AcquiSuite® – A8812

Onboard IO – Modbus Register List

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Overview

This document contains the Modbus register listing for the A8812 onboard IO module running on the io co-processor. These registers may be accessed via the A8812 Modbus TCP gateway feature.

Modbus device software responds to the following modbus functions:

0x11	Report slave id.
0x03	Read holding registers (multiple)
0x06	Preset single register

These should be sufficient to perform all operations (read many values, make single change, and identify). In addition the device will respond to with modbus exceptions for invalid function, value, and register if out of bound requests are made.

Slave ID function 0x11 should report the following:

"Obvius, A8812, Internal I/O", id=48

Input Modes:

Each of the 8 inputs has several different modes (4-20mA, 0-10v, pulse, etc) The following sections list the purpose of each of the Modbus registers depending on the selected mode.

Mode Register value.

The value of the mode register (40065 - 40072) controls the mode of the input (volts, pulse, etc). Users may write to the mode register, and it will be stored in non-volatile memory. Note however that the preferred operation is to use the A8812 AcquiSuite web page interface to configure the input mode. ModbusTCP clients should only read this register.

0 = unconfigured (return 0xFFFF for all registers associated with this input)
1 = reserved.
2 = Analog current mode, 4-20mA range.
3 = voltage mode, 0-10v range.
4 = resistance mode, as ohms measured. 0-10Mohm range.
5 = contact closure mode, reports closure count and dutycycle.
6 = pulse counter input. (standard) counts contact closures only.
7 = pulse counter input. (KYZ mode) counts closure and open.

Pulse Mode:

count: the number of pulses counted on the input port. In standard mode, the pulse is counted on the closure of the contact. If the KYZ option is enabled, both the closure and opening of the pulse are counted. The maximum pulse rate to be able to count is 10 Hz. Expect pulse width to be minimum of 20ms. The pulse count starts at zero (factory default) and always increments as pulses are counted. Rollover at 2^32 (approx 4.3 billion). Count is stored in non-volatile memory. The pulse count can not be reset to zero.

rate-inst: The instantaneous rate of pulses received on the input, calculated based on the time the last N pulses were received. For example, if the pulse rate is 2hz, and N is 5, then 5 pulses will be received in 10 seconds, and the rate-inst value will return 10. N is user selectable from 2 to 20. Note: as the value of rate-inst increases, the pulse rate it represents decreases. thus, a value of 20(seconds) represents a pulse rate that is 1/2 of a 10s value. If the pulse rate is very fast such that rate-inst < N the value of rate-inst will be poor to unusable due to the granularity of the measurement. This should be handled as off-scale-high by the Modbus master system. The rate-inst register will report 65535 when off-scale-low. When reading large values from rate-inst, it is advisable to handle numbers as off-scale-low when the number of seconds exceeds the data logging interval.

rate-min: The minimum rate value as measured in rate-inst. Note: the minimum rate is actually the largest count of seconds seen in rate-inst.

rate-max: The maximum rate value as measured in rate-inst. Note: the maximum rate is actually the smallest count of seconds seen in rate-inst.

*** clear min/max** (register 41021): The Modbus registers for rate-inst, rate-min and rate-max may be cleared by writing to a Modbus register. It is assumed that these three fields will be cleared at the beginning of each new logging period by the Modbus master device. In pulse mode, clearing the inst register does not clear the pulse count history. The fields for inst/min/max will be valid after only one pulse value is received.

*** average rate:** (not an arm7/io datapoint) The AcquiSuite will compute an average rate for the pulse count input. The calculation will be performed at the end of each logging cycle by subtracting the count at the start and end of the interval and dividing by the interval length. (DV/DT). This will provide the average rate over the log interval. If the unit of measure is power related, (kwh, kvarh, kvah, etc) the average rate will be called "demand" as it is the effective block demand value for the input. Because the rate value is not a Modbus register, external Modbus/TCP clients must use the “count” register and compute the average rate value.

Status Mode:

count: the number of pulses counted on the input port. In standard mode, the pulse is counted on the closure of the contact. If the KYZ option is enabled, both the closure and opening of the pulse are counted. The maximum pulse rate to be able to count is 10 hz. Expect pulse width to be minimum of 20ms.

on-time: the cumulative number of seconds the contacts have been closed. The pulse count starts at zero (factory default) and always increments as pulses are counted. Rollover at 2^32 (over 130 years). Count is stored in nv memory. This value has 1 second granularity, rounding is performed by sampling the input once per second and accumulating 1 second if the contact is closed at that time. For practical applications, the pulse width should be a minimum of 1 second.

dutycycle: The ratio of of time the contact is closed vs open. For example, if the contact is closed for 10 seconds and open for 30, the dutycycle register will report 25%. The register value returned must be divided by 1000 to convert it to a percentage with three decimal places.

status: returns 1 if the contact is presently closed, 0 if the contact is presently open.

*** clear min/max** (register 41021): the only value cleared in status mode is the dutycycle field. The data logger will clear this field at the beginning of each log period. The dutycycle register will be used to calculate the dutycycle for one log period only.

Voltage Mode, Current Mode, Resistance Mode:

(all 3 modes are the same unless otherwise noted)

instantaneous: The instantaneous reading will report the present status of the input, represented in ohms, mA, or volts. The value uses a short term average of the last 16 a/d converter readings to compute the value of this register. In voltage and current mode, the instantaneous value is calculated several times per second. In resistance mode, the value is calculated at least every two seconds. 0xFFFFFFFF will report an off-scale-high condition, or any other invalid data.

average: This register reports the longer term average of the input. Each time a short term average is calculated with all-new samples, the value is added to the cumulative average. This value should be reset using the clear min/max register at least once per hour. If not cleared, it will eventually start a moving average after memory storage is exceeded. The AcquiSuite will clear this register at the start of each data logging period.

min: the minimum value seen in the instantaneous register.

max: the maximum value seen in the instantaneous register.

*** Multipliers:** The register value for inst, average, min, and max must be divided by 1000 to convert the number to mA and volts. Volts mode reports 0 to 10.000V. Current mode reports 0 to 20.000mA. In resistor mode value is reported in ohms and no division is required.

*** clear min/max** (register 41021): This register clears the values for average, min, and max. The historical accumulation of samples for the average field will be cleared, and average, min, max will be set to the present instantaneous value after the next instantaneous value is recalculated.

Modbus Register Listing

offset	point	type	desc

offset	point	type	desc	modes--> Pulse	Status	Ohms, mA, volts
0	40001	UINT32	input 1 value MSW	(count/NV,	count/NV,	inst, inst, inst)
1	40002	UINT32	input 1 value LSW			
2	40003	UINT32	input 2 value MSW	(count/NV,	count/NV,	inst, inst, inst)
3	40004	UINT32	input 2 value LSW			
4	40005	UINT32	input 3 value MSW	(count/NV,	count/NV,	inst, inst, inst)
5	40006	UINT32	input 3 value LSW			
6	40007	UINT32	input 4 value MSW	(count/NV,	count/NV,	inst, inst, inst)
7	40008	UINT32	input 4 value LSW			
8	40009	UINT32	input 5 value MSW	(count/NV,	count/NV,	inst, inst, inst)
9	40010	UINT32	input 5 value LSW			
10	40011	UINT32	input 6 value MSW	(count/NV,	count/NV,	inst, inst, inst)
11	40012	UINT32	input 6 value LSW			
12	40013	UINT32	input 7 value MSW	(count/NV,	count/NV,	inst, inst, inst)
13	40014	UINT32	input 7 value LSW			
14	40015	UINT32	input 8 value MSW	(count/NV,	count/NV,	inst, inst, inst)
15	40016	UINT32	input 8 value LSW			

				modes--> Pulse	Status	Ohms, mA, volts
16	40017	UINT32	input 1 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
17	40018	UINT32	input 1 ave LSW			
18	40019	UINT32	input 2 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
19	40020	UINT32	input 2 ave LSW			
20	40021	UINT32	input 3 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
21	40022	UINT32	input 3 ave LSW			
22	40023	UINT32	input 4 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
23	40024	UINT32	input 4 ave LSW			
24	40025	UINT32	input 5 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
25	40026	UINT32	input 5 ave LSW			
26	40027	UINT32	input 6 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
27	40028	UINT32	input 6 ave LSW			
28	40029	UINT32	input 7 ave MSW	(rate-inst,	on-time/NV,	ave, ave, ave)
29	40030	UINT32	input 7 ave LSW			

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30      40031   UINT32  input 8 ave MSW     (rate-inst, on-time/NV, ave,  ave,  ave)
31      40032   UINT32  input 8 ave LSW

                                    modes--> Pulse       Status      Ohms, mA,   volts
32      40033   UINT32  input 1 min MSW     (rate-min,  dutycycle,  min,  min,  min)
33      40034   UINT32  input 1 min LSW
34      40035   UINT32  input 2 min MSW     (rate-min,  dutycycle,  min,  min,  min)
35      40036   UINT32  input 2 min LSW
36      40037   UINT32  input 3 min MSW     (rate-min,  dutycycle,  min,  min,  min)
37      40038   UINT32  input 3 min LSW
38      40039   UINT32  input 4 min MSW     (rate-min,  dutycycle,  min,  min,  min)
39      40040   UINT32  input 4 min LSW
40      40041   UINT32  input 5 min MSW     (rate-min,  dutycycle,  min,  min,  min)
41      40042   UINT32  input 5 min LSW
42      40043   UINT32  input 6 min MSW     (rate-min,  dutycycle,  min,  min,  min)
43      40044   UINT32  input 6 min LSW
44      40045   UINT32  input 7 min MSW     (rate-min,  dutycycle,  min,  min,  min)
45      40046   UINT32  input 7 min LSW
46      40047   UINT32  input 8 min MSW     (rate-min,  dutycycle,  min,  min,  min)
47      40048   UINT32  input 8 min LSW

                                    modes--> Pulse       Status      Ohms, mA,   volts
48      40049   UINT32  input 1 max MSW     (rate-max,  status      max,  max,  max)
49      40050   UINT32  input 1 max LSW
50      40051   UINT32  input 2 max MSW     (rate-max,  status      max,  max,  max)
51      40052   UINT32  input 2 max LSW
52      40053   UINT32  input 3 max MSW     (rate-max,  status      max,  max,  max)
53      40054   UINT32  input 3 max LSW
54      40055   UINT32  input 4 max MSW     (rate-max,  status      max,  max,  max)
55      40056   UINT32  input 4 max LSW
56      40057   UINT32  input 5 max MSW     (rate-max,  status      max,  max,  max)
57      40058   UINT32  input 5 max LSW
58      40059   UINT32  input 6 max MSW     (rate-max,  status      max,  max,  max)
59      40060   UINT32  input 6 max LSW
60      40061   UINT32  input 7 max MSW     (rate-max,  status      max,  max,  max)
61      40062   UINT32  input 7 max LSW
62      40063   UINT32  input 8 max MSW     (rate-max,  status      max,  max,  max)
63      40064   UINT32  input 8 max LSW

                                    Mode setting options.  see below for value details.
64      40065   UINT16  input 1 mode (NV/r/w)
65      40066   UINT16  input 2 mode (NV/r/w)
66      40067   UINT16  input 3 mode (NV/r/w)
67      40068   UINT16  input 4 mode (NV/r/w)
68      40069   UINT16  input 5 mode (NV/r/w)
69      40070   UINT16  input 6 mode (NV/r/w)
70      40071   UINT16  input 7 mode (NV/r/w)
71      40072   UINT16  input 8 mode (NV/r/w)

72      40073   UINT16  input status bitmap. (pulse/status modes only)
73      40074   UINT16  input broken wire alarm bitmap. (resistance, current modes only)
                             Restive mode: bit set when resistance is off-scale-high.
                             4-20mA mode: bit is set when current is below 4mA.

74      40075   UINT16  relay output 1 (r/w)  0=open, 1=closed.
                           relay defaults to open on power-up.
75      40076   UINT16  relay output 1 (r/w)  0=open, 1=closed

--- system settings and information ---

 999    41000    UINT16  contact closure threshold (NV/r/w)  in ohms, default 1000 = 1kohm.
                           (minimum value 100 ohms, maximum value 5000 ohms)
1000    41001    UINT16  contact open wire threshold (NV/r/w)  in ohms,
                           default/unused = 0xFFFF, limit 100 to 10,000 ohms.
1001    41002    UINT16  number of pulses for inst rate (NV/r/w)  default 5.  limit 2 to 20.

1002    41003    UINT16  serial number bytes 1,2 - (ro) Also A8812 / MAC address.
1003    41004    UINT16  serial number bytes 3,4   (ro)
1004    41005    UINT16  serial number bytes 5,6   (ro)

1005    41006    UINT16  firmware version (major) (not A8812 linux/logger firmware ver)
1006    41007    UINT16  firmware version (minor)
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1020    41021    UINT16  clear min/max/ave (r/w)  read returns 0, write any value to clear
                           min/max/ave for all channels.

1029    41030    UINT16  relay output 1 mode. (R/W, NV) 0=manual, 1=follow pulse input #1.
                             Note: input must be in pulse or status mode.
                             (New in io firmware v1.09)
1030    41031    UINT16  relay output 2 mode. (R/W, NV) 0=manual, 1=follow pulse input #2.
                             Note: input must be in pulse or status mode.
                             (New in io firmware v1.09)
```

Register Formatting

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:

count = (MSW * 65536) + LSW

or

count = (MSW << 16) | LSW [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.

Instantaneous Pulse Rate: The pulse rate values for instantaneous, min and max rates are calculated based on the time between arriving pulses. For example, if InstPulse1 = 30, and inst pulse count size is 5, then the average rate for the last 5 pulses is 6 seconds per pulse. To convert the register values (in seconds) to a rate value, use the following formula.

RatePerHour = (N * 60 * 60 / Inst_Register)

Where InstRegister is any of the 6 register values 4 through 9. N is the instantaneous pulse count size at offset 10.

Min/Max pulse rate: These registers are calculated from the instantaneous pulse rate. These latching registers are updated whenever the minimum or maximum rate fields are exceeded by the instantaneous rate.