



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

- 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



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elspec-ltd.com

Espec ACTIVAR

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.

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

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.

Long Life and Reduced Maintenance Costs

Espec 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.

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.

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.



Electromechanically-Switched Capacitors

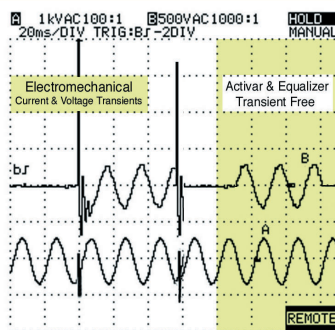
Slow Compensation Time

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

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



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.

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

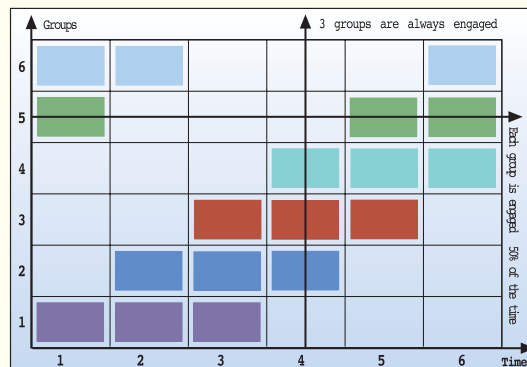
Groups in most conventional systems are engaged dependent on the actual load, but are not equally utilized. The first step generally gets the most usage and is the first to fail due to its high duty cycle compared to the other steps.

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 an electro-mechanical system quickly changes due to 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.

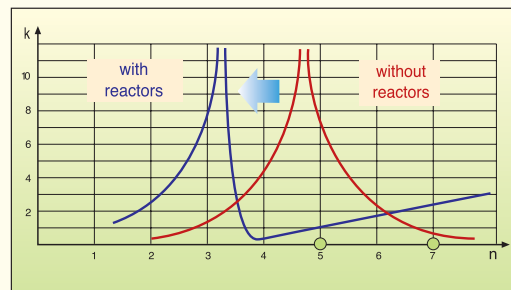


Harmonics Filtration

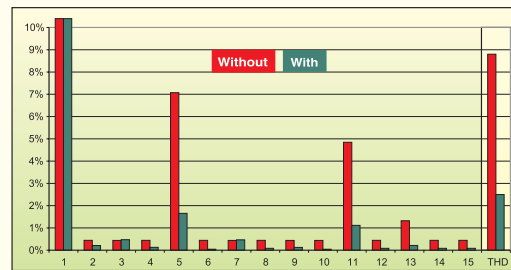
Utilities generate an almost perfect sinusoidal voltage. Harmonics, created by nonlinear loads such as variable speed drives, power rectifiers, inverters etc., cause nonlinear voltage drops and change the sinusoidal nature of the voltage. When reactive energy is compensated using capacitors, there is a frequency at which the capacitors are in parallel resonance with the power source (high impedance). If the resonant frequency occurs in proximity to one of the harmonic sources, current can circulate between the supply and the capacitors, resulting in high voltage on the line. In this scenario, current levels may exceed the capacitor's rated current by more than two or three times, and can cause transformer burn. Resonance can occur at any frequency, however in most cases, current harmonic sources exist at the 5th, 7th, 11th, and 13th harmonic. The Activar's custom-designed reactors, used in series with the capacitors, prevent resonance by shifting the capacitor/network resonance frequency below the first dominant harmonic (usually 5th).

Tuned Activar vs. Active Harmonic Filters

Active filters connect power to the network with an amplitude opposite that of the harmonics. Active filter technology is an expensive solution, and inherently increases system losses. In applications having one or two dominant harmonics, a harmonic tuned Elspec Activar is the right technical and economic choice, effectively minimizing system losses and reducing overall THD (Total Harmonic Distortion).



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

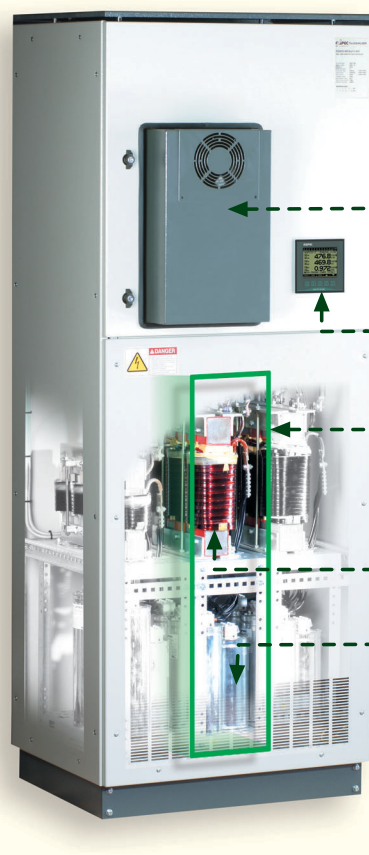
Extruders create a tremendous amount of harmonics. The harmonics cause energy losses, overheating and may sometimes lead to fire. Using tuned or detuned ACTIVAR systems, customers can reduce the harmonic pollution (THD – Total Harmonic Distortion). Decreasing THD both saves energy and prevents potentially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





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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 P#	Inrush Limiting Reactors Only Percents of Capacity. Example: P7 = 7%.
Network Typology	D W V S	Delta 3 wires Wye 4 wires Wye 3 wires Single phase
Group Protection	F M	Groups protected by Fuses Groups protected by MCCBs
Cable Connection	C S M	Single Point with Integral Circuit Breaker Single Connection Point Multiple Connection Points
Cable Entry	T B A L R	Top Cable Entry Bottom Cable Entry Top and Bottom Cable Entry Left-side Cable Entry Right-side Cable Entry

Example:
AR 300:60:3-400.50-P7-FWSA
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 1 2	No Communication RS 485 ELCOM Protocol RS 485 ELCOM and MODBUS/RTU Protocols
Power Supply	1 2	115V 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 alu-zinc

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)