



Mine Flame-proof Inverter and Automation Series Products  
Mine Flame-proof and Intrinsically-safe type MV AC Soft Starter

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## **WOLONG ELECTRIC GROUP CO., LTD.**

As a global well-known manufacturer of motor & drive solutions, Wolong Electric Group co., Ltd. was founded in 1984, after more than 30 years of innovation and development in China, Vietnam, England, Germany, Austria, Italy, Poland, Mexico, India and Serbia it has 39 manufacturing factories and three technology centers with more than 18000 staff. In 2018, total assets reaches CNY 30 billion, and annual sales revenue reaches CNY 36.5 billion. Wolong mainly manufacturers all types of motors, generators, control drive products, industrial automation products and so on to provide our customers optimal solution and service in oil & gas, petrochemicals, power, Mine, rail transportation, building, water & waste water, automation, new energy vehicles and so on.





## Wolong Electric Large Drive Business Group Drive Division

Wolong Electric Large Drive Business Group Drive Division (referred to as the Drive Division) is dedicated to power electronics field, and with many years of experience in design of MV electrical products Drive Division Electric Drive has developed competitive MV inverter--RMVC5000 series & RMVC5100 series, MV SCR type soft starter VFS series, and explosion-proof series electrical products with high reliability as the design principle and easy-to-maintain as the design objective, which have reached to international leading level in technology.

In the field of ex-proof electrical products, Drive Biz Unit is specialized in R&D, manufacturing, sales and service of large drive and automation control equipment with their system application software. Drive Biz Unit has first-class production, detection and test equipment, builds up a set of scientific product quality assurance system strictly following ISO9001 quality management system from components input detection, production & assembly, product parts debugging & testing to finished product FAT. So far, ex-proof electrical products have been applied to more than 40 Mine bureaus and more than 200 coal mines, which received users' unanimous praise.

Ex-proof products mainly include:

- Mine Flame-proof and Intrinsically-safe Type Inverter
- Mine Flame-proof and Intrinsically-safe Type Combined Inverter
- Mine Flame-proof and Intrinsically-safe Type Power Transformation Inverter
- Mine Flame-proof and Intrinsically-safe Type MV Combined Inverter
- Mine Flame-proof and Intrinsically-safe Type Inverter for Ventilator Application
- Mine Flame-proof and Intrinsically-safe Type Dual-power Dual-inverter for Ventilator Application
- Mine Flame-proof and Intrinsically-safe Type (chain type) Static Var Generator
- Mine Flame-proof and Intrinsically-safe Type Programmable Control Box
- Mine Intrinsically-safe Type Consoles
- Mine Flame-proof and Intrinsically-safe Type MV AC Soft Starter



### Mine Flame-proof and Intrinsically-safe Inverter (660V, 1140V)

Power Rating: 30kW-1000kW Voltage Rating: 660V/1140V



#### Product Overview

Mine flame-proof and intrinsically safe inverter - BPJ series inverter, is the new generation (fifth generation) developed by our company after years of market verifications, since the successful application of the first mine inverter in 1998. The mine inverter has powerful functions, complete models, compact size, and high performance-price ratio. It can be adapted to various complicated working conditions and customized flexibly according to the needs of users. It is especially suitable for belt conveyors, scraper machines, emulsion pumps, and reversed loaders, crusher, winch, pump and other AC asynchronous motor or AC permanent magnet synchronous motor load.

#### Technical Features

- Using high-performance V/F control and sensor-less vector control, as well as other control technologies, it can drive not only asynchronous motors but also permanent magnetic synchronous motors.
- The key components are all imported from Germany, Japan, etc. They are safe, stable and reliable.
- The control system is developed independently, with good openness, abundant functions, flexible adjustment, strong anti-interference ability, easy maintenance and upgrade, and low cost.
- Excellent load power auto-balancing function, suitable for multi-motor driving applications, supports coordinated control up to 8 sets of machines.
- $\pm 20\%$  voltage fluctuation range, the inverter can continue with stable operation.
- 7-inch colored LCD screen, full Chinese/English display, intuitive and friendly interface, easy to understand.
- Metal numeric keypad (waterproof and dustproof), strong, corrosion-resistant, easy to operate.
- With cumulated fault records, and operation records up to 10 years, supports automatic and manual USB memory stick exporting function.

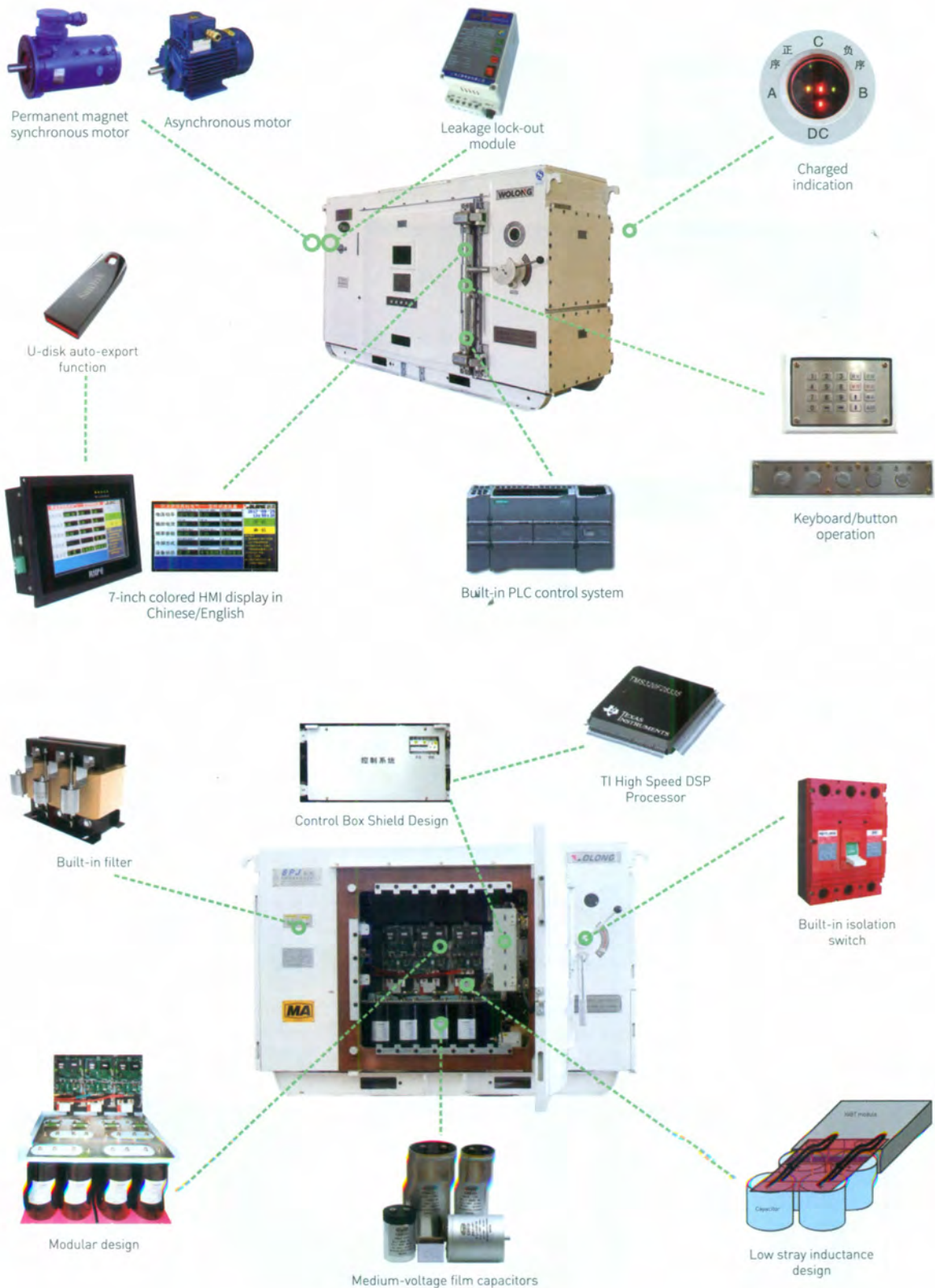
- Automatically adjust the motor voltage and frequency according to load current variations, excellent energy saving effect.
- Automatic oscillation suppression and automatic torque boost function, smooth operation.
- With leakage lock-out function
- Using film capacitors as DC filter, life span up to 15 years with little maintenance work.
- Low frequency and high torque start, starting torque greater than 0.5Hz/200%.
- Able to realize various complicated control processes, energy efficiency control management with built-in PLC (optional).
- Built-in isolation switch with external operating mechanism can realize power delivery and power cut locally without disconnecting the upstream switchgear, easy to maintenance.
- Quick-open door design, easy to maintenance.
- Able to communicate with various system devices via RS485, Ethernet and other communication interfaces.
- Built-in output reactor for cost-down
- Built-in primary circuit bypass function(option)

#### Users Benefits

The future-oriented modular design concept provides high flexibility of mine inverters:

- » Innovation of each module can improve the existing inverter system
- » Users can select and combine as needed
- » Possible to purchase only the related modules for the required functions
- » Simpler module replacement for easier maintenance
- The integration of safety protection functions makes it better applied to equipment and conditions with safety protection requirements.
- Provide a variety of interfaces, support MODBUS-RTU, PROFIBUS, PROFINET and other communication protocols, bandwidth 100M/1000M, able to realize network-wide configuration.
- Innovative cooling concept strengthens environmental adaptability, optional cooling methods including natural-cooled/air-cooled/water-cooled.
- Water-cooled type has external water flow control function to avoid waste of cooling water.
- The equipment data can be exported automatically and manually, the user can check the historical status of the equipment operation, accumulated storage for more than 10 years.
- Compact and space-saving, modular design.
- Realize permanent magnet synchronous motor or asynchronous motor driving by reset parameters only.
- Complete settings of commonly used control methods by 2/3 line selection (level/pulse signal) for digital input.
- Digital input, output port programmable

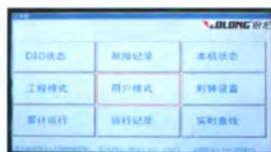




### Single Machine Interface Display



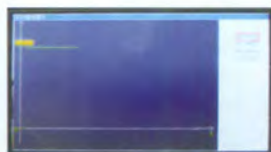
Main Interface



Menu Setting Interface



I/O Monitoring Interface

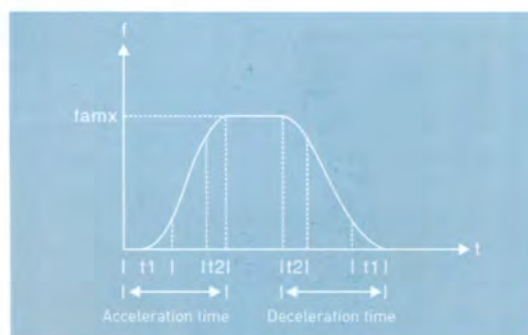
Operation Data  
Recording InterfaceReal-Time Curve  
InterfaceUSB Memory Stick  
Automatic Export Interface

### Typical Applications

#### Application I Belt conveyor, scraper conveyor

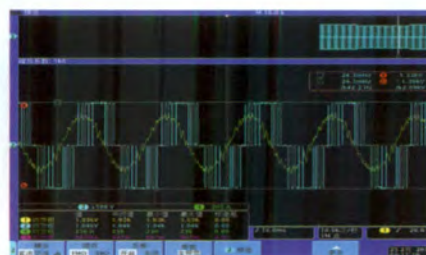
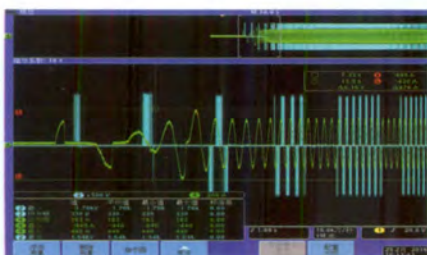
##### Soft start/soft stop

When the motor is directly started with the power frequency, the starting current is about 4 to 7 times of the rated current, with severe mechanical shock, in addition, the starting current is mostly reactive current, which will cause instant drop of grid voltage, affecting the other equipment on grid. Using an inverter to start the motor will increase the frequency and voltage as the motor accelerates. The starting current is limited to 150% of the rated current (125% to 200% depending on the model). The inverter starts to rise from 0.5 Hz during the start-up process, and the accelerating time is adjustable. The impact on the load during the start-up process is very slight.



##### Heavy load start (0.5Hz/200%)

Coal mine underground belt conveyor or scraper machine has to bear large friction during the process from static to motion, if the equipment is loaded with coal, an even larger starting torque is required. The inverter has a torque automatic boost function, able to realize low-frequency and high-torque start, its starting torque reaches up to 0.5Hz/200%, which meets the requirements of heavy load start.

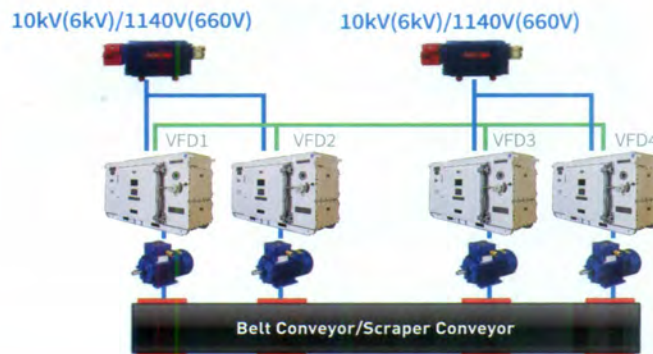




### Power balance (consistent output) for coordinated control of 8 sets of machines

Domestic coal mine underground belt conveyor or scraper generally adopts grid power frequency driving, and a hydraulic coupler is installed between the motor and reducer. The hydraulic coupler changes the oil volume in the chamber between the turbine and the pump impeller through the spoon pipe to achieve the purpose of soft start, soft stop. However, as the hydraulic coupler is a mechanical device and it is impossible to accurately adjust the oil volume in the oil chamber, and it is also impossible to make multiple motors reach the same rotational speed and consistent output during starting, stopping and operation.

Our inverter can solve above problems. It adopts multiple machine master-slave control. The inverters communicate with each other through CAN-BUS communication. The slaves follow the torque and current of the master and adjust its output in real time to achieve the goal of power balance. Regardless of whether the load is in starting or operation process, each motor has almost the same torque.



Single Inverter Application

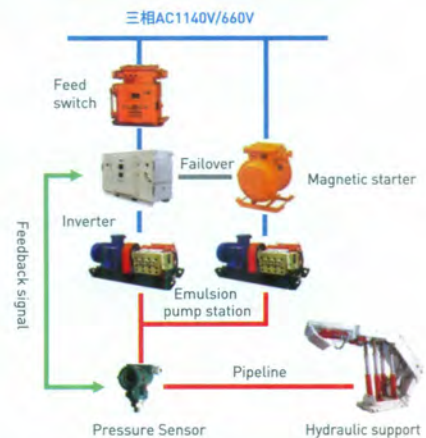
### Low speed belt inspection

The output frequency 0.5-50Hz can be adjusted continuously, which can realize low-speed belt inspection and any belt speed operation that the motor can perform.

### Application II Constant Pressure Control Of Water Pumps And Emulsion Pumps

Emulsion pump control is a kind of constant pressure control. By collecting the analog signal of the pressure sensor installed in the outlet pipe of the pump station via PID control, the speed output of the inverter can be adjusted, and consequently the flow and pressure in the pipeline can be controlled to achieve constant pressure supply to the hydraulic support. At the same time, once the inverter fails, it will immediately switch to the bypass starter at the power grid frequency. The switching mode is selectable, including inverter + inverter mode / inverter + starter mode.

By using the inverter, the system will save a lot of power resources compared with the previous system, reduce the frequent action of the pressure relief valve, reduce the impact on the valve body, improve the reliability of the emulsion pump station, prolong the service life, save energy, and the average power saving rate is about 40%-50%.



### Application III Downwards Belt, Track Car, Monkey Car, Endless Rope Winch, Winch Hoist Application

For those applications requiring four-quadrant inverters, we supply inverters with active front end. The generated energy during braking can be fed back to the grid via the AFE cells. In this way, more than 95% of the renewable energy can be recycled while realizing effective braking. Our four-quadrant inverters have perfect over-temperature, over-voltage and over-current protection functions, featuring low noise, low harmonic pollution, and high power factor.





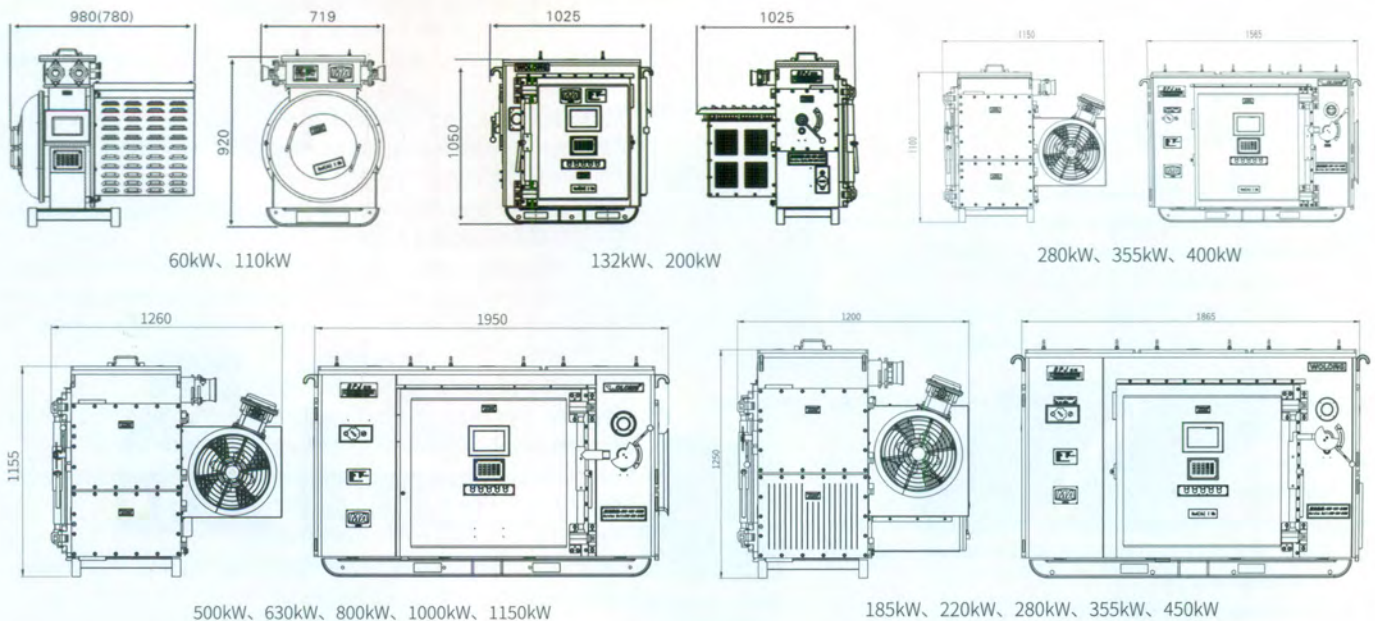
### Technical Spec.

Input	Item	Describe	
Basic Function	Output frequency	0-100Hz	
	Carrier frequency	1 kHz-2 kHz segmentation automatic adjustment	
	Input frequency resolution	Digital setting: 0.01Hz Analog setting: the highest frequency × 0.5%	
	Control Mode	High performance V/F control, speed sensor-less vector control	
	Load type	AC asynchronous motor, AC permanent magnet synchronous motor	
	Starting torque	0.5Hz/200%	
	Speed range	1: 100	
	Steady speed accuracy	±0.5%	
	Power factor	0.9 or more	
	Overall efficiency	97%	
	Overload capacity	110% rated current 60min; 150% rated current 60s; 180% rated current 2s	
	Torque boost	Torque increased 0.1%-30.0%	
	V/F curve	Three methods: linear, multi-point, square [curvature of square-shaped curve can be adjusted]	
	Acceleration/Deceleration Curve	Straight or S-curve acceleration and deceleration	
	Jog control	Jog frequency range: 0.0Hz-100.0Hz	
	Multi-speed operating	Up to 16speed sections operation with DIO control terminals	
	Multi-speed operating	Process control closed-loop control system can be easily realized	
	Automatic voltage regulation [AVR]	When the grid voltage changes, it can automatically maintain the output voltage constant	
	Vibration suppression	When the load device vibrates mechanically during operation, it can automatically suppress the oscillation and stabilize the load.	
	Communication	Smart frequency modulation	Adjust the output frequency intelligently according to the load variation trend
Power balance		The CAN-BUS communication is adopted between the inverters, and the real-time automatic adjustment between the inverters realizes the dynamic power balance among the multiple machines, up to 8 sets of machines are coordinated	
Torque limitation and control		In case of sudden heavy load or overload, the frequency inverter can automatically adjust the torque output to avoid overcurrent tripping due to stall	
Over-voltage, over-current and stall control		Automatic limiting of current and voltage during operation to prevent frequent over-current over-voltage tripping	
Cooling method		Heat pipe / air-cooled / water-cooled, optional cooling	
Fast current limiting		Minimize over-current faults and protect the inverter from normal operation	
Communication method		Integrated RS485 communication interface, standard MODBUS-RTU protocol	
Operating		Command source	Operation panel given (local), control terminal given (remote), communication given (remote)
		Frequency	Sources multiple frequency sources: panel reference, digital reference, analog reference, serial communication port reference, etc.
		Input terminals	6 digital input terminals, 1 analog input terminal, support 1-5V voltage input or 4-20mA current input
	Output terminals	5 digital output terminals, 1 high-speed pulse output terminal, support 200-2000Hz square wave signal output Smooth start, able to start motor with heavy load, realizing various speed for coal transportation, belts inspection and others	
Display and operation	Starting feature	Smooth start is able to start motor with heavy load, realizing various speed for coal transportation, belts inspection and others	
	Display method	7-inch LCD color display in Chinese/English	
	Key lock and function selection	Software protection against mal-operation	
	Operation mode	Mine used special metal keyboard (waterproof and dustproof) + metal button dual redundant design	
Technology	safety protection	Full protection such as output short-circuit detection, input and output phase loss protection, over-current protection, over-voltage protection, under-voltage protection, overload protection, over-heat protection, IGBT short-circuit protection, ventilation fan protection, communication interruption protection, charging failure, leakage lock protection.	
	Built-in electrical control system	Can be customized at any time according to the requirements of PLC and expansion modules, gateways, switches and various types of electrical accessories	
Environment	Installation place	Normal place or environment with methane and coal dust explosive gas	
	Altitude	Lower than 1500m, above 1500m de-rating is required	
	Working Temperature	0°C~+40°C (When the ambient temperature is +40°C ~+50°C, de-rating is required)	
	Humidity	less than 95% RH, no condensation	
	Vibration	less than 5.9m/s <sup>2</sup> (0.6g)	
Storage Temperature	-25°C~ +55°C		



■ Product Type (Single machine series)

Product Type	Voltage	Type Mode	Output power	Dimension	Weight (kg)	Cooling Method	
Mine Flame-proof and Intrinsically-safe Inverter (Two quadrant)	660V	BPJ-60/660	60kW	719X925X780	290	Heat pipe natural-cooled	
		BPJ-110/660	90kW				
		BPJ-200/660	185kW	1565X1100X1150	1400		Heat pipe air-cooled / water-cooled
		BPJ-280/660	250kW				
		BPJ-315/660	280kW				
		BPJ-400/660	355kW				
	BPJ-500/660	450kW	1025X1025X1050	650	Heat pipe natural-cooled		
	BPJ-132/1140	110kW					
	BPJ-200/1140	185kW		700	Heat pipe natural-cooled		
	BPJ-280/1140	250kW					
	1140V	BPJ-355/1140		315kW	1565X1100X1150	1400	Heat pipe air-cooled / water-cooled
		BPJ-400/1140		355kW			
		BPJ-500/1140		450kW	1935X1155X1250	1700	
		BPJ-630/1140		560kW			
BPJ-800/1140		710kW					
BPJ-1000/1140		900kW					
Mine flame-proof and Intrinsically safe low voltage ac converter (Four quadrant)	660V	BPJ-200/660K	185kW	1865X1200X1250	1800	Heat pipe air-cooled / water-cooled	
		BPJ-250/660K	220kW				
		BPJ-315/660K	280kW				
		BPJ-400/660K	355kW				
	1140V	BPJ-200/1140K	280kW	1865X1200X1250	1800	Heat pipe air-cooled / water-cooled	
		BPJ-250/1140K	420kW				
		BPJ-315/1140K	280kW				
		BPJ-400/1140K	355kW				
		BPJ-500/1140K	450kW	2200X900X1250	2400		Water-cooled
		BPJ-630/1140K	560kW				
		BPJ-800/1140K	800kW				





### Mine flame-proof and intrinsically safe combined inverter

Dual-inverter Combination, Triple-inverter Combination, Multi-inverter Combination

Power rating: 2X(110kW-710kW) Voltage rating: 660V、1140V



#### Technical features

- Can drive not only asynchronous motors but also permanent magnetic synchronous motors.
- Common DC-bus for low stray inductance Design
- Inverter Combination on request for small stand space and less cable layout
- Optional 12-pulse rectifier for low input harmonics
- Using film capacitors as DC filter, life span up to 15 years
- Built-in isolation switch with external operating mechanism can realize power delivery and power cut locally without disconnecting the upstream switchgear, easy to maintenance.
- Optional total input isolation or single input isolation
- Optional common rectifier unit for combined inverter or distributed rectifier unit for each inverter
- Independent output, setting and operating for each one of combined inverters
- Perfect EMC solution to decrease negative influence on power grid
- Integrated communication cable for reliable and stable communication quality under power balance operating
- Master-slave control or Droop control for power balance operating mode
- 7-inch colored LCD screen, full English display, intuitive and friendly interface, easy to understand.
- Total HMI or distributed HMIs
- Record Operating data and information of all combined inverters
- Metal numeric keypad (waterproof and dustproof), strong, corrosion-resistant, easy to operate.
- With cumulated fault records, and operation records up to 10 years, supports automatic and manual USB memory stick exporting function.
- Integrated output AC filters

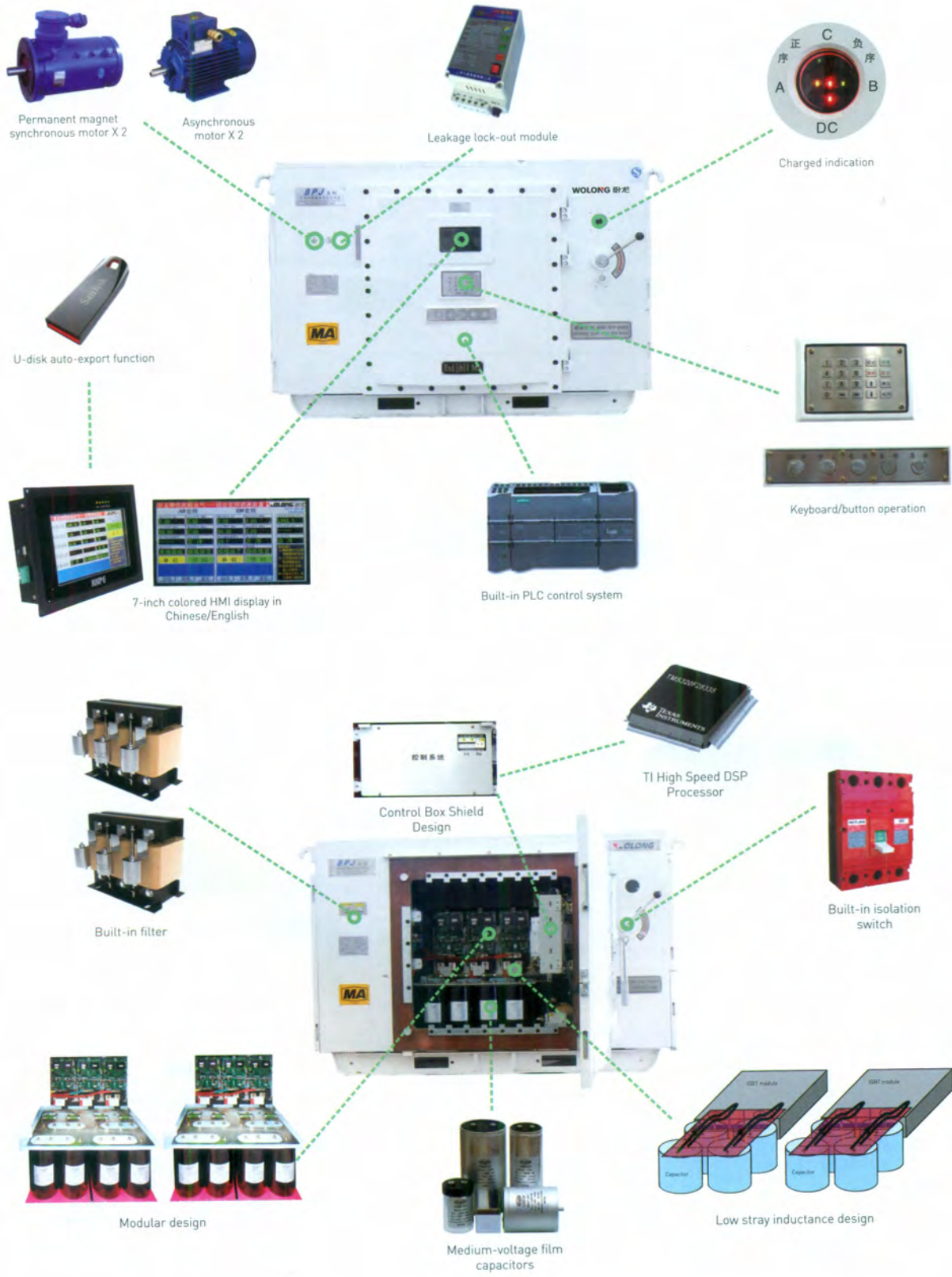
- Able to realize various complicated control processes, energy efficiency control management with built-in PLC (optional).
- Able to communicate with various system devices via RS485, Ethernet and other communication interfaces.
- Water-cooling has external water flow control function
- Water-cooled type has external water flow control function to avoid waste of cooling water.
- Modular design, easy assembly, transport by separation, combined underground

#### Users Benefits

The future-oriented modular design concept provides high flexibility of mine inverters:

- » Innovation of each module can improve the existing inverter system
- » User can decide dual-inverter, triple-inverter on demand to decrease stand space and cable layout.
- » Possible to purchase only the related modules for the required functions
- » Simpler module replacement for easier maintenance
- The integration of safety protection functions makes it better applied to equipment and conditions with safety protection requirements.
- Integrated power supply & power distribution system without extra switch combination
- Provide a variety of interfaces, support MODBUS-RTU, PROFIBUS, PROFINET and other communication protocols, bandwidth 100M/1000M, able to realize network-wide configuration.
- Innovative cooling concept strengthens environmental adaptability, optional cooling methods including natural-cooled/air-cooled/water-cooled.
- Water-cooled type has external water flow control function to avoid waste of cooling water.
- The equipment data can be exported automatically and manually, the user can check the historical status of the equipment operation, accumulated storage for more than 10 years.
- Compact and space-saving, modular design.
- Realize permanent magnet synchronous motor or asynchronous motor driving by reset parameters only.
- Complete settings of commonly used control methods by 2/3 line selection (level/pulse signal) for digital input.
- Digital input, output port programmable
- Reduction in equipment investment, cost-saving and energy-saving & consumption reduction.







Integrated Display Interface



Integrated Display Interface



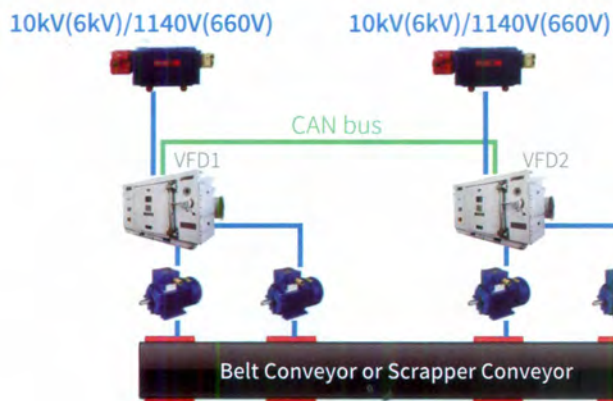
Parameter Menu Interface



Function Setting Interface

Typical Application

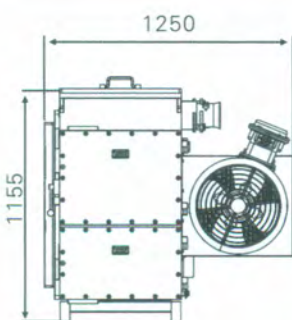
Application I Belt Conveyor, Scrapper Conveyor



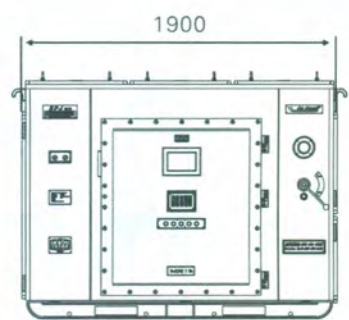
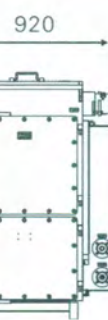
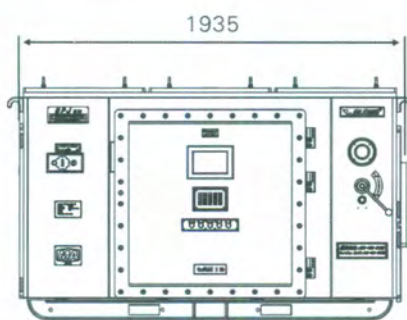
Combined Inverter Application

Product Selection

Product Type	Voltage	Model	Output Power	Dimension (W*H*D, mm)	Weight(kg)	Cooling Method			
Mine Flame-proof and Intrinsically-safe Type Combined Inverter	660V	BPJ-2X110/660	2X90kW	1840X1050X980	1200	Heat-pipe Self-cooling (natural cooling)			
		BPJ-2X160/660	2X150kW						
		BPJ-2X280/660	2X250kW						
		BPJ-2X400/660	2X355kW						
	1140V	BPJ-2X315/1140	2X280kW	1935X1155X1250	1800	Heat-pipe Air-cooling or Water-cooling			
		BPJ-2X400/1140	2X355kW						
		BPJ-2X500/1140	2X450kW						
		BPJ-2X630/1140	2X560kW						
		BPJ-2X710/1140	2X630kW						
		BPJ-3X400/1140	3X355kW				2700X1400X920	3500	Water-cooling
		BPJ-3X500/1140	3X450kW						
		BPJ-3X630/1140	3X560kW						



2 × (280kW、315kW、400kW)



2 × (500kW、630kW、710kW)



## Mine Flame-proof and Intrinsically-safe Type Power Transformation Inverter (3.3kV Mine MV Inverter—13 levels output)

Power Rating: 855~1600kW Voltage Class: 6kV/10kV input, 3.3kV rated output

### Product Overview

This product adopts SPWM technology, high-performance V/f control and speed sensor-less vector control technology. Power modules adopt cascaded connection multi-level topology, dry-type film capacitor, internal-external water isolation water-cooling structure. This product is free of maintenance with long service life, and it has feature of perfect harmonics design with  $PF \geq 0.95$ . This product is applicable to Mine 3.3kV motor drive, especially heavy load motor's long-distance drive control for high power scrapper conveyor, crusher, reversed loader, belt conveyor and so on. It has many excellent performances such as big start torque, high PF, motor soft start, long-distance power supply, multi-motor power balance and so on.

### Technical Features

- 10kV/6kV input, 0~3.3kV variable frequency output, design for easy-to-separate, simplify the system to improve reliability.
- 54-pulse rectifying circuit to effectively avoid high-frequency harmonics into the power grid under the mine. Output voltage harmonics is small, output waveform is very close to sine wave, and it has no interference to electronic equipment such as mine safety supervision system, communication and so on to avoid safety risk.
- 13-level output makes output waveform close to sine wave without output filter, and it has no special requirement to motor, it is applicable to general insulation level cables, motors with high efficiency.
- High efficiency and high power factor. Overall efficiency reaches more than 97%, and PF can reach more than 0.95.
- Output more than 2.2 times of rated torque at low speed to solve heavy load start problem.
- Power modules adopt modular design for reliable operating and easy maintenance.
- Long-distance power supply to motor, which can reach 3000m.

### Technical Spec.

#### Technical Spec.:

		Primary Circuit	
Input Side	Rated Frequency	50Hz ( $\pm 5\%$ )	
	Rated Voltage	AC 3-phase 10kV (-15~+10%)	
	Input Transformer	54 pulses	
	PF	$> 0.95$	
Output Side	Output Frequency	0.1~50Hz	
	Output voltage	0~3.3kV	
	Output Current	0~330A	
	Out Power	855~1600kW	
	Overall Efficiency	$\geq 97\%$	
	Overload	110% for long period	
		120%/30min per 60min	
Start torque $> 2.2$ times			
THD%	$< 4\%$		
Control Characteristic	Control Mode	Speed sensor-less vector control, V/f control	
	Modulation Technology	Optimized SPWM	
	Frequency Accuracy	Digital input: $\pm 0.1\%$ (pre-settable)	
	Frequency Resolution	Digital input: 0.01Hz	
	Torque boosting	Automatic torque boosting	
	Acceleration/Deceleration time	30~360s (depend on load), S curve	
Control Signal Transmission	Optical Fiber		

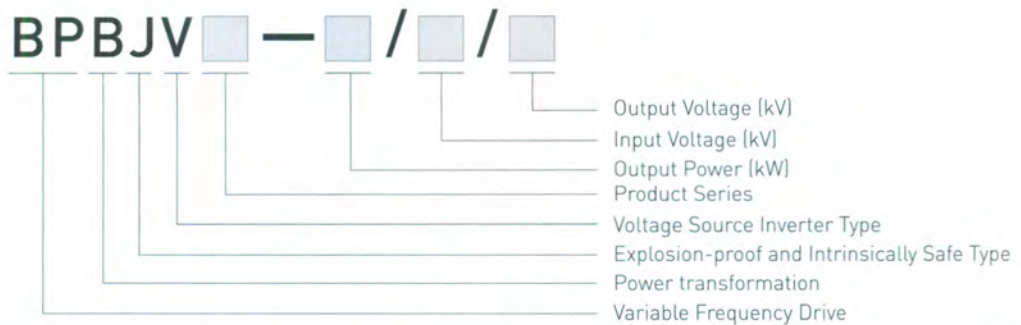


Operating Characteristic	Frequency Setting	Digital setting: Local/Remote	
	Start Mode	Forward/Reverse independent control	
	Stop Mode	Free stop/Controlled stop	
	Main Operating Functions	Multi-motor power balance, smart detection & repair, self-adjusting process curve, automatic torque boosting	
		Frequency skipping, multi-stage operating	
		System self-diagnosis, remote control, Chain-broken protection function, pilot control function	
DI	Dry contact: 24 channels		
DO	Dry contact: 16 channels		
Protection Functions		Over-current, short-circuit, over-voltage, under-voltage, over-load, phase loss, 3-phase unbalance, insulation supervision, communication fault, transformer's over-temperature, water-cooling system's fault and so on	
HMI Display		Fullycolorful touching screen	
Operation Mode		Click mouse, push button, remote centralized control	
Communication	Port	RS485	
	Protocol	Modbus, Profibus-DP	
Mechanical Characteristic	Flame-proof Type	Exd(ib)I	
	IP Grade	IP55	
	Cooling Method	Water Cooling(deionized water for internal circulation, internal & external water isolation)	
	Cabinet Color	White	
Installation Environment	Installation Zone Classification	Environment with CH <sub>4</sub> , Coal dust explosive gases	
	Temperature	-5°C ~+35°C	
	Relative Humidity	≤95%(no condensing)	
	Storage Temperature	-20°C ~+45°C	
	Altitude	0~1000m	

Product Series:

■ How to choose (Dimension)

Naming specification

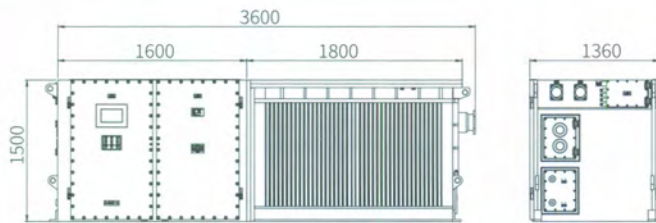


Type Mode	Rated Power (kW)	Input Voltage (kV)	Output Voltage (kV)
BPBJV-855/10/3.3	855	10	0-3.3
BPBJV-1250/10/3.3	1250	10	0-3.3
BPBJV-1600/10/3.3	1600	10	0-3.3
BPBJV-855/6/3.3	855	6	0-3.3
BPBJV-1250/6/3.3	1250	6	0-3.3
BPBJV-1600/6/3.3	1600	6	0-3.3

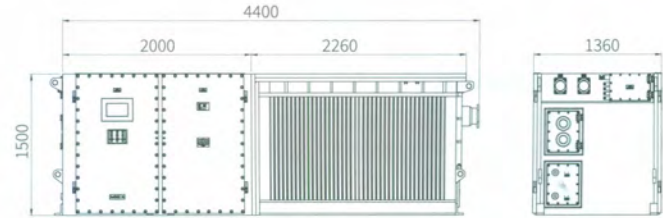
Technical Parameters:



■ Equipment Dimension Drawing



Detachable Mine Explosion-Proof and Intrinsically Safe Power Transmission Variable Frequency Drive  
 BPBJV-855/10 (6) /3.3



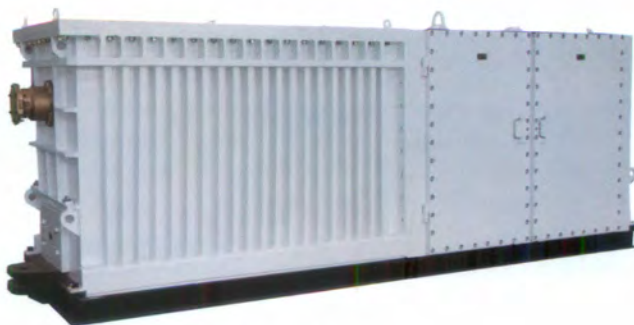
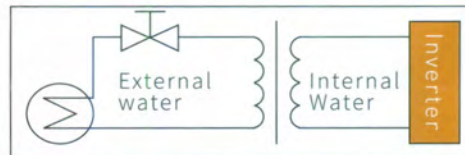
Detachable Mine Explosion-Proof and Intrinsically Safe Power Transmission Variable Frequency Drive  
 BPBJV-1250/10 (6) /3.3, BPBJV-1600/10 (6) /3.3

■ Equipment View



Front view

Imported Alfa Laval Plate Type Heat Exchanger



Rear view



Internal view



**Mine explosion-proof and intrinsically safe medium-voltage (combined) Variable Frequency Drive (3.3KV three-level output)**

Power range: 855kW-2600kW voltage range: Input: 1X3.3kV or 2x1903V output 0-3.3kV Variable Frequency

**Product Overview**

The inverter adopts SPWM technology and high-performance V/F control and sensor less vector control technology; it is designed with three-level topology, equipped with dry type film capacitors, cooled by enclosure water wall structure, cooling water does not enter the equipment cavity. The twin inverters adopt independent rectification and do not share DC busbar, so that they don't affect each other. The built-in emergency switch and output reactor of the inverter can realize power supply distance more than 1500 meters; It is suitable for motor drive control of 3.3kV voltage level in coal mine underground, It is especially suitable for long-distance drive control of heavy-duty motors, such as high-power scraper conveyors, crushers, transfer machines, belt conveyors, etc. It has excellent characteristics such as large starting torque, high power factor, soft start of motor, long-distance power supply and multi-machine power balance.

**Technical features**

- The power part has a simple structure and a small dimension, and has a single type and a combined type.
- 6 pulse / 12 pulse rectification optional, For 6 pulse rectification product, Input without step-up transformer, step-down transformer, star angle transformer, 3300V power supply, can improve system efficiency
- The inverter is cooling by enclosure water wall structure, cooling water does not enter the equipment cavity. It can effectively overcome the water leakage problem of the water-cooled inverter.
- The two combined inverter use two sets of independent rectification, no common DC bus, one inverter failure does not affect the operation of the other inverter
- The inverter is combined with the switch, and the internal two-way emergency switch can realize the emergency start of the switch.
- The IGBT is directly driven by the main control board fiber, no power cell board, compact structure with low failure rate.
- The output has a du/dt filter, which has less harmonics, less damage to the motor and cable insulation, less vibration of the motor, less heat generation, high efficiency, and the power supply distance can reach more than 1500 meters.

**Technical Parameters**

Basic parameters	Rated input voltage	3.3kV-15%—+10%
	Rated input frequency	50Hz
	Rated output power	2×855-2×2600kW
	Output frequency range	5-50Hz
	Output voltage range	0-3.3kV
	Output current range	0-535A
	Overload capacity	110% (long-term), 120% (30 min), 150% (1 min) Starting Torque > 2.2Tn
	Control mode	V/F control, sensorless vector control
	Cooling mode	External Water cooling, cooling water pressure < 3MPa, flow > 130 L/min
	Operation mode	Two-quadrant operation
	Intrinsically safe parameters	FHS1.5W intrinsically safe wireless mouse for Mine purpose, Uo: 1.65V, Io: 1.47A
Explosion-proof Parameters	Explosion-proof type	Explosion-proof and intrinsically safe
	Explosion-proof mark	Exd[ib]I Mb
HMI	Display mode	10.2" true color display
	Operation mode	Metal button, intrinsically safe wireless mouse

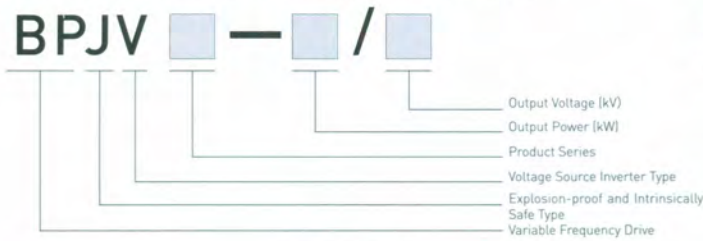
Product Series:



## How to choose (Dimension)

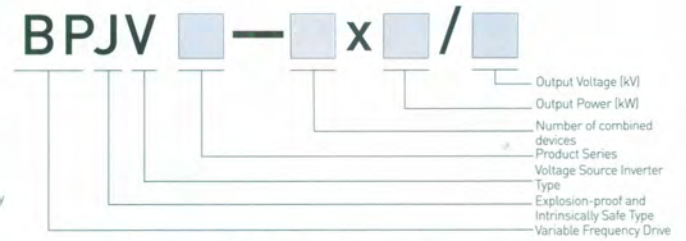
Naming rules

Mine Flame-proof and Intrinsically-safe MV Inverter



Single Type

Mine Flame-proof and Intrinsically-safe MV Inverter

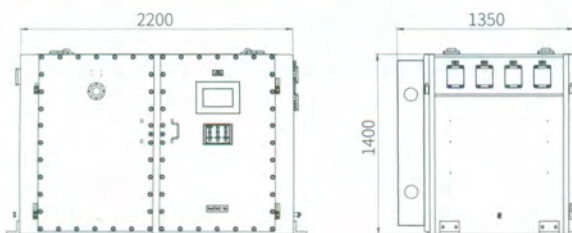


Combined Type: Two-combined, Three-combined

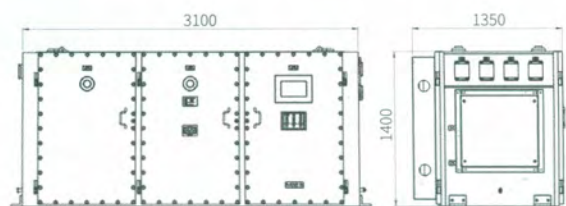
## Selection (including equipment)

Species	Type Model	Rated Power (kW)
Single model	BPJV-855/3.3	855
Single model	BPJV-1250/3.3	1250
Single model	BPJV-1600/3.3	1600
Single model	BPJV-2000/3.3	2000
Single model	BPJV-2600/3.3	2600
Combination model	BPJV-2×855/3.3	2×855
Combination model	BPJV-2×1250/3.3	2×1250
Combination model	BPJV-2×1600/3.3	2×1600
Combination model	BPJV-2×2000/3.3	2×2000
Combination model	BPJV-2×2600/3.3	2×2600
Combination model	BPJV-3×855/3.3	3×855
Combination model	BPJV-3×1250/3.3	3×1250
Combination model	BPJV-3×1600/3.3	3×1600

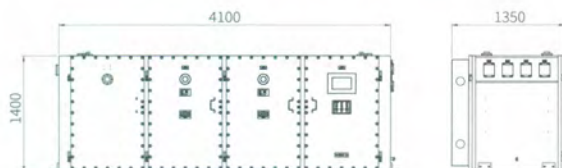
## Equipment Dimension Drawing



Mine explosion-proof and intrinsically safe medium-voltage inverter  
 BPJV-855/3.3, BPJV-1250/3.3, BPJV-1600/3.3  
 BPJV-2000/3.3, BPJV-2600/3.3



Mine explosion-proof and intrinsically safe medium-voltage two-combined inverter  
 BPJV-2×855/3.3, BPJV-2×1250/3.3, BPJV-2×1600/3.3,  
 BPJV-2×2000/3.3, BPJV-2×2600/3.3



Mine explosion-proof and intrinsically safe medium-voltage three-combined inverter  
 BPJV-3×855/3.3, BPJV-3×1250/3.3, BPJV-3×1600/3.3







**Flame-proof and intrinsically-safe inverter for ventilators  
 Mine Flame-proof and Intrinsically-safe Dual-power  
 Dual-inverter for Ventilator (660V、1140V)**

Power rating: 30kW-132kW Voltage rating: 660V / 1140V Structure: Single frequency inverter / dual frequency inverter

**Technical features**

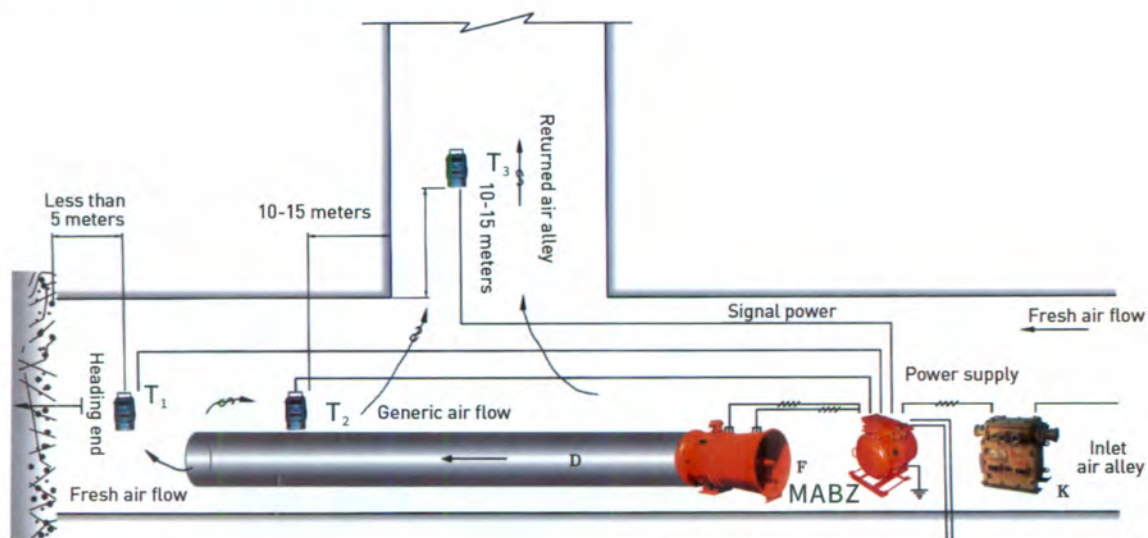
- Built-in line isolation switch
- Support peer-to-peer, master-slave automatic switching
- Support frequency or current type gas sensor
- LCD display in Chinese
- Built-in output filter
- Maximum efficiency of automatic discharge of gas
- Interlocked circuit-breaker of gas concentration and air flow velocity
- Significant energy saving effect and short investment recovery period



**Working principle**

The artificial intelligence fuzzy control technology is adopted to detect the gas concentration signal in the roadway in real time through the gas sensor. When the gas exceeds the limit, the speed of the fan is adjusted intelligently and the output air volume is changed. Completely avoids the 'constant blows' phenomenon of gas discharge, and guarantees the safe production of mines and the life safety of personnel.

**Single frequency inverter configuration diagram**



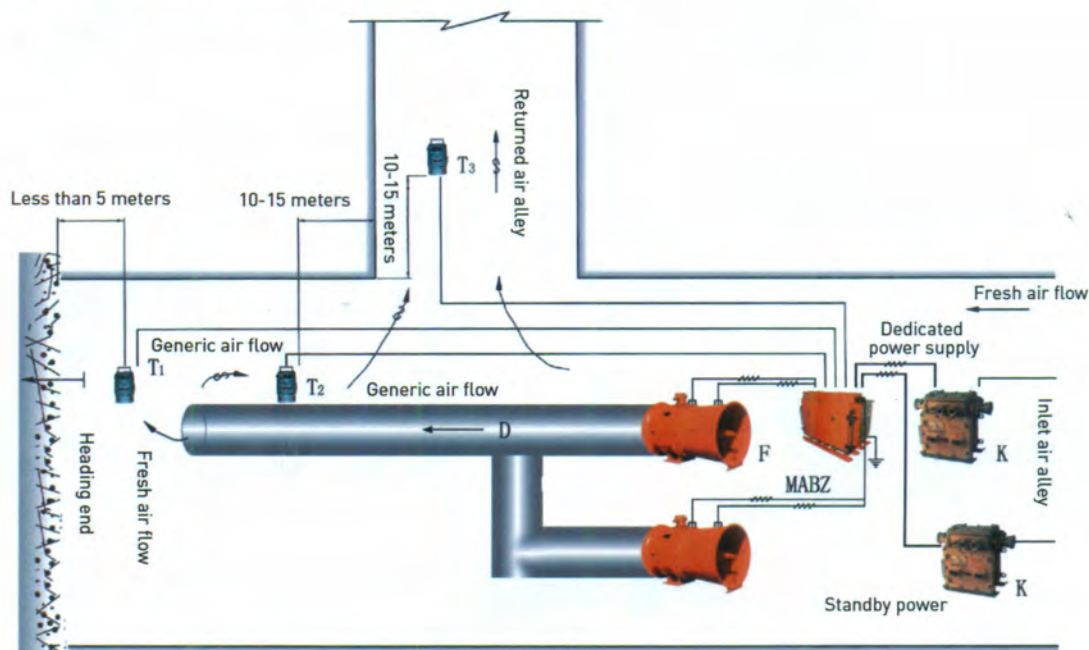
Normally open contact for interlocked circuit-breaker of air flow velocity

- K—local fan power switch
- MABZ—Flame-proof and intrinsically safe frequency inverter for fan
- T1—Heading gas sensor (face gas sensor)
- T2—Drivage gateway gas sensor (gas sensor at return air)

- T3—Gas sensor at the returned air alley of mixed airflow (full-pressure mixed port gas sensor)
- F - Local fan
- D—Air duct



### ■ Dual-inverter System Configuration Diagram



K—local fan power switch

MABZ—Flame-proof and intrinsically safe frequency inverter for fan

T1—Heading gas sensor (face gas sensor)

T2—Drivage gateway gas sensor (gas sensor at return air)

T3—Gas sensor at the returned air alley of mixed airflow (full-pressure mixed port gas sensor)

F - Local fan

D—Air duct

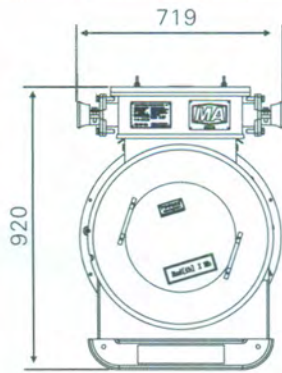
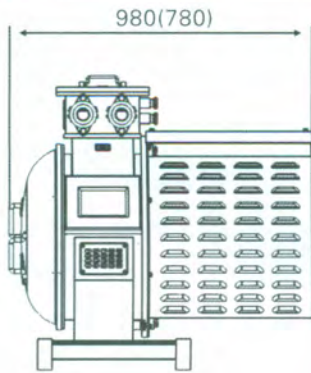
### ■ Technical Spec.

Basic Parameters	Output frequency range	0 ~ 100Hz
	Over-load capability	120% rated current 1min; 150% rated current 10s; 180% rated current 2s
	Control mode	High performance V/F control
Ex-proof parameters	Ex-proof type	Flame-proof and intrinsically-safe type
	Ex-proof mark	Exd(ib)I Mb
HMI	Display mode	LCD screen
	Key-board operation	Mine special metal keyboard(water & dust-proof), metal push button with dual-redundancy design
Environment	Application location	CH <sub>4</sub> , coal dust explosive gas environment( gas has no damage to insulation material and metal material)
	Altitude	<1500m(>1500m by de-rating)
	Working temperature	0~40°C (40~50°C by de-rating)
	Atmosphere	86~106kPa(CH <sub>4</sub> , coal dust explosive gas environment)
	Humidity	≤98%(25°C )
	Installation category	C1
Pollution class	Level 3	
Storage temperature	-25°C ~ +55°C	

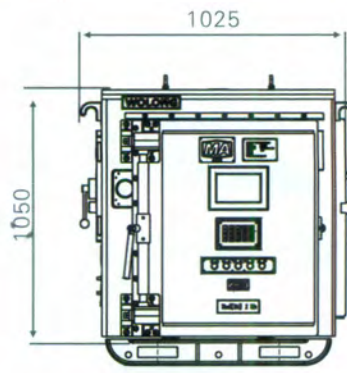


Product Model

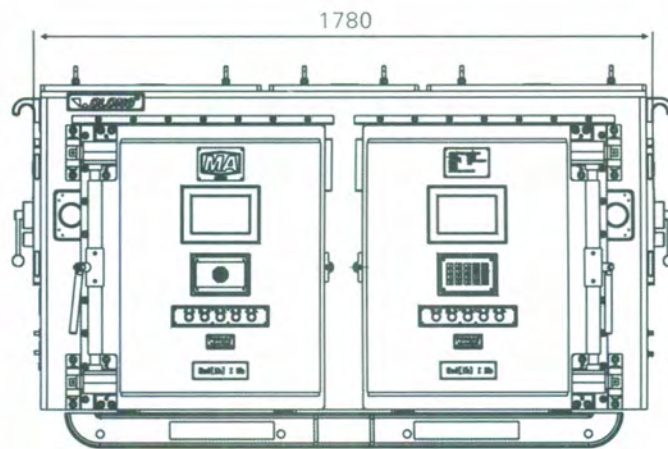
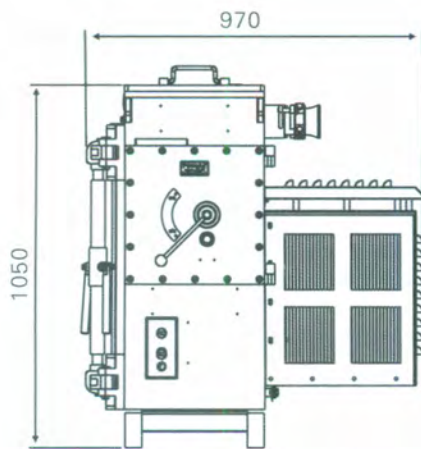
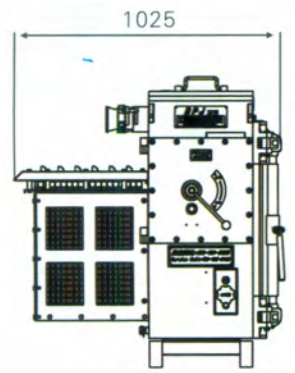
Product Model	Voltage Rating	Type	Output power	Dimension (W*H*D, mm)	Weight (KG)	Cooling Method
Flame-proof and Intrinsically-safe Inverter for Ventilator(Single Machine)	660V	BPJ2-60/660F	60kW	719×920×780	270	Thermal tube self-cooling
		BPJ2-110/660F	110kW	719×920×980	290	
	1140V	BPJ2-110/1140F	110kW	1025X1050X1025	650	
		BPJ2-132/1140F	132kW			
Flame-proof and Intrinsically-safe Dual-power Dual-inverter for Ventilator(Dual Machine)	660V	BPJ2-45/660SF	2×45kW	1780X1050X970	1200	
		BPJ2-75/660SF	2×75kW			
		BPJ2-110/660SF	2×110kW			
		BPJ2-160/660SF	2×160kW			
	1140V	BPJ2-110/1140SF	2×110kW			
		BPJ2-132/1140SF	2×132kW			



60kW、110kW



110kW、132kW



2X(45KW、75KW、110KW、132KW、160KW)



### Mine automation control series product

#### Mine flame proof and intrinsically safe programmable control box



- ◆ Built-in Siemens S7 series PLC (customized brand)
- ◆ Supports protocols such as PROFINET, ETHERNET, PROFIBUS, S7, MODBUS, etc.
- ◆ Built-in industrial Ethernet switch, reserved multi-channel optical port / electrical port access
- ◆ Abundant DI/DO, AI/AO interfaces, meets the logic control of various complicated working conditions
- ◆ Built-in 10-inch colored screen for displaying various process animation information
- ◆ Saves operation records, fault records, and supports export function

#### Mine intrinsically safe type console (including mine flame proof display box)

- ◆ Integrated multi-function button, input voltage intrinsically safe DC 24V
- ◆ Two RS485, one RS232, one Ethernet port, two optical fiber ports
- ◆ Supports various drive protocols such as TCP/IP, MODBUS-RTU, S7 and others
- ◆ 10 inch colored LCD screen displays various process animation information



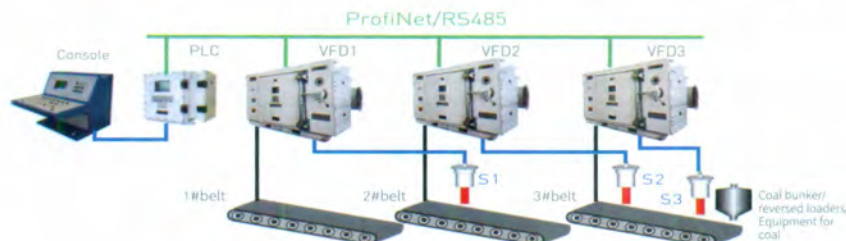
#### Product Model

Product name	Type Mode	Suitable	Dimension (W*H*D, mm)	Weight (KG)
Mine flame proof and intrinsically safe programmable control box	KXJ-1140 (660)	Flexibly compatible with the equipment at installation site	830×800×530	450
Mine intrinsically safe operation box	CXH24		250×366×120	5
Mine flame proof display box	PB24		536×410×152	56
Mine intrinsically safe console	TH24		1000×1262×1030	100
Mine flame proof material flow sensor	GL-24		φ130 (D) ×180 (L)	6
Mine sensor series (for belt)	Coal-filled sensor, sprinkler solenoid valve, coal level sensor, speed sensor, temperature sensor, smoke sensor, deviation sensor, emergency stop switch, material flow sensor, voice alarms, etc.			

### Mine automation control system

#### Belt conveyor energy efficiency management system

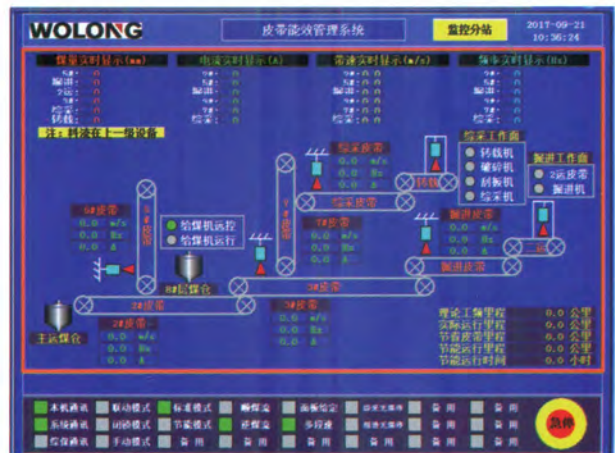
The system is mainly composed of programmable control box, intrinsic safety console, flame proof display box, inverter, material flow sensor, speed sensor, etc. The control box adopts PLC as the core controller, which is mainly used to collect inverter data and sensor signals, front and rear equipment information, operation console and external commands, etc., by the processing of the above information, it is capable of analyzing the operation state of the belt conveyor, the amount of coal on the belt conveyor, the operating state of the equipment of the front and rear stages, the fault status of various equipment, etc., therefore dynamically adjust the operating state of the whole system, implement speed regulation by inverter in accordance with the coal volume to achieve the purpose of energy saving and consumption reduction, and realize the automatic energy-saving operation of the whole system.





**Mine intrinsically safe type console (including mine flame proof display box)**

- ◆ Achieves multi-belt conveyor "start-up in direct coal flow" and a variety of starting methods
- ◆ Capable of "high speed at heavy load ,low speed at light load" energy-saving speed regulation
- ◆ Capable of realizing "drive with coal driving, standby without coal"
- ◆ Real-time monitoring of material transported on the belt
- ◆ Capable of realizing automatic interlocking control with upstream and downstream equipment
- ◆ Capable of saving energy and belt running mileage

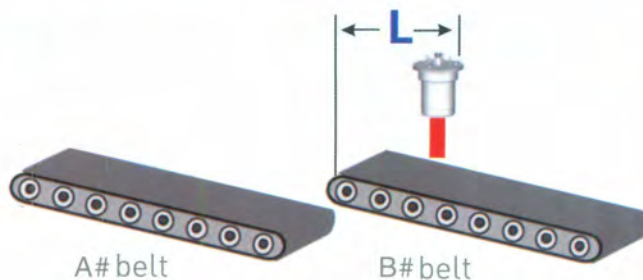


**Mine flame proof material flow sensor**



The material flow sensor is used to detect the amount of material on the belt. The installation position is determined according to the specific conditions of the site. It is generally installed on the upstream belt. The specific installation position is based on the actual situation of the site, decided by the running speed of the upstream belt and the acceleration time of the belt inverter, etc. This is to avoid coal dropping from that belt due to that upstream belt equipment's coal loading suddenly reaches max. value while the belt is running at low speed. The flow sensor is installed behind the coal fallen position on the belt conveyor, when a single belt is used for energy saving control.

Calculation of the flow sensor's installation position:



Sensor arrangement diagram

As shown in above figure, the belt conveyor A is controlled by the inverter. The sensor is installed at the L position of belt conveyor B. The calculation formula of L is:

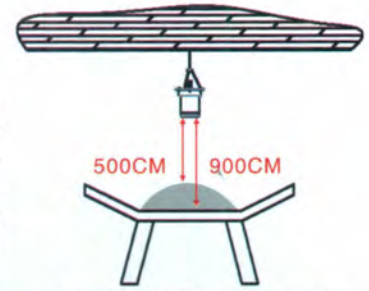
$$L = V_b \times (T_a / F_h \times (F_h - F_1))$$

Where L is the distance from the sensor to the machine head,  $V_b$  is the rated speed of the belt conveyor B,  $T_a$  is the acceleration time set by the inverter of belt conveyor A,  $F_h$  is the rated frequency[50Hz] of the belt conveyor A's motor, and  $F_1$  is the lowest frequency of the belt conveyor A. For example, the rated speed of the belt conveyor B is 2.5m/s, the acceleration time of the belt conveyor A is 20s, and the minimum frequency of the belt conveyor A is 10Hz. Using above values we can do calculation as follows  $L = 2.5 \times [20 / 50 \times (50 - 10)] = 40$  m.



**Technical parameters**

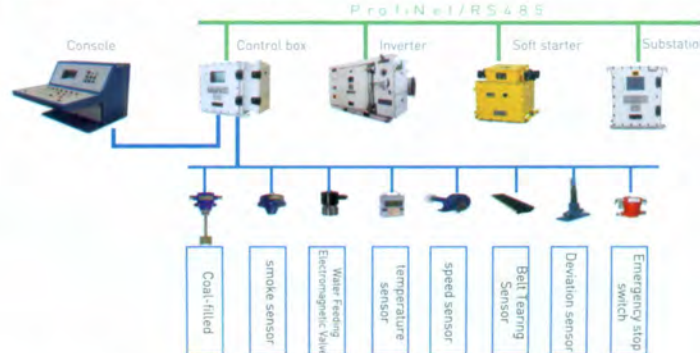
- ◆ Measuring range: measured thickness is 0-3m, can be adjusted according to the actual situation on site
- ◆ Output signal: The output signal is 4-20mA/RS485 communication
- ◆ Transmission distance: 0-1500m (shielded cable of 1.5mm<sup>2</sup> or more is required)
- ◆ Power supply voltage: DC18-30V ◆ Rated current: <100mA ◆ Corresponding speed: 0-7.5m/s
- ◆ Working principle: Mainly based on the principle of microwave ranging, the microwave transmitter emits microwaves in a certain direction, and starts timing until the microwave returns against an obstacle. Knowing the propagation speed of microwaves in the air, the distance between the sensor and the obstacle can be obtained. The signal processing board converts the signal into the thickness value of the material on belt, and output in the form of current, frequency, RS458, etc.
- ◆ Installation method: Lifting



Coal Thickness Detection Diagram

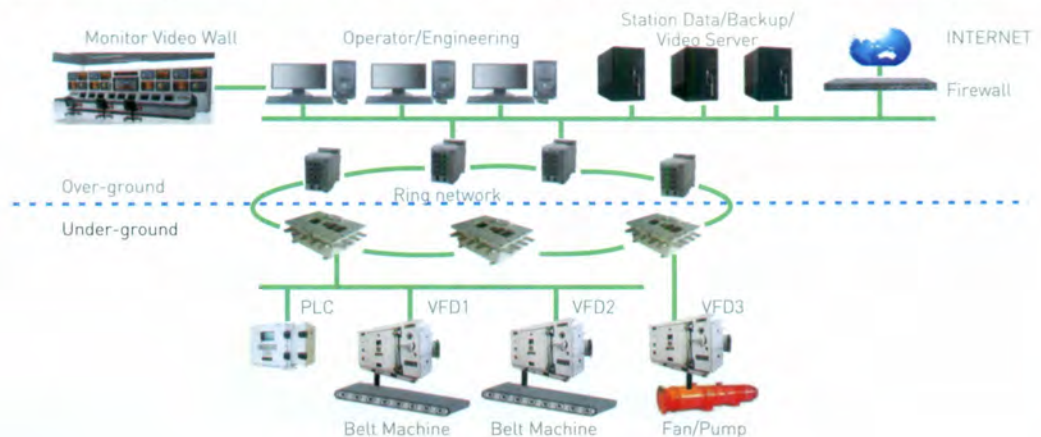
**Belt electrical control system**

The system is mainly composed of programmable control box, intrinsic safety console, flame proof display box, protection sensors, etc. The control box adopts programmable controller PLC as its core controller, which makes the system have good networking and expansion capabilities. Customer is able to expand the system just by adding modules instead of replacing the whole system. In addition, the system has the advantages of stable performance, easy maintenance, convenient operation, and intuitive and easy monitoring.



**Global mine integrated automation system**

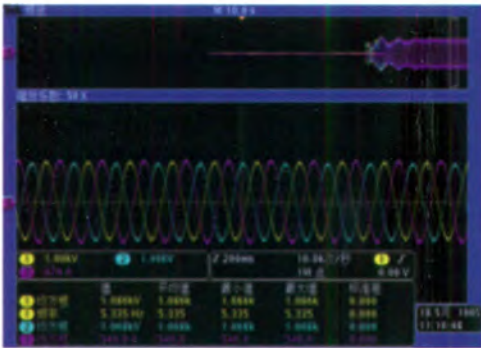
The global mine automation system is a system integrated with SCADA automation platform, field equipment, network information, video monitoring, dispatching command and other systems. It is integrated into the dispatching center through the industrial Ethernet ring network for unified management, unified operation and unified monitoring, thereby achieving the overall goal of digital mine by means of integration of various mine subsystems, reducing labors and increasing efficiency, saving energy and reducing consumption, and safe production.





## ■ Belt conveyor system application case

Six 630kW inverters of our company are installed on three main belts of a mine in Liaoning, the belt inclination angle is 22 degrees, and the three belts are driven respectively. The inverter realizes belt soft start, heavy load start, low speed belt inspection, multi-speed, power balance, and other functions which optimizes the operating curve of the motor, greatly reduces the impact of the machine during the starting process, the starting current and the impact on the power grid. The output current difference of the two inverters is less than 1.5A, which makes the belt conveyor more efficient, safe and stable, and effectively prolongs the service life of the belt conveyor.



## ■ Scraper transport system application case

The combined type water-cooled frequency converter of our company has been installed on the working face of No. 4 shaft of a mine in Shanxi, and tests including heavy-load starting, full-load operation and power balance were carried out the equipment. The equipment successfully realized low frequency high torque start and power balance when the scraper was filled with coal. According to the follow-up feedback from customer, during the production period, the scraper was successfully started even at the extreme condition of being pressed by the rib fall, which was fully affirmed by the user.

## ■ Belt energy efficiency management system application case

The belts of the 12# coal seam fully mechanized Mine face and the excavation face in a mine of China Coal Company are controlled independently. The belt conveyor is operated against the coal flow relying on manual relay force. There is no logical protection between each other. At the time of maintenance or handover, the downstream belt is often at idle operation at least for 30-60 minutes, and the power factor of the entire belt system is about 0.5, it was of low automation level and high energy consumption, and resulted in a large amount of economic loss.

Using our energy efficiency management system, all belt control is gathered in one operation console. The start and stop sequence of the belt is completely locked by PLC logic, which is safe and reliable. All the belts in the system are driven by the inverter, the power factor is raised to 0.9 or more, a large amount of reactive power loss is reduced, and each inverter is integrated with energy efficiency intelligent module which is capable of collecting the flow sensor signal of the upstream belt through Ethernet communication. The system realizes co-current driving of the working face, avoids the no-load loss of the belt, and adjusts the belt speed in real time according to the amount of coal to maximize the carrying efficiency, it also improves production safety efficiency, reduces labor costs, extends belt life, reduces power waste, saving about 700,000 Yuan per year for customer.





### Mine flame proof and intrinsically safe high-voltage AC soft starter

#### Product description

Mine flame proof and intrinsically safe high-voltage AC soft starter (QJGR series products) is an innovative type product. It makes the motor drive system more flexible and lower cost.

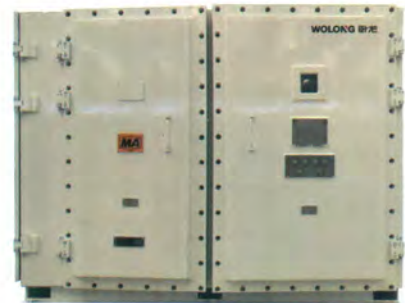
The product adopts advanced digital control mode, mainly used for soft start and soft stop of flame proof three-phase asynchronous motor.

#### Mine flame proof and intrinsically safe high-voltage AC soft starter—— QJGR-200/10(6)K

The product is capable of realizing the start-stop control of motor with rated voltage lower than 10kV/6kV and rated power less than 3000kW. The control method is "one for one", "one for two".

#### Mine flame proof and intrinsically safe high-voltage AC soft starter—— QJGR-400/10(6)K

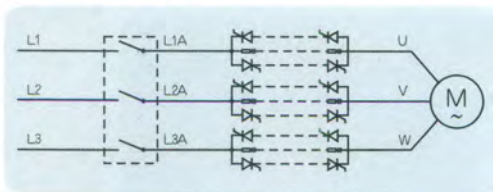
The product can is capable of realizing the start and stop control of the motor with rated voltage lower than 10kV/6kV and rated power less than 6000kW. The control method is "one for one" and "one for two".



#### Technical characteristics

- ◆ Reduce mechanical shock: Minimize mechanical shock to the system during start-up and stop, such as reducing water hammer and surge hazards in the piping system.
- ◆ Reduce grid impact: Minimize the electrical impact to the grid during start-up, such as reducing starting current and grid voltage drop.
- ◆ Maintenance-free: The device adopts thyristor as a non-contact power electronic device, and at the same time, the device has a large amount of redundancy, so it is a maintenance-free device.
- ◆ Emergency work: The device is equipped with a vacuum contactor that can directly start the motor. When the soft start system fails, the vacuum contactor can be used to directly start the motor so as to maintain continuity of production.
- ◆ Easy installation: The device is a complete motor start control and protection system, it is available for operation after only the power supply cable and motor cable connected.
- ◆ Easy to use: System friendly Chinese human-machine interface, convenient for user parameter setting and fault diagnosis, built-in low voltage test available in case of failure The system performs a self-test to determine the point of failure.
- ◆ Protection and monitoring: Built-in motor overload, under-load, overvoltage, voltage imbalance, phase loss, stall, start and other protection functions. Built-in measurement functions such as three-phase current, voltage, power factor, and operating time.
- ◆ Wide range of applications: Suitable for all kinds of equipment such as pumps, fans and belt conveyors.

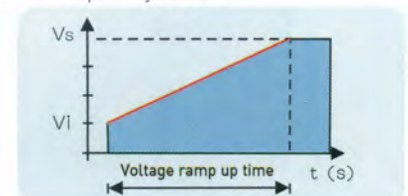
#### Working principle - introduction of starting method



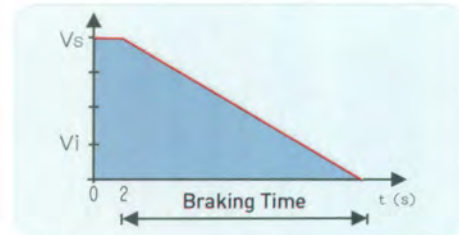
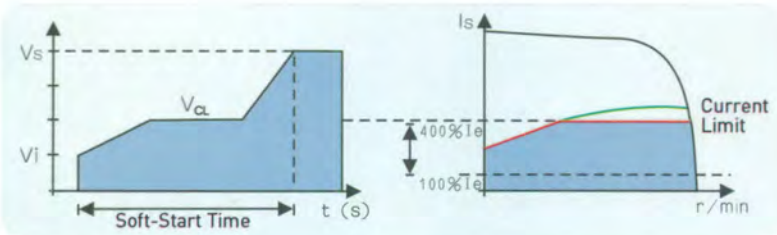
- ◆ The QJGR series products are electrical equipment connected in series between the power supply and the electric motor. When motor soft start is required, the controller adjusts the conduction voltage of the phase-controlled thyristor so as to adjust the voltage of the motor terminal to obtain the proper starting current and the starting torque. QJGR series products can realize various starting methods such as voltage ramp start, current limit start, and two-stage variable frequency start.

#### Voltage ramp start

- ◆ Note: In this mode, the starting current exceeds 500%I<sub>e</sub>, which easily triggers the current trip. The conduction angle increases the output voltage linearly until the rated voltage.







### Current limit start

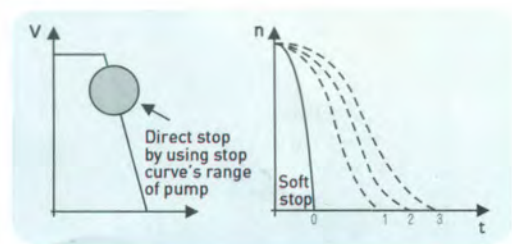
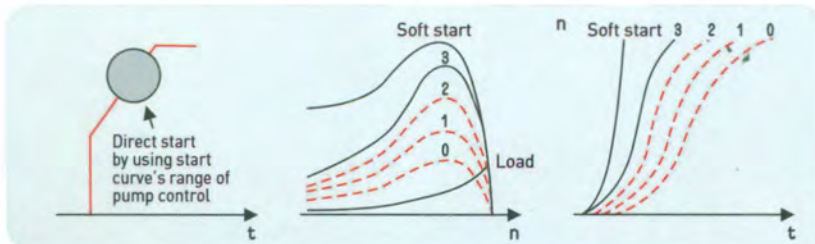
Limited current adjustable range from 100% to 400% nominal current, The current limit does not take effect during operation and soft stop.

### Soft stop

- ◆ Deceleration • Soft stop (slope down time);
- ◆ Deceleration control for high friction loads;
- ◆ Determine the motor voltage ramp down time;
- ◆ The adjustment time is 1~30s.

### Motor start

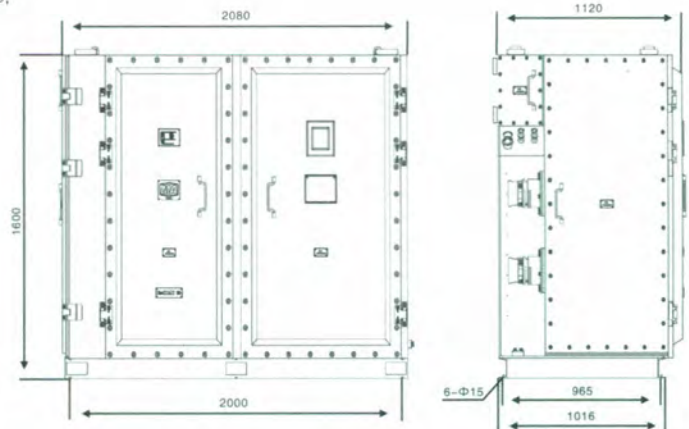
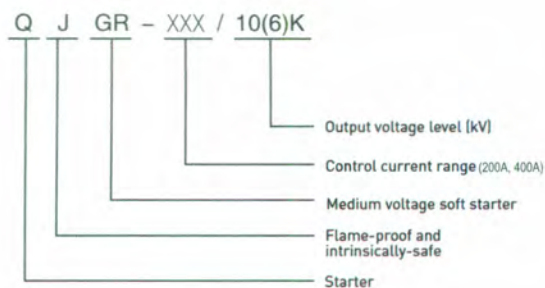
- ◆ Deceleration • Soft stop (slope down time);
- ◆ During start-up, the asynchronous motor produces a peak torque that is three times the rated torque. In some pump applications, this peak causes high thyristor voltage;
- ◆ The QJGR series offers four different starting curves;
- ◆ Curve 0: suitable for debugging of no-load motors;
- ◆ Curve 2: the standard curve (default) is suitable for most motor starting;
- ◆ Depending on the site conditions, users can also select 1, 3 or self-programming start curves.



### Motor stop

- ◆ During the pump stop, if the "soft stop" function is not used, when the liquid level is high, the motor torque will get lower than the load torque in short time, which will cause sudden stop of the motor and produce water hammer phenomenon. "Soft stop" can smoothly reduce the speed to zero to avoid this phenomenon;
- ◆ The QJGR series offers 4 different stopping curves;
- ◆ Curve 0: standard curve (default) free stop;
- ◆ Curve 1, 2, 3: Select according to the actual pump characteristics,
- ◆ It is also possible to select a soft stop curve in addition to the existing curves.

### Selection & Dimension





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