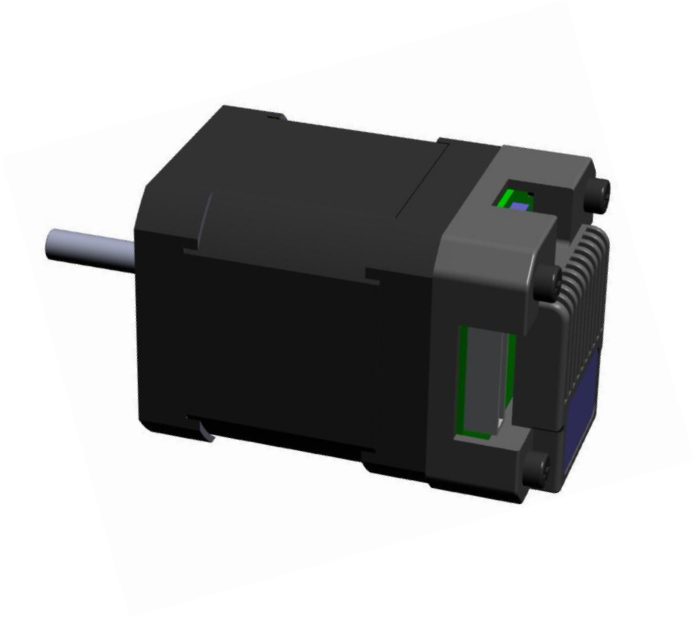
AdamPower



User Manual

ADM42S

RS485 Serial

Stepper Motor Controller

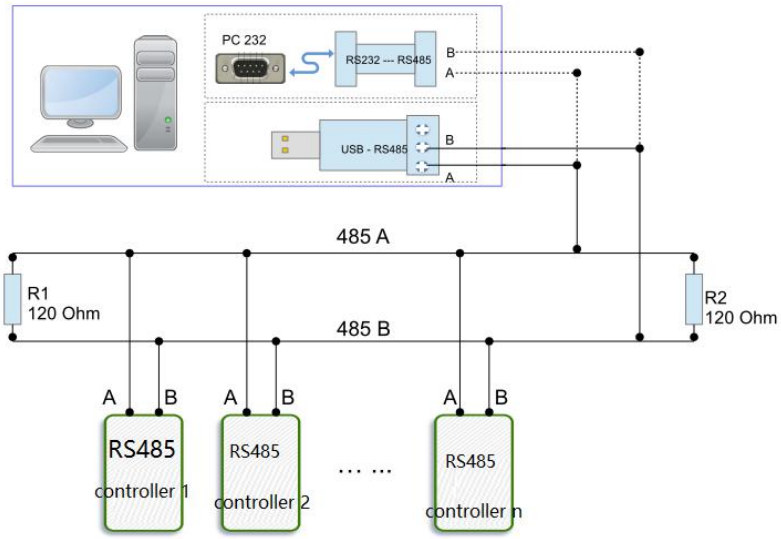
1. Product introduction

1.1. Overview

adm42s is a high-integrated and compact size stepper driver. It adopts standard RS485 communication protocol, can be connected with PLC, HMI, industrial computer and other upper computer with only two communication lines. Up to 32 axes of motion platform networking can be achieved with its built-in motion control commands.

Smooth operation, low noise and controllable temperature of the motor can be ensured by its new control algorithms such as vibration suppression and low heat, with a built-in 32-bit DSP digital chip, and its external dimensions is similar with a 42mm motor(NEMA17).

The maximum output current is 2.2A, which can meet the needs of applications for stepper motor 42mm(NEMA17) and smaller size. The driver uses micro-segmentation technology to achieve high microstep effects through internal algorithms even under low microstep conditions. The motor works with better performance after optimizing the operating parameters automatically by automatic matching function of the adm42s. The drive can be integrated with the 42/39 stepper motor as an integrated product, helping to miniaturize and reduce wiring of the device.



Network layout

1.2. Features

- Standard RS485 communication protocol and built-in motion control instructions.
- Multi-axes control, extending up to 32 axes for simultaneous control.
- DC input voltage 12~32VDC, recommended working voltage 24VDC.
- Continuous output current 1.58A max, max peak current 2.2A.
- Integrated design, mounted with 42/39mm stepper motor.
- Low vibration, low noise, stable operation, low motor heating.
- Any microstep can be set .
- Protection functions such as overvoltage, undervoltage and overcurrent.
- Built-in automatic matching function of motor parameter.
- Serial port RS232/RS485 debugging function.

1.3. Application

Particularly suitable for small volume, small space, high immunity requirements of various

automated devices and instruments.

For example: electronic processing equipment, electronic assembly equipment, laser equipment, automatic grabbing equipment, packaging equipment and industrial robots. It is especially effective when the user expects a high-stationary, low-noise device.

2. Electrical, Mechanical & Environmental Specifications

2.1. Electrical specifications

Parameters	adm42s			
	min	normal	max	unit
Continuous output current	0	-	2.2	A
Power supply voltage (DC)	+12	+24	+32	VDC
Control signal input current	6	10	16	mA
Overvoltage protection voltage	36	38	40	VDC
Insulation resistance	100	-	-	MΩ

2.2. Application environment and parameters

Cooling method		Natural cooling or forced air cooling
Application Environment	environment	Cannot be placed next to other hot devices. Avoid dust, oil mist, corrosive gases, humidity and strong vibration. Forbidden to have flammable gas and conductive dust.
	temperature	-5℃~ +45℃
	humidity	40~90%RH
	vibration	10~55Hz/0.15mm
Storage temperature		-20℃~+65℃

Use altitude	≤1000m
Weight	appr. 60g (incl.the motor)

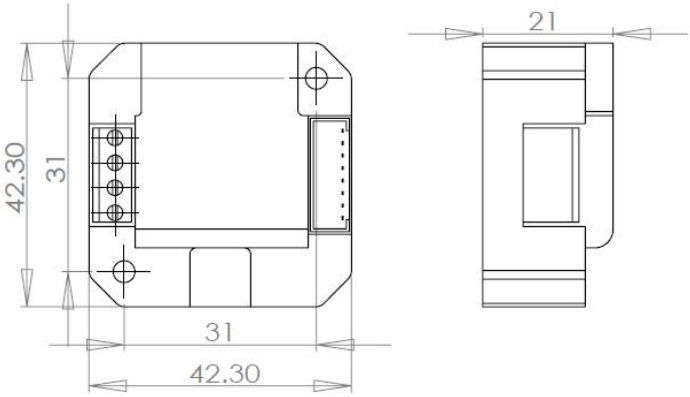
2.3. Product dimension and motor matching

The adm42s driver can be integrated with the 42mm stepper motor. ADAM POWER provides 0.2Nm, 0.35Nm, 0.7Nm and other integrated machine products.

The motor parameters can be directly written into the control algorithm, and the motor performance is superior. If only the adm42s driver is required and the equipment has requirements for low-speed vibration, it is recommended to contact us for parameter matching.

Standard integrated stepper motor parameters:

Model	Holding Torque(Nm)	Length(mm)	Features
adm42s-02	0.22	40	1. Save wiring;
adm42s-03	0.35	48	2. Motor parameters
adm42s-07	0.7	60	are written into control algorithm;



P1 adm42s drive outline drawing

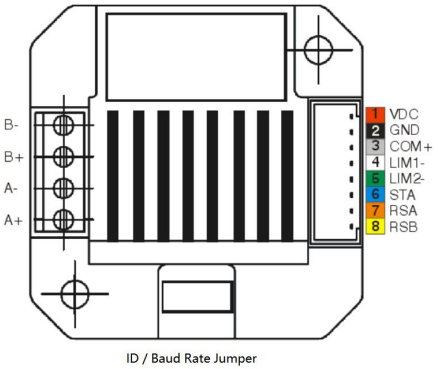
2.4. Heat dissipation precautions

The reliable working environment temperature of the drive is between -5~ 45°C, the drive is within 60°C, the motor is within 70°C. If necessary, install a fan near the drive to ensure that the drive operates within a reliable operating temperature range.

When the driver is integrated with the motor, an insulating flange is recommended to reduce the influence of motor heating on the driver.

3. Drive Interface & Wiring Introduction

3.1 Host computer control signal port



Use 8Pin 2.0mm spacer terminal

PIN	Definition	Remarks
1	VDC	Positive power input: DC voltage 12-32VDC
2	GND	Negative power input: DC voltage GND
3	COM+	IO signal level common anode common terminal, amplitude 5VDC,
4	LIM1-	Positive limit signal port, valid for rising edge
5	LIM2-	Reverse limit signal port, valid for rising edge
6	STA	Start and stop signal port, valid on rising edge

7	485A	RS485 group A signal
8	485B	RS485 group B signal

Notes:

The limit port accepts signals up to 5V.

If the external limit signal is +12V, it needs to be connected in series with 1K resistor;

If the external limit signal is +24V, you need to connect the 2.2K resistors in series.

3.2 Stepper motor ports

Use 4Pin 3.5 spacer screw terminal

PIN	Definition	Remarks
1	A+	Two-phase stepper motor A+ phase
2	A-	Two-phase stepper motor A-phase
3	B+	Two-phase stepper motor B+ phase
4	B-	Two-phase stepper motor B-phase

Note: If the motor lead of A+/A- or B+/B- is exchanged, the initial steering of the motor will be replaced.

3.3 LED status indication

The green LED is the power indicator.

When the drive is powered on, the LED is on.

When the drive is powered off, the LED is off..

4. DIP Switch Setting

The adm42s driver uses a 6-digit DIP switch to set the drive site and communication baud rate. The details are as following:

Site setting

Baud rate setting

SW1	SW2	SW3	SW4		SW5	SW6

4.1. ID address setting

ID address	SW1	SW2	SW3	SW4
Broadcast mode	ON	ON	ON	ON
1	OFF	ON	ON	ON
2	ON	OFF	ON	ON
3	OFF	OFF	ON	ON
4	ON	ON	OFF	ON
5	OFF	ON	OFF	ON
6	ON	OFF	OFF	ON
7	OFF	OFF	OFF	ON
8	ON	ON	ON	OFF
9	OFF	ON	ON	OFF
10	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF
12	ON	ON	OFF	OFF
13	OFF	ON	OFF	OFF
14	ON	OFF	OFF	OFF
15	OFF	OFF	OFF	OFF

Note: The formula for calculating the ID table is: ID=1*SW1+2*SW2+4*SW3+8*SW4. The default ID value is 0. Only data is accepted and no data return on broadcast mode.

4.2. Communication baud rate setting

Baud Rate	SW5	SW6
9600	ON	ON
19200	OFF	ON
38400	ON	OFF
57600	OFF	OFF

Note: When the communication baud rate in the table cannot meet the usage requirements, the baud rate of the bit can be customized by the host computer, and SW5 and SW6 are all turned ON.

5. Communication

The built-in trapezoidal acceleration/deceleration curve generator, which trapezoidal acceleration and deceleration, fixed length operation through communication commands, continuous operation, decelerate to stop, and stop immediately can be realize by. Internal operation supports absolute position mode and relative position mode control, and built-in common zero return function for simplify development. The internal pulse generator uses 32-bit speed, acceleration, and travel to achieve a wide range of trajectories.

5.1. Communication protocol

The communication uses the standard MODBUS protocol and supports 0x03 (read register), 0x06 (write single register), 0x10 (16) (write multiple registers). Serial communication format: baud rate 9600 ~ 115200, 8 data bits, no parity, 1 stop bit.

5.2. MODBUS register address

Add	Item	Details	Default Value	Range	Remarks
0	Peak current	R/W/S	2700	1～5600	Unit: Ma
1	Subdivision	R/W/S	1600	200～51200	The number of pulses required for the motor to run one revolution.
2	Standby time	R/W/S	300	100～10000	The time the drive enters standby, unit: ms
3	Standby current percentage	R/W/S	50	0～100	Unit: %
4	DIP status	R			
5~9	Reserved	R			
10	Filtering time	R/W/S	4000	50～25600	Set the filter filter time: us
11	Reserved				
12	Power-on current	R/W/S	4000	0～65535	To reduce the vibration of the rotor

	soft start time				when the motor is powered up and enabled. Unit: 50us
13	Current loop auto-tuning enable	R/W/S	1	0/1	Current loop PI power-on automatic tuning function: 0: not enabled 1: enabled
14	Reserved	R			
15	Current loop Kp	R/W/S	1000	10～32767	This item is read-only when auto-tuning is enabled; the user can rewrite when it is not enabled.
16	Current loop Ki	R/W/S	200	0～32767	This item is read-only when auto-tuning is enabled; the user can rewrite when it is not enabled.
17	Reserved	R			
18	Baud rate selection	R/W/S	96	96~1152	96 represents 9600
19~30	Reserved	R			
31	Device ID number	R			
32~38	Reserved	R			
39	Total number of pulses L	R			The number of external pulses received is low, 16bit
40	Total number of pulses H	R/W			The number of external pulses received is high, 16bit
41~47	Reserved	R			Write: write 1 clear counter
48	bus voltage	R			
49~50	Reserved	R			Return to bus voltage
51	Motor running direction	R/W/S	1	0/1	
52~59	Reserved	R	0		0: The motor is running in the same direction
60	Zero return speed	R/W/S	200	0～65535	1: Reverse the running direction of the motor
61	Reserved	R			

62	Reduced acceleration is 16bit lower	R/W/S	3200	0～65535	Unit pulse/s
63	Reduced acceleration is 16bit high	R/W/S	0	0～65535	Unit pulse/s^2
64	Low speed 16bit	R/W/S	1600	0～65535	Unit pulses
65	High speed 16bit	R/W/S	0	0～65535	Unit pulses
66	Low acceleration 16bit	R/W/S	3200	0～65535	Unit pulse/s^2
67	Acceleration high 16bit	R/W/S	0	0～65535	Unit pulse/s^2
68	Low stroke 16bit	R/W/S	1600	0～65535	Unit pulse
69	High stroke 16bit	R/W/S	0	0～65535	Unit pulse
70	Motion instruction	R/W	0	0~5	Trigger the corresponding motion, then the address becomes 6 0—Deceleration stop 1—Positive fixed length motion 2—reverse fixed length motion 3—forward continuous motion 4—reverse continuous motion 5—stop immediately 6—default value, meaningless
71	Zero return command	R/W	0	0~2	0—Exit zero 1—zero return to zero with positive limit signal 2—zero return to zero with negative limit signal
72	Steady motion mode	R/W	0	0/1	0: incremental mode 1: absolute mode
73	Device control register	R/W/S			See table 2.2.1 for the details: bit0 - LIM1 port; bit1 - LIM2 port; bit6 - LIM3 0 - normally closed, high level trigger 1 - normally open, low level trigger
74	Zero return limit	R/W/S	10	0~65535	1 means 50us

	filter time				
75	Device status register	R			bit0: Overcurrent; bit1: Overvoltage; bit2: In place; bit3: zero return completed; bit4: positive limit effective; bit5: Negative limit effective; bit7: internal pulsed completed; check 2.2.2 table
76~89	Reserved	R			
90	Save parameter	R/W	0	0/1	Read the address: Return 0: Saved
91	Restore factory default parameters	R/W	0	0/1	Restore factory. Write 1 to restore facotry, Return:0 Restored
92~150	Reserved	R			Reserved

5.3. Drive Control Register

2.2.1 Table

Bit definition	**Name description**	**Default value**	**description**
9~15	Reserved	0	
8	IO trigger level polarity	0	**Edge trigger mode:** 0: Optocoupler does not conduct ---> start when turned on Optocoupler conduction ---> stop when not conducting 1: The optocoupler does not conduct ---> stop when turned on Optocoupler conduction ---> start when not conducting Level mode: 0: The optocoupler is turned on and held up The optocoupler does not conduct and stops when held 1: The optocoupler is turned on and stopped when held The optocoupler does not conduct and is activated when it is held
7	IO trigger mode:	0	0——ENA port edge trigger mode

	edge/level selection		1——ENA port level trigger mode
6	IO trigger motion enable	1	0 - ENA port has no effect 1 - ENA port can trigger motion
2~5	Reserved	0	no
1	Negative limit signal level	1	0—Negative limit occurs when the optocoupler is turned off 1—The negative limit occurs when the optocoupler is turned on.
0	Positive limit signal level	1	0—The positive limit occurs when the optocoupler is turned off. 1—The positive limit occurs when the optocoupler is turned on.

5.4. Drive status register

2.2.2 Table

Bit definition	**Name description**	**Default value**	**description**
8~15	Reserved	0	Reserved
7	Movement completed	1	1——Internal pulse transmission completed 0——internal pulse is not completed
6	Reserved	0	0
5	Negative limit	0	0——no negative limit signal 1——have negative limit signal
4	Positive limit	0	0——no negative limit signal 1——have negative limit signal
2~3	Reserved	0	
1	Overpressure	0	0 - no overpressure 1 - Overpressure occurs
0	Overcurrent	0	0 - no overcurrent 1 - Overcurrent occurs

5.5 Return to zero function

5.5.1 Return to zero with the positive limit signal as zero

The process of returning to zero after registering "1" to register address 71 (zero return command) is as follows:

Step 1: Run forward to the positive limit with the speed and acceleration set by the 62~67 register address.

Step 2: After detecting the positive limit signal, decelerate to stop.

Step 3: Run to the limit signal in the negative direction of the speed set by register address 60 (zero return speed).

5.5.2 Return to zero with the negative limit signal as zero

The process of returning to zero after writing "2" to register address 71 (return to zero command) is as follows:

Step 1: Run at the speed and acceleration set by the 62~67 register address to the negative limit.

Step 2: After detecting the negative limit signal, decelerate to stop.

Step 3: Run to the limit signal in the positive direction of the speed set by register address 60 (zero return speed).

5.5.3 Exit back to zero:

After the "0" is written to the register address 71 (return to zero command), the drive exits the zero

return process and decelerates to a stop.

After completing the zero return, the customer can clear the pulse counter by writing a 1 to the register address 40 as needed (as in absolute position mode).

5.4 MODBUS Common function code

5.4.1 Read Holding Registers command 0x03

Host->slave data

Device address	function code	Register address		Number of read registers		CRC check	
01	03	00	00	00	01	85	0A

Slave->host data

Device address	function code	Return bytes	Number of registers		CRC check	
01	03	02	0A	8C	BF	41

The slave return current value (register address 00) is 2700 mA.

5.4.2 Write a single register command 0x06

Host->slave data

Device address	Function-code	Register add		Data input		CRC check	
01	06	00	40	06	40	8A	4E

Slave->host data

Device address	Function-code	Register add		Data input		CRC check	
01	06	00	40	06	40	8A	4E

Write 1600 pulses/s to the slave's speed of 16 bits (register address 64).

5.4.3 Write multiple register commands 0x10

Host -> slave data

Device add	Function code	Starting add		Input no.		bytes no.	Input contents		Input contents		CRC check	
01	10	00	44	00	02	04	38	80	00	01	3B	24

Host -> slave data

Device add	Function code	Starting add		Input no.		CRC check	
01	10	00	44	00	02	01	DD

Write 14464 to the lower 16dB (register address 64) of the slave, and write 1 to the 16-bit high (register address 65), that is, the total number of trips is 80000pulse.

5.5 CRC check routine

The following routine calculates the CRC in C language

```
Uint16 Funct_CRC16(unsigned char * puchMsg, Uint16 DataLen)
{
Uint16 i,j,tmp;
Uint16 crcdata=0xFFFF;
for(i=0;i<DataLen;i++)
{
crcdata=(*puchMsg)^crcdata;
puchMsg++;
for(j=0;j<8;j++)
{
tmp=crcdata&0x0001;
crcdata=crcdata>>1;
if(tmp){
crcdata=crcdata^0xA001;
}
}
}
returncrcdata;
}
```

5.6 Communication error codes

There are four possible situations in the communication process:

1. The communication is normal, the drive can receive and return information normally.

2. The driver cannot receive the information of the host normally due to communication error. At this time, the host performs timeout processing.

3. The drive receives the data, but an error is detected (such as a CRC error, the frame length is incorrect), the drive does not return information, and the host does timeout processing.

4. The driver receives the normal MODBUS frame, but the driver cannot handle it correctly (such as unsupported function code, unsupported register address, etc.), at which point the drive returns the corresponding fault information.

Format of returning the fault information: slave address + function (0x80 + function code) + fault code + CRC low + CRC high.

Error code	Name	Remarks
01	Illegal function code	This drive only supports 0x03, 0x06, 0x10 function code
02	Illegal register address	If the written register address is out of range. In addition to the listed registers, some addresses are reserved for testing, and customers should not operate other registers.
03	Illegal data	If the 03 function reads more than 100 data at a time, the drive reports this fault. There are restrictions on the data range of some registers inside the drive. Please follow the instructions.

6. Power Supply

The power supply voltage can work normally between the specified ranges. The adm42s driver is preferably powered by a regulated DC power supply or a switching power supply. If using a regulated switching power supply, it should be noted that the output current range of the switching power supply should be set to the maximum.

Cautions:

1) When wiring, pay attention to the positive and negative poles of the power supply.
2) When using a switching power supply, the output current of the power supply should be greater than or equal to the operating current of the driver;
3) Aim to reduce the cost, multiple drivers can share one power supply, but the power supply should be large enough.

7. Motor Choosing

The adm42s driver is suitable for 4, 6 and 8-wire hybrid 2-phase stepper motors. Due to its compact size, it is recommended to use a 42/39mm size, 4-wire, 1.8/0.9 degrees motor. When choosing a motor, it is mainly determined by the torque and rated current. The torque is mainly determined by the length of the motor body, the motor with a large length has a large torque. While the current is mainly related to the inductance, and the small inductor motor has good high-speed performance, but the rated current is large.

8. Protection

8.1. Overvoltage protection

The adm42s driver will stop operating when the input voltage is above 38VDC. At this time, the fault must be discharged and the power-on reset should be resumed.

8.2. Undervoltage protection

When the input voltage is below 10VDC, the drive will stop working. At this time, the fault must be discharged and the power-on reset should be resumed.

8.3. Overcurrent protection

When an overcurrent fault occurs, the drive will stop working. At this time, the fault must be discharged and the power-on reset should be resumed.

Attention!

Since the driver does not have the reverse polarity protection function of the power supply, please confirm the correct connection between the positive and negative terminals of the power supply before powering on. Reversing the positive and negative poles will cause the fuse in the drive to burn out!

9. F.A.Q.

9.1. Common problems and solutions in the application

Item	Possible problem	Solution
Motor does not work	Power light is not lit	Check the power supply circuit, normal power supply
	Motor shaft is powerful	The signal is weak and the signal current is increased to 7-16mA
	microstep is too small	Selective segmentation
	Drive is protected	Re-power
	Does not react to control signals	No power
	The motor line has an open circuit	Check and pick up
	Voltage is too high or too low	Check the power supply
	Motor or drive damage	Replace the motor or drive
Inaccurate location	Signal interference	Eliminate interference
	The shield is not connected or not	Reliable grounding

	connected	
	The motor line has an open circuit	Check and pick up
	microstep error	Reset the microstep
Motor stall during acceleration	Acceleration time is too short	Accelerated acceleration time
	Motor torque is too small	Select a larger torque motor
	Low voltage	Appropriately increase the voltage

9.2. FAQ on drive

9.2.1. What are the advantages of microstep drives?

● increased step uniformity, thus improving control accuracy.

● motor vibration can be reduced.

● reduce torque ripple effectively and increase output torque.

9.2.2 Why is my motor running in one direction only?

● The direction signal may be too weak, or the wiring polarity is wrong, or the signal voltage is too high to burn out the direction current limiting resistor.
● The pulse mode does not match, the signal is pulse/direction, and the drive must be set to this mode.

In case of other questions please contact our application engineers.

Warranty

1 one-year warranty

ADAM POWER provides a one-year warranty on raw materials and process defects for its products from the date of shipment. During the warranty period, our company provides free repair service for defective products.

2 Not covered by the warranty.

● Inappropriate wiring, such as reverse polarity and positive and negative power supply.
● Change internal devices without permission.
● Exceeding electrical and environmental requirements.
● Poor environmental heat.

3 Maintenance procedures

Please contact our sales staff.

4 Warranty limitations

● The warranty coverage of our products is limited to the device and process (ie, consistency) of the product.
● Our company does not guarantee that its products will be suitable for the specific use of the customer, because it is also suitable for the technical requirements and conditions of use and environment of the application.