The ElectroMaax AT3 **U**ser **S**etting **I**nterface (USI) provides the ability to optimize the AT3 based on battery type and system performance. Accessed via a USB connection to the SCM and running the EM3M software application the following window (Figure A) launches having 6 tabs allowing parameter tuning for a wide range of applications.

This manual describes the functionality of the various fields and the process for updating. Reference to the "**E-MAAX AT3 – Distributor**" manual provides additional information.

Contents

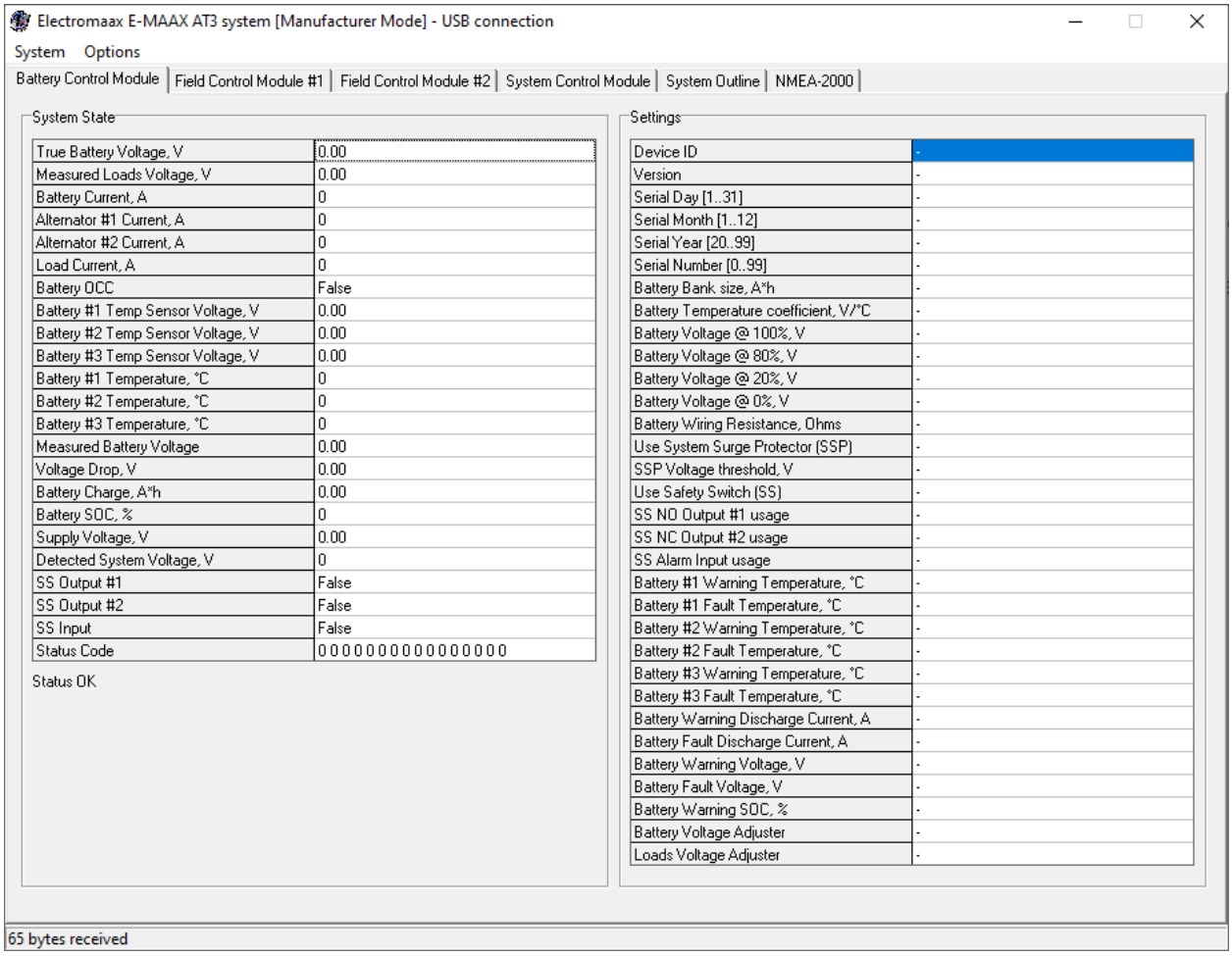
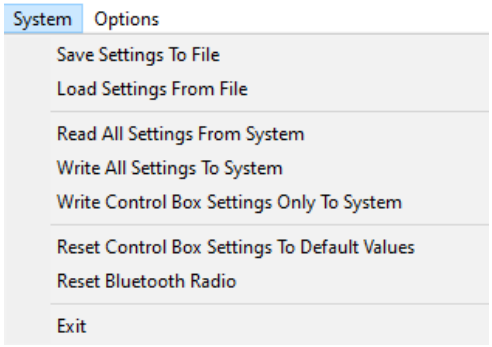


Figure A (Battery Control Module tab showing)

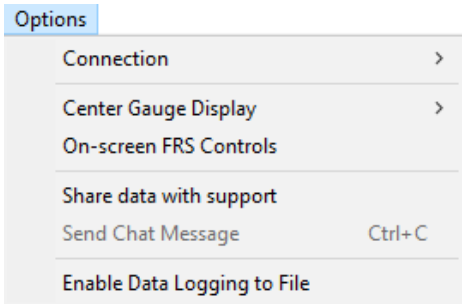
Drop-Down Menus:

Two Drop-downs menus offer the same functionality with all tab selections.

System:



Options:



Changing and Updating Settings:

The ***System*** drop-down menu provides "read / write" functions. The following steps allow access and updating;

1. Click – "Read all Settings from System" – this will bring all present values into the interface.
2. Over-write where desired by high-lighting the specific field and entering a valid value.
3. When completed making changes click "Write all settings to System"; confirm by "reading" settings and verifying changes.

Values can also be saved to, or loaded from a back-up file

Battery Control Module (BCM):

This tab reports the System values and measurements in the ***System State*** table with 23 fields and 1 status window. The ***Settings*** table indicates system information and the set points for the various control parameters with 32 fields.

System State:

1. True Battery Voltage – House Battery voltage compensated for the voltage drop due to the wiring resistance.
2. Measured Loads Voltage – Voltage measured between LOADS and "B-" terminals of the BCM
3. Battery Current – Current measured at "B+" terminal of the BCM. If positive, the House Battery is charging. If negative, the House Battery is draining.
4. Alternator #1 Current – Current measured at "A1" terminal of the BCM. Can be only positive.
5. Alternator #2 Current – Current measured at "A2" terminal of the BCM. Can be only positive.
6. Load Current – Calculated difference between the Battery Current and the Alternator Currents. If positive, the House Battery is charging. If negative, the House Battery is draining.
7. Battery OCC - Internal diagnostic signal to check the health of the Hall Current sensors internal to the BCM. Must show as 1.
8. Battery #1 Temp Sensor Voltage – Voltage signal measured across the House Battery temperature sensor. Must be between 1.0 and 3.5 volts.
9. Battery #2 Temp Sensor Voltage - Voltage signal measured across the Engine #1 Start Battery temperature sensor. Must be between 1.0 and 3.5 volts.

10. Battery #3 Temp Sensor Voltage - Voltage signal measured across the Engine #2 Start Battery temperature sensor. Must be between 1.0 and 3.5 volts.
11. Battery #1 Temperature – House Battery temperature calculated from the Battery #1 Temp Sensor voltage. If the voltage is not within its valid range, shows the "Sensor is not connected" message, and the battery SOC is not calculated.
12. Battery #2 Temperature - Engine #1 Start Battery temperature calculated from the Battery #2 Temp Sensor voltage. If the voltage is not within its valid range, shows the "Sensor is not connected" message
13. Battery #3 Temperature - Engine #2 Start Battery temperature calculated from the Battery #3 Temp Sensor voltage. If the voltage is not within its valid range, shows the "Sensor is not connected" message.
14. Measured Battery Voltage – House Battery voltage measured between B+ and B- terminals of the BCM.
15. Voltage Drop – Calculated voltage drop in the wiring between the House Battery and the BCM. In general, it should never exceed 1.0 Volt
16. Battery Charge – Calculated amount of charge being held in the House Battery.
17. Battery SOC – Calculated State-Of-Charge of the House Battery. The parameter is not calculated if Battery #1 Temp Sensor is not connected, or Battery Bank Size is not set.
18. Supply Voltage – Measured diagnostic voltage internal to the BCM. Must be approximately 7.5 Volts.
19. Detected System Voltage – On start-up, the BCM auto detects the system voltage. This parameter shown the detection result. Can be 0 (undetected); 12 (12V); 24 (24V)
20. SS Output #1 –"1" indicates the active state of the output. "0" indicates the inactive state of the output.
21. SS Output #2-"1" indicates the active state of the output. "0" indicates the inactive state of the output.
22. SS Input –"1" indicates the active state of the output. "0" indicates the inactive state of the output.
23. Status Code – BCM Status Parameters also include the Status Code which is a 16-bit binary value indicating various logical and hardware conditions.

Bit #	Meaning
bit 0 (LSB)	Indicates an internal hardware fault. Equipment cannot be used.
bit 1	Battery #1 Temperature Warning condition; the House Battery temperature exceeds the Battery #1 Warning Temperature set in the settings. The alternators' output is limited to 50% to avoid overheating.
bit 2	Battery #1 Temperature Fault condition; the House Battery temperature exceeds the Battery #1 Fault Temperature set in the settings. The alternators' output is cut to avoid overheating.
bit 3	Battery #2 Temperature Warning condition; the battery temperature exceeds the Battery #2 Warning Temperature set in the settings. The alternators' output is limited to 50% to avoid overheating.
bit 4	Battery #2 Temperature Fault condition; the battery temperature exceeds the Battery #2 Fault Temperature set in the settings. The alternators' output is cut to avoid overheating.
bit 5	Battery #3 Temperature Warning condition; the battery temperature exceeds the Battery #3 Warning Temperature set in the settings. The alternators' output is limited to 50% to avoid overheating.
bit 6	Battery #3 Temperature Fault condition; the battery temperature exceeds the Battery #3 Fault Temperature set in the settings. The alternators' output is cut to avoid overheating.
bit 7	Overvoltage Warning; the system voltage exceeds the Battery Warning Voltage set in the settings. The alternators' output is limited to 50% to avoid equipment damage.
bit 8	Overvoltage Fault; the system voltage exceeds the Battery Fault Voltage set in the settings. The alternators' output is cut to avoid equipment damage.
bit 9	Battery Discharge Overcurrent Warning.
bit 10	Battery Discharge Overcurrent Fault. The alternators' output is cut to avoid equipment damage.

bit 11	Low House Battery SOC Warning. Only available while the system is in the monitoring state.
bit 12	System Surge Protector is active. The alternators' output is cut to avoid equipment damage.
bit 13	Safety Switch is active. The alternators' output is cut to avoid equipment damage.
bit 14	not used
bit 15 (MSB)	not used

24. Status – Identifies any faults, if none reports "OK"

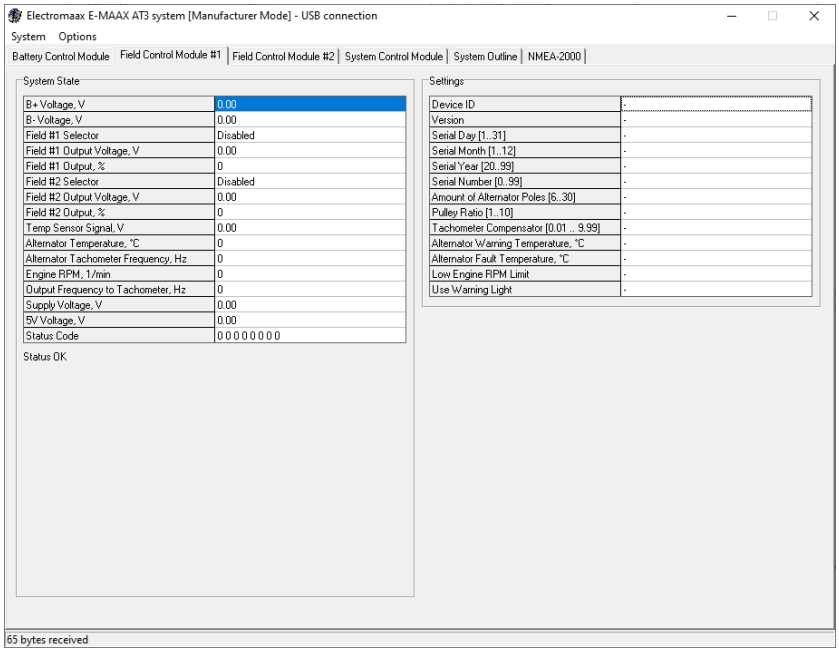
Settings:

1. Device ID – Unique (numeric) identifier for network communications.
2. Version – Firmware version, set at the factory
3. Serial Day – Day of manufacture, set at the factory
4. Serial Month – Month of manufacture, set at the factory
5. Serial Year – Year of manufacture, set at the factory
6. Serial Number – Factory assigned unique number
7. Battery Bank Size – Total capacity of the house bank, used in SOC calculation. Is set to 0, SOC is not calculated
8. Battery Temperature coefficient - Temperature correction factor of the battery's chemistry. Indicates how battery voltage changes with the ambient temperature. **Refer to the battery's manufacturer to obtain the correct value.** Used in SOC calculation. Typical values are between 0.003 and 0.050
9. Battery Voltage @ 100% - House Bank Battery voltage when the battery considered to be fully charged. **Refer to the battery's manufacturer to obtain the correct value.**
10. Battery Voltage @ 80% - House Bank Battery voltage when the battery considered to be 80% charged. **Refer to the battery's manufacturer to obtain the correct value.**
11. Battery Voltage @ 20% - House Bank Battery voltage when the battery considered to be 20% charged. **Refer to the battery's manufacturer to obtain the correct value.**
12. Battery Voltage @ 0% - House Bank Battery voltage when the battery considered to be completely drained. **Refer to the battery's manufacturer to obtain the correct value.**
13. Battery Wiring Resistance - Resistance of the power cables between the House Battery and the BCM. Typical values are between 0.001 to 0.015 Ohms. The parameter is used to recalculate the true voltage at the House Battery
14. Use System Surge Protector –SSP is an internal to the BCM hardware arrangement to suppress short powerful energy spikes (up to 3kW within 0.2 seconds) to protect sensitive boat electronics. If fault condition remains, the Safety Switch will react. Set to 1 to enable the SSP, or 0 to disable
15. SSP Voltage threshold – Voltage to trigger the System Surge Protector
16. Use Safety Switch –SS is an internal to the BCM hardware arrangement to react on prolonged power surges to protect the battery. It is intended to disconnect all loads or charging sources from the battery and cut the alternator outputs of necessary. Set to 1 to enable the SS actions; Set to 0 to disable
17. SS NO Output #1 usage – Output #1 is a set of dry normally open relay contacts; they close for the duration of a fault condition. Set to 1 to enable the Output #1 relay; Set to 0 to disable
18. SS NO Output #2 usage - Output #2 is a set of dry normally closed relay contacts; they open for the duration of a fault condition. Set to 1 to enable the Output #2 relay; Set to 0 to disable

19. SS Alarm Input usage – SS Alarm Input is an opto-coupled (isolated) input to sense an external signal to activate SS. Set to 1 to make the Safety Switch react when the Alarm Input is active; Set to 0 to disable
20. Battery #1 Warning Temperature – House Battery temperature above which the alternator's output is limited to 50% to avoid overheating. Set to 0 is the feature is not used
21. Battery #1 Fault Temperature – House Battery temperature above which the alternator's output is cut to avoid overheating. Set to 0 is the feature is not used
22. Battery #2 Warning Temperature - Start or Aux Battery temperature above which the alternator's output is limited to 50% to avoid overheating. Set to 0 is the feature is not used
23. Battery #2 Fault Temperature - Start or Aux Battery temperature above which the alternator's output is cut to avoid overheating. Set to 0 is the feature is not used
24. Battery #3 Warning Temperature - Start or Aux Battery temperature above which the alternator's output is cut to avoid overheating. Set to 0 is the feature is not used
25. Battery #3 Fault Temperature - Start or Aux Battery temperature above which the alternator's output is reduced to avoid overheating. Set to 0 is the feature is not used.
26. Battery Warning Discharge Current – House Battery discharge current exceeds set value. Set to 0 if the feature is not used
27. Battery Fault Discharge Current – House Battery discharge current exceeds the SS reaction value. Set to 0 is the feature is not used
28. Battery Warning Voltage – System voltage above which the alternator's output is limited to 50%. Set to 0 is the feature is not used
29. Battery Fault Voltage - System voltage above which the alternator's output is cut and the SS reacts. Set to 0 is the feature is not used
30. Battery Warning SOC % - House Battery SOC below which a warning is developed to avoid battery damage. Set to 0 is the feature is not used. Only available while the system is in the monitoring stage
31. Battery Voltage Adjuster - Factory set coefficient to compensate for the tolerance band of the BCM's voltage measurement components
32. Load Voltage Adjuster - Factory set coefficient to compensate for the tolerance band of the BCM's voltage measurement components

Field Control Module (FCM) :

The FCM tab provides parameter access for tuning the various field signal values. 2 tables are shown one for ***System State*** and one for ***Settings***



System State:

1. B+ Voltage – Measured voltage at the "B+" post of the alternator in respect to the battery's ground.
2. B- Voltage – Measured voltage at the "B-" post of the alternator in respect to the battery's ground.
3. Field #1 Selector – Shows the type of output #1 the FCM is set to. Can be P-TYPE, N-TYPE, or DISABLED. Refer to the alternator manufacturer's datasheet to confirm the actual field coil connections. To change the output type, set the jumpers inside the FCM enclosure.
4. Field #1 Output Voltage – Measured averaged voltage at the "F1" post of the FCM in respect to the "B- Voltage".
5. Field #1 Output % - Calculated voltage at the "F1" post of the FCM in respect to the difference between the "B+ Voltage" and "B- Voltage".
6. Field #2 Selector – Shows the type of output #2 the FCM is set to. Can be P-TYPE, N-TYPE, or DISABLED. Refer to the alternator manufacturer's datasheet to confirm the actual field coil connections. To change the output type, set the jumpers inside the FCM enclosure.
7. Field #2 Output Voltage – Measured averaged voltage at the "F2" post of the FCM in respect to the "B- Voltage".
8. Field #2 Output % - Calculated voltage at the "F2" post of the FCM in respect to the difference between the "B+ Voltage" and "B- Voltage".
9. Temp Sensor Signal – Measured temperature sensor signal voltage. Must be within the range of 0.4-4.0 Volts
10. Alternator Temperature – Calculated alternator temperature based on the temperature sensor signal.

11. Alternator Tachometer Frequency – Measured frequency of the tachometer pulses on the "W" post of the alternator.
12. Engine RPM – Calculated engine RPM value based on the Alternator Tach Frequency.
13. Output Frequency to Tachometer – Measured frequency of the tachometer pulses sent to the external RPM gage.
14. Supply Voltage – Measured diagnostic voltage internal to the FCM. Must be approximately 7.5 Volts.
15. 5V Voltage – Measured diagnostic voltage internal to the FCM. Must be 5.0 +/- 0.2 Volts.
16. Status Code – is an 8-bit binary value indicating various logical and hardware conditions.

Bit #	Meaning
bit 0	Indicates an internal hardware fault. Equipment cannot be used.
bit 1	Alternator temperature warning condition; the Alternator temperature exceeds the Alternator Warning Temperature, and is limited to 50% to avoid overheating.
bit 2	Alternator temperature fault condition; the Alternator temperature exceeds the Alternator Fault Temperature, and is cut to avoid overheating.
bit 3	B- and/or B+ leads are not connected correctly. Equipment cannot be used.
bit 4	Low engine RPM warning; engine RPM value is below the "Low Engine RPM Limit". The alternator's output is limited to 50% to avoid engine stall.
bit 5	Tachometer Signal Present; a diagnostic bit indicates that the FCM has detected the incoming tachometer pulses.
bit 6	Ignition Signal Present; a diagnostic bit indicates that the FCM has detected the ignition signal.
bit 7	Warning Light Active; a diagnostic bit indicates that the FCM has enabled the Warning Light output.

17- Status – Identifies any faults if none reports "OK"

Settings:

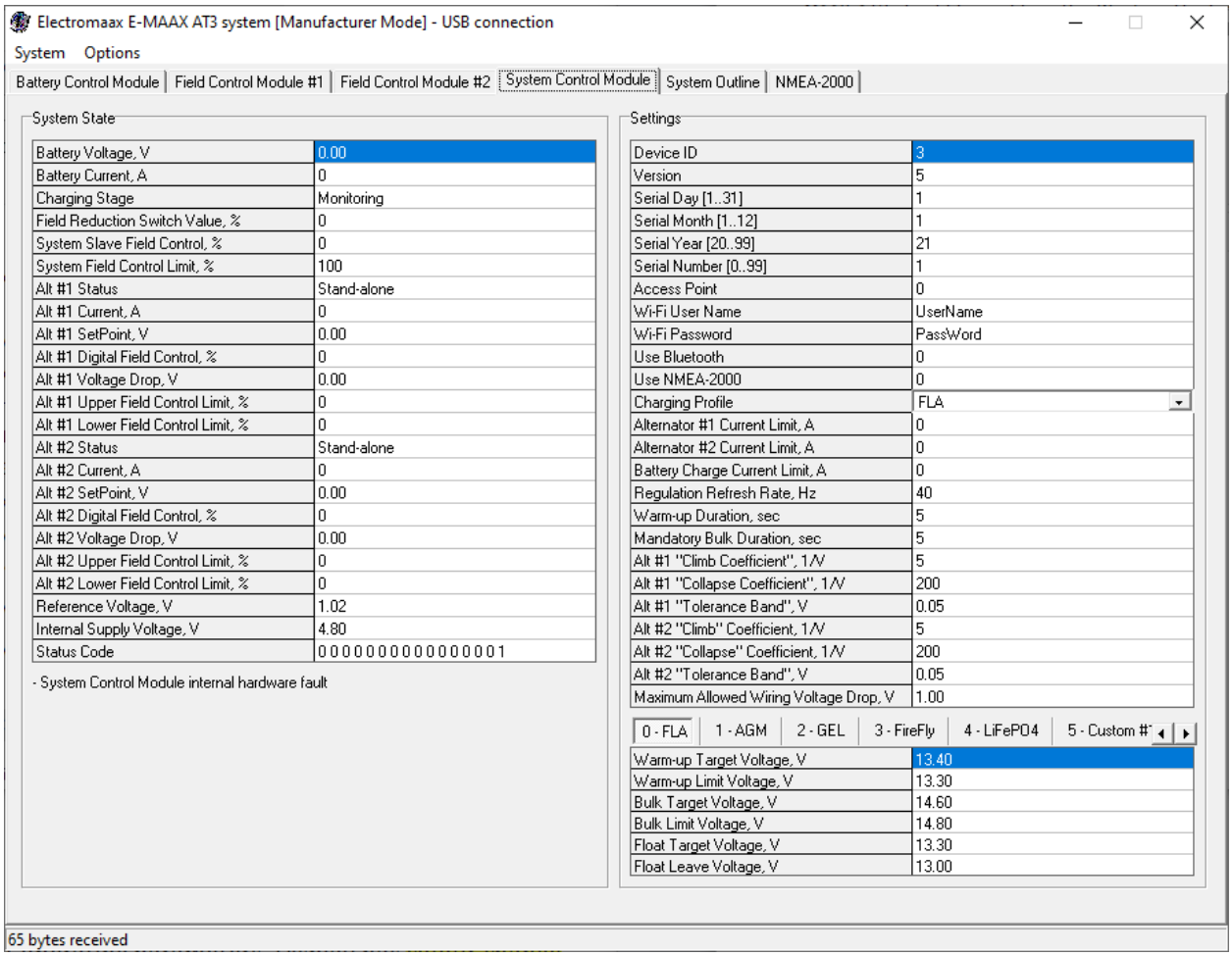
1. Device ID – Unique (alpha –numeric) identifier for network communications
2. Version – Firmware version, set at the factory
3. Serial Day – Day of manufacture, set at the factory
4. Serial Month – Month of manufacture, set at the factory
5. Serial Year – Year of manufacture, set at the factory
6. Serial Number – Factory assigned unique number
7. Amount of Alternator Poles – Actual amount of the poles in the alternator used. Refer to the alternator manufacturer's datasheet. This parameter is used to calculate the engine RPM. If the FCM provides field control for two alternators, enter the amount of poles for the alternator which provides the tachometer signal to the FCM.
8. Pulley Ratio – Actual "Crank Pulley Diameter" to "Alternator Pulley Diameter" ratio. This parameter is used to calculate the engine RPM. If the FCM provides field control for two alternators, enter the ratio for the alternator which provides the tachometer signal to the FCM.
9. Tachometer Compensator – The Coefficient to correct the tachometer output frequency of the FCM so an existing gauge does not have to be re-calibrated. Divide the RPM value displayed in the E-MAAX AT3 software by the engine's tachometer reading , and enter the calculated ratio. The two values should then

be equal. For instance; the gauge shows 1000 rpm, the E-MAAX AT3 software shows 1500 rpm, so the Tachometer Compensator value must be set to 1.5

10. Alternator Warning Temperature – Alternator temperature above which the alternator's output is limited to 50% to avoid overheating. Set to 0 is the feature is not used.
11. Low Engine RPM Limit – Engine RPM value below which the alternator's output is limited to 50% to avoid engine stall. Set to 0 is the feature is not used.
12. Use Warning Light –Set to 1 if the warning light indicator is connected to the FCM (activates when ignition is "on" and there is no alternator output). Set to 0 if this feature is not used.

System Control Module:

As previous 2 tables provide the values for ***System State*** and ***Settings***.



System State:

1. Battery Voltage – Dynamically measured by the SCM battery voltage
2. Battery Current – Dynamically measured by the SCM battery current
3. Charging State – Warm-Up, BULK, FLOAT or Monitoring.
4. Field Reduction Switch Value % present value of nominal alternator output
5. System Slave Field Control – Control input to the Slave alternator (if applicable).
6. Alt #1 Status – Indicates the engine's alternator behavior; can be either Master or Slave
7. Alt #1 Current – Charging current measured by SCM
8. Alt #1 SetPoint - Voltage which the regulator is trying to maintain for the current regulation stage.
9. Alt #1 Digital Field Control – present value of the control input to the alternator
10. Alt #1 Voltage Drop – Present voltage drop between the engine "X" alternator and the House Battery
11. Alt #1 Upper Field Control Limit - Upper limit for the control input to the engine "X" alternator(s). Dependent on the limitations set for the current regulation stage
12. Alt #1 Lower Field Limit - Lower limit for the control input to the engine "X" alternator(s). Dependent on the limitations set for the current regulation stage
13. Alt #2 Status –See above # 6 – values for 2nd alternator if equipped
14. Alt #2 Current – See above # 7 – values for 2nd alternator if equipped
15. Alt #2 SetPoint - See above # 8 – values for 2nd alternator if equipped
16. Alt #2 Digital Field Control - See above # 9 – values for 2nd alternator if equipped
17. Alt #2 Voltage Drop – See above # 10 – values for 2nd alternator if equipped
18. Alt #2 Upper Field Control Limit - See above # 11 – values for 2nd alternator if equipped
19. Alt #2 Lower Field Limit - See above # 12 – values for 2nd alternator if equipped
20. Reference Voltage – Measured diagnostic voltage internal to the SCM. Must be 1.023 Volts (contact Technical Support if different)
21. Internal Supply Voltage – Measured diagnostic voltage internal to the SCM. Must be 7.5 +/- 0.2 Volts
22. Status Code – is a 16-bit binary value indicating various logical and hardware conditions.

Bit #	Meaning
bit 0	Indicates an internal hardware fault. Equipment cannot be used.
bit 1	Indicates that the FCM #1 is present in the system.
bit 2	Indicates that the FCM #2 is present in the system.
bit 3	Indicates that the BCM is present in the system.
bit 4	Indicates that FCM is connected to the NMEA-2000 network
bit 5	Indicates that FCM is connected to a network as a Wi-Fi client
bit 6	Indicates that FCM is connected to a network as a Wi-Fi server
bit 7	When both engines are running, indicates that the FCM #1 is currently assigned as a Slave
bit 8	When both engines are running, indicates that the FCM #2 is currently assigned as a Slave
bit 9	Indicates the presence of a Warning Condition in the system
bit 10	Indicates the presence of a Fault Condition in the system
bit 11	Indicates the incorrectness of the system settings.
bit 12	Indicates the presence of the Overvoltage Condition in the system
bit 13	Indicates the presence of excessive voltage drop in the power wiring between the alternator and the battery
bit 14	not used

bit 15 (MSB)	not used

23. Status – Identifies any faults if none reports “OK”

Settings:

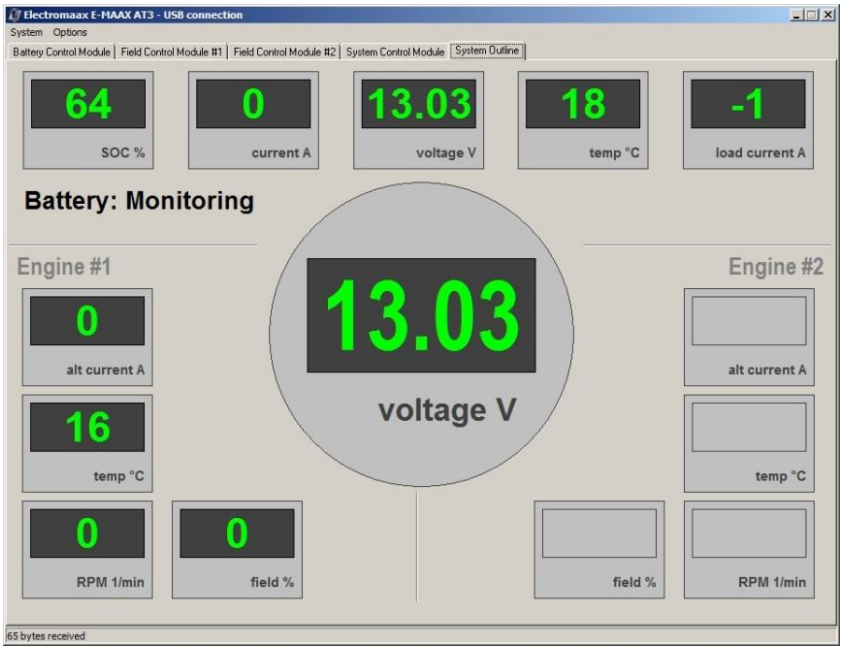
1. Device ID – Unique (alpha –numeric) identifier for network communications
2. Version – Firmware version, set at the factory
3. Serial Day – Day of manufacture, set at the factory
4. Serial Month – Month of manufacture, set at the factory
5. Serial Year – Year of manufacture, set at the factory
6. Serial Number – Factory assigned unique number
7. Access Point – 0- Wi-Fi radio module is disabled
    1. - Wi-Fi radio module presents as a device in an existing local network, and can be connected to as to a client with a local address, i.e. supports one connection at a time
    2. Wi-Fi module presents as a server on an existing local network, and can be connected to as to a website with a local address, i.e. supports multiple connections
8. Wi-Fi User Name – Alpha-numeric String used to connect via Wi-Fi.
9. Wi-Fi Password – Alpha-numeric String used to connect via Wi-Fi.
10. Use Bluetooth – Set to 1 to enable the Bluetooth radio module
11. Use NMEA-2000 – Set to 1 to enable the CAN module
12. Charging Profile –Drop down menu selection for battery chemistry type.
13. Alternator #1 Current Limit –Maximum allowed current for the Alternator #X1. If set to zero, the alternator current is not limited.
14. Alternator #2 Current Limit –Maximum allowed current for the Alternator #2. If set to zero, the alternator current is not limited.
15. Battery Charge Current Limit – Maximum allowed charge current for the House Battery. If set to zero, the battery charge current is not limited.
16. Regulation Refresh Rate – Regulation parameter: Frequency at which the regulator refreshes the system state. Default value is 40 Hz.
17. Warm-up Duration – Duration of the warm-up stage of the regulation. Set according to the power of the engine/alternator arrangement.
18. Mandatory Bulk Duration – Duration of the mandatory bulk charging stage after the warm-up. Set according to the power of the engine/alternator arrangement
19. Alt #1 “Climb Coefficient” – Regulation parameter to set the regulation slew rate when trying to achieve the set voltage from below. Default value is 5.
20. Alt #1 “Collapse Coefficient” - Regulation parameter to set the regulation slew rate when trying to achieve the set voltage from above. Default value is 200.
21. Alt #1 “Tolerance Band”- Regulation parameter to set the precision of the regulation process. Default value is 0.05.
22. Alt #2 “Climb Coefficient” – Regulation parameter to set the regulation slew rate when trying to achieve the set voltage from below. Default value is 5.

23. Alt #2 “Collapse Coefficient” – Regulation parameter to set the regulation slew rate when trying to achieve the set voltage from above. Default value is 200
24. Alt #2 “Tolerance Band”- Regulation parameter to set the precision of the regulation process. Default value is 0.05.
25. Maximum Allowed Wiring Voltage Drop - When the wiring voltage exceeds this value, the alternators’ output is limited to 50% to avoid equipment damage. Default value is 1.0.
26. 

Voltage set-points for the 3 stages (Warm-up / Bulk / Float) of the charge profile specific the battery chemistry or 1 of 3 User custom profiles. (6 fields – items 27 to 32)
27. Warm-up Target Voltage –
28. Warm-up Limit Voltage –
29. Bulk Target Voltage –
30. Bulk Limit Voltage –
31. Float Target Voltage –
32. Float Limit Voltage –

System Outline:

Provides a configurable graphical display of the present operating parameters. Display has colour change (Yellow – warning / Red – Fault) capabilities to alert both warnings and faults. Open the “***Options***” menu to configure the primary center gauge display.



NMEA- 2000:

E-MAAX AT3 system can be connected to an existing NMEA-2000 network allowing current regulator status to be displayed on the vessel's displays.

Network credentials are as following:

- NMEA2000 VID = 1127 decimal or 0x0467 hex
- NMEA2000 PID = 25936 decimal or 0x6550 hex
- NMEA2000 Product Name = Electromaax
- NMEA2000 Function Code = 141
- NMEA2000 Class Code = 35
- NMEA2000 Software Version = 1.0
- NMEA2000 Standard = 3.101

The AT3 regulator reports the state of the "DC Sources" such as:

a) "DC source #0" shows the following values:
   - Alternator Voltage
   - Alternator Temperature
   - Engine RPM

b) "DC Source #1" shows the following values from another X regulator connected to the given X regulator:
   - Peer Alternator Voltage
   - Peer Alternator Temperature
   - Peer Engine RPM

c) "DC Source #2" shows the following values:
   - Alternator Current
   - Peer Alternator Current
   - Battery Current
   - Load Current
   - Load Voltage
   - Battery Temperature
   - Battery Voltage

The following PGNs are transmitted over the network:

- PGN127506()
- PGN127508()
- PGN127751()