LOGIK-VAR

DYNAMIC FAST SWITCHING SOLUTIONS ™

CORRECCIÓN DEL FACTOR DE POTENCIA
REACTIVE CURRENT SWITCH & POWER QUALITY

PASSIVE HARMONICS FILTER - ORDERING CODE
FILTROS DE ARMÓNICOS PASSIVOS - ORDEN DE ENSAMBLE

Serie/Type: LogiKvar™ Harmonics Filter
SKU/OrderCode: LkVAR-XX-XX-XX-XX-XX-XX **Ordering Code Dependent.*

Fecha/Date: Jan 2019
Version: 1.1.Rev.2

**UL Per Request Selected Models*

NOTES/Notas:

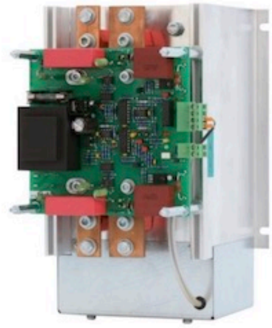
TurnKey System Ordering Info / Solución de Filtro LlaveMano:

Example Ordering Code: *Lkvar-2000-12-480-60-P-D-F-M-T-THY-M-NO*

System Type/Plataforma	Reactive Power/ kVAr	Numero de Pasos/ Groups	Voltage / Voltaje L-L	Freq. Nominal/ Hz	%Reactancia Group/ %Paso	Topologia/ Delta-Wye	Group Protection/Fu/MCB	Cable Connection/Aliment	Entrada Cables/Cable Entry	Thyriistor / Contactor Switch	Modbus Rs485 Port / Cloud™	UL® Compliant Yes / No
Lkvar-	-2000	-12	-480	-60	P1=5%	D-	F-	M-	T-	THY-	M-	No
Lkvar-												

Forme su Modelo/Form your Model

System Type / Plataforma	Lkvar-	Complete Turn Key Assembly - Sistema Llave en Mano
Reactive Power/ @kVAr	2000	75 - Hasta (Up to) 2,000 **kVAr** 480VAc 60Hz
Steps-Groups / Numero Pasos	12	6-12 Steps / Groups
Voltage / Voltaje L-L	480	Voltaje Linea-Linea (Nominal Phase To Phase Voltage)
Freq. Nominal/ Hz	60	Nominal Frequency 50 or 60 Hz
%Reactance Group/ %R Paso	P1-12=5%	P=Paso/Step ; P1=5%,P2=7%,P3=5%...P12=7% etc...
Electric Topology/ Conexión	D	**D**elta 3 Wire/Hilos ; **W**YE 4 Wire/Hilos
Group Protection Fuse / MCB	F	Step Proteccion (Protection) **F**=Fusibles/Fuses, **M**=MainCircuitBreaker
Cable Feed / Alimentación	M	M=MainBreaker(Studs/Zapatas) , D=DirectBus(Zapatas)
Entrada Cables/Cable Entry	T	T=Top(Techo), B=Bottom(piso), L=Left(izq.), R=Right(der.)
Thyrirstor / Contactor Switching	THY	Conmutación (Switching) **THY**=Thryristor **C**=Contactor
Modbus Rs485 / Cloud™	M	**N**one / **M**odbus Rs485 / **C**loud™
UL® Compliant: **Yes** / **No**	No	Built with UL Listed Components Only (**USA Only*)



LOGIK-VAR

A fast switch needs a fast controller

CM controllers with transistor outputs have
a real-time algorithm with approx. 1 ms reaction time after measurement.

All needed steps to reach the target cos phi are switched simultaneously.

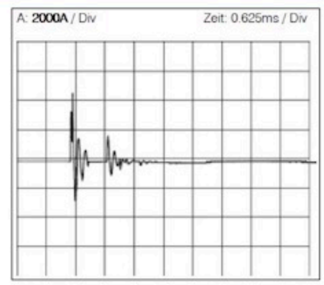
After measuring one cycle of mains voltage, the control deviation is calculated and all necessary steps are switched in one operation. The time from end of measuring to generation of the switching pulse is less 150µsec.

Switching on a 50 kvar capacitor with different switchgear (1)

- Switch-on of a 50 kvar capacitor in a non-choked system without pre-contacts:

→ Massive distortion of current sine wave with a current peak > 4000 A (nominal current peak Î = 101 A).

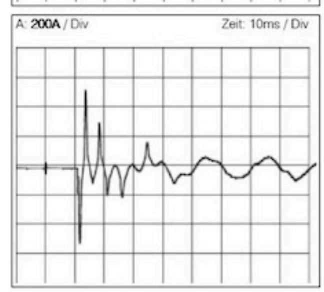
→ Data loss, major disturbances and damage of other components are possible



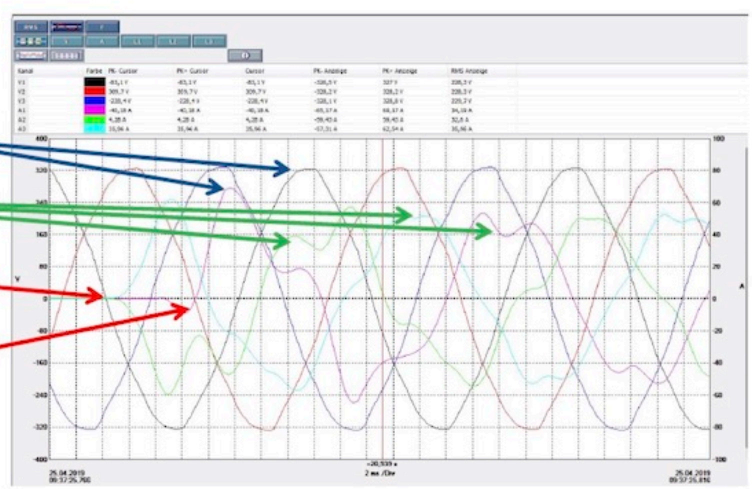
- Switch-on of a 50 kvar capacitor in a choked system without pre-contacts:

→ Significant distortion with a current peak > 500 A (nominal current peak Î = 101 A)

→ Data loss , major disturbances and damage of other components are possible



Switch-ON of a 25 kvar 3-phase capacitor by a thyristor switch:



Technical Data Thyristor Switch / Especificaciones Switch:

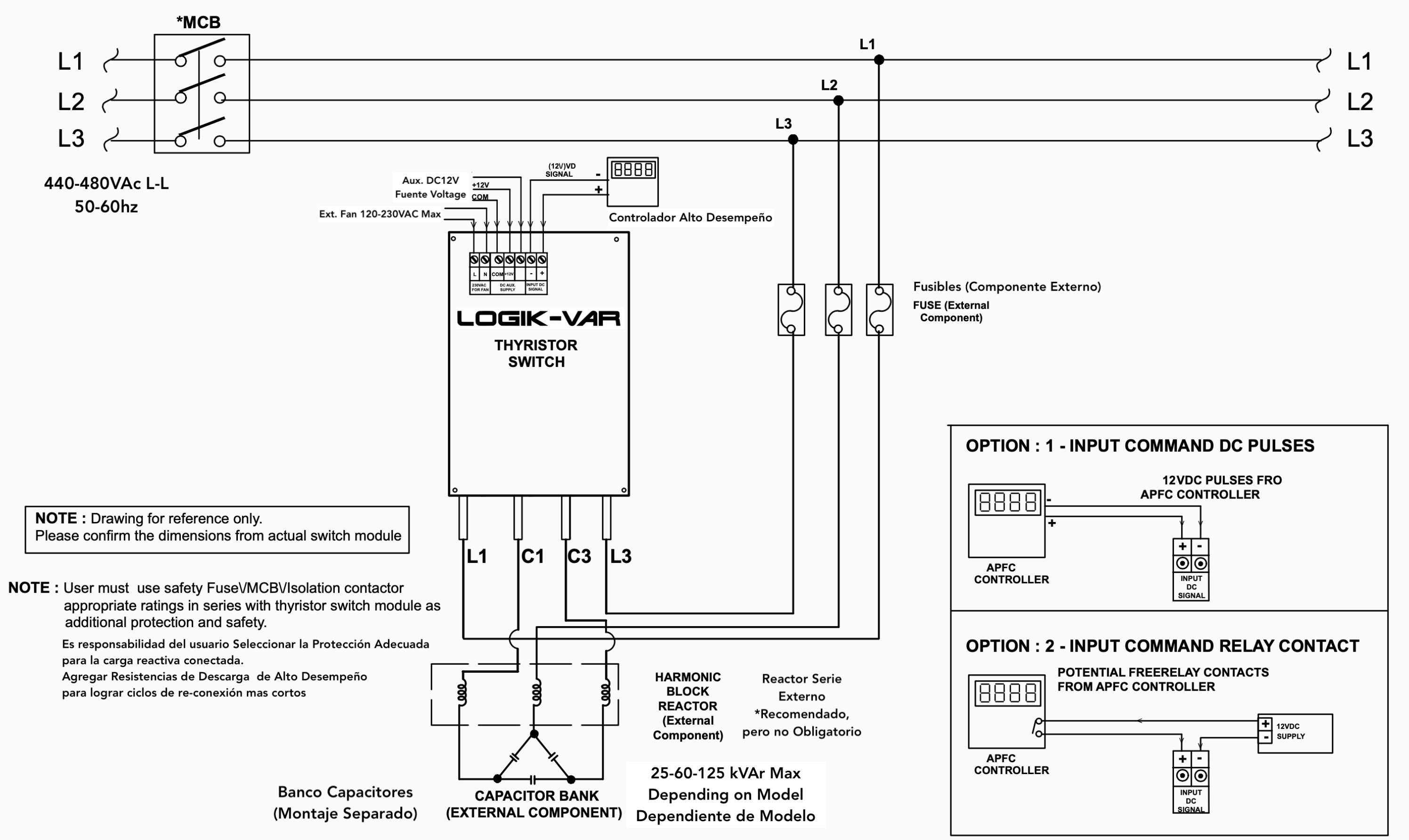
Voltaje Operación / Op.Voltage	380 - 480VAc L-L, 50-60Hz
Señal de Enc. Voltaje / Aux.Signal ON Voltage	12VDc
Carga Capacitiva Máxima / Max Capacitive Load	25 - 125kVAr 480VAc *Depending Model
Tiempo Respuesta / Activation Time	5-10ms Max
Señalizacion LED/ Display	3 Led ; SysOk , Signal ON, Fault
Modo de Operación / Monitoring	Microprocesado mediante Monitoreo de Voltaje y Corriente. Permanent monitoring of net voltage, real current, temperature and operation status. Before re-switching after temperature fault, heat sink temperature must be below 50 °C (hysteresis).
Consumo Potencia / Power Dissipation	35 - 150W Depending Model
Fusibles / Fuses Recomended	3x electronic fuse “superfast” **Ar** (NH00 AC 690 V)
Dimensiones / Dimensiones	20 x 20 x 25 cm (w x h x d)
Peso / Weight	5.3 kg ; 12lb
Montaje / Mounting Position	En Panel ; Vertical, Thru Panel Mounting.
Temperatura Ambiente / Ambient Temp. Operation	-10 -53 ºC Max ; 23 - 140ºF Max
SKU / Ordering Code + Option Codes:	**Ex:** FAR-TS3PLV48012VCD060UL+RTU+Cloud
FAR-TS3PLV48012VCD025	Model 25kvar 480VAc 60hz CE CCC Compliant
FAR-TS3PLV48012VCD060	Model 60kvar 480VAc 60hz CE CCC Compliant
FAR-TS3PLV48012VCD060UL	Model 60kvar 480VAc 60hz UL Recognized
FAR-TS3PLV48012VCD125UL	Model 125kvar 480VAc 60hz UL Recognized
Opciones Adicionales / Option Codes	
+ RTU	2-Wire RS458 Modbus Port
+ Cloud	Medicion/Alarmas Remota de sus Aportes Reactivos. On Demand Metering of each Individual Reactive Branch.
Controlador Estado Solido de 12 Pasos / 12 Step Ctrl	FAR-BK-SSR-12S-RTU

NOTE: The installation, maintenance and operation of Dynamic power Compensation switches shall be carried out by Relevant Professional Knowledge and Skill. Live voltages might be present. Always shut down Main Breaker before any operation/maintenance is executed. Determine whether the power supply system is consistent with your product nameplate. Do Not open the Shell or Remove Cover of Switches to prevent electric shock.
FAILURE TO FOLLOW CAUTIONS MAY RESULT, WORST CASE, IN PREMATURE FAILURES OR PHYSICAL INJURY.

Conexión Sugerida / Suggested Wiring Diagram

DRAWING FOR REFERENCE ONLY

Diagrama de Conexión / Wiring Diagram



BACKGROUND

Advantages of Thyristor switch module over conventional electro- mechanical contactor :

a) Since there is no mechanical contacts involved, no arcing and sparking takes place and no audible switching noise is produced

b) Due to zero cross over switching techniques, voltage transients can be controlled within the safe limits.

c) Using Logikvar Thyristor Switches it is possible to switch the capacitors at <100mS rate, thereby UNITY power factor can be maintained by fast corrections under frequent demand and supply of load variations. Whereas, contactors cannot be switched at the rate of solid state switch.

d) There are no limitations in number of switching operations for thyristor compared to contactor. Whereas contactors undergo wear and tear over a period.

e) These modules are safe to operate under the environment of maximum 60ºC @ 90% Relative Humidity – Non-Condensing.

Harmonic Filters are used to mitigate the power quality problem known as harmonic waveform distortion. Consequently, they minimize the thermal and electrical stress on the electrical infrastructure, eliminate the risk of harmonics-related reliability issues and allow for long-term energy efficiency and cost savings. Harmonic filters will play a vital role in ensuring a better power quality, especially now that most modern electrical devices are of the nonlinear type.

Harmonic filters can be broadly classified into two basic types:

1. Passive
2. Active
3. The so-called hybrid harmonic filter is merely a combination of the passive and active types.

Benefits and Functions

A harmonic filter provides the following benefits and performs these functions:

- Supplies connected loads with non-destructive current and voltage waveforms.
- Releases capacity by reducing losses caused by harmonics on lines and

transformers.

- Reduces triplen harmonics, which increase the current flowing through the neutral.
- Protects the electrical system by reducing overheating of equipment and/or fire hazards.
- Improves phase current and voltage balance.
- Improves the power factor of nonlinear loads.
- Compliance with the required total harmonic distortion (THD) and total demand distortion (TDD) limits set by international standards organizations such as IEEE and IEC.

Applications

Harmonic Filters are appropriate for electrical power distribution systems that supply significant amount of harmonic-producing loads. Some examples are given below:

Industrial - Adjustable Speed Drives, Arc Furnaces, Arc Welders and HVAC
Commercial - SMPS, UPS Systems, Medical Devices and Data Centers
Residential – Computer equipment, and electronic devices and appliances.

Selection

The selection of harmonic filters is practically based on the intended application and power quality objectives. Generally, the engineer or end-user must weigh the pros and cons of using either an active, passive or hybrid harmonic filter for a certain application. As usual, the decision will depend on the technical and economical aspects involved. Once the filter type is chosen, optimized sizing will follow. In sizing, for example, a passive filter may require the following data:

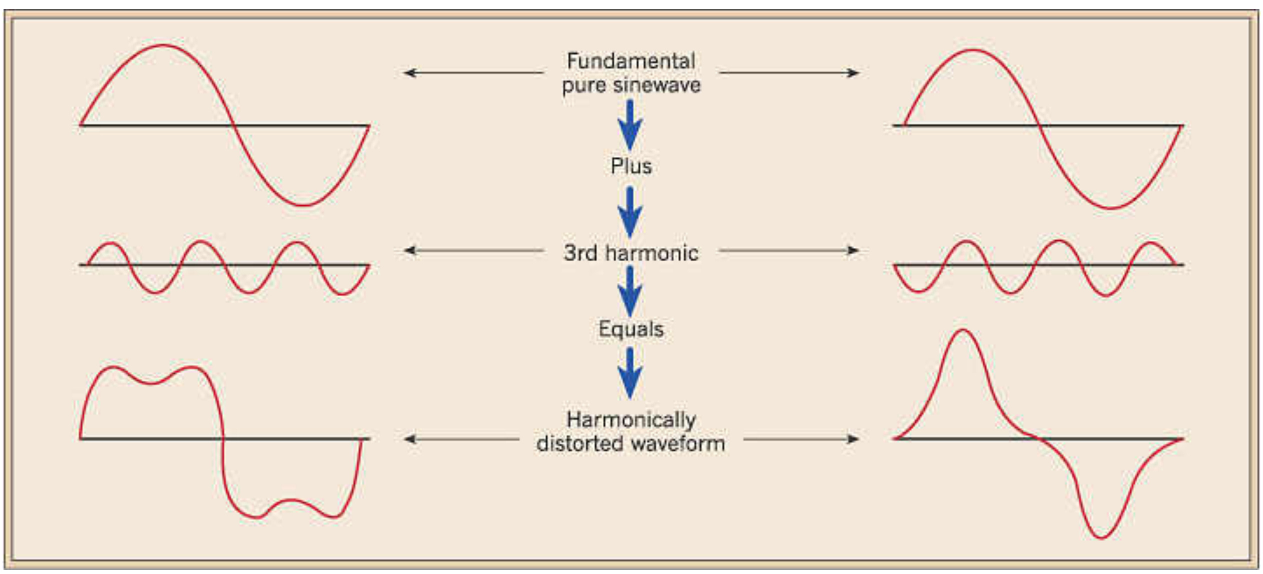
- Harmonic profile load current
- Fundamental load current
- Harmonic factor of the neutral current
- Detailed Power Quality Studies
- Configuration of the existing or proposed system

On the other hand, active harmonic filter (AHF) sizing depends primarily only on the nonlinear load requirement. In addition, the AHF is modular and relatively less extensive power quality studies are needed.

References:

IEEE 1531-2003. Guide for Application and Specification of Harmonic Filters
Thota, S. (2003). Harmonic Filters Overview – Part 1
URL powerqualityworld.com/2011/08/harmonic-filters-power-quality.html

Harmonics are described by IEEE as sinusoidal voltages or currents having frequencies that are integer multiples of the fundamental frequency at which the power system is designed to operate. This means that for a 60-Hz system, the harmonic frequencies are 120 Hz (2nd harmonic), 180 Hz (3rd harmonic) and so on. Harmonics combine with the fundamental voltage or current producing a non-sinusoidal shape, thus, a waveform distortion power quality problem. The non-sinusoidal shape corresponds to the sum of different sine waves with different magnitudes and phase angles, having frequencies that are multiples of the system frequency.



Harmonic distortion levels can be characterized by the complete harmonic spectrum with magnitudes and phase angles of each individual harmonic component. It is also common to use the Total Harmonic Distortion (THD), as a measure of the effective value of harmonic distortion. It has become an increasing concern for many end-users and for the overall power system because of the growing application of power electronics equipment. Protection from high levels of harmonics includes isolation or modification of the source, phase multiplication, pulse width modulator (PWM) and application of passive or active harmonic filters.

Causes

Harmonics exists due to the nonlinear characteristics loads and devices on the electrical power system. These devices can be modeled as current sources that inject harmonic currents into the electrical system. Consequently, voltage distortion is created as these currents produce nonlinear voltage drops across the system impedance.

Prior to the proliferation of power electronic equipment, harmonics are commonly caused by electric machines working above the knee of the magnetization curve (magnetic saturation), arc furnaces, welding machines, rectifiers, and DC brush motors. Today, all non-linear loads, such as power electronics equipment including Switched Mode Power Supplies (SMPS), Adjustable Speed Drives (ASD), high efficiency lighting and data processing equipment.

Consequences

Harmonics primarily result to significant overheating of equipment, cables and wires.
Other consequences of having a high harmonic level in the system include the following:

- Neutral overload in 3-phase systems
- Electromagnetic interference with communication systems
- Loss of efficiency in electric machines
- Increased probability in occurrence of resonance
- Nuisance tripping of thermal protections.
- Errors in measures when using average reading meters

Total Demand Distortion

Current distortion levels can be characterized by the total harmonic distortion, although sometimes this can be misleading. For example, many ASDs will display high THD values for the input current when they are operating at very light loads. Nonetheless, this is not alarming because the magnitude of harmonic current is low, even though its relative distortion is high.

As a result, the IEEE (Std 519) defines the Total Demand Distortion (TDD), in order to typify harmonic currents in a consistent manner. The TDD is the same as the total harmonic distortion except that the distortion is expressed as a percent of some rated load current rather than as a percentage of the fundamental current magnitude at the instant of measurement.

Synopsis:

Magnitude: 0 to 20% (typical)
Spectral Content: 0 to 100th Harmonic
Duration: Steady-state
Source: Nonlinear Devices (i.e. Power Electronics)
Symptoms: Malfunction and Overheating
Occurrence: Low to Medium
Protection: Harmonic Filters, K-Factor Transformers

References:
Almeida, A., Delgado J., and Moreira, L. (nd). Power Quality Problems and New Solutions
Dugan, R., McGranaghan, M., Santoso, S., and Beaty, H.W. (2004).
Electrical Power Systems Quality (2nd Ed.). New York: McGraw-Hill.
IEEE 1159-1995. Recommended Practice For Monitoring Electric Power Quality.
Utility Systems Technologies, Inc. (2009). Power Quality Basics
URL powerqualityworld.com/2011/07/harmonics-power-quality-basics.html