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# User's Manual - BACnet EMX – User Interface and BACnet Communications Guide

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**154-0041-0D**

<b>Rev.</b>	<b>Release Date</b>	<b>By</b>	<b>Description of Change</b>	<b>ECR</b>
0A		NAK	Initial Release	---
0B		NJS	Updates to configuration	---
0C		NJS	Updates for EMX logging Release	---
0D		RJC	Updated point descriptions	---

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## See Also:

152-0390     *EMX Installation Instructions*



154-0040     *EMX Modbus Protocol Guide*



# Protocol Implementation Conformance Statement

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<b>Date</b>	2/9/2023
<b>Vendor Name</b>	Senva Sensors
<b>Product Name</b>	EMX Advanced Energy Meter
<b>Product Model Number</b>	EMX
<b>Firmware Revision</b>	USBHP 14.10
<b>Application Software Version</b>	2.0..x
<b>BACnet Protocol Revision</b>	14
<b>Product Description</b>	Low Voltage Air Quality Sensor
<b>BACnet Standardized Device Profile</b>	BACnet Application Specific Controller (B-ASC)
<b>List of BACnet Interoperability Building Blocks Supported</b>	DS-RP-B, DS-RPM-B, DS-WP-B, DM-DDB-B, DM-DOB-B DM-DCC-B, DM-RD-B
<b>Segmentation Capability</b>	No Support
<b>Standard Object Types Supported</b>	See following. Optional implementations are <b>marked</b> .
<b>Data Link Layer Options</b>	MS/TP Master
<b>Device Address Binding</b>	No Support
<b>Networking Options</b>	No Support
<b>Character Sets Supported</b>	ISO 10646 (UTF-8)
<b>Communications Gateway</b>	No Support
<b>Network Security Options</b>	Non-Secure Device

# Configuration

The *BACnet Protocol Guide* assumes the first stage of installation is complete, with the EMX connected to your local RS485 network and powered.

See "EMX Installation Manual" for setup.



Device information can be configured or referenced using the below table.

Property	Min/Max	Default	Read	Functionality
OBJECT_IDENTIFIER (DEVICE INSTANCE)	0 / 4194302	655xxx	R/W	Set from factory to 655xxx where xxx is the last 3 digits of the serial number of the device.
OBJECT_NAME	N/A	Device Name	R/W	The device allocates 64 bytes for string values.
DESCRIPTION	N/A	Device Description	R/W	The device allocates 64 bytes for string values.
LOCATION	N/A	Device Location	R/W	The device allocates 64 bytes for string values.
PROFILIE_NAME	N/A	665-Device-EMX	read only	
MODEL_NAME	N/A	Varies	read only	Set from factory to complete part number.
VENDOR_NAME	N/A	Senva Inc.	read only	
APPLICATION_SOFTWARE_VERSION	N/A	Varies	read only	Set from factory.
FIRMWARE_REVISION	N/A	VSHP 14.10	read only	
MAX_MASTER	0 / 127	127	R/W	
VENDOR_IDENTIFIER	665	665	read only	
PROTOCOL_VERSION	1	1	read only	
PROTOCOL_REVISION	14	14	read only	

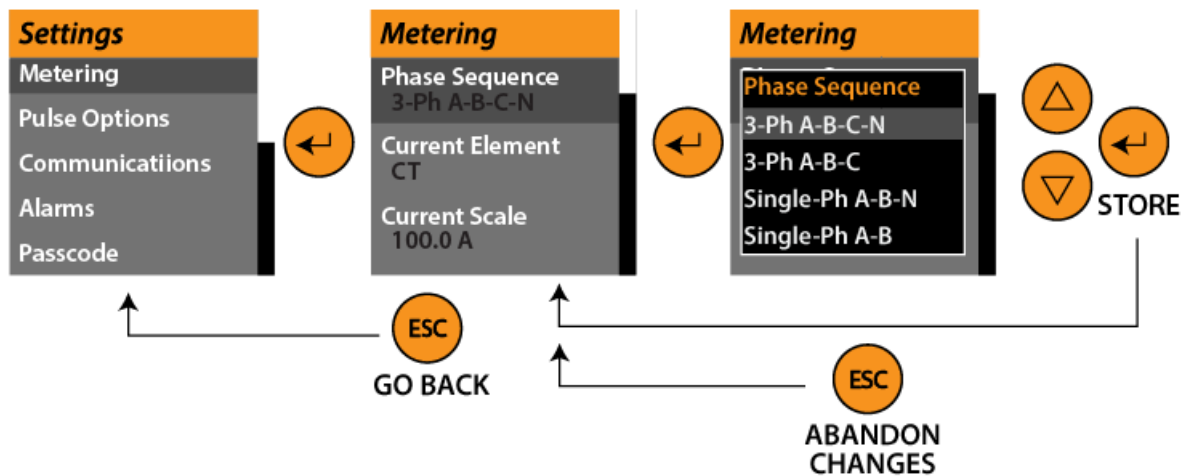
# Display Navigation

Congratulations on installing your new Senva EMX energy meter! This *Modbus Protocol Guide* assumes the first stage of installation is complete, with the meter and any CTs connected and powered. The OLED display should show the home screen when any button is pressed. If not, refer to the separate *Installation Instructions* before continuing. Now, only the network configuration remains between you and the data.

**From any screen, press the ENTER button to access the settings menu.**

You can make selections using the UP and DOWN arrows and then pressing ENTER to proceed to that menu or setting.

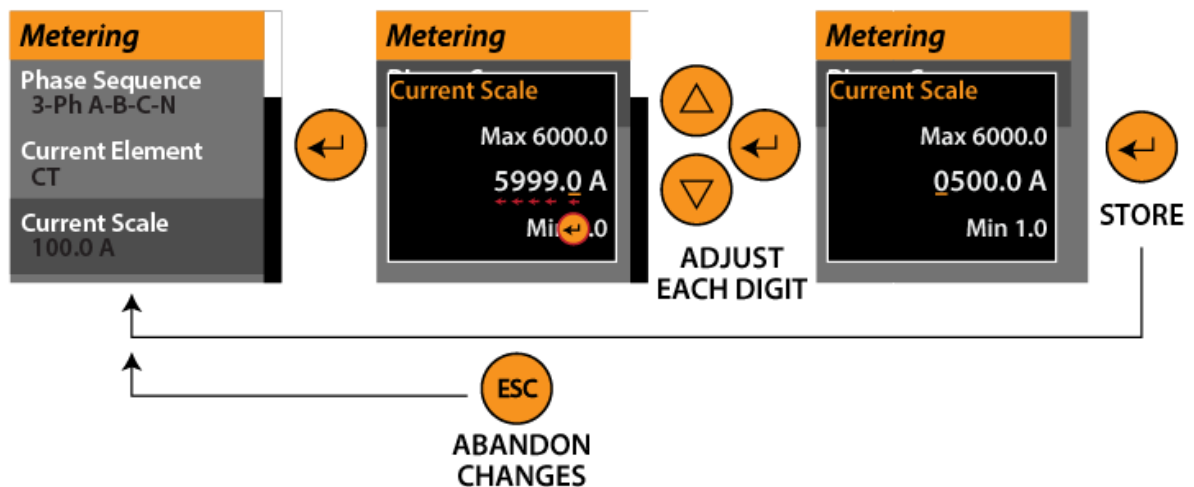
From any menu, press the ESC button to go back one menu.



**To change a value,** use the UP and DOWN arrows to set each digit and the ENTER button to move the cursor left.

Once each digit has been set, hit ENTER a final time to return to the previous menu.

To abandon changes at any time, you may hit ESC.



# Setup Registers and Parameters

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Setup registers and parameters are available in 6 groups in the settings menu using the display or they may also be accessed using BACnet communications.

## Settings

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Settings are available in the following groups on the display. A parameter list is provided in the following sections.

- **Metering** – Adjust metering parameters such as voltage and current scaling, phase sequencing, and display units.
- **Pulse Output** – Adjust the units, duration, and source of the two pulse outputs.
- **Communications** – Set communications parameters such as protocol, baud rate, parity, and addressing.
- **Alarms** - Enable or disable alarms and set trip points.
- **Passcode** – Choose a passcode to lock device.
- **Advanced** – View firmware versions or initiate a factory reset.

### R/W:

R = Readable Only

R/W = Read and writeable

### Scale:

Values must be multiplied by this scale factor to be read correctly.  $15 * 0.1 = 1.5$ . When writing the value should be divided by the scale before being written.  $1.5 / 0.1 = 15$ .

## Multi State Values

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Register	Description	Min/Max	Units	Default Value	Read	Functionality
<b>MSV1</b>	Phase Configuration	1-ABCN, 2-ABC, 3-ABN, 4-AB	None	1	R/W	Sets the configuration of the meter based on the phases connected.
<b>MSV2</b>	Current Element	1-Current Transformer, 2-Rogowski Coil	None	1	R/W	Select if the current input is a 0.33V CT or Rogo Coil
<b>MSV3</b>	Current Orientation	1- +++ 2- ++- 3- +-+ 4- +-- 5- -++ 6- --+ 7- --- 8- ---	None	1	R/W	Ordering is ABC
<b>MSV4</b>	Pulse Out 1 Wh per pulse	1- 1 2- 10 3- 100 4- 1000 5- 10000	None	1	R/W	Sets the Wh associated with every pulse output for Pulse Out 1.
<b>MSV5</b>	Pulse Output 1 Duration	1- 10ms 2- 25ms 3- 50ms 4- 100ms 5- 250ms 6- 500ms	None	1	R/W	Sets the duration in ms of each pulse for Pulse Out 1.
<b>MSV6</b>	Pulse Output 1 Source	1-Import Wh 2-Export Wh 3-Import VARh 4-Export VARh 5-Mirror Input 1 6-Mirror Input 2 7-Alarm Normally Open 8-Alarm Normally Closed 9-Phase Loss Normally Open 10-Phase Loss Normally Closed	None	1	R/W	Sets which parameter is associate with the pulse output for Pulse Out 1.
<b>MSV7</b>	Pulse Out 2 Wh per pulse	1- 1 2- 10 3- 100 4- 1000 5- 10000	None	1	R/W	Sets the Wh associated with every pulse output for Pulse Out 2.

<b>MSV8</b>	Pulse Output 2 Duration	1- 10ms 2- 25ms 3- 50ms 4- 100ms 5- 250ms 6- 500ms	None	1	R/W	Sets the duration in ms of each pulse for Pulse Out 2.
<b>MSV9</b>	Pulse Output 2 Source	1-Import Wh 2-Export Wh 3-Import VARh 4-Export VARh 5-Mirror Input 1 6-Mirror Input 2 7-Alarm Normally open 8-Alarm Normally Closed 9-Phase Loss Normally Open 10-Phase Loss Normally Closed	None	1	R/W	Sets which parameter is associate with the pulse output for Pulse Out 2.
<b>MSV10</b>	Alarm - Voltage Range	1- Disable 2- Enable	None	1	R/W	Sets the state of the Voltage Range alarm, default is set to disable the alarm.
<b>MSV11</b>	Alarm - Current Range	1- Disable 2- Enable	None	1	R/W	Sets the state of the Current Range alarm, default is set to disable the alarm.
<b>MSV12</b>	Alarm - Ground Current Range	1- Disable 2- Enable	None	1	R/W	Sets the state of the Ground Current Range alarm, default is set to disable the alarm.
<b>MSV13</b>	Alarm - Frequency Range	1- Disable 2- Enable	None	2	R/W	Sets the state of the Ground Current Range alarm, default is set to disable the alarm.
<b>MSV14</b>	Alarm - Phase Loss	1- Disable 2- Enable	None	2	R/W	Sets the state of the Phase Loss alarm, default is set to enable the alarm.
<b>MSV15</b>	Alarm - Phase Unbalance	1- Disable 2- Enable	None	2	R/W	Sets the state of the Phase Unbalance alarm, default is set to enable the alarm.
<b>MSV16</b>	Alarm - Low Power Factor	1- Disable 2- Enable	None	2	R/W	Sets the state of the Low Power Factor alarm, default is set to enable the alarm.



## Analog Inputs

Register	Description	Min/Max	Units	Read	Functionality
<b>AI1</b>	Average L-N Voltage	0/65535	V(rms)	Read only	Returns the average rms line to neutral voltage, for all phases.
<b>AI2</b>	Average L-L Voltage	0/65535	V(rms)	Read only	Returns the average rms line to line voltage.
<b>AI3</b>	Average Current	0/65535	A(rms)	Read only	Returns the phase average RMS Current.
<b>AI4</b>	Current Sum	0/65535	A(rms)	Read only	Returns the total RMS sum for all valid phases.
<b>AI5</b>	Total Real Power	-32768/ 32767	W	Read only	Returns the absolute sum of the Real Power of all the valid phases.
<b>AI6</b>	Total Reactive Power	-32768/ 32767	VAR	Read only	Returns the absolute sum of the Reactive Power of all the valid phases.
<b>AI7</b>	Total Apparent Power	-32768/ 32767	VA	Read only	Returns the absolute sum of the Apparent Power of all the valid phases.
<b>AI8</b>	Total Real Energy	-2147483648/ 2147483647	Wh	Read only	Returns the absolute sum of the Real Energy of all the valid phases.
<b>AI9</b>	Total Reactive Energy	-2147483648/ 2147483647	VARh	Read only	Returns the absolute sum of the Reactive Energy of all the valid phases.
<b>AI10</b>	Total Apparent Energy	-2147483648/ 2147483647	VAh	Read only	Returns the absolute sum of the Apparent Energy of all the valid phases.
<b>AI11</b>	A-N Voltage	0/65535	V(rms)	Read only	Returns RMS Voltage of Line A to neutral voltage.
<b>AI12</b>	B-N Voltage	0/65535	V(rms)	Read only	Returns RMS Voltage of Line B to neutral voltage.
<b>AI13</b>	C-N Voltage	0/65535	V(rms)	Read only	Returns RMS Voltage of Line C to neutral voltage.
<b>AI14</b>	A-B Voltage	0/65535	V(rms)	Read only	Returns RMS Voltage of Line A to line B voltage.
<b>AI15</b>	B-C Voltage	0/65535	V(rms)	Read only	Returns RMS Voltage of Line B to Line C voltage.

<b>AI16</b>	C-A Voltage	0/65535	V(rms)	Read only	Returns RMS Voltage of Line C to Line A voltage.
<b>AI17</b>	A Current	0/65535	A(rms)	Read only	Returns the RMS Current of Phase A.
<b>AI18</b>	B Current	0/65535	A(rms)	Read only	Returns the RMS Current of Phase B.
<b>AI19</b>	C Current	0/65535	A(rms)	Read only	Returns the RMS Current of Phase C.
<b>AI20</b>	A Power Factor	-100/100		Read only	Returns the power factor of the given phase.
<b>AI21</b>	B Power Factor	-100/100		Read only	
<b>AI22</b>	C Power Factor	-100/100		Read only	
<b>AI23</b>	A Frequency	-32768/ 32767	Hz	Read only	Returns the Frequency of Phase A.
<b>AI24</b>	A Real Power	-32768/ 32767	W	Read only	Returns the Phase real Power in W, negative values indicate export power.
<b>AI25</b>	B Real Power	-32768/ 32767	W	Read only	
<b>AI26</b>	C Real Power	-32768/ 32767	W	Read only	
<b>AI27</b>	A Reactive Power	-32768/ 32767	VAR	Read only	Returns reactive power in VAR. A negative value indicates a capacitive load.
<b>AI28</b>	B Reactive Power	-32768/ 32767	VAR	Read only	
<b>AI29</b>	C Reactive Power	-32768/ 32767	VAR	Read only	
<b>AI30</b>	A Apparent Power	-32768/ 32767	VA	Read only	Returns apparent power in VA. Values are always positive.
<b>AI31</b>	B Apparent Power	-32768/ 32767	VA	Read only	
<b>AI32</b>	C Apparent Power	-32768/ 32767	VA	Read only	
<b>AI33</b>	Total A Real Energy	-2147483648/ 2147483647	Wh	Read only	Returns the phase Total Real Energy in Wh.

<b>AI34</b>	Total B Real Energy	-2147483648/ 2147483647	Wh	Read only	Value resets at power cycle.
<b>AI35</b>	Total C Real Energy	-2147483648/ 2147483647	Wh	Read only	
<b>AI36</b>	Total A Reactive Energy	-2147483648/ 2147483647	VARh	Read only	Returns the phase Total Reactive Energy in VARh Value resets at power cycle.
<b>AI37</b>	Total B Reactive Energy	-2147483648/ 2147483647	VARh	Read only	
<b>AI38</b>	Total C Reactive Energy	-2147483648/ 2147483647	VARh	Read only	
<b>AI39</b>	Total A Apparent Energy	-2147483648/ 2147483647	Vah	Read only	Returns the phase Total Apparent Energy in Vah Value resets at power cycle.
<b>AI40</b>	Total B Apparent Energy	-2147483648/ 2147483647	Vah	Read only	
<b>AI41</b>	Total C Apparent Energy	-2147483648/ 2147483647	Vah	Read only	
<b>AI42</b>	Alarm Status Bitfield	0/65535		Read only	Bit 0: Pulse configuration error Bit 1: Pulse overrun error Bit 2: Voltage out of range Bit 3: Current out of range Bit 4: Current sum (ground current) out of range Bit 5: Frequency out of range Bit 6: Voltage phase loss Bit 7: Voltage phase unbalance Bit 8: Power factor low Bit 9 - 15: Reserved
<b>AI43</b>	Load Status	0/1		Read only	0: No load detected 1: Load above threshold
<b>AI44</b>	Power On Time	0/ 4294967295	Seconds	Read only	How long in seconds since the last power cycle.
<b>AI45</b>	Load Active Time	0/ 4294967295	Seconds	Read only	Total time in seconds the device has been powered.
<b>AI46</b>	Power Loss Count	0/ 4294967295		Read only	The amount of times that the device has lost power.
<b>AI47</b>	Pulse Count 1	0/ 4294967295		Read only	Total amount of input pulses on channel 1.

<b>AI48</b>	Pulse Count 2	0/ 4294967295		Read only	Total amount of input pulses on channel 2.
<b>AI68</b>	RTC - Seconds	0/59	Seconds	Read only	Real Time Clock seconds
<b>AI69</b>	RTC - Minutes	0/59	Minutes	Read only	Real time Clock Minutes
<b>AI70</b>	RTC - Hours	0/23	Hours	Read only	Real Time Clock Hours
<b>AI71</b>	RTC - Day of Week	0/6		Read only	Real Time Clock day of the week, 0 = Sunday, 6 = Saturday
<b>AI72</b>	RTC - Day of Month	1/31	Days	Read only	Real Time Clock day of the month
<b>AI73</b>	RTC - Month	1/12	Months	Read only	Real Time Clock Month
<b>AI74</b>	RTC - Year	2022/2060 (Default:2022)	Years	Read only	Real Time Clock year
<b>AI75</b>	RTC - AM/PM Flag	0/3		Read only	If in 24-hour mode, will return 0, if in 12 hour mode: 1 = AM, 2 = PM

## Analog Values

Register	Description	Min/Max	Units	Read	Functionality
<b>AV1</b>	Current Scale	1.0/6000.0	Amps	Read/ Write	Sets the scaling of the Current
<b>AV2</b>	Voltage Scale	0.01/320.00	Volts	Read/ Write	Sets the scaling of the Voltage
<b>AV3</b>	Voltage Trim	0.90/1.10		Read/ Write	
<b>AV4</b>	Current Trim	0.90/1.10		Read/ Write	
<b>AV5</b>	Alarm - Nominal Voltage	1.0/6000.0	Volts	Read/ Write	Sets the alarm level for the Nominal Voltage
<b>AV6</b>	Alarm - Voltage Threshold	1/20	%	Read/ Write	Sets the threshold for the voltage alarm
<b>AV7</b>	Alarm - Nominal Current	1.0/6000.0	Amps	Read/ Write	Sets the alarm level for the Nominal Current
<b>AV8</b>	Alarm - Current Threshold	1/20	%	Read/ Write	Sets the threshold for the current alarm
<b>AV9</b>	Alarm - Nominal Ground Current		Amps	Read/ Write	Sets the alarm level for the nominal ground current
<b>AV10</b>	Alarm - Ground Current Threshold	1/20	%	Read/ Write	Sets the threshold for the ground current alarm
<b>AV11</b>	Alarm - Nominal Frequency		Hz	Read/ Write	Sets the alarm level for the nominal frequency
<b>AV12</b>	Alarm - Frequency Threshold	1/20	%	Read/ Write	Sets the threshold for the frequency alarm
<b>AV13</b>	Alarm - Phase Loss Threshold	1/20	%	Read/ Write	Sets the threshold for the Phase Loss alarm
<b>AV14</b>	Alarm - Phase Unbalance Threshold	1/20	%	Read/ Write	Sets the threshold for the Phase Unbalance alarm
<b>AV15</b>	Alarm - Low Power Factor	1/99		Read/ Write	Sets the threshold for Low Power Factor alarm

<b>AV16</b>	Set Passcode	0/62235		Read/ Write	Sets the device passcode.
<b>AV17</b>	Reset Wh	0/1		Read/ Write	Resets the Wh
<b>AV18</b>	Reset Runtime	0/1		Read/ Write	Resets the device runtime
<b>AV19</b>	Reset Pulse Counts	0/1		Read/ Write	Resets the device pulse counters
<b>AV20</b>	Reset Log Contents	0/1		Read/ Write	Write a 1 to reset all log data
<b>AV21</b>	RTC - Seconds	0/59	Seconds	Read/ Write	Set the real time clock seconds
<b>AV22</b>	RTC - Minutes	0/59	Minutes	Read/ Write	Set the real time clock minutes
<b>AV23</b>	RTC - Hours	0/23	Hours	Read/ Write	Set the real time clock hours
<b>AV24</b>	RTC - Day of Week	0/6		Read/ Write	Set the real time clock hours
<b>AV25</b>	RTC - Day of Month	0/31	Days	Read/ Write	Set the real time clock hours
<b>AV26</b>	RTC - Month	1/12	Months	Read/ Write	Set the real time clock hours
<b>AV27</b>	RTC - Year	2022/2060	Years	Read/ Write	Set the real time clock Year
<b>AV28</b>	RTC - Commit Time	0/1		Read/ Write	Set to 1 to commit clock time changes and update PCF85263 RTC module

# Logging Registers

EMX Logging:

Logging on the EMX is only available on models with firmware 2.0 or greater.

Log Source 1 – Log source 12 set the source for the logging. Write the Modbus register 1-188 to the desired source to log that point. If a Modbus register has multiple registers all registers need to be set. For example, if Real Net Energy total is desired to be logged all four registers need to be set.

To trigger a log event Logging – Trigger Source needs to be set to the desired trigger mode, by default it is set to be disabled. Logging can be triggered with the timer, set on Modbus point 5001 in seconds from 15-3600. Triggering can be set over COMMS by writing point 5015 a 1, or Pulse In 1 or 2 can be set to trigger a log whenever a pulse is detected.

## Analog Values

Register	Description	Min/Max	Units	Read	Functionality
<b>AV29</b>	Log - Trigger Mode	0/3		Read/Write	0: Timer 1: Comms 2: Pulse In 1 3: Pulse In 2
<b>AV30</b>	Log - Interval	15/3600 (default:300)	Seconds	Read/Write	Sets the interval in seconds that the logging will trigger will "Log – Tigger Mode" is set to timmer.
<b>AV31</b>	Log - Logging Mode	0/1		Read/Write	0: "One Shot" - once full, stop logging and throw alarm 1: "Continuous" - circle back to first entry and overwrite after final entry
AV32	Log - Source 1	0/188		Read/Write	Log - Source 1- Log - Source 12 will set which data point is being logged. 12 different sources can be set for logging.
<b>AV33</b>	Log - Source 2	0/188		Read/Write	
<b>AV34</b>	Log - Source 3	0/188		Read/Write	
<b>AV35</b>	Log - Source 4	0/188		Read/Write	
<b>AV36</b>	Log - Source 5	0/188		Read/Write	
<b>AV37</b>	Log - Source 6	0/188		Read/Write	
<b>AV38</b>	Log - Source 7	0/188		Read/Write	

<b>AV39</b>	Log - Source 8	0/188		Read/Write	
<b>AV40</b>	Log - Source 9	0/188		Read/Write	
<b>AV41</b>	Log - Source 10	0/188		Read/Write	
<b>AV42</b>	Log - Source 11	0/188		Read/Write	
<b>AV43</b>	Log - Source 12	0/188		Read/Write	
<b>AV44</b>	Log - Create Entry	0/1		Read/Write	Create an entry at current index
<b>AV45</b>	Log - Get Entry at Index	0/4096		Read/Write	Read a log entry from specific index in EEPROM

## Analog Values

Register	Description	Min/Max	Units	Read	Functionality
<b>AI49</b>	Log - Data 1	0/65535	Log source	Read only	Log-Data 1 – Log-Data12
<b>AI50</b>	Log - Data 2	0/65535	Log source	Read only	
<b>AI51</b>	Log - Data 3	0/65535	Log source	Read only	
<b>AI52</b>	Log - Data 4	0/65535	Log source	Read only	
<b>AI53</b>	Log - Data 5	0/65535	Log source	Read only	
<b>AI54</b>	Log - Data 6	0/65535	Log source	Read only	
<b>AI55</b>	Log - Data 7	0/65535	Log source	Read only	
<b>AI56</b>	Log - Data 8	0/65535	Log source	Read only	
<b>AI57</b>	Log - Data 9	0/65535	Log source	Read only	



<b>AI58</b>	Log - Data 10	0/65535	Log source	Read only	
<b>AI59</b>	Log - Data 11	0/65535	Log source	Read only	
<b>AI60</b>	Log - Data 12	0/65535	Log source	Read only	
<b>AI61</b>	Log - CRC	0/65535		Read only	
<b>AI62</b>	Log - Seconds	0/15163		Read only	
<b>AI63</b>	Log - Minutes	0/5919		Read only	
<b>AI64</b>	Log - Hours	0/6153		Read only	
<b>AI65</b>	Log - Day	0/15163		Read only	
<b>AI66</b>	Log - Month	0/5919		Read only	
<b>AI67</b>	Log - Year	0/6153		Read only	