BSQ-JN-P8 type eight-way load cell acquisition module instructions for use

1. Products

The BSQ-JN-P8 eight-way load cell acquisition module can be connected to eight Wheatstone bridge load cells, and the output of the load cells can be connected to the BSQ-JN-P8. The analog differential signals such as ±5mV₹10mV are converted into digital quantities and then uploaded via RS485. It supports the standard Modbus RTU protocol and can be used with other devices that follow the Modbus RTU protocol .合

2. Product Overview

BSQ-JN-P8 type acquisition module mainly consists of power supply circuit, analog input sampling and conditioning circuit, RS485 transceiver circuit and MCU. It adopts high-performance full-speed USB type FLASH microcontroller as the control unit, 24bit analog-to-digital converter for data conversion, stable resolution up to 23 bits, over-voltage and over-current protection functions and anti-interference functions to avoid the influence of industrial field signals on the communication interface of the module and make the communication (data transmission) stable and reliable. The product has high communication efficiency, and the time interval of 8-channel packet transmission can be as low as 5ms under the condition of 9600bit/s baud rate.

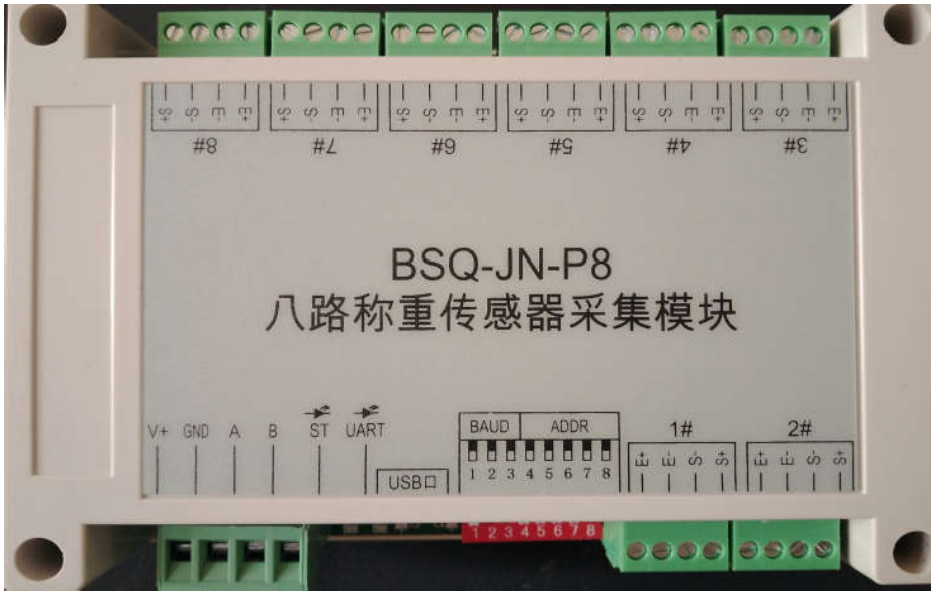
Main technical specifications

1) System Parameters
- Power supply voltage: 8~30VDC, power supply anti-reverse protection
- Power consumption: 1W
- Operating temperature: -25℃~85℃, industrial grade chip
- Relative humidity: 5%~95% non-condensing

2) Analog input parameters
- Input channels: eight differential signals
- Input impedance: greater than 20MΩ
- Normal input range: differential signals within ±12MV
- ADC effective resolution: 19bit, bipolar

3) Communication Interface
- Physical interface: RS485 half-duplex communication port
- Communication protocol: Modbus RTU protocol
- Baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 selectable
- Data format: 1 start bit, 8 data bits, no parity bits, 1 or 2 stop bits

3. Panel terminals and pull switches


BSQ-JN-P8
八路称重传感器采集模块
V+
GND
A
B
ST
UART
USB口
BAUD
ADDR
1 2 3 4 5 6 7 8
1#
2#
8#
7#
6#
5#
4#
3#

3.1 Terminal Description

1) Power and communication terminals

	Definition	Description
1	V+	Input power supply voltage 8 to 30VDC, such as 24VDC
2	GND	Power supply negative terminal
3	A	RS485 Data+
4	B	RS485 Data-

2) Eight-way sensor terminals 1#: channel 1; 2#: channel 2; ... 8# : Channel 8

	Definition	Description
1	E+	5 V sensor excitation power supply +
2	E-	5 V sensor excitation power supply-

3.2 Dipswitch to set module address and communication baud rate

1) Node address (ADDR: factory default node address is 1)

	S4	S5	S6	S7	S8
0	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	ON	ON
4	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	ON	OFF	ON
6	OFF	OFF	ON	ON	OFF
7	OFF	OFF	ON	ON	ON
8	OFF	ON	OFF	OFF	OFF
9	OFF	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON	OFF
11	OFF	ON	OFF	ON	ON
12	OFF	ON	ON	OFF	OFF
13	OFF	ON	ON	OFF	ON
14	OFF	ON	ON	ON	OFF
15	OFF	ON	ON	ON	ON
16	ON	OFF	OFF	OFF	OFF
17	ON	OFF	OFF	OFF	ON
18	ON	OFF	OFF	ON	OFF
19	ON	OFF	OFF	ON	ON
20	ON	OFF	ON	OFF	OFF
21	ON	OFF	ON	OFF	ON
22	ON	OFF	ON	ON	OFF
23	ON	OFF	ON	ON	ON
24	ON	ON	OFF	OFF	OFF
25	ON	ON	OFF	OFF	ON
26	ON	ON	OFF	ON	OFF
27	ON	ON	OFF	ON	ON

28	ON	ON	ON	OFF	OFF
29	ON	ON	ON	OFF	ON
30	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON

2) Baud rate (BAUD: factory default baud rate of 9600,n,8,1, that is, 9600bps, no parity, 8 bits of data, 1 stop bit)

Baud rate	S1	S2	S3
1200bps	OFF	OFF	OFF
2400bps	OFF	OFF	ON
4800bps	OFF	ON	OFF
9600bps	OFF	ON	ON
19200bps	ON	OFF	OFF
38400bps	ON	OFF	ON
57600bps	ON	ON	OFF
115200bps	ON	ON	ON

3) Status indicator and USB port

	Working Status	Description
PWR	Red always on	Power indicator
ST	Blue light	Blinks at equal intervals when

4. Communication module parameters

All analog input channels and related parameters in the module are mapped to specific Modbus components, which can be read and written to operate the module to perform various functions.

4.1 Module communication parameters

The node address and baud rate of this acquisition module are automatically configured at power-on after being set by dip switches, and no software configuration is required.

4.2 Analog input measured value reading (function code: 0x03)

The module has 8 analog input channels, which are mapped to different input registers, and the analog input measurement values can be obtained by reading the input registers. The module provides two data formats for reading and writing, including addresses 0-299 for floating point (four-byte) reading and writing, and addresses 300-999 for long integer (four-byte) reading and writing. (Note: 0x10 means hexadecimal, 10 means decimal, the size of the two values are different, the decimal number of 0x10 is 16)

4.2.1 Eight analog channels measured values are read by floating point number (read command: 0x03)

1 Parameter table for reading measured values of analog channels by floating point numbers

Address	Modbus address	Parameter Name	Data Type	Reading and writing	Description
200	40201	1st measured value	Floating point	R	Floating point measurement values
202	40203	2nd measured value	Floating point	R	Floating point measurement values
204	40205	3rd measured value	Floating point	R	Floating point measurement values
206	40207	4th measured	Floating	R	Floating point

		value	point		measurement values
208	40209	5th measured value	Floating point	R	Floating point measurement values
210	40211	6th measured value	Floating point	R	Floating point measurement values
212	40213	7th measured value	Floating point	R	Floating point measurement values
214	40215	8th measured value	Floating point	R	Floating point measurement values

2 Example of reading the measured value of an analog channel by floating point number (module address assumed to be 1)

(1) Read the 1st channel floating point measurement value (corresponding to the starting address of 200, i.e. 0x00c8)

- Command from the host computer

Module Address	Function Code	Start address high	Low starting address	Register points high	Low register points	CRC Checksum High	CRC checksum low
0x01	0x03	0x00	0xc8	0x00	0x02	0x45	0xf5

■ This module uploads data

Module Address	Function Code	High data length	Low data length	1st channel measured value 4-byte floating point	CRC Checksum	CRC checksum

(2) Reads 8 channels of floating point measurements at once

■ Command from the host computer

Module Address	Function Code	Start Address	Low starting	Register points high	Low register points	CRC Checksum	CRC checksum

■ This module uploads data

Module Address	Function Code	High data length	Low data length	8 channels of floating point measurements in 32 bytes	CRC Checksum	CRC checksum

Note: The floating point measurement value of a single channel or all 8 channels can be read by the corresponding instruction, just change the first address of the register address and the number of register points in the issued instruction, such as reading the floating point measurement value of the second channel, the first address of the register should be 202 and the number of register points should be 2, and so on.

4.2.2 Eight analog channels measured values are read by signed long integer numbers (read command: 0x03)

Note: When reading by long integer numbers, this module does not set the decimal point setting function, please add the specific decimal point position according to the full calibration value, such as when the sensor force is 20kg, the calibrated measurement value output is 20000, then fix the decimal point in the thousands place, that is, 20.000, similarly, if the actual calibrated measurement value is 2000, then please fix the decimal point in the hundreds place, and 20.00

1 Parameter table for reading measured values of analog channels by long integer numbers

Address	Modbus address	Parameter Name	Data Type	Reading and writing	Description
500	40501	1st measured value	Long Integer	R	Long integer measurement values
502	40503	2nd measured value	Long Integer	R	Long integer measurement values
504	40505	3rd measured value	Long Integer	R	Long integer measurement values
506	40507	4th measured value	Long Integer	R	Long integer measurement values
508	40509	5th measured value	Long Integer	R	Long integer measurement values
510	40511	6th measured value	Long Integer	R	Long integer measurement values
512	40513	7th measured value	Long Integer	R	Long integer measurement values

514	40515	8th measured value	Long Integer	R	Long integer measurement values

2 Example of reading the measured value of an analog channel by long integer number (module address assumed to be 1)

(1) Read the measured value of the 1st channel long integer (corresponding to the starting address of 500 i.e. 0x01f4)

■ Command from the host computer

Module Address	Functio n Code	Start Address	Low starting	Register points high	Low register points	CRC Checksum	CRC checksum

■ This module uploads data

Module Address	Functio n Code	High data length	Low data length	Measured value for channel 1 4-byte long integer number	CRC Checksum	CRC checksum

(2) Reads 8 channels of long integer measurements at once

■ Command from the host computer

Module Address	Functio n Code	Start Address	Low starting	Register points high	Low register points	CRC Checksum	CRC checksum

■ This module uploads data

Module Address	Functio n Code	High data length	Low data length	8 channels of long integer measurements totaling 32 bytes	CRC Checksum	CRC checksum

Note: The long integer measurement value of a single channel or all 8 channels can be read by the corresponding instruction, just change the first address of the register address and the number of register points in the issued instruction, such as reading the long integer measurement value of the second channel, the first address of the register should be 502 and the number of register points is 2, and so on.

4.3 Zero calibration (function code: 0x05)

This module provides 8-channel overall zero calibration function and single-channel calibration function. When using the overall zero calibration, it is necessary to ensure that the 8 sensors and this module are properly connected and kept empty, and when using the single-channel calibration, the corresponding single channel is connected to the sensors and the sensors of that channel are kept empty. At the same time, the corresponding zero calibration operation should be performed before the full calibration. The reset code for Modbus function code 0x05 is 0x0000 and the reset code is 0xff00.

Zero calibration parameter table

Address	Reset (0xff00)	Reset (0x0000)	Description
00(0x00)	First circuit zeroing	Zeroing is invalid	This address is set to complete the zero calibration operation of the zero setting machine
01(0x01)	Second circuit zeroing	Zeroing is invalid	
02(0x02)	Third circuit zeroing	Zeroing is invalid	
03(0x03)	Fourth circuit zero setting	Zeroing is invalid	
04(0x04)	Fifth circuit zeroing	Zeroing is invalid	
05(0x05)	Sixth circuit zeroing	Zeroing is invalid	
06(0x06)	Seventh circuit zeroing	Zeroing is invalid	
07(0x07)	Eighth circuit zeroing	Zeroing is invalid	
08(0x08)	Zero on all roads	Zeroing is invalid	

Example, the third channel will be zero calibration operation (corresponding address is 0x02, set code is 0xff00, other similar)

- Command from the host computer

Module Address	Function Code	Address High	Address Low	Reset code high	Reset code low	CRC Checksum	CRC checksum

- This module uploads data

Module Address	Function Code	Address High	Address Low	Reset code high	Reset code low	CRC Checksum	CRC checksum

4.4 Full calibration (function code: 0x10)

This module can realize the full calibration of each analog channel through the command. Before the full calibration of a channel, the zero calibration of the channel must be performed first. The data in the full calibration data frame format is unsigned long integer data. In order to improve the calibration accuracy, when the long integer data in the data field is 100000, the full calibration factor is 1.00000, if the long integer data in the data field

is 10000, the full calibration factor is 0.10000, and so on.

Full-scale calibration parameter table

Address	Parameter Name	Range of values (meaning: calibration factor)	Data Type	Description
800(0x320)	First full calibration	10～999999 (0.00010～9.99999)	Long Integer	See calibration step 4.4.1 and examples 4.4.2
801(0x321)	Second full calibration	10～999999 (0.00010～9.99999)	Long Integer	
802(0x322)	Third way full calibration	10～999999 (0.00010～9.99999)	Long Integer	
803(0x323)	Fourth circuit full calibration	10～999999 (0.00010～9.99999)	Long Integer	
804(0x324)	Fifth way full calibration	10～999999 (0.00010～9.99999)	Long Integer	
805(0x325)	Sixth circuit full calibration	10～999999 (0.00010～9.99999)	Long Integer	
806(0x326)	Seventh circuit full calibration	10～999999 (0.00010～9.99999)	Long Integer	
807(0x327)	Eighth circuit full calibration	10～999999 (0.00010～9.99999)	Long Integer	

4.4.1 Full Calibration Procedure

Take a channel calibration as an example to illustrate the steps of full scale calibration

- Step 1: First perform a zero calibration for the channel, see 4.3 for zero calibration instructions;
- Step 2: Apply a standard load to the sensor of the channel, wait for the data to stabilize, and then read the measured value of the long integer number of the channel, the long integer number

The reading of the measured values is described in 4.2.2;

- If the measured value of the long integer number read for this channel does not match the actual load ☐, a calibration factor correction is made according to the following formula:

Calibration factor correction value = Desired measurement value ÷ Read long integer data

- Write the calibration coefficient correction value to the corresponding address of the corresponding channel according to the full-scale calibration parameter table to complete the full-scale calibration.

4.4.2 Full calibration example

The following is an example of the full calibration method for channel 3 with module address 1.

- Step 1: Leave the channel 3 sensor unloaded and the host computer sends a zero calibration command

Module Address	Function Code	Address High	Address Low	Reset code high	Reset code low	CRC Checksum	CRC checksum

After successful zero calibration of module channel 3, the above command is returned. After the zero calibration is **completed, apply a fixed load to the sensor of this channel, the fixed load is assumed to be 100kg, the desired output is 10000 i.e. 100.00kg, wait for the value to stabilize and then execute step 2;**

- Step 2: Read the measured value of channel 3 long integer, and the upper computer issues a read

Module Address	Function Code	Start Address	Low starting	Register points high	Low register points	CRC Checksum	CRC checksum

If the data returned by the module is 15000, i.e. 150.00kg, which does not match the expected value of 100.00kg, the calibration correction value is calculated according to equation (1) as

$10000 \div 15000 \approx 0.66667$, according to the full calibration parameter table, the calibration correction factor is 66667 (0x1046b), and the correction value is written into the register corresponding to address 802 (0x322), i.e., step 3 is executed;

Step 3: Write the correction factor 666670x1046B) to address 802(0x322)

Module Address	Function Code	Register start address high	Register start address low	Register points high	Low register points	Number of bytes	Data field (calibration coefficient correction value) Four-byte unsigned long integer				CRC Calibrated high	CRC School low test
							Byte3(high)	Byte2	Byte1	Byte0 (low)		
0x01	0x10	0x03	0x22	0x00	0x02	0x04	0x00	0x01	0x04	0x6b	0x76	0x71

The full calibration completion module returns the above command.