

4		3		2		1		
				REVISIONS				
				LTR	DESCRIPTION	DATE	APPR.	
<u>FILE NAME</u>		<u>SIZE</u>						
D	SmarTrax_v5_1_00.hex	636,008B		A	RELEASED PER ECO E14805 VER.5.1.00	6/18/09	JDP	
	SmarTrax_v5_2_00.hex	640,154B		B	REVISED PER ECO E15395 V 5.2.00	12/01/09	JDP	
	SmarTrax_v5_3_00.hex	1,017,206B		C	REVISED PER ECO E16290 V 5.3.00	6/16/10	JDP	
	SmarTrax_v5_4_00.hex	1,046,36B		D	REVISED PER ECO E17873 V 5.4.06	6/27/11	DDK	
C	P269V5704STD.hex	1,138,29B		E	REVISED PER ECO E18198 V 5.7.04	9/01/11	BGO	
	P269V5705.hex	1,138,33B		F	REVISED PER ECO E18299 V 5.7.05	9/21/11	BGO	
	P269V5806.hex	1,158,43B		G	REVISED PER ECO E18915 V 5.8.06	12/16/11	DDK	
	P269V6017STD_MDB_2_13_1.hex	1,410,88B		H	REVISED PER ECO E19086 V 6.0.17	6/15/12	BGO	
	P269V6017STD_MDB_2_17_002.hex	1,441,18B		J	REVISED PER ECO E20188 V 6.0.17	9/4/12	RDP	
	P269V6034STD_MDB_2_19_002.hex	1,456,55B		K	REVISED PER ECO E22560 V 6.0.34	12/12/13	MKR	
	P269V6040STD_MDB_2_25_003.hex	1,464,61B		L	REVISED PER ECO E22646 V 6.0.40	12/30/13	MKR	
	P269V6041STD_MDB_2_25_003.hex	1,466,36B		M	REVISED PER ECO E22797 V 6.0.41	2/03/14	MKR	
	P269V7014STD_MDB_2_47_003.hex	1,621,43B		N	REVISED PER ECO E25078 V 7.0.14	4/24/15	MKR	
	P269V7456STD_MDB_2_52_004.hex	1,488,26B		P	REVISED PER ECO E26669 V 7.4.56	10/12/15	MKR	
	P269V7460STD_MDB_2_52_004.hex	1,487,64B		R	REVISED PER ECO E26773 V 7.4.60	10/27/15	MKR	
	P269V7663STD_MDB_2_66_010.hex	1,668,75B		S	REVISED PER ECO E29171 V 7.6.63	02/21/17	DDK	
	P269V7670STD_MDB_2_66_015.hex	1,668,75B		T	REVISED PER ECO E29381 V 7.6.70	04/03/17	JCK	
	P269V7680STD_MDB_2_68_007.hex	1,670,07B		U	REVISED PER ECO E29468 V 7.6.80	4/13/17	JCK	
	P269V7721STD_MDB_2_74_006.hex	1,683,43B		V	REVISED PER ECO E31163 V 7.7.21	3/19/18	DJW	
	P269V7731_Standard_MDB_2_74_007.hex	1,683,431B		W	REVISED PER ECO E31663 V 7.7.31	7/19/18	BJR	
A	<u>UNLESS OTHERWISE SPECIFIED</u>				RAVEN		INDUSTRIES, INC SIOUX FALLS, SOUTH DAKOTA	
	DIMENSIONS ARE IN INCHES ONE PLACE DECIMALS ±.06 TWO PLACE DECIMALS ±.03 THREE PLACE DECIMALS ±.010 FRACTIONS ± 1/16 ANGLES ± 0°-30° BREAK EDGES .005-.015		<u>NOTICE:</u> THIS DRAWING AND THE INFORMATION PROVIDED ARE PROPERTY OF RAVEN INDUSTRIES INC., AND MAY ONLY BE USED AS AUTHORIZED BY RAVEN INDUSTRIES INC.				TITLE SOFTWARE SPECIFICATIONS, PROGRAM, SMARTRAX/SMARTSTEER NODE	
	MATERIAL		ALL RIGHTS RESERVED UNDER THE COPYRIGHT LAWS.		CODE IDENT. NO.	SIZE	DRAWING NUMBER	
	FINISH				14979	A	077-0171-269	
DO NOT SCALE DRAWING		DRAWN	RRS	11/4/14	SCALE	NA	SHEET 1 OF 9	
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RELEASE NOTES:

Version 7.7.31 (*MD version 1.4.20 or higher is required)

(**This software version is not compatible with front-steered tractors or front-boom sprayers without an SPS/WAS.)

1. Released updated Mako tuneset to support a pressure transducer.

Version 7.7.21 (*MD version 1.4.20 or higher is required)

(**This software version is not compatible with front-steered tractors or front-boom sprayers without an SPS/WAS.)

2. Released Agco Terragator C model tunesets
3. Released Case Trident
4. Released Oxbo Sprayer
5. Added an after burn routine for ISO valves when the CE is at 100%.
6. PWM frequency displayed correctly
7. Quick Cal tune set available
8. Fix for terrace mode functionality to work correctly
9. Changed the 3D hot/3D cold error to only show up if you are running RTK or GS
10. Removed the error that kicks out steering when a max yaw rate steering condition is detected
11. Fixed flowmeter tuneset showing SPS screen on John Deere Steer ready machines.

Version 7.6.80 (SVN Build 73231) (*MD version 1.4.20 or higher is required)

(**This software version is not compatible with front-steered tractors or front-boom sprayers without an SPS/WAS.)

12. Updated tunesets as follows:

- a. Removed Steer Ready configuration for Miller N5275 – N6500, New Holland SP240F/SP240FXP/SP295F and New Holland SP275F/SP300F – SP400F
- b. Updated New Holland front-boom sprayer hydraulic configuration settings to match Miller counterparts
- c. Changed left and right min gains from 0 to 3 for RoGator 900C/1100C/1300C

Version 7.6.70 (SVN Build 73050) (MD version 1.4.20 or higher is required)

(**This software version is not compatible with front-steered tractors or front-boom sprayers without an SPS/WAS.)

1. Released tunesets for the following:
 - a. NH SP240F/SP240FXP/SP295F Steer Ready
 - b. NH SP275F/SP300F-SP400F Steer Ready
 - c. CNH Steiger 2011-2015 Steer Ready Yaw
2. Updated default min gains for RoGator 900C/1100C/1300C
3. Changed error handling for GPS data issues during calibration

Version 7.6.63 (SVN Build 72465) (MD version 1.4.20 or higher is required)

(**This software version is not compatible with front-steered tractors or front-boom sprayers without an SPS/WAS.)

1. Consolidated SmarTrax & SmarTrax MD into single version
2. Added support for MD Track and 2016 CNH Steiger/T9 with ISO valves
3. Added configuration support of 600S on an MD system
4. Improved Calibration Wizard stability

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5. Improved auto-calibration consistency
6. Improved performance with MD on rear-boom sprayers
7. Improved performance on New Holland sprayers
8. Resolved minor issues when running in DEMO mode with MD system

Version 7.4.60

1. Fixed issue when using Viper Pro that caused devices to appear offline
2. Fixed 3D hot / 3D cold errors

Version 7.4.56

FOR MORE DETAILED INFORMATION LOOK AT THE ENGINEERING RELEASE NOTES

1. Support for communicating to a 600S through SmarTrax for configurability of the receiver and for passing additional diagnostic GPS data (BPOS, ZDA, GSV).
2. Added support for B model Agco machines, MT7xx/MT8xx C/E ISO CAN, JD T-Series, PLA sprayers, Hagie DTS 2015/2016, Krone Big M/X. RoGator B model machines support a terrace mode function that runs by changing the state of the anti-oscillation button.
3. SmarTrax now supports loading default auto-calibration parameters (skips wheel calibration). Skipping wheel calibration is currently supported on all B model Agco machines and JACTO machines. More machines can be added if sufficient data is provided to the steering engineers.
4. Added acquire heading page during 3D calibration to ensure an optimal calibration. This feature is on all field computers except Viper 4.
5. Added the ability for displaying warnings on SmarTrax (instead of just errors). The following four warnings were added: (1&2) 3D correction being too hot or too cold from its calibrated temperature (+/-20deg F for sprayers and +/-10deg F for all other machines), (3) 3D Off, (4) if the heading filter resets. Slow valve error was changed over to a warning.
6. Zero speed conditions: 1- Added the ability to engage at zero speed, 2- zero speed engage warning occurs after 14 seconds and disengage after 20 seconds, 3- All controller integrals stop integrating in a zero speed engaged state, 4- When entering a zero speed condition SmarTrax now shuts off power to the valve instead of just stopping control of the valve (issue of the wheels slowly moving on a Sauer Valve).
7. Machine Test: 1- Asks for the node orientation to allow for troubleshooting inertial sensors, 2- Raven Hydraulic option pulses a PWM valve only, Steer Ready pulses a Sauer Valve only, 3- The disengage setting is set to 990 (most likely not functional in this state anyway and usually interferes with being able to pulse the valve), 4-If the user selects Raven Hydraulic the jumper setting can be identified, 5- Default mins, maxs and system gains are loaded so that pulsing the wheels works without the user having to change settings.
8. There are now only three profiles instead of four. Also, the process for using profiles now has NEW, LOAD, and RESET commands to improve understanding of whether or not an existing profile is already calibrated.
9. SmarTrax now automatically updates the gains of a calibrated machine when it is loaded with newer software. Still forces a recalibration when software is backdated.
10. Reduced the minimum calibration speed for swathers (small turning radius).
11. Improved steering performance on Versatile 310 machines and also on articulated tractors with a Sauer valve and an SPS.
12. Removed support for Cruizer 1, RFPSim, Longbox Front Panel, Enhancer Module, Tilt Module, QuickTrax (SmartSteer) and the Production Test Interface.

VERSION 7.0.14_MDB_2_47_003

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FOR MORE DETAILED INFORMATION LOOK AT THE ENGINEERING RELEASE NOTES

1. Made several changes to improve the 3D calibration routine (field issue).
2. Improved the robustness of the SmarTrax heading filter to various GPS conditions. Removed the "Unknown" state (field issue).
3. Fixed bootleg issues related to incorrectly resetting the heading filter (field issue).
4. Implemented a new routine on front and rear boom sprayers for calculating the mins/maxs/system gains (field issue).
5. Added speed compensation to both the inner and outer control loops if the machine type is a front or rear boom sprayer. Modified the line acquire transitioning gains for front and rear boom sprayers (field issue).
6. JACTO nodes can no longer steer in reverse. Star and Plus machines have on set of hardcoded mins and gains. Hidro, 3030, 4530 use a second solution. JACTO disengage is set to calibrate out lower. Increased the range for accepting a "Found the Wheel Lock" condition (OEM request).
7. Added support for John Deere T-series Track vehicles, MacDon Swathers (product management request).
8. Added support for DEMO mode and a DEMO node (product management request).
9. Changed how machine test works. If the user selects steer ready under Machine test it will drive an analog valve. If they select Raven Hydraulic it will drive a PWM valve (enhanced troubleshooting).
10. Modified the conditions for calculating the ISO curvature offset correction, directly applies to Rogator B (field issue).
11. Fixed timing issues with JD ISO CAN communication (field issue).
12. Fixed an issue with machine database not being able to handle more than 128 machines (required for future machine development).
13. Fixed issue of current compensation kicking out inadvertently during auto-calibration (field issue).
14. Developed a SPS/YAW blending algorithm for running the wheel control loop (more robust).
15. Changed the encoder disengage routine and added support for gear-tooth sensor (field issue).
16. Warming up error is now thrown based on a temperature delta >10 or < -10 degrees Celsius from the calibrated temperature (field issue).
17. Added an error state for detecting if the SPS is disconnected and restricted automation in this condition (safety risk).
18. Added GPS Mode, NO GMS, and Slow Valve message errors. Modified a lot of the existing error states to support more methods of being cleared.
19. To help with curves the heading lead was changed from 7 to -19. In addition, for ISO steered systems the curvature offset is added back in correctly as a yaw rate instead of wheel angle (field issue).
20. The majority of sprayers (JACTO excluded), were running into an issue with the 100% PWM auto-calibration point coming out significantly lower than the 90% point ONLY with SPS. This was deemed to be due being too close to the lock causing the sensor to become non-linear. To fix this a "Move away from lock" routine was added to minimize the effect (field issue).
21. If the antenna height is set to 999, the system will stay engaged during zero speed conditions. This change also required that we stop incrementing the navigation loop integrator at zero speed conditions (customer request).
22. Changed the passcode to the service menu (field issue).
23. Added support to be able to directly set the forward/reverse direction instead of just toggling the state (OEM field issue).
24. Clear the wheel control accumulator when steering is stopped (field issue).
25. Added signed speed routine so that functions using speed for conversions are handling the machine direction within the speed function directly (more robust).

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- 26. Removed a significant amount of dead code. Also modified code structure and variable names. Fixed several coding errors like missing breaks on case statements. Added several additional unit conversion routines and a median filter (improve code readability and code robustness).
- 27. Added several new diagnostic CAN messages. Fixed several issues with existing CAN message functionality. Added some of the health test analysis capabilities used in UATI (enhanced diagnostic capabilities).
- 28. Enhanced ISO CAN communication structure (more robust).

VERSION 6.0.41_MDB_2_25_003

- 1. Changed Software version to 6.0.41.
- 2. Fixed bug with SPS systems.

VERSION 6.0.40_MDB_2_25_003

- 1. Changed Software version to 6.0.40.
- 2. Changed machine database Language size to support 32 bit variables.
- 3. Added an information section version to the database.
- 4. If Smartsteer is selected as a control type option, the tuneset is returned as invalid.
- 5. Removed ability to power on the SmartSteer device if that control type is selected.
- 6. If an RG1300 machine is selected with Raven Hydraulic 2 as the control type the mins are now hardcoded to 45 on the Left and 47 on right.
- 7. Added a CASE statement for PWM_RESET to echo data back to the display if auto/manual mode is changed in the node (mins learning).
- 8. Smartsteer was set to invalid for all machines in the machine database, so it shouldn't show up as selectable control type.
- 9. Added Caruelle tunesets to the database.
- 10. Changed LA gain for RG900/RG1100/RG1300 tuneset.

VERSION 6.0.34_MDB_2_19_002

- 1. Fixed bug with the following node orientations: 2-1, 4-1 and 6-1.
- 2. Fixed bug with the node getting stuck in an endless calibration loop..
- 3. Fixed bugs with ISO communication interfaces.
- 4. Removed gain differential too high warning.
- 5. Changed memory locations of softwareVersion and magic_number in FRAM to try to eliminate erroneous reads.
- 6. Lengthened averaging time for auto calibration measurement after each pulse when calibrating using yaw rate sensor only.
- 7. Changed how initial min calibration is calculated for yaw rate control.
- 8. Fixed bug when checking if hardware has failed on Agco node that would cause the software to lock up.
- 9. Changed the order of events that causes the "MAGIC NUMBER" to get set in FRAM to try and eliminate things from not getting initialized. It is believed that this will resolve the issue of the node not passing GPS through all of a sudden. It looks like the baudrates are getting set properly because initialization isn't happening.

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10. Added some code so AUX_VALVE_2_PWR gets configured and used correctly.

VERSION 6.0.17_MDB_2_17_002

1. Release 6.0.17 software with updated Machine Database Version 2.17.002.

VERSION 6.0.17_MDB_2_13_1

1. Improved performance in terrace conditions.
2. Improved performance in contours.
3. Compatible with new "Curve2" messaging scheme from Raven field computers.
4. Reduced calibration time.
5. 3rd party guidance for John Deere Tier IV (ISO) tractors.
6. Fixed communication bug with Cruizer (serial only connection).
7. Separate database file for machine specific tunesets.
8. New machine tunesets.
9. Improved 180 degree tilst calibration for tractors.
10. Machine profiles for moving smartsteer eliminates the need to recalibrate.

VERSION 5.8.06

1. Added the ability to read steering wheel encoders on steer-ready Case machines.
2. Added new machines.
3. Added a counter which updates when consecutive GPS messages with the same differential mode are received in order to assist in yaw sensor zeroing.
4. Removed hardware failure check to resolve issues found in South Africa.
5. Check for blank GPS messages when decoding.
6. Receiver mode must remain unchanged for 10 seconds before auto-zeroing gyros.

VERSION 5.7.05

1. Enabled voltage detection on HS1 for only AGCO nodes.

VERSION 5.7.04

1. Put H-bridge into floating state whenever steering solenoids are off so both the ground connection and the power connection is open on the proportional steering cartridges.
2. Turn mins auto learning off if running analog controlled valve (Sauer valve) AND if SP Sprayer with rear-boom is selected.
3. Added several new hardware platforms to support hardware updates.
4. Added in support for hardware change to monitor a high-side driver output for failure. Upon failure the master enable is turned off in the node and a hardware error is thrown on the CANbus.
5. Added several new AGCO machines.
8. Changed when SPS is looked for to try and reduce some potential issues in the field. The SPS is only looked for until it gets to the point in the startup wizard where it would calibrate it. If it hasn't been found by that point it stops looking during the remainder of the startup wizard. If it sees and during calibration and then gets unplugged and the node gets repowered it researches, it doesn't just assume it should still be there.
9. Turned default mins learning off for Case Sprayers running Sauer Danfoss valve.
10. Added tuneset for Puma 70x0.
11. Changed low speed algorithm for all machines to match how the front-steered tractors currently work.

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12. Perform direction detection even if liability is accepted.
13. Changed wait states during FRAM memory access to lengthen cycle to 120+ns. This may have been the problem with certain nodes losing memory.
14. Changed learning algorithm so valve delay is not fixed if it is running the Sauer valve.
15. Added 120' Case Sprayer tuneset. Modified existing Case sprayer tuneset for Sauer valve.

VERSION 5.4.06

1. Initial system voltage and current compensation ADC values are saved when CC ref value is set. These values can be retrieved to help diagnose problems (CC Error).
2. Added a 120' Case Sprayer tuneset.
3. Changed the values and time at which modes switch from OL to DM.
4. Changed how the roll gyro is factored into the heading correction.
5. Changed how time stats are transmitted on the CANbus.
6. Max steer rate set to 25 deg/sec for 3gpm cartridges on new valve.
7. Added some Apache tunesets.
8. Added in some performance diagnostics screens for Raven controlled testing only. The regular performance screens are overwritten with this new data.
 - a. 2" = Instantaneous position jumps of 6" to 12" when steering is engaged.
 - b. 4" = Instantaneous position jumps of 12+" when steering is engaged.
 - c. 8" = Percentage of GPSXY messages per GGA messages (100% means for every GGA message a GPSXY message was returned).
 - d. Average Error = Calculated delay in milliseconds between transmission of TC corrected GGA message and reception of GPSXY message (basically field computer delay).
9. If more than 40 points come in from the field computer, anything greater than 40 is ignored.
10. Allow message forwarding from LB to DGPS ports.
11. Added some diagnostic and timing checks for development and troubleshooting.
12. JD 40/50/55/60 series updated to use dual transducers.
13. Allow all messages to pass from LB to GPS port unless it is a SmarTrax message, curve message, gpsxy message or a set message for antenna height on a tilt sensor.
14. Fixed a bug in how NMEA strings are read. This was a MAJOR bug in ALL versions of the node.
15. Changed how an SPS is recognized. The node now checks for an SPS at startup if the system was calibrated with an SPS.
16. Added Jacto tunesets.
17. Added steer-ready Case floater tunesets.
18. Modified navigation control algorithm. This change was previously implemented in 5.6. It allows the control to use the LA gains all the time rather than the fixed setup of approach path.
19. When the wheel control loop control effort is 100%, the maximum valve current is overridden and the coil is driven at 100% PWM. This allows maximum flow on the new valve instead of the scaled rate.
20. Changed the TC zero so it doesn't reset the downward direction of the node orientation. The downward direction now only changes when the forward direction is changed.
21. Force user to recal after update if running a Raven hydraulic system. There is no reason to recalibrate if the system is not using current compensation.
22. Changed the hydraulic delay and how the yaw rate gets filtered during mins learning on Apache machines using the new Raven hydraulic valve.
23. Added limit checks on conversions from yaw to sps and sps to yaw to prevent out-of-bounds errors.

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24. Kubota tuneset now uses machine specific control parameters.
25. Added software to allow all Steer-Ready machines to work with Machine Test.
26. Expanded the current measurement range when detected current compensation errors during calibration.
27. Fixed a bug where the mins/maxs would not get saved after calibration until steering had been disengaged.
If the operator powered down the controller without engaging steering first the min would reset to 0.
28. Added Metalfor machines.
29. Added several new AGCO machines.
30. Fixed spelling error on Versatile Sprayer
31. Corrected the FRAM access delay time.
32. Fixed a bug which prevented the field computer from recognizing direction of travel until the liability message was accepted.
33. Added Apache 3D Node (063-0173-350) to valid node list.
34. Fixed a bug with DAC calibration during production testing.

VERSION 5.3.00

1. Added SmartSteer Swather tuneset. Max speed is 7mph, kickout at 9mph.
2. Added Challenger MT Series ISO Ready Tuneset.
3. Added SPS support for Rev C hardware. This was done mainly for front-boom machines and machines with loose suspension.
4. Added -120 valve support.
5. Modified CAN strings to contain more diagnostic information
 - a. None, 1 or 2 pressure readings based off valve selection.
 - b. Total hours of autosteering for the current software version (updating software clears hour meter).
 - c. Amount of time the performance statistics are valid for.
 - d. Target/actual current.
6. Added Multilanguage support for machine selection, control device selection and errors.
7. Added steer-ready Magnum (yaw only).
8. Added several Nitro tunesets.
9. Fixed issue where wheels would drift when machine stopped if steering was still engaged.
10. Added support for new Buhler contract (tilt-only).
11. Added Hagie tuneset.
12. Fixed major issue with interrupts that had been present since early ST10 development.
13. Fixed bug with steer-ready STX machines that allows the machine to turn.
14. Improved forward/reverse detection.
15. Increased serial buffer size from 8 to 16 message per port.

VERSION 5.2.00

1. Increased SmartSteer ramp rate and adjusted gains accordingly for SmartSteer only.
2. Added support for Rev B hardware for test fixture.
3. Changed transmitted program number from 215 to 269.
4. Max current draw from HBridge is factory calibrated.
5. Tuneset was added for front-boom machine.

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6. Fixed bug where CAN transmission would occasionally skip sending a message on full busloads.

VERSION 5.1.00

1. Foot switch doesn't clear "Steer Switch Activated" error. Screen touch is required.
2. PWM pin to h-bridge is inverted if Hardware Rev B or greater (for new optocoupler).
3. Low value for mins limited to 10% if SmartSteer, 25% if Hydraulic.
4. Max duty cycle increased if Hardware Rev B or greater (for new optocoupler).
5. Added Rear-Steered control for SmartSteer (not available with Hydraulics).
6. Current limit for SmartSteer gets set during test procedure in production.
7. Updated gains for Steer Ready Case Sprayers.
8. Updated Track tractor control for Hydraulics (not available for SmartSteer).
9. CAN Rx & Tx lights flash when communicating with Cruizer.
10. Updated gains for Articulated SmartSteer.
11. Fixed Cruizer communication bug.
12. Fixed bug in terrain comp software that caused problems on receivers outputting less than 6 decimals for the GGA position.
13. Added checks for current comp software to make sure it is measuring correctly during initial calibration. If measurements are incorrect current compensation is disabled and the calibration continues.
14. Updated gains for SmarTrax hydraulic control.
15. Modified speed compensation algorithm.
16. Fixed bug with disengage setting not getting reset after calibration.
17. Permanently disable enhancer whenever a node is connected.
18. Fixed antenna fore/aft bug (antenna fore/aft is being used now).

VERSION 5.0.00

1. Initial release for SmartSteer only.

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