

A8911-23 Modbus Pulse Input Module

Obvius, LLC

Installation and Operation Manual

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- This product is not intended for life safety applications.
- Do not install this product in hazardous or classified locations.
- The installer is responsible for conformance to all applicable codes.

FCC Part 15 Information

Note: This equipment has been tested by the manufacturer and found to comply with the limits of a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Modifications of this product without the express authorization of Obvius nullify this statement.

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Markings and Symbols:

WARNING: A potential risk exists if the operating instructions are not followed



General Warning Symbol: This symbol indicates the need to consult the operating instructions provided with the product.



This symbol indicates the presence of electric shock hazards.



This symbol indicates: Do not apply to or remove from hazardous live conductors.



Direct Current symbol.

Overview

The A8911-23 is designed for pulse counting applications where large number of pulse output devices need to be connected to a Modbus network. The A8911-23 will count contact closures on 23 separate inputs and store the totalized pulse count internally using non-volatile memory. The pulse count totals are then read using the RS485/Modbus protocol. Applications include reading gas/water/electric meters in common building areas for energy information and reporting purposes.

Features and Specifications

Processor	Arm7, field upgradeable firmware.
LED	23 input status LEDs (red), 2 Modbus TX/RX (yellow), 1 power/alive status. (green)
Protocols	Modbus/RTU
Power Supply	9VDC to 30VDC, 200mA, Required (not included)
Serial Port ¹	RS-485 two wire, 19200 or 9600 baud. N81
Pulse Inputs ¹	23 independent pulse count inputs. Intended for use with isolated dry contact outputs. Pulse rate/width user selectable to 10hz, 50hz or 100hz. Pulse rate option: 10hz, minimum pulse width 50ms Pulse rate option: 50hz, minimum pulse width 10ms Pulse rate option: 100hz, minimum pulse width 5ms Contact closure threshold 100Ω to 2.5kΩ user selectable Pulse count values are stored in non-volatile memory.
Isolation ² :	Pulse inputs, power input and RS485 are non-isolated.
Environmental	North America: Indoor, temperature 0° - 50°c, 0 - 95% humidity, non-condensing. Europe: Indoor, temperature 5° - 40°c, 0 - 90% humidity, non-condensing.
EMC	FCC CFR 47 Part 15, Class A
Size	4.13" x 3.39" x 1.18" (105mm x 86mm x 30mm)
Mass	3.7 oz (105 g)

¹ inputs are intended for low voltage class 2 outputs.

² if the product is used in a manner not specified by the manufacture, the protection provided by the equipment may be impaired.

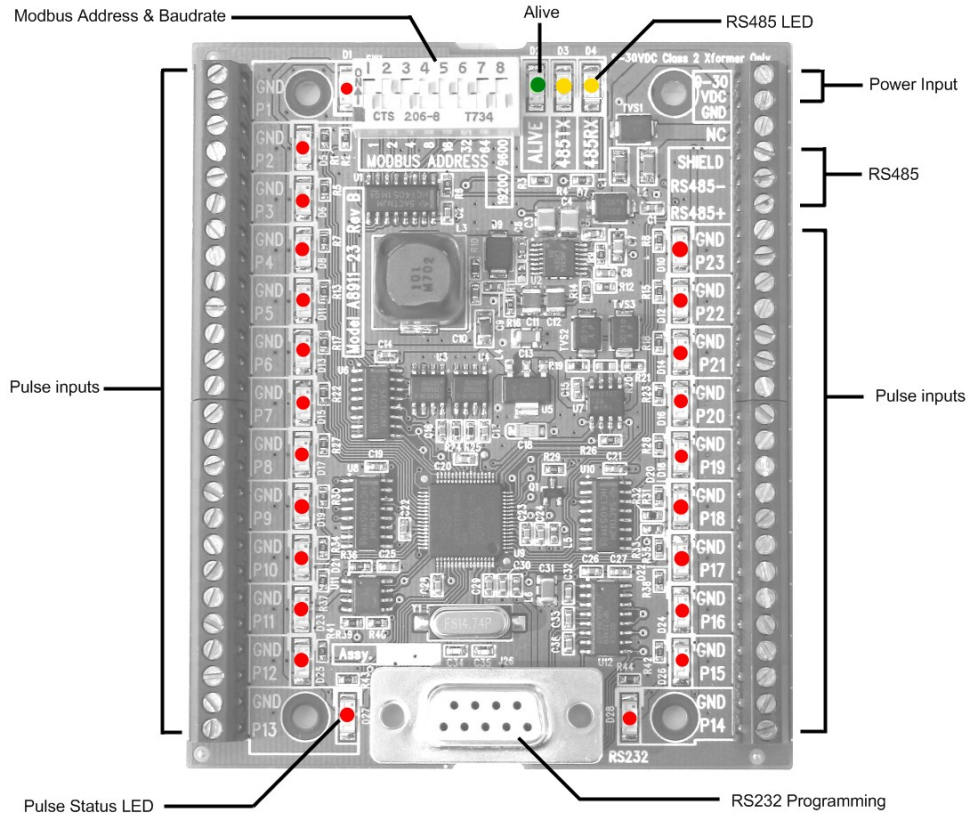
Installation Checklist

The following components are required for a complete A8911-23 I/O module installation:

- A8911-23 I/O module
- Modbus/RTU master device such as an AcquiSuite™ A8812 server
- Pulse output meter
- Power supply: 24VDC typical. (9VDC to 30VDC ok)
- Wire. Typically 18 to 24 gauge ³ for pulse meter connection.
- 2 wire, twisted pair with shield for Modbus/RS485 connection. (Belden 1120A or equivalent)³
- Optional: Termination resistor (120 ohm) for long RS485 runs over 200ft.

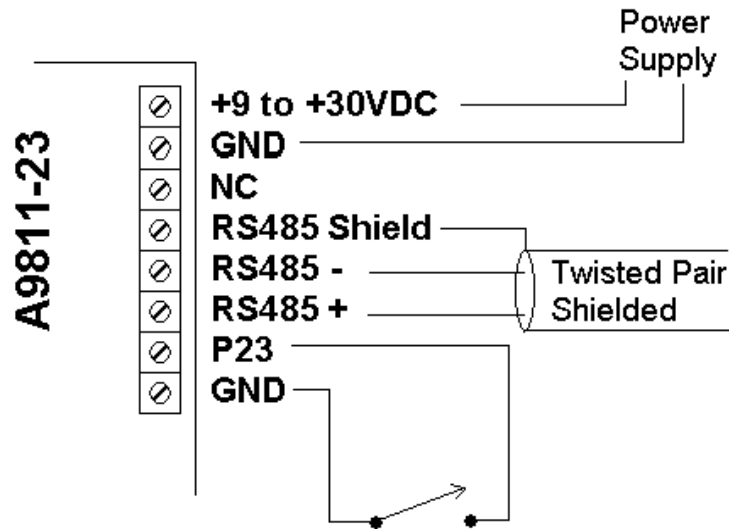
³ Wire connected to pulse meters inside high voltage panels should have an insulation rating in excess of the service voltage. Consult a licensed electrician and local building codes for further requirements that may apply.

Electrical Connections



Hardware Installation

- 1) Mount the A8911-23 on a DIN-Rail or appropriate mounting enclosure.
- 2) Attach the power supply to the input terminals on the A8911-23 module.
- 3) Turn on the power supply. Confirm the green Alive LED starts blinking. Turn off the power to the module.
- 4) Attach the RS485 +, - and shield wires to the A8911-23 module. Attach the other end of the RS485 line to the Modbus master device, such as an AcquiSuite. Be careful to observe polarity on both ends of the RS485 connection. RS485 wiring runs should be limited to 4000 ft.




- 5) Set the Modbus address dipswitches and baud rate dipswitch. For more information on the switch options, see the section below for configuration.
- 6) Turn on the power supply. Confirm the green Alive LED starts blinking. Also check the RS485 yellow LEDs.
 - If the A8911-23 receives any Modbus traffic on the RS485 port, the yellow RX led should blink.
 - If the A8911-23 receives a Modbus query that is addressed to it specifically, the yellow TX LED should blink and it will respond to the query.

If you are using an AcquiSuite Data Acquisition Server, the A9811-23 should appear in the Modbus device list after about 2 minutes. Click on the device, and select “Configure” to give the A8911-23 a logical name. This will allow the AcquiSuite to begin logging data for the device.

- 7) With the power disconnected, attach the pulse input lines to the pulse terminals. Each pulse input should have a GND and a P# terminal. If the pulse output device is polarity sensitive, attach the pulse – terminal to the A8911-23 GND terminal, and the pulse + terminal to the A8911-23 P# terminal. The A8911-23 provides 3-5 volts on the P# terminal for sensing. The remote pulse output device must not supply voltage to the terminals.

Wiring runs to pulse input terminals should be kept as short as possible. Wiring runs longer than 200 ft should be avoided. Wiring should avoid proximity to sources of electrical noise such as running in parallel to electrical cable, and VFD systems.

- 8) Power up the A8911-23. The Input LEDs for each connected input should now blink. The input LED will be on when the contacts are closed.

 **WARNING: After wiring the A8911-23, remove all scraps of wire or foil shield from the electrical panel. This could be dangerous if wire scraps come into contact with high voltage wires.**

Configuration

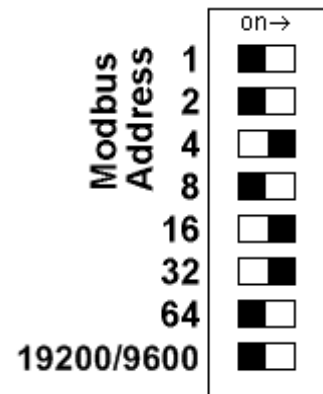
Modbus Address: Before the A8911-23 can be used, you must set the Modbus address of the A8911-23. This address must be unique among all Modbus devices in the system. The A8911-23 supports address 1 through 127.

Select an address, and set the dipswitches to match.

The sum of the value of the switches is the address. In the example to the right, address 52 is set by placing switch 4, 16 and 32 to the on position.

Note: $4 + 16 + 32 = 52$

Baud Rate: This option sets the serial port speed for the RS485 port. Set this option to “off” for 19200. Set the switch to “on” for 9600 baud.



Operation

The device should power up and be ready in a few seconds. The LEDs should blink in the following manner.

- The green "Alive" LED should start to blink approximately once per second.
- The yellow RS485 TX and RX LEDs will blink for local Modbus activity.
- The red input status LEDs will blink when input contact closures are detected. Input status LEDs are adjacent to the corresponding input screw terminals.

If the A8911-23 is attached to an AcquiSuite Data Acquisition Server, you will need to configure each pulse input with a Name, Engineering Unit, and Multiplier.

Troubleshooting

Pulse count not incrementing:

Check the input LED for the specific input that is not working. The LED should blink when the pulse meter closes the contact output. If th not blinking, try bridging the input terminals with a short piece of wire to confirm the LED comes on .

Try bridging the terminals at the other end of the pulse wiring run. This will confirm there are no breaks in the wire.

Verify the pulse output device is operating.

Disconnect the A8911-23 input and use a hand held digital meter and measure resistance of the pulse output device. Verify that the pulse output device is operational and the contact closure reads less than 1000 ohms when closed. For high resistance pulse devices such as intrinsic barriers, the “contact closure threshold” register may need to be configured to a larger value. The default is 1k however up to 2.5k is allowed. If using the AcquiSuite data acquisition server, use the advanced configuration page of the A8911-23 in the Modbus/device list to set this option. Modbus registers

Register Listing

The A8911-23 responds to the following Modbus/RTU functions:

- 0x11 Report slave id.
- 0x03 read holding registers (multiple)
- 0x06 preset single register

All Modbus registers are read-only unless otherwise noted. Registers listed as “NV” are options that are stored in non-volatile memory and will be preserved when power is removed from the device.

Modbus 40xxx registers (read registers)

Data points:

offset	point	type	desc
0	40001	UINT32	pulse count 1 MSW (NV Mem, all pulse counts)
1	40002	UINT32	pulse count 1 LSW
2	40003	UINT32	pulse count 2 MSW
3	40004	UINT32	pulse count 2 LSW
4	40005	UINT32	pulse count 3 MSW
5	40006	UINT32	pulse count 3 LSW
6	40007	UINT32	pulse count 4 MSW
7	40008	UINT32	pulse count 4 LSW
8	40009	UINT32	pulse count 5 MSW
9	40010	UINT32	pulse count 5 LSW
10	40011	UINT32	pulse count 6 MSW
11	40012	UINT32	pulse count 6 LSW
12	40013	UINT32	pulse count 7 MSW
13	40014	UINT32	pulse count 7 LSW
14	40015	UINT32	pulse count 8 MSW
15	40016	UINT32	pulse count 8 LSW
16	40017	UINT32	pulse count 9 MSW
17	40018	UINT32	pulse count 9 LSW
18	40019	UINT32	pulse count 10 MSW
19	40020	UINT32	pulse count 10 LSW
20	40021	UINT32	pulse count 11 MSW
21	40022	UINT32	pulse count 11 LSW
22	40023	UINT32	pulse count 12 MSW
23	40024	UINT32	pulse count 12 LSW
24	40025	UINT32	pulse count 13 MSW
25	40026	UINT32	pulse count 13 LSW
26	40027	UINT32	pulse count 14 MSW
27	40028	UINT32	pulse count 14 LSW
28	40029	UINT32	pulse count 15 MSW
29	40030	UINT32	pulse count 15 LSW
30	40031	UINT32	pulse count 16 MSW
31	40032	UINT32	pulse count 16 LSW

32	40033	UINT32	pulse count 17 MSW
33	40034	UINT32	pulse count 17 LSW
34	40035	UINT32	pulse count 18 MSW
35	40036	UINT32	pulse count 18 LSW
36	40037	UINT32	pulse count 19 MSW
37	40038	UINT32	pulse count 19 LSW
38	40039	UINT32	pulse count 20 MSW
39	40040	UINT32	pulse count 20 LSW
40	40041	UINT32	pulse count 21 MSW
41	40042	UINT32	pulse count 21 LSW
42	40043	UINT32	pulse count 22 MSW
43	40044	UINT32	pulse count 22 LSW
44	40045	UINT32	pulse count 23 MSW
45	40046	UINT32	pulse count 23 LSW

System information points:

offset	point	type	description
1000	41001	UINT16	Serial Number (bytes 1,2) (our serial number)
1001	41002	UINT16	Serial Number (bytes 3,4)
1002	41003	UINT16	Serial Number (bytes 5,6)
1003	41004	UINT16	firmware version major
1004	41005	UINT16	firmware version minor
1005	41006	UINT32	mfg date MSW
1006	41007	UINT32	mfg date LSW
1007	41008	UINT32	up time (seconds) MSW.
1008	41009	UINT32	up time (seconds) LSW.
1009	41010	UINT16	Our modbus address
1010	41011	UINT16	Hardware Version major (8911)
1011	41012	UINT16	Hardware Version minor. HighByte=pcb-rev(0=rev A, etc), lowbyte = part-rev (0=rev A, etc)
1012	41013	UINT16	(NV/r/w) contact closure threshold in ohms, default 1000 = 1kohm. 100-2550 ohms allowed.
1013	41014	UINT16	(NV/r/w) contact closure speed, pulse speed: 0=10hz/default, 1=50hz, 2=100hz
1014	41015	UINT16	(NV/r/w) Pulse KYZ flag bitmap. channels 1-16 0x01 = pulse1 kyz mode, 0x02 = p2, etc.
1015	41016	UINT16	(NV/r/w) Pulse KYZ flag bitmap. channels 17-23
1016	41017	UINT16	power supply voltage monitor. scale: x100
1017	41018	UINT16	pcb temperature monitor. scale: x100
1018	41019	UINT16	5V internal power supply voltage monitor. scale: x100
1019	41020	UINT16	RS485 baud rate. 2=9600, 3=19200.
1020	41021	UINT16	reason for reboot. 0x01=POR, 0x02=EXTR 0x04=WDTR 0x08=BODR, 0x8000=WDTOF

Modbus function 0x11 Slave ID response will report the following:

"Obvius, A8911-23, pulse counter, 23 channel", id=47

Register Functions

Pulse Count: The pulse count is stored as an unsigned 32bit integer. This allows for 2^{32} pulses (4.2billion) to be counted before rollover. On Modbus systems that do not allow you to read 32bit values, you can calculate the pulse count as follows:

$$\text{count} = (\text{MSW} * 65536) + \text{LSW}$$

or

$$\text{count} = (\text{MSW} \ll 16) | \text{LSW} \quad [\text{bit shift high order word by 16 bits and xor against low order word}]$$

Pulse count registers accumulate a total number of pulses received on each pulse input. The pulse count totals always increment and can not be cleared or set to an arbitrary value to prevent tampering. All pulse count totals are stored in non-volatile memory to preserve counts during power failure. The unsigned 32 bit counter values can accumulate up to 4.29 billion (2^{32}) pulses before rollover.

All 32 bit data point values are encoded in 2 Modbus registers (16bits each). Modbus master systems should always query the A8332-8F2D using a single query to read an entire block of registers. Never use two queries to read one register and then combine the two results into a single 32 bit value. Doing so will allow the pulse count to increment in the middle of the two Modbus queries, and will cause intermittent data readings that are incorrect.

For example, a pulse input has a count of 65534. This is represented as a 32 bit hex number 0x0000FFFE. The first 4 digits are the MSW register, the second 4 digits are the LSW register. The Modbus Master reads the first (MSW) register and gets 0x0000. In between the two readings, the pulse input counts 2 more pulses, making the total 65536 or 0x00010000 in hex. Next the Master reads the second (LSW) register and gets 0x0000. When the two registers are combined, the result is 0x00000000. The proper way to handle this situation is to simply read both registers in a single Modbus query.

Mechanical Drawings

DIN-Rail (EN50022) mount package: Width 105mm (6 modules)

