

# Introduction to Remote Control Roadheader Project

## **Significance:**

Tunneling and backstoppings are of great importance to coal production mining technology and machines have direct impact on productivity and safety. The development of centralized production and working face tunneling requires continuous mechanization and automation to speed up tunneling work.

Meanwhile, it also reduce tunneling costs, enhance safety and improve working environment. However, the low degree automation of domestic equipment leads to low efficiency of tunneling, the single heading of fully mechanized tunneling is still at a low level. The bottleneck of mine production in the new economy is the very tunneling technology, and if it can be solved, the productivity and efficiency of mining would be increased, simultaneously, there would be a balance between mining and tunneling, contributing to stability or improvement of production, to safety and to high efficiency, therefore, technology of automatic tunneling for domestic equipment is required to match that of mining.

## **Brief introduction to products**

Cantilever roadheader for hard rocks is the most widely used machine in roadway tunneling. At present, the working environment of roadway tunneling is harsh, and the gas concentration is high. The safety and tunneling efficiency of manual tunneling machine operators have become the focus of attention in the industry.

Line of sight Remote Control System AL281 is based on the roadheader ALZ160 and completes the whole process of tunneling and mining by wireless remote control; the operator is 100m far away from the tunneling site, which can ensure the safety of production and improve operating environment. The operator works within a safe area and the machine goes deep into the coal wall to mine, avoiding industrial injuries.

High reliability of remote control system and its ease of maintenance require safe and durable components, firm and good-look remote control with an operation

icon and characters melted on its handle, and reasonable handle position for safe and convenient operation.

Principle of remote control roadheader: Operator sends all kinds of operation signals to receiver by remote control transmitter. The receiver converts all kinds of signals into corresponding control signals, controls the electromagnetic proportional valve to complete the action of each component, and realizes the off-line operation of the action. At the same time, the receiver communicates with the electric box PLC of the roadheader through RS485/RS232 to control the start and stop of the motor remotely.

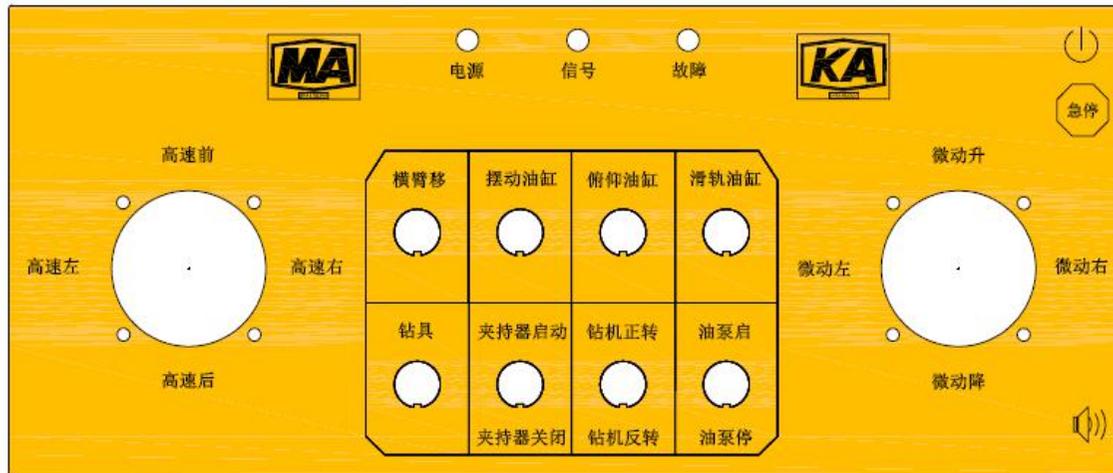
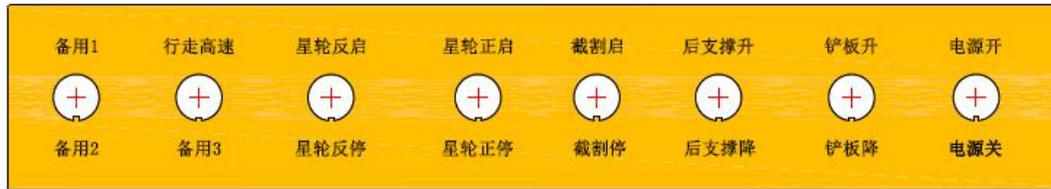
## **Working mechanism of Wireless remote control**

### **1.1.1.1 Explosive-proof Remote-control Transmitter**



FYF40 Explosive proof Remote Transmitter collect status signals from switch and handle in real time and transmit information to FYS40 Explosive proof vehicle-mounted wireless receiver through wireless network. FYF40 has high real-time performance, light weight, small volume and compact structure with simple wiring, low power consumption, easy installing and convenient using, etc. The high-performance microprocessor of 32-bit, input circuits and output circuits in FYF40 display remote control's and receiver's working status and show remote control's operation instructions, wireless signal strength and battery charge.

<b>Product Qualification</b>	<b>Safety Certificate, Explosion Certificate and Mine Safety Certificate of National Mineral Product Safety Mark Center.</b>
Working Voltage	DC12V
Working Current	<50mA
Signal Transmission Rate	1Mbps
Communication Distance	>40m
Interface Configuration	Channel 40 of digital input, channel 12 of analog input, channel 1 of CAN, channel 1 of RS485
Temperature Range	-40°C...+85°C
Certificate	MA, KA
Housing	Industrial anti-static flame-retardant box
Size	350×220×170mm
Weight	2.5kg



Schematic of remote control

## 1.2 Vehicle-mounted wireless receiver



FYS40 Vehicle-mounted Wireless Receiver



FWS40 Explosion-Proof Vehicle-Mounted Wireless Receiver

The above two receivers directly drive the solenoid valve to work, or communicate with other vehicle-mounted controllers such as CAN bus and RS485 bus. Customers can choose one of them according to actual needs.

FWS40 Explosive proof vehicle-mounted wireless receiver is used in the field of complex moving equipment. The controller has achieved an overall improvement in performance with Ultra-Modern 32-Bit three-core technology, 72MHz clock frequency and parallel processing capacity. In addition to application functions of proportional electromagnets programmable control and additional switching, functions of walking drive, transmission control and coordinating highly complex control circuits for moving equipment has been added. Up to 32 outputs (0%\*Vbat to 100%\*Vbat), 4 analog inputs, 8 digital inputs and 1 CAN bus for intelligent communication, these control units provide a high-performance platform for all functions of moving equipment.

There is a high-performance 32-bit microprocessor in FWS40 with all input and output circuits. Analog voltage ranges from 0 to 24V, current from 0 to 20mA, frequency from 0 to 10kHz, and switching information is processed as input signal. In addition, the input is protected against overvoltage and interference from

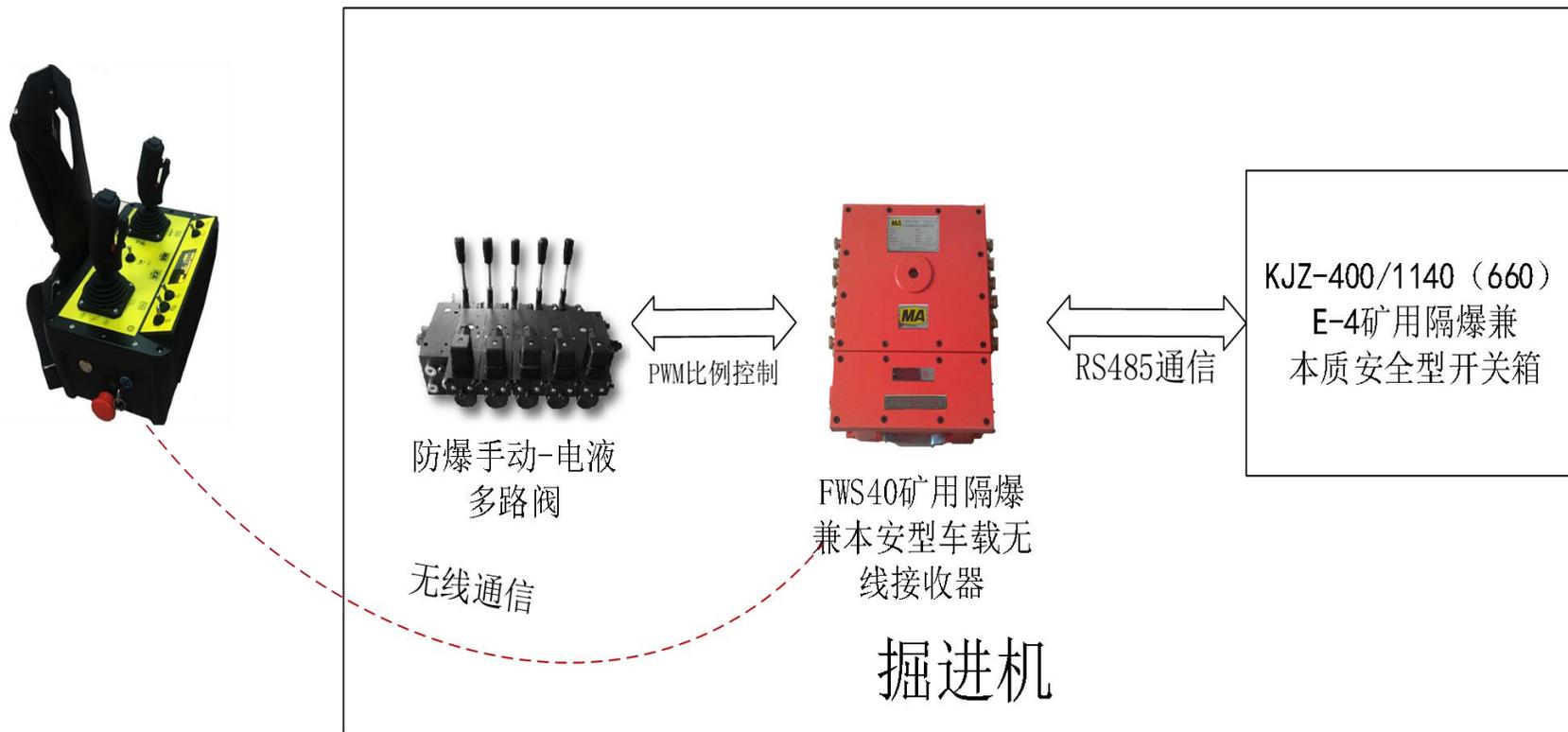
electrical. Voltage input can be monitored to detect cable breaks and short circuits. Pulse width modulation (PWM) is applied to the current-controlled proportional electromagnet output, and temperature and voltage fluctuations are compensated to ensure high accuracy and minimum lag. Switch output is designed for direct on and off of relays and switching electromagnets, simultaneously, in addition, the output has integrated voltage and current monitoring functions.

### Technical Parameters of FWS40

Working Voltage	AC1140/660/127
Working Current	<50mA (No load) (I case of load, the working current depends on the current load)
Wireless Transmission Rate	1Mbps
Wire Communication Distance	>100m
Interface Configuration	32-way output(PWM/digital), 8-way DI, 4-way AI, 1-way CAN, 1-way RS485
Temperature Range	-40°C...+85°C
Certificate	CE, MA, KA
Housing	Explosion-proof
Size	473×450×220mm
Weight	6.5kg

**Technical Parameters of FWS40 :**

Product Qualification	Safety Certificate, Explosion Certificate and Mine Safety Certificate of National Mineral Product Safety Mark Center.
Working Voltage	DC24V
Working current	<50mA (No load) (I case of load, the working current depends on the current load)
Wireless Transmission Rate	1Mbps
Communication Distance	>100m
Interface Configuration	8-way, DI; 4-way, AI; 1-way CAN; 1-way RS485.
Temperature Range	-40°C...+85°C
Certificate	CE, MA, KA
Housing	Industrial anti-static flame-retardant box
Size	220×120×91mm
Weight	2.5kg



Principle Block diagram of line-of-sight wireless remote control

## **Performance and Quality of Products**

### **1. Reliability and Safety**

The wireless remote control system has complete models and numerous interfaces and can be customized for new-opened mines and transformed for old mine projects to reduce consumption, so it is of high performance and low cost. The products have fully independent intellectual property rights with timely and effective after-sales service, and are used in the field of mines. The project fully considers reliability and maturity of technology and products, for example, remote control and receiver have the national certification of mine safety. The remote control handle is imported from Germany, and the liquid crystal display uses OLED to work in harsh environment. The system can steadily work for a long-time with high safety and reliability thanks to its ability of anti-interference. With the redundant backup of key equipment, key data and logical link, and with the automatic fault detection, alarm and recovery functions of system, the reliability is improved.

### **2. Openness and Standardization**

The system adopts open framework, standardized interface and protocol, and has good scalability. The system construction complies with national and industrial standards and norms. As for the possible expansion and upgrade of the system in the future, the main equipment and system have good interconnection and interoperability.

### **3. Advancement and Pragmatism**

Remote control and manual control function can be switched freely; The design is guided by the international advanced technology and theory, and the hardware equipment comes from the domestic or the international well-known manufacturers, and the technical plan will not only maintain the advanced position for a long period, but also can adapt to the future science and technology development. Combined with the actual work requirements of relevant business departments, it pays much attention to the practicality of

the system.

#### **4. Extensibility and Flexibility**

Based on the most advanced WLAN wireless communication network, line-of-sight remote control can be realized from face to face (no network is required), the remote control can as well work good beyond the limited communication distance. The structural of the system is simple with flexible functions and the existing equipment is fully used. The control components adopt modular structure, wireless communication blue tooth, WIFI and other technical measures. There is enough space left for future updating.

The system is characterized by the completely new digital network, which highlights its comprehensiveness, versatility and extensibility in application functions and realizes modernization, intelligence, digitization and networking of the management. Moreover, the feasibility of seamless docking with other systems should be fully considered after the completion of the system. In order to automatically control the process of coal roadway section tunneling, the proportional electro-hydraulic valve set (imported from HAWE, Germany) is configured in it and the linear displacement sensor with strong anti-vibration and anti-impact level is installed in the main cylinder, at the same time, the high-precision two-axis inclination sensor and three-dimensional electronic compass are equipped in the electric control box. By the advanced detection technology, data processing technology, PLC programming technology and electro-hydraulic control technology, the roadheader has functions of positioning automatic cutting, remote control, attitude adjustment and preliminary identification of coal and gangue, automatic monitoring and so on.