A5S1 Datasheet

5-CHANNEL ADC MODULE WITH SINGLE SHUNT AMPLIFIER

FEATURES

- 5 analog voltage inputs (0-300V DC), 12-bit
- Single shunt amplifier for 20mV shunt (low side)
- RS-485 MODBUS RTU Compatible

DESCRIPTION

The A5S1 module can be used to measure up to 5 voltages in relation to the common ground rail. This can be used for example to measure individual battery voltages in a 48V pack, or to measure high voltage battery banks of up to 300V DC. The module also has a shunt amplifier which amplifieds the voltage by 10.
The maximum input on the S1 and S2 in relation to ground is 26V DC so for battery banks with voltages higher than 12V DC, connect the shunt to the negative terminal of the battery rather than the positive.
It can be configured and controlled by any Modbus-compliant server over RS-485.

CONNECTOR DETAILS

Pin	Name	Description
1	S2	Wire to shunt load side
2	S1	Wire to shunt supply side
3	V5	Analog voltage input (0-300V DC)
4	V4	Analog voltage input (0-300V DC)

5	V3	Analog voltage input (0-300V DC)
6	V2	Analog voltage input (0-300V DC)
7	V1	Analog voltage input (0-300V DC)
8	GND	Ground reference for voltage inputs

MODBUS INTERFACE

This module is Modbus RTU compatible. It requires a baud rate of 9600 bps, no parity, and 1 stop bit for correct operation. The default slave ID of this module is set to 1 but can be changed via a Modbus register.
The two RJ45 sockets are connected in parallel, and are used for providing power and interfacing with the RS-485 bus. Devices can be daisy chained together easily using this method. When used in conjuction with the Wattmon controller any standard Ethernet patch cable (straight through) can be used to connect with the Wattmon master. One connector has two LED indicators. One indicates that the module is powered, and the other blinks when a packet is send or received. The second LED will start blinking slowly if Modbus communication stops for over 30 seconds.
When using this device with a third party Modbus master, use the following table for proper connection.

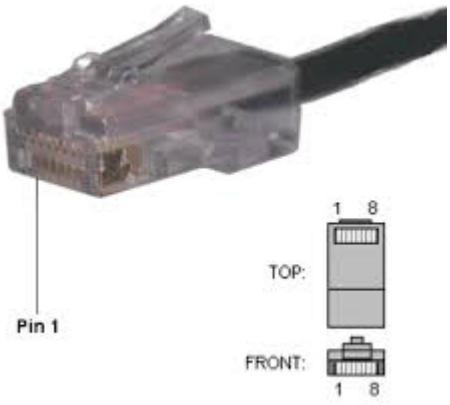


Figure 1: RJ-45 Pinouts

PIN	**Description**
1,2	GND

3	Not connected
4	A (-)
5	B (+)
6	Not connected
7,8	5V DC

MODBUS PROTOCOL

This device supports the following functions:

FUNCTION 3, READ HOLDING REGISTERS
FUNCTION 4, READ INPUT REGISTERS
FUNCTION 6, WRITE SINGLE REGISTER
FUNCTION 16, WRITE MULTIPLE REGISTERS
FUNCTION 17, REPORT SLAVE ID

MODBUS INPUT REGISTERS

Address	**Name**	**Description**
3000	V1	Voltage 1 (x 10)
3001	V1 Raw ADC	Raw ADC value of V1
3002	V2	Voltage 2 (x 10)
3003	V2 Raw ADC	Raw ADC value of V2
3004	V3	Voltage 3 (x 10)
3005	V3 Raw ADC	Raw ADC value of V3
3006	V4	Voltage 4 (x 10)
3007	V4 Raw ADC	Raw ADC value of V4
3008	V5	Voltage 5 (x 10)
3009	V5 Raw ADC	Raw ADC value of V5
3010	Current	Shunt current (x 100) in Amps
3011	Current ADC	Raw ADC value of current

MODBUS HOLDING REGISTERS

4000	V1 Offset	Offset to 0 volts
4001	V1 Mul	Calibration multiplier for V1
4002	V1 Div	Calibration Divider for V1
4003	V1 Invert	Not used
4004	V2 Offset	Offset to 0 volts
4005	V2 Mul	Calibration multiplier for V2
4006	V2 Div	Calibration Divider for V2
4007	V2 Invert	Not used
4008	V3 Offset	Offset to 0 volts
4009	V3 Mul	Calibration multiplier for V3
4010	V3 Div	Calibration Divider for V3
4011	V3 Invert	Not used
4012	V4 Offset	Offset to 0 volts
4013	V4 Mul	Calibration multiplier for V4
4014	V4 Div	Calibration Divider for V4
4015	V4 Invert	Not used
4016	V5 Offset	Offset to 0 volts
4017	V5 Mul	Calibration multiplier for V5
4018	V5 Div	Calibration Divider for V5
4019	V5 Invert	Not used
4020	Current Offset	Offset to 0 amps
4021	Current Mul	Calibration multiplier for current
4022	Current Div	Calibration Divider for current shunt
4023	Current Invert	Change polarity of the current
10000	ADDR	Slave Address. This can be set using WRITE SINGLE REGISTER (Function 6) to set the slave address and is Write Only. To read the slave address, use the REPORT SLAVE ID function.

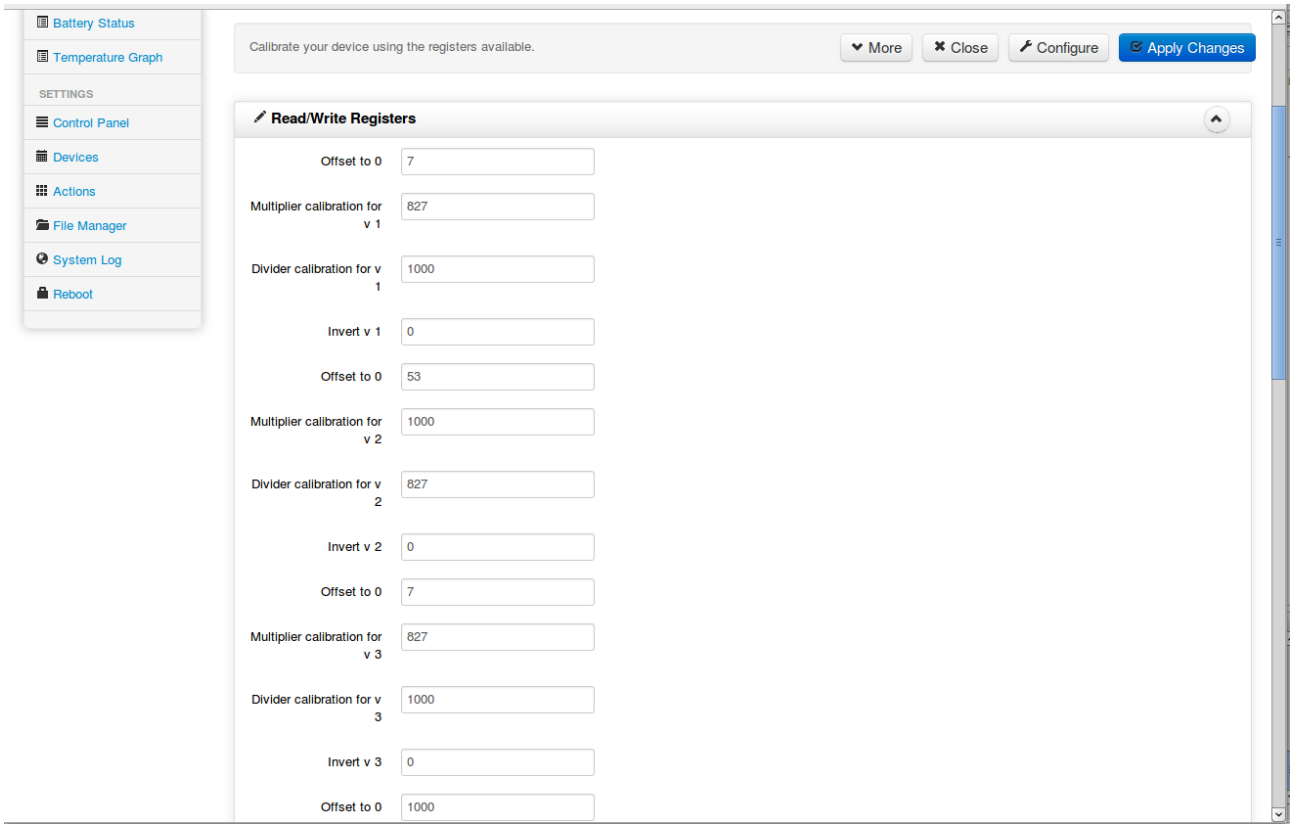
Calibrating Voltage Measurement

The VIN pin can measure a voltage between 0 and 300V with 12 bit accuracy.

The Calibrated voltage is calculated using this formula:

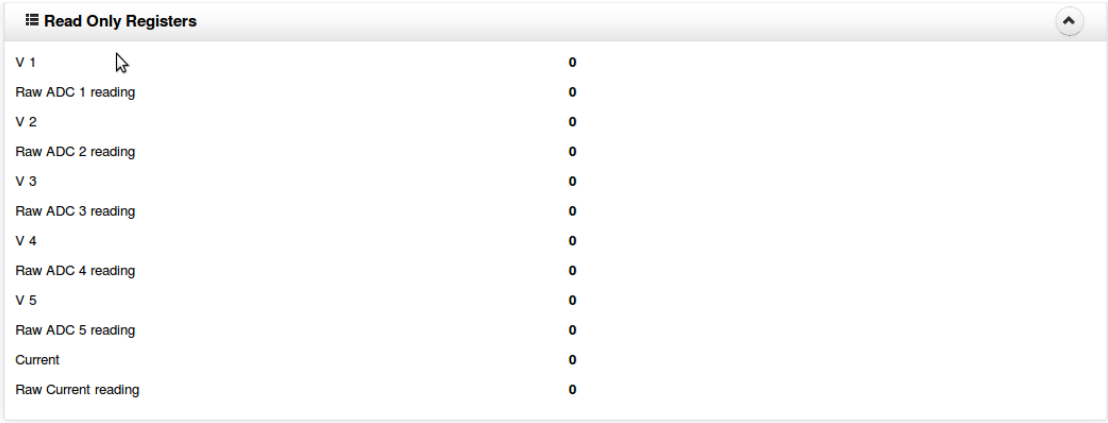
VOLTAGE=RAWADC * VMUL / VDIV

The internal voltage divider is set at 100k and 1 k.
Therefore, the ratio is approximaly 100 times. Enter 330 for VMUL and 4096 for VDIV and check the resulting value. In Wattmon, you can do this from the device calibration page.
Double check the reading with a multimeter and adjust VMUL until your reading matches, this may vary slightly from device to device.
Calibration page in wattmon showing calibration registers and live input values.



Calibrating your Shunt

In order to get accurate current readings, you will need to calibrate your shunt resistor. Once it is connected, open the device calibration page in Wattmon (*Control Panel > Devices > Actions / Calibrate*) for the A5S1 device.
First, ensure that no current is flowing across the resistor, and adjust the *Offset to 0 Current Sensor* value until the *Raw current reading* shows 0. You may need to enter a negative number here.
Next, run a steady current through the shunt and measure it with an external ammeter. Adjust the *Multiplier* and *Divider* for the current until the *Current value* in the Read Only Registers matches your ammeter reading. This is not factory calibrated since every shunt is slightly different. We suggest to use a value like 100 or 1000 for the divider and adjust the multiplier only.
If the shunt is connected in the reverse direction, set the Invert to 1 for the shunt current.
Please note that the offset is set such that a 20mV shunt will have the full range in the discharge direction (source to load) but only about half of the range in the charge mode.



Calculating the Shunt Size

The A5S1 module was designed for a 20mV shunt. If you are using a 75mV shunt, then take a value 4 times higher than the rating you require. For example, if you are planning to measure 100A max, then take a 400A shunt.