BQ370-02 & BQ370-02N
MODBUS ANALOG INPUT DEVICE
USER MANUAL

(Modbus 0-20mA Sensor Reader)

BQTEK

Document Version 1.2.0

Content

About BQ370 Device Family

BQ370 device family contains 6 channel Modbus Analog Input devices. “N” letter in device code represents 12 bit ADC (Analog Digital Converter) ; and others are 16bit ADC.

BQ370-01	16Bit	Modbus PT Temperature Reader
BQ370-01N	12Bit	Modbus PT Temperature Reader
BQ370-02	16Bit	Modbus 0-20mA Sensor Reader
BQ370-02N	12Bit	Modbus 0-20mA Sensor Reader
BQ370-03	16Bit	Modbus 0-10V Sensor Reader
BQ370-03N	12Bit	Modbus 0-10V Sensor Reader
BQ370-05	16Bit	Modbus 10K NTC Temperature Sensor Reader
BQ370-05N	12Bit	Modbus 10K NTC Temperature Sensor Reader

About Device

BQ370-02 (or BQ370-02N) is an Modbus analog input device with 6 analog input. This analog inputs can be use for 0-20mA sensors. Also you can use it for 4-20mA sensors.

Device supports Modbus RTU over RS485. Holding register and Input Register commands of Modbus RTU is supported.

Device Modbus address can be set by user. Also baudrate of device is adjustable. But 8 Bit , No Parity and 1 Stop bit is fixed. Device addresses between 1 and 14 can be set from switches on device. Also you can set address greater than 14; but you must use device manager program for this.

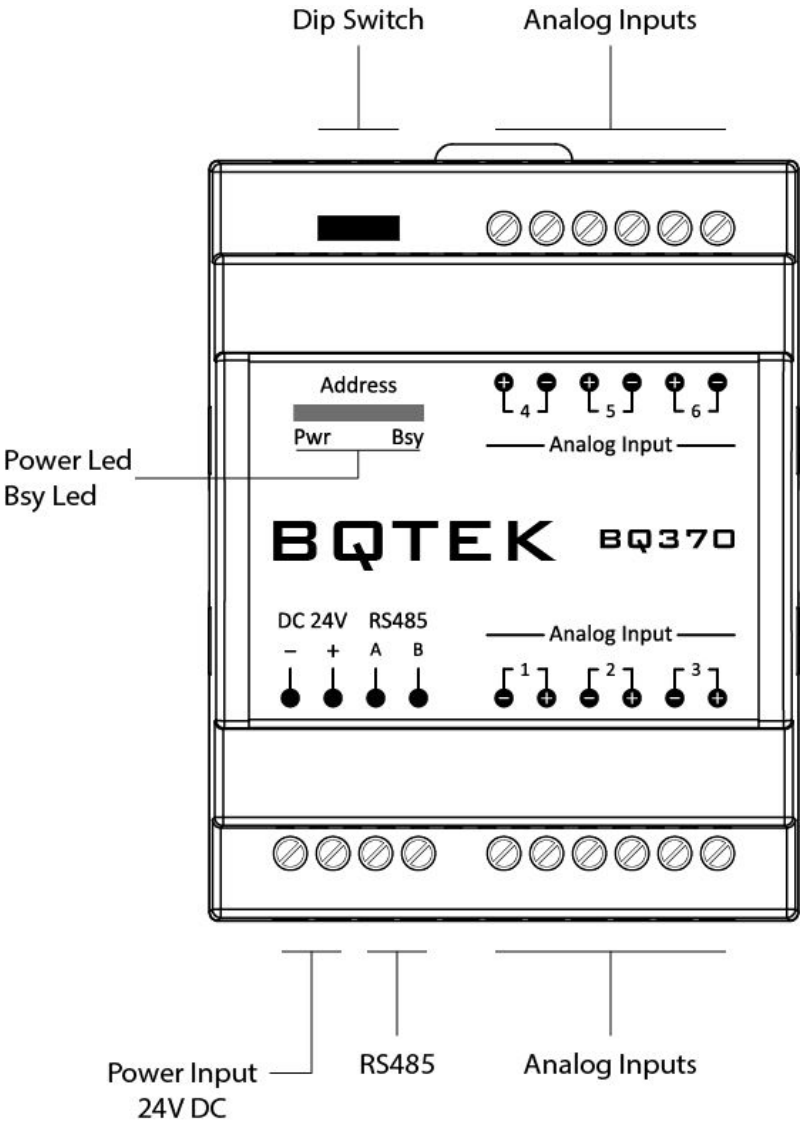
Device Properties

Product Code	BQ370-02 BQ370-02N
Product Name	Modbus Analog Input Device 0-20mA Sensor Reader
ADC (Analog Dijital Converter) Resolution	BQ370-02 : 16Bit ADC BQ370-02N : 12Bit ADC
Power Need	24V DC
Enclosure	Rail Type 70 x 90 x 60 mm
Terminal	Screw type terminal (5.08mm)
Protocol	Modbus RTU over RS485

Factory defults for communication is 9600 Baud, 8 Bit, No Parity, 1 Stop Bit and Modbus address is 1. You can change modbus address with DIP switch or with Modbus Device Manager Software. Also this default 9600 baud can be adjustable.

Device Layout

You can see device layout at the picture below. Terminals are screew type terminals. You can also find descriptions about device connections on the device enclosure.



Power Supply

Device works with 24V DC power. Max current is about 70mA. Connect + and - terminals to power supply.

RS485

A and B terminals are for RS485 communication. Please obey RS485 cabeling rules and use suitable cable for RS485

Dip Switch

Dip switches are for device settings mode and for adjusting and address. Please read this document for usage of dip switch.

Analog Inputs (0-20mA Sensor or 4-20mA Sensors)

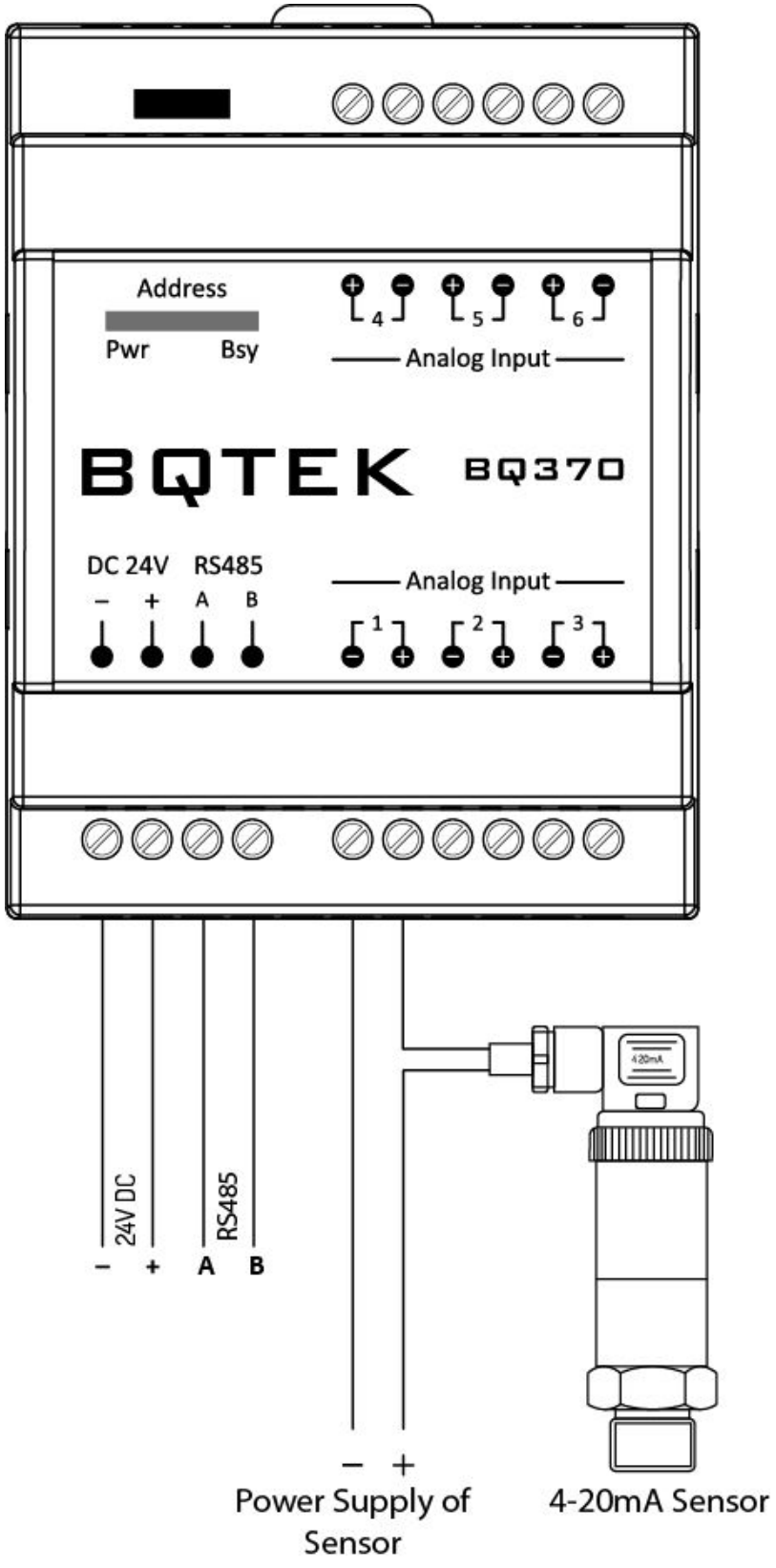
Device has 6 analog input. These analog inputs can be used with 0-20mA (or 4-20mA) sensors. Water level sensors, pressure sensors… etc can be read with this device.

Leds

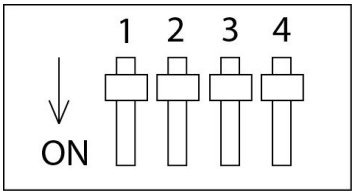
Power led shows device is working. Busy led means there is an communication over RS485. Each relay led means status of relay. Also in device settings mode Power led and busy light is on together during power on. Detailed information about settings are explained next pages in document.

Sample Connection

You can see a sample connection in picture below.



DIP Switch and Address Settings



You can change device modbus address between 1-14 with DIP switch on device. Address greater than 14 can be set from Modbus Device manager software. Making changes and applying changes also needs DIP switch settings.

DIP Switch Modes

Description	1	2	3	4
Settings Mode (Changing device settings from RS485)	OFF	OFF	OFF	OFF
Address 1	**ON**	OFF	OFF	OFF
Address 2	OFF	**ON**	OFF	OFF
Address 3	**ON**	**ON**	OFF	OFF
Address 4	OFF	OFF	**ON**	OFF
Address 5	**ON**	OFF	**ON**	OFF
Address 6	OFF	**ON**	**ON**	OFF
Address 7	**ON**	**ON**	**ON**	OFF
Address 8	OFF	OFF	OFF	**ON**
Address 9	**ON**	OFF	OFF	**ON**
Address 10	OFF	**ON**	OFF	**ON**
Address 11	**ON**	**ON**	OFF	**ON**
Address 12	OFF	OFF	**ON**	**ON**
Address 13	**ON**	OFF	**ON**	**ON**
Address 14	OFF	**ON**	**ON**	**ON**
Get Address from Settings (Apply Settings that made from RS485)	**ON**	**ON**	**ON**	**ON**

Device default baudrate is 9600 baud. (8bit, No Parity, 1 Stop) Adjust any address between 1..14 and easly start to use. For other baudrates and addresses read the document.

Supported Modbus Commands

Device supports listed commands below. These are standard Modbus RTU commands. Most PLC, HMI and Scada applications supports this commands.

Command Description	**Command (HEX)**
Read Holding Register	03
Read Input Register	04
Write Multible Register	10
Write Single Register	06

Modbus Register Table

Global Modbus specifitions says first address is 1 but sometimes some PLC or scada applications accept 0 as first modbus register address. Our documents are prepared for based 1. If your plc accept 0 based register addresses; you can decrease -1 from the addresses below.

Register Number	Register Type	R/W	Description
1	Signed Integer	R	Channel 1 Sensor Value (Multiplied with 100)
2	Signed Integer	R	Channel 2 Sensor Value (Multiplied with 100)
3	Signed Integer	R	Channel 3 Sensor Value (Multiplied with 100)
4	Signed Integer	R	Channel 4 Sensor Value (Multiplied with 100)
5	Signed Integer	R	Channel 5 Sensor Value (Multiplied with 100)
6	Signed Integer	R	Channel 6 Sensor Value (Multiplied with 100)
7	Float	R	Channel 1 Sensor Value
9	Float	R	Channel 2 Sensor Value
11	Float	R	Channel 3 Sensor Value
13	Float	R	Channel 4 Sensor Value
15	Float	R	Channel 5 Sensor Value
17	Float	R	Channel 6 Sensor Value
102	Signed Integer	RW	Calibration for Channel 1
103	Signed Integer	RW	Calibration for Channel 2
104	Signed Integer	RW	Calibration for Channel 3
105	Signed Integer	RW	Calibration for Channel 4
106	Signed Integer	RW	Calibration for Channel 5
107	Signed Integer	RW	Calibration for Channel 6
108	Signed Integer	RW	Channel 1 - Virtual Value For 20mA
109	Signed Integer	RW	Channel 2 - Virtual Value For 20mA
110	Signed Integer	RW	Channel 3 - Virtual Value For 20mA
111	Signed Integer	RW	Channel 4 - Virtual Value For 20mA
112	Signed Integer	RW	Channel 5 - Virtual Value For 20mA
113	Signed Integer	RW	Channel 6 - Virtual Value For 20mA
114	Signed Integer	RW	Channel 1 - Virtual Value For 4mA

115	Signed Integer	RW	Channel 2 - Virtual Value For 4mA
116	Signed Integer	RW	Channel 3 - Virtual Value For 4mA
117	Signed Integer	RW	Channel 4 - Virtual Value For 4mA
118	Signed Integer	RW	Channel 5 - Virtual Value For 4mA
119	Signed Integer	RW	Channel 6 - Virtual Value For 4mA

R: Read Only Register
RW: Readable or Writeable Register

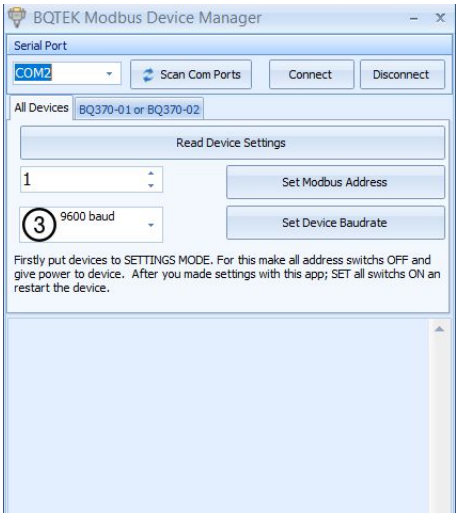
You can find values of sensors in first six register as signed integer format. This signed integer values are multiplied by 100; so you can fin exact value by dividing it to 100. For example if you read 416 it means 4.16mA

Float values are consists of two registers. Forexample first analog input is at register 7 and 8 as float format. For 4.16mA value you can directly read 4.16 value from this float registers.

Calibration values: Each sensor input has an calibration value register. This value is added to sensor measurement value. Default value is zero. This register is signed integer. For example if sensor value is 4.16mA and if you write 100 to calibration; sensor measurement will be 5.16mA Or if you write -200 it will give 2.16mA result value. Calibration values are multibled by 100. So for 1mA change write 100.

Virtual Values: Each sensor has two virtual value register. One of them is for 20mA and one of them is for 4mA. Default value is 2000 and 400. When you use this default values you will get real mA values of sensors. But sometimes you can need calculations for sensors.
For example if you have an 4-20mA water level sensor. And think that this sensor's maximum measurement level is 10meter water. 4mA shows water level is 0meter and 20mA shows water level is 10meter. Write 1000 (value multiplied by 100) to Register 108 (Channel 1 - Virtual Value For 20mA) and write 0 (value multiplied by 100) Now you will get real meter values of sensor. Forexample water level is 5.8 meter you will read 580 from register 1 and you will read 5.8 float value from register 7-8

Device Settings with “Modbus Device Manager”



Device default baudrate is 9600 baud. (8 Bit, No parity, 1 Stop) You can adjust device address from DIP switch and you can start using device with 9600 baud easly.
But sometimes you can need other baudrates or you can need addresses greater then 14. In this situation you can change device settings with RS485.
For this you must put device to “Settings Mode”. After than you can change device settings with our “Modbus Device Manager” application. Also experts users can use Modbus RTU protocol for changing settins instead of Modbus Device Manager. Expert users can reach detailed information about our web page or can contact with us.

Settings Mode

For making settings from “Modbus Device Manager”; you must put device settins mode. Power off device and put all DIP switchs to “OFF” position. Now you can give power to device. You will see power and busy led is ON together; this shows device is in “Settings Mode”
Now connect RS485 to computer and use “Modbus Device Manager” application for reading or changing device settings.
After making changes you must exit from “Settings Mode” For this set all DIP switchs ON position and reset the power of device.

Supported baudrates are 2400, 4800, 9600, 14400, 19200, 28800 and 38400 baud.

If you dont have RS485 port on your computer you can use USB-RS485 converter devices for this.
Also as explained before experts users can change settings from RS485 with Modbus RTU commands. You can find information about this in our web page.