

# GINO-AKA

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Industrial Automation



SK – Liquid starters for Shredders  

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Product Data Catalogue

## 1 General Information

Liquid starters are commonly used for the startup of large wound rotor induction motors (WRIM) in a multitude of applications. In addition to the regular liquid starter portfolio GINO-AKA SAS specializes on custom made solutions for the shredder industry.

High power shredders are used predominantly in the sugar cane as well as the metal scrap recycling industry. With these shredders high density material is reduced to a more manageable size for further processing. During the shredding process the power draw is in direct dependency of the material input and can therefore vary significantly. In practical use this can lead to large power fluctuations and overcurrent appearing on the supply grid of the WRIM.

In contradiction to a classic liquid starter application such as on cement or mining mill drives, for shredders the LRS is used to counteract these overcurrent events by detecting and introducing a calculated resistance value into the rotor circuit of the WRIM.

The benefit of using such a dynamic controlled liquid starters are reduced energy consumption as well as protecting the mechanical and electrical components of the shredders drive train.

GINO-AKA SAS has designed a special liquid resistance starter for shredder applications to guarantee the highest performance for the demanding environment on shredder installations: The SK series.

In order to get the highest possible performance from a shredder LRS the speed of the slip regulation is of utmost importance. For this reason the SK series starters are equipped with the most sophisticated automation and measurement features as well as a closed loop control algorithm. In addition the unique mechanical construction that guarantees optimized temperature distribution and resistance variation.

The SKS Series starters can also be used for other applications that require unique starting profiles and speed control such as fans, pumps or motor test fields.

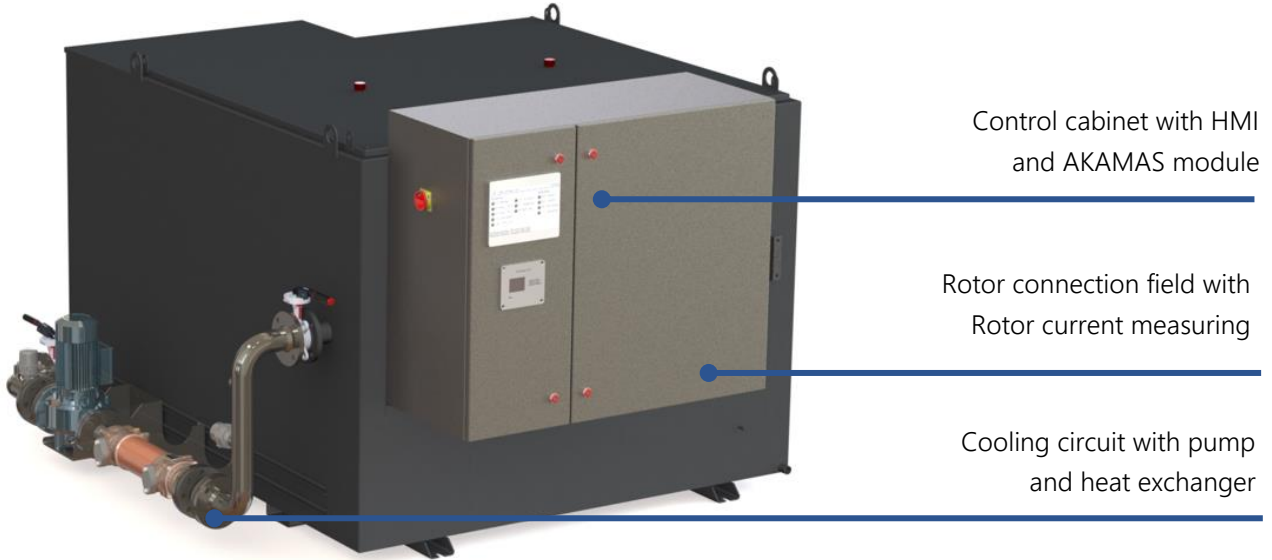
The robust design guarantees high operational reliability and long service life. In addition to the highly dynamic LRS GINO-AKA SAS also provides tailor made arc flash proof medium voltage cabinets with newest MCC technology out of own manufacturing.

The benefits of the SK liquid starter series at a glance:

- High speed belt drive with 800mm/s speed
- Closed loop AKAMAS control algorithm
- Direct electrode cooling distribution
- Active Electrolyte cooling by heat exchangers
- Protection class: IP 55
- Lightweight V-Type Electrodes with high TDR
- Bushings above water level



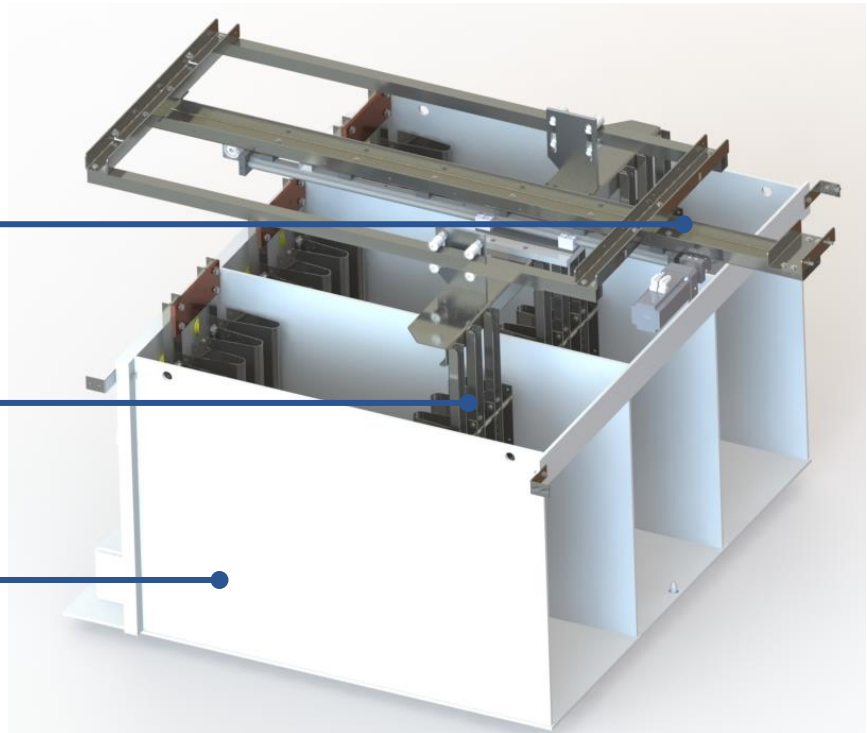
## 2 Design Overview



High speed linear drive system with step motor

Lightweight high ratio V-Type electrodes

Electrode insulation with integrated Electrolyte distribution



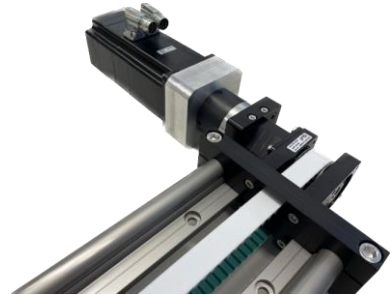
### 3 System Information

Standard Equipment	<ul style="list-style-type: none"> <li>• Electrode system with 1000mm horizontal travel</li> <li>• Electrode material: Stainless steel 1.4301 V-Type</li> <li>• Fast reacting Hall-Effect CTs for Rotor current measurement</li> <li>• PLC controller with Modbus TCP field communication</li> <li>• HMI Display with Visualization</li> <li>• Embedded AKAMAS controller with Touchscreen</li> <li>• Dynamic slip regulation algorithm</li> <li>• AKAMAS Software for analyzing and simulation</li> <li>• Continuous output of: <ul style="list-style-type: none"> <li>○ Rotation speed of MV Motor (rpm)</li> <li>○ Rotor current (A)</li> <li>○ Electrode position (mm)</li> <li>○ LRS resistance (mΩ)</li> <li>○ Motor slip (%)</li> <li>○ LRS / Cooling circuit temperatures (°C)</li> </ul> </li> <li>• High speed linear drive system <ul style="list-style-type: none"> <li>○ Electrode speed: 600mm/s</li> <li>○ Reaction time 10 ms</li> </ul> </li> <li>• Visual level control</li> <li>• Electronic level control</li> <li>• Electrolyte temperature protection: Continuous PT100 in tank</li> <li>• Electrolyte temperature protection: Thermoswitch: 75°C</li> <li>• Cabinets for LV control and HV feed</li> <li>• Cabinet heating with thermostat and hygostat</li> <li>• Drainage valve</li> <li>• Circulation pump</li> <li>• Electrolyte flow protection</li> <li>• Auxiliary terminals for the customer's control</li> <li>• Painting RAL 7016 (tank) RAL 7035 (cabinet)</li> <li>• Tank material: Steel 1.0037 (optional: 1.4301, unpainted)</li> </ul>
Protection class	Starter: IP 55; Switch board: IP55 (acc. to DIN 60529:2019-06)
Ambient temperature	5 °C to +40 °C, deviating temperature range upon request
Installation height	Up to 1000 m above sea level, higher altitudes upon request
Electrolyte fill	<ul style="list-style-type: none"> <li>• Electrolyte powder (Na<sub>2</sub>CO<sub>3</sub> or K<sub>2</sub>CO<sub>3</sub>) supplied in 25 kg bags</li> <li>• Each starter is delivered with quantity for first commissioning</li> </ul>
Site requirements	Water quality: Fresh water
Applied standards and regulations	<ul style="list-style-type: none"> <li>• 2014/ 35/ EU (low voltage regulations)</li> <li>• IEC 60947-4-1</li> <li>• UL/CSA/GOST certification (optional)</li> </ul>

## 4 Unique features:

### High speed linear drive system

The SK1 and SKS dynamic regulating liquid starters utilize a high speed linear drive system for the electrode movement. The linear drive is a guided system with a belt (in case of the SKS) or a special spindle screw (SK1) to achieve speeds of up to 600mm/s. In order to reach an accurate electrode positioning the linear system is driven by a 48VDC step motor with a positioning accuracy of 0.1 mm. The stepped motor is easy to parameterize through a special motor control card. Due to the control card the drive train does not need a variable frequency drive as other comparable systems which reduces energy consumption and simplifies maintenance and parameterization adjustments.



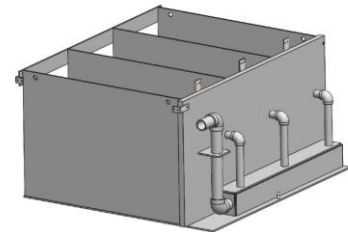
### PLC controller

The quality of dynamic regulating liquid starters is directly determined by the speed of slip adjustments. The reaction time of the LRS is not only depending on the electrode drive system but also on the processing of measurement data. GINO-AKA utilizes a high performance PLC controller with a reaction time of 5ms which makes it possible to quickly read the measurement inputs from the AKAMAS controller and calculate a positioning value for the electrode positioning if certain thresholds are exceeded. For the plant automation GINO-AKA can provide any type of communication protocol (MODBUS TCP, PROFINET, PROFIBUS)



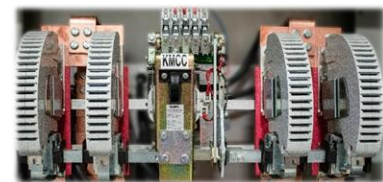
### Cooling circuit

As the dynamic regulating liquid starters are used to continuously regulate a wound rotor induction motor there is a continuous input of energy into the electrolyte. This leads to the necessity of integrating a cooling circuit to manage the temperature of the starter. GINO-AKA utilizes a specially designed cooling circuit that extracts the electrolyte by pump and forces it through a heat exchanger. The cooled electrolyte is then diverted and injected directly into the electrode insulation chambers to avoid the formation of local overheating areas on the electrodes.



### Customized short circuit contactor

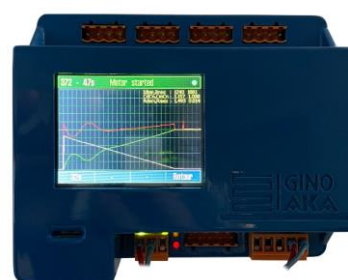
Optional the SK1 or SKS liquid starters can be purchased with a contactor to short circuit the rotor windings. This reduces energy consumption of the LRS in the times where no dynamic slip control is required. In order to be able to open the rotor circuit under load we provide a special bar contactor produced by our sister company TELARC. It utilizes arc suppression chambers as well as mechanical latching for additional operational security.





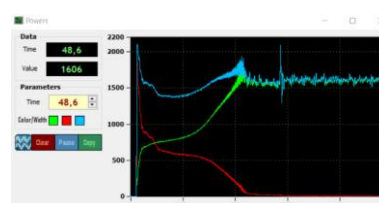
## AKAMAS Measuring device

The heart piece of the GINO-AKA dynamic liquid starter equipment is the AKAMAS controller. Developed in 2016 this measurement device is a unique tool that measures the currents in two phases of the rotor with fast reacting hall effect CTs. From this measurement the AKAMAS calculates multiple performance indicators and quickly transfers it to the PLC by MODBUS TCP for further processing. By measuring the current peaks directly on the rotor and not on the stator side of the WRIM the GINO-AKA dynamic regulating LRS drastically reduces the reaction time on over currents due to rotor blockage.



## AKAMAS software for performance analysis

In combination with the AKAMAS controller we also provide our own software to analyze startup and operational behavior of the LRS and the Wound rotor induction motor. Each startup of the motor is logged by the AKAMAS and saved as a .csv file. This .csv file can be loaded into the AKAMAS software on the users PC for detailed analysis. The software comes with a multitude of useful modules such as a history tool to compare multiple startup curves or an electrolyte amount calculator to set exactly the required starting torque.



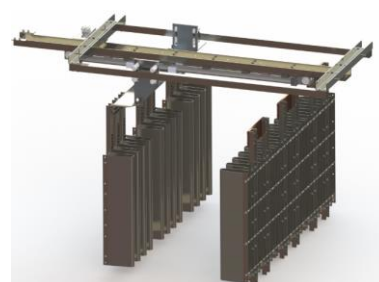
## Heat exchanger

To cool the LRS electrolyte GINO-AKA designs and assembles complete cooling units. Depending on the customers onsite requirements and external cooling water supply we work with renowned exchanger and pump manufacturers to design a fitting solution. The heat exchangers can be provided as Electrolyte/Air or Electrolyte/Water type and are delivered fully installed on the starters or on a separate cooling skid. Temperature thresholds and Electrolyte flow are monitored by sensorics and interconnected to the LRS main PLC to assure the highest safety standards.

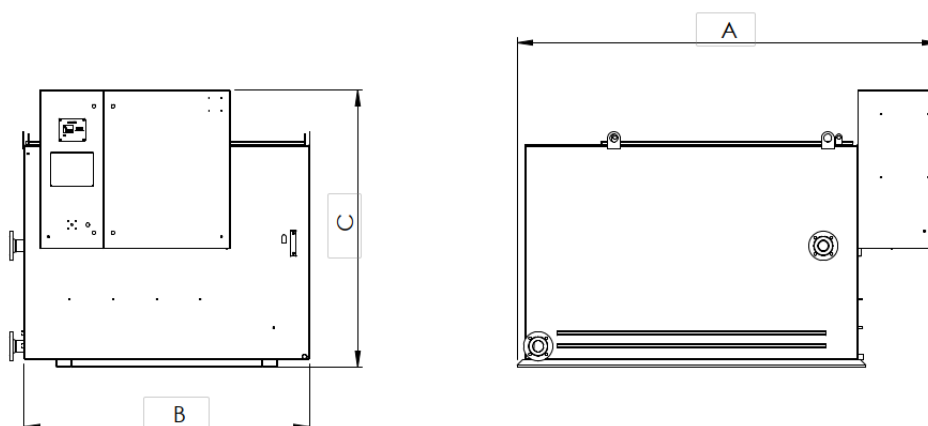


## Electrode system with V-Type Electrodes

The resistance variation of a liquid starter defines the smoothness of the wound rotor induction motor startup. To reach a maximum resistance variation the GINO-AKA liquid starters utilize specially designed V-Type Electrodes as well as a long electrode travel distance (500mm for SK1 / 1000mm for SKS). This leads to a resistance ratio between max and min resistance of above 200:1. In the minimum resistance position the SK starters have such a low ohmic value that also the heat dissipation in the tank and therefore the energy consumption is significantly reduced compared to other dynamic regulating starter manufactures.



## 5 Technical Data and Dimensions



Model Size	Dimensions and Weights *cooling circuit not considered				Max. Rotor Current [A]	Max. Rotor Voltage [V]	Max. Starter Energy at 40°C without active cooling [MJ]
	Length (A)	Width (B)	Height (C)	Weight			
SK1	1500	980	1250	350	1500	3500	95
SKS	2650	1800	1750	950	2500	4000	570

## 6 Required Technical Data

### Power (P, kW)

The largest driving factor for the size of the LRS is the motor power.

### Rotor voltage ( $U_2$ , V)

As specified on the motor data sheet. (This data is needed for the layout of the switchgear and bus bars)

### Number of consecutive starts (z)

The value z determines the number of consecutive starts from cold condition. Depending on this data the cooling circuit is designed

### Starting time ( $t_a$ , s)

The starting time is the value for the duration of the start sequence in seconds and must be specified by the customer.

### Rotor current ( $I_2$ , A)

As specified on the Motor data sheet. (This data is needed for the layout of the switchgear and bus bars)

### Starter load factor (f)

The starter load factor depends on the application and must be provided by the customer.

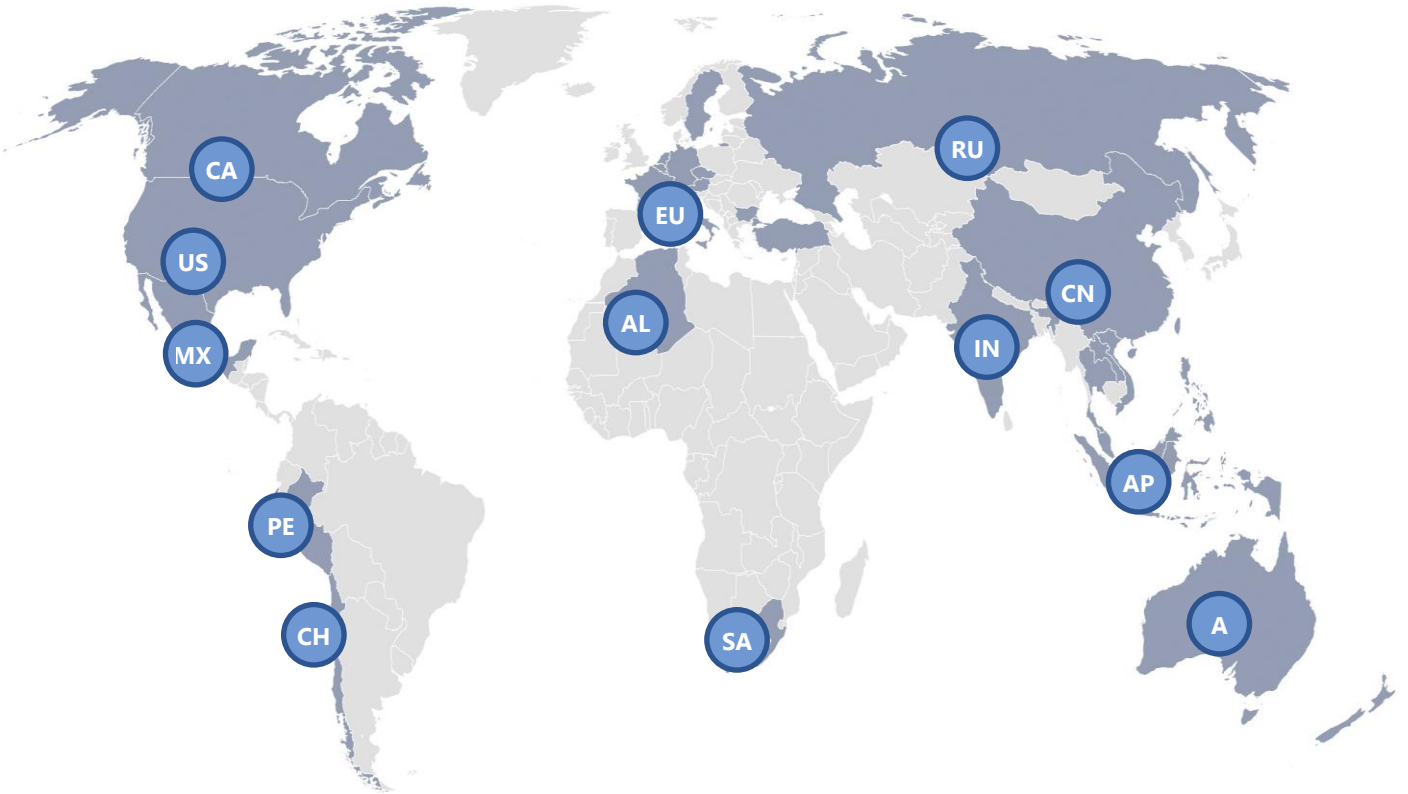
### Starting frequency per hour (h)































After having z starting operations and reaching the operating temperature the value h shows how many starts per hour are possible.

### Environmental data

For exact calculations and in extreme circumstances we must take environmental data (extreme temperature, extreme height) into account. Also the required cooling method is of particular interest

# GINO-AKA SAS Representatives



Algeria		Australia		Austria		Belgium		Bulgaria	
Canada		Chile		China		Czech Republic		England	
Germany		Hong Kong		India		Indonesia		Italy	
Laos		Luxembourg		Mexico		Netherlands		New Zealand	
Peru		Philippines		Russia		South Africa		Sweden	
Taiwan		Thailand		Turkey		United States		Vietnam	



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