QATCH openQCM Real-Time FW Change Control Document			
Release Version	**Date**	**Author**	**Description**
v2.6b1	06/18/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Initial beta version for the v2.6 branch - Updated build information - Initial support for ILI9341 TFT touchscreen - Add custom font and icon support files - Move Temp Control stability checks to FW - Keep track of "ready" status and label states - Bug Fix: Add FW weak pullup to SDO of MAX31855 - Remove support for Seven Segment Display - Increase Temp Control timeout from 1 to 15 minutes - Remove LED_SEGMENT pin definitions - Add screensaver support for touchscreen - Improve error detection of MAX31855 readings - Add ledWrite() method to allow PWM led states - Revert to old HW GPIO configs if not 'USE_ILI9341' - Blink BLUE led during FW update instead of DP seg - Re-detect HW errors on each read, no reboot req'd - Flush serial data at end of calibration sweep - Add UI interface support screens for ILI9341
v2.6b1	06/20/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Bug Fix: Set proper TFT rotation for LCD orientation
v2.6b1*	07/12/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** The source code for a half-baked version of FW v2.6b1 was released with SW v2.6b3 that indicates HEATING vs COOLING but which has a completely re-worked PID controller in the L298NHB driver which was later decided not yet ready for release due to a lack of testing and so it was not included in the v2.6b4 release. The executable "QATCH_Q-1_FW_py_v2.6b1.ino.TEENSY41.hex" in SW v2.6b3 is identical to that of the previous build and it is therefore not a high risk of this code being programmed into a device; however, you should NOT compile the FW source from SW v2.6b3 since it is only half-baked. You have been warned!

v2.6b4	07/18/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Improve MAX31855 error detection and reporting - Detect TFT error on power up - Report hardware errors (if any) in "INFO" reply - Only draw idle UI on "STOP" if it was streaming - Indicate "SERVICE REQUIRED" on HW errors - Reduce unneeded UI redraws on Temp Control - Indicate HEATING vs COOLING when cycling
v2.6b5	08/24/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Ignore "-Wunused-const-variable" in icon files - Breakout icon imports into 'icons.h' header file - Rework TEMP CONTROL PID logic flows (faster) - Allow transient TEMP READ errors without stopping - Report temperature probe errors in messaging - Breakout EEPROM structures into 'NvMem' module - Move main project code into separate 'main.c' file - Main Arduino project .ino file now calls main.c stubs - Increase TEMP_AVG to 8 for more stable readings - Move function declarations from sketch to 'main.h' - Add nv_init and byte <--> float conversion methods - All EEPROM read/write moved to NvMem module - Detect and HW errors to LCD on device startup - Reformat code to comply with VS Code standard - Re-write PV color on transient temp read failure
v2.6b6	09/12/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Revert L298NHB to v2.6b4 - Dynamically detect and support all HW revisions - Apply a fixed -0.75C offset when TEC on, but Idle - Set ambient temp to external temp for old PID code - Remove TEMP_AVG support, no temp averaging - Update formatting of MAX31855 library to VS Code - Set default MAX31855._status = MAX_STATUS_OK - Add support for HW_Revision in NvMem library
v2.6b7	09/17/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Support for variable MAX31855 OffsetM temperature - Removed fixed -0.75C offset, in favor of OffsetM - Use OffsetM when streaming an active measure run

v2.6b8	09/25/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Untested cooldown code, keep fan on for 5 mins - Allow set for OffsetM using serial commands - Detect and report voltage error on TEMP command
v2.6b9	10/03/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Add support for cooldown/venting mode - Add UI support for circular progress bar - Cooldown period changed from 5 to 4 mins - FAN_HIGH_LOW (pin 6) removed as unused - Only enter cooldown mode after stopping TEC - Trigger "auto-off" if voltage error on 1st TEC start - Auto-stop "IDENTIFY" mode on run sweep start - Remain in cooldown mode after MAX31855 fault - Remain in cooldown mode after "auto-off" (if running) - Do not enter cooldown mode if volts out-of-bounds - Pause and resume countdown UI after other activity - Perform advanced pixel updates to correct "holes" - Adjust label text and position for better uniformity
v2.6b10	10/10/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - BUG FIX: Turn off 'identify' when programming FW
v2.6b11	10/11/2023	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b11 uses FW v2.6b10
v2.6b12	10/31/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Add support for setting REF_CLK multiplier - Dynamically set REF_CLK based on HW REV - Add support for HW REVISION 2 (30 MHZ XTAL) - Refactor LED_GREEN_PIN to LED_RED_PIN - Suppress HW errors for secondary PID devices - BUG FIX: Correctly print digits during TEMP mode

v2.6b13	11/03/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Increase MAX_PWR_HEAT from 150 to 200 - Increase EXT_5V voltage deviation to +/- 1V - Ignore OPEN_FAULT from MAX31855 on HW detect - BUG FIX: Ignore transient temp errors on secondary - BUG FIX: Skip "TEMP CHECK" test on secondaries - BUG FIX: Temp jumps on measurement stream start - Report internal (ambient) temp on secondary initialize - Consider temperature jumps > 5C as read errors
v2.6b14	11/10/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - TEC controller PID re-tuned for speed/overshoot - BUG FIX: Screensaver can interrupt TEC cooldown - Reduce L298NHB_AUTOOFF from 15 to 10 mins - Increase TEMP_AVG from 1 to 4 for PID control - Report external temperature resolution as 0.25 C - Pre-seed ambient temperature with internal on start - BUG FIX: TEC cooldown timer ends 2s prematurely - Detect spurious temp reads (>5C off) as bad reads - BUG FIX: Temp can be spurious for a brief period
v2.6b15	11/28/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - PID controller retuned to better track near ambient - Initial support for "MULTI" and "MSGBOX" cmds
v2.6b16	12/12/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Improved MSGBOX performance pixel drawing - Hide MSGBOX text when device in cooldown
v2.6b17	12/19/2023	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Take temperature prior to starting a sweep - No temperature reads in first 3 seconds of run

v2.6b18	01/05/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - BUG FIX: Temp control can pick wrong direction - Improved mode hopping performance - Internal ambient temperature is always 21C now
v2.6b19	01/15/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Decrease 'kd' for temperature PID control to 100
v2.6b20	01/23/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Add ability to tune PID parameters from SW - PID parameters are constant, ki and kd are fixed
v2.6b21	02/06/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Modified L298NHB PID controller logic - L298NHB now has standard PID logic, no "magic"
v2.6b22	02/13/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b22 uses FW v2.6b21
v2.6b23	02/21/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b23 uses FW v2.6b21
v2.6b24	02/22/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b24 uses FW v2.6b21
v2.6b25	02/26/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b25 uses FW v2.6b21
v2.6b26	02/27/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b26 uses FW v2.6b21
v2.6b27	03/01/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b27 uses FW v2.6b21

v2.6r27	03/05/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Release candidate build equivalent of v2.6b21
v2.6b28	03/13/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b28 uses FW v2.6b21
v2.6r28	03/13/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Release candidate build equivalent of v2.6b21
v2.6b29	03/19/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b29 uses FW v2.6b21
v2.6r29	03/19/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Release candidate build equivalent of v2.6b21
v2.6b30	04/09/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - FlasherX updated from v2.1 to v2.4 (hid support) - BUG FIX: Correct for rare millis() rollover issue - Calibration format modified for HID devices - Indicate "Press start then apply drop" when ready
v2.6b31	04/11/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b31 uses FW v2.6b30
v2.6b32	04/18/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Toggle D41 when toggling D5 (TEMP_CIRCUIT) - Doing this avoids a rework requirement on PCBs - D41 (TEC_SENSE) will be repurposed in the future - Detect physical presence of PHY chip at boot - Prevent TEENSY41_NE hw from using NET mode - BUG FIX: TEENSY41_NE boads report IP address
v2.6b33	05/13/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b33 uses FW v2.6b32

v2.6r33	05/13/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - FlasherX updated from v2.1 to v2.4 (hid support) - BUG FIX: Correct for rare millis() rollover issue - Calibration format modified for HID devices - Indicate "Press start then apply drop" when ready - Toggle D41 when toggling D5 (TEMP_CIRCUIT) - Detect physical presence of PHY chip at boot - BUG FIX: TEENSY41_NE boads report IP address
v2.6b34	05/17/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b34 uses FW v2.6b32
v2.6b35	05/21/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b35 uses FW v2.6b32
v2.6r35	05/21/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - No functional changes from v2.6r33
v2.6b36	05/23/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b36 uses FW v2.6b32
v2.6r36	05/23/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - No functional changes from v2.6r33
v2.6b37	05/27/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Disable Ethernet chip in NV features by default Use command 'EEPROM 4 1' to enable Ethernet - Initialize 'ambient' variable to NAN in global scope
v2.6r37	05/27/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Disable Ethernet chip in NV features by default Use command 'EEPROM 4 1' to enable Ethernet - Initialize 'ambient' variable to NAN in global scope

v2.6b38	06/07/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b38 uses FW v2.6b37
v2.6b39	06/17/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b39 uses FW v2.6b37
v2.6b40	06/25/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Remove CAL blips on left of 2nd-ary devices
v2.6b41	06/28/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b41 uses FW v2.6b40
v2.6r41	06/28/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Remove CAL blips on left of 2nd-ary devices
v2.6b42	07/09/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b42 uses FW v2.6b40
v2.6b43	07/26/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b43 uses FW v2.6b40
v2.6b44	07/30/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b44 uses FW v2.6b40
v2.6b45	08/01/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b44 uses FW v2.6b40
v2.6r45	08/01/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - No intentional changes from FW v2.6r41 - BUG: This version has a slower calibration sweep
v2.6b46	08/18/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Tread PIDs A-D as secondary devices

v2.6r46	08/18/2024	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - Tread PIDs A-D as secondary devices
v2.6b47	10/03/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b47 uses FW v2.6b46
v2.6b48	11/01/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b48 uses FW v2.6b46
v2.6b49	11/08/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b49 uses FW v2.6b46
v2.6b50	12/06/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b50 uses FW v2.6b46
v2.6b51	12/23/2024	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b51 uses FW v2.6b46
v2.6b52	02/03/2025	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b52 uses FW v2.6b46
v2.6b53	02/10/2025	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - No functional changes from v2.6b46
v2.6r53	02/10/2025	A. Ross	**SWEEP PERFORMANCE:** **FW: 1.5-7.5ms E2E: 1.5-7.5ms CAL: <2s** - Updated build information - No functional changes from v2.6r46
v2.6b54	02/17/2025	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b54 uses FW v2.6b53
v2.6b55	03/17/2025	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b55 uses FW v2.6b53
v2.6b56	04/07/2025	A. Ross	**BUILD DOES NOT EXIST** SW v2.6b56 uses FW v2.6b53