NANCAL Electric



Medium Voltage Soft Starters

Shanghai Nancal Electric Co., Ltd.

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version number: 202603

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QC 01

NANCAL Electric

Product Family

Medium Voltage AC Drives	Low Voltage Industrial AC Drives	Medium Voltage Soft Starters	Power Quality Products（APF/SVG）	Shore Power
				
Output Voltage			**Output Voltage**	
3 kV-18 kV	400 V, 480 V, 690 V	3 kV-13.8 kV	400 V, 480 V, 690 V	MV: 6 kV-11 kV LV: 380 V-690 V
Rated Value			**Rated Value**	
Air-cooling: 220 kVA-18 MVA Water-cooling: 7 MVA-180 MVA	37 kW-8 MW	70 A-600 A	30 A-1600 A	MV: 300 kVA-20 MVA LV: 40 kVA-8 MVA Frequency: 50 Hz/ 60 Hz
Specificities			**Specificities**	
- Speed sensorless vector control - Medium voltage IGBT (for water-cooling drives) - Main control system redundancy design, Power cell fast automatic bypass design, Torsional vibration and active suppression	- High Performance Vector Control - Common DC bus, multi-machine drive - High power density, high reliability	- Smooth motor starting and stopping, effective protection - Various curves available such as double slope, pulse, current limit, etc. - Multi-motor starting	- Harmonic suppression, reactive power compensation, three-phase unbalance compensation - Modular design for easy expansion	- Sine wave output - Inverse power suppression, nondisturbed switch - Classification Society Certification - Corrosion-proof grade C5

Shanghai Nancal Electric Co., Ltd.

Shanghai Nancal Electric Co., Ltd. specializes in the research, development, production, and sales of power electronics products. This includes Medium Voltage AC drives, Low Voltage Industrial AC Drives, Medium Voltage Soft Starters, Power Quality Products such as Active Power Filters (APF) and Static Var Generators (SVG).

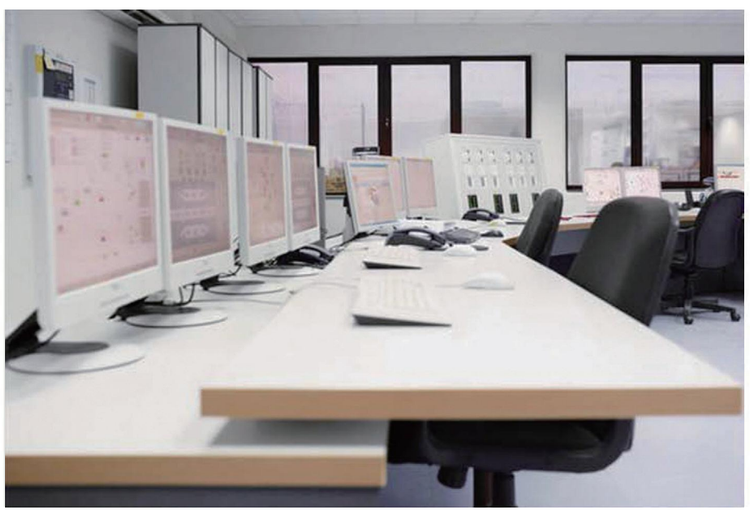
Glories

- National Specialized and Sophisticated Key"Little Giant" Enterprise
- High-Tech Enterprise
- Member of the National Technical Committee 518 on Variable Frequency Regulating Speed Equipment of Standardization Administration of China
- Shanghai Center for Enterprise Technology
- Shanghai Manufacturing Single Item Champion Demonstration Enterprise



Introduction







NC 3S Soft Starter is a new high-tech electrical device designed based on DSP and modern power electronics control technology. It is specialized for medium-voltage and large-capacity motors, providing an optimal soft-start method through voltage reduction and current limiting.

To adapt to different loads and achieve better performance, the NC 3S Soft Starter offers multiple control functions, enabling stable acceleration with minimal motor current, reducing power grid voltage drop during startup, and mitigating current surges and mechanical vibrations.

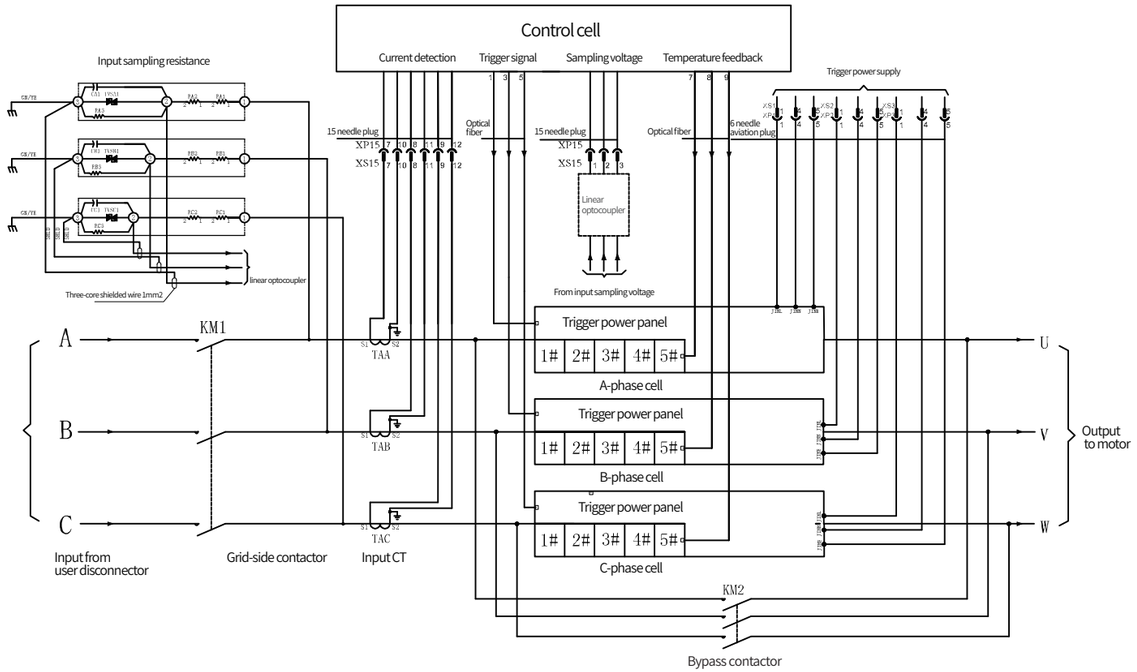
Additionally, the NC 3S Soft Starter includes a soft-stop function, which generates a gradually decreasing control voltage to the motor, allowing the drive system to achieve smooth stopping.

Certification

Product features

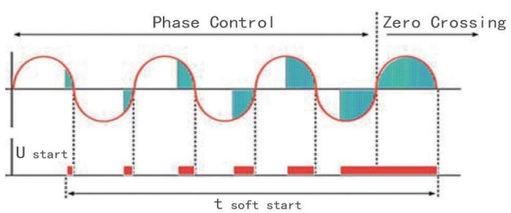
- The NC 3S Soft Starter uses a DSP to manage data and communication. The system has strong anti-interference capability due to signal grading and isolation techniques. In addition, the equipment offers high efficiency, stability, and reliability.
- Advanced optical fiber communication control technology enables triggering and testing of medium voltage thyristors, with high safety isolation between medium voltage and low voltage control circuits.
- High-frequency power isolation and transmission technology provides safe and reliable power to medium voltage electrical devices.
- The RC static network, dynamic voltage balancing, and absorption technology ensure that power devices in series operate safely and reliably under medium voltage.
- Positive/negative/adaptive phase sequence control and 50Hz/60Hz/adaptive frequency control are available.
- Multiple start curves, including customizable curve and stepped variable frequency, stepless voltage regulation curve, adapt to different load characteristics. The motor's maximum torque is adjustable, resultingin a smooth acceleration curve, reduced mechanical impact undering starting.
- A soft-stop waveform prevents water hammer effects during pump load shutdown.
- The pulse jump function improves initial starting torque, adapting to high static resistance torque systems.
- Protection functions include: overvoltage, undervoltage, overload protection, undercurrent, phase loss, current imbalance, incorrect phase sequence, zero-sequence ground protection, and other fault protections.
- Before medium voltage motor operation, the NC 3S Soft Starter performs a low voltage motor (380 V) simulation test to ensure safety compliance and technical data accuracy.

Technical Introduction

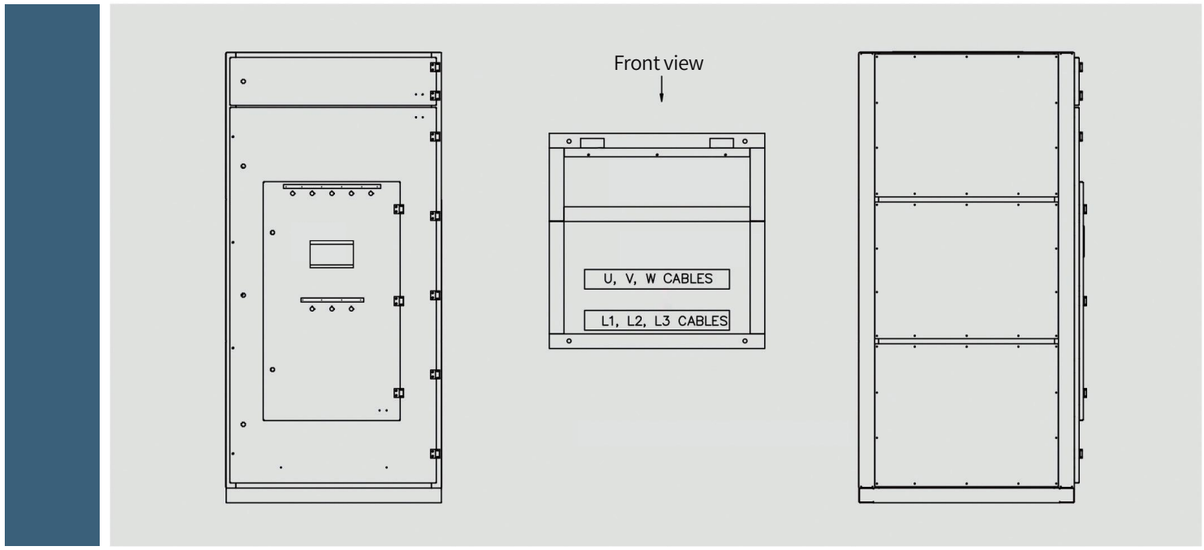


Product Principle

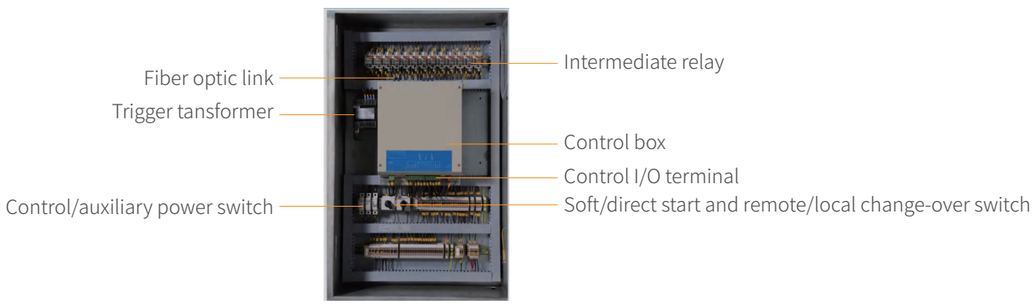
According to the thyristor's controllable conduction characteristics and combined with microelectronic techniques, the actual effective voltage value applied to the motor stator can be adjusted by controlling the thyristor's conduction angle (α). This reduces the motor's starting current. By gradually increasing the motor terminal voltage from a preset starting value to the system supply voltage through phase control, both the starting current and starting torque can be optimally adjusted based on the driving conditions.



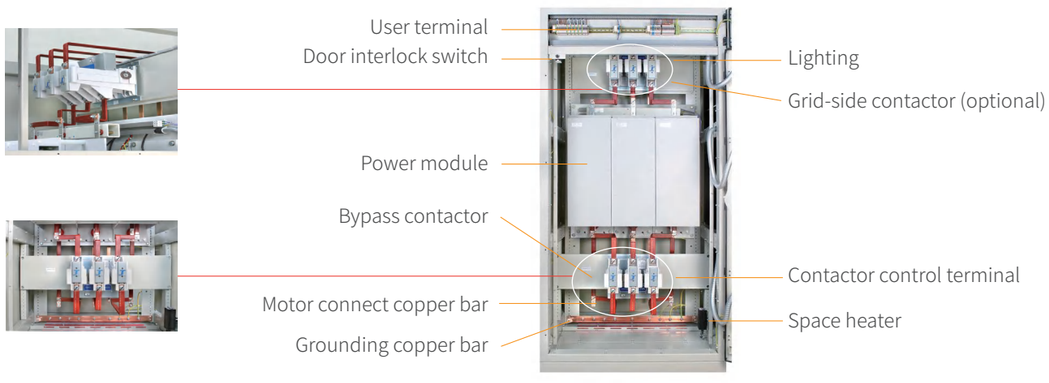
Product Composition



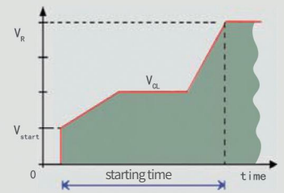
Low voltage compartment (standard configuration)



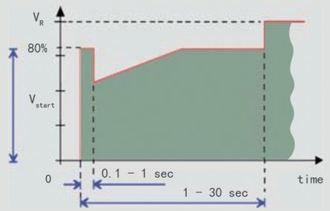
Medium voltage compartment



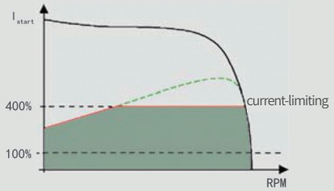
Technical Features



Dual-slope starting curves



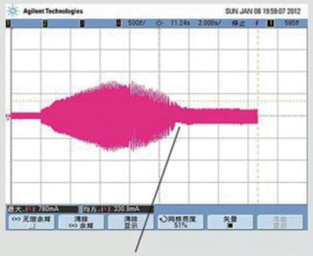
Pulse starting curves



Current-limiting starting curves

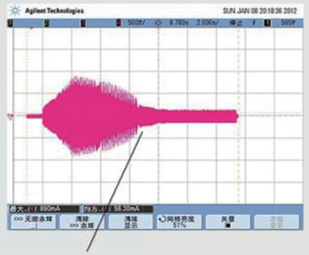


Standard starter and double regulation starting curves



asymmetric current, motor vibration

Other brands soft starter at 3 times starting current



quickly start, symmetric current, running smoothly.

NC3S soft starter at 3 times starting current

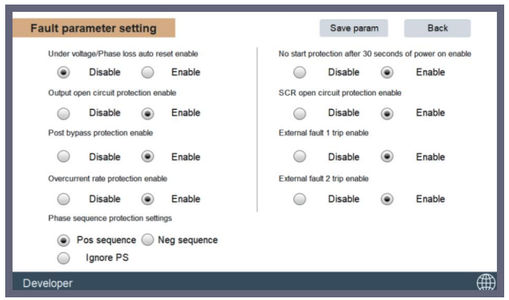
NC3S technical features	NC3S performance features	Control circuits
Patented electronic voltage measurement	Soft start/soft stop	Multifunction programmable input/output (I/O)
Patented power module structure design	Current-limiting, optimized torque and current control	Optocoupler-isolated control input
Innovative low voltage motor measurement	Pump control, pulse jump starting	Three relay output 8A/250VAC - starting immediately - stop accelerate - fault can be programmed to “trip” or “safety trip”
Independent trigger test	Double regulation: start/stop two different electrical performance motors or double speed motor	
Optical fiber trigger control system design		
Isolation between medium voltage and low voltage control circuits		
Positive/negative/adaptive phase sequence control		0/4-20mA, 0-10VDC analog output
50Hz/60Hz/adaptive frequency control		
Customizable curve		
Stepped variable frequency, stepless voltage regulation curve		

Positive/Negative/Adaptive Phase Sequence Control

The soft starter features input phase sequence detection protection and phase sequence adaptation. It can be configured for positive sequence, negative sequence, or phase sequence ignored.

Based on the input-side grid phase sequence, the main control system automatically generates matching trigger pulses to support both positive and negative sequence operation.

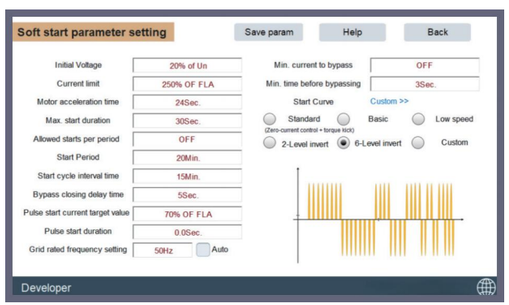
When the detected input phase sequence is inconsistent with the parameter configuration, a phase sequence protection fault will be triggered. This prevents motor reversal caused by reverse grid connection or incorrect incoming cable connections, thereby protecting the load from damage.



50Hz/60Hz/Adaptive Frequency Control

The grid frequency can be manually set within the range of 45-65 Hz. The soft starter can adapt to any grid frequency within this range.

Automatic frequency tracking: when the grid frequency is unknown or unstable, the "Auto" option can be selected. The soft starter will then calculate the grid frequency based on the zero-crossing points of the grid voltage and set it automatically.



Last Three Starting Current Records & Last Three-Phase Starting Current Records

Utilizing ample RAM space, the effective values of the soft starter's three-phase output current are recorded in real time.

When the main control system remains powered, the effective values of the output current during the last three soft starting, as well as the three-phase current effective values from the most recent soft start, can be recorded and compared within the same coordinate system.

This feature is useful for comparing parameter optimization before and after adjustments during commissioning, as well as for diagnostic after fault occurrence.



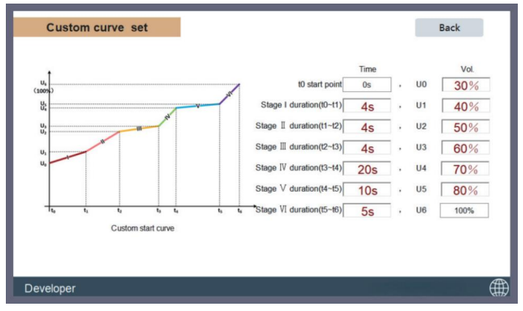
Last three starting current records



Last three-phase starting current records

Customizable Curve

The starting is divided into six stages. By individually setting the ending voltage and duration for each stage, the DSP automatically calculates the voltage ramp slope. By using this curve for parameter adjustments, the soft-start performance under the specific load and motor characteristics can be optimized.



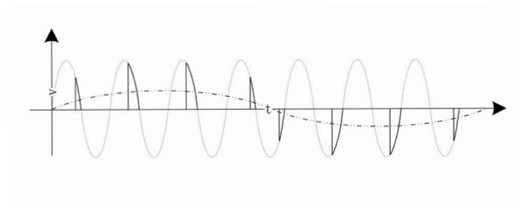
Stepped Variable Frequency, Stepless Voltage Regulation Curve

Configurable for two-stage or six-stage variable frequency.

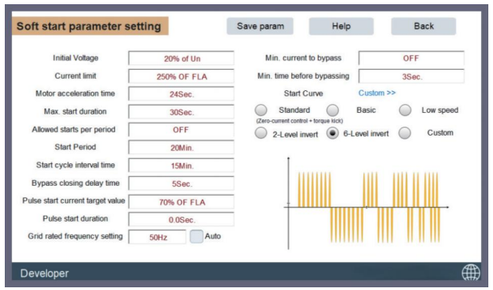
In situations where the load friction torque is high and other curves cannot start the motor, this curve can be used. It reduces the slip during motor starting to increase the maximum starting torque.

Two-stage variable frequency includes two frequency segments: divide by 4 and power frequency. Corresponding to a 50Hz grid, the output frequencies are 12.5Hz and 50Hz.

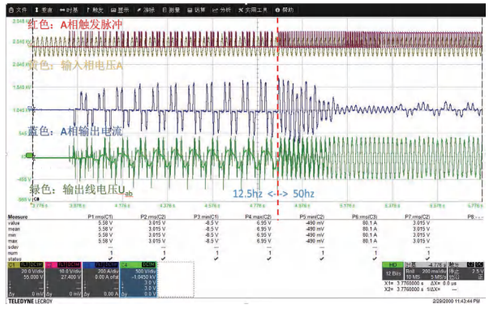
Six-stage variable frequency includes six frequency segments: divide by 13, 10, 7, 4, 3, and power frequency. Corresponding to a 50Hz grid, the output frequencies are 3.8Hz, 5Hz, 7.1Hz, 12.5Hz, 16.7Hz, and 50Hz.



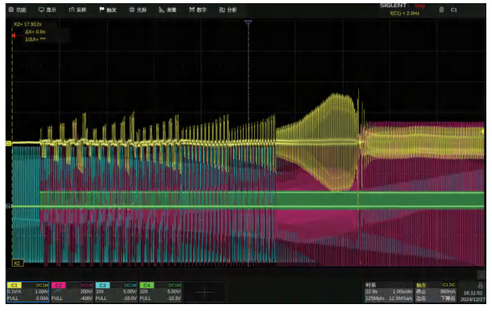
Implementation method



Curve parameter setting interface



Two-stage variable frequency

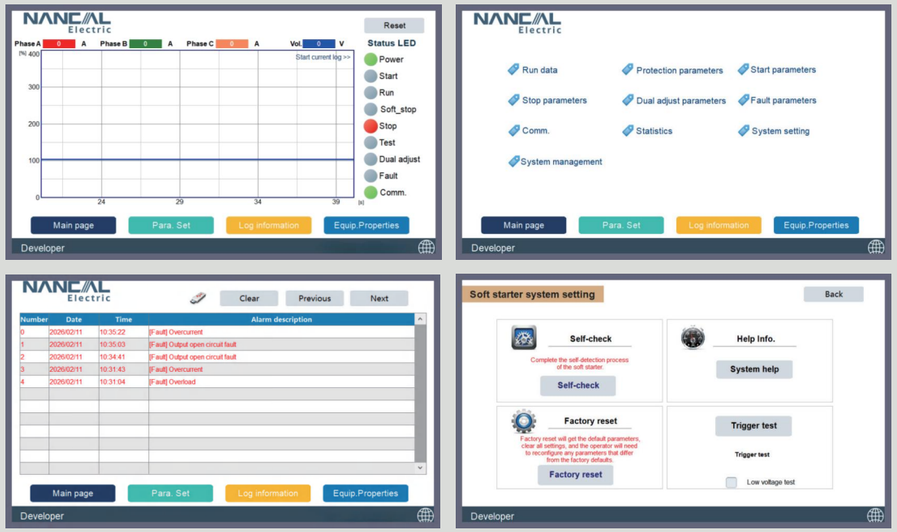


Six-stage variable frequency

Phase A trigger pulse
Phase A output current
Input phase voltage A
Output line voltage Uab

Output current
Grid phase
Output voltage
Trigger pulse

HMI



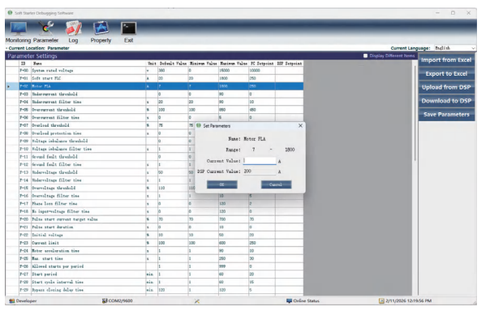
Intuitive Human-Machine Interaction: High-definition touch screen provides visual presentation of operating conditions and parameters, with a clear and easy-to-use interface.
Real-time Data Display: Synchronously displaying core operating parameters like voltage and current, providing an immediate overview of the equipment status.
Convenient On-site Operation: Supporting direct on-site adjustment of starting modes and operating parameters without relying on a PC, making commissioning more efficient.
On-site Fault Alerts: Providing fault alerts, displays fault content in real time for quick problem identification.
Local Data Storage: Retaining historical fault records (approx. 20,000 entries), accessible locally and exportable via USB for on-site analysis.
Industrial-Grade Protection: Adapting to complex industrial environments with factors like temperature, humidity, and dust, offering strong anti-interference capability and stability.
One-Touch Quick Functions: Integrating shortcut buttons for start, stop, reset, etc., meeting on-site emergency operation needs.
Lightweight & Easy Maintenance: Interface supports multi-language switching.

Commissioning & Monitoring Software

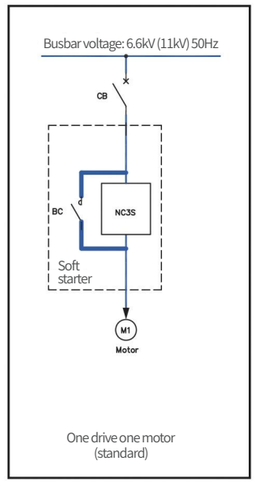
The PC-based commissioning and monitoring software for the NC3S series medium voltage soft starters enables real-time monitoring of equipment operating status, accurately displaying core parameters such as voltage and current. It supports online configuration of starting parameters and comprehensive fault monitoring and alarm functions. The software provides data support for equipment operation, maintenance, and performance optimization, enhancing management efficiency and ensuring system safety and stable operation.

Real-time Performance: Displaying equipment/program operation data with low latency.
I**nteractivity**: Allowing manual sending of debugging commands and parameter modifications, providing real-time feedback on execution results.
Multi-dimensional Monitoring: Covering core dimensions such as operating status, parameters, logs and alarms.
Lightweight & Efficient: The interface supports multi-language switching; parameter backup and restoration are completed with one click for convenient maintenance; it occupies minimal system resources without affecting the normal operation of the commissioned device.

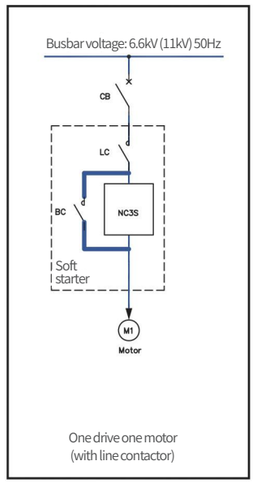




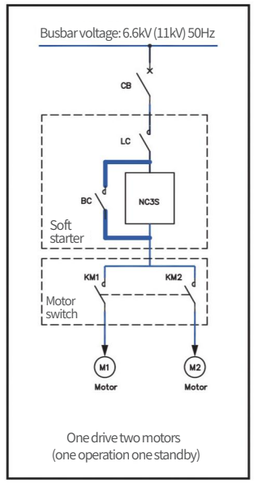
Typical Application SLD



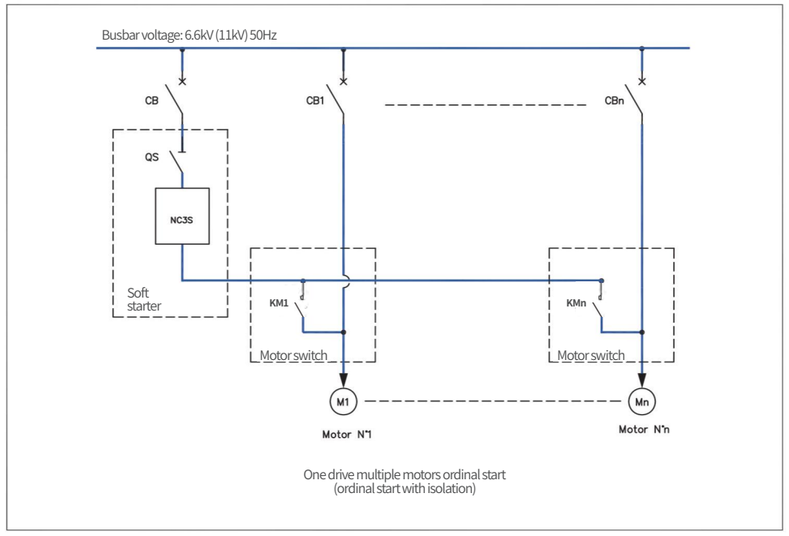
One drive one motor
(standard)



One drive one motor
(with line contactor)



One drive two motors
(one operation one standby)



One drive multiple motors ordinal start
(ordinal start with isolation)

Note:

1.CB, CB1…CBn are power supply side medium voltage vacuum circuit breaker (user supplied)
2.The dotted line box indicates the scope of supply
3.LC is grid-side contactor within cabinet
4.BC is bypass contactor within cabinet
5.QS is input isolation switch
6.KM1, KM2, KMn are motor switch contactor
7.N is number of motors

Product Model

Solid Soft Starter



NC3S - 06 - 250 - A

Size
A-standard, B-customized

Rated current
70 A, 140 A, 250 A, 300 A, 400 A, 500 A, 600 A

Rated voltage
03：3 kV, 3.3 kV；06：6 kV, 6.3 kV, 6.6 kV
10：10 kV；11：11 kV；14：13.8 kV

Product name: Solid Soft Starter

NC: Nancal Electric

Power Module



NCPM - 06 - 250

Rated current
70 A, 140 A, 250 A, 300 A, 400 A, 500 A, 600 A

Rated voltage
03：3 kV, 3.3 kV；06：6 kV, 6.3 kV, 6.6 kV
10：10 kV；11：11 kV；14：13.8 kV

Product name: Power Module

NC: Nancal Electric

Technical Features

Basic Information	
Load type	Three-phase medium voltage squirrel-cage asynchronous motor, synchronous motor
AC voltage	3kV, 3.3kV, 6kV, 6.6kV, 10kV ,11kV,13.8kV AC (-10% ~ +10%)
Frequency	50Hz/60Hz (±1%)
Main circuit	12SCRS、18SCRS、30SCRS、36SCRS (depends on model)
Instant overvoltage protection	du/dt absorb network
Cooling	Passive/forced air cooling
Bypass	Used for equipment direct starting. Below 400A, choose vacuum contactor, above 400A, choose vacuum circuit breaker
Working condition	Temp: -10°C~50°C
	Altitude: ⩽1000m
Control power supply	· 110-240VAC + 10%/-15%, 50/60 Hz (standard) · 110-220VDC (optional)
Assistant relay	3 line dry contact 8A, 250V, 2000VA relay, function respectively are: · Direct Start Relay (User can access the dry contact to check whether the soft starter is directly started) · Fault Relay (User can access the dry contact to check whether the soft starter is faulty) · Start Completion Status Relay (User can access the dry contact to obtain the status information about whether the soft start process is complete)

Motor Protection	
Overload	Inverse time limit, current range: 75%-150%
	Trip delayed: 1-10s
Current unbalance	Unbalance trip standard: 10-100% any two phases
	Trip delayed: 1-60s
Overcurrent	Range: 100%-850%FLA, trip delayed: 0-5s
Undercurrent	Range: 20%-90%FLA, trip delayed：1-40s
Overvoltage	Range: 110%-125%Un (line voltage)
	Delayed: 1-10s
Under/no voltage	Under voltage range: 50%-90% Un (line voltage)
	Under voltage delayed: 1-10s, no voltage delayed: 0-120s
Phase lose	Trip delayed: 0-120s
Ground fault	Fault current range: 10%-100%FLA
	Ground trip delayed: 1-60s
Overlong starting time	Trip when starting time over setting value
	Range: 1-250s
Over temperature	Trip when power module over temperature
Power on but unstart	Trip when main circuit power on 30s but no starting signal
Deceleration time	Trip when starting interval is less than setting time
	Setting time: 0-90s
Number of starts/hr	4 times per hour, with an interval of no less than 15 minutes

Serial Interface	
Communication protocol	MODBUS [1)]
Communication interface	RS485
Functions	Parameter setting, running data and condition monitoring

[1)] for other communication protocol, please contact us.

Product Selection Guides

3 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-03-70-A	70	280	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-03-140-A	140	560			
NC3S-03-250-A	250	1000			
NC3S-03-300-A	300	1250			
NC3S-03-400-A	400	1800	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-03-500-A	500	2240	C 2000*1450*2200		J 2800*1450*2200
NC3S-03-600-A	600	2500			

3.3 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-03-70-A	70	315	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-03-140-A	140	630			
NC3S-03-250-A	250	1120			
NC3S-03-300-A	300	1400			
NC3S-03-400-A	400	2000	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-03-500-A	500	2500	C 2000*1450*2200		J 2800*1450*2200
NC3S-03-600-A	600	2800			

6 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-06-70-A	70	560	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-06-140-A	140	1250			
NC3S-06-250-A	250	2240			
NC3S-06-300-A	300	2500			
NC3S-06-400-A	400	3550	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-06-500-A	500	4500	C 2000*1450*2200		J 2800*1450*2200
NC3S-06-600-A	600	5600			

6.3 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-06-70-A	70	630	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-06-140-A	140	1250			
NC3S-06-250-A	250	2240			
NC3S-06-300-A	300	2800			
NC3S-06-400-A	400	3550	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-06-500-A	500	4500	C 2000*1450*2200		J 2800*1450*2200
NC3S-06-600-A	600	5600			

6.6 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-06-70-A	70	630	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-06-140-A	140	1400			
NC3S-06-250-A	250	2500			
NC3S-06-300-A	300	2800			
NC3S-06-400-A	400	4000	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-06-500-A	500	4500	C 2000*1450*2200		J 2800*1450*2200
NC3S-06-600-A	600	5600			

10 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-10-70-A	70	1000	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-10-140-A	140	2000			
NC3S-10-250-A	250	3550			
NC3S-10-300-A	300	4500			
NC3S-10-400-A	400	5600	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-10-500-A	500	7100	D 2200*1650*2200		K 3000*1650*2200
NC3S-10-600-A	600	9000			

11 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-11-70-A	70	1120	A 1000*1450*2300	A 1000*1450*2300	H 1800*1450*2300
NC3S-11-140-A	140	2240			
NC3S-11-250-A	250	4000			
NC3S-11-300-A	300	5000			
NC3S-11-400-A	400	6300	B 1200*1450*2300	B 1200*1450*2300	I 2000*1450*2300
NC3S-11-500-A	500	8000	D 2200*1650*2200		K 3000*1650*2200
NC3S-11-600-A	600	10000			

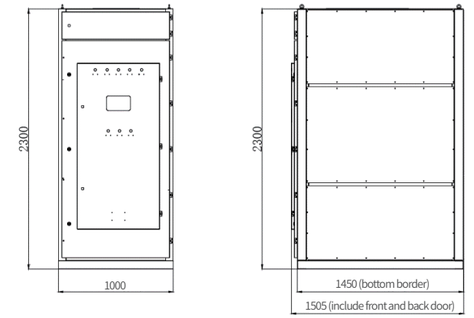
13.8 kV Soft Starter					
Model	Rated current (A)	Motor power (kW)	Dimension (W*D*H) mm		
			without line contactor	with line contactor	with line circuit breaker
NC3S-14-70-A	70	1400	E 2200*1450*2300		E 2200*1450*2300
NC3S-14-140-A	140	2800			
NC3S-14-250-A	250	5000			
NC3S-14-300-A	300	6300			
NC3S-14-400-A	400	8000	F 2400*1450*2200		F 2400*1450*2200
NC3S-14-500-A	500	10000	G 2600*1800*2200		L 3600*1800*2200
NC3S-14-600-A	600	12500			

Note:

1.Parameters are for reference only; actual values shall prevail.
2.Custom cabinet designs are available upon request.
3.Other voltage/current ratings or cabinet sizes are optional—contact us for details.
4.Cabinet dimensions may vary with electrical components—confirm with us prior to order.

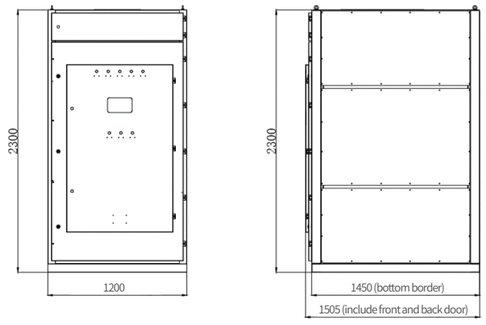
Dimension

A



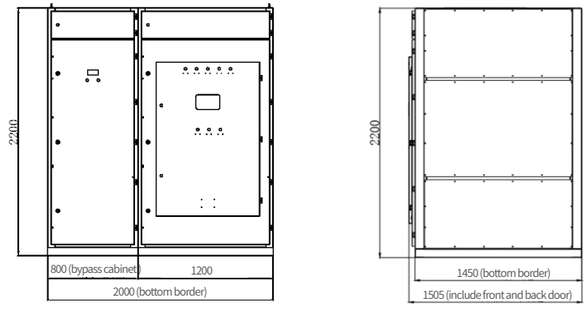
Front view Side view

B



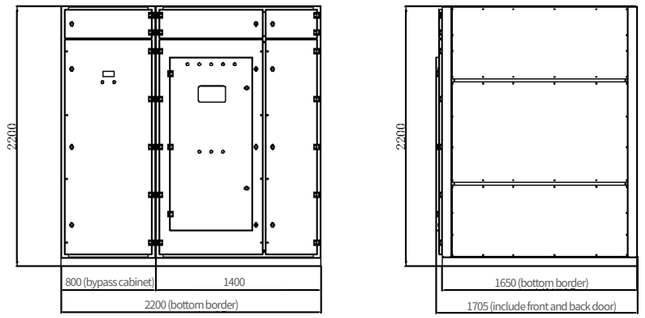
Front view Side view

C



Front view Side view

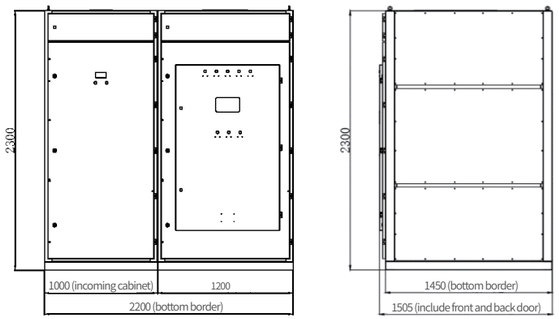
D



Front view

Side view

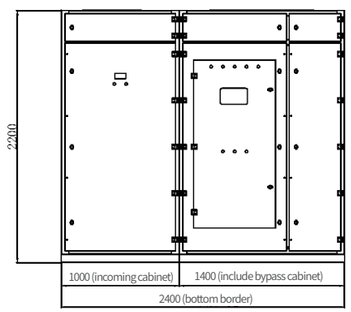
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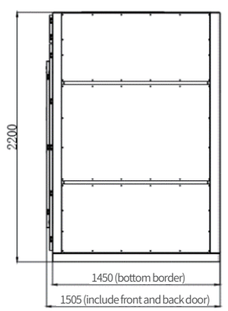
Front view

Side view

F

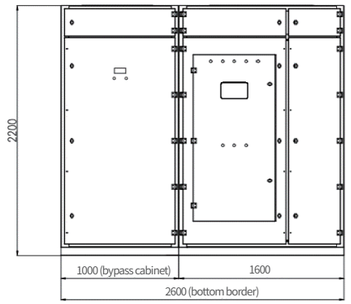


Front view

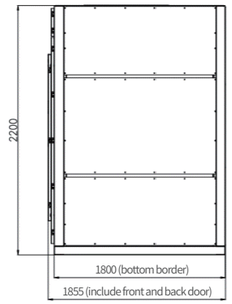


Side view

G

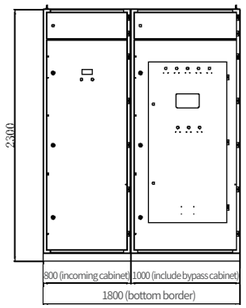


Front view

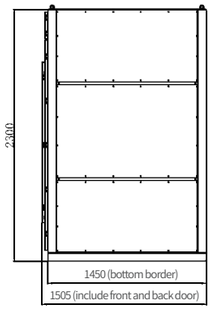


Side view

H

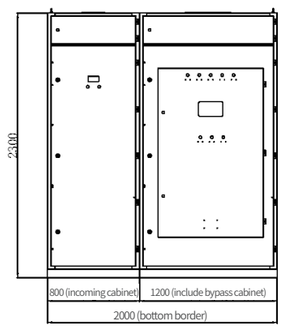


Front view

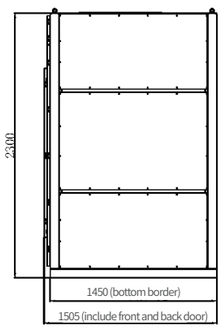


Side view

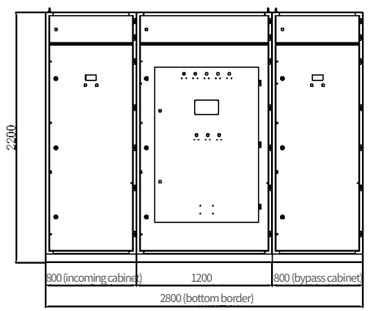
I



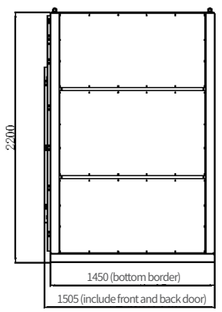
Front view



Side view

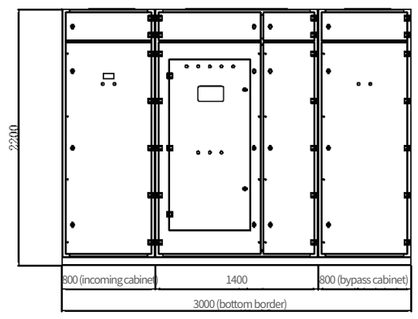


Front view

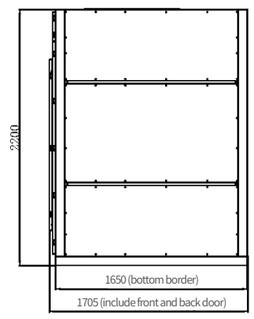


Side view

J



Front view



Side view

K

Note:

1. Cabinet design and production strictly comply with ISO9001 standards.
2. Indoor metal-enclosed fixed cabinets use 2.5mm-thick cold-rolled steel sheets as the main structural material, resistant to damage during transportation, installation, and short-circuit events.
3. The metal shell, protective screen, and cabinet door are grounded as required, with a dedicated grounding busbar for multi-terminal connections.
4. In the medium-voltage compartment, auxiliary contacts of the door limit switch are integrated into the soft starter control circuit to prevent personnel injury risks.
5. The cabinet top is equipped with a pressure relief device (explosion relief vent).
6. Standard protection rating is IP42; custom designs are available upon request.
7. Standard color: RAL7035 (custom colors available).

Applications

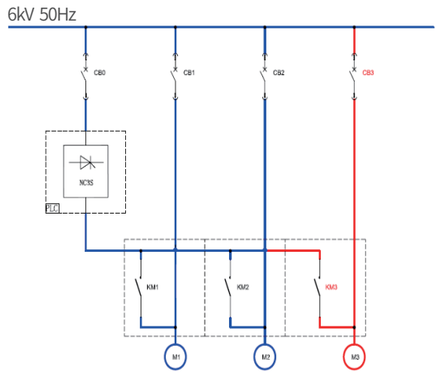
Crusher
Conveyor belt
Heat pump
Air pump
Grinding mill
Press machine
Escalator
No-load motor
Diesel generator
Centrifugal pump
Piston compressor
Centrifugal compressor
Screw compressor
Induced draft fan
Air blower
Elevating machine
Agitator

Cases

1. Metallurgy

Wuhan Iron and Steel, Egang oxygen compressor

Single line diagram

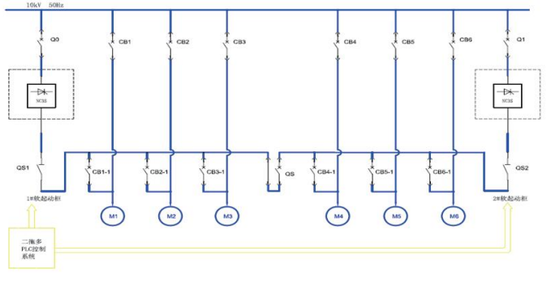


Motor：10kV 6000/3000/2400kW
Load：oxygen compressor, nitrogen compressor
Drive method：one drive three motors

2. Aviation & Military

Gas Turbine (624 institute) air compressor and water pump testing bed

Single line diagram



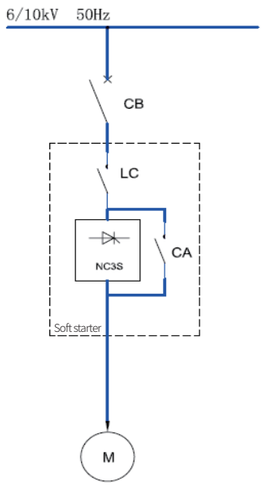
Motor：10kV 1600/1250kW
Loads：draught fan, water pump
Drive method：two drive six motors
Soft starter type： NC3S-10-140-A-2S
Quantity：2 sets

3. Tunnel

Zhongnanshan Tunnel-18.02km, the longest highway tunnel in Asia



Single line diagram



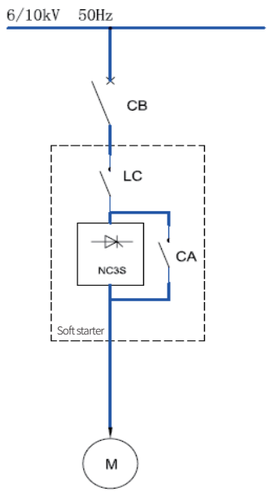
Load: draught fan
Drive method: one drive one
Soft starter type: NC3S-06-140-A-2S
Quantity: 36 sets

4. Petrochemical

Sinopec North branch Taba temple-Yulin natural gas pipeline supercharge and capacity expansion



Single line diagram



Load: compressor
Drive method: one drive one
Soft starter type: NC3S-06-140-A-2S
Quantity: 30 sets

Certifications

- CE certification
- CCS (China Classification Society) certification
- TUV certification
- Arc test
- 6kV/10kV soft starter type-test report
- High power soft starter type-test report
- Ministry of Communications test report
- Invention patents





