) makes it very difficult to examine system performance. Usually, an additional meter is required to check the network power parameters. The option for remote communication and control does not exist.

Low-cost Solution
The initial cost of the ACTIVAR system is slightly higher than traditional electro-mechanically-switched solutions. However, when the costs of operating and maintaining a traditional system (contactor and capacitor replacements and/or possible equipment damage) are added, the ACTIVAR's overall costs are far less than an electro-mechanical system.

Low-cost Solution
The initial cost of an electro-mechanical system quickly changes due do the component replacement and repair. When evaluating electromechanical switching over a period of time, the actual costs and indirect losses become much higher than the initial investment.

Harmonics Filtration

Harmonics pollution increasingly becomes a dominant power quality problem, mainly due to modern loads. Coping with this issue using capacitor bank has two alternatives:

De-tuned Systems

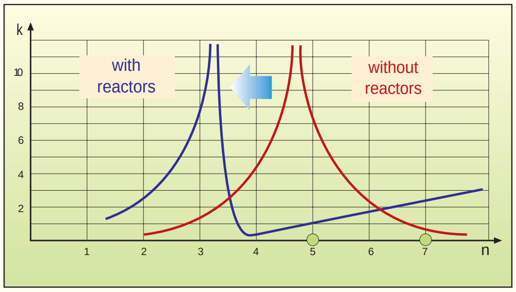
In de-tuned systems, reactors are installed in series with the capacitors and prevent resonance conditions by shifting the capacitor/network resonance frequency below the first dominant harmonic (usually the 5th). The top graph on the right shows the capacitor/network amplification factor and the shifting of the resonance frequency from near the 5th harmony to near the 3rd harmony.

Tuned Systems

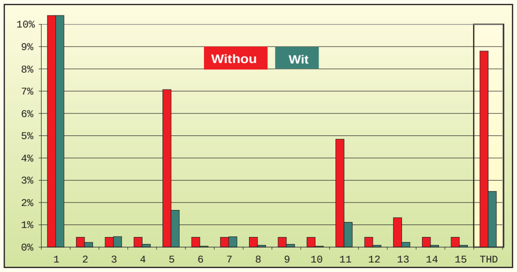
If harmonic filtration is needed, on top of resonance prevention, tuned reactors are applied. The capacitor/reactor filter is tuned to absorb particular harmonics and reduce the Total Harmonic Distortion (THD). The bottom graph on the right shows harmonic filtration using tuned system: the voltage THD was reduced by more than 70% (8.8% to 2.5%) and the dominant harmonics (5th and 11th) were reduced by 75%.

Tuned ACTIVAR vs. Active Harmonic Filters

Active filters inject currents to the network in anti-phase to the harmonics. This technology is an expensive solution, and increases system losses (3% typical). For applications with one or two dominant harmonics, Elspec's tuned ACTIVAR is the preferred choice, both technically and economically, effectively minimizing system losses and reducing the THD.



Shifting resonance frequency below the 5th harmonic



Voltage Harmonic Filtration Example

Applications

The ACTIVAR is the ideal solution for all slow to medium-speed power factor compensation. For fast and ultra-fast applications where the load changes in fractions of seconds, the Elspec EQUALIZER is the right solution.

The following applications dramatically benefit from the ACTIVAR:

Hospitals and Other Medical Centers

Medical equipment includes some of the most sensitive apparatus available. Electromechanical switching transients can cause equipment failure, which may result in serious consequences. The ACTIVAR's transient-free switching, together with its harmonic filtration capabilities, is the only solution for power factor correction at hospitals and other medical centers.

Data Centers

High availability is the requirement of data centers. Due to the large volume of computers, UPS systems and other communications equipment, data centers have very high harmonic pollution and are extremely sensitive to transients. In order to meet the high availability requirements, data centers use the ACTIVAR transient-free compensation systems with harmonic filtration.

Extrusion

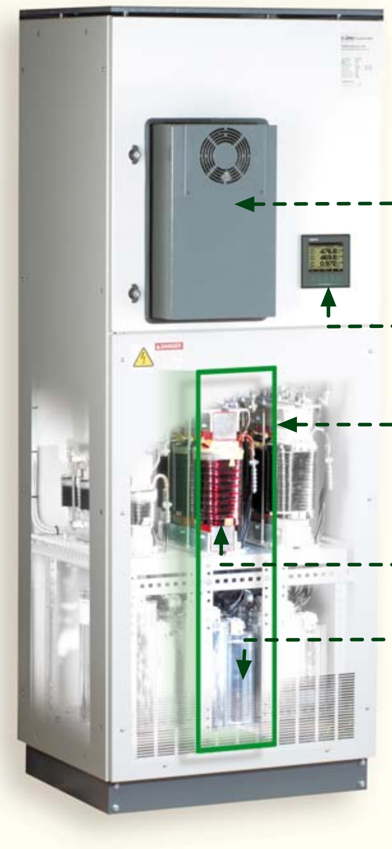
Extruders create a tremendous amount of harmonics. The harmonics cause energy losses, overheating and may sometimes lead to fire. Using tuned or detuned ACTIVAR systems, customers can reduce the harmonic pollution (THD – Total Harmonic Distortion). Decreasing THD both saves energy and prevents potentially dangerous resonance conditions.

Office Buildings

Office buildings incorporate a significant amount of high harmonic polluting apparatus, including computers, fluorescent lighting and modern elevators. Filtering harmonics saves energy and reduces electrical bills. Using an ACTIVAR system with harmonic filtration assures long life and high performance.

Other Industrial Loads

Elspec ACTIVAR solutions are successfully installed in thousands of sites with other applications, that due to space limitation were not described in this catalog. Medium to large factories, regardless of their specific application, will benefit from installing the Elspec ACTIVAR. The advantages for industrial loads are energy saving, harmonic filtration and more. Please contact Elspec authorized engineers for specific application requirements.



System Structure

See the Elspec Equalizer catalog for more details

Switching Module
Solid state, transient free switching module for 3 capacitor groups.

Controller
The brain of the system, includes DSP and VLSI components

Capacitor / Reactor Module
Modular design, designed for ultra high-reliability

Inductors
Class H insulation and exceptionally low temperature rise (ΔT)

Capacitors
Low loss MKP type with self-healing in a cylindrical aluminum case

Power Quality Solutions

Complete System Ordering Information

System Type	Total Power		Step Size		No. of Groups		Nominal Voltage		Nominal Frequency		Reactors Percentage		Network Typology	Group Protection	Cable Connection	Cable Entry
AR	1440	:	120	:	12	-	400	.	50	-	P7	-	W	F	C	A

System Type	AR	Activar Complete System
Total Power		Total power in kVAr
Step Size		Step size in kVAr (Switching Resolution)
No. of Groups		Number of Groups (Physical, max. 12)
Nominal Voltage		Nominal Phase-to-Phase Voltage in Volts
Nominal Frequency		Nominal Frequency in Hz (50 or 60 Hz)
Reactors Percentage	P0	Inrush Limiting Reactors Only
	P#	Percents of Capacity. Example: P7 = 7%.
Network Typology	D	Delta 3 wires
	W	Wye 4 wires
	V	Wye 3 wires
	S	Single phase
Group Protection	F	Groups protected by Fuses
	M	Groups protected by MCCBs
Cable Connection	C	Single Point with Integral Circuit Breaker
	S	Single Connection Point
	M	Multiple Connection Points
Cable Entry	T	Top Cable Entry
	B	Bottom Cable Entry
	A	Top and Bottom Cable Entry
	L	Left-side Cable Entry
	R	Right-side Cable Entry

Example:
AR 300:60:3-400.50-P7-WFSA
300kVAr transient-free complete Activar system with 5 steps of 60 kVAr with 7% inductors, for 400V/50Hz 4-wires Wye network.
Dimensions (W*D*H): 800*600*2100, Short Circuit 35kA, IP 20

Controller Ordering Information

Controller Type	Measurement Level	No. of Groups	Communication Card		Power Supply	Special Type
ACR	3	12	2	-	2	UT

Controller Type	ACR	Activar Controller
Measurement Level	1	
	2	
	3	
No. of Groups		Number of Groups (Physical, two digits, max. 12)
Communication Card	0	No Communication
	1	RS 485 ELCOM Protocol
	2	RS 485 ELCOM and MODBUS/RTU Protocols
Power Supply	1	115V
	2	230V
Special Type		See Controller section on Equalizer catalog Up to two types can be combined

Specifications

Rated Voltage:
Low voltage systems:
220 V - 690 V
50 or 60 Hz
Single phase or three-phase

Medium voltage systems:
up to 69 kV
50 or 60Hz

Ambient Temperature:
+ 40˚C: max (< 8 hours)
+ 35˚C: max 24 hr aver.
+ 20˚C: yearly average
- 10˚C: minimum

Capacitors:
Low loss, self healing
IEC 831-1/2

Protection class:
IP 20 / NEMA 1
(Other on request)

Controller Display:
5” Graphic LCD
160*128 pixels
High visibility (FSTN)
Durable LED Backlight

Design:
Steel sheet cabinet

Enclosure Finish:
Epoxy powder coated
Gray (RAL 7032)

Internal parts:
Rust-proof

EMC Standards:
EN 50081-2, EN 50082-2
EN 55011,
EN 61000-4-2/3/4/5,
ENV 50204, ENV 50141

Safety Standards:
EN 61010-1, EN 60439-1
UL 508 (on request)

Measured Parameters

Parameter	Phases	Loads	Measurement Level 1	2	3
Frequency	Common	Mains	£	£	£
Phase Current	L1, L2, L3	Mains,Load,Cap.	£	£	£
Neutral Current	Neutral	Mains	£	£	£
Phase to Phase Current*	L1-2, L2-3, L3-1	Mains , Load	£	£	£
Phase Voltage	L1, L2, L3	Mains	£	£	£
Neutral Voltage	Neutral	Mains	£	£	£
Phase to Phase Voltage	L1-2, L2-3, L3-1	Mains	£	£	£
Active Power (kW)	L1, L2, L3, Total	Mains	£	£	£
Reactive Power (kVAr)	L1, L2, L3, Total	Mains,Load,Cap.	£	£	£
Apparent Power (kVA)	L1, L2, L3, Total	Mains,Load,Cap.	£	£	£
Power Factor	L1, L2, L3, Total	Mains,Load,Cap.	£	£	£
Time of use (TOU) - in, out, net, total:					
Active Energy (kWh)	Total	Mains		£	£
Reactive Energy (kVARh)	Total	Mains		£	£
THD at Phase Current	L1, L2, L3	Mains,Load,Cap.		£	£
THD at Neutral Current	Neutral	Mains		£	£
THD at Phase to Phase Current	L1-2, L2-3, L3-1	Mains , Load		£	£
THD at Phase Voltage	L1, L2, L3	Mains		£	£
THD at Neutral Voltage	Neutral	Mains		£	£
THD at Phase to Phase Voltage	L1-2, L2-3, L3-1	Mains		£	£
Harmonics of Phase Current	L1, L2, L3	Mains,Load,Cap.			£
Harmonics of Neutral Current	Neutral	Mains			£
Harmonics of Phase to Phase Current	L1-2, L2-3, L3-1	Mains , Load			£
Harmonics of Phase Voltage	L1, L2, L3	Mains			£
Harmonics of Neutral Voltage	Neutral	Mains			£
Harmonics of Phase to Phase Voltage	L1-2, L2-3, L3-1	Mains			£
Waveforms of Phase Current	L1, L2, L3	Mains,Load,Cap.			£
Waveforms of Neutral Current	Neutral	Mains			£
Waveforms of Phase to Phase Current	L1-2, L2-3, L3-1	Mains			£
Waveforms of Phase Voltage	L1, L2, L3	Mains			£
Waveforms of Neutral Voltage	Neutral	Mains			£
Waveforms of Phase to Phase Voltage	L1-2, L2-3, L3-1	Mains			£
System Log			£	£	£
Event Log			£	£	£

* Unique feature: metering internal current of feeder transformer (delta secondary)

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