INSTRUCTIONS FOR THE SERVO ACTUATOR WITH PLC CONTROL

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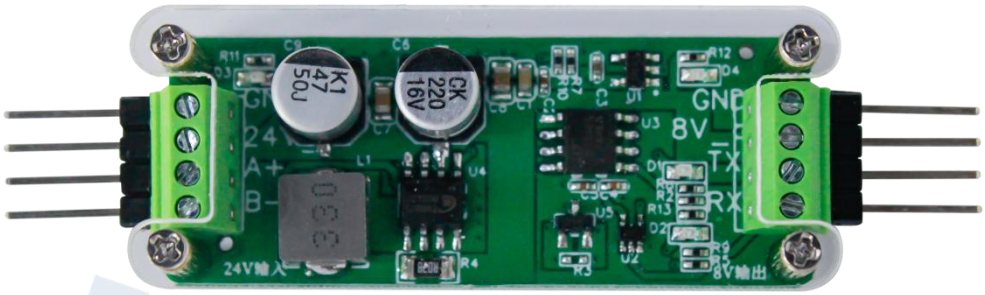
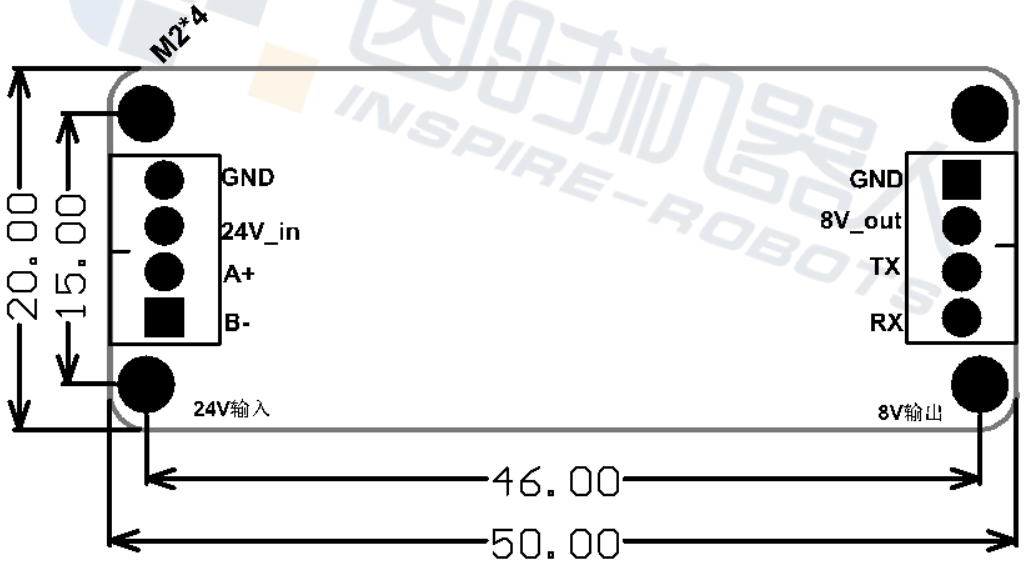
For the motion of the Servo Actuator with PLC Control, the RS485 converter (model: AED-LA-82-12) is required to convert its level and communication format. The RS485 converter can convert DC 24 V to DC 8 V to supply power to the servo actuator, and convert the RS485 level to the LVTTL 3.3 V level.



24 V input	8 V output



24 V input	8 V output

Left signal of the circuit board (connected to the master control terminal)			Right signal of the circuit board (connected to the linear actuator)			
GND	GND	Input	GND	GND	Output	Black cable of the actuator
VCC	24V_in	Input (24V1A)	VCC	8V_out	Output (8V2A)	Red cable of the actuator

Positive terminal of 485	A+	Differential input (positive)	Positive terminal of 485	TX	Transmission via 3.3 V serial port	Yellow cable of the actuator
Negative terminal of 485	B-	Differential input (negative)	Negative terminal of 485	RX	Receiving via 3.3 V serial port	Blue cable of the actuator

Note: This is a passthrough module where the master control terminal sends the instruction data via RS485 from TX to the linear actuator; the feedback data from the linear actuator is converted to the RS485 signal via RX, and then such signal is uploaded to the master control terminal. The maximum baud rate is 115200bps. A module has one linear actuator.

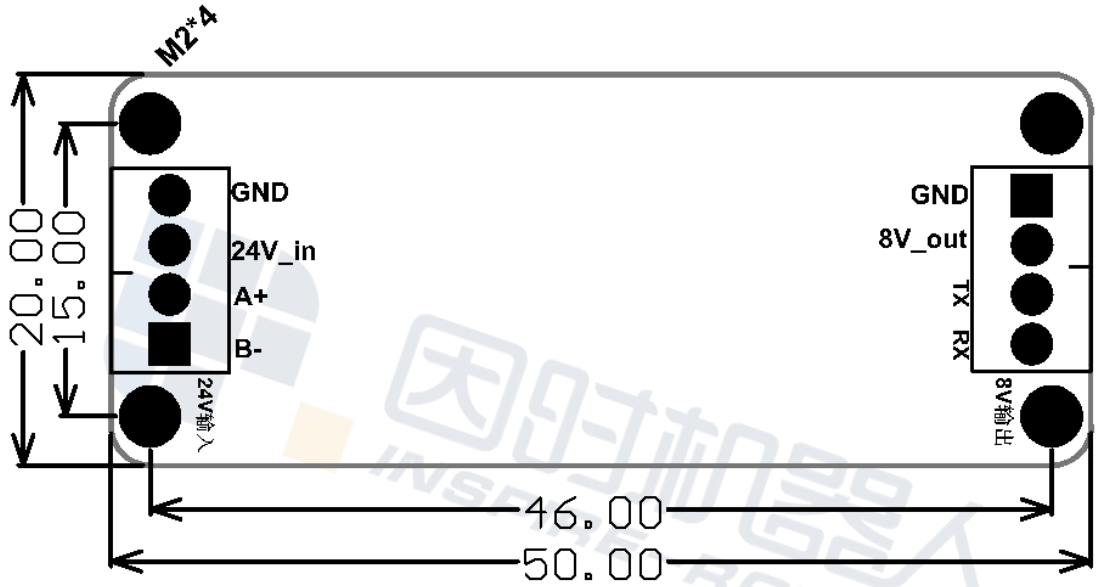
Product: Modbus RTU Converter

Model: AED-LA-92-12

Function description:

1. The built-in MCU can convert the control instruction of RS485 in the Modbus RTU format to the instruction for motion control with LVTTL 3.3 V level that is suitable for the servo actuator;

2. 24 V to 8 V step-down module



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Negative terminal of 485	B-	Differential input (negative)	Negative terminal of 485	RX	Receiving via 3.3 V serial port	Blue cable of the actuator

Note: This is a protocol conversion module where the master control terminal converts the Modbus protocol command via the RS485 interface to the instruction that meets the motion control requirement of the linear actuator, and sends such instruction to the linear actuator via TX; the feedback data from the linear actuator is converted to the Modbus protocol after it is received via RX, and then is uploaded to the master control terminal via the RS485 interface. The maximum baud rate at the Modbus terminal is 115200bps. A module has one linear actuator. Modbus instructions are listed below:

Modbus RTU interface protocol

Communication data structure

9600 (baud rate); 8 (data bit); Even (parity bit); 1 (start bit); 1 (stop bit)

<table>
<tr><td>Start</td><td>Holding the state without input data for ≥10 ms</td></tr>
<tr><td>Slave station address</td><td>Slave station address: 8 bits binary address</td></tr>
<tr><td>Command code</td><td>Command code: 8 bits binary address</td></tr>
<tr><td>Data (n-1)</td><td rowspan="3">Data content
n × 8 bits binary number, n≤202</td></tr>
<tr><td>...</td></tr>
<tr><td>Data (0)</td></tr>
<tr><td>Low-order byte in CRC checksum</td><td rowspan="2">CRC checksum
CRC checksum consists of two 8 bits binary numbers.</td></tr>
<tr><td>High-order byte in CRC checksum</td></tr>
<tr><td>End</td><td>Holding the state without input data for ≥10 ms</td></tr>
</table>

The format of data characters depends on the command code. The valid description of the command code is shown below:

Command code (Hex)	Description	Actionable unit
01 (01H)	Reading node state (the input node state cannot be read)	S, Y, M, T, C
02 (02H)	Reading node state (the input node state can be read)	S, X, Y, M, T, C
03 (03H)	Reading the content of register	T, C, D
05 (05H)	Forced separate node state On/Off	S, Y, M, T, C
06 (06H)	Preset value of separate register	T, C, D
15 (0FH)	Forced multiple nodes state On/Off	S, Y, M, T, C

16 (10H)	Preset values of multiple registers	T, C, D
17 (11H)	Reporting the slave station address	None
23 (17H)	PLC LINK executes the read and write functions simultaneously in a polling period.	None

Cyclic redundancy check (CRC) starts from the "Slave station address" until "the last data content" ends. The CRC calculation method is described below:

Step 1: Load a 16 bits register ("CRC Register") with the content of FFFF (hexadecimal system).

Step 2: Execute the XOR operation of the 8 bits data for the first byte in the instruction information and the 8 bits data for the low-order bytes in the CRC register.

The operation result is stored in the CRC register.

Step 3: Shift the content of the CRC register rightward by 1 bit, and enter 0 in its highest bit.

Step 4: Check the value of the lowest bit in the CRC register. If it is 0, repeat Step 3; if it is 1, execute the XOR operation of the content of the CRC register and A001 (hexadecimal system), and store the operation result in the CRC register.

Step 5: Repeat Steps 3 and 4 until the content of the CRC register is shifted rightward by 8 bits. At that time, the first byte in the instruction information has been processed completely.

Step 6: For the next byte in the instruction information, repeat the actions in Steps 2 to 5 until all bytes in the instruction information are processed completely. The last content of the CRC register is the cyclic redundancy check (CRC) value. When the CRC value is transmitted in the instruction information, the high-order and low-order bytes in the calculated CRC value must be interchanged, i.e., low-order bytes in the CRC value should be transmitted first.

Example: Read the data of 8 consecutive character sets with the PLC number of 01 and the address of H0614-H61B (T20-T27). Read the value of the slave station equipment (communication address: 1).

PC→PLC

"01 03 06 14 00 08 04 80"

Information transmitted:

Field	Data (hexadecimal number)
Start	Holding the state without input data for ≥10 ms
Slave station address	01
Command code	03
Data start address	06
	14

c	Data (hexadecimal number)
Data count (unit: byte)	00
	08
Low-order byte in CRC checksum	04
High-order byte in CRC checksum	80
End	Holding the state without input data for ≥10 ms

Response information:

Field	Data (hexadecimal number)
Start	Holding the state without input data for ≥10 ms
Slave station address	01
Command code	03
Data count (unit: byte)	10
High-order byte in data (T20)	00
Low-order byte in data (T20)	01
High-order byte in data (T21)	00
Low-order byte in data (T21)	02
High-order byte in data (T22)	00
Low-order byte in data (T22)	03
High-order byte in data (T23)	00
Low-order byte in data (T23)	04
High-order byte in data (T24)	00
Low-order byte in data (T24)	05
High-order byte in data (T25)	00

Low-order byte in data (T25)	06
High-order byte in data (T26)	00
Low-order byte in data (T26)	07
High-order byte in data (T27)	00
Low-order byte in data (T27)	08
Low-order byte in CRC checksum	72
High-order byte in CRC checksum	98
End	Holding the state without input data for ≥10 ms

Read and write the register values through Command Code 03 (read) and Command Code 06 (write) of Modbus RTU to execute function commands.

The communication data content is listed below.

Modbus address	**Name**	**Range**	**Description**		
H0001	CMD-ID	H0001-H00FE	Linear servo equipment address (ID)	Read and write	To become effective immediately
H0002	CMD-BAUD	H0001--1200 H0002--2400 H0003--4800 H0004-9600 (def) H0005--14400 H0006--19200 H0007--38400 H0008--56000 H0009--57600 H000A—115200	Communication baud rate setting	Read and write	To become effective after re-power on
H0003	CMD-SAVE	H0000 H0001 (effective)	Parameter saving	Read and write	To become effective after re-power on
H0010	CMD-STOP	H0000 H0001 (effective)	Emergency stop	Read and write	To become effective immediately
H0011	CMD-REST ART	H0000 H0001 (effective)	Recovery	Read and write	To become effective immediately
H0012	CMD-FAUL TACK	H0000 H0001 (effective)	Fault clearance	Read and	To become effective

				write	immediately
H0013	CMD-SETSPEED	The high-order byte indicates the time interval (ms). (1-255) (H01-HFF) The low-order byte indicates the position step. (1-200, 255) (H01-HC8, HFF)	Speed regulation parameter setting	Read and write	To become effective immediately
H0020	CMD-SETPOS	0 to 2000 (decimal system) H0000~H07D0	Setting the motion position of the actuator	Read and write	To become effective immediately
H0021	CMD_CURPOS	-100 to 2100 (decimal system) HFF9C~H0834	Current position of the actuator	Read	To become effective immediately
H0022	CMD_CURTEMP	-20 to 100 (decimal system) HFFEC-H0064	Current temperature of the actuator (℃)	Read	To become effective immediately
H0023	CMD_CURCUR	0 to 2000 (decimal system) H0000~H07D0	Current of the actuator (mA)	Read	To become effective immediately
H0024	CMD_CURERR	H0001: protection from locked-rotor H0002: over temperature protection H0004: overcurrent protection H0008: abnormal operation of the motor	Error code of the actuator	Read	To become effective immediately