



Altivar Process & AccuSine+ Offers

Schneider Electric's Low Harmonic Emission Solutions

This document discusses two of Schneider Electric's solutions capable of achieving total harmonic distortion in current of 5% or less in a low voltage electrical network. An end user can choose an Active Front End (AFE) Variable Frequency Drive (VFD) as a standalone device or a system solution where an Active Harmonic Filter (AHF) is used in combination with one or multiple standard 6 pulse VFDs. Both solutions are often used to achieve very low harmonic current emission in an electrical network. Figure 1 shows various harmonic mitigating methods with the level of harmonic distortion in current that can be expected for any given solution.

VFD with...			VFD with Multi-pulse supply			VFD with Active Harmonic Filter	Active Front End VFD
No Filter	3% Input Impedance	Notch Passive Filter	12-p	18-p	24-p		
					<5% THDi	3% to 5% THDi	2% to 3.5% THDi
		10...20% THDi	12...15% THDi	5...8% THDi			
		30...40% THDi					
90%-120% THDi							

Figure 1 THDi levels achieved with various harmonic mitigation methods

Can you afford poor Power Quality?

Poor power quality has negative consequences at the business level, causing 30-40% of business downtime*. Traditionally, utilities have penalized customers for poor Power Factor (PF). But given the negative impact that harmonics can have on a business, they have become stricter in terms of regulation. Harmonic compliance to IEEE 519 is no longer an option in various states.

*Electric Power & Light Study

“\$119B - \$188B

ESTIMATED LOSSES
DUE TO POWER
QUALITY PHENOMENA”

- ELECTRIC POWER RESEARCH INSTITUTE

- Only 20% of Power Quality Disturbances are caused by the grid
- The other 80% are created inside facilities

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Options for Harmonic Compliance

To achieve harmonic compliance, there are two options - an Active Front End (AFE) VFD as a standalone device or AccuSine PCS+ used in combination with one or multiple standard 6 pulse VFDs. Both solutions can achieve very low harmonic current emission in an electrical network. The charts below compare the options, with 1,3 and 5 identical units of VFDs ranging from 110kW to 500kW.

The analysis reviews the cost of ownership, the lineup footprint, the lineup weight and the power losses of each solution. The green color gives the advantage to the AFE VFD offer and the blue color gives the advantage to the standard VFD when combined with the AccuSine PCS+.

VFD Size (kW)	Cost of ownership	Footprint	Weight	System Losses (kW)
110	Green	Green	Green	Blue
132	Green	Green	Green	Blue
160	Green	Green	Green	Blue
200	Green	Green	Blue	Blue
250	Green	Green	Blue	Blue
315	Blue	Green	Blue	Blue
355	Blue	Green	Blue	Blue
400	Blue	Green	Blue	Blue
450	Blue	Green	Blue	Blue
500	Blue	Green	Blue	Blue

VFD Size (kW)	Cost of ownership	Footprint	Weight	System Losses (kW)
110	Blue	Green	Green	Blue
132	Blue	Blue	Green	Blue
160	Blue	Blue	Green	Blue
200	Blue	Blue	Green	Blue
250	Blue	Green	Green	Blue
315	Blue	Green	Blue	Blue
355	Blue	Blue	Blue	Blue
400	Blue	Blue	Blue	Blue
450	Blue	Blue	Blue	Blue
500	Blue	Green	Blue	Blue

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355	Blue	Blue	Blue	Blue
400	Blue	Blue	Blue	Blue
450	Blue	Blue	Blue	Blue
500	Blue	Blue	Blue	Blue

While the Active Front End (AFE) VFD has an advantage when only one drive is installed, a definitive advantage can be seen with the AccuSine PCS+ with standard 6-pulse VFDs (when multiple drives are operating on the same bus). The greatest benefits are reflected in the cost of ownership and power losses due to the optimization of two technologies.

AccuSine+ as the solution

AccuSine PCS+ is an active device capable of attaining a THDi < 5%. AccuSine+ is a static power electronic product that employs digital logic and IGBT semiconductors to synthesize a current waveform that is injected into the electrical network to cancel harmonic currents caused by nonlinear loads. AccuSine+ employs current transformers to measure the load current to determine the content of harmonic current present. By injecting the synthesized current, network harmonic currents are greatly mitigated, thus reducing the heating effects of harmonic current and reducing voltage distortion to permit other equipment to operate properly and enjoy a long product life span.

In addition, AccuSine+ can be configured for Power Factor and Mains Current Balancing. Unlike a conventional capacitor bank, AccuSine+ can provide leading (capacitive) or lagging (inductive) reactive power. Mains current balancing is achieved by measuring the negative sequence current present and injecting the inverse negative sequence current to balance the current for the upstream network.

How can you be PQ Ready?

AccuSine PCS+ can meet almost all PQ standards. It offers a centralized solution, regardless of the type of nonlinear load (VFDs, LEDs, SMPS, UPSs etc.). AccuSine+ is scalable and multiple modules can be connected in parallel.

Table: Sizing chart for AccuSine+ based on transformer utilization, harmonic distortion and power factor design recommendations*

Transformer Rating	Utilization (85%) in Amps	Utilization (85%) in KW	Utilization (85%) in KVA	ITHD Design Range	PF Design Range	AccuSine Amps	KVAR @ 480V	AccuSine Modules	AccuSine Reference	Feeder Breakers	Breaker Rating
3000	3067.26	2346.00	2550.00	28.55% - < 5%	0.8-0.95	1200	1000	4	PCSP300D5N2	2	800A
2500	2556.05	1955.00	2125.00	28.55% - < 5%	0.8-0.95	900	750	3	PCSP300D5N2	2	800A
2000	2044.84	1564.00	1700.00	28.55% - < 5%	0.8-0.95	900	750	3	PCSP300D5N2	2	800A
1500	1533.63	1173.00	1275.00	28.55% - < 5%	0.8-0.95	600	500	2	PCSP300D5N2	1	800A
1000	1022.42	782.00	850.00	28.55% - < 5%	0.8-0.95	400	332.6	2	PCSP200D5N2	2	250A
750	766.82	586.50	637.50	28.55% - < 5%	0.8-0.95	300	250	1	PCSP300D5N2	1	400A
500	511.21	391.00	425.00	28.55% - < 5%	0.8-0.95	200	166	2	PCSP200D5N2	1	250A

AccuSine+ ratings recommended would ensure compliance to local utility regulations on PF & Harmonics. PF > 0.95 & Harmonic Levels within IEEE 519 - 2014

The VFDs should have a minimum of 3% impedance.

*Results would vary if design parameters are altered. SE can help you size suitable active filters for your project's specific requirements.

AccuSine+ Catalog Numbers

End-to-end system solutions that leverage the latest technology of variable speed drives and active harmonics filtering range



Advantages of Altivar + AccuSine+

- **Cost effective:** One AccuSine PCS+ can mitigate harmonics of multiple VFDs.
- **Less losses** when multiple VFDs are involved, reducing operating costs over time.
- **Improved PQ** by simultaneously providing PF improvement, load balancing and harmonic mitigation.
- **Easy retrofit and increased continuity of service** because of the parallel installation (the drive operates even if AccuSine PCS+ is offline)

AccuSine PCS+ 380-480V, 50/60Hz					
Rated Current	kVAR Rating @ Voltage	Catalog Number	Enclosure Rating	Style	Cable Entry
60	39.5 @ 380V	PCSP060D5IP00 + PCSPWMKIT60A	UL Type 1	Wall mount	Bottom
	41.6 @ 400V	PCSP060D5N2	UL Type 2	Floor standing	Top or bottom
	43.1 @ 415V 49.9 @ 480V	PCSP060D5N12	UL Type 12		
120	79.0 @ 380V	PCSP120D5IP00 + PCSPWMKIT120A	UL Type 1	Wall mount	Bottom
	83.1 @ 400V	PCSP120D5N2	UL Type 2	Floor Standing	Top or bottom
	86.3 @ 415V 99.8 @ 480V	PCSP120D5N12	UL Type 12		
200	131.6 @ 380V	PCSP200D5IP00 + PCSWMKIT300A	UL Type 1	Wall mount	Bottom
	138.6 @ 400V	PCSP200D5N2	UL Type 2	Floor standing	Top or bottom
	143.8 @ 415V 166.3 @ 480V	PCSP200D5N12	UL Type 12		
300	197.5 @ 380V	PCSP300D5IP00 + PCSWMKIT300A	UL Type 1	Wall mount	Bottom
	207.8 @ 400V	PCSP300D5N1	UL Type 1	Floor Standing	Top or bottom
	215.6 @ 415V	PCSP300D5N2	UL Type 2		
	249.4 @ 480V	PCSP300D5N12	UL Type 12		

For additional information, refer to the AccuSine+ Catalog (Document Number 5820CT2001)

EcoStruxure Power

AccuSine+ and Altivar are part of the EcoStruxure Power platform of IoT-enabled solutions that drive operational and energy efficiency. EcoStruxure™ is Schneider Electric's open, interoperable, IoT-enabled system architecture and platform. It delivers enhanced value around safety, reliability, efficiency, sustainability, and connectivity for our customers. EcoStruxure leverages advancements in IoT, mobility, sensing, cloud, analytics, and cybersecurity to deliver innovation at every level including Connected Products, Edge Control, and Apps, Analytics & Services.



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Schneider Electric
 6700 Tower Circle
 Suite 700
 Franklin, TN 37067
 1-888-797-6468
www.se.com/us

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