

H71 SERIES JOYSTICKS

Mate Joystick, Single axis joysticks, Panel Mounted



Single axis with
multi- buttons



Single axis 1
button



2-axis, handle
rotatable



Single axis



Center with
mechanical lock

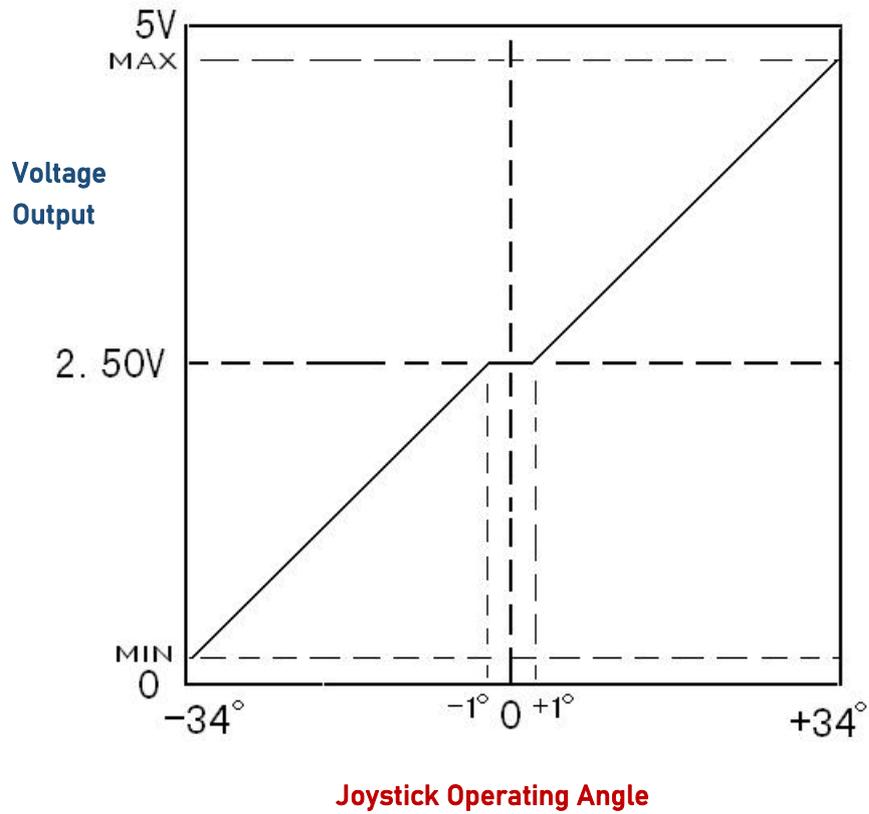
DESCRIPTION

Single axis joystick is mainly used for the control of engineering vehicles, electric vehicles, instrument panel installation, stainless steel and aluminum alloy materials, spring automatic return structure, the use of imported high-precision Hall sensor, the full temperature range linear positive, IP66 protection grade, smooth operation feel, ergonomic mechanical design.

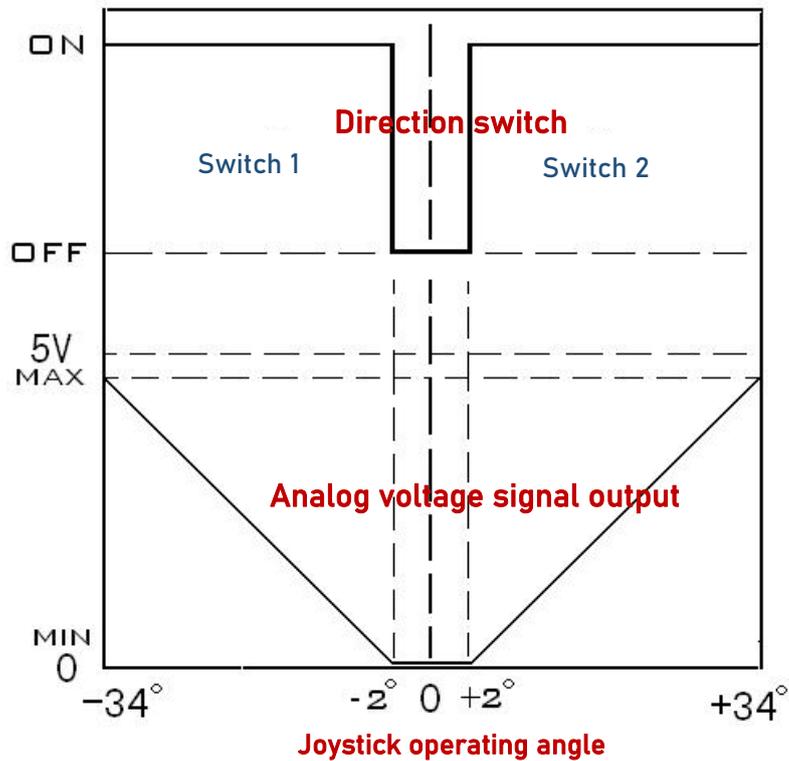
SPECIFICATION

Material	Stainless steel + aluminum alloy
Lever Action	Spring return / Friction hold
Lever Mechanical Angle	±34°
Sensor Type	Hall effect
Linerity	Less than 1%
Signal Output	Analog voltage 0-5V, RS422, RS485, RS232, CAN, USB, PWM power drive
Direction Switch	Front + Back
Power Supply	DC5V/12-29V/48V
Operating Cycles	10 Million Cycles
Repeat Return Precision	Less than 0.8%
Operating Temperature	-40℃~+70℃
Storage Temperature	-50℃~+80℃
Degree of Protection	Above the flange IP67
Base Dimension	71.21(L) x 71.21(W) x 58.45(H) mm
Electronic Parameters	
Lowest Working Voltage	4.2V(5V) / 10V(12-28V)
Max. Input Voltage	36V(12-28V) / 5.5V(5V)
Working Current	Less than 12 mA (5V power supply, analog voltage signal output)
Button Switch Capacity	1A/24V
Limit Switch Capacity	1A/24V
Analog Voltage Signal Output Load	More than 1KΩ
Analog Voltage Signal Output Center Voltage	2.50V or 50Vdd
Analog Voltage Output Signal	0V-5V/0.3-4.7V/0.5V-4.5V/1V-4V

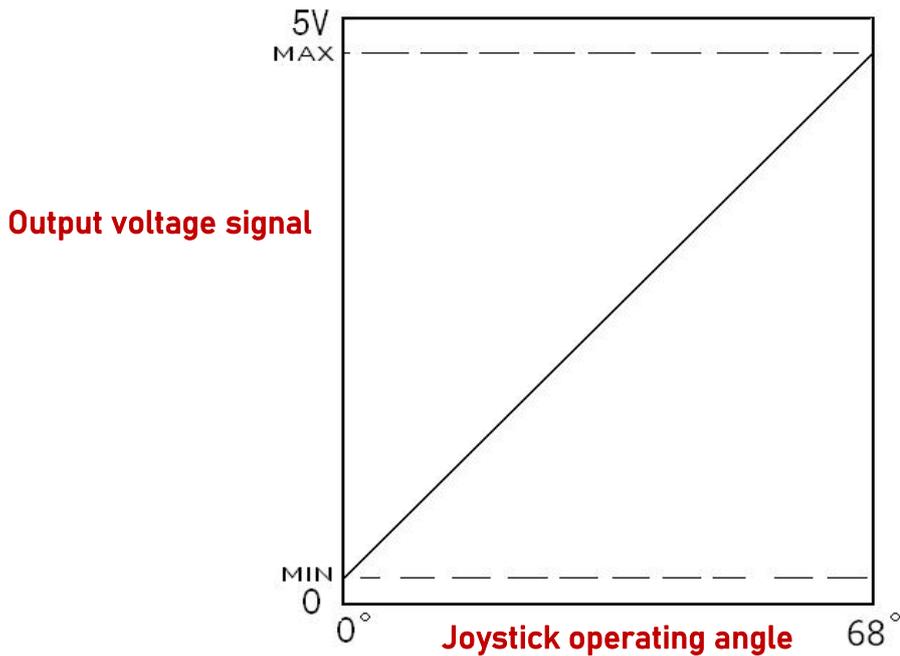
Spring return - Analog voltage signal - linear output (output curve 1)



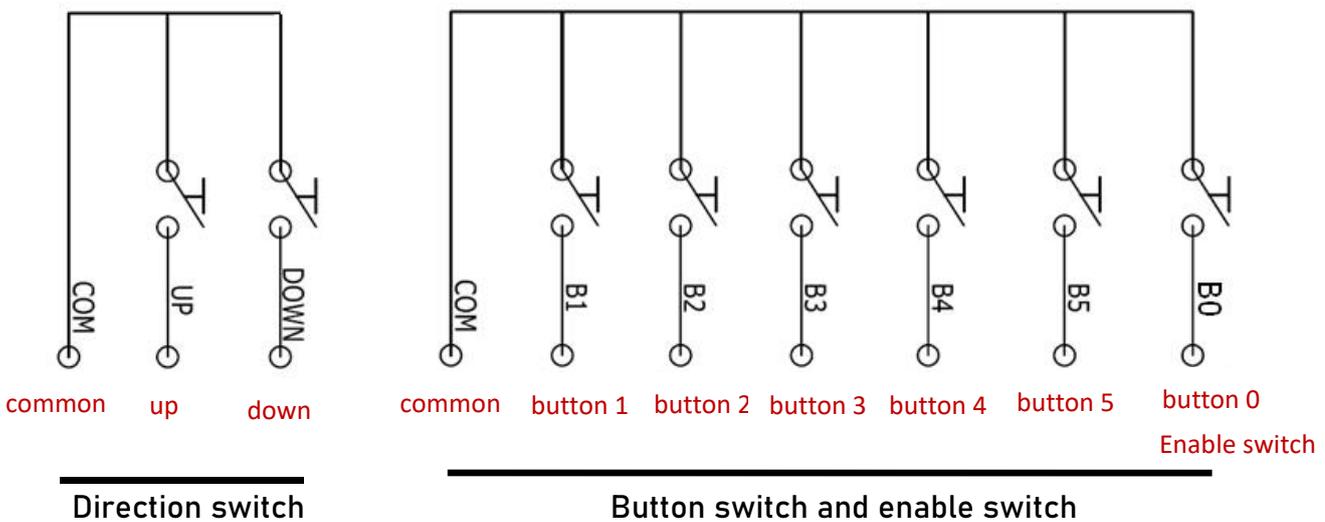
Center position-analog voltage signal V-shaped signal output (output curve 2)



Frictional resistance positioning-analog voltage signal output (output curve 3)



Joystick direction switch and button schematic diagram



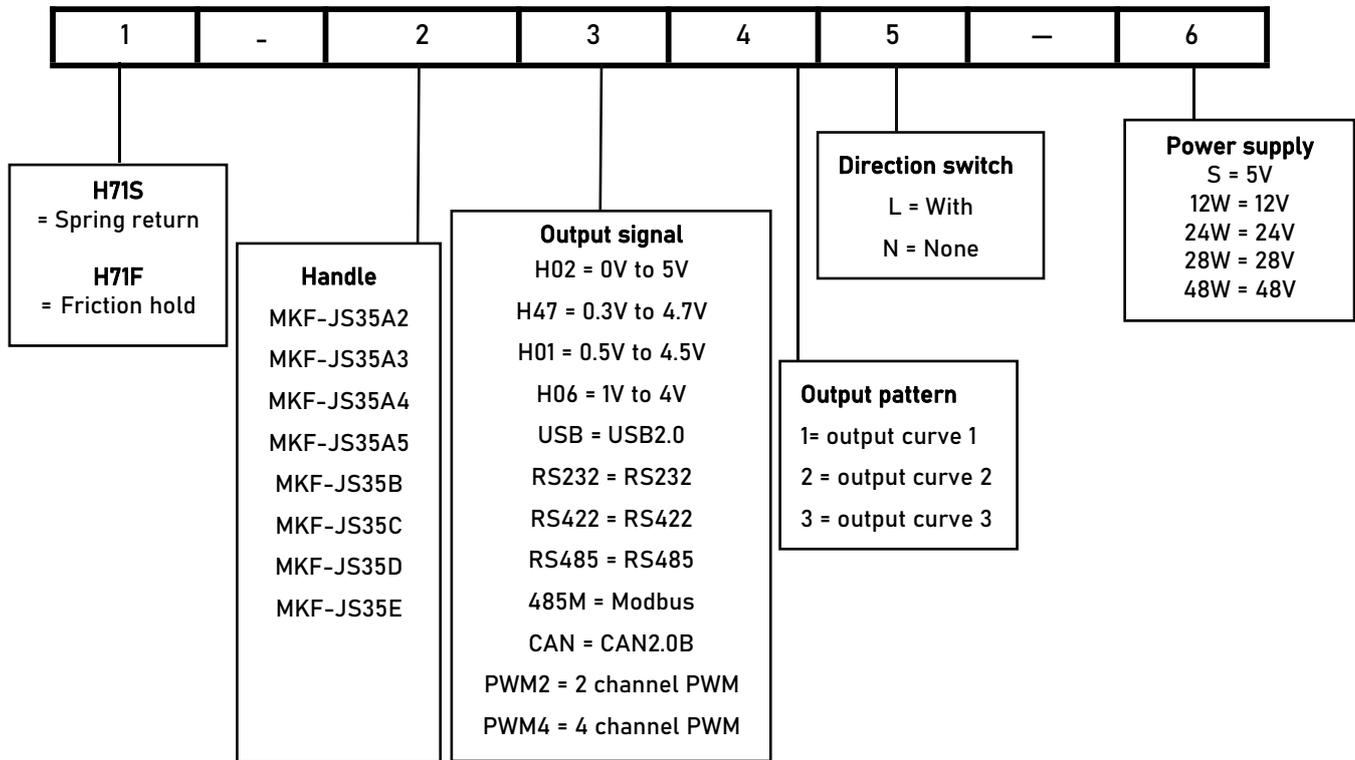
Direction switch technical specification

- Switch mode: Normal open
- Starting angle: >2°
- Contact current: 1A/24V

Button switch and enable switch

- Switch mode: Reset button (normal open)
- Contact current: 1A/24V

PRODUCT CONFIGURATION

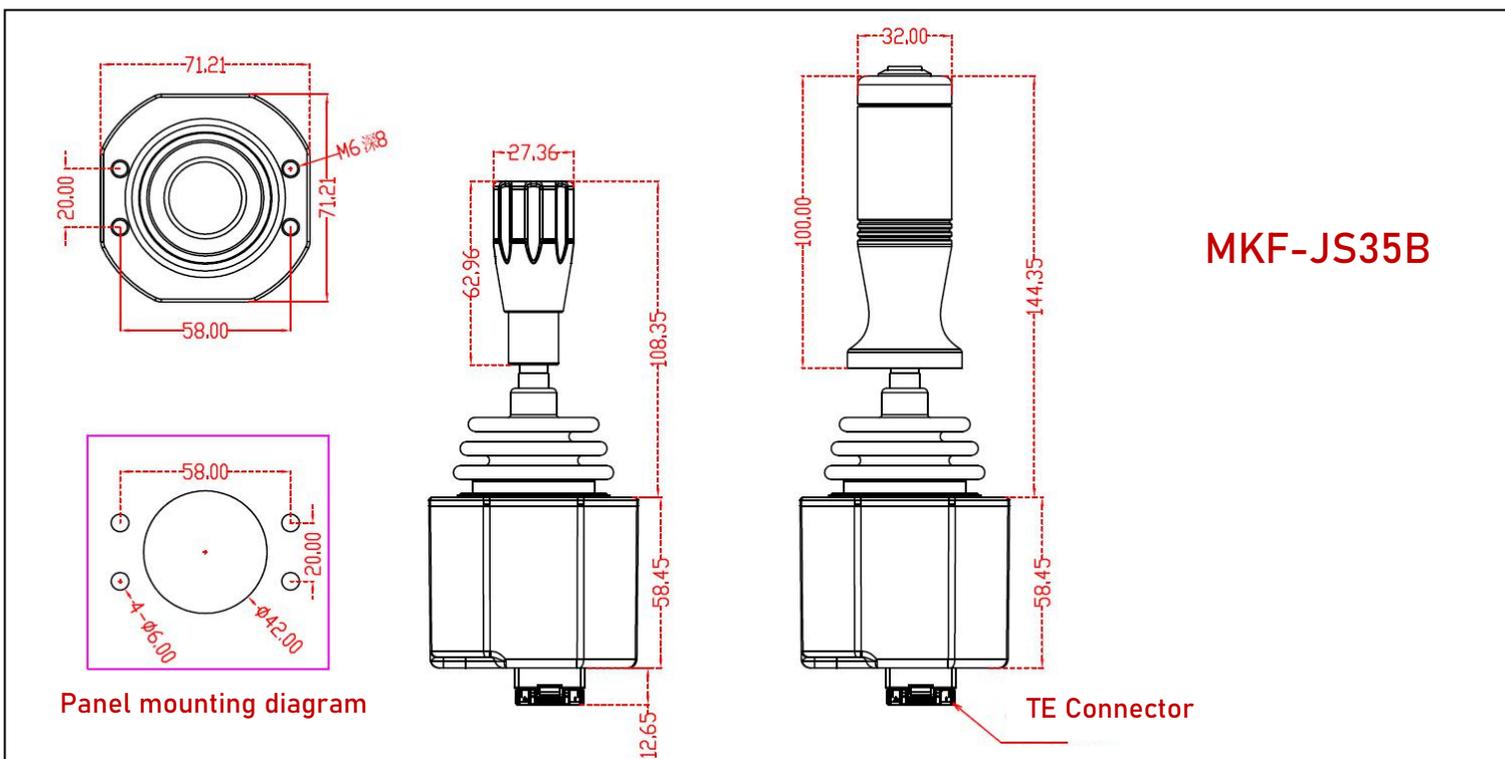
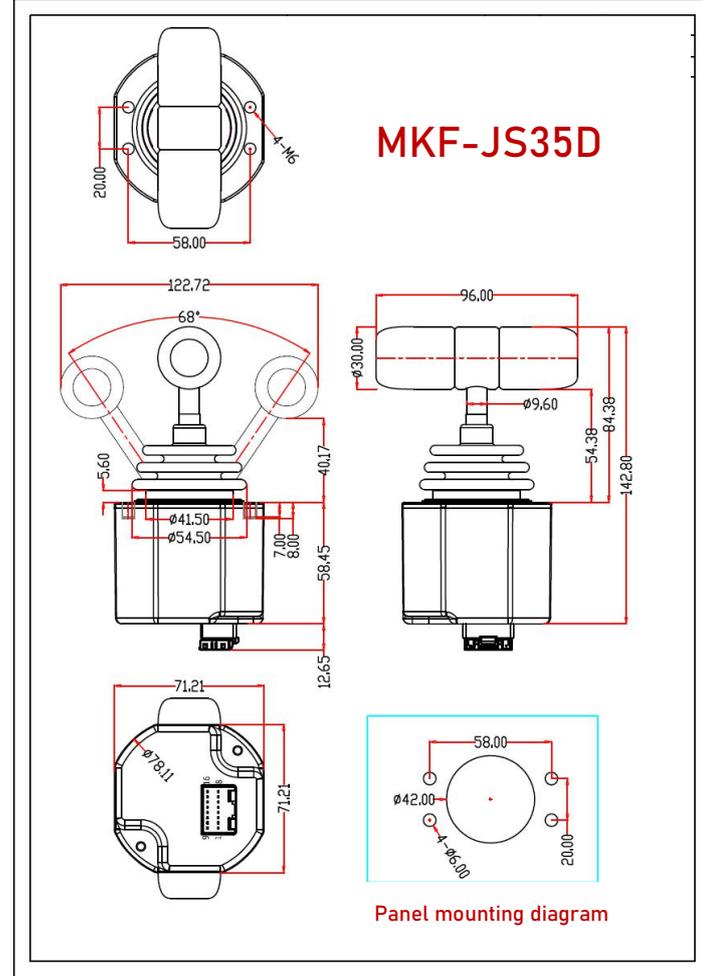
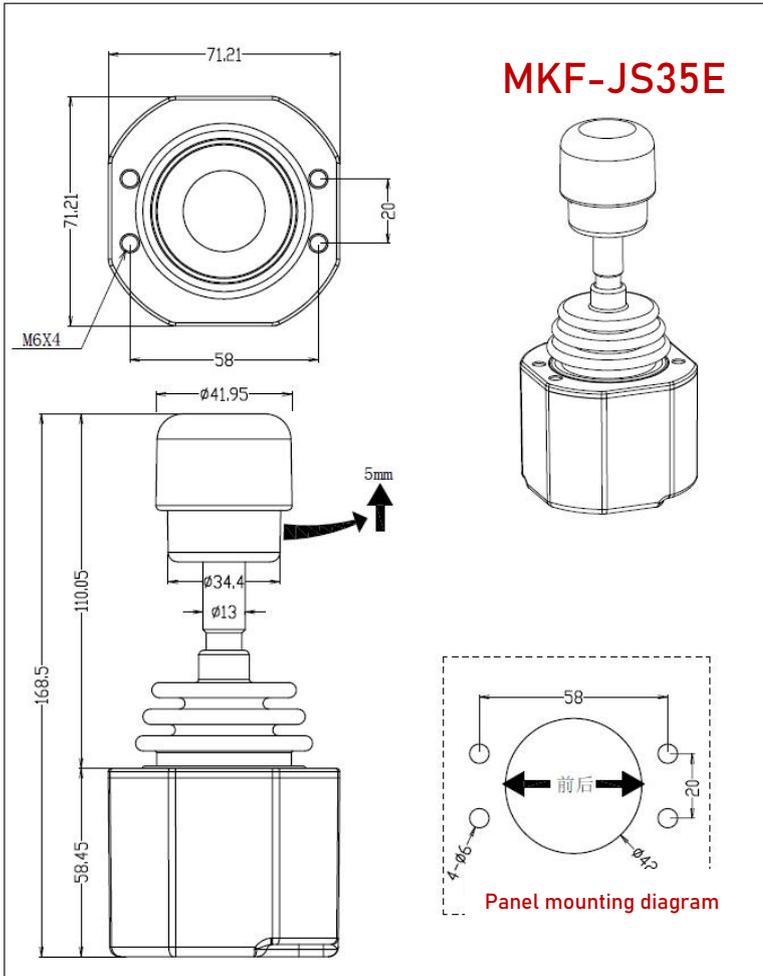


- For RS232, RS422 protocol, please contact MATE (www.matend.com)
- CAN communication, baud rate, support standard frame ID, extended frame ID and remote frame, protocol can be customized
- PWM current output is used to control proportional valve, 0-1A , (Max/Min current can be set up)

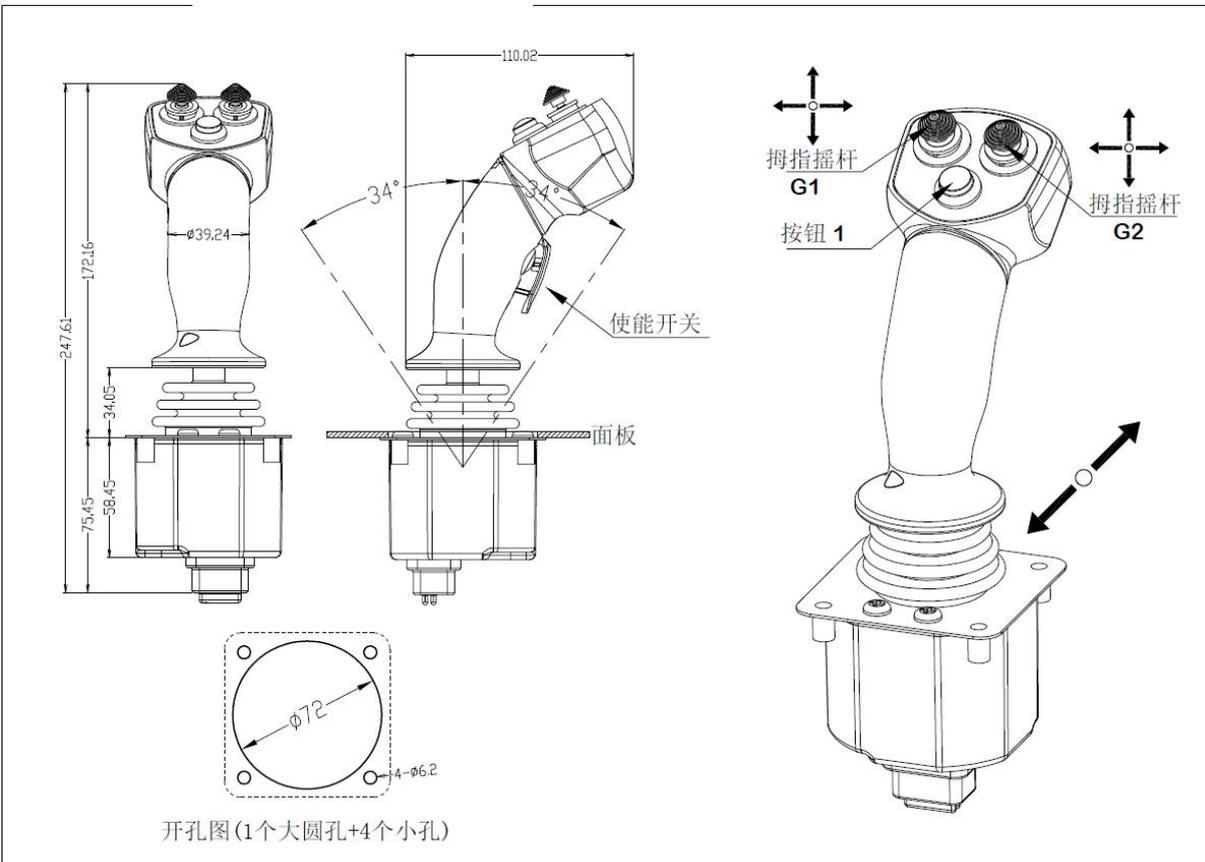
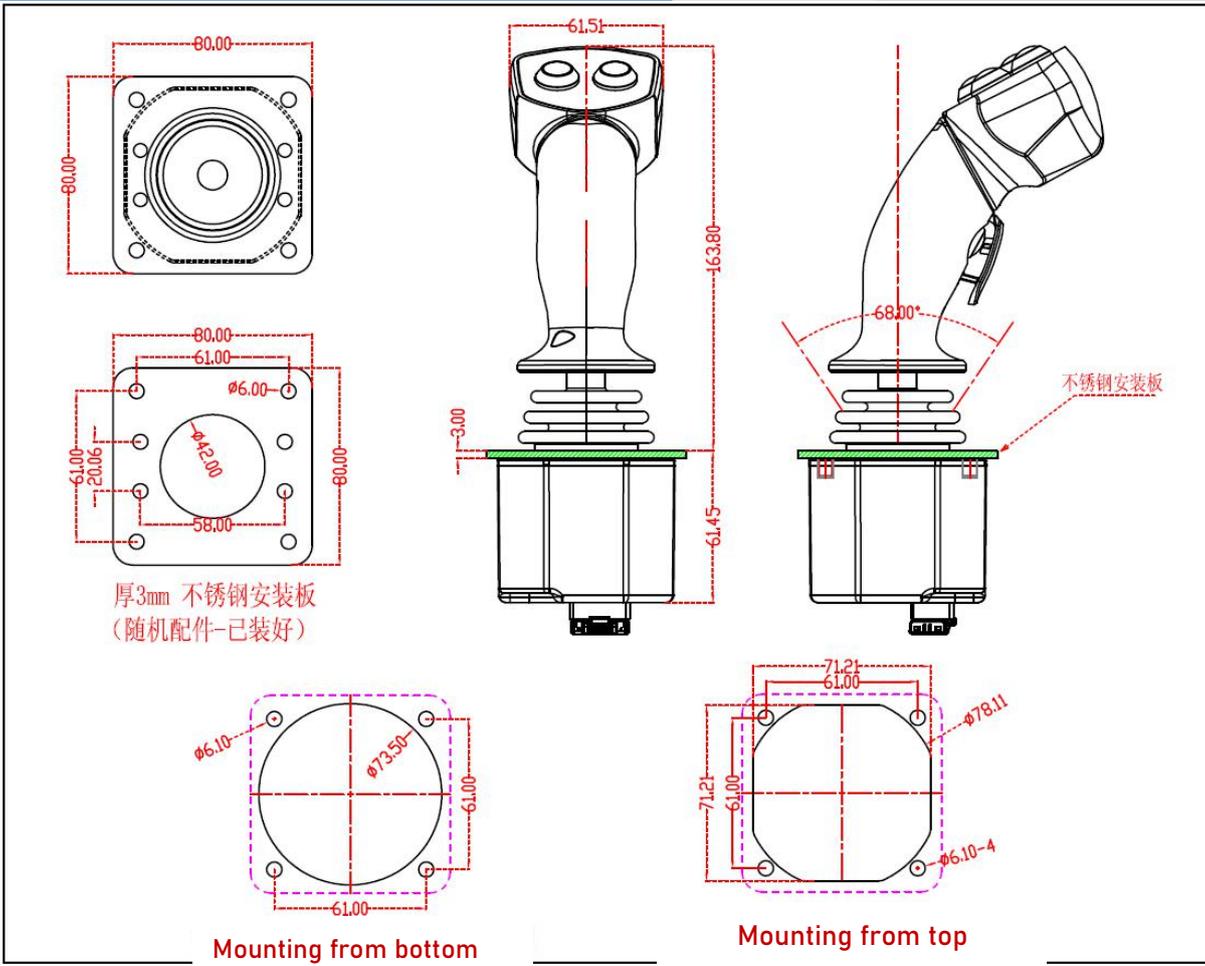
HANDLE OPTIONAL



MECHANICAL DRAWING

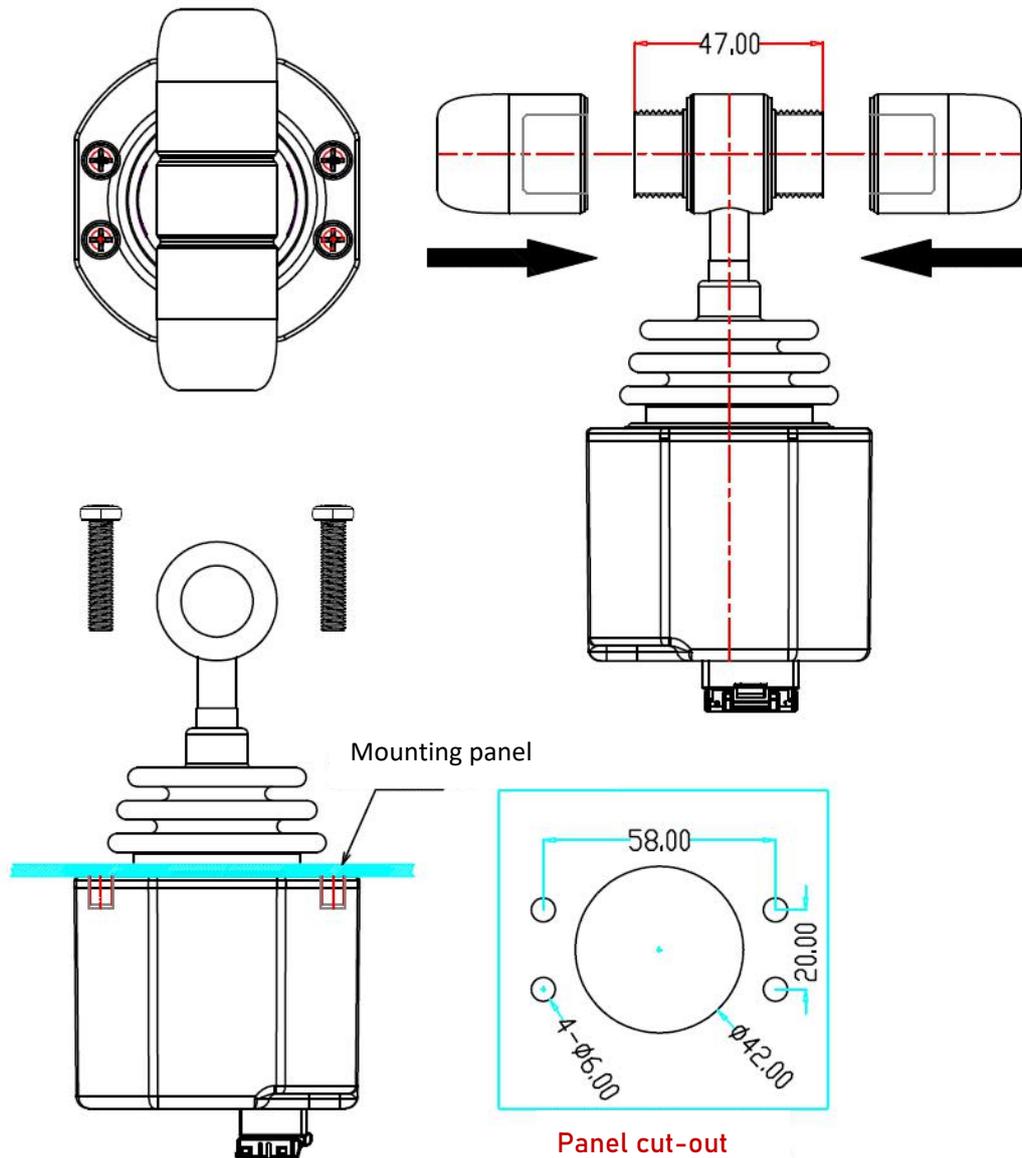


MKF-JS35A

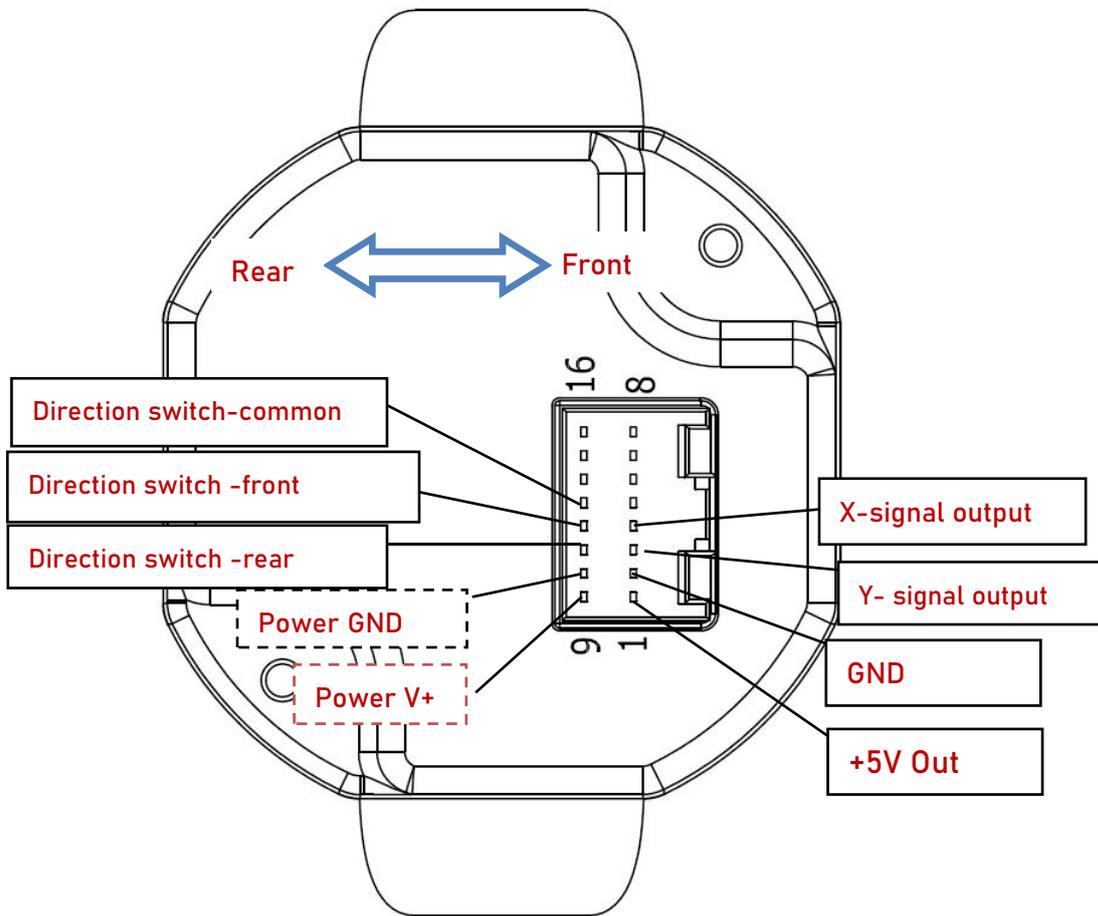


INSTALLATION DIAGRAM

1. First unscrew the handle cap of the handle
2. Put the joystick through the cabinet panel and start installation
3. Install 2 handle caps. If you need to prevent them from coming off, screw glue on the handle caps before installation.



ANALOG VOLTAGE SIGNAL OUTPUT



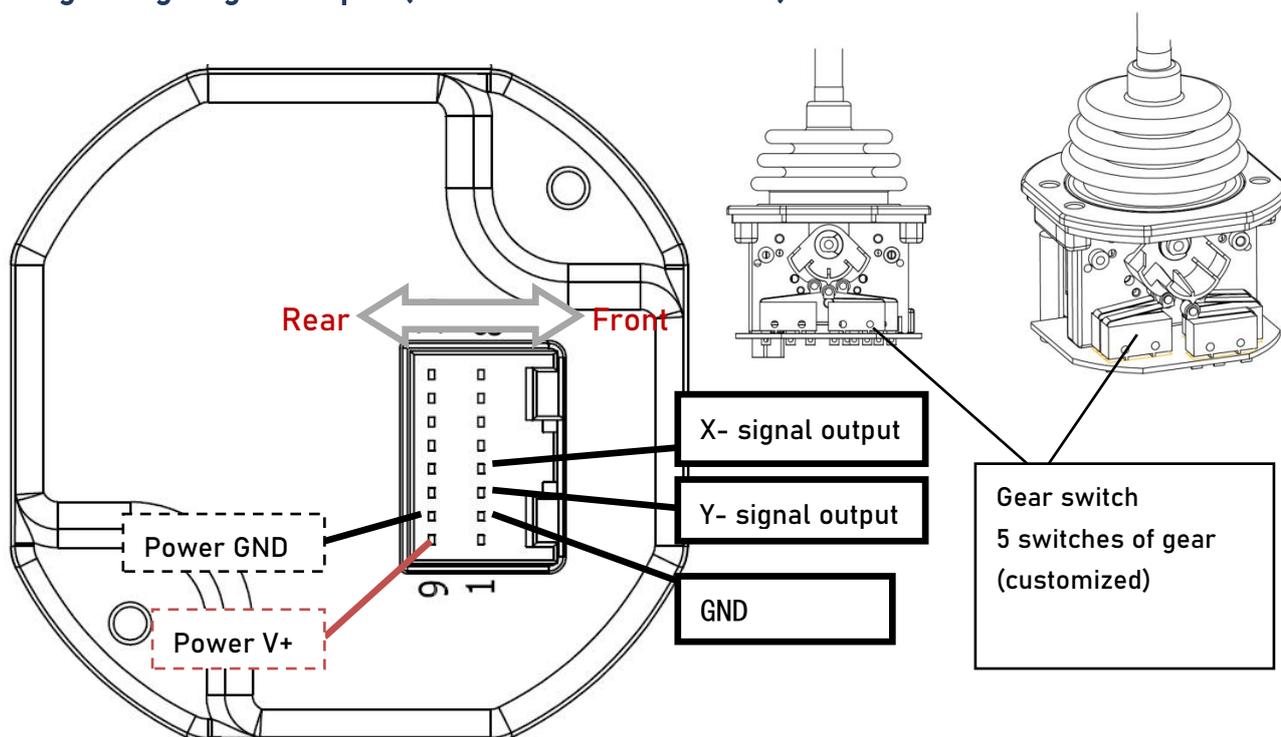
Analog voltage signal output (Direction switch front/rear each 1)

Pin	Symbol	Color	Function
1	+5V		+5V voltage
2	GND		GND
3	Y-OUT		Y axis (front/rear)signal output: analog voltage 0-5V
4	X-OUT		X axis (left/right)signal output: analog voltage 0-5V
5	COM2		Button switch common port COM
6	B0		Trigger switch (enable switch)
7	B1		Button 1
8	B2		Button 2
9	V+		Power input anode, 5V or 12-29V
10	GND		Power input cathode, GND
11	N-SW		Direction switch -rear
12	P-SW		Direction switch -front
13	COM1		Direction switch-common port COM
14	B5		Button 5
15	B4		Button 4
16	B3		Button 3

Analog voltage signal output

Pin	Symbol	Color	Function
1	+5V		+5V power
2	GND		0V GND
3	Y-OUT		Signal output (Y): analog voltage 0.5-4.5 (front-big, rear-small)
4	X-OUT		Signal output (X): analog voltage 0.5-4.5 (front-small, rear-big)
5	COM2		Button common port COM
6	B0		3-gears switch -up
7	B1		Button 1 (1)
8	B2		Button 2 (3)
9			
10			
11			
12			
13			
14	B5		3-gears switch - down
15	B4		Button 4 (4)
16	B3		Button 3 (2)

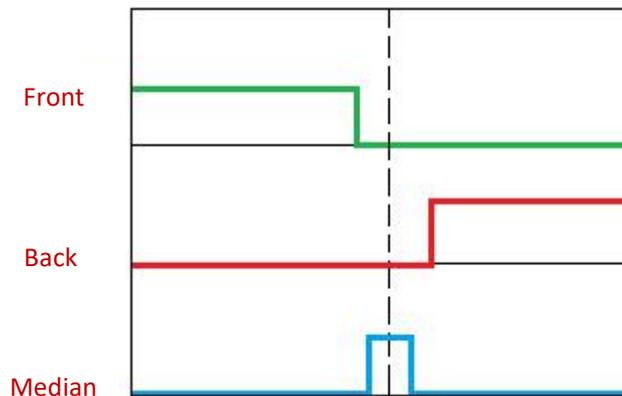
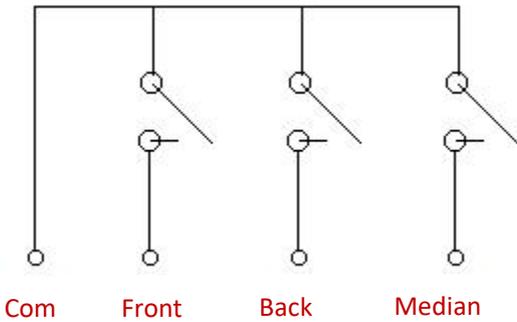
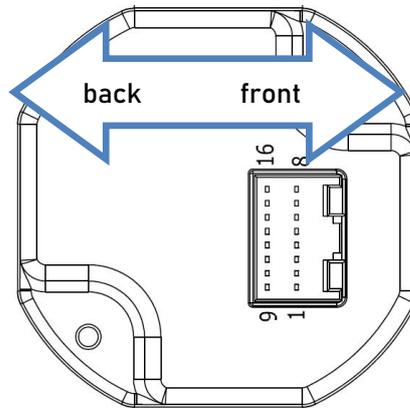
Analog voltage signal output: (Multi-combination switch)



Analog voltage signal output: (front/rear-multi-combination switch value)

Pin	Symbol	Color	Function
1	K2		Handle panel-button 2
2	GND		Signal (GND)
3	Y-OUT		Y axis (front/rear)signal output
4	X-OUT		X axis (left/right)signal output(Reserve or thumbwheel)
5	K-COM		Handle button switch- common port COM
6	K0		Trigger switch (enable switch)
7	K1		Handle panel -button 1
8	C-2		Gears-center switch-wiring 2
9	V+		Power anode, 5V or 12-29V
10	GND		Power cathode (power GND)
11	1R		Gears switch-rear 1
12	2R		Gears switch-rear 2
13	2F		Gears switch -front 2
14	1F		Gears switch -front 1
15	D-COM		Gears switch COM port (1 st gear-COM)
16	C-1		Gears-center switch-wiring 1

Pull-lock mechanical switch schematic diagram



Pull-lock switch- Analog voltage signal output:

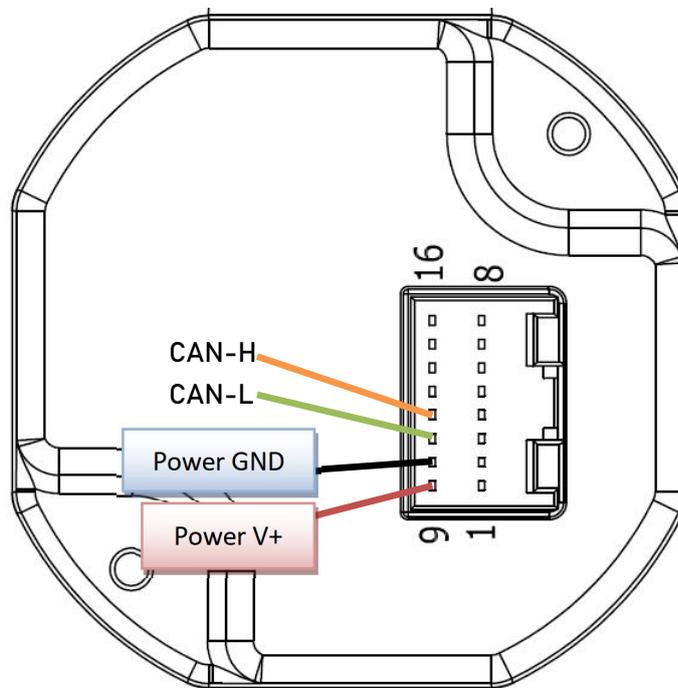
Pin	Symbol	Color	Function
1	K0		Trigger switch (enable switch)
2	K1		Handle panel-button 1
3	K2		Handle panel-button 2
4	GND		Signal (GND)
5	Y-OUT		Y axis (front/rear)signal output
6	X-OUT		X axis (left/right)signal output (Reserve or thumb wheel)
7	N-SW		Micro switch- direction-back
8	P-SW		Micro switch -direction-front
9	V+		Power anode, 5V or 12-29V
10	GND		Power cathode (power GND)
11	K5		Handle panel-button 5
12	K4		Handle panel-button 4
13	K3		Handle panel-button 3
14	K-COM		Handle button switch COM port
15	D-COM		Microswitch COM port
16	C-SW		Microswitch -center

CAN bus signal output

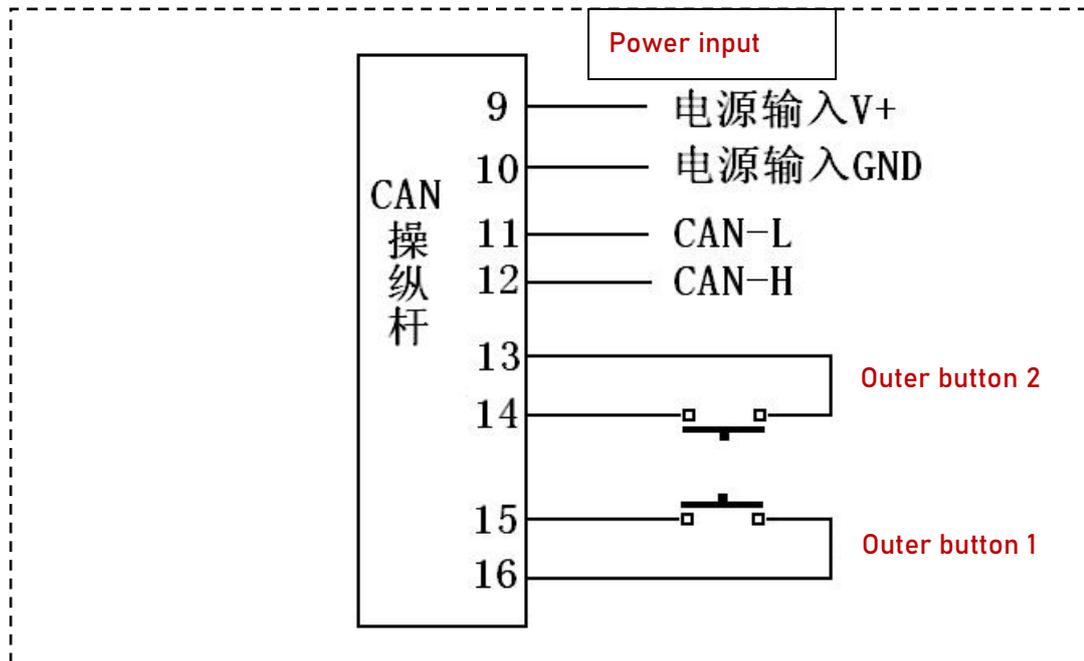
Pin	Symbol	Color	Function
1	+5V output		OUTPUT +5V voltage output +5V (Max 100mA)
2	GND		GND
3	232-RXD		RS232 receive
4	232-TXD		RS232 send
5	422-RX-		RS422 receive - (RX-)
6	422-RX+		RS422 receive +(RX+)
7	422-TX+		RS422 send + (TX+)
8	422-TX-		RS422 send - (TX-)
9	Power V+		Power input anode, 5V or 12-29V
10	Power GND		Power out cathode, GND
11	CAN-L		CAN communication CAN-L
12	CAN-H		CAN communication CAN-H
13	GND		GND
14	Input2		Input 2 (outer button 2)
15	Input1		Input 1 (outer button 1)
16	GND		GND

✧ RS422 for parameter setting, or customize

CAN connector diagram



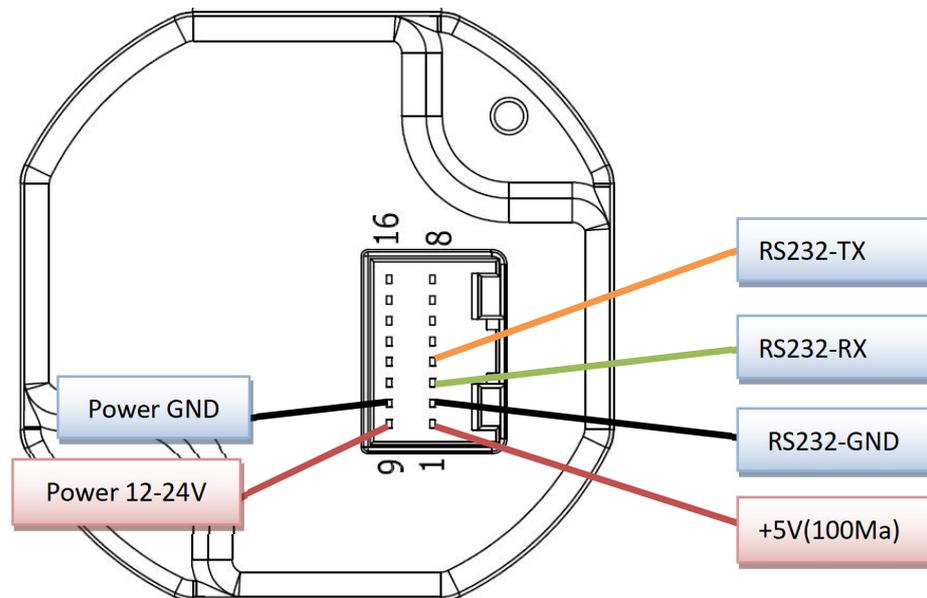
CAN communication joystick wiring diagram:



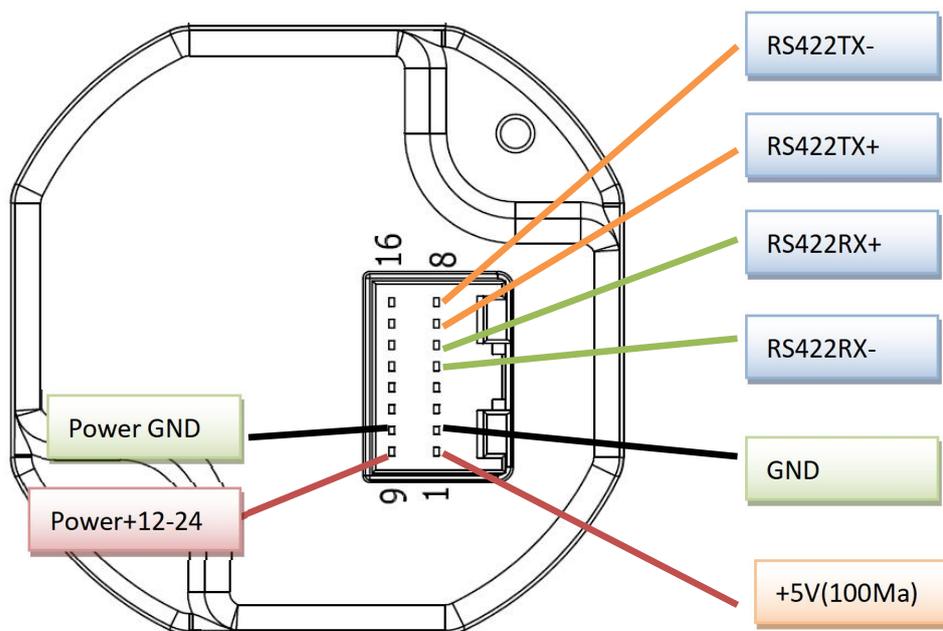
Output lead: Lead length 40CM

RS232/RS422 communication protocol

RS232 connector diagram:



RS422 connector diagram:

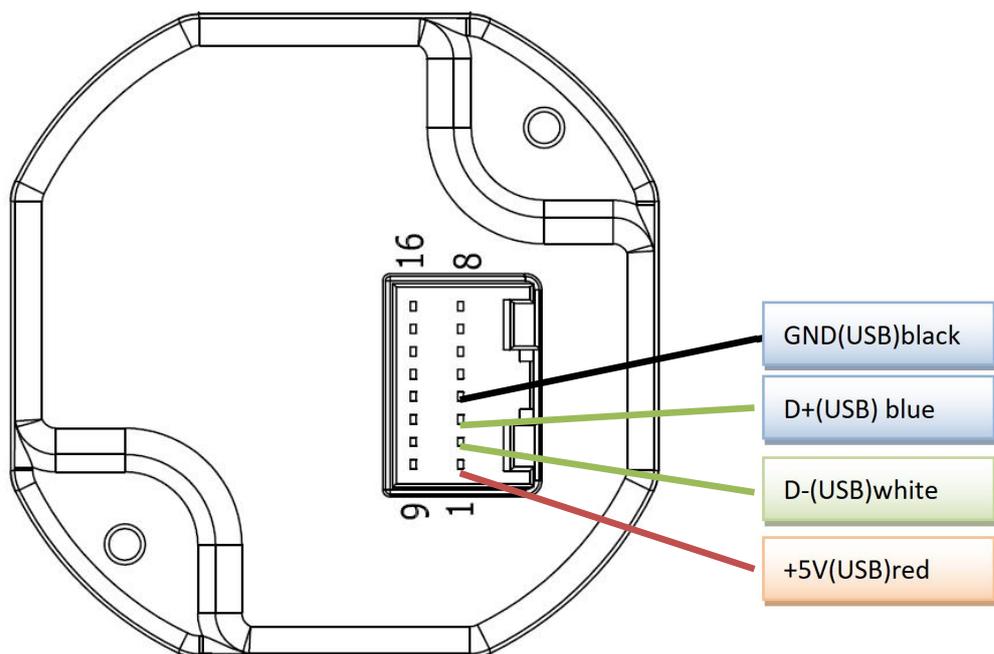


USB Bus signal output

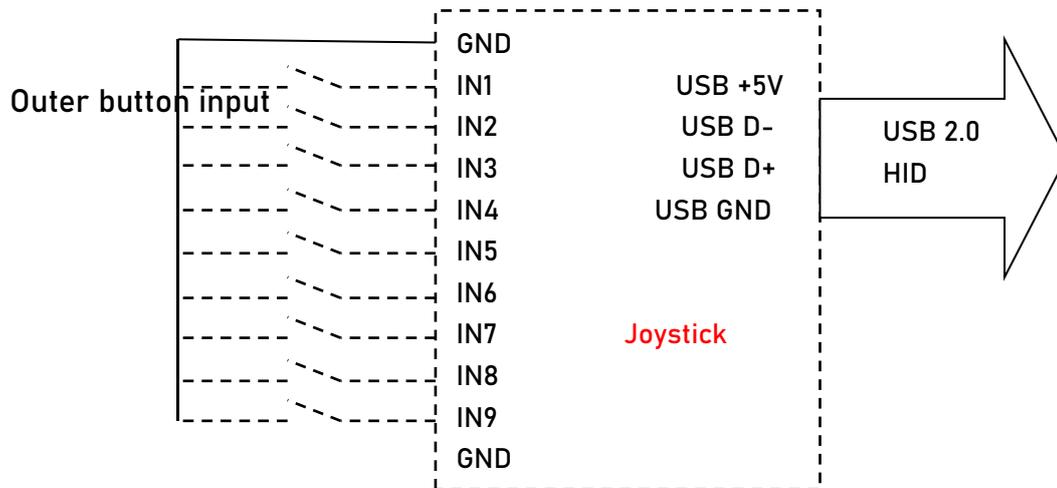
Pin	Symbol	Color	Function
1	USB +5V	Red	USB communication +5V
2	D-	White	USB communication data -
3	D+	Blue	USB communication data +
4	GND	Black	USB communication GND
5	Button IN9		Input 9 (outer join button 9)
6	Button IN8		Input 8 (outer join button 8)
7	Button IN7		Input 7 (outer join button 7)
8	GND		outer button input COM GND
9	GND		outer button input COM GND
10	Button IN6		Input 6 (outer join button 6)
11	Button IN5		Input 5 (outer join button 5)
12	Button IN4		Input 4 (outer join button 4)
13	Button IN3		Input 3 (outer join button 3)
14	Button IN2		Input 2 (outer join button 2)
15	Button IN1		Input 1 (outer join button 1)
16	GND		outer button input COM GND

Note: Outer join button input - Button terminal connect "GND", other terminal connect "Button IN1-9"

2. USB connector diagram:



3. Outer button switch input diagram



4. USB protocol: USB 2.0

HID man-machine interface protocol standard

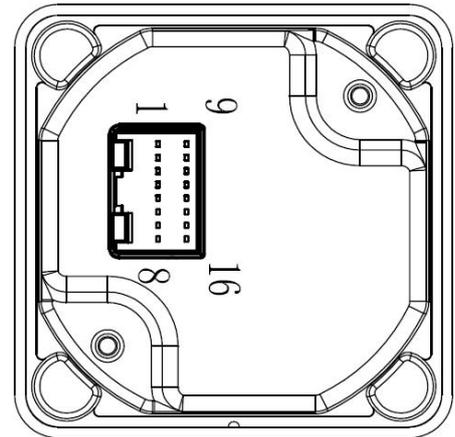
Support Microsoft operating system, no driver, support direct X

PWM output diagram (proportional valve)

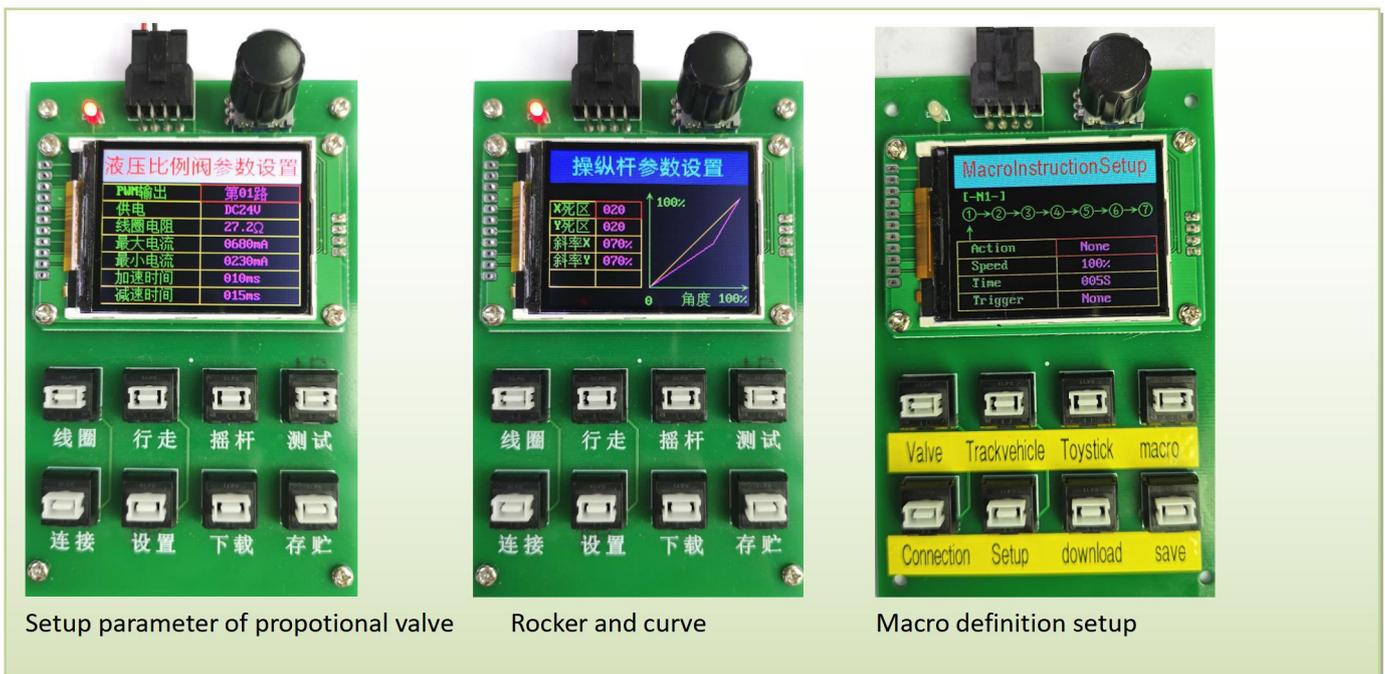
H71 series, there are 2 ways output of proportional valve, first one is 4 channels PWM signal output PWM4; another is 2 channels PWM signal output PWM2, it's with direction switch and stop switch signal as well.

PWM signal output, support 50-1000mA load drive capability, It is based on the digital current control, by adjusting the duty ratio to achieve accurate current control, it has the advantages of programmable, high precision, low heating, long life style.

1. Starting current can setup
2. The maximum opening angle current can be set
3. Slope curve of rocker can be set
4. Acceleration and deceleration can be set
5. There is current detection, open circuit detection
6. Direct drive solenoid valve, no amplifier
7. DC24V power supply;
8. Current signal output 0-01000mA



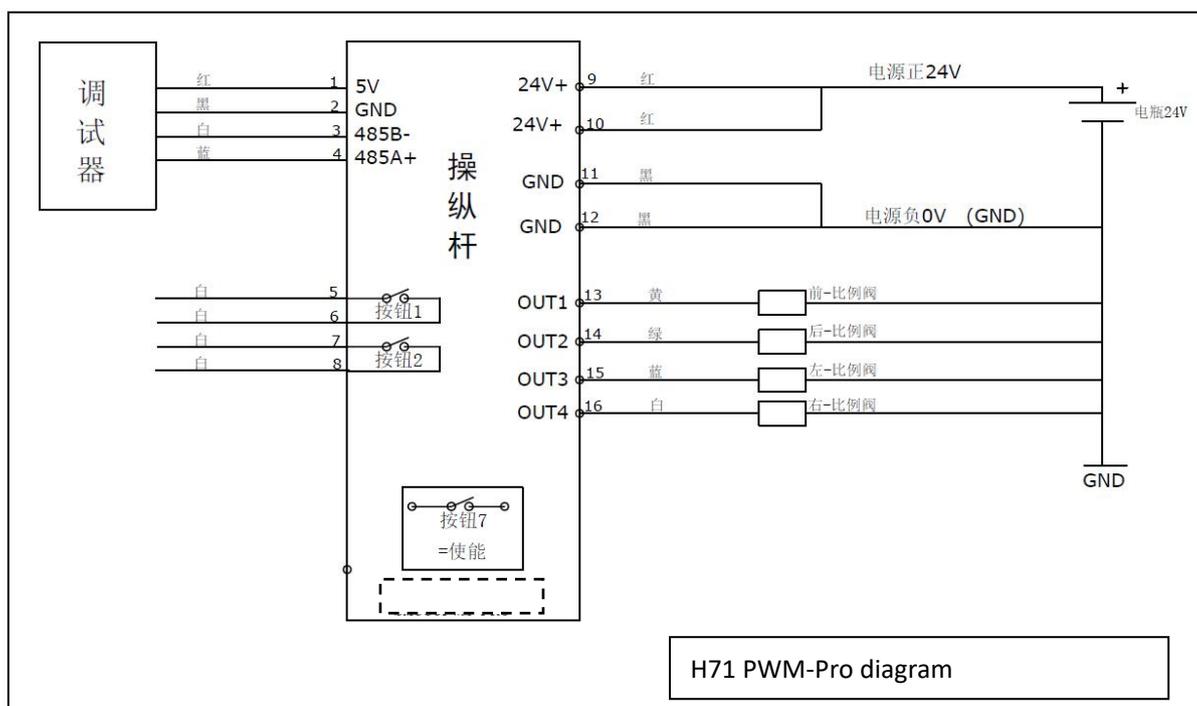
Field debugging



- Separate acceleration and deceleration Settings for each channel;
- Free for programming, some functions can be defined on site macro (user programming)
- PWM output - 1st channel = direction- front OUT1
- PWM output - 2nd channel= direction-backOUT2
- PWM output - 3rd =direction-left OUT3
- PWM output - 4th =direction-right OUT4
- OUT3 and OUT4 for thumb-rocker control only

PWM4-Pro output wiring diagram (proportional valve): 4 channel

Pin	Symbol	Color	Function	
1	5V out	Red	Debugger power supply +5V (joystick output)	LCD Debugger port
2	GND	Black	Debugger GND	
3	RS485-(B)	Yellow	Debugge communication RS485-(B)	
4	RS485+(A)	Green	Debugge communication RS485+(A)	
5	B1-1	White	Panel button 1=reset button-red button	Panel button
6	B1-2	White	Panel button 1=reset button-red button	
7	B2-1	Blue	Panel button 2=blue button	
8	B2-2	Blue	Panel button 2=blue button	
9	24V+	Red	Power input to anode, 24V	Power supply
10	24V+	Red	Power input to anode, 24V	
11	GND	Black	GND connect with power GND	
12	GND	Black	GND connect with power GND	
13	PWM Out1	Yellow	Front-proportional valve coil	Proportional valve coil
14	PWM Out2	Green	Rear- proportional valve coil	
15	PWM Out3	Blue	Left- proportional valve coil	
16	PWM Out4	White	Right- proportional valve coil	



Note : 1. Over-current protection, open circuit test 2. Enable protection

Factory parameter:

1. Coil internal resistance 27.2Ω
2. Under 0.1% valve firing current 230MA
3. 100% firing current 680MA
4. Rocker slope: Low segment angle =70%, location=50%
5. Accelerated: 15ms
6. Deceleration: 15ms
7. Center dead zone=±20

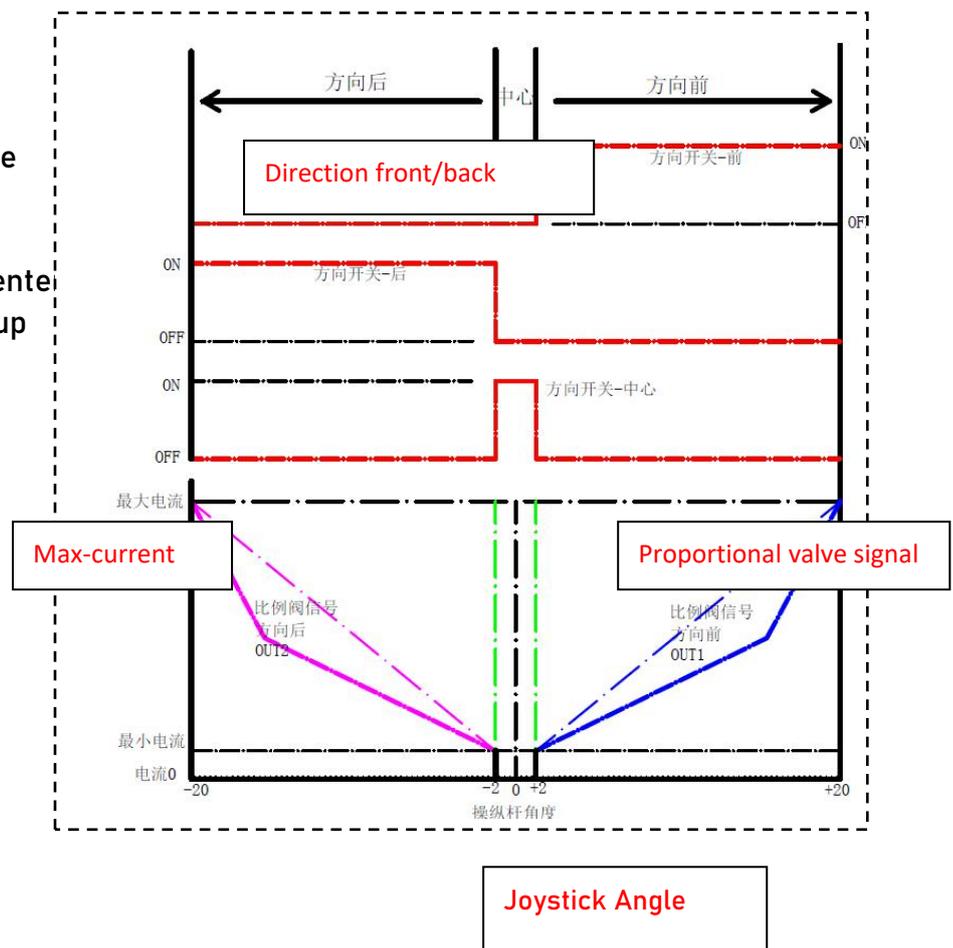
For details please contact with factory

PWM2-Pro output wiring diagram (proportional valve): 2 channel

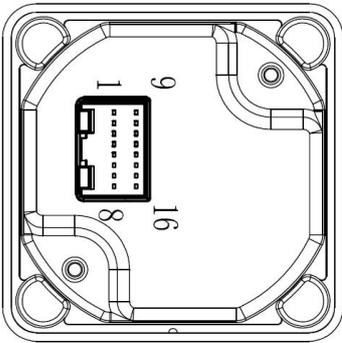
2 channel proportional valve
Signal output

The output has over temperature
and over current protection

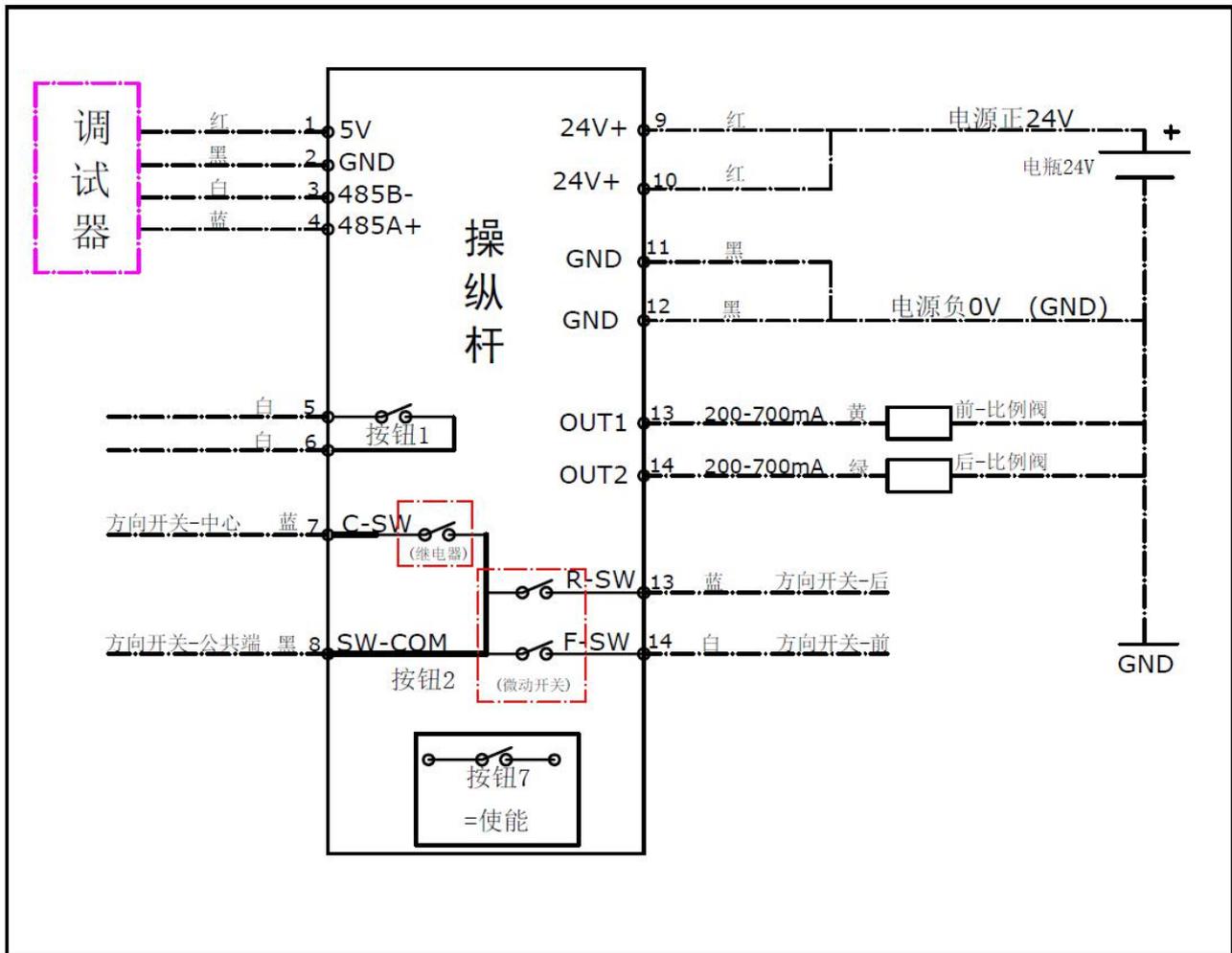
Direction switch: front/rear/center
Accelerated and decelerate setup
Rocker curve setup



Pin	Symbol	Color	Function	
1	5V out	Red	Debugger power supply +5V (joystick output)	LCD Debugger port
2	GND	Black	Debugger GND	
3	RS485-(B)	Yellow	Debugge communication RS485- (B)	
4	RS485+(A)	Green	Debugge communication RS485+ (A)	
5	B1-1	White	Panel button 1=reset button-red button	Panel button
6	B1-2	White	Panel button 1=reset button-red button	
7	C-SW	Blue	Direction switch -cente (closed when rocker in center)	Direction switch
8	SW-COM	Black	Direction switch - COM port	
9	24V+	Red	Power input to anode, 24V	Power supply
10	24V+	Red	Power input to anode, 24V	
11	GND	Black	GND connect with power GND	
12	GND	Black	GND connect with power GND	
13	PWM Out1	Yellow	Front-proportional valve coil	Proportional valve coil
14	PWM Out2	Green	Rear- proportional valve coil	
15	R-SW	Blue	Direction switch- rear	Direction switch
16	F-SW	White	Direction switch - front	



PWM2 schematic diagram



Note: 1. Over-current protection, open circuit test 2. Enable protection

RS232 communication protocol

Default baud rate 9600.8.1.N

Factory default without add bit

Function: Transmit location parameter of joystick

Joystick send data (11 bytes) (Joystick-PC)

Joystick transmit data format: (16 system HEX)

FF	Address	Dir	YYL	YYH	GXL	GXH	GYL	GYH	Button	CH
Head	Address	Direction	Y Low	Y High	0x00	0x00	0x00	0x00	Button	Checksum

Master lever angle: YL/YH, 2 bytes 0x0000~0x07a0; Low-order in the front, high-order in the back

When without thumb rocker-GXY, GXL,GXH,GYL,GYH corresponding is 00.

YYYY Y axis angle Center=0x0000, Max=0x07a0

GX Thumb rocker in handle X axis: 0x0000-0x07a0

GY Thumb rocker in handle X axis: 0x0000-0x07a0

Button joystick button

CH = Address+Dir+YYL+YYH+GXL+GXH+GYL+GYH+Button

The sum of all the previous bytes except the head (FF), take the lower byte of the result

E.g.: FF 01 08 00 70 00 00 00 00 00 79

DIR Direction indicator

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	GY Down	GY Up	Down (Rear)	Up (Front)	GX Left	GX Right	

GX,GY means thumb-rocker.If no GX, GY then the bit is 0

Button parameter

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Button 7		Button 5	Button 4	Button 3	Button 2	Button 1

Button = 1: button pressed, 0: non-button pressed

Button 7 is the trigger button in handle A

CAN communication protocol (SAE-J1939 and CANopen)

Baud rate: 250K (can modify via RS232)

Data format:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Direction state	Y axis angle Low	Y axis angle high	0x00	0x00	0x00	0x00	Button state

Low-order in the front, high-order in the back

Byte2,Byte1= 0x0000-0x7a00 Start from center

When rocker in center (stop) angle value=0x0000

When rocker angle (max) angle value=0x07a0

Byte0 direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Angle more than 15 °=1	Thumb rocker down	Thumb rocker up	(Master) down (back)	(Master) Up (front)	Thumb rocker right	Thumb rocker left	

1 valid, 0 invalid meso-position (stop position) Bit4,Bit3=00

Byte7 button state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Input1 Outer input 1	Trigger switch	Button 6 Or Input1 Outer input 1	Button 5	Button 4	Button 3	Button 2	Button 1

Button = 1: button pressed, 0: non-button pressed

Outer button IN1, IN2; one port connect IN1 or IN2, another port connect GND

The refresh rate of timed automatic data transmission is set by RS232 , Mix 20ms

CAN communication protocol - 5 axes (there are 2-cross thumbjoysticks on the panel)

CAN ID: Support 11 bit and 29 bit, Ref. CAN send ID setup.

Data transmit mode: Timing transmit, interval 20ms(default), Can change these parameters via refresh rate

Data frames; 8 bytes; Data format:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
IO-DIR1 Button state	IO-DIR2 Thumb rocker direction state	DIR Main Y axis direction state	Main Y axis angle	G1-X thumb 1 X angle	G1-Y thumb 1 Y angle	G2X thumb 2 X angle	G2Y thumb 2 Y angle

Byte3 Y axis (front/back) angle value, Meso-position =00, Max angle=FF

Byte4 G1-X: thumb 1, X axis angle value, Meso-position =00, Max angle =FF

Byte5 G1-Y: thumb 1, Y axis angle value, Meso-position =00, Max angle =FF

Byte6 G2-X: thumb 1, X axis angle value, Meso-position =00, Max angle =FF

Byte7 G2-Y: thumb 1, Y axis angle value, Meso-position =00, Max angle =FF

Byte0 (IO-DIR1) button and direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Enable switch	Button 6	Button 5	Button 4	Button 3	Button 2	Button 1

1 valid, 0 invalid (1: button pressed, 0: non-button pressed)

Byte1 (IO-DIR2)

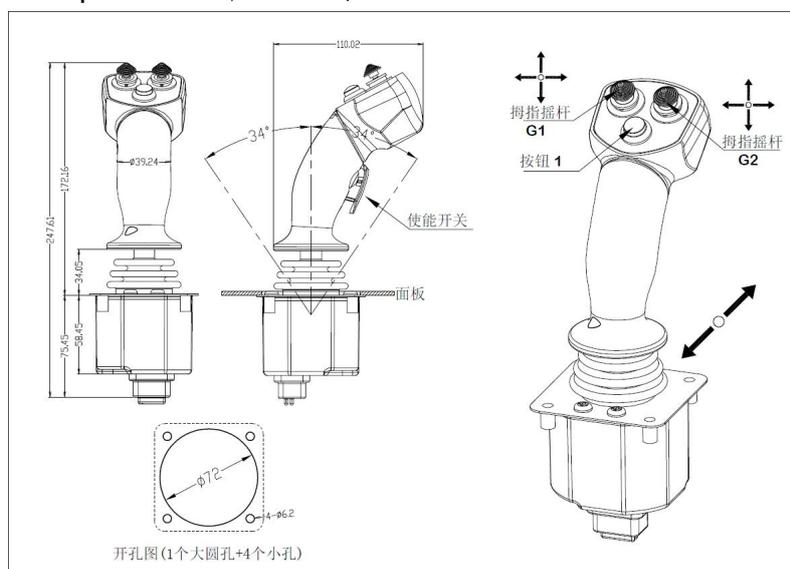
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
G2 down	G2 up	G2 left	G2 right	G1 down	G1 up	G1 left	G1 right

1 valid, 0 invalid

Byte2(DIR)Y direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
						(master) Down(back)	(master) Up(front)

1 valid, 0 invalid (meso-position Bit1, Bit0=00)



CAN communication protocol (SAE-J1939 and CANopen)

Baud rate: 250K can modify via RS232

1. Boot up

Data frame
COB-ID=0x700+ID
DLC=1
DATA=0X00

2. Joystick send data format:

PD01 Rocker parameter

Data frame
COB-ID=0x180+ID
DLC=8
DATA=

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Direction state	Y axis angle low	Y-axis angle high	0x00	0x00	0x00	0x00	Button state

Low-order in the front, high-order in the back

Byte2, Byte1= 0x0000-0x07a0 Start from center

When rocker in center (stop)angle value=0x0000

When rocker angle (max) angle value=0x07a0

Byte0 direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Thumb rocker down	Thumb rocker up	(Master) Down (back)	(Master) Up (front)	Thumb rocker right	Thumb rocker left	

1 valid, 0 invalid meso-position (stop position) Bit4, Bit3=00

Byte7 button state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Input1 outer input 1	Trigger switch	Button 6 Or Input1	Button 5	Button 4	Button 3	Button 2	Button 1

1: button pressed, 0: non-button pressed

Outer button IN1,IN2; one port connect IN1 or IN2, another port connect GND

The fresh rate of timing-automatic sending data via RS232 setting, minimum 20ms

3. Master-slave query mode instruction (This instruction is valid only when “master-slave query mode”)

Support remote frame query instruction

When received remote frame ID=280+ID (PC-joystick)

COB-ID=280+ID DLC=0

Joystick receive this remote frame then send one frame data PD01

CAN communication protocol (SAE-J1939 and CANopen)

Baud rate: 250K (can modify via RS232)

Data format:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Direction state	Y axis angle Low	Y axis angle high	0x00	0x00	0x00	0x00	Button state

Low-order in the front, high-order in the back

Byte2,Byte1= 0x0000-0x7a00 Start from center

When rocker in center (stop) angle value=0x0000

When rocker angle (max) angle value=0x07a0

Byte0 direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Angle more than 15 °=1	Thumbrocker down	Thumbrocker up	(Master) down (back)	(Master) Up (front)	Thumbrocker right	Thumbrocker left	

1 valid, 0 invalid meso-position (stop position) Bit4,Bit3=00

Byte7 button state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Input1 Outer input 1	Trigger switch	Button 6 Or Input1 Outer input 1	Button 5	Button 4	Button 3	Button 2	Button 1

Button = 1: button pressed, 0: non-button pressed

Outer button IN1, IN2; one port connect IN1 or IN2, another port connect GND

The refresh rate of timed automatic data transmission is set by RS232 , Mix 20ms

CAN communication protocol -5 axes (there are 2-cross thumbjoysticks on the panel)

Vir CAN1.0+CAN2.0B Time: 2020-07-2

CAN ID: Support 11 bit and 29 bit, Ref. CAN send ID setup.

Data transmit mode: Timing transmit, nterval 20ms(default), Can change these parameters via refresh rate

Data frames; 8 bytes; Data format:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
IO-DIR1 Button state	IO-DIR2 Thumb rocker direction state	DIR Main Y axis direction state	Main Y axis angle	G1-X thumb 1 X angle	G1-Y thumb 1 Y angle	G2X thumb 2 X angle	G2Y thumb 2 Y angle

Byte3 Y axis (front/back) angle value, Meso-position =00, Max angle=FF

Byte4 G1-X: thumb 1, X axis angle value, Meso-position =00, Max angle =FF

Byte5 G1-Y: thumb 1, Y axis angle value, Meso-position =00, Max angle =FF

Byte6 G2-X: thumb 1, X axis angle value, Meso-position =00, Max angle =FF

Byte7 G2-Y: thumb 1, Y axis angle value, Meso-position =00, Max angle =FF

Byte0 (IO-DIR1) button and direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Enable switch	Button 6	Button 5	Button 4	Button 3	Button 2	Button 1

1 valid, 0 invalid (1: button pressed, 0: non-button pressed)

Byte1 (IO-DIR2)

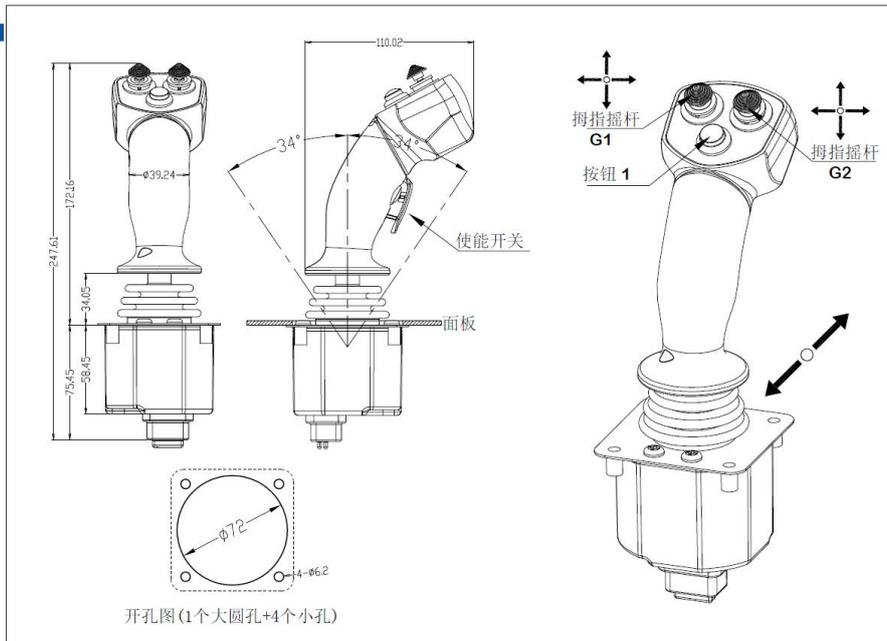
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
G2 down	G2 up	G2 left	G2 right	G1 down	G1 up	G1 left	G1 right

1 valid, 0 invalid

Byte2 (DIR) Y direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
						(master) down (back)	(master) Up (front)

1 valid, 0 invalid (meso-position Bit1, Bit0=00)



CAN communication protocol (SAE-J1939 and CANopen)

Baud rate: 250K can modify via RS232

一、Bootup

Data frame
 COB-ID=0x700+ID
 DLC=1
 DATA=0X00

二、Joystick send data format:

PD01 Rocker parameter
 Data frame
 COB-ID=0x180+ID
 DLC=8
 DATA=

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Direction state	Y axis angle low	Y axis angle high	0x00	0x00	0x00	0x00	Button state

Low-order in the front, high-order in the back

Byte2, Byte1= 0x0000-0x07a0 Start from center

When rocker in center (stop) angle value=0x0000

When rocker angle (max) angle value=0x07a0

Byte0 direction state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Thumb rocker down	Thumb rocker up	(Master) down (back)	(Master) Up (front)	Thumb rocker right	Thumb rocker left	

1 valid, 0 invalid meso-position (stop position) Bit4, Bit3=00

Byte7 button state

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Input1 outer input 1	Trigger switch	Button 6 Or Input1	Button 5	Button 4	Button 3	Button 2	Button 1

1: button pressed, 0: non-button pressed

Outer button IN1,IN2; one port connect IN1 or IN2, another port connect GND

The fresh rate of timing-automatic sending data via RS232 setting, minimum 20ms

≡ . Master-slave query mode instruction (This instruction is valid only when "master-slave query mode")

Support remote frame query instruction

When received remote frame ID=280+ID (PC-joystick)

COB-ID=280+ID DLC=0

Joystick receive this remote frame then send one frame data PDO1

Joystick communication parameter setting

Ver: 17.11.20

Users can be set and adjust the communication parameters of the joystick (including CAN, RS232, RS422)

All the above "parameters" can be adjusted only through RS422 or RS232 ports of the joystick, including CAN parameters.

PC→Joystick (RS422、RS485 or RS232) PC (serial assistant) software send instruction to joystick

If no RS232 in PC (DB9 9 pin connector), then USB to RS232 convertor (standard convertor, not TTL lever)

RS422,RS485 or RS232 communication interface of joystick, default baud rate 9600.8.1.N

—、Basic instruction:

1、ACK confirmation (Joystick-PC)

AA 55 AF

It indicates that the joystick successfully receives instructions and executes them

2、Joystick ID address setting;

ID is in RS232/RS422 communication protocol, or CANopen (PC→ Joystick)

0xaf 0x0d 00 00 00 Add 0xf5

Head Command Data 1 Data 2 Data 3 Data 4 Tail

Add=0x01~0x7F Address 1-127

Add=0x00 Invalid

E.g.:

Reset joysticks(ID=1) af 0d 00 00 00 01 f5 (HEX)

Reset joysticks(ID=2) af 0d 00 00 00 02 f5 (HEX)

The Joystick return ACK

3. Reset joystick (PC->joystick)

0xaf 0x15 00 00 00 Add 0xf5
Head Command Data1 Data 2 Data 3 Data 4 Tail
Add=0x01~0x7f Only addrss same with joystick addr then can reset
Add=0x00 Reset all joystick
Add Out of rang (0-0x7f) Invalid

E.g.:

Reset all joysticks: af 15 00 00 00 00 f5 (HEX)
Reset joysticks(ID=1): af 15 00 00 00 01 f5 (HEX)
Reset joysticks(ID=2): af 15 00 00 00 02 f5 (HEX)

3、 Setting the center position of the joystick (PC-> joystick)

This command is set up in factory, user can ignore it.

PC connect with RS422, baud rate 9600

0xaf 0x09 00 00 00 00 0xf5

Head Command Data1 Data 2 Data 3 Data 4 Tail

Transmit these data to joystick, re-set stop position of joystick(centre)

E.g.: af 09 00 00 00 00 f5 (HEX)

4、 Communication port selection: (PC->Joystick)

Joystick communication port RS232, RS422, CAN(select one); (Set in factory)

0xaf 0x05 XX 00 00 00 0xf5

Head Command Data 1 Data 2 Data 3 Data 4 Tail

XX=00 CAN port

XX=01 RS232 port

XX=02 RS422 port

XX=03 RS485 port (standard RS232/422/485 protocol)

XX=04 RS485 Modbus RTU protocol

E.g.: af 05 00 00 00 00 f5 (HEX) CAN port

af 05 01 00 00 00 f5 (HEX) RS232 port

af 05 02 00 00 00 f5 (HEX) RS422 port

af 05 03 00 00 00 f5 (HEX) RS485 port (standard 485 protocol)

af 05 04 00 00 00 f5 (HEX) RS485 Modbus RTU protocol

5、 Refresh rate setting(PC->Joystick)

Refresh rate=frame interval of send data, e.g. setting 20ms(per 20MS send one frame data to master)

0xaf 0x11 00 00 00 Ref 0xf5

Head Command Data1 Data 2 Data 3 Data 4 Tail

Ref =0x0A~0x64 (10-100)ms, Units is"Millisecond"; (Default:20ms)

Setting up this parameter will take effect after reset or restart

E.g.: Set refresh rate = 20MS (send one frame/ 20MS, send 50 times/ second))

Set 20MS af 11 00 00 00 14 f5 (HEX)

Set 25MS af 11 00 00 00 19 f5 (HEX)

Set 33MS af 11 00 00 00 21 f5 (HEX)

Set 50MS af 11 00 00 00 32 f5 (HEX)

The joystick receives this instruction→reply ACK→resets the joystick

Note: If the baud rate is lower, the frame interval time will be longer

Default:Refresh rate 20ms (CAN baud rate 250K, RS232 and RS422 baud rate 9600)

6、Communication mode (master-slave query, timed auto-send, include CAN and RS232/422)
(PC->Joystick)

Master-slave query: Joystick is slave device, it will transmit data to master only when received the query command of master

Timed auto-send: Joystick will send data to master once power-up, sending rate reference“refresh rate setting”

The factory has been set up and stored permanently.

Format:

```

0xaf    0x08    00    00    00    Mode    0xf5
Head   Command  Data1  Data 2   Data 3   Data 4   Tail
Mode=00  Timed send
Mode=01  Master-slave query
  
```

E.g.: (PC->joystick)

Auto-send mode af 08 00 00 00 00 f5 (HEX)

Master-slave query mode af 08 00 00 00 01 f5 (HEX)

Set succeed then joystick return ACK (AA 55 AF) (Joystick->PC)

7、Number of joystick signal axis: (PC->Joystick) (Only for factory)

Format: af 0c XX 00 00 00 f5

XX byte:

Number of axis (1=have, 0=no)				1=center calibration, 0=no-center calibration			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	GY	GX	Y	0	GY	GX	Y
0	0	0	1	0	0	0	1

GX Thumb rocker X-axis in handle

GY Thumb rocker Y-axis in handle

Y Main joystick (front/back)

The red mark is for Ref.: (0x11)

The factory has been set up, user can ignore it.

1 axis (Y axis) with central point : af 0c 11 00 00 00 f5 (HEX)

1 axis (Y axis) no central point af 0c 10 00 00 00 f5 (HEX)

2 axes: Y axis with central point +GX axis with central point:
af 0c 33 00 00 00 f5 (HEX)

2 axes: Y axis no central point +GX with central point:
af 0c 32 00 00 00 f5 (HEX)

3 axes: Y axis +GX axis +GY with central point:
af 0c 77 00 00 00 f5 (HEX)

Query device information: (PC->Joystick) af 20 00 00 00 00 f5 (HEX)

Reply format of joystick: Joystick->PC

```

FF    60    18    18 01 20    53 4D 43 36 31 41    3B
Head  Model Ver    Date    S M C 6 1 A    Checksum
  
```

Checksum = The sum of all the previous bytes except the head (FF), take the lower byte of the result

The above information includes the following contents :

Ver code: 60 Ver: 1.8 Date: 2017-01-20 Name: SMC61A

二、 Set communication parameter of RS232, RS422

9、 Set baud rate of RS232, RS422 (PC->Joystick)

RS232 and RS422 are same baud rate, settings are valid concurrence

0xaf	0x0b	00	00	00	Baud	0xf5
Head	Command	Data1	Data 2	Data 3	Data 4	Tail
	Baud=0X00	Baud rate =9600				
	Baud=0X01	Baud rate =19200				
	Baud=0X02	Baud rate =57600				
	Baud=0X03	Baud rate =115200				

E.g.:

Set 9600 af 0b 00 00 00 00 f5 (HEX)

Set 19200 af 0b 00 00 00 01 f5 (HEX)

Set 57600 af 0b 00 00 00 02 f5 (HEX)

Set 115200 af 0b 00 00 00 03 f5 (HEX)

Set succeed then joystick return ACK

10、 Inquire the position of the joystick (PC-> Joystick)

This instruction is valid only when "master-slave query mode"

When the joystick does not receive the inquiry instruction, it does not send data, and when it receives the inquiry instruction, the joystick returns a frame of data

0xaf	0x07	00	00	00	Addr	0xf5
Head	Command	Data1	Data 2	Data 3	Data 4	Tail
◆	Addr =	0x01-0x7f If address is correct, return send				
◆	Joystick return send current position when receive this data					

E.g. RS232 communication inquiry:

(PC-> Joystick) af 07 00 00 00 01 f5 (HEX)

(Joystick ->PC) FF 01 08 00 70 00 00 00 00 79

Joystick return send current position when receive this data

三、 CAN parameter setting: CAN parameter setting via RS232or RS422 port

11、 CAN port baud rate: (PC->joystick)

0xaf	0x06	XX	00	00	00	0xf5
Head	Command	Data1	Data 2	Data 3	Data 4	Tail
	XX=00	125K				
	XX=01	250K (Default)				
	XX=02	500K				
	XX=03	1000K				

XX=04 100K

E.g.:
 af 06 00 00 00 00 f5 (HEX) CAN baud rate =125K
 af 06 01 00 00 00 f5 (HEX) CAN baud rate =250K (Default)
 af 06 02 00 00 00 f5 (HEX) CAN baud rate =500K
 af 06 03 00 00 00 f5 (HEX) CAN baud rate =1000K
 af 06 04 00 00 00 f5 (HEX) CAN baud rate =100K

12. CAN protocol setting: (PC->Joystick)

0xaf	0x0a	00	00	TP	SS	0xf5
Head	Command	Data 1	Data 2	Data 3	Data 4	Tail

SS=00 Standard protocol ID= Send node ID,Ref . (1) Joystick sending note ID default
 SS=01 CANopen protocol ID=180+ID (Ref. (2) Set joystick ID address)
 (The factory has set up)

E.g.:
 af 0a 00 00 00 00 f5 (HEX) General protocol
 af 0a 00 00 00 01 f5 (HEX) CANopen protocol
 af 0a 00 00 00 03 f5 (HEX) CANopen SDO
 af 0a 00 00 00 04 f5 (HEX) Pull lock±15° gears indicate
 af 0a 00 00 00 05 f5 (HEX) 5 axes standard protocol

13. Joystick sending node ID setting: (PC->Joystick)

Only for "standard protocol", not for CANopen

0xaf	0x01	D1	D2	D3	D4	0xf5
Head	Command	Data 1	Data 2	Data 3	Data 4	Tail

D1.7=0 29 bits extend frame
 D1.7=1 11 bits standard frame

- 29 bits extend frame: Data range 0X0-0X0FFFFFFF, data D1-D4 corresponding "identification code"

E.g.: Set sending node identification code- Extend frame "0X00F0F101"
 af 01 00 f0 f1 01 f5 (HEX)

- 11 bits standard frame: Data range 0X000-0X3FF, data D3-D4 corresponding "Node identification code"

E.g.: Set sending node identification code - standard frame "0X181"
 af 01 80 00 01 81 f5 (HEX)

14. Joystick "Receiving node ID" setting: (PC->Joystick)

Only for "standard protocol", Not for CANopen

0xaf	0x02	D1	D2	D3	D4	0xf5
Head	Command	Data 1	Data 2	Data 3	Data 4	Tail

D1.7=0 29 bits extend frame
 D1.7=1 11 bits standard frame

- 29 bits extend frame: Data range 0X0-0X0FFFFFFF, data D1-D4 corresponding "identification code"

E.g.: Set receiving node identification code-extend frame "0X00F0F101"

af 02 00 f0 f1 01 f5 (HEX)

- 11 bits standard frame: Data range 0X000-0X3FF, data D3-D4 corresponding "identification code"
E.g.: Set receiving node identification code -standard frame "0X1E1"
af 02 80 00 01 E1 f5 (HEX)

15、Joystick "Shield node ID" setting: (PC->Joystick)

0xaf	0x03	D1	D2	D3	D4	0xf5
Head	Command	Data 1	Data 2	Data 3	Data 4	Tail

D1.7=0 29 bits extend frame

D1.7=111 bits standard frame

- 29 bits extend frame: Data range 0X0-0X0FFFFFFF, data D1-D4 corresponding "identification code"
E.g.: Set Shield node identification code -extend frame "0X00002201"
af 03 00 00 22 01 f5 (HEX)
- 11 bits standard frame: Data range 0X000-0X3FF, data D3-D4 corresponding "identification code"
E.g.: Set Shield node identification code -standard frame "0X122"
af 03 80 00 01 22 f5 (HEX)

四、Communication parameters of Modbus RTU (RS485) setting:

(Modify time: 2018-01-19)

16. Set "Device address": factory default 1

Ref. 《一, 2, Set ID Address of the joystick》

17. Joystick operating mode (PC->Joystick):

Ref. 《一, 6, Communication mode》

When in master mode, the joystick receives the correct "host reads data" instruction (01 03 40 01 00 04 0009), and the working mode is automatically changed to slave mode. After restarting the joystick, it restores the master mode.

18. Register address setting (PC->Joystick):

Data format:

0xaf	0x18	D1	D2	D3	D4	0xf5
Head	Command	Data 1	Data 2	Data 3	Data 4	Tail

D1: Register address high byte

D2: Register address low byte

(D3 and D4=0x00)

Register address default by factory =0x4001

After setting, it is permanently stored in joystick

E.g.: set the register address =0x4001(hexadecimal), if octal ,change to hexadecimal

ID=0X4001 af 18 40 01 00 00 f5